**French Institute
of Science and Technology
for Transport, Development
and Networks**

Macrotexture Assessment methods and their correlation

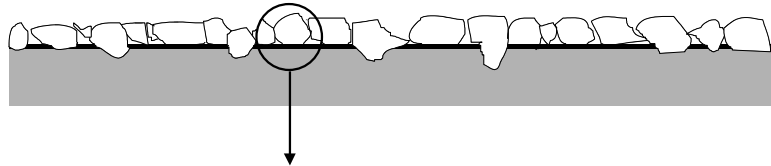Veronique Cerezo, AME/EASE
Minh-Tan Do, AME/EASE

IFSTTAR

Introduction

- **Surface texture**

  - **Deviation of a pavement surface from a true planar surface, with a texture wavelength less than 0.5 m**

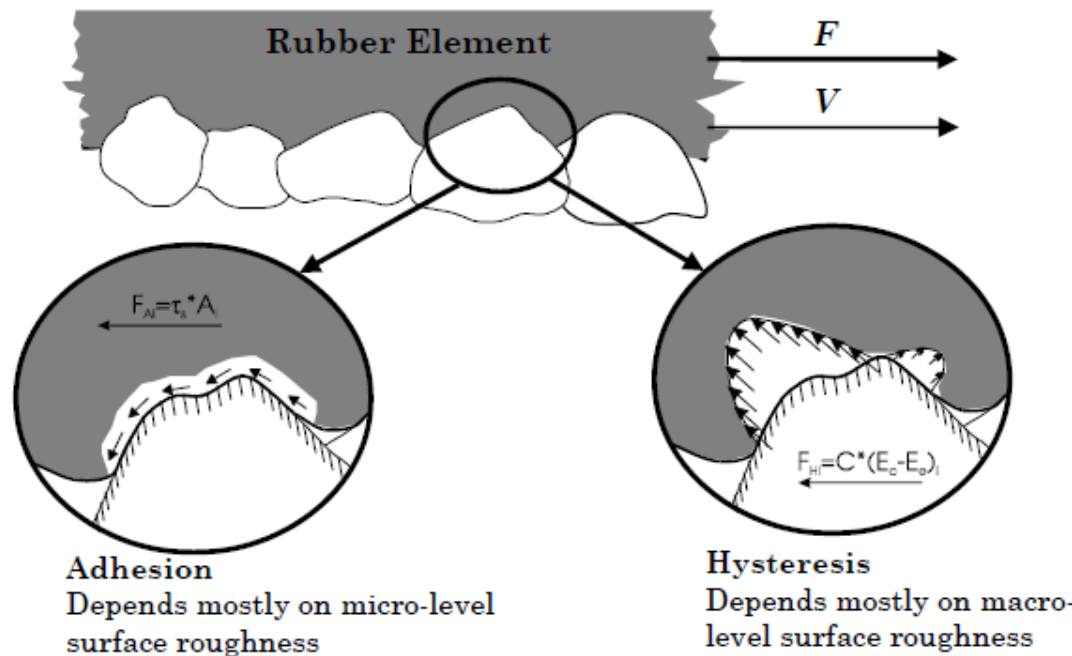Macrotexture

0,1 - 20 mm

0,5 - 50 mm

Microtexture

0,001 - 0,5 mm

< 0,5 mm

(Sandberg, 1998)
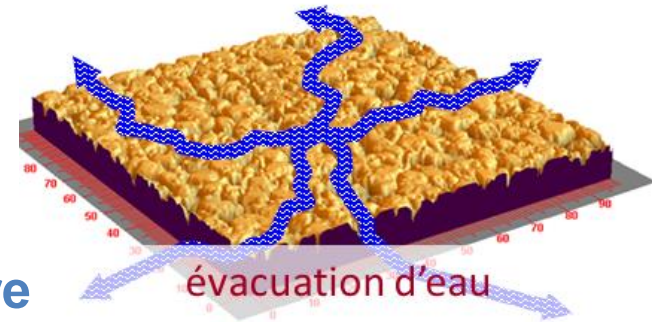
Skid resistance/ Macrotexture

- **Generation of friction forces on dry surfaces**

(Hall et al., 2009)

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Skid resistance/ Macrotexture

- **On wet surfaces**

  - **Bulk water evacuated by macrotexture**

  - **Thin water film squeezed by microtexture**

(Beautru, 2012)

