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Mobility scenarios

City of Gradiska

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Strategic framework for the development of the City of Gradiska

A key strategic document guiding the development of the local community is the Gradiška City Development Strategy for the period 2019 to 2027. The strategy focuses on three major aspects: economic, social and environmental aspects. Issues related to the mobility of people, services and goods are cut across all three segments as sustainable mobility planning is based on an interdisciplinary approach. The Strategy recognizes that road infrastructure is the dominant type of infrastructure in the City of Gradiška, that there are all three categories of roads and that in the previous period the quality has been improved primarily by increasing the share of paved local roads. The strategy envisages the following measures: modernization of local and uncategorized roads, improvement of pedestrian zone with city square, construction of a bypass, modernization of city streets and parking spaces.

The City of Gradiška is one of the local communities in BiH that has joined the European Commission 'Covenant of Mayors' initiative. With this agreement, the mayors are committed to implementing concrete energy efficiency improvement measures that aim to reduce CO₂ emissions by up to 20% by 2020 and increase the share of energy produced from renewable sources by 20%. In accordance with the signed Agreement, Gradiska developed a Sustainable Energy Action Plan (SEAP). During the preparation of the document, local self-government units from BiH analyzed for the first time their energy consumption and greenhouse gas emissions in their area. SEAP Gradiška has plans to reduce CO₂ emissions by 2020 by sector, namely: construction, heating and waste, transport, forestry and agriculture. Within the transport sector, measures are foreseen in the form of increasing pedestrian zones, construction of bicycle lanes, installation of interchangeable traffic signs and promotion of electric vehicles, which would lead to improved mobility and reduced emissions in the Gradiška area. The consequences of the economic crisis, the flood of 2014 and unrealistic goals have led to the SEAP not being fully realized. An additional difficulty in achieving certain SEAP goals is the lack of state-level legal frameworks.

Gradiška developed the Local Environmental Plan (LEAP), which set goals to rationally manage scarce natural resources and take care of the environment. The plan provided guidance for better environmental management in different areas, and areas of air quality protection and noise management are of particular importance for sustainable mobility.

The City of Gradiška has adopted the Road Safety Strategy on the Roads of the Municipality of Gradiška for the period from 2013 to 2022. The Strategy defined the goals in the field of improving traffic safety for all participants as well as reducing the number of traffic accidents in the territory of Gradiška. The principles underlying the Strategy are: striving for the highest standards, comprehensiveness of access to road safety (involvement of all sectors) and proportionality of shared responsibility. Activities in the following five pillars are proposed: Organization and implementation of road safety, safer roads and traffic, safer vehicles, safer road users and post-accident activities.

The City of Gradiška has adopted a spatial and urban plan for the period 2005-2020.



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1. “Business-as-usual” scenario

Area Name	City of Gradiška, Bosnia and Herzegovina
Scenario Name	Business-as-usual
Date	April 2020
Policy target year	2030

Baseline data for 2017 shows that Gradiska has a motorization rate of 275 per 1000 residents. The modal split is the following: car 56,6%, public transport 13,8%, cycling 0,9% and walking 28,7%. Other types of transport (tram, train, metro) do not exist on the target territory. Green vehicles are not registered in the territory. On the demographic side, Gradiska has a population of around 48000 residents with negative trend of slow decrease of population, which is characteristic for the wider area. Gradiska, and Bosnia and Herzegovina as a whole, are considered as low income areas. Number of registered accidents in 2017 with serious injuries is 38, while there were 4 fatalities. The baseline data is based on the previously carried out survey, experts estimates and calculations using the EU Urban Transport Roadmaps tool¹.

This scenario foresees continuation of the current transport/mobility policies in the next 10 years.

The local authorities will continue with current trend of small investments in regular maintenance of the road network. Construction of cycling lanes and pedestrian paths is not considered as a priority. The public transport is operated by private companies, licensed by the local authorities and no incentives for replacement of the bus fleets are foreseen by the local authority. The bus network does not cover the central urban area of Gradiska, rather it connects the suburban areas to the main bus station in the city.

The results of scenario “Business as usual” are mainly influenced by overall trend of economic growth are slightly rising incomes, leading to increase of the motorization rate and modal share of cars. The motorization rate will continue its current trend of increase and will be 353 vehicles per 1000 residents. The modal split of cars will increase to 57,6%, while other modes will slightly decrease. The uptake of green vehicles will be negligible and in any case not a result of policies, but rather the result of rising incomes and individual awareness of citizens on environmental protection. Emissions from transportation (CO₂, PM, CO, NO_x and VOC) will decrease, mostly as a result of technological improvements and replacement of older vehicles with newer, cleaner engines. However, this decrease is not a result of any specific policy or incentive by the local authority.

