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Measures for green and efficient urban distribution

Stakeholder evaluations of mobile depots, night and evening deliveries

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Project memo

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ABSTRACT

Urban distribution is characterized by challenges related to lack of coordination between actors in the logistics chain, inaccessible and unavailable loading zones, ineffective stock receipts and ad-hoc events requiring improvised solutions. The project *Green Urban Distribution* aims at identifying and demonstrating green and efficient solutions for urban goods distribution through improved organization, service innovation and the application of technology. The purpose of this study has been to collect inputs from relevant stakeholders, and provide an overview over their prerequisites and needs related to the introduction of measures aimed at improved utilization of street areas and increased 24/7 utilization. As an example of such measures, this study investigates stakeholders' responses to the introduction of mobile depots, night and evening deliveries. Through literature review, pilot interviews and SWOT analysis, this study finds that stakeholders are generally sceptical to the introduction of mobile depots, but consider night and evening deliveries a significant contribution to the efficiency of urban distribution activities.

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1 Introduction

The distribution of goods is an important prerequisite for living cities with a concentrated population and a competitive business sector. Goods distribution is crucial for the economic system in distributing goods to retail, commercial establishments, offices and homes. However, urban distribution is characterized by challenges related to lack of coordination between actors in the logistics chain, inaccessible and unavailable loading zones, ineffective stock receipts and ad-hoc events requiring improvised solutions. The development of efficient and environmentally friendly urban goods distribution depends on increased knowledge and cooperation between business and authorities.

The project *Green Urban Distribution* aims at identifying and demonstrating green and efficient solutions for urban goods distribution through improved organization, service innovation and the application of technology. The main purpose of the project is to develop green and effective distribution solutions in the city center of Oslo, aiming at i) improved utilization of street areas, ii) improved 24/7 utilization, iii) utilization of technology such energy efficient vehicles and unmanned stock receipts.

The *Green Urban Distribution* project explores prerequisites for the introduction of measures expected to contribute to more efficient and environmentally friendly urban distribution. Such prerequisites are largely related to stakeholders in the distribution chain, whose opportunities and limitations will ultimately influence both the design of measures and the probability of measures being implemented.. Increased knowledge about stakeholders is thus vital in assessing the feasibility of measures aimed at improved utilization of street areas and improved 24/7 utilization.

This memo presents stakeholders' responses to one measure aimed at improving utilization of street areas and one measure aimed at improving 24/7 utilization: i) mobile depots, and ii) night and evening deliveries. Mobile depots are intended to improve the utilization of streets in urban areas through enabling reallocation of land, whereas night and evening deliveries are expected to promote urban goods distribution in periods with low traffic and spread distribution activities across 24 hours. The purpose of this study has been to collect inputs from relevant stakeholders, and provide an overview over their prerequisites and needs related to each measure. The overarching research question has been *how do relevant stakeholders evaluate potential measures for facilitating green and efficient urban distribution?* Findings are also submitted and to be presented as a paper on the World Congress of Transport Research 2013.

2 Stakeholders in urban distribution

Stakeholder perspectives are rarely emphasized in studies on urban distribution measures. Preliminary results from on-going projects are to a little degree reported, and the majority of projects are concerned with demonstrating solutions for improved urban distribution rather than documenting stakeholder evaluations. Consequently, existing knowledge on stakeholder perspectives is limited. A stakeholder is an actor or group of actors which affects or are affected by the phenomenon under study (see also Freeman 1984). Among stakeholders traditionally identified in logistics are receivers, carriers and forwarders (Ogden 1992), but recent research also emphasizes the involvement of policy makers, decision makers and local authorities (Lindholm 2012, Russo and Comi 2010, Stathopoulos et al. 2011).

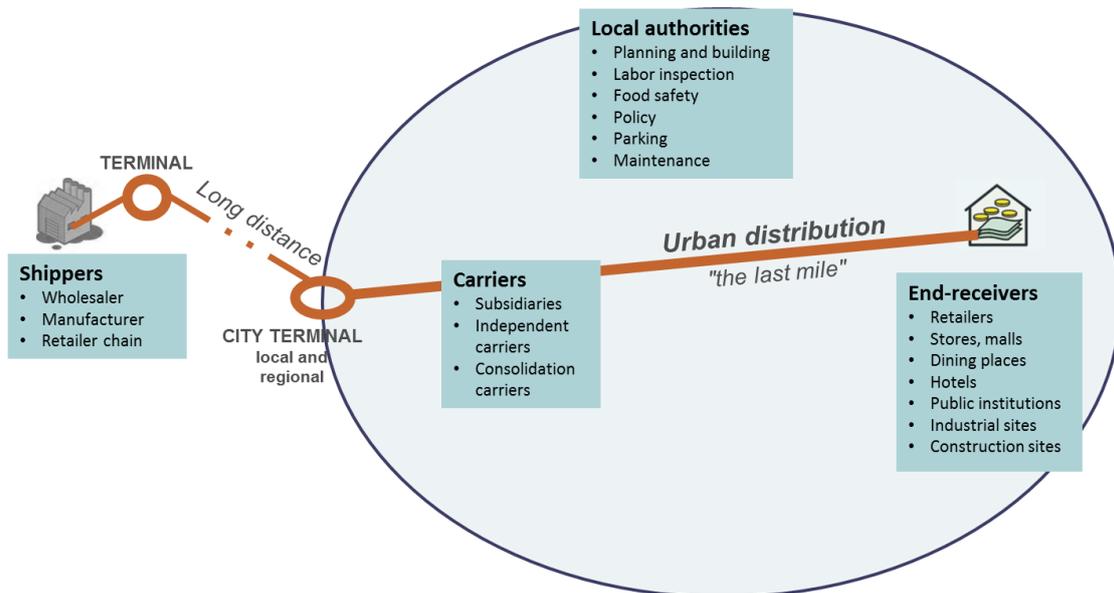


Figure 1. Stakeholders in the urban distribution chain

Research has identified carriers, end-receivers and local authorities as the most relevant stakeholders in the *urban* distribution chain (Lindholm 2012, Russo and Comi 2010, Stathopoulos et al. 2011). These are also considered vital for the introduction of measures in the city of Oslo, and are the main focus of this study. Figure 1 shows stakeholders and their interrelations in the urban distribution chain, whereof three are explicitly included in this study. As most measures for achieving green and efficient urban distribution are directed at carriers, the majority of research involving stakeholders focuses on carriers. Hence, there is more available knowledge regarding carrier responses to potential measures, and their needs and prerequisites related to urban distribution policies. Although acknowledged as important stakeholders, end-receivers and local authorities have received less attention.

