GOING THE LAST MILE:

Best Practices of Urban Freight Movement

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Photo Credit[1]

Columbia University in the City of New York

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Acronyms

CBD	Central Business District
CEP	Courier Express and Parcel
EU	European Union
EV	Electric Vehicles
EFV	Environmentally friendly vehicles
GDP	Gross Domestic Product
LTL	Less Than Full Truck Loads
MAMCA	Multi-Actor Multi-Criteria Analysis
MDC	Micro Distribution Center
PPP	Public Private Partnership
SST	Self-Service Technology
UCC	Urban Consolidation Center
UFT	Urban Freight Transport
ULS	Urban Logistics Space
VMT	Vehicle Miles Traveled

Table of Contents

Executive Summary

I. Background of Tel Aviv-Yafo

Tel Aviv-Yafo, Israel is a major cultural and financial center in Israel. Every day, several hundred thousand vehicles enter and leave the city during rush hour causing traffic congestion. The Municipality is facing increased pressure to resolve the congestion while at the same time promoting economic growth in the city. In the past few years, the Municipality has focused on planning for pedestrians and cyclists through increased bike-only pathways and public transportation lanes. The plans for commercial vehicle activity have been limited.

II. Purpose of research study

The Municipality of Tel Aviv-Yafo currently does not regulate commercial vehicles. Delivery and shipping vehicles use existing lanes and parking zones at their convenience. This creates traffic congestion in the city center when these vehicles double-park on narrow roads or park in designated public transportation lanes. The Municipality is beginning to develop a vision to address these issues. The purpose of this study is to support the creation of the vision by providing the Municipality with recommended solutions from cities across the world. These recommendations address the issues of traffic congestion, environmental impacts and the overall improving freight system efficiency through urban distribution centers.

III. Methodology

Forty-six cities worldwide with known traffic congestion and/or vehicular pollution were reviewed for urban distribution center solutions. Three solutions were identified as best practices: Micro Distribution Centers, Mobile Package Delivery, and Parcel Lockers. Each solution was analyzed for the following information through literature review and interviews:

Regulation and Policy	Logistic Services	Organizational Model
Signage	Type of distribution (business to business or business to customer)	Ownership of land
Specified delivery routes	Characterization of cargo (refrigerated goods, food goods, non-food goods, heavy goods, parcels, or mixed)	Percentage of government funding
Specific time of deliveries	Mode of delivery (trucks, electric vehicles, cargo bikes, etc.)	Percentage of private funding
Vehicle load restrictions		Percentage of other funding

IV. Overview of findings

Three solutions were identified as possible urban distribution center solutions: Micro Distribution Centers, Mobile Package Delivery, and Parcel Lockers.

A. Micro Distribution Centers (MDCs)

A recent innovation, also known as "urban warehouses," "urban micro-consolidation centers," (UCCs) or "transshipment centers," around the world, are the first point of consolidation and dispatch for freight delivered via air, rail, road or ship to the city for last-mile distribution. Micro distribution centers (MDCs) are located in close proximity to the Urban Consolidation Centers as well as the final destination of freight to reduce the time and costs associated with last-mile deliveries, ease congestion and reduce the environmental footprint of freight delivery companies. Governments can encourage the implementation of this last-mile solution by incentivizing private freight companies to invest in UCCs and MDCs through preferential zoning or property tax relief for committing to greener last-mile freight delivery. Although initial costs can be prohibitively high, the long-term cost and environmental benefits from investments in developing UCCs and MDCs can exceed the upfront costs incurred by both the private and public sectors. Moreover, flexibility of location (such as in unused and/or underground spaces) can allow some reprieve in sunk costs, and allow for implementation in cities with limited and expensive real estate.

B. Mobile Package Delivery

This option involves a two-part system whereby packages are delivered to a micro distribution center (MDC) located within close proximity to the city center and then dispatched to their final destination via green-vehicles (electric vans and/or cargo bikes). Successful pilots in many European cities have provided valuable case studies to show the success of the system, especially when the following issues were present: insufficient or inadequate loading and unloading zones, pedestrian safety, delivery time restrictions, low emission zones, speed restrictions, and congestion. This solution is ideal for non-perishable goods; and the system increases parking flexibility, reduces delivery time, congestion, and greenhouse gas emissions. Moreover, mobile delivery and cargo bikes allow private freight delivery companies to abide by the strict rules and policies that are being implemented to regulate freight delivery in inner-city neighborhoods around the world. Public funding and multi-stakeholder collaborations around planning and roll-outs have proven to be critical in the success of these projects.

C. Parcel Lockers

These unmanned last mile innovations allow convenient and secure package pick-up and drop-off services to customers 24/7, and reduce the congestion and pollution generated by door-to-door delivery. Parcel lockers are best suited for non-food and non-refrigerated goods, and ideal locations include high-foot traffic areas (such as shopping malls or convenience stores). Parcel lockers have low labor costs, are relatively quick to install, and have been successfully rolled out in many cities. Public-private partnerships have worked well to identify appropriate locations. Many successful pilots led by major freight delivery companies such as Amazon and InPost have led to the rapid proliferation of parcel lockers around the world.

IV. Recommendations

This report provides a comprehensive analysis of the three recommended urban logistics spaces (ULS) that alleviate the socio-economic and environmental problems related to freight delivery efficiency in Tel-Aviv. The adoption and implementation of any or all of these solutions must be customized to fit the city's needs, and be developed in line with a vision for a larger freight plan or sustainability strategy for the entire municipality. It is recommended that the following are considered: urban population demographics, consultations with all constituents and stakeholders, and deficiencies in Tel-Aviv's overall transportation management system. Finally, the implementation must be informed by best practices in urban logistics by other cities around the world.

Objectives

1. Review best practices of urban logistics spaces worldwide
2. Identify last mile delivery solutions
3. Solutions to address:
   - Traffic Congestion
   - Air pollution
   - Improved delivery logistics

Phase I

Research:

- Tel-Aviv
- Freight delivery
- Urban logistics
- Last mile solutions

List of Cities:

- Variable size, congestion, urbanization
- Growth of e-commerce
- Sister cities and partnerships

Analysis of Cities:

- Freight Plans
- Sustainability Plans
- Innovations
- Urban logistics solutions
- Supporting mechanisms

Phase II

Cities Solutions

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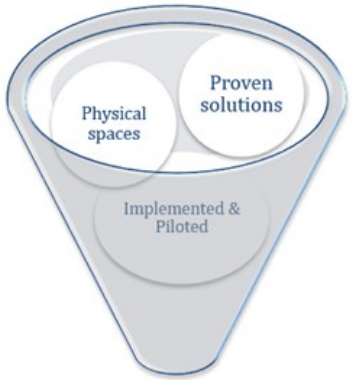
Client Filter



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- Micro Distribution Centers
- Mobile Package Distribution
- Parcel Lockers

Implementation

Next Steps

STEP 1: Information Gathering

STEP 2: Stakeholder Engagement

STEP 3: Goal Setting

STEP 4: Financial Viability

STEP 5: Policy Development

Overview

The objective of this report is to provide the Tel Aviv-Yafo Municipality with potential solutions through the development of urban distribution centers that address the primary issues associated with last mile freight delivery. These issues include traffic congestion, environmental impacts, and overall freight system efficiency. The solutions discussed in this report were selected with the goal of alleviating negative impacts to the city for its residents, retail businesses, and freight companies.

Phase I

Research

The project team conducted extensive research to understand the freight industry and the elements associated with the last mile delivery. The research focused on existing practices for supply chain management, logistics services, freight carriers and transportation planning methods. The initial research provided base knowledge of the issue of freight delivery from an industry perspective. In addition, research was gathered on Tel Aviv's population, demographics, geography, urban plans, traffic patterns, commercial zones, and transportation network. Current municipal plans in place to regulate pollution and address Tel Aviv's environmental health were also reviewed.

City Selection Criteria

A list of cities with traffic congestion and vehicular pollution challenges was developed. These cities ranged in size, population, gross domestic product (GDP), and relationship with Tel-Aviv, both geographically and classification as a 'Sister City.' This list provided a primary focus to review how each city managed and regulated urban freight delivery. Forty-six cities met this criterion, which served as a starting point for researching viable solutions to recommend to the Tel Aviv Municipality. (Appendix A)

Several cities within the European Union (EU) have implemented last mile delivery solutions through regional associations including but not limited to the Civitas Initiative,6 BESTUFS7 and the LaMilo Project.8 Each of these groups have supported, or continue to support, pilot programs that promote freight efficiency. A significant portion of the case studies reviewed relied heavily on information provided by these programs because of the well-organized structure intended for duplication, as well as the variety of initiatives that have been piloted with proven results.

Analysis

In the next round of analysis, the project team focused specifically on cities that had developed sustainability or freight plans, had developed regulations around congestion, and/or had partnered with key private companies to address freight logistics. Best practices and the most common solutions across cities were identified and analyzed for government involvement and funding models.

Interviews:

The project team conducted select interviews with key stakeholders to gain supplemental information on the feasibility and implementation process for respective Urban Logistic Space (ULS) types. These included interviews with the Business Development Manager of Amazon Lockers and a representative from the TNT Express Shipping Company. (Appendix B)

Phase II

Urban Logistics Spaces-Client Objectives

The client requested that only cities that have successfully implemented a physical space solution for urban distribution be considered in the analysis. By focusing on the physical spaces, the list of cities was reduced to eight. Case studies emerged that had solutions relevant to Tel Aviv's needs, such as a differentiation between actual physical spaces, herein referred to as an Urban Logistic Space (ULS), and mechanisms that support the ULS and last mile delivery. These supporting mechanisms were categorized as 1) regulation and policy; 2) logistic services; and 3) funding model.

A ULS Selection Matrix was developed to categorize each ULS case study based on the client's criteria for a physical space and supporting mechanisms. The ULS Selection Matrix can be referenced in Appendix C. The following information is included for each case study reviewed (as information was publicly available):

Regulation and Policy:

- Signage;
- Specified delivery routes;
- Specific time of deliveries; and
- Vehicle load restrictions.

Logistic Services:

- Type of distribution (business to business or business to customer);
- Characterization of cargo (refrigerated goods, food goods, non-food goods, heavy goods, parcels, or mixed); and
- Mode of delivery (trucks, electric vehicles, cargo bikes, etc.).

Organization Model:

- Ownership of land;
- Percentage of government funding;
- Percentage of private funding; and
- Percentage of other funding.

Micro Distribution Centers, Mobile Package Distribution, and Parcel Lockers

Based on the research discussed above, it was determined that the most relevant best practices fell within three categories: Micro Distribution Centers (MDCs), Mobile Package Distribution, and Parcel Lockers. The case studies within each category represent the best examples of last mile solutions that address the primary challenges of traffic congestion, negative environmental impacts, and overall freight system efficiency that were identified in the initial research. Information is also provided on stakeholder involvement, the funding required to execute the solution, and the available results of each case study. This report will go into detail on the role of the government in each scenario and any policies needed to enforce or incentivize the initiative.

Implementation:

Recommendations and an implementation road map highlighting short term and long term strategies for the consideration of the Tel Aviv-Yafo Municipality are provided for each of the three suggested solutions. These recommendations review potential costs, the local government's role, and key performance indicators (KPI's).

3.0 Urban Logistic Space Delivery Strategy

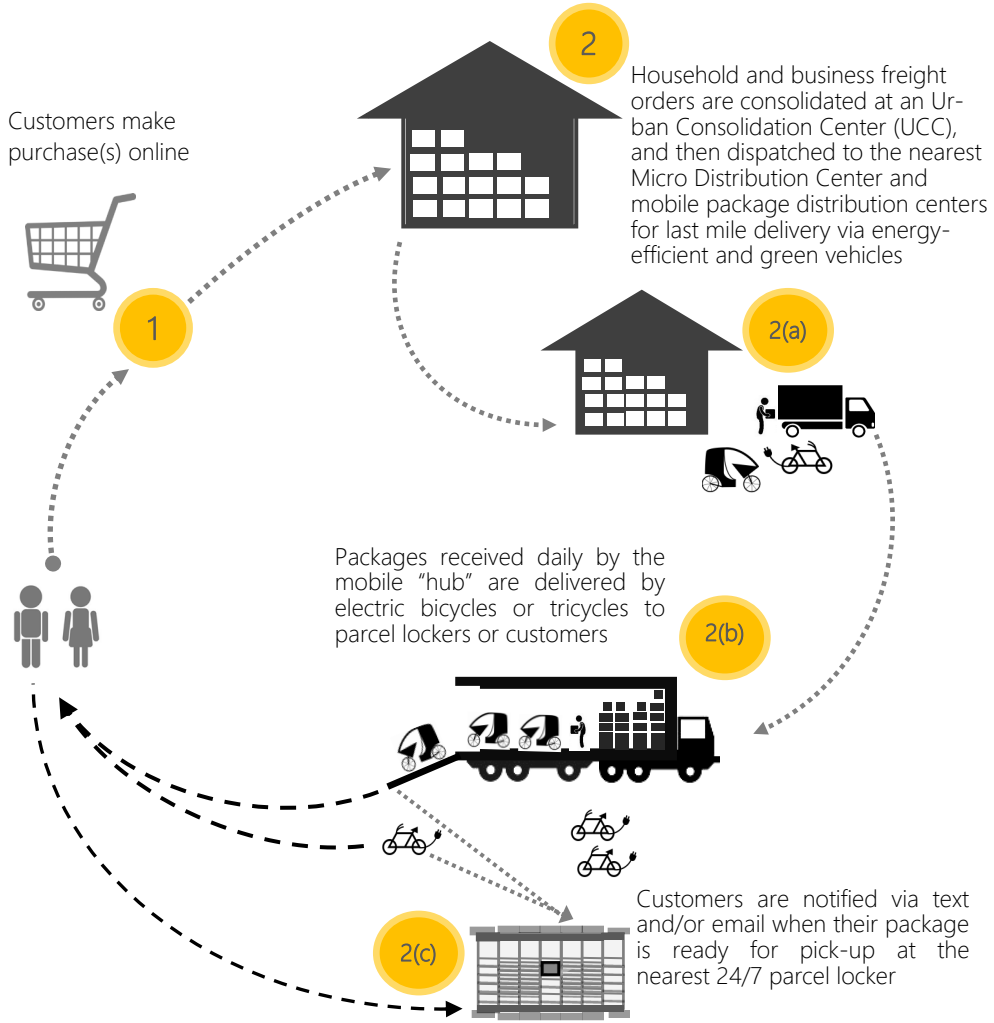
The following sections of the report will provide in-depth detail on the three recommended Urban Logistic Space (ULS) solutions: Micro-Distribution Centers, Mobile Package Distribution, and Parcel Lockers. Sections 3.1, 3.2, and 3.3 will include the following information for each ULS:

1. An overview of the ULS type including key characteristics;
2. Locations including the city and/or description of the physical space;
3. Primary benefits provided by the ULS;
4. A description of the operations and/or main activities;
5. Regulation and policy examples, and, as available, government pre-requirements;
6. Business model including sources of funding;
7. Criteria for success and considerations; and
8. A description of the implementation process including short-term objectives, long-term objectives, metrics, and key performance indicators.

A list of the main ULS' reviewed can be referenced in Appendix C; and detailed worksheets of these main case studies can be referenced in Appendix D.

3.1 Micro Distribution Center

Figure 3.1.1: Last Mile Delivery Via Micro Distribution Center



Infographic by Hadia A. Sheerazi based on information collected by the research team

Overview

A new concept in the field of urban logistics, which has been successful in cities including Paris and London, is the use of micro-distribution centers (MDCs). These spaces are also called urban warehouses, urban micro-consolidation centers, or transshipment centers, depending on the facility. MDCs are best described as logistical spaces established in key urban locations to assist with last mile freight movement. MDCs are smaller than Urban Consolidation Centers (UCCs) and don't necessarily focus on consolidation. MDCs are located close to the final destinations to allow for cargo vans or bicycles to perform the deliveries into the central business districts. Cargo vans are smaller than traditional commercial vehicles, thereby reducing the amount of space it occupies when loading and unloading. This alleviates the congestion that would otherwise be caused from traditional delivery methods. These types of operations have been set up throughout Europe.[9] While MDCs will be the intended main focus of this section, UCCs will also be discussed for supplemental information as regulations, policies, and key performance indicators are similar between UCCs and MDCs.

To better understand MDCs, it's important to define UCCs. UCCs are best described as facilities that reduce freight traffic from circulating within a target area by consolidating cargo in a central location before dispatching to the last mile.[10] Freight carriers that otherwise would make separate trips to the target area with relatively low load factors, which is the ratio of product to space within a vehicle, instead transfer their loads to a neutral carrier that consolidates the cargo and conducts the last leg of the deliveries.[11] In cities where large freight operators already deliver efficient loads, UCC's help to centralize the freight process and provide the city with increased management of transportation logistics and pedestrian/vehicle competition. UCCs are typically 30,000 m^2 or less.[12] In contrast, a typical MDC is 3,000 m^2 or less.[13] MDCs do not necessarily replace UCCs, but rather, can serve as an additional logistic space focused on improving the efficiency of the last mile of the freight supply chain.

Location

UCCs consist of facilities or warehouses located near commercial districts, shopping centers, or construction zones. UCCs are generally found outside city limits or on the outskirts of a city. This location ensures close proximity to final destinations and relative ease of access for deliveries. The high costs associated with financing a UCC are generally due to the large area of real estate required. Therefore, smaller MDCs are more appealing to place in the city limits.[14]

MDCs are located inside the city but generally outside of the central business district. MDCs often use mixed-use schematics and can be set up within an existing multi-family residential building, office building, or parking structure. MDCs have allowed municipalities to use unconventional less expensive real estate as logistical spaces within the city. For example, Chronopost, an express shipping company occupies 1,000 m^2 of an underground parking garage beneath the Place de la Concorde shopping center in the Montorgueil region of Paris.[15]

Regulations can also incentivize or require new buildings to be designed with space allotted for MDCs. Instead of trying to find space for a new UCC, it has been suggested by Colliers International that government entities work in tandem with real estate developers to integrate UCCs into new development projects. The potential expansion components of an ideal building include: physical space expansion, installation of more elaborate handling systems, or the installation of additional capabilities such as chilled and frozen produce storage.[16]

A private company operating in Paris, called Green Link, operates three MDCs, each of approximately 750 m^2 in size.[17] These are called 'green hubs' which utilize cargo bikes and electric vans to deliver within the last mile and information systems to process flows in real time.[18] The Green Link operates as a sub-contractor for shipping companies such as DHL and TNT.[19] Another successful example of an MDC with cargo tricycles for delivery in Paris is La Petite Reine, which operates out of two terminals, and has been operational since 2003.[20]

The UCC was modeled after the Place de la Concorde facility. This is a smaller than average UCC designed for distribution and collection of parcels 30 kilos or less. The design of the Beaugrenelle UCC was complex but resembles the model of MDCs in allowing for the use of electric-vehicles to accommodate last mile delivery due to its close proximity to the city center. This project was highly subsidized by the government in the early stages, but is wholly operated by the shipping company, Chronopost. The UCC utilizes a fleet of ten (10) electric vehicles and other alternative modes of transport to help reduce distance traveled and CO_2 emissions. This UCC allows Chronopost to distribute 5,000 parcels over 42 daily rounds within the Beaugrenelle region of Paris. Their goal is to have 25 vehicles by 2020.[21] This case study illustrates the key benefits of establishing logistic spaces close to the final destination.

Benefits

MDCs and UCCs are critical in freight efficiency and the benefits of these facilities stand out in the discussion amongst urban freight logistic literature. A report by Michael Browne *et al.* details the main benefits to include:

- Increase load capacity of packages in a vehicle, while reducing underused space and empty truck deliveries;
- Reduce pollution and emissions caused by large trucks in heavy populated areas;
- Alleviate the congestion of trucks, cars and pedestrians in city centers and/or commercial areas;
- Reduce competition in loading and unloading areas and delivery bays;
- Provide improved accuracy and consistency in delivery service times;
- Improve customer experience and overall customer relationships with vendors;
- Improve return convenience for both customers and vendors;
- Improve safety for truck workers and pedestrians in urban areas; and
- Reduce cost of the "last mile" delivery by reducing miles driven per commercial vehicle.[22]

Operations

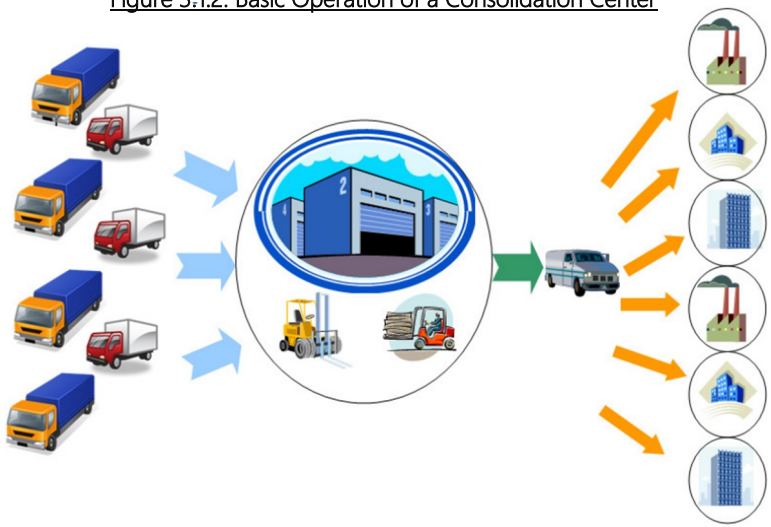
The operations of UCCs are focused on a process between retailers and suppliers. Retailers and contractors place orders for their goods and materials with suppliers and vendors as the first step. Instead of shipping goods directly to the businesses, the deliveries are made to the UCC. Retailers and contractors then place an order with the UCC to coordinate the delivery of the purchased goods and materials. Finally, the order is assembled at the UCC and separated by zone or location. The delivery consists of consolidated orders from different businesses and commercial entities loaded onto each vehicle. The orders are taken from large commercial vehicles and put onto smaller vehicles via the transfer at the UCC. These smaller vehicles allow for the navigation of traffic and loading/unloading conditions with optimized speed, efficiency and flexibility in congested areas. Most deliveries and orders requested from the consolidation center are delivered within a 24-hour period from the original deposit into the UCC.[23]

When MDCs are used in the freight supply chain, freight vehicles deliver the packages to the MDC nearest to the final destination, instead of trucks delivering directly to the final destination.[24] Under this system, vehicles only need to make one stop at the MDC to unload packages rather than multiple stops throughout the congested city center. An additional efficiency improvement comes from time coordination as deliveries can be made to MDCs during hours that do not conflict with rush hours, typically before the morning rush hour.[25] From the MDC, packages are loaded into environmentally friendly vehicles, or in most cases, onto electrically-powered or human-powered cargo cycles.[26] Cargo cycles can navigate narrow roads and congested streets more effectively than small trucks. Cargo cycles will be discussed in greater detail in the Mobile Cargo Distribution section of this report.

