

# Automated data production test: mobile laser scanning of road network, quality control and accurate road geometry

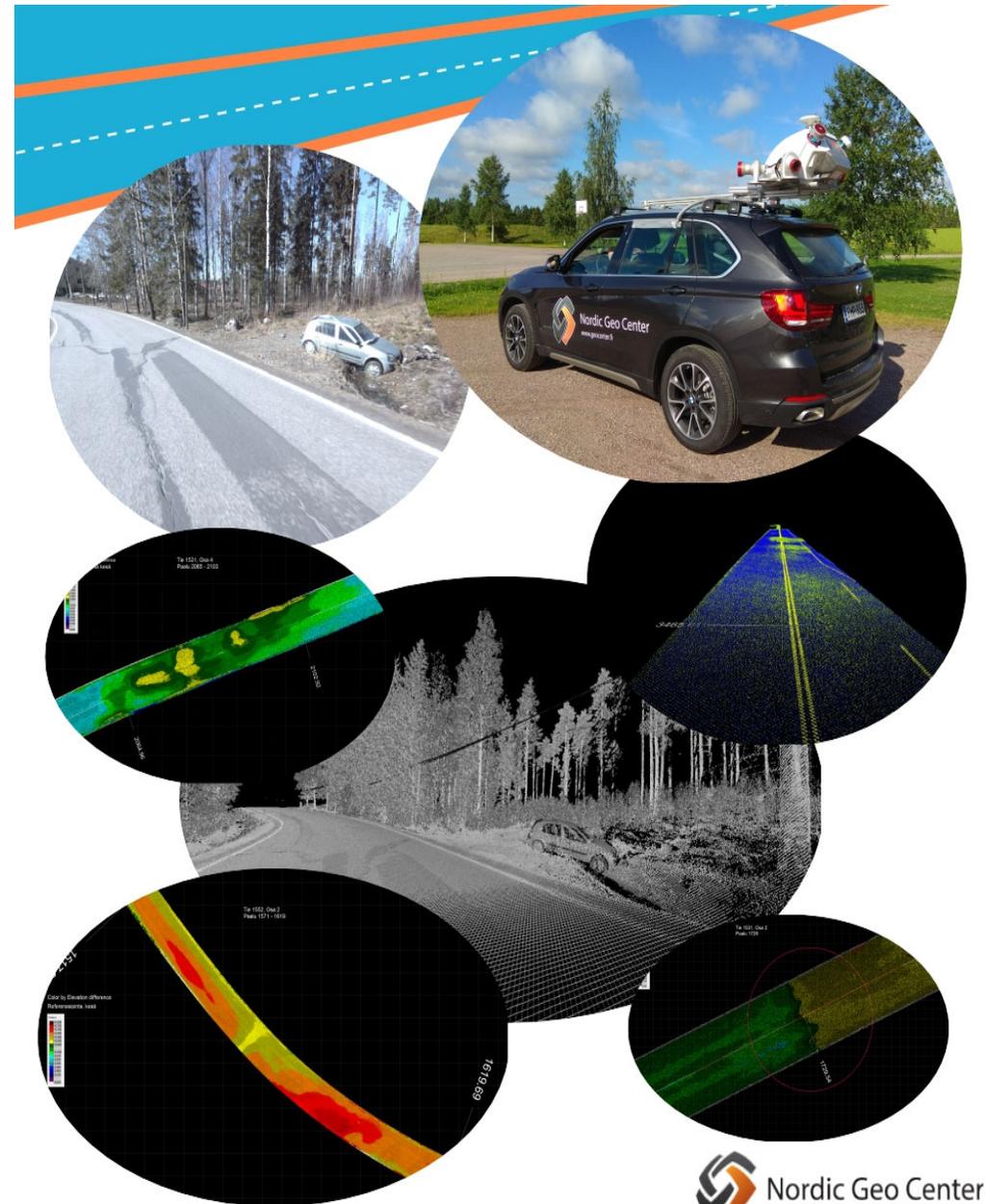
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Puheloinen and Tauno Suominen



Nordic Geo Center

# Aims of the test

- Planning of the road maintenance
- Road infrastructure management
- Network level pavement management
- Added value



