

An aerial photograph of a city, likely Stockholm, showing a dense cluster of buildings along a waterfront. A river or harbor is visible on the left side, with a few boats. The buildings are mostly multi-story, with various roof colors and styles. The overall scene is a high-angle, top-down view of the urban landscape.

HOW CAN NEW TECHNOLOGY BE USED IN WINTER ROAD MAINTENANCE

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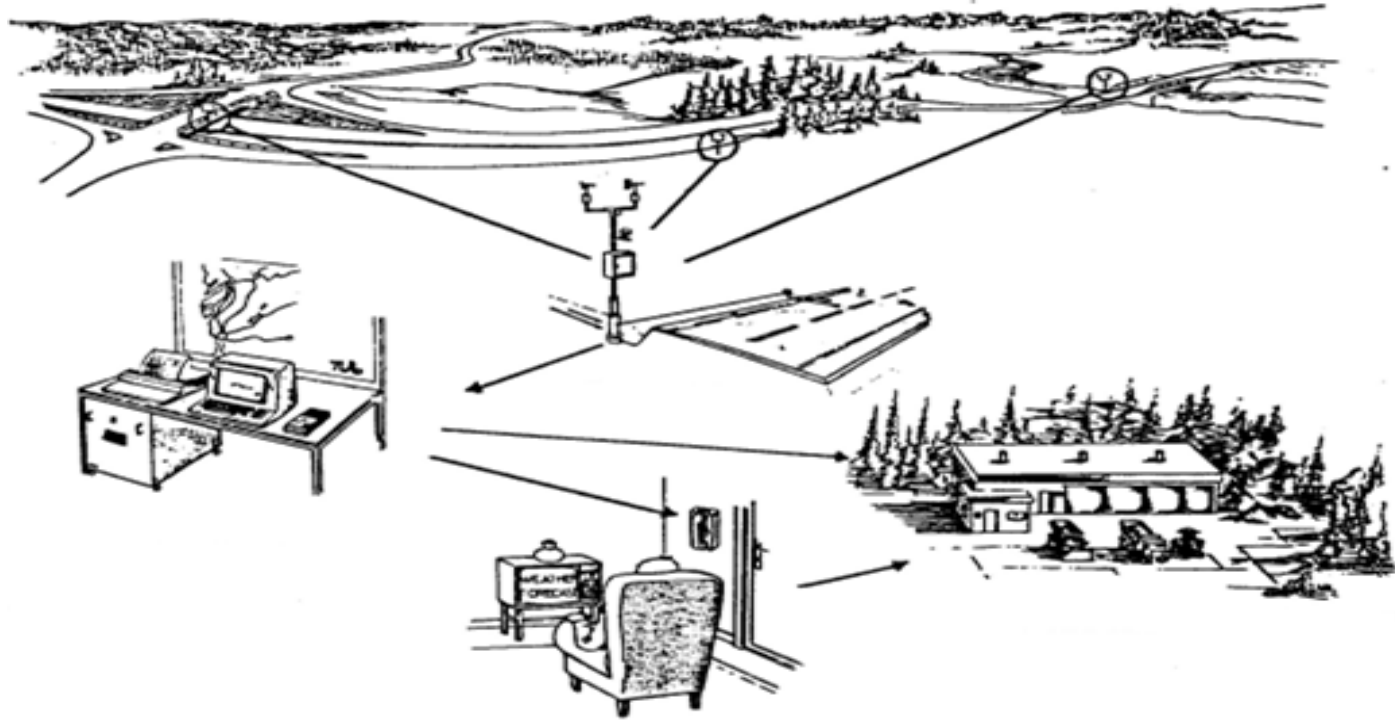
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13-15 December 2021
PIARC online seminar, Kiev

