

Report of the MLS User Group

Focus on Swiss Experience and short reference to applications by other users

by

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Mobile Load Simulator MLS10

M.N. Partl: TRB 2010 AFD40(2)

Pilot-Study for Evaluation of MLS10 ASTRA 2004/018

Report Published

Pilotstudie zur Evaluation einer mobilen Grossversuchsanlage für beschleunigte Verkehrslastsimulation auf Strassenbelägen

Étude de pilote pour l'évaluation d'une machine mobile à vrai grandeur qui permet de simuler le trafic sur les routes dans une matière accélérée

Pilot-Study for the Evaluation of a Mobile Full-Scale Accelerated Pavement Testing Equipment

EMPA, Eidgenössische Materialprüfungs- und Forschungsanstalt
 Abteilung Strassenbauabdeckungen
 Astrid Anzaldúa, dipl. Ing.
 Martin Anzaldúa, dipl. Geophysiker, MBA
 Alois Kalogeropoulos, dipl. Geophysiker, MBA
 Johannes Högenschmid, dipl. Ing. ETH
 Manfred N. Partl, Prof. Dr. dipl. Ing. ETH

ETH, Eidgenössische Technische Hochschule
 Markus Cramer, Dr. dipl. Ing. ETH
 Carlo Balzani, Dr. dipl. Ing.

ETHZ/IGT Prof. A. Putz-Andri

ETHZ/IGT-DELTA (Displacement Basin under Load)

0 Passing

10 Passg.

Cracks

Real Life: Failure after 40yrs = ca. 0.74 mio Equival. Axle Loads13t

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MLS10 – Calibr. Tests „Fildern“ (ASTRA 2007/011)

How much MLS10 loading is required to detect significant changes in new CH pavements?

Cold Recycling

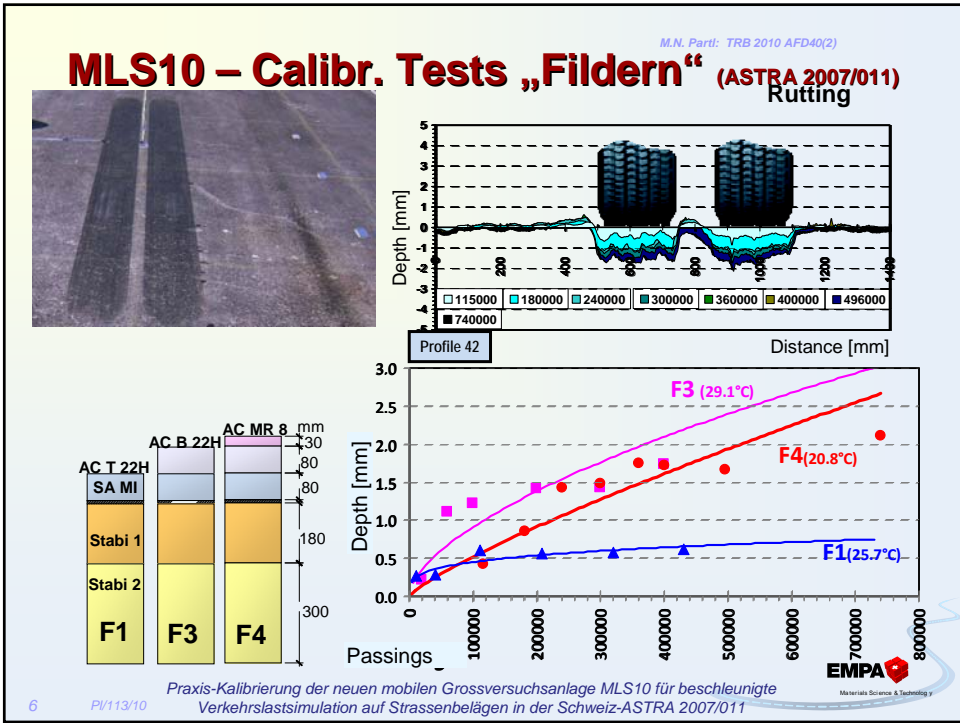
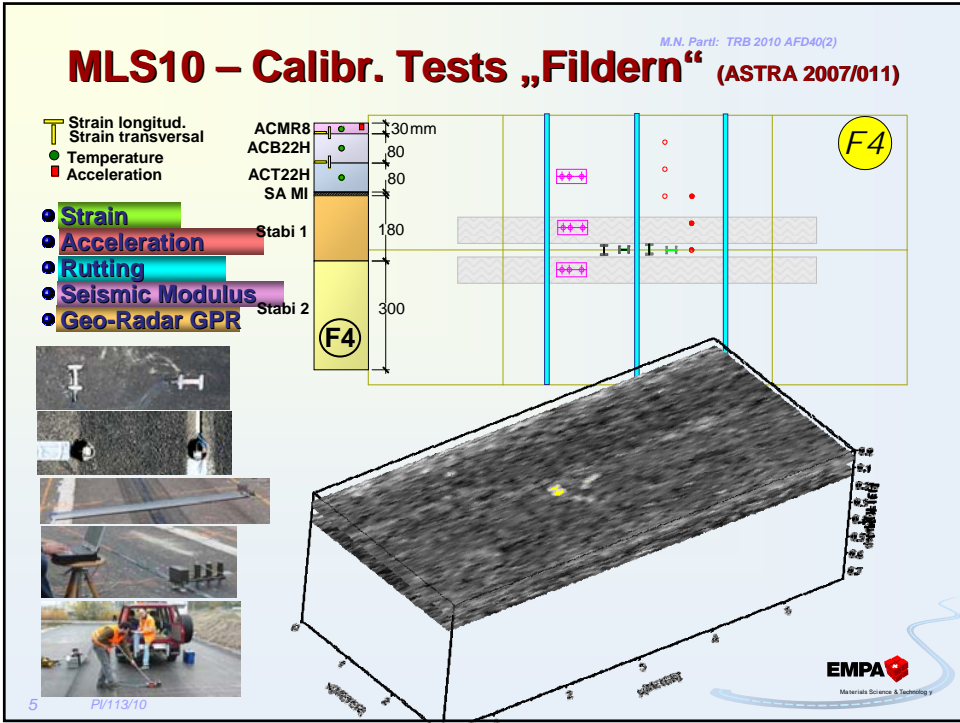
Materials	Thick. [cm]
SMA 8	3
AC B 22 H	8
AC T 22 H	8
SAMI 8/11	1
upper KMF(H)	18
lower KMF(H)	>22
Subgrade ME _i	>30MN/m ²

