FRAMTIDSSPANING – NYA TEKNIKER FÖR MÄTNING

Thomas Wahlman

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Är du årets *spanare*?

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Hur kom vi hit?

Var står vi nu?

Vart (kan) vi gå?

Var står vi idag

Samma typ av utrustning för **vägyta** sedan >25 år

Även om tekniken var ”färdig” för länge sedan så är det först på de senaste 5 åren som användning av bas-data har ökat samt att ytterligare parametrar kan skapas utifrån befintlig mätteknik.

Omfattande användning

Samma typ av utrustning för **bärighet** sedan >25 år

Kombination av olika information + GPR

Begränsad användning

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Trender

1. Stillastående ->låg hastighet ->trafikhastighet
2. Låg upplösning ->högre upplösning
3. Enstaka sensorer-> Kombinerade sensorer ->”Allt i ett system”
4. Små datamängder ->Omfattande datamängd
5. Enstaka parameter ->Multipla parameter -> Komplexa parametrar
6. FoU -> Projektnivå -> vägnätsnivå
7. Enstaka användare -> Många användare
8. Krav som vara möjliga->Stora krav på tillförlitlig och användbar mätdata

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Är mer ”mätdata” önskvärt?

Tre riktningar:

1. 3D, laser scanning, ”allt i ett system”
2. Anpassade system för entreprenader
3. Mätdata används

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Trend 1

”allt i ett system”

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Technology – Positioning and Sensors

A Inertial Positioning System - GPS

With POS LV we have a fully integrated, turnkey position and orientation system, which generates continuous, accurate, position and orientation information even under difficult GPS conditions.

B Pavement Profile Scanner - PPS

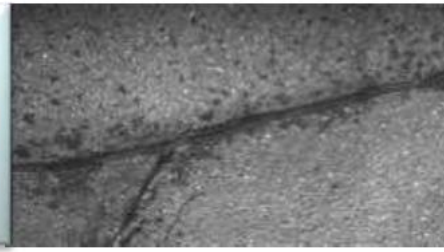
With the PPS we have a LiDAR device on-board being specifically designed for the purpose of real 3D-road surface/evenness detection. It works with an height accuracy of 0.3 mm while being speed independent.

C Clearance Profile Scanner - CPS

The CPS provides the ideal complement to the road surface scanner PPS. The CPS is a 350° laser scanner for precise detection of clearance profiles and 3D area scans having a measuring coverage of in total 60m.

D Surface Ortho-Photo System

With our special road surface analysis system we provide an outstanding solution for recognition of any kind of surface defects. Officially authenticated, cracks from a width of 0.5 mm can be detected.



E Panoramic Camera Solution

A coupled system of photogrammetric survey cameras can be mounted on the roof frame to provide round-view imagery. The camera solution comes with a special image viewer and measurement tool.

