Interreg CENTRAL EUROPE
SULPiTER
European Union
European Regional
Development Fund

SULP IN RIJEKA FUA

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1. The SULPiTER project

Transport is the second largest energy-consuming sector, with a 32 % of share of final energy consumption. Therefore it is necessary to consider the White Paper (2011) of the European Commission, which sets 10 goals for a competitive and resource-efficient transport, two of which are specific for urban areas: “Halve the use of ‘conventionally-fuelled’ vehicles in urban transport by 2030, phase them out by 2050“ and “Achieve essentially CO_2-free city logistics by 2030 - in major urban centres.” Paris climate agreement (2015) – the world's first comprehensive climate agreement – has an important role also in the logistic sector , if we are looking into the aims of it: "Making finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development.". Recognising the important role Sustainable Urban Mobility Plans can play, the European Commission proposed in its Action Plan on Urban Mobility of 2009 to accelerate the take-up of Sustainable Urban Mobility Plans in Europe by providing guidance material, promote best practice exchange, and support educational activities for urban mobility professionals.

To fully understand possibilities for mitigating urban freight flows and to solve the problem holistically, we would need to tackle urban freight on the level of entire supply chain (including enterprise’s strategies) and from the perspective of Functional Urban Areas (FUA). By the definition, FUA consists of the city and its commuting zone and is identified as polycentric cores and the hinterlands of FUAs identified based on commuting data, including all settlements from where at least 15% of the workers commute to any of the core settlement(s) (OECD, 2016).

The project SULPiTER (Sustainable Urban Logistics PlannIng To Enhance Regional freight transport) has been developed to support policy makers in improving their understanding of the FUA freight phenomena in an energy and environmental perspective, enhancing their capacity in urban freight mobility planning in order to develop and adopt Sustainable Urban Logistics Plans – SULPs. The Project focused on several FUAs in Central Europe, namely Bologna, Budapest, Poznan, Brescia, Stuttgart, Maribor and Rijeka, whose authorities were involved in the project as fully-fledged partners.

SULPiTER designed and developed a tool aimed at estimating the freight demand generated by the economic activities in the FUA individuated by the project partners. SULPiTER tackles urban freight in the perspective of FUAs, taking into consideration the functional transport and economic relations between inner urban centres (the usual and limited territorial target of public regulations) and the surrounding urban territories, as well as the functional transport and economic relations within FUAs not affecting downtowns. The SULPiTER tool is intended to be a decision support system for policy makers to facilitate the process of elaboration of alternative city logistics scenarios.

2. The SULP Policy Document

This document is the basis of the SULP development for each FUA in the frame of the SULPiTER project. Each partner will follow this template in order to report the main points of each Sustainable Urban Logistics Plan at Functional Urban Area level. Based on the EC ELTIS guidelines, it describes the process as each city uses the SULPITER procedure to access the SULP from the data collection through the processing of the data.

In each FUA, Authorities will develop their own SULP in a more detailed document, including all the necessary information listed in the national guidelines. In order to make them transnational, this template will include only the most important issues and the relevant results from other Work Packages. The SULP in original language may be attached as annex of this document.

3. Transport policies - state of the art analysis

There are 3 existing transport policies that directly influence freight transport in Rijeka FUA:

- *On national level: Transport Development strategy of the Republic of Croatia 2014-2030*

The Strategy sets out the basic guidelines for the development of the transport sector within the Republic of Croatia over a medium and long-term horizon (2014-2030), aiming to define an overall and coherent framework to ensure the linkage of infrastructure and transport policy and enabling decision making. The Strategy is the result of a deep analysis and reflection process but also of participation and debate open to the whole of society for this purpose. A high level of social and technical consensus has been pursued for the elaboration of the Strategy, with the higher possible input and transparency. For this a specific procedure for participation and debate has been set up. As a result, a committed participation of main stakeholders has been registered, getting important contributions in the form of suggestions and proposals to improve and enrich the Strategy. The Transport Development Strategy has taken into account the concern for sustainable development and by great sensitivity to environmental concerns and criteria. As a result, it constitutes a decisive commitment to the future of the Republic of Croatia, to its economic development and its competitiveness, to its social and territorial cohesion and to the improvement of the quality of life of its citizens, with a set of measures designed to create a transport system which is more integrated, safer, efficient and respectful of its environment.

There are six major strategic multimodal objectives of the Transport Development Strategy:

Objective 1: Improvement of transport connectivity and coordination with neighbouring countries – in transport development the Republic of Croatia has to be well connected within its own territory, as well within the system of European routes; it is necessary to establish integrated transport

Objective 2: Improvement of passengers' long distance accessibility inside the country - the improvement of the long distance accessibility for passengers will help "reducing the distance" from the remote regions to the Capital of Croatia (Zagreb), reducing regional disparities on one hand by allowing an increased participation of remote regions' citizens in the industrial, political and business spheres of the country, and on the other hand by helping to enhance the relevance of regional industrial and business centres so diversifying the currently very centralized focus

Objective 3: Improvement of the regional connectivity in passenger transport by enhancing territorial cohesion - accessibility of remote towns and villages in less populated and poorer areas, and side connections to the islands, some of which are quite far away from the continental coast; as in many countries, also in Croatia the main issue is to guarantee adequate connectivity/accessibility to the main national and regional economic centres

Objective 4: Improvement of the passenger's accessibility to and within the main urban agglomerations - urban transport is responsible for about a quarter of CO2 emissions from transport and 69% of road accidents occur in cities; it is necessary to increase the modal split in favour of public transport and soft modes (pedestrians and cyclists), and in order to achieve that, it is a priority to increase the efficiency and physical, operational and organizational integration of all the modes: railway, tram and bus; it is necessary to provide as well good public transport connections to the main demand generator centres (such as airports, sea ports, inland waterway ports, cultural centres, city centres, etc.); in cities, switching to cleaner transport is facilitated by usually higher availability of public transport services and higher population density; pre-trip/on-trip users' information, electronic booking and integrated ticketing covering all transport modes should facilitate multimodal travel

Objective 5: Improvement of freight transport accessibility in the country – the economy in general is considerably built on the mobility of freight and in this sense maritime, rail and inland waterway transport is addressed in long distance transport while road in regional context; the ports of Republic of Croatia

serve as a gate for trade especially in the Central-European North-South axis; Central and South-Eastern Europe communications uses Sava and the East-West railway connection; it is crucial for involved countries to ensure the freight movements in an ecologically sustainable way

Objective 6: Improvement of the transport system organizational and operational setup to ensure the efficiency and sustainability of the system – ensure coordinated approach to sustainable social and economic growth of all parts of the country; achieve more equal development and decrease social and economic differences;

- *On regional level: Development Strategy of the Urban Agglomeration Rijeka 2016-2020*

The Development Strategy of the Urban Agglomeration Rijeka 2016-2020 was prepared in accordance with the Guidelines for drawing up urban area development strategies, following up their implementation and valuation, adopted by the Ministry of Regional Development and EU Funds in September 2015. The Strategy was entirely prepared by the capacities of the City of Rijeka and is a result of the partnership activity of 10 cities and communes and was submitted in May 2016, to the competition published by the Ministry of Regional Development and EU Funds, where it was positively assessed. The Urban Agglomeration Rijeka was chosen as an area for the implementation of integrated territorial investments whereby it was given a possibility to use EU funds.

The Development Strategy of the Urban Agglomeration Rijeka is based on strategic and territorial documents of all cities and communes included in the Urban Agglomeration Rijeka and is linked with all strategic higher order documents.

Total policy budget is 66.117.775 Euro; source of funding is Ministry of Regional Development; ITI mechanism.

The Development Strategy of the Urban Agglomeration Rijeka has goals determined for execution in the period 2016-2020.; in regards to the freight transportation networks, there are several projects being developed in this period: Rijeka Gateway project; County Transport Master plan; Rijeka ECC and the Sustainable Energy Action plan of the City of Rijeka that also deals with the traffic sector but from the viewpoint of energy efficiency, energy consumption and using alternative fuels and renewable energy sources. Also several other projects of local importance performed by partners in the Agglomeration will be executed during this period, and they will be coordinated within this Strategy.

The main objectives of the Strategy are:

- Development of ecologically acceptable urban public transport – replacing the fleet of diesel powered buses on urban and suburban public transport lines with gas-driven vehicles
- Innovative traffic/mobility solutions - introducing new intelligent traffic light technology on all semaphored intersections in the Agglomeration area, to provide centralized surveillance and automatic coordination and traffic control; includes replacing existing outdated traffic light technology with smart control units which constantly measures traffic intensity on control points, decides upon the best control strategy and coordinates the work of traffic lights accordingly; Integrating intelligent Video Surveillance System and Traffic Guidance System in the new Urban Integrated Traffic Control centre that detects anomalies in traffic (traffic jams, road accidents etc.), brings appropriate decisions and informs all relevant institutions and stakeholders in the traffic system.

- *On local level: Development Strategy of the City of Rijeka 2014-2020*

In September 2013, the City of Rijeka adopted the Development Strategy of the City of Rijeka until 2020. The Development Strategy of Rijeka is based on the Strategy of the European Union until 2020 and on electoral program RI2020. The participation of the public in the creation and adoption of this Strategy started already in February 2013 with the project “Razgovori o Rijeci 2020 / Talks about Rijeka 2020”, it continued with professional workshops during June 2013 in which more than 130 professionals took part

and a wide public discussion on the Draft Strategy that included businessmen from Rijeka, city councillors, and via e-consultations all citizens and all interested groups.

The Development Strategy of the City of Rijeka has goals determined for execution by 2020.; in regards to the freight transportation networks, there are several projects being developed in this period: Rijeka Gateway project; County Transport Master plan; Rijeka ECC and the Sustainable Energy Action plan of the City of Rijeka that also deals with the traffic sector but from the viewpoint of energy efficiency, energy consumption and using alternative fuels and renewable energy sources.

The Rijeka traffic route is a major investment opportunity for the whole country, especially for the city`s economy. The Rijeka traffic route is a "packet of projects" that includes investments in the port infrastructure, road infrastructure, railway, tourist capacities in the port area being renovated into a public – commercial area, airport and investments in the business-logistics zones, city and regional traffic projects related to the traffic infrastructure.

