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URBAN EFFECTS OF THE CONSTRUCTION OF THE POCURO LINEAR PARK AND CYCLE PATH, IN SANTIAGO

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I. INTRODUCTION

The latest Origin-Destination Survey (EOD, in Spanish) for the city of Santiago demonstrated an important increase in bicycle use, which rose from 2% to 4% of the trips (Sectra, 2012). This increase is very positive, since bicycles are a non-contaminating means of transportation that also help decongest the road network, using a fraction of the space that a private car uses, both when moving and when parked (Pettinga et al, 2009). Likewise, cycling helps to improve the immunological system and lung capacity, as well as to prevent the development of mental illnesses like depression (Frank & Engelke, 2001; Frumkin, Frank and Jackson, 2004, Deeniham & Caufield, 2014). Using a bicycle on a daily basis to commute to work reduces the risk of dying from cardiac diseases by 40% and from dying of cancer by 40% (Celis-Morales et al, 2017). Alongside this, promoting bicycle use would also help fight the extended sedentarism of the Chilean population, which reached 87% in the latest National Health Survey from 2016-17 (Ministry of Health, 2017).

The boom in bicycle use has been accompanied by recent regulatory changes, like the Road Co-existence Law (Ministry of Transport and Telecommunications, 2019), that recognizes bicycles as a means of transportation that is different to pedestrians and motorized vehicles. While the National Urban Development Policy (PNDU, in Spanish) from 2014 makes a clear call to develop "urban mobility", stating that this "goes beyond cars and public transport systems, considering walks and the use of bicycles and other unmotorized means, which include the bicycle, walking and other emerging unmotorized means" (Ministry of Housing and Urbanism, 2014: pg. 73).

To a great extent the new role of the bicycle has been preceded by an important increase in the cycle lane network in Santiago, from 20 km in 2003 to almost 400 km in 2018 (IDB 2015). This trend is repeated in other Chilean cities, like Concepción or Rancagua, with the latter recently named as the town with most cycle lanes in Chile (El Rancagüino, 2019).

International studies have sustainably shown that the availability of cycle lanes is key to encouraging bicycle use (Hull & O`Holleran, 2014; Krizek & Johnson, 2006; Ogilvie et al., 2011), improving the perception of safety for cyclists (Scott, 2009), and their comfort (Li, Wang, Liu & Ragland, 2012). Despite this, there are currently few studies in Chile that have analyzed the implications emerging from building infrastructure for bicycles and, in particular, cycle lanes, in terms of improving the appeal of the neighborhoods for property developers to build housing, the emergence of commercial activity in the neighborhoods, and finally, in the use of the street by the people. Looking to fill this void, this article proposes identifying the real-estate effects on land prices and street use, that have arisen from the transformation of Pocuro Ave. in Santiago.

Pocuro Ave

Figure 1 shows the location of Pocuro Ave., which in a little over 3 kilometers connects downtown Santiago with the eastern sector (districts of Las Condes and La Reina), along the streets Diagonal Paraguay – Alférez Real – Pocuro – Isabel La Católica.

The origins of Pocuro are linked to the origins of the garden-city model that was implemented at the beginning of last century in Santiago with the construction of Ricardo Lyon Ave. (Palmer, 1984), and that was consolidated in 1956, when the San Ignacio El Bosque school, one of the most traditional private schools in Santiago, was built.

Towards the mid-70's, there were mainly large manor houses lining Pocuro, residences for the capital's wealthy families. However, the development of Providencia's commercial hub increased property pressure on the areas located to the south of this road, leading to the construction of three low-rise buildings along Tobalaba Ave. at the beginning of the 70's. This process sped up during the 80's, with 2 five-story buildings built on the southern side of the street.

Figure 1: District of Providencia and Pocuro Ave. Source: Prepared by the authors (2019)

The most significant change in the development of Pocuro Ave. occurred in the mid 90's, when the Mayor, Cristián Labbé, decided to call for a citizen consultation to decide upon a series of urban works to be built in the district. One of them consisted in remodeling Pocuro Ave. and transforming it into a linear park, which would become part of the "Integrated Parks" circuit (Municipality of Providencia, 2007). The results of the aforementioned citizen consultation allowed choosing from five initiatives, namely: strengthening citizen security, technical studies to build underground parking along Providencia Ave., the Integrated Elderly Attention Program, aerial and underground cabling along some avenues in the district, and finally the first stage of the Integrated Parks System, which consisted in the construction of the Pocuro linear park.

