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RECONDITIONING TRAIN TO SUBWAY: planning and design tools based on sustainable urban mobility in Rio de Janeiro, Brazil

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This work addresses the following topic(s) from the Call for Contributions:
(Please check at least one box)

- Placemaking to integrate urban spaces and mobility
- Promoting sustainable mobility choices in metropolitan regions
- Governing responsible mobility innovations
- Shaping the transition towards mobility justice
- System analysis, design, and evaluation
- other: _____

Extended Abstract

Problem statement

Since 1940s, the expansion of big Brazilian cities has mainly been driven by the development of highways and the increased use of automobiles, with commuting as a key factor in organizing intra-urban spaces (Villaça, 2001). In Rio de Janeiro, at first, urbanization was predominantly concentrated in central areas, expanding afterwards to the suburbs, process facilitated by the railway system, which encouraged settlement near railway stations (Prefeitura do Rio de Janeiro, 2021) (Figure 1).

Rio de Janeiro is divided into five administrative areas, with the south zone, where the beaches are located, having the highest income concentration, while the north zone is much less privileged in financial and urban infrastructure; and, between these zones, the downtown area, that contains most of the city's jobs. This creates a clear socio-spatial segregation, worsened by a lack of integrated transport and land-use planning and contributes to the ongoing metropolitan expansion and loss of urban density, leading to a predatory territorial expansion model (Magalhães and Izaga, 2017).

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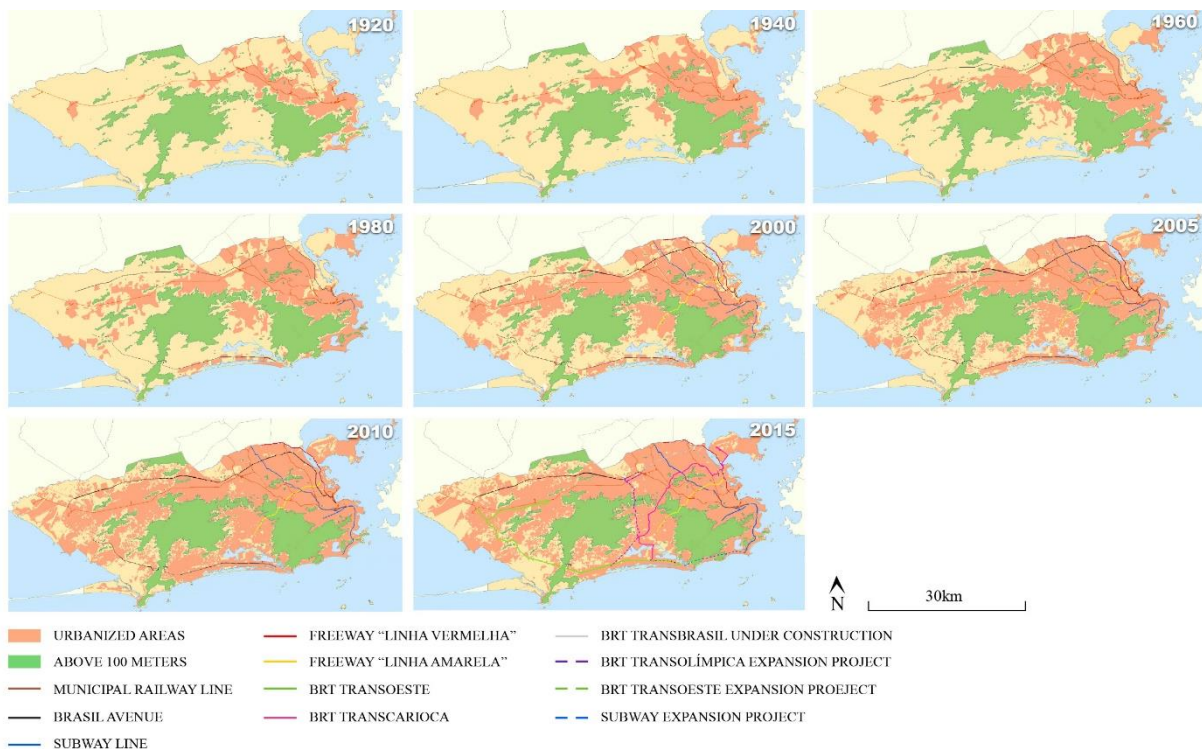


Figure 1: Urban area's evolution in Rio de Janeiro. Font: DataRio.

