



Bearing information through vehicle intelligence

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**KLIMATOR SEMCON**

 **TRAFIKVERKET**

 **VÄRMLANDSÅKARNA**



UNIVERSITY OF  
GOTHENBURG



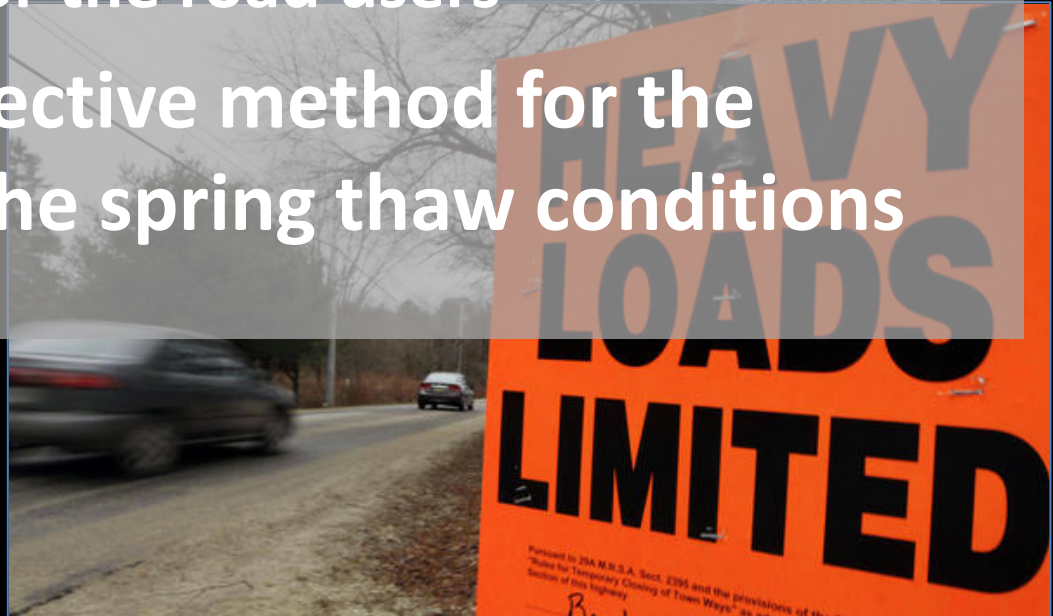
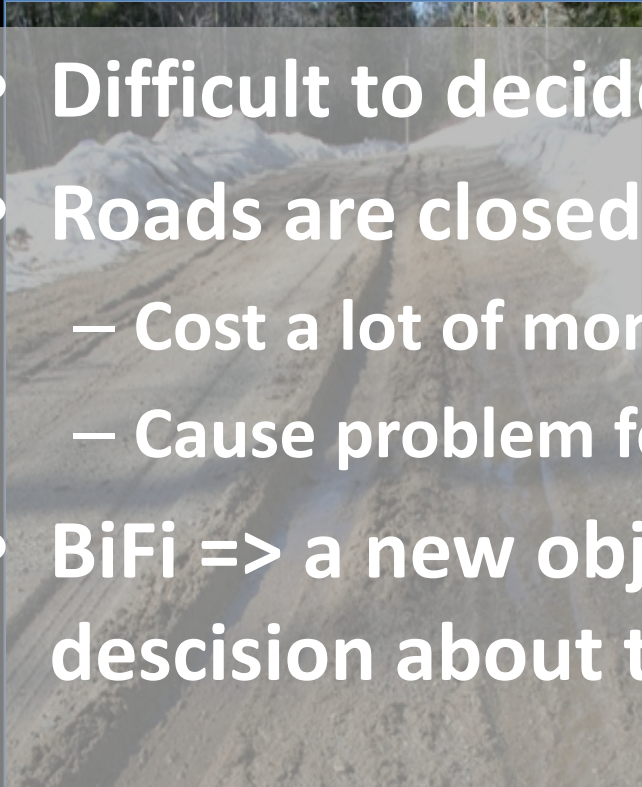
HÖGSKOLAN  
DALARNA

LULEÅ  
TEKNISKA  
UNIVERSITET



# Problem

- Difficult to decide about the bearing strength
- Roads are closed for a long time
  - Cost a lot of money for the state & industry
  - Cause problem for the road users
- BiFi => a new objective method for the decision about the spring thaw conditions





One of four

Asfalt Quality

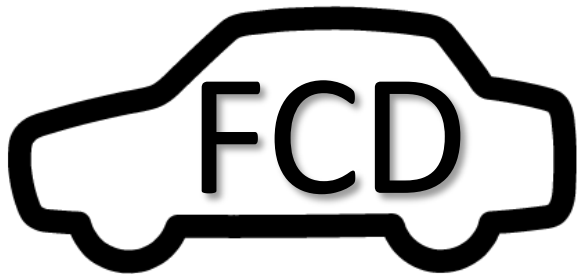
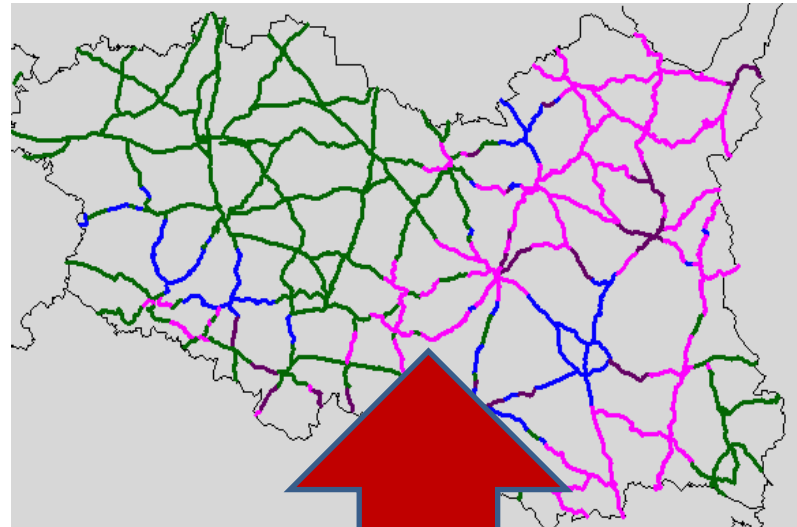
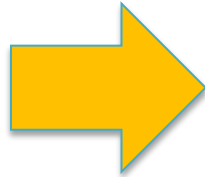
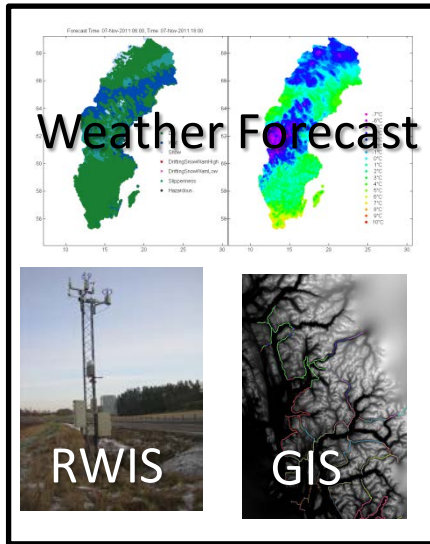
Slippery Roads



