Freight Trip Generation Patterns in Developed Countries
Questions and Answers.

Q1: Where does the push/pull system of inventory control fit into either modeling approach?
R/ USA: In our FTG models, industry classification is used as a proxy for the underlying economic activity taking place in the establishments. Establishments are grouped by industry sectors that share some characteristics, including inventory strategies. However, there is no explicit consideration of the specific inventory control system, such as push or pull system of inventory control. Considering specific inventory management and control strategies can be useful to explain the number of freight trips generated, but from a system modeling perspective it would not be practical. Especially for forecasting purposes where the information related to inventory strategies would not be available.
Portugal: Building on the previous answer, although we included questions about the supply chain characteristics in the survey, details about the inventory system were not explored. Also, we didn´t include any variables about the establishments' supply chain in these models, but some of these variables were explored by us in a modeling context, please see the reference *Alho and de Abreu e Silva (forthcoming 2014)*.

Q2: For both presentations: When selecting independent variables, did you consider cause and effect relationships with freight trip generation?
Portugal: In our models we assume that the category of establishments and their size, represented by sales area and number of employees explain the number of deliveries. The selection of variables, in this case study, was defined by those three variables being the only available data for the remaining population of establishments (i.e., those that were not surveyed). Hence, as we want to apply these models to the population, our selection was constrained. Our case study revealed weak to moderate relationships between Freight Trip Generation and business size, for some industry categories.
USA: For this study, the independent variables were selected based on their explanatory power and their practicality. In this context, along with the industry segment, employment and area were the variables that held a better causal effect with FTG and could be easily obtained for practical uses. However, for most of the sectors the empirical evidence suggested that FTG was independent from business size, meaning that a constant FTG per establishment can provide better estimates.

Q3: How to address different types of vehicles in your model? Because we are simply saying trips that combines all vehicles is it?
Portugal: these models consider deliveries as a unit, regardless of the type/size of vehicle. This is a data-supported assumption as our survey results revealed that the majority of the delivery vehicles are < 3.5T. We could, if we wished, develop models that consider vehicle size. Also, we highlight that each case-study has their own particularities and this approach should not be generalized without prior knowledge of the vehicles visiting the study zone.
USA: in the first phase of the study we did not make any distinction between the types of vehicles, but we plan to model FTG by type of vehicle in the second phase of the project.

Q4: For the case of Portugal: why those models differ one to another?

Portugal: They differ in the way variables are considered, assumed variable distribution, theoretical construct, etc. We chose to present a multitude of modeling approaches, which resulted in significantly different predictive capabilities, to illustrate that their selection should not be taken lightly. Model output quality should be adjusted to their application. For example, we can assume that a lower resolution model is suitable for a high-level comparison, while a more sophisticated approach would be more suitable to feed a micro-simulation of freight traffic.

Q5: Without supply chain details these trips are overestimated right? How to deal with that?

Portugal: they are not necessarily overestimated. Some are overestimated, others are underestimated, and others are spot on. By exploring several modeling approaches we aimed to get more correct predictions and minimal errors. As you can see in the reference *Alho and de Abreu e Silva (forthcoming 2014)*, supply chain details contribute to better predictions. Unfortunately, these details are rarely available for the full population of establishments, limiting their application to the collected sample.

US: We agree with André, they are not necessarily overestimated. Including supply chain details could improve the explanatory power, but at a cost: significantly higher data needs, limited applicability and lack of transferability, among others. We need to find variables (related to the supply chain) that improve the explanatory power of the models, without hurting their practicality.

Q6: For small establishment more number of small vehicles are needed whereas for large establishment few truck trips are enough to fulfil their need? So how to deal this? And why those differences are important? Or how this will inform freight planning decision making?

Portugal: in our opinion both types of establishments should be modelled separately as there is, based on the data, considerable differences in the ordering and receiving processes. The differences before “small” and “big” should be explored in each case study as the frontier can change. Also, it should be kept in mind that small stores which are not independent might have distribution patterns more similar to big stores (automatic ordering process, timed deliveries from single supplier, etc.). Hence, assumptions must be made carefully. Better decisions in freight planning can arise from having better models, which predict with increased precision/accuracy the number of deliveries. In our case, better models allow a better representation of demand that will shape the design of an optimized parking infrastructure.

US: It is interesting to see that while in the US the type and size of vehicles were different than those used in India and Colombia, for some industries the FTG was about the same. This could be explained by the indivisibility of truck trips. And the low loading factors observed in the urban distribution industry.

If the indivisibility of truck trips is not considered—which is the case of employment rates models—, FTG for small businesses will be underestimated and FTG for large businesses will be overestimated. A way to deal with this issue, from the modeling perspective, is to use functional forms that include both a constant and an employment term, or to use non-linear specifications, see (Holguín-Veras et al., 2011; Sanchez-Diaz et al., 2014).

Q7: Can we convert all the vehicles to Equivalent trucks?

Portugal: in our case-study the majority of the deliveries was performed by vehicles lighter than 3.5T. While a conversion factor can be applied, it would not serve a purpose as it would not fit to the observed reality.

US: Converting to equivalent trucks is not something we would advise as the PCE factors that are used for large trucks are too crude.