Workers of the Urban Consultancy Department of the district at the time, German Bannen and Jaime Márquez, defended this last project in a session of the Municipal Council on June 17th 1997, mentioning the need to recover communal public space so that pedestrians, cyclists, skaters and children could go back to playing in the street. According to what was mentioned in the same session (Municipal Council, minutes of extraordinary session N°31 from 1997), the cost associated to these works was 200 million pesos at

EFECTOS URBANOS DE LA CONSTRUCCIÓN DEL PARQUE LINEAL Y CICLOVÍA POCURO, EN SANTIAGO
RODRIGO IVAN MORA VEGA, VICTOR ROCCO
REVISTA URBANO Nº 41 / MAYO 2020 - OCTUBRE 2020
PÁG. 166 - 183
ISSN 0717 - 3997 / 0718 - 3607

the time, which in August 2018 was the equivalent of almost 404 million pesos[4] (Municipality of Providencia, 1997).
The construction of the Pocuro linear park, between Los Leones Ave. and Tobalaba Ave. (1.5 kilometers approximately), modified the profile of the street, changing it from having four lanes for cars running east-west located on both sides of a central reservation, to three lanes running in the same direction on the south sidewalk, and a lane and a half (4.6 meters) running east-west on the north sidewalk. Although the central space was widened by just two meters, the resulting space was enough to hold a two-way cycle path and a walking area with a width of 2.2 m and 4 m, respectively. Benches and rest areas were placed along the central reservation, along with 1,300 trees. The works were shown to the neighbors between August 21st and 30th 1997 in Club Providencia, beginning on August 23rd, 1997. Figures 2 and 3 show these changes.
The modification of Pocuro Ave. also implied building surrounding green areas, like Rio de Janeiro Square, in the intersection of El Bosque Ave. and Pocuro Ave. Here, El Bosque Ave. was branched into two parallel streets, which allowed building the aforementioned square. The change of Pocuro Ave.'s profile also implied narrowing the broad strip in front of the northern sidewalk, where neighbors used to park their cars. Despite the opposition to this, the works were inaugurated in March 1998.
Twenty years on from its creation, Pocuro linear park seems to have had an important impact on bicycle use in the east of the capital, while generating property investment in the area. In fact, the last Origin-Destination Survey of 2012 (Sectra, 2012) showed that in the 2002-2012 period, bicycle trips in the eastern sector had grown 686%, more than in any other area of Santiago. Although it is not possible to attribute this increase to Pocuro Ave., those in charge of urban planning at the Municipality of Providencia stated that the success of the Pocuro cycle path opened the way to build new cycle paths in the district, like those of Antonio Varas Ave. and Ricardo Lyon Ave., over the next decade. Looking to understand this impact, a research project which recorded and evaluated the changes in real-estate activities and land prices that have taken place on Pocuro Ave. over the last twenty years, is presented below.

Figure 2: the building of the Pocuro Linear Park in 1997. Source: Municipality of Providencia (2019)

Figure 3: modifications made to the profile of Pocuro Ave. Source: Prepared by the authors (2019)

