REDUCTION OF NOISE FROM TRANSPORT IN RELATION TO DIRECTIVE 2002/49/EC

Rudolf Cholava*[1], Petra Dvorakova[1], and Petr Smekal[1]

[1]Transport Research Centre (CDV), 636 00 Brno, Lisenska 33a, Czech Republic
rudolf.cholava@cdv.cz

Abstract

The development of transport brings together with positive effects also the amount of negative impacts, including the excessive noise burden especially in the vicinity of roads. To ensure the effective system of the assessment and management of environmental noise, the Directive 2002/49/EC of the European Parliament and of the Council was adopted. The paper presents partial results from the ongoing project, which deals with the action planning in accordance with the mentioned directive and is being worked out by the team from Transport Research Centre (CDV) in the Czech Republic together with other partners. The objective of the project is to create methodology for elaborating action plans that will manage the annoying and harmful noise effects in the specified areas and will determine procedures for noise reduction. The solution starts from strategic noise maps for major roads, major railways and major airports and will include the design of measures for noise reduction in places, where limit values of noise indicators will be exceeded, in the frame of the feasibility study in a selected region. The findings from other projects of CDV, aimed at both the verification of the official Czech method for calculation of road traffic noise for traffic on multi-lane highways and the method for determination of the number of people exposed to excessive road traffic noise, will be applied.

INTRODUCTION

The main objective of the presented ongoing research project „Methodology for elaborating action plans for the neighbourhood of major roads, major railways and major airports“ is to create the methodical guidance which will enable the elaboration of action plans for the mentioned areas according to the Directive 2002/49/EC and the systematic approach to the management of traffic noise in accordance with the directive [2]. This project is supported by the Czech Ministry of Transport which is designated as the competent authority for the development of action plans for major roads, railways and airports specified by the directive.

STATE-OF-THE-ART IN THE FIELD OF REDUCTION OF NOISE BURDEN FROM TRANSPORT

A wide ranging review of the most important measures, which can achieve reduction of noise burden from transport in the different extent, was carried out in the first stage of the project. This review covered relevant sources of information and also reflected findings and experience of the project team. The output from this initial phase is the database of information sources described later which should be helpful particularly for future developers of action plans. In the wide field of measures for road traffic noise abatement, which includes measures at sources, on the way of noise propagation and at receivers, there exist different approaches to classifying those measures [3, 6, 7, 10]. In the project the hierarchic approach was respected and anti-noise measures were split into the following categories regarding the priorities:

- urban-architectural measures,
- urban-traffic measures,
- traffic-organizational measures,
- building-technical measures.

Table 1 - Summary table of road traffic noise reducing measures (selection)

Anti-noise action	Existing roads/buildings			
	Efficiency	Feasibility	Durability	Cost
Roads in cuttings	***	**	****	**
Roads on embankments	**	**	****	**
Tunnels (rock)	****	*	****	*
Cut and cover	****	**	****	*
Viaducts	***	**	****	*
Barriers	**	**	**	***
Facade insulation	***	***	***	***
Traffic management	**	***	***	***
Special routes for heavy vehicles	**	***	***	***
Smooth flow	**	**	**	***
Increase public transport	*	***	**	**
More silent vehicles	**	**	**	***
Low noise pavement	**	**	*	***
More silent vehicle tyres	**	**	*	****

* = poor; ** = fair; *** = good; **** = very good

The choice and use of different noise-reducing measures depend on the physical situation, financial feasibility, political acceptance and the cultural values which form the basis for decision-making. Table 1 presents a summary of the efficiency,

feasibility, durability and cost of the different kinds of anti-noise measures [10]. The measures with the most asterisks can be regarded as the most suitable solutions. Table 2 contains selected measures at the source [7] and shows their potential.

