QUADMAP, three pilots and a methodology

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ABSTRACT

QUADMAP a LIFE+ project is running in three European cities, Bilbao, Florence and Rotterdam. The project aims to develop a methodology for identification, selection and management of quiet urban areas (QUA's). This because a methodology is still lacking. In the pilot various types of Quiet Urban Areas have been studied. The areas were analyzed by means of noise mapping, noise measurements and field surveys, asking visitors to their perception. An expert judgment was also conducted. Based upon these analyses interventions were proposed for the selected areas in order to improve the current soundscape, and the overall perception and valuation of the visitors of these areas. The aim of designating and protecting Quiet Urban Areas is that areas with a good acoustic quality and relatively low noise levels are beneficial for health because it offers relaxation and reduce stress levels. Some results are already available on the noise levels determined, perception of wellbeing and all kind of elements present in these areas. Interventions have been planned and employed. The QUADMAP pilot projects will comprise an ex-ante evaluation as well, giving more insight on the effects of various interventions such as noise barriers, low noise asphalt and nature features, on both acoustic and perception factors.

1. INTRODUCTION

As the Environmental Noise Directive 2002/49/EC is not clear how to identify, designate and manage quiet urban areas, the partners in the QUADMAP project decided to develop a methodology that supports competent bodies in doing this. This methodology is being developed within the LIFE+ QUADMAP project. QUADMAP is an acronym for **QU**iet **A**rea **D**efinition and **M**anagement in **A**ction **P**lans. The QUAMAP project will deliver a guideline that will support authorities by offering them a methodlgy. Quiet (Urban) Areas are important because they are more or less a haven of quietness or peace for the residents. Residents can flee from the bustle in the city in order to relax, perceive calmness, nature and natural sounds. That quiet urban areas are contributing to residents health was already acknowledged by experts and also by administrations [1]. Partners involved in the QUADMAP project are the municipality of Florence, the University of Florence (UNIFI), Vie.en.Rose, the municipality of Bilbao, TECNALIA, BruitParif, the municipality of Rotterdam and DCMR Environmental Protection Agency (DCMR EPA).

2. THE PROVISIONAL METHODOLOGY

In order to develop the methodology an action plan with several steps was drafted. A quick overview is depicted in figure 1. The first stage (I) of the project was to make an inventory of legislation, policies and approaches that was already in place in EU Member States.   Also the noise maps provided during the first round of noise mapping according the Environmental Noise Directive (END) delivered input because by means of these maps quiet or relative quiet areas can be identified. During this stage also the use and function of these area should be examined. Based on the latter information derived from the noise maps and use/function potential quiet areas could be pre-selected (II). A subsequent desk study, so is assumed, could give additional data and information about the selected potential quiet areas (III). Realizing that quiet areas do have different noise levels, different size, different morphology, different functions and different use it was also decided to include the possibility to define and designate sub areas. The next step (IV) was to conduct noise measurements in the selected areas, both short term and long term. During this step also visitors and users of the selected areas will be questioned by means of standardized questionnaires. The last step (IV)