II. THEORETICAL FRAMEWORK

Contemporary debate about mobility has begun to integrate subjective aspects to the experience of moving around the city (Jirón, Lange & Bertrand, 2010). In this regard, Kauffman, Bergman and Joye (2004) suggest that mobility is part of the "capital" of each person to interact with other agents and individuals of society. Meanwhile, Sheller and Urry (2006) outline the need of a new epistemology of mobility, that seeks the scalar juxtaposition of places of the city. These visions have run through Chilean academic debate, with authors who have sought to overcome the auto-centric vision that has dominated urban policies in the last two decades (Greene & Mora, 2005, Alvárez, 2013, Sagaris & Landon, 2017).
The debate on urban mobility has also implied a questioning of the city streets. Although this debate began in the 60's with the ideas of Jacobs (1961), it was not until the 80's that the discussion acquired a more technical and instrumental outlook under the approach known as "Complete Streets". This vision proposes a more inclusive road space, in the sense of incorporating all means of moving in the city (walking, cycling, public transport, private cars), and safety, in the sense of allowing street access for different types of users, especially the most vulnerable ones, like children and the elderly (Hui, Saxe, Roorda & Miller, 2017, Mc Cann, 2013, Smart Growth America, 2015). Several manuals (NACTO, 2016) have sought to transform these goals into concrete design criteria, seeking a new "urban recalibration" (Cervero, Guerra & Al, 2017). Studies that have mainly been made in developed countries show that the transformation of streets into Complete Streets increases commercial activities in neighborhoods by up to 60% (Smart Growth America, 2015). For its part, a study made in Washington D.C. showed that converting a street into a complete street attracted more than forty new stores and two hundred new jobs related to increased sales and pedestrian volumes (Smart Growth America, 2015).
On the other side of the Atlantic, in Europe, the questioning of the modernist vision of the street (Marshall, 2004) began in the 60's (Gehl, 1971), incorporating geometric and topological aspects of the road network into the discussion (Hillier, 1996, Marshall, 2004, Jiang & Ma, 2018). As a result, countries like Switzerland, the Netherlands or Germany have implemented extensive remodeling of urban areas, looking to have safe and inclusive streets, while London has reconceptualized the street itself, coordinating both the role of "movement" (of people or vehicles) and the public space (Roads Task Force, 2012).
However, from a more critical point of view, it has been maintained that contemporary urban regeneration projects which include the pacification or remodeling of streets often have strongly speculative motivations (Harvey, 1989), which are supported by the local governments. It is argued that, more than improving the social space, this type of intervention degrades social space and fosters residential segregation (Fernández-Ramírez & Roch-Peña, 2012). For example, Morcillo-Alvaréz (2017), in an analysis of urban regeneration projects in Madrid between 1998 and 2007, outlined that property speculation had reduced the "random" nature of the urban space and had strengthened its "fetishistic" nature, imposing logics of use based on consumption. Viewed in this way, urban transformations that seek to drive new urban practices, like those linked to sustainable mobility,

4 http://encina.ine.cl/CALCULADORA.

EFECTOS URBANOS DE LA CONSTRUCCIÓN DEL PARQUE LINEAL Y CICLOVÍA POCURO, EN SANTIAGO
RODRIGO IVAN MORA VEGA, VICTOR ROCCO
REVISTA URBANO Nº 41 / MAYO 2020 - OCTUBRE 2020
PÁG. 166 - 183
ISSN 0717 - 3997 / 0718 - 3607

would be part of the urban expulsion and exclusion dynamics of vulnerable residents and their replacement by monied groups of professionals who demand new services, like cafés, bookstores or urban amenities. Research made for downtown Santiago demonstrates the presence of these processes, linked especially to the expulsion of the original residents, who often cannot pay the values of the newly built homes (López-Morales, Gasic-Klett & Meza-Corvalán 2012).

III. METHODOLOGY

For the methodological aspects, the building permits granted by the Municipality of Providencia for Pocuro Ave., between Tobalaba Ave. and Los Leones Ave., the segment that changed the existing sidewalk, were reviewed for the period covering from the 70's to the end of 2018. The surface area of the strip, the m^2 built, the number of floors, number and surface area of the apartments of each one of the buildings that have been built and are being built on Pocuro Ave. to December 2017, were recorded. Then, the land prices paid by the property developers of these buildings were registered. For this, the Santiago Land Registrar's Office was visited, to identify the first buyer of these strips, in other words, who bought the manor houses there were until the 60's to build residential buildings. The price paid was recorded in Units of Foment (UF), a unit that considers monthly inflation and that is used for almost all property transactions in Chile. The value paid in UF was divided by the land surface area, to know the UF/m^2 value of the land sold. In the two cases where sites were sold in pesos, these were updated for comparison purposes. The same procedure was done for two parallel roads that are similar to Pocuro Ave., namely Francisco Bilbao Ave. and Carlos Antúnez St. (see figure 1).

Alongside this, the flow of people using Pocuro Ave. and their type of activity was recorded by observing six points located between Tobalaba Ave. and Los Leones Ave. This was done on a weekday and on one weekend in July (winter), 2017. The counting discriminated by gender, apparent age (with ranges of 18 to 30, 31 to 65 and over 65), and the type of activity (jogging, walking, and cycling).

