

## **Utilizing technology to reduce costs in Winter Service under constrained budgets**

**Björn Ólafsson  
Icelandic Road Administration  
Borgartun 7  
105 Reykjavik  
Iceland**

Tel +354 522 1000/fax +354 522 1109  
E-mail: [bjorn.olafsson@vegagerdin.is](mailto:bjorn.olafsson@vegagerdin.is)

### **ABSTRACT**

The challenge facing the Winter Service consists in exploring all possible means to meet budget cuts in the wake of the extensive crisis through which Iceland has been going. From the viewpoint of society in general and the road user in particular, reductions of service level present certain difficulties.

This is why increased emphasis has been laid on improved measuring techniques, optimal route planning for service vehicles, more efficient utilisation of equipment and materials for friction control, vehicle tracking, measurements of residual road salt and strictly controlled use of salt. Staff training and instruction has also been intensified.

### **KEYWORDS**

ECONOMIC CRISIS / WINTER MAINTENANCE SERVICE REDUCTIONS / MEASURING TECHNIQUES MANAGEMENT SYSTEMS / OPTIMAL ROUTE PLANNING / PREVENTIVE SALTING / AUTOMATIC VEHICLE LOCATION / DATA COLLECTION / TRAFFIC SAFETY

### **1. INTRODUCTION**

When, in the autumn of 2008, the crisis struck in Iceland, there was an immediate and continued call for austerity. Harsh measures were taken, orders issued for increased efficiency and cost cuts in the society in general. Naturally, cost cuts on the one hand and increased efficiency and reorganization on the other hand are two different way of tackling the situation, they need different lengths of time for preparation, introduction and implementation and they also have a different possible lifetime.

Cost cuts may be implemented through simple decision-making and at short notice with in most cases a certain understanding on the part of the consumer in the atmosphere of the

current economic situation. The authorities must realise that this understanding has its limits.

In a long-term perspective therefore, we must realise that lasting economies/savings consist in more permanent efficiency measures instead of cost cuts. A consumer who has become used to good service wants to recover it, in one way or another, as soon as possible.

The first step was therefore to cut down on the scope and quality of the Winter Service and at the same time to begin preparations for a thorough review of the entire organisation and the execution of the task at hand

## **2. BUDGETARY CUTS**

It was clear that cost-cutting measures would affect the service capability of the traffic system and at the same time restrict the possibilities of the business sector, with some negative effect on social life in the country as well. Thus, cost cuts would have to be looked upon as a short-term, provisional measure, and means would have to be explored leading to more effective use of available financing through better technology/techniques, better organization and more targeted management.

Cost cuts in Winter Services were implemented in the year 2009, the first of these consisting in a decreased service level, shorter service hours and reduced quality, in particular on less-travelled roads, where there was minimum danger of a decrease in traffic safety. Furthermore, preparatory work was undertaken to find out what further possibilities there might be regarding increased efficiency and better organization.

As was to be expected, the social/sociological effects of the cost cuts were negative, with the result that the scope was increased again and soon returned to its earlier state, at the onset of the crisis.

## **3. ANALYSIS OF THE TASK/ASSIGNMENT**

In direct continuation, during the winter of 2010-2011, an extensive analysis was made of all the aspects of the task and work was undertaken on the preparation and implementation of measures which in the beginning consisted of increased control and belt tightening in all sectors.

In order to approach the task/assignment in the most intelligent way, it was decided that instead of being critical of, or bound by, current arrangements, the winter service was to be looked at from the outside, impartially, through the eyes of/from the viewpoint of project and action management, i.e. what would be the most sensible and cheapest/most inexpensive way of resolving the matter with regard to the demands made.

In order not to be too bound by earlier methods and habits, it was decided to approach the task in such a way as if the aim was to set up series of winter service projects for a new firm where the task was approached as a connected whole.

Thus it would be necessary to decide on the organisation, division of tasks, methodology, stock control/inventory management and everything else related to this, in order to achieve a satisfactory level of service, the shortest possible service time and the greatest efficiency.

