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Influence of thin water film on skid resistance

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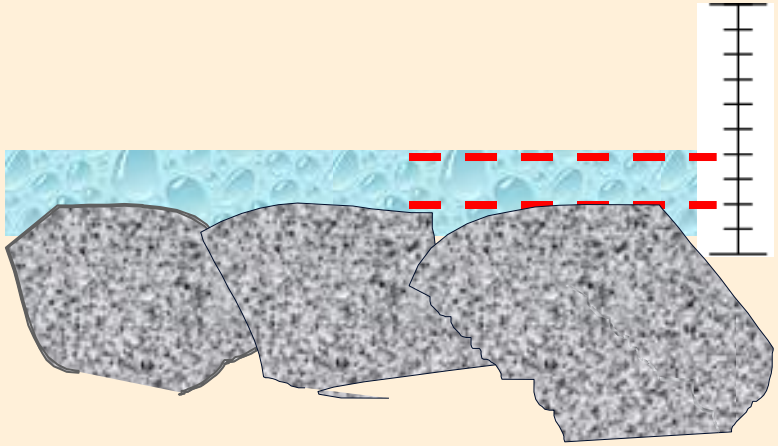
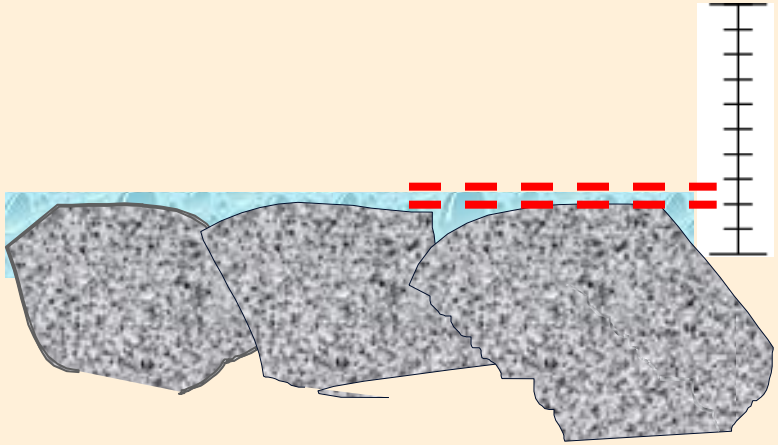
Driving on wet roads

- **Risk perception**





Driving on wet roads

- **Speed adaptation**

Situation			Risk perceived	Speed adaptation
Road surface	Flooded		Yes	V ↘
	Wet		No	V ≈ V dry
	Damp		No	V ≈ V dry
Visibility	Rain	Heavy	Yes	V ↘
		Light	No	V ≈ V dry
	After rain		No	V ≈ V dry

Source: French APTP project

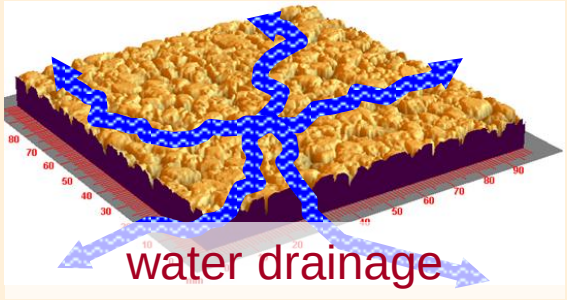
Previous researches

1950

speed

road surface (macrotexture)

tire tread (pattern, depth)

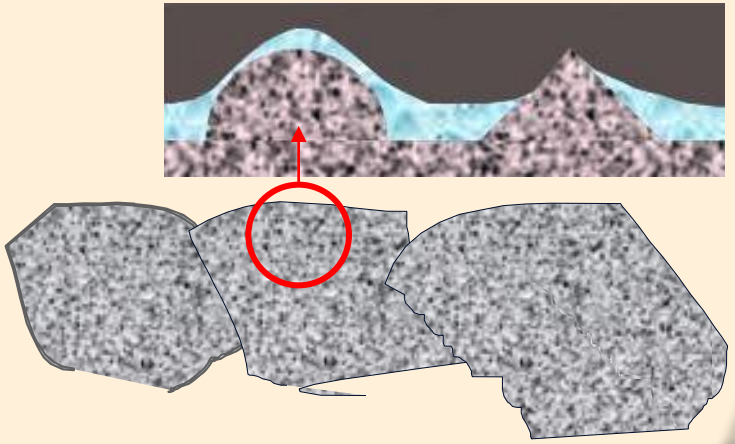


1970

1990

road surface (microtexture)

tire (rubber)



