

Changes in night-time distribution of goods to the city centres as a tool to meet the requirements of the EU white paper on transport

Jozef Gnap¹, Dominika Beňová¹, Radovan Slávik¹, Grzegorz Dydkowski²

¹Department of Road and Urban Transport, Faculty of Operation and Economics of Transport and Communications, University of Zilina, Univerzitná 1, Zilina, 010 26, Slovak Republic (University of Zilina),

² Department of Transport, University of Economics in Katowice, Ul.1. Maja 50, 40-287 Katowice, Poland 517,

Abstract The report focuses on assessing the advantages and disadvantages of night distribution in selected European cities. The first chapter is focused on projects focused on night distribution of goods in the city centre. The second chapter deals with a more detailed analyses of night distribution in some countries of the European Union. It shows concrete example, a solution for night distribution, which can be applied to our Slovak cities. Even in Slovakia, it has to deal with the issue in view of the constantly increase the number and the duration of traffic accidents not only in Bratislava, but also in all regional cities.

Keywords logistics, distribution, city centre

JEL R 41, R42

1. Introduction

In today's modern times, the logistics of supplying cities is becoming more and more important. This importance of logistics is growing steadily. Creating various specific transport service requirements in densely populated areas, in cities and large agglomerations. The term "urban logistics" has emerged that solves the flows of goods, generally with regard to the territory of the city centre. Some European countries have endeavoured to eliminate the negative impacts of supply on the environment, residents in urban agglomerations, but also to reduce the number of vehicles and to create a transport system. [1]. EU transport policy objectives in the field of urban logistics are very ambitious "Reduce the use of" conventionally driven "vehicles in urban transport by mid-2030 by phasing them out of urban traffic by 2050, to achieve the introduction of urban logistics in the centres of major cities, of CO2 emissions by 2030. [9], [10] Urban logistics in the field of freight transport must also contribute to this objective, in addition to exhaust emissions in the field of night traffic in particular, it is an important aspect of traffic noise. EU Member States have

addressed or addressed a number of research projects that have been analysed in the following chapters.

2. Projects relating to night distribution of goods

2.1. NICHES Project

The aim of the NICHES project was to support at a high level the development and deployment of innovative and policy-based urban transport policies that will contribute to the development of sustainable urban transport systems. This project was expected to make a significant contribution to a more efficient and competitive transport system, a healthier environment and improved quality of life in urban areas.

Night Delivery is the delivery to retailers and shops in the inner city area during the night hours when the city is usually quiet and inactive. Typical times are between 10.00 p.m. and 7.00 a.m. In several cities such as Barcelona or Dublin, successful experiences with trials on night delivery are made replacing a (higher) number of vehicles operating during day time by a (fewer) number of vehicles operating during night time.

The Concept Inner-city Night Delivery addresses the following aspects:

- the delivery during night time with specially equipped low noise vehicles (low noise equipment, CNG etc.);
- allowance for larger trucks to enter the city centre which are restricted during the day time.

Key benefits:

- reduces delays for the logistics service providers by using the free road capacities at night;
- reduces emissions and energy consumption (less congestion during night time, direct access to the shops);
- enhances road safety.

2.2. PIEK Project, The Netherlands

The aim of the PIEK program is to reduce noise levels in the evening and night, of supply traffic, loading and unloading activities in residential areas. At the end of 1998 the renewed "Decree Retail Trade Environmental Protection" came into effect. This Dutch decree sets down that the noise emission level must remain within noise emission standards set. It stipulates that the noise emission generated when loading and unloading goods, in particular from trucks, between 19.00 and 7.00 hours must comply with strict peak noise standards:

- 19.00 – 23.00 hours 65 dB and
- 23.00 – 7.00 hours 60 dB.

Research has shown that many loading and unloading actions exceed the 60 and 65 dB noise standards.

The Ministry of Housing, Spatial Planning and Environment, the Ministry for Economic Affairs and the Ministry for Transport, Public Works and Water Management introduced a long-term PIEK (peak noise) program in 1999 in order to bring about the necessary technical adjustments, by tackling the source, to the means of transport, the materials used when loading and unloading goods and the loading/unloading locations.