2.1 Carriers

Freight carriers are heterogeneous and not easily defined. Whereas some carriers are subsidiaries of wholesaler companies distributing own products to retailers, others are independent carriers providing third-party logistics. Yet others are consolidation carriers facilitating transport services between customers (transport users) and smaller transport providers. Consequently, size, economy and influence vary significantly between carriers, but their general purpose is to collect, transport and deliver goods

commissioned by manufacturers, wholesalers and receivers. The objective of freight carriers is profit growth, which they seek to achieve by minimizing transportation costs and maximizing sales (Taniguchi and Tamagawa 2005). Consequently, carriers seek to collect and deliver goods as efficiently as possible by optimizing load capacity, co-loading and delivery routes. This is also reflected in the literature, which primarily relates carrier challenges to the planning of pick-up and delivery, vehicle routing and operational costs (Stathopoulos et al. 2011).

2.2 End-receivers

End-receivers are a complex group, but in general receivers of goods respond to the demands of the final consumers (Stathopoulos et al. 2011). Some end-receivers are retailers or companies operating stores and dining places, but they also include hotels, public institutions and other business requiring regular deliveries. End-receivers could further be industrial- or construction sites depending on the delivery of goods and materials to maintain production. End-receivers vary both in turnover and number of employees, whether they are part of a larger retailer chain or operate independently. Some are located in streets, others at shopping malls. These variations suggest that different end-receivers can influence and be influenced differently by measures directed at urban distribution.

End-receivers are the final link in the logistics chain, and their main tasks are related to commissioning and receiving deliveries. Commissions can be made to wholesalers, manufacturers or departments within own organization, but end-receivers are in most cases responsible for being present and receiving deliveries themselves. The primary concern of end-receivers in urban distribution is keeping personnel expenses low and securing staff appropriate to handle designated tasks, e.g. receiving goods.

2.3 Local authorities

Although they to a varying degree are aware of their potential influence (Lindholm 2012), local authorities can influence both when and how urban distribution is performed. However, local authorities consist of a range of departments with different and potentially conflicting goals, rationalities and motivations. Local authorities can among others include labor inspection agencies, food safety authorities, agencies for planning and building services, police and parking agencies as well as local, regional and national maintenance departments. Combined, these actors represent a multifaceted influence.

The heterogeneity of local authorities suggests great variations in terms of tasks and responsibilities, but one of the responsibilities of local authorities is to facilitate green and efficient urban freight transport. Their role is to define the policy scenario within which private stakeholders operate (Stathopoulos et al. 2012:36) and to revitalize the city both economically and environmentally (Taniguchi and Tamagawa 2005:3064). Research shows, however, great variation in the degree to which local authorities consider urban distribution a public responsibility. A study among 94 Swedish municipalities found that local authorities commonly consider urban distribution a non-public issue and that the transport industry itself is responsible for optimizing urban distribution (Lindholm 2012:142). Dablanc (2007) argues that local authorities are aware that they should control goods transport activities because of their impact on the urban environment, but that most authorities do not know how.

As the degree to which local authorities consider urban distribution a public matter varies, so do their perceptions of problems and goals related to green and efficient urban distribution. According to Russo and Comi (2010) the main objective of local authorities is to make cities attractive to visitors and residents, while minimizing negative effects of transport. Hence, local authorities can introduce measures aimed at urban distribution which can facilitate private and public involvement alike, stimulate interest and commitment to industrialist measures and provide financial and legal counseling (Browne et al. 2012).

Although measures developed and introduced by local authorities are included in studies of urban distribution, studies do to little degree investigate the reasoning, reflection and handling of these measures by local authorities. Further, research is little devoted to investigating the local authorities' interaction with other stakeholders in the design of such measures. Stathopoulos et al. (2012:36) stress that local authorities tend to ignore the nature of logistics in the design of measures and treat other stakeholders as opponents rather than partners. This is presumably related to cultures and traditions within public agencies which influence what problems to prioritize and what solutions to choose, and which consequently can represent significant barriers for succeeding with measures directed towards urban distribution (Lindholm 2012).

3 Selected measures in urban distribution

There is a growing concern with environmental effects of urban distribution, and the European Commission's *Roadmap to a Single European Transport Area – Towards a Competitive and Resource Efficient Transport System* stresses the need for prioritizing last mile transport in achieving CO₂ free city logistics in major urban centers by 2030. Thus, there is a significant amount of research on urban freight distribution and a number of past and on-going projects investigating city practices and city initiatives in urban freight distribution. The following section presents previous and on-going research on the urban distribution measures included in this study and their influence on stakeholders.

3.1 Mobile depots

Several projects aim at improving the *utilization of street areas*, and propose alternative delivery systems. For instance, the purpose of the CITYLOG¹ project is to reduce unsuccessful deliveries when end-receiver is not present by decoupling parcel delivery by carriers and end-receivers picking up their goods. As part of this project, a solution called BentoBox (a mobile "pack-station" with removable trolleys) has been demonstrated in several European cities and found technically and operationally feasible (Quak et al. 2012). A similar practice is facilitated by DHL and other European postal services. The objective is to eliminate the need for end-of-chain delivery by motorized vehicles by use of pack-stations where end-receivers can pick up, frank and send parcels 24 hours a day. Further, the STRAIGHTSOL² project aims to increase efficiency of deliveries in city centers by use of mobile depots placed on central locations in the inner city, where last mile deliveries are made by electric tricycles.

Other practices for improved utilization of street areas are based on multiple use lanes (CIVITAS³ SMILE), route optimization (CIVITAS MIMOSA), environmentally friendly vehicles (FIDEUS⁴, Cargohopper,

¹ CITYLOG: Sustainability and efficiency of City Logistics, www.city-log.eu/

² STRAIGHTSOL: Strategies and measures for smarter urban freight solutions, www.straightsol.eu/

³ CIVITAS: Cleaner and Better Transport in Cities, www.civitas-initiatives.org

⁴ FIDEUS: Freight intelligent Delivery of Goods in European Urban Spaces, www.fleetranner.net/FRCCommon_fideus_overview.htm

ECOLOGISTICS⁵), and intelligent traffic management (CIVITAS RENAISSANCE). Further, consolidation represents an important aspect of mobile depots in this study. Several projects have demonstrated use of consolidation centers (CIVITAS VIVALDI, CIVITAS SMILE, TRAILBLAZER⁶, ELCIDIS⁷). The general purpose of these projects is to reduce the presence of freight vehicles in city areas through consolidation, alternatively supplemented with electric vehicles on last mile transport.

