

## Methods of Goods Delivery to the Historic Core of the City of Šibenik During the Tourist Season

Darijo Šego<sup>1\*</sup>, Martina Ljubić Hinić<sup>1</sup> and Ana-Mari Poljičak<sup>1</sup>

<sup>1</sup>*Polytechnic of Šibenik, Department of Traffic, Trg Andrije Hebranga 11, 22000 Šibenik, Republic of Croatia; Email: darijo@vus.hr, ljubicvus@gmail.com, jankovic@vus.hr*

**\*Corresponding Author:** Darijo Šego

**Abstract:** City logistics has the goal of optimizing the entire logistics system within the city area and thus positively impact the quality of life. Different measures and initiatives, aimed at the optimisation of city logistics and reduction of the negative effects of urban freight transport are access zones or goods (freight) receiving points in the city centre, restrictions of vehicle dimensions, time schedule of delivery, consolidation strategies, use of urban distribution or consolidation centres, use of electric cars, use of urban public transport and mobility management. In the last couple of years, the city of Šibenik has experienced a tourism boom, which includes the organisation of numerous festivals in the old town core, an increase in the number of visitors, an increase in the number of catering and shopping facilities, private accommodation units, hotels and hostels. The increased number of tourists and commercial establishments also broaches the question of delivery of food and non-food products into the old part of the city, especially during the tourist season.

**Keywords:** Supply, concepts, city of Šibenik, urban consolidation centre

### 1. Introduction and Literature Review

Logistics activities, such as the transportation, consolidation and distribution of goods in cities, can be unified under the term “city logistics” [1]. The author [2] defines city logistics as the process of optimising logistics and transportation activities of individual companies in an urban area, while taking into account factors related to traffic, energy and the environment, and the organisation of urban transportation with the aim of meeting specific criteria. According to the author [3], the goal of city logistics is to optimise the entire logistics system within the city area and thus impact the quality of life in the city in a positive manner without influencing the level and quality of distribution to any significant extent.

According to [4], city logistics can be deemed a branch of transport modelling which deals with the typical problems related to urban freight transportation, such as congestion, time window rules,

the loading and unloading of goods in the street and environmental emissions caused by cargo vehicles. The distribution of urban goods plays an important role in the sustainable development of the city, aids in supporting the urban way of life and carrying out and maintaining industrial and commercial activities and contributes to the competitiveness of industry in the respective region. Despite the importance of its role, the distribution of goods is also in conflict with other urban functions, thus causing negative (economic, environmental and social) impacts such as air pollution, traffic accidents, noise disturbances, reduced local traffic safety, lack of reliability in travel and delivery delays [3].

The optimisation of freight movement is considered one of the main goals of city logistics, with four groups of participants: manufacturers, distribution companies (freight forwarders, shipping services), consumers/recipients (shops, food suppliers) and city authorities [2,4,5]. Different measures and initiatives are aimed at improving and optimising city logistics and reducing the negative effect of urban freight transportation, such as transshipment areas or points in city centres, restrictions of vehicle dimensions, time schedules and delivery restrictions, consolidation strategies, use of urban distribution or consolidation centres, use of electric cars, use of public city transport and mobility management [1,3,6].

Among the alternatives for mitigating the negative external impacts of freight transportation, that include the city logistics concept, is also the city cargo centre for urban cargo (urban consolidation or distribution centre), which is described as an important factor for the improvement of the logistics process in cities [6]. Even though there have been a few unsuccessful attempts at establishing such centres and research of their role in city logistics during the 1990s, the period after the year 2000 has seen a renewed interest in these centres, due to the examples of implemented initiatives or research of European cities such as Berlin, Rome, Lyon, Nijmegen, Bristol, West Pomeranian Region, Padua, Athens, Copenhagen, Bologna, Milan, Venice, La Rochelle, Bordeaux, Porto and Belo Horizonte in Brazil [4,7-10].

