HARMONICA PROJECT

News tools to inform the public about environmental noise in cities and to assist decision-making

www.noiseineu.eu

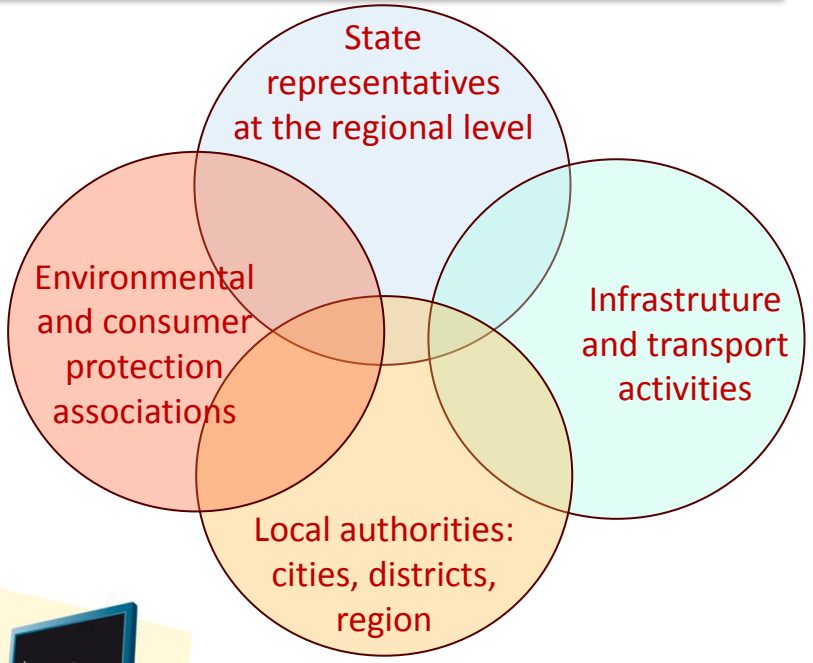
DYNAMAP SPECIAL SESSION
22 International Conference on Sound and Vibration
Florence 12-16 Jully 2015

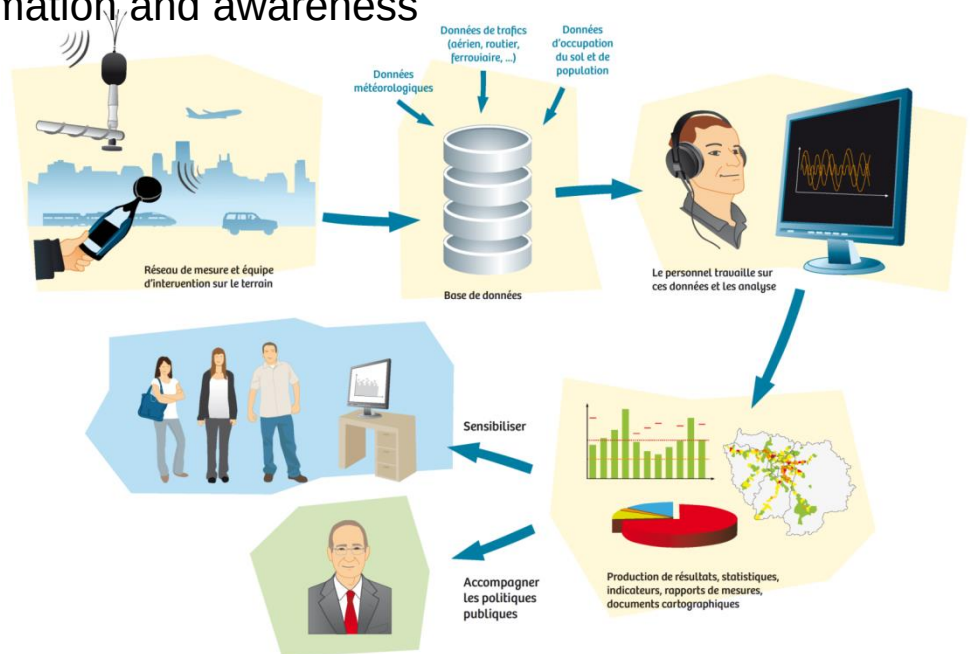
OUTLINES

- Brief overview of the noise observatory Bruitparif and the Île-de-France region
- Results of the HARMONICA project
- Possible links between DYNAMAP and HARMONICA

Bruitparif, what is it?

- A collegiate association (NGO)
- 100 members
- Staff: 11 persons
- 3 main objectives:
  - Observation and evaluation
  - Support to public policies
  - Information and awareness





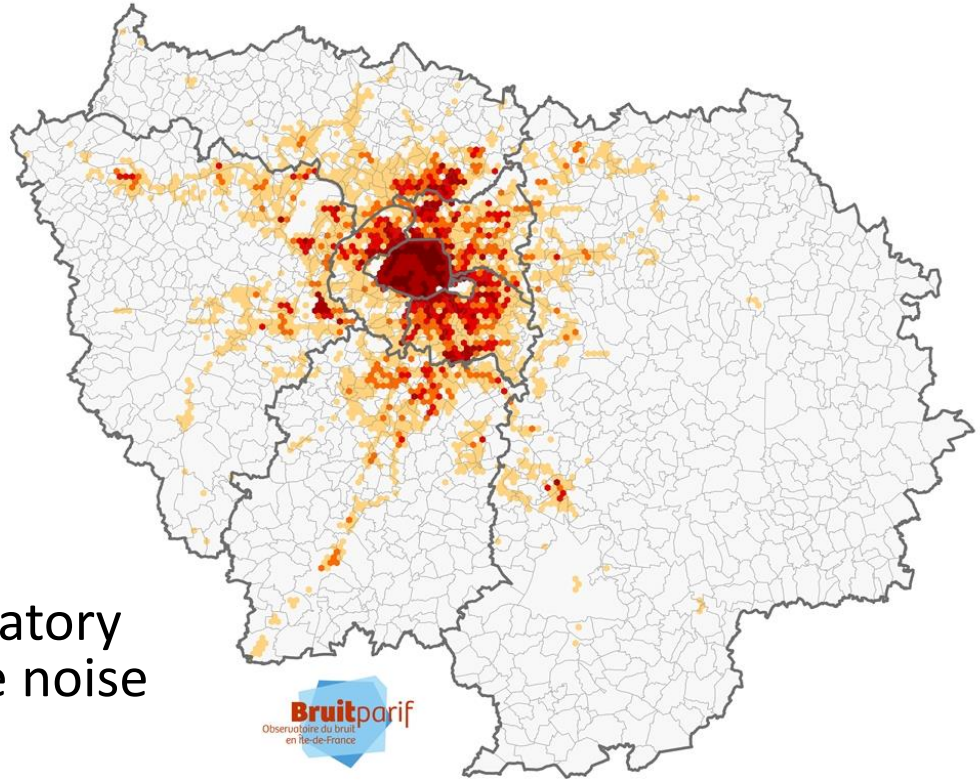
The Paris region « Ile-de-France »

- 12 000 km^2
- 12 million inhabitants
- 40 000 km of roads
- 1 800 km of railways
- 3 main airports
- 71% of inhabitants said they are annoyed by noise at home

→Need for a regional noise observatory to get reliable information on the noise levels in the Ile-de-France region

→Bruitparif was created in 2004

- END application
  - 20% of the population are exposed to noise levels that exceed the French limit values



