

'DE ALUGUNA MANERA, LLEGAS':
USING GEOGRAPHIC INFORMATION SYSTEMS AND
THE GOOGLE DISTANCE MATRIX API
TO ESTIMATE THE PUBLIC TRANSIT ACCESSIBILITY OF
PRECARIOUS SETTLEMENTS IN
METROPOLITAN BUENOS AIRES, ARGENTINA

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Abstract

TO BE COMPLETED.

Part I: Introduction

Despite their quotidian nature, urban transportation systems have an indisputably vital role in contemporary human society. Without transportation, it would be impossible for people to reach essential daily sites of employment, education, public services, healthcare, and family (Cervero, 2011; Guzman, et al., 2017). In fact, its role as a facilitator of accessibility is perhaps its most important function. Transportation services, modes, and infrastructures are the means for people to traverse distances and reach strategic activity sites and, in an ideal setting, they fulfill this role equitably, ensuring that all people—regardless of their socioeconomic background or location—can access any other destination within a metro area within a reasonable amount of time or cost.

Nevertheless, this is rarely the case, with accessibility levels varying throughout the territory of a city or region. In such cases, the transportation system—and its many components, public and private—prevents, or even impedes, some members of the public from affordably making trips across the landscape while sanctioning, and even promoting, mobility for others. For those belonging to the former group, poor accessibility can have deleterious consequences: social isolation, underemployment, poverty, worsened health, and poor education. When these transportation links are suboptimal—whether measured by financial cost, time, discomfort, or insecurity—people are at risk of exclusion from participation in urban life.

Concerns about the negative impacts of a substandard transportation system on accessibility are most acute when those burdens overwhelmingly disadvantage marginalized groups of people, like the poor, women, racial minorities, and the disabled. Some of the most mobility-limited people in a society, publicly-available transportation services are often the only link between these groups and the benefits that come with participation in city-life. Oftentimes these links are ignored or neglected by authorities, especially when marginalized groups lack proper representation needed to shape transit policy in the face of stronger, more politically-influential mobility interests. In turn, there is great merit in studying these inequalities, helping to produce policies and planning strategies that circumvent such inequalities. Such concerns have been noted, as evidenced by their inclusion as a United Nations sustainable development goal for the provision of “access to safe, affordable, accessible, and sustainable transport systems for all ... notably by expanding public transport, with special attention to the needs of those in vulnerable situations (11.2).”¹

Buenos Aires, Argentina—the focus of this study—is one of many cities where these concerns about transportation, accessibility, and inequality are prescient. As with many other cities in the Global South, where transport “conditions remain highly inadequate for most of the population ... [with] low accessibility, poor public transport supply, accidents, discomfort, pollution, and congestion,” metropolitan Buenos Aires’ territorial landscape is marked by inequalities related to income, housing, education, transportation, and access (Vasconcellos 2001). Perhaps no better illustration of this characteristic are the hundreds of informal, precarious settlements found in its urban periphery. Known as *asentamientos*, they are illegal communities settled by low-income

¹ <https://sustainabledevelopment.un.org/sdgs>

families, situated in isolated, environmentally-precarious locations, and lack access to most common services, like plumbing, electricity, sewerage, and—as is widely suspected—*transportation*.

Emblematic of structural inequalities that plague Latin American cities, the *asentamientos* represent the struggles for access to the city faced by marginalized peoples, especially in the face of a substandard offering of transportation services. Originally founded as communal refuges for families forcibly evicted from the shantytowns of Buenos Aires' urban center, they exist on whatever land their residents found available, oftentimes along riverbanks or other undesirable tracts of land in the city's suburban fringes, peripheral locations inherently isolated from the region's established core. Public transportation services, deteriorated by decades of mismanagement and characterized by services inefficiencies, have not followed the *asentamientos*, leading many to speculate that the *accessibility* of Buenos Aires' *asentados* is being inhibited by a dearth of effective mobility options. That the wealthier, "motorized" classes of metropolitan Buenos Aires have seen great improvements in the speed and cost of their mobility conditions during the same time period only exacerbates concerns about suspected inequalities.

Nevertheless, there are no existing studies that specifically attempt to document the existence of inequalities of access between the *asentamientos* and their surroundings. In turn, there is a clear and present need to thoroughly and robustly analyze the degree to which the existing transit system equitably meets the multifaceted accessibility and mobility needs of these zones' critically vulnerable inhabitants. The purpose of this paper, therefore, is to quantify the *accessibility* levels of these communities—vis-à-vis the regional public transportation network—and illustrate the degree to which these inequalities exist. As such, I seek to answer the following questions:

- Within metropolitan Buenos Aires, do the *asentamientos* enjoy worse public transit-facilitated access to important activity sites (e.g. employment sites, public health care, public schools, etc.), measured in travel time, than other parts of the conurbation?
 - Does accessibility vary across the conurbation and those departments characterized by different degrees of urbanization (e.g. totally urban, mostly urban, and partially urban)?
 - What explains the variability (or lack thereof) of accessibility (a) between the *asentamientos* and traditional neighborhoods and (b) between these formal and informal communities across differently-urbanized parts of the metro area?

This study is a direct answer to a series of calls made by geographer David Keeling, an expert on transportation systems in Latin American and Buenos Aires. For instance, he believes that, "Latin America should offer fertile ground for studies of **accessibility**, mobility, infrastructure, and transport policies... [and] more research is needed on accessibility and mobility in megacities like... Mexico City, Sao Paulo, and **Buenos Aires** (2008, pg. 103-104)." He also beseeches researchers to consider similar questions about the region's spatial mismatches in the supply and demand for infrastructure and accessibility services, socio-economic and political origins and impacts of projects, spatial impacts of transportation infrastructure, and livelihoods of those people living in

the precarious informal communities that exist along the peripheries of all major Latin American cities (2002, 2008, 2013).

At the same time, I also answer a methodological call for a greater incorporation of GIS and mixed-methods approaches into Latin American-based transit research (Keeling 2008). In fact, these are this paper's primary contributions, especially its incorporation new travel time data. I use Google's Distance Matrix API web tool to query its servers for estimations of transit-travel times within Buenos Aires, a novel approach that relies on their recently-digitized archive of transit schedules from across the metro area. Using these data, I can get realistic estimations of travel times for trips made using public transportation, an unprecedented operationalization of *accessibility* in AGBA. Rather than considering access as just a factor of distance, I can understand the role of **time**, far more impactful on individual access to destinations. The adoption of such methods fulfills one other plea: that results are provided to governments and planning agencies, making them aware of the problems of suboptimal accessibility in their communities. By selecting a simplistic, easily-understood accessibility metric (i.e. the minimum time between each community and its nearest opportunity sites), I can accomplish this goal.

In the subsequent pages, I present the background, literature review, methods, results, and findings of my study. I begin with an overview of the study area, which includes Buenos Aires' metropolitan region, its transportation system, and its *asentamientos*. I take a geographical and historical perspective, highlighting how the current situation, and its territorial configuration, are the result of decades of political decisions (and indecisions) regarding housing, transportation, and urban growth/land use management. Then, I review the literature on *accessibility*, focusing on its definition, policy relevance, and prior applications, especially in Latin America. Next, I overview my methodology, which includes the application of the Google Distance Matrix API web tool for calculating travel times. After discussing the statistical tests that I performed on these data, I summarize and analyze my results, contextualizing within Buenos Aires' urban geography. I culminate the piece with a few concluding remarks on the state of transit-facilitated accessibility in the *asentamientos* of Buenos Aires and suggest some directions for future investigation.