Vägytemätning i Norden

TRAFIKVERKET

Lite om vad som är på gång i våra grannländer

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Statens vegvesen
Norwegian Public Roads Administration

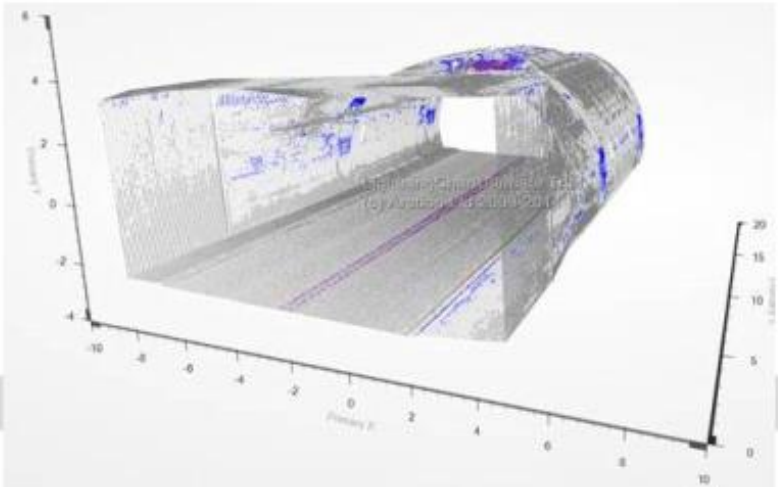
Measuring rutting/roughness/crossfall and texture with ViaPPS:

Norwegian road scanner – developed from 2007

Statens vegvesen
Norwegian Public Roads Administration

New generation laser scanner

- 360 deg scanning
- Double resolution compared to old eq.
  - Cross profile dist. 8 cm @60 km/h
  - 1300 data points cross profile, 3 mm dist. between points
- Better possibility for detection of damages (cracks, texture, homogenity)
- Potential for new areas of use:



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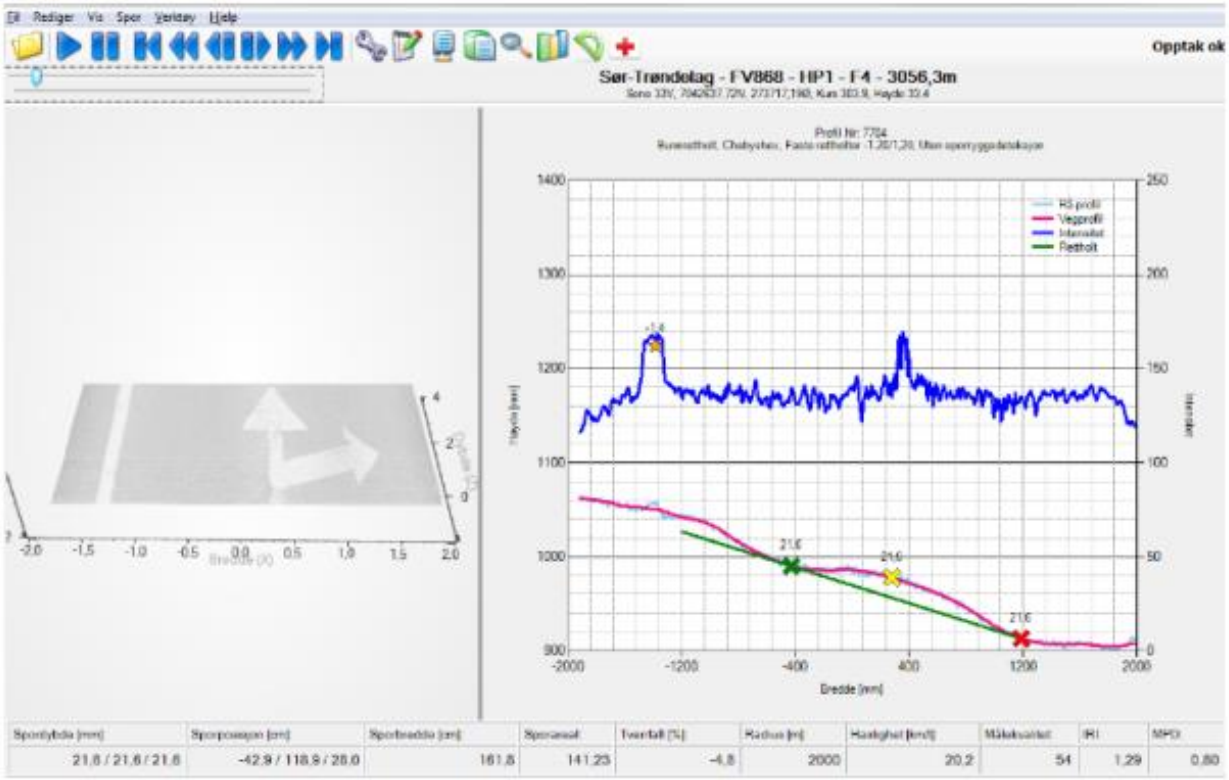
Norwegian Public Roads Administration