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Overview

- Friction-water depth variation
- Critcal waterdepth definition
- Effect of road surface microtexture

SKIDSAFE
Enhanced Driver Safety due to Improved Skid Resistance

(FP7)

Experiments

- **Laboratory specimens**

Real pavement surfaces

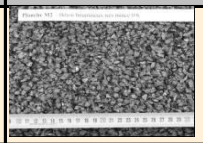
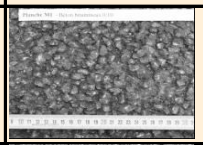
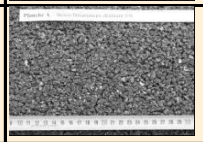
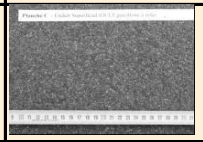
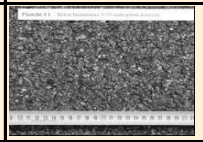
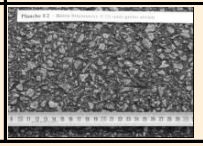
Changing microtexture by sandblasting

Experiments

- **Ifsttar test tracks**

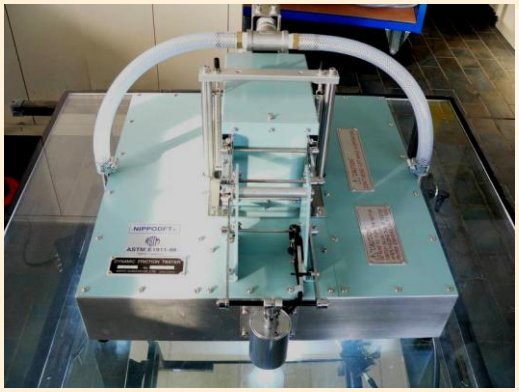
Experiments

- **Test surfaces**

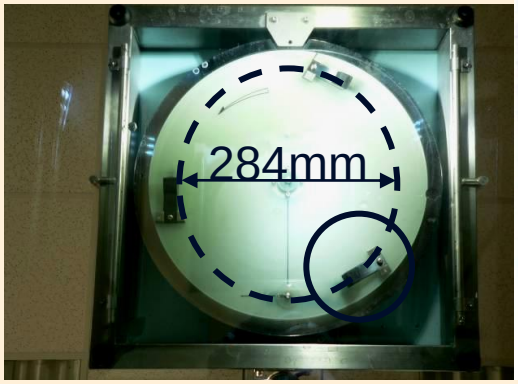
Type of pavement	Size of aggregates (min/max)	Acronym	Photography	SFC	MPD (mm)
Very Thin Asphalt Concrete	0/6	VTAC 0/6		0.56	1.00
Very Thin Asphalt Concrete	0/10	VTAC 0/10		0.71	1.30
Porous Asphalt Concrete	0/6	PAC 0/6		0.65	2.90
Surface Dressing	0.8/1.5	SD 0.8/1.5		0.90	0.45
Semi-coarse Asphalt Concrete (old)	0/10	SCAC 0/10		0.73	0.66
Semi-coarse Asphalt Concrete (new)	0/10	SCAC 0/10		0.59	0.82

