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The freight landscape: Convergence and divergence in urban freight distribution

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Abstract: The paper introduces the concept of the freight landscape: the spatial distribution of freight activity and intensity in a metropolitan area. Using population and employment density information, a freight landscape matrix is calculated for four major metropolitan areas: New York, Los Angeles, Paris and Seoul. Levels of convergence and divergence between population and employment densities are assessed, each characterized by different freight landscapes requiring different city logistics strategies. Results reveal substantial variations between metropolitan areas, which are observed across the respective levels of zonal specialization as well as density changes over distance from central areas.

Keywords: City logistics, urban freight distribution, land use, spatial structure.

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1 Introduction: The freight landscape

Urban freight distribution, also often referred to as city logistics, has received increasing attention as an issue relevant to urban mobility. It is conventionally defined as the means used for freight distribution in urban areas as well as the strategies that can improve its efficiency while mitigating its externalities (Giuliano, O'Brien, Dablanc, & Holliday, 2013). City logistics do not involve a single transportation strategy, but a diversity of urban freight distribution systems with different purposes, modes of operation and locational characteristics. This underlines the need to look at urban spatial structure as a key element of city logistics since variations in this spatial structure will be associated with different city logistics contexts and strategies. City size and complexity are interrelated. Large metropolitan areas have a complex spatial structure in terms of the range of socioeconomic activities and their organization, an issue that has been extensively researched in the urban planning literature (Cavailhès, J., Gaigné, C., Tabuchi, T., & Thisse J.-F., 2006). Yet, the spatial structure of freight activities in urban areas has

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received far less attention, despite its significant imprint on urban land use in the form of terminals, distribution centers and other major facilities (Hesse, 2008; Cidell, 2010; Dablanc, Ogilvie, & Goodchild, 2014). Freight related activities, locational behavior and circulation remain relatively absent from the concerns of urban planning (Rodrigue, 2013; Lindholm & Blinge, 2014). The prevailing paradigm is biased towards passenger mobility considerations, and without adequate consideration of freight our understanding of urban mobility and land use is undermined (FHWA, 2012).

In this context, the concept of freight landscape is put forward as representative of the spatial distribution of freight activity and intensity within metropolitan areas. It expresses the urban spatial structure and the socioeconomic function of the city, considering the context in which urban freight distribution takes place with attributes such as the spatial distribution and the density of the demand for freight and the related freight flows. The freight landscape is a tool to help understand changes in the spatial distribution of urban freight activities, particularly in terms of the main drivers of these changes and their outcomes on the urban spatial structure. It is a multidimensional concept composed of several interrelated landscapes:

- Political Landscape. The array of jurisdictions and regulations impacting the locational and operational behavior of freight distribution. This can involve zoning and building codes, operating hours, parking and delivery conditions and even restrictions concerning the use of vehicles and fuels.
- Socioeconomic Landscape. The general land uses, mostly in terms of population and employment densities, reflecting the economic and social functions of the city. Cities are commonly organized around commercial, institutional, residential, manufacturing and logistics districts. These are the main generators and attractors of freight flows.
- Infrastructure Landscape. The transportation infrastructure supporting urban freight flows, which is primarily contingent upon the structure and the capacity of the road transport system. Freight terminals, such as ports, rail yards and airports are also important components of this landscape with many cities acting as commercial gateways to global trade.
- Mobility Landscape. Represents the dynamic aspect of city logistics in terms of freight flows and the means that carry freight, which includes a range of vehicles, technologies, routes, scheduling, pickups and deliveries.

The paper provides an overview of the freight landscape concept through a comparative framework involving four major global cities, New York, Los Angeles, Paris and Seoul. These cities are major hubs in the global economy and have very large populations. In particular, it looks at the population and employment densities of these cities where a robust relationship with freight generation and city logistics is expected. These large metropolitan areas are facing acute transport problems and thus are motivated to invest resources in understanding the problems and experimenting with solutions. Their governance and institutions are highly complex, making policy development and implementation particularly challenging and hence providing a rich analytical environment.

Particular attention will be placed on the level of spatial convergence and divergence of their respective population and employment densities, to which a robust relationship with freight generation is hypothesized. A situation of convergence is reflective of an urban landscape where land uses are relatively mixed, implying intense interactions between standard urban mobilities (e.g., commuting) and freight distribution since they share the same infrastructure and take place in the same vicinity. For instance, commercial districts experience a convergence of freight (as commercial activities attract deliveries) and passenger (workers and customers) mobilities, creating a unique array of problems and mitigation strategies. A divergence leans more on specialized land uses and forms of freight distribution where each acts as a distinct socioeconomic function and derived freight activities. For instance, residential or manufacturing districts each involves specialized and clearly definable forms of freight mobilities (FHWA, 2012).

It is expected that a better understanding of the urban freight landscape would help articulate urban freight policy and mitigation strategies by identifying specific freight supply and demand zones. It is also a measure helping assess the level of spatial order of urban freight distribution.

2 Urban density and freight

A prevalent perspective concerning urban planning is that higher densities are preferable since they generate various economies. Higher densities are more readily serviced by retail activities and by public transit and are perceived to be a suitable goal towards more sustainable cities, particularly in terms of public transit use (Handy, 2005; Reid, Hamidi, Preuss, & Dodds, 2015). There is a debate concerning the level of association between density and urban economies, as well as which density level is suitable for specific urban land uses (Gordon & Richardson, 1997). Arguments over the advantages of higher densities with regard to energy consumption, the loss of agricultural land and infrastructure provision are common (Newman & Kenworthy, 1999). The concept of smart growth further expanded the density perspective into a more comprehensive planning framework (Knaap & Talen, 2005). However, from a freight distribution perspective density is an important structural element of city logistics, but with several diseconomies associated with higher densities. As such the density perspective differs between the conventional planning discourse and city logistics.

