

Spatial Dynamics of Logistics Facilities and Implications for Freight Flows

Genevieve Giuliano, Sanggyun Kang, and Quan Yuan

METRANS Transportation Center, Sol Price School of Public Policy, University of Southern California

Contact Information: giuliano@usc.edu

Issue

The purpose of this research is to examine changes in the spatial pattern of warehousing and distribution (W&D), and whether these changes result in more truck vehicle miles traveled (VMT). It is argued that W&Ds are decentralizing (moving away from the central core to the urban peripheries), trading off higher transport costs and diminished access to the local market for lower land costs.

Decentralization may contribute to reducing total freight shipping cost, but increased distance from urban centers may result in increased truck VMT and associated externalities: congestion, increased fuel consumption, noise, GHG and criteria emissions, accidents, and infrastructure damage.ⁱ While the logistics business benefits from cost savings, however, any additional external costs are incurred by society at large.ⁱⁱ

Understanding how these shifts are affecting truck VMT is essential for developing effective policies for managing truck activities and their associated externalities. Due to the dearth of truck shipment data, we focus on the changes in W&D facility and employment location and use measures of relative location to infer potential truck VMT impacts. We use ZIP Code Business Patterns data for 2003 and 2013 in four metropolitan areas in California: Los Angeles (LA), San Francisco (SF), Sacramento (SC), and San Diego (SD).

Key Research Findings

We document a mixed picture of W&D location change. First, spatial patterns differ across metro areas. LA W&Ds have decentralized the most, yet

SF has the most decentralized distribution. W&Ds in SC and SD have barely decentralized. Second, larger W&Ds are more likely to locate near the outskirts. Third, W&Ds are relatively concentrated, and concentration is increasing. Fourth, W&Ds are shifting to lower employment density locations in LA and SF, but the opposite trend is observed for SC and SD. Figure 1 presents W&Ds by ZIP Code in LA in 2003-2013.

We identify three factors to explain W&D decentralization. The first is metropolitan size (population), which is correlated with density – a proxy for demand (land prices). In general, the largest metro areas have the highest peak and average density. Thus, as W&D operations continue to grow in scale, they seek cheaper land away from the center. Also, competition for land may “zone out” less preferred activities as industrial land is repurposed for residential or mixed use development.

Economic structure is the second factor. Large metropolitan areas are the hubs of global commerce, in which W&Ds serve both local and non-local markets. W&Ds oriented to non-local markets are more likely to decentralize to increase capacity for regional and national commerce. They would value land rent and access to national supply chains more than a specific location within the metropolitan area. Freight and W&D demand should be related to industry composition. Relative to metro areas with more service industry, those with a trade/manufacturing-orientation (LA & SF) should generate/attract more freight activities, which implies more decentralization.

The third factor is physical geography. In LA, population and employment are distributed across

a great expanse of land with few physical barriers; W&Ds are relatively closer to local markets, even as they decentralize. In SC, low density and plentiful land availability near the center make W&D decentralization unnecessary. The physical constraints of SF and SD (water, border, and hilly terrain) contribute to high land prices and limit where development can occur.

A mixed picture of location change implies the VMT impacts are likely mixed as well. First, if all W&D activity were locally oriented, decentralization would imply more truck VMT. However, if larger, more distant W&Ds are oriented to non-local trade, we cannot conclude that decentralization leads to more truck VMT. The difference in pattern between W&D facilities and employment is consistent with larger facilities being built where land is cheaper and more available. Second, W&Ds are located throughout the populated areas of each metro area, a logical outcome considering both market and labor force access. We therefore cannot rule out that local serving W&Ds continue to seek locations near their markets. The growth in e-shopping and same-day delivery should reinforce the demand for near

market locations. Third, truck VMT could change without any change in W&D locations. Supply chains and shipment patterns are constantly changing in response to changing input costs and changing markets.

We cannot conclude that the changes we observe should lead to more truck VMT. W&Ds in the smaller metro areas are closely located to the local market, whereas only LA shows decentralization across all indicators. More research is needed to understand why spatial patterns vary across metropolitan areas. More shipment data at the sub-metropolitan level is needed to develop better understanding of the relationship between spatial organization, shipment patterns, and truck VMT.

Further Reading

This policy brief is drawn from NCST report *Spatial Dynamics of Logistics Facilities and Implications for Freight Flows*, Report USC-CT-TO-004, 2016, by Genevieve Giuliano, Sanggyun Kang, and Quan Yuan. Available at <http://ncst.ucdavis.edu/project/usc-ct-to-004/>

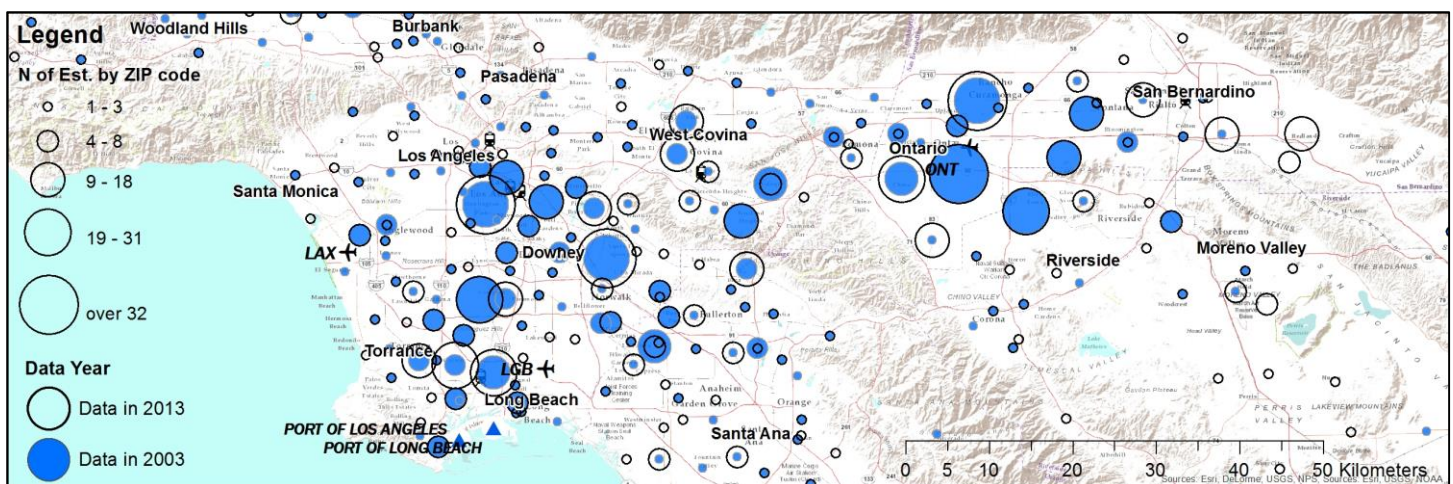


Figure 1 W&Ds by ZIP Code in 2003-2013 in Los Angeles CSA.

ⁱ Anderson, S., Allen, J., & Browne, M., (2005). Urban logistics: how can it meet policy makers' sustainability objectives? *Journal of Transport Geography*, 13(1), 71-81.

ⁱⁱ Rodrigue, J-P., Slack, B., & Comtois, C. (2001). *Green Logistics (The Paradoxes of)*. In: A. M. Brewer, K. J. Button and D. A. Hensher (eds.) (2001). *The Handbook of Logistics and Supply-Chain Management, Handbooks in Transport #2*, London: Pergamon/Elsevier.