Qcity

issue 2

Quiet City Transport

Newsletter

SIXTH FRAMEWORK PROGRAMME

Quiet City Transport

is an integrated research project partly funded by the European Commission under the 6th Framework programme. This four year research project which started in February 2005 has a budget of about 13.5 million Euros.

Objectives:

The aim of this project is to develop an integrated technology infrastructure for the efficient control of road and rail ambient noise by considering the attenuation of noise generation at source at both vehicle/infrastructure levels.

The activity will support European noise policy to eliminate harmful effects of noise exposure and decrease levels of transport noise creation, especially in urban areas, deriving solutions that will ensure compliance with the constraints of legislative limits.

A major objective is to provide municipalities with tools to establish noise maps and action plans (Directive 2002/49/EC) and to provide them with a broad range of validated technical solutions for the specific hot-spot problems they encounter in their specific city.

The cities involved are:

Amsterdam, Antwerp, Athens, Augsburg, Brussels, Göteborg, Malmö Nieuwpoort, Ostend, Stockholm, Stuttgart.

These cities are representative for actual city noise situations across Europe.

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Please book your time to visit the **the QCITY session at**

the Acoustics ´08

Paris/ France

Secession (NS21): **"Action planning and global solutions for urban noise"**

When: Monday Afternoon, **30 June 2008** from 1 pm to 3 pm

Location: **Room 251**

Programme:

Paul de Vos, DHV: *"Strategies for noise action plans"*

Marilo Jiménez, Road Directorate of the Spanish Ministry of Public Works: *"Strategic noise maps to action plan: Perspective of Spanish main roads"*

Jeroen Borst, TNO (Qcity): *"Decision support system for Action Planning in the framework of the European Noise Directive"*

Melanie Kloth, Polis (SILENCE): *"Urban Noise Action Planning - an integrated approach towards noise abatement in the frame of urban development: Tools and recommendations developed within the SILENCE project"*

Fanny Mietlicki, Bruitparif (SILENCE): *"Noise Action Plan in the Ile-de-France region: a complex process"*

Markus Petz, ACCON (Qcity):*"Action planning procedures and realized action plans of municipalitiesand cities – results from the implementation of END"*

Eric Gaucher, Acoustique & Conseil: *"Action plans (PPBE) : experience of municipal noise fighting plans"*

João G. Baring, University of São Paulo: *"Urban and building acoustics management in the next decades: a matter of prevention, simplification and education"*

Åsa Stenman, Acoustic Control (Qcity): *"NERS-analysis extended to include the existence of neighboring quiet areas"*

Peter Malm, Acoustic Control (Qcity): *"NERS-analysis extended to include noise levels measured on city courtyards"*

Sandro Guidati, HEAD acoustics (Qcity): *"Auralisation and psychoacoustic evaluation of traffic noise scenarios"*

Duane E. Marriner, Wakefield Acoustics Ltd *"Lions Bay noise mitigation program"*

Alexander Ossipov, Goodyear (Qcity): *"Tire road noise reduction"*

Marine Baulac, CSTB: *"Calculations of low height noise barriers efficiency by using Boundary Element Method and optimisation algorithms"*

Laurent Cosandey, Office Fédéral de l'Environnement: *"Status of noise abatement measures for roads in Switzerland"*

Michael G. Dittrich, TNO (Qcity): *"Evaluation of Directive 2000"14"EC on outdoor machinery noise"*

Arnaud Can, LICIT: *"Influence of noise source representation on the estimation of specific descriptors close to traffic signals"*

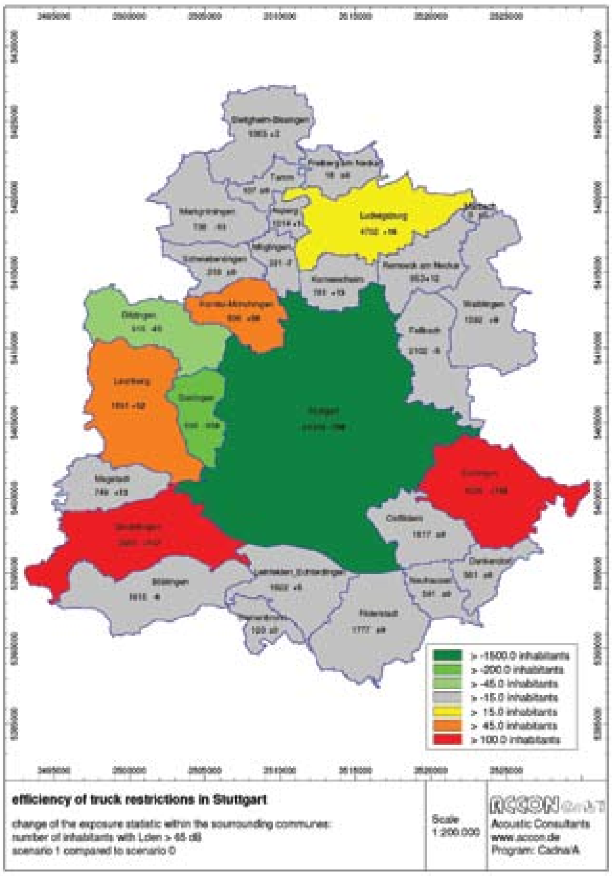
Michel Maurin, INRETS-LTE: *"Some algebra and statistics on isolated noise events"*