Mobile depots are one of several possible solutions for improving land use and providing a more optimal *utilization of city streets*. This lies primarily in opportunities for reallocating land. There is limited research on stakeholder perceptions of mobile depots, but certain studies investigate stakeholder assessments of other measures with similar objectives. For instance, distribution or consolidation centers are an essential part of solutions for mobile depots. Urban distribution centers can represent an arena for consolidation of deliveries transported to inner mobile depots in cities outside peak hours (see for instance Regan and Golob 2005). The ELCIDIS project showed that consolidation in so-called distribution platforms was associated with a three-hour reduction in the time carriers spent making deliveries. Additionally, eliminating stress from inner city deliveries improved working conditions for drivers. However, in a study among logistics stakeholders Stathopoulos et al. (2012) found that carriers are more negative to urban distribution centers than other stakeholders. The successful introduction of distribution centers depends on the commitments of all involved stakeholders, and the involvement of these in early stages of the decision process (van Duin et al. 2010). For instance, the SUGAR⁸ project shows that successful implementation depends on the high participation of retailers and suppliers alike.

There is limited research on end-receiver evaluations of mobile depots or other measures for improved utilization of street areas. A recent study, however, surveyed end-receivers' support of twelve different policy measures (Stathopoulos et al. 2012). It finds that end-receivers worry about illegal parking in loading zones, and that increasing the number of loading zones as well as introducing systems for electronic booking of loading zones are among measures most supported by end-receivers. End-receivers are further fairly positive towards urban distribution centers and so-called pick-up points for last mile transport, which resemble mobile depots. Another study examined the effects of an urban consolidation center more directed against retailers (van Rooijen and Quak 2010), but has yet to report explicit stakeholder evaluations.

3.2 Night and evening deliveries

Several projects also aim at reducing the impact of freight transport by use of *delivery time windows*. In the city of Paris trucks are banned during day-time, and since 2007 afternoon deliveries are only allowed by vehicles which are electric, gas or follow increasingly stringent euro standard requirements. As seen below, the C-LIEGE⁹ project has pointed to several benefits and disadvantages resulting from such practice. Additionally, the CIVITAS MIRACLES project demonstrated night deliveries with adapted trucks to reduce pollution and avoid blockages on narrow streets. Results show significant reductions in fuel consumption and emission levels, and that journey times were reduced by 50 %. In a Swedish study, stakeholder

⁵ ECOLOGISTICS: www.calparma.eu/ecocity

⁶ TRAILBLAZER: Transport and innovation logistics by local authorities with a zest for efficiency and realization, www.trailblazer.eu/content.php

⁷ ELCIDIS: Electric Vehicle Distribution Systems, www.elcidis.org

⁸ SUGAR: Sustainable Urban Goods Logistics Achieved by Regional and Local Policies, www.sugarlogistics.eu

⁹ C-LIEGE: Clean last mile transport and logistics management, www.c-liege.eu

representatives gave their evaluations of a night delivery trial in the city of Stockholm (Franzén and Blinge 2007) and identified a range of positive and negative aspects. The study found the primary resistance towards night deliveries to exist among end-receivers, who preferred day-time deliveries as they involve lower wage expenses and lower risks of robbery. An off-hour delivery trial recently conducted in New York showed that the switch to night deliveries brought about significant economic benefits, travel speeds were significantly increased, and service times were reduced (Holguin-Veras et al. 2012). The trial further showed that the receivers are the key decision makers, and that the ability of carriers to unilaterally change their delivery times is very limited.

A small number of studies investigate the carrier responses to night and evening deliveries. These typically revolve around time-based access restriction and time-windows introduced to promote deliveries outside peak traffic. Research shows that carriers already try to avoid peak hour deliveries because they are considered inefficient, unpredictable and involving greater fuel consumption (Vilain and Wolfrom 2001). Night deliveries involve shorter and more reliable travelling time and do not require vehicle alterations (Allen et al. 2003). Yet, they are associated with increased personnel costs, and noise regulations have proved challenging to carriers in several European cities (Quak and Koster 2006). Among other things, the C-LIEGE project found that night deliveries in the city of Paris inflicted higher costs for silent vehicles and loading equipment upon carriers. Still, carriers also experienced increased efficiency and less delay. Similar findings are reported in the CIVITAS MIRACLE project demonstrating night deliveries in Barcelona: although carriers had to invest in silent vehicles and equipment, loading capacity increased and delivery times were reduced by one third compared to day-time deliveries.

Research on time-windows places greater emphasis on end-receivers. End-receivers are primarily concerned with deliveries being made during opening hours (Russo and Comi 2010), which to a certain degree would conflict with night and evening deliveries. The CIVITAS VIVALDI project showed that end-receivers often demand particular delivery times. Yet, end-receivers involved in the ELCIDIS project claimed night-deliveries improved the environment surrounding their business as traffic and congestion was reduced. Studies show that end-receivers are less positive towards measures which require behavioral change and alternations in their business operation (Stathopoulos et al. 2012). In a Dutch study, end-receivers claimed they would continue regular deliveries despite time-window restriction in order to reveal whether restriction are in fact monitored (Quak and de Koster 2007). The main reason for their resistance towards night deliveries lies in perceived increased risks and exposure to crime for both personnel and goods. Additionally, night deliveries are expected to involve wage increases as someone will have to be present to receive and validate deliveries. The C-LIEGE project found that night deliveries in the city of Paris were accompanied by personnel costs, which would burden small business in particular. Similar results were reported from Barcelona in the CIVITAS MIRACLE project. End-receivers expect increases in operating costs, equipment and wage increases from night and evening deliveries to exceed potential fees from making deliveries outside designated time-windows (Holguín-Veras 2008).

Few studies of urban distribution include local authorities. Several projects on urban distribution refer to aspects of measures which are typically relevant to local authorities, but without making an explicit connection. For instance, end-receivers involved in the ELCIDIS project stated that the introduction of night deliveries did not result in increased noise levels compared to day-time traffic. Noise could in part be

expected to concern local authorities responsible for the welfare of inner city residents. Similar findings were reported by the CIVITAS MIRACLE project. Additionally, the C-LIEGE project found that night deliveries involve a more optimal use of public space, which is particularly important as there exists little available urban land for logistics activities (Dablanc 2007:281).

