Laser

instead of sand or water for Texture-Depth Measurement:

ELAtextur 3.0

SMETS
TECHNOLOGY

ELAtextur

for measuring the macrotexture of pavements

For many years the outflow meter (Moore) in combination with the SRT pendulum test or the sand-patch method have been used to determine the macrotexture of pavement surfaces.

Both methods require consumables (water/ sand or grease). At the same time, the measured data obtained by these methods are prone to operator errors due to the manual testing procedure.

In contrast, the measurement device ELAtextur works largely free of operator errors and hence operates more accurately and faster.

The rotating laser sensor scans the pavement surface with high resolution.

The new device version 3.0 is equipped with an integrated Mini-PC working with a fast ARM processor for control and data storage.

The MPD (Mean Profile Depth) and ETD (Estimated Texture Depth) values are determined directly in the measuring device and displayed right after the measurement. For additional evaluations and test reports, a software tool for the desktop PC is available.

Evaluation parameters:

- **MPD (Mean Profile Depth) based on a circular segment of the texture.**
- **ETD (Estimated Texture Depth, equivalent to MTD/ sand-patch method)**

according the standard EN ISO 13473-1:2004 and the ISO 13473-1: 2019.

The rotating laser sensor of the ELAtextur scans the pavement surface with a horizontal resolution of 0.2 mm. The circumference of the circular path is 400 mm (according to the sand-patch method).

The surface profile determined in this way permits a calculation of the MPD (Mean Profile Depth) and ETD (Estimated Texture Depth) values based on circular segments of the macrotexture based on the requirements of the standard EN ISO 13473-1.

In this standard, a line/ segment of 100 mm is chosen as basis for computing the mean profile depth.

While the laser sensor scans the circular path, 4 mutually independent MPD values (according EN ISO 13473-1:2004) respectively 4 MSD values (according EN ISO 13473- 1:2019) are determined and automatically converted into a MPD value for the measurement run over the circular path by the electronic measurement system.

After every measurement the MPD value of the circular path will be automatically transformed to an ETD value (Estimated Texture Depth) of the circular path. The transformation will be according to the following formula:

ETD = 0.2 mm + 0.8 MPD

according to section 7.9 of the EN ISO 13473-1:2004

dETD = 1,1. dMPD

according to section 7.11 of the EN ISO 13473-1:2019

The ETD value can be equated with the MTD value of the manual volumetric test methods. The standard states: „*The use of this transformation equation, which has been derived in reference [1] (see annex F) should give ETD values which are as close as possible to MTD values measured with the volumetric patch method. The error in the transformation equation is estimated to be much less than the variation due to different operators and equipment of the volumetric patch method.*" (Quotation of EN ISO 13473-1:2004)

This scan of the circular path and the computation of the corresponding MPD and ETD values is carried out twice per test run (measurement 1 + measurement 2). Based on the values of both measurements the mean value is calculated. This mean value represents the final test result.

