

DELIVERY VEHICLES CITY LOGISTICS AS A FACTOR OF TRAFFIC SAFETY

Dragana NENADIĆ

University of East Sarajevo, Faculty of Transport and Traffic Engineering Dobo, Bosnia and Herzegovina

Abstract

A big number generators of a city logistics initiates great amounts of merchandise flows every day, which considerably affects the town's traffic. Retail stores are the most frequent generators in the city logistics structure and represent about one third of all generators. The main goal of this paper is defining the parameters of retail stores in the urban area of the town of Brod and a special review of delivery spots and time of delivery vehicle's parking. This parameter – dock front that don't exist in most generators - is the factor that blocks the streets and, often, puts the safety of all road users in danger. Suggestions for improving these circumstances are made in the end of the paper in order to increase the traffic safety.

Key words: city logistics, traffic security, delivery

INTRODUCTION

Discussions about the concept of urban areas started in 1986 by Frideman [1], who had starting ideas, through Sassen [5], who did some research in the city logistics field, and are current in present. Different authors indicate the problems with urban areas and the negative effects which are the consequences of those problems.

In order to keep the economic growth of cities and towns, but also to fulfill all the requirements of City logistics, the number of delivery vehicles in urban areas of towns is increasing, which has negative consequences such as: towns' traffic being stuck, air pollution, noise, time losses, etc. Mainly for that reason, City logistics should be one of the basic ways for keeping the development of urban areas on the one side, and getting the most effective realization of more frequent and smaller deliveries on the other. Based on a research and analytics of all the parameters which noticeably effect the traffic safety, the data about the

influence of delivery vehicles in the town of Brod on traffic safety has been collected. The data is primarily focused on 'vulnerable' traffic participants - pedestrians, who are directly endangered by delivery vehicles parked on sidewalks. The problem of pedestrians' safety in urban areas is very present, and is talked about in significant papers published in Bosnia and Herzegovina [2;3] and abroad [4;10;11]. Specifically, this paper analyses retail stores as the parameters of City logistics generators, in the town of Brod's area. The goal of the paper is to propose an example of suggestions for increasing the town's traffic safety, based on collected data about the current state of cargo flows, through both certain conceptions of City logistics and the field of traffic safety itself. According to [8] the awareness of parameters is necessary in order to plan urban areas' logistics and solve problems; and by defining and analyzing them the insight in cargo flows in the urban area is gotten. The paper shows next parameters: the structure of retail stores work, retail stores objects, delivery frequency, types of delivery vehicles, delivery durations, and the spots delivery vehicle park at, etc. where all of them in the one part negatively influence the town of Brod's population. Besides the analyzes of the parameters, the paper contains the data from the poll with citizens in which they've been questioned on the subject of their own safety in traffic when deliveries are done in non – delivery places.

1 CITY LOGISTICS STRUCTURE GENERATOR

1.1 Structure of activity

Based on the data provided by Town's Economy Sector in Brod, there are 561 generators of different activities, which are shown in Chart 1. Based on the chart, we can see that the biggest number of generators is retail stores, making the third out of the total number of generators, more accurate – 37,255%. Retail stores have great participation as generators in all urban areas in general, which is confirmed by the research from paper [7], in which retail stores make 33%. They are the main goal of this paper's research because of their big participation. After them, the biggest participation have restaurants, bars and clubs with 26.56%, and then handicraft shops with 17.469%. Pharmacies have relatively small participation – 1.961%. The rest of the generators are: administrative and government objects, educational objects, construction, betting shops, banks and currency exchange offices, private offices etc., which are all in 16.756%.

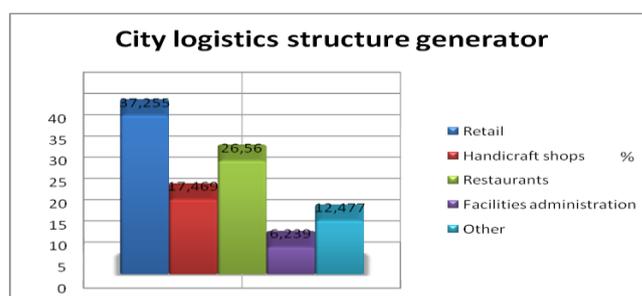


Chart 1. City logistics structure generator

1.2 The structure of retail stores

With the biggest percentage the retail stores include different City logistics generators, from which the boutique shops are leading with 69.856%. After them, there are grocery shops with 22.01%, then supermarkets with 5.263%, kiosks with 0.957% and the rest with 1.914%. The rest are flower shops, book stores, perfumery shops, car part shops, etc. This data is in Chart 2.



