

Winter Maintenance Index – Next Level of Road Winter Maintenance Analysis

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ABSTRACT

Winter Maintenance Index (WMI) is a system of deep analysis and comparison of road winter maintenance performance and costs depending on real meteorological conditions on a defined road network. WMI is a unique tool of qualitative interpretation of the costs that takes the evaluation and control of winter road maintenance performance (e.g. salting, plowing) to complete new levels.

The comparison of maintenance level among different contractors independently of climate, terrain, altitude, and road length... is now available. Based on this analysis it is possible to detect divergences from the standard level and separate any isolated or long-time anomalies and unjustified raising of costs. It is also possible to establish objective and precise regional/national „winter maintenance standards“ which allows resources allocation optimization as well as helps to increase traffic safety.

The purpose of Winter Maintenance Index is to give an objective indication of winter severity and especially to compare maintenance performances among different contractors or centers working in different climate conditions. Unlike currently used systems it is the first time that not only winter severity is calculated for specific regions but also a long-term average or maintenance standard” in that particular region is found.

The key advantage of WMI lies in the innovative way of „calculating the winter” that has not been possible using other methods. Detailed analysis of performance and cost-effective control of winter maintenance is much easier and for clients – road authorities - brings noticeable savings – up to 10 % of total winter maintenance expenses while keeping safety standards high.

Keywords: winter maintenance performance analysis and contractors comparison based on real weather conditions

1. INTRODUCTION

Winter Maintenance Index (WMI) is a system of deep analysis and comparison of road winter maintenance performance (e.g. salting, plowing) and costs depending on real meteorological conditions on a defined road network. The purpose of WMI is to give an objective indication of winter severity and especially to compare maintenance performances among different contractors or centers working in different climate conditions by using an innovative comparative method.

2. BASIC PRINCIPLES

WMI is a system of analysis and comparison of road winter maintenance performance and costs depending on real meteorological conditions on a defined road and highway network.

The main activities that are monitored are:

- salting (or gritting) the roads
- consumption of salt and other materials
- plowing/snow removal

It is obvious that there is a direct link between the current weather conditions and the extent of the above mentioned parameters. It is also clear that when winter condition become more severe (snowfall, temperature around zero, freezing rain, ice on the road etc) in order to maintain the road safe for driving it is necessary to

employ more maintenance vehicles and use larger amounts of salt, which represent the major item in winter maintenance expenses.

WIM is a unique tool that enables retroactive control of road maintenance performances and comparison of maintenance level between different contractors. Based on this analysis it is possible to detect divergences from the standard level and separate any isolated or long-time anomalies and unjustified raising of costs.

The basis for elaborating WMI is to establish winter severity strictly from the maintenance point of view in a defined region and compare it with real maintenance performance.