Table 3.1.1: UCC's Main Activities[27]	
Consolidation	Multiple daily deliveries can be consolidated into a reduced number of deliveries, which enables retail staff to concentrate on core activities like stocking, customer service, and inventory management, thereby increasing productivity.
Cross Docking	Deliveries can be made to a consolidation center at a time suitable to the supplier, with onward delivery at times suitable to the store, customer or MDC, therefore reducing staff and transport costs (in some cases staff is paid overtime to manage deliveries and inventory).
Storage	This can be short, medium or long term, depending on requirements. Storage can be a carton, case, cage, or pallet level.
Replenishment	Regular deliveries are made if a product is needed by the user throughout the day, rather than one unmanageable delivery. Staff is able to react quickly to customers' needs, therefore eliminating lost sales.
Pre-Retailing	For retailers, pre-merchandising activities can be carried out at the consolidation center before the stock arrives at the retail outlet. This includes unpacking, hanging, security tagging, re-labeling, size cubing and sale markdowns. This activity enables store staff to concentrate on customer facing activity rather than being at the back of the store. Ultimately, this lowers staff turnover and increases motivation and job satisfaction.

Table 3.1.2: MDC's Main Activities[28]	
Sorting	Sorting packages by barcode for delivery
Loading and unloading cargo	Loading cargo cycles
Bicycle maintenance	Repairing and charging cycles
Delivery scheduling	Information system smart technologies are becoming frequently popular for organizing and tracking delivery schedules. Green Link in Paris utilizes smart technology for tracking deliveries.

Figure 3.1.2: Basic Operation of a Consolidation Center[29]



Key Performance Indicators:

Michael Browne and Jose Holguin-Veras have identified the following key performance indicators in order to evaluate the overall impact of UCCs on freight efficiency, reduced congestion, and reduced delivery time. These indicators help in defining how best to measure their success and progress:

- Reduction in the number of vehicle trips per day;
- Decrease of the vehicle kilometers traveled by trucks;
- Reduction in the number of vehicles needed for daily distribution;
- Reduction in travel time from port to customer;
- Increased number of goods delivered per delivery point;
- Vehicle load factor is optimized;
- Reduction in the parking time and frequency of delivery vehicles;
- Reduction in the total fuel consumed by freight vehicle;
- Reduction in overall vehicle emissions; and
- Reduction in operating costs and fees associated with freight delivery.[30]

The key performance indicators below are more general, but also provide a context for determining how to gauge the effectiveness of a UCC or MDC. With regard to logistics and supply chain, these are the goals that UCC developers can focus on and use to show progress, also developed by Michael Browne and Jose Holguin-Veras:

- Potential to improve efficiency at receiving premises due to fewer and more reliable deliveries;
- Potential to improve efficiency/sales at receiving premises because of the reducing the number of times the staff must prepare for deliveries and manage inventory;
- Increased focus on providing on-time delivery, punctuality and accurate times for delivery;
- Improved order cycle time (time between when the product is shipped and when it is received by the customer;
- Efficient consolidation of items that are ordered frequently by multiple customers;
- Reduction in the total handling costs for goods passing through UCC; and
- Reduction in total freight transport costs for goods passing through UCC.[31]

In the case of the Bristol/Bath UCC, a 371 m^2 facility operating within an existing distribution warehouse,[32] key performance indicators showed success in pollution emissions reduction and number of vehicles. According to the CIVITAS Case Study report on the Bristol/Bath UCC, more than 16,224 vehicle trips have been eliminated since its opening, resulting in 158 tons of CO_2 saved, 5,136 kg of NO_x saved, and a 79% reduction in delivery trips for retailers.[33]

Regulations and Policies

Government regulation has had significant effects on the viability and continued success of many UCCs and MDCs. In general, it is the government's role to enact regulations that prioritizes reduction in traffic to effectively move goods in and out of the city. These regulations are created through investment in research, data collection, and discussion with stakeholders of the freight delivery network to determine what works best for all parties.

According to a report by Transport for London, governmental regulations have been effective in the city by implementing a range of regulations including charging a fee for vehicles that do not adhere to emissions levels and defining a Low Emission Zone (LEZ) for separating high polluting vehicles from those that follow emissions standards. London enforces this by tracking all vehicles with a LEZ automatic tracker and issuing tickets to those that do not comply with standards.[34] In cities like Berlin[35] and Paris,[36] the government has invested in signage to help freight delivery vehicles navigate the city and identify loading zones and non-freight areas.

Some cities have regulations that designate delivery time windows. In the Netherlands, more than 50% of the cities have this policy.[37] Delivery times are outside of rush hours to reduce traffic congestion but the specific times vary from city to city. To create the ideal delivery time window, municipalities need to work closely with shipping companies to assess when customers require goods to be delivered and the length of time it takes them company to complete its deliveries.

Furthermore, government must incentivize receivers or carriers, and actively engage them to determine what their specific needs are, and how a UCC or MDC might benefit them. Some government incentives are preferential zoning or property tax relief on properties in urban goods movement. This has been proven to be effective in several Canadian cities, where incentives were introduced to incorporate goods movement into new development plans.[38] These preferential zoning and tax relief programs foster sustainable practices by incentivizing one or more participants in the supply chain. Combining both incentives and regulations has been found to have a meaningful impact on the interest of freight agents. Environmentally friendly vehicles can be incentivized through public initiatives by charging penalties to carriers using inefficient vehicles, and by regulating minimum environmental standards.[39]

In the Netherlands, the United Kingdom, and Germany, tax-incentive programs geared towards carriers were found to accelerate the adaptation of electric and low-emission vehicles.[40] The Hong Kong Environmental Protection Department utilizes a number of incentive programs including a $3.2 billion program to help operators replace non-compliant vehicles with cleaner vehicles that comply with the latest emission standards. Hong Kong also has a tax incentive, which allows for deductions of capital expenditures for environmentally friendly vehicles.[41]

Governmental regulation should be careful not to create regulations that act as a disincentive to using a MDC or UCC. In the case of the Tenjin Joint Distribution System in Fukuoka Japan, participation by shipping companies is falling and one reason may be due to a new regulation that provided designated freight parking spaces. There are other factors that may be playing into the decline in participation of the Tenjin Joint Distribution System including an increase in cost per parcel, a lack of strategic planning to attract new clients, and a lack of introducing new technologies into operations; however, adding freight parking doesn't help the case for collaboration.[42]

Organizational Model

It should be noted that details of capital and funding costs for UCCs and MDCs are often under reported and hard to identify. In order to build a UCC, there generally needs to be a large space available around the outside of an urban city center. The costs associated with these spaces are often high, which tend to discourage some cities from pursuing the development of such facilities. In planning a UCC or MDC it is important to engage all stakeholders to reduce possible negativity and opposition. These stakeholders involve private freight companies, government, suppliers, public residents and union laborers.

Funding sources for most UCC or MDC development can vary from case to case. The most successful strategies have combined private partnership with public subsidies. For each UCC and MDC, it is essential to perform a cost-benefit analysis to determine viability and likelihood of success.

In some cases government will take on the role of financially supporting the creation and daily operations of a UCC, however this is not necessarily a sound long-term plan, as evidenced by the Bristol Bath UCC. The Bristol City Council is reducing subsidies each year, which makes the success of the UCC dependent on retailers paying to be involved in the scheme. The Bristol City Council's transport planning officer, Tim Hatgood, reported that the council is happy to support the UCC through its revenue budget; however, he wanted to see the council's subsidy decreasing. Currently the city subsidy comprises 65% of the total revenue invested. The remaining 35% comes from a mix of other European grants and contributions from retailers. The Bristol UCC's biggest problem is participation by retailers on a voluntary basis. Mr. Hatgood said the ideal scenario would be similar to that at Heathrow, where there is a landlord. He sees this organizational structure as the future of UCCs.[43] The Bristol/Bath UCC was subsidized with 221,910 Euros in its first year; however, the subsidy decreased to 141,083 Euros its second year when a charge for use was introduced. This charge was in the form of a fee that delivery companies paid for using the UCC.[44]

As part of a new pilot study initiated in 2015, 600 m^2 of space has been set aside for freight logistics within the underground transit corridor of the newly developed "Forum Les Halles" shopping center, located in Paris' Montorgueil region.[45] The pilot study was funded primarily by the city of Paris, and is intended to be a multi-operator system. Several issues have already been recognized with the new space. The size of the space is small, making sharing the space among multiple operators difficult and undesirable. The configuration of the space does not allow for the use of cargo-cycles, which was an intended mode of delivery when designed. In addition, the shopping center was sold during the launch of this pilot study, which has further complicated negotiations between stakeholders.[46] This study further highlights the importance of stakeholder engagement during initial stages of the business development.

In the situation of Chronopost's MDC located in the underground parking garage of Place de la Concorde shopping mall, Chronopost invested 500,000 Euros in the renovation of the terminal. The city of Paris negotiated a low rental price of 60 Euros per m^2 per year.[47] The reduced pricing means a loss of revenue to the city of Paris. A similar rental agreement is in place with at least one of the Le Petite Reine MDCs in Paris.[48]

Green Link 10th District of Paris Micro Distribution Center or "Green Hub"[49]

Micro-distribution center, London[50]

MDCs generally require shipping companies to pay a transshipment cost for sorting and transferring packages to the cargo cycles or electric vans.[51] In London, the transshipment cost was greater using a MDC than the traditional diesel-van deliveries due to the increase in the number of cargo cycle drivers and operating staff. Although costs may be transferred to different segments of the delivery, overall logistic costs were found to be approximately the same in London under the traditional delivery operation and that including the MDC.[52]

If government officials decide to develop an MDC, it is critical that private transport and delivery companies are engaged in the implementation process before developing the UCC or MDC to educate them on the value of the operation, and the shared benefit of the space. The goal is to also convince these partners that their costs would ultimately be reduced because of the UCC or MDC. For example, key cost reductions could come from a decrease in time being spent on deliveries in congested zones, shorter delivery times to the end customer, less fuel use for deliveries and increased times to be able to deliver. It is also important to note the cost savings associated with reducing environmental externalities that these companies should consider.

The following chart summarizes the costs and benefits generally associated with a UCC to the various stakeholders, as found through a research project on UCCs funded by the Department for Transport and carried out by the University of Westminster in London in 2005. Due to the similarity between UCCs and MDCs in improving the efficiency of last mile urban logistics, some of these costs and benefits are also associated with MDCs as well.

Table 3.1.3: Potential Benefits and Costs of a UCC and an MDC[53]

	Costs	Benefits
Supplier	• Not a single "door-to-door" operation	• Less time spent making deliveries in cities, leading to reduced operating costs • Potential to use time savings to generate additional revenue
Transport Provider	• Security • Loss of control over timed deliveries/responsibility • Perceived increase in damage through extra handling • Additional handling/delivery charges – could be passed to supplier as "surcharge"	• Routes involving UCCs allow more deliveries per day • Opportunity for night deliveries • Helps counter WTD driver shortage • Greater efficiency as no time spent slow running in town/parking problems etc. • Less slow running = improved fuel usage
Receivers	• Additional stage when chasing missing/late deliveries	• Improved delivery reliability • Fewer deliveries/less staff disruption • Ability to call-off orders in parts • Clients able to collect purchases from UCC • Less storage/more selling space • Off-site value-added activities • Improved retailing (street) environment • Continuous waste removal/recycling • Clients avoid travelling to store to collect orders – collect at UCC
Local Authority	• Cost of policing freight movements	• Potential licensing revenue • Fewer delivery vehicles in zone, leading to cleaner air, less congestion, pedestrian benefits and improved traffic flow • Potential for alternative fuel vehicles
UCC Operator	• Multitude of IT & paperwork systems to handle but not if UCC is considered final delivery point and operator has own system to cover the "last mile" • Timed deliveries – how to service • Responsibility for identifying losses/damages at intake stage	• Profit-making business
Developer (new retail sites only)	• Cost of establishing UCC if condition of planning consent	• A revenue stream, either if managed in-house or additional charge on rent • More rentable space as result of centralized receipt point and less "in-store" storage space • Single UCC makes whole site more attractive with fewer freight vehicle movements

Criteria for Success

In the case of UCCs and MDCs that are developed by municipalities, it is critical to establish the "societal problem" that the operation will help to solve. Generally, it is often best for the municipality to develop a partnership with a private entity to operate the UCC or MDC, such as Green Links.[54] A private-private partnership between the UCC operating entity and a landlord will drive value creation. The public and landlord's involvement would be driven by sustainability problems caused by distribution vehicles.[55]

In addition to private sector involvement, successful UCCs or MDCs have also been driven by "bottom up" pressure from the community and or groups who support the public interest. Once the citizens of a municipality show direct interest in reducing the congestion of the area, or the noise and pollution, then the government can and should begin to look at options to address these issues.[56]

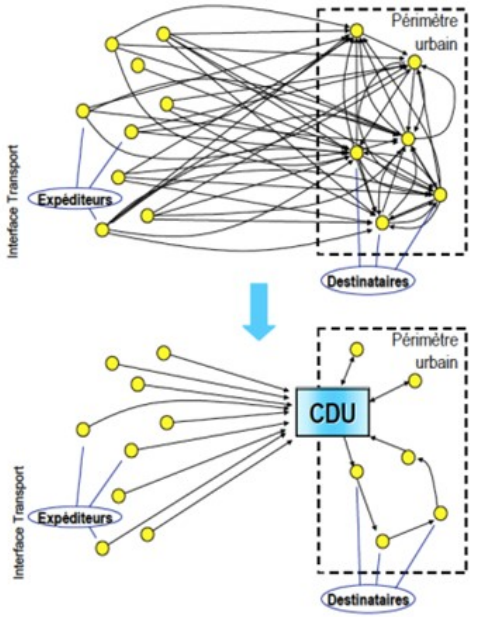
Implementation Process

It is important for Tel Aviv to conduct a site analysis to determine potential feasible locations for a UCC or MDC. In addition to this analysis, there should be conversations with the real estate and urban planning development teams to discuss integrating a UCC or MDC into future projects. The next step involves engaging key private stakeholders like DHL, FedEx and UPS to receive feedback on location, specific needs and their general opinion of the project. It would be important to also discuss the possibility and likelihood of one of these partners to operate the UCC or MDC.

Considerations should be taken to develop policy and regulation to mitigate congestion that would work in tandem with the UCC or MDC. These policies and regulations could include:

- Implement access restriction rules such as: deliveries based on times of day, specific days, low emission zones, specific traffic areas;
- Enforcement and control of activities such as: fees associated with breaking rules or a monitor of all UCC activity;
- Devise rules for electric vehicles such as: establishing the rules for the delivery by an electric vehicle and possible incentives for utilizing "green vehicles" used for delivery; and
- Establish certificates/permits for quality such as: developing permits for those delivery trucks that are improving their freight distribution by using the UCC or MDC.

Figure 3.1.3: Transportation Flows Before and After the Implementation of the Urban Consolidation Center (UCC)[57]



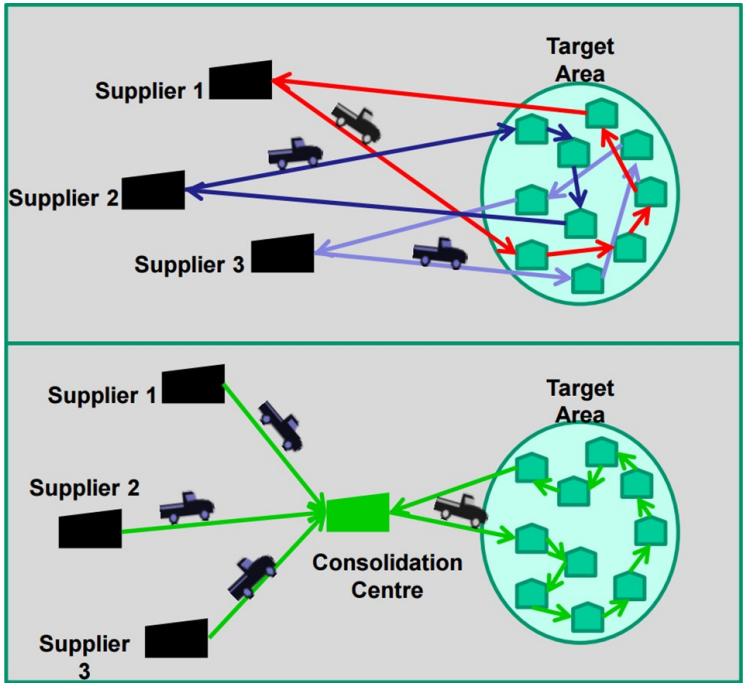
A cost-benefit analysis should be developed and carried out to determine the initial costs involved with building a UCC or MDC, and the benefits associated with the space. This would assist in framing the dialogue with key stakeholders. According to Michael Browne and Jose Holguin-Veras, critical KPI's to track include:

- The number of on-time deliveries;
- The reduction in order cycle time for the customer;
- The reduction of fuel consumption by the freight company;
- The reduction of kilometers traveled/trips taken by each vehicle;
- The reduction of space used by delivery vehicles;
- The tons of CO_2 reduced; and
- The kg of NOx saved.[58]

Figure 3.1.4: Variations in sizes of Urban or Micro Distribution Centers[59]

Urban or Micro Distribution Center	Surface Size (m^2)
Micro-Consolidation Centre London	160
Motomachi UCC, Yokohama	330
Ecologis Brescia	400
Broadmead UCC, Bristom	465
The Green Link	750
La Rochelle UCC	800
Lucca	810
City Depot Brussels	1000
Padova UCC	1000
Monaco	1300
Leiden	1500
Beaugrenelle Urban Logistics Space	2900

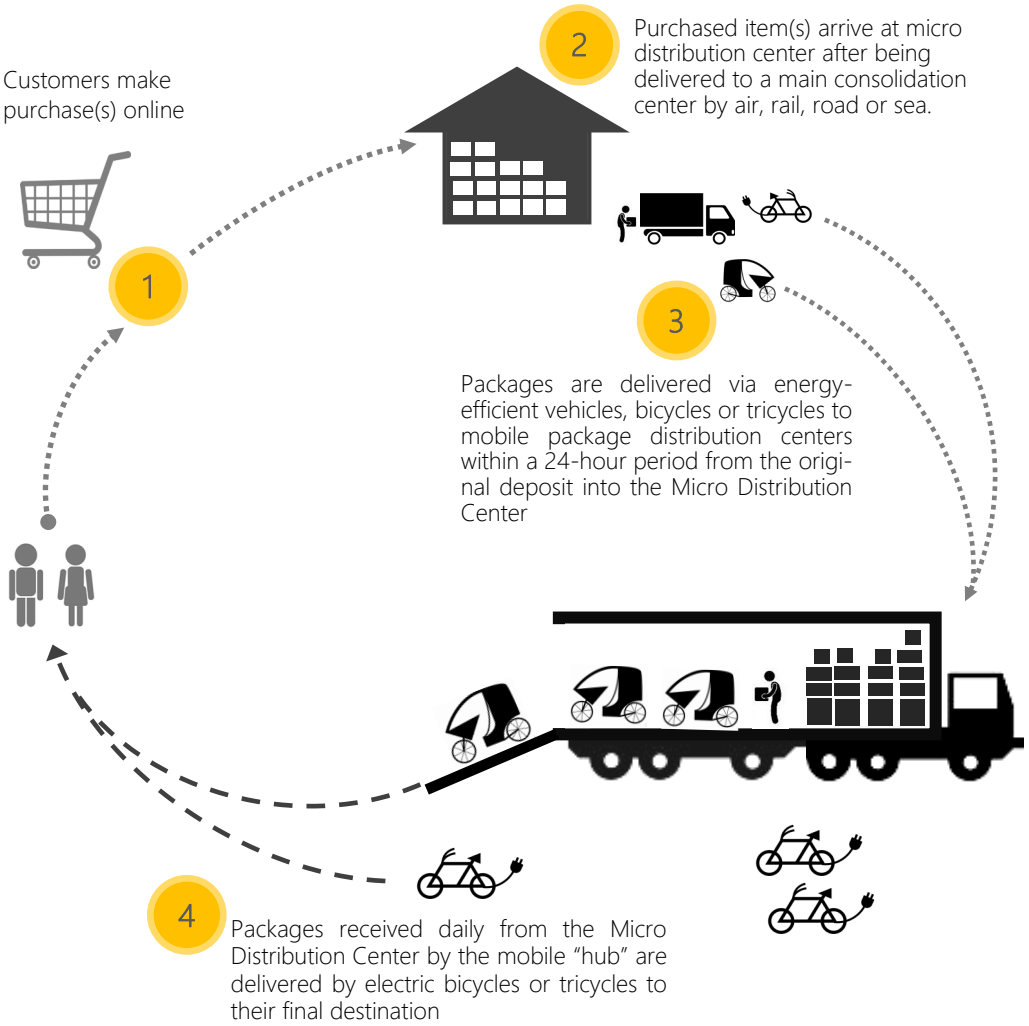
Figure 3.1.5 Consolidation Model[60]



Lastly, to gain support to develop a UCC or MDC from neighborhoods that might be adversely impacted by increased freight traffic in the area, a Public Awareness Campaign should be implemented to highlight the benefits to the city and community as a whole. Public comments, program goals, and key objectives to the campaign should be published to keep the residents involved and engaged.

3.2 Mobile Package Distribution

Figure 3.2.1: Last Mile Delivery Via Mobile Package Distribution



Overview

Mobile package distribution, also recognized as moving cargo distribution, is a solution created to improve the efficiency of last mile freight movement. This solution is a two-part system, where packages are first moved to a micro distribution center (MDC), and then are distributed by mobile units such as cargo bicycles and cargo tricycles. This system has been titled, "mobile package distribution," for the purpose of this report. Some studies refer to this as transshipment terminals or transshipment platforms.[61] In one case, the MDC used was a mobile trailer that was loaded at a larger urban consolidation center and then set in different stationary points throughout the city.

Pilot studies on the use of cargo bikes for last mile deliveries have been conducted by the SMILE Project in six Mediterranean cities: Bologna, Rijeko, Piraeus, Montpellier, Barcelona, and Valencia;[62] and in Brussels, TNT piloted a unique variation to the mobile cargo distribution model as part of the European FP7 project STRAIGHTSOL.[63] Furthermore, Paris and London have already successfully integrated cargo cycles into their last mile logistics.[64] Mixed-use schematics using a portion of an existing office building, garage, residential building, or hotel as the MDC, and cycles for last-mile delivery, have also been implemented in San Sebastian, Spain; and Milan, Padova and Bologna Italy.[65]

The TNT pilot study in Brussels, named TNT Mobile Depot, consisted of a truck that carried packages into the city center from the TNT consolidation center at the Brussels freight airport.[66] Once inside the city center, the Mobile Depot was stationed in temporary locations that served as a convenient spot to load cargo cycles for goods to be delivered to their final destination. The Mobile Depot pilot test began at the end of 2013 and lasted three months.[67]

Infographic by Hadia A. Sheerazi based on information collected by the research team

Most mobile package distribution schematics implemented the use of cargo cycles in place of traditional small trucks and vans. These replacements address various last mile delivery issues including difficulties caused by narrow streets, lack of designated loading and unloading zones, pedestrian safety, delivery time restrictions, low emission zones, speed restrictions, and congestion.[68] The popularity of this last mile schematic illustrates its success.

