Ongoing and future activities in ISO/TC 43/SC 1/WG 39, Characterization of pavement texture by use of surface profiles

Erpug 2021, 10 November, Vienna, Austria

Thomas Lundberg, Convenor of ISO/TC 43/SC 1/WG 39

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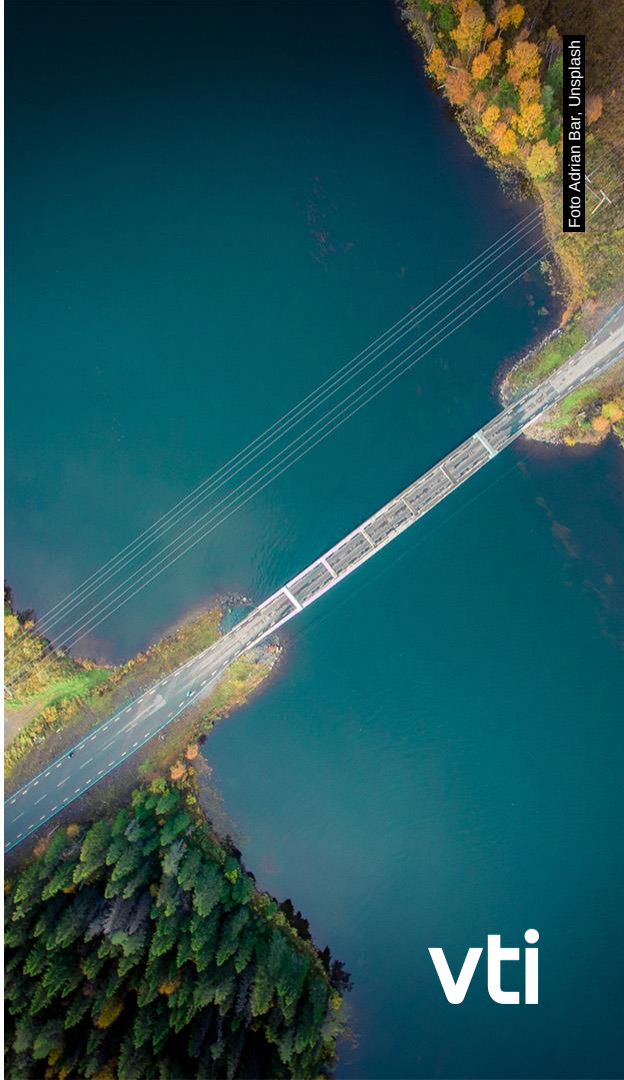
OUTLINE

- Introduction of ISO TC 43/SC 1/WG 39
- Correction of 13473-1, Determination of mean profile depth
- A new document (PAS) 13473-6, Verification of the performance of laser profilometers used for pavement texture measurements
- Reference program code and reference calculations of Mean Profile Depth
- Future work items within WG 39



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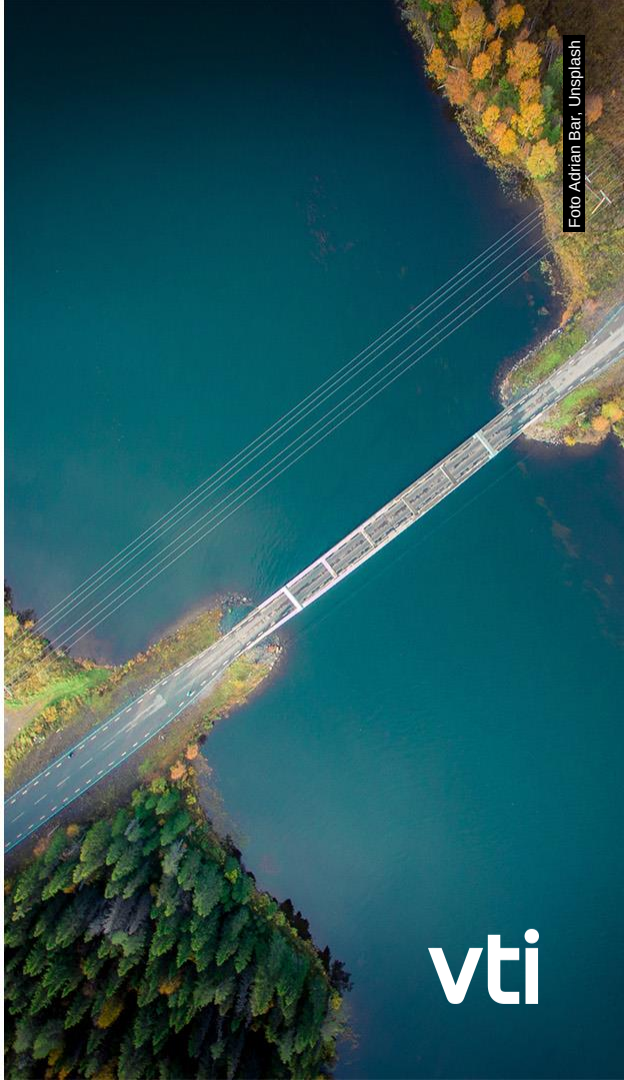