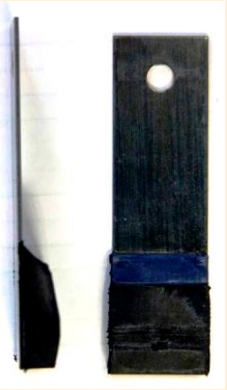
Experiments

- **Friction measuring machines**



Dynamic Friction Tester

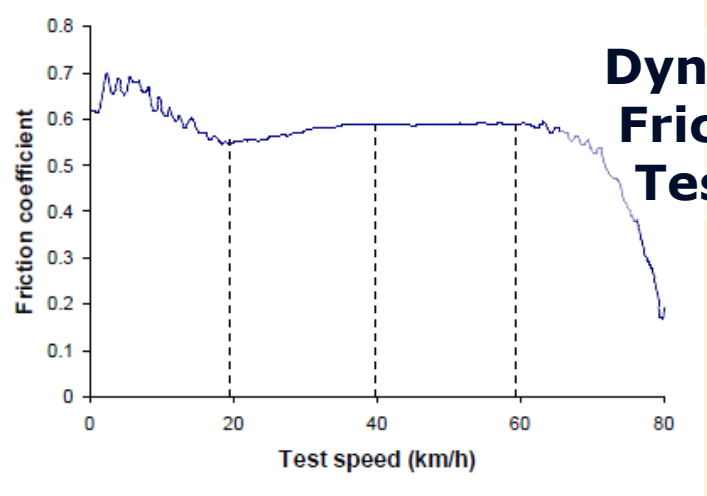




Adhera

Experiments

- **Friction coefficients**

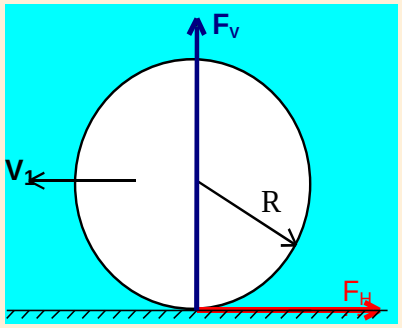


Dynamic Friction Tester

- Braking curve
- 20, 40 and 60 km/h
- ASTM E1911 (2009)

Adhera

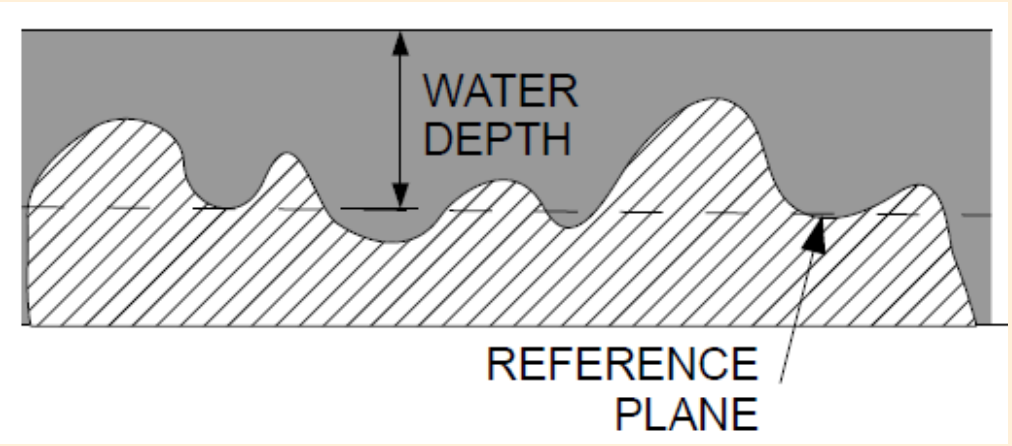
$$LFC = \frac{F_H}{F_V} = \mu$$



- Blocked wheel
- 40, 60 and 90 km/h
- EN TS 15901-4 (2009)

