MetSense | 2DRoad

A New Road Weather System Paradigm

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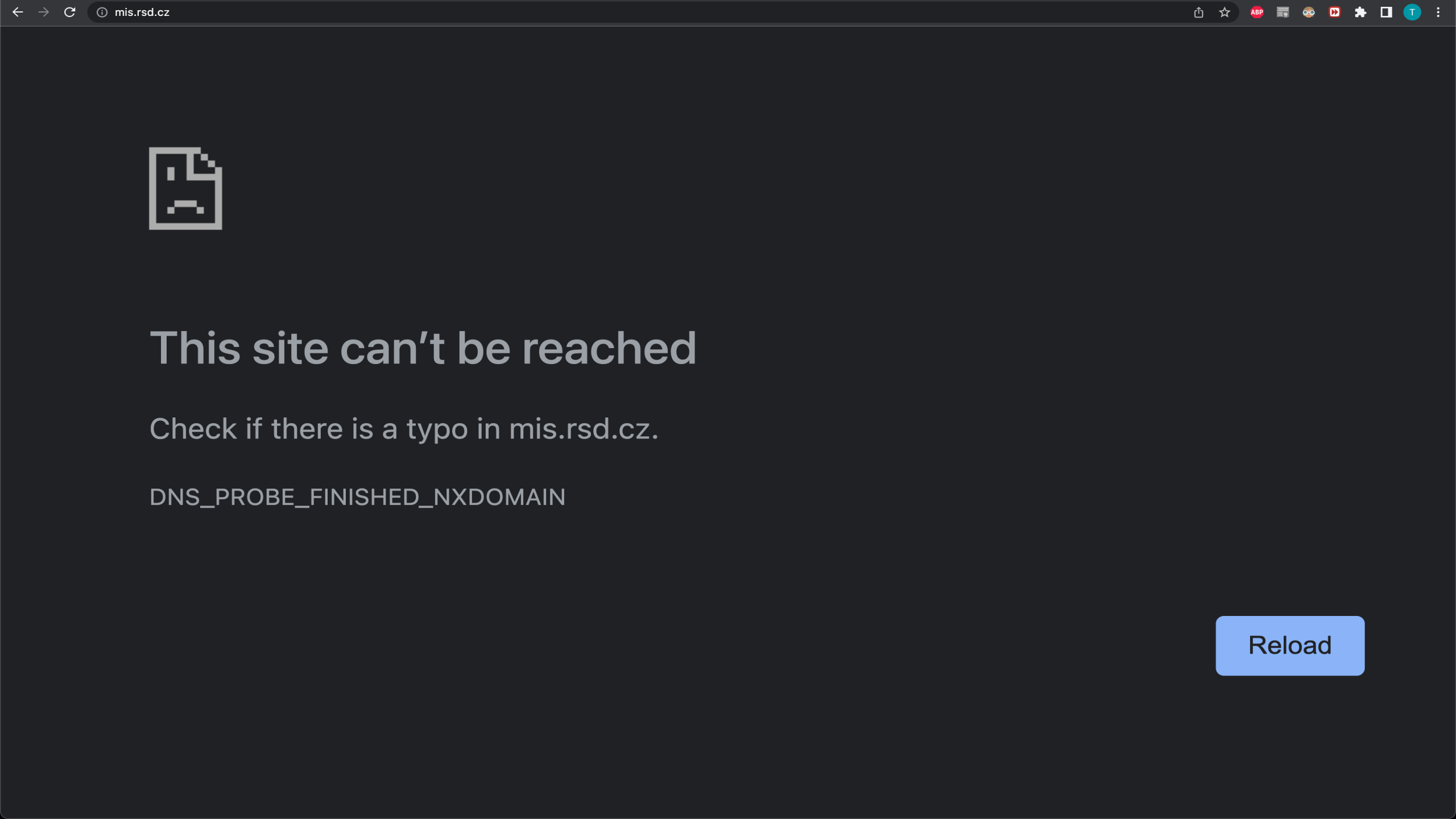
Content

- // MIS – hacker attack

- MetSense products
  - 2DRoad
  - MetRoad Mobile
  - MetSalt
  - MetIoT (Klimator Denmark)
- A new road weather system paradigm
- Discussion: why do it this way?


mis.rsd.cz
This site can’t be reached
Check if there is a typo in mis.rsd.cz.
DNS_PROBE_FINISHED_NXDOMAIN
Reload

ROZHOVOR

Kybernetický útok se nás pokusil zlikvidovat, škoda může jít do desítek milionů korun, říká šéf ředitelství silnic

Ondřej Charvát redaktor

2. 6. 2022 00:00 ▪ 7 min čtení

Reklama | Předplatné HN+ je zcela bez reklam.

Vnitřní systémy Ředitelství silnic a dálnic jsou již dva týdny zablokované. Generální ředitel ŘSD Radek Mátl odhaduje, že jeho organizace bude fungovat jako před kyberútokem za čtyři až pět měsíců. Autor ▪ ČTK

Kybernetický útok, kterému Ředitelství silnic a dálnic (ŘSD) čelilo v polovině května, bude mít pro státní organizaci tvrdý dopad a dlouho se z něj bude sbírat. Ve firmě nefungují interní systémy

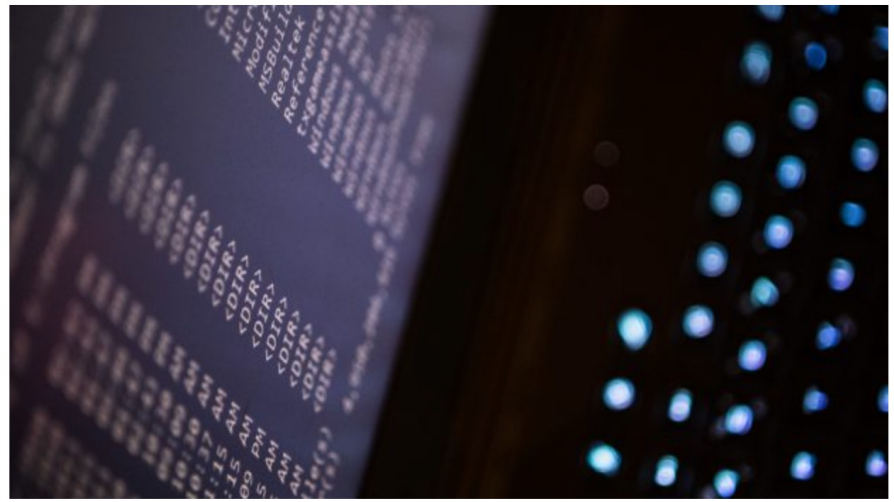
iROZHLAS

Sledujte dění na Ukrajině v naší online reportáži →

Mělo by ŘSD zaplatit výkupné, které po něm vyžadují hackeři? Experti si myslí, že ne

Ředitelství silnic a dálnic (ŘSD) zvažuje zaplacení výkupného hackerům, kteří jim zablokovali servery a zaměstnancům znemožnili jakýkoliv přístup do systému. Je to ale rozumné? Experti přes IT pro server iROZHLAS.cz odpovídali v anketě na otázky spojené s útokem, se kterým se státní instituce potýká.

Praha 5:00 11. června 2022



Pokud k zaplacení výkupného dojde, nemají ale společnosti záruku, že svá data od hackerů dostanou zpět (ilustrační foto) | Foto: René Volfík | Zdroj: iROZHLAS.cz

„S teroristy se nevyjednává," odpověděl na otázku, jestli je rozumné

ZPRÁVY, KTERÉ JSTE NEČETLI

Hlubuček opouští další funkce. Rezignuje na funkci náměstka primátora i pražského radního

‚Omezení kontroly.' Za zveřejnění majetku politiků má být pokuta 50 tisíc, Senát ‚chybu' neopravil

Pomohl by chytrý elektroměr. Až polovina lidí sleduje spotřebu energií, ale neumí srovnávat, říká Prokop

‚Bez pozlátka.' České předsednictví navazuje na témata Topolánkovy vlády, výchozí pozice je ale jiná