Map: Population density that exceeds noise limit values

The LIFE HARMONICA Project

HARMONICA = HARMOnised Noise Information for Citizens and Authorities

- **Co-funded over 3 years and 3 months (01/10/2011-31/12/2014) by EC**
- **Two French non-profit associations specialised in the observation of environmental noise:**
  - Coordinator : Bruitparif for the Ile-de-France region (12 000 km^2, 12 millions inhabitants, 45 long-term measurements stations, www.bruitparif.fr)
  - Associated partner : Acoucité for the Greater Lyons agglomeration (516 km^2, 1,3 million inhabitants, 18 long-term stations, www.acoucite.org)
- **Several objectives:**
  - Make information on noise more accessible and closer to people's perceptions
  - Assess noise abatement actions in a harmonised way and promote effective actions
  - Facilitate the transfer of this approach to European cities
  - Contribute to the development of a common and shared culture about noise

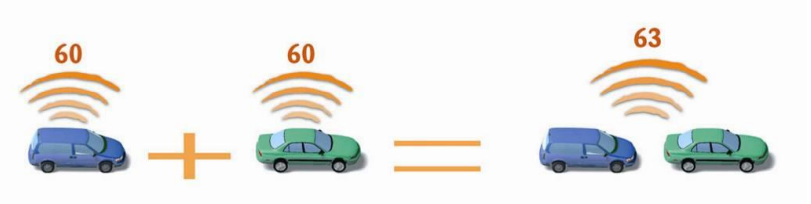
3 new tools

- **The Harmonica index**
- **A collaborative database of noise abatment actions**
- **An on-line platform www.noiseineu.eu to display Harmonica index results coming from different cities in Europe and to share best practices**

The Harmonica index: Why a new noise index ?

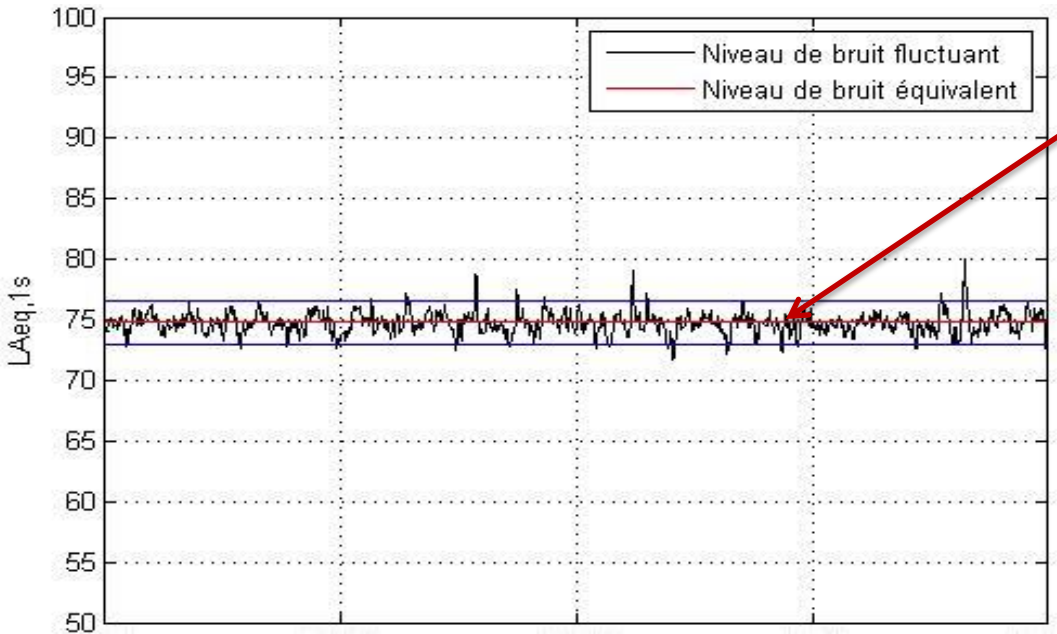
- **The decibel unit**

  … a logarithmic gymnastics

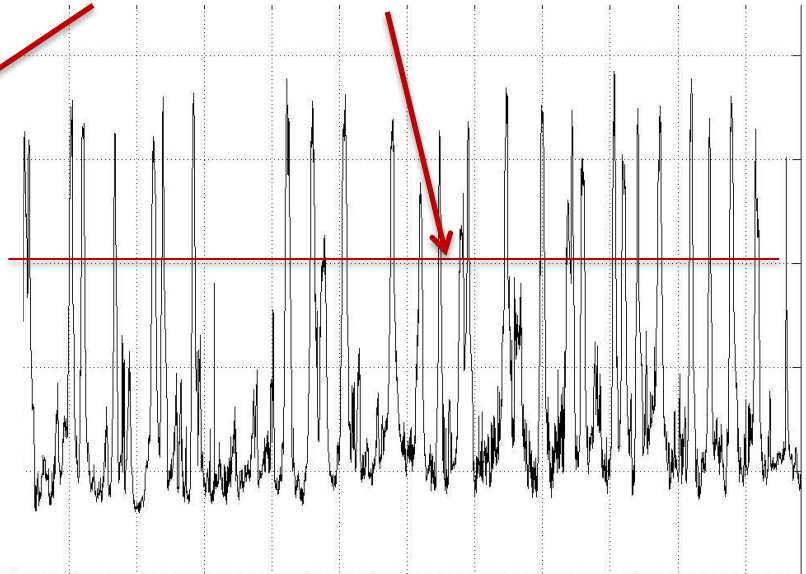


- **2 different noise exposure situations in terms of perception inhabitants**

  …And yet the same score according to the traditional indicators



LAeq = 75 dB(A)



The Harmonica index: The objectives

- **Ease of understanding by the general public**

  → scale from 0 to 10 without decibels

- **Simple calculation from measured data usually collected by noise measurement devices (LAeq,1s)**

- **Calculate for one-hour time slots and to derive results over any type of periods**

- **Closer to the people'perceptions of their noise environment than do the LAeq or Lden indicators**

The Harmonica index: 3 stages to construct it

A combination of:

- statistical analysis carried out on database of measurements
- interviews with 246 residents from 8 different noise situations and tests in laboratory conditions (130 people)

A 3-stage methodology

Step 1: Development of proposals of index

Step 2: Consideration of the public's opinion and perceptions

Step 3: Development of the formula of the index

Step 1: Development of proposals for the index

Database containing 24-hour measurement at 24 different sites representing different types of noise exposure (road noise, railway noise, aircraft noise, multi-exposure, urban environments, quiet areas)

60 descriptors calculated from the LAeq(1s) to 1-hour time slots

LAeq

Statistical descriptors LAXX, LAmin, LAmax ...