4 Methods

The purpose of this study has been to chart relevant stakeholders' perceptions and assessments of mobile depots and night deliveries. The majority of research in the field of urban distribution focuses on carriers, as they are targeted in most urban distribution measures. However, the successful implementation of measures depends on the cooperation and interaction also with other stakeholders. In addition to carriers, end-receivers and local authorities are considered essential in developing solutions promoting green and efficient urban distribution, and this study revolves around these three actors' inputs, prerequisites and needs related to the mentioned measures.

4.1 Literature review

The purpose of this paper is to present stakeholder perceptions and assessments of mobile depots, and night and evening deliveries. In order to develop an appropriate theoretical and methodological framework, a limited review of existing research on stakeholders in urban distribution was performed before the stakeholder interviews took place. The review included 30 publications published in the period between 2000 and 2012, which aimed fully or partially at understanding the role of stakeholders in urban distribution. Based on the literature review carriers, end-receivers and local authorities were identified as the most relevant stakeholders for implementing measures for more green and efficient urban distribution in Oslo.

The selection of included measures was based on the literature review of stakeholders, as well as a review of previous and ongoing projects where solutions for more efficient and environmentally friendly urban distribution have been implemented (Roche-Cerasi 2012). Measures were selected to represent problem descriptions related to both the improved utilization of street areas as well as improved 24/7 utilization. Additionally, measures were selected based on previous and current demonstrations in European cities. By reference to urban logistics practices across Europe (see Roche-Cerasi 2012), mobile depots and night deliveries were identified as two potentially effective measures suited for introduction in Oslo. They were further considered appropriate proxies for stakeholder evaluations of measures aimed at improved utilization of street area and improved 24/7 utilization in general.

4.2 Pilot interviews

After identifying the most relevant stakeholders, pilot interviews were performed with representatives from all groups. The purpose of the pilot interviews was to establish a basic understanding of the stakeholders' operations, challenges and problem areas regarding urban distribution in Oslo, and to establish mutual trust and confidence. The interviews further illustrated the individual stakeholder groups' level of freedom of action, competence, and action plans not taking other stakeholders into consideration. The interviews confirmed that stakeholder groups identified in existing research also were relevant to the case of Oslo.

4.3 Focus group seminar

Representatives from included stakeholders were invited to a focus group seminar. The intention of the seminar was to gather input on the specific measures, as well as to provide an arena for debate and discussion in which potential conflicts and clashes of interest between stakeholders could be brought to the fore. In particular, the seminar aimed at demonstrating ways in which needs, challenges and latitudes are influenced by the positions and premises of other stakeholders.

Table 1. Definition of included measures

<p>Mobile depots</p> <p>Here, mobile depots are defined as containers placed on strategic points within a given geographical area. Goods to end-receivers located within the area are delivered in the same depot. The depots arrive from consolidation centers where goods have been collected, organized and transported to the depot area in the early morning. Goods are available to end-receivers for a certain period of time, for example until noon, when traffic is low. End-receivers are responsible themselves for collecting own deliveries before the depot is removed. End-receivers are also free to return packaging waste by loading it into the emptied depot.</p>
<p>Night and evening deliveries</p> <p>Night and evening deliveries are implemented by restrictions or other incentives to reduce delivery vehicles' access to urban areas during daytime. Here, night and evening deliveries are defined as deliveries performed between 6 pm and 6 am, but no particular time window within this period is specified.</p>

A total of 15 stakeholder representatives participated: four representatives from carriers, four representatives from end-receivers and seven representatives from local authorities. The carrier group consisted of representatives from two large carriers, as well as representatives from two large interest groups. End-receivers represented a large retailer chain, one trade association and one goods delivery interest group. Local authorities were represented by national and regional levels of the Norwegian Public Roads Administrations, as well as five representatives from the city of Oslo. City representatives in this project were responsible for transport planning, parking, traffic safety, universal design, road maintenance, environmental issues and investments.

There were two sessions of focus group discussions. In the first session, the individual stakeholder groups were assembled separately to discuss prerequisites and needs related to the potential introduction of mobile depots, night and evening deliveries. Stathopoulos et al (2011) argue that separate stakeholder discussions allow for a more uninhibited description of problems and issues without the presence of adversaries. Stakeholder groups were provided with documents explaining the purpose and functioning of the measures, which were presented to stakeholders as described in Table I. Measure definitions are based on a review of best practices on European cities (Roche-Cerasi 2012) and adapted to the specific Oslo context taking into consideration geographical factors, urban design and competitive conditions within commerce and the transport industry.

In the second session stakeholder groups presented their individual evaluations, before all stakeholders were invited to discuss each other's inputs. The purpose of the second session was to make stakeholders aware of the views and perspectives of others, as well as building a mutual understanding of problem descriptions and potential measures among stakeholders.

4.4 SWOT analysis

In order to systematize inputs, stakeholders were asked to perform SWOT analyses. SWOT analysis as applied here is a tool for identifying strengths, weaknesses, opportunities and threats related to the implementation of specified measures. . Each stakeholder group developed SWOT matrixes which described their views on the measures. The method of SWOT analysis cannot be traced back to a single publication and is not the result of an identifiable academic contribution. Rather, SWOT analysis has emerged as a commonplace business procedure without any documented epistemology. However, a common perception is that SWOT analysis is a strategic planning method which involves identifying internal and external factors that are favorable or unfavorable to the implementation of included measures. Despite different approaches and applications of SWOT, all advocates maintain a clear distinction between external factors (threats and opportunities) and internal viewpoints (strengths and weaknesses) (Hill and Westbrook 1997:47).

Table 2. Description of SWOT analysis

Strengths	characteristics of the measure that give it an advantage compared to other measures
Weaknesses	characteristics that place the measure at a disadvantage relative to other measures
Opportunities	external chances to reach the objectives of the measure
Threats	external elements that could endanger the implementation of the measure

Although normally applied to strategic business planning, SWOT analysis could also prove beneficial in assessing the potential of transport policy measures. Good performances are the result of correct interaction between stakeholders and their internal or external environment (Houben et al. 1999:125). In a study similar to this, Franzén and Blinge (2007) performed a SWOT analysis to evaluate stakeholder perception of night deliveries. They argue that SWOT analysis is appropriate to illustrate qualitative data which represents the interpretations and experiences of different actors.

