

From the Last Mile to the Last 800 ft

Key Factors in Urban Pickup and Delivery of Goods

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Pickup and delivery operations are an essential part of urban goods movements. However, rapid urban growth, increasing demand, and higher customer expectations have amplified the challenges of urban freight movement. In recent years, the industry has emphasized improving last-mile operations with the intent of focusing on what has been described as the last leg of the supply chain. In this paper, it is suggested that solving urban freight challenges requires an even more granular scale than the last mile, that is, the last 800 ft. The necessary operations in the last 800 ft require integration of diverse stakeholders, public and private infrastructure, and a diverse set of infrastructure users with multiple, varied objectives. That complexity has led to a gap in the needs of delivery operations and the characteristics of receiving facilities (i.e., unloading and loading facilities and pickup-drop-off locations). This paper focuses on accessibility for pickup and drop-off operations, taking a closer look at urban goods movement in the last 800 ft from the final customer. The paper presents and analyzes previously documented approaches and measures used to study the challenges at the proposed scale. Finally, it proposes a more holistic approach to address accessibility for urban pickup-delivery operations at the microscale to help develop more comprehensive urban freight transportation planning.

Dense urban areas concentrate many commercial activities; as a result, significant urban goods movement (UGM) is generated. Urban freight flows can account for about one-fourth of the street traffic in an average size city, but even more space required is for urban freight distribution, such as load-unload zones (LZs), storage facilities, and packing capacity (1).

Transportation flows for the last mile are important because of the cost burden for the freight system, which is expected to increase as urbanized populations and concentrations of freight demand increases (2–5). According to the Council of Supply Chain Management Professionals, the cost of the last mile can be as much as 28% of the cost of the entire supply chain (6).

To date, much of the research on urban freight has focused on vehicle mobility (e.g., traffic speed and congestion), and far less attention has been paid to land use accessibility (7–9). This has led

to a lack of understanding of key aspects of goods movements in dense urban areas, such as the pickups and deliveries of freight in downtown areas. In some cases, the time the driver is away from the vehicle making deliveries can account for as much as 87% of the total time for the route (9). For these reasons, cities need to design and integrate strategies at the microlevel to enhance the efficiency of the final delivery (10).

The “complete streets” concept is an example of policies that consider design at the street level to enable safe access for all users. By using this concept, the Chicago Department of Transportation in Illinois has considered the limitations of traditional traffic methodologies, such as level of service, which focus on the through movement of vehicles and neglect key aspects of curb management such as the coordination of demand for and supply of loading and parking spaces (11). The New York State Association of Metropolitan Planning Organizations and the City of Philadelphia, Pennsylvania, have also adopted the complete streets concept by explicitly including UGM issues through the design and strategic location of LZs (12). Despite these examples, and to the extent of the authors’ knowledge, no research has looked at a holistic approach for integrating all factors that affect the ease of delivery and pickup operations in urban areas.

In this paper, the last 800 ft of an urban delivery or pickup operation were closely examined, and the lack of a holistic approach was highlighted to address the costs of this key portion of urban freight movement. The 800-ft distance between the parking location of a delivery vehicle and the location of the end customer highlights the importance for freight operators to find an LZ within a maximum tolerable distance to the end customer for dispatching deliveries or picking up goods (3, 13, 14).

The next section of this paper defines the pickup-delivery process in the last 800 ft, followed by a summary of the problems and approaches used to analyze each of the steps in the last 800-ft process. Next, the requirements of a holistic approach suited to analyze the last 800-ft process are presented. Finally, the main conclusions of this research are presented.

PICKUP-DELIVERY PROCESS FOR THE LAST 800 FT

In setting up the analysis of the pickup-delivery process for the last 800 ft, the steps that freight operators must follow to drop-off or pick up goods must be understood. Figure 1 shows the process of a typical delivery to an end customer, focusing only on the last 800 ft of the operation.

