



HOW POLICY CHOICES ON INDUSTRIAL NOISE IN ACOUSTIC ZONING RELATES WITH ECONOMY AND URBAN DEVELOPMENT

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ABSTRACT

Most of Italian companies are small or medium enterprises. Apart from few industrial areas, companies carry out their production in mixed areas in urban context. This opens several issues in terms of health protection of citizens, especially from exposure to noise. This work investigates Bolzano industrial area as a case study to discuss how the different policies might deal with health and noise issues. The site is chosen for its settlements originating long time ago, with its background mainly related to the history of the steelworks. Born as an exclusive industrial site, the actual situation is mix of industries, university and offices. Furthermore, Bolzano has a particularly low background noise, making the noise issue even more participated by citizens, as their annoyance threshold is very low. In this context, Bolzano acoustic zoning was attempted several times, but has never been approved due to the great challenge of combining economic and health impacts especially in the industrial area. Following the 2022 new acoustic zoning proposal, still under development, the paper describes the policies constraints with regards to properties values, mixed use of the industrial area, city development, current energy issues and obviously health protection that should be taken into account in zoning process.

Keywords: *industrial noise, cost benefit analysis, acoustic zoning.*

1. INTRODUCTION

Many studies have been dedicated to the emission, transmission and effects on human health of the main noise sources, which are mainly transport infrastructures: roads [1-4], railway traffic [5-7], airports [8, 9], port activities [10, 11]. Although it is considered one of the fundamental sources of noise by European legislation, industrial noise is difficult to treat in a homogeneous way and therefore it has been investigated almost exclusively as case studies. The result is a lack of legislation which often leads to conflicts. This paper intends to discuss economic and health impacts that policy might drive in managing noise, discussing the industrial area of Bolzano as a case study. In fact, it is well known that noise has different socioeconomic impacts, and they depend on source type and related control strategies [12]. For the best of the authors' knowledge, not many studies on property values related to industrial noise exclusively have been published, as most of the studies relates to transportation noise [13]. The city and the industrial site will be described concerning noise regulation framework and history of the industrial settlement. In fact, acoustic zoning in Bolzano is still to be approved, despite the Italian law established the process of zoning more than 25 years ago. Noise limits are currently in force based on a specific urban plan (a territory plan based on land usage and activities), but a zoning plan has been drafted by the authors which is still under discussion. In fact, besides being one of the best cities for quality of life and income in Italy [14], conflicts between health protection intent and economic development needs are still lacking a peaceful solution. The paper tries to move out of the industrial area conflict zone "Oltreisarco" to show how the property value depends on acoustic levels and not simply on planning, comparing property values with acoustic zoning under discussion.

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2. BOLZANO: THE CITY AND THE HISTORY OF INDUSTRIAL AREA

Bolzano is an autonomous province in Italy, it is second in quality of life, third in wealth, and fourth in environment and services [14]. The municipality has more than 100.000 inhabitants and hosts everyday a lot of people coming to work in the city which includes the industrial area “Bolzano Sud”. There are more than 1700 companies employing more than 18.000 people with a high innovative approach. Furthermore, recently the Bolzano Sud area hosts also university buildings and a lot of services facilities such as sanitary offices, clinics, kindergarten, markets, hotels, etc... Thus, it is an area of proximity between services and offices and industrial noisy facilities. In fact, it is not simply an industrial area with a lot of stores and markets, but it hosts a significative number of plants working 24h such as several waste treatment plants, aluminum production plant, defense vehicles production and the steelworks “Acciaierie Valbruna”. Even if the industrial area is nowadays a mixed area and it is close to residential areas in the city, it was not always like that. The industrial area was developed from 1934 in a rural area with the aim of supporting economic self-sufficiency policy. The development of the area and especially of the steelworks is due to Bruno Falck, managing the plant from 1935 to 1982, who strongly believed in the development of the steelworks for the city and for the workers. He is known as an innovative person with high social view. He started building houses for the workers, funding schools for future employers and funded insurance mechanisms to cover health expenses of workers. He also claimed for safety attention the board of the steelwork and succeed in installing air filters in the steelworks for the first time.

