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## **TRAFFIC NOISE SURVEY DURING AND AFTER THE TRAFFIC CLOSING OF THE CITY CENTER IN A MIDDLE SIZE TOWN**

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**ABSTRACT**

A traffic noise survey was conducted in a middle size north-west Italian town, Vercelli, regarding the impact on the noise deriving from the traffic closing of the city center. The measurements were carried out during two days: the closing and normal traffic conditions ones. Four locations were chosen in the city center and five locations on the five entries to the town. The closing of the city center has abated dramatically the traffic (only permitted vehicles were circulating). In one of the sites, during all the day, the vehicles ranged from about 14,000 to 1,100 vehicles and the noise decreased of about 10 dBA. Also in the peripheral locations a decreasing of traffic was recorded, until 25% in a site, but a very slight abatement of noise (1.3 dBA) was measured.

**1 - INTRODUCTION**

A lot of researches focused on the understanding of the environmental impact of the traffic control measures (TCMs), overall in the built-up areas, are present in the scientific literature.

Numerous research efforts are aimed to evaluate the air quality while less studied are the effects on the environmental noise derived from traffic management. The noise disperses in the air like the pollutants and it causes some problems to the people as well as some epidemiological surveys demonstrate [1,2]. The present research has the objective to investigate the effect of a traffic control measure as the pedestrianization of a great part of the city center. The survey started moving from the European initiative regarding the "European day: in the city without the car" on the 22<sup>nd</sup> of September 1999.

**2 - THE SURVEY**

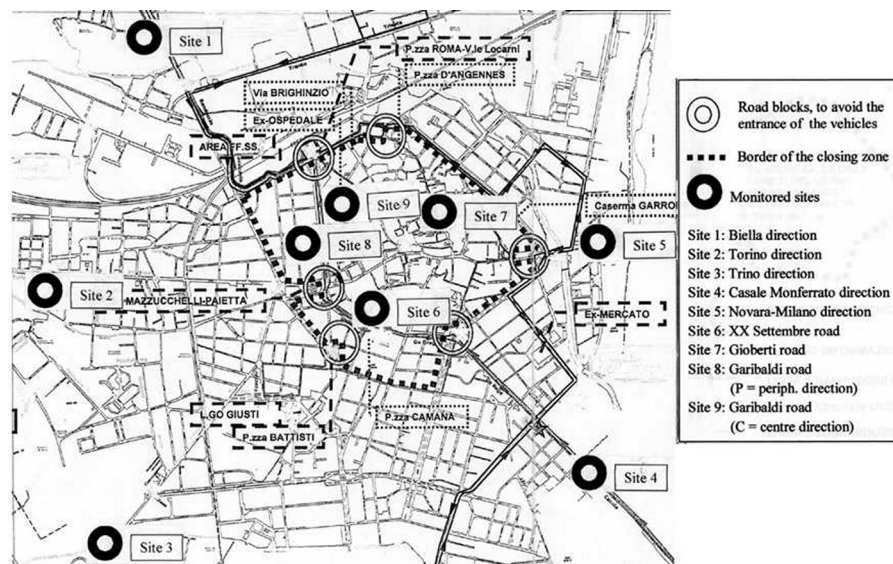
A traffic noise survey was carry out in a middle-size north Italian town, Vercelli (90 km from Turin). The measurements were carried out during the closing, on the 22<sup>nd</sup> of September 1999 and the following week, on the 29<sup>th</sup> of September, during normal traffic conditions.

On the 22<sup>nd</sup> of September, four locations were chosen in the city center (fig. 1), in the closing zone, and some noise spot measures (9.00-12.00 and 15.00-18.00) were carried out. Outside the center, five locations on the five entries into the town, as depicted in figure 1, were chosen and the traffic and noise were measured from 7.30 a.m. to 9.00 p.m.. In each of the five sites a sound meter and a traffic counter were installed. The former has given partial data (each five minutes) of  $L_{eq}$  and the latter the number of vehicles each five minutes, classified in three categories (motorcycles, light and heavy duty vehicles). In addition, average speed during the 13.5 monitored hours, on the chosen road sections, was given.

On the following week (the 29<sup>th</sup> of September) the traffic and noise measures in the five peripheral sites were repeated; in addition, in the four central locations, traffic and noise data were recorded. The measures were carried out from 7.30 a.m. to 9.00 p.m. and with the same conditions of the previous week (fig. 1).

It is important to emphasize that outside the closed zone six exchange peripheral car parks were located, where shuttle buses were available. On the border of the closed zone some parking areas for short and long parking (these last for the resident population) were prepared.

The objectives of the survey were to understand the effects of closing the central zone of the city, in respect to:



**Figure 1:** The map of Vercelli with the indication of the closing zone and the monitored sites.

- know the acoustical climate of a middle size town during a typical weekday (Wednesday), in the city center and in the peripheral zones;
- compare the environmental noise in the city center and outside of it when the center is closed to traffic or when the traffic transits in it.

The last objective is aimed to understand which is the effect on people habits of a traffic control measure as a closure of the central part of the city. In particular it is important to know if the people change their transport mode or not in function of the accessibility to the center.

