

Editorial

SILENCE is an integrated research project, co-funded by the Sixth Framework Programme of the European Commission. The SILENCE project will provide relevant and world leading methodologies and technologies for the efficient control of noise caused by urban road and rail transport. The overall outcome of the project should be a reduction of noise emission in urban areas of up to 10 dBA.

SILENCE has now just started its third and last year. After two successful seminars in 2006, targeting respectively local authorities and the rail sector, **a third seminar is planned in Spring 2007**, especially focusing on the road noise reduction activities of the project. More details will soon be made available on www.silence-ip.org. Throughout the third year **SILENCE will also start up its training activities**, which will target local transport and urban planners, local decision makers, as well as young transport engineers. The first SILENCE training event is scheduled for September 2007 within the framework of the European Summer University of Clermont-Ferrand.

This third issue of the SILENCE newsletter wishes to inform you of the progress made over the last six months within the different activities of the project. We wish you a pleasant read!

For more detailed information, including public reports from the different activities, visit our website on www.silence-ip.org.

Noise Perception & Annoyance

A step further has been taken in the analysis of noise perception and annoyance through the submission of a **specific questionnaire to residents living in urban areas**.

The purpose of this survey is to relate annoyance to the noise load (as provided by noise maps and expressed in LDEN) to selected socio-demographic variables (age, gender) and to personal traits, in particular to noise sensitivity.

The questionnaire is available in **eight languages** (German, English, French, Dutch, Italian, Polish, Swedish, Hungarian) and **consists of four parts**:

1. Questions on demographic variables
2. Questions on the living environment
3. Questions on annoyance
4. Questions on noise sensitivity

Noise caused by road traffic determined – as expected – the degree of annoyance and this was significantly influenced by noise sensitivity ($p < 0.001$), meaning that **sensitive persons felt more annoyed than robust persons**. Concerning the various aspects of sensitivity, **'habitation' and 'sleep' proved to be the most significant predictors for annoyance**. Noise sensitivity and noise load did not correlate.

In agreement with the literature, noise sensitivity shows to be an important non-acoustic moderator for the evaluation of noise annoyance, whereas noise load proves to be a significant predictor for annoyance concerning road traffic noise. This was not the case for rail traffic noise, which might be related to the low number of persons exposed to rail traffic, as well as due to relatively low noise doses. Moreover, the noiseless intervals between trains might play a significant role.

Overall, the questionnaire seems to be suitable for application in greater areas.

The questionnaire is available at www.ifado.de/silence/.



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Global Modelling

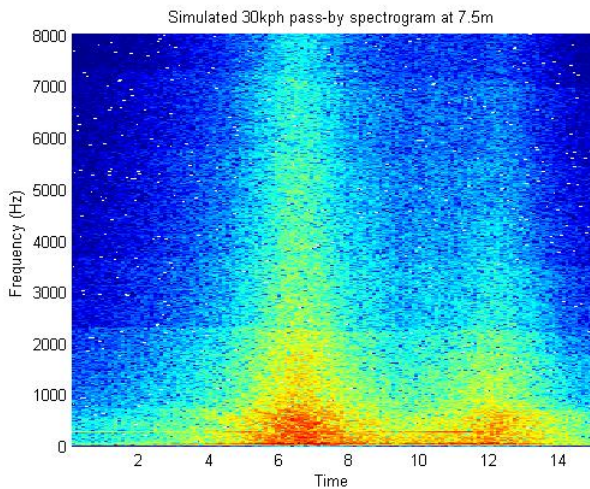
The Global Modelling Tool is a software to simulate the pass-by noise of a car or a train. The programme provides a sound sample of the pass-by and the time evolution of the sound pressure level and the spectrum. The pass-by sound sample is calculated in B-format to allow listening to the noise pass-by in mono, stereo, transaural, binaural, etc.

The first prototype of the global modelling tool has been updated: the ground effect is now taken into account, and the management scenario (acceleration, constant speed, breaking...) is available.

The sources database includes a set of source characteristics to define an electric or diesel multiple unit train. In a first step, the software will be used to conduct a parametric study on an electric/diesel multiple unit train.

The potentials of noise reduction of the rolling stock and of the track (according to the solutions developed in SILENCE) will be used to compute a set of pass-by sound samples.

In addition, listening tests will be carried out in SP-A to evaluate the noise reduction solutions in terms of perception & annoyance.



