



Approaches adopted by CEDR's working groups to address road traffic noise in Europe

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Summary

Between 2006 and 2017, the Conference of European Directors of Roads (CEDR) designated working groups specifically aimed at addressing issues relating to road traffic noise. During this period, specialists involved in these working groups dedicated significant resources to improving road traffic noise environments in close proximity to motorways in Europe. The group comprised noise, road and planning specialists from national road authorities across Europe. The main goal of the group was to collect, share and disseminate state-of-the-art knowledge relating to topics such as road traffic noise abatement, Environmental Noise Directive noise mapping and action planning, noise barriers, cost-benefit analysis and noise-reducing pavements.

Currently, the issue of road traffic noise is still high on CEDR's agenda and the following sections summarize the activities of CEDR's working groups on road traffic noise. The various deliverables will be described, including the dissemination of this knowledge. Also, current research gaps related to road traffic noise will be identified.

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1. Introduction

The Conference of European Directors of Roads (CEDR, refer to <u>http://www.cedr.eu/</u>) is the platform for cooperation and promotion of improvements to the road system and its infrastructure, as an integral part of a sustainable transport system in Europe. Its members represent their respective national road authorities (NRAs) or equivalents and provide support and advice on decisions concerning the road transport system that are taken at national or international level. 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, economical and environmental aspects of sustainability;
- Promote an international network of personal contacts between road directors and their staff;

- Provide a platform for understanding and responding to common problems;
- Develop a strong involvement in European Union (EU) developments on matters relating to road transport systems;
- Use existing representations on relevant international groups for mutual benefit;
- Utilize the results of common understandings as well as research results in each member country.

Since the creation of CEDR in 2003, strategic action plans are used to structure activities. These plans identify and prioritise topics for the duration of the plan, commonly a period of approximately four years. There is a terms of reference for each topic, dealing with issues such as summary of the task, goals to be achieved, output, human and financial resources, time schedule and the list of CEDR member states interested in participation. After approval by CEDR management, the different working groups commenced work in order to produce their deliverables.

From commencement in 2006, working groups on road traffic noise (RN) were integral to the objectives of CEDR. Road traffic noise was incorporated into each of the respective CEDR action plans and many of the 26 CEDR member states had representations on the various working groups (refer to Table I).

Table I. Overview of the number of CEDR countries and their representatives participating in RN.

Group	Period	CEDR Countries	Representatives	
RN1	2006–2008	12	14	
RN2	2009–2013	17	19	
RN3	2013–2017	14	20	

The background of RN participants ranged from acoustics and spatial planning to road maintenance, with road traffic noise as a common theme in their day to day activities. The fact that there was (and still is) significant interest within CEDR NRAs to address road traffic noise issues, provided a strong incentive for RN to produce state-of-the-art knowledge relating to specific road traffic noise topics.

2. Knowledge reports

During the period 2006–2017, three CEDR RN working groups produced a number of reports with state-of-the-art knowledge relating to specific road traffic noise topics. The focus of the reports was largely dictated by the objectives of the successive CEDR action plans.

Generally, each RN group produced a summary report supported by several technical reports. The summary report targeted CEDR's executive and governing boards and it provided an overview of the group's work including а set of recommendations for consideration. The technical reports targeted road traffic noise experts dealing with researching, planning, constructing, operating and maintaining noise-reducing measures on major road networks in their respective CEDR NRAs.

2.1. RN1: 2006–2008

The main objective of RN1 was to facilitate knowledge sharing on noise management and abatement issues among CEDR NRAs. As a result, RN1 delivered two reports describing the findings of a survey conducted among CEDR member states at the start of 2007.

2.1.1. Noise management and abatement [1]

The report on noise management and abatement focused on several themes that were considered relevant for knowledge exchange as follows:

- Noise regulations for new and existing roads;
- Responsibility and noise management where community developments impact noise levels;
- Integration of noise in road maintenance;
- Noise abatement measures;
- Construction noise;
- Communication of noise-related matters to the public.

Based on the assessment of results obtained from the survey, several conclusions are listed in the report. Also, recommendations for beneficial governance regarding noise management and abatement are provided, such as:

- Due to the significant noise problems along major roads in Europe, it was recommended that noise abatement along these roads is crucial in order to launch a process whereby noise exposure is reduced in the long term; and
- A continuation of international cooperation on noise abatement and management between the NRAs would add value to this objective. The noise mapping and noise action planning requirements arising from the Environmental Noise Directive (END) were identified to aid this overall process.