Chart 2. The structure of retail stores

2 PARAMETER ANALYZES

2.1 Retail stores objects

When talking about retail stores parameters, the data in this paper is about the parameters that have the biggest influence on the town's traffic safety. The first of those parameters is a driveway purposed only for delivery vehicles. The data that is collected in the research is: from the total number of retail stores, specific driveways have 5.742% of the stores, while 94.258% don't have driveways for deliveries. For that reason, the greatest number of merchandise deliveries is done at the main entries of the stores, which is done by 93.258% of the stores and only 6.126% of them deliver their merchandise at the back entries. This data is shown in Chart 3. Considering that the greatest number of retail stores are boutique shops, the data observed shows that most of them don't have warehouses or stockrooms – 88.995% of them. Only 11.005% of the objects have stockrooms or warehouses for their merchandise and that data is shown in Chart 4.

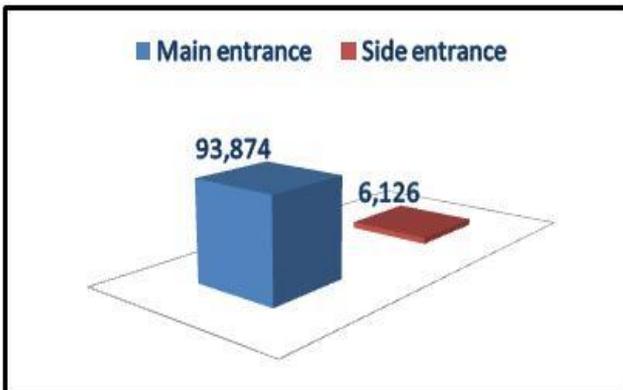


Chart 3. Delivery entrance

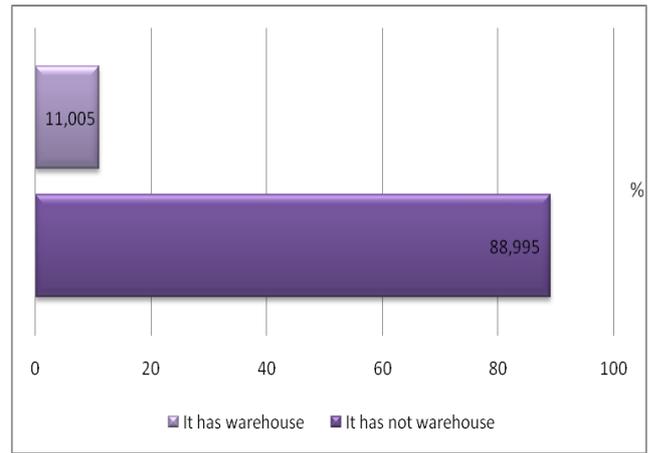


Chart 4. Warehouses

Considering the number of deliveries, with the biggest number of retail stores being boutique shops, delivery is done 2 to 3 times a week by 54.965% of the stores. Besides boutique shops, this type of delivery is done by groceries shops too. Getting merchandise weekly is done by large number of retail stores, mostly grocery shops and supermarkets with 19.581%. Everyday deliveries are done in 12% of the stores, mostly in malls, kiosks and grocery shops. Some boutiques get deliveries 2 to 3 times a month, based on monthly sales and their percent is 13.45. All of the data above is in the Chart 5.