ISO/TC 43/SC 1/WG 39

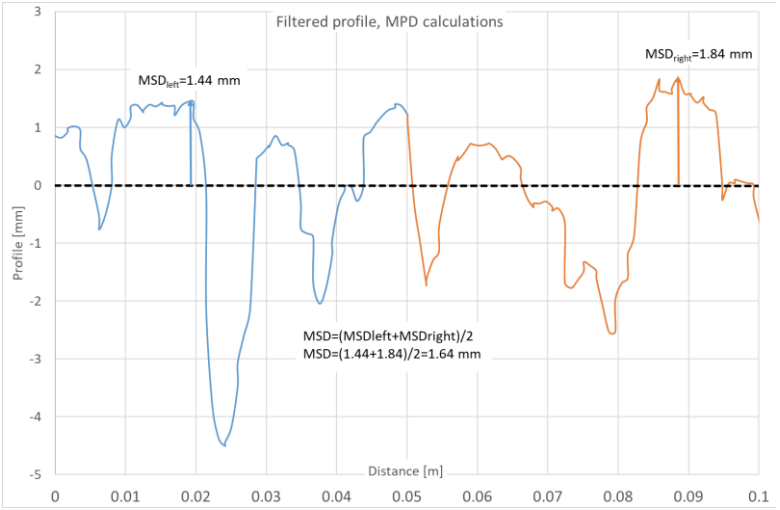
- Technical committee (TC) 43 is working with standardization regarding properties associated with acoustics.
- There are four working groups (WG) under TC 43 and three sub committees (SC).
- Sub committee 1 is working with noise and properties associated with noise – 19 WG.
- Sub committee 2 is working with building acoustics – eight WG.
- Sub committee 3 is working with underwater acoustics – five WG.
- Working group 39 handles standardization about “Characterization of pavement texture by use of surface profiles”
- The standardization series within WG 39 have 6 parts, 13473-1 to -6

ISO/TC 43/SC 1/WG 39

- The background to why WG 39 is under noise is,
  - At the start of 1990 there was a need to have a measure that described surface texture and sound absorption. An ASTM standard for sand patch existed but no standardized method that could be used for longer sections.
  - No other committees was dealing with surface texture, so the initiative to start the standardization came from noise experts.
  - Ulf Sandberg, VTI and Guy Descornet, BRRC, started the work with Part 1, MPD

ISO 13473-1:2019, DETERMINATION OF MEAN PROFILE DEPTH

- Mean profile Depth (MPD) is a measure used to describe the macrotexture level of a road surface.
- The macrotexture range covers wavelengths between 0,5 mm and 50 mm.
- MPD is important for tyre/road friction, exterior tyre/road noise, rolling resistance, tyre wear and noise in vehicle.
- MPD calculation:
  MSD (Mean Segment Depth) is calculated every 0,1 m and the average of MSD for the presentation length is MPD.



