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Report of the 7th INQUEST workshop

"Low-Noise Road Surfaces"

Ljubljana, Slovenia
April 25th, 2008

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1. Introduction

The **INQUEST** project (**I**nformation **N**etwork on **QU**iet **E**uropean road **S**urface **T**echnology) 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

1. by organizing dissemination workshops (6 in total) in countries which did not participate in the SILVIA project.
2. by setting up a European group of the main stakeholders, a so-called "Users Group", with a view to paving the way to future European standards on the classification, labelling and conformity of production testing of low-noise road surfaces.

The latter was the objective of the seventh INQUEST Workshop organized in conjunction with TRA – The Transportation Research Arena meeting in Ljubljana on April 25th, 2008.

This document is the official report of that workshop.

2. Participants

A full list with the names and details of the 19 participants is given in **Annex 1**. Twelve European countries were represented, namely: Austria, Belgium, Denmark, France, Germany, Great-Britain, Netherlands, Norway, Portugal, Slovenia, Spain and Sweden, as well as EC DG RTD and CEN.

3. Programme

The workshop programme is given in **Annex 2**. It was fully performed as planned.

G. Descornet, Project Coordinator, and H. Bendtsen, Convener of the Users Group, respectively chaired the morning and the afternoon sessions.

3.1 Opening

G. Descornet first greeted Mrs Maria-Cristina Marolda, Project Facilitator, and thanked her for her presence and support to this event. After a round of self-introductions, the timely participation of Thierry Legrand as CEN Programme Officer was welcomed.

3.2 Introduction by Guy Descornet (See ppt in Annex 3)

- Main difficulty for classification is the large spread of noisiness within the same surfacing type.
- Threshold levels emphasised: Annoyance: 55 dB(A); Unacceptability 65 dB(A).
- Brief overview of SILVIA and INQUEST.
- Why need a CEN standard? There is a need to widen the market for surfacing contractors across the whole of the EU. This is best achieved by having a harmonised classification system including acoustic labelling and COP assessment. A CEN standard would formalise such a classification system and achieve this wider marketing.
- Brief overview of ERA-NET Road Fast Track Pilot II project. The main recommendation was *"to introduce type approval testing and a conformity of production procedure"*.
- Organization of the remainder of the meeting: I. Overview of European view - II. Overview of current practice – III. The way forward.

3.3 EC perspective by Maria-Christina Marolda

- Commission's attitudes towards transport have changed. Transport is now a programme to itself and no longer fragmented.
- Now consider transport system as a whole. Surface transport considers the vehicle, the infrastructure and the user, with infrastructure being a fundamental part.
- There are 5 pillars in the programme which must be taken into account: greening, urban, safety, competitiveness, logistic & decongestion.
- Pavements which can reduce noise and reduce maintenance (decongestion aspect) and maintain safety are very important.
- INQUEST, as a dissemination project, appears to have responded to many of the objectives of the Commission's research programme.
- Standards are a fundamental tool for harmonization of the classification.

3.4 The need for harmonisation by Luc Goubert (See ppt in Annex 4)

- A summary of classification systems is presented, identifying where in Europe and elsewhere these are used. Relevant EU projects and WGs are also identified.
- Single sheet summaries of European systems – these are not necessarily systems that are used for procurement but includes classification of surfaces/surface corrections within calculation models including Austria (RVS prediction model), Belgium (noise reductions for different surface types at different speeds), France (prediction model), Germany (DStrO), Hungary (noise

corrections for different categories), Italy (corrections for different surfaces in terms of broadband and spectral levels; this also includes corrections for surfaces on gradients), Netherlands (C_{road}), Slovenia, Spain, UK, USA, Europe.

- Comparison of correction terms for comparable surfaces presented; it can clearly be seen that the values differ between different countries.
- Sources of inconsistency: different indices, different reference surfaces, non-comparable surface types, among others.
- Conclusion: inconsistent classification across Europe, although there is a lot of experience.

Discussion:

- Descornet – classification as described here, generally only used for prediction models. Using existing systems give different values, so need to focus on a classification system that can be used in a contract.
- Bendtsen – we are talking often about noise reductions, but this is dangerous. The best way is to talk in terms of absolute levels.
- Goubert – absolute values don't mean very much to non-experts.
- Descornet – when speak of relative values can often sound unimpressive when the reference surface is already quiet.
- Kragh – in Danish systems encouraged by surface contractors to have a noisier reference.
- Alberts – have 'silent pavements' and classification systems in each country. No confusion within individual countries – why need an EU system?
- Marolda – need to open the market to other countries and have a European structure.
- Descornet – say a French contractor has a proprietary product. If you specify a product you can have a wide range of noise reductions as shown in introduction presentation.
- Sandberg – must remember that the same product will not be equally effective in different countries, e.g. weather conditions etc. Will have biggest impact on lifetime rather than initial levels.
- Bendtsen – most of work on pavements is only done within the borders of individual countries – many surfacing contractors do not 'export' their surfaces. More complicated without common classification or description
- Haberl – to implement low-noise pavements more widely, need EU system. E.g. in Austria, Porous Asphalt has a poor reputation.