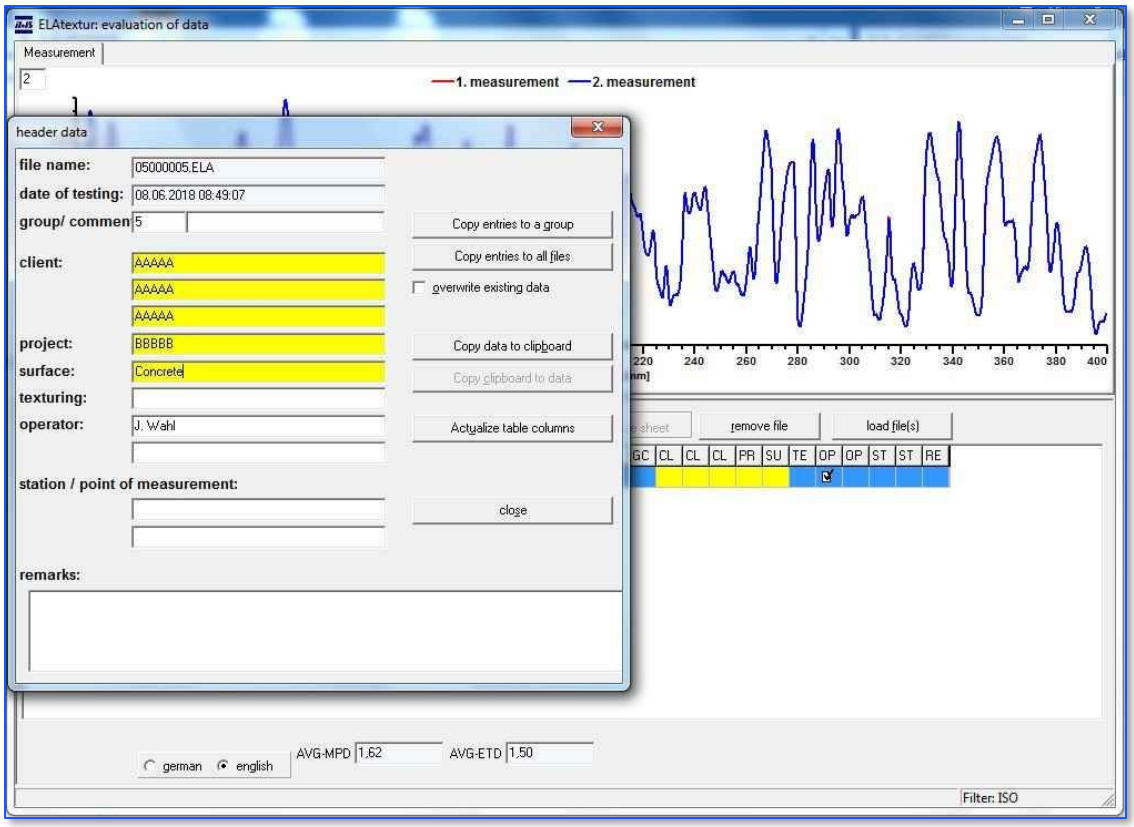
In order to scan a test profile with a minimum length of 1 m for one test section according to the standard it is recommended to make up to three measurements at slightly different positions around the test area.

The measurements of one test section can be assigned to a group directly at the measurement device.

Technical parameters:

Resolution/ vertical:	0.01 mm
Resolution/ horizontal:	0.2 mm
Measurement range/ vertical:	20 mm 20 mm (+5/ -15 mm of the footprint)
Measurement spot:	≤ 1 mm
Circumference of the measurement circle:	400 mm Scanned point
per measurement:	2000
Rotations per test:	2 (measurement+ repeated measurement)
Test duration:	about 6 seconds
Test duration incl. storage of the data in the device:	about 10 seconds
Time required for transferring the data of 100 measurements to an external USB stick for evaluation on a PC:	< 1 second

In addition, the core adapter allows texture depth measurements on cores in the laboratory (standard: Ø 150mm/ other sizes on request)



For evaluation and printouts of measurements carried out with the ELAtextur a software has been developed to realize the following visualisation:

- Graphical representation of the individual measurements on the computer screen as well as an output of the header and measured data for the test together with a graphical representation of both measurement curves in a test protocol;
- Graphical representation of the calibration measurements on the computer screen as well as an output of the measurements in a calibration protocol;
- Compilation of tests into groups and the computation of MPD and ETD average values for each group;
- Generation of printout lists for selected tests containing their MPD and ETD values under specification of the corresponding group averages;
- Graphical representation of the GPS coordinates recorded during the measurement as a means of checking the intended group allocation.

The software offers the possibility to compare measurement data, to determine mean values of selected measurement groups and to print or store test reports of these evaluations.