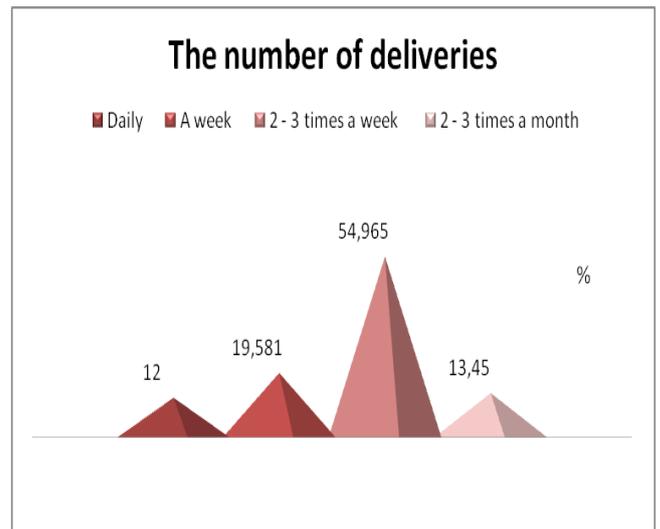


Chart 5. The number of deliveries

2.2 Delivery vehicles

The data about the types of delivery vehicles for retail stores in Brod is also collected in the research and shown in Chart 6. Vans are the type of vehicle used in almost all of the generator, used 49.378% of the stores. That means that almost half of cargo flows is done with these vehicles. Besides vans, the most used vehicles are Volkswagen Caddies – 24.586% of the stores use them, and passenger cars – 23.596%.

The least used delivery vehicles are trucks, which are used only in bigger malls, being 2.44% of delivery vehicles.

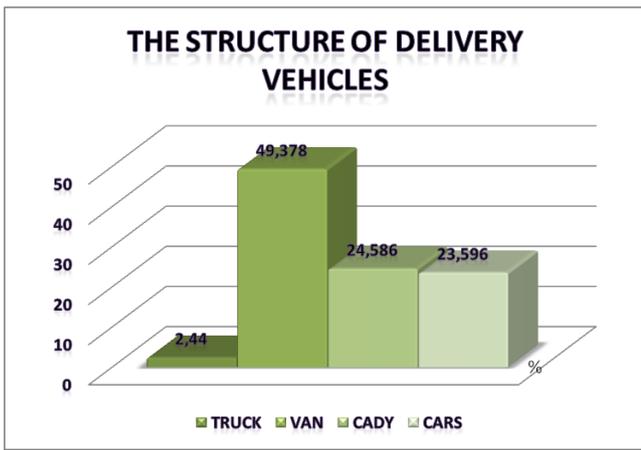


Chart 6. The structure of delivery vehicles

When examining parking spots for delivery vehicles there are several places used. The most common place used for deliveries is sidewalk, used by 45.632% of stores, then the road – 34.378% - which is one of the biggest problems in traffic safety, for both drivers and pedestrians. 12.502% of delivery vehicles park on marked parking spots, while 7.49% of them deliver merchandise in the places that are meant for that – delivery zones. All of the data above is in Chart 7. Based on the data, we can conclude that the biggest number of traffic participants is endangered by delivery vehicles, considering that the most common duration of a delivery is 10 minutes, in which time is 15 pedestrians and about 70 vehicles are noted to pass, especially in the central parts of town. When we talk about the duration of delivering merchandise, the most common time is between 5 and 10 minutes – 40.166% of deliveries are done in that time, then 10 – 15 minutes – 13.34%, then 15-20 minutes – 17.751%, then 20 – 30 minutes – 24.892%, then 30 – 60 minutes – 2.424% and over 60 minutes – 1.247%. The data about delivery duration is shown in Chart 8. Based on this data, we can see that, along with the most common duration being between 5 and 10 minutes, the next most common time of delivery is around 20 to 30 minutes. That tells us something – if between 5 and 10 minutes we have about 15 pedestrians and 70 vehicles passing by, in 20 to 30 minutes that number gets bigger 3 or 4 times. According to that, traffic safety is very much put in jeopardy, because bigger number of traffic participants is encountered with unsafe situations of safe passage of roads, but also getting into great traffic jams caused by this type of parking. Chart 8 shows us this data.