Data from Brazil's 2022 census showed that the population density has decreased and is expected to stabilize from 2040 onwards in Brazilian metropolitan cities (IBGE, 2010), however the demand for housing and urban infrastructure persists and tends to increase (Magalhães and Izaga, 2017). Therefore, maintaining the current urban occupation model could result in the expansion of the city to further peripheral areas, reducing density in consolidated areas and increasing the need for infrastructure, transport and public services.

Thus, it is evident that the challenge for the next generations in Rio will be to stimulate urban density in the already urbanized territories with the aim of restraining urban sprawl (Magnabosco, 2018). Given the interdependence between transportation and land use planning (Straatemeier and Bertolini, 2020), it becomes essential to adjust and integrate these planning strategies, by stimulating housing densification through the implementation of infrastructure that enable greater accessibility in these urbanized territories and, consequently, to promote equity, social integration and city adaptation to contemporary urban and environmental requirements as a condition, even for, its own existence.

Research objectives

The present design proposal starts with this question: 'how to attenuate urban housing deficit without urbanization expansion, whilst meeting new housing demands?' The objective is to develop a possible practical and conceptual response through a meta-project of reconditioning a train line to a metro line in the suburbs of Rio de Janeiro, Brazil, to contribute for integrated multi scale strategies and planning and design tools based on sustainable urban mobility.

Methodological approach

The methodology is based upon research through design (Luck, 2019; Lenzholzer *et al.*, 2013; Hauberg, 2011) framed by the concepts of contiguity (Magalhães, 2005) and accessibility (Levine, 2019; Straatemeier and Bertolini, 2020), to develop a strategy to restrain urban expansion. A meta-project considering mobility transformation and public space requalification is then proposed as a plug-in urban design typology (Lang, 2005) to promote urban density, taking advantage of the network and pre-existing railroad line structure, which no longer responds to current urban demands - transforming it into a subway line - in Olaria District, located in the north zone (Planning Area 3) of Rio de Janeiro.

(Expected) results and perspectives of implementation

Olaria is a relatively low built density district in Rio de Janeiro, in spite of the presence of the railroad line, which plays an important role in the daily commuting of its population, towards the downtown area. In order to increase accessibility and promote density in consolidated urban areas, Olaria district was chosen as a reference case for the subway station project that could be replicated along the Saracuruna branch railroad line and in other territories of the Planning Area 3 (AP3) (Figure 2).

