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SOLVING ROAD CARGO TRAFFIC PROBLEMS IN CITIES – A LOGISTICS APPROACH

1. Urban road cargo traffic problems. An overview

Urban cargo traffic is related to the operation of economic entities and institutions located within city limits¹. Delivery to industrial, commercial and service companies generates the biggest part of the above traffic. Furthermore, there are deliveries of office equipment, stationary, and foodstuffs to institutions and offices. Moreover, there is cargo traffic as distribution initiated by the entities. The remainder of urban cargo traffic is unrelated to the operation of entities located in the city, since the place of dispatch and the place of delivery are situated outside city limits. This is transit traffic.

Observations bear out that car transportation accounts for 80% of the entire delivery transport². Cars supplying commercial, service, and industrial companies account for ca. 10 – 17% of the total vehicular traffic in the city³, and delivery transport predominates in the entire urban cargo traffic. Despite the low scale of traffic, cargo traffic in cities poses a number of problems and besides it is growing the fastest. Problems of cargo traffic in cities concern in particular the following four questions⁴:

- difficulty in delivering cargo to destination points,
- impact on the environment,
- safety and smooth flow of traffic on the roads,
- influence on the image of the city, vital and economic functions.

¹ We are skipping the goods transport carried out for inhabitants, as for example a transport of furniture at moves or supply of goods purchased in the shops here.

² H. Sonntag, B. Meimbresse, U. Castendiek, *Entwicklung eines Wirtschaftsverkehrsmodells für Städte*, BAST, Heft V33, Bergisch Gladbach 1996, p. 57.

³ A. Chyba, W. Starowicz, *Transport towarowy w miastach*, „Transport Miejski” 1997 nr 5, p. 2.

⁴ See M. Hesse, *Wirtschaftsverkehr, Stadtentwicklung und politische Regulierung*, DIFU, Berlin 1998.

The above problems may be solved in various ways: through the reconstruction of transportation infrastructure, a change in the organisation of traffic, the use of eco-friendly vehicles, and the introduction of new forms of freight transport, such as a cargo tram⁵ or capsule pipelines⁶. They can also be solved through administrative measures, by means of a complete ban of vehicular traffic, a prohibition of entry for vehicles of a particular maximum weight or a given axle load, as well as on an organizational basis, for instance by the introduction of night-time deliveries. The expected effect here should be a decrease in cargo flows, and therefore a reduction of exhaust emissions and noise levels, an increase in road safety, and as a consequence higher living standards and the levels of good management in the city. The application of any of the above methods is either impossible in particular urban conditions or extremely expensive, or else is feasible only in a longer term.

2. The power of cooperation: drivers, initiatives, and possible results

Retail entities, restaurants, institutions, and companies have different transport needs. Small shops prefer frequent and small deliveries. Department stores opt for large and frequent deliveries. Such entities are supplied with a wide range of goods, calling for dissimilar transportation conditions, which additionally increases their demand for transport: there are separate deliveries of foodstuffs, apparel, household and electronic appliances. All commercial establishments are interested in regular deliveries. A similar situation occurs in the case of catering and gastronomic services companies. Restaurants, bars, and cafes must have fresh products at their disposal, and thus need frequent, small, and very regular deliveries. Industrial enterprises that are supplied with big-size deliveries are also interested in their high frequency and regularity. Today no delivery recipients are interested in maintaining excessive stock, and therefore deliveries are more frequent than in the past.

The increasing integration level of present-day supply chains and networks, enhanced by the dynamic development of communications technologies, allows these structures to operate with a minimum level of stock. Lean and flexible logistics systems, applying the strategies of *just-in-time*, *quick response*, and *efficient consumer response* (ECR) generate substantial profit for companies in the form of cost reduction and become extremely popular among many sectors of the economy. Unfortunately, such systems require a constant restocking in particular nodes,

⁵ H. Igliński, M. Szymczak, *Warunki wprowadzenia towarowego transportu tramwajowego do miast, 1st International Conference of Logistics INTLOG 2006, 23-26 September 2006, Gdynia, „Logistyka” 2006 nr 5, published on CD.*

⁶ For a description of a sample project, see O.J. Fiske, *The Magtube Low Cost Maglev Transportation System*, Proceedings of the 19th International Conference on Magnetically Levitated Systems and Linear Drives, 13-15 September 2006, Dresden, Germany, <http://www.maglev2006.com/homepage.html>, retrieved on 21 January 2008.

which is extremely frequent and must be repeated on an ongoing basis. This means a marked increase in transportation needs in the sense of the number of trips made. In this case contemporary tendencies in business logistics are not conducive to relieving city transportation infrastructure as far as cargo traffic is concerned.