Location

In a mobile package distribution scheme, cargo cycles pick up packages from an MDC or a consolidation center near the city center. The space required for the MDC to support cargo cycles is small, which allows for significant variability in locations. For example, in the case of La Petite Reine in Paris, one location is approximately about 600 m^2 (6,458 ft^2) and is located in a an underground parking lot in the Central Business District.[69] In London, one pilot project was approximately 160 m^2 (1,722 ft^2).[70] The SMILE Project Valencia pilot study was set up in the parking lot of the North Train Station, located along the border of the historic center.[71] Additional specific locations, which have been used in other cities, are included in the UCC/MDC section of this report. The best location for an MDC that will support cargo cycles is a centralized location, ideally within a 3.5-km radius from final delivery destinations, and a location that is connected to roads with easy access to delivery destinations.[72]

As further detail on the previous TNT example mentioned above, the Brussels Mobile Depot serviced approximately 12 km2 of a dense urban area.[73] This area was chosen because of its high quantity of small shipments.[74] The potential temporary stations where the Mobile Depot established itself each day included alleyways, apartment complexes, parks, or parking lots for its dispatching locations.[75] Similar to choosing a location for an MDC that will support the efficient use of cargo cycles, the location decision for a Mobile Depot should consider the following: area congestion levels, convenience to final destinations, connections to paved roadways, permitting requirements, and fees for parking the depot unit.

Benefits

Moving cargo distribution schematics increase parking flexibility, reduce delivery time in traffic-congested areas, and reduce greenhouse gas emissions. According to companies that use cargo cycles, the benefit of parking flexibility is important.[76] Particularly, cargo cycles can be parked on wide sidewalks, reducing the need for creating special unloading spaces. In addition, cargo cycles are not subject to the same unloading regulations as motor vehicles, thus reducing the parking fines that are a frequent operational cost for truck deliveries.[77]

Cargo cycles can also bypass traffic congestion and reduce their delivery times by utilizing designated bike lanes. Cargo cycles are powered by a mix of electricity and human determination, either scenario leading to a reduction of greenhouse gas emissions. The amount of emissions reductions depends on the travel distance, number of stops, and the type of vehicle the cargo cycle replaces.[78] As an example, the Brussels Mobile Depot pilot study resulted in a reduction of diesel km from 1.34 km per stop to 0.52 km per stop.[79] This decrease represents a 24% reduction in CO_2 emissions.[80]

In Barcelona in 2003, approximately 100,000 commercial deliveries in that city were delivered each day from the curbside because the majority of the retailers did not have off-street loading areas.[81] The Barcelona case study presented time and logistical savings, safer urban distribution, and improved energy efficiency. At 120 daily operations with 16.8km done by tricycle per day, the results estimate a savings of 5.3% per trip.[82] The project was calculated to have saved 63.9 km by day, 31.95 by tricycle, and ultimately preserved 7,987 km, 2.05 tons of CO_2 and 2,398 liters of fuel.[83] Furthermore, savings also result from a decrease in the distance traveled from the distribution center to the final destination.[84] The number of shipments per month increased throughout the pilot program as operations became more efficient.

La Petite Reine, a privately operated cargo cycle delivery service in Paris, reported that over a 12-month period, 203 tons of CO_2 were saved by not utilizing vans for delivery.[85] An independent consultant conducted this study in 2012. Operations by La Petite Reine have since increased, and currently it's estimated that they make approximately 1,000,000 deliveries by cargo cycles per year throughout France.[86]

Operations

Mobile package distribution models have generally been implemented to accommodate non-perishable goods. However, companies that can accommodate refrigerated goods have been found to operate well on limited scales. Green Links in Paris has refrigerated cargo containers and is testing their refrigeration capacity over trip length.[87] In the case where cargo cycles operate in conjunction with an MDC, logistics operators deliver the parcel to the MDC in the morning or during their specified scheduled time, and cargo cycles are loaded at the MDC and dispatched for final deliveries according to pre-designed delivery routes.[88]

The actual number of required cargo cycles has varied amongst cities and case studies. The number is dependent on the capacity of the distribution center as well as a cost benefit analysis of the economic effects of using this mode of freight delivery. The case studies reviewed have also varied in their use of human-powered or electric-powered cycles. Of note, most cases implemented tricycles in lieu of bicycles. The decision to use human-powered or electric-powered cycles should take into account distance traveled, terrain, capacity for charging electric-powered cycles, and the different maintenance requirements.

In the case of the Brussels TNT Mobile Depot, key operating procedures included loading and unloading the Mobile Depot at the cargo airport consolidation center, loading and unloading the cargo cycles at the dispatch location, and maintaining the depot and cycles. The Mobile Depot is usually loaded in the mornings at the consolidation center before relocating into the city center. Once there, the Mobile Depot is stationed in temporary dispatch locations convenient for cargo cycles to deliver the packages to their final destinations. The cargo cycles also accommodated customer returns. At the end of the day, the mobile depot returned to the consolidation center to drop off out-going packages.[89]

The dimensions of the cargo containers have been found to be similar throughout most case study examples. In Barcelona and Valencia, the pilot studies used electrically assisted pedal tricycles that pulled cargo containers with a loading capacity of 1.5 m^3 and dimensions measuring 2.78 m long, 1.03 m wide and 1.95 m high.[90] These cycles were able to transport a maximum load of 280 kg, although the average weight of transport was 180 kg (approximately 40 parcels).[91] In Barcelona, the MDC is composed of an enclosed module and a loading deck. The enclosed module occupies around 33m^2, and the porch around 40m^2.[92] The MDCs also supported parking of the tricycles overnight and recharging.[93]

Regulations and Policies

The implementation of targeted regulations and policies are critical to support the successful implementation of a mobile package distribution system. Inner city restrictions increase costs for shipping operators, and restrictions provide incentives for urban freight stakeholder support. Paris is a great example of a city that has implemented numerous restrictions and as a result has achieved success in cargo cycles for the last mile distribution.[94] Regulations and restrictions used in Paris that are favorable to cargo cycles and mobile distribution schematics are outlined in the City of Paris' Freight Policy and include:

- Establishing restricted times of day that vehicles over a certain size or efficiency are not allowed within the city center;
- Regulated night deliveries;
- Established air quality indicators in city legislation;
- Identified areas for logistic use in the city master plan- near major roads, rail and ports;
- Require private delivery facilities for high volume freight generators (categorized by size): stores above 500 m^2; office above 2,500 m^2; and hotels above 150 rooms; and
- Revise requirements for micro-distribution space allocation with parking garage concessions upon contract expiration.[95]

Additional regulations and restrictions identified by the City College of New York that are favorable to cargo cycles and mobile distribution schematics include:

- Load Capacity Restrictions;
- Speed Restrictions;
- Low Emission Zones (LEZ); and
- Particulate matter emission standards for freight trucks.[96]

In the Barcelona's SMILE pilot study, delivery restrictions played a large role in advancing the use of electric cycles for delivery. Barcelona's delivery restrictions prohibit freight delivery during high-volume traffic hours.[97] The delivery restrictions utilized in Barcelona support a sustainable initiative, the 2013 Sustainable Urban Mobility Plan, which established objectives that give priority to public transportation and to the movement of goods throughout the city center. One of the plan's initiatives is to establish a network of distribution centers that will provide for the receiving and delivery of goods by cargo bikes.[98]

Business Model

Public funding for pilot studies, as was the case in Barcelona and Valencia, can play a large role in stakeholders realizing the value created by using a mobile package distribution model. The support of the city council is critical to obtain positive feedback. However, once stakeholder support is achieved, the process works best when a shipping company or a third party takes the control of the financing and operations for the micro-distribution platform and cargo cycles.[99]

In most of the pilot studies and successful case studies researched, the first step to implementation was to bring all public and private urban freight transport stakeholders together for a forum. Financing for the case studies have often been achieved through participation in multi-country projects with the objective of sharing information on innovative logistic solutions. Project examples include the Smart Green Innovative Urban Logistics for Energy Efficient Mediterranean Cities (SMILE) project,[100] the EU CIVITAS project,[101] the western European LaMiLo project,[102] and the EU STRAIGHTSOL project (no longer active).[103] These projects are generally funded partially by participating partners. The participating partners in most of these projects are reported on their websites to included municipalities and capital from countries' collaborative funds.

In both the Barcelona and Valencia case studies, the city´s municipality was directly involved in orchestrating the stakeholder meetings. Barcelona and Valencia also included two experienced research centers, CENIT and Fundacion Valenciaport, to provide technical support.[104] Furthermore, four transport operators participated in the Barcelona and Valencia pilot studies, utilized the service for free during the six-months of the pilot project, and facilitated the delivery of the parcels from the UCC to the MDC. These case studies contracted with an eco-logistic company to operate the MDC and contracted with a separate company to provide, operate, and maintain the electric tricycles.[105] In addition, the companies that owned and managed the parking lots where the MDCs were placed compensated for providing the space for the MDC.[106]

The costs of the Mobile Depot included bicycle delivery, the Mobile Depot truck investment, loading and shipping the cargo cycles, costs for oversized packages, additional warehouse and infrastructure costs, costs for parking bans in the area of the Mobile Depot, and rental of the parking locations.[107]

Successful privately owned cargo cycle operators in Paris including Green Link and La Petite Reine, operate as subcontractors to shipping companies such as FedEx and DHL. La Petite Reine collects fees for deliveries from these shipping companies. They also generate revenue from selling advertising space on their cargo cycles.[108] The city of Paris and the French Agency of Environmental Management initially supported La Petite Reine financially by providing 15% investment towards cycles and 50% towards the pilot studies and evaluation reports.[109] It's critical that the municipality set a priority to ensure proper functioning of the mobile cargo distribution schematics. An evaluation of the costs and benefits should be developed and reviewed in advance by the Municipality. The municipality should also play a role in the identification of proper locations and total numbers of all MDCs to be placed in the city center.[110]

Criteria for Success

The TNT Mobile Depot pilot study was found to be successful in social acceptance based on a limited survey;[111] however, the pilot program was not significantly financially sound. The Mobile Depot was twice as expensive as TNT's original last-mile delivery method.[112] TNT is confident that by increasing the use of the Mobile Depots to their full capacity and through further refining the handling of packages, operational costs will decrease. A multi-actor multi-criteria analysis of the Mobile Depot concept identified conditions under which the Mobile Depot concept would become more profitable to TNT Express. This analysis revealed that the Mobile Depot would not meet the objectives of most stakeholders.[113] However, by internalizing external costs, increasing capacity use, and increasing drop density, TNT Express can achieve greater profitability.[114] Using the cargo-cycles themselves for advertising space is another way the Mobile Depot could increase profit margins, as was done with La Petite Reine.[115]

The TNT Mobile Depot was found to offer a generally comparable quality of service to its customers as its business as usual approach, with less than a 10% difference in on-time deliveries.[116] The continued use of the operation is expected to increase efficiencies and provide for the same level of customer service as with original modes of delivery.[117] From an operational standpoint, employees at the TNT cargo airport consolidation center had to adapt operations to accommodate the Mobile Depot.[118] On average the employees surveyed at the consolidation center preferred the business as usual approach to the Mobile Depot approach.[119]

The main barrier to overcome with any mobile package distribution schematic is convincing the stakeholders. Other technical barriers that have to be solved before implementation are: the identification of a viable location for the MDC; defining the business model; obtaining or creating permits to support the schematic; identifying the area of implementation; determining the type and size of parcels that can be supported; and determining the modes of transportation to be used.[120]

Figure 3.2.2 TNT Express Mobile Depot,

Piloted: May 28 - August 22, 2013

Location: City-centre Brussels

Coverage: Schaarbeek, Etterbeek and Sint-Joost-ten-Node Municipalities

Suitability: High drop density of small shipments

Vehicles: Mobile Depot
Electric Tricycles (75% deliveries)
Vans (25% pick-up/drop-off)

Features:
Mobile Depot:
- Length: 14 m
- Width: 6.5m
- Extendable side
- Ramp
- Warehouse and small office
- GPS, camera's, alarm
- Bathroom

TNT Express Mobile Depot in Brussels[121]

TNT Express Electric Tricycles in Brussels [122]

TNT Express Mobile Depot (interior view) [123]

Implementation Process

The Barcelona and Valencia case studies were designed to measure results throughout the duration of the projects using an evaluation model borrowed from the EU's STRAIGHTSOL project. The following indicators were measured:

- Investment costs: capital spent on the distribution center infrastructure and cycles;
- Operational costs: costs for operating and maintaining the distribution center and cargo cycles;
- Number of shipments;
- Km traveled per shipment;
- Emissions of CO_2 saved, as derived from number of shipments and km traveled and compared to original modes of delivery; and
- Social acceptance, which was difficult to measure.[124]

Figure3.2.2: SMILE Project, Valencia, Spain

Piloted: Jan 1, 2013 - April 30, 2015

Location: North Train Station to the

Coverage: Postal codes 46001, 46002 and 46003

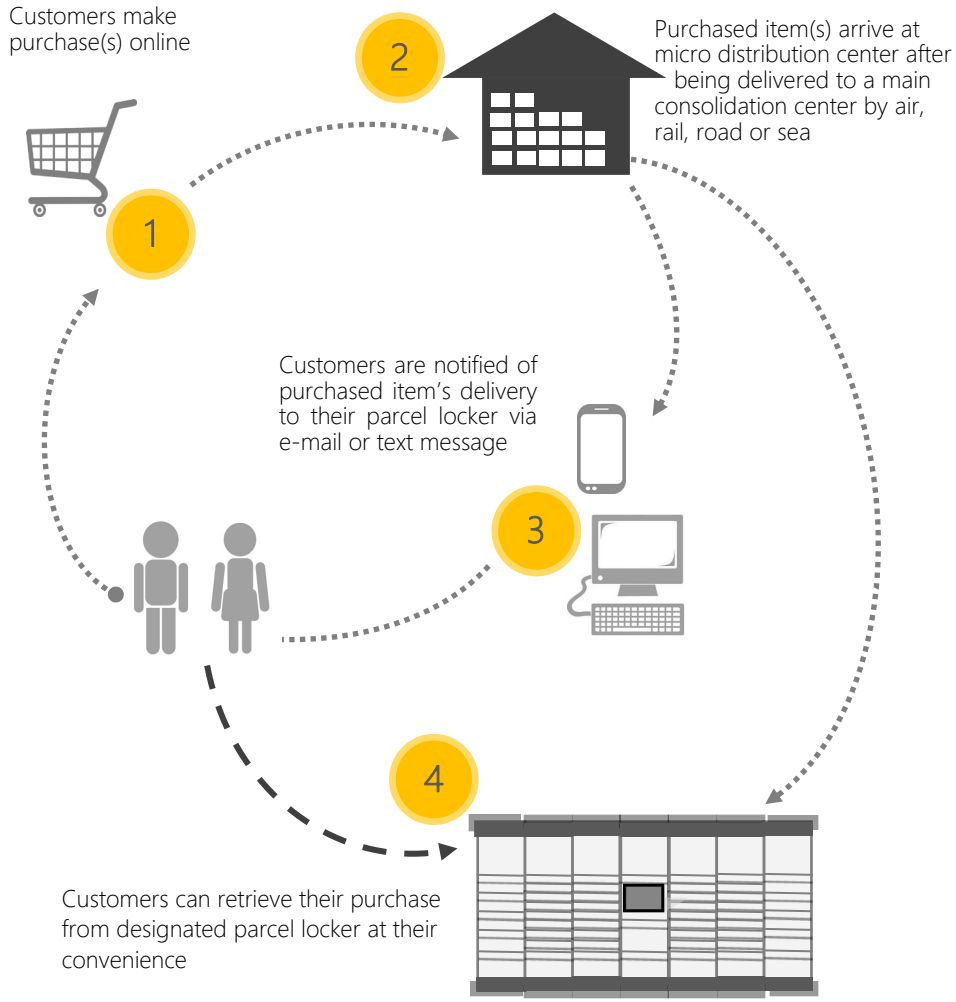
Suitability: City center with noise and air pollution & congestion

Vehicles: Vanapedal Electric Tricycles

SMILE Project Electric Tricycle in Valencia, Spain [25]

3.3 Parcel Lockers

Figure 3.3.1: Last Mile Delivery Via Parcel Lockers



Infographic by Hadia A. Sheerazi based on information collected by the research team

Overview

Parcel lockers are a last mile innovation that was developed in part as a reaction to the rapid global increase of e-commerce. According to a report by the International Post Corporation, the growth of e-commerce presents challenges of meeting customer expectations, especially in reference to effective and efficient parcel delivery.[126] In response to these customer expectations, European postal agencies have invested in secure parcel locker units over the last decade.[127] Automated parcel lockers can be found all around the world given their capacity to reduce time and costs that impact private companies and improve customer convenience. Currently, there are over twenty companies offering secure locker networks in Europe alone.[128]

Parcel lockers function as stationary modular structures located throughout city centers. Parcel lockers are a self-service technology, which does not require the presence of a postal agent. As customers order goods online, they have the option to select a convenient parcel pick up location during check out.[129] Alternatively, if shipping or postal companies host the parcel lockers, parcels can be sent from one private individual to another private individual, to be delivered to a locker location (customer to customer).[130] Once the package arrives, the customer is notified via e-mail or text message. The notification also includes directions and an access code to open their secure locker for package collection. Depending on the security limitations of the site, parcel lockers can be accessed twenty-four hours a day, seven days a week.

Parcel lockers can be owned and operated by government postal services,[131] e-retailers[132] or private operators.[133] In some cases, such as Amazon[134] and the United States Postal Service trial in Washington D.C.,[135] the lockers are operated as a subscription service. Typically, the key stakeholders involved in the operation of a parcel locker system are private retailers or freight delivery companies and postal corporations. Local government agencies have an opportunity to incentivize, build space for, and ease the process of implementation through partnership with the private companies.

Location

Parcel lockers are a modular unit designed to fit conveniently in unused publicly or privately owned spaces. Parcel lockers can be installed in:

- Retail stores;
- Public transportation stations;
- New construction spaces; and
- Public outdoor spaces such as wide sidewalks

Benefits

The primary benefit of parcel lockers is the convenient and secure service provided to the customers. As stated above, parcel lockers can be available 24/7, be unmanned and secured against vandalism (through automatic locks and video surveillance) and be low maintenance. Logistically, delivery vehicles are only required to make one stop to a locker location for several customers rather than multiple individual stops. This reduces vehicle idling time, vehicle miles traveled, and eliminates repeat delivery attempts.[136] InPost states that they have experienced 95% reduction of CO_2 emissions and fuel consumption based on these efficiency improvements.[137] Furthermore, parcel lockers have the potential to increase revenue from increased foot traffic as customers visit retail spaces to pick up their packages.[138]

Figure 3.3.2: Parcel Lockers Around the World

Buckhurst Hill Station, London[139]

Launched: June 9, 2014
Location: Parking lot
Hours: 24/7

Brisbane GPO Parcel Locker, Brisbane[140]

Launched: 17 October 2011
Location: 261 Queen St, Brisbane QLD 4000, Australia
Hours: 24/7

7-Eleven Convenience Store, New York[141]

Launched: August 2013 (approx.)
Location: 345 W 42nd St, NY 10036

Operations

Type of distribution

Business to customer (B2C) and Customer to Customer (C2C):

Parcel lockers are relatively small and compact in size, which make them excellent solutions when limited space is available. However, the small size also limits the size of the parcels they are able to hold. For example, the dimensions of InPost locker units range from 8cm height x 48cm width x 64 cm depth to 38 cm height x 48 cm width x 64 cm depth.[142] InPost also limits the maximum weight of each parcel to 20 kg per item.[143] Thus, the locker units themselves are only suitable for small to medium sized parcels.

Characterization of cargo

Non-Food Goods and Mixed.:

In general, the guidelines for acceptable parcel contents to be delivered to a parcel locker are more stringent than that of regular mail. There may be statutory law restrictions for liquids, articles requiring special treatment, plants and money.[144] Parcel lockers are best suited for non-food and non-refrigerated goods.

Mode of Delivery

- Delivery Vehicles (to locker station) and Customer Pick-Up (from locker station).

Deliveries are made to the parcel locker through a variety of methods and follow the mode of transport for the delivery agency. This may range from small commercial trucks, to electric vehicles or cargo cycles. Customers pick-up their parcel from the locker station to complete the delivery. This model is essentially "splitting the last mile" between carriers and recipients.[145]

Locker Models

- Indoor option:[146]

Roof with 2 cameras and LED lighting

- Indoor/Outdoor option:[147]

Roof with 2 cameras

LED lighting

Polymer concrete base

Banner with backlight

Regulations and Policies

The parcel locker system depends on the participation of a freight and shipping corporation, which is typically the owner of the actual locker unit. However, even though the management process does rely heavily on the private sector, local government agencies have an opportunity to regulate, build space for, and incentivize the implementation of parcel lockers. By supporting the process of parcel locker location selection and incentivizing the private sector to broadly adopt the concept, the overall freight efficiency benefits can be achieved across the entire system. The following list details beneficial regulation and policy opportunities.

1. Specify delivery routes and times.

Specific delivery routes and times vary based on the local codes and ordinances. As the local government agency considers locations to incentivize parcel locker installment, key points should be considered based on customer convenience and proximity to desired freight transportation routes. This will help support the realization of the benefits of reduced vehicle miles traveled, reduced vehicle idling time, and reduced pollution to achieve an efficient solution.

2. Designate space in publicly owned locations.

As exemplified by the case studies analyzed, a few of the critical locations to install parcel lockers include government and publicly owned spaces such as along public transportation routes.[148] The local government can work with the private freight corporations to discuss the criteria for installing a unit, and then work to build the features into the space.

For example, based on an interview with Russell Dougherty, Business Development at Amazon Lockers, Amazon worked closely with the United Kingdom government to install lockers at Tube stations.[149] Dougherty also stated that governments have the opportunity to build shelters at transportation points, such as bus stops, to facilitate locker installation.[150] The typical physical criteria of parcel locker units can be referenced below.

3. Incentivize incorporation into new construction: residential, commercial, and/or office space.

Local governments also have the opportunity to influence the parcel locker addition into new construction buildings. This can take the form of an addition to construction regulations or a tax incentive. Of the best practices reviewed, it is common that a private corporation works directly with the private space owner.[151] Therefore, government incentives of this type are yet to be implemented, but the opportunity does exist. DHL entered a partnership with Germany's largest housing company, Deutsche Annington, to launch a pilot program to install locker units in apartment buildings.[152] This exemplifies the type of relationship the government can work to influence and support.

Business Model

<u>Funding and type</u>
Cost- 90% private, less than 10% government

The bulk of the upfront costs associated with installing parcel lockers is generally covered by the private company. The financial support from government entities may be required in two scenarios: the first scenario if the government chooses to provide financial or tax incentives to encourage the adoption of parcel lockers; and the second scenario if the parcel lockers are installed by the government in a government owned space. In this second scenario, some of the operational costs would need to be absorbed by the owner of the space, especially since the parcel locker units require an electricity source to provide the automated service.

