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**Urban form related to historical patterns, morphogenesis, and transformations.
The case of "La Tola" in the city of Quito, Ecuador**

Ph.D. Gonzalo Hoyos Bucheli¹

¹ Architecture, Territory and Build Habitat Research Program, Faculty of Architecture and Civil Engineering, Universidad Internacional SEK, Ecuador

Abstract

The city of Quito, like many Latin American cities, is going through an extensive urban growth process. Therefore, it caused different morphological patterns with their problems and characteristics. One of the most severe repercussions of extensive growth is undoubtedly the deterioration of the heritage areas that include the Historical Center, included in the UNESCO World Heritage List in 1978. "La Tola", located in the limits of this Historical Center, constitutes a traditional neighborhood of the city, which appeared as an extension of the Historical Center in the mid-20th century and holds a cultural tradition. "La Tola" is settled on a hill, leading to a semi-radial pattern that contrasts with the orthogonal grid pattern of the Historical Center. Growth sub-patterns of the urban fabric in "La Tola" show different morphological characteristics within the same neighborhood. This study is based on an analysis of urban form, which includes analyzing the demographics, streets, plots, and buildings, in contrast to the current regulations. It shows, as in other areas of Quito, an informal phenomenon of overuse of the ground floor and underutilization of height build potential. The results also demonstrate that current regulations do not correspond to the different morphological sub-patterns. Continuous population decline has resulted in the deterioration and poor quality of the urban built space.

Keyword: Quito City, "La Tola", Historical Center, morphological patterns, regulations

Introduction

Quito in Ecuador (2,850 m. above sea level) currently has approximately two million inhabitants (Figure 1). UNESCO inscribed its Historical Center on the UNESCO World Heritage List in 1978 due to its high compactness of historic buildings, most of them from the Republican period and some from the Spanish colonial era. Since the inclusion of the Historical Center on the World Heritage List, the municipality improved and expanded the preservation system (Hoyos, 2008).



Figure 1. Location of Quito city, Historical Center, and "La Tola" neighborhood

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However, there has been a progressive deterioration in the Historical Center and its surrounding areas in recent years. Within the surroundings of the Historical Center are included neighborhoods as a buffer zone, which includes "La Tola". It is a neighborhood that appeared in the mid of the 20th century and has a semi-radial organization, contrasting with the Historical Center's orthogonal grid pattern. Furthermore, are identified sub-patterns of growth of the urban tissue according to the time of appearance (Figure 2).



Figure 2. "La Tola" neighborhood

This study analyzes the urban form in its layout, plots, and buildings from its origins to the present to compare the results with the existing regulations. Demographic analysis is also considered to recognize the different changes in the population in the neighborhood. Furthermore, it is essential to understand the morphogenesis of the neighborhood through the analysis of historical maps to grasp the different phases of development of the built structure of the neighborhood and its morphological features. The morphological analysis is carried out by evaluating municipal cadastral information to explain the morphological components in terms of the size and shape of either block and plots and the form of occupation of the buildings. Finally, the comparison with the current regulations allows us to understand whether it promotes the preservation of the historic landscape, or on the opposite, whether if the regulations promote an irregular and heterogeneous growth model. The study area is the same as the boundaries of the neighborhood established by the municipality of Quito. Therefore, the place that corresponds to the old "La Tola" corresponds to the closest to the Historical Center.

Background

Many urban researchers use concepts and theoretical tools developed in the first world to explain its realities in Latin America without considering the socio-historical differences (Pradilla, 2012). In Ecuador, urban space thinking is fragmented and runs from partial, specific, and exclusionary approaches from different fields of thought and disciplines that do not reach the construction of an integrating vision of the urban. Even there

is multidisciplinary and interdisciplinary empirical research of the city, and it is not enough to formulate legitimate public policies with transforming capabilities of urban space (Fierro & Hoyos, 2018). Regarding the methodology of this study as background, Moudon argues that his studies start from the theoretical assumption that the city, in general, can be read or analyzed through its physical form. At the most elementary level, these analyses are based on three principles: "1. *Urban form is defined by three fundamental physical elements: buildings and their open spaces, plots or lots, and streets*"; "2. *Urban form can be understood as different levels of resolution. Commonly, four are recognized, corresponding to the building/lot, the street/block, the city, and the region*"; and "3. *Urban form can only be understood historically since the elements of which it comprised undergo continuous transformation and replacement*". Furthermore, when the analyzes aim to construct a city theory, the three schools show different purposes, each of which specifies their descriptive, explanatory, and prescriptive intentions (Moudon, 1997).