Finally, a semi-structured interview was made with store keepers on Pocuro Ave. (see figure 4). The interview asked store owners or keepers why they had chosen this location and which other alternative locations, other than Pocuro Ave., they had looked at to set up shop, also asking whether the linear park had had a positive, negative or neutral effect for their business. A total of 11 shop owners were interviewed, ranging from store, café or launderette owners.

Figure 4: places of the interviews along Pocuro Ave. Source: Prepared by the authors (2019)

IV. RESULTS

Table 1 shows three aspects of the real-estate activity recorded on Pocuro Ave. in the last 40 years in the dimensions analyzed:m^2 built, number of buildings, and number of apartments built. As can be seen, there were 78,358 m^2 built from 1960 to 1997 along Pocuro Ave., while in the last 20 years (1998-2017), 175,205 m^2 were developed (a rise of 223%). On the other hand, the number of apartments rose from 645 to 1,172 (+181%), with an increase in their average surface area compared to what was built prior to 1997. The real-estate activity generated as of 1998 took place in a context of a better use of the lot (which in practice leads to higher buildings, which reached up to 15 floors). This is demonstrated in the fact that only 21 buildings were built in the last 20 years, compared with the 49 that had been built prior to 1997. Regarding land prices, the value paid in Pocuro Ave. was 11 UF/m^2 in the 1987-1996 period (11 transactions analyzed), 21 UF/m^2 between 1997-2006 (7 transactions analyzed), and 26.2 UF/m^2 in the 2007-2016 period (10 transactions analyzed). This last period saw a great variation in the prices, from 15 UF/m^2 paid in 2010 to values of close to 40 UF/m^2 paid as of 2014.

Table 1: characteristics and land prices of constructions built on Pocuro Ave., Francisco Bilbao Ave and Carlos Antúnez St. Source: Prepared by the authors (2019).

Figure 5: Evolution of building permits along Pocuro Ave. Source: Prepared by the authors (2019)

Figure 6: Estimated flows of people along Pocuro Ave. Source: Prepared by the authors (2019)

The land values (UF/m^2) paid on Pocuro Ave. were contrasted against those of Carlos Antúnez St. (between Tobalaba Ave. and Los Leones Ave.) for the periods of 1988-1997 (18 cases), 1998-2007 (4 cases) and 2008-2017 (4 cases)**5**. Although there were not any significant differences in land prices of both roads, a significant increase in the speed of the property development activity was detected for Pocuro Ave. from 1995 onwards (see figure 5). It is worth asking in this point, whether this property development activity was enough to pay the costs that the construction of the Pocuro park demanded?

To answer this question, it is necessary to identify the additional property development activity that took place on Pocuro Ave. to compare it against similar streets in the last 20 years. If we compare the 175,205 m^2 built on Pocuro Ave. between January 1998 and December 2017 against the 43,743 m^2 built on Carlos Antúnez St. in the same period, we see that an additional 131,463 m^2 was built on the former. A quick review of the marketing that the buildings currently on sale on Pocuro

5 Francisco Bilbao Ave. is excluded from this analysis due to the shortage of transactions in the period.

EFECTOS URBANOS DE LA CONSTRUCCIÓN DEL PARQUE LINEAL Y CICLOVÍA POCURO, EN SANTIAGO
RODRIGO IVAN MORA VEGA, VICTOR ROCCO
REVISTA URBANO Nº 41 / MAYO 2020 - OCTUBRE 2020
PÁG. 166 - 183
ISSN 0717 - 3997 / 0718 - 3607

Ave. has, makes one think that the remodeling of Pocuro Ave. has had an important impact on this phenomenon. Now, all architectonic projects in Chile must pay building rights to be built, rights that are defined by Minvu (Ministry of Housing and Urbanism) for the entire country and updated on a half-yearly basis by the accumulated inflation. Conservatively assuming that these buildings are category B3, the category of most mid and high segment residential projects, the council received for each one of the "additional" 131,743 m^2 built on Pocuro Ave. versus Carlos Antúnez St., $3,019 in municipal rights (1.5% of the referential value of the table for category B3 in the first semester of 2018, which was $201,316 Chilean pesos). Thus, the payment of municipal rights to December 2018 of the buildings built on Pocuro Ave. was almost 397 million pesos, equivalent to 98.5% of the cost invested in 1997 to remodel the avenue (considering the cost of the works adjusted by the accumulated inflation to October 2017).

