Project n° 031409
Project acronym: INQUEST
Project title: Information Network on Quiet European road Surface Technology
Instrument: Coordination Action
Thematic priority: FP6-2005-Transport 4

Deliverable D06
“6th INQUEST Workshop – Athens (Greece) – 14th March 2008”
(Report)

Due date of deliverable: 31st January 2008
Actual submission date: 14th March 2008 (Event)
8th April 2008 (Report)

Start date of project: 1st June 2006
Duration: 24 months
Lead contractor for this deliverable: BRRC – Belgian Road Research Centre

Revision: 0
Report of the 3rd INQUEST workshop

“Low-Noise Road Surfaces”

Athens, Greece
March 14th, 2008

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1. Introduction

The INQUEST project (Information Network on QUIet European road Surface Technology) is a coordination action under the Sixth Framework Programme of the European Community (2006-2006). It is realized by a consortium consisting of the Belgian Road Research Centre (BRRC), the Danish Road Institute (DRI) and the Forum of the European National Highway Research Laboratories (FEHRL).

The goal of the project is to foster the use of low-noise pavements throughout Europe by disseminating the knowledge and experience acquired in Europe and elsewhere on that rather cost/effective means of reducing traffic noise.

This is realized by organizing workshops (6 in total) in countries which did not participate in the SILVIA project.

The sixth INQUEST workshop was organized in collaboration with NTUA (National Technical University of Athens, Department of Transportation Planning and Engineering) in their premises, 5 Iroon Polytechniou, Zografou 15773, Greece.

This document is the official report of this workshop.

2. Participants

A full list with the names and details of the 136 participants in addition to the three INQUEST presenters, namely G. Descornet (BRRC), P. Morgan (TRL) and H. Bendtsen (DRI) is given in Annex 1. See overall view of the auditorium and of the discussion panel on Figures 1 & 2.
Figure 1 – View of the auditorium

Figure 2 – The discussion panel: G. Descornet (INQUEST), H. Bendtsen (INQUEST, Prof. A. Loizos (NTUA) and P. Morgan (INQUEST).
3. Programme

The workshop invitation and programme is given in Annex 2.

Copies of the slide shows were handed out to the participants in the form of a CD-ROM (Figure 3).

Figure 3 – The CD-ROM handed over to the participants (HESPER is the Hellenic Society for Pavement Engineering Research).

The Workshop was chaired by Prof. Andreas Loizos who opened the Workshop by recalling that “EU requires Greece to deal with noise issues and to adapt as necessary. As motorways come closer to the city, it becomes more important to protect urban areas against noise. Technology is increasing to assist in this issue. Noise has been a very long-standing issue for hundreds of years. Roads must have certain characteristics to benefit the user. However, in the current climate, we are not only addressing skidding resistance, but also noise, i.e. issues affecting people other than just the users. Currently, traffic noise is a major environmental problem and has a critical impact on mental and physical health. Pavement surface has a significant role in the noise production. The emphasis of today’s presentations is on the noise performance aspect. Other important characteristics include ravelling, rutting, skidding resistance: we hope that today’s speakers will reassure us that low-noise pavements do not have an adverse effect on these issues. There are key issues to be considered: ride quality, skid resistance, noise & environment, bearing capacity and road safety. These must all be considered when evaluating/selecting surfaces” (Annex 3).
4. Discussion

The presentations were followed by a debate between the audience and the panel. Hereunder follows a list of the comments, questions and answers.

**Question:** Any results on the effect of different binders on noise: does e.g. binder hardness have an effect, or the effects of PMBs?

**Answer:** Binder has a big influence on the working lifetime of the pavement, especially for porous pavements. One must use PMBs for porous pavements. But this in relation to structural durability. In SILVIA, the acoustic durability and the softness of the binder was investigated – flexibility of the pavement should be of the order of the flexibility of the tyre for optimum performance. Using bituminous binders, there will be no noise reduction effect regardless of what is done/added to the binder. Therefore the potential for working with binder to improve the noise reduction is minimal if at all. American results suggest there is, but this is more due to the surface texture.

**Question:** One assumes that the measurements results shown refer to tyres with the proper pressures. What are the effects on noise of under-deflated tyres?

**Answer:** SPB uses real passenger cars as the basis for the measurements: cars in ‘bad condition’, i.e. those which appear particularly noisy, e.g. noisy exhausts, etc. are ignored. However, one picks at least 100 passenger cars so the measurements are representative of the ‘normal vehicle fleet’ so the effects of tyre inflation eliminated.

**Question:** we are measuring noise that is a result of the tyres and the surface of the pavement. Are there experiments done where different tyres have been used, e.g. size, tread pattern and the amount of wear. Also CPX – what tyres and what about the tyres on cars for SPBs?

