# *Social Inclusion: A proposal from the University of Guayaquil to design popular housing with citizen participation*

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***Abstract*—** *One of the main factors affecting the acceptance of social housing projects is the non-participation of users in their building's design. The VIS Project breaks with this idealistic scheme of unilateral projection and proposes a concurrent engineering where citizen participation is taken into account in the collection of statistical data and also in its idiosyncrasy, ancestral values and life models. The Quality Function Deployment is one of the methodologies that are implemented in addition to bioclimatic design with passive cooling and solar control strategies. The multidisciplinary team made up of engineers, architects and interior and industrial designers together with students of Architecture and Interior Design careers of the School of Architecture and Urbanism of the University of Guayaquil have managed to bring to low-income sectors practical solutions to self-build dwellings problems. The procedures and methods applied are adapted to the particular case of each user, giving particular solutions analyzed under multiple criteria.*

***Keywords—social inclusion; concurrent engineering; citizen participation; bioclimatic design; low-income housing design***

## I. INTRODUCTION

Globally, the architectural profession faces complex challenges, bringing the transformation of the curriculum to the forefront of critical discourse. The research-based design approach enables graduates to be prepared for complex decision-making and the collaboration required for the development of socially sensitive design [1].

The accelerated growth of families, informal self-build dwellings, access to urban land and inefficient distribution have been the fundamental causes of the reduced spaces and deterioration that characterize the homes analyzed in the western suburb of Guayaquil. Families settled on riverfront of Estero Mogollon, a western suburb of Guayaquil, with informal dwelling practices at the estuary for more than 40 years, are generations of families who have lived all their lives in the same place, in whose first settlements the estuary was wider and filled over the years to consolidate as a low-income settlement *suburbio*.

At present they would be affected by several multidimensional problems, among the most important ones, the qualitative and quantitative deficit of housing and these problems are due to multiple factors, as the reluctance to vertical densification of Guayaquil, the lack of urbanized land, the formal housing program deficit, among others. Dwellings settled at the shore of the estuary, are specifically affected by the waterfront redevelopment Project called "Guayaquil Ecologico" that aims to quantitatively increase the green área per inhabitant to reach WHO-indicated standards through the construction of a 40-km-long linear park. The government intends to evict and relocate the houses with emphasis on recovering the banks of the estuary and cleaning it [2].

The Inter-American Development Bank points out that the great challenge of the region's policies should be aimed at improving the quality and location of low-income housing, without contributing to the expansion of the urban frontier. The tendency to horizontal growth of the city limits must be curbed, which demands natural resources, increases social segregation and the cost of access to basic services. In the last decade, in Latin America, the growth rate of the urbanized area quadrupled that of the population. It is imperative that cities and other territorial entities provide for reasonable development in their territories; and specifically in the case of housing, where an increase in population density is required (with vertical solutions to take better advantage of the urban

space), thus aiming at a better quality of life and at a sustainable development where the social, environmental and economic find their balance [3], [4].

The eviction of families occurred in an violent way, breaking social, economic and family networks. At the time of implementing the relocation, needs and aspirations of the families in the design of the new housing units were not taken into account, and the solar for the relocation was not socialized, the long routes to their activities were not taken into account. productive sectors outside the sector, which were in many cases in the vicinity of their old home and thus omitted several factors that had to be implemented in the socialization on the intervention.

The general objective of the research is to analyze the types of existing housing in the sector to be able on designing a comfortable design project for the inhabitants of the sector. Among the specific objectives are: conducting surveys and interviews to users of the sector for the analysis of existing homes, statistically process the information obtained and propose improvements to the conditions in which they live by means of a housing proposal.

## II. METHODOLOGY

The characterization of the territory allows approaching from the physical environmental, economic and social aspects by studying the requirements to determine not only the formal qualities of the architectural envelope its spaces and uses, but also to establish the guidelines of the proposal that is inserted in a specific urban space. These will allow projecting appropriate architectural responses to the relationships between habitat and housing. This habitability must be developed also linked to the use and management of economic resources, building the mitigation of inequality and vulnerability [5].

