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NOISE CONTROL FOR A BETTER ENVIRONMENT

Cities with a Positive Evolution on Noise Action Plans Are Requiring a More Accurate Assessment to Advance Towards New Goals. Two Examples: Donostia-San Sebastián and Vitoria-Gasteiz

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ABSTRACT

This paper shows the positive evolution during the last 15 years of the noise levels and the population noise exposure for two cities: Donostia-San Sebastian and Vitoria-Gasteiz, located in the Basque Country (Spain). Both cities have a long experience on environmental noise assessment, applying comparable and consistent assessment methods based on noise level calculation at real height on building facade, together with effective action plans on traffic management and mobility. This progressive improvement got, in that period, a reduction of 30% of inhabitants exposed over 55 dB(A) for Ln, reaching values that nowadays are recommending to look at new more ambitious aims for the next action plan, starting to assess population exposed to noise levels according with a calm and healthy city.

Having the advantage of detailed statistics population exposition for both cities from at least three noise maps during the last 15 years, it is able to analyse the evolution to support new goals on noise management, and to consider how it will affect to the input data and to the working methodology with calculation models, because accuracy will become more relevant to get representative results.

Keywords: Urban Noise, Noise Map, Action Plan
I-INCE Classification of Subject Number: 68, 76

1. INTRODUCTION

Noise mapping for cities based on calculation methods using computer models started more than 20 years ago and some cities that began to apply this methodology at that time and kept consistent assessment procedures, are nowadays able to measure their evolution and learn from the experience looking for new horizons in the urban noise management.

Two of these cities are Donostia-San Sebastian and Vitoria-Gasteiz, located in the Basque Country (Spain), both were pioneer in the introduction of these methodology to assess the environmental noise levels.

Vitoria-Gasteiz made its first noise maps based on calculation methods on 1998, obtaining the people exposed to different noise levels in its second noise map on 2003, evaluating the calculated noise levels at 4 m., according to the EU Directive 2002/49/CE (END) and, additionally, this same evaluation process was also made for real heights,

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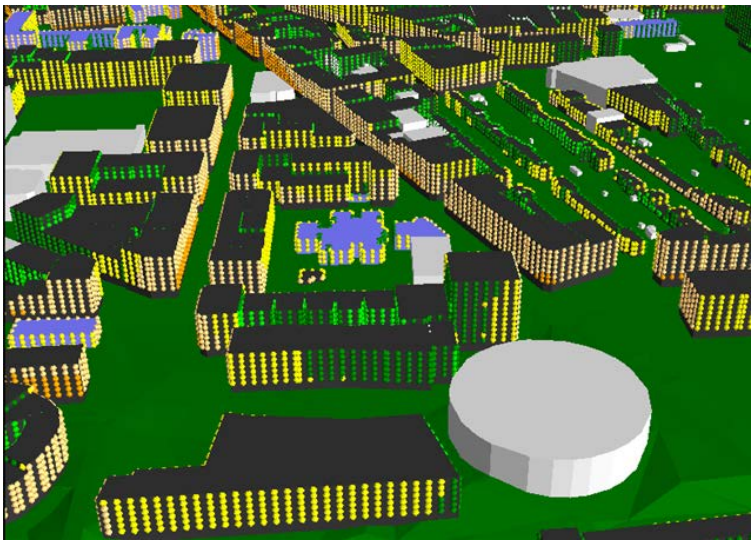
calculating the façade noise levels at all the building floors. The aforementioned calculation have been likewise made on 2005, 2011 and 2017. The city started this process with 224.000 inhabitants in 2003, growing to 252.000 in 2019.