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is the so called management step which means preservation and improvement of the selected area but also other managerial issues that are relevant to maintain such an area.
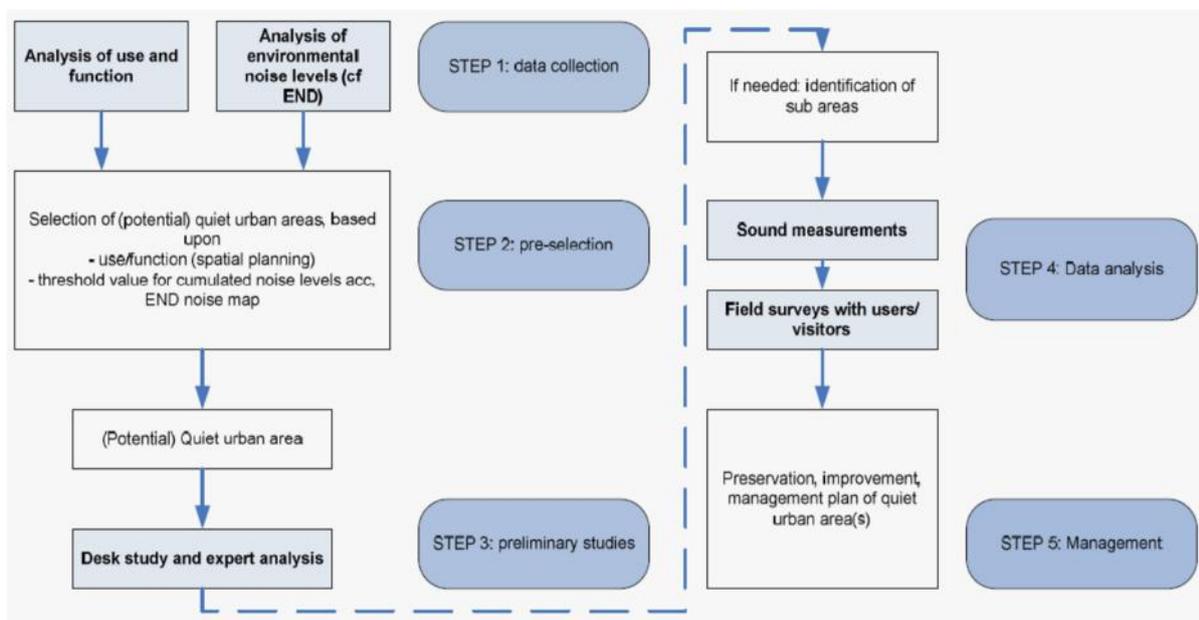

Figure 1- flow-chart of the provisional methodology (source: M.Weber, re 9).

The methodology contains also a special tool developed by BruitParif and the city of Paris [2] that could be practiced when the noise over the area differs a lot (gradient). One can imagine that especially in large areas the noise levels are quite different. Along roads, railways, tramways and other noise sources the noise will be higher than elsewhere in these areas. By means of a grid, laid over the area the noise gradient could be set. With the help of these gradient also the so called sub-areas could be defined. This can be visualized by a four color map of the area, see table 1 and figure 2. A radius of 250m is used in this tool. Green and yellow classified areas can be considered as 'relatively quiet' urban areas, whereas orange and white classified areas will require substantive interventions in order to reduce the absolute noise levels and/or the contrasts with the acoustic climate of the surrounding area(s).

Table 1: categories of areas identified by the rQUA method

Colour	$Lden\_absolute$ dB(A)	$\Delta = Lden_{aritmetic\_average} - Lden\_absolute$
Green	≤ 55	> 10
Yellow	≤ 55	≤ 10
Orange	> 55	> 10
White	> 55	≤ 10

is the arithmetic average L_{DEN} over the grid cell compared to the adjacent cells

3. PRELIMINARY OUTCOMES

The outcomes of the inventory done during the first step has been reported yet [3,4,5]. It seemed that some legislation was already in place and some policies too but an approach or methodology was still lacking. The approaches and/or methodologies used differed a lot, not only Europe-wide but also nation-wide. As far as the project identified, numerous indicators to identify quiet urban areas has been used. This has also been found by the Good Practice Guide on Quiet Areas of the European Environmental Agency that recently has been published [6]. Based on that data, an expert judgment and previous experiences by the partners, the preliminary methodology was developed. A rough description of this methodology is already been given.

Figure 2: noise levels and noise gradients Rotterdam areas

4. POTENTIAL QUIET URBAN AREAS

Identifying and selecting a quiet urban areas need a deeper look into the latest noise maps. From these noise maps has been learnt which part of the agglomeration or city is rather quiet compared to other areas. These areas are often parks, squares, pedestrian areas or areas enclosed by building (courtyards). Having these areas inventoried the functions and use of such an area were examined. This could be on spatial, natural characteristics but also on other physical factors. This was mainly collected from the urban planning department and an additional field inspection. Regarding the use numerous uses have been found like sporting, reading, playing, relaxing, sun bathing et cetera. By the consortium it was decided to use an acoustic threshold of 55 dB L_{DEN} and use and function of the area for pre-selection. Based on the collected data the potential quiet urban areas were selected. In Florence a number of schoolyards were selected [7], in Bilbao a square in the inner city and a peri-urban park [8]. Rotterdam selected two city parks. These parks are the Spinoza Park, a small park enclosed by urban streets and buildings (mainly houses) and the Southern Park, the largest urban park in The Netherlands. Both parks are situated in the southern part of Rotterdam.   The selected quiet areas in Florence, Rotterdam and in Bilbao are quite divers in function, size and use as can be derived from the descriptions [9] which made the project quite challenging. It might that a schoolyard or a square in the inner city is expected to result in other noise levels and other perceptions of the visitors and users?