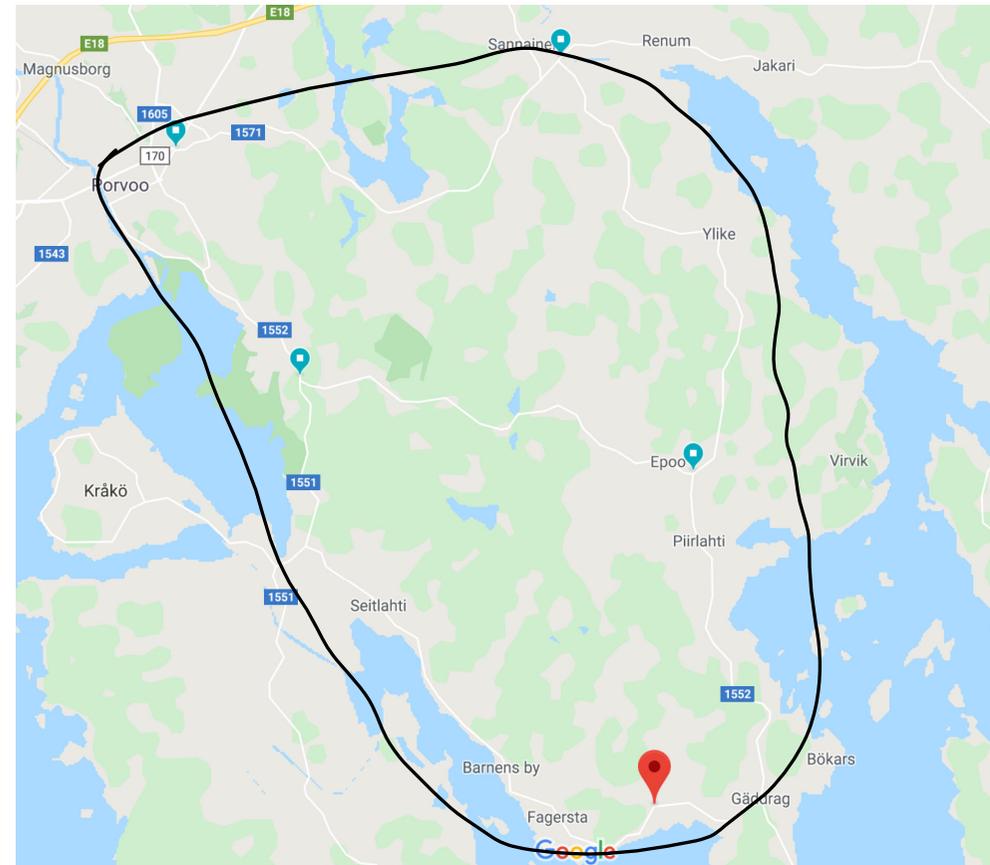
# Measured roads

## Near Porvoo:

- 55 (Kt 55 Porvoon sisääntulo) 1,5 km
- 1531 (Vanha Kuninkaantie) 16,4 km
- 1571 (Veckjärventie) 8,1 km
- 1552 (Epoontie) 8,2 km
- 11859 (Voolahdentie) 11,7 km

## Pavement test:

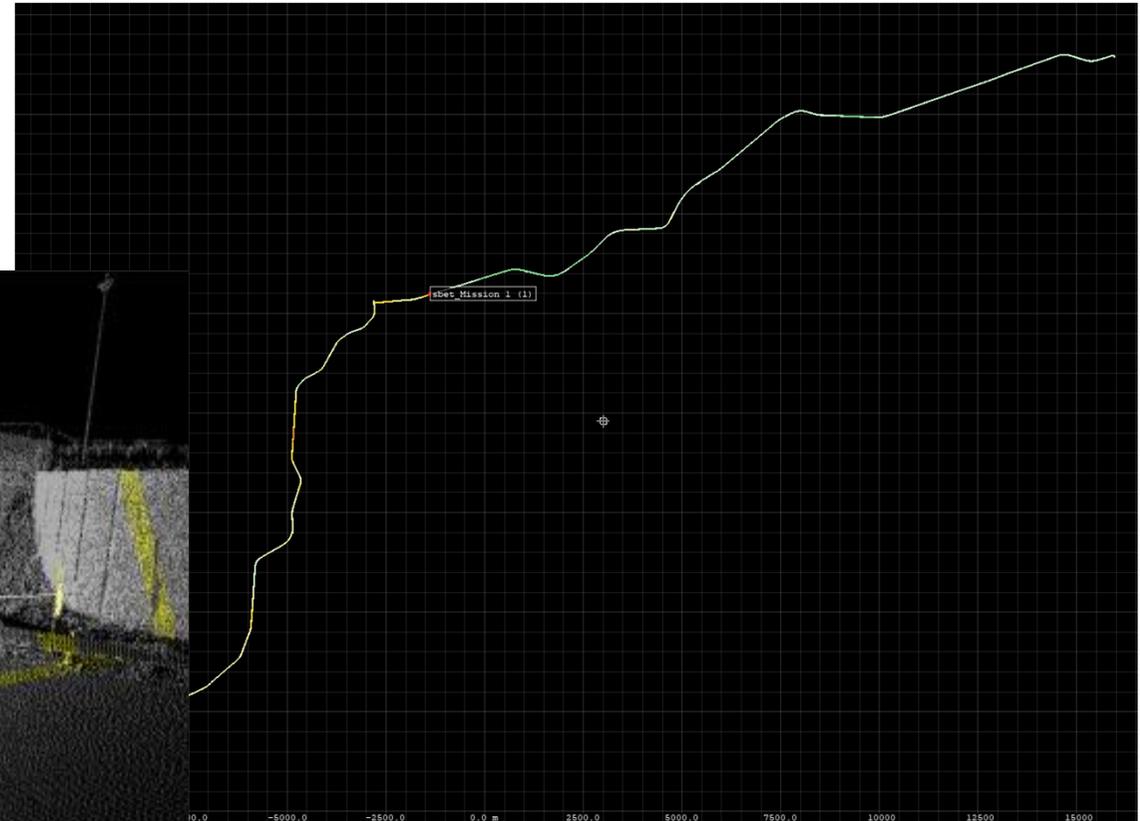
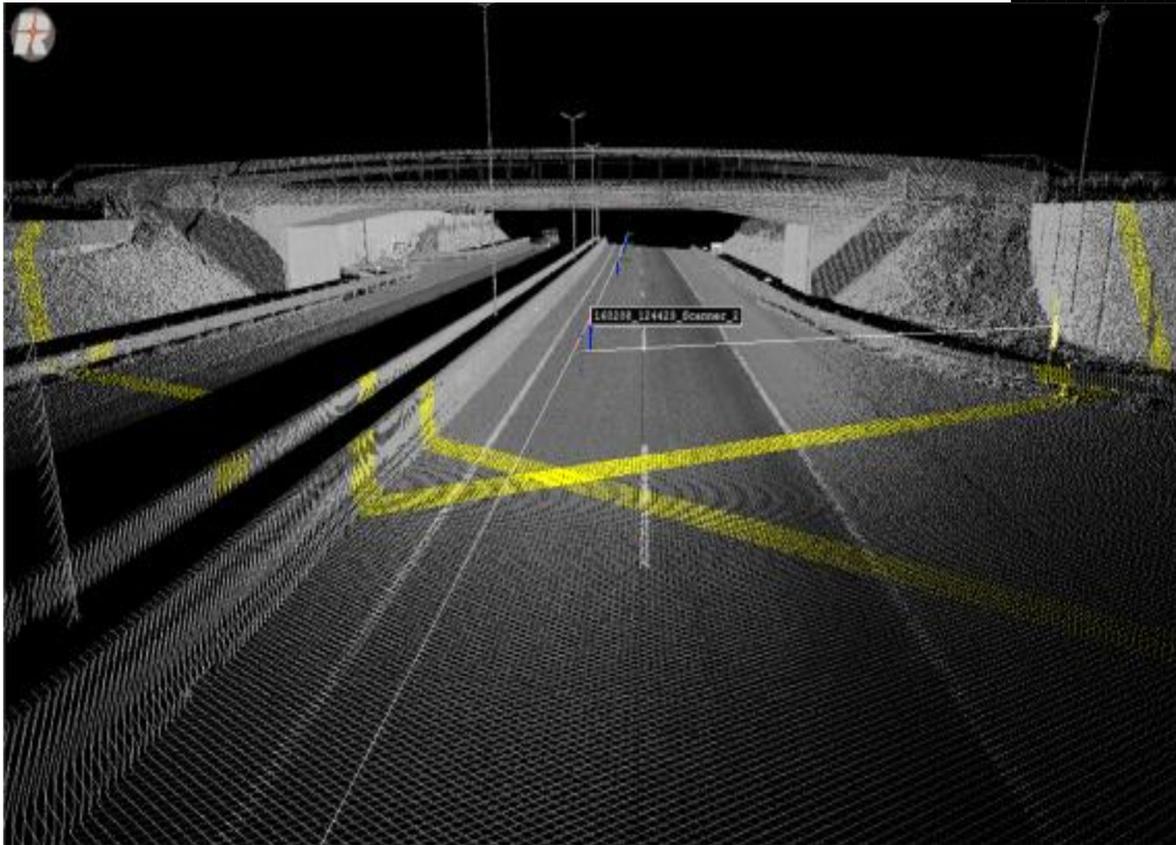
- St148\_Nikkilä\_1019
- Vt4\_Hiekkaharju\_1011
- St148 mitattiin 11.8.2017 ja Vt4 6.10.2017



