Towards an acoustic categorization of urban areas in Mexico City

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ABSTRACT
The complexity of large cities requires spatial organization such as the designation of land use, roads, transportation systems, infrastructure and risk areas, etc. The city should be assessed in all of its components. One of the leading problems being analyzed in cities nowadays is environmental noise. Noise maps are the main tool used to study this problem, as they provide solution strategies. In order for these strategies to be effective, urban areas and their sensibility levels to environmental noise should be categorized. Although Mexico City already has a noise map, there is a lack of acoustics standards. Acoustic pollution is severe, and is aggravated particularly by road traffic. From an urban standpoint, Mexico City needs a system of acoustic zones. This paper presents the process developed to establish such categorization based on each zone’s activities and their corresponding acoustic sensibility level. The categorization was primarily based on space analysis, demographic studies and acoustic cartography. This categorization is still at a proposal level and is intended to be utilized in the future as part of urban planning strategies for Mexico City.

Keywords: environmental noise, acoustic zoning, urban space

1. INTRODUCTION
We all know today that environmental noise is a threat to urban dwellers, particularly those who live in cities with intense economic activities that have become Megalopolis by reaching neighboring towns and incorporating them to its metropolitan area. The effects of environmental noise on health, which are widely documented by organizations such as WHO and other national institutions, cannot be ignored. However, there are still countries that both government and population do not have awareness of this major pollution problem. Although the main sources of noise are common to all big cities, such as road traffic, aviation, railways, industry, trade and construction, road traffic is the one that most impacts cities, and mainly the cause of major health problems due to environmental noise in large cities.

MCMA or Metropolitan Area of Mexico City, with more than 20 million people and the mobility of more than 5 million vehicles a day is a conurbation affected mainly by environmental noise due to road traffic. A noise map was developed in 2011 (Fig. 1) which shows this situation and notes the important influence of the main roads in the sound environment of the city.

The MCMA is comprised of two key political areas, Mexico City and all the neighboring municipalities that belong to the State of Mexico. Thus, Mexico City has 16 districts and each district neighborhoods or colonies. The municipalities of the metropolitan area are 18. Although it is a metropolitan region, there is no metropolitan government. A central government of Mexico City with district governments and for the State of Mexico, 18 municipal governments. The metropolitan issues are decided through specific thematic commissions as is the case of the Environmental Commission of the Megalopolis, which encompasses several states around the city and among other situations, is responsible for environmental pollution problems, but this commission do not consider the environmental noise problem.

The urban planning of the city is mainly based on the organization of land uses. The roads and transportation suffer from a strict urban planning and until now, there is no relationship between land use and road and transportation planning.

This situation has influenced the overall environmental noise levels affecting areas of the city where we find also sensitive land uses and urban facilities such as housing, hospitals and schools. The urban planning does not include an acoustic approach. On the one hand, due to the absence of regulations aimed at mitigating and controlling the existing noise pollution. And on the other hand due to the lack of information regarding the effects of noise pollution on population’s health and further exploration and characterization of the problem of the city.

The first noise map for Mexico City Metropolitan Area represents an important antecedent of the problem of environmental noise but it requires further studies to characterize the acoustic urban space in specific areas of the city.
To carry out a study with these characteristics it is necessary to make a global analysis of the city starting from land uses, sensitive noise areas and demographic aspects, besides the review of environmental noise studies of the city in order to take a broad view and a detail of it.

The central idea of this research is to find a classification for a detailed acoustic zoning of the city. This classification will allow the identification of the acoustic zones with which recognize and determine sound sources, human activities, sensitive areas and social and cultural population aspects.

Nowadays Mexico City doesn’t have guidelines to develop a methodology for an acoustic classification of urban areas. There are important studies in Europe, particularly in Spain, Germany and Italy, that have been used here as background to establish a proper methodology that can be applied to Mexico City.

The acoustic classification presented at this document is a partial result of what is intended to be applied in the entire city. It is based on the review of literature and on studies made from different districts of Mexico City. This document presents various concepts and an analysis of one of the most important and contrasting districts of Mexico City: Miguel Hidalgo District.

2. BACKGROUND STUDIES AND METHODOLOGY

2.1 Background studies

Derived from Directive 200/49/EC of the European Parliament Council (2), about the assessment and management of environmental noise, a great concern about the noise pollution problem has evolved in Europe. Regulations have been created for the evaluation and management of the environmental noise and its acoustic zoning.