Thus, even if health issues were in his concerns, the fast development of the steelworks with high employment needs in the 60's leads to the actual situation, in which a lot of residential buildings are close to the steelworks and not anymore used by employees which number decreased after the 80's. Nowadays the whole area in Oltreisarco is badly influenced by the industrial area and in particular by the steelworks noise and air pollution. What's more, even inside the Bolzano Sud area, the mix use of buildings and even more specialized labs are demanding for silence, but this clearly conflicts with heavy production of industrial plants which cannot completely avoid noise emissions. Namely, for safety reasons it is not possible to enclose emitting large machineries.

3. NOISE RELATED ISSUES IN THE CITY

This paragraph briefly describes the law framework in which the acoustic zoning should be set, and it would highlight the conflicting noise issues concerning the Oltreisarco area: on one hand there is the need of preserving health of citizens living next to the industrial area, on the other hand the limits actually inhibit the full development of the production of the steelworks. Main pro and cons are debated in paragraphs.

3.1 Noise protection framework in the specific area

In Italy, acoustic zoning is required by law [15] and every municipality must establish zones in which limits are associated for equivalent noise levels during diurnal and nocturnal periods. There are 6 classes with increasing limits (the higher the class is, the higher is the level allowed). The sixth class can be assigned only to exclusive industrial areas without inhabitants. Bolzano as a municipality of an autonomous province has also its own law framework. In 2012 a local law [16] established that without an approved acoustic zoning plan, the limits are calculated on the basis of the use of the area according to municipality's urban plan of environment and territory, following a specific lookuptable. Then, the same law prescribes which ones of the six acoustic zones can be associated to areas of the urban plan. This means that the choice of the acoustic zone is limited to a specific set on the base of the urban area (i.e. a residential area can only be zoned with classes one to three). A specific guideline was also developed with local environmental protection agency (APPA Bolzano) to guide planners in the zoning process.

Bolzano has a further relevant difference compared to Italian law framework in the ruling of industrial noise: the differential limit is not applicable, meaning that there is no limit between the residual noise and the noise that can be introduced by a specific source. This limits the power of acting against the single source and forces policy to act more generally on noise management.

To this aim, a further difference compared to national approach is to neglect road and railway traffic noise when considering the acoustic climate of a zone during the zoning process. In fact, transport noise sources are already ruled by specific decrees of Italian law and Bolzano approach allows to assign lower zones to areas and to have a greater power in protecting citizens from noisy activities.

3.2 Noise issues in Oltreisarco related to industrial area

As described above, the actual limits depend only on urban area types and no zoning plan is in force. Thus, in the

specific area of the steelworks, and of the close residential buildings in Oltreisarco, the classes would be IV (productive) and III (residential, higher class allowed) respectively with a very small separation due to the railway lines to which the IV class is due. [17].

The zoning proposal developed in 2022 suggested to assign a V class to the east part of the steelwork and a VI in the west which does not conflicts with inhabitants, however the railway lines area of IV class is not really sufficiently large to lower the noise at residential buildings. A mitigation plan is also under development by the province and steelworks considering the noise estimated by the steelworks' s technicians for the environmental integrated authorization required by law. However, since the steelworks has to be compliant with III class limits (60 dB(A) diurnal and 50 dB(A) nocturnal), a big effort has to be done in terms of mitigation costs and their realization is not necessarily possible. In fact, available noise estimations come from the noise maps required by the directive 2002/49/EC [18] and by the environmental authorization but are not at each flat. Even if the residential buildings are already partially screened by a noise barrier built for railway noise, which is in embankment, the higher floors "see" directly the source and are expected to be disturbed on that façade especially during nighttime, i.e. when traffic noise is extremely low and impact noise of steelworks might be perceived. However, it is not easy to find on the web news on citizens raising their hands to claim for silence due to industry, instead there were complainers on railway noise. On the contrary, the steelworks have claimed for higher limits as hereafter explained.