Lehman&Patner LiDAR Technology

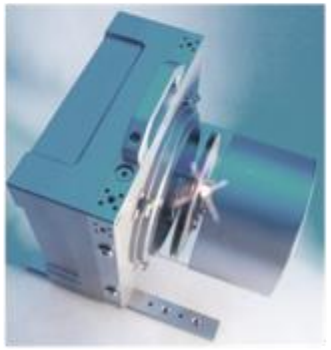
LIDAR Technology by Fraunhofer IPM

Pavement Profile Scanner - PPS

Focus on Road Surfaces

Clearance Profile Scanner - CPS

350 Degree Scanning



3D ROAD

Condition Assessment

Profile Database Generation

Environment Assessment

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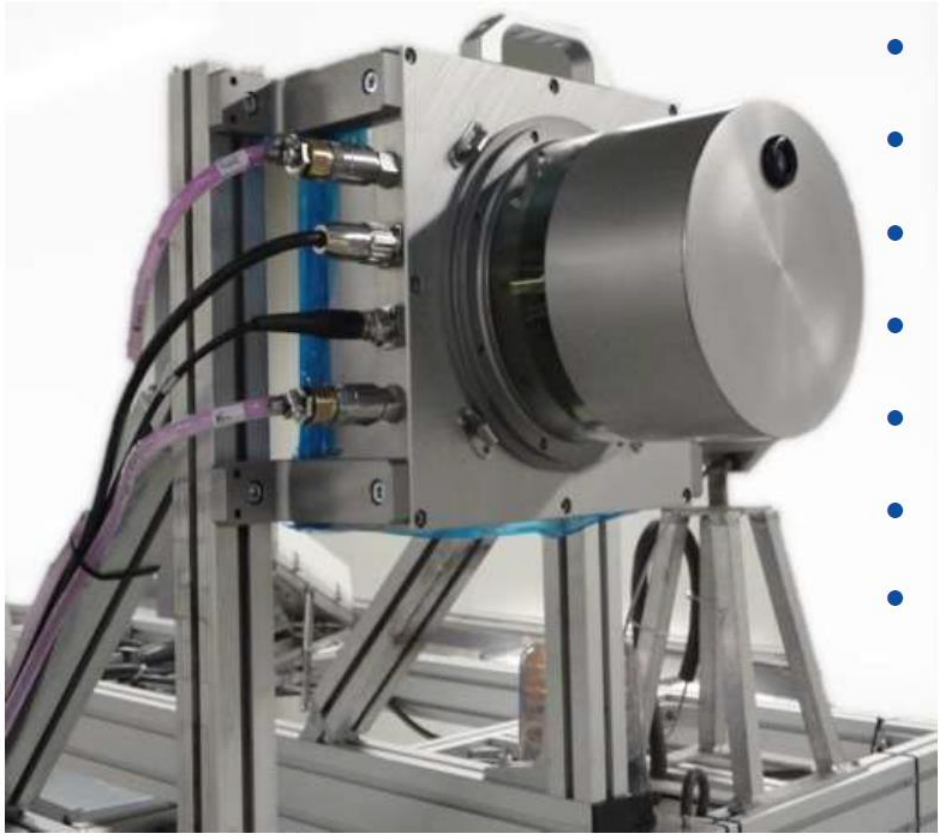
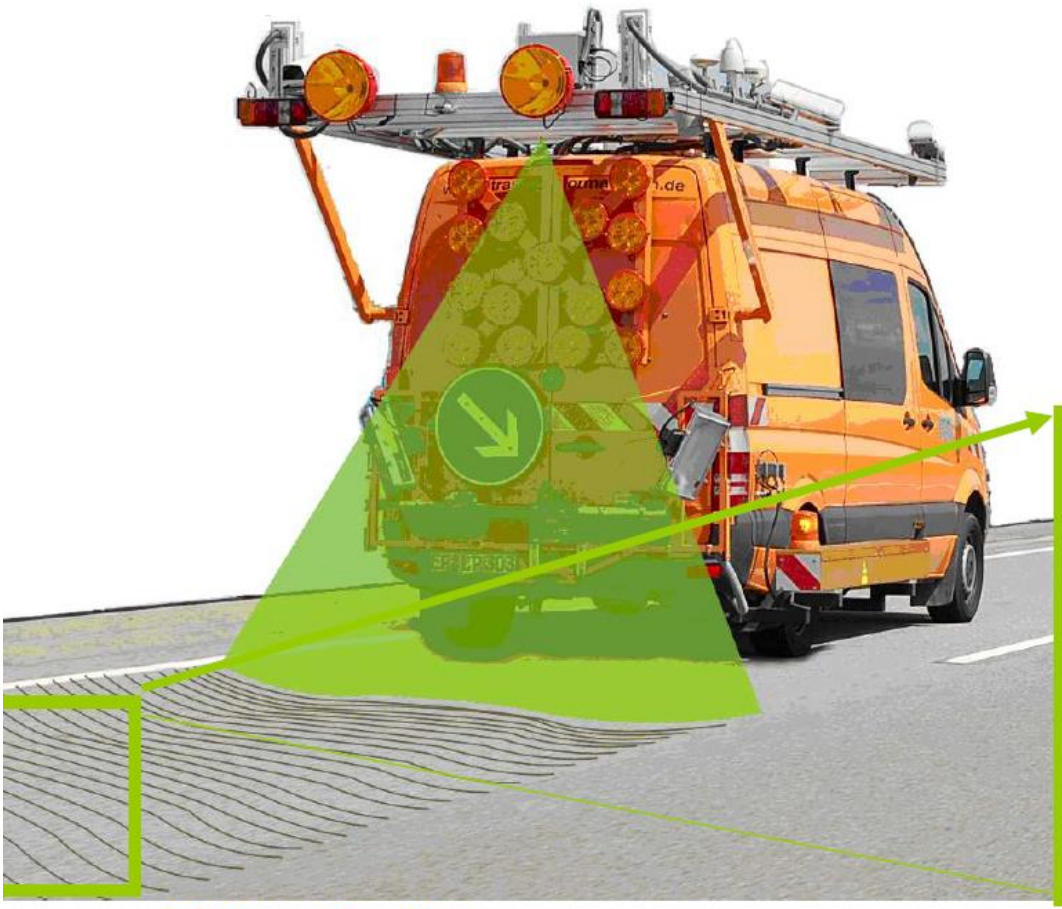
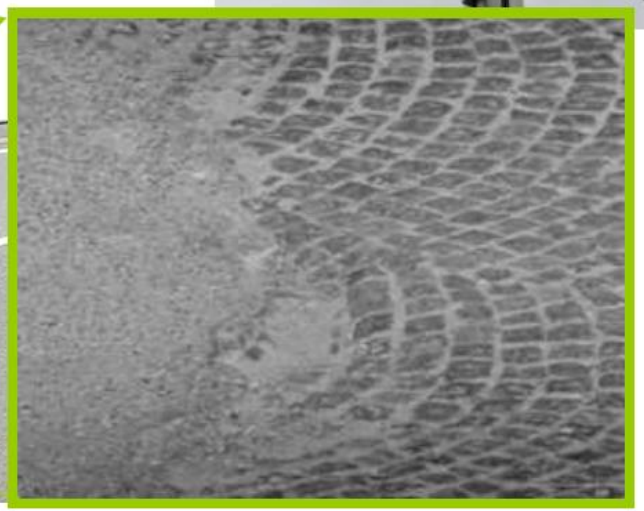
Laser Scanner CPS for 350° Scans