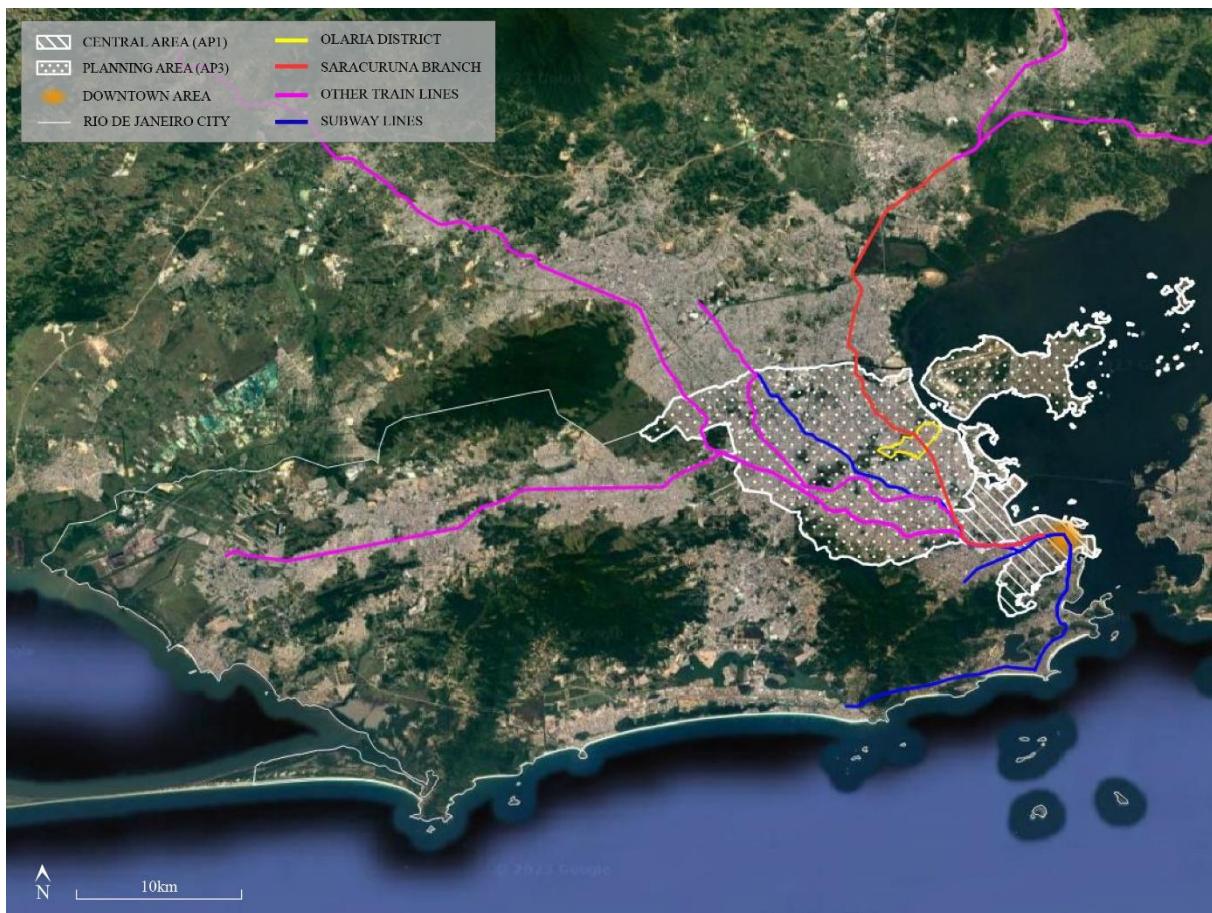


Figure 2: Olaria district, planning area, subway and railroad lines in Rio de Janeiro. Font: Authors, 2023.

The project consists of a subway station, intended as a meta-project, which means it is not a finished plan, but a set of rules that offers multiple combinations for an indefinite possible variants and procedures. Hence, the final plan is a flexible scheme as well as a (meta) project itself, to set in motion a proposal and trigger communication with stakeholders, main agents and organized society.

It is formulated by the main element of a large ramped structure, which in addition to having the subway station's function is also a large public space that connects two parts of the neighborhood that are crossed by the train (Figure 3). In this space, green and paved areas, covered and uncovered, will be implemented for leisure and commercial activities, with the aim of providing connectivity with surrounding areas, offering accessibility at multiple scales in the territory (Figure 4).



Figure 3: Model design implementation. Font: Authors, 2023.

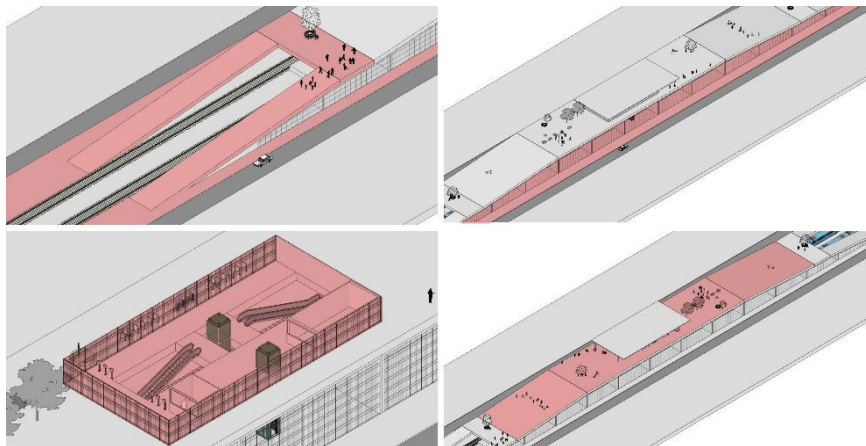


Figure 4: Model subway station design. Font: Authors, 2023.

Bearing in mind the strategy urgency to meet current urban demands while curbing the expansion of the city's edges, and the need for intra-urban integration in the city of Rio de Janeiro, the meta-project of transforming the train line into a subway in Rio de Janeiro is a possible project to improve accessibility and to promote density in the already urbanized city. The project is a research through design aimed at rethinking actual guidelines of city planning foreseeing future housing demands, providing greater accessibility and preventing growing segregation and precariousness in peripheral areas in Rio de Janeiro, Brazil.

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