INTRODUCTION



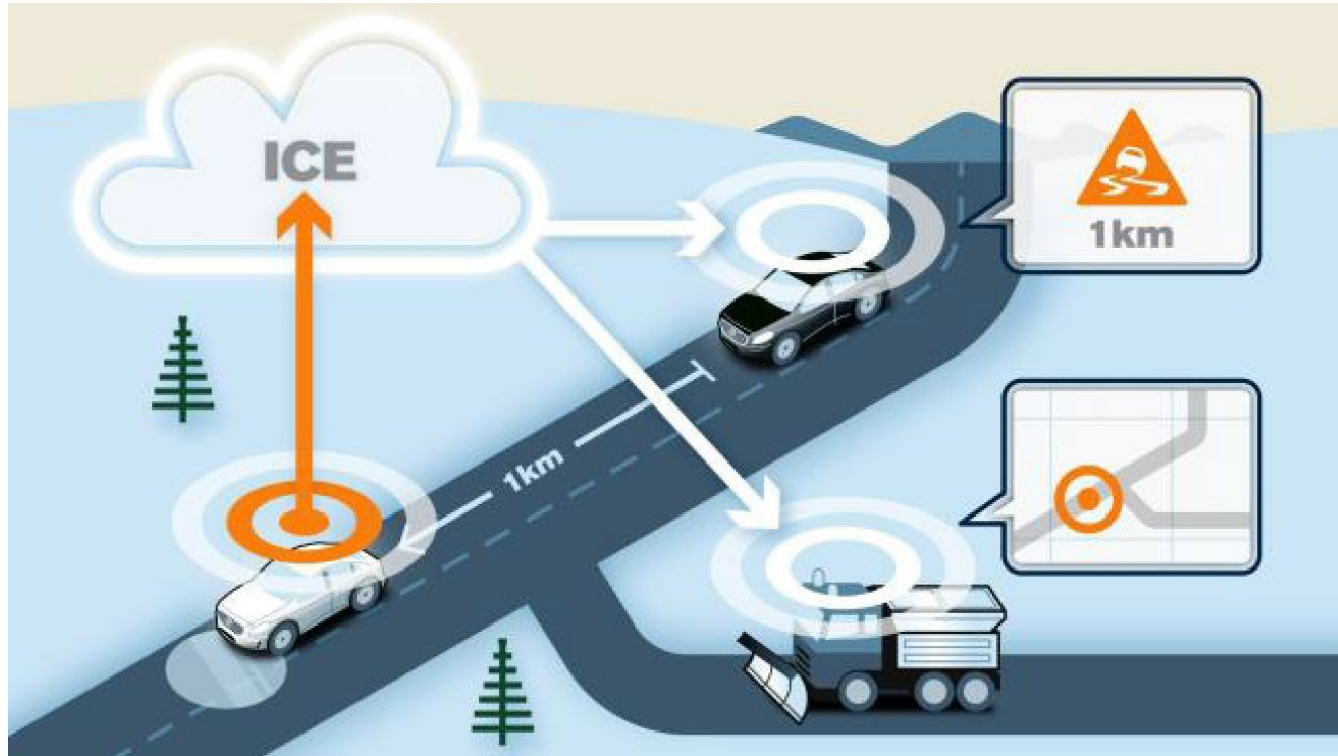
INTRODUCTION



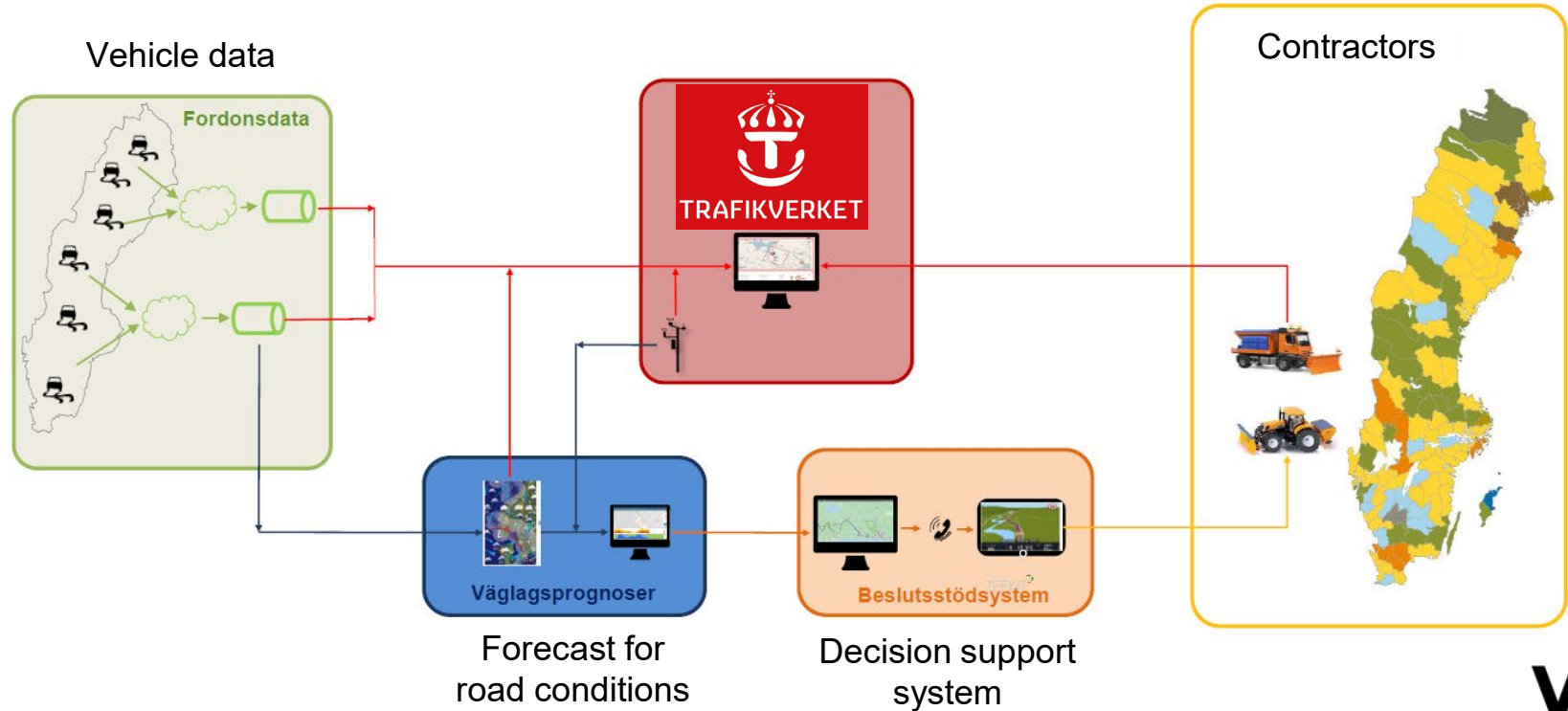
ROAD WEATHER INFORMATION SYSTEM (RWIS)



