

Winter Maintenance in Denmark

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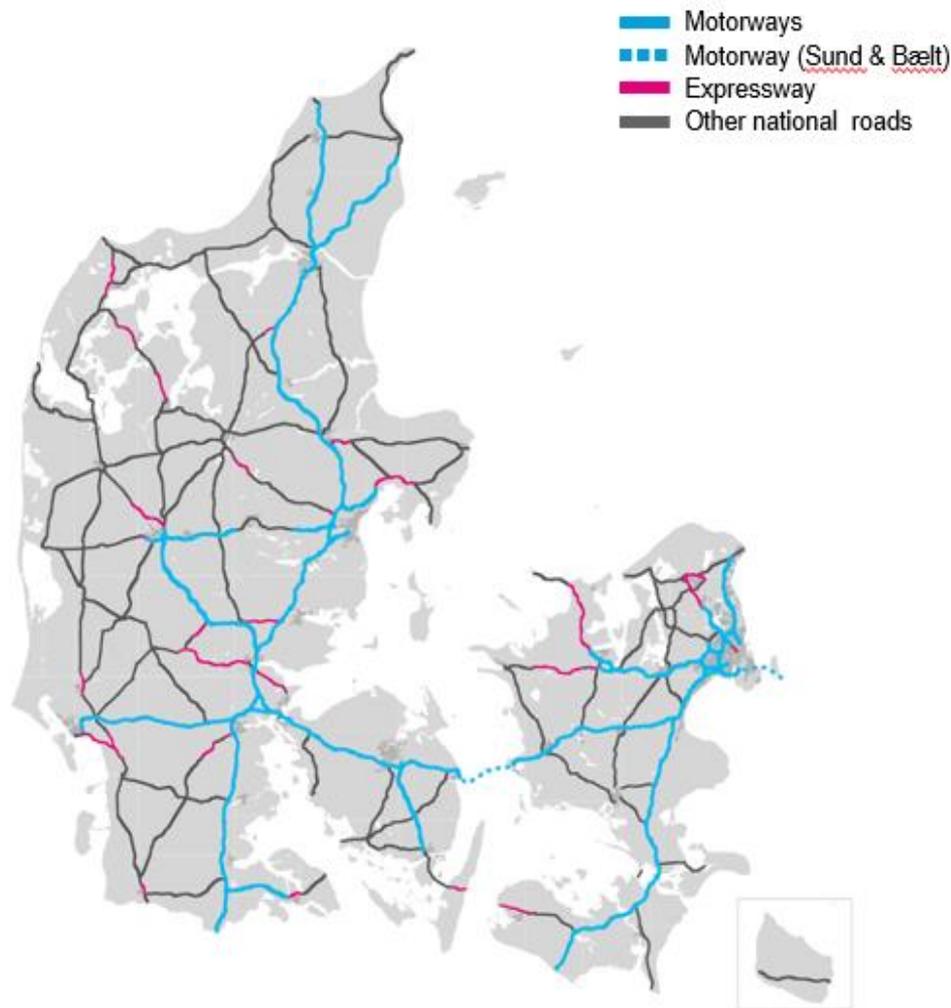


The National Road Network

Consists of **3,800 km**
1,167 km of which are motorways

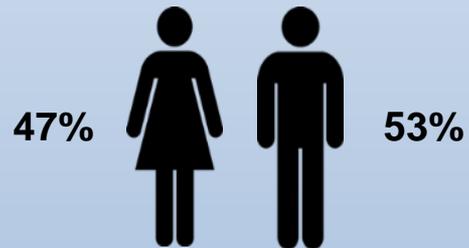
This corresponds to
approximately **5%**
of the total
public road network in Denmark (74,407 km)