Parcel lockers can be installed on public or private land, and case studies have shown variability in the percentage of government and private involvement. For example, the United States Postal Service supported the funding and logistics for a trial locker system in Washington D.C.[153] Alternatively, private corporations may work directly with other private locations to rent space within a retail location or existing structure. For instance, DHL partnered directly with K-Group retail stores in Finland to launch a pilot program of lockers that began operation in March of 2016.[154]

Criteria for Success

There are some challenges in the use of parcel lockers that must be considered for implementation, including relatively upfront initial investment and ongoing maintenance costs (repairs and electricity). The lack of an agent or human contact at the locker station can result in delays or unsuccessful pick-up attempts. For example, a customer may have issues with the PIN or locker security system and thus unable to retrieve their package. In addition, the lack of human interaction may result in lower customer satisfaction rates. In addition, it can also be difficult to secure convenient and safe locations for the lockers, as well guaranteeing the safety and security of customers and their packages (particularly privately owned parcel lockers). It could potentially be unsafe to access the lockers late at night if the lockers are not located in a secure bank ATM-like enclosure. These disadvantages could be overcome by the provision of a customer service phone attached to the lockers, the inclusion of voice-commands for those with disabilities, and locating the lockers inside a glass-enclosure (i.e. banking centers) for added security.

The criteria that must be met for parcel lockers to become a viable and sustainable option to improve efficiency and reduce externalities include:

1. Physical criteria of the space:
   - Indoor or outdoor public or privately owned spaces able to fit a modular structure with dimensions at least 2.9 m width x 2.2 m height x 1 meter in depth. Minimally invasive space is ideal.[155]
   - The space must have access to electricity to support the automated service. Significant costs (thousands of dollars) will be incurred if electricity is not readily accessible.[156]
   - Recommended spaces with high public foot traffic to promote the ease of the service.
   - Additional security of locations for customer pick-up safety.
   - Locations that can be accessed over a wide timeframe, twenty-four **hours** a day, seven days a week, is ideal for optimum customer convenience.
2. Funding and partnership
   - High initial investment with operation and maintenance costs which is typically covered by the private service provider.
   - Partnership between the local government, freight corporations, and parcel locker hosts is critical; especially for planning and maintenance so that high efficiency can be achieved.
3. Advertising
   - Advertising of the locker service will be required as the system generally relies on customer awareness to select the parcel station pick up station. Additional advertising can also be placed on the locker station unit to either promote the service or serve as a source of revenue.

Implementation Process

One of the key areas where the Tel Aviv Municipality can influence and incentivize the use of parcel lockers is through the city zoning and development codes. In the short term, the city must involve major business and freight companies to gauge interest in partnering to fund parcel lockers, begin the process of identifying potential locations, and also determine regulation and incentive possibilities to implement this strategy, potentially the following:

- Tax incentives and other financial incentives for new and existing structures to install parcel lockers; and
- Potential permitting programs to generate revenue for the municipality.

In the long term, the city should consider methods to measure the growth in usage of parcel lockers and seek opportunities to influence the advancement of technology and system improvements.

Metrics measures/milestones

Generally, the success of both the individual unit and the delivery option as a whole is measured by the volume of customer use. For example, Amazon measures the volume of repeat customers as a metric of success.[157] As parcel lockers are a relatively new solution, specific measures and metrics are still being defined. The following are suggested pathways for information gathering:

- Volume of customer use and repeat customer use;[158]
- Customer satisfaction surveys;[159]
- Customer comments on social media and private corporation web-sites;[160]
- Number of parcel lockers installed; and
- Delivery efficiency measurements such as vehicle miles traveled change, shipping cost change, vehicle standing time change.

Time to Implement

In general, the modular parcel locker units are available for assembly and relatively quick to install. Based on the interview with Russell Dougherty from Amazon Lockers, the costs are generally about $5,000 for a three-foot locker center. These costs are dependent on the area so they may vary accordingly. In order to actually place a locker, Amazon rents property from the existing tenant or store. As stated above, local governments can support the installment of parcel lockers by providing the ability to build units into publicly owned spaces, such as bus shelters, and provide space for advertising.[161]

4 Conclusion

The last mile of freight delivery has become a challenge for cities, urban courier services, and transportation companies. As has been discussed in this report, last mile delivery touches on a variety of issues including congestion, space allocation, zoning, funding, and city regulation. The Tel Aviv-Yafo Municipality is actively addressing each of these issues, as the city's population increases, the economy grows, and the use of e-commerce expands.

Urban logistics spaces (ULS) are used as a tool to help mitigate the issues related to inefficient freight delivery; however, they must be included as part of a larger freight plan or sustainability strategy. Tel Aviv can address stakeholders' needs, define supporting policy recommendations, designate key milestones and ultimately improve the city's overall transportation management system by developing a detailed plan to address the specific freight issues.

Urban consolidation centers (UCC) and Micro Distribution Centers (MDC) are the most common logistics spaces used in cities for helping to manage freight efficiency. They have proven to increase load efficiency of delivery vehicles, reduce competition in loading and unloading areas, and reduce delivery times in congested areas. UCCs and MDCs are often expensive solutions because of the real estate costs associated with the space and the construction costs to build them. For these to see positive returns, private freight companies must be incentivized to use them and a realistic funding model must be established.

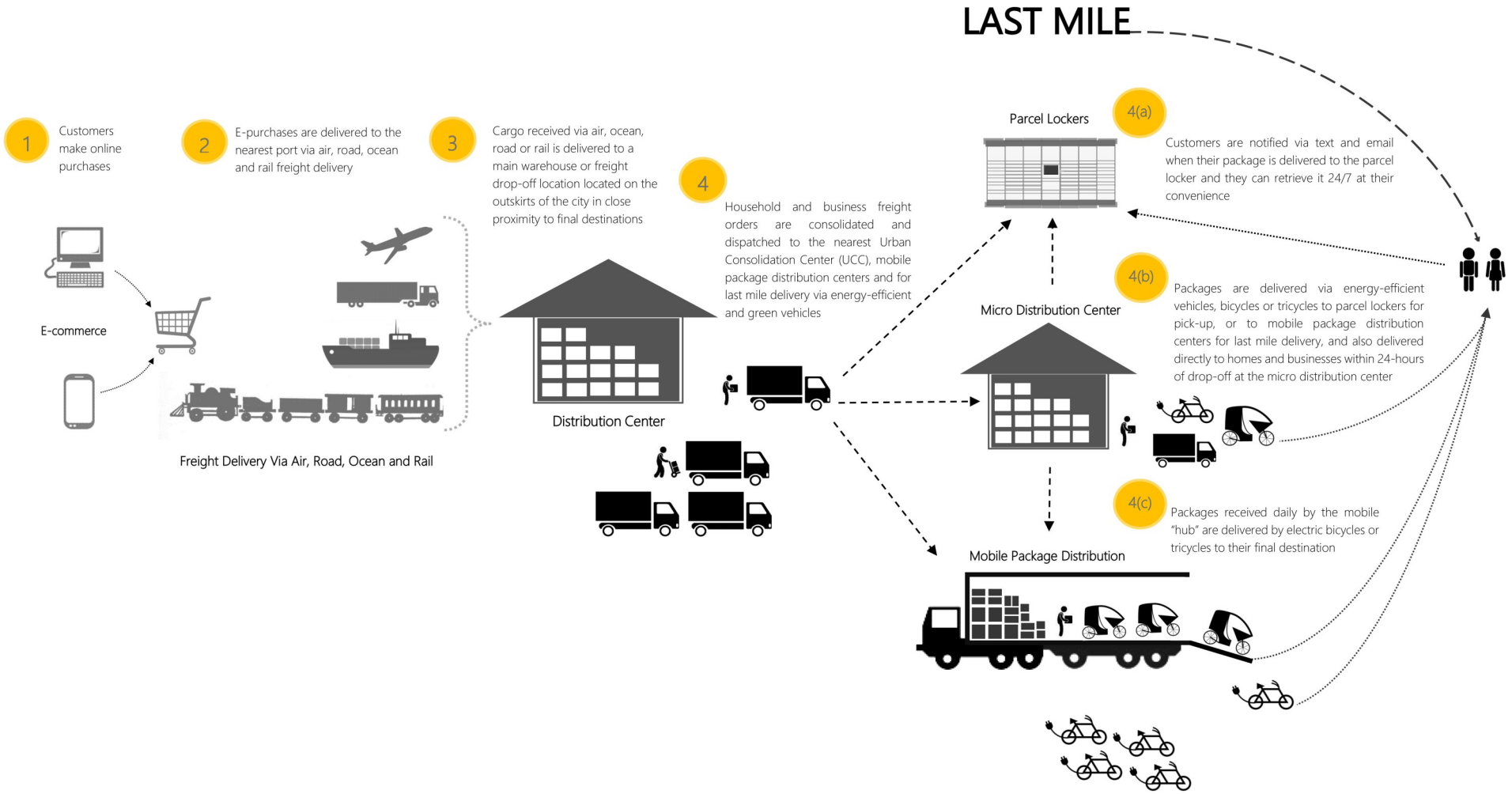
Mobile Package Distribution is a two-part system. The first part is the distribution center or transshipment terminal; the second part is use of electric cargo cycles that carry out the last mile delivery. The size and space of this solution is customizable, and can change according to the needs of the city. The use of cargo cycles increases mobility throughout the city center, and allows for less competition between large vehicles and other users of the paved roadways. Cargo cycles provide many benefits, but also are restricted in the number and size of packages that can be delivered in each trip. To develop a successful mobile package distribution system, it is important to partner with a private company that will provide, maintain, and operate the cargo cycle delivery service.

Parcel Lockers are a relatively new ULS solution that private companies have developed to allow packages to be picked up by customers at convenient locations. These lockers are commonly located close to public transportation lines and shopping centers. While lockers are a smart and useful innovation, the sizes of parcels that can be delivered are limited due to the size of each individual locker unit. Private freight companies generally manage this solution either alone or by renting space from other private companies. As such, they do not require detailed governmental partnership to implement. However, regulations, such as zoning, should be established to accommodate and regulate locker installations. Government involvement will help to ensure that parcel lockers support overall system efficiency improvements.

The use of technology as a part of the supporting mechanisms in implementing Urban Logistic Spaces is outside of the scope of this project. However, it's important to note that there are many programs and applications that are currently being utilized in different cities to help companies deliver packages to their customers. For example, SmartTruckRoute is an application that allows commercial truck drivers to efficiently map out roads that are suitable for truck travel by taking into account bridge height, load limits, and sharp turns.[162] Government can support the creation and advancement of technology through supplying open data. According to McKinsey's 2013 Report focused on Open Data, $3 trillion in economic value globally can be realized through the promotion of open data.[163] Open data in freight transportation helps shipping companies make better-informed choices about travel modes and routes.

Cities across the world are approaching last mile efficiency improvements from different angles as it pertains to their specific needs and challenges. No one single solution has been developed that will work for all locations; rather, solutions should

be tailored from identified best practices to meet each individual city's requirements. Municipalities like Tel Aviv recognize that freight efficiency is vital to developing a more sustainable city. Implemented solutions must result in a positive impact on the residents and the multiple industries operating within each location. Detailed suggested next steps for the Municipality can be referenced in Appendix E. Regardless of the ULS type(s) that Tel Aviv chooses to implement, successful last mile initiatives originate from clear objectives and active engagement from key stakeholders, coupled with meaningful and specific key performance indicators to measure progress through time.



Infographic by Hadia A. Sheerazi based on information collected by the research team

5 Glossary

Cargo cycles	Bicycle or tricycle couriers with a modular parcel carrier in tow, in most cases cargo bikes are electric.
Central Business District	The commercial business district of the city.
Courier express and parcel	Courier, express and parcel (CEP) service providers provide a service to companies or private persons who want to have a particular shipment sent to a particular location within a certain time constraint.
Cross-docking	A practice in the logistics of unloading materials from an incoming semi-trailer truck or railroad car and loading these materials directly into outbound trucks, trailers, or rail cars, with little or no storage in between.
E-commerce	Buying and selling goods and/or services over the internet.[1]
Environmentally Friendly Vehicles (EFV)	Alternative fuel vehicles including liquefied petroleum gas, compressed natural gas, bio-fuels and hydrogen based-technology; or electric vehicles, or electric hybrid vehicles.[2]
Freight transport management systems	Computerized routing and scheduling systems that aid operators in the efficient planning of vehicle loads and trips.[3]
Last Mile	The final physical transfer of goods to the consumer.[4]
Load factor	Ratio of product to space within a vehicle.
Low Emission Zones (LEZ)	A “Low Emission Zone” (LEZ) or “Environmental Zone” is an area that can only be entered by vehicles meeting certain emissions criteria.[5] Zones aimed to promote the operation of cleaner vehicles, and reduce the number of older, more polluting vehicles operating in central city areas.
Micro-Distribution Platform	A raised structure built on or near an Urban Consolidation Centre to facilitate loading and unloading for a small delivery vehicle.
Mobile Depot	A mobile trailer with an office, loading bay, and storage capacity.
Parcel lockers	A modular and customizable system of secure lockers for small to medium size parcel pickup.

Preferential zoning	Regulation developed by municipalities to identify key areas within a city designated for certain vehicles to park, load and unload freight. These schemes are designed to reduce congestion in cities and encourage the use of low-emission vehicles and smaller delivery vehicles.
Property tax relief	Regulation developed by municipalities to incentivize private businesses to build or operate in an area. Property taxes are waived or reduced in order to encourage business development and shared investment.
Public Private Partnership	Cooperation between the public sector authority and one or more private entities.
Slot booking systems	Used to co-ordinate and plan goods vehicle arrivals at major sites generating large flows.[6]
Transshipment terminal	A micro-urban consolidation center, can be located as a stand-alone unit within a parking lot, or can consist of a designated area in an office building, residential building, or hotel. The size of a transshipment terminal, or
Urban Consolidation Center	The phrase Urban Consolidation Centres (UCCs) has had many different meanings. Different terminology has been used over time and between countries. UCCs are often confused with Urban Distribution Centers. The broad general definition of a UCC is a logistics facilities that are located in relatively close proximity to the receivers where goods are dropped off, sorted and consolidated for the final stage of delivery.[8] For the purpose of this report, a UCC is considered a facility larger than 3,000 m^2, and is located outside of the Central Business
Urban Distribution Center	Urban Distribution Centers enable the cooperation among shippers, carriers, and retailers to consolidate deliveries, thus requiring a lower number of delivery trips by trucks between a distribution center and final delivery destinations, while achieving the same throughput.[9]
Urban freight	Goods transported to a city in bulk by truck, air, ship or train.
Urban Logistics	Urban logistics is defined as the movement of goods, equipment and waste into, out, from, within or through an urban area.[10]
Urban Logistic Solution	Guided principles designed to improve the challenges associated with freight delivery, including congestion, pollution and delivery times.
Urban Logistics Space	A designated space used to facilitate freight delivery and improve issues around freight transportation within cities. Urban consolidation centers, micro-distribution centers, and Parcel Lockers are examples of Urban Lo-
Vehicle Miles Traveled	A measure of the extent of motor vehicle operation; the total number of vehicle miles traveled within a specific geographic area over a given period of time.[11]

A City Selection

	Country	City
1	Austria	Vienna
2	Belgium	Brussels
3	Brazil	Rio de Janeiro (Copacabana)
4	Canada	Vancouver
5	China	Hong Kong
6	China	Shanghai
7	Colombia	Bogota
8	Costa Rica	San Jose
9	Croatia	Zagreb
10	Czech Republic	Prague
11	Denmark	Copenhagen
12	England	London
13	France	Paris
14	Germany	Berlin
15	Germany	Magdeburg
16	Greece	Piraeus
17	Holland	Rotterdam-Hague
18	Ireland	Dublin
19	Israel	Jerusalem
20	Italy	Bari
21	Italy	Rome
22	Japan	Tokyo
23	Kazakhstan	Almaty

	Country	City
24	Kenya	Mombasa
25	Malaysia	Kuala Lumpur
26	Malaysia	(Port) Klang
27	Malta	Valletta
28	Netherlands	Amsterdam
29	Netherlands	Utrecht
30	New Zealand	Auckland
31	Portugal	Lisbon
32	Qatar	Doha
33	Singapore	Singapore (all)
34	Spain	Barcelona
35	Taiwan	Taipei
36	United Arab Emirates	Abu Dhabi
37	United States	El Paso
38	United States	Kansas City
39	United States	Los Angeles
40	United States	Miami
41	United States	Minneapolis-St. Paul
42	United States	New York
43	United States	Philadelphia
44	United States	Pittsburgh
45	United States	Portland (Oregon)
46	United States	Seattle

B Interviews

Interview: Russell Dougherty, Business Development at Amazon Lockers
Date: April 12, 2016
Contact info:
Email: drussell@amazon.com
Phone: 1.206.266.8713

1. Have you developed partnerships with cities to implement Amazon Lockers?
The roll out of Amazon Locker Tube stations has been in partnership with the UK government. Currently over 600 locations in the UK and continuing to expand in Europe; Amazon will have over 1500 global locations; 200 locations/month.

It would make sense for us to work with a city that wants to offer convenience to their community; Obviously a great way to help people who don't have access to quick and efficient delivery.

2. If so, can you provide a general structure of the relationship between Amazon and a public body? What does the financial model look like (basic upfront funding)?
"We are not making revenue, the idea is getting the package to the end customer and get customers to re-use Amazon's core services."

I think working with governments is very easy. The ability to build into bus shelters and also provide a space for advertising would be interesting. In addition to selling advertising space, the area could be where customers could use immediate mobile technology to order? Make it the next generation of the mailbox. Tech version mailboxes.

3. What is the average size of space needed to build an Amazon Locker area?
Sizing: Built in 3 foot increments, only start with 6 feet, 3 feet long x 2 feet deep (total about 6.9 feet); Each add-on section has slots (3 feet-15 slots, 6 feet-35 slots, 9 feet-60 slots)

For the location we need 6 foot length, 9 foot length, 12 foot length spaces. We also need areas that are in close walking distance from the city center and very convenient and visible.

4. What kind of areas are best for building an Amazon Locker program?
It's important for these locations to have sidewalk space, like post office boxes. Often connected to shopping centers or convenient stores (enclosed/outdoors). Outdoor locations are often connected to grocery stores (ex. Albertson's Grocery). Other convenient stores include Speedway, Circle K and 7/11. Amazon is looking at ways to specifically target rail lines and rail stations. Amazon is also looking at how to build in apartment complexes, and housing developments.
Having power/electricity in the area is critical which is why we have partnered with existing spaces or businesses. If we have to find power and get it to the location, then we have significant costs associated with wiring and connectivity. (Thousands of dollars to get going).

5. What are the primary costs associated with building an Amazon Locker area?
Obviously there is a transportation cost savings, but somewhat minimal for packages. Costs are generally about $5,000 for a 3ft locker center, but this is dependent on the area. We aim to create increased sales conversion for and make our vendors happy; also make it easier for people to buy more at groceries/convenient stores connected to these lockers; thus far there has been a high conversion rate from locker usage to store/grocery sales.
We are currently charging the customer a subscription fee and we are renting property from the existing tenant or store. Often this is also a good marketing benefit for Amazon, but also the business/store we are partnering with.

6. Can you provide any general metrics that show the success of Amazon Lockers in an area?
For metrics, the turn is important or how regularly the customers are using the service; Repeat usage shows success. We rely on customer feedback through Twitter feed, Comments on our website; Generally positive reviews thus far. Amazon has conducted a round of customer satisfaction surveys, but just to small groups. Some negative comments include the need for more lockers in certain areas, not close enough to certain neighborhoods, limited amount of slots.

7. Does you measure any environmental or social impacts of Amazon Lockers? If so, what and how?
One of the critical sustainability issues is extra boxes or extra packaging that makes the parcel difficult to fit into the locker; Using a minimally invasive space is a benefit
Not directly a sustainability issue, but we are trying to figure out how to streamline the packaging to fit.

Interview: Jan-Harmen Hietbrink, Head of Service Improvement at TNT
Date: April 12, 2016
Contact info:
Email: jan.harmen.hietbrink@TNT.com
Phone: 31 6 53 24 7297

1. Have you developed partnerships with cities to implement the Mobile Depot?
A partnership was developed with Straightsol/EU to be one of the case studies. We also developed a partnership with the University and City of Brussels to perform the study, survey potential sites, traffic patterns and help develop metrics for the project. This solution does not need government funds to keep running.

2. If so, can you provide a general structure of the relationship between TNT and a public body? What does the financial model look like (basic upfront funding)?
Since this was a pilot and part of Straightsol, the EU provided 50% of the cost to run the 3 month pilot. This included development and construction of the mobile unit.

3. What is the average size of space needed to locate the Mobile Depot – land area around the structure? How many mobile depots has TNT launched and where?
A plot of land needs to be large enough to receive a semi vehicle hauling a shipping container. The first location was selected because it was easy to get to and served both commercial and residential customers. 2 additional mobile depots were launched in Brussels.

4. What kind of areas are best for locating the depot?
Within the city center, accessible to a large truck, pedestrian and cycles
Space to park trailer, Model where customer volume is.

5. What are the primary costs associated with building the depot?
Not shared

6. Can you provide any general metrics that show the success of the mobile depot?
GHG emissions dropped significantly, by 24%. Time to customer was 85% on time only down 10% but that can be improved over time.

7. Do you measure any environmental or social impacts from using the mobile depot? If so, what and how?
Safety, customer satisfaction, and environmental impact.

8. Are there any general challenges you have faced?
Project failed because the tricycles were being stolen – branding probably had something to do with this, but there are many other countries using cycle curriers with success. Analysis of that success could be evaluated for this project. Also, Brussels has a high crime rate, location was not a good location to perform the pilot. In addition, the driver for the project, sustainability leader left, tricycles were being stolen. If branding was partially ghosted and location was discrete thefts may have been avoided.

9. Are you familiar with Tel Aviv Yafo City Center? Do you think that the city would be a good candidate for the mobile depot solution?
TNT would be interested in working with Tel Aviv with this innovative urban logistics solution.

10. Are they generally coming from a consolidation center? If so how far away is it from the City Center?
Goods arrive at the airport to a large distribution center; the mobile depot is loaded there.

11. What challenges have you faced with competition?
None, new concept

12. Typically what size parcels are handled?
Small parcels

13. Who are your customers?
Residents and commercial

Interview: Jan-Harmen Hietbrink, Head of Service Improvement at TNT
Date: April 12, 2016
Contact info:
Email: jan.harmen.hietbrink@TNT.com
Phone: 31 6 53 24 7297

14. What were the benefits of this solution?

- Reduce time in the supply chain
- Efficient process
- Trailer
- Presorted depot
- Cheap
- Flexible less sorting time

15. How would you suggest Tel Aviv begin to investigate the potential to use this type of solution? Do you have a process developed that can be shared?

Regulate large trucks to not have access in the city
Develop one point of delivery for all parcels, All parcel delivery companies deliver there.
The challenge will be IT issues – that is because all companies have different types of tracking systems but this can be solved with the right technology.