In the following descriptions of the included stakeholders' SWOT analysis, internal and external factors are not treated separately. Firstly, stakeholders had trouble with clearly understanding differences between threats and weaknesses on one hand and strengths and opportunities on the other. Thus, their discussions revolved more around what they considered to be positive and negative attributes related to each measure. Secondly, it has proved difficult to make an empirical distinction between internal and external factors. As stakeholder functions and operations in urban logistics are characterized by interaction and cooperation, it is difficult to define an influential factor as either internal or external. An internal factor of one stakeholder might very well represent an external factor to another. As such, the descriptions below do not refer specific components of the SWOT analysis, but rather to factors which by the stakeholders are presented as *facilitators* (strengths and opportunities) or *obstacles* (threats and weaknesses) to successful measure implementation.

5 Mobile depots

5.1 Consequences to carriers

5.1.1 Facilitators

In general, stakeholders struggled to identify positive aspects related to mobile depots. An obvious benefit to carriers would be reduced fuel consumption as a result from a larger share of transportation being performed in periods with little or no congestion. This was to a little degree emphasized by carriers. However, improvements in EHS (environment, health, safety) for drivers were discussed, as drivers were relieved from performing doorstep deliveries of potentially heavy goods.

5.1.2 Obstacles

One of the main objections of stakeholders was mobile depots being inadequate measures in reaching the main share of urban freight transport. Mobile depots were clearly described as relevant only to carriers of certain types of small goods. For one, carriers of large or heavy goods depend on making doorstep deliveries. Second, carriers of fresh foods, refrigerated and/or frozen products could not be included because these types of products involve specific storage requirements. Thus, mobile depots are not considered a large-scale solution, but rather a contribution to more efficient freight in certain segments.

Carriers were also concerned with business models related to mobile depots. Their acceptance of such a measure depends on economic viability, and mobile depots must pay off for carriers. Their concern is strongly related to consolidation costs, and stress that increased consolidation before transportation to mobile depots is expected to increase costs by 20 %. Someone must be willing to cover this increase, carriers are not. Further, carriers point out that consolidation schemes typically reduce the percentage of filling for goods cages, and also that mobile depots will probably inflict greater losses of such cages. One of the large carriers loses approximately 2000 cages per year, which represents a significant financial strain. Additional consolidation further places increased strain on the value chain and reduces the flexibility of the individual carrier. Time consuming consolidation entails longer delivery schedules and careful planning of shipments to end-receivers, and with express deliveries becoming less feasible. This is further complicated as the size of shipments to the individual end-receiver varies from one day to another.

Finally, carriers worry that the introduction of mobile depots might lead to unintended changes in the freight market. They are concerned that a new, unregulated market for the transport of goods between depots and end-receivers will emerge, with new actors who do not necessarily comply with existing norms and protocols for urban deliveries.

5.2 Consequences to end-receivers

5.2.1 Facilitators

The primary benefit to end-receivers is increased flexibility accompanied by mobile depots. With depots stationed in their proximity, end-receivers can collect their deliveries when time and work load allows it. As a result, they can choose times more appropriate to the operation of their business. Retailers and other end-receivers can reduce noise and disturbance to visitors or customers by collecting deliveries at times with less

activity. Mobile depots also represent flexibility because of the involved consolidation. As many end-receivers normally receive several small deliveries, mobile depots represent a more efficient strategy to handle and organize deliveries. They also accommodate end-receivers in waste management, as they make it easier to dispose of packaging waste.

5.2.2 Obstacles

As mentioned above, one of the benefits of mobile depots to carriers was improved EHS to drivers. However, EHS challenges related to doorstep deliveries of large and/or heavy goods will in the case of mobile depots be transferred to end-receivers. The Norwegian Labour Inspection Authority¹⁰ advises against carrying goods across a distance longer than 20 meters and carrying goods of more than 25 kilos. This is heavily emphasized by end-receivers. For one, this again implies that mobile depots will be limited to segments with small goods. Second, mobile depots will not render issues of strenuous doorstep deliveries irrelevant.

In addition to the size and weight of deliveries, end-receivers raise numerous objections regarding the transport of goods from the depot to their business. Transporting goods from depot to the end-receiver in an urban environment can be challenging, in surpassing road blockages from road maintenance and particular weather conditions, tram tracks and traffic. The safety of goods and personnel might also be compromised both in the depot and during transport to the end-receiver. Several stakeholders are concerned with delivery security: how to assure the security of the depot and make sure that each end-receiver collects own goods only. A requirement stated by end-receivers is thus that mobile depots should only allow each end-receiver access to his or her goods.

Mobile depots are also described as inconvenient to end-receivers. In addition to collecting own deliveries, they will have to allocate personnel in such a way that someone will remain in the store when goods collections are made. Here, large differences between segments are expected, but in general some stakeholders worry that such inconveniences will cause end-receiver to relocate outside the city center. As such, mobile depots contribute to distortion of competition in favor of large, suburban shopping malls and might put the ideal of living cities at risk. This fear is also related to increased time consumption in consolidation, which leave end-customers as well as end-receivers to wait longer before goods are available to them.

5.3 Consequences to local authorities

5.3.1 Facilitators

Local authorities are a heterogeneous group with a variety of responsibilities. One common, declared policy goal however is traffic reduction by restricting car accessibility in city center areas, and local authorities consider mobile depots an opportunity for supporting existing policies in that direction. For one, mobile depots are expected to result in less freight transport during day time, which relieves congestion and reduces emission concentrations. They allow local authorities to reallocate land use from parking spaces to spaces for placement of depots, and it might provide them with an incentive to allow freight transport in public transit lanes and pedestrian streets outside high traffic.

¹⁰ <http://www.arbeidstilsynet.no/artikkel.html?tid=78627>

Local authorities further consider mobile depots a useful alternative when adequate, individual stock receipts are not possible. Accessing certain inner city areas with HDVs is challenging both in terms of accessibility and safety, and depots could as such prove a more efficient way of distribution. This could be particularly beneficial considering traffic restrictions of certain streets and alleyways in the wake of the 2011 terrorist actions.

