DEKRA

Alles im grünen Bereich.

New progress in load-securing measures

Ladungssicherung auf Straßenfahrzeugen
Securing of Cargo on Road Vehicles
23. und 24. Oktober 2013
EuroSpeedway Lausitz

Fraunhofer IML

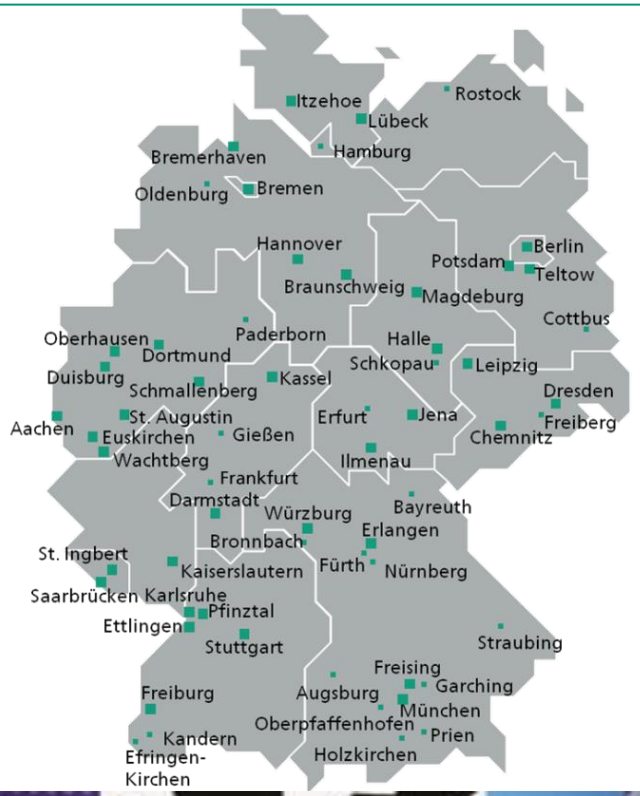
Gerrit Hasselmann

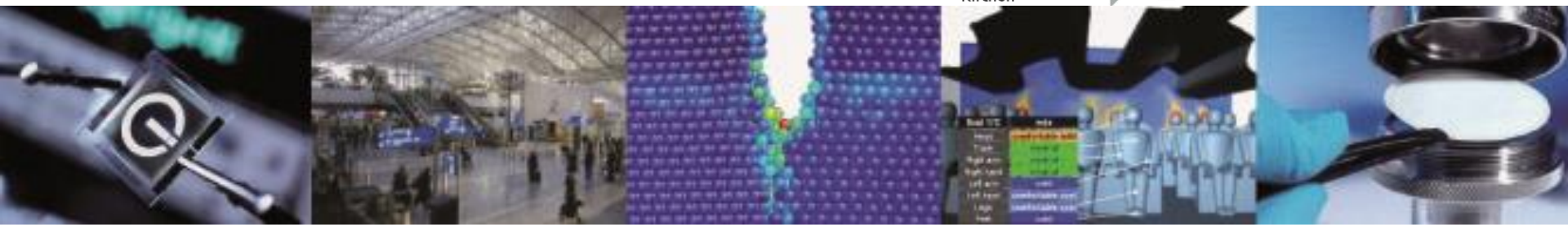
Fraunhofer Institut IML

Packaging Laboratory / Cargo Securing

Die Fraunhofer Society - Institutes in Germany

- 66 Institutes
- More than 22.000 Employes
- http://www.fraunhofer.de/de/institute-einrichtungen.html





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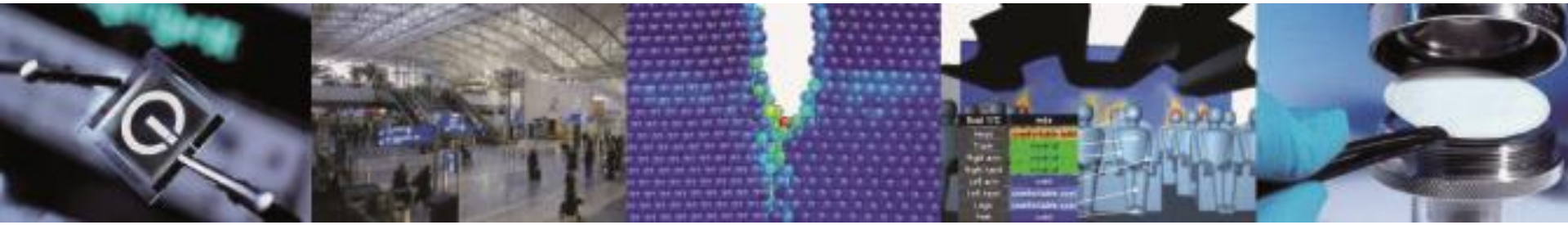
Die Fraunhofer- Society - Traffic and Mobility

Fraunhofer Crashtest Device

Are low weight material cars save? What happens in an accident with a accumulator driven car? This and many more questions are subjects of the researcher at the latest Crash-test plant in Efringen-Kirchen, Baden-Württemberg, Germany.



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Das Fraunhofer Institute IML – Facts and Figures

- Founded1981 by Prof. Dr.-Ing. Reinhard Jünemann
- Relevant 220 Scientiest
- About 250 student co-worker
- 23 Mio. € turnover (2012)
- Branch & Project Center:
  Cottbus, Frankfurt am Main, Hamburg, Prien / Chiemsee
- Cooperation :
  HSG St. Gallen (Schweiz), Georgia Tech (USA),
  Lissabon (Portugal), Shanghai (China), Rio de Janeiro (Brasilien)

Technique for Securing of Cargo

Performance

- Measurement of friction coefficient
  - With real load
  - On real truck floor
- Certificate for anti-slide material (VDI 2700, Bl. 14)
- Measurement technology for dynamic driving test, Basis DIN EN 12642
- Certification of Cargo Securing System
- Developement & Research

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Dyn. Driving Test acc. DIN EN 12642