High concentration levels generate conflicts between freight and passengers transportation, induce congestion, pollution, noise, and higher levels of energy consumption and risks of accidents. All of these are associated with higher delivery costs. The relationship between density and delivery costs is however a nonlinear one (Figure 1). In a low density setting, such as in rural or low density suburban areas, delivery costs per unit are higher due to the longer average delivery distances. The same number of deliveries requires longer distances, which is compounded from more separated pickup or delivery points. In a medium density suburban setting, delivery costs are lower as shorter distances are observed while very few constraints are still impacting mobility. There is limited congestion, and parking for deliveries is rarely an issue since space can readily be found. Additional opportunities for cargo consolidation are present as well. As density increases, however, a set of constraints becomes more prevalent, particularly as it relates to parking, which incites the use of specialized vehicles having less capacity in spite of a higher demand density; consolidating cargo become more challenging. The number of deliveries increases as well as its costs.

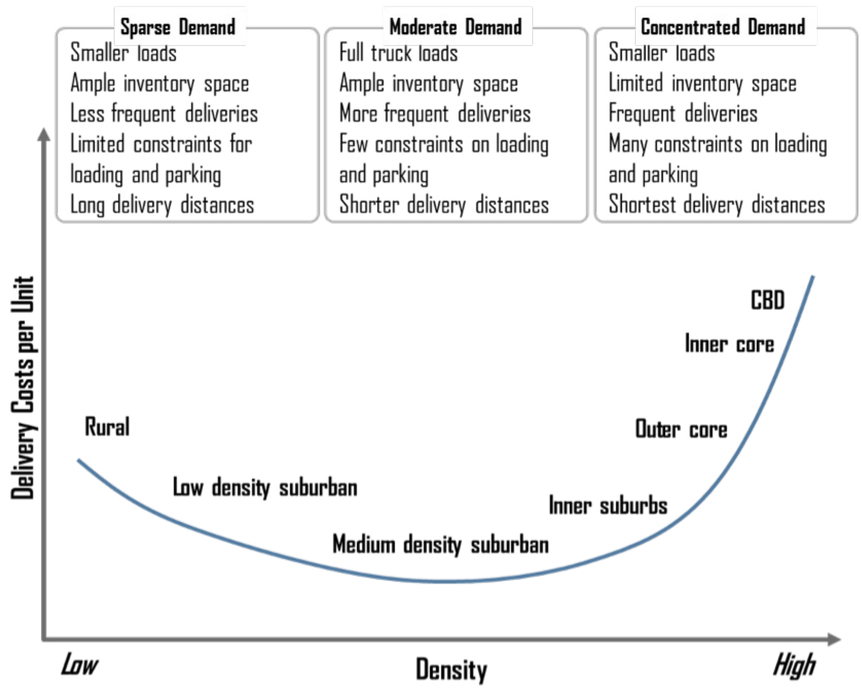


Figure 1: Relationship between urban density and commercial freight deliveries[1]

For retailing, higher density is related to higher sales per floor space, but also with less space available for storage. All this implies more frequent deliveries, which are taking place in an environment where there is limited parking and competition for the use of road and curb space. This may also increase the use of smaller delivery vehicles (either by choice or imposed by regulation), which results in even more frequent deliveries and higher costs. At the highest density levels, truck size may be limited, again increasing trip frequency and cost. This is the main reason why freight distribution in higher density settings commonly requires mitigation strategies that are a core focus in city logistics approaches. This raises the question as to what extent higher densities and their associated concentration of freight demand compensate for the higher related distribution costs. Further, the simple pattern observed in Figure 1 underlines that urban freight distribution is particularly contingent upon the density setting in which it takes place.

Population and employment densities are related to freight generation (Gonzalez-Feliu, Semet, & Routhier, 2014). Economic classifications of employment are usually more effective than land uses in estimating freight generation (Lawson, Holguin-Veras, Sánchez-Díaz, Jaller, Campbell, & Powers, 2012), because different industry sectors have different demands for physical goods. For example, commercial services (e.g., management) generate less freight demand than retail services. Population density is much less associated with freight transportation, although the rise in home deliveries coming from the growth of e-commerce (Boyer Prud'homme, & Chung, 2009) has started to change that relationship. Employment density is a good proxy for the intensity of freight generation, with sectorial variations (Ambrosini and Routhier, 2004). Density figures and distributions are also readily comparable among cities and reveal different spatial structures and mobility patterns (e.g., Bertaud, 2001).

3 Assessing the freight landscape

In a succinct form, the freight landscape is a function of the spatial structure of freight transport supply

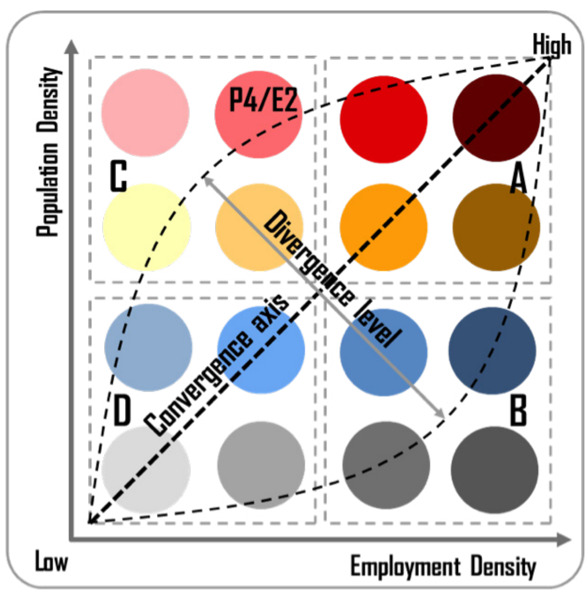
[1] Source: METROFREIGHT (2013), METRANS Transportation Center, University of Southern California and California State University Long Beach.

and demand. Although the freight landscape is a multidimensional component of urban freight distribution, this analysis will focus upon the socioeconomic dimension of the freight landscape, particularly since both population and employment density are vectors of freight generation and attraction. This will set the background for further expansion and analysis of the concept.