The long-term PIEK project includes, for example measures:

- transfer of knowledge to the companies involved on a general level;
- stimulate quiet behaviour;
- create the optimal loading and unloading bay;
- low noise trucks (up to 7,5 tons);
- low noise trucks (over 7,5 tons);
- low noise transport refrigeration system;
- low noise take along forklift truck;
- reduce noise of roll containers, pallet-trucks and hand pallet-trucks;
- quiet shopping trolleys;
- electric drive or electric hybrid drive.

Key aspects an important issue during operation of night delivery is that the residents can complain about noise directly to the service centres. A permanent monitoring of the noise levels should guarantee that the noise levels do not increase by the used transport vehicles and drivers.

2.3. CIVITAS Project

CIVITAS is a network of cities for cities dedicated to cleaner, better transport in Europe and beyond. Since it was launched by the European Commission in 2002, the CIVITAS Initiative has tested and implemented over 800 measures and urban transport solutions as part of demonstration projects in more than 80 Living Lab cities Europe-wide. The knowledge garnered through these practical experiences is complemented, and supported, by a number of research and innovation projects (ECCENTRIC, PORTIS and DESTINATIONS), also run under CIVITAS. These research projects look at ways of building a more resource efficient and competitive transport system in Europe.

The project works on 10 thematic areas, related to sustainable transport mobility covering: Car-Independent Lifestyles, Clean Fuels & Vehicles, Collective Passenger Transport, Demand Management Strategies, Integrated Planning, Mobility Management, Public Involvement, Safety & Security, Transport Telematics, Urban Freight Logistics.

2.4. C-LIEGE Project

C-LIEGE is the showcase for good practices and a helpful hand for all European cities striving for cleaner and sustainable urban transportation. On the basis of good practices the project will define an integrated framework for energy efficient Urban Freight Transport (UFT) management and planning. A novel set of integrated solutions and "push-and-pull" demand-oriented measures will be tested and shared in roadmaps for the implementation in European cities. Seven pilot experiments in six European countries ensure the applicability of the C-LIEGE approach: Bulgaria, Italy, Poland, United Kingdom, Germany and Malta.

C-LIEGE empowers a cooperative approach between public and private stakeholders that is targeted on the reduction of energetic and environmental impacts of freight transport in European cities and regions. In order to reach this objective, C-LIEGE will promote cleaner and energy efficient freight movements in urban areas. The aim of the program integrated urban freight transport – more co-operation and better management for more energy efficiency and less CO₂.

3. Analysis Of Night Distribution In Selected States

3.1. Broadening Of Loading And Unloading Times - Amsterdam, The Netherlands

Several districts have set time windows for loading and unloading in order to reduce noise and unsafe situations, and to avoid congestion and to optimize parking spaces. Loading and unloading are permitted during certain periods of the day on one or more parking spaces. At congestion areas, one or more delivery bays are usually available. Outside these times, parking spaces are for cars. At certain locations, deliveries times for loading and unloading at night are not permitted. It is permitted within the boundaries of sound legislation: between 19.00 – 23.00 pm, up to 65dB and between 23.00 – 7.00 pm, up to 60dB. In the city of Amsterdam, delivery is available in pedestrian areas between 7.00 and 11.00 am.

Aim of project:

- to reduce the number of trip km per vehicle in order to promote the consolidation of goods among neighbour cities;
- to create flexible time windows by introducing one hour more in order to reduce kilometres per vehicle and freight traffic. With wider delivery times, the carriers will enable to supply more stores per trip, to plan better delivery routes resulting in fewer vans and Lorries in the city.

Results:

- reduction of kilometres:
Time windows: -4% kilometres of freight transport
Consolidation of goods: -5% kilometres of freight transport
- reduction of NO-concentrations:
Time windows: -0,1µh/m³
Consolidation of goods: -0,2µg/m³
LEZ's: -0,6µg/m³
Electric freight transport: -0,3µg/m³

3.2. Night And Off-Hours Deliveries- Ile De France

Stakeholders on the project are the city of Paris and carriers' and shippers 'associations. To deliver every day more than 700 000 establishments and around 11 millions of people, 1 million of deliveries and removals are done in Ile de France. The city of Paris and the most important carriers 'and shippers 'associations signed an urban freight transport charter, in which they committed to certain points, which are favourable to the environment, working conditions and the productivity of urban delivery activities. Paris has banned trucks during day time and on-street delivery areas must be at least 10 meter long, to facilitate truck's manoeuvres and the handling of goods. Some bus lanes are shared with delivery vehicles. In Paris deliveries in the afternoon are only allowed by commercial vehicles that are electric, gas or that follow Euro norms.