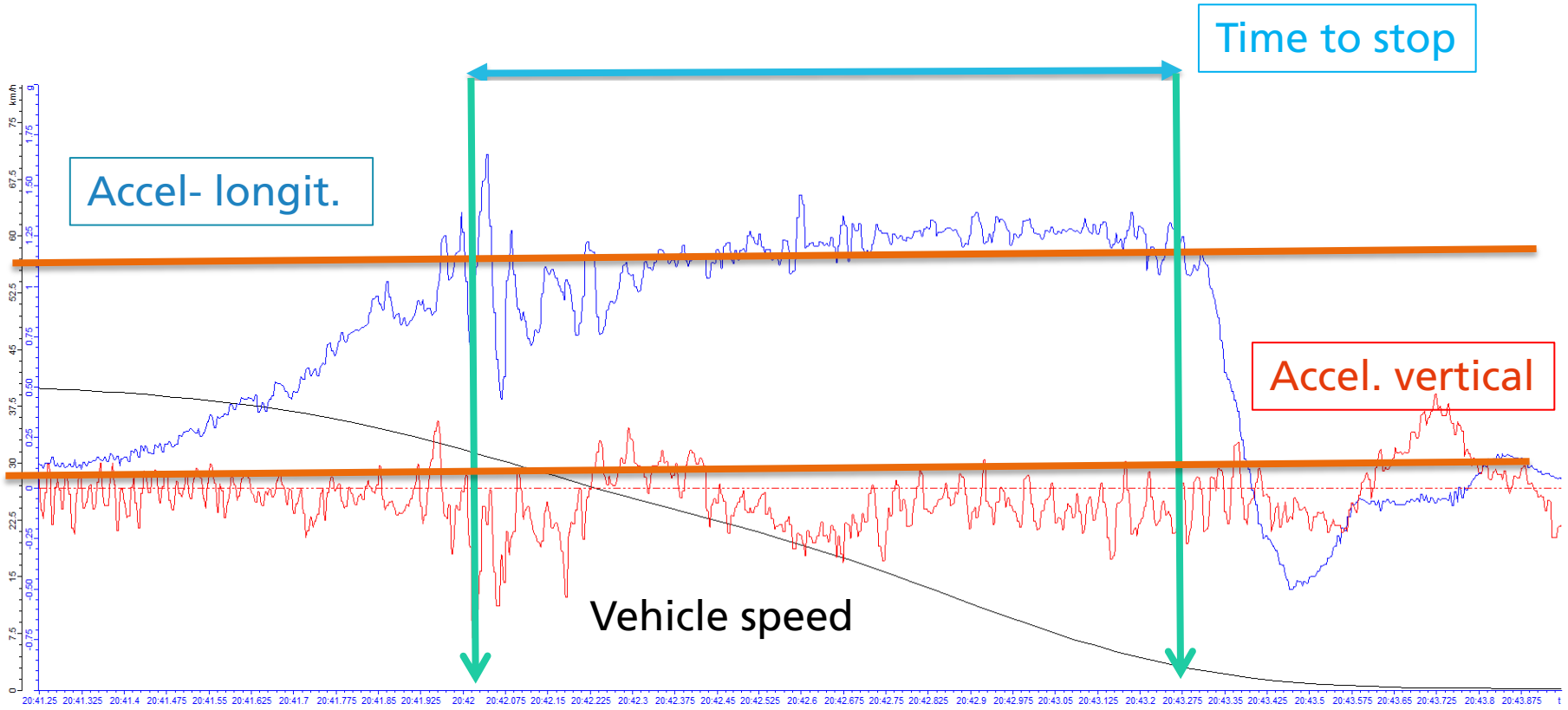
- Check of
  Cargo Securing Conception

- Vehicle strain acc. to VDI 2700
  - a = 0,8 g in driving direction
  - a = 0,5 g crossways
  - a = 0,5 g against

- Report / Certificate

Strain within Transport

Acceleration within emergency stop
X-acc. (blue) vs. Z- acc. (red) and truck speed (black)



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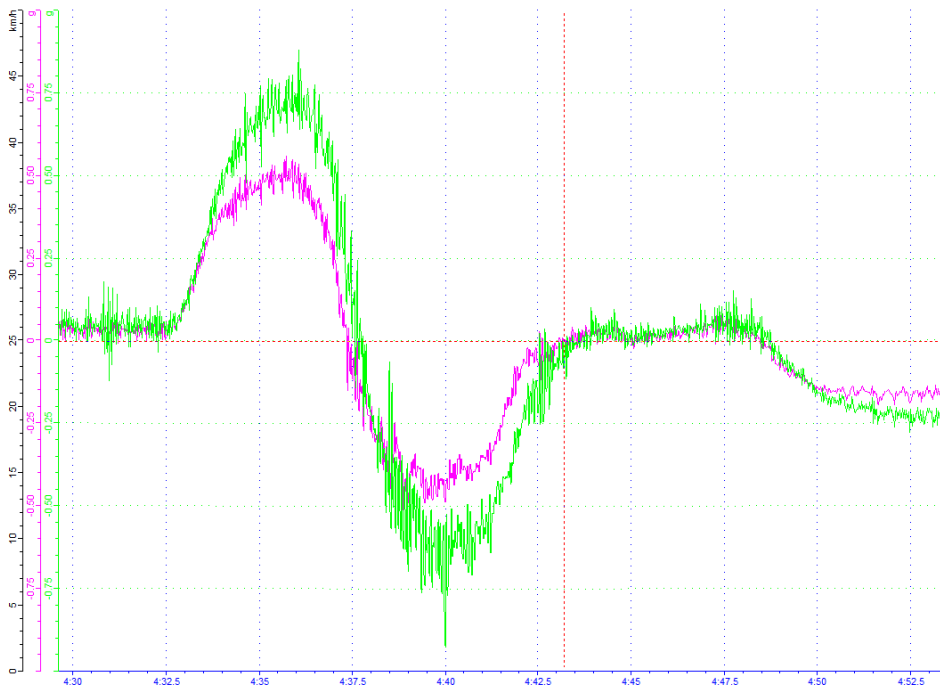
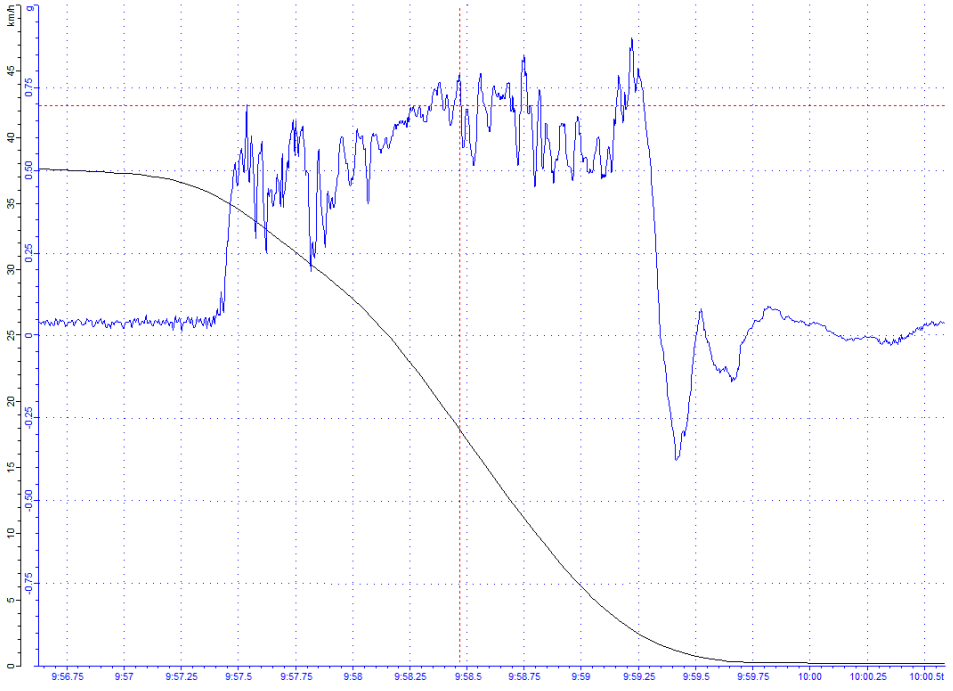
Measurement of acceleration