4 The density matrix

The freight landscape can be represented as a density matrix that cross-references population and employment densities for spatial units (per square km), both of which are associated with freight generation and attraction. A spatial unit is simply a unit from which statistical information is collected and aggregated (such as a census tract). For simplification (since the number of freight landscape categories would increase exponentially with the number of classes), population and employment data are classified in four classes using the quantile method where each class has the same number of associated units. Then, each density class is assigned a simple label: Population (P1 to P4) and Employment (E1 to E4), with classes ordered from lowest to highest.

Density classes are then cross-referenced to form the freight landscape matrix with one axis being the population density classes and the other the employment density classes (see Figure 2). Each cell (such as P4/E2 as an example) is the intersection of a class pair and populated by the number of spatial units in that specific class pair. The structure of this distribution reveals different types of freight landscapes that can be plotted and mapped.



A (High Density Convergence): Commercial and financial districts.
B (Employment-based Divergence): Manufacturing and warehousing.
C (Population-based Divergence): Residential districts.
D (Low Density Convergence): Suburbia.

Figure 2: The freight landscape matrix

Spatial unit size is generally correlated with density of development; units with low density are usually larger than units with high density. Because we do not have point level data, a conversion to units of equal size would either require defaulting to the largest units and losing the detail provided by small units, or making arbitrary assumptions about the spatial distributions of population and employment in the larger units. A second issue are differences in the number and size of spatial units between cities, which leads to potential discrepancies. A metropolitan area that has more spatial units than another of the same size is likely to have a more heterogeneous freight landscape. Although there is no effective way to compensate from the differences in the number and size of spatial units between metropolitan areas, classifying these units in a 4x4 population and employment density matrix (with 16 possible cells) mitigates those discrepancies.

5 Levels and patterns of convergence and divergence

In metropolitan areas, there are usually large clusters of freight generators such as employment zones, logistics zones and terminal facilities. A particular attention is placed upon the circumstances where population and employment densities either converge or diverge and how this is reflective of different freight landscapes. Four specific quadrants can be identified, each characterized by a general level of convergence / divergence (See Figure 2):

- Quadrant A (High density convergence). Commercial and financial districts where retail and service activities are related to high employment densities. Further, the presence of apartment complexes is associated with high population densities, underlining the mix of population and employment in the same geographical unit which is characteristic of this form of convergence. The outcome of this convergence is a complex city logistics framework (even a patchwork) that includes courier services, retail logistics, food deliveries (restaurants and groceries) as well as home deliveries. The mix of these activities and the associated complexity in the freight demand has incited the setting of city logistics regulations, particularly in central areas since they are the most difficult to serve. The quadrant is thus the focus of most city logistics strategies.
- Quadrant B (Employment-based divergence). Manufacturing and warehousing districts with high employment densities, including transport terminals such as warehouse clusters, airports, ports and rail yards. This divergence is in part driven by externalities (less appeal for housing), regulations and planning (defined manufacturing and logistics districts). The dominant city logistics activity is freight distribution and the haulage (Full Truck Load, Less than Truck Load) flows it entails.
- Quadrant C (Population-based divergence). Specialized residential districts (often planned) with lower employment levels, focusing on retail logistics and home deliveries. The growth of e-commerce has resulted in new forms of urban freight distribution in residential areas where parcel deliveries are becoming more dominant.
- Quadrant D (Low density convergence). Various forms of peri-urban and suburban activities, which are usually a mix of low density residential areas, malls and some light manufacturing or distribution clusters. In this quadrant, there is no particular city logistics activity, but simply regular distribution which takes place unhindered. This is the realm of suburban logistics, large distribution and fulfillment centers, a growing feature of large metropolitan areas across the world (Dablanc and Fremont, 2015).

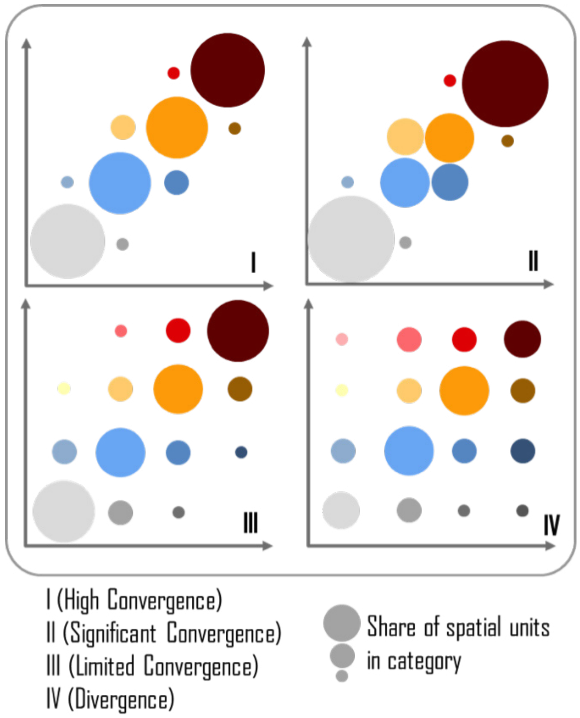


Figure 3: Level of divergence of freight landscapes

The distribution of the observations (how many spatial units per cell) can form four specific patterns (Figure 3):

- Pattern I (High convergence). The metropolitan area has mixed urban land use zones that are dominant since the great majority of the spatial units have their population density correlated with their employment density. This usually represents monocentric cities having a concentric gradation of their densities, although the matrix does not necessarily have a spatial meaning. There are few places where employment or population concentrations are respectively dominant, so few specialized manufacturing zones or residence zones are present. A common structure that such a pattern represents would be a well-defined central area of high residential and services concentrations with outlying areas supporting logistics related to manufacturing and distribution. Such a pattern can also be reflective of cities having a more pronounced service orientation.
- Pattern II (Significant Convergence). The metropolitan area has some level of specialization, particularly at mid-level densities. Commercial sub centers may be present as well as areas having specialized manufacturing and distribution activities.
- Pattern III (Limited Convergence). The metropolitan area has a more diverse structure with a range of specialized urban zones. This implies a large array of urban distribution systems with notable areas of retailing, manufacturing and distribution specializations. The metropolitan area may be polycentric, with several mixed commercial and population clusters of varying densities.
- Pattern IV (Divergence). The metropolitan area is composed of highly specialized urban zones with high population density areas generally separated from high employment density areas. Such a city may have highly diversified freight distribution systems related to distribution or manufacturing which have different patterns of origins and destinations as well as different operational characteristics. In such a context, strategies to manage city logistics must take into account the many different types of flows that are generated.