## **2. Existing Mode of Supply of the Old Part of the City of Šibenik**

The old part of the city of Šibenik represents the main tourist landmark of the city, with narrow stone streets, St. Michael's Fortress, St. Jacob's Cathedral, small squares, the city museum, remains of the medieval city walls, the theatre and numerous churches, dating from the Middle Ages until the beginning of the last century. Apart from these tourist landmarks, festivals are also held within the old city core and they attract numerous visitors from other regions of the Republic of Croatia, Europe and the rest of the world. In the old part of the city of Šibenik, there are a few small hotels, hostels, numerous private accommodation opportunities in apartments and around 68 catering facilities (restaurants, cafés, cake shops, fast-food establishments) and 32 shopping facilities (shops

with food and non-food products), which procure their goods from the same or different suppliers. A large number of catering and shopping facilities are open only from mid-April until the end of October, i.e. during the tourist season, when the number of tourists and the supply needs are at their highest [11]. The subject of research in this paper is to find a city logistics concept which would enable the old part of the city to organise delivery in a quality manner during the tourist season.

The scientific methods that have been used in the work on this paper are the statistics method (for the processing and comparison of collected data), the compiling method (use of facts, knowledge and data from previous research and authors relevant for the fields of the said research), the analysis and the synthesis method (analysis of information and data collected, on the basis of which appropriate conclusions and proposals of possible solutions have been developed), the interview method (expert interviews with persons from the Šibenik city authorities responsible for the area of logistics).

The tourism boom in the city of Šibenik in the last couple of years includes the organisation of numerous festivals in the old city core, an increasing number of visitors, who stay in the accommodation facilities and visit the old part of the city, and year after year, an increase in the number of catering and shopping facilities, private accommodation units, as well as the construction of a few new hotels. The increased number of tourists and facilities also broaches the question of delivery of food and non-food products to the old part of the city, especially during the months of May, June, July, August and September, when the number of open establishments and tourists in the city is at its highest.

According to the authors, [2,4,5] the flows of goods in the cities can be divided in three basic categories, namely: the flows of goods towards and from an individual establishment, flows of services and other flows of a commercial purpose, while the supply of cities takes place by applying the centralised (internal – for establishments owned by a company with an own distribution network, which supplies its facilities from its own distribution centre, and external – for establishments supplied by a wholesaler or when all suppliers send their goods through one transportation company which has its distribution network), decentralized (goods come to a specific establishment via multiple suppliers) or hybrid supply system (combination of the centralised and decentralised supply systems). The existing manner of goods distribution towards shopping and catering facilities in the old part of the city is a hybrid system, i.e. a combination of the centralised and decentralised systems. The centralised system is applied by a few large trading companies, which have their shops in the old city, but their main warehouses are in the Zadar and Split-Dalmatia counties.

The decentralised system is applied by all shopping and catering establishments in the old city. The mode of goods delivery by means of a decentralised system causes problems because suppliers

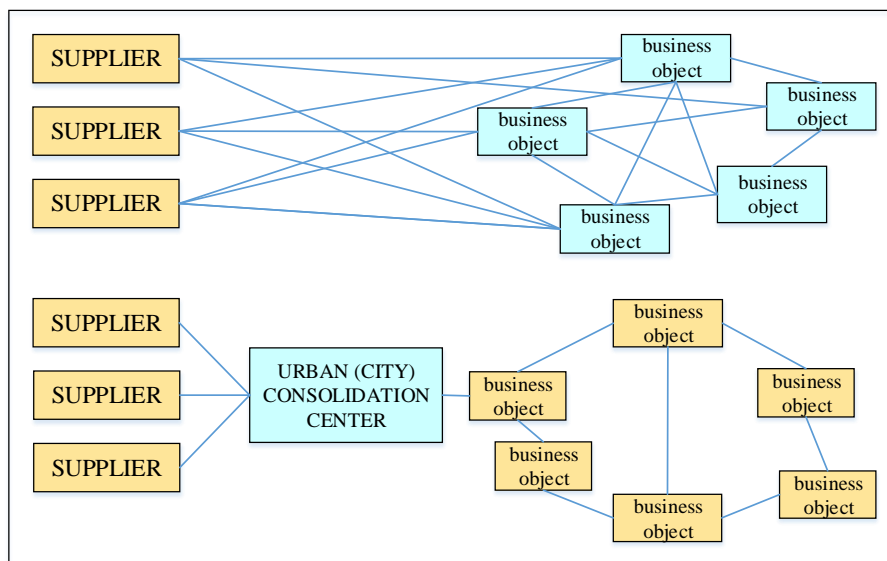
of different types of goods carry out the distribution of larger or smaller quantities of necessary products with their road vehicles several times per week, thus causing additional traffic jams. Namely, the delivery vehicles are mostly parked on the city streets, which generally have only one traffic lane in each direction, which means that the vehicles thus occupy parts of the road and create traffic congestion. Also, some shops procure their goods from the same suppliers, for which reason the suppliers deliver the goods in very small quantities every day, thus increasing their transportation costs, because they need to be on the road for a very small quantity of delivered goods, and the utilisation rate of the vehicles is very low.

