UNIVERSITY OF ZAGREB
FACULTY OF TRANSPORT AND TRAFFIC SCIENSES
Vukelićeva 4, HR-10000 Zagreb

DELOITTE ADVISORY SERVICES D.O.O.
Radnička cesta 80, HR-10000 Zagreb

Sisak Urban Transport – Sustainable Urban Mobility Planning (SUMP)

European Bank
for Reconstruction and Development

Deloitte.

Zagreb, March 24th, 2017

Project title:	**Sisak Urban Transport – Sustainable Urban Mobiltiy Planning (SUMP)**	
Clients:	**Auto promet Sisak d.o.o.** Zagrebačka 19 HR-44000 Sisak	**City of Sisak** Rimska ulica 26 HR-440000 Sisak
Contractors:	**Faculty of Transport and Traffic Sciences of the University of Zagreb** Vukelićeva 4 HR-10000 Zagreb	**Deloitte advisory services d.o.o.** Radnička cesta 80 HR-10000 Zagreb
Supervising Bord:	**Novela Rimay Ferenčak, dipl. ing. arh., president – City of Sisak** **Darko Majić, mag. ing. traff. – AP** **Zoran Solomun, dipl. ing. prom. – City of Sisak** **Martina Mađerić – City of Sisak** **Milovan Zrakić – City of Sisak** **Damir Borić – City of Sisak**	
Coordinators by the Client:	**Novela Rimay Ferenčak, dipl. ing. arh. – Team Leader** **Darko Majić, mag. ing. traff. – public transport** **Zoran Solomun, dipl. ing. prom. – transport and infrastructure** **Alan Đozić, dipl. ing. agr. – Strategic environmental Assessment**	
Financal support:	**European Bank for Reconstruction and Development** Miramarska 23 HR-10000 Zagreb Contract Number: C32480/EBSF-2015-08-142	
Internal project number:	**FPZ-ZGP 902-9**	
Project duration:	**January 12th, 2016 – March 24th, 2017**	
Project type:	**Traffic study – Sustainable Urban Mobility Plan**	
Project managers:	**Prof. Davor Brčić, Ph.D.** **Marko Šoštarić, Ph.D.**	
Project authors:	**Orsolya Barsi** **Mario Ćosić** **Mladenka Ćosić** **Ivana Dominković** **Domagoj Drndelić** **Ivan Grgurević** **Marijan Jakovljević** **Jan Janousek** **Bojan Jovanović** **Marinko Jurčević** **Julijan Jurak** **Gordan Kožulj** **Bia Mandžuka** **Branko Mikinac**	**Vladimir Milošević** **Luka Novačko** **Ivica Perica** **Emina Popović** **Hrvoje Pilko** **Goran Radosović** **Dražen Rajaković** **Tomislav Rožić** **Marko Slavulj** **Marko Ševrović** **Ljupko Šimunović** **Dino Šojat** **Idis Turato**

Project manager:	*Dean of the Faculty:*
prof. **Davor Brčić, Ph.D.**	Prof. **Hrvoje Gold, Ph.D.**

GLOSSARY OF TERMS

ABBREVIATION	*FULL TITLE*
AP	Auto promet Sisak Ltd.
City	The City of Sisak
Consortium Agreement	Consortium Agreement from December 21th, 2015, concluded by the Faculty of Transport and Traffic Sciences (Leader) and Deloitte Advisory Services Ltd. (Member)
Consultancy Contract	Consultancy Contract from December 21th, 2015, concluded by Auto promet Sisak Ltd and Faculty of Transport and Traffic Sciences of the University of Zagreb
Consultant, Consortium	Consortium of contractors consisting of: Faculty of Transport and Traffic Sciences of the University of Zagreb (Leader), and Deloitte Advisory Services Ltd. (Member)
DPU	Detailed plan (Croatian: Detaljni plan uređenja)
DTT, Deloitte	Deloitte Advisory Services Ltd.
EBRD, Bank	European Bank for Reconstruction and Development
EC	The Expert Choice software
EUR	Eurozone Euro
FOPIP	Financial and Operational Performance Improvement Programme
FPZ	Faculty of Transport and Traffic Sciences of the University of Zagreb
GIS	Geographic Information System
GUP	General Urban Plan (Croatian: Generalni urbanistički plan)
HRK, kn	Croatian kuna
Loan Agreement	Loan Agreement from September 10th, 2014, concluded by the EBRD and AP
PPUG	Municipal Spatial Plan (Croatian: Prostorni plan uređenja grada)
Project	Sisak Urban Transport – Sustainable Urban Mobility Planning
PSC	Public Service Contract
PSP	Private Sector Participation
Sisak Urban Transport - FOPIP	Sisak Urban Transport – Implementation Support and Financial and Operational Performance Improvement
SUMP, Plan	Sustainable Urban Mobility Plan
TOR	Terms of Reference
UPU	Urban Development Plan

TABLE OF CONTENTS

1 ABSTRACT 1
2 INTRODUCTION 6
3 THE CHOSEN VARIANT 10
4 SUSTAINABLE URBAN MOBILITY PLAN 12
4.1 The role of institutions 12
4.2 Public transport 15
4.2.1 Visual identity 15
4.2.2 Line route adjustment 16
4.2.3 Service improvement by reducing interval between vehicles 18
4.2.4 Converting the bus stop Kolodvor into a terminal 18
4.2.5 Bus stop renovation 18
4.2.6 Introducing real-time info displays 19
4.2.7 Tariff system 19
4.2.8 Introducing e-Ticketing system 20
4.2.9 Introducing Wi-Fi in city buses 20
4.2.10 Public transport promotion 21
4.2.11 Further line route adjustments due to the new bridge 21
4.2.12 Replacing the existing bus park with eco-friendly buses 23
4.2.13 On-demand transport 23
4.2.14 Bus priority at signalized intersections 24
4.2.15 Transport to the Zagreb Airport 24
4.2.16 Park-and-ride system 24
4.2.17 Multi-modal public transport app 25
4.2.18 Public bicycle scheme 27
4.2.19 Tourist train 28
4.2.20 Passenger transport by water (water taxi) 28
4.2.21 Public car scheme – Carsharing 29
4.2.22 Taxi service improvements 33
4.2.23 Integrating public transport and railway systems 33
4.2.24 Goals and indicators 33
4.3 Pedestrian and bicycle traffic 38
4.3.1 The development of predestrian surfaces in the city centre for the purpose of protecting cultural and historical heritage and increasing quality of life 40
4.3.2 The development of independent walking routes (paths, sidewalks) and cycling network in accordance with examples of good practice 40
4.3.3 The definition of terminals intermodal transport (as Bike-and-Ride) 43
4.3.4 Measures for reconstruction of pedestrian and bicycle network 44
4.3.5 Indicators for non-motorized traffic 45
4.4 Road infrastructure 46
4.4.1 Changing the regulation and organization of traffic flows in the city centre 49
4.4.2 Optimization of traffic lights at intersections (ATM, TMS or ITS) 54
4.4.3 Reconstruction of critical intersections 60
4.4.4 Bridge construction 63
4.4.5 The construction of highly-important roads 65
4.4.6 Concluding observations on objectives and indicators of road network 67
4.5 Parking policy management 69
4.6 City logistics 74
4.6.1 Analysis of freight transport infrastructure in the City of Sisak 74
4.6.2 Basic city logistic concepts 76
4.6.3 Proposed solutions of City of Sisak city logistics 77
4.6.4 Measurable effects of city logistics 82

4.7 Road safety 84
4.7.1 Analysis of compliance with EU directives and international standards 85
4.7.2 Road safety and vulnerable road users 85
4.7.3 Road safety analysis according to the Plan 87
4.7.4 Analysis and proposals to improve safety during road works 89
4.7.5 The involvement of local authorities in the knowledge transfer with the aim of integrating road safety principles into transport planning 90
4.7.6 The involvement of non-governmental organizations in programs to improve road safety and to introduce education for vulnerable road users 91
4.7.7 The measures and indicators for improving road safety in the City of Sisak 92
4.8 The role of public and private sector in service provision 94
5 COST ESTIMATIONS 100
6 STRATEGIC ENVIRONMENTAL ASSESSMENT 109
6.1 The state of the environment and the possible impacts of the Plan 110
6.1.1 Air quality 110
6.1.2 Noise 111
6.1.3 Water quality 112
6.1.4 Biodiversity 113
6.1.5 Cultural heritage 114
6.1.6 Soil and agriculture 115
6.1.7 Landscape 116
6.1.8 Forestry and Hunting 117
6.1.9 Waste management 118
6.2 Main Assessment of the Plan for the ecological network 119
6.3 Environmental protection measures 119
6.4 Proposal of the environmental monitoring program 123
6.5 A short overview of Plan variants, evaluation, and difficulties in the data collection process 123
7 MEANS OF FINANCING 125
7.1 Overview 125
7.2 Administration 126
7.3 Decentralisation 126
7.4 Budget 127
7.5 SUMP overview 127
7.6 Overview of key assumptions & financial forecast 128
7.7 Conclusion 132
8 THE COMMUNICATION AND PROMOTION OF THE PLAN 133
8.1 The goal and purpose of the communication plan 133
8.2 Target groups and stakeholders 134
8.3 Communication channels 136
8.4 Management and conduction 137
LIST OF FIGURES AND TABLES 138
REFERENCES 141
ANNEXES 143

1 ABSTRACT

The purpose of the Sustainable Urban Mobility Plan of the City of Sisak is to define the guidelines of sustainable transport and urban space policy, while respecting the development of space, traffic, economy and social plans of the City.

The objective of the Sustainable Urban Mobility Plan of the city of Sisak is to determine the City as a successful dynamic regional center, in which public transport system will provide citizens with better mobility and availability, while reducing the external costs of transport, thus enhancing economic development, environmental protection, and better and healthier urban environment for all citizens - transport system users, especially the most vulnerable ones (pedestrians, cyclists, children, people with disabilities, and the elderly).

Better mobility in urban environment includes all forms of sustainable modes of transport such as public transport, non-motorized modes (cycling and walking), while reducing the use of private cars for travelling. Smaller usage of private cars for city trips will have an impact on reducing greenhouse gas emissions, noise, traffic congestion and road accidents. Promoting public transport usage will result in better social inclusion for all categories of inhabitants of the City and will also contribute to better availability and quality of services of the other non-motorized modes of travel with less impact on the environment.

The integration of transport modes, and especially non-motorized ones with public transport contributes to the reduction of external costs of transport and increases the quality of life in the City of Sisak.

Therefore, the main guidelines of the new sustainable transport policy of Sisak should be:

- Changes in modal distribution in favour of public transport and non-motorized modes with better environment and energy efficiency;
- Reduced private car usage for city trips;
- Encouraged non-motorized modes such as walking and cycling;
- Encouraged public transport usage;
- Pedestrian zone establishment with limited access for private cars;
- Construction and improvement of the existing transport infrastructure;
- Traffic management in the City by using ITS systems;

- Road safety improvement;
- Car park management (on-street and off-street) and parking charging scheme;
- Urban logistics management and freight transport distribution;
- Transport subsystem integration;
- Improved quality of life and increased mobility and availability.

A new vision in implementing sustainable transport policies of the City of Sisak will provide a range of benefits listed below:

- **Integrated approach in transport and spatial planning**:
  - Integrated transport and spatial approach in planning enables long-term strategic vision for better mobility. It reinforces the effective integrated planning approach, including policy level, competent institutions and neighboring conurbations, enabling better realization of traffic, economic, social and environmental objectives of the City;
- **Better quality of life for residents**:
  - Integrated transport planning means planning for people rather than for motor vehicles. The approach is reflected in the improved quality of public space usage, greater security of vulnerable groups in traffic (children, disabled, elderly), lower emission of greenhouse gas emissions, pollution and noise;
- **Positive effects on the environment and human health**:
  - Activities to improve air quality, reduce noise and impact on climate change, encourage residents to use sustainable and healthy modes of transport (walking, cycling), which ultimately contributes with external costs savings addressed to society, cleaner environment and healthier citizens.
- **Improved mobility and accessibility**:
  - Sustainable and integrated transport and spatial planning provides residents greater mobility and access to the areas of the City and better quality of services provided;
- **Better City image**:
  - The City that seeks the implementation of integrated transport and a sustainable urban mobility plan improves its image as an innovative and progressive city, which directly attracts younger residents to live in such a city;
- **Improved citizen involvement by making decisions supported by the citizens**:
  - Planning which is oriented at people - transport system users and every social category, enhancing social inclusion of the majority of citizens and thus making city administration obtaining a very high level of "public legitimacy";

- **Increased capacity to meet the City's obligations**:
    - Sustainable Urban Mobility Plan of the City of Sisak is an efficient way to meet the obligations from EU legislation at national level, related to air quality and noise, mobility, road safety, space, energy and environmental protection;
- **Better access to funds (EU and other development funds):**
    - Adoption and implementation of the Sustainable Urban Mobility Plan creates the conditions for accessing EU financial resources and the possibility of applying tenders for innovative transport, environment and energy solutions, which increases the competitiveness and capacity of available funds of the City of Sisak.

Therefore, the strategic goals of the Sustainable transport policy of the City of Sisak should be:

- To achieve for Sisak by 2020 to be the leading city in the county and among the leading cities at national level regarding sustainable mobility;
- To achieve the changes in the modal distribution of city trips in favour of public transport and non-motorized modes;
- To reduce the number of urban journeys by private vehicles;
- To achieve a reduction in the number of road accidents in accordance with the National Road Safety Programme of the Republic of Croatia;
- To achieve GHG emission reduction in accordance with the EU Directive by 40% in 2030 compared to 1990.

Accordingly, the Sustainable Urban Mobility Plan (SUMP) of the City of Sisak is the essential transport and spatial plan which in the mid-period term (by 2030) determines the development of transport, and which should consequently affect the improved economy picture of the City (by increasing the number of jobs and reducing the depopulation trend in the City).

The plan is worked out at the conceptual level, according to the selected three time horizons – 2017, 2020 and 2030, with a series of measures in the areas of: public transport, non-motorized traffic (walking and cycling), road infrastructure, motorized traffic (traffic management, vehicle parking management, raod safety management), and logistics.

According to these segments, measures and their holders (which have the responsibility for implementation) are presented in tables, and detailed description of the measures and the related indicators is specified in subsequent chapters. The cost of the plan sustainable urban mobility is summarized in the tables given below:

- Individually according to areas: Table 1 – Table 6;
- Total by areas and administration bodies: Table 7 and Table 8, respectively.

Table 1. Capital investments in public transport

Investment type	*2017 HRK*	*2020 HRK*	*2030 HRK*
Projects	1.204.000,00	893.333,33	2.226.666,67
Construction works (without building parcels)	725.000,00	7.650.000,00	8.800.000,00
Machinery and equipment	600.000,00	380.000,00	1.700.000,00
Transport vehicles	3.000.000,00	-	40.875.000,00
TOTAL PER YEAR	**5.529.000,00**	**8.923.333,33**	**53.601.666,67**

Table 2. Capital investments in pedestrian and bicycle traffic

Investment type	*2017 HRK*	*2020 HRK*	*2030 HRK*
Projects	525.000,00	3.600.000,00	-
Construction works (without building parcels)	7.825.000,00	7.400.000,00	31.600.000,00
Machinery and equipment	-	-	-
Transport vehicles	-	-	-
TOTAL PER YEAR	**8.350.000,00**	**11.000.000,00**	**31.600.000,00**

Table 3. Capital investments in road infrastructure

Investment type	*2017 HRK*	*2020 HRK*	*2030 HRK*
Projects	6.262.000,00	6.195.000,00	9.000.000,00
Construction works (without building parcels)	2.358.000,00	225.905.000,00	241.500.000,00
Machinery and equipment	-	2.000.000,00	-
Transport vehicles	-	-	-
TOTAL PER YEAR	**8.620.000,00**	**234.100.000,00**	**250.000.000,00**

Table 4. Capital investments in parking policy management

Investment type	*2017 HRK*	*2020 HRK*	*2030 HRK*
Projects	412.000,00	20.000,00	-
Construction works (without building parcels)	900.000,00	-	-
Machinery and equipment	158.000,00	-	-
Transport vehicles	-	-	-
TOTAL PER YEAR	**1.470.000,00**	**20.000,00**	**-**

Table 5. Capital investments in city logistics

Investment type	*2017 HRK*	*2020 HRK*	*2030 HRK*
Projects	200.000,00	-	1.000.000,00
Construction works (without building parcels)	30.000,00	-	11.000.000,00
Machinery and equipment	225.000,00	-	-
Transport vehicles	-	-	-
TOTAL PER YEAR	**455.000,00**	**-**	**12.000.000,00**

Table 6. Capital investments in road safety

Investment type	*2017 HRK*	*2020 HRK*	*2030 HRK*
Projects	488.000,00	504.000,00	550.000,00
Construction works (without building parcels)	1.917.000,00	2.061.000,00	-
Machinery and equipment	-	-	-
Transport vehicles	-	-	-
TOTAL PER YEAR	**2.405.000,00**	**2.565.000,00**	**550.000,00**

Table 7. SUMP costs by responsible entities

Responsibility	*2017 HRK*	*2020 HRK*	*2030 HRK*
City of Sisak	18.409.000,00	115.828.333,33	77.726.666,67
AP	3.900.000,00	3.110.000,00	42.525.000,00
City of Sisak and taxi service providers*	-	100.000,00	200.000,00
City of Sisak, AP, Croatian Railways**	-	100.000,00	-
City of Sisak, Croatian Roads*	2.170.000,00	1.950.000,00	-
Croatian Roads***	2.200.000,00	135.370.000,00	207.000.000,00
Public-private partnership	-	-	11.000.000,00
Ministry of culture**	-	-	9.000.000,00
City of Sisak, Ministry of Interior, NGOs	150.000,00	150.000,00	300.000,00
TOTAL	**26.829.000,00**	**256.608.333,33**	**347.751.666,67**
* One half of the total costs for each participant			
** One third of the total costs for each participant			
*** Public-private partnership			

Table 8. SUMP costs by activity areas

Activity area	*2017 HRK*	*2020 HRK*	*2030 HRK*
Public transport	5.529.000,00	8.923.333,33	53.601.666,67
Pedestrian and bicycle traffic	8.350.000,00	11.000.000,00	31.600.000,00
Road infrastructure	8.620.000,00	234.100.000,00	250.000.000,00
City logistics	455.000,00	-	12.000.000,00
Parking policy management	1,470.000,00	20.000,00	-
Road safety	2.405.000,00	2.565.000,00	550.000,00
TOTAL	**26.829.000,00**	**256.608.333,33**	**347.751.666,67**

2 INTRODUCTION

Final Report is a fifth scheduled deliverable upon the signed consultancy contract by the parties Auto promet and the Consortium consisting of the Faculty of Transport and Traffic Sciences of the University of Zagreb and Deloitte Advisory Services Ltd. (hereinafter: Consultant) for the preparation of project "Sisak Urban Transport – Sustainable Urban Mobility Planning".

The goal of the Final Report is to establish the Sustainable Urban mobility Plan for the City of Sisak, based on the Draft Final Report (in which the Plan was presented, and the City of Sisak decided upon accepting the Plan according to the public hearing held in City Administration headquarters).

The City of Sisak decided, at the presentation of the Susatainable Urban Mobility Plan held in December 12th, 2016, and the public hearing after the presentation, to accept the presented SUMP solution for 2017, 2020 and 2030 time horizons. Therefore, the next task of the Consultant is to adjust the proposed Sustainable Urban Mobility Plan of the City of Sisak according to the public hearing and stakeholder remarks in written form.

Sustainable Urban Mobility Plan is the plan that includes a new vision in traffic and spatial planning, taking into account the current traffic and zoning plans with integration, participation and evaluation principles to satisfy the needs of urban residents for mobility, today and in the future, and to provide a better quality of life in cities and their surroundings.

The goal of a SUMP in cities is to create a sustainable transport system by:

- Ensuring the availability of job places and services to everyone;
- Improving road safety and security in transport system;
- Reducing pollution, greenhouse gas emissions and energy consumption;
- Increasing efficiency and effectiveness in transport of people and goods;
- Increasing the attractiveness, quality of life, and mobility in the city.

Transport policy and its measures set out in the sustainable urban mobility plan in cities should include all forms and modes of transport in the entire city agglomeration such as public and private, passenger and freight, motorized and non-motorized, moving and stationary. A special emphasis is put on the role of the parking policy in managing total transport demand, aggravated by unfavorable modal split and excessive private car usage. Therefore, the parking supply management and defined rule management present powerful tools for achieving the reduction of the excessive private car usage in

urban space. Local administration units should perceive that the Sustainable Urban Mobility Plan is an upgrade of the existing plans. The plan provides an effective way of solving problems related to transport system in the observed area.

Furthermore, to the existing EU practice on member state regulations, the main SUMP features are the following:

- A clear vision, objectives and measurable targets;
- Sustainability that will balance economic growth, social justice and environmental quality;
- An integrated approach, which takes into account the practices and policies of different sectors and administration levels;
- A review of transport costs and benefits, taking into account the overall social costs and benefits;
- Participatory approach, involving citizens and stakeholders from the beginning to the end of the planning process.

In the action plan for urban mobility published in 2009, the European Commission has supported the rapid adoption of sustainable mobility plans in European cities by using general guidelines, promoting the exchange of best practices, benchmarking and supporting educational activities for urban mobility professionals.

EU transport ministers are supporting the process of developing SUMPs in cities. The conclusion of the action plan for urban mobility of June 24th, 2010, states that the Council of the European Union supports the development of sustainable urban mobility plans, and encourages the development of incentives, such as professional assistance and information exchange, for the creation of such plans.

In order to develop SUMP of the City of Sisak, the methodology was implemented in accordance with the following documents: Green Paper – Towards a new culture for urban mobility (COM 2007), Action Plan on Urban Mobility (COM 2009), A call for smarter urban vehicle access reglation (SWD 2013), Mobilising Intelligent Transport Systems for EU cities (SWD 2013), Targeted action on urban road safety (SWD 2013), A concept for sustainable Urban Mobility Plans (COM 2013), Together towards competitive and resource-efficient urban mobility (Com 2013), A call to action on urban logistics (SWD 2013), and GUIDELINES – Developing and implementing Sustainable Urban Mobility Plan (EU 2013), all of them based on the EU traffic policy (White paper 2011 – Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system).

Based on the analysis of the current transport system in the City of Sisak, and in cooperation with the

City, the potential for creating a successful sustainable urban mobility plan is estimated, and the purpose and objective of the Plan are defined. Then, a common vision of sustainable urban mobility plan is defined based on previous transport planning documents. Three alternative variant solutions were made, based on which the City administration of Sisak finally selected the alternative. In accordance with the decision, priorities and measures were set. With the Interim Report 3, based on clear priorities and measures, the development of effective packages of measures for certain structural parts of the Sustainable Urban Mobility Plan was started, including: non-motorized transport, public transport, logistics, road infrastructure, and road safety. The report also gives an estimate of the cost in the time horizons of the Plan (2017, 2020, 2030), followed by the responsibility to implement the parts and measures. Also, based on the precise indicators, a system for monitoring the implementation of the plan is proposed.

After the adoption of the Sustainable Urban Mobility Plan for the City of Sisak by the city administration, the final step follows - the plan adoption.

The City of Sisak is the centre of Sisack-Moslavina County which has over 4.468 km^2 of space and, in its territory 172.439 inhabitants live. The County includes 19 local governments, with 7 cities and 12 municipalities. The City of Sisak is the largest city in the county, with an 422,75 km^2 area with 47.768 inhabitants, where in 35 urban areas 33.322 inhabitants live. The City was one of the biggest industrial cities in Croatia with a rich cultural heritage, and a very favorable geographic position with transport routes to the three rivers: Sava, Kupa and Odra. Sisak is one of the oldest cities in central Croatia whose urban-based roots date to around the 4th century BC.

Today, the City of Sisak, due to the consequences of the Homeland War, the transition and the global economic crisis, has weakened economy. The number of jobs has been in a decline in the past decade, due to the reduction of economic activity. In the last year, the City recorded new economic prosperity, which was a result of creating new jobs for citizens.

The current status is reflected in the transport system of the City of Sisak. The modal distribution of travel is very unfavourable – about 47 % of trips are made by private cars, 36 % by walking, 8 % by cycling, and only 8 % is done by public transport (3 % by train, 5 % by bus).

The private car usage dominates, but walking also has a very big share, as a result of the relatively small inner city area. Low public transport percentage in the modal split is worrying.

During a day, according to the purpose, types of journeys are the following: commuting (42%), shopping (21%), school (12%), recreation (10%) and other activities (15%).

A daily journey length by mode is following: by train 63.51 km (due to the distance of the gravitational area of the City of Zagreb), by bus 13.05 km, by private car 12.37 km / 8.27 km, by motorcycle 7 km, by bicycle 4.58 km and by walking 1.13 km. Private car usage and public transport usage is almost the same. The relatively large distance (4.58 km) in cycling comes from the fact that the bike is used for transport in broader areas and rural areas.

The reasons the excessive private car usage are speed, availablibity, lack of alternative transport and joy of travelling.

When expressing the satisfaction of transport services, private car dominates, followed by walking and cycling, while the public transport rating (train and bus) was significantly lower. This is confirmed by a continuing decline in the number of passengers transported by bus from 2011 to 2015 by 21 % in city traffic. Although the most recent data on passengers transported (from 2015 to 2016) imply positive trends (the number of passengers increased by 3,6 %, the number of unemployed passengers is 5 % lower, and the number of pasesngers with monthly employee tickets increased by 1,6 %), the survey conducted indicates that it is necessary to take measures to improve the quality of public transport, both bus and rail.

In conclusion, for the purpose of better economy and the future transport state in the City, continuing the economic development, to create a sustainable urban mobility plan for the City of Sisak. Sustainable Urban Mobility Plan should include a clear vision, goals and measures, with detailed indicators of achievement as well as periods in which certain measures will be implemented, in order to allow the City of Sisak economic prosperity, social inclusion, ensuring conditions for better quality of life for all citizens.

Therefore, in the City of Sisak, a new vision of the transport system should include a change in modal distribution in favor of public transport, the integration of transport systems in order to improve mobility and access to town facilities by: reducing the private car usage in city traffic, improving road infrastructure, encouraging the use of walking and cycling as modes of transport by expanding pedestrian zones and improving cycling infrastructure, improving delivery traffic and city logistics, improving parking policy, reducing the negative impact on the environment (noise and GHG emissions), increasing road safety, and reducing external costs caused by the transport system.

3 THE CHOSEN VARIANT

In the process of drafting the Sustainable Urban Mobility Plan of the City of Sisak, the Consultant (FPZ and DTT) have obliged to develop three alternative variant solutions. Based on the three proposed variants, the stakeholders in the project have agreed on the implementation of all three variants and corresponding measures, and therefore the Sustainable Urban Mobility Plan of the City of Sisak will be implemented according to the following timeframes:

- By the end of 2017;
- By the end of 2020;
- By the end of 2030.

The sustainable urban mobility plan covers the following activities:

- Improving mobility and availability and modal shift;
- Developing and promoting the usage of non-motorized transport (walking and cycling);
- Improving public transport and the integrating transport subsystems (bus transport, taxi transport, Park-and-Ride, public bicycles, tourist train, carsharing, railway transport);
- Improving delivery transport;
- Improving road safety;
- Improving transport infrastructure;
- Managing road infrastructure (automatic traffic management, intelligent transport systems, public transport priority);
- Creating solutions for a comprehensive parking policy;
- Implementing measures of the sustainable urban mobility, and providing indicators and cost estimations for the stakeholders;
- Reducing the environmental impact;
- Sugessting potential stakeholders from public and private sectors and public relations.

With the development of the proposals and measures aimed at promoting sustainable transport modes in the scope of the existing transport policy, a sustainable, effective and energy-efficient transport system in the City of Sisak has been attempted to define for the future. In this regard, the development of chosen variants includes defining a road network, the concept of traffic flow management (one-way streets) in the city centre, the concept of solutions for delivery and freight traffic, the concept of pedestrian zones in which public transport is permitted, the concept of zones

exclusively for pedestrians and cyclists, bicycle traffic concept, street reconstruction proposals and new intersection layouts to improve traffic flows and to increase road safety, proposals for improving the signalling system at intersections, proposals of reconstructing the centre for maneuver traffic with TMS and ITS, a comprehensive concept for planning off-street parking (Park-and-Ride) with proposed tariff system. The solutions are primarily focused on road network in the city centre, but in accordance with the identified problems, the solutions are also related to the secondary network (for example, streets in which public transport operates). Special attention was paid to the areas that are important attractors of travel such as the city marketplace, city hospital and shopping areas. The plan is specially prepared for the mobility needs of the most vulnerable group of road users (schoolchildren, elderly and people with disabilities).

Regarding public transport, the plan estimates the need for replacing rolling stock with more modern and more environment-friendly vehicles. It was also suggested to introduce a system of informing passengers in vehicles and at stops, and a proposal to improve the ticket sales system. Also, the communication strategies of the plan are prepared with the idea of increasing sensibility of the public to the proposed plan. In the following chapter, the detailed solutions are elaborated with proposed plan measures, costs and indicators for monitoring the implementation of certain measures.

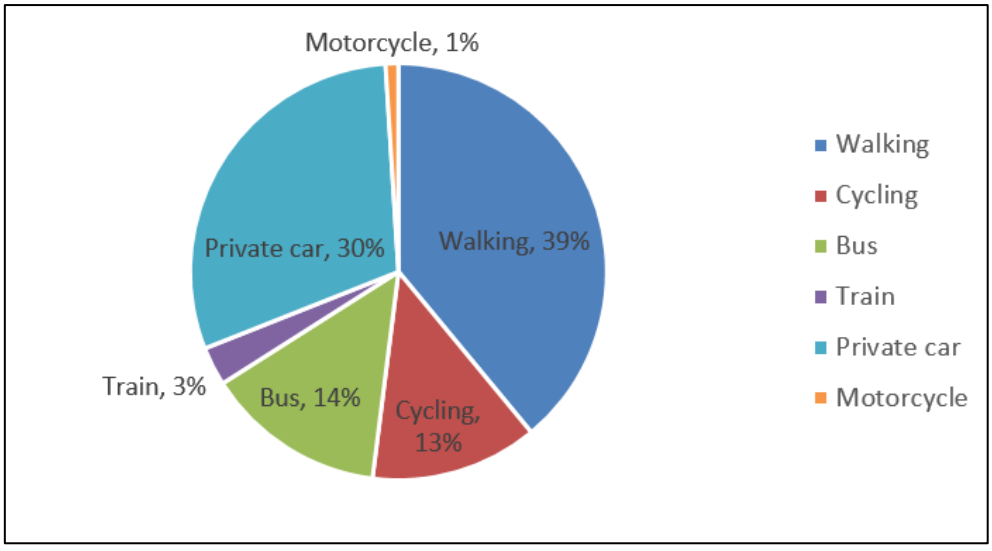


Figure 1. Modal split of city trips – goal for 2030

According to the survey, which was conducted in the first phase of the project, there is a very unfavorable modal distribution of city trips – about 47% of travelling is done by car, by motorcycle 1%, by walking 36 %, by cycling 8 %, and only 8 % was done by public transport (3 % by train, and 5 % by bus). The aim of the sustainable urban mobility plan by 2030 for the City of Sisak is to reduce the private car share from 47 % to 30 %. It is planned to increase urban public transport to 17 % (14 % by bus, 3 % by train), 39 % by walking and 13 % by cycling (Figure 1).

4 SUSTAINABLE URBAN MOBILITY PLAN

The Sustainable Urban Mobility Plan of the City of Sisak encompasses seven main activity areas:

- The role of institutions;
- Public transport;
- Pedestrian and bicycle traffic;
- Road infrastructure;
- City logistics;
- Road safety;
- The role of public and private sector.

4.1 The role of institutions

Institutional traffic ecosystem includes all bodies responsible for planning, financing, operations and maintenance of transport infrastructure, services and transportation. Relations among these bodies play a key role in ensuring efficient and reliable transport system, and the rules governing the entire transport sector include administration, budget, regulation and other segments. As a result, the successful implementation of the sustainable urban mobility plan is a complex interdisciplinary task that requires coordination and cooperation of all relevant institutions based on the requirements of the public and political consensus.

In the same way, cooperation on the implementation of the urban mobility plan is needed at different levels: territorial, political, administrative and inter-department level. Due to this complexity, the Sisak City Administration should appoint a management team for Plan project implementation and its role. Therefore, it is necessary to devise a management concept for implementing SUMP, because in this way, among other things, all relevant stakeholders at all times would know who, what and when is working on a specific project. Therefore, by looking at the implementation of the Plan as a major project, the role of project management is to become more important, when best practices suggest the need for establishing a special administrative unit for project management within local authorities.

The head of the team for implementing and monitoring the progress of the project could be a representative of the Department of Economy and municipal system of the City of Sisak, and the

representatives of other key city departments such as the Administrative Department of Planning and Environmental Protection and the Administrative Department for Budget and Finance. Other members could be three to five representatives of key external institutional stakeholders, and they can be defined later (after identification) to join the team. It is necessary to clearly define the roles of team members, in order to reduce the number of conflicts during interaction, and ensure the optimal usage of available human resources (competence, working hours etc.). It is important to point out that the work of the management team requires certain management and communication skills and, if they are not part of the management and practices of the local authorities, then the team members must actively develop them. At the same time, team members need to understand the national (or regional) legal environment in terms of institutional cooperation which applies to plan carefully, and to respect the legal requirements. Also, the team has to have the capacity to generate political support that has competence over transport networks and services, as well as technical excellence in implementation.

The first task in implemeting Sustainable Urban Mobility Plan is to determine relevant institutional partners for the implementation of the Plan. This is established by understanding functioning of institutions by geographical jurisdiction, focus area and the possible financial contribution. An attention to the institutions that enable inter-sectoral and inter-modal cooperation should be payed. The key roles and responsibilities of the management team for Plan implementation are:

- Coordination with all relevant authorities and utility companies in the City (different departments, AP Sisak Sisak Projects Ltd., Komunalac, etc.) with respect to:
    - Analysis of the current status of their KPIs and the need for updating the PSC;
    - The coordination of public procurement associated with planned projects;
    - The analysis of additional opportunities for involving private partners in the urban mobility of Sisak;
- Communication of roles and coordination with institutional partners such as ministries (Ministry of Maritime Affairs, Transport and Infrastructure, etc.) of Sisak-Moslavina County, especially in the context of:
    - The integration of planning process and implementation of the identified measures and compliance of local, regional and national activities;
    - The adoption of legal forms or formal agreements by establishing responsibility in the implementation of SUMP projects;
    - The definition of procedures for public company participation in certain measures;
    - SUMP project financing and analysis of available EU funds, etc;
- Coordination with all relevant national public enterprises in the transport sector (Craotian Railways, Croatian Highways, Croatian Roads, etc.);

- Communication and understanding transport needs of municipalities in Sisak region;
- Providing information to citizens on the activities related to sustainable urban mobility plan and conduct their education in the field of urban mobility;
- Determining the level and method of stakeholder involvement;
- Harmonization of responsibilities and implementation of the package of measures;
- Management participation and conflict resolutions related to Plan measures among the institutions;
- Collecting, monitoring, data analysis and evaluation indicators related to the implementation of the Plan with result presentation (evaluated Plan implementation)

Such a structured approach to institutional cooperation can be seen as pragmatic cooperation with key stakeholders to assist in achieving the set plan. Without institutional cooperation and their commitment to achieving the objectives, the achievement of the Plan will be partial and therefore realized with less benefit for the entire community.

After identifying the institutions and defining tasks, the task is to design and formalize cooperation with key institutions. When it comes to public enterprises providing public transport services, as in the case of AP Sisak, it is necessary to clearly define the Public Service Contract (PSC), which has to be in accordance with Regulation No. 1370/2007 of the European Parliament and the Council on public rail and road passenger transport services. Besides the amount and manner of financing, the contracting between the City of Sisak and the carrier (AP Sisak) it is necessary to determine the scope and quality of services of local transportation, and other issues that affect the need of co-financing. In other words, the agreement should only cover the provision of the current state of public transport services, but should include elements to encourage continuous improvement in financial efficiency and service quality. At the time of this report, the agreement has been prepared and its finalization and signing is expected shortly.

Also, pursuant to suggestions from this plan, it is necessary to provide a platform for a unique integration of public transport. This means to include other public companies (and their departmental institutions) like Croatian Railways and Croatian Roads, public transport carriers in neighboring local governments and private entities involved in public transport. This could be achieved by unambiguous and credible contract agreements on cooperation. Specifically, the long-term viability of the integrated passenger transport concept at all relations between the involved parties in public transport, including the relations between the government (in terms of connecting traffic of interest), should have a basis in the contracts. In this context, the task for the implementation of the Plan should be to identify the best forms of formalizing cooperation and to develop proposals for the agreement/contract.

4.2 Public transport

Public transport is the backbone of sustainable urban mobility in cities due to the high operating capcity compared to the private car, availability for the majority of citizens, and the rationality in torms of space, energy consumption and the environment. In terms of one passenger transported, public transport requires the least amount of space, has the lowest transport costs and has the minimum impact on the environment among the motorized modes of transport. The mentioned above makes public transport the framework of the sustrainable urban mobility plans.

Despite the unsustainable massive private car usage, private car is the main competitor to public transport because of shorter travel times and higher comfort. The majority of urban environemts in the EU face excessive private car usage, and consequently, the external costs become higher (as well as noise, pollution, traffic congestion, higher number of road accidents), causing the regressive investment policy in terms of economy. Therefore, when developing sustainable urban mobility plans, the cities aim to shift a certain amount of city trips from private car to public transport and non-motorised modes of transport (walking and cycling). In accordance to the fact stated, public tanasport needs to be made more attractive.

The goal of the sustainable urban mobility plan is not to go into detail with every proposed measure (public transport network concept is shown only), so the recommended step is proposed for 2017 in form of a a study called **The analysis and solution proposal for the public transport in the City of Sisak**. The stated study would encompass an in-depth analysis of passenger flows, with the solutions for public transport lines according to the passenger desires and the possibilities of the provider for both 2020 and 2030 horizons.

4.2.1 Visual identity

Visual identity of bus stops is crucial for encouraging public transport to be made attractive for passengers, because of the image, which is represented as the desired public transport characteristic to the passengers, in addition to the information, safety and simplicity. Bus stop with excellent visual indentity is characterized by:

- Easily-detectable stop location from large distances;
- Recognizable road markings for vehicles and passengers;
- Passenger information system (displays, schedules, map of the network, ticket sales information);

- Visible stop name with the list of lines belonging to the stop;
- Markings of the exact vehicle stopping location;
- Sense of security and comfort among passengers;
- Characteristic design;
- Totem with the sign, logo of the provider and the city, and other information.

The project which will contain a study of the visual identity is a condition for reconstructing bus stops and making them more attractive to passengers.

4.2.2 Line route adjustment

The changes in the public transport network are suggested for the end of 2017, such that the line routes would change according to the current transport demand by improving vehicle interval and the new traffic regulation in the city centre. Since the routes for each line would be unchanged during a day, it is suggested (due to simplicity) to rename Line 3(1) into Line 1, Line 4(2) into Line 2, and Line 5 into Line 3. Figure 2 shows the new transport network state.

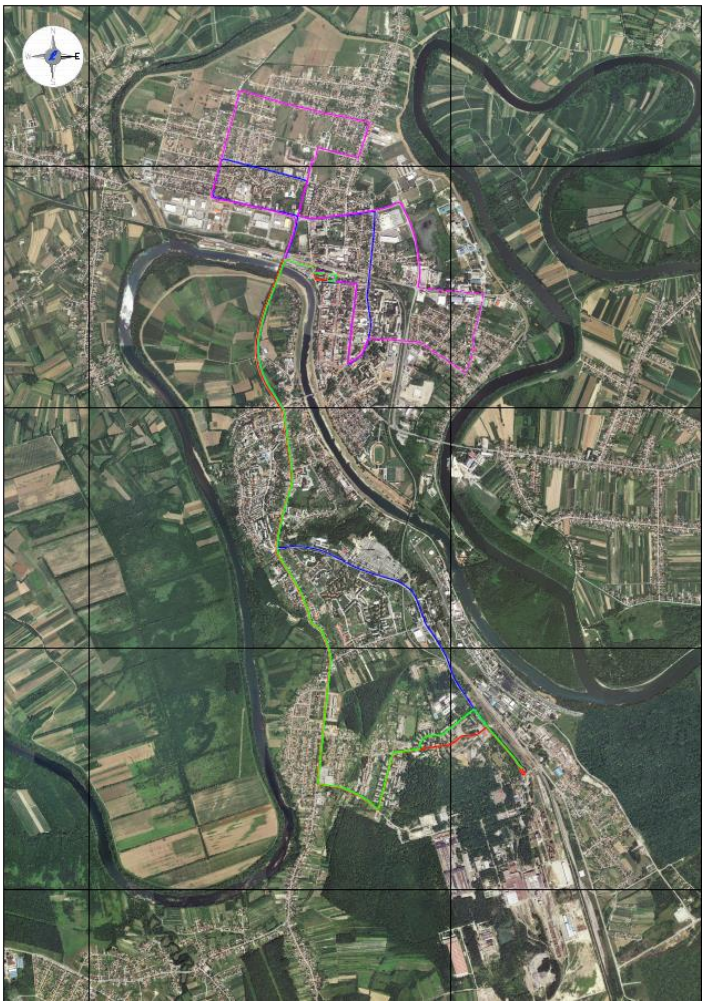


Figure 2. Public transport network – proposed state for the end of 2017

The Line 1 route is shortened in the north-eastern part where, instead of Ivan Fistrović Street, it changes to Nikola Šipuš Street and Franjo Lovrić Street, continuing to the Bus station over the Gimnazija stop, in accordance with the new traffic regulation in the city centre. The route to Željezara becomes 6,0 km long, and 10,6 km long to Kolodvor. The Line 2 route remains unchanged. The line route length to Željezara is 7,5 km, and 12,0 km to Kolodvor.

The Line 3 is suggested to be extended over the Tomićev put neighbourhood by Ivo Rukavina Street, Mijo Gorički Street and Nikola Tesla Street, to Ivan Fistrović Street, accompanied with the analysis of stops, traffic and infrastructure. The line length with this route would be 9,7 km.

The public tranasport system is also suggested to be upgraded with a new line – Kolodvor-Galdovo-Kolodvor, which would connect Galdovo neighbourhood and the city centre. The suggested route passes through Ante Starčević Street, Franjo Lovrić Street, Kralj Tomislav Street, Vatrogasna Street, Galdovačka Street, ending at the intersection with Stevo Berek Street. The line length would be 12 km, both directions. The introduction of the new line is suggested to be a pilot for the first 6 months, and afterwards, a decision on permanent introduction, route adjustment or cancellation would be made.

Figure 3. New public transport line Autobusni kolodvor – Galdovo

The new transport network state contributes to the better management of the existing network; however, in order to make a comprehensive network reorganization, it is necessary to conduct detailed research, and to design new line routes, which would certainly cause additional costs in terms of infrastructrure (new bus stops).

4.2.3 Service improvement by reducing interval between vehicles

In the current state, the vehicle interval on lines 3(1) and 4(2) is 30 minutes. On joint corridors, the average interval is 15 minutes. With these kind of intervals, passengers have to rely on timetables when planning their journeys. Since the sustainable urban mobility plan has a goal to achieve modal shif of city trips from private car to public transport, it is necessary to reduce the interval between vehicles at least to 20 minutes on lines 3(1) and 4(2) by the end of 2017 (i.e. 10 minutes on the joint corridor) in order to make waiting times at stops acceptable for passengers who arrive at stops randomly. This could be done by adding one vehicle on each line. This kind of change would result in inreased operating costs in peak periods; however, the increased quality of service would certainly result in modal shift of city trips from private car to public transport, which results in the increased number of city trips by public transport, and therefore, better public transport utilization and revenue increase for the service provider (AP) as well as the decreased external costs produced by private car usage (pollution, noise, road accidents, etc.).

4.2.4 Converting the bus stop Kolodvor into a terminal

In the current state, Sisak Bus Station serves as a regular bus stop for public transport lines only, and therefore, the existing bus lines have only one terminal on their routes. In this manner, line route length and cycle time are rather big, resulting in problems related to the timetable execution in terms of punctuality and regularity of vehicles arriving at stops. The existing fare collection system in vehicles causes long stop dwelling times, additionaly contributing to punctuality and regularity in terms of timetable execution, which contributes to the declining public transport attractiveness. Therefore, it is suggested to upgrade the Kolodvor stop to a terminal, considering cycle times as partial, which results in reduction of irregularities in timetable execution and increased punctuality in arriving at stops. This could have impact on the public transport attractiveness by encouraging passengers to use public transport. In this manner, the current modal split of city trips would be changed in favour of public transport.

Since Sisak Bus Station already has a bus stop for public transport lines, it is necessary to adjust the location of the Kolodvor stop to act as a public transport terminal, which will enhance the role of Sisak Bus Station as an intermodal passenger transfer point.

4.2.5 Bus stop renovation

After the establishment of stop visual identity, the following is the renovation of the existing bus stops in the City of Sisak. Is is planned to rennovate 50 stops in two stages - in the first stage, 25 stops would

be renovated until the end of 2020, and the other 25 until the end of 2030. The costs to renovate one bus stop consist of a conceptual solution, awning instalation, paving, and concreting. In addition, the rennovation includes installing tactile surfaces for visually impaired persons.

