

DELIVERABLE 1

“Survey report”



**Progetto
LIFE 09
ENV/IT/1
02**

*“NADIA”
Noise
Abatement
Demonstrat
ive and
Innovative
Actions
and
information
to the
public*

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Annexes

Annex 1: Questionnaire report of the Province of Genova;
Annex 2: Questionnaire report of the Province of Savona;
Annex 3: Questionnaire report of the Municipality of Vicenza;
Annex 4: Report of the noise measurements;
Annex 5: Report of the traffic measurements;

Introduction

This document constitutes the report of the Action 2 of the NADIA project

The Action 2: Survey, was focused in the following activities:

1. collection of data and reports related to the noise levels of infrastructures in the project areas (at least three years), population distribution, meteorological conditions, characteristics of ground;
2. collection data on noise annoyance in some specific positions in the project areas;
3. analysis of noise propagation models from roads with particular reference to the recurring problems and their causes which affect the noise mapping activities;
4. the realisation of eventual noise measurement campaigns for integrating the available data from the quantitative and qualitative point of view in relation with the identified causes of errors;
5. deepening of the state of the art of noise reduction systems among those which are based on sustainable solutions (landscape compatibility, recycled materials, etc.).

The road of the Provinces of Genoa and Savona to be modeled are indicated in the following table:

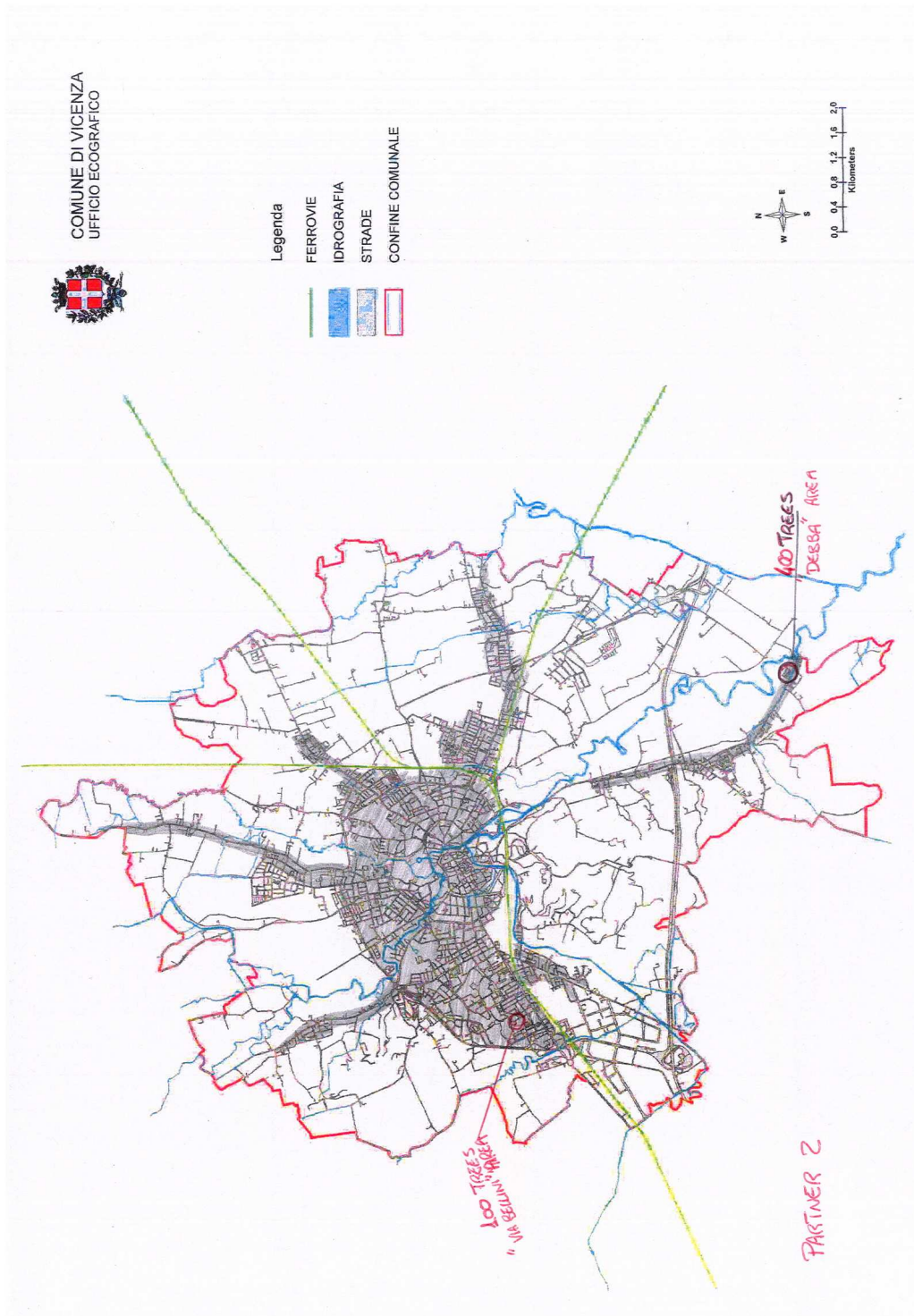
Table 1: List of roads modeled

Partner	Road	Partner	Road
Province of Genoa (PROVGE)	SP 33	Province of Savona (PROVSV)	SP 28 bis
	SP 35		SP 29
	SP 225		SP334
	SP 333		-
	SP 523		-

Every road contained in the table 1 is characterized of traffic flow at least of 3.000.000 vehicles/year.

The area of the Municipality of Vicenza (COMVI) to be modeled is shown in figure 1.

Figure 1: Area of the Municipality of Vicenza to be acoustically modeled within NADIA Project



The data concerning the situation of the Municipality of Prato (COMPR) will be transmitted by the 31/09/2012, 6 months after the other partner. This delay is due to the fact that the Municipality of Prato has entered in NADIA Project only in 07/03/2012.

Collection of data related to the noise level of infrastructures in the project areas, population distribution, meteorological condition, characteristics of the ground.

Data related to the noise level of infrastructures

The data needed for the realization of the noise maps has been specified in the Milestone 1:

- Traffic flow and composition;
- Mean vehicle velocity;
- Road pavement type;
- Characteristics of traffic flow;
- Digital Ground Model;
- Noise measurements

In the milestone has been indicated the input data quantity and quality, differentiated in relation to the type of infrastructure to be modeled. The approach needed for the simulation of a single road is substantially different from the one for an interconnected group of city road. In table 2 and 3 are reported respectively the kind of data transmitted by the Provinces of Genoa and Savona and by the Municipalities of Vicenza and Prato.

Table 2: Data related to noise level of infrastructures of the Provinces of Genoa and Savona

Data type	Partner	Kind of data transmitted
Traffic flow and composition	PROVGE (Annex 1)	The Province of Genoa has transmitted the total traffic flow of the daytime. Traffic flow in <i>evening</i> and <i>night</i> periods has been evaluated using the traffic data available and the coefficients reported in [1]. Other coefficient contained in [1] has been used for the determination of traffic flow composition (percentages of light and heavy vehicles).

Data type	Partner	Kind of data transmitted
	PROVSV (Annex 2)	The Province of Savona has transmitted data about traffic flow only for 4 hours of the day period. Nevertheless the percentages of light and heavy vehicles has been in these case transmitted.
Mean vehicle velocity	PROVGE	The mean value of the velocity of the vehicles did not considered the differences between heavy and light vehicle.
	PROVSV	The mean value of the velocity of heavy and light vehicles was given.
Road pavement type	PROVGE and PROVSV	Both the Provinces has specified the parts of their roads where the asphalt could be considered strongly irregular (like uneven pavement stones)
Characteristics of traffic flow	PROVGE and PROVSV	This kind of data could be considered not relevant for the simulation of the road of the competence of the two Provinces.
Digital Ground Model	PROVGE and PROVSV	Both the Provinces has transmitted the isoipse of the areas interested by the noise maps.
Noise measurements	PROVGE	The results of five weekly measurements in terms of L_{diurno} , $L_{notturno}$, L_{day} , $L_{evening}$ and L_{night} have been evaluated. The results of the simulation has been compared with the outcomes of the noise measurements.