The main goal of this project is to build the missing traffic infrastructure, which is most notably related to the strengthening of global competitiveness of the Port of Rijeka. This priority requires integration of all transport modes with the city`s traffic projects. The modernization of the port of Rijeka, container terminal Brajdica and new port terminal with the new waterfront, are a base for building competitiveness of Rijeka in the EU. This also means that it is necessary to develop an integrated system of management of the Rijeka traffic route to create synergy effects on the European and global level. The Rijeka traffic route is also a business opportunity for entrepreneurs from all sectors of economy. By developing traffic infrastructure and connecting different transport modes, new opportunities will be created for the processing industry and new services regarding transport. The goal of this priority is the development of the transport sector as the most important part of the local economy. Rijeka can be seen, by 2020., as a developed transport – logistics centre, in which traffic and connected services will be the leading sector in the city`s economic structure.

There are three strategic goals of the Strategy: 1. Position Rijeka globally owing to the development of the Rijeka transport corridor, 2. Develop a competitive economy on a knowledge-based society and new technology, 3. Enable dignity of all citizens by strengthening social inclusion and developing projects of common interest.

Priorities and measures of the first strategic goal, which is relevant for freight transport in Rijeka FUA are:

- Building traffic infrastructure - Zagreb port terminal; road D-403 – new west entranceway into the city of Rijeka; new 2rail railway through the city
- Integrated management of the Rijeka traffic route- modernization of airport; new complex of bus and rail infrastructure; 2 new public garages
- Strengthening of the logistics and maritime cluster – business – logistics zones Miklavija and Škrljevo
- Global promotion and international cooperation
- Coordination of transport stakeholders – Delta area for public use- public needs, hotel, congress centre, business infrastructure etc.; use change of port Baross; renovation of Molo longo, removal of parking lot on the promenade; new roundabouts etc.
- Coordination of transport stakeholders – Delta area for public use- public needs, hotel, congress centre, business infrastructure etc.; use change of port Baross; renovation of Molo longo, removal of parking lot on the promenade; new roundabouts etc.

The City of Rijeka cooperates with all relevant institutions at the local, regional and national level, both in projects related to the development of the traffic route, as well as through participation in the consultation process for the adoption of strategic documents.

4. Urban Freight Transport - state of the art analysis

Rijeka FUA is divided into 5 zones. The zones are divided according to size, population density, intensity of commercial activity and transport routes;

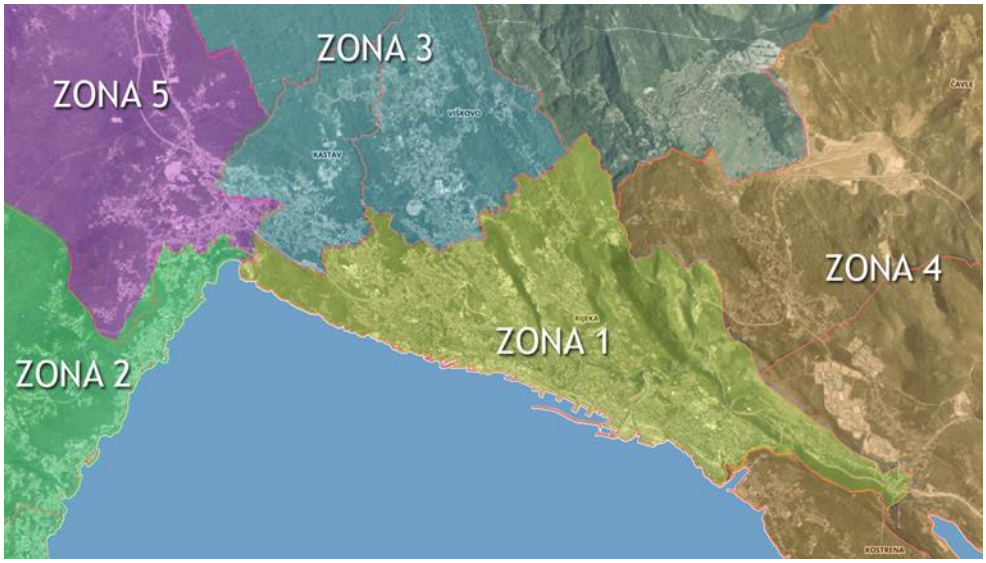
Zone 1. City of Rijeka,

Zone 2. Opatija, Lovran,

Zone 3. Kastav, Klana, Viškovo,

Zone 4. Čavle, Bakar, Kostrena,

Zone 5. Matulji, covering routes to the Croatian – Slovenian border.



Picture 1. Rijeka FUA

All the zones belong to the same nuts 2 level in which the Republic of Croatia is divided into the Continental, and Adriatic region which is 2, level 2 regions. The Rijeka FUA belongs to the Adriatic Croatia region.

The country is further divided according to counties. The Rijeka FUA is located whole in the Primorje-Gorski kotar county. The zones differ according to size and it was challenging to divide the area into zones because of the geographical location of the area. The Rijeka FUA is located on a coastal area and is the principal port of the country located in Kvarner bay. Two important land transport routes start in Rijeka due to its location. The first route is to the Pannonian Basin given that Rijeka is located alongside the narrowest point of the Dinaric Alps (about fifty kilometres or 31 miles). The other route, across Postojna Gate connects Rijeka with Slovenia, Italy and beyond.

The terrain configuration consists of the coast and into the hinterland, mountains rising steeply just a few kilometres from the shore. The landscape contrast has an important role in the distribution of inhabitants and possibilities for routing traffic. The zones in the coastal part of Rijeka FUA have a much greater number of inhabitants than the inland, which has important roads connecting the area to neighbouring countries and the Croatian capital of Zagreb, which is an important origin of goods delivery.

The zones follow the administrative borders of the municipalities because of the need to overlap maps with administrative borders and main local, regional and national roads in the area. As the City of Rijeka is the most intense area of commercial activity, and the most congested by daily traffic (the city takes upon about 60 thousand vehicles every day), daily migrations revolve around the city so it is the smallest zone territorially but the most commercially active. Zone 5. Includes important traffic routes to the Istrian peninsula and the western borders. Zone 4. is a large industrial zone connected by road and railway and the location of large warehouses used as the delivery origin for the Rijeka FUA. These are, respectively the largest zones of the Rijeka FUA with almost 400 km2. They are also less populated. As oppose to the Zone of the City of Rijeka with almost 3 thousand inhabitants per km2, only Zone 2. with Kastav, Klana and Viškovo has over 200 inhabitants per km2. Zone 4. Čavle, Bakar, Kostrena and Zone 5. Matulji have 89 and 63 inhabitants per km2, respectively.

The total area of the Rijeka FUA is 652,75 km2. The spatially smallest zone of the Rijeka FUA is the zone of the City of Rijeka. The City of Rijeka is located on the area of only 44 km2 and has over 128 000 inhabitants, making it very densely populated and the most commercially active area in the County Primorje – Gorski kotar in which it is located.

The biggest zone is zone 4, with 221,08 km2, that includes a large industrial zone and warehousing facilities, and is an origin for a lot of delivery routes.

The total number of inhabitants in the Rijeka FUA is 202,169. As mentioned, the most densely populated zone is the City of Rijeka with 128,624 inhabitants. Zone 2 has 26,860 inhabitants, Zone 3 15,760, Zone 4 19,679 and Zone 5 11,246 inhabitants.

The most densely populated area is the City of Rijeka with 2923 inhabitants per km2, and the least densely populated zone is Zone 5 which includes the municipality Matulji with 63 inhabitants. This is due to the fact that the city of Rijeka is not a municipality and is located on a limited area. The surrounding cities and municipalities however, are located on a several times larger territory and the inhabitants are more disperse.

4.1. Current situation of logistics flow in Rijeka FUA

In terms of concentration of industrial facilities, the key city in the FUA is the City of Rijeka.

Rijeka road junction is one of the main traffic junctions in Croatia. Rijeka is the binding site and the intermingling of international maritime, road and rail corridors, which gives the city interregional character. The port of Rijeka is the core of the TEN-T network (Trans-European Transport Networks).

Major road transport routes in the hinterland of Rijeka: A7 motorway connects the highway A8 (the Istrian Y) and the highway A6 (Rijeka-Bosiljevo).

In the Rijeka area there are large industrial, logistics and transport facilities:

1. Shipyard 3. Maj
2. Port of Rijeka
3. Adriatic Gate Container Terminal – AGCT

In the wider area of the City of Rijeka are several shopping centres that generate their logistic chains:

1. Large shopping centres – TCR (Tower centre Rijeka) and ZTC (Zapadni trgovački centar) - concentration of large number of trade and logistics chains (food and drink, clothing, footwear, household appliances, IT systems and technology, etc.)
2. Stand-alone stores - Lidl, Plodine, Department Store Ri, Decathlon

A significant concentration of commercial facilities are located in the Industrial zone of Kukuljanovo, which belongs to the City of Bakar, and another rapidly growing concentration of shopping facilities located in the Commercial zone Marinići which belongs to the Municipality of Viškovo, in which currently operates more than 50 businesses.

