Pavement Evaluation 2014

Evaluation of the TSD in Germany

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Outlook

Federal Highway Research Institute (BASt)

- Technical and Scientific Research Institute
- Responsible to the
  Federal Ministry of Transport and Digital Infrastructure

Federal Ministry of Transport and Digital Infrastructure

- Approximately 400 Employees
- Place of Training and Education

Responsibilities

- Scientifically Sound Decision Support on Technical Issues and Questions of Traffic Policy for the Ministry
- Drawing up of Regulations and Standards at National and European Level

Get to know with BASt

- Located near Cologne
- Complex with
  - Offices
  - Laboratories
  - Full-scale testing facilities (indoor/outdoor)

Get to know with BASt

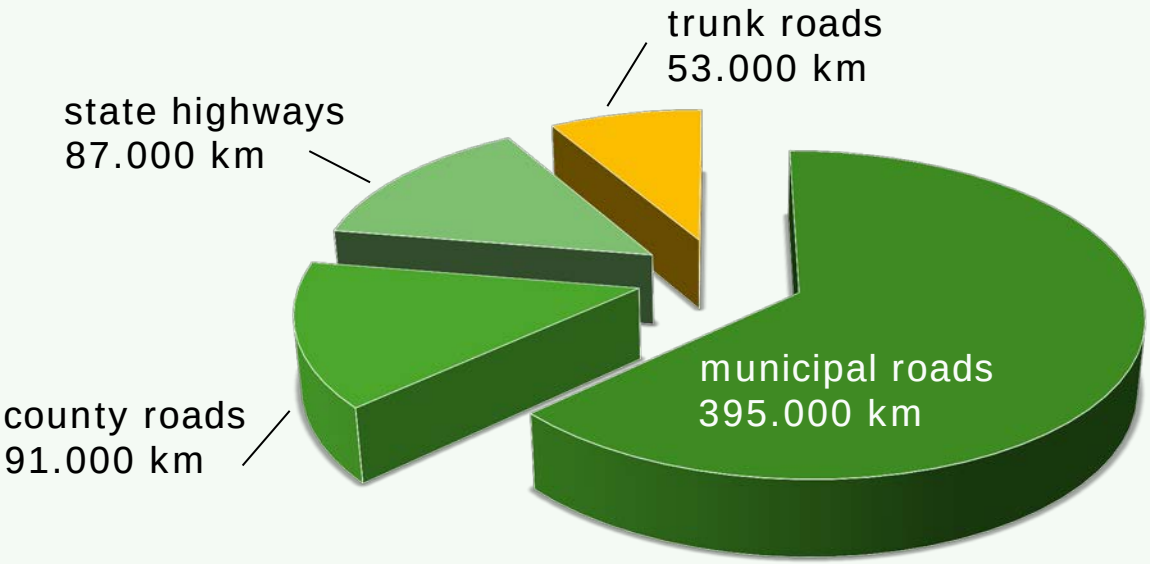
- Road construction innovations group
  - Section “Design and Structure of Pavements”



  - Section “Surface characteristics, Evaluation and Maintenance of Roads”




Germany's road network



total

626.000 km

389.000 mi

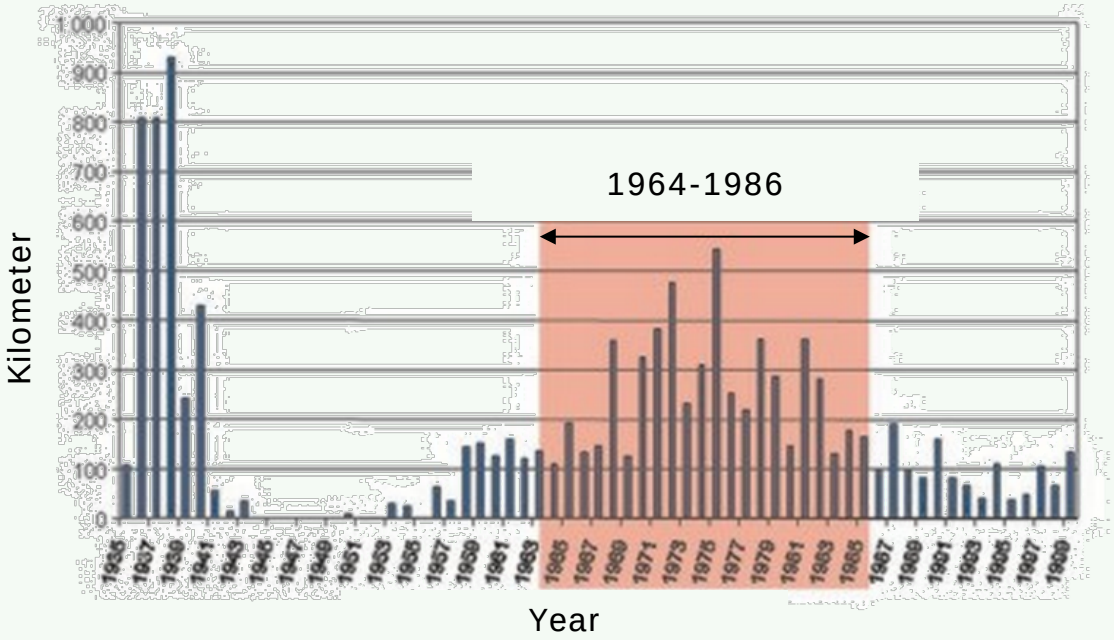
Top 10 of network density

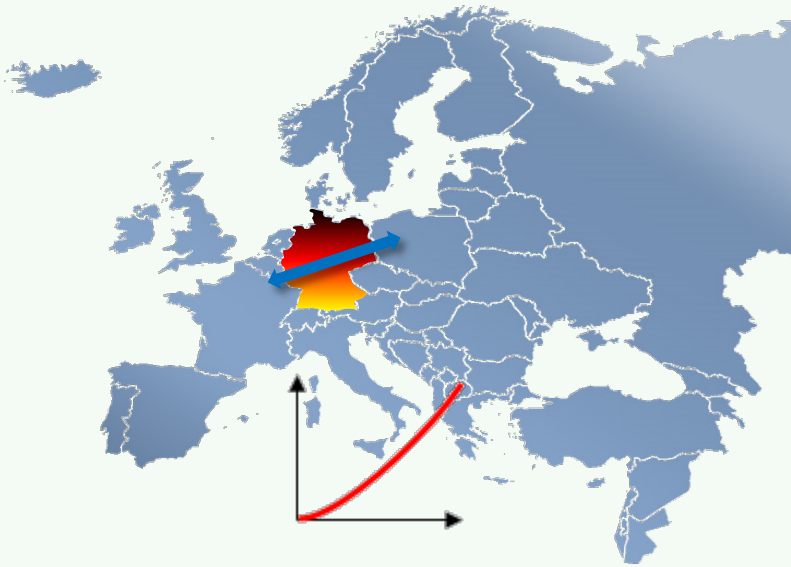
Nr.	Country	Density of Network [km / km²]
1	Japan	3.20
2	**Germany**	**1.80**
3	France	1.42
4	Spain	1.35
5	India	1.01
6	**USA**	**0.68**
7	China	0.40
8	Australia	0.11
9	Canada	0.10
10	Russia	0.06