Emphasis has been laid on exploring all possible means of using equipment /vehicles and deicing materials more efficiently and to use to the best advantage available measuring techniques, data systems, meteorological forecasts, management systems and the possibilities consisting in activating the experience and knowledge of all those who are connected to the task/project in one way or another.

The analysis disclosed among other things that centralised and coordinated management, improved route planning for snow removal and deicing equipment, optimal route planning, measurements of residual road salt and efficient control of the use of salt, were aspects which should be greatly emphasised, as well as increased education/instruction and training of those who handle or are engaged in providing winter service.

#### **4. ORGANISATIONAL CHANGES**

When there is a need for organisational changes and adoption of new work methods/processes in a large enterprise, experience has shown that great care is also needed during the preparatory work and adaptation periods in order to ensure good results.

Over time, certain habits and customs have developed and general staff and management may be reluctant to change work methods which up to that time have been considered good and proper. Improved equipment, increased research and development work, measuring technology and data processing have, however, led us swiftly on our way and built a solid foundation for the ensuing changes and made it easier to implement drastically changed work processes in the winter services.

Introducing organisational changes is a complicated and time-consuming operation and demands intensive preparation, consultation, presentation, instruction, as well as general meetings, in order to activate all staff and other parties involved in the task/project, with regard to coordination and changed work processes, areas of responsibility and the duties entrusted to each and every one.

There already was on hand a fairly well developed management and data distribution system and the Icelandic Road Administration has developed and worked on the further development of a joint management and information system for winter services.

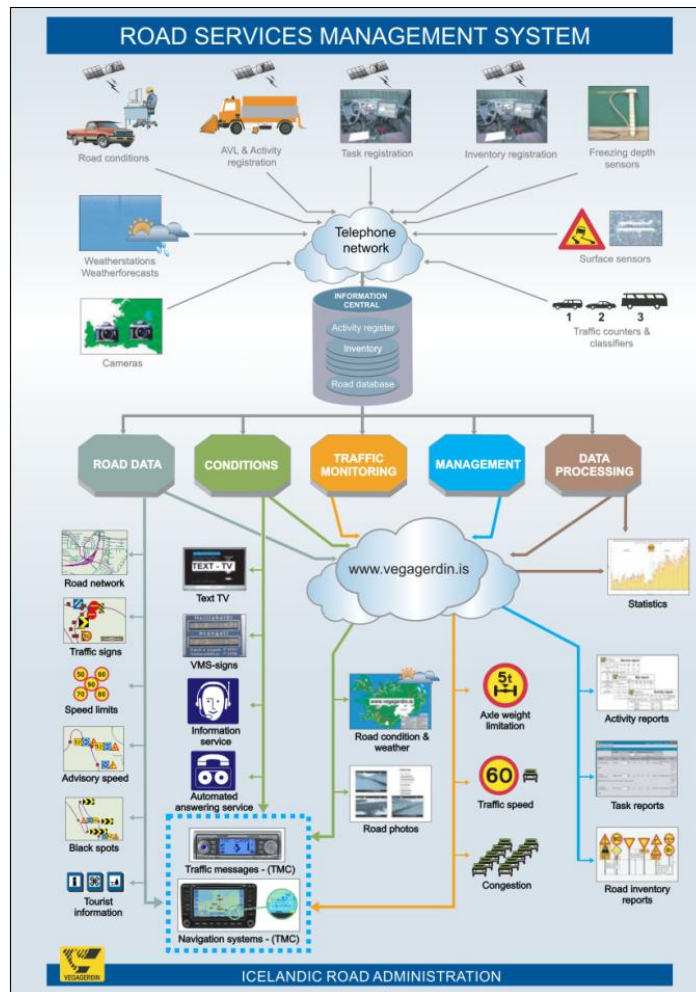


Figure 1

This management system covers most of the information necessary for managing the winter service. The system's database includes information on service routes and degrees of service for particular routes, information on work procedures, materials and use of materials, information about parties performing procedures, on shift plans, work rules and working procedures on particular routes, agreements/contracts, price lists and unit prices, etc.

Road and road-side equipment and measuring devices have been considerably augmented, as about 800 measuring devices, cameras and sensors now monitor the main part of the road system and automated operational vehicle tracking has been installed in all snow removal equipment /vehicles.