# Road survey



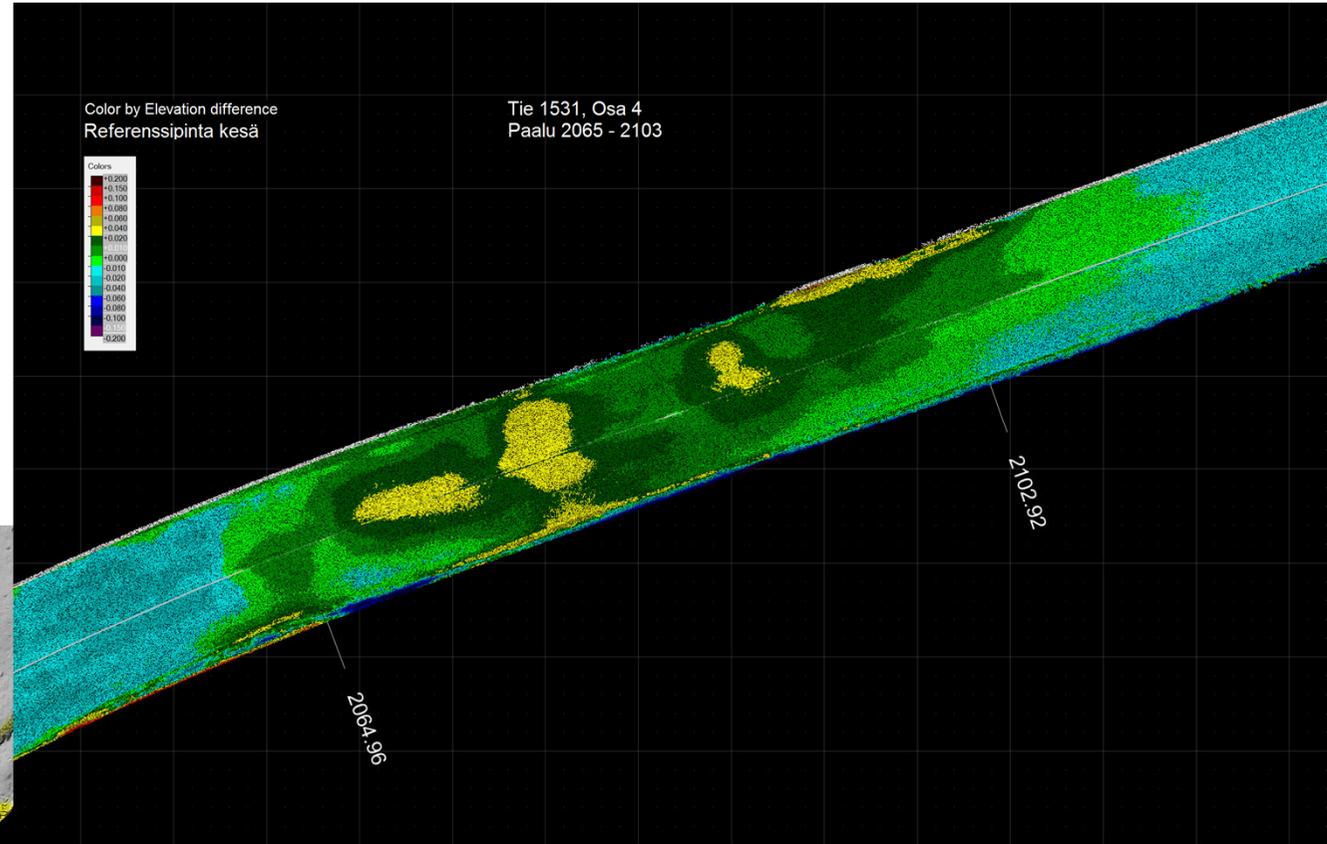
# Processing



# Processing

Keskilinjageometria ja sovitettu vaakageometria

Road fit results	
Lines	26
Worst poss.	0.239 m
Arcs	63
Worst comp.	0.128 m
Chords	7
Average residual	0.034 m
Total	116



