National Center for Sustainable Transportation

POLICY BRIEF

Spatial Dynamics of Logistics Facilities and Implications for Freight Flows

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Issue

One of the most notable recent trends in U.S. metropolitan areas is the rapid growth in warehousing and distribution (W&D) activity. The number of warehousing establishments increased 15%, and warehousing employment increased 33% between 2003 and 2013.[i] At the same time, some operations in some markets appear to be decentralizing (moving away from the central core to the urban peripheries) in search of lower land costs.

Although decentralization may contribute to reduced total freight shipping cost, increased distance from urban centers may result in increased truck vehicle miles traveled (VMT) and associated externalities: congestion, increased fuel consumption, noise, greenhouse gas (GHG) and criteria emissions, accidents, and infrastructure damage.[ii] While the logistics business benefits from cost savings, society at large incurs any additional external costs.[iii]

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, this research focuses on the changes in W&D facility and employment location and uses measures of relative location to infer potential truck VMT impacts. It uses ZIP Code Business Patterns data for 2003 and 2013 in four California metropolitan areas: Los Angeles (LA), San Francisco (SF), Sacramento (SC), and San Diego (SD).

Key Research Findings

The study documents a mixed picture of W&D location change. First, spatial patterns differ across metro areas. W&D activity in LA has decentralized the most, yet SF has the most decentralized distribution. W&D operations in SC and SD have barely decentralized. Second, larger W&D operations are more likely to locate near the outskirts. Third, W&D operations are relatively concentrated, and concentration is increasing. Fourth, W&D centers 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&D activity by ZIP Code in LA in 2003-2013.

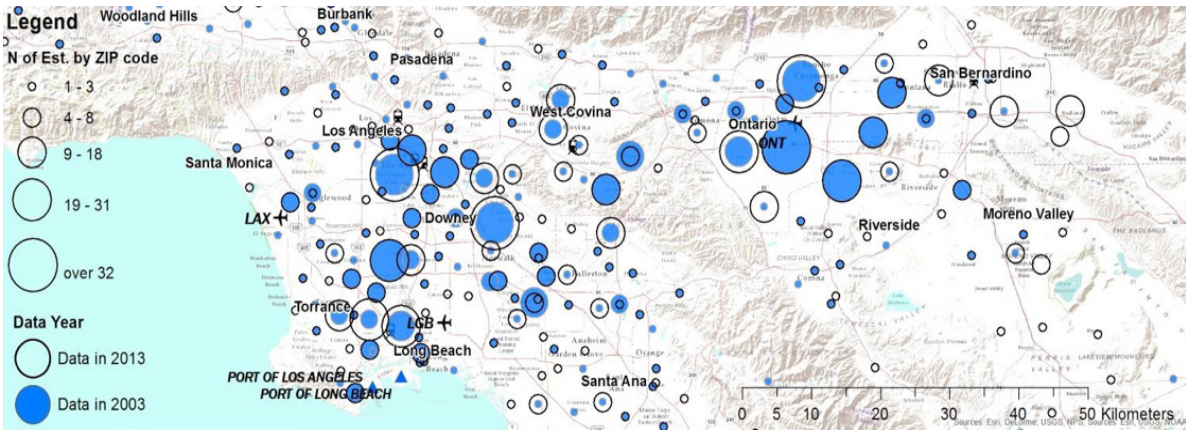

Figure 1: W&Ds by ZIP Code in 2003-2013 in Los Angeles CSA.

Three factors explain W&D decentralization. The first is metropolitan 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&D centers serve both local and non-local markets. W&D operations 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 or manufacturing orientation (LA and SF) should generate or 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&D operations 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&D operations are oriented to non-local trade, one 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&D facilities are located throughout the populated areas of each metro area, a logical outcome considering both market and labor force access. Therefore, one cannot rule out that local serving W&D centers 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.

One cannot conclude that the observed changes should lead to more truck VMT. W&D operations 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 "Spatial Dynamics of Logistics Facilities and Implications for Freight Flows," a report prepared for the California Department of Transportation (Caltrans) by Genevieve Giuliano, Sanggyun Kang, and Quan Yuan (University of Southern California). To download report, visit http://ncst.ucdavis.edu/project/usc-ct-to-004/

[i] *In North American Industry Classification System (NAICS) 493 Warehousing and Storage.*

[ii] *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.*

[iii] *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.*

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