It is important to monitor temperature, and meteorological forecasts as well as road conditions and residual salt. The roads with the heaviest traffic loads have sensors which provide information on temperature, surface moisture and residual salt on the road surface. Manual methods are also employed to evaluate road surface moisture and residual salt.

The emphasis in snow removal is on attaining "a black road" as soon as possible before salting, we do not remove snow through salting. If necessary, salt is used during snowfall in order to avoid snow compaction and to ease snow removal.

On high traffic volume roads, the goal is to practice preventive salting before weather events causing slipperiness, which demands even closer monitoring of road conditions and the weather outlook.

Salt dosage is determined on the basis of road temperature, residual salt, the time of day, road surface moisture, current weather and weather forecast.

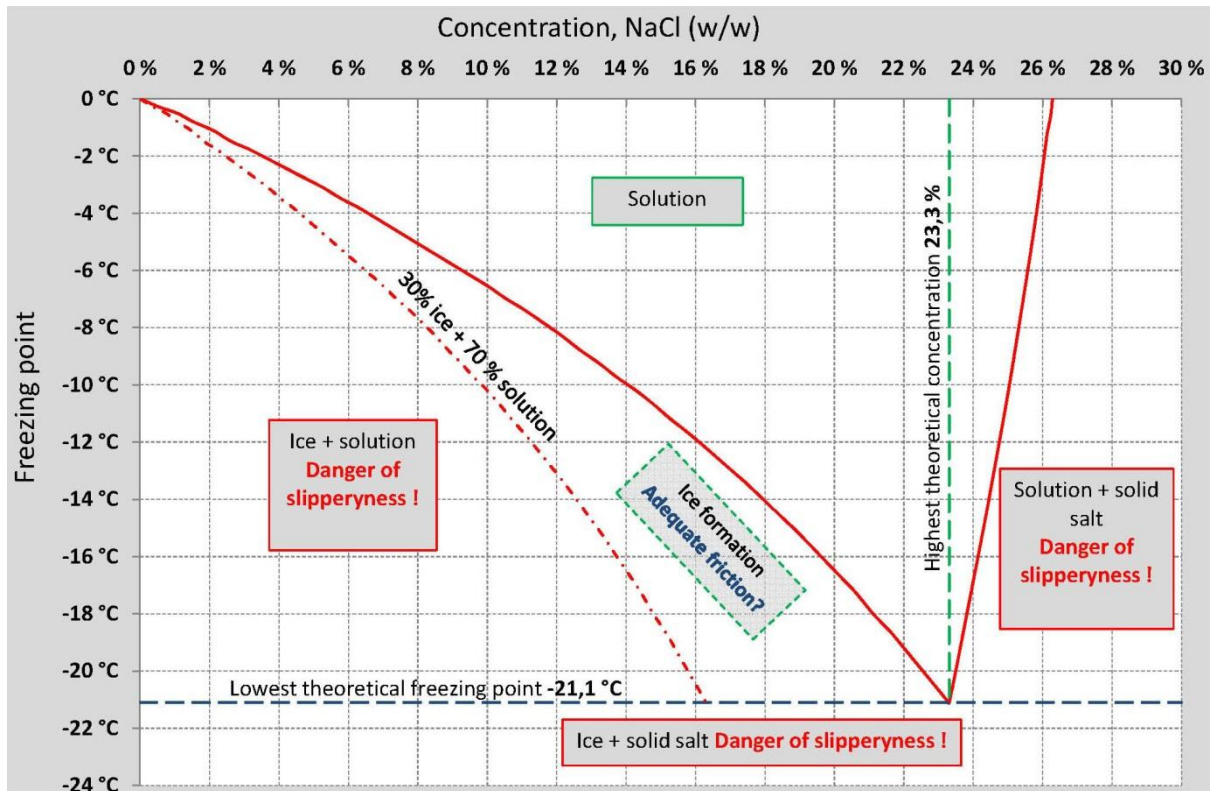


Figure 2 [1-3]

Improved measuring techniques, optimal route planning for service vehicles, measurements of residual road salt, vehicle tracking and strictly controlled use of salt are among the factors which have been emphasised.