Source: Ministry of Transport BMVI / Wikipedia

Germany's road network

Challenges:
‚Aging Infrastructure' & ‚High traffic load'



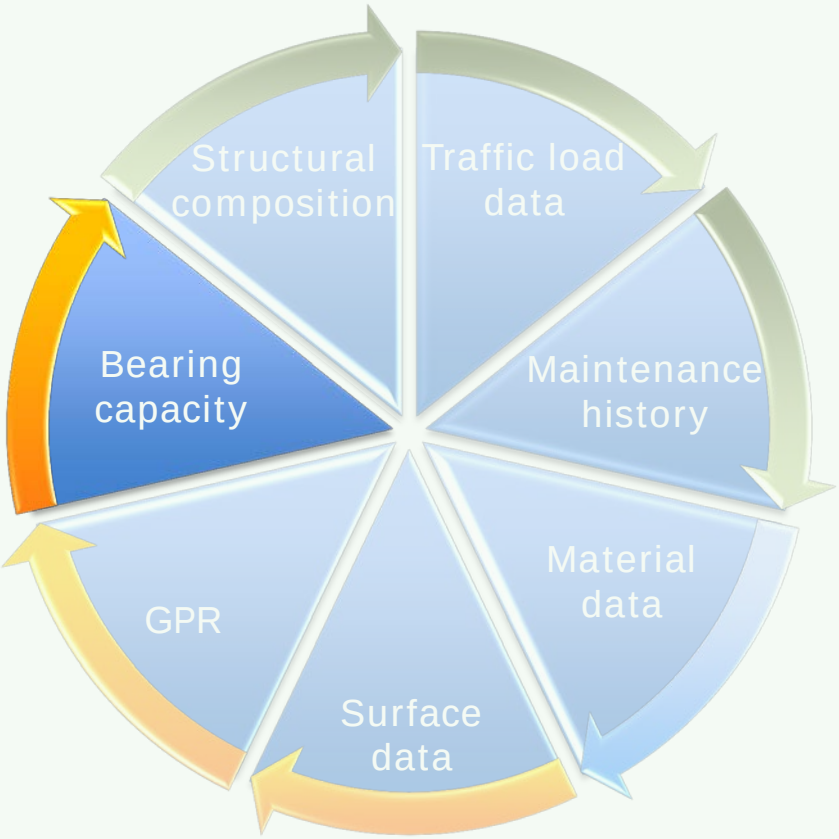


→ Structural evaluation becomes more important than ever

Structural evaluation

Perfect data mixture

Network level



TSD evaluation

Project overview

1st generation TSD

- 2006: Measurements on BASt indoor test road
- 2008: Measurements on different in situ pavements

2nd generation TSD

- 2012: 300 km of measurements on different pavements
- 2014: 50 km comparative measurements on highway section

TSD evaluation

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TSD evaluation

2nd generation measurements in 2012

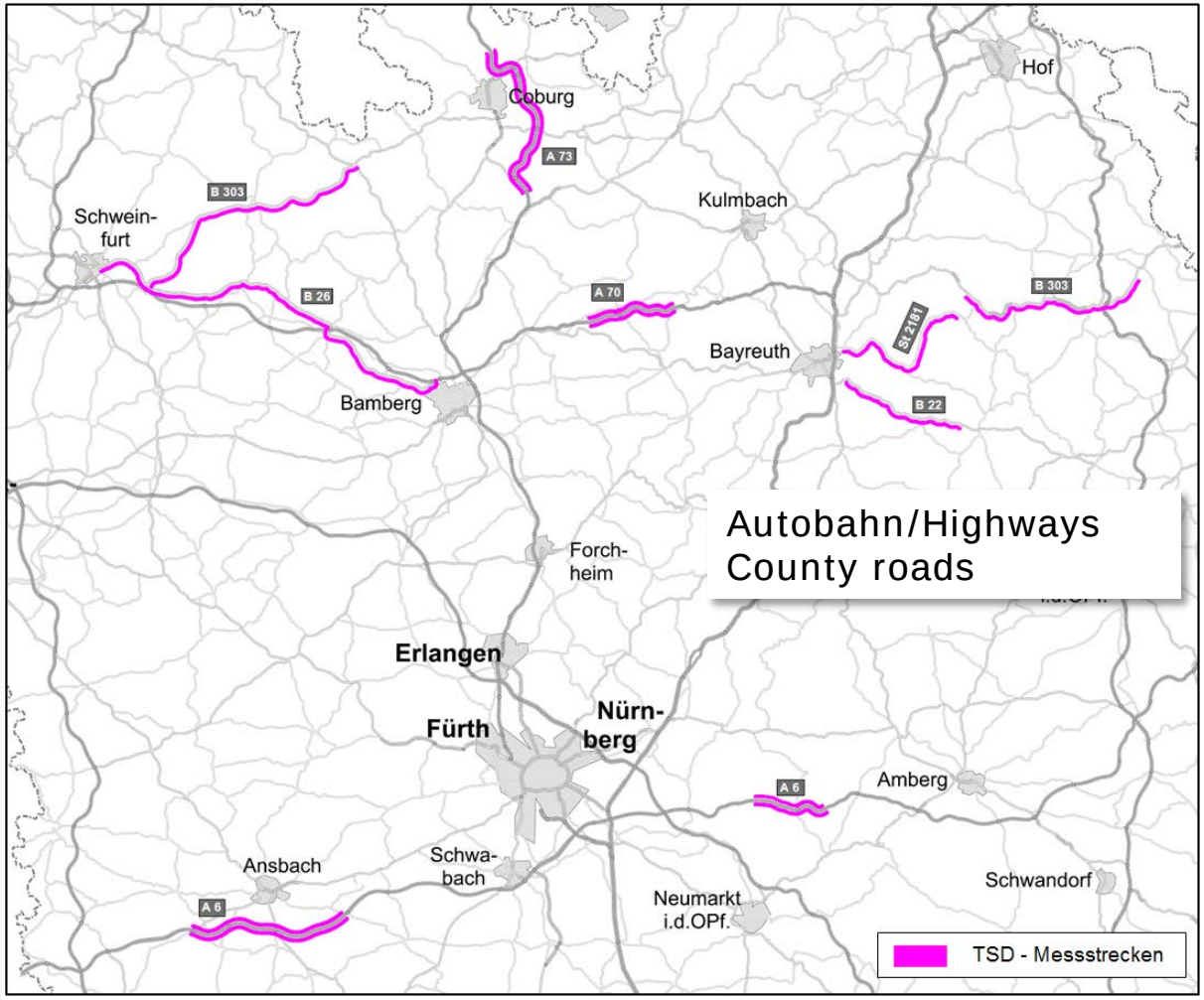
- 300 km / 187 mi
- different road classifications
- different equipments