Pád kryptoměn? Trend se obrátí možná za dva roky, odhaduje publicista

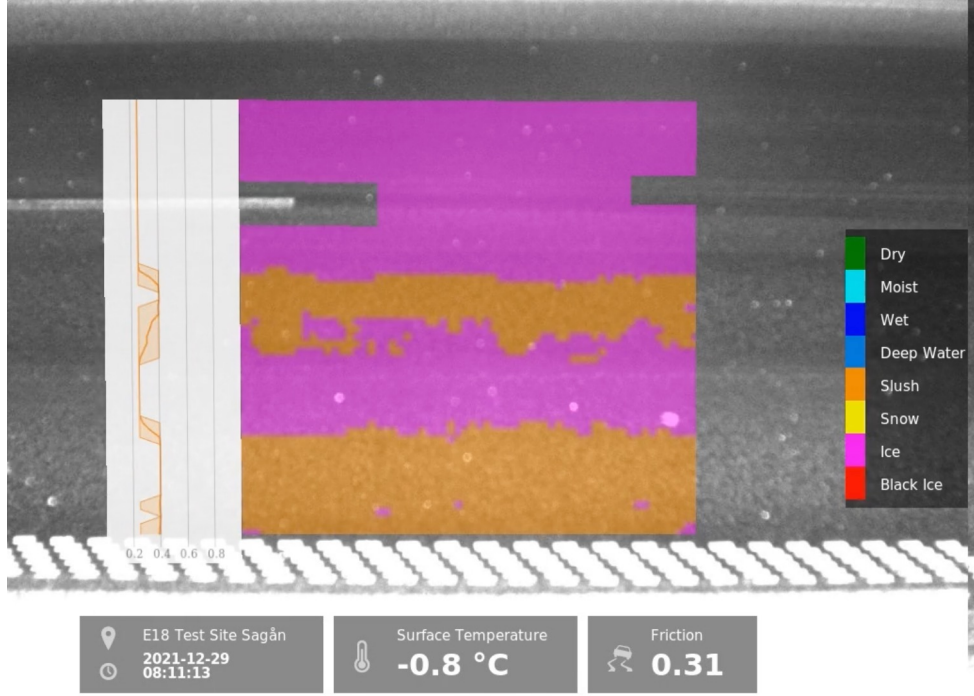
MetSense Products

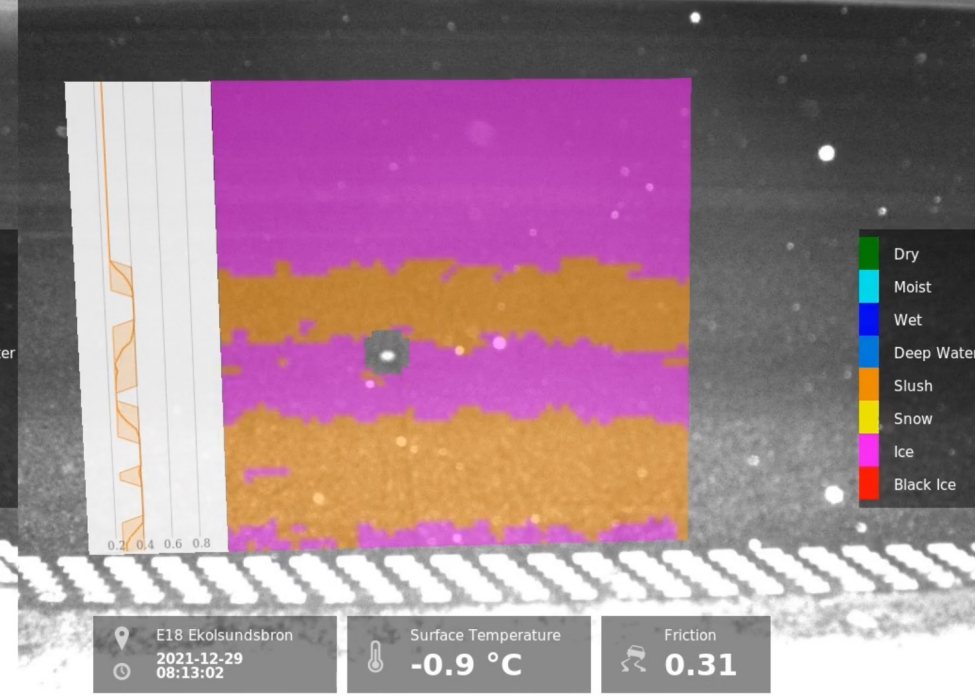
- 2DRoad
  - Road Condition & Friction in 2D
  - Road Temperature
- MetRoad Mobile
  - Mobile Road Condition & Friction
- MetSalt
  - Freezing Point, Surface & Subsurface Temperature
- MetIoT
  - Air Temperature & Humidity
  - Road Temperature
  - Non-freezing Precipitation

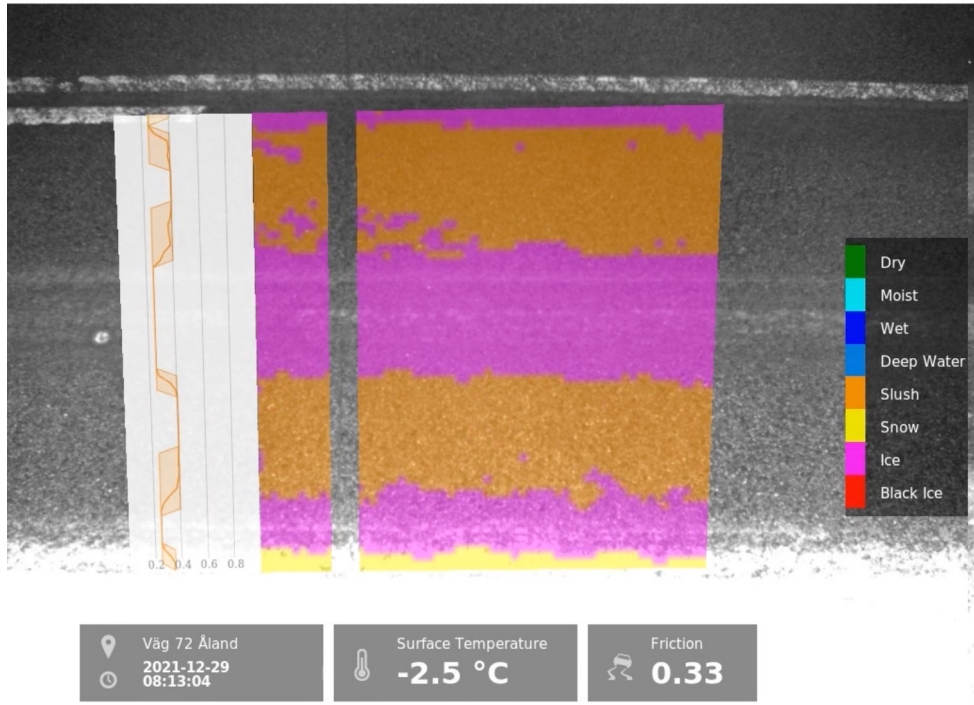
2DRoad

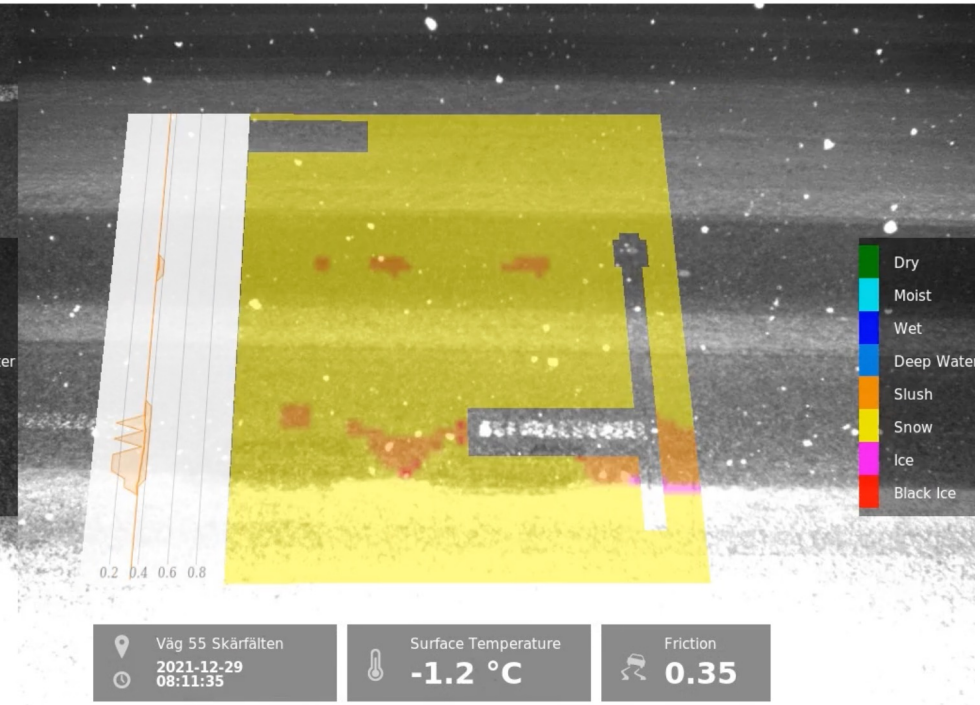
- Flagship MetSense product
- 5-in-1 device that delivers:
  - 2D Surface Status (NIR chip with 64 x 64 pixel resolution)
  - 2D Friction (Row based, i.e. 64 data points)
  - Overview Background Image
  - Single Point Surface Temperature (pyrometer)
  - Data Logging (integrated logger with ETH / LTE connectivity)
    - Can collect data from other sensors, e.g. the MetSalt or other

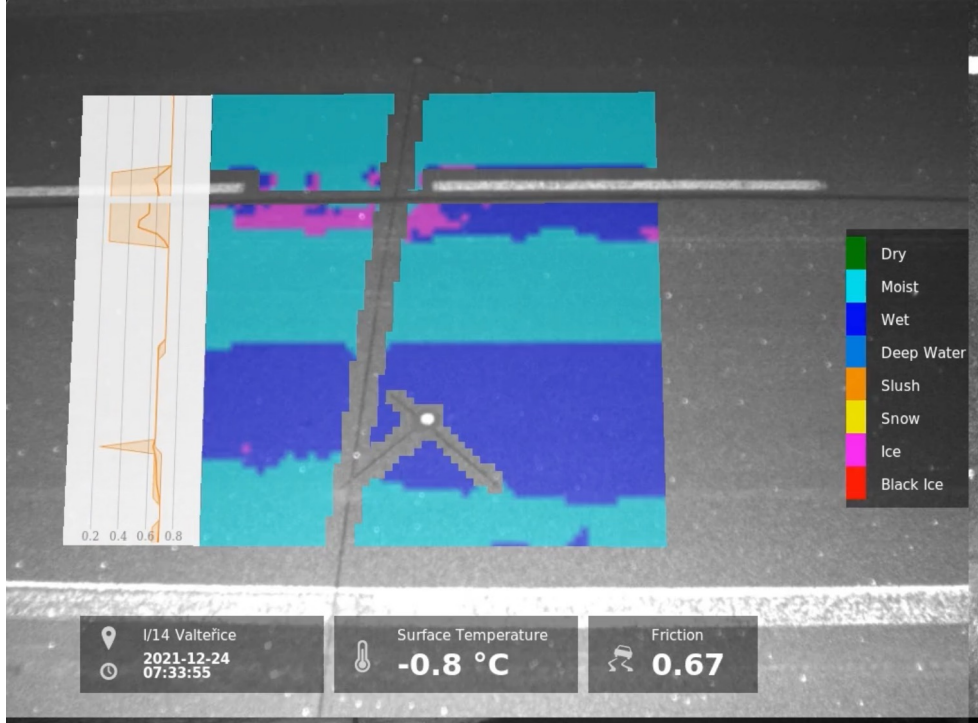
    3rd party sensors, if needed. RS485 RTU Modbus readily supported
- **More of a weather station than a sensor!**