## 5. OPERATIONS CENTRALS

The revised organisation of winter services sets out a defined division of work between operational centrals and service stations.

The service stations, which are regional road service centers next to the workplace in question handle supervision at the workplace, quality control and all communication with contractors. There is close cooperation and communication of information between the operational centrals and the regional service stations.

The main tasks/duties of the stations are monitoring, coordination and quality control of registration, data processing and data analysis. Automatic Vehicle Location (AVL) monitoring and registration of operations is carried out in the operational centrals, offering

daily overviews on the cost situation and a comparison with the budgets allotted to /planned for each service route.

Winter Service management is centralised, with two operation centrals covering the whole country. All operations are determined by the centrals in consultation with on-site supervisors and inspectors. All decisions are registered and constantly re-evaluated with regard to results from operations.

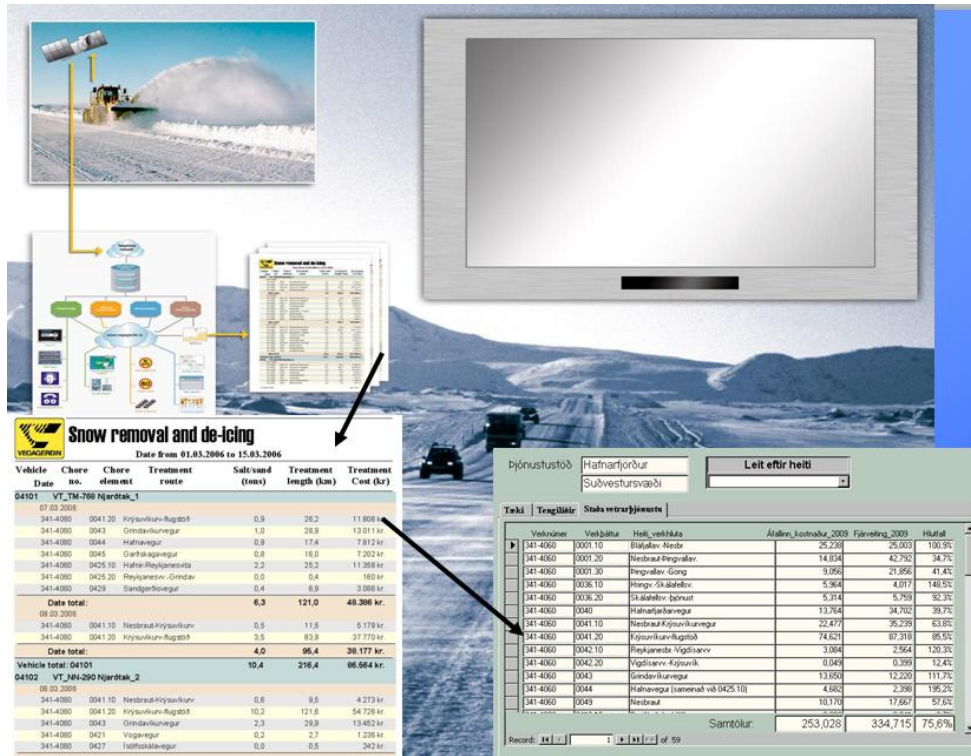


Figure 3

Management systems employed/implemented in the operational centrals contain the following information/data:

- **Management data for each supervision area**

The system registers all basic data with corresponding information concerning geographical division, Road Administration staff, contractors, telephone numbers, material used, equipment/vehicles, area to be deiced, service routes, unit prices, contracts/agreements and watch plans schedules.

- **System for on-duty and the activation of a task**

The system handles on-duty calls and also transmits/passes on messages/commands and information to others concerned, i.e. to management, information service staff, road users etc.

- **System for the registration of operations, tasks and other observations (logbook):**

Registration of all tasks carried out, everything that happens in connection with an on-duty call, actions and task completion as well as everything else that the registration party concerned feels should be registered, including local bad weather or drifting snow as well as any and all observations and indications made by road users.

### • **System for settlement and situation evaluation**

It is possible to assess the financial situation of the winter service and relevant cost items at each given moment, as all operations are registered in the system as well as contracts/s and unit prices.