3.5 SILVIA classification system by Phil Morgan (See ppt in Annex 5)

- The system focuses on new surfaces and does not include acoustical aging.
- CPX can also be used for acoustical monitoring of road networks at specific periods like every second year or more.
- It was discussed how many test sections to include for acoustical labelling. SILVIA suggests a compromise of 2. Germany and the Netherlands state using 5. It is a balance between accuracy and practical implementation. A higher tolerance can account to some extent for using fewer test sections.
- Who is going to suffer for the uncertainty, the environment or the contractor?

Discussion:

- Bartolomaeus – Need more than 2 test sections for type approval. In Germany use 5.
- Bendtsen – the more test sections included will improve the accuracy, but it is a balance between accuracy and practicality. In order to get started, then perhaps 2 is acceptable.
- Bartolomaeus – if make labelling with SPB and also use CPX, you are not solving the SPB/CPX relationship. Ideally want narrower tolerances.
- Descornet – SPB/CPX relationship is not reliable.
- Sandberg – all the uncertainties in the measurement methods will work in both directions; it is a sensitive political issue – who will suffer: contractor or environment?. Risk/uncertainty should be shared by both.
- Morgan – labelling should be for individual products: DAC 0/10 ≠ DAC 0/14.
- Bartolomaeus – the SILVIA proposal presents big problems.

3.6 SILENCE classification system by Guy Descornet (See ppt in Annex 6)

- SILENCE project started on year before the end of SILVIA and focuses on urban conditions.
- There are specific issues in urban areas which must be taken into account when doing measurements – unavoidable sound reflections, low speeds, low gear settings and few heavy vehicles.
- To use the SILVIA scheme in an urban environment, it requires some adaptations – SPB measurements are undertaken using a backing board. Using also an adapted SPB index so that measurements are weighted differently according to the road type and vehicle categories. Also need to measure much less heavies. Using wider confidence intervals for validity of SPB results. SPB could be replaced by CPB on a test track provided certain conditions are satisfied.

Discussion:

- What types of heavy vehicles should be used?
- Descornet – buses are quite possibly the most likely, but again it should be noted that this, like SILVIA, is still only a proposal.
- Sandberg – increased use of hybrid vehicles in urban areas will be a significant problem that needs to be addressed in the future.
- Bartolomaeus – are aware these vehicles exist, but they are excluded from the measurements.
- Descornet – label values should have an ‘expiry date’ to take into account changes in the vehicle fleet, etc.

3.7 Current practice in Slovenia by Mihael Ramšak (See ppt in Annex 7)

- Traffic noise is the major environmental noise problem in Slovenia.
- Predominant noise control measures are noise barriers, façade insulation and SMA (mainly on motorways). Main surfaces are asphalt concrete (68.1%) and SMA (23.8%). PA only 0.1%.
- No reliable noise results for surfaces in Slovenia – measurements performed in 2002 but using a non-standard pass-by method. More extensive measurements currently being performed within SPENS.
- PA used for better drainage but not for noise control due to costly and difficult maintenance difficulties, poor durability. However, reasons for implementing PA for noise control are recognised. There are plans for more use of PA.

Discussion:

- Descornet – what is the primary use of the noise reduction values?
- Ramšak – they are used only for modelling. There are no classification or control procedures in Slovenia. Measurements are sometimes taken to see if the corrections in the model are representative of the real situation.

3.8 Current practice in Sweden by Ulf Sandberg (See ppt in Annex 8)

- SMA 0/16 almost everywhere. Road noise recognised as a critical and increasing problem. Swedish pavements are among the noisiest in Europe.
- New 5-step road surface selection policy issued in October 2007.
- Swedish Road Administration believe it is time to coordinate research .

Discussion:

- Milford – will there be more innovation in Sweden than only to use SMA 11 and SMA8?
- Sandberg – when the SRA are presented with additional data for surfaces such as thin layers, then there may be a shift in policy.
- Sandberg – the effects of particulates are being increasingly recognised. Rolling resistance may be more important than noise since it can play a major part in reducing CO_2 emissions.
- Descornet – lack direct comparisons between noise and rolling resistance.
- Goubert – can you not make SMA with smaller aggregate more resistant to ravelling from studded tyres?
- Sandberg – already use high PSV aggregate, but more research on the binder is required. It is also being considered for ways of reducing the use of studded tyres.