Methodology

The methodology of this study is divided into three components (Figure 3): The first concentrates on the delimitation of the study area based on municipal cartography. It is important to note that the study area is close to the site declared World Heritage by UNESCO, included in 1978. Therefore, it is essential to understand its location and urban form. The second component focuses on the process of morphogenesis and transformation. The morphogenesis process is analyzed through historical cartography to understand the different stages of development. Finally, the third component is the urban form's normative analysis in the three essential elements of the morphology (blocks, plots, and buildings). Moreover, the population analysis finally focuses on the data from the national census of Ecuador from 1990, 2001, and 2010.

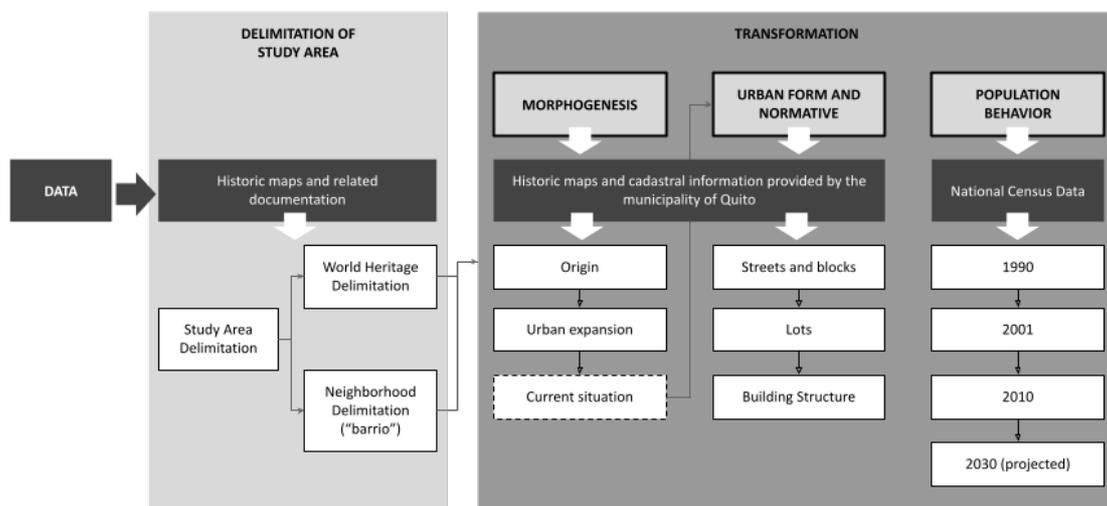


Figure 3. Components of the methodology of the study: delimitation, morphogenesis, normative analysis, and demography

The delimitation of the study area was based on the analysis of historical cartography and bibliographic information related to the "La Tola" neighborhood. The normative delimitation considered maps used for

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the inscription of the Historical Center on the World Heritage List. In addition, this study assessed the geopolitical maps of the neighborhood from the georeferenced data of the municipality. The resulting limit is the one used as the base for this study (Figure 2).

The morphogenesis and transformations were based on analyzing historical maps and bibliographic information to understand the neighborhood's transformation process, from its origins to the present. In addition, it allowed understanding the different development phases of the built structure and the morphological characteristics of the urban tissue in each of these developing phases.