# Results – PTM parameters

Station	LeftEast	LeftNorth	LeftZ	RightEast	RightNorth	RightZ	EdgeSlope	LeftRut	RightRut	MaxRut	LeftRutPos	RightRutPos
0.0	25508178.02	6696992.255	44.14	25508176.53	6696989.42	44.12	-0.37	0.02	0.02	0.03	1.10	2.60
0.1	25508178.11	6696992.209	44.14	25508176.62	6696989.38	44.12	-0.40	0.03	0.02	0.03	1.05	2.55
0.2	25508178.19	6696992.163	44.14	25508176.71	6696989.33	44.13	-0.36	0.02	0.02	0.03	1.05	2.50
0.3	25508178.28	6696992.116	44.15	25508176.80	6696989.28	44.13	-0.37	0.02	0.02	0.03	1.10	2.60
0.4	25508178.37	6696992.07	44.15	25508176.89	6696989.24	44.13	-0.35	0.02	0.02	0.02	1.05	2.55
0.5	25508178.46	6696992.023	44.15	25508176.97	6696989.19	44.14	-0.37	0.02	0.02	0.03	1.05	2.55
0.6	25508178.55	6696991.977	44.15	25508177.06	6696989.14	44.14	-0.36	0.02	0.02	0.03	1.10	2.55
0.7	25508178.64	6696991.931	44.16	25508177.15	6696989.10	44.14	-0.40	0.02	0.02	0.03	1.05	2.65
0.8	25508178.73	6696991.884	44.16	25508177.24	6696989.05	44.14	-0.36	0.02	0.02	0.02	1.05	2.50
0.9	25508178.81	6696991.838	44.16	25508177.33	6696989.00	44.15	-0.41	0.02	0.02	0.03	1.00	2.55
1.0	25508178.9	6696991.791	44.16	25508177.42	6696988.96	44.15	-0.19	0.02	0.02	0.02	1.05	2.55
1.1	25508178.99	6696991.745	44.16	25508177.51	6696988.91	44.15	-0.34	0.02	0.02	0.02	1.00	2.45
1.2	25508179.08	6696991.698	44.17	25508177.59	6696988.86	44.15	-0.40	0.03	0.02	0.03	0.95	2.40
1.3	25508179.17	6696991.652	44.17	25508177.68	6696988.82	44.15	-0.37	0.03	0.02	0.03	1.15	2.50
1.4	25508179.26	6696991.606	44.17	25508177.77	6696988.77	44.16	-0.38	0.03	0.02	0.03	1.00	2.50
1.5	25508179.35	6696991.559	44.18	25508177.86	6696988.73	44.16	-0.36	0.03	0.02	0.03	1.00	2.75
1.6	25508179.43	6696991.513	44.18	25508177.95	6696988.68	44.16	-0.40	0.02	0.02	0.03	1.00	2.65
1.7	25508179.52	6696991.466	44.18	25508178.04	6696988.63	44.16	-0.33	0.03	0.02	0.03	1.05	2.55
1.8	25508179.61	6696991.42	44.18	25508178.13	6696988.59	44.17	-0.31	0.02	0.02	0.03	1.15	2.60
1.9	25508179.7	6696991.374	44.18	25508178.21	6696988.54	44.17	-0.29	0.02	0.02	0.02	0.95	2.55
2.0	25508179.79	6696991.327	44.18	25508178.30	6696988.49	44.17	-0.34	0.03	0.02	0.03	0.90	2.45
2.1	25508179.88	6696991.281	44.19	25508178.39	6696988.45	44.17	-0.30	0.02	0.02	0.03	1.05	2.50
2.2	25508179.97	6696991.234	44.19	25508178.48	6696988.40	44.18	-0.29	0.02	0.02	0.03	1.00	2.55



