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Improving the design of urban loading zone systems

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ABSTRACT

Despite the ubiquity of loading zones in most commercially dense streets of medium and large cities, there exists no generally acknowledged procedure to establish their number, location and management system. We propose a methodology divided in two steps, where the first one estimates the required number of loading zones on a given street and the second one locates them taking into account the delivery characteristics of the retail establishments they will be serving. The application of the methodology is tested in four streets in the Spanish city of Seville, following a retailer survey to collect all the relevant data. The results provided by the application in terms of number and location of loading zones are simulated together with other scenarios with different numbers of loading zones, and the outcomes are compared with the existing situation. The new methodology results in an improvement in the level of service provided with a similar – or smaller – number of loading zones, but most importantly causes a significant reduction in the distances between loading zone parking spaces and final destinations.

1. Introduction

All medium and large cities possess some type of infrastructure system aimed at facilitating the curbside operation of delivery vehicles. This infrastructure typically consists of specifically identified and reserved parking spaces called loading zones, usually subject to a series of restrictions of use in the form of availability periods, maximum standing time limits, etc. The local administration provides these loading zones normally in those areas where the affluence of delivery vehicles due to the density of retail commercial premises can represent an obstacle for traffic circulation if those vehicles cannot find a space available to park and deliver, always keeping in mind that the use of metered parking spaces is not an option in a sector with very low profit margins.

However, and despite the opposing facts that parking spaces are extremely scarce in the dense and commercial areas of cities and also that most cities consider this infrastructure as essential to ensure the smooth operation of delivery operations, there is not a clearly defined methodology to define, design and manage loading zones in urban areas, apart from the French guidelines published by CERTU (2009). Three different studies, published by Dezi et al. (2010) for the city of Bologna, Alho and De Abreu e Silva (2014) for the city of Lisbon, and Gardrat and Serouge (2016) for Bordeaux and Lyon contain in-depth assessments of urban loading zone systems, but without fully developing a methodology to assist local authorities in the provision of this type of spaces. As a result, decisions like how many should be provided, where should they be located or how should they be managed are taken by city administrators without a clear understanding of the needs, practices and restrictions of the different types of freight transport operating in the area. Loading zone systems are therefore sometimes insufficient and sometimes oversized and inefficient.

Furthermore, many urban freight reports focus their land use analyses at the zone level, evaluating different load-zone related options for given urban sectors (Woudsma et al. 2008; Alho and De Abreu e Silva, 2015). In our context, we nevertheless believe that decisions regarding the number, size and location of loading zones should be taken for individual streets, and not for sectors or areas. Loading zones on a given street, street segment or group of streets service those locations only, and the system designed for them may be entirely different from the one designed for another street two blocks down, with a different geometrical configuration, different types of commercial establishments, etc.

Seeking to refine and improve the CERTU guidelines, we have developed a procedure to design urban loading zone systems, including the determination of the number of loading zones required and the selection of the ideal location for those loading zones, which latter issue is in fact not addressed by CERTU. It is important to stress here that our focus is only on the design of traditional loading zone systems. Several innovative initiatives aimed at improving the management of these systems through the use of information technologies have been documented in the recent years (Roche-Cerasi 2012), but no urban area has so far undergone a generalized implementation of this type of initiatives.

In the following section we will describe our methodological proposal, divided into a quantification phase and a location-allocation process. The remaining of the paper will show the expected effects of introducing this methodology on a series of densely commercial streets,

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Table 1
Mathematical description of the three approaches considered to estimate the loading zone demand D.

a) Average demand	b) Peak demand	c) Coincident demand
$\frac{1}{T}\sum_j \sum_t f_{jt} \cdot e_j$	$\max_t \sum_j f_{jt} \cdot e_j$	$\sum_j \lceil f_j \rceil \cdot e_j$

analyzed through microscopic simulation. The results obtained will validate the methodology and show its potential as a decision-making tool to assist urban authorities when determining how many loading zones should be provided on a given street and where they should be located.

2. Methodological proposal

Our research objective was to develop an easily applicable methodology, which may be put into practice by local authorities interested in improving their public loading zone systems. We thus split the process into two stages, the first one aimed at determining the minimum number of loading zones required to service a given group of commercial establishments, and the second one seeking to determine the best location for those loading zones. The following sections provide the details of these two sequential stages.