Table 1. Benefits of Night Distribution in the Ile de France; Authors based on [11]

	Current delivery	Night delivery	Gains
Departure time	7:22 hod.	21:23 hod.	
Kilometres	41 km	40,5 km	
Duration	2 hod.3 min.	1 hod.37min.	21%
Fuel consumption	32,4 l/100km	27,5 l/100km	10%
CO ₂ emission	1137,2 g/km	938,4 g/km	17 %
NO _x emission	4,9 g/km	3,8 g/km	22 %
PM emission	0,22 g/km	0,17 g/km	25 %

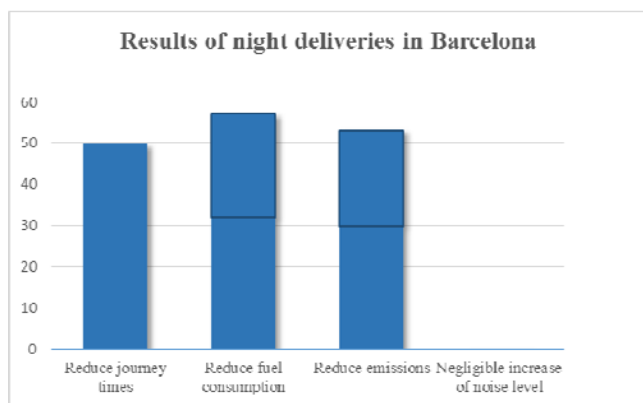
3.3. Night Deliveries In Barcelona

In Spain, all the cities have a provision of load zones and restricted access to zones depending on vehicle weight, normally banning trucks over 3,5t from city centres. There are also strict regulations such as city truck routes. Truck parking is normally limited to a maximum of 30 minutes and only as long as the load/unload operations are being carried out. The freight vehicles are sometimes allowed to use parking places and can be exempted to pay the parking meters. Within Barcelona, a night delivery trial was carried out concentrating the delivery processes between 23.00h and 24.00h in the night and between 5.00h and 6.00h in the morning. 40t trucks were delivering to grocery stores directly during the night instead of going to a regional distribution centre. The equipment used was noise adapted, both for the truck as well as the loading and unloading utilities. As a result, the trial was successful in terms of noise intrusion and from the commercial point of view. About 7 trucks could be replaced during day time allowing 2 large trucks to enter the city during the night time.

The operator Mercadona has demonstrated that quiet delivery is possible with a 30T lorry serving supermarkets with a rather large capacity and with substantial refrigeration facilities. The result is quantified in terms of noise measures compared to ambient noise levels on nights when the delivery was not being made; the average of the minimum values recorded during unloading inside buildings (23.5 dB) was 0.3 dB greater than those recorded before loading started; for maximum values, no difference was recorded for measurements inside buildings (33.4 dB), and the maximum values recorded in the street varied by only 0.1 dB average with unloading of 52.2 dB. It is important to know that in Spain the supermarkets (shop owners) are responsible for the organisation of the goods transports. They even rent trucks and decide directly about the logistics process.

Results:

- reduce journey times: 50%
- reduce fuel consumption: 32%-57%
- reduce emissions: 30%-53%
- more loading capacity
- not possible for small business (staff during night hours),
- Large investments for quiet vehicles and silent loading equipment's,
- Negligible increase of noise level: +0,2dB.

Table 2. Results of night distribution of goods in Barcelona [source: author]

The main arguments in favour of night time delivery from the shop owners' point of view are:

- reduction of cost by use of bigger vehicles during night time (consolidation);
- reduction of cost due to faster driving times during night time (night time driving takes only 1/3 of the time necessary during day time);
- and reduction of complaints from inhabitants.

