QUIETER SURFACE TRANSPORT IN URBAN AREAS

ISSUE 2 – AUGUST 2006

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. 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.

With the project being half way, SILENCE already has some interesting results to show. In March, the first SILENCE seminar was organised in Brussels and attracted the interest from a wide range of stakeholders. The second SILENCE seminar, focusing specifically on the railway activities within the project, took place in June. Presentations of both events are available on the SILENCE website.

This second 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. All public reports that have been produced so far have also been made available online at www.silence-ip.org. We wish you a pleasant read!

Noise Perception & Annoyance

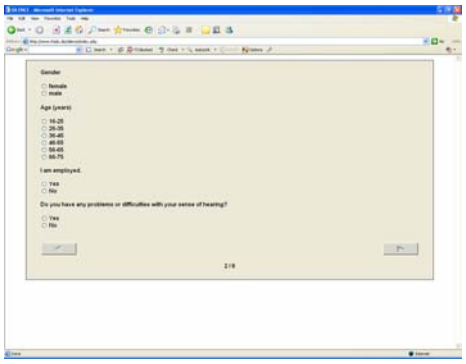
Within the Noise Perception and Annoyance activity of SILENCE, several noise scenarios were created to investigate the following aspects:

1) significance of the amount of heavy vehicles, even and clustered traffic
2) significance of the emergence of heavy vehicles
3) annoyance due to noise from a truck, bus and tram
4) significance of bus and tram within complex scenarios
5) significance of speed perception

Three 10-minute sequences were created for each scenario. 2-hour sequences will be designed by linking randomly the three versions of each scenario.

Another study compared the noises emitted from a truck, tram and bus. 21 subjects were exposed 30 times each to a single noise of a bus, tram and truck and maximum levels varying in 7 steps of 3 dBA. Annoyance estimated immediately after each presentation followed almost parallel dose-response curves, where annoyance was almost the same for trucks and buses but 3 dBA lower for trams, indicating a tram bonus.

This subproject also wants to describe the association between noise load as determined from noise maps on the one hand and annoyance on the other hand, where noise sensitivity will be used as an explanatory variable. A questionnaire was designed to this end. The first section concerns some demographic variables (age, gender), while the second part focuses on the living environment, enquiring about noise annoyance. The respondents are then asked to fill in their address (for the link with noise maps).



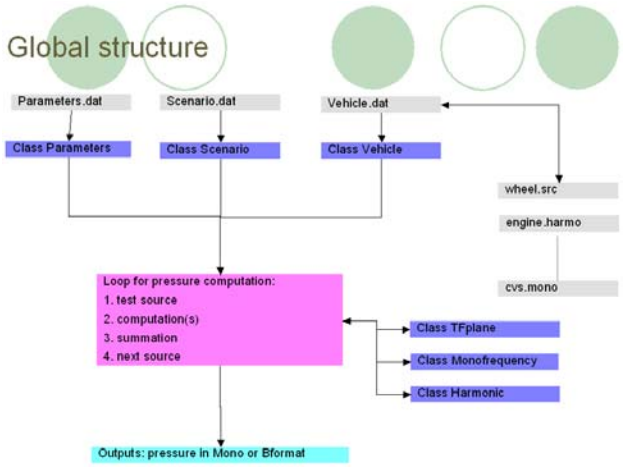
Finally, 12 questions deal with noise sensitivity in relation to work, housing and sleep. Respondents also receive feedback concerning their personal noise sensitivity. The questionnaire is currently available in 7 languages (Dutch, English, French, German, Hungarian, Italian, and Polish) and can be tested at http://www.ifado.de/silence.

Global Modelling

The Global Modelling Tool is a software tool that can be used to simulate the pass-by noise of a car or train. The programme will provide a sound sample of the pass-by, as well as the time evolution of the sound pressure level and spectrum.

The sound synthesis sub-programme has been developed and validated. The pass-by sound sample is calculated in mono to preserve the calculation time. On demand, the associated B-format tracks can be calculated to listen to the noise pass-by in stereo, transaural, binaural, etc. A first global modelling tool prototype is available now.

Description of the global modelling software



The other sub-programmes are still being developed. The combination of numerous sources to define a train or a car and the scenario management (acceleration, constant speed, braking, etc.) will be implemented.
In addition, a source database has been developed. A set of source characteristics is available to define an electric or diesel multiple unit train.