Experiments

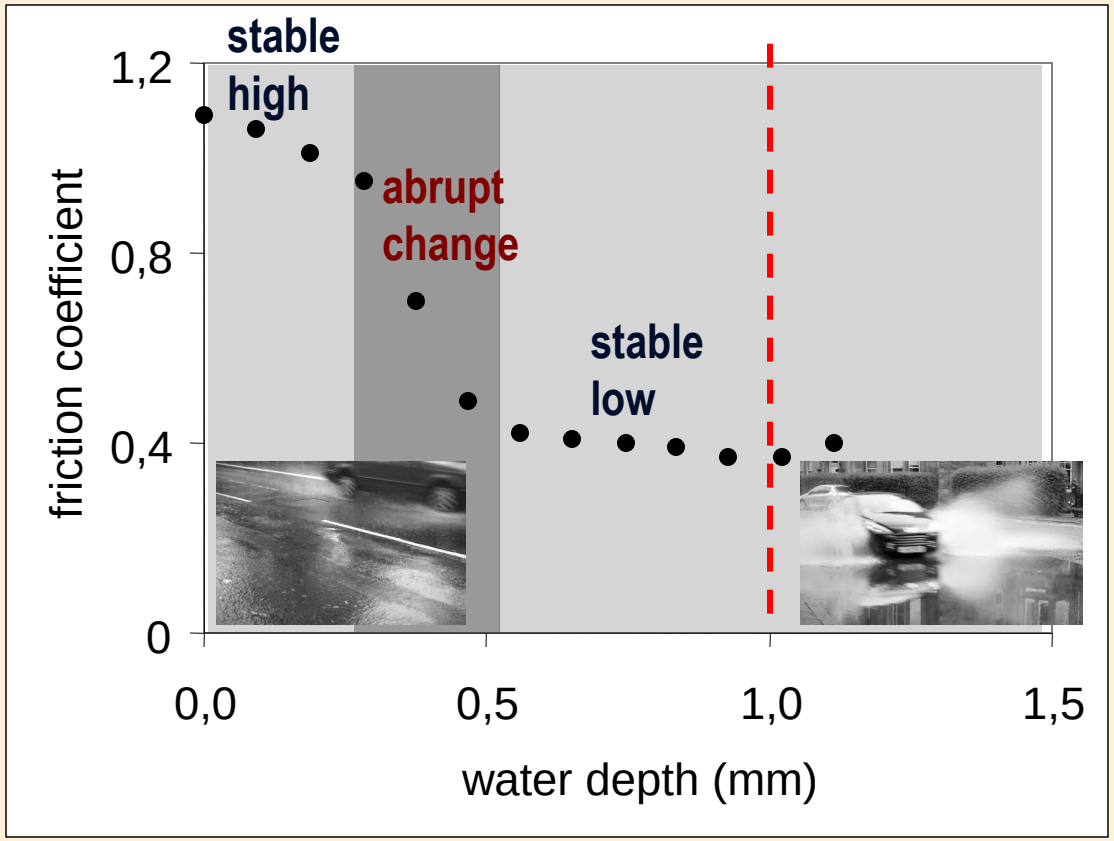
- **How obtaining reproducible very thin waterfilm?**



