The Possibilities of Utilising Data Gathered from Laser Measurements of Pavement Surface Texture

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Background

• Change in the road network´s condition is monitored at regular intervals by using service lever measurements

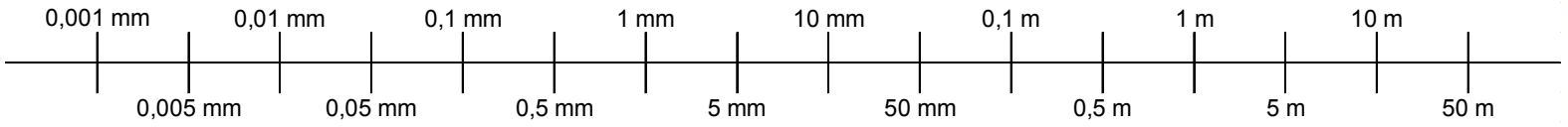
• Surface texture measurements in Finnish Road Administration started of paved roads with a service level measurements vehicle in 2003

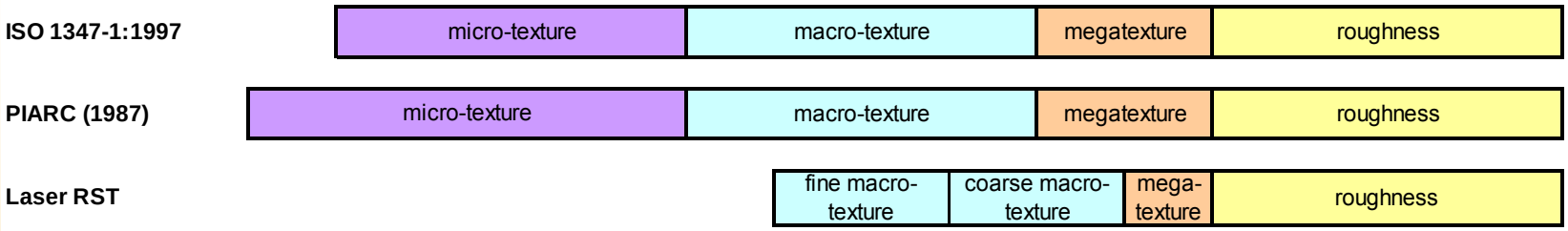
• Each year the entire main road network and approximately one third of the roads within the lower road network are measured

• This presentation presents the results of surface texture measured during two years (total approximately 44 000 km). Measurements were done both years with the same service level measurements vehicle.

Texture measurements

- Values are corresponding to the right wheel vehicle path
- The data is based on the data of 100 metre mean values stored in the condition register



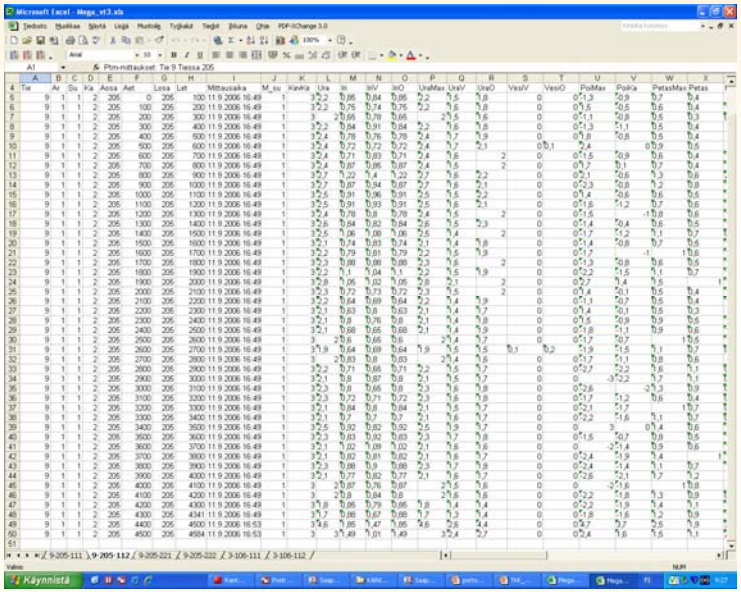


Research data

- Dublicated measurement data and measurements containing deficient information have been eliminated from the data

- Typing errors or other errors caused by human factors have not been eliminated from the data