Example of measurement



New possibilities with 360 deg laser scanning

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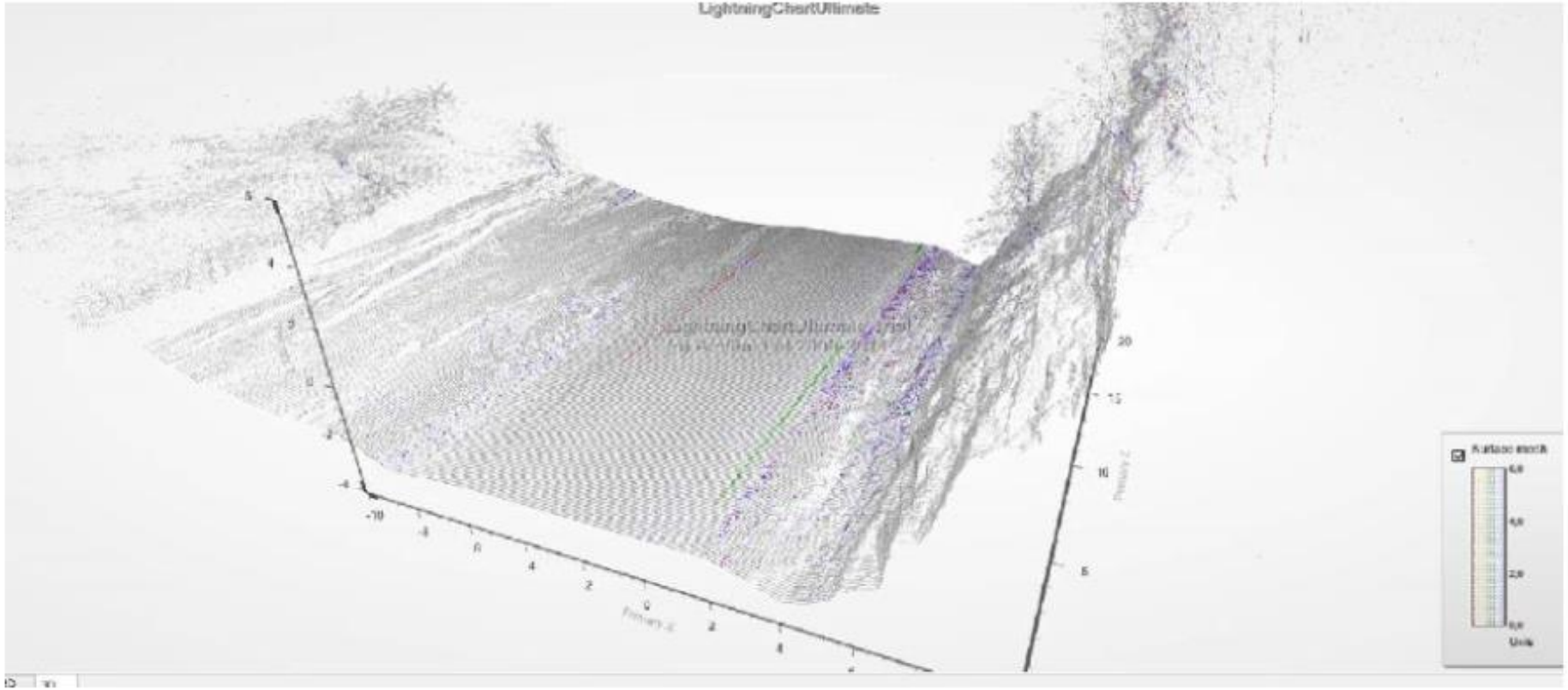