Nearly **50%**
of road traffic runs on
the national road network



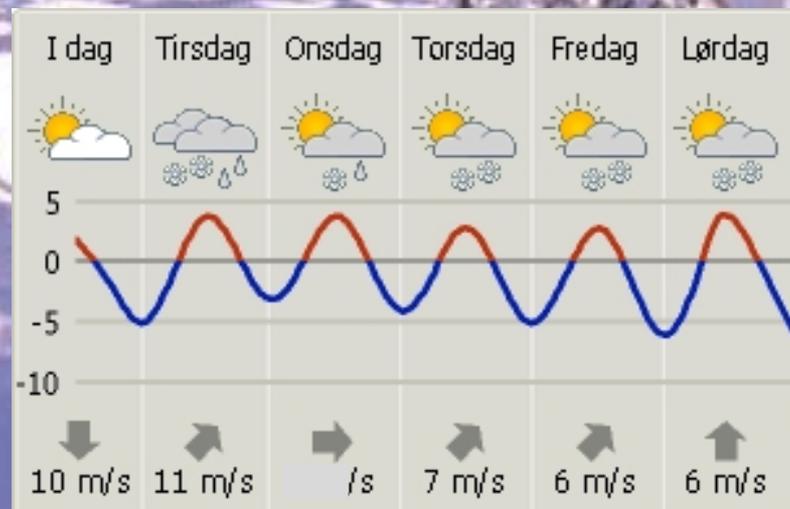
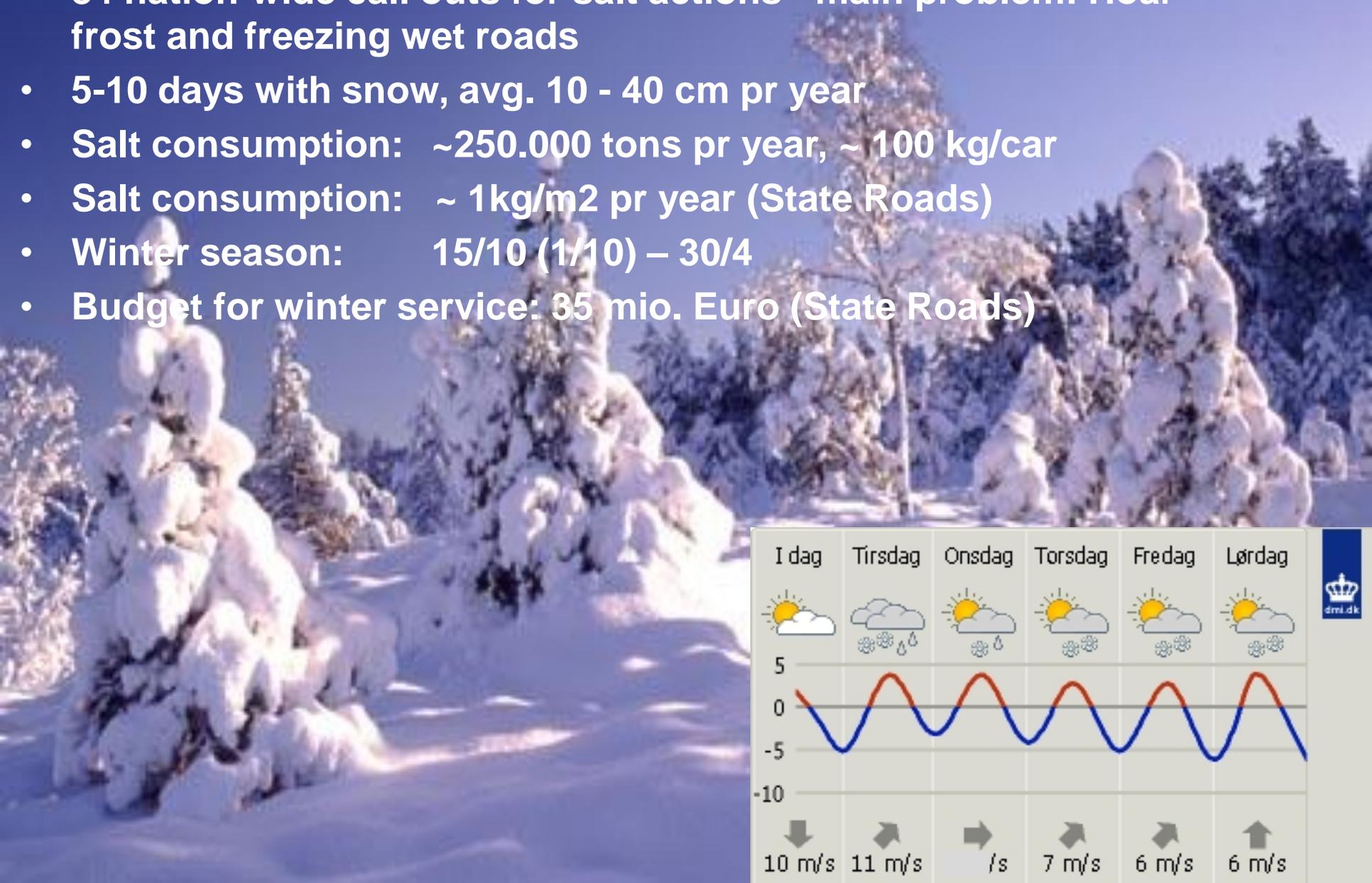
Employees in figures

886 employees

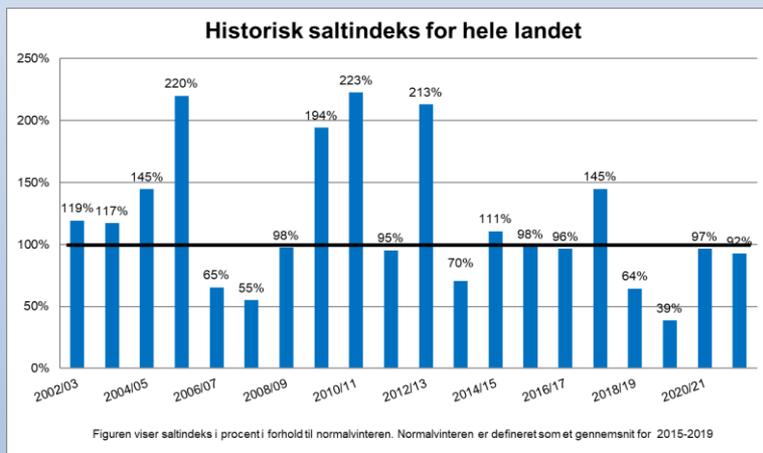


Winter in Denmark – a “normal” vinter...

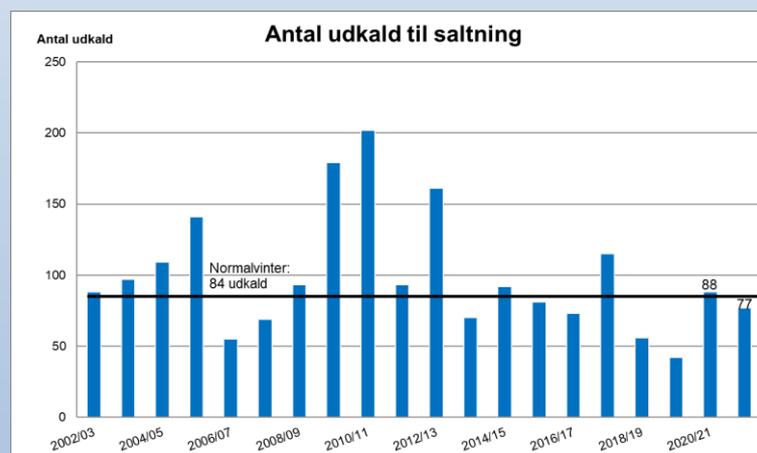
- 84 nation-wide call outs for salt actions - main problem: Hoar frost and freezing wet roads
- 5-10 days with snow, avg. 10 - 40 cm pr year
- Salt consumption: ~250.000 tons pr year, ~ 100 kg/car
- Salt consumption: ~ 1kg/m² pr year (State Roads)
- Winter season: 15/10 (1/10) – 30/4
- Budget for winter service: 35 mio. Euro (State Roads)