**Answer:** Needs another lecture! Tyre is very important component. We are looking from the side of the road engineer who cannot influence what tyres are used by the public. SPB takes tyres into consideration because we get an “average” tyre – in terms of load. CPX – only special selected tyres are used and new ones are being identified. Can you change tyre design and change noise – yes!! FEHRL has made a big study for the EU on different tyres. General conclusion is that the span of noise is wide (6 dB) but not as wide as for pavements. But no noise marking on tyre, so difficult for public to voluntarily choose low-noise tyres.

**Question:** Comparison between winter and summer tyres or measurements done in winter?

**Answer:** SPB has a meteo window when we can measure. Always try to only use summer tyres. Noise levels usually at 20 degrees and the temperature has an effect on the noise. Traditionally thought that winter tyres were rough and therefore noisy, but now using softer winter tyres for more grip so less noisy.
Question: Interesting subject. Methods of measurement? SPB appears to be subjective to many factors whereas CPX appears easy and appears to give better results?
Answer: Establishment of noise maps – not based on SPB or CPX but consider global environment based on $L_{den}$. Includes all effects of traffic variation. SPB/CPX provide corrections for different road surfaces in these global noise indices. CPX is best representative of the influence of the surface on traffic noise (total noise of vehicle). CPX only measures tyre/road interaction noise. That is why classification is based on the SPB but the CPX is used for COP. If CPX levels comparable, implies that SPB would be similar. Noise mapping would be using predictions software.

Question: Bituminous mixtures used in porous surfaces: Mix designs? Aggregate, grading? What happens about cleaning and lifetime?
Answer: Series of big questions! PA has special grading curves (shown in presentations). When designing, must optimise grading curve to optimise porosity. Also need certain technical durability. Air in voids makes bitumen stiffer and reduces lifetime of bitumen. Need a highly modified bitumen, e.g. as used in Copenhagen. Clogging: Tricky on PA. As a rule of thumb, in urban conditions there is a threat of clogging. TLPA is designed to tackle this. High pressure cleaning was used in Copenhagen, but pavement clogged over a 7 year period regardless. Use of 8 mm aggregate provides more chance of keeping voids unclogged. Highways: not much clogging before getting very old; due to the self-cleaning action of the traffic. Clogging/cleaning needs further research. Pilot in Greece done with low-noise porous pavements. Clogging occurred very quickly!

Question: Did one test in-situ methods for thermal recycling for restoration of voids?
Answer: to avoid clogging on urban roads one must start cleaning as soon as pavement is constructed and thereafter twice a year. Once pavement is clogged, one cannot recover the voids. Clogged PA can be recycled in-situ. Dirt that clogs it doesn’t pose any problems.

Question: There have been complaints in Germany about the accuracy of some of the noise maps. Measured noise levels were 10 dB higher than predicted on the noise maps. How accurate are these maps in relation to the pavement?
Answer: We are not experts on mapping/prediction but it is to be expected that such a problem could occur if the description of the pavement is incorrect. Could also be that the prediction model is not so good or the way it is used was not so good; there is a human factor involved. Anyway, prediction methods are the only way for new roads.

Comments: Noise barriers used in Greece have been misunderstood. All barriers are considered to be ‘transparent’. The effects of reflections are not considered. Safe pavements have been provided but noise has traditionally been overlooked.

Question: Did measurements include temperature, road gradient?
Answer: Temperature could have an influence. It is being studied and can be corrected for by applying 0.1 dB reduction per 1°C increase. SPB/CPB/CPX are anyway recommended to be conducted in certain temperature range. The slope is already included in traffic noise models. No SPB may be carried out where there is a slope, only on flat even roads.

Question: If we have an ideal porous pavement that has cracks or faults, to what extent does this reduce the noise mitigation?
Answer: Porous pavements are strong (resistance to rutting) but if cracking appears then cracks increase the noise level. At end of lifetime, ravelling will increase noise by 1-2 dB. Same will occur with cracking. It has been investigated and modelled in SILENCE.

Unanswered questions: Can we use porous pavements and thin layers that are currently available in Greece? One wonders about the durability and maintenance of PA. SMA is very expensive. So what to do? The problem is that cost reduction is the issue and doesn’t take into account maintenance issues. SMA might be the best option. Investigations have highlighted the importance of the pavement. Now we know about noise performance. Can we simply use a less noisy pavement?

Comment: Noise reduction values commonly of order of 1-4 dB. All these values are based on a DAC reference or an SMA, which is generally already not noisy but not necessarily quiet.

5. Conclusions

Prof. A. Loizos concluded: next after traditional safety considerations, now noise is becoming important. Greece must not lag behind. This event encourages us to think about the issues.

6. Evaluation

An evaluation form was distributed during the session. Thirty-two of them were returned. The synthesis of the replies is given in Annex 4.