4.2. Analysis of Rijeka FUA regarding freight traffic with special emphasis on industrial and commercial areas

Zone 1. City of Rijeka

- Port of Rijeka (Central port basin) - general cargo; freight traffic between the port basins (Brajdica-Žabica-Mlaka), and transport between the port basin and terminal Škrljevo
- AGCT Brajdica (Adriatic Gate Container Company) – containers; transport of heavy goods vehicles
- Shipyard 3.maj - supply of raw materials (steel, machinery, electrical equipment); traffic of heavy goods vehicles
- The City Centre - supply of shops, catering facilities, accommodation and business facilities; combined freight transport
- Tower centre Rijeka – supply; combined freight transport
- Other stores (Plodine, Lidl, DM, etc.) – supply; combined freight transport
- West shopping centre – supply; combined freight transport

Zone 2. Opatija, Lovran

- The Centre of Opatija - supply of shops, catering facilities, accommodation and business facilities; combined freight transport
- The Centre of Lovran - supply of shops, catering facilities, accommodation and business facilities; combined freight transport

Zone 3. Kastav, Klana, Viškovo

- The Centre of the municipality of Viškovo - supply of shops, catering facilities, accommodation and business facilities; combined freight transport
- Commercial Zone Marinići, Viškovo - total area covers 27.9 ha; permitted activities: mixed; permitted building coefficient: 0.4-0.8; coefficient of variations: 1.2 to 1.6; number of active entities in the area: 48; total number of employees: unavailable data; land to building ratio: >66%
- Commercial Zone Marišćina, Viškovo - total area covers 7.2 ha; permitted activities: production and service; permitted building coefficient: 0.4; coefficient of variations: 0.8; number of active entities in the area: 0; total number of employees: 0; land to building ratio: 0%
- Commercial Zone Žegoti, Kastav - total area covers 29.91 ha; permitted activities: mixed; permitted building coefficient: 50; coefficient of variations: 200%; number of active entities in the area: 23; total number of employees: estimation 220; land to building ratio: <66%
- Commercial Zone Kunfin, Klana - total area covers 10.3 ha; permitted activities: mixed; permitted building coefficient: 0.6; coefficient of variations: 2; number of active entities in the area: 2; total number of employees: 100; land to building ratio: 0
-

Zone 4. Čavle, Bakar, Kostrena

- Commercial Zone Cernik, Čavle - total area covers 18.95 ha; permitted activities: mixed; permitted building coefficient: 0.50; coefficient of variations: 1.2; number of active entities in the area: 2; total number of employees: 150; land to building ratio: >66%
- Commercial Zone Soboli, Čavle - total area covers 16.5 ha; permitted activities: economic; permitted building coefficient: 0.50; coefficient of variations: 1.2; number of active entities in the area: 2; total number of employees: 20; land to building ratio: <66%
- Industrial zone Kukuljanovo, Bakar - - total area covers 500 ha; permitted activities: production and business; permitted building coefficient: 50 %; coefficient of variations: 150%; number of active entities in the area: 170; total number of employees: 4.000; land to building ratio: 73.66

- logistic chains: container traffic from AGCT Brajdica; freight transport and storage services for the Port of Rijeka; supplying the store chains (Plodine, Lidl, Pevec, Lesnina; Bauhaus, Građa, et.)
- Commercial Zone Šoići, Kostrena - total area covers 15.96 ha; permitted activities: production and service; permitted building coefficient: 0.6; coefficient of variations: 0.8; number of active entities in the area: 6; total number of employees: 120; land to building ratio: unavailable data
- Shipyard Viktor Lenac, Kostrena - supply of raw materials (steel, machinery, electrical equipment); traffic of heavy goods vehicles

Zone 5. Matulji

- Commercial Zone Miklavija, Matulji - total area covers 158.5 ha; permitted activities: production and business; permitted building coefficient: 0.6; coefficient of variations: 1; number of active entities in the area: 0; total number of employees: 0; land to building ratio: <33%
- Commercial Zone Mučići, Matulji - total area covers 13.38 ha; permitted activities: production and services, storage area; permitted building coefficient: 0.40; coefficient of variations: 1.60; number of active entities in the area: 1; total number of employees: 8; land to building ratio: unavailable data
- Commercial Zone Rupa, Matulji - total area covers 10.32 ha; permitted activities: services, permitted building coefficient: 0.35-0.40; coefficient of variations: 0.80-0.90; number of active entities in the area: 3; total number of employees: 50; land to building ratio: <33%
- Commercial Zone Jušići, Matulji - total area covers 6.38 ha; permitted activities: services and production, permitted building coefficient: 0.50; coefficient of variations: 0.20-1.50; number of active entities in the area: 1; total number of employees: 50; land to building ratio: >33%

4.3. Analysis of survey on distribution flows in Rijeka FUA (D.T1.2.9)

The survey on distribution flows was carried out among 232 interviewees.

Per supply chain:

Category 1 (Caffe bar, Restaurant, Hotel): 101

Category 2 (Food products): 45

Category 3 (Consumer goods): 63

Category 4 (Textile products): 23

Almost 50% of interviewees use DDP delivery mode, while the other 50% use ex-work and off truck deliveries.

While the absolute majority of shop employees have stated that the duration of deliveries is up to 10 minutes, transport operators say that it is rarely or never less than 10 minutes per delivery.

The majority of interviewees have, on average, 3.9 suppliers, and 45% have goods delivered 3 or more times per week. Mondays and Wednesdays are the busiest days in the week in terms of deliveries with the share of 62% and 59%, respectively.

The number of suppliers per category goes as follows:

Category 1 (Caffe bar, Restaurant, Hotel): 6,258

Category 2 (Food products): 7,974

Category 3 (Consumer goods): 0, 71

Category 4 (Textile products): 0, 81

Over 90% of suppliers complete deliveries from 6 am until 12, and 10% deliver in the afternoon hours.

The number of items per delivery varies according to the destination of delivery. Kiosks receive from 1 to 10 items which usually weigh up to 3 kg. Caffe bars receive up to 30 items, and stores (supermarkets, retail stores, grocery stores etc.) can receive from 1 up to a 100 items that can weigh up to 2000 kg depending on delivery. The number of load units per deliveries is max.200, and min. is on average 13, 82.

Over 53 % of suppliers use private parking when delivering goods, but more than 35 % park illegally.

The interviewees were not very outspoken about problems during deliveries as they usually consider deliveries a task that the supplier has to take on. Shop employees and owners do not consider the problems that suppliers have to undergo to deliver goods, but only that they receive goods. The majority of all interviewees did not share any opinion on problems or suggestions to improve the delivery system and that is why this was one of the key topics in the freight quality partnership with transport operators because transport operators have knowledge on specific problems and problematic locations destined for deliveries which they must use in daily operations.

The problems shared in the survey are:

1. Delivery time
2. Difficult access to loading/unloading areas
3. Difficult movement of goods from parking to customers premises
4. Lack of loading bays

This part of the questionnaire was not of particular interest by the shop interviewees, because they only receive goods delivered by the supplier or third party, in most of the cases. The question was largely skipped and left unanswered.

4.4. Analysis of survey on transport operators flows (D.T1.2.9)

The survey on transport operators has been conducted among 15 companies that deal with logistics in transport and which have an impact on the delivery system of the Rijeka FUA. The 15 companies interviewed, have a combined fleet of 200 vehicles that include: cars, Caddy cars, vans, light trucks, trucks, heavy trucks and mopeds for currier companies.

All transport operators make delivery trips from manufacturer or warehouses to their final destinations and the frequency of deliveries depends on the type of goods for the end destination. While the survey on distribution flows has shown that the shops regard the delivery process as an operation of up to 10 minutes, all transport operators point to the duration of 20 minutes and more. A total 73% of transport operator`s deliveries last up to 20 minutes and over.

The transport operators also point out to the issue that the parking spot for vehicles in the city of Rijeka centre is reserved for 30 minutes, while they make 5-6 deliveries from that location which can last even more.

The weight of vehicles used for deliveries can take from 1.5 to 3.5 tonnes of item weight.

All delivery vehicles run on diesel fuel exclusively, and none use types of fuel or alternative fuels.

The frequency of movement per trips is very diverse, but for a specific destination, it is from once a day, to once a week at least. 40% of interviewees make one or more delivery trips a day, 40% make 2-3 delivery trips a day, and 20% of interviewed transport operators make deliveries several times a week. 47% of all deliveries start at 8 AM.

The parking of these interviewees ranges from usual private parking at the end destination, but also includes parking on the road and any place when it comes to textile goods.

Parking is one of the biggest issues when it comes to delivering goods, not only the availability of parking spots for deliveries which are often occupied by non - delivery vehicles, but also the accessibility, and duration of the delivery spot which can be occupied by a certain operator for a limited time. Another issue is the duration of delivery operations in terms of goods acceptance. While the shop owners state that deliveries take up to 10 minutes, the transport operators report the duration of 20 minutes as the usual duration of services. Shops do not take into account the time that the transport operators have to wait after unloading goods to complete the operation with the goods receivers, and several transport operators mentioned issues in the procedure of accepting goods and its duration.

73% of interviewees report that the deliveries take up to 20 minutes and more.

When it comes to usual hours of delivery, the deliveries are usually in regular working hours and only 20%, or 3 of the interviewed companies are able to make deliveries in other hours than the ones specified. Some influence on this fact is due to the working hours of the recipients of goods, and unwillingness of employers to pay for working overtime, before or after hours.

All stakeholders involved do admit to the need to arrange the delivery system in a comprehensive way and to improve the whole supply-demand chain operations.

The problems with the delivery operation are often and existing for all transport operators. Some of the occurring issues are the lack of loading space, lack of unloading space, the need to use a forklift and it is not a possibility, the duration of loading operations, difficult access to the loading and unloading point, the lack of available positions for loading and unloading, and the lack, or absence of coordination between deliveries. These issues are most quoted by the interviewed companies.

4.5. Analysis on traffic counts (D.T1.2.9)

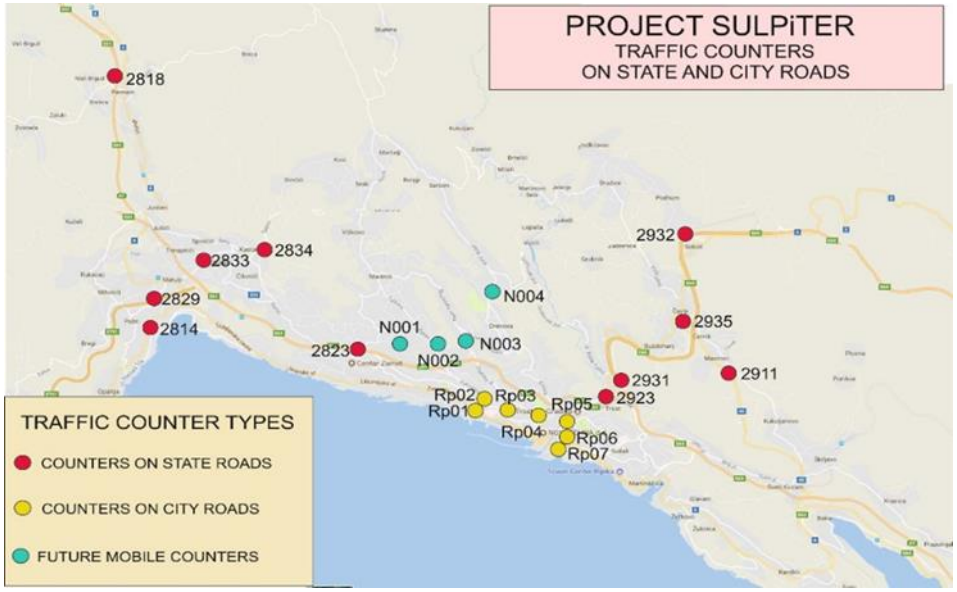
Before the Rijeka bypass was completely built, the city roads in the centre of the City of Rijeka would take upon almost 70 thousand vehicles daily. When the Rijeka bypass`s final kilometres were constructed, the average daily count of vehicles was up to 72 thousand per day. The bypass was completed in late 2009 in full profile from the junction Matulji to Orehovica in the length of 8, 85 km. It has branches to Trieste, Ljubljana, Zagreb and Split. After the completion of the bypass, the daily traffic load on the city roads decreased to an average of 60 thousand vehicles daily.