Regarding street use, a total of 1,665 people / hour was detected, with a minimum of 860 people / hour between 10 and 11 pm, and a maximum of 3,070 people / hour, between 7 and 8 pm. On Saturday, an average estimate of 940 people / hour was recorded, and a totally different movement distribution to the weekdays. Just as figure 6 shows, on Saturday the flows were concentrated in the morning, peaking between 1 and 2 pm (1476 people / hour). On average, women represented 36% of the users of Pocuro Ave., reaching 37% and 38% on Wednesday and Saturday, respectively, in the 10 to 11 pm interval. Regarding the activity, jogging and walking represented 15% and 25% respectively on the weekday, while 60% circulated on bicycles. On Saturday, cyclists represented 45%, while those jogging and walking represented 29% and 26%, respectively.

On the weekday, cyclists were concentrated in the morning (76% between 8 and 9 am and 73% between 6 and 7 pm), while those jogging were concentrated before 8 am and after 8 pm. Finally, walking was concentrated around lunchtime. On Saturdays, activities on Pocuro Ave. changed little. For example, joggers were seen in the morning (48% between 8 and 9 am), while cyclists rode before lunchtime and after 9 pm, and walkers were concentrated during the afternoon. Figure 7 shows these differences. Regarding the age of the users, it was detected that the elderly (65 and above) represented a little over 4% on the weekday and 4.4% on Saturday. They tended to concentrate around midday, representing 17% of users in the 12 to 1 pm period. On Saturday, unlike the weekday, the elderly used the street less intensively, representing 9% in the 10 to 11 am period.

Figure 7: activity performed by people on Pocuro Ave.

Shop keepers (both traders and owners), valued the presence of the linear park and cycle path as beneficial for commercial activity. The vitality of the path and its sporting nature had led to events like the CicloRecreoVia (Recreational Cycle Path) on Sundays, an aspect that was highly valued by store keepers. *"I feel that all that [the Pocuro linear park and cycle path] is positive, and what I have seen in the last … I would say 6 years, is that bike use has increased. You see more families doing sport, the southern sidewalk is closed on Sundays and is full of people. It's completely improved the quality of life"* (woman, owner of a gift shop, 52 years old). In fact, the family nature that Pocuro Ave. and its linear park has taken on is accentuated on Sundays. This is taken advantage of by shops like cafés, bookstores or corner shops. *"A lot of people go by, at least a lot across the street, there's a lot of people at the weekend, a lot of families. Pocuro is closed on Sundays and it's a family festival with babies and bikes"* (man, 42, owner of a framing workshop).

The presence of good quality walking and cycling spaces has had a positive impact on commercial activity. When asked about how customers came in, those interviewed answered that a good part did so on foot, and that at the weekend many did so on bicycle. *"On foot, for the neighbors. I would say most do so on foot. They also come by car, but that would be 30% at most. A lot come by bike, more by bike than car, I would say. So, first walking, then by bike and finally by car"* (woman, 47, owner of a corner shop-café). Many users of these stores are elderly, who use the spaces to walk as of 11 in the morning, especially in the week, although several mentioned the importance of young families, single residents, and construction workers as shop customers. *"Our niche is basically based on two aspects, one is the construction workers who, on one hand, activate the business during lunch hours. And during the afternoon, it's the families, people on their way home, because all this is perfect let's say, I mean, it's good to pick things up on the way home and then get home to eat them".* (man, 20, son of a corner shop owner).

V. CONCLUSIONS

The transformation of Pocuro Ave. seems to have led to a change of trend in real-estate development on the street, converting it into a very attractive space for the residential activity of buildings aimed at medium-high segments, especially young professionals. The presence of these new residents has attracted the setting up of cafés, bookstores or specialized stores, just as reported recently by Morcillo-Alvarez (2017) for the Spanish case, who states that urban investments in recent years have basically led to an increase in consumer-related services. Future research should explore whether this type of project has forced traditional residents out or reduced the social heterogeneity of the users of Pocuro Ave., or to explore the mechanisms used by the property developers to buy properties located on this road.