5.3.2 Obstacles

The most prominent challenge raised by local authorities is related to land use. Mobile depots require designated spaces and the development of a strategic plan for depot placement. As city center streets are already crowded with a variety of road users with particular needs, local authorities need to decide what road users to prioritize and whose space will be reduced at the expense of mobile depots. Although existing policies do provide local authorities with necessary input for making these prioritizations, they are nonetheless expected to induce objections. For instance, reallocating street areas could be in conflict with goals of accessibility for particular road user groups such as pedestrians and cyclists. Local authorities also worry about complaints regarding the design, or lack thereof, of mobile depots and anticipate complaints regarding the depots' contribution to the esthetical environment. Consequently, local authorities might struggle to incorporate mobile depots into existing strategies for urban development, and other stakeholders fear that designated spaces mobile depots will not be prioritized by local authorities who have to consider the needs of all road users.

Another issues emphasized by local authorities was increased road maintenance required by the placement of mobile depots. As transport from depots to end-receivers will be performed manually, efforts must be increased to ensure safe and unhindered passage. This involves increased requirements to the design of streets and sidewalks with additional emphasis on universal design, smooth surfaces and immersed curbstones. The Nordic climate further involves particular maintenance during winter time.

One of the responsibilities of local authorities is facilitating and monitoring parking restrictions and regulations, as well as sanctioning violations. This requires both available time and resources. If introduced, mobile depots will require particular signposts and surveillance for assuring the availability of spaces designated for depot placement.

Finally, local authorities express concerns regarding two structural changes occurring as a result of mobile depots deliveries in urban areas. As other stakeholders, local authorities worry that the inconvenience associated with depots on behalf of end-receivers will cause business to relocate outside the city center and compromising goals of a living city. Local authorities also repeatedly stressed that deliveries to mobile depots must *replace* existing deliveries, and not be a supplement. They have little faith in mobile depots replacing all deliveries and believe the introduction of mobile depots will create two sets of delivery regimes: the existing regime which requires regulation of spontaneous (ordinary) deliveries, and the regulated regime for mobile depots.

6 Night and evening deliveries

6.1 Consequences to carriers

6.1.1 Facilitators

As opposed to discussions of mobile depots, carriers are generally positive towards night and evening deliveries. The main reason lies in the opportunity to distribute terminal management, operations and deliveries across a 24 hour period. This enhances the utilization of vehicle capacity, deliveries become more time efficient, street areas are more accessible as a larger share of deliveries are performed off peak hours, and the percentage filling is expected to increase because more deliveries can be performed per trip. Deliveries outside heavy traffic are anticipated to provide drivers with a more stable and calm working environment. More deliveries outside peak hours also contribute significantly to reducing fuel consumption, and as such carriers' operational costs. Carrier representatives maintain that savings anticipated from continuous operation are expected to exceed increased salary expenses related to shift work, and are thus willing to increase tariffs in order to facilitate night and evening deliveries.

Carriers also identify specific opportunities related to receipt of night and evening deliveries. Today, *key contracts* are typically used for deliveries made outside the opening hours of the end-receivers. Key contracts are legal documents which specify delivery arrangements made to end-receivers when the end-receiver is not present. Carriers are equipped with keys or codes to the receipt, while end-receivers have 24 hours to control and validate deliveries. Key contracts are most suited for carriers with regular routes and large deliveries. SLUS (Norwegian lock system) as an alternative to key contracts is also mentioned.

6.1.2 Obstacles

The primary objection towards night and evening deliveries among carriers were EHS concerns, and carriers were unsure of what reaction they might face from labor organizations. This is above all related to working hour inconveniences and regulations, driving and resting regulations, fear of robbery, theft and violence.

The second concern of carriers is related to insecurities regarding delivery predictability. End-receivers might not be willing to or prevented from showing up for receipt of deliveries. If key contracts are involved, difficulties related to keys, codes and access might occur and preventing carriers from making deliveries. Further, Consolidation might prove challenging if not all end-receiver welcome night deliveries, and would require the development of two distinct consolidation and delivery regimes.

6.2 Consequences to end-receivers

6.2.1 Facilitators

As carriers, end-receivers are more positive towards night and evening deliveries than towards mobile depots. End-receivers will also benefit from a more evenly distributed work load, and emphasize in particular opportunities to do stock replacements in periods with otherwise low activity. Less noise and disturbance during opening hours creates a more inviting atmosphere to existing and potential customers and might contribute to increased competitiveness.

End-receivers further appreciate technological approaches to facilitating night and evening deliveries. They already actively engage in key contracts, but are also favorable to other solutions which render the presence of staff unnecessary.

Night and evening deliveries are further considered an opportunity to place incentives on the retailer chain as a whole. End-receivers believe deliveries within retail chains could be more organized and coordinated, contributing to more time and cost efficient goods distribution in urban areas.

6.2.2 Obstacles

Although end-receivers are generally positive towards the idea of more extensive night and evening deliveries, certain challenges are identified. In terms of EHS, end-receivers are faced with similar issues as carriers. Unless fully automated solutions are installed, night and evening deliveries will require staff being available at inconvenient times. Again concerns are related to demands of labor organizations, legal aspects surrounding work contracts and safety issues related to night work. Additionally, end-receivers stress that night and/or evening deliveries must be punctual and predictable to keep working hour inconveniences to a minimum. Currently, there is great variation in when staff arrives and delivery schedules are not necessarily regular. Thus, the coordination of delivery schemes and working hours is vital.

As not all end-receivers consider key contracts possible, technological solutions are highly regarded. They stress however, that not all buildings and premises are suitable for such solutions (e.g. lock systems). Hence, to some end-receivers night and evening deliveries are inevitably related to increasing staff presence.

6.3 Consequences to local authorities

6.3.1 Facilitators

One of the primary policy goals of local authorities is to reduce local pollution. Night and evening deliveries represent one opportunity for pursuing these goals. More evenly distributed traffic is expected to produce less congestion and less pollution, and in particular the reduction of HDVs in peak hours could contribute to keeping pollution below limit values. Distributing traffic more evenly across 24 hours increases the utilization of land and city areas. Removing delivery vehicles from daytime traffic will reduce conflicts with pedestrians and public transport and improve safety, accessibility and efficiency for other road users and other traffic. Such improvements might encourage travel by foot, bike or public transport. Additionally, concentrating delivery traffic around low-traffic periods provides more space for large vehicles allowing for fewer, larger vehicles and more efficient delivery.

As mentioned below, noise disturbances are the most prominent threat to night and evening deliveries. Yet, public authorities consider this an opportunity to impose noise reduction requirements, and stress that confining deliveries between 6 pm and 12 pm would significantly reduce complaints regarding noise. Although recognizing risks of theft or robbery involved in night time deliveries, local authorities also suggest that night and evening deliveries might increase the general safety in city streets by increasing activity and the presence of sober persons.