In Spain, it is recommended that autonomous regions or municipalities be in charge of the acoustic zoning. The objective of making an acoustic zoning is to establish a relationship between land use and noise sensitivity associated with certain areas. Thus, the acoustic areas are classified due to its predominant land use, in the way the autonomous regions or municipalities recommend and have to provide, at least, the residential, industrial, recreational and entertainment, health, education and cultural use, and others that require special protection against noise pollution (Table 1) (3).
Table 1 – Royal Decree 37/2003, quality objective on urban areas (Spain)

<table>
<thead>
<tr>
<th>Acoustic Area</th>
<th>LAeq</th>
<th>Ld/Le/Ln</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health, Education and Culture</td>
<td>60</td>
<td>60 50</td>
</tr>
<tr>
<td>Housing</td>
<td>65</td>
<td>65 55</td>
</tr>
<tr>
<td>Tertiary Use (Housing, Commerce, Office)</td>
<td>70</td>
<td>70 65</td>
</tr>
<tr>
<td>Recreation and Entertainment</td>
<td>73</td>
<td>73 63</td>
</tr>
<tr>
<td>Industrial</td>
<td>75</td>
<td>75 65</td>
</tr>
</tbody>
</table>

Other decrees, such as in Andalusia (4) have regulated the areas of acoustic sensitivity, as homogeneous noise zones, in which will have to be maintained or decreased the existing values defining areas of acoustic sensitivity, as those areas where it is intended to have a homogenous sound quality. Thus it was established the following classification (Table 2).

Table 2 – Decree 326/2003, Andalusian Regulation for the protection against noise pollution

<table>
<thead>
<tr>
<th>Acoustic Sensitivity Area</th>
<th>Equivalent Noise Level LAeq (Day/Night)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silent Area</td>
<td>55/40</td>
</tr>
<tr>
<td>Slightly noisy area</td>
<td>55/45</td>
</tr>
<tr>
<td>Tolerably noisy area</td>
<td>65/55</td>
</tr>
<tr>
<td>Noisy Area</td>
<td>70/60</td>
</tr>
<tr>
<td>Especially noisy area</td>
<td>75/65</td>
</tr>
</tbody>
</table>

In Germany, ideal acoustic limits are determined for areas with an urban planning approach (Table 3) (5).

Table 3 – Acoustic reference values for traffic noise according to DIN 18005 Supplement 1 (in dB(A))

<table>
<thead>
<tr>
<th>Using Area</th>
<th>Levels (Day/Night)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Housing Area</td>
<td>50/40</td>
</tr>
<tr>
<td>Housing Areas with shops and restaurants; camps</td>
<td>55/45</td>
</tr>
<tr>
<td>Cemeteries, parks and home gardens</td>
<td>55/55</td>
</tr>
<tr>
<td>Housing Areas with commerce, hotels and offices</td>
<td>60/45</td>
</tr>
<tr>
<td>Unurban center and mixed Areas with entertainment places</td>
<td>60/50</td>
</tr>
<tr>
<td>Central and commercial Areas</td>
<td>65/55</td>
</tr>
<tr>
<td>Protected Areas</td>
<td>45-65/35-65</td>
</tr>
</tbody>
</table>

The acoustic zoning in Italy sets the limit values of sound sources during the day and night according to the land use and classified them into 6 areas, in which the main activities and conditions of land use are considered (Table 4) (6).

Table 4 – President of the Council of Ministers decree (11/14/1997)

<table>
<thead>
<tr>
<th>Sound Quality Values – Leq in dB (A)</th>
<th>Temporary Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land use</td>
<td>Day (06.00-22.00) / Night (22.00-06.00)</td>
</tr>
<tr>
<td>Protected Area</td>
<td>47/37</td>
</tr>
<tr>
<td>Housing Area</td>
<td>52/42</td>
</tr>
<tr>
<td>Housing / Mixed Use Area</td>
<td>57/47</td>
</tr>
<tr>
<td>Intense Human Activity Area</td>
<td>62/52</td>
</tr>
<tr>
<td>Mainly Industrial Area</td>
<td>67/57</td>
</tr>
<tr>
<td>Exclusively Industrial Area</td>
<td>70/70</td>
</tr>
</tbody>
</table>
These examples show the criteria used to define acoustic zones in three European countries using a subjective perception and land use approach. Particularly they refer to a universal urban criterion, so they can almost be applied everywhere, but for Mexico City there are some important particularities to consider.