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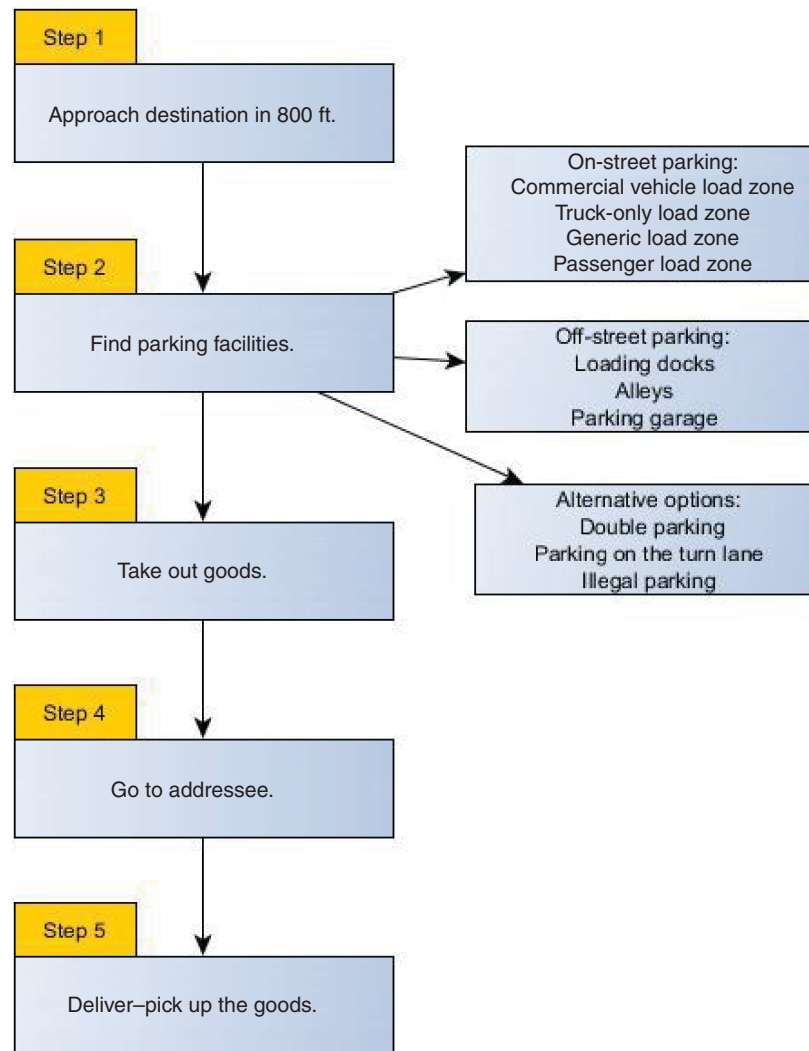


FIGURE 1 Process of a typical delivery to an end customer.

After entering the 800-ft radius from the delivery address, the driver starts to search for parking (Step 1). When finding parking facilities (Step 2), the driver has three options: on-street parking, off-street parking, and alternative parking. Alternative parking options may include double parking, parking on the median (or center turning lane), and parking illegally. (In some states, double parking and parking on the median are considered to be illegal parking.) Sometimes, because of a lack of available parking options, or if the delivery point is too far away from the parking location, the driver may choose one of these alternative parking options. The decision of where to park includes consideration of the size and weight of the package and the distance to the recipient's location.

Once the vehicle is parked, the driver unloads the goods by hand or with special equipment (Step 3). Then, the driver walks to the recipient's location (Step 4), moving the goods from the truck to the delivery point by carrying them or by using a hand truck or another means of assistance. Goods must be delivered to the place indicated by the customer or by a receiver who will inspect and receive them (Step 5). The driver may be required to walk to the back of a building, take the stairs, or find an office in a large building. After the driver returns to the vehicle, if there are more deliveries in that

radius, the driver repeats the operations until all goods have been delivered.

The following section presents the existing literature on the challenges, approaches, and measures used to study each step of the delivery process described above.

LITERATURE REVIEW

Approaching the Destination

When drivers are within a distance of their delivery destination adequate for parking the vehicle and dispatching the goods, they may face issues related to traffic flow, congestion, and transport policy.