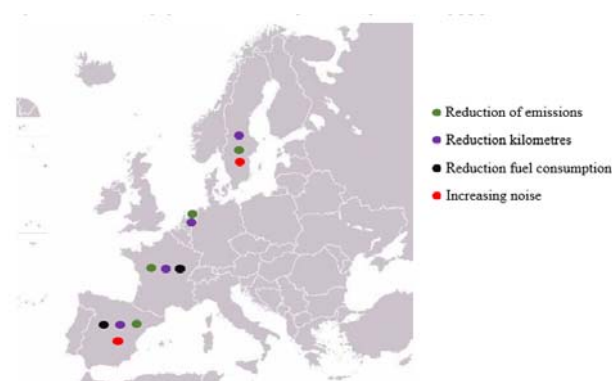
3.4. Night Deliveries In Stockholm

In Stockholm there are regulations prohibiting deliveries with heavy vehicles in the city centre between 22:00 and 6:00, to avoid night time noise. In 2014 the Stockholm freight plan 2014-2017 an initiative for safe, clean and efficient freight deliveries, was released with goals to improve accessibility and improve efficiency for urban freight transport. One of the activities was to conduct an OPHD pilot giving permissions for night time deliveries to two vehicles during 2015 and 2016. In parallel with the pilot a research project was started to assess the potential efficiency gains from OPHD for the private sector, evaluate the socio-economic benefits for society and the develop low-noise freight distribution solutions.

The evaluation of the pilot study showed that off-peak deliveries in general have better performance regarding driving efficiency, delivery reliability and energy efficiency. The driving speed on the same delivery route in off-peak is approximately 31% higher than in the morning peak using the data from the truck making dedicated deliveries, and the driving speed in the entire urban network in off-peak is 59 %

higher than in the afternoon peak based on data from the consolidated deliveries.

However, the sound emitted by the vehicles themselves (especially if noise reduction measures are applied) is less disturbing than the noise accompanying the loading and unloading. It is also important to take into account the basic noise: in zones with busy streets, failure was caused by a negative distribution, but on the other hand a more pronounced impact on the surroundings of small residential areas (4% higher). This suggests that there is no problem in the emergency areas of night-time trucking, while in many streets more measures are needed to reduce the impact of night-time distribution.

**Figure 1.** Results of night distribution of goods in selected countries according to analysed projects [source: author]

4. Noise Regulations In The Slovak Republic And Comparison With Selected Countries

At present, the protection of the area against noise in Slovakia is stipulated in the Decree of the Ministry of Health of the SR no. 549/2007 as amended by the Decree of the Ministry of Health of the SR no. 237/2009 Coll., which are the implementing regulations for § 27 of Act No. 355/2007 Coll.

Table 3. Noise level measurement values at night distributions [source: author]

Country	Acceptable sound pressure values for time intervals		Noise level at night distribution
	6:00-22:00	22:00-6:00	
Slovakia	60 dB	50 dB	
Spain	65 dB	55 dB	+ 0,2 dB
Sweden	70 dB	55 dB	+ 4%

In tab. No 4, the noise distribution values for night distribution in the selected analysed countries are compared with the values prescribed by the SR legislation. As is evident, the strictest rules are in place in Slovakia. As is true, for example, in shopping centres, in close proximity to residential areas, have control authorities in their competence.

Measurement of the noise level in Žilina at Škultéty Street, where complaints were made by the inhabitants of the disproportionate increase in freight traffic leading to the industrial part of the town on Kamenná Street. [16]. For example, in the time from 14:00 to 17:00, 128 trucks have crossed this street. The highest measured value was 79.6 dBA at 22:00 and 86.1 dBA between 14:00 and 17:00. (Figure 2).

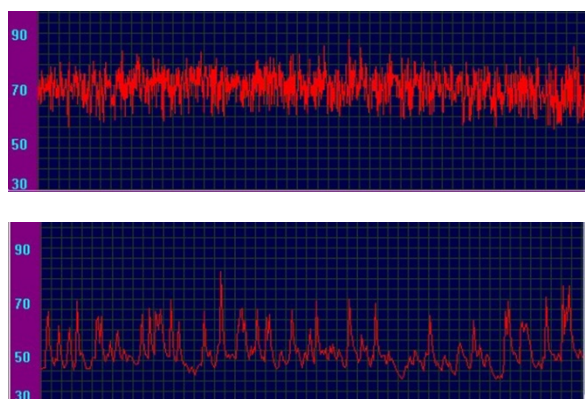


Figure 2. The course of measured noise levels at 14:00 to 17:00 (left) from 22:00. (right); Source: processed by authors [16].

Also, based on the measured data in Žilina, it is clear that we also have problems with freight transport noise in the Slovak Republic and it is therefore necessary to start systems for regulating road freight. In our reviewed street in Žilina, the regulation of road freight has been introduced since 2016.