1'606'000 Passings 65kN

439k 427k 740k Übrig

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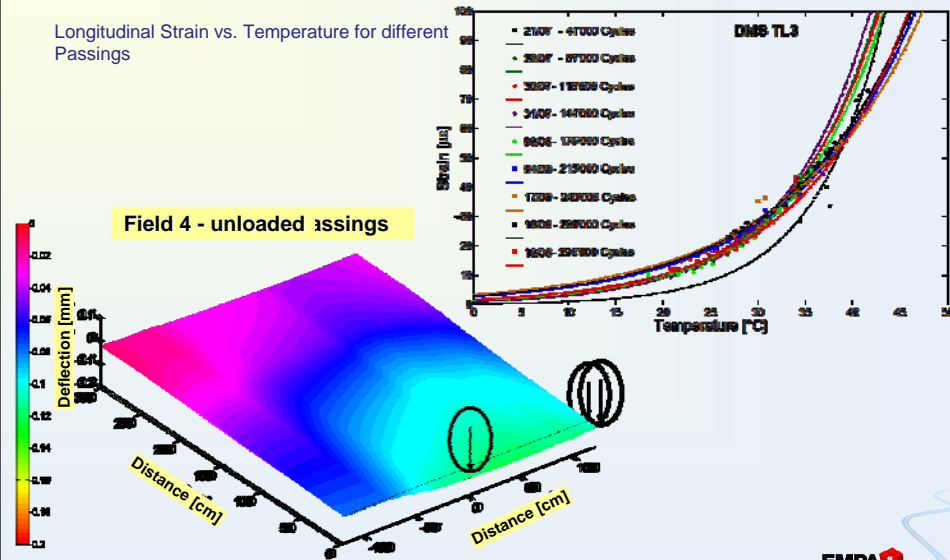
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MLS10 – Calibr. Tests „Fildern“ (ASTRA 2007/011)

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Longitudinal Strain vs. Temperature for different Passings



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Praxis-Kalibrierung der neuen mobilen Grossversuchsanlage MLS10 für beschleunigte Verkehrslastsimulation auf Strassenbelägen in der Schweiz-ASTRA 2007/011

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Conclusions

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- After total 1.6 mio passings from June - November, the motorway pavement turned out to be very **stiff and of high bearing capacity** (evaluation ongoing)
- Compared to the **old untrafficked equivalent** Hinwil pavement that failed after ca 500'000 passings this pavement was superior. It was **new and designed & built** according to modern standards