The density matrix also enables the calculation of the level of divergence (or inversely convergence) based on a simple divergence index (D):

$$D = 1 - \sum_{1}^{N} \frac{|C_N - C|}{S} \Big/ 1.5$$

Where N is the number of cells in the density matrix (16 in the 4x4 matrix used in this analysis), S is the total number of spatial units, CN is the number of spatial units in cell N and C is the number of spatial units per cell if each cell had the same number of spatial units (uniform distribution). A pre-condition to use the index is that the density matrix is classified by the quantile method; each class has the same number of associated spatial units. An index of 0 would imply a complete convergence (all the observations are along the convergence axis) while an index of 1 would imply a functional divergence (all the cells have the same number of spatial units). So, the higher the index, the higher the level of divergence.

6 The freight landscape: Convergence and divergence

6.1 The spatial unit problem

Geodatabases covering New York, Los Angeles, Paris and Seoul were constructed. Official definitions of metropolitan areas were used; consolidated statistical areas (CSA) for New York and Los Angeles, the Region of Ile-de-France for Paris and the Seoul Metropolitan Area. Table 1 shows the main characteristics of the spatial units used with some discrepancies being apparent. The Los Angeles CSA is about 2.4 times the size of the New York CSA and about 7.2 times the size of Paris and Seoul metro areas. While 2.4 times smaller, New York CSA contained 1,526 more census tracts than Los Angeles. Seoul has only 79 spatial units available, corresponding to urban districts. Both New York and Paris have a relative small size and standard deviation in the size of their spatial units, while the average spatial unit is much larger in Los Angeles, as well as the standard deviation. This is due at least in part to the large amount of sparsely populated areas within the Los Angeles CSA[2]. These constraints can be partially mitigated by the classification methodology used to build the freight landscape matrices (statistical aggregation), but cannot be removed. A possible alternative approach could be the spatial aggregation of units for metropolitan areas having a larger number of spatial units into a comparable number. It is unclear the impact such an approach would have on the distribution of the values within the freight landscape matrix, but the assumption is that spatial aggregation would not lead to a significant change in the freight landscape matrix of the metropolitan area being aggregated. Therefore, the analysis and interpretation of the results must take these disparities into consideration.

Table 1: Characteristics of the spatial units of four metropolitan areas

Metropolitan Area	Type of spatial unit	Number of spatial units	Total surface (square km)	Average unit size (square km)	Standard deviation
New York CSA	Census Tract	5,444	36,776	6.75	19.47
Los Angeles CSA[2]	Census Tract	3,918	87,604	22.36	372.27
Paris region (Region Ile-de-France)	Municipalities	1,287	12,058	9.27	7.7 5
Seoul Metropolitan Area	Gu (equivalent to borough or district)	79	11,753	148.77	226.53

[2] CSAs are constructed on the basis of counties. The counties making up the Los Angeles CSA are very large, and include national forest, national parks, and uninhabited desert. If we were to eliminate these unpopulated or sparsely populated areas, the CSA would be about 14,000 km^2.

6.2 Geographical and functional distributions

Using the methodology developed in the previous section, freight landscape matrices were built for the four major metropolitan areas. Their respective population and employment densities were classified in four classes, each having the same number of spatial units (quantiles). Figure 4 gives the respective average population and employment densities by quantile for the four metropolitan areas, with densities graphed in log scale.

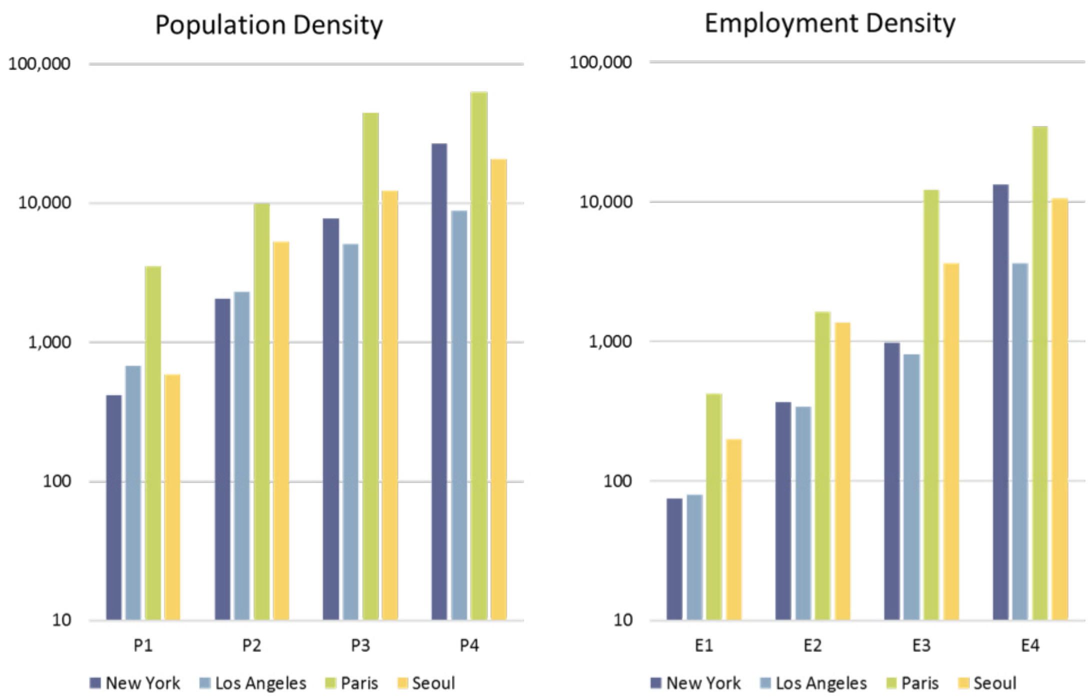


Figure 4: Average population and employment densities by quantile (per square km)

Paris has at least twice the population and employment densities by quantile than the three other metropolitan areas. This underlines the comparatively unique case of Paris from a city logistics perspective, with more acute spatial constraints. For all metropolitan areas population densities are systematically 3 times higher than employment densities, which reflects the standard average of one employed person per three urban residents.