Cargo traffic in these entities is most often not carried out with the use of the companies' own means of transportation. Instead, companies take advantage of the extensive service offer of logistics services providers. LSPs, which provide services to a large number of clients, can combine shipments and reduce empty trips. As a consequence, the vehicles are used to a greater extent and cargo flows are reduced⁷. Therefore economic entities faced with the *make or buy* dilemma as far as transport services are concerned, decide on the volume of urban cargo traffic, and making the *buy* decision is conducive to its restriction.

Short-distance cargo trips within city limits are not too profitable. The methods of subsidising freight transport in the city from profits obtained from long-distance and international trips are becoming exhausted, too. The present difficult situation of road carriers makes them little interested in providing transport services in the city. Paradoxically, this situation helps the implementation of ideas aiming at the restriction of the number of trips. Competing transport companies implement cooperative projects with a view to reducing operation costs and improve their economic standing (*co-opetition*). The consolidation of resources of different carriers results in a greater degree of rolling stock usage, the restriction of empty trips, the enhancement of the level of services provided to clients, and in general is a critical factor for being able to meet certain order conditions. Delivery systems are designed with a view to using the rolling stock to the full; the very process of deliveries should engage fewer vehicles and be less chaotic. This decreases cargo traffic and its burden on the city, limits congestion in city streets, shortens the wait time at the ramp in transport hubs and distribution centres, which additionally contributes to the reduction of operating costs in those companies, demonstrates the benefits of cooperation and promotes its development. We can observe numerous examples of such cooperation in Germany. It is in order to mention here projects on a national scale: IDS (*Interessengemeinschaft der Spediteure*) and Pinguin-Frischfracht. In Stuttgart, in turn, joint deliveries by three companies: Dachser, Steinle, and DHL, allowed them to note a cost reduction in the order of 25-30%⁸ after one year of running the programme.

⁷ For example, there are no such possibilities in handling small cargo transports realized on the order of individual customers in the form of so-called cargo taxis. As a result of more and more attractive (also for the individual customer) offers of logistics service providers and messenger service agents this form of transport is at the moment on the wane. In Poznań the number of cargo taxi vehicles declined from 426 in 2002 to only 13 in 2005. See *IV kadencja Samorządu Miasta Poznania. Poznań w latach 2002-2006*, Urząd Miasta Poznania, Wydział Rozwoju Miasta, Poznań 2006, p. 83.

⁸ *City Logistik – Kooperation von Speditionen*, „Internationales Verkehrswesen” 1995 No. 3, p. 58; [za:] A. Szeryńska, *Logistyka miejska*, master thesis, Warsaw School of Economics, Warszawa 1999, typescript, pp. 35-36.

The most spectacular cooperative initiative of this kind so far is another German project ISOLDE implemented in Nuremberg⁹. The project consists in the application of methods of supplying large chain markets for the supply of small retailers and service providers through the division of the city into five zones and the establishment of a small logistics centre in each of them. Apart from storage facilities, the centres offer services of preparing goods for retail sale (packaging, blister-packaging, the creation of multipacks, labelling, etc.). Recipients gain the advantage of being able to receive the goods in a convenient location (proximity of the city centre) and at a convenient time – centres operate 24 hours a day, 7 days a week. Such a model is at present strongly promoted in Europe¹⁰, where logistics centres become the most crucial nodes in the logistics systems of individual countries and regions.