ISO 13473-2:2002, TERMINOLOGY AND BASIC REQUIREMENTS RELATED TO PAVEMENT TEXTURE PROFILE ANALYSIS

- This part defines terms, expressions and parameters that are related to the analysis of pavement texture.
- The terms are anticipated to be useful in modeling of pavement characteristics such as tyre/road noise emission, tyre/road friction, tyre rolling resistance, tyre wear, etc.

ISO 13473-3:2002, SPECIFICATION AND CLASSIFICATION OF PROFILOMETERS

- This part specifies requirements for profilometers used in pavement engineering in order to give meaningful and accurate measurement of micro-, macro- and megatexture characteristics of paved road and airfield surfaces.
- It also includes schemes for the classification of such profilometers with respect to their use and overall accuracy.

ISO/TS 13473-4:2008, SPECTRAL ANALYSIS OF SURFACE PROFILES

- This Technical Specification describes methods that are available to perform a spectral analysis of pavement surface profile signals.
- The Technical Specification is under revision and will be changed.
  - Analogue filtering will be removed.
  - Preprocessing of texture profiles will be done according the same procedures as in part 1.
  - Power Spectrum with constant-percentage bandwidth will be the method to use for spectral analysis.
  - Spectral analysis by means of Discrete (Fast) Fourier Transform will be moved to an informative annex.
- The target date for a new publication is 2023-06-16

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ISO 13473-5:2009, DETERMINATION OF MEGATEXTURE

- This standard specifies procedures for determining the average depth or level of pavement surface megatexture by measuring the profile curve of a surface and calculating megatexture descriptors from this profile.
- The megatexture range covers wavelengths between 50 mm and 500 mm.
- Irregularities in the meagtexture range is unwanted, it affects several properties such as, discomfort, vehicle wear, internal and external noise, tyre road friction and rolling resistance.
- A revision of 13473-5 will be the next work item for WG 39.

REVISION OF 13473-5, DETERMINATION OF MEGATEXTURE

- **The revision will focus on,**
- Use the same preprocessing procedures as in Part 1 (spike removal, missing value etc.)
- Make RMS in mm the default measure instead of LMe in dB.
- Use digital band pass filter instead of spectral analysis as calculation method.
- Add an informative annex describing the implementation of program code used to calculate megatexture. A guide and reference for developers of software.

ISO/PAS 13473-6, VERIFICATION OF THE PERFORMANCE OF LASER PROFILOMETERS USED FOR PAVEMENT TEXTURE MEASUREMENTS

- New document, just published (will be described later in this presentation)

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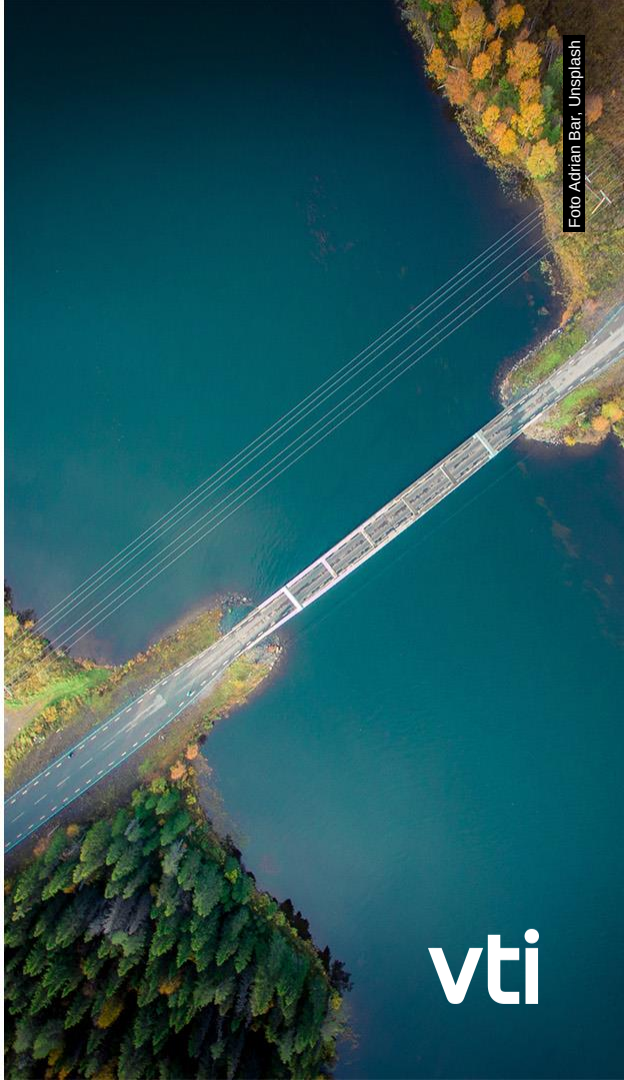