4.2.6 Introducing real-time info displays

A large amount of information in public transport can often cause confusion among passengers. Therefore, the role of the info displays at bus stops is to provide the passengers with additional help in their journeys from origin to destination. The info displays provide passengers with information about vehicle departures and arrivals in real-time. An info display should have a long lifespan with minor necessity for maintenance, and the frame holding it should be sturdy enough to protect it from vandalism or bad weather conditions. Info displays can be operated by cable or wiresselly with a computer software. The types og messages showing on them can be adjusted to fit the needs of the public traansport operator – usually, the minimum information requirement to be displayed are vehicle arrivals in real-time.

Info panels have to be compatible with the other systems installed such as ticketing or automated vehicle location in order to function reliably. The implementation costs consist of construction site adjustment for the info display installation, and a GPRS modem for communicating wiressly with the system.

It is planned to have 25 info panels installed until the end of 2020 (first stage) at the selected locations in the City, and the other 25 in the second stage until the end of 2030.

4.2.7 Tariff system

In order to increase public transport usage, the existing tariff system in public transport should be made as simple and attractive as possible to passengers. The tariff system needs to be simple with a reasonable number of tickets considering user needs. The fare charging scheme should be transparent, easily understanable, and efficient.

Ticket sales points should be widely available, on as many as possible distribution channels, sales points located at the most important city locations, with ticket vending machines for automated ticket sales, via Internet or smartphone app.

It is suggested to make corrections in the existing tariff system by introducing single tickets valid for an hour, enabling passengers to use public transport independently of the direction or the route within the City. In this manner, fare charging for commuting would remain unchanged, because commuters

mostly use public transport in different time periods; in addition, such decision would increase public transport usage among tourists, visitors or citizents that need to make a return trip in short time (shopping, private activities, etc.). This could increase public transport attractiveness additionally.

In order to integrate public trasnport into a joint passenger trasnport system (train, inter-city bus, carsharing schemes, and similar), it is suggested to establish a project considering a joint tariff system which could provide detailed solutions for fare charging.

4.2.8 Introducing e-Ticketing system

It is necessary to completely avoid fare charging systems based on buying tickets in the vehicle. These kind of systems mainly cause longer stop dwelling times, which makes cycle times longer, and reflects on cycle speed by reducing it, and this results in assuring higher transport supply because the dynamics of the existing capacities are diminished. Therefore, if the fare charging system with ticket sales in vehicles is chosen to be kept, it is necessary to reduce the number of sold tickets to minimum such that ticket sales are encouraged through alternative distribution channels (kiosks or the Internet), or the number of monthly sold tickets is increased (by interventions into tariff system). By introducing stop voice announcements in vehicles as an component of the fare charging system, the public transport attractiveness can be additionally increased with significantly improving conditions for visually impaired persons.

4.2.9 Introducing Wi-Fi in city buses

Free wireless internet in bus transportation was used for the first time on buses operating on international regular bus lines as an additional service. The comments of the passengers were very satisfactory, so the service was applied also on intercity lines, and lately on city lines, thus raising public transport attractiveness. The principle is quite simple – a router or multiple ones are needed for transmitting free Wi-Fi signal inside the vehicle (depending on the vehicle configuration). The routers can also be put on public transport stops. Figure 4 shows an example of a bus equipped with Wi-Fi Internet.

The passengers can connect their smartphones with a password provided on a single ticket on the monthly or yearly ticket. The installation of Wi-Fi Internet in city buses is planned to be completed until the end of 2020.

Figure 4. A city bus equipped with Wi-Fi, Copenhagen, Denmark

4.2.10 Public transport promotion

The goal of promoting sustainable traffic is to inform and raise public awareness to use offered sustainable modes of transport and simultaneously, to perform activities for the public. The promotion should be conducted by the department of the city administration in charge of traffic together with the civil associations dealing with traffic. The public transport service promotion is required to be designed with originality and high quality, because such activity can significantly contribute to the number of public transport users. It is possible to promote public trasnport at stops and on vehicles, in order to avoid additional advertising space costs.

Citizen involvement increases the quality of sustainable mobility measures, and thus is increasingly recognized as an important part of every decision-making process. In the scope of stakeholder consult process, citizen involvement is a procedure which enables the people to participate in planning and making solutions for local problems such that the solutions reflect their needs. The citizens are usually (and often) the end-users of transport service. Although the decisions made by the decision-makers finally have impact on the citizen lives, the significance of an active citizen involvement in the decision-making process has been recognized only recently.

4.2.11 Further line route adjustments due to the new bridge

Due to the new bridge on the Kupa River, changes for 2030 are suggested for lines 1 and 2 (Figure 5). Line 3 route would be extended to the Tomićev put neighbourhood The new bridge will enable high-quality road infrastructure, and several possibilities for public transport by adjusting line routes to match the passenger needs.

The modification of the Line 1 route is suggested, so that it becomes a completely circular line with the bus station as the only terminal. Instead of the current continuation of the route along Ante Kovačić Street after the main city cemetery, the buses would turn left in Antun Grahovar Street and by the new bridge to Ivan Fistrović Street, Ferdo Hefele Street, Vlado Janjić Street and finally by Rimska Street to the Bus Station, with 3 buses operating on the line which would then be 9,2 km long.

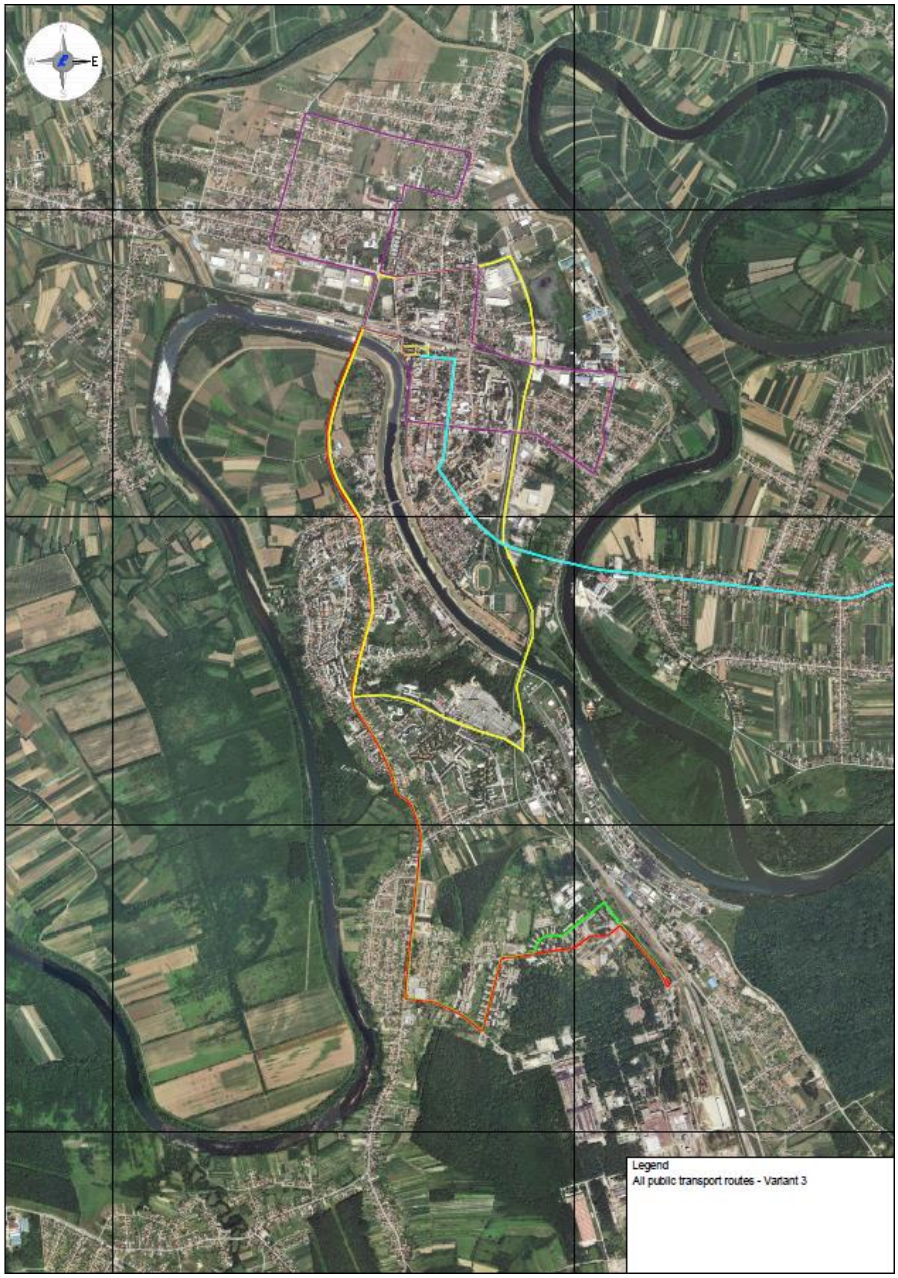


Figure 5. Public transport network – suggestion for the end of 2030

On Line 2, a shortening is recommended in direction towards the bus station so that, instead of continuing towards Zeleni brijeg, the modified route turns right to Rimska Street and to the bus station. Such a route would have a length of 7,4 km to Željezara, and 7,6 km to Kolodvor. Because of this, passenger demand for transport to Zeleni brijeg would be taken over by Line 3.

4.2.12 Replacing the existing bus park with eco-friendly buses

As an additional encouragement for using sustainable transport modes, it is necessary to encourage eco-friendly vehicles in the City of Sisak. Electric and hybrid vehicles are primarily considered as motor vehicles friendly to the environment.

The buses procured in 2016 will have to be replaced by the end of 2030. Iti s necessary to develop a feasibility study for the new envirnment-friendly buses. The stated study will be used to make recommendations whether to choose CNG, hybrid or electric buses. Iti s planned to procure 15 buses for public transport in the city area.

4.2.13 On-demand transport

On-demand transport is an advanced, user-focused public transport mode which is characterized by a flexible route and the application of small, medium or large vehicles transporting from origins to destination according to passenger needs. There are several synonims for on-demand transport: Demand Responsive Transport or Demand-Responsive Transit (DRT), Demand Responsive Service, Dial-a-ride and Flexible Transport Services.

The advantages of on-demand transport are: increased accessibility and social equity, transport cost reduction, increased number of users due to the greater user satisfaction, reduction of need for using priavte car (or a second car in the family) – all this have the effect of filling the gap between the private car and conventional public transport.

The costs for introducing come from: capital investments (vehicles, management and control centre, call centre), operations (salaries for drivers and employees in the call centre, vehicle maintenance, fuel, insurance) and administration (marketing campaigns and office staff).

The users and target groups are the residents in less densely populated areas, and the users who need transportation when transport demand is low (transport services during evenings or nights). The stakeholders during the implementation process are public transport operators, local and regional authorities, service providers for vehicle management and control, taxi companies and research institutions. The possibilities to apply on-demand transport in the City of Sisak are most prominent in suburban areas where population density is rather low. Before the implementation of on-demand transport, additional research must be conducted, in which public-private partnership can be considered as an option.

4.2.14 Bus priority at signalized intersections

In the scope of future public transport development into a mode that can offer a high-quality service fore passengers, it is necessary to enable priority at intersections for it. Although the current priority state in the City of Sisak is satisfactory (operating speed in public transport is 19 km/h), it is necessary to have constant monitoring on potential intersections which could become problematic in the future, and therefore, continuous analysis of priority within corridors and at intersections is recommented by collecting vehicle speed data in the network.

In the case of detecting locations in the network with signficantly lower driving speeds compared to the theoretical values (for example, below 50 % of the theoretical values), public transport priority by the existing vehicle detection technology and technology for exchanging information between vehicles and signalized intersections (for giving priority to pass the intersection) is suggested.

The majority of signalized intersections in the City of Sisak have microprocessing traffic light devices installed, so the installation of modules for giving priority to public transport vehicles would not pose a technical or technological problem when the necessity for introduction appears. The systems for public transport priority have to also be taken into account when introducing automated traffic control systems.

4.2.15 Transport to the Zagreb Airport

Passenger transport to the Zagreb Airport is currently not worthwile because of the insufficient transport demand. The specific departures and routes of the existing intercity lines Zagreb – Velika Gorica – Sisak, already passing by the Airport, can be used for adjustment if the necessity for it arrives before 2020.

One of the possible solutions can be a carpooling service, which should be highly promoted in order to be recognized as a valid service for passengers who travel to the Zagreb Airport. The information about carpooling should be provided on the bus station, the railroad station, and on the web.

If there would be a significant increase in transport demand between the City of Sisak and Zagreb Airport before 2030, besides the buses, the railroad transport has to be provided as a realistic alternative to the inter-city bus transport, considering prices and travel times.

4.2.16 Park-and-ride system

Park-and-ride, as a system, includes parking spaces for vehicles located in the vicinity of public

transport stops or terminals with a joint tariff system. The condition to offer Park-and-ride as a service includes unused space next to public transport stops which could be used for parking spaces. The trips to Zagreb and from Zagreb are the main reason for developing park-and-ride systems in the City of Sisak, for passengers who have to travel to the City of Zagreb for education or work.

It is proposed to build first multi-modal park-and-ride car park in the Kralj Zvonimir Street with the capacity of 500 parking spaces until the end of 2020. A second multi-modal park-and-ride car park is suggested for the area sorrounded by Ivan Fistrović Street, Nikola Tesla Street and the railroad, with 600 spaces capacity until the end of 2030. The necessity of the second park-and-ride car park should be examined based upon the utilization of the first car park in Kralj Zvonimir Street.

Besides the two stated locations described in detail in chapter 4.5, it is suggested to examine the possibility to implement a P+R car park at the Sisak-Caprag train station, as well as for the stations Greda, Blinjski Kut and Stupno, also located in the city administration area. For further analysis and provision of P+R parking spaces, it is necessary to conduct preliminary studies and traffic elaborates in cooperation with the City of Sisak and Croatian Railways.

4.2.17 Multi-modal public transport app

The modal share of public transport is extremely low. The application of modern technologies in transport, specifically, ITS services, can be used to achieve the sustainable mobility concept in the City of Sisak. In this manner, intellgent transport systems offer a whole series of applications and services as a support to deal with problems in transport. One of these services are passenger information about travel possibilities. In contrast to static information systems, the dynamic ones enable a right-time decision while choosing on travel mode and route.

The majority of minor and major European cities has incorporated advanced passenger information systems, and the product of those systems are time savings, less road congestion, less pollution, increased level of service, etc. It is necessary to make public trasport in the City of Sisak closer to passengers, i.e. make it more attractive and accessible. One of the ways for achieving this is to make passenger information transparent. The passengers want real-time and accurate information, pre-travel and travel. Static information, in form of timetables, usually deviating, is not sufficient and attractive anymore. Therefore, it is necessary to develop and offer an application which provides advanced real-time information in public transport. The development and upgrade of the multi-modal journy application is suggested in two stages. In the first stage, an application offering real-time public transport (bus and train) would be developed with the information about pedestrian and cycling routes. In the second stage, the application would be extended by adding carpooling information and

charging, public bicycle information and ticket sale information in public transport.

Multi-modal journey information systems provide users with dynamic, real-time information, which would integrate the available modes of public transport in the City of Sisak. In this manner, the user plans this or her journey according to preferences. In accordance to the stated, the systems provide passengers better information when choosing the transport mode, making them opt for the best choice for their needs, when choosing transport vehicles, routes, prices, travel time, and even the environment-friendly option; and in the end, the option which can get them to a successful completion of their journey (including the on-trip information, such as ticket sales, route changes, and similar).

Figure 6. An example of a multi-modal passenger information system

The basic function of the system is to solve the problem of getting from position A to position B in specific time od departure/arrival with certain conditions. Basically, the system contains information about departures and arrivals for vehicles integrated into public transport system of the City of Sisak – information about buses, trains, incidents, road condition, ticket sales, etc. Fully equipped passsenger information systems provide real-time information, e.g. cuurent vehicle departure time at a stop, information about incidents which could have effect on travelling and travel times, with predictable delays included. A multi-modal passenger information system (Figure 6) encompasses different data the system is based upon. These data can be information about destinations (points of interest) for users, timetables for different transport modes, schematic maps of transport nodes, points of interest next to public transport stops, pricing, fare charging zones, gas emissions, etc. The stated data is necessary to be standardized in compliance with the European directives. Multi-modal IT systems and planng services also enable better modal integration and sustainability of traffic system in terms of providing the best choice of transprt modes along the entire journey.

The introduction of a new information systems and a fare charging scheme is an important step to a high-quality transport system. Joint tickets (which integrate all transport modes) are a functional uprade of the multi-modal information system. Joint ticket is a key feature of an attractive, user-friendly, multi-modal transport system and a condition for high-quality journeys. The usage of a joint ticket during the transport process is a valuable encouragement for passengers whenn choosing to travel by several modes.

4.2.18 Public bicycle scheme

Public bicycle systems provide bicycle rental services for short rides (less than 5 km long) in urban areas. This kind of system consists of a bicycle fleet, automated bicycle park network (where bicycles can be put away and distributed further), and the system maintenance program in addition to the above stated.

The bicycles can be rented on one terminal, and returned on the other. The terminals with automated self-service can hold from five to twenty bicycle located at main destination and transport centres. The service is free of charge or very cheap if the usage time periods are considerably low (less than 30 minutes).

The advantages of public bicycle systems are the following:

- It is cheap, simple, and flexible for private transport in the city;
- It has a positive effect on urban mobility and enriches transport infrastructure;
- It contributes to the public transport sustainability with low prices;
- It encourages multi-modal journeys by making users change their modes;
- It relieves traffic surfaces in the city;
- It has a positive effect on air quality and noise;
- Indirectly, it raises the health standard and decreases health-care costs.

The disadvantages of public bicycle systems are the following:

- High investment costs, and it becomes cost-effective very late, even with simple maintenance;
- The service usage heavily relies on weather conditions;
- Distance between terminals can be very high;
- The number of bicycles can be small;
- There is constant fear of vandalism, damage on bicycles or bicycle theft present.

For the City of Cisak, it is required to procure **four terminals, 40 spaces and 30 bicycles until the end of 2017**. The following locations are suggested for placing the terminals:

- Bus / rail station in the city centre;
- City marketplace (with the new pedestrian zone on Ban Jelačić Square as an alternative);
- Rail Station Sisak-Caprag;
- Viktorovac (by the Faculty of Metallurgy).

4.2.19 Tourist train

The introduction of tourist train in the City of Sisak was conceived as an additional support to public transport until the end of 2030. The tourist train would be an additional offer to tourist services for increasing the attractiveness of the City of Sisak, and with such measure, the Old Town would be constantly connected with the city centre.

Figure 7. An example of a tourist train

Technically, the train would consist of two parts – the first part is the motor vehicle powered by electricity, and the second part are several smaller wagons with maximum capacity of 60 passengers, as shown in Figure 7. The train route would have a length of maximum 5 km. The route would begin in the pedestrian zone and end in the Old City.

The train can be managed as a part of the AP services or as and external service. Besides the tourists, it can be suited for pre-schools and schoolchildren.

4.2.20 Passenger transport by water (water taxi)

Public transport service in cities alongside rivers or seas can be also provided by water. The service can be managed as a public tranasport line or on-demand (as a taxi service). The transport service itself is

provided by boats which cah have different capacities.

The implementation of water transport in the City of Sisak is planned to be a taxi service until 2030 (on-demand). The main goal of establishing these kind of service is the new kind of mobility service (passenger transport by water) in order to increase offer for tourists in the City of Sisak. The boats are planned to be fully-electric, with the boat design that promotes natural beauties of the City. The eastblishment of such a service is planned in form of public-private partnership.

Figure 8. Water taxi in New York City

4.2.21 Public car scheme – Carsharing

The public car service – carsharing, is one of the mobililty management measures in cities, representing an alternative mode of transport, and in this manner, it is an encouragement for reducing private car usage. Carsharing is one type of joint ride options based on using private cars already owned by third persons (legal persons), which enables users to drive around the city and sorrounding areas by shared cars, instead of their own cars, via standardized card at specific terminals with well-defined compensation fee[1]. In order to include a greater number of users (citizens), mostly for daily migrations, it is necessary to ensure availability of every element which act as a component of shared cars and shared rides. This kind of measure can be started by designing a public car project in which private cars could be used mainly by city administration employees or city company employees, and by citizens pre-registered for the service in afternoon periods. The cars should be hybrid or electric. This kind of model is attractive for people who use their private cars only occasionally, as well for those who want to be able to use a car although they do not posses a private one, compensating for the service with

[1] Grgurević, I.: *Determining Carpooling Trip Origin Locations in Urban Areas*, Ph.D. thesis, University of Zagreb, Faculty of Transport and Traffic Sciences, Zagreb, 2013

mothly or yearly subscriptions.

Due to its geographic location, the City of Sisak has a great potential to develop joint ride systems by private cars, i.e. to develop carsharing service. This kind of measure can be encouraged by constructing carsharing terminals which will offer free parking, by developing web and mobile applications to exchange information about means of connecting the users etc. On an individual scale, carsharing can cause reductions in travel time, need for car ownership, savings in travel costs and maintenance, all making private car last longer, driver strees become less at journeys, thus creating greater social interactions among citizens.

The City of Sisak has not had developed joint car systems yet; however, at non-formal level, private car sharing among family members, friends, and working colleagues is common (such a form of joint rides is known as casual carpooling). Joint rides for daily migrations between Sisak and Zagreb can be noticeable, as well as for migrations between the City of Sisak and towns in the gravitational area: Pertinja, Glina, Hrvatska Kostajnica, etc. The private car mode takes 47 % of the total modal split of the City of Sisak, which is the highest percentage. After the private car, the following is walking with over a third (36 %), which is an interesting piece of information, because carsharing users throughout the world point point out walking as one of the two most common modes of transport. According to the length of each transport mode in kilometres as an indicator, the results of the survey conducted showed the following most common distances: 1,1 km for walking, 12,4 km for private car (as drivers), and 8,3 km for private cars (as passengers). With every analysis conducted (modal split, motorisation rate, number of registered vehicles, etc.), conclusions about possibility for application and the system potential can be made.

According to the available relevant traffic data of the City of Sisak, the implementation of carsharing is recommended. The goal of the carsharing project in the City of Sisak is to introuce a new, alternative, and sustainable public transport mode. In order to make the system as attractive as possible to users, its introduction could be planned according to the most recent experiences and trends in the world. Before the introduction of carsharing in form of a standard service (make a reservation, drive, and return to the same location), it is necessary to take into account different service models: Open end, Instant access, One-way, Cashcar and others. The world trends in applying different service models are focused on applying innovative solutions and systems from the domain of intelligent transport systems in order to increase the usage of alternative and sustainable transport modes. The intensity of developing traffic system as a whole and the intensity of developing carsharing demands significant application of information and communication technology and services. By using different specialized web portals and applications for mobile terminal devices, an efiicient usage of the exsting capacities

(private cars, carsharing terminals and carpooling stops, heavily-occupied lanes and similar) can be achieved.

The key elements (activities) for the implementation of the efficient carsharing system are shown in Table 9 and Table 10. The determination of the implementation area is very important due to a high-quality locations of carsharing terminals as well as determining the number of available cars in the carsharing system. Based upon the criteria for determining carsharing terminal locations, implementation area and geografic traffic analysis of the City of Sisak and its surrounding areas, three locations are suggested – first in the city centre in the vicinity of the bus station and the rail station, the second next to the rail station in the Caprag neighbourhood, and the third one next to Zagrebačka Street and Odranska Street.

Table 9. Gantt-chart for carsharing activities in 2017

No	Activity	1	2	3	4	5	6	7	8	9	10	11	12
1	Project documentation, legislation activities			x	x								
2	Determining the implementation area			x									
3	The choice on the number of carsharing terminals			x									
4	Number and characteristics of the offered vehicles (based on research)			x	x	x							
5	Terminal equipment and information support for carsharing system			x	x	x	x	x	x				
6	Tendering and tender conduction					x	x	x	x				
7	Work contracts, equipment procurement, project supervision									x	x		
8	Promotion campaign					x	x	x	x	x	x	x	x
9	Continuous monitoring of each project activity			x	x	x	x	x	x	x	x	x	x

The definition of the number of available private cars for carsharing in the City of Sisak is preceeded by the survey on citizens and data analysis. The data analysis will be used for detemining the number of private cars that should be procured and used for for the service needs. For a more efficient application of carsharing, it is important to spread relevant information about means of using the service, terminal locations, potential users, and to make the information available on the visible service plan (e.g. by a web portal or a mobile phone app). Table 9 shows the activity Gantt-chart for 2017, and Table 10 for 2018.

Table 10. Gantt-chart for carsharing activities in 2018

No	Activity	1	2	3	4	5	6	7	8	9	10	11	12
1	Carsharing terminal – construction, design		x	x									
2	Promotion campaign				x	x	x	x	x	x	x	x	x
3	Continuous monitoring of each project activity	x	x	x	x	x	x	x	x	x	x	x	x

In the majority of the European cities which have had joint ride systems such as carsharing and carpooling implemented, the project carriers are the private companies which operate based on concession (e.g. carsharing operators). The cities encourage this mode of transport to be used more frequently by cost deductions through concessions or by favouring system users in certain traffic condition, such as assigning priority to public transport on a specific street (segregated lanes, priority at intersections), parking privileges, cost subsidies for a percentage of transport costs, etc. Besides the stated, financing the project of implementing carsharing and carpooling can be carried out with the support of the EU funds which encourage the development of the sustainable alternative modes of transport within the project.

Table 11. Carsharing activity carriers

No	Required carsharing activity	Activity carrier
1	Project documentation	Chosen contractor, City of Sisak
2	Determining the implementation area	Administration body, traffic consultants
3	The choice on the number of carsharing terminals	Administration body, traffic consultants
4	Number and characteristics of the offered vehicles (based on research)	Administration body, traffic consultants
5	Terminal equipment and information support for carsharing system	Management body, consultants in civil engineering, trafic engineering, and electrotechnics
6	Tendering and tender conduction	City of Sisak, traffic consultants
7	Work contracts, equipment procurement, project supervision	City od Sisak, consultants in civil engineering, trafic engineering, and electrotechnics, chosen contractor
8	Promotion campaign	City of Sisak
9	Continuous monitoring (for each project activity)	Supervising engineers in civil engineering, trafic engineering, and electrotechnics, City of Sisak
10	Project evaluation	Chosen contractor

The initiator and the carrier of every activity in the carsharing project initiation and its implementation is the City of Sisak, which can delegate tasks and assignments related to the model establishment conduction. The carriers of the specific activities on the project are suggested according to the activities determined (Table 11).

Due to the numerous positive effects on urban transport, carsharing is the one of the most used joint car models in a large number of cities throughout the world.

The carsharing service mostly depends on the demand by the end users – citizens. In order to achieve noticeable results, it is necessary to conduct continuous mnonitoring of every activity within the suggested project, and to have a right-time decicion on introduciong new or adjusted measures (the strengthening of the information and promotion activities due to the decreased public interes tor similar). The continuous monitoring of every project activity would be carried out in a functional

scheme and according to the belonging activities necessary to evaluate the results.

The purpose of monitoring the indicators of the carsharing system is to collect statistical data required to analyse energy savings, gass emissions, evaluation of the results, the influence the system could have on the existing traffic system in the City of Sisak, and the impact the system could have on the environment and quality of life.

4.2.22 Taxi service improvements

Iti s required, by the City and the Environmental Protection and Energy Efficiency Fund, to co-finance the procurement of eco-friendly taxi vehicles for the existing taxi service operators. The significance of the measure comes from the fact that taxi vehicles cross large distances over a year and thus can have a great impact on the environment.

Due to the lawbreaking competition, it is required to cooperate with the road inspection (the Department of Road Traffic) if the problem of illegal taxi operators in the City of Sisak continues.

4.2.23 Integrating public transport and railway systems

The development of railroad infrastructure is the main objective of the EU transport strategy in order to have minimum travel costs for the residents, and the increased mobility based on the sustainable transport principles. The City of Sisak, due to its convenient location in the rail network, should be additionally focused on railroad from both passenger transport and the City as a potential railway centre for intermodal transport and logistics.

The solution for 2020 is the increased railroad transport usage for trips to work between Zagreb and Sisak, such that timetables of the city buses in Sisak would be adjusted to match the ones in railways; in addition, the land next to railroads would be used for buisiness activities related to manufacturing and logistics in the vicinity of railway infrastructure.

4.2.24 Goals and indicators

The basic transport policy guidelines of the City of Sisak in public transport are: increased share of public transport in the modal split, high-quality public transport service, better integration between different public transport modes with other modes of transport and the increased availability for the people with disabilities.

The analysis of the existing public transport state in the City of Sisak revealed areas wich require special

attention. One of the high-priority measures is a project for enhancing visual identity, in which public transport stops should define a characteristic and familiar stop appearance, which includes a totem with the sign, logo of the provider and the City, easily-detectable stop name with the list of lines belonging to the stop and passenger information (displays, timetables, transport network map, city map ticket sales information, etc.). After the visual identity solution, it is required to radically rennovate the stops and to install real-time displays on them.

By adjusting routes of public transport lines and with decreasing intervals between vehicles in peak periods, a significant service improvement in public transport can be achieved. Currently, public trasnport service has a poor score of 2,3, and new vehices have also to be introduced if the service is to be improved.

In order to achieve goals set, and to improve public transport, measures within Table 12 are suggested. The basic goals are: increased public trasnport usage, enhanced public transport offer, better integration of different public trasnport modes and other transport modes, and better accessibility for people with disabilities.

Table 12. Goals and measures in public transport

Transport policy guideline	*Public transport goal*	*Measure for goal achieving*	*Goal planned*
Modal split	Increased public tranasport usage	• Visual identity • Line route adjustment • Service improvement by reducing interval between vehicles • Converting the bus stop Kolodvor into a terminal • Bus stop renovation • Introducing real-time information displays • Tariff system • Introducing e-Ticketing system • Introducing Wi-Fi in city buses • Public transport promotion • Further line adjustments due to the new bridge • Replacing the existing bus park with eco-friendly buses • On-demand transport • Bus priority at signalized intersections • Transport to Zagreb Airport • Park-and-ride system • Multi-modal public transport app • Public bicycle scheme • Tourist train • Public car scheme – Carsharing • TAXI service improvements • Integrating public transport and railway systems	• Increase in the number of public transport users in the City by 10 % until 2020, and an another 10 % until 2030, compared to 2015; • Increase of the public transport share in modal split from the existing 5 % (2016) to 10 % (2030)
Public transport offer	Enhanced public transport offer		• Introduction of the enhanced fare charging system until the end of 2017 • Reduction of the interval between buses on main corridors to 10 minutes until 2017 in peak periods • The introduction of the carsharing until 2017 • The introduction of the public bicycle service until 2017 • Increased quality of service in public transport and railroad transport

Transport policy guideline	Public transport goal	Measure for goal achieving	Goal planned
Integration	Better integration of different public trasnport modes and other transport modes		• Establishment of two Park-and-Ride car parks • Public bicycle locations at public transport terminals/stops and at railroad station • Developing a multi-modal spmartphone app which includes carpooling
Accessibility for people with disabilities	Better accessibility for people with disabilities		• Equipping urban buses with folding ramps for people with disabilities • Adjusting every bus stop to meet the needs of visually impaired persons

There is a series of measures that can also have impact on the passenger number increase and the increase of the quality of service in public transport such as: public tranasport promotion, Wi-Fi Internet in city buses, multi-modal application and bus priority on signalized intersections.

In addition, the bus fleet has to be monitored properly, i.e. roadworthiness coefficients (age and kilometres crossed), and the bus fleet has to be renewed on-time by eco-friendly buses, in order to reduce the average bus fleet age to 10 years in 2030.

Tariff policy measures dealing with the fare charging system are highly important. Tariff policy, as a part of the financing policy for public transport, can represent a significant obstacle for achieving a certian level of service, and therefore, the financing policy has to serve quality of service and measures. The existing ticket prices are suggested to be maintained, with an option to analyse reductions in ticket pricing according to the Public Service Contract.

The ticketing system has to be reliable, enabling simple passenger monitoring. The basic system costs come from: procurement and installation of the equipment, personnel training, and maintenance.

The analysis of the existing state in the City of Sisak reveals that the public bicycle, park-and-ride, and carsharing do not exist, and that carpooling service does not have the right attention (it is sporadically performed on the route Sisak-Zagreb by the initiatives of the people). The implementation of the mentioned measures and the integration with public and railroad transport will result in a synergy of sustainable mobility in the City of Sisak.

Considering high unemployment rates and the decreased number of unemplyeed people by 4 % until 2020, public transport has to offer a high-quality service in order to attract new users on their routes

to work. It is assumed that a high-quality public transport service should attract one quarter of the unemployed people, and that the number of trips in a workday should increase by a significant 10 % until 2020. An additional 10 % increase (until 2030) was planned to be achieved with shifting from private car to public transport.

The implementation of the on-demand transport measure could result in significant cost decrease in suburban transport on routes in places with low population density. The quality of the implementation of each measure will be monitored by measuring indicators shown in Table 13.

Table 13. Public transport indicators

Indicator	Unit	Evaluation	Methodology
Number of passengers in urban bus transport (inner city area) on each line and total	passengers	Yearly	Yearly AP report
Number of passengers in urban bus transport (wider city area) on each line and total	passengers	Yearly	Yearly AP report
Increase of the urban bus share in the modal split	%	Every three years	Survey
Quality of service in public transport	1-5	Yearly	Survey
Average bus cycle speed on each line	km/h	Yearly	GPS logging units
Interval between buses in peak periods on each line	minutes	Yearly	Timetables
Timetable feasibility on each line	%	Yearly	Comparison timetables / reality
Offered capacity utilization on each line	%	Yearly	Number of passengers transported / Number of offered passenger seats
Tariff system: conduction	yes / no	-	-
Tariff system: integration with other transport modes	yes / no	-	-
e-Ticketing: implementation	yes / no	-	-
e-Ticketing: integration with other transport modes	yes / no	-	-
Park-and-ride: number of spaces	spaces	Yearly	Counting
Park-and-ride: price	HRK	Yearly	Yearly report of Komunalac Ltd.
Park-and-ride: occupancy	%	Yearly	Counting
Carsharing: number of trips	number of trips	After the implementation of the pilot project (first stage) / After the second project stage	Data collection by GPS and user registrations by web portal, smartphone app or terminal devices
Carsharing: average distance crossed	km	-	-
Carsharing: average time per ride	minutes	-	-
Carsharing: the number of users	number of users	-	-
Carsharing: modal split	% per mode	Before the pilot implementation / After the pilot implementation / After the second stage	Data collection by questionnaires
Carsharing: average vehicle occupancy	persons per vehicle	Before the pilot implementation / After the pilot implementation / After the second stage	Data collection by passenger counting in vehicles
Carsharing: user satisfaction	descriptive	After the pilot implementation / After	Data collection by questionnaires or interviews

Indicator	Unit	Evaluation	Methodology
		the second stage	
Carsharing: greenhouse gas emissions	g/km	Before the pilot implementation / After the pilot implementation / After the second stage	Automated stations for air quality monitoring and/or analysis based on traffic volume
The number of bikes in the public bicycle system	bicycles	Yearly	Counting
The number of terminals in the public bicycle system	terminals	Yearly	Counting
The number of public bicycle rentals	rentals / month	Monthly	Counting
The number of kilometres crossed by public bicycles	km / month	Monthly	GPS logging devices
Public bicycle price	HRK / renting hour	Yearly	-
Passenger information app in public transport	yes / no	-	-
Multi-modal smartphone app fpr public transport users	yes / no	-	-

4.3 Pedestrian and bicycle traffic

The construction of the pedestrian zone and the further development of bicycle network provides a more efficient, more safe and more attractive infrastructure for the movement and the residence of pedestrians and cyclists. Such transport infrastructure contributes to better connection of attractors, provides space for communication of citizens, expression of opinion, leisure of citizens, revives trade in the city centre and, therefore, humanizes the city centre. The basic purpose of urban roads in the city is the multifunctionality of traffic, or substitute for the lack of living space – not just the omission of motor vehicles. The increased number of motor vehicles in the city centre, which prevents pedestrians and their free interaction, is an additional motive for the construction of the pedestrian zone in the ciy centre. The pedestrian zone will allow the creation of diversity, strength the economy, enable revival of retail trade and gastronomy, and finally, contribute to the revitalization of the City of Sisak and increase the quality of life. The network of cycling roads in the city area will enable fast, comfortable and safe travel from origins to destinations.

Figure 9 presents the development vision of the pedestrian zone in the city centre for 2017, 2020, 2025 and 2030.

In 2017, the pedestrian zone will consist of Silvije Strahimir Kranjčević Street and a section of Stjepan Radić Street from Sivije Strahimir Kranjčević to Ivan Kukuljević Sakcinski Street. The proposed city project is under implementation, and is accepted as a positive solution for the promotion of sustainable mobility. The goal of costructing the pedestrian zone is to strengthen the city centre and to create a city “for people”, not “for motor vehicles”. The pedestrian zone does not allow the movement of motor vehicles, contributing to the reduction of negative influence of motor traffic. Vehicles for residence, delivery, or public utilities will have to obtain permissions in order to get rights to drive in the zone.

After the first phase of construction and implementation of pedestrian zone at Silvije Strahimir Kranjčević Street and at section of Stjepan Radić Street from Sivije Strahimir Kranjčević to Ivan Kukuljević Sakcinski Street (currently in progress), in the second phase planned for 2020, the pedestrian zone will be expanded along the Stjepan Radić Street to the Ljudevit Posavski Square, and to the railway station by 2025. This part of the pedestrian zone would be adapted for longer holdings of citizens, and therefore it has to be equipped with benches, trees, flower beds, bicycle racks, trash cans and a high-quality street lighting. The textured surfaces have to be used in order to divide the space reserved for people in movement from the space that will be used for people while resting.

The longitudinal streets – Ivan Kukuljević Sakcinski Street, Franjo Lovrić Street and Ljudevit Posavski Square will retain the existing orientation. At the intersection with the Antun and Stajepan Radić Street, or, in contact with the proposed new pedestrian zone, the traffic regulation at these streets will allow the possibility of a semi-circular rotation. In the zone including the intersection of Antun and Stjepan Radić Street (pedestrian zone) and Frankopanska Street, a raised surface is proposed in order to reduce the motor vehicle speed in Frankopanska Street. This would ensure a safe corridor for walking and cycling between the bus station, train station, and the pedestrian zone.

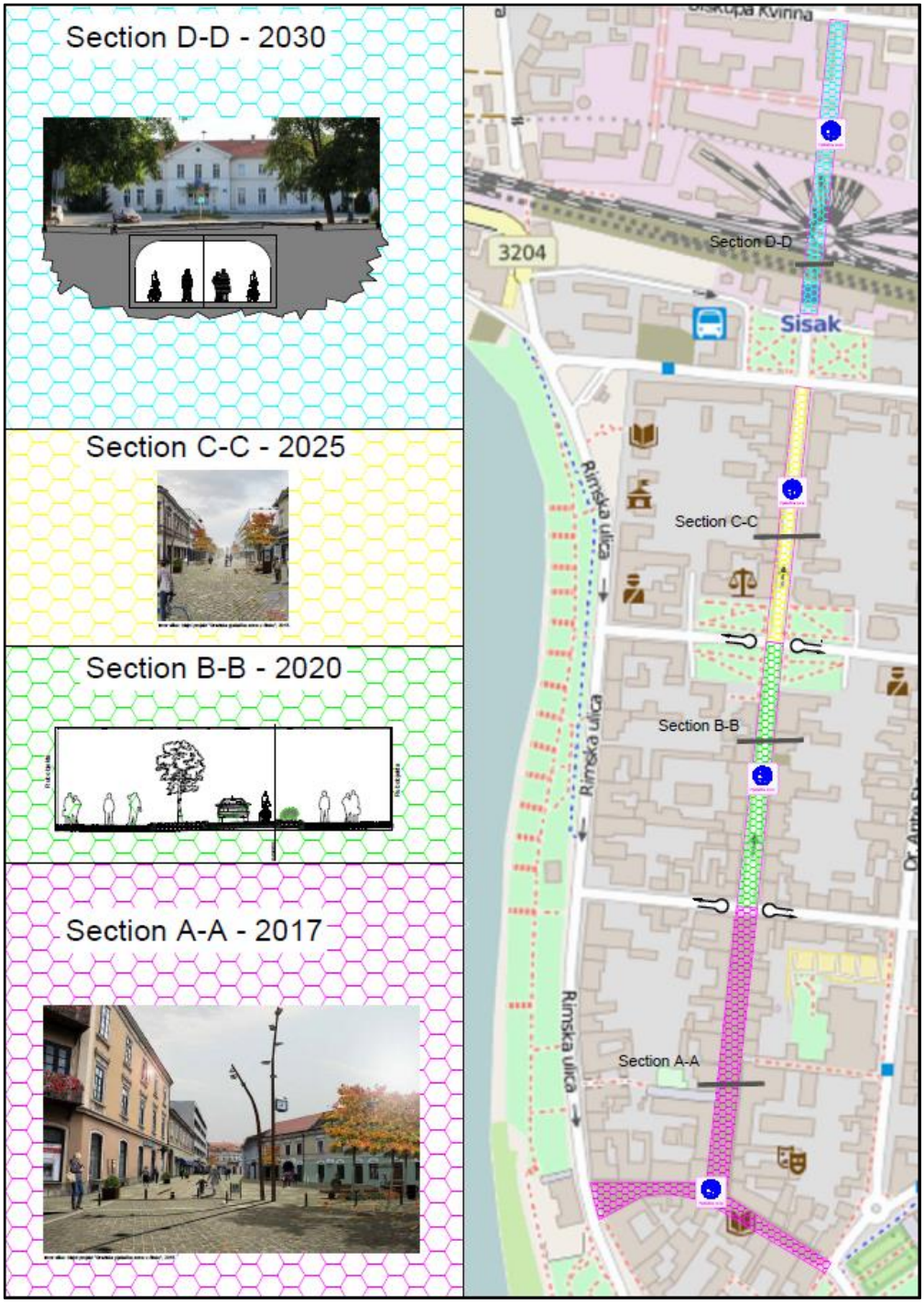


Figure 9. The development concept of the pedestrian zone in the city centre

By the end of 2030, the continuation of the pedestrian zone is planned bellow the station, as proposed by the Urban Development Plan[2], and an underpass is planned under the Antun Cuvaj Street. In the case of too complex construction process, a possibility is to construct pedestrian passageway over the railway station. The construction of the future interpretation centre Siscia as a part of the Segestica factory, serving for future "neighbourhood of museums" (representing archaeological findings and industrial heritage, is planned. The new corridor will also contribute to the revitalisation and reurbanization of the northern city parts. It is important to emphasize that the construction of the pedestrian underpass or bridge can be excuted significantly earlier, if the project is adequately incorporated within the mentioned Siscia-Segestica project, with the support of the EU funds and the corresponding ministry of culture. In this manner, the City would get a high-quality pedestrian zone which would serve as a central part for public space gatherings in the city centre.

To conclude, the implementation of such zone in the city centre would encourage non-motorized modes of transport, discouraging private car usage, which would be a significant contribution to sustainable transport and sustainable development of the City in general.

4.3.1 The development of predestrian surfaces in the city centre for the purpose of protecting cultural and historical heritage and increasing quality of life

The proposition for extending pedestrian zone until the end of 2020, together with enforcing the development of bicycle network and the closure of the Old bridge, will result in encouraging walking and cycling, and also in discouraging motor vehicle usage in the City. This will reduce negative impacts of motor traffic (noise, emissions, acid rainfall, etc.), which will contribute to the preservation of cultural and historical heritage, increase the offer for tourists, and return the positive image of the City as a desirable destination for recreation and vacation. Further decrease in the number of motor vehicles and increase in the percentage of non-motorised traffic will additionally contribute to the quality of life for citizens, which will result in peole coming back (especially young ones) into the City of Sisak.

4.3.2 The development of independent walking routes (paths, sidewalks) and cycling network in accordance with examples of good practice

The centre of the City of Sisak, where the city's main content is concentrated, covers an area of about 0,3 km^2, and is the ideal area for a 5-minute walking which is the most natural form of movement. The area located within a radius of 600 meters from the city centre is also ideal for the development of the

[2] Urbanistički plan uređenja centra grada Siska, Službeni glasnik 12/04.

pedestrian (10 minutes) and bicycle traffic (up to 3-4 minutes), which means that the daily needs of the citizens can be satisfied without using private cars.

The City of Sisak has a well-connected pedestrian infrastructure, which has local weaknesses due to the failure of planning and lack of infrastructure maintenance. Local weaknesses are caused by spatial concessions for motor traffic due to an increase in the motorization rate in the last two decades. The potential for improving pedestrian traffic is the removal of "point" type barrier, the implementation of measures for traffic calming, street greening, implementation of pedestrian crossings on main roads if missing and the construction of the pedestrian zone in the city centre.

