CEDR

Conférence Européenne
des Directeurs des Routes

Conference of European
Directors of Roads

Report Factsheets:

END noise mapping data for major roads
Policy options END improvement
Colour proposal END noise mapping
Common noise assessment method (CNOSSOS-EU)

February 2013

REPORT FACTSHEETS

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Prepared by: CEDR Project Group Road Noise: subgroup factsheets

Wiebe Alberts (NL) subgroup leader
Wolfram Bartolomaeus (DE)
Jesús Rubio Alférez (ES)
Vincent O'Malley (IE)
Michiel Roebben (NL)

Members CEDR Project Group Road Noise:

Klaus Gspan and Christof Rehling (AT)
Ms Barbara Vanhooreweder (BE-FL)
Ms Elena Sophocleous (CY)
Wolfram Bartolomaeus (DE)
Jakob Fryd (DK)
Villu Lükk (EE)
Jesús Rubio Alférez (ES)
Arto Kärkkäinen (FI)
Marc Di Martino and Emmanuel Le Duc (FR)
Ms Efterpi Giannopoulou (GR)
Vincent O'Malley (IE)
Ms Patrizia Bellucci (IT)
Guntis Graveris (LV)
Wiebe Alberts (NL) chairman
Nico Faber (NL) secretariat
Michiel Roebben (NL) secretariat
Ms Ingunn Milford (NO)
Jacek Wojtowicz (PL)
Kjell Strömmer (SE)

Approved and amended by: EXECUTIVE BOARD on

Addressed to: GOVERNING BOARD on

Executive summary

Topics CEDR Road Noise

The topics identified for of the CEDR Road Noise were listed in the CEDR Strategic Plan 2009-13:

- noise mapping,
- action planning,
- informing and consulting the public,
- tyre noise and tyre label,
- European noise model,
- factsheets on different issues.

During the initial meeting of CEDR Road Noise, the group reviewed how the different short listed topics contributed to the overall goals of CEDR TD Construction. The outcome of this assessment highlighted that the topic on 'informing and consulting the public' was scored relatively low compared to the other listed topics. Therefore, the decision was taken not to proceed with this topic. In addition, the issues identified within the topic 'factsheets' were reassessed during the work of CEDR Road Noise and it was concluded that 'road noise research needs' should be addressed under this heading.

Reports CEDR Road Noise

In concluding their work, CEDR Road Noise produced following six reports:

1. CEDR Road Noise executive summary report,
2. noise mapping report,
3. action planning report,
4. report on tyre/vehicle noise (value for money),
5. report road noise research needs,
6. report factsheets.

This report focuses on the findings of the issues addressed in the factsheets. During the period 2009-13, CEDR Road Noise produced four factsheets addressing END major road data, END policy options, END colour proposal and CNOSSOS-EU.

END major road data

In accordance with the requirements of the European Noise Directive (END), the European Environment Agency (EEA) launched on their website, the most comprehensive overview of noise exposure to date. In 2011 CEDR Road Noise carried out an assessment of the EEA data for noise exposure along major roads. This assessment identified a number of anomalies associated with the data which called into question the veracity of the published data. It is important that any data published on the EEA website is robust because this END noise exposure data are the key drivers for noise abatement at a European level.

The issues associated with the major road data published on the EEA website may be attributed to several sources of errors. Important errors may be related to the incorrect handling of data such as rounding data to the nearest hundred, misinterpretation of the dwellings definition, the definition of noise bands and missing major roads data inside agglomerations.

In order to improve NRAs' output of future END noise mapping in terms of (more) accurate noise exposure data, a number of recommendations were formulated. The most important recommendation is the use of a data quality assessment. NRAs should have quality control procedures in place to assess the quality of their data using such variables as household size, residential density and distance of noise contours before the data is reported to the END competent authority of the relevant EU member state.

END policy options

The recent END implementation report by the European Commission (EC) has identified several implementation issues and a range of other shortcomings the NRAs encountered during the preparation of their strategic noise maps and action plans in 2007 and 2008. The EC Report identifies several policy options in two main areas, namely improvements of implementation and further development of legislation. By performing a survey among its members, CEDR Road Noise was able to formulate a common view on the proposed options.

The most important policy option considered desirable to improve END is the development of a harmonised noise mapping methodology. This improves the comparison of noise maps across Europe. There is, however, less consensus on the extent to which a harmonised method should be used: specifically for strategic END mapping only or also for detailed noise mapping of road projects. The introduction of mandatory EU noise limit values which cannot be exceeded, is a good example of a policy option not to improve the situation. Many countries already have limit values in place which have been adapted to local conditions. Setting EU-wide limit values might be an unrealistic and an unwanted situation and may have the potential to incur high costs on member states.

CEDR Road Noise used the information in their final draft position paper to complete the consultation questionnaire of the EC's Directorate-General Environment (DG-ENV), in order to inform DG-ENV about the opinion of the CEDR NRAs towards the proposed END policy options.

END colours proposal

On reviewing the END strategic noise maps produced by CEDR national road authorities in 2007, it became clear that the colours used by each member state to depict the various noise bands differed significantly across Europe. At a European level, there appears to be no coordination regarding the choice of colours to be used for the various noise bands under consideration.

The CEDR Road Noise group prepared a proposal on the use of colours for strategic noise mapping. In preparing the proposal, consideration was given to the use of specific colours for various noise bands for example, green colours for noise bands below 50 dB and a red colour for the noise band 65-69 dB. The proposal also recommends that the area to be mapped should be limited to the validation distance of the model.

In order to standardize END strategic noise maps across the EU, it is recommended that each CEDR member state should follow a common approach to the colours used in mapping noise on the major roads.

CNOSSOS-EU

In line with the END, the European Commission embarked upon the preparation of a Common Noise Assessment Method (CNOSSOS-EU) for strategic noise mapping across the EU. The objective of having a common assessment method is to improve the reliability and comparability of noise mapping results. During a meeting of the Noise Regulatory Committee (NRC) in June 2010, EU Member States were invited to nominate experts to be involved in the development and implementation process of CNOSSOS-EU. The first meeting of this Technical Forum of Experts took place in November 2010. This expert group then established a number of working groups to assess various aspects of a common calculation method addressing the requirements of the Directive.

The following is a summary of recommendations arising from the first drafting phase of CNOSSOS-EU:

- Input data for traffic flows should ideally be available from regular national traffic counting that is already undertaken by the NRAs;
- The effect of low noise road surface should be derived from national datasets to account for national differences;
- Geometry of traffic lanes and noise screens should be available from existing databases that were generated during the first two rounds of strategic noise mapping;
- For the propagation model, the type of ground (G value), especially in close proximity to roads should be given by default values.

In June 2012, the Commission announced a call for tenders to develop the next phase of the CNOSSOS-EU framework. The overall objectives of the call is to have a common noise assessment methodology operational for the third round of noise mapping in 2017 and to develop a set of guidelines for the competent use of the CNOSSOS-EU framework. This contract was formally awarded to Extrium Limited in December 2012.

At a recent meeting of the Regulatory Committee on Noise, a new platform CIRCA BC was announced for implementing phase B of CNOSSOS-EU. On this platform, one national expert per EU-Member State can bring forward the national discussion addressing CNOSSOS issues. This platform will act as an expert group to follow progress in the development of the CNOSSOS project as well as the development of the guidelines. Therefore, it is recommended, in order to ensure the simplicity of CNOSSOS-EU and the availability of road related data (traffic flow, low noise surface corrections, geometry of lanes and noise screens) a close collaboration of CEDR Project Group Road Noise members with the national responsible person for CNOSSOS is encouraged.

The legislative progress for implementing the CNOSSOS-EU will be discussed further in the NRC.

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1 Anomalous data of END noise mapping for major roads on the website of the European Environment Agency

1.1 Introduction

The European Environment Agency (EEA) has launched the most comprehensive map of noise exposure to date, revealing the extent to which European citizens are exposed to excessive acoustic pollution. Their database NOISE (Noise Observation and Information Service for Europe) provides a good picture of the number of people exposed to noise generated by air, rail and road traffic across Europe and in 102 urban agglomerations. The database fits well into the objectives of the EEA in providing sound and independent information related to environmental issues.

The Project Group Road Noise of the Conference of European Directors of Roads (CEDR) has assessed the EEA data for noise exposure along major roads in accordance to the European Noise Directive (END). There appears to be a number of anomalies associated with these data which may call into question the veracity of the data. In this factsheet, the results of the examination are described and possible errors are defined. Also several recommendations are made to improve the accuracy of the data gathered in noise mapping major roads.

1.2 Noise exposure data from END noise mapping in Europe

The European Topic Centre on Land Use and Spatial Information (ETC-LUSI) is supporting the EEA in monitoring the land use and land cover change in Europe and analysing the environmental consequences. The ETC is part of the European Environmental Information and Observation Network (Eionet) and cooperates with other European institutions like the Joint Research Centre (JRC), Eurostat and different Directorates-Generals of the European Commission. A substantial part of the ETC work is dedicated to collecting, managing, analysing and displaying land use related spatial data. They claim to have extensive experience in data management and quality assurance.

The ETC has developed a geospatial database of noise data provided by the European member states. This project was undertaken to comply with the Environmental Noise Directive (END) reporting obligations. In order to facilitate the delivery of this data, the Directorate-General for Environment of the European Commission proposed, in 2007, a Reporting Mechanism that should be utilised by Member States (EC, 2007). Reporting in accordance with the END is now the key information flow for environmental noise data in Europe and the EEA has adapted Reportnet for use in delivery of such noise data. To offer guidance on the use of Reportnet the EEA has made a delivery guide (EEA, 2010 and 2012). In short, European member states can upload their END data by using Reportnet. The delivery process provides two ways to help the EU member states verifying that their data meets quality requirements: visual inspection and quality assessments. Visual inspection will simply show the metadata of the uploaded files. The quality assessment can be triggered on demand by an EU member state. This will run a collection of quality assessment scripts and produce a report describing the tests and the results of them. Syntax issues and incomplete entries can be detected, but the accuracy of the original data can not be assessed. Once officially submitted by an EU member state, quality assessment is automatically triggered by the system. The rules checked by the EEA are the same as in the case of the on demand quality assessment by a European member state.

1.3 END data for major roads to be sent to the European Commission

In the first round of END noise mapping, according to Annex VI of the Directive 2002/49/EC the following data for major roads had to be sent to the European Commission:

"2.5. The estimated total number of people (in hundreds) living outside agglomerations in dwellings that are exposed to each of the following bands of values of L_{den} in dB 4 m above the ground and on the most exposed façade: 55-59, 60-64, 65-69, 70-74, > 75.
(…)
2.6. The estimated total number of people (in hundreds) living outside agglomerations in dwellings that are exposed to each of the following bands of values of L_{night} in dB 4 m above the ground and on the most exposed façade: 50-54, 55-59, 60-64, 65-69, > 70. These data may also be assessed for value band 45-49 before the date laid down in Article 11(1).
(…)
2.7. The total area (in km²) exposed to values of L_{den} higher than 55, 65 and 75 dB respectively. The estimated total number of dwellings (in hundreds) and the estimated total number of people (in hundreds) living in each of these areas must also be given. Those figures must include agglomerations" (EC, 2002).

For agglomerations "an indication should also be given on how major roads (…) contribute to" the estimated number of people living in dwellings that are exposed to different bands of values of L_{den} and L_{night} due to road traffic noise (EC, 2002). Also the length of the (major) roads should be given.

