ABSTRACT
Currently we live in a noisy world and traffic figures prominently in the sources of noise burden of inhabitants. The paper presents results from the ongoing project named „Methodology for elaborating noise action plans for the neighbourhood of major roads, major railways and major airports”, whose main objective is to create the methodical guidance, which will enable the elaboration of noise action plans for the mentioned areas according to Directive 2002/49/EC of the European Parliament and of the Council and the systematic approach to the management of traffic noise in accordance with the directive. This project is supported by the Czech Ministry of Transport which is designated as the competent authority for the development of action plans for roads, railways and airports specified by the directive. Based on the realized activities and in accordance with the directive and the Czech legislation, the first proposal of the methodology for elaborating noise action plans was worked out. During the next period this proposal will be modified and refined according to findings from the feasibility study, which was realized in the selected region.

INTRODUCTION
Creation of the methodical guidance, which will enable the elaboration of noise action plans for the vicinity of transport infrastructure according to Directive 2002/49/EC and the systematic approach to the management of traffic noise in accordance with the directive, is 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” [2]. The 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 and the project is being worked out by the team from Transport Research Centre (CDV) together with other partners. This project is also aimed at the feasibility study of the proposed methodology, which was realized in the selected region. The following chapters describe the applied procedure and present findings from particular project phases.

METHODOLOGY
The first stage of the project was focused on the 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. The output from this initial phase is the database of information sources which should be helpful particularly for future developers of action plans. 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 be continuously completed and updated and will provide developers of action plans and other stakeholders with necessary detailed information.

Based on the mentioned activities and in accordance with Directive 2002/49/EC (END) and the Czech legislation, the first proposal of the methodology for elaborating noise action plans was
worked out. The following items, which are required by the END [12] for these types of action plans, are respected in the proposal:
- 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. More detailed information is available in [2].

FEASIBILITY STUDY
In 2006, activities realized in the frame of the feasibility study of the proposed methodology for elaborating noise action plans for the neighbourhood of major roads, major railways and major airports were focused on the most important selected procedures and measures.

In consideration of the previous selection at the Pardubice Region for verification of the proposed methodology for developing noise action plans, town Vysoke Myto was chosen for the feasibility study in the field of road traffic noise. Town Vysoke Myto is located in eastern Bohemia; it is one of the oldest and most important towns of the Pardubice Region. One of the main environmental issues in this town is the first class transit road from Hradec Kralove to Olomouc, Ostrava and Brno.

Figure 1. – Transit road I/35 and the proposed bypass of town Vysoke Myto
Road traffic noise reduction measures, which were analyzed in the first project stage, are concretized in the feasibility study.

**Noise reduction measures in the field of traffic and land-use planning**

These measures represent the essential potential for noise burden reduction of inhabitants and regarding to specifics of town Vysoke Myto, the stress was laid especially on these measures.

The problem of transit traffic can be solved through the bypass, in the feasibility study the option according to Figure 1 was considered. For simulating the acoustical situation after construction of the bypass, it is necessary to determine traffic volumes on relevant roads. In the project the software EMME/2 was applied for modelling traffic volumes and traffic modelling was based on the national traffic model.

All calculations of the acoustical values in the vicinity of the assessed route in the area of town Vysoke Myto refer to the height of 4.0 m above the ground. The input and output data are processed in the environment of the software SoundPLAN that enables their effective graphical presentation. This specialized software, in the applied version for modelling noise from road traffic, enables to evaluate and visualize conflict information in relation to the noise map (module Grid Noise Map Evaluation) and also the assessment of noise burden of inhabitants in buildings in relation to noise levels at facades (module Facade Noise Map).

The basic background materials for creating the model in the environment of the software SoundPLAN are geographical data of town Vysoke Myto, these data were provided for the purpose of noise calculations in the frame of the feasibility study in the digital form by the Municipal Office of Vysoke Myto [8]. The 3D model of the area of town Vysoke Myto in SoundPLAN had to be completed with some data from the detailed field survey (e.g. heights of dwellings), because these data were not included in the provided data set and at the same time they are essential for noise calculations.

Basic input data for noise calculations are data on road traffic on the assessed road I/35 and parameters of this road. For calculation, this road is split into particular segments which correspond to road segments in traffic census. Traffic volumes for particular options, with and without the bypass, were determined.

The calibration of the calculation model is the necessary requirement for achieving correct calculation results, calibration measurements for this purpose were realized on the chosen sites. Traffic volumes, percentages of particular categories of vehicles, climatic and topographical data were determined simultaneously on measuring sites during acoustical measurements. The calculation road traffic noise map of Vysoke Myto for the situation with the bypass is presented in Figure 2.

![Figure 2. - Noise map of Vysoke Myto (option with the bypass)](Image)
Calculations of noise levels at facades of dwellings for determination of the number of people exposed to traffic noise in particular 5-dB bands 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.

Data on the number of people, who live in dwellings exposed to traffic noise, were acquired from the evidence database, these data were prepared and provided by the Municipal Office of Vysoko Myto [8]. 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 3 and Table I.

![Figure 3. – Road traffic noise burden of inhabitants along road I/35 in Vysoko Myto (option without the bypass), $L_{den}$ [dB(A)]](image)

![Table I. – Numbers of inhabitants exposed to road traffic noise along road I/35 in Vysoko Myto (option with and without the bypass), $L_{den}$ [dB(A)]](image)

<table>
<thead>
<tr>
<th>Decibel band of $L_{den}$ [dB(A)]</th>
<th>40,0 - 44,9</th>
<th>45,0 - 49,9</th>
<th>50,0 - 54,9</th>
<th>55,0 - 59,9</th>
<th>60,0 - 64,9</th>
<th>65,0 - 69,9</th>
<th>70,0 - 74,9</th>
<th>≥ 75,0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of inhabitants (without bypass)</td>
<td>0</td>
<td>57</td>
<td>268</td>
<td>250</td>
<td>576</td>
<td>455</td>
<td>933</td>
<td>230</td>
</tr>
<tr>
<td>Number of inhabitants (with bypass)</td>
<td>0</td>
<td>245</td>
<td>320</td>
<td>276</td>
<td>610</td>
<td>680</td>
<td>522</td>
<td>116</td>
</tr>
</tbody>
</table>

**Summary**

The proposed methodology was gradually applied in other main fields of noise reduction measures (technical measures at noise sources to reduce noise, quieter sources, measures to reduce sound transmission) and also for railway and air traffic [2]. The stress was laid especially on the analyses of selected measures, obtaining necessary data and determination of priorities in relation to typical situations. Attention was also laid on evaluating the economic effectiveness of proposed measures and scenarios. The choice and use of different noise-reducing measures depend on the concrete physical situation, financial feasibility, political acceptance and the cultural values, which form the basis for decision-making. The results from other research projects of Transport Research Centre (CDV), aimed at both calculation of noise from traffic on multi-lane highways and determination of the number of people exposed to excessive road traffic noise, were reflected as well.
CONCLUSIONS
Main phases and results from the ongoing research project, which is focused on the creation of methodology for developing noise action plans in the neighbourhood of major roads, railways and airports in accordance with Directive 2002/49/EC, were presented. During the next stage of the solution, the proposal of the methodology will be modified and refined according to findings from the realized feasibility study and the application of the project outputs will contribute to improvement of the acoustic environment quality.

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References