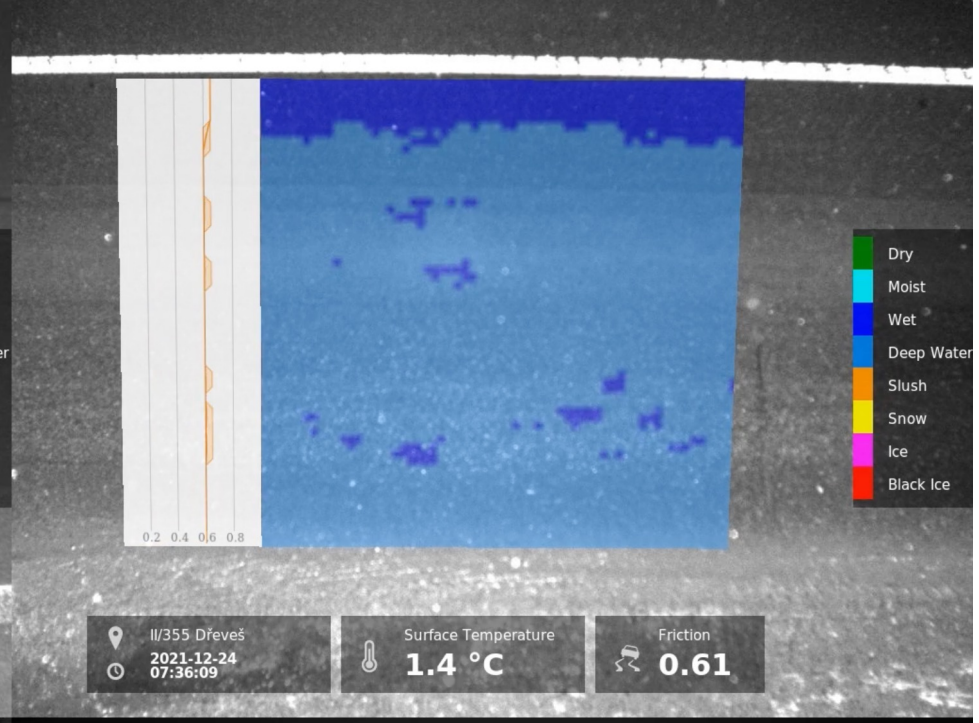

Dry
Moist
Wet
Deep Water
Slush
Snow
Ice
Black Ice
0.2 0.4 0.6 0.8
E18 Test Site Sagån
2021-12-29
08:11:13
Surface Temperature
-0.8 °C
Friction
0.31

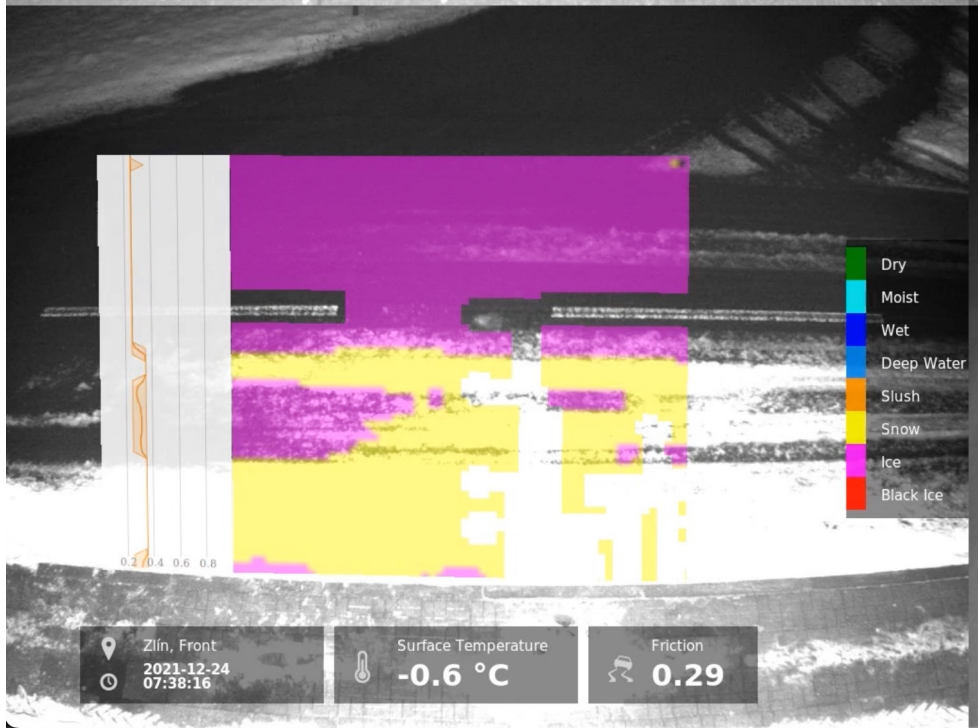

Dry
Moist
Wet
Deep Water
Slush
Snow
Ice
Black Ice
0.2 0.4 0.6 0.8
E18 Ekolsundsbron
2021-12-29
08:13:02
Surface Temperature
-0.9 °C
Friction
0.31

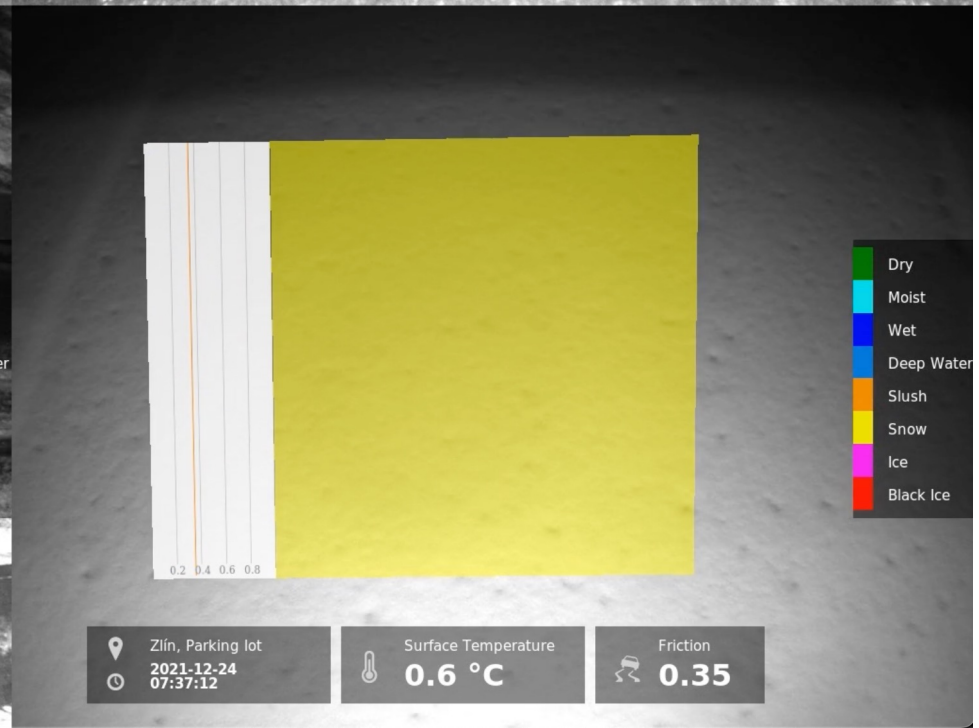

Dry
Moist
Wet
Deep Water
Slush
Snow
Ice
Black Ice
0.2 0.4 0.6 0.8
Väg 72 Åland
2021-12-29
08:13:04
Surface Temperature
-2.5 °C
Friction
0.33


Dry
Moist
Wet
Deep Water
Slush
Snow
Ice
Black Ice
0.2 0.4 0.6 0.8
Väg 55 Skärfälten
2021-12-29
08:11:35
Surface Temperature
-1.2 °C
Friction
0.35


Dry
Moist
Wet
Deep Water
Slush
Snow
Ice
Black Ice
0.2 0.4 0.6 0.8
I/14 Valteřice
2021-12-24
07:33:55
Surface Temperature
-0.8 °C
Friction
0.67


Dry
Moist
Wet
Deep Water
Slush
Snow
Ice
Black Ice
0.2 0.4 0.6 0.8
II/355 Dřeveš
2021-12-24
07:36:09
Surface Temperature
1.4 °C
Friction
0.61

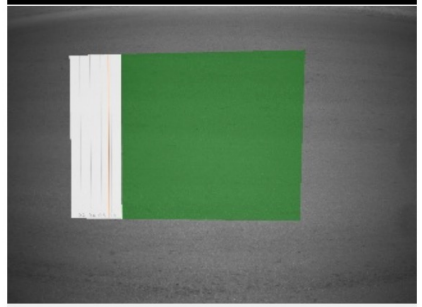

Dry
Moist
Wet
Deep Water
Slush
Snow
Ice
Black Ice
0.2 0.4 0.6 0.8
Zlín, Front
2021-12-24
07:38:16
Surface Temperature
-0.6 °C
Friction
0.29


Dry
Moist
Wet
Deep Water
Slush
Snow
Ice
Black Ice
0.2 0.4 0.6 0.8
Zlín, Parking lot
2021-12-24
07:37:12
Surface Temperature
0.6 °C
Friction
0.35

Show filter Erase filter

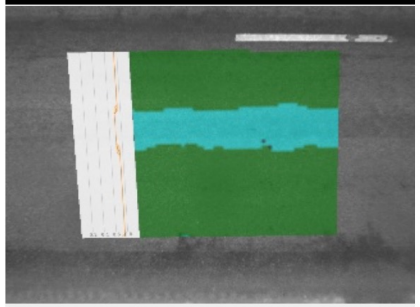
- **Šiauliai, Serbentų – Dubijos** 6/16/2022 9:43 AM Dry
- **Klaipėda, Lideikio overpass** 6/16/2022 9:39 AM Dry
- **M8 Test Site Duntilland** 6/16/2022 7:38 AM Dry
- **E18 Test Site Sagån** 6/16/2022 8:41 AM Dry
- **Väg 72 Åland** 6/16/2022 8:41 AM Dry
- **Väg 55 Skärfälten** 6/16/2022 8:41 AM Dry
- **E18 Ekolsundsbron** 6/16/2022 8:39 AM Dry
- **I/35 Gajer** 5/20/2022 12:13 PM
- **I/34 Františky** 5/20/2022 12:15 PM
- **Zlín, Front** 6/16/2022 8:41 AM Dry
- **Zlín, Parking lot** 6/16/2022 8:39 AM Dry