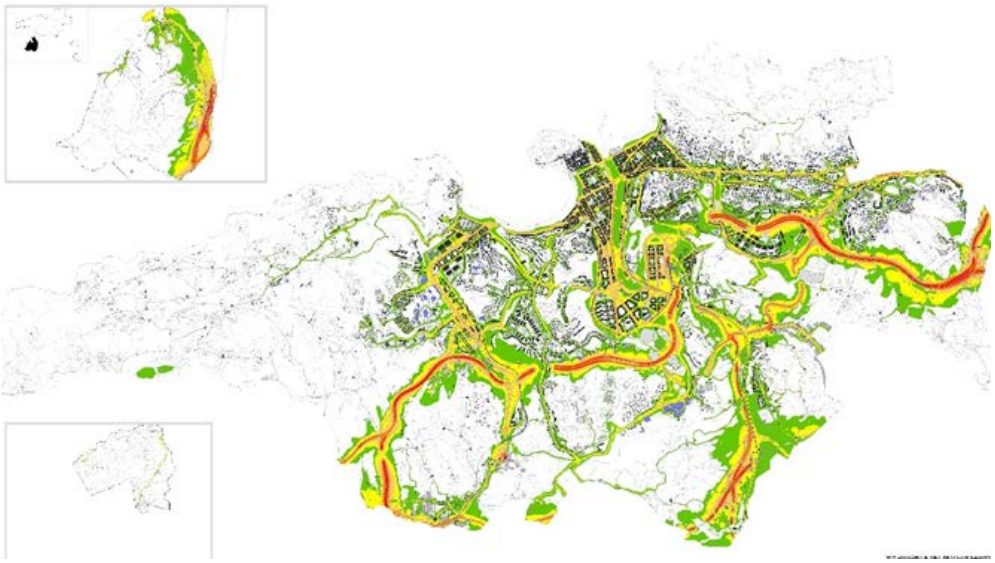
Donostia-San Sebastian, began to apply this methodology on 2001 and got its first noise map with the calculation of people exposed to noise also in 2003, at 4 m and at the different noise floors. The city up-dated the assessment on 2011 and 2017. The city had 182.000 inhabitants in 2003 and has 187.000 in 2019.



Example of noise level results to obtain exposition to noise at real height

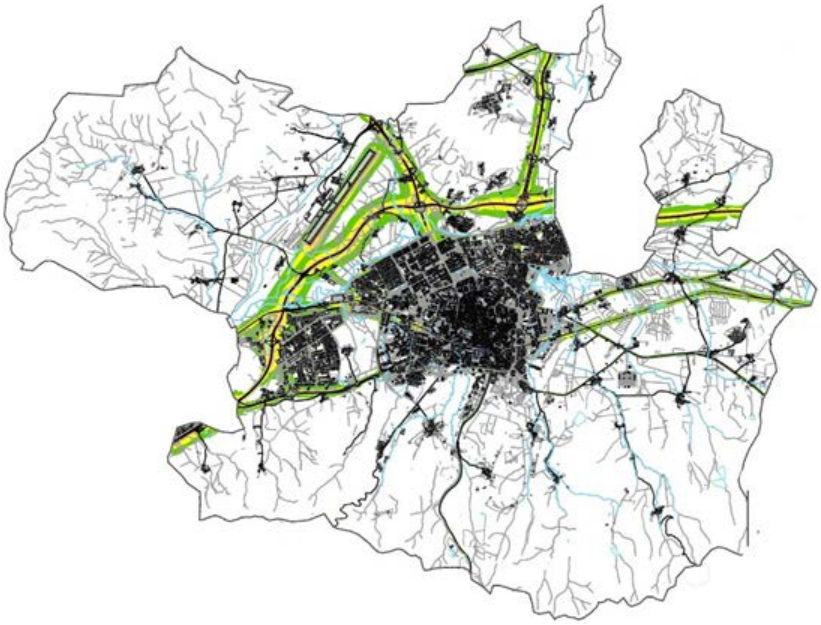
Both cities have approved different action plans in this period, with different characteristics, but both cities combine the noise action plans with its long experience promoting sustainable mobility, increasing pedestrian areas and zones with reduced speed.

The consistent methods to obtain the different noise maps and to obtain the population exposed to noise during these years provides comparable results allowing the measurement of the continuous improvement and providing references to explain the positive evolution of noise in both cities. Nevertheless each city had its specific way to manage their environmental noise.



Strategic noise map of agglomeration of Donostia – San Sebastian 2017

Strategic noise map of Donostia – San Sebastian 2017: City centre



Strategic noise map of agglomeration of Vitoria-Gasteiz 2017

Strategic noise map of Vitoria-Gasteiz 2017: City centre

2. METHODOLOGY AND RESULTS

When sustainable mobility policies have been developed during the last 20 years, the number of streets where the maximum speed limit is reduced to 30 km/h or less, has been continuously growing. Being urban traffic the main noise source affecting to most people, it was a major need to include how speed reduction influences on the noise levels and how it is considered in the noise assessment methods.

As the official method established by the END for road traffic noise: NMPB-96, doesn't reflect, , that noise emitted by light vehicles is reduced when the speed decreases under 50 Km/h. therefore some corrections to the emission criteria of NMPB-96 were needed in order to show the positive effect of these actions in the reduction of urban noise.