Traffic counters were included in the city traffic system in 2002, with the installation of the automatic traffic management system and introduced the ability to count traffic on 6 points and categorize vehicles that enter the City of Rijeka centre. The majority of vehicles enters Rijeka from 7 to 8 am on their way to work, and the least in the evening hours. The months with the most traffic load are March, April and May, and the month with the least traffic is July because of the summer holidays.

The information for the project was obtained by counting traffic by 18 available traffic counters and 4 points will be counted manually. 11 counters are available that cover state roads, 7 counters that cover city roads are strategic ones, able to categorize vehicles immediately, and, after assessing the needs of the project, 4 additional locations will be covered by manual counting.

The most important counters relate to the traffic in the city centre which was identified by the authorities and by the transport operators, as the points with the most issues. The days taken into account were Monday and Friday, out of tourist season, and the results show that on both days, 93% of all traffic consists of personal vehicles, 4% are commercial vehicles with the chassis from 6-9m (vans and light truck), 2-3% are trucks, and 1% heavy trucks (over 12m in chassis length). The peak hours for personal vehicles are from 7-8 am, in morning commute, and the total decline is after 9 pm. The cargo traffic

begins to intensify after 8 am, and the numbers remain steady throughout the day, with the total decline at 12pm. From 60 thousand vehicles daily on the city roads, around 35-40 thousand directly come into the wider city centre.



Picture 2. State and city roads in the Rijeka FUA + traffic counters

When considering whether to include industrial flows in the SULPiTER study of the Rijeka FUA, the first stakeholder that came to mind was the Port of Rijeka stakeholders. Rijeka is known as a harbour city with cargo traffic entering the very heart of the city by sea.

To make sure that the cargo coming from the port is not an issue for daily city traffic, a stretch on the Rijeka bypass was built connecting the Rijeka harbour to the industrial zone in Kukuljanovo. This allows the cargo traffic to exit the city on the east and not to come in contact with the city roads and daily traffic. The port cargo is also transported through the circular tunnel located under the eastern part of the city of Rijeka. Considering all this information, and due to the fact that port traffic has little impact on city logistics, it was decide to include only distribution flows in the project study. The Port of Rijeka is embarking on projects which aim to enhance capacities and efficiency in freight transport, one of which leans on the reconstruction of the railway. The construction of the multimodal platform in the Port of Rijeka is starting with the modernization of the Rijeka traffic route.

Concretely, in terms of freight transport, the plans include construction of 4 new rail tracks, a contact line, signal and telecommunication devices, a new light network and the reconstruction and expansion of the tunnel Sušak. The latter reconstruction, will mean that the freight that is transported by the railway through the railway tunnel Sušak from the port terminal Brajdica, will be transported through the Rijeka centre for next 2 years, while the 37 million € project is realized. The contract for the project Rijeka Brajdica implementation was signed by HŽ infrastructure and the Port of Rijeka Authority in April 2018.

AADT / ASDT on state and county roads												
FREIGHT TRAFFIC		2013					2015				Difference	
Label	Location		B2	B3	B4	TOTAL	B2	B3	B4	TOTAL	2013-15	%
2935	G.JELENJE	AADT	37	38	161	236	30	42	185	257	21	9
		ASDT	34	45	168	247	26	36	132	194	-53	-21
2917	KOSTRENA	AADT	44	5	22	71	39	4	17	60	-11	-15
		ASDT	47	2	20	69	39	3	17	59	-10	-14
2814	MEDVEJA	AADT	58	9	4	71	20	1	3	24	-47	-66
		ASDT	63	9	5	77	21	1	2	24	-53	-69
2813	OPATIJA-JUG	AADT	55	4	5	64	63	4	9	76	12	19
		ASDT	40	4	5	49	60	4	7	71	22	45
2819	OPATIJA	AADT	250	4	7	261	-	-	-	-	-	
		ASDT	271	3	8	282	-	-	-	-	-	
2823	RUJEVICA-W	AADT	756	293	811	1860	694	316	1030	2040	180	10
		ASDT	922	298	922	2142	826	344	1113	2283	141	7
2932	KIKOVICA	AADT	264	189	369	822	273	178	452	903	81	10
		ASDT	392	222	422	1036	411	212	518	1141	105	10
2911	MAVRINCI-KUKULJANOVO	AADT	190	67	448	705	170	69	495	734	29	4
		ASDT	-	-	-	-	175	78	513	766	-	
2804	MUČIĆI	AADT	66	16	120	202	71	18	123	212	10	5
		ASDT	72	14	140	226	55	18	137	210	-16	-7
2818	RUPA	AADT	541	177	376	1094	635	203	611	1449	355	32
		ASDT	1473	273	385	2131	1564	311	606	2481	350	16
2833	KASTAV	AADT	-	-	-	-	110	4	40	154	-	
		ASDT	-	-	-	-	151	4	25	180	-	
2834	VIŠKOVO	AADT	-	-	-	-	98	4	35	137	-	
		ASDT	-	-	-	-	106	4	69	179	-	

Table 1. Traffic count data - AADT / ASDT

4.6. Development trends in commercial and industrial areas in Rijeka

Global trends in the development of freight transport in the FUA from the aspect of the application of ICT systems, ITS and process automation are primarily related to the commercial, industrial and multi-modal transhipment terminals.

Modernization of the Container terminal Brajdica

Modernization of the Container terminal at Brajdica is planned as a part of the Rijeka Gateway II project. It includes: coast extension, new building of the input-output checkpoint in connection with the road D-404, railway station for containers and service activities (garage for servicing transhipment devices).

In the last three years around 30 million euros has been invested in the Container terminal at Brajdica. Extra 328 meters of the coast has been build, and the sea depth along the coast increased to 14 meters. Furthermore, it has been built 30,000 m2 of warehouse space, the new entry-exit point and a new veterinary border inspection station (BIP), which allows greater speed of transport, since all border and customs control can be performed at the terminal.

The maximum capacity of the terminal now stands at 600,000 TEU-s, and there is a possibility of servicing container vessels with a total length up to 370 meters. Presently there are ten new cranes (two shore cranes, six gantry crane for storage and two cranes to work on the railways). The new shore cranes have a reach of 50 meters, which is about 18 rows of containers that can lift to a height of 36 meters above the plateau terminal. It is fully equipped in accordance with international standards, and in the next years new investment of 35 million euros are planned, with the aim of increasing the annual turnover.

Container terminal Zagreb pier

The increase of container traffic throughput in the Port of Rijeka calls for further development of the port handling capacity. Therefore, the planned construction of a new container terminal in the western part of the harbour area suggests itself a logical solution. The container terminal at the Zagreb pier which, when completely finished, will occupy an area of approximately 22 hectares, is conceived as a 680 m long pier with the terminal 300 m wide on average. The minimum planned depth of the sea alongside the pier is 20m. Two construction phases (stages) are planned for this terminal. The first includes 400 m long pier. The extension of the terminal to a total pier length of 680 m is foreseen in the second phase as a result of which the terminal would be capable of achieving throughput capacity of 500.000 TEU /year.

The construction of connector road D 403 and reconstruction of a shunting yard to meet the needs of container loading/discharge operation on the fringe of the terminal, would be undertaken concurrently with the construction of terminal.

It is planned that the new pier construction should be financed by the funds received from the World Bank, while a public-private partnership should be used as a financing model for the development of infrastructure facilities at the existing part of the terminal.

Modernization of General cargo terminal

Transhipments of general cargo is currently being done in the area of De Franceschi pier, Vienna pier and Orlando pier, which require immediate refurbishment. Vienna pier is rehabilitated as part of the Rijeka Gateway project. The reconstruction of Orlando's pier has also started and two new Liebherr cargo handling cranes were put into operation.

Plans for the Delta area and Porto Baross

The urban redevelopment of the port facilities located in the Rijeka city centre is based on the long public and expert perception and awareness of the need for the integration of the city residential and commercial spaces and its port. The citizens of Rijeka would like to see their port actively engaged with its environment. The so called Port-City Interface redevelopment (PCI) foresees a complete redesign and modernization of an area (15 hectares) in the centre of Rijeka, presently used for the port activities, with various port facilities and warehouses.

The decision to have the strictly industrial facilities, placed within the port area, transformed and redeveloped into new urban spaces providing a public benefit to the city residents and visitors, is certainly an important indicator of the willingness to accept and follow the modern European and global trends in the urban organization of the city.

The PCI component includes: a modern maritime passenger terminal to accommodate car-ferries and cruisers – breakwater, nautical centre –marina – Port Baross, various commercial-residential, business, cultural, entertaining and public facilities – DELTA.

In accordance with the Master Urban Development Plan, the Danish companies COWI and Gehl Architects have worked out the guidelines for the redevelopment of the existing 15 ha area at Delta and Port Baross. These reputable Danish companies, engaged through a public international competitive process, were expected to offer such architectural-urban design solutions which would be to the satisfaction of both, the investors/developer and the residents of Rijeka and its visitors. There is a number of potential

investors/developer from all over the world showing interest to take part in the redevelopment of the mentioned area.