Impacts of “Business as usual” scenario are very limited since it is not made by the choices of the local authority but rather by external factors. There are some positive impacts regarding decrease of emissions and accidents, but there is constant increase of use of personal cars for transport that will have negative effects of congestion. If these policies continue to be implemented in the long term, the currently positive impacts will turn to negative, caused by the high motorization rate, neglected public transport and active modes. The scenario foresees continuation of the current, very limited and outdated, mobility policies.

¹ <http://www.urban-transport-roadmaps.eu/>

2. Scenario description

This scenario foresees continuation of current transport / mobility policy in the next 10 years. The traffic congestion caused by border crossing in the municipality will be increasing until establishment of new border crossing in 2025. The modal share of cars will increase, with increase of the motorization rate to 353 cars per 1000 residents, while congestion in the urban center will be increased. Traffic will adversely affect the environment and business activities. The modal share of cycling and walking will decrease. Public transport will be of poor quality and its modal share will decrease. There will be an increase in the number of improperly parked vehicles, and a worsening of traffic safety. Vehicles will have an advantage over people. Integrated mobility will not exist.

The total population in the city will decrease by 5% and will be around 45.000 but number of private vehicles will be increased by 10%. There will be significant changes in the age structure, they will continue the current trend. The share of the population 0-44 will decrease, and the share of the elderly population will increase. The share of population older than 45 will be over 60%.

Regarding the types of transport technology that will be diffused by 2030, it is predicted that the modal share of public transport will further decrease to 13,5% while the modal share of cars will further increase to 57,6%. The modal share of cycling will remain negligible at 0,8%, while walking will decrease slightly to 28,1%. The uptake of green vehicles will be negligible.

This scenario is a continuation of the current mobility policy of the City of Gradiska. The current mobility policy does not feature sustainable development. The scenario business as usual will not lead to improvement of living quality in particular related to acceleration of mobility, transport safety and land use.

Emissions from transport will be decreased as a result of technological improvements and purchase of vehicles with newer, cleaner engines. Traffic safety will be increased, with reduction of accidents with serious injuries and fatalities resulting from regular activities and safety campaigns, for all groups and traffic modes, especially for pedestrians.

The number of public transport users will be reduced due to the lack of a policy of favoring public transport. Then there will be an increase in the price of tickets in public transport, which will lead to further reduction of the number of passengers. Costs related to maintenance and construction of new roads will increase due to increased traffic. The end users will have higher costs due to increase of fuel prices and vehicle ownership duties.

CO2 emissions will be slightly decreased. However, this reduction is not result of policies but rather the result of technological improvements and replacement of older, more polluting vehicles.

Characteristics of transport:

- the number of trips will not increase and the average length of trips will remain the same
- the motorization rate will increase to 353 vehicles per 1000 population
- the modal share of cars will increase to 57,6%

- the modal share of public transport will decrease to 13,5%
- the modal share of cycling will remain negligible and decrease to 0,8%
- the modal share of walking will decrease to 28,1

3. Fostering „active“ transport modes (walking and cycling) scenario

Area Name	City of Gradiška, Bosnia and Herzegovina
Scenario Name	Fostering „active“ transport modes (walking and cycling)
Date	April 2020
Policy target year	2030

Baseline data for 2017 shows that Gradiska has a motorization rate of 275 per 1000 residents. The modal split is the following: car 56,6%, public transport 13,8%, cycling 0,9% and walking 28,7%. Other types of transport (tram, train, metro) do not exist on the target territory. Green vehicles are not registered in the territory. On the demographic side, Gradiska has a population of around 48000 residents with negative trend of slow decrease of population, which is characteristic for the wider area. Gradiska, and Bosnia and Herzegovina as a whole, are considered as low income areas. Number of registered accidents in 2017 with serious injuries is 38, while there were 4 fatalities. The baseline data is based on the previously carried out survey, experts estimates and calculations using the EU Urban Transport Roadmaps tool².

This scenario foresees fostering of active transport modes. The local authority will support increase of the modal share of walking and cycling by implementing targeted measures.

The local authorities will implement targeted measures in order to support increase of modal share of walking and cycling.

- Land use planning will be utilized during planning and design of new construction and development in the target territory in order to support sustainable urban mobility and active transport modes.
- The local authority will implement a bike share system, mainly as a promotional tool for the larger population but also to incentivize cycling as a transport mode. The bike share system will at first be set up in the central urban area and later expanded to cover wider area of the FUA.
- The local authority will widen the walking/cycling network, with obligatory pedestrian and cycling paths constructed with each new road. Cycling paths will be built along the streets, the green surfaces, Sava river and off-road trails to National park Kozara. Traffic signs for bicycle traffic will be set up as well as parking spots for bicycles.
- The local authority will implement traffic calming measures during urban planning and design of neighborhoods with the aim to increase safety and support use of sustainable mobility modes, mainly walking and cycling.
- Implementation of access regulation will define low-emission zones where regulation will define the emission standards of vehicles that may operate in that area, while other will be prohibited.