3.3 Noise limitations for economic development of industry

Besides the steelwork has asked a revision of the local law, the court has confirmed that local authority can establish limits that are more protective for citizens than the ones that could have been established by national laws. Thus, the steelworks should establish a mitigation plan to comply with levels assigned to residential area (class III limits). Such noise limits currently inhibit the full production: besides the plant is a 24h operating one, some of the works cannot be carried out and in particular the rolling mill cannot be used nighttime [19] otherwise limits are overcome, and environmental authorization would not be released. Thus, the economic impact on the industry is double: one side they cannot boost the production to their maximum potential, since the rolling mill is off during nighttime, one the other side the furnaces are always turned on due to the needed energy to maintain the plant in

working conditions. The production site in Bolzano is now part of a bigger company, but it still employs more than 500 persons, and its development is obviously relevant for Bolzano as a whole.

Therefore, the mitigation plan establishment is an ongoing process which is carried out in accordance with the province authorities since the steelworks company has a rental agreement with the province, which is the owner of the buildings and lands in which the industry is in place.

4. ANALYSIS OF PROPERTIES VALUES RELATED TO NOISE REGULATION

This work would analyze from an economic point of view if the property values are affected by noise, even if no clear complaints from citizens living in Oltreisarco address directly noise of the steelworks. The study would also investigate if policy choices can improve citizen wellbeing without limiting the development of the city economy. To this aim the properties values are analyzed taking advantages of data published by a website [20] for selling and renting buildings and relating them to noise zoning proposal's classes. The specific case of Oltreisarco area will be detailed.

4.1 Economic districts in Bolzano

The data retrieved by the website [20] provide average selling and renting cost per square meter of properties divided in 3 main categories and subcategories:

- Residential (R):
 - Apartments in upper class buildings
 - Apartments in medium class buildings
 - Apartments in low class buildings
 - Detached and semi-detached Houses
- Offices and Commercial spaces (O)
 - Private offices
 - Commercial spaces
- Company spaces (P)
 - Warehouse
 - Laboratories
 - Typical sheds
 - Productive sheds

In this paper only selling prices are analyzed and not the renting values, because they are expected to be related to long term wellbeing.

These values are averaged over economic homogenous areas as identified by the website, which mainly corresponds to the urban areas of Bolzano. In particular, 11 central/semi-central zones (1-11), 5 peripheral zones (12-

16) and 3 rural zones (17-19) are described and here referred as “economic districts”. These districts have been assigned in QGIS (the website provides purchasable datasets, but it is behind the scope of this paper) to acoustic zoning proposal in order to connect the information. Figure 1 show the economic districts subdivision.

Then, acoustic classes and economic districts are associated to buildings in the city, based on centroid position. Then their built surface is summed up over the acoustic classes for each economic district. Results are shown in the following paragraph.

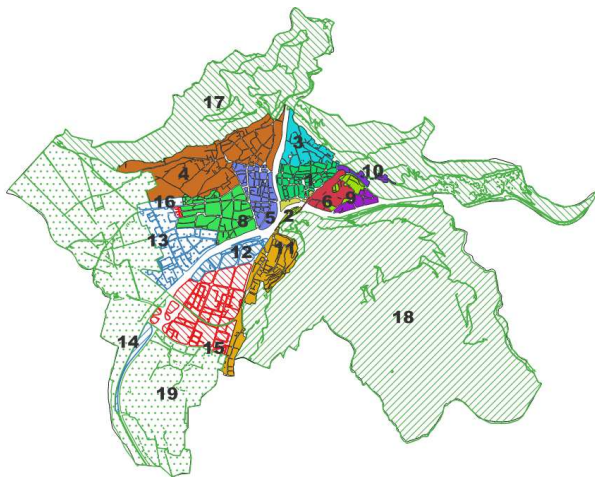


Figure 1. Economic districts in Bolzano.