- Laser class 1 (eye safe)
- 1mm distance resolution
- Measuring distance up to 30m
- Scanning angle 350°
- Protection class / housing - IP67
- Frequency: 200 Hz
- 5000 points per scan (200 times per second)

Laser Scanner PPS for Pavement Scanning





- 3D Road Profiles
- 800 profiles per second
- IP 67
- Laser: infrared, class 1 (eye save)

- Measurement range: 1,3m to10m
- 900 points per profile
- width of the recording: 4 m

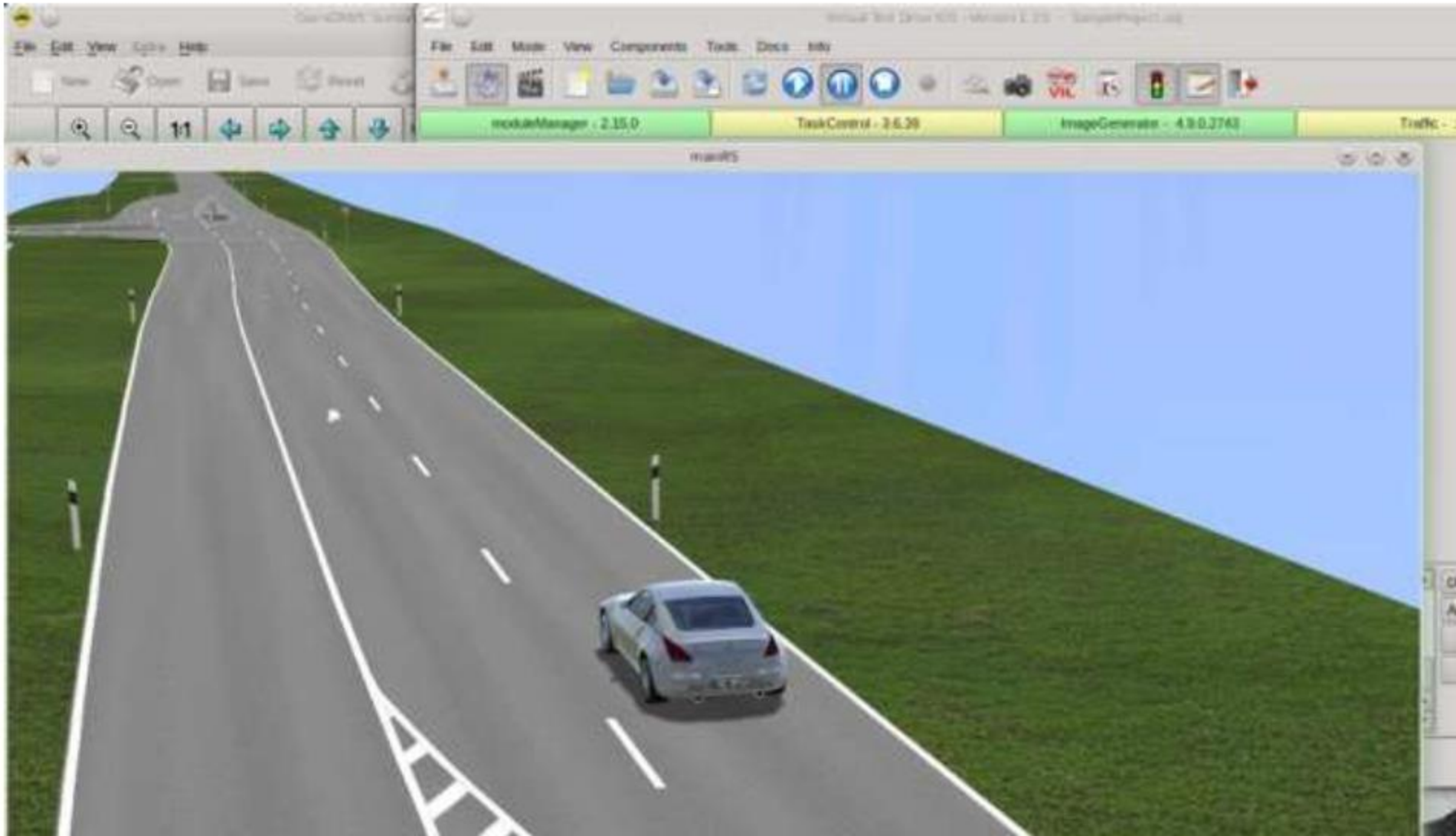
Examples of 3D Measurements

Intensity image of a test track

Real photo

Source: ARAI, India

Simulation Model for Driving (III)