Table 2 - Noise reduction at the source (selection for road traffic)

Measure		Local effect [dB(A)]
Low-noise road surfaces		0-10
Traffic management	volume, redirection, by-passes	0-5
	restrictions in time and area	0-15
Speed reduction, traffic flow	speed limits	0-4
	traffic restraints	0-3
	optimal flow, accessibility, green wave	0-2
	road junction design	0-2
	road alignment	0-2
	driver behaviour	0-5

Relevant information in the field of railway and aircraft noise was processed in a similar way as well. A lot of attention was also paid to methods for the assessment of the economic effectiveness of anti-noise measures because ranking solutions to noise problems is principally guided by two - sometimes competing – criteria that is effect reduction and cost-benefit ratio [4, 11].

The database of information sources on anti-noise measures, which is based on the carried out review and analyses, is the outcome of this phase of the project. Particular items of the database relate to noise reduction in the field of traffic planning, land-use planning, technical measures at noise sources, selection of quieter sources, reduction of sound transmission and regulatory or economic measures. The database will being continuously completed and updated and will provide developers of action plans and other stakeholders with necessary detailed information.

MODELLING ACOUSTICAL SITUATIONS IN THE VICINITY OF ROADS AND THE EFFECT OF SELECTED ANTI-NOISE MEASURES INCLUDING ECONOMIC ASSESSMENT

Acoustical situations and the effect of selected anti-noise measures have been modelled by using the software SoundPLAN [2]. The output from this phase of the project is the database of model situations, which complete taken over information about the effect of particular anti-noise measures on acoustical quality of the environment along transport ways, it will be used in the feasibility study and in being prepared methodology for elaborating noise action plans.

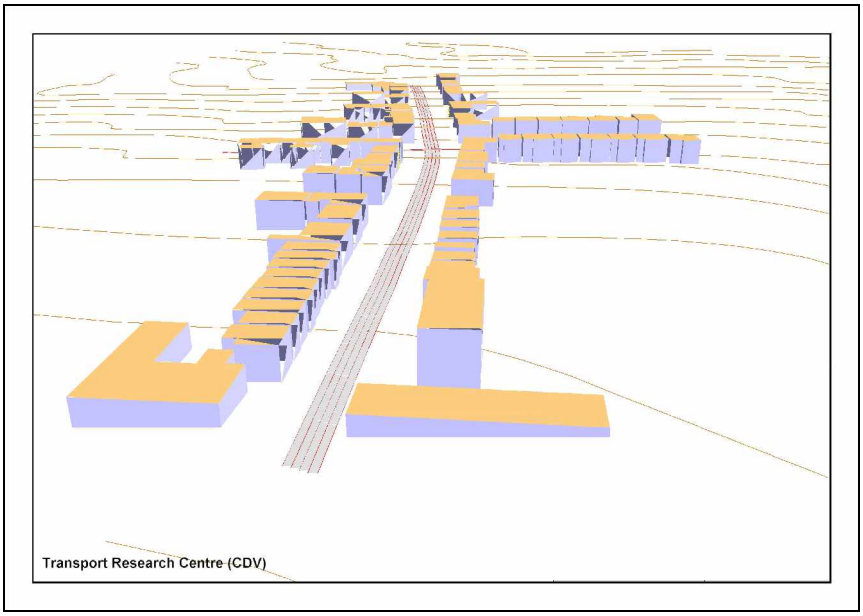

Figure 1 – Model situation (urban street canyon)

Figure 1, 2 and 3 present one of the model situations, where the effects of particular measures were demonstrated and compared. Basic input traffic data are as follows: traffic volume cca 23 000 vehicles.24h^{-1} (according to sections), percentage of heavy vehicles 15 %, maximum speed limit 50 km.h^{-1}.