Crack detection with ViaPPS

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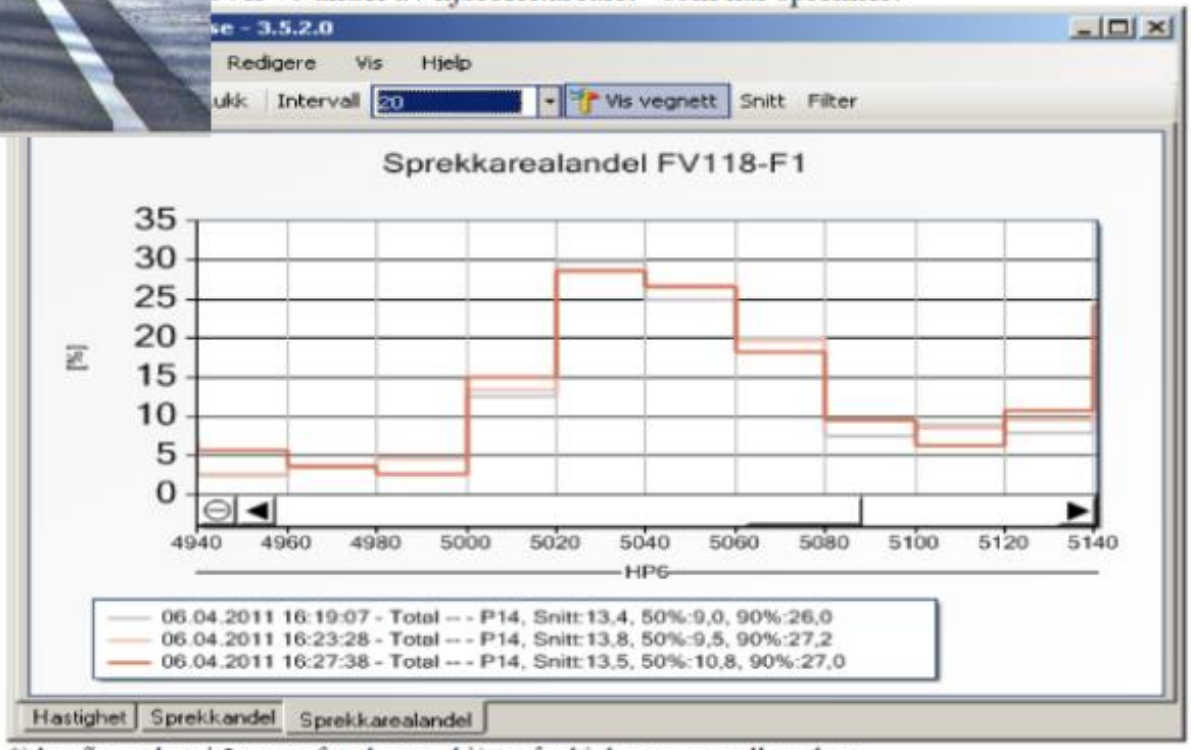
over %-andel av kjørefeltarealet* som har sprekker:



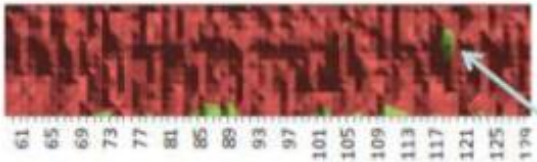
*) konfigurerbart i 5 soner, for eksempel i/utenfor hjulspora og mellom dem

