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**Residential Architecture of the XIX Century in Malaga, Europe:
Review and Case Study**

Rafael Assiego de Larriva

Athens Institute for Education and Research

8 Valaoritou Street, Kolonaki, 10683 Athens, Greece

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Rafael Assiego de Larriva, Professor, University of Malaga, Spain

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ABSTRACT

This work shows the main characteristics of the vernacular architecture of the XIX century in Malaga. A study about daylight and cross ventilation has been made. Current rules for new buildings have been also studied, the position of the courtyard, clear high between the floor and the roof. Finally, a new building based on old features is showed. The building has seventeen dwelling and is placed on Malaga. As a results of the study is concluded that densification of urban areas and therefore retrofitting of existing heritage in urban settings is one of the key for developed world cities and new building can be designed attended to the new and vernacular rules.

Keywords: City of Malaga, Vernacular Architecture, Contemporary design, Daylight, Cross Ventilation.

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Introduction

Situated in the extreme south of Spain, on the Mediterranean and almost completely sheltered by the Strait of Gibraltar, Malaga today, along with Seville, Cordoba and Granada, is one of the most important places in Andalusia.

The first settlements on which the city of Malaga was founded date back to the fourth century BC, when an Iberian- Phoenician town was established in the coast area, in the extreme southwest of the 'Gibralfaro' promontory. The theory of Phoenician origin appears in the writing of the historian Estrabon. Rome conquered Malaga around 205 BC.

After conquering the city, the Arabs for 800 years of domination, carried out a series of changes and expansions of notable importance and established the basics of an urban structure of the modern city. Two fortresses were built: The Alcazaba, and continuing along the northeast top of the promontory, the Gibralfaro castle.

After the Re-conquest in 1487, the Spanish Crown established itself. From the 16th to the 18th centuries, the city would undergo short, slow expansions beyond its limits, as well as a series of internal changes, such as the building of the cathedral over the site of the Islamic mosque. Around the 18th century, new and significant expansions can be seen, one towards the northeast... From the second half of the 19th century, the city underwent changes, and various expansions took place as consequence of the growth in the population, from 15,000 during the time of the Re-conquest to 115,000 in the 19th century [Marín et al., 2008], see Figure 1.

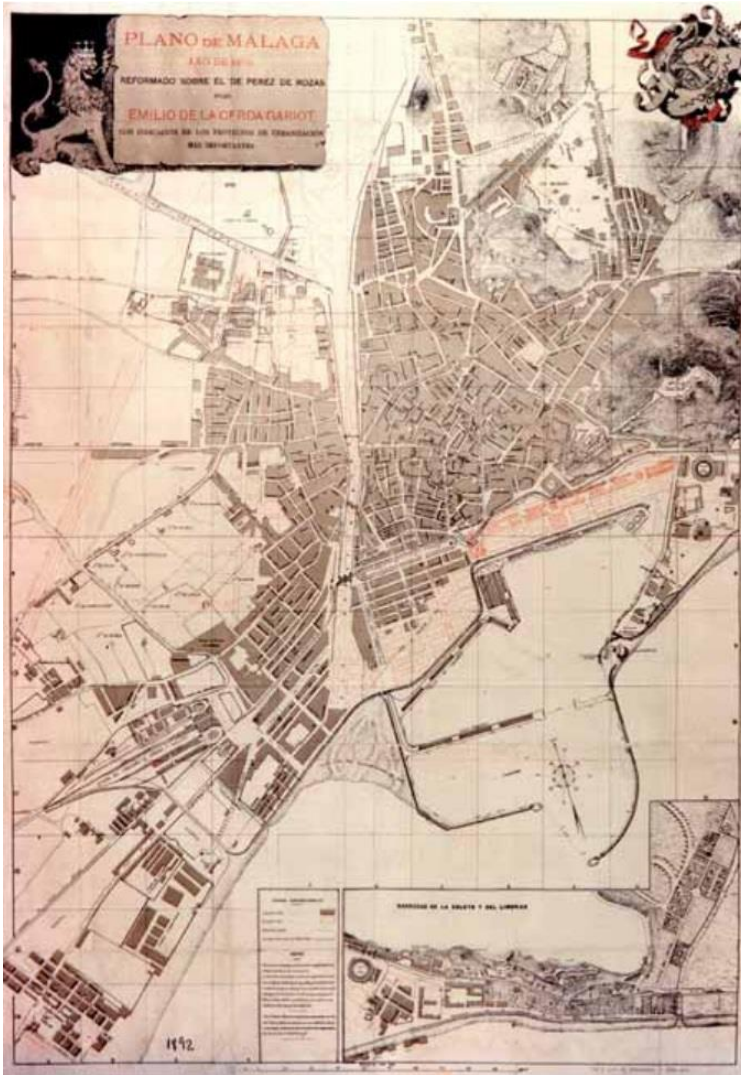
This paper is focused on providing information about vernacular residential architecture of the nineteenth century in Malaga, Spain (Europe), in terms of geometry, daylight and cross ventilation. This research is a complement of a vernacular commercial architecture study [Cifuentes et al., 2016].