Pollution  
Monitoring

Spring Thaw

# Combination of data





# Hypothesis

- FCD => Data about the actual conditions
- Filtering and processing of signals from the FCD => Surface hard or soft
- Combination of FCD and weather modeling gives information for larger areas & possibility to determine the true status of the roads



# Project Background

- **BiFi Part 1: February 2010 to August 2011.**
  - Proof of concept; Reference measurements.
  - Initial field trials in small scale.
  - Larger field trials with version 1 of BiFi hardware mounted in small car fleet.
- **BiFi Part 2: September 2011 to July 2012**
  - BiFi system up and running.
  - Expand field trials.
  - Version 2 of the BiFi hardware.

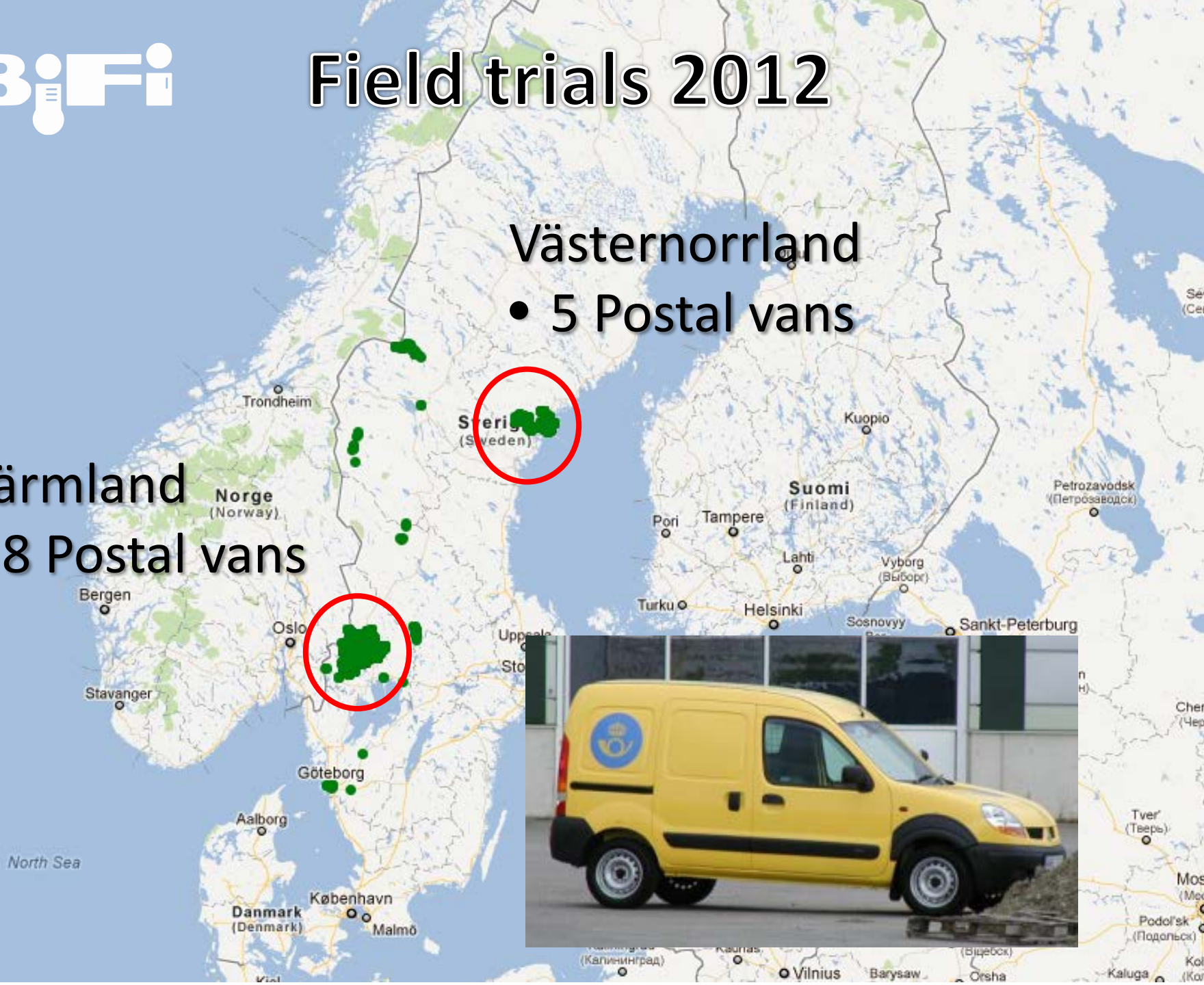
# Field trials 2012

Västernorrland

- 5 Postal vans

Värmland

- 8 Postal vans



Ytuppmjukning

Mina Bilar

Tidsperiod

Från  
12/03/2012 23:59

Till  
25/04/2012 16:01



Visningsalternativ

Låg risk

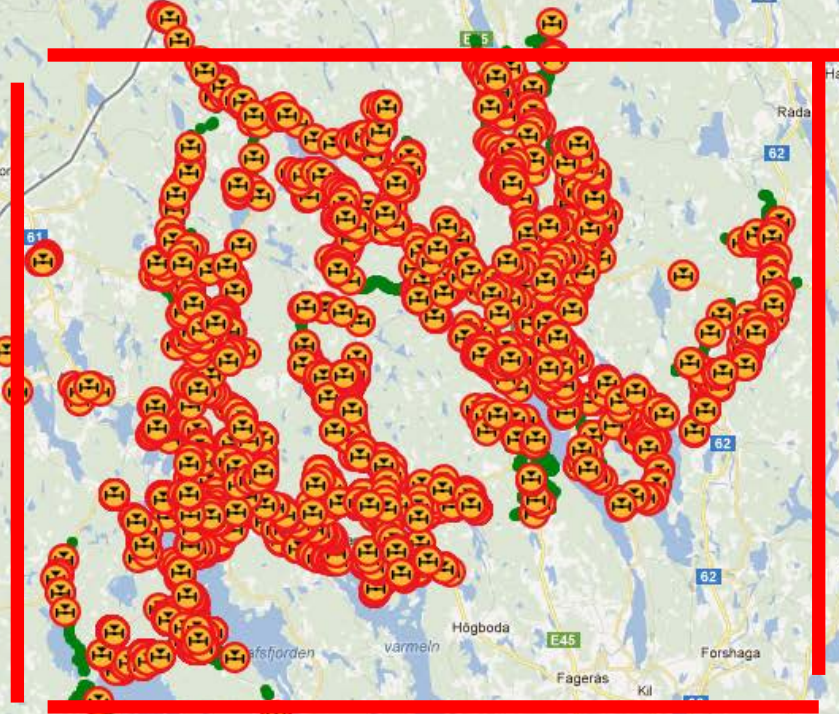
Hög risk

Beläggingskvalitet

Väglagsinformation

# March 12 – April 25 – 2012

## 8 cars



= Low bearing strength



Ytuppmjukning