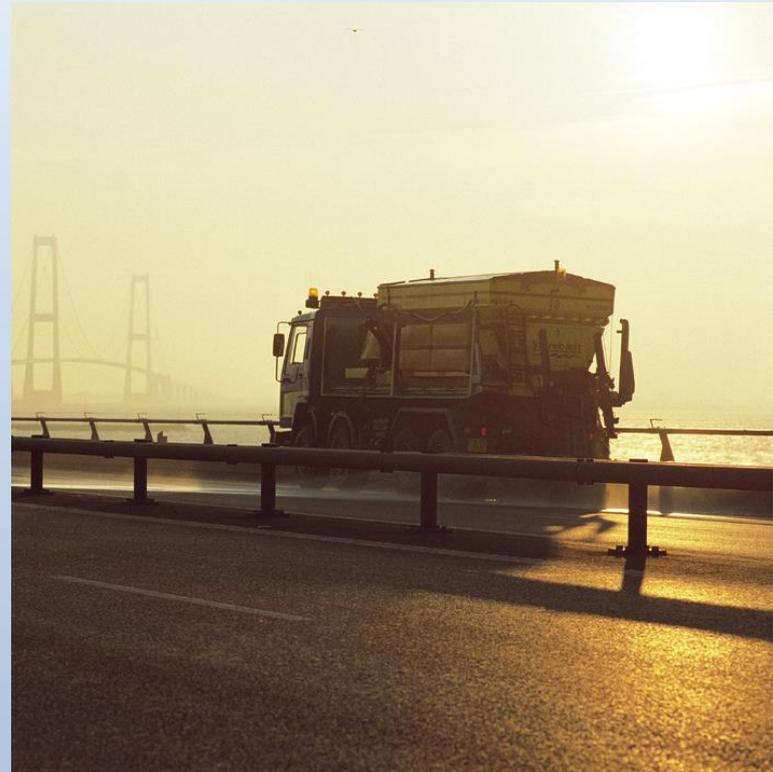
Salt index



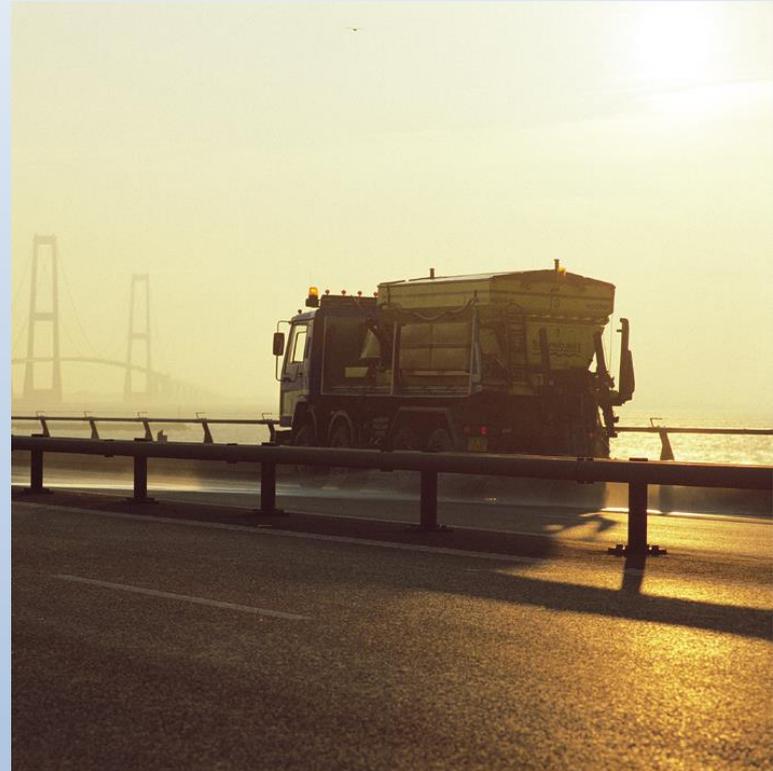
Number of call-outs



Typical Danish Winter



Typical Danish Winter



Performance Management – Service Level

Kørebaner			
Vejklasse	Vinter- vejklasse	Vejtype	Service mål og metode
Gennemfartsveje	Klasse I	<p>Omfatter veje som udgør det trafikale bindeled inden for regionen, eksempelvis motorveje og højst prioriterede indfalds- og omfartsveje.</p> <p>Veje til hospitaler, brand- og redningsveje, beredskaber, livsvigtige institutioner o.l.</p>	<p>Saltning hhv. snerydning udføres på <u>alle tider af døgnet</u>.</p> <ul style="list-style-type: none"> • Glatførebekæmpelse tilstræbes foretaget ved præventiv saltning efter behov. • Snerydning igangsættes efter behov, således at færdslen i videst muligt omfang kan afvikles uden gener.
Fordelingsveje	Klasse II	<p>Omfatter veje som udgør bindeledet mellem gennemfartsveje og lokalvejene, eksempelvis veje mellem enkelte bysamfund eller kvarterer i større byer, fordelingsveje i industri- og boligområder, vigtige P-pladser o.l.</p>	<p>Saltning hhv. snerydning udføres som minimum <u>mellem kl. 5.00 og 18.00.⁴⁾</u></p> <ul style="list-style-type: none"> • Glatførebekæmpelse foretages ved konstateret glatføre og kun inden for nævnte tidsrum. • Snerydning igangsættes efter behov inden for nævnte tidsrum, således at færdslen kan afvikles i videst muligt omfang uden væsentlige gener.

Examples:



Performance Management- Service Level

Examples

Kørebaner			
Vejklasse	Vinter- vejklasse	Vejtype	Servicemål og metode
Lokalveje	Klasse III	Omfatter lokalveje og pladser, som har <u>betydning for afvikling af den lokale trafik</u> , eksempelvis boligveje og veje på landet, samt øvrige P pladser o.l.	<p>Saltning/grusning hhv. snerydning udføres <u>kun på hverdage, inden for normal arbejdstid²⁾</u>.</p> <p>Indsats igangsættes når opgaverne på klasse I til II veje tillader det og kun inden for nævnte tidsrum.</p>
Øvrige veje	Klasse IV	Omfatter veje til enkelt-bruger områder og mindre boligveje.	<p>Saltes/grusses og sneryddes <u>kun undtagelsesvis</u>.</p>