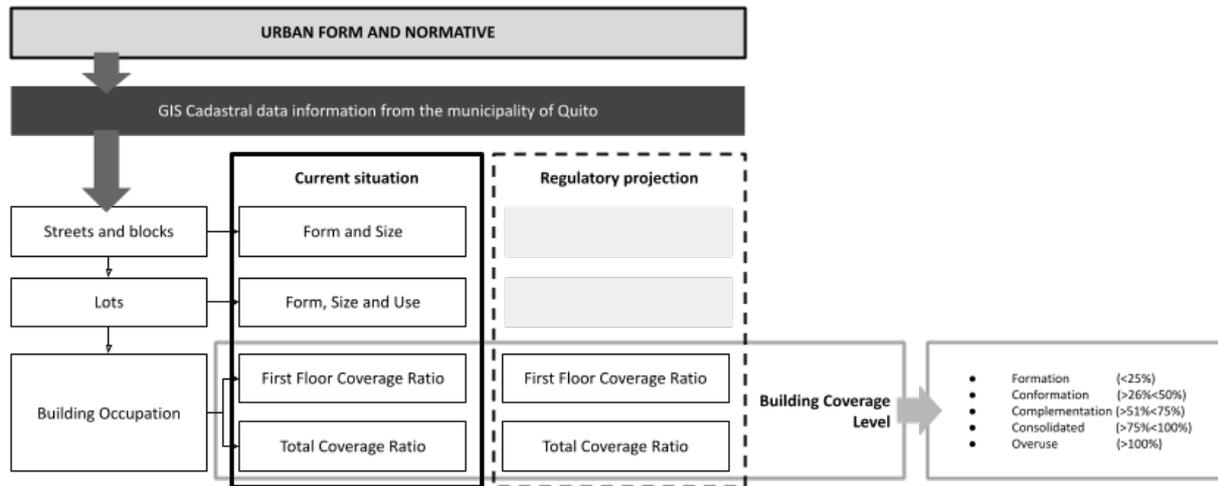


Figure 4. Components of the methodology of the study: Urban form and normative

Figure 4 shows a detail of the methodology for the analysis of urban and normative form. The data analyzed were processed from the municipal cadastral info of Quito. The examination of data allowed a clear understanding of the development of the shape and size of the blocks. Furthermore, a comparative analysis was carried out between the regulations and their buildable potential and the current situation regarding the plots and buildings.

In this way, the study considered five levels of occupation of the plots. The first level, called "formation," implies that less than 25% of the plot has been used according to the regulations. "Conformation" level is between 26 - 50%, and so on, until "over-consolidation," which implies that more than 100% has been built exceeding existing normative.

Results and Discussions

"La Tola" is a traditional neighborhood in Quito city that appeared in the mid of the 20th century and has a semi-radial organization, contrasting with the Historical Center's orthogonal grid pattern. It is located on the easter side of the Historical Center. The study area is the same as the boundaries of the neighborhood established by the municipality of Quito.

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Therefore, the place that corresponds to the old "La Tola" corresponds to the closest to the Historical Center. In the southern neighborhood, the area is limited by the "Machángara" river, which became a barrier to urban growth. Furthermore, in aerial photographs, many ravines can be seen, contributing to creating different urban fabrics.

