

## **Territorial analysis of mobility in the Greater Santiago Metropolitan Region - May 2020**

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This document corresponds to the territorial analysis carried out by the Complex Engineering Systems Institute (ISCI) that accompanies and gives depth to the third mobility report that ISCI delivered on June 11 regarding the impact that quarantines have had in the Metropolitan Region (see Report 3 at <https://covidanalytics.isci.cl/reportes/>). As with previous reports prepared by ISCI related to the impact of quarantines on the flow of people, the mobility of people is strongly influenced by socioeconomic determinants. In this sense, this report delves into factors such as the presence of supply channels (open-air markets), land use, and socioeconomic levels.

Our hope is that this series of territorial analysis reports, together with the mobility reports, contribute to the design and evaluation of mitigation strategies for the health and social crises that affect us as a result of the COVID-19 pandemic.

### **1. Methodology**

In order to visualize the impact of quarantines in the different boroughs of the Greater Santiago Metropolitan Region, we analyzed the journeys of the region's inhabitants using statistical data and information on the use of telecommunications infrastructure, delivered anonymously and aggregated by Entel, grouped on a census area level<sup>1</sup>. For each working day (Monday to Friday), the flow from each "household census tract" (corresponding to the area where people are frequently found outside of work hours) to other areas during work hours was quantified. These flows can be within the same borough or to other boroughs (but outside the home zone), so the

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<sup>1</sup> For a confidence interval of 99%, under a Mann-Whitney nonparametric U test of different media.

interpretation we give to this movement is associated with labor and supply activities. Subsequently, the weekly averages of these flows (excluding weekends) are calculated on an aggregate borough level.

From the aforementioned analyses, the mobility parameter “**departures**” was generated, which measures the number of journeys that leave a census tract and is what is reported – in terms of its variation – in the three previous mobility reports. On this occasion, the focus is on the “**entries**” metric. That is to say the number of trips from other census areas to the census area under study. This metric is relevant to help understand the causes of observed mobility.

For the purposes of measuring the variation in mobility, the first two weeks of March 2020 were considered, prior to the declaration of Phase 2 of the COVID-19 pandemic in Chile (“base” week). In this way, there is a relative and comparable approximation that accounts for the usual inputs to each zone.

## **2. Spatial analysis of possible causes that contribute to mobility**

In the search for causes that explain the mobility of people, supply areas are examined to acquire basic necessities, work areas, service areas, and household areas according to socioeconomic levels. Methodologically, shopping at open-air markets is analyzed as it is the main supply channel of fresh produce for people, classification of land use (office, public administration, commercial, and industrial), and socioeconomic groups (SEG) from the 2017 census separated into upper-middle (ABC1 and C2) and low (D and E) groups.