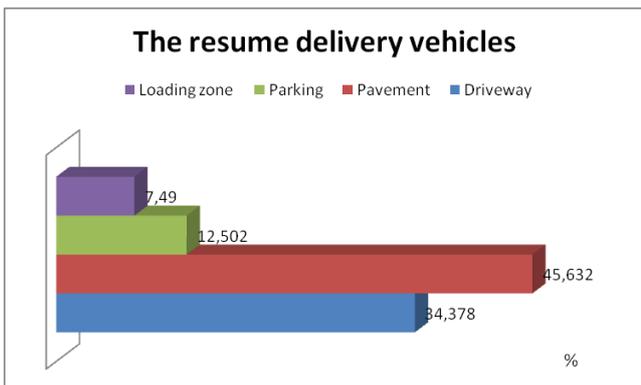


Chart 7. The resume delivery vehicles

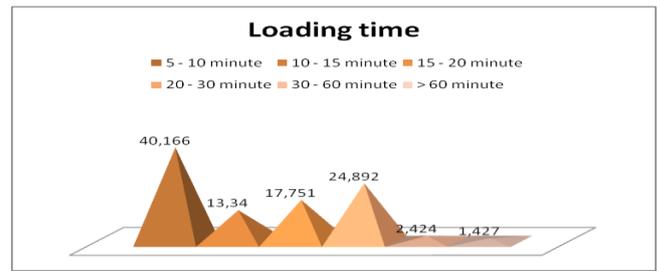


Chart 8. Loading time

3 DELIVERY VEHICLES AS A FACTOR OF TRAFFIC SAFETY

Besides the done research, a poll among the citizens of Brod was held, in order to get the data about the influence delivery vehicles have on traffic safety. First of all, the employers of the retail stores were questioned have the accidents ever happened during deliveries, and 15.333% of the answers were positive, and 84.667% said an accident never happened. Considering that 100 employers were questioned, the percentage of 15.333% is not insignificant. The data about this is shown in Chart 9.

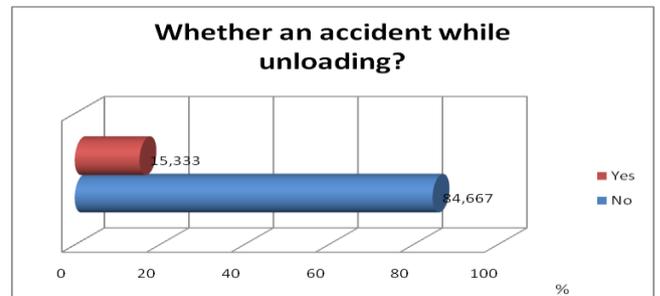


Chart 9. Wheter an accident while unloading?

Because of that, the conclusion of this paper will have some suggestions for increasing traffic safety for all participants. Passers were asked questions too. Passers were examined by asking several questions, which they answered, and that were recorded. The first question was: Do you have an accurate view of a road when you come across a delivery vehicle parked on a sidewalk or a road (which is mostly the case)? Out of a hundred passers questioned, 46 answered yes and 54 answered no. According to that, more than half of passers questioned have been endangered by a delivery vehicle in a way that they had to wait or pass the vehicle in their own risk.

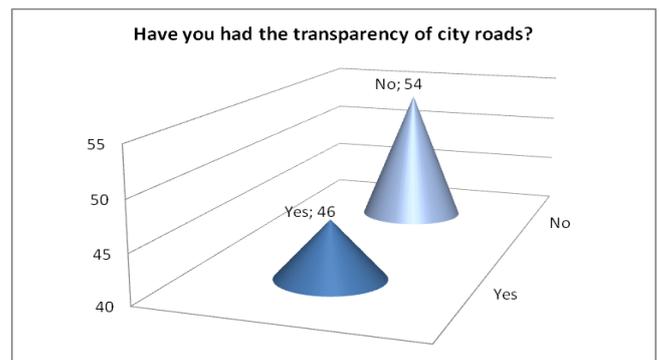


Chart 10. Have you had the transparency of city roads?

The next question was: Have you ever had an accident caused by a delivery vehicle parked illegally, on which 9 had a positive answer, 26 said they succeeded in avoiding an accident and 65 said they never had an accident. This data is shown in Chart 11.