5. SULP's specific objectives

After the surveys, roundtables and research, the most important requirements of key users were identified in four main categories as follows:

- Technical aspect – requirements from the technical and functional aspects of the logistics system
- Operational aspect - requirements in terms of frequency (daily supply, weekly, etc.), type of delivery, weight of shipments, motivation, and control and management of delivery system
- Commercial aspect - requirements with regard to economic and commercial processes; this category refers to the service and quality of supply, impact on customer satisfaction, competitive advantage and reputation of the company
- Socio-economic aspect - the wider impact of urban logistics system to the socio-economic needs of the user

1. Strategic goals (SG) harmonized with Master Plan for Developing the Traffic System of the Functional Region of Northern Adriatic:

SG1 - Ensure good traffic connection of the Functional Region of Northern Adriatic with TENT transport network (all types of traffic)

SG2 – Improve transport accessibility and availability (international, national, regional, micro-regional) of the entire area of functional region of all traffic branches, taking into account the principles of development of efficient, optimal and sustainable transport system

SG3 - Increasing urban and regional mobility using the integrated public transport and other forms of transport that are environmentally friendly, energy and economically acceptable

SG4 - Increasing the quality of transport services using modern transportation solutions such as intelligent transport systems (particularly in urban areas)

SG5 - Enhancing the division of transport types in favour of public transport, environmentally friendly and alternative forms

SG6 - Increasing quality of transport and logistics services in relation to the competitive state

SG7 - Increasing the financial sustainability of the transport system and the usage of ESI funds and other EU programs

SG8 - Link strategic priority objectives of the transport sector with aim toward developing competitive and sustainable economy and horizontal areas through research projects, development of new technologies and innovations

2. Operative goals (OG) harmonized with Master Plan for Developing the Traffic System of the Functional Region of Northern Adriatic:

OG1 – Developing road infrastructure of high-serviceability

OG2 - Developing road network around urban areas

OG3 - Improving the transport system in terms of organization and operating structure, to ensure the efficiency and sustainability of the system

OG4 - Reducing the traffic of motor vehicles in urban areas to reduce environmental impact

3. Operative goals defined in SULP

OG5 - Defining access and transit of freight transport corridors and related space for logistical needs

OG6 – Introducing vehicles of low or zero gas emissions in the logistics delivery system of Rijeka

OG7 - Introducing IT solutions for control and management of the delivery system in the City

OG8 - Harmonizing supply regulations adopted by the City of Rijeka with these specific objectives and measures

6. Measures vs. demands

Identification and analysis of possible measures and solutions which will be applied by the local government depend on the results of the analysis of logistics processes, and determined deficiencies that must be corrected. There are a number of measures aimed at elimination of defects that prevent equal and sustainable flow of the logistic process.

- *Types of measures commonly used in the immediate city centre, and their applicability rating*:
  - Introducing low carbon emitting vehicles for Last Mile Delivery - cargo electric bicycles or tricycles - because of its low implementation cost in practice as well as to the fact that they do not emit any harmful substances into the air, this is one of the most popular measures used in many European cities in response to the daily traffic jam created by motor vehicles.
    Freight bicycles and electric bicycles are used for short distance freight transport and shipment, whose weight does not exceed 250 kg. This measure is often used in combination with the limited traffic zones or no traffic zones, and where possible, rely on the existing cycling infrastructure. It is also suitable for combination with other measures such as urban distribution centres or mobile storage. Bicycle types are related to bicycles or tricycles combined with a trailer for transportation of different weight and volume. This kind of transport is suitable for the delivery of various shipments and food. Freight bicycles and tricycles are often used in combination with electric drive, which gives them greater autonomy and flexibility.

    Applicability rating: The application is possible in pedestrian zones and limited traffic zones in Rijeka, provided that off-street location for transhipment to low carbon emitting vehicles are planned in their operating range. It is proposed as a priority measure.
  - Mobile storage - it is a mobile warehouses on wheels that represent urban (city) distribution centres. From them to the recipient, the "last mile delivery" is perform in environmentally friendly vehicles such as cargo bikes, trolleys or as a personal delivery. Operating principle consists in the fact that the mobile warehouse are loaded at the depot outside the city during the evening or night, and then transported to some of the larger car parks in the city centre. From there to the end user, delivery is carried out by their own eco-vehicles. This measure has recently been particularly promoted by specialized private logistics companies (such as TNT Express Shipping) with the support of the public sector, and has been applied in practice in Turin and Brussels.
  - Delivery outside peak hours - delivery is performed at night, or at the time when the daily traffic is at weakest. Such delivery can be arranged for the chains of products that are not tightly bound to the time of day, such as technical goods, textile, furniture, and food. This measure primarily favours logistics companies whose cargo can be delivered at night when it can more rapidly reach the destination because there are no traffic jams, and there are more free parking locations. Delivery of some cargo can be carried out without the presence of the recipient, but when recipient has to be present, the measure must be accompanied by a change in working hours (which in turn causes higher delivery costs to recipient). It is proposed as a priority measure.

- Urban (city) distribution centres (UDC) - instead of mobile warehouses, some larger cities have organized urban distribution centres (UDC), to be a warehouse on surfaces and locations that are close to a certain circle of end recipients. The cargo is loaded into logistics centres outside the city, transported to the UDC's where is transhipped on environmentally friendly vehicles and then transported to the end user. In many cases, the public sector has provided the location and became a proctor for the UDC (abandoned industrial warehouse, etc.), and the management was taken over by a private company. Examples of such UDC can be seen in Brno, Toulouse, Paris, Norwich, London and etc.

- *Types of measures proposed for wider FUA area:*

- Spatial planning for the needs of logistics and freight transport - this measure focuses on land reserved for logistic purpose, such as working Industrial Zone in the City of Bakar. On land intended for such needs, larger or smaller distribution centres can be situated that respond to the demand for transhipment, storage and distribution of cargo which are then sent around the FUA. In Rijeka there is no systematic planning and reservation of land for logistic purposes. An example is the company Pert Ltd. which deals with the distribution of goods. Pert Ltd. bought land of former smallish factory and has established its own distribution centre with warehouse in the street of Miroslav Krleža in Srdoči, area that was not expressly designed for such activity. This has created a number of problems for the traffic of heavy trucks and their access to the narrow streets of the distribution centre.

  Part of these measure is also to define freight routes and corridors - it is a very important measure for Rijeka FUA because it can have a big impact on the total traffic flow. The main objective of this measure is channelling traffic routes of freight traffic on the roads of higher level of service, enabling greater speed, less time for delivery and reducing traffic congestion. At the same time, the city centre and the roads below the level of serviceability (or those with restricted capacity) will relieve the burden of heavy vehicles, thereby increasing the flow of traffic. Freight lines can be combined with advanced IT solutions such as routing vehicles in real time, thereby providing a more flexibility in case of unforeseen situations (sudden congestion and jams due to road accidents, etc.).

  It is proposed as a priority measure.

- Organization of logistics processes - complex logistics chains, such as container transport for the container terminal AGCT Brajdica, substantially burden the transportation infrastructure and require the active involvement of disparate participants (Luka Rijeka, AGCT, Port of Rijeka, shippers, carriers, etc.). To be able to operate in a sustainable manner, that is to meet all the needs of the container terminal, complete all the requirements of local government in terms of reduction in freight traffic through the city centre, noise reduction and greenhouse gas emissions, it requires perfect coordination of the entire logistics process. The analysis process in the SULP has shown that in the planning of key logistics processes such as road traffic of container terminal AGCT Brajdica, except directly involved participants (AGCT, Port Authority, Port of Rijeka, freight forwarders, carriers), it is necessary to involve other relevant road users (owners of roads – Hrvatske ceste and the City of Rijeka, the city traffic management and etc.). In this way omissions and deficiencies when introducing new measures and solutions can be avoided. An example of this is the introduction of a new IT solution for internet obtaining permits for trucks entering in container terminal AGCT Brajdica, that didn’t predicted alternative parking for trucks that arrive too early, or have to wait to entry for some other reason. This plan proposes to solve this problem but it also highlights the need to include all partners in the planning phase. It is proposed as a priority measure.

- Harmonizing delivery regulations with other regulations related to traffic - local authority decisions on traffic regulations must be coordinated with other local regulations on delivery. It is proposed as a priority measure.

- *Types of measures that can be applied to specific areas within the city centre:*

- Off-street areas reserved for logistics operations - measure that can be the result of the systematic planning of the City of Rijeka that will determine the location for transhipment to areas outside the roads, or the result of users initiative. Especially applicable for the purposes of supply stores and supermarkets. It is proposed as a priority measure.
- "Ecological delivery" - a measure that implies the adoption of policies and regulations that promote the use of vehicles on environmentally friendly fuels with low CO2 emissions. This implies the adoption of regulations and declaring "zones without pollution" and limitation of delivery in such areas to vehicles using alternative energy sources, or to classic vans for which mandatory financial compensation will be prescribed if they want to enter such zone.
- Introducing IT solutions for control and management of the delivery system - includes on-line control of the occupancy of parking spaces. In the event of any misuse, IT system automatically notifies traffic police. It is proposed as a priority measure.

7. Layout of measures

SWOT analysis provides an overview of the strengths, weaknesses, opportunities and threats and refers to both groups of processes - traffic for the purpose of ports/shipyards and for the supply requirements of the City of Rijeka.

Strengths:

- Favourable geographical position – proximity to the developed European regions/countries
- Road transport is dominant and the most developed mode of transport
- Good connectivity of the region with roads of high serviceability
- Road network in certain parts of FUA
- Economic development of FUA
- Favourable geographical position of the Port of Rijeka

Weaknesses:

- Uneven development of different parts of the FUA
- Using environmentally unacceptable delivery vehicles
- Insufficient coordination of participants in large logistics processes
- Disconnect between key players in the logistics process
- Lack of control over the usage of parking spaces reserved for delivery
- Inadequate regulations on urban supply

Opportunities:

- Increasing traffic safety
- Possibility of using ESI funds and other programs of the EU
- Possibility to connect with other forms of transport (intermodality)
- Defining and reserving corridors for freight traffic
- Reducing air pollution and environmental impact
- Ability to influence local government to modify the regulations on urban supply
- Introducing low carbon emitting vehicles for delivery in the city centre

Threats:

- Reduced road safety
- Increase in travel time due to bottlenecks
- Inadequate operational link between all participants in the logistics process
- Negative environmental impacts due to CO2 emissions
- Negative impact of freight transport on the inadequate road infrastructure (increased wear)

7.1. The measures proposed resulting from the SWOT analysis:

- Measures proposed for the wider area

1. Spatial planning of roads and corridors for logistics and freight transport
2. Organization of logistics processes
3. Harmonizing supply regulations with other regulations related to traffic

- Measures proposed in the immediate city area

4. Introducing low carbon emitting vehicles for Last Mile Delivery
5. Delivery outside peak hours
6. Reservation of off-street areas for logistics operations
7. Introducing IT solutions for control and management of the Delivery system in the City

7.1.1. Measure 1 - Spatial planning of roads and corridors for logistics and freight transport

Measure 1 is elaborated in accordance with the specific aim of SC5 - Defining access and transit of freight transport corridors and related space for logistical needs. As a part of this measure and carried out analysis of the state of transport corridors within the FUA area, it is proposed that the signpost traffic signs mark the freight transport corridors, which connect the city of Rijeka with the hinterland.