évacuation d'eau

- **Skid resistance model**

$$\mu = \mu_0 \ (1 - F_{hydro})$$

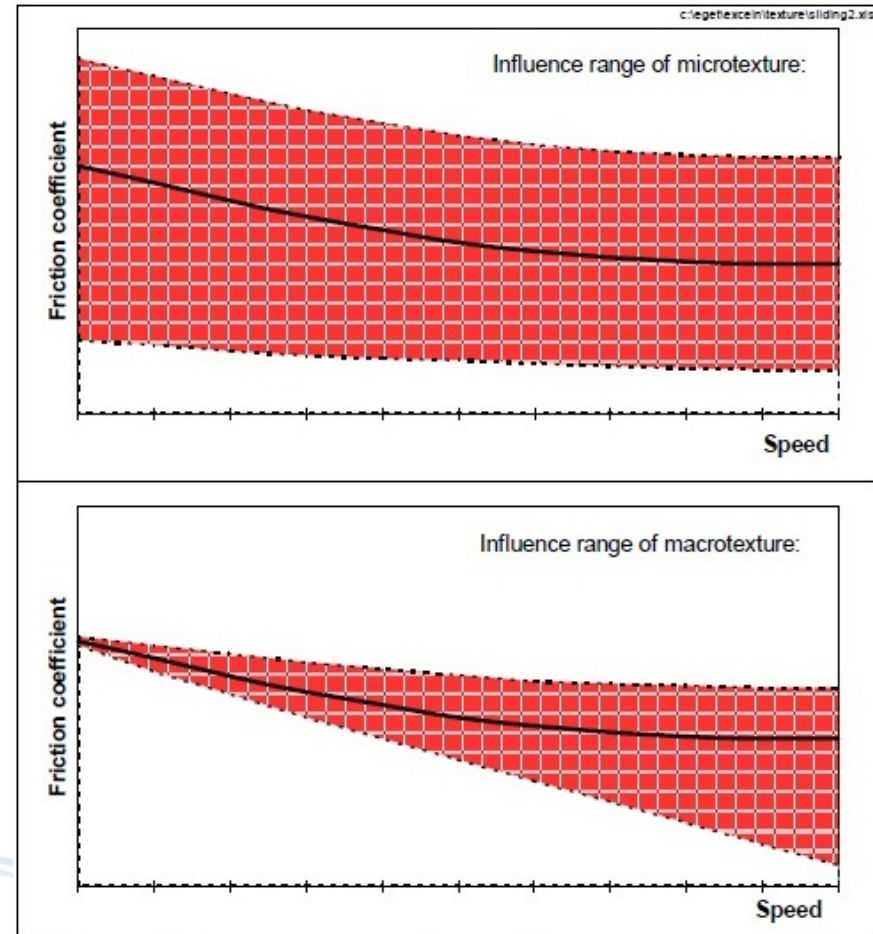Microtexture
Water depth (< 1mm), tire rubber