According to Allen et al., traffic flow and congestion problems include traffic levels, traffic incidents, inadequate road infrastructure, and poor driver behavior (15). Additionally, delivery vehicles not only suffer from traffic congestion in local streets but also generate it. For instance, delivery vehicles have been identified as a major cause of traffic congestion in the city center district of Philadelphia (16). In this regard, cruising for parking and illegal parking are

behaviors that contribute to congestion and affect the performance of LZs (15–17). The role of LZs in the urban pickup–delivery process is further described in the section on finding parking facilities.

While approaching the delivery destination, drivers may also encounter policy-related issues related to vehicle access restrictions on the basis of time, size or weight of vehicles, bus lanes, or a combination of some or all of these factors (15). For this step of the process, the application of technology to wayfinding signs may also be relevant, because all parking signage and infrastructure should follow design standards that are sensitive to the logistical needs of users (14).

Finding Parking Facilities

Drivers need to find an adequate location for parking and leaving the vehicle to conduct pickup–delivery operations. For this study, drivers' options in dense urban areas were classified as on-street LZ, off-street LZ, and alternative options.

On-Street LZs

On-street parking facilities are a key aspect of urban freight transportation planning, because they are part of the assets that local governments can administer to assist freight transport operations related to the delivery and collection of goods. This type of facility provides dedicated space for loading and unloading for locations that generate freight trips but lack suitable off-street LZs. On-street LZs are especially useful when road users are competing for space (15).

Many studies have documented problems related to the operation of LZs in dense urban areas, and these can be grouped into three categories: the lack of LZs, infrastructure design, and law enforcement. Concerns about the lack of LZs in central business districts (CBDs) have been repeatedly voiced by freight operators in driver surveys in locations as diverse as Seattle, Washington; New York; and Mexico City, Mexico, to name a few (18–20).

Freight generation models are useful for assessing the balance between supply of and demand for LZ parking. Dablan and Beziat used a freight generation model to measure freight operations generated in districts of Paris at different times of day (17). Determining demand for a particular facility is a critical issue, especially in a dynamic e-business environment with consequent increases in package deliveries. Jaller et al. also proposed a methodology to estimate commercial parking demand and space availability as a function of the truck trips produced and attracted by commercial establishments (21). The model produced approximate estimations of on-street parking demand but did not include important factors such as parking prohibitions, types of restrictions, and different engineering designs for parking.

The existence of LZs does not guarantee that they are suitable for freight operations. The design of these facilities frequently does not consider the space (i.e., length and clearance) required for trucks to load and unload goods (14, 19, 22).

Another issue delivery vehicles face is competing for space with other users of the curb, which is a scarce resource, especially in dense urban areas. Local governments frequently implement management strategies such as user and time-of-day restrictions and pricing for LZ use. In this regard, the enforcement of policies that address competing needs is a key aspect of LZ management, because illegally parked delivery and private vehicles compromise the efficiency of

such management strategies (18, 19). The complexity of the regulations and the clarity of signs at the facilities are factors that affect the performance of these facilities as well (14, 18).

The following key aspects of on-street parking facilities are considered to be important elements of local parking management policies and have been the subject of research efforts aimed at improving the performance of LZs in urban areas:

- Time restrictions. Restrictions on duration of stop and time-of-day restrictions.
- User restrictions (parking purpose restrictions). The parking zones can be restricted to different purposes. For example, the city of Seattle enforces several types of purpose-related parking restrictions, such as generic LZ, passenger LZ, truck-only LZ, and commercial vehicle LZ.
 - Geometric design. The design of these facilities should be sensitive to the sizes of the vehicles likely to use them. Some guidelines recommend spaces between 30 and 100 ft (8, 14).
 - Location relative to the block. Locating parking facilities at the end of the block, in the direction of travel, and ensuring adequate design for handcart delivery (e.g., curbside height) may be important (3, 20).
 - Parking-meter technology. From coin-operated meters to multi-space parking stations, different technologies may affect the efficiency of parking enforcement and revenue collection (14).
 - Parking pricing strategies. These strategies may range from flat rates to escalating rates to more advanced, demand-responsive pricing, such as that implemented in the SFPark project in San Francisco, California, and in the LA Express Park in Los Angeles, California.
 - Booking system. Some cities are implementing parking reservations as part of smart parking management systems; these can include information about parking spaces, routes, parking booking, and convenient mobile payments (23).
 - Signage system. Digital (LED) wayfinding is often used in no-entry signs in parking lots and garages and also to indicate how many parking spaces are available and where to exit and enter. Static signage is often used to indicate on-street parking.