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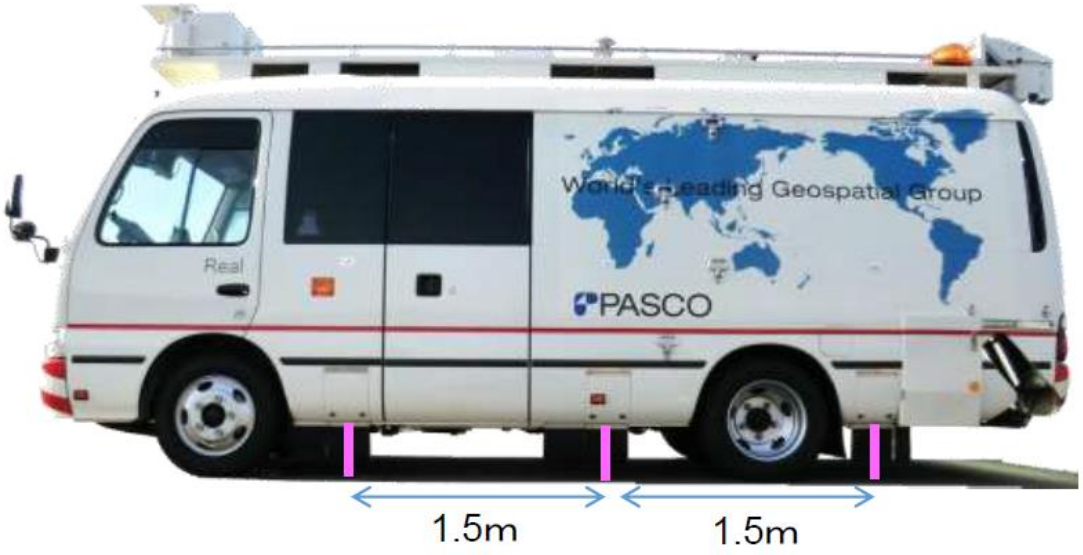
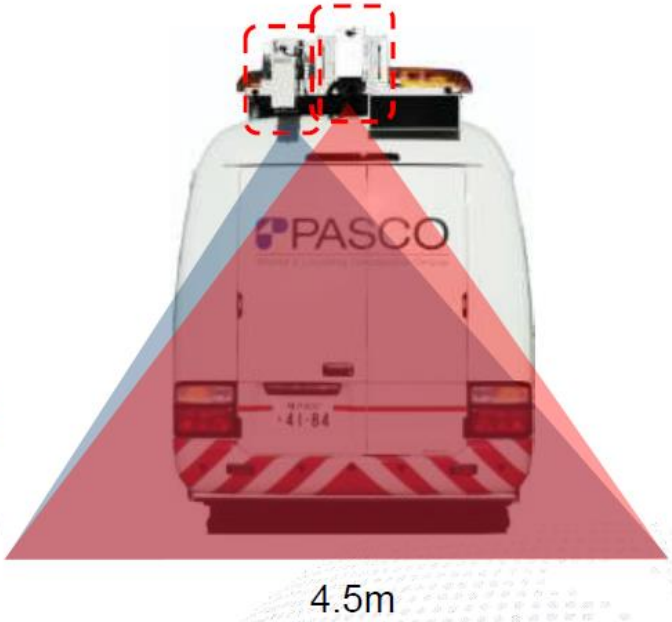
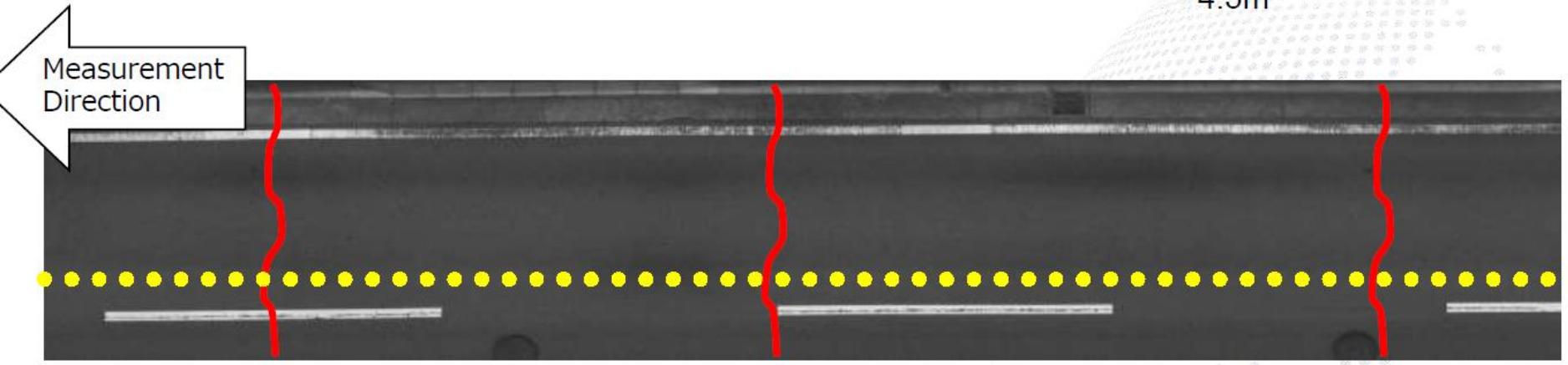
LCMS – Sensor specifications