Surface wetting protocol in laboratory
➔ WD < 0.1 mm

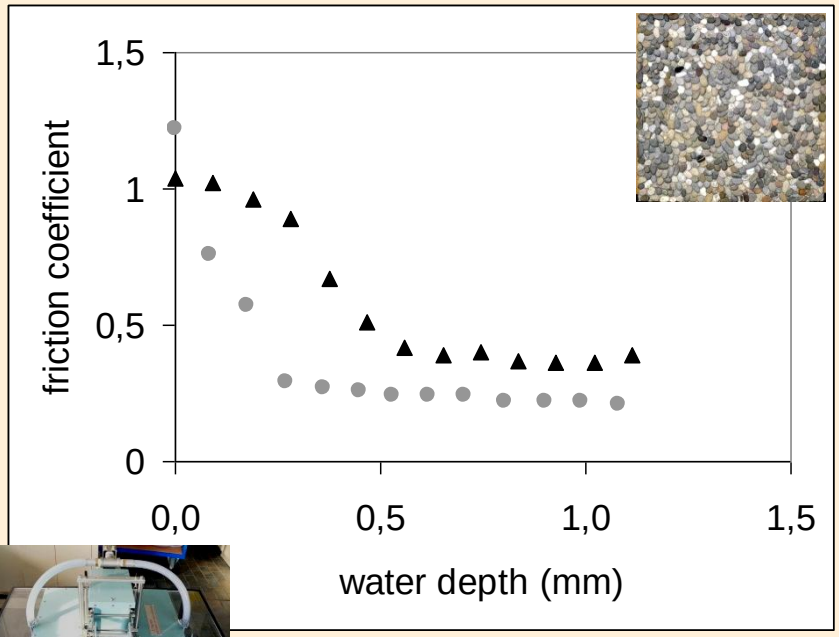
Results

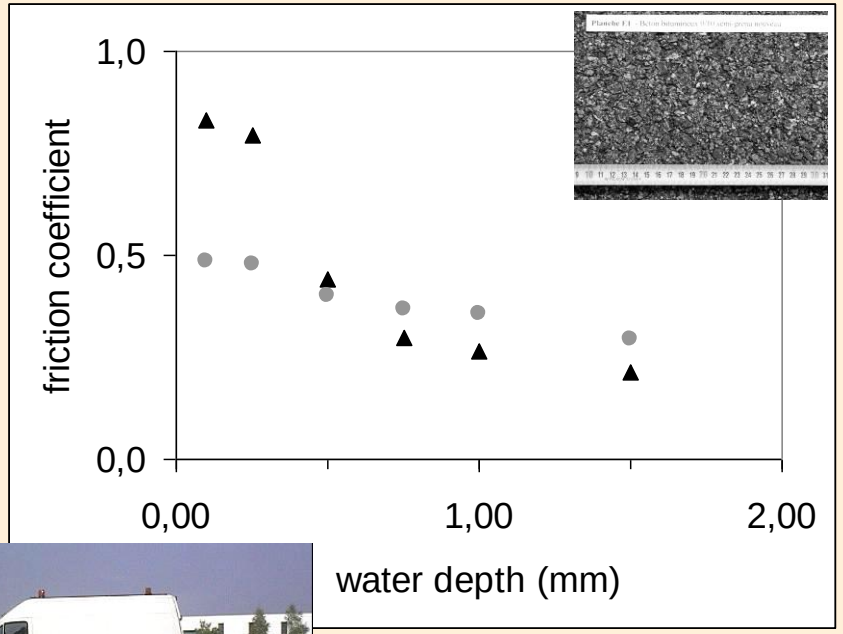
- **Friction-water depth variation (laboratory)**