Despite research on the above, there are few examples in the literature that link the performance of the various types of on-street parking facilities to urban delivery indicators or other general UGM system parameters. Table 1 shows some of the documented urban freight objectives and performance measures closely related to on-street LZs. Allen et al. documented Objectives 1 through 4 in a thorough literature review of European UGM models (15). According to the authors, the state of the art in UGM modeling (in 2007) was not ready for standardization, and many different policy-oriented models could be developed. Thus, Objectives 5 and 6 could refer to the subsequent modeling approaches that aim to help decision makers estimate the impacts of LZ policies.

Objective 5 is based on the approach of Nourinejad et al. (3). The authors used traffic microsimulation to evaluate the effects of different configurations of user restrictions for existing LZs in an urban area. The performance measures used to track the policy impacts were average parking search time, average walking distance from the LZ to the delivery point, and average access time (i.e., search time plus walking time).

They also used a model to simulate parking choice decisions on the basis of the type of parking facility and distance to the destination. To model dwell times and parking decisions, Nourinejad et al. fitted their distribution on the basis of data from a driver survey and implemented

TABLE 1 Examples of Previous Research Objectives and Indicators Related to the Last 800 ft

Objective	Performance Measures
1. Measure the contribution of each industry sector to road congestion by looking at on-street double-parking deliveries.	Loading and unloading time in a zone, per vehicle, per activity
2. Measure the impacts of location of the platform for delivering goods related to its market radius.	Average length of the first leg (one-way) from LZ to the delivery area
3. Measure the contribution of one delivery–pickup to urban traffic (per type of vehicle involved).	Average distance traveled per pickup or delivery
4. Measure the time taken for a delivery in a tour, on a street, for an industry activity.	Average time taken per delivery (e.g., per vehicle type, per vehicle, or per ownership type)
5. Evaluate the impacts of LZ user restrictions in a study area.	Average search time Average walking distance Average access time Total network travel time
6. Evaluate the impacts of numbers and locations of LZs on delivery costs in the central business district.	Transportation costs per van and handcart travel distance

them with Monte Carlo simulation (3). Dwell times were fitted with a cumulative percentage distribution function and a maximum dwell time of 77 min from the observed data. Parking choice consisted of a binomial logistic regression that modeled the decision of whether to park in a facility within 820 ft of the destination or to wait for a closer spot. The binomial logit model showed a driver preference for loading bays and a negative effect on parking preferences of the distance between the parking facility and the on-street LZ.

Objective 6 resulted from the approach of Muñuzuri et al., who used network modeling and optimization with genetic algorithms to solve the location problem and to estimate the number of LZs in a CBD (13). The analysis included an estimate of the distance cost for delivery drivers (both legs of the trip by van and handcart), which was translated into a monetary value by using national average estimates of transportation costs.

Off-Street LZs

Off-street freight parking areas have a very specific role in the last 800 ft of UGM. They accommodate delivery trucks, allowing operators to undertake loading and unloading without causing inconvenience to other road users. Inefficient use and infrastructure design problems of such facilities have an immediate effect on the surrounding traffic (24) and delivery cost.

Scott et al. identified important aspects of off-street LZ problems (14), and Pivo et al. documented drivers' concerns about driving in urban areas (20). These studies broadly categorized the problems associated with these facilities as outdated building codes, poor geometric design standards, insufficient LZ facilities, and inefficient alleyways.

The reuse and redevelopment of older infrastructure for commercial or retail use can result in buildings that rely only on on-street parking because of a lack of adequate off-street parking. Furthermore, the outdated design of many of these facilities may no longer meet truck

loading–unloading safety needs because of inadequate turnaround space, insufficient access, and parking congestion. The efficiency of alleyways may be hindered by blockages because of trash containers, the violation of one-way policies, and tight access pathways.