Macrotexture
Water depth (> 1mm), speed, tire tread depth

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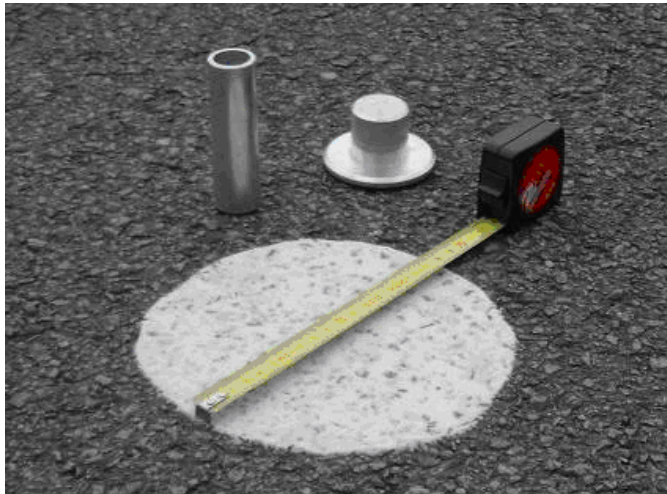# Skid resistance/ Macrotexture
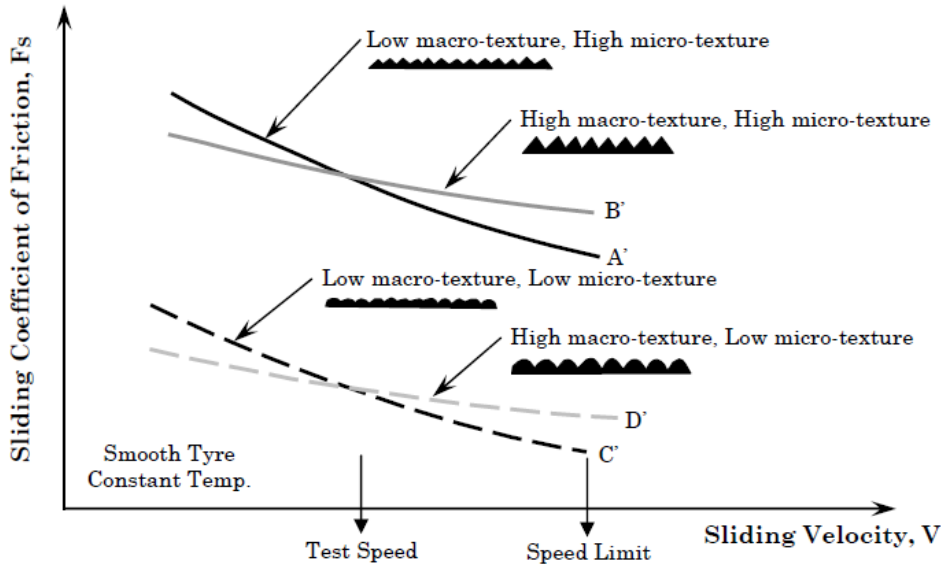
(Hall et al., 2009)

(Sandberg, 1998)

Macrotexture evaluation
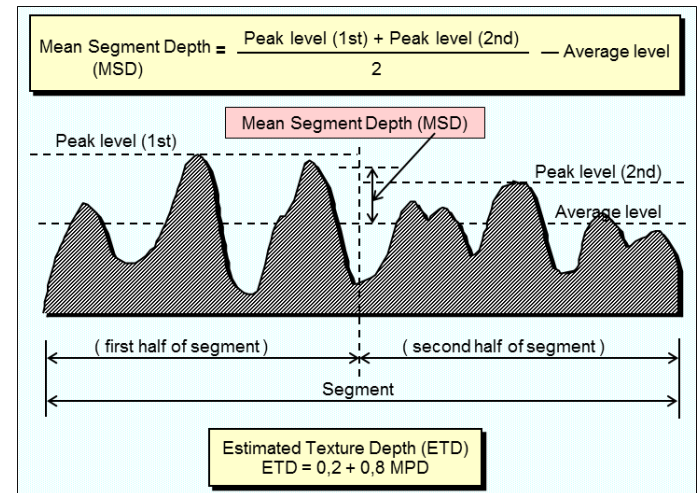
- ## Operational field

Volumetric method: « sand patch » test (EN 13036-1)

(Prevost, 2013)

Mean Texture Depth (mm)
$$MTD = 4V / \pi D^2$$

Profilometric method: contact or contactless sensor (ISO EN 13473-1)

Mean Segment Depth = $\dfrac{\text{Peak level (1st)} + \text{Peak level (2nd)}}{2}$ — Average level
(MSD)

Estimated Texture Depth (ETD)
ETD = 0,2 + 0,8 MPD

Mean Profile Depth (mm) (MPD)
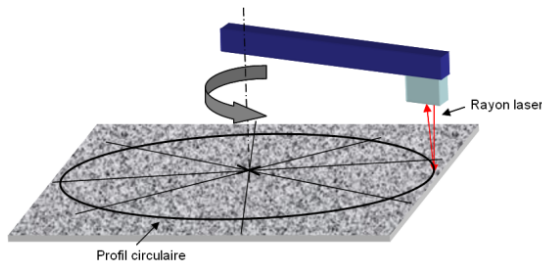
Macrotexture evaluation

- **Some existing devices…**

Static devices: circular profilometers

(Ifsttar, 2012)

