



## A COMPARISON OF URBAN ACOUSTIC VALUES SAMPLED IN 2020 AND 2023

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### ABSTRACT

#### Minimum Ambient Noise Levels in an Urban Context

The restrictions imposed in 2020 during the early stages of the pandemic afforded an opportunity to make a hypothesis as to what levels of noise reduction can be reached through ideal acoustic bonification.

The work started from a series of instrumental samplings carried out at different sites of the city during the lockdown stage at hours otherwise associated with intense activity, with an aim to gather some values descriptive of the acoustic indicators.

The measuring campaign provided a picture of the acoustic situation in that anomalous context, which was then compared with analogous samplings carried out three years later, at the same sites, on the same days and at the same hours, with somewhat surprising results.

The results of these samplings are presented briefly and followed by a few considerations on affordable bonification objectives.

**Keywords:** urban noise, pandemic, comparison

## 1 INTRODUCTION

### Purpose of the research

The restrictions imposed in 2020 during the early stages of the pandemic brought about a near total elimination of urban vehicular traffic, with a dramatic decrease in the average sound level perceived in cities, which was produced almost exclusively by technological installations inside buildings.

A series of samplings was carried out in places of the city of Padua having diverse characteristics, with the aim of comparing the values measured in that particular situation with those that would be measured in the same places in ordinary circumstances.

Samplings were made, over short durations of time, first in 2020 and then again in 2023, in the same month and using the same instrumental settings. They concerned the gathering of percentile statistic values and the values of the “global” indicators referred to the entire sampling

time [LAeq, L<sub>Amax</sub>, L<sub>Amin</sub>, L<sub>peak</sub>]; the duration of each sampling time was of 20 minutes.

In 2023 it was not possible to carry out the samplings on the same days and at the same hours as made in 2020, but care was taken that there was no significant change in the contour conditions, in order that the results would be as comparable as possible. The only variable that was left free was the traffic flow.

For formatting reasons it is impossible to faithfully reproduce the tables of the results; what is presented below is the graphs obtained from them.

## 2 CRITERIA FOR CHOOSING SAMPLING SITES

The characteristics of each sampling site will be now briefly described. They will be useful to understand a few important aspects which made up the criterion for their choice and affected the results. Some sites of the city were chosen on account of their diversity from one another:

- x with a slow, if heavy, city-center traffic
- x with heavy but fast traffic (urban slip roads)
- x with limited traffic and/or pedestrian areas

Attention was also devoted to the road surfaces: some of the roads in the city center are paved with pebbles or porphyry cubes, but most of them are smoothly tarmacked.

It must be noted that some of the sampling sites are next to public transport paths, whereas others are only associated with private vehicular traffic (including motorbikes and three- or four-wheeled vans).

The samplings were carried out by the roadside, the microphone being placed at a height of ca. 2 m, the operator standing 1 m away from the sampling location.

Following pictures shows four sites where measurements was made (2020):

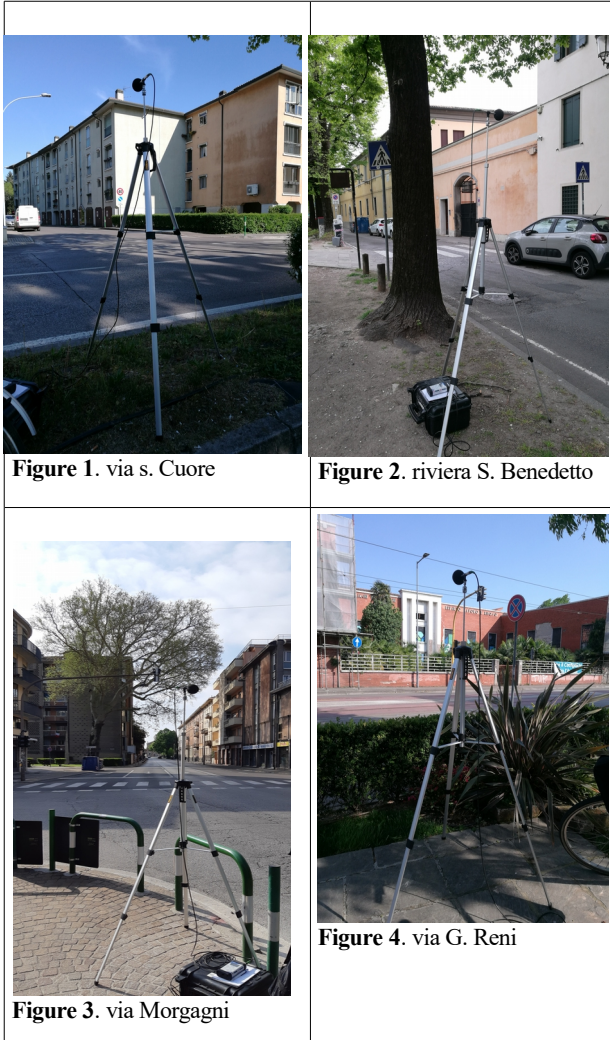


Figure 1. via s. Cuore

Figure 2. riviera S. Benedetto

Figure 3. via Morgagni

Figure 4. via G. Reni

### 3 SAMPLING RESULTS AND COMPARISON

Following are the compared results of the samplings referring to sites with similar characteristics as to traffic type, road surface and route shape. The values are presented in such a way as to be readily assessed.