4.2 Properties' values and noise limits

The present paragraph shows the distribution of acoustic zones within economic districts. Analysis is presented according to current acoustic zoning proposal and for all type of buildings (Figure 2) and for the solely residential ones (Figure 3).

These distributions might be related to average property values for each main category (Figure 4) and to the average residential property values (Figure 5).

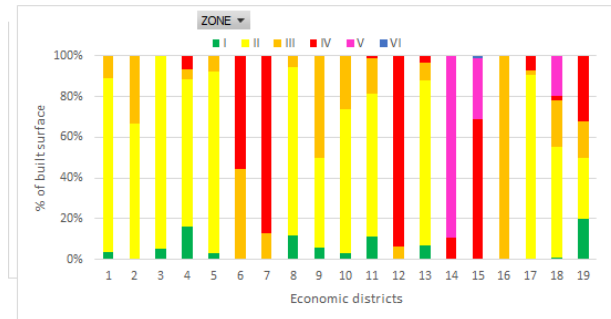


Figure 2. Distribution of built surface in acoustic zones within economic districts.



Figure 3. Distribution of residential built surface in acoustic zones within economic districts.

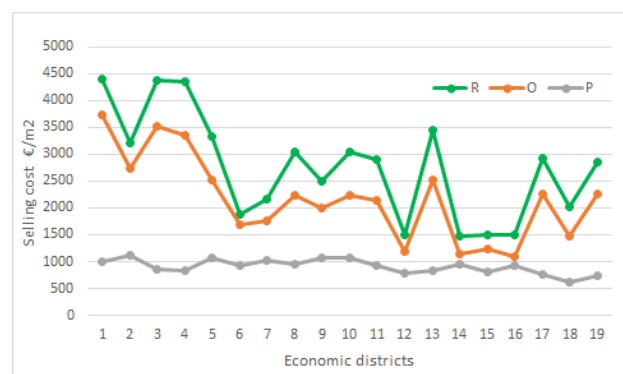


Figure 4. Average property values for main buildings categories within economic district.

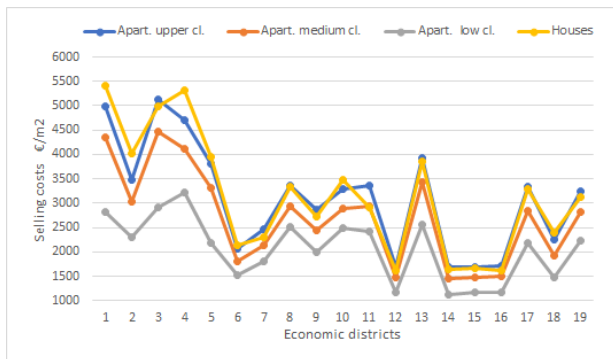


Figure 5. Average property values for each residential category within economic district.

Looking at the figures, it is quite clear that “P” sheds have almost the same value all over the city, instead offices and residential ones moves together along districts. The residential ones are varying a lot and are definitely lower in productive areas as defined by urban plans (6, 7, 12, 14, 15,16), to which higher limits applies according to local law [16]. The current zoning proposal already considers lower limits for productive districts n. 6,7,12,16 which are not involving industry but only craftworks and commercial activities. Within central and semi-central districts, it appears quite clear that district 13 (Resia, ex semi-rural area) has a great value compared to other semi-central districts and this is due to a renewal of the area, with new residential buildings. The renewal also allowed low noise limits predominance. Moreover, the districts 7 and 9 in the “Piani” area, have relatively low property values but a not so bad zoning. This is due to the ongoing process of renewal of the area which is currently planned (within ArBO project) but not in progress. Thus, new noisy activities are limited but the area will be rebuilt so properties are still low values. However, properties’ values are expected to increase rapidly as soon as the plan would be put in place since acoustic is already good.