Dynamic descriptors LA10-LA90, LAeq-LA90…

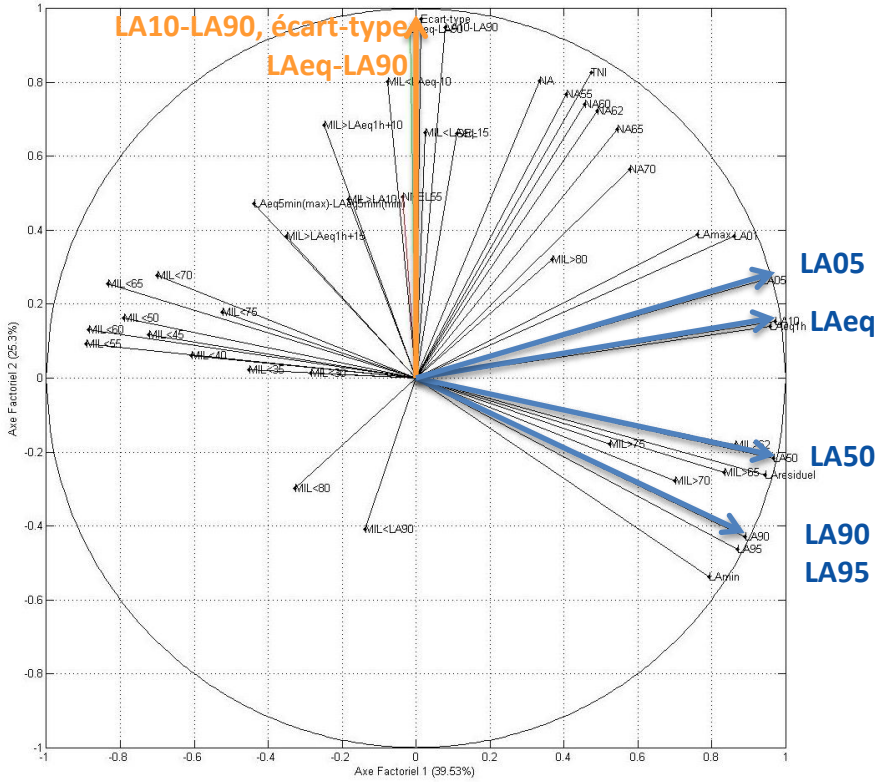
Number of events Nevt > threshold, T > threshold

Principal Component Analysis

allowed to retain 2 major types of descriptors which explain 2/3 of the variance of the data

- Average noise descriptors, percentile levels

- Descriptors of the variation of noise related to events

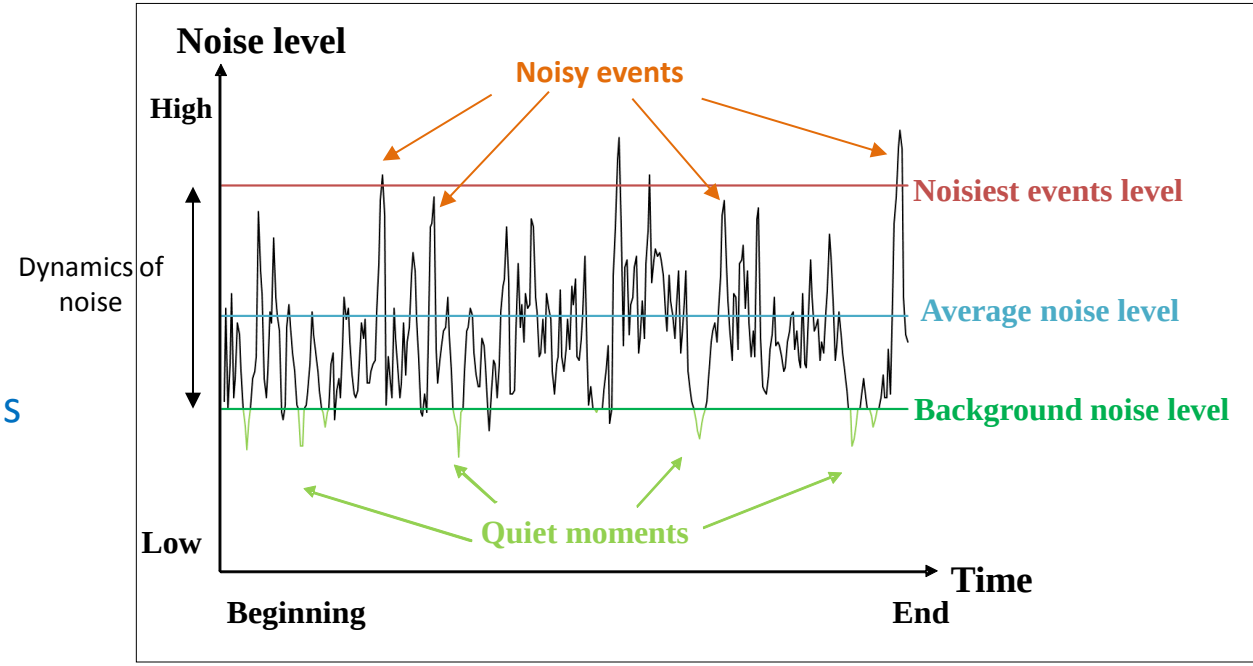


Step 1: Development of the proposals for the index

4 proposals for principles of the index (compositions of descriptors)

- **Proposal 1:**

- background noise
- dynamics of noise
- number of noisy events



- **Proposal 2:**

- periods during which noise levels remain below thresholds (different day, evening, night)

- **Proposal 3:**

- average noise
- background noise
- number and duration of the quiet moments
- level of the noisiest events

- **Proposal 4 (reference) :**

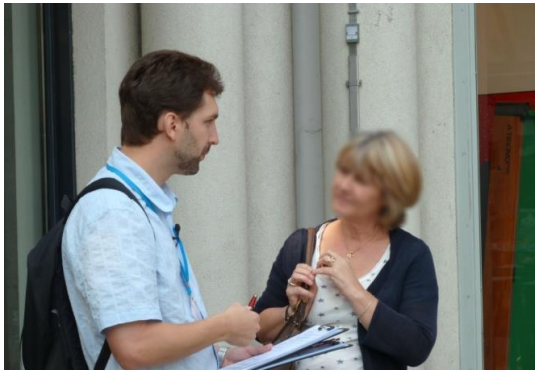
- average noise

Step 2: Consideration of the public's perceptions

Method:

Field questionnaire, face-to-face

among 246 residents or users of public spaces
on 8 different sites (4 in Paris area / 4 in Lyons area)



Laboratory survey with 130 people

Panel of elected officials, experts and representatives of civil society

Objectives:

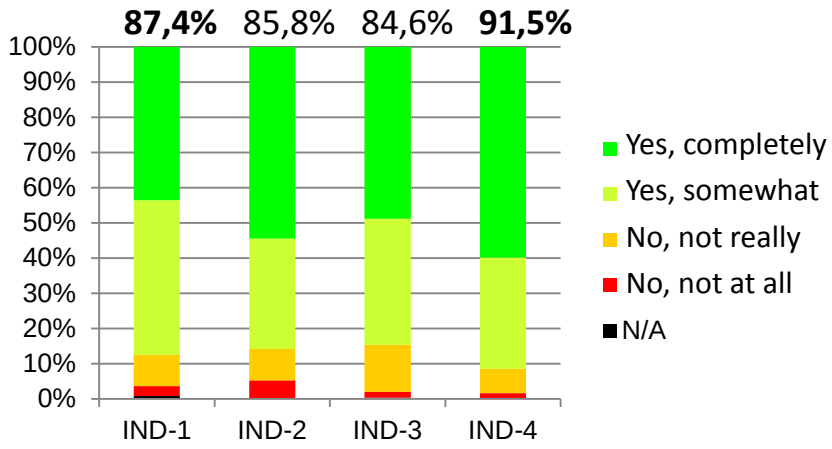
- Understand perception in terms of level of noise pollution
- Assess the level of understanding and relevance of the index's proposals

