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SUSTAINABLE URBAN MOBILITY PLAN FOR VELES 2019-2030

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ABBREVIATIONS:
SUMP - Sustainable Urban Mobility Plan
PT – public transport
HCM – highway capacity manual

GLOSSARY

Accessibility: The ability to access or reach a desired service or activity. Deliberate establishment or transformation of the environment in view of people with reduced mobility in order to assist them in any activity in which they are impeded.

Action plan: The process of putting into practice a plan, policy or measure. Action sets out how the policy or measure will be implemented in reality. Action plan typically includes established priorities, implementation schedules, responsibilities and funding sources.

B+R parking: Bike and Ride. A bicycle storage facility with an option to transfer to other public transport means.

Carsharing: A controlled passenger car rental service, providing shared access to a particular fleet for registered users. Car-sharing schemes are an organisational measure, providing people with access to cars for trips that would not be practical using public transport, or by walking and cycling, while discouraging private cars as the default option for all trips. (CH4LLENGE, 2015)

Governance: Term governance applies to the way decisions are made. This includes how policies are formulated and implemented within a state government, institutions and procedures which regulate the actions of state, non-state and private-sector actors. Outside of formal government it includes non-governmental, non-commercial arrangements, which supplement institutions and support social self-organisation.

Indicator: An index or measure defined for indicating effects and processes. Indicators enable us to measure the performance of a plan and therefore provide a basis for its evaluation. An indicator is a clearly-defined set of data that can be measured to allow for the monitoring of progress towards the achievement of a particular target. Indicators can be qualitative or quantitative and absolute or relative. (CH4LLENGE, 2015)

Integrated traffic planning: is a strategic and targeted traffic planning, which promotes sustainable transport, in the context of which they are equivalent all travel modes are covered and the public is also involved. It refers to collaboration and joint working within and across organizations to develop and implement a plan. Such cooperation may involve the alignment of objectives and policies and the sharing of knowledge, data, resources, finance and powers between several organizations.
Horizontal and vertical integration main characteristic of the SUMP approach. (CH4LLENGE, 2015)

Intermodality: relates to improving the efficiency and attractiveness of a single trip made with more than one transport mode. This requires creation of organised connections between different transport modes (P+R, B+R). Traffic planning should encourage a balanced development of all relevant transport modes, with a shift towards more sustainable modes. (CH4LLENGE, 2015)

Intermodal hub: An intersection of various transport modes providing change/reloading options, coordinated in space.

Measure: The set of tasks ordered to the strategic goals that helps in attaining the given target. Certain measures can also help the implementation of more than one project. From the aspect of operative targets, a tool for realizing the target; from the aspect of the project, the target. In the context of SUMP, the term measure refers to a policy, campaign or project that is implemented to contribute to the achievement of the SUMP's objectives and targets. (CH4LLENGE, 2015)

MOBILITY is the ability to move people and goods and it depends on the available travel
ways. It is defined as the potential for movement and the ability to get from one place to another using one or more modes of transport to meet daily needs. (CH4LLENGE, 2015)
Modal split: is the proportion of journeys made travel mode, or the proportion of passengers traveling through a certain travel route. Modal share can be defined as the share of people using a particular mode of transport (including cycling and walking) within the overall transport usage of an urban area. The modal share of different modes of transport is typically displayed as a percentage value for each mode. (CH4LLENGE, 2015)

Monitoring: is the systematic collection of data on specified indicators to provide authorities and stakeholders with an indication of the extent of the progress and the achievement of objectives in an ongoing plan. (CH4LLENGE, 2015)

Objective: An objective is a broad statement describing the improvements a city or municipality is seeking. Objectives specify the directions for improvement, but not the means for achieving it. (CH4LLENGE, 2015)

On demand public transport: is an advanced form of public transport that is carried out in areas where is no organized public passenger transport or in areas with lower demand for public passenger transport services.

P+R car park: The abbreviation comes from the English “Park & Ride”. It is a parking site that offers long-term parking and enables the users to change from a passenger car to public transport.

Promotional campaign: An awareness campaign is a measure that is used to attract public attention to priority issues and to encourage the use of sustainable transport modes.

Scenario: A scenario is a description of possible actions or events in the future.

Service line: The scheduled route and stops of public passenger transport specified in the timetable.

Shared space: is an traffic design approach that minimises the segregation between modes of road user. By removing user priority it de-prioritizes motorized vehicles while focusing not only on the interaction between road users, but also on the residential aspect of the area. A shared space design is typically a low-speed environment that desegregates road users by removing traffic controls (traffic lights, traffic signalisation).

Stakeholder: Stakeholder is an individual, group or organisation that is affected by a proposed plan or project or that can affect the proposal and its implementation. This includes the general public (citizen and community groups), public authorities, businesses and research institutions. (CH4LLENGE, 2015)

Strategy: A plan of action, comprising a combination of measures, designed to meet specified objectives. The selected measures should reinforce one another in meeting the objectives and overcoming barriers – see complementarity and synergy. (CH4LLENGE, 2015)

Sustainable development: Sustainability is often used as a short form for sustainable development, for which the most commonly cited definition is: development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs. A very widely established attempt to operationalise this term stipulates that sustainability requires a careful balance between social, economic and environmental goals. (CH4LLENGE, 2015)

Sustainable mobility: Modes of transport, and systems of transport planning, which are consistent with wider concerns of sustainability. It means providing effective and equal access for all, with the emphasis on limiting personal motor transport and energy consumption and the promotion of sustainable travel ways.

Sustainable Urban Mobility Plan: A Sustainable Urban Mobility Plan is a strategic plan designed to satisfy the mobility needs of people and businesses in cities and their surroundings for a better quality of life. It builds on existing planning practices and takes due consideration of integration, participation, and evaluation principles. (CH4LLENGE, 2015)

Traffic calming: Physical and other measures used to improve traffic safety for motorists, pedestrians and cyclists and reducing the volume and of road traffic.

Traffic model: Transport modelling is a mathematical representation of transport demand and resulting trips, based upon economic, municipal, household and transport data and projections, and using formalised behaviour hypotheses and assumptions. Traffic models are used to analyse and forecast the traffic situation and to predict the outcomes of transport strategies. This can include the identification of potential congestion “hotspots” within the transport system. (CH4LLENGE, 2015)

Transport mode: Transport mode refers to the way in which passengers and/or goods can be transported. Sustainable transport modes are public transport, bicycling and walking, complemented by use of clean technology powered vehicles (electric and hybrid vehicles). (CH4LLENGE, 2015)

Travel habits: are established ways of traveling people on their daily routines (to work, school, shopping and other activities).

Vision: A qualitative description of a desired urban mobility future that serves to guide the development of targets and the selection of suitable measures throughout the SUMP preparation process. (CH4LLENGE, 2015)

Source: CH4LLENGE, 2015 (https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=5&ved=2ahUKEwjT_M37l4zjAhUEi8MKHRi1A6AQFjAEegQIARAC&url=http%3A%2F%2Fwww.sump-challenges.eu%2Fsites%2Fwww.sump-challenges.eu%2Ffiles%2F3_ch4llenge_sump_glossary.pdf&usg=AOvVaw3ltO4jacsHKBtX6m7W-Jt8)

1. SUSTAINABLE MOBILITY FOR A SUCCESSFUL FUTURE

Integrative traffic planning is a new way of planning that originates from experiences and good practices of many European cities and regions that have been working on successfully implementing its key principles. Its main objective is to reduce environment related burden caused by transport system and contributing to establishment of a sustainable, liveable, attractive, accessible and healthy environment.

The process was designed to use tested planning methods that balance economic development, social justice and quality of the environment while taking into account existing practices and policies of different sectors and levels of authority. Public involvement in all stages of the planning process allows to set a clear vision and goals whose achievement is measurable and that are accepted by relevant stakeholders and general public.

The central element of the integrative traffic planning is Sustainable urban mobility plan - SUMP. It is based on EU documents and guidelines set by European commission. A sustainable urban mobility plan is a document in which the municipality Veles drafted a set of measures which will help achieve a shift toward more sustainable transport modes and higher quality of living. The key to the change is a shift towards integrative traffic planning. Sustainable urban mobility plan offers possibility for transition from classic to modern and comprehensive traffic planning. Integrated traffic planning does not reject, but upgrades current planning practices and it has a long-term and strategic vision striving towards sustainable mobility.

The Plan is aiming towards an attractive public passenger transport, branched network of safe cycling routes and good conditions for pedestrians. It focuses on city centre as a regulated, attractive, accessible and safe urban space.

2. WHAT IS SUSTAINABLE MOBILITY PLAN

A Sustainable urban mobility plan is a document that incorporates and upgrades existing strategic documents of the Municipality. It is a new way of thinking and planning that represents a step towards more sustainable traffic planning in the region - in line with modern guidelines and recommendations of the European commission. It's prepared by an interdisciplinary group of experts in the field of transport and spatial planning. It is based on EU documents and guidelines set by European commission.

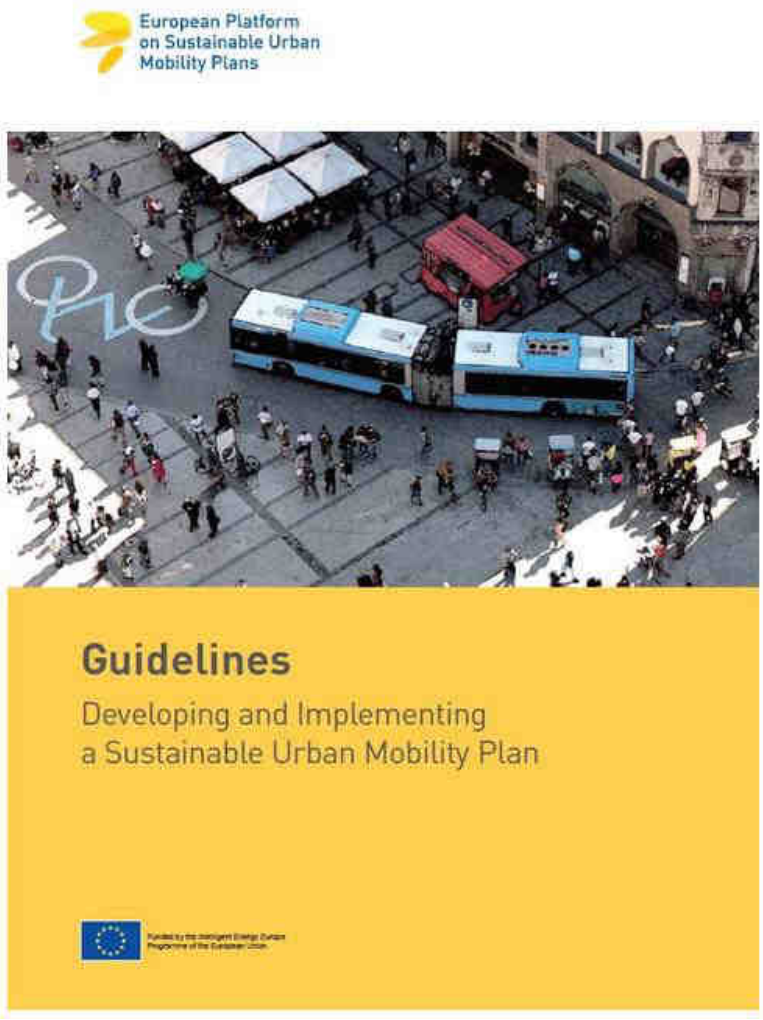


Figure 1: Guidelines. Developing and Implementing a Sustainable Urban Mobility Plan

Municipality of Veles will use the proposed document to upgrade existing spatial acts and strategic documents, leading to more comprehensive planning and inclusion of sustainable strategies into planning act.

The document sets long term transport development strategy for the period from 2019 to 2030 year.

Sustainable urban mobility plan is a result of the participation of an expert group on transport planning, local authorities and affected social groups. Local institutions and citizens played an important role in the creation of the document as their values and proposals serve as a basis for proposed measure packages.

The document reflects the planned development of city of Veles and is prepared in line with existing spatial and urban planning documents. Individual measures can be implemented and coordinated with existing and incorporated in future planning documents. Infrastructural projects will be implemented in connection with soft measures, aimed at reducing demand for private motorised transport and incentivising other more sustainable modes of transport, strengthening each other's impacts.

In course of preparation of the document public consultations regarding challenges and opportunities that municipality faces were held with local authorities and interest groups. The participants presented their aspects and views on the existing situation in the municipality while their comments were evaluated and utilised in preparation of proposed vision and measures.

Measures and projects that have impact on the city and its inhabitants will be planned and implemented in line with the framework proposed in this document. Strategic transport development practices are in synergy with urban development of the area and give priority to increasing quality of life by promotion and implementation of sustainable measures.

Adoption of the strategy does not mean its conclusion, but a transition to its implementation.

The planning process consists of eleven main steps made up of 32 activities. They should be taken as part of a regular planning cycle in the sense of a continuous improvement process. The preparation process is based on EU documents and guidelines set by European commission.

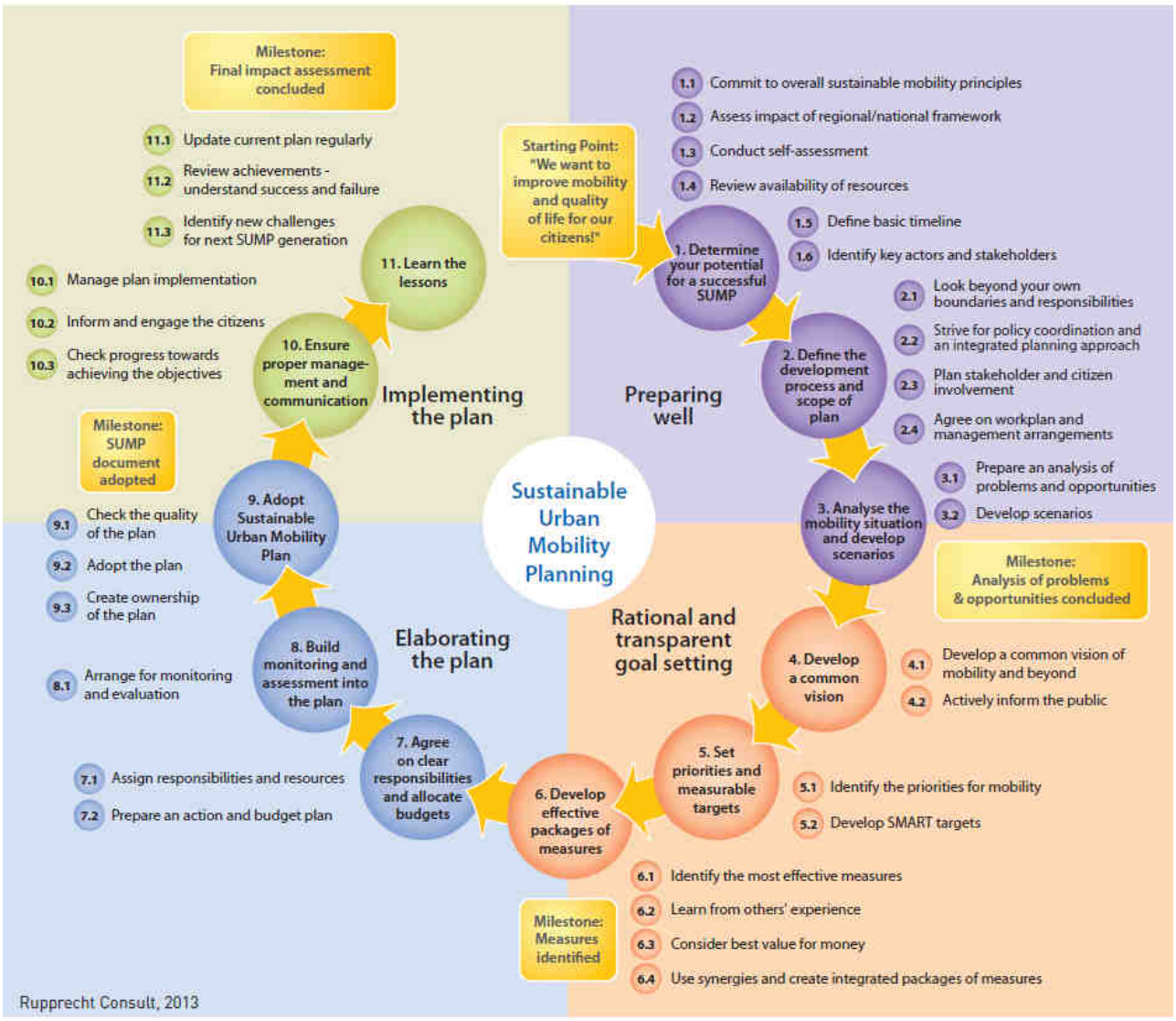


Figure 2: Planning cycle for a sustainable urban mobility plan, source: Guidelines, 2014, https://www.eltis.org/guidelines/sump-guidelines

The planning process will not come to an end with adoption of Sustainable urban mobility plan. The process will continue with gradual preparation and implementation of proposed measures. The monitoring system is set to evaluate implemented measures and their contribution to set strategic goals. Integrated traffic planning is a cyclic process and should be considered as a continuous improvement process with regular reassessments and renewals.

Good communication is essential for the success of planning decisions. It encourages citizens and stakeholders to take ownership of sustainable mobility ideas while it allows the city administration to incorporate local feedback into their work. The local administration will set up a communication plan which will enable comprehensive implementation and monitoring of the strategy. The promotion of sustainable values should be done with the cooperation of the public and private sector.

3. INTEGRATIVE TRAFFIC PLANNING

A principal shortcoming of urban transport planning today is the lack of coordination between policies and organisations. Addressing this deficit represents a major challenge for sustainable urban mobility planning, but is also a main source for innovation and improvement.

Existing planning practices in the municipality included some sustainable mobility ideas and proposals but they still lacked complex analysis and ranking of the projects. Planning should provide quality services that meet demands of the public as well as constant renewal of existing transport system that fits the needs of its users. A strategic planning practice is aimed at satisfying mobility need of population while improving the quality of living in urban areas.

Traditional Transport Planning		Sustainable Urban Mobility Planning
Focus on traffic	→	Focus on people
Primary objectives: Traffic flow capacity and speed	→	Primary objectives: Accessibility and quality of life, as well as sustainability, economic viability, social equity, health and environmental quality
Modal-focussed	→	Balanced development of all relevant transport modes and shift towards cleaner and more sustainable transport modes
Infrastructure focus	→	Integrated set of actions to achieve cost-effective solutions
Sectorial planning document	→	Sectorial planning document that is consistent and complementary to related policy areas (such as land use and spatial planning; social services; health; enforcement and policing; etc.)
Short- and medium-term delivery plan	→	Short- and medium-term delivery plan embedded in a long-term vision and strategy
Related to an administrative area	→	Related to a functioning area based on travel-to-work patterns
Domain of traffic engineers	→	Interdisciplinary planning teams
Planning by experts	→	Planning with the involvement of stakeholders using a transparent and participatory approach
Limited impact assessment	→	Regular monitoring and evaluation of impacts to inform a structured learning and improvement process

Table 1: Difference between planning processes, source: Guidelines, 2014, https://www.eltis.org/guidelines/sump-guidelines

With implementation of integrated transport planning the municipality of Veles is choosing:

All-inclusive planning
We want take advantage of knowledge from different professions, planning practices and strategies and experiences of different decision-making sectors, public institutions and enterprises and all levels of government.

Participatory approach
We want to solve complex development issues by integrating the public throughout the course of decision-making, implementation and evaluation.

Sustainable Development
By practicing sustainable transport planning we want to achieve a balance between social equality, healthy environment and economic development.

Effective measure packages
By interconnecting and complementing proposed measures we want to increase the ability and efficiency of the municipality in overcoming development challenges.

Measurable strategic objectives
Proposed measure packages are derived from strategic goals which are in line with the set vision of the municipality. This kind of hierarchy allows us to evaluate implemented measures and their contribution to set strategic goals.

Real cost assessment
Future transport planning will include wider social costs and benefits to all sectors. Strategic planning allows control over and rational use of public funds.

Financial sustainability
We want to give priority to the solutions that are realistic, practical, achievable with available resources and are the most cost efficient.

With integrated traffic planning the municipality can obtain many benefits:

Better quality of living
There is strong evidence that sustainable urban mobility planning raises the quality of life in urban areas. Well-coordinated policies result in a wide range of benefits, such as more attractive public spaces, improved road safety, better health, and less air and noise pollution.

Positive effects on the environment and health
More sustainable mobility directly translates into better air quality and less noise. Cities need to play their part in reducing greenhouse gases in the transport sector while travelling more actively is good for citizens' health.

Improved mobility and accessibility
Integrated traffic planning ensures better mobility of all inhabitants and facilitates accessibility to individual areas and service.

Improved image of the municipality
The municipality, which seeks to integrate sustainable mobility values in traffic planning, can pride oneself on innovation and progress.

Decisions supported by the public
Planning for people includes responding to needs of different user groups. By involving the public in decision making and assessment of proposed measures, planning sector acquires a significant degree of "public legitimacy".

Effective compliance with legal obligations
A Sustainable Urban Mobility Plan offers an effective way to respond to national and international control regulations (air quality improvement, noise regulation…) through one comprehensive strategy.

New and comprehensive political visions
Integrated traffic planning offers long-term and strategic a vision for mobility. It encourages effective and integrated planning, which seeks to integrate the sectoral policies as well as achieving other objectives of the municipality (economic, social, environmental).

Improve access to funds
An integrated transport strategy can provide access to resources, which are available for innovative solutions, and increase competitiveness municipalities to apply for calls for national and international funding.

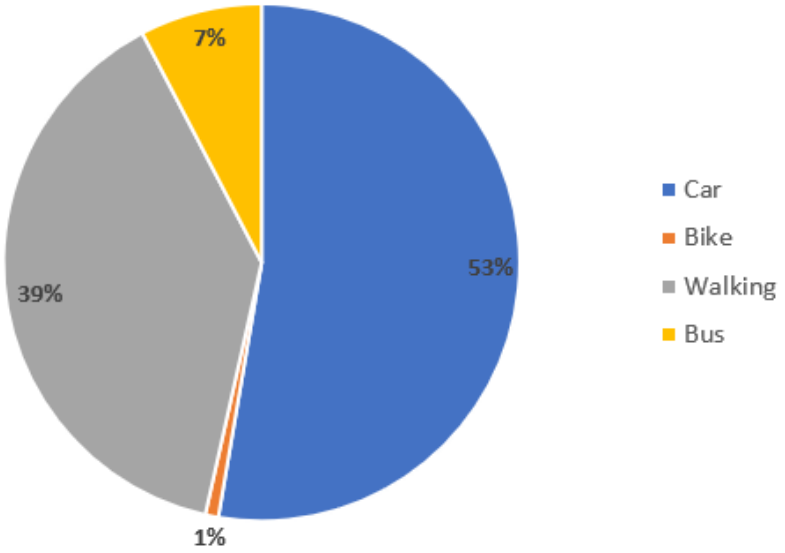
source: Guidelines, 2014, https://www.eltis.org/guidelines/sump-guidelines

4. ASSESSMENT OF THE SITUATION

4.1. MODAL SPLIT AND TRANSPORTATION HABITS

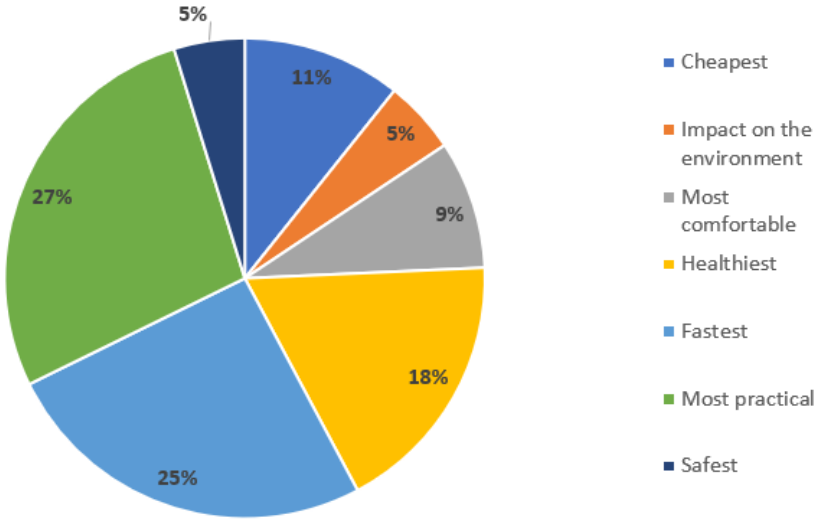
Part of the phase *Analysis of the existing situation and scenario design* is the preparation and implementation of a household survey on traffic habits in the Municipality of Veles, including an analysis of the results. In the development of Sustainable Urban Mobility Plan, a questionnaire was prepared for the general population of municipality. The survey was carried out within elementary schools in the municipality, where pupils delivered physical forms of surveys to their households, which they then filled in and returned to an assembly place in elementary school. The survey included 4600 respondents, which is almost 10% of the population of the Municipality of Veles. The survey was mostly attended by respondents between 25 and 49 years of age, 86% of them working, 13% at the stage of education, and 1% by retired persons.

Majority of population (53%) uses car as primary means of transportation. Other more sustainable means of transport are used by 47% of respondents of which 39% are pedestrians, 7% use PT and cycling only 1%. The results show that a good part of the population uses sustainable means of transport but the shares of PT and cycling are very low. The low shares reflect the troubles that citizens encounter while using latter means of transport – steep terrain and insufficient cycling infrastructure for cyclists and unorganised public transport.

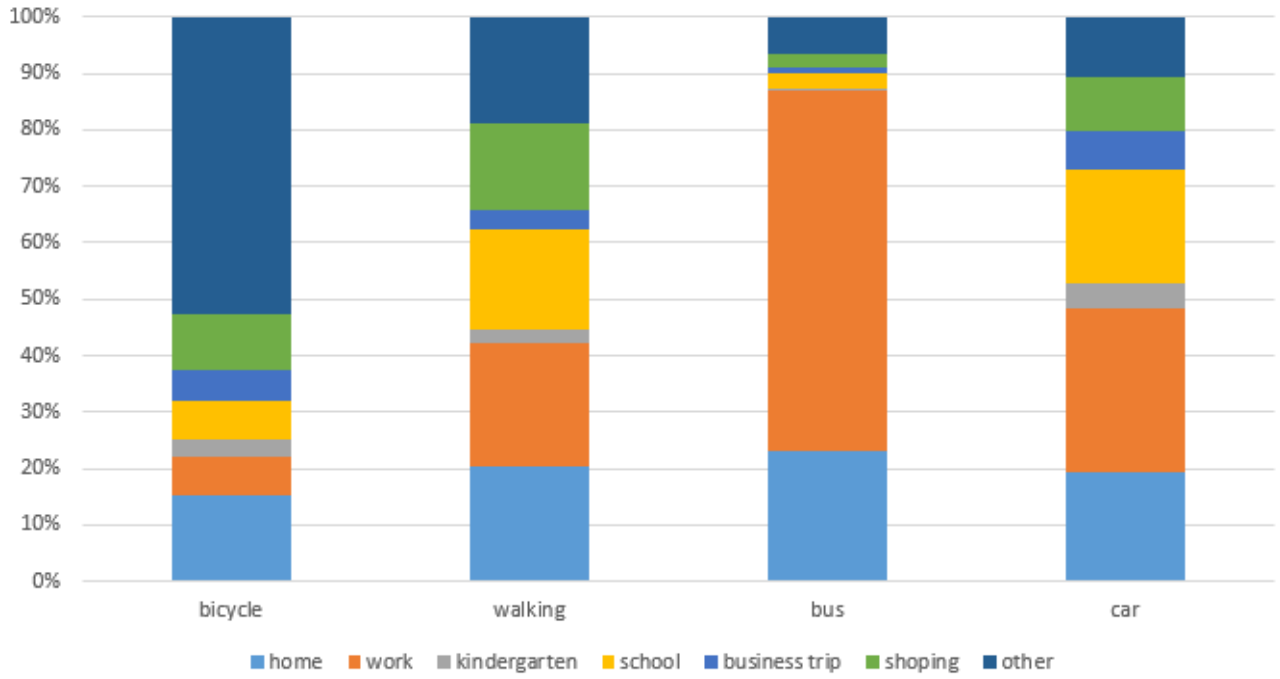


Graph 1: Modal split of municipality of Veles

The reasons for using a means of transport reflect the results of the first question, as the most common answer to the choice of means of transport is practicality and speed, and health in the third place. The impact of traffic on the environment and safety, according to results, are in the last place, as only 5% of respondents chose them. The results thus show that sustainable mobility and environmental protection have a very low priority in the choice of means of transport.



Graph 2: Reason for using transport mode



Graph 3: Purpose of trip by individual means of transport

We examined the purpose of trips made by individual means of transport. We observe that the purpose of walking trips are equally distributed with the exception of trips to kindergarten and business trips. The similar situation occurs with trips by car but with slightly bigger share of work related trips. The purpose of trips made by bus are for trips to and from work which consist of almost 90% off mentioned trips. The similar situation occurs with trips made by bike as more than 50% of trips fall in category other which shows that bike is used most for recreational purposes. This results show the need for optimisation of public transport and promotion of cycling as to establish them as competitive sustainable means of transport.

4.2. ANALYSIS OF THE SITUATION

Traffic planning investments were oriented in motor traffic and in most of the cases was carried out within the framework regulation of motor traffic. Investments in other areas of transport were neglected which shows in underdeveloped infrastructure intended for pedestrians and cyclists while public transport stays unoptimized and underused. Combined factors influence an increase in inequality of vulnerable social groups as well as an increased strain on urban environment.

The municipality did not perform systematic monitoring of citizens' travel habits and analysis of the mobility of citizens, which would enable direct monitoring of the impacts and cost effectiveness of the implemented measures. Monitoring of the travel habits would identify main sources and destinations of trips which can be a basis for optimization of public passenger transport and valuation for proposed measures.

The Municipality of Veles has already implemented sustainable traffic planning but on a limited scale. A large proportion of funds was designated to manage the infrastructure for pedestrians as the majority of the city centre is equipped with pedestrian infrastructure. A parking policy regulation (zonning) project is being prepared while a Veles Smart City Strategy was accepted by municipality.

Accessibility is defined as the property of the space. It is most often associated with the time, energy and costs we spend to achieve the desired goal. The basis of daily routines is to make them as fast and as comfortable as possible. For this reason, people prefer to resort to the comfort of their own car. Increased use of own transport is reflected in traffic-laden road networks. With recent GIS programs, it is possible to calculate accessibility with a vehicle using different models. The most basic model is the Euclidean distance model, which calculates areas that are distant from the target point for a limited time, excluding the terrain and the road network. So the theoretical scope of accessibility is based on the average speed of the means of transport. The analyses are based on the average speed of the participant in traffic (cyclist - 17 km / h, pedestrian - 4.3 km / h). The theoretical network of accessibility thus shows the possible theoretical accessibility of the participant in transport and thus its reach for which it is necessary to arrange a suitable, secure infrastructure.

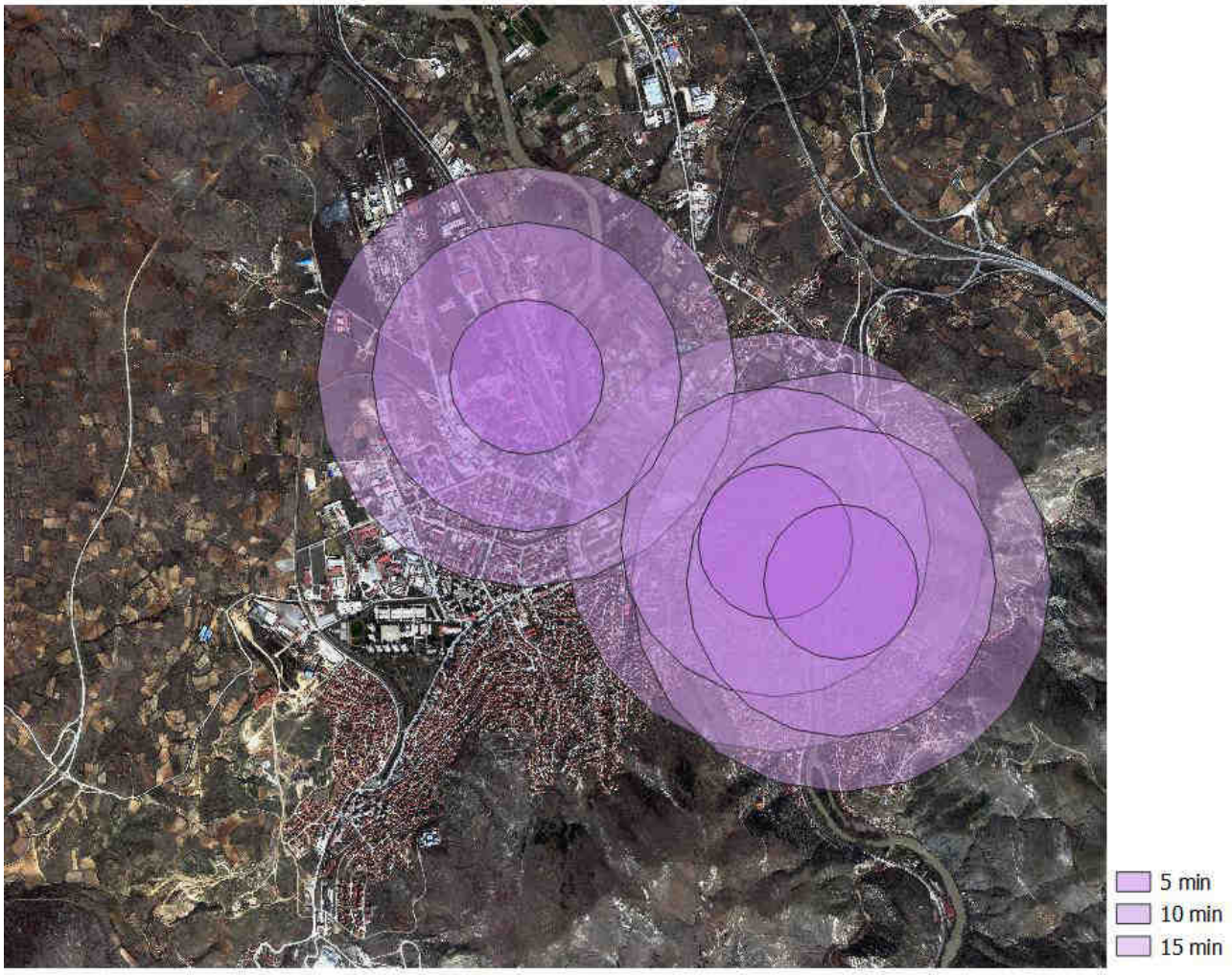


Figure 3: Euclidean distance model of pedestrian accessibility

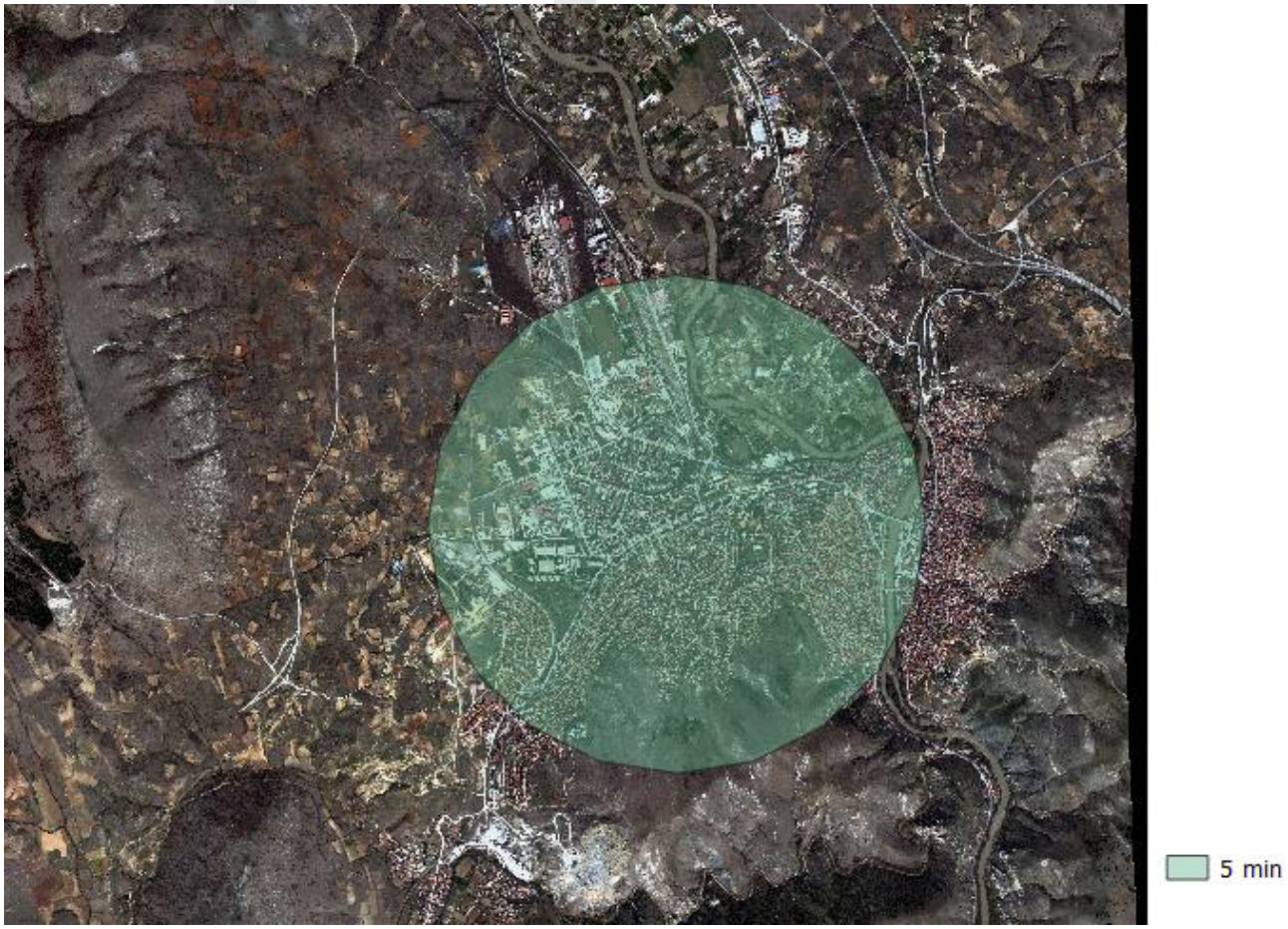


Figure 4: Euclidean distance model of cyclist accessibility

Most of the points of interest in the city centre can be reached in 15 minutes on foot and 5 minutes on bike. Steep slopes on both sides of the centre increase the time needed to access the main residential areas and reduce accessibility for pedestrians and cyclist.

The last changes in the street network in the General Urban Plan of Veles were adopted in 2008. The plan envisages large and expensive infrastructure facilities (connecting the east with the western part of the city through planned Street 3 with a category of main road with bridge over the river Vardar), outdated categorization of streets (wide profile of the carriageway, no bicycle paths), no pedestrian zones and paths are provided, there is no reference at all to public public passenger transport, etc. The general assessment is that access of this General plan is to solve traffic problems by favouring motor traffic, without taking into account the possibilities for its realization.