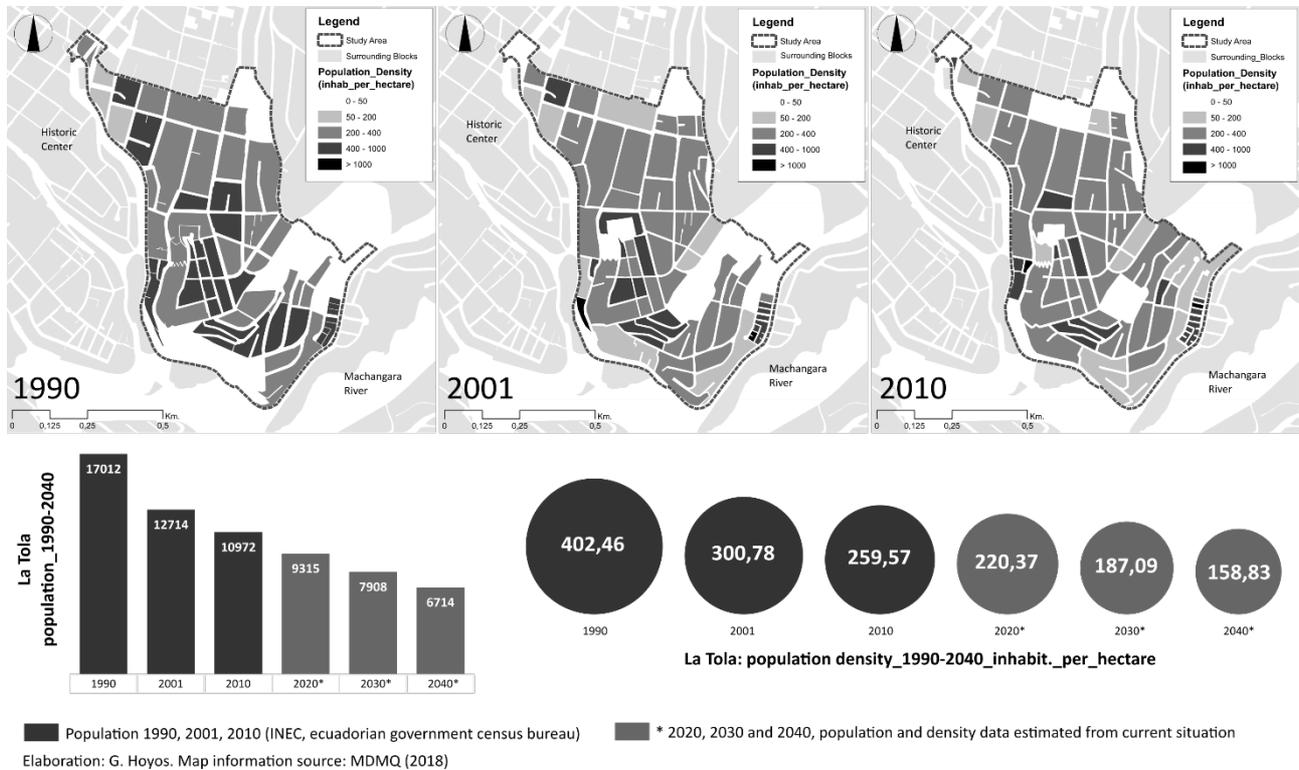


Figure 5. Demography of "La Tola" neighborhood

Analyzing the demography of the national census bureau, a deep analysis of the demography at the block scale in the neighborhood finds that the population and density decline. For instance, in 1990, "La Tola" had more than 17 thousand inhabitants. In 2001, the population decreased to 12 thousand, while in 2010, the population decreased to more than 10 thousand inhabitants. However, it is crucial to consider that there is no recent data due to the cancellation of the national census due to the Covid pandemic. Therefore, with the available data, it is projected that by 2030 the population will reach almost 8 thousand inhabitants. The density could decrease since 1990, from 403 inhabitants per hectare to 187 in 2030 (Figure 5). The results mean a significant population decrease in the study area, and there is no specific reason to explain the exodus of the population. However, a possible hypothesis could be the degradation of the built space.

Morphogenesis and transformations

As seen in Figure 6 on the maps, "La Tola" appeared with an original layout in 1914. In 1940 the neighborhood began a process of expansion, adapting to the topography of the hill. By the end of 1960, "La Tola" appeared with two types of layouts. One derives from the Historical Center's orthogonal block patterns and adapts

Urban form related to historical patterns, morphogenesis, and transformations. The case of "La Tola" in the city of Quito, Ecuador more to the topography, originating a radial layout. By the late 1970s, the neighborhood soccer field is visible. This soccer field is in the highest part of the hill.

At the beginning of the 80s, the growth on the south side is evident. However, this growth is manifested with a more significant number of buildings that possibly appeared with a more informal character, using inadequate construction systems and the lack of control regarding the plots' height and shape.