- Profil
- Point
- Field
- Verti
- Later
- Data

Real



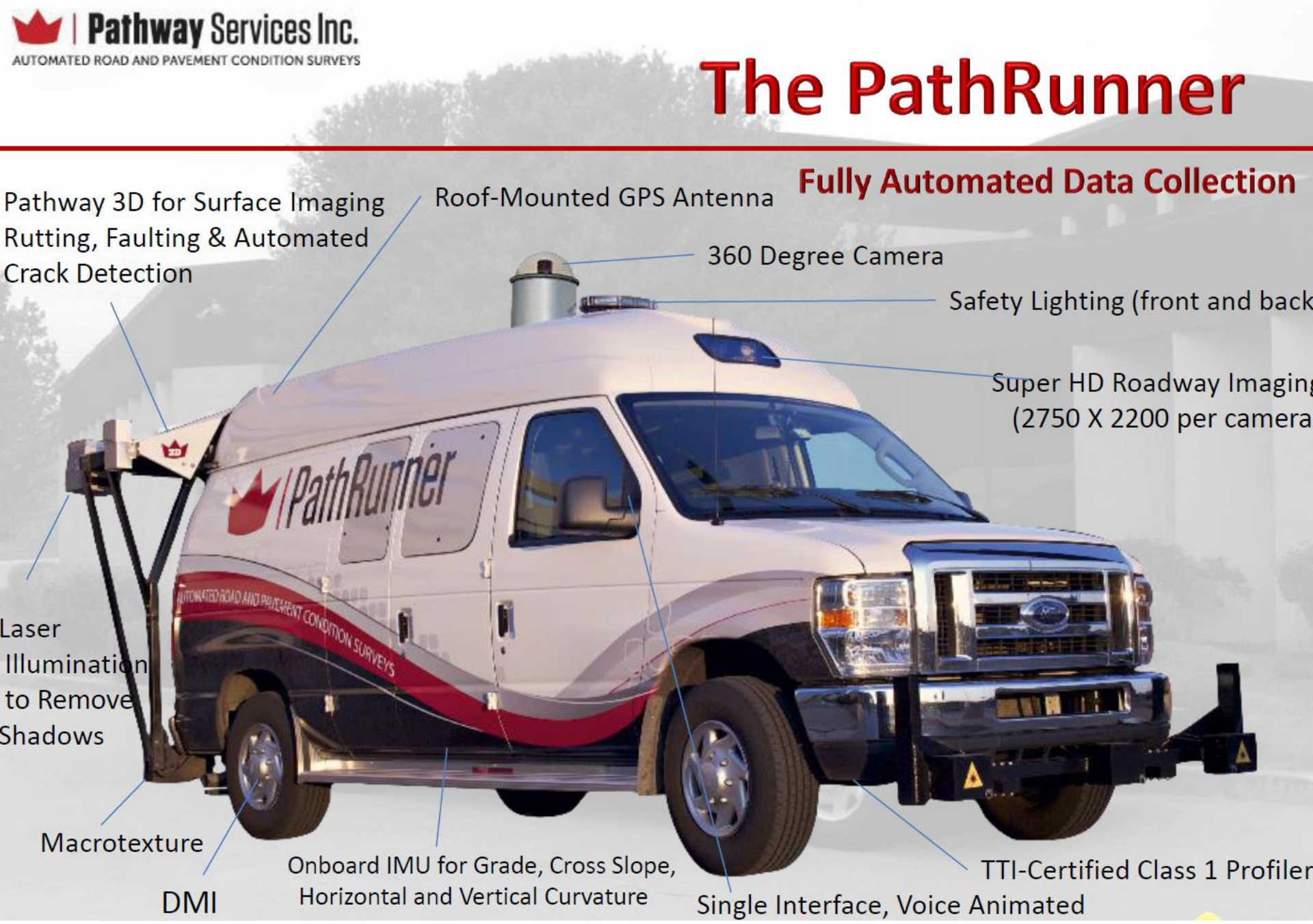




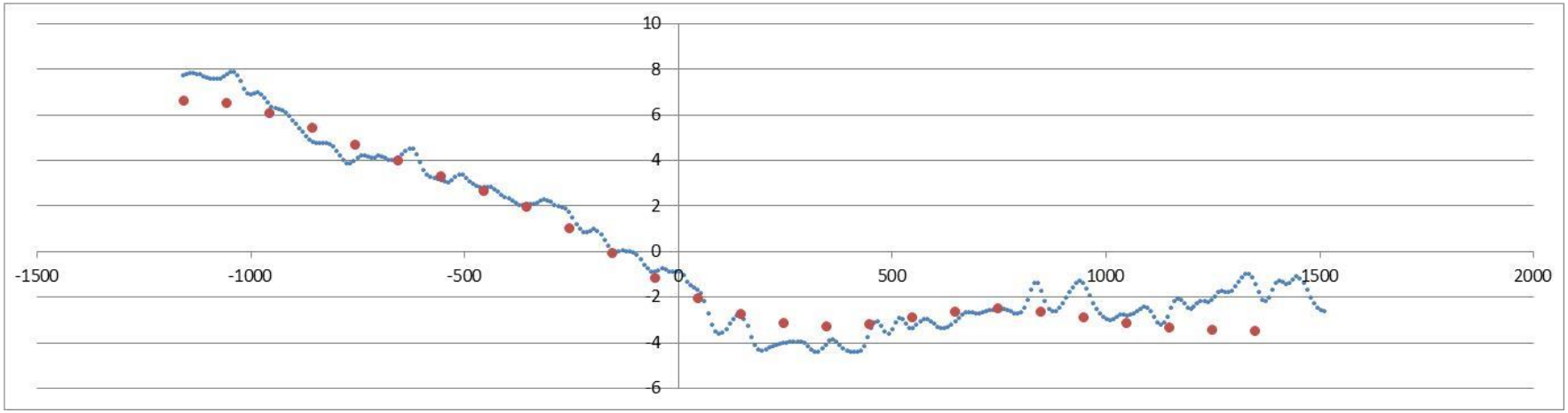
Pathway Services Inc.
AUTOMATED ROAD AND PAVEMENT CONDITION SURVEYS