For the purposes of this paper, we have carried out a survey on delivery, which covered catering and shopping establishments in the old town core of the city of Šibenik. 37 catering establishments participated in the survey, out of which 30 have daily food and drinks deliveries (81%), while 7 do not have daily deliveries (18,9%). Out of the shopping establishments, 5 have daily deliveries (15,6%), while 13 do not have daily deliveries (40,6%). Catering establishments that order food and beverages every day do not have their own warehouse premises and, when they have used up one type of product, they immediately order it anew, whereas those that do not have delivery on a daily basis have appropriate warehouse premises. The shopping establishments are in a similar situation.

### **3. The Method of Goods Distribution to the Old Part of the City by Applying the Urban Consolidation Centre and Transshipment Points**

The delivery of goods to the old part of the city poses certain problems, because there are many places which expect delivery, such as shops, restaurants, shopping centres and public institutions, which leads to traffic congestion during the day on the main arteries that lead from/to the city centre, an increase in CO<sub>2</sub> emissions, particles and other compounds in the air that are harmful for people, an increase in noise levels, the number of accidents and vehicle collisions, an increased fuel consumption and wear of the vehicle components, as well as increased stress for drivers [12]. In order to reduce the negative effects of deliveries and urban freight transportation, the local (city) government uses rules that mostly refer to parking regulations, restrictions in the times of movement and dimensions of vehicles that are allowed to enter the city centre, regulation of delivery times and the places used for loading/unloading of the goods (access zones or points) that are necessary to commercial establishments [7,13] and various measures and initiatives aimed at improving and optimising city logistics, which include the reduction of the negative effects of urban freight transportation by using urban distribution or consolidation centres, the use of electric vehicles and public city transport [1,3,6].

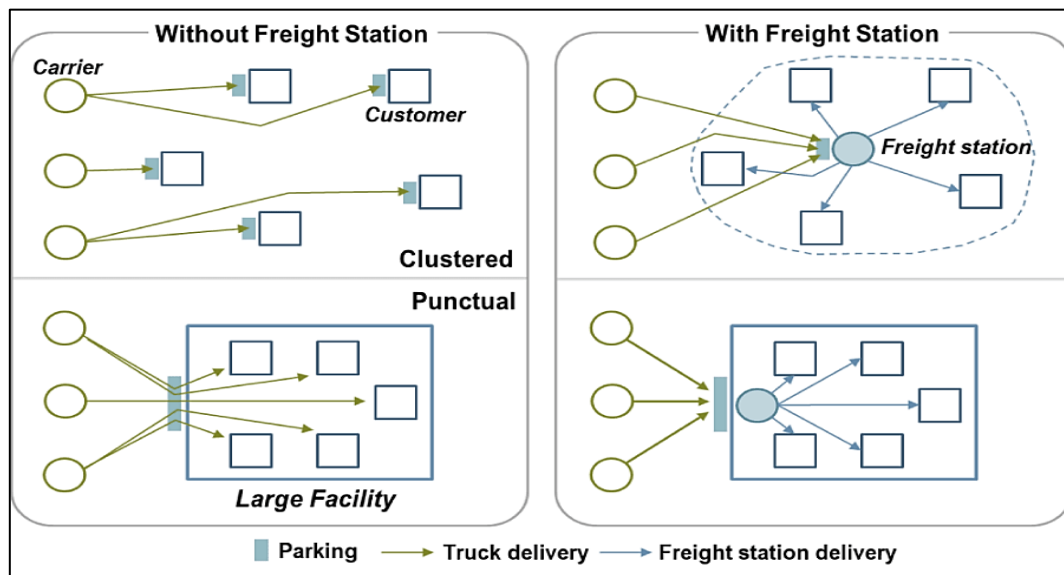
The urban consolidation centre has a central role in many solution concepts for the reduction of the influence of urban freight transportation [14], it plays a key role in the supply chain, has the goal of rationalising the distribution of goods in accordance with the interests of the city authorities, the local population, city visitors, traders and caterers, transport operators and suppliers [6]. Situated on the edge of the city it services, it plays a key role in the supply chain, because it constitutes a modal point, in which the assembled freight is transhipped from large freight vehicles and freight transportation units, aggregated and consolidated into smaller, more flexible vehicles that deliver goods to the city centre from access zones or points [9,14,15] (Fig. 1).