Croatian Roads (Hrvatske ceste) and the City of Rijeka are responsible for the implementation of this measure.

7.1.2. Measure 2 - Organization of logistics processes

The analysis process in this plan has shown that in the planning of key logistics processes such as road transport for Brajdica container terminal, apart of directly involved participants (AGCT, Port Authority,

Port of Rijeka, freight forwarders, carriers), it is necessary to involve other relevant road users (owners of roads - Croatian roads and the City of Rijeka, City traffic centre, Interior Ministry traffic police). In this way omissions and deficiencies when introducing new measures and solutions can be avoided. An example of this is the introduction of a new IT solution for internet obtaining permits for entry of trucks in Brajdica Container Terminal, that doesn't predicte alternative parking for trucks that arrive too early, or have to wait to entry for some other reason. This plan proposes to solve mentioned problem through the use of alternative capacity for parking and waiting trucks on locations Grobnik field and Truck Terminal Kukuljanovo.

Picture 3. Locations for the waiting trucks and corridors with access to the container terminal Brajdica

It takes precise planning, information exchange and coordination of activities between key partners in the logistics process: AGCT - Port of Rijeka Authority - Port of Rijeka - carriers, in order that delivery on a container terminal is done right and on time. It is essential that the carriers receive information on time (and that means - before vehicles arrival at a container terminal), if the terminal is for some reason blocked and cannot receive vehicles. In such a situation the carriers are given the instructions to divert them to locations where they can wait for the order to go to the container terminal. The optimal location for redirection and temporarily parking is Freight terminal Kukuljanovo which has the capacity for receiving a large number of heavy goods vehicles, and supporting capacity - storage, catering, reloading and others, which allow detention until departure at the container terminal. The location is very favourable for the proposed purpose as it already has built all the necessary infrastructure, and good road connections associated with the highway Rijeka-Zagreb through which the shortest route comes to Brajdica container terminal.

As an alternative parking location for trucks waiting to go to the container terminal, it is proposed location Grobnik, on the site of the abandoned construction base. The location is at a tollbooth on Kikovica in the immediate vicinity of the Rijeka-Zagreb highway. Location is only partially regulated in terms of stabilization of the field but it is necessary to further regulate and build on it objects of retention, and also resting places for drivers and other supporting facilities. Excellent road network ensures shortest route to the container terminal Brajdica.

7.1.3. Measure 3 - Harmonizing supply regulations with other regulations related to traffic

The City of Rijeka is the local government that has elaborated decisions and regulations related to transport and supply. Two city departments, Utility Services Department and Department of Development, Urban Planning, Ecology and Land Management,each in their own part, are responsible for the issues in the field of transport. Apart from them, municipal company, Rijeka promet d.d. is in charge of surveillance and traffic management in the city. Given proposed measures, it is essential that those bodies take the necessary steps to amend or supplement the existing regulations governing the processes of supply in the city, to ensure the implementation of the planned measures.

Corrective measures such as the introduction of fees for supply vehicles in pedestrian zones can be a good tool for putting under control the uncontrolled and excessive traffic related to supply.

Before making a decision, it is necessary to define the objectives of the measures intended for implementation with aim to introduce order in the supply system.

It is also recommended to ban traffic vehicles whit maximum mass exceeding 12 tonnes.

7.1.4. Measure 4 - Introducing low carbon emitting vehicles for Last Mile Delivery

It is one of the most popular measures used in many European cities in response to the daily bustle created by motor vehicles because of its low cost implementation in practice as well as to the fact that it does not emit any harmful substances into the atmosphere. Freight bicycles and electric bicycles are used for freight transport and shipment in a short distance, whose weight does not exceed 250 kg. This measure is often used in combination with the introduction of the zones of limited traffic or no traffic in the city centre, and where possible, rely on the existing cycling infrastructure. In Rijeka, as well in any other local government units in the FUA area, cycling infrastructure that would allow cycle traffic to be physically separated from other aspects of road transport is not developed. Possible solution are electric bikes with cargo space, which allows a slightly higher speed of the traffic and to transport cargo to a distance of 2 km.

Picture 4. Example of electrical bicycles with cargo space (source: Urban Arrow, London, UK)

This measure is suitable for combination with other measures such as urban distribution centres or mobile storage. This kind of transport is suitable for the delivery of various shipments and food. Freight bicycles and tricycles are often used in combination with electric drive, which gives them greater autonomy and flexibility. Examples of this kind of supply vehicles can be seen in Vienna, Paris, Turin and elsewhere.

Freight bicycles and tricycles are optimal for performing supply in urban areas where the passage of vehicles is limited, such as eg. the streets within the area of the Old City of Rijeka. Since it is a pedestrian zone, a cargo bike can be an acceptable means for the delivery in the areas which are otherwise intended for pedestrians, because it can be easily adapted to speed of pedestrians of 3.5 km / h. Various combinations of cargo space in the electric bicycles allows great flexibility and ability to adapt to the delivery of a wide range of goods, from food and beverages, pharmaceuticals and perishable products, to clothes and fast shipment.

For the City of Rijeka, the introduction of electric vehicles such as electric bicycles requires the following preparations:

- Creating a legal framework - adapting the traffic regulations in zones of limited traffic and pedestrian zones and determining the conditions for the vehicles of the supply (jurisdiction of the City);
- Adjustment of Croatian law on categorization, approval and registration of cargo electric bicycles / tricycles as motor vehicles with current EU regulations
- Defining off-street spaces as a point of reloading from the classic trucks on the electric bicycles (jurisdiction of the City);
- Creating terminals for charging electric bicycles (jurisdiction of the City?)
- Involvement of companies specializing in the electric bicycles (concessionaires-partners-beneficiaries);

7.1.5 Measure 5 - Delivery outside peak hours

Supply service in urban FUA areas is not time-limited, which means that the supply may be performed at any time within the 24-hour period. The result is that the vast majority of goods is delivered in time that is not appropriate, because it coincides with the daily (morning and afternoon) peak hours. On roads with more lanes in the same direction (eg. Strossmayer, Adamićeva Krešimirova street) some supply vehicles stop at the roadside to perform unloading and loading of the cargo. This results in a pronounced disturbance of the traffic (vehicles are trying to realign into another lane which is also filled with vehicles) which causes congestion.

In order to reduce pressure, it is possible to limit the delivery of certain goods for a period which is less than 24 hours. It should take into account that some goods can continue to be delivered throughout the 24-hour period, and these are drugs, food and perishable goods. The rest of the goods can be delivered in time between 22:00 to 7:00 pm.

7.1.6. Measure 6 - Reservation of off-street areas for logistics operations

In order to successfully implement Measure 4 - Introducing low carbon emitting vehicles for Last Mile Delivery, it is necessary to find and arrange adequate off-street areas in which transhipment of cargo from classic trucks onto electric bicycles and vice versa is possible.

Optimally, this off-street areas will be as close to the pedestrian zone Corso and the Old Town as they can be, and that is not further than 2 km from the centre of the pedestrian zone.

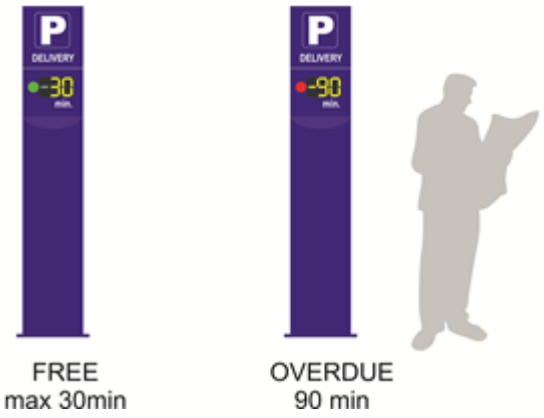
Picture 5. Proposal of off-street locations for the establishment of "Hot-Spot" places for the transhipment of goods

7.1.6. Measure 7 - Introducing IT solutions for control and management of the Delivery system in the City

Technological solution that aims to limit the usage of delivery spaces up to 30 minutes per user, and to simplify the penalty system.

The solution foresees three stages of development. The first phase includes the installation of devices that are covering two parking spaces. Each device is equipped with IT LED screen and scoreboard in which the green light and the numerical count down of (remaining) minutes is ensuring orderly use of the delivery / supply spaces. After the allowed 30 minutes, the red light is turning on, scoreboard starts counting minutes overdrsft and system automatically alerts the traffic police about the traffic tackle. Performance data are transferred manually from the memory card to a central computer. Software selects the data and stores them in a central database. The selection is done according to:

- Each location (device)
- Data type (data about usage, service information)
- Time period



Picture 6. Example of the device

The second phase of the IT solution concerns the networking of devices in the centralized delivery control system via LAN POWER NET devices and GSM data devices. Group of devices communicates with the central computer via the GSM 2G / 3G / 4G device. Program support allows you to collect all data in a central computer and visualize them in the supervisory centre. The central computer selects and distributes part of the data on the mobile device of the controllers in the field according to the required parameters by the customer. Program control must be made for standard mobile devices (phone, tablet).

The third phase involves the installation of the LPR system that reads vehicle license plate and distribution of data to the central control and control system for filling the delivery parking spaces. Data processing of license plates of offenders are automatically distributed to the existing system of traffic warden for direct penalizations. Completion of the third phase provides a complete network management system for delivery locations and enables the creation of a database on which it is possible to analyse network and system efficiency, create system upgrades, statistical indicators etc.

8. Road-map for implementing the measures

SCENARIO 1

Business as Usual: No action is taken

We consider the scenario by which traffic conditions are adapted to the current situation, without taking any measures. This implies that the usual means and methods are affecting already established business and transport processes in which it does not take any radical measures to achieve the goals.

In such a situation the following developments are expected:

1. On the wider area (including the entire FUA area) freight traffic is still taking place according to well-established traffic routes, without the formation of freight corridors

Expected impact on the traffic: Imbalance of the traffic volume on the road network within the FUA, the overload of certain parts of the road network, the crowds and congestion at certain points / intersections, increased CO2 emissions at congestion points, delays in the delivery, customer discontent with supply system.