FWD
2009/2012

Deflectograph Lacroix
2012/2013

Curviametro
2008

TSD
2012

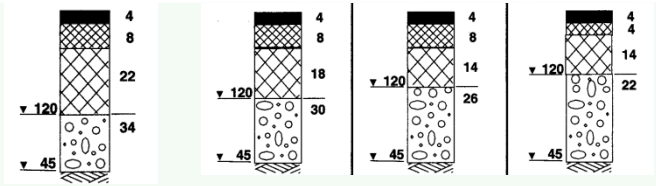


TSD evaluation

2nd generation measurements in 2012

Quantity of TSD data

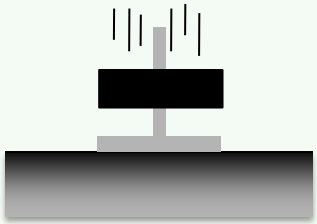
TSD	Autobahn/ Highway		Federal Highway		State highways		all	
	[km]	[%]	[km]	[%]	[km]	[%]	[km]	[%]
„Valid“ data	**74,8**	**54,8**	**128,9**	**95,8**	**22,9**	**97,0**	**226,6**	**76,9**
No measurements, reason given by operator	0,0	0,0	0,8	0,6	0,0	0,0	**0,8**	**0,3**
Road constructions, passing, dirty road surface, etc.	12,4	9,1	0,2	0,1	0,0	0,0	**12,6**	**4,3**
Values marked as „unvalid“ (below given value limit)	49,3	36,1	4,6	3,4	0,7	3,0	**54,6**	**18,5**
Total	**136,5**	**100,0**	**134,6**	**100,0**	**23,6**	**100,0**	**294,7**	**100,0**



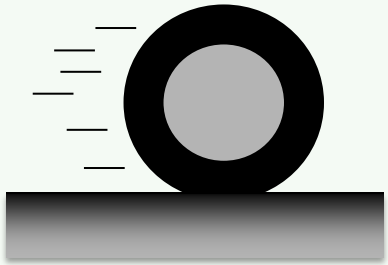
TSD evaluation

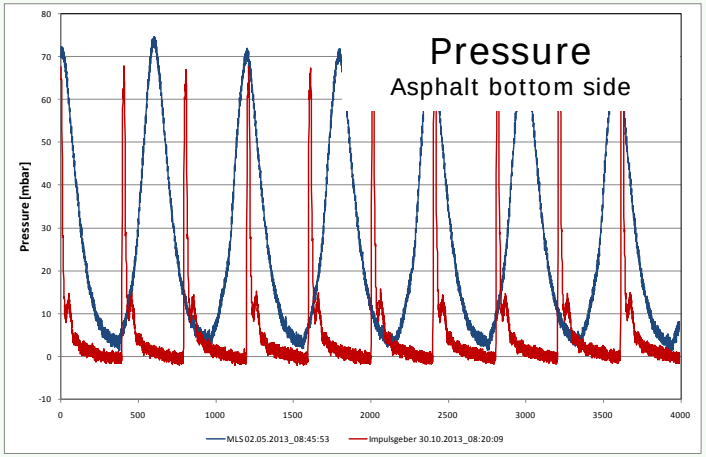
2nd generation measurements in 2012

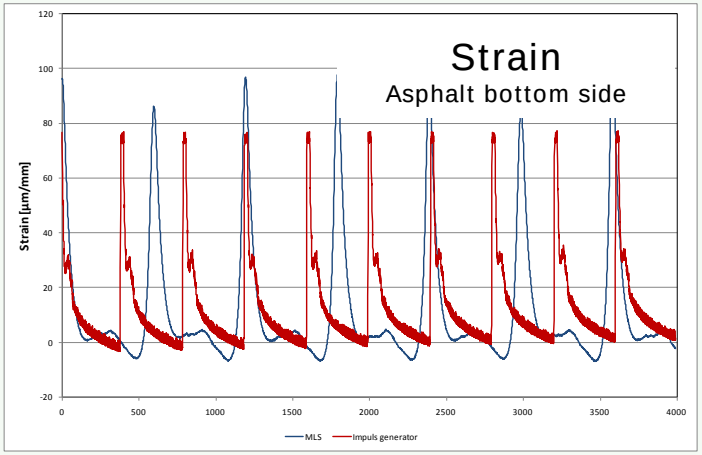
Comparison to …



vs.