Equipment, Routes & Contracts

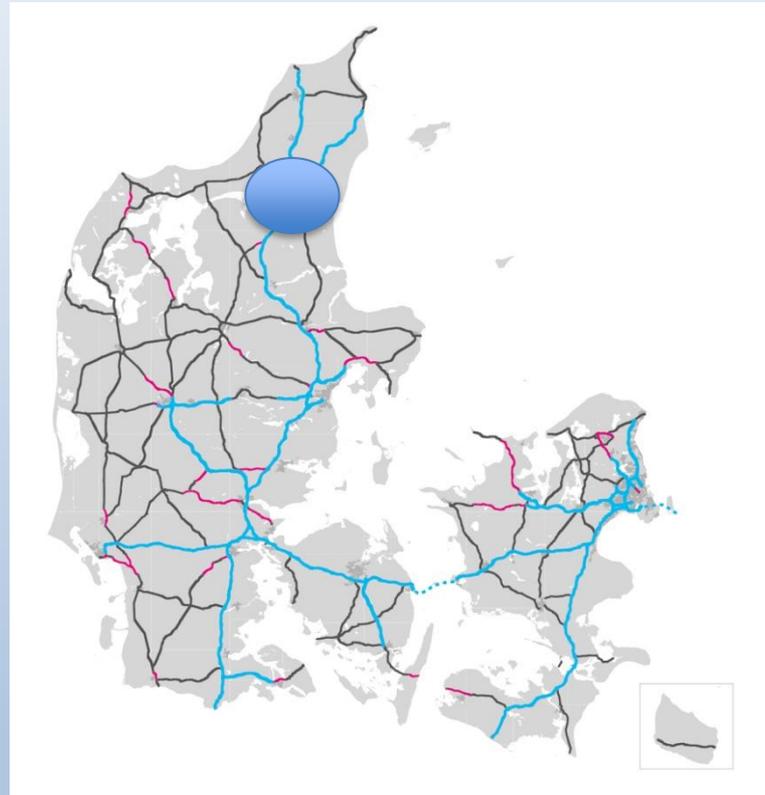
State Roads:
~ 175 salt spreaders
~ 450 ploughs



State Roads:
~ 6.100 km route length
~ 100 Salting routes
~ 60 km as avg. length
~ 25 Contractors