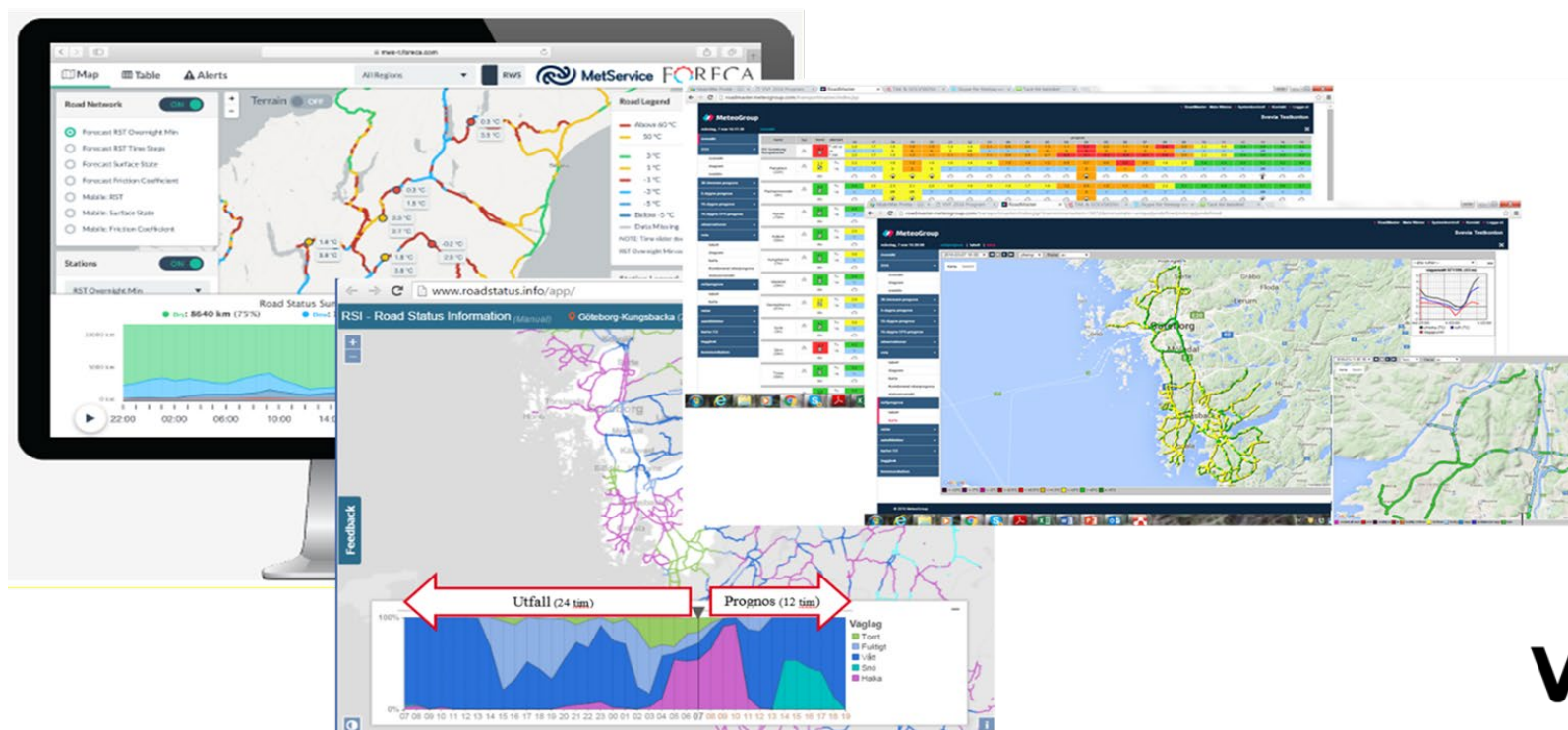
CONNECTED VEHICLES



WINTER ROAD CONDITION – DIGITAL INFORMATION



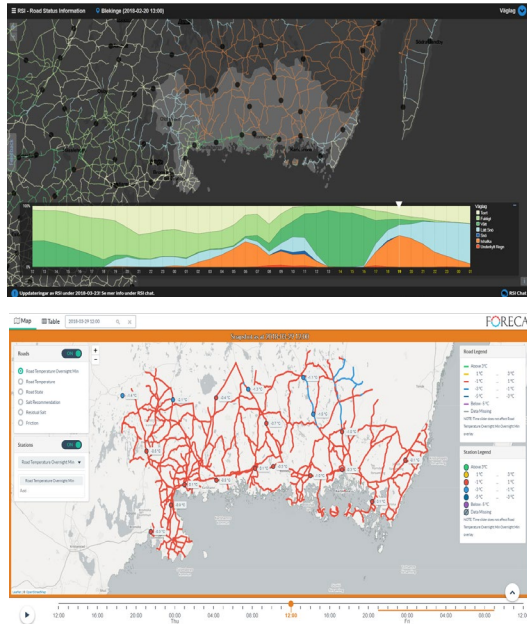
DYNAMIC FORECAST CONTROLLED WINTER ROAD MAINTENANCE



INTRODUCTION

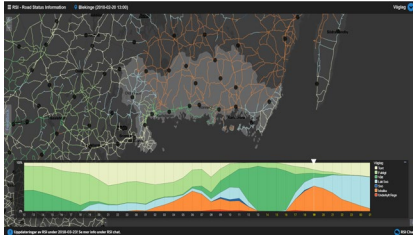
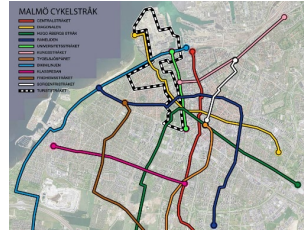
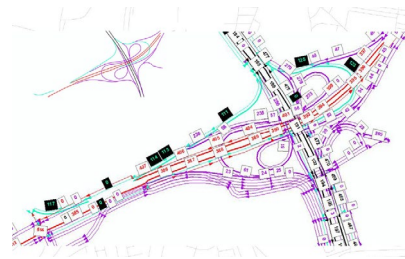
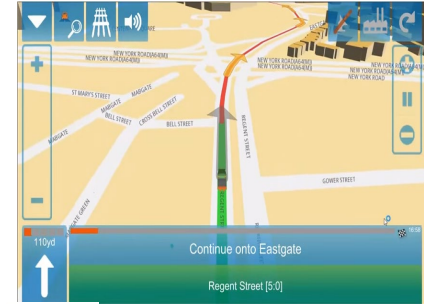
- Several road weather forecast services can provide qualified support to decisionmakers in winter road maintenance
- The services provide dynamic road conditions forecasts and, in some cases, even proposals for actions needed for different road sections
- Main advantage - forecasts clearly show which parts of the road network need to be addressed

HOW CAN WE USE DETAILED INFORMATION IN THE PRODUCTION?



WHY DYNAMIC OPTIMISATION?

Simply: Variations in climatology and weather gives incitement for optimisation.



PROJECT AIM

- Make the decision-making process easier
- Integrate data from a weather forecast service to existing GPS management and monitoring system
- Reduce the error margin regarding communication between performer and the winter maintenance contractor

Conclusion: Create a more productive winter road maintenance with dynamic road conditions information through system integration and automatization.