The next step in the creation of the freight landscape matrices involves the cross-referencing of population and employment densities with each cell (intersection) populated with its number of spatial units. Figure 5 provides the results for the four metropolitan areas. The left side depicts the spatial distribution of the density matrix according to what category (cell) each spatial units belongs to. The right side shows the functional distribution of the respective density matrices; the larger the circles, the larger the share of the cells they represent in the freight landscape.

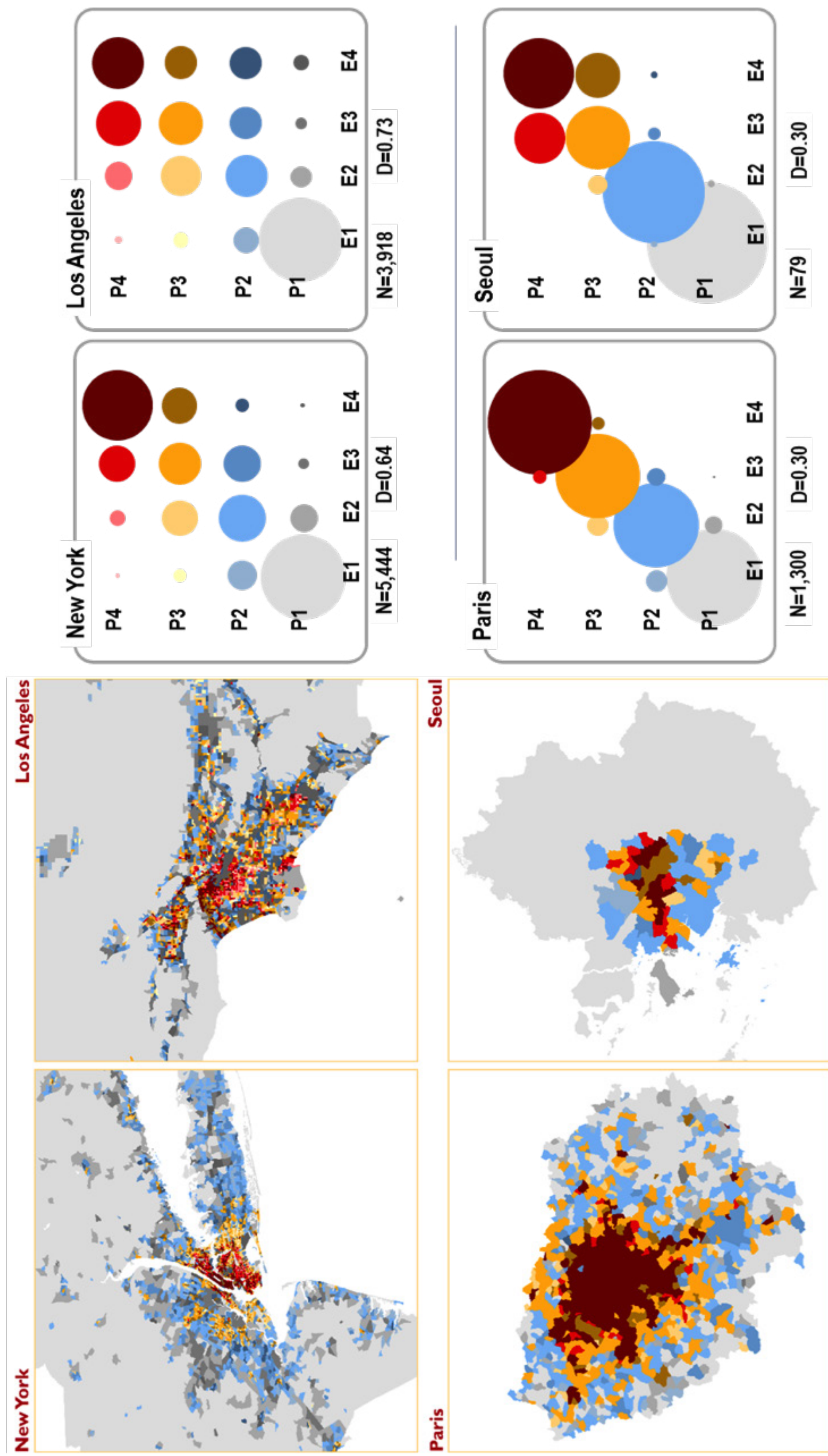


Figure 5: Freight landscape matrix by metropolitan area[3]

[3] Note: All metropolitan areas are shown at the same scale. New York and Los Angeles metropolitan areas are not entirely shown.

The results show an impressive diversity of freight landscapes in terms of the spatial and functional distributions. The largest number of spatial units of each metropolitan area are almost exclusively in the low population and employment density category (P1/E1). These units are also of larger size with a greater probability of a mix of activities, including rural. This suggests that a substantial part of these metropolitan areas is comprised of areas that have limited levels of city logistics activities, or at least few constraints to freight distribution activities. As expected, Los Angeles has the highest level of divergence in its freight landscape (D=0.73), followed by New York (D=0.64). Although Paris and Seoul have the same divergence index (D=0.30), Seoul's level of divergence is likely to be higher due to the limited number of spatial units that were considered in this assessment.