CORRECTIONS MADE IN ISO 13473-1:2019, MPD

- In June 2021, a corrected version of 13473-1 was published. The correction was done because of recent discovered ambiguities in the standard.
- The corrections are described in the standard and can be summarized in the following points.
  - The segment length was corrected to 100 mm throughout the document (earlier 100 ± 10 mm). **Several places**
  - A more precise description of how to handle dropouts at the start and end of the profile and how to mirror data if there are no data available before and after the section. **7.3 and 7.6**
  - A new requirement was introduced. It must be a least 50 % valid MSD-values to calculate MPD for a section at any length, otherwise it will be No Data for the section. **7.10.** This was not specified in the previous version of the standard.
  - Better described spike removal procedures. **Annex E**

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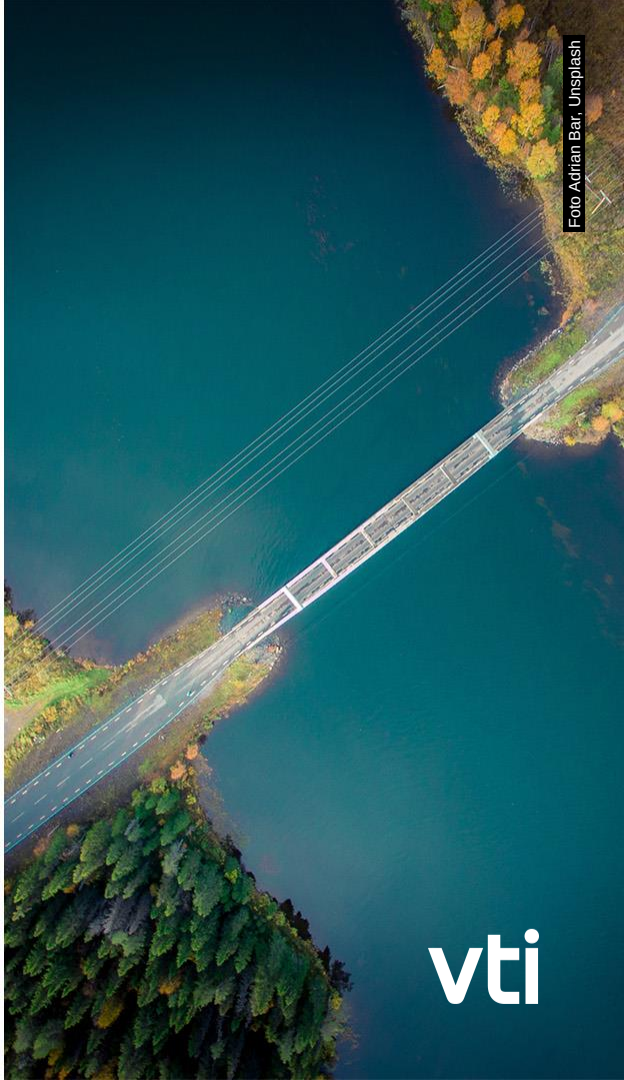

A NEW PAS, 13473-6, VERIFICATION OF THE PERFORMANCE OF LASER PROFILOMETERS USED FOR PAVEMENT TEXTURE MEASUREMENTS

- PAS, Publicly Available Specification, not the same weight as an IS or TS.
- The objective of this document is to make available an internationally accepted procedure by which performance of various laser-based equipment for pavement texture measurements can be evaluated.
- The document includes guidelines and recommendations intended to assist users of laser profilometers in verification of their equipment.
- The procedure aims at providing tools for verifying that such systems perform satisfactory in all respects important for the correct measurements of texture.