It must be noted that at a particular site the measurement carried out in 2020 was disturbed by the continuous emission of an electric transformation substation which was instead inactive in 2023.

The most interesting values for the purposes of an initial assessment of the specifications of urban noise are the percentile statistic parameters L50 to L99, from which the distribution of average ambient noise can be inferred, if one neglects sporadic events that only temporarily affect the acoustic climate.

The sampling sites were grouped on the basis of the following criteria:

- ◆ type of traffic, average speed
- ◆ type of road surface and layout (presence of roundabouts, traffic lights, etc ...)
- ◆ type of road (central city, pedestrian and/or limited traffic road, urban road, etc ...)
- the first graph refers to survey points along streets in the city center affected by light but continuous traffic, with reduced average speed.
- the second graph shows the data collected on neighborhood roads with normally continuous traffic at medium speed (inter-neighborhood urban roads)
- the third graph shows the results obtained on urban roads affected by intense traffic and average speed
- the last graph refers to a survey point located on a central pedestrian only road.

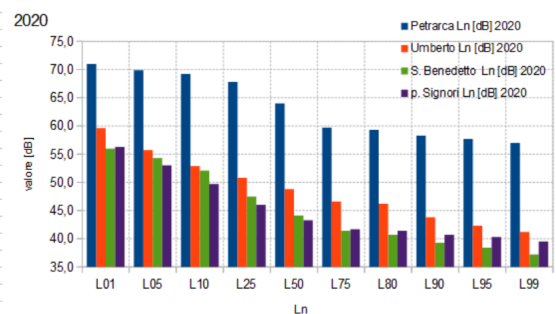


Figure 5. 2020 results in center city routes

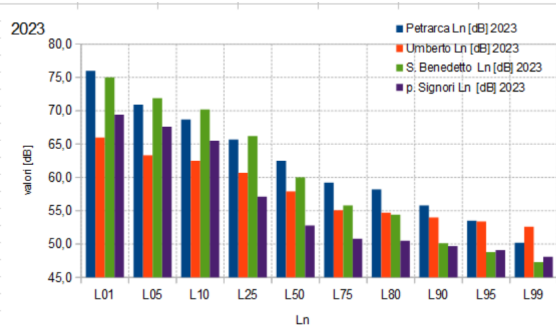


Figure 6. 2023 results in center city routes

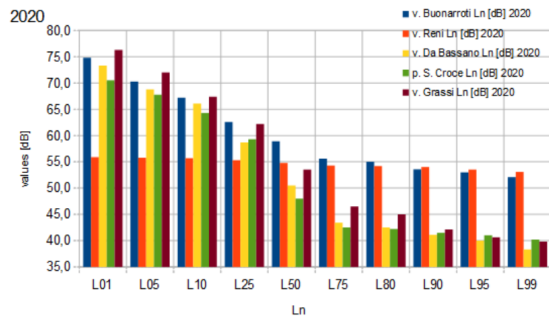


Figure 7. 2020 results in urban roads

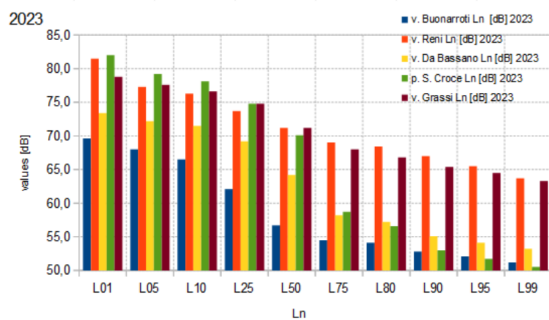


Figure 8. 2023 results in urban roads

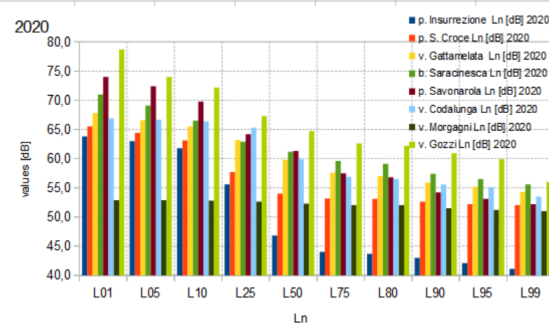


Figure 9. 2020 results in urban slip roads

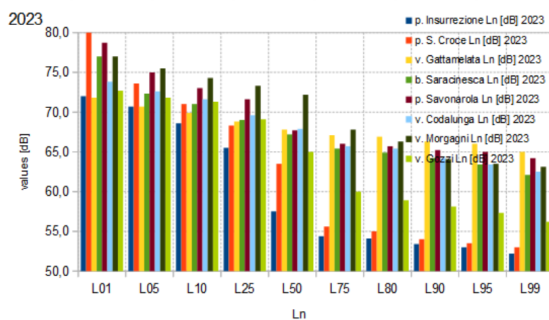


Figure 10. 2023 results in urban slip roads

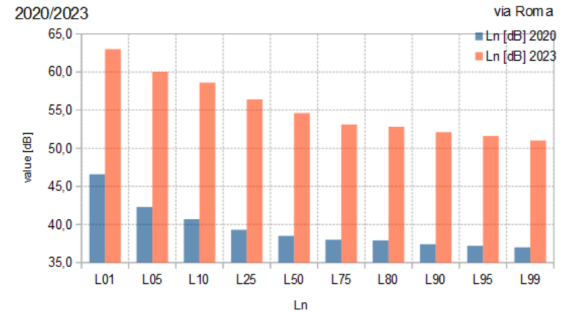


Figure 11. compared results in pedestrian area

In the pedestrian area (via Roma) in 2020 the sound level was very low (very few passers-by) while in 2023 the street was almost full of people and this is reflected in the results shown in the graph.

An examination of the graphs leads to the identification of a significant gap between the values of the percentile levels of 2020 and those of 2023, with specific reference to indices L50 to L99, which present a difference between the values of 2020 and the corresponding values referring to 2023 which can even exceed 20 dB (the "via Petrarca" site being made unique by the very noisy cobblestone road surface<sup>(1)</sup>).

In other neuralgic sites for city traffic (like via Gattamelata), while showing a decrease in 2020, sound levels remained high, this can be folded with the greater speed allowed by the lower volume of traffic.

