SUSTAINABLE URBAN LOGISTICS PLAN OF MARIBOR FUA

Deliverable D.T3.2.3 **April 2019**

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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. The European Commission's White Paper (2011) set 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 – likewise importantly influences the logistic sector, for it is specifically stated: "*Making finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development.*« Important impact of Sustainable Urban Mobility Plans was recognized in the European Commission's Action Plan on Urban Mobility of 2009 where the need for up-take of Sustainable Urban Mobility Plans (SUMPs) in Europe was acknowledged. To accelerate application of SUMPs, guidance material, promotion of best practice exchange, and supporting educational activities for urban mobility professionals were provided.

Still the SUMP methodology is somewhat misaligned with issues of urban freight transport. To fully understand possibilities for mitigating urban freight flows and to solve the problem holistically, urban freight should be approached on the level of entire supply chain (including enterprise's strategies) and from the perspective of Functional Urban Areas (FUA). By the definition, Functional urban areas consist of a densely inhabited city and a less densely populated commuting zone whose labour market is highly integrated with the city (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 from an energy and environmental perspective, enhancing their capacity in urban freight mobility planning to develop and adopt Sustainable Urban Logistics Plans – SULPs. SULPiTER tackles urban freight from the FUA perspective, taking into consideration the functional transport and economic relations between inner urban centres and the surrounding urban territories, as well as the functional transport and economic relations within FUAs. The project was implemented in several FUAs in Central Europe, namely Bologna, Budapest, Poznan, Brescia, Stuttgart, Maribor and Rijeka, where authorities of these FUAs were actively involved in the project as fully-fledged partners. SULPiTER consortium designed and developed a tool aimed at estimating freight demand generated by the economic activities in FUAs, the tool was

deployed in each individual FUA. The SULPiTER tool is designed as a decision support system for policy makers to facilitate the process of elaboration of alternative city logistics scenarios.

2. The SULP Policy Document

In 2015, the Municipality of Maribor has produced and adopted the Sustainable Urban Mobility Plan (hereinafter SUMP), which determines the priorities for development in the field of urban mobility. SUMP follows the EU methodology on SUMP development and it therefore mainly deals with the segment of people and passengers. Still it does mention freight transport and logistics as part of the fifth pillar where the problem of rationalization of urban freight transport is partially addressed (more details about the SUMP are presented in the next chapter).

In the case of Maribor, SULP should be understood as a strategic document complementing the existing SUMP, covering the specific area of city logistics. Since the guidelines for the development of SULP at the European and national level do not yet exist, this plan is based on the methodology of project SULPiTER. As such, the document provides qualitative analysis of the current state and develops strategic guidelines through dialogue with key stakeholders in the FUA.

Maribor's SULP is based on the principles of sustainable development of logistics through the use of environmentally friendly means of transport and through the synergies created with deployment of advanced technological and information solutions. It is also built on the principles of new cooperation models and a continuous improvement process of identified solutions.

SULP document is originally written in Slovene language in a format corresponding with expectations of the City authority and City council. This document represents the English version of the original Slovene SULP including the most important and relevant results achieved in the SULPiTER project. The SULP in original language is attached as annex to this document.

3. Transport policies - state of the art analysis

Transport Development Strategy of the Republic of Slovenia Until 2030 was adopted in 2015 and represents the main strategic policy document on the national level. The Strategy is the first document to deal with the transport system in a comprehensive manner, thus enabling greater synergies in achieving the objectives of transport and spatial policies of the state and of other policies, and greater control of the impact of transport on the environment and the economy.

Based on traffic flow forecasts, traffic safety, environmental impacts and social acceptability, strategy determined future transport measures for all transport types, i.e. sea, air, rail and road transport, and for sustainable mobility. It determines 29 measures for rail transport, 37 measures for road transport, 22 measures for public passenger transport or sustainable mobility, 14 measures for waterborne transport (sea and inland waterways) and 6 measures for air transport, thus, a total of 108 measures governing infrastructure, organisation, traffic management, traffic safety and vehicle fleet.

Green city logistics is mentioned as one of the priorities that play a great part in the supply of the economy, and also influences the way of life. It is stated that the public sector needs to revive the skills needed for sustainable goods' transport by providing a dedicated area for this type of services. This means introducing devices and tools into the comprehensive system of city logistics with the cooperation of the public (city) and private (commercial) sector, as well as urbanists and landscape architects. These three sets of factors come together in city logistics platforms, expressing and forecasting needs and proper solutions to these needs. The issue of increasing external costs, which is most evident in the quality of life in Slovenian cities, is related to noise, particulate matter (PM10, air quality) and congestions. The impact of so-called green city logistics (supply chains and logistics centres) on the development of individual cities, along with the calculation of external costs, may be also be seen in the analysis of the quality of life in cities.

The objectives of accomplishing sustainable logistics in cities should be attained with: (1) improved transport efficiency, (2) intermodality (better exploitation of capacities), (3) good management of city needs in terms of the supply of goods and (4) application of more environmentally friendly vehicles and energy products.

In order to fulfil the EU objectives on lowering greenhouse gas emissions, traffic noise, mobility costs and dependability on fossil fuels, Republic of Slovenia and most of municipalities in FUA Maribor region developed energy and transport/mobility strategies to reach the objectives. On local level in FUA Maribor Sustainable urban mobility plans (SUMP) are adopted by Municipality of Maribor (adopted in 2015), Ptuj, Slovenska Bistrica, Hoče - Slivnica, Lenart, Miklavž (all adopted in 2017) and Ormož (adopted in 2018). Priority in SUMPs is given to residents and various modes of transport are planned in accordance to benefit the quality of life for all inhabitants. With regard to mobility and transport, Municipality of Maribor has identified challenges in quality of transport infrastructure (inadequate maintenance, limited use for all users/modes), insufficient public transport supply, low transport culture, no clear vision of

transport network, social exclusion of the elderly, no real alternative to car transport for households and daily commuters.

Major activities, dealing with issues stated above, are structured in 5 pillars focusing on walking, cycling, public transport (PT), motorized traffic and planning /infrastructure. Restructuring is planned to be in line with SUMP, strategic transport department is planned to be established, with major role to cover all modes equally (also in terms of investments).

The Specific Objective of the Municipality of Maribor's SUMP are:

SO	SO NAME AND SHORT DESCRIPTION
SO1	To plan the traffic according to the guidelines and integrated approach: Establishment of financial, systemic and administrative conditions for improved mobility management. Ensuring transparency of decision-making by involving public in all stages mobility planning. The introduction of tools for the systematic monitoring of Mobility. Integration between different planning sectors within the Municipality.
SO2	To promote walking as one of the most important ways of travelling: Create conditions that most inhabitants could make a large part of daily trips on foot. Increase modal share of walking in the city and the presence of pedestrians in urban area. Increase of traffic safety and a sense of safety for pedestrians. Monitor number and behaviour of pedestrians.
SO3	Further popularization of cycling and creation of additional cycling infrastructure in the city: Create conditions for a comfortable, safe and attractive cycling in the city. Increase the share of cycling in urban trips. Increase traffic safety and sense of safety of cyclists. Monitor the number and behaviour of cyclists.
SO4	Improve public transport to be appealing and useful to the citizens Increase use of public transport. Improve the supply of public transport in the city. Improve integration between different modes of public transport and between public transport and other modes of transport. Improve accessibility of public transport for people with impaired mobility. Improve the image of public transport.
SO5	Enforce rational use of motorized vehicles (cars, motorbikes) Improve air quality and reduce noise pollution. Increase traffic safety. Improve parking

	situation in the city. Reduce car dependence. Increase share of environmentally-friendly vehicles. Reduce negative effects of freight transport.

The SUMP document (p60) briefly describes main measures for freight transport, stating tendencies towards closing the city centre and friendly zone for deliveries is stated. The priority for entering the pedestrian zone and friendly zone will be given to environmentally friendly vehicles, additional benefits to be granted (e.g. longer time for unloading/loading/parking processes). Consolidation points will be equipped with transhipment equipment (carts, hand trucks, cargo bikes), will be well marked and equipped with charging facilities where necessary. Supply in the city centre will be done with cargo bikes. A network of loading bays outside city centre is to be established.

Qualitative or quantitative indicators affecting logistics set in the SUMP (p.32 and 33) use general statistics (e.g. unemployment rate, share of quality transport infrastructure, share of surfaces for multi-use) as well as specialized indicators for walking, cycling, public transport and motorized transport (e.g. share of environmentally friendly freight vehicles).

4. Urban Freight Transport - state of the art analysis

4.1. General data

Functional Urban Area Maribor (FUA Maribor) is, according to OECD methodology, considered as a medium-sized urban area with 246.306 inhabitants (2014 data).

Considering "statistical" NUTS 3 regions FUA Maribor is best correlated with Podravje statistical region with 41 municipalities and 679 settlements. Geographically the region is located in the northeast of Slovenia, bordering Austria and Croatia with well-developed transport infrastructure. The FUA Maribor covers an area of 2.170 km² (10,7% of the national territory). With 320.100 inhabitants (16,1% of the national population), it is the second largest Slovenian region in terms of population. There are several towns (urban municipalities) in the FUA: Maribor (population 113.000, area 147,5 km²), Ptuj (population 24.000, area 66,7 km²), Slovenska Bistrica (population 30.100, area 260,1 km²) and Ormož (population 17.700, area 212,4 km²).

Maribor FUA consists of 41 municipalities shown in figure below.

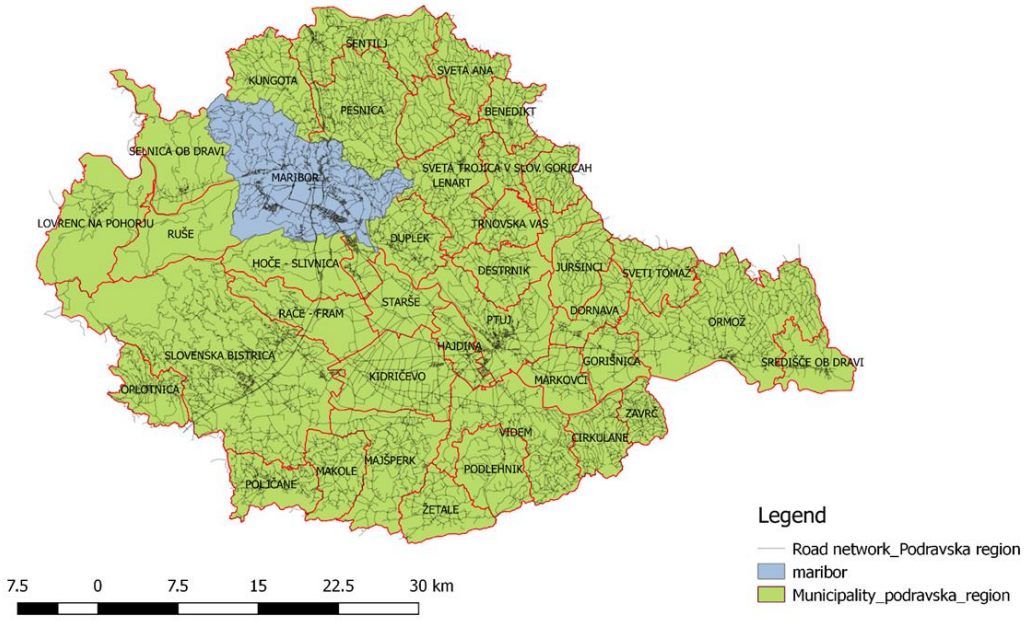

Figure 1: FUA Maribor – 41 municipalities and area of Maribor City (Municipality of Maribor)

For analytical purposes 41 municipalities of FUA Maribor have been grouped into 7 Geographical Units (GUs) based on the road network and major settlements of the region with Municipality of Maribor as a central unit.