6.3.2 Obstacles

Noise disturbance to the neighboring environments is the largest threat to the introduction of night and evening deliveries, and local authorities have already received complaints regarding existing deliveries. These complaints are an expression of the conflict between inner city residency and goals of a living city. Local authorities wish to facilitate a viable city center involving both business activities and permanent residents. Local authorities expect it will be difficult to get approval for night or evening deliveries in residential areas, especially if this entails alterations of parking regulations. Night and evening deliveries could also be a threat to the living city if they are so inconvenient to end-receivers that they relocate outside the city center. As such, night and evening deliveries might compromise overarching policies.

Another challenge identified by local authorities is land use. Parking regulations must be adapted to delivery times in particular zones, and land use plans must be adapted to new delivery regimes. As different road users compete for the same space, delivery spaces are typically in conflict with parking spaces. Successful night and evening deliveries thus require signposts with particular traffic and parking regulation applying to particular periods and particular areas. Additionally, night and evening deliveries require around the clock maintenance, and lack of loading bays might cause delivery vehicles to obstruct road maintenance. A particular challenge in Nordic countries is further related to snow and ice: delivery vehicles' access to inner city areas depends on road maintenance being performed before deliveries are made.

Finally, local authorities stress that the successful implementation of night and evening deliveries depends on the documented legality of activities and consequences such as night work and noise levels. Local police should be involved and the operation of night deliveries rooted in law.

7 Concluding discussion

The purpose of this study has been to collect inputs from relevant stakeholders on mobile depots on the one hand, and night and evening deliveries on the other. The study shows that stakeholders are in general sceptical to the introduction of mobile depots, and that this scepticism particularly rests on the inability of mobile depots to encompass the majority of urban deliveries. Mobile depots would further require significant alterations of the organization of logistics, particularly among carriers and end-receivers. Physical inconveniences experienced by carriers today, are expected transferred to end-receivers with the introduction of mobile depots. Local authorities are concerned with contribution of the depots to the esthetical environment, and stress the importance of deliveries to mobile depots replacing existing deliveries instead of becoming an additional delivery regime.

Table 3. Summarized evaluations of mobile depots

	Facilitators	Obstacles
Carriers	<ul style="list-style-type: none"> • EHS improvements • Reduced fuel consumption 	<ul style="list-style-type: none"> • Relevant to small share of urban distribution • Business model • Additional consolidation • New, unregulated market
End-receivers	<ul style="list-style-type: none"> • Increased flexibility • Less noise and disturbance to customers • One, single delivery 	<ul style="list-style-type: none"> • EHS, increased work load • Last mile transport • Safety and delivery security • Distortion of competition
Local authorities	<ul style="list-style-type: none"> • Support existing policies • Reduced congestion and emission levels • Alternative to individual stock receipts • Reallocate land from parking • Allow freight transport in public transit lanes and pedestrian streets 	<ul style="list-style-type: none"> • Land use conflict with other road users • Design of depots • Increased maintenance • Relocation of business • Two delivery regimes

Night and evening deliveries were described more positively by all stakeholders. To carriers this results from opportunities to distribute operations across longer periods of time with consequent savings from a more efficient logistics system. Similar expectations are found among end-receivers who already seek to establish key contracts and who will be able to reduce noise and disturbance during opening hours. Local authorities are primarily concerned with noise disturbance related to night deliveries in particular, but emphasize opportunities for improving conditions for other road users when day time deliveries are reduced to a minimum.

Table 4. Summarized evaluations of night and evening deliveries

	Facilitators	Obstacles
Carriers	<ul style="list-style-type: none"> • Cost reductions exceeding increased costs • Key contracts/lock systems 	<ul style="list-style-type: none"> • EHS, working hours • Delivery predictability • Two consolidation and delivery regimes
End-receivers	<ul style="list-style-type: none"> • Work load distribution • Less noise and disturbance to customers • Technology and key contracts • Incentives on retailer chains 	<ul style="list-style-type: none"> • EHS, working hours • Unpredictable deliveries • Staff required in buildings not suited for technological solutions
Local authorities	<ul style="list-style-type: none"> • Lower emission concentrations • Improved land use • Encourages green transport • Noise reduction regulations • Increased safety 	<ul style="list-style-type: none"> • Conflicts with goals of living city • Land use, conflict with parking spaces • Around-the-clock maintenance • Legality

The purpose of this study has been to collect inputs from relevant stakeholders on measures for more sustainable urban distribution, with a particular focus on mobile depots and night and evening deliveries. The study shows that stakeholders are in general skeptical to the introduction of mobile depots, and that this skepticism particularly rests on the inability of mobile depots to encompass the majority of urban deliveries. Mobile depots would further require significant alterations of the organization of logistics, particularly among carriers and end-receivers. Physical inconveniences experienced by carriers today are expected transferred to end-receivers. Local authorities are concerned with the contribution of mobile depots to the esthetical environment, and stress the importance of deliveries to mobile depots replacing existing deliveries.

Night and evening deliveries were described more positively by all stakeholders. To carriers this results from opportunities to distribute operations across longer periods of time with consequent savings from a more efficient logistics system. Similar expectations are found among end-receivers who already seek to establish key contracts and who will be able to reduce noise and disturbance during opening hours. Local authorities are primarily concerned with noise disturbance related to night deliveries in particular, but emphasize opportunities for improving conditions for other road users when day time deliveries are reduced to a minimum.

If a measure for implementation based on the stakeholder evaluations of this study should be prioritized, night and evening deliveries appear more appropriate than mobile depots. The introduction of night and evening deliveries will depend on a clarification of working hours and other EHS regulations. Further, a regulatory framework for night and evening deliveries should adhere to laws and regulations, and governing principles established. Among other things, requirements of silent vehicles and loading equipment should be specified, and routines for handling complaints and violations established. Regulations must also specify responsibilities related to the use of (preferably standardized) key contracts or other measure rendering the presence of end-receivers unnecessary. To accommodate end-receivers unable to facilitate unmanned stock

receipts, delivery contracts should be as specific and predictable as possible to ensure a cost-efficient organization of work. Regulations should further specify the commitments and responsibilities of each individual stakeholder, including carriers and end-receivers not making night and evening deliveries. As stressed by local authorities, introduced measures should encourage a *shift* in delivery strategies rather than supplementing existing strategies. Consequently, facilitating night and evening deliveries should take into account the combined organization of night and day-time deliveries and aim at a coherent delivery regime incorporating the needs and prerequisites related to both delivery strategies.