The design of a loading dock considers the following basic requirements: dimensions of the area used for maneuvering (called the apron), the number of loading bays, and the width of each bay (25–27). These are estimated on the basis of input parameters such as throughput or demand, types of loads and trucks, and total handling time. These factors vary with the type of building and the location of the building within the city. These parameters seem straightforward but are difficult to capture in a meaningful way, and their standards are rarely homogeneous across cities.

Eidhammer and Andersen acknowledged the difference between the dimensions of loading docks and those of the trucks using them, a difference that can increase the total unloading time and thus add to delivery costs (28). They performed a cost–benefit analysis on coordinating the dimensions of urban loading docks with those of trucks. Four scenarios were considered: two for estimating the effects of truck height and length restrictions and two based on the dimensions of the loading docks. The authors determined that the cost–benefit ratio was highest when the dimensions of the truck, especially the length, were altered because any changes to loading docks in existing buildings are very expensive because of the financial and spatial challenges faced by old buildings constructed with outdated ordinances.

Shoup asserted that minimum requirements for passenger car parking spaces that are equal in area to the retail floor or business area are illogical and baseless (29). These requirements have pushed developers to provide more parking spaces than necessary; consequently, they remain empty most of the time. Muñuzuri et al. proposed ways to deal with these additional parking spaces (30). Properly designed land use regulations can transform these parking spaces into spaces for load–unload operations and remove the delivery operations from curbsides and streets. In dense urban areas where on-street parking spaces are scarce, building regulations can be used to reorganize the existing parking spaces as freight delivery spaces, preferably inside the building. Depending on the building size, loading docks can be provided underground. Muñuzuri et al. also introduced the concept of hub areas, where delivery vehicles can park while deliveries are dispatched on foot with moving equipment such as handcarts (30).

According to Kawamura and Sriraj, the efficiency of alleyways can be increased with adequate turning radii, multiple exits in long blocks, and one-way policies (31). They also suggested proactive provision of LZs on streets before businesses request them, and loading docks accessible by all truck types without competition for space from passenger vehicles.

Alternative Options

Various studies have pointed out that scarcity of both on- and off-street parking facilities leads to illegal or inadequate parking, including double parking, parking on the curb, and parking on the turning lane. Holguín-Veras and Patil concluded that carriers park in unsuitable spaces because of a lack of options (32). These parking behaviors reduce the capacity of the roadways, inconvenience pedestrians, create conflicts with other modes, and ultimately lead to congestion and safety issues.

Han et al. estimated that pickup and delivery activities caused a total national delay of 500 million vehicle hours, equivalent to a cost of \$10 billion (33). They are the third most frequent cause of tempo-

rary loss of transportation capacity, after vehicular crashes and work zones—even ahead of adverse weather conditions.

Kawamura et al. analyzed parking violations by trucks in Chicago to identify the factors that affect high levels of violations and to determine the spatial distribution of parking violations in relation to the built environment and socioeconomic factors (34). The study provided a breakdown of all the possible types of truck violations, with contravention of truck bans being the top reason and producing \$8.2 million in fines for a 1-year period. Parking violations were highest in the CBD and decreased with increasing distance from the core of the city. Furthermore, a regression analysis of the number of citations in relation to various socioeconomic and built environmental variables indicated that highly developed, mixed-use neighborhoods and areas with high food-service sales had relatively more citations than did industrial and transportation areas. These results corroborate the need for better land use plans and policies.

Delaître et al. conducted one of the few studies that looked into the interaction between truck parking and the flow of surrounding traffic (24). The authors used two French tools to calculate unserved demand for parking for deliveries and its effects on surrounding traffic. The tools, FRETUB and DALSIM, were developed individually in two studies. FRETUB calculated the delivery times for each establishment in an area at any time of the day for various types of vehicles. DALSIM simulated scenarios of the distribution of delivery areas, taking into account impacts on the surrounding area. Delaître et al. evaluated whether the use of FRETUB results in the DALSIM model would provide more thorough results than analysis without their application (24). Actual observations on the same streets showed that using FRETUB results led to a more realistic estimate. This tool could be helpful in planning, because the model includes decision variables such as the location and dimensions of the delivery spaces and the economic activity related to the space.