4.3 Oltresarco & Bolzano Sud districts

In order to understand if the industrial noise and in particular the steelworks induced lower property values in Oltresarco, the analysis focused on residential buildings acoustic and values (Figures 3 and 5). Looking at acoustic zoning predominance and at average properties values, the district is not much different from the other semi-central areas. However, it is the only district in which the category of houses has a lower value than the medium class apartments. This is not necessarily correlated to noise,

neither to industry, but it reveals that the area is less attractive than others for the richest people able to buy houses instead of flats [21]. The results it is coherent with others found in [22] in which the percentage of property value loss with noise exposure was greater for detached houses in richest area. Unfortunately, the Oltresarco economic district includes also Aslago area and it is not possible to analyze separately the values of properties facing the railway and the industrial area (see Figure 6). Figure 6 shows that the most exposed buildings are not houses but apartments. Thus, the lower values if related to a lower willingness to pay for a house in Oltresarco cannot be related directly to the industrial area noise or air exposure. These findings are coherent with ones in [23] where is demonstrated that noise induces property values changes at finer scale than air pollution, needing for detailed analysis not carried out in this phase.

Another relevant difference within the Bolzano Sud district (n.15), compared to the other productive economic districts (14 and 16), is the differences between values of offices and “P” sheds which is higher than in the two other ones. That might be related to the requests of offices for services within the Bolzano Sud area, which is however in contrast with the real noise of the area.

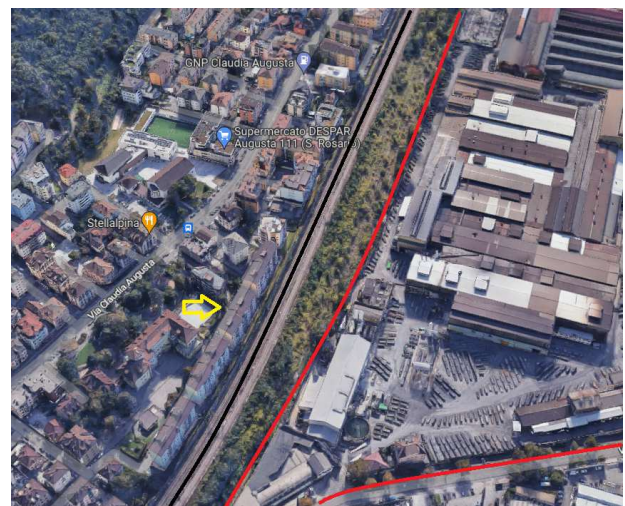
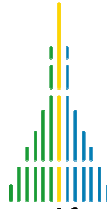


Figure 6. Oltresarco and Bolzano Sud conflict area.

5. CONCLUSIONS

This study includes a first discussion of property values and acoustic zoning correlation. The objective was to understand if the claimed economic impact of noise emitted

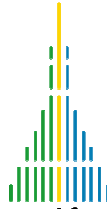


by the industries can be reflected in an economic deprivation of the properties of exposed citizens. From a general point of view, the area has a medium value as other similar areas and the only effect seems to be on houses and not on apartments, which are the directly exposed to noise and air pollution. Thus, the area is not attractive, but it might be related to its semi-central position and to traffic connection with the city center more than on the industry. In general, even other studies demonstrate the difficulties on finding significative results of noise pollution on property values as a whole in the city [24] and a refined study should address values of houses facing the Bolzano Sud area to understand better the industrial noise impact on properties. However, the study shows that plans on the city might improve wellbeing and properties' values, if renewal of areas is planned. Of course, a plan for this area is needed at least to understand real exposure and health assessment of the citizens, since economic evaluation cannot be complete without health costs inclusion. If Bruno Falck decided to pay for its ill workers more than 50 years ago, why should not be valuable the noise mitigation now? For sure a less polluted area will increase property values and wellbeing in the city. On the other hand, it is not clear how much is this pollution since no specific health assessment is ongoing and the noise maps required by Eu Directive [17] evaluate noise only at 1st floors (and the site has a very height dependent exposure).

The findings indicate that probably the issue affects a minority in the area, not changing to much properties' values, but noise still limits the attractiveness, development, and improvement of the area. It would be useful to evaluate economic impact of health exposure in the conflict area to drive plans that might really improve the city, as in other areas they were successfully applied.

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