Step 2: Consideration of the public's perceptions

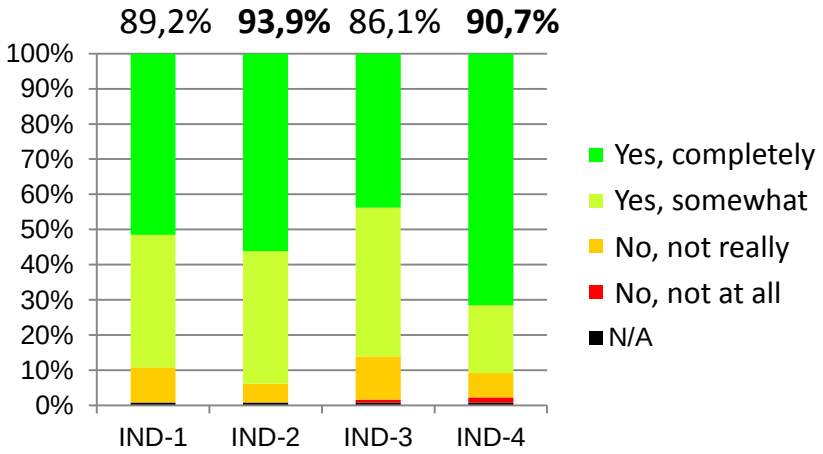
Results of the field and laboratory surveys:

Comprehensibility

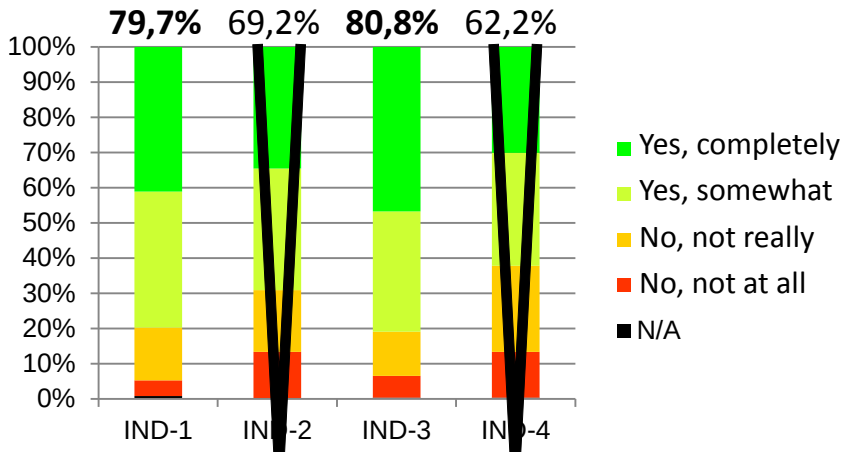
FIELD SURVEY

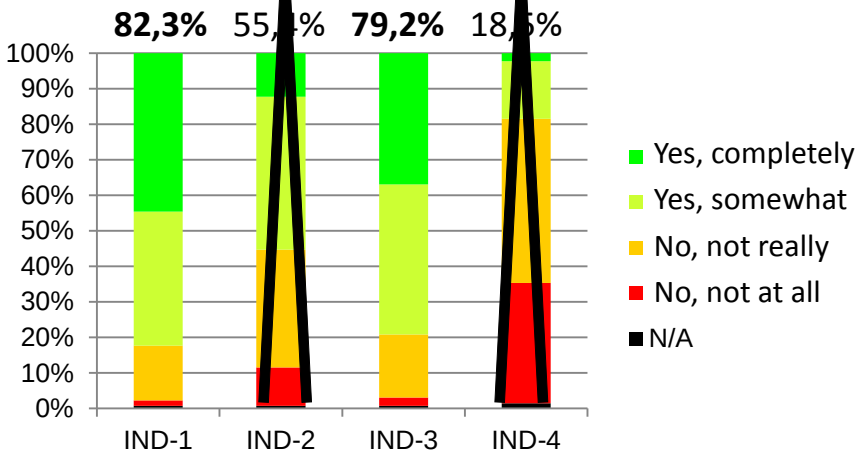


LABORATORY SURVEY



Relevance





Step 2: Consideration of the public's perceptions

The results of the three surveys match the learnings of the PCA

Concepts/descriptors that seem ‘clearer' to the public:

Background noise, Average noise, Quiet moments, Noisy events

Principle adopted for the formula of the index:

Index = BGN + EVT

- a component relating to the background noise (BGN)
- a component relating to the sound events (EVT)

Step 3: Development of the formula of the index

Method:

Working database for the operational test: 2013 measurements from the Bruitparif noise monitoring network

Around 350,000 calculated values (24 × 365 days × 40 sites)

Research and testing of the most relevant and robust descriptors for both components of the index: BGN and EVT

Descriptors used for BGN: LA90 eliminated, LA95eq retained

Descriptors used for EVT: LA10-LA90, N_{evt} eliminated, LAeq-LA95eq retained

Calibration of the index's minimum and maximum values

Index score 0 ←→ very quiet environment: continuous noise 30 dB(A)

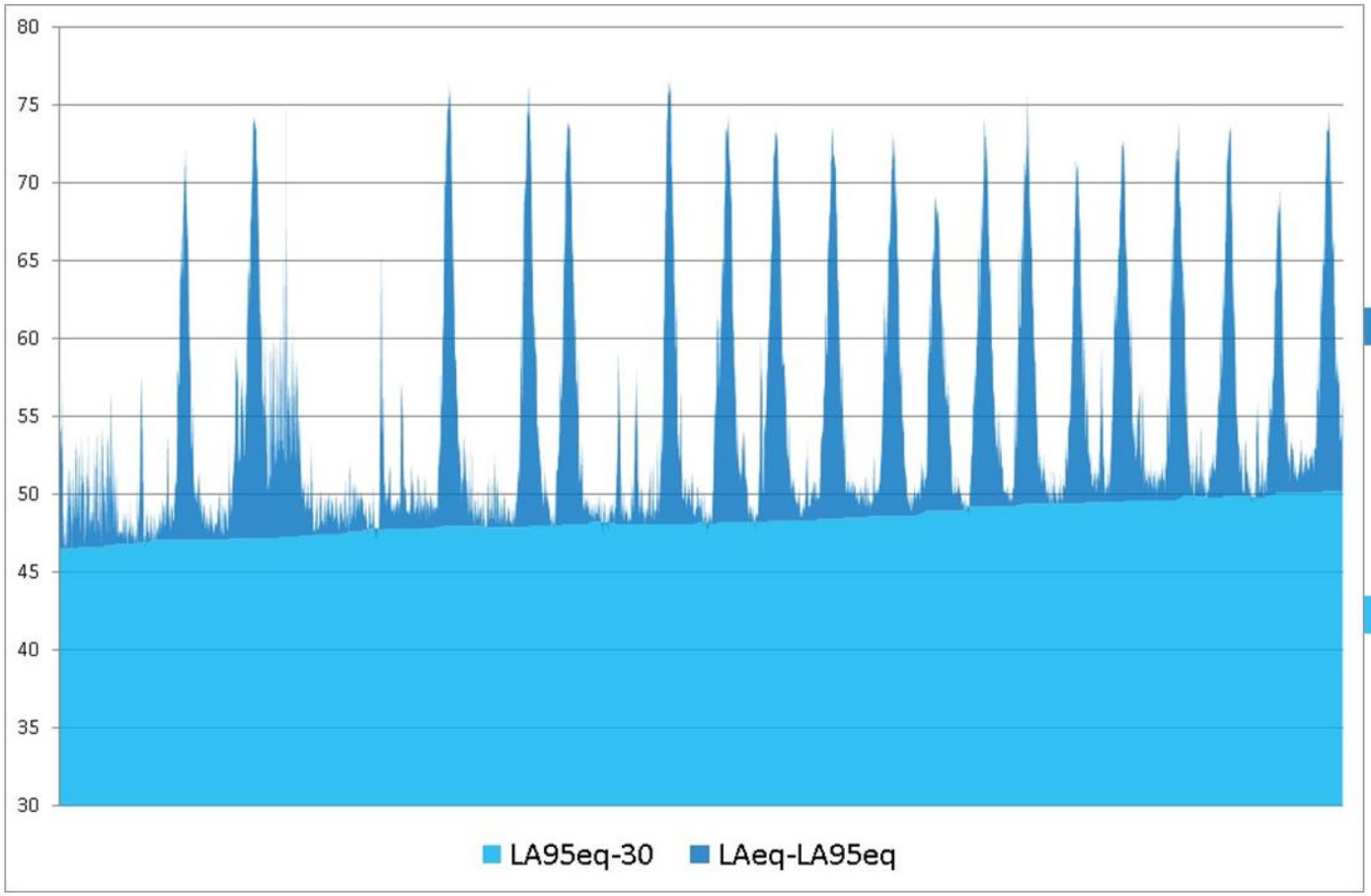
Index score 10 ←→ very noisy environment: continuous noise 80 dB(A)