Liikenneviraston tutkimuksia ja selvityksiä

17/2018

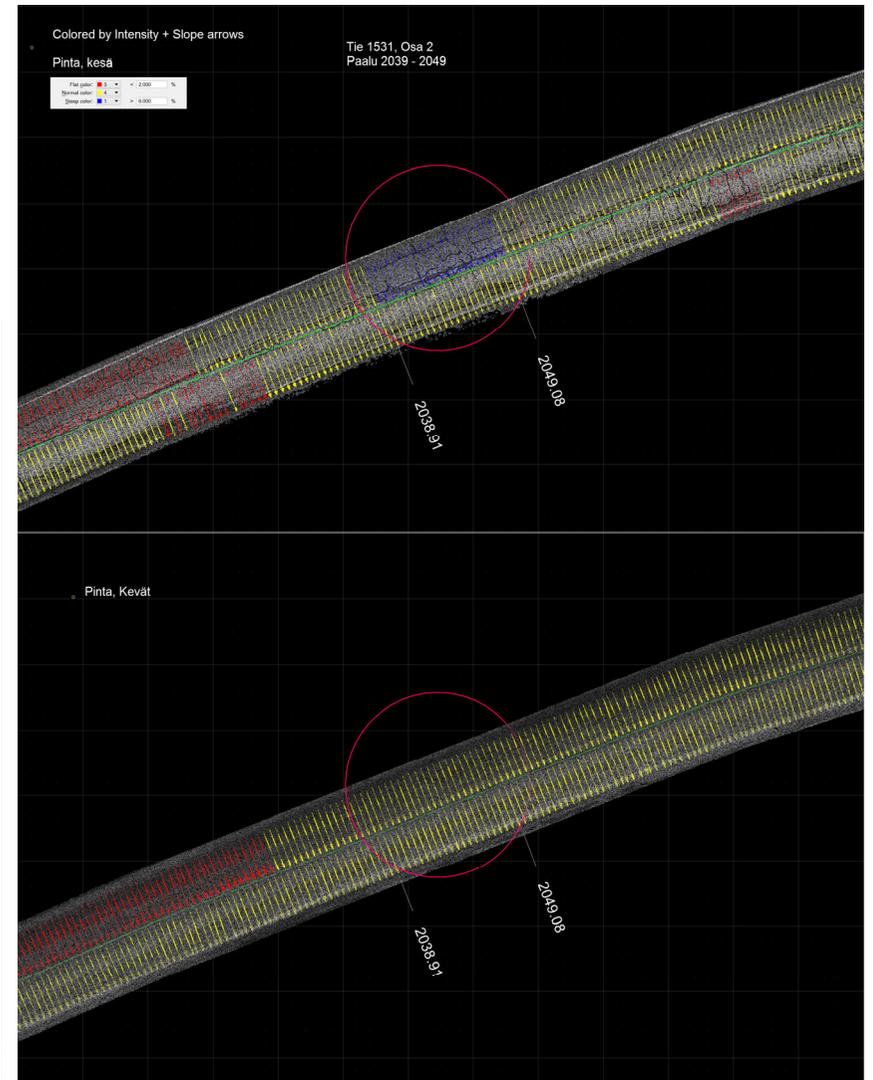
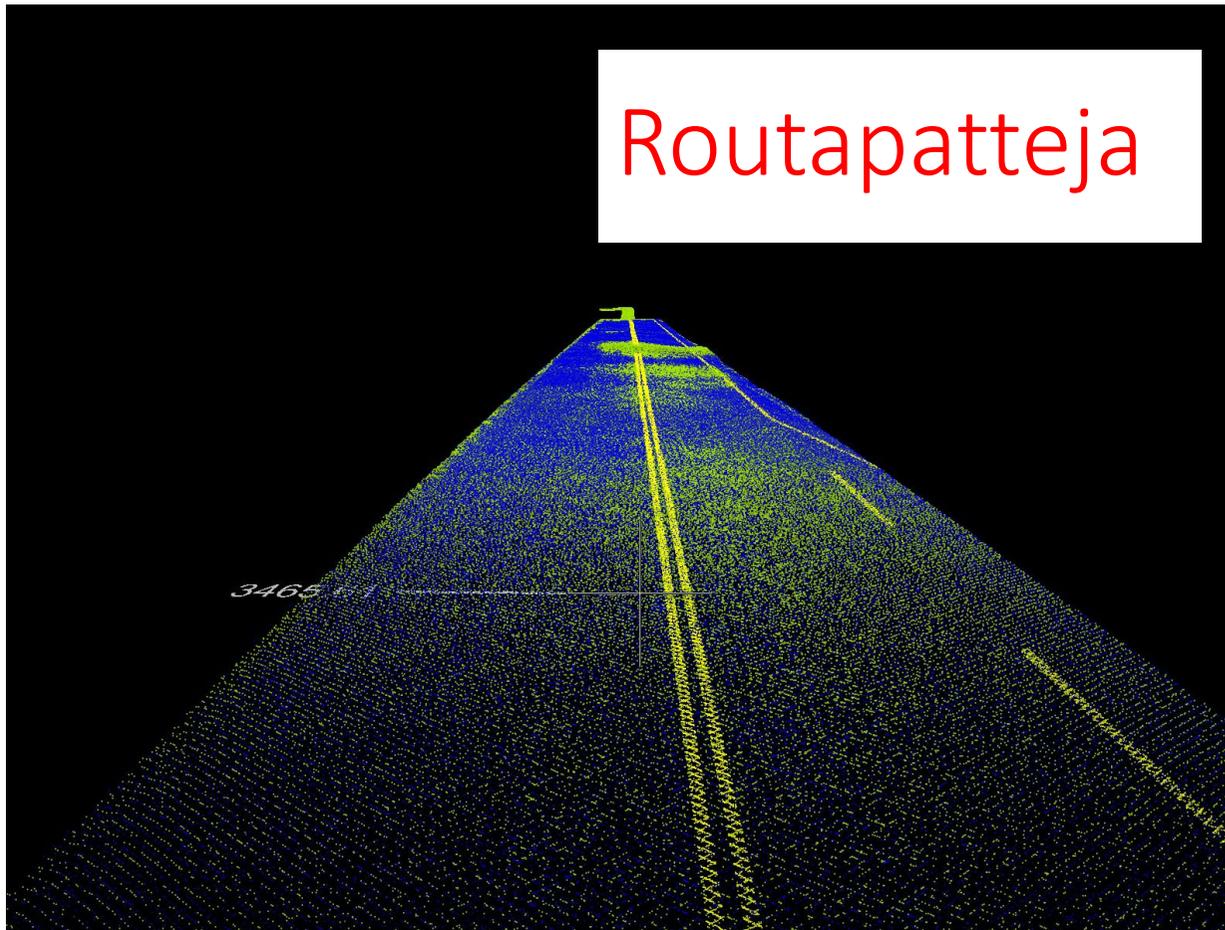
Pertti Virtala  
Pauli Alanaatu  
Eeva Huuskonen-Snicker