1.4 Assessment of noise exposure data for major roads

The EEA noise exposure data for major roads can be downloaded from the Noise website <http://noise.eionet.europa.eu>. After entering Noise Viewer, one can find interesting END noise data under the 'Information' button (check 'download data'). The most interesting figures are to be found in the sheets MRoad_Data and MRoad_Coverage. The 2010 and 2011 EEA data for major roads was used to do additional calculations in order to check the accuracy of the reported END data. Data for people, dwellings, areas and length can be used to calculate new variables like household size, residential density and distance of noise contours. The output of some of these calculations is reported in appendix A. A closer look at the output of these calculations reveals some remarkable figures, sometimes far outside the range that one would expect.

Average household size
Dividing the number of people exposed to a certain noise level from major roads by the number of dwellings exposed to the same noise level, gives the average number of persons per dwelling or simply the average household size. From the data presented, this calculation appears to range from 0 up to 3750 persons per dwelling (see Annex A). In Ireland for example, the number of persons per dwelling in the noise exposure category of > 55 dB is 1426 persons per dwelling. According to data from the statistical office of the European Union, one would expect the average household size to range between 2.0 and 3.0 persons per dwelling (Eurostat, 2010). Therefore, the veracity of any figures far outside this range would have to be questioned.

Average residential density per km²
If the area in km² exposed to a certain amount of noise from traffic on major roads is divided by the number of dwellings exposed to the same noise level, one gets the average residential density per km². Normally, in a highly urbanized country like the Netherlands these figures are expected to vary significantly ranging from about 2 500 dwellings per km² in urban areas to about 10 dwellings per km² in rural areas (CBS, 2010). However, in the band > 55 dB L_{den}, there are EU member states such as France, Italy and Luxembourg with unexplained anomalies for their original figures far outside this range (see Annex B).

Distance of L_{den} contours
With the data presented in the database, it is possible to calculate the average distance of L_{den} contours alongside major roads. As a rough indication for the European major roads, the contour of 55 dB is at a distance of 300 to 600 meters, the 65 dB contour at 100 to 200 meters and the 75 dB contour at 25 to 50 meters. As for these indications, European differences in parameters such as the national noise model, traffic volumes and silent pavements are neglected. Still there are some issues associated with the original figures for member states like Italy, Luxembourg and Norway. The distances of their L_{den} contours are far outside these ranges. It should be noted anyway that in the first cycle of END some countries like Italy used a simplified model to noise map the road network and that in the second round a different approach has been undertaken in order to achieve more accurate results.

People living inside agglomerations alongside major roads
Other calculations were made to establish the number of people living alongside major roads in agglomerations. This figure should be zero in cases where an EU member state has no agglomerations. However, there are agglomerations in Austria (agglomeration Vienna), Slovenia (Ljubljana) and France (FR has 24 agglomerations). But there appears to be no people exposed to noise alongside the major roads in these agglomerations.

Conclusions
The examples described above demonstrate that the END major road data has figures that are sometimes not in line with what can be expected. It appears that for several member states things went wrong somewhere in the process which initially started with the END noise mapping within CEDR member states and culminated in the data reported by the EEA on their 'Noise Viewer' website. Whatever the cause, it is imperative that the final reported data is accurate and correct. The data is an important information source for those involved in developing, adopting, implementing and evaluating environmental noise policy on a European and on a national level.

1.5 Checking the EEA data for major roads

In order to identify where data anomalies could have arisen, member states of CEDR Road Noise and some END competent authorities were requested to check their 2010 data for major roads on the website of the EEA. In total there were 29 EU countries involved in the first round END noise mapping. Out of these 29, 23 EU National Road Authorities (NRAs) and competent authorities reacted upon our request to check their data and to correct them when necessary. Special attention was asked for the indicator 'number of dwellings exposed to noise', because in END noise mapping this indicator is considered as the one with the most expressiveness. Often, the number of people exposed to noise is calculated by simply multiplying the number of dwellings by their average household size. The original and corrected data for the number of dwellings and people is shown in Table 1.

For the number of dwellings exposed to more than 55 dB L_{den} alongside major roads, the corrections made by the EU NRAs and EU member states resulted in an increase of 25 % on the EU level. The same 25 % goes for the noise band of more than 65 dB L_{den}. For the noise band of more than 75 dB L_{den} the increase is 14 %. As for the number of people exposed to different noise bands in L_{den}, there is only a small increase of 1 % for the noise bands of more than 55 dB and more than 65 dB L_{den}.

The corrected figures for noise exposed dwelling and people alongside major roads were used to recalculate variables like household size and residential density. As one can see in Annex A and B, these recalculations resulted in credible figures for those EU and CEDR member states that corrected their original data.

Table 1 Number of dwellings and exposed people - original and corrected data

	Number of dwellings and people exposed to more than 55 dB Lden alongside major roads inside and outside agglomerations			
	dwellings > 55 dB Lden:		*people > 55 dB Lden:*	
country:	*original data*	*corrected data*	*original data*	*corrected data*
Austria	1.958	195.800	778.500	778.500
Belgium	3.009	300.900	681.800	681.800
Bulgaria	1.700	1.700	5.200	5.200
Switzerland	2.648.400	2.648.400	5.410.200	5.410.200
Cyprus	no data	19.800	no data	59.800
Czech Republic	1.739	173.900	1.052.800	1.052.800
Germany	1.521.952	1.521.952	3.848.000	3.848.000
Denmark	214.300	214.300	405.400	405.400
Estonia	0	0	0	200
Spain	12.010	1.201.000	2.583.500	2.583.500
Finland	23.500	23.500	142.400	142.400
France	5.549.558	5.549.558	11.099.100	11.099.100
Greece	no data	no data	no data	no data
Hungary	782	782	759.400	759.400
Ireland	426	347.400	607.400	607.400
Italy	14.586	1.458.600	4.669.500	4.669.500
Lithuania	82	7.700	22.300	22.300
Luxembourg	52	52	100	100
Latvia	48	4.800	9.000	9.000
Malta	no data	9.700	no data	23.200
Netherlands	341.400	141.400	802.100	327.200
Norway	888	88.800	191.100	191.100
Poland	110.299	110.299	443.400	443.400
Portugal	75	325.100	12.800	816.500
Romania	115	11.500	81.300	81.300
Sweden	2.791	279.100	554.000	554.000
Slovakia	173.400	173.400	444.900	444.900
Slovenia	244	24.400	136.300	136.300
United Kingdom	6.624.619	6.624.619	15.363.300	15.363.300
TOTAL IN EU-27 + CH + NO:	**17.247.933**	**21.458.462**	**50.103.800**	**50.515.800**

Remarks:
1. Figures for all major roads which have more than six million vehicle passages a year.
2. Original data is based on data EEA website end 2010.
3. The corrections are marked in green.
4. For two countries, Bulgaria and United Kingdom, the output of the calculations showed that additional checking was not necessary.
5. Only France, Hungary, Luxembourg and Slovakia did not react upon our request the check their major roads figures.

1.6 Possible sources of errors

In general incorrect major road data on the EEA website may be attributed to:

Incorrect handling of data rounded to the nearest hundred
The handbook "Reporting Mechanism proposed for reporting under the Environmental Noise Directive 2002/49/EC" gives detailed information on how to specify and report data to the EEA (DG ENV, 2007). As for the rounding to hundreds the handbook gives the following methodology: "the number of dwellings, in hundreds and rounded to the nearest hundred (for example 77 598 in this case is equivalent to 776 hundred)". Due to different interpretations of how to round data to the nearest hundred, quite a lot of NRAs divided their figures for the number of dwellings by 100 where this was not required. It is not clear why they did this incorrect handling of rounding to the nearest hundreds only for the number of dwellings and not for the number of people or the area exposed to noise.

Misinterpretation of the dwellings definition
Since the variable 'dwelling' was not defined, the NRAs interpreted this variable differently. In such cases, therefore, 'incorrect' data was sent to the EEA by the EU member states.

Definition of noise bands
The different bands of values of L_{den} and L_{night} in dB in the annexes of the Directive are given in terms of 50-54, 55-59, 60-64, 65-69, 70-74 and > 75. This definition can be interpreted in two different ways: for example ≥ 55 to < 59 or > 55 to ≤ 59. These two ways to define noise bands will result in differences in the figures for people and dwellings exposed to different noise bands, especially at the lower noise levels.

National roads are not the only major roads
In some EU member states, the competent authority added figures for regional roads to the figures given by the NRAs for their national roads. Although there is no question of an error, some NRAs will not find their figures for national roads on the EEA website. Instead they will find higher figures for the total of the major roads in their member state.

Missing major roads data inside agglomerations
In several European countries, the major road figures outside agglomerations are the same as for the national total inside and outside agglomerations. This can only be true in cases where a member state has no agglomerations, has no major roads inside agglomerations or did not do noise mapping for major roads inside agglomerations (like in Austria). Cyprus and Luxembourg were the only countries reported to have no agglomeration with more than 250 000 inhabitants. Estonia has mapped their roads inside the agglomeration of Tallinn, but did not mapped major roads according to the END definition. For some European countries and CEDR member states like France and Slovenia, there are no data for the major roads inside agglomerations. The reason for this may be related to the fact that it is not clear which authority should, can or is willing to generate the figures for major roads inside agglomerations.

1.7 Update END figures in 2011 and 2012

In the first half of 2011, CEDR Road Noise used the 2010 END data to do the assessment of the EEA data for noise exposure along major roads. By the end of 2011, after our assessment, quite a lot of END figures were adjusted on the Noise website. Especially in the numbers of dwellings exposed to noise, there were some remarkable changes. All of a sudden, several figures were hundred folded (compare the columns 2010 and 2011 in Table 2).

Table 2 END data: number of dwellings throughout the years

	Number of dwellings exposed to more than 55 dB Lden alongside major roads inside and outside agglomerations:			
country:	*on Noise website in 2010*	*CEDR check in 2011*	*on Noise website in 2011*	*on Noise website in 2012*
Austria	1.958	195.800	195.800	195.800
Belgium	3.009	300.900	590.300	590.300
Bulgaria	1.700	1.700	1.700	1.700
Switzerland	2.648.400	2.648.400	2.648.400	2.648.400
Cyprus	nd	19.800	nd	nd
Czech Republic	1.739	173.900	173.900	173.900
Germany	1.521.952	1.521.952	1.486.796	1.486.800
Denmark	214.300	214.300	214.300	214.300
Estonia	0	0	0	0
Spain	12.010	1.201.000	2.689.976	1.346.700
Finland	23.500	23.500	23.500	23.500
France	5.549.558	5.549.558	3.766.000	3.885.600
Greece	nd	nd	nd	nd
Hungary	782	782	78.200	78.200
Ireland	426	347.400	347.400	347.400
Iceland	nd	nd	nd	14.140
Italy	14.586	1.458.600	1.458.600	1.458.600
Lithuania	82	7.700	8.200	8.200
Luxembourg	52	52	5.200	5.200
Latvia	48	4.800	4.800	4.800
Malta	nd	9.700	9.700	9.700
Netherlands	341.400	141.400	341.400	341.400
Norway	888	88.800	88.800	88.800
Poland	110.299	110.299	11.029.900	11.029.900
Portugal	75	325.100	7.500	7.500
Romania	115	11.500	11.500	11.500
Sweden	2.791	279.100	279.100	279.100
Slovakia	173.400	173.400	173.400	173.400
Slovenia	244	24.400	24.400	24.400
United Kingdom	6.624.619	6.624.619	6.624.619	6.624.619
TOTAL IN EU-27+CH+IS+NO:	**17.247.933**	**21.458.462**	**32.283.391**	**31.073.859**

For most EU member states, these adjustments are in line with the outcome of the CEDR 2011 assessment (see the figures for AT, CZ, IT, LV, NO, RO, SE, and SL for instance). There is one exception: Poland. By the end of 2011 the number of Polish dwellings exposed to more than 55 dB L_{den} has become 11 029 900, instead of the correct figure 110 299. However, it is hard to believe that a third of all the European dwellings exposed to more than 55 dB L_{den} are located in Poland.