5. NOISE, JUDGMENT, PERCEPTION AND APPRECIATION

To test whether the provisional methodology would work the selected areas (pilots) were examined on:

o   Occurring noise levels, by conducting short en long term noise measurements.

o   Visitors and users were questioned on perception and appreciation of the selected area.

o   Expert analysis on non-acoustic factors and general characteristics of the pilot areas were executed..

The short term measurements were carried out during the interviews and the long term measurements were conducted over at least 4 weeks.   During the measurements also sound recording were made in the Florence and Rotterdam pilot areas. A lot of data was collected because samples had been taken every second. This made that almost every parameter could be estimated, from L_1 to $L_{Aeq(24\,hr)}$.   This information delivered information on events, background noise, events, dynamics of the noise, et cetera.   It appeared that the noise levels in the Rotterdam parks and the San Marina peri-urban park were rather low compared to the other pilot areas.

Figure 3: noise measurements in the Southern Park

By means of a standardized questionnaire, visitors and users of the Quiet Urban Areas have been interviewed on their perception and appreciation of the area and the surroundings. Some variables that have been scrutinized and analyzed are:

Table 2- some variables

Dependent	Independent
Perception of the area as good	LAeq short term
Perception acoustic environment (noisy-calm)	LA50
Perception of the acoustic environment as pleasant	LAeq long term (Florence)
	LA10-LA90
	Perception of natural elements as pleasant
	Psycho acoustic parameters (sharpness, roughness, et cetera.

From the analysis it was learnt that most of the correlations between noise levels short term (L_{Aeq}) and perceived annoyance only is positive in situations where the noise levels are higher than 60 dB(A). The presence of natural elements in the park is highly appreciated by the respondents.

Ante operam outcomes of the Rotterdam pilots showed that respondents appreciate when the quiet area (park) is well kept, accessible and when natural and visual elements are present, see table 4. The acoustic environment was to be find less important which is also confirmed from the conclusion of the ante operam survey in Florence. In Rotterdam this is due to the fact that the noise levels in these areas are rather low. The found are L_{Aeq} between 52-57 dB(A). For the schoolyards in Florence the reasons could be explained by the

nature of the areas. Expectations of users and visitors of these schoolyards are not especially focused on noise but more on safety and natural elements. Much of the interviewees, being interviewed on the schoolyards, were children. It can be assumed that they are not especially interested in noise, especially when playing.

Table 3 – scores Rotterdam areas

Element	Visitors about Spinoza park	Vistors about Southern Park	General opinion visitors Spinoza park	General opinion visitors South. park	Average general opinion about QUA
Air Quality	10	8	7	7	7
Safety	7*	9	1*	5	3
Maintenance Well kept	2*	3	1*	1	1
Services equipment	4	5	6	5	5.5
Accessibility	1	2	4	3	3.5
Acoustic environment	6	6	8	8	8
Nature	2*	1	1*	2	1.5
Climate (humidity, wind, etc.)	7*	7	9*	9	9
Visual	5	3	5	4	4.5
Smells	9	10	9*	10	9.5

Explanation: ex æquo means that the score is equal. People were asked what to find of the parks (2nd and 3rd column and people visiting the park were asked what to find –in general- about quiet urban areas (2 groups of respondents).

6. EXPERT JUDGMENT

An expert's judgment was made on non-acoustic factors regarding the area and the noise measurements have been conducted. These judgments have been made based on a field observations and by consulting the urban planning and public green department.