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13473-6, TESTS INCLUDED

Tested parameter	Suggested frequency of testing, at least	Notes
Laser power	1 year	If the laser is used only occasionally, it is enough with testing every 2nd year
Laser spot size	6 years	According specifications, equipment - laser beam analyzer
Calibration (scale) factor	2 years	Measurements against well known heights
Linearity	4 years	A linear representation for the entire measurement range
Background noise	1 year	If the laser is used only occasionally, it is enough with testing every 2nd year

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13473-6, TESTS INCLUDED

Tested parameter	Suggested frequency of testing, at least	Notes
Horizontal position measurement accuracy (distance measurement)	1 year	Distance measurement. It is good practice to do it more often, if max. precision is needed in road locations
Sensitivity to abrupt change in surface reflectivity	4 years	Tests at surfaces with different reflectivity
Spike content of measured signal	1 year	Measurement at demanding surfaces
Effect of ambient light	4 years	Sensitivity to sun light

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13473-6, TESTS INCLUDED

Tested parameter	Suggested frequency of testing, at least	Notes
Dropout rate	2 years	Test surface, new SMA
Validation of dropout detection system	Once	Tested only when sensor is new
Synchronization between invalid parts of the profile and dropout indications	Once	Tested only when sensor is new

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13473-6,

- A PAS must not have limits for all tests.
- To establish limits for the tests and to make the document an IS or TS, WG 39 must have feedback and experience from the end users and manufactures of laser profilometers when the tests in the PAS is done.
- We need feedback on periodicity of the test, requirements, used equipment, test surfaces etc. to go further. Any comments, results from tests or suggested improvements could be sent to thomas.lundberg@vti.se.