1.8 Recommendations

Based on the findings outlined above, the following recommendations are given.

- The NRA should assess the quality of their data by using variables like household size, residential density and distance of noise contours, before they report their END data to the competent authority in an EU member state. Only when the output of these calculations lies in the range one would expect, the accuracy is assured.
- The data quality assessment system adopted by the EEA is not rigorous enough to identify discrepancies within datasets. By enhancing their quality assessment with variables like household size, residential density and distance of noise contours, it becomes possible to detect problems with the accuracy of the reported END noise exposure data for major roads.
- Communication and coordination between the government authorities at different levels of administration, as well as private actors responsible for infrastructure management in some EU member states, should optimize the process of obtaining data and calculating the figures for major roads. Also, there should be adequate feedback between the NRA, the competent authority in a member state and EEA regarding the reported figures to ensure that errors are avoided.

The evaluation reports on the END implementation already gave recommendations to improve the future END noise mapping and action planning (Milieu, TNO & RPA, 2010; EC, 2011 and 2012). This factsheet not only confirms some of these recommendations, but it also adds some new recommendations. All these recommendations are meant to improve the output of future END noise mapping in terms of (more) accurate noise exposure data. Unbiased data is essential because the END noise exposure data are the driving force in noise abatement on a European level as well as on a national level.

1.9 Follow-up actions by CEDR Road Noise

The added value of assessing the quality of the END data should not be limited to the CEDR organization. In order to promote the use of a data quality assessment system outside CEDR, the following actions have been carried out:

- presenting a draft of this factsheet at the Transport Research Arena Conference April 2012 in Athens (Alberts, 2012);
- sending the final concept of this factsheet December 2012 to Mr Nugent, the project manager noise at the EEA, and to Ms Blanes Guàrdia, coordinating the noise work programme of ETC-LUSI;
- sending the final concept of this factsheet December 2012 to all the persons who reacted upon our request to check their END figures for major roads.

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Annex A Calculation results regarding average household size with original and corrected END data for major roads

Country (remarks):	AVERAGE HOUSEHOLD SIZE in different noise bands along major roads in- and outside agglomerations based on **original** data: > 55 dB	> 65 dB	> 75 dB	AVERAGE HOUSEHOLD SIZE in different noise bands along major roads in- and outside agglomerations based on **corrected** data: > 55 dB	> 65 dB	> 75 dB
Austria (1)	398	592	1.050	4	6	11
Belgium-Flanders (2)	227	217	224	2	2	2
Bulgaria	3	5	-	3	5	-
Switzerland (3)	2	2	2	2	2	2
Cyprus (4)	no data	no data	no data	3	3	3
Czech Republic	605	580	837	6	6	8
Germany	3	3	3	3	3	3
Denmark	2	2	2	2	2	2
Estonia (5)	-	-	-	-	-	-
Spain	215	198	120	2	2	1
Finland	6	6	2	6	6	2
France (6)	2	2	2	2	2	2
Greece (7)	no data	no data	no data	no data	no data	no data
Hungary (8)	971	2.017	768	971	2.017	768
Ireland	1.426	2.338	3.750	2	1	2
Italy	320	446	396	3	4	4
Lithuania	272	250	-	3	3	-
Luxembourg (9)	2	-	-	2	-	-
Latvia	188	150	-	2	2	-
Malta (10)	no data	no data	no data	2	2	-
Netherlands	2	3	2	2	2	2
Norway (11)	215	215	223	2	2	2
Poland	4	4	4	4	4	4
Portugal	171	133	0	3	2	3
Romania	707	671	1.600	7	4	16
Sweden	198	194	170	2	2	2
Slovakia (12)	3	2	2	3	2	2
Slovenia	559	784	350	6	8	4
United Kingdom	2	2	2	2	2	2

General remarks: Figures for all major roads which have more than six million vehicle passages a year.
Original data is based on data EEA website end 2010.
Marked in green: figures based on corrected data.
Marked in orange: anomalous figures based on original, not checked data.

Specific remarks:

(1) Austria did no noise mapping for major roads inside agglomerations.
(2) Figures for Belgium-Flanders only.
(3) Switzerland did their noise mapping for all roads and all cities with more than 10.000 inhabitants.
(4) Cyprus gave new data for major roads in urban areas only.
(5) Figures for Estonia are for major roads outside agglomeration Tallinn only.
(6) France did not react upon our request to check their data for major roads.
(7) Greece is still in the process of making first round noise maps and action plans.
(8) Hungary did not react upon our request to check their data for major roads.
(9) Luxembourg did not react upon our request to check their data for major roads.
(10) Malta gave new data they recently reported to the EEA.
(11) Norway discovered errors in their original figures for area exposed to noise.
(12) Slovakia did not react upon our request to check their data for major roads.

Annex B Calculation results regarding average residential density with original and corrected END data for major roads

Country (remarks):	AVERAGE RESIDENTAIL DENSITY in km² in different noise bands along major roads in- and outside agglomerations based on **original** data: > 55 dB	> 65 dB	> 75 dB	AVERAGE RESIDENTAIL DENSITY in km² in different noise bands along major roads in- and outside agglomerations based on **corrected** data: > 55 dB	> 65 dB	> 75 dB
Austria (1)	1	0	0	79	40	2
Belgium-Flanders (2)	3	4	2	260	420	172
Bulgaria	31	6	0	31	6	-
Switzerland (3)	767	848	82	767	848	82
Cyprus (4)	no data	no data	no data	1.053	867	205
Czech Republic	1	1	0	96	113	40
Germany	98	71	17	98	71	17
Denmark	221	236	32	221	236	32
Estonia (5)	-	-	-	-	-	-
Spain	2	2	1	170	155	142
Finland	51	25	5	51	25	5
France (6)	671	1.119	2.491	671	1.119	2.491
Greece (7)	no data	no data	no data	no data	no data	no data
Hungary (8)	2	3	8	2	3	8
Ireland	1	0	0	588	735	157
Italy	0	0	0	238	170	102
Lithuania	1	1	0	93	51	-
Luxembourg (9)	0	0	0	0	0	-
Latvia	2	1	0	199	148	-
Malta (10)	no data	no data	no data	333	400	-
Netherlands	167	39	1	69	20	1
Norway (11)	0	0	0	-	-	-
Poland	115	107	53	115	107	53
Portugal	1	1	0	342	212	90
Romania	1	1	0	122	144	32
Sweden	2	1	1	186	126	57
Slovakia (12)	295	386	529	295	386	529
Slovenia	1	0	0	59	39	10
United Kingdom	314	188	61	314	188	61

General remarks: Figures for all major roads which have more than six million vehicle passages a year.
Original data is based on data EEA website end 2010.
Marked in green: figures based on corrected data.
Marked in orange: anomalous figures based on original, not checked data.

Specific remarks:

(1) Austria did no noise mapping for major roads inside agglomerations.
(2) Figures for Belgium-Flanders only.
(3) Switzerland did their noise mapping for all roads and all cities with more than 10.000 inhabitants.
(4) Cyprus gave new data for major roads in urban areas only.
(5) Figures for Estonia are for major roads outside agglomeration Tallinn only.
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2 Position paper on proposed policy options regarding END improvement

2.1 Introduction

National Roads Authorities (NRAs) have been pioneering road developments ever since the advent of national road networks. NRAs not only play a significant role in facilitating transport and mobility, but they also are responsible for maintaining environmental quality standards in close proximity to their networks.

At a European level, the NRAs cooperate in an agglomeration known as the 'Conference of European Directors of Roads' (CEDR). The mission of CEDR is to contribute to future developments of road traffic and networks as part of an integrated transport system under the social, economic and environmental aspects of sustainability.

Within CEDR there are several project groups working on specific transport and environment related issues. The CEDR Project Group Road Noise focuses on environmental noise related to vehicular traffic on the national road networks. There are 16 NRA representatives participating in this CEDR project group. Therefore, the CEDR Road Noise can be considered as important stakeholders with regard to how noise issues are addressed on national road networks.
The European Commission (EC) has recently published its first report on the implementation of the Environmental Noise Directive (END) (European Commission, 2011), based on a project reviewing the implementation of the END by Milieu et al. (2010). One of the objectives of the Milieu et al. project was to develop an action plan outlining further implementation strategies.

The agenda of CEDR Road Noise is dominated by the European Noise Directive. The recent END implementation report has identified several implementation issues and a range of other shortcomings the NRAs encountered during the preparation of their strategic noise maps and action plans in 2007 and 2008. The European Commission Report identifies two main areas of possible follow up action that are based on the implementation analysis by Milieu et al., namely improvements of implementation and further development of legislation regulating noise sources.

The aim of this paper is to gain insight in the most preferred policy options as described in the Milieu et al. report and to formulate a common view on the proposed options, by performing a survey among CEDR Road Noise members. This paper also compares CEDR Road Noise's view on the various policy options and the 'possible action in the short and medium term' as described in the European Commission report.

2.2 Policy options to improve the END

In the final report on task 3, 'Impact assessment and proposal of action plan', Milieu et al., proposes seven policy options, some of which have a number of different features. The following Table 3 lists all policy options and their main features and risks (European Commission, 2011).

Table 3 Features and risks of policy options

no:	policy option:	main features, costs and risks:	in short:
1.	Baseline	This option provides the baseline for comparison of the other options and consists of no modification to the existing Directive. It includes the impacts of action plans adopted under the END, together with other measures to reduce noise exposure. The baseline does not include the impacts of any legislation that has not yet been adopted, because of uncertainties over the final form of legislation and the implementation timetable. This includes, for example, proposals for Directives on Tyre Labelling and a Regulation on General Vehicle Safety (Regulation concerning type-approval requirements for the general safety of motor vehicles). The main risk of this option is that difficulties in implementing the END will remain and potential benefits of the END will not be fully realised.	no change to END
2.1.	Minor changes to the text	This option will involve minor changes to the text of the END, specially aimed at clarification of the definitions and thus enhancing implementation. It will also aim to address inconsistencies highlighted by the consultees with regard to the lack of balance in terms of its regulatory depth (i.e. in some areas the requirements are very detailed whereas in others are very general or absent). In particular, Option 2 will comprise the following: • Clarify the status of END; • Provide more detailed definitions of: o agglomeration (in line with other directives); o quiet areas; o major roads; o industrial noise; o action plan. • Clarify measurement points (interim computation methods for industrial sites and in open country) and introduce flexibility on measurement heights. The benefit from this option is quite uncertain, since tighter definitions might not address the problems of implementation. Some member states (MS) welcome the flexibility in the definitions. Option 2 does not address the risk that the END in its present form is insufficient to provide adequate protection against noise.	clarify the status of END
2.2.			provide more detailed definitions
2.3.			clarify heights of measurements points
3.1.	Compliance promotion	This option will involve additional guidance and training for MS to assist them to enforce and implement the END more effectively. In particular, it will comprise the following: • Provide guidance on: o predictive value of noise maps; o dose-response relationships; o calculating multiple exposure; o producing action plans and possible triggers • Organise workshops and training on: o mapping methodologies; o methods and exchange of best practice. The main costs related to this option will fall to the Commission, for developing guidance and organising training. The main benefits will fall to the competent authorities in the MS, through enabling more efficient implementation of the END. There may also be some benefits for people exposed to noise, if the clarifications result in better identification of areas where exposure to noise is high, designation of additional quiet areas and better targeting of measures to address noise. The END's issue of leaving room for interpretation and different implementation can be addressed by the development of guidance documents, information exchange of best practices or organisation of workshops and training courses. The benefit from this option is quite uncertain, since more training and guidance might not be sufficient to address the problems of implementation. Option 3 does not address the risk that the END in its present form is insufficient to provide adequate protection against noise.	provide guidance for MS (guidance documents, exchange of best practices)
3.2.			organise workshops and training for MS