THE IMPLEMENTATION OF TRUCK RESTRICTIONS IS PARTICULARLY BENEFICIAL WHEN ANY INTERVENTION MEASURES ARE DESIGNED AND IMPLEMENTED ACROSS A REGION.

Stuttgart has been used as an example to determine the noise reduction potential of a city-wide ban on heavy vehicle traffic. Accordingly, the impact of local traffic restrictions and the noise effects induced by traffic relocation were considered. Detailed statistics have been compiled for the noise effects within Stuttgart, as well the surrounding communities, and these have been predicted using detailed noise mapping so that the overall performance could be measured and identified.

The study has shown that the implementation of truck restrictions provides the greatest benefits when designed and implemented regionally. Nevertheless, as might be anticipated, effective intervention measures do not necessarily result in positive effects at all locations. In particular, applying truck restrictions regionally does not necessarily result in the best solution for localised hot-spots. Where the hot-spots are single multiple occupancy buildings, more localised measures such as changing the land-use, the orientation of sensitive rooms within quiet facades or the implementation of sound insulation etc, is more likely to result in greater benefits.

Every ban on truck transit traffic inside of Stuttgart results in an increased traffic volume and noise exposure in the surrounding communities. It was demonstrated that the communities in the east and west of Stuttgart derived the greatest benefit whilst the communities to the north and south experienced a very small change in noise exposure.



DECISION SUPPORT SYSTEM

The European Noise Directive (END) requires assessment of noise exposures as well as the formulation of Action Plans for the reduction of the number of people harmfully affected by environmental noise. In view of this, TNO is currently developing a decision support system for evaluating noise mitigating measures. Such a system helps users to localise the noise sources that have most impact and to choose noise abatement measures that are most (cost) effective. This interactive tool enables users to evaluate the effect of noise abatement measures real time.

In contrast of focusing on places in a city where relatively many people are harmfully affected by high noise levels ('hot spots') the decision support system focuses on noise sources that are responsible for a large number of people being harmfully affected by noise. Doing so, the decision support system points towards those noise sources where lowering noise emissions have most effect on the specific noise impact indicator used. The noise impact indicator we use presently is the number of highly annoyed people (HA).

On the basis of a detailed noise map, for each road segment (noise source) an indication is given for the amount of negative effect it causes per metre, i.e. HA. On the basis of the characteristics of the road segment (such as traffic intensity, traffic speed, size of the road, distance of road to buildings, types of buildings along road, etc.) the system suggests possible noise mitigation measures. This is illustrated in the figure. This figure displays a screenshot of the system showing a map for the city of Amsterdam. Pointing at a road segment that causes a relatively large number of highly annoyed people results in the appearance of a window containing a short list of possible noise abatement measures.

The effect of the measure chosen by the user can be interactively explored with the system. It directly shows the updated detailed noise contour maps as well as indicators describing the impact after a measure has been applied though the interactive interface. In the near future also other noise sources than road traffic can be implemented. Also other impact indicators than HA could be used. An important step would be to extend the decision support system such that it can also consider overall noise measures such as the application of silent tires or the introduction of car free city zones.