Circular Textur Meter (CTM®)
ASTM E2157-9

ElaTextur®

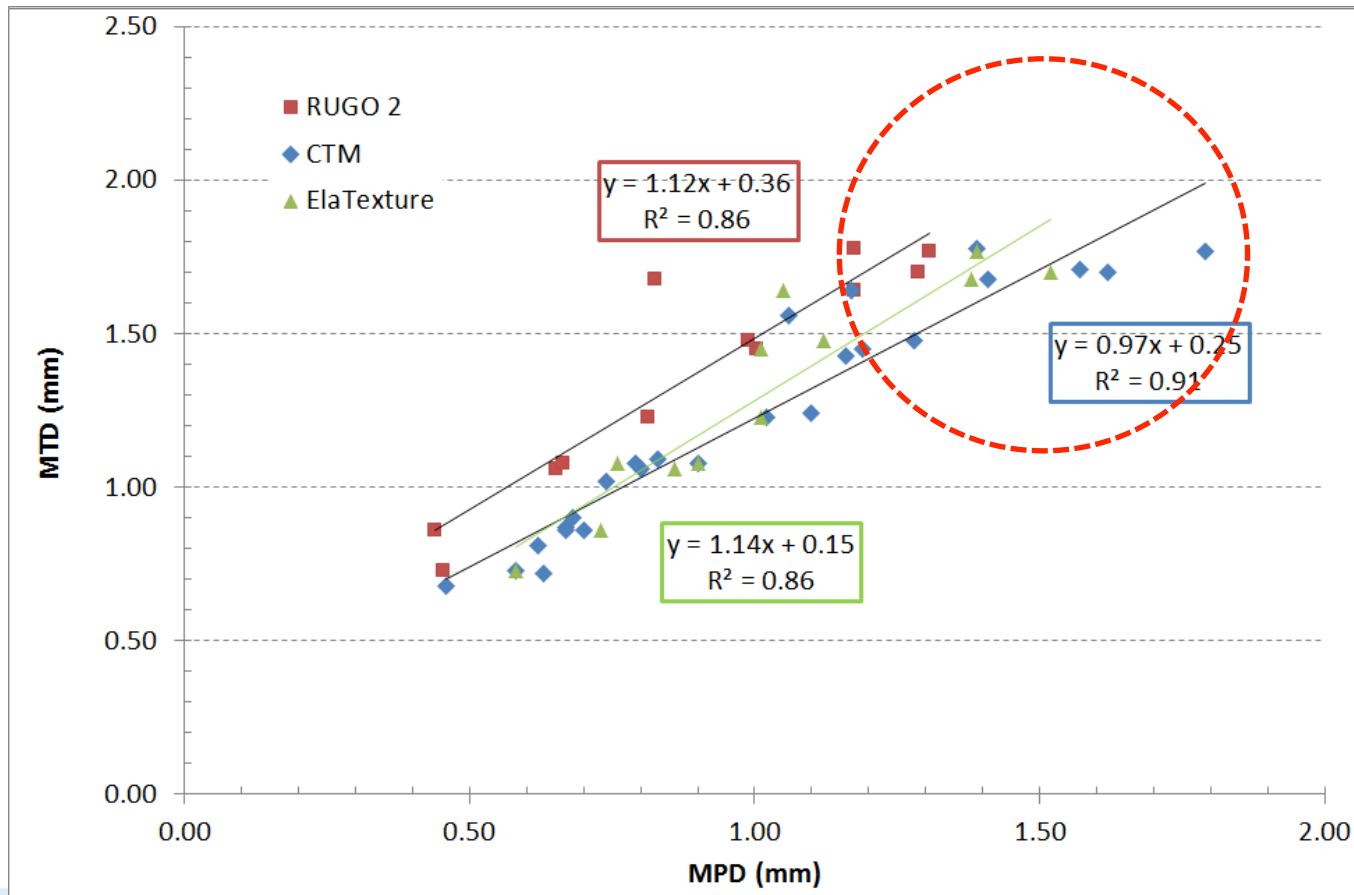**Dynamic devices**: linear profilometer

Rugolaser (Rugo2®)

TM2 (Protex®)


(Cerema, 2015)