2. Irrational utilization of logistics resources and lack of organization of the logistics process

Expected impact on traffic: Serious disturbances in the supply system and logistic chains, over-load of the transport network component of freight traffic in the peak hours, overload of reserved parking place for supply, non-compliance with contractual obligations of the participants in the logistics process, the high cost of logistics and reduced efficiency of the supply system.

3. Non-compliance of supply regulations with other regulations in the field of transport

Expected impact on traffic: The consequence is the non-compliance off the rules and regulations adopted by individual local government, loss of effective control over the functioning of the logistics and supply system.

4. Further usage of vehicles with high CO2 emissions, the supply is carried out within the entire 24-hour period, there is no control over the use of parking spaces reserved for the supply

SCENARIO 2

The optimal situation: applying all selected measures

5. On the wider area (including the entire FUA area) freight traffic is routed to a pre-established freight corridors

Expected impact on traffic: Achieving better distribution and balance of traffic volume on the road network within the FUA, a better balancing of certain parts of the road network, relief on certain points/ intersections with less bandwidth capacity, shortening waiting times at intersections, lower fuel consumption and total reduction of CO2 at points of congestion, customer satisfaction with supply system.

6. Organization of logistic processes and better usage of logistical resources

Expected impact on traffic: Optimal functioning of the supply chain and logistics, the optimal usage of reserved parking spaces for supply, satisfaction of participants in the logistics process, reducing logistics costs and increasing the efficiency of the supply system.

7. Harmonizing supply regulations with other regulations in the field of transport

Expected impact on traffic: Compliance with the rules and regulations adopted by individual local government, effective implementation of measures to sanction offenders, creating conditions for complete control over the functioning of the logistics and supply system.

8. Introducing low carbon emitting vehicles for Last Mile Delivery
9. Delivery outside peak hours
10. Reservation of off-street areas for logistics operations
11. Introducing IT solutions for control and management of the Delivery system in the City

Expected impact on traffic: Reducing CO2/greenhouse gases in the city centre, relieving traffic in the peak hours in the city centre, effectively controlling and managing the supply system.

SCENARIO 3

The realistic situation: applying only those measures that are most important and which can realistically be carried out with regard to the overall situation

12. Established corridors for freight traffic
13. Better connection and coordination between key players in the logistics process
14. Harmonized supply regulations
15. Created conditions for introduction of low carbon emitting vehicles for Last Mile Delivery
16. IT project for control and management of the supply system is established

Expected impact on traffic: Achieves better distribution and balance of traffic volume on the road network within the FUA, a better balancing of certain parts of the road network, lower fuel consumption and total CO2 reduction at points of congestion, better planning of supply system, greater compliance with the rules and regulations adopted by local government, the implementation of measures to sanction offenders, creating conditions for complete control over the functioning of the logistics and supply logistics process, less strain on public-traffic areas.

9. Evaluation of impacts

Sustainability is the starting point of every decision in the field of transport planning and traffic management. With a complex system of decision-making, sustainability requires the creation of tools in order to properly evaluate all available data, which will then allow making the right decision.

This created tools for multi-criteria analysis, which enables correct evaluation of a large number of parameters that influence the sustainability and are related to the field of economics, environment, society and the transport system. Creating an integrated tool is further complicated by the involvement of multiple layers of participants in the process.

Logistics Sustainability Index (LSI) is essential for all decisions in the field of transport and logistics, as it represents evaluation the overall logistics system. LSI is useful when comparing the current situation and the condition expected after implementation of the proposed measures, or when comparing two possible scenarios.

The first Logistics sustainability index calculation was carried out after the first freight quality partnership in Rijeka, where private stakeholders shared their experiences with the logistics policies that are in force in Rijeka. After discussing the issues with the logistics system in the Rijeka FUA, by their opinion, the parties discussed the proposed measures which could be included in the Rijeka SULP document, and how would those measures affect their business. The private stakeholders who participated in the freight quality partnership in Rijeka have, determined that the issues in the logistics of FUA Rijeka, are exclusively in the Rijeka centre, and did not point out other FUA locations as problematic.

The measure whose inclusion in the Rijeka FUA logistics system would be well received by the participating stakeholders, is the last mile (and less) delivery of goods by electric vehicles.

The stakeholders shared their experiences with this measure in different locations (during tourist season, such as Baška, Krk, and Stari Grad) and explained the ratio behind this proposal. Delivery locations in the Rijeka centre are limited to a specific duration of delivery. When the supplier or 3rd party delivery needs to use the delivery parking on these locations, it is often occupied. If there were to be a system developed which could assign time slots to interested companies, then the delivery companies can approach the delivery location on their assigned time slot, and transport the goods to the electric vehicle that will make the last mile delivery. This is also a good idea, according to private stakeholders, because they often have only 30 minutes to use the delivery location, but have to deliver to up 5 locations in the city centre in that time range.

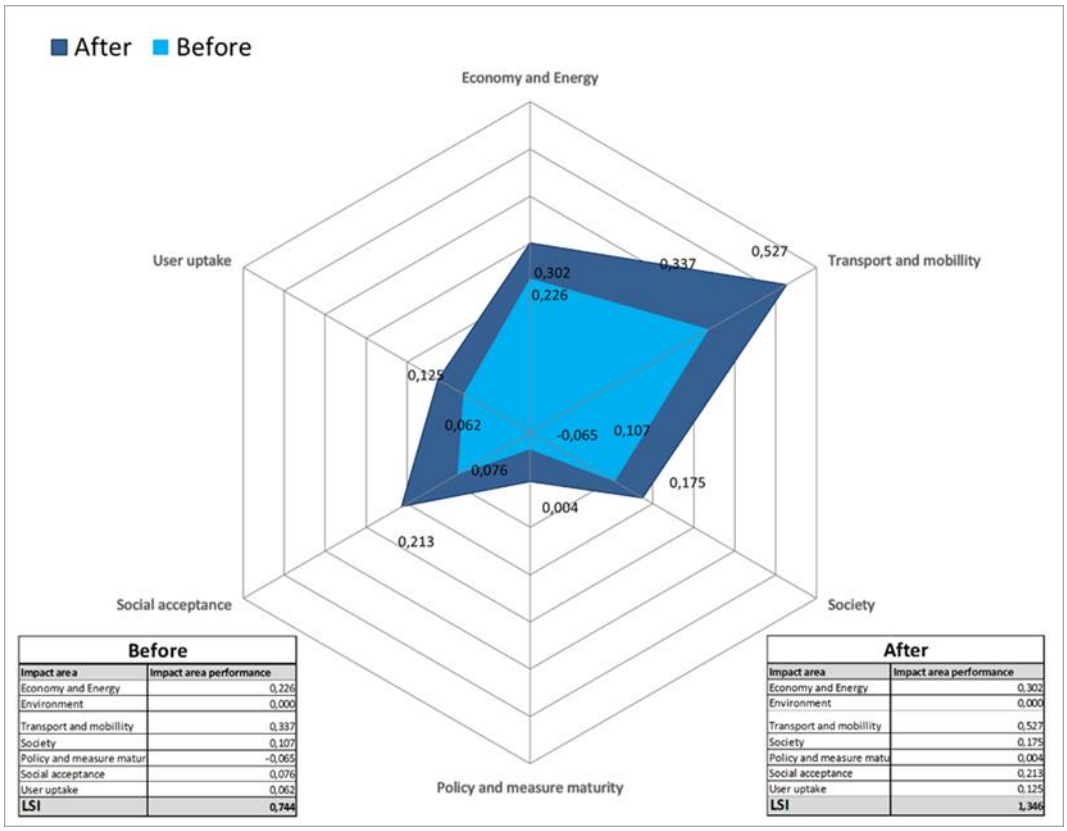
For the calculation of the LSI, the following hypothesis and measures of action were defined:

H: the introduction of a hotspot for unloading goods will increase the quality of the deliveries in Rijeka

M: enforcing the measure of a hotspot for goods acceptance from the hotspot to the end users

- Defining hotspot locations
- Equipping hotspot locations and ensuring 3rd party delivery services to the end user
- Setting up signs and informatics support for stakeholders
- Regulatory support (redefining delivery hours and monitoring)
- Developing IT support/reservation services and assigning time slots

For every area of influence (impact area), except for environment, there was a need to define multiple criteria and indicators of assessment because of the principle of the multi-criteria analysis (showing the impacts and intensity among criteria). The impact area for environment was not included because of the need to qualitatively evaluate the criteria. As explained before in this document, it is impossible to connect the environmental impact of the logistics vehicles included in this study and its impact on the environment as oppose to the total impact of traffic on the environment. The surveys did not provide information which could be used for such an estimation.



Before	
Impact area	Impact area performance
Economy and Energy	0,226
Environment	0,000
Transport and mobillity	0,337
Society	0,107
Policy and measure matur	-0,065
Social acceptance	0,076
User uptake	0,062
LSI	0,744

After	
Impact area	Impact area performance
Economy and Energy	0,302
Environment	0,000
Transport and mobillity	0,527
Society	0,175
Policy and measure matu	0,004
Social acceptance	0,213
User uptake	0,125
LSI	1,346

Picture 7. LSI Calculation

These numbers were calculated based on expert evaluation, which is one of the possible and legitimate approaches to the LSI calculation. Experts from different fields related to the chosen impact areas brought on their research and data, and evaluated specific indicators.

The goal is to further study this measure`s inclusion in the SULP document by getting more feedback in the future freight quality partnerships. There are plans to explore other measures which are also interesting to the competent traffic authorities, in addition to the one calculated now, and to see how the stakeholders would react to their introduction in the logistics policies.

10. Role of the stakeholders involvement

There were 5 Freight Quality Partnership in Rijeka FUA. Members varied from regional and local authorities, representatives of higher research, private companies and members of the traffic police. The FQP have had a major role in proposing the measures and solution for the SULP development. All the members accepted that there is a complex situation and aimed at finding a common view on urban freight transport.

Picture 8. FQP in Rijeka

1st FQP – Participants were introduced to SULPiTER project and to the development of the SULP document. The importance of the document was explained in the context of the regional master plan which is in progress. The participants were introduced to the suggested measures in the document template, which continued in an open discussion with all participants, on their experiences.