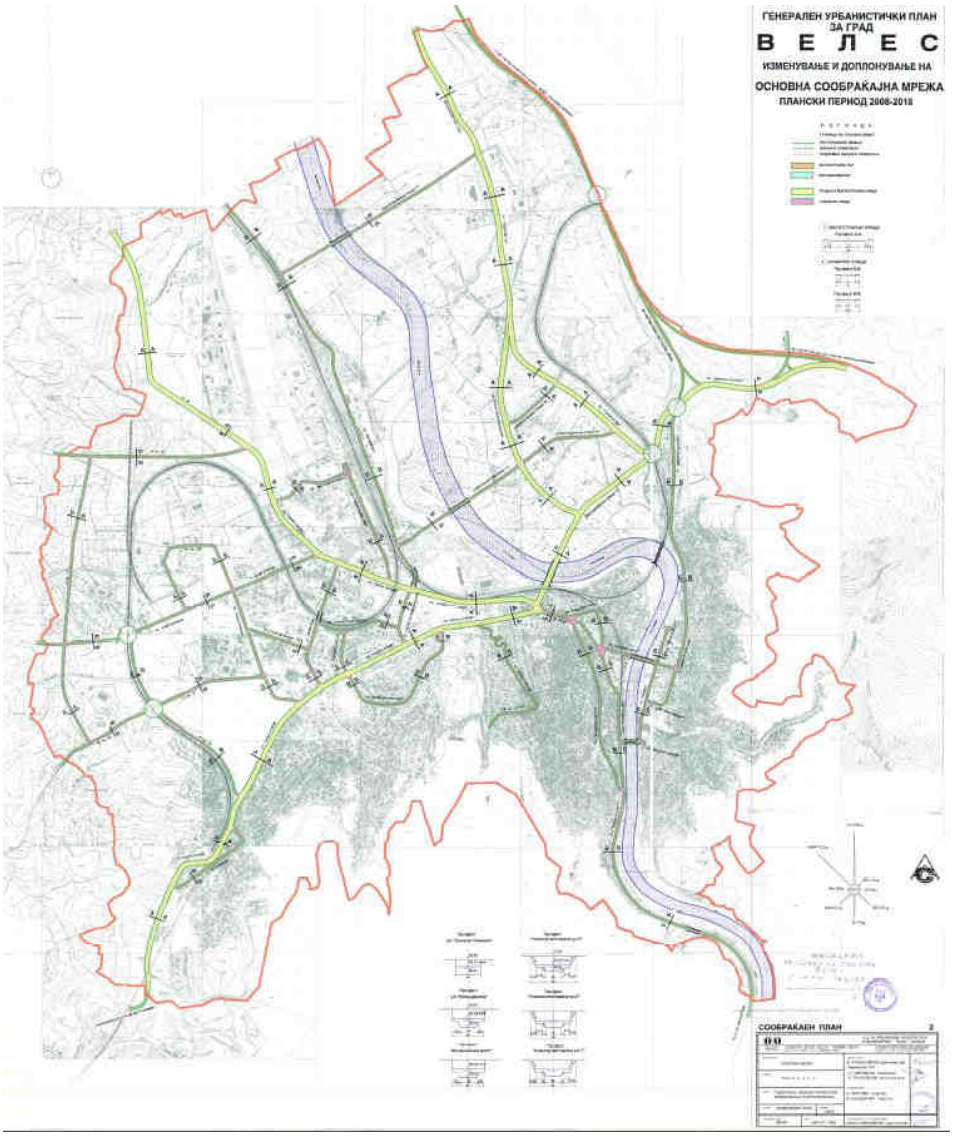
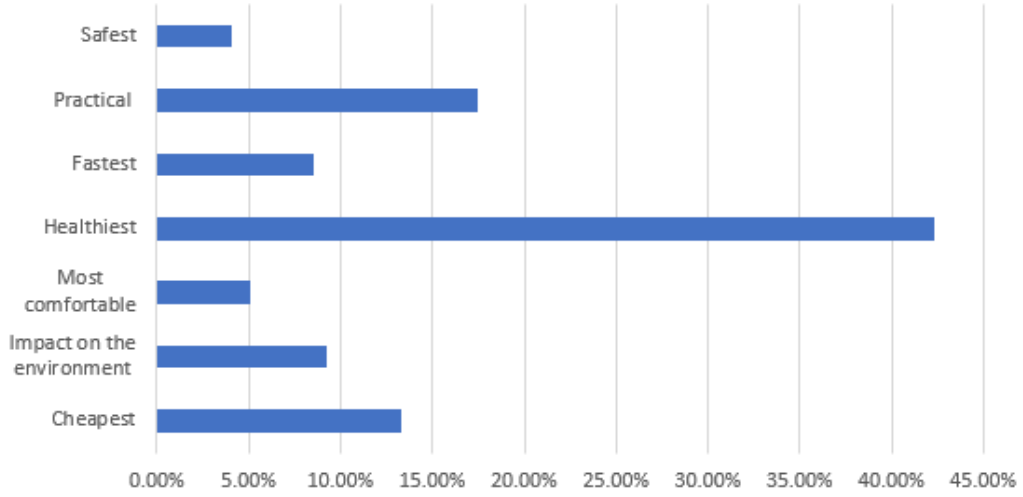


Figure 5: GUP Veles – road infrastructure

In the survay 39% of respondents use walking as their main mode of transport. The most common reason for choosing walking is health (42% of respondents). For 17% the reason is it being most practical and for 13% because it's the cheapest. The other reasons collected less than 10% of responses.



Graph 4: Reasons for choosing walking as the means of transport

The Municipality of Veles has carried out extensive investments in implementing infrastructure for pedestrians with construction of sidewalks and pedestrian bridge across river Vardar.

Figure 6: Pedestrian bridge crossing river Vardar

Figure 7: Pedestrian railway crossing

While the city centre is well equipped with pedestrian infrastructure the existing sidewalks are in many cases deteriorated, their surface is in bad condition and there are frequent conflicts in relation to other traffic modes (parking, crosswalks) in addition the infrastructure is inadequately equipped for access of sensory and physically impaired citizens.

Figure 8: Sidewalk locations in city of Veles

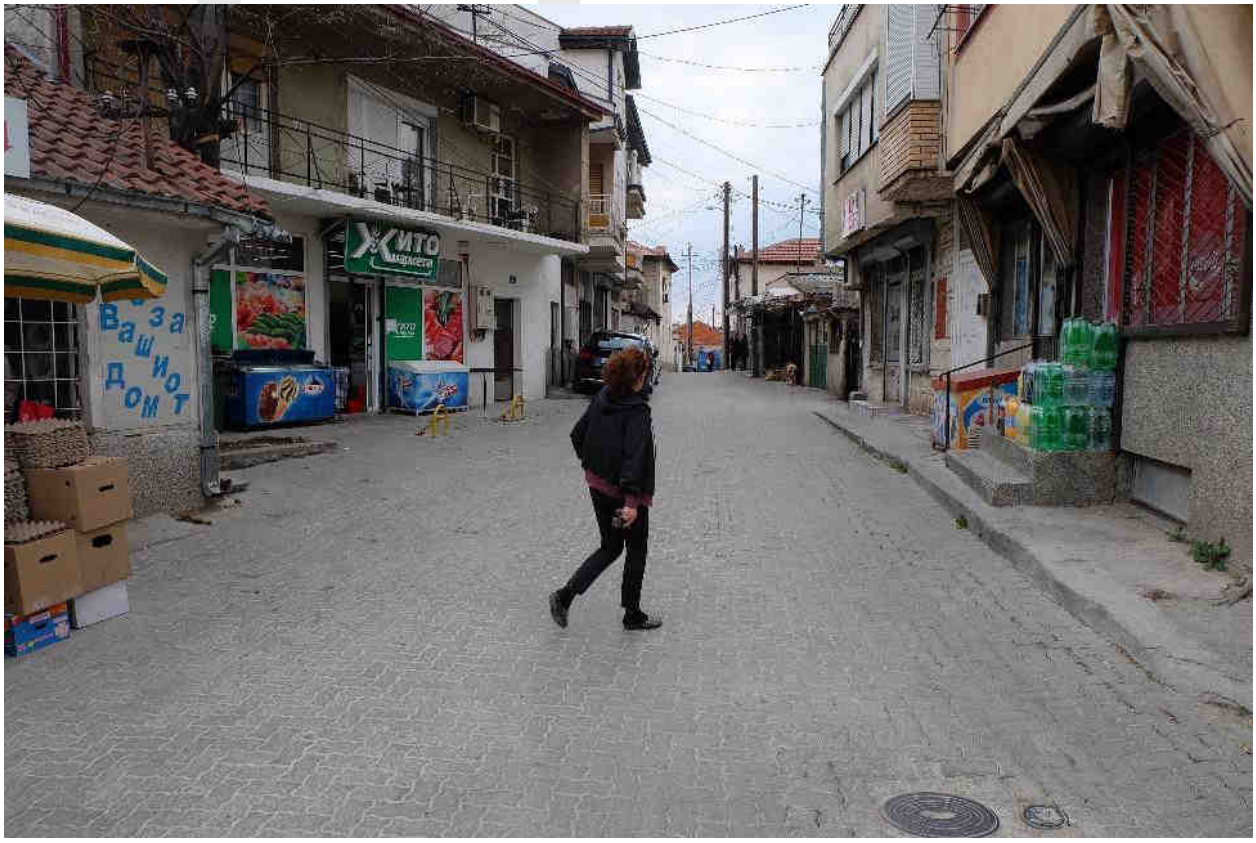


Figure 9: Pedestrian areas in Kojnik square

Figure 10: Inadequately equipped pedestrian crossing

Most areas in the city centre are used for parking lots and hence take away surfaces for pedestrians and reduce the attractiveness of the area for walking and cycling. It is also common practice that owners park their cars on unsuitable places along the sidewalks or even on them.

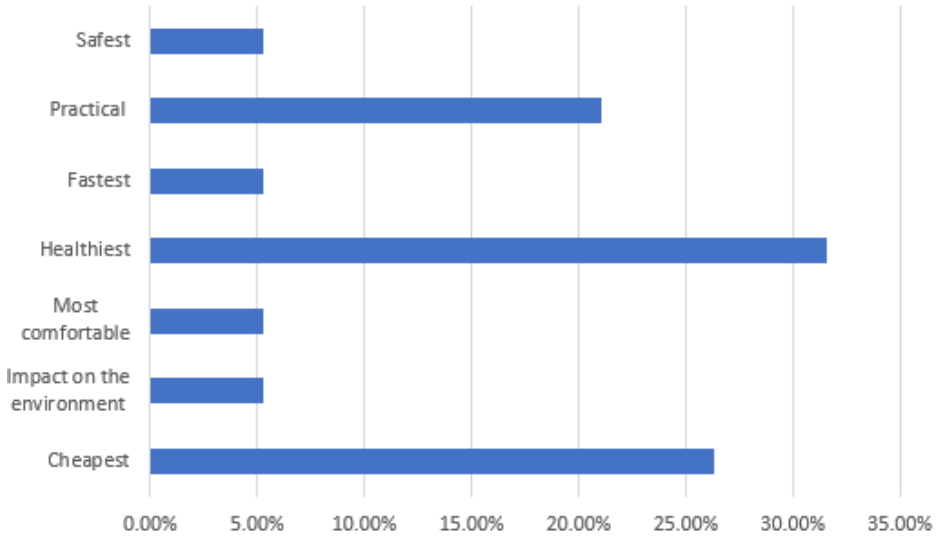
Figure 11: Illegal parking on pedestrian surfaces

Figure 12: Illegal parking in Kojnik square

A questionnaire conducted amongst citizens showed that 96% of respondents felt that it was necessary to introduce measures to reduce the speed of traffic in areas surrounding the schools and other educational institutions.

Figure 13: Elementary school area

Cycling is one of the key aspects of sustainable mobility in spite of this, results of the questionnaire of citizens travel habits show that only 1% use bicycle for everyday trips.



Graph 5: Reasons for choosing cycling as the means of transport

Main reasons why responders decide for cycling because its healthiest (31%), cheapest (26%) and most practical (21%). Other reasons were chosen by about 5% of responders. Healthiness as reason coincides with the answer that most respondents use bike for recreational purposes.

Despite many advantages of cycling there is almost no cyclist infrastructure available in the Municipality of Veles. In most of regional and local roads the cyclist is a subordinate position compared to the motor traffic. Taking into account insufficient traffic lane widths, vehicle speed, traffic load and shares of freight traffic a lot of road segments feel dangerous for cycling.

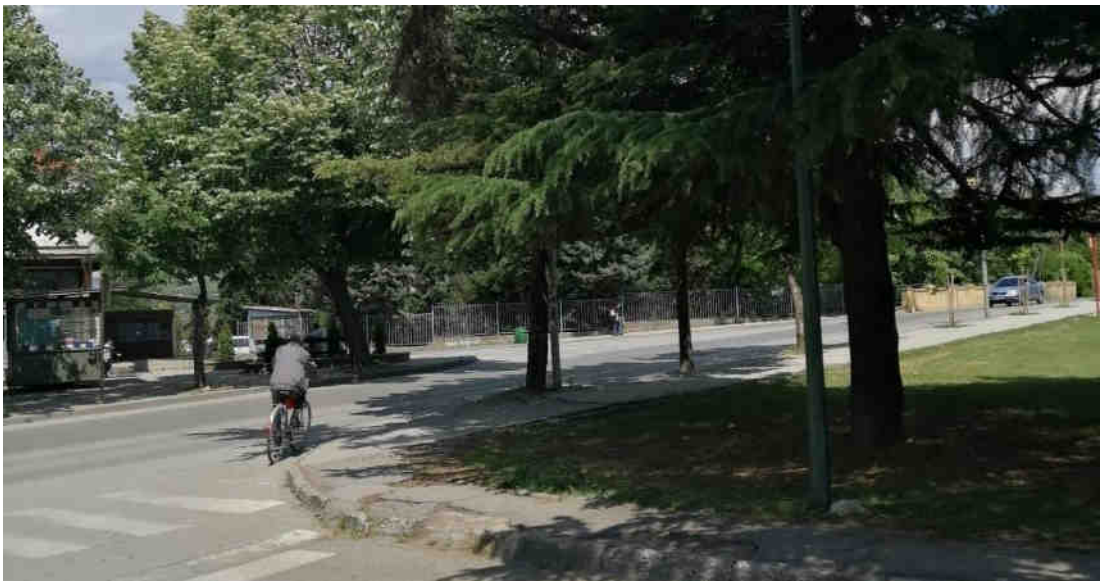


Figure 14: Inadequately equipped roads for bicycle traffic

Figure 15: Cyclist traffic in city centre

Figure 16: Cyclists share roads with motor vehicles, source: Veles biking, 2019

Perhaps one of the biggest obstacles for the development of cycling is natural relief with steep slopes (where a big part of residential areas is located), that are unsuitable for comfortable cycling. Steep incline makes the access to these areas burdensome and challenging which dissuade a larger part of residents from cycling as everyday transport mode.

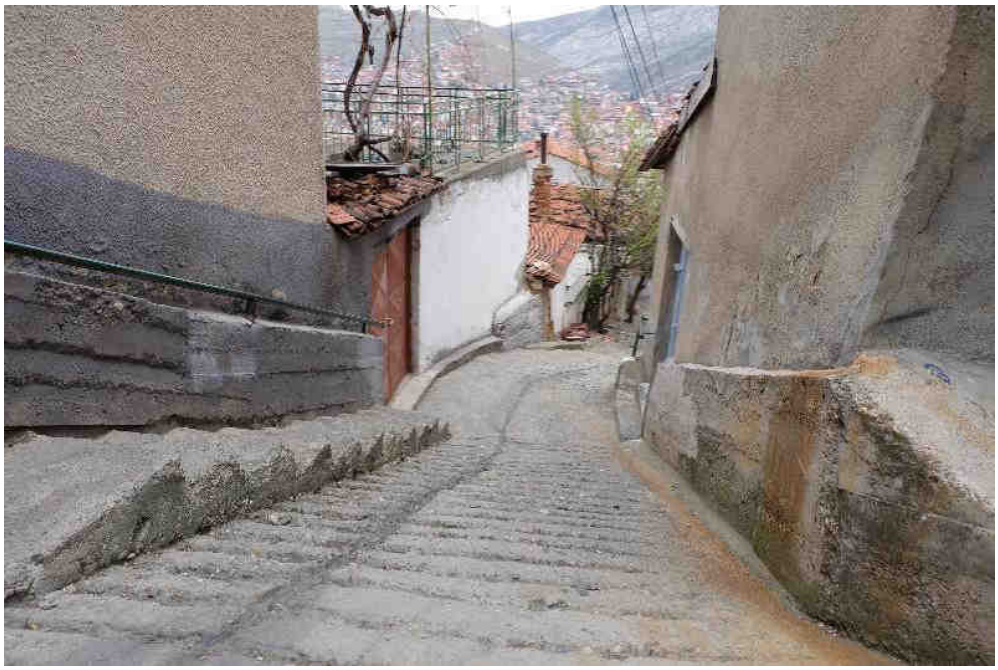


Figure 17: Steep roads in residential areas

Areas for bicycle parking and other cycling infrastructure is subservient to parking areas or in most public areas non-existent. Public transport stations are not adapted to access with bikes as there is no safe storage for bicycles while most of public transport vehicles don't allow bicycles onboard.

Figure 18: Improperly parked vehicles on railway station

Figure 19: Improperly parked vehicles near public service buildings

The area shows high potential for recreational and tourist cycling as there are many opportunities for establishing recreational trails (along the river Vardar, old industrial railway, Lake Mladost, etc.)

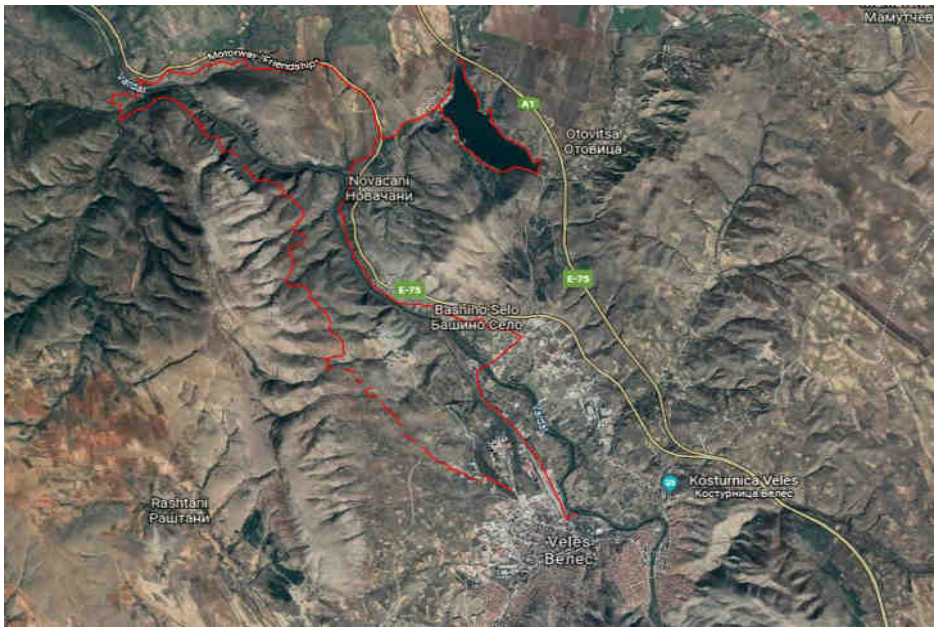


Figure 20: Recreational cycling trails in Veles area

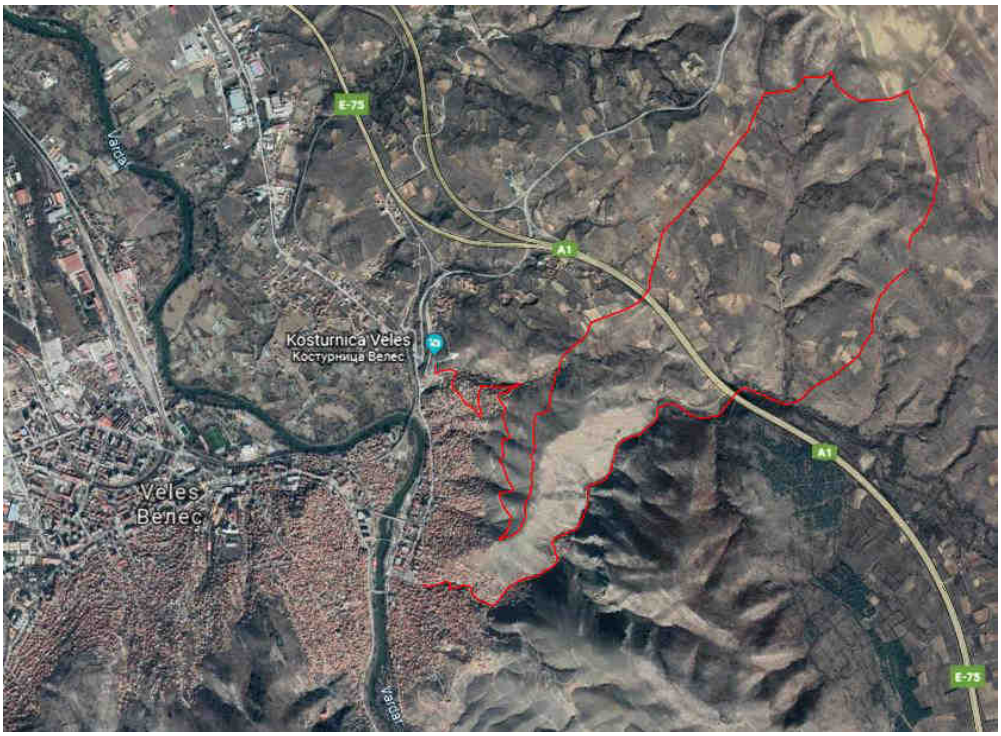
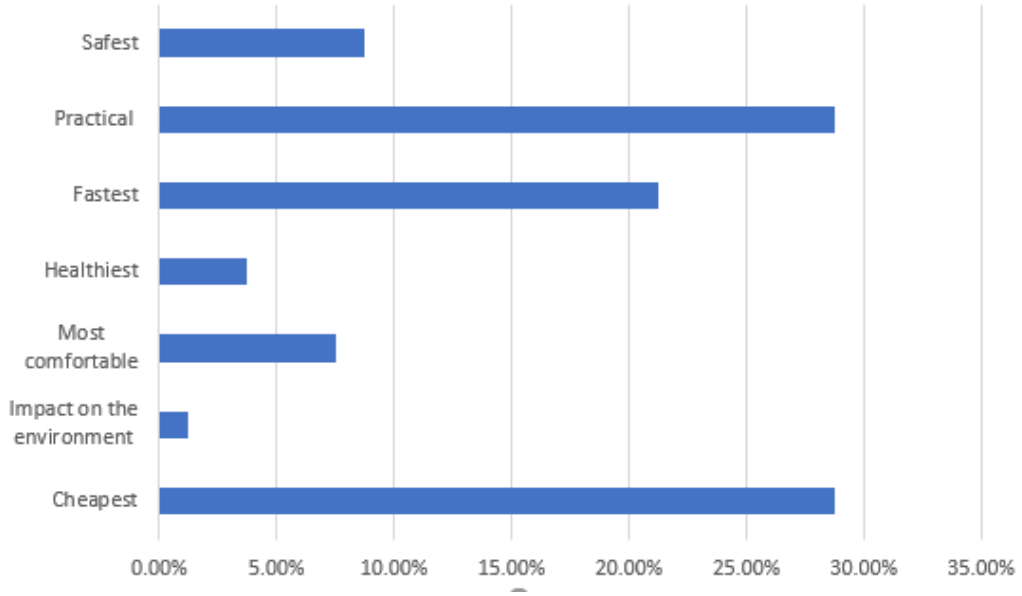


Figure 21: Recreational cycling trails in Veles area

The proposed *EuroVelo 11* cycling trail passes through Municipality of Veles. EuroVelo is a network of long-distance cycle routes connecting and uniting the whole European continent. The routes can be used by cycle tourists as well as by local people making daily journeys.

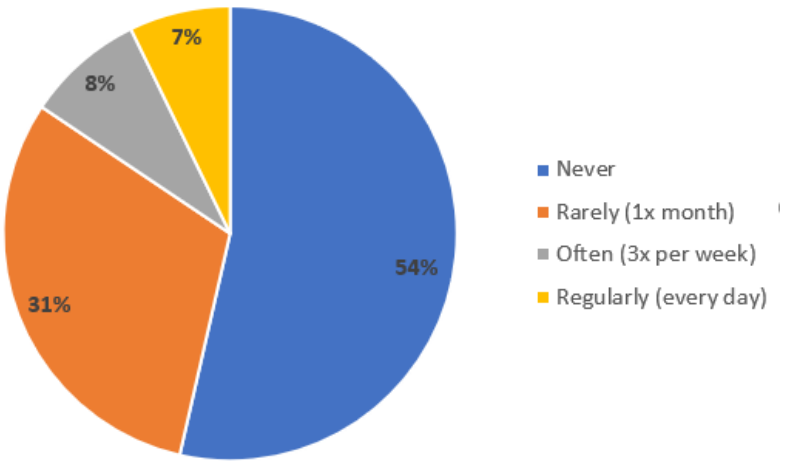
Figure 22: Eurovelo 11 cycling route, source: Eurovelo 11, http://en.eurovelo.com/ev11

Public passenger transport has been largely neglected in urban planning after the increase in motorization and could not flexibly follow personal car use. Only 7% of citizens use public transport as their main mode of transport for daily trips. When it comes to choosing bus as transport mode, the responders primarily state that their reason is convenience (28%) and the price (28%) followed by its speed with 21%. Only 2% of responders chose environmental impact as the reason for choosing a means of transport which shows that public transport is not yet regarded as sustainable alternative to cars.

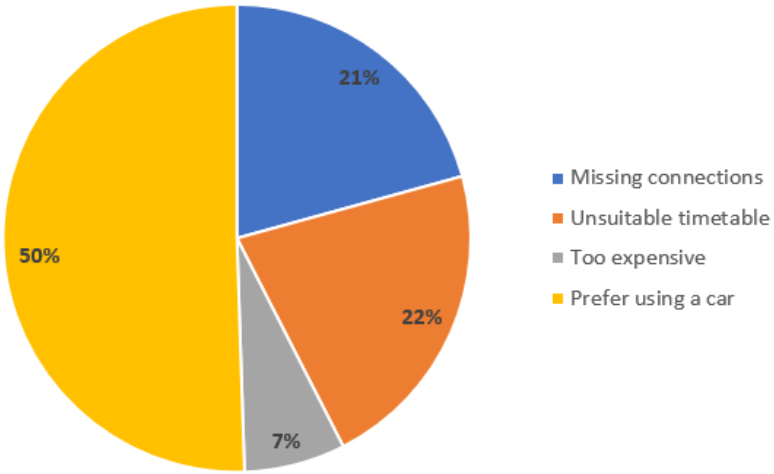


Graph 6: Reasons for choosing personal vehicle as the means of transport

The set of questions concerned the use of public passenger transport by citizens. More than half of respondents never use public transport, and 31% use it rarely. The main reason for non-use is the choice of car as a primary means of transport. Half of the respondents do not use public transport because of the schedules themselves and the running of bus lines. 21% say it as a reason for a bad connection and 22% an unfavourable timetable.



Graph 7: Frequency of JGPP use by residents



Graph 8: Reasons for notusing JGPP by residents

Municipality has implemented public city transport which comprises of 11 service lines. Service lines connect most bigger surrounding settlements with the city of Veles. Although there is a significant number of existing connections most have a very low frequency of operating public transport vehicles. Most of them offer from 4 to 8 departures from starting station, while the bus frequency through city centre is every 30 min. Departures are concentrated during morning and afternoon rush hour and serve as means of transport for locally employed citizens. Only service line with higher frequency of departures is line no.1 that operates on the main road that runs through the city centre and offers half-hourly service.

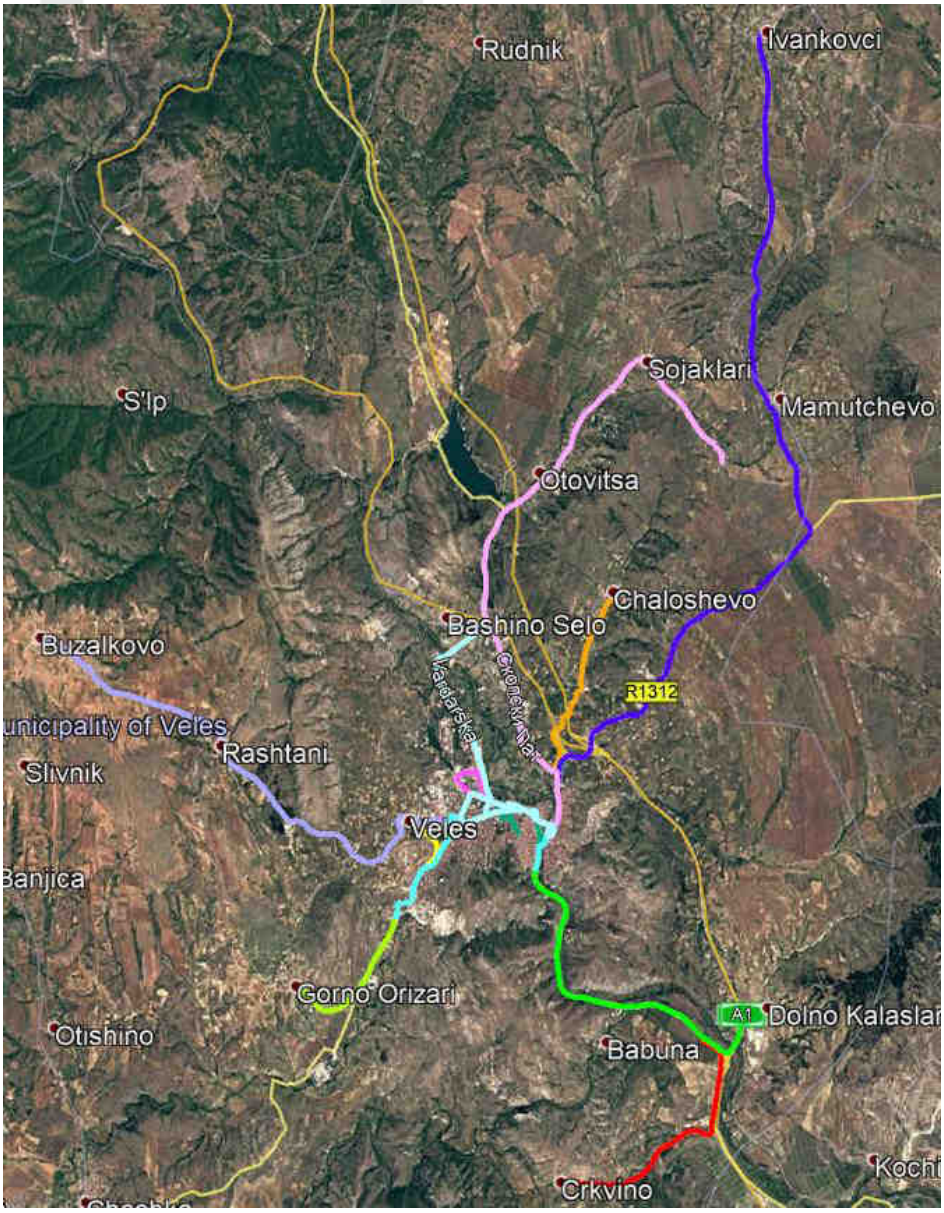


Figure 23: JGP service lines in Municipality of Veles

ДАТУ ПАН ПРОМЕТ ДООЕЛ ВЕЛЕС
(ПОЛН НАЗИВ НА ПРЕВОЗНИКОТ)

ПАТНИЧКА
(ВИД НА ЛИНИЈА)

ВОЗЕН РЕД

За линија во општинскиот превоз на патници на подрачјето на Општина Велес

Автобуска станица - Железничка - Автобуска станица
(назив на линијата)

време на поаѓање														СТОЈАЛИШТА	км.
1	2	3	4	5	6	7	8	9	10	11	12	13	14		
6,15	6,45	7,15	7,45	8,15	11,45	12,15	12,45	13,15	13,45	14,15	14,45	15,15	15,45	автобуска станица	-
6,17	6,47	7,17	7,47	8,17	11,47	12,17	12,47	13,17	13,47	14,17	14,47	15,17	15,47	Основен суд	0,8
6,19	6,49	7,19	7,49	8,19	11,49	12,19	12,49	13,19	13,49	14,19	14,49	15,19	15,49	спортска сала	1,3
6,22	6,52	7,22	7,52	8,22	11,52	12,22	12,52	13,22	13,52	14,22	14,52	15,22	15,52	железничка станица	2,3
6,27	6,57	7,27	7,57	8,27	11,57	12,27	12,57	13,27	13,57	14,27	14,57	15,27	15,57	театар	3,8
6,30	7,00	7,30	8,00	8,30	12,00	12,30	13,00	13,30	14,00	14,30	15,00	15,30	16,00	с,рмаале	5,1
6,33	7,03	7,33	8,03	8,33	12,03	12,33	13,03	13,33	14,03	14,33	15,03	15,33	16,03	автобуска станица	6,4

Figure 24: JGP timetable for service line connecting bus and railway station

Because of lack of maintenance many bus stops in the Municipality are deteriorated and insufficiently furnished with urban equipment like bus shelter, benches, trash cans and timetables. Scarcely equipped and neglected bus stops reduce the attractiveness of the public passenger traffic. Bus stops should be appropriately equipped, illuminated and labelled so public transport users will find them attractive and safe.

Figure 25: Deteriorated JGPP bus station

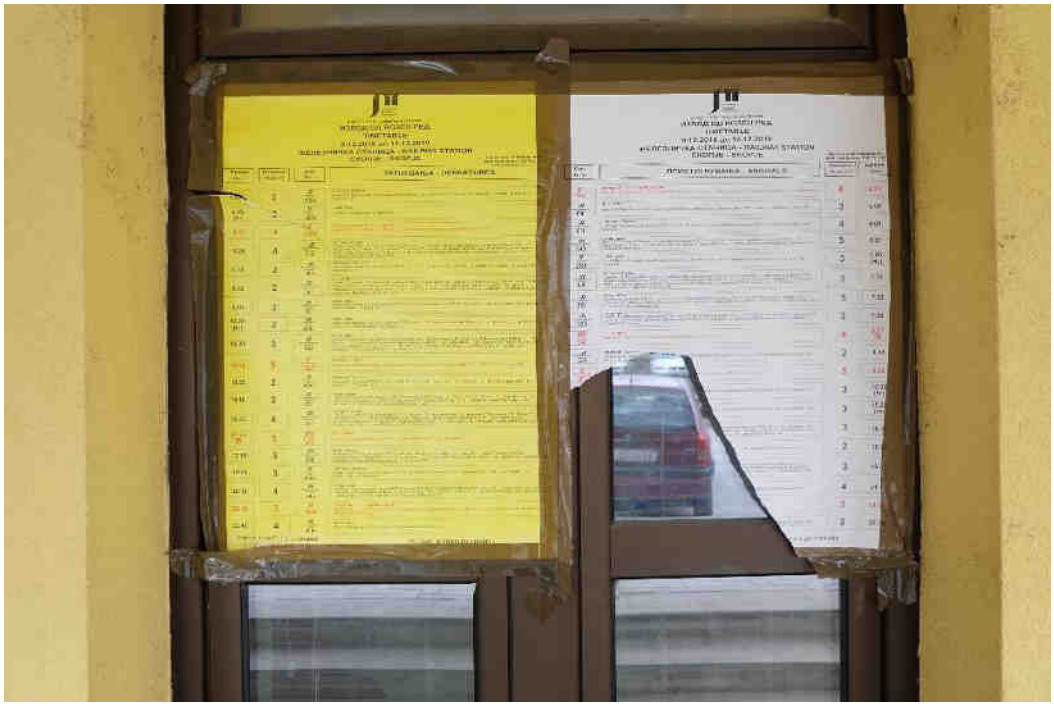
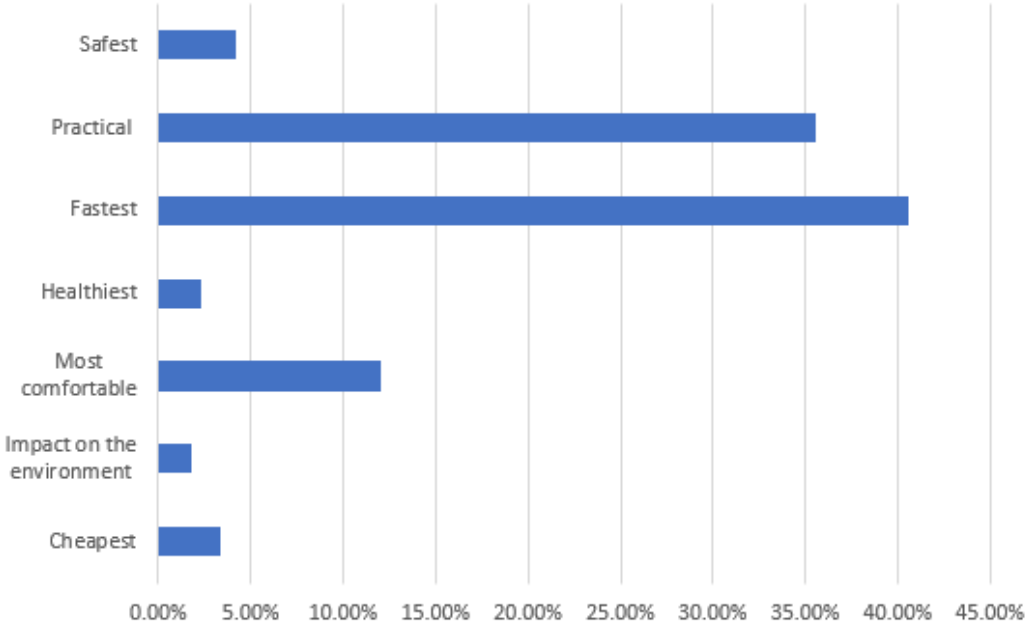


Figure 26: Destroyed timetable at the railway station

Veles is located on the X European corridor, which connects Salzburg with Thessaloniki and represents the main connection of South Eastern European countries to the rest of Europe. Most busy road section, next to the motorway, is the main road R1312 that runs through the city centre. The consequence of heavy traffic load (especially freight traffic) is a decrease in road safety and quality of life due to noise, vibrations and emissions.

According to survey, 53% of respondents use personal vehicles as their main mode of travel. The main reasons for choosing car are speed and its practicality which were chosen by 41% and 35% respondents respectively. The least chosen answers are health (3%) and impact on the environment (2%).



Graph 9: Reasons for choosing public passenger transport as the means of transport

Big part of the city centre is equipped with parking spaces. There are about 400 registered public parking spaces. Despite this the city centre is heavily occupied with parked vehicles.

Parking	Capacity
P1 (Parking Old Bridge)	30
P 2 (Parking to Bazar)	90
P 3 (BUS station)	80
P 4 (Parking Bazar 2)	No data
P 5 (Clock tower)	17
P 6 (Court Center)	43
P 7 (Art salon)	31
P 8 (High school)	63
P 9 (Panini)	18
P 10 (Lake Mladost)	23
P 11 (KAM market/Glorius)	20

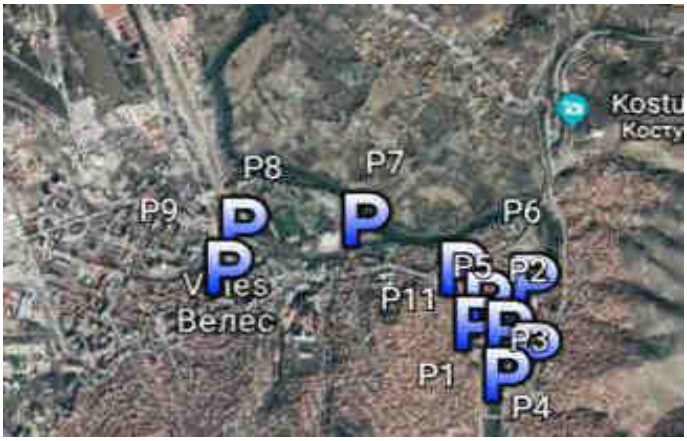


Figure 27: Public parking areas in city if Veles

Illegal parking represents additional challenge despite the fact that a big part of the city centre is equipped with parking spaces. Illegal parking occurs on sidewalks, bus stops, traffic lanes and greenery and hinders accessibility for pedestrians (especially for people with disabilities) and cyclists and additionally decreases the attractiveness of the area. Illegal parking and unregulated macadam parking lots deteriorate the visual appearance of the urban space.