Students and teachers of the Faculty of Architecture and Urbanism of the University of Guayaquil, carried out the survey of information in a sample of 432 families that represents the population of 4 pre-cooperativas. The instruments conceived are oriented to consider the topology, main characteristics of the dwellings, as well as the social configuration related to the age, gender and quality of life of the people. Statistical analysis was performed with the SPSS software and the results allowed to enhance the decision-making process of the multidisciplinary teamwork by identifying which dwellings were representative for design and constructive improvements.

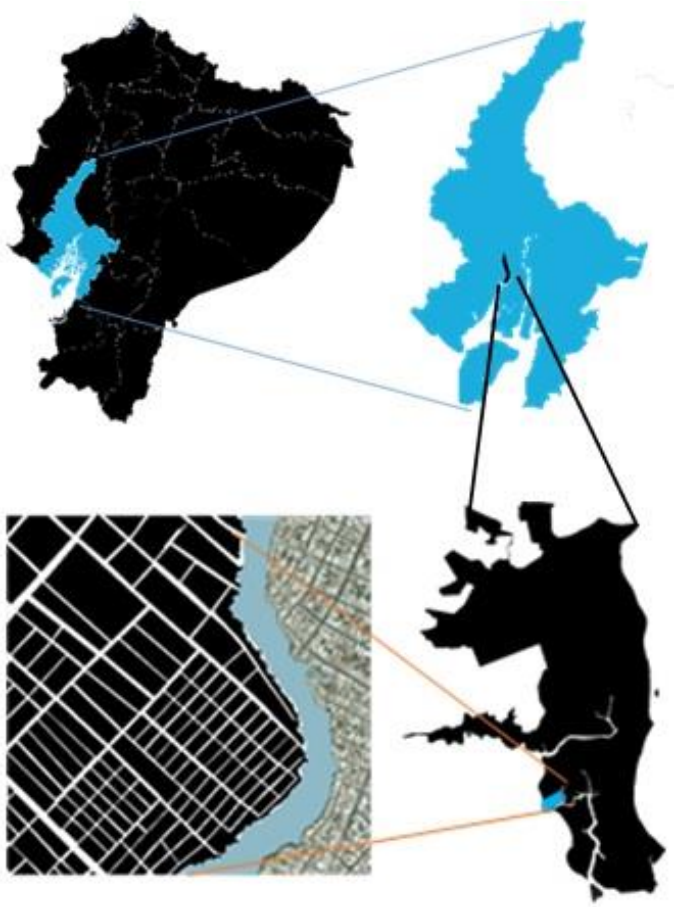

Fig. 1. Macro and micro location of the study area. Ecuador (a), Guayas (b), Guayaquil (c) and west suburb of Guayaquil (d).

At the national level, this work is located in the planning zone 8 of Ecuador, in the city of Guayaquil at Guayas province, see figure 1.

The sample size is 432 families from the western suburb of Guayaquil representing a population of 1200 families. The analysis was performed for a 99% reliability, a Z value of 2.58, with values of p and q of 0.5 and an error of 0.05%. 36 instruments were distributed for 12 students of the eighth semester of the Architecture career.

Figure 3 illustrates the geographical location of the study population which includes four Pre-Cooperatives: Plan Piloto, 2 De Agosto, Progreso para el Suburbio y San Francisco De Asís.


Fig. 2. Geographical location of the study cooperatives. Project VIS.

## III. STATISTIC ANALYSIS

The processing of the information with the statistical system SPSS allowed obtaining the graphs shown below related to the dimensions of: width and length, of the batches analyzed.

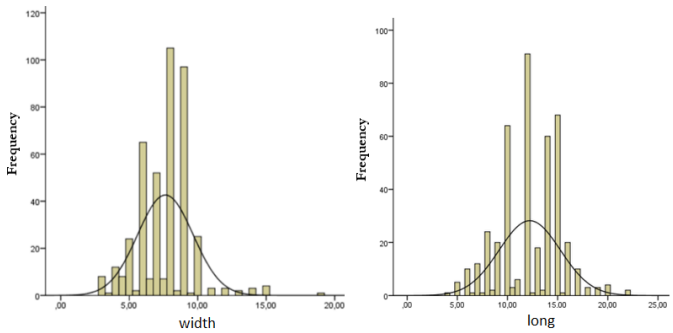


Fig. 3. Frequency analysis in terms of width and long of the batch.