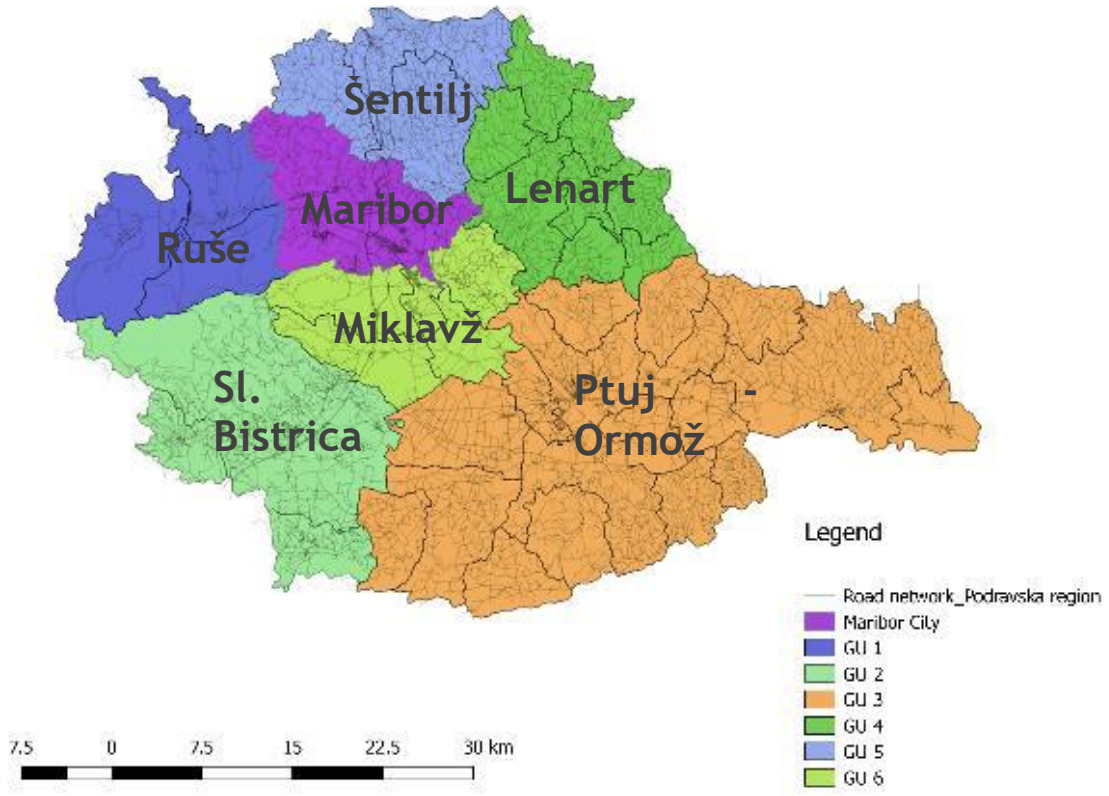

Figure 2: FUA Maribor – Geographical Units (GUs)

FUA Maribor has a long industrial tradition and most companies are in the processing industries such as metal processing, chemicals and food & beverages, moreover a specialisation in agriculture (especially fruit and wine growing) is to be mentioned.

In total, 26.126 companies are registered in FUA Maribor (2016). Largest companies in region are Pošta Slovenije, Boxmark leather, Carrera optyl, Perutnina Ptuj, Swatycomet, ISS facility services, Henkel Slovenija, Dravske elektrarne Maribor, HC Hidromontaža, Impol, Sodo and Talum.

City of Maribor is the largest town in the region and it is the seat of the City Municipality of Maribor. The city is located on the banks of Drava river, the city centre with historical old town is mostly residential with retail and commercial activities including many small craft workshops and service activities. Presently city of Maribor is faced with cessation of activities

in city centre due to concentration of large commercial centres on the outskirts of the old city, problems with delivery options and accessibility of the old city centre (delivery options are restricted in the pedestrian zone in the old city centre).

4.2. Freight Transport data

4.2.1. Survey on distribution flows

Survey on distribution flows of different types of commercial entities (retail, Ho.Re.Ca[1], small shops (crafts) and home accessories) in city centres of Maribor and Ptuj showed that the average entity has a surface of approximately 100 m^2. Smaller entities are located mainly in the strict city centre, larger entities are located outside the city centre.

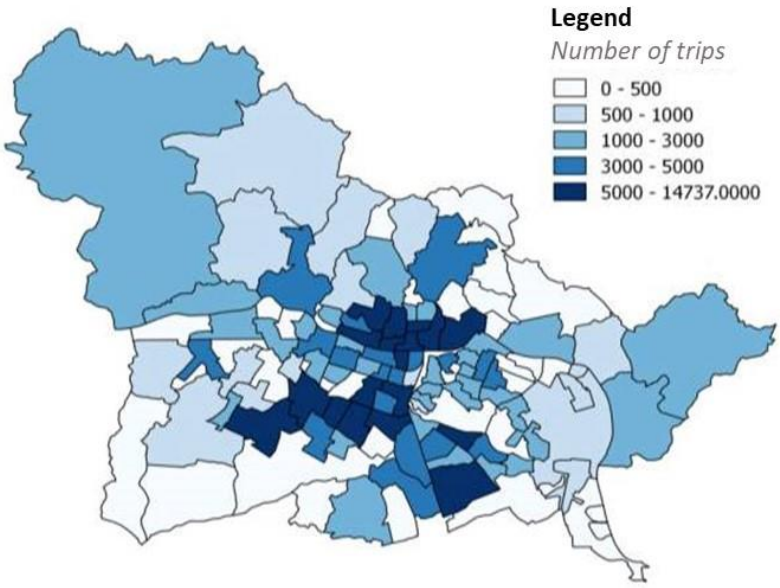

Figure 3: The main traffic generators in Municipality of Maribor

Commercial entities have rather modest share of surface dedicated to warehousing (vast majority in the range up to 20m^2). This indicates that deliveries need to be very frequent and inventories are not substantial. Deliveries are mainly managed, organized and performed by goods' suppliers. The share of self-replenishment at commercial entities is very low and there are actually no cases of off-truck supply. Commercial entities have rather small

[1] Hotel and restaurant sector (Hotel, Restaurant, Café)

number of suppliers (predominantly 1 or 2). This is characteristic for smaller shops with specialised goods on one side and for bigger retail stores, which consolidate all the goods at distribution centres. Deliveries are made mainly to the shop of commercial entities. Only very small share is delivered to external depots. Commercial entities, located in the city centres, very seldom use external depots, except for some specialized businesses – e.g. flower shops that need depots with cooling options for larger quantities of flowers. Packages are predominantly medium or small in size. Only few deliveries include large packages and even smaller number have to do with pallets and roll cage pallets (RLCs). This indicates that deliveries could be possibly done on foot or by freight bicycle. Lightweight packages (up to 5 kg) are characteristic for shipments to urban centres. This again correlates to previous findings and possibilities for innovative urban freight delivery options. Majority of commercial entities receive shipments containing small number of packages (up to 5). This again is indicative of frequent orders of smaller number of packages in order to avoid inventories.

In the majority of cases, we can notice single daily (one delivery per day) or weekly (three times a week) deliveries. Some commercial entities have up to 6 daily deliveries originating from bigger number of suppliers used by these entities. Moderate sample of commercial entities have deliveries twice or three times a week, the same holds for monthly deliveries. A big number of deliveries are caused by commercial entities not holding inventories thus orders/deliveries need to be more frequent.

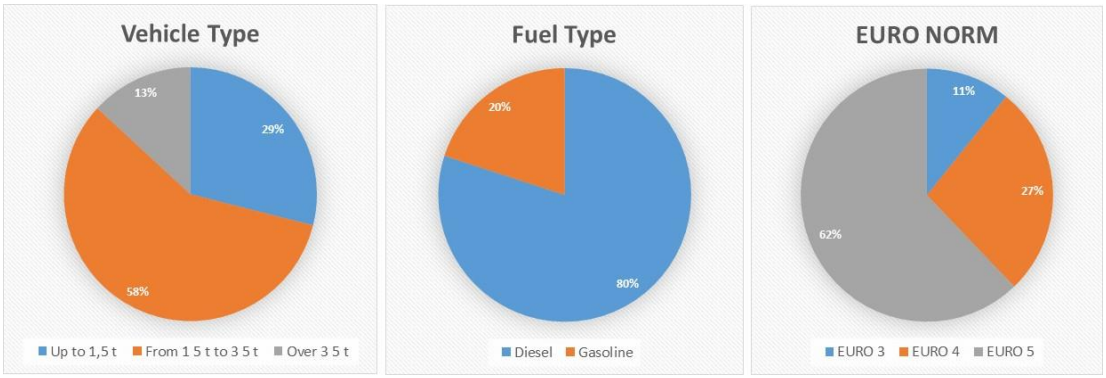

Figure 4: Vehicle types used for urban freight deliveries (commercial entities' own fleet)

The biggest share of deliveries is performed with vehicles from 1,5 to 3,5 tons with mainly diesel fuelled EURO 5 engines. 29% of deliveries are done with personal cars with up to 1,5 tons.

Majority of deliveries are performed in the early morning period when vehicles are allowed to enter city centre/pedestrian zone. In the afternoon, when access to the city centre is

restricted and only selected express courier companies are allowed access, number of deliveries is considerably lower.

Delivery time is limited to fixed morning time slots and fixed afternoon time slots with no other options. More options for deliveries outside present time windows are required by the customers. In addition, initiatives for delivery coordination among suppliers are lacking, issues with cargo security at delivery have been noticed.

4.2.2. Survey on Transport operators flows

Survey on transport operators' flows was focused mainly on transport operators engaged by bigger retail chains in the FUA Maribor. In general, the large retailers are outsourcing transport services to few large transport operators covering the majority of all retail shops in the region. We have interviewed and gathered data from five transportation companies working for the most important retail chains in the region (Mercator, Hofer, Lidl, Leclerc, Jager) and have altogether 255 trucks and vans.

Characteristics of vehicle fleet:

- majority of trucks up to 20 tons (40%), articulated trucks up to 26 tons (30%) and vans up to 3,5 tons (30%),
- mainly EURO 5 and EURO 6 diesel engines (75%), others from EURO 2 to EURO 4 (25%,)
- on average vehicles are 6 years old.

Sequence of movements:

- number of stops on one trip depends upon a commodity that is being transported,
- for retailers (groceries) vehicles up to 9 stops per trip – on average 3 to 4 stops, in case of pharmaceutical products even up to 20 stops per trip.

Typical quantity:

- quantity also depends on type of commodity being transported,
- on average the whole shipment weights approximately 10 tons but when considering deliveries to city centres, which are limited to vehicles with up to 3,5 tons, average shipment weights about 1,5 tons (and usually only small part of it is dedicated to customers in the strict city centre).

Frequency of movements:

- in majority the deliveries are performed daily (60%) or every other day (40%),
- vehicles perform several deliveries per day.

Parking during deliveries:

- in general, transport operators did not report specific problems referring to parking during delivery,
- since deliveries are regular (mainly daily deliveries to particular shops), transport operators manage to align delivery time windows with access restriction in city centres.

In addition to survey on transport operators' flows, analysis of statistical data (data collected by Statistical office of the Republic of Slovenia) on transport operators was done. This allowed for deeper understanding of share of different vehicle types, a total number of trips, total quantity of goods transported and information relevant for generating Origin/Destination (OD) matrices. The analysis also provided quantities and number of trips for different commodity groups. Enquiries were numerous and are shown below except results of load factors analysis in relation to number of trips within 7 zones of FUA Maribor (see below).

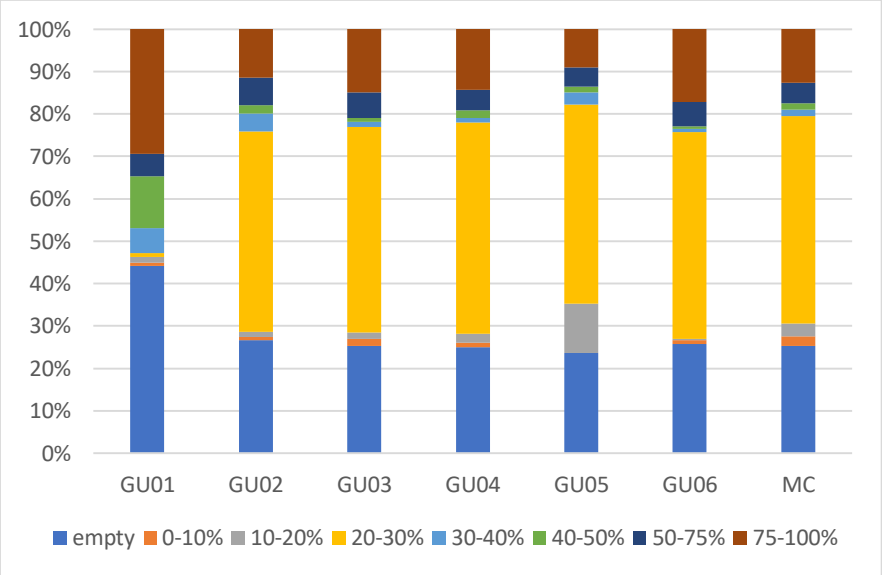

Figure 5: Load factor (utilisation rate) of vehicle trips within zones of FUA Maribor

As can be seen, approximately one-quarter of vehicles travel empty and an additional half of them are utilised below 30% of their capacities. Only 15% of all vehicle trips are performed with fully loaded vehicles. Very similar results are evident for trips between zones of the FUA Maribor. This indicates the need to consolidate goods and to optimise vehicle trips.

Statistical office of the Republic of Slovenia is (among others) providing data on number of performed trips, total volume of transported freight and occupancy rates of freight vehicles. For the Podravje region (NUTS 3 category corresponding to the FUA Maribor), 49% of all trips (in total 750.000 per year) and 62% of road freight transport (in total 9,3 mio ton per year) has its origin and destination within the functional urban area. In that respect, supply chain aspects and logistics activities of FUA are of most importance. When considering occupancy rates of transport trips within the region, 40% of empty driven kilometres and

48% of empty trips can be observed, showing the problem of low utilisation of freight vehicles and empty runs within the FUA.

4.2.3. Annual Average Daily Traffic (AADT)

Data on annual traffic flows and traffic volumes in Slovenia was obtained from 113 traffic counters in FUA Maribor (Podravje statistic region).