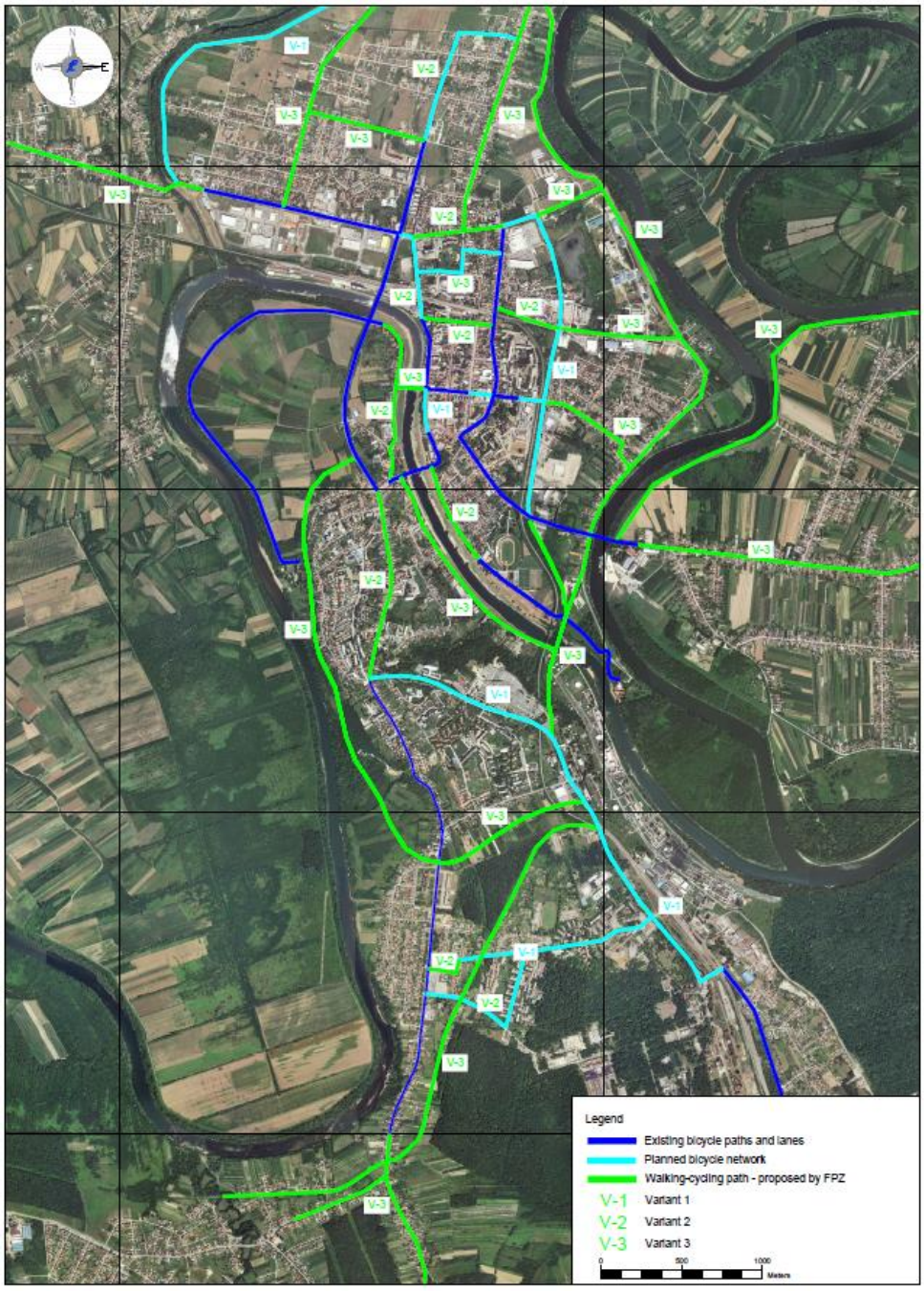


Figure 10. Proposal for developing bicycle paths/lanes in the City of Sisak (2017, 2020, and 2030)

Outside the city centre, where needed, it is necessary to provide walking paths and sideways (especially around schools and kindergartens), such that is necessary to build a one-sided or two-sided paths, and to provide additional traffic lights at pedestrian crossings. It is important for streets that all legal measures should be taken in order to remove the parked cars from sideways, so they could be used for safe and smooth pedestrian movement.

In order to further strengthen the bicycle traffic, it is necessary, in the immediate and wider area of the centre, to design and implement an integrated (comprehensive) network of bicycle paths and routes that will connect major attractors, and which will provide a safer and a more direct way to get from one place to another. The existing cycling infrastructure needs horizontal and vertical traffic signs and lighting, in order to increase the level of subjective safety among cyclists. The current bicycle network in the City of Sisak is fragmented, unsafe at particular sections, and does not connect main traffic attractors. Despite the mentioned, in the past several years, a significant progress has been noticed in the bicycle infrastructure regarding construction; therefore, it can be expected that, in the following period, some shortages would be eliminated, resulting in positive and service-friendly environment for cyclists.

Until 2017 (Figure 10), the projects of the construction of cycling paths is proposed: in Rimska Street (the construction of the southern bicycle connection in Rimska Street is in progress), Ivan Fistrović Street in D36 corridor (currently in construction), Ante Kovačić Street in the corridor from the county road Ž3205, and on the Odra River embankment. Further development of the planned bicycle network of Sisak, which has to be complemented with new suggestions, is therefore proposed. In addition to bicycle paths and lanes, it is necessary to install additional equipment, such as bike racks and other equipment (compressors, repair shops, resting points, buffets) on the main points of interest in the City.

As a basic proposal for upgrading bicycle infrastructure by 2020, a construction of bicycle paths/lanes in the city centre is proposed, especially at the corridor of Frankopanska Street, Kralj Zvonimir Street and Obrtnička street. It is necessary to build a corridor in Mihanovićeva street to the city stadium which could be used for tourist and recreation purposes by linking existing cultural attractions. Besides the lanes in the city centre, it is necessary to build (but also, to renew the existing in accordance with the new standards of bicycle path design) continuous interrupted paths at D36 (bypass), Josip Juraj Strossmayer Street (D37), and in Caprag neighbourhood. As an important measure to encourage bicycle traffic, the existing regulation of bicycle traffic in the city centre is approved, such that the pedestrian zone will continue to be used by cyclists in 2020 and 2025 construction phases.

By 2030, the proposal is to build cycling infrastructure throughout the administrative part of the City

of Sisak by the corridor of state roads D36 and D37 (towards Petrinja, Sela, Galdovo), Ž3120 and at embankments of Kupa and Sava rivers. Also, the proposal includes construction of bicycle paths/tracks in parallel of the capital new roads in the city, such as west bypass from Gromovi Bridge (DC37), trough Zibel and further on route from Školska Street to the new bridge over the Kupa River and Ivan Fistrović street (D36). This would create significant conditions for appropriately connecting neighbourhoods at the left and right enbankments of the Kupa River and the city centre, and, in addition, for completing a high-quality pedestrian and bicycle network in the City and sorroundings. This would also create better image for tourists by the related content in the inner city parts, and raise the importance of the Kupa River coastline, because the bicycle-pedestrian path would connect Zibel public beach, city centre and the Old Town. Accordingly, it is necessary to examine the possibility of placing car parks on the right bank of the Kupa River, similar to the park reconstruction project in Lađarska Street. In this manner, the visitors of the centre could park their cars at the right coastline, and continue on foot or by public bicycle over the bridge towards the city centre.

It is necessary to analyse the possibility of constructing tourist and recreational cycling route on the crown of the abandoned railway line Caprag – Petrinja and towards to the other neighbourhoods. This would contribute to the development of cycling tourism in the peripheral areas and other settlements of the Banovina region.

4.3.3 The definition of terminals intermodal transport (as Bike-and-Ride)

The bicycle is primarily a mode of transport for short trips. It can play an important role in the longer journeys, as an additional mode of transport. The integration of the bicycle and/or bicycle-sharing schemes in the public transport system is an important way of encouraging intermadality in public transport.

Intermodal connections of bicycles and public transport includes three levels:

- Bicycle parking near public transport stops;
- Bicycle transport by public transport;
- Rental system.

In the case of Sisak, proposed position of the first bicycle park is in the city centre (bus and train station) and the other one at the railway station in Caprag. The parking infrastructure should include standard equipment (racks and holders), preferably covered or otherwise protected from all weather conditions at all stations. Bicycle parks should be designed to enable smooth transfer from the bicycle to the train and vice versa, should be located on accessible route, within a short walking distance from the

platform, with long working hours and with affordable price. Services may include all of the services such as bicycle rentals and various accessories, showers, and cycling information. It is necessary to arrange the transport of bicycles on trains with Croatian Railways and AP buses in accordance with transport demand.

Figure 11. Bicycles in public transport vehicles: in train (left), in front of bus (centre), folded in train (right)

One option in the intermodal chain is to allow cyclists to take bicycles with them to public transport vehicles (Figure 11). The advantage of this practice is that it allows cyclists to use their own bicycle from "door to door". The application of this solution is limited, since only a small number of cyclists will be able to use this service, due to the fact that bicycles take up space and can lead to overcrowding. Also, loading and loading of the vehicle can take a lot of time. Bicycles in the vehicle can pose a security problem if not attached firmly.

4.3.4 Measures for reconstruction of pedestrian and bicycle network

The length of the cycling network in Sisak at the end of June 2016 was 16 km. According to the proposed plan, the total length of bicycle paths compared to the current would be doubled by 2020, and increased almost four times to 60 km by the end of 2030. (Table 14). That will form a completed bicycle network that could also, besides for daily commuting, be used for recreational purposes.

Table 14. Measures related to the bicycle network

measure	period (length in km)
Existing paths and lanes, July 2016.	(16 km)
New cycling infrastructure	2017 (10 km)
New cycling infrastructure	2020 (6 km)
New cycling infrastructure	2030 (28 km)
Construction of a pedestrian zone (work in progress)	2017
New pedestrian zone in Stjapan and Antun Radić Street connecting the rail station	2020
Pedestrian underpass beneath the railway station	2030

The costs of constructing pedestrian and bicycle infrastructure (Section 5) include costs for the construction and expansion of the pedestrian zone in the city centre, and pedestrian underpass or

overpass over the railway station.

4.3.5 Indicators for non-motorized traffic

In order to increase the share of pedestrian and bicycle traffic in the modal distribution the City of Sisak, solutions and measures have been proposed as parts of the Plan in periods until 2017, 2020, and 2030, with the purpose of improvement of health, reduction of medical treatment costs, increased productivity, increased road safety, reduction of the negative environmental impacts (noise, greenhouse gases, etc.), which will ultimately lead to the improved quality of life for all citizens of Sisak.

The aim of the sustainable urban mobility plan by 2030 for the City of Sisak is the reduction of private car share from 47% to 30%, and increase of walking share to 39% and bicycle share to 13%.

In order to meet objectives set, it is necessary, during the forthcoming period, to continuously monitor indicators of pedestrian and bicycle traffic, which are shown in Table 15.

Table 15. Indicators for non-motorized traffic

Indicator	Measuring unit	Evaluation	Methodology
Bicycle network length	km	Yearly	Annual report
Pedestrian surface area	m^2	Yearly	Annual report
Number, length and purpose of travel by cycling	number of trips, km	Yearly	Counting, survey
Number, length and purpose of travel by walking	number of trips, km	Yearly	Counting, survey
Number of car parks at the points of interest in the City	number	Yearly	Annual report
Number of public bicycle terminals	number of terminals, number of bicycles	Yearly	Annual report
Number of road accidents with cyclists	number of accidents	Yearly	Annual report
Number of road accidents with pedestrians	number of accidents	Yearly	Annual report

4.4 Road infrastructure

The road network of the City of Sisak is analyzed by the macro-simulation tool PTV Visum. PTV Visum is the world's leading simulation tool for the analysis of the existing and forecasted traffic flows on the macroscopic scale (city, county, state). A traffic model of the current situation was developed by the household and cordon survey at the entrances/exits of the City. The traffic model was developed for the morning and afternoon peak hours in order to highlight problematic areas of transport network with a high saturation (Figure 12). The pictures show the model results for the afternoon peak hour due to the more intense traffic flows. Significant traffic volume by motor vehicles is noticeable in the narrow city centre, which is not in accordance with the sustainable urban mobility.

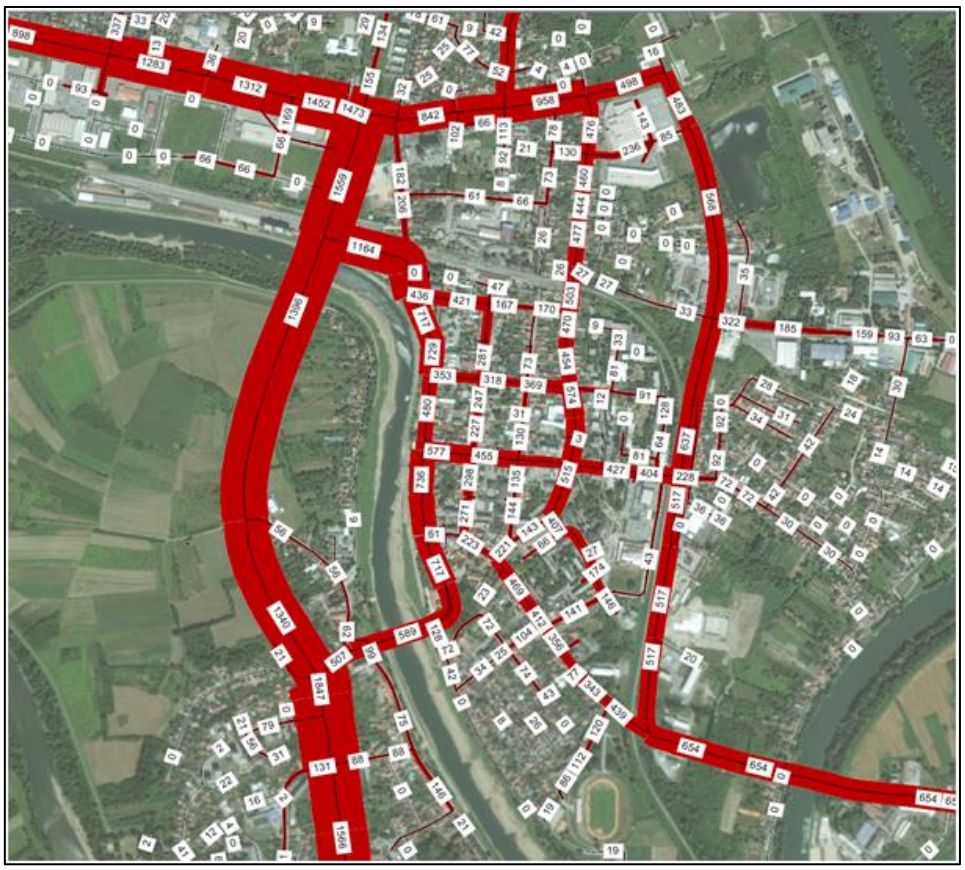


Figure 12. Traffic volume in 2015 – afternoon peak period, both directions

Despite the continued depopulation trends, and due to the expected mild recovery of the economy (real GDP growth), it is expected that Sisak will have a slight upward trend in the number of private cars. Although 2030 predicts changes in the modal split, it is expected that the private car share will decline from the current 47 % to 30 %, and the volume is also expected to increase on the city road network by 8 % (Figure 13), which is a result of an increased GDP (number of jobs) and the consequent growth of the motorisation rate.

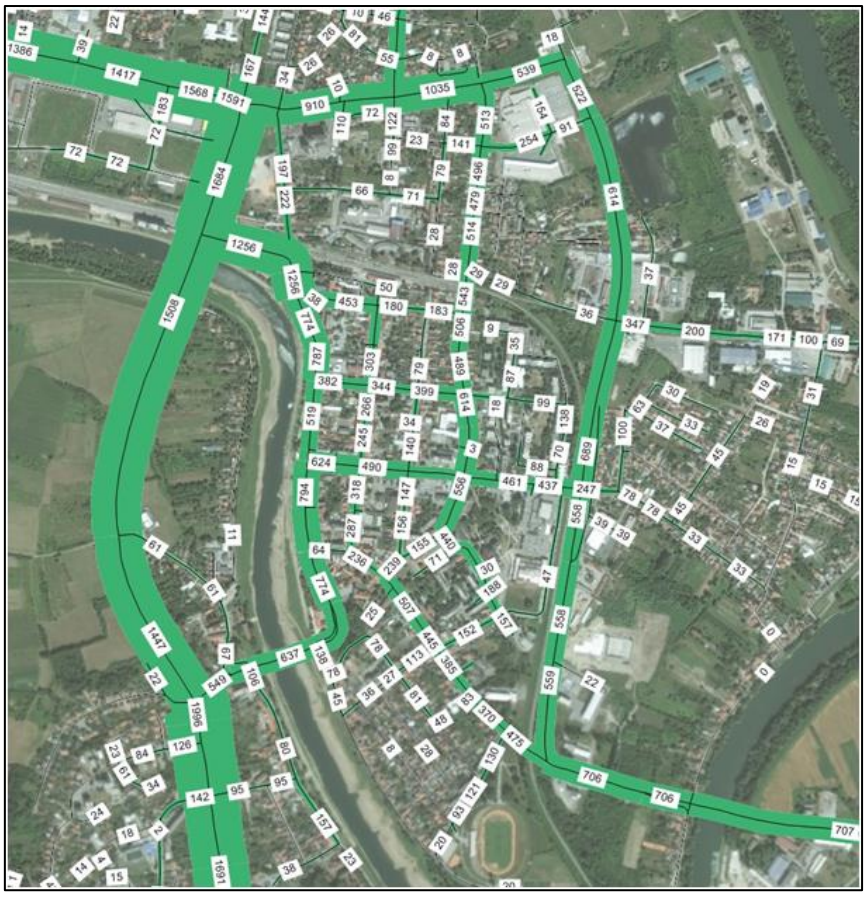


Figure 13. Traffic volume prediction for 2030 – "Do nothing"

In order to enhance traffic flows and to give priority to the sustainable forms of transport, the proposals in the field of road transport and road network are based on:

- Changing the regulation and organization of traffic flows in the city centre;
- Optimization of traffic lights at intersections (ATM, TMS or ITS);
- Construction of the new bridge over the Kupa River in the city centre (in parallel to the railroad bridge);
- Reconstruction of critical intersections and road sections (bottlenecks or hot spots);
- Construction of other bridges;
- Construction of underpasses;
- Construction of roads with high importance.

Regulation and organization of traffic flows in the city centre includes the determination of the streets in which road traffic is allowed, street direction determination (one-way or two-way), and the definition of the directions in one-way streets.

The streets where traffic is forbidden and streets intended primarily for pedestrian traffic are defined in the section describing the pedestrian traffic, so this chapter includes the definition of street direction

and determination of directions of streets in the contact area of the pedestrian zone in the city centre.

From the point of encouraging sustainable mobility in the segment of road traffic, one-way streets are very positive solution for the city centre. The one-way street system in the city centre provides better traffic flows, opening new opportunities for pedestrians, cycling surfaces and green spaces, because if the majority of streets are converted from two-way to one-way, one lane can then be used for the movement of one-way traffic flow, and the other for another purpose. In this way, the level of traffic safety for motor vehicles, pedestrians and cyclists is significantly increased. One-way streets are much easier for handling traffic at intersections. At the intersections of one-way streets, there are only two incoming directions, so there are a lot less conflict areas, and it is necessary to regulate only two incoming vehicle flows. A special advantage lies in left turns left because there is no oncoming traffic flow in the opposite direction which is conflicting with the traffic flow turning left. This significantly increases the capacity, level of service, and the road safety at the intersections. In intersections of one-way streets, if the traffic flow turning left is high, then the separate lane for left turns is not necessary because the vehicles turning left may leave the intersection without interference of the oncoming traffic flow (traffic flow which turns left can be observed the same as the traffic flow which turns to the right, and it is disturbed only by the pedestrians). With establishing optimal regulation and traffic flow organization, it is certainly important to mention the positive environmental effects, because **the increased network flow eliminates a substantial number of start-stop operations which have extremely adverse effect on emissions.**

Light signalling system at intersections (traffic lights) is one of the most important and most widely used system of ITS in cities. The system of traffic lights is closely linked to sustainable mobility. By optimizing traffic light operations at intersections, corridors and traffic zones, then waiting time, intersection passing time, road safety, and electricity consumption for traffic light operation can be and will be improved. The reduction of waiting time and intersection passing time make a significant contribution to the reduced fuel consumption and exhaust as positive effects on the environment and give a boost to the sustainable mobility. By improving road safety, social costs and the cost for the individuals due to the accidents are reduced, thus increasing the standard of living among citizens. The funds saved due to reduction of the number of road accidents can be invested in the development of sustainable transport or other useful purposes. The reduction of energy consumption for traffic light operation also has a positive effect on the environment and this reduces the financial pressure.

The construction of the new bridge has a direct impact on improving transport system because it shortens the length of the journey, fuel consumption, and gas emissions. The above has a significant positive impact on sustainable mobility. **The new bridge over the Kupa river parallel to the railway**

bridge is one of the most important urban projects and it will solve one of the city's major traffic problems, that is the lack of transport capacity between the left and right bank of the Kupa River. The construction of this bridge will significantly reduce congestion in the entire City.

The reconstruction of critical traffic points also has a positive impact on sustainable mobility. Certain points in traffic can be critical in terms of capacity and safety. If they are critical in terms of capacity, they may create unacceptable traffic congestion. The remediation of these points increases their capacity, which reduces congestion, fuel consumption, gas emissions and noise. If points are critical in terms of safety, they have a large number of road accidents and they create huge costs to the society and the individuals. If these points are remediated, reduced road accident costs can be invested in improving transport system in other places.

The construction of other bridges and underpasses that are not as important as the main bridge over the Kupa river in the city centre, also has a positive impact on the sustainability of the transport system because it reduces trip length, energy consumption, and gas emissions.

The construction of new roads (although not a fundamental measure to encourage sustainable mobility), can also give a boost to the sustainable mobility as new roads reduce the length of travel, increase road safety and in case of detours, they relocate traffic from the city centre to the periphery.

4.4.1 Changing the regulation and organization of traffic flows in the city centre

In the present condition, traffic flow regulation on the network of one-way and two-way streets is well organized. Rimska Street and Stjepan Radić Street are a pair of one-way street transversal to the correct orientation. Such pair of one-way streets provides relatively good capacity and level of service. Based on the analysis of traffic volume and level of service at the majority of intersections in the city centre, it can be concluded that their level of service are satisfactory (A or B). Only at one analyzed intersection (Stjepan Radić Street – Ivan Kukuljević Sakcinskin Street), level of service E, due to the high concentration of pedestrians, was determined. However, in measures to improve pedestrian traffic, Stjepan Radić Street was proposed as a pedestrian zone, so it can't be in the system of one-way streets for motor traffic. For this reason, it is necessary to propose changes in the regulation and organization of traffic flows in the contact area of the pedestrian zone. Although the main purpose of developing sustainable transport in cities encourages sustainable transport modes, in which private cars are out of scope, the private car presence on the streets cannot be completely avoided. Research on the modal split in the city centre has shown that 47 % of trips are made by car, and forecasts predict that in 2030, still 30% of the journeys will be done by car. Measures to encourage sustainable transport modes will ensure the reduction of this share, but private car will have a significant proportion of city trips,

because, for objective reasons, other modes of transport cannot or do will not be used. For this reason, it is necessary to arrange adequate road infrastructure for motor traffic.

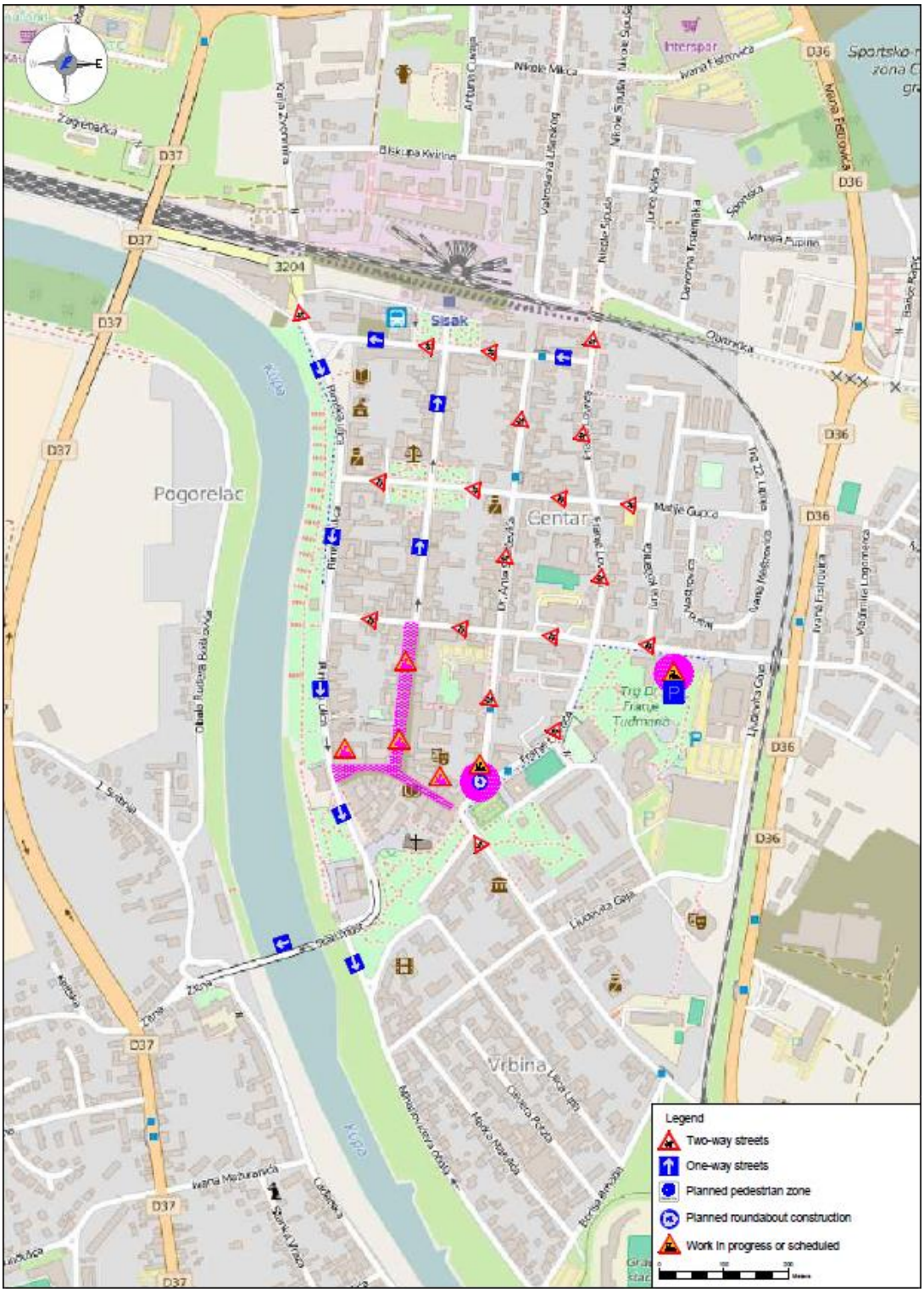


Figure 14. Traffic flow regulation – proposal for 2017

The changes in the traffic flow regulation in the city centre are proposed in two phases. In the first phase, the construction of the pedestrian zone in the Silvije Strahimir Kranjčević Street and Stjepan Radić Street from Silvije Strahimir Kranjčević Street to Ivan Kukuljević Sakcinski Street are planned, and

traffic flow regulation will be adjusted to the new pedestrian zone. The stated solution has been implemented at the time of this Plan. The proposal for traffic flow regulaiton in the first phase is shown in Figure 14.

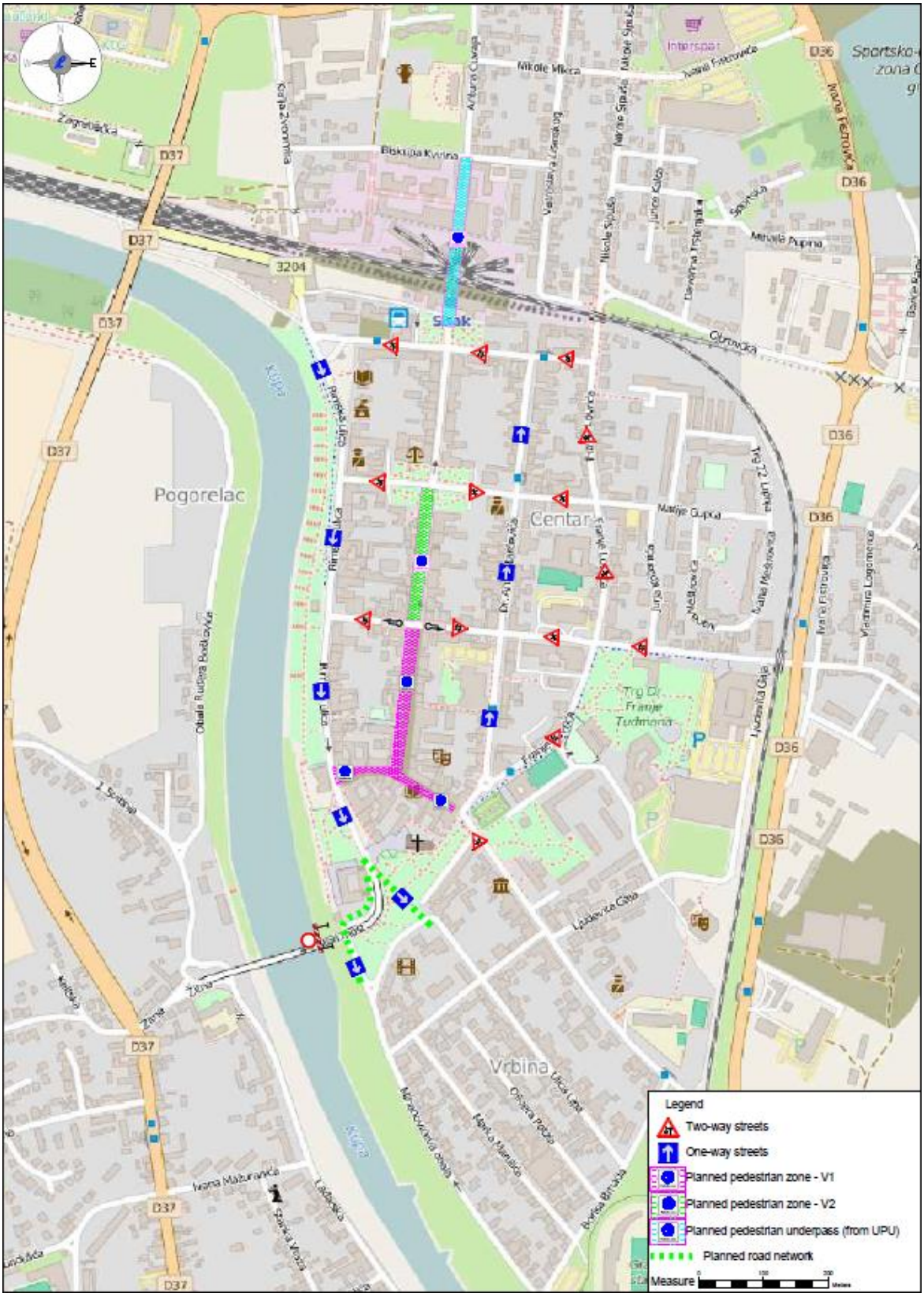


Figure 15. Traffic flow regulation – proposal for 2020

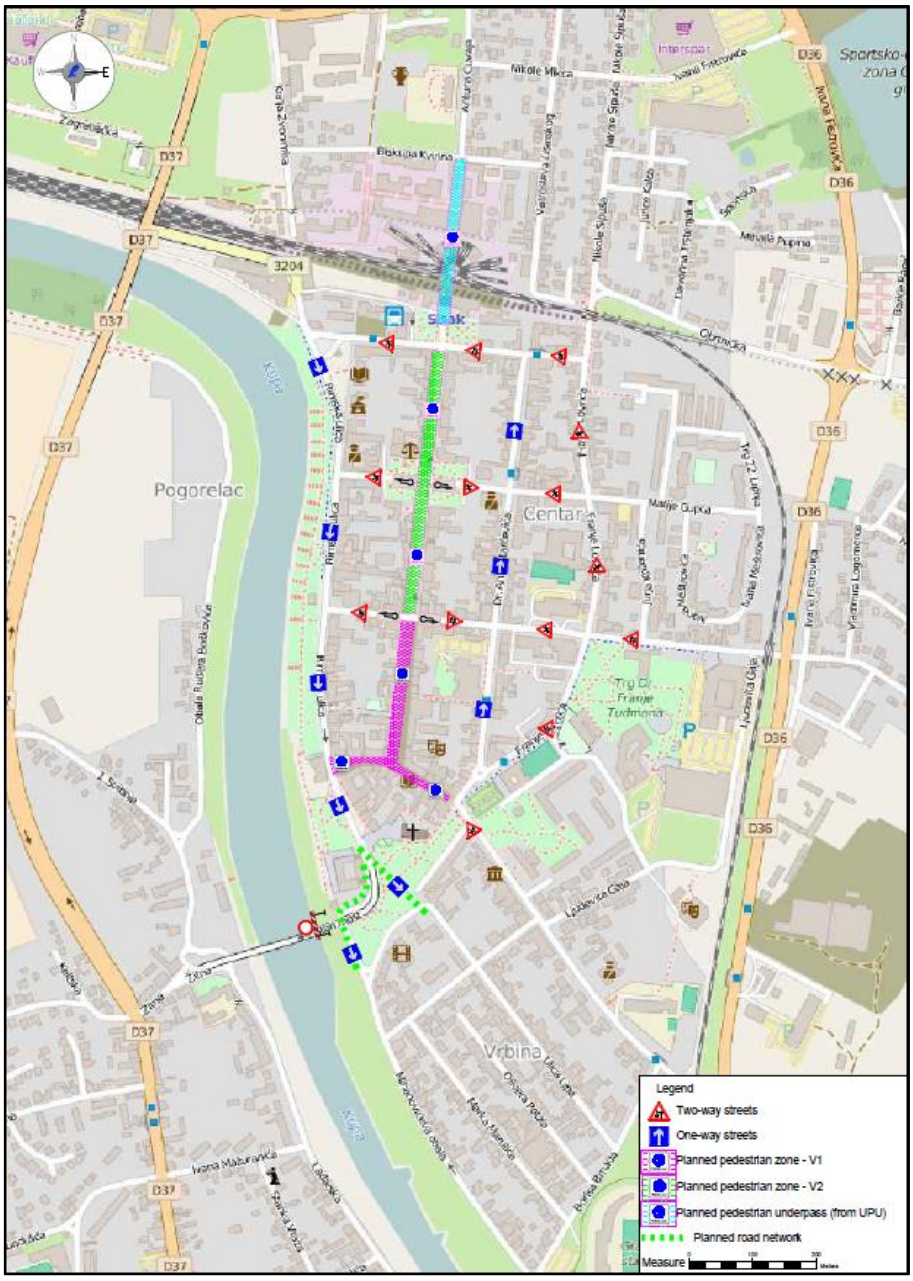


Figure 16. Traffic flow regulation – proposal for 2025

In the second phase ending by 2025 (Figure 16), a significant change in terms of the implementation of pairs of longitudinal and transversal street is suggested. It is proposed to implement one-way street pairs:

- Rimska street - direction from north to south (existing orientation remains);
- Street Ante Starčević Street - one-way from south to north (change from two-way);
- Longitudinal streets (Ivan Kukuljević Sakcinski Street, Matija Gubec Street and Ljudevit Posavski Square) remain two-way, but with an important note for the intersection with the Antun and Stjepan Radić Street, which will become dead-end at the pedestrian zone, with the possibility of semi-circular rotation. It is proposed to allow the passage of a pedestrian zone

only by heavily-occupied vehicles, delivery, public transport, emergency services, and other vehicles with the permission of the City only;

- Fran Krsto Frankopan Street - one-way from Franjo Lovrić Street to Ante Starčević Street and two-way from Ante Starčević Street to Rimska Street. Due to traffic safety, it is proposed to arrange the intersection of Stjepan Radić Street (future pedestrian zone) and Fran Krsto Frankopan Street such that the whole surface is elevated, in order for motor vehicle drivers to have a clear signal that they are approaching the pedestrian zone and that they have to reduce speed;
- Antun and Stjepan Radić Street becomes a pedestrian zone in its entire corridor to the train station (changes from one-way) - in a later stage, this street would be gradually transformed into a pedestrian zone.

In the second phase, the closure of the Old bridge for motor traffic is proposed. This will allow greater comfort and safety of pedestrians and cyclists when crossing the bridge, and on the other hand, this will protect from further deterioration caused by the intense motor traffic at one of the main symbols of the City of Sisak. On the other side, the closure will contribute to the preservation of cultural heritage of the City, and it will allow further strengthening of the tourist offer with the City as a desirable destination for pedestrian and bicycle traffic.

Following Rimska street to the Josip Jelačić Square, it is necessary to provide connections to Vrbina neighbourhood and through in order to provide access to Kralj Tomislav Street towards the future new bridge (**the new bridge is the capital city project, necessary for the sustainability of the transport system, and it will be addressed in a separate chapter below**). This connection can be realized by an underground tunnel below the park (less likely option because of the archeology) or by a road under the Old bridge, lowering the vertical alignment of the existing road to allow bus passage under the bridge. A possible solution can be suggested in form of a street at the western edge of the Vladimir Nazor Promenade. After the construction of this connection and the construction of a new bridge, it is possible to close the Old bridge for motor traffic and to convert it into a pedestrian and bicycle bridge that will eliminate motor traffic, and to develop sustainable mobility in the city centre.

In the case of objective restrictions in the implementation when connecting Vrbina neighbourhood, an alternative solution for public transport vehicles and delivery vehicles (which cannot pass under the Old bridge in the current state) can be traffic flow reorganization in Ante Starčević Street, Franjo Lovrić Street and Ivan Kukuljević Sakcinski Street near the Highs School and Franjo Tuđman Square. Delivery vehicles and buses can be guided from Rimska Street by Ivan Kukuljević Sakcinski Street to Ante Starčević Street. In this variant, Ante Starčević Street would be two-way for public transport, i.e. public

transport vehicles would be allowed to pass through Ivan Kukuljević Sakcinski Street to Franjo Lovrić Street. Delivery vehicles could continue on Ivan Kukuljević Sakcinski Street to Franjo Lovrić Street, and then continue in any direction.

The closure of Stjepan and Antun Radić Street and the Old Bridge will result in increased traffic volume on the Vlado Janjić Street, the streets at the Vrbina neighbourhood, at the beginning of Rimska Street, Frankopanska Street and Franjo Lovrić Street, but below the degree of saturation. The implementation of the proposed changes in traffic flow management in the city centre and new traffic flow management at intersections will eliminate waiting queues and congestion (Figure 17).

Figure 17. Traffic volume prediction for second stage in 2020 – afternoon peak period

4.4.2 Optimization of traffic lights at intersections (ATM, TMS or ITS)

On the roads of the City of Sisak, there are currently 15 traffic light intersections, where as many as 12 are located at the intersections of roads managed by the City of Sisak and state roads D36 and D37. The City of Sisak manages the intersections completely independently with only three signal heads. It should be noted that the busiest roads in the City of Sisak are D36 and D37 (Petrinjska Street, Josip

Juraj Strossmayer Street, Vlado Janjić Street, Zagrebačka Street, Ferdo Hefele Street and Ivan Fistrović Street), where a part of the traffic flows transits (intercity), so intersections with traffic lights on these roads have an especially high volume. The analysis of traffic flows and service levels at the selected intersections with traffic lights have shown a very low level of service at intersections:

- Josip Juraj Strossmayer Street (D37) - Hrvatski domobrani Street - Narodni heroji Street („Zibel – by the Special police) have particularly low level of services when turning from Josip Juraj Strossmayer Street towards the east;
- Josip Juraj Strossmayer Street (D37)- Žitna Street (Old bridge) – particularly low level of service at the turn from Žitna Street towards the south.

From the field analysis and the review of traffic light sytems at intersections, the following can be concluded:

- Almost all traffic signals have microprocessor technology, in addition to the traffic lights at the intersection of Vlado Janjić Street (D37) – Rimska Street (new bridge) which is an older technology (electronic traffic signals) which is positive, because these devices allow easy adjustment of signal program for real-time traffic;
- At most intersections, signal programs are not coordinated with traffic volume;
- At most intersections, devices do not work according to traffic despite the detectors;
- There is no traffic center or automatic traffic management system (ATM);
- Traffic light lanterns are mainly halogen, which significantly increases power consumption compared to the LED technology that has become a standard;
- Technology used for detectors for vehicles is mostly based on inductive loops, except at intersections Josip Juraj Strossmayer Street – Hrvatski domobrani Street and Ferdo Hefele Street – Marijan Celjak Street, where microwave detectors are installed. The induction loops are subject to frequent breakdowns, and therefore, most of the intersections with the induction loops in Sisak do not have a traffic-dependent operation;
- There is no coordination system of road sections (Josip Juraj Strossmayer Street).

Based on the analysis of the traffic light system, it is possible to conclude that the traffic light systems at almost every intersection can be optimized in order to reduce the waiting time and intersection passing time in order to improve road safety, and to reduce electricity consumption for traffic light operations.

The proposed measures to optimize traffic light system in order to reduce waiting times and intersection passing time, in order to increase safety and to reduce energy consumption for operation

of the traffic lights, is given for each traffic light intersections separately. As a measure that combines several intersections, a proposal to implement coordination is given. As a general measure that combines the entire traffic light system, it has been proposed to implement traffic control centre that would combine all traffic lights with the implementation of automatic traffic management (ATM).

The system improvements for each intersection is proposed below:

- Petrinjska Street (D37) – Caprag Street (by Konzum) (Figure 18):
  - LED lantern installation;
  - Overground detector installation;
  - Signal program optimization;
  - New road lanes;
- Josip Juraj Strossmayer Street (D37) – Hrvatski domobrani Street – Narodni heroji Street (at Zibel neighbourhood near the Special Police):
  - Video detector installation;
  - Signal program optimization;
  - Cancellation of the flashing green light;
- Josip Juraj Strossmayer Street (D37) – Ivan Mažuranić Street – Ivan Gundulić Street (next to the hospital):
  - LED lantern installation;
  - Overground detector installation (microwave detectors recommended);
  - Traffic light coordination with intersections 3 and 5 by an adaptive two-way coordination system;
- Josip Juraj Strossmayer Street (D37) – Hrvatski domobrani Street (by the "GOS"):
  - LED lantern installation;
  - Overground detector installation after the existing ones wear off;
  - Traffic light coordination with intersections 3 and 5 by an adaptive two-way coordination system;
- Josip Juraj Strossmayer Street (D37) – Žitna Street (Old bridge):
  - LED lantern installation;
  - Overground detector installation after the existing ones wear off;
  - Traffic light coordination with intersections 3 and 4 by an adaptive two-way coordination system);
- Vlado Janjić Street (D37) – Rimska Street (New bridge):
  - Installation of the modern (microprocessor) device to replace the older one;

- LED lantern installation;

- Ferdo Hefele Street (D36) - Marijan Celjak Street (by the County Road Administration):
  - Cancellation of the flashing green light;
- Ivan Fistrović Street (D36) - Nikola Mikec Street (by Interspar):
  - Traffic light system adjustment after the reconstruction of the eastern driveway;
- Ivan Fistrović Street (D36) – Ivan Kukuljević Sakcinski Street – Ivo Rukavina Street (by the marketplace):
  - Replacement and improvement of the existing traffic light devices;
  - LED lantern installation;
  - Detector installation (video detection);
  - Installation of condition-dependent traffic light devices;
- Franjo Lovrić Street - Ivan Kukuljević Sakcinski Street (by the hotel Panonija):
  - Replacement and improvement of the existing traffic light devices;
  - LED lantern installation;
  - Detector installation (video detection);
  - Installation of condition-dependent traffic light devices;
- Franjo Lovrić Street – Matija Gubec Street (by the elementary school "22. lipnja"):
  - Overground detector installation after the existing ones wear off;
- Kralj Tomislav Street – Silvije Strahimir Kranjčević Street (by the Sisak High School):
  - LED lantern installation;
  - Detector installation (video detection);
- Installation of condition-dependent traffic light devices.

Traffic light systems at intersections of Zagrebačka Street (D36) at Kaufland, Zagrebačka Street (D36) at Lidl and Ivan Fistrović Street Street (D36) at Crodux gas station are brand new, but they are not operational yet, so any new actions for them will not be proposed.

The proposal to implement (improvements) coordination is proposed for the roads between the intersections of Josip Juraj Strossmayer Street (D37) – Ivan Gundulić Street (at the hospital), Josip Juraj Strossmayer Street (D37) - Hrvatski domobrani Street (by the waste management company) and Josip Juraj Strossmayer Street (D37) – Žitna Street (Old bridge).

Due to extreme traffic volume on minor approaches to the intersection of Josip Juraj Strossmayer Street and Žitna Street (from the city centre), the position of intersections on the 250 m stretch, two-way traffic (double coordination) and with the existing technology that isn't recording traffic flow characteristics and the traffic light system isn't adaptive according to requirements, it is extremely

difficult to achieve both coordinations (green waves). As the implementation of adaptive traffic management systems requires significant financial resources, the optimum would be, in the first stage, to install a plan selection system, which, depending on the traffic volume in a particular period and based on the historical traffic data, selects the optimal predefined signal program.