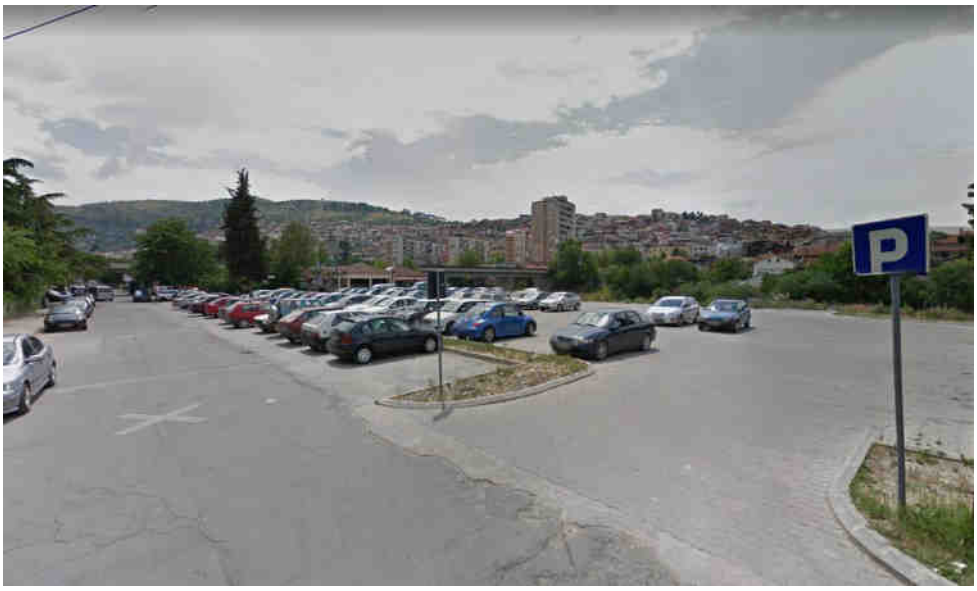


Figure 28: Parking area near bus station

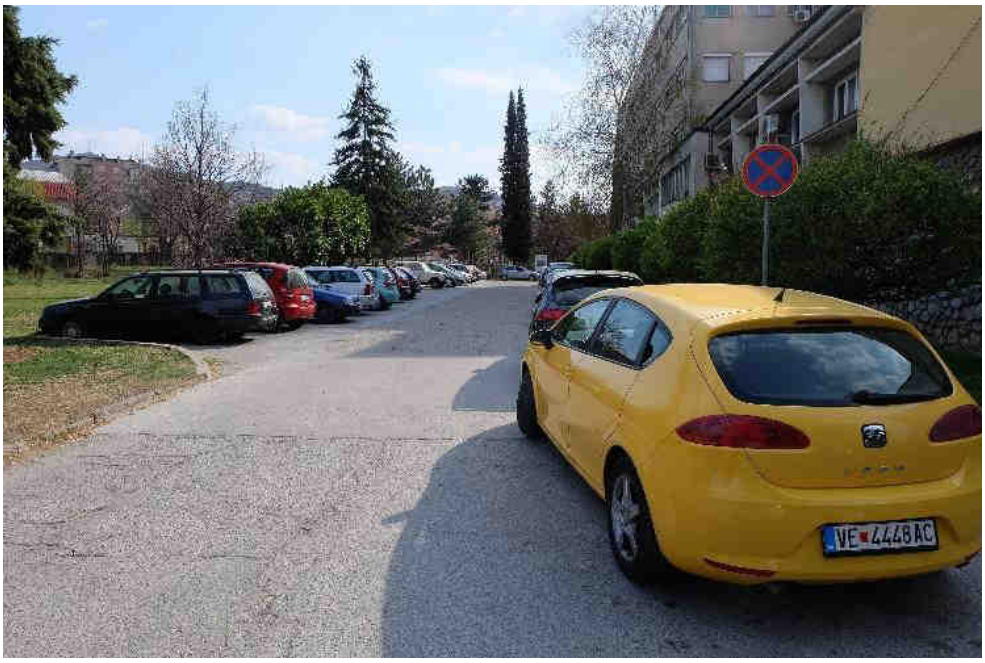


Figure 29: Improper parking near public service building

The municipality has implemented time and spatial restrictions on delivery in the city. Delivery areas are divided into the area of the city centre and the remaining city streets. Freight traffic is allowed along the primary street network (Blagoj Gjorev Blvd., Industrial Street, ASNOM Blvd., Vardarska Street) from the west to the north of the city and vice versa.

1. Доставувањето на стока во зоната на централното градско подрачје е дозволено секој ден во временски период од 23.00 до 06.00 часот и од 09.30 до 11.30 часот.

1.1. Во централното градско подрачје во временскиот период декември-февруари доставувањето на стока ќе се врши само во период од 18.00-07.30 часот

2. Доставувањето на стока во зоната до и од градските пазари е дозволено секој ден во временски период од 04.00 до 07.00 часот, 12.00-14.00 часот и од 18.00 до 20.00 часот.

3. Доставувањето на стока на сите преостанати улици во Велес е дозволено секој ден во временски период од 21.00 до 06.00 часот и од 09.30 до 11.30 часот.

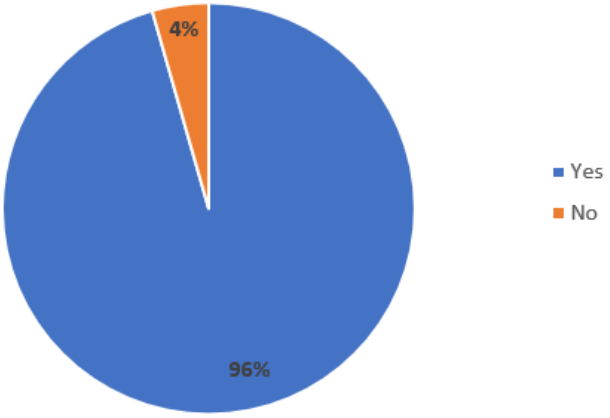
општина велес

ОРГАНИЗАЦИЈА НА ДОСТАВА НА СТОКА

Figure 30: Decree of organization of the delivery of goods

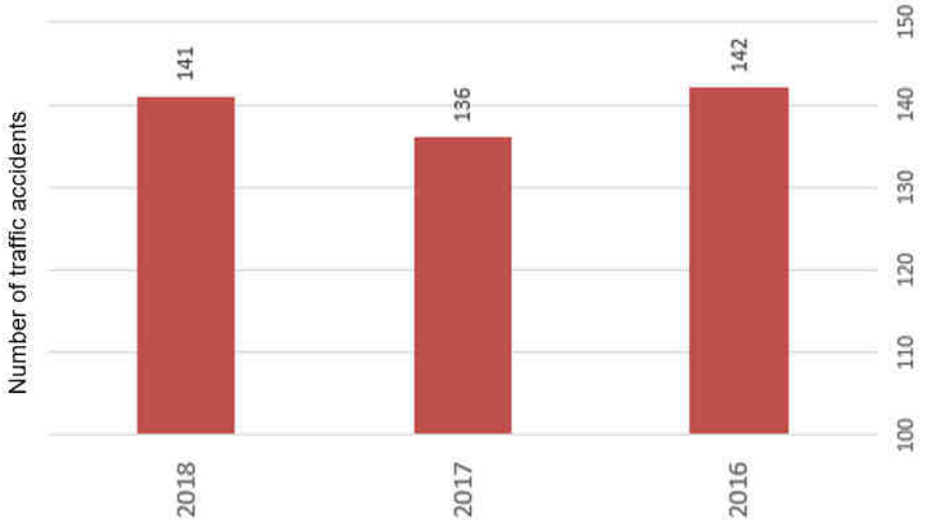
Figure 31: Organization of the delivery of goods in city centre

The survey respondents express a strong need for implementing additional measures for slowing the traffic in surrounding the schools and other educational institutions as 96% responded affirmative to the given question. This shows that the residents recognise safety of the most vulnerable participants as an important value, which should be enforced with additional measures.

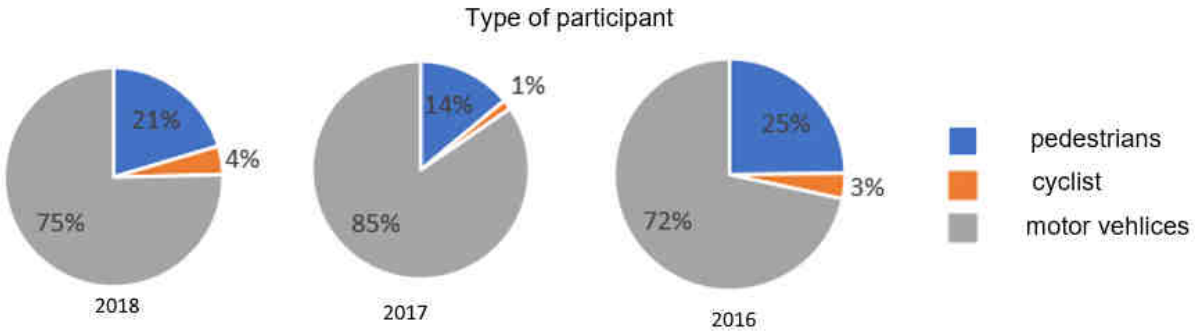


Graph 10: Share of residents that felt that it was necessary to introduce measures to reduce the speed of traffic in areas surrounding the schools and other educational institutions.

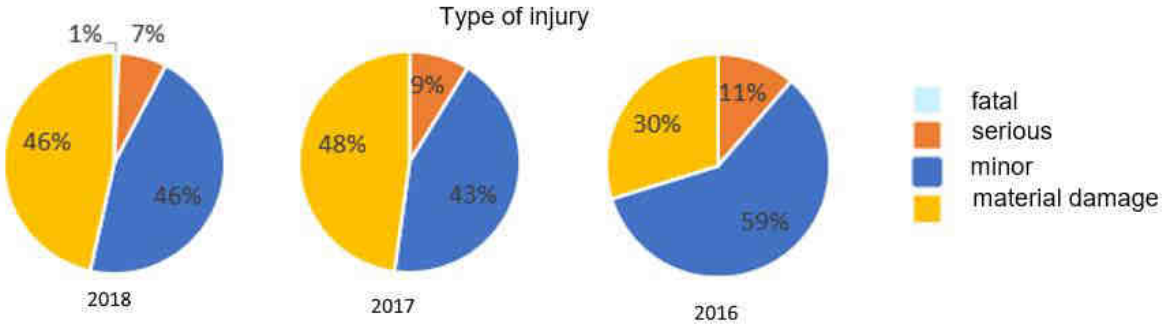
In the area of the Municipality of Veles there were 141 traffic accidents in 2018, of which 7% of the participants were seriously injured, 46% of the participants had minor physical injury and one accident with fatal outcome. The number of accidents over the years fluctuates, so it is not possible to determine the trend of changes in the number of traffic accidents. 75% of road accidents involved a passenger car, 21% pedestrians and in 4% of accidents the cyclists were involved. The most common causes of accidents were: failure to observe the pedestrian, inappropriate overtaking, unsuitable safety distance, driving without a driving licence, driving under the influence of alcohol



Graph 11: Number of traffic accidents in municipality of Veles

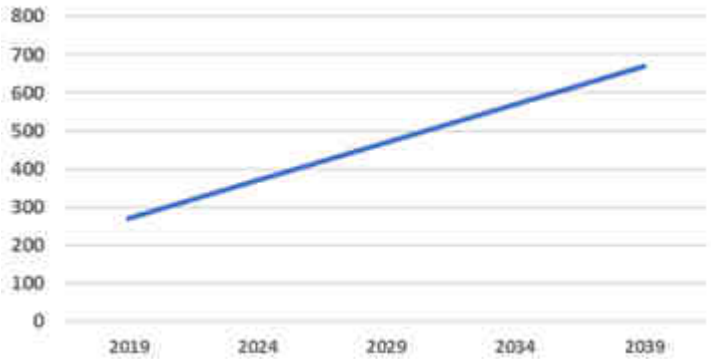


Graph 12: Type of participants in traffic accidents in Municipality of Veles



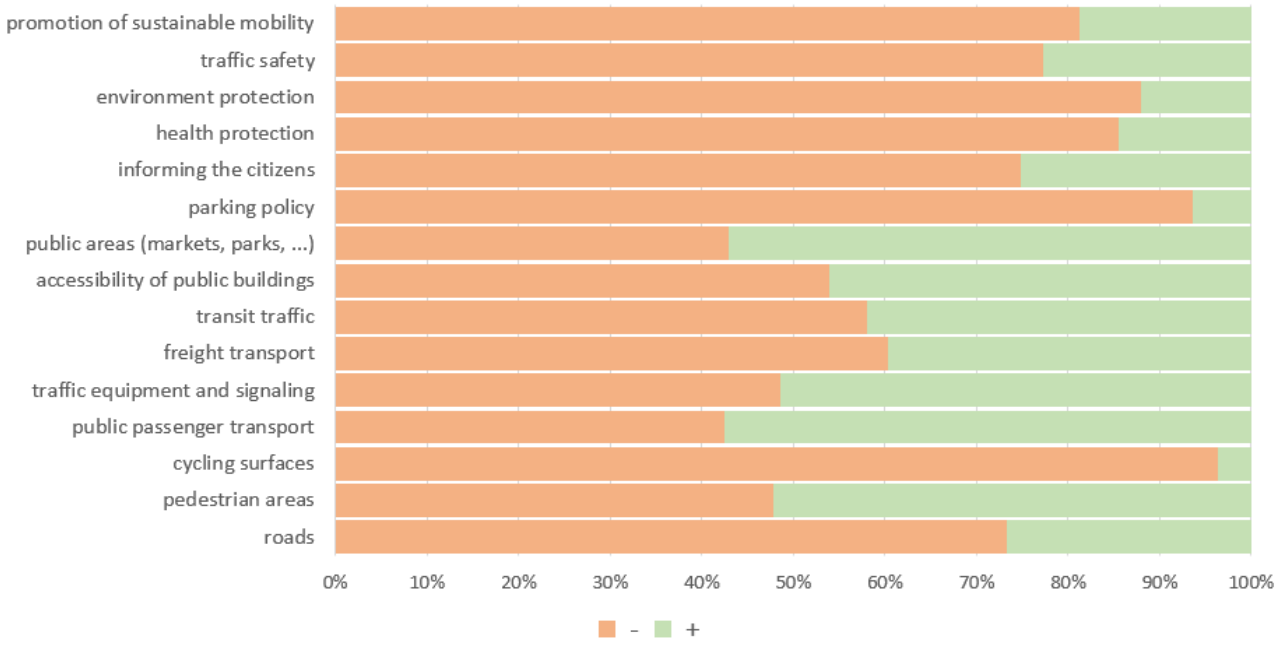
Graph 13: Type of injury in traffic accidents in Municipality of Veles

Following current trends, motorization rate in 2039 will be 670 veh / 1000 inhab (Slovenia currently 520 veh / 1000 inhab). Following the current trends in mobility rates city of Veles will reach Slovenian rates by 2024. With growth of national GDP, the number of vehicles owned and number of daily trips made by residents will heavily increase. Already existing traffic problems will only intensify with increase of number of personal vehicles on the road network. The rapid mobilisation should be countered by encouraging and implementing sustainable transport solutions.



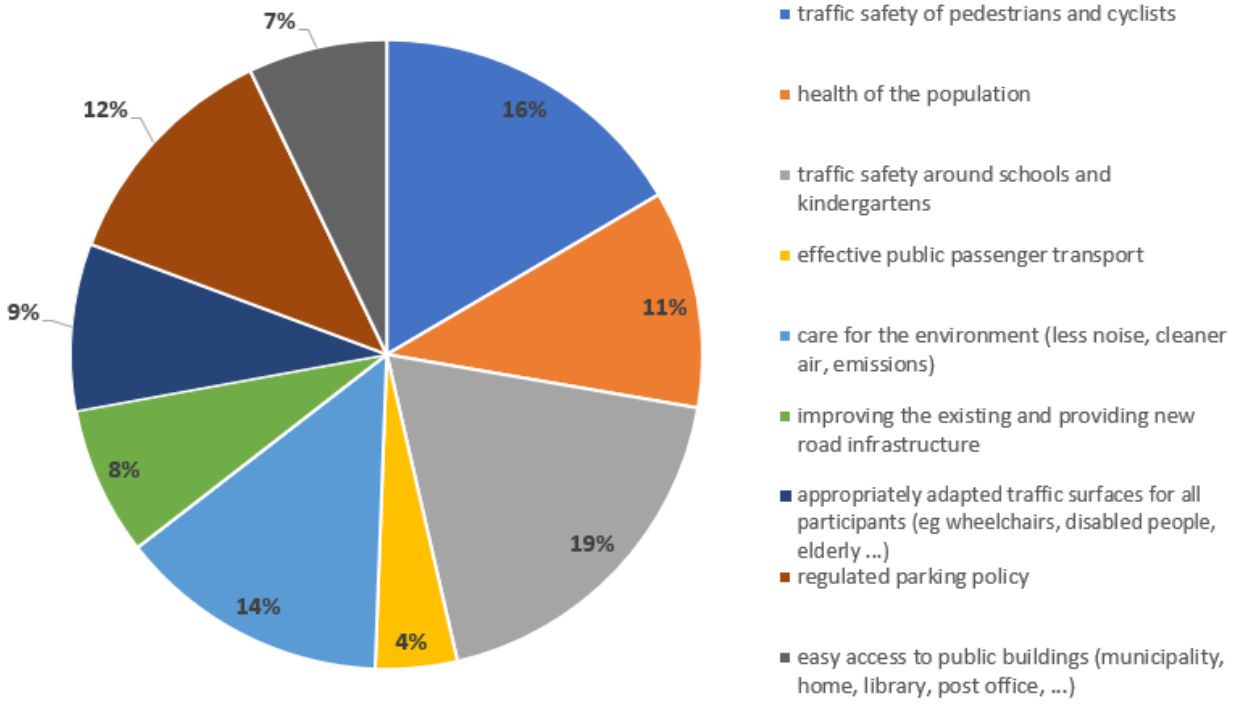
Graph 14: Current trend of motorisation in Municipality of Veles

In the framework of the survey carried out among the inhabitants, we obtained data on satisfaction with the traffic situation in the municipality and the values of the population in the area of sustainable mobility.



Graph 15: Satisfaction with the traffic situation in the municipality

As the best regulated traffic planning areas, the respondents pointed out the arrangement of pedestrian areas, the regulation of public passenger transport and the regulation of public spaces. As the two worst-regulated areas respondents chose the cycling infrastructure and parking policy.



Graph 16: Sustainable transport planning areas

As the most important value the respondents highlighted road safety with 19% of the respondents choosing the answer safe school routes, while 16% answered the traffic safety of pedestrians and cyclists. Sustainable aspects are represented among the inhabitants as the answers relating to sustainable transport and population health represent more than 10% of interests (environmental protection, population health, parking policy). The values that were the least recognized as the most important are the efficient public passenger transport (4%), accessibility to public buildings (7%) and the improvement of the present and the construction of a new transport infrastructure (8%).

The results show that citizens recognise transport planning, traffic safety and the development of sustainable forms of transport as the main values. The results of the survey show that residents do not recognize public passenger transport as an important part of their mobility, as only 7% of respondents marked it as the main mode of travel, and only 4% of the survey were selected as the most important value in traffic planning.

5. VISION

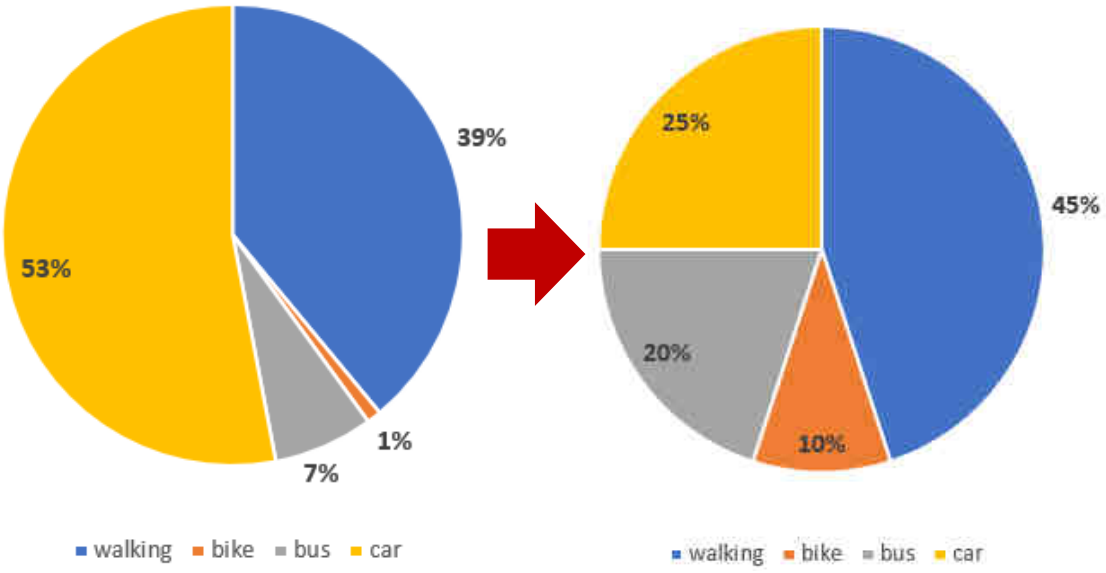
The Municipality of Veles has the potential for successful future development of transport. This vision is designed to cover general ideas for the development of sustainable transport in the municipality whose main goal is to improve the quality of life in terms of economy and tourism.

"The City of Veles will implement a **transport policy close to the needs of citizens and environmental protection**. The new integrated and innovative approach will enable the improvement of **traffic safety, development of ecological environment with high quality of life and promote the local economy and tourism**„

6. STRATEGIC GOALS

Municipality of Veles has set strategic objectives that will serve to achieve the vision and will represent the basis for proposed measure packages. Strategic objectives indicate the type of change desired serve as a basis for proposed measure packages. Objectives are higher level aims of the Sustainable Urban Mobility Plan while measures are the means to achieve them. Strategic objectives proposed in this document strive for liveable urban environment and safe and accessible transport network based on sustainable planning principles.

1. Greater accessibility for all population groups throu transport modes for a higher quality of life in the municipality.
2. Establishing greater integration, competitiveness and accessibility among all transportation modes, with an emphasis on existing public passenger transport.
3. Establishing a smart parking policy that will relieve the city centre of vehicular traffic.
4. To halve the number of accidents with serious injuries and to achieve zero mortality on the streets in the municipality.
5. Promotion of sustainable travel methods for all groups of citizens, with an emphasis on young people.



Modal split 2019

Modal split 2030

7. SCENARIOS

Within the framework of the working group, four scenarios for the development of the transport network in the municipality were designed. For each scenario, measures were identified that are integrated and verified using traffic modelling tools. In accordance with the methodology, a 20-year planning period is taken into account in transport modelling. All scenarios are modelled on current situation and year 2039 with 1% annual traffic growth.

In the case of **Scenario 1 (do nothing),** transport model shows, what will happen if traffic network doesn't change despite increase of traffic flows by the year of 2039.

In the case of **Scenario 2** transport model shows, how traffic flow will redistribute by the end of 2039 if following short and middle term actions will be taken:

- Reconstruction of city centre;
- One-way regime to the church Sv. Pantelejmon;
- One-way regime to the church Sv. Spas;
- One-way traffic over railway bridge;
- One-way regime inside area of Blagov Gjorev / Boris Trajkovski / Andon Shurkov st.;
- One-way regime on Alekso Demnievski Bauman/ Vasa Koshulcheva st..

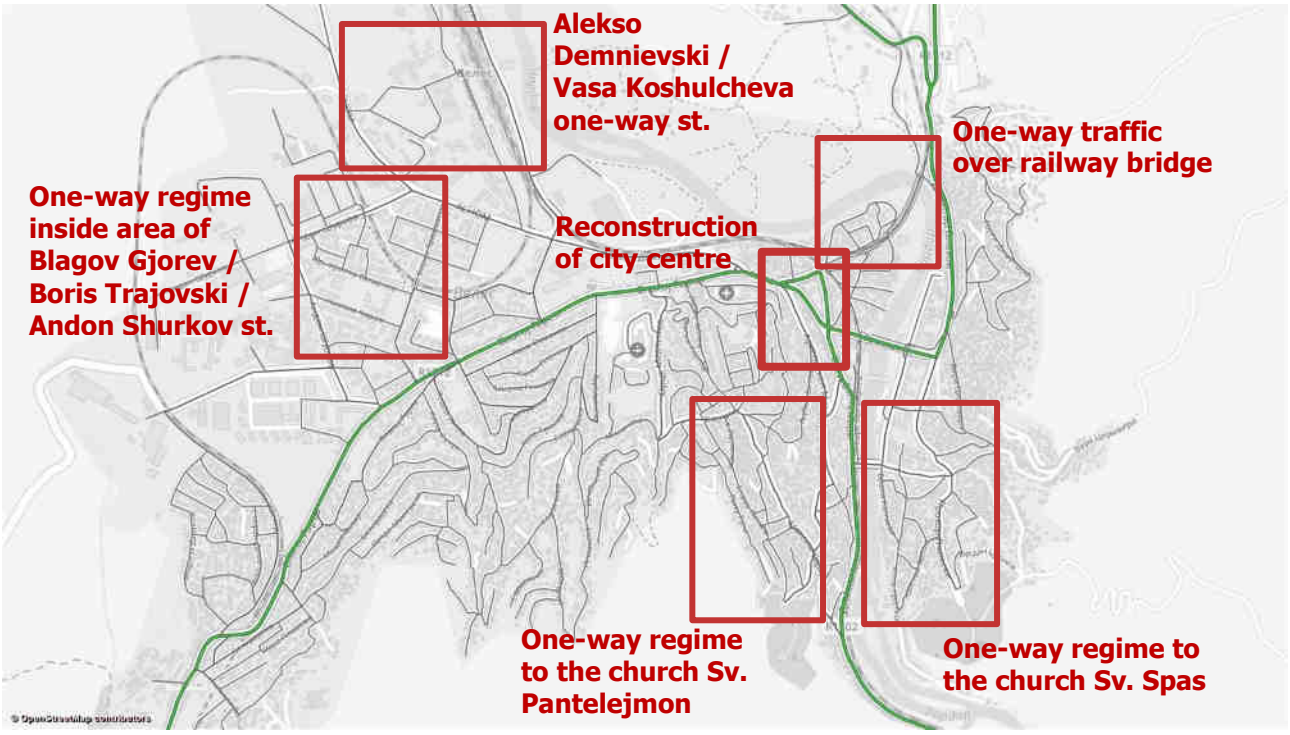


Figure 32: Measures used in Scenario 2

In the case of **Scenario 3** transport model shows, how traffic flow will redistribute by the end of 2039 if in addition to short- and medium-term measures, long-term investment measures are implemented:

- Western bypass road;
- Rečani new bridge across Vardar river.

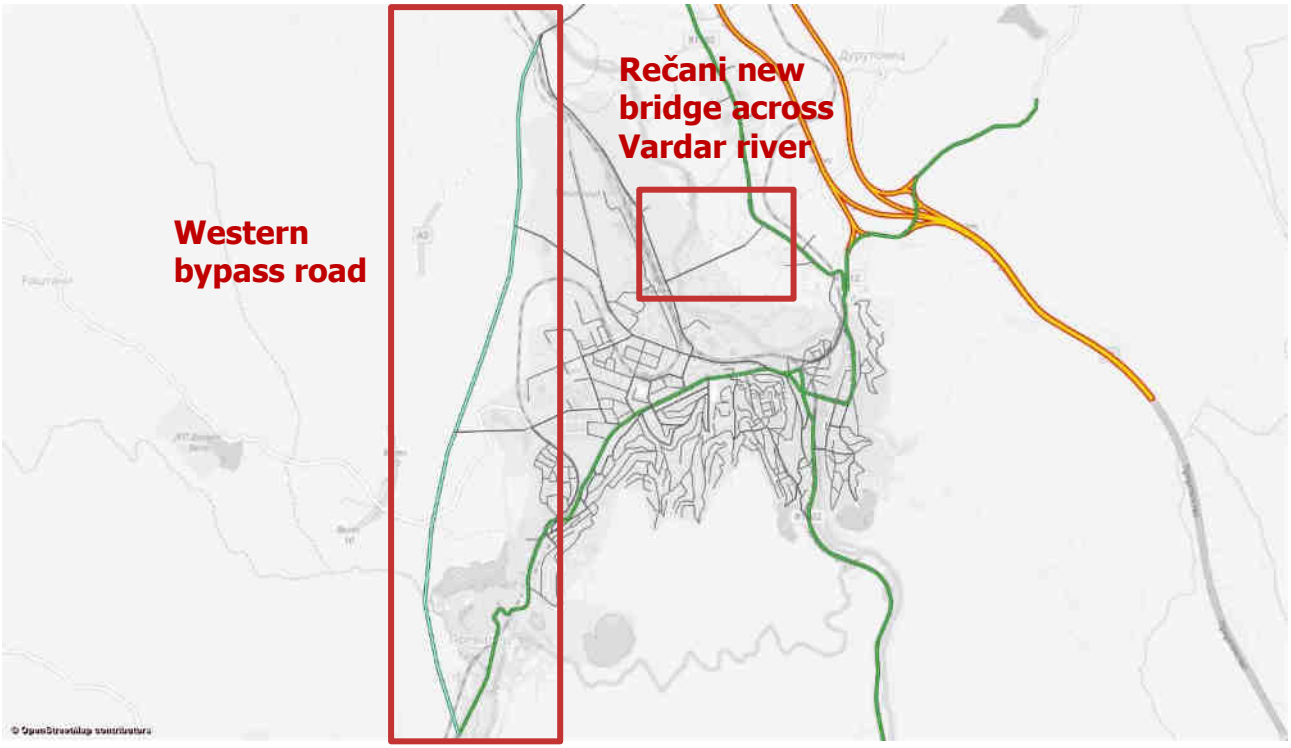


Figure 33: Measures used in Scenario 3

In the case of **Scenario 4** transport model shows, how traffic flow will redistribute by the end of 2039 if in addition to proposed measures, new public passenger transport service lines are implemented. The scenario takes into account 20% redistribution of personal motor traffic passengers to public transport (bus and train).

7.1. TRANSPORT MODEL OF THE MUNICIPALITY OF VELES

7.1.1. INTRODUCTION

As part of the preparation of SUMP document, a transport master plan – transport model of the Municipality of Veles is produced. According to »Guidelines – developing and implementing a sustainable urban mobility plan«, transport model is foreseen in 3th step of 1st faze of SUMP, named Develop scenarios. Transport model is mathematical model, combining road infrastructure - transport network and daily or hourly trips – traffic demand. It can be macroscopic, covering area of municipality Veles or microscopic, analysing foreseen measures on smaller areas, streets, intersections - microsimulation.

It's intended to evaluate proposed actions, changes of transport network or transport regime, transport habits, spatial development, new trip generations, traffic impact on environment, cost benefit analyses. Besides current traffic condition, macroscopic model usually include scenarios »do nothing«, when existing trends continue unchanged and scenarios that represent new transport policy and solutions. It is used to forecast and compare future scenarios in quantitative terms. Scenarios help better understand the likely combined effects that the measures discussed in a SUMP.

Transport model of the city of Veles is made for morning and afternoon peak hour (hourly model) and period of 24 hours (daily model). It is based on socio-demographic data, intensity of industrial activity, number of working places, shopping activity, … For purpose of calibration 16-hours traffic counts were made on 7 intersections, for analysis of transit and origin-destination traffic, 9-hour licence plate survey was made on 5 locations. Transport model consist of cars, buses, heavy vehicles up to 7,5t and above 7,5t. It is made according to the methodology HCM.

7.1.2. TRANSPORT NETWORK

Transport model is based on “OpenStreetMap” web application, which provide user with accurate, up to date information about current road infrastructure with all attributes important for modelling. Current model is assembled of 418 nodes and 1.096 links in total length of 243 km. Links describe roads of the transport network and they connect nodes, which means intersections. A link is represented as a directed element. For every link, permitted transport systems is specified. Main attributes of links are capacity, speed and restrictions on vehicles.

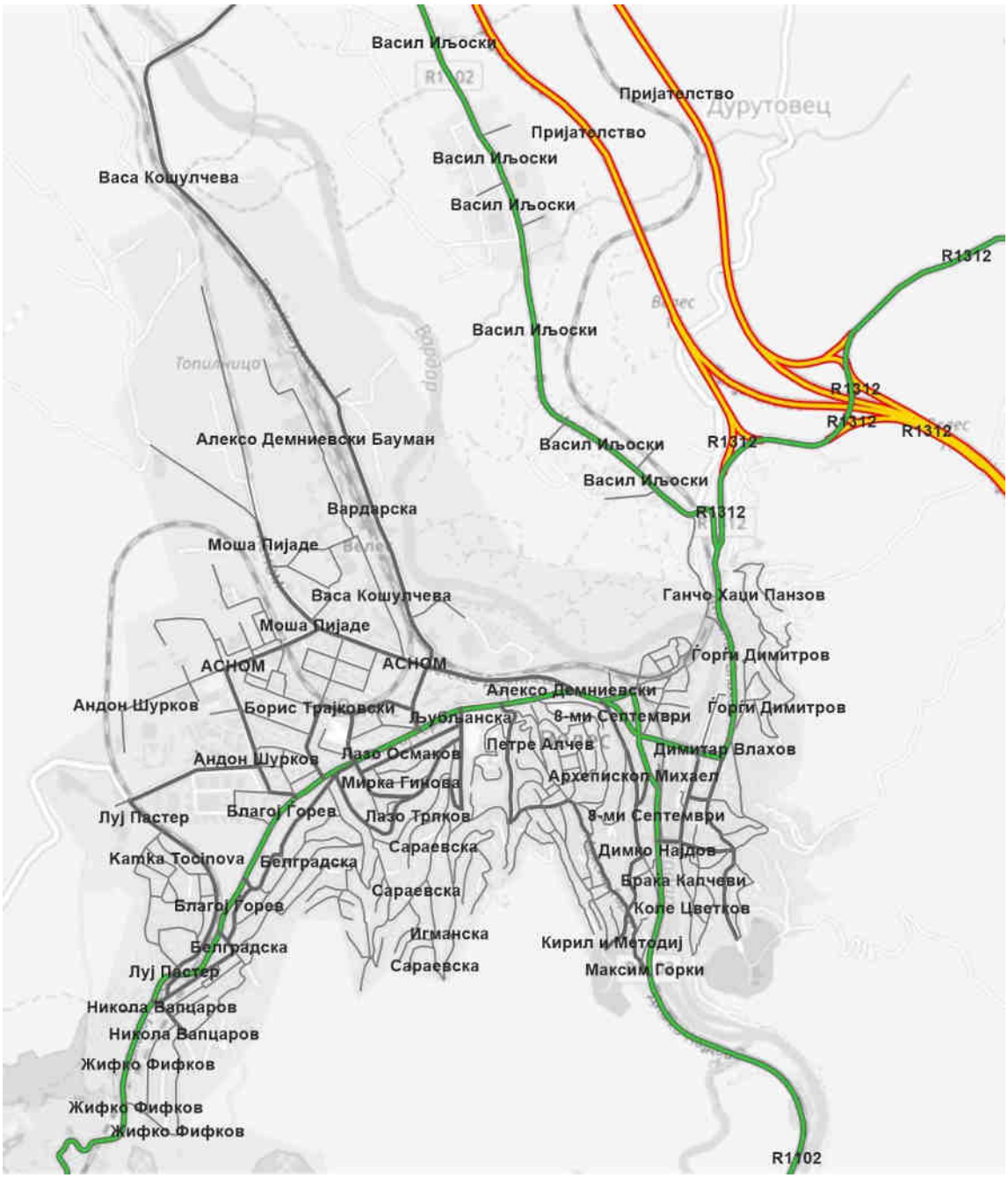


Figure 34: Traffic network of the model

7.1.3. ZONES

Zones are the origins and destinations of trips or movements. This means that each trip starts in a zone and ends in another zone. Zones connect the transport supply (network model with nodes, links) and the travel demand (in the form of demand matrices), which contain the demand (trips) of all OD pairs of the model. Zones generally represent homogeneous and spatially concluded units (residential area, industrial area, shopping zones,). Transport model of the Municipality of Veles is consisted of 33 internal and 5 external zones.

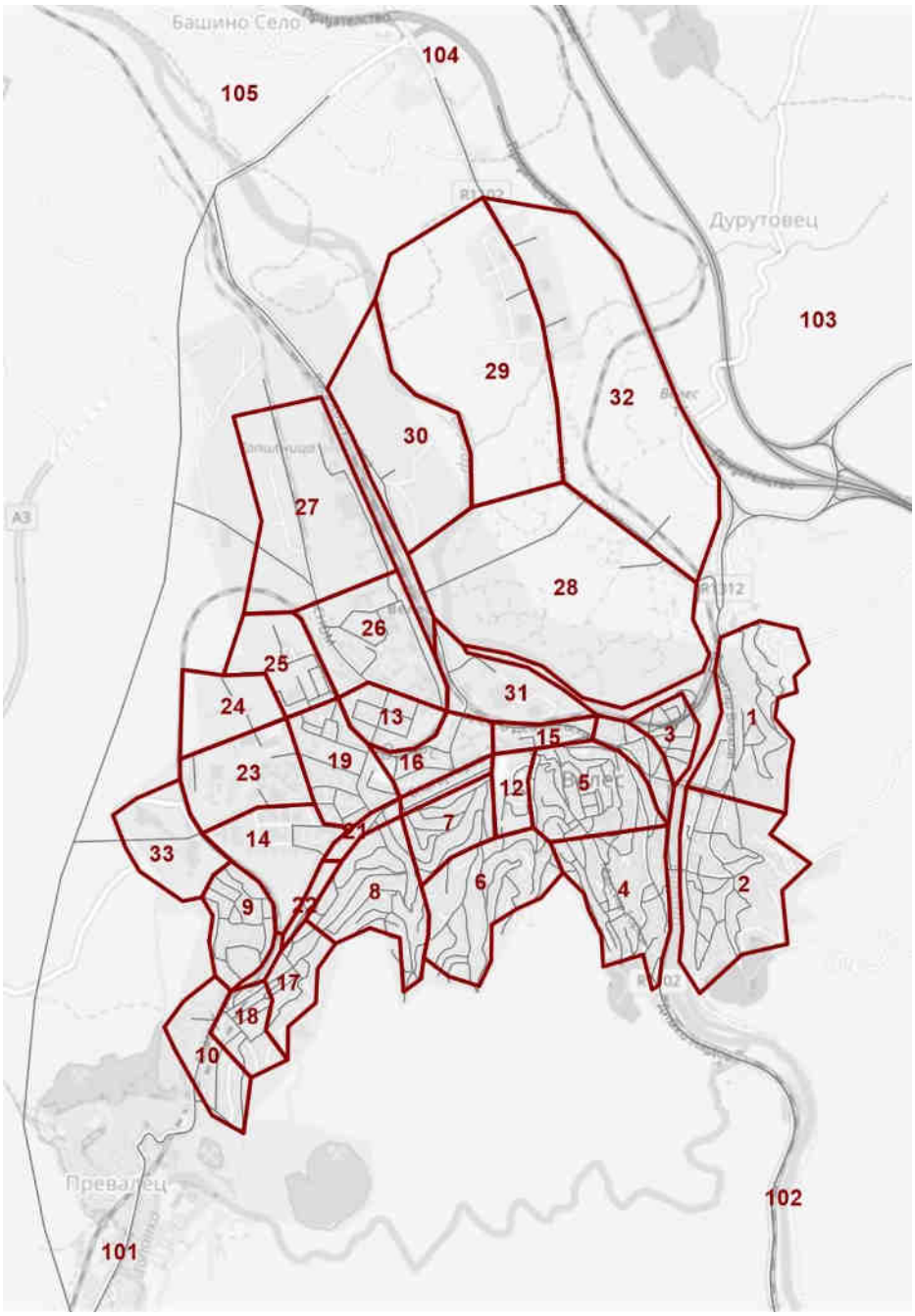


Figure 35: Traffic zones

7.1.4. TRAFFIC SURVEY

In the process of data collection for the model, extensive transport survey was done. For purpose of calibration 16-hours traffic counts were made on 7 intersections, separately by traffic structure and directions. For analysis of transit and origin-destination traffic, 9-hour licence plate survey was made on 5 different locations.