Paris is characterized by a very high level of convergence (well within pattern I) implying a close correlation between population and employment densities. As such, the monocentric city has a concentric-like distribution of densities, implying a rather uniform freight landscape in terms of its operational constraints. This is particularly the case for the central area characterized by a continuous presence of P4/E4 densities. This represents a coherent zone for the application of city logistics strategies servicing an array of commercial, retail and personal consumption freight demands. Still, this is also reflective of multiple freight distribution systems operating within the same area. On the opposite side of the spectrum, Los Angeles has a high level of divergence (beginning of pattern IV), which reflects its polycentric character with more specialized land uses. As such, comprehensive city logistics strategies are less prevalent because of geographical and functional variations in densities. New York offers a more distinct level of convergence than Los Angeles, particularly in its central areas.

6.3 Focus on Los Angeles

Los Angeles is used to provide two examples of how logistics activities are related to the freight landscape population and employment categories. In Figure 6, a corridor of high employment and high population (P4/E4, P3/E4, P4/E3) is evident along Downtown LA-Hollywood-Westwood-Santa Monica. This is the largest and most dense population-employment concentration in the region. Right next to Downtown LA is the old industrial zone, where two major truck-rail intermodal facilities are located as well as many warehouses. In this context P1/P4 and P1/P3 patterns are prevalent.

Figure 7 shows employment-dominant zones along major highway corridors, with a large employment cluster surrounding one of the region's main airports (Ontario), which is a major air and road distribution hub for UPS. Other clusters further East and along the freeways are dominated by new warehousing developments.

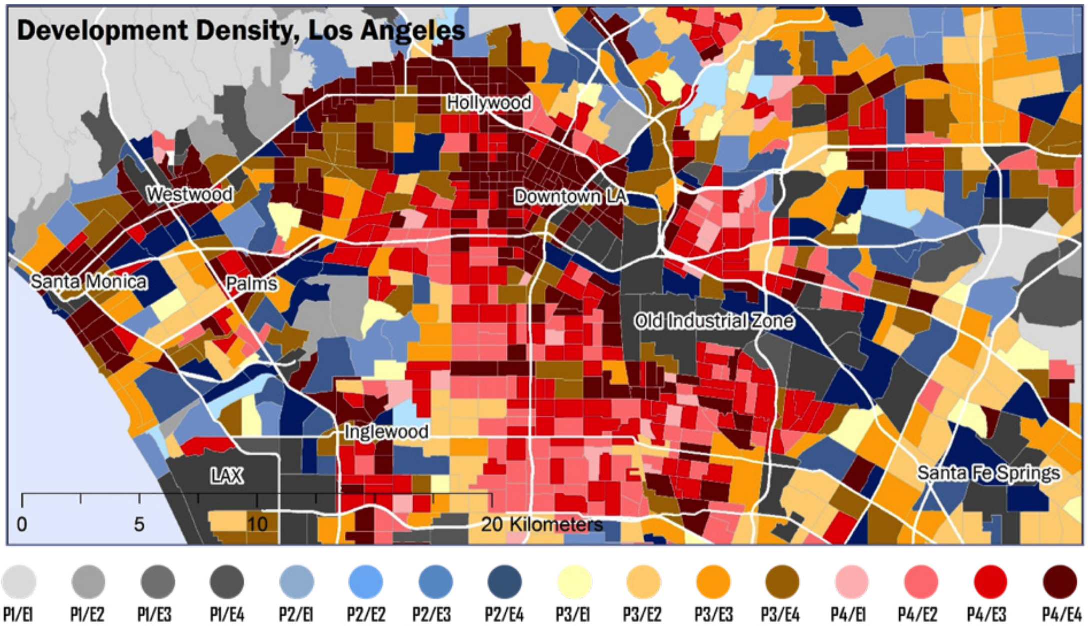


Figure 6: Downtown LA-Hollywood-Westwood-Santa Monica corridor

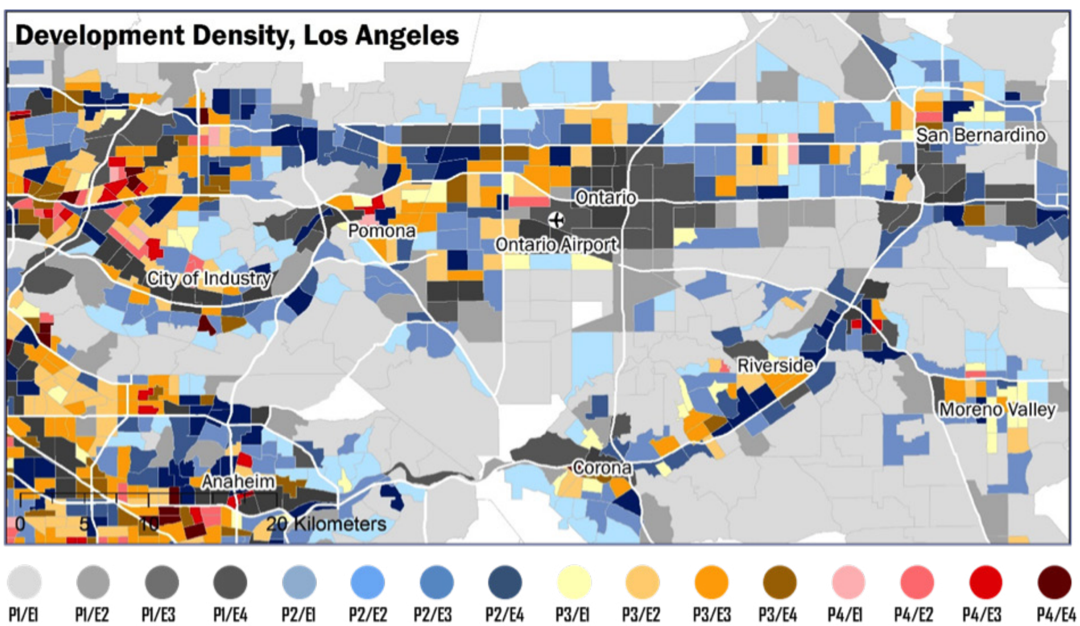


Figure 7: Employment-dominant zones along major highway corridors

6.4 Spatial variations

To further understand the spatial variations in the freight landscape, freight landscape density matrices were created at 5 km concentric ring increments up to 50 km from the official central business district or center of each metropolitan area (Figures 8, 9 and 10). The limited number of spatial units available for Seoul did not permit such an analysis, so the metropolitan area was excluded.