3.9 Current practice in Denmark by Jørgen Kragh (See ppt in Annex 9)

- Presentation of first generation classification system – no legal consequences at the present time. Details of the scheme are published.
- Based on CPX measurements on purpose-built test sections (>= 100 m, measure at least 400 m), and three classes of noise reduction are defined. Classes have been derived based on the correlation between predicted SPB and CPX_{DK}. Labels for 50 and 80 km/h.
- The CPX index is modified to give a Danish CPX index.
- Field calibration of different CPX trailers is carried out on an annual basis. 6 different surfaces for urban calibration, 5 different surfaces for high-speed road calibration.
- Contractors have confidence in the existing system. COP testing might be introduced in the future.

Discussion:

- Bendtsen – developed in consensus between contractors and road owners. Road owners tendering for projects now include the noise classes. One has brought noise onto the agenda and one may speak of a breaktrough in Denmark. Now getting less noisy pavements on Danish roads. Obviously less sophisticated than the SILVIA proposal.
- Descornet – only criticism is that there is no reliance at all on SPB measurements. SILVIA said that SPB was the only representative measurement method.
- Sandberg – when SILVIA was finalised, it was the right procedure. However since then, there is a greater understanding of the variation in CPX measurements. Are now trying to reduce uncertainties due to tyres – expected to be finished at the end of 2008 resulting in an improved CPX method. In this case, it is considered that the Danish procedure might be a better one to be adopted than SILVIA.
- Descornet – my point was about the representativity at the road side.
- Sandberg – may be easier to get consensus from all parties because CPX measurements are easier. There is a way of making the CPX method better – doing something at a European level might allow the construction of reference surfaces that could be protected from weathering, e.g. by covering them with a 'tent'. This is already done in Japan. All CPX vehicles in Japan are tested once a year on these surfaces.
- Descornet – such a facility could also be used for calibration of friction testers.
- Bartolomaeus – CPX method is interesting for COP but noise predictions in regulations could not be done using CPX because they don't take account of variations in the vehicle fleet. Therefore should keep CPX.
- Goubert – should also keep a SILVIA "LABEL2" approach.
- Kragh – should be able to establish general SPB/CPX relationship for different families of surfaces.

3.10 Current practice in Austria by Jürgen Haberl (See ppt in Annex 10)

- A wide range of noise reducing pavements is used in Austria. All these pavement types are fixed in regulations and guidelines. Have limit values for rolling noise for new pavements in RVS.08.16.01 (Jan 2007). CPX but with a different trailer and tyre.
- Acceptance tests are however not generally done despite being in the regulations. Many parties want to place a low-noise surface simply to say that one has been laid, but it is never proved whether the promised noise reduction is actually achieved.

Discussion:

- Descornet – Austrian noise reductions values only used for noise prediction?
- Haberl – That is correct.

3.11 The way to move forward through CEN by Thierry Legrand

- Legrand - Quickest way to get normative document is to pass through the workshop process. A normative document is not as strong as a standard but can be produced quicker – within 6 months. Have an IT workshop/website where all interested parties are registered. All members meet. At least after 2 months a document is put on the website and then give the opportunity to receive comments for 2 months. Core group then takes back comments and tries to produce a final document. If you want to do more work, the workshop can be created with a much longer programme. A business plan must first be elaborated. This approach does not pass through the national standardisation bodies. Such a document would have more strength then say an INQUEST report. After two years, it can then be converted into a standard.
- Descornet – So we can set up a 'WG' which is endorsed by CEN, so publication of any document will be through CEN but doesn't have the same status/weight as a CEN standard. The document is a CEN CWA (CEN Workshop Agreement) and is only a 'recommendation'.
- Legrand - The basic timetable: Create a business plan, e.g. a plan to produce a document on classification. Business website put on public area of CEN website for parties to declare an interest. Interested parties then register. Then have a meeting with all interested parties. The interested parties then work to produce the document. When the document is prepared, the registered parties have 2 months to make comments. Comments acted upon to produce a final document which will then be approved by CEN and published as a CWA. After 2-3 years, this document can be turned into a regular standard using the usual procedure involving the national bodies and comprising a formal vote.
- Descornet – who can make a proposal?
- Legrand – any group of stakeholders (could be FEHRL, but does not have to be a national standards association) submits the proposal to CEN. The proposal is discussed with CEN on the basis of the business plan. All (most of the) costs related to the proposal and the document will need to be provided by the

stakeholders. Sometimes it might be possible to get some funding from the Commission, but not very often. The budget needed is about 30 k€.