In addition, the measurement files can be supplemented with header data (name of the customer, project, type of pavement and texture, operator, measurement section, annotations etc.). To avoid the tedious entry of these header data in every measurement file, the evaluation software offers automatic writing routines.

At the top of the test report, your company data and logo can be integrated based on a bmp file.

Single measurement curves can be stored as an image file for further use.

The following test protocols are possible:

Single sheet = test protocol of one test with the measurement values, the measurement curves, and the header data:

(Reduced display/ original size: 297 x 210mm)

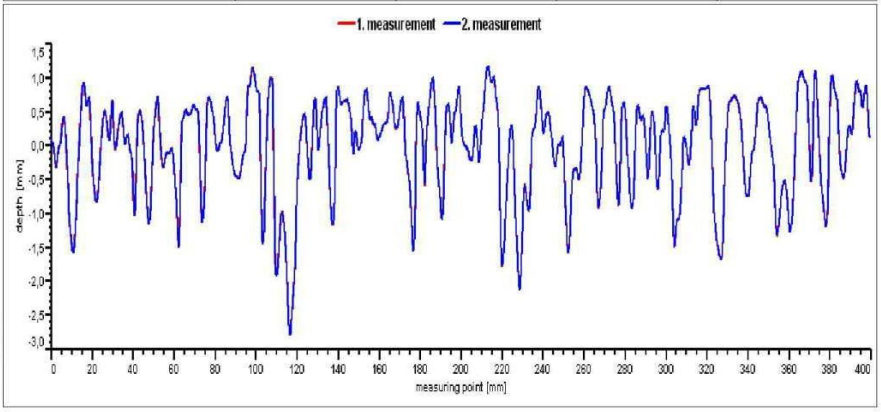
Freely configurable report header

Determination of Mean Profile Depth (EN ISO 13473-1:2004)

profil: **circuit with a circumference of 400 mm**
measurement speed: **stationary with a rotating speed of 0,6 km/h**

device:	ELAtextur No.:180108	**client:**	IWS Messtechnik GmbH
file name:	02007405.ELA		
group:	2		
date of testing:	03.05.2018 10:46:00	**project:**	verification measurement
operator:	Smith	**surface:**	concrete
		texturing:	
calibration:	03051801.EAK 03.05.2018 09:39 03051802.EAK 03.05.2018 10:02	**station / point of measurement:**	5236.03133N 959.82262E

test result	MPD [mm]	ETD [mm]	st. dev. [mm]	Dropout [%]
measurement 1	0,99	0,81	0,08	0
measurement 2	0,99	0,81	0,08	0
mean value	0,99	0,81		



notes (information over possibly existing impurities, joints, cracks, potholed):

List = Summary of selected tests with the mean values of the MPD and ETD value of each group and the total mean value of all selected tests.

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Determination of Mean Profile Depth (EN ISO 13473-1:2004)

profil: **circuit with a circumference of 400 mm**
measurement speed: **stationary with a rotating speed of 0,6 km/h**

device:	ELAtextur No.:180108	**client:**	IWS Messtechnik GmbH
date of testing:	03.05.2018 10:02:00	**project:**	verification measurement
operator:	Smith	**surface:**	concrete
		texturing:	
calibration: 03051801.EAK 03051802.EAK		**station / point of measurement:**	

file name	GPS / distance to middle of group [m]	MPD-Value	ETD-Value
group 1:	GK-coordinate: 5828288 N 32567523 E		
01007398.ELA	1,9	0,40	0,34
01007399.ELA	0,7	0,35	0,30
01007400.ELA	1,9	0,38	0,33
01007401.ELA	0,6	0,38	0,33
01007402.ELA	0,9	0,40	0,34
	group 1 average:	0,38	0,33
group 2:	GK-coordinate: 5828301 N 32567526 E		
02007403.ELA	0,4	0,90	0,74
02007404.ELA	1,7	0,92	0,75
02007405.ELA	1,5	0,99	0,81
02007408.ELA	0,5	1,02	0,84
	group 2 average:	0,96	0,78
group 3:	GK-coordinate: 5828300 N 32567526 E		
02007406.ELA	0,2	0,97	0,79
03007407.ELA	0,2	0,95	0,78
	group 3 average:	0,96	0,79
	mean value:	0,68	0,56

