

### Editorial: What is SILENCE?

SILENCE is an integrated research project, co-funded for 3 years 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. This includes innovative strategies for action plans on urban transport noise abatement, and practical tools for their implementation. The overall outcome of the project should be a reduction of noise emission in urban areas of up to 10 dBA.

SILENCE involves the right mix of European expertise to develop appropriate solutions. The project gathers city authorities, public transport operators, research and engineering institutes, European associations, vehicle manufacturers, equipment, systems and technology suppliers, and specialised SME's. It is co-ordinated by AVL List GmbH (Austria).

Now that the project has been running for one year, the first results become available. This six-monthly electronic newsletter aims to keep you up to date on the progress of SILENCE and its published results. Have a pleasant read!

### Noise Perception & Annoyance

Within the project's activity on noise perception and annoyance, a source library was established, which contains more than 300 recordings of a large variety of



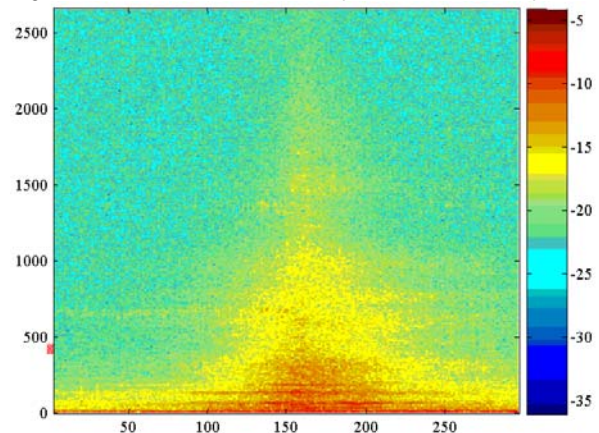
road and rail vehicles, provided by different project partners. The purpose is to identify annoying acoustic components of individual vehicles in order to develop guidelines for individual source-oriented noise reductions. Also, acoustic features will be defined for optimal global

noise abatement by means of sound barriers, insulating windows etc., in order to formulate guidelines for global urban noise reduction.

The varying recording modes, operational modes of the vehicles, distances from the noise source etc. require a selection according to the following criteria: single pass-bys, complete recording of the pass-bys (emerging from until fading away into the background), clear signals (not mixed with sounds of animals (birds, dogs etc.), and recording mode (mono, stereo recordings will be converted).

### Global Modelling

The global modelling tool is a noise pass-by simulation programme, that will calculate levels, spectra and signatures, but also sound samples that allow to predict



Time frequency representation of a train pass-by noise

the noise in the near field (7,5m, 25m). All these outputs are calculated under real operating conditions, i.e. acceleration, deceleration (simulation when the vehicle is stopped), braking, curve rolling, stop of the ventilation sources, stop of the engine etc.

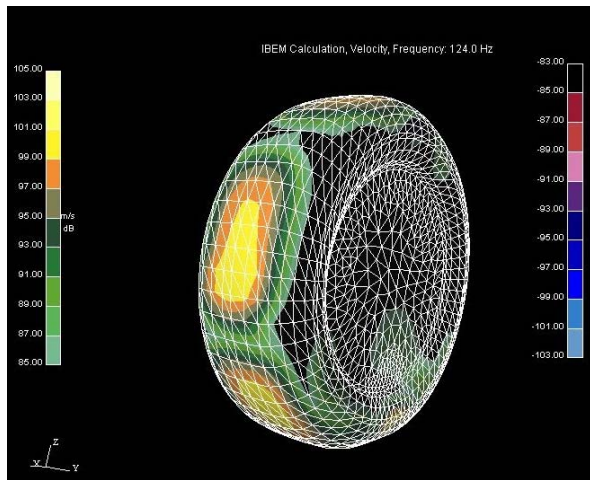
The tool will be valid for both rail and road applications. It will provide a common basis, including a differentiation with respect to level, source and vehicle shape.

The tool will require a sufficient degree of realism with reasonable calculation times, in view of parametric studies. Several sound synthesis algorithms have already been tested and, at the same time, the source definition is being performed. In addition, a scenario has to be defined for the different events that occur during the pass-by.