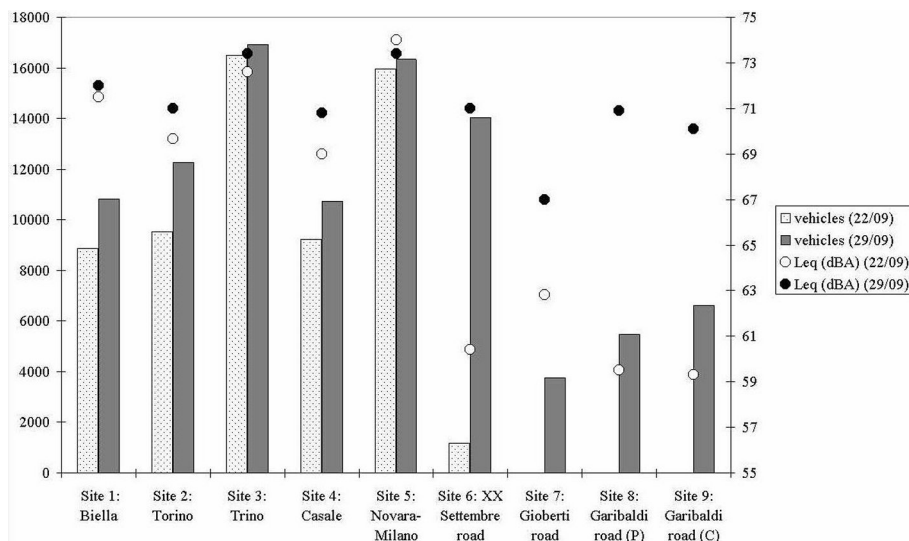
### 3 - THE RESULTS

A first analysis of the data allowed knowing the environmental noise in the city on a typical weekday (Wednesday, the 29<sup>th</sup> of September). The results show that during the day the noise level ranges from 71 to more than 73 dBA on the five roads accessing the town. Precisely, towards Trino (site 3) and Novara-Milano (site 5) the Leq is 73.4 dBA (7.30 a.m. to 21.00 p.m.) and the total traffic in the same period is about 16,300 vehicles. Generally, outside the center on the five entries into the town, the percentages of heavy-duty vehicles is about 5% with the exception of the Novara-Milano direction where it doubles (10%).

During the normal conditions, in the city center (sites 6 to 9) the traffic is quite less than in the other sites, with the exception of XX Settembre road (site 6) where about 14,000 vehicles transit during the day (fig. 2). It is interesting to observe how the noise levels are quite similar in the different sites: in central roads as Garibaldi (site 8 and 9) and XX Settembre (site 6) the Leq values are close to some accessing roads (sites 1, 2 and 4), also if the number of vehicles is different. In this case the road geometry and the surrounding environment play an important role in the noise dispersion; if the traffic is undoubtedly the main noise source, also other variables influence the noise level. This is an important finding explaining also the results obtained from a noise survey carried out in Turin [2] where the people annoyance has not revealed itself to be mainly related with the traffic quantity. The width of the road and the presence of building influence the noise level, so that roads as Garibaldi one (sites 8-9) with tall building lining the street have similar Leq to larger roads without or with low buildings.

The figure 2 depicts the traffic and the Leq in the nine sites from 7.30 a.m. to 21.00 p.m.. It is interesting to observe the difference, in term of number of vehicles and noise level, between a typical weekday (29/09) and the day (22/09) when the closing of the central part of the city has been carried out.

The figure depicts clearly how the closure of the city center has abated dramatically the traffic (only permitted vehicles were circulating) from about 14,000 to 1,100 vehicles during all the day in one of the sites (site 6) and, consequently, a noise decrease of about 10 dBA was recorded. The exception of Gioberti road (only 4 dBA) is due to the presence of a school; the noise due to the pupils entering and going out from the school is always present.



**Figure 2:** The vehicles and the Leq measured in the nine sites from 7.30 a.m. to 21.00 p.m.

Also in the external locations a decreasing of traffic was noted, 20% and 25% in the sites 1 and 2 (Biella and Torino direction), but a very slight noise abatement was measured, 0.5 and 1.3 dBA, respectively. Towards Casale (site 4) the major decrease was recorded, 1.8 dBA, with a 15% traffic decrease and a reduction of 85% of heavy-duty vehicles.

The most little variation of traffic and noise level were recorded towards Trino and Novara-Milano (sites 3 and 5) where the noise decreased less than 1 dBA and the traffic diminished of about 2.5%. The difference is due to the fact that Trino is the access to the linking stretch going towards the highways Torino-Milano, Torino-Aosta and Genova-Sempione. Novara-Milano road is the main national road linking Vercelli with Milano. The Novara-Milano direction records an increase in the 22nd of September because of a great increase of heavy-duty vehicles from the 7.00 to 9.00 p.m. (the two hourly noise levels are more than 78 dBA).

Moreover, either the great or low reduction of traffic in the peripheral roads did not affect the average speed and also the percentages of the different classes of vehicles have been almost unchanged. The interesting thing is that the major decrease is visible on the roads linking the neighboring villages with Vercelli and is spread along all the day while the main entries into the city do not seem to be affected by any consistent change. It seems that the commuters have maintained unchanged their behavior and the people with other motivations than work have changed their trip plan.

#### 4 - CONCLUSIONS

These are only some representative data of the survey, but some interesting reflections regarding the Traffic Control Measures (TCMs) can be done. It is important to understand the real impact on traffic and environment of an intervention on circulation as, for example, a closing of a zone. It is undoubted that an elimination of traffic induces a substantial improvement, but what happens around this happy isle? Can such a measure induce the people to change their behavior and not use the own vehicle? How many vehicles have to be eliminating from circulation to obtain visible benefits?

The answers to these questions are not trivial. This survey has helped to understand that the noise problem in the urban context is really great and the closing of the city center is not effective to obtain a decrease of the general environmental noise. In fact the noise is greatly abated in the closed area, but the rest of the city do not improve its environmental quality. Surely this survey should be extended to other sites and for longer periods to validate the obtained results. In addition, a survey on the population would be interesting to understand the people behavior when TCMs are carried out and to evaluate which interventions on traffic are really effective to have an improvement on acoustical climate.

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