- The final data used for describing surface texture is 38 041 km



Measured roads and surfaces

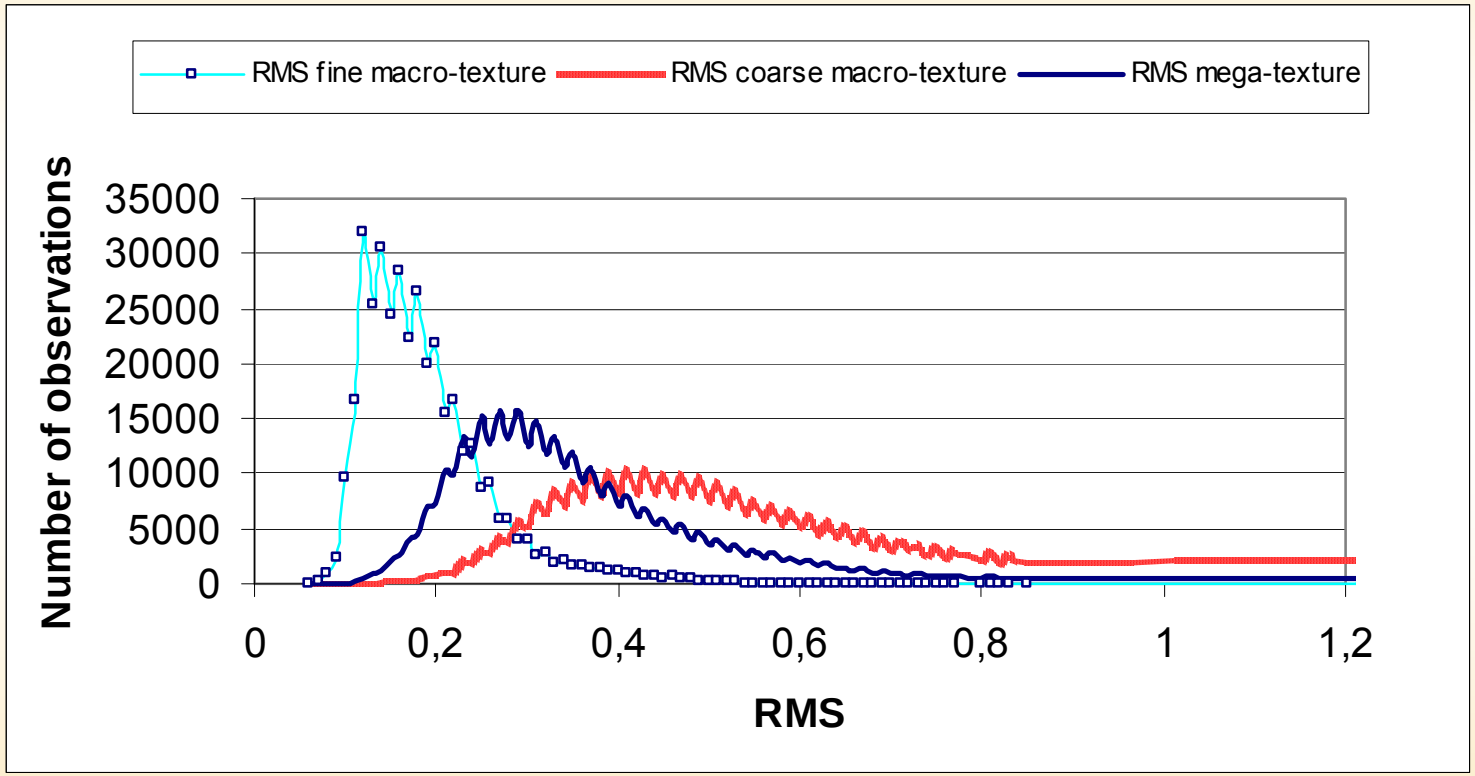
Surface texture data according to the functional classes of roads

- 93 % of highways	7969 km
- 94 % of main roads	4422 km
- 72 % of regional roads	9748 km
- 31 % of connecting roads	15902 km
Total	**38041 km**

Surface texture data according to different pavement types

- Asphalt concrete (AC)	13994 km
- Split mastix asphalt (SMA)	1773 km
- Soft asphalt (SA)	19988 km
- Surface dressing on gravel roads (SDGR)	2286 km
Total	**38041 km**

Distributions of measured data



Average values of surface texture based on statistical observation

Surface texture type	Functional class			
	Highway	Main road	Regional road	Connecting roads
RMS fine macro-texture	0.33	0.30	0.28	0.31
RMS coarse macro-texture	0.75	0.67	0.70	0.72
RMS mega-texture	0.48	0.51	0.63	0.74

Surface texture type	Pavement type			
	AC	SMA	SA	SDGR
RMS fine macro-texture	0.31	0.31	0.28	0.31
RMS coarse macro-texture	0.67	0.78	0.69	0.88
RMS mega-texture	0.53	0.45	0.76	0.71

Surface texture type	**Average daily traffic**			
	< 350	**350…1500**	**1500…6000**	**>6000**
RMS fine macro-texture	**0,32**	**0,29**	**0,29**	**0,34**
RMS coarse macro-texture	**0,78**	**0,67**	**0,67**	**0,78**
RMS mega-texture	**0,71**	**0,68**	**0,55**	**0,48**

Average values of surface texture presented according to traffic volume and pavement category

