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Title: Public Transport Network Resilience Across Different Urban Forms

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Investments in public transport (PT) in cities are an effective measure to both decrease negative externalities of private transport and increase accessibility for different categories of citizens. However, inefficient planning could negatively affect the resilience of the network. Moreover, cities differ greatly in their urban structures. There is significant literature on the effects of urban form on different variables. Despite that, there are limited studies analysing its impact on transport network resilience. This study aims to fill this gap. To do that, I analyse three cities having different urban forms: a monocentric city, a polycentric city, and an "elongated" city, whose form stretches in length, and perform a resilience analysis of their transport network through the simulation of different disruption scenarios. This work considers both public transport (PT) and bike-sharing (BS) networks, since the latter could alleviate the impact of PT disruptions, improving its resilience. To select the cities, I use different indicators. For monocentric and polycentric cities, I adopt the Urban Centrality Index of Pereira et al. (2013). On the other hand, for elongated cities, I adopt the Shape Index of Medda et al. (1998). For each city, I measure resilience through a connectivity analysis of the transport network. The analysis considers both unweighted and weighted networks. For weighted networks, an Origin-Destination (OD) matrix, measuring flows, is required, although it is rarely available online. Otherwise, it needs to be simulated, using different methodologies. In this study I adopt the following two: the first one is to disaggregate aggregate mobility data available online and simulate individual behavior through agent-based models. The second one is to simulate OD data through G1ODGEN, a data generator developed by Rong et al. (2025) simulating networks using satellite images. To perform the resilience analysis, I follow the approach of Malandri et al. (2023) using their SmartHubs Resilience Tool. To build the PT network of each city, I use GTFS data. BS networks are simulated with different methods depending on their nature (free-floating vs. station-based). Network resilience is measured through indicators of efficiency, accessibility and centrality of each node. Results of this study will be useful for policymakers to understand how to plan mobility interventions in cities with different urban forms. This study will also help policymakers deal with the case of elongated cities, which cannot be fully integrated into the monocentric or polycentric framework.

Keywords: transport, resilience, bike-sharing, urban form