2.1. Quantification problem

We consider a street, street segment or group of streets with M commercial establishments ($j = 1...M$), each one of them receiving an average f_j deliveries per day and with an average delivery time equal to e_j for each delivery. In that case, the theoretical average daily loading zone demand (expressed in time units, usually

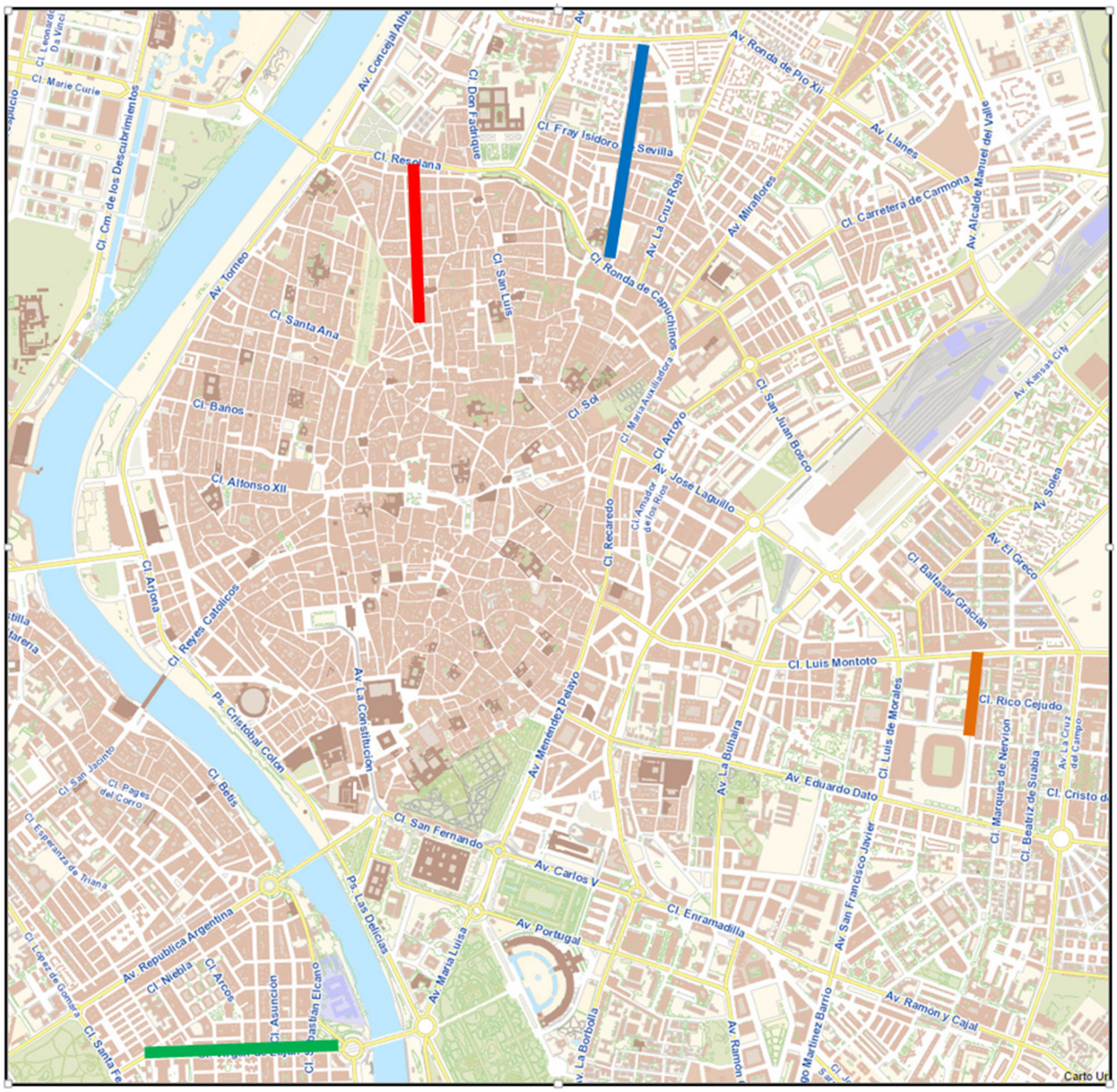

Fig. 1. Location of the analyzed streets in the city of Seville: Feria (red), León XIII (blue), José Luis de Casso (brown) and Virgen de Luján (green). (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)