## Vehicle-Tyre-Road Interaction

Another goal of the SILENCE project is to provide design as well as hardware solutions for noise reduction, with respect to vehicle/tyre/road interaction, under typical urban and suburban traffic conditions.

These improvements will be based on an increased understanding of noise generation and radiation mechanisms, gained by further developed experimental and simulation techniques. These will be focused on tools for the prediction of contact forces due to the interaction between tyre and road surfaces; a hybrid tyre/road noise model to optimise the road surfaces; equivalent sources for low noise tyres, and a propagation model. Hardware

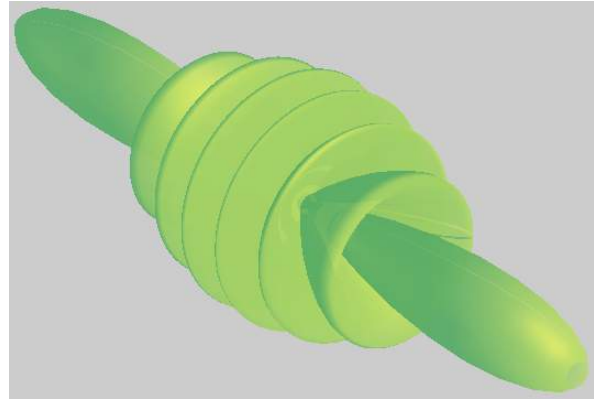


Inverse boundary element method validation of a tyre

solutions will be provided by new passenger car tyres, which are silent on different road surfaces, as well as by modifying the noise radiation of tyres due to modifications at the vehicle. SILENCE will further support the EU noise policy by establishing fundamentals for new standards and directives.

## Road Vehicle Noise

The SILENCE project advocates a holistic approach to urban traffic noise problems. Future noise action plans should consist of an optimised blend of measures regarding traffic management, city planning, infrastructure adaptations and vehicle noise targets. In order to allow vehicle manufacturers to reach such targets, SILENCE invests considerable effort in the development of calculation tools and experimental methodologies. Improved simulation methods allowing the extension of the calculated frequency range have been developed. The numerical prediction of noise from light-weight vehicles is addressed. New experimental engine noise characterisation methods, including various array techniques, are under investigation. Special emphasis is



Spherical harmonic directivity pattern (spherical holography)

put on user-friendly experimental methods which try to achieve engine noise characterisation with simple measurement techniques and without removing the engine from the vehicle.

## Rail Vehicle Noise

The overall approach of SILENCE, to reduce transport noise in urban areas, is based on the selection - through noise maps of some cities - of representative cases which will be the basis for detailed work on each individual source.



Noise measurement campaign at Pierrelatte test track (FR)

Representative cases have been identified for trams, metros and heavy rail. They are a combination of state of the art rail vehicles running on state of the art infrastructures, preferably located at railway hot spots defined

through noise maps. Noise sources have been identified from pass-by measurements. Work is now focusing on reducing the identified sources.

Furthermore, noise reductions which are industrially feasible within the project's time constraints will be implemented on the validation platforms (rolling stock and

infrastructure), where the effectively obtained noise reduction will be measured.

## Road Surface

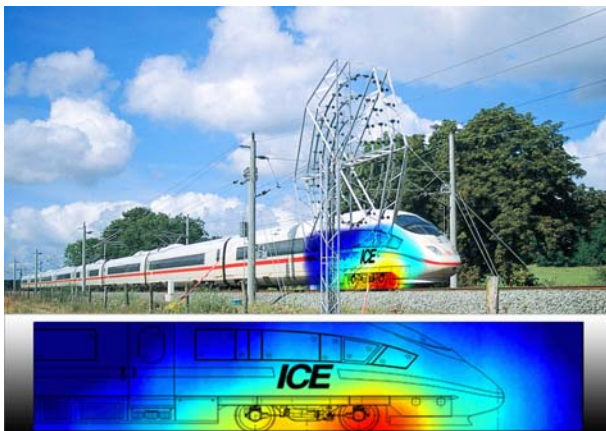
The integral design and maintenance of lower noise road surfaces is the main objective of the SILENCE activities



on "Road Surface". As materials technology is advancing around Europe, it is important to investigate the use of these new and innovative materials both for city streets with low speeds and for high speed roads such as city ring roads and city arterial roads. However, it is not sufficient to just develop new materials. One should also make sure that maintenance methods and strategies allow low-noise surfaces to preserve their cost/effective acoustic performance throughout their lifetime. Quantifying noise levels requires equipments and procedures for determining and classifying the influence of road surface noise in the urban environment. The importance of providing valuable information to be used for an optimised asset management evaluation and the planning of strategies for the road pavements in European cities, is a crucial part of the road surface work in SILENCE.