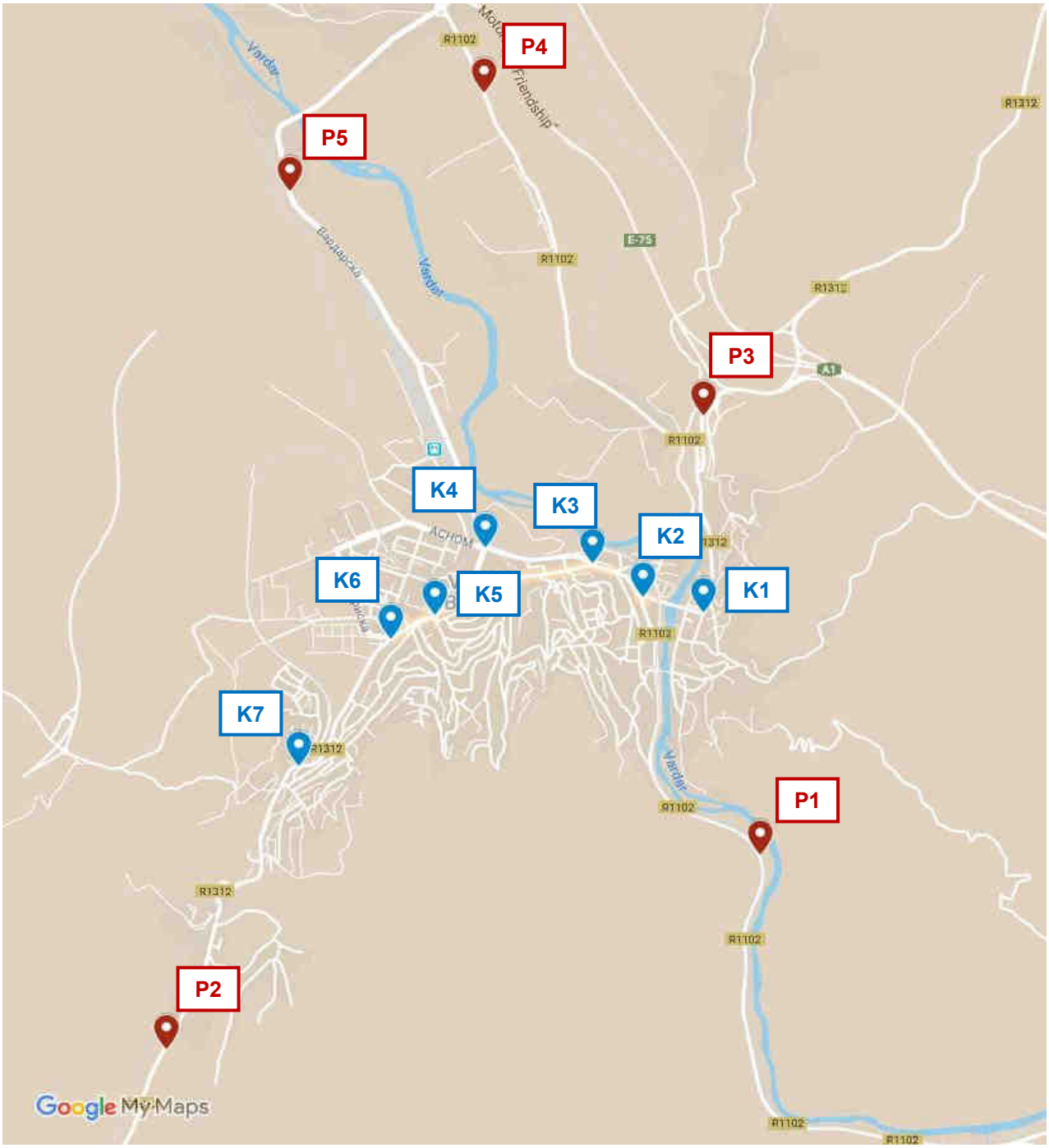


Figure 36: Locations of traffic survey

Licence plate survey points	Direction
P1	Prilep/ Gradsko/ Negotino/ Gevgelija/
P2	Čaška/ Dolno Orizari
P3	Štip/ Kumanovo/ Bitola/ Prilep/ Gevgelija/ Skopje
P4	Otovica/ Lake Mladost
P5	Bašino Selo

Traffic count points	Location (intersection)
K1	Ilindenska/ Dimitar Vlahov
K2	Roundabout/ 8 September/ Goce Delčev/Nikola Orovčanec/ Ilindenska
K3	Blagoj Gjorev/ Alekso Demnievski Bauman
K4	Vardarska/ Alekso Demnievski Bauman
K5	Roundabout/ Blagoj Gjorev
K6	Blagoj Gjorev/ Andon Shurkov
K7	Blagoj Gjorev/ Luj Paster

Table 2: Locations of transport survey

The results of traffic counts on intersections are found in the addendum.

7.1.5. CALIBRATION AND VALIDATION

In the assignment phase of the modelled network with the calculated OD matrix, there is a deviation between calculated traffic flows and counting data, a traffic model calibration is required. Validation of a traffic model means a comparison of modelled and countable traffic loads. Validation was made separately for passenger cars, light, and heavy goods vehicles (for the 24h model), passenger cars and goods vehicles (for the peak hour model). Comparison of modelled and countable traffic loads is based on the following methods of validation:

- absolute difference (difference between count and model value)
- relative difference (percentage of absolute difference with respect to the count value)
- calculation of the GEH statistical value (x2 test form including absolute and relative errors); it is calculated by the formula: GEH = √ (2 * (M-C) 2 / M + C) where M is the modelled value and C is counted data; The GEH criterion is relevant only for hourly traffic loads
- correlation analysis (denotes the dependence or the relationship between counted and modelled values)

The international criteria for validating transport models determine, that the traffic model is appropriate, if the GEH factor is less than 5 on more than 85% of the network. The validation of the traffic model during the morning and afternoon peak hours as well as the 24h period shows that GEH parameter is less than 5 on all sections considered for all types of vehicles. The GEH criterion therefore corresponds to 100% of all sections, which means that the traffic model is made with appropriate accuracy during the morning and afternoon peak hours as well as 24h period.

The correlation factor shows how the amount of modelled traffic is matching to the real state represented by the count. Correlation factor 1 means a complete matching of counting and modelling loads. In broader areas, acceptable factors are acceptable in the range of 0.90 to 1.00. The calculated correlation factors are shown in the table below. The correlation factor criterion during morning and afternoon peaks and the 24h period indicates that the traffic model is made with the correct accuracy!

	Model 24h	**Model Morning PH**	**Model Afternoon PH**
Car	0,995	0,985	0,992
Goods vehicle	Light: 0,903	0,911	0,908
	Heavy: 0,948		

Table 3: Correlation factors

7.1.6. TRANSPORT MODEL RESULTS

Within the transport model four scenarios of the development of the transport network were checked. Scenario 1 present the continuation of existing trends. This means that the existing transport network is not being modified, despite unchanged trends in traffic growth. Scenarios 2, 3 and 4 present short-term and long-term measures on the transport network as described in Chapter 6 SCENARIOS. By the end of the planning period of 2039, according to the established factors for passenger cars and heavy vehicles, 1% overall traffic growth was taken into account. At the end of the planned period, traffic loads are thus increased by 22%. The results of the traffic model are presented below.

7.1.6.1. RESULTS OF SCENARIOS IN YEAR 2019

Comparation of results of transport model will be shown below for different scenarios of transport network for the base year of 2019.

Current transport network in 2019:

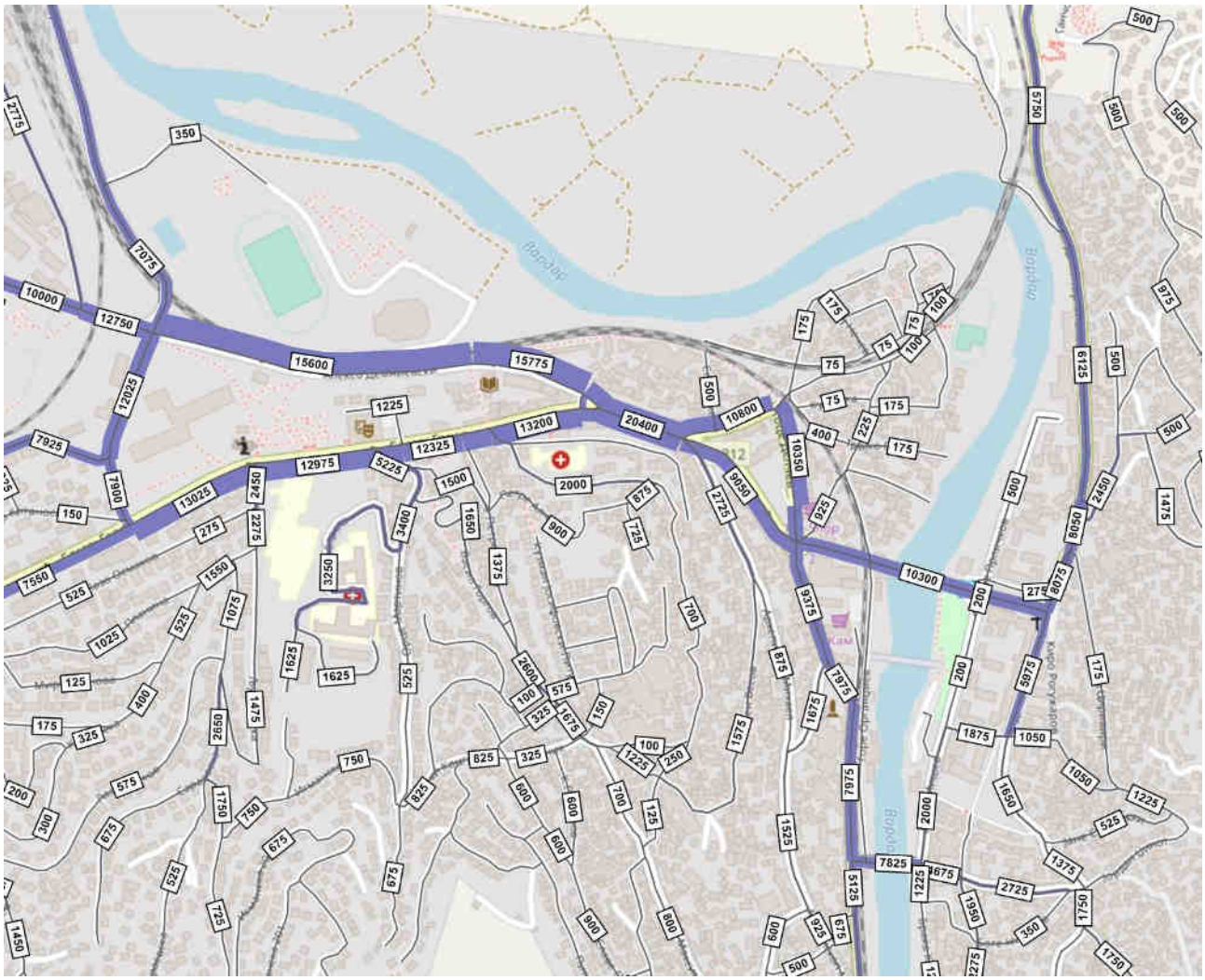


Figure 37: Current transport network in 2019, 24h (all vehicles)

Today the busiest part of the network in current network is section of 8-mi Septemvri st. between Alekso Demnievski Bauman and Strasho Pindzur st.. There are around 20.400 vehicles traveling every day. Blagoj Gjorev st. is passed by 12.975 vehicles and Alekso Demnievski Bauman st. with 15.600 vehicles every day. Goce Delchev st. is passed by 10.350 and 8-mi Septemvri st. by 9.050 vehicles. From direction of motorway A1 6.125 vehicles are coming every day. Gemidzii bridge is crossed by 10.300 vehicles, Old bridge with 7.825 vehicles and the section of 8-mi Septemvri st. between bridges with 7.975 vehicles. Arhiepiskop Mihail st. is passed by 2.725 and Vardarska st. by 7.075 vehicles. The most heavily loaded intersection in the network is Vardarska / Alekso Demnievski Bauman / N. N. Borche st. with 23.725 vehicles.

Scenario 2 in 2019:

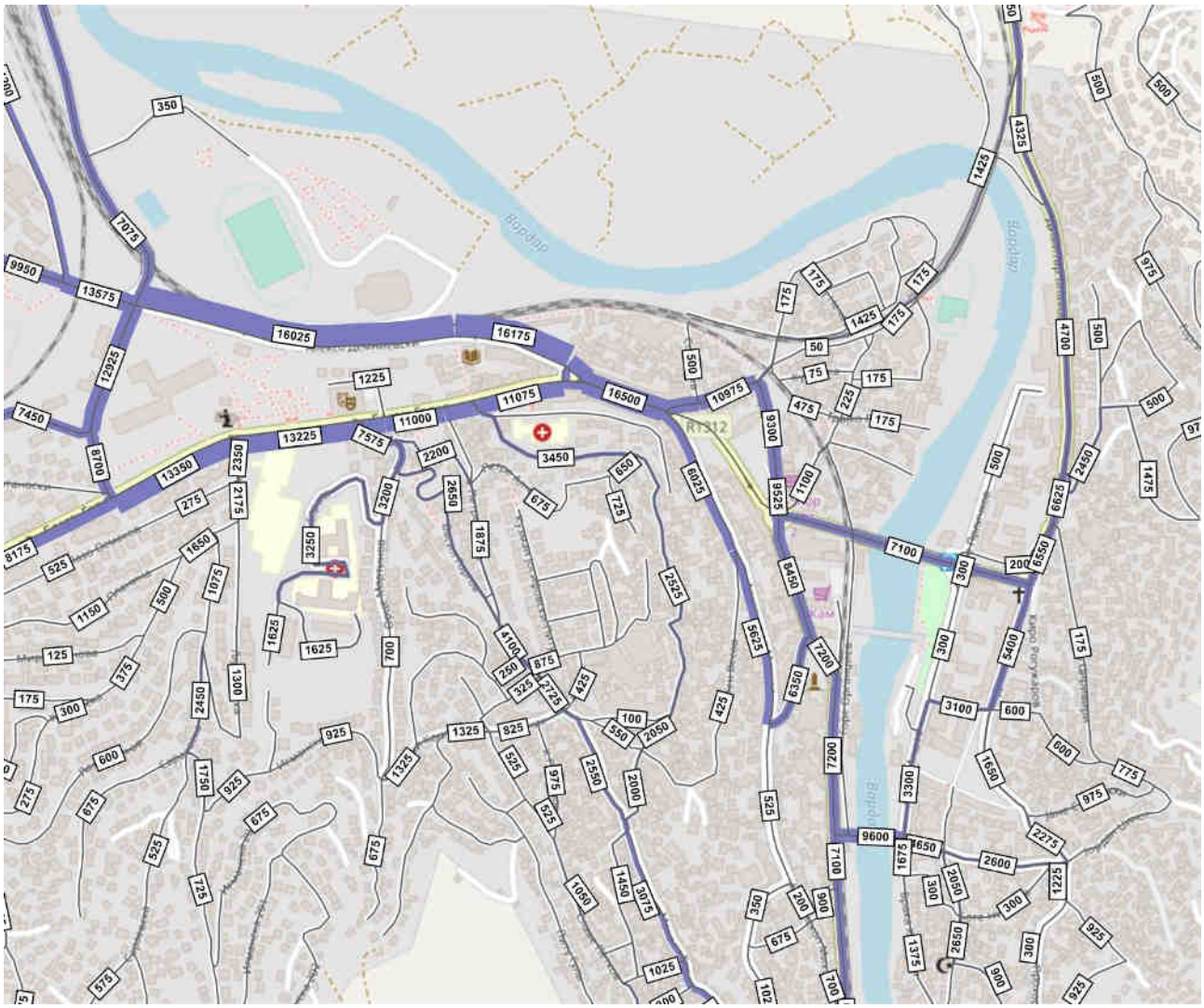


Figure 38: Scenario 2 in 2019, 24h (all vehicles)

Comparing Scenario 2 with current network in 2019, the traffic flow in the section of 8-mi Septemvri st. between Alekso Demnievski Bauman and Strasho Pindzur st. will reduce by 3.900 vehicles daily. Traffic flow on Blagoj Gjorev st. will increase by 250 vehicles and Alekso Demnievski Bauman st. by 425 vehicles every day. Since 8-mi Septemvri st. in the city centre will be closed for traffic (except public transport), traffic flow will redistribute to Arhiepiskop Mihail st. with 6.025 vehicles, Goce Delchev with 9.300 and new one-way connection over railway bridge with 1.425 vehicles daily. Gemidzii bridge is crossed by 7.100 vehicles and Old bridge by 9.600 vehicles daily. The most heavily loaded intersection in the network remains Vardarska / Alekso Demnievski Bauman / N. N. Borche st. with 24.795 vehicles. Change to one-way regime to the church Sv. Pantelejmon will increase traffic on Maksim Gorki by 2.275 vehicles.

Scenario 3 in 2019:

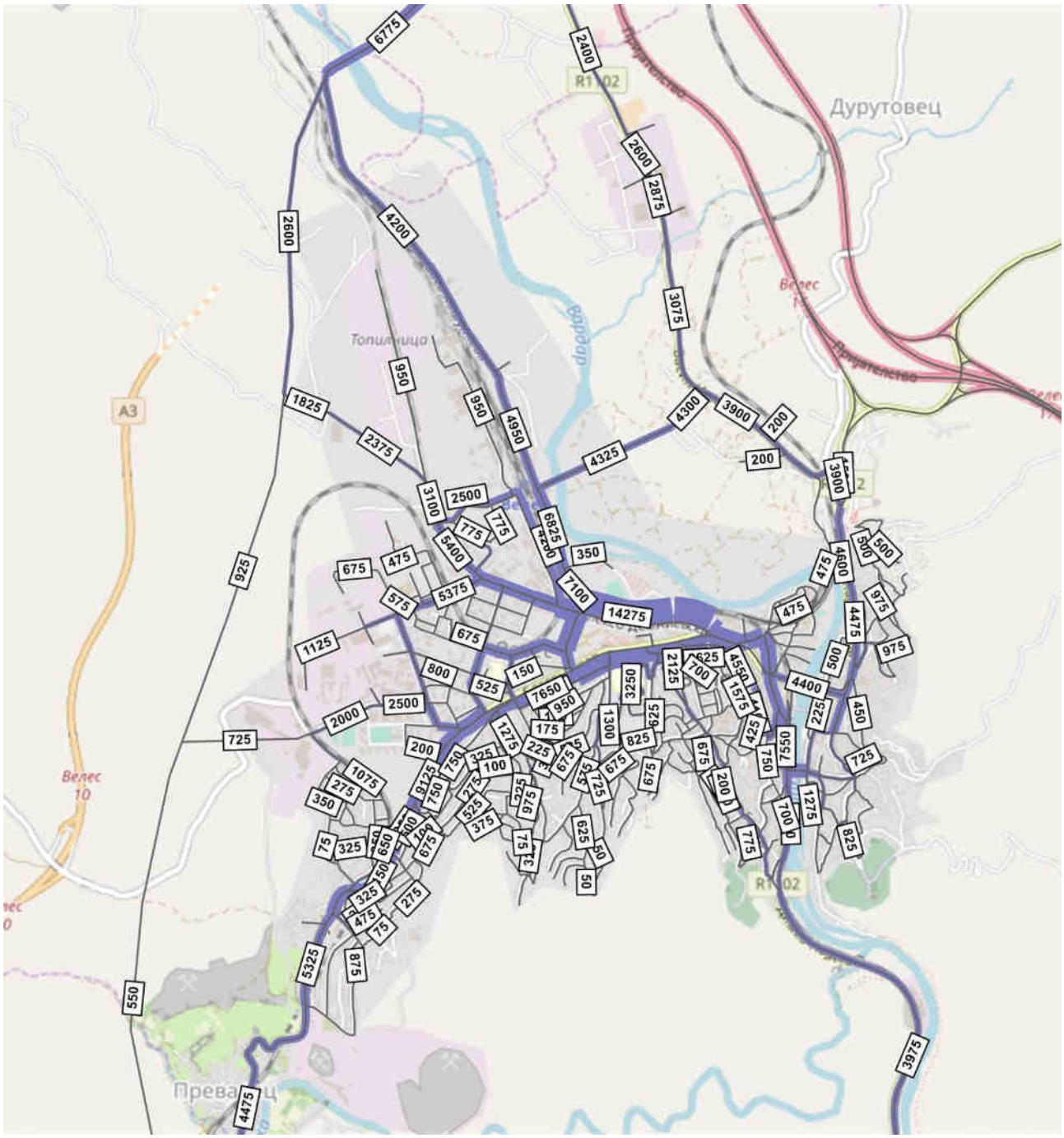


Figure 39: Scenario 3 in 2019, 24h (all vehicles)

In 2019 new Western bypass road would be loaded from 550 to 2.600 vehicles daily, while new Rečani bridge across Vardar river would take around 4.325 vehicles daily, that would greatly reduce traffic flows through city centre.

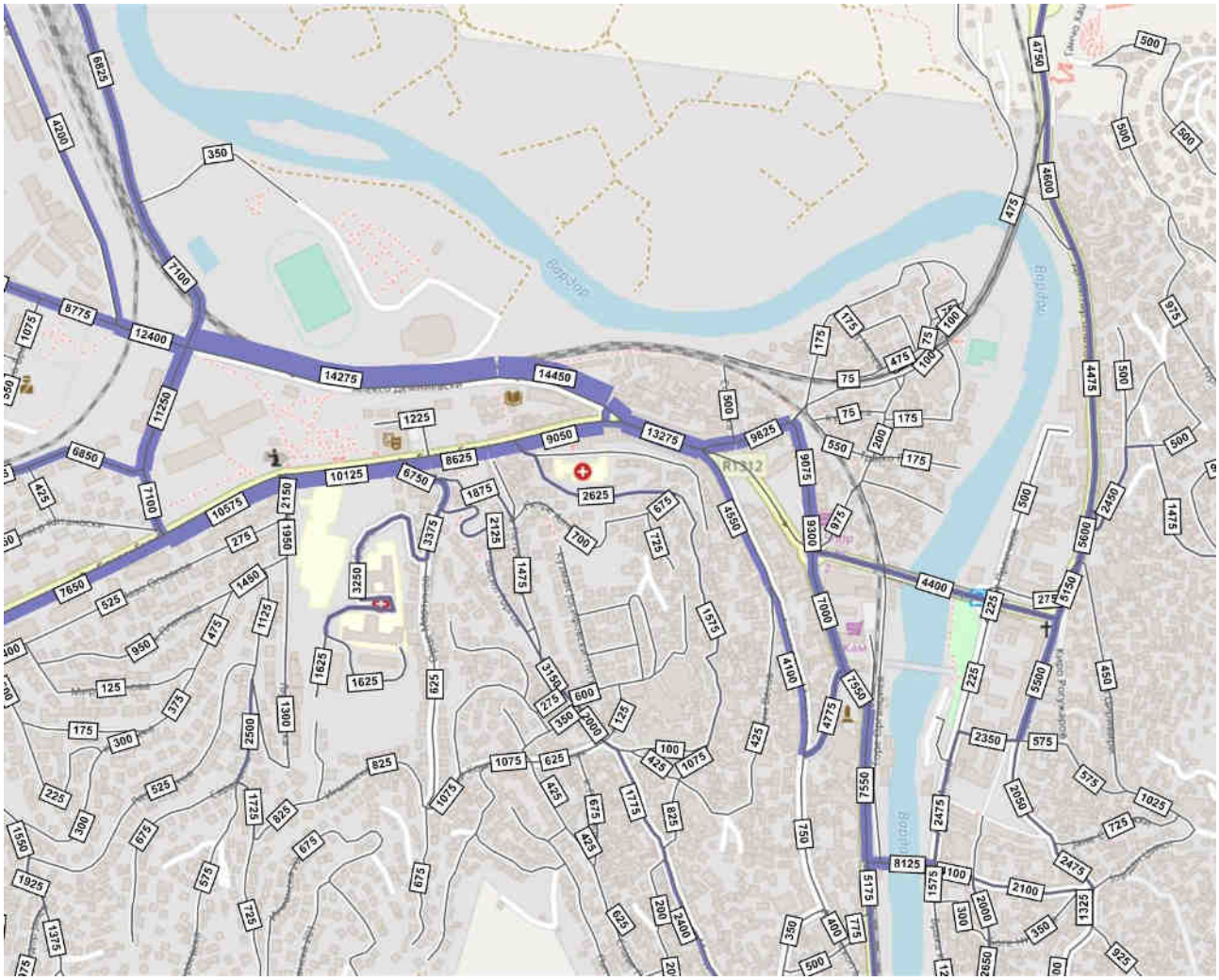


Figure 40: Scenario 3 in 2019, 24h (all vehicles)

Comparing Scenario 3 with Scenario 2 in 2019, the traffic flow in the section of 8-mi Septemvri st. between Alekso Demnievski Bauman and Strasho Pindzur st. would reduce by 3.225 vehicles daily. Traffic flow on Blagoj Gjorev st. would reduce by 3.100 vehicles and Alekso Demnievski Bauman st. by 1.750 vehicles every day. Traffic flow on Arhiepiskop Mihail st. would reduce by 1.475 vehicles, Goce Delchev by 225 and new one-way connection over railway bridge by 950 vehicles daily, comparing to scenario 2. Gemidzii bridge is crossed by 4.400 vehicles and Old bridge by 8.125 vehicles daily. The most heavily loaded intersection in the network remains Vardarska / Alekso Demnievski Bauman / N. N. Borche st. with 22.516 vehicles. One-way Maksim Gorki st. would pass 675 vehicles less than in Scenario 2 each day.

Scenario 4 in 2019:

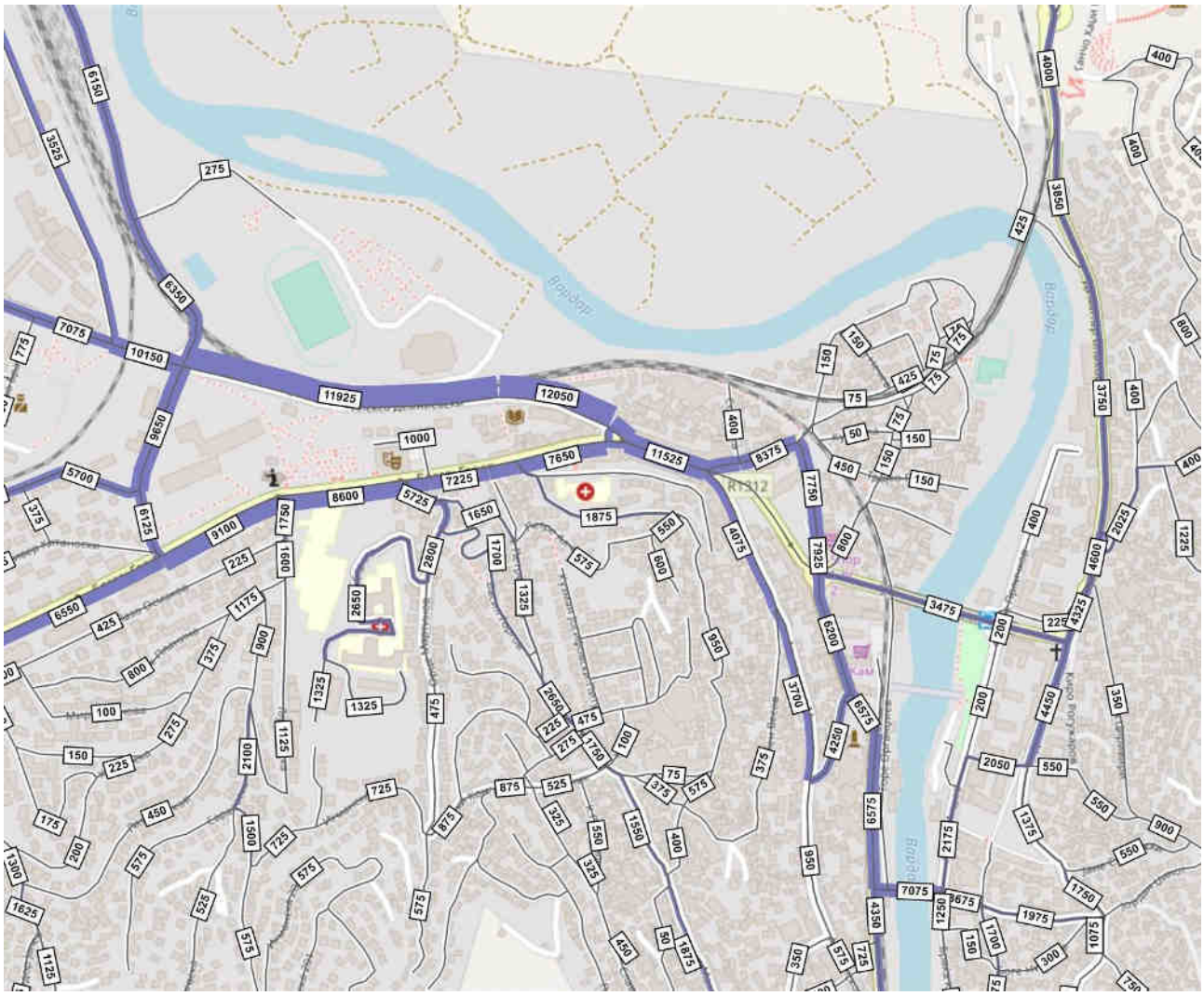


Figure 41: Scenario 4 in 2019, 24h (all vehicles)

Comparing Scenario 4 with Scenario 3 in 2019, the traffic flow in the section of 8-mi Septemvri st. between Alekso Demnievski Bauman and Strasho Pindzur st. would reduce by additional 1.750 vehicles daily. Traffic flow on Blagoj Gjorev st. would reduce by 1.525 vehicles and Alekso Demnievski Bauman st. by 2.350 vehicles every day. Traffic flow on Arhiepiskop Mihail st. would reduce by 475 vehicles, Goce Delchev by 1.325 and new one-way connection over railway bridge by 50 vehicles daily, comparing to scenario 3. Gemidzii bridge is crossed by 3.475 vehicles and Old bridge by 7.075 vehicles daily. The most heavily loaded intersection in the network remains Vardarska / Alekso Demnievski Bauman / N. N. Borche st. with 19.025 vehicles. One-way Maksim Gorki st. would pass 525 vehicles less than in Scenario 3 each day.

Evaluation of analysed actions can be made for different scenarios. Representative sections in the city centre will be analysed as shown on next picture.

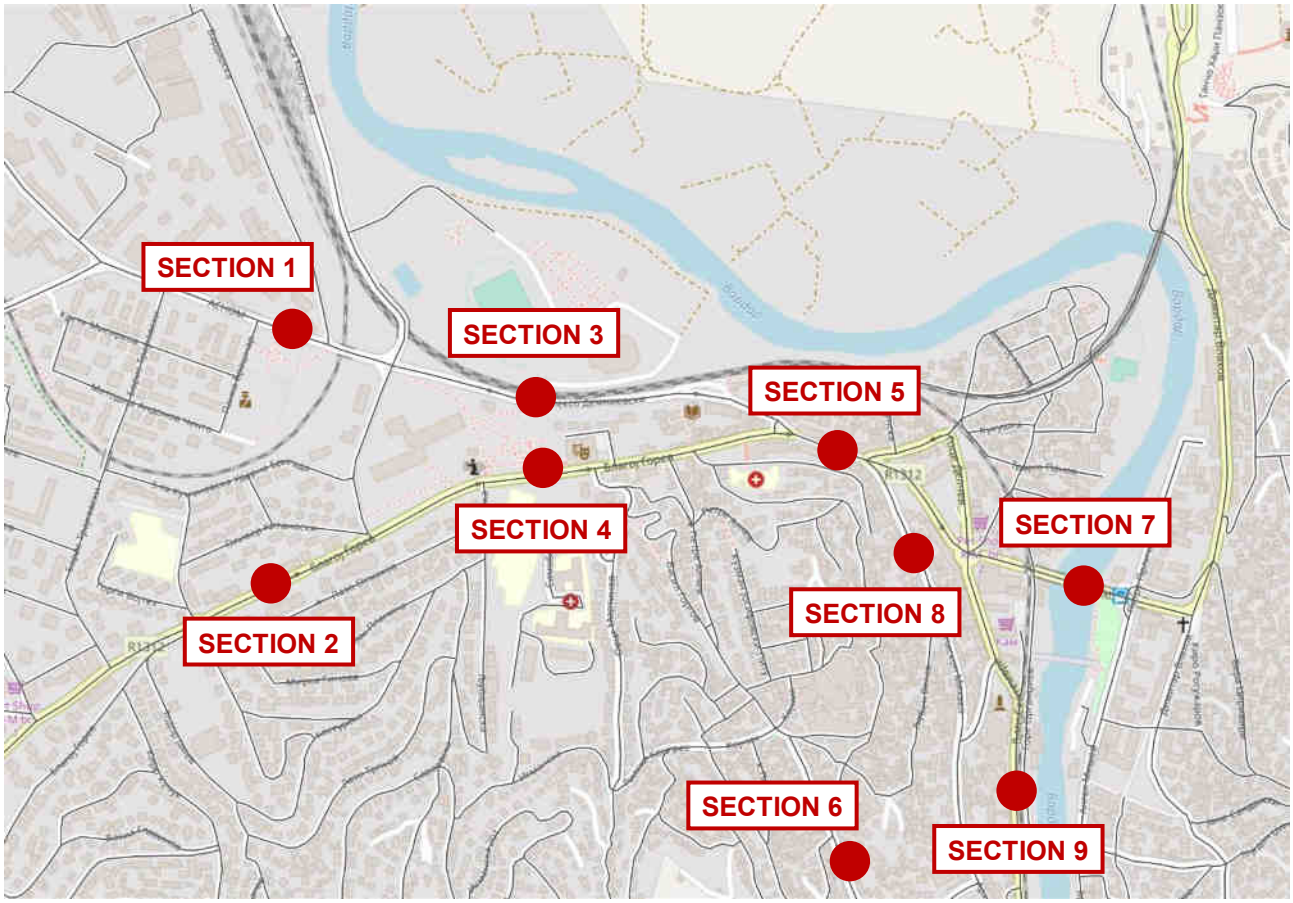


Figure 42: Representative sections for comparison of traffic flows

In the following table comparison of traffic volumes are displayed for the year 2019.

Section	Current network 2019	Scenario 2 2019	Scenario 3 2019	Scenario 4 2019
1 (ASNOM st.)	10.000	9.950	8.775	7.075
2 (Blagoj Gjorev st.)	7.550	8.175	7.650	6.550
3 (Alekso Demnievski Bauman st.)	15.600	16.025	14.275	11.925
4 (Blagoj Gjorev st.)	12.975	13.225	10.125	8.600
5 (8-mi Septemvri)	20.400	16.500	13.275	11.525
6 (Maksim Gorki st.)	800	3.075	2.400	1.875
7 (Gemidzii bridge)	10.300	7.100	4.400	3.475
8. (Arhiepiskop M. st.)	2.725	6.025	4.550	4.075
9. (8-mi Septemvri st.)	7.975	7.200	7.550	6.575

7.1.6.2. RESULTS OF SCENARIOS IN YEAR 2039

Comparation of results of transport model will be shown below for different scenarios of transport network for the year of 2039.

Scenario 1 in 2039:

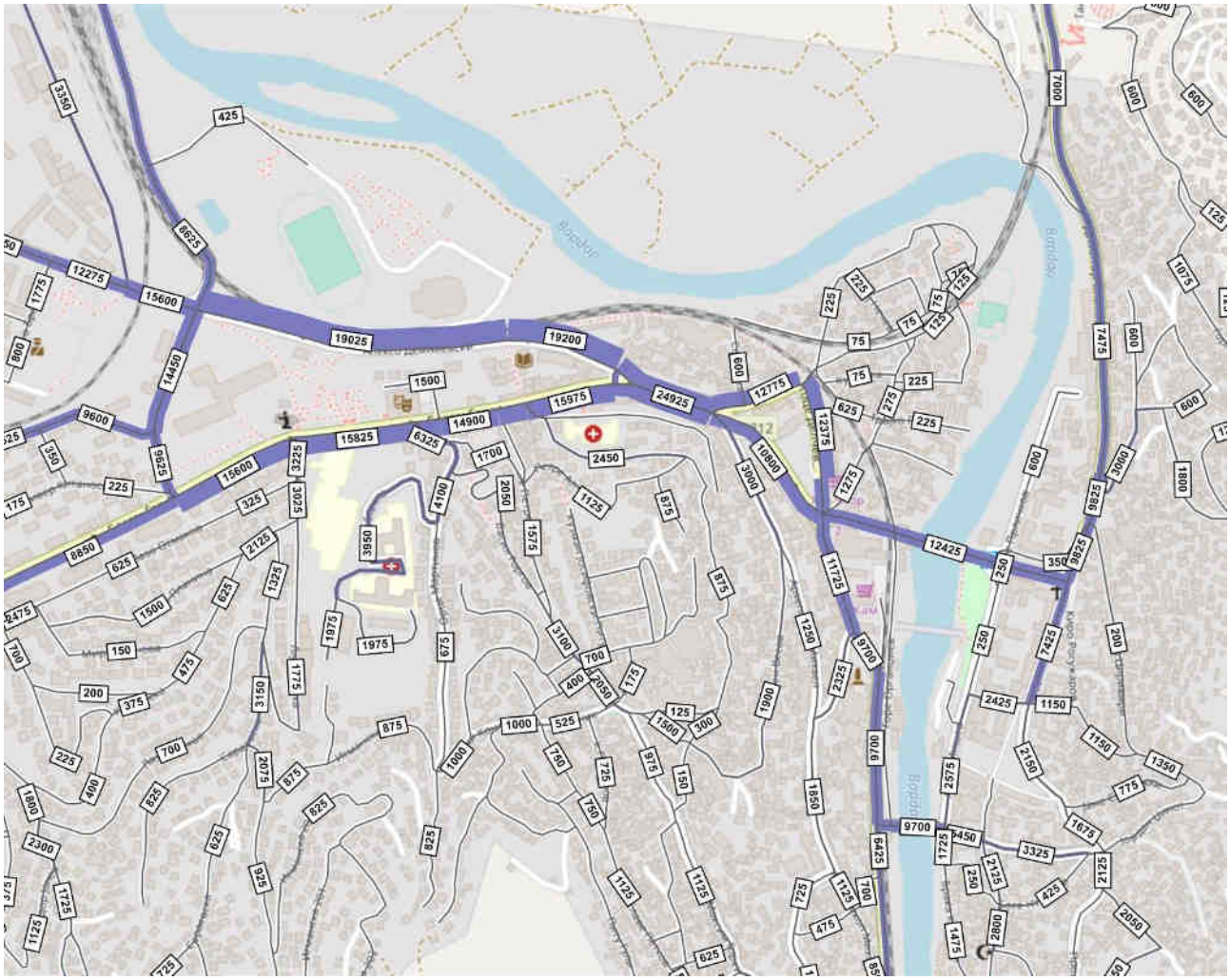


Figure 43: Scenario 1 in 2039, 24h (all vehicles)

Most busy part of the network in Scenario 1 is section of 8-mi Septemvri st. between Alekso Demnievski Bauman and Strasho Pindzur st.. There are around 24.925 vehicles traveling every day in 2039. Blagoj Gjorev st. is passed by 15.825 vehicles and Alekso Demnievski Bauman st. by 19.025 vehicles every day. Goce Delchev st. is passed by 12.375 and 8-mi Septemvri st. by 10.800 vehicles. From direction of motorway A1 7.475 vehicles are coming every day. Gemidzii bridge is crossed by 12.425 vehicles, Old bridge with 9.700 vehicles and the section of 8-mi Septemvri st. between bridges with 9.700 vehicles. Arhiepiskop Mihail st. is passed by 3.000 and Vardarska st. by 8.625 vehicles in 2039. The most heavily loaded intersection in the network is Vardarska / Alekso Demnievski Bauman / N.N.Borche st. with 28.845 vehicles.