- Marolda - funding this standardisation process is unfortunately not in the scope of DG TRE.

3.12 Current practice in Germany by Wolfram Bartolomaeus (See ppt in Annex 11)

- RLS-90 noise classification system in Germany. Includes correction for the road surface (DStrO).
- SILVIA method – there are issues using this method because of the spread in levels on PA – results presented show a 12 dB spread for SPB measurements on high-speed roads.
- Have looked at the effect of variance in production. Standard deviation of production has a big effect.

Discussion:

- Kragh – Has PA been tried on low-speed roads?
- Bartolomaeus – yes but not widespread. More experiences in Denmark.
- Goubert – Have the benefits of cleaning on acoustic performance been investigated?
- Bartolomaeus – investigated on a 70/80 km/h road.

3.13 Current practice in The Netherlandsby– Rob Hofman (See ppt in Annex 12)

- Classification to stimulate use of low-noise surfaces. Use a SILVIA type system. Harmonised product labelling used, but COP only carried out by a few authorities. C_{road} value based on SPB measurements at a 5 m microphone height and are publicly declared as the official noise reductions for broad categories of surface, e.g. SLPA, TLPA.
- Contracts state acoustic performance requirement in terms of the product category. Not checked after laying.
- RWS has interviewed all relevant parties (noise experts, asphalt specialists, decision makers). Only noise experts wanted labelling and COP. Nobody wanted a lifetime requirement and the system/measuring techniques were considered to be unreliable.
- In political arena, classification is undesirable – needs long-lasting trials which would prevent construction of new roads.

Discussion:

- Descornet – invitation to this meeting sent to all European road directors – how do you get them involved?
- Bendtsen – need to start it and then they will get involved, so that they will also all get involved in the development.
- Alberts – know what the decision-makers want. When have a technical consensus, then stakeholders will get involved.

- Goubert – surprised that Netherlands say undesirable because investigations for ERANET showed positive view, particularly for the procedure used for the "Stimulation Regulation" for the low speed roads.
- Hofman – main problem is mobility, which is the most important thing. If a product was poor, then it would need to be removed which would affect mobility.
- Goubert – one could work with a bonus/malus system, rewarding/punishing financially contractors who did a good/bad job.
- Sandberg – is there a significant difference between national authorities who would want TLPA and local authorities who would want thin layers?
- Hofman – there does seem to be a different perspective.

3.14 Current practice in UK by Phil Morgan (See ppt in Annex 13)

- The latest 10 year strategic pavement plan to be ended in 2011 is that 60 % of the road network shall be resurfaced by noise reducing pavements.
- The pavements used in the past were HRA and concrete. And the surfaces used as low noise is AC and SMA which is the standard reference pavements in other European countries.
- In the HAPAS system there is also an option for including noise classification/labelling. A HAPAS certificate has generally a 5 year lifetime. HAPAS have some mandatory tests. Noise is an optional test. Noise test must be carried out on two road sections with the same pavement type. The noise test is SPB measurements including 3 vehicle categories. There are levels for 80 and 110 km/h. The reference level is a HRA. Here SMA gives -3 dB level and single layer porous asphalt -6 dB. If a contractor wants to make pavements on the national highway network a noise labelling from HAPAS is necessary.

Discussion:

- Sandberg – noise test in HAPAS is only optional. What happens if the surface has not been noise tested? Can it still be used?
- Morgan – I believe only on non-HA roads because HA always want low-noise surfaces (RSI = -2.5 dB(A)).

3.15 Current practice in France by Philippe Klein (See ppt in Annex 14)

- INRETS has done work on hybrid models for predicting noise from texture and tyre contact data. Originally initiated during SILVIA, it would be used within LABEL2 of the SILVIA classification procedure. More recent work done using measured noise levels rather than the calculated noise levels used in SILVIA. A prediction tool has now been developed based on this which can predict noise levels based on texture but also allows a comparison of texture measurement systems.

Discussion:

- Fraga – how was the texture determined?
- Klein – using static laser but slide example uses data from BASt.

- Bendtsen – are labelling procedures being used in France?
- Klein – not at the present time.
- Goubert - envelopment process does not appear to be so efficient if the surface has a lot of positive texture.
- Klein – envelopment parameters were not appropriate to deal with the strong positive texture.