**Fig. 1** Delivery of goods to the city in cases without (above) and with an urban consolidation centre (below). Source: [17]

The urban consolidation centres are most frequently situated at locations which are a few kilometres away from the city centres, and there are no residential areas in their immediate surroundings, but there is a good and fast road connection and necessary communal infrastructure. The potential location, with a large plot area and infrastructure, as is necessary for the construction of this type of centre for the city of Šibenik, is the area of the former military barracks Bribirski knezovi. The location is connected to the city centre via the state road D8, while the access to the A1 motorway [16] is also in its immediate proximity, and it would be constructed in accordance with the public-private partnership model. The arrival of large delivery vehicles from the urban consolidation centre to the edge of the old city core, the entry and movement of vehicles within the old core creates a lot of congestion in the city streets, noise, air pollution with vehicle exhaust fumes, the disapproval of tourists and the domestic population, damage to the stone pavements and difficulties in the total functioning of the old town core, especially at the time of the summer tourist season.

Due to the above, the goods intended for commercial facilities in the old town core directly from the consolidation centre to the access points or receiving zones (point of cargo reception or transshipment point (location) that constitute a micro-location platform on the edge of the old town core as part of the road which, at specific times, is reserved for the loading and unloading of goods [17] on the edges of the old town core, would be distributed by means of light delivery vehicles, while electric delivery vehicles would deliver them from the freight receiving points to the facilities in the old core itself (Fig. 2) [18].



**Fig. 2** Delivery of goods to city centres by using access points for receiving cargo.

Source: [20]

In the literature, the delivery of goods from the access points to the commercial facilities as the final section is referred to as “the last kilometre” [4]. The benefits of such a manner of reception are an increase in successful deliveries, optimisation of transportation routes, decrease in environmental pollution and less traffic congestion caused by freight transportation in the very city centre [8]. Due to a hilly terrain configuration, narrow streets, a large number of stairs, old houses and facilities of public and private purposes (red lines on Fig. 3 indicate the boundaries of the old part of the city), it is desirable to establish two freight receiving points or transshipment points in the old part of the city of Šibenik. The first available and potential freight receiving point for the supply of the old town is the present car parking lot on the waterfront (the street Obala Hrvatske ratne mornarice) (Fig. 3, blue circle), while the second point is part of the Kralja Zvonimira street before the Croatian National Theatre Šibenik building (the premises of the former Old Market) (Fig. 3, green rectangle).

The first freight receiving point could supply the catering and shopping facilities in the areas of the streets Obala Hrvatske ratne mornarice, Doktora Franje Tuđmana and Palih omladinaca, and parts of the streets Vladimira Nazora, Sarajevska and Biogradska (Fig. 3, blue arrows). The second freight receiving point could supply the catering and shopping facilities from the area of the old

town centre to St. Jacob's Cathedral, as well as parts of the streets Zadarska, Miminac, Težačka, Kninska and Ive Zanimovića (Fig. 3, green arrows).