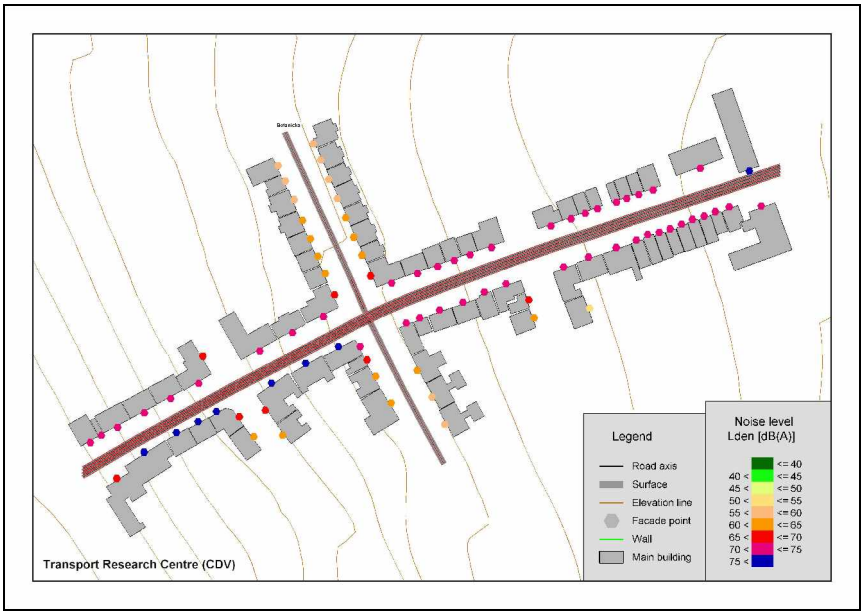

Figure 2 – Noise levels at facades of buildings (height 4 m)

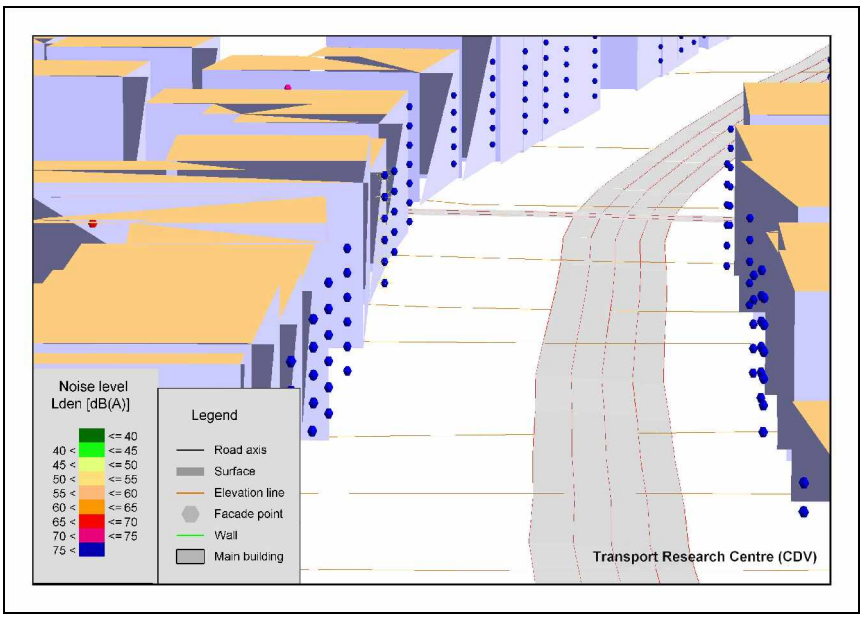

Figure 3 – Noise levels at facades of buildings

Examples of results from the assessment of the effect of particular measures are shown in Figure 4 and 5. It is obvious, that there is a limited effect of noise protection walls from the point of view of high buildings, which cannot be easily screened by walls.