Scenario 2 in 2039:

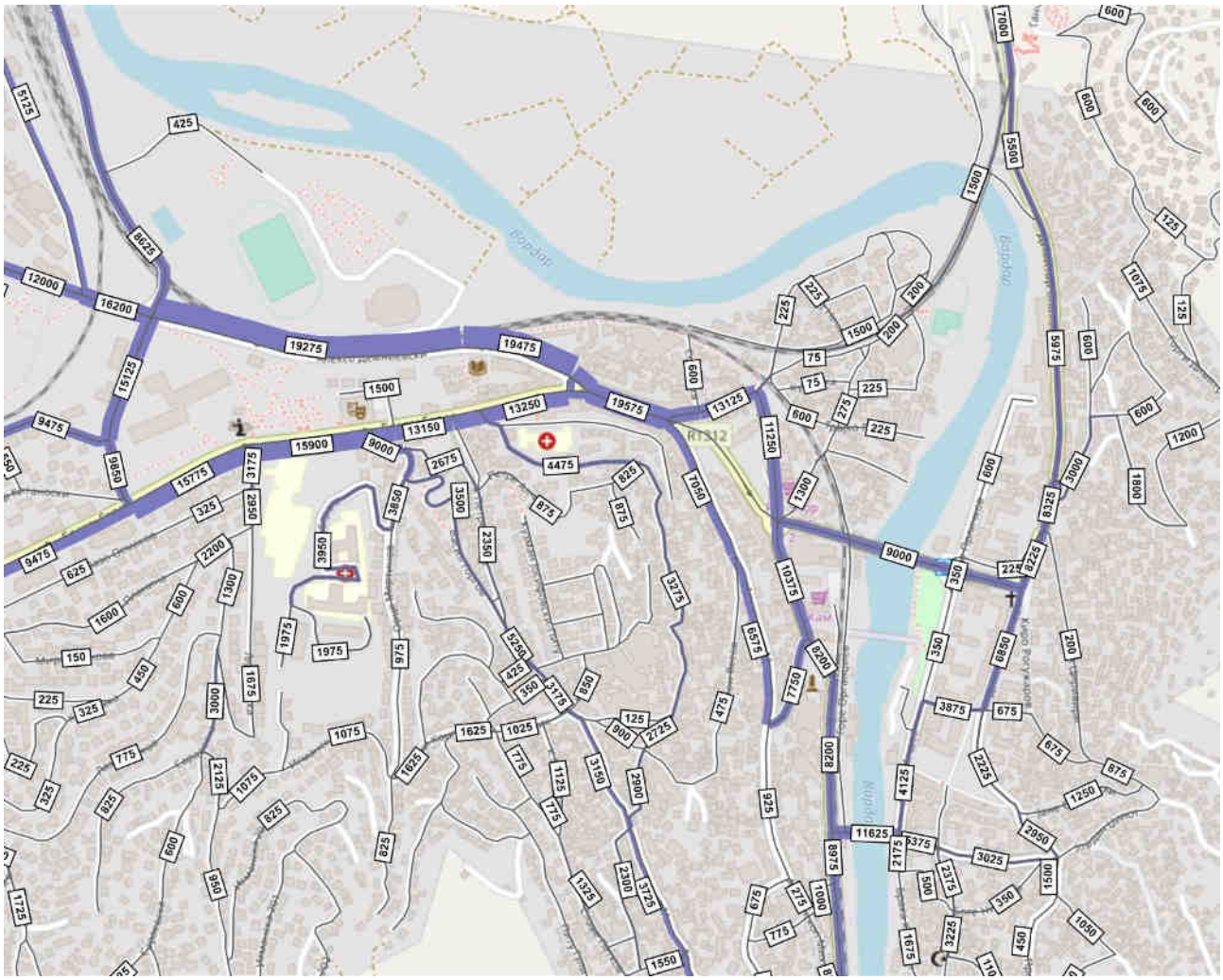


Figure 44: Scenario 2 in 2039, 24h (all vehicles)

Comparing Scenario 2 with Scenario 1 in 2039, the traffic flow in the section of 8-mi Septemvri st. between Alekso Demnievski Bauman and Strasho Pindzur st. will reduce by 5.350 vehicles daily. Traffic flow on Blagoj Gjorev st. and Alekso Demnievski Bauman st. will stay roughly the same. Since 8-mi Septemvri st. in the city centre will be closed for traffic (except public transport), traffic flow will redistribute to Arhiepiskop Mihail st. with 7.050 vehicles, Goce Delchev with 11.250 and new one-way connection over railway bridge with 1.500 vehicles daily. Gemidzii bridge is crossed by 9.000 vehicles and Old bridge by 11.625 vehicles daily. The most heavily loaded intersection in the network remains Vardarska / Alekso Demnievski Bauman / N.N.Borche st. with 29.620 vehicles. Change to one-way regime to the church Sv. Pantelejmon will increase traffic on Maksim Gorki by 2.600 vehicles.

Scenario 3 in 2039:

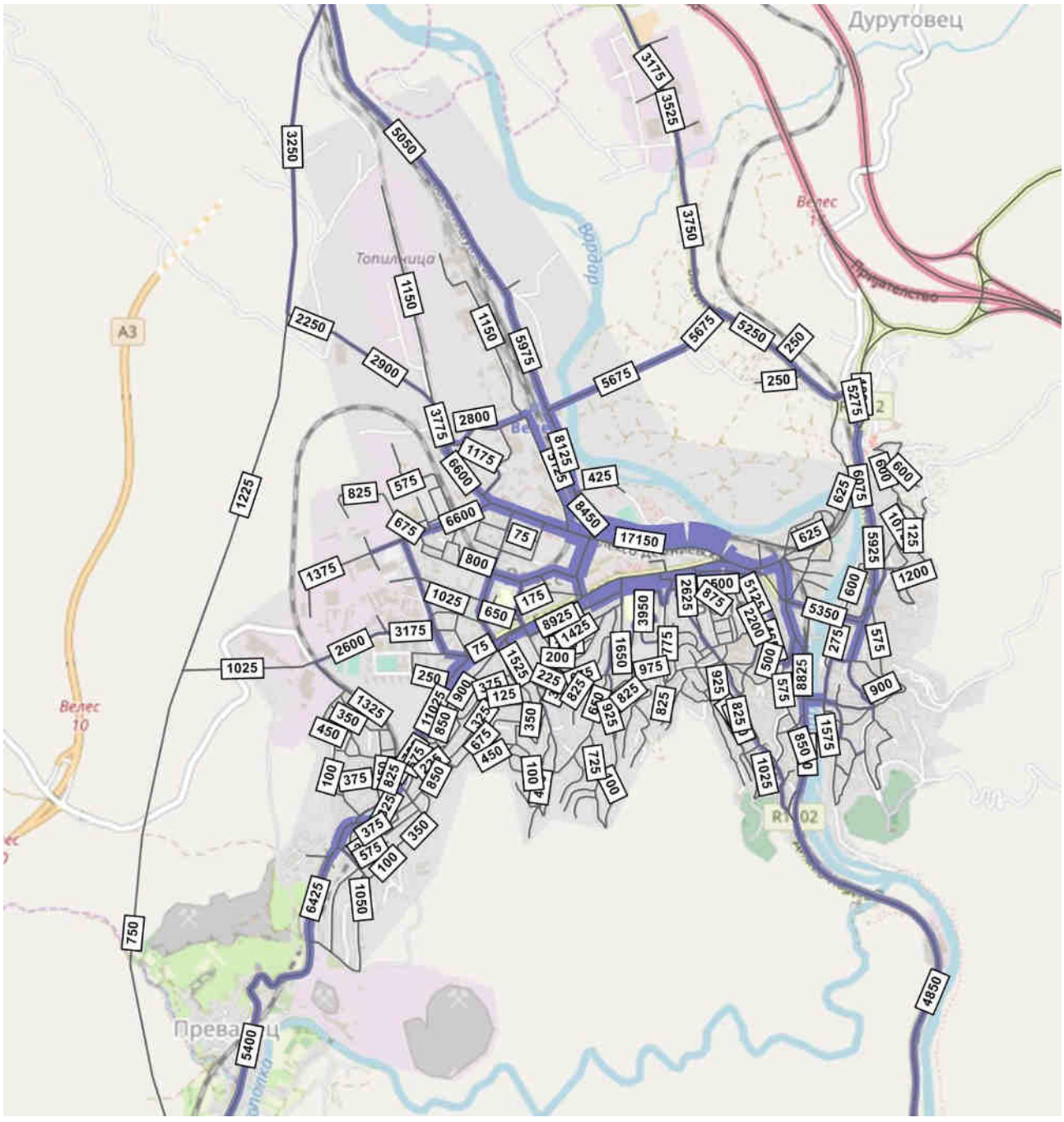


Figure 45: Scenario 3 in 2039, 24h (all vehicles)

In 2039 new Western bypass road would be loaded from 750 to 3.250 vehicles daily, while new Rečani bridge across Vardar river would take around 5.675 vehicles daily, that would greatly reduce traffic flows through city centre.

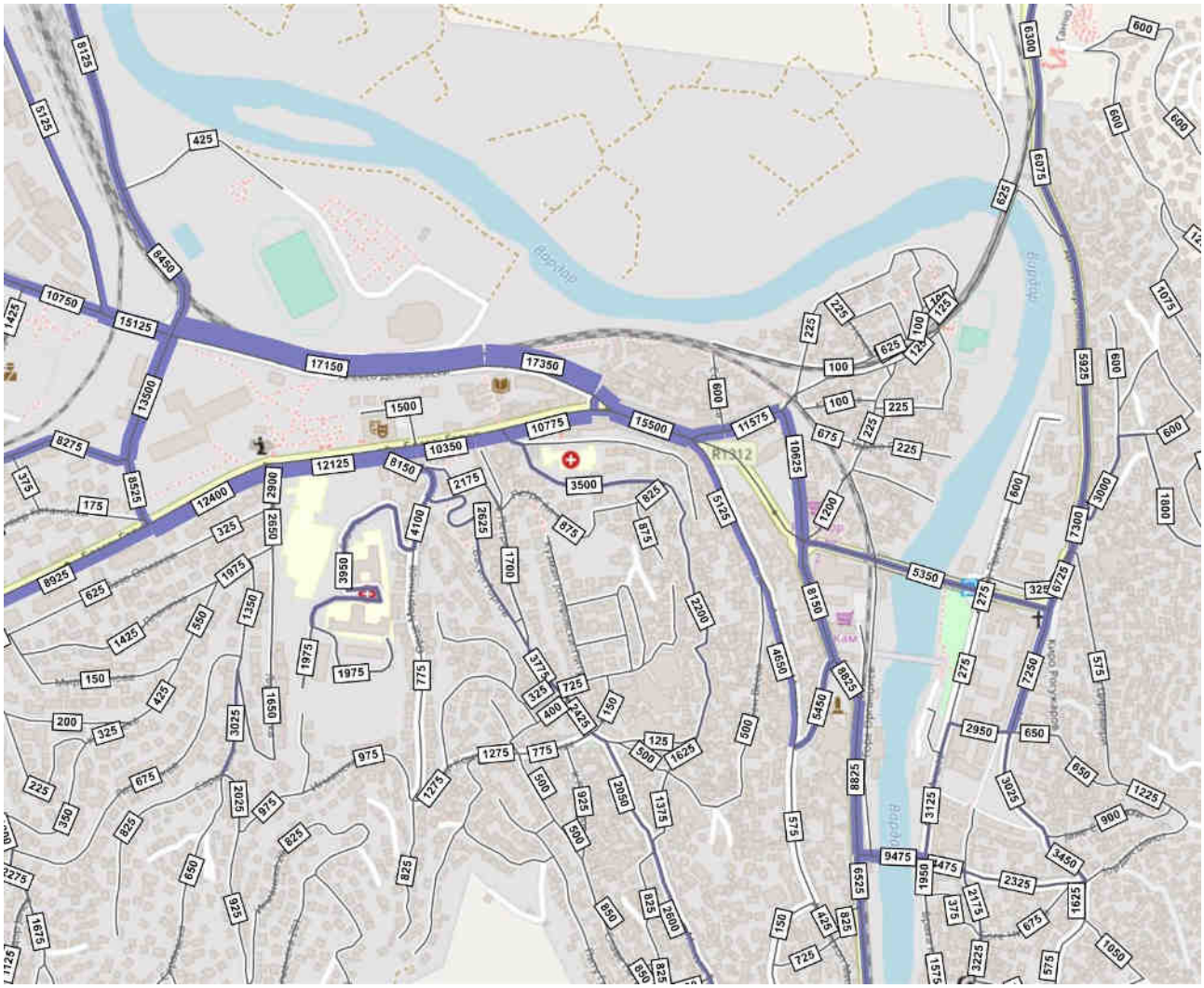


Figure 46: Scenario 3 in 2039, 24h (all vehicles)

Comparing Scenario 3 with Scenario 2 in 2039, the traffic flow in the section of 8-mi Septemvri st. between Alekso Demnievski Bauman and Strasho Pindzur st. would reduce by 4.075 vehicles daily. Traffic flow on Blagoj Gjorev st. would reduce by 3.775 vehicles and Alekso Demnievski Bauman st. by 2.125 vehicles every day. Traffic flow on Arhiepiskop Mihail st. would reduce by 1.925 vehicles, Goce Delchev by 625 and new one-way connection over railway bridge by 875 vehicles daily, comparing to scenario 2. Gemidzii bridge is crossed by 5.350 vehicles and Old bridge by 9.475 vehicles daily. The most heavily loaded intersection in the network remains Vardarska / Alekso Demnievski Bauman / N.N.Borche st. with 27.120 vehicles. One-way Maksim Gorki st. would pass 1.125 vehicles less than in Scenario 2 each day.

Scenario 4 in 2039:

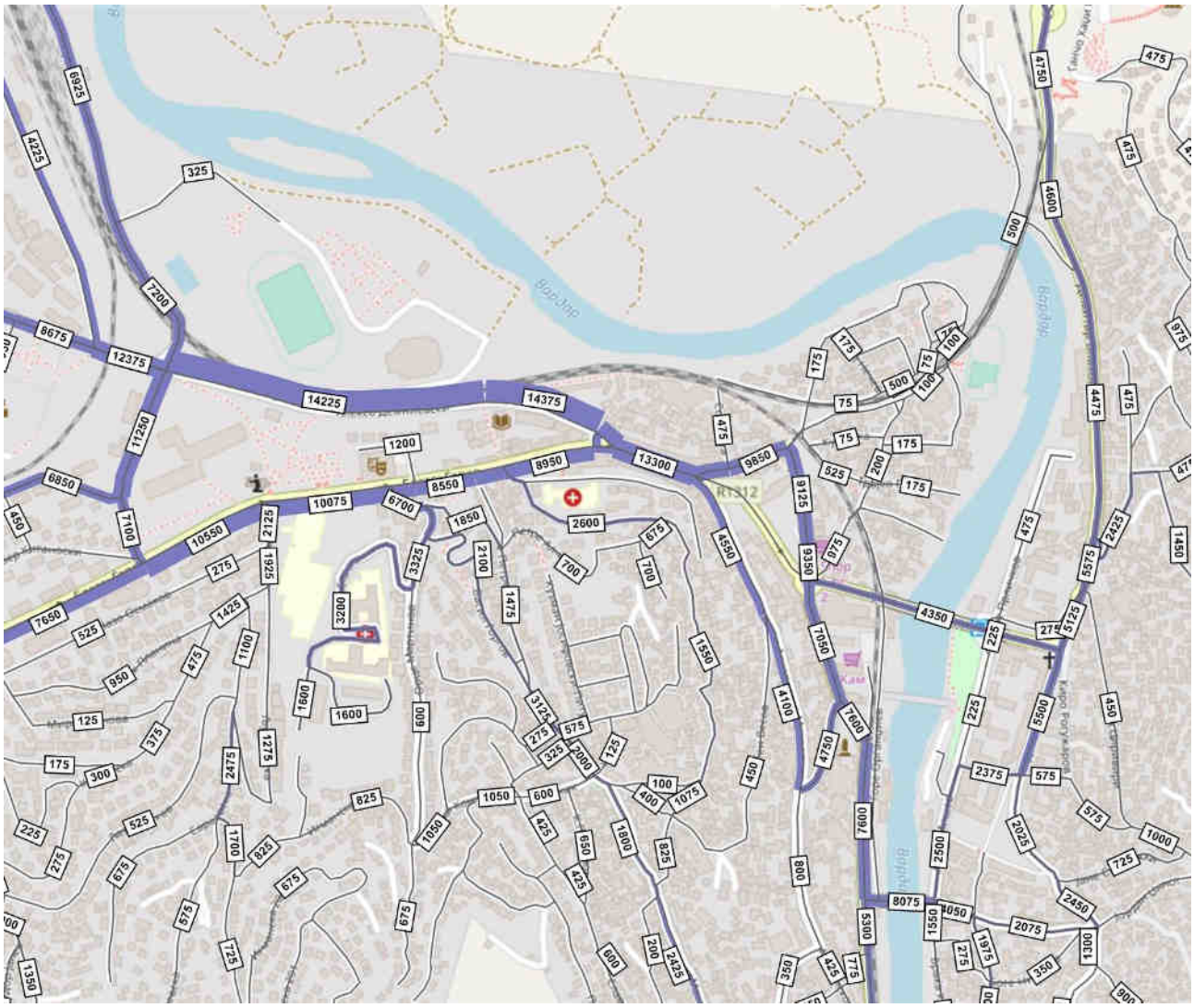


Figure 47: Scenario 4 in 2039, 24h (all vehicles)

Comparing Scenario 4 with Scenario 3 in 2039, the traffic flow in the section of 8-mi Septemvri st. between Alekso Demnievski Bauman and Strasho Pindzur st. would reduce by 2.200 vehicles daily. Traffic flow on Blagoj Gjorev st. would reduce by 2.050 vehicles and Alekso Demnievski Bauman st. by 2.925 vehicles every day. Traffic flow on Arhiepiskop Mihail st. would reduce by 575 vehicles, Goce Delchev by 1.500 and new one-way connection over railway bridge by 125 vehicles daily, comparing to scenario 3. Gemidzii bridge is crossed by 4.350 vehicles and Old bridge by 8.075 vehicles daily. The most heavily loaded intersection in the network remains Vardarska / Alekso Demnievski Bauman / N.N.Borche st. with 22.515 vehicles. One-way Maksim Gorki st. would pass 175 vehicles less than in Scenario 3 each day.

Evaluation of analysed actions can be made for different scenarios. Representative sections in the city centre will be analysed as shown on next picture.

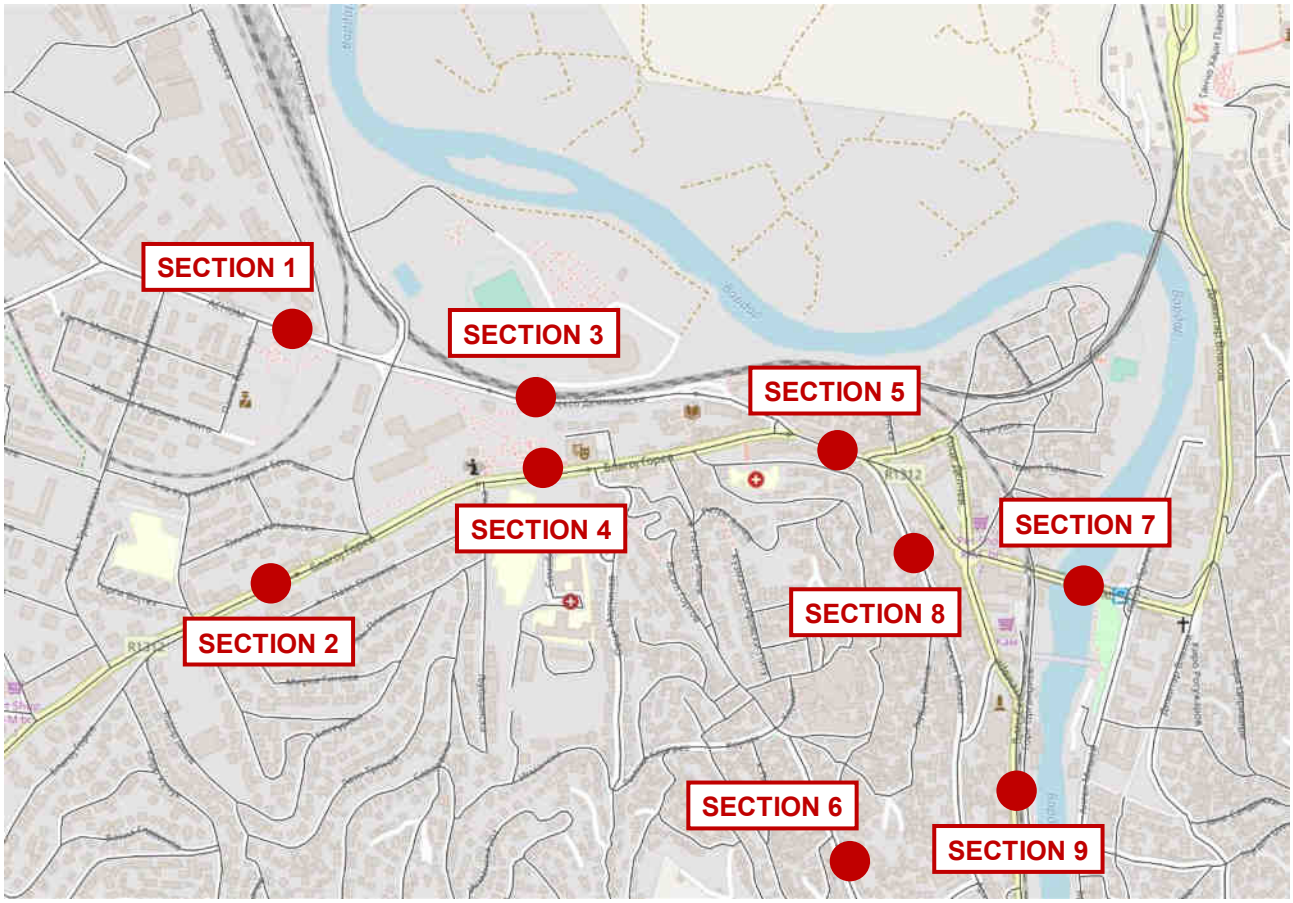


Figure 48: Representative sections for comparison of traffic flows

In the following table comparison of traffic volumes will be displayed for the year 2039.

Section	Scenario 1 2019	Scenario 2 2019	Scenario 3 2019	Scenario 4 2019
1 (ASNOM st.)	12.275	12.000	10.750	8.675
2 (Blagoj Gjorev st.)	8.850	9.475	8.925	7.650
3 (Alekso Demnievski Bauman st.)	19.025	19.275	17.150	14.225
4 (Blagoj Gjorev st.)	15.825	15.900	12.125	10.075
5 (8-mi Septemvri st.)	24.925	19.575	15.500	13.300
6 (Maksim Gorki st.)	1.125	3.725	2.600	2.425
7 (Gemidzii bridge)	12.425	9.000	5.350	4.350
8. (Archbishop M. st.)	3.000	7.050	5.125	4.550
9. (8-mi Septemvri st.)	9.700	8.200	8.825	7.600

7.1.7. CAPACITY ANALYSIS OF CITY CENTRE RECONSTRUCTION

For the purposes of the capacity analysis of the reconstruction of the city centre (Scenario 2), a microsimulation was made for the period of morning and afternoon peak hour in 2019. Microsimulation is made with software tool PTV VISSIM, in accordance with the methodology HCM. The software tool enables precise modelling of the geometry of connections and intersections, various traffic participants, simulation of traffic regimes, fixed and traffic-dependent control of traffic lights and offers a numerical calculation of various traffic characteristics. On the basis of the DOF image and traffic conception, a series of links & connectors elaborated the mathematical model of the considered area.

In order to properly analyse and evaluate the capacity parameters, it is necessary to collect the traffic characteristics and the results of the "real time" simulation. VISSIM offers a wide range of output results, the task is correct choice and presentation of traffic criteria. In accordance with this problem, we decided to evaluate the performance of the analysed geometry on the basis of the following criteria:

	Characteristics
Veh(All)	Number of Vehicles, All Vehicle Types
Delay(All)	Average delay per vehicle [s], All Vehicle Types
Stops(All)	Average number of stops per vehicles, All Vehicle Types
aveQueue	Average Queue Length [m]
maxQueue	Maximum Queue Length [m]

Table 4: Presentation of benchmarking criteria for evaluating crossroads performance

Below is a table of levels of service and delays (HCM 2010):

Level of service	Delay in seconds (d)	
	Signalised intersections and roundabouts	Nonsignalised intersections
A	d <=10	d <= 10
B	10 < d <= 20	10 < d <= 15
C	20 < d <= 35	15 < d <= 25
D	35 < d <= 55	25 < d <= 35
E	55 < d <= 80	35 < d <= 50
F	80 < d	50 < d

Table 5: Limit values for the criteria for determining the level of services based on vehicle delays

Traffic load data were summarized from the transport model as shown below:

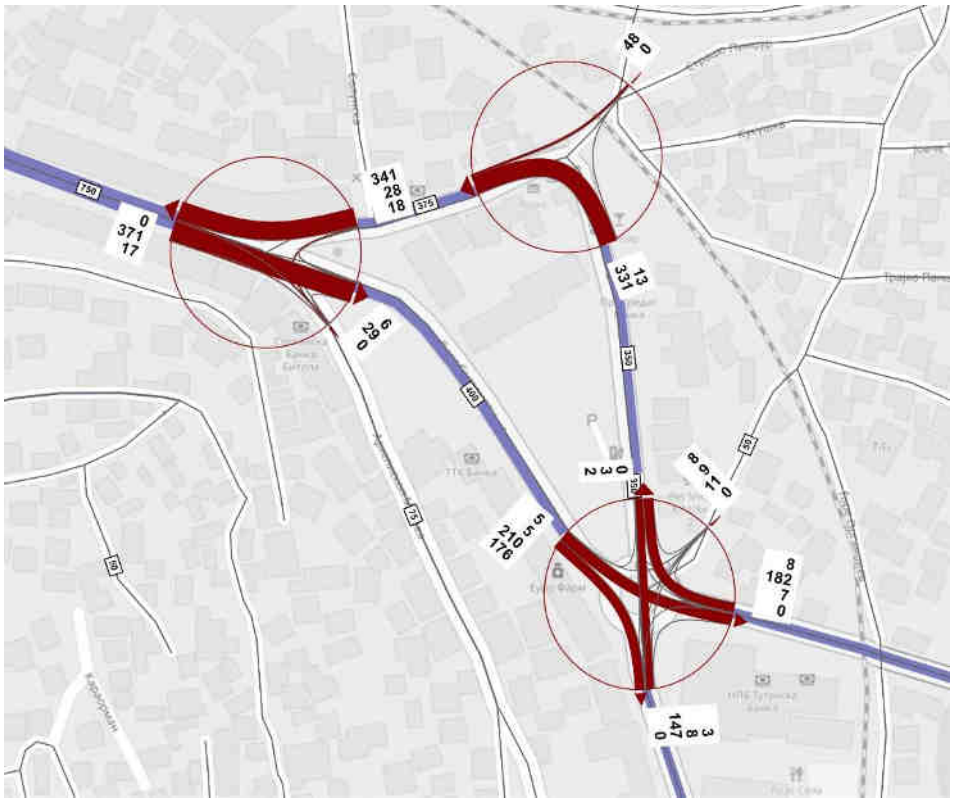


Figure 49: Current transport network, morning peak hour in 2019

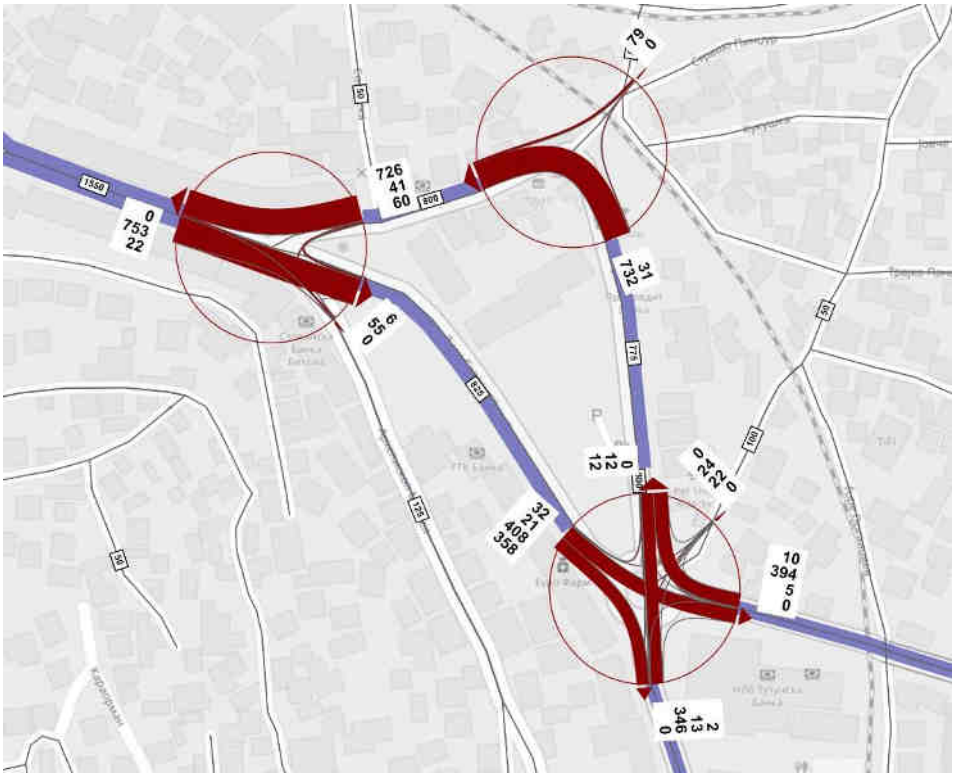


Figure 50: Current transport network, afternoon peak hour in 2019

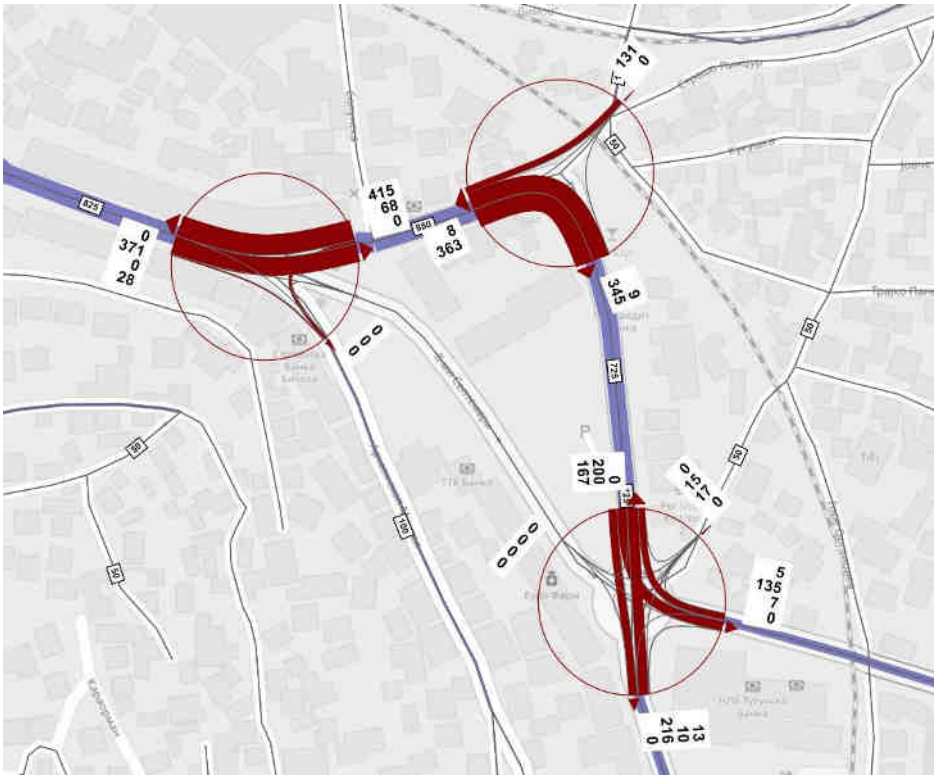


Figure 51: Scenario 2, morning peak hour in 2019

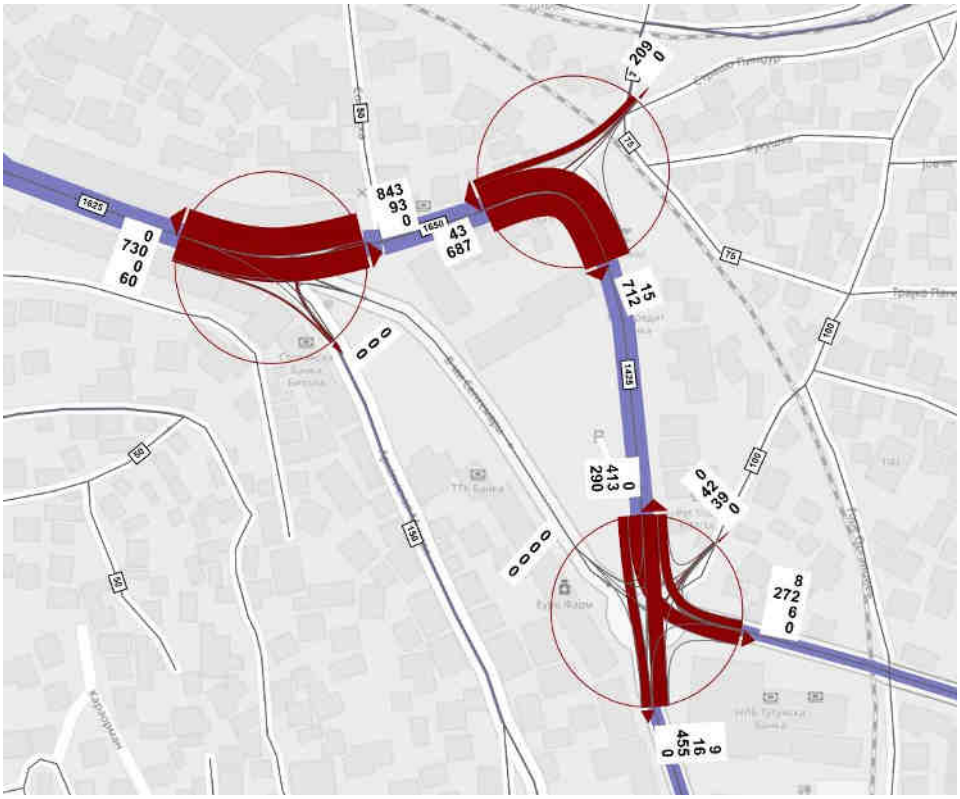


Figure 52: Scenario 2, afternoon peak hour in 2019

In the picture below, a microsimulation model of current transport network is shown:

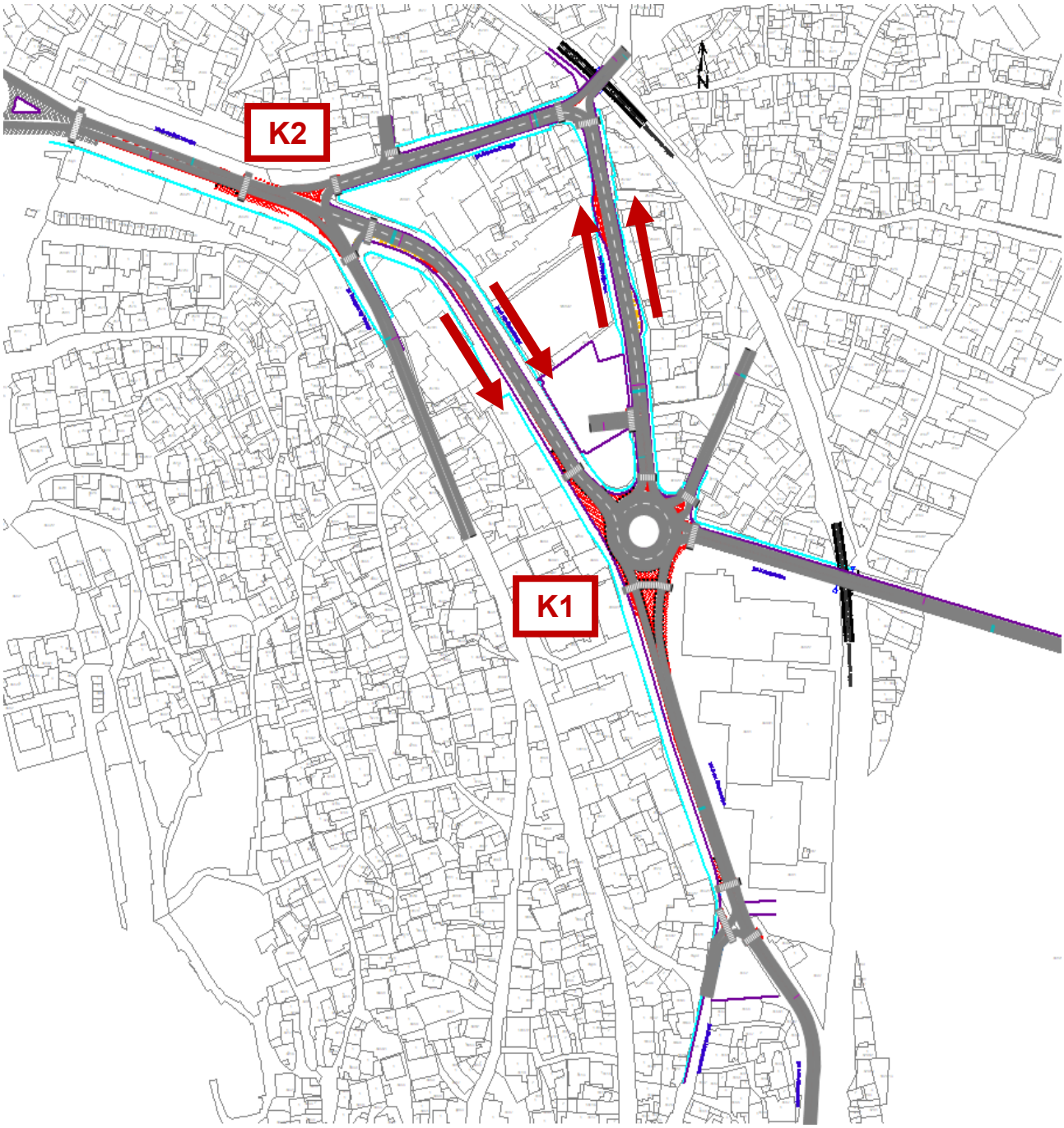


Figure 53: Microsimulation model of current transport network

The results of capacity analysis of current transport network are shown below:

Morning peak hour – K1:	Veh	Delay [sek]	Stops	Ave. Queue [m]	Max. Queue [m]	LOS
8-mi Septemvri N → 8-mi Septemvri S	162	2,22	0,07	0,21	44,03	A
8-mi Septemvri N → Gemidzii	241	2,44	0,07	0,21	44,03	A
8-mi Septemvri N → Goce Delchev	3	1,31	0,00	0,21	44,03	A
8-mi Septemvri N → Nikola Orovcanec	6	2,48	0,13	0,21	44,03	A
8-mi Septemvri S → Gemidzii	2	2,82	0,17	0,30	24,24	A
8-mi Septemvri S → Goce Delchev	156	3,65	0,27	0,30	24,24	A
8-mi Septemvri S → Nikola Orovcanec	7	3,84	0,28	0,30	24,24	A
Gemidzii → 8-mi Septemvri S	6	2,70	0,23	0,56	32,05	A
Gemidzii → Goce Delchev	181	3,97	0,34	0,56	32,05	A
Gemidzii → Nikola Orovcanec	6	1,98	0,07	0,56	32,05	A
Goce Delchev → 8-mi Septemvri S	2	2,44	0,33	0,00	1,83	A
Nikola Orovcanec → 8-mi Septemvri S	15	3,60	0,42	0,00	0,00	A
Nikola Orovcanec → Gemidzii	8	3,64	0,48	0,00	0,00	A
Nikola Orovcanec → Goce Delchev	9	3,88	0,29	0,00	0,00	A
	804	**3,04**	**0,19**	**0,21**	**44,03**	**A**

Afternoon peak hour – K1:	Veh	Delay [sek]	Stops	Ave. Queue [m]	Max. Queue [m]	LOS
8-mi Septemvri N → 8-mi Septemvri S	350	6,76	0,28	3,42	102,65	A
8-mi Septemvri N → Gemidzii	437	6,65	0,26	3,42	102,65	A
8-mi Septemvri N → Goce Delchev	35	6,19	0,23	3,42	102,65	A
8-mi Septemvri N → Nikola Orovcanec	22	8,09	0,34	3,42	102,65	A
8-mi Septemvri S → Gemidzii	2	26,59	1,92	12,33	90,10	C
8-mi Septemvri S → Goce Delchev	339	22,87	1,68	12,33	90,10	C
8-mi Septemvri S → Nikola Orovcanec	11	20,94	1,70	12,33	90,10	C
Gemidzii → 8-mi Septemvri S	4	50,15	5,13	33,14	155,42	D
Gemidzii → Goce Delchev	382	37,18	3,45	33,14	155,42	D
Gemidzii → Nikola Orovcanec	8	37,14	3,50	33,14	155,42	D
Goce Delchev → 8-mi Septemvri S	12	4,58	0,65	0,05	7,79	A
Nikola Orovcanec → 8-mi Septemvri S	29	8,32	1,11	0,06	11,37	A
Nikola Orovcanec → Gemidzii	21	6,87	0,96	0,06	11,37	A
Nikola Orovcanec → Goce Delchev	0	0	0	0,06	11,37	A
	1652	**17,53**	**1,36**	**9,80**	**155,42**	**B**

Most critical is the afternoon peak hour. Intersection of streets 8-mi Septemvri / Goce Delchev / Nikola Orovcanec and Gemidzii bridge is passed by 1.652 vehicles. Total delay of intersection is 17,5 sec which means that level of service is LOS=B. In average, vehicles stop more than once. Largest delays and queues come from the way of Gemidzii bridge. Level of service from this way is LOS=D (acceptable). Longest queue from this side is in length of 155 m. Capacity parameters of intersection are appropriate.