Šiauliai, Serbentų – Dubijos



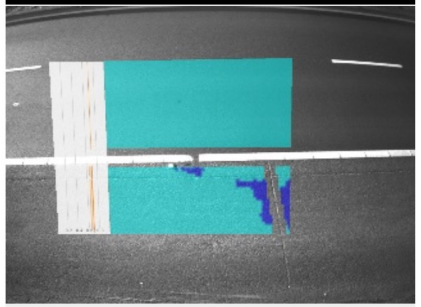
DATE AND TIME 3/19/2022 10:05 AM
SURFACE STATUS Dry
FRICTION 0.75
SURFACE TEMPERATURE 6.9 °C

Klaipėda, Lideikio overpass



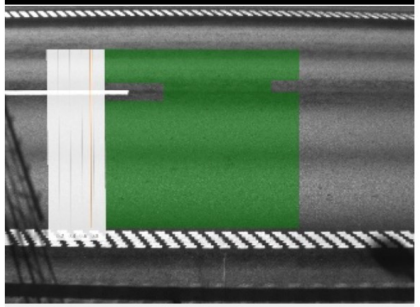
DATE AND TIME 3/19/2022 10:02 AM
SURFACE STATUS Dry
FRICTION 0.74
SURFACE TEMPERATURE 7.0 °C

M8 Test Site Duntilland



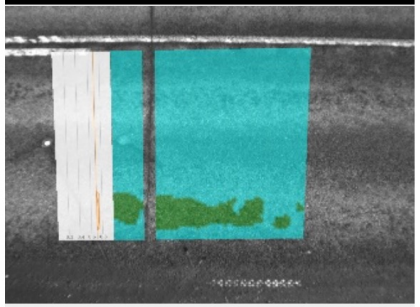
DATE AND TIME 3/19/2022 8:02 AM
SURFACE STATUS Moist
FRICTION 0.70
SURFACE TEMPERATURE 4.1 °C

E18 Test Site Sagån



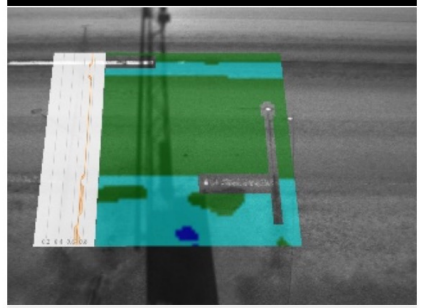
DATE AND TIME 3/19/2022 9:00 AM
SURFACE STATUS Dry
FRICTION 0.75
SURFACE TEMPERATURE 2.8 °C

Väg 72 Åland



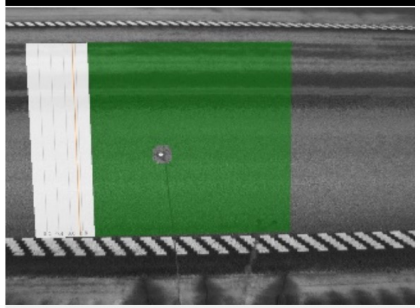
DATE AND TIME 3/19/2022 9:05 AM
SURFACE STATUS Moist
FRICTION 0.71
SURFACE TEMPERATURE 1.6 °C

Väg 55 Skärfälten



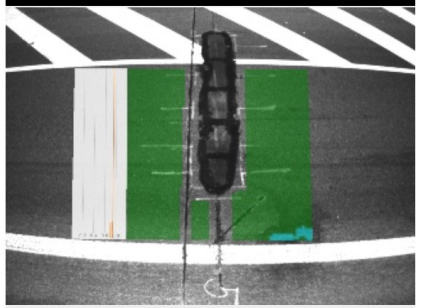
DATE AND TIME 3/19/2022 9:01 AM
SURFACE STATUS Dry
FRICTION 0.73
SURFACE TEMPERATURE 1.2 °C

E18 Ekolsundsbron



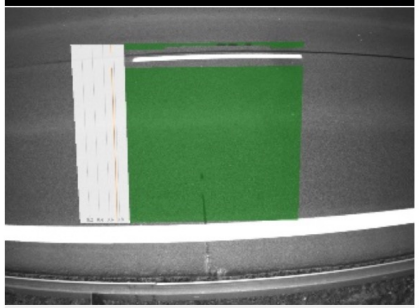
DATE AND TIME 3/19/2022 9:02 AM
SURFACE STATUS Dry
FRICTION 0.75
SURFACE TEMPERATURE 1.9 °C

I/35 Gajer



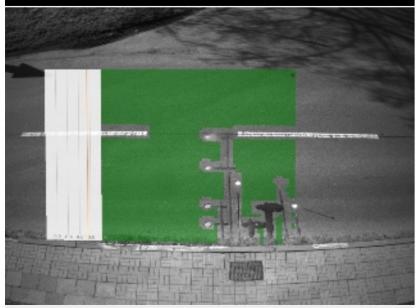
DATE AND TIME 3/19/2022 9:00 AM
SURFACE STATUS Dry
FRICTION 0.75
SURFACE TEMPERATURE 7.1 °C

I/34 Františky



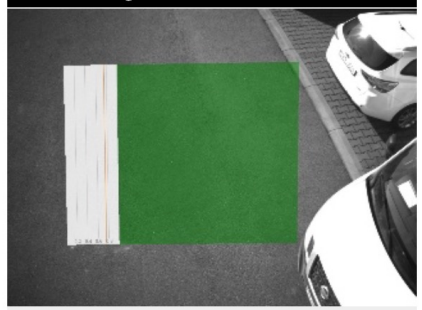
DATE AND TIME 3/19/2022 9:01 AM
SURFACE STATUS Dry
FRICTION 0.75
SURFACE TEMPERATURE 3.6 °C

Zlín, Front



DATE AND TIME 3/19/2022 9:05 AM
SURFACE STATUS Dry
FRICTION 0.75
SURFACE TEMPERATURE 4.7 °C

Zlín, Parking lot



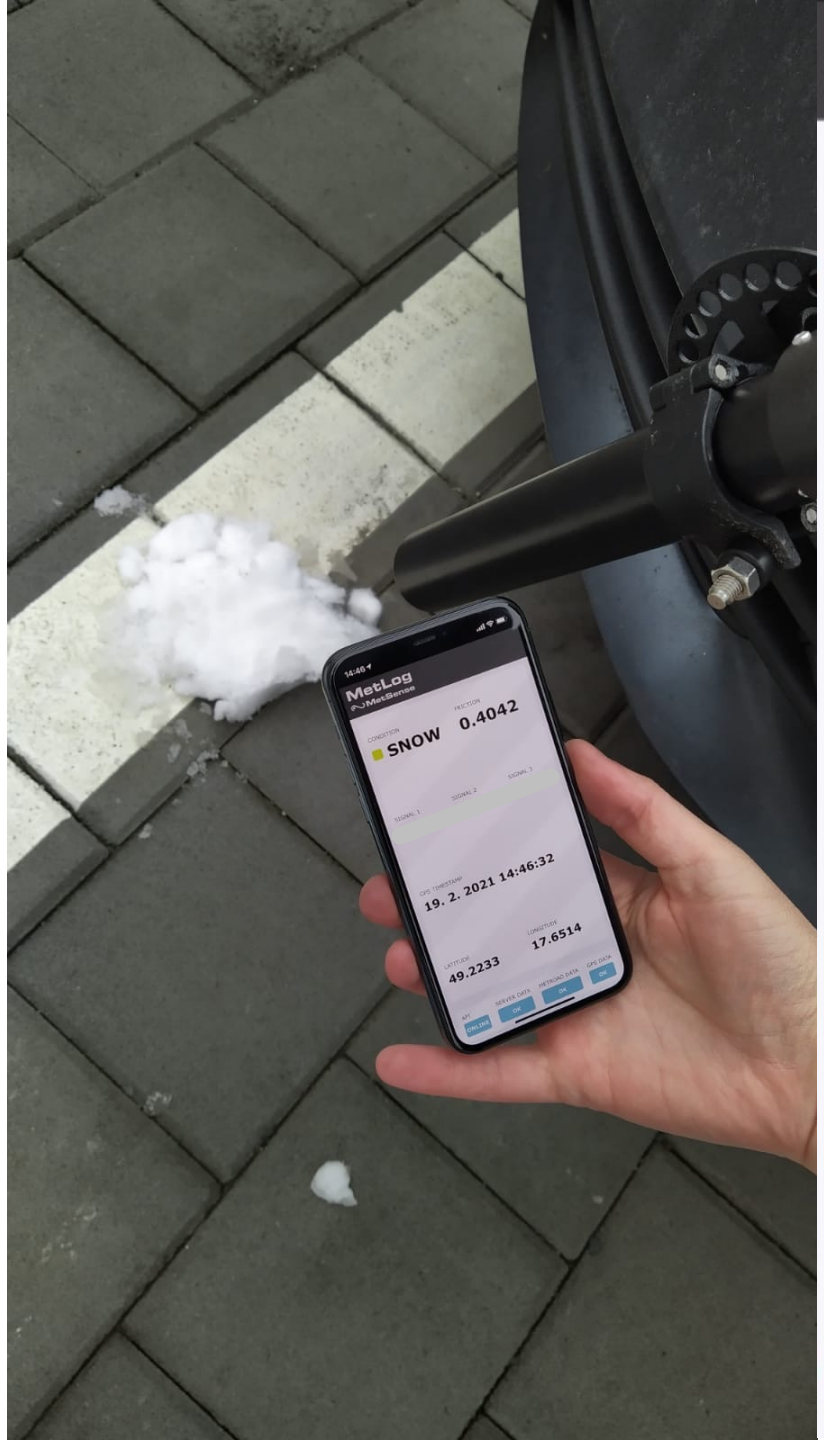
DATE AND TIME 3/19/2022 9:05 AM
SURFACE STATUS Dry
FRICTION 0.75
SURFACE TEMPERATURE 9.2 °C

MetRoad Mobile

- Oldest MetSense sensor, re-worked in 2020/21, hundreds sold
- Mobile Road Condition & Friction Estimate
- Delivered independently or with a data logger
- RS 485 RTU Modbus Protocol (wired!)