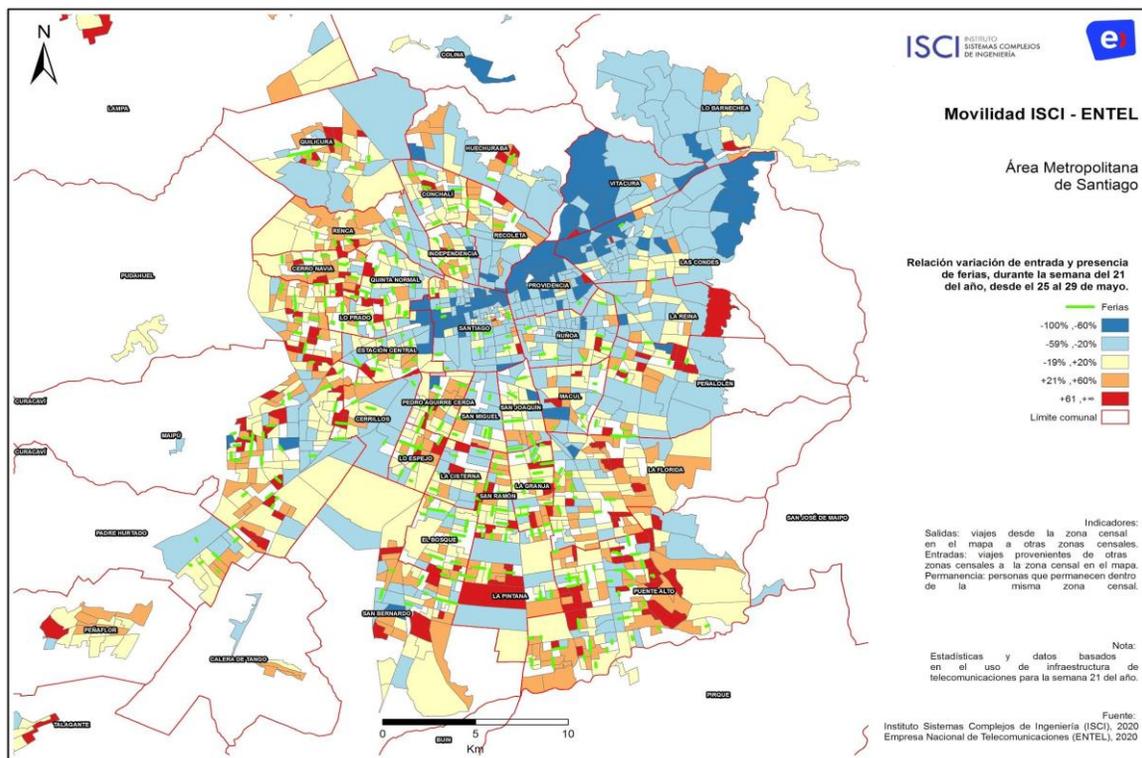
### **2.1. Variation of entries and shopping at open-air markets.**

The analyzed metric “entries”, presented in Figure 1, shows that in those areas that are usually more gravitational for work reasons (Santiago, Providencia, and Las Condes), entries fall by 60%, while in the rest of the city an increase in entries is detected, generating replacement centralities greater than 60%, especially along the Américo Vespucio orbital route.

For their part, open-air markets account for the most relevant supply channel for fresh products for the nation's urban population. Its spatial distribution in the urban area of Santiago is high and homogeneous in low-income communities, while its presence decreases in high-income communities. Additionally, Figure 1 also shows an overlap of the location of open-air markets

in relation to the entrance metric defined by ISCI. In this context, markets are located in census areas with a predominance of medium and low SEG. A spatial relationship can be inferred between areas with variations in inputs greater than 20% and in some cases greater than 60%, with these differences being statistically significant<sup>2</sup>. This situation increases in areas of the western sector of the city such as Pudahuel, Cerro Navia, and Maipú, as well as in the south and southeast sectors like Puente Alto, La Pintana, La Granja, San Ramón, San Bernardo, and Lo Espejo.

**Figure 1 – Spatial distribution of the Rate of Entries in the Greater Santiago Metropolitan Region and Open-air Markets.**



Source: Prepared by the authors based on telecommunications infrastructure data.

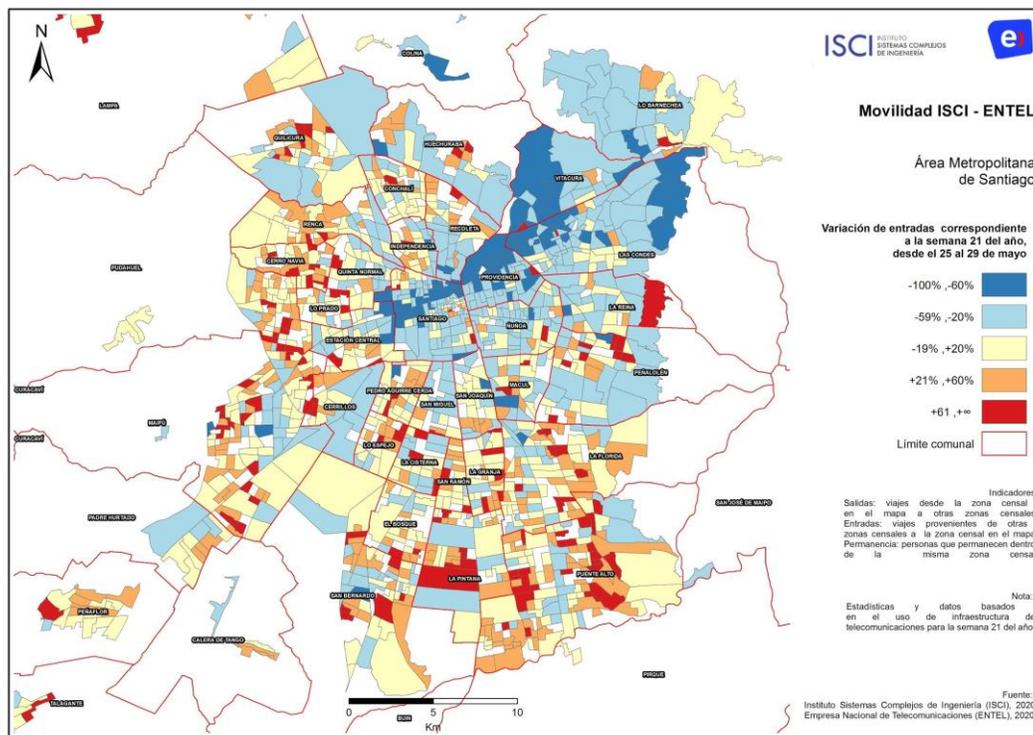
<sup>2</sup> For a confidence interval of 99%, under a Mann-Whitney nonparametric U test of different media.