Malaga has a Mediterranean climate with mild temperatures in winter, hot and humid in summer with an average annual temperature of 17.9 °C. Vernacular architecture under study (1870-1930) has been designed to achieve comfort conditions in summer with the design of passive measures.

A study about daylight and vernacular cross ventilation design has been made [Pastor 1980, Folgueras 1982]. Current rules in terms of high and courtyards in buildings has been also analysed [PGOU Malaga 2011].

Finally, a building of the twenty-first century is presented. The building integrates current rules and vernacular cross ventilation principles.

Figure 1. *Map of Malaga. 1892*



Source: Emilio de la Serda Gariot [Marín et al. 2011].

Literature Review

From an aesthetics point of view, the architecture of the end of siglo XIX had a continuity in the early years of the siglo XX [Marín et al., 2008]. The facade decoration of residential buildings define the difference for each siglo. Sobriety versus an increase of decoration.

Into 20th century, traditional elements, of the 19th century, of wood and steel are replaced for volumnes made of bricks, see Fig. 2 and 3 [Méndez et al., 2011].

Figure 2. *Residential Buildings Placed on Merced Square and Granada Street (s.XIX)*



Source: Rafael Assiego.

Figure 3. *Residential Building Placed on Moreno Carbonero Street and Alamos Street (s.XX)*



Source: Rafael Assiego.

Methodology

A study based on indoor comfort conditions has been made. Characteristics of design has been analysed in a current apartment placed on Mendez Nuñez Street. In particular over the first floor (see Figure 4). Charactericts of design from the current rules are also described.

Figure 4. *Residential Building Placed on Mendez Nuñez Street (S.XIX)*



Source: Rafael Assiego.

The indoor main design characteristics of vernacular apartments are:

Position of the ventilation and light courtyard in relation to apartment design. Figure 5 shows the position of the courtyard in a traditional apartment in Malaga. The hallway is between the courtyard and the bedrooms and the living room.

Structural system is made of wood. Envelope is made of solid stone. Width is 50-60 centimetres.

Clear high, between the floor and the roof of apartments is 3.50 metres. Figure 6 depicts an example of wood structure and shows the clear high in the apartment.

Windows are designed to supply a flow of air to the apartment over the useful space of 2 metres. Figure 7 shows a traditional window. It is made in wood, has five rows and the top row is separated of the rest. The top row can be opened in separated time.

Hydraulic floor with colourful and geometrics pictures is placed, see Figure 8.

Active systems to fulfil comfort in winter are not efficient: electric radiators, Joule effect systems.

Figure 5. *Position of the Courtyard in a Traditional Apartment in Malaga*



Source: David Burbano.

Figure 6. *Wood Structure and Free High in a Vernacular Apartment in Malaga*



Source: David Burbano.

Figure 7. *Window Configuration and Courtyard in a Vernacular Apartment in Malaga*



Source: David Burbano.

Figure 8. *Hydraulic Floor in a Vernacular Apartment in Malaga*



Source: David Burbano.

On the other hand, the main characteristics, based on current rules, of the recent designs are:

Bedrooms, bathrooms, kitchens are usually placed on between courtyards and corridors.