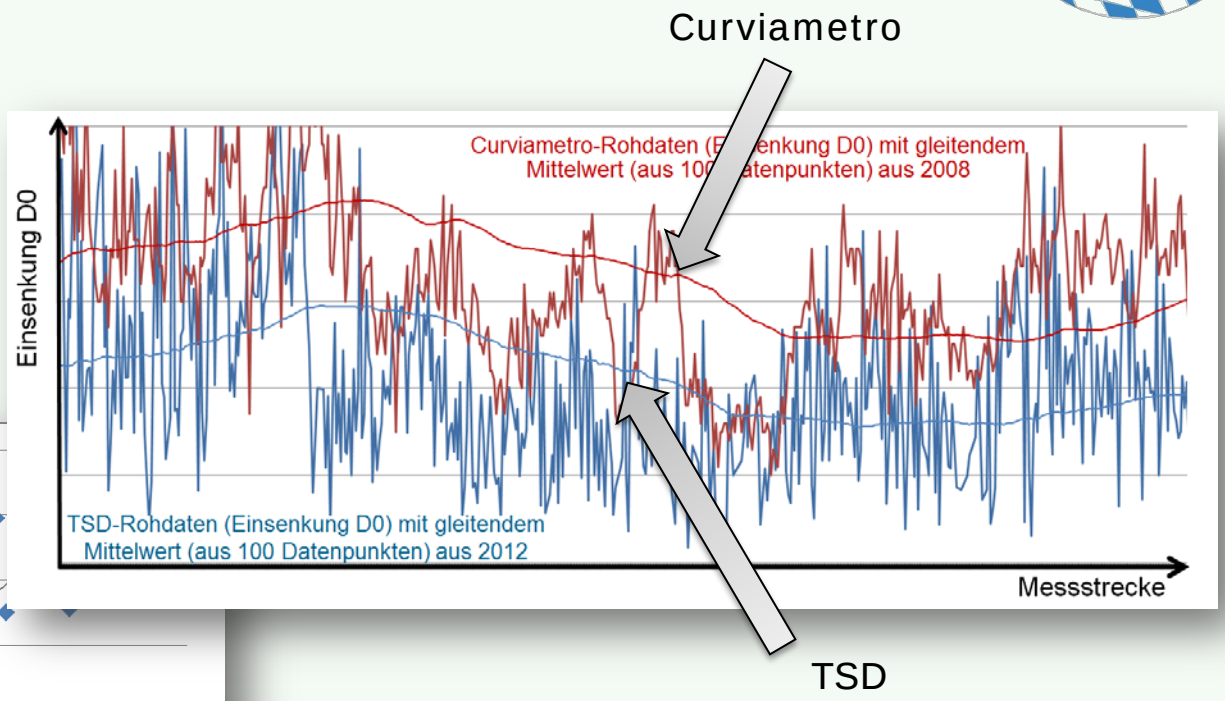


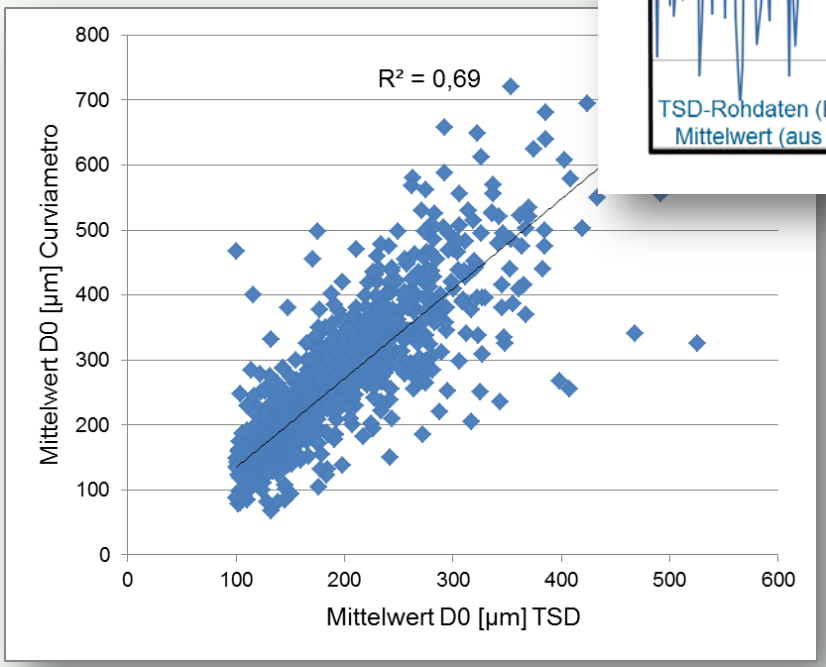
Can we expect comparable results?

TSD evaluation

2nd generation measurements in 2012

Comparison to Curviametro





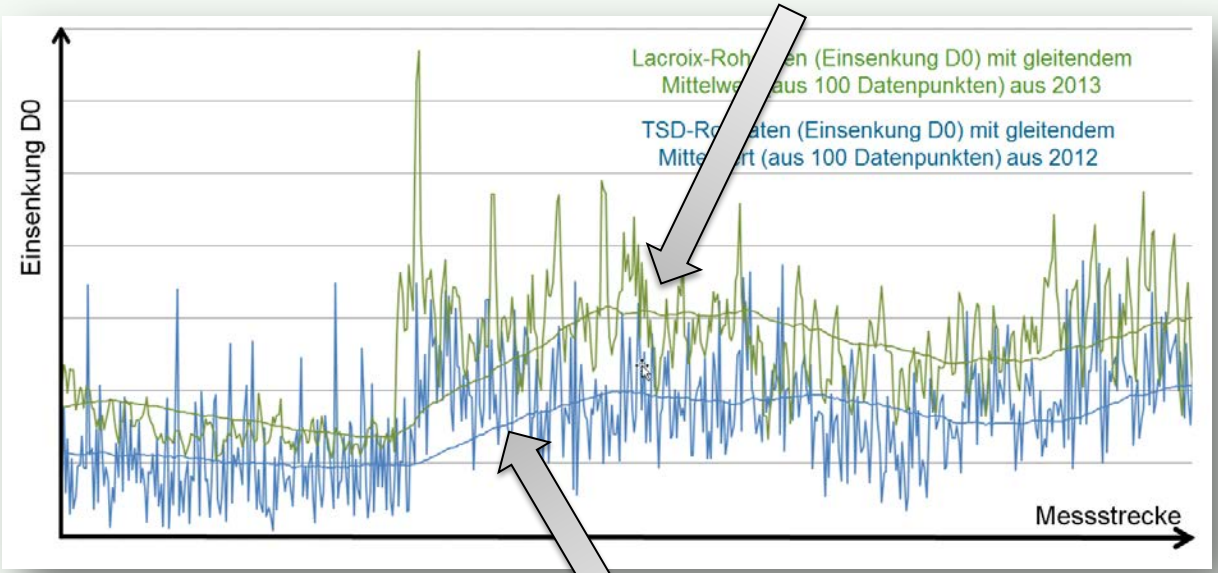
Time lack between TSD and Curviametro measurements was 4 years!

TSD evaluation

2nd generation measurements in 2012

Comparison to Deflectograph Lacroix

Deflectograph Lacroix



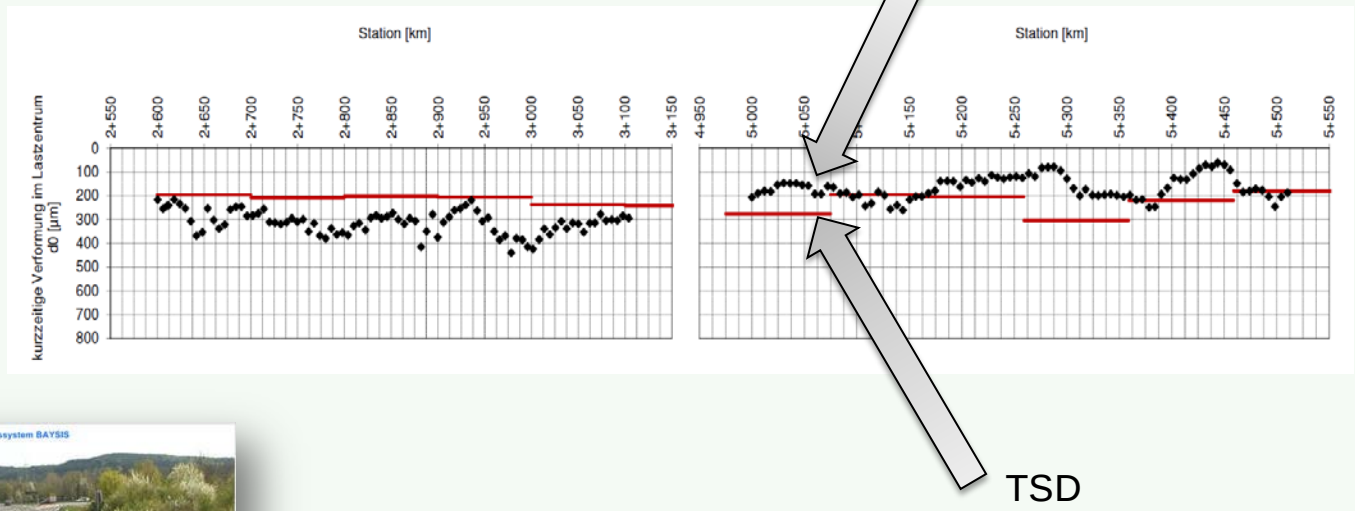
TSD

Time lack between TSD and Deflectograph measurements was ¾ year!