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The texture measurement device ELAtextur is also available with an **integrated GPS receiver including an active GPS antenna.**

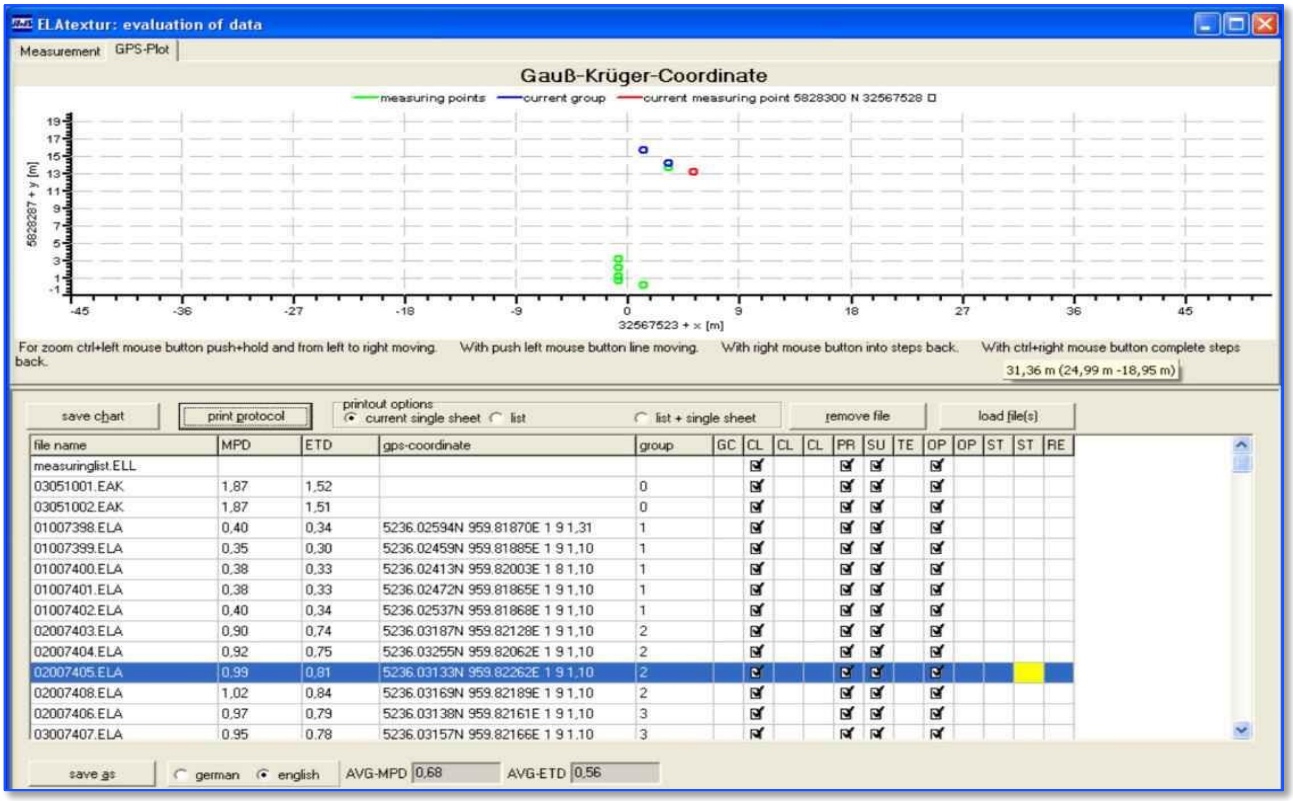
mode:	NMEA
format of coordinates:	WGS 84
UTM data updating:	1 Hz

number of receiving satellites, the HDOP and the fix status proven repeatability at unilateral shadowing:
≤ 5 m (95%)

In this case the program screen “GPS-Plot“of the evaluation software enables you to check the correct spatial positioning of the individual measurement points.