Data type	Partner	Kind of data transmitted
	PROVSV	The results of four weekly measurements in terms of L_{diurno} , $L_{notturno}$, L_{day} , $L_{evening}$ and L_{night} has been evaluated The results of the simulation has been compared with the outcomes of the noise measurements.

Detailed data regarding the traffic flow and composition of the roads of the two Provinces are reported in the Annex 1 and 2.

Table 3 Data related to noise level of infrastructures of the Municipalities of Vicenza and Prato

Data type	Partner	Kind of data transmitted
Traffic flow and composition	COMVI	The Municipality of Vicenza has transmitted the measurement of traffic flow and composition in compliance with the requirements of the Milestone 1. The measurements has been used to evaluate the traffic of the whole road network using a traffic simulation software.
	COMPR	<i>Data not yet available, due to the delay in the participation of the participation of the Municipality of Prato in the NADIA Project</i>
Mean vehicle velocity	COMVI	Where not available by measurements , it has been used the road speed limit.
	COMPR	<i>Data not yet available, due to the delay in the participation of the participation of the Municipality of Prato in the NADIA Project</i>

Data type	Partner	Kind of data transmitted
Road pavement type	COMVI	The Municipality of Vicenza has specified the parts of their roads where the asphalt could be considered strongly irregular (like uneven pavement stones)
	COMPR	<i>Data not yet available, due to the delay in the participation of the Municipality of Prato in the NADIA Project</i>
Characteristics of traffic flow	COMVI	This data has not been considered because its impact in the noise modeling has been considered not essential.
	COMPR	<i>Data not yet available, due to the delay in the participation of the Municipality of Prato in the NADIA Project</i>
Digital Ground Model	COMVI	The Municipality has furnished the isopse and the elevation point of the areas interested by the noise maps
	COMPR	The Municipality of Prato has furnished a Digital Terrain Model in a .tif file.
Noise measurements	COMVI	The results of 31 measurements have been evaluated. The results of the simulation will be compared with the outcomes of the noise measurements.
	COMPR	<i>Data not yet available, due to the delay in the participation of the Municipality of Prato in the NADIA Project</i>

Detailed data related to the traffic flow and composition of the road of the Municipality of Vicenza are not reported because the roads modeled are too much to be listed in this deliverable.

Detailed data related to the traffic flow and composition of the road of the Municipality of Prato are still not available.

Data related to the distribution of population

The data related to the inhabitants of the study areas of the Provinces and of the Municipalities has been determined from the results of the national official census. This kind of data consists in a group of georeferenced areas (census areas) everyone having two attributes: identification name and inhabitants.

Meteorological conditions

The effect of meteorological condition has not been considered relevant. At this purpose for the modeling of the propagation of the sound emitted by the roads analyzed, the standard coefficient indicated by [1] and [2] has been used. The usage of this coefficient keeps a overestimate on the evaluation of noise level on the receivers. This kind of approach has been chosen because the determination of the meteorological condition in the calculation areas is very expensive in terms of time and costs.

Regarding the roads of the Provinces of Genoa and Savona, the only meteorological data available in terms of quality and quantity is related to the Genoa Airport. This data *cannot be considered representative* of the whole areas to be modeled. Genoa Airport is built on an artificial peninsula of the Gulf of Genoa, so their meteorological condition is very different from the ones of the inland parts of Liguria.

For this reasons the usage of the standard coefficients established by the [1] and [2] was preferred.

Moreover it could be noticed that the most part of the receivers reasonably exposed to noise level above noise limits of the Directive 2002/49/CE, even in the Municipality of Vicenza and Prato, are located near the roads modeled; in this conditions the effects of meteorological condition on the sound propagation is not relevant so the standard coefficient established by the [1] and [2] could be reasonably used within NADIA project.

Characteristics of the ground

PROVGE, PROVSV, COMVI and COMPR have transmitted data about the characteristic of the ground in compliance with the suggestions of the [1]. The data has been furnished in forms of georeferenced areas everyone having two attributes: an identification name and the ground factor (equal to 1 for the high absorption ground like grass, 0 for the reflective ground like parking).

Collection data on noise annoyance in some specific positions in the project areas

Evaluation of noise annoyance has been collected through a questionnaire developed by CIRIAF. The questionnaire was released in buildings where the noise exposure has been considered reasonably high by the local authorities. The results of this activities are reported in Annex 1, 2 and 3.