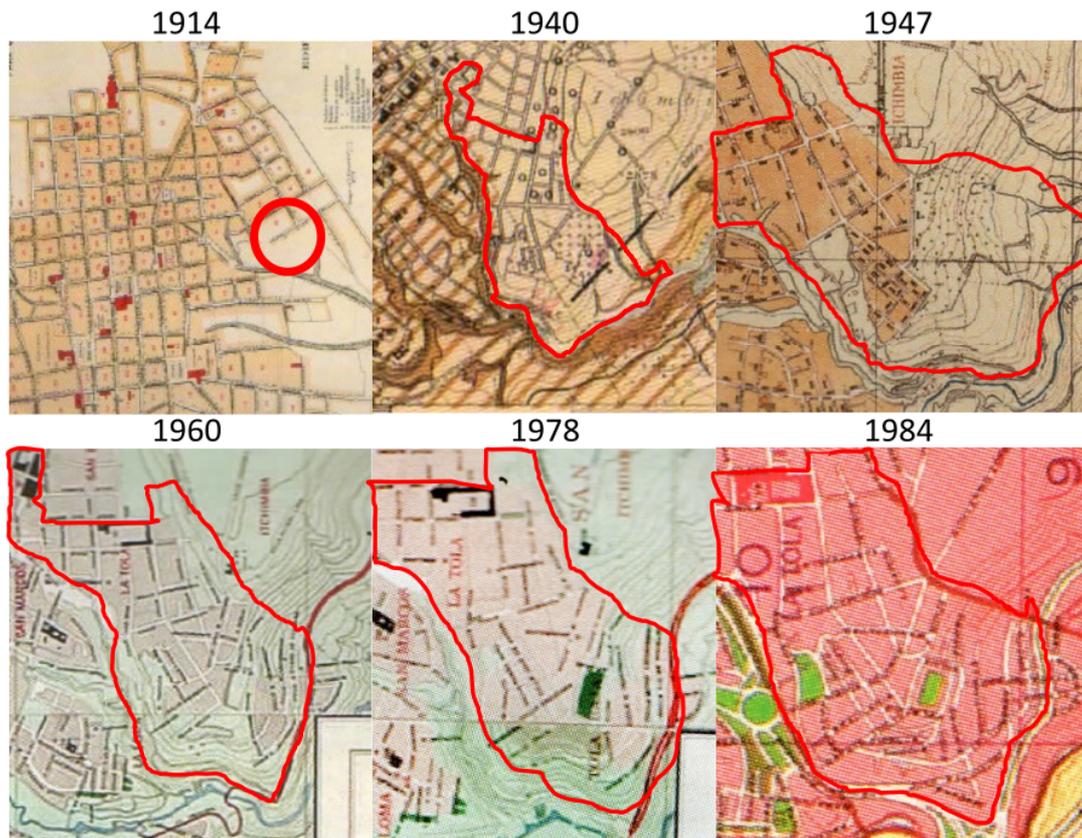


Figure 6. Development of the built structure of "La Tola" neighborhood from 1914 to 1984 (Source: Ortiz, 2004)

Urban form and normative

Correspondingly, Figure 7 shows the different types of buildings according to the chronology. Although "La Tola" is a relatively recent neighborhood, the 1940's period buildings have a certain coherence with the republican residential architecture that characterizes the Historical Center. However, it is in the new "La Tola" where there is evidence of a change in the types of buildings.

In the decade of the 60s, it continues with buildings on the property line (without setback). In the decade of the 70s, a new typology of paired buildings with front setbacks became visible. Many of these buildings are on one or two floors. Finally, in the decade of the 80s, there was evidence of slums of up to eight floors.

These two maps in Figure 7 show the level of occupation of lower floors and upper floors separately. As mentioned in the methodology, five coverage levels have been determined to analyze the relationship

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between the current situation and the existing regulations. The coverage level is obtained by dividing the area built on the ground floor by the potential normative area (building coverage ratio by the lot area).

Visually it can be defined that there are higher levels of occupancy in lower floors than on upper floors. Therefore, it is possible to determine the excess occupation on the ground floor. The buildings in black color represent those that exceed 100% of the building coverage ratio (80%) established by the regulations.