Stakeholders

- University of Brussels
- TNT
- City of Brussels

C Urban Logistic Spaces Matrix

Types of Urban Logistic Spaces	Regulation/Policy			Logistic Services			Organization Model			
	Signage	Specified Deliv-ery Routes	Specific Time of Deliveries	Type of Distribution	Characterization of Cargo	Mode of Delivery	Owner-ship of Land	% of gov-ernment funding	% of private funding	% of other funding
Stationary Pickup - Parcel Lockers										
InPost	Y		24/7 pick-up	Business to Customers	Non-Food Goods	Customer pick-up	Variable			
US-UPS & Post Office partner-ship - Blue and Brown Make Green	N	N	N	Business to Customers	Non-Food Goods	Trucks, EV	Public-Private	50%	50%	
Amazon										
Locker banks (Portland)	Y	Y	Y	Business to Customers	Non-Food Goods	Customer pick-up	Private			
Parcel lockers, DHL Asia Pacific Innovation Center (APIC), Singapore				Business to Customers	Mixed	Smart trucks				
Micro Distribution Centers										
Beaugrenelle - Paris - Parking Lots		15th and 16th Arrondissements	6 AM - 9 PM	Business to Business	Non-Food Goods	Electric vehicles	Private	0	100	
Fukuoka, Japan - UCC		Y	Y	Business to Business	Non-Food Goods	Trucks, natural gas	Private	0	100	
Bristol/Bath Consolidation Centre	Y	Y	Y	Business to Business	Non-Food Goods	Electric vehicles	Public	25%	75%	
London Borough Consolidation Centre	Y	Y	Y	Business to Customers	Non-Food Goods	Low Emission Trucks	Public	100%		
Citylogistik		Y	Y	Business to Business	Non-Food Goods	EV vans and trucks	Variable	40%		
Utretcht (4 UDCs)	Y	Y	Y	Business to Customers	Mixed	EV, cargohopper, beer boat	Public-Private			
City of Portland Central City	Y	Y	Y	Business to Customers	Mixed	EV, hybrid	Public-Private			
Asia Pacific Innovation Center (APIC), Singapore			Y	Business to Customers	Mixed	Smart trucks, drones, driverless trucks				
Mobile Package Distribution										
Brussels	y	Y	Y	Business to Customers	Non-Food Goods	Cargo Bikes	Variable	20%	100%	
Barcelona Microplatform						Electric Tricycle				
La Petite Reine, Paris		Paris and outlying suburbs		Other	Non-Food Goods	EV, cargocycle	Public	0	100	
Rickshaw New York City UMC Warehouse	Y	Y	Y	Business to Business	Mixed	Trucks	Public-Private			

D Case Study Worksheets

Mobile Package Distribution: Barcelona, Spain	
Location (if applicable)	Barcelona, Spain
Company Name (if applicable)	Vanapedal, Barcelona Dept. of Transport, Department of Commerce, Institute of Urban Landscape, SAP Smile, Smart Green Innovative Urban Logistics for Energy efficient Mediterranean cities (4 Private Shippers—ASM, TNT, SEUR, DHL)
Description	• Urban freight distribution center in the Ciutat Vella district; • Built micro platform located in the Paseo Lluis building with loading and unloading docks, from which electric tricycles undertake last-mile deliveries; • Deliveries take place within a regulated time frame, distribution to all commercial establishments, efficient tool that enables time and kilometer savings, safer urban distribution, energy efficiency; • 120 daily operations with 16.8km done by tricycle per day, 5.3% saving per trip.
Origin of the project	City council and the Department of Prevention, Security and Mobility has set a priority to ensure proper functioning of the mobility of public transport; Test the efficiency of the vehicles and the economic balance of this initiative; a need to locate several transhipment points, where goods can be transferred from trucks to smaller vehicles.
Size of ULS	Varies
Characterization of Cargo	☐Refrigerated goods ☐Food goods ✓ Non-food goods ☐Heavy parcels (ie - furniture, etc.)
Type of Distribution	✓ Business to Business ☐Institutions (government, hospitals, etc.) ☐Shopping malls ☐Business to Customers
Results	This new model can save 63.9 km by day, 31.95 by tricycle which means 7,987 km, 2.05 tonnes of CO_2 and 2,398 litres of fuel.
Regulation Required	The opening time for the mini-loading and unloading bay is at 08:30 in the morning. This infrastructure has two parking spaces for small trucks or vans, with a management and changing room area and a small warehouse. The goods can be received and sent from Monday to Friday between 09:00 and 10:00 in the morning, while the goods that have not been delivered or that should be sent somewhere else can be picked up between 18:30 and 19:30 in the afternoon.
Business Model	☐Public ☐Private ✓ Public-Private Partnership
% Government Sector Involvement	☐Low ✓ Medium

	☐High
% Private Sector Involvement	☐Low ☐Medium ✓ High

Advantages	**Disadvantages**
- Utilizing electric vehicles - Reduces congestion and large truck use - Organizes delivery times - Increases the efficiency of the consolidation center	- The six month pilot was conducted for free to get local businesses on board; - Long-term business plan - Only parcels can be delivered (envelopes and small boxes); - Main barrier to overcome is access to market players; - Defining the area of implementation

Resources

"Best Practice Case Quick Info: Green Logistics & Co-Modality- Smart green innovative urban logistics fir energy efficient Mediterranean cities (SMILE)." Best Practice Factory for Freight Transport. Web. <http://www.bestfact.net/wp-content/uploads/2016/02/2-143_BESTFACT_CL2_QuickInfo_SMILE.pdf>

"Barcelona: Distribution of Goods." SMILE. Web. <http://smile-urbanlogistics.eu/projects/smile-pilots/barcelona>

"The courier services company DHL creates a green delivery in Barcelona and Valencia by using electric tricycles." Energy News. 21 May 2015. Web. <http://www.energynews.es/english/the-courier-services-company-dhl-creates-a-green-delivery-in-barcelona-and-valencia-by-using-electric-tricycles/>

"SMILE reference guide for energy efficiency in Urban logistics." Smart Green Innovative Urban Logistics for Energy Efficient Mediterranean Cities. 30 June 2015. Web. <http://www.smile-urbanlogistics.eu/sites/default/files/docs/smile_reference_guide_for_energy_efficiency_2_1.pd>

"Vanapedal, micro-distribution of goods by electric tricycle." Ajuntament de Barcelona. 21 July 2014. Web. <http://w42.bcn.cat/web/en/noticies-i-premsa/noticies/actives/Vanapedal-micro-distribution-of-goods-by-electric-tricycle.jsp>

"Electric tricycles deliver goods in Ciutat Vella." Ajuntament de Barcelona. 27 January 2014. Web. <http://w110.bcn.cat/portal/site/MediAmbient/menuitem.7120b3cf16112e13e9c5e9c5a2ef8a0c/?vgnextoid=4b30bf428a4d3410VgnVCM1000001947900aRCRD&vgnextfmt=formatDetall&lang=en_GB>

"Vanapedal micro-distribution platform, Barcelona." Vanapedal. 8 April 2014. Web. <https://www.youtube.com/watch?v=0WlH11VcNFs>

Mobile Package Distribution – Amazon Flex, Multiple Locations	
Location (if applicable)	Seattle, New York, Richmond, Nashville, Portland, Raleigh, Virginia Beach, Austin, Dallas, Baltimore, Miami, Atlanta, Houston, San Antonio, Las Vegas, Phoenix, Minneapolis/St. Paul, and Indianapolis metro areas.
Company Name (if applicable)	Amazon
Description	• Amazon Flex is paying drivers $18 to $25 dollars an hour to deliver packages. • Amazon Flex drivers require an Amazon account, car, a valid driver's license, an Android phone, the ability to pass a background check and must be 21-years or older. In the future, they may offer options to drive but in the future we may offer opportunities to deliver via bike or on foot. • Drivers are able to schedule when they want to work in two, four and eight hour time windows. They can also receive tips. • Currently, Amazon Flex drivers aren't able to select a specific delivery neighborhood within a metro area or make a preference related to package contents. • They arrive at a Flex location (usually a small warehouses near metropolitan areas and not a huge fulfillment center), take a numbered ticket, watch for their number to be displayed on the wall and pick up their packages once their number is shown. • The launch of Amazon Flex will facilitate its new one-hour delivery service, Amazon Prime Now. • Amazon Flex drivers will start with the delivery of Amazon Prime Now package, though they may deliver other types of packages in the future.
Origin of the project	The launch of Amazon Flex was a means for the e-commerce giant to facilitate its new one-hour delivery service Amazon Prime Now. Industry analysts said it could help Amazon contain its shipping costs, which grew more than 18 percent to $11.5 billion last year. Routing more deliveries through its own network of contract drivers gives Amazon more control over its supply chain and cut costs.
Size of ULS	Small warehouse
Characterization of Cargo	☐Refrigerated goods ✓Food goods ✓Non-food goods ☐Heavy parcels (ie - furniture, etc.)
Type of Distribution	✓Business to Business ☐Institutions (government, hospitals, etc.) ☐Shopping malls ✓Business to Customers
Results	
Regulation Required	

Business Model	☐Public ✓Private ☐Public-Private Partnership
% Government Sector Involvement	✓Low ☐Medium ☐High
% Private Sector Involvement	☐Low ☐Medium ✓High
Resources	"Amazon Flex." Amazon. Web. <https://flex.amazon.com> Demmitt, Jacob. "Amazon set to launch new 'Amazon Flex' package pickup service with Prime Now in Seattle Area." GeekWire. Web. <http://www.geekwire.com/2015/amazon-set-to-launch-new-amazon-flex-package-pickup-service-in-seattle-area-with-prime-now/> Tracy, Abigail. "Amazon Launches Flex in Seattle, Will Pay Part-Time Drivers to Deliver Packages." Forbes, 29 September 2015. Web. <http://www.forbes.com/sites/abigailtracy/2015/09/29/amazon-launches-flex-in-seattle-will-pay-part-time-drivers-to-deliver-packages/#38820b5f3509> Saito, Mari. "Exclusive: Amazon expanding deliveries demand drivers." Reuters, 18 February 2016. Web. <http://www.reuters.com/article/us-amazon-com-logistics-flex-idUSKCN0VR00O>

Mobile Package Distribution: Brussels, Belgium	
Location (if applicable)	Brussels, Belgium
Company Name (if applicable)	TNT Express
Description	• Trailer equipped with various facilities, office, loading, unloading and sorting. • Can be extended outwards and a lift provides access to the electric cycles to load and unload parcels. • Can hold 11 containers for the parcels. • Each day, the mobile depot will drive from the TNT Express hub to designated location
Origin of the project	Brussels is a congested city in terms of traffic jams. It was rated number 1 most congested city at the time the project began. Drivers face, on average, delays of over 33% during peak hours. Urban deliveries are usually carried out by diesel fueled trucks and vans negatively impacting the air quality and pollution.
Size of ULS	Normal truck dimensions (14 x 2.5 m). Parked, full size of 14 x 6.5 m.
Characterization of Cargo	☐Refrigerated goods ☐Food goods ✓ Non-food goods ☐Heavy parcels (i.e. - furniture, etc.)
Type of Distribution	✓ Business to Business ✓ Business to Customers ☐Institutions (government, hospitals, etc.) ☐Shopping malls
Results	Brussels is a congested city in terms of traffic jams. Was rated number 1 most congested city at the time the project began. Drivers face, on average, delays of over 33% during peak hours. Urban deliveries are usually carried out by diesel fueled trucks and vans negatively impacting the air quality and pollution.
Regulation Required	Permit for location, other regulations required unknown
Business Model	☐Public ✓Private ☐Public-Private Partnership
% Government Sector Involvement	✓ Low ☐Medium ☐ High
% Private Sector Involvement	☐Low ☐Medium ✓ High

Resources	"TNT Express introduces mobile depot in Brussels." TNT. 29 May 2013. Web. <http://www.tnt.com/content/corporate/en/data/press/2013/05/tnt-express-introduces-mobile-depot-in-Brussels.html> Verlinde, Sara, Cathy Macharis, Lauriane Milan, and Bram Kin. "Does a Mobile Depot Make Urban Deliveries Faster, More Sustainable and More Economically Viable: Results of a Pilot Test in Brussels." Transportation Research Procedia 4 (2014): 361-73. Web. <http://www.sciencedirect.com/science/article/pii/S235214651400310X>

Urban Consolidation Center: Bristol-Bath, London, UK	
Location (if applicable)	Bristol, London, UK
Company Name (if applicable)	Bristol City Council, Bath & Northeast Somerset Council, DHL, Civitas Initiative
Description	• Suppliers deliver goods to a strategically located warehouse on the periphery of the city • 24-hour delivery and assisted deliveries • Product is consolidated in order to maximize vehicle utilization on "last mile" • Utilize two 9 ton electric vehicles vans (8 pallets, 15 cage spaces) • Vehicles can travel for 75 miles per charge with a max speed of 50mph • Currently the platform is funded by the city councils
Origin of the project	Final mile logistics solution; Reduce the number of large delivery vehicles entering central Bath by providing a facility where goods can be consolidated and dispatched by electric vehicle; Relieve pressure on parking and loading/unloading; Reduce congestion, air pollution, Increase Quality of Life, Improve cyclist safety
Size of ULS	The facility occupies 4,000 sq. ft. of space (371 m^2) within a major distribution operator's existing warehouse.
Characterization of Cargo	☐Refrigerated goods ☐Food goods ✓ Non-food goods ☐Heavy parcels (ie - furniture, etc.)
Type of Distribution	✓ Business to Business ☐Institutions (government, hospitals, etc.) ✓ Shopping malls ☐Business to Customers
Results	• Reduction in pollution emissions, reduction in the # of vehicles • 79.5% reduction in delivery trips for retailers • 158 tonnes of CO2 and 5,136kg of NOx saved • More than 16,224 vehicle trips removed • Cost of subsidizing the initiative reduced from 221,910 Euros in year 1 to 141,083 Euros in year 2 when a charge was introduced
Regulation Required	• Weight restrictions can be for environmental or structural reasons. Environmental weight restrictions are in place for amenity reasons, eg to deter HGVs from using residential streets. Structural weight restrictions are in place where a structure may weaken, collapse or fail if too great a weight is placed up on it. • Width or length restrictions are in place where there is a physical constraint so that vehicles of a greater width or length would be at risk of causing damage or not being able to pass. • Where loading restrictions are in place for waiting vehicles whilst loading and unloading. If it is desirable to keep space for loading and

	unloading vehicles, bays can be provided where there is a requirement, ie retail or commercial concentration creates demand. Loading bays are created by way of a Traffic Regulation Order, which includes a formal consultation process inviting comments.
Business Model	☐Public ☐Private ✓ Public-Private Partnership
% Government Sector Involvement	☐Low ☐Medium ✓ High
% Private Sector Involvement	☐Low ☐Medium ✓ High

Advantages	**Disadvantages**
- Delivery to stock room, Security of delivery, Staff time saved, Duration of delivery, Set Delivery times - Productivity of construction workforce: several studies show that operatives save 30 min per day through better logistics which gives a 6% productivity improvement and 3% cost reduction. - Productivity of hauliers: a 10-20% reduction in delivery cost is achievable. - Material waste: if just one half of material waste were eliminated material costs would reduce by 7.5% and construction cost by 3%.	- Quiet vehicles are dangerous for pedestrians - Difficult to reach all retailers in the area - Transfer costs reduce financial viability of UCCs - Carriers do not have the power to push for UCCs - Difficult to identify all the savings that are achieved through waste reduction and reduced over-ordering, productivity improvements, reduced waiting time, reduced haulage costs, programme certainty etc.

Resources	"Viewpoint: InPost UK's Ian Caminsky on how locker boxes can reduce number of parcel deliveries in towns." Freight in the City. 28 July 2015. Web. <http://freightinthecity.com/2015/07/viewpoint-inpost-uks-ian-caminsky-on-how-locker-boxes-can-reduce-number-of-parcel-deliveries-in-towns/> "InPost installs first London Underground locker." Post &Parcel. 30 May 2014. Web. <http://postandparcel.info/61363/news/inpost-installs-first-parcel-locker-at-buckhurst-hill-underground-station/> "Delivering the Future." pteg: the voice of urban transport. February 2015. Web. <http://www.urbantransportgroup.org/system/files/general-docs/Delivering%20the%20future%20FINAL%20020315.pdf> "Freight in Bristol." Bristol City Council. 23 March 2015. Web. <https://www2.bristol.gov.uk/committee/2015/sc/sc048/0409_14.pdf> Browne, Professor Michael and Jose Holguin-Veras Rensselaer. "Urban Consolidation Centers: The UK Experience." VREF Center of Excellence for Sustainable Urban Freight Systems. 6 May 2014. Web. <https://coe-sufs.org/wordpress/wp-content/uploads/2014/05/UCC-UK-webinar.pdf> "Case Study: Helping to preserve the fabric of historic buildings." Transport for London. Web. <http://content.tfl.gov.uk/bath-case-study.pdf>

Urban Consolidation Center: London, UK	
Location (if applicable)	Camden, London, UK
Company Name/Stakeholders (if applicable)	Camden Council, operated by DHL, multi borough (Edmonton, Enfield, Waltham Forest, Eco2City, Brussels Mobility, The Green Link, Cross River Partnership, funded by European Regional Development Fund and the Mayor's Air Quality Fund
Description	• Suppliers are delivering goods to a nearby consolidation centre for onward delivery , instead of making individual journeys (LaMiLo Project) • Camden is a diverse wedge of 22 sq.km of inner London • Covenant Garden and King's Cross are busy central areas in Camden • Population approximately217,000 3% of London
Origin of the project	LaMiLo (Last Mile Logistics) is a European project to test innovative solutions to improve delivery of last mile of supply chains. MAQF has committed 20 Million Euros in funding over 10 years to help reduce air pollution; Reduce congestion, air pollution, fewer vehicles, noise on roads;
Size of ULS	2,000sq ft warehouse space
Characterization of Cargo	☐Refrigerated goods ☐Food goods ✓Non-food goods ✓Heavy parcels (ie - furniture, etc.)
Type of Distribution	☐Business to Business ☐Institutions (government, hospitals, etc.) ☐Shopping malls ✓Business to Customers
Results	50,000 items delivered to over 250 council buildings, 46% reduction in the number of vehicle trips, 45% reduction in kilometers traveled
Regulation Required	Suppliers deliver into the LBCC at pre-agreed time slots between 0630-0800hrs. 15-20min turnaround time for suppliers' vehicles; Vehicles: Two 7.5t Euro 5 emissions standards; 2 vehicles in use Mon-Fri; Serves 300 council buildings across 3 London Boroughs
Business Model	☐Public ☐Private ✓Public-Private Partnership
% Government Sector Involvement	☐Low ☐Medium ✓High

% Private Sector Involvement	☐Low ☐Medium ✓High

Advantages	**Disadvantages**
- Environmental benefits are achievable - Consolidation model likely to have a greater overall positive impact than converting existing fleet to zero emissions - Savings expected to come from primarily Delivery Time savings by suppliers. - Now 1 delivery not 20, per day.	- Market development needed – only 2 bidders. - Difficult to extend the reach and number of boroughs - Only two delivery vehicles - Need to understand returns process and how this works for each supplier – impact on ordering systems - Some staff may perceive a consolidation centre will lead to delays – be ready - Suppliers are reluctant to forego the control associated with performing their own logistics & reducing delivery frequency

Resources	"Camden Business Case." LaMiLo, 2February 2015. Web. <http://knowledgehub.lamiloproject.eu/resources/41-camden-business-case.php> Churchill, Kevin. "London Boroughs Consolidation Centre (LBCC) Project." LaMiLo, 1 July 2014. Web. <http://ec.europa.eu/environment/gpp/pdf/01_07_2014/LBCC%20-%20Webinar%20-%20Tuesday%201st%20July%202014_Kevin%20Churchill.pdf> "LAMILO- Sustainable City Logistics: London Borough Consolidation Centre Pilot (LBCC)." London Councils, 6 July 2015. Web. <http://www.londoncouncils.gov.uk/node/26663>

Urban Consolidation Center: Beaugrenelle, Paris, France	
Location (if applicable)	Paris, France
Company Name (if applicable)	Sogaris, part of the Chronopost network
Description	• It is located in two levels of an above ground parking garage. • This is the second UCC implemented by Chronopost in Paris after the first one in Place de la Concorde. It took two years to plan the project and one year to realize it. The UCC opened in 2013. • The space is 3000 m2 on two levels for distribution and collection of parcels smaller than 30 kg. Located in the Beaugrenelle district in the 15th Arrondissement and deliveries serve Vanves, Boulogne-Billancourt and Issy-les-Moulineaux (7th Arrondissement). This UCC is integrated in the Chronopost network (domestic and international shipping company). Express freight deliveries. • The UCC makes it possible for Chronopost to optimize flows from the hub of Chilly-Mazarin while being closer to the consumer market. The fleet consists of ten (10) electric vehicles and other alternative of transport to help reduce distance traveled and CO2 emissions. • This UCC allows Chronopost distribute 5,000 parcels over 42 daily rounds. Goal is to have 25 vehicles by 2020. • 100% renewable energy to power the UCC. • Assisted by grants from the city through two development companies and authorization of the architects. The UCC received 500k Euros of investment for development, security and mechanization from the public and private sector. There are 52 salaried staff (42 drivers).
Origin of the project	Improved deliveries within city with less pollution and congestion.
Size of ULS	3000 square meters on two levels of an above-ground parking garage
Characterization of Cargo	☐Refrigerated goods ☐Food goods ✓Non-food goods ☐Heavy parcels (ie - furniture, etc.)
Type of Distribution	☐Business to Business ☐Institutions (government, hospitals, etc.) ☐Shopping malls ✓Business to Customers
Results	5,000 parcels delivered daily over 42 rounds.
Regulation Required	Hours of operation are 6 AM - 9 PM.

Business Model	☐Public ✓Private ☐Public-Private Partnership
% Government Sector Involvement	☐Low ☐Medium ✓High (beginning with subsidies)
% Private Sector Involvement	☐Low ☐Medium ✓High

Advantages	**Disadvantages**
- Underground space used - Reduction in pollution and congestion	- Limited scope of delivery and collection services

Resources

"L'espace logistique urbain de Beaugrenelle" Chronopost. 20 March 2016. Web. <http://www.chronopost.fr/fr/aide/tutoriaux/lespace-logistique-urbain-de-beaugrenelle>

Heitz, Adeline. *Paris: Urban Laboratory for Urban Logistics* MetroFreight Volvo Center of Excellence, December 2015. 15-2.1c. Web.

