HIGH-DENSITY IN SANTIAGO: Contribution of prominent projects to the compact-city model

MAGDALENA VICUÑA
Profesora asociada Instituto de Estudios Urbanos y Territoriales Pontificia Universidad Católica de Chile, Investigadora del Centro de Investigación para la Gestión Integrada del Riesgo de Desastres, CIGIDEN, Santiago, Chile

CATALINA TORRES DE CORTILLAS
Arquitecta consultora en la Dirección de Extensión y Servicios Externos DESE, Pontificia Universidad Católica de Chile, Santiago, Chile

The COVID-19 pandemic transformed physical proximity into a possible threat and, with it, cast doubt on urban density as a value. But the opposite – the sprawled city – means longer commuting that punishes the lower classes. Hence, the question is not whether to densify or not but rather how to do it. This text addresses this question through the analysis of well-known recent cases from Santiago.

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Over the past few decades, density has been posed as a basic condition for urban sustainability and equity (Lee & Vernez, 2006; Navarro & Ortuño, 2011; Campoli, 2012). It is a fundamental variable of the ‘compact city’ model, which refers to the proximity of urban uses and functions, bringing diversity, intensity, and complexity to the city (Rueda, 2012). Urban compactness expresses the relationship between built and unbuilt space (García, 2016) while supporting the efficient use of non-renewable resources, the reduction of carbon emissions, the supply of affordable housing, the promotion of active mobility, and constituting a precondition for interaction and social cohesion (Newman & Kenworthy, 1999; Moliní & Salgado, 2012; Hermida et al., 2015; Pronlas-Descours, 2017).
But in times of pandemic and confinement, high density becomes a condition of vulnerability: externalities such as lack of ventilation, privacy, lighting, and the reduced area of housing (which, in many cases, leads to overcrowded conditions) become critical. Common spaces in co-ownership, such as accesses, corridors, and elevators, also lead to potential contagion spaces. At the same time, depression and loneliness have become recurring phenomena (Sim, 2019), thus, balancing privacy and sociability becomes even more difficult in situations of confinement.

Furthermore, the verticalization associated with intensive residential densification does not necessarily respond to the compact city model (Vicuña, 2017). It structurally transforms urban space, often compromising the continuity of densification processes by promoting ruptures in the consolidated fabric (Scussel & Sattler, 2010).

Intensive and deregulated densification generates a number of negative externalities in its mediated and immediate environment: congestion, environmental degradation, and decreased quality of life (Fernández Per & Arpa, 2007; Cheng, 2010). In addition, bad habitability conditions constitute a risk factor for infections (Medeiros et al., 2020). Recent studies have shown that, in scenarios with diverse populations, the rate of COVID-19 contagion is proportional to population density (Rocklöv, 2020), and that areas with the highest number of people per household have higher rates of infection. Thus, although the effects of the pandemic on urban life are not yet entirely clear, density is a factor that must be considered for future threats of contagious diseases.

In Chile, the verticalization associated with residential densification became relevant just over a decade ago. In less than then years, the Metropolitan Area of Santiago (AMS) will have four times more apartments than houses (IEUT & INCIT, 2018). And in the last 25 years, residential high-rise projects of over nine floors have been the most common way to densify the central areas of the city (Vergara, 2017). In districts with specific planning, the scale of residential operations has increased considerably, reaching more than 30 floors with more than 4,000 living units per hectare.

The problem presented is not only the notoriously high density achieved but how it materializes in urban space (Vicuña, 2020). These real estate projects constitute standardized and anonymous typological models, tested countless times, profitable as a business, but lacking architectural expression (Pérez et al., 2019).

In many cases, architecture can be literally an obstacle to desirable models of activities in urban space (Gehl, 2010). Indeed, when density increases, the relationship between the public and private domains becomes particularly critical. Thus, the interface spaces between public and private space gain relevance: entrance transitions, front yards, or privacy and transparency levels, as they account for a series of exchange practices (Dovey & Wood, 2018). Public-private boundaries constitute a continuum of interfaces ranging from ‘soft’ (social, permeable, active) to ‘hard’ (antisocial,
Undoubtedly, the forms of these boundaries make greater sense in the post-pandemic city, distinguishing privacy from the longed-for sociability.

