

Urban planning and traffic noise in Portugal: How did we get here?

Cecília; ROCHA

Territorial Planning & Environment Laboratory
Faculty of Engineering, University of Porto
Porto, Portugal
carocha@fe.up.pt

António; CARVALHO

Laboratory of Acoustics
Faculty of Engineering, University of Porto
Porto, Portugal
carvalho@fe.up.pt

1. Abstract

As result of the European Directive 2002/49/CE (25th June 2002), the Portuguese government through a preliminary study made by the Portuguese Road Authority (EP – Empresa Pública Estradas de Portugal) became aware of the road traffic noise present situation. So, it seemed important to question the influence of land use management on this issue.

Over the past decades, the Portuguese cities have enlarged, mostly due to migration movements from the eastern to the western part of the country or even from the rural areas to the closest cities. At the same time, the construction of the Portuguese major road network saw a huge development mainly due to European Union founding. These two circumstances created complex land use dilemma. On one hand, there was the need to build good transportation infrastructures to allow people and goods movements and on the other hand the need to build more dwellings for the newest inhabitants. As the municipalities were not aware of this incompatibility on land use (noise *versus* housing) and thought the closest the housing area was to a highway junction the most excellent it would become, many urban planning errors emerged. On 1987, the first Portuguese Noise Code established some principles in order to prevent annoyance situations. It referred the need to make illegal the construction of sensitive buildings on noisy areas, except on the special condition of reducing the exterior noise either on the source or on the receptor (for instance, adapting the facade sound insulation to those circumstances) and with a special authorization of the government. As the enforcement of this Noise Code was not efficient and the land use management plans allowed the construction of dwellings, schools, hospitals, etc. on the vicinity of the major roads regardless noise levels, this problem become worst. On November 2000, a new noise code (DL 292/2000) was approved. This particular code switched responsibilities. On the previous one, the property owner (if on a noisy area) had to reduce the noise levels to be able to construct a dwelling there. On the present noise code, the responsibility on reducing noise levels – exterior environmental noise – relies on the infrastructure's Authorities, which means the reversal of responsibility agent. As so, there are no restrictions on land use since those Authorities are required to take adequate measures to accomplish the new noise limits.

As result of the European Directive and this noise code, the municipalities are requested to have zoning maps (sensitive and mixed areas), noise maps and noise conflict maps that should help on the development of new land use management plans. At the present time several municipalities are reviewing their territorial plans, which enlighten the actuality of this theme.

This paper mentions the relationship between noise and land use planning in Portugal and states the reasons to be on this complex situation that may well be similar to many other countries at the same socio-economic development status.

2. The Portuguese Planning System

"Until 1971 the municipal exercise of development control was based on the Administrative Code of 1936-1940 and the Decree-Law n. ° 33921 from 1944, and was geographically limited to existing town and city boundaries." [1]

Since 1971, with **Decree-Laws n. ° 560/71** and **n. ° 561/71**, 17th December [2], the Portuguese municipalities were enforced to have territorial planning instruments, namely, PU (urban development plans) or even PAT (general urban development plans for territorial areas) in order to guarantee the maximum revenue and comfort for the citizens, regarding their economical and social standards, and the current aesthetics, hygiene and traveling concepts. Along with PU and PAT, these Decrees also introduced another new type of planning instrument – PP (detailed local plans).

In 1976, the **Portuguese Constitution** [3] defined some concepts regarding "*the right to private property*" and the referring payment of fair compensation on compulsory acquisition for public use purposes (Art. 62), "*housing and urban planning*" where it is stated the duty of public administration to define and implement a general national territorial planning policy that guarantee an adequate transportation and public facilities network (Art. 65), and "*environment and quality of life*" mention the guarantee of a sustainable development as part of public authorities duties, regarding pollution prevention and control, land-use planning to establish proper locations for activities and a balance between economic and social development, environmental quality of populated areas and urban life and "*To promote the inclusion of environmental objectives in the various sectors of policy*" (Art. 66).

In 1977 and after the approval of the Portuguese Constitution, the **Law n. ° 79/77**, 25th October [4] established the responsibilities of local authorities, as representatives of municipal citizens, on the prosecution of population best interests.