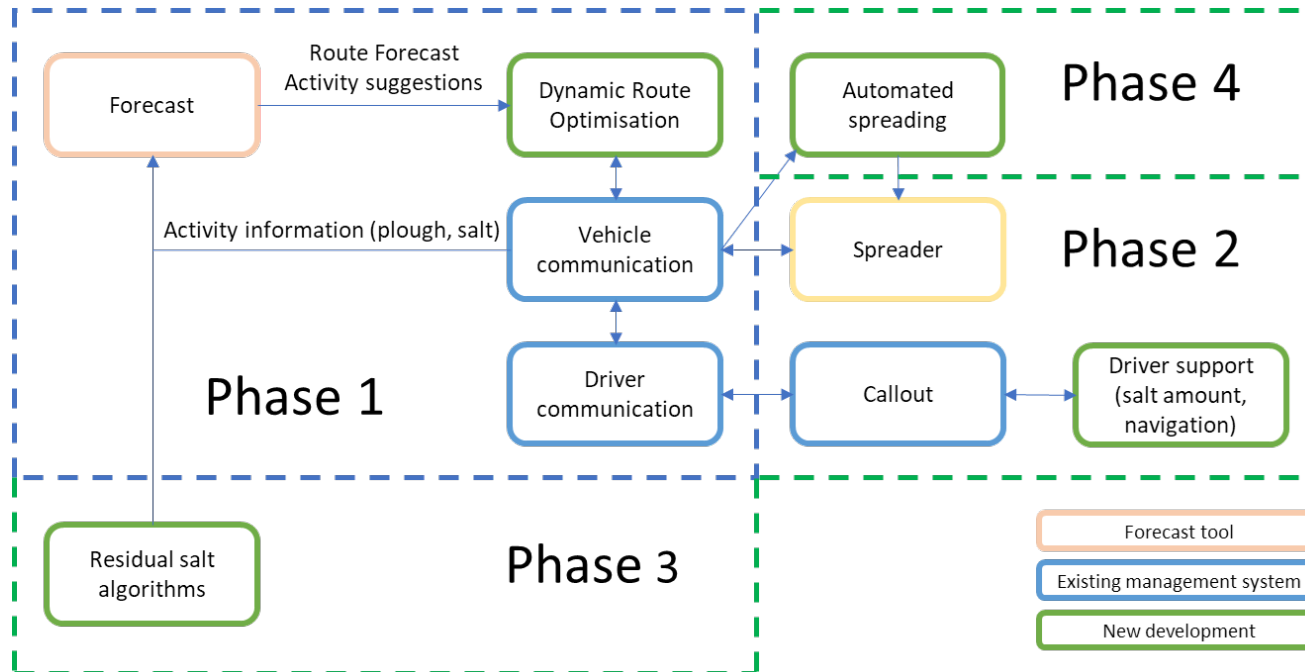
Phase 1: Proof of concept

Phase 2: Adaptation and implementation

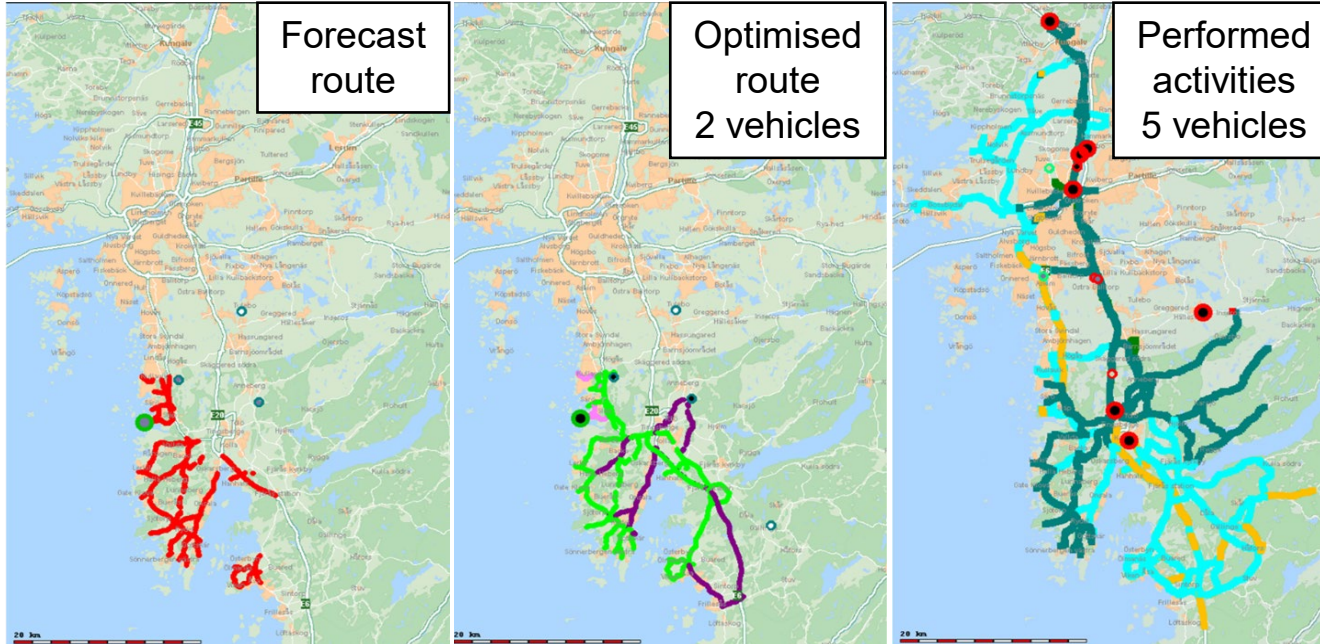
Phase 3: Residual salt algorithms

Phase 4: Automated salt spreader

Phase 5: Improved forecasts with more data (sensors, FCD, road information)