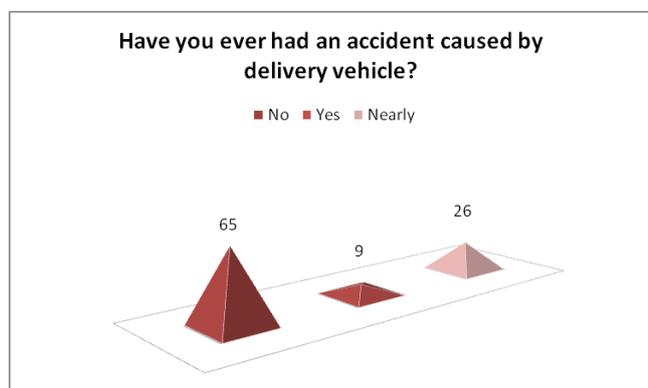


Chart 11. Have you ever had an accident caused by delivery vehicle?

These data shows that more frequent delivery in the territory of the city threatens the safety of road users that exist in the town of Brod. Because of that, there are some suggestions for increasing the safety if city traffic.

4 SUGGESTIONS FOR INCREASING THE SAFETY OF CITY TRAFFIC

4.1 Special delivery driveways

The biggest number of merchandise deliveries to retail stores is made at the main entries to the stores. That is the reason why delivery vehicles' park on sidewalks, roads, or marked parking spots. However, a solution for replacing these vehicles during deliveries is building special driveways that are purposed only for them. Building these driveways would make merchandise deliveries safe for traffic participants and make no traffic holds or time losses. There is also a need for including a certain regulative which can regulate the existence of delivery zones according to the size of city logistics. There is an example of this – in the city of Paris it is given that any commercial store bigger than 250 sq. meters has to have its own delivery zone aside from the roads, as said in [13]. Considering the fact that this paper is about a small urban area, which cannot be compared to the example above in any way, it is possible to adjust the regulative to the specific case. It would mean that the size of a generator that has to have a delivery zone in the town of Brod would have to be much smaller.

4.2 The organization of Traffic

Considering the town's traffic, the first notable thing are different amounts of traffic participants in different periods of a day. In urban areas, some periods of a day are busier than others – those are the time periods when the traffic is larger in a town or a city. Usually, that time is the time city's residents go or get off the workplaces. Knowing about that data, we can give a suggestion for traffic organization, which would mean delivery vehicles are

forbidden to operate at that time, before all. Doing that, big traffic jams that are made by parking delivery vehicles on roads would be avoided. The next step would be to count the number of roads, and based on the PDS to determine at what time there is the least number of vehicles passing and do deliveries at that time to the objects which are in the urban area. In the area of Brod, more precisely in the two city streets was carried out traffic counting, in order to get concrete information on the number and types of motor vehicles. The counting was done in two city streets, streets of St. Sava, the main street of town Brod, and street 7 October where we have a large number of retail. The counting is performed in the peak time, that is, from 7 to 8 o'clock in the morning and in the afternoon, more precisely from 13 to 14 hours. Counting was carried on working and weekend days, to show the differences between them. The recorded data are as follows:

The average number of motor vehicles that operates on city streets on working days is:

- From 7 to 8 hours: 850 motor vehicles.
- From 13 to 14 hours: 470 motor vehicles.

The average number of delivery vehicles that operates on city streets on working days is:

- From 7 to 8 hours: 70 delivery vehicles
- From 13 to 14 hours: 30 delivery vehicles.

On weekends, we have significant changes in the number of vehicles in view that the peak time is not so burdened.

The average number of motor vehicle that operates on city streets weekend days is:

- From 7 to 8 hours: 480 motor vehicles
- From 13 to 14 hours: 600 motor vehicles.

The average number of delivery vehicles that operates on city streets weekend days is:

- From 7 to 8 hours: 30 delivery vehicles
- From 13 to 14 hours: 8 vehicles.

This shows us that there is a big difference between the day, and that means, delivery vehicles can operate in urban city areas at the time when there's no traffic jam. That would increase traffic safety for every traffic participants.