Morning peak hour – K2:	Veh	Delay [sek]	Stops	Ave. Queue [m]	Max. Queue [m]	LOS
8-mi Septemvri. W → Arhiepiskop Mihail	15	1,04	0,00	0,00	0,00	A
8-mi Septemvri. W → Strasho Pindzur	361	0,95	0,01	0,04	19,24	A
Arhiepiskop Mihail → 8-mi Septemvri	27	1,48	0,12	0,00	0,00	A
Arhiepiskop Mihail → 8-mi Septemvri W	5	2,85	0,33	0,00	0,00	A
Strasho Pindzur → Arhiepiskop Mihail	19	2,70	0,15	0,01	5,64	A
Strasho Pindzur → 8-mi Septemvri	25	0,92	0,00	0,01	5,64	A
Strasho Pindzur → Blagoj Gjorev W	346	1,64	0,01	0,01	5,64	A
	798	**1,33**	**0,02**	**0,01**	**19,24**	**A**

Afternoon peak hour – K2:	Veh	Delay [sek]	Stops	Ave. Queue [m]	Max. Queue [m]	LOS
8-mi Septemvri. W → Arhiepiskop Mihail	19	1,28	0,00	0,00	1,99	A
8-mi Septemvri. W → Strasho Pindzur	762	1,65	0,02	0,07	23,72	A
Arhiepiskop Mihail → 8-mi Septemvri	55	5,68	0,49	0,06	10,21	A
Arhiepiskop Mihail → 8-mi Septemvri W	9	5,94	0,42	0,04	10,76	A
Strasho Pindzur → Arhiepiskop Mihail	64	5,74	0,52	0,16	25,94	A
Strasho Pindzur → 8-mi Septemvri	32	1,16	0,01	0,16	25,94	A
Strasho Pindzur → Blagoj Gjorev W	720	2,63	0,02	0,16	25,94	A
	1661	**2,38**	**0,06**	**0,07**	**25,94**	**A**

Most critical is the afternoon peak hour. Intersection of streets 8-mi Septemvri / Arhiepiskop Mihail is passed by 1.661 vehicles. Total delay of intersection is 2,3 sec which means that level of service is LOS=A. In average, vehicles stop less than once. Largest delays come from Arhiepiskop Mihail st., largest queues come from the way of Strasho Pindzur st.. Capacity parameters of intersection are appropriate.

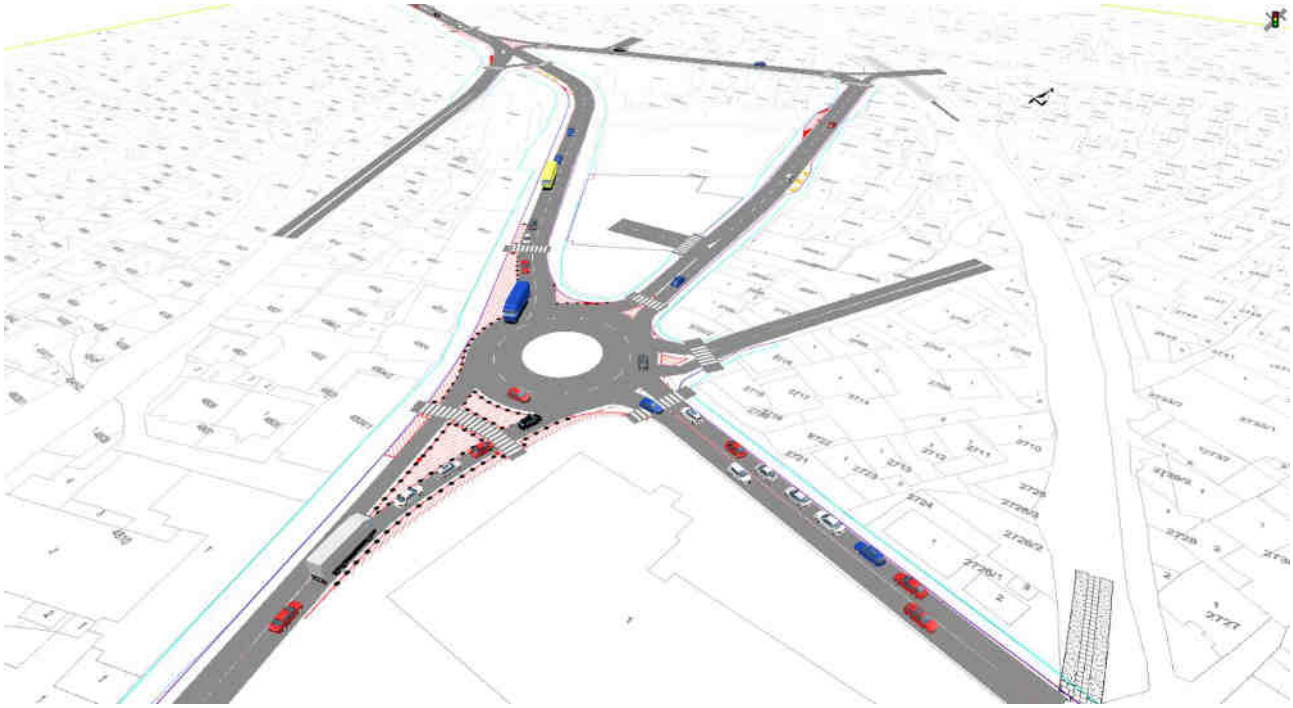


Figure 54: Carasterictical view of "real time" simulation – intersection 8-mi Septemvri / Goce Delchev / Nikola Orovcanec and Gemidzii bridge

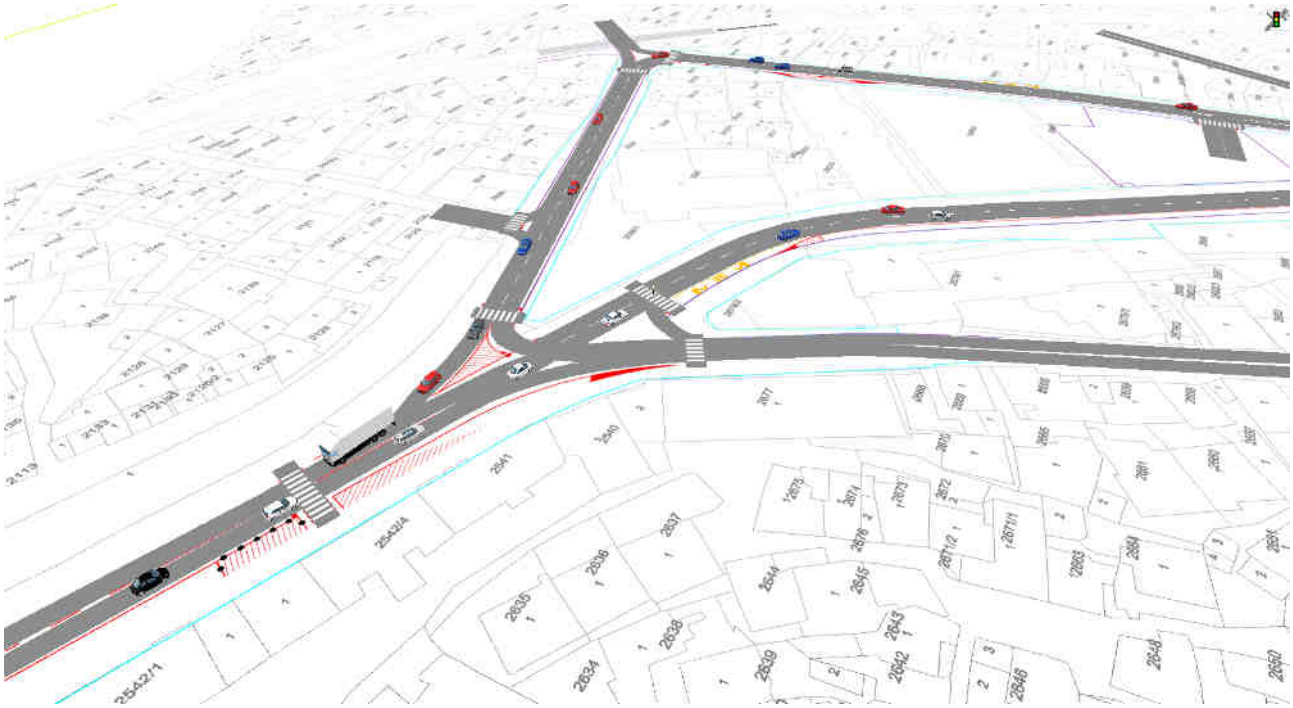


Figure 55: Carasterictical view of "real time" simulation – intersection Blagoj Gjorev / 8-mi Septemvri / Arhiepiskop Mihail

In the picture below, a microsimulation model of transport network according to scenario 2 is shown:

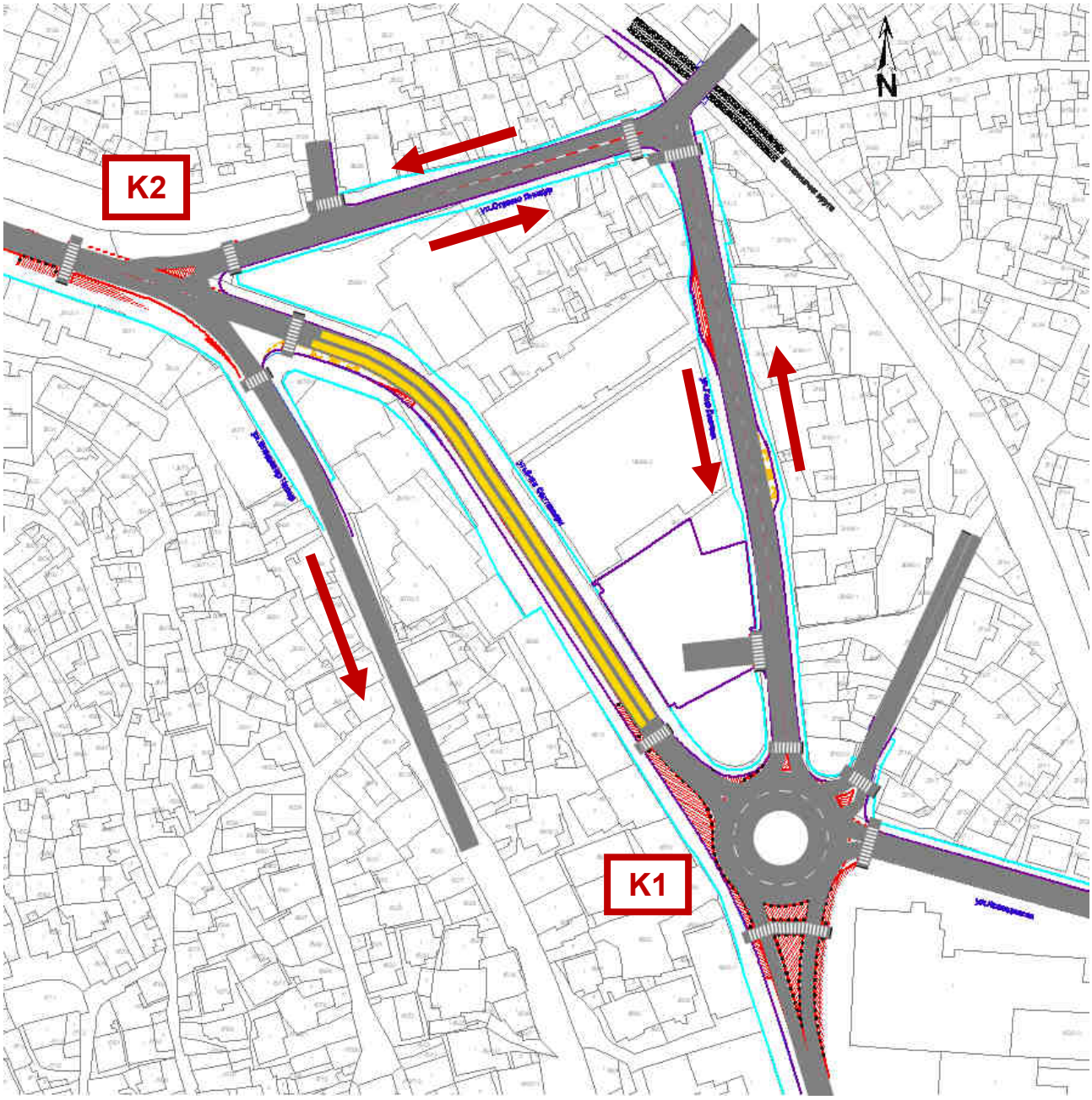


Figure 56: Microsimulation model of transport network according to scenario 2

The results of capacity analysis of Scenario 2 network are shown below:

Morning peak hour – K1:	Veh	Delay [sek]	Stops	Ave. Queue [m]	Max. Queue [m]	LOS
8-mi Septemvri S → Gemidzii	13	3,85	0,20	0,39	26,03	A
8-mi Septemvri S → Goce Delchev	207	2,88	0,17	0,39	26,03	A
8-mi Septemvri S → Nikola Orovcanec	10	2,63	0,24	0,39	26,03	A
Gemidzii → 8-mi Septemvri S	7	4,59	0,46	0,29	16,56	A
Gemidzii → Goce Delchev	131	3,22	0,26	0,29	16,56	A
Gemidzii → Nikola Orovcanec	5	2,11	0,13	0,29	16,56	A
Goce Delchev → 8-mi Septemvri S	195	4,85	0,30	1,21	48,22	A
Goce Delchev → Gemidzii	163	4,37	0,26	1,21	48,22	A
Nikola Orovcanec → 8-mi Septemvri S	17	3,09	0,19	0,00	0,00	A
Nikola Orovcanec → Gemidzii	21	4,44	0,24	0,00	0,00	A
	768	**3,82**	**0,24**	**0,38**	**48,22**	**A**

Afternoon peak hour – K1:	Veh	Delay [sek]	Stops	Ave. Queue [m]	Max. Queue [m]	LOS
8-mi Septemvri S → Gemidzii	11	10,95	0,76	4,96	104,08	B
8-mi Septemvri S → Goce Delchev	438	8,90	0,56	4,96	104,08	A
8-mi Septemvri S → Nikola Orovcanec	13	9,41	0,69	4,96	104,08	A
Gemidzii → 8-mi Septemvri S	5	13,93	1,28	5,10	53,97	B
Gemidzii → Goce Delchev	266	13,32	1,46	5,10	53,97	B
Gemidzii → Nikola Orovcanec	7	11,16	1,53	5,10	53,97	B
Goce Delchev → 8-mi Septemvri S	315	62,69	4,79	123,10	274,78	E
Goce Delchev → Gemidzii	225	63,48	4,74	123,10	274,78	E
Nikola Orovcanec → 8-mi Septemvri S	44	8,08	1,00	0,14	19,99	A
Nikola Orovcanec → Gemidzii	47	8,45	1,02	0,14	19,99	A
	1371	**31,11**	**2,43**	**26,66**	**174,78**	**C**

Most critical is the afternoon peak hour. Intersection of streets 8-mi Septemvri / Goce Delchev / Nikola Orovcanec and Gemidzii bridge is passed by 1.371 vehicles. Because of congestion of network around 280 vehicles cannot enter network. Total delay of intersection is 31,1 sec which means that level of service is LOS=C. In average, vehicles stop more than twice. Largest delays and queues come on the street of Goce Delchev. Level of service from this way is LOS=E (permissible). Longest queue from this side is in length of 275 m. Capacity parameters of intersection are still appropriate (border criterion is LOS=F).

Morning peak hour – K2:	Veh	Delay [sek]	Stops	Ave. Queue [m]	Max. Queue [m]	LOS
8-mi Septemvri W → Arhiepiskop Mihail	22	1,41	0,00	0,00	1,97	A
8-mi Septemvri W → Strasho Pindzur	370	2,01	0,03	0,19	32,08	A
Strasho Pindzur → Arhiepiskop Mihail	65	6,12	0,39	0,77	59,01	A
Strasho Pindzur → 8-mi Septemvri W	392	2,59	0,07	0,77	59,01	A
	850	**2,58**	**0,07**	**0,20**	**59,01**	**A**

Afternoon peak hour – K2:	Veh	Delay [sek]	Stops	Ave. Queue [m]	Max. Queue [m]	LOS
8-mi Septemvri W → Arhiepiskop Mihail	44	45,28	2,29	0,00	3,54	E
8-mi Septemvri W → Strasho Pindzur	604	56,19	3,31	174,42	247,89	F
Strasho Pindzur → Arhiepiskop Mihail	89	12,39	0,84	9,91	126,76	B
Strasho Pindzur → 8-mi Septemvri W	792	6,22	0,26	9,91	126,76	A
	1528	**27,43**	**1,56**	**65,34**	**247,89**	**D**

Most critical is the afternoon peak hour. Intersection of streets 8-mi Septemvri / Arhiepiskop Mihail is passed by 1.528 vehicles. Total delay of intersection is 27,4 sec which means that level of service is LOS=D. In average, vehicles stop more than once. Largest delays (56,1 sec) and queues (248 m) comes on 8-mi Septemvri st.. Capacity parameters of intersection are not appropriate, level of service on 8-mi Septemvri st. is LOS=F (not permissible).

The results of the capacity analysis show, that the closure of the city centre (8-mi Septemvri st.), except for public transport vehicles and the introduction of the two-way regime on Goce Delchev and Strasho Pindzur st. cause extensive congestion and queues on transport network. Most critical is afternoon peak hour. If level of motorization will increase over the years, congestions and saturation will be even greater.

Figure 57: Carasterictical view of "real time" simulation – intersection 8-mi Septemvri / Goce Delchev / Nikola Orovcanec and Gemidzii bridge

Figure 58: Carasterictical view of "real time" simulation – intersection Blagoj Gjorev / 8-mi Septemvri / Arhiepiskop Mihail

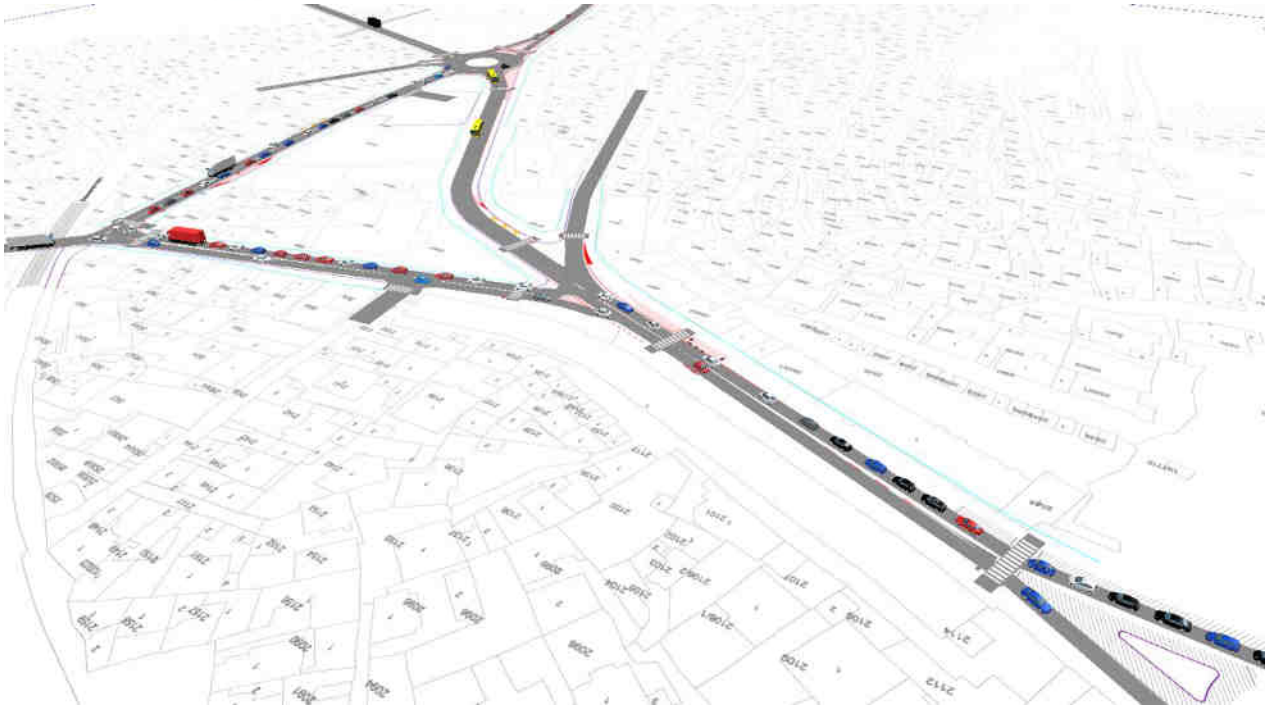


Figure 59: Carasterictical view of "real time" simulation – queues on Blagoj Gjorev st.

Figure 60: Carasterictical view of "real time" simulation – queues on Goce Delchev and Strasho Pindzur st.

In order to find solution for congestions, additional measures were taken on the existing transport network:

(1) The microsimulation has shown, that existing roundabout has to be reconstructed. Single-lane import on Goce Delchev has to be reconstructed into a two-lane import, thus increasing capacity of the roundabout. Additional study has to be made, to determine the most appropriate geometry of the roundabout (spiral course).

(2) Goce Delchev and Strasho Pindzur st. have to be reconstructed as well, increasing the capacity of traffic flow. Physical measures have to be taken to prevent illegal parking and obstruction of traffic flow on that section.

(3) To increase capacity on the section, it is necessary to prevent left turning from Strasho Pindzur st. to Archbishop Mihael st.. For this purpose, intersection of Blagoj Gjorev / Alekso Demnievski Bauman has to be reconstructed into roundabout. This action will enable semi-circular turning (180 degrees), and thus the accessibility of the Arhiepiskop Mihail st. will be enabled.

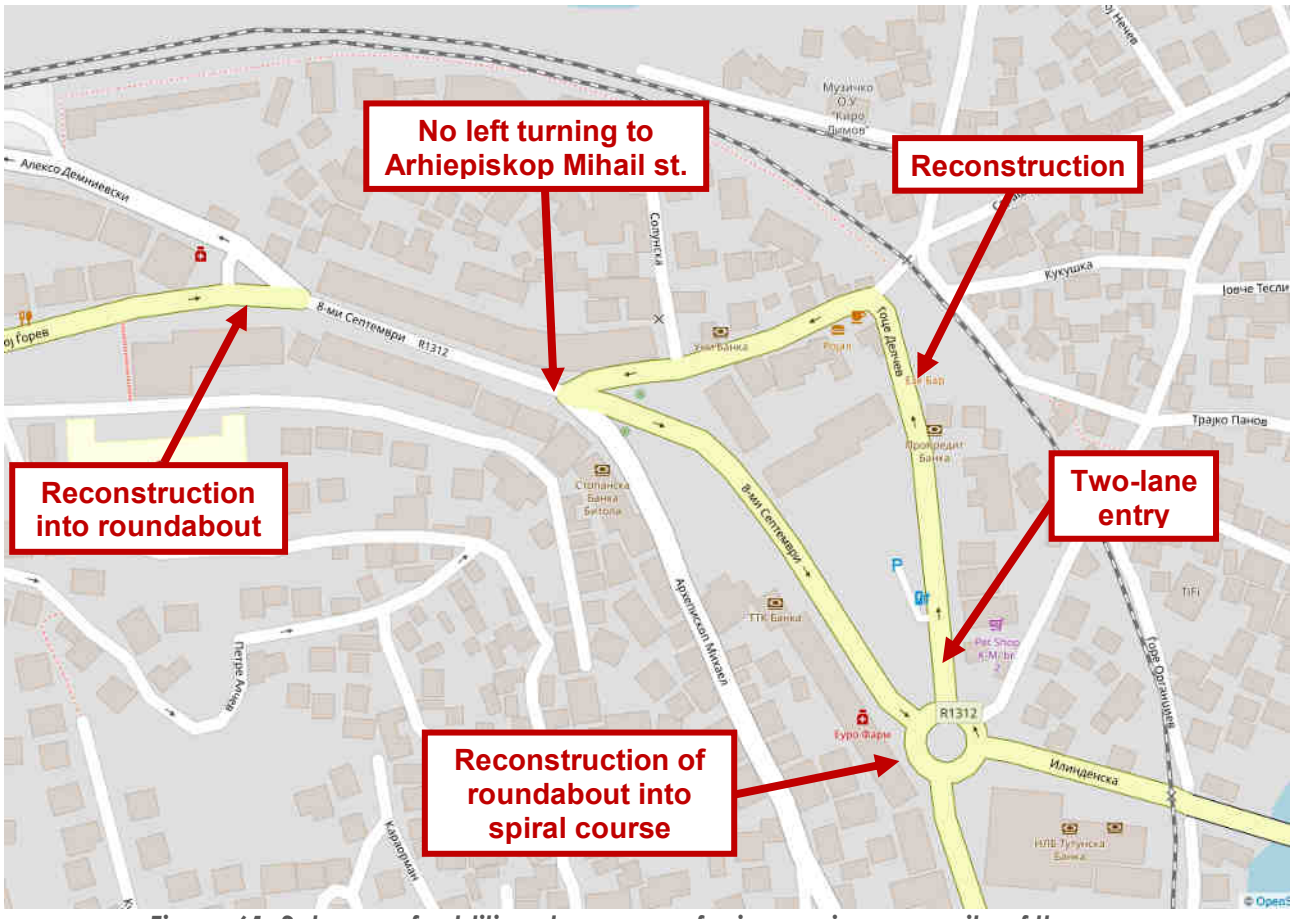


Figure 61: Scheme of additional measures for increasing capacity of the area

Fot the critical (afternoon) peak hour, results of capacity analysis of modified Scenario 2 network are shown below:

Afternoon peak hour – K1:	**Veh**	**Delay [sek]**	**Stops**	**Ave. Queue [m]**	**Max. Queue [m]**	**LOS**
8-mi Septemvri S → Gemidzii	11	15,40	1,13	9,05	105,87	B
8-mi Septemvri S → Goce Delchev	437	12,63	0,82	9,05	105,87	B
8-mi Septemvri S → Nikola Orovcanec	13	13,17	1,08	9,05	105,87	B
Gemidzii → 8-mi Septemvri S	5	13,59	1,19	5,68	65,77	B
Gemidzii → Goce Delchev	266	14,01	1,55	5,68	65,77	B
Gemidzii → Nikola Orovcanec	7	11,99	1,07	5,68	65,77	B
Goce Delchev → 8-mi Septemvri S	397	16,29	1,35	9,97	76,67	B
Goce Delchev → Gemidzii	278	14,72	1,16	9,97	76,67	B
Nikola Orovcanec → 8-mi Septemvri S	44	7,45	0,71	0,08	22,88	A
Nikola Orovcanec → Gemidzii	47	8,56	0,94	0,08	22,88	A
	1506	**14,03**	**1,16**	**4,96**	**105,87**	**B**

Afternoon peak hour – K2:	**Veh**	**Delay [sek]**	**Stops**	**Ave. Queue [m]**	**Max. Queue [m]**	**LOS**
8-mi Septemvri W → Arhiepiskop Mihail	134	3,90	0,13	0,01	6,25	A
8-mi Septemvri W → Strasho Pindzur	725	4,05	0,12	6,42	212,44	A
Strasho Pindzur → 8-mi Septemvri W	884	1,60	0,00	0,00	0,00	A
	1744	**2,80**	**0,06**	**2,13**	**212,44**	**A**

Intersection of streets 8-mi Septemvri / Goce Delchev / Nikola Orovcanec and Gemidzii bridge is passed by 1.506 vehicles. Total delay of intersection is 14,0 sec which means that level of service is LOS=B. In average, vehicles stop more than once. Largest delays and queues comes on the street of 8-mi Septemvri. Level of service from this way is LOS=B (permissible). Longest queue from this side is in length of 106 m. Capacity parameters of intersection are appropriate.

Intersection of streets 8-mi Septemvri / Arhiepiskop Mihail is passed by 1.744 vehicles. Total delay of intersection is 2,8 sec which means that level of service is LOS=A. In average, vehicles stop less than once. Largest delays (4,0 sec) and queues (212 m) comes on 8-mi Septemvri st.. Capacity parameters of intersection are appropriate.

Figure 62: Carasterictical view of "real time" simulation – intersection 8-mi Septemvri / Goce Delchev / Nikola Orovcanec and Gemidzii bridge

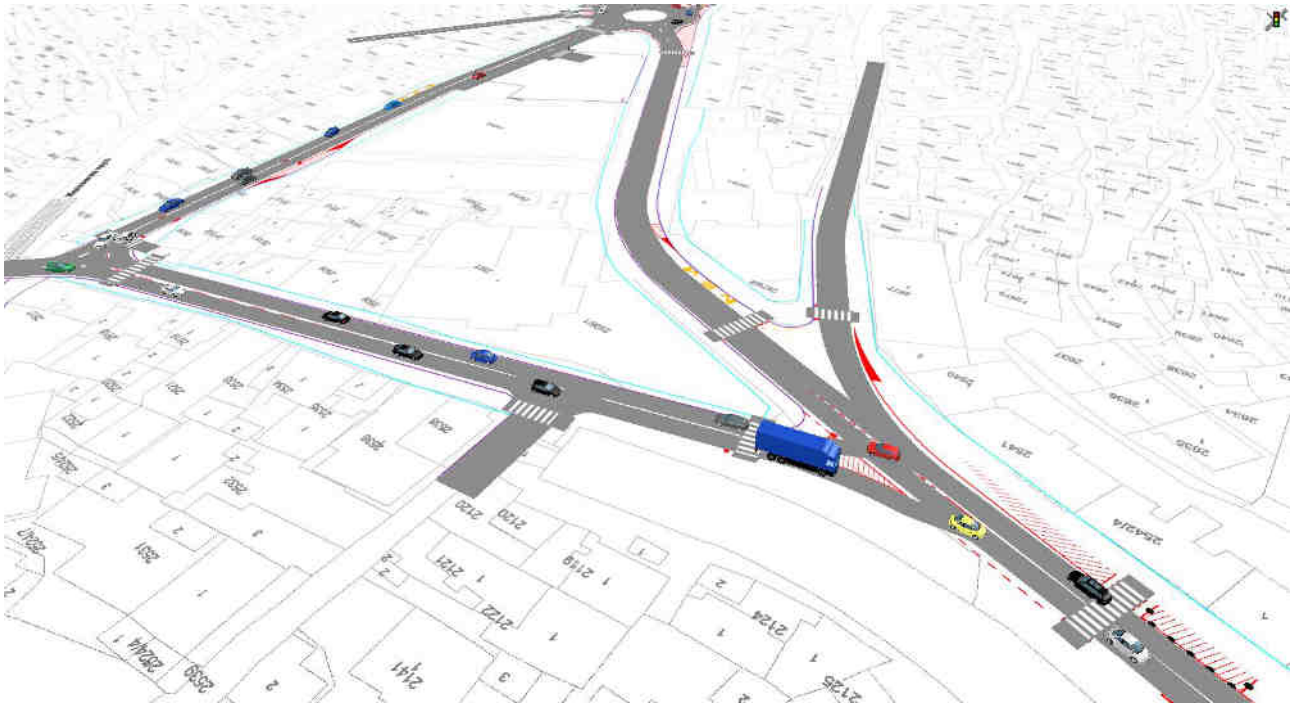
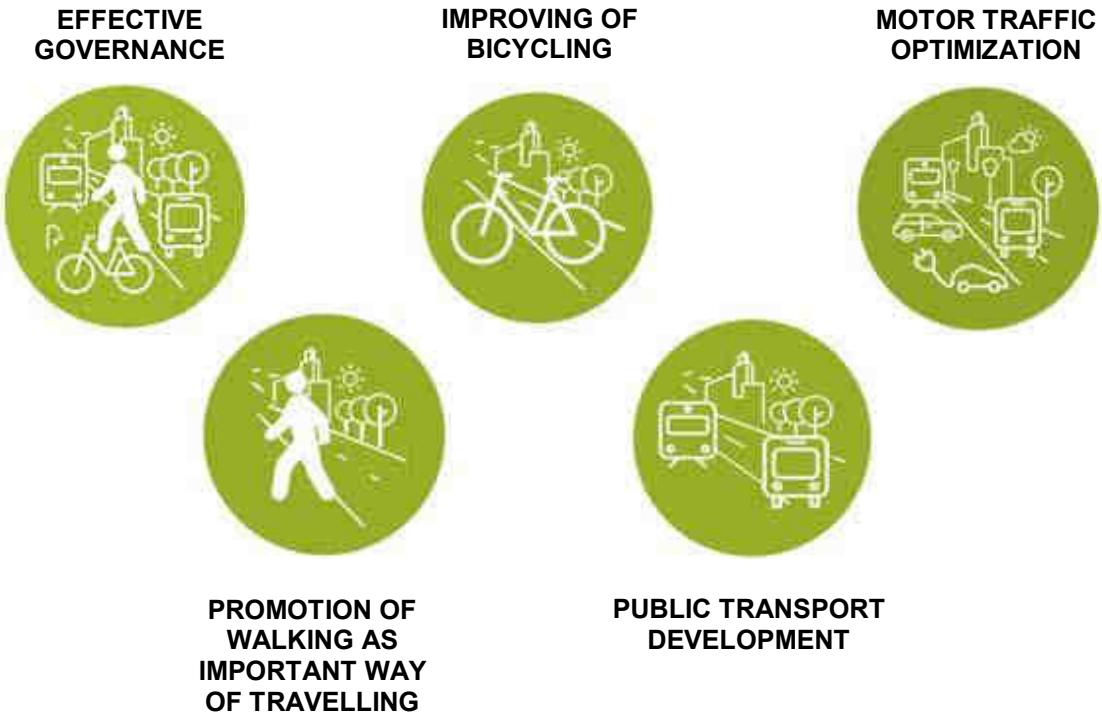


Figure 63: Carasterictical view of "real time" simulation – intersection 8-mi Septemvri / Arhiepiskop Mihail

8. MEASURES

Revitalising of city centre and redistribution of public areas creates an attractive and liveable urban environment. Integrated infrastructure planning helps to facilitate the disproportionalities of road network and increases the competitiveness of public transport, walking and cycling which in turn improves multimodality and decreases pollution of the urban space.

Sustainable urban mobility plan of the municipality of Veles is based on five key areas of action. The objectives have been defined for five intervention areas and a set of measures was assigned to each of them. Measures include infrastructural projects and soft measures which will be developed and implemented and represent tools for implementation of the strategy. By realizing goals in complementary strategic areas, the vision of an intelligently organized city in the field of transport can be achieved.



Five packages are developed, that include 31 measures cover all key aspects of sustainable mobility planning and serve as a tool to achieve the Municipality's vision.

8.1. EFFECTIVE GOVERNANCE

The integrated transport planning was not practiced in the municipality of Veles. Individual projects in the transport and mobility sector were dealt with more or less separately and were not included into a broader development strategy. With the Sustainable urban mobility plan the Municipality of Veles will receive a document which will change the practice so far.

Planning issues have emerged because traffic planning was dealt as individual projects and a strategy that effectively integrated planning traffic has not yet been formulated. Planning did not include the main stakeholders and the general public, which often leads to opposition and criticism.

Promotion of the values of sustainable mobility requires cooperation of all stakeholders: general public, institutions, organizations and other stakeholders in transportation planning sector, for this reason stakeholders should be included in the decision-making process.

The main guideline in preparing SUMP of Municipality of Veles was its strategic location as regional centre and important crossroad that connects central part of Republic of Northern Macedonia with other regions in the country and represents an important international transport corridor.

Effective governance system requires a sustainable financing framework which is a prerequisite for implementation of proposed measures.

The municipality has recognized sustainably mobility as an important part of its further development. The Sustainable urban mobility plan will upgrade current planning practices and help adopt strategic guidelines to integrated transport planning. Preparation of the strategy shows the willingness of the main stakeholders to improve the situation in the traffic and transport as well public support for implementation of the vision that was set in this document.

Wide consensus of all stakeholders and interested groups is needed for enforcement of sustainable principles and measures set in Sustainable urban mobility plan.

8.1.1. PROPOSED MEASURES

G1 Acceptance, commissioning, revision and reform of the strategy
With the adoption of the Sustainable urban mobility plan, the Municipality of Veles continues its path towards sustainable mobility. The process will be supported by the revision of the strategy every two years and renewal every five years. Yearly evaluation of the objectives will serve as monitoring of document performance. With the adoption of the Sustainable urban mobility plan, the municipality of Veles upgrades traffic planning with sustainable mobility.

G2 Personnel training in field of sustainable mobility and its implementation in planning processes
The municipality administration will attend training and workshops on the subject of sustainable mobility and thus upgrade their knowledge and experience in integrated and sustainable planning and exchange experiences with others experts in the field.

Figure 64: Toolbox for institutional cooperation

G3 Preparing a balanced budget
The municipality will support the implementation of sustainable mobility by preparing a balanced budget that will include investments in all key areas of the Sustainable urban mobility plan and proportionally support all forms of sustainable mobility. For projects that will be included in the budget it is recommended to prepare a cost-benefit analysis, so that the measures will be chosen optimally according to their effectiveness.

G4 Periodic survey on travel habits

An annual survey will be carried out investigating travel habits of citizens. Results will be basis for evaluation of the achievements of the objectives of the strategy, they will also be serving to inform the public about changes in their travel habits.

Figure 65: Toolbox for monitoring and evaluation

G5 Promotional and educational campaigns for promotion of sustainable transport modes

In addition to continuing the successfully carried out European Mobility Week project, additional activities will be organized within the framework different of events to promote all aspects of sustainable mobility. promotion will be carried out with the involvement of the public and private sector.

