

Geo-spatial Analysis of Truck Parking Needs

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Abstract: The availability of safe and convenient temporary parking facilities for commercial trucks is essential for both efficient truck transport and compliance with hours of service (HOS) regulations for drivers. With increasing volumes of trucks on the highways, adequate truck parking is becoming scarce. This study describes an online GIS survey instrument that is used for collecting the location information of areas with truck parking capacity shortages. To effectively analyze the sporadic and widely spread location data, this paper adopts an algorithm for location clustering and cluster ranking and proposes an alternative cluster visualization method along highways. This clustering concept recognizes that parking capacity shortages occur along highway segments. It is found that the most frequently experienced shortages are in the outskirts of major urban areas, reflecting the need of staging for next day delivery. These findings are consistent with observations by highway patrol.

Key Words: freight mobility; truck parking survey; web-based GIS; Google maps; cluster analysis; Geo-spatial analysis

1 Introduction

Truck parking has become a growing concern for the trucking industry in the United States. The lack of adequate truck parking facilities and the mismatch between available facilities and truckers' needs with regard to location, amenities, and functional characteristics affect both the safety and efficiency of truck transportation. The National Transportation Safety Board regarded the lack of safe commercial vehicle parking in or near interstates as a major issue^[1]. This issue has been exacerbated by the growth of freight traffic combined with new hours of service (HOS) regulations implemented by the FHWA in 2005^[2]. A recent survey indicated that only 34 percent of truck drivers find suitable parking at commercial truck stops and travel plazas when they need it, and this number drops to 11 percent for public rest areas.

The objective of this paper is to present a method that identifies and ranks locations with truck parking problems, and it focuses on parking capacity shortages along major interstate freight corridors. The goal is to identify the actual problems experienced by truckers traveling along the major freight corridors in terms of location, timing, frequency, and impacted industry sectors. This paper discusses the collection of geo-spatial information that is associated with truck parking

issues within a large geographic area using an online GIS instrument which is capable of engaging a large number of stakeholders simultaneously. Data collection is followed by cluster analysis and ranking that prioritizes locations with truck parking shortages. These results provide the information that is necessary for effectively increasing short-term truck parking availability.

The scope of this study is ten states in the central United States that are encompassed by the Mid-America Freight Coalition (Fig. 1). The region has about 20 percent of the nation's metropolitan areas and population^[1], including Chicago and Detroit—both of which are among the nation's largest cities. In addition, the region is in the heart of the United States, servicing freight shipped between the east and west as well as those to the north and south. Freight mobility problems caused by frequent freight bottlenecks and inadequate truck parking are critical issues in this region^[2].

This research develops and deploys the google maps application program interface (API) for survey^[3]. An advantage of the online survey tool is its continuous availability to participants. The online interface serves as a platform for involving stakeholders and opens up a new medium for information exchange. In this case, we only need to have a Web server for our database and associated files.



Fig. 1 Ten-state mississippi valley region with its major interstate freight corridors

Many other applications use Google Maps^[4–8], and all of them take advantage of the practical convenience of not having to maintain a GIS server.

Targeted capacity expansion can effectively increase short-term truck parking availability. The survey participants often marked locations in the vicinity of each other where capacity expansion is needed. Capacity expansion at one location may contribute to capacity shortage relief in the surrounding locations. Therefore, when considering capacity expansion, it makes sense to cluster adjacent locations of parking shortages into groups.

In this paper, we discuss the challenges associated with this clustering and the methodologies for clustering that make practical sense. Location clustering is key to this research. Cluster ranking is another important step in this research, because it helps prioritize locations when adding capacity.

The rest of this paper is organized as follows. After a brief introduction to the development of the online GIS survey instrument for data collection and its contents, we present the clustering algorithms and analysis. The Web survey contains both general and location-specific questions. The GIS tool is based on Google Maps and allows participants to add and delete locations on the map. The collected data are preprocessed and then subjected to cluster analysis and a ranking process. The major findings from the cluster analysis are verified. This paper will be concluded with final remarks and recommendations for the areas in which increases in parking capacity will have the greatest impact.

2 Online GIS survey

Figure 2 shows the functional design of the survey tool. This survey included questions tailored to three groups of participants: truckers, highway patrol officers, and

public-sector freight planners. Each of these groups has varying experiences, priorities, and concerns about truck parking locations. In order to collect comprehensive information on truck parking, the survey questionnaire has two parts: one with general questions for each participant group and the other with questions about specific parking facilities and the issues associated with each particular location.

We surveyed truck drivers to identify locations where parking is needed, highway patrol officers about observed parking violations and safety concerns, and public freight planners for their awareness of known locations with parking shortages. Appendix B shows the complete survey content. Highway patrol officers identified locations where trucks park on highway ramps. Truckers identified the time of day when parking is needed and the frequency and severity of shortages experienced at various locations. Surveys from truckers about capacity issues are the main source of information for later analysis in this paper. For public freight planners, the primary concerns are the financial and regulatory constraints to expanding truck parking facilities.

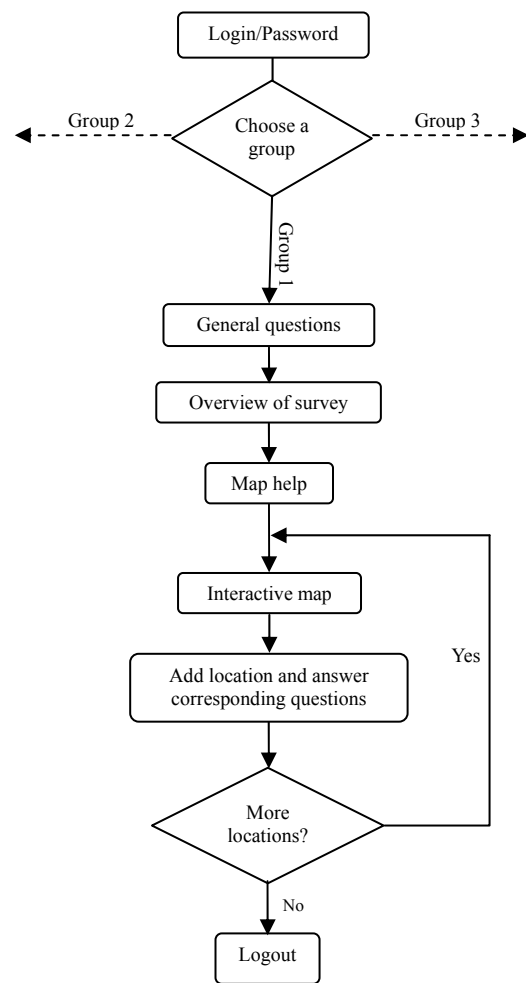


Fig. 2 Functional design of survey tool

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