**Fig. 3** Possible cargo delivery points for the supply of the old part of the city of Šibenik.

Source: [21]

The border between these two supply areas would be the Kralja Tomislava street, that leads to the Cathedral (street without stairs which represent an obstacle for delivery vehicles in the old town). Time restrictions, such as the city logistics initiative of the city authorities, restrict delivery vehicles from entering the city centre in a specific period. Vehicles are usually permitted delivery only during specific hours, at which the inhabitants and guests are not disturbed by their activities. Time restrictions can improve the attractiveness of the city centre and the safety of traffic [4].

#### 4. Methods of Goods Delivery to Old Town Cores in the Large Dalmatian Cities

With the aim of solving the said problems of goods delivery to the old town cores, the large Dalmatian cities (Zadar, Split and Dubrovnik) conducted a research, among the domestic population and tourists, on the quality of life and sojourn in the old town cores, on the basis of the results of which they established freight receiving points on the edges of the old cores and defined the time at which the deliveries were to be performed (time restriction), something that should also be done by the city of Šibenik [22]. None of the said towns have an urban consolidation centre, but they receive goods from other cities and regions.

When analysing the number of freight receiving points and the area of the old town cores, we observed that the city of Zadar has the best coverage, in the city of Split, each point covers one half of the old town core, while Dubrovnik, due to its spatial configuration, has no space for any additional points.

**Table 1** Comparison of the freight receiving points and delivery times in the old town cores of the 4 large Dalmatian cities. Source: [23]

City	Area of old town core [m <sup>2</sup> ]	Number of catering (CF) and shopping facilities (SF)	Number of freight receiving points	Time of delivery
Dubrovnik	243,471.20	158 CF, 168 SF	1	05:00h.-09:30h., 17:00h.-19:00h.
Split	211,899.92	288 CF, 82 SF	2	05:00h.-09:00h., 14:00h.-17:00h.
Zadar	399,157.92	115 CF, 42 SF	11	06:00h.-08:30h., 20:00h.-21:00h.
Šibenik	259,818.88	68 CF, 32 SF	0	06:00h.-10:00h. 14:00h.-18:00h.

The city of Šibenik currently has no freight receiving point (Table 1). The cities of Split, Zadar and Dubrovnik have morning and afternoon delivery restrictions and, according to the conducted research, the city of Split has the best afternoon delivery time, because at the said time, tourists are predominantly outside of the old town core. In this case, the afternoon delivery can be performed without large pedestrian congestions.

If an establishment should desire to have the goods delivered outside of the times stated in Table 1, it should be charged a multiple price for such a service, because the facilities in the city should be encouraged to perform their deliveries at the designated times. According to the conducted research, the city of Zadar has the best morning time of delivery, because the people who work and approach the old town core with their vehicles usually begin work at 7:00 A.M. In analysing the number of catering and shopping facilities, the city of Šibenik, which has the smallest number of facilities, should introduce restricted times of morning and afternoon delivery (according to the survey conducted among the catering establishments in the city of Šibenik, the best time of delivery to the receiving points would be from 11:00 P.M. until 2:00 A.M. (end of the opening times) and from 5:00 until 7:00 A.M. (before the opening time), because in the said time periods, the lowest number of cars and people are on the streets, wherefore the supply for the following day can be carried out without any major difficulties and congestions.

The city of Šibenik should introduce an afternoon delivery time in the period between 5:00 P.M. until 6:00 P.M., following the models of Dubrovnik and Split, but restrict it to only one hour and charge a higher price. After the arrival of the delivery vehicles to the freight receiving points, the goods should arrive to the catering and shopping facilities in the old town core by small and electric vehicles. According to communications with the Administrative Departments of the cities of Split, Zadar, Dubrovnik and Šibenik, the very transport of goods in the cities of Split, Zadar and Dubrovnik from the freight receiving points to the catering and shopping facilities is carried out by

legal entities which have fulfilled the conditions of the call for the concession for the transportation of goods to the old part of the city (their number is not limited).

