VREF RESEARCH
BRIEF 2

FREIGHT TRIP GENERATION MODELLING

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THIS BRIEF TARGETS

- Metropolitan planning organizations and local departments of transportation
- Urban planners and transportation authorities
- Researchers, practitioners and consultants interested in urban freight and freight-demand modelling

KEY MESSAGES

- The amount and impacts of freight traffic attracted by cities depends on the demand and inventory policies of individual establishments.
- Quantifying freight traffic – via Freight Trip Generation (FTG) modelling – is crucial for enabling local transport authorities to understand local needs, assess potential solutions to existing problems, and anticipate future needs.
- Having access to the right data and models can contribute toward a better understanding of the freight system and enable well informed decision making.

This research highlights the importance of quantifying freight trips as a step toward enhancing understanding of urban freight systems. The authors provide an overview of the different uses of Freight Trip Generation models and a glimpse into the state-of-the-art in freight-transport modelling.

Increasing urbanization around the globe, and the environmental and liveability impacts associated with urban activity, have directed attention to the need for sustainable cities with efficient transportation systems. However, most public-sector transportation-planning efforts have focused on passengers and ignored the movement of goods. This is due in part because of the complexity of freight transportation systems and lack of knowledge, and partly because freight has traditionally been seen as a private-sector issue. Yet, ensuring an efficient freight-transportation system requires public-sector attention, as it is crucial to maintaining vibrant cities with competitive economies.

Achieving sustainable urban development requires studying urban freight from a systems perspective and including freight systems in strategic urban development plans. In this context, joint efforts involving the public and private sectors, as well as research organizations to collect the right data and develop suitable models, can contribute toward

- a better understanding of urban freight patterns, the quantification of freight's traffic impacts, and the development of appropriate methodologies to support well-informed decision making and strategic plans.

Urban activity and freight trip generation

Urban residents benefit from the diverse goods and services that are offered by commercial establishments. However, most goods are produced, processed and stored outside cities, and therefore must be transported by freight vehicles. The amount of freight traffic (and associated negative impacts) attracted by a city is a direct consequence of the quantities of goods demanded and the inventory and ordering policies of the receiving establishments.

Urban planners and transportation authorities often lack a clear idea about the amount of freight trips that different commercial activities generate, which leads to underestimations of local needs and difficulties in finding appropriate solutions to traffic problems. Freight Trip Generation (FTG) models can be used to quantify the number of freight trips that commercial establishments generate.

The role of FTG Models

Quantifying freight traffic – via FTG modelling – is necessary for characterizing freight activity, assessing potential solutions to problems, and anticipating future infrastructure and policy needs.

FTG models are used to identify who generates freight traffic (e.g., business type, business size), how much freight traffic they generate (e.g., how many freight trips per day), where they are located (e.g., large buildings, malls, central business districts), and the types of freight vehicles they attract (e.g., vans, trucks).

FTG models play a key role in supporting short- to medium-term urban transportation planning. FTG models generate estimates of the number of trips produced and attracted by a given establishment over a given unit of time. This information is needed to anticipate traffic impacts and parking and loading space needs associated with new developments, assess the traffic impacts resulting from land-use changes, enhance parking and traffic management strategies, and assess the potential benefits/impacts of new policies (e.g., off-hour deliveries, freight consolidation).

For long-term transportation and infrastructure planning, FTG models are a first step toward developing demand models that integrate passenger and freight flows.

State-of-the-art in FTG modelling

FTG consists of freight trip attraction (i.e., deliveries) and freight trip production (i.e., pickup requests). It is important to study them independently because they are driven by different factors. FTG models are calibrated at the establishment level to obtain the number of freight trips attracted and produced as a function of the commercial sub-sector (usually as categorical factor) and business size (measured by number of employees, area, and sales). Some exploratory models have identified other variables that also affect FTG, such as land value and the width of an establishments' front street.

The most common modelling techniques in the literature include trip rates per establishment or per employee, linear and non-linear regression models, and multiple classification analysis. More advanced techniques have successfully used discrete-continuous models to account for the role of urban freight intermediaries in freight trip production, and spatial regression models to assess the spatial effects intrinsic to FTG.

The study of FTG and modelling efforts has shown that: (i) freight generation (FG) and FTG are two different concepts, while FG quantifies production and consumption of goods, FTG quantifies the freight traffic needed to transport the FG; (ii) as FTG is a consequence of FG and the firms' logistics decisions (e.g., shipment size), an increase in business size does not necessarily imply an increase in FTG; (iii) establishments located in premises with high land values have higher FTG, because the potential revenue per unit of area makes them favour commercial space over storage space; (iv) retail stores, wholesalers and restaurants are responsible for the majority of freight trips in urban environments; (v) small establishments (less than 10 employees) are responsible for more than 50% of urban FTG, and; (vi) establishments in some commercial sub-sectors exhibit similar FTG patterns in different geographic locations (e.g., USA, Colombia, Portugal, India).

AUTHORS

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