Sogaris, Chronopost, SemPariSeine. "Inauguration de l'Espace Logistique Urbain (ELU) de Beaugrenelle (Paris 15eme)." Web. <http://www.chronopost.fr/transport-express/webdav/site/chronov4/users/chronopost/public/pdf/presse/dp/DPELUPARISBEAUGRENELLE.pdf>

Sevillano, Christine. "Chronopost: vers une logistique proper a Paris."*Journal de l'Environnement*. 1 July 2005. Web. <http://www.journaldelenvironnement.net/article/chronopost-vers-une-logistique-propre-a-paris,8891>

Ripert, Christophe. "Urban Logistics: Next challenge for cities" Cannes, 7 March 2012. Web. <http://www.slideshare.net/MIPIM/urban-logistics-next-challenge-for-cities>

Micro Distribution Center: Nijmegen, Netherlands	
Location (if applicable)	Nijmegen, Netherlands
Company Name (if applicable)	Binnenstadservice.nl (BSS)
Description	• Differs from other MDC initiatives by its focus on receivers rather than on carriers. • Small and independent retailers have to join and then allow BSS to send a change of address to its suppliers (i.e. BSS' address). Only store-owners can join the initiative. • Carriers make appointments with BSS's national organization, called ECO2CITY, about contacting their delivery-addresses (stores in the city centre) to join the local BSS initiative. • Next to this basic service, the retailers can purchase extra services at BSS for money: - Storage (so that retailers no longer have to use their shop to store goods or rent storage space elsewhere), - Home-deliveries (for example for large goods, such as fridges and computers), - Value-added logistics including retour logistics (of for example clean waste), and - Possibilities for e-tailing in the city of Nijmegen. • By focusing on small retailers, almost all deliveries are small deliveries, so no FTL deliveries have to be split up into multiple vehicles. • BSS uses clean transportation to deliver goods in the city centre in order to reduce the emissions; i.e. an electronic bicycle and a natural gas truck. These vehicles do not hinder other traffic. • BSS also provide logistical services to local inner city stores, regional consumers, carriers and local government.
Origin of the project	Nijmegen's medieval city centre is situated on a small hill and has a historical structure with streets where many small, independent retailers are located. BSS's consolidation centre (started in 2008) is located about 1.5 km away where goods can be picked up 18 hours a day. BSS deliberately focuses on small and independent retailers, since their deliveries are usually not optimized, in contrast to those of retail chains. By bundling the deliveries from multiple suppliers for the store-owner and delivering the goods at the time the retailer wishes, BSS offers a service that saves the small store-owners time. BSS received a government subsidy for one year to start business in Nijmegen and then had time to build a sufficient amount of stores.
Size of ULS	
Characterization of Cargo	☐Refrigerated goods ☐Food goods ✓Non-food goods ☐Heavy parcels (ie - furniture, etc.)
Type of Distribution	✓Business to Business ☐Institutions (government, hospitals, etc.) ☐Shopping malls ☐Business to Customers

Results	After one year, residents face less inconvenience by urban freight transport due to BSS. More BSS consolidation centres throughout the country have a positive impact on the financial stability of the BSS-concept. Due to the national expansion process, new opportunities arise for BSS; BSS becomes a more serious partner for transport companies to handle the transport in the last mile distribution in cities. Besides, it probably decreases total CO2 emissions, because carriers are able to plan more efficient roundtrips with larger vehicles, since they are not hindered by local authorities' restrictions such as time-windows and vehicle restrictions. The positive results of BSS in Nijmegen gave rise to BSS franchise initiatives in other Dutch cities, the second BSS started business in Den Bosch (without subsidy) and at least two new BSS centres opened later in 2009. There was a decrease in number of trucks and trucks kilometres in the city centre. In spite of the many positive impacts for carriers, i.e. no longer inefficient operations in cities, and for cities found in many studies, only a few urban consolidation centre initiatives have been realized in practice that did not terminate after a few years.
Regulation Required	Air quality standards that limit the number of vehicles in use.
Business Model	☐Public ✓Private ☐Public-Private Partnership
% Government Sector Involvement	✓Low ☐Medium ☐High
% Private Sector Involvement	☐Low ☐Medium ✓High
Resources	Rooijen, Tariq van *et al*. "Local impacts of a new urban consolidation centre- the case of Binnenstadservice.nl." Procedia Social and Behavioral Sciences, 4 April 2010. Web. <http://www.sciencedirect.com/science/article/pii/S1877042810010645>

Mobile Package Distribution: La Petite Reine, Paris, France	
Location (if applicable)	Paris, France. Neuilly-Sur-Seine, France
Company Name (if applicable)	La Petite Reine
Description	• Consolidation system using cargo cycles distributed within city center, has secured a large client base and are looking to expand in Paris and other cities. • 25 electric-aided cargo cycles, ~250k deliveries and additional collection services per year (2011). 100 cargocycles and 50 light-duty electric vehicles, 280k deliveries annually (2015). • Privately owned and operated, self-sustaining with good marketing strategy. • Cross-docking. • In addition to charging delivery and collection service fees, the company sells advertising space on side panels of the cargo bins, thus generating additional revenue. • Good marketing strategy, benefits from several strategic alliances that ensure a good volume of merchandise processed each day. • Services offered include distribution for “express” transport companies and deliveries to its own client base. • Favorable rental agreement with the city on at least one of the two hubs helps ensure profitability.
Origin of the project	Improved last mile delivery within city core. Efficient short distance deliveries, increased access to restricted areas (pedestrian zones, urban core).
Size of ULS	There are three (3) hubs where cross-docking takes place.
Characterization of Cargo	☐Refrigerated goods ✓Food goods ✓Non-food goods ☐Heavy parcels (ie - furniture, etc.)
Type of Distribution	✓Business to Business ☐Institutions (government, hospitals, etc.) ☐Shopping malls ✓Business to Customers
Results	Roughly 250,000 deliveries and collections in Paris city center.
Regulation Required	Minimal government involvement required (Panero, Marta et al, 6).

Business Model	☐Public ✓Private ☐Public-Private Partnership
% Government Sector Involvement	☐Low ☐Medium ✓High
% Private Sector Involvement	☐Low ☐Medium ✓High

Advantages	**Disadvantages**
- LPR cargocycles can be parked anywhere - Decreased time spent looking for parking and traveling from vehicle to customer - Slower than motorized vehicle, but cargo cycles are better at navigating through congested traffic, as long as the delivery routes remain relatively short - Fuel savings of roughly 90 tons of oil equivalent and associated pollution.	- Not good for longer routes - Limited cargo capacity (180 kg)

Resources

Panero, Marta et al. "Urban Distribution Centers: A Means to Reducing Freight Vehicles Miles Traveled". The NYU Rudin Center for Transportation Policy and Management. March 2011. Web. <https://www.dot.ny.gov/divisions/engineering/technical-services/trans-r-and-d-repository/C-08-23_0.pdf>

"La Petite Reine" *Petit Fute*. 20 March 2016. Web.<http://www.petitfute.com/v17231-17301-paris-75006/c1122-voyage-transports/c1145-avion-bateau-bus-train-taxi-parking/c1154-transport-urbain/c913-velo/1456732-la-petite-reine.html>

Solard, Gilles. "La Petite Reine pedale fort" *Strategies Logistiques*. 28 May 2015. Web. <http://www.strategielogistique.com/La-Petite-Reine-pedale-fort,5505>

Le Goff, Silvia. "Star's Service: La Petite Reine Devient Grande"*Transport Info*. 22 May 2015. Web. <http://www.transportinfo.fr/stars-services-petite-reine-devient-grande/>

Alternatives Economiques Poche no. 062. "La Petite Reine: livraison zero CO2" June 2013.Web. <http://www.alternatives-economiques.fr/la-petite-reine--livraison-zero-co2_fr_art_1223_64307.html>

Urban Consolidation Center: Fukuoka, Japan	
Location (if applicable)	Fukuoka, Japan
Company Name (if applicable)	Tenjin Joint Distribution System (TJDS)
Description	• Opened in February 1978 • Carriers deliver freight to Hakozaki distribution center, a freight terminal located in the Higashi-hie ward, which is located at roughly 4 km from Tenjin and near the interchange of urban expressways as well as the Japan Railway line. • At the terminal, all parcels are sorted and consolidated according to their final delivery address. • Then the TJDS vehicles are loaded and packages delivered throughout Tenjin's central business district • In terms of reducing the time spent looking for parking the Tenjin district has re-designated some parking spaces from passenger to freight vehicles, leading to decreased delivery time • Other activity areas may be run more time efficiently if various policy alternatives are introduced. The following have been considered: requiring that buildings have loading docks, developing joint reception of cargos at each building or within each block, employing electric cargo carts to alleviate time spent to access buildings or in-building transportation
Origin of the project	Reducing transportation costs, addressing pollution, limiting congestion, limited load capacity
Size of ULS	Not reported
Characterization of Cargo	✓Refrigerated goods ✓Food goods ✓Non-food goods ☐Heavy parcels (ie - furniture, etc.)
Type of Distribution	✓Business to Business (includes banks) ☐Institutions (government, hospitals, etc.) ☐Shopping malls ☐Business to Customers
Results	• services to various customers were improved through co-deliveries and higher load efficiency • declining customers from 36 in late 1990s to 32 in 2010 and decrease in delivery schedule from 3 to 2 per day (34 vehicles down to 20-24 vehicles), due to increase in cost per package due to increasing parking costs • eliminated pick up services • a survey determined that before its establishment, the TJDS' companies had employed 174 vehicles making 5 round trips or a total of 870 trips and traveling 2,622 vehicle km (~1,622 VMT). By 1997, the TJDS was employing 34 vehicles, each traveling two round trips per day or an average of 15 km (~9 miles) that included approximately five stops for unloading and loading merchandise. This was equal to 68 vehicles, 340 trips and 1,020 vehicle-km (~634 VMT)

	• Other cost savings accrue from load consolidation. In 1997 it was estimated that the TJDS had taken 100 vehicles out of circulation per day, and as a result approximately 530 trips and 1590 vehicle-km (~988 VMT) were avoided daily. • cost savings to participating customers • 60.9% reduction in traffic volume • 0.80 % reduction in traffic congestion along the truck road • 6.8% reduction in traffic congestion in service roads • .40% reduction in traffic pollution • .30% reduction in energy • higher overall system reliability due to decreased driver shortages, previously experienced by the freight companies. • achieved a decrease of 65% in the numbers of vehicles and 28% of traveled distance • vehicle trip reduction of 70% with CO2 savings of 3,100 kg per week • from communications with the TJDS in 2010 (through a translator) we perceived that the center is losing competitiveness, and thus clients.
Regulation Required	- converted more parking spaces to truck only use - fee per parcel - additional regulations and policy may be needed
Business Model	☐Public ✓Private ☐Public-Private Partnership
% Government Sector Involvement	✓Low ☐Medium ☐High
% Private Sector Involvement	☐Low ☐Medium ✓High

Advantages	Disadvantages
- Reduced externalities - Reduced damaged goods - Since 1984 the TJDS has been employing trucks powered by natural gas, and the system has been able to pass on the fuel savings to the customers. - Cost benefit analysis not available for participating companies; however, TJDS members have stated delivery costs are relatively cheaper than those paid by independent carriers	- Private sector carries the costs and benefits are heavier to society as a whole - Doesn't satisfy customers request for frequent deliveries per day - Additional costs for additional insurance policies - Center fails to adopt new technologies such as email or website - Lack of strategic plans to recruit new clients

Resources	Tario, Joseph D. et al. "Urban Distribution Centers: A Means to Reducing Freight Vehicle Miles Traveled." New York State Energy Research and Development Authority, March 2011. Web. <https://www.dot.ny.gov/divisions/engineering/technical-services/trans-r-and-d-repository/C-08-23_0.pdf>

Parcel Lockers: Germany	
Location (if applicable)	Germany
Company Name (if applicable)	Deutsche Post, run by DHL Parcel Germany
Description	• Opened in 2001. • 24/7 self-service collection and dispatch services to customers and professionals. • Customers are issued with a pin number and CD-ROM showing all locations. • Can make return shipments via the system as well. Customer is informed of delivery by email or SMS. • More than five million users, 90 % of people within Germany are located within 10 minutes of one. • 2,650 kiosks throughout Germany, Located in 1,600 cities and towns. • Looking toward international expansion, starting in Holland and Italy.
Origin of the project	Small to medium size parcel postal service
Size of ULS	Small
Characterization of Cargo	☐Refrigerated goods ☐Food goods ✓Non-food goods ☐Heavy parcels (ie - furniture, etc.)
Type of Distribution	☐Business to Business ☐Institutions (government, hospitals, etc.) ☐Shopping malls ✓Business to Customers
Results	Great success throughout Germany
Regulation Required	No
Business Model	☐Public ✓Private ☐Public-Private Partnership
% Government Sector Involvement	✓Low ☐Medium ☐High

% Private Sector Involvement	☐Low ☐Medium ✓High
Advantages - Eases on-line shopping collection and delivery	**Disadvantages** - Competitive on the international front
Resources	Bonn. "DHL Packstation- success story continues." Deutsche Post DHL Group, 6 May 2014. Web. <http://www.dpdhl.com/en/media_relations/press_releases/2014/dhl_packstation_success_story_continues.html>

Parcel Locker: Amazon, Multiple Locations	
Location (if applicable)	Portland, New York, London, Seattle, Austin, Dallas, Philadelphia, Phoenix, Cincinnati, Chicago, California and Virginia
Company Name (if applicable)	Amazon
Description	• A customer orders a parcel from Amazon and has it delivered to a Locker location at a grocery store, convenience and drugstore outlets.Amazon pays a small fee each month, like rent, to 7-Eleven and other store owners where it has lockers. • There are other limits to what can be shipped to a locker. The services is only available for products sold and shipped from an Amazon warehouse. • All packages delivered to Amazon Locker locations must be picked up within three business days. If you're not able to collect your package within this timeframe, the package will be returned to us for a refund. • Amazon's preferred carriers deliver the packages into the kiosk, at which point the customer receives a digital pick-up code via email or text messaging. • Once the unique pick-up code is input on the touch screen, the assigned door opens for package retrieval. Amazon customers have three days to collect their packages once they receive their pick-up code. • Amazon customers can also return packages to select Amazon Lockers
Origin of the project	Packaging and shipping orders is a central expense for Amazon. The company has been on a warehouse building frenzy in recent years, constructing facilities close to urban centers to speed delivery times. Amazon spent $8.59 billion on order fulfillment in 2013, up from $6.42 billion a year earlier. By adding the lockers, Amazon is addressing the concerns of some urban apartment dwellers who fear they'll miss a delivery or have their items stolen from their doorstep. Amazon is also taking on some of its rivals who are shipping to appointed sites, such as other retailers or United Parcel Service Inc. stores.
Size of ULS	Product dimensions smaller than 16.5 x 13.8 x 12.6 inches and have a shipping weight that is less than 10 lbs
Characterization of Cargo	☐Refrigerated goods ☐Food goods ✓Non-food goods ☐Heavy parcels (ie - furniture, etc.)
Type of Distribution	✓Business to Business ☐Institutions (government, hospitals, etc.) ☐Shopping malls ✓Business to Customers
Results	Staples and RadioShack ended the Amazon Locker test run. Amazon has continued to expand its service even though Google will close its similar service which is offered through BufferBox. It is also offering a return service for unwanted merchandise through its lockers.

Regulation Required	Last year, the U.S. Supreme Court declined to hear a challenge by Amazon to a New York law that required online retailers to collect a tax on sales to residents of that state. There have been some attempts to pass federal legislation to unify the country's system of how online retail taxes should be collected.
Business Model	☐Public ✓Private ☐Public-Private Partnership
% Government Sector Involvement	✓Low ☐Medium ☐High
% Private Sector Involvement	☐Low ☐Medium ✓High
Resources	Ashley, Monty. "Why Amazon Lockers is better than home delivery." PCWorld, 28 January 2014. Web.<http://www.pcworld.com/article/2458561/why-amazons-locker-is-better-than-home-delivery.html> Bensinger, Greg. "Amazon Will Now Allow Returns Using Lockers." The Wall Street Journal, 1 April 2014. Web. <http://blogs.wsj.com/digits/2014/04/01/amazon-will-now-allow-returns-using-lockers/> Bensinger, Greg. "Amazon's New Secret Weapon: Delivery Lockers." The Wall Street Journal, 7 August 2012. Web. <http://www.wsj.com/articles/SB10000872396390443545504577567763829784538> "How to Use Amazon Locker." wikiHow. Web. <http://www.wikihow.com/Use-Amazon-Locker> Townsend, Matt and Chris Burritt. "Staples. RadioShack Yank Amazon Lockers from Stores." Bloomberg, 18 September 2013. Web. <http://www.bloomberg.com/news/articles/2013-09-18/staples-radioshack-yank-amazon-lockers-from-stores> Stohr, Greg. "Amazon Rejected by U.S. High Court on New York Sales Tax." Bloomberg, 2 December 2013. Web. <http://www.bloomberg.com/news/articles/2013-12-02/amazon-rejected-by-u-s-high-court-on-new-york-sales-tax>

Parcel Lockers: InPost, Multiple Locations	
Location (if applicable)	Company: 20 Countries, including 14 EMEA markets (Australia, Chile, Great Britain, Ireland, Iceland, Italy, France, Latvia, Lithuania, Ukraine, Estonia, Poland, Russia, Cyprus, Slovakia, the Czech Republic, Columbia, Saudi Arabia, Costa Rica, El Salvador and Guatemala) Parcel locker operations (launched): UK, France, Italy, Poland, Iceland, Lithuania, Latvia, Estonia, Russia, Czech Republic, Slovakia, Colombia, Canada, Australia, Saudi Arabia, Netherlands.
Company Name (if applicable)	InPost
Description	• The Parcel Lockers enable sending and collecting parcels 7 days a week, 24 hours a day • No waiting in queues and collect parcels from a convenient location • In some locations, InPost has partnered with a single parcel carrier, such as PostNL in the Netherlands. In other countries, InPost acts as the network and offers the parcel locker service to multiple carriers by allowing them access. • InPost UK Locker Boxes The UK generates about 670m parcels a year from e-commerce according to the e-retail industry association IMRG, although 5-10% of that is from sales on British websites by consumers located overseas. How it works: 1. Customers can shop online and select a convenient locker location for delivery and pickup. 2. They will receive an email and/or text when their purchase is in transport and information to track the parcel throughout delivery. 3. InPost offers an application for download that also simplifies this process. 4. Once the package is delivered, customers will have three days to pick up their package from the secure locker location. Each parcel station will have extra security, and each locker can only be accessed with a security code, which is personalized for each package.
Origin of the project	• Congestion: deliver multiple packages for a variety of customers to one central location • Logistical issues and reduced deliveries caused by the increase of ecommerce (carriers, deliverers) • Additional revenue from unused space
Size of ULS	Dimensions/weight depends on model. <u>On average:</u> Width: 2.996 m – 4.421 m Height: 2.2 – 2.3 m Depth: 0.94 m + canopy 0.9 m Space requirements (suggested): - 5 sq. meters - electrical supply - 24/7 access - preferably a parking lot close-by
Characterization of Cargo	✓ Refrigerated goods ✓ Food goods ✓ Non-food goods ☐Heavy parcels (i.e. - furniture, etc.)

Type of Distribution	☐Business to Business ☐Institutions (government, hospitals, etc.) ☐Shopping malls ✓ Business to Customers
Results	Reduced fuel consumption, fewer deliveries, etc.
Regulation Required	Signage, etc.
Business Model	✓ Public ✓Private ✓ Public-Private Partnership
% Government Sector Involvement	✓ Low ✓ Medium ☐High
% Private Sector Involvement	☐Low ☐Medium ✓ High

Advantages	**Disadvantages**
- Adaptable models that can be installed in any public or privately owned unused space (specifically rail, petrol, retail, office, banks, etc.) - Ability to generate additional revenue - Ability to partner with local parcel distributors - Ability to air condition, heat, or provide fans - Ability to build own design (small, medium, or large sized lockers) - Can be easily integrated with Client's IT system - Modular construction enables easy upgrades as needed - Excellent solution for customers who cannot be at home during the working day to receive their parcels - Operated by a trusted company	- Requires an electricity source - Challenge to logistically work with retail distributers and market to customers (required to select as a delivery option) - Size limit of parcels, will not work for larger packages - Non-transparent business model - Targets a small population

Resources	"InPost Portfolio." InPost. 8 July 2013. Web. <https://inpost24.com/pliki/Portfolio_InPost_1200.pdf> "InPost arrives in UK, plans to install 2,000 parcel terminals in 2013." Post & Parcel. 8 February 2013. Web. <http://postandparcel.info/53738/news/companies/inpost-arrives-in-uk-plans-to-install-2000-parcel-terminals-in-2013/> "Viewpoint: InPost UK's Ian Caminsky on how locker boxes can reduce number of parcel deliveries in towns." Freight in the City. 28 July 2015. Web. <http://freightinthecity.com/2015/07/viewpoint-inpost-uks-ian-caminsky-on-how-locker-boxes-can-reduce-number-of-parcel-deliveries-in-towns/> "InPost installs first London Underground locker." Post &Parcel. 30 May 2014. Web. <http://postandparcel.info/61363/news/inpost-installs-first-parcel-locker-at-buckhurst-hill-underground-station/> "Delivering the Future." pteg: the voice of urban transport. February 2015. Web. <http://www.urbantransportgroup.org/system/files/general-docs/Delivering%20the%20future%20FINAL%20020315.pdf>

E Recommendations for Next Steps

The steps below provide a roadmap for developing a comprehensive freight plan for the city. These steps are a combination of best practices gathered from a variety of EU funded initiatives, including BESTUF, LaMiLO, CIVITAS, Straightsol, and SMILE. These key steps include information gathering, stakeholder engagement, goal setting, financial viability, and policy development.

Step 1: Information Gathering

Before determining which ULS to implement, it's important for the city to gather information on its commercial activity and traffic patterns.

1) Evaluate Tel Aviv's Retail Companies:
- Type of retail
- Location
- Size
- Time of operations
- Number of commercial deliveries per week

2) Track Tel Aviv Residential Activity:
- Number of packages delivered to each neighborhood
- Delivery routes and time

3) Analyze Tel Aviv's Traffic information:
- Location of congested streets
- Possible sources of congestion

Surveys and Interviews: Comprehensive surveys and interviews should be conducted with Tel Aviv's identified firms to determine the frequency of their deliveries, nature of their goods, and vehicles used.

Modeling: Data modeling will extrapolate useful indicators on the flows of traffic throughout the city center. In France, the FRETURB Model175 was created, and Brussels adapted a similar model to obtain metrics and develop a matrix on urban freight flow.[176]

Step 2: Stakeholder Engagement

Generating feedback and buy-in from all stakeholders (freight companies, retailers, residents, government officials, etc.) will help in defining material issues, establishing objectives and identifying opportunities for collaboration.

As described by the European Commission Projects, Straightsol C-LIEGE, BESTUFS and CIVITAS, identifying the key stakeholders early on in the process is fundamental to addressing the interests for all that are affected. Tel Aviv's stakeholders can include those that are directly involved in the solution such as shippers and receivers but should also include those that are not directly involved in the freight transport solution such as public authorities and residents. Although each group will have their own interests and concerns, the overlap in interests should take priority.