Figure 18. An example of the possible traffic light optimization by adding a road lane if there is space availyble (the intersection of D37 and Capraška by the "Konzum")

Therefore, first of all, it is necessary to create a traffic study to define the signal programs, algorithm changes, location, traffic counters, and traffic counters installed on the critical points of the green wave, to adjust the direction depending on the traffic volume with predetermined signal programs (a minimum of five: for the morning and afternoon peak hour, daily traffic, Sunday afternoon period and night periods).

At a later stage, it is possible to suggest:

- Real-time system management;
- Real-time system management based on traffic policies.

The management system in real-time operates such that traffic signals are connected with each other and they are exchanging a large number of traffic data in only one second. Based on these data (number of vehicles, waiting time, queue interval of following vehicles ...) the system for each traffic

signal determines green time duration the one-second resolution depending on the macro and micro-location conditions. In order to adapt to the expected traffic requirements for a certain part of the day of the week, historical data are also used by the system. This is extremely important in the morning peak period, since traffic volume at night is negligible compared to the morning peak period, so in a very short period, changes are going from minimum tom maximum in the signaling program.

The real-time management system based on the traffic policy works such that traffic signals operate as a management system in real-time with the possibility of determining traffic policy, which means that it is possible (in the ATM center) to assign different priorities during the day such as public transport, pedestrians, private cars, etc.

As a general recommendation for significant optimization of the entire traffic light system, the proposal of connecting all devices to a unique traffic centre is given. Traffic centre should be under the jurisdiction of the city department in charge of traffic. Traffic center could performe traffic analytics such as traffic system response to actual traffic demands, and based on that, the system could be improved in real-time. This would result in additional savings in travel time and fuel consumption, which would be a positive contribution to the energy efficiency of transport and sustainable mobility. In addition, from the centre, traffic in the event of emergencies could be managed by giving priority to public transport vehicles or to react promptly to eliminate the possible defects on system, which again would result in more efficient traffic system.

Besides with traffic lights, the ATM system could unify more traffic systems in one place – the traffic control centre. With the ATM, besides the traffic light system, it could be possible to connect parking system, public transport, emergency services, suburban railway system, video surveillance, speed control, variable traffic signs, information displays, road lightning and others (Figure 19 and Figure 20). The data from these systems and devices are visible in the centre, allowing engineers to perform adjustments in the system, and to optimize traffic by assigning different traffic policy. As a basis for the phase implementation, the existing GIS system could be utilized, which is currently being used in the City of Sisak.

Recently, the EU market has a whole series of low-cost solutions, which have all the features as the previous relatively expensive systems, but the technologies and software solutions have significantly reduced the cost of such systems. These solutions are based on web technologies that eliminate expensive and complex IT infrastructure. In addition, the possibility of cloud solutions offers reliability and automatic maintenance of software (software upgrade) without the expensive capital investments. Initial problems related to the security of such systems are solved with multiple levels of security in communications today.

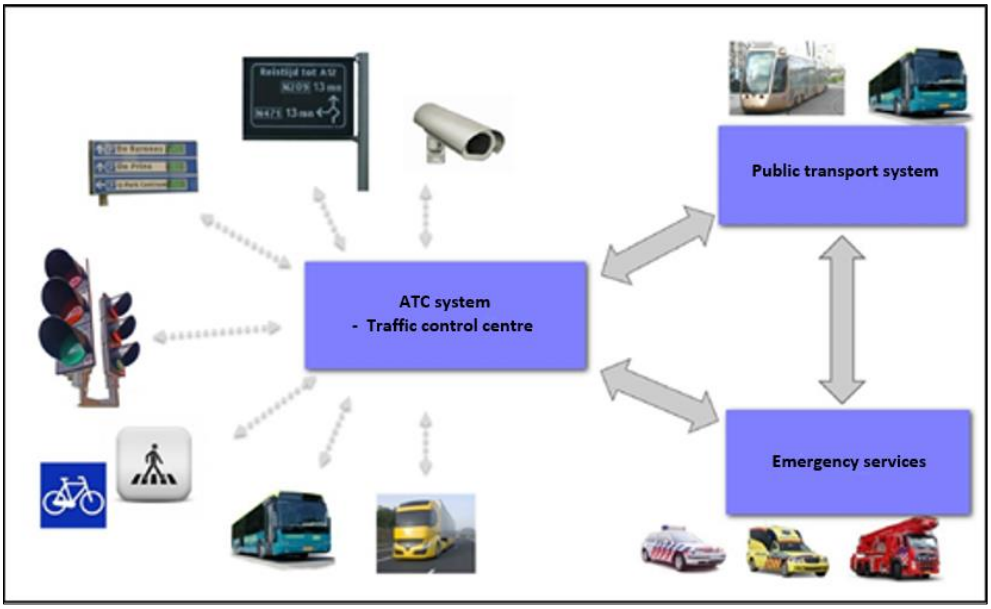


Figure 19 The ATC scheme

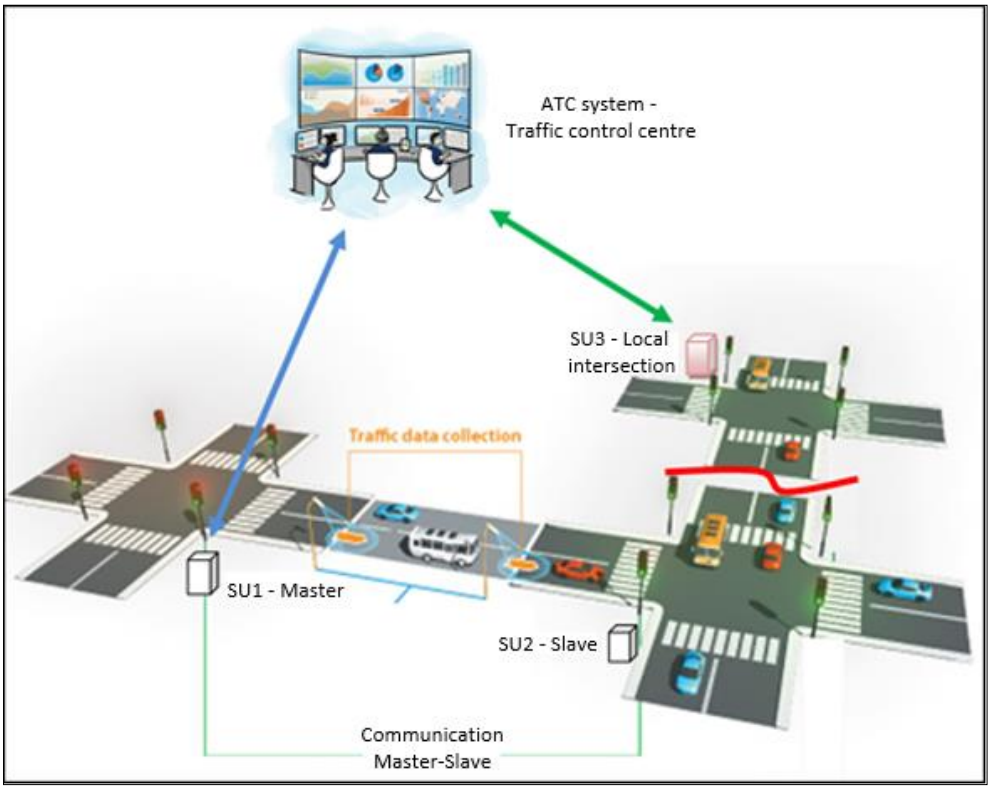


Figure 20. The elements of the ATC system

4.4.3 Reconstruction of critical intersections

From the existing intersections of the traffic network of Sisak, there are especially emphasized problems in traffic flow, capacity, level of service and traffic safety at two intersections. Below is an analysis of the current situation, proposed measures, and the estimated costs of implementation, construction, or reconstruction with associated indicators for two intersections:

- Ivan Fistrović Street (D36) – Nikola Tesla Street;
- Petrinjska Street (D37) i D224.

The intersection **Ivan Fistrović Street (D36) – Nikola Tesla Street** is located in the northeastern part of the City on the significant Ivan Fistrović Street which stretches from north to south, and it is the state road D36, representing the eastern bypass of the city centre. Nikola Teslea Street, which extends in east-west direction connecting the eastern parts of the city which are limited to the east along the Sava River and through Mijo Gorički Street is the only connection to the west to Ivan Fistrović Street (D36) and the city centre. North from Nikola Tesla Street and west and east from Ivan Fistrović Street (D36), lies the industrial and commercial zone of the City, which further emphasizes the importance of roads and the intersection. South from Nikola Tesla Street and east and west from Ivan Fistrović Street, residential buildings are located. The intersection is a one-level type and unsignalized. Along south roadway from Nikola Tesla Street, the industrial railroad track connects the main train station with industrial facilities around Nikola Tesla Street. This affects the classification of intersections as railway crossings, but it has extremely unfavorable shape, with questionable sight distance and traffic flow management at the intersection, particularly in terms of priority. Therefore, the level of service and road safety are significantly low.

Because of its location and the role in the transport network of the City, and according to the current and future traffic volume, the planned infrastructure traffic projects for the centre (Section 4.4.1) and analyzed road safety (Section 4.7), it is necessary to reconstruct the intersection. For this purpose, two stages are proposed:

- Implementation of proper traffic lights and regulation of pedestrian and cycling traffic management (plan for 2017);
- Denivelation of the intersection (plan for 2030).

The first phase, as a temporary solution, includes the implementation of appropriate traffic lights and regulation of pedestrian and cycling traffic according to the Section 4.2.16, which is the most effective measure according to the planned period of time. A classic road-railway crossing with the appropriate signalling and equipment (ramps) is suggested. If a detail traffic analysis show the possibility to implement more appropriate solution (such as roundabout with traffic lights), such kind of solution can be implemented. Any konf of solutions for the intersection would significantly contribute on improving traffic flow and road safety at the intersection, and it would also prioritize sustainable modes of transport.

The second stage requires significant financial resources, but it would be a final solution for the

intersection, meeting all the objectives of sustainable transport, mobility and safety. In the differenet level version, Ivan Fistrović Street should be raised to the level +1 or reduced to the level -1, and Nikola Tesla Street and the railroad should remain on the same level, such as the current situation. This solution is complicated in terms of space, therefore, before the final decision, different design variants should be studied. Financing assets for this variant should be provided mostly by Croatian Roads, and in the minor extent by the City of Sisak and Croatian Railways – Infrastructure (land purchase, and the reconstruction of the intersection environment, access roads, and the industrial railroad track).

The intersection **Petrinjska Street (D37) – D224** is located in the southern part of the City of Sisak, between Caprag in the north, Mošćenica in the west and Novo Pračno in the east. The intersection is important because of its position and role in the transport network of the City and County, because it connects Sisak to Glina and Topusko through Petrinjska Street in the west and Hrvatska Kostajnica and Hrvatska Dubica (the border with Bosnia and Herzegovina) on the southeast. The intersection is has a non-standard three-way Y-shape, and with the analyzed traffic volume, the shape significantly impairs sight distance, level of service and safety.

Figure 21. The existing situation at the intersection D37 and D224 (left) and the situation after the suggested redesign into a mini-roundabout (right)

According to the analysis, the reconstruction of the intersection into a mini-roundabout (Figure 21) in order to reduce approach speeds (by making approaches perpendicular to the roadway) is proposed. This would also significantly increase the sight distance on every approach and the intersection itself. Due to the current situation, organization and location of pedestrian crossings, bicycle crossings and bus stops, the intersection is extremely unsatisfactory in terms of road safety, organization, traffic management at the intersection, and the capacity, so the following locations for the crossings are proposed:

- Northern approach on Petrinjska Street and along the west traffic lane;
- Space between Petrinjska Street – north approach and D224, and the circulatory roadway.

The proposed intersection design, traffic management and the location of new pedestrian crossings, bicycle crossings and bus stops would significantly increase the level of road safety, capacity and level of service at the intersection. This would ultimately contribute significantly to the promotion of sustainable modes of transport and mobility in the wider and narrower area of intersections and its driveways.

4.4.4 Bridge construction

In the current state, the basic transport system characteristic of the city centre is the lack of road connections between the left and right banks of the Kupa River in the city centre. The road links between the two parts of the city separated by the Kupa river are based on Gromovi Brigde (D37) and the Old bridge, which was opened for one-way traffic (for exiting the centre), and only for private cars. This capacity is not sufficient for the current traffic demand, which is why the the city centre (left bank of the Kupa River) is characterized by frequent traffic congestion and delays. This problem is known to the City of Sisak for many years, and Croatian Roads has a ready project documentation for the construction of a new bridge (Figure 22).

The construction of this bridge would solve the problem of connecting the city separated by the Kupa River. This would be a significant contribution to the sustainable mobility, as it would significantly reduce travel distances, fuel consumption, gas emissions, and time spent in traffic.

The influence of the construction of a new bridge over the Kupa River by 2020 and 2030 is tested with analysis of traffic parameters, noise emissions, and harmful gases in the central part of the City of Sisak. The central part of the City is bounded by Vlado Janjić Street on the east, Old Bridge and Kralj Tomislav Street on the south, Ivan Fistrović Street on the west and Ferdo Hefele Street on the north. The analysis was conducted for the afternoon peak hour due to higher traffic volume in comparison to the morning peak hour.

According to the traffic model, if the bridge is built by 2020, traffic volume in the city centre will be reduced by 15.8 %, the total delay time by 15.7 %, and the number of hours for passengers spent in the car during peak hours will decrease up to 20 %. Total emissions of carbon monoxide will be reduced by 17.6 %, and the total noise level by 0.39 %.

If the bridge is built in 2030 (assuming that all road infrastructure facilities that was planned were built), a new bridge over the river Kupa will reduce traffic volume in the center of Sisak by 18 %, the

total vehicle delay time by 28.5 % and the number of hours passengers spent in the car during peak hours will be reduced by 22.8 %. Total emissions of carbon monoxide will be reduced by 19.6 %, and the total noise level by 0.45 %.

When these parameters are incorporated into the cost-benefit analysis of the new bridge project, they will surely give a great contribution to the overall benefits of the bridge, increasing its feasibility.

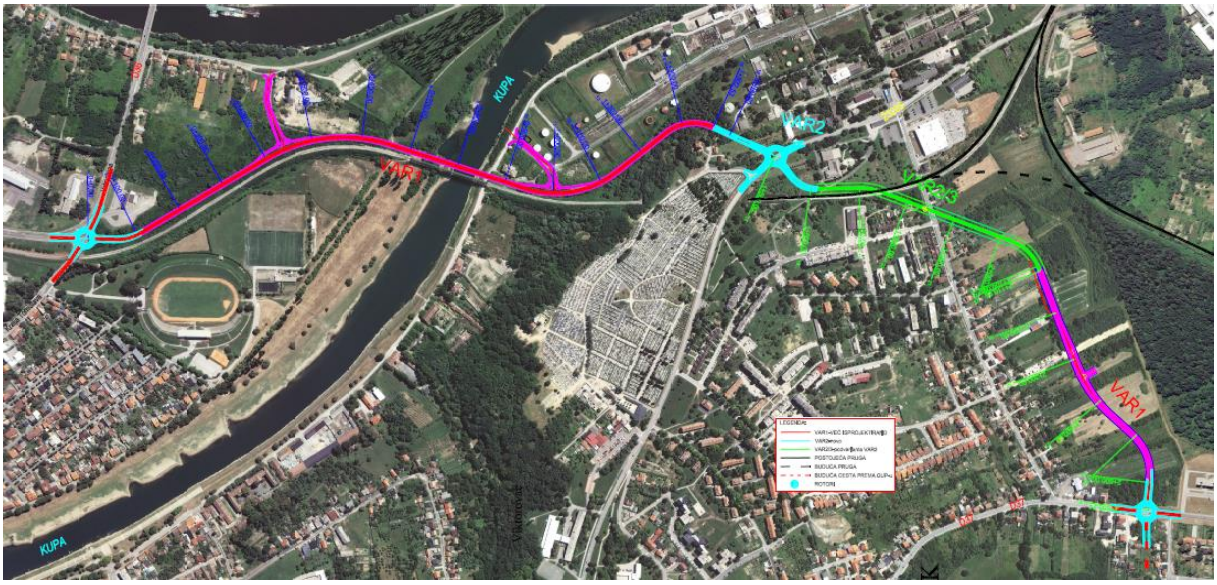


Figure 22. The proposed location of the new bridge over the Kupa River related to the city centre

From the traffic aspect, is not important what type of an architectural or civil solution of the bridge will be. He is traffic justified, necessary and can significantly contribute to the relief of the entire transport system of Sisak. The financial assets for the bridge should be provided by Croatian Roads, with the possibility to use assets from EU funds.

Among the bridges for motorized traffic, the construction of a road bridge over Sava River at Kratečko or near Lukavec Posavski is proposed. This has great importance due to better city connectivity with the eastern locations around the Sava River, or areas bounded by places Veliko Svinjičko on the north, Sunja on the south and Lonjsko Polje on the east. This would enable an easier access to the attractors of the tourist areas such as Lonjsko Polje and Čigoč, and encourage further development of these tourist areas. These bridges do not have such a great importance, but it is necessary to have them in plans, because every bridge improves traffic system, shortening the travel time. The financing assets for the bridge should be entirely provided by the County Road Administration of the Sisak-Moslavina County, with the possibility of using financial assets from EU funds.

4.4.5 The construction of highly-important roads

Given the present level of development and the condition of the road network of the City of Sisak and the County, as well as on current and future traffic flow trends, it is necessary to build and reconstruct new road routes. In this chapter, the current situation, proposed measures, and the estimated costs of implementation, construction or reconstruction with associated indicators for the road section D36 and D37 passing through Sisak are analyzed.

In total, the existing road sections of State roads D36 and D37 have poor condition in terms of current traffic demand, the level of service and road safety. The section of the road D36 of Žažina on the west to Selsko Polje is in satisfactory condition. However, the section of the road D36 through Sela, Stupno, and Odra at the entrance to the City of Sisak has to be repaired urgently. In particular, this applies to existing Odra bridge with the connecting roads and approaches that have extremely unfavorable condition, and the results are numerous road accidents and bad traffic flow.

The section of the road D36 in the eastern part of the City is in satisfactory condition, and it is necessary to reconstruct certain intersections (e.g. Ivan Fistrović Street and Nikola Tesla Street), and the other is discussed in Section 4.4.2). The section of the road D37 in satisfactory condition; however, it is necessary to reconstruct certain intersections (Section 4.4.2), and especially in Petrinjska street (D37) and D224 which was mentioned earlier.

A great importance for the entire geographic position, transport position, and the economic development of the City of Sisak and the County, has the construction of the following roads:

1) D36 and the new Odra bridge (Phase 1);
2) D36 and the connection to the A11 highway (Phase 2);
3) D36 to Novo Selo Palanječkog (Phase 3);
4) D36 to Veliko Svinjičko and Gušće.

New road routes stated under 1), 2), and 3) should be built in 3 phases. In the first phase, it is needed to build the road shorter, but still adequately long, considering the Odra bridge. Then, it is necessary to construct a longer road which would connect to the road build in Phase 1 at the new crossroad of Staro Pračno Street. The next phase is the construction of the new D36 section and the new bridge over Sava River, which would in fact create a northern bypass for the City of Sisak. The construction of 1) to 3) would provide prerequisites for creating bypasses for transit traffic of the City and the County. The construction of the roads would satisfy all transport needs of the City of Sisak and its close surroundings. The construction stated under 4) would create a new connection to D36, and a complete road reconstruction from the mentioned connection to Veliko Svinjičko and Gušće on the east,

resulting in conditions for better connection of the eastern part of Donja Posavina with the City of Sisak and A3 highway. The financial assets for the new country roads and bridges should be entirely provided by the Croatian Highways, with the possibility of providing the assets from EU funds.

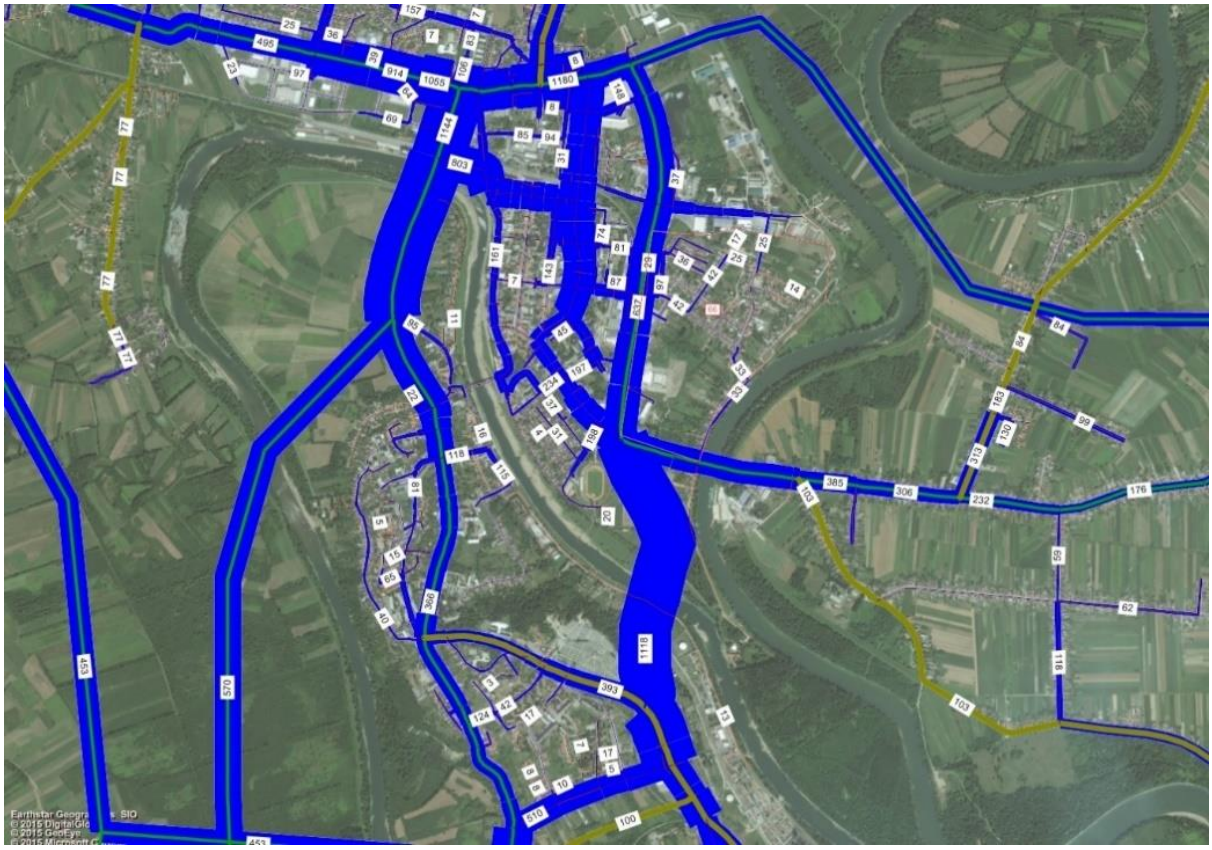


Figure 23. Traffic volume (both directions) in 2030 – afternoon peak period

The suggested solutions for the new roads are solutions that require significant investment of financial resources, and prior to implementation of these solutions, it is necessary to make a detailed feasibility study of these solutions.

The proposed measures in the road transport were tested on a traffic model. With the analysis of the results obtained with traffic model (Figure 23 and Figure 24) **it was found that the new bridge takes significant traffic load from the centre**, particularly Vlado Janjić Street, Rimska Street, Frankopanska Street, Ivan Kukuljević Sakcinski Street and other streets in the centre. Based on the data, the new bridge would be one of the busiest roads in the City, **confirming its traffic justification**. The construction of new road routes would significantly reduce traffic in the central part of the city, especially transit traffic. Due to the conversion of a part in the city centre into a pedestrian zone and converting a part of the street into dead-end, a significant increase in traffic volume in Franjo Lovrić Street and Frankopanska Street below the degree of saturation is noticeable.

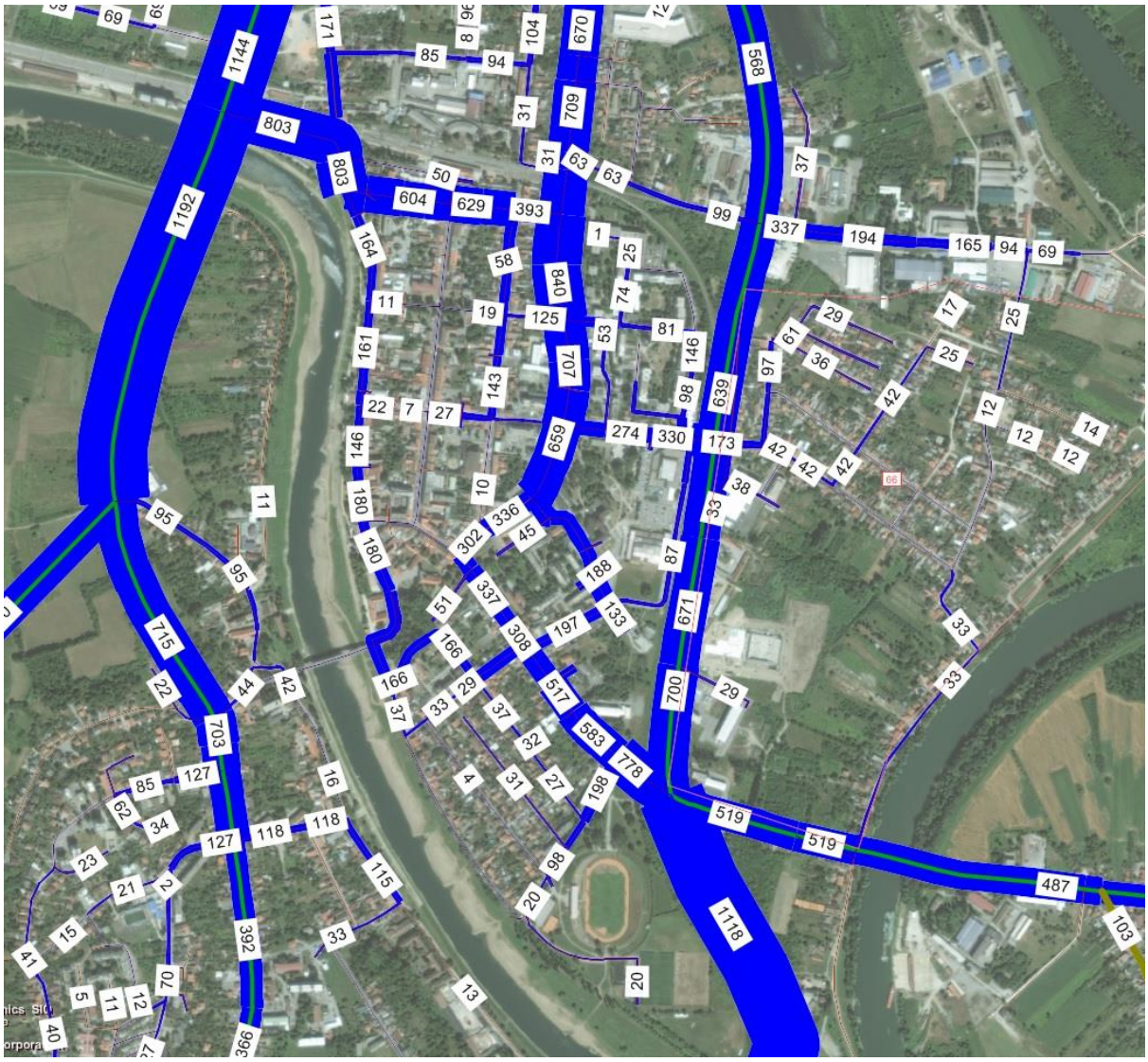


Figure 24. Traffic volume (both directions) in the city centre in 2030 – afternoon peak period

4.4.6 Concluding observations on objectives and indicators of road network

Indicators related to the road network and related activities and frequencies are shown in Table 16.

Table 16. Road infrastructure indicators

Indicator	Required measures	Implementation	Unit
Intersection reconstruction	Preparation of traffic studies of construction works and conceptual design, main and executive project	Phase one 2017 year, second phase by 2020. depending on financial resources	Two intersections
Construction and reconstruction of the new road routes	Preparation of traffic studies of construction works and conceptual design, main and executive project	Phase one by 2020 year, other phases until 2020. depending on financial resources	One intersection, six roads and five bridges
Level of service	Conduct traffic count on analyzed intersections and road sections	In the existing state / after realization of the first phase / after the realization of another (other) phases	Average delay time of the vehicle d (s/veh); A – best, F – worst
Road safety	Analysis of the current state of road safety in quantitative and qualitative	In the existing state / after the implementation of the	Number of traffic accidents per year;

	range	first phase / after the realization of another (other) phases	the number of injuries per year; number of fatalities per year; cause of traffic accidents
Greenhouse Gas Emissions	Automatic station for air quality monitoring and / or analysis of the budget based on the intensity of traffic flow	Before the start of implementation / after each phase of implementation	g/km
Customer satisfaction	Collecting data via survey method and / or interview	Realized after an each phase	Descriptively
Number of optimized traffic light intersections	Preparation of transport studies and construction works	Every year several intersections depending on financial resources	Number descriptively of intersections
Level of service / volume to capacity on signalized intersections	Conduct traffic count on the key intersections	In the existing state / after realization of the first phase / after the realization of another (other) phases	Level of service (A-F) / volume to capacity
Implemented AUP system	Preparation of transport studies andconstruction works	Immediately	Yes/No
Traffic volume in the city centre / level of service	Conduct traffic count on analyzed intersections and road sections	in the existing state / after realization of the first phase / after the realization of another (other) phases	Number of vehicles / level of service (A-F) / volume to capacity

4.5 Parking policy management

In this part, a comprehensive parking policy proposals have been offered with the phases of the implementation, including facilities, payment, time limits, penalties and instruments for enforcement. The proposals are given in order to consider the possibility of introducing a system such as Park-and-Ride at public transport terminals.

A sustainable transport policy for urban areas, in order to be successful in the implementation, should include a complementary parking policy. Parking policy has become one of the most important factors of transport policy in urban agglomerations. The imperatives of transport policy in urban areas are identified as traffic congestion reduction, protection and preservation of the environment, reduction of private car usage, and summarized, to adjust the entire urban transport to accommodate the life and work of its people. The parking policy has been proven as a very good management tool for transport demand, with a goal of changing the modal distribution and reduction of excessive private car usage in the City. A series of policy measures regarding parking policy is used for the described purpose: the introduction of on-street parking, the introduction of Park-and-Ride, introducing off-street parks, parking time limitations, parking charging scheme and similar.

Private car traffic in the city centre is not reduced – it is actually stimulated to a certain level, due to the fact that construction of the parking spaces at all suitable surfaces deprives surface for pedestrian and bicycle traffic. The increased motorization rate has caused increased concentration of cars in the city centre with a significant share of commuting purposes.

The City of Sisak has already implemented parking charging schemes on street parking spaces. Also, at several locations in the City, off-street parking areas are also being used for parking. Illegal parking has also been registered at several locations within the City. Therefore, for the implementation of a sustainable urban mobility plan, as a means to reduce excessive private car usage in the city, traffic and parking policy has to be supplemented with the following comprehensive measures:

- At the end of 2017 (Figure 25):
    - The existing concept of parking zones in the city centre is proposed to remain the same, with a proposal to introduce other payment zones for parking around the city marketplace – since the city marketplace is an important business and economy point of interest, a parking charging model is proposed such that the flow of goods in the vicinity of the marketplace would be interrupted, and parking spaces would be available for visitors (e.g. free parking in the first hour with discouraging all-day

parking);

- Proposed introduction of payment zones for parking in Zibel, Josip Juraj Strossmayer Street (opposite to the city hospital), in the park with around 40 spaces with two-hour limit;
- In other parts of the City, such as Caprag, Zibel and Viktorovac, there was no significant need for the introduction of paking charging detected, unless new conditions are met following the construction of new attractors that will generate significant motor traffic in the relevant areas;
- Eliminating the existing on-street parking in Silvije Strahimir Kranjčević Street and as part of the Stjepan and Antun Starcevic street, i.e. in the current pedestrian zone. This will result in eliminating 60 spaces;
- Around 50 parking spaces are currently under construction in the city marketplace, which will compensate for the lack of parking spaces “lost” at the pedestrian zone;

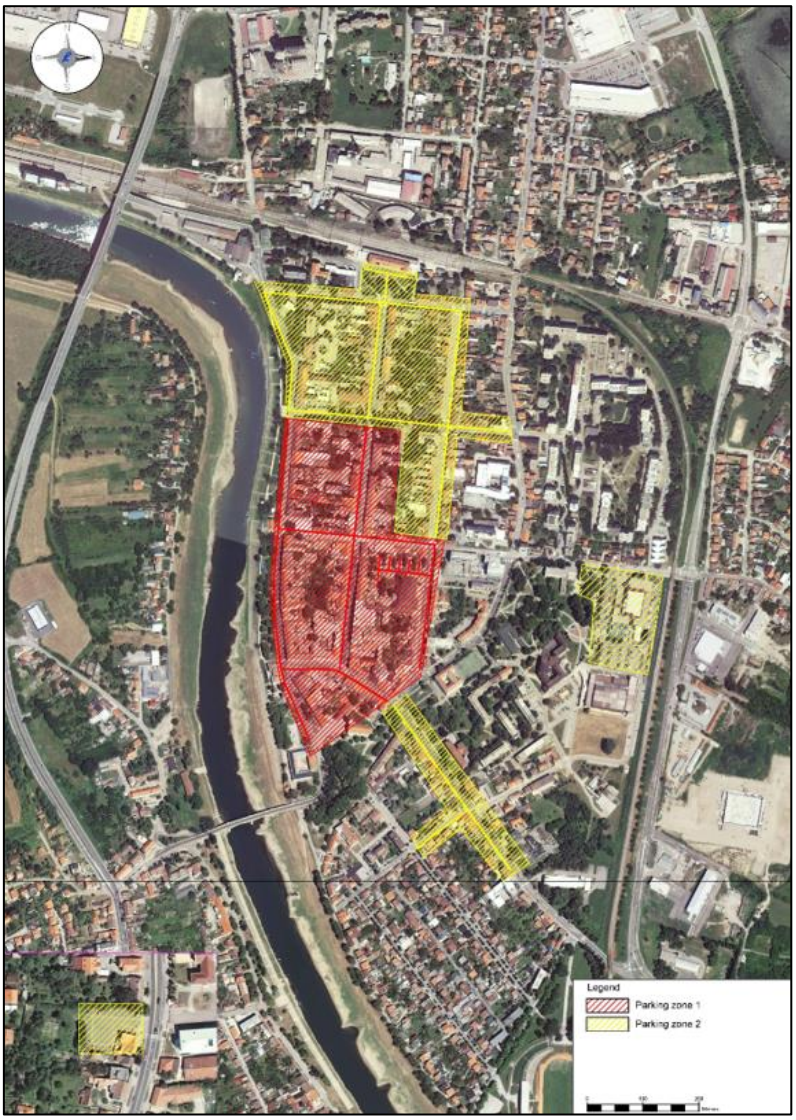


Figure 25. Parking charging zones at the end of 2017

Figure 26. Parking charging zones at the end of 2020

- At the end of 2020 (Figure 26):
  - Extension of the first parking zone in the city centre is proposed over the entire Zone 2, in addition to the expansion of parking areas in Lipa Street, Josip Runjanin and Vladimir Nazor Street, together with its inclusion in Zone 1.
  - Conversion of parking spaces at the city marketplace in the Zone 2;
  - Eliminating the existing on-street parking around the corridor of Stjepan and Antun Starčević street, i.e. at the proposed expansion area of the pedestrian zone towards the railway station – this will eliminate 90 parking spaces;
  - New parking spaces for residents and other public institutions and entities in the pedestrian zones can be provided on the outside streets, i.e. internal building blocks, (as parking in blocks). Therefore, it is proposed to examine the model of co-financing by the City of Sisak for adjusting such parking areas and, if necessary, to offer them for

commercial purposes for non-residents in the city centre. In addition to meet the needs of parking for residents, it is necessary to provide a small number of parking areas for other business and public entities as well, in order to enable further economic and social development of the city – an example of planned solutions by the City is the construction of new parking spaces in the area between Franjo Lovrić Street, Ante Starčević Street and Ivan Kukuljević Sakcinski Street;

- In the case of higher demand for parking spaces in the city centre, it is necessary to redefine the existing tariff policy in accordance with the new requirements;
- Proposed construction of the first multi-modal Park and Ride car parks in Stjepan and Antun Radić Street (by the mill), with a capacity of 500 parking spaces;

Figure 27. Parking charging zones at the end of 2030

- Until the end of 2030 (Figure 27):
    - In the city centre, the extension of the first zone is proposed to cover the entire second zone. Proposal includes expansion of the capacity of the park in Lipa street, Josip Runjanin i Vladimir Nazora Street and assimilation by the first zone;
    - The construction of a second multi-modal Park-and-Ride car park in the area bounded by Ivan Fistrović Street, Nikola Tesla Street and the railroad, with the capacity of 600 spaces. The need for construction has to been examined, depending on the availability of the first Park-and-Ride park at Kralj Zvonimir street;
    - Examining the possibility to introduce zonal parking charging on the remaining narrow areas of the City bounded by the railroad in the north and east.

Table 17 shows the indicators of the parking policy management.

Table 17. Indikatori politike upravljanja parkiranjem

Indicator	*Unit*	*Collection frequency*	*Methodology*
Number of car parks	car parks	Annually	Counting
Proportion of parking spaces by zones	percentage	Annually	Counting
Parking price	HRK / h	Annually	Parking policy of the City of Sisak
Parking time limit	h	Annually	Parking policy of the City of Sisak

4.6 City logistics

Traffic in cities is a complex system conditioned by the interaction of many different factors - from the intensity of traffic to the environmental impacts. Traffic in large or medium-sized Croatian cities (as Sisak) from year to year is increasing rapidly, resulting in ever higher degree of pressure on the infrastructure and environment at practically the same area.

Due to increasing number of vehicles in cities, especially the number of delivery vehicles, a systematic approach in solving transport problems of light and heavy delivery vehicles on a wider and inner-city area arises. Delivery vehicles, especially with larger dimensions and capacity, due to dimensions and limited maneuverability are not suitable for transport in cities. The consequences of delivery transport in urban areas are most often traffic jams or slow traffic on certain locations, as well as possible traffic accidents, which, because of the vehicle characteristics, often have very serious consequences. In most cases, solutions to distribution problems are partial and far from optimal, and therefore, this fact seeks for an integrated system of goods distribution in certain urban areas.

4.6.1 Analysis of freight transport infrastructure in the City of Sisak

For the purposes of the project, the research included areas which connect the central part of the City. Due to the concentration of population and economic activity, a large number of private as well as light and heavy delivery vehicles concentrates in the City of Sisak. The emergence of light and heavy delivery vehicles during peak periods additionally burden transport network, which slows down the traffic. More detailed analysis is shown in Annex 1 and Annex 2.

Due to these characteristics, most of the light and havy delivery vehicles are not suitable for operations in the inner-city area, especially in heavy traffic conditions throughout the day, as in the City of Sisak. The transport system of the City of Sisak is extremely complex – in the metropolitan area, a large number of different vehicles, from passenger vehicles to light and heavy delivery vehicles operate on daily basis. Delivery transport can be distinguished based on the different delivery cargo types, mainly carried out by using light and medium delivery vehicles, and heavy delivery vehicles that supply different economic entities with large amount of goods.

According to detailed research conducted on 9 locations in the city centre, the main delivery transport volume in Sisak is carried on the following areas (streets):

- Rimska Street;
- Stjepan and Antun Radića Street;

- Ante Starčević Street;
- Franjo Lovrić Street;
- Ivan Kukuljević Sakcinski Street (City marketplace);
- Ljudevit Posavski Street and Matija Gubec Street;
- Zagrebačka Street (Supernova shopping mall);
- bridges on Sava River.

In accordance with the obtained research, the main disadvantages of delivery transport are determined. It can be noted that the majority of light and heavy delivery transport in the City takes place in areas that are intended for residence, although these roads mainly border residential areas. In the city centre, there are also the most important sites, and the the vast majority of administration organizations, which generate daily flows of light and heavy delivery vehicles. Also, due to the fact that these roads are used for public transportation, and the fact that the residential buildnigs are located in immediate vicinity, it can be concluded that there is a definite impact of light and heavy delivery vehicles on quality of life in neighbourhoods along the mentioned streets.

Delivery in the city centre is regulated by the Decision on the regulation of road transport in the City of Sisak (Official Gazette of Sisak-Moslavina County No. 14/06, 6/09, 1/13). In Article 67 of the mentioned Decision, heavy delivery traffic is forbiden except for the purpose of delivery and for vehicles with total mass up to 3,5 tonnes in the period from 07:00 to 17:00, and the vehicles with total mass up to 7,5 tonnes from 17:00 to 07:00 . Exceptionally, in period between 10:00 and 14:00, with the special approval of the Governing Body in charge of traffic, transport of light and havy delivery vehicles in the City of Sisk centre can be allowed. During 2015, the Administrative Department of Planning and the Environmental Protection issued 14 approvals for exceptional transport for a total of 19 delivery vehicles. The approval stated that the exceptional transport does not apply to transport across the Old Bridge, the future pedestrian zone, the streets with temporary transport regulation during the construction and various events on the streets, and will be issued for a one-year period. It should be noted that the number of delivery vehicles in the City of Sisak is much higher than the number of approvals, and therefore, it is necessary to conduct a detailed analysis of the number of light and heavy delivery vehicles with the goal to regulate delivery transport in the City of Sisak.

It is assumed that there is an increase in a number of delivery vehicles on city roads. The largest delivery traffic increase can be expected exactly on routes where goods deliveryis being carried out today. It is therefore important to conduct a series of measures in order to regulate the delivery transport flows and thus to relieve the city roads.

To conclude, the following disadvantages of city logistics can be determined:

- The traffic of light and heavy delivery vehicles takes place on city roads, where the largest proportion occurs near or along the edge of residential areas;
- The generators of delivery transport are dispersed throughout the metropolitan area; however, the largest concentration of delivery vehicles is in the central part of the City of Sisak (Figure 28);
- There are no defined parks intended for delivery vehicles, nor plans for them, and this results in occupation of parking spaces intended for private vehicles, delivery vehicles stopping on marked pedestrian zones, sidewalks or at places intended for them, but they create traffic congestion, worsened road traffic safety for pedestrians and cyclists and increasing air pollution;
- Delivery vehicle drivers (especially heavy delivery vehicles) do not comply with the Decision on the Organization of road transport in the City of Sisak, and based on the conducted survey, they are not properly introduced with it, and they are not familiarized with the transport time limits in the city centre;
- On the busiest city roads (e.g. Stjepan and Antuna Radića Street and Ante Starčević Street), there are no markings for delivery time limits;
- there is a continuous supervision over the compliance with the Decision on the regulation of road transport in the City of Sisak related to transport of light and havy delivery vehicles on the busiest city roads.

Figure 28. Delivery vehicles in the city centre

4.6.2 Basic city logistic concepts

The concepts of solving goods supply problems in urban areas cover all forms of activities related on goods optimization and logistics in a particular metropolitan area. The individual city logistic concept is affected by following factors: sociological, cultural and demographic characteristics of a particular

city, architecture, concept of transport infrastructure and the habits and expectations of the population. The most common concepts of city logistics are:

- Cooperative logistic systems;
- Logistic centers;
- Concentration of information;
- Control of the utilization of vehicle cargo space;
- Underground systems of goods transport;
- Focusing on eco-friendly vehicles;
- Logistics association;
- City government regulation.

Measures of delivery regulations can be evaluated according to different criteria. The most important criteria for evaluating the measures are the possibility of implementation, acceptability, sustainability and the reduction of the negative impact on the environment. According to these criteria, the mentioned logistics control systems in the City of Sisak will be evaluated.

The analysis of the mentioned regulation goods delivery system shows that, currently, the most appropriate measure for application is the **Regulatory concept of city government**, which has the highest degree of acceptability according to the criteria of implementation possibilities and acceptance testing from the perspective of stakeholders and sustainability. The level of delivery vehicles impact on air pollution reduction as a result of application of this method is estimated, and depending on the delivery vehicle reduction degree, it can be significant. Similarly, other measures acceptable for implementation of city logistics according to the set criteria are the following: **centralized delivery from logistic centres, the concept of focusing on eco-friendly vehicles and the concept of logistics association**.

Hereinafter, based of proposed and acceptable concepts, the suggested city logistics solutions for the City of Sisak will be elaborated.

4.6.3 Proposed solutions of City of Sisak city logistics

The city logistics solutions can be achieved in two phases. First phase plans to modify the Decision on the regulation of road transport in the City of Sisak (Official Gazette of Sisak-Moslavina County No. 14/06 6/09 1/13) and the definition of parking spaces for delivery vehicles in the city centre. The implementation of the first phase is planned in 2017. The second phase of proposed solutions is the construction of the distribution centre with implementation in 2025.

For a high-quality regulation of delivery transport in the City of Sisak, it is necessary to adopt or upgrade legal documents (decisions) of the City of Sisak:

- Decision on the regulation of road transport in the City of Sisak (Official Gazette of Sisak-Moslavina County No. 14/06 6/09 1/13);
- Decision on the method of collection and the definition of parking spaces for delivery vehicles in the City of Sisak.