But density is a numerical representation and does not necessarily correspond to an architectural or urban typology (Pérez de Arce, 2006: Marengo et al., 2015; Vergara & Asenjo, 2019), which complicates its use and understanding. One complication lies in the difficulty of measuring and comparing density, as there are several ways to define and calculate it: gross and net density, residential and adjusted, demographic, built and social, among others (Churchman, 1999). An urban area can present different density indicators – depending on how it is measured – and similar average densities, measured on a neighborhood scale, allowing extremely different densities on the building level (Berghauser Pont & Haupt, 2010; Sim, 2019; Vicuña, 2020). Density also responds to physical, sociological, and cultural factors (Pranlas-Descours, 2017). It is, then, a subjective and perceived experience, associated with different degrees of information, which results from the relationship between people, and between people and architecture (Rapoport, 1975).

So, to what extent can the residential project contribute to the configuration of dense urban space where we will re-socialize after the pandemic? What alternatives do we see to promote growth in density, without compromising physical and mental health, especially in pandemic scenarios?

A ‘good density’ is not necessarily high, medium or low, but is combined evenly with other spatial properties of the neighborhoods receiving the high-rise project, such as the availability of public spaces, dialogue and respect for pre-existing buildings, and a diverse offer of services and public transport both at the ground and underground levels (Jacobs, 1961; Lynch, 1981; Lozano, 1990; Berghauser Pont & Haupt, 2010; Sim, 2019). The mix of housing and services contributes to urban complexity and multifunctionality, fundamental components of the compact city model (Rueda, 2012). It promotes a greater functional diversity of the densified neighborhoods, and a perceptive diversity for the pedestrian experience, regarding its relationship to the front of buildings and public spaces (Gehl, 2010). The proximity between housing and various complementary uses is also fundamental to sustaining new forms of development associated with creative society, which have transitioned from the industrial economy to that of knowledge (Vanden Hoek, 2008). Since trips by public transport mean greater exposure to the current virus, short commuting distances to work, diversity of uses, more alternatives, or prioritization of the bicycle are attributes of the compact city that would prevent possible contagion.

In turn, ‘good density’ promotes walkability, encounters, exchanges, and interactions through a flexible relationship, both visual and of pedestrian flow, between the public and the private at the ‘0’
level of the street. This condition is known as 'porosity' (Llop, 2008). Thus, large buildings with long facades, scarce accesses, and few visitors, tend to disperse activities and events (Gehl, 2010), reducing porosity. Another relevant density component that contributes to the compact city is the spatial dialogue between the residential project and its urban environment, i.e., the coherence of scale between the building type and the urban morphological structure (Pérez de Arce, 2006). On various occasions, the residential high-rise building is located in plots of decontextualized scale, language, and materiality, with a strong visual presence (Fedele & Martínez, 2015). In this way, the architecture of the residential project is essential for density to contribute to the compact city model and, consequently, to the realization of the urban space that we will occupy post-confinement.

**Methodology**

This work aims to raise attributes of high-density residential projects – distinguished by academic and state institutions – that contribute to the compact city model in these three dimensions. Thus, 24 AMs densification projects are analyzed [FIG. 1], whose architecture contributes to its urban context through attributes that materialize three dimensions of the compact city: (a) diversity; (b) porosity between public and private space; and, (c) coherence in the urban fabric scale. The variables that allow these dimensions to be measured are addressed at the scale of the residential project [Chart 1].

Diversity is assessed regarding the extent to which the building incorporates apartments of different areas and, therefore, can accommodate various types of residents (Lin & Gámez, 2018) as well as uses other than residential, such as offices or commerce on the first floor. This work is interested in measuring whether both these commercial uses and the front yard deploy their activity towards the sidewalk, promoting the activation and vitality of the public space. To measure porosity, variables that define the relationship between the building and the public space are selected: in terms of a fluid visual relationship between the building at its ground level and the road, and also in pedestrian routes. Finally, the variables selected to understand scale coherence seek to measure the relationship of the residential project with the pattern of existing urban morphology; in other words, how much is related to the predominant urban fabric ‘grain’ (Kropf, 2014). Here, the study focuses on measuring whether the form of grouping, the height, the front, the predial surface, the height/width ratio of the street, and the rhythm of the building’s facade are distant or close from the predominant ones in the context where it is located.