### • **Information service system**

Through vehicle activity monitoring and a road condition registration system, more extensive information is registered on the situation, i.a. whether snow removal or deicing is in process, whether activities are on time, when operations will be completed, whether there is any (particular) local information on hand, s.a. bad weather on certain stretches of road, etc., all such information to be also registered in the logbook.

Each week, key figures are issued on costs, unit prices, kilometres of snow removal or deicing measures, use of salt and brine, hours of work carried out, etc.

Using the vehicle activity monitoring information in the data bank, we further-more made, for comparison, an extensive survey of the travels, of /distances covered by snow removal vehicles/equipment in the same areas at different times in order to find out possibly better solutions than those already adopted earlier.

In order to obtain the most effective utilization of equipment with regard to minimising inactive manoeuvres of vehicles, the route-plan for each area is based on a fixed network, depending among other things, on traffic volume, specific duration of operations and the shared utilisation and location of service-vehicles and supply stations.

The execution of this particular assignment consisted in a parallel approach: familiarisation with the methodology and meeting with specialists in the field, while addressing each area as an integrated project and a number of inspections and surveys were made on different routes, comparing and evaluating a number of options. No limits were laid down regarding this, neither between service areas or regional road service centrals nor between administrative areas .

Various aspects may have an influence here and it can be difficult to take all of these into consideration, i.a.

- Different types of vehicles
- Vehicle speed and capacity
- Location/initial position of equipment/vehicles
- Permitted speed and speed possibilities on individual routes or parts of routes
- When and how it is possible to turn around and come back
- Permitted operation/activity time for different types of road
- Minimum number of routes for each combination of supply stations/types of equipment
- Total minimum number of routes/vehicles needed to fulfil requirements for total work time
- Special limiting circumstances, s.a. (road) width, one-directional stretches, etc., which may have an effect

In order to attain the most efficient utilisation of vehicles with regard to inactive driving, the system for each area sets out a defined basic network, which depends i.a. on traffic in-

tensity, a defined time length of operations and the shared utilisation and positioning of equipment/vehicles and supply stations. Various options were set out for each area/route. Subsequently, those route systems/networks were chosen that gave the shortest service time and a minimum of inactive driving.

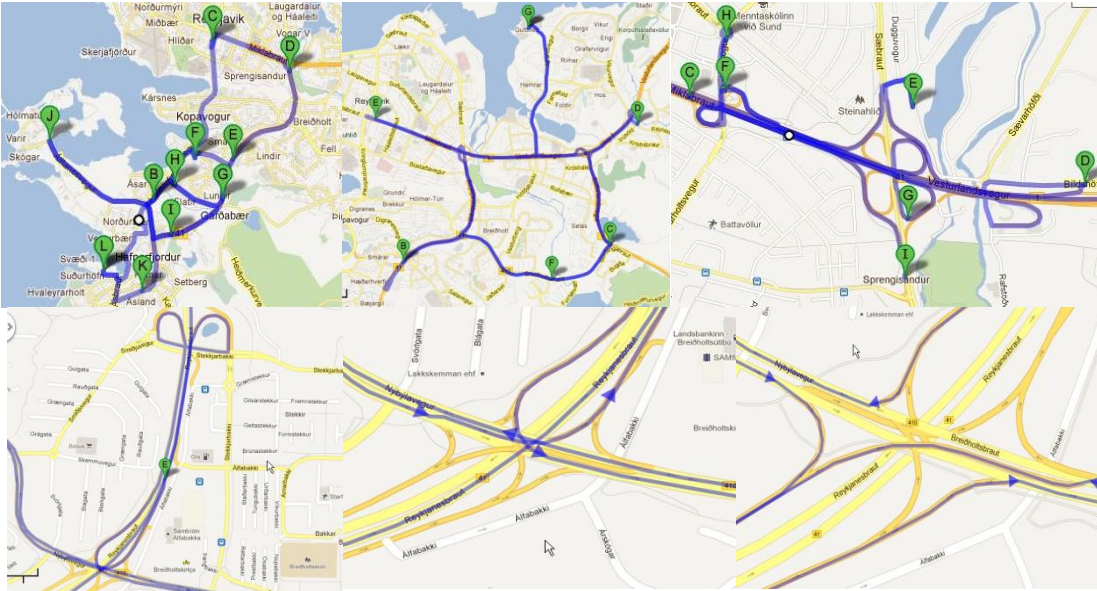


Figure 4 Route-plan (example) [4]

All service routes are defined and prioritised and different tasks are assigned to individual service vehicles on each route. Different implementation procedures may be employed according to snow amount or whether the operation only includes friction control.