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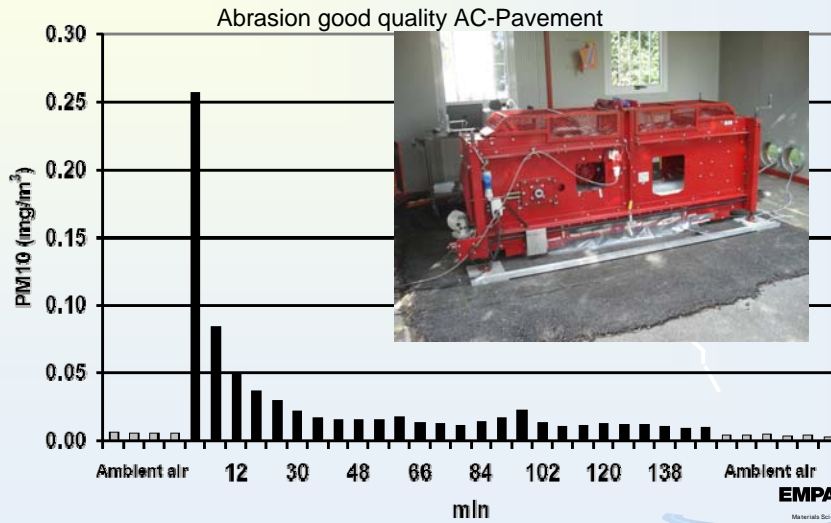
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MMLS3 for abrasion and resuspension of fine particles in pavements (ASTRA 2005/007)

Gehrig, R., Zeyer, K., Bukowiecki, N., Lienemann, P., Poulidakos, L.

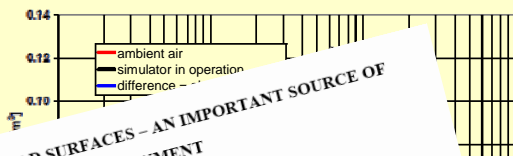


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MLS10 for abrasion and resuspension of fine particles in pavements (ASTRA 2005/007)

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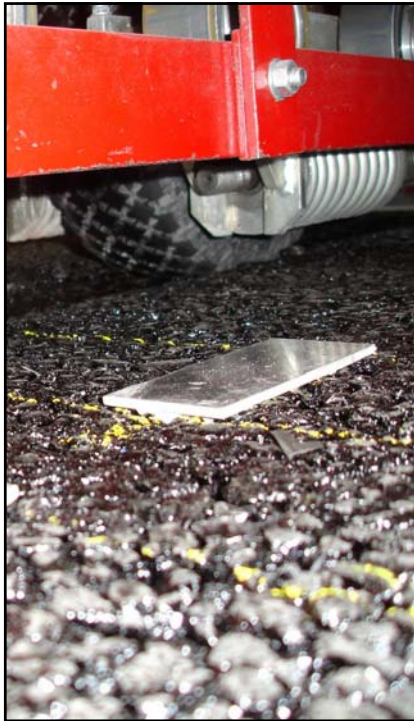


ABRASION AND RESUSPENSION FROM ROAD SURFACES – AN IMPORTANT SOURCE OF FINE PARTICLES IN THE ENVIRONMENT
 R. Gehrig, K. Zeyer, N. Bukowiecki, P. Lienemann, L. Poulidakos
 Empa, Swiss Federal Laboratories for Materials Testing and Research, Dübendorf, Switzerland

ABSTRACT
 Specific quantification of PM₁₀ emissions due to abrasion and resuspension from road pavement is not easily obtained from field studies because a large part of the total PM₁₀ concentration is due to other local PM sources. It is extremely difficult to quantitatively attribute the measured PM₁₀ to the individual sources. In this study emission rates were derived from measurement with two road simulators of different size on two types of road pavement (asphalt concrete, porous asphalt). The experimental set-up allows for a separate characterization of the contribution of fresh in-situ abrasion and resuspension of previously deposited dust. The results show an important contribution of resuspension to the fine particle emissions of road traffic. Direct abrasion from the road surface is of minor importance for intact pavements. Resuspension of pavement surfaces can cause significant fine particle emissions.