2.2 Methodology

It has been necessary to select specific cases in order to carry out the study for the definition of acoustic zones of the city. Mexico City is divided into 16 districts and Miguel Hidalgo has been chosen for this study. This district is located in the western part of the city (Fig. 2).

Primarily, an analysis for a general definition of the acoustic areas has been conducted based on an urban analysis, which have considered the noise map, urban and socioeconomic characteristics and land use. Thus, general acoustic zones were defined (Fig. 3) and specific areas determined: the Tacuba – Polanco area, where after a detailed analysis, acoustic specific zones for the general area are proposed. This complex and rich mixed area was chosen as an example of what within each district can occur with a brief analysis.

![Figure 2 – Political Division of Mexico City and Miguel Hidalgo location](image)

2.3 Analysis of urban characteristics and the case of study

The Miguel Hidalgo District is part of the central city of Mexico City. It has a population of 392.244 inhabitants. It is an consolidated district, it has initiated from 1970 a restructuring land use to become nowadays in a typical service district, such as offices, commerce, administration, culture, education, recreation, among others; attracting 872.757 travel/person/day, this means a floating population of about 200 % higher than its current population, every day (15).

According to the Development Plan from 1997 (14), it was encouraged to reverse the decline of population in residential use (Fig. 4). Nevertheless, in 2008 this plan was not fulfilled, however uses as housing and mixed use, commerce and offices went grow beyond expectations (Fig. 5). According to this and an upgrade of the urban development plans (7, 8), this district maintains its structure and uses at the west area, but the north zone tends to have residential and mixed use and the central and east zone tend to housing, mixed, office and commerce use mainly (Fig. 6).

![Figure 4 – Projection of population from 1985 to 2015](image)

![Figure 5 – Percentage of land use against period](image)

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2 https://es.wikipedia.org/wiki/Miguel_Hidalgo_(Ciudad_de_M%C3%A9xico)

A peculiarity that is producing noise in the district are the arterial and the collector roads. This happens firstly, due to external and internal mobility of native and floating population, and secondly, due to the connections between main roads with the north and west zone of the city, besides urban areas of the metropolitan area (15). Such is the degree of urbanization, that some of these pathways are within the sensitive land uses, like large urban facilities and services. Alternate transportation systems in the district besides cars, are the subway, buses and bicycle system, being insufficient and in some occasions inadequate.

Miguel Hidalgo District locates the central park of the city known as the Bosque de Chapultepec, a residential area of greater exclusivity known as Lomas de Chapultepec, the most important shopping area known as Polanco, which includes also a wealthy residential area. It also situates new large developments of residential areas in the city known as "Nuevo Polanco", museums, theaters and shops. Some neighborhood centers, with low and medium socioeconomic classes, are located in the northern part of the district. These neighborhoods are mixed with shops, workshops and local trade and services.

2.3.1 Land Use
Most of the current land uses of Miguel Hidalgo District (Fig. 6) correspond to housing with two variations: the housing with commerce and housing mixed use. In the first case, the residential land use (yellow) in the southern part of the district tends to be residential, homes on individual lots without exceeding an average of three levels; in the central part of the district, for its proximity to main roads, buildings come to exceed five levels. The housing with commerce land use (orange) corresponds to a type of residential area that has commerce activities in ground floor and whose average height is two to three levels and buildings up to five levels or more on main and arterial roads; and the housing mixed use (in pink) provides housing with diverse services and infrastructure.

There are also important areas such as open spaces and green areas, which are shown in light green and dark green respectively; where the Bosque de Chapultepec is located, with an area of almost 700 hectares (16) known as "lungs of the city".

In blue color, health, education and culture social infrastructure is shown, which are scattered within the entire district, large areas in this color are shown in the map.

2.3.2 Population density
An analysis of the concentration of population within the district (Fig. 7) shows that the exclusive residential area, on south-west of the district, has the lowest density. The highest concentration is located at north and north-east, the land uses of housing and housing with commerce which have higher saturation with more than 400 inhabitants per block. This density is also due to the proximity of the historic center of the city and major office centers and services as well as transport networks found in this area of the city.