5. Conclusions

Night distribution has not only an economic, environmental and social benefit that is substantially larger than noise generation through distribution. The night-time distribution system shows that logistics operations can be performed at night or early in the morning without creating a harmful noise problem for the population.

Traffic efficiency has improved from a number of aspects due to night-time distribution of goods in comparison with daily distribution. The truck's idle speed was on average 31% faster than at the time of the morning hours when the traffic is high. Average net network speed is nearly 60% higher than in the afternoon. It is important to keep in mind that in the busy streets the noise that is generated by the distribution is negligible. But on the other hand, the noise had a stronger impact on the surroundings in the quiet residential areas. We recommend that noise measurements be made and that afterwards they are taken.

Night off-peak distribution of goods reduces CO₂ emissions but also emissions of other pollutants that pollute the air. Therefore, night distribution of goods can contribute significantly to improving the quality of local air. However, noise abatement measures need to be applied, especially when handling loads and using less noisy Lorries.

REFERENCES

- [1] Pernica, P.: *Logistika pro 21.století*, III.diel,2004, ISBN 80-86031-59-4
- [2] *Innovative Approaches in City Logistics, Inner-city Night Delivery* [online], [cit. 2017-10-10]. Online available <https://www.polisnetwork.eu/uploads/Modules/PublicDocuments/14683_pn7_night_delivery_ok_low.pdf>
- [3] Methods of measurement for peak noise during loading and unloading [online], [cit. 2017-10-12]. Online available <<http://www.piek-international.com/english/news/default.asp?page=detail&id=26>>
- [4] Civitas projekt [online], [cit. 2017-10-12]. Online available <<http://civitas.eu/about>>
- [5] C-liege projekt [online], [cit. 2017-10-10]. Online available <<http://www.c-liege.eu/about.htm>>
- [6] State of the Art report "Urban logistics practices" [online], [cit. 2017-10-10]. Online available <https://www.sintef.no/contentassets/067ef756b7644281ad2514bef7955c53/gbo/gbo-l-2.1-state-of-the-art-report-urban-logistics-practices_1.pdf>
- [7] Transport Efficiency of Off-peak Urban Goods Deliveries: a Stockholm Pilot Study [online], [cit. 2017-10-15]. Online available https://people.kth.se/~jenelius/FJ_2017.pdf
- [8] Výskum nočnej distribúcie, Transport a logistika, Ročník 19, č.3 (2017), str.24,
- [9] Dopravná politika: všeobecné informácie [online], [cit. 2017-11-02]. Online available http://www.europarl.europa.eu/atyourservice/sk/displayFtu.html?ftuId=FTU_5.6.1.html
- [10] Biela kniha, Plán jednotného európskeho dopravného priestoru – Vytvorenie konkurencieschopného dopravného systému efektívne využívajúceho zdroje, KOM(2011) 144, Brusel 28.3.2011
- [11] Barriers and opportunities for night time deliveries in urban context: A French case study, [online], [cit. 2017-11-10]. Online available <http://www.wctrs.leeds.ac.uk/wp/wp-content/uploads/abstracts/lisbon/general/01022.pdf>
- [12] Vyhláška Ministerstva zdravotníctva Slovenskej republiky č. 549/2007 Z.z., [online], [cit. 2017-11-12]. Online available http://www.uvzsr.sk/docs/leg/549_2007_hluk_infra.pdf
- [13] Gnap, J.: Mestská logistika alebo regulácia cestnej nákladnej dopravy, Transport 9/2010, Vydavateľstvo LUXUR Media s.r.o., ISSN 1235-7433, s. 39
- [14] Šarkan, B.- Gnap, J.- Caban, M.- Vrabel, J.- Merczuk, A.: Composition of exhaust gases of spark ignition engine under conditions of periodic inspection of vehicles in Slovakia, Przemysl Chemiczny, vol.96, iss.3 (2017) s. 675-680, ISSN 0033-2496, DOI: 10.15199/62.2017.3.36
- [15] Paris- enviromental situation, [online], [cit. 2017-11-12]. Online available http://www.airqualitynow.eu/city_info/paris/page2.php
- [16] Noga, M.: Vplyv dopravného prúdu na hluk, Diplomová práca (vedúci práce: Gnap, J.), Žilinská univerzita v Žiline, Fakulta PEDAS, 2012