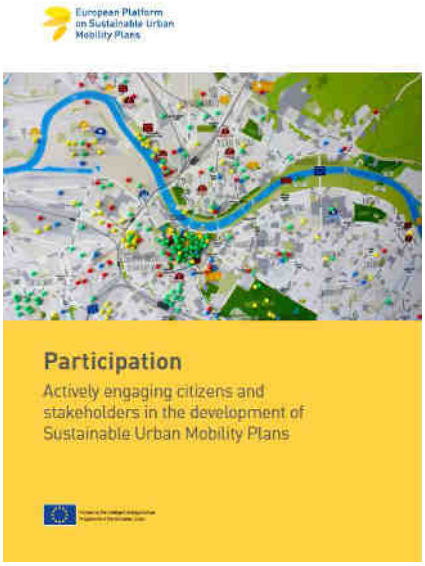


Figure 66: Toolbox for public participation

EFFECTIVE GOVERNANCE		Level of complexity	Responsibility / jurisdiction	Financing sources	Indicators	Costs	Time frame
G1	Acceptance, commissioning, revision and promotion of the SUMP	Moderately	Municipality of Veles, City council	Budget of Municipality of Veles Budget of RNM Private sector and investitors Public-private partnership EU founds and other international founds Credits Donations, etc.	SUMP done, decision on adoption of SUMP	Low	Short term, continuous
G2	Training of staff in the field of sustainable mobility for the purpose of more efficient implementation and planning	Moderately	Municipality of Veles		Number of trainings, organization and attendance of seminars, study trips, etc.	Low	Continuous
G3	Preparation of a balanced budget	Hard	Municipality of Veles		Budget adopted	Low	Continuous
G4	Periodically survey of travel habits	Easy	Municipality of Veles, tenderer		Reports, studies, reports etc.	Low	Continuous
G5	Promotional and educational campaigns to promote sustainable transport modes	Easy	Municipality of Veles		Number of campaigns per year	Low	Continuous

Table 6: Proposed measures for effective governance

8.2. PROMOTION OF WALKING AS IMPORTANT MODE OF TRAVELLING

The basis of the human movement is walking and its positive effects on health are well known. Short walking trips can not only help human health, but also reduce the environmental burden. By consistent planning and achieving of the proposed goals we can make a big step towards ensuring safe and comfortable infrastructure for pedestrians. The objective is to improve existing areas and incorporate new pedestrian public spaces into a continuous network.

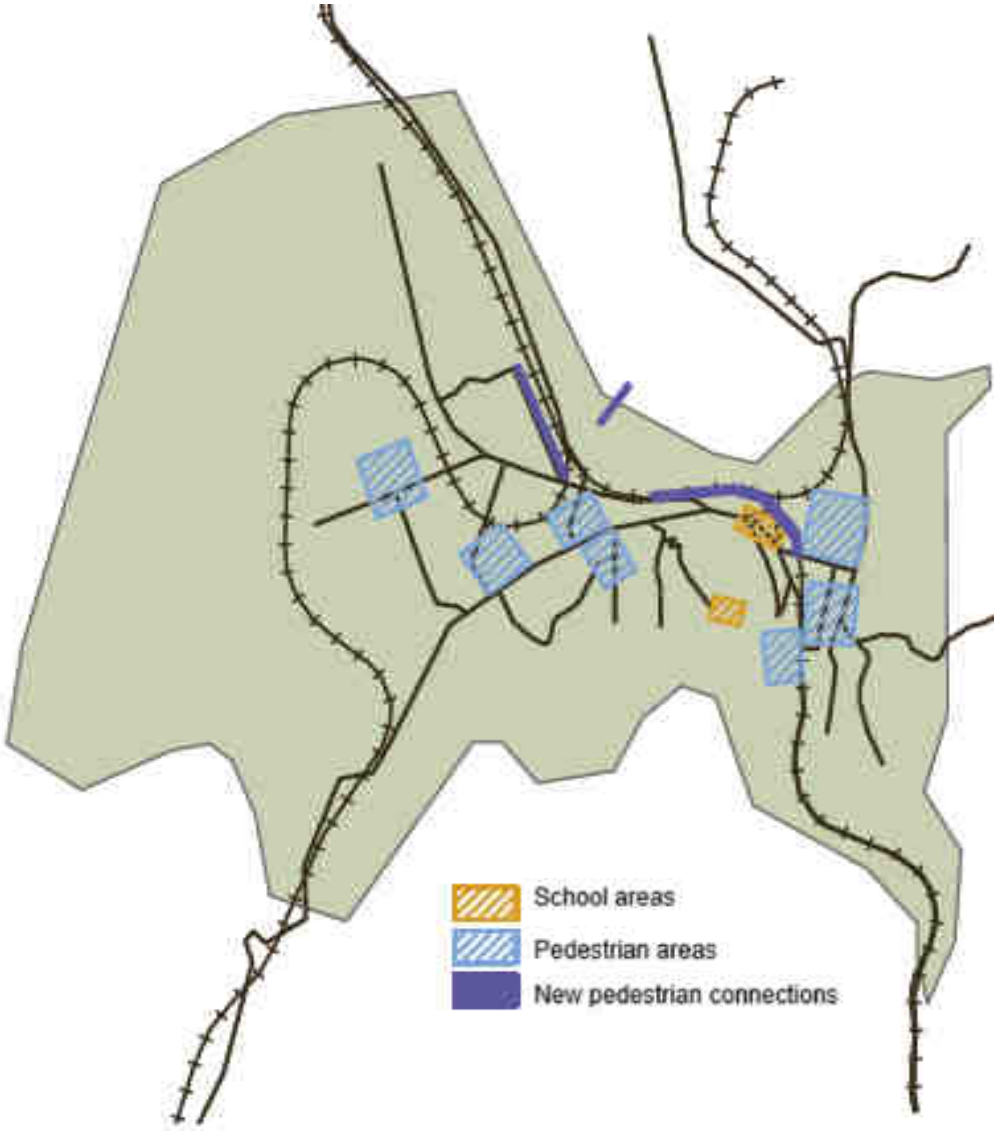
Although most of the city centre is equipped with sidewalks, they are in poor condition and need reconstruction. Poor condition of pedestrian infrastructure reduces the sense of pedestrian safety in traffic and thereby decreasing the attraction of walking as everyday travel mode. Deficiency of infrastructure for pedestrians is most noticeable in residential areas on the outskirts of city that are not connected to city centre and main areas of employment, so employees prefer to come to work with personal cars.

The Municipality of Veles has carried out extensive investments in implementing infrastructure for pedestrians with construction of sidewalks and pedestrian bridge across river Vardar. While the city centre is well equipped with pedestrian infrastructure the existing sidewalks are in many cases deteriorated, their surface is in bad condition and there are frequent conflicts in relation to other traffic modes (parking, crosswalks) in addition the infrastructure is inadequately equipped for access of sensory and physically impaired citizens.

The city needs areas for socializing, cultural engagement and recreation. These areas can be provided by renewal and reconstruction of existing walking paths and public areas and by establishment of new infrastructure intended only for pedestrians and cyclists. Most areas in the city centre are used for parking lots and hence take away surfaces for pedestrians and reduce the attractiveness of the area for walking and cycling. It is also common practice that owners park their cars on unsuitable places along the sidewalks or even on them. The proposed reconstruction of main road connections through the city centre and redesign of Kojnik square will offer an attractive and safe space for its users. Revitalization of urban centre follows the direction of modern European cities that with withdrawal of motor traffic enable the revival of city centres and offer renewed places for socializing.

A questionnaire conducted amongst citizens showed that 96% of respondents felt that it was necessary to introduce measures to reduce the speed of traffic in areas surrounding the schools and other educational institutions. The municipality will in connection with school administration prepare safe school routes plans that will help parents and pupils plan for safe everyday trips to school and back. The document will also serve as basis for priority areas for implementing measures and improving pedestrian and cycling infrastructure.

With an integrated mobility planning and investments in pedestrian infrastructure we will achieve the set goals, this is to provide comfortable and safe areas intended for pedestrians which will lead to increased modal shift towards walking and alternative modes of transport and increase in of quality of urban environment in the city centre


School areas
Pedestrian areas
New pedestrian connections

8.2.1. PROPOSED MEASURES

W1 Establishing pedestrian areas

By establishing new pedestrian areas, the city centre will become more attractive to citizens. By closing off for personal vehicles a part of 8-mi Septemvri street, between roundabout and Strasho Pindzur St., can be redesigned and reconstructed into shared space. Shared space is an urban design approach that minimises the segregation between modes of road users. The road surface that was originally intended for motor traffic will now be shared between pedestrians, cyclist and public transport vehicles. The area will be reconstructed by removing parking spaces and widening space for walking & bicycling. Public transport will be the only motorised traffic allowed in the area in two-way regulation on existing road surfaces.

Figure 67: Shared space in Ljubljana

Existing pedestrian area in Kojnik square will be reconstructed. Existing square surface will be expanded and delineated with curbs and physical barriers that will prevent illegal parking while the inner area will be refurbished with urban equipment. The width of existing road surface will be narrowed to allow one-way traffic around the square. Proposed arrangement will allow accessibility of the area by car for local residents but will prevent saturation of the area with parked illegally vehicles

Withdrawal of motor traffic enables the revitalisation of city centre and square and offers a new place for socializing for the inhabitants and visitors.

W2 Implementation of safe pedestrian crossings

The natural and infrastructural barriers hinder accessibility of pedestrians. In Veles the biggest obstacles are river Vardar and railway infrastructure. In order to shorten the distances between the main housing, employment and service areas multifunctional links that will enable faster and safer crossing of physical barriers must be established. Existing railway crossings have to be redesigned and reconstructed to ensure the safety of all participants while new pedestrian overpasses should be introduced. To connect Rečani area with city centre a new pedestrian and cyclist bridge will be implemented. A construction of a pedestrian bridge across railway will connect important recreational areas of Mladinski park and city park. Reconstruction of problematic pedestrian crossings with proper lighting and traffic signalisation will improve traffic safety of pedestrians. With proper redesign and implementation of level crossings helps establish safer traffic condition and warn drivers of the most vulnerable road users.

Figure 68: Pedestrian crossing on speedbump

Figure 69: Pedestrian areas arranged for easier access

W3 Building a new and improving the current pedestrian infrastructure

The Municipality of Veles will improve and implement new infrastructure for pedestrians. Infrastructure will create corridors that connect main sources and destinations of trips. With construction of the relevant infrastructure walking will become an important way of traveling, not just for recreation, but as means of everyday travel (coming to work, going to school...). This will be achieved by establishing uninterrupted pedestrian infrastructure that will connect main sources and destinations of trips. At the same time measures set in SUMP will help improve traffic safety of pedestrians. Surfaces that are physically separated from other traffic are the safest as the prevent direct conflict with other participants in traffic. Most of the city centre is already equipped, however, there are still areas that need to be connected with pedestrian infrastructure. In combination with cycling multipurpose paths that connect city of Veles with nearby settlements and lake Mladost should be built. Within road infrastructure reconstruction works a barrier free pedestrian surfaces will be provided through the city. Submerged curbs, pavement and additional designated crossings will reduce separating effect and ease pedestrian movements. This will not only help physically impaired people but also elderly and families with strollers.

Figure 70: Alerting drivers of pedestrian presence with texture differences

W4 Adaptation of infrastructure for people with mobility impairment

A key aspect of integrated traffic management is ensuring accessibility for all population groups. Uneven curbs on the pavements, architectural barriers and inadequately equipped pedestrian crossings reduce accessibility for people with mobility impediments, such as people with disabilities and the elderly. Proper adjustment of traffic infrastructure improves accessibility for both physically and sensory impaired people, elders and families with carriages. Main connections in the settlement will be adapted to all user groups with implementation of wheelchair ramps and the expansion of sidewalks. Adaptation of the present obstacles - lowering curbs at the crossings, editing slopes, elimination of architectural barriers, outfitting traffic lights with audio signals, tactile paving - will allow a pleasant and safe mobility for all inhabitants. Priority will be given to corridors connecting the train and bus station to city centre and areas surrounding public buildings thereby facilitating access to services for all population groups.

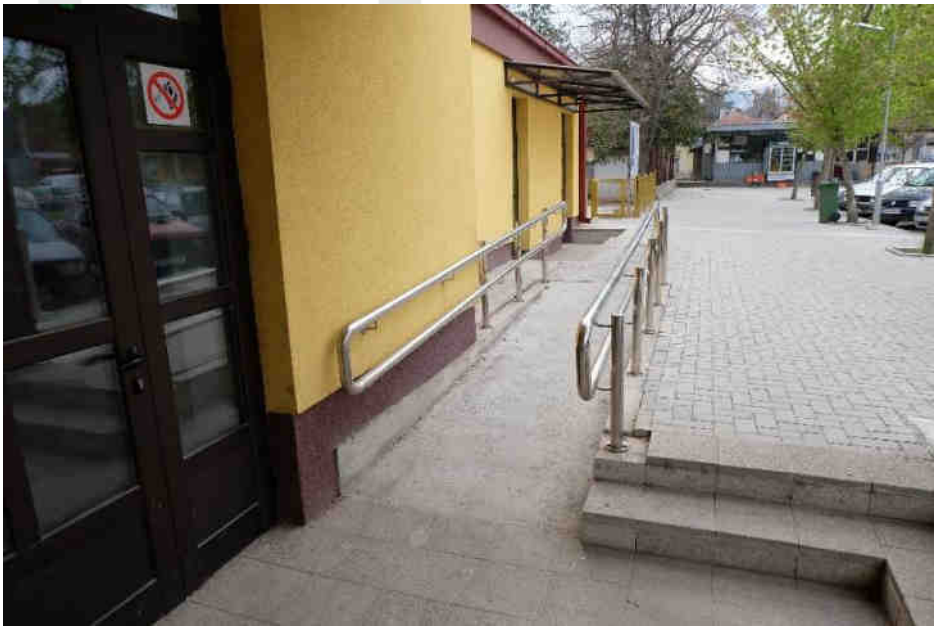


Figure 71: Wheelchair ramp on Veles railway station

Figure 72: Tactile paving on pedestrian crossing

W5 Introduction of safe school routes

Safe school routes are an approach that with analysis of existing traffic situation proposes safe and comfortable connections. It helps parents and school children plan everyday trips to school and that promotes walking and bicycling to school through infrastructure improvements, safety education, and incentives to encourage walking and bicycling to school. The plans are prepared with cooperation of municipality administration and all elementary schools and is oriented towards safer school environment without fatalities and severe accidents in road traffic.

Figure 73: Traffic signalisation in school area, source: Občina Krško, 2018

Figure 74: Traffic signalisation for safe school routes, source: MOL, 2019

Figure 75: Traffic signalisation in school area, source: Občina Krško, 2018

W6 Promotion of walking

Special emphasis will be put on the promotion of walking with various campaigns and workshops. This will help establish sustainable mobility as an important value with population. Educating citizens on the positive effects of walking on health and the quality of the life increases people's awareness on the benefits of sustainable mobility. In addition to already known promotional activities carried out (European mobility week), new activities will be introduced which include socializing and active use of public space including all social groups from the youngest to people mobility impairments and the elderly.

Figure 76: Pešbus – promotional activity for elementary schools

PROMOTION OF WALKING AS IMPORTANT MODE OF TRAVELLING		Level of complexity	Responsibility / jurisdiction	Financing sources	Indicators	Costs	Time frame
W1	Introduction of pedestrian zones	Hard	Municipality of Veles	Budget of Municipality of Veles Budget of RNM Private sector and investitors Public-private partnership EU founds and other international founds Credits Donations, etc.	Number of pedestrian zones introduced	High	Medium term
W2	Implementation of safe pedestrian crossings	Moderately	Municipality of Veles , MTC Macedonian railways-infrastructure		Number of safe pedestrian crossings performed	High	Short term, Continuous
W3	Building new and improving existing pedestrian infrastructure	Hard	Municipality of Veles , Ministry of transporation and communications (MTC)		Area of new and reconstructed pedestrian infrastructure	High	Short term and long term
W4	Adaptation of infrastructure for people with limited mobility	Easy	Municipality of Veles		Adapted areas and adequate infrastructure facilities for people with limited mobility	Low	Short term, medium term
W5	Introducing safe school routes	Easy	Municipality of Veles		Number of safe school routes introduced	Low	Short term
W6	Promotion of walking	Easy	Municipality of Veles, local institutions and civil society		Number of campaigns and activities	Low	Continuous

Table 7: Proposed measures for promotion of walking as important mode of travelling

8.3. IMPROVING OF BICYCLING

Cycling is one of the key aspects of sustainable mobility. Compared with motor traffic it does not generate emissions and is spatially less demanding. At the same time, it is accessible to all social groups of the population is and is the fastest means of transport in settlements for overcoming shorter distances. Cycling is a good alternative to everyday use of motor vehicles, that favourably affects our health and environment.

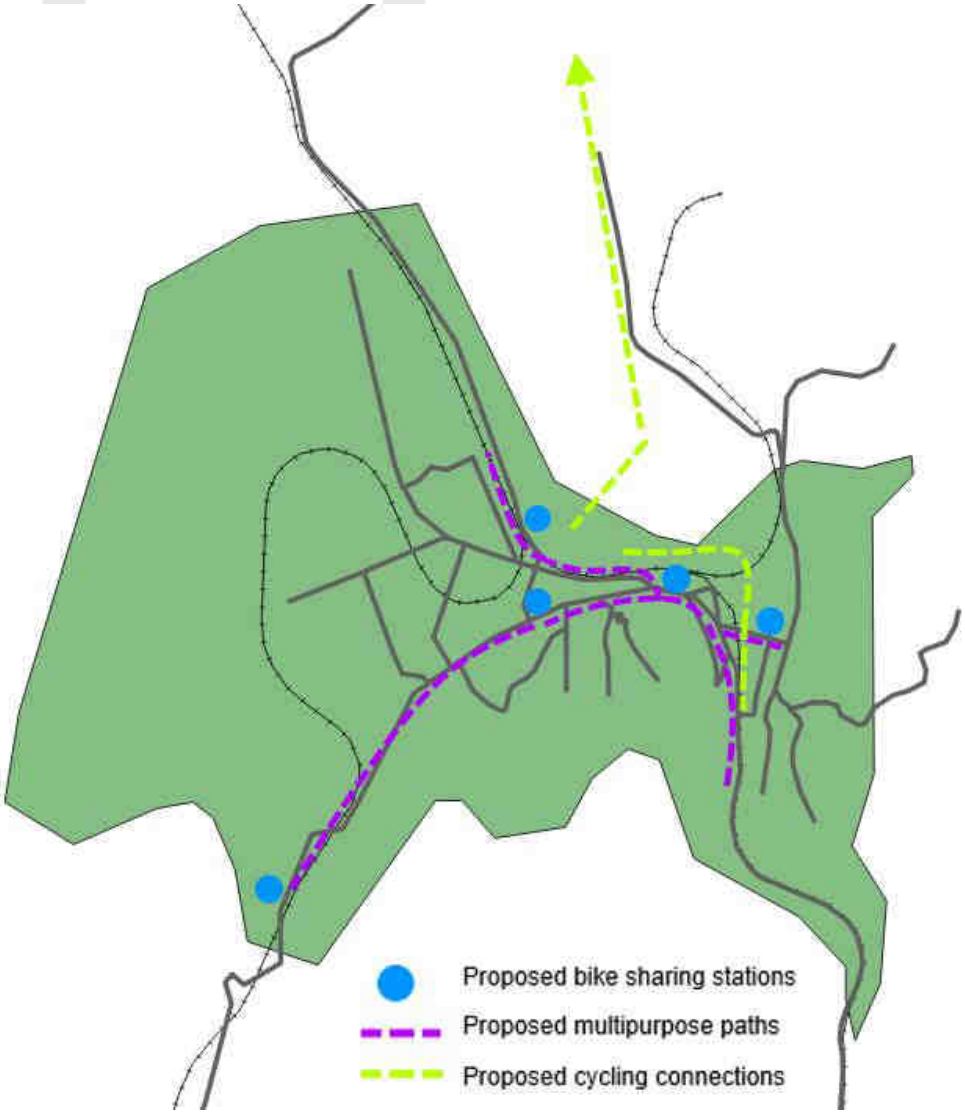
Cycling is one of the key aspects of sustainable mobility in spite of this, results of the questionnaire of citizens travel habits show that only 1% use bicycle for everyday trips. Despite many advantages of cycling there is almost no cyclist infrastructure available in the municipality of Veles. In most of regional and local roads the cyclist is a subordinate position compared to the motor traffic. Taking into account insufficient traffic lane widths, vehicle speed, traffic load and shares of freight traffic a lot of road segments feel dangerous for cycling.

Areas for bicycle parking and other cycling infrastructure is subservient to parking areas or in most public areas non-existent. Public transport stations are not adapted to access with bikes as there is no safe storage for bicycles while most of public transport vehicles don’t allow bicycles onboard.

Perhaps one of the biggest obstacles for the development of cycling is natural relief with steep slopes (where a big part of residential areas is located) that are unsuitable for comfortable cycling. Steep incline makes the access to these areas burdensome and challenging which dissuade a larger part of residents from cycling as everyday transport mode. Most services are located by the main road on the flatter terrain which makes them easily accessible from surrounding areas. The reconstruction of the existing road infrastructure will cross main service areas and enable cyclist to safely access the city centre while also connecting it with P+R areas.

An additional development opportunity for cycling is also one of its challenges. The dynamic and hilly terrain in a natural environment offers many possibilities for development of recreational and mountain biking. Municipality has already prepared conceptual designs for long distance cycling roads that would connect city of Veles to surrounding settlements and points of interest. Safe and well-equipped cycling routes have exceptional importance in increasing awareness of advantages of cycling and its promotion.

The conditions for safe cycling can be ensured by building infrastructure that separates cyclists from of the remaining traffic and by introduction of zones with traffic calming measures. Opening one-way streets for cyclist noticeably shortens lengths needed to reach destinations while establishment of barrier free environment with comfortable surfaces improves the attractiveness of cycling network. Connecting and well-equipped cycling routes that form a comprehensive and continuous cycling infrastructure network will increases accessibility and road safety for cyclists and thereby present cycling as an attractive mobility mode.


Proposed bike sharing stations
Proposed multipurpose paths
Proposed cycling connections

8.3.1. PROPOSED MEASURES

C1 Arrangement of cycling infrastructure along the main streets cross the city

The bicycle is the fastest and cheapest transport on shorter distances. For safe and attractive cycling, it is necessary to establish a network of cycling infrastructure which will connect all the points of interest in the city. In city of Veles there is almost no cyclist infrastructure available which means that the cyclist has to use either sidewalks drive on roads where they are in subordinate position compared to the motor traffic. High volume of traffic combined with high number of parking places that are located parallel to the road create dangerous conditions for cycling. Reconstruction of existing roads and implementation of cyclist infrastructure along main connections will improve the conditions for biking in the city which will positively influence the share of daily travels made by bicycles. Reconstruction of roads with implementation of cycling infrastructure should be prioritized on connections Prevalec -Blagoj Gjorev – 8-mi Septemvri – Dimko Najdov, 8-mi Septemvri - Gemidzii bridge-BUS station and 8-mi Septemvri - Alekso Demnievski Bauman – Vasa Kosulceva.

Figure 77: Physically separated bike lane

Figure 78: On-road bike lane

New and reconstructed cycling infrastructure should be implemented according to highest safety standards. It is advisory that physically separated bike lane is implemented on roads that have speed limit ≥ 50 km/h or AADT (Annual average daily traffic) exceeds 7500 vehicles while on-road bike lanes can be implemented on roads with speed limit lower than 50 km/h and AADT is lower than 7500 vehicles.

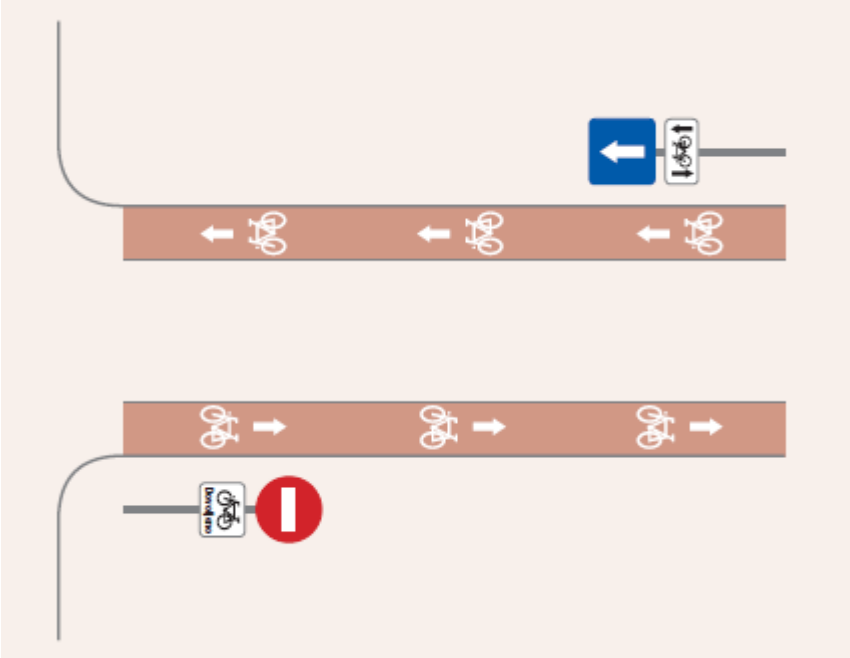


Figure 79: Cyclist lanes in one-way streets

Implementation of too-way cyclist traffic in one-way streets (contra-flow cycling) shortens the distances cyclist have to travel to reach their destinations, improves local access and increases the safety of cyclist.

Figure 80: Bike crossing on speed bump

Figure 81: Lowered curbs on bike crossing for comfortable cycling

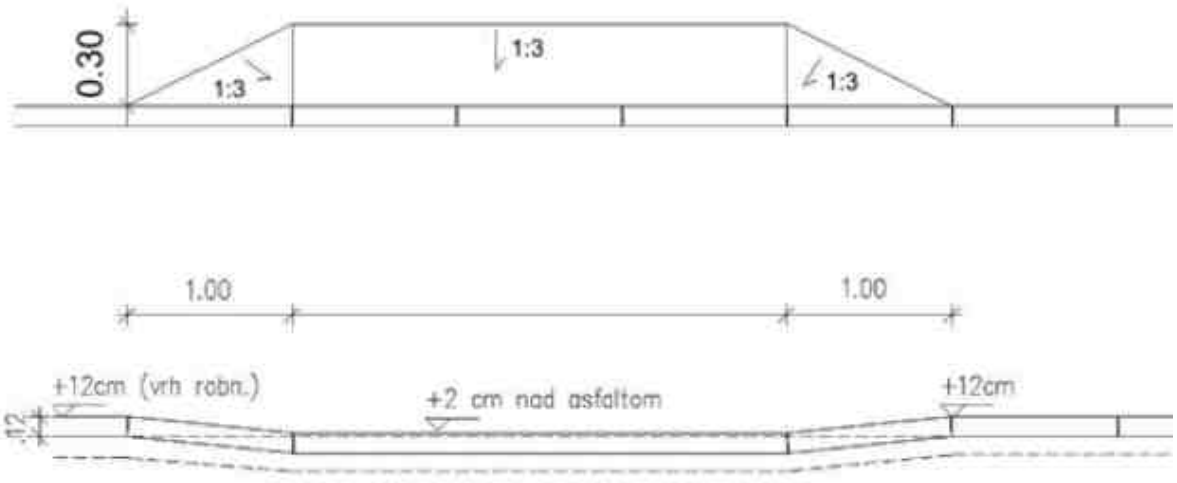


Figure 82: Curb reconstruction for easier cyclist access

Figure 83: Grate positioning for comfortable cycling

Cycling infrastructure should be designed without physical barriers which reduce comfort of bicycle riding. Locations of the start and end of the cycling infrastructure and bike crossings should be equipped with lowered curbs. Additional safety of cyclist on bike crossings can be achieved by construction of crossing on a raised platform to increase visibility and reduce vehicle speeds.

Figure 84: On road parking in combination with bike lane

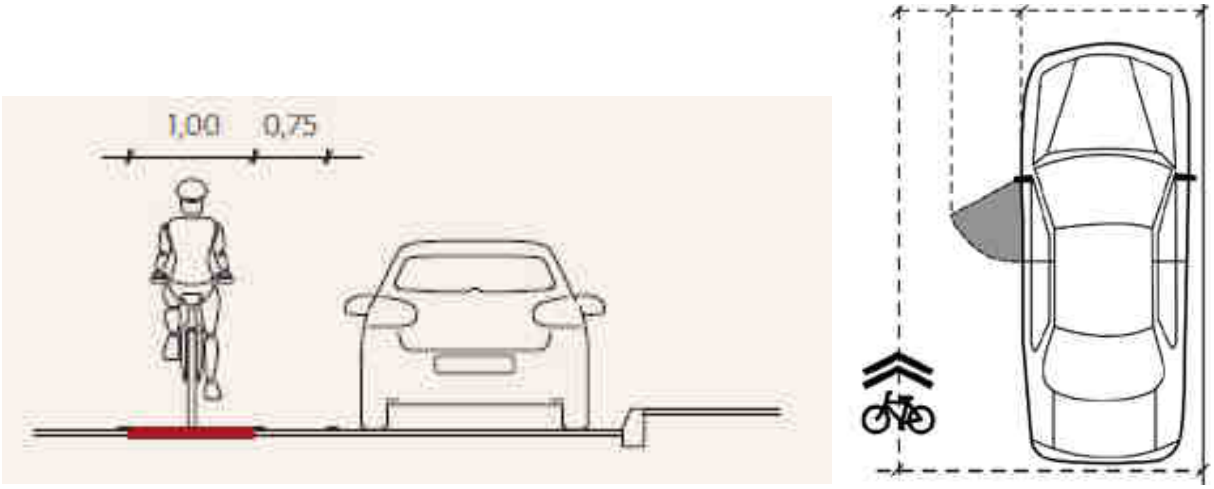


Figure 85: Proper bike lane planning in connection with parking areas

If parking spaces are located next to on-road bike lines a safety distance must be designed to offer safe cycling. Safety distance offers parked vehicles enough space to safely open car doors in case of the passing cyclist.

C2 Traffic signalization implementation on bicycling routes

Regulated traffic signalling allows for proper guiding, alerting and general information to cyclists. If cyclists share road infrastructure with motor traffic, it is essential that the markings are sufficiently visible for drivers of motor vehicles, as they are alerting them of cyclist's presence. The traffic signalisation will be set up along existing and future cycling paths. Traffic signaling will be set up along all existing and newly anticipated bicycle lanes. With the realization of the proposed EuroVelo 11 bicycle route, which passes through the area of the Municipality of Veles, the traffic signalization will be redesigned and implemented in coordination with the design and practices of the EuroVelo 11 route, (marking the EuroVelo 11 route from Lake Mladost to the town, in to the city and others). Continuous marking with proper traffic signaling will be done on each bicycle path on the street network and marking the connections between them.

Figure 86: Traffic signalling on long distance cycling routes

Figure 87: Traffic signalling Eurovelo cycling routes, source: Eurovelo, 2019

C3 Construction of the bicycle network - multipurpose paths

It is necessary to establish as many safe sections as possible for cyclists and pedestrians. Construction of multipurpose paths connecting surrounding settlements and Lake Mladost with city centre will serve as attractive recreational and tourist infrastructure while also offering possibility for locals to use the infrastructure for daily trips. A multipurpose path on the riverside of river Vardar connecting Old bridge and City park will serve as a connection to city centre for residential areas while offering a high-quality recreational area in the city. A comprehensive and connected infrastructure network will provide safe access and connection of the Veles to its hinterland.

Figure 88: Long distance cycling roads

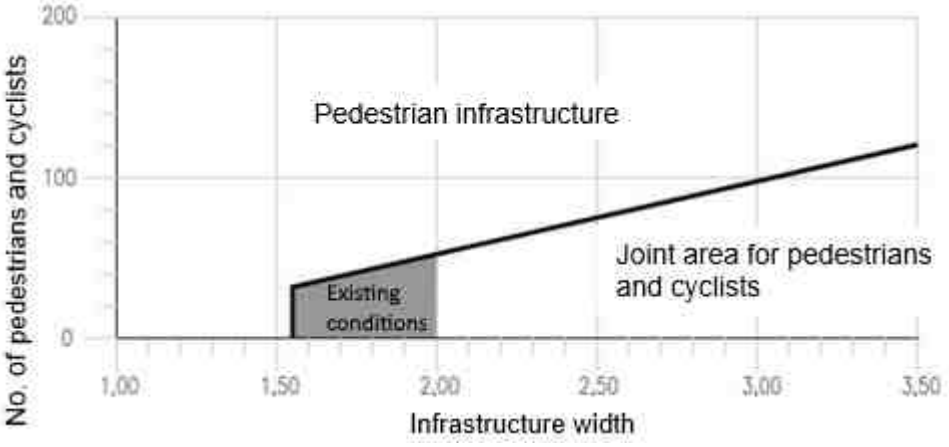


Figure 89: Directions for planning of pedestrian and multipurpose infrastructure

Figure 90: Separated long distance cycling roads

C4 Construction of parking lots for short-term and long-term bicycle parking

Bicycle stands will be put in areas of interest (public building, shopping areas, tourist points, parks,) and will be arranged in such a way that they protect vehicles from various weather conditions and will ensure safe bicycle storage. Bicycle sheds will be assembled on train station, bus station, P+R parking's on entry points and in the city centre that will support multimodality.

The citizens will have a possibility of safe storage, which will greatly increase the attractiveness of cycling as means of transport and as a part of transport chain.

Figure 91: Parking areas for bicycles - bike shed

Figure 92: Parking areas for bicycles - bike stands

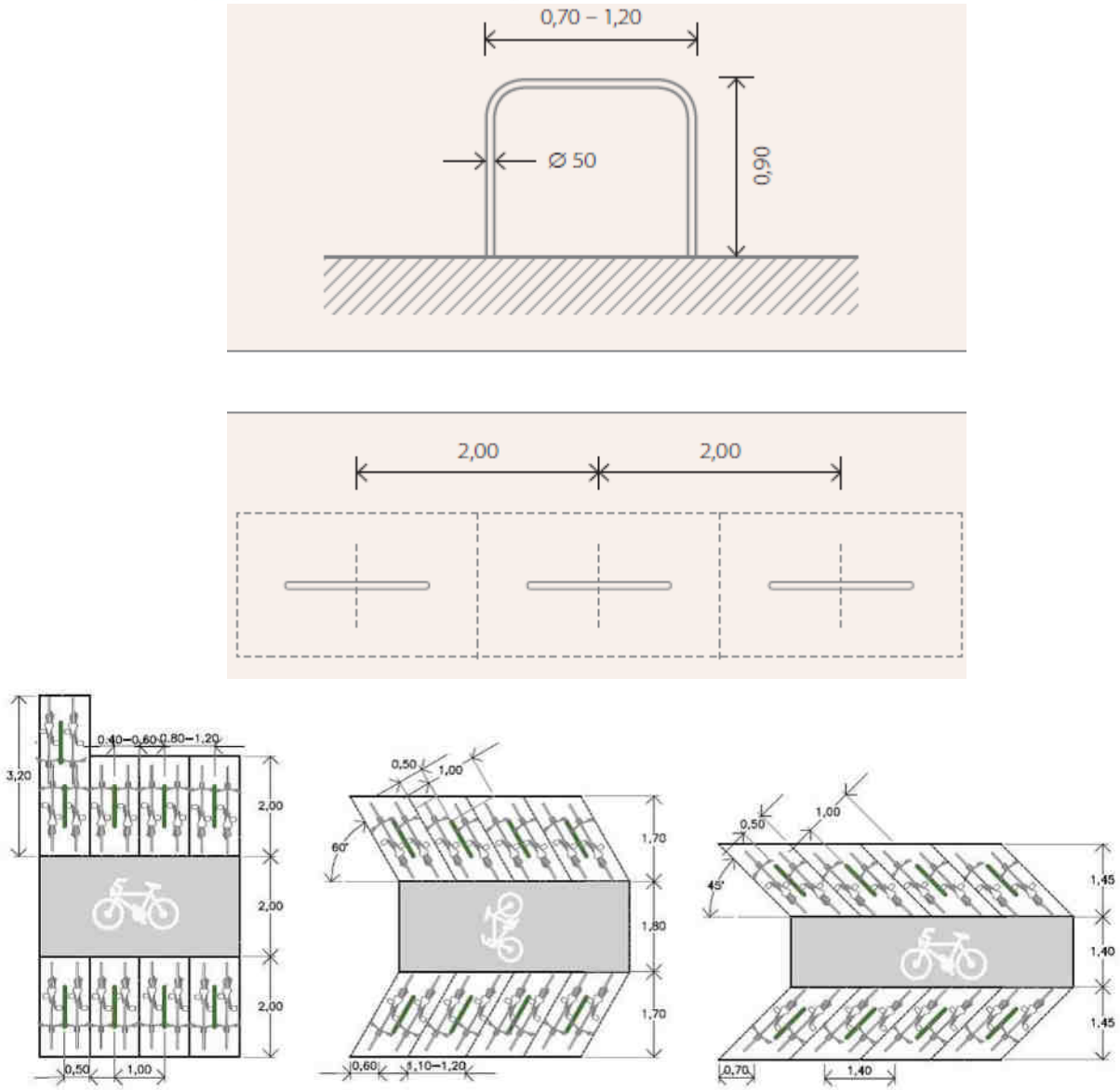


Figure 93: Directions for planning parking areas for bicycles

C5 Bike rental system

The bike rental system allows citizens the possibility to use the bike for shorter trips in the city area and integration of public passenger transport and cycling. This system will be set up points of interest around the city of Veles and its vicinity like bus and train station, city centre, Lake Mladost and purposed P+R parking lots where rental stations will provide ordinary or electric bicycles, so the bike will be available for shorter or longer journeys and different terrains. Locating rental stations along the main traffic generators will enable the use to as much users as possible.

Figure 94: Bike rental station in Celje

C6 Promotion of bicycling

Only 1% of daily trips are made by bicycle which shows that citizens perceive cycling as recreational activity and not a viable mode of transport for shorter and middle length distances. Promotional campaigns will promote sustainable mobility among people by educating them about its positive effects on health and the environment. Activities will include all population groups and will in addition to continuing established practices introduce new ways of promotion. Special attention will be given to education of schoolchildren with continuation of workshops focusing on safe cycling and cyclist behaviour in traffic.

Figure 95: Promotional activity for cycling

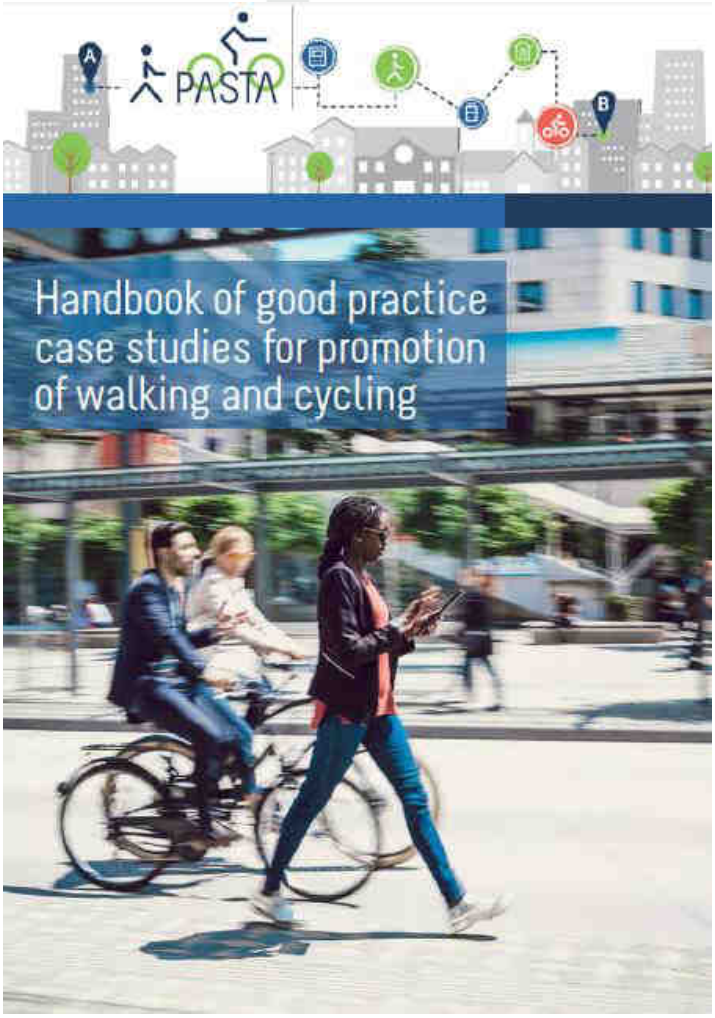


Figure 96: Handbook for promotion of walking and cycling

source: https://www.eltis.org/sites/default/files/trainingmaterials/2017-pasta-project_handbook_web_02.pdf

IMPROVING OF BICYCLING		Level of complexity	Responsibility / jurisdiction	Financing sources	Indicators	Costs	Time frame
C1	Arrangement of cycling infrastructure along the main streets cross the city	Hard	Municipality of Veles, MTC	Budget of Municipality of Veles Budget of RNM Private sector and investitors Public-private partnership EU founds and other international founds Credits Donations, etc.	Length of arranged bicycle infrastructure	High	Medium term and long term
C2	Traffic signalization implementation on bicycling routes	Easy	Municipality of Veles, MTC		Length of marked bike paths	Low	Short term
C3	Construction of the bicycle network - multipurpose paths	Hard	Municipality of Veles, MTC		Length of built bicycle network	High	Medium term
C4	Construction of parking lots for short –term and long-term bicycle parking	Easy	Municipality of Veles		Number of realized parking spaces for bicycles	Low	Short term
C5	Bike rental system	Moderately	Municipality of Veles		Built-in bicycle rental system and number of users	High	Long term
C6	Promotion of bicycling	Easy	Municipality of Veles, local institutions and NGO sector		Number of campaigns and activities	Low	Continuous

Table 8: Proposed measures for improving of bicycling

8.4. PUBLIC TRANSPORT DEVELOPMENT

Accessible and high frequency public transport vehicles are a prerequisite for attractive public transport. Proper maintenance and cleanliness ensure that the passengers are offered services of sufficient quality. Despite the many positive effects of public passenger transport, it is nowadays highly neglected and its reputation has greatly decreased.