Traffic volume (vehicles/day)	ADT < 350			350 < ADT < 1500			1500 < ADT < 6000			ADT > 6000		
Pavement type	RMS fine macro-texture	RMS coarse macro-texture	RMS mega-texture	RMS fine macro-texture	RMS coarse macro-texture	RMS mega-texture	RMS fine macro-texture	RMS coarse macro-texture	RMS mega-texture	RMS fine macro-texture	RMS coarse macro-texture	RMS mega-texture
SMA	-	-	-	-	-	-	0.28	0.77	0.45	0.35	0.83	0.49
AC	0.24	0.63	0.48	0.30	0.60	0.54	0.31	0.67	0.58	0.34	0.74	0.48
SAC	0.30	0.77	0.82	0.28	0.73	0.83	0.27	0.54	0.59	0.28	0.36	0.29
SDGR	0.41	0.94	0.76	0.28	0.75	0.62	-	-	-	-	-	-

Proposal for surface texture classification

RMS fine macro-texture	> 0.2 (37 %)
o asphalt concrete (and soft asphalt concrete)	> 0.1 (99 %)
o split mastix asphalt	> 0.2 (37 %)

(Preferably as large a value as possible. Positive effect on friction.)

Proposal for surface texture classification

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(Preferably as large a value as possible. Positive effect on friction.)

RMS coarse macro-texture > 0.4 (70%)

- asphalt concrete (and soft asphalt concrete) > 0.4 (70 %)
- split mastix asphalt > 0.5 (47 %)

(Wide value area with occurrence of seasonal variation. The value area varies according to different pavement types. Positive impact on the friction between the tyre and the road and on safety.)

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o asphalt concrete (and soft asphalt concrete)	> 0.4 (70 %)
o split mastix asphalt	> 0.5 (47 %)

(Wide value area with occurrence of seasonal variation. The value area varies according to different pavement types. Positive impact on the friction between the tyre and the road and on safety.)

RMS mega-texture	< 0.6 (92 %)
o asphalt concrete (and soft asphalt concrete)	< 0.5 (85 %)
o split mastix asphalt	< 0.4 (70 %)

(Preferably as small a value as possible. On highways and main roads the value shall be smaller compared to other functional classes of roads. Negative impact on driving comfort, rolling friction, fuel consumption and noise in the car.)

Influencing surface texture

• A contractor is able to influence most the surface texture of a pavement

• Materials, work methods and conditions during work used by the constractor have a great significance on the surface texture of a pavement

The Finnish Road Administration´s re-pavement contracts

- The Finnish Road Administration has a service agreement contract comprising maintenance of the road network for the period 4/2007 – 10/2018.
- The agreement covers classified road network totalling 1169 lane kilometres and 102 lane kilometres of ramps.
- The agreement includes maintenance of the classified road network's driveways, additional lanes, acceleration and slow down lanes, shoulders, ramps, stops, parking areas without intermediate lane, private roads and field road junctions, coated visors, gravel shoulders and road markings.
- In the service agreement contract the contractor programmes and defines the measures in compliance with the condition and functionality requirements determined by the buyer, implements the measures and is responsible for and reports about the condition and quality.
- Mega-texture has been adopted as the criteria to be evaluated in a service agreement.

The maximum value determined for mega-texture in contract documents is 0.9

- Finnish Road Administration wanted to test mega-texture value within broad limits.
- Roads were paved with split mastix asphalt and asphalt concrete.
- In case mega-texture exceeds the permitted limiting values, the price of the contract will be reduced by EUR 3000 for each exceeding 100 m section.
- At ramps, bus lanes, acceleration and slow down lanes the value reduction is EUR 1500 for each exceeding 100 m section.

Quality measurements

Measured values on 1-carriageway road sections describe measurements made in one year of road sections paved in the year in question.

Mega-texture, right carriageway	Mega-texture, lane mid-section
mean value 0.70	mean value 0.74
53 % of values ≤ 0.7	40 % of values ≤ 0.7
95 % of values ≤ 0.8	72 % of values ≤ 0.8
100 % of values ≤ 0.9	97 % of values ≤ 0.9

Measured values on 2-carriageway road sections describe measurements made in one year on road sections paved in the year in question.

Mega-texture, right carriageway	Mega-texture, lane mid-section
mean value 0.58	mean value 0.54
87 % of values ≤ 0.6	98 % of values ≤ 0.6
100 % of values ≤ 0.7	100 % of values ≤ 0.7

(Measurements have done with different measurement vehicle than big data)

Key conclusion of the research (1/2)

As regards further utilisation of surface texture knowledge the following conclusions are the most important:

- It would be sensible to take gradually the parameter RMS of surface texture into use
- In observation of the parameters surface texture data measured from the right vehicle path should be used
- Testing the applicability to practice of the proposed surface texture values requires annual monitoring of the development and change of surface texture in the road network

Key conclusion of the research (2/2)

- Surface texture knowledge and the target values determined for it could after observation be taken as properties to be evaluated in the Finnish Road Administration's re-surfacing contracts and as a condition parameter in road network measurements
- The surface texture value facilitates getting knowledge about the condition of the road network and its development
- The quality of surface texture data should be monitored each year
- Round robin tests between different vehicles have to be performed annually.