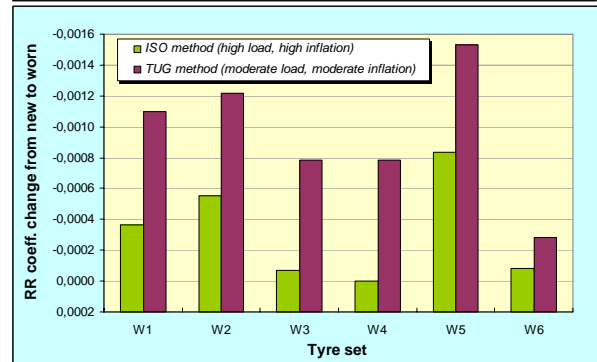
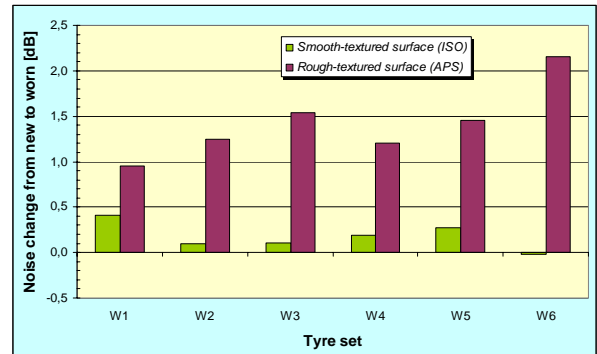
Time frequency representation of a train pass-by noise calculated with the Global Modelling Software

Vehicle–Tyre–Road Interaction

Over the last few months, work was focussed on the influence of tyre tread wear on noise emission is studied. Six tyre sets were selected and are currently worn from the original 8 mm in steps of 2 until tread depth reaches 2 mm. So far, measurements on laboratory drums have been performed on tyres worn to 6 mm tread depth.

The study shows that rolling resistance is reduced by the wear, for both smooth and rough surfaces, and that noise emission is increased, but mainly for a rough surface. In actual road traffic, results would in most situations lie somewhere in between the smooth and rough surfaces.

The work is conducted in cooperation between BAST in Germany, VTI in Sweden and Continental AG. Measurements were done at the Technical University of Gdansk.



The highest value represents a reduction of rolling resistance by about 15 %

Road Vehicle Noise

SILENCE is delivering improved experimental and numerical techniques. At CRF, spherical holography was successfully applied to engines while TUB is performing a theoretical study in order to further improve the technique. INSA's PTF-based software packages are currently being applied at CRF for calculations of the sound transfer via flexible structures and at Renault for high frequency predictions. Renault has furthermore obtained interesting results with regard to the "in-situ" engine characterisation using a Microflown probe. RIETER is intensively collaborating with CRF on the engine bay optimisation, with Renault on heat resistant absorbing treatments for the pre-catalyst, with VOLVO

and VW on the surface treatment of engine structures. AVL manufactured a second improved aluminium foam oil pan, whereas ACC used the powertrain surface velocity measurements performed at VOLVO as input for their

WBT calculations.



Optimised acoustic shields and linings

Rail Vehicle Noise

Representative cases of railway (light and heavy rail) noise have been selected from noise maps in urban areas and characterised in operating conditions. A source ranking was performed, using arrays of microphones to characterise each noise source during the train/tram/metro pass-by. The contribution of each source to the global pass-by noise was quantified.

In parallel, research is focussing on the reduction of the main noise sources: diesel engine, exhaust, cooling, traction motor. **Optimised cooling fans and heat exchangers, new design of skirts, exhausts with resonators are proposed and simulated.**



Some of the most efficient solutions will be implemented on rolling stocks and tested on an optimised infrastructure

Road Surface

A report on “Acoustic Pavement Management (APM)” was prepared under the guidance of DRI. Pavement Management Systems (PMS) are used to support and plan road maintenance work in an effective way. Road traffic noise emission, however is generally not included as a relevant parameter in these systems. Especially the real acoustic working life of noise-reducing pavements is

very often unknown and disregarded. The report proposes workable classification systems based on the most important noise-related parameters, which can be used to design action plans and road-surface-based noise abatement strategies.



Rail Infrastructure & Operation

The phase of identification of those infrastructure components which contribute most to noise generation has been concluded, as well as the development of concepts and prototypes for noise mitigation measures.