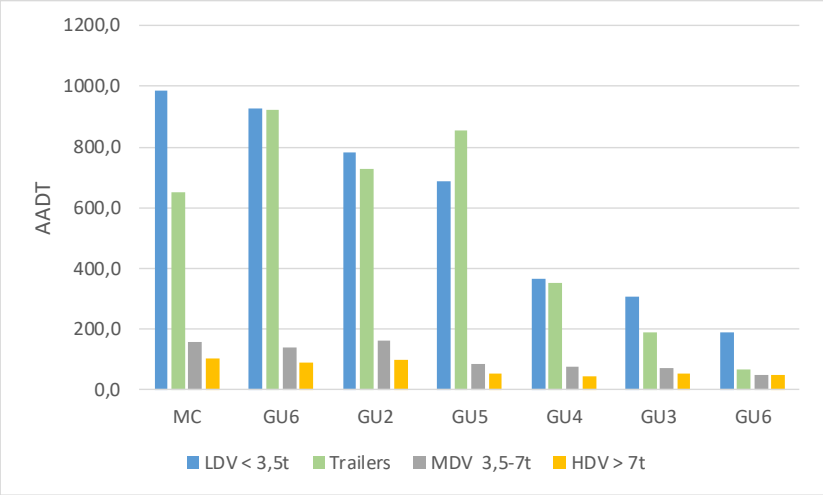

Figure 6: AADT for different freight vehicle categories and FUA zones

Light duty vehicles (LDVs) represent the highest share of AADT among all freight vehicle categories. In Maribor City zone AADT (average among all traffic counters in the zone) for this category is almost 1.000, in GU6 925, in GU2 780 and in GU5 685. The second most important category is trailers with AADT in Maribor City zone 648, GU6 921, GU2 730 and GU5 854. Other vehicle categories are less important and are producing smaller numbers of AADT.

LDVs are (on average) the most important among freight vehicle categories on all types of roads. The biggest share of LDV traffic is on motorways and main roads within the cities. Other categories of vehicles have on average lower values.

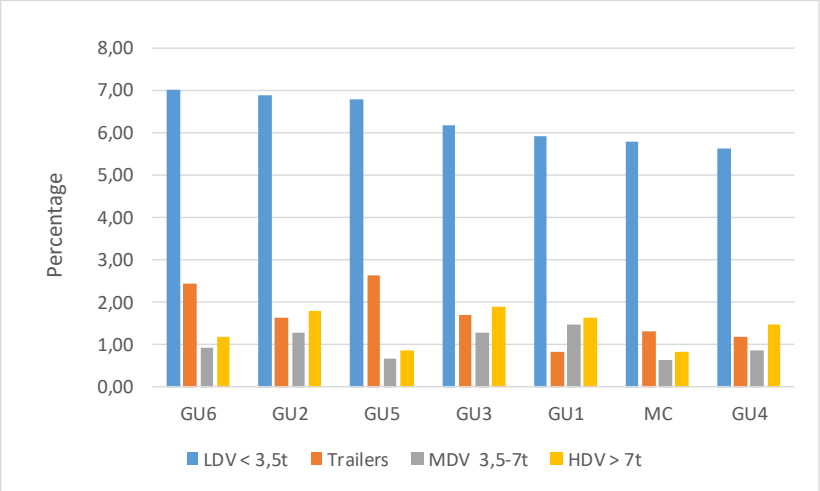

Figure 7: Percentage of freight vehicles AADT in comparison to overall AADT (all vehicle groups)

LDVs represent approximately 6% of the overall traffic in FUA Maribor. Other vehicle categories are much less relevant.

More detailed analysis of the AADT data was carried out on the main intersections to the city of Maribor and on the highway bypassing Maribor (to identify the volume of transit freight traffic). The analysis was done for the period of five years (from 2013 to 2017) in order to identify freight transport characteristics also from time perspective.

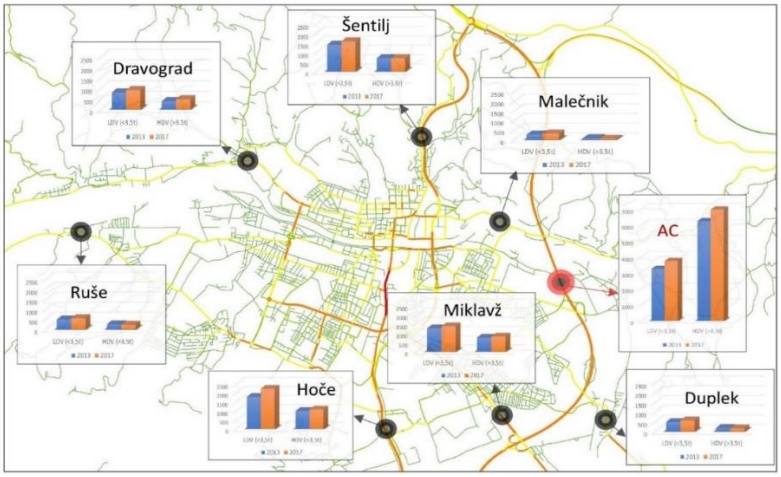

Figure 8: Growth trend of light and heavy-duty traffic on the main intersections and on the highway bypassing Maribor

The results show that freight traffic is growing on all main intersections and roads to the city centre. The highest growth is recorded for light delivery vehicles (< 3,5 t), which increased on average by 16,06 % (3,2 % p.a.) in the period from 2013 to 2017. The volume of heavy freight traffic (> 3,5 t) increased on average by 4,26 % (0,85 % p.a.) over the same period.

4.2.4. OD Matrices

Following the SULPiTER methodology more detailed analysis was done only for the Foodstuffs and Home accessories supply chains. For the Foodstuffs, two zones of FUA Maribor are of major importance, MC (Maribor City) with 209,8 tons/day and GU3 (zone of Ptuj and surrounding towns) with 244,4 tons/day. Freight flows between zones and intra zonal flows in other regions are much less relevant in this respect. What concerns the Home accessories supply chain, quantities of two most important zones (MC and GU3) are still prevailing in terms of intra zonal flows: MC (42,3 tons/day), GU3 (31,1 tons/day) and flows between zones MC-GU3 (35,1 tons/day).

The importance of Maribor and Ptuj zone is again recognized but this time also the number of deliveries per day is shown: over 1.000 daily deliveries of foodstuffs and 377 daily deliveries of Home accessories in FUA Maribor.

Table LGV and MGV total [vehicle/day]

Origin	MC	GU1	GU2	GU3	GU4	GU5	GU6	Total
MC	123,38	0,52	24,53	25,32	7,81	13,21	17,21	211,98
GU1	8,15	0,21	1,00	0,78	0,68	0,00	0,25	11,06
GU2	27,04	0,30	4,71	4,58	1,89	1,95	2,81	43,27
GU3	27,87	0,28	4,97	4,88	1,92	2,17	3,06	45,14
GU4	10,97	0,25	1,46	1,20	0,89	0,15	0,48	15,39
GU5	6,98	0,00	1,49	1,58	0,41	0,89	1,12	12,48
GU6	15,12	0,21	2,50	2,36	1,10	0,89	1,37	23,55
Total	219,50	1,77	40,65	40,69	14,70	19,26	26,30	362,87

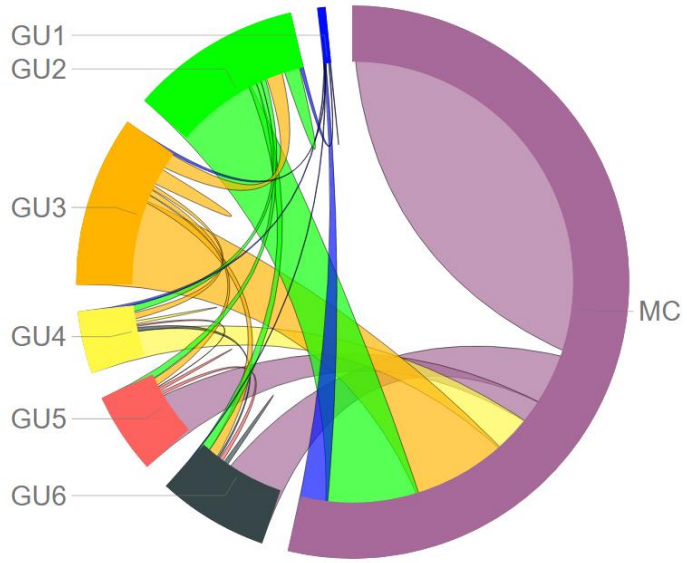

Figure 9: Origin and destination of LGV and MGV among zones of FUA Maribor

Data on origin and destination of trips within FUA and between GUS regions show that more than a half of trips is generated or distributed in Maribor City. Traffic counts show that freight vehicles represent approximately 10% of all traffic, while LDV represents the majority of freight vehicles and 7% of total traffic.

The biggest share of vehicles to be assigned on the road network are MGVs in the morning period (246 vehicles in total), followed by LGVs in the morning period (61 vehicles in total), MGVs in the afternoon period (44 vehicles) and LGVs in the afternoon period. At this point it needs to be emphasized once again that this represents only two supply chains which are most relevant for distribution flows in the region. Total number of freight vehicles to be assigned on the network is substantially bigger.

4.2.5. TRAFFIC ASSIGNMENT – TRAFFIC MODEL

In order to fully understand the urban freight transport in the Municipality of Maribor (as central part of wider FUA Maribor), the multi-modal transport model was deployed on data of the Municipality of Maribor including:

- statistical data about economic production,
- survey among transport companies and
- data from national traffic counters.

Model includes five separate categories of freight vehicles, which are assigned to the road network simultaneously with personal cars (in order to avoid assignment of freight vehicles to an empty road network).

With the model, efficiency of wide range of traffic measures in the city can be tested (e.g. expansion of pedestrian zone, change of corridors allowed for heavy freight traffic, changed system of deliveries in the city centre, etc.).

The traffic model of Maribor enables the creation of a projection of the freight traffic volume on the road transport network. The current state for 2016 and the projections for 2025 and 2035 are shown in figures below.

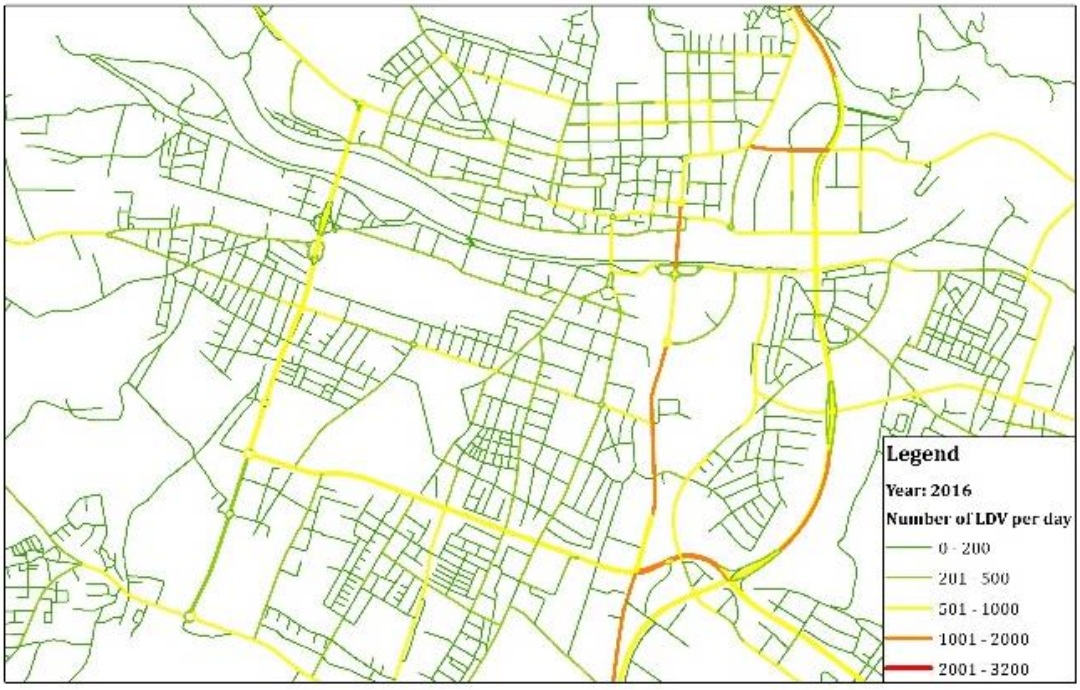

Figure 10: Transport of freight vehicles (AADT) in 2016

Figure 11: Transport of freight vehicles (AADT) in 2025

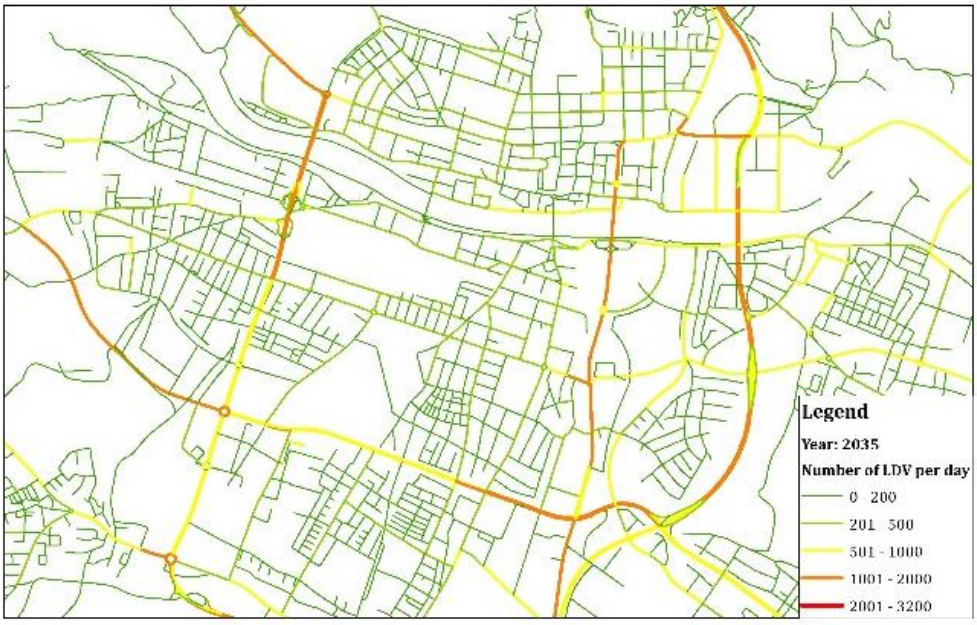

Figure 12: Transport of freight vehicles (AADT) for 2035

The projection of freight vehicles traffic flows in Maribor shows that the volume of traffic will continue to increase. Increased traffic loads are to be expected on the main intersections in the city and on the roads close to Friendly zone.