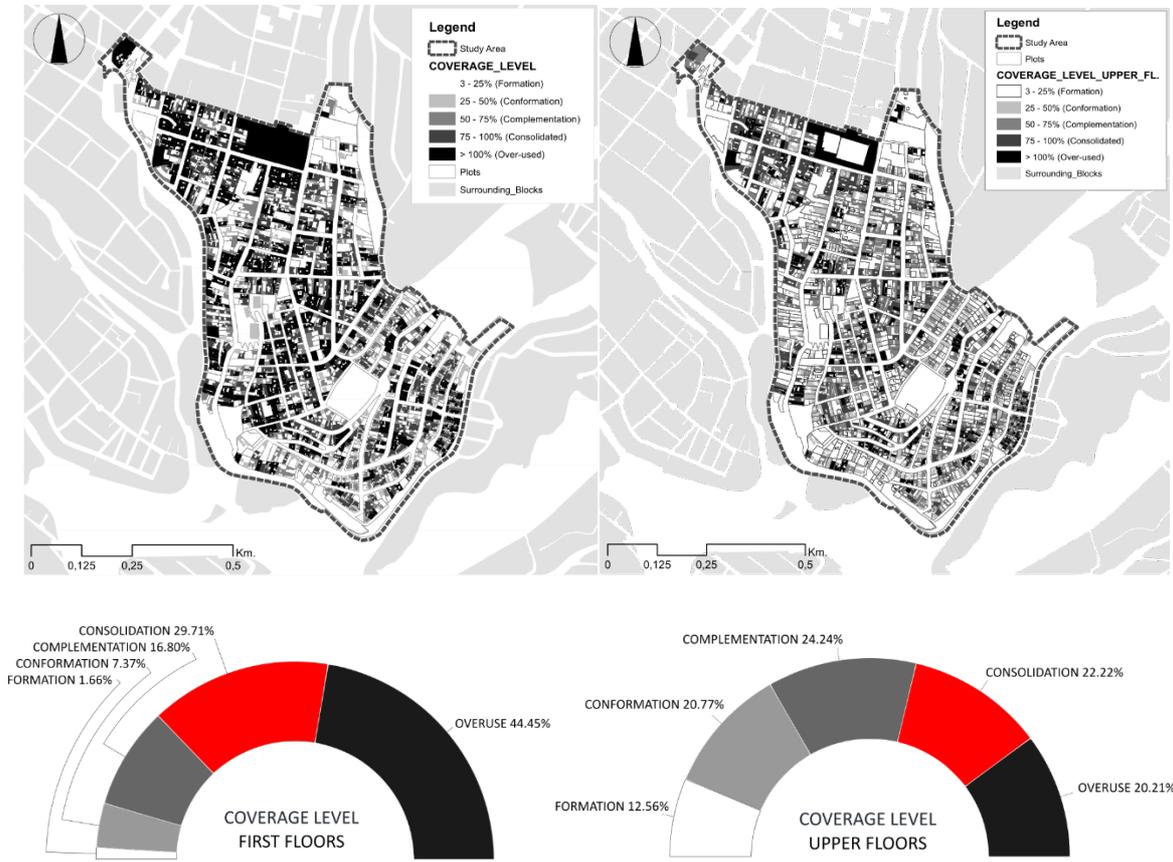


Figure 7. Coverage levels in ground floors and upper floors

In some cases, they occupy the entire plot with a high density of buildings, many of which are built as temporary additions that become permanent. On the contrary, we find that the buildings do not significantly reach the height restrictions in the map on the right. Those buildings that exceed the normative height of three floors are visible in the urban skyline. However, it is questioned that the regulations establish three-story of height restrictions in an urban environment where two-story buildings predominate.

Quantitative data on the findings concludes that on ground floors, it is evident that more than 40% of buildings exceed what is established by the existing regulations due to illegality. On the other hand, about 10% of the buildings neglect to comply with the legal instruments regarding the building coverage ratio. On the upper floors, on the contrary, there is evidence of more than 33% of buildings that do not reach the height regulations (three floors). Thus, more than 20% illegally exceed the height restriction.

Conclusions

Compared to the Historical Center, "La Tola" is a relatively new neighborhood that appeared at the end of the 1940s but initially acquired its morphological characteristics (grid layout). It reaches its current consolidated form between the end of the '70s and mid of '80s. The most recent buildings show regulatory non-compliance and even an anti-technical construction process. A significant population decrease has been detected in the study area. More detailed studies on the correlation between population mobility and its causes are necessary as population decline in certain areas, especially historical ones. A possible hypothesis could be the degradation of the built space.

The study shows an atypical layout of patterns compared to the orthogonal blocks of the Historical Center. However, they show uniformity and greater dynamism in building implantation due to their location on a hill. The study found plots subdivision and over-occupation (over-use) on the ground floor due to illegal constructions. Therefore, it affects the urban image (homogeneity) as well as the permeability of the land.

Analysis of the buildings' upper floors shows a more balanced occupation according to the regulatory instruments. About 20% of the buildings in the study area exceeded the height restriction. A small-scale study of the building typology shows that the normative scenario is not compatible with the homogeneity of the historic cityscape. There is a need to review the height regulations in "La Tola." Although more than 33% do not meet the height provided by regulatory instruments, more than three floors in more homogeneous areas could alter the historic landscape. There is a need for more related studies regarding building codes for new constructions in the historic landscape areas.

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