## 6. RESULTS

During the winters of 2010-2011 and 2011-2012, the extent of the winter servicewas increased again and emphasis was laid on work and preparation for a changed organization and methodology in harmony with what has already been mentioned. In the winter of 2012-2013, work was carried out with full implementation of the changed arrangements and the resulting cost figures show that the changes have led to an approx. 20% reduction in the variable cost of the task/project or about 10% of the total cost.



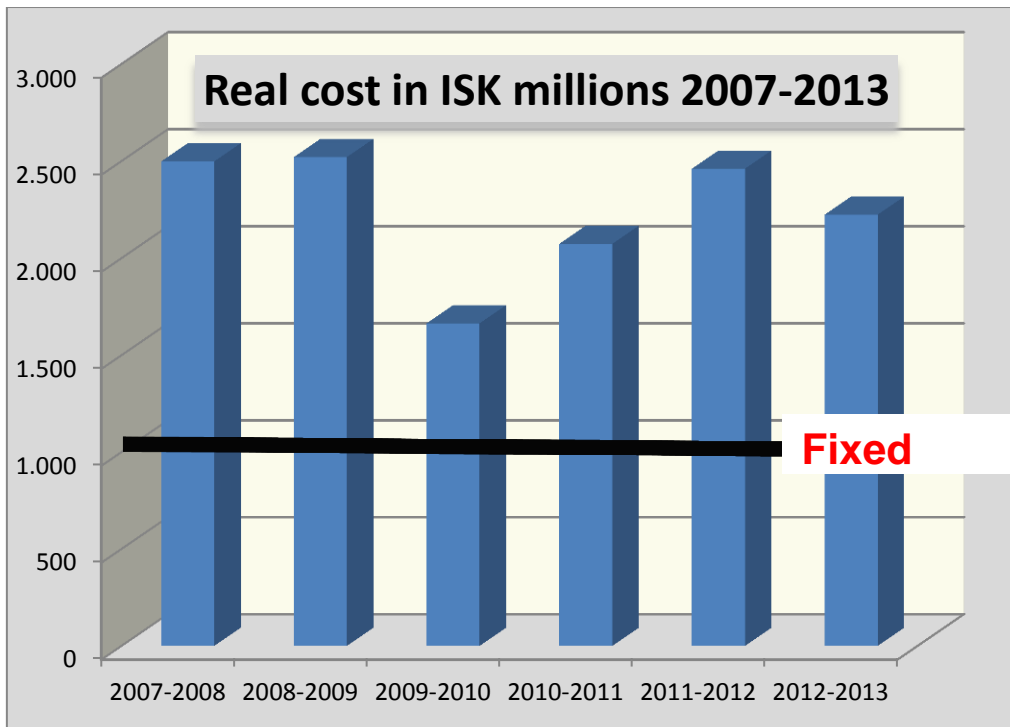


Figure 5 - Winter Service costs 2007-2013

Furthermore, the winter of 2012-2013 registered unusually heavy snowfalls, with the winter index about 25% higher than the year before. This index is based on the amount of snow, the frequency of icy conditions arising, accumulation of snow, drifting snow etc.