Bend road test:
Y – Acceleration crooswise

Emergency stop test:
X – Acceleration longitudinal





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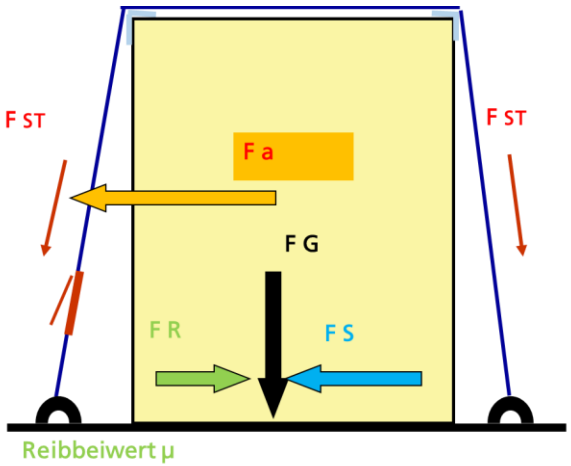
Securing of Cargo by Friction

- A tied down cargo is pressed against its underground.
- Result is an increase of the friction F_R between cargo and underground
- Effect:
- The lashings do not secure the cargo directly.



- A seperate calculation has to be done to prevent a cargo from tilting.
- Within this calculation the friction coefficient is not of interest.

Securing of Cargo by Friction

Importance of Friction for Securing of Cargo

- Determine Friction coefficient μ for each specific pairing cargo / load surface by measurement. Friction coefficient of a single load is governed by the load underground. **Example:** Wooden pallet on wooden truck floor or steel floor. Steelbox on wooden or steel plated floor, Paper reel on wooden floor or on paper reel.

- Measurement with real cargo in a real environment will deliver trustworthy results. A reliable friction coefficient allows load securing calculation.

European Research Project „COSATT“

- Sponsor: Federal Ministry of Economics and Technology (BMWi)
- Cooperation:
  - Ka Ho St. Lieven, Gent, Prof. Marc Juwet
  - Transport-Technik Günther, Augsburg
  - Spedition Nuber, Augsburg
  - Spedition Bode, Reinfeld (Holstein)
- <u>Research aim:</u>
  - Increase Cargo Security
  - **Innovative Trailer Construction (Truck Floor, Lashing point)**
  - Optimize Load and Unloading process
  - Relevant answer to Vibration within Transport

Results from the Research project COSATT
Anti-Slip-Materialies for Truck Floor (Test #1)

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Results from the Research project COSATT
Anti-Slip-Materialies for Truck Floor (Test #1)

Floor element in trailer	Neutral product code	Initial coefficient of friction (measured with VCAT equipment)	Used floor friction (measured with Fraunhofer)
2a/2b	EVC Type 1 Polyester base	0,96	0,77 en 0,80
3a/3b	EVC Type2 Polyrice	0,53	0,61 en 0,58
4	EVC Type 3 PU base, fine grain	0,79	Panel too small
5	EVC Type 4 Phenol base, rough	0,79	0,71
6	KCN1	0,68	Panel too small
7	elastocoat 6335/101	0,75	0,77 en 0,73
8a/8b	BST fine	0,85	Panel too small
9	BST medium	0,84	0,71
10	Sk transfloor	0,75	0,76
11	VDH starline	0,44	0,35
12	VDH ecoline	0,43	0,49
13a/13b	LG ecotrans	0,43	0,65
14	Bux rubber grooved	0,64	0,91
15	Bux rubber bumped	0,80	0,82
16	PRTX UVR R11	0,56	Panel damaged
17	LG Tra-Woyla	0,33	Panel near end of trailer
18	UPM Wisatrans	0,34	Panel near end of trailer
19	LG ecotrans rood	0,43	Panel too small
20	VDH ecotrans rubber strokes	0,72	Panel damaged

Results from the Research project COSATT
Anti-Slip-Materialies for Truck Floor (Test #1)

Best results and emphasized for further tests:

2 a/ 2 b – EVC Type 1 Polyester base – European Van Company
5 – EVC Type 4 Phenol base rough – European Van Company
7 – elastocoat 6335/101 – Elastgran BV
10 – Sika transfloor – Sika NV
15 – Bux rubber bumped - BUX

Results from the Research project COSATT
Anti-Slip-Materialies for Truck Floor (Test #2)

Material surface at the end of the test

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Results from the Research project COSATT
Anti-Slip-Materialies for Truck Floor (Test #2)