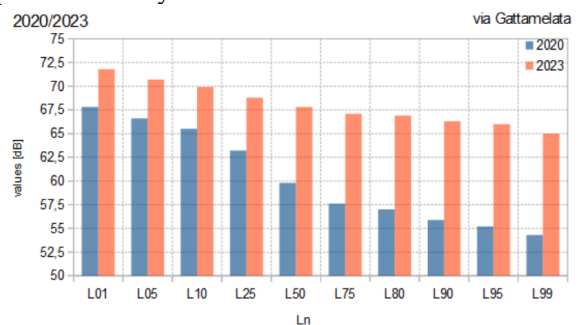


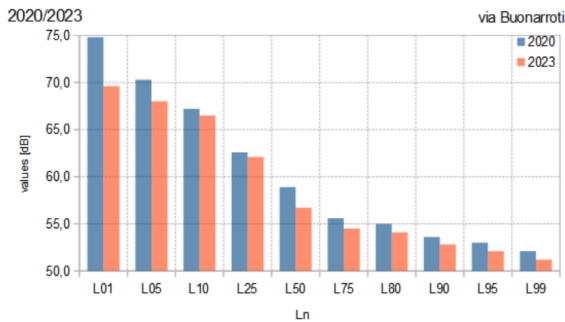
Figure 12. 2020/2023 comparison of results in via Gattamelata

It must also be considered that some sites, located on the roads leading to the hospital, are always affected by the transit of emergency vehicles, whose acoustic contribution remains similar in the two situations.

A special situation occurred on the "via Buonarroti" site: in 2020 a medium voltage electrical substation was

<sup>1</sup>Traffic was heavy in 2023, but speed was reduced in comparison to 2020: that made the difference

active, which was the most important source in the place, which however was turned off in 2023.



**Figure 13.** 2020/2023 comparison of results in via Buonarroti

Other points did not show substantial variations in the volume of traffic, so the results are slightly different: via A. Da Bassano, piazza Insurrezione, ... this demonstrates once again that road traffic is the main source of noise in our cities.

It can be inferred that urban traffic, even where not particularly heavy, is the main source of ambient noise and thus the main source of discomfort.

However, even on strictly pedestrian-only streets, the increase in the number of pedestrians leads to considerable variations in the sound level, which rises by about 15 dB in all the percentile indicators which mark the persistent noise level of the place.

#### 4 CONCLUSIONS

If one neglects the values assumed from energy-related parameters, which are certainly not representative for the purposes of this study, and one focuses only on the percentile indicators, one can see how decisive the effect of road traffic is on persistent noise in the various parts of the city. It should be borne in mind that a small number of vehicles were circulating even during the 2020 lockdown phase.

These results could also point to possible benefits deriving from measures aimed at limiting the speed of the vehicular traffic flow.

This survey also affords an evaluation of what requirements could potentially be set for the insulation systems of buildings facing different types of road axes inside cities; another, more general task, could consist in identifying which noise levels would be tolerable in an advanced city; from another point of view, one can find an answer to the question: “what would be a reasonable target for the achievable noise level after adequate interventions in our cities?”

This is a very important aspect in order to improve the quality of life in our cities, whether large or small.

#### 5 REFERENCES

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