MetRoad Mobile

klimator
Precise and reliable road washing
S
klimator



MetLog
MetSense

CONDITION
MOIST

FRICTION
0.6326

SIGNAL 1 SIGNAL 2 SIGNAL 3

MetSense Proprietary Data

GPS TIMESTAMP
19. 2. 2021 14:57:58

LATITUDE
49.2021

LONGITUDE
17.6641

API ONLINE
SERVER DATA OK
METROAD DATA OK
GPS DATA OK

Return

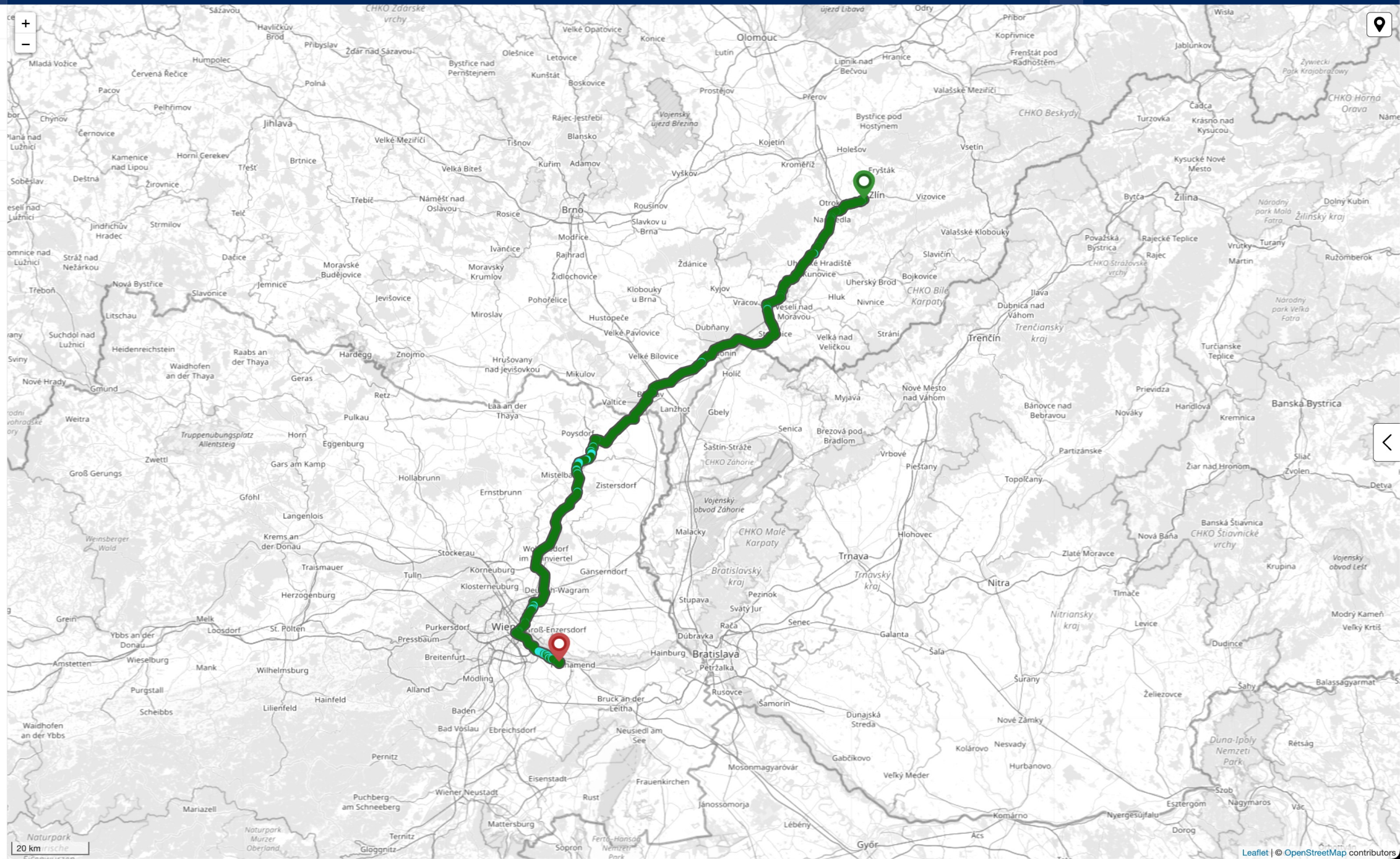
David Konecny

6/13/2022

Data count	From	To
521	7:31 AM	7:39 AM
108	9:16 AM	9:18 AM
103	9:57 AM	9:59 AM
11401	11:06 AM	2:21 PM

Daily data JSON CSV

Trip data JSON CSV



MetSalt

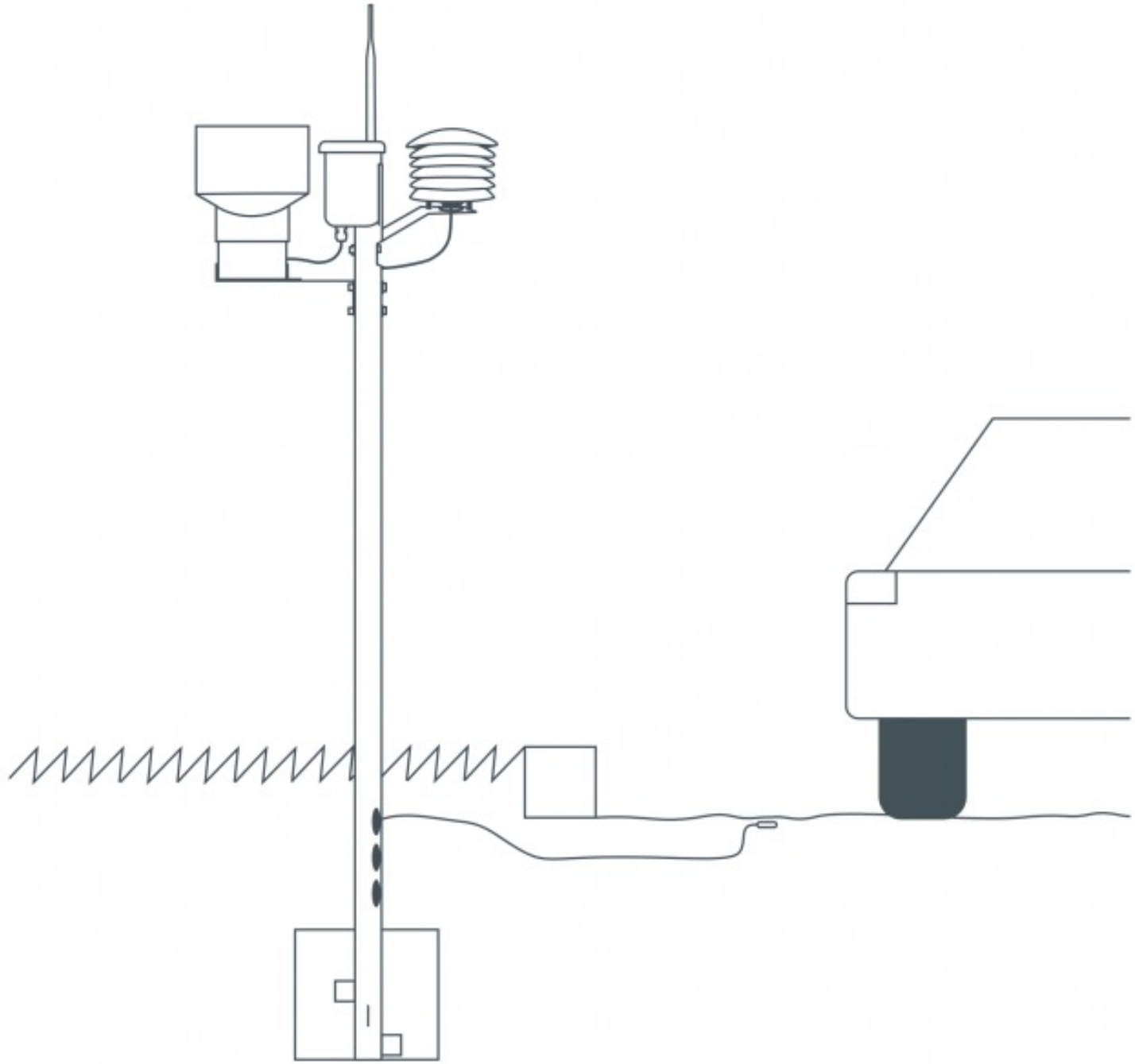
- Continuous cycle of cooling and heating
- Measures
  - Freezing point up to 15° C below ambient temperature
  - Surface temperature
  - Subsurface temperature
- Low Power (<0.2 W continuous, <12 W peak)
- RS 485 RTU Modbus Protocol
  - Integrated in 2DRoad
  - Open protocol – can be integrated into any data logger

MetSalt

MetIoT

- White-labelled product from Klimator Denmark
- NB-IoT, Sigfox
- Battery powered
- Measures
  - Road temperature
  - Air temperature & humidity
  - Non-freezing precipitation

Antenna
Casing
Radiation Shield
Sensor
Rain Sensor
ID
Thermo Cable
Pole



tti
traffic technology international
DECEMBER 2021
ITS AMERICA 2021
CHARLOTTE, NORTH CAROLINA
SHOW SPECIAL!
PLUS previews of Gulf Traffic, TRB Annual Meeting and CES

V2P

Can new technology help to bring vulnerable road users safely and equitably into the connected vehicle ecosystem?