4.3. Main challenges

In order to provide a broader view on current challenges in FUA Maribor, the identification of challenges showed, that commercial entities are mainly lacking loading bays near their premises.

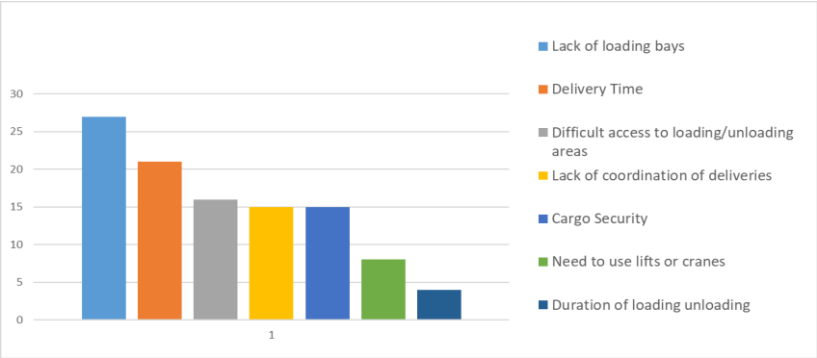

Figure 13: Urban freight deliveries problems identified in FUA Maribor

These problems arise from two reasons: 1) loading bays are not well positioned, 2) loading bays are more or less always occupied (by other delivery vehicles or illegally by private cars). Delivery vehicles consequently double park or circulate around the city to find alternative available loading bay. In case of illegal parking, retailers/suppliers are often penalized by city wardens. A survey within Freight Quality Partnership (FQP) Maribor revealed following ranking of key strategic challenges: transport and mobility, environment, economy, society, planning, user's acceptance and acceptance by inhabitants. The priority challenge is the impact of logistic processes on efficient transport.

STATUS	AVERAGE	PERCEPTION
TRANSPORT AND MOBILITY (the impact of logistics processes on the efficient operation of the transport system - e.g. on traffic congestion)	**4,5**	Very acute
ENVIRONMENT (influence of logistics processes on environmental indicators - emissions, noise ...)	**4,2**	Acute
ECONOMY AND ENERGY (influence of logistics on efficient functioning of companies and energy eficciency)	**4,1**	Acute
SOCIETY (awareness of the importance of logistics services for the efficient functioning of cities in the quality of life)	**3,8**	Very often
PLANNING AND POLICY (the effectiveness of planning logistics activities and actions in the city - eg. advanced planning / policy approaches and actions)	**3,6**	Very often
USERS ACCAPTANCE (user accaptance of proposed measures / solutions - e.g. carriers are willing to accept and adapt to the new delivery rules)	**3,6**	Very often
SOCIAL ACCAPTANCE (the readiness of the citizents to implement new solutions at the city anf regional level)	**3,5**	Often

Figure 14: Main challenges of logistics in FUA Maribor

It needs to be stressed that environmental impacts of logistics represent a challenge to be improved in next years. For economy and energy sector the logistics represents a challenge in energy efficiency and final costs of products/services. On priority list the awareness of society for efficient logistic is next challenge, which needs to be tackled. Following the general planning procedures all actors and stakeholders should be involved in the process while keeping the sustainability aspect in mind. As new changes mostly affect the end users and inhabitants, the non-negligible challenge is users' and inhabitants' acceptance of new sustainable measures, which can also be restrictive and less attractive.

STATUS	AVERAGE	PERCEPTION
PARKING VIOLATIONS (parking on the road, on the sidewalk, at the bus station, illegal parking of cars)	4,5	Very critical
LOADING BAYS (they are often occupied, number smaller in comparison to the needs, inappropriate locations are not well marked)	4,4	Critical
DELIVERY ROUTES (not defined, not marked, lack of signalisation)	4,1	Critical
UTILISATION OF VEHICLES (low utilisationh rates, big share of empty runs, a lot of empty kilometres)	4,1	Critical
LOGISTICS INFRASTRUCTURE (lask of capacity, poor service offer, high service price)	4,1	Critical
TRANSHIPMENT PROCESES AND PROCEDURES (demanding administrative procedures and long waiting times for transhipment)	4	Very often
DELIVETY TIME WINDOWS (delivery hours are not appropriate, time windows are too short, delivery time is too limited)	3,8	Very often
WAREHOUSE CAPACITIES IN THE CITY (modest offer, lack of capacity, unappropriate location)	3,7	Very often
ACCESSIBILITY TO SOME CUSTOMERS IN THE CITY CENTRE (there are physical and / or administrative barriers to access to certain customers in the city)	3,6	Very often
GARBAGE COLLECTION (not appropriate vehicles, inadequate delivery times, creating congestion in cities)	3,6	Very often
INSUFFICIENT CONTROL (due to insufficient control, there are violations of road traffic regulations and delivery rules)	3,6	Very often
TRANSHIPPMENT EQUIPMENT (lack of appropriate technologies for more efficient transhipment between road transport vehicles and in combination with other traqnsport modes)	3,5	Often
PACKAGING (unsuitable packaging, damaged shipments)	3,5	Often
LACK OF EQUIPMENT (lack of loading and unloading equipment, delivery trolleys and bicycles are missing, additional ramps)	3,3	Often
ACCESS PERMIT (time-consuming administrative procedures for obtaining access permits, high price permits)	3,2	Often
MISUSE OF ACCESS PERMIT (permissions are linked to the RFID card - perceived abuses by certain stakeholders)	2,8	Occasionally

Figure 15: Operative challenges of logistics in FUA Maribor

On operational level main challenges are related to:

- delivery (incorrect parking of other vehicle, vehicles hindering the delivery, lack of loading bays, bad signalling, narrow delivery routes, no priority delivery routes, inappropriate time windows and delivery times),

- logistic infrastructure (no logistic centres or UCC - Urban consolidation Centres), no multimodal connections, lack of warehouses and storage areas, no alternative to road delivery, lack of transhipment facilities),
- vehicles (low percentage of environmentally friendly vehicles — delivery, supply and garbage removal, no vehicles appropriate for city centre including pedestrian area (e.g. cargo bikes, electric vans),
- packaging (inappropriate packaging, damaged packages),
- administrative procedures and services (long and complicated transhipment and administrative procedures, no clear strategy on allowances for city centre access including price, permissions and abuse).

Several discussions within FQP additional operative challenges where reported:

- staff deficit (police and city wardens) and issues in general traffic safety (not irregular parking),
- increased law enforcement is not always a solution, especially where short parking facilities are missing (e.g. pharmacy nearby Hospital). Driving culture is inadequate (incorrect parking is not seen as a major violation),
- incorrect parking causes inaccessibility for large vehicles (waste removal) or in case of emergency/interventions,
- lack of communication between Municipality, public utility companies and inhabitants in case of road works or interventions,
- conflicts between pedestrians and delivery vehicles in pedestrian zone.

4.4. Already implemented measures

After WWII Maribor was developing as a typical industrial town up until beginning of 1990s when Slovenia seceded from Yugoslavia. The loss of the Yugoslav market severely strained the city's economy resulting in a record unemployment rate of nearly 25%. Since then Maribor is in process of regaining its identity as economic and cultural capital of the region. This turbulent history affected also the freight transport, predominantly in relation to city centre where different access restrictions and entering systems were in place. At present only freight vehicles with a maximum mass of 7,5 t are allowed to enter city centre while more strict access rules are implemented for access to the historical city centre (pedestrian zone). Access to pedestrian zone is limited to freight vehicles up to 5 t permissible maximum mass within limited time slots (between 5:00 and 10:00, and between 20:00 and 22:00) and

only with permit (issued by the Sector for Public Utility and Transport at the Municipality of Maribor).

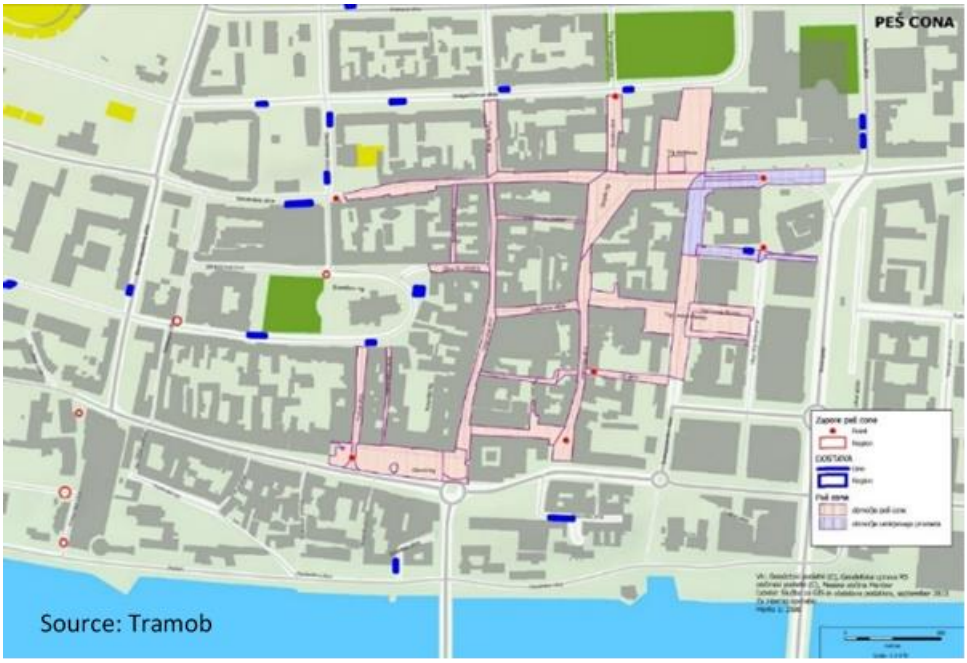

Figure 16: Pedestrian zone with marked entry points and loading bays

During the preparation of SULP (and according to the analyses done for the city Centre) Maribor's authorities have modified the time slots. Entrance to the pedestrian zone is now set to 9:30 and exit from the pedestrian zone till 10:00. After 10:00 entrance to pedestrian zone is possible exclusively for delivery for construction purposes, for service and courier activities, for electric vehicles, for transport to the nearest loading bay within the pedestrian zone, and for some other exceptions. For access to pedestrian zone a mandatory permit is required, the permit is issued by the Sector for Public Utility and Transport at the Municipality of Maribor.

Within city centre loading bays for freight vehicles are positioned, allowing stops for up to 20 minutes. Delivery from the loading bays to the end users' facility is done with trolleys or on foot. Based on the analysis made by the SULPiTER project team, new loading bays where positioned on routes entering city centre as these bays were mostly occupied.

There are also some private practices connected to the means of delivery. Some logistics service providers have already upgraded their fleet according to valid decree (MUV nr. 9/18), and today they carry out deliveries to the city mainly with electric vehicles. Some other suppliers have started delivering parcels outside the delivery times with delivery bicycles.

Some business in pedestrian zone voluntarily carry out their deliveries before 8:00 to minimize impact of freight traffic minimizes and to clear the streets for pedestrians.

5. SULP's specific objectives

Following main strategic challenges and objectives set in SUMP (ensuring sustainable mobility, which would decrease the household and the city budget for transport, stop emigration of local citizen due to economic situation, lowering noise and emissions caused by traffic and increase quality of life) the strategic goals for freight transport for FUA Maribor are:

- ensuring conditions for efficient traffic by reducing congestions,
- creating a liveable urban environment, reducing the environmental impact caused by freight traffic,
- ensuring efficient logistic processes for shippers in regard to energy efficiency,
- achieving high awareness of society for the need of high-quality logistic services,
- involving all stakeholders in the logistic planning to secure higher quality of life,
- achieving stakeholders' acceptance of sustainability in terms of operations and measures,
- social acceptance of new environmentally sustainable logistic solutions,
- ensure environmentally friendly delivery in the FUA region.

Relating to SUMP, SULP identified logistics challenges in quality of transport/logistic infrastructure (inadequate maintenance, infrastructure not accessible for all users (modes), missing signalisation, irregular parking, poor accessibility and services), poor multimodal supply, low transport culture, lack of clear vision of transport network, social exclusion of the elderly, no real alternative to conventional delivery for households, consumers and suppliers.