A too large number of delivery vehicles at the restricted time also means higher congestion in the narrow streets of the old cores and dissatisfaction of the inhabitants and the tourists because of the congestion of space [22]. In the city of Šibenik, this part is performed by the city-owned company Gradski parking in accordance with the decision of the Šibenik City Council. After the goods have been delivered at the designated time, the freight receiving points can have the function of a car parking lot and bus stop. For the collection of returnable packaging and waste from the shopping and catering facilities, there are already pre-designated and built locations with underground waste containers.

## **5. Conclusion**

Goods arrive in the old part of the city of Šibenik from all directions and at all times of the day, thus creating congestion on the city streets, increasing noise levels, causing nervousness and dissatisfaction among the inhabitants and tourists, for which reason there is an increasing need for a new mode of supply. The distribution of goods to the old part of the city of Šibenik via an urban consolidation centre and goods receiving points can help achieve several goals, such as the reduction in the number of deliveries which need to be carried out for a single location, the reduction in the time spent by drivers at the delivery locations and the time they spend in travelling to the delivery locations.

The proposed manner of delivery and smaller number of delivery vehicles helps reduce street congestion and the number of conflict situations between traffic participants, improve air quality, accelerate and simplify the delivery process, along with improving the service provision to the clients. There is also the possibility of introducing additional services and maximising sales, enabling the traders to expand their sales areas, and also making the maximum availability of stocks and of the product assortment possible and preventing or reducing the number of thefts of goods.

## **References**

- [1] Björklund, M. & Johansson, H. (2018). Urban consolidation centre - a literature review, categorisation, and a future research agenda, *International Journal of Physical Distribution & Logistics Management* 48 (8), 745-764. Retrieved date of access December 13, 2019. DOI: 10.1108/IJPDLM-01-2017-0050
- [2] Zečević, S. & Tadić, S. (2006). *City logistika*, Belgrade, Republic of Serbia: Faculty of Transport and Traffic Engineering University of Belgrade.

- [3] Quak, H. J. (2008). Sustainability of Urban freight transport: Retail distribution and local regulations in cities. Doctoral dissertation. Erasmus Research Institute of Management (ERIM). Rotterdam, Netherland.
- [4] Macharis, C. & Melo, S. (2011). City distribution and Urban freight transport: Multiple perspectives. Cheltenham, UK, and Northampton, Massachusetts, USA: Edward Elgar publishing.
- [5] Brook O. (2003). Inner Urban Freight Transport and city logistics, transport teaching material, available at: [https://www.eltis.org/sites/default/files/kt8\\_wm\\_en\\_6.pdf](https://www.eltis.org/sites/default/files/kt8_wm_en_6.pdf), access 14.01.2020.
- [6] Olsson, J., & Woxenius, J. (2012, June). Location of freight consolidation centres serving the city and its surroundings, *Procedia - Social and Behavioral Sciences* 39, 293 – 306. DOI: 10.1016/j.sbspro.2012.03.109
- [7] Crainic, T.G. & Ricciardi, N. & Storchi, G. (2004, April). Advanced freight transportation systems for congested urban areas. *Transportation Research Part C: Emerging Technologies* 12, 119-137. DOI: 10.1016/j.trc.2004.07.002
- [8] Trentini A., Jesus G.F. & Nicolas M. (2015). Developing urban logistics spaces: UCC and PLS in South-Western Europe. Retrieved date of access December 13, 2019, from HAL ARCHIVES-OUVERTES on <https://hal.archives-ouvertes.fr/halshs-01214749/>, HAL Id: halshs-01214749.
- [9] Malindretos, G. & Mavrommati, S. & Bakogianni, M.A. (2018). City logistics models in the framework of smart cities: urban freight consolidation centers. 4th international conference of supply chain, 14.-15. November 2018. Katerini, Grece: <http://olympusicsc.teicm.gr/>
- [10] Leonardi, J. & Browne, M. & Allen, J. & Bohne, S. & Ruesch, M. (2014). Best Practice Factory for Freight Transport in Europe: Demonstrating How 'Good' Urban Freight Cases are Improving Business Profit and Public Sectors Benefits. *Procedia - Social and Behavioral Sciences* 125, 84-98. DOI: 10.1016/j.sbspro.2014.01.1458.
- [11] Personal survey of catering and shopping facilities in the city of Šibenik by authors of this paper between 01 and 24. December 2019., City of Šibenik (2019).
- [12] Jacyna, M. (2013). The role of the cargo consolidation center in urban logistics system. *International Journal of Sustainable Development and Planning* 8 (1), 100-113, Retrieved date of access January 05 2020. DOI: 10.2495/SDP-V8-N1-100-113.
- [13] Quak, H.J. (2012). Improving Urban Freight Transport Sustainability by Carriers: Best Practices from The Netherlands and the EU Project City Log. *Procedia - Social and Behavioral Sciences* 39, 158-171, Retrieved date of access December 18 2019., DOI: 10.1016/j.sbspro.2012.03.098.