Using apps for tolling
Smartphone technology has taken time to break into the toll industry – but now new solutions are here

Roads that talk to drivers
Smart, connected road studs that can combat wrong-way driving and even read road weather are being piloted on The Ray, Georgia

TrafficTechnologyToday.com

MetSense

A new road-weather station paradigm

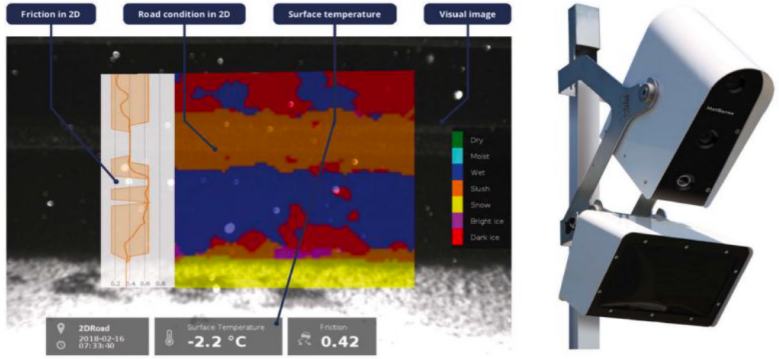
A new non-intrusive weather camera is helping to provide more accurate and detailed road condition forecasts

4,000
Pixels captured by MetSense 2DRoad camera over a 6x6m area

Road weather forecasts are highly dependent on input data. This data comes from road weather stations (RWS) which measure the ground truth or baseline weather conditions on roads. This truth or baseline then serves as a starting point for a road weather forecast.

Road and air temperature are measured by almost all RWS. As the air temperature measurement method is standardized, this parameter is highly reliable. Road temperature measurement is, to a large degree, also standardized (PT sensor placed at a set depth). Therefore dense, high quality, and standardized data sets of road and air temperatures are readily available.

When the aforementioned inputs are fed into an advanced road weather forecasting system such as RSI from MetSense's sister company Klimator, road and air temperature can be forecast extremely accurately far into the future.



1

Measurement challenges

The situation is different for road condition or road status measurements. Traditional RWS only attempt to infer road conditions from the other measured parameters, and rarely measure road conditions directly. If they do measure, they measure only a representative spot either in or in between the wheel tracks.

However, unlike air temperature or road temperature, road condition is not constant for a measurement site – it varies greatly across the road slice, often with three different road conditions at once for a standard winter scenario. Furthermore, different sensors measure and report the road condition differently. As a result, the available data sets for road condition can be sparse, low quality, and unstandardized.

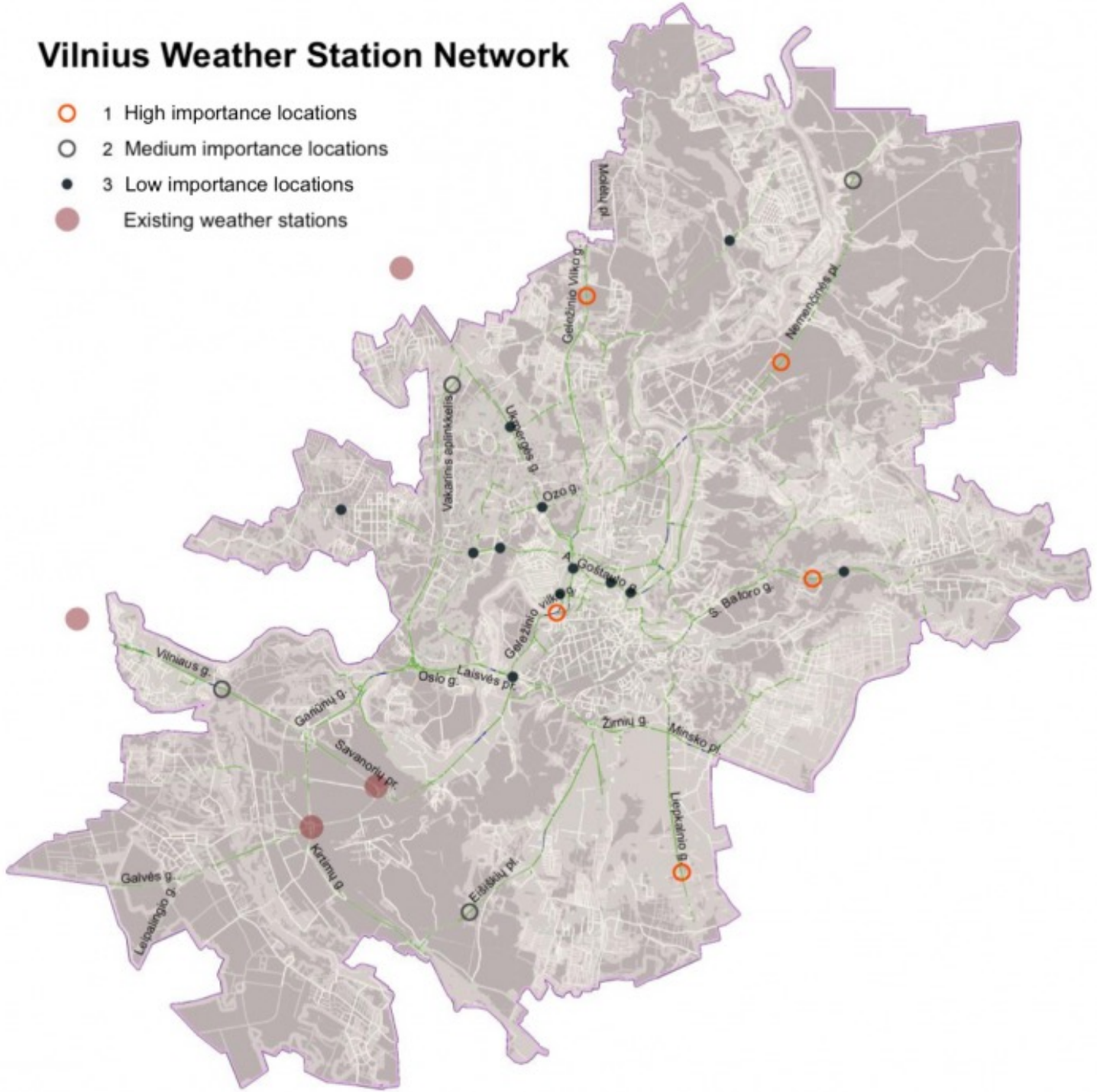
To make things worse, road condition and road slipperiness forecasts are very sensitive to input data. This means that if the ground truth or baseline measurement is off, wildly inaccurate road condition and road slipperiness may be forecast even a couple of hours into the future.

A high-tech solution

MetSense took on the challenge of lacking road condition data by developing a non-intrusive weather camera, called 2DRoad. 2DRoad measures road condition with a resolution of over 4,000 pixels captured across an area of up to 6x6m. This means that standard winter scenarios are reported in full context, such as "ice with wet in the wheel tracks", where before only "ice" or "wet" would be reported.

The availability of such high-quality measured road condition data greatly improves the accuracy of road weather forecasts. Furthermore, as the road condition data is presented overlaid on a high-resolution camera image, winter maintenance personnel get insights into the present status of roads that was

> APART FROM THE 2DROAD, METSENSE MAKES A LOW-COST MOBILE SENSOR, CALLED METROAD MOBILE, WHICH CAN BE MOUNTED ON A MAINTENANCE VEHICLE, INSPECTION VEHICLE, OR A CITY FLEET VEHICLE

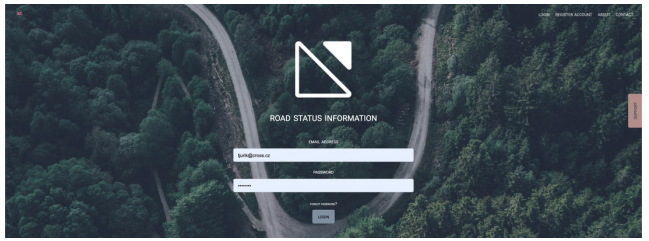

Vilnius Weather Station Network
1 High importance locations
2 Medium importance locations
3 Low importance locations
Existing weather stations
Molėtų pl.
Geležinio Vilko g.
Nemenčinės pl.
Vakarinis aplinkkelis
Ukmergės g.
Ozo g.
A. Goštauto g.
S. Baforo g.
Geležinio vilko g.
Vilniaus g.
Oslo g.
Laisvės pr.
Ganūnų g.
Savanorių pr.
Žirnių g.
Minsko pl.
Liepkalnio g.
Kirtimų g.
Galvės g.
Leipalingio g.
Eišiškių pl.