Analysis of noise propagation models

The noise propagation model used in the noise map of NADIA project is the Routes-NMPB-96 indicated by the European Directive 2002/49/UE [3] as the ad interim reference method.

The D.Lgs. 194/2005 [4] has established that the NMPB.Routes 96 is the noise propagation model to use in the realization of noise map and strategic noise map of roads.

The methodology developed for the noise map of NADIA project takes into account the type of input data needed by the Routes-NMPB-96 and indicated in the first Milestone of NADIA project.

Realization of additional noise measurement campaign

The available measures about traffic flows, traffic velocity and noise levels has been considering sufficient for the successive activities.

Analysis of different innovative solutions for the integration of noise barriers and primary school and kindergarten outdoor areas.

Noise barriers represent a traditional method of noise pollution mitigation, mostly used to reduce loudness from road, highway and railway traffic noise sources.

However, noise walls can be integrated with innovative features which can bring different benefits in term of energy saving, environmental integration and aesthetic needing.

In this stage of the activity, innovative noise barrier designs and treatments in relationship with kindergarten and primary school outdoor areas have been investigated, analyzed and classified in terms of characteristics, design and benefits.

Materials

An innovative contribution in terms of materials can be achieved by vegetated noise barriers. This eco-friendly green walls are characterized by excellent noise abatement capabilities and, plus, have many benefits such as:

- low building and maintenance costs,

- sustainable recyclable elements,
- quality of the air and microclimate improvement
- surrounding environment easily fitting
- aesthetically pleasant solution



Specifications:

Soundproofing: class B3, standard DIN EN 1792-2

Acoustic absorption: class A4, standard DIN 1793-1

Average costs: 120-250 € /m²

Energy Saving

Acoustic barriers can be integrated with special devices that allow energy savings. For example, photovoltaic modules or solar thermal collector can be installed on the top of the barriers.

This solution allow to:

- generate no cost energy,
- no air polluting emissions,
- no extra land consumption,
- contribute to auto-finance the installation of the barrier.

Furthermore, solar panels on noise walls technology can feed light plants placed on the wall or along the road.



Specifications:

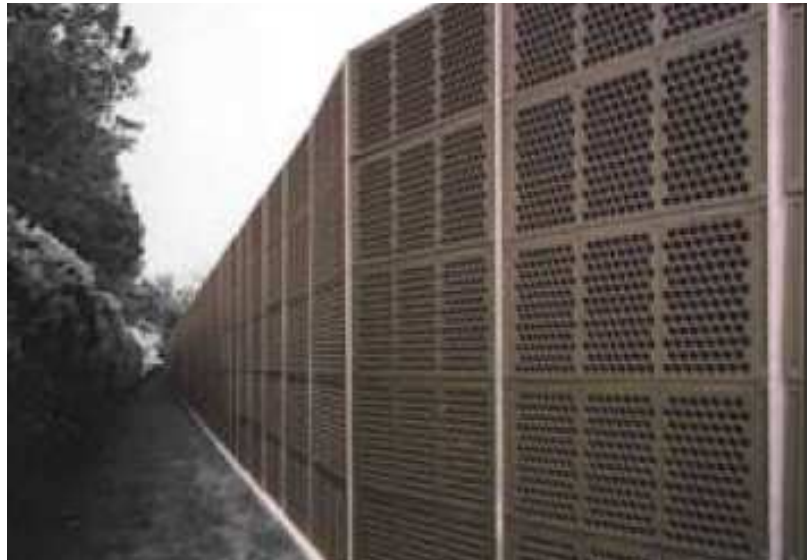
PV system on the barrier: 170 kWh/m/year

Recycled materials

Noise screens made from recycled materials have been considered as well. Plastic panel composing the barriers generally derives from industrial, household or building waste and results 100% recyclable. After the disassembly of the barrier, recycled panels could be eventually easily pulverized to be reused in new elements.