Although stakeholders present mobile depots deliveries as less preferable than night and evening deliveries, similar practices have proved efficient across Europe. One reason for the skepticism against mobile depots might however rest on mobile depots being less familiar to stakeholders than night and evening deliveries. Research shows that the acceptability of transport policies increases with increasing knowledge, familiarity and experience with a measure (Bies et al. 1993, Gaunt et al. 2007, Tretvik 2006). Consequently, future introduction of mobile depots heavily depends on increasing stakeholders' scheme perceptions, but also detailed clarifications of responsibilities, commitments and business models.

One of the obstacles related to mobile depots could also stem from stakeholder perceptions of own roles. By taking into consideration the needs and prerequisites of other stakeholder groups, each stakeholder will have to redefine its role and approach to urban freight transport. This is a general challenge with introducing new solutions: each stakeholder will have to revise its role in the logistics chain. For instance, as last mile deliveries were previously the responsibility of carriers, mobile depots would require end-receivers to collect own deliveries. Additionally, stakeholder perception of the roles of others could come into play. For instance, the focus group seminar revealed polarization and an inherent conflict between particular stakeholder groups. This suggests an underlying structural disagreement which might hamper future cooperation. As such, dissimilar areas of interest and priorities are expected to be a prominent challenge regarding the implementation of measures.

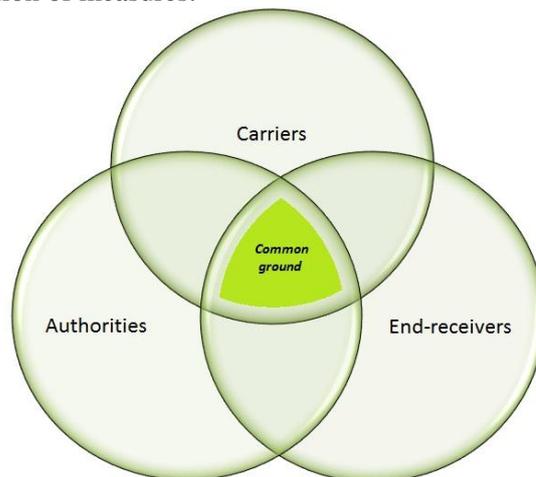


Figure 2. Common ground of urban distribution stakeholders

Hence, the successful introduction of measures facilitating green and efficient urban distribution heavily depends on identifying the stakeholders' common ground. Common ground refers to congruent areas of interest where strengths and opportunities outweigh threats and weaknesses, or where the combination of facilitators and obstacles provide a nutritious breeding ground for effective measures (see figure 2). Identifying common ground is thus a matter of charting stakeholder needs and prerequisites.

As such, this study is a contributor to the identification of common ground for measure implementation in the city of Oslo. The purpose of this study has been to chart stakeholder evaluations of potential measures for facilitating green and efficient urban distribution. As such, it contributes to filling knowledge gaps both in research and among policy makers designing future transport policies. This study provides a basis for estimating implications of measure implementation and thus prerequisites for achieving policy goals. Although included measures and stakeholders were selected within a specific local and national context, findings may yet be transferrable to urban transport systems in general.

In general, stakeholders display great commitment and positive attitudes towards solving problems in urban distribution. One purpose of this study has been to increase the stakeholders' awareness of each others' needs and prerequisites in order to facilitate the evolution of policies which take into account the complex interaction of stakeholders. As such, this study might prove a cardinal step towards achieving viable and effective solutions for green and efficient urban distribution.

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Appendix A. Summarized research findings on advantages and disadvantages related to measures in urban distribution, according to stakeholder group

MEASURE	STAKEHOLDER	ADVANTAGE	DISADVANTAGE
Access restrictions			
- time	Carrier	Shorter and more reliable travel time. No necessary need for fleet renewal (depends on time window).	Increased costs and lower efficiency, might force carriers to use more vehicles with less loading capacity. More expensive transport services. Might need more staff if night deliveries, involved increased wage costs. Security and safety issues. Noise problems with deliveries at certain times. Can be solved with silent vehicles.
	End-receiver	Few operational consequences. Can differentiate between end-receivers according to segment, accept deliveries at different times.	
	Local authorities	Less rush hour traffic.	
- night/evening delivery	Carriers	Short travel time, easier to load/unload, improved utilization of vehicle fleet, less stressful work environment to driver	Risk illegal parking in loading zones, increased costs. Might require silent vehicles. More expensive transport services. More staff, increased risks of robbery, delivery errors no necessarily uncovered. Low percentage filling in stores. Noise problems with deliveries at certain times. Can be solved with silent vehicles.
	End-receiver	Higher percentage of filling at opening hours. Can differentiate between end-receivers according to segment, accept deliveries at different times.	
	Local authorities	Less rush hour traffic.	
- weight	Carrier	No operational consequences.	Increased costs, lower efficiency. More expensive transport services Possible CO ₂ increase
	End-receiver		
	Local authorities		
- emissions	Carrier	Improved competitiveness among environmentally friendly carriers. Adaptability varies.	Improved competitiveness among environmentally friendly carriers. Adaptability varies. More expensive transport services Increased administration
	End-receiver	No operational consequences.	
	Local authorities	Less pollution, improved traffic safety.	
- loading capacity		No known results	
Infrastructure			
urban distribution centers	Carrier	Time savings and predictability. More flexibility if access restriction.	Increased costs if not subsidized. Some solutions require end-receivers to transport deliveries last mile (similar to pick-up-points) Should be subsidized by authorities.
	End-receiver	More efficient and environmentally friendly goods distribution, fewer HDVs in inner city	
	Local authorities		
- increased no of loading zones		No known results	
-booking loading zones	Carrier	More efficient driving, less illegal parking, improved traffic flow	Might require planning if booking in advance of delivery or if zone is reserved for a certain period

	End-receiver Local authorities	Lower emissions, improved traffic flow, improved city atmosphere	Monitoring and sanctioning
- reserved lanes/multiple use lanes	Carrier	Improved traffic flow, improved access to loading zone	Monitoring and sanctioning
	End-receiver Local authorities	Multiple use lanes improved street area utilization	
- pick-up-points		I No known results	
ITS			
- travel time information	Carrier	Predictability	
	End-receiver Local authorities	May keep HDVs from entering zones with extensive traffic	
- Booking loading zones		No known results, but authorities and end-receivers are more positive to the possibility of booking of loading zones than carriers.	



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