Kawamura and Sriraj analyzed interactions between the built environment and truck behaviors by using data from video cameras installed on specific Chicago streets to monitor truck activities (31). They found that trucks engaged in illegal parking more frequently (28.7%) than did passenger cars (3%). Additionally, larger trucks were more prone to illegal parking behaviors, with heavy trucks accounting for more than one-third of the violations; this finding reflects the lack of adequate parking spaces. This study also found that half of the reasons for truck parking did not involve pickups or deliveries. Instead, many of the stops were related to truck drivers' personal needs (e.g., food purchases or taking care of personal business); other stops were attributed to scheduled adjustments or waiting for delivery time windows.

Retrieving Goods from the Vehicle and Transferring Them to the Addressee

The next steps of the delivery process are retrieving the goods for delivery and transferring them to the addressee. These parts of the delivery process have not been well researched or measured.

In the case of small and light deliveries, the driver usually hand carries the goods. For larger or heavier deliveries, cargo-handling tools such as hand trucks, dollies, floor hand trucks, or two-wheeled hand trucks are frequently used. Big deliveries may require a forklift, platform truck, or pallet jacks. Conflicts with pedestrians and bicyclists are one of the problems that truck drivers can face while carrying goods between the parking location and the end customer. Additionally, when trucks are parked on the turn lane or double

parked, unloading activities can cause conflicts with vehicles trying to move through the area.

Delivery or Pickup

One of the main issues related to the pickup–delivery step is the interaction with customers: sometimes the truck driver fails to deliver goods because the appropriate recipient is not present. Additionally, if the delivery has to be made to a building without a reception or a package room, the truck driver must find the addressee, significantly increasing the dwell time of the delivery.

In the last several years, some innovations have been introduced to improve operations at this step of the delivery process. Companies such as Amazon, UPS, and FedEx have introduced pickup and drop-off locations for packages such as neighborhood businesses (e.g., UPS Access Point) or lockers (an approach used by Amazon and FedEx). This strategy allows parcel delivery in bulk to a single location and consequently makes this step of the delivery process less costly (35). The following list includes five broad categories of methods for goods delivery:

- Without a scheduled delivery time.
- With a scheduled delivery (i.e., exact time). The customer provides the exact time when the truck driver must make a delivery.
- With a scheduled time window. The truck driver has a time window in which to make the delivery.
- Unattended delivery. This is the most common type of parcel delivery, in which the truck driver leaves the goods at the customer's door.
- Locker delivery (reception boxes). The truck driver drops off packages in a locker, frequently located in a retail space such as a 7-Eleven. This approach solves the problem of the failed delivery and saves the driver a possible second or third attempt to deliver the goods.

Summary of Literature Review

Previous research has addressed the following elements of the last 800 ft of urban pickup–delivery movements: parking, access to pickup–drop-off locations (e.g., sidewalks), parameters related to building codes (e.g., building entrances and facilities within the building), and the characteristics of the pickup–drop-off point.

The literature provides analysis of the performance of LZs with network modeling and optimization, microsimulation, and supply–demand studies with freight generation models. In the case of off-street parking, a cost–benefit analysis approach has been used to look into coordination of the design standards for off-street loading facilities and vehicle dimensions and requirements. In addition, the causality of illegal parking behaviors has been explored with spatial hot-spot analysis of traffic citations. Lastly, advanced extensions of freight generation models have been useful for modeling the interactions between truck parking and surrounding traffic flow.

Nevertheless, the literature review undertaken for this study highlights the lack of an integrated approach that considers the interdependent steps of the last 800 ft of the pickup–delivery process and also the lack of methodologies specific to each step. Research is particularly limited in regard to the performance of out-of-vehicle activities and off-street parking facilities.

The adequate design, management, and use of this shared urban infrastructure is fundamental for the efficiency of the system. Differences in objectives and goals of various stakeholders that are involved in the last 800 ft of delivery and a lack of integration into the design and management processes have led to a gap in urban freight movement—a gap between the needs of deliverers and the characteristics of receiving facilities that impedes delivery drivers in carrying their jobs. For instance, city planners rarely consider freight in urban planning; this omission increases the operational and social costs of the delivery (36).