A New Road-Weather Station Paradigm

Smart City Layer

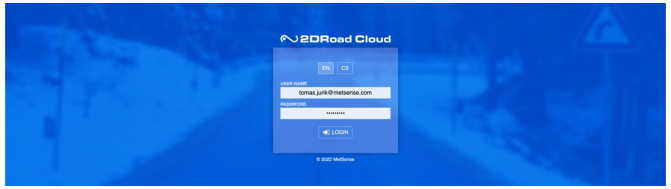
Incinity - Invipo

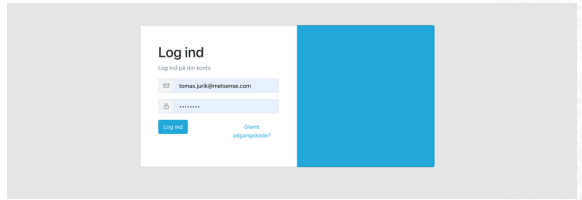
Forecast Layer

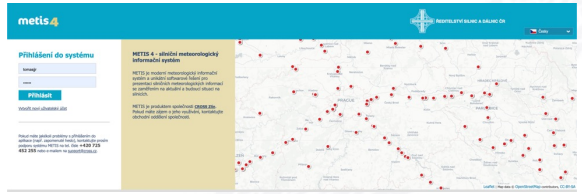


Klimator SE - RSI

Device Layer







MetSense

Klimator DK

CROSS

A New Road-Weather Station Paradigm

Smart City Layer

Incinity - Invipo

Forecast Layer

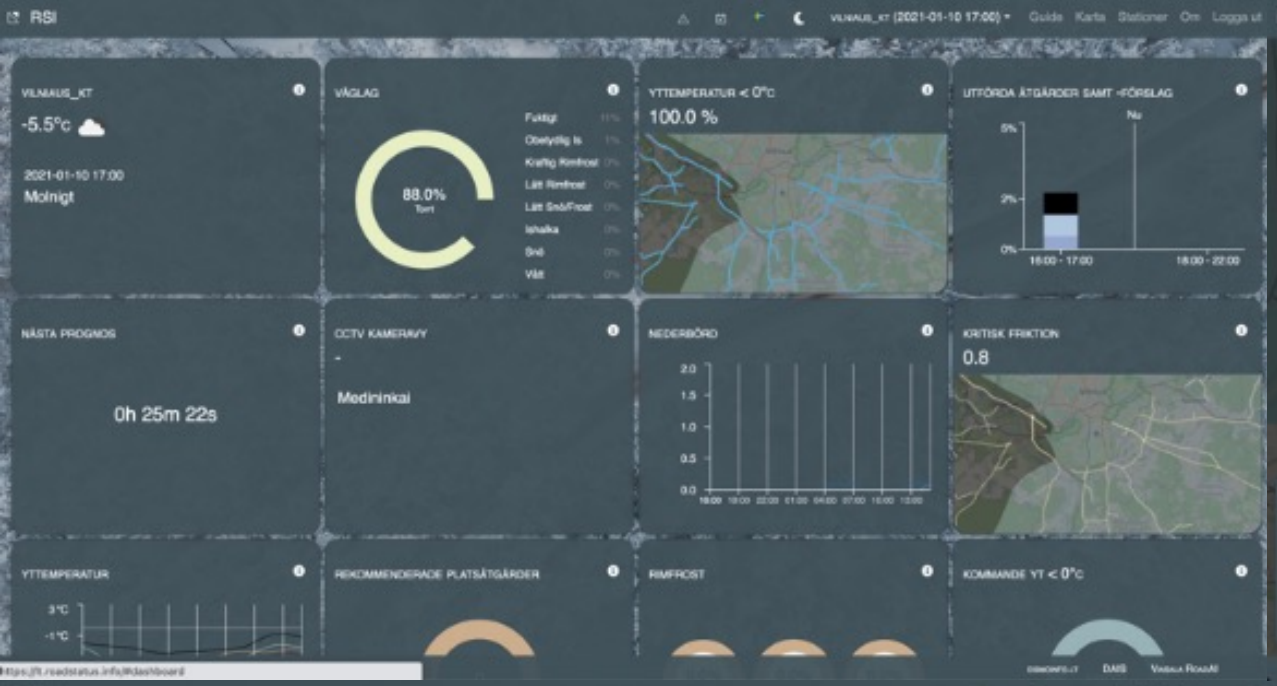
Klimator SE - RSI

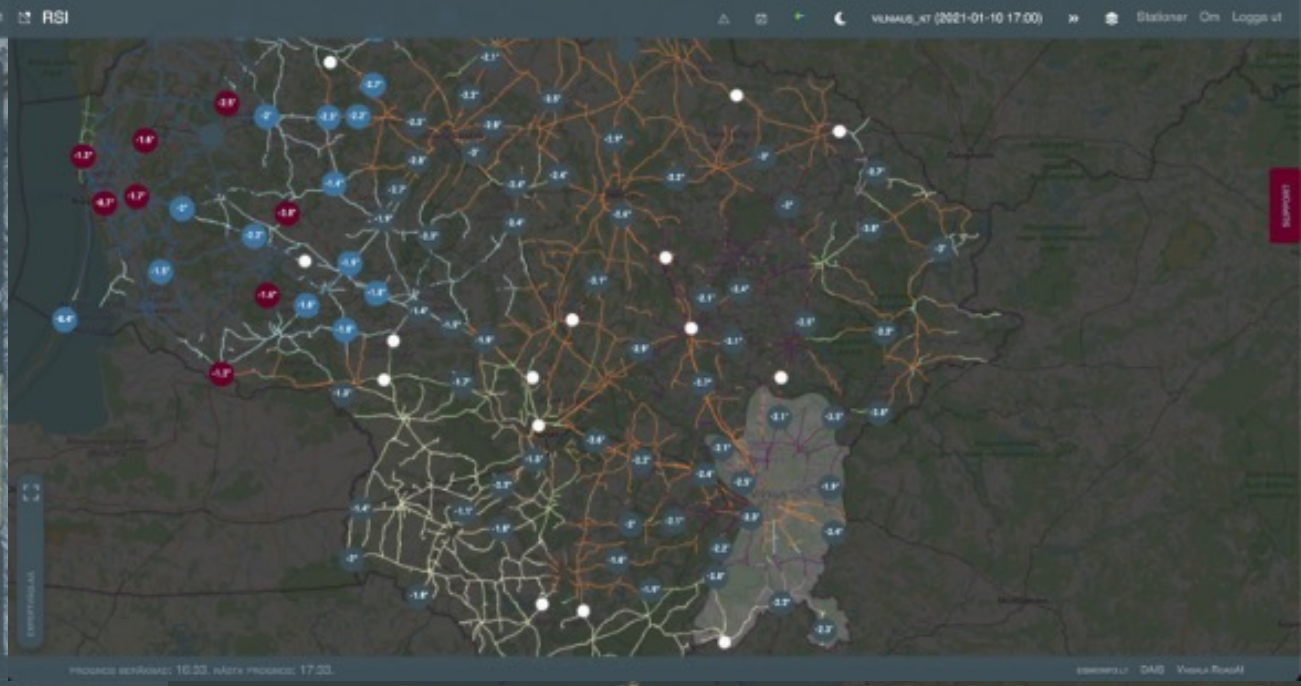
Device Layer

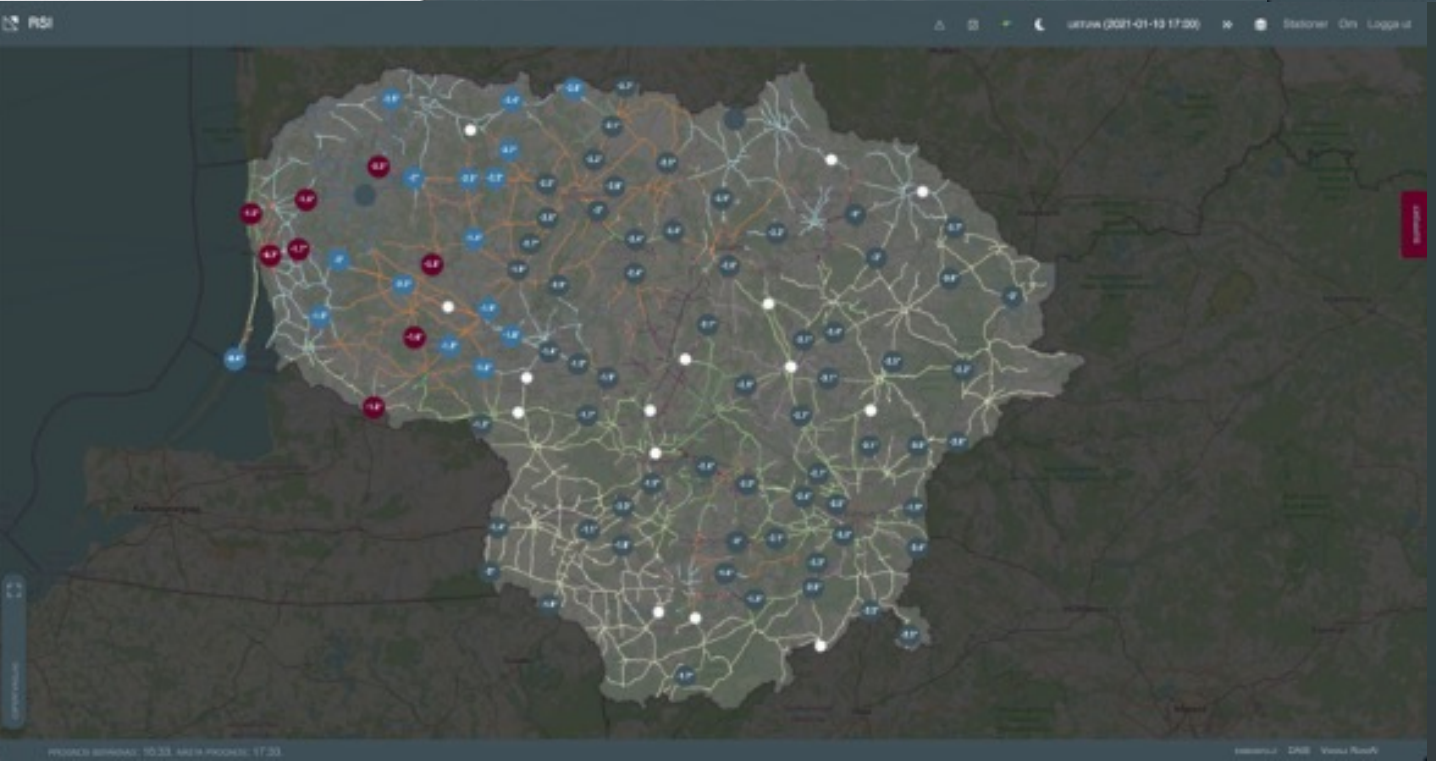
MetSense

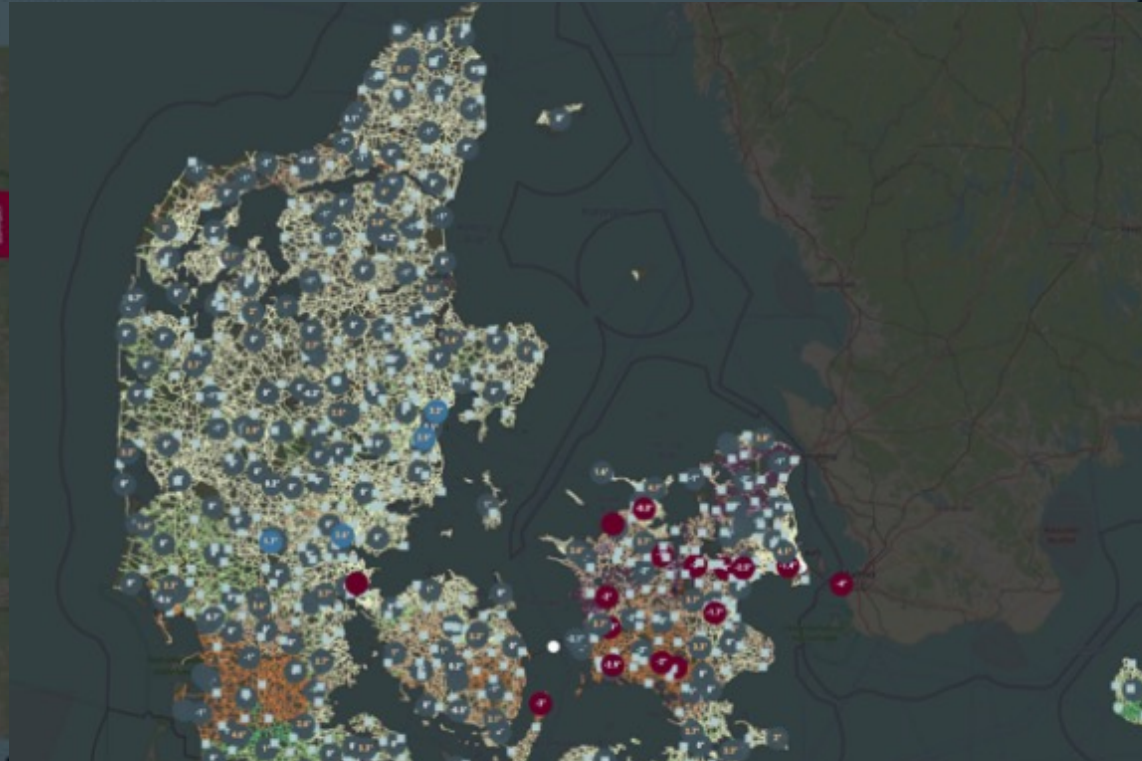
Klimator DK

CROSS


RSI
VILNIAUS_KT
-5.5°c
2021-01-10 17:00
Molnigt
VÄGLAG
88.0%
Torrt
Fuktigt
Oberyttig Is
Kraftig Rimfrost
Lätt Rimfrost
Lätt Snö/Frost
Isbalka
Snö
Våt
YTTEMPERATUR < 0°C
100.0 %
UTFÖRDA ÅTGÄRDER SAMT -FÖRSLAG
Nu
16:00 - 17:00
18:00 - 22:00
NÄSTA PROGNOS
0h 25m 22s
CCTV KAMERAVY
Medininkai
NEDERBÖRD
KRITISK FRIKTION
0.8
YTTEMPERATUR
REKOMMENDERADE PLATSÅTGÄRDER
RIMFROST
KOMMANDE YT < 0°C
DAIS
Vaisala RoadAI


RSI
Stationer
Om
Logga ut


RSI
Stationer
Om
Logga ut



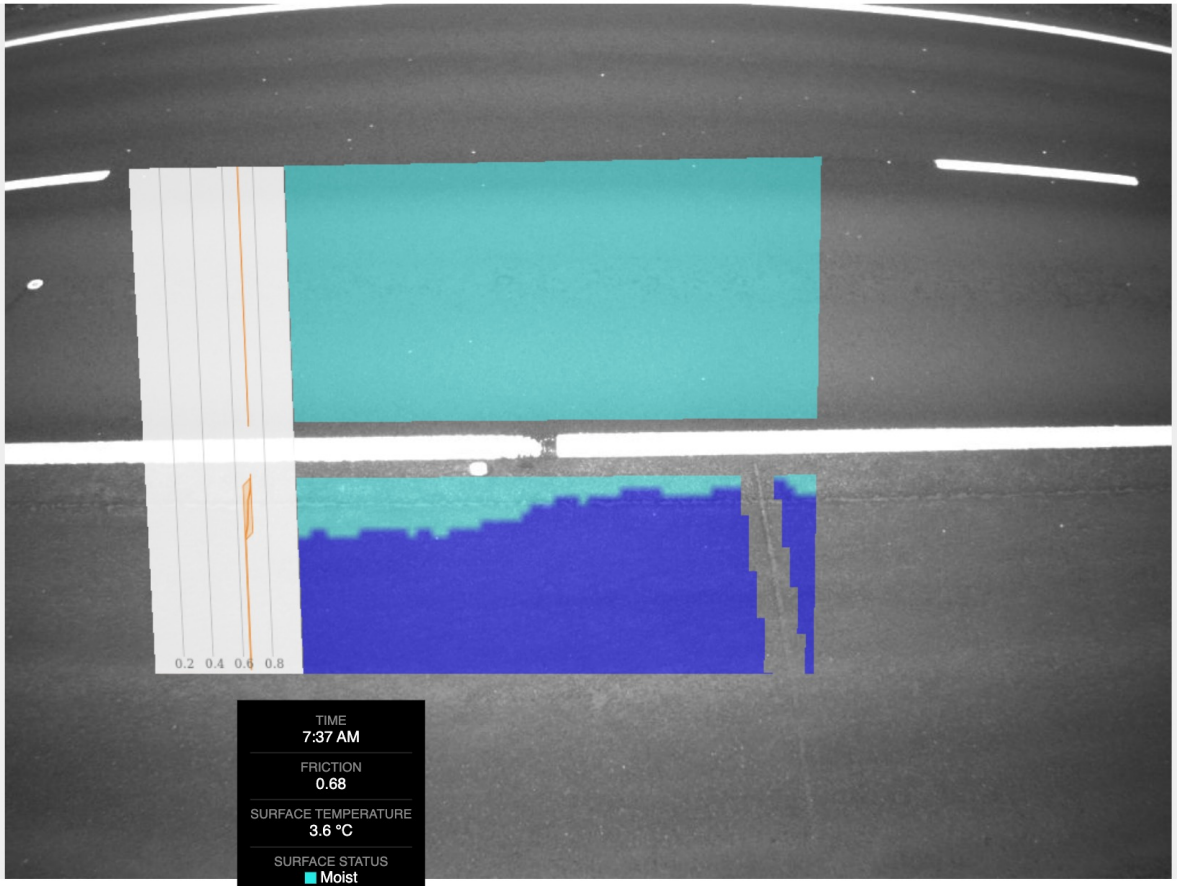
A New Road Weather System Paradigm

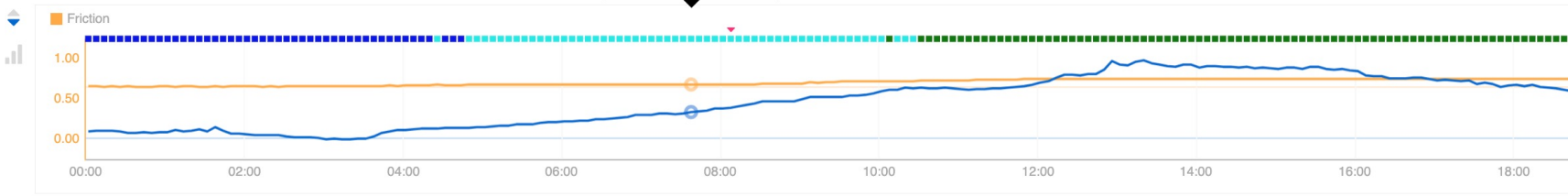
- System which uses legacy RWSs
  - Use of historical investments