The Winter Central in Aalborg



-  Motorways
-  Motorway (Sund & Bælt)
-  Expressway
-  Other national roads



The Winter Central

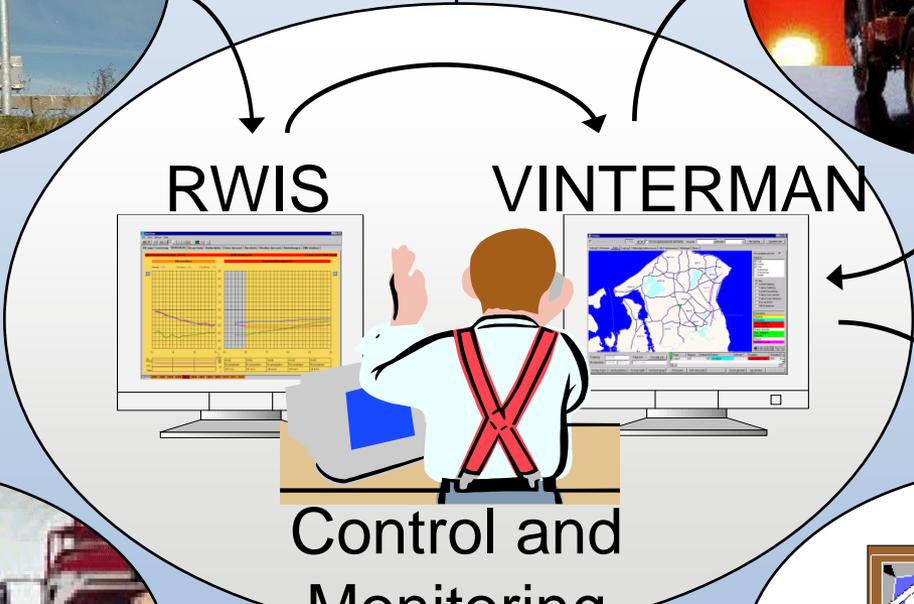
Weather & forecasts



Call-out



Winter Central



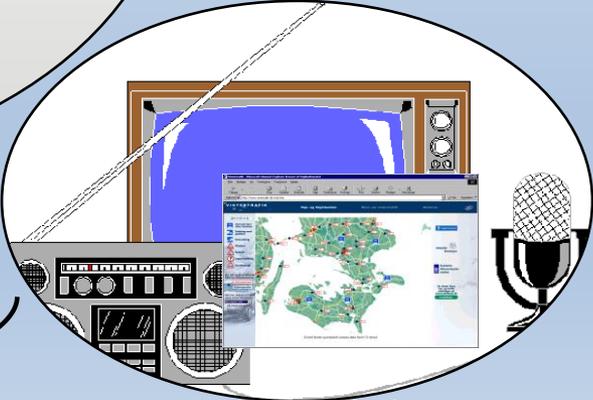
RWIS

VINTERMAN

Control and Monitoring



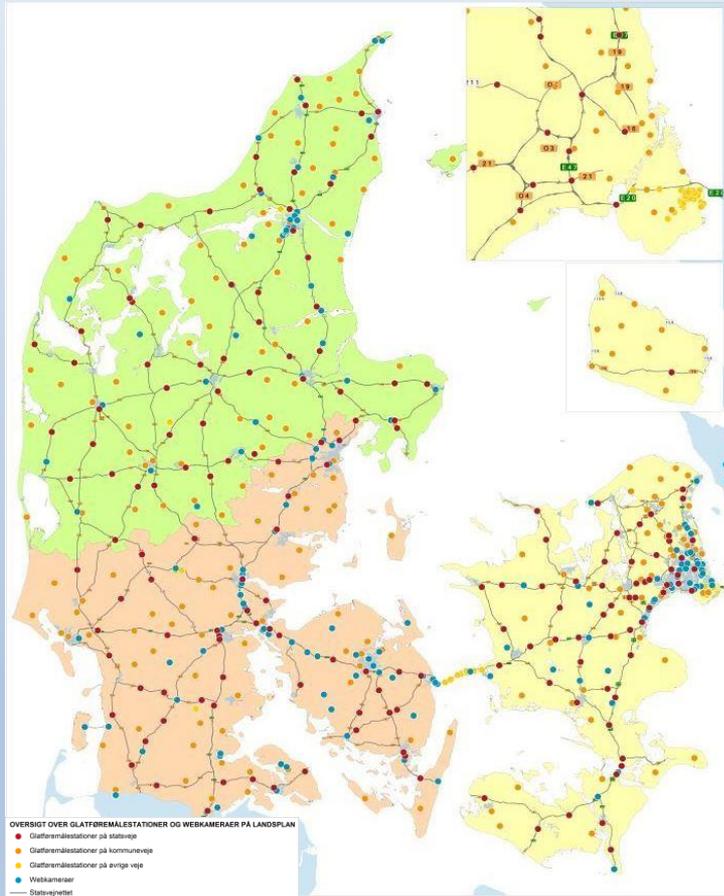
Road Users



Veidirektoratet

Information

Measuring Stations and Cameras



500 Measuring stations

500 IOT - stations (municipalities)

400 Cameras



Road Weather Station

- Road temperature
- Road resistance
- Air temperature
- Relative air humidity
- (Water thickness)
- (Residual salt)
- (Wind direction)
- (Wind speed)
- (Precipitation)
- (Visibility)
- (Freezing point)
-



RWIS Structure



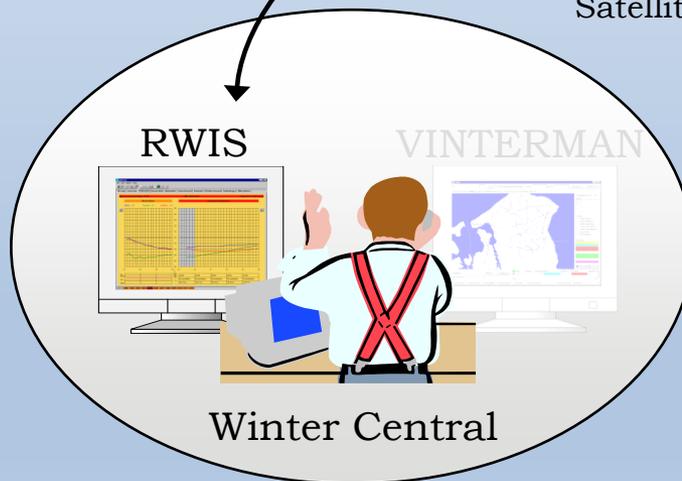
...



Measurements
every 5. minute

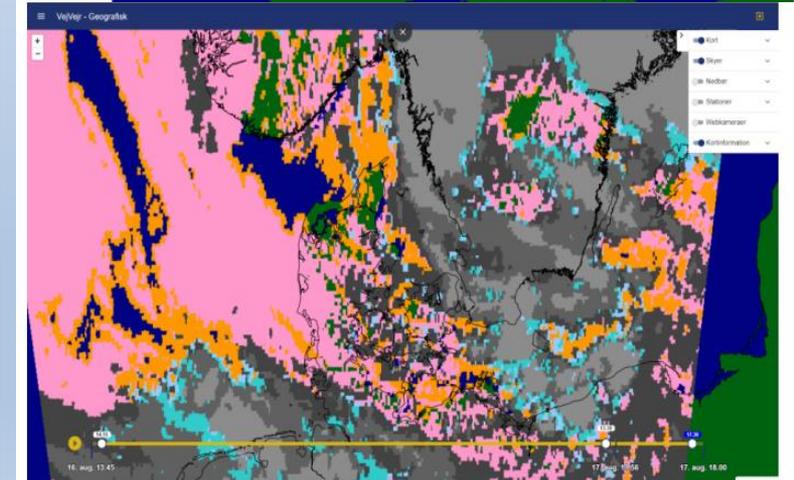
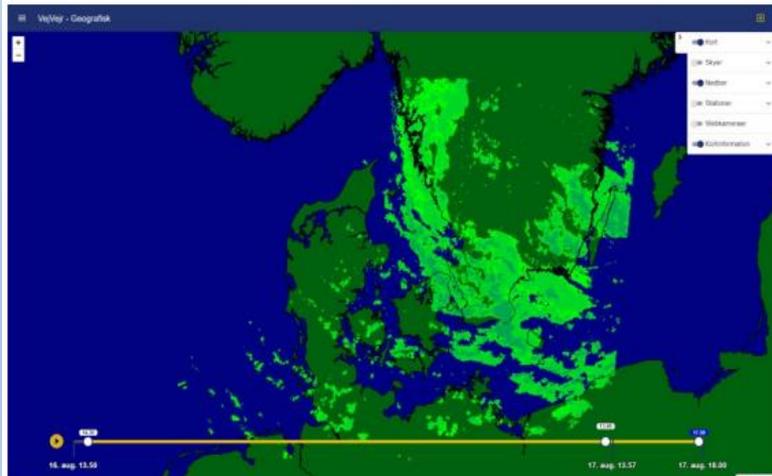
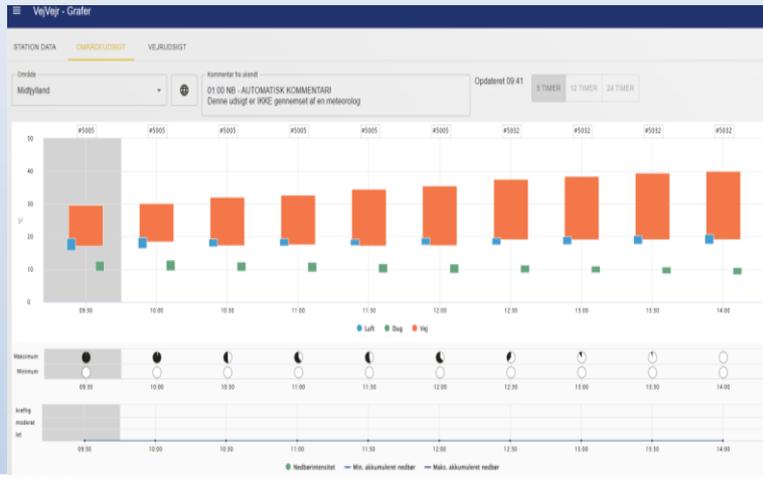


Prognoses for each station (24h)
Regional 24 hours prognoses
Radar images
Satellite images