Mina Bilar

Tidsperiod

Från

12/03/2012 23:59

Till

13/03/2012 23:59



Visningsalternativ

Låg risk

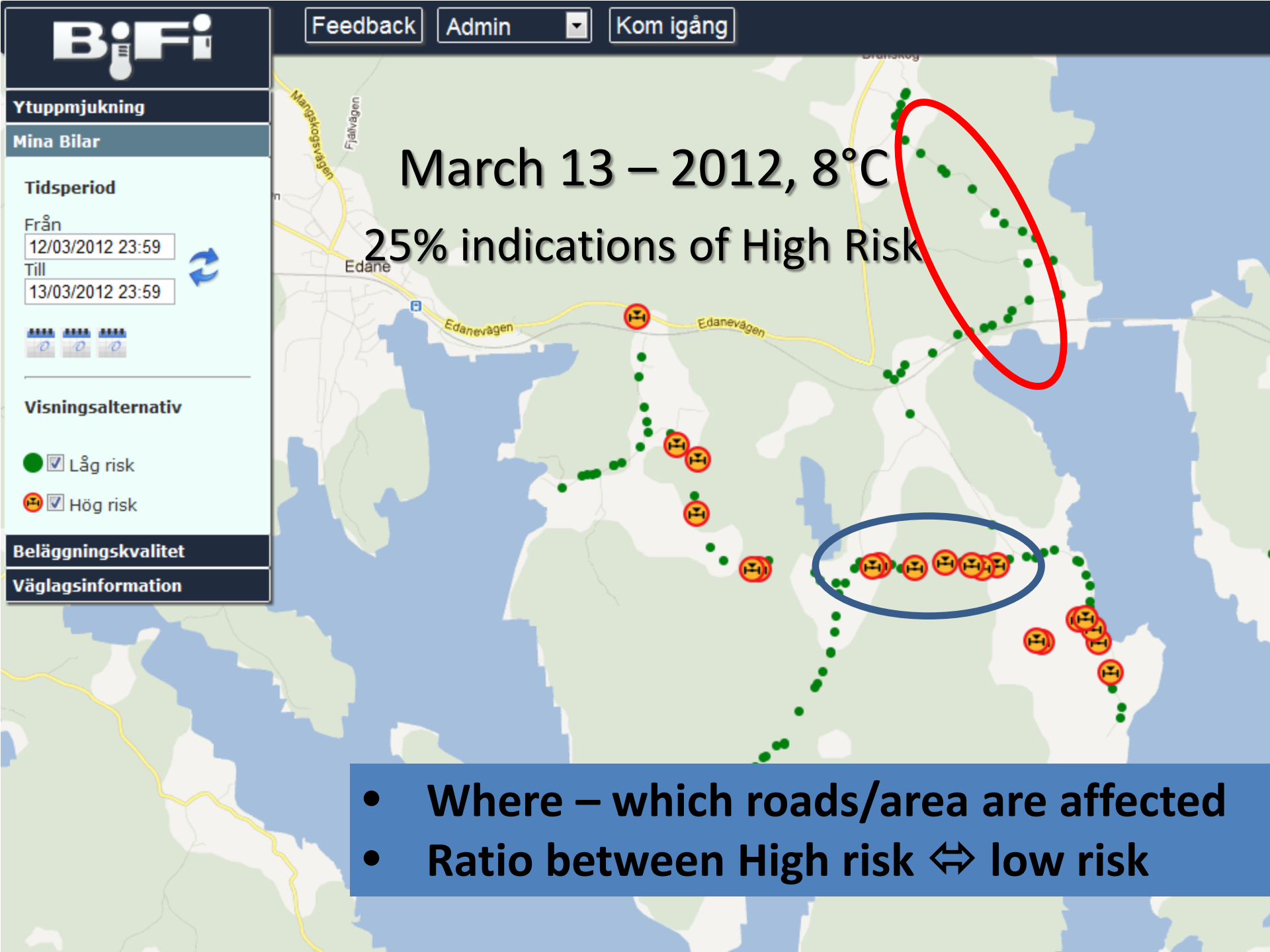
Hög risk

Beläggingskvalitet

Väglagsinformation

March 13 – 2012, 8°C  
25% indications of High Risk

- Where – which roads/area are affected
- Ratio between High risk ↔ low risk



### Ytuppmjukning

### Mina Bilar

### Tidsperiod

Från

13/03/2012 23:59



Till

14/03/2012 23:59



### Visningsalternativ

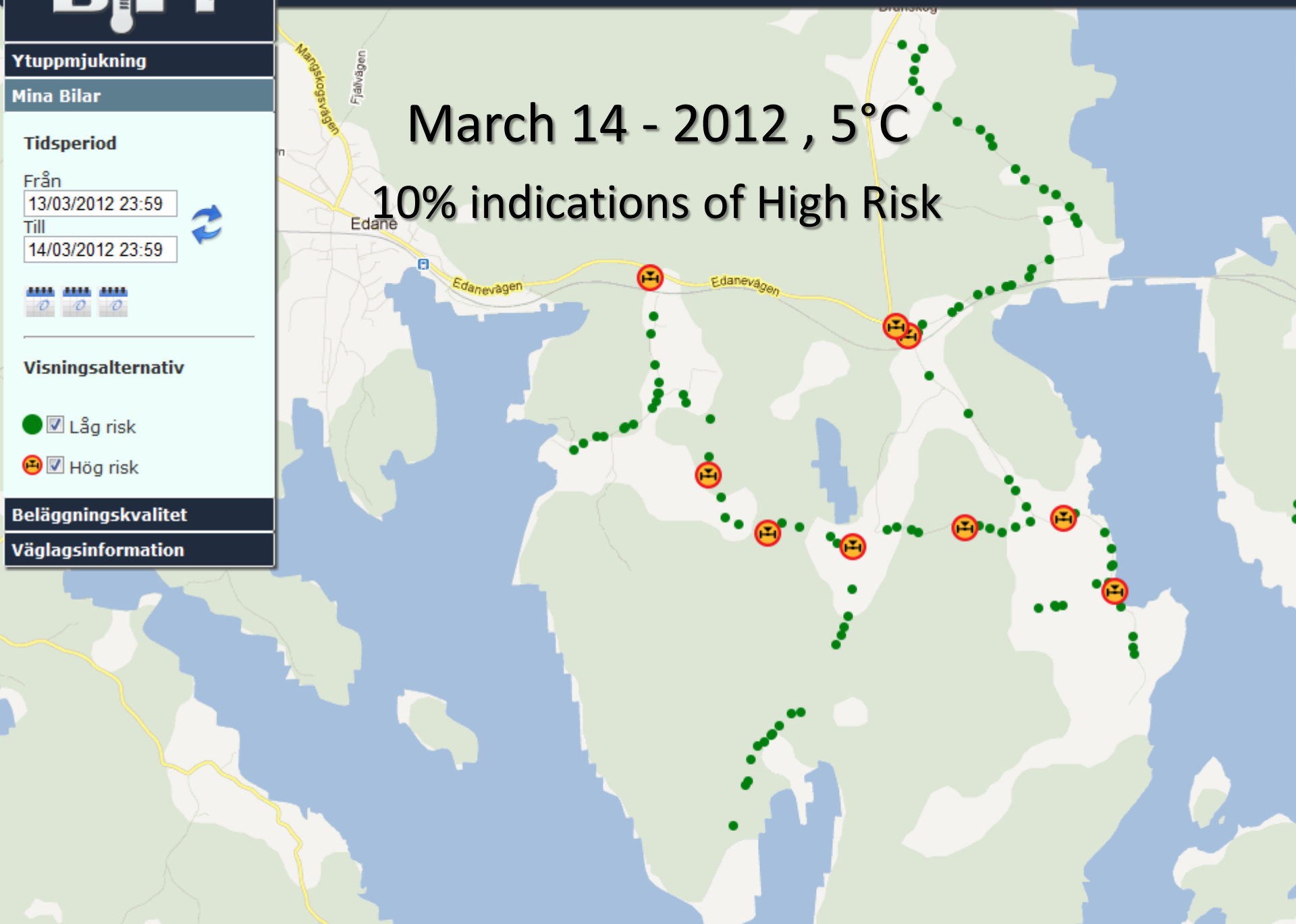
Låg risk

Hög risk

### Beläggingskvalitet

### Väglagsinformation

March 14 - 2012 , 5°C  