Material surface at the end of the test

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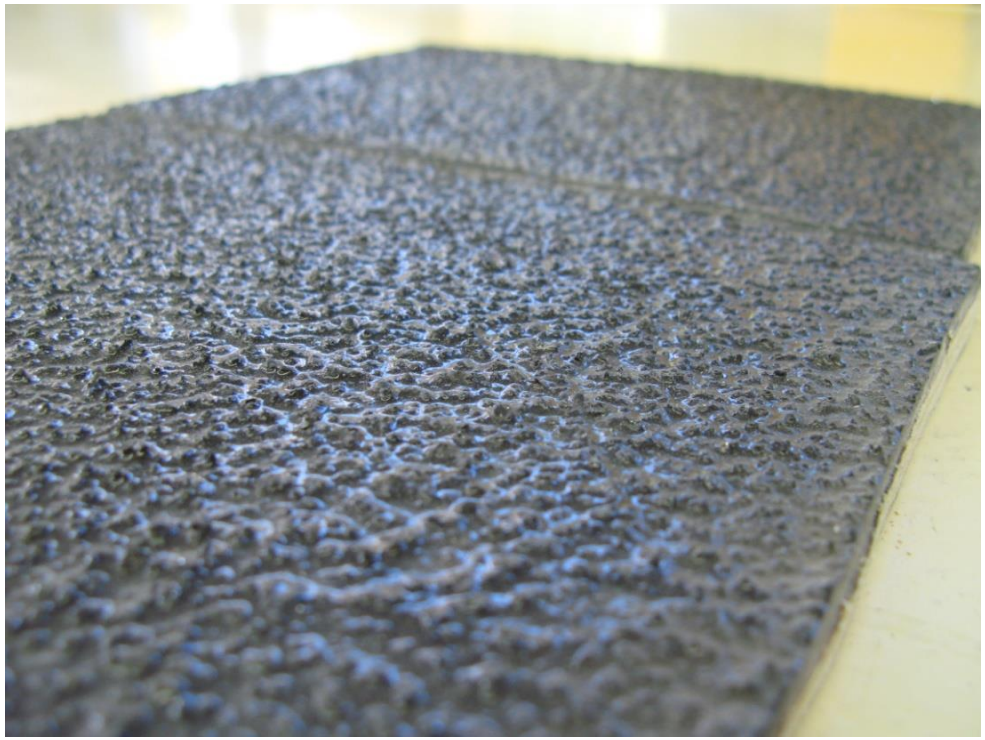
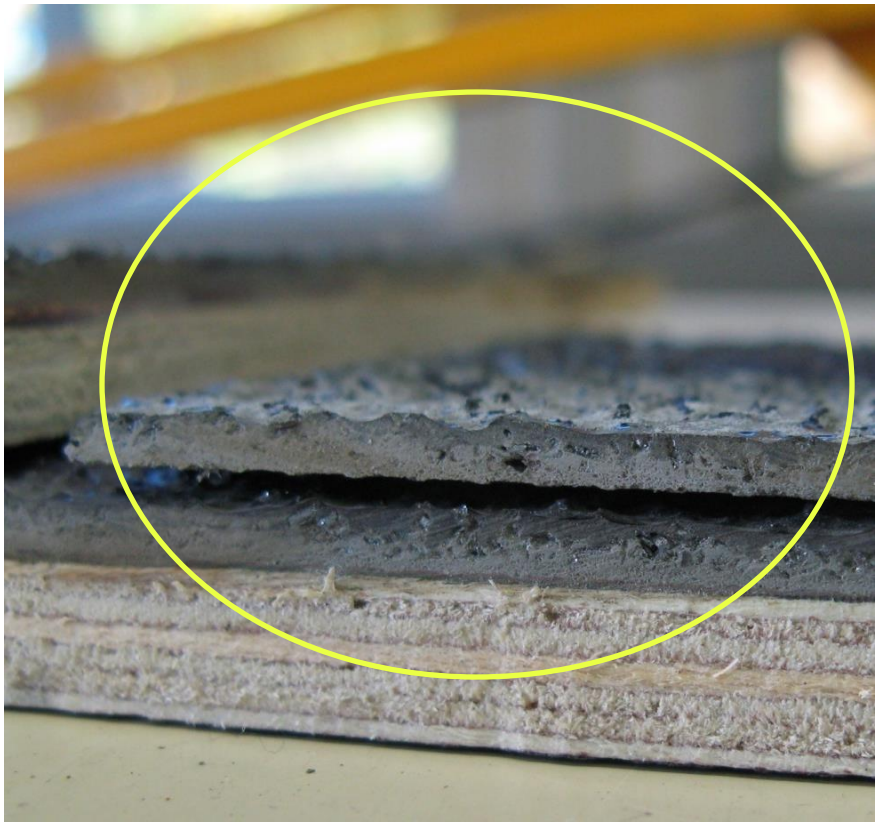
Results from the Research project COSATT
Anti-Slip-Materialies for Truck Floor (Test #2)

Best results and emphasized for further tests:

1 – Rubber – one side vulcanized– Marotech GmbH
2 – Silikat Coating– Antirutschboden Keller® /Transport Technik Günther
(3) – Silikat Coating 335/13 – KCN Rolf Blaess
9 – Coated Foam (transpofoam) - Astorplast

Coated truck floor with anti-slip feature : Antirutschboden®





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Innovative Trailer Construction

Coefficient of Friction measurement: Antirutschboden ® (2007 / 2008)

Coated truck floor (uncovered)
after 6 month in operation

Results for Antirutschboden ® (2007 / 2008):

Coefficient of Friction for wooden pallet : μ = 0,7

Coefficient of Friction for Steel Box : μ = 0,6

Coefficient of Friction for cobble stone: μ = 0,6

Coefficient of Friction measurement:
DSB Totaal Onderhoud, Rotterdam, (2010)

Coated Truck Floor in a closed truck

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Coefficient of Friction measurement: KCN Stuttgart (2011/ 2013)

Coated truck floor at an open vehicle after 9 month in operation (Stone, concrete industry)