Recycled noise barriers contribute to:

- avoid environmental pollution,
- save natural primary resources



Specifications:

Noise abatement: until 12 dB(A)

Soundproofing: class B3, standard UNI EN 1793-2

Acoustic absorption: class A3, standard UNI EN 1793-1

Shapes

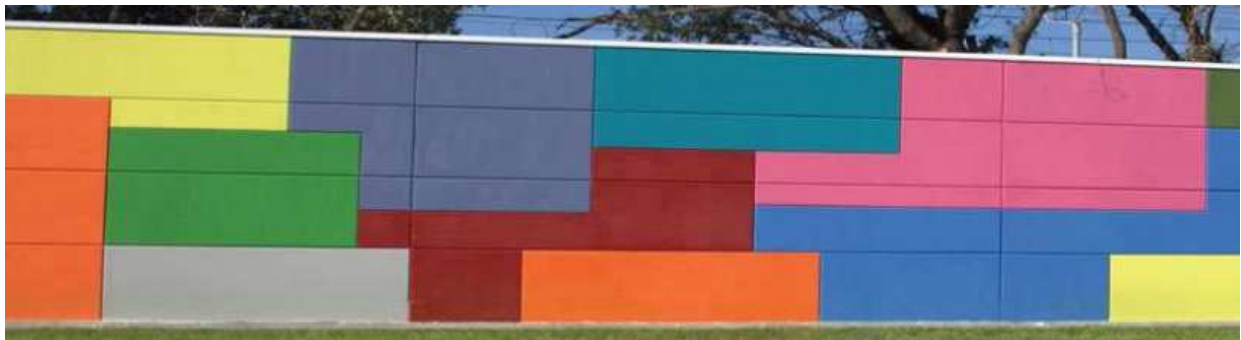
Due to the proximity to a primary school or a kindergarten, a noise barrier can be analyzed and designed by studying particular shapes and drawn. For example, a series of transparent windows can be inserted in the wall so that children can play and look outside the courtyard.





Colors

The use of colors can be considered as well in noise screens in proximity of schools. Colored panels can be used both in the external side of the wall on the road -to report the presence of children- and in the internal side in order to decorate the courtyard.



Use of the internal side

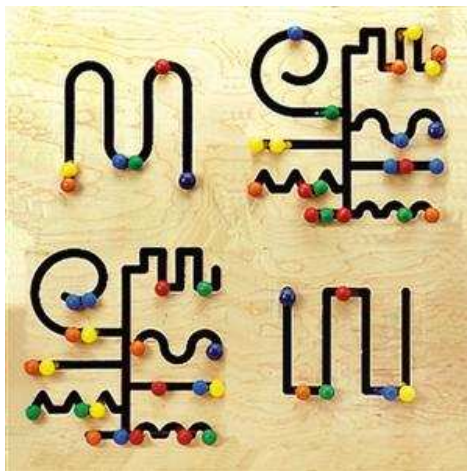
In case of noise barriers delimiting a school area from the road, the side of the wall faced on the outdoor areas can be used as a surface available to the entertainment of the children during school breaks.

Usually boundary walls in school courtyard aren't used during the their games by the children while playing. Especially in those cases where available outdoor area is not large, vertical surface may be equipped for the children's entertainment.

Acoustic wall internal part can be treated as a cleaning surface where children can draw, paint or play sticking tiles:



Furthermore parts of the walls can be integrated as well with educational games, so children may learn by playing



Constrains

The only constrain that has been verified during the *Survey* activity regards the determination of 3D characteristics of buildings of the Province of Genoa. At this purpose an height of 6 m has been considered for every building of the Province of Genoa. The parameter has been chose after a series of inspections.

References

- [1] European Commission Working Group Assessment of Exposure to Noise, *Good practice guide for strategic noise mapping and the production of associated data on noise exposure*, Position Paper, Version 2, 12/08/2007
- [2] UNI/TS 11387:2010, Acustica - Linee guida alla mappatura acustica e mappatura acustica strategica - Modalità di stesura delle mappe
- [3] European Directive 2002/49/EC, relating to the assessment and management of environmental noise, 25th June 2002;
- [4] Decreto Legislativo 19 agosto 2005, n. 194, *Attuazione della direttiva 2002/49/CE relativa alla determinazione e alla gestione del rumore ambientale*, Gazzetta Ufficiale della Repubblica Italiana, Serie generale n. 222, 23/09/2005