The next section presents a holistic way to analyze the mismatch between delivery requirements and receiving facilities.

ADDRESSING “THE MISMATCH”: ANALYSIS OF THE LAST 800 FT

The gap between the characteristics of the pickup–delivery operations and the receiving facilities reduces accessibility for urban pickups–deliveries in the last 800 ft. To address the last 800-ft operation of the pickup–delivery process, a more holistic approach that focuses on the accessibility of the location to help improve understanding and cooperation among stakeholders is proposed here.

By using this approach, a “mismatch” diagram (Figure 2), which addresses all aspects necessary to facilitate the accommodation of goods movement in the urban environment at the microscale, was developed. This section covers a discussion of the definition of freight accessibility and then of the mismatch diagram.

Freight Accessibility

Litman defined accessibility as the ability of a person to reach certain destinations to access the goods, services, or activities (also called opportunities) they need or want to perform (37). Accessibility is about how easily someone can access a certain destination, not the movement itself. Consequently, accessibility includes the interaction between the transport system and land use patterns as an additional level of analysis (38). However, accessibility is a

challenging concept to measure because of the many factors that affect it. Measuring accessibility requires a detailed understanding of people’s access needs and abilities, travel mode constraints, and the quality of service at a destination.

It is argued here that accessibility for pickup and delivery operations is dependent on the ability of the available infrastructure to meet the delivery needs and characteristics. Freight accessibility must take into account the freight facilities that match a particular goods movement, including the spaces connecting those facilities with the final destination.

The Mismatch Diagram

Figure 2 describes the aspects that directly affect the performance of operations that occur in the last 800 ft. The delivery characteristics represent the needs of the delivery and restrict the options for adequate facilities for that particular activity. In contrast, the facilities characteristics represent the infrastructure that exists in an 800-ft radius of the pickup–delivery location that could match those needs.

As stated before, freight accessibility is the ability of the existing infrastructure to match the needs of a delivery. Therefore, both the delivery and facilities characteristics described in the diagram together can indicate how accessible a location is, depending on the number of adequate parking facilities or opportunities available for the volume and the nature of the pickups or delivery trips generated by and for that particular location.

For a more detailed explanation, the mismatch diagram is divided into two parts, reflecting Steps 1 through 3, that is, approaching the destination, finding parking, and retrieving goods from the vehicle. Operations away from the vehicle are related to both Step 4, which covers transferring goods to the addressee, and to Step 5, which covers pickup or delivery of the goods.

As can be seen in Figure 2, delivery characteristics during the vehicle phase of a pickup–delivery include the following:

- Vehicle type and size: dimensions and maneuverability of the delivery vehicle,
- Delivery schedule: time window of the delivery or for the stop,