Step 3: Development of the formula of the index

Formula of the Harmonica index

Harmonica index = BGN + EVT

BGN = 0.2 × (LA95eq-30) EVT = 0.25 × (LAeq-LA95eq)



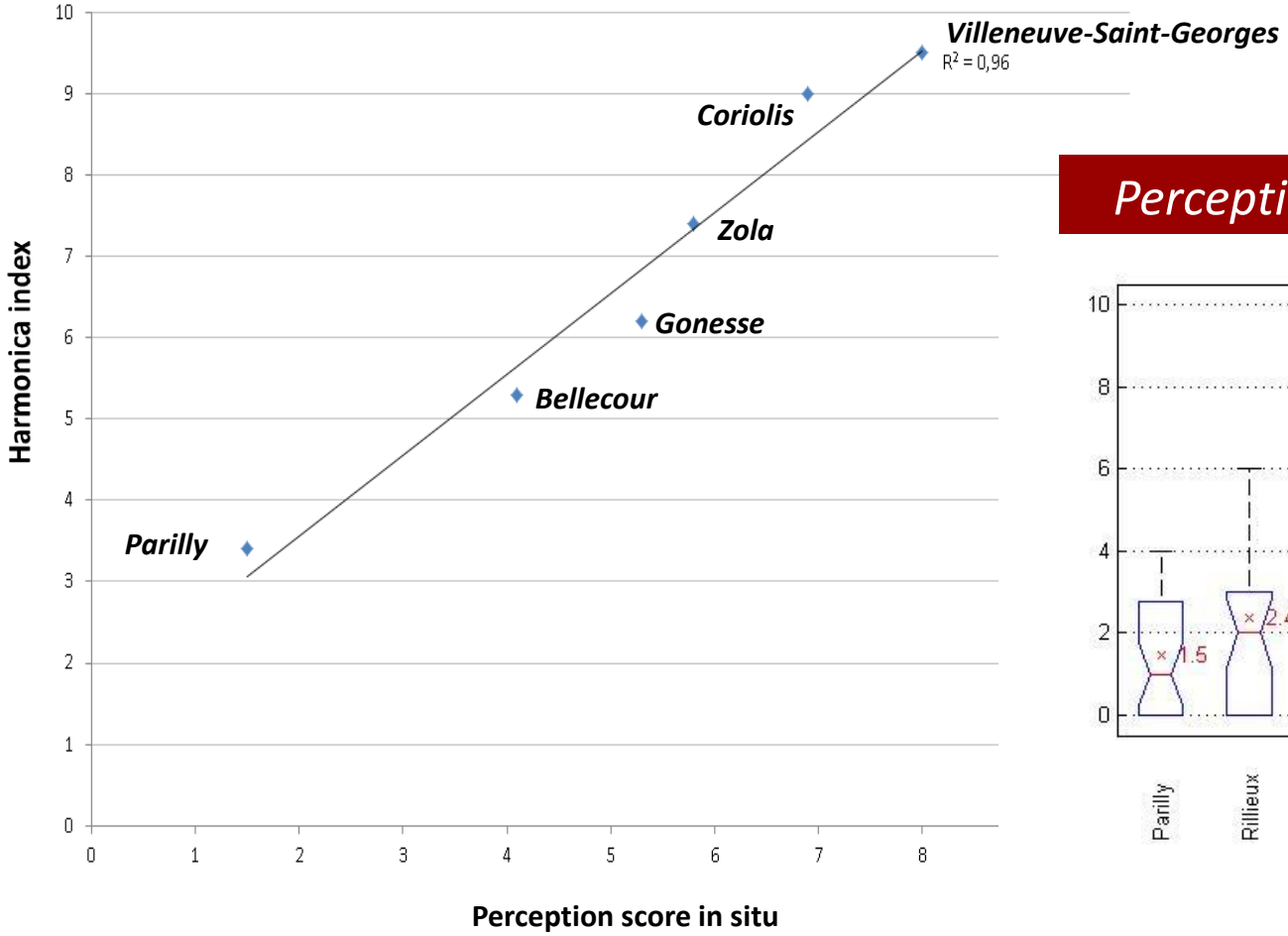
Harmonica index 7.3

EVT 3,6

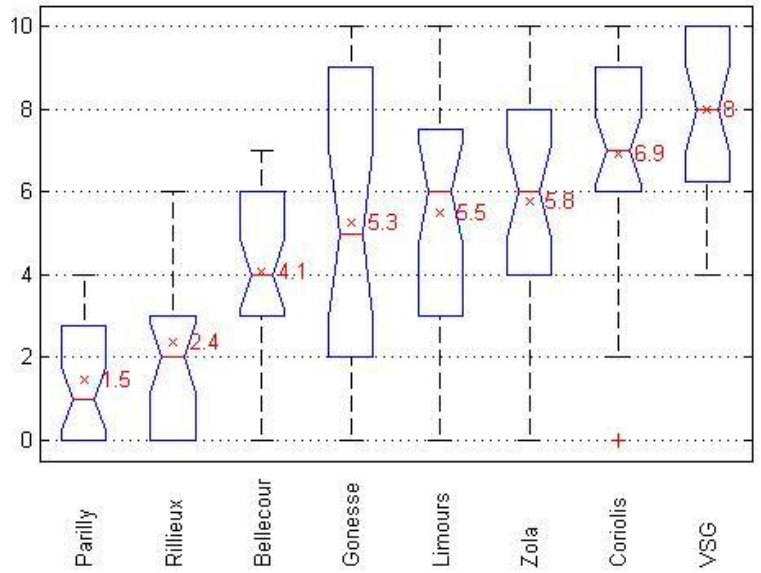
BGN 3,7

Step 3: Development of the index's formula

A good correlation between Harmonica index results and perception score given by people during face–to-face surveys

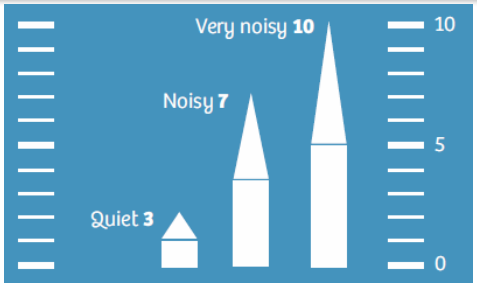


Perception score in situ (0 to 10)

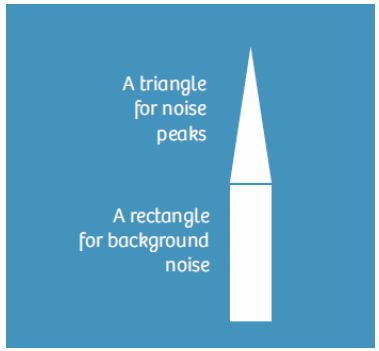


The Harmonica index graphical representation

1 score for the noise pollution level



2 shapes to distinguish between the contribution of background noise and noise peaks