The specific studies to assess urban noise after the noise maps made in 2003, required a new emission criteria to urban streets, since low speed limits in streets began to be common. The newest reference at that time was the Nord-2000 method, which established a progressive lower noise emission when speed reduces from 50 Km/h to 20 Km/h, defined for constant speed driving conditions.

As NMPB-96 had a specific criteria, unsteady flow, to consider the urban traffic conditions against the road conditions steady flow, a conservative criteria was defined for the definition of a representative criteria assuming that part of the traffic flows at constant speed, but part of it doesn´t. The new criteria was an average criteria to reflect the unsteady traffic condition in urban street to be comparable with NMPB-unsteady.

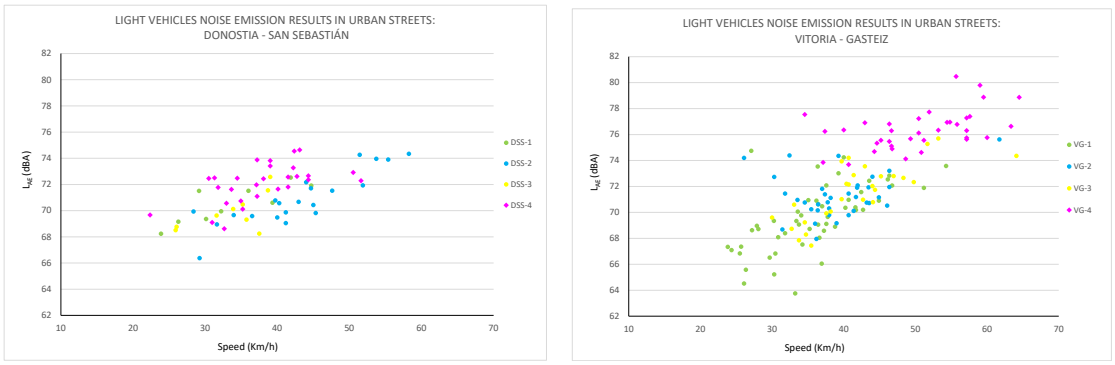
This correction based on Nord2000 was applied in both cities in the noise map made in 2011. Noise action plans approved in 2013, between other actions to improve the sound environment in the cities, focusing in the reduction of population exposed to noise in the city mobility plan, being a main action to promote the progressive limitation of maximum speed to 30 Km/h, or even 20 Km/h. This proposal required a progressive increase of accuracy in the noise calculations.

To solve it, a new criteria was defined considering the new reference established by NMPB-2008, reducing the sound power levels for light vehicles with respect to Nord2000, resulting in more representative values to the expected real effect. A new theoretical approach was established for noise assessment, changing the emission reference values from Nord-2000 to NMPB-2008, but still keeping in the criteria the considerations of the emission values, assuming the same mixture of driving conditions: steady and unsteady to avoid an artificial reduction of real noise.

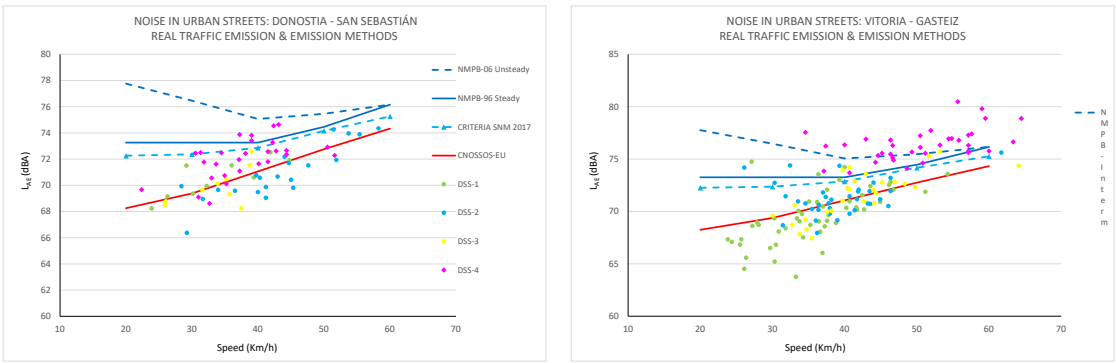
This criteria was used to obtain the strategic noise maps in 2017 in both cities, but some measurements on real traffic were made to validate the method in each city, looking also for references about the accuracy of the criteria looking for a new step in to improvement of the accuracy for a future assessment method to the city.