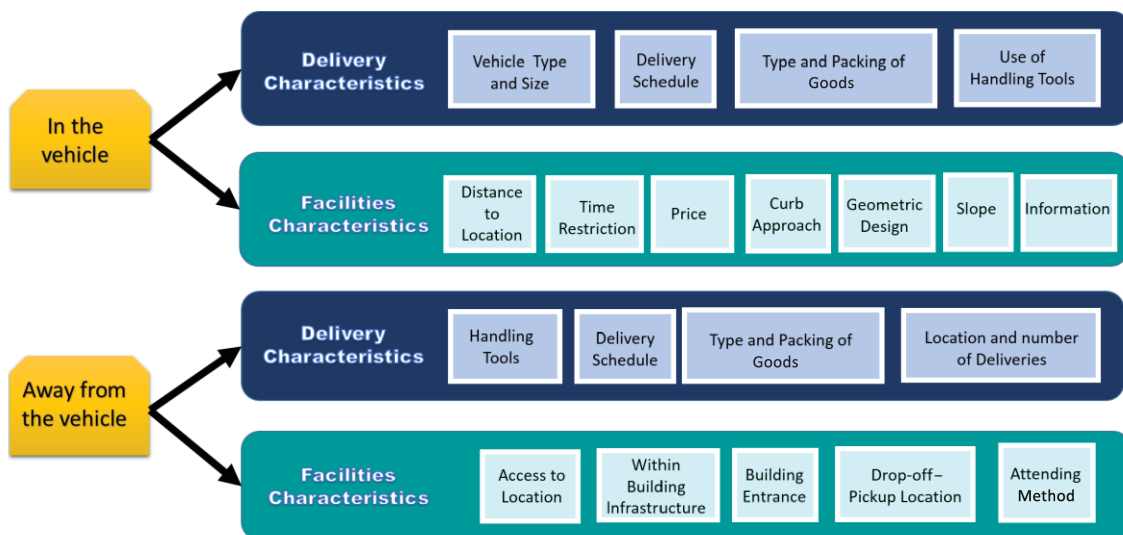


FIGURE 2 The mismatch diagram.

- Type of goods: type of goods that are being delivered or picked up and special needs they may require (e.g., refrigeration),
- Packing of goods: size and type of packaging, and
- Use of handling tools: hand truck or lift gates (or carried by hand).

The most relevant facility characteristics for the “in the vehicle” phase include distance to the pickup–drop-off location, time restrictions related to the facility’s maximum use time and its price, the geometric properties of the curb to access the space, the slope of the space, the geometric design of the parking facility (height, length, width, and vertical clearance), and the information available to the truck driver for making an informed decision (e.g., signage and real-time information).

The delivery characteristics important in the “away from vehicle” phase are similar to those of the “in the vehicle” phase: delivery schedule, nature of the goods, packing of the goods, and handling tools, as well as the number of deliveries and the pickup–drop-off location. The two latter characteristics affect the number of required walking trips, their distances, and the type of pickup–drop-off point (e.g., office in a big office building, lobby of a residence building, public lockers, retail store, or store functioning as a location for picking up and dropping off packages).

The facilities’ characteristics for the second phase include access to the location or the path to reach the pickup–drop-off location (e.g., dimensions of the sidewalk, slope and conditions, or mode conflicts), location and dimension of the building entrance, infrastructure within the building (i.e., elevators, ramps, and stairs inside the building), and methods for attending to the goods at the delivery location (e.g., personnel available to dispatch the goods, lockers in a residence building).

CONCLUSIONS

Urban areas concentrate a lot of commercial activity that generates a significant amount of freight movement. Freight flows can account for approximately a quarter of the volume of urban traffic (*I*). Efficient design, management, and use of the urban space are fundamental to accommodating this activity and to supporting quality of life. In this research, the last 800 ft was discussed as the key challenge to UGM, the state of research on relevant issues was reviewed, and a framework was proposed for considering improvements in the last 800 ft of the supply chain.

The last 800-ft stretch is important for the following reasons.

- It is essential for the driver to find an adequate parking facility.
- The operational phase away from the truck can be lengthy.
- Stationary delivery vehicles can cause traffic problems (e.g., contribute to high levels of congestion, safety issues, and infrastructure damage).
- There is constant pressure to increase speed and reliability because of higher customer expectations.

For the receiving facilities to be able to provide freight accessibility in urban areas their characteristics need to complement those of the pickup–delivery operation. However, the lack of integration among the many stakeholders involved in this portion of the UGM, each with their own unique perspectives and needs, creates a gap between those characteristics.

Limitations in current analytical approaches also hinder the integration of strategies into the last 800 ft. The methodologies reviewed

do not comprehensively include all relevant performance factors that are part of the steps of the pickup–delivery operation, nor do they integrate all those steps into their analysis. This is especially noteworthy for the portion of pickups–deliveries that occur out of the vehicle from the loading zone to the end consumer, and for aspects of off-street parking facilities, probably because of a lack of data on private operations.

Further research on the last 800 ft will help public and private stakeholders better understand how to improve accessibility for urban freight pickup and deliveries by focusing on physical infrastructure. In the public sector, planning departments could benefit from this enhanced knowledge by developing more informed urban freight policies and strategies. Future work along these lines will increase the likelihood of successful public–private collaborations by articulating common goals and needs.

It is hoped that this paper will motivate other researchers to look more closely at this key portion of UGM, ultimately supporting local governments, carriers, shippers, receivers, and consumers by reducing the operating and social costs of the supply chain’s last 800 ft.

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