R&D: Homogenity- Measurement of texture/separation

Statens vegvesen
Norwegian Public Roads Administration

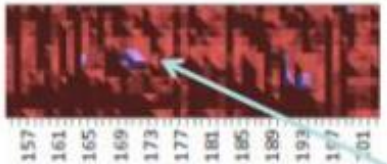
Via Tech

Eksempler på deteksjon



Separasjon

Vi snur om, og ser etter blødninger

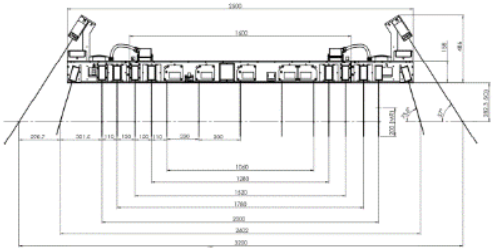


Current topics in Finland

Stockholm/Arlanda 12.4.2018

Juho Meriläinen/FTA

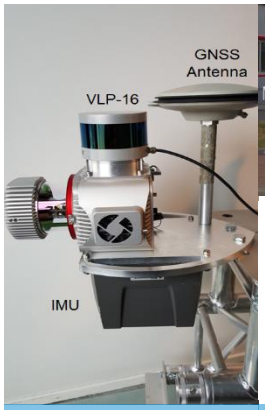
Background



- In Finland point laser profilers are used since 2003.
- Procurement of network level measurement contra
- New laser/lidar based techniques available producing continuous cross profile.
  - But very little information on how well they perform and and is the data comparable with the data produced by point laser profilers.
  - New technical specs and demands for the procurement?
- Don’t want to experience what happened in 2003 again…
- Focus on rut depth
  - Repeatability of new techniques?
  - Level difference between point laser cross profiles and continuous profiles?
  - Possibilities and better exploitation of continuous cross profiles.
  - Effects of measurement width?

Main goal: to gather information for the next procurement

Scanner test phase I: participants



Solid Potato
Riegl VUX-1HA
Resolution 2-3mm
360° field of view
Sampling interval 80mm (80km/h)

Nordic Geocenter
Riegl VMX-1HA
Resolution 3mm
360° field of view
Sampling interval 4,4mm (80km/h)

Terratec
Z+F profiler 9012
Resolution 0,1mm
360° field of view
Sampling interval 110mm (80km/h)

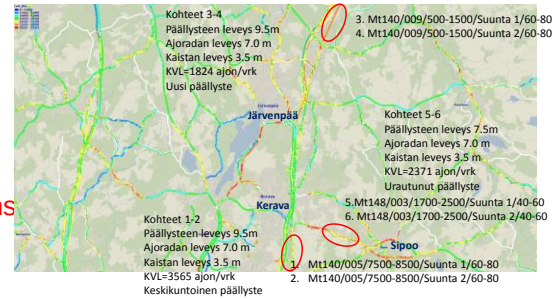
Roadscanners
SICK LMS511-HR
Resolution 25mm
190° field of view
Sampling interval 222mm (80km/h)

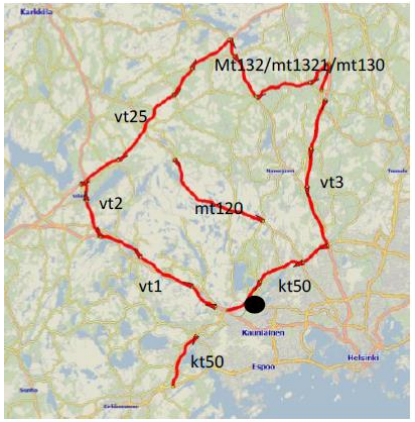
Ramboll
Pavemetrics LCMS v2
Resolution 0,1mm
4m meas.width
Sampling interval 4mm (80km/h)

References (17 point laser profilers):
- Destia P69 (Greenwood)
- Ramboll RST21

Scanner test phases: test setup

- 1st phase
  - in september 2017
  - 6 x 1km sections in capitol area
    - 5 runs with speed 60km/h and 80km/h = total 10 runs
    - Rut depth from ~ 3mm to ~ 27mm
- 2nd phase network level route
  - in september 2017
  - 139 km
    - 2 runs
- Calculate parameters with three ways:
  - Algortihm A: from continuous profile pick 17 point cross profile configuration by using 3,2m width and (only Ramboll could do this)
  - Algortihm B: from continuous profile by using 3,2m measurement width
  - Algortihm C: from continuous profile by using own measurement width (excluding road markings)
  - Parameters: rut depths (maximum, left, right), ri[illegible] and cross fall
  - 100m averages
  - Repeatability
  - Level differences
  - Six Sigma quality parametrs (GageRR%)