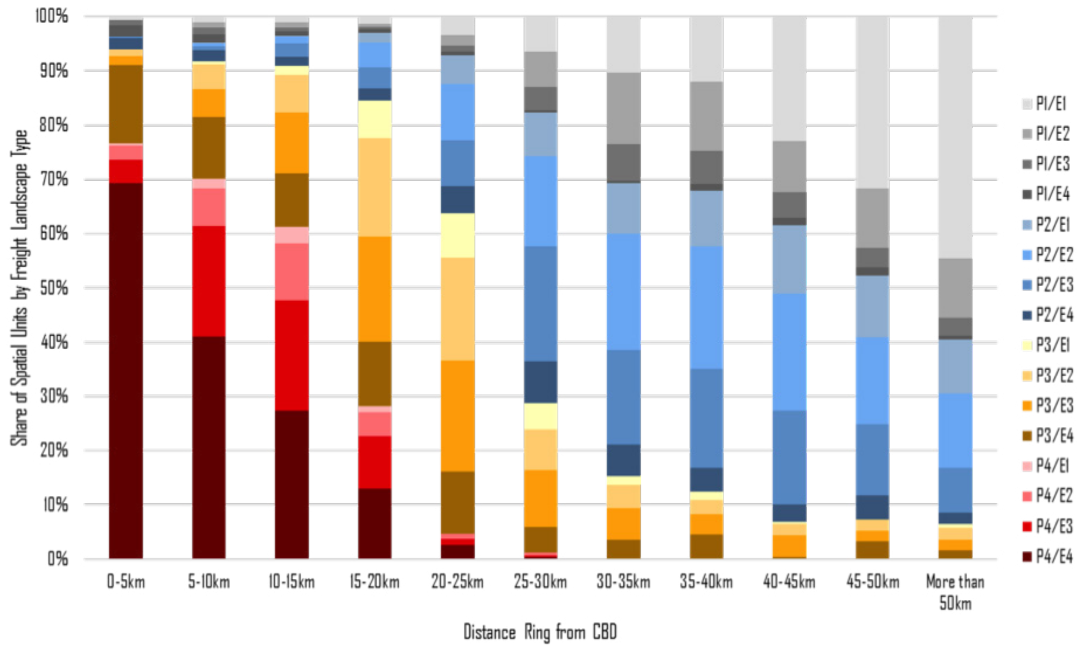


Figure 8: New York: Freight landscape matrix by distance from CBD (Midtown)

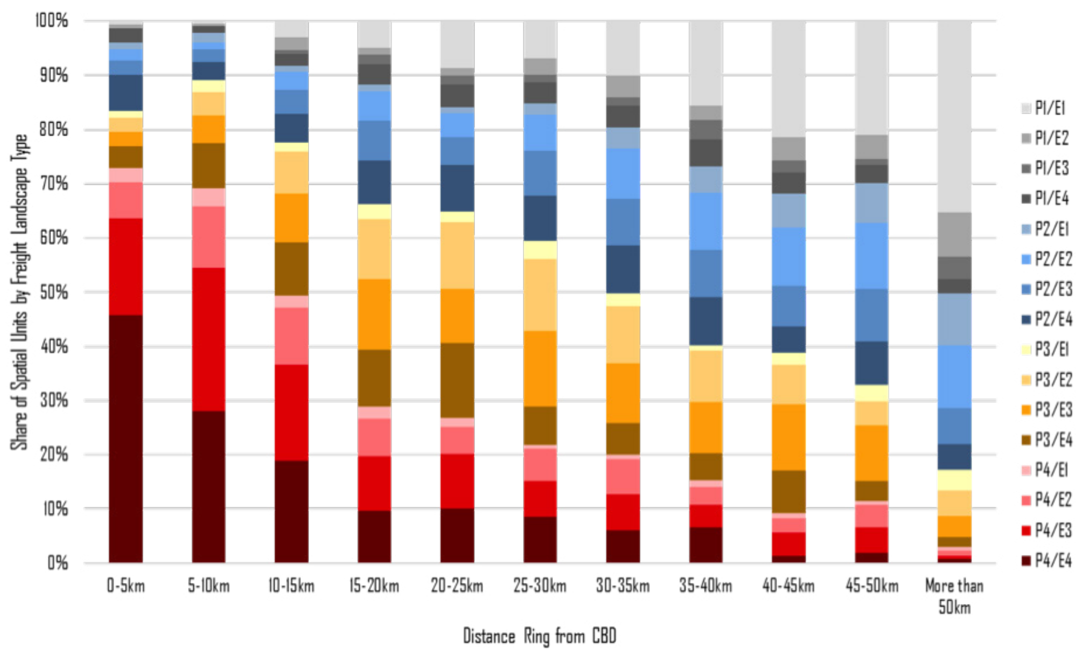


Figure 9: Los Angeles: Freight landscape matrix by distance from CBD (Downtown LA)