## Uramittausten mittaustekniikoiden vertailu

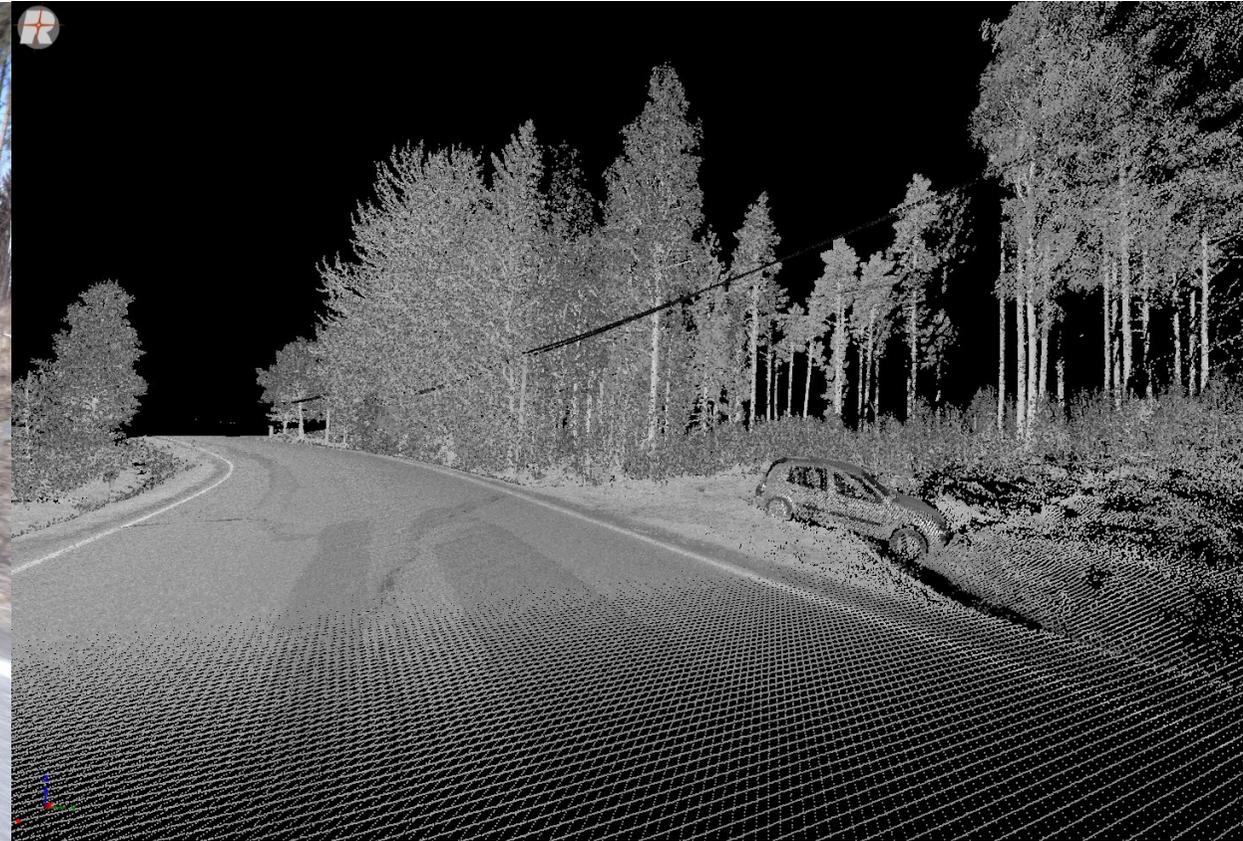
Tositimitta- ja tuotantomittaustesti



# Results – ground frost



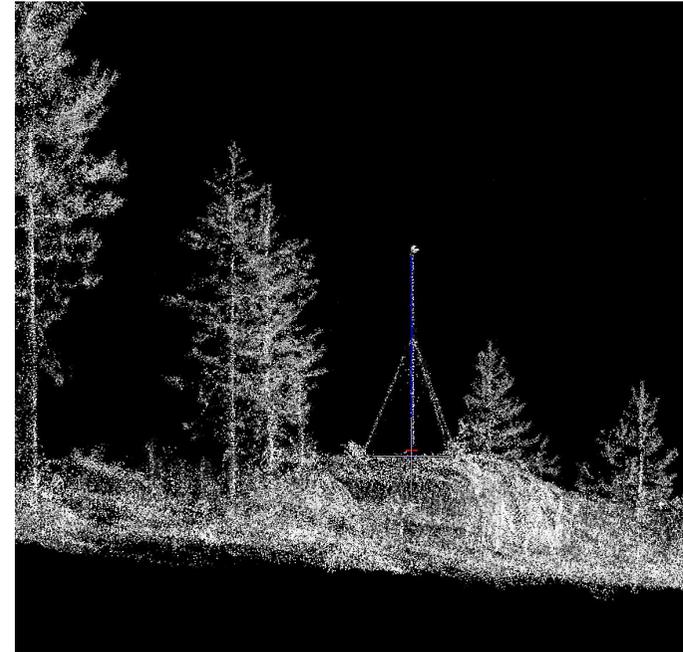
# Results - driving



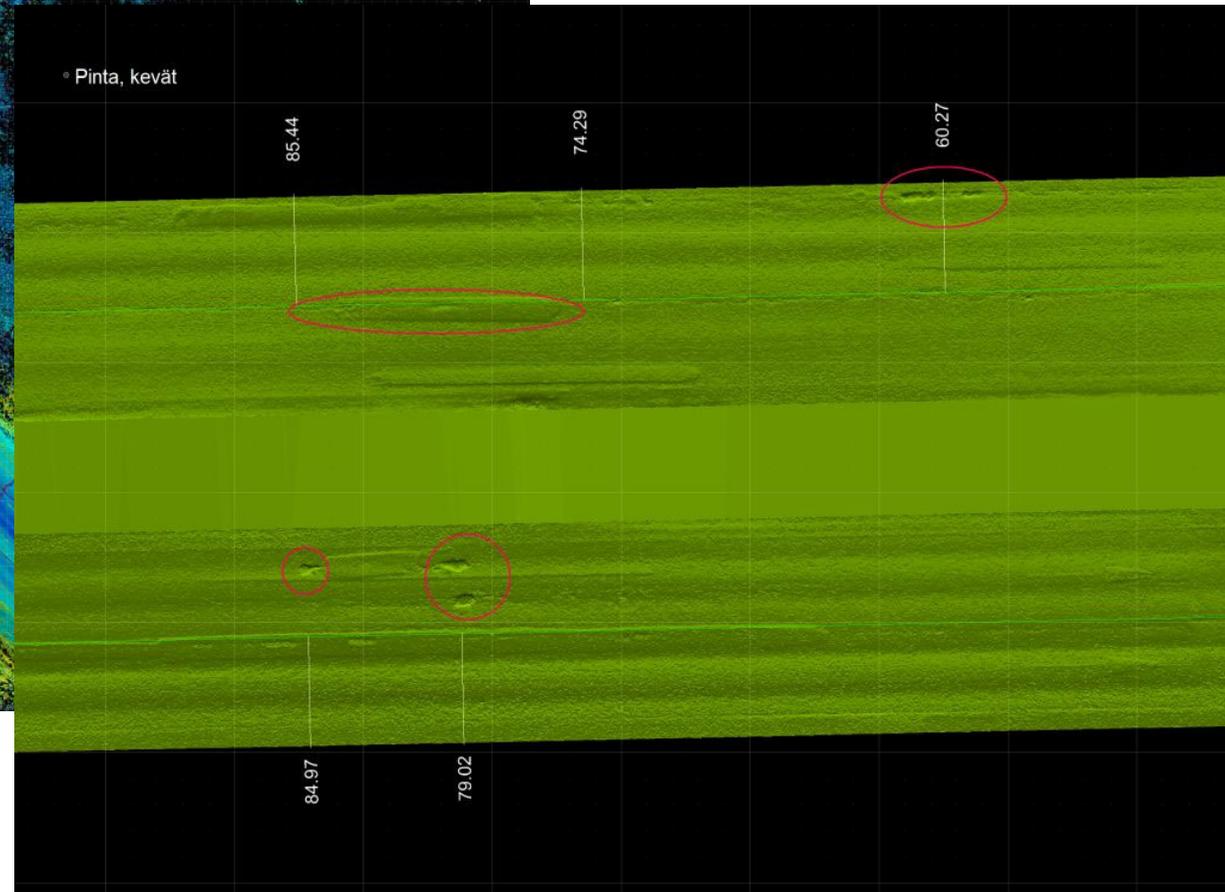
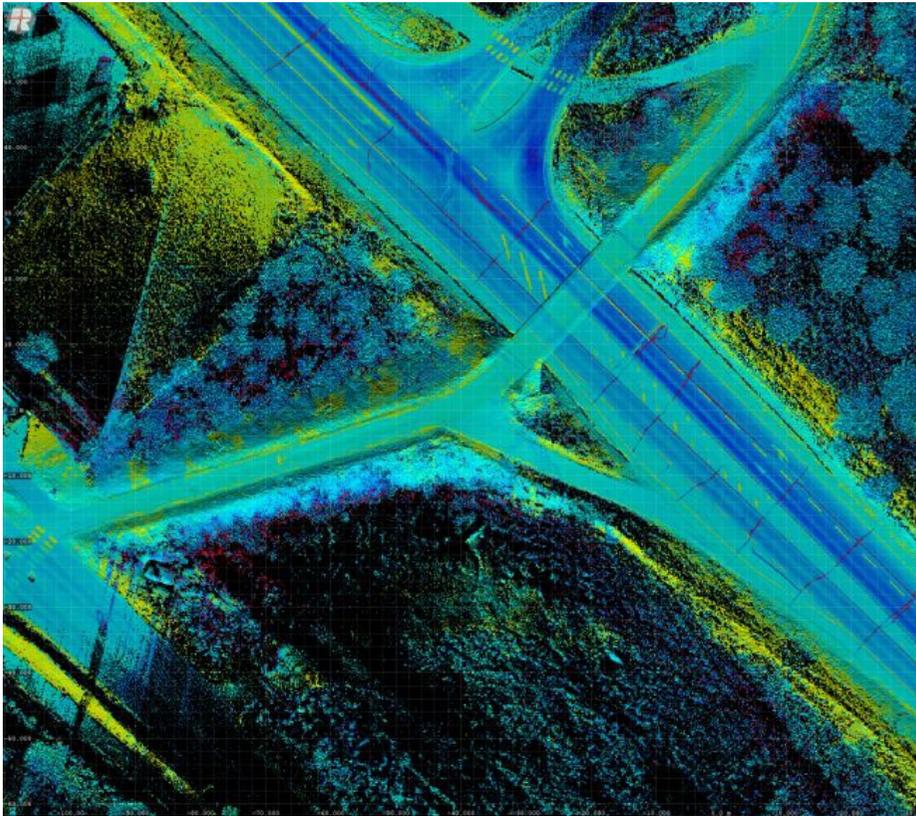