Direct correlation

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Advantages/ drawbacks

- ## Sand "patch" test method

  - **Easy to implement (even on new pavement surfaces)**

  - **Reference method in France (level of acceptance for new roads)**

  - **Static, dependant from the operator ➔ representability?**

  - **Operator training and regular round robin tests needed**

    - **Uncertainty ± 0.23 mm [0.5 – 1.3 mm] for a level of confidence of 95% (2010)**
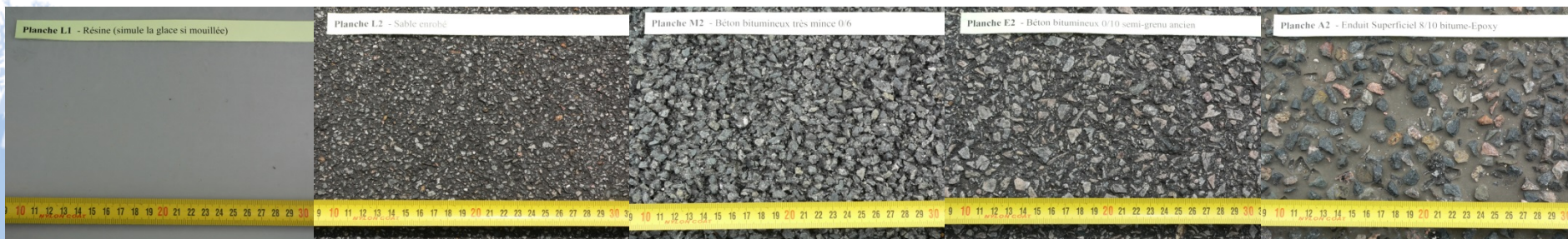
(Prevost, 2013)
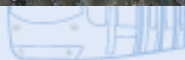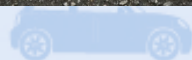
Advantages/ drawbacks

- **Profilometric methods**
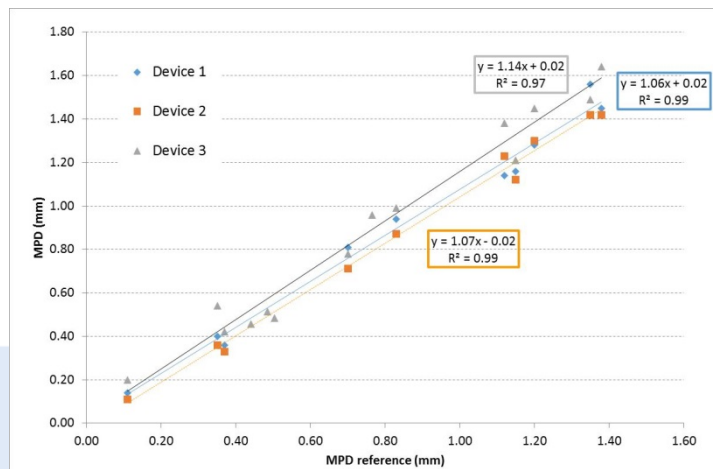
  - **Static measurements or continuous measurements in the traffic flow**

  - **Not adapted to wet or bright surfaces**

  - **Positive/negative texture**

  - **New sensors related issue: Peaks?**

  - **Use of ISO 13473-1 for circular profilometer? Filtering methods?**

- **Unique linear correlation between MPD and MTD…**

The ROSANNE project

- **FP7 EU Research project (2013 – 2016)**

  - **Ifsttar test tracks (10-12 surfaces)**

  - **Various macrotexture assessment methods**

    - **Linear profilometers (4)**

    - **ElaTextur, TL5 (laser beam), T3G**

http://rosanne-project.eu/

www.ifsttar.fr

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Main future changes

- **New ISO 13473-1 standard**

  - **Peak removal**

  - **2nd order Butterworth filter**

  ➔ ROSANNE dataset: decrease of the standard deviation on a given test track (≈ 0.03)

- **Parallel CEN/ISO enquiry (2016)**

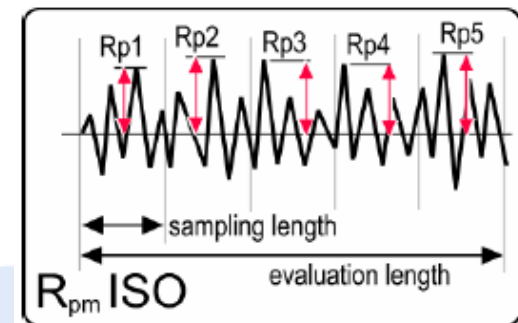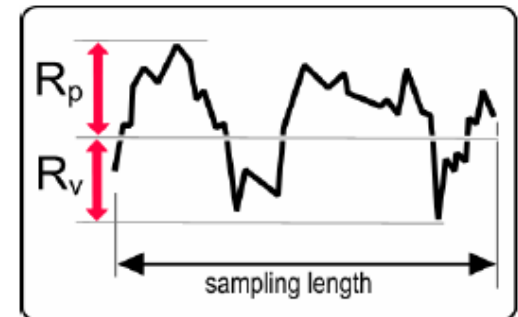French Institute of Science and Technology for Transport, Development and Networks