no:	policy option:	main features, costs and risks:	in short:
4.1.	Harmonise noise mapping methods	This option could involve a number of different measures to improve implementation of the mapping requirements of the END: • Developing harmonised noise mapping methodologies (work is already under way by the Commission to develop a harmonised approach; in addition, consultation highlighted the potential to use Harmonoise or Nord 2000 as possible models); • Making adoption of these harmonised approaches mandatory; • Organising workshops and training on mapping methodologies; and • Delaying the deadline for strategic noise maps to allow new methodologies to be adopted. In order to facilitate the objective of reducing exposure to harmful noise levels, this option could also include a requirement on MS to report on the numbers of people exposed to night time levels down to 40 dB, rather than the current 50 dB, and levels of L_{den} down to 50 dB, rather than the current 55 dB. In 2008, Commission efforts have started on developing harmonized methods for assessing noise exposure (according to article 6.2). A project entitled "CNOSSOS-EU" (Common Noise Assessment Methods in Europe) led by the Joint Research Centre will provide the technical basis for preparing a Commission Implementing Decision. Provided the technical work for CNOSSOS can be completed in 2011, the Commission is considering a possible revision of Annex II of the END in early 2012. The harmonised methodological framework could focus on the strategic mapping and would have to carefully balance the needs for harmonisation by proportionality and sectoral specificities, e.g. as regards data requirements. As part of this decision, the Commission intends to propose a joint Commission/EEA/MS work programme for the implementation of CNOSSOS-EU during 2012-2015 with the view to making it operational for the third reporting cycle in 2017. The risk in producing maps by the harmonised method lies in the fact that it might prove to be less cost-effective or cause delays. Changes in mapping methods may make it more difficult to follow up on the evolution through the course of time and thus to judge the effectiveness of the END. Option 4 does not address the risk that the END is insufficient to provide adequate protection against noise.	develop harmonised noise mapping methodology
4.2.			make adoption of this harmonised approach mandatory
4.3.			organise workshops and training on mapping methodology
4.4.			delay the deadline for strategic noise maps to allow new methodology to be adopted
5.1.	Closer integration between END and air quality directive	The END has adopted a similar approach to Directive 96/62/EC on Ambient Air Quality Assessment and Management, i.e. data collection in agglomerations, action plans, adequately informing the public, improvement of assessment methods, collection of data and reporting to the Commission. This option aims to promote closer integration between the END and the Air Quality Directive. It would consist of providing guidance to MS on how actions to address noise and air quality problems could be integrated, together with any changes to the END needed to address barriers to closer integration. The costs of the option would fall mainly on the Commission. The benefits could include administrative savings and, potentially, greater efficiency in increasing protection from noise pollution. The risk of this option is that, due to differences in the administrative structures for noise and air quality in member states, further integration would mainly focus on the impact of road traffic noise. Option 5 does not address the risk that the END in its present form is insufficient to provide adequate protection against noise.	provide guidance to MS on how noise and air quality remediating actions could be integrated
5.2.			change END to address noise and air integration issues
6.1.	Introduction of EU-wide noise limit values or trigger values	Option 6 provides an incentive for additional action to protect against the effects of exposure to noise, by introducing mandatory noise limit values. There are two sub-options: • mandatory limit values, which cannot be exceeded, to ensure a consistent level of protection for EU citizens against the impacts of noise; or • noise trigger values, requiring action to be taken within a specified time limit where the limit values are exceeded.	introduce mandatory limit values which cannot be exceeded

no:	policy option:	main features, costs and risks:	in short:
6.2.		The costs of this option will depend on the specific limit values adopted and the noise reduction measures required to be taken to meet the limits. MS already have a range of limit values in place, although these do not always appear to be met in practice due to the disproportionate costs of measures to control noise. The WHO guidelines recommend a night noise value for Europe of 40 dB, with an interim value of 55 dB L_{night} where this cannot be met. In general, noise levels in the day and evening are higher than those at night, with L_{den} values being around 10 dB higher than L_{night}. This would imply L_{den} values of 50 dB L_{den} or 65 dB L_{den} to meet the WHO guidelines. In the case studies, we have assessed the impacts of meeting an L_{den} limit value of 60 dB, which aims to move towards meeting the long-term WHO guideline. The initial costs of meeting limit values will fall to the authorities responsible for implementation, in drawing up and implementing action plans to meet the new limits. However, the measures adopted could also impose costs to other stakeholders (for example public and commercial users of roads and airports, owners of properties etc). There will also be costs to the Commission from changes to the legislation and developing and agreeing limit values. The benefits will accrue to the population currently affected by the impacts of noise. Very few MS have estimated the benefits of implementing their action plans. The key risk of limit values is that the limit may be technically infeasible or excessively costly to meet. Therefore, the use of the limit value as a trigger for action is also examined. The repeated transgression of existing national noise limits due to technical or budgetary reasons could indicate that EU-wide limit or trigger values would meet the same obstacles.	introduce noise trigger values that require action to be taken within a specified time limit when these values are exceeded
7.1.	Additional source-based measures	This option would improve protection from noise through linking source-based measures under other EU legislation, including noise emission limits for vehicles, vehicle tyres and outdoor equipment; rules on noise-related operating procedures for airports, the 'greening transport' initiative and integrated pollution prevention and control legislation, to the END; This could include, for example, linking review of source Directives to the END five-year cycle, requiring that noise levels be reduced by a certain amount in each cycle, unless it could be demonstrated that this was not feasible. Noise levels in source Directives could also provide the basis for the use of price mechanisms by MS authorities, for example by charging more for noisier equipment to use infrastructure. However, this would be an issue for MS to decide rather than being determined at EU level. This option could result in a more cost-effective improvement of noise protection than Option 6, but its outcome could be more uncertain, because it would require changes to other legislation. This option would also address some of the recommendations by the consultees indirectly, including for instance one MS suggestion for excluding industrial sites from END, since they are already dealt in Directive 96/61, and the deletion of reference to surveys of community annoyance. The risk of this option is related to whether the source Directives can deliver the necessary protection against the impacts of noise. Quantification of the level of protection is difficult, due to the large number of policies and lack of available data on their effectiveness in term of noise reduction. Although several studies concluded that reduction at the source seems to have the highest potential, the risk of this option is related to whether the source Directives can deliver the necessary protection against noise. Even if source Directives succeed, there will still be local noise problems.	link source measure legislation (like tyre directive) to the END, e.g. by reviewing source directives every five years, requiring that noise levels be reduced by a certain amount in each cycle
7.2.			the use of price mechanisms by charging more for noisier equipment

2.3 CEDR questionnaire to score the policy options

CEDR Road Noise comprises of 17 members and all members were requested to give their opinion on each of the policy options features by giving a score, ranging from 1 (poor option) to 10 (good option). In addition to that, members were encouraged to elaborate on their opinion by outlining their views on the benefits, risks, drawbacks, difficulties, etc., of the various policy options. 16 members of the group responded to the survey.

When scoring the options, the members were asked to take into account:

- the ability of the policy options to achieve the overall objective of reducing noise pollution;
- costs that are linked to the various policy options;
- coherence with other EU objectives and policies.

Box plots were prepared in order to help differentiate between the various policy options. Box plots are a convenient way of graphically depicting groups of numerical data through their five-numbered summaries: the smallest observation (sample minimum), lower quartile (Q1), median (Q2), upper quartile (Q3), and largest observation (sample maximum). A box plot may also indicate which observations, if any, might be considered as outliers.

Box plots provide a non-parametric approach to analysing data, therefore, they display differences between populations without making any assumptions of the underlying statistical distribution. The spacings between the different parts of the box help indicate the degree of dispersion (spread) and skewness in the data, and they also identify outliers.

The box plot in figure 1 shows the results of the questionnaire among CEDR Road Noise members.

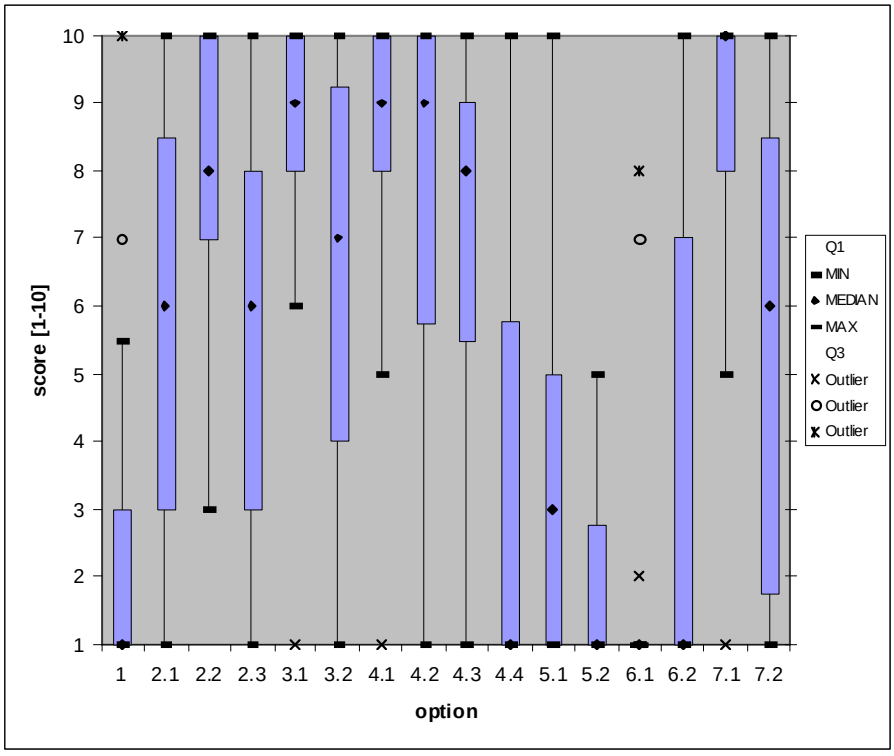

Figure 1 Box plot of scores of policy options to improve the END

Option:	Description:
1	no change to END
2.1	clarify the status of END
2.2	provide more detailed definitions
2.3	clarify heights of measurements points
3.1	provide guidance for MS (guidance documents, exchange of best practices)
3.2	organise workshops and training for MS
4.1	develop harmonised noise mapping methodology
4.2	make adoption of this harmonised approach mandatory
4.3	organise workshops and training on mapping methodology
4.4	delay the deadline for strategic noise maps to allow new methodology to be adopted
5.1	provide guidance to MS on how noise and air quality remediating actions could be integrated
5.2	change END to address noise and air integration issues
6.1	introduce mandatory limit values which cannot be exceeded
6.2	introduce noise trigger values that require action to be taken within a specified time limit when these values are exceeded
7.1	link source measure legislation (like tyre directive) to the END, e.g. by reviewing source directives every five years, requiring that noise levels be reduced by a certain amount in each cycle
7.2	the use of price mechanisms by charging more for noisier equipment

2.4 Policy options that are considered desirable to improve END

The following six policy options received high scores from the CEDR NRAs. This indicates that the CEDR NRAs would like to see these options incorporated into an amended END or addressed in some other fashion.

