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Commercial traffic 2.0 – Analysis and recommendations of delivery strategies for the CEP industry in urban areas

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Abstract. This research project deals with the analysis and comparison of delivery strategies used by courier/express/parcel (CEP) companies. Focus is set on transport impact. In a first step on one hand side interviews with CEP managers were conducted; on the other side 40 delivery tours were attended. The cluster was mapped in a second part. It considers the relevant aspects of delivery processes. Due to extensive traffic survey the transport impact was analysed. The generated data base was used for identifying potential for improvement in particular districts as well as recommending a way to integrate delivery traffic to the inner-city traffic. The analysis of inner-city and mixed use areas indicates that vehicles are already used as depots. Drivers do more walking routes than in other districts. Since parking pressure is immense, distances in between the customers are low and the huge amount of one-way streets a two stage delivery strategy in inner-city and mixed use areas is recommended. That delivery strategy should be conducted by a micro depot in combination with electric cargo bicycles.

1 Introduction

The courier, express and parcel industry showed average growth rates of 4,3% during the past 10 years. This goes along with an increase of 5,1% in delivery volume which leads to 3,8 billion deliveries [1]. Due to this increase in deliveries the courier/express/parcel (CEP) companies as well as local authorities have to face the challenge of managing the growing traffic in a more efficient and greener way in addition with better adjustment to local needs. Especially the so-called last mile is in focus due to limited capacity concerning the streets as well as the general public areas in the cities.

CEP companies are currently working on new concepts to deliver parcels to their final destination. To evaluate current delivery strategies and to initiate innovative concepts it was necessary to create a data basis within this project. Doing such a close collaboration with DHL, DPD, Hermes and UPS was an essential requirement. The project was initiated by the network of stakeholders built by the House of Logistics and Mobility (HOLM) and was based on the results of the predecessor project “Optimierung des Wirtschaftsverkehrs in der Frankfurter Innenstadt” (optimisation of commercial traffic in the city center of Frankfurt/Main) [2] conducted by the Frankfurt University of Applied Sciences.

2 Research interests

According to commercial traffic in fields of transport research and logistics research there has been a

lack of a reference to the specific requirements of the CEP industry.
A detailed report analyses the identification process of loading and delivery zones in different cities [3]. Relevant policies consider commercial traffic in the way of how to design loading areas [4]. In logistics there are reports about new technologies as electro mobility whereas transport impact is not taken into account [5]. Lindholm points out, that developed city logistic concepts were not examined scientifically to its full extent [6]. In a survey about sustainable city logistics engaged by BIEK Bogdanski presents four major influence aspects: electro mobility, micro depots, further options to home delivery and design of loading areas [1]. According to data multiple surveys examine delivery processes. Data as the duration and location of parking as well as the use of vehicles were gathered [7, 2].

There is no data that on one hand concentrates exclusively on CEP delivery strategies and on the other hand focuses on traffic impact. The following research questions revealed due to this:

- Which delivery strategies are in use by CEP providers?
- How do they differentiate among all providers and do differences in districts exist?
- What kind of optimisation potential consists by using alternative delivery strategies?

The project goal was to analyse and compare existing as well as planned delivery strategies of different CEP companies. Subsequently recommendations about suitability in different districts were supposed to be prepared. The consideration behind this is the possibility of different structural conditions from one inner-city district to another. This indicates that delivery strategies need to be rated differently. City districts should be additionally clustered parallel to analysing strategies. Especially transferability of all clustered district types was an important issue.

3 Methodology

The used research concept is divided into three parts described hereafter (see figure 1). The first part (orange) is based on a close collaboration with the CEP companies. The current delivery strategies were analysed and evaluated. It was conducted by interviews with experts and observance of delivery routes. 40 delivery tours were arrested. All holding operations and deliveries were documented and GPS tracking apps were used for further insights. A special focus was set on traffic impacts occurred by holding operations. Afterwards the evaluation of delivery strategies took place from the logistic and traffic planning point of view. The attached theoretical part (blue) dealt with traffic impact of deliveries in public streets, independent of the internal processes at the CEP companies. Therefore, a cluster of districts delivered by the CEP companies was generated. The project focused on the following types of districts: inner-city area, mixed use area, residential area, commercial area, industrial area. After that a survey of identified hotspots occurred. After all the results of the applied part and of the theoretical part were merged. Specific and common recommendations were phrased for the developed types of districts.