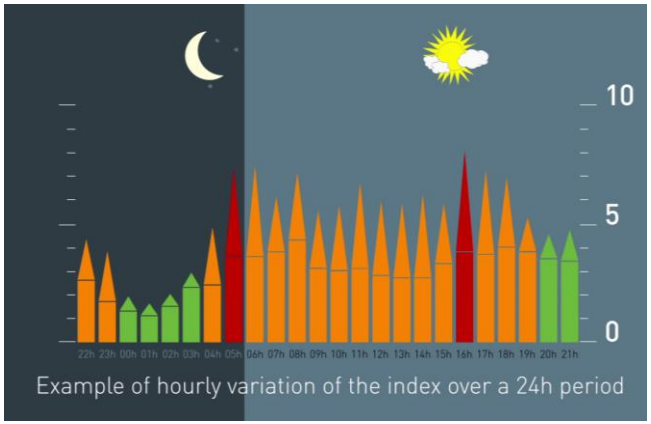


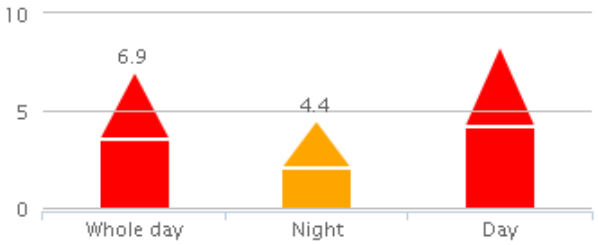
3 colours to indicate the situation compared to the quality objectives or values recognised excessive

Colour	Day from 6 am to 10 pm	Night from 10 pm to 6 am
	between 0 and 4	between 0 and 3
	between 4 and 8	between 3 and 7
	over 8	over 7

4 time periods

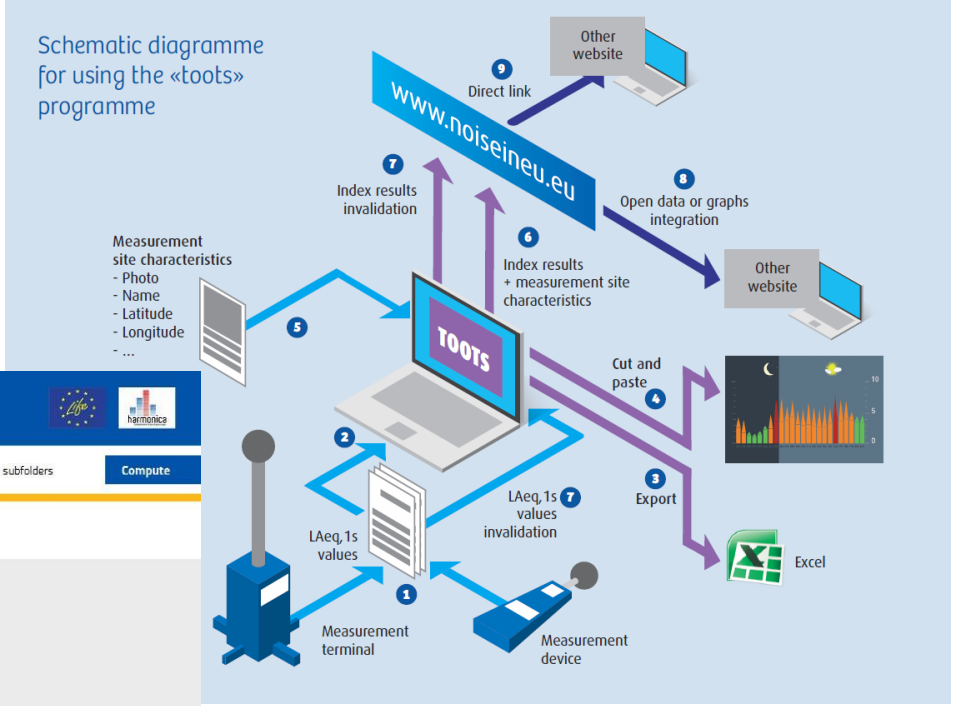
hour, day, night, 24h

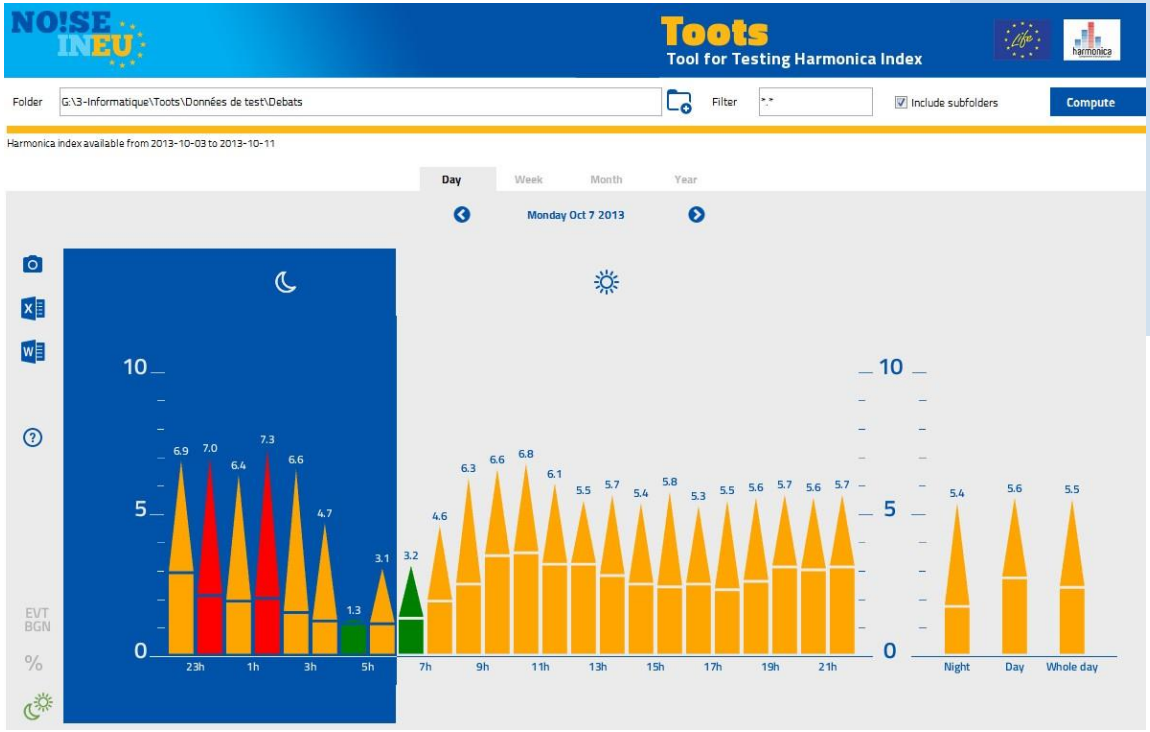




How to test the Harmonica index?