Following this legal document, was approved the **Decree-Law n.° 208/82**, 26th May [5] where are settled guidelines for the use of PDM (Municipal Director Plan) as the key territorial planning instrument and enlightened its particular relation with other territorial plans. The PDM defines the goals for economic and social development of the city regarding territorial planning. It is an instrument of territory occupation, use and transformation resultant from the different sectorial activities developed and a programming instrument of the municipal accomplishments and investments coordinated with "*higher*" planning instruments – regional and national.

In 1990, the **Decree-Law n. ° 69/90**, 2nd March [6] (amended by Decree-Law n. ° 211/92, 8th October) replaced DL n. ° 560/71 and DL n. ° 208/82. This statutory document aims to harmonize the procedures for elaboration, approval and ratification of PDMs, to reinforce population involvement in the process, to ensure the compliance with other territorial instruments and to simplify the revision of the plan.

At the present moment, only three municipalities do not have the first municipal director plan (PDM) approved. The reason for that particular situation concerns the date of birth – 1998 – of those new municipalities. As so, their territorial planning policy is based on Preventive Norms derived from the "*parent*" municipalities.



Without PDM
 Until 1987
 1988 – 1995
 1996 – 2000
 After 2001

Table 1 – Number of PDM's approval, regarding ratification year

Year	PDM approvals	Year	PDM approvals	Year	PDM approvals
1985	1	1992	6	1998	5
1986	1	1993	22	1999	8
1987	1	1994	87	2000	5
1989	1	1995	104	2001	1
1990	1	1996	8	2002	3
1991	1	1997	22	2003	1

Municipalities without PDM: 3

Currently, the Portuguese territorial planning system is founded on the territorial management system defined on the **Decree-Law n. ° 380/99**, 22nd September [7] with the amendment introduced by **Decree-Law n. ° 310/2003**, 10th December. This legal framework the Portuguese territorial management system involves the coordination of planning instruments at three levels: National, Regional and Local.

Fig. 1 PDM's approval year

The *national level* concerns the territorial planning policy (national program of territorial planning politics – PNPOT), the definition of guidelines for sectorial plans with territorial incidence – PSIT – and for special territorial plans – PEOT (ex.: areas of protected landscape, coastal zone, areas for nature preservation, areas for agricultural purposes, ...), the *regional level* emerges through the regional territorial plans (PROT) and, finally, the *local level* with the inter-municipal territorial plans (PIOT), Municipal Territorial Plans (PMOT), municipal director plan (PDM), urban development plan (PU) and detailed local plan (PP).

In 2003, with the **Decree-Law n.º 104/2003**, 23rd May, were extinguished all Regional Coordination Commissions and Regional Directorates for the Environment and Territorial Planning and subsequently created the Regional Development and Coordination Commission (CCDR) as the main link between local and central administration. The CCDR are disconcentrated services of the Ministry of the Environment, Territorial Planning and Regional Development (MAOTDR), endowed with administrative and financial autonomy, charged to execute, within the respective geographical areas, the environmental, territorial planning and regional development policies regarding a sustainable regional development. This five CCDR, represent the following five Portuguese regions considered on the continental part of Portugal: *North* (CCDR Norte), *Center* (CCDR Centro), *Lisbon and Tagus Valley* (CCDR LVT), *Alentejo* (CCDR Alentejo) and *Algarve* (CCDR Algarve).

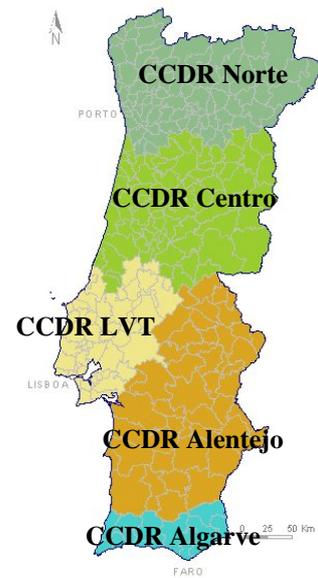


Fig. 2 Portuguese Regions (CCDR)

3. The Portuguese Road System

Between 1850 and 1880 with the efforts of the Minister Fontes Pereira de Melo (Engineer) appears the first general structure of the Portuguese road network.

Some years later, in 1927, was created the Portuguese Roads Authority (JAE, 20th July 1927) which renewed the road network and raised its extension improving accessibility.