TSD evaluation

2nd generation measurements in 2012

Comparison to FWD



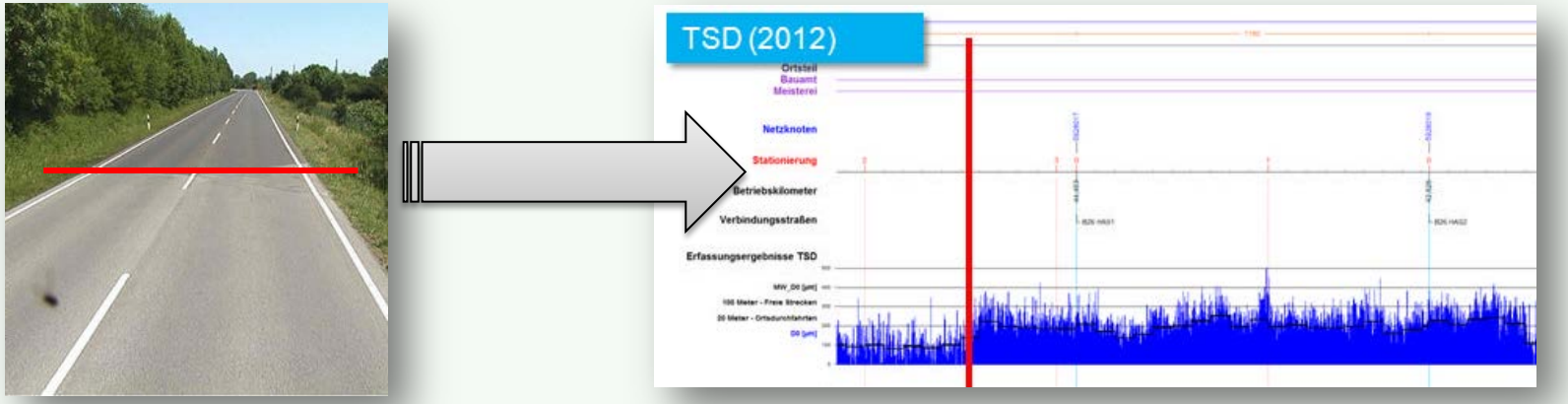
→ no resilient correlation found
→ same deflection level
→ unevenness plays an important role

TSD evaluation

2nd generation measurements in 2012

Conclusion of ‘12 measurements

- TSD gives valuable information and has the needed potentials
  - more on state/county roads
  - less on autobahn/motorways
- Comparison to “rolling devices” shows good results
- Discussion about considering unevenness/dynamic loads has to be done



TSD evaluation

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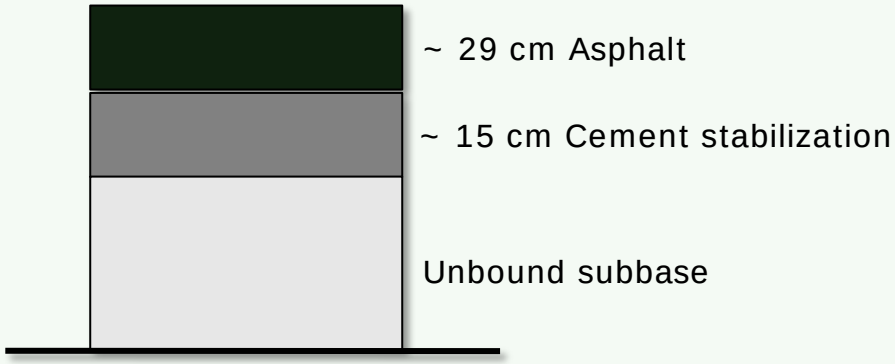
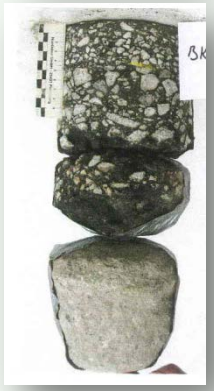
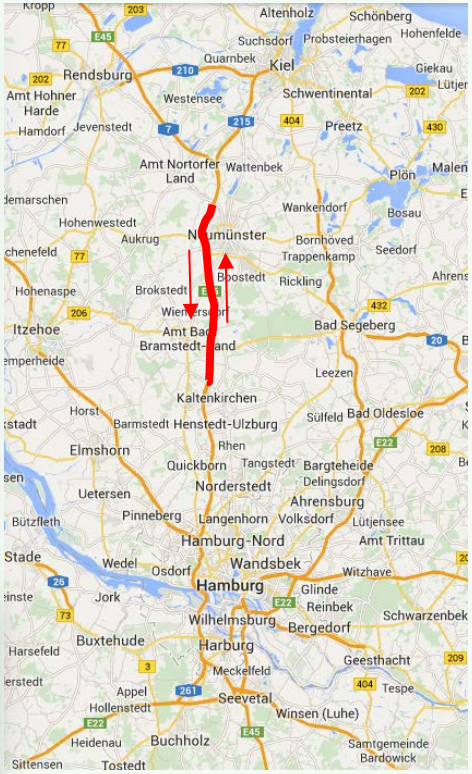
TSD evaluation

2nd generation comparative measurements in 2014

- Autobahn/motorway A7 north of Hamburg
- 25 km / *15.5 mi* northbound
- 25 km / *15.5 mi* southbound
- old but very stiff asphalt pavement
  - top layer ~ 10-15 years
  - bottom layers ~ 44 years







TSD evaluation

2nd generation comparative measurements in 2014

- Two 2nd generation TSD
  - May 2014
  - direct runs one TSD after the other
  - real traffic situation
  - 70 km/h = 43 mp/h
  - two runs at each of the two sections (25 km / 15.5 mi each)
    - Run 1 northbound
      - 9:30 a.m. – 9:55 a.m.
      - mean air temp 11 °C / mean surface temp 11 °C
    - Run 1 southbound
      - 10:00 a.m. – 10:25 a.m.
      - mean air temp 11,5 °C / mean surface temp 11 °C
    - Run 2 northbound
      - 11:50 a.m. – 12:15 a.m.
      - mean air temp 13,5 °C / mean surface temp 14 °C
    - Run 2 southbound
      - 10:15 a.m. – 12:40 a.m.
      - mean air temp 13 °C / mean surface temp 13 °C

