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## WP3 – Task 3.3:

# Parameters influencing noise emissions – proposal for an Interdependency Matrix

3<sup>rd</sup> TYROSAFE Workshop  
13<sup>th</sup> May 2009, Brussels

Marco Conter



## Objectives of task 3.3

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- Describe different parameters of road surfaces and tyres which are relevant for noise emissions
- Identify interdependencies between parameters influencing skid resistance, rolling resistance and noise emission
- Make recommendations for optimization of the interaction of road surfaces and tyres related to those issues
- Identify lack of knowledge that can be closed with future research which is determined by this work package

## Overview

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1. Objectives of task 3.3
2. Planned activities of task 3.3
3. Analysis of research projects and models
4. Relevant question for further discussion
5. Presentation of Dr. van Blokland
6. Proposal for an Interdependency Matrix
7. Open discussion

## Planned activities

- Collection of existing knowledge + noise emission models (literature + consortium + external experts)
- Review of existing knowledge on basic parameters and on modeling of road surfaces and tyres concerning the impact on noise emissions
- Review of the current research on parameter combinations concerning the output parameters of noise emissions
- Targeted supplementary questions to experts
- 1st WP3 workshop in May 2009
- Analysis of workshop results
- Contribution to D10 (Report on different parameters influencing skid resistance, rolling resistance and noise emissions)
- Building a matrix of dependencies (D14)
- Identification of knowledge gaps (D15)
- Outline of needed research activities

## Task 3.3 Noise emissions

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### Analysis of research projects and models:

- SILVIA
- SILENCE
- ROTRANOMO
- HARMONOISE/IMAGINE

To be included

- SPERoN
- ....

## Task 3.3 Noise emissions

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### SILVIA

- Main output: Guidance Manual for the Implementation of Low-Noise Road Surfaces
- Analysis of influence factors in Chapter 3
- Proposal for a classification and COP scheme relying on direct acoustic measurements or measurements of proxy characteristics (texture, sound absorption, dynamic stiffness)

## Task 3.3 Noise emissions

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### SILENCE

- Subproject F was concerned with road surfaces
- WP F3: Improved systems for maintenance of quieter surfaces
  - Evaluation of noise-emission related monitoring and maintenance
  - Analysis of the influence of surface discontinuities (cracking, etc.)
  - Evaluation of influence parameters
- WP F4: Noise classification methods for urban road surfaces
  - Evaluation of ageing influence

## Task 3.3 Noise emissions

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### ROTRANOMO

- WP40: Vehicle noise emission model (Steven)
- Parameters: Vehicle type, speed, 3 types of road surface (AC11, OPA11, EACC)
- Input data derived from acoustic calibration measurements, not based on basic surface properties



## Task 3.3 Noise emissions

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### HARMONOISE/IMAGINE

- Model based on speed, vehicle type
- Includes corrections for road surface, meteorology, driving condition
- Surface correction based on SILVIA results
- Aggregate size
- Age influence
- Surface wetness
- Temperature
- Reference surface DAC11/SMA11

## Some relevant questions

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- Which parameters influence the noise emission of road surfaces and tyres?
- Do these parameters act in the same way for road surfaces and tyres?
- Do these parameters have interdependencies?
- What about the durability of the low noise road surfaces?
  
- How is tyre/road noise influenced by tread design, tyre stiffness or tyre width?
- Possible use of a multi-texture-range road surface model for prediction of noise emission?
- Noise performance of worn tyres and old road surfaces?
- There are specific needs for HGVs?

**influence of road surface characteristics on rolling noise of car tyres:**

- texture
- flow resistance
- acoustic absorption
- stiffness

**source: Sperenberg project (client BAST)**

Author:

Dr. G.J.van Blokland, M+P (NL),

| Influence parameter |                        |                                 | Noise emission<br>measured as SPBI (ISO 11819-1) |                         |
|---------------------|------------------------|---------------------------------|--|-------------------------|
| Parameter Group     | Parameter              | Measured as                     | Low freq.<br>(< 1 kHz)                           | High freq.<br>(> 1 kHz) |
| Texture             | Microtexture           | Texture levels<br>(ISO 13473-4) | ?  | ?                       |
|                     | Macrottexture          | MPD<br>(ISO 13473-1)            | 2  | -1                      |
|                     | Macrottexture          | Texture levels<br>(ISO 13473-4) | 2  | -1                      |
|                     | Megattexture           | Texture levels<br>(ISO 13473-4) | 1  | 0                       |
|                     | Unevenness             | IRI (EN 13036-5)                | ?  | ?                       |
|                     | Unevenness             | Texture levels<br>(ISO 13473-4) | ?  | ?                       |
|                     | Surface Shape          | Positive/negative<br>texture    | 1  | 1                       |
|                     | Discontinuity density  | ?                               | 1  | 0                       |
|                     | Friction               |                                 | ?  | ?                       |
|                     | Orientation of texture | Isotropic/anisotropic           | 2  | 2                       |

Correlation expressed as integer number  
from -2 to +2 or unknown (?)

# Proposal for an Interdependency Matrix and discussion



| Influence parameter  |                          |                                       | Noise emission<br>measured as SPBI (ISO 11819-1) |                         |
|----------------------|--------------------------|---------------------------------------|--|-------------------------|
| Parameter Group      | Parameter                | Measured as                           | Low freq.<br>(< 1 kHz)                           | High freq.<br>(> 1 kHz) |
| Sound absorption     | Sound absorption         | Extended surface method (ISO 13472-1) | -1   | -2                      |
|                      | Sound absorption         | Kundt's tube (ISO 10534-1,-2)         | -1   | -2                      |
|                      | Thickness of the layer   | mm                                    | 2  | 2                       |
|                      | Air void content         | Drainability (EN 13036-3)             | -1   | -2                      |
| Mechanical impedance | Dynamic Stiffness        | SILVIA method                         | -1   | -1                      |
| Age and wear         | Surface age              | years                                 | ?  | ?                       |
|                      | Maintenance condition    | ?                                     | ?  | ?                       |
| Meteorology          | Humidity                 | Water film thickness                  | 1  | 2                       |
|                      | Road surface temperature | °C, usually contactless               | -1   | 0                       |

Correlation expressed as integer number from -2 to +2 or unknown (?)

# Proposal for an Interdependency Matrix and discussion

| Influence parameter    |                         |                  | Noise emission<br>measured as SPBI (ISO 11819-1) |                         |
|------------------------|-------------------------|------------------|--|-------------------------|
| Parameter Group        | Parameter               | Measured as      | Low freq.<br>(< 1 kHz)                           | High freq.<br>(> 1 kHz) |
| Tyre / tyre properties | Rubber hardness         | Shore A hardness | 2  | 0                       |
|                        | tyre compound           |                  |  |                         |
|                        | Tread pattern           | ?                | 2  | 2                       |
|                        | Tread depth             |                  |  |                         |
|                        | Sidewall stiffness      | Young's modulus  | 1  | 0                       |
|                        | Tyre width (dimensions) | M m              | 1  | 0                       |
|                        | Tyre pressure           | kPa              | 1  | 0                       |
|                        | Tyre load               | kN               | 1  | 0                       |
|                        | Tyre type               | HGV or PC        | 2  | 1                       |
|                        | Tyre age                | years            | -1   | -1                      |
|                        | Tyre wear               | ?                | ?  | ?                       |

Correlation expressed as integer number from -2 to +2 or unknown (?)

| Influence parameter  |                                     |                  | Noise emission<br>measured as SPBI (ISO 11819-1) |                         |
|----------------------|-------------------------------------|------------------|--|-------------------------|
| Parameter Group      | Parameter                           | Measured as      | Low freq.<br>(< 1 kHz)                           | High freq.<br>(> 1 kHz) |
| Aggregate properties | size                                | mm               | -2   | -2                      |
|                      | kind                                |                  | 1  | 1                       |
|                      | polishing resistance                |                  | ?  | ?                       |
|                      | shape                               |                  | 1  | 1                       |
| Driver influence     | Speed                               | Km/h             | 2  | 2                       |
|                      | Acceleration                        | m/s <sup>2</sup> | 2  | 2                       |
|                      | tangential force: longitudinal slip |                  | 1  | 1                       |
|                      | side forces: lateral slip           |                  | 1  | 1                       |

Correlation expressed as integer number from -2 to +2 or unknown (?)

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