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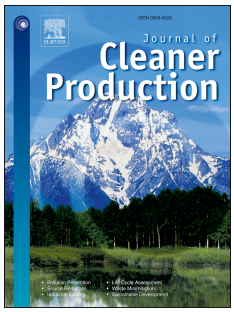

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The Accessibility Vehicle Routing Problem

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Abstract

In a distribution process where the demand relates to essential products or services, is important to consider the access for people to fulfill their needs. In particular, for land use and urban transportation planning, accessibility relates to appropriately allocating opportunities to satisfy a demand or provide a service considering the cost of mobility. Measuring accessibility is a challenging task, indeed, it depends on the context of the study and has not been properly considered in the definition of vehicle routing problems, which are commonly used to represent distribution processes. In the study reported here, we addressed a vehicle routing problem to optimize accessibility based on six indicators: the number of zones with access to opportunities with delimited mobility, the number of zones covered by the route, the cost of travel, the distance to the nearest opportunity, the number of opportunities, and geographical disaggregation. We defined a mixed-integer linear formulation for the proposed problem that we used to show the potential benefits of our approach compared with a maximum coverage vehicle routing problem for small instances. In turn, we designed an iterated local search algorithm and analyzed its efficiency according to a benchmark of randomly generated instances. Numerical results show that we obtain high-quality solutions for acceptable computational times.

Keywords: Accessibility, vehicle routing problem, mixed-integer programming, iterated local search

1. Introduction

Given the world's ever-increasing human population, the sustainability of planning and of the implementation of processes, whether in manufacturing, public services, or land use, among other fields, is important to guarantee equilibrium between populations and their ecosystems. To attain the desired characteristics of such activities, different indicators have been considered. Juwana et al. (2012), for example, have reviewed indicator-based water sustainability assessments, in which access to water resources for people was an important indicator.

In general, improving accessibility means guaranteeing more and better-allocated opportunities for people to obtain a service or meet a demand without relying as much on mobility and is therefore undoubtedly important from a socioeconomic perspective. Indeed, measures of accessibility have been applied to land use and transportation analysis, among other studies on socioeconomic factors. However, perspectives on accessibility differ depending on the context, and to the best of our knowledge, no consensus on the definition of the term or best measures for it exist. According to Geurs and van Wee (2004), any measure of accessibility should consider the impedance, or cost, imposed upon an individual to cover the distance between an origin and a destination, as well as the number and locations

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