The proposed documents should complement each other, with the aim of complete regulation of delivery transport in the City of Sisak, which will result in city roads disburdering and increase of citizen safety (pedestrians and cyclists), and the reduction of air pollution caused by a large number of light and havy delivery vehicles, i.e. increasing quality of life in the city centre.

Considering the above mentioned, it is proposed to improve measures to regulate delivery transport in the city defined by the document "Urban Design Plan of City of Sisak centre" from 2004. (Rimska Street, Silvije Strahimir Kranjčević Street, Kralj Tomislav Street, Mihanovićeva obala Street, Boris Brnad Street, Ivan Fistrović Street, Ferdo Hefele Street, Kralj Zvonimir street). It is necessary to amend the Article 67 of the Decision on the regulation of road transport in the City of Sisak (Official Gazette of Sisačko-moslavačka County No. 14/06 6/09 13/01) in a way to ban entering into the city centre for every delivery vehicle from 07:00 to 22:00. Exceptionally, in the period from 07:00 to 12:00, and with the special approval of the Governing Body Sisak charge of traffic, exceptional transport of light and havy delivery vehicles in the City of Siska centre may be allowed.

In order to ensure the supply and goods delivery in the city centre, the delivery traffic for vehicles up to 3,5 tons and vehicles over 3,5 tons is allowed only with the specific approval of the Governing Body Sisak in charge of traffic.

In the city centre, stopping and parking of delivery vehicles for the supply and goods delivery can be achieved only on places designated for that purpose, which are marked by road signs and horizontal markings. Delivery vehicles may be stopped with a maximum 15 minutes per ton of cargo.

The supervision of the implementation of the mentioned decisions can be achieved by introducing municipal services monitoring by oficers who will charge fines for those who do not comply with the proposed regulations. The proposed measure for introducing monitoring will result in recruiting new employees as well as costs for the City administration; but in a long term, this will enable compliance with the proposed decisions for all delivery vehicles in the city centre. Another method of supervision is the introduction of video surveillance cameras, which will enable automatic registration of traffic violations. For such a control method, it is necessary to develop a pilot project aimed for testing the

technical and technological capabilities of the proposed system.

The cost of introducing monitoring services and control through video surveillance cameras is shown in detail in section 5.

As a part of the Sisak delivery transport strategy, it is necessary to define park locations for delivery vehicles in the City centre. Taking into account the project of the pedestrian zone in the city centre, the proposed location of delivery vehicles parking spaces are placed in accordance with the new project of the pedestrian zone. The proposed locations pf delivery vehicle parks in the city centre are shown in Figure 29.

Figure 29. Proposed delivery vehicle parks in in the city centre

At the intersection of **Rimska Street – Ban Josip Jelačić Square - Silvije Strahimir Kranjčević Street (delivery place no. 1)**, due to the need for frequent goods delivery to various business entities (about

15 fo them) in particular restaurants, newsstands, pharmacies and other service facilities, one parking space for delivery vehicles is proposed. A longitudinal delivery park will be positioned on Rimska street across to the location 6 on the east side of the roadway with a 15-minute time limit per ton of cargo. The proposed park would serve to goods delivery to facilities in Rimska Street, partly for Ban Jelačić Square and partly for facilities in Hemingway Street.

In **Silvije Strahimir Kranjčević Street (delivery place no. 2)**, due to the frequent goods delivery to various business entities (about 16 of them), especially the tailor shop, stores, restaurants and bars, one parking space for delivery vehicles is suggested. Based on the research, the average daily load and unload are approximately 1 ton of various goods. A longitudinal delivery park will be drawn in Silvije Strahimire Kranjčević Street across the location 8 (before the passage) on the north side of the roadway with a 15-minute time limit per ton of cargo. The proposed delivery park would serve for goods delivery to facilities in Silvije Strahimir Kranjčević Street and Stjepan and Antun Radić Street.

In **Ivan Kukuljević Sakcinski Street (delivery place no. 3)**, due to the need for frequent goods delivery to various business entities (about 8 of them), especially shops, restaurants and bars, one parking space for delivery vehicles is proposed. The mentioned objects everyday generate a large number of delivery vehicles with an average amount of 500 kg tons of loaded and unloaded goods. The first longitudinal delivery parking place will be located on the front of Ivan Kukuljević Sakcinski Street on the northern side of the roadway with a 15-minute time limit per ton of cargo. The proposed delivery park would serve for delivering goods to facilities in Ivan Kukuljević Sakcinski Street and Antun Radić Street.

In **Stjepan and Antun Radić Street (delivery place no. 4)**, due to the need for frequent goods delivery to various business entities (about 19 of them), especially Konzum store, Tisak, few bakeries, restaurants, bars and different shops, one parking space for delivery vehicles is suggested.The mentioned objects everyday generate a large number of delivery vehicles with an average 2 tons of loaded and unloaded goods. A longitudinal delivery park is suggested in Stjepan and Antun Radić Street in the front of location 33 on the west side of the roadway with a 15-minute time limit per ton of cargo. The proposed parking place would serve for goods delivery to facilities in Stjepan i Antun Radić Street.

The postponed parking for all delivery vehicles in in the city centre, **should be introduced in 2017**, following the adoption of the proposed documents on the regulation of delivery transport in the City of Sisak. Likewise, it is necessary to harmonize the delivery park locations with the following documents:

- „Smart energy City of Sisak, Object of delivery 2: A strategic framework for the development

City of Sisak";

- „City of Sisak Master plan (Official Gazette of Sisačko-moslavačka County 11/02, 5/06, 3/11 i 4/11 - revised text");
- The city pedestrian zone in City of Sisak no. 300/2 and southern part no. 945, Old Sisak.

The costs of the proposed delivery parking spaces marked by traffic signs and horizontal markings are shown in Section 5.

A medium-term strategic solution of city logistics in the City of Sisak is the introduction of a centralized goods distribution with the logistics distribution centre. This concept is primarily intended for the business entities operating in the city centre, and for the ones who do not use a system of centralized distribution (smaller economic operators, restaurants etc.,). By using this concept of distribution the number of deliveries and delivery vehicles is reduced, while the quality of logistics services remain the same. For users, this reduces the cost of transportation and the cost of goods storage. The reduction of the number of delivery vehicles in the City of Sisak centre and shifting heavy delivery vehicles away from the main city roads will increase the level of road safety for citizens. The construction of logistics distribution centre will allow goods consolidation at one place, and distribution to end-users, i.e. goods generators, by light-delivery vehicles.

For the construction of logistics distribution center Sisak., the following locations are proposed:

- Southern industrial zone (Božidar Adžija 19, 41.1 ha, with a total available area 32,8 ha, and the largest free area 20,2 ha) – the southern Industrial Zone has enough space to accommodate logistics distribution centre and is very well connected with the central part of the city;
- The future truck terminal will be located near the southern industrial zone, large industrial facilities, INA refinery in Sisak and TE Sisak, important city roads and the future location of the river port – the location of the future terminal will be in the southern part of the City, north of the Ž 3205 road to the bridge Crnac on the Sava River, which creates exceptional conditions for good road access and logistics support; in addition, the location is directly linked to the future transport junction of southern highway A11, which is currently under construction, and the junction Popovača on highway A3.

The construction costs of modern logistics distribution centre Sisak are presented in Section 5. Given the current state and dynamics of cargo flows in the City of Sisak, the period for the construction of modern logistics distribution centre is during 2025.

After construction of logistics distribution centre, it is possible to develop the following city logistic

systems in the City of Sisak:

- The concept of the logistics association with the aim of rational conducting of given functions – it is proposed to implement Sisak logistical platform - alliance of all participants in urban goods transport. This may involve representatives of local authorities, generators of logistics flows, transport companies, citizens, etc. The objectives of such a system are: informing the participants in the urban goods transport on the legal measures of the public administration, introducing about possible solutions to the problem of urban goods transport, introduction to technical systems that may be used in city logistics systems, and initiating of research studies and projects in the area;
- The concept of focusing on eco-vehicles – the implementation of electric or hybrid delivery vehicles which can only be granted permission to enter the city centre; and other concepts involving the usage of other transport systems, such as water transport, which is possible to be developed in the City of Sisak.

4.6.4 Measurable effects of city logistics

Based on the proposed objectives and measures of the city logistics, measurable effects of proposed measures are defined (Table 18):

Table 18. City logistics – objectives and proposed measures

Proposed measure	Objective	Planned objective
• Modification of the Decision on the road transport regulation in the City of Sisak	• Time limits for all delivery vehicles in the city centre	• Reduction of delivery vehicles in the city centre; • Increasing quality of life and safety; • Air pollution reduction;
• Decision on the method of collection and the definition of parking spaces for delivery vehicles in the City of Sisak	• Development of the city logistics system	• Quality improvement in city logistics • Improvement of fare collection system for delivery vehicles entering the city centre
• Supervising the implementation of proposed measures	• Regulation of delivery vehicles entrances/exits	• Improving control over the delivery vehicles entering and exiting the city centre
• Delivery vehicles park locations in the City centre	• Development of city logistics system • Improving the accessibility to bussines entities by delivery vehicles	• Quality improvement in city logistics • Increasing quality of life and safety
• Logistics and distribution centre Sisak	• Development of city logistics system	• Improving control over delivery vehicles entering and exiting the city centre • Free city roads of delivery traffic • Quality improvement in city logistics • Increasing quality of life and safety;

		• Air pollution reduction;

The measurable effects of city logistics development will be gain by measuring indicators shown in Table 19.

Table 19. City logistics – indicators and corresponding activities for the evaluation of the results

Indicator	*Methodology*	*Evaluation*	*Unit*
Number of delivery vehicles entering city centre	Data collection via counting delivery vehicles or by establishing monitoring by personnel or video surveillance cameras	after the implementation of proposed delivery parks	number of trips
Delivery time in city centre			min
Dwelling time for goods loading/unloading			min
Average occupancy in the vehicle	Data collection via survey (questionnaire)	after the implementation of the proposed delivery parks	%
Customer satisfaction	Data collection via survey or interview	after the implementation of the proposed delivery parks	descriptive
Air pollution	Automated station for air quality monitoring and / or budged analysis based on traffic flow volume	after the implementation of the proposed delivery parks	g/km

The purpose of monitoring the indicators of city logistics is in gathering statistics on the implementation of goods delivery in the city centre in order to perform an analysis of the impact on the existing transport system. This will be a basis for developingt new solutions aimed at reducing of air pollution and improving quality of life and safety.

4.7 Road safety

In the Republic of Croatia, including the City of Sisak, road safety problems are very expressed. Road safety is a very important segment of road transport and one of the most frequently mentioned measurable characteristic that indicates a numerous traffic management factors, particularly traffic culture and attitude of participants in traffic. In the Republic of Croatia, there is no central body at a national level that would systematically deal with the issue of road safety today. Because of the lack on the national level, the existing problems are present in the City of Sisak. Due to the fact that, at the state level, there is no effective system of road safety that would enable effective preventive subsystem at the local level, it is obvious how it manifests on the management model and the way of safety subsystem function in the City of Sisak.

Today, the control and management of road transport in Croatia is carried out exclusively by the Ministry of Interior for the entire territory of the country, according to the internal territorial organisation; therefore, the majority of the activities related to road safety is connected with the Ministry. The Ministry of Interior is the carrier of the National Road Safety Programme of the Republic of Croatia for the period 2011 – 2020, in accordance with the EU legislation.The Ministry of Interior is a leader of institutional activities related to road safety throughout the country, and it contributes to the existing framework and local government activities to improve road safety. Based on the existing legal provisions, the Ministry of Internal Affairs, who systematically monitors the state of the road safety, annually publishes basic information on road accidents (by the Road Safety Bulletin) to the experts and public. The current road safety indicators, and relatively speaking, the ones on the local level, are not satisfactory. The Republic of Croatia, compared to the other EU member states, belongs to the group of countries with the worst road safety indicators.

According to the mentioned, since the road safety of the City of Sisak is a part of the Croatian road safety system, it is obvious that the state of road safety reflects, and has a direct impact on road safety in the City of Sisak. However, a significant involvement of the local government in the area of traffic safety is required, which will encourage all social subjects relevant to road safety, as well as all road users, to get as detailed and completed picture of the road safety in the City of Sisak witg all risk factors endangering it. Therefore, the Plan proposes measures that would lead to the improvement of road safety at the local level, which can be enforceable under the existing road safety system at the national level. These are:

- The infrastructure adaptation for people with reduced mobility – by lowering curbs and constructing of ramps for people with disabilities;

- Traffic calming measures;
- Conducting continuous education of city services (for the implementation of road safety analysis);
- Construction of the educational walking and cycling training sites;
- Conducting educational campaigns to raise road safety awareness.

4.7.1 Analysis of compliance with EU directives and international standards

Currently, the guidelines for the implementation of Directive 2008/96/EC on the road safety are in the process of drafting and acceptance by the Republic of Croatia. The concerning guideline in the process of preparating spatial and planning documentation is Road Safety Impact Assessment, as a part of the impact assessment carried out on road safety in the planning stage. Since the need for the proposal and selection of optimal transport solutions, as a part of regional plans, is not conditional to preliminary design or study, it is not possible to conduct the RSIA process. Moreover, the guidelines that are in the process of making for the Republic of Croatia are in contradiction to EU regulations. The change of spatial and planning documents is a very time-consuming, costly process, especially for land areas with a high value. In accordance with the above, it is necessary to change the conditions for preparing regional plans with parts dealing with traffic based on positive international examples. The analysis of the problems, which result from inadequate solutions as a part of spatial planning documents, is shown within the case study.

4.7.2 Road safety and vulnerable road users

Vulnerable road users (pedestrians, cyclists, children, elderly and people with disabilities) are the most endangered road users of the transport system. They are extremely vulnerable (vulnerable than others) and have a higher risk of injury in a collision with vehicles, unprotected from the outside (by the armor or shield), with no seat belts or air cushions to absorb the energy of the vehicle during a collision. The main danger for vulnerable road users, in the collision, are higher speeds and vehicle weights. In the narrowest sense, vulnerable road users are pedestrians (children, elderly, people with disabilities) and cyclists (on pedelecs or electric bicycles).

In statistical reports, accidents that occurred as a result of collisions with motor vehicles are generally recorded. Many accidents, involving vulnerable road users (falls, roadside hits, etc.), are not recorded, and therefore, the real state is unknown.

According the obtained data from Ministry of the Interior, Sisak Police Station, an in-depth analysis of

vulnerable road users accidents in Sisak in the last five years has been conducted. Detailed analysis is included in the annexes (Annex 3 - Annex 8).

Table 20. Accidents involving cyclists

Year	With casualties	With injuries	With material damage	Total accidents	Total casualties	Severe injuries	Minor injuries	Total injuries	Total involved
2011	0	31	5	36	0	13	15	28	28
2012	1	20	4	25	1	4	16	20	21
2013	1	21	3	25	1	9	11	20	21
2014	2	16	3	21	2	6	10	16	18
2015	0	13	6	19	0	2	11	13	13

Table 21. Accidents involving pedestrians

Year	With casualties	With injuries	With material damage	Total accidents	Total casualties	Severe injuries	Minor injuries	Total injuries	Total involved
2011	1	29	1	31	1	9	22	31	32
2012	2	11	1	14	2	3	10	13	15
2013	0	15	2	17	0	4	11	15	15
2014	1	19	0	20	1	10	9	19	20
2015	1	13	0	14	1	4	9	13	14

Table 20 and Table 21 show the total number of road accidents involving pedestrians and cyclists, and the total number of pedestrian and cyclist casualties in the City of Sisak. In general, there has been a decreasing trend in the number of injured pedestrians and cyclists. However, a positive decline in the reduction of traffic accidents involving vulnerable road users is not accompanied by the decrease in the number of traffic accidents considering drivers and passengers in motor vehicles on the national level. The number of casualties in the City of Sisak, can be assigned to the continuous construction of new road infrastructure, taking into account the pedestrian and cycling requirements.

4.7.3 Road safety analysis according to the Plan

According to the SUMP, the expansion the pedestrian zone primarily, and the application of the new traffic flow regulation in the city centre will significantly reduce the number of road accidents for all traffic participants, especially the most vulnerable road users (pedestrians and cyclists). With the in-depth analysis of road accidents in the City of Sisak, accidents blackspots as the intersection in the city centre (expressed by motor, pedestrian and cycling traffic) are obtained. Detailed analysis of the location and the number of accidents is in the annexes (Annex 9 – Annex 12), and the confirmation of the above is shown in the following two examples.

Extension of the pedestrian zone in the Stjepan and Antun Radić Street from the intersection with Ivan Kukuljević Sakcinski Street to the railway station. Based on the traffic accidents collected data and detailed analysis of the causes and consequences of road accidents in the city centre, the following can be concluded:

- The problems are not:
    - The existing traffic flow on the road network – the existing capacity of the two-lane street with unidirectioned traffic, where the pedestrian flow has medium intensity, parking spaces are located on one side of the street, the participation of commercial vehicles is relatively small, and the volume is about 2200 veh/h. On the other hand, the average measured traffic flow during the afternoon peak hours is about 150 veh/h and such volume is appropriate for the capacity;
    - The number of pedestrian crossings on the road, where the pedestrian volume is about 250 pedestrians;
- The problems are:
    - The large width of the corridor, with two lanes in one direction and space for on-street parking;
    - The roads are have excessive capaity (they are mostly unused);
    - Based on the above, there is a possibility of achieving high-speed vehicle movement in the city centre which poses a threat, especially for vulnerable road users.

The impact of SUMP in improving road safety in the city centre, is in the large extent by reducing the existing negative impacts of road accidents. In fact, the SUMP proposed the extension of the pedestrian zone in the entire corridor of the Stjepan and antun Radić Street to the railway station, in which the motor vehicles (except for delivery vehicles and other emergency and municipal services with special permissions) are proposed to be forbidden. Besides that, the longitudinal side streets (east-west) that intersect the future pedestrian zone, Ivan Kukuljević Sakcinski Street and Matija Gubec

Street will become streets without exits. The parallel streets with pedestrian zone, Rimska Street and Ante Starčević Street will become one-way streets. This will reduce the significant number of conflict points at intersections in the city centre, but also discourage the motor vehicles entering it. Pedestrians and cyclists will get a safer space for the movement by reducing the risk of road accidents.

In parallel with the pedestrian zone expansion, building high-quality cycling network paths will enhance the cyclist security. By the conducted analysis of bicycle accidents, it has been observed in the City of Sisak that the most cycling accidents happen on roads without a marked bicycle route.

In conclusion, it is necessary to change the design of the road network, i.e. public space according to the needs, satisfaction and better road safety for everyone.

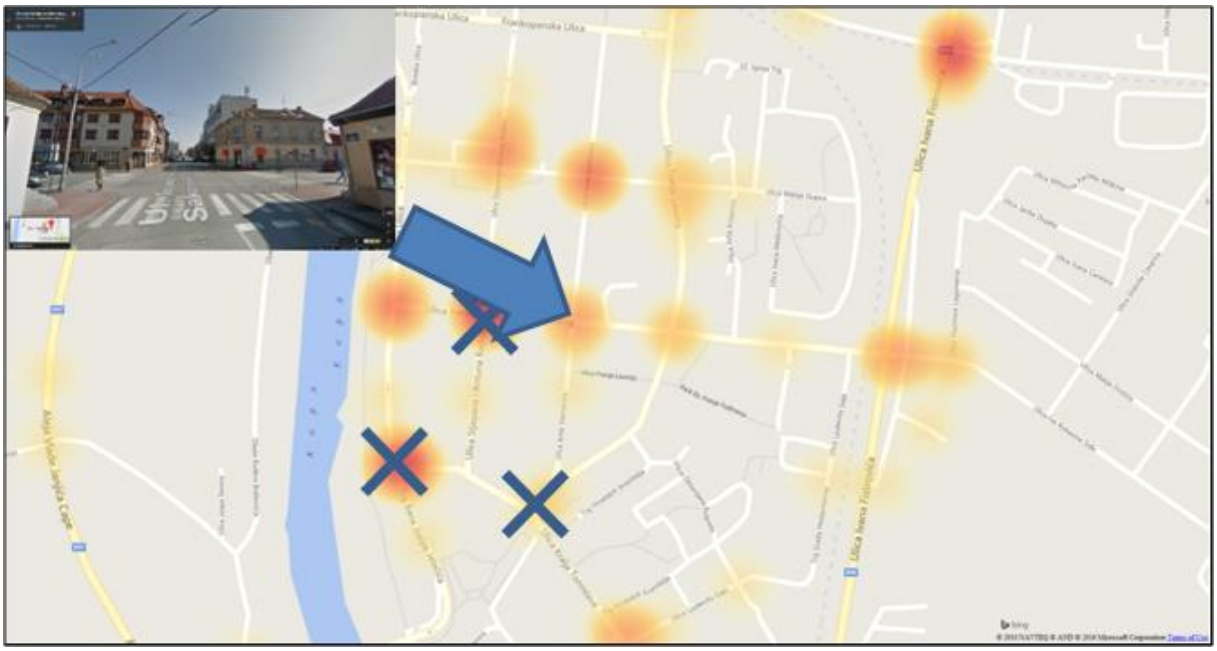


Figure 30. Accident blackspots in the city centre from 2012 to 2014 with the intersection of Ivan Kukuljević Sakcinski Street and Ante Starčević Street as a potential accident blackspot

Removing the conflicting points on the intersection of Ivan Kukuljević Sakcinski Street and Ante Starčević Street by introducing the new traffic flow regulation in the city centre. The intersection of Ivan Kukuljević Sakcinski Street and Ante Starčević Street (Figure 30) is a place with a high number of conflict points, and thus it is a potential accident blackspot.

The proposed solutions are:

- New traffic regulation (SUMP proposal by 2020);
- Mini roundabout with the over-driveable center;
- Traffic signal installation.

Figure 31 shows the proposed solution in which the total number of conflict points at the intersection of Ivan Kukuljević Sakcinski Street and Ante Starčević Street is reduced. Based on the newly-proposed traffic flow regulation on the road network in the City (by 2020), the current situation in the intersection zone is changing such that Ante Starčević Street becomes one-way. With this kind of solution, the risk of road accidents is reduced, since it reduces the total number of conflict points between vehicles and cyclists by 60%. In the scope of further improvements in intercsection capacity and safety, it is necessary to examine the possibility to introduce mini-roundabouts with over-driveable centre. Compared to the previously suggested regulation, the advantagre is better safety (the reduction of the nuber of conflict points is from 16 to 10, which is 38 %). The greatest problem are space limitations and space shortage. If the intersection cannot be constructed as a mini-roundabout (due to previously-mentioned reasons), the intersection has to be properly solved by introducing traffic lights.

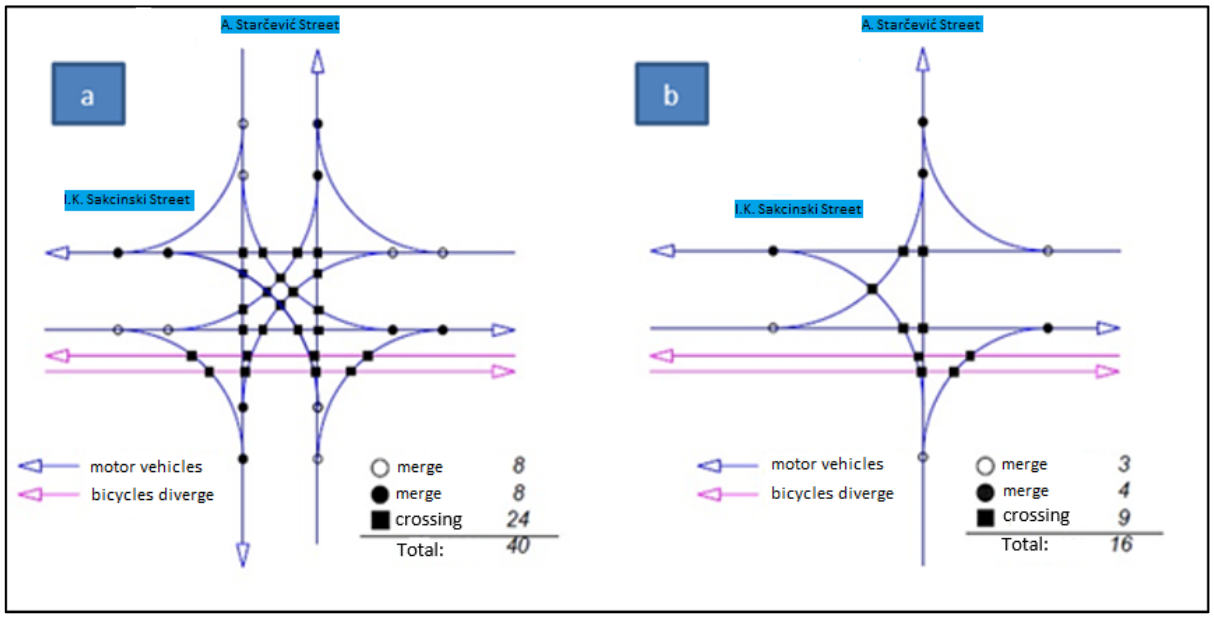


Figure 31. The number of conflict points depending on traffic regulation at the intersection of Ivan Kukuljević Sakcinski Street and Ante Starčević Street: existing (left) amd after the reconstruction (right)

4.7.4 Analysis and proposals to improve safety during road works

In the process of planning and organizing temporary traffic regulation in long-term and complex situations, a large number of interested parties are involved – the owner of the infrastructure, transport operators, traffic police and others. Their participation in every planning stage of temporary traffic regulation is highly important for the whole society. In order not to ignore safety, all stakeholders in traffic must comprehend that warnings have to be given or the attention has to be drawn to the limitations and dangers that exist on the road in the process.

Temporary traffic regulation is the establishment of a new traffic setting of a temporary nature under

the influence of various factors. Road works may pose a hazard, not only for road users (drivers and pedestrians), but also for the working staff that appears in the working zone.

With proper planning, organizing and implementing, temporary traffic regulation can improve road safety – not only in the working areas, but also on the access and exit areas. In this way, a safer working environment for all employees can be achieved. In order to achieve this, it is extremely important that, in the planning and organizing process, all interested parties are involved. In this manner, every problem that can arise can be solved properly. It is also important that, during the execution of works, contacts in order to solve the problems that arised later are being held. According to the mentioned above, during planning every operation on the infrastructure, it is necessary to create projects of temporary traffic regulation in the construction zone.

Temporary traffic regulation projects can be divided into three types: point, line and zone. Point temporary regulation can be simple - standard (e.g. with the reconstruction of the intersection in cities) and complex point provisional regulation (e.g. with the reconstruction of the large intersection in level in cities).

Temporary line regulation could be simpler - standard (e.g. with the reconstruction of streets in cities or on short highway sections) and complex, where original solutions are applied (e.g. with redirecting traffic on the highways partly or completely to the other roadway, keeping four lanes on a road with temporary regulation according to the logarithmic distribution).

Zonal temporary regulation is one of the most complex types of traffic regulation, in which it is necessary to harmonize traffic flows on the road sections with a high level of service, requiring specific knowledge of traffic flow theory. The zonal temporary traffic regulation, with temporary signs on the roads, extends over longer sections of highways and county roads.

4.7.5 The involvement of local authorities in the knowledge transfer with the aim of integrating road safety principles into transport planning

Assessment of Traffic Safety under the Directive is binding only for TEM roads, but it is recommended that Directive should be applied to all other roads. In Republic of Croatia, TEM network makes about 1,600 km of roads, where about 1,300 km are highways and 300 km are national roads. Although the backbone of the Sisak transport network are two state roads (D36 and D37), it is needed to make a safety assessment for the other roads in the City.

The importance of the Directive protocol enlargement on urban transport network is visible through to the road accident data. According to the traffic police data of the Republic of Croatia, in 2013, only

5 % of road accidents occurred on highways. Also, 57 % of accidents with casualties occurred in urban areas, and 78 % of total accidents with injuries occurred in urban areas.

In accordance with the Directive, road safety assessment must be carried out by an authorized person – auditor. The auditor is qualified person who independently assesses expert road solutions in terms of road safety in the planning and design phases, and reviews the existing road in terms of safety features. Because of the responsibility and complexity (especially when it comes to designing the urban transport network), the person who is an auditor must meet certain requirements and pass an audit examination.

4.7.6 The involvement of non-governmental organizations in programs to improve road safety and to introduce education for vulnerable road users

Today's trend in modern societies is conceived to educate road users on training sites. These are individually designed and constructed areas that are not in physical contact with the real transport, but give a very realistic picture of roads. There are different types of these sites, depending on the purpose. Sites for motor vehicles are used for training new drivers without previous driving knowledge. There are also specialized additional trainings of drivers who already have been driving (safe driving school). Sites for non-motorized traffic have primarily purpose, which is to educate people of school or pre-school age as well as the highest risk age groups in traffic. At a completely safe situations, the children come in various conflict situations in traffic and thus acquire a car culture, experience and knowledge that will be used in the entire life.

To increase the safety of bicycle and pedestrian traffic in Sisak, it is also necessary to conduct continuous education, for younger and older ones, especially when it comes to bicycle traffic.

Education on traffic training sites is not the only solution, but it is essential to increase the safety of every road user. Theoretical training in school is necessary, but it is insufficient. A practical approach to the problem, with professional staff qualified for working with children, results in the real impression, from which children can learn the most in controlled environment. The basic objectives are:

- Indication of threats in certain situations;
- Correct thinking and response;
- Adoption of correct and right-time decisions;
- Acquisition of responsibility for one's actions.

Children as pedestrians or cyclists gain some new experiences and knowledge, and at the same time,

they are not exposed to any danger as in everyday life. The first contact with a new, to them unknown traffic signs and signalised intersections, roundabouts, railway crossings, and even the traffic policeman, will contribute to the overall understanding of the very complex traffic processes.

Because of this, it is realistic to expect that a training site significantly contributes to raising traffic awareness among young people, and thus, the most desired effect – significant reduction of the number of casualties in traffic, will be achieved.

As part of the Plan, the training sites for all primary schools and kindergartens in Sisak are predicted. Site construction and training is scheduled for 2020. The education of young children about safety by joining traffic with bicycles is not mandatory at the national level, but many stakeholders encourage the introduction of such kind of training in order to reduce the number of traffic accidents involving cyclists and to encourage children to use bicycles for daily commuting.

4.7.7 The measures and indicators for improving road safety in the City of Sisak

Regarding the improvement of road safety level in Sisak and its surrounding areas, the Police Department of Sisak-Moslavina County (supported by the City of Sisak) occasionally co-finances measures to improve road safety. These measures are primarily related to rasing the level of road safety in the area of schools and playgrounds in the City of Sisak.

Table 22. Road safety measures

Measure	*Period*
Adaptation of infrastructure for people with reduced mobility - lowering curbs and construction of ramps for people with disabilities	2017 - 2020
Traffic calming measures	2017 - 2020
Conducting continuous education of city services for safety analysis and implementation	2017 - 2020
Construction of educational pedestrian and bicycle training site	2017 - 2020
Conducting educational campaigns to raise road safety awareness	2017 - 2020

Under this Plan, and for the purpose of further road safety improvement, measures are proposed, stated in Table 22.

In order to increase the safety of all road users, it is necessary to continuously monitor the main indicators, shown in Table 23.

Table 23. Road safety indicators

Indicator	*Measurement method*	*Evaluation*	*Methodology*
Number of accidents (casualties, injuries and material damage)	Number	Yearly	Annual report
Types of vehicles in road accidents	Type of vehicle	Yearly	Annual report

Indicator	Measurement method	Evaluation	Methodology
Injured road users	Type of user	Yearly	Annual report
Education of the city services	Number of activities	Yearly	Annual report
Pedestrian and bicycle activities at the training site	Number of activities	Yearly	Annual report
Conducted activities in the field of safety	Number of campaigns, workshops, lectures, working groups activities	Yearly	Annual report

4.8 The role of public and private sector in service provision

Quality management in developing sustainable urban mobility requires the City, as the holder of such a project, for close cooperation between the different stakeholders in businesses, citizens and other stakeholders. In fact, the term "management" is a term for a culture of good cooperation in decision-making, and this should be the modus operandi for connecting public and private entities in sustainable urban mobility. The practice has shown that the private sector can encourage the public sector to continuously provide quality and improve its services. So today, public institutions increasingly seek cooperation with the real sector, which can contribute significantly to the quality of transport projects primarily in the project planning and implementation by improving accessibility (closeness to residence, work, etc.), accessibility (usable by the majority of the population), the adaptive prices (reasonable costs for citizens), and comfort and safety in urban public transport.

These improvements in the private sector are achieved based on three key approaches: rational operations and savings in public transport, the establishment of innovative concepts for urban mobility, and by taking some of the responsibilities and risks in the public transport operations:

- When the private sector is investing its own resources for the performance of public transport services, it reduces the need for public sector resources, and then the resources can be invested in the other development areas of the City. Also, private public transport operators are more likely to have a rational resource management, achieving cost savings throughout the value chain of the urban mobility;
- The establishment of innovations relates to the improvement of public transport services according to the world's best practices through knowledge and expertise of the private sector, which is often much more agile in tracking new trends and technological improvements. As examples, the improvement of rolling stock management and maintenance, new routes establishment, more efficient resource utilization, and cost reduction can be pointed out;
- When a private company, best suited and best equipped to perform services in public transport, takes the role of bearer of services, then it takes the part of the responsibilities and risks, which increases the overall value added in transport sector. Therefore, during the selection of a private operator for the performance of public transport services, the cities take into account the previous experience, the availability of the necessary resources and implementation plan of public transport in order to determine whether a private operator is willing to take responsibility and the expected risks in the public transport system.

To achieve and maintain the required expectations of private sector in sustainable urban mobility, and

ultimately, to achieve private interests, it is necessary that the city creates a platform for joint financial initiatives. Such initiatives are realized in four general steps:

- Identification of needs - including detailed scheduling of all needs in the field of sustainable urban mobility that affect the success of providing services to citizens. It is necessary to conduct a detailed review of the whole transport system and related financial indicators, and to make comparison with transport services in comparable cities;
- Choice between public financing and public-private partnerships - includes conducting financial analysis as a basis for choosing between public financing and public-private partnerships. Generally, the projects that have a higher value than the market rate of return are suitable for public-private partnerships (PPP);
- The development of public-private partnership structures - including the definition of owners of involved property/resources, and consequently, the identification od risk allocation in the project;
- Preparation for the acquisition of services - in accordance with a defined structure, public procurement services are prepared through a high-detail elaborated tender in accordance with the before-made analysis of needs and the expected level of services.

As pointed out, the models involving the private partners in the provision of services as part of the public transport services (eg. Parking services) can be a kind of institutional or contracted public-private partnerships. In December 2014, the amendments of the Law on Public-Private Partnership (NN 152/14) enabled contracts of public-private partnerships with value less than or equal to 5 million EUR. This allowed the off-balance sheet financing of public infrastructure projects that, by definition of Eurostat and the Budget Law, does not belong in public financial obligations.

Institutional PPP is based on the co-ownership relationship of local government and private partner, which is considered as the alternative to privatization. Contractual PPP is concluded for a definite period and represents all forms of partnership between local governments and private partners who are defined by the contract, as in the case of parking construction and management. The most common models of contractual PPPs are service contracts, management, leasing, concession, and the contract to build-operate-trasfer / BOT infrastructure. It should be noted that the concession contracts are the most common and are used in approximately 70 % of cases. When the goal of the PPPs is to increase efficiency of service, a service contract or a management contract applies, and if a significant investment by the private partner is expected, then the concession contract by BOT is used.

When selecting the PPP model, is extremely important to implement the following analysis as a

condition for the establishment of sustainable cooperation:

- Legal analysis - includes the analysis of the existing laws governing jurisdiction and ways to manage the services, describes how to perform control over the service, defines binding quality standard services and price policy. Where appropriate, the legal analysis also includes an analysis of the law on occupational safety and the law on foreign investment. Also, besides taking care of respecting the laws of Croatia, cities or local governments must take into account the adjustment of its own legal framework (statutes, regulations, etc.) for the implementation of the selected PPP model in the performance of services in urban public transport;
- Technical analysis - provides a snapshot of the current state of the required services, contributing to the identification of possibilities to improve the same through the introduction of PPP and ultimately defines the specifications of future services that will be entrusted to private business partner;
- Financial and economy analysis - enables the assessment of the financial viability and justification for carrying out the required services and investment in facilities. The main indicators of the profitability of the project include the net present value, internal rate of return / refund and payback period;
- Risk analysis - derives from the fundamental assumptions of establishing a PPP or the assessment / calculation of demand that affects how the expected costs of the project and the expected revenues (especially in the case if a major source of cash flow are user charges such as tolls or parking payments). The creation of assumptions and making traffic forecast / model present a significant risk of deviations from the actual level of traffic, no matter how good the models / forecasts are. With such an element of uncertainty, defining and then the allocation of risks between public and private partners is a key dimension of making high-quality public-private partnerships.

The proposals of some of the segments, where the City recommends the consideration of active involvement of private partners in the project, are described below.

The "smart city" project that greatly influences traffic segment. In addition to construction projects, the framework of the PPP model provides the possibility to make additional budget revenues or savings for cities in other areas and by implementing the concept of smart city. The wide involvement of private partners can provide significant savings for example in the street / public lighting. The public lighting is a part of the municipal infrastructure of each residential area whose construction and maintenance is regulated by the Utilities Act in the last ten years under the jurisdiction of cities and municipalities. One of the solutions for contracting PPPs with private companies is to offer a complete,

full service improvement of the urban traffic segment: designing, financing (partially or totally based on savings), setting up and managing street lighting. In addition (or as part of the same project) to the establishment of new lighting infrastructure, it is possible to implement systems such as surveillance (monitoring consumption and cost, noise, traffic density, emissions), wireless telecommunication systems, charging stations for electric cars and other systems that allow the creation of additional revenue for the local economy and the city budget.

Road maintenance. A PPP town may also establish cooperation with the private sector in the field of rehabilitation and maintenance of roads, which is used to maximize the efficiency of management and maintenance of transport assets. The arrangement of such cooperation is mostly based on the specifications of the output requirements and the required result, opposite to the means of achievement. So this kind of private company engagement belongs to the category of contracts based on performance (Performance-based contracting). Therefore, the effectiveness of agreements differ significantly from traditional contracts for road rehabilitation and maintenance to avoid the tendency of private partners to maximize the amount of work in order to increase revenue of the company. The content of the effectiveness contract of the private partner is encouraged to provide more efficient services by a small number of field tasks with respect to the agreed level of maintenance and rehabilitation of roads (The Services Levels). The role of the City in such PPP is the monitoring (quantitative and qualitative) of service levels in accordance with the contract, and monitoring the compliance with laws and regulations. By the definition of such a contract, it is necessary to take into account the following criteria: the volume and type of traffic, the current status (quality) and the type of roads (urban, rural), type of terrain (mountainous, flat, etc.), the quality of the available building materials, the capacity of potential private partners, and the restrictions related to the environmental protection. It is also necessary to assess which level of service is financially justified for certain roads. The implementation of the agreement on the service effectiveness provides savings from 10% up to 40% compared with traditional contracts for road rehabilitation and maintenance, and it shows the improvement trend of road assets condition and reduction of the number of roads in poor condition.

The inclusion of private partners in offering public transport services. By increasing the number of partners in public transport, the role of the City should be gradually changed from the operator to the contractor, coordinator and supervisor of services. Such a role implies ensuring a common platform for all interested partners / stakeholders of urban traffic able to connect with it, and to upgrade it. An integral part of the platform would be the Integrated Transport Ticket, which includes measures and activities to simplify and unify tariff schemes for different transport systems within a metropolitan area or region. This aims to increase the interoperability of different networks and to encourage the growth of the total number of users of public transport system. One of the practical possibilities for the City of

Sisak is the integration of passenger tickets for buses and railways with a system of public bicycles (e.g. Nextbike) or car-sharing (e.g. Spin City) on a single card. Also, the same card could allow taxi and parking payments. With such a card, users can make payment on the website / platform, where they could be also offered a wide range of related information. Most of the services could be paid for by subscriptions or an individual service (pay-per-use). In addition, subscribers / users could thus provide a wide range of savings for every mode of transport. The Integrated Transport Ticket is a great example of the integration of the private sector in public transport system which encourages more efficient and more effective utilization of various vehicle types, and thus relieves traffic and reduces congestion in the city which is in line with the guidelines of this document. Moreover, private partners may include the regulation of bus stops, and, in return, they get the chance to rent marketing space at these locations. There are a number of other practical examples, some of which were described earlier in this document (Sections 4.2.9 and 4.2.17).

The inclusion of private partners in the segments of real estate and mobile property. When it comes to private sector, the involvement in business activities of city enterprises in charge of public transport, such as AP Sisak, it is possible in segments of property utilization, movable and non-core business (e.g. marketing), and outsourcing certain non-core society functions.

Sisak Bus Station, as an important and frequent point of the City it has strategic value to AP Sisak, which now tends to the coarsening stake in the business entity. In fact, one of the owners of Sisak Bus Station, company Slavijatrans Ltd is in bankruptcy, and it is the best interest for AP and the City of Sisak to acquire Slavijatrans Ltd by auction.

The estimation for the Sisak Bus Station, conducted in 2014 by a court expert (the Station is a buiding with land included), resulted with value of 2.874.804,83 HRK or 375.300,89 EUR (1 EUR = 7,66 HRK). By ownership, the value is divided into:

- AP: 55 % (1.581.142,66 HRK);
- Slavijatrans Ltd Petrinja (in bankruptcy): 40 % (1.149.921,93 HRK);
- Autoprijevoz Dvor: 5 % (143.740,24 HRK).

Without the consolidation of ownership of Sisak Bus Station, it is not advisable to make further investments in infrastructure, having significant participation of a new private entity in the station processes. By addressing current barriers, opportunities open up, and they include new private companies for the Stations via:

  - Entering into the ownership structure and establishing a new management model fo the Bus Station (by selling the AP share and separating operations management and

maintenance to external contractors);

- Renting the available office space for additional commercial activities inside the Station, ATMs, etc.)

- Other real estate owned by AP Sisak – for the property next to the company headquarters, the AP has the proper documentation and the potential to be relatively quickly put into the market. Also, the adjacent land is owned by the company in the bankruptcy which has one million HRK debt to the AP. Therefore, there is a legitimate interest to purchase that land by the AP and the City in order to complete the field adjacent to AP Sisak headquarters, and thus to be more attractive to potential private investors, or even the City of Sisak, with the goal of realocation of utilities from the centre and the formation of the utility holding company and its realocation to this property;
- Outsourcing - so far, the AP outsourced the cleaning services and security services, and a percentage of the tickets are sold by kiosks. Other possibilities refer to outsourcing other non-core business processes such as accounting, marketing and similar operations.

The inclusion of private partners in the field of electro-mobility. Given the growing presence of electric vehicles and their rapid growth, it is believed that the installation of electric charging stations has a great potential for the City, and as such investment would represent a great interest for private partners.

5 COST ESTIMATIONS

Within the Sisak Urban Transport – SUMP project, an estimation of the investment costs for the measures within specific areas was made according to the planning horizon. The cost estimation was made for the measures within public transport, pedestrian and bicycle traffic, road infrastructure, city logistics, road safety and parking policy management. At the end of the section, a cost estimation according to the responsible bodies and areas was made for short-term (2017), mid-term (2020) and long-term (2030) periods:

- By areas in detail: Table 24 - Table 29;
- By areas in general: Table 30 - Table 35;
- By areas and responsibilities in total: Table 36 and Table 37, respecitvely.