Option 2.2: provide more detailed definitions
Member states have various interpretations of the terms that are defined in Article 3 of the END. Different interpretations have the potential to lead to inconsistent results across Europe. The provision of clearer definitions should result in better comparable data across member states. With regard to the definitions that need further clarification, there is a clear need within CEDR NRAs for a more refined definition of what an agglomeration really means. Other terms that require clarification are "quiet areas" and the difference between major roads within and outside of agglomerations and their delimitation.
Although Annex VI of the END provides good examples of rounding figures, there is still the potential for misinterpretations of the requested data because of the joint use of 'round to the nearest hundred' and 'in hundreds'. The latter can be understood as a number divided by one hundred. For example, 1742 inhabitants gives 17 'hundred' inhabitants.
In Annex VI of the END, the L_{den} values of 70 and 75 dB seem to be omitted in paragraphs 1.5, 1.6, 2.5 and 2.6.
The definitions and terms could be clarified in guidelines, or amendments be made to the Directive itself. Although better definitions will improve comparability among member states, it should be born in mind that local situations in member states differ and definitions should not be too rigid in order for them to be applicable in all locations. Additional guidelines and/or clarifications will streamline the outcome of noise calculations.

Option 3.1: provide guidance for member states
The comments received from CEDR NRAs on option 3.1 (guidance) generally refer to the exchange of best practice, guidance documents, guidance on cost-benefit analysis, dose-response relationships and socio-economic costs. This option is not the absolute solution to the noise issue, but it could help fulfilling the target of abating noise by leading to a more consistent implementation and a deeper understanding of how the noise issue can be more appropriately handled.

Option 4.1: develop a harmonised noise mapping methodology
Developing and making use of a harmonised mapping methodology is considered to be necessary for the comparison of noise maps across Europe. There is, however, less consensus on the extent to which a harmonised method should be used for specifically strategic END mapping only or for detailed noise mapping of road projects. Having comparable noise maps in different member states will not solve noise problems at a national level.

Option 7.1: link source-based measures under other EU legislation (such as tyre Directive) to the END by reviewing source directives every five years, requiring that noise levels be reduced by a certain amount in each cycle
Source-based measures are considered to be the most cost-effective in mitigating road traffic noise. This option should be given comprehensive consideration by the European Commission, particularly when updating or revising the tyre directive or developing new policies to mitigate road traffic noise.

Option 4.2: to make adoption of the harmonised noise mapping approach mandatory
This option has a high median score of 9, but there is more spread in the scores compared to the other four options listed above. This means that most members regard it as a good option, but some feel that there may be difficulties or drawbacks associated with it. Based on some of the comments, some CEDR members fear that this option could lead to excessive costs. A phased introduction of a mandatory approach is preferred by most CEDR members. It is also felt that if a harmonised approach is mandatory, then it should only be mandatory for strategic noise mapping.

Option 4.3: organise workshops and training on harmonised mapping methodology
This option also received a high median as well as showing a significant amount of data spread. Workshops are considered to be an excellent way of exchanging knowledge in producing maps of a specific standard. It is anticipated that this initiative could be considered as a low cost option.

2.5 Policy options that are considered not to improve END

The following six options received relatively low marks from CEDR member states, therefore, they are considered as options that will not enhance the effectiveness of END.

Option 1: baseline, no change to END
There seems to be a consensus that some amendments are necessary to END in order to pursue a more effective European noise policy.

Option 4.4: delay deadline for strategic noise maps to allow harmonised methodology to be adopted
With regard to the proposal to delaying the deadline for the submission of the second round of strategic noise mapping, there is a general consensus that such a proposal is not appropriate at this time. Most NRAs have already commenced work and invested significant resources in preparing for the second round of strategic noise mapping. Postponing the second round to a later date and adopting a new methodology will not only result in significant cost implications for most member states but it will also lead to frustration with the whole noise mapping process. If a harmonised method is to be adopted, then it should only be introduced when the new methodology is fully prepared and verified. There is general agreement that the new harmonised method should be introduced for the third round of strategic noise mapping in 2017. Therefore, it is generally agreed that in the interim, current methods should be continued to be used in the preparation of strategic noise maps. Such an approach allows for comparability of results until a new harmonised method is introduced. This avoids a situation for NRAs of having to explain to the public differences in calculated noise levels between the different methodologies despite the public being exposed to the same noise levels.

Option 5.1: provide guidance on how actions to address noise and air quality problems could be integrated
This is considered to be an undesirable option because CEDR Road Noise participants cannot see the benefit in addressing noise and air quality, jointly. Noise and air quality are issues of a different kind that require specific and targeted actions. However, there may be advantages in integrating them from a data collection perspective.

Option 5.2: change END to address barriers to closer integration
Considering the fairly limited experience in noise mapping, integrating END and Air Quality Directive could potentially lead to further confusion.

Option 6.1: introduce mandatory limit values which cannot be exceeded
Introducing mandatory limit values for noise has the potential to incur high costs on member states. Many countries already have limit values in place which have been adapted to local conditions. Setting EU-wide limit values might be an unrealistic and an unwanted situation.

Option 6.2: introduce noise trigger values requiring action to be taken within a specified time limit where these values are exceeded
The introduction of noise trigger values is seen as an effective way of protecting European citizens against noise pollution. Trigger values show areas where the need to take action is unavoidable, the so called "hotspots". There are, however, a few objections to this option because it is felt that it will be difficult to find EU-wide trigger values that could be applied in all member states, considering the different baseline scenarios and levels of ambition to mitigate noise in each member state. It is generally feared that introducing trigger values will entail significant increases in noise mitigation costs.

2.6 Other policy options

All the other options considered in this study had a significant spread in responses with a medium score of 6 or 7. Therefore, these options can be considered as medium and member states do not appear to have strong opinions either for or against the options listed below, or member states do have strong but contradictory opinions.
Option 2.1: clarify the status of END;
Option 2.3: clarify the height of measurement points;
Option 3.2: organise workshops and training for member states;
Option 7.2: the use of price mechanisms by charging more for noisier equipment.

2.7 Community actions on environmental noise

The European Commission report (2011) identifies significant achievements but also several difficulties and areas for improvement. The Commission will consider further actions aimed at improving the effectiveness of the noise legislation. To this end, the Commission intends to present a work programme to the Noise Committee including some of the elements listed below.

Finalising the harmonised framework for mapping methods
The ongoing development of a harmonised strategic noise mapping method in the CNOSSOS-EU project is closely related to option 4 (harmonise noise mapping methods) of the Milieu et al. report. This option is generally considered to be a good option by CEDR Road Noise. The point of delaying the deadline for strategic noise maps to allow new methodologies to be adopted is not well received by CEDR Road Noise. Many feel noise mapping should continue until the new methodology is finalized. The CNOSSOS method could be used no earlier than the third round of noise mapping. This view seems to be shared with the European Commission who intends to

propose a programme on the implementation of CNOSSOS, making it operational for the third reporting cycle in 2017.

Develop EU implementation guidance
Developing guidance is closely related to option 3 of the Milieu et al. report: compliance promotion. It also contains some elements of option 2: minor changes to the text, e.g. providing more detailed definitions. Within CEDR Road Noise the general feeling is that there is a need for more guidance. Apart from more detailing or explanation in the definitions of agglomeration, quiet areas, the difference and delimitation between major roads within and outside of agglomerations, rounding figures to the nearest hundred, bands of values of L_{den}, guidance could be improved by the exchange of best practices and by setting up guidance documents on cost-benefit analyses, dose-response relationships and socio-economic costs. Workshops and training courses should be organized by the member states.

Improving synergies between air quality and noise management
Although the European Commission's report labels closer integration between END and Air Quality Directive as a potential area for improvement, this is considered to be an undesirable option by CEDR Road Noise because the benefit in addressing noise and air quality, jointly, is uncertain. Noise and air quality are regarded as issues of a different kind that require specific actions, however, there may be advantages in integrating them from a data collection perspective.

Facilitating reporting issues
Facilitating reporting issues is not considered in the CEDR Road Noise enquiry.

Legislation regulating noise sources
CEDR Road Noise considers source-based measures (like tyre directive) to be the most cost-effective measures. They can effectively abate noise pollution, but require European Commission action.

2.8 Follow-up actions by CEDR Road Noise

The process of reviewing and improving the END is of immense importance to the national road authorities. The outcome of this process will have direct implications on future noise mapping and action planning programmes. CEDR Road Noise has a strong interest in new developments in Brussels and is enthusiastic about participating in the consultation process in order to produce outcomes that are favourable to CEDR NRAs.
Regarding the process of improving END, CEDR Road Noise has performed the following actions:

1. Alerted the Directorate-General for the Environment (DG-ENV) of the European Commission in Brussels by letter on 23 September 2011 indicating that CEDR Road Noise is available and willing to participate in any discussion forum addressing END improvement (see Annex C).
2. Sent the final draft of the position paper to the members of CEDR Road Noise in January 2012 to inform them about the views of the CEDR NRAs towards the proposed END policy options. The members of CEDR Road Noise used this information in their discussion with their national END competent authority in order to improve the reaction from each EU member state in the European Commission consultation process on END.
3. Used the information in the final draft position paper to complete the consultation questionnaire of the European Commission's Directorate-General Environment on 14 October 2012, in order to inform DG-ENV about the opinion of the CEDR NRAs towards the proposed END policy options.

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Milieu, RPA, TNO (2010). Final report on task 1. Review of the implementation of Directive 2002/49/EC on environmental noise. Retrieved from <http://www.milieu.be/noise/final_reports/end_task_1_final_report.pdf>

Annex C LETTER FROM CEDR ROAD NOISE TO DG-ENVIRONMENT

Dear Balazs Gergely,

National Roads Authorities (NRAs) have been pioneering road developments ever since the advent of national road networks. NRAs not only play a significant role in facilitating transport and mobility, but they also are responsible for maintaining environmental quality standards in close proximity to their networks.

At a European level, the NRAs cooperate in an agglomeration known as the 'Conference of European Directors of Roads' (CEDR). The mission of CEDR is to contribute to future developments of road traffic and networks as part of an integrated transport system under the social, economic and environmental aspects of sustainability.

Within CEDR there are several project groups working on specific transport and environmental related issues. The CEDR project group "Road Noise" focuses on environmental noise related to vehicular traffic on the national road networks. There are seventeen NRA representatives participating in this CEDR project group. Therefore, we consider ourselves as to be important stakeholders with regard to how noise issues are addressed on national roads.

The agenda of the CEDR Road Noise is dominated by the European Noise Directive (END). The recent END implementation report identified several implementation issues and a range of other shortcomings the NRAs encountered during the preparation of their strategic noise maps and action plans in 2007 and 2008. Currently, we are working on a position paper addressing a range of policy issues to improve the END and it is anticipated that this paper will be finalised at our next meeting in October. Unfortunately, it will not be available for the stakeholder conference on the 30th September. However, once the content of this paper is agreed, we would be happy to forward you a copy for your consideration.

CEDR Road Noise is available and willing to participate in any discussion forum addressing improvement to the END. We hope to use future opportunities to contribute to such consultation process. In the meantime, I would be grateful if you could inform me of any plans you may have in this regard.

Kind regards,

Wiebe Alberts
Chairman CEDR Project Group Road Noise

3 Proposal for the use of colours in END noise mapping

3.1 Problem

On reviewing the END strategic noise maps produced by CEDR national road authorities in 2007, it became clear that the colours used by each member state to depict the various noise bands differed significantly across Europe (see Table 4). At a European level, there appears to be no coordination regarding the choice of colours to be used for the various noise bands under consideration.