The PathRunner

Fully Automated Data Collection



Point versus Line scan



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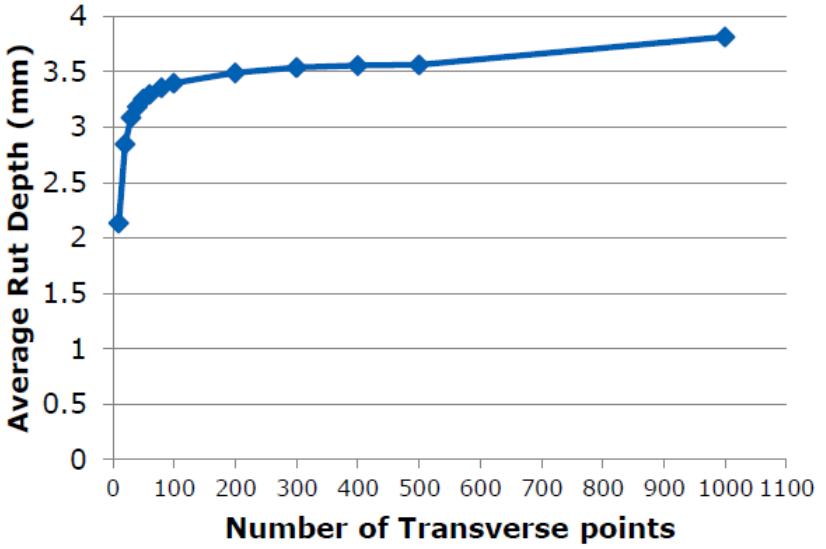
HiSPEQ3: Transverse Evenness – Recommendations

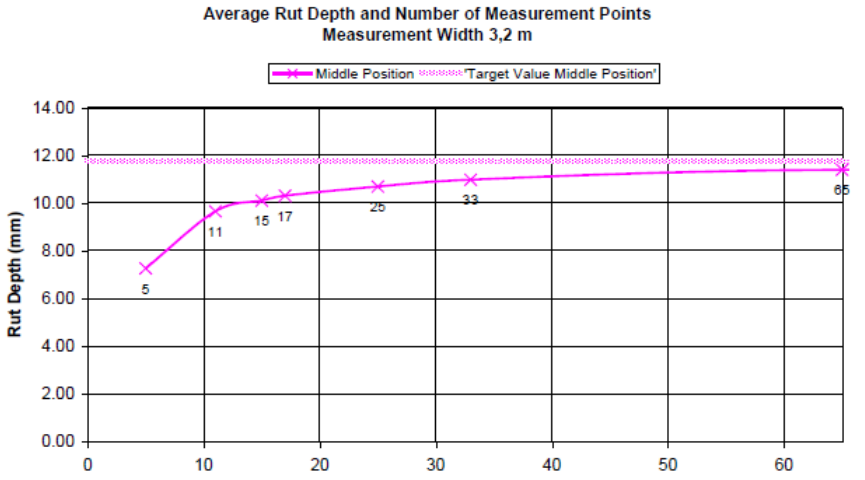
- Measurement width
  - Must cover full lane
    - Minimum 3m
    - Maximum 4m
  - Closer to upper range on highways
- Reporting interval
  - Maximum 0.1m longitudinal spacing
- Vertical accuracy
  - Better than 0.1mm
  - Reporting to max 2 decimal places

HiSPEQ3: Transverse Evenness – Recommendations

- Number of points
  - Minimum 20 points
  - Maximum 100 points
  - Evidence that
    - >50 points does not improve rutting calculation
    - >500 potential adverse influence of texture?



- Transverse Spacing
  - Even is recommended
  - Not clustered at the wheelpaths



Trend 2

”anpassade system”