Effective public passenger transport is tailored to the needs of its users, enables high-quality accessibility to the main daily travel destinations in the municipality, offers competitive alternative mobility mode to all groups of citizens and reduces the dependence of the population on the car. As the result of measures originating form Sustainable urban mobility plan City public transport will be optimised and new service lines will be implemented.

Public transportation provides people with mobility and access to employment, community resources, medical care, and recreational opportunities. It benefits those who choose to ride, as well as those who have no other choice. Public transit provides a basic mobility service to these persons and to all others without access to a car. The incorporation of public transportation options and considerations into broader economic and land use planning can also help a community expand business opportunities, reduce sprawl, and create a sense of community through transit-oriented development. By creating a locus for public activities, such development contributes to a sense of community and can enhance neighbourhood safety and security. For these reasons, areas with good public transit systems are economically thriving communities and offer location advantages to businesses and individuals choosing to work or live in them. Public transportation also helps to reduce road congestion and travel times, air pollution, and energy and oil consumption, all of which benefit both riders and non-riders alike.

The Main Bus Station does not allow for optimal development of public city passenger transport in the city. Existing design does not provide travelers with the necessary comfort and services, as well as quality pedestrian and bicycle connections to the city center. Providing a combination of different modes of transport has a significant impact on reducing car use and increasing the use of sustainable modes of transport.

Urban areas on and around the steep on south and east areas of the city are not served by public passenger transport. Spatial constraints due to high slope terrain configuration and dense habitat development limit the possibilities for public transport with large vehicles, and therefore no public transport lines have been established.

The absence of public passenger transport encourages the use of the car as a major transport method, and further exacerbates the situation for vulnerable groups of citizens, such as the elderly, the disabled and persons with disabilities. At the respondents' request, public transport will offer alternative means of transport in areas not related to public transport.


Intermodal node – BUS station
Proposed service lines destination
Proposed service lines

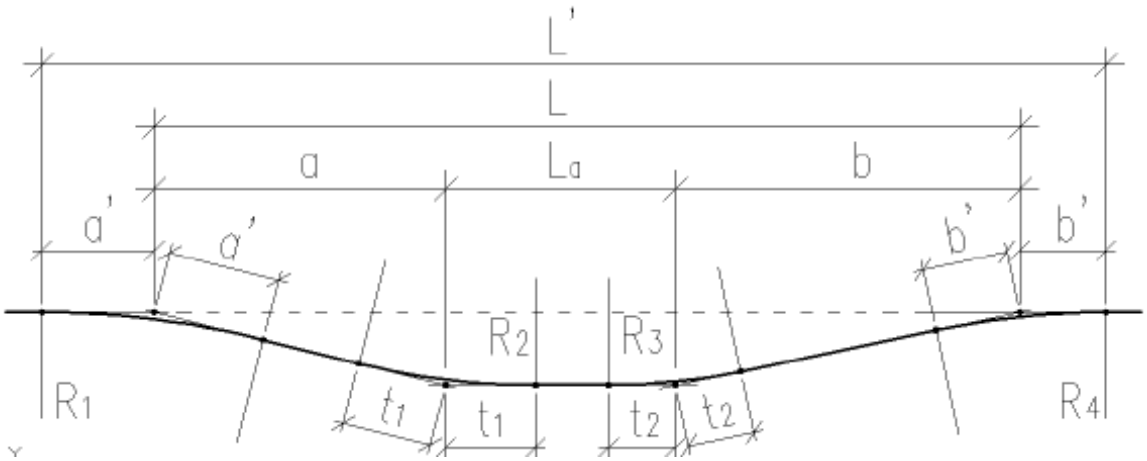
8.4.1. PROPOSED MEASURES

P1 Establishing visual identity of municipal public transport service

Municipality of Veles will implement a unified design for municipal public passenger transport. The redesign will include physical redesign of existing infrastructure and new visual identity of the service (corporate design). Insufficiently equipped and deteriorated bus stop will be equipped according to municipal policies (with predefined shelters and furnished with needed urban furniture). Information system will be developed and will include complete information for users of public transport – timetables, maps of service lines, information about ticket prices and sale points,). Non-regulated bus stops are often point of conflict between pedestrians and other traffic users as passenger is exposed passing vehicles. Existing and new bus stops will be connected to existing pedestrian infrastructure with sidewalks and road crossings. Reconstructed and new bus stops must be built in accordance to traffic safety standards and new visual identity.

Figure 97: Properly equipped bus station

Figure 98: Properly traffic signalisation on bus station



Uvozna hitrost (km/h)	a (m)	b (m)	a' (m)	b' (m)	l (m)	R1 (m)	R2 (m)	R3 (m)	R4 (m)
30	16,00	15,00	3,80	4,00	3,10	40,00	30,00	20,00	40,00
40	17,00	15,00	5,30	4,00	3,10	60,00	40,00	20,00	40,00
60	25,00	15,00	4,80	4,00	3,60	80,00	60,00	20,00	40,00

Figure 99: Directions for bus stop planning

P2 Implementation of new public passenger transport service lines

Municipality will increase the mobility by establishing a new bus service line. A new bus line will be implemented on a route connecting main bus station and hospital. The bus will serve as the main transport mode for accessing the hospital building. Transport will be carried out with smaller transport vehicles (vans) as spatial restrictions do not allow access with larger vehicles. Rides will be carried out with ecologically friendly vehicles (gas/electrify hybrid).

Existing parking spaces in front of the hospital entrance will be reconstructed to a turning area for the JGP vehicle including new bus stop equipped with bus shelter and urban furniture. Remaining parking spaces will be reassigned as short-term parking spaces (15 min) used for boarding and drop off points for hospital users. Additional bus service lines will be implemented connecting city centre and churches St. Spas and St. Panteleimon. The time table should be optimised regarding demand with higher density of rides during holidays and before and after church services. Transport will be carried out with small ecologically friendly vehicles as spatial restrictions hinder access with larger vehicles. After the completion of P+R parking capacities those will be connected to city centre with high frequency service lines. Additional line will be implemented to connect Lake Mladost with higher frequency on weekends, holidays and during summer which will incite locals and tourist to use public transport. The vehicles operating on service line to Lake Mladost should be able to accommodate bikes (bicycle racks) to enable intermodal access to recreational and tourist area.

New municipal railway line will be implemented on existing railway infrastructure. The lines will operate inside municipal borders from direction of Bitola to Veles railway station and Gevgelija to Veles railway station. The lines should be included in comprehensive study of the development of JGP and optimised regarding demand and existing railway traffic. New service lines will improve the connectivity of larger employment and residential areas with points of interest in the city.

All new service lines must be first included in the comprehensive Study for the development of public transport for evaluation and optimisation.

P3 Reassignment of main bus station into intermodal node

The main bus does not allow optimal development of public passenger transport in the city. Existing design does not offer the passengers the necessary comfort and services as well as quality pedestrian and bicycle connections to the city centre. The construction of a new bus stop at the planned location under the provisions of the General Urban Plan (GUP) (near the train station) is impossible due to the fulfillment of previous conditions regarding the construction of a viaduct and a bridge over its entire length, starting with a new road. node from Highway A1. Planned reconstruction of the bus station will be based on intermodal passenger transport principles and will enable easy and convenient combining of various transportation options. Enabling the combination of different means of transport has a significant impact on reducing the use of the car and improving the use of sustainable modes of transport. Public passenger transport hub will be designed in combination of P + R parking service that will offer daily commuters to continue on with their journey with public transit. Bus station will be equipped with bicycle sharing station and will also allow safe storage of proprietary bikes.

Figure 100: Bus station in Veles

P4 Preparation of comprehensive Study for development of public transport

A comprehensive study of the development of public passenger transport will evaluate existing lines and study the possibility of introducing new lines. Optimization of public transport with adjustment of schedules and frequencies will increase the attractiveness of public passenger transport for everyday use. The study will examine timetables, possible extension of service lines, public image of JGP among citizens and the possibilities of introducing new forms of public passenger transport (carpooling, carsharing, integration of bicycles on JGP, on demand public transport…). The analysis must include the assessment of possible financial sources (for example subsidies, public-private partnerships, national and international funds,) and pricing policy (for example price, type of travel cards, electronic ticketing system,). The study will assess the implementation of modern technological solutions and information systems such as real time buss arrival displays and web/mobile applications for public transport users. Study will serve as a basis and is a prerequisite for adoption and implementation of any new service lines an forms of public transport (measures P2, P3 and P5).

Figure 101: Timetable on bus stop

P5 Introduce a System of public transport on demand

Residential areas on Kojnik, on on steep southern and eastern hillsides are not serviced by public passenger transport. Spatial restrictions which are the consequence of steep incline and dense housing development offer limited possibilities for public transport with large vehicles so service lines were never established. Absence of public passenger transport encourages the use of the car as main transport mode and also further worsens the situation for vulnerable groups of citizens, such as the elderly, physically handicapped and underprivileged people. On demand public transport with environmentally friendly small vehicles will be used to service those residential areas that are not part of public transport network. Population groups, who have due to medical or financial problems limited accessibility will be given easy access to services and enable autonomy and greater mobility.

Figure 102: On demand public transport in Maribor

P6 Promotional campaigns to promote the use of public passenger transport

Implementation of promotional campaigns will improve public image of JGP. Promotional activities will together with route optimization bring public transport closer to the citizens. Adding new service lines and increasing the number of passengers on public transport the dependence on personal vehicles will be reduced.

Figure 103: Promotional leaflet for public transport in Celje

PUBLIC TRANSPORT DEVELOPMENT		Level of complexity	Responsibility / jurisdiction	Financing sources	Indicators	Costs	Time frame
P1	Establishing visual identity of municipal public transport service	Easy	Municipality of Veles	Budget of Municipality of Veles Budget of RNM Private sector and investitors Public-private partnership EU founds and other international founds Credits Donations, etc.	Created visual identity for public transport (PT), number of remarked and arranged bus stops with all necessary equipment and systems in function of PT	High	Medium term and long term
P2	Implementation of new public passenger transport service lines	Moderately	Municipality of Veles, MTC, Macedonian railways-infrastructure		Number of new PT lines, Number of new PT rail stops	Low	Short term
P3	Reassignment of main bus station into intermodal node	Hard	Municipality of Veles , MTC		Complete functional intermodal transport center	High	Medium term
P4	Preparation of comprehensive Study for development of PT	Hard	Municipality of Veles		PT development study done	Low	Short term
P5	Introduce a System of public transport on demand	Moderately	Municipality of Veles		Implemented system of public transport on demandl for users	High	Long term
P6	Promotional campaigns to promote the use of public passenger transport	Easy	Municipality of Veles , local institutions and NGO sector		Number of campaigns and activities	Low	Continuous

Table 9: Proposed measures for public transport development

8.5. MOTOR TRAFFIC OPTIMIZATION

The basis of daily routines is that they are as fast and as comfortable as possible. People prefer to resort to the comfort of their own car, which is most convenient. Sustainable traffic planning is striving for the promotion of other travel modes and reducing the number of daily trips done with personal vehicles in municipality. This will decrease emissions and noise pollution resulting from use of motor vehicles.

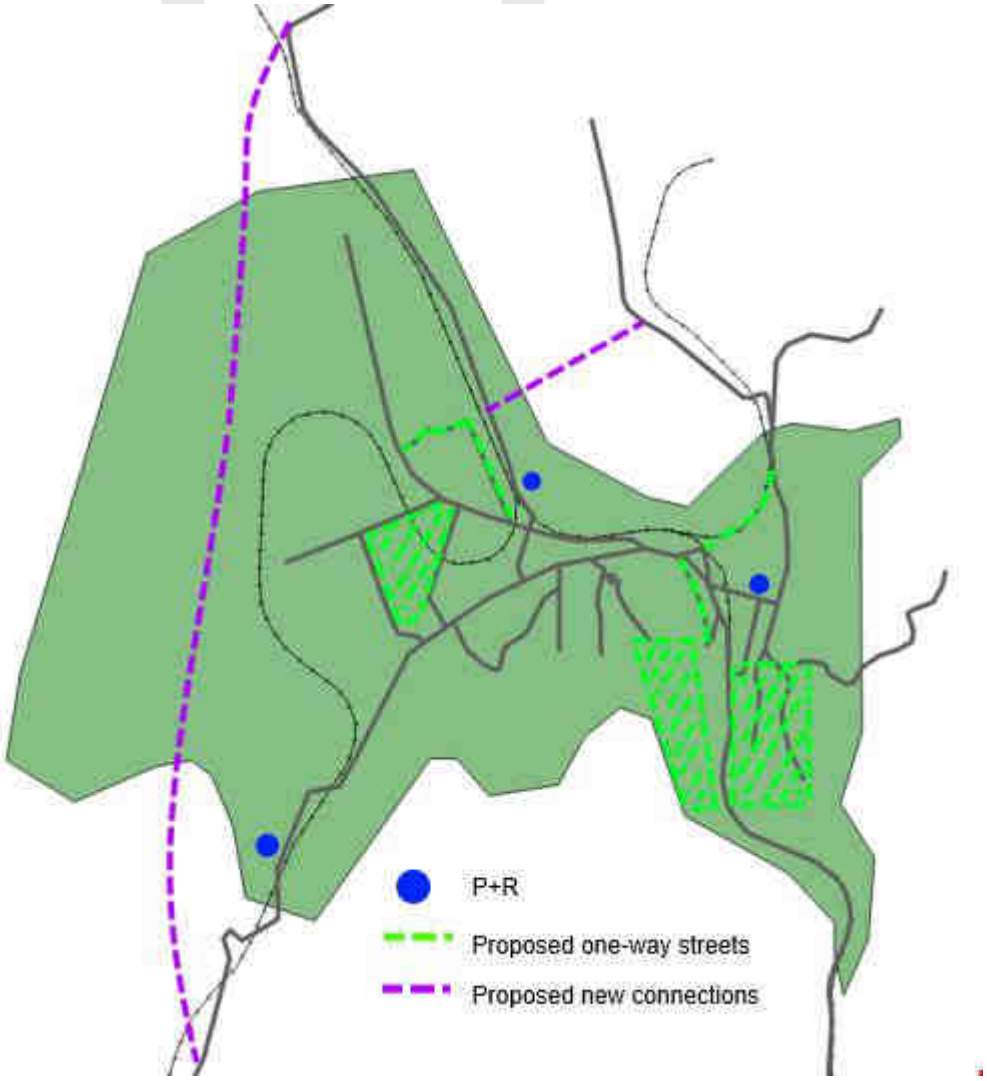
One of the biggest challenges for the Municipality of Veles is strong traffic load. Veles is located on the X European corridor, which connects Salzburg with Thessaloniki and is the connection of South Eastern European countries with the rest of Europe. Most busy road section, next to the motorway, is the main road R1312 that runs through the city centre. The consequence of heavy traffic load (especially freight traffic) is a decrease in road safety and quality of life due to noise, vibrations and emissions.

Additional challenge represents illegal parking despite the fact that a big part of the city centre is equipped with parking spaces. Illegal parking occurs on sidewalks, bus stops, traffic lanes and greenery and hinders accessibility for pedestrians (especially for people with disabilities) and cyclists and additionally decreases the attractiveness of the area. Illegal parking and unregulated macadam parking lots deteriorate the visual appearance of the urban space. Public car parking for daily work commuters will be reduced in inner city areas and relocated on outskirts of the city, while existing parking spaces in city centre will be redesigned according to new regulated parking policy. Construction of large capacity car parks at the edge of congestion zones in connection of public transport services and bike sharing system offers combined comfort of personal car use with sustainable transport modes that help reduce congestions and improve urban environment.

In course of reconstruction of existing road network, the goal is to create safe traffic conditions with adequately selected speed limits, clearly defined traffic signalisation and road elements that help establish safe driving conditions. Special attention will be paid to accident prevention and traffic regulation in areas surrounding educational institutions. The municipality will introduce restricted speed zones in the vicinity of kindergartens and elementary schools. Implementation of zones with reduced speed limits and reconstruction of existing roads with traffic calming elements will increase safety off all participants in road traffic. Roads in densely populated areas will be redesigned so high speeds will not be allowed or possible.

Proposed western bypass road will reduce negative environmental impacts by enabling better traffic fluidity, reducing congestions and re-routing of freight traffic past the residential and city centre areas. New bridge across Vardar river will facilitate the development of the surrounding areas (Rečani area) so the city can follow a more balanced and less centralised development. The investments will help to increase traffic safety, the reduction of traffic will redistribution existing road infrastructure to other travel modes.

The municipality already offers one electric vehicles charging station in city centre, another additional is planned in lake Mladost area. The extension of charging station network will service new electric and hybrid public transport veils while also encourage locals to invest in environmentally friendlier vehicles.


P+R
Proposed one-way streets
Proposed new connections

8.5.1. PROPOSED MEASURES

M1 Implementation of a parking zoning plan

Strong traffic load during peak hours and the need for parking areas in the main employment areas and in city centre presents a big challenge in future traffic planning. Traffic is an important source greenhouse gas and PM10 particles that are harmful health and pollution. The concentration of harmful emissions even greater in slow moving traffic which takes place in peak hours. The volume of long-term parking spaces in city centre must be reduced and substituted with Park and Ride capacities. Existing parking spaces in city centre will be redesigned according to new parking zoning plan which will establish short time and payable parking zones. Existing parallel parking spaces along main streets will be redesigned in compliance with urban design so that they will allow higher traffic safety and improve visual appeal of public spaces. Illegal parking will be reduced with installation of physical obstacles which will prevent parking on sidewalks and other surfaces that are intended for other uses.

Figure 104: Time regulated parking spaces

Figure 105: Physical obstacles for prevention of unauthorized parking

Figure 106: urban planning of parking spaces

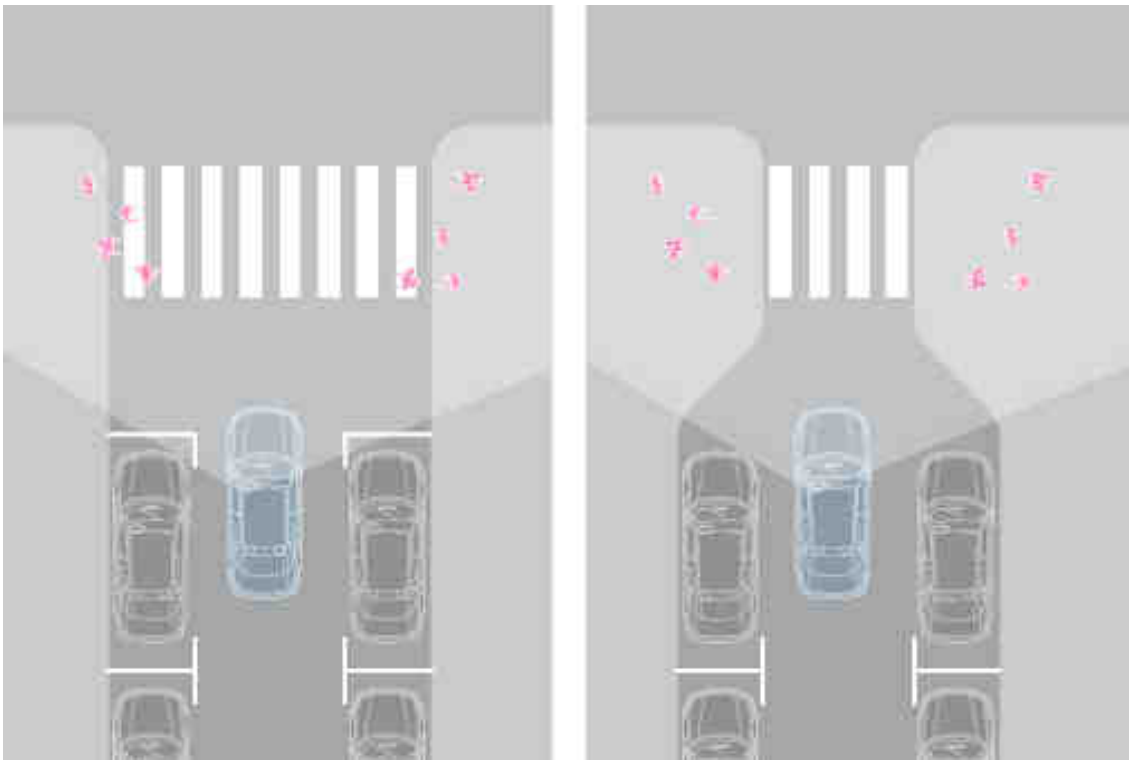


Figure 107: Marking parking spaces for safer pedestrian crossing

M2 Implementation of one-way traffic regimes

One-way regimes are arranged on roads that, due to spatial constraints, do not allow safe and smooth traffic to all participants. Other criteria for implementation of one-way regimes are to provide additional parking spaces, traffic calming, and providing space for the construction and expansion of pedestrian and cycling infrastructure. One-way arrangements are planned at:

- One-way regime to the church Sv. Pantelejmon
- One-way regime to the church Sv. Spas
- One-way regime inside area of ACHOM/Andon Shurkov/Blagov Gjorev/Boris Trajkovski st.
- One-way regime on Alekso Demnievski/Vasa Koshulcheva st.

Figure 108: One-way regime to the church Sv. Pantelejmon and Sv. Spas

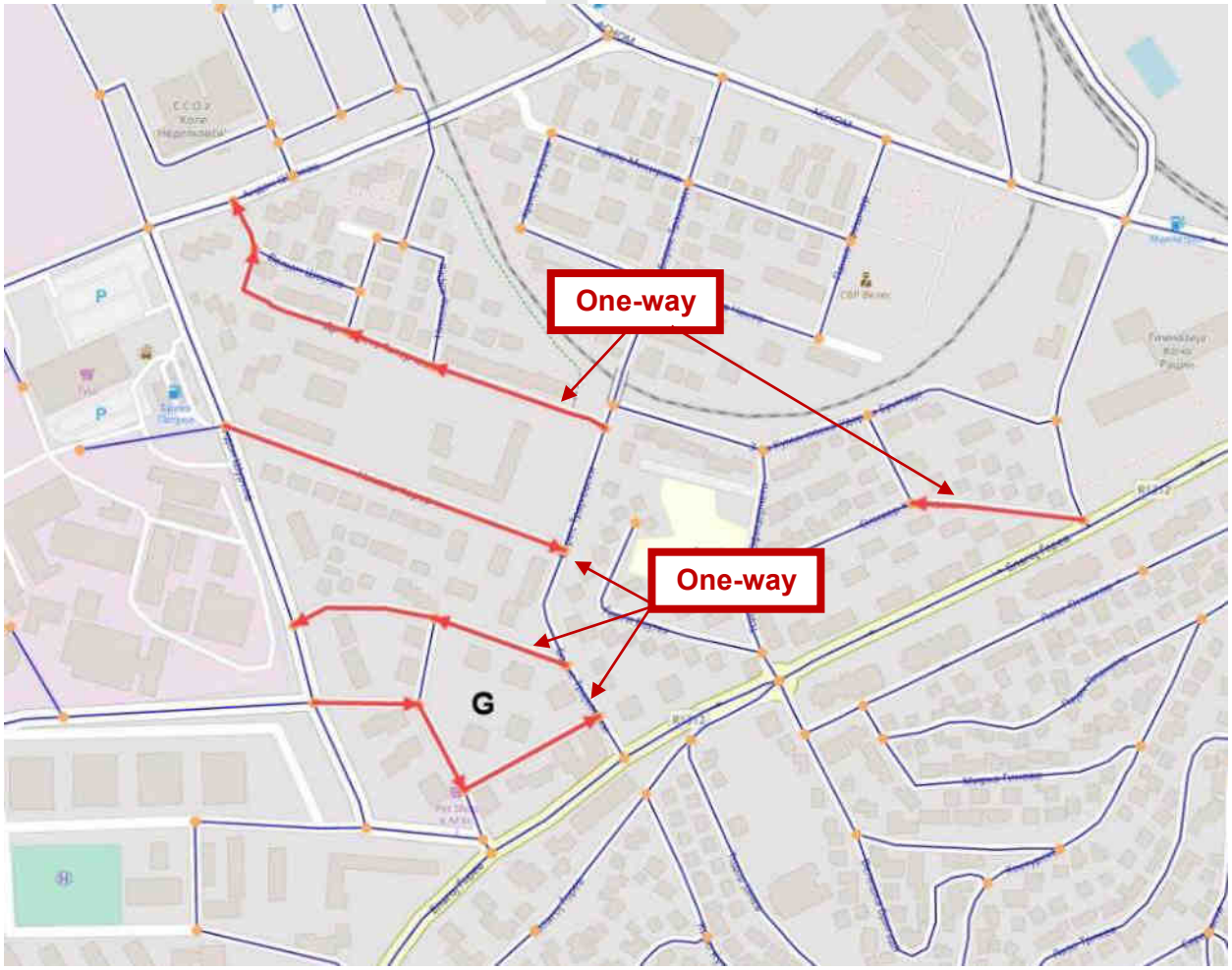


Figure 109: One-way regime inside area of Blagov Gjorev/Boris Trajkovski/Andon Shurkov

Figure 110: One-way street regulation

Figure 111: One-way road regulation with cycling and pedestrian lanes

M3 Implementation of P+R system on main entrance points

Park and Ride capacities for daily commuters will be built on main entrance points to the city. New parking areas will be connected to main employment and service areas with high frequency JGP service lines. Additionally, P+R will be equipped with bike sharing station that will offer an alternative sustainable mode of transport. Establishment of P + R system with the integration of parking for motor traffic and public passenger transport and bike sharing system will provide an intermodal point that reduces the volume of road traffic through city centre and encourages the use of sustainable transport modes. Reducing the traffic congestions will guarantee reduction of harmful emissions due to road traffic and allow reduction of parking in public spaces.

Park and ride (P&R) journey occur when a private vehicle, normally a car, is parked at a public transport node, to enable the use of a public transport service for part of the journey. The modal interchange is made either because the traveller wishes to use the public transport service as the primary mode for the journey, but a private car is judged the most effective way to access the public transport network, or, conversely, the car is the preferred primary mode for the journey, but advantages are perceived if the final part of the journey is made by public transport.

Depending on network configuration and service patterns, a specific station car park may be oriented towards opening up a whole network of destinations or towards a particular city. Moreover, the interchange may occur at various points in the journey. Where it is early, the car acts as a station access mode; where it is very late, the railway is in effect a shuttle service within the destination area. When it provides this latter function, rail P&R operates in a similar mode to most bus P&R schemes, which are oriented towards local or regional demand for travel to a core city and typified by interchange relatively late in the overall trip. One key difference, however, is that rail P&R is typically an add-on to an existing public transport service, whereas bus P&R usually involves a dedicated car park on the periphery of the urban area and a dedicated shuttle bus service which is additional to the existing bus network.
The current chapter focusses on P&R facilities with a sub-regional function, as this type of scheme features more intense and direct interactions with the urban parking market. Within this focus there is an emphasis on the empirical evidence about the effects of P&R policies. As much of this

evidence relates to bus-based schemes there is a further pragmatic focus on that mode. The chapter will begin by examining P&R as a transport planning practice, through two sections which first consider interchange capacity provision as being variants of a sociotechnical system and then examine the different policy perspectives which can motivate formal P&R policy implementation. The third and fourth sections in turn then consider the empirical evidence on the behavioural effects of P&R systems and the implications of that evidence for the wider sustainable development context, including how P&R might be delivered in ways which achieve enhanced accessibility benefits whilst also reducing total traffic. The chapter concludes by noting that the main contributions of P&R policy to date have been in the economic and traffic management domains, and by emphasising the key strategic transport planning requirements if P&R is to make a sustainable mobility contribution.

Park and ride facilities are parking lots with public transport connections that allow commuters and other people heading to city centres to leave their vehicles and transfer to a bus or rail system for the remainder of the journey. The vehicle is left in the parking lot during the day and retrieved when the owner returns. Park and ride facilities allow commuters to avoid congested roads and a search for scarce or expensive city-centre parking. They may well reduce congestion by assisting the use of public transport in congested urban areas.

The purpose of park and ride car parks is to encourage the use of public passenger transport, optimize transport costs and consequently reduce the use and thus the number of passenger cars in urban centres. Park and ride system are one of the common elements of more effective sustainable mobility as it promotes better and more flexible passenger transport. The parking area on the outskirts of the city becomes a point of contact, where car park users park it on the way to the city centre with a city bus line or bicycle rental bicycles, often provided with (nearby) park and ride parking spaces.

Park and ride are a sustainable measure, which long-term effects are reducing road congestions, reducing emissions and protecting the environment, improving the use of space in urban centres and increasing the quality of life in the city. Use of park and ride is stimulated with traffic and parking policy (price and availability of parking) and suitability of park and ride infrastructure, which usually include facility for commuters like shops, restaurants, post office,…

Figure 112: Park and ride areas

M4 Analysis and registry of accident blackspots

Analysis of traffic and road security and creating a registry of accident blackspots and dangerous sections will allow administration and police to review the dangerous traffic areas in municipality. With the on-going review will keep the register up-to-date and will allow the detection of new dangerous areas. The register will allow to set priorities for the rehabilitation of problematic areas, which will be systematically reconstructed to safety standards. By implementing various measures transport safety will be increased, especially regarding walking and cycling

Figure 113: Traffic calming measure with intersection plateau

M5 Expanding the network of charging stations

Lack of support infrastructure for electrical and gas vehicles has a negative impact on the decision to buy these types of vehicles. Because of the short distance radius that can be done with one charge, users often do not opt for long journeys with electric vehicles. Implementation of denser network of charging stations will enable easy and comfortable use of electric vehicles. New chargers should be located in areas with high demand like P+R areas, high density residential areas, city centre and tourist and recreational areas. The city should be equipped with at least 5 new charging stations.

Figure 114: Parking spaces designated for electric car charging

Figure 115: Electric car charging stations

M6 Extension of the road network

Construction of new road surfaces that bypass the city centre of Veles will relieve the main roads in the city. Redirection of transit traffic, in particular freight, will reduce the negative impacts of motor traffic. Lower traffic load main connection in the city (8-mi Septemvri st., Blagoj Gjorev st., Alekso Demnievski Bauman st.) will increase the safety of all participants and enable redistribution of existing infrastructure to other participants in traffic and increase quality of life in areas along the main road. A bypass road is planned on the western side of the city and will reroute the transit traffic from Bitola, Skopje, Gevgelija and Shtip and remove unnecessary traffic from residential and service roads. New bridges across Vardar river will create new connections with areas that are now disconnected from main service areas and allow better balanced network area by providing alternative access for local traffic and thus reducing the traffic strain on two existing bridges leading into city. The reconstruction of the existing railway bridge into the combined traffic surface for railways and motor vehicles is planned with one-way traffic regime in the direction of the city centre.

Figure 116: Railway bridge in Veles

M7 Introduction of new environmentally friendly vehicles

The municipality of Veles will with purchase of additional electric and hybrid vehicles continue to work on a path of improved sustainable mobility. The new vehicles will be used as part of JGP fleet and will operate in densely populated residential areas that are vulnerable to pollution. Smaller electric vehicles will operate on service lines connecting churches St. Spas and St. Panteleimon and serve as on demand public transport in residential areas with difficult accessibility. Bigger hybrid vehicles will be used to service bus line to General Hospital Veles.

Figure 117: Environmentally friendly vehicles in JGP fleet

In the future the municipality can invest in additional electric and hybrid vehicles that will replace administration official vehicles and include new environmentally friendly vehicles in JGP fleet. The municipality of Veles will with implementation of sustainable vehicles become a leading force of sustainable mobility on regional and national level.

M8 Implementation of Urban transportation terminal center and urban loading platforms
Although freight transport is crucial to the economic life of a city, it is also a source of congestion and emissions. Urban consolidation centre is a logistics facility that is situated relatively close to the area that it serves from which consolidated deliveries are carried. Distribution centre should be situated in a location that offers optimal connection to the rail and road network so it allows for intermodal goods distribution. An urban consolidation centre offers freight transport companies the opportunity to deliver goods to a specialist centre rather than having to make the delivery to the final customer in a busy part of the city. The collected goods are then delivered by consolidation centres own vehicles following optimised (shortest, fastest) delivery routes following municipal restrictions and delivery areas. Given the limitations in these areas (narrow roads, high density of population, residential areas), there is the need use vehicles that are smaller and sustainable. Additional option for highly congested residential areas is nearby delivery areas.

The system proposes the installation of an urban transhipment platforms - area of street space that has been dedicated to goods vehicles for the loading and unloading of goods destined for the nearby shops. Goods are unloaded from incoming vehicles and are loaded onto smaller more sustainable vehicles for the final distribution leg. Platforms should operate according to existing time regulations for freight transport.

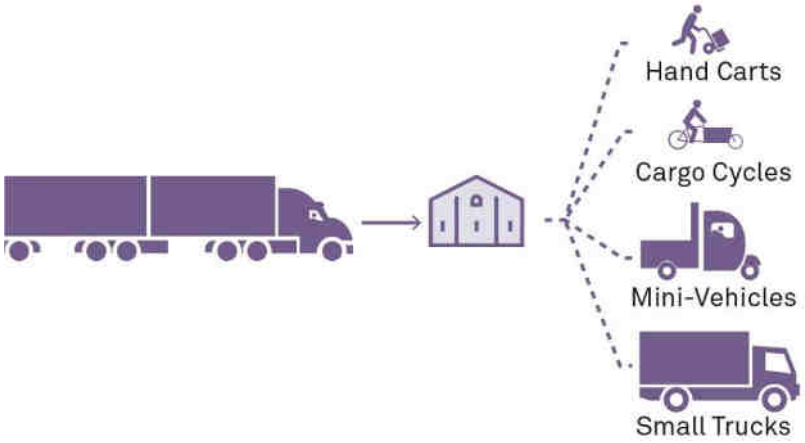


Figure 118: Consolidation centre distribution system

MOTOR TRAFFIC OPTIMIZATION		Level of complexity	Responsibility / jurisdiction	Financing sources	Indicators	Costs	Time frame
M1	Implementation of a parking zoning plan	Moderately	Municipality of Veles, Public company competent for parking	Budget of Municipality of Veles Budget of RNM Private sector and investitors Public-private partnership EU founds and other international founds Credits Donations, etc.	Implemented functional zone parking system, Number of parking spaces in parking zones	Low	Short term
M2	Implementation of one-way traffic regimes	Easy	Municipality of Veles		Number of streets with introduced one-way traffic	Low	Short term
M3	Implementation of P+R system on main entrance points	Hard	Municipality of Veles, MTC, Public company competent for parking		Number of implemented P + R systems	High	Long term
M4	Analysis and registry of accident blackspots	Moderately	Municipality of Veles MOI Veles		Reduced number of black spots	Low	Continuous
M5	Expanding the network of charging stations	Easy	Municipality of Veles		Number of supplied electric chargers	Low	Medium term
M6	Extension of the road network	Hard	Municipality of Veles, MTC		Length / area of an extended road network	High	Long term
M7	Introduction of new environmentally friendly vehicles	Easy	Municipality of Veles		Number of new environmentally friendly vehicles	Moderate	Continuous
M8	Implementation of Urban transportation terminal center and urban loading platforms	Hard	Municipality of Veles, MTC		Functionalized terminal and number of completed transshipment platforms	High	Medium term

Table 10: Proposed measures for motor traffic optimization

Goal	Objectives	Measure	Indicator
1. Greater accessibility for all population groups for a higher quality of life in the municipality	Establishing conditions for mobility management	G1 Acceptance, commissioning, revision and promotion of the SUMP G2 Training of staff in the field of sustainable mobility for the purpose of more efficient implementation and planning G3 Preparation of a balanced budget	Acceptance and revision of SUMP
	Introduction of a systematic monitoring of citizen mobility	G4 Periodically survey of travel habits	Results of mobility analysis
	Improved accessibility for all population groups	W4 Adaptation of infrastructure for people with limited mobility	Percent of adopted infrastructure
2. Establishing greater integration, competitiveness and accessibility among all transportation modes, with an emphasis on existing public passenger transport	Increased share of trips made on foot	W1 Introduction of pedestrian zones W3 Building new and improving existing pedestrian infrastructure	Percent of daily trips made on foot
	Increased share of trips made by bike	C4 Construction of parking lots for short – term and long-term bicycle parking C5 Bike rental system	Percent of daily trips made by bike
	Improving existing public passenger transport	P1 Establishing visual identity of municipal public transport service P3 Reassignment of main bus station into intermodal node P4 Preparation of comprehensive Study for development of PT	- Percent of optimized public passenger transport service lines - Share of redesigned bus stops
	Increased share of trips made by public passenger transport	P2 Implementation of new public passenger transport service lines P5 Introduce a System of public transport on demand	Percent of daily trips made by public passenger transport
	Reducing traffic load of the roads	M2 Implementation of one-way traffic regimes M6 Extension of the road network M8 Implementation of Urban transportation terminal center and urban loading platforms	Percent of daily trips made by personal motor vehicles
3. Establishing a smart parking policy that will relieve the city centre of vehicular traffic	Reducing demand for parking and new parking policy	M1 Implementation of a parking zoning plan M3 Implementation of P+R system on main entrance points	Percent of regulated parking spaces

Goal	Objective	Measure	Indicator
4. To halve the number of accidents with serious injuries and to achieve zero mortality on the roads in the municipality	Ensuring conditions for safe pedestrian trips	W2 Implementation of safe pedestrian crossings W5 Introducing safe school routes	No. of road accidents with involved pedestrians in the municipality
	Ensuring conditions for safe cycling	C1 Arrangement of cycling infrastructure along the main streets cross the city C2 Traffic signalization implementation on bicycling routes C3 Construction of the bicycle network - multipurpose paths	- Meters of new cyclist infrastructure - Percent of cycling routes with regulated traffic signalling - No. of road accidents with involved cyclist in the municipality
	Increased traffic safety and reduction of traffic accidents	M4 Analysis and registry of accident blackspots	No. of road accidents in the municipality
5. Promotion of sustainable travel methods for all groups of citizens, with an emphasis on young people	Promotion of sustainable transport modes	G5 Promotional and educational campaigns for promotion of sustainable transport modes W6 Promotion of walking C6 Promotion of bicycling P6 Promotional campaigns to promote the use of public passenger transport	No. of promotional campaigns carried out
	Promotion of environmentally friendly motor vehicles	M5 Expanding the network of charging stations M7 Introduction of new environmentally friendly vehicles	- No. of electric charging stations installed - Percent of environmentally friendly vehicles in municipality

Table 11: Integrated presentation of measures according to SUMP strategic goals