Winter Central

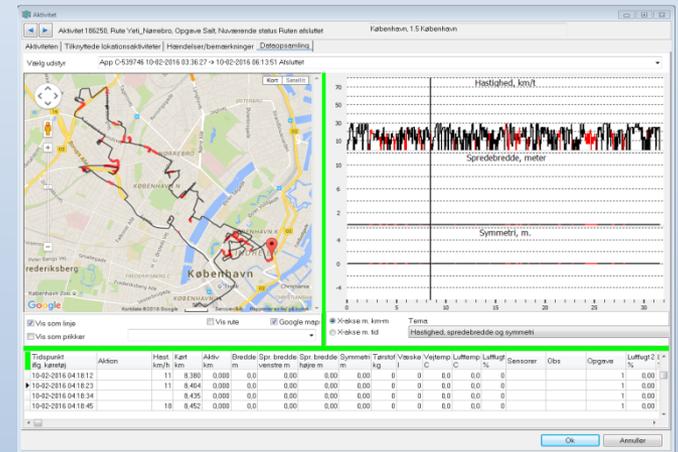
Examples from VejVejr (Road Weather)



Main Winterman Tasks



Handling the entire callout process
Documentation
Automatically invoicing
Equipment maintenance
Road weather stations and webcams
Weather Information



The screenshot shows a software interface with a map of Copenhagen on the left and a data table on the right. The table has columns for 'Støt', 'Års', 'Tid', 'Afbryng', 'Hæms', 'Rog', 'Hæms', 'Rog', 'Hæms', 'Rog'. The data rows show various measurements for different road sections.

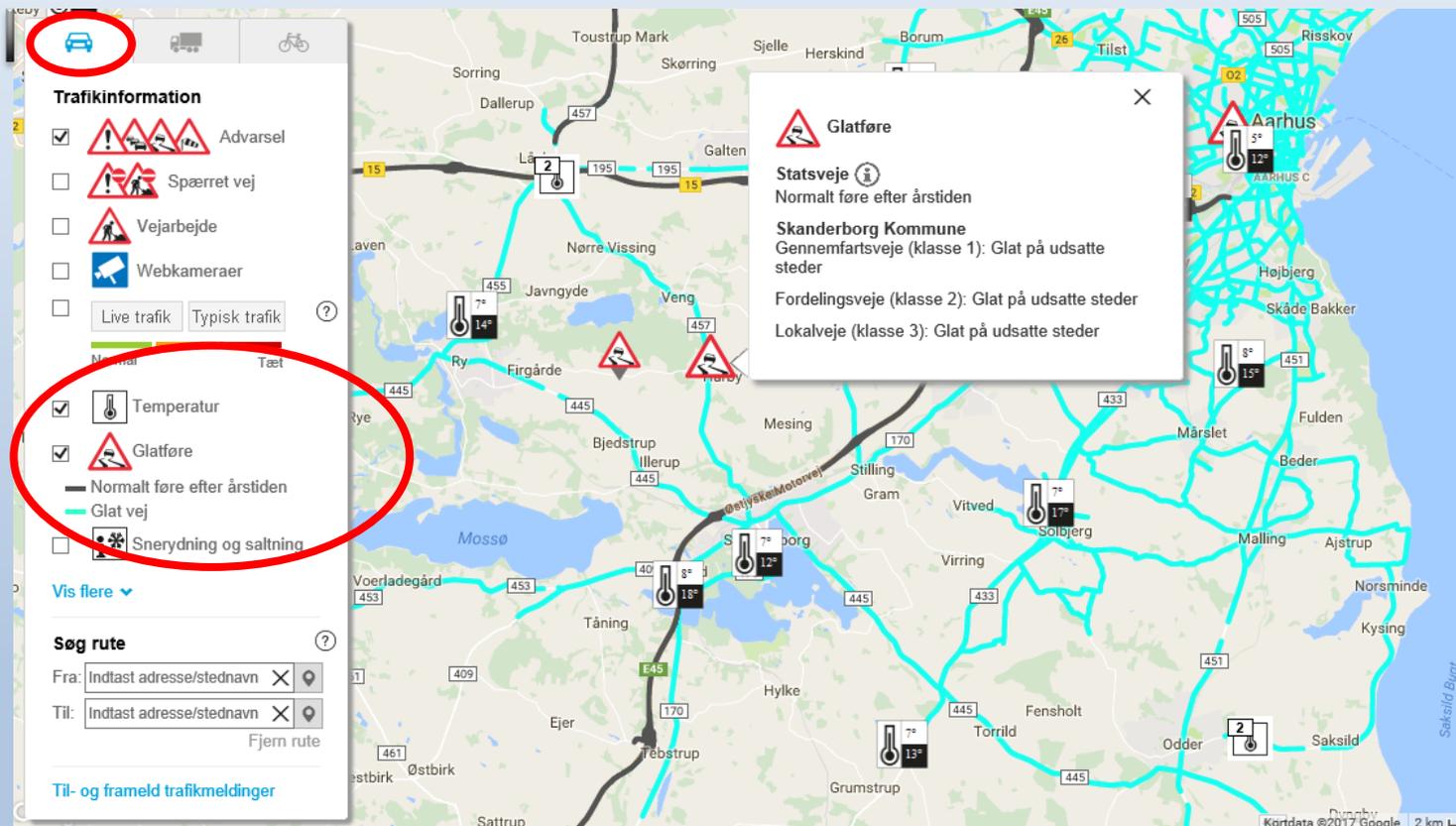
Støt	Års	Tid	Afbryng	Hæms	Rog	Hæms	Rog	Hæms	Rog
82 23	05 42	2 19	Fæst	2009 54	2009 54	2009 54	2009 54	2009 54	2009 54
18 39	18 41	202	Fæst	2009 54	2009 54	2009 54	2009 54	2009 54	2009 54
04 17	00 23	2 06	Fæst	2009 54	2009 54	2009 54	2009 54	2009 54	2009 54
03 38	05 36	1 58	Fæst	2009 54	2009 54	2009 54	2009 54	2009 54	2009 54
03 28	05 41	2 13	Fæst	2009 54	2009 54	2009 54	2009 54	2009 54	2009 54
03 21	05 20	1 59	Fæst	2009 54	2009 54	2009 54	2009 54	2009 54	2009 54
03 53	13 52	4 59	Fæst	2009 54	2009 54	2009 54	2009 54	2009 54	2009 54
03 28	05 56	2 28	Fæst	2009 54	2009 54	2009 54	2009 54	2009 54	2009 54
03 39	05 22	1 44	Fæst	2009 54	2009 54	2009 54	2009 54	2009 54	2009 54
02 59	05 22	2 23	Fæst	2009 54	2009 54	2009 54	2009 54	2009 54	2009 54
03 55	04 52	1 46	Fæst	2009 54	2009 54	2009 54	2009 54	2009 54	2009 54
01 56	05 46	6 50	Fæst	2009 54	2009 54	2009 54	2009 54	2009 54	2009 54
04 15	05 54	1 39	Fæst	2009 54	2009 54	2009 54	2009 54	2009 54	2009 54
07 51	05 54	3 03	Fæst	2009 54	2009 54	2009 54	2009 54	2009 54	2009 54
19 33	11 27	1 54	Fæst	2009 54	2009 54	2009 54	2009 54	2009 54	2009 54
02 54	05 15	1 51	Fæst	2009 54	2009 54	2009 54	2009 54	2009 54	2009 54
02 55	04 47	1 52	Fæst	2009 54	2009 54	2009 54	2009 54	2009 54	2009 54
02 43	04 59	3 07	Fæst	2009 54	2009 54	2009 54	2009 54	2009 54	2009 54
04 03	05 54	1 51	Fæst	2009 54	2009 54	2009 54	2009 54	2009 54	2009 54
03 17	05 09	1 52	Fæst	2009 54	2009 54	2009 54	2009 54	2009 54	2009 54
04 03	04 46	1 55	Fæst	2009 54	2009 54	2009 54	2009 54	2009 54	2009 54
04 07	06 27	1 50	Fæst	2009 54	2009 54	2009 54	2009 54	2009 54	2009 54
03 31	04 17	1 46	Fæst	2009 54	2009 54	2009 54	2009 54	2009 54	2009 54
03 56	05 24	2 18	Fæst	2009 54	2009 54	2009 54	2009 54	2009 54	2009 54
22 23	00 19	1 56	Fæst	2009 54	2009 54	2009 54	2009 54	2009 54	2009 54
02 58	04 36	1 38	Fæst	2009 54	2009 54	2009 54	2009 54	2009 54	2009 54