In order to reach collaborative approach of stakeholders for reaching general objectives on sustainability, SULP identified following operative goals for FUA Maribor:

Operative goals (with indicators):

GOALS	TARGET VALUE
Establishment of systematic, financial and administrative conditions for improving organization of logistics	*Adoption of Maribor's SULP in 2019, revision every two years, revision every five years* *Establishment of a municipal organizational unit for logistics by 2022*
Ensure decision-making transparency by	*Consultation with inhabitants and key stakeholders on conditions for entering in Friendly Zone will be performed in addition to the legally*

involving public in all stages of logistics planning	*envisaged involvement of the public from 2020.*
Introduce tools for systematic monitoring of logistics	*The introduction of monitoring of logistics indicators and the investments' effects by 2020*
Reduce emissions and noise	*No CO^2 emissions in Friendly Zone (for delivery vehicles) by 2030* *Reduce the noise of delivery vehicles by 20 % until 2030*
Increase the share of freight delivered by environmentally-friendly vehicles	*Reach 50 % share of the environmentally-friendly delivery vehicles, entering LEZ by 2025* *A system for renting electric delivery vehicles should be established by 2025* *50 % of environmentally-friendly vehicles should be used for waste removal and delivery vehicles for municipal public utilities by 2025* *A case study on the development of rail transport in the FUA Maribor should be prepared by 2024*
Increase the occupancy of vehicles and reduce the share of empty trips	*Achieve 50 % occupancy of vehicles by 2024* *Establish a consolidation centre for pedestrian zone and reduce the share of empty travels and the number of entries to the city centre by 70 % by 2024, compared to 2018*
Encourage stakeholders to achieve sustainable goals	*Clear rules for delivery should be laid down, and the satisfaction of shareholders and end-users on delivery should increase by 15 % until 2024* *Establish a stakeholder certification system for sustainable forms of delivery by 2024* *Reach 30 % of stakeholders, offering a sustainable delivery by 2024* *Reduce the administrative procedures (times) for 20 % for obtaining permits by 2022* *Reduce delivery costs for 5 % by 2025, compared to 2018*
Increase safety and reduce conflicts between pedestrians, delivery vehicles and delivery bicycles	*Reduce average speed of delivery vehicles and delivery bicycles in the pedestrian zone by 25 % until 2025, compared to 2018* *Reduce the number of violations regarding the limited speed in the pedestrian zone by 25 % until 2025, compared to 2018* *Reduce the number of improper parking violations at loading bays and intervention routes by 30 % until 2025, compared to 2018*
Reduce the amount of damaged and destroyed shipments	*Reduce the proportion of destroyed and damaged shipments by 20 % until 2024* *Ensure 1 % of quality (covered) loading bays by 2024*
Ensure physical and time availability to end users	*Increase quality and marked delivery and intervention routes by 20 % and increase the number of loading bays by 30 % until 2024* *Improve the transhipment time by 10 % (to the city centre/between modes) and processes in the supply chains by 2024* *Improve delivery time by 10 % until 2024* *Increase storage capacities in the city by 5 % until 2024*

6. Measures vs. demands

The measures are in line to fulfil the identified vision:

Logistics planning focuses on determining the conditions for access the city centre and other areas of the city with environmentally friendly vehicles, advanced ICT services and fair, transparent relationships between stakeholders. Measures, such as number of loading bays and time windows are optimized, quality and marked intervention and delivery routes are

established, also there is improvement in enforcement. Greater emphasis is put on multimodal connections, establishment of consolidation activities and attainment of a waste-free city. Concepts of green logistics are also introduced by encouraging local economy and greater self-sufficiency.

Measures are grouped into: market measures, regulatory measures, infrastructure measures, ICT and ITS related measures, measures for land use planning, management and service measures, and technological innovation.

6.1. Market and regulatory measures

Maribor identified the Friendly zone, where priority in planning and in operations is given to pedestrians, cyclists and public transport. Motorised traffic is permitted but measures in the friendly zone should follow the concept of traffic calming, law enforcement is frequent as to increase transport culture. Loading and unloading facilities are planned to be increased on entries to friendly zone, multiuse lanes allowing on street loading/unloading to be put in operation. Time windows will be more flexible and aligned with end users preferences, deliveries and waste removal in friendly zone to be permitted during night hours. Expansion of areas where only short-parking is permitted, prices for long-term parking to be increased. Policies and measures that imply access restrictions to certain areas based on concrete constraints (environmental vehicles, vehicle weight, etc.) will be identified for all roads in city centre, especial for special freight transport (e.g. theatre) in relation to goods, time and day of delivery. All intervention routes will be identified and marked. Enforcement (penalties for noncompliance) is planned to be increased alongside measures providing alternatives for end users. Delivery with route optimization and quality signalisation would decrease the delivery time and minimize traffic jams. Training activities focusing on new traffic regulation would also include eco-driving innovative reward schemes to increase the efficiency of deliveries and decrease fuel consumption and emissions.

6.2. Infrastructure development

Infrastructure development, construction/development of consolidation/distribution centres and logistics places is planned in city centre and on regional level. Urban Consolidation Centre (UCC) serves for transhipment and consolidation of freight from long-range transport operators to operators accessing city centre – last mile delivery. UCC is planned to be constructed to

decrease kilometres driven for delivery and to increase occupancy rate for freight vehicles accessing city centre. With such centre approximately 50 % less trips are reported in city centre as experiences from other cities show (e.g. Almada). Lower number of trips alleviates congestions due to less traffic and consequently less emissions and noise are caused by deliveries.

In order to enhance multimodal connections, existing rail freight facilities in city of Maribor and other cities in FUA Maribor are planned to be modernized with appropriate transhipment technology, storage capacities and frequent rail service connections delivering goods to/from Maribor, Ptuj, Slovenska Bistrica, Ruše, Hoče and Šentilj.

Multimodal logistic centre for FUA Maribor region on Airport Maribor is planned as to increase the competiveness of the region.

With regard to road infrastructure, the concept of road delivery sections, optimal number of loading bays, quality delivery routes and intervention routes is to be applied on FUA Maribor region.

6.3. Measures for Land Use planning

Measures for land-use planning are introduced with the aim of changing current patterns of land use in the direction of providing additional surfaces for logistics activities in cities. Land-use planning to include logistics infrastructure such as delivery routes, locations of loading bays (on street, on public and/or on private land), pick-up points (delivery boxes), collection/delivery centres (urban consolidation centres), terminals for combined transport (for FUA MAribor) and larger logistic distribution centre (Maribor Airport).

Additionally, the infrastructure for electric charging stations to be part of land planning (for e-delivery vehicles and multi-functional charging points).

6.4. ITS (Intelligent Traffic Systems) and ICT (Information Communication Technology) measures

ICT route finder and reservation of delivery loading bays will on one side support the supplier and forwarded in order to plan, dispatch and track the deliverables on time and on the other side the costumers to get the deliverables on time and to get the information about estimated

time of arrival (ETA). The developed concepts on data sharing of planned deliverables in order to maximize occupancy rate and join rides, will be implemented.

ICT platform will be implemented to serve the needs of UCC.

To avoid conflicts between pedestrians and delivery vehicles in pedestrian zone, access can be limited to smaller delivery electric vehicles (vans).

Alternatively, cargo bikes would serve for city centre delivery.

6.5. Service measures

New distribution and logistics models suggest introduction of a city logistic manager, taking over responsibilities for coordination of logistics related measures in the municipality: management of access to the city centre (off-peak deliveries, consolidation schemes and joint operations, etc.), implementation of multiuse lanes, loading bays, charging facilities, contracting, developing and coordinating the services of UCC and micro UCC (e.g market). Its role is mostly to coordinate the users' needs and to implement measures initiated by the private sector (also through FQP meetings). UCC may also serve for (in addition to last mile delivery service):

- Third party warehousing with on-demand delivery
- Direct storage from suppliers
- Park&buy … delivery service extension to the urban surroundings
- Packaging collection (reverse logistics)
- Hotel baggage delivery for tourists (large groups arriving by bus)
- Specific solution for "self supply"
- Special urban quick deliveries
- Out of hours deliveries

The business UCC models to be considered:

- "In house" company; a structure belonging to the Municipality (public owned company), entrusted with service management
- Public-private partnership or

- Service based on a public tender and on a relevant “service contract” regulating the relationship between Municipality and Private Company. In this case a detailed “Management Performance Chart” for UCC management should be defined.

6.6. Technological innovations

Technological innovation measures are aimed at direct or indirect promotion of environmentally friendly, sustainable and energy-efficient delivery. Municipality of Maribor will encourage sustainable delivery where transport is carried out with alternative transportation modes (railway, public transport, river Drava, underground piping system). Multimodal connections in the wider region is to provide handling devices for quick and easy cargo handling.

In the FUA Maribor there are several possibilities for:

a) Revitalization of railway for delivery or larger parcels/shipments, as most of the larger municipalities are connected by railway infrastructure, and at the same time almost all city centres have cargo warehouses (e.g. Maribor Center, Maribor Tezno, Maribor Studenci, Ptuj, Ormož, Ruše, Šentilj). A study on the development possibilities for setting up a railway connection for the delivery outside peak hours between larger cities in Podravje region/Slovenia and on international corridors, will be carried out. The possibilities of using existing cargo warehouses for consolidation purposes and the possibility of transhipment to environmentally friendly vehicles for the last mile delivery should also be taken into account. The possibilities for establishing a mandatory multimodal connection between centres (pedestrian zones) in FUA Maribor should also be investigated.

b) Revitalization and revival of accompanied and unaccompanied combined transport. A study on innovative solutions in FUA Maribor region in terms of the development possibilities for upgrade of existing terminal (Maribor – Tezno) and for establishment of new terminals for combined transport should be carried out.

c) Use of river waterways for freight transport – a study on development potentials for using the Drava River to establish river waterways and possible transhipment terminal should be carried out.

d) Merging public transport and delivery in regional relations. The system can be organized in such a way that the shipping company leases space on the bus (for parcels/packages). Packages are then delivered at the bus stop at a specific time at the time of passengers pick-up/drop-off. A simpler form is for the customer to arrange directly with the passenger

transport provider for the consignment delivery according to the price list. Possibilities on establishing a similar concept in urban public transport are taken into consideration, as buses nowadays already have allocated space for luggage, skis or bicycles.

e) Underground freight pipeline system (freight delivered in capsules via dedicated underground network) the city centre can be considered a serious alternative to classical land transport. The system can drastically reduce the number of vehicles while achieving very high speeds (e.g. Hyperloop). Underground systems can also be planned for a particular type of cargo (underground vacuum transport of waste already in use in some cities). Legal frameworks, standards and business models should be explored.

f) Environmental aspects – electric delivery vehicles will be tested for application on a wider area. Appropriate concept for electrification of delivery fleet will be identified based on delivery driving cycle and charging technology. Following the guidelines on electrification of traffic, the multipurpose use of charging technology will also be considered for delivery and garbage vehicles (e.g. multipurpose use of same charging infrastructure for Public transport (buses) and garbage trucks).

g) On the long run, Maribor FUA will adhere to global trends of freight transport. Autonomous vehicles, freight/delivery drones, dedicated freight/waste pipelines and Internet of Things as future measures represent solutions for more sustainable logistics in FUA Maribor.

7. Layout of measures

Action plan includes measures, which are divided into following categories:

1. Delivery/Freight areas
2. Municipal Authority for logistics and defining conditions for delivery
3. ICT and ITS
4. City logistic service
5. Multimodal connections
6. Subsidies for environmentally friendly vehicles
7. Logistics centre
8. Charging infrastructures for e-vehicles (delivery)
9. Technological innovations
10. Education and communication

In addition, implementation complexity of measures is assessed and categorised:

1. Simple
2. Moderate
3. Complex
4. Very complex

Table represents an action plan with approximate implementation date and estimated budget costs.