# Results – location and positioning accuracy



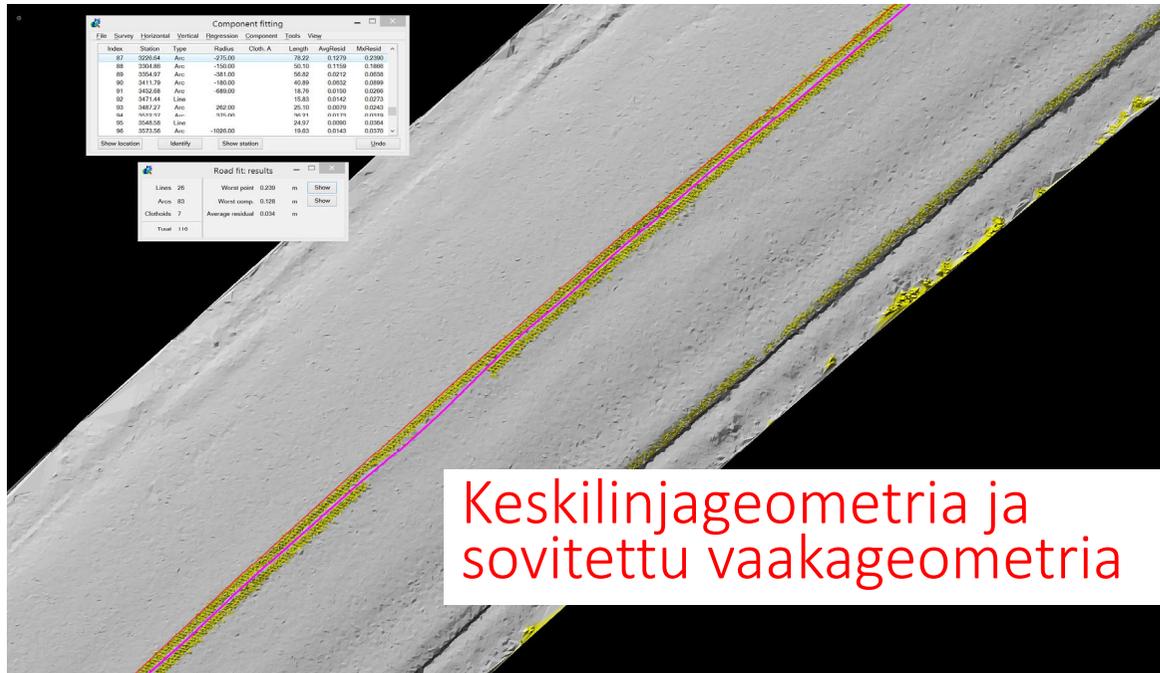
- Post-processing using CORS network
  - Absolute accuracy < 10 cm (typical)
  - Absolute accuracy < 25 mm (Porvoo)
  - Absolute accuracy < 10 mm (asphalt tests)
- Change detection: use local frame of reference