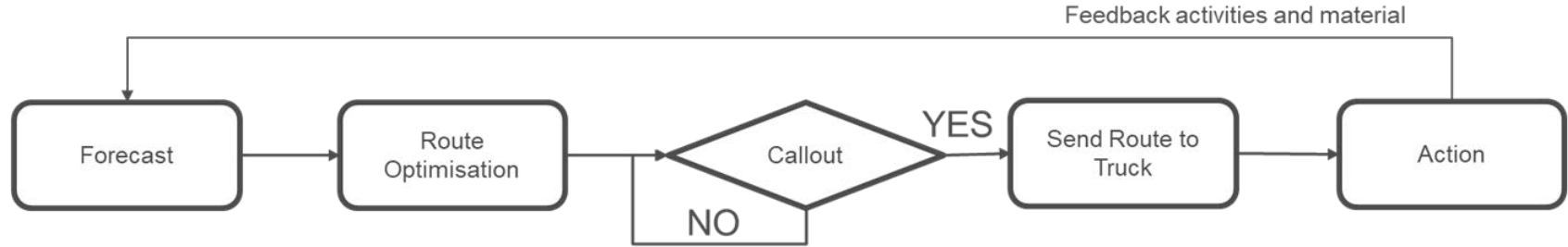
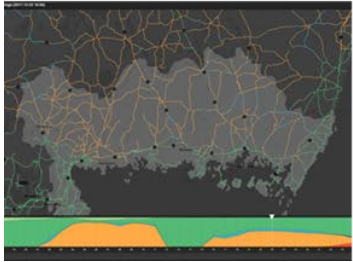
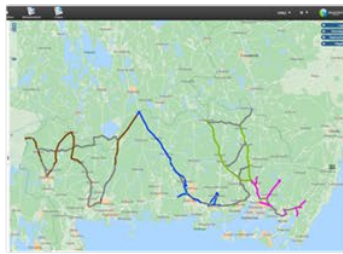


PHASE 1 – PROOF OF CONCEPT



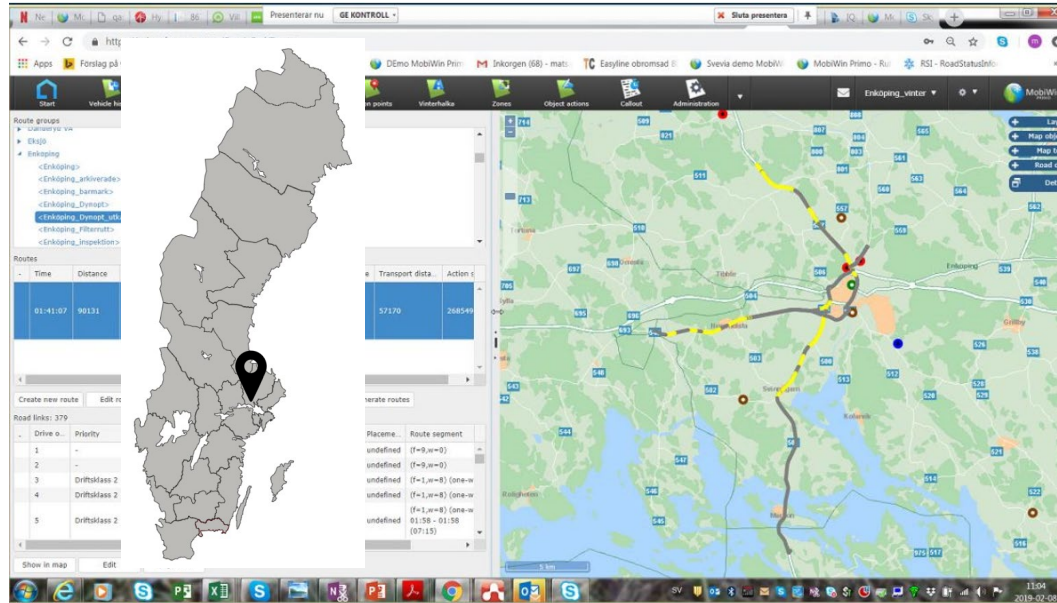
- Concept was working
- Calculated reduction of machine hours 15-25% throughout the year i.e. reduction of salt and emissions
- Verified in the projects test area where the system was used last winter