Table 4 Colours used to depict noise bands by a number of CEDR member states during the first round of END strategic noise maps for major roads

Noise band [dB]:	AT	BE	DE	DK	EE	ES	FI	FR	GR
35-39 (<40)									
40-44									
45-49									
50-54									
55-59									
60-64									
65-69									
70-74									
≥75 (75-79)									

Noise band [dB]:	IE	IT	LV	MT	NL	NO	PL	SE
35-39 (<40)								
40-44								
45-49								
50-54								
55-59								
60-64								
65-69								
70-74								
≥75 (75-79)								

3.2 Objectives

In order to standardize END strategic noise maps across the EU, it is recommended that each CEDR member state should follow a common approach to the colours used in noise mapping the major roads in their respective networks, provided that national legislation does not dictate the use of specific colours.

In addition, to ensure that there is more consistency on the use of colours in END strategic noise mapping, it is proposed by CEDR Project Group Road Noise that there be coordination on this issue between the various experts groups working on the development of the common noise assessment methods in Europe (CNOSSOS-EU). To date, no work has been undertaken in the area of a colour scheme for END noise mapping. Any proposal from CEDR Road Noise would be welcomed, especially by the working group dealing with the development of guidelines for the competent use of the CNOSSOS method.

3.3 Searching for an existing solution

ISO 1996:2 (ISO, 1987) defined a range of colours to be used for the presentation of noise maps. However, in the second edition of ISO 1996:2 (ISO, 2007) they cancelled the relevant section of the first edition in which colours were defined. However, in Germany for instance they still use the colours based upon those set out within ISO 1996:2 (1987) since it is required by national legislation.

3.4 Initial steps for the development of a colour proposal

In preparing a proposal for the use of specific colours for various noise bands, the proposal should fulfil the following considerations:

1. Cover a wide range of noise bands
The proposal should cover a wide range of 5 dB noise bands, from 40 dB up to levels greater than 80 dB, including:

- noise bands up to 80 dB and more for mapping very high noise levels;
- noise bands down to 40 dB in order to cope with the possible addition of noise bands with low noise levels in the future as proposed by the EC in their report: "In the current Directive, Member States are required to use specified noise indicators of L_{den} and L_{night} and report the noise exposure of the population of 55 dB and 50 dB or more, respectively (...). However, the current reporting neglects the fact that there is a considerable share of EU population exposed to noise pollution at lower levels which are still likely to cause harmful effects on health (…). According to the latest WHO recommendations, reporting bands of the indicator values of L_{night} should be lowered to 40 dB L_{night} in order to achieve a much more realistic assessment of noise pollution impacts across the EU" (EC, 2011).

Having noise band colours covering the range from 40 dB up to greater than 80 dB does not mean that all bands have to be used in strategic noise mapping. According to the information in Table 4, most CEDR member states will use the noise bands in the range from 45-49 or 50-54 dB up to 75 dB and more in their second round noise mapping for major roads.

2. Green colours for noise bands below 50 dB
In general, there seems to be a consensus that noise levels around 50 dB L_{den} represents a good quality noise environment (EEA, 2010). Therefore, it is accepted that all noise bands below 50 dB should be depicted with green colours, because such colours are normally associated with a safe and good quality environment.
Considering the scientific evidence on the thresholds of night noise exposure, an $L_{night,outside}$ of 40 dB should be the target of the night noise (WHO, 2009). Therefore, a noise band of less than 40 dB should have a dark green colour indicating that this noise band represents the best situation. Under the present END regulation mapping noise levels in the range of 40 dB and lower is optional, so noise maps do not have to show these low level noise bands.

3. Limiting the area of noise mapping
Mapping low noise levels will:

- increase the need for data regarding surrounding terrain, buildings and population, resulting in increasing costs for obtaining and processing these additional data;
- exceed, at least in some cases, the validation distance of noise calculation models, limited to for example 800 m in the proposed CNOSSOS-model (EC-JRC, 2011) and the French road noise prediction model (Sétra, 2009) and to 600 m in the Dutch road noise calculation model (RWS, 2009);
- result in maps that give the public a too optimistic representation of the actual noise levels, certainly far from the major road, because accumulation of noise from other sources is neglected in mapping noise from major roads.

To avoid these problems, one can chose not to map low level noise bands far outside the validation distance of the noise calculation model.

4. Red colour for noise band 65-69 dB
In many EU member states, noise levels above 65 dB L_{den} are considered to be problematic due to annoyance and associated health implications. Therefore, the colour red is used to depict the noise band of 65-69 dB. For noise bands with levels greater than 65-69 dB, dark red and violet colours are used to indicate a deteriorating noise situation.

5. Suitable for different noise indicators
It is also proposed that any colour proposal should not only be suitable for use with noise indicators such as L_{den} and L_{night}, but also for supplementary indicators such as L_{day}, $L_{evening}$ and L_{Amax}. It is recommended to use the same colours in situations where noise levels are the same for different noise indicators. The justification for such recommendation is that noise maps should give objective information about noise levels in dB. From the perspective of annoyance or health risks however, the impact of e.g. 60 dB L_{den} is not the same as 60 dB Lnight or 60 dB L_{Amax}.

6. Definition of colour codes
The colours should be given in RGB (Red, Green, and Blue) and HEX (hexadecimal) code.

7. Noise band of 5 or 10 dB
Some EU member states, such as Sweden for instance, tend to use noise mapping based on the 55, 65 and 75 dB contours instead of a range of 5 dB noise bands. In such circumstances, these member states should use the colour of the 55-59, 65-69 and 75-79 dB noise bands to map their specific noise bands. And in case of adding the 45 dB contour or the noise band less than 55 dB, simply use the colour for the 45-49 dB noise band.

8. Differentiation between colours
Current computer monitors are capable of showing all colours. However, printing such colours may present some difficulties. In some situations, the differentiations between colours disappear or are not entirely evident. Although, the colour proposals have been tested on different computer

monitors and printers throughout Europe, there still may be some minor problems with the differences between the proposed colours while printing maps based on these colours. In situations where a map reader can see subtle differences between the individual colour patches in a legend, this does not mean that they will be able to recognize those same differences on a map (Brewer, 1997).

9. Transparency of the colours and topographic information
To prevent colours fading, it is recommended to use non-transparent colours for the noise bands. And to facilitate orientation, topographical information like roads, buildings, rivers, etc., should be used as the layer(s) at the highest level(s) in a geographical information system. But the topographic information must not be conspicuous. To prevent the topographical information dominating the noise map, it is recommended to use (partially transparent) light gray colours.

3.5 CEDR Road Noise colour proposal

Colour plays a central role in thematic cartography. Despite this, using colour effectively on maps is surprisingly difficult. On the one hand, a good colour scheme needs to be attractive while on the other hand, the colour scheme should support the purpose of the map and be appropriately matched to the nature of the data (Harrower & Brewer, 2003).
Diverging colour schemes use a light/neutral colour to represent average values and contrasting dark colours for low to high values. A diverging colour scheme is made for the noise bands 65-69 dB down to 35-40 dB, based on the use of yellow to represent the average value and the use of green and red for low and high values. For the noise bands 65-69 dB up to 80 dB and more, a different approach is used. For these higher noise bands, a sequential colour scheme is proposed, using intervals of two colours graduating from light to dark with low values in the lighter red colours and high values in darker blue and violet colours. Fortunately, there are a number of software tools available, such as Colorbrewer2 <http://colorbrewer2.org/> and RGB Color Gradient Maker <http://www.perbang.dk/rgbgradient>, to assist with colour scale generation for different schemes.

3.6 Recommendations

Therefore, based on the requirements outlined above, the CEDR Project Group Road Noise has developed the following proposal for a colour scheme to be used in END noise mapping for European major roads (see Table 5). In order to standardize END strategic noise maps across the EU, each CEDR member state should follow a common approach to the colours used in mapping noise on the major roads.

Table 5 Colour proposal for the various noise bands to be used for END strategic noise mapping

Noise band (dB) *	Colour	RGB code	HEX code	Name
less than 35	none			
35-39		R: 35 G: 132 B: 67	#238443	Moderate sea green
40-44		R: 120 G: 198 B: 121	#78C679	Greyish green
45-49		R: 194 G: 230 B: 153	#C2E699	Light greyish chartreuse green
50-54		R: 255 G: 255 B: 178	#FFFFB2	Pale yellow
55-59		R: 254 G: 204 B: 92	#FECC5C	Light brilliant amber
60-64		R: 252 G: 141 B: 60	#FD8D3C	Brilliant tangelo
65-69		R: 255 G: 9 B: 9	#FF0909	Light brilliant red
70-74		R: 179 G: 6 B: 34	#B30622	Moderate amaranth
75-79		R: 103 G: 3 B: 59	#67033B	Dark rose
80 and more		R: 28 G: 0 B: 84	#1C0054	Deep blue violet

* It is recommended that boundaries between noise bands be at XX.00, e.g. 60 to 64 dB is actually 60.00 to 64.99 dB.

3.7 Follow-up actions by CEDR Road Noise

The added value of using of the CEDR colour proposal for END noise mapping should not be limited to the CEDR organization. In order to promote the use of our colour proposal outside CEDR, the following actions have been carried out:

- presenting the CEDR colour proposal at the EuroNoise congress June 2012 in Prague (Alberts and Rubio Alférez, 2012);
- sending the CEDR colour proposal December 2012 to Mr Shilton, the facilitator of the Working Group 6 on the Good Practice Guidelines CNOSSOS, and to Mr Jones, managing director of Extrium. On behalf of DG Environment of the European Commission, Extrium will develop and implement the harmonised noise assessment methods in the near future, including the development of guidelines on the competent use of CNOSSOS. They were asked to consider including the CEDR proposal in the Good Practice Guidelines for CNOSSOS.

References

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Sétra (2009). Road noise prediction, 2 -Noise propagation computation method including meteorological effects (NMPB 2008). Bagneux, France.

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Examples

Two examples to illustrate the looks of noise maps based on the colour proposal.