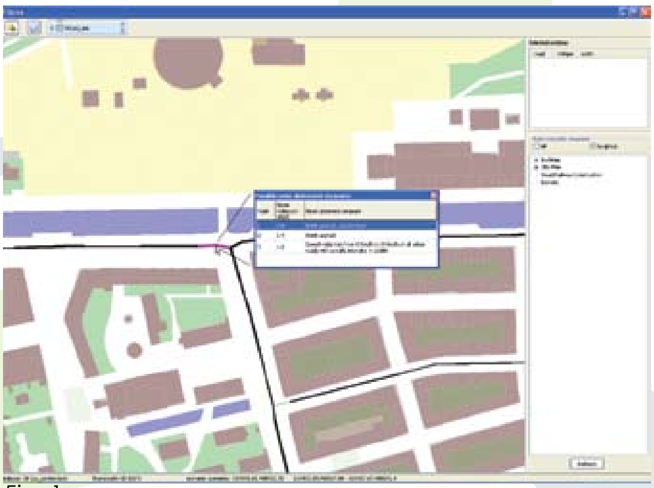


Fig. 1

Screenshot of a zoomed in map of Amsterdam. The purple coloured road segment causes a relatively large number of HA per meter. Selecting it generates automatically a list with possible noise abatement measures.

DESIGN AND IMPLEMENTATION OF A TRACK FASTENER FOR STEEL BRIDGES TO REDUCE STRUCTURAL NOISE

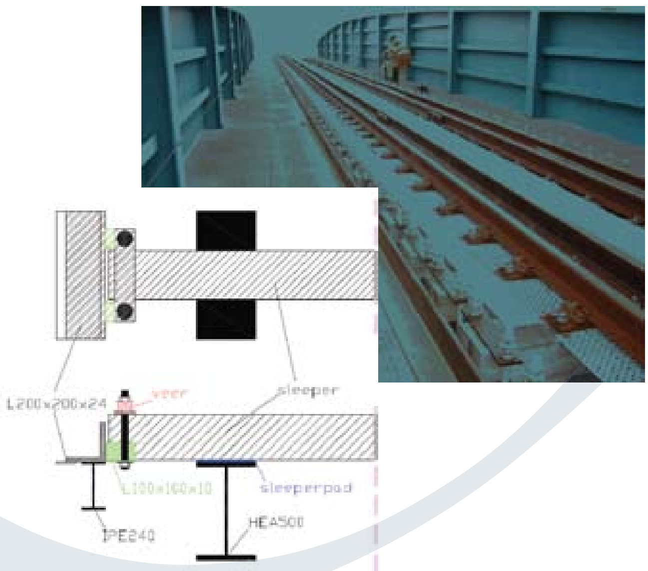
APT (Track products and measurement devices) developed, within WP5.7, a patented track fastening system for steel bridges in order to reduce the structural noise radiation during train passage. With support of the Port Authority of Ostend (Belgium), a validation site is selected: a steel bridge used by the National Belgian Railways (NMBS). During operation, the bridge is lifted hydraulically and can be turned over a local maritime channel.

In a first stage of the project, before modification of the track, APT performed detailed noise and vibration measurements including a characterisation of the existing noise situation and a complete modal analysis of the steel railway bridge. Based on the conclusions of this technical report, the design principle of the new track system is a low frequency suspension in order to obtain a first wheel/rail resonance frequency below 35 Hz. In this way structure borne noise emission can be reduced above 50 Hz. In the new track design, resilient elastomers are inserted between the longitudinal girders and the wooden sleepers of the bridge. To guarantee the lateral stability of the track, longitudinal profiles are added on both sides of the sleepers to restrain the sleepers transversally. In order to limit the vertical displacement and keep the high vertical resiliency, the elastomer is vertically pre-stressed against the bridge deck with a patented spring systems. During the installation of the elastomers, a crane, located on the bank, lifted the existing track so workers could insert the elastomers.

Because of the increased bridge weight by adding the bolts, springs, elastomers and L-profiles, the counter weight of the bridge needed to be increased to keep it in balance over its asymmetric rotating point. For safety reasons, the metal plates in-between the wooden sleepers were restored to their original state. All works were executed in a relatively short time to minimise the hinder for the port operations.

Currently the bridge is being put into service and a significant structural noise reduction has been observed.

Pictures show the design (left picture) and the installation (right picture) of the track fastening on the steel bridge.



MEASUREMENT OF EFFECT FROM RAIL DAMPERS COMBINED WITH SILENT WHEELS.

The concept of rail dampers has been developped within the EU-project Silent Track and has been developped as an industrial product thereafter. However, the noise reduction obtained is most often very limited. This is due to the fact that train wheels also radiate noise and significant reduction of track noise (up to 7 dB) will not lead to a major reduction of total noise. Reducing noise from wheel is therefore necessary.