First measurements have been carried out to test the developed solutions both for tram and for heavy rail. Laboratory tests proved that the innovative rail fastening system for trams based on a pre-load sleeper combines low resonance frequency and low vertical deflection of the rail during train passage, which means that **low noise emissions are combined with good vibration isolation.**

The optimised damping system for UIC-60 rails was installed on a track near Augsburg (Germany) and the effect on the noise emission was measured for regular rail traffic. Reductions up to 4 dB were recorded. A computer model has been developed to simulate the dynamical behaviour of track and wheel and to predict the roughness developed over a period of time under actual traffic conditions. This model has been used to assess the effect of different rail dampers with various tuning frequencies on the noise emission and on roughness growth on the rail surface. Noise maps have been worked out for depots in Amsterdam and Genoa, giving equivalent sound pressure levels and maximum levels at the dwellings for a number of immission points located in close vicinity to the depots. The noise can be

attributed to the various sources at the depots, giving insight in the most important contributions of separate sources and source groups. This is an important basis for the optimisation of the noise situations of the depots.



Fatigue testing of the innovative rail fastening system for trams

Road Traffic Flow

Five focus groups discussed perception of noise and acceptance of noise reducing systems in Gothenburg, Sweden. The participants were heavy vehicle drivers, fleet managers and local authority representations. They specified the concept of noise as “unwanted and disturbing sounds that affect the individual in a negative way”.



The participants perceived noise levels in the

inner city as uncomfortably high. Generally, they had a positive attitude towards implementing noise reducing systems in vehicles. Many systems were discussed and it was concluded that a system likely to be accepted by both drivers and implementers would be an in-vehicle-information device supporting the driver on a conceptual level, i.e. through route optimisation, traffic information (accidents, congestion), reminders on gentle driving and more.

City Planning

Over the last six months soundwalks were carried out in Barcelona, Bristol, Brussels and Genoa. On the basis of these walks, soundscapes of particular areas of the respective cities were described and recommendations for urban design were elaborated in order to improve the cities' soundscapes.

In parallel, work was carried out to prepare for the key deliverable of the SILENCE City Planning activity, i.e. the



development of an integrated framework for urban action plans. A draft version of this framework was produced and will be further elaborated throughout the last year of the project, as useful output from the other activities

within SILENCE becomes available and can be integrated. The aim is to draft a methodology for developing urban action plans as well as preliminarily define the content of local noise action plans, meeting the requirements of the European Directive on Environmental Noise, as well as the local needs and wishes of cities. An overview has been given of the typical noise problems European cities are facing and the requirements imposed by the European Noise Directive. The report also looks into a number of key aspects related to the development of a local noise strategy, such as the local institutional framework, the importance of public consultation, measures to tackle noise and especially hot spots, and more strategic long-term abatement policies.

SILENCE partners

AVL List, Centro Ricerche Fiat, Deutsche Bahn, Forschungsgesellschaft für Arbeitsschutz and Arbeitsphysiologie, Continental, Forum of European National Highway Research Laboratories, Société Nationale des Chemins de Fer Français, Polis, Renault, Volkswagen, Volvo Technology Corporation, AEA Technology Rail, Alstom Transport, Bombardier Transportation, Brüel & Kjær Sound & Vibration Measurement, Dynamics, Structures + Amp Systems International, University of Southampton, Rieter Automotive Management, Stiftelsen for industriell og teknisk forskning ved Norges tekniske Høyskole, Société des Transports Intercommunaux de Bruxelles, Technical University of Berlin, Adam Mickiewicz University Poznan, AnsaldoBreda, Università Politecnica delle Marche, Chalmers Tekniska Högskola, University of Hannover, Institut National des Sciences Appliquées de Lyon, Centre National de la Recherche Scientifique, Lucchini Sidermeccanica, M+P Raadgevende Ingenieurs, Régie Autonome des Transports Parisiens, TÜV Nord Mobilität RW TÜEV Fahrzeuge, Trenitalia, Corus, Vibratec, Kugliga Tekniska Högskolan, Brussels Capital Region, Comune di Genova, Autostrade per l'Italia, Skanska Sweden, Bristol City Council, Disseny de Sistemes i Desenvolupament, City of Munich, Bruitparif, Dublin Institute of Technology

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