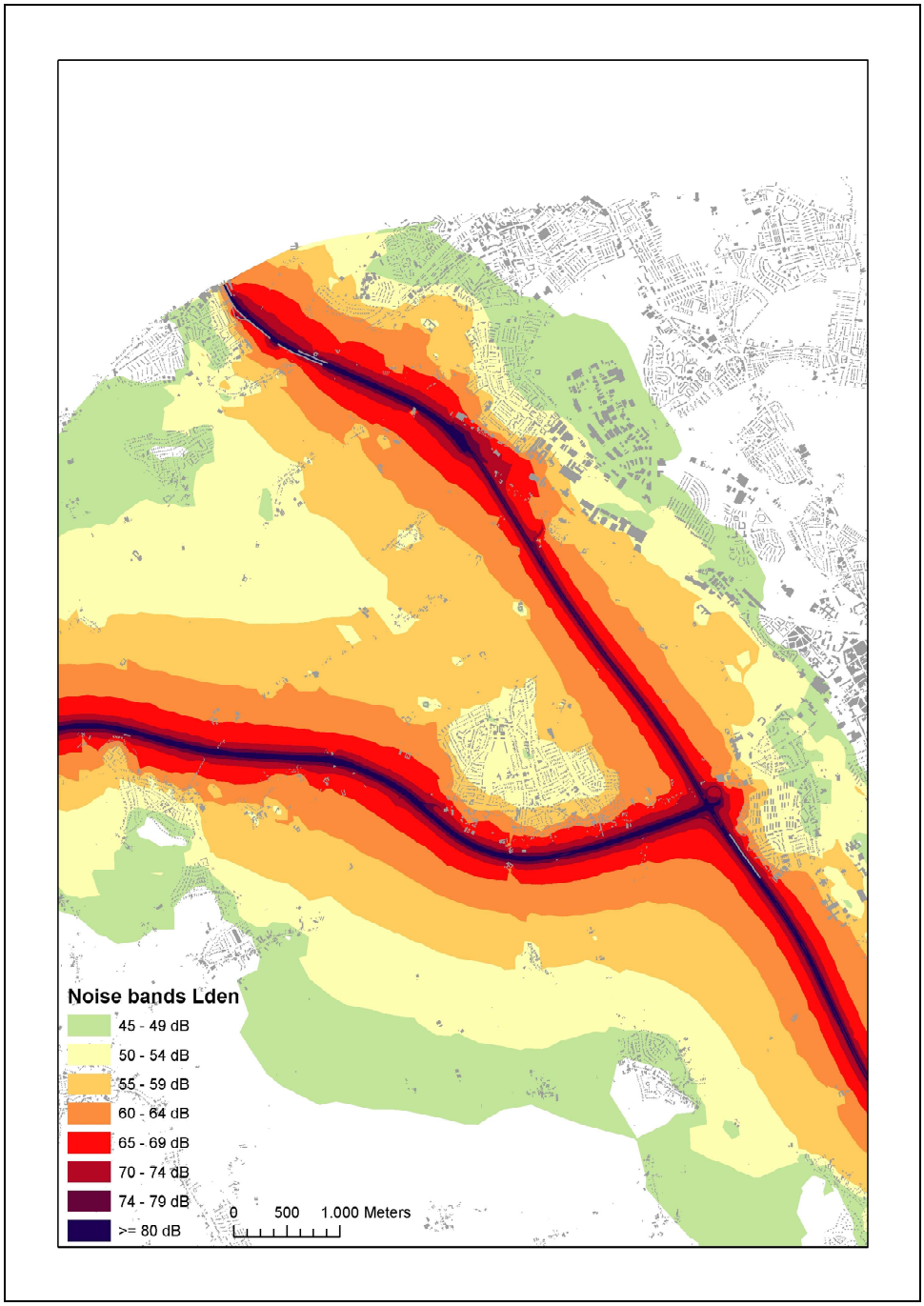

Figure 2 Colour proposal example from the Netherlands

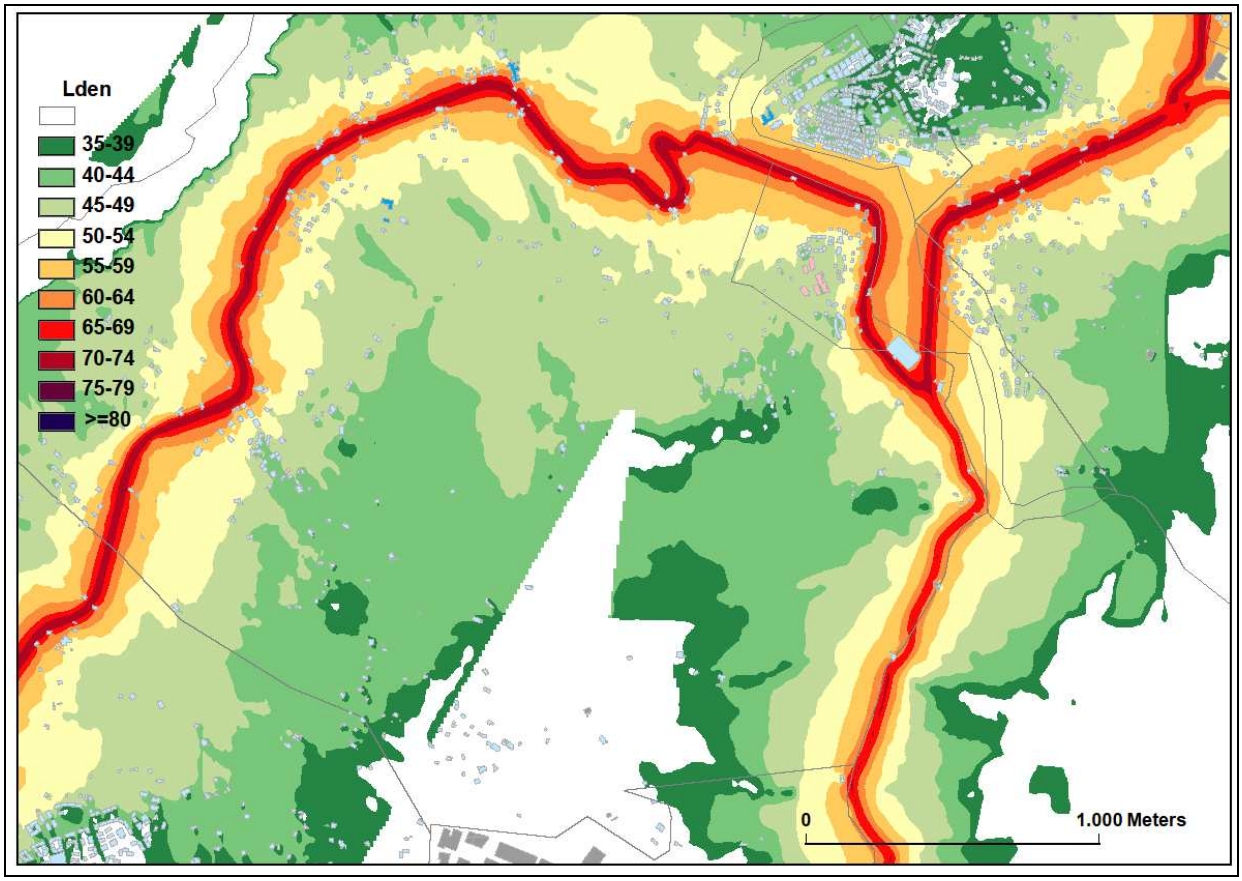

Figure 3 Colour proposal example from Spain

4 Common noise assessment method (CNOSSOS-EU)

4.1 Introduction

Following the publication of the EU Green Paper on Future Noise Policy (Commission of the European Communities (1996)), the EU issued Directive 2002/49/EC, the Environmental Noise Directive (END) (EC, 2002), to establish a framework for environmental noise planning. The END called for the production of environmental noise maps for designated areas as well as the development of appropriate noise action plans. Primarily, in response to the Directive extensive noise studies have been undertaken for the first time in many Member States. In 2007, the first phase of these noise mapping studies were completed and results were published by the European Environment Agency (EEA) via the "Noise Observation and Information Service for Europe (NOISE)".

The END states one of its aims as the definition of a common approach intended to avoid, prevent or reduce, on a prioritised basis, the harmful effects, including annoyance, due to exposure to environmental noise. Member States were required to develop strategic noise maps in 2007, for agglomerations, major roads, major railways and major airports. This programme runs cyclically every five years and the second round of noise mapping was completed in July 2012.

4.2 Principles of the European Noise Directive

The fundamental principles of the END may be summarized as follows:

Monitoring the environmental problem
For the first phase (2007) strategic noise maps were to be developed for all agglomerations of over 250 000 inhabitants, all major roads with over 6 million passages a year, major railways with more the 60 000 train passages a year and major airports with over 50 000 take-off or landing movements a year. The second phase (2012) required the production of maps for agglomerations having over 100 000 inhabitants, roads with over 3 million vehicle passages a year and railways with over 30 000 train passages a year. Strategic noise maps must also take account of high volume outdoor industrial and machinery noise levels.

A strategic noise map presents data on an existing, previous or predicted noise situation in terms of a noise indicator, the exceeding of a limit value and an estimation of the number of dwellings, schools and hospitals in a given area that are exposed to specific values of a noise indicator. Maps must be made for an assessment height of 4 m and must be expressed in terms of the universal noise indicators L_{den} and L_{night}.

Development of noise action plans
Article 8 of the END instructs Member States to ensure that the competent authorities have drawn up action plans to reduce noise where necessary and enforce protection of quiet areas. The action plans must also include a record of public consultation together with what action is intended for the next five years, including measures to protect quiet areas.

Informing and consulting the public
Competent authorities are required to ensure that the general public are kept well informed, are consulted in relation to any proposed noise action plans and given an opportunity to participate in the preparation and review of such action plans. The results of this participation will be taken into account when considering action plans and the public should be informed in respect of all decisions taken. This should lead to a well-informed and educated public forming the basis for a more consistent and effective approach to the management of environmental noise.

Development of a long term EU strategy
The primary objective of the END is to reduce the number of people exposed to unacceptable noise levels throughout Europe in the long term. Establishing a common approach to noise control will lead to the development of a framework for the EU to reduce noise levels.

4.3 Implementation of the European Noise Directive

Based on the EEA report (EEA, 2010), most Member States reported to the Commission on time and all Member States allocated competences for implementation of the END to relevant administrative bodies. The cross-cutting scope of the END has led to the participation of several different government agencies as well as private actors for infrastructure management in some Member States. Several Member States reported problems associated with the coordination of the participating bodies, both in the early stages of data collection and in the later stages of action and implementation planning.

The END introduced noise indicators for reporting but it did not set any legally binding EU-wide noise limit values or targets. However, Member States were required to report their own national limit values which were either in force or under preparation. Most Member States have set legally binding noise limit values while other have recommended guideline values (CEDR, 2010).

In general, the efforts of Member States on reporting enabled the Commission and the EEA to produce an information base that did not previously exist at EU level. However, the quality of the reports and the timing of the deliverables varied considerably and this hampered the compliance assessment process (EC, 2011). Initially in 2005, Member States were required to inform the Commission of the major roads, major railways, major airports, and agglomerations according to the upper thresholds, within their territories. This list was updated in June 2008 to take account of the lower thresholds. Then from 2010 onwards, Member States were required to update the list for both thresholds every five years. The experience gained in the reporting process led progressively to a more timely, comparable and manageable reporting process. After some initial teething problems in 2005, reporting appeared to significantly improve in 2010, the delay was reduced to five months. Overall, in 2010, 18 Member States reported on time, eight were deemed to be late (EC, 2011).

With regards to the delivery of strategic noise mapping in 2007, 12 Member States provided all the mandatory data for all sources, 11 provided data for all sources with some minor shortcomings and 3 provided data for some of the sources. The assessment relating to the first round of noise mapping suggests that around 40 million people across the EU are exposed to noise above 50 dB from roads within agglomerations during the night (Table 6). More than 25 million people are exposed to noise at the same level from major roads outside agglomerations. However, it should be noted that in 2009 there were 512 million people living in the EU (including Norway and Switzerland).

The Commission also looked at the administrative burden and costs required to produce noise maps. The most demanding tasks were obtaining data on the noise sources, topography, surrounding buildings and population. The costs for noise mapping vary between 0.33 - 1.16 EUR/inhabitant, with an average of 0.84 EUR/inhabitant (EC, 2011).

Table 6 Summary of total number of people exposed to environmental noise based on data submitted by the Member States related to the first round of noise mapping (from EC (2011))

Scope:	Number of people exposed to noise above L_{den} > 55 dB (in million)	Number of people exposed to noise above L_{night} > 50 dB (in million)
Within agglomerations (163 agglomerations in EU with more than 250 000 inhabitants in the EU):		
All roads	55.8	40.1
All railways	6.3	4.5
All airports	3.3	1.8
Industrial sites	0.8	0.5
Major infrastructures, outside agglomerations:		
Major roads	34.0	25.4
Major railways	5.4	4.5
Major airports	1.0	0.3

Methodological issues associated with the END

The first phase of noise mapping has yielded certain real benefits; it has enabled a step forward in addressing noise pollution at an EU level and has introduced a management system for environmental noise in all Member States. However, this system is by no means complete and many significant issues, that threaten the ability of the END to meet its intended goals, have still to be addressed. A number of methodological issues concerning the implementation of the END have been identified by academics (Murphy & King, 2010); for example, no standard method for estimating population exposure to noise exists implying that the results from noise studies across Member States cannot be reliably compared or combined. Furthermore, the Directive defined two common indicators that must be used when presenting strategic noise maps, L_{den} and L_{night}. These indicators claim to be common in the following ways:

- Firstly, they allow the comparison of different noise sources. However, in order to reliably achieve this, one needs more than simple A-weighted long term sound pressure levels. Annoyance or sleep disturbance assessments require the detailed analysis of the characteristics of the noise and until now such methods have not been finalized.