Figure E1—Stakeholders and Their Interests in UFT[177]

Category of Stakeholders	Stakeholders	Main Interest in Context of UFT
Supply chain stakeholders	Shippers	Delivery and collection of goods at the lowest cost while meeting the needs of their customers.
	Transport operators (own account, third party providers)	Low cost but high quality transport operations and satisfaction of the interests of the shippers and receivers.
	Receivers (major retailers, shop owners, etc.)	On time delivery of products, with a short lead-time.
Resource supply stakeholders	Consumers	Availability of a variety of goods in shops in the city centre
	Infrastructure providers	Cost recovery and infrastructure performance
	Infrastructure operators (managers)	Accessibility and use of infrastructure
Public authorities	Landowners	Profitability of local areas
	Local government	Attractive city for inhabitants and visitors, with minimum inconvenience from freight transport, while also having an effective and efficient transport operation.
Other stakeholders	National government	Minimum externalities from freight transport, while maximizing economic efficiency and effectiveness.
	Other economic actors located in the urban area (manufacturers, service providers, etc.)	Site accessibility and on-time deliveries.
	Residents	Minimum inconvenience caused by UFT
	Visitors/tourists	Minimum inconvenience from UFT and a wide variety of products in the shops

Step 3: Goal Setting and Key Performance Indicators

In order to implement and manage a successful freight solution initiative, Tel Aviv must prioritize the overall objectives for their freight plan and identify key performance metrics from which to measure progress.

Goal setting should be organized by short-term, mid-term, and long term. Examples of timeframes and goals are shown below:

Short term goals	Outline a plan of goals that will be accomplished within the next 3 years. These goals can address issues such as pedestrian safety, awareness campaigns, specialized training geared to improve urban logistics.
Mid term goals	Develop an 8 to 10 year plan expanding on the 3-year goals including greenhouse gas reduction goals, improved social impact, and positive economic contribution. Sample of goals could include: greenhouse gas emissions improvements because of public private partnership with taxi companies that use electric vehicles; additional spaces will be developed to improve pedestrian and tourism experiences; and the city will introduce a cleaner fuel alternative for transportation that will also provide jobs for the citizens.
Long term goals	20-30 year plan with clearly defined goals addressing economic, environmental and social impact. More concrete values and recommendations to be developed after in depth assessment of the problem(s). GHG emissions will be reduced by x in 20xx, pedestrian safety will improve by separating vehicle traffic from bicycle and pedestrian traffic by widening their paths, all freight vehicles will have transitioned to electric fleets.

<u>Key performance indicators:</u>
Identifying Key Performance Indicators (KPI) early in the development process will aid Tel Aviv in determining the progress of the selected project. Some recommended indicators to consider are:

- Economy – cost (investment, operating, enforcement) and benefits (revenues)
- Environment – air quality, emissions, noise (both perceived and actual)
- Society –acceptance level, attractiveness of urban environment, accessibility, traffic safety, employee satisfaction
- Quality of service – Punctuality and accuracy of deliveries, supply chain visibility, suitability of service, security of goods, operators' green concerns

Examples of the indicators utilized in the LAMILO Brussels Freight Flow Survey project are included in the appendices of this report:

Indicators or challenges	Example, Impact or Issue Addressed
Share of shipping and receiving according to industry	Small retail (x%), wholesale (x%), craft industry services (x%), and warehousing and transport (x%)
Share of shipping and receiving between sectors	What percentage of each sector's share is shipping vs. receiving
Frequency per week of shipping and receiving according to sector	What days are the busiest
Number of kilometers driven within city center by sector and vehicle type	Large freight vehicles (x%), small trucks (x%), hybrid vans (x%), electric vehicles (x%), cargo cycles (x%)
The distribution of movement throughout the day calculations, separated by type of trucks	Identifies where and when congestion accumulates, and identifies patterns in freight congestion according to vehicle type
Identify potential optimization flow options based on anticipated or planned changes to the city within the next 10 years	Demographic growth rate, large real estate and infrastructure projects, behavior changes of shippers/receivers and logistic services providers due to new technology and services, and road charging for HGV

Information for this table sourced from Brussels Freight Flow Survey [178]

STEP 4: Financial Viability

CIVITAS, City Freight, BESTUFS, and Smart Freight all use similar analysis as outlined below to determine the financial viability of the project to the city and the private partnership.

Key components	Description
Partners	Who are Tel Aviv's key partners and suppliers? Which key resources are required from partners? Which key activities do partners perform?
Activities	What key activities do our value propositions distribution channels, customer relationships and revenue streams require? Translate to recommendations – Tel Aviv activity with private company
Value proposition	What value does the organization/company deliver to the city? Which problems are we helping to solve?
Public Private relationships	What type of relationship is established between Tel Aviv and freight transportation company?
Partner segments	For whom is the government creating value? Who are the most important private partnership?
Key resources	What key resources do our value propositions, public private relationships, partner relationships and revenue streams require?
Externalities	Which environmental and societal impacts does the business model cause?
Cost structure	What are the costs associated with the business model Tel Aviv is responsible for? Which key resources and key activities are most expensive?
Revenue stream	Will the partnership generate revenue for Tel Aviv? Create jobs? How?[179]

STEP 5: Policy Development

The Municipality will need to play a critical role in creating policies that will ultimately support the freight solution, as well as incentivize and encourage stakeholders to alter behavior. Regulatory Control, also called command and control measures "are rules, prohibition, enforcement systems designed to control the activities of private freight operators in order to preserve the livability of the urban environment and to provide efficient mobility. These generally are applied to all traffic conditions including freight traffic."[180]

Below is a condensed list of types of policies designed to improve environmental social and economic issues associated with last mile issue as pointed out in the DG Move European Commission: Study on Urban Freight Transport.[181]

Figure E2 – Government Policies[182]

Efficient deliveries	Encouraging the obtaining and supplying of efficient deliveries and collections in urban areas, while attempting to improve the cost of delivery.
Low emission vehicles	Encouraging the development and use of low emission vehicles for "last mile" deliveries.
Intelligent Transport Systems	Promoting the use of ITS to increase the efficiency of urban freight transport (UFT).
Night deliveries	Allowing the most efficient use of scarce road infrastructure by beginning to allow night-time deliveries.
Intermodal transfer facilities	Encouraging the construction of facilities in urban areas for the transfer of freight between sustainable modes of transport for "last mile" deliveries.
Developing and disseminating good practice	in UFT throughout Tel Aviv by encouraging the use of third-party UFT services rather than using own account vehicles.

In addition to developing regulation, Tel Aviv should consider incentivizing freight transport companies to gain support for developing a UCC or other last mile logistics solution, since it has been show that this last leg is more expensive for private companies. Here are examples of incentives:

Free loading and unloading for environmentally friendly vehicles
Reduced congestion charge for entering the city center
Mobility credits
Government funding of pilot projects designed to complement the city's logistics goals.

Tel Aviv has begun the journey to become a more sustainable and environmentally friendly city by acknowledging the need to reduce congestion in its freight logistics system. The global best practices and examples outlined in this report are a starting point, however, it will be incumbent upon the Tel Aviv municipality to determine what the best solution is. By developing a freight strategy with clear goals and realistic measures for improvement, Tel Aviv will solve the challenges related to "Last Mile Delivery", while preparing and protecting the city for the future.

7 Endnotes

[1] imgur. “Tel Aviv Shore.” 2015. Web. Apr 2016. <http://imgur.com/G4cBfxd>

[2] Columbia University. “Integrated Workshop in Sustainability Management Master of Science in Sustainability Management, Columbia University, The Earth Institute, and School of Professional Studies, Spring 2016.” January 2016. Print.

[3] CIVITAS: 2Move2. “D8.1 Analysis of Existing SUMPs in all four cities, Draft Chapter 3.”12 Feb 2015. Print. Apr 2016.

[4] Columbia University. “Integrated Workshop in Sustainability Management Master of Science in Sustainability Management, Columbia University, The Earth Institute, and School of Professional Studies, Spring 2016.” January 2016. Print.

[5] Google Maps. “Downtown Tel Aviv-Yafo.” 2016. Web. Apr 2016. <https://www.google.com/maps/d/u/0/viewer?mid=10E4DTalkr6IH0Fex-wv7Ja-o6z4>

[6] CIVITAS. "Clean and Better Transport in Our Cities-Final Brochure." January 2009. Web. Apr 2016. <http://www.civitas.eu/content/cleaner-and-better-transport-our-cities-final-brochure>

[7] BESTUFS. "Best Urban Freight Solutions." 2008. Web. Apr 2016.<http://www.bestufs.net/>

[8] LAMILO: Sustainable City Logistics. "Last Mile Logistics Project, Sustainable Logistics Solution." 2015. Web. Apr 2016. <http://www.lamiloproject.eu/>

[9] Colliers International. “From First Mile to Last Mile Global Logistics, Global Industrial & Logistics Trends.” Oct 2015. Page 21. Web. Apr 2016. <http://www.colliers.com/-/media/files/marketresearch/global/global-logistics-2015.pdf?la=en-us>

[10] The City College of New York/CUNY. “Final Report: Freight Tricycle Operations in New York City.” Oct 2014. Page 113. Web. Apr 2016. <http://www.utrc2.org/sites/default/files/pubs/Final-Freight-Tricycles-NYC.pdf>

[11] VREF Center of Excellence for Sustainable Urban Freight Systems. “About Us.” 2016. Web. Apr 2016. <www.coe-sufs.org>

[12] Colliers International. “From First Mile to Last Mile Global Logistics, Global Industrial & Logistics Trends.” Oct 2015. Web. Apr 2016. <http://www.colliers.com/-/media/files/marketresearch/global/global-logistics-2015.pdf?la=en-us>

[13] Ibid

[14] Ibid

[15] Dablanc, Dr. Laetitia. IFSTTAR. “Challenges to a seamless urban freight transport policy.” 2 May 2012. Pages 5-7. Web. Apr 2016.

<http://2012.internationaltransportforum.org/sites/itforum2012/files/documents/en/WCTR_UrbanFreight_Dablanc.pdf>

[16] Allen, Julian, Michael Browne, Jacques Leonardi, and Allan Woodburn. Transport Reviews, Vol. 32, No. 4. "The Role of Urban Consolidation Centres in Sustainable Freight Transport." Jul 2012. Web. Pages 473-490. Apr 2016.<http://web.b.ebscohost.com.ezproxy.cul.columbia.edu/ehost/pdfviewer/pdfviewer?sid=49d02312-9402-4ba0-a3bb-d8f0b8145d37%40sessionmgr105&vid=1&hid=107>

[17] Janjevic, Milena. Qalinca Labs. “Urban Freight Consolidation Centres- Trends, Challenges, Solutions.” Oct 2015. Web. Apr 2016. <http://eclfconference2015.bike/presentations/8.ECLF2015Day1%20Milena%20Janjevic.pdf>

[18] Metro Freight: Volvo Center of Excellence. “Paris Urban Laboratory for Urban Logistics.” Feb 2015. Web. Apr 2016. <https://www.metrans.org/sites/default/files/MF%2015-2%201c_Paris%20Urban%20Laboratory%20Final%20Report_12232015.pdf>

[19] Ibid

[20] The City College of New York. "Urban Micro-consolidation and last mile goods delivery by freight tricycles in Manhattan: Opportunities and Challenges." Aug 2011. Web. Apr 2016. <http://docs.trb.org/prp/12-2682.pdf>

[21] Metro Freight: Volvo Center of Excellence. “Paris Urban Laboratory for Urban Logistics.” Feb 2015. Web. Apr 2016. <https://www.metrans.org/sites/default/files/MF%2015-2%201c_Paris%20Urban%20Laboratory%20Final%20Report_12232015.pdf>

[22] Browne, Michael. Woodburn, Allen. Allen, Julian. European Transport. “Evaluating the potential for urban consolidation centres.” 2007. Pages 48-49. Web. April 2016. <https://www.openstarts.units.it/dspace/bitstream/10077/5939/1/Browne_Woodburn_Allen_ET35.pdf>

[23] Wilson, Scott Ltd. South East Scotland Transport Partnership. “Freight Consolidation Centre Study Final Report.” 2010. Page 8. Web. Apr 2016. <http://www.dryport.org/files/doc/SEStran_Freight%20Consolidation%20Centre%20Study%20-%20Final%20Report.pdf>

[24] Metro Freight: Volvo Center of Excellence. “Paris Urban Laboratory for Urban Logistics.” Feb 2015. Web. Apr 2016. <https://www.metrans.org/sites/default/files/MF%2015-2%201c_Paris%20Urban%20Laboratory%20Final%20Report_12232015.pdf>

[25] Dablanc, Dr. Laetitia. IFSTTAR. “Challenges to a seamless urban freight transport policy.” 2 May 2012. Pages 5-7. Web. Apr 2016.

<http://2012.internationaltransportforum.org/sites/itforum2012/files/documents/en/WCTR_UrbanFreight_Dablanc.pdf>

[26] The City College of New York. "Urban Micro-consolidation and last mile goods delivery by freight tricycles in Manhattan: Opportunities and Challenges." Aug 2011. Web. Apr 2016. <http://docs.trb.org/prp/12-2682.pdf>

[27] Wilson, Scott Ltd. South East Scotland Transport Partnership. “Freight Consolidation Centre Study Final Report.” 2010. Page 8. Web. Apr 2016. <http://www.dryport.org/files/doc/SEStran_Freight%20Consolidation%20Centre%20Study%20-%20Final%20Report.pdf>

[28] The City College of New York/CUNY. “Final Report: Freight Tricycle Operations in New York City.” Oct 2014. Page 113. Web. Apr 2016. <http://www.utrc2.org/sites/default/files/pubs/Final-Freight-Tricycles-NYC.pdf>

[29] United Nations ESCAP. “Sustainable Urban Transportation Systems: An Overview.” 2012. Web. Apr 2016. <http://www.uncclearn.org/sites/default/files/inventory/unescap20_0.pdf>

[30] Browne, Professor Michael and Jose Holguin-Veras Rensselaer. VREF Center of Excellence for Sustainable Urban Freight Systems. “Urban Consolidation Centers: The UK Experience.” 6 May 2014. Page 49. Web. Apr 2016. <https://coe-sufs.org/wordpress/wp-content/uploads/2014/05/UCC-UK-webinar.pdf>

[31] Ibid

[32] Mayor of London, Transport for London. "Case Study - Helping to Preserve the Fabric of Historic Buildings, how urban freight consolidation centers help to reduce the number of goods vehicles on the roads of Bath". Date not provided. Web. April 2016. <http://content.tfl.gov.uk/bath-case-study.pdf>

[33] Carroll, Sean, Ciara Leonard and Gloria Spezzano. CIVITAS. “Case Study: Freight Consolidation in Bath.” 2012. Page 3. Web. Apr 2016. <http://www.civitas.eu/sites/default/files/civitas-plus-case-study-freight-consolidation-bath.pdf>

[34] Transport for London. “Low Emission Zone” 2016. Web. Apr 2016. <https://tfl.gov.uk/modes/driving/low-emission-zone>

[35] EU Urban Action Regulations. “Urban Access Schemes by Country.” 2015. Web. Apr 2016.<http://urbanaccessregulations.eu/countries-mainmenu-147/germany-mainmenu-61/berlin>

[36] BESTFACT. “Best Practice Factory for Freight Transport.” 2015. Web. Apr 2016. <http://www.bestfact.net/category/urban-freight/>

[37] Van Duin, J.H.R.WIT Transactions on Ecology and the Environment, Vol 84. “Sustainable Freight Urban Policies in Netherlands: a Survey.” 2005. Page 9. Web. Apr 2016. <http://www.witpress.com/Secure/elibrary/papers/SPD05/SPD05001FU1.pdf>

[38] Seattle Urban Mobility Plan. “10 Best Practices in Freight Movement.” Jan 2008. Web. Apr 2016. <http://www.seattle.gov/transportation/docs/ump/10%20SEATTLE%20Best%20Practices%20in%20Freight%20Movement.pdf>

[39] VREF Center of Excellence for Sustainable Urban Freight Systems. “Pricing, Incentives, and Taxation.” 2016. Web. Apr 2016. <https://coe-sufs.org/wordpress/ncfrp33/psi/pricing/>

[40] The Week. “Paris conference: all new UK cars to be zero-emissions by 2050.” Dec 2015. Web. Apr 2016. <http://www.theweek.co.uk/67605/paris-conference-all-new-uk-cars-to-be-zero-emissions-by-2050>

[41] VREF Center of Excellence for Sustainable Urban Freight Systems. “Pricing, Incentives, and Taxation.” 2016. Web. Apr 2016. <https://coe-sufs.org/wordpress/ncfrp33/psi/pricing/>

[42] Panero, Marta; Lopez, Daniel Polo, The NYU Rudin Center for Transportation Policy and Management. “Urban Distribution Centers a Means to Reducing Freight Vehicle Miles Traveled” April 2011. Pages 27-29. Web. Apr 2016. <https://www.dot.ny.gov/divisions/engineering/technical-services/trans-r-and-d-repository/C-08-23_0.pdf>

[43] Tindall, Chris. Freight in the City: SustainableUrban Deliveries. “Consolidation centres: urban myth?” 24 Apr 2008. Web. Apr 2016. <http://freightinthecity.com/2008/04/urban-myth/>

[44] Carroll, Sean, Ciara Leonard and Gloria Spezzano. CIVITAS. “Case Study: Freight Consolidation in Bath.” 2012. Page 3. Web. Apr 2016. <http://www.civitas.eu/sites/default/files/civitas-plus-case-study-freight-consolidation-bath.pdf>

[45] Metro Freight: Volvo Center of Excellence. “Paris Urban Laboratory for Urban Logistics.” Feb 2015. Web. Apr 2016. <https://www.metrans.org/sites/default/files/MF%2015-2%201c_Paris%20Urban%20Laboratory%20Final%20Report_12232015.pdf>

[46] Ibid

[47] Dablanc, Dr. Laetitia. IFSTTAR. “Challenges to a seamless urban freight transport policy.” 2 May 2012. Pages 5-7. Web. Apr 2016.

<http://2012.internationaltransportforum.org/sites/itforum2012/files/documents/en/WCTR_UrbanFreight_Dablanc.pdf>

[48] Panero, Marta; Lopez, Daniel Polo, The NYU Rudin Center for Transportation Policy and Management. “Urban Distribution Centers a Means to Reducing Freight Vehicle Miles Traveled” April 2011. Pages 27-29. Web. Apr 2016. <https://www.dot.ny.gov/divisions/engineering/technical-services/trans-r-and-d-repository/C-08-23_0.pdf>

[49] Metro Freight: Volvo Center of Excellence. “Paris Urban Laboratory for Urban Logistics.” Feb 2015. Web. Apr 2016. <https://www.metrans.org/sites/default/files/MF%2015-2%201c_Paris%20Urban%20Laboratory%20Final%20Report_12232015.pdf>

[50] Janjevic, Milena. Qalinca Labs. “Urban Freight Consolidation Centres- Trends, Challenges, Solutions.” Oct 2015. Web. Apr 2016. <http://eclfconference2015.bike/presentations/8.ECLF2015Day1%20Milena%20Janjevic.pdf>

[51] The City College of New York. "Urban Micro-consolidation and last mile goods delivery by freight tricycles in Manhattan: Opportunities and Challenges." Aug 2011. Web. Apr 2016. <http://docs.trb.org/prp/12-2682.pdf>

[52] Ibid

[53] Browne, Michael, Allan Woodburn, and Julian Allen. European Transport. “Evaluating the Potential for Urban Consolidation Centres.” 2007. Page 55. Web. Apr 2016. <https://www.openstarts.units.it/dspace/bitstream/10077/5939/1/Browne_Woodburn_Allen_ET35.pdf>

[54] Metro Freight: Volvo Center of Excellence. “Paris Urban Laboratory for Urban Logistics.” Feb 2015. Web. Apr 2016. <https://www.metrans.org/sites/default/files/MF%2015-2%201c_Paris%20Urban%20Laboratory%20Final%20Report_12232015.pdf>

[55] Dam, Timo van. Technische Universiteit Delft. “Towards a framework to explain viable urban consolidation centers: The design of an analytical framework to evaluate value creation of the UCC-concept and validation in a case-study research.” 5 Aug 2014. Web. Apr 2016. <http://studenten.tudelft.nl/fileadmin/Files/studentenportal/os/CiTGspecifiek/TIL_Afstudeerverslagen/Summary_T._van_Dam.pdf>

[56] Ibid

[57] Janjevic, Milena. Qalinca Labs. “Urban Freight Consolidation Centres- Trends, Challenges, Solutions.” Oct 2015. Web. Apr 2016. <http://eclfconference2015.bike/presentations/8.ECLF2015Day1%20Milena%20Janjevic.pdf>

[58] Browne, Professor Michael and Jose Holguin-Veras Rensselaer. VREF Center of Excellence for Sustainable Urban Freight Systems. “Urban Consolidation Centers: The UK Experience.” 6 May 2014. Page 49. Web. Apr 2016. <https://coe-sufs.org/wordpress/wp-content/uploads/2014/05/UCC-UK-webinar.pdf>

[59] Janjevic, Milena. Qalinca Labs. “Urban Freight Consolidation Centres- Trends, Challenges, Solutions.” Oct 2015. Web. Apr 2016. <http://eclfconference2015.bike/presentations/8.ECLF2015Day1%20Milena%20Janjevic.pdf>

[60] Browne, Professor Michael and Jose Holguin-Veras Rensselaer. VREF Center of Excellence for Sustainable Urban Freight Systems. “Urban Consolidation Centers: The UK Experience.” 6 May 2014. Page 49. Web. Apr 2016. <https://coe-sufs.org/wordpress/wp-content/uploads/2014/05/UCC-UK-webinar.pdf>

[61] Panero, Marta; Lopez, Daniel Polo, The NYU Rudin Center for Transportation Policy and Management. “Urban Distribution Centers a Means to Reducing Freight Vehicle Miles Traveled” April 2011. Pgs 27-29. <https://www.dot.ny.gov/divisions/engineering/technical-services/trans-r-and-d-repository/C-08-23_0.pdf>

[62] SMILE. “Valencia pilot on electric mobility and Urban consolidation centers description.” Web. Apr 2016. <http://smile-urbanlogistics.eu/projects/smile-pilots/valencia-pilot-electric-mobilty-and-urban-consolidation-centers-desciption>

[63] Verlinde, Sara, Cathy Macharis, Lauriane Milan, and Bram Kin. "Does a Mobile Depot Make Urban Deliveries Faster, More Sustainable and More Economically Viable: Results of a Pilot Test in Brussels." *Transportation Research Procedia* 4 (2014): 361-73. Web. Apr 2016. <http://www.sciencedirect.com/science/article/pii/S235214651400310X>

[64] Navarro, C., M. Roca-Riu, S. Furió, and M. Estrada. "Designing New Models for Energy Efficiency in Urban Freight Transport for Smart Cities and Its Application to the Spanish Case." *Transportation Research Procedia* 12 (2016): 314-24. Web. Apr 2016. <http://www.sciencedirect.com/science/article/pii/S2352146516000697>

[65] Colliers International. “From First Mile to Last Mile Global Logistics, Global Industrial & Logistics Trends.” Oct 2015. Web. Apr 2016. <http://www.colliers.com/-/media/files/marketresearch/global/global-logistics-2015.pdf?la=en-us>