2.3.3 Socioeconomic status
Most of the Miguel Hidalgo district has a high socioeconomic level, shown in purple color in Figure 8 and corresponds to a low population density. The area with a medium-high level in red color, is a transition between the high and medium level, located in the middle of the district and mostly composed of new buildings and housing complexes whose population density tends to rise considerably in next years. The areas of medium socioeconomic status are new and some historical neighborhoods that are located in the middle of the district shown in orange. Zones in blue color show industrial areas. Green colors, show open spaces and industrial zones respectively.

To the north low a medium low socioeconomic levels are located, shown in yellow and pink. There are mixed areas of housing with little shops and workshops mainly. In this area near Tacuba, informal commercial activity can be located.

2.3.4 Roads
Controlled-access highways, one-way arterial and main arterials are shown in Figure 9. The first are characterized by communicating the population with other districts and allow continue flow transit. One-way arterial and main arterials also communicate the population with other districts or neighborhoods and traffic lights in some intersections are found. All these roads connect north-south and east-west direction, Mexico City to the State of Mexico. Some of the important roads in the city are located in Miguel Hidalgo district.

This main arterials network were considered in the noise map of road traffic, with a length of over 20 km and noise levels exceeded in some sections 80 dBA, such as in the controlled-access highways like the Viaduct "President Miguel Aleman" and the "Anillo Periférico" which allow a very high transit capacity.
Figure 6 – Map of land use of Miguel Hidalgo District

Figure 7 – Map of population density of Miguel Hidalgo District

Figure 8 – Map of socio-economic classification of Miguel Hidalgo District

Figure 9 – Map of main streets of Miguel Hidalgo District
2.3.5 Noise Map

The Miguel Hidalgo district road traffic noise map (Fig. 10), includes main arterials and controlled-access highways. The transit capacity of these main arterials generate high noise levels on residential areas. Considering that an acceptable noise level according to Berglund is 55 dBA (17). Most of the district has a housing land use (see Figure 11), where 52% of the district exceeds this limit, 40% of the area has "tolerable" values (between 55 and 65 dBA), 6% considered "annoying" in the range of 65-70 dBA and also 6% "unacceptable" those who exceed the 70 dBA.

This map shows merely the noise generated by main arterials, excluding collector roads, which affect more locally to the inhabitants of the district. For this reason, specific area analysis needs to be made in order to generate an approach of what happens in each urban space of Mexico City.

![Figure 10 – Noise map of Miguel Hidalgo District](image1)

![Figure 11 – Miguel Hidalgo District Noise Areas](image2)

2.4 A first general acoustic classification approach

To define general acoustic areas for the district of Miguel Hidalgo and from the previous urban analysis, it has been essential to establish a general classification based on general land uses of the different zones of the district. Thus, it has come to a general acoustic zone classification of Table 5. This classification considers some aspects established by Berglund (17) as well as the analysis in section 2.1.

<table>
<thead>
<tr>
<th>Using Area</th>
<th>Land use category</th>
<th>Input limit value L_{dn} (dBA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Protected areas</td>
<td>Outdoor natural areas, schools and hospitals</td>
</tr>
<tr>
<td>B</td>
<td>Quiet and rest areas</td>
<td>Housing, open areas, streets, pedestrian zones, parks and playgrounds.</td>
</tr>
<tr>
<td>C</td>
<td>Moderate commercial areas</td>
<td>Mixed zones of housing areas, office buildings and retail stores.</td>
</tr>
<tr>
<td>D</td>
<td>Intensive commercial areas</td>
<td>Mixed zones of housing areas, office buildings, commercial areas, hotels, museums, libraries and theatre. Small industry and workshops.</td>
</tr>
<tr>
<td>E</td>
<td>Industrial areas, intensive road traffic &amp; transport hubs.</td>
<td>Industrial areas, transportation hubs and heavy traffic roads.</td>
</tr>
</tbody>
</table>
The application of this classification to the Miguel Hidalgo District is reflected on map in Figure 12 and a correlation of these acoustic zoning criteria intended to further apply to specific areas of the district are shown in Table 6.

Based on the type of land use and intensity of commercial activities in accordance with Table 5, emphasizing the influence of the main arterials and in contrast to the general noise map (Figure 10), a general acoustic zoning has been constructed (Figure 12). The zones are defined from type A to type E, and are determined by the character of the predominant economic and acoustic activity of the area.