The selected cases meet at least one of the following criteria: published in architectural magazines; nominated and/or winner of the Urban Contribution Award or the Chilean Architecture Biennale; published by architectural websites; associated with outstanding real estate...
FIG. 1 Localización de casos y sus densidades netas. / Location and net densities of the cases. Fuente / Source: Elaboración propia / Elaborated by the authors.
As a result of the literature consulted, 22 attributes associated with the compact city model were defined, which are organized according to the three dimensions mentioned: diversity and mixing of uses; porosity and experience of pedestrians at ground level; and coherence and harmony of scale with the immediate urban environment. These variables are verified for each case by an evaluation that establishes three main criteria:

- ‘meets,’ ‘close to meeting,’ or ‘does not meet.’
- The degree of compliance with some attributes is verified by parameters that put the building in relation to its immediate urban context. For example, in ‘Grouping shape is predominant on the block,’ the case ‘meets’ the criterion when the building has the same grouping of at least 66% of the buildings located on the block; ‘close to meeting’ when it has the same grouping as the 33%-66% of the buildings located on the block; and ‘does not comply’ when its grouping corresponds to less than 33% of the block.
FIG. 2 Fachada principal, mancha de la edificación y densidad residencial (viviendas/hectárea) de los casos de estudio. / Main facade, building sprawl, and residential density (dwelling/hectare) of case studies. Fuente / Source: Elaboración propia / Elaborated by the authors.
Attributes of the Residential Building in Density that Promote the Compact City Model

Although the cases analyzed vary significantly in terms of density, site area, and constructed area, the predominant grouping is continuous, and half of the cases have a public front yard. These are possible to group into 3 main typologies: isolated towers (higher height and constructability, low land occupation); townhouses (low height and constructability, high land occupation); and medium format collective housing assemblies [Fig. 2]. Chart 1 allows us to visualize the performance of the cases in each of the selected variables to discuss their contribution to the compact city model. The attributes with the highest degree of compliance are those of scale consistency (53%), followed by porosity (49%), and, finally, diversity of uses (28%).

Buildings located in districts that are part of the high-income cone have a higher degree of compliance with the different variables. The percentage of variable compliance in Santiago Centro reaches 40%, and in peri-central districts such as Quinta Normal, Recoleta, and Estación Central, the percentage drops...
TABLA/CHART 1 Dimensiones y variables asociadas al modelo de ciudad compacta en 24 edificios del AMS. / Dimensions and variables associated with the compact city model in 24 AMS buildings. Fuente / Source: Elaboración propia / Elaborated by the authors.

*Se verifica el parámetro de todos los predios y edificios existentes en las nezas y lo que enfrentan cada caso de estudio.

** Se establece el módulo predial del conjunto que es promedio de lo establecido por los PRC consultados.

*La elaboración de la tabla y el esquema se realizó con la colaboración de los autores.*
to 29%, 27%, and 25%, respectively. Finally, in the district of Pudahuel variables are met only at a 17%. These percentages seem to show that compliance with variables associated with the compact city model could be related to the predominant socioeconomic condition.

**Diversity of Uses and Activities**

The best performing variables were those related to the quality of the front yard. No cases were found that met the attribute of 'Contributes to the neighborhood with uses other than residential on upper floors,' and only 5 cases met the 'Contributes to the neighborhood with different uses than the residential on the first-floor' variable. Of the latter, 4 cases comply with 'Uses on the first floor promote activity on the sidewalk'. However, these buildings do not necessarily coincide with those that met 'Space of the front yard provides furniture for pedestrian pause.'

The Bo4502 (Ñuñoa district) and Pocuro (Providencia district) buildings performed best in this dimension [Fig. 3]. The first combines 65 apartments with 32 offices and 250 m² of commercial spaces. This combination, plus the presence of a 5-m public front yard, promotes pedestrian detention and the activation of the sidewalk. The Pocuro building includes 72 apartments and 2 commercial spaces, and offers a *plazoleta* as an extension of the sidewalk, with arborization, luminaires, and urban furniture. The presence of commercial areas and the setback of the first floor promote a 'soft' and active edge between the building and the city.