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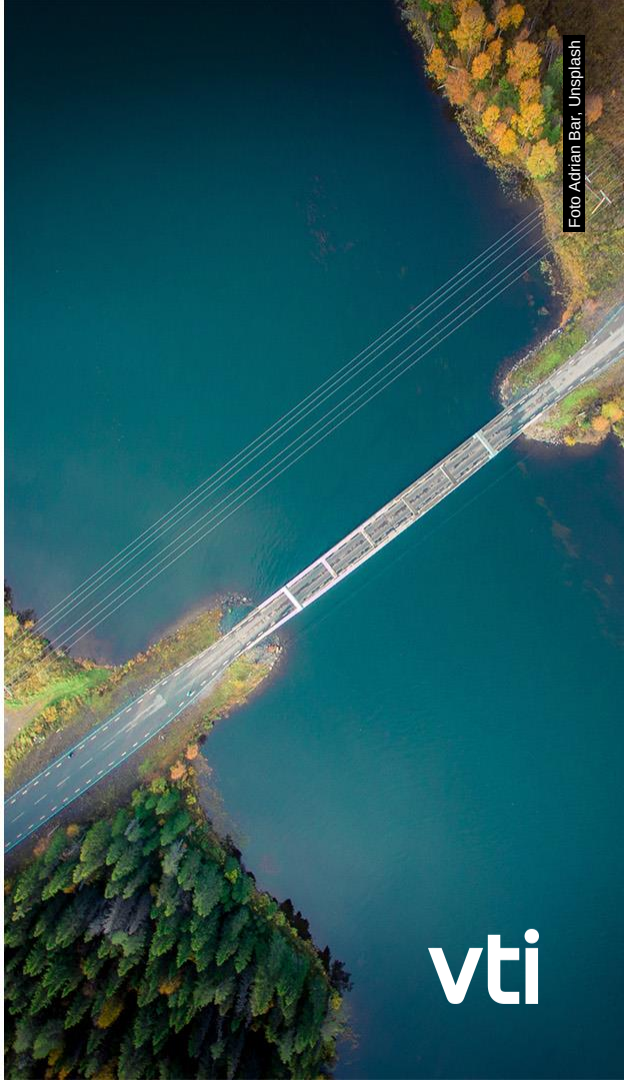
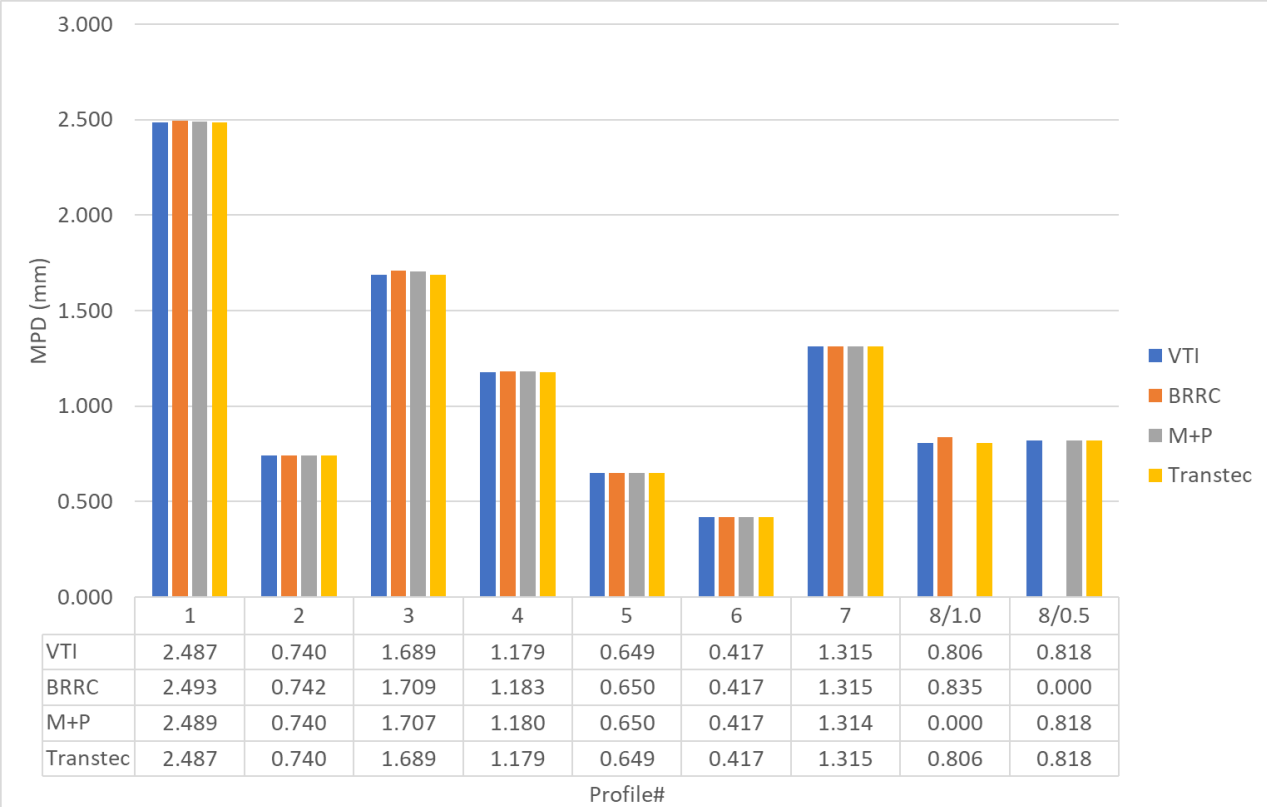


IMPLEMENTATION AND VERIFICATION OF MPD-CALCULATIONS

- To help and support manufacturers of laser profilometers WG 39 has written reference program code in Matlab® that can be used to verify an implementation of MPD calculations according 13473-1.
- The code is verified by three organizations within WG 39 and the program code is publicly available at the erpug.org homepage together with eight sample profiles used for the calculations.
- WG 39 intends to make reference calculation for spectral analysis and megatexture as well. It will also be available at erpug.org.