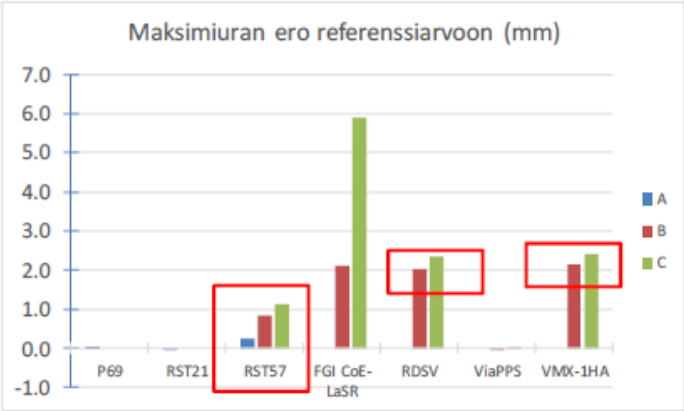




Main goal: to compare point laser and continuous laser data and to choose companies for the second phase of testing

Scanner test phase I: some results from short sections (6 x 1km)

Level differences to reference in max.rut with different algorithms



- With LCMS the difference ~ 1mm
- ViaPPS had some issues in data deliveries. Results almost too good. Uncertainties in using algorithm C

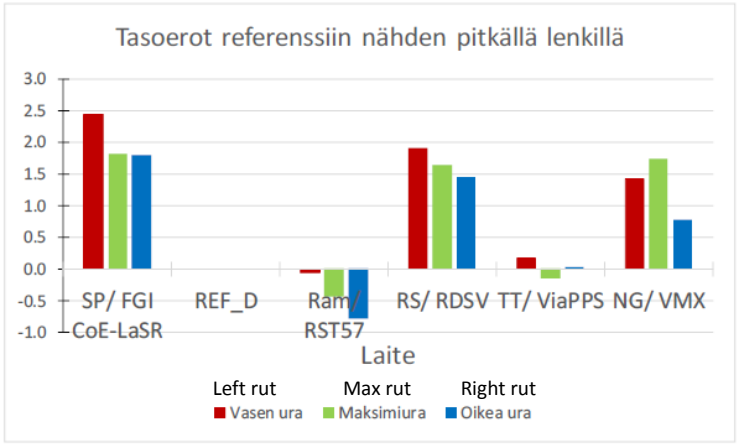
Used algorithm/Device | Site number | Max.rut average

Algoritmi/laite	Kohde						Keskim.	
	1	2	3	4	5	6		
A	**11.53**	**10.65**	**3.37**	**2.74**	**20.82**	**21.80**	**11.14**	
P69	11.53	10.56	3.47	2.88	20.63	21.51	11.10	References
RST21	11.39	10.60	3.15	2.68	20.63	21.77	11.03	
RST57	11.66	10.81	3.45	2.62	21.24	22.22	11.30	
B	**12.48**	**11.61**	**4.87**	**4.29**	**22.31**	**23.47**	**12.48**	
FGI CoE-LaSR	13.22	13.23	4.90	4.20	23.16	24.64	13.18	
RDSV	12.84	11.58	6.07	5.45	22.61	24.01	13.08	
RST57	12.35	11.49	3.93	3.08	21.92	22.88	11.91	
ViaPPS	11.50	10.25	3.06	2.80	20.99	21.65	11.02	
VMX-1HA	12.48	11.49	6.38	5.94	22.87	24.14	13.20	
C	**13.26**	**12.41**	**5.82**	**5.34**	**23.38**	**24.48**	**13.42**	
FGI CoE-LaSR	17.26	16.96	8.67	7.85	26.96	28.32	16.96	
RDSV	12.76	11.64	6.09	5.92	23.52	24.72	13.39	
RST57	12.72	11.92	4.05	3.19	22.27	23.17	12.19	
ViaPPS(*)	10.77	9.72	3.60	3.60	21.02	21.83	11.07	
VMX-1HA	12.77	11.83	6.70	6.14	23.13	24.37	13.47	

Scanner test phase II: some results from long route (139km)

References

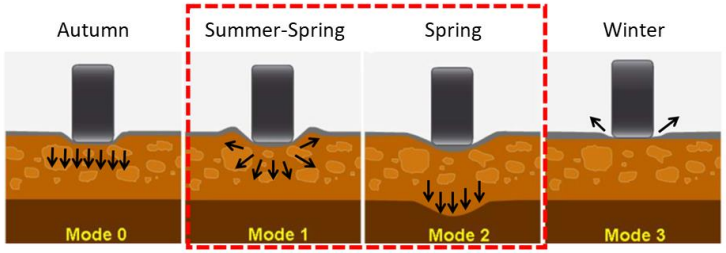
Level differences to reference with algorithm B