Real-estate development has managed to recover almost all the initial investment made by the council, incorporating to December 2017, a total of 1,171 apartments and a little over 175,000 m^2. Although this is not related to what is known as the

EFECTOS URBANOS DE LA CONSTRUCCIÓN DEL PARQUE LINEAL Y CICLOVÍA POCURO, EN SANTIAGO
RODRIGO IVAN MORA VEGA, VICTOR ROCCO
REVISTA URBANO Nº 41 / MAYO 2020 - OCTUBRE 2020
PÁG. 166 - 183
ISSN 0717 - 3997 / 0718 - 3607

recovery of capital gains, since the revenues collected are not the result of the valuation of real-estate resulting from public investment (Smolka & Amborski, 2003), the results, from a council point of view, are similar, which allows thinking in new ways of financing for Chilean and Latin American cities. For example, the recently introduced Public Space Contributions Act, where property developers have to finance improvements to communal public space to build their buildings, may be an interesting mechanism for the expansion of infrastructure like linear parks or cycle paths, similar to those built on Pocuro Ave. In fact, the results of this research show that, rather than investing in improving the conditions of those who own cars, the councils should prioritize improving public space and building infrastructures for walking and bicycle riding.

Following current research made in Chile (López-Morales, Gasic-Kleitt & Meza-Corvalán 2012), the increase in land value was mainly captured by the property developers who bought the manor houses located on Pocuro Ave and who sold new apartments, but not by the original residents. This suggests that the rent gap capture processes are not limited to central middle-low class neighborhoods (López-Morales et al, 2012), but also to well-off middle-class sectors. The latter emphasizes the need of implementing regulatory mechanisms that allow counteracting the negative implications of property speculation in residential areas.

A second effect of the construction of the Pocuro linear park is related with the validation of the bicycle as a means of transportation in well-off sectors of the capital. Until 2001, bicycle trips were concentrated in fringe districts of Santiago, specifically in the south of the capital, with 26.4% of the trips, while the eastern area had a little over 10% of the trips (Waintrub, Rossetti, Oliva, Galilea & Hurturbia, 2018). In 10 years, bicycle use in the eastern sector increased nearly sevenfold (Sectra, 2012). Here it is suggested that building the Pocuro linear park (and its cycle path) could have had an important effect on this process, on introducing a new “lifestyle” in the eastern sector of the capital, a more cosmopolitan, diverse and modern style, which has also occurred in other sectors of the city (Matus, 2017). In this sense, those in charge of urban planning in the Municipality of Providencia outline that the success of the Pocuro cycle path opened the way to build new cycle paths over the following decade. Future research should explore this hypothesis or investigate the cultural phenomena associated to using bicycles in the sector.

A third aspect of interest refers to the use of the public space by different groups. In this regard, the use of the street by women, even after 10 pm (one must consider that the flows were measured in winter), suggests that the central reservation is perceived as safe by those who use it. Unlike other analysis made in Chile (Paydar, Kamani-Fard & Etminami-Ghasrodashti, 2017; Mora, Greene & Reyes, 2018), which detected a higher perception of insecurity from women, the results outlined here suggest that the construction of cycle paths associated to recreational spaces could help improve the safety of neighborhoods.

Finally, the results bring the positive implications of implementing binding citizen participation mechanisms at a district level to light. As was mentioned above, the Pocuro linear park was chosen by the neighbors themselves and discussed on later occasions with them, a novel aspect in Chilean urban planning. This contributed to its acceptance by most of the neighbors and to it being built in a limited period of time. In a context of the general reduction of citizen participation nationally (Herrmann & Van Klaveren, 2015), this indicates that one of the mechanisms to increase the democratization of Chilean society is improving citizen participation at a local level (Sagaris & Landon, 2017).

Ultimately, the results suggest that the transformation of Pocuro Ave. has resulted in a more intensive and diverse use of the street, contributing, at the same time, to the commercial development along its sidewalks. This development has managed to pay back the costs associated to the investment, which allows inferring that this type of investment may be highly positive for local governments.

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