Table 24. Investment cost estimations for public transport

Code	Measure	Estimated costs in HRK	Difficulty	Responsibility	2017 HRK	2020 HRK	2030 HRK
1	PT visual identity - project	150.000	Low	AP	150.000		
1	Route adjustments (Line 1 shortening)		Low	AP			
3	Route 3 extension to Tomićev put – construction works	200.000	Medium	City of Sisak	200.000		
3	New pilot line to Galdovo	300.000	Medium	City of Sisak	300.000		
5	Service improvements (interval reduction from 15 to 10 minutes on the route Kolodvor – Željezara by adding two buses)	3.000.000	Medium	AP	3.000.000		
1	Converting the stop Kolodvor into a terminal - project	25.000	Medium	AP	25.000		
3	Converting the stop kolodvor into a terminal – construction works	225.000	Medium	AP	225.000		
4	E-ticketing in public transport		Medium	AP			
4	Public bicycle scheme	600.000	Medium	City of Sisak	600.000		
1	Tariff system - project	500.000	Low	AP	500.000		
4	Introducing wireless internet into city buses	30.000	Low	AP		30.000	
1	Bus stop renewal – phase 1 (project)	250.000	High	AP		250.000	
3	Bus stop renewal – phase 1 (construction works)	2.250.000	High	AP		2.250.000	
1	Introducing real-time information displays – phase 1 (project)	50.000	Medium	AP		50.000	
3	Introducing real-time information displays – phase 1 (construction works)	100.000	Medium	AP		100.000	
4	Introducing real-time information displays – phase 1 (devices)	350.000	Medium	AP		350.000	
1	Public transport promotion	40.000	Low	City of Sisak		13.333	26.667
1	Taxi service improvements	300.000	Medium	City of Sisak,		100.000	200.000

Code	Measure	Estimated costs in HRK	Difficulty	Responsibility	2017 HRK	2020 HRK	2030 HRK
				taxi service providers			
1	Bus stop renewal – phase 2 (project)	200.000	High	AP			200.000
3	Bus stop renewal – phase 2 (construction works)	1.800.000	High	AP			1.800.000
1	Introducing real-time information displays – phase 2 (project)	50.000	Medium	AP			50.000
3	Introducing real-time information displays – phase 2 (construction works)	100.000	Medium	AP			100.000
4	Introducing real-time information displays – phase 2 (devices)	350.000	Medium	AP			350.000
1	Further line route adjustments due to the new bridge	400.000	Medium	AP			400.000
5	Replacing the existing bus park with new eco-friendly buses until 2030	39.375.000	High	AP			39.375.000
5	Tourist train	1.500.000	Medium	City of Sisak			1.500.000
1	On-demand transport	900.000	Medium	AP			900.000
1	Bus priority on signalized intersection (project)	150.000	High	AP			150.000
4	Bus priority on signalized intersection (machinery and equipment)	1.350.000	High	AP			1.350.000
INTEGRATED TRANSPORT							
1	Public car scheme – Carsharing	529.000	Medium	City of Sisak	529.000		
1	Multimodal real-time app for journey planning in PT (bus and train), public bicycle, walking, carpooling	80.000	Low	AP		80.000	
1	First Park-and-Ride car park in Kralj Zvonimir Street (project)	300.000	High	City of Sisak		300.000	
3	First Park-and-Ride car park in Kralj Zvonimir Street (construction works)	5.300.000	High	City of Sisak		5.300.000	
1	Integrating public transport and railway system	100.000	High	City of Sisak, AP, Croatian Railways		100.000	
1	Second Park-and-Ride car park between Ivan Fistrović Streer, Nikola Tesla Street and the railroad (project)	300.000	High	City of Sisak			300.000
3	Second Park-and-Ride car park between Ivan Fistrović Streer, Nikola Tesla Street and the railroad (construction works)	6.900.000	High	City of Sisak			6.900.000
TOTAL PER YEAR, HRK					**5.529.000**	**8.923.333**	**53.601.667**
TOTAL, HRK							**68.054.000**

PUBLIC TRANSPORT

Responsibility	2017 HRK	2020 HRK	2030 HRK	TOTAL HRK
City of Sisak	1.629.000	5.613.333	10.876.667	18.119.000
AP	3.900.000	3.110.000	42.525.000	49.535.000
City of Sisak, taxi service providers		100.000	200.000	300.000
City of Sisak, AP, Croatian Railways		100.000		100.000
TOTAL PER YEAR	**5.529.000**	**8.923.333**	**53.601.667**	**68.054.000**

Table 25. Investment cost estimations for pedestrian and bicycle traffic

Code	Measure	Estimated costs in HRK	Difficulty	Responsibility	2017 HRK	2020 HRK	2030 HRK
1	Pedestrian zone reconstruction – in progress (project)		Low	City of Sisak			
3	Pedestrian zone reconstruction – in progress (construction works)		Low	City of Sisak	5.300.000		
1	Bicycle path/lane construction (project)	500.000	Low	City of Sisak	500.000		
3	Bicycle path/lane construction (construction works)	7.600.000	Low	City of Sisak	7.600.000		
1	Removing the existing obstacles fpr pedestrians and cyclists (project)	25.000	Medium	City of Sisak	25.000		
3	Removing the existing obstacles fpr pedestrians and cyclists (construction works)	225.000	Medium	City of Sisak	225.000		
1	Pedestrian zone reconstruction – (project)	300.000	Medium	City of Sisak		300.000	
3	Pedestrian zone reconstruction – (construction works)	5.400.000	Medium	City of Sisak		5.400.000	
1	Bicycle path/lane construction (project)	300.000	Low	City of Sisak		300.000	
3	Bicycle path/lane construction (construction works)	4.700.000	Low	City of Sisak		4.700.000	
1	Pedestrian underpass 10 m wide (project)	1.900.000	High	City of Sisak		1.900.000	
3	Pedestrian underpass 10 m wide (construction works)	9.000.000	High	City of Sisak			9.000.000
1	Bicycle path/lane construction (project)	1.100.000	Low	City of Sisak		1.100.000	
3	Bicycle path/lane construction (construction works)	19.900.000	Low	City of Sisak			19.900.000
				TOTAL PER YEAR, HRK	8.350.000	11.000.000	31.600.000
				TOTAL, HRK			50.950.000

PEDESTRIAN AND BICYCLE TRAFFIC				
Responsibility	2017 HRK	2020 HRK	2030 HRK	TOTAL HRK
City of Sisak	8.350.000	11.000.000	22.600.000	41.950.000
Ministry of culture			9.000.000	9.000.000
TOTAL PER YEAR	8.350.000	11.000.000	31.600.000	50.950.000

Table 26. Investment cost estimations for road infrastructure

Code	Measure	Estimated costs in HRK	Difficulty	Responsibility	2017 HRK	2020 HRK	2030 HRK
1	Reconstruction of the intersection D36 Nikola Tesla Street – first phase of introducing traffic lights (project)	42.000	High	City of Sisak, Croatian Roads	42.000		
3	Reconstruction of the intersection D36 Nikola Tesla Street – first phase of introducing traffic lights (construction works)	378.000	High	City of Sisak, Croatian Roads	378.000		

Code	Measure	Estimated costs in HRK	Difficulty	Responsibility	2017 HRK	2020 HRK	2030 HRK
1	Reconstruction of the intersection D37/D224 – change into a roundabout (project)	220.000	High	Croatian Roads	220.000		
3	Reconstruction of the intersection D37/D224 – change into a roundabout (construction works)	1.980.000	High	Croatian Roads	1.980.000		
1	Reconstruction of the intersection D36 – Nikola Tesla Street – second (denivelation) stage (project)	3.000.000	Medium	City of Sisak			3.000.000
3	Reconstruction of the intersection D36 – Nikola Tesla Street – second (denivelation) stage (construction works)	35.100.000	Medium	Croatian Roads			35.100.000
3	Reconstruction of the intersection D36 – Nikola Tesla Street – second (denivelation) stage (construction works)	81.900.000	Medium	Croatian Roads			81.900.000
1	D36 – Variant A, Odra Bridge (project)	3.295.000	High	Croatian Roads		3.295.000	
3	D36 – Variant A, Odra Bridge (construction works)	29.655.000	High	Croatian Roads		29.655.000	
1	D36 – Variant B, without the connection to the highway A11 (project)	2.000.000	Medium	Croatian Roads		2.000.000	
3	D36 – Variant B, without the connection to the highway A11 (construction works)	45.840.000	Medium	Croatian Roads		45.840.000	
1	Change in traffic flow regulation, reconstruction of roads in the vicinity of the pedestrian zone, with the Old Bridge underpass (project)	500.000	Medium	City of Sisak		500.000	
3	Change in traffic flow regulation, reconstruction of roads in the vicinity of the pedestrian zone, with the Old Bridge underpass (construction works)	8.410.000	Medium	City of Sisak		8.410.000	
1	Traffic light optimization (project)	200.000	Medium	City of Sisak		200.000	

Code	Measure	Estimated costs in HRK	Difficulty	Responsibility	2017 HRK	2020 HRK	2030 HRK
4	Traffic light optimization (machinery and equipment)	140.000	Medium	City of Sisak		140.000	
4	Traffic light optimization (machinery and equipment)	1.260.000	Medium	Croatian Roads		1.260.000	
1	Automated traffic control (project)	200.000	Low	City od Sisak, Croatian Roads		200.000	
4	Automated traffic control (machinery and equipment)	480.000	Low	City of Sisak, Croatian Roads		200.000	
4	Automated traffic control (machinery and equipment)	120.000	Low	Croatian Roads		120.000	
1	Bridge over the Kupa River in the city centre in parallel to the railroad bridge (project)	4.000.000	High	City of Sisak	4.000.000		
3	Bridge over the Kupa River in the city centre in parallel to the railroad bridge (construction works)	76.000.000	High	City of Sisak		76.000.000	
1	Road bridge on the Kupa River next to Kratečko or Lukavec Posavski (project)	2.000.000	Medium	City of Sisak			2.000.000
3	Road bridge on the Kupa River next to Kratečko or Lukavec Posavski (construction works)	38.000.000	Medium	City of Sisak			38.000.000
1	D36 to Novo Selo Palanječko and the bridge over Sava River (project)	4.000.000	Medium	Croatian Roads			4.000.000
3	D36 to Novo Selo Palanječko and the bridge over Sava River (construction works)	86.000.000	Medium	Croatian Roads			86.000.000
1	D36 to Veliko Svinjičko and Gušća (project)	2.000.000	Medium	City of Sisak	2.000.000		
3	D36 to Veliko Svinjičko and Gušća (construction works)	66.000.000	Medium	City of Sisak		66.000.000	
				TOTAL PER YEAR, HRK	**8.620.000**	**234.100.000**	**250.000.000**
				TOTAL, HRK			**492.720.000**

ROAD INFRASTRUCTURE

Responsibility	2017 HRK	2020 HRK	2030 HRK	TOTAL HRK
City of Sisak	2.000.000	75.730.000	43.000.000	120.730.000
City of Sisak, Croatian Roads	420.000	200.000	-	620.000
Croatian Roads	6.200.000	158.170.000	207.000.000	371.370.000
TOTAL PER YEAR	**8.620.000.00**	**234.100.000**	**250.000.000**	**492.720.000**

Table 27. Investment cost estimations for parking

Code	Measure	Estimated costs in HRK	Difficulty	Responsibility	2017 HRK	2020 HRK	2030 HRK
1	Parking zone extension in the city centre by the city marketplace - devices and signallization (project)	12.000	High	City of Sisak	12.000		
4	Parking zone extension in the city centre by the city marketplace - devices and signalization (equipment)	108.000	High	City of Sisak	108.000		
1	Parking zone extension in the city centre between Franjo Lovrić, Ante Starčević and Ivan Kukuljević Sakcinski streets - project	20.000	High	City of Sisak		20.000	
4	Introducing parking charging scheme by Ivo Pedišić Hospital – devices and signalization	50.000	Medium	City of Sisak	50.000		
1	Co-financing model and parking surface construction within buildings as blocks (project)	100.000	High	City of Sisak	100.000		
3	Co-financing model and parking surface construction within buildings as blocks (construction works)	900.000	High	City of Sisak	900.000		
1	Corrections within the existing parking tariff system	300.000	High	City of Sisak	300.000		
				TOTAL PER YEAR, HRK	**1.470.000**	**20.000**	
				TOTAL, HRK			**1.490.000**

PARKING POLICY MANAGEMET				
Responsibility	**2017 HRK**	**2020 HRK**	**2030 HRK**	**TOTAL HRK**
City of Sisak	1.470.000	20.000		1.490.000
TOTAL PER YEAR	**1.470.000**	**20.000**		**1.490.000**

Table 28. Investment cost estimations for city logistics

Code	Measure	Estimated costs in HRK	Difficulty	Responsibility	2017 HRK	2020 HRK	2030 HRK
1	Change in the Decision on road traffic in the City of Sisak (Ofiicial Gazette on the Sisak-Moslavina County 14/06, 6/09, 1/13)	20.000	Low	City of Sisak	20.000		
1	Adoption of the Decision on means of charging and parking space definition for delivery vehicles in the City of Sisak	20.000	Low	City of Sisak	20.000		
1	Video surveillance system – introduction and maintenance (project)	25.000	High	City of Sisak	25.000		
4	Video surveillance system – introduction and maintenance (equipment)	225.000	High	City of Sisak	225.000		
1	Introducing utility officers	130.000	Medium	City of Sisak	130.000		
1	Parking space marking for delivery and cargo vehicles by traffic signs and horizontal markings (project)	5.000	Medium	City of Sisak	5.000		
3	Parking space marking for delivery and cargo vehicles by traffic signs and horizontal markings (construction works)	30.000	Medium	City of Sisak	30.000		
1	The construction of the	1.000.000	High	City of Sisak			1.000.000

Code	Measure	Estimated costs in HRK	Difficulty	Responsibility	2017 HRK	2020 HRK	2030 HRK
	distribution centre in the City of Sisak (project)						
3	The construction of the distribution centre in the City of Sisak (construction works)	11.000.000	High	City of Sisak			11.000.000
				TOTAL PER YEAR, HRK	455.000		12.000.000
				TOTAL, HRK			12.455.000

CITY LOGISTICS

Responsibility	2017 HRK	2020 HRK	2030 HRK	TOTAL HRK
City of Sisak	455.000		12.000.000	12.455.000
Public-private partnership				
TOTAL PER YEAR	455.000		12.000.000	12.455.000

Table 29. Investment cost estimations for road safety

Code	Measure	Estimated costs in HRK	Difficulty	Responsibility	2017 HRK	2020 HRK	2030 HRK
1	Infrastructure adjustments for people with disabilities – curb lowering and ramps (project)	38.000	High	City of Sisak	38.000		
3	Infrastructure adjustments for people with disabilities – curb lowering and ramps (construction works)	342.000	High	City of Sisak	342.000		
1	Traffic calming measures (project)	350.000	Medium	City of Sisak, Croatian Roads	175.000	175.000	
3	Traffic calming measures (construction works)	3.150.000	Medium	City of Sisak, Croatian Roads	1.575.000	1.575.000	
1	Continuous education of City administration for conducting road safety analysis	500.000	High	City of Sisak	125.000	125.000	250.000
1	Educational activities to raise awareness of the public	600.000	High	City of Sisak, Ministry of Interior, NGOs	150.000	150.000	300.000
1	Educational bicycle-pedestrian training site (project)	54.000	Medium	City of Sisak		54.000	
3	Educational bicycle-pedestrian training site (construction works)	486.000	Medium	City of Sisak		486.000	
				TOTAL PER YEAR, HRK	2.405.000	2.565.000	550.000
				TOTAL, HRK			5.520.000

ROAD SAFETY

Responsibility	2017 HRK	2020 HRK	2030 HRK	TOTAL HRK
City of Sisak	505.000	665.000	250.000	1.420.000
City of Sisak, Croatian Roads	1.750.000	1.750.000		3.500.000
City of Sisak, Ministry of Interior, NGOs	150.000	150.000	300.000	600.000
TOTAL PER YEAR	2.405.000	2.565.000	550.000	5.520.000

Table 30. Capital investments in public transport

Investment type	2017 HRK	2020 HRK	2030 HRK
Projects	1.204.000,00	893.333,33	2.226.666,67
Construction works (without building parcels)	725.000,00	7.650.000,00	8.800.000,00
Machinery and equipment	600.000,00	380.000,00	1.700.000,00
Transport vehicles	3.000.000,00	-	40.875.000,00
TOTAL PER YEAR	**5.529.000,00**	**8.923.333,33**	**53.601.666,67**

Table 31. Capital investments in pedestrian and bicycle traffic

Investment type	2017 HRK	2020 HRK	2030 HRK
Projects	525.000,00	3.600.000,00	-
Construction works (without building parcels)	7.825.000,00	7.400.000,00	31.600.000,00
Machinery and equipment	-	-	-
Transport vehicles	-	-	-
TOTAL PER YEAR	**8.350.000,00**	**11.000.000,00**	**31.600.000,00**

Table 32. Capital investments in road infrastructure

Investment type	2017 HRK	2020 HRK	2030 HRK
Projects	6.262.000,00	6.195.000,00	9.000.000,00
Construction works (without building parcels)	2.358.000,00	225.905.000,00	241.500.000,00
Machinery and equipment	-	2.000.000,00	-
Transport vehicles	-	-	-
TOTAL PER YEAR	**8.620.000,00**	**234.100.000,00**	**250.000.000,00**

Table 33. Capital investments in parking policy management

Investment type	2017 HRK	2020 HRK	2030 HRK
Projects	412.000,00	20.000,00	-
Construction works (without building parcels)	900.000,00	-	-
Machinery and equipment	158.000,00	-	-
Transport vehicles	-	-	-
TOTAL PER YEAR	**1.470.000,00**	**20.000,00**	**-**

Table 34. Capital investments in city logistics

Investment type	2017 HRK	2020 HRK	2030 HRK
Projects	200.000,00	-	1.000.000,00
Construction works (without building parcels)	30.000,00	-	11.000.000,00
Machinery and equipment	225.000,00	-	-
Transport vehicles	-	-	-
TOTAL PER YEAR	**455.000,00**	**-**	**12.000.000,00**

Table 35. Capital investments in road safety

Investment type	*2017 HRK*	*2020 HRK*	*2030 HRK*
Projects	488.000,00	504.000,00	550.000,00
Construction works (without building parcels)	1.917.000,00	2.061.000,00	-
Machinery and equipment	-	-	-
Transport vehicles	-	-	-
TOTAL PER YEAR	**2.405.000,00**	**2.565.000,00**	**550.000,00**

Table 36. SUMP costs by responsible entities

Responsibility	*2017 HRK*	*2020 HRK*	*2030 HRK*
City of Sisak	18.409.000,00	115.828.333,33	77.726.666,67
AP	3.900.000,00	3.110.000,00	42.525.000,00
City of Sisak and taxi service providers*	-	100.000,00	200.000,00
City of Sisak, AP, Croatian Railways**	-	100.000,00	-
City of Sisak, Croatian Roads*	2.170.000,00	1.950.000,00	-
Croatian Roads***	2.200.000,00	135.370.000,00	207.000.000,00
Public-private partnership	-	-	11.000.000,00
Ministry of culture**	-	-	9.000.000,00
City of Sisak, Ministry of Interior, NGOs	150.000,00	150.000,00	300.000,00
TOTAL	**26.829.000,00**	**256.608.333,33**	**347.751.666,67**
* One half of the total costs for each participant			
** One third of the total costs for each participant			
*** Public-private partnership			

Table 37. SUMP costs by activity areas

Activity area	*2017 HRK*	*2020 HRK*	*2030 HRK*
Public transport	5.529.000,00	8.923.333,33	53.601.666,67
Pedestrian and bicycle traffic	8.350.000,00	11.000.000,00	31.600.000,00
Road infrastructure	8.620.000,00	234.100.000,00	250.000.000,00
City logistics	455.000,00	-	12.000.000,00
Parking policy management	1,470.000,00	20.000,00	-
Road safety	2.405.000,00	2.565.000,00	550.000,00
TOTAL	**26.829.000,00**	**256.608.333,33**	**347.751.666,67**

6 STRATEGIC ENVIRONMENTAL ASSESSMENT

The objective of the Sustainable Urban Mobility Plan for the City of Sisak (SUMP) is to define guidelines for Sustainable urban transport policy, taking into account development of the spatial, economic and social plans of the City.

The objective of the Sustainable Urban Mobility Plan for the City of Sisak is to determine the City as a successful dynamic regional centre, where transport system will provide better mobility and availability for its citizens while reducing the external costs of transport, provide economic development and environmental protection, and as well, a better and healthier urban environment for all of its citizens - users of the transport system, especially for the most vulnerable (pedestrians, cyclists, children, persons with reduced mobility, and the elderly).

The main guidelines of the new Sustainable transport policy of Sisak should be:

- Changes in modal distribution of travel in favour of public transport and non-motorized modes of travel with better environmental and energy efficiency;
- Reduced use of cars in urban travel;
- Encouraging non-motorized modes of travel such as walking and use of bicycles;
- Encouraging the use of public transport;
- The establishment of pedestrian zones with limited access using personal vehicles;
- Construction and improvement of existing transport infrastructure;
- Management of traffic flows in the city using the ITS system;
- Increasing road safety;
- Management of parking system (street and out-street) and billing system;
- Management of urban logistics and distribution of freight transport;
- Integration of transport subsystems;
- Improve the quality of life and work through increased mobility and availability.

Sustainable Urban Mobility Plan (SUMP) of the City of Sisak is the basic transport-spatial plan that determines the development of its transport system in the medium term (until 2030).

The Plan was worked out at the conceptual level, according to the selected three time horizons; 2017, 2020 and 2030, with a series of measures in the areas of: public transport, non-motorized traffic (pedestrian and cycling), road infrastructure, motorized traffic (traffic management and traffic flow

managing, parking management, traffic safety management), and logistics. The abstract and the conclusions of the strategic environmental assessment are shown below, and the strategic environmental assensment in complete form is in the form of an annex to this Report.

6.1 The state of the environment and the possible impacts of the Plan

The following describes the state of the environment and the potential impacts of the Sustainable Urban Mobility Plan on the environment through the categories described below.

6.1.1 Air quality

In the area of the City of Sisak, air quality monitoring is conducted at three automatic measuring stations (AMP): Sisak-1 in the settlement of Caprag, Sisak-2 Galdovo and Sisak-3, located in the centre of the city. According to the results of air quality monitoring in the period from 2012 to 2015, in the City of Sisak, at all monitoring stations, an air pollutions of suspended particles PM_{10} were measured and at station Sisak-1, located in the settlement of Caprag, higher concentration of hydrogen sulphide H_2S were found, as well. Increased concentrations of hydrogen sulphide are due to the emissions of hydrogen sulphide from the nearby oil industry INA Sisak Refinery.

Pollution of suspended particulate matter PM_{10} in the City of Sisak is the result of the emissions of particulate matter PM_{10} from the industry (the largest sources of air pollutant emissions are ABS Sisak d.o.o. (production of steel), INA Industrija nafte d.d. - Sisak refinery and Thermal Power plant Sisak), small and medium-sized combustion installations, households, machinery and mechanization in agriculture and transport sector.

The Sustainable Urban Mobility Plan of the City of Sisak proposed measures for further sustainable development of the transport system of the City. The envisaged measures such as: improvement and modernization of public transport, construction of walking zones and walking routes / tracks, changes in the regulation of traffic flow and traffic lights system optimization will contribute to reducing the air pollution within the City of Sisak, by reducing the emissions of pollutants from traffic, including greenhouse gas emissions. An impact on the air quality can be expected during construction work of new planned parking lots, cycling routes, carpooling terminals, charging stations for electric cars, reconstruction and construction of local stations. It is primarily due to emissions of particulate matter as a result of groundwork and construction work and the emissions of exhaust gases from operating machines. These impacts are temporary and of local character. While respecting technological

protection measures (covering of trucks carrying bulk cargo, regular control of the vehicle, water sprinkling of work surfaces in extremely dry conditions, the suspension of work in the case of strong winds, ...) larger impact on the surrounding area is not expected.

The construction of bridges (new bridge over Kupa, new bridge over Odra as part of D36) and roads of the major importance (D36 and new bridge over Odra (the first phase); D36 and connection to A11 (the second phase); D36 to Novo Selo Palanječko (the third phase); D36 to the settlements Veliko Svinjičko and Gušće) are projects that are subject to the environmental impact assessment procedure. The construction of a road bridge over Sava near Kratečko or near Lukavac Posavski and access roads will have an effect on the air quality in the vicinity of the roads and the bridge due to the emission of exhaust gases and particulates from vehicles with internal combustion engines. Construction of new state roads will also have an impact on air quality in the vicinity of the road. However, construction of bypasses that reduce traffic load in the centre of the city has a positive impact on air quality due to the reduction of urban traffic where stopping of vehicles and increasing the density of the point sources in one place and difficult dispersion cause highest emissions of air pollutants.

6.1.2 Noise

In the period from 2006 to 2010, under the program of noise protection (according to the Noise Protection Act (OG 20/03) that was in force in that time), the City of Sisak has prepared noise maps of noise from road traffic, railway traffic and from industry, a collective map of noise and conflict noise map. Noise maps provide an overview of the existing and predicted noise emission levels at all locations within the study area, depending on a particular source or all sources of noise. Maps can provide day or night noise levels and the average 24-hour noise in all areas of the city with the precision of street and house number level. It was estimated a relatively favourable situation in terms of vulnerability of the population by noise from road and rail traffic and industry in the city of Sisak.

By comparing the situation with and without the implementation of the Plan, it can be concluded that the implementation of the Plan will have an impact on the reduction of noise levels, not only by opening pedestrian zones and cycling routes but also by increasing availability of parking space at the edges of the city and better public transport connections. By improving the quality of public transport (frequency and additional offer such as wireless Internet connection, a mobile application for reaching the data on the current state of public transport, etc.) the attractiveness of public transport also increases. Promoting forms of joint use of cars (car-pooling and car sharing) will also contribute on reducing noise levels, but to a lesser extent. The concept of focusing on eco-friendly vehicles will help to reduce noise levels. Construction of the city bypasses will help to reduce noise levels in the city, but

will contribute to an increase of local noise levels along the bypasses, which also applies to all other planned roads and bridges. During construction of planned projects an increase in noise levels is expected (a short-term impact) and these levels must comply with the noise levels in accordance with the Regulations on maximum permissible noise levels in areas where people work and live (Official Gazette 145/04).

6.1.3 Water quality

City of Sisak is surrounded by rivers Sava, Kupa and Odra and at the easternmost part of the city, by river Lonja. More than half of 24 waterbodies (54,17%) in the Sisak City area is in good overall status. The most of the waterbodies (83,33%) are in good chemical state. Waterbodies that are in very bad condition are: CSRN0001_013 Sava, CSRN0007_002 Lonja Trebež, CSRN0007_001 Lonja Trebež i CSRN0024_001 Odra and the causes of this bad condition are: elevated concentrations of hexachlorobutadiene, degraded hydro-morphological conditions and physio-chemical indicators. Moreover, sewage outlets from combined sewerage system of Sisak City are discharged in river Odra, Sava and Kupa. Moreover, big pollutants are located near river Kupa.

Good overall status is achieved in both subsurface waterbodies (DSGNKCPV_28, Lekenik-Lužani and DSGNKCPV_31, Kupa) and both waterbodies are not in risk in terms of quality or quantity. But, it has to be mentioned that ground waterbodies are near surface, so the negative potential effect of the pollution can't be excluded. Water supply system of Sisak City is connected with water supply system of Petrinja City. Within the area of Sisak City there are no sanitary protection zones of drinking waters established by *decisions on the sanitary protection zones which are used for public water supply* since water captions from river Kupa are located in the area of the City of Petrinja.

Nearly whole area of the City of Sisak, apart from the southernmost part, is situated in the area that is at risk from floods. Some parts of wider area of riverflows have a high probability of being flooded.

Construction of pedestrian zones and improving of public transport contributes to the reduction of pollution from the roads. Promoting the forms of joint use of personal vehicles will reduce the volume of traffic on the existing roads which will have a positive effect since it will reduce emissions into the water and the likelihood of accidents.

Construction of new parking spaces would increase the potential negative impact on the water. The construction phase includes ground clearing (removal of natural cover), which increases the vulnerability of groundwater or aquifer, and the possibility of contamination, whether accidental or exceptional, becomes larger. At the locations where previously there was no emissions to water caused

by the traffic, they now exist. Depending on the position of the new roads in relation to surface water bodies or water protection zones, the impact can be stronger or weaker.

The construction of bridges can lead to negative impacts on surface water and groundwater as well as on hydro-morphological characteristics of the river, both during construction and during its use, therefore detailed analysis of the optimal location and the feasibility of the construction is required.

Since the wider area of Sisak is located in the high, medium or low flood risk area, in order to avoid negative impacts special attention should be given to potential risks of pollution and damage to the infrastructure itself caused by flooding during construction and afterwards during use.

Although there are no sanitary protection zones of drinking waters in the City of Sisak established by *decisions* on the sanitary protection zones which are used for public water supply, during project planning, the area of the water spring on the Kupa River north of New Pračnog should be taken into the consideration.

6.1.4 Biodiversity

Area of Sisak is dominated by anthropogenic habitats – agricultural surfaces and urban centre areas. Through the centre of Sisak flows Kupa River, while Odra River and Sava River surround the city. Various aquatic habitats are located along those rivers, e.g. wetlands and floodplains which are inhabited by many animal and plant species. A lot of these species are rare and endangered.

Besides the disappearance and fragmentation of habitats caused by urbanization, expansion of cities and invasive species, other problems concerning biodiversity in the area of Sisak include pollution of habitats due to industrial production, spreading of chestnut bark cancer in sweet chestnut forests and draining of wetlands for agricultural purposes.

Development of public transport and construction of sidewalks and cycling routes encourage citizens to use alternative means of transportation thus, in the long term, reducing the pollution of habitats.

Road transport occupies, fragments and indirectly pollutes habitats by increasing the traffic load. Given the fact that new routes will be built on widespread habitats already under anthropogenic influence, significant negative impacts on biodiversity are not expected. Crossings of roads over the rivers should be implemented in a way that rare and endangered riparian habitat types are impacted as little as possible.

By the implementation of urban logistics system and traffic safety, negative impacts on biodiversity are not expected.

6.1.5 Cultural heritage

The long urban history of Sisak and rich rural traditions of its surroundings created the actual identity of the city and resulted in a large number of protected cultural monuments. In the area of the city Sisak numerous protected cultural properties have been included in the State Register of Croatian Cultural Assets as immovable cultural goods-individual and immovable cultural property- cultural and historical complex. The industrial heritage of the city is represented by twenty three facilities divided into following categories: complex within the protected cultural and historical entity of Sisak, individual buildings within the protected cultural and historical entity of Sisak, individual protected cultural objects and registered industrial heritage buildings/complexes. Overall, the Register contains 51 cultural heritage sites in Sisak, of which 49 protected and 5 preventively protected.

In addition to cultural assets registered in the State Register of Cultural Assets, cultural and historical values are protected by Regional Plan of the City of Sisak, which recorded 153 sites/objects of cultural heritage.

Impacts on cultural-historic heritage may occur during the construction works on planned roads included in all variants. These impacts may occur especially in central part of Sisak because of numerous cultural goods (for example numerous civil buildings in Rimska ulica) and also because Sisak is defined as an inner zone of archaeological protection within Master plan (GUP). Considering the density of cultural goods, is possible distortion of spatial and visual integrity of architectural heritage, as well as damage to the archaeological sites in inner zone of archaeological protection. It is therefore necessary during planning of interventions that are located near the cultural-historic heritage to obtain the conditions from Ministry of Culture, **Conservation Department in Sisak** to ensure the protection of the integrity of cultural property.

Besides that, considering historical continuity of settlement and use of these areas, there is a possibility of discovering archaeological findings out of zone of archaeological protection, therefor archaeological survey of the terrain and defining of eventual problematic spots is needed for applying specific protection measures. During bigger construction works archaeological survey is mandatory. Projects like construction of main roads and highways, and construction of logistics distribution centre require environmental impacts assessment. Therefor detailed analysis of impacts on cultural heritage will be conducted and based on that, adequate protection measures can be defined.

Interventions such as the planned construction of new parking lots, terminals for car sharing, "block parking" zone in the pedestrian zone, the two "Park and Ride" parking lots, reconstruction and construction of the local stations, construction of underpasses below the railway station and

roundabout should not have a significant negative impact on cultural heritage, unless the **Conservation Department in Sisak** is included during planning and execution of construction works in the vicinity of cultural goods, or conservation conditions for their protection are determined.

6.1.6 Soil and agriculture

In the wider area of Sisak most common pedosystematic units are marsh gley vertic soil, alluvial soil (fluvisol, defended from flood), pseudogley on plain and pseudogley on slope. In addition to these soil types, at the level of the dominant units to a lesser extent occur marsh gleys partially hydromeliorated soil and pseudogley soil partly hydromeliorated. Present pedosystematic units belong to the hydromorphic soils characterized by occasionally excessive wetting by superfluous underground water, flood or stagnant rainwater. In the nearby area of the rivers Sava and Kupa, on unconsolidated Holocene flood sediments composed of silt and sand, occur alluvial soils and fluvisol. On the surface composed of Pleistocene loess sediments and alluvial terraces composed of sands, gravels, clays, conglomerates and sandstones of Pliocene age, occur pseudogley soil on plain, pseudogley on slope and partially hydromeliorated pseudogley.

According to the analysis and the inventory of the area given by the Spatial Plan of the City of Sisak and the Spatial Plan of the City of Petrinja, it was found that main land categories in the subject area are P2 (valuable arable land) and P3 (other arable land) and to a very small extent category P1 (particularly valuable arable land).

According to the data from ARKOD and in addition to the building areas, the wider area of Sisak (area under General Urban Plan with surroundings) is under intensive agricultural use, of which most of belongs to arable land and less to meadows.

One of the biggest problems is the lack of systematic monitoring of soil condition in the city. Sporadic analysis of contamination, carried out at the sites of accidents in the industrial areas of the city and at the location of traffic accidents indicates increased concentrations of heavy metals and other chemical compounds that are not characteristic to the soils.

Fragmentation of agricultural land in this area prevents significant agricultural production.

The implementation of some of the measures of the plan, like construction of the planned roads, may cause the permanent loss of the soil, changes in land use, permanent loss of agricultural land and its fragmentation.

If it won't be otherwise defined by further project documentation, a temporary loss of soil in the areas

used for disposal of excavated soil material during construction works for roads, bike and pedestrian traffic can occur as well.

Degradation of soils in the working area (or disrupting their production capabilities, structural characteristics and the consequent reduction or loss of their functions) during construction works on the planned roads and supporting infrastructure area, can also occur.

In addition to the direct impact on the soil and vegetative cover (among other on the nearby crops), inappropriate handling of various tools used in the construction (paints, solvents, fuels, lubricants, etc.) can result in their infiltration into the soil and underground water. The likelihood of this negative impact in the project area can be reduced by proper storage of waste and building materials, regular maintenance and servicing of machines, banning the storage of fuel and lubricants in the construction site and filling fuel at gas stations or by special vehicle from which oil can be refuelled into working machines at the location of impermeable plateau with oil and grease separator.

Since the area of Sisak considered by this Plan is mainly the area where the soil has lost its function (urban land) and to a smaller degree of gardens, fields and parks without the implementation of this plan, the current state of soils in this area would remain similar to the present situation. This means the continuation of all negative processes and impacts on ground that are now taking place such as soil contamination by suspended particulate matter, heavy metals and other chemical products produced during the transport, the possibility of accidents and contamination of soil.

6.1.7 Landscape

According to landscape regionalization of Croatia based on natural features (Bralic I, 1995), the wider area of Sisak is located in the southwestern part of the landscape unit *Lowland areas of northern Croatia*. This landscape unit is characterized by agrarian landscape complexes with oak forests and floodplains. The main spatial and landscape complexity and excitement of this area consists of fluvial-wetland environments such as Lonja ad Odra fields. The southern area of Sisak belongs to the landscape unit *Pannonian mountains* characterized by an isolated wooded mountain ranges, the diversity of forest types, preserved stream valleys and agricultural landscape. Considering the geomorphological and natural features, land use, spatial organization, patterns of the landscape and the typology of the village, the wider area of Sisak belongs to lowland urban-rural general type of landscape (town of Sisak with surrounding agricultural areas and smaller settlements) surrounded by natural landscape lowland fluvial area. The urban green spaces of Sisak represent natural green corridors that connect protected areas and Natura 2000 areas in one unique green infrastructure which is a base for tourism, sports and recreational activities linked in the bicycle and pedestrian

corridors.

The main problem in the area, that is relevant to the landscape, is the violation of the integrity and authenticity of landscapes mainly by construction. This problem is particularly noticeable in the region of Sisak and its surroundings and the natural landscapes along the river banks and forest edges. As stated in the spatial plan of Sisak-Moslavina County, new settlements are in conflict with the tradition and the architectural expression is incomplete. By the expansion of the intensive agricultural production and existing and planned infrastructure routes, highly valuable wetlands of Lonja and Odra fields are endangered and so are the forest areas and edges cut. Degradation of the landscape in the terms of changes in landscape character, reduction of landscape diversity and its ecological functions are especially visible in the southern area of the city where there are anthropogenic structures such as refineries, landfills and steel plants.

Undesirable impact of the construction of planned projects on the landscape is reflected in changes of the physical structure of landscape (land cover and/or morphology of the terrain) and consequently in the changes of the appearance and perception of areas. The significance of these impacts vary depending on the characteristics of the very procedure, the character, visual and environmental values of landscape areas where interventions are foreseen, as well as the visual exposure of the planned locations. Interventions such as the construction of state roads and the construction of logistical distribution canter are subject to the procedure of environmental impact assessment. Therefore, a detailed analysis of the impacts on the landscape, through the EIA procedure at the project level, must be carried out, so the adequate measures can be recommended. Given that the impact of planned projects are considered on the strategic level, it can be concluded that projects will not cause adverse impacts on the landscape that could not be mitigated by the application of measures on the project level. Therefore the planned projects can be considered as acceptable. In addition, for certain cases, such as the construction and modernization of cycling and hiking trails, widening of pedestrian zones adapted for citizens by landscaping, furnishing with the urban equipment, adaptation of the infrastructure for people with disabilities, the landscape's residential values in the relation to the current situation will improve.

6.1.8 Forestry and Hunting

In the area covered by this Plan there are smaller areas mainly of lowland forests of willow, poplar, ash, oak and several cultures of Euro-American poplar. These forests are located at the edge or in the floodplain of the Sava River. Most of these forests is owned by the state and governed by Hrvatske šume (Croatian Forests Ltd) (parts of the management units Brezovica, Kotar - Stari Gaj, Letovanički

lug and Petrinjski lug - Piškornjač). Forests in the inundation of the Sava river basin are managed by Hrvatske vode (Croatian waters Ltd.). Most of these forests are for commercial purposes with a reduced intensity of management.

In the inner city area of Sisak there is no hunting area. Therefore, most of the area covered by this Plan is not defined as hunting area. This area is surrounded by three state hunting units (Belčićev gaj, Brezovica and Šašna greda) and four county hunting units (Golo brdo, Ogransko polje, Petrinja i Piškornjač). The peripheral parts of these hunting units that surround the city of Sisak make the edges of the city and suburbs. These parts are almost completely non-hunting and hunting unproductive areas in which occasionally enters small game (rabbit) and birds (pheasant).

Since this is the area of small forest enclaves, the biggest problem is access to forests for the purpose of management and the pressure of the local population by illegal felling and disposal of waste.

Since these are peripheral parts of hunting grounds that are densely populated and where the traffic is intense, sometimes during the migration of wild animals they get killed.

The forests in this area are independent enclaves located at the borders of the city and in the floodplain of the Sava River and are not significantly burdened by traffic. The main transport corridors do not pass through these forests, so the impact of traffic is negligible. In the case of not implementing this Plan, the situation would not change significantly.

Parts of hunting grounds that are marginally covered by the area of the Plan are mainly non-hunting and hunting unproductive areas and the impacts of traffic in those parts of the hunting grounds and game and hunting management are relatively small. In the case of not implementing this Plan, the situation would not change significantly.

6.1.9 Waste management

County Assembly of Sisak-Moslavina County adopted in 2005 the Waste Management Plan of Sisak-Moslavina County for the period 2005-2013 (Official Gazette of Sisak-Moslavina County 14/05 and 2/06). The City Council of Sisak in March 2010 adopted the Waste Management Plan of the City of Sisak for the period 2008-2015 (Official Gazette of the City of Sisak 3/10).

Based on the review procedures and identified facts, taking into account the objectives of audit, the National Audit Office finds that waste management in Sisak-Moslavina County and local governments of Sisak-Moslavina County is not effective enough. Namely, it is necessary to plan the construction of recycling yards for municipal and construction waste as priority infrastructure projects.

During the construction phase, different types of waste such as construction waste are created, and to a lesser extent municipal waste, packaging waste and hazardous waste from maintenance of machinery and vehicles (used lubricating oils, grease, oil, etc.). If all generated waste is disposed of in a proper manner and in the appropriate containers for different types of waste at the predetermined surfaces that prevent the spill and spreading of waste material into the surrounding soil and water, negative impact of produced waste is not expected. For all types of the created waste the operator should keep the records and waste should be delivered only to the authorized collectors.

6.2 Main Assessment of the Plan for the ecological network

The aim of the Main Assessment of the Plan for the ecological network is to determine the probability that the Plan (alone or in combination with other plans or projects) will have an impact on the target species and habitats as well as on the integrity of the ecological network. Therefore, to assess the impact of the Plan on the integrity of the ecological network, main features of the ecological network in the area of Sisak and key environmental conditions and habitat features that are necessary to preserve the integrity were considered. By analysing the characteristics of the ecological network and the analysis of potential impacts of the plan objectives, planned activities and assessment of their significance, the Main Assessment has identified and assessed the elements of the Plan that could have a significant impact on the conservation objectives and integrity of the ecological network.

Several planned roads and bridges pass through the areas of ecological network, most of them over the areas HR200642 Kupa, HR20000416 Lonjsko polje than over HR2001311 Sava nizvodno od Hrušćice and HR1000004 Donja Posavina. Existing impacts in these areas include pollution from transport (cars and trucks, public transport), noise, vibration and fragmentation of habitats.

Due to recognized character and assumed area of influence, it can be assumed that for all planned operations possible negative impacts can be reduced or completely removed on the level of each project. For some of the planned projects it will be necessary to carry out impact assessment for the ecological network. But it is estimated that there is a small risk of significant negative impacts for which it would be impossible to carry out the objectives of the Plan.

6.3 Environmental protection measures

Environmental protection measures and measures of mitigation of negative impacts on conservation

objectives and integrity of the ecological network were proposed based on the analysis of current state and assessment of possible impacts of the objectives and measures defined in the Plan.

Recommendation at project level are proposed as well: (1) guidelines for project design and development (2) recommendation for further research and/or analysis of the impacts through Environmental Impact Assessment procedure in order to define all problematic points and to implement specific environmental measures to mitigate impacts to negligible levels.

Table 38. Environmental protection measures at Plan's level

Potential impacts on the environment	*Proposed measures to mitigate environmental impacts*
AIR QUALITY	
• Urban public transport • The concept of pedestrian and bicycle traffic in the Transport policy of Sisak	• During the preparation of project documentation for the construction of parking lots include the measures for the retention of existing trees as much as possible and implement further greening of the area.
WATER QUALITY	
• Construction of roads and parking spaces	• Avoid construction works in the area of the water spring. Within water protection zones carry out planned activities strictly in accordance with the regulations on water protection. • Develop an appropriate system of collection and treatment of rainwater.
BIODIVERSITY	
• Bridge construction • Construction of the roads of major importance	• During the designing phase of the construction of bridge over Sava near Kratečko or Lukavac Posavski, rare and endangered habitats which are situated in the area should be considered. Construction should be planned in a way that they are affected as little as possible. • The planned routes pass over rivers Kupa and Sava. Therefore, the impact on rivers, endangered habitat types and riparian vegetation in that area should be kept at minimum. A more detailed analysis of cumulative impacts of these projects should be carried out through environment impact assessment procedure.
LANDSCAPE	
• Construction of pedestrian zones • Widening of pedestrian zones and introduction of urban equipment (benches, greenery, flower beds, bicycle racks, trash bins and street lighting)	• Selection of urban equipment and materials should be adjusted to the urban context. • Native plant species and ornamental plants that are appropriate to the climate should be used in newly planned green areas and flower beds.
• Development of pedestrian and cycling routes	• After completion of the construction work, it is required to restore the disturbed area to its original conditions wherever it is possible.

• Urban public transport
  • Construction of „Park and Ride“ parking lot
  ▪ Construction of terminal for car sharing
	• Develop landscape design project with the solutions for the rehabilitation of areas affected by the construction works and for maximum visual integration of projects in the surrounding area.

• Proposal of a comprehensive parking management policy
  ▪ „bloc parking“,
  ▪ Construction of „Park and Ride“ parking lot in Kralja Zvonimira street zone,
  ▪ Construction of second „Park and Ride“ parking lot between I. Fistrović street, Nikola Tesla street and railroad	

Potential impacts on the environment	Proposed measures to mitigate environmental impacts
• Changes in regulation and organization of traffic directions ▪ Joint to Vrbina (tunnel or lowering of exiting road level beneath the bridge) or construction of roads at the western periphery of the Perivoj Vladimira Nazora	
CULTURAL HERITAGE	
• Urban public transport (construction of planned parking lots, construction of car sharing terminal, reconstruction and construction of local public transport stops) • Construction of pedestrian zones (construction of underpasses below the railway station and roundabout) • Construction and modernization of bicycle routes (construction of terminals for change of transport mods) • Proposal of a comprehensive parking management policy (construction of „bloc parking“ in pedestrian zone , construction of two „Park and Ride“ parking lots)	• When planning projects that are located near cultural properties it is necessary to obtain the conservational conditions to ensure the visual integrity of the architectural complex.
• Changes in regulation and organization of public transport routes (construction of tunnel, lowering existing road level below the bridge) • Bridges for road traffic (construction of new bridge over Kupa river in city center, construction of bridge over Sava in Kratečko or in Lukavac Posavski)	• Before the construction works, archaeological survey of the terrain is needed for definition of possible problem areas and the implementation of specific protective measures to mitigate the impacts to cultural heritage to negligible level.
• Changes in the regulation and organization of traffic flow (construction of roads at the western periphery of the Perivoj Vladimira Nazora)	• • During planning of interventions that are located near the cultural-historic heritage to obtain the conditions from Ministry of Culture, Conservation Department in Sisak to ensure the protection of the integrity of cultural property.