2.1.2. Road traffic noise research needs [2]

The focus of the report on road traffic noise research needs was on knowledge gaps in noise assessment and abatement techniques, such as those experienced by the CEDR NRAs. The survey aimed to identify priority themes, common within Europe, and to establish a shared approach to the noise issues to promote national and joint future research projects. A questionnaire, covering 14 thematic domains, was developed based on publications on research visions and scientific articles on specific subjects related to road traffic noise.

The top five thematic domains were:

- Rolling noise;
- Advanced noise-reduction technologies between source and receivers;
- Improved regulations related to noise emission (including test methods) and noise control management;
- Traffic management;
- Improved or new socio-economic instruments to promote efficient noise abatement.

As for research gaps, themes related to systems and methods to mitigate noise were considered of primary importance. In particular, the priority list reasserts the common opinion that noise must initially be reduced at source (rolling noise) before introducing measures to mitigate noise between source and receivers.

In summary, RN1 achieved its objective of placing the issue of road traffic noise on the agenda of CEDR NRAs. Not only did RN1 provide the NRAs with important technical information on noise management and abatement, they have also made an important contribution to define the future research agenda for road traffic noise.

2.2. RN2: 2009–2013

In the CEDR Strategic Plan 2009–2013, the following general goals were defined for RN2:

- Establish and update modern standards in line with the objectives of the NRAs and how to facilitate the individual use of new standards;
- Monitor European lawmaking and take appropriate action on EU Directives;
- Develop and share knowledge on sustainable infrastructure.

Based on these goals, CEDR RN2 formed subgroups, each with a designated subject area: END noise mapping, END action planning, road traffic noise abatement, road traffic noise research needs and factsheets on specific road traffic noise issues.

2.2.1. The European Noise Directive and NRAs: final summary report CEDR road noise 2009–2013 [3]

The summary report outlined a short synopsis of the main findings of each subgroup's report along with highlighting some of the key recommendations formulated by the various subgroups in their technical reports.

2.2.2. Technical reports from RN2 subgroups

The following summarizes the findings from the various technical reports and fact sheets:

- END noise mapping [4]:

Based on the work undertaken for END noise mapping, it was recommended that all NRAs should closely monitor or actively participate (through the relevant channels in their country, e.g., Noise Regulatory Committee representative) in the development of the new calculation methodology (Common Noise Assessment Methods in Europe (CNOSSOS-EU)) to ensure that a simplified approach rather than a more advanced approach was adopted for strategic noise mapping.

- END noise action plans [5]: The findings in relation to the END noise action plans highlighted the need for caution when preparing noise action plans as most CEDR member states had issues around the availability of adequate resources to implement the necessary noise abatement measures required to reduce road traffic noise levels in close proximity to major roads.

- Value for money in road traffic noise abatement [6]:

The main conclusion arising from the value for money in road traffic noise abatement report, clearly demonstrated that source-related noise measures (quiet vehicles and tyres) are by far the most cost-effective measures for reducing road noise from major roads.

- CEDR road noise research needs [7]: The work addressing CEDR's road noise research needs, called for the inclusion of road traffic noise topics, such as the design and development of effective and efficient solutions to abate noise, in CEDR's transnational research programme.

- CEDR road noise factsheet report [8]: Finally, during the lifetime of RN2, a number of noise factsheets were produced responding to road traffic noise-related issues that had the potential to have a significant impact on how CEDR members addressed noise in close proximity to major roads. Issues addressed included END major road data, policy options for the improvement of END, END noise mapping colour regimes, and CNOSSOS-EU.

In summary, implementation of the work undertaken by RN2 enhanced the approach taken by CEDR member states in addressing all END activities. More specifically, it had a profound impact on the cost-effectiveness of the various CEDR member states implementing EU noise legislation.