10% indications of High Risk



### Ytuppmjukning

### Mina Bilar

#### Tidsperiod

Från

14/03/2012 23:59

Till

15/03/2012 23:59



#### Visningsalternativ

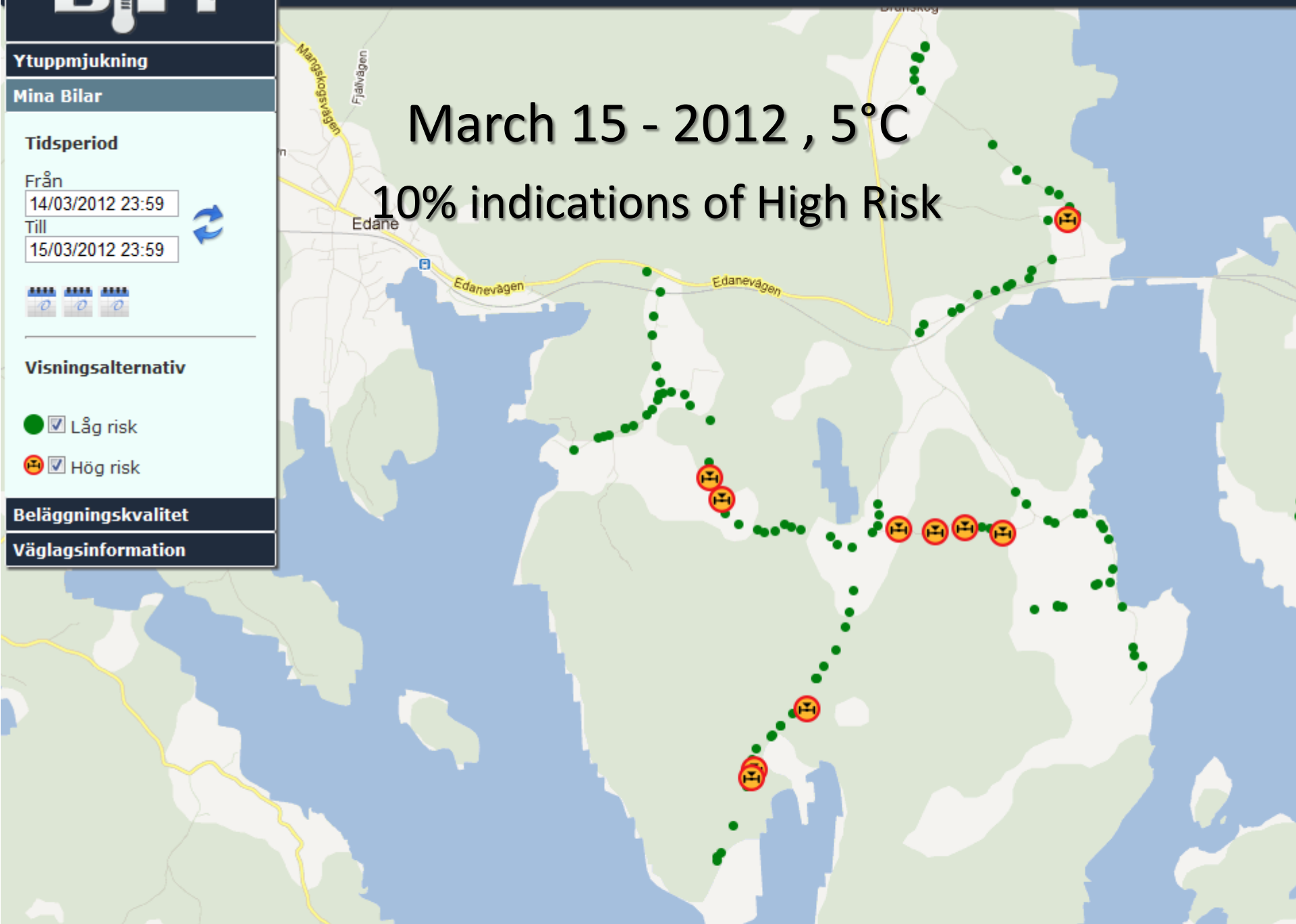
Låg risk

Hög risk

### Beläggingskvalitet

### Väglagsinformation

March 15 - 2012 , 5°C  
10% indications of High Risk



Ytuppmjukning

Mina Bilar

Tidsperiod

Från

15/03/2012 23:59

Till

16/03/2012 23:59



Visningsalternativ

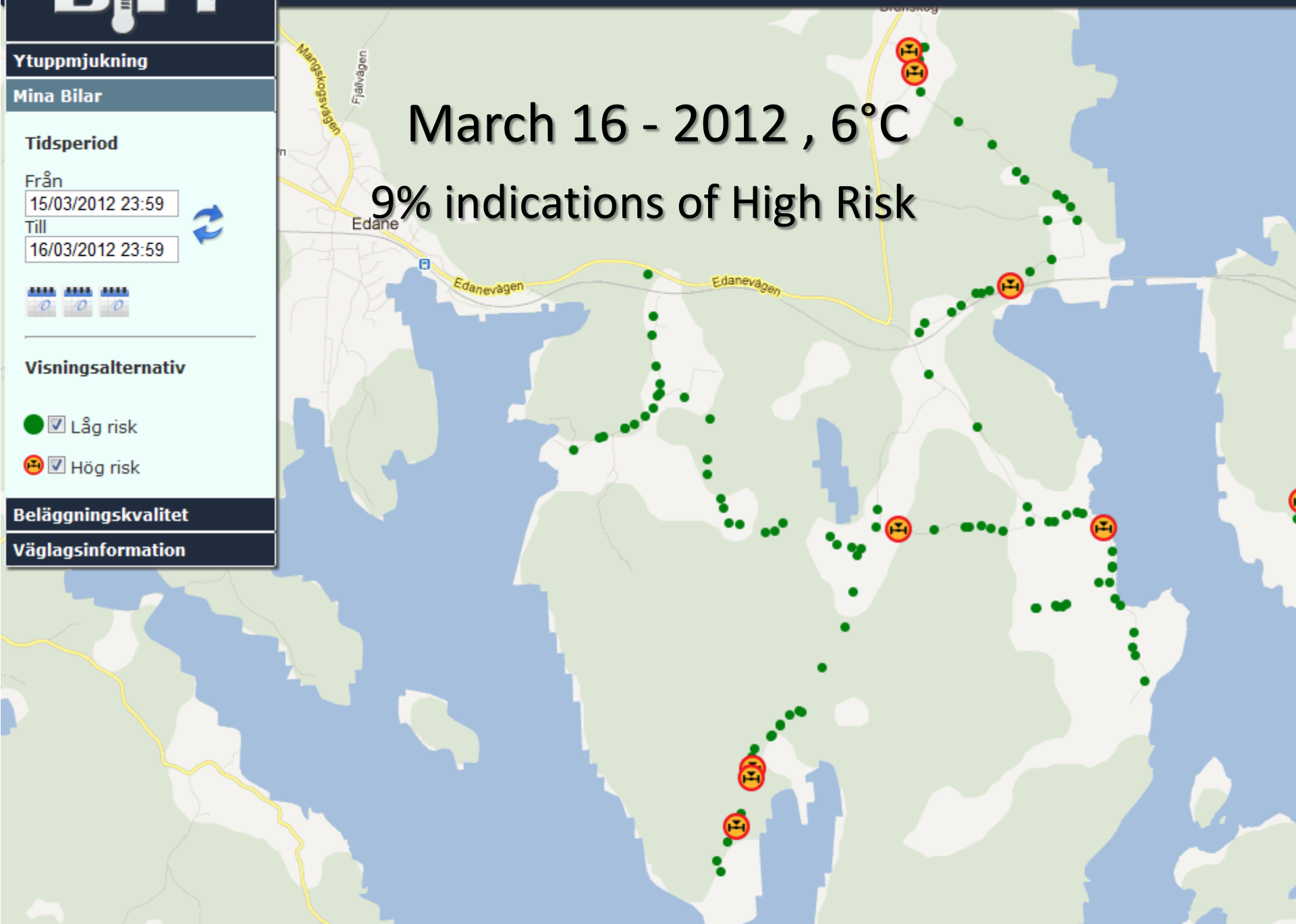
Låg risk

Hög risk

Beläggingskvalitet

Väglagsinformation

March 16 - 2012 , 6°C  