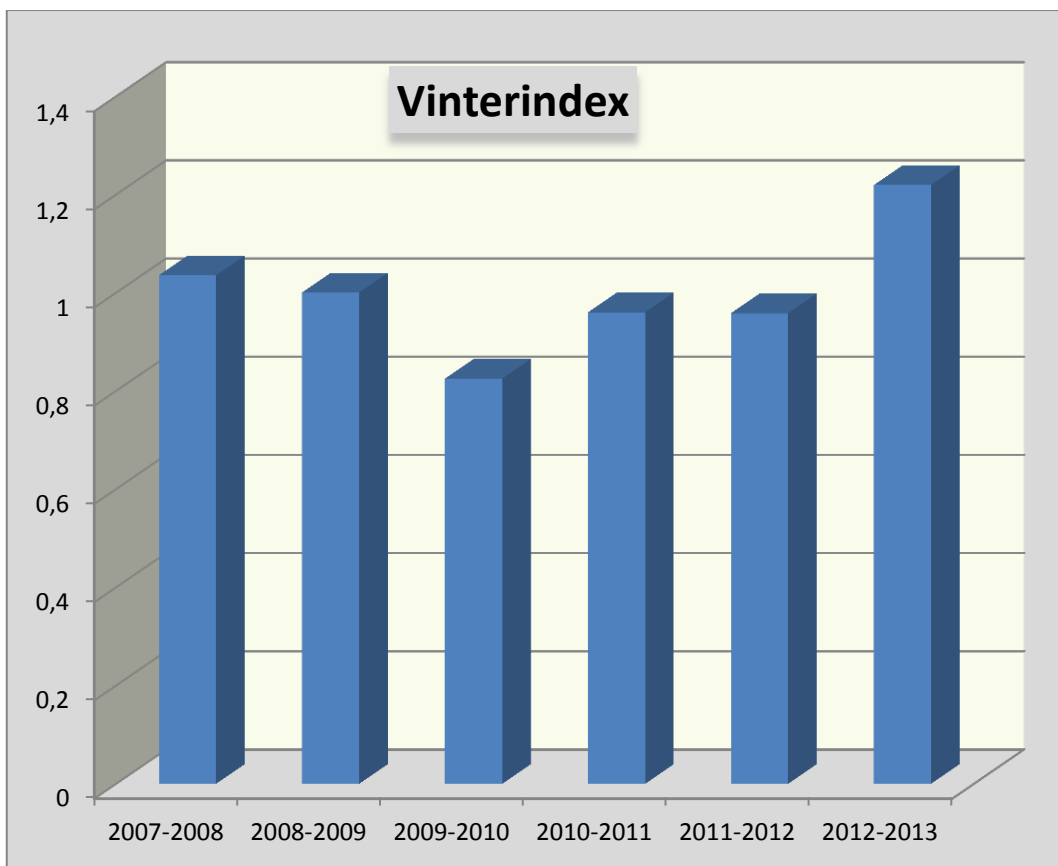


Figure 6 - Winter index

By doing a conversion of costs with regard to the winter index, it may be assumed that the difference in total costs between years could be up to 40%, although it would be incautious to expect so great a difference, given the inherent inaccuracy in the calculatory aspects of the index.