2.3. RN3: 2013–2017

A key recommendation emerging from the final RN2 summary report was that NRAs should use innovative noise-related research undertaken by CEDR members when defining the scope of the CEDR RN3 work programme. The latest innovative research in the areas of noise-reducing pavements, noise barriers, and cost-benefit analysis (CBA)/cost-effectiveness analysis (CEA) was comprehensively reviewed and assessed by RN3. The main objective of this knowledge review was to collate results and make the latest innovative research findings as well as the main conclusions from previous CEDR RNs available to CEDR member countries.

2.3.1. State of the art in managing road traffic noise: summary report [9]

This summary report identified key issues and potential research topics for the CEDR 2018 Noise Research Call. It also presented recommendations for each of the three research areas considered which were described in the following technical reports.

2.3.2. Noise-reducing pavements [10]

This technical report addressed the following key issue, e.g., pavement costs, the importance of high-quality construction, lifetime acoustic performance and the incorporation of the parameter of noise into pavement management systems. These were the key issues NRAs encounter when considering using noise-reducing pavements as a noise mitigation measure during the planning, construction and maintenance of national road projects.

2.3.3. Noise barriers [11]

This technical report presented an overview of the issues associated with using noise barriers along European major roads. This was undertaken by assessing results from innovative research projects undertaken within specific CEDR member states and from reports arising from the CEDR 2012 transnational research call on road traffic noise (refer to par. 4 for further information). The primary objective of this exercise was to assist each NRA in the planning, building and maintaining processes of noise barriers for new and existing road infrastructure.

2.3.4. Cost-benefit analysis and costeffectiveness analysis [12]

The objective of this technical report was to enhance CEDR member states knowledge and awareness of theories and techniques necessary to carry out cost-benefit analysis (CBA) and costeffectiveness analysis (CEA). The report presents an introduction to economical assessment methods in general and their potential role in the decisionmaking process of noise impact assessments or implementation of noise mitigation measures in NRAs. Based on the work undertaken by RN3, it was concluded that the majority of measures identified has the potential to reduce costs for NRAs in the planning, construction and maintenance phases of both new road projects and existing roads, as well as potentially reducing the number of noiseannoyed people living in close proximity to motorways. However, it is clear that further work is needed to promote the use of common methodologies across CEDR NRAs and to fill knowledge gaps where such gaps are identified.

3. Knowledge dissemination

Early in the process, the CEDR RN working groups identified that it was insufficient to only generate reports on the processes involved in improving noise quality along motorways and increasing noise abatement within NRAs. They were acutely aware of the importance of also disseminating any new knowledge at a national participants initially level. RN undertook dissemination of new knowledge by informing their colleagues within the NRAs using lectures at departmental level as well as participating in national noise conferences. They also prepared articles for publication in professional literature. Internationally, RN participants promoted their findings at various international forums [13]–[23]. Additional examples of knowledge dissemination

Additional examples of knowledge dissemination activities included:
In April 2014, RN2 members gave presentations relating to END noise mapping

- presentations relating to END noise mapping and END action plans at the Transport Research Arena (TRA) conference in Paris, France;
- In September 2015, RN3 members participated in the end of programme workshop in Hamburg, Germany, which discussed the findings of the 2012 CEDR transnational noise research call;
- In May 2017, the CEDR symposium Road Traffic Noise Management and Abatement was held in Copenhagen, Denmark. At this symposium, RN3 presented their reports, key findings and recommendations to over 75 people from European organisations, national road administrations, national environmental agencies, EU agencies, research institutes and noise consulting companies from 15 European countries. The RN3 presentations were augmented by additional presentations and discussion focusing on new solutions and

methods linked to the area of road traffic noise abatement and the integration of road traffic noise into road and traffic planning and management;

In March 2018, the first meeting of the CEDR Knowledge Exchange Centre on Road Pavements is scheduled to be held in Haarlem, Netherlands The purpose of the the Knowledge Exchange Centre is to share knowledge on noise-reducing pavements among the European NRAs. During this two day lunch-to-lunch meeting, experts from the Dutch NRA (Rijkswaterstaat) will share their knowledge on a variety of topics, such as mix design, long service life, regular and winter maintenance, recycling, costs, noise reduction and other performances.

Based on the listed dissemination activities, it can be concluded that the findings of the RN working groups have been comprehensively disseminated. However, successful dissemination does not guarantee that implementation within NRAs will be undertaken successfully.