On the following year (1928), JAE approves a new **National Roads Plan 1928** (PRN 1928) and until 1939 were built over 500 km of National Roads. Meanwhile, in 1933, the **Decree-Law n.º 23239** reorganizes the previous road classification system considering the partition of national road network in *1st class roads*, *2nd class roads*, *municipal roads* and *vicinal ways*, with a total length of 16900 km.

By the year of 1945, considering PRN 1928 dated, was approved another Plan, **National Roads Plan 1945** (Decree-Law n.º 34593, 11th May 1945) [8]. The Plan approved 17000 km roads and classified the national road network in *three categories* (1st class, 2nd class and 3rd class; municipal roads and public ways) and expected to increase the total extension of the road network to 59000 km. This Decree introduces new concepts: principal itinerary (associated to 1st class roads) and fundamental national road network (integrating 1st and 2nd class roads). The 3rd class roads were intended to establish the connection between the fundamental road network and the municipalities, the richest regions, harbors, railway stations and tourist areas.



Fig. 3 PRN 1945

On 1949 was created the **National Roads Act** (Law nº2037, 19th August 1949) [9]. This piece of legislation refers to JAE organization, roads circulation conditions, road network mapping, protection corridors and land-use restrictions on roads vicinity.

Along the following decades, the national road network helped on the adjustment of existing imperfections concerning territorial planning policy and regional decentralization.

By the year 1977, JAE informed the Government about the maladjustment of national road network regarding the current traffic conditions and their maintenance and design inadequacy

(winding and narrow roads with deeply damaged road surfaces). Recognizing this situation and on the expectation for European funding, the Government decided to amend the previous national roads plan (PRN 1945) based on the excessive density of existing road network, compared to other European countries.

Table 2 – Roads Network Density (1984)

Country	Population density (persons/km ²)	Total Roads Length Index (km/1000 persons)	National Roads Index (km/1000 persons)
Belgium	322.8	12.9	1.4
Denmark	118.7	13.7	0.9
France	99.8	14.6	0.6
Germany	245.5	8.0	0.7
Italy	189.0	5.2	0.9
Portugal	108.0	4.8	2.0
United Kingdom	238.0	6.3	0.3

Source: Zúniga J., 1994 [10]

As so, in 1985 was approved the Decree-Law n. ° 380/85, 26th September 1985, concerning the new **National Roads Plan 1985 (PRN 1985)** [11] in order to assure a proper development of the transportation system, a balanced regional development, reduction of operational costs, improve safety conditions and face the international traffic volume. This plan follows the concept expressed on the previous plan PRN 1945 regarding **Fundamental (Principal Itineraries – IP)** and **Complementary (Complementary Itineraries – IC and other roads)** national roads network and takes the opportunity to eliminate from the national roads plan 12000 km of roads. The *fundamental* road network guarantees the connection between district capitals and from them to the major harbors, airports and country borders. The *complementary* road network assures the connection between the fundamental road network and all the other municipalities.



Fig. 4 PRN 1985

With the entrance of Portugal in EEC and the subsequent funding availability for infrastructure investment, JAE was able to expand the existing national road network with the construction of the remaining roads, in particular, the ones referred to the fundamental road network.

From 1990 to 1995 were constructed over 800 km of IPs and about 350 km of ICs. This vast expansion of the Portuguese road network resulted from European Union funding acquired with the Portuguese adhesion to the EEC, on the basis of road transportation dependence for the economical development, the reduction of regional disparities and the integration on the transeuropean road network.



Fig. 5 PRN 2000

In 1996, was announced the need for PRN 1985 revision that would only occur two years later. The approval of the present **National Roads Plan 2000 (PRN 2000)**, (Decree-Law n. ° 222/98, 17th July 1998) [7] defends the maintenance of PRN 1985 main purpose: proper development of the transportation system, a balanced regional development, reduction of operational costs, improve safety conditions and face the international traffic volume.