Vintertrafik.dk (Winter Traffic)

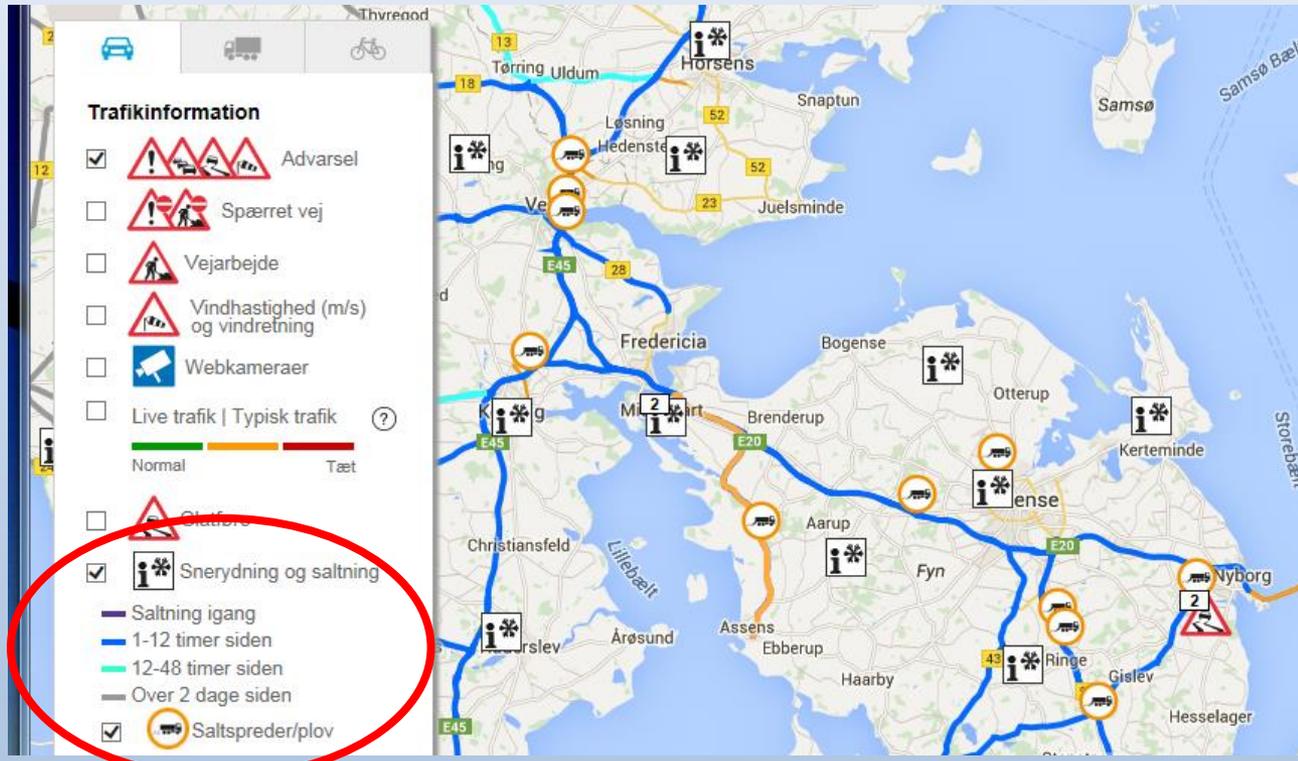
The screenshot shows the Vintertrafik.dk website interface. At the top, there is a navigation bar with the logo of Vejdirektoratet and menu items: TRAFIKINFO, PROJEKTER, VEJSEKTOR, VIDEN OG DATA, OM OS. Below this is a secondary navigation bar: LOKAL TRAFIKINFO, FÆRGER, VEJARBEJDE, APPS, GPS, FOR ERHVERV, BAG OM TRAFIKKEN. The main content area features a map of Denmark with various icons representing road conditions. A sidebar on the left, titled 'Trafikinformation', contains several checked options: Advarsel, Spærret vej, Vejarbejde, Webkameraer, Live trafik | Typisk trafik, Temperatur, Glatføre, and Snerydning og saltning. Below these are color-coded bars for salt application timing: Saltning igang (purple), 1-12 timer siden (blue), 12-48 timer siden (green), and Over 2 dage siden (grey). There is also an unchecked option for Saltspreder/plov. At the bottom of the sidebar is a search bar labeled 'Søg rute' with a 'Fra' field containing 'Indtast adresse/stednavn'. The map itself shows a network of roads with various icons, including snowflakes and salt application symbols. Two red circles highlight specific icons in the top left corner of the map area.