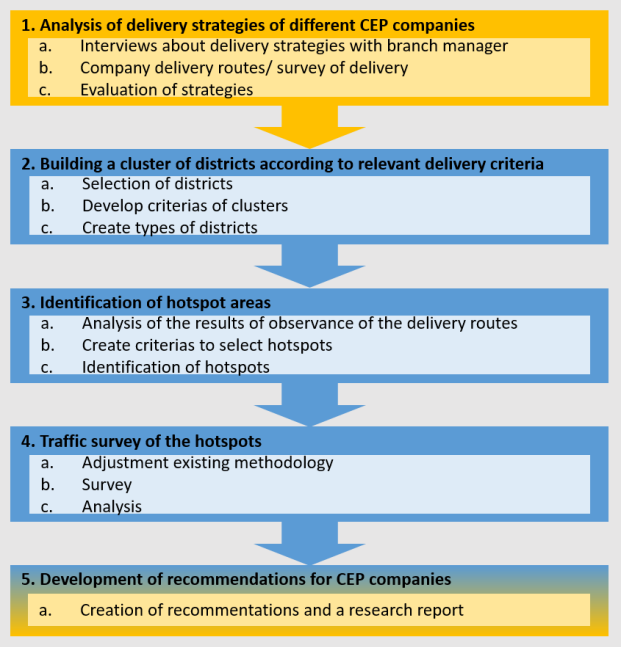

Figure 1. Project stages of research concept

4 Results and recommendations

In general, an impact in between duration of a holding operation, the number of walking routes and the number of parcels delivered at that particular holding operation was identified (see figure 2).

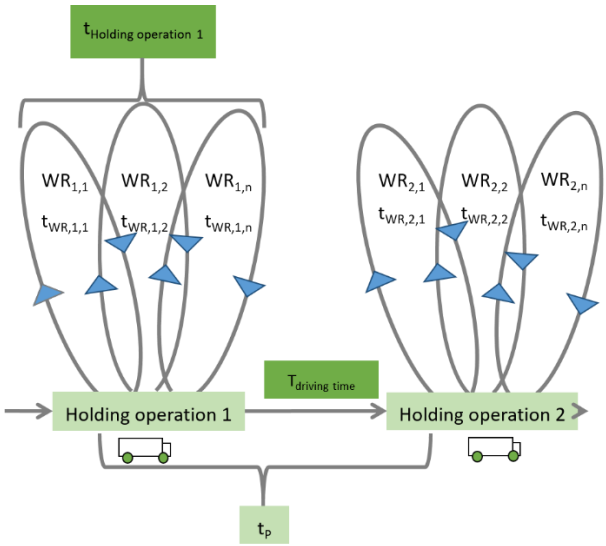

Figure 2. time reduction per customer by increasing number of walking routes

In certain city districts (e.g. inner-city and mixed use areas) the density of customers is much higher than in e.g. industrial areas. In combination with extensive usage of public place in cities, CEP drivers choose a suitable stopping place (by 80% not compliant to rules) and start the delivery. This is more economical than moving vehicles from one "illegal" parking area to another and it is the only suitable way to perform.

Figure 3. holding operations compared to parcels per tour

As shown in figure 3 the mix in between holding operations per tour and parcels per tour differs from district to district. In inner-city and mixed use areas the productivity of parcels per holding operation is significantly higher than in other urban areas. In the following results and recommendations are presented per type of district.