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Hyrbil från
BYGGMASKINER
www.byggmaskiner.se
UHT 369
Norrköping Söderbergs Nyköping
CADDY
TDI
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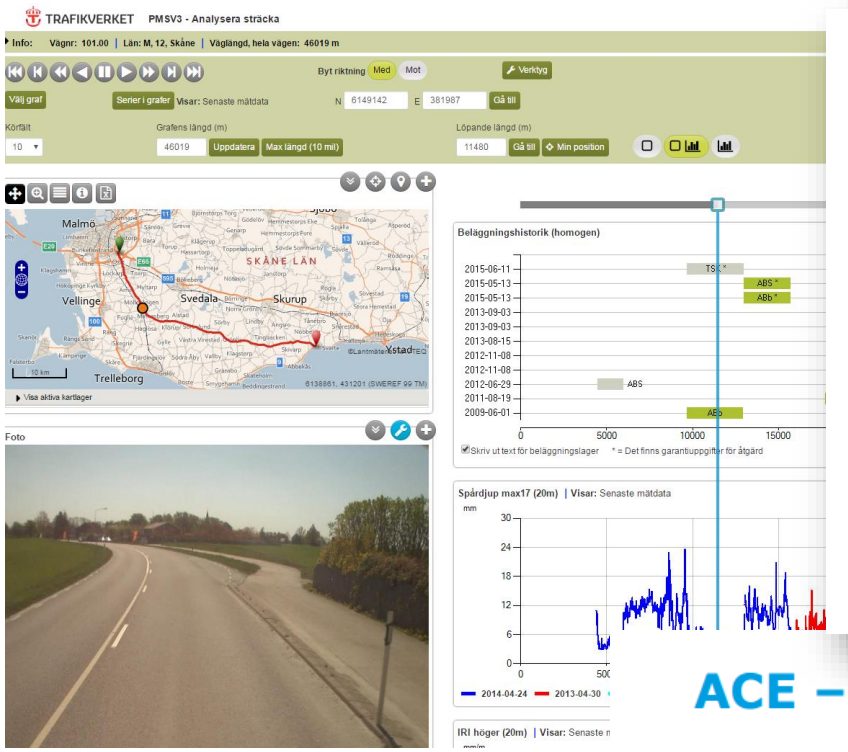
Trend 3

”data används i flera tillämpningar”



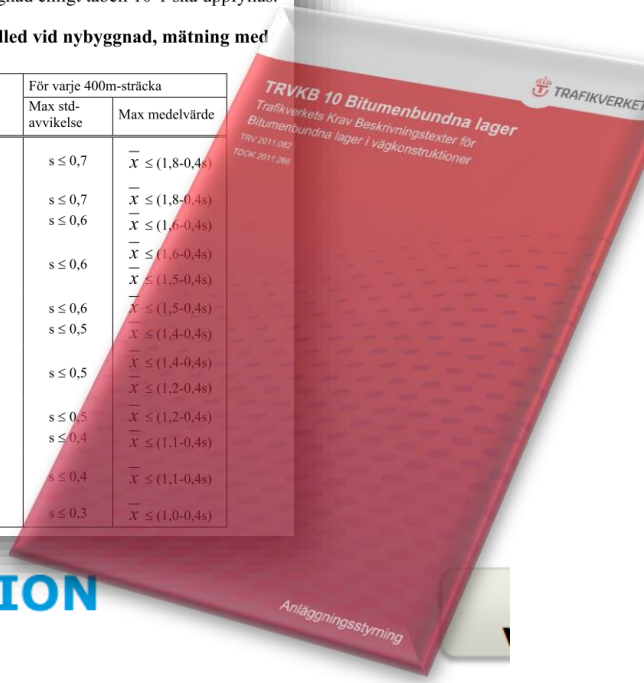
10.1.2.1. Krav på jämnhet i längdled mätt med mätbil

10.1.2.1.1. Krav på jämnhet i längdled vid nybyggnad

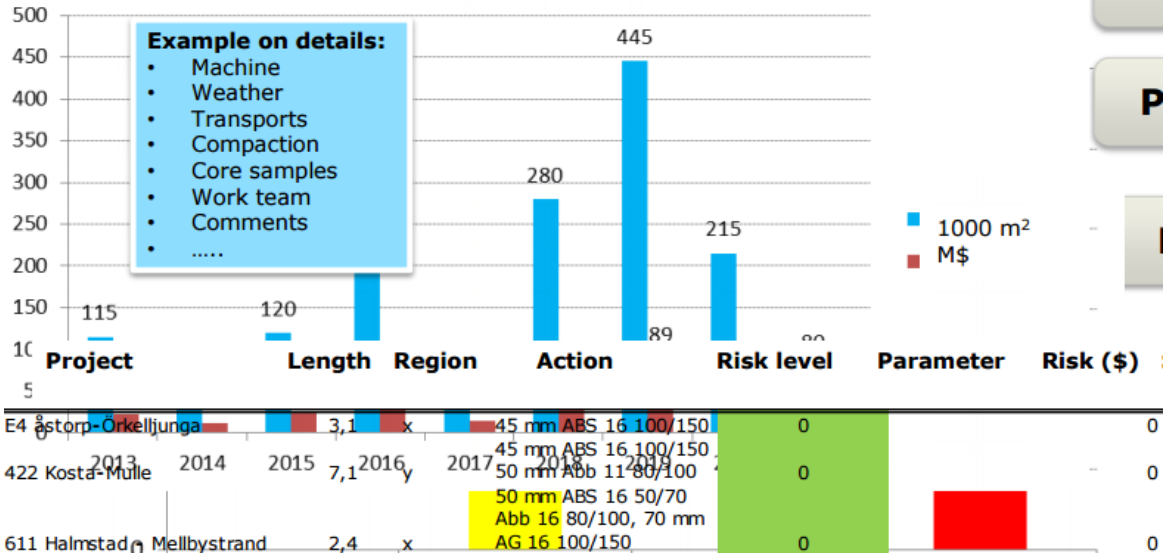
Krav på jämnhet i längdled vid nybyggnad enligt tabell 10-1 ska uppfyllas.