In the district of Santiago, the compliance degree of the attributes associated with the diversity of uses is practically zero, which constitutes a paradox in terms of the residential project, because, although it has attributes of porosity and consistency in scale, cases do not contribute to the neighborhoods where these are located, of high centrality, with a greater diversity of uses and activities.

**Porosity**

The best performing variables are those linked to pedestrian access. Of the total, 14 cases do not have parking on their front yards and in only 7, the access of the car is secondary to pedestrian access. The buildings Hamlet (Las Condes) and Activa San Cristóbal (Recoleta), 100% residential, are the only ones that comply with the variable 'Incorporates passages for public use' [Fig. 3]. The Hamlet building gives up a space of more than 70 m long, connecting the streets adjacent to the site and functioning as a public passage. It has seats, luminaires, and a garden, and the walk invites pedestrians to visit the common workshops and facilities of the first level. The Activa San Cristóbal building is located between the San Cristóbal and Blanco hills, in a different context, with an industrial vocation and a high predial subdivision. With a plot of 4,375 m², it provides a pedestrian passage that connects the streets to the east and west of the property.

The building La Juliana [Fig. 3] – with 16 houses, 2 commercial spaces on the first floor, and an office – is
located in the heart of the city, close to important landmarks of Santiago. With a front of only 8.7 m, the building has a collective ‘yard’ to the center, open towards the north and south facades, taking advantage of the double orientation, and articulating the depth of the interior with the city’s activity.

Although 10 buildings are close to complying with this attribute, only in two cases the architecture of the first-floor facade promotes 100% visibility between public and private space. The Bo4502 and Pocuro buildings are those that promote greater porosity. By including non-residential uses at street level, they configure a permeable and active interface.

**Consistency in Scale**

This aspect has a high degree of compliance. In practice, all cases conform to the predominant building line and grouping form and, in most of them, the architecture of the first floor is structured from elements that dialogue with adjoining grounds (heights, windows, modulation). This is the result of the district’s regulatory plans’ ability to conduct these variables with more precision by establishing building requirements.

Such is the case of buildings in Santiago Centro that, contrary to what we observe in the diversity attribute, have a high degree of coherence of scale. The buildings Santiago Patrimonial II [Fig. 3] and Club Hípico V comply with all the variables of this dimension. Located in the Brasil-Yungay neighborhood, they respect the system of grouping and the construction line, the heights, and the prevailing predial areas. The predominant grouping allowed is the continuous one. The heights are restricted to 5, 6, and 9 floors in most residential areas and 16 floors in the more mixed ones.

While the average building height/street width ratio corresponds to ‘2,’ 15 cases meet or are close to meeting a ratio lower than ‘1.5.’ In addition, 14 cases meet or are close to meeting the condition of ‘Predial surface of less than 2 times the average of predial fronts of the block where it is located and of the one it faces,’ and ‘Building height is less than 2 times the average height of the buildings of the block.’ In 13 cases the predial front is less than 2 times the average of the predial fronts of the block where it is located and of the one it faces. Also, 8 cases meet all three scale consistency conditions.

The degree of compliance with this dimension is weaker in cases located in peri-central and peripheral sectors. These constitute buildings of between 5 and 19 floors, of continuous grouping, located in neighborhoods of mostly housing of 1 to 2 floors, paired or with continuous facades, and with reduced predial surfaces. For example, the Gabriel Palma Urban Complex (Recoleta) and the UKAMAU project (Estación Central), with 132 dwellings per hectare and 135 dwellings per hectare, respectively, are far from the average of the neighborhoods in which they are located: 44 dwellings per hectare and 32 dwellings per hectare. In turn, they only meet one of the 8 variables associated with this dimension. The first case [Fig. 3] has a plot of 2.1
hectares and a predial front of 186 m, in a neighborhood with an average of 676 m² of surface and a predial front of 13 m. The second, with a site area of 2.7 hectares and a front of 230 m, is located in a neighborhood where the lots average 1,297 m² and the fronts 33 m.

