Improving Freight Movement: Location of Urban Transfer Centers for the Historic Center in the City of Quito

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Abstract: In many cities around the world, urban population growth is causing an increase in the demand for goods and services. This increase translates into several logistical challenges for both municipalities and businesses, who are seeing a greater and more complex number of logistical activities required, especially during last mile distribution. The city of Quito-Ecuador is currently facing these challenges as it expects to have 75% of its population living in urban areas by 2050. Moreover, there is a lack of comprehensive urban planning in the city and well-designed freight-related public policies that meet the city's needs and requirements. One critical issue that is being analyzed is the pedestrianization and thus the prohibition for vehicles to access the most chaotic sector of the city, the Historic Center. It has approximately 3975 stores within a square kilometer therefore it embraces much of the commerce in Quito. The goal of this paper is to present how to implement the solution of urban transfer centers by applying mathematical models to determine the number and location of these facilities in such way that they minimize the maximum distance travelled from these potential locations to historic center shops. These transfer centers will locate outside the restricted zone, where companies can transship freight to less-disruptive, eco-friendly vehicles allowed throughout a pedestrianized zone. To obtain the optimal locations, three different approaches and models were considered. The first one was a bounding circle outside the Historic Center without any additional restrictions, the second one was a bounding circle that restricted the most dense area within the Historic Center and the third model used a bounding shape that taking into account streets and restricted one the most touristic blocks. After calculating the optimal number and location of the facilities for each approach, the distance and time each delivery would need to take was measure using the Google Distance Matrix API. The models presented in this work can be adapted to specific requirements of policy makers and can help companies to continue with their activities with fewer challenges. The transfer centers will have a positive impact by reducing time traveled that will help an adequate flow of goods within this area.

Keywords: urban logistics, optimization model, logistics practices, transfer centers, last-mile delivery