Typically, such facilities are located in the vicinity of metropolitan areas, but designed networks of logistics centres differ markedly from one country to the next, not only as to the investment scale but as to the very idea. In some projects the needs of urban agglomerations are taken into account right from the start. This applies to the logistics centres developed in Germany. They are based on the assumption of a rational spatial and functional layout of urban agglomeration¹¹. They ensure harmonised distribution services within the metropolitan area (and thus serve as their supply centres) and offer eco-logistics services, namely the collection of municipal waste and its management. Apart from the economic and ecologic aspects, the social aspect is of vital importance here. The development and protection of urban landscape are seen as some of the key functions of German centres (*centralised landscape maintenance*). Logistics centres as places of concentration (and coordination) of logistics activities can potentially play a significant role here.

The Creation of conditions conducive for the cooperation of entities is one of the fundamental requirements present-day logistics centres must meet¹². The centralisation of the logistics service providers who settle there contribute to occasional contacts and the exchange of opinions, which allow the identification of similar problems and bring the providers closer to one another. From this point, upon an economic analysis, it is close to taking joint action for the benefit of both businesses and the city. To be precise, at issue here is a consolidation of shipments and transportation routes, contributing to the restriction in the number of cargo trips. It turns out that even a relatively small reduction in this respect, with an im-

⁹ See E. Gołębska, P. Czajka, D. Tomaszewska, *Logistyka miejska XXI wieku*, „Eurologistics” 2001 nr 3, pp. 68-69.

¹⁰ A lot of emphasis was laid on the idea of urban logistics centres (called there *Urban Consolidation Centres*) in the Best Urban Freight Solutions (BESTUFS) project financed by the European Commission and realized in 2000-2008. See *BESTUFS Good Practice Guide on Urban Freight Transport*, BESTUFS Consortium, Rijswijk 2007, p. 59 and next.

¹¹ W. Paprocki, J. Pieriegud, *Rozwój centrów logistycznych w Polsce*, „Eurologistics” 2003 nr 5, p. 52.

¹² They should integrate businesses. Ibidem, p. 54.

mense number of daily trips within an urban agglomeration, can greatly contribute to the reduction in the emission of pollutants. S.D. Lee estimates that, for instance, at the median annual number of 50,000 delivery trips within city limits, a reduction of this number by 10-15% allows an annual reduction of fuel in the order of 1-2m litres and a decrease in the emission of carbon dioxide and sulphur dioxide by 120 tons, with the assumption of an average delivery distance typical of a middle-sized city. The above calculations were conducted for the city of Hamm in North Rhine-land-Westphalia, with 200,000 residents¹³. Such estimates and the very fact of restricting traffic of delivery and commercial vehicles make city authorities take up a series of initiatives with a view to restricting the number of deliveries (especially in the downtown area) through encouraging cooperation of transportation companies and logistics service providers. Such efforts have already been taken by e.g. Berlin, Copenhagen, and Bangkok. In Berlin, a “Goods Traffic Platform” was launched as a public-private partnership. As a result, round table talks led to working out an agreement on the principles of reducing the number of deliveries, setting parking space for unloading, and the reconstruction of some crossroads¹⁴. A programme called “City Goods Ordinance” was launched in the historical centre of Copenhagen. The objective of the programme was to limit the entry of freight and commercial vehicles by a better use of their load capacity. The access to the historical centre of Copenhagen (which was previously entered daily by ca. 3,500 freight and commercial vehicles making an approximate 6,000 trips, with only 20% of their load capacity used) has been restricted; access certificates are issued¹⁵. In downtown Bangkok a network of public reloading terminals has been created and a complete ban on the traffic of heavy commercial vehicles introduced. This limited the number of destinations of these vehicles and contributed to the restriction of their traffic in the city. The above was possible due to combining shipments and increasing the level of using loading space, but led to an increase in the amount of cargo traffic in the centre¹⁶.

The effects of combining shipments and transportation routes with the use of a logistics centre is demonstrated in Figure 1. One cannot uncritically assume that the establishment of a logistics centre will automatically facilitate such fruitful cooperation between logistics service providers. Observations made so far¹⁷ show that at the initial stage of the cooperation, activities aiming at the consolidation of

¹³ S.-D. Lee, *Reduzierung des städtischen Güterverkehrs am Beispiel Hamm*, Diplomarbeit an der Fakultät Raumplanung der Universität Dortmund, Dortmund 1996, p. 34; [za:] A. Szeryńska, op. cit., p. 44.