Conclusions

Although still incipiently, a market for smaller-scale densification projects emerges in the AMS, with spatially consistent average densities in relation to their environment, and contributing significantly to the promotion of pedestrian flow, mixed-use, and activity in public space. The examples presented contribute to a 'good density,' which advances the attributes of the compact city, mainly by a good architecture of the public-private interface. Noteworthy is the importance that residential projects in dense areas give to the elements of border and access to the building, including them as a relevant object and as a threshold that connects the building with the city. In addition, the conditions of land occupation, front yard, and grouping can affect the quality of the public space and its ability to establish itself as a place of encounter and social interaction. While the objective of this study is not to analyze the role that territorial planning instruments have in promoting good density variables, there is no question that defining the height, grouping, land occupation, buildability or front yard parameters, as well as regulatory incentives for mixed-use and the contribution of a residential project to the activation of public space, are of great impact. Future analyses should focus on systematizing this contribution from district planning. Likewise, the cases discussed here could be relevant references when designing urban standards that aim to become parameters for building more diverse and inclusive neighborhoods.

The compliance with variables associated with the compact city model – analyzed here –, demonstrates a relationship with the predominant socio-economic status of the population, even between buildings distinguished by both academic and state institutions. Buildings located in the AMS high-income cone have attributes that further promote the compact city model. In Santiago Centro, there is greater harmony between the cases and their urban fabric; however, they do not necessarily contribute to a greater diversity of uses and activities. On the contrary, buildings located in the pericentral and peripheral sectors of the AMS have large areas and contribute to public space, although in less dialogue with the morphology of their urban contexts.

If density responds to physical, sociological, and cultural factors, variables such as diversity, porosity, and scale coherence are compact city attributes that become particularly relevant in times of pandemic and confinement. The need to inhabit central and dense areas requires dwellings at walking distances from services and workspaces, as well as quality green spaces and sidewalks that promote the walkability and usability of the public space in which we will reunite when the pandemic is over.
It is urgent to innovate in architectural typologies for residential densification that allow us to coexist in harmony with our fellow citizens, with the environment, and be prepared for future threats of contagious diseases. It is possible to move towards densification processes with better quality densities, distributed more homogeneously, at a lower height and higher land occupation, and on justifiably defined areas in the metropolitan territory. The residential project in density is key to achieving this great challenge of the twenty-first century. ARQ

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Magdalena Vicuña
<mvicunad@uc.cl>

Architect, Pontificia Universidad Católica de Chile, 1999. Master in Community Planning, University of Maryland, United States, 2004. Doctor in Architecture and Urban Studies, Pontificia Universidad Católica de Chile, 2015. She has participated in a number of academic and applied research projects, being the principal researcher of “Excepciones a la normativa urbana local y sus efectos en la conducción de los procesos de densificación residencial intensiva, el caso del Gran Santiago” (MINVU, 2017-2018) and “Impacto de la densificación residencial intensiva en la re-estructuración espacial de la ciudad neoliberal: morfología y normativa urbana en el Área Metropolitana de Santiago” (FONDECYT-CONICYT project, 2018-2020). She is currently an associate professor at the UCh Institute of Urban and Territorial Studies, she is Head of FADU UC Research and Postgraduate Studies, and a researcher at CIGIDEN, Chile.

Catalina Torres de Cortillas
<ctorres3@uc.cl>

Architect and master in Urban Project, Pontificia Universidad Católica de Chile, 2019. She has participated in research projects related to urban and territorial planning at IIEU UC, more importantly in the project “Impacto de la densificación residencial intensiva en la re-estructuración espacial de la ciudad neoliberal: morfología y normativa urbana en el Área Metropolitana de Santiago” (FONDECYT-CONICYT, 2018-2020). She currently serves as a consultant architect at the Directorate of Extension and External Services DESE UC.
A prize that aims to recognize, distinguish, and incentivize those public and private projects that constitute a quality contribution to Chilean cities, and which is organized by the Cámara Chilena de la Construcción, the Ministry of Housing and Urbanism, the National Council for Urban Development, the Colegio de Arquitectos, the Association of Architecture Offices (AOA), and the Association of Real Estate Developers (ADI).

2. The study analyzes a 25-hectare polygon around each case.

Notas/Notes

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