[66] Verlinde, Sara, Cathy Macharis, Lauriane Milan, and Bram Kin. "Does a Mobile Depot Make Urban Deliveries Faster, More Sustainable and More Economically Viable: Results of a Pilot Test in Brussels." *Transportation Research Procedia* 4 (2014): 361-73. Web. Apr 2016. <http://www.sciencedirect.com/science/article/pii/S235214651400310X>

[67] Verlinde, Sara, Cathy Macharis, Lauriane Milan, and Bram Kin. "Does a Mobile Depot Make Urban Deliveries Faster, More Sustainable and More Economically Viable: Results of a Pilot Test in Brussels." *Transportation Research Procedia* 4 (2014): 361-73. Web. Apr 2016. <http://www.sciencedirect.com/science/article/pii/S235214651400310X>

[68] Navarro, C., M. Roca-Riu, S. Furió, and M. Estrada. "Designing New Models for Energy Efficiency in Urban Freight Transport for Smart Cities and Its Application to the Spanish Case." *Transportation Research Procedia* 12 (2016): 314-24. Web. Apr 2016. <http://www.sciencedirect.com/science/article/pii/S2352146516000697>

[69] Department of Roads and Mobility Management, Mairie de Paris, SUGAR, "City of Paris Freight Policy", September 22, 2011. Powerpoint. Web. April 2016. <www.sugarlogistics.eu/>

[70] Browne, Michael, Julian Allen, and Jacques Leonardi. "Evaluating the Use of an Urban Consolidation Centre and Electric Vehicles in Central London." *IATSS Research* 35, no. 1 (2011): 1-6. Web. Apr 2016. <http://www.sciencedirect.com/science/article/pii/S038611121100015X>

[71] SMILE. “Valencia pilot on electric mobility and Urban consolidation centers description.” Web. Apr 2016. <http://smile-urbanlogistics.eu/projects/smile-pilots/valencia-pilot-electric-mobilty-and-urban-consolidation-centers-desciption>

[72] Navarro, C., M. Roca-Riu, S. Furió, and M. Estrada. "Designing New Models for Energy Efficiency in Urban Freight Transport for Smart Cities and Its Application to the Spanish Case." *Transportation Research Procedia* 12 (2016): 314-24. Web. Apr 2016. <http://www.sciencedirect.com/science/article/pii/S2352146516000697>

[73] Verlinde, Sara, Cathy Macharis, Lauriane Milan, and Bram Kin. "Does a Mobile Depot Make Urban Deliveries Faster, More Sustainable and More Economically Viable: Results of a Pilot Test in Brussels." *Transportation Research Procedia* 4 (2014): 361-73. Web. Apr 2016. <http://www.sciencedirect.com/science/article/pii/S235214651400310X>

[74] Verlinde, Sara, Cathy Macharis, Lauriane Milan, and Bram Kin. "Does a Mobile Depot Make Urban Deliveries Faster, More Sustainable and More Economically Viable: Results of a Pilot Test in Brussels." *Transportation Research Procedia* 4 (2014): 361-73. Web. Apr 2016. <http://www.sciencedirect.com/science/article/pii/S235214651400310X>

[75] Ibid

[76] The City College of New York/CUNY. “Final Report: Freight Tricycle Operations in New York City.” Oct 2014. Page 25. Web. Apr 2016. <http://www.utrc2.org/sites/default/files/pubs/Final-Freight-Tricycles-NYC.pdf>

[77] Ibid

[78] Ibid, page 113.

[79] Verlinde, Sara, Cathy Macharis, Lauriane Milan, and Bram Kin. "Does a Mobile Depot Make Urban Deliveries Faster, More Sustainable and More Economically Viable: Results of a Pilot Test in Brussels." *Transportation Research Procedia* 4 (2014): 361-73. Web. Apr 2016. <http://www.sciencedirect.com/science/article/pii/S235214651400310X>

[80] Ibid

[81] Navarro, C., M. Roca-Riu, S. Furió, and M. Estrada. "Designing New Models for Energy Efficiency in Urban Freight Transport for Smart Cities and Its Application to the Spanish Case." *Transportation Research Procedia* 12 (2016): 314-24. Web. Apr 2016. <http://www.sciencedirect.com/science/article/pii/S2352146516000697>

[82] SMILE. “Valencia pilot on electric mobility and Urban consolidation centers description.” Web. Apr 2016. <http://smile-urbanlogistics.eu/projects/smile-pilots/valencia-pilot-electric-mobilty-and-urban-consolidation-centers-desciption>

[83] BESTFACT. “Best Practice Case Quick Info.” Web. Apr 2016. <http://www.bestfact.net/wp-content/uploads/2016/02/2-143_BESTFACT_CL2_QuickInfo_SMILE.pdf>

[84] Navarro, C., M. Roca-Riu, S. Furió, and M. Estrada. "Designing New Models for Energy Efficiency in Urban Freight Transport for Smart Cities and Its Application to the Spanish Case." *Transportation Research Procedia* 12 (2016): 314-24. Web. Apr 2016. <http://www.sciencedirect.com/science/article/pii/S2352146516000697>

[85] Dablanc, Dr. Laetitia. IFSTTAR. “Challenges to a seamless urban freight transport policy.” 2 May 2012. Pages 5-7. Web. Apr 2016.
<http://2012.internationaltransportforum.org/sites/itforum2012/files/documents/en/WCTR_UrbanFreight_Dablanc.pdf>

[86] Panero, Marta; Lopez, Daniel Polo, The NYU Rudin Center for Transportation Policy and Management. “Urban Distribution Centers a Means to Reducing Freight Vehicle Miles Traveled” April 2011. Pages 27-29. Web. Apr 2016. <https://www.dot.ny.gov/divisions/engineering/technical-services/trans-r-and-d-repository/C-08-23_0.pdf>

[87] Metro Freight: Volvo Center of Excellence. “Paris Urban Laboratory for Urban Logistics.” Feb 2015. Web. Apr 2016. <https://www.metrans.org/sites/default/files/MF%2015-2%201c_Paris%20Urban%20Laboratory%20Final%20Report_12232015.pdf>

[88] Navarro, C., M. Roca-Riu, S. Furió, and M. Estrada. "Designing New Models for Energy Efficiency in Urban Freight Transport for Smart Cities and Its Application to the Spanish Case." *Transportation Research Procedia* 12 (2016): 314-24. Web. Apr 2016. <http://www.sciencedirect.com/science/article/pii/S2352146516000697>

[89] Verlinde, Sara, Cathy Macharis, Lauriane Milan, and Bram Kin. "Does a Mobile Depot Make Urban Deliveries Faster, More Sustainable and More Economically Viable: Results of a Pilot Test in Brussels." *Transportation Research Procedia* 4 (2014): 361-73. Web. Apr 2016. <http://www.sciencedirect.com/science/article/pii/S235214651400310X>

[90] Navarro, C., M. Roca-Riu, S. Furió, and M. Estrada. "Designing New Models for Energy Efficiency in Urban Freight Transport for Smart Cities and Its Application to the Spanish Case." *Transportation Research Procedia* 12 (2016): 314-24. Web. Apr 2016. <http://www.sciencedirect.com/science/article/pii/S2352146516000697>

[91] Ibid

[92] Ibid

[93] Ibid

[94] Department of Roads and Mobility Management, Mairie de Paris, SUGAR, "City of Paris Freight Policy", September 22, 2011. Powerpoint. Web. April 2016. <www.sugarlogistics.eu/>

[95] Department of Roads and Mobility Management, Mairie de Paris, SUGAR, "City of Paris Freight Policy", September 22, 2011. Powerpoint. Web. April 2016. <www.sugarlogistics.eu/>

[96] The City College of New York/CUNY. “Final Report: Freight Tricycle Operations in New York City.” Oct 2014. Page 113. Web. Apr 2016. <http://www.utrc2.org/sites/default/files/pubs/Final-Freight-Tricycles-NYC.pdf>

[97] Navarro, C., M. Roca-Riu, S. Furió, and M. Estrada. "Designing New Models for Energy Efficiency in Urban Freight Transport for Smart Cities and Its Application to the Spanish Case." *Transportation Research Procedia* 12 (2016): 314-24. Web. Apr 2016. <http://www.sciencedirect.com/science/article/pii/S2352146516000697>

[98] Ibid

[99] Ibid

[100] SMILE. “The SMILE Project.” Web. Apr 2016. <http://smile-urbanlogistics.eu/>

[101] CIVITAS. “CIVITAS Activity Fund.” 2013. Web. Apr 2016. <http://www.civitas.eu/content/activity-fund>

[102] LAMILO. “Funding the Project.” 2014. Web. Apr 2016. <http://www.lamiloproject.eu/funding_the_project/>

[103] STRAIGHTSOL. “STRAIGHTSOL: Strategies and measures for smarter urban freight solutions.” 18 Jan 2015. Web. Apr 2016. <http://www.straightsol.eu/index.htm>

[104] Navarro, C., M. Roca-Riu, S. Furió, and M. Estrada. "Designing New Models for Energy Efficiency in Urban Freight Transport for Smart Cities and Its Application to the Spanish Case." *Transportation Research Procedia* 12 (2016): 314-24. Web. Apr 2016. <http://www.sciencedirect.com/science/article/pii/S2352146516000697>

[105] Ibid

[106] Ibid

[107] Verlinde, Sara, Cathy Macharis, Lauriane Milan, and Bram Kin. "Does a Mobile Depot Make Urban Deliveries Faster, More Sustainable and More Economically Viable: Results of a Pilot Test in Brussels." *Transportation Research Procedia* 4 (2014): 361-73. Web. Apr 2016. <http://www.sciencedirect.com/science/article/pii/S235214651400310X>

[108] Panero, Marta; Lopez, Daniel Polo, The NYU Rudin Center for Transportation Policy and Management. “Urban Distribution Centers a Means to Reducing Freight Vehicle Miles Traveled” April 2011. Pgs 27-29. <https://www.dot.ny.gov/divisions/engineering/technical-services/trans-r-and-d-repository/C-08-23_0.pdf>

[109] Allen J. Thorne; Browne, M. BESTUFS, "Good Practice Guide on Urban Freight Transport" Date not included. Web April 2016. <http://www.bestufs.net/download/BESTUFS_II/good_practice/English_BESTUFS_Guide.pdf>

[110] Navarro, C., M. Roca-Riu, S. Furió, and M. Estrada. "Designing New Models for Energy Efficiency in Urban Freight Transport for Smart Cities and Its Application to the Spanish Case." *Transportation Research Procedia* 12 (2016): 314-24. Web. Apr 2016. <http://www.sciencedirect.com/science/article/pii/S2352146516000697>

[111] Verlinde, Sara, Cathy Macharis, Lauriane Milan, and Bram Kin. "Does a Mobile Depot Make Urban Deliveries Faster, More Sustainable and More Economically Viable: Results of a Pilot Test in Brussels." *Transportation Research Procedia* 4 (2014): 361-73. Web. Apr 2016. <http://www.sciencedirect.com/science/article/pii/S235214651400310X>

[112] Ibid

[113] Ibid

[114] Ibid

[115] Panero, Marta; Lopez, Daniel Polo, The NYU Rudin Center for Transportation Policy and Management. “Urban Distribution Centers a Means to Reducing Freight Vehicle Miles Traveled” April 2011. Pgs 27-29. <https://www.dot.ny.gov/divisions/engineering/technical-services/trans-r-and-d-repository/C-08-23_0.pdf>

[116] Verlinde, Sara, Cathy Macharis, Lauriane Milan, and Bram Kin. "Does a Mobile Depot Make Urban Deliveries Faster, More Sustainable and More Economically Viable: Results of a Pilot Test in Brussels." *Transportation Research Procedia* 4 (2014): 361-73. Web. Apr 2016. <http://www.sciencedirect.com/science/article/pii/S235214651400310X>

[117] Ibid

[118] Ibid

[119] Ibid

[120] BESTFACT. "Best Practice Case Quick Info." Web. Apr 2016. < http://www.bestfact.net/wp-content/uploads/2016/02/2-143_BESTFACT_CL2_QuickInfo_SMILE.pdf>

[121] Verlinde, Sara; Cathy Macharis, Lauriane Milan, and Bram Kin. TUM. "Does a Mobile Depot make urban deliveries faster, more sustainable and more economically viable: results of a pilot test in Brussels."2014. Web. Apr 2016. <http://www.mobil-tum.vt.bgu.tum.de/fileadmin/w00bqi/www/Session_Poster/Verlinde_et_al.pdf>

[122] STRAIGHTSOL. "Project Demonstrations TNT Express in Brussels - City Logistics Mobile Depot." 28 Feb 2012. Web. Apr 2016. <http://www.straightsol.eu/demonstration_B.htm>

[123] Mette Kok. STRAIGHTSOL. "Mobile Depot TNT Express: STRAIGHTSOL Workshop 2." 2 Jul 2013. Page 7. Web. Apr 2016. <https://docs.google.com/file/d/0B7oEyNF3009ld2FoS2xfUjdaeEk/edit>

[124] Navarro, C., M. Roca-Riu, S. Furió, and M. Estrada. "Designing New Models for Energy Efficiency in Urban Freight Transport for Smart Cities and Its Application to the Spanish Case." *Transportation Research Procedia* 12 (2016): 314-24. Web. Apr 2016. <http://www.sciencedirect.com/science/article/pii/S2352146516000697>

[125] Fundacian Valenciaport. "Tricycles used by courier services will reduce traffic congestion and contamination in the historical centre." 18 Dec 2014. Web. May 2016. <http://www.fundacion.valenciaport.com/Schedule-news/News/Triciclos-para-mensajeria-disminuiran-la-congestio.aspx?lang=en-US>

[126] International Post Corporation. "Secure Electronic Parcel Lockers: Postal Industry Review." Nov 2010. Page 3. Web. Apr 2016. <https://www.ipc.be/~/media/documents/public/markets/e-lockers.ashx>

[127] Ibid

[128] Fleming, Sean. "Analysis: locker networks and parcel shops- the European landscape." 18 Aug 2015. Web. May 2016. < http://edelivery.net/2015/08/locker-networks-and-parcel-shops-the-european-landscape-pt-2/>

[129] InPost. "Any questions?" Web. Mar 2016. <http://inpost.my/en/faq#faq_business>

[130] Office of Inspector General United States Postal Service. "U.S. Postal Service Parcel Delivery Lockers: Management Advisory." 6 May 2013. Web. Mar 2016. <https://www.uspsoig.gov/sites/default/files/document-library-files/2015/dr-ma-13-002.pdf>

[131] Ibid

[132] Amazon. "About Amazon Locker." 2016. Web. Apr 2016. <http://www.amazon.com/gp/help/customer/display.html?nodeId=201530900>

[133] DHL. "DHL recipient service- Packstation." 2016. Web. Apr 2016. <https://www.dhl.de/en/paket/pakete-empfangen/packstation.html>

[134] Amazon. "About Amazon Locker." 2016. Web. Apr 2016. <http://www.amazon.com/gp/help/customer/display.html?nodeId=201530900>

[135] Office of Inspector General United States Postal Service. "U.S. Postal Service Parcel Delivery Lockers: Management Advisory." 6 May 2013. Web. Mar 2016. <https://www.uspsoig.gov/sites/default/files/document-library-files/2015/dr-ma-13-002.pdf>

[136] International Post Corporation. "Secure Electronic Parcel Lockers: Postal Industry Review." Nov 2010. Page 4. Web. Apr 2016. <https://www.ipc.be/~/media/documents/public/markets/e-lockers.ashx>

[137] InPost. "Parcel machines- green solutions for green cities." Web. Apr 2016. <http://conference.grassproject.eu/wp-content/uploads/2014/05/2-J_Bilik-InPost-presentation_Grass-Szczecin-19.05.2014.pdf>

[138] InPost. "How it works for a sitehost?" 2016. Web. Apr 2016. <https://inpost24.com/en/host-an-inpost-locker/how-it-works-for-a-sitehost>

[139] InPost. "InPost installs first parcel locker at a London Underground tube station." 30 May 2014. Web. Mar 2016. <http://inpost.my/en/inpost/news/inpost-installs-first-parcel-locker-at-buckhurst-hill-underground-station>

[140] "Australia Post's Parcel Locker system in operation." matthewmcdonald.com Web. March 28, 2012 <http://www.matthewmcdonald.com/>

[141] Chao, Loretta. The Wall Street Journal. "7-Eleven Expands Locker Space, hoping to Cash In on the E-Commerce Wave." 12 Nov 2015. Web. Mar 2016. <http://www.wsj.com/articles/7-eleven-expands-locker-space-hoping-to-cash-in-on-e-commerce-wave-1447326538>

[142] InPost. "Any questions?" 2016. Web. Apr 2016. <https://inpost.co.uk/en/faq#faq_site-hosts>

[143] Ibid

[144] Ibid

[145] City of Portland Bureau of Transit. "City of Portland Central City Sustainable Freight Strategy: Report and Recommendations." Oct 2012. Web. Mar 2016. <https://www.portlandoregon.gov/transportation/article/406590>

[146] InPost. "InPost Portfolio." 8 Jul 2013. Web. Apr 2016. <https://inpost24.com/pliki/Portfolio_InPost_1200.pdf>

[147] Ibid

[148] InPost. "Any questions?" 2016. Web. Apr 2016. <https://inpost.co.uk/en/faq#faq_site-hosts>

[149] Interview with Russell Dougherty, Business Development Officer, Amazon Lockers, 12 Apr 2016.

[150] Ibid

[151] InPost. "Any questions?" 2016. Web. Apr 2016. <https://inpost.co.uk/en/faq#faq_site-hosts>

[152] Post & Parcel. "DHL Parcel pilots parcel lockers for apartment buildings in Germany." 2 Apr 2015. Web. Apr 2016. <http://postandparcel.info/64360/news/innovation/dhl-parcel-pilots-parcel-lockers-for-apartment-buildings-in-germany/>

[153] Officer of Inspector General United States Postal Service. "U.S. Postal Service Parcel Delivery Lockers: Management Advisory." 6 May 2013. Web. Mar 2016. <https://www.uspsoig.gov/sites/default/files/document-library-files/2015/dr-ma-13-002.pdf>

[154] DHL. "First wave of DHL parcel lockers in operation in Finland." 18 Dec 2015. Web. Apr 2016. <http://www.dhl.fi/en/press/releases/releases_2015/local/first_wave_of_dhl_parcel_lockers_in_operation_in_finland.html>

[155] Interview with Russell Dougherty, Business Development Officer, Amazon Lockers, 12 Apr 2016.

[156] Ibid

[157] Ibid

[158] Ibid

[159] Ibid

[160] Ibid

[161] Ibid

[162] TeleType Co., Inc. "Instant Truck Routes." Web. Apr 2016. <http://www.smarttruckroute.com/>

[163] Chui, Michael, Diana Farrell, and Kate Jackson. McKinsey & Company. "How Government can promote open date." Apr 2014. Web. Apr 2016. <http://www.mckinsey.com/industries/public-sector/our-insights/how-government-can-promote-open-data>

[164] Merriam-Webster's Dictionary. "E-Commerce." Web. Apr 2016. < http://www.merriam-webster.com/dictionary/e–commerce>

[165] BESTUFS. "Good Practice Guide on Urban Freight Transport." 2007. Web. Apr 2016. <http://www.bestufs.net/download/BESTUFS_II/good_practice/English_BESTUFS_Guide.pdf>

[166] Ibid

[167] Fahimnia, Behnam, Michael G. H. Bell, David A. Hensher, and Joseph Sarkis. *Green Logistics and Transportation: A Sustainable Supply Chain Perspective*. Web. Apr 2016. <http://library.wur.nl/WebQuery/clc/2092143>

[168] BESTUFS. "Good Practice Guide on Urban Freight Transport." 2007. Page 21. Web. Apr 2016. <http://www.bestufs.net/download/BESTUFS_II/good_practice/English_BESTUFS_Guide.pdf>

[169] Ibid

[170] Colliers International. "From First Mile to Last Mile Global Logistics, Global Industrial & Logistics Trends." Oct 2015. Web. Apr 2016. <http://www.colliers.com/-/media/files/marketresearch/global/global-logistics-2015.pdf?la=en-us>

[171] Fahimnia, Behnam, Michael G. H. Bell, David A. Hensher, and Joseph Sarkis. *Green Logistics and Transportation: A Sustainable Supply Chain Perspective.* Web. Apr 2016. <http://library.wur.nl/WebQuery/clc/2092143>

[172] BESTUFS. "Good Practice Guide on Urban Freight Transport." 2007. Web. Apr 2016. <http://www.bestufs.net/download/BESTUFS_II/good_practice/English_BESTUFS_Guide.pdf>

[173] European Commission. "Commission Staff Working Document: A call to action on urban logistics." 17 Dec 2013. Page 2. Web. Apr 2016. <http://ec.europa.eu/transport/themes/urban/doc/ump/swd(2013)524-communication.pdf>

[174] ecomii. "Vehicle Miles Travelled (VMT)." Web. Apr 2016. <http://www.ecomii.com/dictionary/vehicle-miles-travelled-vmt>

[175]Alain Bonnafous, Jesus Gonzalez-Feliu, Jean-Louis Routhier. An alternative UGM Paradigm to O-D matrices: the FRETURB model." 2013. Web. Apr 2016. <https://halshs.archives-ouvertes.fr/halshs-00844652v1>

[176] Tritel and Parnter Transport Consultants, Tritel Transport Infrastructure & Telematics for Ministries van de Vlaamse Gemeenschap. "Elaboration of a Freight Model in Flanders." Oct 2005.Web. Apr 2016. <http://www2.vlaanderen.be/pps/documenten/dam/vrachtmodel%20fase%201_okt2005.pdf>

[177] MDS Transmodal Limited and Centro di Ricerca per il Trasperto e la Logistica (CTL). "DG Move European Commission: Study on Urban Freight Transport." Apr 2012. Page 126. Print. Apr 2016. <http://ec.europa.eu/transport/themes/urban/studies/doc/2012-04-urban-freight-transport.pdf>

[178]Debauche, Wanda. Decock, Davy. BESTUFS. "Urban freight data collection in Belgium." Aug 2006. Pages 12-14. Print.

[179] Straightsol. "Strategies and measures for smarter urban freight solutions." Sep 2011. Web. Apr 2016. <https://drive.google.com/file/d/0ByCtQR4ylfYDeGU5TnV3Yk9YRFU/edit>

[180] CIVITAS. "Smart choices for cities making urban freight logistics more sustainable." Pag 21. Web. Apr 2016.<http://www.eltis.org/sites/eltis/files/trainingmaterials/civ_pol-an5_urban_web-1.pdf>

[181] MDS Transmodal Limited and Centro di Ricerca per il Trasperto e la Logistica (CTL). "DG Move European Commission: Study on Urban Freight Transport." Apr 2012. Page 126. Print. Apr 2016. <http://ec.europa.eu/transport/themes/urban/studies/doc/2012-04-urban-freight-transport.pdf>

[182] Ibid