Other descriptors

- **Surface topography**

  - **Skewness (asymmetry of height distribution)**
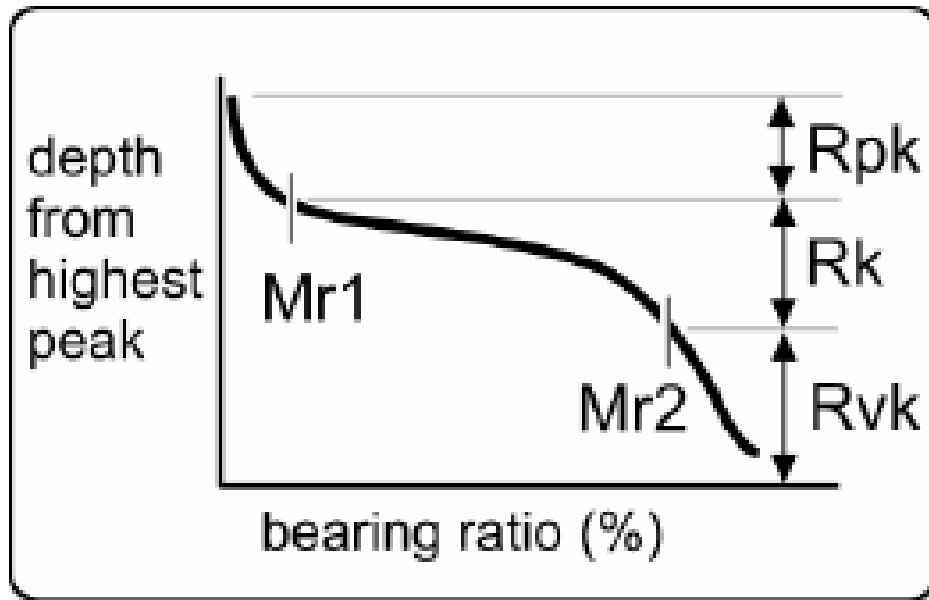
  - **Kurtosis (sharpness of height distribution)**

- **ISO 4287 (1998)**

  - **Maximum profile peak height (Rp)**

  - **Mean profile peak height (Rpm)**

(Zygo, 1993)

Other descriptors

- **Abbott curve: bearing area ratio (%)**

  - **Length of a profile at any specified depth in the length evaluation**
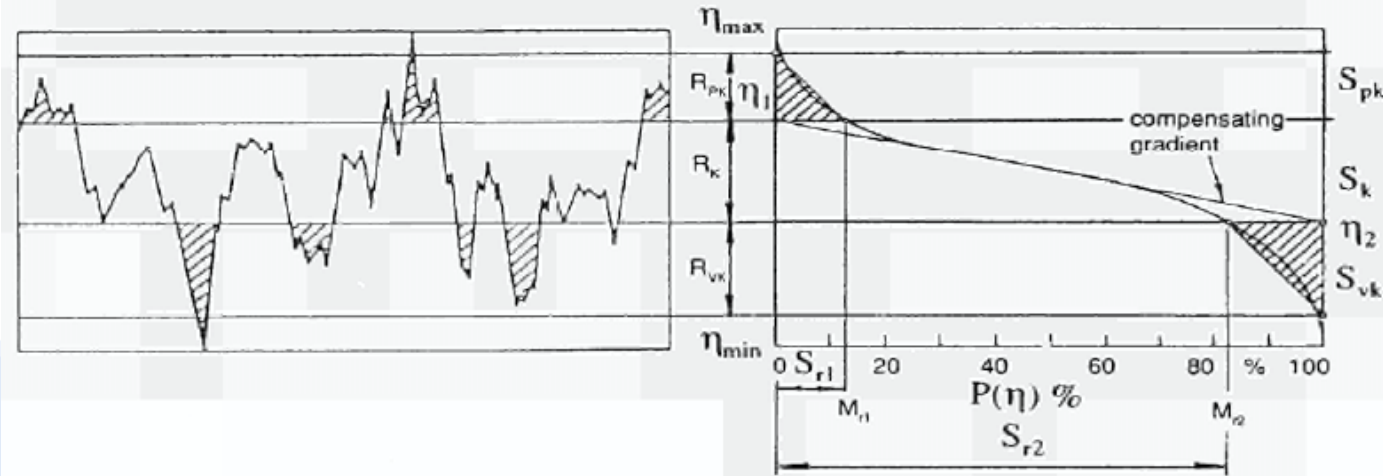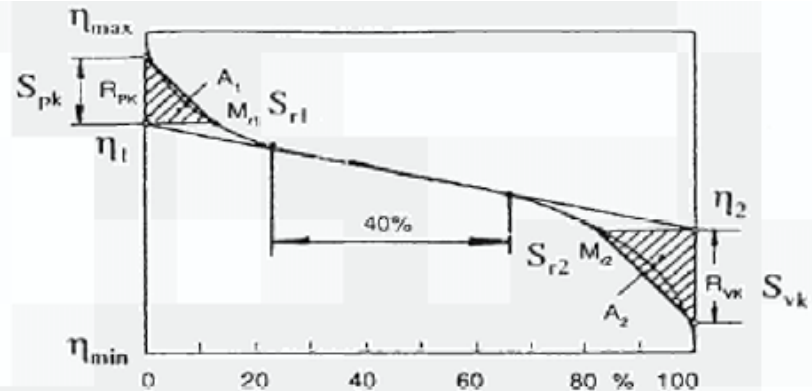