- [14] Wouter V.H., Larsen R. & Larsen A. (2019). An urban consolidation center in the city of Copenhagen: A simulation study. *International Journal of Sustainable Transportation* 13, 675-691, Retrieved date of access December 13 2019., From data base University of Twente <https://research.utwente.nl/en/publications/an-urban-consolidation-center-in-the-city-of-copenhagen-a-simulat-2> , Netherland. DOI: 10.1080/15568318.2018.1503380.
- [15] Gogas, M. A. & Nathanail, E. (2017). Evaluation of urban consolidation centers: a methodological framework. *Procedia Engineering* 178, 461-471. Retrieved date od access December 03 2019. DOI: 10.1016/j.proeng.2017.01.089.
- [16] Šego, D., Poljičak, A-M. & Ljubić Hinić, M. (2016). Determining location of implementation logistic-distribution center Šibenik, *Proceedings of the Polytechnic of Šibenik*, (1-2/2016), 129-135. Retrieved date od access December 08 2019. From data base HRCAK <https://hrcak.srce.hr/161801>
- [17] Created by authors of this paper, according to Le Roch E., Philippe R., Zouzout A. (2013, June). Urban logistic. Retrieved date of access January 4 2020. from <https://www.slideshare.net/remiphilippe/urban-logistics>
- [18] Rodrigue J.P. (2017-2020). Urban freight stations. Retrieved date of access December 01 2019. From [https://globalcitylogistics.org/?page\\_id=27](https://globalcitylogistics.org/?page_id=27)
- [19] Savelsbergh, M. W. P. M. & van Woensel, T. (2016). City Logistics: Challenges and Opportunities. *Transportation Science*, 50(2), 579-590. Retrieved date of access December 21 2019., From data base Eindhoven University of Technology <https://research.tue.nl/en/publications/city-logistics-challenges-and-opportunities>, DOI: 10.1287/trsc.2016.0675.
- [20] Rodrigue J.P. (2017-2020). City Logistics: Concepts, Policy and Practice. Retrieved date of access December 01 2019. From [https://globalcitylogistics.org/?page\\_id=270](https://globalcitylogistics.org/?page_id=270)
- [21] Šego, D., Ljubić Hinić, M. & Poljičak, A-M. (2020). Blue and green circle, rectangle, arrows are created by the authors of this paper, on the background of On-line map city of Šibenik available at Google maps <https://www.google.com/maps>. Retrieved date of access February 05 2020.
- [22] City of Dubrovnik, Zadar and Split (2019). Internal documents of the Administrative Departments for Municipal Activities and Services. Personal contact of authors of this paper with named departments. Retrieved dates from December 15 to 25 2019.
- [23] Geoportal of the State Geodetic Administration of the Republic of Croatia (<https://geoportal.dgu.hr/>) and meetings with the Administrative Departments for Municipal Activities and Services of the said cities. Retrieved dates from December 15 to 25 2019.