Paper Published

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Model Mobile Load Simulator MMLS3



Stripping of Noise Reducing Surfacing under Tire Rolling in Lab Scale

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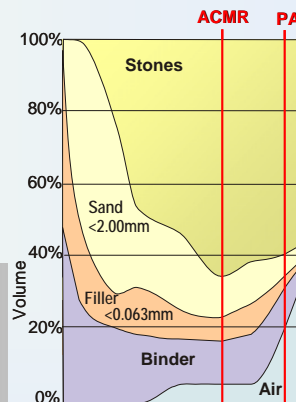
Elements

- Cores from real roads
- MMLS testing @ 40°C (up to 100'000 pass.) under water & without water (comparison)

Porous Pav. (PA)	Rough Asphalt (AC-MR)
Tessin PA 11	Aargau AC-MR 8 (Binder w. rubber)
Uri PA 11	Bern AC-MR 8 (PmB)
Wallis PA 11	Zürich AC-MR-8 (PmB)
Aargau PA11 (NAF)	
Aargau PA11	



FA VSS 2007/502

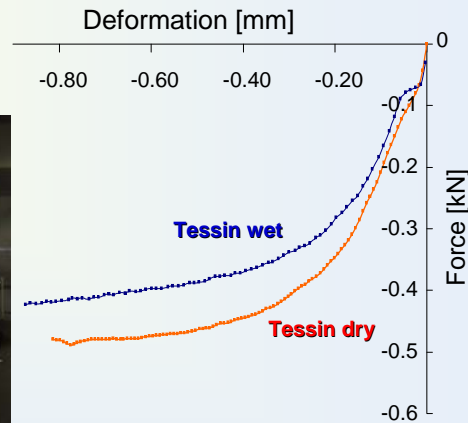


Testing of Mechanical 4 Point Bending Resistance

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Preliminary results



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MLS/MLS10 Bibliography

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- Gehrig, R., Zeyer, K., Bukowiecki, N., Lienemann, P., Poulidakos, L., **Abrasion and resuspension from road surfaces – an important source of fine particles in the environment,** International Air Quality Conference, März 2009, Istanbul, 4p on CD (2009)
- Kim, H., Sokolov, K., Poulidakos, L.D., Partl, M.N.: **Fatigue Evaluation of Carbon FRP-Reinforced Porous Asphalt Composite System Using a Model Mobile Load Simulator.** Transportation Research Record, Vol.2116, pp.108-117 (2009).

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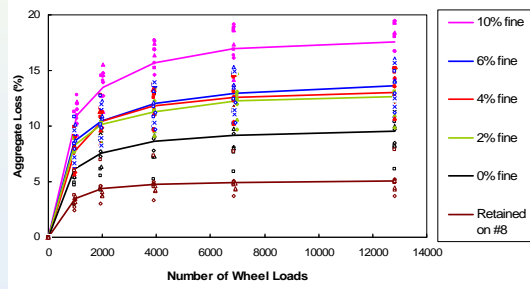
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Chip Seal Specimen Investigation NCSU

Richard Kim et al



- Towards **performance** based test and analysis methods to chip seal specs, design, and construction
- Improve the performance
- Extend the application of chip seals to higher traffic volume roads
- Balance between Bleeding and Raveling



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Before Loading



990 passes at 77°F



2,970 passes at 77°F



5,940 passes at 77°F



11,600 passes at 77°F



23,760 passes at 122°F

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MLS66



Heating System



Moisture damage on bituminous stabilized materials using the MIST device

M. E. Twagira & K. J. Jenkins Univ of Stellenbosch

- **MMLS3** used for validation of moisture induction simulation test (*MIST*) to assess **moisture-induced damage** –ravelling. MIST is based upon cyclic pulsing of water, at pressure, into a triaxial specimen.
- Aggregate blends with/without RAP, different bitumen **binder types** and additional active **fillers** were investigated.
- Found that **MIST** device has potential for use as a tool to condition bit stab specimens.

MMLS3 Research in SA

Evaluate **skid resistance, macro texture & colour retention** of coloured high friction course surfacings (HFCS)

PD Naidoo and Prof Kim Jenkins

- Testing of similar surfacings at 2 **bus terminals** under real actual bus wheels (field testing)
- MMLS trafficking performance using two test conditions.
 - **dry-wet** cycle for 100 000 load Reps.
 - dry trafficking at 53°C for 500 000 load Reps.
- **MMLS helped in all three evaluations**

South African Commercial Applications of MMLS3

Total Tests	118	
	Pavement Type	Test Protocols
	Airports	Wet/dry
	Heavy duty highways	Lab cores/briquettes
		Field constructed pavements
		Slow /Fast trafficking 2400 - 7200 axles/h
		Temperature 45 - 60C