Reduced Peak Height (R_{pk})

Core Roughness Depth (R_k)

Reduced Valley Depth (R_{vk})

Other descriptors

- **Abbott curve and profile parts**

  - **Polishing assessment**

(Stout et al., 1993)

Needs for further researches

- **Short term**

  - **Assessment of new MPD standard impact**

  - **Correlations MPD/MTD with new ISO standard on various pavement surfaces**

(IFSTTAR, 2014)

- **Mid-term**

  - **New road descriptors in 2D ➔ classification of road performances not only based on MPD**

  - **Surface descriptors for operational purposes: 2D ➔ 3D**

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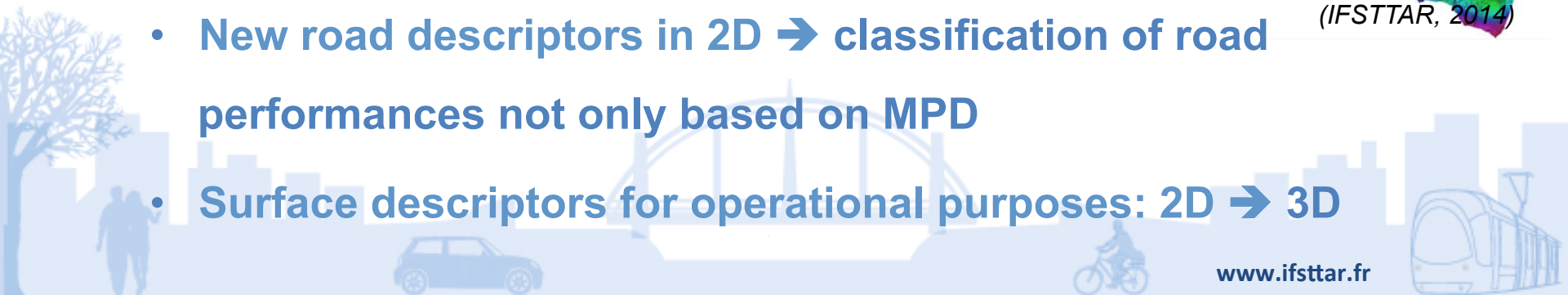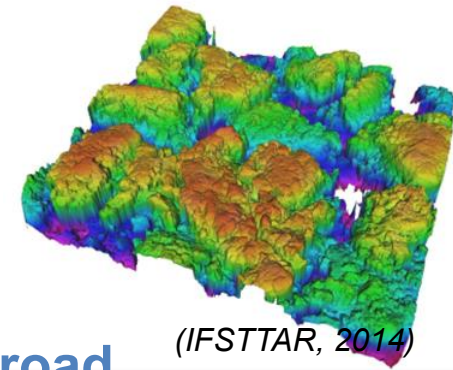
Thank you for your attention

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