In this new PRN 2000 the national road network (fundamental and complementary road networks) was expanded from 9900 km to 11350 km, introduced a new road classification – **regional road (ER)** for which were affected 5000 km of existing "other roads", representing the total of 16500 km for the entire road network and added 10 new ICs and accelerate the economical development in some interior regions. Also included on PRN 2000 is the Portuguese highways network with a total length of 3000 km, which represents 50% of IPs and ICs road networks. At present, there is an enormous effort to conclude the road network defined on PRN 2000 until 2015, which represents an average construction capability of 200 km per year to accomplish the remaining 1.058 km of missing IPs and ICs. [12], [13]

4. The *Non-Aedificandi* Areas

Since 1945, with the National Roads Act [9], were established different protection areas (*non-aedificandi* areas - means 'of not building'. Under this servitude, the owner of the servient tenement is prohibited from building on his own land) to defend the National Road Network. Those *non aedificandi* areas, defined according to the importance of each road category and type of building use, prevented people from interfering with circulation and safety conditions of vehicles.

Law n° 2037, 19th August 1949 – National Roads Act [9]

Decree-Law n.° 13/71, 23rd January 1971 [14]

Non-Aedificandi Area concerning construction of buildings should respect the following minimum distances:

International: 20 m for regular buildings, 70 m for industrial buildings;

1st class road: 15 m for regular buildings, 50 m for industrial buildings;

2nd class road: 12 m for regular buildings, 50 m for industrial buildings;

3rd class roads or within *Visibility area*: 10 m for regular buildings or 50 m for industrial buildings;

Highways: 70 m for any building.

Decree-Law n.° 13/94, 15th January 1994 [15]

1st designing stage – Non Aedificandi Area: 200 m on each side of road axel or 1300 m circle centered on each planned intersection until the publication of the compulsory purchase plan.

Construction or maintenance stage – Non Aedificandi Area should respect the following minimum distances:

Principal Itineraries: 50 m on each side of road axle and never less than 20 m from zone road

Complementary Itineraries: 35 m on each side of road axle and never less than 15 m from zone road

Other Roads: 20 m on each side of road axle and never less than 5 m from zone road

Decree-Law n.° 294/97, 24th October 1997 [16]

1st designing stage – Non Aedificandi Area: 200 m on each side of road axel or 1300 m circle centered on each planned intersection until the publication of the compulsory purchase plan.

After compulsory purchase plan approval – Non Aedificandi Area respecting the following minimum distances:

General buildings: 40 m from highway platform, intersections, highways accesses, toll areas and areas de service or 20 m from highway zone;

Industrial buildings: 70 m from highway platform, intersections, highways accesses, toll areas and areas de service or 50 m from highway zone.

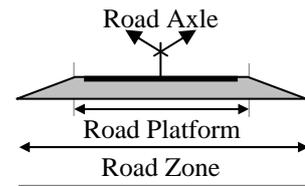


Fig. 6 Concepts

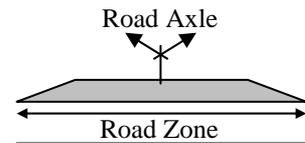


Fig. 7 Concepts

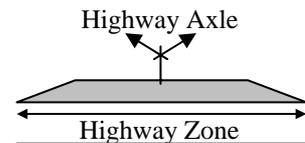


Fig. 8 Concepts

5. Noise Legislation

Before the approval of the first Portuguese Noise Code, the existing statutory documents, like the Portuguese Constitution [3], only mentioned general concepts of well-fare, quality of life, environmental rights, nature and environmental protection and natural resources protection (Art. 9, Art. 66 and Art. 81) referring them as National Authorities duties.

In 1987, was approved the *Portuguese Environmental Act* [17](Law n. ° 11/87, 7th April 1987) and transposed to the Portuguese statutory documents the European Directive n. ° 85/337/CEE, 27th June 1985 through the *Decree-Law n. ° 69/90, 6th June 1990* amended by Decree-Law n. ° 278/97, 8th October and Regulatory-Decree n. ° 38/90, 27th November (amended by Regulatory-Decree n. ° 42/97, 10th October). This piece of legislation refers "*human environmental factors*"

such as landscape, natural or built heritage and pollution (*noise*, chemical composites, effluents and residues and radioactive substances). Concerning *noise* it is defined the obligation to establish noise limits, noise reduction on source, noise propagation reduction and adequate land-use policy.