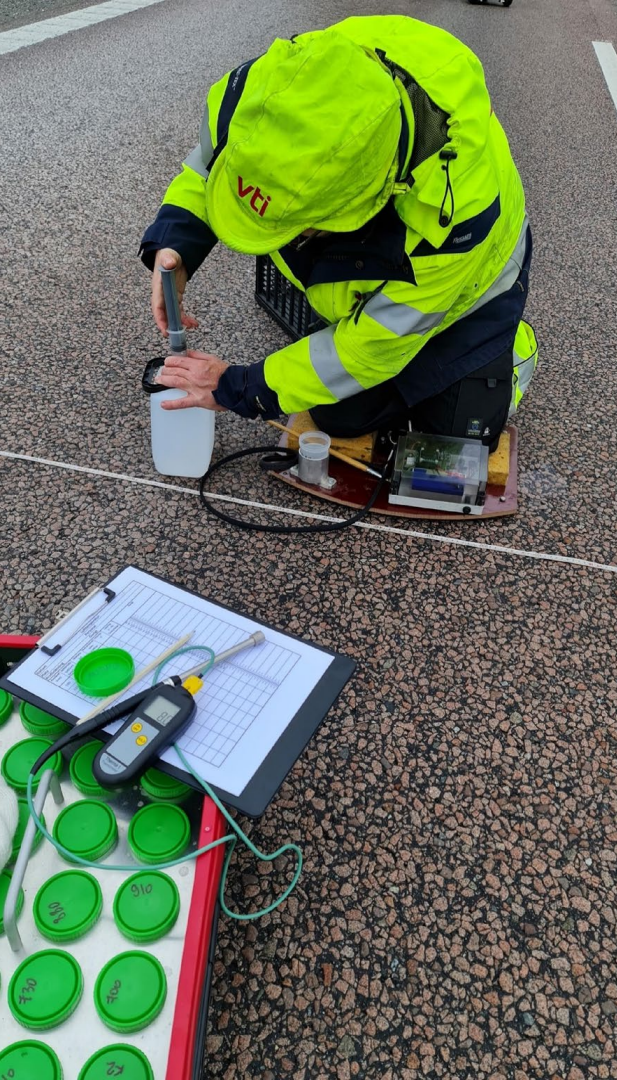
PHASE 2 – ADAPTATION AND IMPLEMENTATION



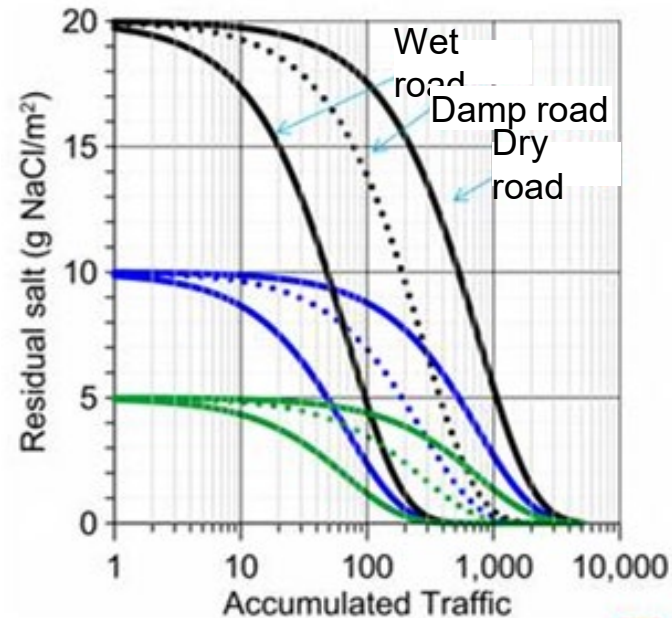
- Functions (optimisation, callouts, navigation)
- How good are the forecasts?

The world (?) premiere of the first fully digitalised dynamic forecast-controlled winter road maintenance action for preventative salting was made in Enköping, Sweden on February 7, 2019





PHASE 3 – RESIDUAL SALT



http://www.nordfou.org/Documents/MORS/MORS_Bestemmelse%20af%20restsaltmodel.pdf

PHASE 3 – RESIDUAL SALT

Testsite E18



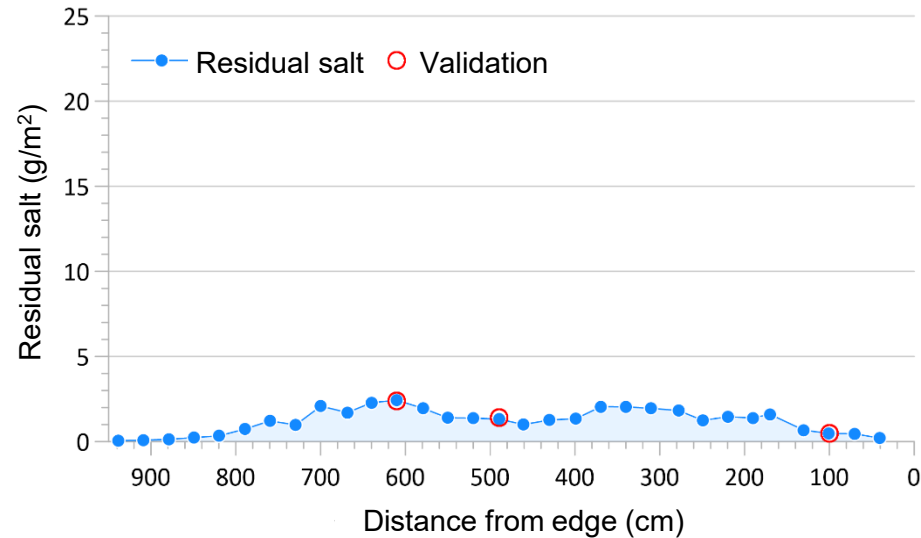


PHASE 3 – RESIDUAL SALT

Residual salt measured with VTI-Wet Salt Sampler (WSS)