Q8: I am thinking to convert equivalent trucks based on tonnage, will it work?
Portugal: in our survey, data about the weight of the deliveries was not collected. While we did collect data about the number of packages and an approximation of volume/size, the conversion would most likely have considerable errors.
US: At the establishment level, this would neglect the role of logistics decisions. At the aggregate level, that could work for inter-city transportation, but for urban freight it will be prone to large errors mainly because cargo and truck trips follow different patterns: tonnage movements follow production-consumption links, and trucks follow multi-stop tours.

Q9: What will you do with the results presented?
US: The models estimated as part of the NCFRP 25 project, are used to update the ITE Trip Generation Manual. The report for NCFRP 25 is published and available online (Holguín-Veras et al., 2012). They have also been used for many applications that require quantifying the truck trips produces and attracted by establishments (e.g., parking studies, off-hour deliveries project, receiver-led consolidation programs).
Portugal: the models are being used in the context of a micro-simulation. The models predict the total deliveries that establishments receive and, based on the relative location of loading/unloading bays and parking demand, freight vehicles opt to park inside the bays or double park. This allows us to calculate the impact of double parking due to inadequate parking infrastructure or lack of enforcement assuring bay availability. Also, these results are being used in comparative studies of freight trip generation, to understand better the transferability potential of these models.

Q10: For the case of the US: do you think logistics decision would affect land use for freight more than economic decision or is it the case of the other way around? And do you think freight land use models are needed for small towns?
US: We assessed both the role of industry classification and land-use classification systems, and we saw that industry classification systems are a better proxy for the decisions related to FTG. FTG models can contribute towards more informed decision making in both large and small towns. Our models where applied to Troy (New York) with good results.

Q11: Currently, what is the most efficient way to collect real time information to develop such models? Did you use any mechanism to expedite the data collection? Like a cellphone app or websites?
US: To our knowledge, there is no real time data collection for FTG. We use websites to collect data, and that could be a good way to maintain a continuous data collection flow.
Portugal: At the moment we are not aware of any real time data collection platform. We used laptops to collect the data directly to the desired format. The Megacity Logistics Lab at M.I.T. (Cambridge, USA), with whom we are working at the moment, developed a smartphone app to collect data about establishments/freight deliveries and a website to allow a quick visualization of the collected data. If you wish to know more please contact us.

Q12: Which agents are more likely to participate survey? Establishments, carriers, truck companies?

Portugal: In our case we think that it will be easier to contact establishments as the carriers/truck companies are very loosely organized and, most likely, have higher time pressure when they stop for a delivery. While our survey was long (over 30 minutes), establishment employees were willing to answer as long as we let them perform their duties at the same time.
US: We have collected information from the different economic agents involved in the freight process. There is no evidence that indicates which agents are more likely to participate. However, to have a complete view of the system and the operations, information needs to be collected from all (Holguín-Veras and Jaller, 2014).

Q13: Most of establishments in cities are attractions. How did you find freight production in order to do freight distribution?
Portugal: our focus was solely on the trips attracted by establishments. Data about freight production such as home deliveries was not captured. If by freight production you mean the origin of the deliveries, we also did not capture this information as it is not crucial for our study.
US: In urban environments, we find establishments that are pure receivers (e.g., restaurants) and establishments that are intermediaries (e.g., manufacturing), see Jaller et al., 2014. The shares of freight attraction and production depend on the type of economic activity predominant in the zones. In the case of New York City, freight trip attractions clearly dominate (70% of trips are attraction vs 30% of production), but this may not be the case for cities with important manufacturing activities.

References:

Alho, A. and J. de Abreu e Silva (forthcoming 2014) Development of a road freight demand model: testing methodological alternatives to predict urban freight weekly parking demand from retail establishments' characteristics. Transportation Research Record. Provisional WebLink: http://trid.trb.org/view.aspx?id=1289202

Holguín-Veras, J., M. Jaller, L. Destro, X. Ban, C. Lawson and H. Levinson (2011). "Freight Generation, Freight Trip Generation, and the Perils of Using Constant Trip Rates." Transportation Research Record: Journal of the Transportation Research Board **2224**: 68-81. 10.3141/2224-09

Holguín-Veras, J., M. Jaller, I. Sánchez-Díaz, J. Wojtowicz, S. Campbell, H. Levinson, C. Lawson, E. Powers and L. Tavasszy (2012) "NCHRP Report 739 / NCFRP Report 19: Freight Trip Generation and Land Use." National Cooperative Highway Research Program / National Cooperative Freight Research Program, from http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_739.pdf.

Holguín-Veras, J., and M. Jaller (2014). Comprehensive Freight Demand Data Collection Framework for Large Urban Areas. Sustainable Urban Logistics: Concepts, Methods and Information Systems. J. Gonzáles-Feliu, F. Semet, and J.L. Routhier (eds.), EcoProduction, DOI: 10.1007/978-3-642-31788-0_6, Springer-Verlag Berlin Heidelberg.

Jaller, M., I. Sanchez, and J. Holguín-Veras (2014). Freight Trip Attraction, Freight Trip Production, and the Role of Freight Intermediaries. Transportation Research Board 93rd Annual Meeting, Washington, D.C.

Sanchez-Diaz, I., J. Holguin-Veras and C. Wang (2014). "An Exploratory Analysis of Spatial Effects on Freight Trip Attraction." Transportation **In print**: 16.