- Secondly, they allow for the comparison of different noise maps across member states. This goal is also hard to fulfil. For both the 2007 and 2012 mapping rounds, an interim method was specified in the END. For road traffic noise, the French 'NMPB-Routes-96 (SETRA-CERTU-LCPCCSTB)', referred to in 'Arrêté du 5 mai 1995 relatif au bruit des infrastructures routières, Journal Officiel du 10 mai 1995, Article 6' and in the French standard 'XPS 31-133' was chosen. However, the use of national methods was also allowed. It has been observed that all methods currently being used for noise prediction are empirical or semi-empirical methods which contain many simplifying assumptions and use a simplified representation for the noise source. Accordingly, differences of five decibels for the outcomes of different calculation methods are by no means exceptional (Wolde, 2002). In reality, greater differences may be observed, therefore, significant differences in the 2007 and 2012 noise maps are expected.

In related to previous CEDR work on noise, a number of possible sources of errors in the noise mapping process were noted and these include:
1. incorrect handling of data rounded to the nearest hundred,
2. misinterpretation of the dwelling definition,
3. definition of noise bands,
4. national roads are not the only major roads, and
5. missing major roads data inside agglomerations.

4.4 Development of a common assessment method

The Commission also undertook an assessment of the degree of comparability of the results generated by the different methods. The assessment concluded that the national assessment methods differ from the interim methods for 13 Member States. Following the study, coupled with the results of the 2007 strategic noise maps, it became abundantly clear that for both noise emission and noise propagation a common method was required for use in noise mapping. Attempts to develop such a method began with the Harmonoise project.

1. HARMONOISE

The main objective of this project was to develop a common European noise prediction method, which would meet all aspects of the Directive and was expected to become the obligatory prediction method for all Member States.

Harmonoise delivered two prediction models, an engineering model intended for everyday use and a reference model, the "Golden Standard", that would serve to calibrate the engineering model and also as a high accuracy model for complex propagation problems that could not be adequately solved in a satisfying way by the engineering model. A core aspect of the Harmonoise Model was the separation of source and propagation models. By decoupling the description of the source from the description of noise propagation, the Harmonoise project provided the basis for a generic noise propagation model, which has been validated within the project for surface transport sources (road and railway noise), but which could in principle be extended for other noise sources.

A main priority of the Harmonoise project was to improve the description of weather conditions and their influence on sound propagation. A description of sound propagation through a turbulent or layered atmosphere led to short-term noise levels for 25 meteorological classes. An important advantage of the Harmonoise methods compared to other existing methods is the fact that the level of accuracy will mainly depend on the accuracy of the chosen input parameters. This makes the methods suitable for mapping purposes, where usually less detailed information about source and mapping area is required or available, but also for detailed computations in case of noise assessment studies.

2. IMAGINE

The Imagine project started in December 2003 and was seen as the natural successor to the Harmonoise project. The purpose was to establish a more practical engineering method for sound propagation without knowledge of all meteorological details. Similar to the Harmonoise project, the initial aim was to deliver harmonized methods to be used within the END, however, this project also failed to deliver this ambitious goal.

3. CNOSSOS-EU

In line with the END, the European Commission decided to prepare a Common Noise Assessment Method across the EU (CNOSSOS-EU), for the purposes of strategic noise mapping, in order to improve the reliability and comparability of noise mapping results. During the Regulatory Committee on Noise (June 2010), EU Member States were invited to nominate experts to be involved in the development and implementation of CNOSSOS-EU. The first meeting of this

Technical Forum of Experts took place in November 2010. This expert group then established a number of working groups to assess various aspects of a common calculation method addressing the requirements of the Directive.
Following a number of international meetings, workgroups and communications, the JRC, along with the Technical Forum of Experts, released the first version on the CNOSSOS-EU Reference Report in September 2012 (Kephalopoulos et al., 2012). This reference report describes the proposed common method in some detail and represents the technical basis for the amendment of Annex II of the Directive.

Furthermore, in June 2012 the Commission announced a call for tenders to develop the next phase of the CNOSSOS-EU framework. The objective of this work was to support the next step in the implementation of CNOSSOS-EU. Specifically the project's deliverables included:

- a complete set of input values for each source model,
- CNOSSOS-EU software for testing purposes with open-source technologies,
- guidelines for the competent use of the CNOSSOS-EU framework and a website describing these guidelines.

This project was formally awarded in December 2012. Overall, the goal is to have the common noise assessment methodology operational for the third round of noise mapping in 2017.

4. The Source Model

The source model for road traffic vehicles is probably most relevant to CEDR members as this model will dictate the necessary input data requirements. As such, this section outlines the source model as currently described in the Reference Report.

Initially the Technical Forum of Experts developed a number of sub working groups to analyze various different aspects of CNOSSOS-EU. Working Group Two (WG2: Road Traffic Noise) was established to develop a source model to calculate the sound power of road traffic for use in strategic noise mapping. The first task of WG2 was to assess the current state-of-knowledge regarding the default data currently used and available for strategic noise mapping in the Member States. To achieve this, tables describing each dataset were circulated to all members of WG2. Experts were asked to fill/correct/amend the tables according to the current practice in their country, and according to the relevant information they wanted to share. These tables went on to form the main items for the development of the source model.

A final version of the source model is presented in the CNOSSOS-EU Reference Report. The main aspects of the source model are discussed below.

- Vehicle categories

Five vehicle categories will make up the source model. These include (i) Light Vehicles, (ii) Medium Heavy Vehicles, (iii) Heavy Vehicles, (iv) Powered Two Wheelers and (v) Open Category (to be defined according to needs in the future, examples may include electric cars or buses). The merits of the open fifth category were discussed in some detail. The emission data for this category do not exist, but such a category signifies that the model is being developed in a fashion that will be capable of adapting to the needs of the future.

- Number and position of sound sources

After a detailed assessment of a number of different possibilities it was decided to represent each vehicle type with only one source at a standard height of 0.05 m. It should be noted that, following from the next phase the CNOSSOS-EU project, it may become appropriate to alter the number and position of these point source as this is intrinsically linked with the chosen propagation model.

- Frequency content

The source will be described in separate octave bands as opposed to one-third octave bands.

- Acceleration and deceleration

A simple method to account for the acceleration/deceleration of vehicles near junctions has been developed.

- Correction for studded tyres

The method also considers situations where a significant number of light vehicles in the traffic flow use studded tyres during several months every year. As such a simple method to correct the rolling noise contribution has been included.

- Road gradient

The road gradient has two effects on the noise emission of the vehicle: first, it affects the vehicle speed and thus the rolling and propulsion noise emission of the vehicle; second, it affects both the engine load and the engine speed via the choice of gear and thus the propulsion noise emission of the vehicle. Thus the influence of the road gradient has also been included in the method.

- Directivity

The directivity of the source will not be considered for strategic noise mapping.

- Road surface corrections

The emission coefficients provided in the model are valid for the reference road surface defined in the standard representing a virtual road surface corresponding to an average of dense asphalt concrete 0/11 and stone mastic asphalt 0/11, between 2 and 7 years old and in a representative maintenance condition. For road surfaces with other acoustic properties, the recommendation is to apply a spectral correction factor on rolling noise, and in the case of a porous road surface, to apply spectral correction factors on both rolling and propulsion noise.

- Other issues

Some concerns exist about possible mismatches between road/rail source models and the propagation model with respect to frequency range and source power validation. The next stage of the project should address these concerns.

4.5 Discussion and concluding remarks

Despite the improvements of comparability of strategic noise maps, the situation has still some way to go in order to ensure that noise maps are directly comparable between member states. This issue has also been addressed in our factsheet on the END colour proposals. Ongoing assessments have shown that it remains difficult to present comparable figures on the number of people being exposed to excessive noise levels. Difficulties relate, inter alia, to the many different ways data is collected, quality and availability and assessment methods used. This has led to great variability of results across EU Member States.

In 2010, the Commission started to develop a harmonized method for assessing noise exposure (according to article 6.2). A project entitled "CNOSSOS-EU" (Common Noise Assessment Methods in Europe) led by the JRC provided the technical basis for preparing a Commission Implementing Decision. The JRC released the first version on the CNOSSOS-EU Reference Report in September 2012. This reference report describes the proposed common method in some detail and represents the technical basis for the amendment of Annex II of the Directive. Following on from this, the next phase of CNOSSOS-EU has been initiated and should provide an open source computational model for the testing of the proposed CNOSSOS-EU model. The overall goal is to have a complete, validated model in operation for the third round of noise mapping in 2017.

It is the view of CEDR Project Group Road Noise that the CNOSSOS-EU model should be as complex as necessary and as simple as possible. Noise mapping should be seen as a valuable strategic tool leading to the identification of noise hot spots which should then be assessed in more detail using national methodologies as outlined in relevant national legislation. However, in member states that do not have their own national approach for action planning it is proposed to develop an annex to CNOSSOS-EU that will facilitate these member states to undertake such planning. This should be included in the proposed guidelines for the competent use of CNOSSOS-EU.

A certain amount of trade-off between the complexity of the model and the accuracy of results will be required to make it a workable model across member states. Simplifications that do not significantly impact results but enhance the accessibility of the model should be embraced. Such simplifications which will not alter the L_{den} or L_{night} result at the receiver position of more than ± 2 dB(A) yearly averaged should be based on the availability of input datasets across Europe.

It is recommended that non essential parameters should either be aggregated with the relevant essential parameter, and/or have a default input value defined. This should ensure that CNOSSOS-EU may be implemented across member states using current resources, therefore, avoiding any additional costs in acquiring complex data sets.

4.6 Recommendations

The following is a summary of recommendations arising from the first drafting phase of CNOSSOS:

- input data for traffic flows should ideally be available from regular national traffic counting that is already undertaken by the NRAs;
- the effect of low noise road surface should be derived from national datasets to take national differences into account;
- geometry of traffic lanes and noise screens should be available from a database already existing from the first two rounds of noise mapping;
- for the propagation model, the type of ground (G value), especially in close proximity to roads should be given by default values.

4.7 Follow-up actions by CEDR Road Noise

At a recent meeting of the Regulatory Committee on Noise (22 January 2013) a new platform CIRCA BC was announced for implementing phase B of CNOSSOS-EU. On this platform, one national expert per EU-Member State can bring forward the national discussion addressing CNOSSOS issues. This platform will act as an expert group to follow the progress in the CNOSSOS project, conducted by a British consultant (Extrium Limited). The idea of "pilot group" with experts will no longer be considered.

Therefore, it is recommended, in order to ensure the simplicity of CNOSSOS-EU and the availability of road related data (traffic flow, low noise surface corrections, geometry of lanes and noise screens) a close collaboration of CEDR Road Noise Group members with the national responsible person for CNOSSOS is encouraged. Since the tender includes the development of guidelines on the competent use of the CNOSSOS-EU framework, the influence on that issue is also limited through the national representative.

There are no members of the Regulatory Committee on Noise in the CEDR Road Noise group, but strong personal connections do exist for getting and distributing information about CNOSSOS-EU.

The legislative progress for implementing the CNOSSOS-EU will be discussed further in the NRC.

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