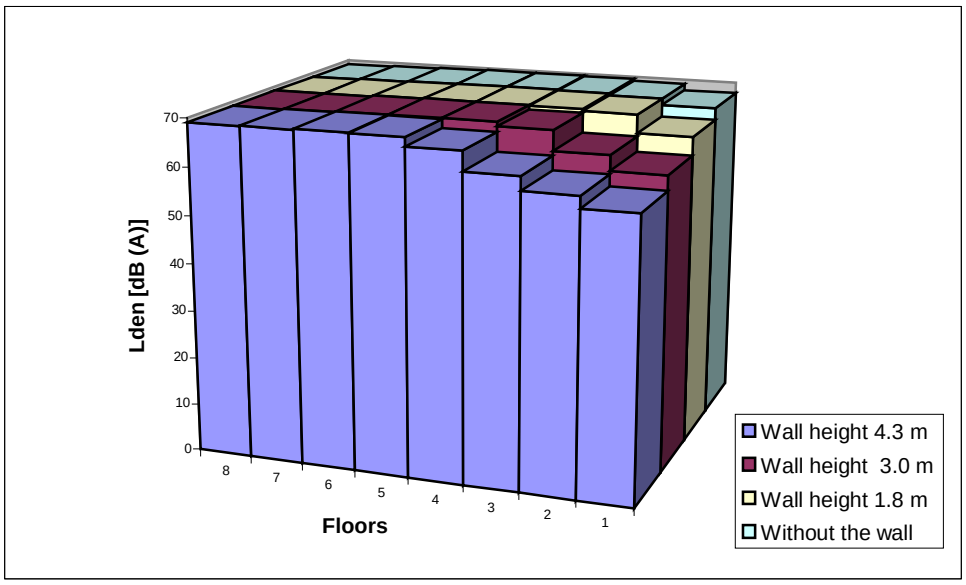

Figure 4 – Effect of noise protection walls (smooth asphalt)

Significant reduction of road traffic noise is feasible in dependence on the suitable road surface type as shown in Figure 5.

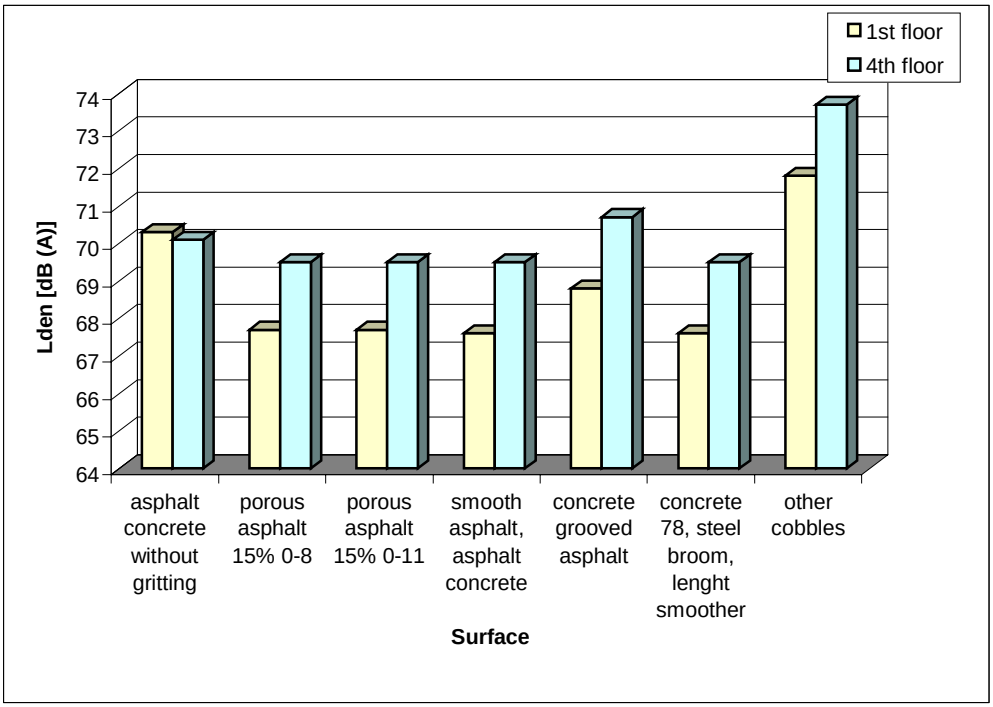

Figure 5 – Effect of road surface types

DETERMINATION OF THE NUMBER OF INHABITANTS AFFECTED BY TRAFFIC NOISE

The application of the method for determination of the number of people exposed to traffic noise, which was proposed by CDV, is assumed in the project.