The representatives of public authorities were focused on the possibilities of infrastructural adaptation to the measures, while the private stakeholders shared their experiences in the delivery systems of other cities and pointed out to good practices which should be taken into account when drafting the document. The representatives of the private stakeholders also pointed out, in their view, faults of the current system in place, and suggested improvements.

2nd FQP - The participating professors from the Faculty of Maritime studies presented the steps for the LSI calculation, showing the layers of the multi criteria calculation and the complexity of the method.

Danijel Frka, from Rijeka promet made a short introduction on the development of a SULP document and the delivery service in Rijeka. The delivery is nowadays organized in 24 hours a day, while the first organization of the activity 20 years ago, and arranged for an off peak, night time delivery.

The discussion then switched to the proposed measures for the meeting. The representatives of Rijeka promet and TIA partner discussed the number of locations that would suffice the needs of the Rijeka city centre, and the possible cost of such a service for distributers, suppliers or delivery companies. Also, mentioning the off peak measure, Orbico noted the necessity to grasp the whole issue of planning deliveries, because if a delivery was organized in morning hours, the n their company would possibly need to send more vehicles and drivers to these locations.

The representatives of the Dept. of Urban planning and Traffic wardens noted that the issue with deliveries lies with large deliveries. So, they proposed a possible different arrangement of deliveries for heavy vehicles, or in other hours than light deliveries. The transport operators added that they are ok with delivering in off peak hours but the stores and shops aren`t available for receiving goods at night or before working hours. Rijeka promet also proposed the measure of re-evaluating delivery parking positions, their locations, number and assigned time for delivery, and their availability.

3rd FQP - The participants were informed on the progress of the SULPiTER project, and that the sustainable urban action plan is finally underway, after the finalization of the tender procedure, and selection of the subcontractor. The SULP will be developed by the municipal company Rijeka promet that deals with traffic management, research and monitoring of traffic, and among other projects, guides development projects in the field of traffic. The company monitors the issues in traffic and analyses issues regarding road infrastructure, the signalization system, parking system, public transportation, road

terminals, railway infrastructure, the port and port infrastructure, and the airport infrastructure. The company is also included in development strategies that concern the local and regional area.

The measures proposed so far, as discussed by the participants, include: introduction of hotspots for 3rd party delivery, development of an IT system for hotspot reservation (discussion on hotspot location); goods reception before morning peak; changing the hours of delivery; revision of delivery locations – IT monitoring of availability

4th FQP – Organized specifically between Rijeka promet, municipal company in charge of SULP development, and the Port of Rijeka, company whose basic activity is to provide port services. The Port of Rijeka was informed about the measures proposed so for by the private and public stakeholders in previous freight quality partnership meetings. The representatives of the Port of Rijeka provided inputs regarding the logistic process, including information about: average daily traffic (30-35 trucks per day) and monthly traffic (500-600 trucks per month); entry and exit points to the City of Rijeka; number of additional trucks performing local transport (50 per day)

5th FQP - The meeting was held in the premises of Adriatic Gate Container Company, a port operating company which operates port facilities at Port of Rijeka. Regarding the logistic process, AGCT specified the following: all truck traffic for AGCT arrives (and departs) by State road D-404; average daily traffic is 250-270 trucks, plus local traffic; most arrivals to Brajdica Terminal are between 13-19.00 hrs.; AGCT is more than the container terminal – it provides customs and forwarder's services to a variety of other customers; modal split between railway-road is 30% - 70%

Mr. Ognjen Ružić, from AGCT also pointed the specific problems in operation of the logistic system, such as: arrival of trucks is coordinated with terminal Škrljevo operated by the Port of Rijeka company (Luka Rijeka d.d.), where drivers purchase tickets for entering the AGCT Container terminal Brajdica; in rare cases, due to terminal's closure, the line of trucks waiting to enter the Container terminal spreads into the Pećine tunnel, thus blocking complete incoming traffic on this route; trucks in local traffic Brajdica-Žabica tend to use the shortest route through the city centre, but to do this, they deliberately break the law and turn over full dividing line on the State road D-404, what is very dangerous for all traffic on this road; private cars of AGCT employees and other services are parked on the accessing road to the terminal, thus limiting the manoeuvring space for trucks.

After SULPiTER - The role of the FQP in Rijeka FUA is uncertain. One of the major problems encountered was the lack of response from private stakeholders so it could present problems to involve them in the future.

11. Main steps for the adaptation of the SULP

By adopting the Sustainable urban logistic plan on the local, regional or national level it is guaranteed the implementation in accordance with the general interest of the whole society, not just interested individuals. By integrating SULP with SUMP (Sustainable Urban Mobility Plan) it will be achieved the compliance with the overall strategy of sustainable development of transport in certain area. SULP should be seen as an integral part of SUMP, therefore, the two plans must have a common basis or SULP, as the plan of a lower order, must act according to basic guidelines of SUMP. The link between the two can be flexible, and can be defined in different ways and to connect on different levels, depending on the overall goals of urban logistics.

In that sense, the SULP proposes measures for implementation, which are compatible with the objectives and measures set out in the Master Plan for Developing the Traffic System of the Functional Region of

Northern Adriatic. Primorje-Gorski Kotar County as a leading partner, in cooperation with partners carried out activities to create a Master Plan for Developing the Traffic System of the Functional Region of Northern Adriatic based on the Partnership Agreement which was signed by Primorje-Gorski Kotar County on May 30th 2016. Its development, which is currently underway, is conditioned by the necessity of further sustainable development of the mentioned areas, in accordance with economic and social objectives and needs to improve living conditions, environmental protection and preservation, achieving energy savings and energy efficiency and other sustainable development goals.

The City of Rijeka is one of the most important stakeholders of the entire drafting process because the City of Rijeka is a traffic and economic focus of the functional region, and is involved in the development process through its professional representatives.

The Master Plan for Developing the Traffic System of the Functional Region of Northern Adriatic will be applied for the period until 2030 (in accordance with the Transport Development strategy of the Republic of Croatia 2014-2030), and the Plan needs to be made by December 31st 2018. Since the said Plan will contain the essential elements of the logistics system, which is subject of this SULP, it is important that these plans be coordinated in key logistic elements.

12. Application and monitoring

It is necessary to carry out an analysis of each measure applied in order to assess the overall effectiveness of the SULP and responsibility of each of the participants in the logistic process.

Implementation plan must be realistic, measurable and enforceable, in order to give a clear picture of the results depending on the passage of time.

Implementation Plan on the proposed measures

The first step in the dynamics of the implementation of the selected measures is to define a Plan of measures. The Plan defines measures that are related and valid for entire FUA area, and measures envisaged for certain narrow parts of FUA area. In particular, by analysing the logistics process, by identifying the users and partner needs, the state of traffic infrastructure and according to results of the SWOT, a proposal for the measures is indicated in the table below. These measures reflect the need to take steps to improve the overall logistics of the situation.

Table 2. Proposed measures and objectives of city logistics

	PROPOSED MEASURES	CONTENT OF PROPOSED MEASURES	EXPECTED OBJECTIVES
WA1	**Spatial planning of roads and corridors for logistics and freight transport**	Land reserved for logistic purposes; defining freight routes and corridors in the FUA	Securing areas for logistics manipulation; relieve the city centre of freight traffic; reducing traffic congestion and CO2 emissions

WA2	**Organization of logistics processes**	Connect all relevant stakeholders in the logistics process and establish the mutual coordination of all Activities	Optimal utilization of existing logistics resources; relieve the city centre of freight traffic; delivery "on time"; reducing traffic congestion and deadlock
WA3	**Harmonizing delivery regulations with other regulations related to traffic**	Local authority decisions on traffic regulations must be coordinated with other local regulations on delivery	Ensuring sustainable development of the logistics system
IA1	**Introducing low carbon emitting vehicles for Last Mile Delivery**	Introducing light electric vehicles in pedestrian zones and the zones of limited traffic (electric bicycles and tricycles)	Reduction of CO2 emissions in the city centre; reducing the risk of cargo trucks interacting with foot traffic – increasing pedestrian safety
IA2	**Delivery outside peak hours**	Time limit for delivery vehicles at the city centre; harmonization of delivery regulations and amendments to the Decision on the organization of traffic in the City of Rijeka	Reducing the number of supply vehicles in the city centre; improving the life quality in the city centre; CO2 reduction
IA3	**Reservation of off-street areas for logistics operations**	Introducing off-street location for transhipment to low carbon emitting vehicles in the city logistics system	Improving the urban delivery system; reducing traffic congestion; CO2 reduction; improving the life quality in the city centre
IA4	**Introducing IT solutions for control and management of the delivery system in the City**	Improving delivery system in the city centre	Raising the quality of the delivery system in the city; stimulating delivery at a time of reduced traffic intensity; reducing traffic congestion

13. Promotion and Communication Plan

The promotion includes presentation of the main strategies in the field of logistics to the public, and especially among with main aim to extend all information about various activities and measures taken, and the expected sustainable results. Promotion is achieved through targeted press conferences, distribution of printed promotional materials as well as using modern media solutions in the form of videos or TV commercials, where we can present perceived problems, set goals, select methods of solutions and measures, and the manner and deadlines for implementation of selected measures. It is important to emphasize the public benefits resulting from the implementation of the plan, such as a positive effect on the environment, sustainable development and the improvement of the overall quality of life of inhabitants.

Dissemination of information about the Plan is extremely important in the wider context of the whole FUA area. Understanding the purposes for which the plan is made, as well as acceptance of its underlying assumptions - objectives and measures, and acceptance of the role of each individual in the system of implementation of the measures and thus the Plan, are basic conditions for the overall success of the Plan. The expansion plan includes information about any action on a wide range of knowledge transfer, communication with users, promoting information of the chosen measure and the expected sustainable and environmentally acceptable results in improvement of the total cargo transport in urban functional area. This actions are critical to the success of Plan. Especially important are contacts and cooperation with staff in charge of monitoring legislation and the preparation of decisions, conclusions and solutions that local governments adopts as traffic regulation, since measures proposed in this Plan are based on those documents.

14. Annexes

14.1. Annex 1: FUAs transport policies state of the art analysis

SULPiTER D.T3.
1.1_State of the art a

14.2. Annex 2: Transnational report on understanding freight behaviours and impacts in SULPiTER FUAs

DT.1.2.9_FUA Report including SU

14.3. Annex 3: SULP RIJEKA on national language

SULP RIJEKA-FINAL.DF.doc