In addition, considering that applying general criteria of an acoustic zoning would exceed or being limited considering the mixture of land uses and particular activities of each zone. There is a need for a more detailed acoustic zoning. Being an acoustic general zoning proposed to an existing city, the land uses and infrastructure that exceed or are sensitive to the established levels might exist. Therefore, it is important to develop a local acoustic zoning where the protected and sensitive areas are preserved, and by limiting activities that exceed the established levels. To this purpose, a correlation between acoustic zones is proposed (Table 6) indicating specific cases, to be applied at detailed commercial and land use areas.

### Table 6 – Correlation criteria of acoustic zones for its application on specific acoustic areas

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Parks, health and educational</td>
<td>Parks, health and educational</td>
<td>Parks, health and educational</td>
<td>Parks, health and educational</td>
<td>Parks, health and educational</td>
</tr>
<tr>
<td>B</td>
<td>Isolated housing, open spaces, walkways and bikeways</td>
<td>Isolated housing, open spaces, walkways and bikeways</td>
<td>Isolated housing, open spaces, walkways and bikeways</td>
<td>Isolated housing, open spaces, walkways and bikeways</td>
<td>Isolated housing, open spaces, walkways and bikeways</td>
</tr>
<tr>
<td>C</td>
<td>Mix use, offices, local commerce</td>
<td>Mix use, offices, local commerce</td>
<td>Mix use, offices, local commerce</td>
<td>Mix use, offices, local commerce</td>
<td>Mix use, offices, local commerce</td>
</tr>
<tr>
<td>D</td>
<td>Isolated areas of intense social, cultural and economic activity</td>
<td>Isolated areas of intense social, cultural and economic activity</td>
<td>Isolated areas of intense social, cultural and economic activity</td>
<td>Isolated areas of intense social, cultural and economic activity</td>
<td>Isolated areas of intense social, cultural and economic activity</td>
</tr>
<tr>
<td>E</td>
<td>Industry, roads and transportation hubs</td>
<td>Industry, roads and transportation hubs</td>
<td>Industry, roads and transportation hubs</td>
<td>Industry, roads and transportation hubs</td>
<td>Industry, roads and transportation hubs</td>
</tr>
</tbody>
</table>
3. DETAILED ACOUSTIC ZONING IN THE AREA OF TACUBA-POLANCO

Within the case study, the Tacuba and Polanco areas were selected, which by themselves are two contrasting areas that include several neighborhoods divided one from each other by a main arteria (San Joaquin River Av.), as well as by the railway tracks, where currently rail freight runs sporadically. These areas are contrasting in terms of population density and socioeconomic status; in both the residential land use prevail with its different variants. In general, these acoustic zoning areas appear mostly as intense commercial activities, i.e. areas of mixed use with office and retail, entertainment, hotels and cultural services. There appears also a moderate commercial activities with medium and small industry areas, small workshops; and mixed-use areas of housing, offices, shops and neighborhood shops. In detail, these zones require different zoning criteria, whether for protection or control, according to the following analysis.

3.1 Roads and land use

The Tacuba and Polanco areas contain all kind of roads (Figure 13). Controlled access highways (blue) and arterials (red) with high levels of road traffic are bounding this area. Roads connect the primary areas and within each area, there are collectors (green and orange) which communicate arterials or controlled-access highways within the district. These roads may or may not contain traffic light systems.

Collectors have a second classification: collector with services (orange) and local collector (green). The first one is characterized by high traffic density caused by services offered in the area and public transport running through it, and the second one are alternate routes without public transport and with only few services.

Tacuba is an area with housing land use with commerce, and with the existence of some informal commerce, causing a great flow of population into this area due to the services offered. The Polanco area is a predominantly residential land use located central and south; north there is a mixed with presence of large housing complexes, blended with commercial and cultural developments; and to the east on major avenues an intense commercial use in addition to the presence of exclusive department stores. It should be noted that the mixed land use development generates diverse infrastructure, which increases the value of the area. There are also isolated land uses such as social infrastructure, green areas and open spaces (Figure 14).

3.2 Population distribution

In terms of population density, this section contrasts from the southern area (Polanco) to the northern (Tacuba). The latter can be seen as the highest density population area defined by the highest number of people per block (Fig. 15), particularly the north-west side where many multifamily dwellings are located blended with workshops and small shops. The northeastern area, with more housing land use, has a lower population density.

In contrast, there is the "Nuevo Polanco" and Polanco area with a very low population density and at some points of medium density with mixed-use areas to the southeast, where buildings of significant height prevail.