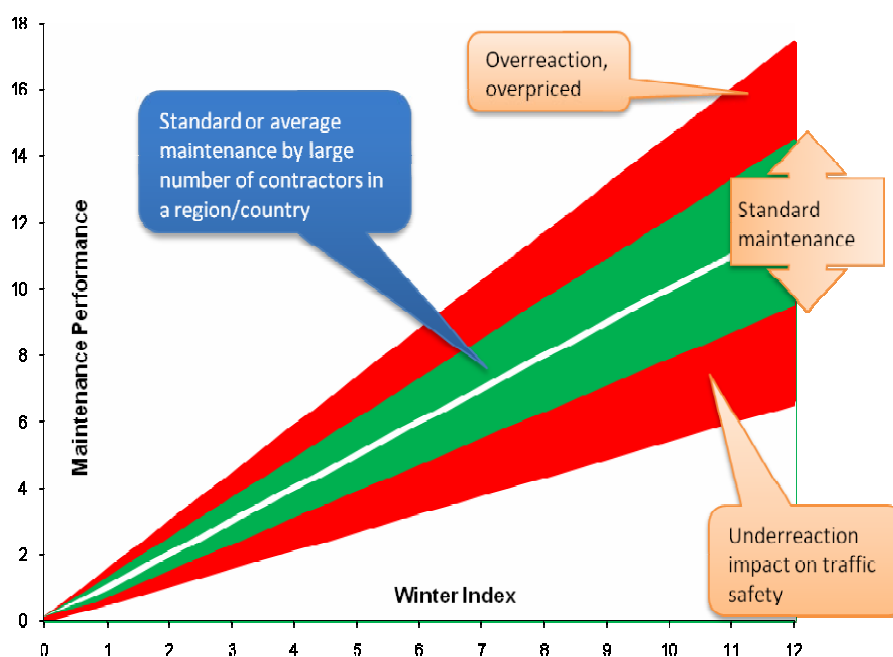


Fig. 1 Dependence of maintenance level on weather

Summing up:

- This basic principle has been well known for a long time but at the same time is the key to understanding why WMI really works: with the severity of winter grows maintenance
- Different contractors employ different approaches towards maintenance according to the local “habits” history, country etc. resulting many times in striking differences even among local branches/units of the same company/organization
- By using WMI it is possible to define the “standard” or “average” performance for specific winter conditions
- Having defined the standard maintenance based only on maintenance data and figures supplied by the contractors themselves – not “laboratory” established, it is possible to evaluate the behavior of the contractors with the estimated precision $\pm 15\%$, moreover the development continues to reach $\pm 10\%$.

3. INPUT DATA FOR THE SYSTEM

The basis for elaborating WMI is to establish winter severity (from the maintenance point of view) for selected road region. For this task, precise historical and current meteorological data are needed. To calculate winter severity, every parameter that influences the maintenance performance is taken into account, namely snowfall, temperatures, ice, frost etc.

This data has to be collected from the local official meteorological institutions that, under normal conditions, are the only organizations with sufficient number of professional weather stations and databases of historical weather data.

Second indispensable data input are winter maintenance performances from all the contractors performing winter maintenance on the road network.

Example of daily monitored parameters:

- Gritting [km]
- Salting [km]
- Gritting and plowing/snow removal [km]
- Salting and plowing/snow removal [km]
- Plowing/snow removal [km]
- Inspection route with gritter [km]
- Inspection route with passenger car [km]
- Salt consumption [t]
- Brine consumption [l]
- Sand consumption [t]

The above mentioned data inputs are collected directly from the maintenance contractors. In the Czech Republic, secured web forms are periodically filled out but also other alternative methods of data collection are possible. Recommended frequency for the data collection is 24 hour period.

Indispensable for the correct function of the whole system is detailed GIS (Geographic Information System) data about road network, in particular:

- Length and width/surface of maintained roads based on categories (e.g. highways, II. class roads) and type of maintenance (e.g. salt, brine, gritting)
- Exact boundaries between different contractors

4. OUTPUTS

Winter maintenance performance in a defined road network is periodically analyzed and compared to weather conditions. The outputs are presented in detailed graphs with text description of the important discrepancies.

Watched parameters are recalculated with respect to the surface of the road network; geographical conditions (altitude etc.) are also observed so it is possible to compare contractors working in different conditions as well as the performance of the same contractor in different winter seasons.

Outputs are presented to a client in form of weekly analysis. After the winter maintenance period a complex report is prepared describing in detail every watched parameter of every organization/contractor and presenting all anomalies and divergences from the standard levels.

Parallel output is a complete statistical overview of winter maintenance data that can be accessible in real time on a secured web page.

All outputs can be tailor-made respecting special wishes of the client.