Table 39. Environmental mitigation measures for Ecological Network

Code and the name of the area	Projects that can have a negative impact on Ecological Network	Proposed measures to mitigate negative impacts
HR1000004 Donja Posavina	- new road route D36 to Novo Selo -D36 to V. Svinjičko and Gušće	1. On the project level ensure measures to mitigate negative impacts of road construction on target bird species
HR2000642 Kupa	- new bridge over Kupa River in the city centre (parallel to train bridge)	2. On the project level plan new road infrastructure in a way to minimize impacts on river habitats and habitats along the river, and prescribe protection measures as a part of the EIA process. 3. In the design phase of the bridge (before producing EIA study) it is necessary to plan research of target species to avoid negative impacts and mitigation measures prescribed
HR2000416 Lonjsko polje	- D36 to V. Svinjičko and Gušće - Bridge at Kratečko	4. In the design phase of the bridge (before producing EIA study) it is necessary to plan research of target species in order to avoid negative impacts and prescribe mitigation measures
HR2001311 Sava nizvodno od Hrušćice	- new road bridge over Sava River at Kratečko or at Lukavac Posavski - new road route D36 to Novo Selo	5. Plan new road infrastructure in a way to minimize the impact on river habitats and habitats along the river, and prescribe protection measures as a part of the EIA process. 6. In the design phase of the bridge (before producing EIA study) it is necessary to plan research of target species in order to avoid negative impacts and prescribe mitigation measures

Table 40. Recommendations to be taken into account during development of further design documentation

Potential impacts on the environment	*Proposed measures to mitigate environmental impacts*
AIR QUALITY	
• Urban public transport • The concept of pedestrian and bicycle traffic in the Transport policy of Sisak	• During construction phase, implement the measures to reduce emissions of air pollutants (covering the trucks carrying bulk cargo, regular control of the vehicle, water sprinkling of work surfaces in the extremely dry conditions, the suspension of work in the event of strong winds, ...)..
• Bridge construction • Construction of the roads of major importance	• On the project level, carry out an analysis of the impact of emissions of air pollutants from vehicles on the air quality in the nearby area of the bridge, or access roads and, if necessary, propose appropriate mitigation measures.
NOISE	
• Construction of the bridges • Construction of the roads of major importance	• On the project level, carry out an analysis of the noise emissions and possible cumulative impacts and, if needed, propose appropriate mitigation measures to reduce noise emissions at source and noise protection measures during construction and the use of the roads.
WATER QUALITY	
• Conversion of the station Kolodvor into a separate terminal. • Renovation of bus stations	• During the station reconstruction design a system of sanitary and sewerage facilities in accordance to current regulations
• Bridge construction • Construction of the roads of major importance	• In case of flooding stop the all the activities, securing the construction site and heavy equipment from possible accidental situations. • Construction activities can be continued only after the water completely retreats from the site.
SOIL	
• Construction of the roads of major importance	• During construction, separately store waste and building materials on impermeable surfaces to prevent their infiltration into the soil and groundwater • Regular maintenance and service the machines, • Ban the storage of fuel and lubricants at the construction site and fill the fuel at gas stations or by special vehicle with refuling into working machines at the location of impermeable plateau with oil and grease separator.
LANDSCAPE	
• Bridges for road traffic - construction of new bridge over Kupa in city center, - construction of bridge over Sava in Kratečko or in Lukavac Posavski • Construction of the roads of major importance ▪ D36 + new Odra bridge (I. Phase); ▪ D36 + joint to the A11 highway (II. Phase); ▪ D36 to Novo Selo Palanječko (III. Phase); ▪ D36 form V. Svinjičko to Gušće • The basic characteristics of urban logistics - construction of logistical distributive center of Sisak	• On project level, a detailed analysis of the impacts on the landscape must be carried out, so that the adequate measures can be prescribed. • Within Main design, develop landscape design project with the solutions for the rehabilitation of areas affected by the construction works and for maximum visual integration of projects in the surrounding area.
• Traffic safety ▪ construction of educational pedestrian-cycling	• After completion of the construction work, it is required to restore the disturbed area to its original conditions wherever it is possible.
CULTURAL HERITAGE	
• Bridges for road traffic - construction of new bridge over Kupa in city center, - construction of bridge over Sava in Kratečko or in Lukavac Posavski • Construction of the roads of major importance	• On project level, a detailed analysis of the impacts on cultural heritage must be carried out, based on which the possible impacts on cultural heritage will be defined and adequate mitigation measures will be prescribed

Potential impacts on the environment	*Proposed measures to mitigate environmental impacts*
▪ D36 + new Odra bridge (I. Phase); ▪ D36 + joint to the A11 highway (II. Phase); ▪ D36 to Novo Selo Palanječko (III. Phase); ▪ D36 form V. Svinjičko to Gušće • The basic characteristics of urban logistics - construction of logistical distributive center of Sisak	• Considering historical continuity of settlement and use of these areas, there is a possibility of discovering archaeological findings out of zone of archaeological protection, therefor archaeological survey of the terrain and defining of eventual problematic spots is needed for applying specific protection measures. • During major construction works, archaeological survey is mandatory.

6.4 Proposal of the environmental monitoring program

This strategic study does not propose the establishment of new environmental monitoring program besides those that are already established on the national, county and local level and whose results are part of the Environmental Protection Information System that is govern by Croatian Agency for Environment and Nature. These results are as well, part of the Environmental state report for specific area.

Furthermore, in the Republic of Croatia, mechanisms for environmental monitoring program are established through the procedure of environmental impact assessment and water rights permits for specified projects.

6.5 A short overview of Plan variants, evaluation, and difficulties in the data collection process

As a part of the consideration of future road transport development (Measure -Changes in the regulation and organization of traffic flow) the Plan considered three alternative solutions.

After the establishment of one-way traffic in the street Rimska ulica, in the continuation of the street Rimska ulica or on the square Trg bana Jelačića, it is necessary to enable the connection to the settlement of Vrbina and through the settlement to provide access to the street Ulica kralja Tomislava to future new bridge.

The realization of this connection was proposed through next alternatives:

- Underground tunnel beneath Park;
- Lowering of the vertical alignment of the existing road under the old bridge to allow the

passage of buses under the old bridge;

- In a case of objective constraints in the implementation of this connection to the settlement of Vrbina, alternative solution can be sought in the re-regulation of streets Ulica Dr. Ante Starčevića, F. Lovrić and I. K. Sakcinskog in the zone of the Gymnasium and square Trg dr. Tuđmana.

According to the results of the analysis of the environmental impacts of these alternatives, as the most suitable solution, a third variant was proposed.

In addition to considering the alternatives proposed by the Plan itself, strategic study analyses an alternative without the implementation of the Plan as well.

Based on the analysis, positive effects of implementing the Sustainable urban mobility plan of Sisak on the environment are estimated, including improving the quality of air, water, soil and the status of biological and landscape diversity, in relation to the alternative "without the implementation of the Plan". Therefore, the implementation of the planned measures together with the environmental protection measures and measures of mitigation of negative impacts on the ecological network, the Plan is considered the most acceptable alternative solution.

7 MEANS OF FINANCING

This financial forecast has been prepared from publically available information and other sources and the information contained here is accurate to the best of our knowledge. Since the information has been collected from multiple sources prepared by different public and private research organisations and according to different methodologies, some data sets may not be fully consistent with one another. Further, this financial forecast has been prepared based on a number of operating/financial assumptions from various sources that were assumed to be reliable by Deloitte However, Deloitte is not responsible for, and Deloitte provides no assurance regarding, the accuracy of any such information.

This financial forecast includes certain statements, estimates, assumptions and projections with respect to the anticipated future performance of the City of Sisak as well as future performance of the Croatian economy. Such statements, estimates, assumptions and projections reflect best estimates made by various studies and by others concerning forecast results. Actual results generally differ from forecast results and these differences can be material. Accordingly, such statements, estimates and projections may not actually be realised (whether materially or otherwise), and no representations are made by any party as to their accuracy, completeness or achievability.

7.1 Overview

Croatia has three tiers of government: local, regional and national (or central). Municipalities, towns and cities represent the local level of government and counties represent the regional level of government. The national or central government represents the highest and financially most powerful level of government supporting the lower levels of government via the transfer of funds ("equalisation grants").

The territory of the Republic of Croatia at the local level is comprised of 429 municipalities and 126 cities/towns while at the regional level it is comprised of 20 counties and the City of Zagreb. In total, there are 576 sub-national units of government. The City of Sisak is the 11th largest city in Croatia and is the seat of the Sisak-Moslavina county. In 2011, the City of Sisak itself had a population of 47,768 (with 172,439 inhabitants in the county of Sisak-Moslavina making it the 10th largest county in Croatia).

7.2 Administration

In Croatia, there exists a division of responsibility among different government levels. However, it should be noted that there is overlap between these functions between for example the national and local governments. These divisions of responsibility of the different levels of government are based on provisions of the Law on Local and Regional Self-Government Units as well as other laws like the Law of Primary Education, Law on Secondary Education, Law on Social Welfare, Law on Health Insurance etc.

As a city, Sisak decides independently on a number of activities related to satisfying citizens' needs other than those delegated to government bodies, such as: the adoption of physical plans (e.g. urban development plans); the organisation of: drinking water supply and wastewater management, the collection and disposal of municipal waste, public transport, markets, cemetery maintenance, chimney-sweeping, public lighting and other utilities; and the establishment of kindergartens, primary schools, fire service organisations, etc.

7.3 Decentralisation

Decentralisation is a process in which selected functions of government are assigned to subnational units and fiscal decentralisation is the assignment of revenue sources and expenditure functions to the sub-national levels of government. It is generally accepted that higher levels of decentralisation with respect to administrative power and responsibilities thereof results in: a strengthening of local governance; an increase in local development; and a general increase in public sector efficiency.

In July 2001, Croatia launched a partial decentralisation of its public functions. The decentralisation reforms have been directed in two areas:

- Delegation of administrative and professional tasks from the national government (ministries) to local and regional government units;
- Fiscal decentralisation where a part of financing public needs was transferred from the national government budget to regional and local government budgets.

Further decentralisation in Croatia is expected in the future in Croatia. However, it should be noted that between 2013 to 30 June 2016, no further fiscal decentralisation had occurred impacting the City of Sisak's budget. Notwithstanding decentralisation, **equalisation grants** for decentralised functions

are ensured from the national budget to cover public expenses in the area of primary and secondary education, social welfare and health care. Equalisation grants are transferred to local and regional government units in the case they do not have sufficient revenues from the additional share of income tax for the financing of decentralised functions.

The City of Sisak's budget users are institutions established by the City, which are largely financed from the budget. There are 17 users of the City budget (2 child care centres, 9 primary schools, 1 library, 1 museum, 1 gallery, 1 cultural centre, 1 sports centre and the fire brigade).

7.4 Budget

The budget consists of two parts:

- Revenue and expenditure account which itself consists of two sub-parts:
  - Revenues and expenditures from/for operations;
  - Revenues and expenditures from/for the sale or acquisition of non-financial assets;
- Financing account i.e. receipts from financial assets & borrowing and outlays for financial assets and loan repayment.

The terms revenues and expenditures are used in the revenue and expenditure account when it comes to business operations and the purchase and sale of non-financial assets. The terms receipts and outlays are used in the financing account and relate to financial assets and the granting, taking out and repayment of loans.

Level 22 financial statements of the City of Sisak (general or non-earmarked funds) are used in the financial forecast of the City as they reflect funds that the City has the most discretion to spend. Level 23 or consolidated financials include non-general/earmarked funds that are earmarked by law and set aside for specific purposes. Any surplus potentially generated and not earmarked (level 22) only can be used to potentially repay loans taken to fund SUMP.

7.5 SUMP overview

Per discussions with the City of Sisak, it was confirmed that scenario 3 was chosen for the SUMP project. Scenario 3 entails a thorough and more complete overhaul of Sisak's traffic infrastructure than that envisaged under scenario's 1 and 2. Accordingly, scenario 3 involves the highest capex of the three

scenarios i.e. a total of **HRK 631.2 million** to be invested in the period 2017 to 2030. It should be noted that while the total capex under scenario 3 is HRK 631.2 million, due to participation by other entities (e.g. stakeholders like HC, MUP and others), the total share to be invested by the City of Sisak is assumed to be only **29,7 %** or **HRK 187,6 million**. The City of Sisak's share of total capex is based on the estimate by the Faculty (FPZ) of each stakeholder's estimated share in the total cost of this SUMP project.

7.6 Overview of key assumptions & financial forecast

In order to assess the financial capacity of the City of Sisak to undertake capital expenditures relating to SUMP, a financial forecast (level 22) was prepared for the years 2016 to 2030. Items forecast included: the revenue and expenditure account (which includes capex); various balance sheet items; and cash flow. It should be remembered that in addition to capex related to SUMP, that other "non-SUMP" (or "ordinary") capex is included in the forecast relating to the addition or renewal of the City's stock of fixed assets.

There are a number of risks to the financial forecast. Some of these prominently include: relapse into economic recession in Croatia; alteration to tax rates hence impacting City of Sisak's revenues; further decentralisation of functions without potential compensation from equalisation grants and/or ability to raise revenue locally etc.

Notwithstanding the many real risks that could significantly impact the City of Sisak's budget, a financial forecast to the year 2030 was prepared based on the following main principles and assumptions:

- Economic forecast: Forecast economic parameters largely drive the financial model. This economic forecast was obtained from the Economist Intelligence Unit - Croatia country forecast June 2016. Forecast by the Economist is to the year 2020 which was extended to 2030 by assuming a mostly steady state between 2020 and 2030. Following the period of economic recession/stagnation in Croatia between the end of 2008 and 2015, real GDP had declined by a cumulative total of 12%. However, from 2015, Croatia has experienced economic recovery which to the date of most recent economic statistics, has been sustained:
    - Real GDP growth is forecast to accelerate and reach 1.9% per annum in 2020 which is assumed to continue to 2030;
    - Inflation is forecast to accelerate to 1.8% in 2020 and assumed to accelerate further

to 2.0% per annum in 2021 and thereafter stay constant to 2030 (note: ECB's stated inflation target is 2.0% per annum);

- Resulting nominal GDP growth forecast is 3.7% per annum in 2020 which is assumed to continue to 2030;
- Average real wages is forecast to increase to 1.1% per annum (nominal 3.1% per annum);
- Annex 13 shows an overview of the economic forecast & assumptions to 2030;

- **Revenue and expenditure account**: The revenue and expenditure ("R&E") account is largely driven by the various economic parameters forecast per point 1. Specifically, the main assumptions underlying the R&E account are:
  - Tax revenues (actually net tax revenues adjusted for refunds) are forecast to increase by the forecast nominal wages growth per annum. Tax rates including tax surcharge currently levied at 10% are assumed to remain the same as we are not aware of any changes in tax policies;
  - Assistance from abroad and from subjects within the general budget; revenue from assets; revenue from sale of products and goods, services rendered and revenue from donations are assumed to increase by the forecast rate of growth in nominal GDP. Further, additional grants are assumed to be obtained from the EU of HRK 7,5 million per annum from 2017 which is increased by the forecast rate of growth in nominal GDP;
  - Revenue from management and administrative fees, fees based on specific regulations and fees; penalties, administrative measures and other revenues are forecast to increase by the forecast inflation rate per annum;
  - Employee expenses are forecast and assumed to increase by the average expense per employee multiplied by the total number of employees. The average expense per employee is forecast to increase per the forecast and assumption in increase in nominal wages. Currently, there are 129 employees of which, 109 are permanent employees while 20 employees are on temporary contracts pending completion of work related to legalisation of real estate properties assumed to be completed by the end of 2020. Accordingly, from 2021 to 2030, only 109 employees are assumed to remain in employment;
  - Material expenses are forecast to be at 30.7% (average of 2014 and 2015) of operating revenue through to 2030;
  - Financial expense which mainly reflects the interest expense on loans, have been calculated per the loan interest schedule of payments on loans currently held by the

City of Sisak (level 22). In addition, new loans totalling HRK 43 million have been assumed to be taken by the City of Sisak from 2022 to 2030 to assist in financing capex – the assumed interest rate of these loans is 4.50% with loan terms of 15 years and loan instalments payable quarterly;

- Subsidies; and grants abroad and within the general budget are forecast to increase by the nominal growth in GDP;
- Payments to citizens and households based on insurance and other fees; and other expenses have been forecast to increase by the forecast inflation rate;
- Revenue from the sale of non-financial assets is forecast to be HRK 1.7 million in 2016 following the sale of housing units and then increase between 2017 and 2030 by the forecast rate of inflation;
- Capex not related to SUMP (or "ordinary" capex) is assumed at a relatively steady state of HRK 16.2 million per annum between 2018 and 2030. In 2016, capex of HRK 51.6 million and HRK 31,0 million in 2017 is assumed which is mainly financed by HBOR loan proceeds (total of HRK 50 million). Note: the average capex per annum between 2013 and 2015 was HRK 18.4 million. No increase to allow for inflation was applied to this "ordinary" capex during the forecast period;
- Capex related to SUMP (scenario 3) is estimated at HRK 631.2 million – this amount is to be invested between the years 2017 and 2030.
- Of this, the City of Sisak will participate and invest HRK 187.607.333 (or 29,7 % of the total). This amount to be invested by the City of Sisak per se is per the guideline provided by the Faculty;
- Capex by the City of Sisak to be directed to three main asset categories: project documentation HRK 17,2 million (9 % of capex); building/infrastructure works HRK 167,9 million (89% of capex); and plant & equipment HRK 2.5 million (1% of capex);
- The timing of the capex by the City of Sisak is approximately HRK 5,2 million per annum in the years 2017 to 2019; and HRK 15,7 million per annum for the period 2020 - 2030;
- Overall, due to strongly increased capex mainly due to SUMP, the R&E account swings from a position of being HRK 2.7 million in surplus in the year 2015 to either shortfalls or minor surpluses in the years between 2016 and 2025. In 2026, the R&E account is forecast to have a surplus of HRK 2,3 million and increase thereafter to 2030;
- Annex 14 shows an overview of the historical and forecast of the R&E account;

- **Balance sheet account**: A number of line items were forecast as they impact the cash position of the City of Sisak. Some of the more notable line items included:
  - Deposits and guarantee deposits and receivables from employees and for overpaid

taxes and other. This was forecast by calculating in days, this line item divided by the operating revenue 2015 and multiplying by 365 days. Day's collection was 19 days in 2015 (13 days in 2013 and 12 days in 2014). We used 19 days as the collection period throughout the period 2016 to 2030;

- Receivables for loans of HRK 7.2 million as at end of 2015 mainly to Sisački Vodovod and Autopromet Sisak which are not likely to be repaid. Per advice from the City of Sisak, there will likely be a debt/equity swap during 2017 with result of this line item becoming zero while shares & equity held by City of Sisak increasing by the equivalent amount;
- Receivables from sale of non-financial assets (i.e. housing units to citizens which are repaid to the City of Sisak at concessional interest rates) are assumed to taper off over 10 years and be fully repaid by 2025;
- Liabilities for operations expenses was forecast by calculating in days, this line item divided by the operating expense in 2015 and multiplying by 365 days. Day's liabilities for operations was 36 days in 2015 (40 days in 2013 and 42 days in 2014). We used 36 days as the payment period throughout the period 2016 to 2030;
- New loans have been assumed to be taken by the City of Sisak commencing in 2022 to 2030 mainly to assist in financing significant capex related to the SUMP project. The total of these new loans to be taken is HRK 43 million. Due to continual repayment of principal of existing loans, the maximum peak in loan outstanding is forecast to be HRK 57,4 million in 2025.

Per the Budget Act (Article 88), the City of Sisak (like other local governments) are limited in the amount that they can borrow i.e. the total annual debt service (i.e. repayment of loan principal and payment of loan interest) of the current year (debt service per level 23) can be up to a maximum of 20% of the adjusted total revenues realised in the previous year (adjusted total revenues per level 22).

- **Cash flow:** The resulting cash flow is divided into cash flow from operations and cash flow from financing activities. Note: cash flows from investment are included within the R&E account:
  - Value adjustment of HRK 7.2 million in 2017 as already stated relates to a debt/equity swap whereby no cash flows (in or out) are to occur;
  - Loan repayments reflect loans on balance sheet as at 31 December 2015 as well as new loans assumed to be taken from 2022 to 2030;
  - Loan proceeds in 2016 and 2017 relate to HRK 44.9 million yet to be fully drawn down to pay for capex not related to the SUMP project;
  - EU grants are assumed at HRK 7,5 million in 2017 and increased thereafter to 2030 by

the forecast growth in nominal GDP;

- Annex 15 shows for an overview of cash flow from 2016 to 2030;

- **Ratios:**: the highlights of the various ratios and key financial metrics are shown in Annex 16, and they include:
  - Increase in total revenues in nominal terms from HRK 257,8 million in 2015 to HRK 257,8 million in 2030;
  - Operating surplus increasing from HRK 19.2 million in 2015 to HRK 36,8 million in 2030;
  - Total surplus of HRK 2.7 million in 2015. However, from 2016 to 2025, there are mostly shortfalls with four years of minor surpluses. From 2026 to 2030, the surpluses increase to HRK 7,2 million in 2030.

7.7 Conclusion

The obvious conclusion with respect to the possibilities to finance SUMP are:

- Based on the aforementioned assumptions and financial forecast thereof, the SUMP project can be financed through a mixture of own funds and new loans (HRK 43 million) based on an assumed willingness of banks to provide loan finance per the stated conditions:
- In order to ensure that the SUMP project is able to be fully realised per the forecast, it is essential that the City of Sisak ensure that its total capex does not exceed HRK 187,6 million. Further, other stakeholders are required to adhere to their assumed respective minimum size of capex in the SUMP project.

8 THE COMMUNICATION AND PROMOTION OF THE PLAN

Every strategy/plan has to ensure a clearly defined approach which will be used during the communication and promotion of the strategy/plan itself, as well as the connected activities/projects, which should result in the realization of the respective strategy/plan. The present communication and promotion should be established in order to ensure continuous updating of all relevant stakeholders and to increase public awareness of the important activities and projects by the supported Sustainable Urban Mobility Plan. The communication plan with all the basic guidelines is presented and submitted here. This communication plan aims to ensure that all the relevant stakeholders that should be informed about the Sustainable Urban Mobility Plan of the City of Sisak are reached. Some of the major groups that will be covered by this communication plan are the residents of the Sisak-County and the City of Sisak, as well as Ministry of Maritime Affairs, Transport and Infrastructure, Croatian Railways (Passenger Transport and the Infrastructure), Croatian Roads, Croatina Highways, AP, and the others. Moreover, this plan clearly defines the communication tools that could be used for the promotion, education and information of every relevant stakeholder, as well as their own roles and responsibilities in the communication process.

8.1 The goal and purpose of the communication plan

Sustainable urban mobility plan (SUMP) of the City of Sisak focuses on the development and the establishment of strategies that will help the City of Sisak in its efforts to become one of the European cities aiming to promote the usage of intermodal transport, non-motorized transport vehicles and walking, along with reduced private car usage for travel. The plan, strategy, and related projects should attempt to affect all relevant stakeholders and the citizens, in order to encourage, and promote the usage of intermodal transport, non-motorized modes of transport and walking, with the private car usage as less as possible.

In order to achieve the main objectives of the SUMP, it is of utmost importance to use the communication plan with the purpose to present the benefits of the proposed plan to the residents of the City of Sisak and its surroundings, as well as all other relevant stakeholders, in order to motivate them to actively contribute to the sustainable urban mobility. The communication with the stakeholders should be ensured at all stages of the project, and stakeholders should perceive the

importance of the projects adopted by the Plan. Stakeholders should be also informed about the project aims and goals, its implementation process and its benefits, beginning from the pre-project activities, implementation, to the end – the completion of the project. These definitions and other relevant information should be delivered to the stakeholders by the communication activities defined by the communication plan.

The aim of the communication plan is to reach out to as many relevant stakeholders and citizens as possible, and to include all age groups, from childhood and adolescence, to the working population and elderly. The primary communication message that should reach the former mentioned age groups is the usage of cycling, walking, and the public transport usage instead of private cars. Public authorities, businesses and other stakeholders should encourage and motivate their employees and try to adapt their business processes related to the traffic aiming to become more oriented towards sustainable urban mobility.

The sustainable urban mobility plan encourages the development of transport infrastructure in a way that all traffic participants in allow a high-quality transition from the present to the new sustainable urban mobility form. The communication plan ensures an individual approach to each target group and presentation of the unique segment of the Plan which will easily lead to a positive change.

8.2 Target groups and stakeholders

The population of the City of Sisak and its surroundings is a fundamental target group, where individuals participate in daily transactions, and constitute a fundamental component of urban mobility.

The youngest age group, which includes the population younger than 18 years of age, represents the most important target group because they are the future working population. It is therefore extremely important to insist on a high-quality education about sustainable urban mobility and the mode on how this target population can actively contribute to it. Moreover, young population has a strong influence on their parents and grandparents, which can be used to create the cumulative effect. This population is accessible through new technologies, which allows fast and high-quality monitoring of stakeholders feedback and can create a base for communication about projects and ideas from the Plan. The basic communication messages for this population groups will be presentations of traffic safety policies, new cycling and walking routes, green areas and related activities.

The second group of residents is defined as population aged from 18 to 65 years. This is an active

population that takes the largest part in the traffic of the City of Sisak, and whose actions will have the highest impact on short-term sustainable urban mobility. This population group has limited amount of time that can be set aside for education on sustainable mobility, thus the message to them should be simple, short, easily understandable and motivating. New roads, better connections with the roads outside the city centre, new public transport lines, and quality of service in urban mobility are some of the messages that need to be transmitted to this target group. The use of digital media and new technologies can also be easily accessed by this group.

The last group has population over 65 years of age. As previously indicated, this population group is larger than the youngest one, and all projections indicate that this group will continue to grow. In relation to the working population, the oldest group has more time, which open possibilities for holding workshops and education projects supported by the Plan. This group is relatively inaccessible by the digital channels of communication, and should be reached by more classical means such as printed brochures, radio messages, TV programs and similar.

All **legal entities** indirectly participate in the trade, since their employees commute to and from work. As individuals, all these employees will be covered by the communication campaign described in the previous section. In this chapter, we will concentrate on communication towards legal entities whose business processes generate traffic and whose business decisions can greatly contribute to positive changes and encourage active participation in sustainable urban mobility.

The public administration, from the institutions such as the Ministry of Maritime Affairs, Transport and Infrastructure to the county and city departments in charge of traffic, must add their contribution in raising awareness of sustainable urban mobility. This target group, which is formally involved in the development and implementation of the Plan, should take steps in project disseminations under the Plan, and to actively participate in the implementation of the plan.

Public companies participating in the management of the traffic and transport infrastructure should be thoroughly included and have a good understanding of the projects supported by the Plan.

Legal entities such as logistics and commercial enterprises, and similar companies that significantly contribute to the generation of traffic transport of people and goods, should be completely familiar with the idea, objectives and projects of the Plan. These companies should be acquainted with the ideas of sustainable urban mobility and present those ideas and projects of the Plan that would bring direct or indirect business benefit to their companies. Legal entities would be especially interested in the apparatus that will ease traffic such as construction of new roads with bigger capacity, avoiding transiting through the narrow city centre or usage of small commercial electric or hybrid vehicles.

8.3 Communication channels

In order to provide the maximum of the planned results, it is of utmost importance to clearly define channels of communications at the very beginning of the process. After the Project completion and its acceptance by the City, the Plan should be presented to the general public through all relevant communication channels (local and regional radio and TV stations, local and regional relevant forums, local and regional newspapers, Internet sites of Sisak and Sisak County, Facebook page of the City, etc.). Introducing the Plan to the relevant stakeholders should be the prime step in starting the communication process, which should then ensure that all stakeholders understand the meaning of the sustainable urban mobility plan and the development resulting from it, in addition to the role of each stakeholder in its realization.

In addition, the basic communication plan should be followed by a continuous communication which will cover the implemented activities and projects of the Plan as well as the accomplished results. The proposal is to establish a unique Web site that adjoins the City of Sisak website. The Web site should be used for regular communication with all relevant stakeholders. Besides the abovementioned Web page, the proposal is to establish a Facebook page, which would be an additional channel of communication with stakeholders. It is of utmost importance to establish a two-way communication with stakeholders, with the possibility of receiving stakeholder's comments and suggestions not only on the existing, but also the future projects and activities that could enhance sustainable urban mobility of citizens. The main page of the Plan (Internet and Facebook) would be referenced to all other communication channels that would be adapted by the target groups. Communication campaigns should be organized for the target groups, and should use banners, printed or electronic, to communicate key messages that would attract users to access the Internet or Facebook pages where they could find more information about the project, activities and actions. The electronic mode of communication is extremely convenient for gathering feedback information from stakeholders, which should be used as a tool to adapt campaign according to the elements that share the greatest interest. The use of Internet services such as Facebook and Twitter are ideal for presentations and dissemination of information about the Plan, and they are also suitable for collecting customers or stakeholders opinions and ideas.

Besides classic short printed materials such as brochures or banners, it would be advisable to organize brief workshops and education for children in kindergartens and schools. For example, children could be informed about current state of cycling and walking routes during the regular lectures on the traffic in the City, and they could get familiar with the plans of further development and new routes.

The elderly population over 65 years could be informed through brochures placed in the health centers and similar places where this population commute. Moreover, a collaboration could be made with the health centers in order to organize trainings on benefits of sustainable mobility and positive effects of walking and cycling on health and quality of life, in contrast to private car usage. However, the positive health segment of the Project should not be reserved for the elderly population alone, but also to other age groups.

The usage of other communication modes such as television and radio highly depends on the budget provided for the communication plan, as this modes havee significantly higher price than aforementioned ones.

8.4 Management and conduction

Another very important element of communication strategy and plan is defining the team and organization responsible for the operational implementation of the communication plan. As the implementation of the Plan is closely linked to the local public administration and public companies which also have direct authority over its projects, it is believed that in the best solution, the same body takes over the management of the communication plan implementation. Defining communication messages, their review and final adoption certainly calls for professional communication experts to communicate to the best of their professional and specialized knowledge to provide the best proposals. As the sustainable urban mobility plan is planned to be large and long-term, the implementation of a communication strategy requires the same long-term engagement. The bodies responsible for the SUMP should be also responsible for the communication plan and dissemination projects supporting the Plan. It is suggested that, in the scope of the current organizational structure, a project should provide a communication expert who will ensure that the communications plan is consistently implemented. Also, it is believed that it will be necessary to engage additional resources in order to promptly update the respective websites and to provide answers to questions and ideas of every stakeholder.

LIST OF FIGURES AND TABLES

Figure 1. Modal split of city trips – goal for 2030 11
Figure 2. Public transport network – proposed state for the end of 2017 16
Figure 3. New public transport line Autobusni kolodvor – Galdovo 17
Figure 4. A city bus equipped with Wi-Fi, Copenhagen, Denmark 21
Figure 5. Public transport network – suggestion for the end of 2030 22
Figure 6. An example of a multi-modal passenger information system 26
Figure 7. An example of a tourist train 28
Figure 8. Water taxi in New York City 29
Figure 9. The development concept of the pedestrian zone in the city centre 39
Figure 10. Proposal for developing bicycle paths/lanes in the City of Sisak (2017, 2020, and 2030) ... 41
Figure 11. Bicycles in public transport vehicles: in train (left), in front of bus (centre), folded in train (right) 44
Figure 12. Traffic volume in 2015 – afternoon peak period, both directions 46
Figure 13. Traffic volume prediction for 2030 – "Do nothing" 47
Figure 14. Traffic flow regulation – proposal for 2017 50
Figure 15. Traffic flow regulation – proposal for 2020 51
Figure 16. Traffic flow regulation – proposal for 2025 52
Figure 17. Traffic volume prediction for second stage in 2020 – afternoon peak period 54
Figure 18. An example of the possible traffic light optimization by adding a road lane if there is space availyble (the intersection of D37 and Capraška by the "Konzum") 58
Figure 19 The ATC scheme 60
Figure 20. The elements of the ATC system 60
Figure 21. The existing situation at the intersection D37 and D224 (left) and the situation after the suggested redesign into a mini-roundabout (right) 62
Figure 22. The proposed location of the new bridge over the Kupa River related to the city centre .. 64
Figure 23. Traffic volume (both directions) in 2030 – afternoon peak period 66
Figure 24. Traffic volume (both directions) in the city centre in 2030 – afternoon peak period 67
Figure 25. Parking charging zones at the end of 2017 70
Figure 26. Parking charging zones at the end of 2020 71
Figure 27. Parking charging zones at the end of 2030 72
Figure 28. Delivery vehicles in the city centre 76

Figure 29. Proposed delivery vehicle parks in in the city centre 79
Figure 30. Accident blackspots in the city centre from 2012 to 2014 with the intersection of Ivan Kukuljević Sakcinski Street and Ante Starčević Street as a potential accident blackspot 88
Figure 31. The number of conflict points depending on traffic regulation at the intersection of Ivan Kukuljević Sakcinski Street and Ante Starčević Street: existing (left) amd after the reconstruction (right) 89

Table 1. Capital investments in public transport 4
Table 2. Capital investments in pedestrian and bicycle traffic 4
Table 3. Capital investments in road infrastructure 4
Table 4. Capital investments in parking policy management 4
Table 5. Capital investments in city logistics 4
Table 6. Capital investments in road safety 5
Table 7. SUMP costs by responsible entities 5
Table 8. SUMP costs by activity areas 5
Table 9. Gantt-chart for carsharing activities in 2017 31
Table 10. Gantt-chart for carsharing activities in 2018 31
Table 11. Carsharing activity carriers 32
Table 12. Goals and measures in public transport 34
Table 13. Public transport indicators 36
Table 14. Measures related to the bicycle network 44
Table 15. Indicators for non-motorized traffic 45
Table 16. Road infrastructure indicators 67
Table 17. Indikatori politike upravljanja parkiranjem 73
Table 18. City logistics – objectives and proposed measures 82
Table 19. City logistics – indicators and corresponding activities for the evaluation of the results 83
Table 20. Accidents involving cyclists 86
Table 21. Accidents involving pedestrians 86
Table 22. Road safety measures 92
Table 23. Road safety indicators 92
Table 24. Investment cost estimations for public transport 100
Table 25. Investment cost estimations for pedestrian and bicycle traffic 102
Table 26. Investment cost estimations for road infrastructure 102
Table 27. Investment cost estimations for parking 105

Table 28. Investment cost estimations for city logistics 105
Table 29. Investment cost estimations for road safety 106
Table 30. Capital investments in public transport 107
Table 31. Capital investments in pedestrian and bicycle traffic 107
Table 32. Capital investments in road infrastructure 107
Table 33. Capital investments in parking policy management 107
Table 34. Capital investments in city logistics 107
Table 35. Capital investments in road safety 108
Table 36. SUMP costs by responsible entities 108
Table 37. SUMP costs by activity areas 108
Table 38. Environmental protection measures at Plan's level 120
Table 39. Environmental mitigation measures for Ecological Network 121
Table 40. Recommendations to be taken into account during development of further design documentation 122

REFERENCES

[1] Action Plan on urban mobility [COM(2009) 490 . [Online. Available: http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52009DC0490&from=EN. [Accessed: Jul 2015].

[2] Active Travel Discussion - Chapter 3: Economic analysis, 2012.

[3] Broaddus, A., et.al., Transportation Demand Management. Eschborn, Germany: Federal Ministry for Economic Cooperation and Development, 2009.

[4] Brojenje prometa na cestama Republike Hrvatske godine 2011., Prometis d.o.o., 2012.

[5] Brojenje prometa na cestama Republike Hrvatske godine 2012. - prosječni ljetni dnevni promet, Prometis d.o.o., 2012.

[6] Centar kompetencije za planiranje održive gradske mobilnosti za Jugoistočnu Europu (KC-SUMP) u okviru projekta CIVITAS DYN@MO. [Online. Dostupno na: http://kc-sump.eu/wordpress/o-nama/. [Pristupljeno: 30 srpnja 2015.].

[7] CROW, Road safety manual, Record 26, 2009.

[8] CROW. Design manual for bicycle traffic, 2007.

[9] Crozet, Y.: The Future for Interurban Passenger Transport, International Transport Research Symposium, Discussion Paper No. 2009-14, Madrid, Spain, 2009.

[10] D. Brčić, M. Slavulj, Zbornik s okruglog stola Planovi održive urbane mobilnosti - SUMP, Fakultet prometnih znanosti, Zagreb, lipanj 2014.

[11] Directorate-General for Internal Policies. Policy Department, Sustainable Urban Transport Plans - Note, 2010.

[12] Eltis - Europe's main portal on urban mobility, http://www.eltis.org [pristupljeno: lipanj 2016].

[13] EMTA Barometer of public transport in the European metropolitan areas, European Metropolitan Transport Authories, January 2009.

[14] EU Commission: 2030 climate & energy framework, http://ec.europa.eu/clima/policies/strategies/2030/index_en.htm [pristupljeno: rujan 2016].

[15] EU Commission: A call for smarter urban vehicle access regulations, http://ec.europa.eu/transport/themes/urban/doc/ump/swd(2013)526-communication.pdf [rujan 2016].

[16] EU Commission: A call to action on urban logistics, http://ec.europa.eu/transport/themes/urban/doc/ump/swd(2013)524-communication.pdf [rujan 2016].

[17] EU Commission: A concept for Sustainable Urban Mobility Plans, http://ec.europa.eu/transport/themes/urban/doc/ump/com(2013)913-annex_en.pdf [rujan 2016].

[18] EU Commission: Mobilising Intellgent Transport Systems for EU cities, http://ec.europa.eu/transport/themes/urban/doc/ump/swd(2013)527-communication.pdf [rujan 2016].

[19] EU Commission, Study to support an impact assessment of the urban mobility package, Activity 31 Sustainable urban mobility Plans, Final report, October 2013.

[20] EU Commission: Targeted Action on urban road safety, http://ec.europa.eu/transport/themes/urban/doc/ump/com(2013)913_en.pdf [rujan 2016]

[21] Final Report of the Expert Working Group on Sustainable Urban Transport Plans, 2004.

[22] Final report, Result of the public consultation 'The urban dimension of the EU transport policy', European commision DG MOVE, April 2013.

[23] Great Britain Department for Transport, Guidance on Local Transport Plans, 2009.

[24] Green Paper, Towards a new culture for urban mobility, 2007.

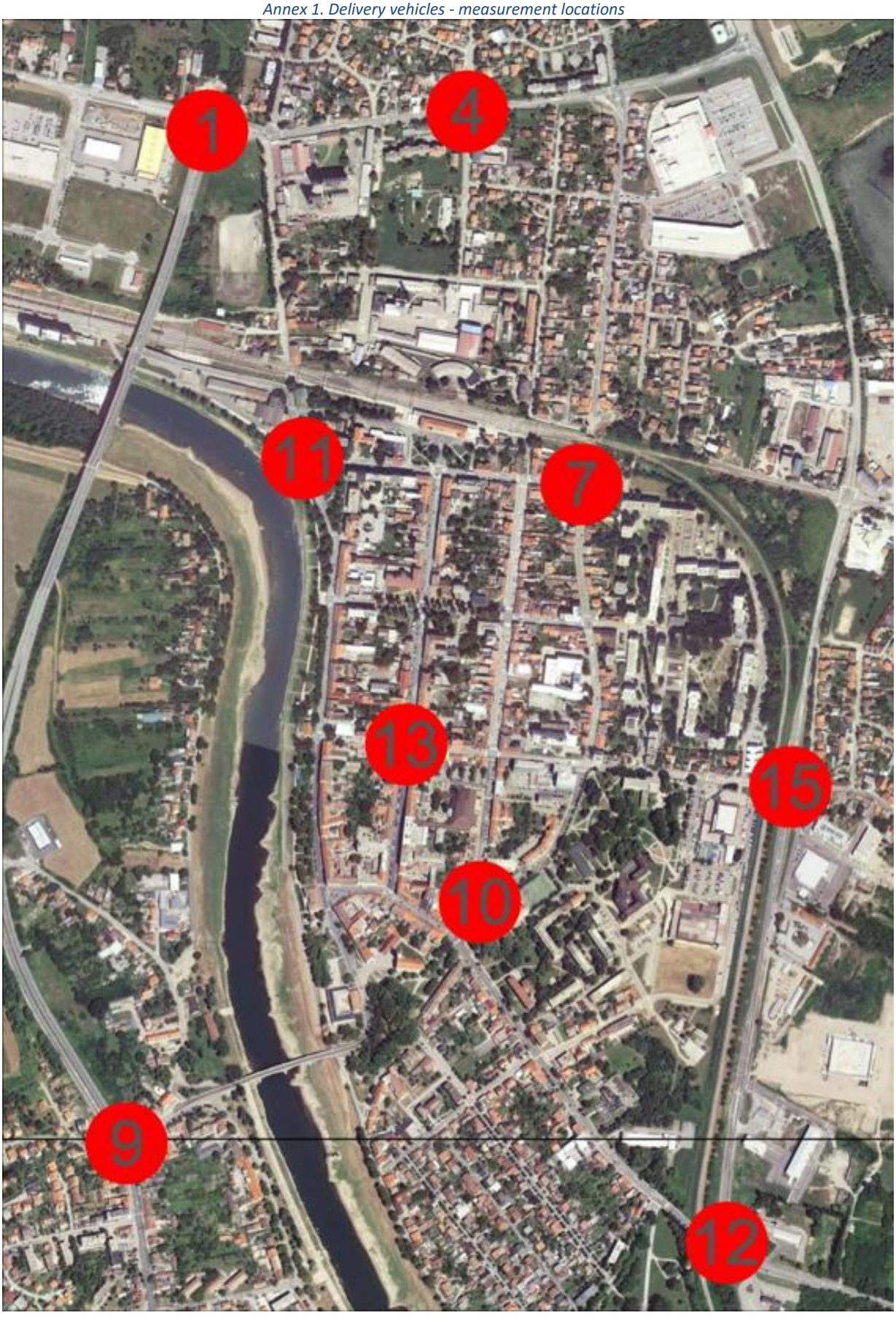
[25] Guidelines - Developing and Implementing a Sustainable Urban Mobility Plan, 2011.
[26] Handbook on estimation of external costs in the transport sector. Produced within the study Internalisation Measures and Policies for All external Cost of Transport (IMPACT), 2008.
[27] Hanson, S., Genevieve, G.: The Geography of Urban Transportation, Third Edition, The Guilford Press, 2004.
[28] Highway Capacity Manual, Transportation Research Board, National Research Council, Washington, 2000.
[29] Ison, S., Rye, T.: The Implementation and Effectiveness of Transport Demand Management Measures: An International Perspective Ashgate Publishing Limited, United Kingdom; 2008.
[30] Kutz, M.: Handbook of Transportation Engineering, McGraw-Hill Company, Columbus, 2004.
[31] Maffii, S., et.al., Mobility management. Brussels: Directorate general for internal policies, Policy department b: structural and cohesion policies, Transport and tourism, 2009.
[32] Meyer, D. M., Miller, E. j.: Urban Transportation Planning, Second Edition, 2001.
[33] Ministarstvo pomorstva, prometa i infrastrukture. Pravilnik o biciklističkoj infrastrukturi (Narodne novine br. 28/2016).
[34] Navodila za projektiranje kolesarskih površin, Ministarstvo za infrastrukturo in prostor, Direkcija Republike Slovenije za ceste, 2012.
[35] Optimising Bike Sharing European Cities OBIS, Handbook, June 2011.
[36] Ortúzar, J. de D., Willumsen, L. G.: MODELLING TRANSPORT, Fourth Edition, John Wiley & Sons, Ltd, 2011.
[37] Porast biciklizma u malim i srednje velikim gradovima Srednje i Istočne Europe do 2020. godine, Mobile 2020, 2012.
[38] Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system, European White Paper, 2011.
[39] Rodrigue, J.P., Comtois, C., Slack, B.: The Geography of Transport Systems, second edition, Taylor and Francis Group, Abingdon, United Kingdom, 2009., ISBN 0-203-88415-9.
[40] Rupprecht Consult, 2014: Guidelines on Developing and Implementing a Sustainable Urban Mobility Plan. [Online. Available: http://www.eltis.org/sites/eltis/.
[41] Sælensminde, K.: Cost-benefit analyses of walking and cycling track networks taking into account insecurity, health effects and external costs of motorized traffic, Transportation Research Part A: Policy and Practice, 38 (8), pp. 593-606, 2004.
[42] Small, K.A., Verhoef, E.T., The Economics of Urban Transportation.: Taylor & Francis, 2007.
[43] SUMP Challenges. [Online. Available: http://www.sump-challenges.eu/. [Accessed: Jul 2015].
[44] Sustainable Urban Transport Plans (SUTP) and Urban Environment: Policies, Effects, and Simulations, 2005.
[45] Sustainable Urban Transport Plans. Preparatory Document in relation to the follow-up of the Thematic Strategy of the Urban Environment, 2007.
[46] The State of the Art of Sustainable Urban Mobility Plans in Europe, Rupprecht Consult, 2011.
[47] The State of the Art of Sustainable Urban Mobility Plans in Europe, Rupprecht Consult, Revised, 2012.
[48] The State-of-the-Art Report of Sustainable Urban Mobility Plans in Europe, 2012.
[49] Thematic Strategy on the Urban Environment, 2006.
[50] Traffic Engineering Handbook 6th Edition, Institute of Transportation Engineers, 2009.
[51] Urbanczyk R., PRESTO, Intelligent Energy Europe, Vodič za strategiju, 2010.
[52] Victoria Transport Policy Institute, Canada. VTPI, Online TDM Encyclopedia,2010. www.vtpi.org.
[53] Vuchic, V. R.: Urban Transit Operations, Planning and Economics, John Wiley and Sons, Inc., 2005.
[54] White Paper: Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system [COM/2011/0144] final.