European Research Project „COSATT“

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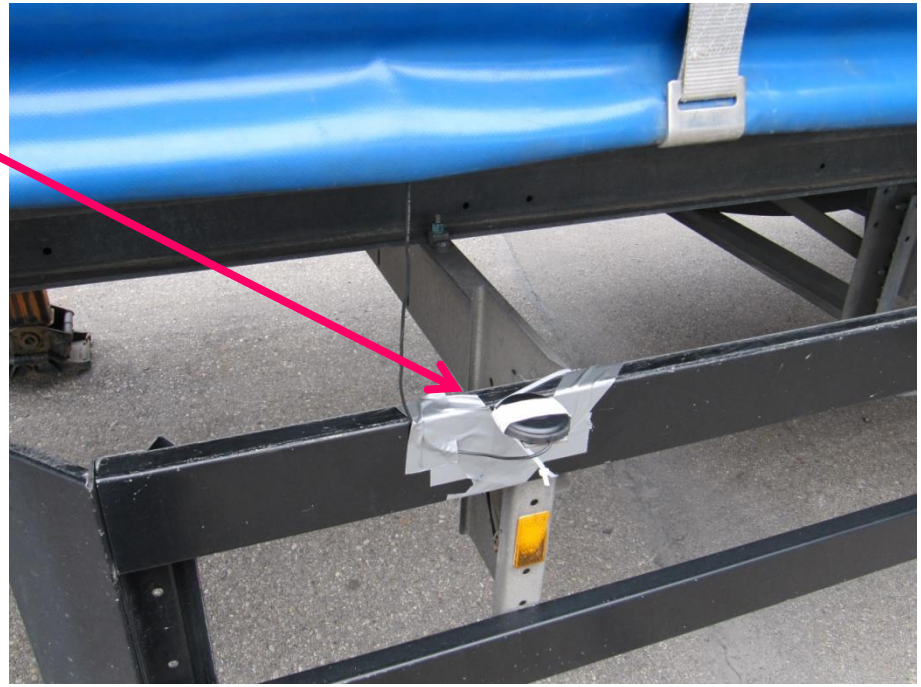
  - Transport-Technik Günther, Augsburg
  - Spedition Nuber, Ausgburg
  - Spedition Bode, Reinfeld (Holstein)
- <u>Research aim:</u>
  - Increase Cargo Security
  - Innovative Trailer Construction (Truck Floor, Lashing point)
  - Optimize Load and Unloading process
  - **Relevant answer to Vibration within Transport**

Vibrationen within Transport

Truck with fixed GPS Sensor



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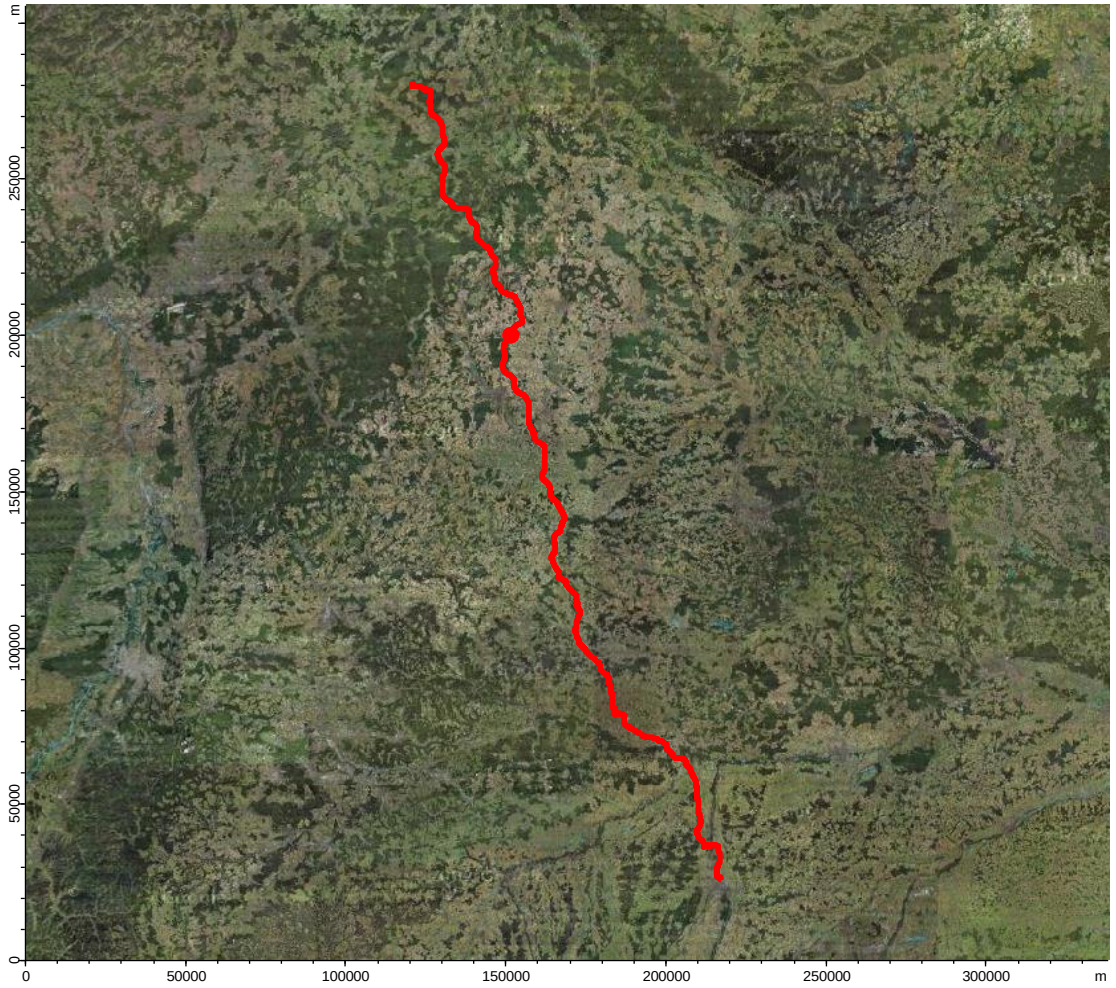
Vibrationen within Transport

Example: Route Augsburg – Schlitz (380 km) generated by the GPS signal of the truck



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Vibrationen within Transport

Several acceleration sensors were fixed at different type of cargo (paper sheet stack, steel box)

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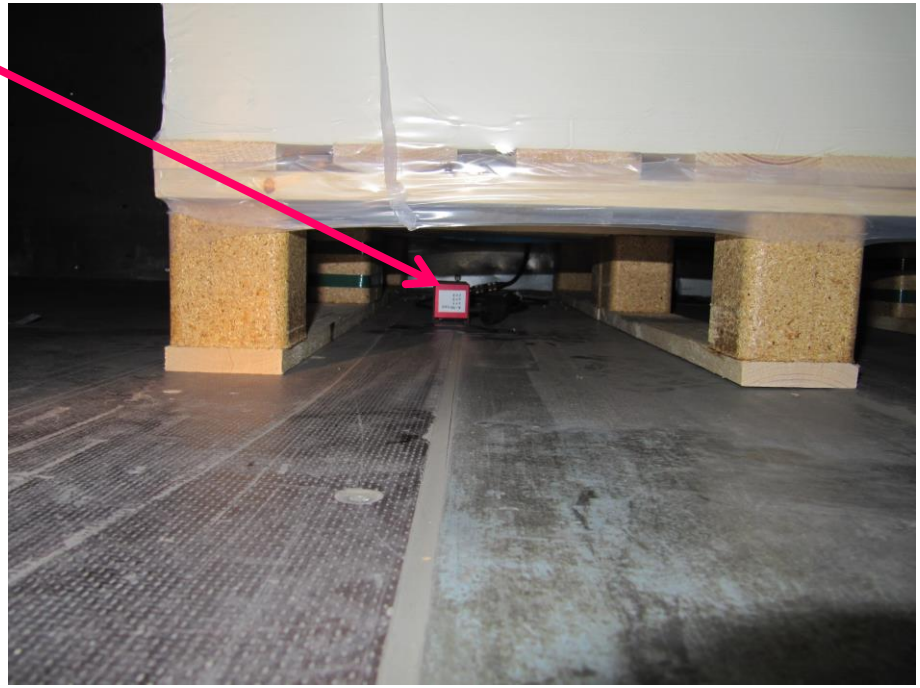
Vibrationen within Transport