¹⁴ <http://www.managenergy.net/products/R937.htm>, retrieved on 20 November 2007.

¹⁵ <http://www.managenergy.net/products/R950.htm>, retrieved on 20 November 2007.

¹⁶ A.G. Qureshi, S. Hanaoka, *Analysis of the Effects of a Cooperative Delivery System in Bangkok*, in *Recent Advances In City Logistics*, eds. E. Taniguchi, R.G. Thompson, Elsevier, Oxford 2006, p. 294.

¹⁷ See J. Miklińska, *Znaczenie lokalizacji centrów logistycznych dla portów morskich i miast portowych*, „Spedycja i Transport” 2002 nr 8, p. 7.

deliveries and routes relate to only some groups of cargo, and thus only some problems tied with the supply and distribution of goods in the city can be resolved. In the course of development of logistics centres, one can assume a broader cooperation of successive entities and the extension of the group of cargo serviced through partnerships. Besides, the cooperation of entities in a logistics centre consists in making full use of the common infrastructure of the centre: warehouses, depots,

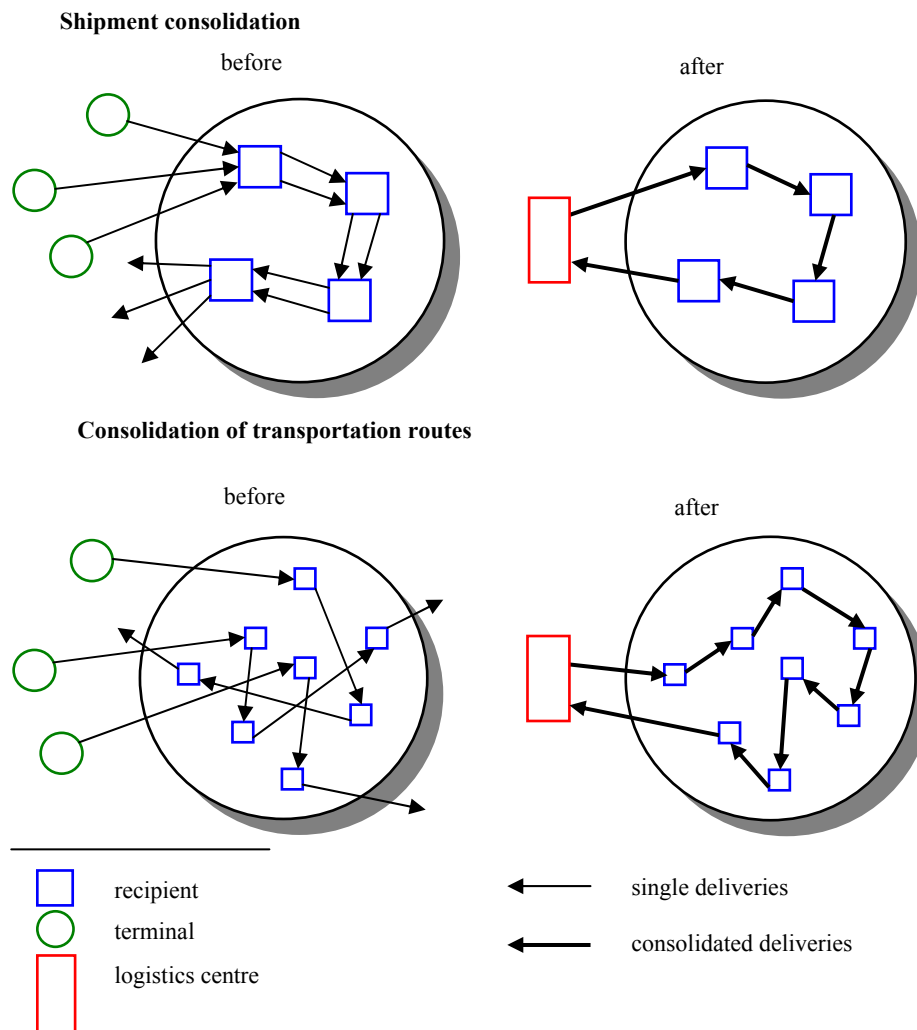


Fig. 1. Effects of consolidation of shipments and transportation routes

Source: A. Weis, *Der Beitrag der City-Logistik zur stadtverträglichen Gestaltung des Verkehrs*, Diplomarbeit an der Fakultät Raumplanung der Universität Dortmund, Dortmund 1997, p. 37; [za:] A. Szeryńska, op. cit., p. 43.

ramps, IT systems, etc. This eliminates multiplication of investments which are indispensable in the work of each entity. As a result, a smaller area (which is however better taken advantage of) within city limits is used for these infrastructure facilities.