Following the publication of the Environmental Act, a large number of legal documents were approved, for instance the first Portuguese regulation with reference to noise – **Decree-Law n.º 251/87, 24th June 1987 - Noise Code** [18] (changed by DL n.º 72/92, 28th April 1992 and DL n.º 292/89, 2nd September 1989). The scope of application of this decree concerns housing, industry, commerce and services; equipments; entertainment and recreational activities; noise signals; traffic; and noise generating activities. This decree established some territorial planning constraints for buildings implantation. Urban areas were classified as *extremely noisy*, *noisy* and *low noise* zones based on a statistical level parameters – L_{A50} – over a daytime (DT: 7 h – 22 h) or nighttime (NT: 22 h – 7 h) period with the following limits:

Low Noise Zone (LNZ): $L_{A50, DT} \leq 65$ dB or $L_{A50, NP} \leq 55$ dB;

Noisy Zone (NZ): $L_{A50, DT} \leq 75$ dB or $L_{A50, NP} \leq 65$ dB;

Extremely Noisy Zone (ENZ): $L_{A50, DT} \geq 75$ dB or $L_{A50, NP} \geq 65$ dB

These urban areas are suitable for buildings construction under the following conditions: on LNZ there are no restrictions concerning building areas (residential, educational or healthcare buildings); on exceptional cases Local Authorities might authorize the construction of this type of buildings – on NZ or ENZ – if the owner shows evidence of noise reduction solutions, either on the noise source or on the building itself or even on the building surroundings.

Concerning road and rail infrastructures, responsible Authorities must have the purpose of preventing traffic noise, in order to not restrict existing or foreseen uses on surrounding areas and, if necessary, to promote noise mitigation measures.

The second and current Noise Code, **Decree-Law n.º 292/2000, 14th November 2000 (RLPS)** [19] (changed by DL n.º 76/2002, 26th March 2002 and DL n.º 259/2002, 23rd November 2002) has the same scope of application of the previous noise code but changes the acoustical parameter from L_{A50} to L_{Aeq} . As fundamental principles, it states the importance of an interaction between noise reduction strategy, territorial planning and economic and social development policies to guarantee the appropriate environmental noise conditions on urban areas devoted to housing, educational or healthcare facilities or even on resting spaces.

This Decree (Art. 3), concerning territorial planning instruments states the need for an appropriate land-use planning, especially with housing, employment and leisure activities, namely through the introduction on the municipal *Map of Constrains* of another restriction – **Noise Zoning: Mixed and Sensible Zone**. This classification refers to the following forms of occupancy within a certain area:

Mixed Zone: coexistence of housing occupancy with other uses

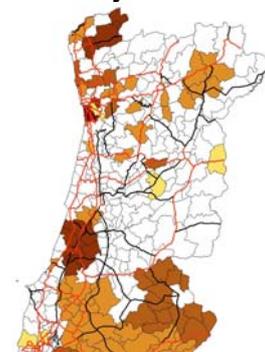
Sensible Zone: include hospitals, schools, housing (exclusively), religious buildings and public facilities regarding a quiet environment

Table 3 – Maximum Noise limits for Mixed and Sensible zones

Form of Occupancy	Daytime period (7 h – 22 h)	Nighttime period (22 h – 7 h)
Mixed Zone	$L_{Aeq} = 65$ dB	$L_{Aeq} = 55$ dB
Sensible Zone	$L_{Aeq} = 55$ dB	$L_{Aeq} = 45$ dB

This new *Noise restriction* should be included on Municipal Directory Plan (PDM) revised after the approval of this Decree. Municipalities are advised to produce a Noise Map before the definition of the Noise Zoning, in order to decide whether a noise reduction plan is required. For prevention purposes (Art. 4), the **RLPS** impose some circumstances for land subdivision schemes, previous information request, building permits and authorization for use. On each of those phases, petitioners are required to join a noise map extract or, when it does not exists, an acoustical data report of the piece of land under analysis, then an acoustical study of the situation and finally a certificate that guarantee the accomplishment of RLPS.

Whenever noise zoning limits are exceeded, RLPS requires **noise reduction municipal plans** (Art. 6) whose implementation might be phased, considering the exceeding level (zones where the



exceeding environmental noise level is greater than 5 dB(A) should be the first priority).

Regarding *transportation infrastructures*, the only requirements implies not exceeding noise zoning limits on correspondent areas (indicated no Table 3) either for existing roads or for new or renewed roads, which means the implementation of noise mitigation measures wherever those limits are exceeded.

Concerning existent roads, conflict situations should be identified and *monitoring plans* or *noise reduction plans* ought to be done.