Vehicle–Tyre–Road Interaction

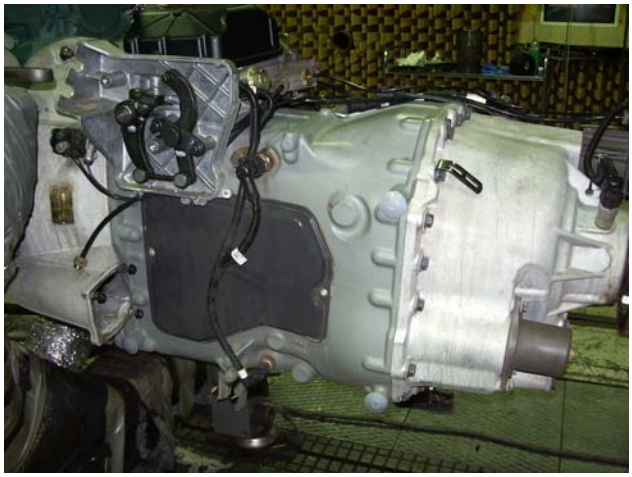
Continental has developed realistic tyre constructions for further lowering the tyre/road noise on urban roads by building a series of prototype tyres, which show the potential for noise reduction but have not been tested on other tyre performance criteria yet. A selection of appropriate road surfaces for testing was defined and the Federal Highway Research Institute has built up an interior drum test facility (PFF), which has a diameter of 6.5 m. Real existing road surfaces, as well as experimental new surfaces will be tested.

Drum test facility (PFF) at BASt without acoustic enclosure

The main advantage of tyre and road surface testing in such a big drum test facility is, besides the possibility of quick installation of different road surfaces, the possibility to measure small differences of tyre/road noise emissions because of the existing laboratory test conditions, stationary tyre and microphone positions, and a non reflecting wall covering.

Road Vehicle Noise

This activity within SILENCE deals with experimental methods and calculation techniques and is rapidly gaining momentum and delivering exciting results. At the Technical University of Berlin, the spherical holography is being adapted to IC engines. Fiat is teaming-up with Berlin and applying this technique in practice. At Renault, simulation software has been developed to study the effects of design variations on pass-by noise. INSA has further elaborated the PTF method and is closely cooperating with both Renault and Fiat for the practical applications. Recently, VW performed a measurement campaign using antenna techniques to investigate the acoustic field of a Fiat engine. AVL has been refining their source ranking method and did experimental investigations on a highly damped aluminium foam oil pan.



Engine structure with local surface treatment

Meanwhile ACC is applying the Wave Based Technique to model the engine bay, whereas Volvo, VW and Rieter started working on local surface treatments.

Rail Vehicle Noise

The rail vehicle partners in SILENCE selected representative cases of railway (light and heavy rail) noise from noise maps of urban areas. Measurement campaigns were carried out to characterise the noise emitted by state of the art rolling stocks on state of the art tracks.

A source ranking has been performed using arrays of microphones to characterise each noise source during the train/tram/metro pass-by in normal operating conditions. The contribution of each source to the pass-by noise has also been computed.

At the same time, research studies are looking into the reduction of the main noise sources, i.e. diesel engine, traction motor, cooling unit, HVAC unit.

Noise reduction solutions that will be industrially feasible within the project duration will be implemented on rolling stock and tracks, to be evaluated at the end of the project.

Antenna of 64 microphones to achieve the source ranking of a metro during its pass pass- by in normal operating conditions

Road Surface

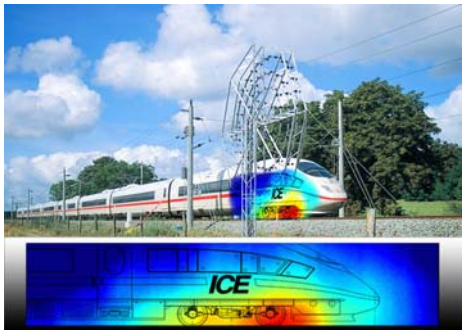
The subproject “Road Surface” has completed a user manual on “Measurement methods” for noise. Presently, the road surface team is working on a proposed methodology for classifying road surfaces with respect to noise. As a contribution to this task, LCPC in France has tested the “Backing-Board” technique (BB) (see picture) which will be used for CPB (Coast Pass By) and SPB (Statistical Pass By) measurements in urban areas. The validity of the “Backing Board” equipment has been tested for different urban locations and different vehicle speeds. In all configurations, the correction term with respect to free field is consistently very close to 6 dB.