9% indications of High Risk



### Ytuppmjukning

### Mina Bilar

#### Tidsperiod

Från

18/03/2012 23:59

Till

19/03/2012 23:59



#### Visningsalternativ

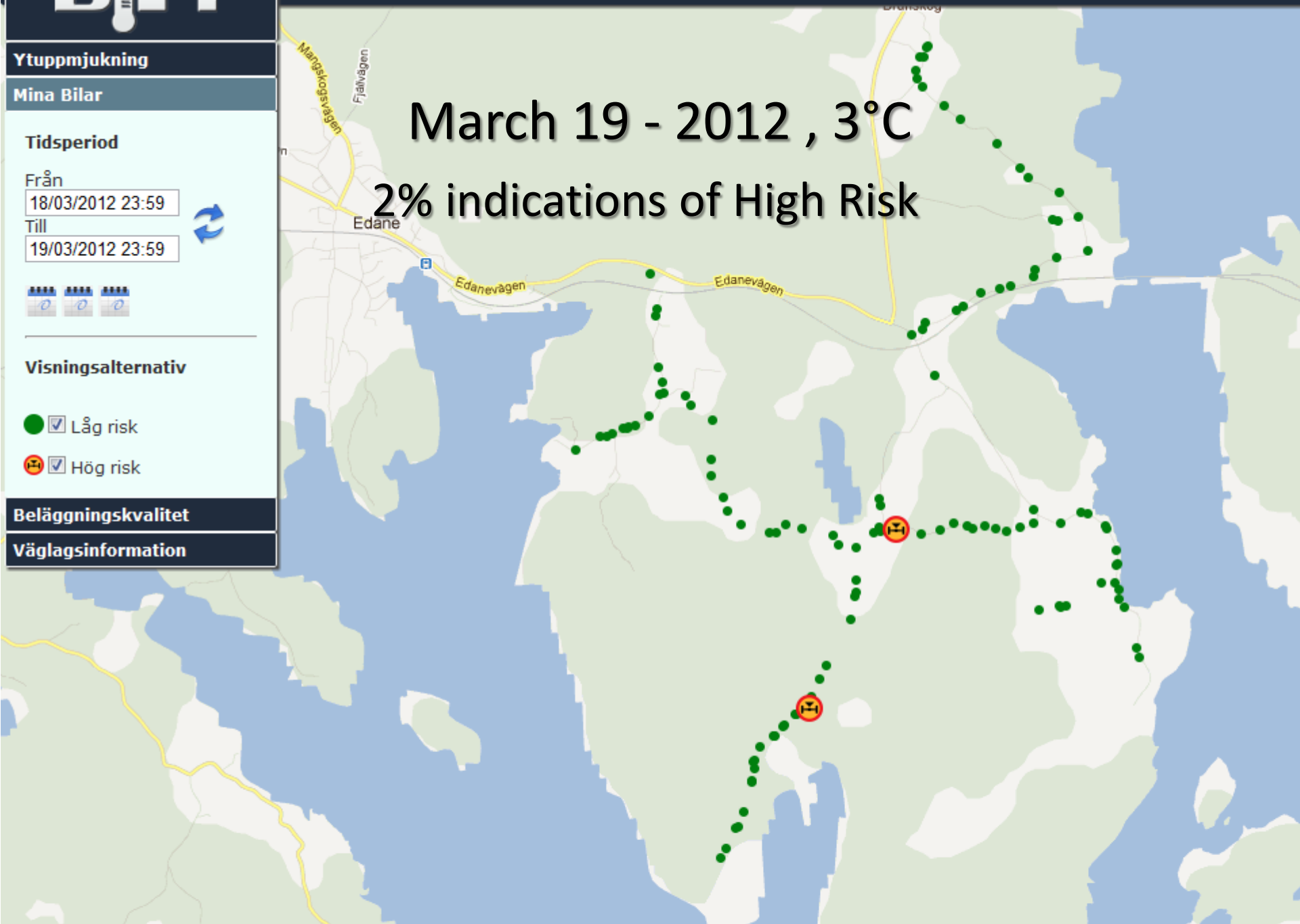
Låg risk

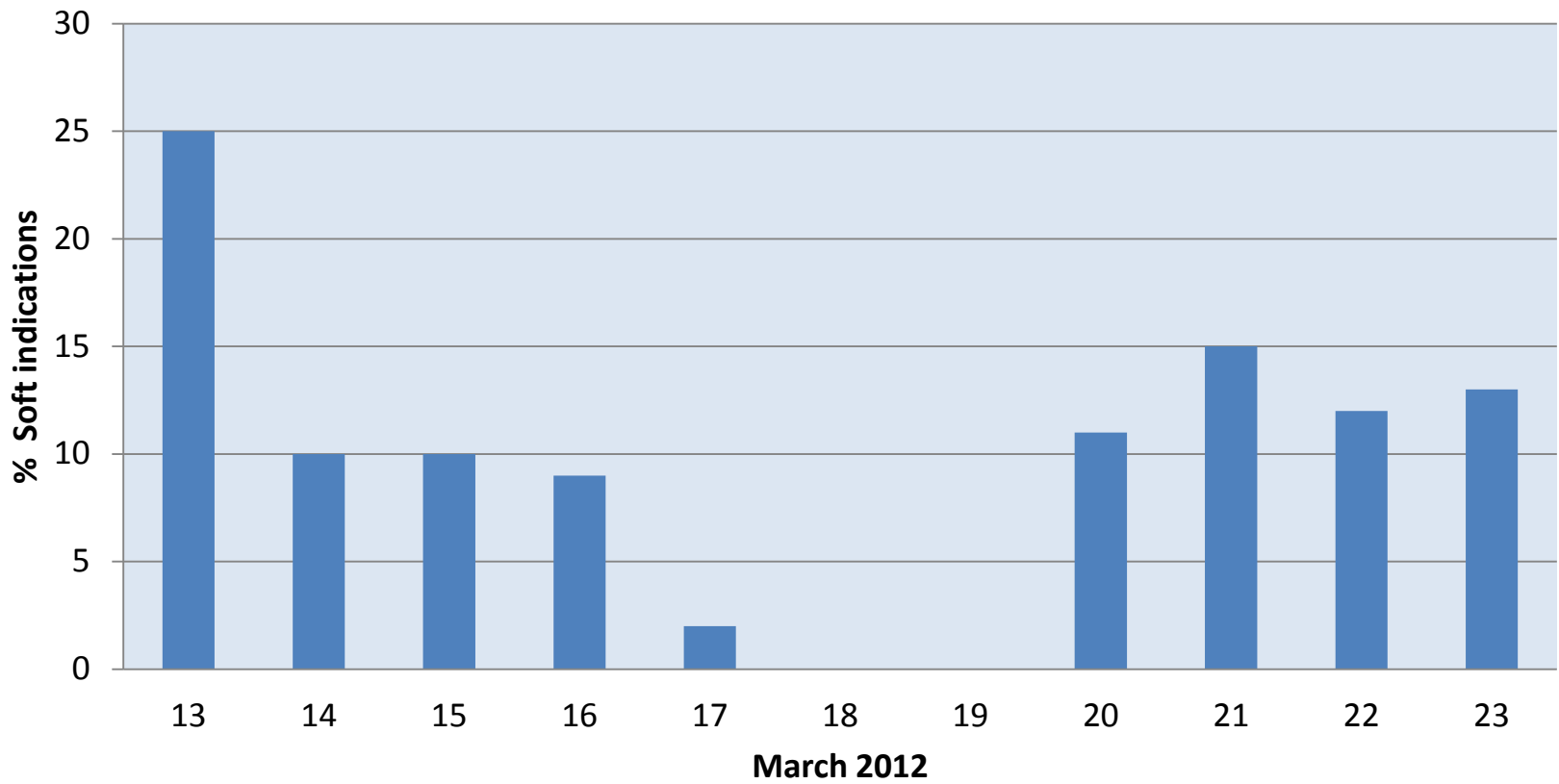
Hög risk

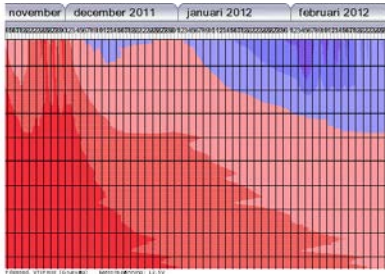
### Beläggingskvalitet

### Väglagsinformation

March 19 - 2012 , 3°C  
2% indications of High Risk







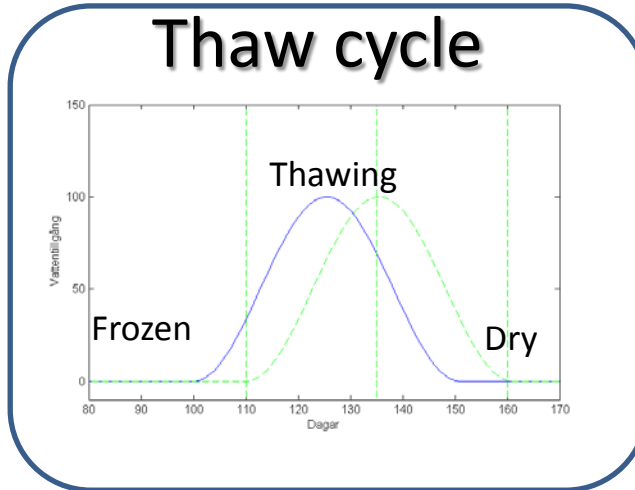
Thaw status: from frost depth meters



RWIS



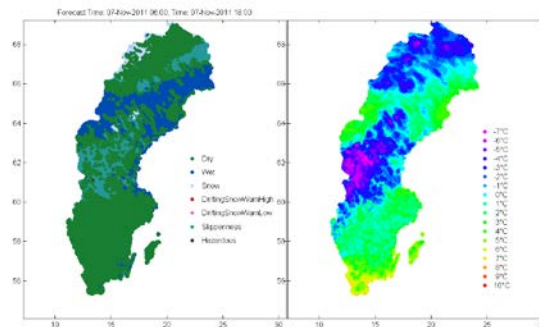
Vehicle indications