Maksimiura																		23.1.2018					
Mittauskerta 1							Mittauskerta 2							Tasoerot									
Tie / osa	SP/ FGI CoE-LaSR	REF_D	Ram/ RST57	RS/ RDSV	TT/ ViaPPS	NG/ VMX	Tie / osa	SP/ FGI CoE-LaSR	REF_D	Ram/ RST57	RS/ RDSV	TT/ ViaPPS	NG/ VMX	Tie / osa	SP/ FGI CoE-LaSR	REF_D	Ram/ RST57	RS/ RDSV	TT/ ViaPPS	NG/ VMX			
1							1							1									
6	8.71	6.81	6.72	8.67	6.80	8.90	6	8.67	6.88	6.75	8.70	6.72	8.92	6	1.85		-0.11	1.84	-0.08	2.06			
7	7.22	5.50	5.07	7.14	5.18	7.33	7	7.35	5.52	5.10	7.17	5.19	7.12	7	1.78		-0.42	1.65	-0.33	1.71			
8	6.72	5.45	5.12	6.86	5.21	7.42	8	6.88	5.49	5.16	6.92	5.21	7.23	8	1.33		-0.33	1.42	-0.26	1.86			
1 Summa	7.43	5.78	5.46	7.40	5.56	7.72	1 Summa	7.52	5.82	5.50	7.44	5.55	7.57	1 Summa	1.67		-0.32	1.62	-0.25	1.84			
2							2							2									
1	10.82	8.27	7.88	10.31	8.02	9.83	1	10.93	8.36	7.86	10.37	8.07	9.85	1	2.55		-0.45	2.02	-0.27	1.52			
2	9.16	7.79	6.83	9.29	7.59	9.15	2	9.41	7.70	6.77	9.31	7.69	9.24	2	1.54		-0.94	1.55	-0.11	1.44			
2 Summa	10.26	8.12	7.55	9.99	7.89	9.61	2 Summa	10.41	8.15	7.52	10.04	7.95	9.66	2 Summa	2.20		-0.60	1.88	-0.22	1.50			
3							3							3									
103	8.71	6.69	6.07	7.97	6.82	8.65	103	8.82	6.65	6.04	8.20	6.33	8.46	103	2.09		-0.62	1.42	-0.10	1.89			
104	6.31	4.78	3.97	5.58	4.28	6.45	104	6.34	4.76	3.94	5.60	3.94	6.18	104	1.56		-0.82	0.82	-0.66	1.55			
105	6.07	4.98	4.12	5.36	4.27	6.35	105	5.98	5.17	4.07	5.44	3.99	6.09	105	0.95		-0.98	0.32	-0.94	1.15			
3 Summa	7.15	5.63	4.89	6.49	5.31	7.32	3 Summa	7.17	5.67	4.85	6.61	4.92	7.09	3 Summa	1.51		-0.79	0.90	-0.54	1.55			
25							25							25									
24	6.52	4.44	3.88	6.59	4.41	7.47	24	6.61	4.58	3.88	6.55	4.16	7.46	24	2.06		-0.63	2.06	-0.22	2.96			
25	13.85	12.74	11.32	13.98	12.58	13.08	25	13.86	12.87	10.95	13.97	12.60	13.09	25	1.05		-1.68	1.17	-0.22	0.28			
27	8.41	6.58	6.11	8.82	6.33	8.21	27	8.37	6.60	6.13	8.92	6.42	8.25	27	1.80		-0.47	2.28	-0.21	1.64			
28	5.07	3.35	3.23	7.91	3.32	6.74	28	4.95	3.51	3.22	7.61	3.18	6.83	28	1.58		-0.20	4.33	-0.18	3.36			
25 Summa	9.50	7.94	7.14	10.25	7.82	9.73	25 Summa	9.49	8.06	6.99	10.19	7.76	9.76	25 Summa	1.49		-0.94	2.22	-0.21	1.74			
50							50							50									
1	12.09	10.19	9.46	12.21	10.07	11.63	1	11.82	10.26	9.31	12.17	10.04	11.35	1	1.73		-0.84	1.97	-0.17	1.26			
3	9.75	7.64	7.73	9.91	7.90	9.76	3	9.76	7.83	7.74	9.72	7.87	9.68	3	2.02		0.00	2.08	0.15	1.98			
4	8.82	6.90	8.75	8.82	7.96	9.38	4	9.05	7.30	8.89	8.85	7.84	9.20	4	1.83		1.72	1.73	0.79	2.19			
5	9.51	7.48	8.03	9.51	8.03	10.07	5	9.96	7.75	8.01	9.74	7.85	9.64	5	2.12		0.40	2.01	0.32	2.23			
50 Summa	10.21	8.23	8.60	10.28	8.64	10.30	50 Summa	10.26	8.45	8.59	10.27	8.56	10.08	50 Summa	1.90		0.26	1.94	0.26	1.85			