## Rail Infrastructure & Operation

Efficient noise reduction for rail traffic requires an integrated approach including both railway vehicles and railway infrastructure. Based on the analysis of real



Noise source localisation on a German ICE train

locations with existing noise problems, typical situations are being identified and characterised in terms of noise sources, noise level and annoyance. These include both light rail and heavy rail and are located in Brussels and Augsburg. Additionally, depots in Amsterdam for trams and in Genoa for heavy rail were selected. In all locations noise measurements have been carried out in order to demonstrate the state of the art. Accompanying modelling and simulation work has started, aiming at the prioritisation and optimisation of noise reduction options (e.g. damping of the rail). The next steps will concentrate on the development of noise reduction solutions particularly suited for the identified locations and the demonstration of their effectiveness.

## Road Traffic Flow

Road traffic noise abatement through traffic management needs further exploration. More specifically, there is a need for developing the results of many surveys into tools which can be used in practical traffic planning. Traffic management is currently used to decrease congestion, improve safety and reduce air pollution. Similarly, practical urban traffic management techniques for noise reduction should be developed. This is the objective of the Road



Traffic Flow activities within the SILENCE project. The findings of the SILENCE City Planning activity (see next page) provide the framework for these tools. An initial survey in cities has just started, which aims at clarifying statutory powers, noise and traffic management problems, relevant policies and the feasibility of different measures. A literature study on noise effects of traffic flow management measures is in progress. Work has also begun on the further development of methods to monitor noise from vehicles in the traffic flow, as well as on driver attitudes and behaviour related to noise-reducing techniques and noise level feedback.

The findings from these activities, combined with feasible traffic management techniques, will be synthesised into a practical, advisory toolkit for cities.

## City Planning

Main target group of the SILENCE project are local authorities. SILENCE aims to help them



Noise Map of the City of Genoa

in tackling the urban transport noise that citizens are suffering from, in line with what the European Directive on Environmental Noise prescribes. The City Planning activity within the project has just concluded its first phase, in which the State of the Art on current noise abatement policies and tools in cities was compiled. Also, noise abatement priorities in typical European cities were identified, as well as necessary technologies for tackling urban transport noise problems in an appropriate way. The report, which will shortly be available on the SILENCE website, looks into noise abatement policies of cities such as Barcelona, Bristol, Brussels, Genoa, London, Paris, Copenhagen and Stockholm. As a next step, further barriers and solutions to implementing noise scenarios were studied and a guidance framework for implementing noise action plans will be developed.

## City Seminar

On 30 March 2006, a city seminar will be organised in Brussels on how to abate transport noise in an urban environment. Issues that will be addressed include the impact of noise pollution on citizens' health, quiet road surfaces, the role of traffic management in noise abatement, and silent rails vehicles. Noise policies from Paris and London will also be presented. The programme and registration form are available on the SILENCE website [www.silence-ip.org](http://www.silence-ip.org).

## More Information

SILENCE wants to keep you informed on what the project is developing. Visit our website on [www.silence-ip.org](http://www.silence-ip.org) for more detailed information.

## 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, Briel & Kjaer 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 Appliqués de Lyon, Centre National de la Recherche Scientifique, Lucchini Sidermeccanica, M+P Raadgevende Ingenieurs, Regie Autonome des Transports Parisiens, TÜV Nord Mobilität RW TÜEV Fahrzeug, 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

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**Pictures:** AVL-LIST, Continental, CRF, Deutsche Bahn, City of Genoa, Andrea Jaccarino, PORTAL, SNCF

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