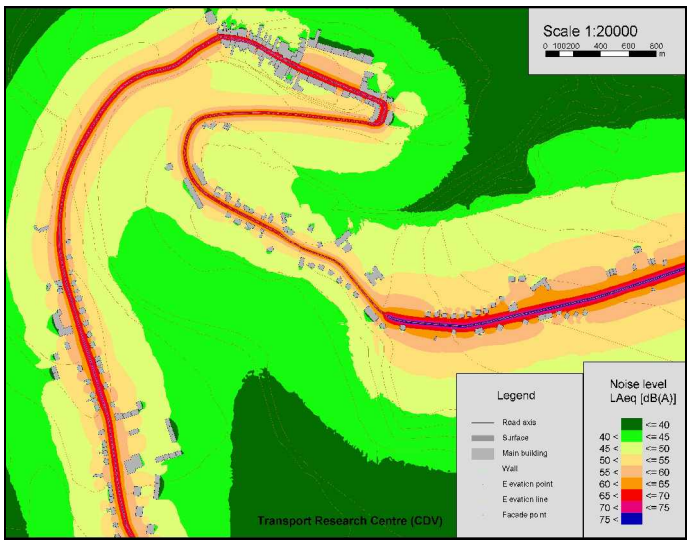

Figure 6 – Noise map of Moravsky Krumlov

The procedure and results are presented on the following example of the town Moravsky Krumlov [1]. Calculations of noise levels at facades of the first row of dwellings were being done on the both sides of roads, the software SoundPLAN was used [5, 8, 9]. All calculations of the acoustical values in the vicinity of the selected road network refer to the height of 4.0 m above the ground and to the distance of 2.0 m from the most noise exposed facades of each dwelling.

Table 3 - Numbers of inhabitants affected by noise from road traffic in Moravsky Krumlov

Decibel band of L_{Aeq} [dB(A)]	40-45	45-50	50-55	55-60	60-65	65-70
Affected inhabitants [%]	4	6	40	23	15	12

Data on the number of people, who live in dwellings exposed to traffic noise, were acquired and the numbers of people exposed to traffic noise in particular 5-dB bands are received by cumulative summarizing people living in all exposed dwellings. The brief overview of selected results is given in Figure 6 and Table 3.

METHODOLOGY FOR ELABORATING ACTION PLANS FOR THE NEIGHBOURHOOD OF MAJOR ROADS, RAILWAYS AND AIRPORTS

Based on the described activities and in accordance with the Directive 2002/49/EC (END) and the Czech legislation, the first proposal of the methodology for elaborating noise action plans was worked out. The methodology respects the following items which are required by the END [12] for these types of action plans:

- a description of the major roads, the major railways and major airports,
- the authority responsible,
- the legal context,
- limit values in place,
- a summary of the results of the noise mapping,
- an evaluation of the estimated number of people exposed to noise, identification of problems and situations that need to be improved,
- a record of the public consultations,
- noise-reduction measures already in force and projects in preparation,
- actions which the competent authorities intend to take in the next 5 years,
- long-term strategy,
- financial information,
- provisions envisaged for evaluating the implementation and the results of the action plan.

The proposed methodology defines steps to develop action plans for the efficient management of noise issues in the specified areas. During the next period this proposal will be refined and modified according to findings from the feasibility study in a selected region and with reference to the development in the legislation.

SUMMARY

Particular phases and outputs from the ongoing research project, which is aimed at the creation of methodology for elaborating noise action plans in the neighbourhood of major roads, railways and airports in accordance with the Directive 2002/49/EC, were presented. The activities in the frame of the project resulted in the proposal of the mentioned methodology which will being verified in the feasibility study in a selected region in the next period.

ACKNOWLEDGEMENT

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