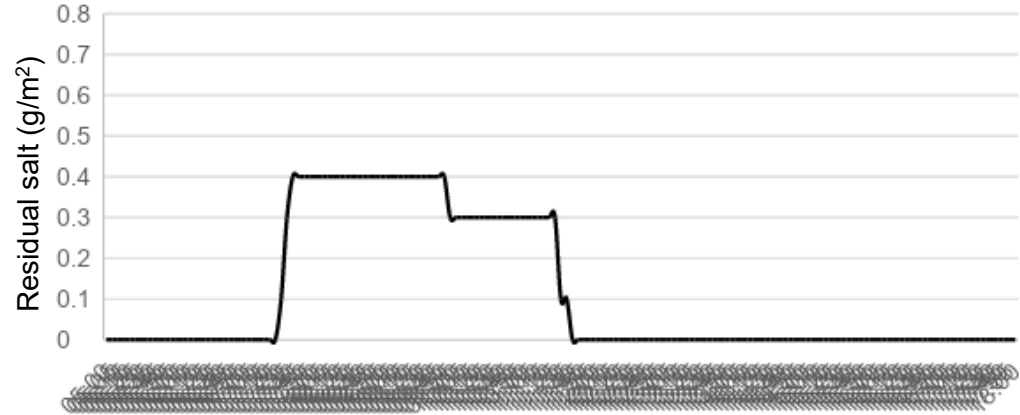
PHASE 3 – RESIDUAL SALT





PHASE 3 – RESIDUAL SALT

One of many sensors at the testsite...



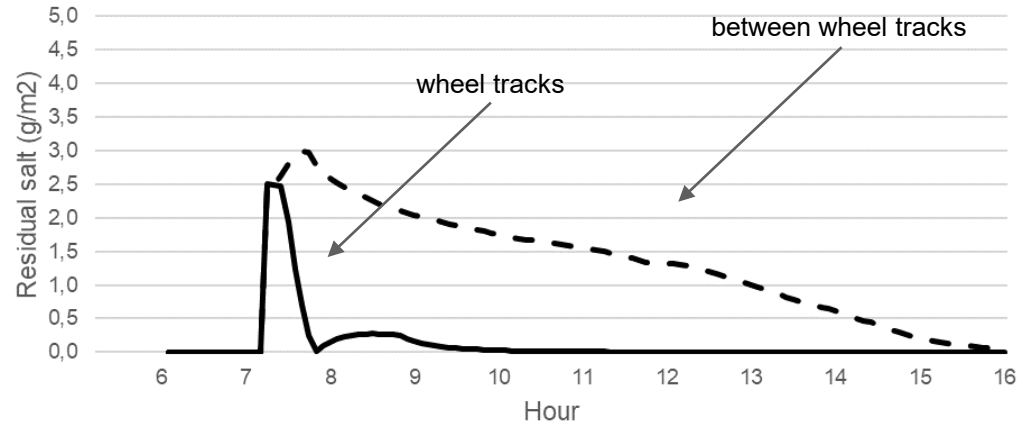
12 g/m² brine at 07:15

Salt lasted 4 hours on the road



PHASE 3 – RESIDUAL SALT

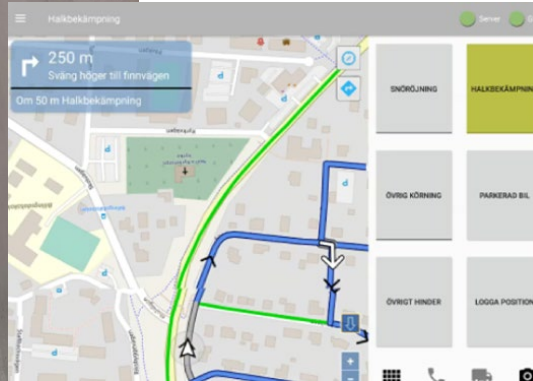
Modelled with MORS



PHASE 4 – SALT SPREADING

How can we get the modern forecast technology all the way to the salt spreader?

Salting and spreading width controlled by the optimised navigation route



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PHASE 5 – IMPROVED FORECASTS WITH MORE DATA (SENSORS, FCD, ROAD INFORMATION)

Still ongoing project this winter, focus on enhancing the road weather forecasts

PARTICIPANTS AND CONTRIBUTORS

SVEVIA

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Verkstäder AB**

 **BM SYSTEM**

KLIMATOR

VAISALA

SMHI


RoadCloud
WAY AHEAD


PEAB

SKANSKA



SENSEBIT


NordFoU


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VEJFORUM


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 **TRAFIKVERKET**

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Thanks for your attention!