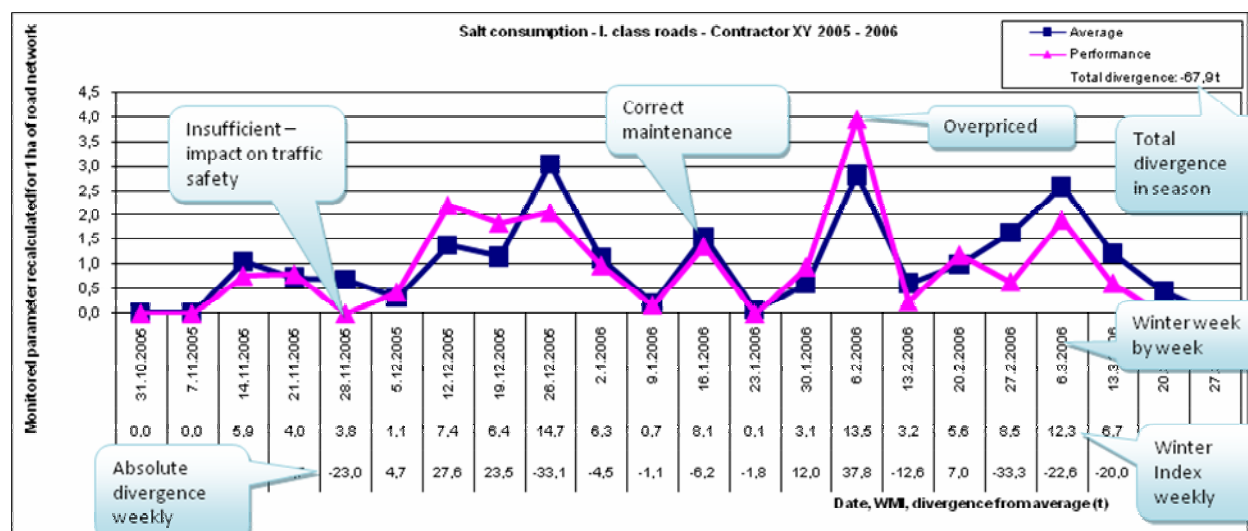


Fig. 2: Example of weekly output of WMI

Optional enhancement of WMI is Winter Inspection that comprises the following:

- System of detailed retroactive verification of maintenance performance depending on the weather
- Full use of GPS data from mechanisms (if available) and of specialized meteo data
- Expert evaluation of striking differences in performances based on weekly WMI
- Detailed check of routes and days with weekly output
- Full quality maintenance inspection from the office without need for the inspectors to be outside at night and/or at weekends...

5. WMI KEY BENEFITS/HIGHLIGHTS

- Weekly and seasonal analysis of winter maintenance performances on road network depending on real meteorological conditions
- Evaluation of long-time meteorological conditions on selected territory from the winter maintenance exigency perspective for planning purposes
- Establishing “standard performance” for a selected road network
- Detection of isolated anomalies and long-time divergences from this standard
- Precise analysis of whole winter period from the maintenance point of view
- Real time access to statistical data about consumption of salt and other spreading materials as well as other maintenance performances
- Objective evaluation of maintenance costs effectiveness with the view to weather conditions
- Achieving adequate quality of winter maintenance and increasing traffic safety while keeping costs down
- Financial controlling (invoice validation)

6. REFERENCES

WMI is delivered on a weekly basis for the following road networks within the Czech Republic:

Description	Highways	I. class roads	II. and III. class roads
Length of road network	990	5 900	49 000
Number of independent contractors	1	20	11
Number of regions	17	114	58

Table. 1. WMI references.

Long-term business partners:

- Road and Motorway Directorate of the Czech Republic
- Administration and Road Maintenance of Pardubice Region
- Directorate of the Roads of Zlin Region
- Regional Authority of Central Bohemia

7. CONCLUSION

After several years of innovative development, WMI has established itself as a product/service that can be presented on international level as a fully functional system for achieving a complete control over the expenses on winter maintenance. WMI profiles as powerful tool not only for comparative analysis of maintenance performance on regular basis but also as an unrivalled financial controlling instrument, tailor-made for every authority that wants to improve the winter maintenance of roads and cut the unnecessary costs while keeping the highest standards of safety.

WMI is proved competent in sea-continental mixed climate, typical for many countries in Central Europe, large parts of USA and Scandinavia.