The evaluation software also allows the **visualization of the measurement points in digitalmaps**, based on KML-files.

A coloured display of the measured data according to individual determined limits is possible.

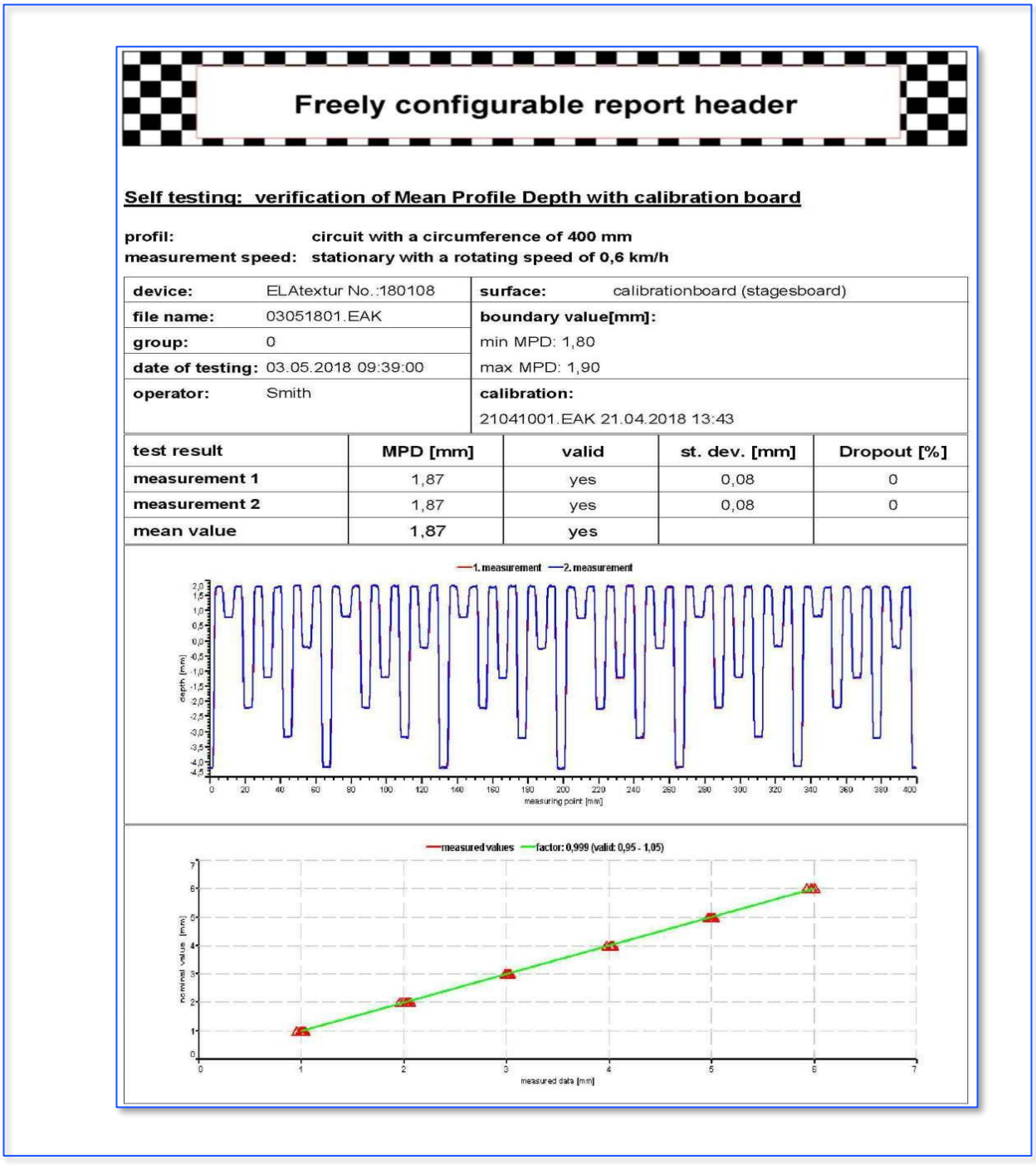


In order to ensure uninterrupted supervision of the measuring device as well as functional control, every ELAtextur device is provided with a **transportation case with an integrated calibration plate.** Calibration measurements should be carried out on this calibration plate at the beginning and end of a day of measurement in each case. These measurements are stored in a file with a special data format (*.EAK).

The evaluation software permits a graphical presentation of the measurement curve and a graphical control of the nominal/measured values of a calibration measurement in the form of a regression line. Both graphs may also be stored as an image file.

A separate test protocol including both graphs has been developed:

(Reduced display/ original size: 297 x 210mm)



Freely configurable report header

Self testing: verification of Mean Profile Depth with calibration board

profil: circuit with a circumference of 400 mm
measurement speed: stationary with a rotating speed of 0,6 km/h

device:	ELAtextur No.:180108	**surface:**	calibrationboard (stagesboard)
file name:	03051801.EAK	**boundary value[mm]:**	
group:	0	min MPD: 1,80	
date of testing:	03.05.2018 09:39:00	max MPD: 1,90	
operator:	Smith	**calibration:**	
		21041001.EAK 21.04.2018 13:43	

test result	MPD [mm]	valid	st. dev. [mm]	Dropout [%]
measurement 1	1,87	yes	0,08	0
measurement 2	1,87	yes	0,08	0
mean value	1,87	yes		

1. measurement 2. measurement
depth [mm]
measuring point [mm]

measured values factor: 0,999 (valid: 0,95 - 1,05)
nominal value [mm]
measured data [mm]

For outdoor measurements:

ELAmobil

Modified foldable pushcart for the ELAtextur device with special holding plate and additional keypad for outdoor measurements without lifting thedevice