	Preparation		Execution

Measure	Estimated costs	Complexity	Responsibility	2020	2021	2022	2023	2024	2025
1 Delivery/Freight areas									
1a) Plan of delivery routes, road delivery sections and loading bays	Map of existing and planned delivery areas 10.000 €	2	MoM (Municipality of Maribor) / EU						
1b) New loading bays	Signalization installation/road marking 15.000 €/quality loading bays – roofed and with electric charging station	2	MoM / Private partner (electric charging stations)						
1c) Delivery road sections	Technical guidelines – 5.000 € Signalization installation/road marking 50 € per running meter	3	MoM / EU						
1d) Delivery/freight corridors and intervention areas	10.000 € - Traffic signalization Surface marking 100 € per running meter	1	MoM						
2. Municipal Authority for logistics and defining conditions for delivery									
2a) Access time windows adjustments	2.000 € per year – meetings of the logistics group	2	MoM						
2b) Establishment of the municipal authority for logistics	20.000 € per year	2	MoM						
2c) Revision and upgrading of SULP	3.000 € for revision every 2 years 18.000 € for upgrading every 5 years	2	MoM / EU						
3. ICT and ITS									

3a) ICT-supported tool for delivery routing and online booking platform for loading bays	40.000 € for establishment 10.000 € for maintenance	3	MoM						
3b) ITS for displaying the availability/occupancy of loading bays	60.000 € for establishment 15.000 € for maintenance	2	MoM						
4 City logistics service									
4a) Collection points (delivery lockers)	10.000 € - detailed plan for location of delivery lockers or collection points	2	MoM / Private investor						
4b) Urban consolidation centre	10.000 € - detailed plan (location and business plan) 300.000 € - investment (600 m^2) 200.000 €/year operation	4	MoM (responsible office)						
4c) ICT platform for consolidation centre	20.000 € for establishment 10.000 € for maintenance	4	MoM						
4d) Office for delivery service at MoM	25.000 €/year – MoM staff for end-users/municipality police department and delivery service providers	1	MoM/ Concessionaire						
4e) Handling and delivery equipment/machinery	10.000 € - delivery carts, lifts, ramps 2.000 €/delivery bicycle (10 pieces) 6.000 € /e-delivery bicycle (10 pieces)	1	MoM/ Concessionaire/End users						
4f) Electric delivery vehicles rental	10 e-vehicles … 30.000 € /e-vehicle … 300.000 € + maintenance 20.000 €/year	3	MoM or Private partner						
4g) Tradeable permits – certification of companies for environmentally friendly delivery	A case study – Development opportunities – 10.000 €	4	MoM/ Ministry of the environment and spatial planning /Chamber of Commerce and Industry of Slovenia						
5 Multimodal connections									

5a) Railway delivery	15.000 € - A case study – Development possibilities of railway delivery between major municipalities in FUA Maribor/Slovenia	3	MoM/Municipalities in FUA Maribor/ Slovenian Railways /Ministry of Infrastructure /EU						
5b) Railway network in FUA Maribor	15.000 € - A case study – Development strategy of rail transport in FUA Maribor	2	MoM/Municipalities in FUA Maribor/ Slovenian Railways /Ministry of Infrastructure /EU						
5c) Combined transport in FUA Maribor	15.000 € - A case study – Possibility for establishment of terminals for combined transport in FUA Maribor	2	MoM/Municipalities in FUA Maribor/ Freight forwarders/Slovenian Railways/Ministry of Infrastructure /EU						
6 Incentives and subventions for companies									
6a) Grants for electric delivery vehicles	10.000 €/ for smaller electric delivery vehicle 500.000 € for larger delivery vehicle	3	Eco fund/EU						
6b) Grants for electric charging stations	1.000 € - for smaller electric delivery vehicles 300.000 € fast multi-function electric charging stations Dynamic charging – 1.000 € m1	2	Eco fund						
6c) Tax incentives for companies with environmentally friendly vehicles	2.000 € / environmentally friendly vehicle	2	Ministry of the environment and spatial planning						
7 Logistics centre									
7a) Logistics centre	Establishment of the multimodal logistics centre at Maribor Airport	3	Municipalities in FUA Maribor, Ministry of						

	30.000 € - Case study 3 to 6 mil. € - Multimodal terminal		Infrastructure Investor						
8 Charging infrastructures for e-vehicles (delivery)									
8a) eCharging stations	10.000 € - A case study – Plan for e-charging stations for delivery vehicles. 2.000.000 € - Establishment of e-charging stations for delivery and freight vehicles.	3	MoM						
9 Technological innovations									
9a) Technological innovations in logistics field	A case study – Development opportunities for technological innovations in logistics - 10.000 €	3	MoM / Ministry of Infrastructure /EU						
10 Education and communication									
10a) Education	15.000 € - Training of small businesses on the importance of safe and economical deliveries	2	MoM / GZS /Ministry of environment/ EU						
10b) Communication	5.000 € / year – flyers, communication with public, decree for public communication.	2	MoM						

The above action plan serves as a framework, guidelines or recommendations for implementation of measures in the field of logistics and traffic management of Municipality of Maribor.

8. Road-map for implementation of measures

The overall aim of this chapter is to identify the support conditions of each measure/service for the implementation, designed in Chapter 6 and 7 and for the evaluation of the different impacts presented in Chapter 9. The complexity of measures/services is directly linked to the complexity of levels of every single component involved in the specification and design. For the identification of the supporting conditions, it is essential to consider, at least, the following issues:

8.1. Delivery/Freight areas

The measure identifies three types of delivery/freight surfaces:

- loading bays
- delivery road sections and
- freight corridors and intervention routes/areas.

8.1.1. New loading bays

The measure focuses on development of off-street loading and unloading areas with objective of lessoning the congestion of public areas and increasing liveability of public spaces. This measure can be result of: private agreements among businesses, the initiative of a single business, part of a regulatory intervention of city transport planning, etc. The loading bays can differ according to the importance and location, where simple loading bay is equipped with on-street signalisation and appropriate road markings. High quality loading bay can also be roofed, to prevent weather damage of consignments (rain/snow), and equipped with multipurpose e-charging system. The implementation of this measure results in reduced congestion, improved quality of public infrastructure use and more efficient loading and unloading activities in dense urban areas. City of Paris, for example, decided to impose off-street loading bays (spaces dedicated to freight activities) to stores of at least 500 m^2, offices of 2,500 m^2 and hotels with 150 rooms or more. In Rome, simulation of ICT based management of loading bays resulted in reduction of the total delivery time of 66%.

8.1.2. Road delivery sections

Road delivery sections are an opposite concept of delivery. The streets are on purpose built without loading bays, to allow short term parking in defined time windows for delivery anywhere on the narrow street. It represents similar concept as on street bus stop, which can be seen as a measure for traffic calming. The concept can be modified for city centre – allowing the multiuse or multifunctional streets for pedestrians, cyclists, delivery, inhabitants, emergency vehicles and/or public transport.

Impact of new loading bays /multiuse lanes is on:

- Improved quality of public infrastructure
- More efficient loading and unloading

- Reduced delivery times

8.1.3. Freight corridors and intervention routes/areas

Freight corridors can be specified on rod level (roads dedicated for freight transport) for access to large, industrial sites or terminals (e.g. Tezno), where priority is given to trucks. Similar concept is to be applied for intervention routes and surfaces. This measure focuses on regulating freight vehicles' routes. The measure is part of authorities' traffic regulatory actions aiming to limit traffic conflicts between cars and freight vehicles. The main objective is improvement of the efficiency of freight deliveries and interventions by providing optimal routes to transport nodes and industrial areas. This results in increased average speed of commercial vehicles and reduced congestion. This measure can be further developed by means of IT applications for real time routing of vehicles in a wider smart city context.

Delivery routes are to be well marked (on-street signalisation) and synchronised with ICT apps. Additionally, the measure identifies the inappropriate routes or streets to narrow for freight vehicles.

Quality deliverable/intervention routes have an impact on:

- Delivery time
- Distance travelled
- Fuel reduction
- Emissions reductions
- Cost reduction

8.1.4. Plan of delivery routes, road delivery sections and loading bays

Map of existing and planned delivery and freight areas is to be created and it is part of a short-term plan in Maribor.

8.2. Municipal Authority for logistics and defining conditions for delivery

Management of conditions for access to city centre, other parts of the city and FUA region is to be managed by Municipal Authority for Logistics in the future. This authority will also be

responsible for planning, implementing and measuring the effects of measures identified in SULP.

8.2.1. City logistic manager

City logistic manager is a person responsible for management of city's freight transport, based on SULP's recommendations and implementing suggested measures. He/she is responsible for development of logistic infrastructure and regulation. Additionally, the manager should provide clear instructions and communication regarding permits for city centre access. He/she would also be in charge of contracts with UCC, ICT platforms and delivery/logistic companies, where relevant. He/she will also be responsible for monitoring of impacts and as FQP manager (initiator of FQP meetings and activities).

Impact of City logistic manager is on

- General objectives of SUMP

8.2.2. Delivery conditions (time window, occupancy, environmental friendly vehicles)

This measure focuses on shifting delivery schedules out of peak hours or into night deliveries. It focuses on supply chains that do not necessarily need daytime deliveries, such as retail and wholesale companies, food, groceries and similar products. The measure is focussed on the benefit for transport operators deriving from the fact that delivering at night is faster (e.g. less congestion, more space for unloading, less fines). Deliveries at night can be attended or un-attended and can require a change in receivers' staff working hours. The City of Barcelona (ES) promoted a pilot project to deliver at night to supermarkets with a truck equipped with the PIEK[2] technology to reduce noise (carpeted floor, low-noise pneumatic technology and low-noise rubber wheels). The pilot proved that journey times were reduced by 50%, fuel consumption up to 57% and emissions up to 53%.

Delivery is performed in off-peak hours - late afternoon, night or early morning. The delivery is done with environmentally friendly and quiet vehicles. Night waste removal represents an added value, due to lowering congestions. Retailers and other companies can build a trust relationship,

[2] In 1998 the Dutch Government set out standards for noise emission during loading and unloading in retail trade and craft businesses. This resulted in a project called PIEK and in 2004 in the PIEK certification scheme for vehicles and equipment operating under 60dB(A) which are suitable for use in night time deliveries without causing noise disturbance.

where the keys of facilities for delivery are trusted to delivery companies to deliver in off-peak times and out of opening hours.

Impact of off-peak delivery time windows has an impact on:

- Reduced traffic (less congestion)
- User oriented delivery
- Reduction of costs for delivery (fuel consumption)
- Reduced journey time
- Reduced emissions

In parallel to time window conditions, occupancy rate and emission standards can be set.

8.3. Information Communication Technologies (ICT) and Intelligent Transport Systems (ITS) measures

8.3.1. ICT supported route finder and reservation of delivery loading bays

ICT Route finder is a real time routing of vehicles in a wider smart city context. The city identifies the freight corridors and delivery routes, which are then considered in end user app. The app can be upgraded with reservations of loading bays.

The city of Amsterdam has developed the document “Voorkeursnet Goederenvervoer” defining a selective network of preferential routes that freight carriers can use in a flexible and safe manner for deliveries. Introduction of Intelligent Freight Routing Optimisation in Vienna resulted in up to 60% reduction in time, up to 15% reduction in distance, up to 20% reduction in fuel and emissions and up to 30% reduction of costs for deliveries in urban areas.

The combination of smartly identified Freight network and ICT route finder has an impact on:

- Delivery time
- Distance travelled
- Fuel reduction
- Emissions reductions
- Cost reduction
- Reducing empty runs

- Increasing occupancy rate

8.3.2. Intelligent Transport Systems (ITS) for displaying occupancy of delivery bays

Smart parking systems are implemented on the loading bays, where displays provide the information of the number of free loading bays. The ITS of displaying the occupancy of delivery bays has an impact on:

- Delivery time
- Travelled distance
- Fuel reduction
- Emissions reduction
- Cost reduction
- Reducing empty runs
- Traffic congestions, due to on street parking

8.3.3. The UCC/ICT Platform for Consolidation centre

The UCC/ICT Platform represents a data base of shippers and recipients in order to optimise number of deliveries and occupancy rate.

8.4. City logistic service

8.4.1. UCC – Urban Consolidation centre

UCC is an institution, where goods from different transport companies are collected and consolidated before being shipped to a certain area in the city. A consolidation centre performs an aggregate delivery function between suppliers and customers.

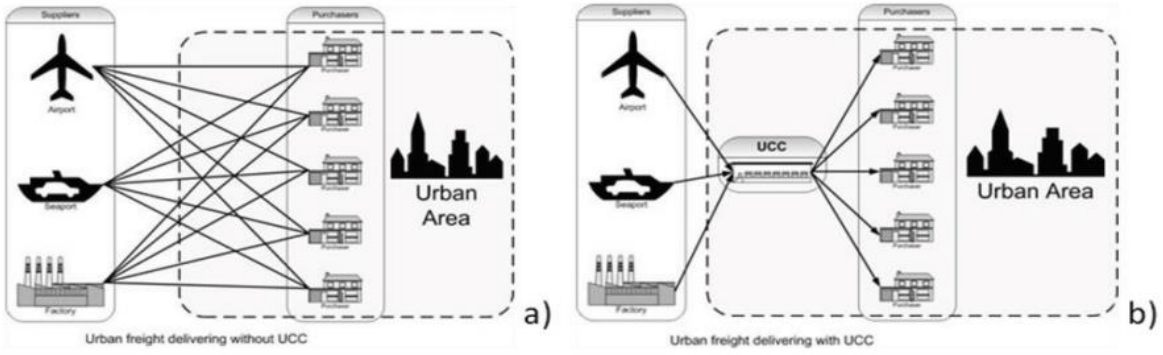

Figure 17: Delivery to the city without and with consolidation centre

The last mile delivery is performed by small electric vehicle or cargo bikes. The main advantages of establishing a consolidation centre are: increased level of vehicle utilization; better route planning; reduction in number of vehicles accessing the pedestrian zone (up to 80 %); drastic reduction of travelled kilometres within the pedestrian zone (up to 70 %); positive impact of fewer travels on traffic in general, reduced costs of last mile (up to 40 %) at the expense of fewer kilometres, lesser time spent in congestions, and smaller number of delivery vehicles required. Consolidation centre can also serve as a warehouse, short-time warehouse (up to 12/24 hours) or for reverse logistic processes.

The main disadvantages are: additional costs of setting up and operation, an extra step in the supply chain and increased delivery costs, warehouse adjustment needed (based on the type of goods stored).

Additionally, the direct contact between suppliers and consumers is interrupted, moreover majority of suppliers may not be willing to provide the data on consumers (these data is seen as business advantage). Main factors for the success of UCC are; the same conditions for all, location, clearly defined targeted area for last mile delivery, business sector (goods), delivery vehicles, opening times, management (in house, PPP or service), financial flow – subsidies, user obligations (mandatory or not). A testing period for UCC is recommended. In regard to contractual issues the possibilities of establishing a monopoly represents a challenge. Relationships between different actors should be clear and open to avoid lawsuits.