In addition, a procedure has been applied to estimate the CPB value for a light vehicle from the CPX (Close Proximity) measurement in the speed range 30–70 km/h. This procedure has been validated with respect to measurements in a “free field” situation and in an urban location with the “Backing Board”.

Backing Board Technique

Rail Infrastructure & Operation

The start-up phase of the “Rail infrastructure” activity within SILENCE focussed on the identification of noisy infrastructure components and has now been completed.

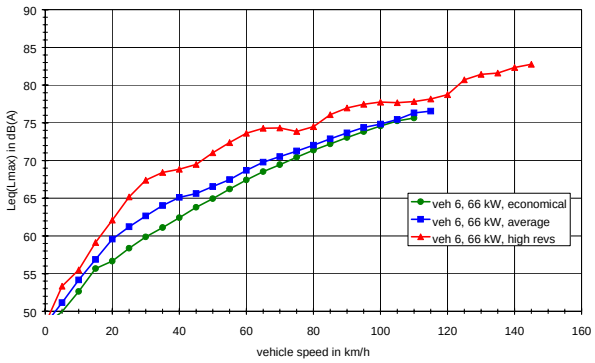


Concepts and prototypes for mitigation measures were developed, based on the combination of computer simulations and experimental work. The next steps will concentrate on the implementation, testing and optimisation of the elaborated concepts and solutions. An innovative rail fastening system for tracks for trams has been developed, which combines good vibration mitigation and considerable reduction of the air-borne noise. A damping system for UIC-60 rails has been optimised in order to directly reduce noise emission from rail due to increased rail damping and to indirectly reduce noise emission by lowering the roughness growth rate. Noise models for depots in Amsterdam and in Genoa were built, the major noise sources were identified and are at present being analysed in terms of annoyance.

Road Traffic Flow

The preparations for the development of a toolbox with practical traffic management techniques for urban noise abatement began with a survey of urban noise and traffic management problems, relationships between traffic management devices and noise, the development of noise monitoring techniques, and studies of driver acceptance of

Driving behaviour and noise emission



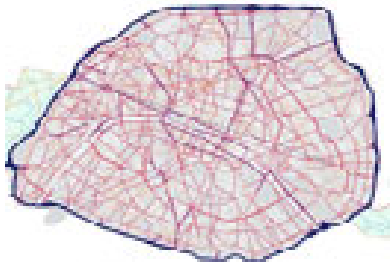
in-vehicle functions to reduce noise.

One essential tool for enforcement and access control is the identification of noisy vehicles in the traffic stream. Technical development of a prototype to such a system has begun. The system will register characteristics for a pass-by vehicle, acoustical parameters and meteorological data. The latter will enable corrections for external conditions.

Another essential aspect is user acceptance of and willingness-to-pay for noise-reducing functions. The focus group technique has been used to capture opinions of different user groups (city authorities, fleet owners and professional drivers).

City Planning

The first SILENCE newsletter reported on the State of the Art study of current noise abatement policies in European cities. You now find the full report on www.silence-ip.org.



City of Paris

As a next step, barriers and solutions to implementing noise scenarios in cities were identified. This survey revealed for example, that legislation does not sufficiently define relations between different bodies, that there are not enough possibilities for local government to enforce the private sector and that there is often a lack of cooperation between different entities. Also, air quality and road safety are still a higher priority on the political agenda. The cost of measures remains a significant barrier to implement the appropriate measures and cities feel that appropriate cost benefit analyses are lacking. The survey also identified which noise abatement solutions local authorities consider to be the most effective – with low noise vehicles and road surfaces and land use planning scoring high –, which of these measures are being used and for which cities have competences. The report is also available online. Currently, a tool for local authorities to develop noise action plans that both meet the needs of cities and comply with the requirements of the European Noise Directive is being drafted.

More Information

SILENCE wants to keep you informed on what the project is developing. Visit our website on www.silence-ip.org for more detailed information, including public reports from the different activities highlighted in this newsletter.

SILENCE partners

AVL List, Centro Richerche 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, Bruel & 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 TUEV 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, City of Munich, Bruitparif, Dublin Institute of Technology

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