3.3 Socioeconomic distribution

The socio-economic conditions are distributed at all levels: in the north the lower status and lower middle condition are located; at the center the middle and the upper middle condition; to the south the high status condition. This situation correlates with population density in the sense that the southern zone of low density corresponds to the upper and middle socio-economic conditions; and the northern area of high density with low and lower middle conditions (Fig. 16).
3.4 Specific acoustic zoning

By observing the General Acoustic Zones map (Figure 12), the study area of Tacuba-Polanco appears defined by three main acoustic zones: north an area of moderate commercial activity, with a detail of intense activity on the northern end. To the center and south, Nuevo Polanco and Polanco, an intense commercial activity acoustic zone and an area of acoustic tranquility, being residential. The arteries are commercial corridors either severe or moderate.

Within the specific area of Tacuba-Polanco (Figure 17), the general acoustic zones are broken down according to the activity or real and concrete use. Small specific areas (in green) are acoustic protection zones corresponding to the social infrastructure: education and health facilities, they are scattered throughout the district without conforming specific areas, as can be seen. In this case, they are located as an alert for acoustic protection points.

The controlled-access highways as main roads imply by themselves a special classification, due to the level of acoustic emissions from road traffic; arteries are related to intense and moderate commercial activities, in blue and purple. In some cases, the very presence of the acoustic effect of the road defines an acoustic zone, as in the case of the controlled access highway that divides the whole area at the middle.

Areas of intense commercial activity surround as belts the north areas of moderate commercial activities. These areas inside belts are of moderate commercial activity blended with housing, shops and local workshops. At the central area, an industrial acoustic zone is defined and next to it, the development zone of Nuevo Polanco, with its intense commercial activity.

To the south of this region, tranquility residential areas in orange, including moderate business activity in purple; and west, specific areas of intense commercial activity in blue, delimit the Polanco area.
4. FINAL DISCUSSION

The acoustic zoning is a complex activity when applied to already build cities and especially to those where urban planning did not contemplate it, in fact it is common that acoustic zoning is not part of the urban plans of any city. 

Mexico City is a complex case of acoustic zoning also because of the absence of acoustic criteria in their planning, and a poor urban planning due primarily to the lack of compliance of plans and in some cases the lack of a prospective vision. Planning for Mexico City has focused in recent years on solving the problem of road traffic by implementing elevated or depressed roads. The result of this policy is a further increase of the vehicle fleet. Another big problem associated with this is the insufficient and poor public transportation.

The absence of legislation focused on environmental noise, to prevent, reduce and monitor noise pollution in all aspects in order to protect human health, property or the environment, and to establish mechanisms to improve environmental quality from the acoustic point of view is one of the fundamental problems to reach an acoustic planning of the city.

Although an acoustic zoning should be derived from existing regulations, in this case it has been a result of a research aimed at exploring Mexico City in order to define the acoustic environment of its urban space. One of the objectives of this research is to define acoustic zones trying to understand the acoustic behavior of the urban space.

A two-way classification has been proposed: The overall city level or district level, to have a general view of the big urban area, and the specific classification at a neighborhood level, in order to understand with more detail the acoustic urban space.

The general classification will always be more demanding, but it is necessary to develop classifications to protect sensitive areas not considered in it and limit those areas that by its nature acoustically pollute the urban space.

A first reflection could be that if these zoning classifications will help today to regulate and normalize the environmental noise problem in Mexico City and particularly in the Tacuba-Polanco area. Certainly, at this moment it would not be possible to achieve these goals; however, it is possible to explore and establish an acoustic zoning system like this in order to promote noise mitigation and the acoustic conditioning of the area, the district or even of the whole city, in the future.

This research work is only just the beginning of a study that will include both the existing acoustic environment, the ideal acoustic environment and the possible, accompanying the latter with solution models.

ACKNOWLEDGEMENTS

*The author acknowledges the support that the National Council of Science and Technology in Mexico (CONACYT) has given to the research project titled: “El ruido ambiental en el espacio urbano de la Ciudad de México: Problemas y modelos de solución” (The environmental noise in the urban space of Mexico City: Problems and solution models). This communication is part of the preliminary results of the project. The support has been possible through funds of the “Fondo Sectorial de Investigación para la Educación SEP-CONACYT” (Sectorial Research Fund for Education).

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