Select the top between road lanes and paths

Winter announcement on vintertrafik.dk



Last salting on vintertrafik.dk



Spreaders with data collection will appear if marked in Winterman (MDSS)

Webcams & temperatures on vintertrafik.dk

The screenshot displays the 'vintertrafik.dk' website interface. On the left, a sidebar menu titled 'Trafikinformation' contains several options, with 'Webkameraer' and 'Temperatur' highlighted by red circles. The main area shows a map of Denmark with various road segments color-coded by traffic conditions. A pop-up window titled 'Visby - N' shows a live webcam view of a road, with the text 'Rute 11 - Oddesundvej ved Visby Å. Kameraet peger mod nord retning Thisted.' and a timestamp of '08:51:03'. The map also shows temperature indicators for various locations, such as -7°C and -8°C.

Trafikinformation

- Advarsel
- Spærret vej
- Vejarbejde
- Webkameraer**
- Live trafik / Typisk trafik
- Temperatur**
- Glatføre
- Snerydning og saltning

Normal Tæt

Saltning igang
1-12 timer siden
12-48 timer siden
Over 2 dage siden
Saltspredning/plov

Vis flere

Visby - N
Rute 11 - Oddesundvej ved Visby Å.
Kameraet peger mod nord retning Thisted.
08:51:03

Vis alle webkameraer

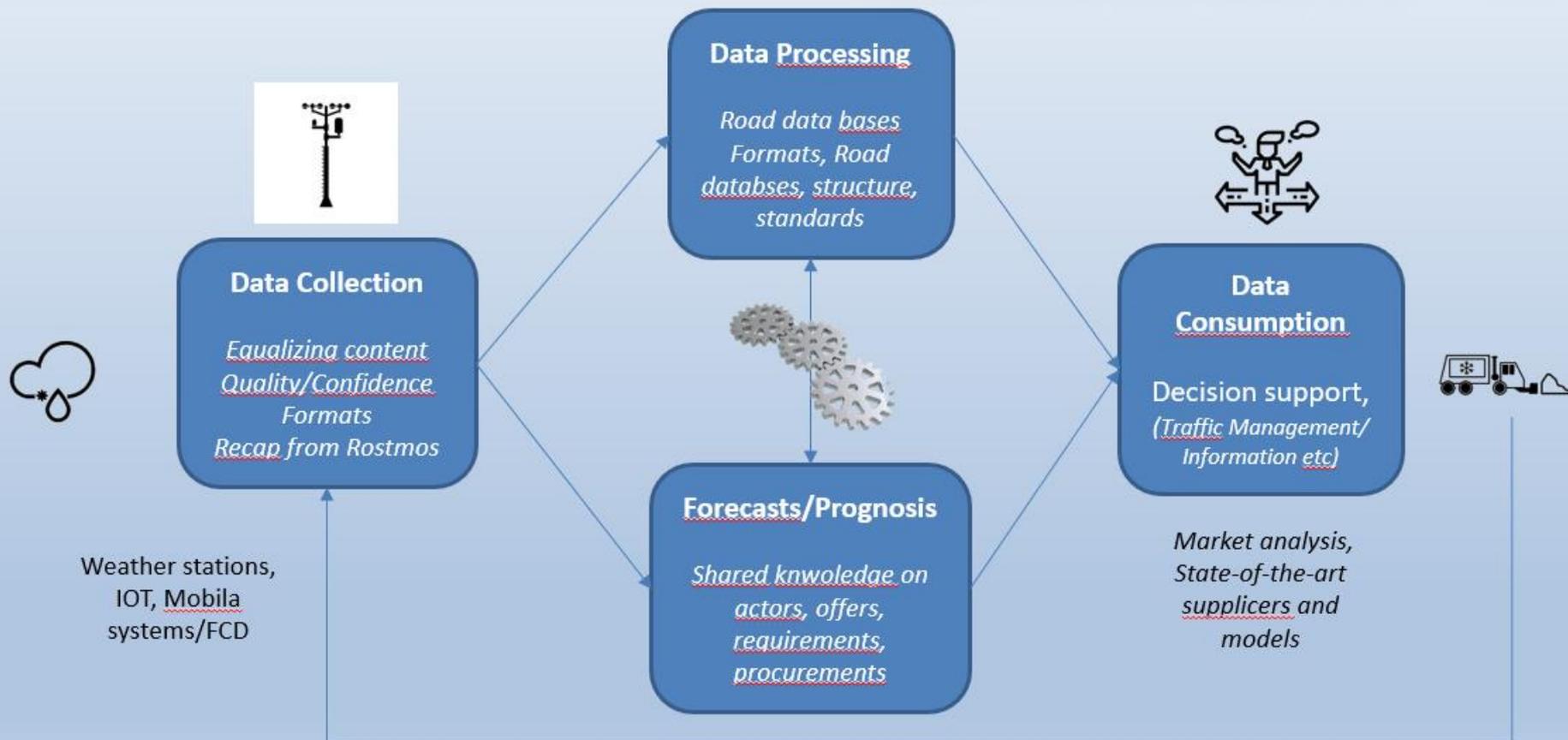
Spreaders with data collection will appear if marked in Winterman (MDSS)



W.R.i.P

WINTER • ROAD • INTELLIGENCE • PROJECT

WRIP



Test sites:

Sagån

Bergfors North



Bergfors



Test of IOT- measuring stations

Company	Country
Snower Oy	Finland
Volue	Norway
Campbell Scientific	UK
Decentlab GmbH	Switzerland
Vaisala Oy	Finland
Tectal	Norway
Mowic AB	Sweden
Klimator AB	Sweden
Cordulus/Fieldsense	Denmark
Edeva	Sweden

Test Sites:

E8 Borealis

Bjorli Test Center



Thank You...