Sisak Urban Transport – Sustainable Urban Mobility Planning

ANNEXES

Annex 1. Delivery vehicles - measurement locations 145
Annex 2. The number of vehicles within vehicle categories at intersections 146
Annex 3. Road accident comparison according to vehicle categories in the last five years 147
Annex 4. Comparison of accident consequences in the last five years 147
Annex 5. The state of road safety, 1995 – 2015 148
Annex 6. The number of road accidents, comparison by months, 2012 – 2014 148
Annex 7. The number of road accidents, comparison by days within a week, 2012 – 2014 148
Annex 8. The number of road accidents, comparison by hours within a day, 2012 – 2014 149
Annex 9. Road accidents on the specific roads in the City of Sisak, 2015 149
Annex 10. Road accidents at the specific intersection in the City of Sisak, 2015 149
Annex 11.Road accidents involving casualties and injuries – locations in the City of Sisak during 2014 150
Annex 12. Accident focal points in the City of Sisak, 2012- 2014 150
Annex 13. Financial forecast and assumptions - Croatia 151
Annex 14. Revenue and expenditure account (historic and forecast) 152
Annex 15. Cash flow 153
Annex 16. Ratios and key metrics 154

Annex 1. Delivery vehicles - measurement locations



Annex 2. The number of vehicles within vehicle categories at intersections

	Period	Private car	Light-duty	Heavy-duty	Total
Zagrebačka Street - Vlado Janjić Capa Street	05:30 - 06:30	88%	7%	1%	706
	06:30 - 07:30	89%	7%	2%	1369
	11:00 - 12:00	87%	8%	2%	1683
	15:00 - 16:00	88%	7%	2%	2078
	16:00 - 17:00	90%	7%	1%	1985
	18:30 - 19:30	94%	5%	1%	1420
Ferdo Hefele Street – Marijan Celjak Street - Antun Cuvaj Street	Period	Private car	Light-duty	Heavy-duty	Total
	05:30 - 06:30	91%	4%	2%	515
	06:30 - 07:30	91%	4%	3%	986
	11:00 - 12:00	88%	6%	3%	1261
	15:00 - 16:00	89%	4%	3%	1456
	16:00 - 17:00	91%	4%	2%	1280
	18:30 - 19:30	95%	2%	1%	1052
Franjo Lovrić Street – Frankopanska Street	Period	Private car	Light-duty	Heavy-duty	Total
	05:30 - 06:30	82%	13%	1%	179
	06:30 - 07:30	89%	9%	0%	465
	11:00 - 12:00	82%	12%	1%	696
	15:00 - 16:00	90%	7%	0%	784
	16:00 - 17:00	90%	7%	0%	673
	18:30 - 19:30	91%	8%	0%	581
Keltska Street – Josip Juraj Strossmayer Street – Žitna Street	Period	Private car	Light-duty	Heavy-duty	Total
	05:30 - 06:30	84%	10%	1%	575
	06:30 - 07:30	89%	7%	1%	1497
	11:00 - 12:00	88%	7%	2%	1449
	15:00 - 16:00	91%	5%	1%	1905
	16:00 - 17:00	91%	6%	0%	1758
	18:30 - 19:30	94%	4%	0%	1170
Franjo Lovrić Street – Ante Starčević Street	Period	Private car	Light-duty	Heavy-duty	Total
	05:30 - 06:30	74%	11%	0%	84
	06:30 - 07:30	92%	2%	0%	399
	11:00 - 12:00	86%	6%	1%	547
	15:00 - 16:00	93%	3%	0%	626
	16:00 - 17:00	91%	3%	0%	455
	18:30 - 19:30	96%	3%	0%	507
Rimska Street – Frankopanska Street	Period	Private car	Light-duty	Heavy-duty	Total
	05:30 - 06:30	83%	9%	0%	270
	06:30 - 07:30	92%	3%	0%	875
	11:00 - 12:00	90%	4%	0%	943
	15:00 - 16:00	92%	3%	0%	1206
	16:00 - 17:00	93%	3%	0%	1113
	18:30 - 19:30	96%	2%	0%	794
Ivan Fistrović Street – Vatrogasna Street – Kralj Tomislav Street	Period	Private car	Light-duty	Heavy-duty	Total
	05:30 - 06:30	88%	4%	1%	361
	06:30 - 07:30	91%	2%	3%	834
	11:00 - 12:00	89%	4%	1%	920
	15:00 - 16:00	89%	5%	2%	1084
	16:00 - 17:00	91%	4%	2%	797
	18:30 - 19:30	95%	3%	0%	502

	Period	Private car	Light-duty	Heavy-duty	Total
Ivan Kukuljević Sakcinski Street – Stjepan and Antun Radić Street	05:30 - 06:30	95%	2%	0%	520
	06:30 - 07:30	94%	2%	0%	850
	11:00 - 12:00	96%	1%	0%	801
	15:00 - 16:00	97%	1%	0%	1055
	16:00 - 17:00	94%	2%	0%	851
	18:30 - 19:30	96%	1%	0%	919
	Period	**Private car**	**Light-duty**	**Heavy-duty**	**Total**
Ivan Kukuljević Sakcinski Street – Ivo Rukavina Street	05:30 - 06:30	83%	11%	2%	380
	06:30 - 07:30	89%	5%	3%	857
	11:00 - 12:00	86%	7%	2%	984
	15:00 - 16:00	87%	9%	2%	1253
	16:00 - 17:00	88%	7%	1%	1140
	18:30 - 19:30	94%	4%	0%	900

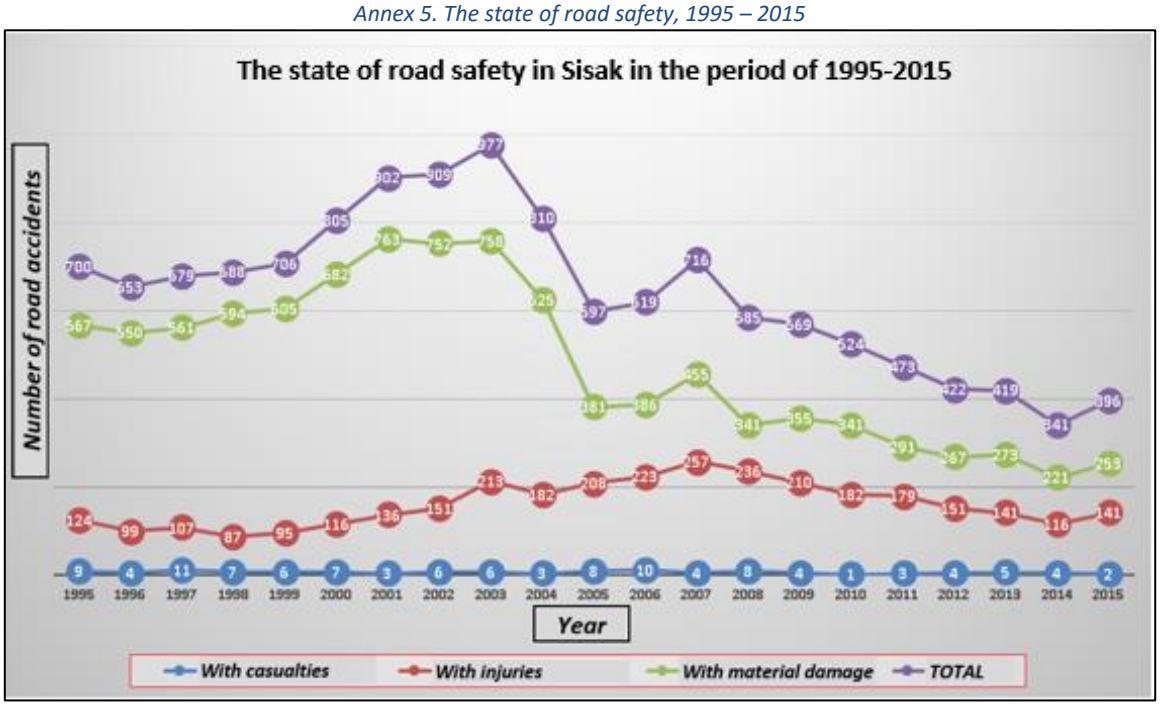
Annex 3. Road accident comparison according to vehicle categories in the last five years

Vehicle type	2011 No	2011 (%)	2012 No	2012 (%)	2013 No	2013 (%)	2014 No	2014 (%)	2015 No	2015 (%)	change 2011-2015
Moped	1297	6.3%	1225	6.1%	1145	5.8%	1088	5.5%	1028	5.2%	-20.7%
Motorcycle	474	2.3%	453	2.3%	455	2.3%	453	2.3%	447	2.3%	-5.7%
Private car	15606	76.0%	15270	76.2%	15096	76.3%	15198	76.5%	15234	76.8%	-2.4%
Bus	54	0.3%	51	0.3%	52	0.3%	50	0.3%	51	0.3%	-5.6%
Cargo and duty	1392	6.8%	1323	6.6%	1256	6.3%	1260	6.3%	1289	6.5%	-7.4%
Combined car	49	0.2%	39	0.2%	28	0.1%	22	0.1%	22	0.1%	-55.1%
Working machines	88	0.4%	85	0.4%	99	0.5%	100	0.5%	96	0.5%	9.1%
Tractor	1217	5.9%	1215	6.1%	1212	6.1%	1215	6.1%	1193	6.0%	-2.0%
Trailer	332	1.6%	349	1.7%	423	2.1%	461	2.3%	472	2.4%	42.2%
Light quadricycle	4	0.0%	4	0.0%	4	0.0%	4	0.0%	5	0.0%	25.0%
Quadricycle	11	0.1%	13	0.1%	14	0.1%	12	0.1%	10	0.1%	-9.1%
Total	20524	100.0%	20027	100.0%	19784	100.0%	19863	100.0%	19847	100.0%	-3.3%

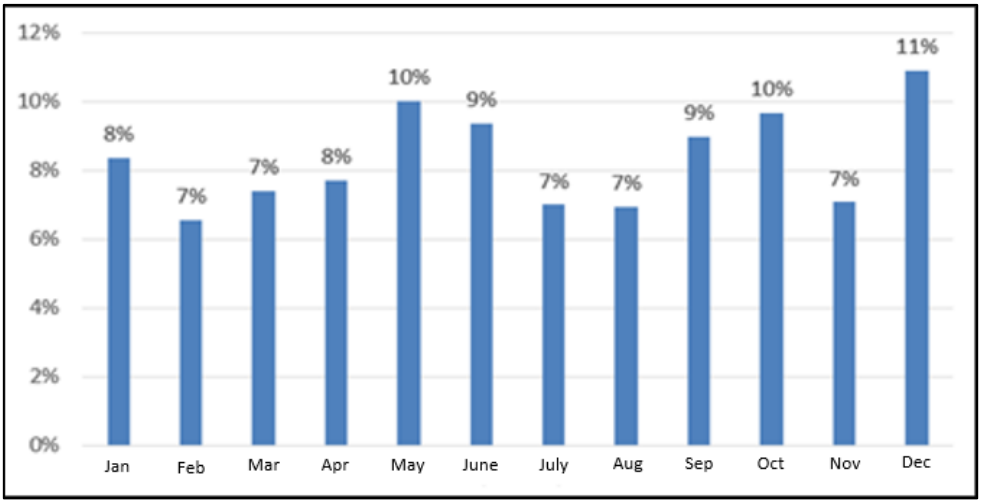
Annex 4. Comparison of accident consequences in the last five years

Consequence	2011 No	2011 (%)	2012 No	2012 (%)	2013 No	2013 (%)	2014 No	2014 (%)	2015 No	2015 (%)	change 2011-2015
With casualties	3	0.6%	4	0.9%	5	1.2%	4	1.2%	2	0.5%	-33.3%
With injuries	179	37.8%	151	35.8%	141	33.7%	116	34.0%	141	35.6%	-21.2%
With material damage	291	61.5%	267	63.3%	273	65.2%	221	64.8%	253	63.9%	-13.1%
Total	473	100.0%	422	100.0%	419	100.0%	341	100.0%	396	100.0%	-16.3%

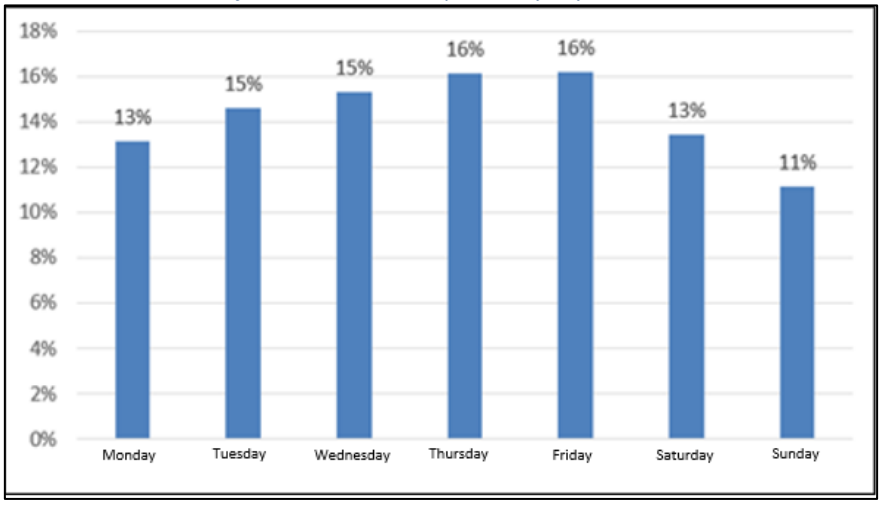
Annex 5. The state of road safety, 1995 – 2015



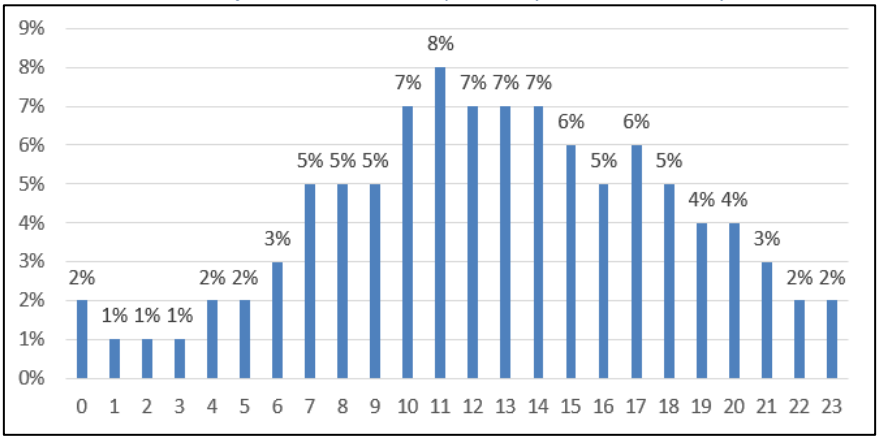
Annex 6. The number of road accidents, comparison by months, 2012 – 2014



Annex 7. The number of road accidents, comparison by days within a week, 2012 – 2014



Annex 8. The number of road accidents, comparison by hours within a day, 2012 – 2014



Annex 9. Road accidents on the specific roads in the City of Sisak, 2015

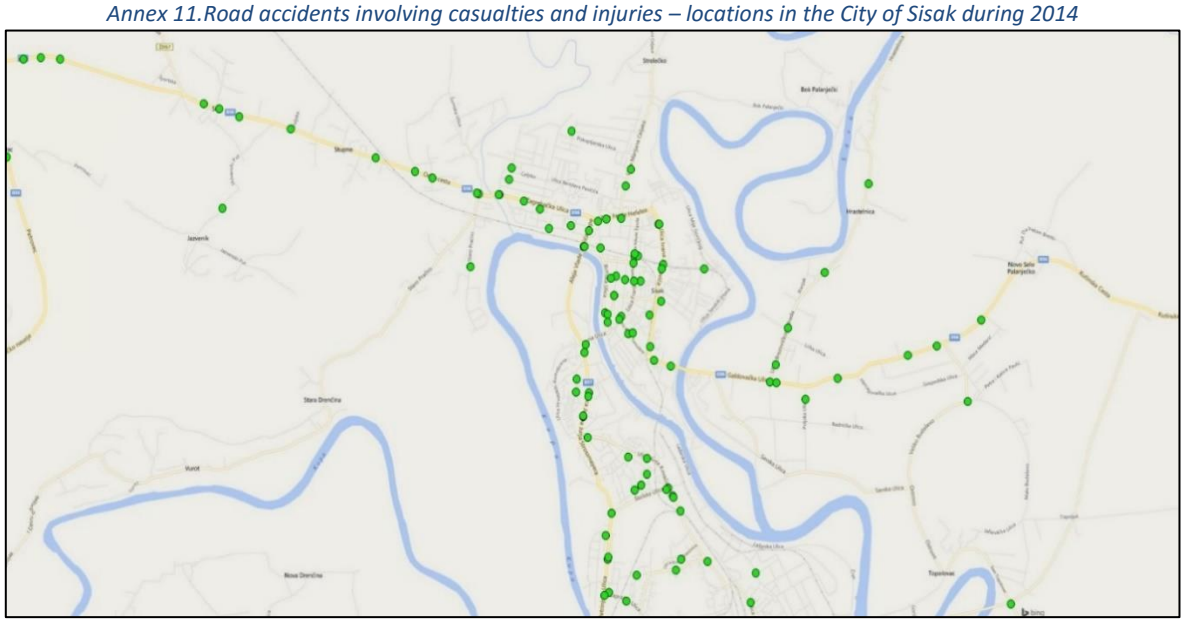
Road section	Injuries total	Material damage total	Bicycle injuries	Bicycle material damage	Pedestrian injuries	Notes
Josip Juraj Strossmayer Street (DC37)	16	19	1	2	2	22 slight injuries (16 driivers, 4 passengers, 2 pedestrians)
Zagrebačka Street (DC36)	5	17	1	-	-	1 severe injury (driver) 4 slight injuries (2 drivers, 2 passengers)
Ivan Kukuljvić Sakcinski Street	7	13	-	-	1	2 severe injuries (1 driver, 1 pedestrian) 6 slight injuries (4 drivers, 2 passengers)
Rimska Street	5	13	-	-	1	8 slight injuries (4 drivers, 3 passengers, 1 pedestrian)
Galdovačka Street (DC36)	7	8	1	-	-	8 slight injuries (6 drivers, 2 passengers)
Stjepan and Antun Radić Street	3	12	-	-	2	1 severe injury (pedestrian) 2 slight injuries (1 driver, 1 pedestrian)

Annex 10. Road accidents at the specific intersection in the City of Sisak, 2015

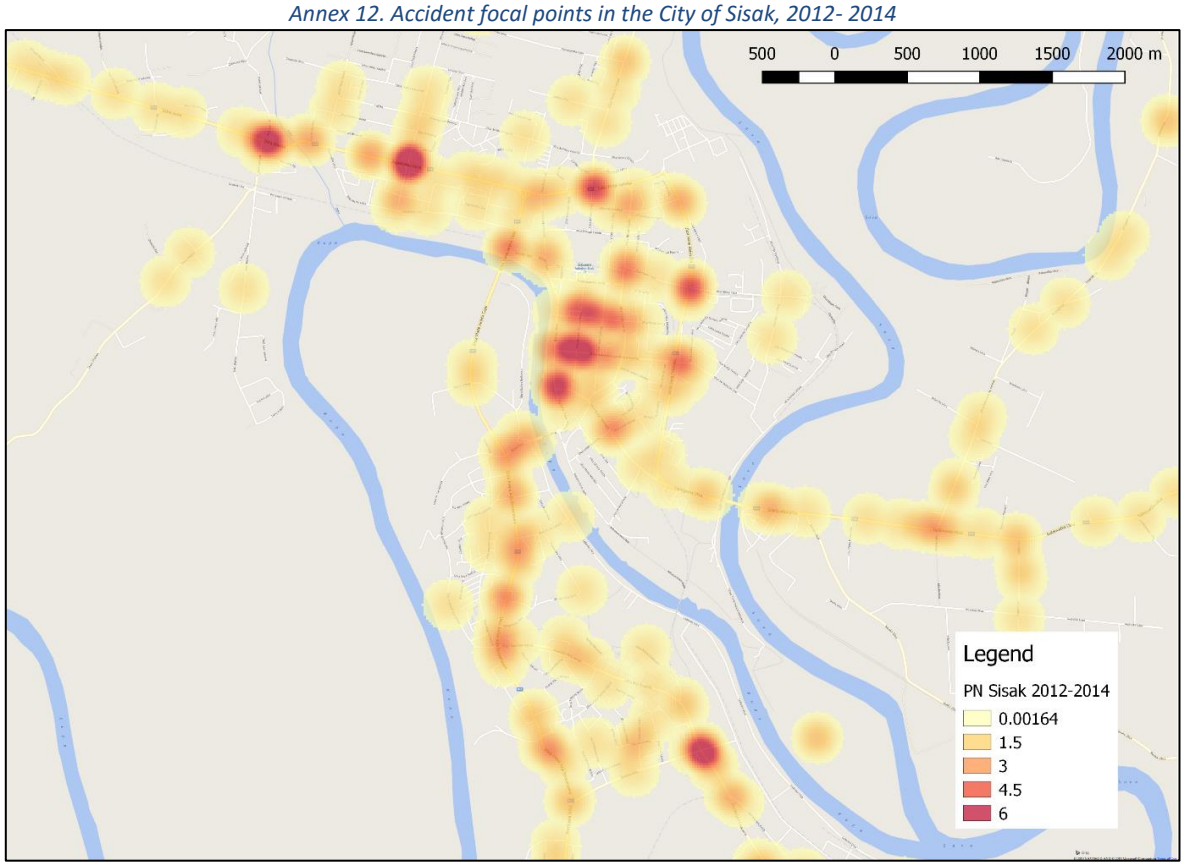
Intersection	Total injuries	Total material damage	Bicycle injuries	Pedestrian injuries	Notes
Ivan Kukuljević Sakcinski Street – Stjepan and Antun Radić Street	2	3	-	1	2 slight injuries (1 passenger, 1 pedestrian)
Matija Gubec Street – Antun Starčević Street	2	2	-	-	2 slight injuries (drivers)
Ivan Kukuljević Sakcinski Street – Antun Starčević Street	1	3	-	-	1 slight injury (driver)
Josip Juraj Strossmayer Street – Narodni heroji Street	2	1	-	-	3 slight injuries (drivers)
Ivan Kukuljević Sakcinski Street – Franjo Lovrić Street	2	-	-	-	2 slight injuries (drivers)
Marijan Celjak Street – Ferdo Hefele Street	2	-	1		3 slight injuries (drivers)

Intersection	Total injuries	Total material damage	Bicycle injuries	Pedestrian injuries	Notes
Ivan Kukuljević Sakcinski Street - Rimska Street	1	1	-	-	1 slight injury (driver)
Ljudevit Posavski Square - Rimska Street	1	1	-	-	1 slight injury (driver)

Annex 11.Road accidents involving casualties and injuries – locations in the City of Sisak during 2014



Annex 12. Accident focal points in the City of Sisak, 2012- 2014



Annex 13. Financial forecast and assumptions - Croatia

Economic indicators	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Real GDP growth/decline (% per annum)	-1.1%	-0.4%	1.6%	1.7%	1.7%	1.9%	1.9%	1.9%	1.9%	1.9%	1.9%	1.9%	1.9%	1.9%	1.9%	1.9%	1.9%	1.9%
Real private consumption growth/decline (% per annum)	-1.8%	-0.7%	1.2%	1.3%	1.2%	1.5%	1.7%	1.7%	1.9%	1.9%	1.9%	1.9%	1.9%	1.9%	1.9%	1.9%	1.9%	1.9%
Consumer prices (average, %)	2.2%	-0.2%	-0.5%	-1.0%	0.6%	1.5%	1.5%	1.8%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%
Nominal GDP growth/decline (% per annum)	1.1%	-0.6%	1.1%	0.7%	2.3%	3.4%	3.4%	3.7%	3.7%	3.7%	3.7%	3.7%	3.7%	3.7%	3.7%	3.7%	3.7%	3.7%
Lending rate (average, %)	6.7%	6.3%	5.8%	6.5%	6.5%	6.6%	6.7%	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%
Deposit rate (average %)	3.9%	3.5%	3.2%	3.1%	3.0%	3.0%	3.2%	3.4%	3.4%	3.4%	3.4%	3.4%	3.4%	3.4%	3.4%	3.4%	3.4%	3.4%
Labour costs per hour (HRK)	30.6	30.6	30.7	31.2	31.5	31.9	32.6	33.0	34.0	35.1	36.2	37.3	38.5	39.7	40.9	42.2	43.5	44.9
Average real wages growth/decline (% per annum)	-1.5%	0.5%	1.6%	3.0%	0.9%	0.5%	1.0%	0.2%	1.1%	1.1%	1.1%	1.1%	1.1%	1.1%	1.1%	1.1%	1.1%	1.1%
Average nominal wages growth/decline (% per annum)	0.7%	0.3%	1.1%	2.0%	1.5%	2.0%	2.5%	2.0%	3.1%	3.1%	3.1%	3.1%	3.1%	3.1%	3.1%	3.1%	3.1%	3.1%
EUR:HRK exchange rate (average)	7.57	7.63	7.61	7.57	7.59	7.61	7.63	7.65	7.65	7.65	7.65	7.65	7.65	7.65	7.65	7.65	7.65	7.65

Source: The Economist Intelligence Unit - Croatia country forecast June 2016

in HRK	2013	2014	2015	2016 (I-VI)	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
OPERATING REVENUE	**163,248,521**	**166,194,327**	**165,420,147**	**85,607,105**	**171,058,418**	**180,739,704**	**184,467,848**	**188,723,063**	**192,924,968**	**198,398,529**	**204,035,305**	**209,840,362**	**215,818,929**	**221,976,398**	**228,318,339**	**234,850,497**	**241,578,802**	**248,509,377**	**255,648,538**
1. Tax revenue	85,189,727	83,286,524	75,818,170	42,755,198	85,510,396	86,793,052	88,528,913	90,742,136	92,556,979	95,444,756	98,422,633	101,493,419	104,660,013	107,925,406	111,292,679	114,765,010	118,345,678	122,038,064	125,845,651
2. Assistance from abroad and from subjects w ithin the general budget	13,123,370	19,167,705	15,567,858	7,603,678	15,260,582	23,111,575	23,897,369	24,709,879	25,624,145	26,572,238	27,555,411	28,574,961	29,632,235	30,728,627	31,865,587	33,044,613	34,267,264	35,535,153	36,849,953
3. Revenue from assets	3,595,865	5,370,813	6,408,029	3,297,108	6,617,296	6,769,494	6,999,656	7,237,645	7,505,438	7,783,139	8,071,115	8,369,746	8,679,427	9,000,565	9,333,586	9,678,929	10,037,049	10,408,420	10,793,532
4. Revenue from management and administrative fees, fees based on specific regulations and fees	60,606,497	57,830,822	66,811,327	31,134,179	62,268,358	62,641,968	63,581,598	64,535,322	65,696,957	67,010,897	68,351,115	69,718,137	71,112,500	72,534,750	73,985,445	75,465,153	76,974,456	78,513,946	80,084,225
5. Revenue from sale of products and goods, services rendered and revenue from donations	317,000	267,705	496,767	393,296	789,345	807,500	834,955	863,343	895,287	928,413	962,764	998,386	1,035,327	1,073,634	1,113,358	1,154,552	1,197,271	1,241,570	1,287,508
6. Penalties, administrative measures and other revenues	416,062	270,758	317,996	423,646	612,441	616,116	625,357	634,738	646,163	659,086	672,268	685,713	699,428	713,416	727,685	742,238	757,083	772,225	787,669
OPERATING EXPENSES	**154,622,237**	**149,434,331**	**146,256,093**	**68,288,307**	**151,570,782**	**156,781,266**	**160,330,911**	**164,056,186**	**168,266,346**	**170,591,005**	**175,403,911**	**180,326,020**	**185,470,590**	**190,771,419**	**196,187,369**	**201,701,941**	**207,321,765**	**213,053,708**	**218,853,764**
1. Employee expenses	56,280,407	15,531,879	13,676,655	6,789,539	13,579,078	13,782,764	14,058,419	14,409,880	14,698,078	12,806,788	13,206,360	13,618,398	14,043,292	14,481,443	14,933,264	15,399,182	15,879,636	16,375,081	16,885,984
2. Material expenses	57,096,809	50,559,980	51,269,182	21,790,106	52,528,206	55,501,112	56,333,629	57,178,634	58,207,849	59,372,006	60,559,446	61,770,635	63,006,048	64,266,169	65,551,492	66,862,522	68,199,772	69,563,768	70,955,043
3. Financial expenses	653,167	731,470	1,424,345	412,199	2,180,620	2,644,522	2,589,481	2,542,721	2,508,469	2,489,279	2,537,857	2,549,298	2,632,071	2,715,020	2,751,883	2,720,863	2,623,108	2,459,817	2,181,119
4. Subsidies	11,021,312	10,529,795	8,290,293	2,628,591	9,947,133	10,175,917	10,521,899	10,879,643	11,282,190	11,699,631	12,132,517	12,581,420	13,046,933	13,529,670	14,030,267	14,549,387	15,087,715	15,645,960	16,224,860
5. Grants abroad and w ithin the general budget	50,000	44,482,568	46,054,825	26,505,624	53,011,248	54,230,507	56,074,344	57,980,872	60,126,164	62,350,832	64,657,813	67,050,152	69,531,007	72,103,655	74,771,490	77,538,035	80,406,942	83,381,999	86,467,133
6. Payments to citizens and households based on insurance and other fees	6,952,101	8,173,145	7,325,422	3,604,558	7,209,116	7,252,371	7,361,156	7,471,574	7,606,062	7,758,183	7,913,347	8,071,614	8,233,046	8,397,707	8,565,661	8,736,974	8,911,714	9,089,948	9,271,747
7. Other expenses	22,568,441	19,425,494	18,215,371	6,557,690	13,115,380	13,194,072	13,391,983	13,592,863	13,837,535	14,114,285	14,396,571	14,684,502	14,978,193	15,277,756	15,583,311	15,894,978	16,212,877	16,537,135	16,867,878
SURPLUS/(SHORTFALL) FROM OPERATIONS	**8,626,284**	**16,759,996**	**19,164,054**	**17,318,798**	**19,487,636**	**23,958,438**	**24,136,937**	**24,666,876**	**24,658,623**	**27,807,524**	**28,631,394**	**29,514,343**	**30,348,338**	**31,204,979**	**32,130,970**	**33,148,555**	**34,257,037**	**35,455,669**	**36,794,774**
7. Revenues from the sale of non-financial assets	**1,672,503**	**1,822,548**	**1,401,451**	**973,040**	**1,673,040**	**1,683,078**	**1,708,324**	**1,733,949**	**1,765,160**	**1,800,464**	**1,836,473**	**1,873,202**	**1,910,666**	**1,948,880**	**1,987,857**	**2,027,614**	**2,068,167**	**2,109,530**	**2,151,721**
8. Expenses for procurement of non-financial assets	**20,877,356**	**16,446,700**	**17,834,815**	**8,742,276**	**51,585,853**	**30,971,333**	**21,371,333**	**21,371,333**	**31,879,444**	**31,879,444**	**31,879,444**	**31,879,444**	**31,879,444**	**31,879,444**	**31,775,333**	**31,775,333**	**31,775,333**	**31,775,333**	**31,775,333**
Tangible assets - natural wealth (land)	59,125	43,050	274,692	10,944	20,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000
Intangible assets	53,002	237,713	2,070,699	757,026	1,100,000	2,895,833	2,895,833	2,895,833	2,055,528	2,055,528	2,055,528	2,055,528	2,055,528	2,055,528	2,605,333	2,605,333	2,605,333	2,605,333	2,605,333
8.2.1 Building objects	17,971,364	10,697,476	11,827,242	5,689,650	47,255,853	24,957,833	15,357,833	15,357,833	26,730,583	26,730,583	26,730,583	26,730,583	26,730,583	26,730,583	25,880,000	25,880,000	25,880,000	25,880,000	25,880,000
8.2.2 Plant and equipment	409,004	214,233	244,686	193,397	300,000	377,667	377,667	377,667	353,333	353,333	353,333	353,333	353,333	353,333	550,000	550,000	550,000	550,000	550,000
8.2.3 Transport means (equipment)	36,032	27,911	-	-	10,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000
8.2.4 Books, artwords and other exhibits of value	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8.2.5 Intangible produced assets	554,833	946,708	166,797	238,445	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000
Additional investments in building objects	1,793,996	2,038,445	2,248,914	1,641,166	2,500,000	2,200,000	2,200,000	2,200,000	2,200,000	2,200,000	2,200,000	2,200,000	2,200,000	2,200,000	2,200,000	2,200,000	2,200,000	2,200,000	2,200,000
Additional investments in other non-financial assets	-	2,241,164	1,001,785	211,648	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SURPLUS/(SHORTFALL) FROM NON-FINANCIAL ASSETS	**(19,204,853)**	**(14,624,152)**	**(16,433,364)**	**(7,769,236)**	**(49,912,813)**	**(29,288,255)**	**(19,663,009)**	**(19,637,384)**	**(30,114,284)**	**(30,078,981)**	**(30,042,971)**	**(30,006,242)**	**(29,968,778)**	**(29,930,565)**	**(29,787,476)**	**(29,747,719)**	**(29,707,167)**	**(29,665,803)**	**(29,623,613)**
TOTAL REVENUE	**164,921,024**	**168,016,875**	**166,821,598**	**86,580,145**	**172,731,458**	**182,422,783**	**186,176,172**	**190,457,012**	**194,690,129**	**200,198,992**	**205,871,778**	**211,713,565**	**217,729,595**	**223,925,278**	**230,306,196**	**236,878,111**	**243,646,969**	**250,618,907**	**257,800,259**
TOTAL EXPENSE	**175,499,593**	**165,881,031**	**164,090,908**	**77,030,583**	**203,156,635**	**187,752,599**	**181,702,245**	**185,427,520**	**200,145,790**	**202,470,449**	**207,283,355**	**212,205,464**	**217,350,035**	**222,650,863**	**227,962,702**	**233,477,275**	**239,097,098**	**244,829,042**	**250,629,098**
SURPLUS/(SHORTFALL)	**(10,578,569)**	**2,135,844**	**2,730,690**	**9,549,562**	**(30,425,177)**	**(5,329,817)**	**4,473,928**	**5,029,492**	**(5,455,661)**	**(2,271,457)**	**(1,411,577)**	**(491,900)**	**379,560**	**1,274,414**	**2,343,494**	**3,400,836**	**4,549,871**	**5,789,865**	**7,171,161**

in HRK	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Cash flow from operations															
Surplus/(shortfall) from R&E	(30,425,177)	(5,329,817)	4,473,928	5,029,492	(5,455,661)	(2,271,457)	(1,411,577)	(491,900)	379,560	1,274,414	2,343,494	3,400,836	4,549,871	5,789,865	7,171,161
Decrease/(increase) in deposits and guarantee deposits and receivables	(296,005)	(508,261)	(195,725)	(223,396)	(220,597)	(287,358)	(295,927)	(304,762)	(313,871)	(323,263)	(332,948)	(342,934)	(353,232)	(363,851)	(374,801)
Decrease/(increase) in trade receivables	(1,652,308)	(2,837,124)	(1,092,541)	(1,247,001)	(1,231,378)	(1,604,040)	(1,651,870)	(1,701,186)	(1,752,033)	(1,804,461)	(1,858,520)	(1,914,264)	(1,971,746)	(2,031,021)	(2,092,148)
Decrease/(increase) receivables for loans	-	7,167,609	-	-	-	-	-	-	-	-	-	-	-	-	-
Decrease/(increase) receviables from sale of non-financial assets	754,041	769,235	784,735	800,548	816,680	833,136	849,924	867,051	884,522	902,346	-	-	-	-	-
(Decrease)/increase in liabilities for operations expenses	517,684	507,534	345,758	362,865	410,096	226,436	468,808	479,445	501,114	516,334	527,548	537,154	547,406	558,328	564,962
(Decrease)/increase liabilities for procurement of non-financial assets	9,289,483	(5,673,847)	(2,642,261)	-	2,892,205	-	-	-	-	-	(28,655)	-	-	-	-
(Decrease)/increase accrued expenses and deferred revenue	83,689	143,700	55,337	63,160	62,369	81,244	83,667	86,165	88,740	91,396	94,134	96,957	99,869	102,871	105,967
Value adjustments (non-cash items)	-	(7,167,609)	-	-	-	-	-	-	-	-	-	-	-	-	-
Net cash flow from operating activities	**(21,728,593)**	**(12,928,580)**	**1,729,231**	**4,785,670**	**(2,726,287)**	**(3,022,037)**	**(1,956,976)**	**(1,065,187)**	**(211,967)**	**656,766**	**745,053**	**1,777,750**	**2,872,169**	**4,056,192**	**5,375,141**
Cash flow from financing activities															
Loan principal repayments	(2,281,300)	(1,138,550)	(1,161,430)	(901,590)	(765,000)	(621,100)	(5,665,170)	(5,872,587)	(6,192,845)	(6,559,043)	(6,925,404)	(7,267,708)	(7,564,809)	(7,855,511)	(7,289,429)
Loan proceeds	35,255,853	9,600,000	-	-	-	-	3,000,000	6,000,000	7,000,000	7,000,000	6,000,000	5,000,000	4,000,000	3,000,000	2,000,000
Net cash flow from financing activities	**32,974,553**	**8,461,450**	**(1,161,430)**	**(901,590)**	**(765,000)**	**(621,100)**	**(2,665,170)**	**127,413**	**807,155**	**440,957**	**(925,404)**	**(2,267,708)**	**(3,564,809)**	**(4,855,511)**	**(5,289,429)**
Total net cash flow	11,245,960	(4,467,130)	567,801	3,884,080	(3,491,287)	(3,643,137)	(4,622,146)	(937,774)	595,188	1,097,724	(180,351)	(489,958)	(692,641)	(799,319)	85,712
Cash as at 1 January	5,543,782	16,789,742	12,322,612	12,890,413	16,774,493	13,283,206	9,640,068	5,017,922	4,080,148	4,675,336	5,773,060	5,592,709	5,102,751	4,410,110	3,610,792
Cash at 31 December	**16,789,742**	**12,322,612**	**12,890,413**	**16,774,493**	**13,283,206**	**9,640,068**	**5,017,922**	**4,080,148**	**4,675,336**	**5,773,060**	**5,592,709**	**5,102,751**	**4,410,110**	**3,610,792**	**3,696,504**

Annex 16. Ratios and key metrics

Ratios	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Total debt (in HRK)	21,718,673	19,280,356	20,746,851	53,721,404	62,182,854	61,021,424	60,119,834	59,354,834	58,733,734	56,068,564	56,195,977	57,003,132	57,444,089	56,518,685	54,250,978	50,886,168	45,830,657	40,541,228
Interest paid (in HRK)	381,334	482,018	557,317	1,966,880	2,429,500	2,371,233	2,321,200	2,282,960	2,259,260	2,303,237	2,309,986	2,387,973	2,466,040	2,497,923	2,461,824	2,358,888	2,190,313	1,906,225
Loan principal paid (in HRK)	8,285,732	6,548,747	5,020,300	2,281,300	1,138,550	1,161,430	901,590	765,000	621,100	5,665,170	5,872,587	6,192,845	6,559,043	6,925,404	7,267,708	7,564,809	7,855,511	7,289,429
Debt service/total installment paid (in HRK)	8,667,066	7,030,765	5,577,617	4,248,180	3,568,050	3,532,663	3,222,790	3,047,960	2,880,360	7,968,408	8,182,573	8,580,818	9,025,082	9,423,327	9,729,532	9,923,698	10,045,824	9,195,654
Surplus/(shortfall) from operations in HRK	8,626,284	16,759,996	19,164,054	19,487,636	23,958,438	24,136,937	24,666,876	24,658,623	27,807,524	28,631,394	29,514,343	30,348,338	31,204,979	32,130,970	33,148,555	34,257,037	35,455,669	36,794,774
Total surplus/(shortfall) in HRK	(10,578,569)	2,135,844	2,730,690	(30,425,177)	(5,329,817)	4,473,928	5,029,492	(5,455,661)	(2,271,457)	(1,411,577)	(491,900)	379,560	1,274,414	2,343,494	3,400,836	4,549,871	5,789,865	7,171,161
Total revenues (in HRK)	164,921,024	168,016,875	166,821,598	172,731,458	182,422,783	186,176,172	190,457,012	194,690,129	200,198,992	205,871,778	211,713,565	217,729,595	223,925,278	230,306,196	236,878,111	243,646,969	250,618,907	257,800,259
Operating revenue (in HRK)	*163,248,521*	*166,194,327*	*165,420,147*	*171,058,418*	*180,739,704*	*184,467,848*	*188,723,063*	*192,924,968*	*198,398,529*	*204,035,305*	*209,840,362*	*215,818,929*	*221,976,398*	*228,318,339*	*234,850,497*	*241,578,802*	*248,509,377*	*255,648,538*
Revenues from the sale of non-financial assets (in HRK)	*1,672,503*	*1,822,548*	*1,401,451*	*1,673,040*	*1,683,078*	*1,708,324*	*1,733,949*	*1,765,160*	*1,800,464*	*1,836,473*	*1,873,202*	*1,910,666*	*1,948,880*	*1,987,857*	*2,027,614*	*2,068,167*	*2,109,530*	*2,151,721*
Total expenses (in HRK)	175,499,593	165,881,031	164,090,908	203,156,635	187,752,599	181,702,245	185,427,520	200,145,790	202,470,449	207,283,355	212,205,464	217,350,035	222,650,863	227,962,702	233,477,275	239,097,098	244,829,042	250,629,098
Operating expenses (in HRK)	*154,622,237*	*149,434,331*	*146,256,093*	*151,570,782*	*156,781,266*	*160,330,911*	*164,056,186*	*168,266,346*	*170,591,005*	*175,403,911*	*180,326,020*	*185,470,590*	*190,771,419*	*196,187,369*	*201,701,941*	*207,321,765*	*213,053,708*	*218,853,764*
Expenses for procurement of non-financial assets (in HRK)	*20,877,356*	*16,446,700*	*17,834,815*	*51,585,853*	*30,971,333*	*21,371,333*	*21,371,333*	*31,879,444*	*31,879,444*	*31,879,444*	*31,879,444*	*31,879,444*	*31,879,444*	*31,775,333*	*31,775,333*	*31,775,333*	*31,775,333*	*31,775,333*
Total capex (in HRK)	20,877,356	16,446,700	17,834,815	51,585,853	30,971,333	21,371,333	21,371,333	31,879,444	31,879,444	31,879,444	31,879,444	31,879,444	31,879,444	31,775,333	31,775,333	31,775,333	31,775,333	31,775,333
Ordinary capex (in HRK)	*20,877,356*	*16,446,700*	*17,834,815*	*51,585,853*	*25,790,000*	*16,190,000*	*16,190,000*	*16,190,000*	*16,190,000*	*16,190,000*	*16,190,000*	*16,190,000*	*16,190,000*	*16,190,000*	*16,190,000*	*16,190,000*	*16,190,000*	*16,190,000*
Related to SUMP (in HRK)					*5,181,333*	*5,181,333*	*5,181,333*	*15,689,444*	*15,689,444*	*15,689,444*	*15,689,444*	*15,689,444*	*15,689,444*	*15,585,333*	*15,585,333*	*15,585,333*	*15,585,333*	*15,585,333*
Operating surplus/debt service ratio	1.00x	2.38x	3.44x	4.59x	6.71x	6.83x	7.65x	8.09x	9.65x	3.59x	3.61x	3.54x	3.46x	3.41x	3.41x	3.45x	3.53x	4.00x
Total surplus/debt service ratio	(1.22x)	0.30x	0.49x	(7.16x)	(1.49x)	1.27x	1.56x	(1.79x)	(0.79x)	(0.18x)	(0.06x)	0.04x	0.14x	0.25x	0.35x	0.46x	0.58x	0.78x
Total debt outstanding/total revenues	0.13x	0.11x	0.12x	0.31x	0.34x	0.33x	0.32x	0.30x	0.29x	0.27x	0.27x	0.26x	0.26x	0.25x	0.23x	0.21x	0.18x	0.16x
Total debt service to total revenues	0.05x	0.04x	0.03x	0.02x	0.02x	0.02x	0.02x	0.02x	0.01x	0.04x	0.04x	0.04x	0.04x	0.04x	0.04x	0.04x	0.04x	0.04x
Capex to total revenues	0.13x	0.10x	0.11x	0.30x	0.17x	0.11x	0.11x	0.16x	0.16x	0.15x	0.15x	0.15x	0.14x	0.14x	0.13x	0.13x	0.13x	0.12x
Operating surplus/total revenues	0.05x	0.10x	0.11x	0.11x	0.13x	0.13x	0.13x	0.13x	0.14x	0.14x	0.14x	0.14x	0.14x	0.14x	0.14x	0.14x	0.14x	0.14x