Acceleration sensor fixed each on top and right below cargo on truck floor



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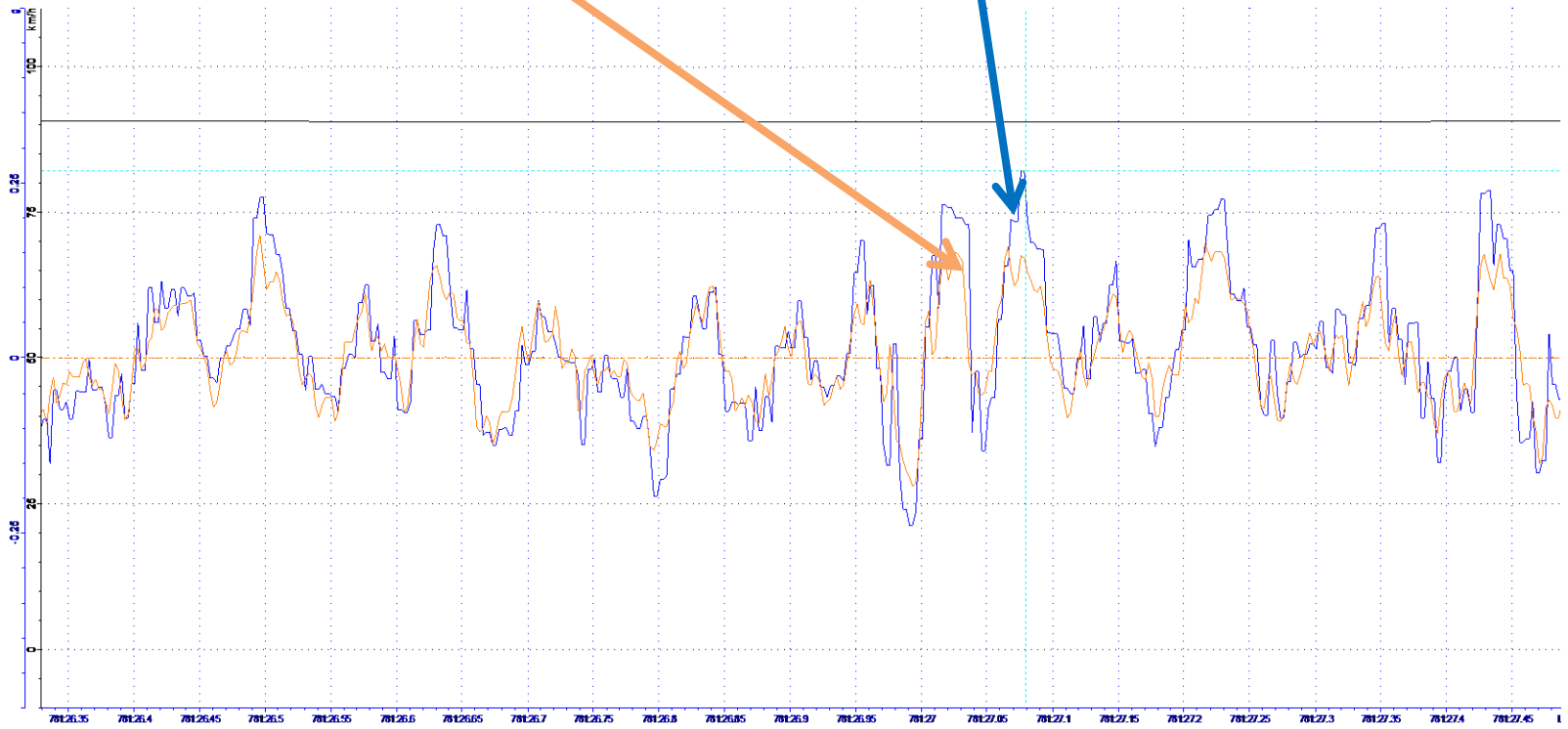
Vibrationen within Transport

<u>Acceleration between cargo and truck floor:</u>

The diagram shows quite typicall acceleration data between the cargo and the truck floor below. The graph in blue shows the truck floor and the graph in orange the cargo.