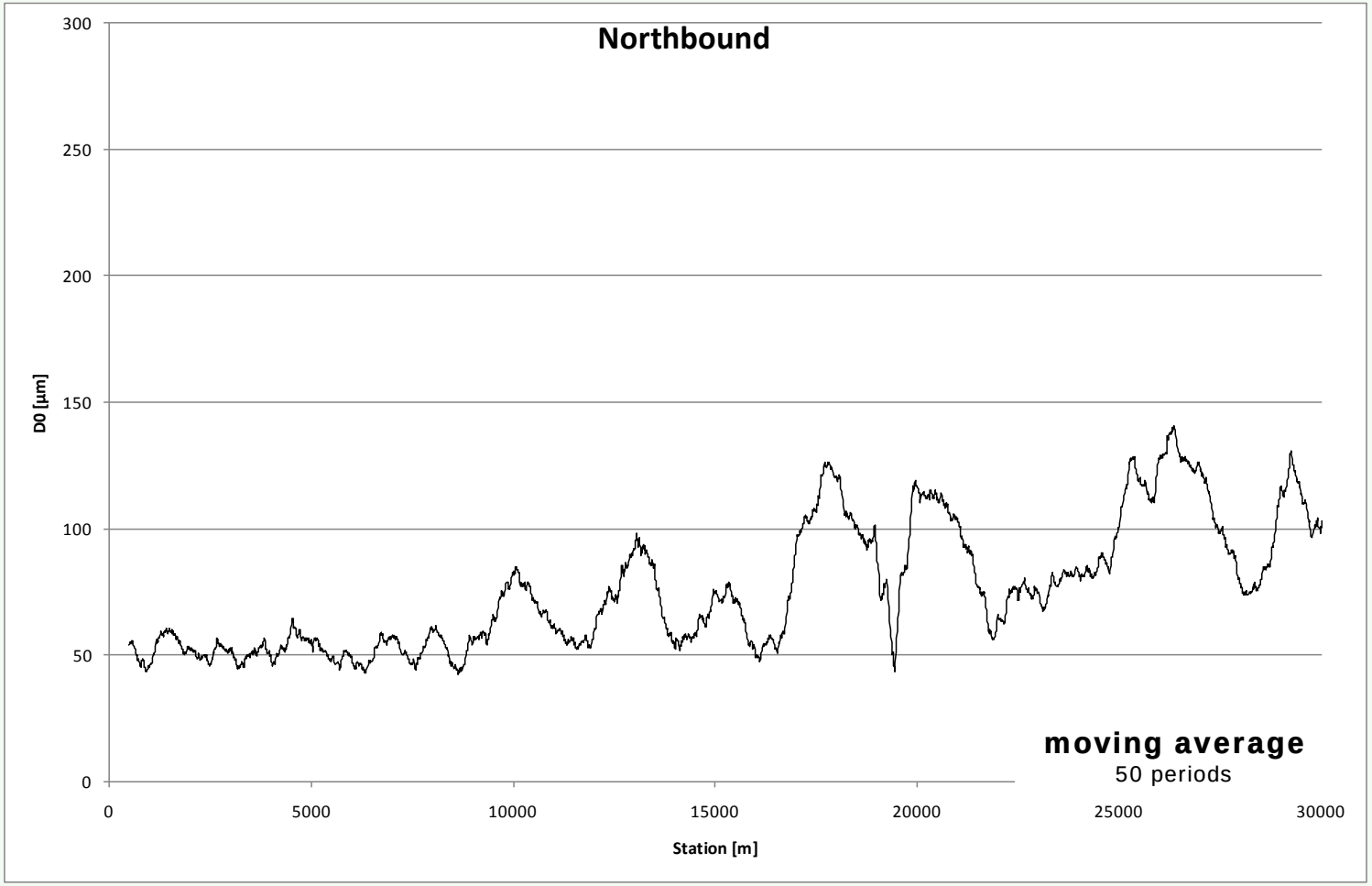
11 °C = 52 °F

14 °C = 57 °F

TSD evaluation

2nd generation comparative measurements in 2014

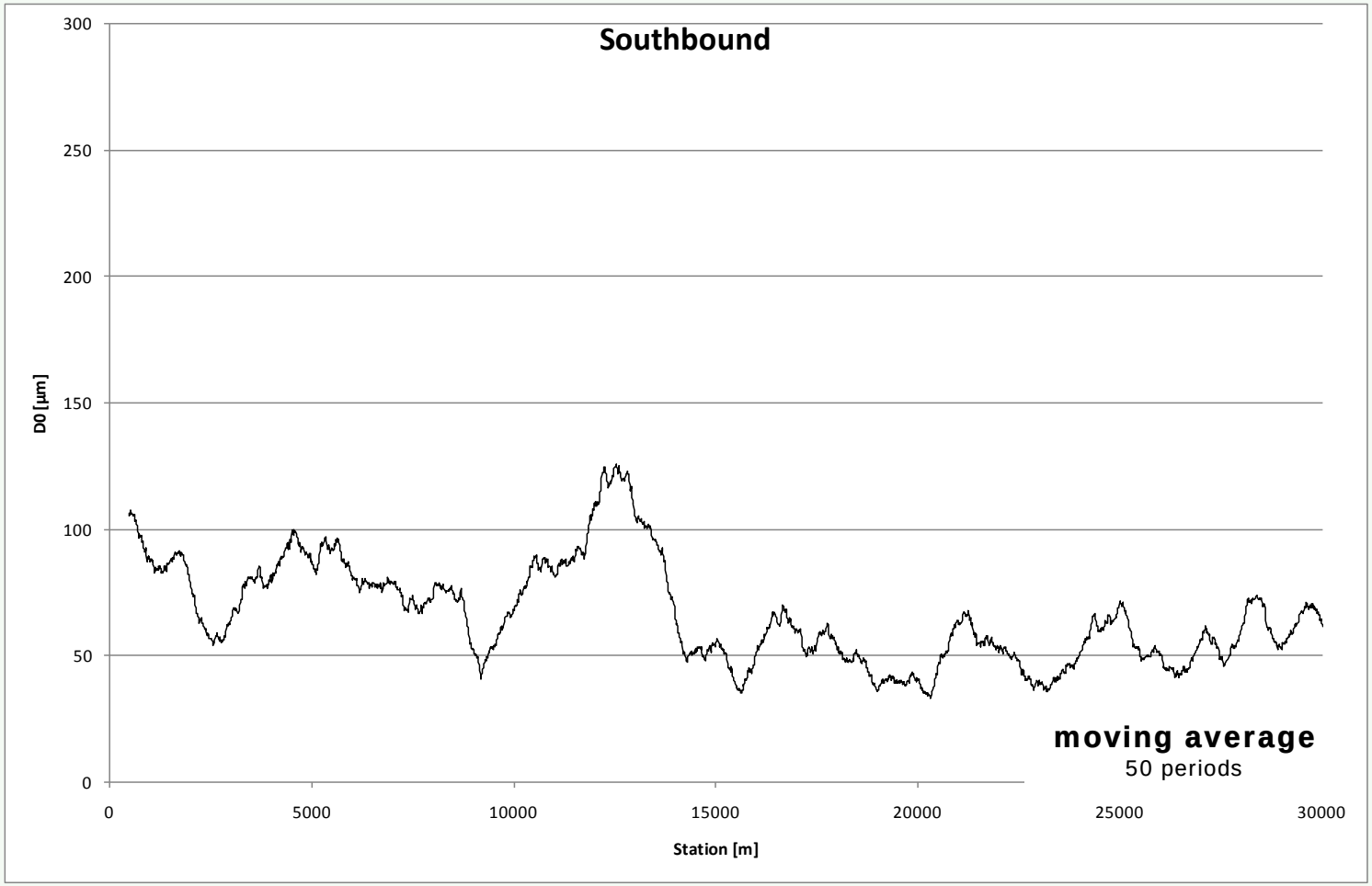
- Overall results



TSD evaluation

2nd generation comparative measurements in 2014

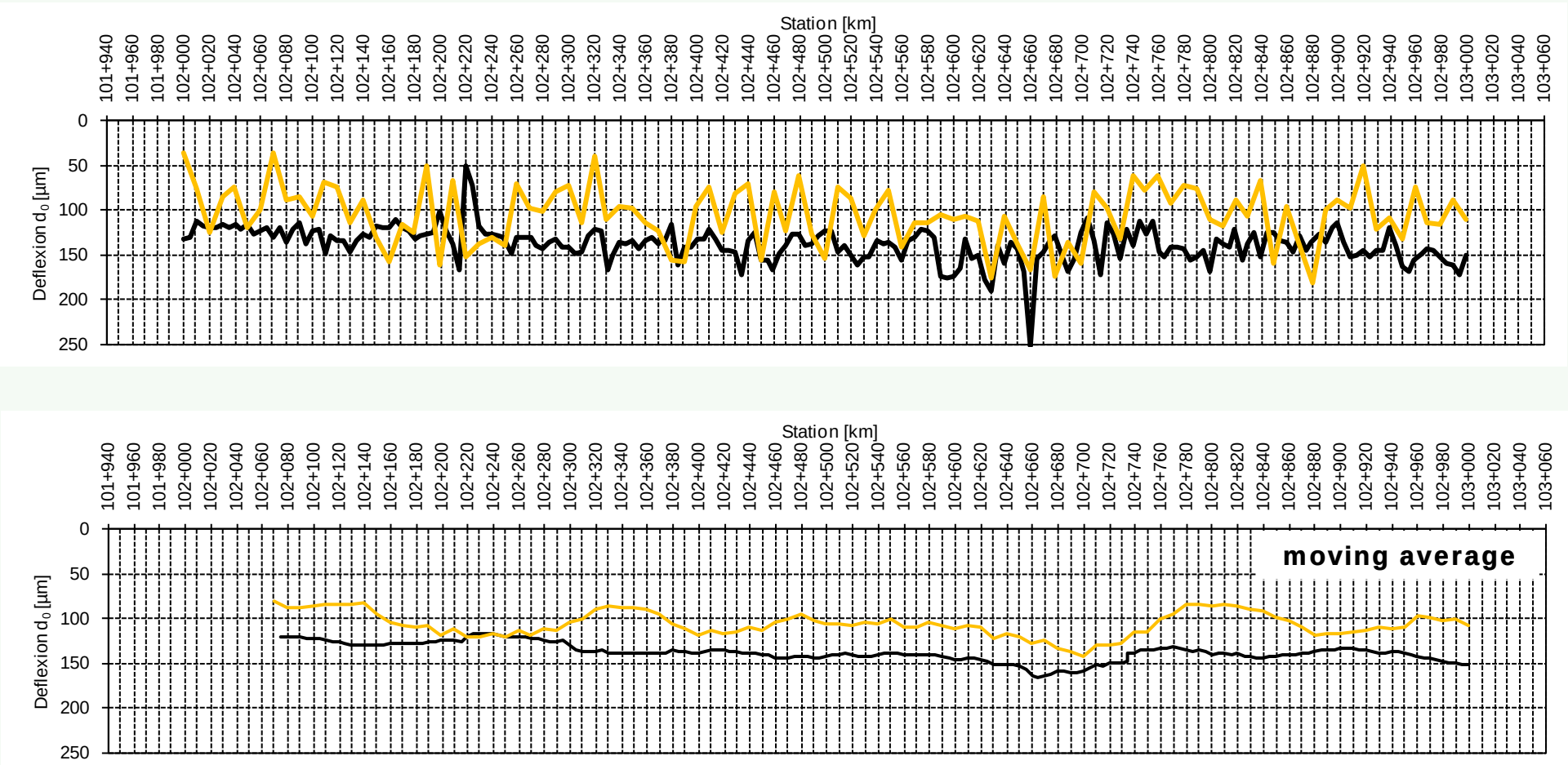
- Overall results



TSD evaluation

2nd generation comparative measurements in 2014

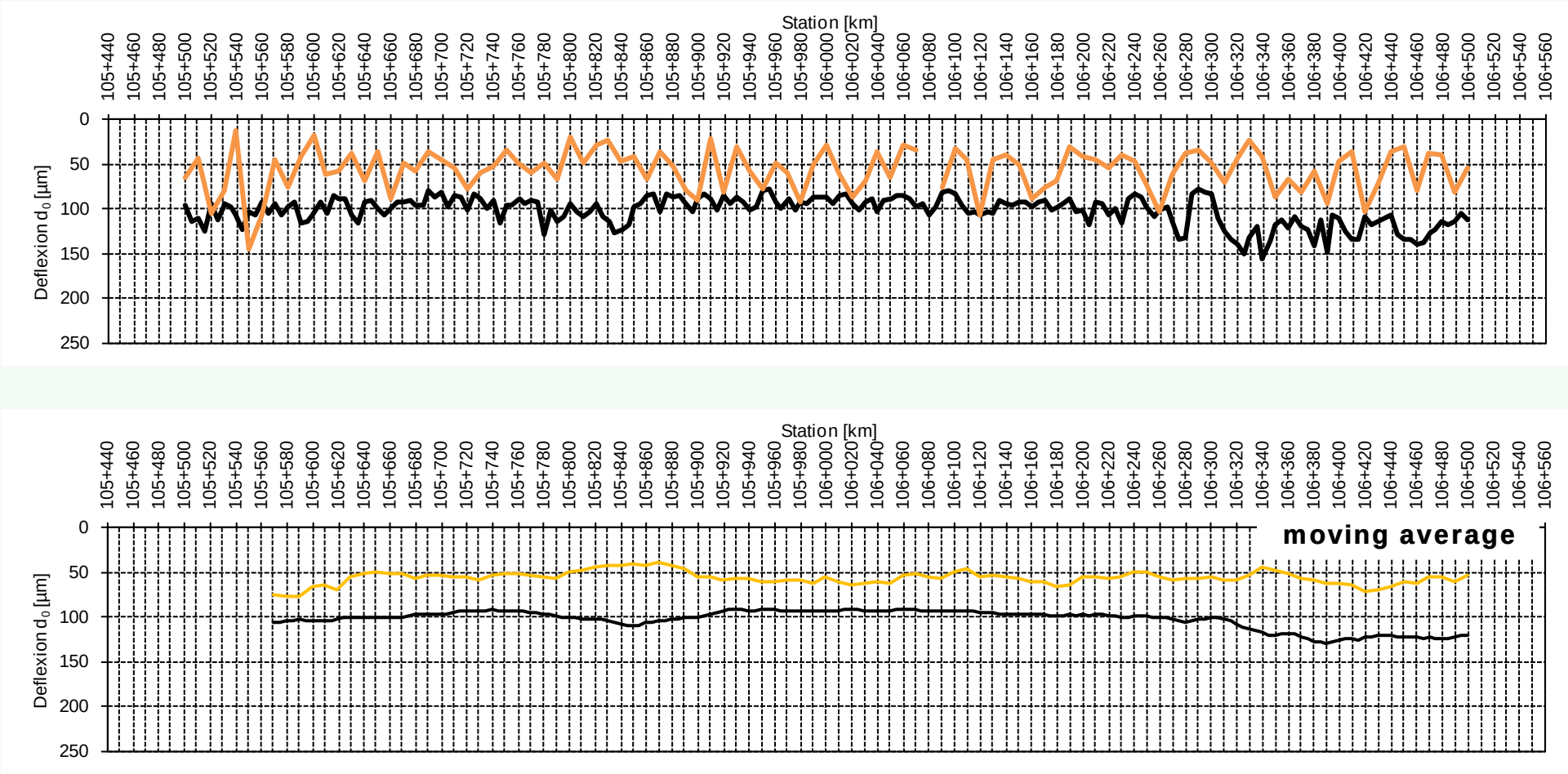
- Comparison to FWD – Section I



TSD evaluation

2nd generation comparative measurements in 2014

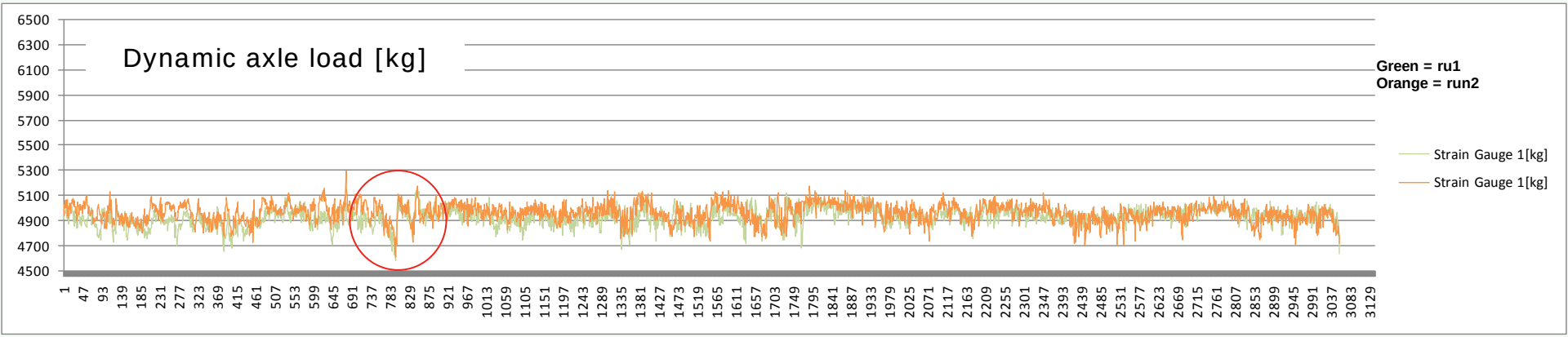
- Comparison to FWD – Section II

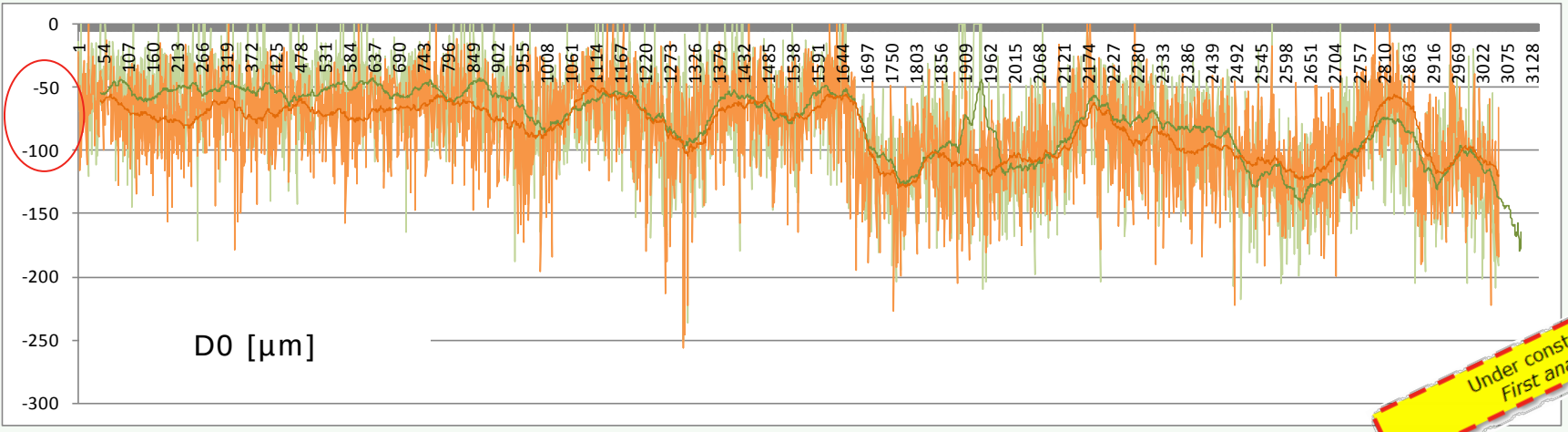