Tabell 10-1 Krav på jämnhet i längdled vid nybyggnad, mätning med mätbil

Skyltad hastighet	IRI för varje 20m-sträcka	För varje 400m-sträcka	
		Max std-avvikelse	Max medelvärde
VR ≤ 50 km/h, $ÅDT_k \leq 4\,000$ VR 50 km/h, $ÅDT_k > 4\,000$	x ≤ 2,4 x ≤ 2,2	s ≤ 0,7	$\bar{x} \leq$ (1,8-0,4s)
VR 60 km/h, $ÅDT_k \leq 4\,000$ VR 60 km/h, $ÅDT_k > 4\,000$	x ≤ 2,2 x ≤ 2,0	s ≤ 0,7 s ≤ 0,6	$\bar{x} \leq$ (1,8-0,4s) $\bar{x} \leq$ (1,6-0,4s)
VR 70 km/h, $ÅDT_k \leq 4\,000$ VR 70 km/h, $ÅDT_k > 4\,000$	x ≤ 2,0 x ≤ 1,8	s ≤ 0,6	$\bar{x} \leq$ (1,6-0,4s) $\bar{x} \leq$ (1,5-0,4s)
VR 80 km/h, $ÅDT_k \leq 4\,000$ VR 80 km/h, $ÅDT_k > 4\,000$	x ≤ 1,8 x ≤ 1,7	s ≤ 0,6 s ≤ 0,5	$\bar{x} \leq$ (1,5-0,4s) $\bar{x} \leq$ (1,4-0,4s)
VR 90 km/h, $ÅDT_k \leq 4\,000$ VR 90 km/h, $ÅDT_k > 4\,000$	x ≤ 1,7 x ≤ 1,5	s ≤ 0,5	$\bar{x} \leq$ (1,4-0,4s) $\bar{x} \leq$ (1,2-0,4s)
VR 100 km/h, $ÅDT_k \leq 4\,000$ VR 100 km/h, $ÅDT_k > 4\,000$	x ≤ 1,5 x ≤ 1,4	s ≤ 0,5 s ≤ 0,4	$\bar{x} \leq$ (1,2-0,4s) $\bar{x} \leq$ (1,1-0,4s)
VR 110 km/h, klimatzon 3-5 VR 110 km/h, klimatzon 1-2	x ≤ 1,4 x ≤ 1,2	s ≤ 0,4	$\bar{x} \leq$ (1,1-0,4s)
VR 120 km/h	x ≤ 1,1	s ≤ 0,3	$\bar{x} \leq$ (1,0-0,4s)



ACE – RISK EVALUATION



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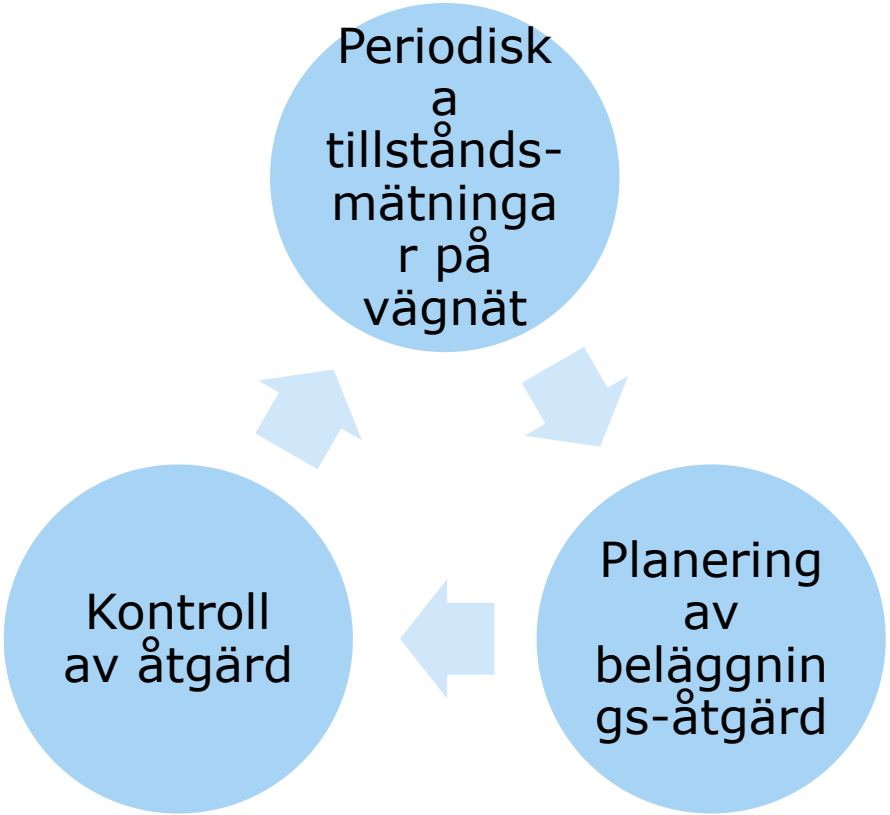
NÄR ANVÄNDS VÄGYTEMÄTNING?

- i alla skeden…..



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Hur kom vi hit?

Var står vi nu?

Vart (kan) vi gå?