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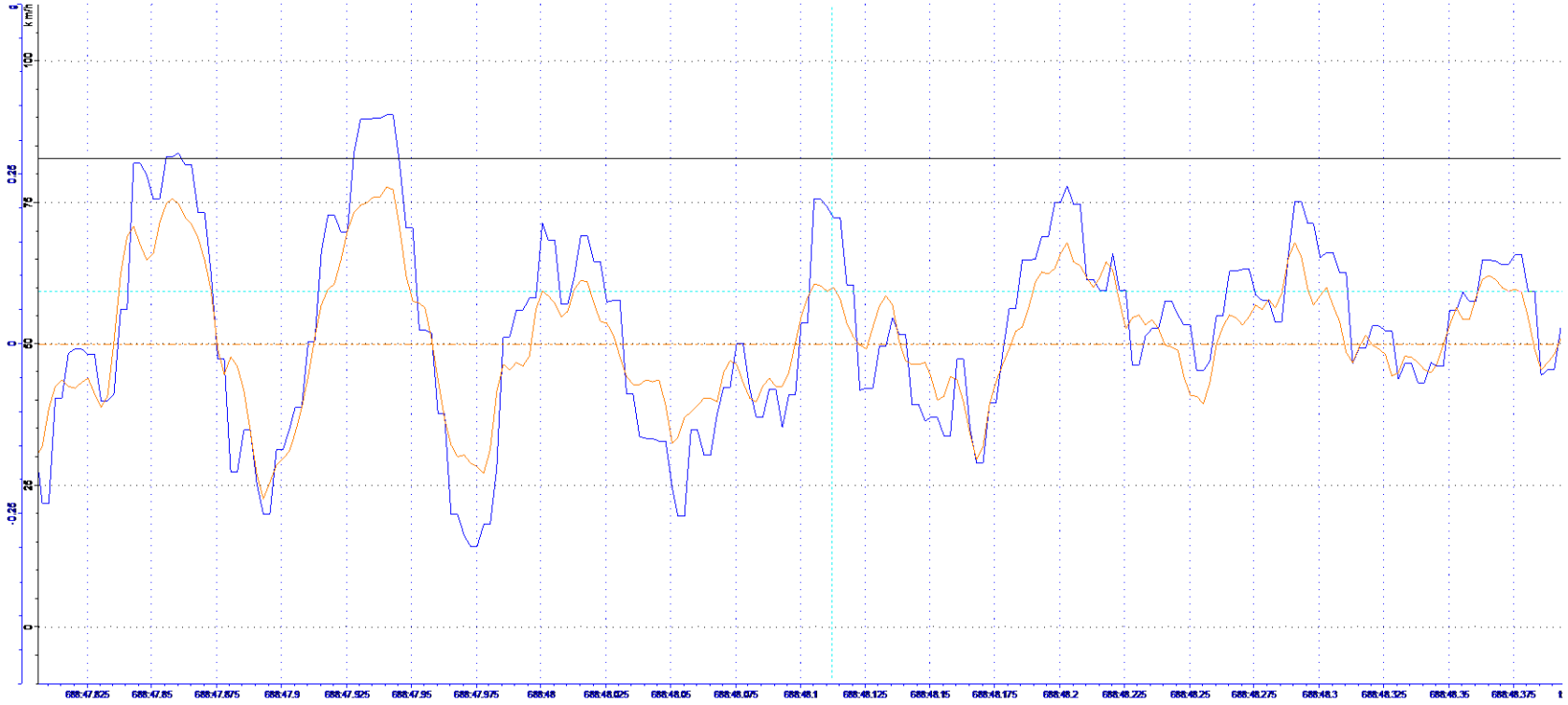
Vibrationen within Transport

The accelerations of the cargo are lower than those of the truck floor right below. After analysis of all data over 3000 km distance a reduction of 35 % could be determined. The cargo within 95 % of the time in tune with the truck floor. The main vibration frequenz is 16 Hz for the cargo.



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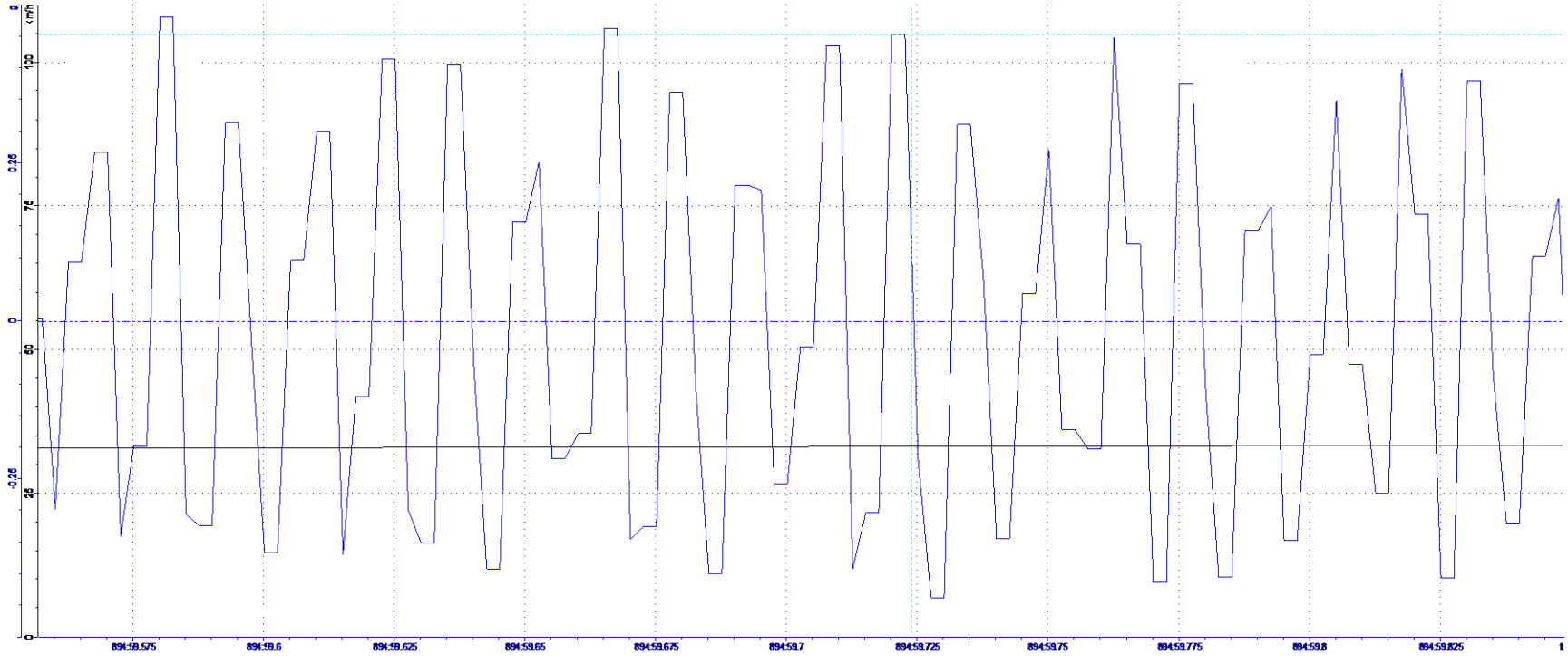
Vibrationen within Transport

This is a typical graph of the highest accelerations found within the measurements. The acceleration of the truck floor varies between a = 0,15 g and a = 0,4 g which is the maximum.