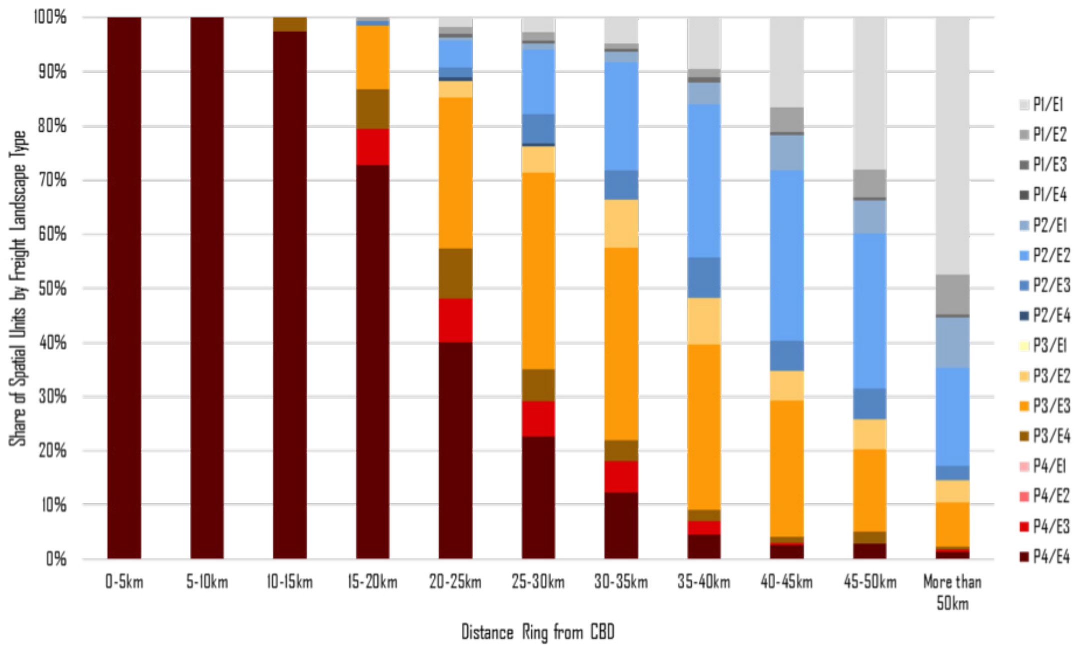


Figure 10: Paris: Freight landscape matrix by distance from CBD (Hotel de Ville)

Comparatively, the spatial variations of the freight landscape can be divided in three main zones:

- Less than 15 km from CBD. New York presents a clear area of high population and employment densities, with other functions of limited importance. It has a relatively clear freight landscape leaning on commercial and retail functions. Los Angeles shows a much higher diversity of landscape with significant pockets of distribution and manufacturing activities in proximity. Paris is an absolute case where almost all the freight landscape within this distance is in a single class of highest population and employment densities.
- From 15 to 30 km of CBD. New York experiences a rapid change in the freight landscape with prevalent distribution and manufacturing functions. For Los Angeles, the diversity in the freight matrix increases slightly and remains consistent with limited distance-based variations in this zone. However, the high population and employment density class (P4/E4) remains consistently present at about 5 to 10% of the number of spatial units. This underlines the polycentric character of the urban freight landscape with high population and employment density clusters. For Paris, the freight landscape goes to a direct transition from high to medium densities without an increase in specialization.
- Above 30 km from CBD. The freight landscape of New York transits rapidly to lower densities with an increasing level of specialization. For distances of more than 50 km from the CBD, the lowest density spatial units (P1/E1) account for about 50% of the landscape. The specialization level of the freight landscape for Los Angeles endures with gradually declining densities. For Paris, the transition to lower densities without a notable change in the level of specialization endures. Similar to New York, about 50% of Paris' spatial units are in the lowest density categories.

7 Conclusion

The paper developed the concept of the freight landscape, which offers a methodology to identify specific geographical conditions in which urban freight distribution is taking place. This underlines the question of what the freight landscape reveals about city logistics. The empirical evidence provided in this paper showed a substantial diversity in economic and population densities, which were approximated to diverse freight landscapes; and therefore conditions in which city logistics strategies are taking place. Such differences were assessed in terms of the level of convergence and divergence between different population and employment density classes. Incidentally, the selected cities belong to four different convergence patterns. New York offers a distinct convergence in its central area, focusing on commercial and retail logistics, with a divergence in its outlying areas. Los Angeles, due to its polycentric nature, shows an impressive diversity of freight landscapes throughout the metropolitan area; it shows the highest level of divergence among the four metropolitan areas investigated. On the other side of the spectrum, Paris shows a very high level of convergence implying a rather uniform freight landscape that is shaped in large concentric zones. However, each of these zones is subject to highly diversified freight distribution systems and thus of a complexity of city logistics. Seoul is also experiencing a high level of convergence, but the limited number of spatial units available for the case study makes the assessment of its freight landscape less effective.

It is also interesting to note that the convergence/divergence patterns identified in New York, Los Angeles, Paris and (to a lesser extent) Seoul closely resemble the way public administrations in these metropolitan areas have considered city logistics. The municipality of Paris together with cities in the metropolitan area of the region have been quite active in identifying a city logistics strategy. New York City, especially for Manhattan, has also started to implement freight policies. Administrations in Los Angeles are, on the contrary, rather indifferent to city logistics, reflecting a more dispersed, less concentrated, freight landscape.

The representations of the freight landscape that are provided in this paper are partial, since they only focus on the density dimension, while the freight landscape includes political, infrastructure and mobility dimensions as well. Employment groups are known as freight generators, but further research is needed to more effectively link employment density, freight activity and the urban spatial structure. This effort has begun. Giuliano, Kang and Yuan (2015) used network model data to test the relationship between density of truck flows and freight landscape densities in the Los Angeles region. They found that these simple proxies have significant explanatory value, and hence may provide an effective means for approximating spatial patterns of freight activity.

Here, aggregate employment figures were used, which by definition included a large variety of employment categories. A disaggregation of employment density data, such as warehousing and manufacturing employment, could provide a more nuanced perspective about the urban freight landscape. Doing so would enable a more effective spatial characterization of freight activities in urban areas and underline the contribution of freight to its spatial structure.

Overall, the method provides a robust proxy to identify, within an urban region, the areas that require specific attention as to freight mitigation/accommodation measures. It provides a framework for cities with no previous global understanding of freight intensity. That framework needs to be followed by more detailed data collection and analysis of freight activities if a city wants to design specific city logistics policies that are reflective of their densities, level and composition of freight activity.

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