4.1 Inner-city area

Table 1. inner-city area results

Results
Periodic long term parking of vehicles in the red zone
high proportion of holding operation leads to potential disruptions in traffic movement
Many walking routes per holding operation (vehicles are already used as depot, see figure 3)
An increase of walking route numbers leads to most efficient time reduction (due to customer density) (see figure 2)

Due to the results above a two stage distribution strategies should be performed. Considering short distances in between delivery area and depot, stage one should be performed via electric vehicles. Reason to do so is a decrease of air and noise pollution. Leading aspect is the distance in between depot and district. Stage two needs to be accomplished by an electricity supported cargo bicycle (eCargoBicycle). Since an eCargoBicycle is very efficient and flexible it is ideal for the density of building as well as for one way routes in the inner-city area. Especially the timely limited pedestrian zone (for motor vehicles) can be easily handled.

4.2 Mixed use area

Table 2. mixed use area results

Results
largest number of potential disruptions (lack of parking areas)
long time holding operations (already used as depot, see figure 3)
high time reduction due to multiple walking routes per holding operation (see figure 2)

In view of the results above it is also recommended to use a two stage distribution strategy. Stage one should be performed by diesel or electric vehicles. The focus should be set on electric vehicles since a lot of apartments are located next to commercial units. Distance in between delivery area and depot decides about the use of diesel or electric vehicles. Stage two needs to be accomplished by an eCargoBicycle. Especially one way routes are a lot easier to handle.

4.3 Residential area

Table 3. residential area results

Results
low number of parcels and customers per holding operation (leads to a wider customer density)
short time holding operations (on designated parking areas)
number of holding operations per tour is a lot higher than in mixed used and inner-city areas (higher distance in between customers)

Due to the facts above a one stage distribution strategy is recommended. This stage is supposed to be performed by diesel or electric vehicles. Electric vehicles should be preferred since noise pollution is an important aspect in these areas.

4.4 Commercial area

Table 4. commercial area results

Results
low number of customers per holding operations
short time holding operations (on loading zones)
low number of potential disruptions in public streets

For this type of district, a one stage distribution strategy by diesel or electric vehicles is recommended. The choice of motorisation is driven by the distance in between the delivery area and the depot, vehicle capacity and spaciousness of the delivery area.

4.5 Industrial area

Table 5. industrial area results

Results
lowest number of customers per holding operation
highest number of parcels per customer
shortest time holding operations
holding operations are located almost unexceptional on loading zones or designated private parking areas

Equally a one stage distribution strategy by diesel or electric vehicles is recommended. The choice of motorisation is driven by the distance in between the delivery area and the depot, vehicle capacity and spaciousness of the delivery area.

4.6 Further recommendations

Further advices related to the implementation of the delivery routes are listed below.

- Shelf space in vehicles: Easy locating of parcels due to structured shelf space.
- Loading procedure performed by previous shift: Governmental working hours are obeyed.
- Daily adjustment of delivery areas: Customer and parcel density determines the borders of the delivery area.
- Digitalisation of delivery processes: Reachability of private customers a major aspect. 24/7 delivery models as packing stations, package boxes/butlers and trunk delivery need to be focused on in logistics future. At best all providers would cooperate as a community.
- Drivers training according to traffic safety: Driving behaviour of each individual massively impacts traffic. Trainings need to focus, among others, on situations that are uncommon and difficult to estimate. The development of a guideline by local authorities and companies is recommended.

5 Conclusion

The project results represent an extensive amount of CEP provider delivery data [2]. Analysed data points out what kind of delivery strategy needs to be applied in every individual city district. Research results also approve the high importance of micro depots for inner-city delivery which is already supported by the delivery behaviour of drivers in inner-city and mixed use areas that are using their vehicles as depots. In those cases, vehicles were parked for multiple walking routes without moving them once. Even though most disruptions appeared due to this procedure since parking pressure and density of building is high. This supports the assumption that identification of locations is a major task in view of micro depots. Local authorities and CEP providers both take advantage of research recommendations which allows to increase process efficiency and decrease CO2 emissions. In some cases, electric supported vehicles or bicycles allow to perform emission-free. This brings along less traffic which equals to a lower rate of potential disruptions. To put it in a nutshell, results show an immense potential for improvement. There is need for further research regarding micro depot locations, the efficient design of two stage distribution strategies and emission rates in view of different delivery strategies.

Acknowledgement

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