## Result

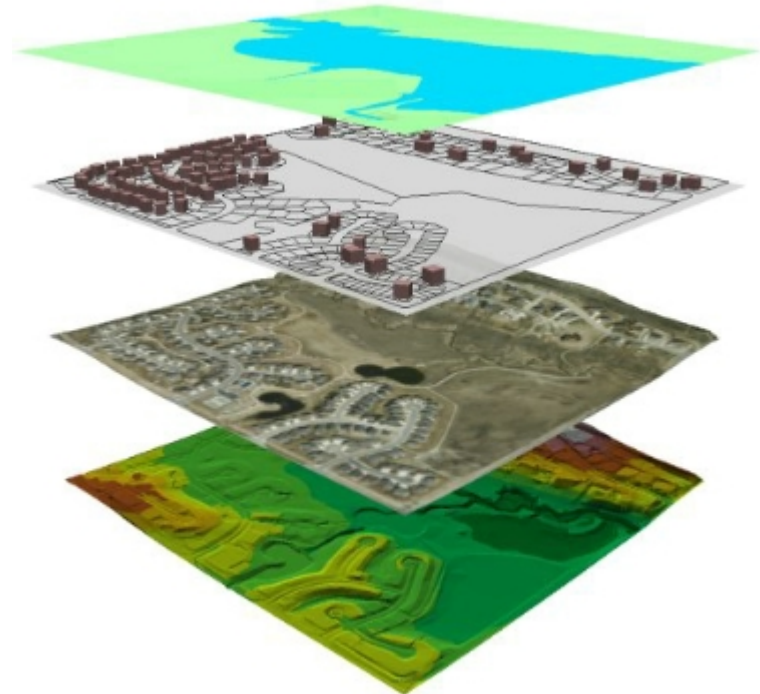
- Low
- Medium
- High

Load bearing strength



Forecast Model Results

- Energy Balance Model+ thaw cycle
- Input
  - RWIS – Air temperature, dewpoint, etc.
  - GIS – Geographical data; topography, shadowing, water, etc.
  - Weather forecast in GRIB-format.







Feedback Admin

Map Satellite White

**Ytuppmjukning**

**Prognostid**  
10/04/2012 16:00

**Visningsalternativ**

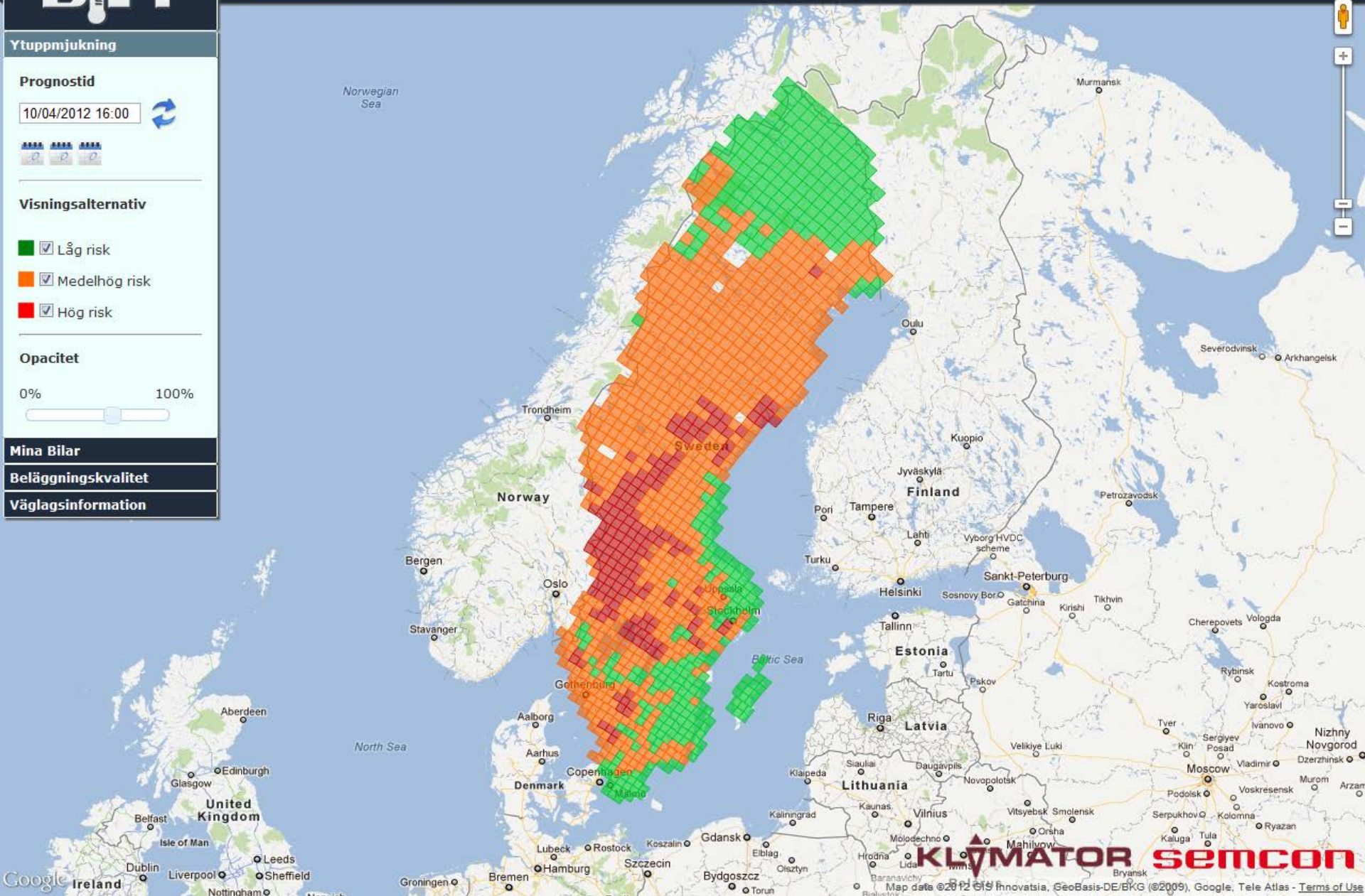
- Låg risk
- Medelhög risk
- Hög risk

**Opacitet**  
0% 100%

**Mina Bilar**

**Beläggningskvalitet**

**Väglagsinformation**





# Measurement validation

## Reference measurements



- FCD-data gives true information regarding the surface status (where & intensity)
- Combination of FCD and weather model gives:
  - Good information regarding the frost-thaw situation
  - The possibility to cover large areas
  - Valuable input to forecast models



Asfalt Quality



Slippery Roads

**We want new test areas**



Pollution  
Monitoring



Spring Thaw



# Thanks for listening!

For more information

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