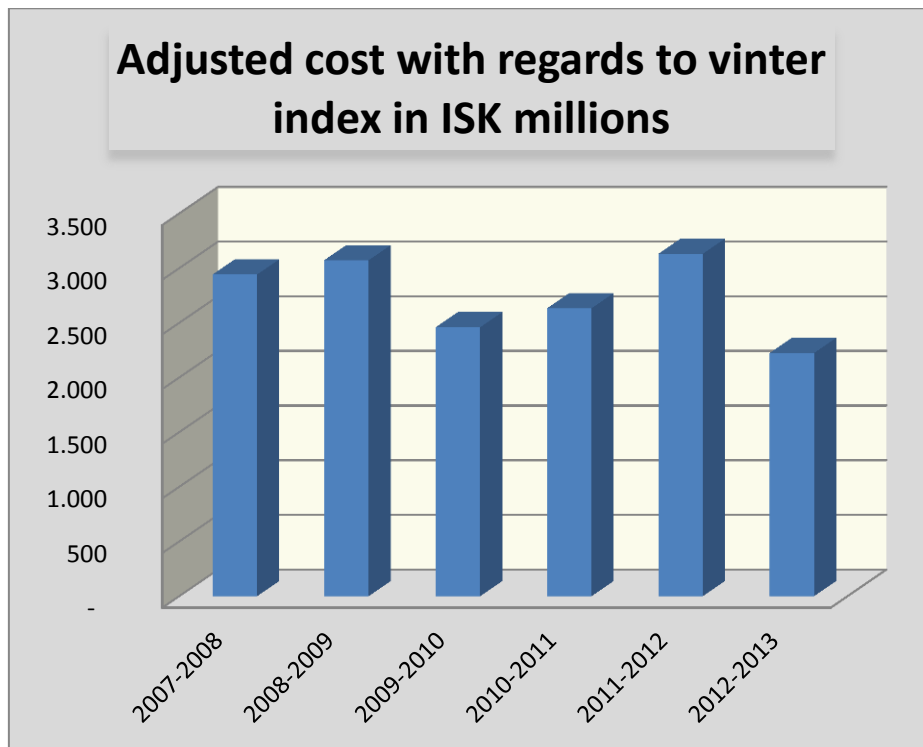


Figure 7 - Corrected costs with regards to winter index

There was a decrease in the number of traffic accidents in the wake of the crisis, which may in part be traced to less traffic in general but since that time, changes in skid accidents have not been noticeable.

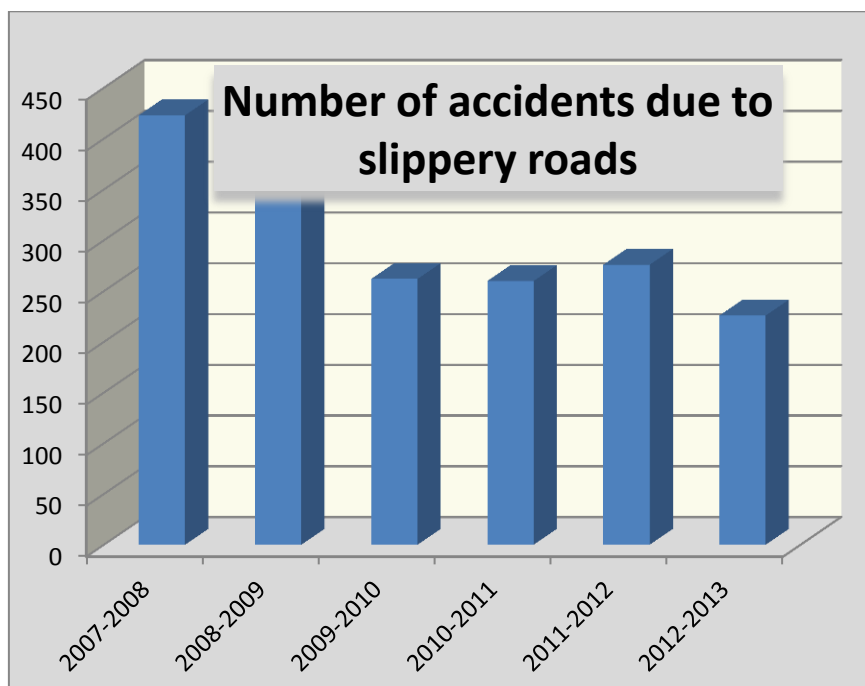


Figure 8

## **7. CONCLUSION**

To cut down the scope of tasks is a relatively simple method, which it must be assumed will have only a short lifetime.

Organisational changes are complicated and time-consuming operations which require a great deal of work, consisting in the acquisition and processing of data, review and reformulation of a new methodology, techniques and work procedures, discussions, introductions and marketing inside the company/enterprise of the new methodology and work procedures, the teaching/education and training of staff, activation and coordination of staff and other parties involved and a change of their work procedures with regard to fields of responsibility and the duties of each and every one and, last but not least, the implementation of the changes themselves.

The factors which give the greatest cost savings in daily work are measuring techniques, optimal route planning, vehicle tracking, measurements of residual road salt and controlled use of salt.

What stands out is that the experience we have been through is something from which we can learn, i.e. that in a really tight corner we face a situation where we have to think all aspects anew and from a very different viewpoint than before, when the budget was not such a limitative factor. In this way the crisis has had a positive effect for in such a situation, all possible means must be explored for increased economy and efficiency, means which we might not even have given a thought in earlier times.

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