The main impacts of UCC are on:

- Although delivery vehicles represent only 6 % of overall traffic, their impact on traffic conditions is higher than from other vehicles. Reduced number of delivery vehicles positively affect traffic conditions in urban areas (less congestion).

- Last mile delivery costs are estimated from 28 to 40 % in regards to overall daily run (due to higher consumption in cities, congestions resulting in additional costs, additional costs of empty runs and low occupancy vehicles, inappropriate time windows, more vehicles for delivery, longer travel time, more emissions).

8.4.2. Office for delivery service at Municipality of Maribor

Office for delivery service at Municipality of Maribor will be responsible for coordination between logistic transport providers, end users and regulatory authorities. When UCC is to be implemented a consolidation centre will be managed from the Office for delivery service of Municipality of Maribor.

8.4.3. Handling equipment/machinery

In order to provide door to door service, last mile delivery can be carried out by environmentally friendly vehicles like carts or trolleys. Additional lifts or forklifts can be implemented on transhipment sites.

The transhipment area should be under the roof to avoid damages of packages by rain/snow. Entrance to transhipment facilities and storage areas should be wide enough to allow unhindered transhipment activities without negative impact on other users.

Transhipment equipment has impact on:

- Enhancing logistic infrastructure (percentage of multimodal connections, quality delivery routes)
- Reducing administrative procedures and lead time for delivery and transhipment (door to door delivery time)
- Reducing the damage of deliverables

8.4.4. Cargo bikes

Cargo bikes can be used for light deliveries (up to 250 kg) and on short distances. They are ideal for deliveries in city centres or parts of urban areas. Implementation requires presence of a cycling infrastructure, logistics facility from which bicycles can run their last mile delivery and it is often associated with other measures, such as urban distribution centres or mobile depots.

Cargo bikes bring environmental friendliness and noise reduction. For example, in Turin (Italy) an emissions reduction of 250 grams of CO^2 per km was estimated. In London pilot project total

distance travelled decreased by 14% and the CO^2 emissions per delivered parcel fell by 55%. There are some cost benefits for businesses due to lower purchase prices and maintenance costs for bikes compared to other transport means such as vans. Cargo bikes can have access to city areas where, due to regulations, vans do not have access.

Impact of cargo bikes is on:

- Decreased distance travelled
- Decreased CO^2 emissions

8.4.5. E-van sharing

Different electric vehicles' (EV) sharing concepts are available on the market. Main advantage of e-vans sharing for delivery are lower costs of delivery for retailers (elimination of ownership costs). Sharing is especially appropriate for businesses that don't actually need own delivery vehicles. It can serve as a joint service for delivery (more packages for different end users are delivered by one user) or individual service for broader area (not only city centre). Locations of e-van sharing stations are planned to cover main freight generation areas (city centre, shopping centres and industrial areas) and living areas. On these locations electric charging is needed.

Impact of e-van sharing is on:

- Costs for delivery
- Occupancy rate
- Reducing traffic
- Less emissions

8.4.6. Certification

Friendly Zone permits will be issued according to prior determined allowable emission limit with the help of certifications programs (labelling of environmentally-friendly vehicles and logistic companies). Certification has an impact on:

- Costs for delivery
- Occupancy rate
- Reducing traffic

- Travelled distance
- Fuel reduction
- Emissions reduction
- Cost reduction
- Traffic congestions, due to less entries in Friendly zone

8.5. Multimodal connections

8.5.1. Rail delivery and combined transport

Although rail freight service is seen as efficient for long freight logistics, some regions have demonstrated efficiency of rail on short distances (100 km) as a service between main hubs. A rail network between cities located in FUA Maribor already exists and has a potential to provide a daily (or nightly) delivery service between FUA Maribor cities/hubs. Delivering packages directly to city Centre on the rail is the most environmentally friendly and cost-efficient delivery. The packages are then transported (from rail storage areas) to end users by electric vehicles or cargo bikes. This measure is only effective if all cities within FUA region participate in door-to-door rail delivery.

The revitalization of railways could be utilized for delivery or larger parcels/shipments, as most of the larger municipalities are connected by railway infrastructure, and at the same time almost cargo warehouses are already located in strategic positions within cities (e.g. Maribor Center, Maribor Tezno, Maribor Studenci, Ptuj, Ormož, Ruše, Šentilj). A study on the development possibilities for railway delivery (setting up a railway connection for the delivery outside peak hours between larger cities) in FUA Maribor/Slovenia and on international corridors will be carried out. The possibilities of using existing cargo warehouses for consolidation purposes and the possibility of transhipment to environmentally friendly vehicles for the last mile delivery should also be taken into account. The possibilities for establishing a mandatory multimodal connection between centres (pedestrian zones) in FUA Maribor should also be investigated.

Multimodal connection has impact on:

- Enhancing the logistic infrastructure (percentage of multimodal connections, quality delivery routes)

- Enabling user oriented delivery (time window, physical accessibility) (user satisfaction)
- Increasing storage capacity in the city centre (utilisation of storage capacity)
- Reducing traffic congestion from freight loading and parking (AADT, percentage of traffic jams caused by logistics/delivery)

8.5.2. Railway network in FUA Maribor

Development strategy of rail transport in FUA Maribor will provide future investments for railway infrastructure and services in FUA Maribor. Main goal of investments in rail network is to shift increasing freight traffic on highways to rail. For the entire FUA Maribor, the meaningfulness of building a quality railroad crossing (North – South: Graz – Maribor – Ptuj – Zagreb and East – West: Koper- Maribor – Lenart – Murska Sobota – Budapest) should be considered.

8.5.3. Combined transport

On the existing railway network in FUA Maribor, the program for setting-up terminals for combined transport should continue.

Revitalization and revival of accompanied and unaccompanied combined transport. A study on innovative solutions in FUA Maribor in terms of the development possibilities for upgrading existing (Maribor – Tezno) and establishing new terminals for combined transport, should be carried out. Multimodal connections (combined transport) can serve also as an alternative to road broadening concepts (E.g. on relations Ormož- Ptuj – Slovenska Bistrica/Maribor).

8.5.4. Public Transport and Delivery

Merging public transport and delivery in regional relations. The system can be organized in such a way that the shipping company leases space on the bus (for parcels/packages). Packages are then delivered at the bus stop at a specific time at the time of passengers pick-up/drop-off. A simpler form is for the customer to arrange directly with the passenger transport provider for the consignment delivery according to the price list. Possibilities on establishing a similar concept in urban public transport are taken into consideration, as buses nowadays already have allocated space for luggage, skis or bicycles.

8.6. Subsidies for electric vehicles (EVs)

8.6.1. Subsidies for electric delivery vehicles

The main objective of this measure is to foster sustainable and low carbon delivery services in urban areas. This measure can be applied as a selection criterion for access to urban areas and regulatory incentive for clean vehicles. Secondly, this type of measure can be included in a local or wider regional system of subsidies as stimulating instrument for procurement of clean vehicles.

Reductions of emissions and pollution are the main benefit of this measure. In case of Los Angeles port, emissions from trucks were reduced by 80% in 2012 based on progressive ban for trucks with higher emission levels accessing port area. In the City of London, replacing diesel vans with electric vans and tricycles operating from a micro-consolidation centre resulted in decrease of 20% for total distance travelled and reduction of 54% for the CO2 emissions per parcel delivered.

Currently the subsidies for electric vehicles in Slovenia can reach up to 7.000 €. In order to increase the share of environmental friendly vehicles, and to consider the usage of the delivery vehicles (90 % of vehicles are used 1 hour – mostly for work purposes, while delivery vehicles are in use up to 12 hours a day), the impact of electric delivery/freight vehicles is much greater than of EV. Therefore, the subsidies should be increased.

8.6.2. Subsidies for electric charging stations and tax incentives for companies with environmentally friendly vehicles

In order to support the access to city centre with electric vehicles, regulatory incentives for electric charging station can be applied. Additionally, tax incentives for companies with environmentally friendly vehicles may stimulate transport operators to procure e-vehicles. Subsidies for e-charging stations represent a stimulating instrument for investors, who want to procure e-charging stations.

8.7. Logistic centre

Rethinking the possibility for investments into a larger, logistical-distribution, multimodal centre for the whole FUA Maribor at Maribor airport is of considerable importance for the economy of the region.

8.8. E-charging stations

Consolidation centres should also be equipped with electric charging stations to promote and trigger use of electric vehicles for delivery/pick-up. As a part of newly identified delivery areas, a plan for e-charging stations for delivery vehicles will be prepared. The backbone of the development for the electrification of logistics system should be represented by the so-called multifunctional electric charging stations for fuelling also larger electric delivery vehicles/trucks, public transport vehicles, garbage trucks, electric bicycles and electric cars. Municipality of Maribor will also check the possibilities for testing of dynamic charging of electric vehicles.

8.9. Technological innovations in logistics

Municipality of Maribor will encourage and test technological innovations in the field of logistics and transport, such as delivery with drones or autonomous delivery vehicles and trucks (including robots for delivery in the city centre). With a goal to reduce the number of deliveries to the city, Municipality of Maribor will also support 3D printing.

A study on establishment potentials, possibilities of use and necessary requirements for service providers of innovative solutions will be carried out. The study will enable better understanding of challenges posed by new technologies to enable easier and faster adaptation of the city to future circumstances of freight delivery.

The city will also support online ordering + delivery. Additionally, digitalisation of management and organization of data between senders to the recipient in order to digitize whole supply chain will be supported. A study on the development possibilities of digitalization of logistics for the city centre, according to the principle Internet of Things (IoT) (delivery 4.0), will be carried out.

8.10. Education

Municipality of Maribor will provide support in training of small logistics companies on the importance of economical driving, tachographs and safety (removal of hazardous roof loads (snow and ice build-up) from freight vehicles) of delivery vehicles and trucks.

9. Evaluation of impacts

Generation of elaborated potential measures/solutions was based on best practices in other European cities, initiatives from FQP members and objectives already defined. Measures are on three different geographical levels:

- in a specific part of the city, including the city centre;
- at the wider city – FUA level;
- at different territorial levels in the city

The types of measures are structured according to market, regulatory, technology, infrastructure, services, economic, urban and technological innovation aspect. In general, these types of measures are more frequently concerning regulation and transport services.

Table includes an overview of the low carbon logistics measure types and their territorial level of applicability.

	Business as usual Scenario
	Trend Scenario
	Future Scenario

Table 2 Overview and benchmark of logistics measures in Maribor FUA

Parameters of assessment	Delivery and intervention areas	City logistic manager	ICT and ITS measures	City logistic service	Multimodal connections
Market	X	X		X	
Regulation	X		X	X	
Infrastructure	X			X	X
Land use	X			X	X
Management and service		X		X	
ITS and ICT	X		X	X	
Energy- technological innovation					
Scale of appl.					
city centre	X	X	X	X	X
wider city – FUA level		X	X	X	X

different territorial levels in the city	X	X	X	X	X

Parameters of assessment	Subsidies for EV	Logistic Centre	E-charging stations	Technological Innovation	Education
Market	X				X
Regulation				X	X
Infrastructure		X	X	X	X
Land use		X	X	X	
Management and Services			X	X	X
ITS and ICT			X	X	
Energy- Technological innovation		X	X	X	
Scale of appl.					
city centre	X		X	X	X
wider city - FUA level	X	X		X	X
different territorial levels in the city	X		X	X	X

The measures are in line with SUMP, energy strategy (SEAP), Sustainable urban strategy (TUS) and urban development plan (Enclose). On tactical level, the measures are to be assessed with Cost Benefit Analysis (CBA) or Multy Criteria Analysis (MCA), where different packages of measures are to be assessed in parallel. On operational level, investment plans and project documentation should follow the EU directives, national and international calls for co-financing, and Public Private Partnership (PPP) options for co-financing.

Different components for evaluation were weighted during FQP sessions. In regard to results of main general challenges the weights are shown in the table below.

Impact areas	Economy and energy	Environment	Transport and mobility	Society	Policy	Social acceptance	User uptake
Economy and energy	1	0,5	0,33	2	3	5	4
Environment	2,0	1	0,5	3	4	6	5
Transport and mobility	3,0	2,0	1	4	5	7	6
Society	0,5	0,3	0,3	1	2	4	3,0
Policy	0,3	0,3	0,2	0,5	1	3	2,0
Social acceptance	0,2	0,2	0,1	0,3	0,3	1	0,5
User uptake	0,3	0,2	0,2	0,3	0,5	2	1

Total	7,3	4,5	2,6	11,1	15,8	28	21,5	Total	Average
Economy and energy	0,1	0,1	0,1	0,2	0,2	0,2	0,2	1,1	0,16
Environment	0,3	0,2	0,2	0,3	0,3	0,2	0,2	1,7	0,24
Transport and mobility	0,4	0,4	0,4	0,4	0,3	0,3	0,3	2,5	0,35
Society	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,7	0,11
Policy	0,0	0,1	0,1	0,0	0,1	0,1	0,1	0,5	0,07
Social acceptance	0,0	0,0	0,1	0,0	0,0	0,0	0,0	0,2	0,03
User uptake	0,0	0,0	0,1	0,0	0,0	0,1	0,0	0,3	0,05
SUM									1,00

Priorities were ranked as follows: Environment (24 %), Economy and energy (16 %), Society (11%), Policy (7 %), user uptake (5 %) and Social acceptance (3 %). This is quite in line with SUMP priorities, although SUMP's main general challenge is society (unemployment).

