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From Gridlocks to Greenways: Analyzing the Network Effects of Low Traffic Neighborhoods

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Extended Abstract

Cities around the world are facing the challenge of creating more livable environments for their citizens. With growing populations and increasing car dependency, cities are experiencing problems of congestion, pollution, and accidents. In response, urban planners and policymakers are exploring new solutions that prioritize sustainability, health, and well-being. One such approach is the concept of low traffic neighborhoods (LTNs), which restrict or reduce through-traffic in residential areas, creating more pedestrian-friendly spaces. This approach aligns with the idea of 15-minute cities, where citizens have access to all their needs within a 15-minute walk or bike ride. As Carlos Moreno puts it, ”the rhythm of the city should follow humans, not cars” [5]. Also, turning a whole city into LTNs has been examined before for the impacts of pollution and proven effective [4], as has been the negative impact of cars on our health been quantified [1].

This work in progress study aims to explore the potential impact of low traffic neighborhoods (LTNs) on a city's transportation network and to develop an approach for implementing LTNs that minimizes travel time increases. To achieve this objective, we pose the following questions:

- How would it impact a city if all of it were LTNs, and what network metrics can be used to evaluate this impact? We will analyze network metrics like directness, global/local efficiency, and edge centrality, to compare the transportation networks of different cities with and without LTNs.
- How can we implement LTNs without significantly increasing travel times? This is a crucial question, as for the justification of implementation, the deviation of the status quo is a deciding factor. A big increase in travel times for private car transport would discourage the political implementation of this plan. Our aim is to optimize the placement of traffic restrictions within a city's transportation network, ensuring that travel times do not increase significantly. In any case such solution would promote sustainability, health, and well-being.

To achieve our objective, we use a computational approach to model and analyze transportation networks. We leverage open-source data from OpenStreetMap (OSM), using OSMnx [2], to create network models for multiple cities across different continents, of varying sizes and cultures. Our method assumes that LTNs have no through-traffic, meaning that drivers will have to take alternative routes to reach their destination. To ensure that our approach can be used by cities with diverse resources and needs, we develop a tool that is affordable, user-friendly, and can be easily customized to fit specific urban contexts. This tool will enable urban planners and policymakers to identify the optimal placement of traffic restrictions while minimizing the impact on travel times. By doing so, we aim to promote equitable and sustainable urban development, regardless of a city's size or socioeconomic status.

Our method for evaluating the impact of LTNs on a city's transportation network involves three main steps: finding an approaches that automate the placement LTNs or from the opposing perspective, that sparsify the drivable street network. Secondly, building a framework for evaluating the approach, and comparing network metrics across multiple cities. We explore multiple approaches for the transformation of a city's transportation network into LTNs. We consider approaches that assume a fixed number of LTNs, minimal/maximal block sizes or other desirable constraints. We compare the effectiveness of each approach and evaluate them based on our objectives. To evaluate our approach, we have already built an adaptable framework that calculates the network metrics of directness, global/local efficiency to compare the impact of LTNs. The framework uses OSM data to create network models. We use this framework to simulate the impact of LTNs on a range of cities [3] and compare the effectiveness of different automation approaches.

Looking ahead, we may also explore the placement of network filters such as bollards to automate the suggestion of implementation measures. This will allow for a more comprehensive approach to designing low traffic neighborhoods and could lead to even more effective and efficient solutions. The results of this study can inform policy decisions related to transportation planning and sustainability, and can help to create more livable and sustainable urban environments for all citizens.

References

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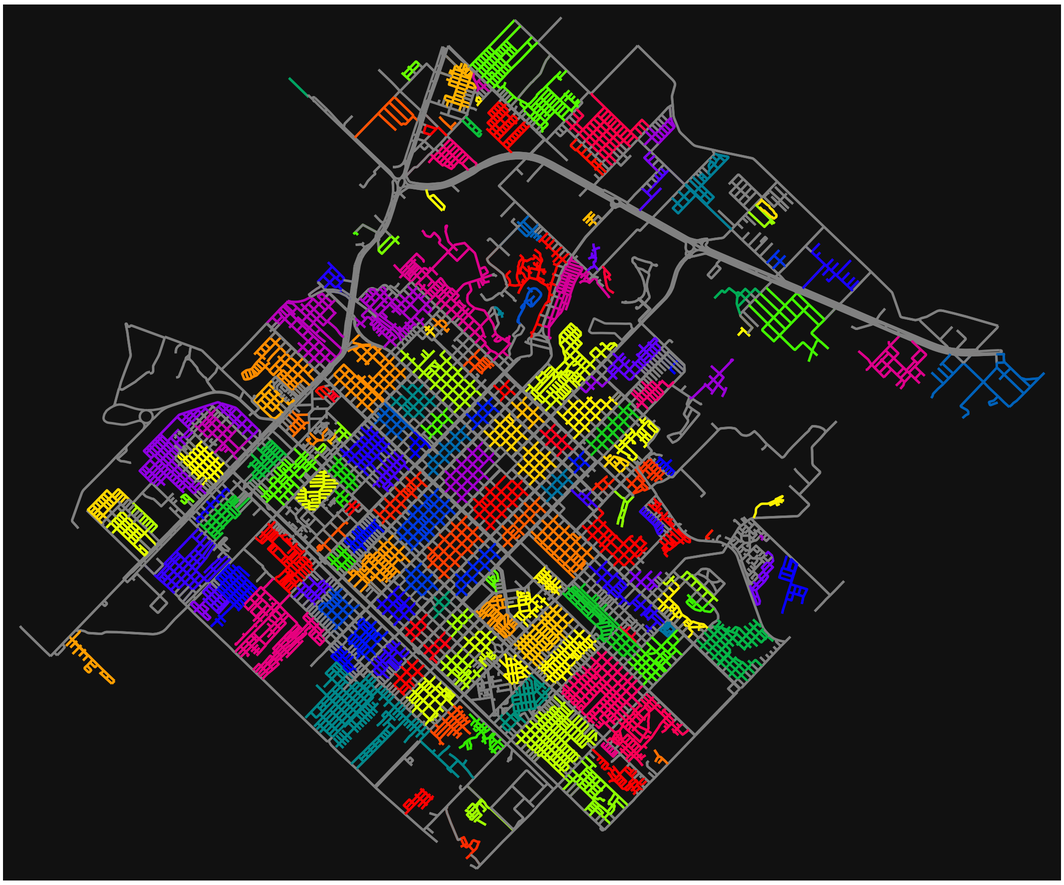

Figure 1: This map shows a partitioning of Resistencia, a city located in the Chaco province of Argentina, into low traffic neighborhoods (colored) and a drive-network (gray). The total area of the city is 562 km^2, and it has a population of approximately 291 thousand inhabitants.