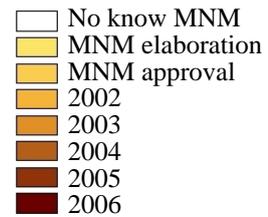


Fig. 9 Municipal Noise Map(MNM)

Table 4 – Municipal Noise Map's (MNM) approval

Year	Noise Maps	Year	Noise Maps
No known MNM	228	2003	52
MNM elaboration	9	2004	23
MNM approval	1	2005	18
2002	1	2006	2

(Data under collection)

6. Noise Legislation versus Planning System

As it could be inferred from the previous analysis of the Portuguese situation, the synchronization between land-use and noise was not carefully considered over the past decades. In fact, there is no evidence of concern about "noise issue" until 1987 – Portuguese join the EEC – when began the obligation to transpose some European Directives (ED) to the Portuguese legal system as ED

n. ° 85/337/CEE (Environmental Act).As so, there was the need to regulate noise, as one of human environmental parameters and then the first statutory document was issued (Noise Code, RGR – DL 251/87). Previous to that moment, there was only a general perception about welfare and quality of life that was not noticeable on existent territorial planning instruments, for instance, on urban development plan (PU). After 1987, spite the approval of the Noise Code and the Noise Classification of urban areas, the new approved plans (see Fig. 1 and Table 1), such as Municipal Director Plans (PDM), still did not have any noise restriction to urban development expressed on Municipal Constraints Map.

The situation persisted until 2000, with the approval of the new Noise Code (RLPS), there was only noticed the existence of a statutory document for noise when someone complained about noise annoyance or on the environmental impact assessment studies done for the major transport infrastructures subsidized by the European Union. When it comes to land-use constraints, the only evidence were the heavy industrial sites placed outside the urban limits defined by municipalities. All the rest, light industries, services, schools, hospitals, housing and transportation systems coexisted on the same space.

Since then, some PDMs reached their revision deadline time (10 years after approval) and began their revision procedures. Those municipalities that started revision process before RLPS approval were not obliged to accomplish RLPS new requirements and remained with no noise constraints regarding land-use. All the others, with PDM under revision or still active, will have to fulfill those requirements. As starting point, most municipalities are undertaking Municipal Noise Maps, which will help to understand their municipal noise situation.

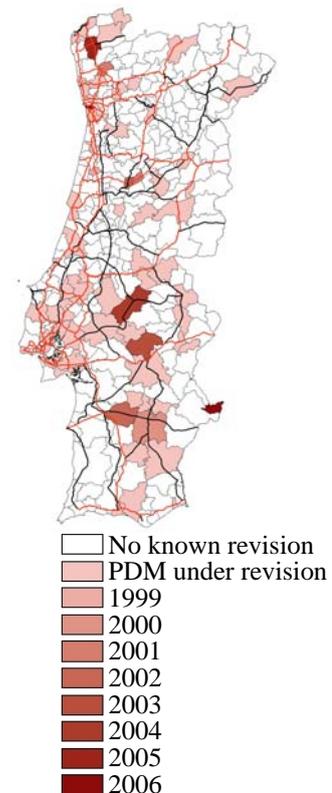


Fig. 10 Municipal Director Plan under revision

Table 5 – Municipal Director Plans(PDM) under revision

Year	PDM revision	Year	PDM revision
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No known revision	256	2002	2
PDM under revision	65	2003	1
1999	1	2004	1
2000	1	2005	1
2001	2	2006	2

(Data under collection)

At this moment, and considering Mixed Zones and Sensible Zones concept and the related environmental noise levels, the municipalities are advising their consultants to classify most municipal urban development areas as Mixed Zones based on different activities coexistence. As result, the number of municipal noise reduction plans needed for the entire country will decrease, as the noise mitigation measures needed, because the allowable maximum environmental noise level will be 10 dB(A) higher than the correspondent to Sensible Zones ($L_{Aeq} = 55$ dB, nighttime period). This is an important issue as *noise restrictions* will take part of *Municipal Constraints Map* and will become a legal instrument. This will have strong reflections on urban development and on municipal economy as the noise reduction plans will have to involve municipal finance resources and will interfere with construction potential of some areas. It is soon to see any real improvement in the urban planning being done at Municipal level in Portugal under the new Portuguese (and "European") legislation concerning noise but the panorama is now much better than 10 years ago. The general feeling is that the mood is now changing... for better.

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