A window program named « Toots »
available free of charge
Juste send an email to: join@noiseineu.eu



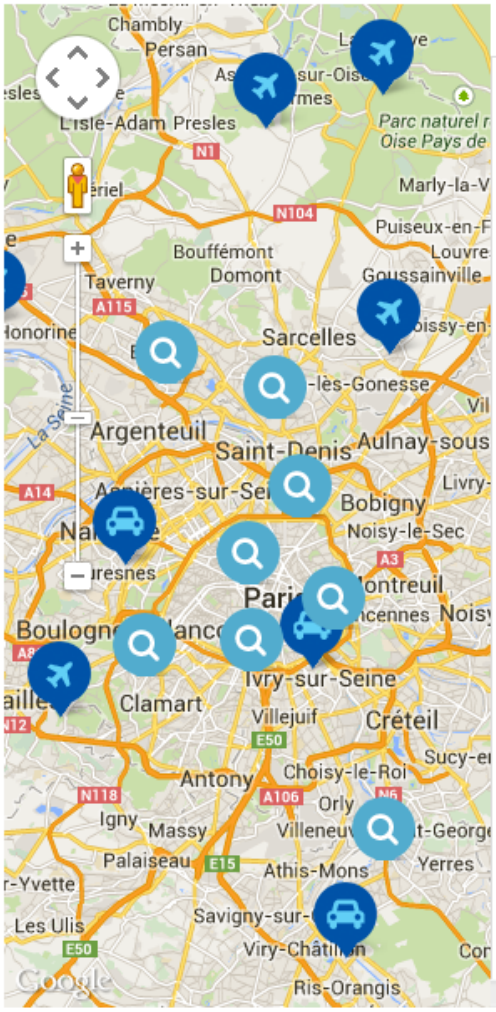


The Harmonica index results platform

View results

The Harmonica index results platform

View results



Use geolocalisation | Search... | OK

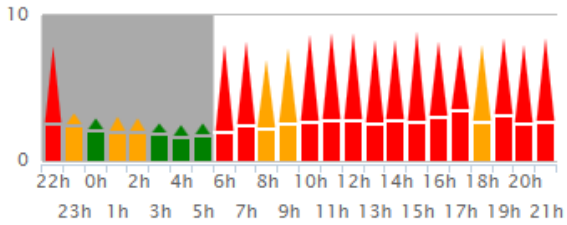
Harmonica Index | Hourly | Day / night

Day | Week | Month | Year

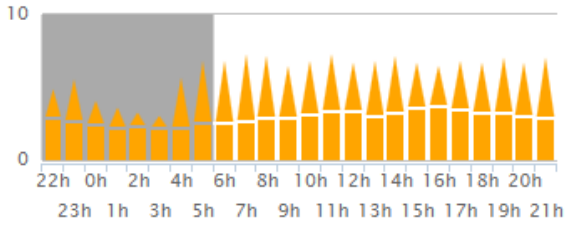
Sun Nov 16th 2014

Delete date

Villeneuve-le-Roi (94) - Georges Brassens school complex



Gonesse (95) - Media library



Day | Week | Month | Year

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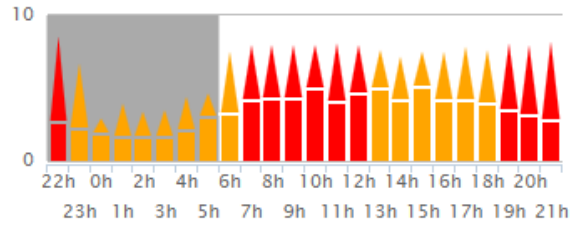

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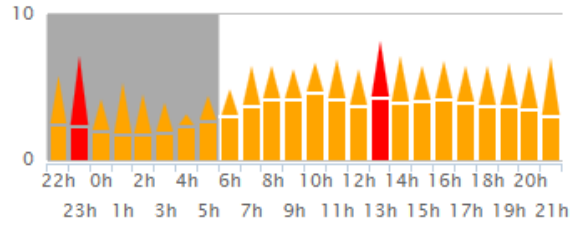

The collaborative database of noise abatment actions

DYNAMAP
Dynamic Acoustic Mapping

Bruitparif
Observatoire du bruit

îledeFrance

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NOISE IN EUROPE | THE HARMONICA INDEX | VIEW RESULTS | INITIATIVES | CONTRIBUTORS

Initiatives

LIST OF INITIATIVES BY THEME | SEE ALL INITIATIVES ON A MAP

All | Road traffic noise | Rail traffic noise | Aircraft noise | Noise from activities | Recreational noise | Quiet areas | Town planning and development | Prevention

Paris (75)
Low-noise road surfaces on the Paris ring road

INDEX : 9 → 8.3

Pierrefitte-sur-Seine (93)
Urban re-qualification of the former RN1 expressway

INDEX : 9.1 → 7.9

Paris (75)
Reduction of the speed limit on the Paris ring road

INDEX : 8.9 → 8.7

Lyon (69)
Plant-based noise screen on the quai Fulchiron

INDEX : 8.2 → 7.1

Villabé (91)
Resurfacing of a 16 km section of the A6 motorway

INDEX : 8.3 → 6.1

Paris 17 (75)
Paris 18 (75)
Redevelopment of avenue de Clichy and transition to a 30 km/h zone

INDEX : 9.4 → 9

Ile-de-France
Change of brake shoes of trains running on the Regional Express Railway (RER)

Ile-de-France
Raising airport approach altitudes

The collaborative database of noise abatment actions

PIERREFITTE-SUR-SEINE (93)
Urban requalification of the former RN1 road

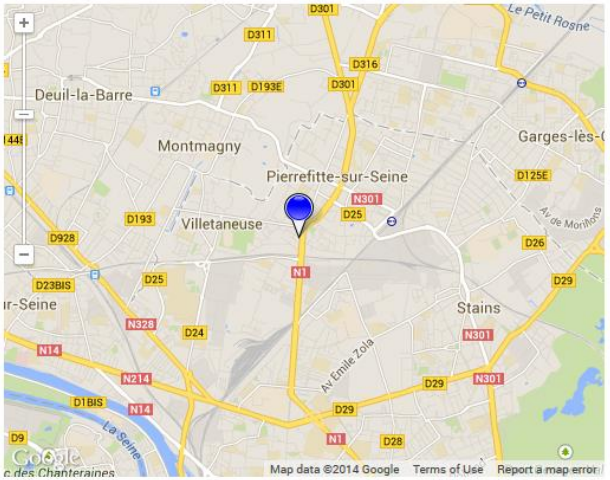
2008-2013

The General council of the Seine-Saint-Denis département completely redeveloped the former RN1 between 2009 and 2013 in order to allow the T5 tramline - which was commissioned at the end of July 2013 - to be laid in the town.

Bruitparif installed a measurement device along this road in Pierrefitte-sur-Seine, in order to measure the change to the acoustic environment related to the redevelopment of this road.

AUTHORITIES

LOCATION



DESCRIPTION

RN1 AT PIERREFITTE-SUR-SEINE AFTER REQUALIFICATION
Bruitparif

Initial evalulation : 9.0 | Final evaluation : 7.9 | Results : -1.1

The fact that the traffic was counted twice on the RN1 - once in July 2008 and once in July 2013 - allowed an in-depth analysis of the noise measurements obtained through the permanent noise measurement terminal Bruitparif had installed along this road in Pierrefitte-sur-Seine.

The comparison of the two periods shows a noise reduction of 1 index point in the daytime (between 6 am and 10 pm) and 1.3 index points at night (between 10 pm and 6 am), making an average decrease of 1.1 points over 24 hours. It is worth noting that the fall can essentially be explained by the event-based component of the index, indicating that the traffic has become more fluid and calm (less noise generated by acceleration/braking and horns, etc.).

Over the same period, the daily flow of traffic has increased by 6 - 7 %. The traffic's speed fell significantly, from 39 to 31 km/h in the daytime and 52 to 40 km/h at night.

