

## **WG 3 „Computation and Measurement“ Progress Report September 1999**

### Work programme of WG 3

WG 3 shall elaborate common calculation and measurements methods for noise from road, rail, air traffic, outdoor machinery and industry.

The calculation methods shall be suited for calculating the noise exposure in terms of  $L_{EU}$  and  $L_{EU,N}$  as proposed by WG 1. Additionally for air and rail traffic and for impulsive industrial noise the calculation methods should be able to predict sound levels for single events.

Calculation methods shall be developed for a variety of topographical and meteorological conditions occurring in the Member States.

A new task of WG 3 is to specify preliminary guidelines for the period when common methods are not yet available.

### Meetings

Since May 1999 (last report) WG 3 met twice:

3rd meeting July 1999 in Berlin

4th meeting September 1999 in Brussels

### Current activities

In the framework of its action scheme WG 3 has worked at the following activities:

- preparation of an inventory of existing methods
- elaboration of specifications for the EU computation methods for road and rail traffic noise
- elaboration of research needs
- elaboration of preliminary guidelines

### Preparation of an inventory of existing methods

The WG is preparing an inventory of existing methods to predict noise from road, railway, and aircraft noise in the Member States. The inventory shall include both procedures and limit values for various purposes. It can partly be based on existing evaluations which have been carried out in some European countries. For aircraft noise the inventory is nearly complete, and it can hopefully be made available soon. For the other sources information from some Member States is still lacking, and it will be collected in a research project.

An impression about the variations in regulations is given in Table 1. It presents an overview over the situation for road traffic noise. Obviously  $L_{Aeq}$  is the preferred noise indicator (in accordance with the proposals of WG 1) but percentile levels are still in use in some countries.

The reference times vary considerably between countries: 3 (day, evening, night), 2 (day, night) or only one period (24h) are in use. Additionally the definition of daytime, evening and night-time can vary.

Differences are also found for the decisive receiver location. It is chosen either in the free-field (FF: reflection at the building not considered) or F : at the façade). The

differences in level amount to 3 dB(A) which has to be taken into account when limit values are compared.

Country	Indicator	Day	Night	Receiver location	limits day	limits night	prediction
Austria	$L_{Aeq}$	6 - 22	22 - 6	FF	60	50	RVS 3.114
Belgium	$L_{Aeq}$	different guide values in the regions					various
Denmark	$L_{Aeq}$	24 h		FF	55		NPM 96
Finland	$L_{Aeq}$	7 - 22	22 - 7	FF			NPM 96
France	$L_{Aeq}$	6 - 22	22 - 6	F	60 - 65	55 - 57	NMPB 1996
Germany	$L_{Aeq}$	6 - 22	22 - 6	FF	59	49	RLS 90
Greece	$L_{Aeq}$	8 - 20		F	67		CRTN
Ireland	$L_{A10}$	6 - 24		F	65 - 68		CRTN
Italy	$L_{Aeq}$	6 - 22	22 - 6	F			-
Luxembourg							
The Netherlands	$L_{Aeq}$	7 - 19	23 - 7	FF	55	45	RVM
Portugal	$L_{50}$	7 - 22	22 - 7		65	55	-
Schweden	$L_{Aeq}$	24 h		FF	55		NPM 96
Spain	-	-	-	-	-	-	-
UK	$L_{A10}$	6 - 24		F	68		CRTN

Table 1: Regulations for road traffic noise

Typical noise limits at new roads range from 55 to 67 dB(A) at daytime and 45 to 57 dB(A) at night time. The field of application may vary, e.g. planning purposes, licensing of new roads, enforcement of insulation schemes.

The last column of Table 1 indicates that various calculation procedures are applied in the Member States. It turns out that the general formulas for the emission of sources and the transmission are very similar, but there is a large variety in the definition and quantitative representation of emission factors (e. g. types of vehicles, reference points for emissions, speed dependencies) and transmission factors (e. g. weather conditions, reduction by screens). E. g. differences up to 5 dB(A) are found between the emission data for light and heavy vehicles at the same speed.

To give an example of possible differences between procedures Fig. 1 shows data of a comparison between the German and the French procedure being applied for the same road on the basis of equal information about the traffic. The German procedure is based on weather conditions favourable to sound transmission. The French procedure takes the long-term weather condition into account. For comparisons the French results for

favourable weather conditions are shown, too. It can easily be seen that the difference can amount to more than 5 dB(A) even under equal weather conditions.

These findings strongly support the need for harmonisation of procedures when the noise situation in the Member States shall be compared and assessed.