Table 4: Outcomes expert judgement Southern Park Rotterdam

Criteria	Description	Parameters	Rating	Comments, explanations
Urban equipment	Presence and location of urban equipment	% m² or n. of benches, games and other facilities		
			🟩	
Proximity from/to noise sources	Proximity to noise sources means possible high noise levels. If users can see noise source it influences on their noise perception psychologically.	Main noise source is next to QUA and it is visible by users	🟥	Depending upon which position within the park. Along the borders of the park main roads that are visible, but ample opportunity to get deeper in the park and out of sight (and ear) of noise sources.
		Main noise source is next to QUA and it is invisible by users	🟨	
		Main noise source is far to area		
Presence of a noise sources	Presence of one or more kind of noise sources	Road, rail and airplane traffic noise	🟥	See above regarding road and railway (metro) noise
		Road and rail traffic noise		
		Road traffic noise		
Taxonomy of noise sources	Identification and classification of noise sources	Traffic sounds (cars, tractors, buses, planes)	🟥	All sources can be heard in different parts of the park and in different combinations (and perception/valuation).

7. ANALYSIS

After completing the measurements, the interviews and the expert analysis the post processing of the collected data started. Not only the data of the noise measurements but also the data gathered during the questionnaires and the expert judgment data were scrutinized and analyzed. Statistical analysis with SPSS have estimated the correlations between perception/appreciation and the noise data. The SPSS analyses were not only done in Rotterdam but also by UNIFI analyzing the whole dataset.

8. MANAGING QUIET URBAN AREAS

Identification, designation and preservation of Quiet (Urban) Areas is just one side of the same coin. It is also important to maintain such areas, to improve them and to make the public aware of the presence of these areas but also to keep these areas attractive. From [10] can be learnt that the owners of the Quiet Urban Areas or the municipality should:

o   Frequently repeat the interviews among visitors and users of these premises in order to observe trends in perception and to collect ideas for making these areas more attractive.

o   To provide quiet areas with provisions that prevent the Quiet (Urban) Areas from mopeds, scooters and other motorized vehicles. E.g. by means of gates that can not be used by mopeds and scooters and signs that prohibit those vehicles to enter the area. Local regulation should be in place in order to do inspections, enforcement and prosecution of the offenders.

o   The sound in Quiet (Urban) Areas should be preferably dominated by natural noise like bird life, rustling leaves, playing children, et cetera. In case these sound are missing it could be added by means of fountains, trees, play grounds or even aviaries.

o   In order to make Quiet (Urban) Areas more attractive, these areas could be made greener by means of plants, flowers, trees, bushes or green walls. It contributes to climate adaptation, human health and makes these areas more attractive.

o   Quiet (Urban) Areas should be recognizable by signs and shields that show people the route to those areas and also makes people aware that these areas are present and accessible. Quiet Urban Areas

  should be included in walking, hiking and biking routes. The shields could also contain information of the area and instructions for the visitors.

o Municipalities should promote the use of Quiet (Urban) Areas by means of a campaign and inform people about their benefits.

o Municipalities should involve the preservation and management of Quiet (Urban) Areas in their environmental, public green and general policies.

o Municipalities could or should involve residents living in the surrounding districts in order to participate in the management of the Quiet (Urban) Areas.

o Large Quiet (Urban) Areas could be guarded by park keepers that also pay attention to misuse of the area .

It should be noticed that these recommendations also are applicable for quiet areas situated in a rural area.

9. PRELIMINARY CONCLUSIONS

  Based upon the preliminary results the following conclusions can be drawn: (I) the stepwise approach and the triangulation method are considered applicable and usable by local authorities (conclusion from the Paris workshop with French municipalities in January 2014), (II) the main explanatory factors for appreciation of quiet urban areas are acoustic as well as 'non-acoustic' including absolute and relative sound levels, soundscape characteristics and visual characteristics.

  As mentioned above the method and instruments have been slightly adjusted incorporating practical experiences in the pilot studies. During summer 2014 the last interventions are planned in the Rotterdam pilot areas; the effects of these will be analysed in a post-intervention study at the end this year. The main aim is to evaluate whether the various interventions resulted in changes (positive or negative) in the perception and/or valuation of the acoustic and overall environments. Insights gained will be used for final improvement of the project's guidelines and disseminated internationally. Results, congress papers and presentations as well as information on future actions are available at the project website, www.quadmap.eu.

ACKNOWLEDGEMENTS

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