The noise reduction can, therefore, be explained by a combination of the following factors:
- Reduction in traffic speed.
- Change in the type of traffic (from stop-start traffic to more "fluid" traffic).
- Changes to vehicles on the road in five years.
- Effect of the change in road surface.

DYNAMAP
DYNAMIC ACOUSTIC MAPPING

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Bruitparif
Observatoire du bruit

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Life harmonica

NOISE IN EUROPE | THE HARMONICA INDEX | VIEW RESULTS | INITIATIVES | CONTRIBUTORS

Noise pollution is so pervasive in cities that citizens and policymakers tend to believe it is unavoidable.

The Life Harmonica project has developed innovative tools to better inform the public about environmental noise and to help local authorities make the right decisions in fighting noise pollution. These tools include an easy-to-understand noise index , **the Harmonica index** and **a platform** for displaying information about environmental noise in European cities.

This website will allow you to:

- find out more about the Harmonica index
- consult Harmonica index results for various European cities
- discover noise abatement solutions implemented around Europe

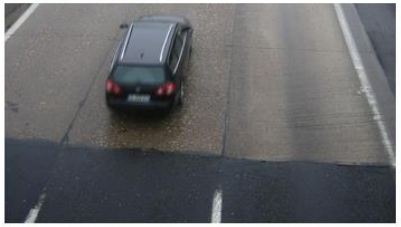
If you are a local government representative involved in environmental noise management or you manage a noise monitoring network,

JOIN THE PLATFORM AND CONTRIBUTE!

MEASUREMENT SITES

Saint-Prix (95) - Town hall
VIEW ALL SITES

INITIATIVES



Resurfacing of a 16 km section of the A6 motorway
VIEW ALL INITIATIVES

NEWS

03/04/2015
Toots 1.1, the tool for testing Harmonica index is available for Windows. Click here to know how to get it.

31/12/2014
Download the Layman's report to be informed about tools developed within the Life+ Harmonica project.

09/12/2014
Life+ Harmonica project final event at the Museum of Natural Sciences, Brussels

Links between DYNAMAP and HARMONICA :

Noise measurement network of the DYNAMAP project will **provide data in real time To dynamic noise mapping** .

Noise measurement network can also **address three main challenges (share our experience in Paris region)** :

- **The challenge of understanding phenomena:**
- **The challenge of evaluating actions**
- **The challenge of providing and disseminating information in complement of real time noise mapping by using the HARMONICA index**

Need to storage detailled elementary data : Laeq, 1s (one-second) to be able to recalculate new noise indicators and contribution of events

Links between DYNAMAP and HARMONICA

Noise measurement network addresses those two main challenges :

The challenge of understanding phenomena:

- Better understand the factors that have an influence on noise (traffic conditions, weather parameters, urban fabric, etc.).
- Monitor changes in noise over time relative to changes in technology, travel, social expectations, etc.
- Obtain exposure data for performing epidemiological studies on noise and health or studies on the socio-economic impacts of noise.
- - Promote an understanding of the effects of transport in terms of noise as well as pollution, its impact on the environment, etc., to make it easier to control and pool these effects.

The challenge of evaluating actions:

- Document the impact of the measures taken on an on-going or occasional basis and evaluate the effectiveness of these actions.
- Anticipate, track and capitalise on knowledge during the implementation of major projects.
- Obtain indicators for tracking the impact of the use of noise criteria in travel and spatial planning policies.

Links between DYNAMAP and HARMONICA

Noise measurement network addresses also this very important challenge :

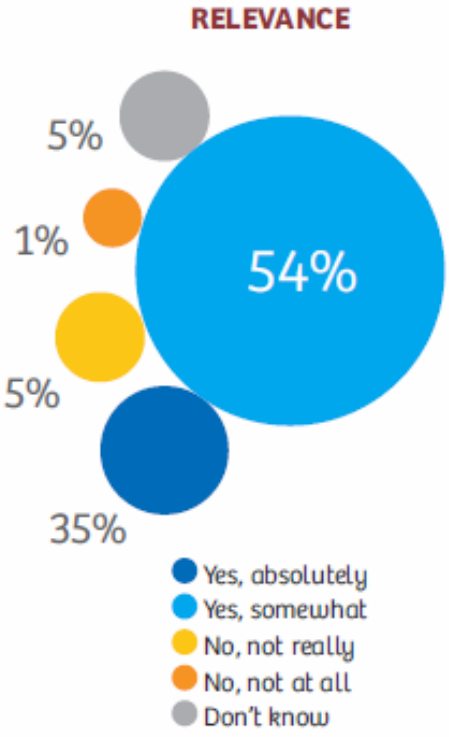
The challenge of providing and disseminating information to the Public :

- Respond to one of the key concerns of residents concerning the quality of their way of life and their health.
- Provide clear, transparent and independent information to the public on the current status of and changes to the acoustic environment ***by using the new HARMONICA index***
- -Provide citizens and the various stakeholders in the fight against noise pollution with the means to understand and analyse noise nuisance.
- Allow for a more precise and targeted quantification of noise exposure than is possible using maps based on modelling.
- Compile statistics on the acoustic environment in the Paris region.

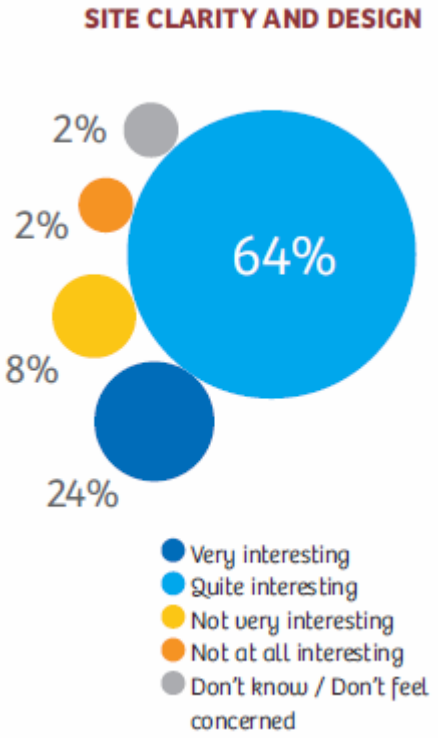
Evaluation by the public

Survey conducted with a questionnaire at the end of the project on 843 people

89% of people surveyed said that **the index is relevant** and matches their perception of noise



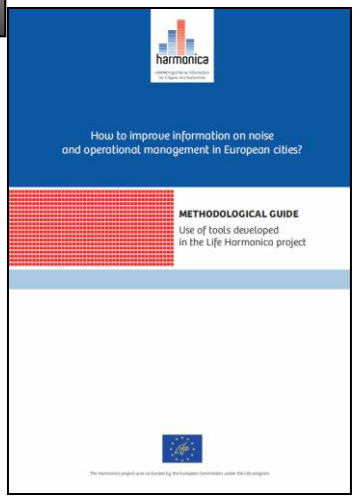
88% of people surveyed found www.noiseineu.eu **is clear** and well designed



How to participate ?

The Layman's report gives you
an overview of the Harmonica project results

A **methodological guide** explains how to make
use of tools developed in the Life Harmonica project



Scientific articles about HARMONICA index

Contact Bruitparif team : contact@noiseineu.eu

To become a member of the platform, it couldn't be more simple...

- Publish on the platform the Harmonica index results
  in your area by simply send a email to: join@noiseineu.eu
- Share the noise abatement initiatives implemented in your area by simply completing the form template, available on the website