4. Research gaps

From initial establishment, RN invested significant resources in assessing research relating to road traffic noise issues. Recurring issues revolved around research gaps relating to road traffic noise. While considerable research has been undertaken in previous years, there are still important gaps to fill. Based the 2017 RN3 reports, it is possible to produce an overview of the main issues where further research effort is required (refer to Table II).

In order to avoid making excessive demands on individual NRAs, CEDR developed the CEDR Transnational Research Programme. It operates through a series of annual transnational calls on topics that address the needs of European road authorities. The aim is to produce research results that can be implemented by CEDR member states which contribute to a safe, sustainable and efficient road network across Europe. It is funded by CEDR members on a voluntary basis and tendering for projects is open to any legal entity, established in a European country. For example, CEDR Call 2012 launched in May 2012 with an overall budget of €4.35 million and this Call funded programmes on climate change, noise, recycling and safety. The programme addressing noise issues was entitled 'Integrating strategic noise management into the operation and maintenance of national road networks'. Six CEDR member countries formed the project executive board for this programme. This noise research programme was developed to address the needs of NRAs by providing appropriate guidance and tools to assist with integrating noise into the

Table II. Potential topics for consideration in future CEDR research calls.

Description

Pavements topics proposed in 2017 CEDR Summary Report Road Traffic Noise: - enhancing the long-term performance (durability and noise reduction capabilities) of noise reducing pavements - assessing the impact of winter maintenance on porous pavements in different climatic zones - optimising the noise-reduction potential of cement concrete by focusing on pavement surface texture - developing an asset acceptance methodology to be adopted by CEDR member countries Noise barrier topics proposed in 2017 CEDR Summary Report Road Traffic Noise: - improving the long-term quality of noise barriers - In situ test methods that do not require the carriageway side of the barrier to be used by operators and/or equipment (for safety reasons) - correlating results of in situ test methods (EN 1793-5 and -6) and laboratory-based methods (EN 1793-1 and -2) - reviewing and compiling published data on the long-term acoustic in situ performance of noise barriers Cost-benefit analysis topics proposed in 2017 CEDR Summary Report Road Traffic Noise: - identifying the rationale behind the use of varying cost factors in Europe for the same noise indicators - reviewing and revising the various cost factors, particularly health effects, considering new sources such

as the forthcoming World Health Organization (WHO) environmental noise guidelines for the European region

planning of new and the management of existing national roads, while considering planning legislation in EU member states.

The CEDR 2012 Call, addressing noise, contained the following four research projects:

- QUESTIM, Quietness and Economics Stimulate Infrastructure Management [24];
- ON-AIR, Optimised Noise Assessment and Management Guidance for National Roads, a handbook on integration of noise in all aspects of road planning and maintenance [25];
- DISTANCE, Developing Innovative Solutions for Traffic Noise Control in Europe [26];
- FOREVER, Future Operational impacts of Electric Vehicles on national European Roads [27].

The findings and recommendations arising from these four research projects are summarized in the CEDR Call 2012 Noise Final Programme Report [28] published in September 2017.

Similar to other research calls, the 2012 noise research programme proved very effective at tackling specific research gaps. Therefore, careful consideration should now be given to preparing future noise research calls with the list of main topics identified in Table II forming the basis of any research discussions.

5. Conclusions

Road traffic noise is still high on CEDR's agenda and the activities of the working groups have helped to elucidate some of the issues around tackling road traffic noise in close proximity to major roads in Europe. Some of the achievements of these working groups between 2006 and 2017 can be summarised as follows:

- RN produced a range of reports which provided CEDR NRAs with up-to-date knowledge on a wide range of road traffic noise issues;
- RN contributed to defining road traffic noise research gaps and helped close these gaps by participating in the CEDR Call on road traffic noise;
- RN disseminated road traffic noise knowledge and research gaps at departmental, national and international level.

In general, it can be concluded that the RN working groups delivered the objectives related to road traffic noise, identified in CEDR's strategic plans. However, while the benefits of implementing this output is clear, it is anticipated

that successful implementation at individual NRA level will be a long-term objective. Once implementation is complete, it is expected that a positive outcome will be achieved in terms of key performance indicators at NRA level, such as cost savings and improved noise quality along national roads in Europe.

Disclaimer

The views expressed in this paper are those of the authors and not necessarily those of CEDR or any of the CEDR member countries.

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