# Results – traffic signs and road furniture



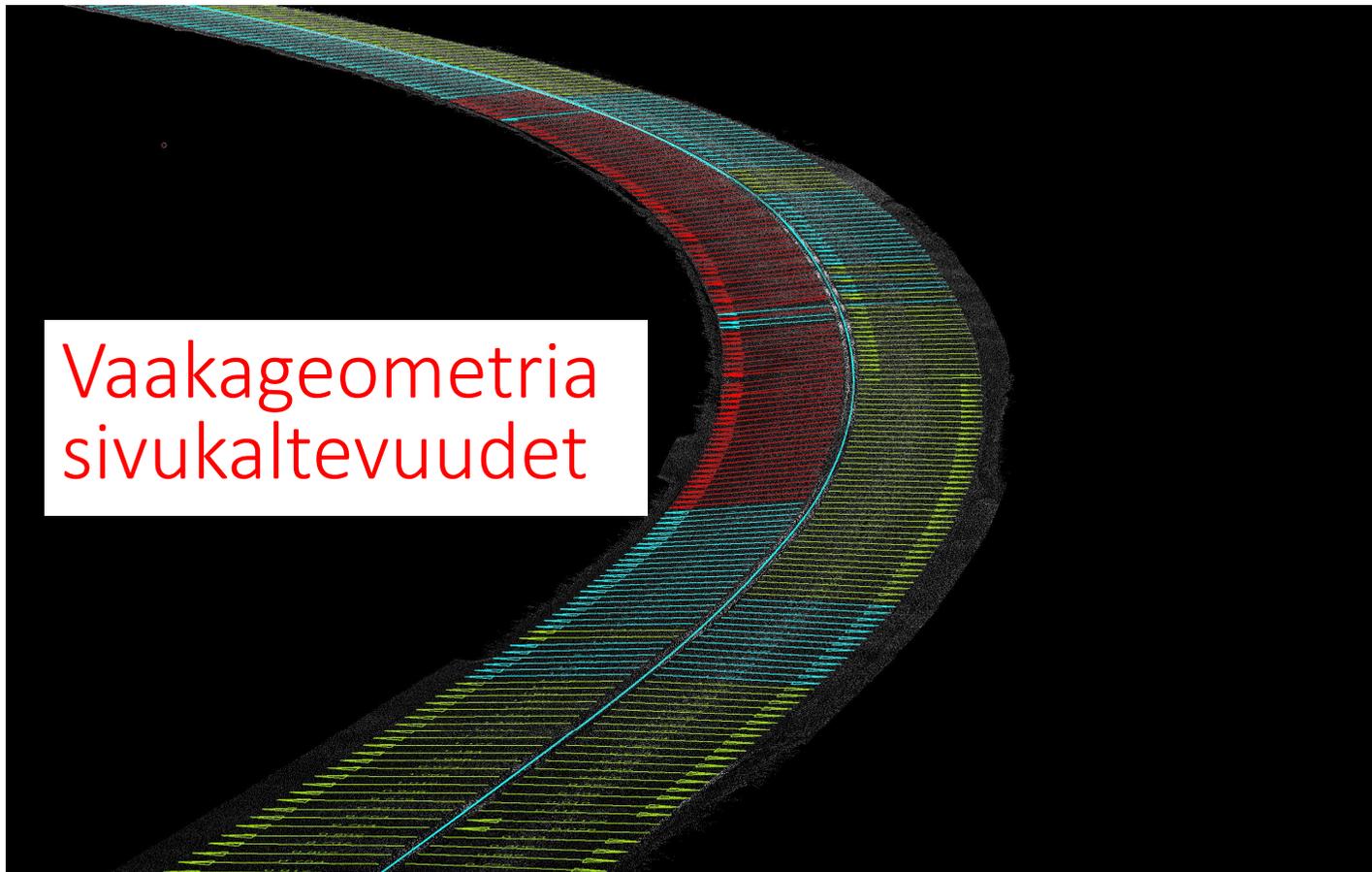
# Results – center line and ruts



Keskilinjageometria ja sovitettu vaakageometria

Pystygeometria kohouma

## Results – 3D surface model



Vaakageometria  
sivukaltevuudet

# What can be achieved with the VMX systems

*Comparable values to the traditional network level pavement measurements*

## **In addition:**

- Accurate center line of the road , vertical and horizontal geometry
  - Curvature radii and straight lane parameters, difference between designed and measured geometry, long distance deviations
- Accurate 3D surface model of the road
  - Latitudinal and longitudinal inclinations
  - Analysis of the driving geometry
  - Drainage gradient/pooling of the water
- Change detection – due to good positioning accuracy
- Road furniture and traffic signs
- Damages of the road surface
- Reflectance values of the road lines and traffic signs
- Vegetation analysis



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# What can be achieved with the VMX systems

One survey provides an abundant amount of data:

- First the traditional rut and evenness analyses can be calculated and decided what should be done with the different road sections
  - The same data can be used for designing a repair plan for the sections requiring repair
  - When resurfacing the road, minor geometry repairs can also be conducted due to the excellent positioning accuracy of the data
  - After resurfacing the results can be checked with a new scanning
- ⇒ The location data of the national road register can be enhanced
- ⇒ HD maps for the autonomous vehicles can be created

# VMX vs. traditional network level pavement analysis

	Traditional PTM	VMX technology
Calibration of the distance acceptance limit < 10m	Required	Not required
Driving line (position of the wheel) affects the end result	Yes	No
Accurate road geometry	Not suitable	Yes
Repeatability	? Depends on many factors	Excellent

Thank you for your interest!  
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