Figure 4 shows that the majority of dwellings currently have a single floor corresponding to 64.35% of the data thrown by the statistical software. The horizontal distribution is a feature that stands out in the area although a percentage of the houses shows a tendency to grow in height.

Fig. 4. Visual representation of the horizontal distribution of dwellings.

The western suburb of Guayaquil is composed of families settled for more than four decades on the shores of Estero Mogollón. Figure 5 shows the typological evolution of housing: lot of initially occupied a part of the land and supported by columns leaving the ground floor free by the passage of water from the estuary. Subsequently the horizontal growth of housing is taking a tendency to horizontal growth due to the growth of the family, as they need more spaces in which they can generate different activities that change according to the need over the years. This trend brings different lifestyles and constructions that adapt to the particular needs of each family and with the weather.

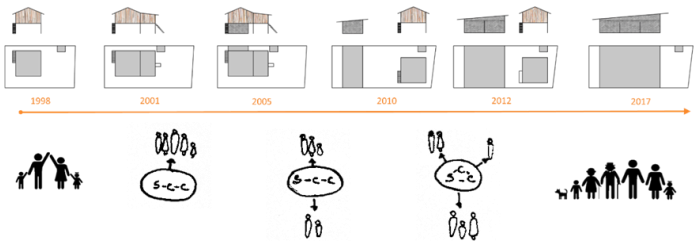


Fig. 5. Typological evolution of the houses of the western estuary of Guayaquil.

Below is a summary of the most relevant percentages obtained:

- Number of men: 55.09% (one only)
- Number of women: 51.39% (one only)
- Number of infants: 58.8% (2 to 3 children)
- Number of elderly: 67.36% (Does not have)
- Discomfort: 58.73% (Heat and noise)
- Cover: 69.68% (Zinc)
- Structures: 81.25% (Reinforced concrete)
- Walls: 81.71% (Block)
- Floors: 78.24% (Cement)
- Doors: 76.85% (Metal)
- Window: 61.48% (Aluminum and glass)
- Stairs: 64.12% (Does not have)
- Number of floors: 64.35% (one floor)
- Lot division: 76.68% (no division).
- Bedroom: 49.07% (one only)
- Bathroom: 68.52% (one only)
- Interior space: 90.05% (living room and dining room-kitchen)

In the cases studied, it was possible to demonstrate that the desire to occupy the maximum of the own lot, brought with it spatial configurations that are not the most recommendable for the hot-humid climate of the city of Guayaquil, and are

characterized by a deficient or null crossed ventilation. This is compounded by the use of building materials found on site, with high thermal transmittance of the building envelope, such as zinc roofing and the absence of ceilings that isolates heat transfer into homes [6]. Part of this reality is corroborated by the data obtained in the field where the main sources of discomfort suffered by its inhabitants are related to heat and noise.

## IV. INCLUSIVE BIOCLIMATIC DESIGN

The implementation of bioclimatic design approach for thermal comfort needs to focus on four factors that are: wind orientation, climate, solar radiation, and materials [7]. The best orientation of the house to achieve maximum natural ventilation is whereby the openings such as windows need to face the direction of the wind. A site study must be made to determine wind directions to design the orientation of the building and the location of openings. In terms of solar radiation, the north-south orientation is an option since east-west orientation receives maximum solar radiation [8]. A study conducted on the climate of the site can assist the process of implementing suitable bioclimatic design and materials selection, which is also based on the availability of local materials [9].

The bioclimatic design starts with the collection of information describing the geographical location of the city and its most important climatic characteristics, which are essential elements to characterize the environment where the project is located. Within the reality of a specific site, there are also construction systems and local materials with their respective thermal performances that accompany the habitability conditions of a home.