REFERENCE MPD FROM FOUR ORGANIZATIONS

- Good agreement
- Much better than earlier comparisons
- The new corrected version of part 1 will give much less room for different interpretations



	1	2	3	4	5	6	7	8/1.0	8/0.5
VTI	2.487	0.740	1.689	1.179	0.649	0.417	1.315	0.806	0.818
BRRC	2.493	0.742	1.709	1.183	0.650	0.417	1.315	0.835	0.000
M+P	2.489	0.740	1.707	1.180	0.650	0.417	1.314	0.000	0.818
Transtec	2.487	0.740	1.689	1.179	0.649	0.417	1.315	0.806	0.818

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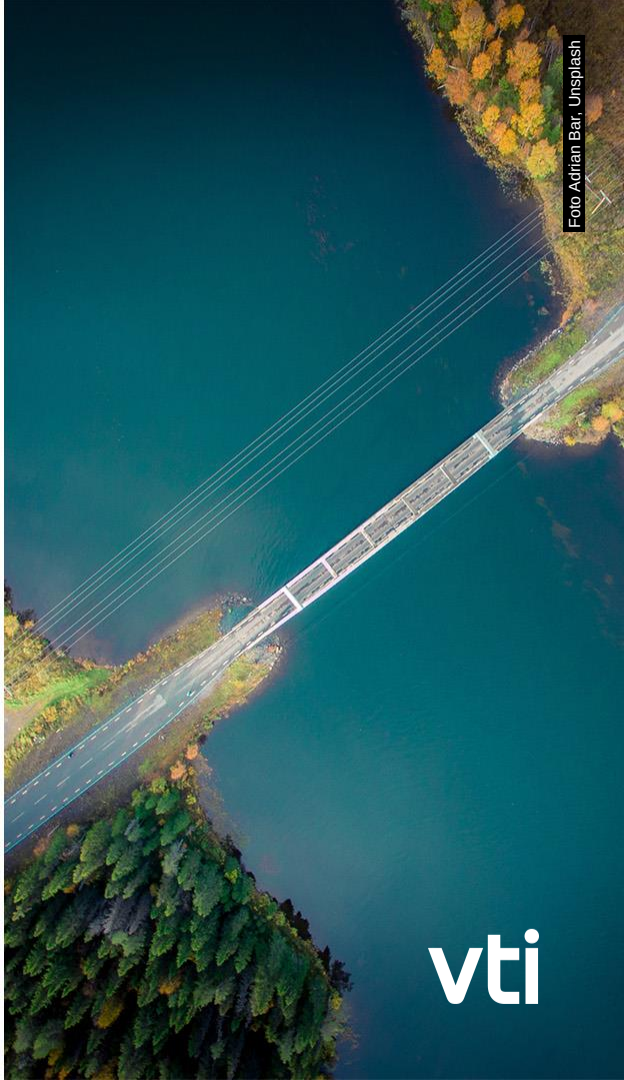
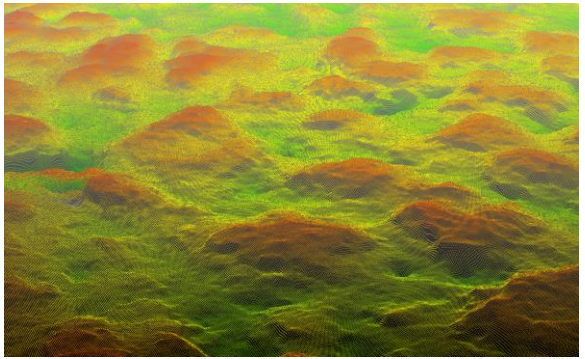


FUTURE WORK ITEMS WITHIN WG 39

- The next work item to be done within WG 39 will be the revision of the megatexture standard, ISO 13473-5, as described earlier in this presentation.
- WG 39 has also started the discussion of how to calculate texture properties from 3D texture sensors.



Picture: Austrian Institute of Technology

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THANK YOU FOR THE ATTENTION!

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Swedish Road and Transport Research Institute

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