120							120							120									
5	7.45	5.44	5.31	6.92	5.28	7.30	5	7.63	5.55	5.31	6.95	5.33	7.36	5	2.04		-0.19	1.44	-0.19	1.84			
120 Summ	7.45	5.44	5.31	6.92	5.28	7.30	120 Summ	7.63	5.55	5.31	6.95	5.33	7.36	120 Summ	2.04		-0.19	1.44	-0.19	1.84			
130							130							130									
5	14.05	11.66	10.51	13.11	11.72	13.22	5	14.03	11.67	10.46	13.22	11.57	13.17	5	2.37		-1.18	1.50	-0.02	1.53			
130 Summ	14.05	11.66	10.51	13.11	11.72	13.22	130 Summ	14.03	11.67	10.46	13.22	11.57	13.17	130 Summ	2.37		-1.18	1.50	-0.02	1.53			
132							132							132									
4	11.71	10.34	8.89	11.20	10.02	11.22	4	11.46	9.88	8.60	11.24	9.90	11.11	4	1.48		-1.36	1.11	-0.15	1.06			
5	7.23	5.11	4.95	6.59	5.43	7.24	5	7.19	5.10	4.92	6.55	5.32	7.23	5	2.11		-0.17	1.47	0.27	2.14			
132 Summ	10.47	8.94	7.80	9.93	8.75	10.12	132 Summ	10.28	8.60	7.59	9.94	8.63	10.04	132 Summ	1.60		-1.08	1.16	-0.08	1.31			
1321							1321							1321									
1	6.95	4.97	4.84	6.65	5.26	6.78	1	6.68	4.95	4.80	6.64	4.98	6.82	1	1.85		-0.14	1.69	0.16	1.84			
2	8.42	6.55	6.22	8.14	6.87	8.90	2	8.45	6.56	6.13	8.19	6.73	8.55	2	1.88		-0.39	1.61	0.24	2.17			
1321 Sum	7.42	5.47	5.29	7.14	5.78	7.45	1321 Sum	7.25	5.46	5.23	7.14	5.55	7.37	1321 Sum	1.87		-0.21	1.67	0.20	1.94			
Keskim.	8.70	6.88	6.50	8.54	6.82	8.70	Keskim.	8.74	6.95	6.45	8.56	6.73	8.62	Keskim.	1.81		-0.44	1.64	0.14	1.74			

Phase III 2018-2019: Two projects

1. Summer-winter rutting research
   - At what time of year and how much rutting is deloped during the year
   - How to separate rutting caused by heavy vehicles from rutting caused by studded tyres?
   - What are the charasteristics that should me measured to identify fiddefent rutting modes?



Shape? Width?
Volume?
Distance between rut bottoms?
AASHTO P69 – standard?

   - From phase II one epuipment to measure in 2018 (still unofficialt)
   - Chance for other companies in 2019 if they can meet the requirements (implementation of new parametrers, test measurements against the reference etc.)

Phase III 2018-2019: Two projects

2. Procurement of next network level profile measurement contract
   - Continue gathering data for increasing knowledge of scanner system capabilities and it's comparability to point laser system
   - ~ 1000km of measurements in 2018
   - Algorithms A-C used
   - Testing of parameters not involved in project 1 (f.ex edge deformation, charasteristics related to hydroplanning)
   - Effect of lane width on results (wide/narrow)
   - Effect on FTA's condition target values? Is expected or not?

Basic idea is to gather knowledge as much as possible
and utilize it in procurement