Measurements were independently made in each city, considering different streets conditions in flat areas, in order to have a support to the criteria suggested by AAC, based on local values to give credibility to the results provided by the noise map.

Results in both cities showed that the applied criteria based on NMPB-2008 still was really conservative because it overestimates the emission. The results also reflect as an opportunity to change to the new official method, Cnossos-EU, to improve its accuracy. For this purpose it is necessary to take into account the different local effects on noise emission for urban road traffic (see specific paper from AAC about the topic in this conference)



Measurement results: noise emission in real traffic, L_{AE} at 7,5 m



Comparison of measurements results vs emission criteria used in SNM 2017 and the EU reference methods

As summary of this experience during more than 15 years, both cities have reduced the population exposed over 55 dB(A) for Ln (objective value to existing residential areas in the Spanish legislation), from around 40 % in 2003 to 8 and 6 % in 2017, but having a clear opportunity to reduce these values even further if the accuracy

increases on noise emission levels in the near future, based on a better characterization of the noise emission levels for the urban traffic.

Table 1: Evolution of exposed population in the cities

Year	Donostia – San Sebastian Ln > 55 dB(A)	Vitoria - Gasteiz Ln > 55 dB(A)
2003	43%	39%
2005		35%
2011	28%	18%
2017	8%	6%

3. LEARNING FROM THESE XPERIENCES

Firstly, these two examples show that adequate policies and to keep consistent assessment methods generate positive results, assuming that noise management requires work in different fields simultaneously and time to see the effects on the indicators.

Urban traffic noise reduction in cities together with its effect on the indicator about population exposed to environmental noise, really is a combination of progressive improvement in the environmental noise due to the positive effect of sustainable mobility plans, together with a progressive increase in the accuracy of the methods that still should be further improved.

Cnossos introduce more variables to describe the noise emission for urban traffic and it offers the possibility to increase the accuracy in the following noise maps, but it also haves the risk to underestimate real levels if it is not adequately used. The experience of the two exposed examples indicates how important is to be conservative in the assessment when there is not enough information, because a good management should provide a progressive improvement in the assessment methods and a higher accuracy must guide towards lower levels, since the uncertainty coefficients are reduced.

The 2017 results, which considered that the emission values should still be reduced, points out that the people exposed over 55 dB(A) during the night period probably should be under 5 %, and this values justify future horizons for the following action plan should consider more ambitious objectives, since goals as 55 dB(A) that were quite far 5 years ago, are now only exceeded in some streets with higher traffic volume.

The approach towards goals as the recommended by the WHO (World Health Organization) looking for 40 dB(A) in the night to get a healthy environment, could be a new long term goal, with intermediate partial targets, as Ln values of 50 and 45 dB(A), but it will require also technical improvement in the assessment, because it will require that noise maps will increase its accuracy to calculate lower noise levels.

To reach this aim, several improvements in the assessment methodology should be developed, for example: creating a more detailed model, higher accuracy in the input data and the source definition, more precise calculation parameters, etc.

These means that a higher requirement must be demanded to the noise assessment studies in order to get representative results and effective references to support the decision making in the noise management and in the action plans.

4. CONCLUSIONS

Both cities, Donostia – San Sebastian and Vitoria - Gasteiz have had a great reduction on the 15 years period, because noise from urban traffic has reduced due to the policies which reduce private traffic, increase pedestrian areas and a progressive increase of streets with its speed limited to 30 Km/h.

These results are also due to a progressive improvement in the accuracy of the calculation methods applied to characterize the noise emission of urban traffic noise, even when measurements are showing that noise maps are still overestimating.

The use of the new official method Cnossos-EU could be an opportunity to improve the accuracy, if local aspects are adequately included in the assessment to progressively approach and represent the real situation, demonstrating that noise map will be a more powerful tool to manage effectively the urban noise.

But at the same time, once noise levels in cities due to traffic are decreasing, noise management in cities should look for more ambitious goals that will require the improvement of noise map methodology to get representative results going down to objective noise levels as 40 dB(A) or even 45 dB(A)) in the night period. This will require a more detailed description in the assessment methods of the different effects affecting to the noise level, as a more detailed model of the real scenario, better input data and the use of more accurate calculation parameters.

5. ACKNOWLEDGEMENTS

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6. REFERENCES

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