There is no doubt that cooperation between companies of the logistics service sector should be encouraged by the city. Promotional campaigns must stress the improvement of the economic standing of companies, which in this case corresponds with the improvement of traffic in the city, a relief of the road network, and the betterment of living standards and management quality. This was the case with Freiburg, where city authorities along with the regional union of transportation companies conducted studies on:

- the number and kind of vehicles owned by the companies,
- type of cargo delivered,
- locations of the suppliers and recipients of shipments,
- extent of the use of these vehicles in individual companies.

The results of the study were published. They pointed to substantial profits for the city connected with restricting cargo traffic, and at the same time indicated potential benefits for carriers who join efforts and resources to service deliveries. As a follow-up on the activities taken, 12 transportation and shipment companies joined the agreement¹⁸.

3. A survey on delivery traffic in Polish cities. Any chance to make things better?

In Poland only programmes of restricting and regulating access for commercial vehicles in city centres have so far been implemented. They are preceded by the analyses of vehicular traffic and for the time being are only pilot studies. Unfortunately, there is no involvement on the part of city authorities. Wrocław is one of the first cities to implement such a programme. The programme called DORED has been conducted with the collaboration of researchers of Wrocław Technical University led by K. Lewandowski and the members of the Student Science Circle “Logistics” at Wrocław Technical University. The programme aims at working out a methodology of monitoring commercial cargo traffic that supply retailers in selected parts of the city in order to minimise the effect on the natural environment. Pilot studies within the DORED programme were carried out for the Przedmieście Świdnickie district. 135 entities generating delivery traffic in this area were analysed. The results of the study indicate as follows¹⁹:

- the biggest number of entities (87%) are serviced by commercial vehicles with the load capacity of between 0.5 t to 3.5 t,

¹⁸ Ibidem, p. 67-68.

¹⁹ K. Lewandowski et al, *Pilotażowe badania programu DORED*, „Logistyka” 2005 nr 2, p. 62-64.

- the most frequent deliveries are those of goods weighing 500, 100, 300 and 20 kg, but because of the fact that the entities were of divergent branches, a lot of types of load units are used (e.g. cartons, multipacks, sacks, boxes, pallets),
- the parking time of a commercial vehicle, determined by the time of unloading, in the majority of cases does not exceed 15 minutes (56%), and in the vast majority does not exceed 30 minutes (77%),
- in general, deliveries are made to the individual entities every day (40%), three times a week (17%), twice a week (13%), or once a week (10%),
- deliveries are made at different hours, usually however during the working hours of a commercial business, i.e. between 10 am and 6 pm, with a marked intensification between 11 am and 2 pm,
- only 19% entities said they had parking space.

The team led by the author along with students from the Student Science Circle “AE Logic” conducted a similar study in Poznań in November 2007. The study comprised an area in the strict centre of the city, in close proximity to the Old Market Square, bounded by the streets: Garbary, Wodna, Ślusarska and Szewska, Mała Garbary. 108 entities of this area generating delivery traffic agreed to participate in the study. The study results lead to the following conclusions:

- nearly one-fourth of the entities (24.1%) receive goods deliveries once a day, nearly one-third (32.4%) more rarely, but at least once a week, and only 15.7% entities are supplied more than once a day,
- strangely enough, the biggest number of entities located within this area (25.9%) are supplied less than once a week – this stems from the specific types of entities in this area, a site of a large number of art galleries, antique shops, law offices and notary publics’ offices, consulting companies, bank branches, bureaux de change, pawnshops, etc.,
- half the entities run a delivery schedule (25.9% entities deviate from the schedule, which most often results in a greater frequency of deliveries); for the other half the declared frequency was not tied with a schedule but only indicated a median frequency of deliveries,
- in the majority of case (50.9%) a single average delivery does not exceed 20 kg, and in the vast majority (85.5%) does not exceed 100 kg; only 5.6% of entities admitted to receiving deliveries in excess of 300 kg,
- deliveries are provided by commercial vehicles with the maximum weight of up to 3.5 t (55.6%), light commercial vehicles up to 2 t (34.3%), more rarely by freight vehicles over 3.5 t (7.4%),
- goods are primarily delivered in cartons, multipacks or containers (90.7%); palleted goods are regularly delivered to a small number of entities (3.7%),
- deliveries are made at different times, by and large however during the working hours of the majority of entities, i.e. between 10 am and 6 pm (75%); because of paid parking during these hours some entities receive deliveries before 10 am (14.8%),

- most of the participants of the study (60.2%) indicated problems with the parking of a vehicle during the unloading: there is insufficient parking space or a specially designated parking space is used by another vehicle; 20.4% entities can find a convenient parking place for the duration of a delivery, and only 14.8% declare that they have a specially designated parking space and have no problems with its accessibility.

The results of both studies unanimously confirm that the basic deliveries for economic entities located in city centres are small (up to 100 kg) and frequent (daily or nearly daily), and are carried out by light commercial vehicles. It is therefore easy to combine shipments for the whole vehicle. Recipients have similar requirements as to the date and hour of the delivery, and the ability to anticipate supply needs by many of them leads to a compilation of an assumed delivery schedule. This greatly facilitates vehicle routing and scheduling for providing simultaneous services to many entities²⁰. These factors should provide a powerful impetus and encouragement for logistics service providers to initiate the above-described cooperation activities with a view to consolidating shipments and routes for the benefit of the supplied entities, logistics service providers, as well as for the city and its residents.

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²⁰ The additional result of these examinations is an observation that having specially designated parking space has the intense influence on the efficiency, the frequency and the date of deliveries.

Sonntag H., Meimbresse B., Castendiek U., *Entwicklung eines Wirtschaftsverkehrsmodells für Städte*, BAST, Heft V33, Bergisch Gladbach 1996.

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ORGANIZACYJNE MOŻLIWOŚCI ROZWIĄZANIA PROBLEMÓW RUCHU TOWAROWEGO W MIASTACH – PODEJŚCIE LOGISTYCZNE

Streszczenie

Transport dostawczy dominuje w całym ruchu towarowym w miastach. Ruch towarowy w miastach rodzi wiele problemów, a do tego ruch ten szybko się zwiększa. Aby podnieść jakość życia w mieście, powinno się ograniczyć potoki towarowe, a tym samym ograniczyć emisję spalin i hałasu, podnieść poziom bezpieczeństwa na drogach. Można to osiągnąć, ograniczając liczbę przewozów towarowych. Przedsiębiorstwa transportowe realizują projekty kooperacyjne w celu obniżenia kosztów działalności i poprawy swojej sytuacji ekonomicznej. Przede wszystkim konsolidują ładunki i trasy przejazdowe. Łączenie zasobów różnych przewoźników owocuje większym stopniem wykorzystania taboru, ograniczeniem pustych przebiegów, zwiększeniem poziomu obsługi klientów. To zmniejsza ruch towarowy i jego uciążliwość dla miasta, ogranicza tłok na ulicach miast, a dodatkowo wpływa na redukcję kosztów działalności w tych przedsiębiorstwach, przekonuje o słuszności współpracy i skłania do jej rozwijania. Liczne są już przykłady takiej kooperacji. Powstanie miejskich centrów logistycznych zachęca do podejmowania takiego współdziałania z korzyścią zarówno dla przedsiębiorstw, jak i dla miasta. W Polsce na razie prowadzi się jedynie programy ograniczania i regulowania dostępu samochodów dostawczych w centrach miast. Są one poprzedzane analizą ruchu pojazdów i, jak na razie, mają charakter pilotowy. W artykule dokonano porównania wyników badań ruchu dostawczego, jakie przeprowadzono we Wrocławiu i Poznaniu celem oceny, czy wdrożenie wspomnianej współpracy operatorskiej jest rzeczywiście możliwe.