Clear high, between the floor and the roof of apartments is 2.50 metres.

Floor material is wood, ceramic, marble...

Case Study

The building studied was built in 2004 in Alhaurin de la Torre, Malaga, Spain.

The main orientation of the building is south- north.

The building has seventeen dwellings. It is divided into six volumes, with three housing by volume. The last volume includes two housing and the access to the parking, see Figure 9.

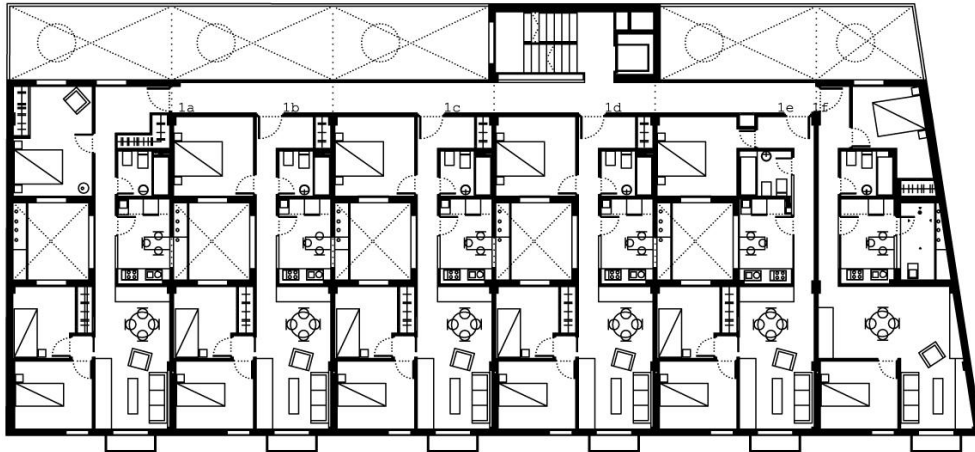
Figure 9. *Exterior View of the Building [5]*



Source: Rafael Assiego.

Ground floor and level 1 houses have three bedrooms, one living room, one bathroom and one kitchen. There are two differences between Level 1 and 2 houses: Level 2 dwellings have two bedrooms and one terrace. For each dwelling a courtyard is designed. The corridor is designed between the kitchen and the courtyard. A wall divides the kitchen with the next courtyard, see Figure 10.

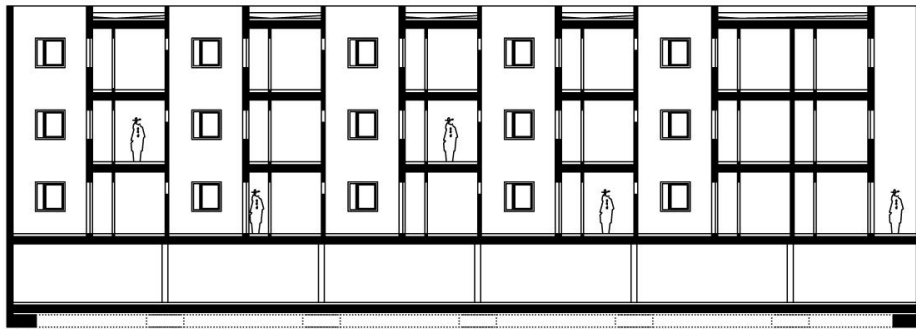
Figure 10. *Level 1 Dwellings (Scale: Individual Courtyard Size is 3 by 3 m)*



Source: Rafael Assiego.

The design of the apartments is based on one goal: respond to the current rules applying daylight and ventilation concepts of Malaga vernacular architecture. A window with translucent glass placed on the top of the kitchen wall resolves the natural ventilation and the privacy of the householders (see Figure 11).

Figure 11. *Longitudinal Section by Courtyards and Kitchens*



Source: Rafael Assiego.

Conclusions

The main conclusions are:

Retrofitting of existing vernacular heritage in urban setting is one of the key for developed world cities.

Comfort conditions in summer can be fulfilled with the design of a hallway between courtyard and kitchen, bedroom, ...

Application of new rules and vernacular cross ventilation can be achieved in new buildings.

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