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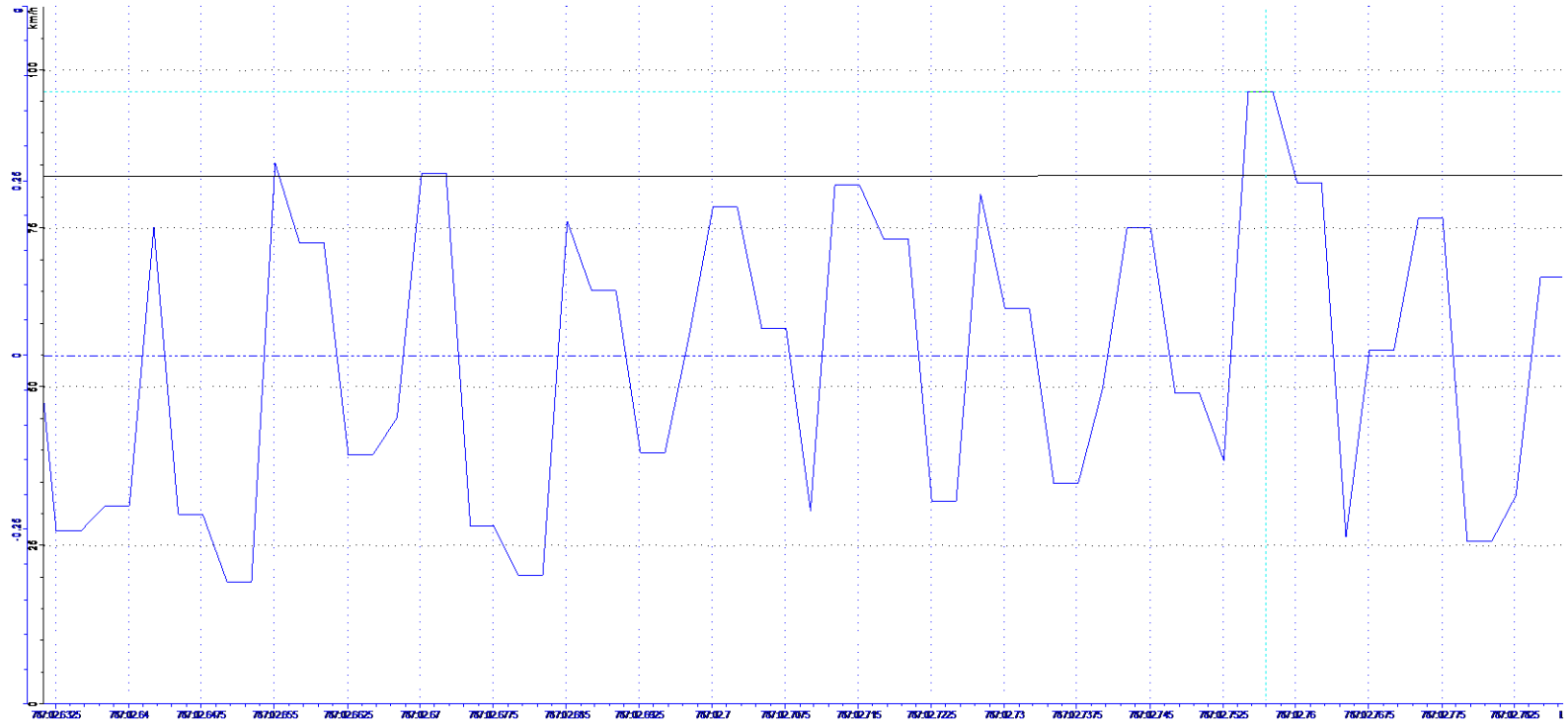
Vibrationen within Transport



For the cargo acceleration a maximum of a = 0,4 g * 0,65 = 0,26 g can be approved.

Field test with coated truck floor

Aim of a field test:

Reduction of vertical acceleration towards cargo
by specific coated truck floor:

- Coating with a definable anti-slip coefficient (cargo specific)

&

- Coating with the feature to deaden the transmission of vibration.

Field test with coated truck floor

Start: November 2013, **Period of time**: 1 year

Cycle to take measurements: each 3 month

Coordination: Transport-Technik Günther, Augsburg

Research: Fraunhofer Institut IML

Participants:

Spedition Gustke, Rostock, Spedition Nuber, Augsburg, Spedition Hellmann, Osnabrück

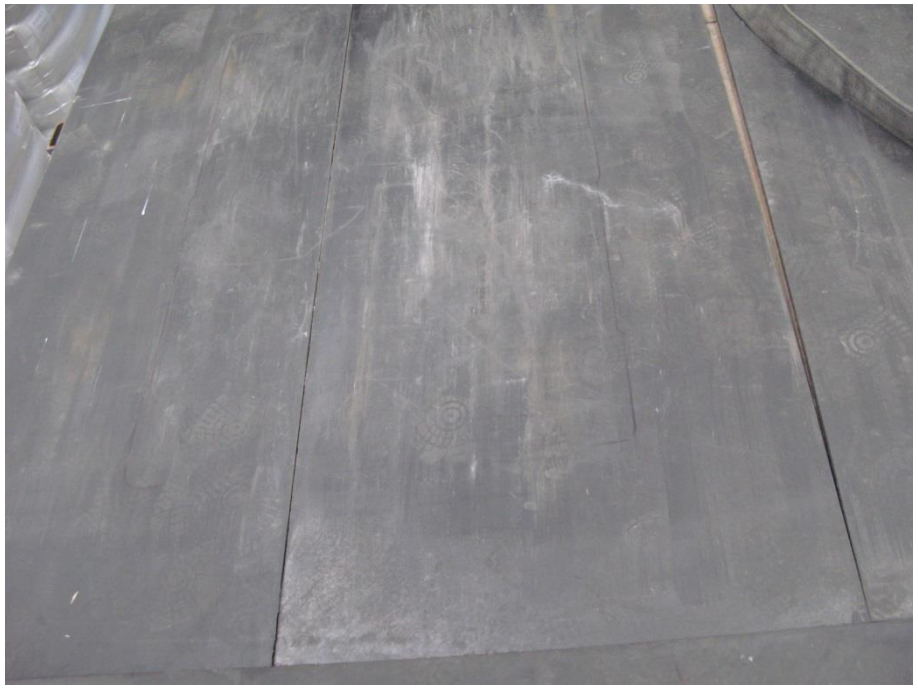
KCN Stuttgart, Ottensteiner Kunststoffe, Ahaus

Vehicle: Different Trailer

Roads: Germany

Field test with coated truck floor

Of topical interest: Friction measurement on coated truck floor with vibration deaden feature. Coating "OKULEN®-PRO-GRIP-56„ by Ottensteiner Kunststoffe



Fraunhofer Institut Materialfluss und Logistik IML Dortmund

Fraunhofer Institut für Materialfluss und Logistik

Dept. Verpackungs- und Handelslogistik

Laboratory Packaging D & R, Cargo Securing

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