Results

- **Laboratory vs in-situ**

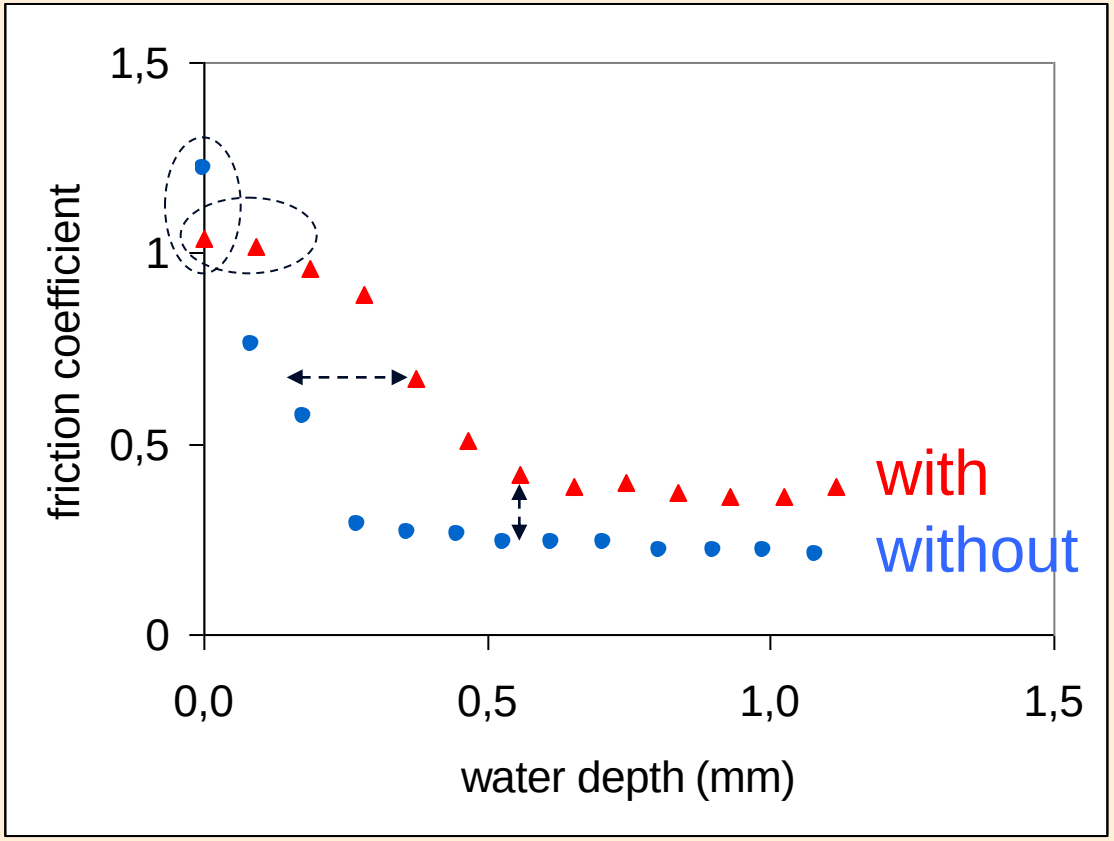




Results

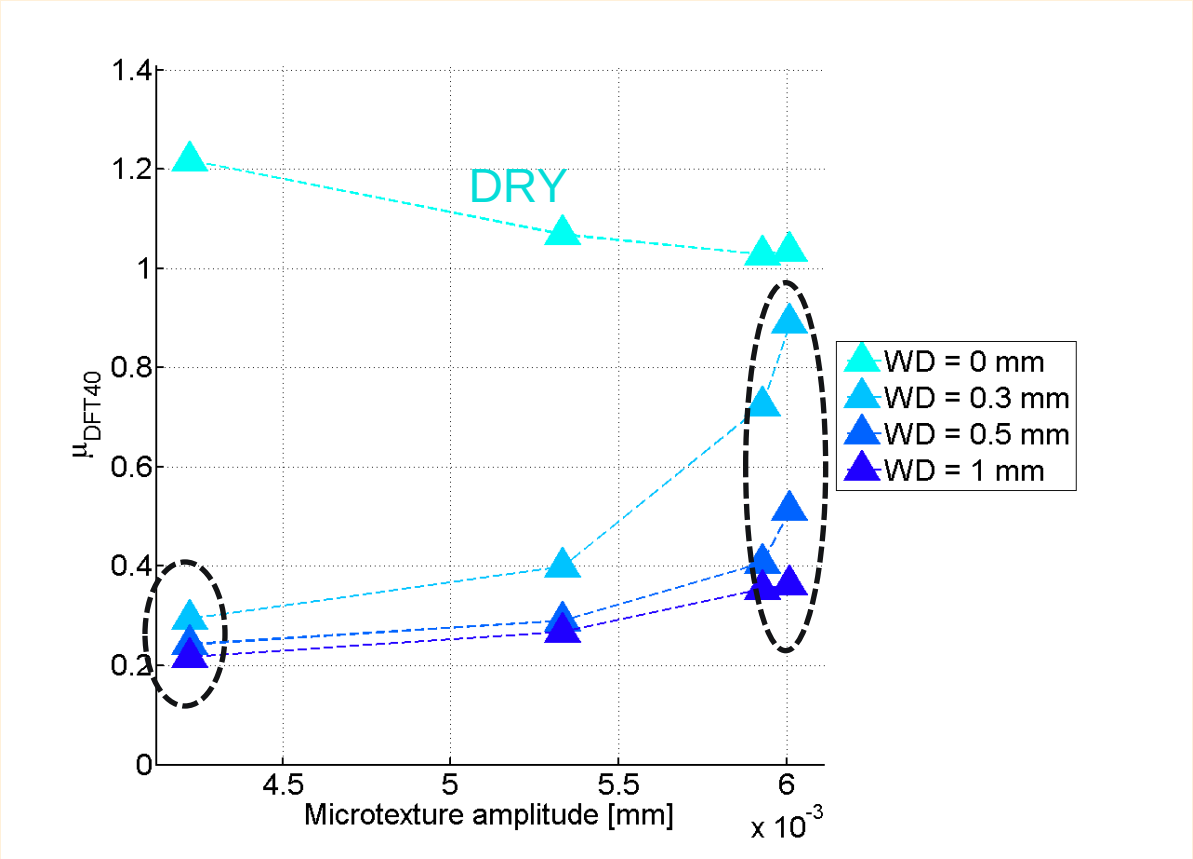
- **Microtexture effect**

Smooth aggregates vs sandbasted aggregates



Results

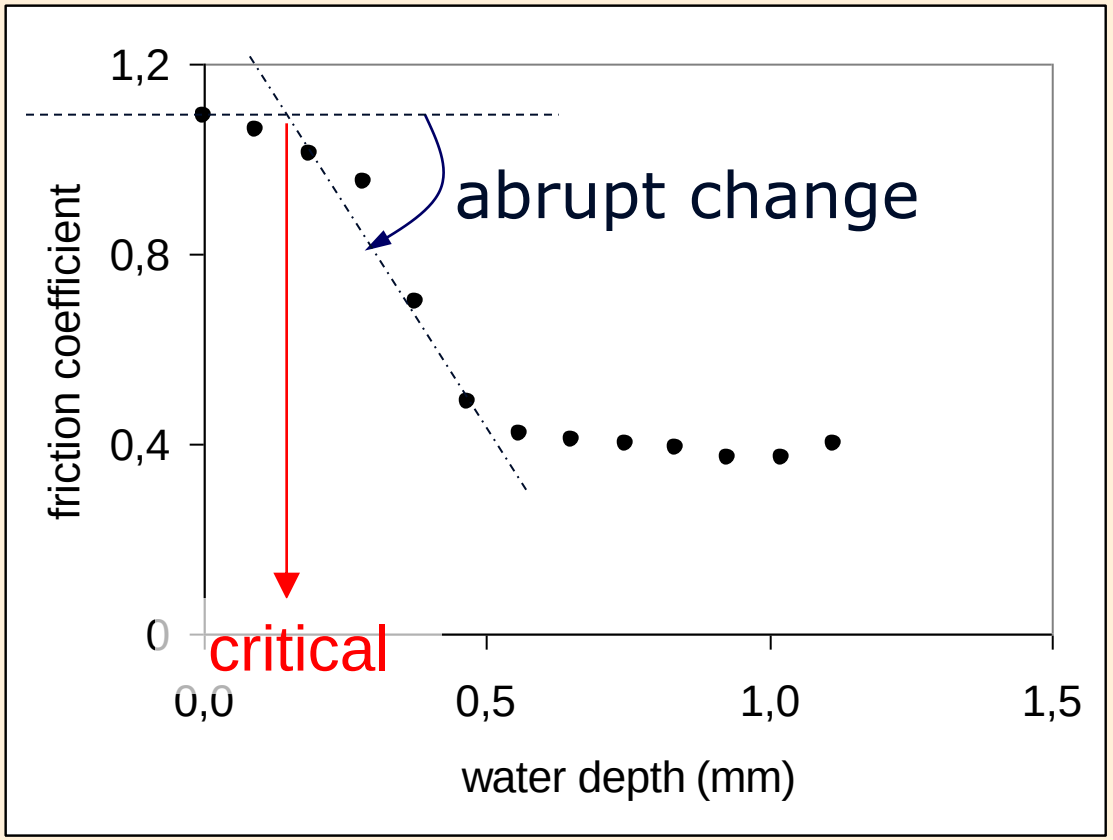
- **Microtexture effect**



Results

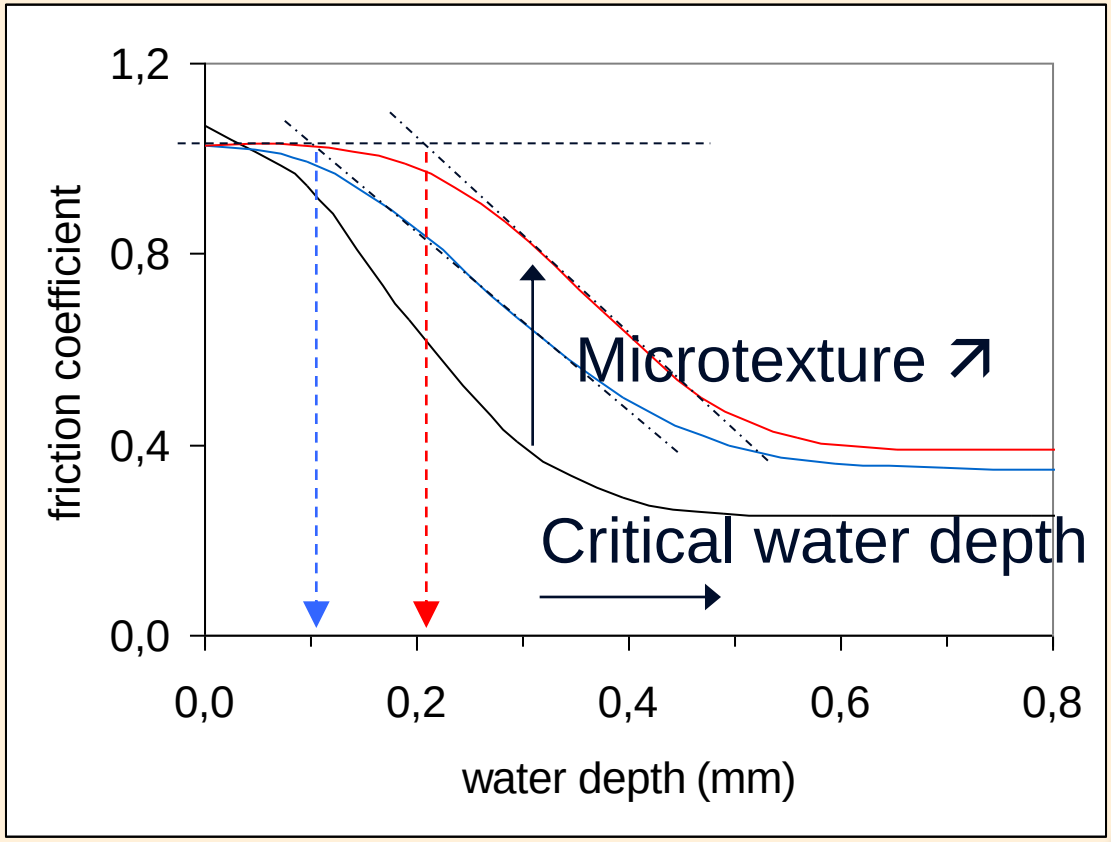
- **Critical water depth**

⇔ Limit between the boundary and mixed lubrification



Results

- **Microtexture effect on critical water depth**



Conclusions

- Effect of very thin water film on friction coefficient both in laboratory and on real test site

➔ Stribeck curve shape with boundary, mixed and hydrodynamic lubrification regimes

➔ Definition of a critical waterdepth

- Effect of microtexture on critical waterdepth

- Next step: modeling friction with texture descriptors and predicting viscoplaning phenomenon

Acknowledgments

This study was carried in the context of the project: Enhanced Driver Safety due to Improved Skid Resistance (SKIDSAFE) financed by the European Union 7th Framework Program, Theme: Safety and Security by Design.

http://www.skidsafe.org/

Thank you for attention…

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