For passenger trains, there are several ways to make the wheel quieter: reduced wheel diameter, straighter wheel webs and wheel dampers. For modern passenger trains, wheel combining those three properties are already available. Commuter trains between Sweden and Denmark are equipped with such wheels, and therefore tests with rail dampers could show higher noise reduction. Assessment of noise reduction by combination of rail dampers and silent wheel is a work topic within the Eu-project QCITY.

Previous tests performed in April 2006 showed a scattering in noise reduction from 3,5 to 6 dB(A). During those tests, rail roughness has been measured, but incertainty remained on wheel roughness. This is especially important since rail roughness was quite low at the test site and total roughness is therefore dependant on wheel roughness. Even with those wheels, wheel noise is dominating from 2500 Hz, which at those speeds corresponds to a roughness wavelength of 2cm. If total roughness is high below that wavelength, then rail dampers might loose part of their effectiveness. Furthermore, those measurements were carried out in cold conditions, which means that rail noise reduction was not optimal due to a higher pad stiffness.

Further tests will be carried out in 2008 in order to assess the effect of combined rail dampers and silent wheels accurately. Combined roughness measurements will be performed with the PBA method in order to relate noise reduction with roughness distribution in wavelength. Effectiveness of rail dampers will be assessed in terms of transferfunction, i.e the ratio in third-octave bands between noise emission and roughness level. Roughness and noise levels measurements will be made on a large number of train passages in order to get a good statistical basis for this assessment.

The tests will be carried out at the latest in September 2008, and the results will be presented in a technical report, as well as gathered with the other WP results in the final deliverable D5.9.

RESILINET WHEEL DEVELOPMENT

Resilient wheels, those incorporate rubber blocks between the steel tyre and the centre-wheel, are largely adopted on urban trams and light weight trains. Mainly, the advantage is to have a first suspension stage already at the wheel level gaining a higher ride comfort passengers.

Resilient wheel, even if they are considered far more silent than solid wheels, are generally more effective in damping low frequencies but can actually suffer from squealing noise: this type of noise is tonal and generally would correspond to a resonance of the tyre decoupled from the centre-wheel, as such the tyre is considered to be the major noise source in a resilient wheel and absorber should then be mounted to the tyre. Squealing phenomena takes place when approaching curves and the tread starts to slip against the rail and a self-sustained excitation of the tyre starts.

The Lucchini task inside the QCITY project is the development of a new absorber for the resilient wheel of the Sirio Goteborg tram. The damping system is tuned for this particular wheel to solve the squealing noise problem. The strategy is to damp directly the tyre vibration by designing passive dampers. A preliminary investigation is required in order to identify, when the tram approaches the curves, the most important resonance frequencies involved in this phenomenon. On the basis of these measurements the absorber shape and thickness are optimised. Previous experiences showed that the main modal loss factors have to be increased form the standard value of 0.2 % up to 2%. Differently from noise reduction solutions made in the past, the damper mounting system doesn't require screws. The bogie configuration doesn't allow the use of the current wheel tyre. Thus a little review of the tyre is required. The in-service experimental tests showed that the highest squealing resonances take place around 1408 Hz and 2544 Hz. The laboratory tests and FEM analysis confirmed that the tyre vibrates at these specific frequencies. Completed the damper optimisation, in service acoustic tests will be carry out for the final assessment.

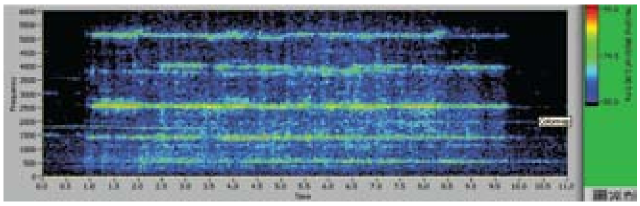


Figure 1 – Pass-by colour map, curve radius 30 m, 15 km/h

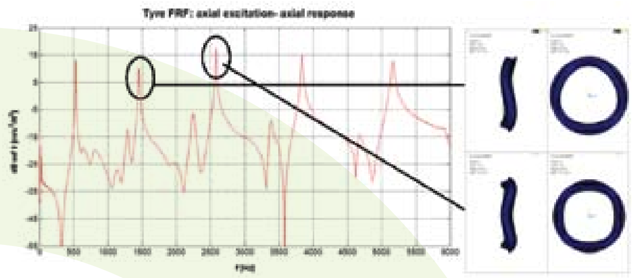


Figure 2 –Laboratory tests and FEM analysis

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