## 2.2. Socio-economic status

The first partial confinement measures decreed for high-income boroughs (March 25) – which concentrate a significant number of commercial activities – affected the habitual configuration of travel and the urban mobility structure of Santiago. The areas that concentrate entries have now been replaced by other sectors of the city, generally with a different socioeconomic configuration to the initial one (Figure 2). In this sense, the floating population (journeys related to work, study, administrative errands) and consumer of goods and services are no longer travelling to these boroughs, instead accessing these goods and services locally, drastically changing the focal points of mobility. Additionally, many people are unable to access work due to quarantines or they work remotely.

Regarding SEGs, a negative association of entries is observed with the proportion of households in the ABC1 and C2 groups, ( $r = -0.453$ ;  $p\text{-value} < 0.01$ ), while the entries are positively related to the proportion of people from groups D and E. ( $r = 0.394$ ;  $p\text{-value} < 0.01$ ).

**Figure 2** - Spatial distribution of the Rate of Entries in the Greater Santiago Metropolitan Region.



Source: Prepared by the authors based on telecommunications infrastructure data.



### 2.3. Land use

Land use represents the activity that takes place in an area or space in the city. The variation of this activity in relation to the input indicator allows us to understand the current urban dynamics compared to the base week.

In those census areas of a predominantly commercial use, public administration and offices show a reduction in entry flows, mainly around the Alameda and Avenida Providencia road axes and the Ciudad Empresarial business sector in Huechuraba (office cluster). Residential areas have increased this indicator, which implies a marked change in the movement pattern of inhabitants (Table 1).

Census tracts of industrial use show modest negative variations of 6% in the influx of inhabitants. For their part, those areas of predominantly educational and cultural use show significant reductions of around 32%. This decrease can be seen in sectors such as Barrio República in the borough of Santiago, the university cluster of the borough of San Joaquín, the Andrés Bello Campus of the Universidad de Chile, and the headquarters of the Pontificia Universidad Católica (see Figure 2).

**Table 1** – Principal land use by census tract and the average variation in the “Entries” indicator.

Land use	Variation
Offices	-56%
Education and Culture	-32%
Public Administration	-30%
Commercial	-23%
Industrial	-6%
Residential	13%

Source: Prepared by the authors based on telecommunications infrastructure data.

### **3. Conclusions**

The trend observed until the last week of May continues to show the disparate effects that quarantines have had in the boroughs of the Greater Santiago Metropolitan Region, which for the most part are differentiated by the socioeconomic characteristics of the people and the land use of the zones in the different boroughs. Census tracts made up mostly of middle- and high-income households have seen a significant reduction in income compared to those areas made up of lower-income households.

On the other hand, there are census zones with a positive variation of entries with open-air markets, in particular those sectors with a medium to low socioeconomic income.

Finally, commercial and service areas have reduced the incoming flow, as well as those for education. It is relevant to mention that the industrial zones have varied their entries modestly in contrast to the increases of predominantly residential boroughs.