- System which is built on the world-unique 2DRoad
  - The highest possible quality of road condition detection
- System which uses mobile sensors and IoT stations
  - Cheap densening of the RWS network with mobile sensors and IoT stations
- System which uses the world leading road weather forecasting platform
  - The highest possible forecast quality
- System which is presented in the world leading Smart City Platform
  - Invipo is the recipient of Intertraffic Innovation Award from 2016

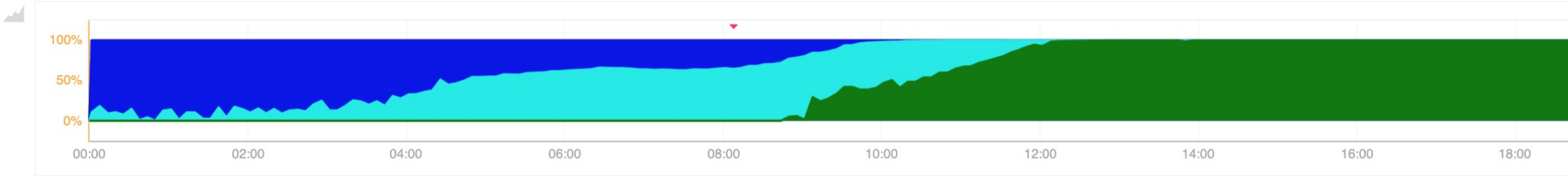
Why this way?

- Why not just use MetRoad Mobile for road condition?
  - Data density in the middle of the night?
- Why 2DRoad?
  - Full description of the road
  - User-selectable areas to feed into forecast(s), forecasts extremely sensitive to RC data

M8 Test Site Duntilland







Why this way?

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  - Data density in the middle of the night?
- Why 2DRoad?
  - Full description of the road
  - User-selectable areas to feed into forecast(s), forecasts extremely sensitive to RC data
- Why IoT?
  - Cheap!!! ~EUR 1k / station
- Why RSI?
  - The highest possible forecast quality
  - Output into any system

MetSense | 2DRoad

Thank you for your attention

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