The lightweight, foldable pushcart is easy tohandle and offers a safe and comfortable transport of the device on long measuring distances.

The ELAtextur device is fixed by the three stopholes in the holding plate of the pushcart. Thethickness of the base plate ensures thenecessary loose standing of the device on the pavement during the measurement without influences of the pushcart. The additional keypad provides a fast handling and saves your back.

ELAlinear

for the stationary texture measurement of pavements on a linear measurement line

This new device allows the determination of the macrotexture of pavements on a linear measurement line using the proven ELAtextur sensor and control.

With a maximum measuring range of 1,650 mm (horizontal resolution: < 0.2 mm) it is the perfect choice for example for the easy but precise detection of ruts in the wheel path or for the quality control of texturing performances (e.g., Grinding). Thus, it provides a cost-efficient alternative to the expensive use of high-speed measurement vehicles for many questions in the condition survey.

To prove the repeatability and comparability of the ELAtextur device, we have participated in several round robin tests in the past:

Seven devices ELAtextur have taken part successfully at the measurement program of the International Friction Workshop 2011 at the Thomas D. Larson Pennsylvania Transportation Institute.

In 2015/ 2016 we organized a round robin test in Germany. 15 devices of our customers participated in this successful comparative test on six different pavement probes.

We participated both time with two ELAtextur devices in the comparative measurements of the “1st European Pavement Friction Workshop 2017” and the “2nd European Pavement Friction Workshop 2019” in Nantes/ France.

For further details please contact:

Smets Technology Gmbh
Handerwerkerstraße 5a,
15366 Hoppegarten, Germany

Info@smets-technology.com
+49 [0]3342 – 508 95 40