4.3 The possibility of applying conceptive solutions

One of the ways of solving the problems of city logistics is the use of its conceptive solutions which can be found in [12]. Considering everyday changes that happen (according to [9]), applying one concept of city logistics doesn't have to mean needed improvement, therefore the forming of a script of city logistics is something to aspire to. Through forming a script of a city logistics by the use of the concepts of consolidation and cooperation it is possible, according to [6], to make certain savings in the economic aspects, as well as reduction of negative aspects that cargo traffic makes in urban areas, therefore increase environmental pollution.

CONSLUSION

After the research has been done, and the data collected in it for the certain urban area has been analyzed, a big influence of delivery vehicles on the traffic safety for all participants is noted. The reason for that is the number of delivery vehicles in the town of Brod's area has been increasing. The first suggestion for increasing the safety is

building special delivery driveways in retail stores. If that was done, all delivery vehicles would be removed from roads, sidewalks and parking spots, which would allow easy and safe movement for the residents of this area. One of the other ways to solve the problems that delivery vehicle cause is to organize the town's traffic. For that reason the counting of participants in traffic was made and with that the organization of traffic in the terms of setting the time periods in which delivery vehicles can drive and operate can be made. The last suggestion made is about the conception of city logistics, which has importance in the urban development, especially smaller towns in which we have increasing number of the generators of the city logistics, including the retail stores.

REFERENCES

1. Friedmann, J., 1986. *The world city hypothesis*. Development and Change 17, 69- 84.
2. Marić, B. 2016. *Bezbednost saobraćaja u zoni pešačkih prelaza*, doktorska disertacija, Saobraćajni fakultet Beograd.
3. Marić, B., Šmitran, G., Tešić, M. i Đerić, M. 2015. *Bezbednost pješaka na putevima Republike Srpske*. IV međunarodna konferencija Bezbednost saobraćaja u lokalnoj zajednici, Banjaluka str. 87-94
4. Pulgurtha, S. S., V. Vasudevan, S. S. Nambisan, and M. R. Dangeti, 2012. *Evaluating the Effectiveness on Infrastructure-Based Countermeasures on Pedestrian Safety*. Presented at the 91st Annual Meeting of the Transportation Research Board, Washington, D.C.
5. Sassen, S., 1991. *The Global city: New York, London, Tokyo*. Princeton University Press, Princeton. Revised edition.
6. Stević Ž., (2016). *Formiranje scenarija city logistike Doboja u cilju smanjenja zagađenja životne sredine*. 6. Međunarodni simpozijum o upravljanju prirodnim resursima, Zaječar, str. 82-89
7. Stević Ž., 2011. *Parametri city logistike Doboja - trgovine na malo*, III Međunarodni simpozijum Novi horizonti saobraćaja i komunikacija, Doboj, str. 569-574
8. Stević Ž., Alihodžić A., Vasiljević M., 2015. *Delivery vehicles city logistics as a factor of environmental pollution* V International Congress Biomedicine and geosciences - influence of environment on human health Belgrade, pp. 235-246
9. Stević Ž., Tanackov I., Vasiljević M., Vesković S., 2016. *Evaluation in logistics using combined AHP and EDAS method*, XLIII International Symposium on Operational Research SYM-OP-IS pp. 309-313
10. Transport Research Laboratory, (2006). *Factors Influencing Pedestrian Safety: A Literature Review*.
11. Wang, S., Yang, J., Hu, C., and Chen, Y. 2011. *Study on pedestrian safety evaluation and improvement at urban intersections*. Proc., ICTIS 2011, 1st Int. Conf. on Transportation Information and Safety: Multimodal journal of transportation engineering © asce / february 2013 / 171 Approach to Sustained Transportation System Development-Information, Technology, Implementation, ASCE, Reston, VA.
12. Zečević S., Tadić S., 2005., *Cooperation models of city logistics*, Transport & Logistics, Beograd 9/2005. pp. 13-141
13. Zečević S., Tadić S., 2006. *City logistika*, Saobraćajni fakultet, Univerzitet u Beogradu, Beograd

Contact address:

Dragana Nenadić,

Faculty of Transport and Traffic Engineering

74000 Doboj Vojvode Mišića 52

E-mail: dragana_95@hotmail.com