The values hierarchy of the logistics system in Maribor, assessed by stakeholders within the project SULPiTER

Traffic and mobility	Environment	Economy and energy	Society	Policy and planning	User acceptability	Society acceptability
Safety and security (5)	**Noise (4,7)**	**Costs (4,5)**	**Green environment (4,5)**	**Awareness (4,6)**	**Flexibility (4,8)**	**Adoption of measures (4,6)**
(fatal accidents, injuries of road users, consignment damages, vandalism, shipment theft)	*(affected population - dB)*	*(long-term cost reduction for logistics processes)*	*(human-friendly living environment)*	*(importance of changes in the deliveries)*	*(consideration of facts and analyses in the implementation of sustainable measures)*	*(information of measures, adoption of measures at the local level, confirmation of measures through social networks)*
Service level (4,8)	**Air quality (4,6)**	**Development (4,4)**	**Living standard (4,4)**	**Background (4,6)**	**Adoption of measures (4,5)**	**Rules/Decrees (4,3)**
(delivery accuracy, proper vehicles, sufficiently frequent delivery, fast and clear communication)	*(omission - PM particles, NOx, CO)*	*(new job opportunities due to the development of logistics)*	*(quality of life, changes in delivery rules (permits))*	*(experience in planning, considering research analysis, a good overview of guidelines and legislation)*	*(integration of actions by all stakeholders, promotion of actions)*	*(agreement on new conditions, such as for economical driving and increased control)*
ICT system (4,7)	**Greenhouse gases (4,4)**	**Energy (4,3)**	**Comfort (4)**	**Risk management (4,2)**	**Success (4,5)**	
(quality delivery routes, adequate transport infrastructure, access to modern ICT technology)	*(CO2 emissions)*	*(energy consumption for delivery and other logistic processes)*	*(presence of suitable visual and audio content)*	*(implementation of measures - poor management, communication, stakeholder involvement, bureaucracy)*	*(measuring the effects of implemented measures)*	
Delivery vehicles (4,5)		**Benefits (4,0)**	**Society differences (4,0)**		**Mobility (4,4)**	
(vehicle utilization, empty runs)		*(diversity of local economy)*	*(possibility of a strike, changes in habits, aging population)*		*(transferability of sustainable actions by and to other stakeholders)*	
Traffic system (4,4)		**Risk (4,0)**			**Agreement (4,3)**	
(traffic offenses, e.g. incorrect parking)		*(impact of inflation, taxes, unstable regions, revenue deficit on logistic processes)*			*(contractual involvement of stakeholders in pilot projects on sustainable logistics)*	

Additionally, FQP prioritised the main values of logistic systems in order to assess possible measures. The list above provides the hierarchy of values, where more focus in the future of Maribor planning will be on providing better safety and security in transport and mobility, noise reduction, cost reduction, green environment building, the importance of policy awareness in planning, flexibility from users and the adoption of the measures, proposed by the companies.

Stakeholders assessed the values according to a scale (from 1 to 5). The higher the rating, the more important is the value and should be taken into account as such, when setting up the logistics system in the future.

10. Role of the stakeholders involvement

City authorities are faced with the problem of implementing transport/logistics policy measures caused by different acceptance levels of large number of stakeholders and actors. Those, who directly influence conditions in urban freight are actors (**policy makers, decision makers and local authorities**), those who have a direct interest in urban freight and are affected by measures are stakeholders (companies, individuals, interest groups, etc.). Traditionally receivers, carriers and forwarders have been considered as the most relevant stakeholders but they have often been excluded from the policy making process. The importance of involvement of non-public decision makers in a fully participatory transport planning process in cities is recognized in several case studies. Involvement of all relevant stakeholders and actors is recognised as a precondition for successful implementation of measures.

Figure 17: FQP meeting in Maribor

In recent years Freight Quality Partnership (FQPs) has emerged as the most promising approach for involving stakeholders in discussions about problems and identification of solutions. Freight Quality Partnerships are collaborative networks of freight partners. The objective of FQP is to optimize freight transport by working together on logistics operation issues, exchanging information and experiences and developing a common freight strategy. Implementation process includes identification of target groups and their different needs, development of a communication platform and deployment of dedicated, specific city measures. FQP has been recently enhanced with the concept of living lab aiming at constantly revising and continuously

improving logistics performance to meet stakeholders' needs. Final aim is to obtain long lasting impact and to cope with the complexities of the urban freight system.

FQP was recognized as one of the most important mechanisms of the SULPiTER project for development of SULP in Maribor. In the initial phase, several discussions were done with the public authorities to define aims and objectives of FQP and to understand the existing policies and logistics vision of the Municipality of Maribor. Private stakeholders were engaged in later phases to provide their views and to validate ideas discussed with public authorities at the beginning of SULP development process.

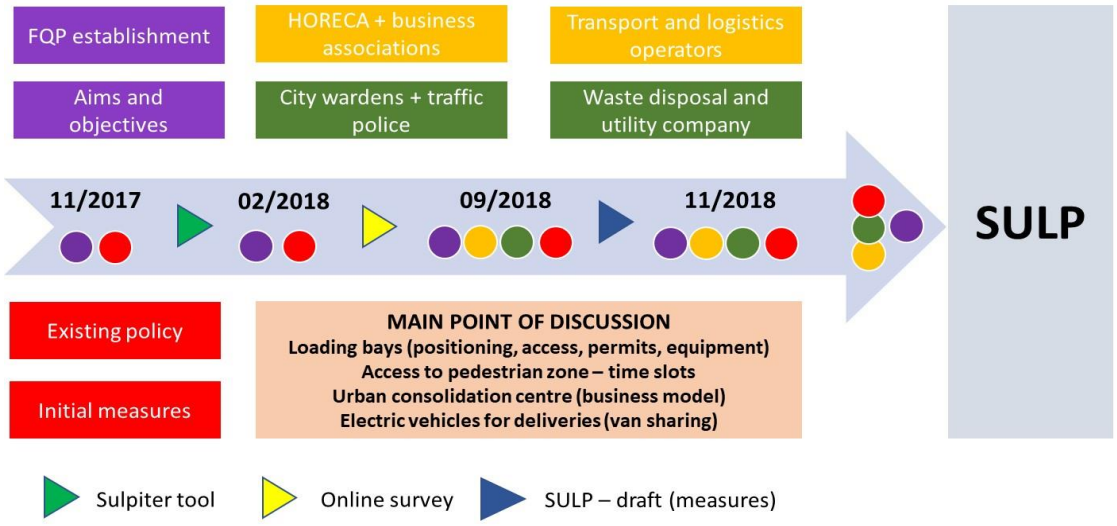

Figure 18: SULP development process based on FQP meetings

All the analyses conducted during the initial phase of the SULPiTER project (survey with shop owners, transport operators, analysis of statistical data and traffic counters) presented basis for discussions with FQP members. In addition to that, Logistics Sustainability Index (LSI) tool was used during the FQP meetings to further identify the most crucial problems and measures to be addressed in the SULP document.

The FQP in Maribor is to be understood as informal association (formally the group will act within the framework of the Smart City Initiative) which currently accounts of 28 members from both, public and private, sectors. Long term vision is to continue active discussions with FQP members and to jointly examine solutions in the field of urban freight issues.

11. Main steps for the adoption of the SULP

As already mentioned, Municipality of Maribor developed and adopted the Sustainable Urban Mobility Plan (SUMP) in 2015. SUMP was developed according to EU methodology and is in line with the practices of European cities. Therefore, it mainly deals with the segment of people and passengers. Nevertheless, it also identifies importance of freight issues and seeks to address urban freight issues in the near future.

In the process of developing urban logistics policies it was found that this topic should be addressed more thoroughly, therefore the Municipality of Maribor, in cooperation with the University of Maribor, the Faculty of Civil Engineering, Traffic Engineering and Architecture, joined the implementation of the SULPiTER project, whose main aim was to develop a Sustainable Urban Logistics Plan (SULP).

During the project, SULP was developed, building on the existing SUMP and as such, in the case of Maribor, complements SUMP. Formal adoption of SULP requires public presentation and final acceptance of the document as an annex of the SUMP at the City council. This process is planned to be finished in May 2019.

12. Application and monitoring

Municipality of Maribor will establish a regular monitoring and evaluation of key logistics indicators by 2021, which will be the main tool for achieving the goals and objectives from SULP. Table below presents main categories of measures, indicators, data sources and timeline for monitoring.

Category	Indicator	Data source and methodological approach	Timeframe
Market	Emissions and noise levels in the LEZ zone	Ground measurement/noise chart	4 * annual/ biannual
Market	Share of environmentally friendly vehicles in LEZ	Vehicle registry	Annual
Market	Delivery vehicles occupancy	Survey	Biannual
Market	Share of accurate parcels	Survey	
Infrastructure	Share of quality delivery surfaces	Visual inspection	Annual
Infrastructure	Share of well-marked delivery routes	Visual inspection	Annual
Infrastructure	Share of surfaces, intended for logistical activities	Visual inspection	Annual
Infrastructure	Number of electric charging stations for delivery vehicles and trucks	Visual inspection	Annual
Regulation	Share of improperly parked delivery vehicles	Statistics (Municipal Police Department/Police Department)	Annual
Regulation	Speed of delivery bicycles in the pedestrian zone	Control (Municipal Police Department/Police Department)	Annual
Management	No. of entries of delivery vehicles in the pedestrian zone	Statistics	Annual
Management	No. of km travelled in the pedestrian zone	Field measurement /ICT	Annual
Management	Cost of the last mile delivery	Survey	Annual
Management	Average annual daily turnover	Traffic count	Annual
ITS/ICT	% of occupancy of loading bays	Statistics	Annual
ITS/ICT	% of traceable parcels	Survey	Annual
Energy	Modal split	Field measurement	Biannual
Land use	% of accepted files according to the Sustainable Urban Logistics Plan	Visual inspection	Annual

RISKS IN IMPLEMENTATION OF SULP measures

Risks associated with Market measures represent the unwillingness of end users to accept the regulated access to city centre/Friendly Zone with environmentally friendly vehicles compliant with predefined, clear and transparent set of conditions. Municipality of Maribor will therefore support the stimulation of transport operators in procuring environmentally friendly vehicles. Additionally, awareness and communication activities will be carried out.

Regulatory risks are associated with non-efficient enforcement and imprecise rules. SULP of Maribor provides solutions for this area regarding implementation of ICT/ITS solutions or monitoring of violations. FQP will be continued after the project end in order to raise the awareness and support the decision makers. FQP members will meet when needed (presumably once or twice a year).

Risks associated with infrastructure can manifest in low acceptability of new traffic rules on road delivery sections by end users. A good communication plan and clear rules will minimise the uncertainty of end users. Moreover, the time window for usage of such areas is proposed in order to minimize traffic jams. For larger investments, like logistics centre or new rail infrastructure, the main risk is the unacceptability of projects, due to negative environmental impacts on local communities. Here SULP propose the LSI methodology to be implemented to assess the project according to values and according to different stakeholders.

Risks for Land use planning are associated with non-integrated planning of logistic measures, SUMP measures and measures within other strategies (SEAP, E-mobility, etc.). To avoid parallel planning, the newly established City Logistic Manager will be coordinating planning activities among strategies and with FQP discussions.

Risks related to management and services are related with unsuccessful operation of consolidation activities. Municipality of Maribor will provide a competitive, fast and reliable service for all customers. All steps and decisions will be discussed within FQP.

Risk within ITS and ICT logistic services are associated with unknown costs of measures due to relatively novelty of products. Additional risk is unwillingness of users to provide data of their customers for consolidation activities. The SULP proposes a novel business model, where these relationships are to be clarified.

Risks in new innovation technologies are affiliated with relatively high investment costs, due to lack of experience from other cities. The city will avoid these risks with long term planning evaluations and the ambition to be a trendsetter in logistics in the area.

13. Promotion and Communication Plan

The case of Slovenia is a bit specific because regions are not yet established. The FUA Maribor is comprised of 41 municipalities each governed by its own mayor and council. As Slovenia does not have regions nor regional governments the adoption of SULP on the FUA level would require consensus of all 41 municipalities which is by itself an impossible task. We therefore decided to divide Maribor FUA on smaller number of zones and have executed the analysis of freight flows characteristics on the level of zones within the FUA. Tthe outcomes of SULPiTER analytical tool showed that the Municipality of Maribor is the main origin and destination of freight traffic flows in the region. Thus the SULP was developed for the Municipality of Maribor. However, it needs to be stressed that Maribor's SULP contains a set of measures indirectly and partially influencing other parts of the FUA.

Since Maribor is the only city in Slovenia where SULP is currently developed, we are planning to share these experiences firstly with municipalities within the Maribor FUA and latter with all other cities in Slovenia (especially with bigger cities like Ljubljana and Celje). We are planning to disseminate our experiences and knowledge through Association of Slovenian Municipalities and through the Ministry of Infrastructure of Republic of Slovenia, which just lunched the call for establishment of guidelines for development of Sustainable Urban Logistics plans.