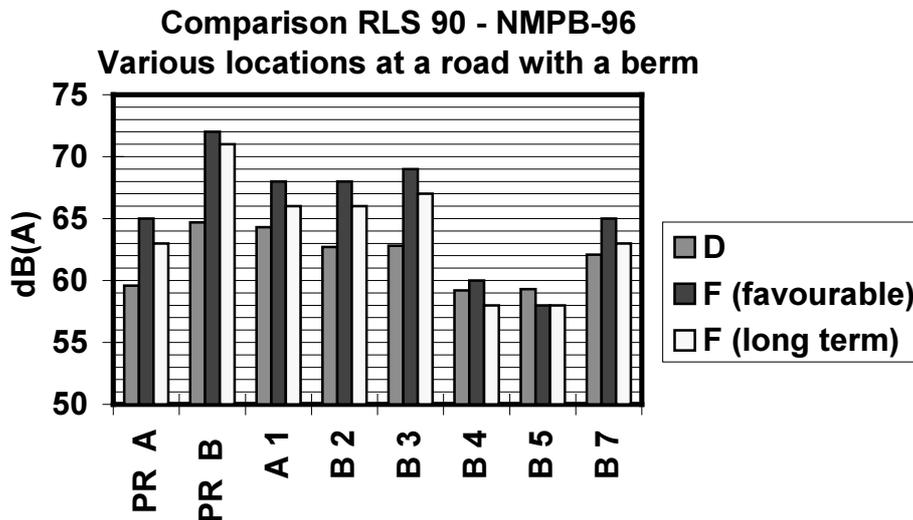


Fig. 1 Comparison of the German and French prediction method for road traffic noise (different receiver locations at a road)

#### Elaboration of specifications for the EU computation methods for road and rail traffic noise

As many of the prediction methods are based on research results from the 70s and 80s WG 3 decided that the common calculation methods should not be a compromise among existing methods. The methods should be a „step ahead“ making use of the scientific knowledge of the last decade and the potential of modern computers. By this a more precise prediction of the exposure can be achieved resulting in a fairer use of the restricted financial means for noise reduction measures.

In the model to be developed

- source emission data shall be clearly separated from sound transmission data
- the same sound transmission model shall be applied for all sources
- the presentation and categorisation of noise sources shall be improved so that future technical developments can be easier integrated into noise prediction schemes.

During the meeting in September 1999 qualitative and quantitative specifications have been discussed including requirements for accuracy and validation. These specifications will be worked out in the next months and will be made available for the public.

#### elaboration of research needs

For the elaboration of the common calculation methods extensive research is still necessary. WG 3 has outlined the indispensable projects:

### *Sound emission (road)*

The aim of the project is to deliver a source characterisation for road traffic noise which complies with the requirements given above. Working packages of the project are:

- definition of the main sources of noise from vehicles under all reasonable operating conditions. The data shall comprise source positions, sound power levels, frequency characteristics, directivity.
- categorisation of road vehicles, vehicle/road interaction, operating conditions of roads, and weather conditions to be considered
- evaluation of number of categories depending on the necessary accuracy
- definition of methods how data for a European data bank can be got from existing information and/or new measurements

### *Sound emission (railway)*

A project similar to the one described above has to be performed for railway noise. Special attention has to be given to aerodynamic noise at high speeds of the trains.

### *Sound emission (aircraft)*

To get a consistent prediction methods there is an urgent need for detailed sound emission data of aircrafts under all operating conditions as well. The availability of information on spectra and directivity is rather poor since controlled measurements are very costly. But it is known that the aircraft manufacturers have these data at their disposal. Therefore, efforts should be undertaken to make the information available.

Nevertheless, WG 3 would like to continue its work on a prediction method for aircraft noise. WG 3 has got information that some projects related to aircraft noise have been worked out for the 5. Environmental Research Programme. WG 3 intends to co-operate with the research teams.

### *Propagation Modelling*

The aim of the project is to provide sound propagation models that are suitable for use with the source models being developed in the projects described above.

Models with different degrees of complexity shall be developed which meet the needs for different fields of applications. These models should be derived from a comprehensive reference model with a given accuracy which should be validated.

Factors to be taken into account are:

geometrical spreading of noise, air absorption, meteorological effects, ground effects, height of propagation, topography, the presence and effects of barriers, berms and other forms of screens and reflections from buildings and other surfaces.

In the project, the possibilities of advanced modelling technique such as Finite Element and Boundary Element Methods, Wave Field Extrapolation (particularly Parabolic Equations) should be evaluated to improve the physical representation of some of the factors given above.

The project shall include investigations how the geometry and acoustical properties of the environment has to be described and how the necessary information concerning the meteorological influences can be obtain.

#### *Integration of the source and propagation modelling*

The models shall be integrated and a set of prediction models (as handbook or computer programme in a suitable programming language) shall be developed. It shall be worked out how the maintenance, extension, and improvement of the prediction models shall be organised.

In the view of WG 3 it seems to be sensible and possible to carry out a large project which covers the development of road and railway noise prediction methods.

#### elaboration of preliminary guidelines

WG 3 has started discussions about an interim proposal for calculation methods for the period when the common methods are not yet available.

For aircraft noise the updated Integrated Noise Model (INM 6.0) which will be available soon is a possible candidate. It will be checked after the publication.

For road traffic and railway noise a check list has been worked out to evaluate the existing models. The evaluation will be carried out by international experts in a research project.

#### measurement methods

Concerning measurement methods WG 3 is in close contact to an ISO working group (ISO TC 43/SC1/WG45) which is revising ISO 1996 „Description, measurement, and assessment of environmental noise“. Information about the progress will be available by the end of 1999.