3.16 Current practice in Spain by Adolfo Guell (See ppt in Annex 15)

- Most Spanish noise legislation is very recent.
- Several experiences in Spain with TLPA 5 mm aggregate in upper (20-30 mm), 16 mm aggregate in lower layer.
- Also experiences with SMA. Results were good but noise reduction was soon lost. Rubber modified bitumen has also been tried.
- Currently studying surfaces made of bitumen with added tyres dust.
- Measurements are done using an M+P trailer which has been purchased by CEDEX. Should be noted that measurements are never repeated in the same locations.
- Cleaning machines are being developed.

Discussion:

- Bendtsen – How many km of porous asphalt?
- Guëll – Amount laid is now considered unimportant because of the following: PA surfaces are being changed in the north because of problems with winter maintenance. PA surfaces in the south are being changed because due to the dry weather the pores get clogged too quickly.

3.17 Current practice in Norway by Milford Ingunn (See handout in Annex 16)

4. Need for a users group - Discussion

- Bendtsen - There is labelling systems in action in United Kingdom (HAPAS), the Netherlands (C_{road}) and in Denmark (SRS). Only the Netherlands have a COP system and it is used on local level but not on state level. There is a consensus that traffic noise is a problem and that the pavement should be tackled to reduce noise. However, the way that this is done varies considerably across Europe. New tendency in Europe seems to be the use of smaller aggregate and more open, thinner pavements. When thin layers are optimised, you can end up with a thin porous layer which is perhaps a step too far. How to apply these pavements on the market? Only a few countries undertake noise labelling (RSI, C_{road}, SRS). Nobody seems to actually undertake COP – in the Netherlands it is done but generally on local roads (because it is legally prescribed) and not on the highway network.
- Descornet – What to do next? Let us ask around the table.
- Alberts – there is not a problem at a national (Dutch) level, so still not convinced that there has to be a European wide system. Would provide benefits in terms of

using pavements from outside the Netherlands, but would most likely only be of interest if they could get the same pavement from abroad for less cost than they would pay in the Netherlands. The benefits for decision-makers in terms of the costs need to be established – this is obviously not a technical problem. Can live with the existing uncertainties.

- Hofman – we want more silent roads in Holland and this might only be achieved by bringing in pavement technologies from outside of the country. The increased maintenance costs of low-noise pavements are an issue because bringing down costs is also a target.
- Bendtsen – having the labelling system puts noise as a competing factor for the pavement industry. Therefore have good experiences with the system. Lord Mayor of Copenhagen has said will use low-noise pavements based on the results of SILENCE.
- Klein - There are studies about durability already being done in France. Easier for administrations to build noise barriers rather than laying low-noise surfaces. There is forthcoming work looking at implementing classification methods similar to those proposed in SILVIA. LCPC and suppliers are involved in this work.
- Descornet – there are many proprietary products in France, so when a contractor has something to sell, it results in interest in a classification system.
- Hofman – medium speed roads in Holland have a classification system.
- Bendtsen – would be good if info from this system could be fed back to us.
- Sandberg – there is CEN group (TC227/WG5) interested in classification. We should be aware of this.
- Descornet – Michel Boulet (Chairman of CENTC227WG5) sent a request for a work item on classification to CEN, but no reply so far. It will be chased up again this summer. Perhaps a CWA procedure might be a more effective approach.
- Goubert – first have to agree on what the procedure will comprise.
- Descornet – no time limit with CWA?
- Legrand – it must be at least 6 months.
- Bendtsen – consensus work done in Denmark based on the SILVIA proposals having industry involved has been very important. Any joint European effort would have to find a way to include such a consensus.
- Descornet – contact EAPA? ERF? CEDR? FEHRL Task force?
- Bendtsen – could the next meeting include some local pavement contractors?
- Morgan – the need to use low-noise surfaces in END action plans might provide a greater drive incentive for COP assessment and improved labelling of surface.
- Hofman – everybody is using low-noise pavements and there is some cross-over between the test methods that are applied.
- Kragh – must distinguish between what is to go in contracts and what is to feed in to calculation methods.
- Descornet - Should there be a standard reference surface? ERANET project was intended to make recommendations to road directorates. What has happened to that?
- Milford – Need some form of defined process before you can approach the road directorates.
- Fraga – In Portugal, national road administration is in the state, not clear who is in charge of what. Should try to have a meeting to clarify contacts etc. There is interest in local administrations but needs further investigation to clarify interests.

5. Conclusions

The majority thinks that there is a need to move forward and to associate more stakeholders. As INQUEST was planning to formally establish a group, these proceedings can be considered as the founding document of a group. One obvious way to keep in contact is through Internet. Therefore, FEHRL will be asked to host it on their web site. The Danish Road Institute will act as first Convener of the Group. They will host the next meeting in Copenhagen on 16/17 September 2008.