TSD evaluation

2nd generation comparative measurements in 2014

- Repeatability





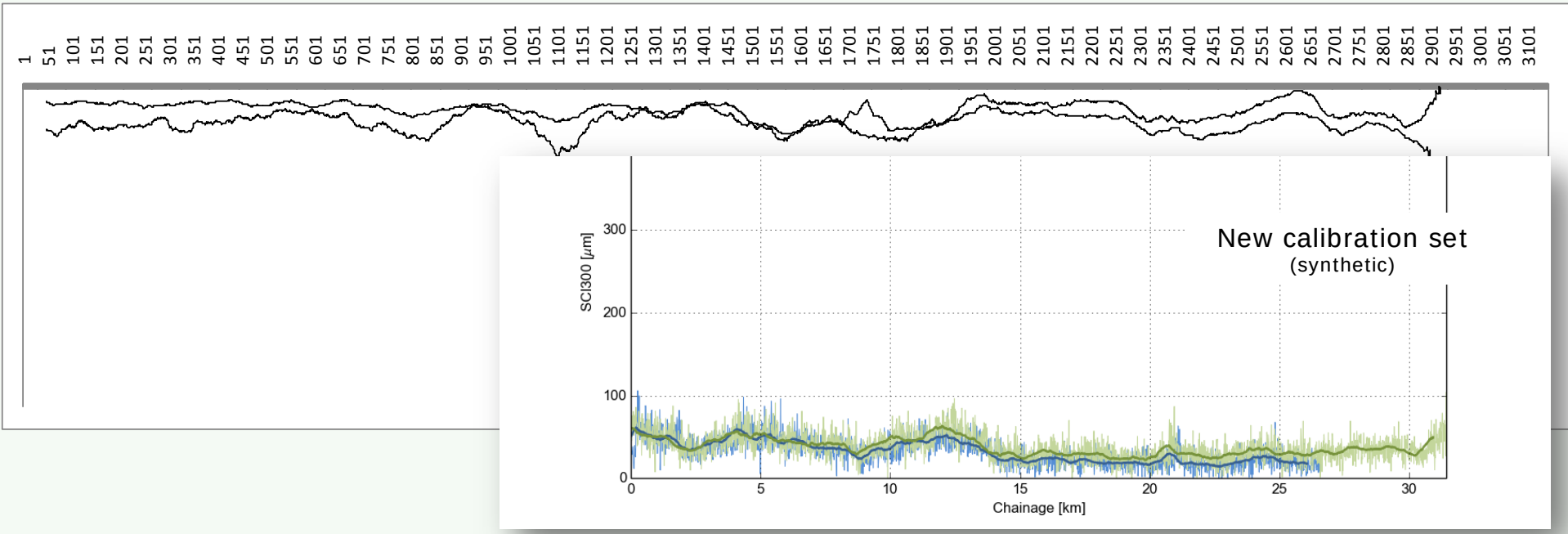
Under construction
First analysis

TSD evaluation

2nd generation comparative measurements in 2014

Under construction
First analysis

- Comparison of two TSD



→ Results show slight differences between the two TSD

→ Ongoing fruitful discussion between BASt, operators and manufacturer

→ Calibration (doppler-laser angle up to 5th decimal place)

plays an very important role and will be improved

Outlook

- TSD now has a status which brings us further on in (German) pavement evaluation
  - No disrupting of flowing traffic
  - Network monitoring is possible
  - Works also on stiff asphalt pavements
  - ...
- Need of evaluation methods which bring a benefit on network level and on project level as well (→ *see plenary discussion on Monday "massive improvements in measurement techniques but not in analysis methods")*
- Further projects:
  - Test on selected parts of network
  - Repeatability tests at different times of year
  - ...

Thank you!

Dr. Dirk Jansen

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Design and Structure of Pavement

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