The architectural proposals will take into account the understanding of the requirements and their respective validation through the calculation of thermal and energy balance of the building. The main requirement for dwelling's design is to cool indoor spaces and block the solar radiation to avoid the gain of heat. As can be seen in Figure 6, during the first months of the year there is the greatest need for ventilation in order to improve termal sensation due high values of relative humidity, accompanied by protection against solar incidence to reduce indoor heat gain.

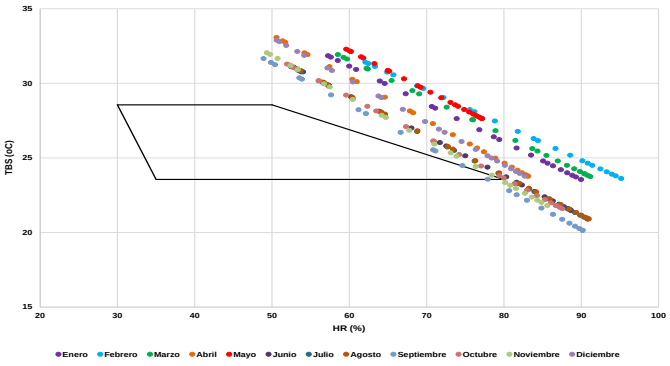


Fig. 6. Bioclimatic annual chart for Guayaquil. Source: Analyzed from Gomez-Azpeitia (2016).

Because it is close to the equatorial line at two degrees of south latitude, in Guayaquil the north and south facades receive sunlight for approximately six months each, see figure 7 . Solar control devices are needed on all its facades.

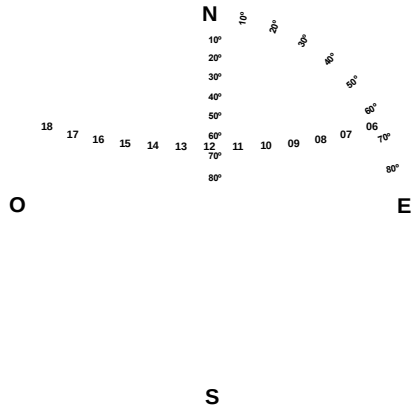


Fig. 7. Solar chart for Guayaquil [11] .

The bioclimatic diagnosis allows to outline the requirements of the project from the analysis of the information in the first stage. For this reason, the architectural proposals are developed using strategies, tactics and techniques derived from the understanding of the established requirements, obtaining as a result architecture projects such as those shown in Figure 8.

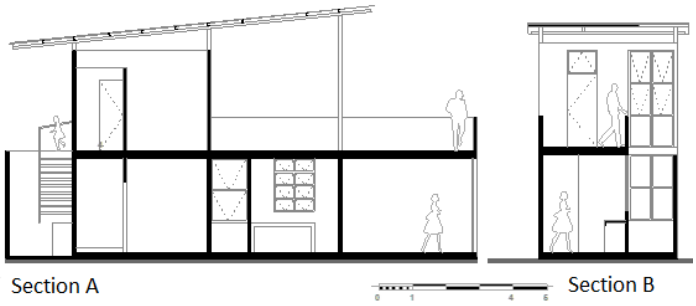


Fig. 8. Section A and B of the dwelling design. Project VIS.

## V. CONCLUSION

Statistical analysis enhances the decision-making process during the design by allowing to define what is the predominant family composition, the main activities that the residents perform at indoor spaces and the causes of discomfort product of the materials used. The housing projects are designed to a distribution that integrates living-dining room and separate the kitchen as was required by users. The presence of a common bathroom makes it possible to take advantage of the space available to design two or three bedrooms, with the priority being given to the space that could be used for job opportunities. The inclusive systemic approach guarantees the sustainability of the architectural project when considering the criteria of the users, the bioclimatic design and

the care of the environment for a future of peace. The provision of new housing will have to encompass user-based design and allow for more flexible structures to be produced in a dialectic process between multitudes of city-makers [12].

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