² <http://www.urban-transport-roadmaps.eu/>



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This measure will greatly incentivize walking and cycling as they are the least expensive model of complying with the regulation.

The results of scenario “Fostering active transport modes” are focused on the modal shift to sustainable mobility modes and decrease in emissions. The motorization rate will continue its current trend of increase and will be 350 vehicles per 1000 residents. The modal split of public transport, cycling and walking will increase to 16,6%, 1,7% and 36,7% respectively, while the modal share of cars will decrease to 45%. The uptake of green vehicles will remain negligible and in any case not a result of policies, but rather the result of rising incomes and individual awareness of citizens on environmental protection. Emissions from transportation (CO₂, PM, CO, NO_x and VOC) will decrease significantly as a result of increase in the modal share of sustainable mobility modes. The focus on safety will result in decrease of accidents with serious injuries and fatalities.

The “Fostering active transport modes” scenario has a significant impact on the modal split and its shift to sustainable mobility modes. Furthermore, transport emissions will be significantly reduced and accidents will be moderately decreased. While the overall population is expected to be reduced, the quality of life will be improved. Congestion caused by local vehicles will be reduced, while congestion caused by the border crossing is expected to be eliminated with construction of the new bridge and border crossing outside of the urban area, expected to be completed in 2025.

4. Scenario description

Topographically, Gradiška is very favorable for bicycle traffic. There will be a network of bicycle trails and tracks in the municipality. On the street, where possible, cycling routes will be marked. Some streets will turn into one-way ones, and there will be space for marking bicycle tracks. Bicycle paths will be built along the streets and along the green surfaces, Sava river and off-road trails to National park Kozara. Traffic signs for bicycle traffic will be set up, as well as parking spots for bicycles. The bike sharing system will be implemented with terminals for rent in every major part of the City. Walking trails will be maintained and new will be build up. The area of joint use for all traffic modes will be designated in the municipal center.

The quality of life in the municipality will be better. The municipality will attract young people to come to live in. The total population will steadily slow its decline while the share of the population 0-14 and 15-39 and 40-64 will increase in comparison with the previous years, and the share of the elderly population (65-84 and 85+) will start to decline.

Penetration of green vehicles will be negligible, while the population will slowly replace older vehicles with newer, more efficient and cleaner ones.

This scenario is in line with the upper-level transport policy of the country, the region and the sustainable urban mobility policy of the EU. Thanks to increased modal share of walking, cycling and public transport, population will be healthier, transport emissions will be significantly reduced and overall traffic in FUA will be more efficient. The quality of life in the area will be improved.

The use of cycling and walking as a transport mode by all inhabitants will increase. Simultaneously with the construction of bicycle trails along the Sava river and through the park (green) areas, pedestrian tracks

will be built and this will lead to increased movement of the older population. Tourists and local population will be able to use a bike sharing system. With a high number of users, bike sharing system will be available at lower costs, so it will be accessible for low-income groups.

Local governments will find financing models in order to invest in infrastructure and bike sharing system that will be eventually payed off by end users of the system. In total, end users will achieve savings thanks to lower cost of fuel, parking and vehicle maintenance. There will be a reduction in transport-related energy consumption.

Transport-related CO2 emissions will be significantly reduced due to decrease in the modal share of passenger cars and gradual replacement of older, more polluting vehicles with newer, more efficient and cleaner ones.

Characteristics of transport:

- the number of trips will increase
- the modal share of cycling will increase to 1,7%
- the modal share of walking will increase to 36,7%
- the modal share of public transport will increase to 16,6%
- the modal share of passenger cars will decrease to 45%
- the local population will develop awareness of healthy life-styles and non-motorized movements

5. “Making public transport more attractive” scenario

Area Name	City of Gradiška, Bosnia and Herzegovina
Scenario Name	Making public transport more attractive
Date	April 2020
Policy target year	2030

Baseline data for 2017 shows that Gradiska has a motorization rate of 275 per 1000 residents. The modal split is the following: car 56,6%, public transport 13,8%, cycling 0,9% and walking 28,7%. Other types of transport (tram, train, metro) do not exist on the target territory. Green vehicles are not registered in the territory. On the demographic side, Gradiska has a population of around 48000 residents with negative trend of slow decrease of population, which is characteristic for the wider area. Gradiska, and Bosnia and Herzegovina as a whole, are considered as low income areas. Number of registered accidents in 2017 with serious injuries is 38, while there were 4 fatalities. The baseline data is based on the previously carried out survey, experts estimates and calculations using the EU Urban Transport Roadmaps tool³.

³ <http://www.urban-transport-roadmaps.eu/>

The local authorities, in addition to regular maintenance of the road network will develop and implement measures in order to boost utilization of the public transport by residents and tourists. The local authorities will implement the following group of measures:

- Land use planning – planning of new construction and development in the target territory in order to support sustainable urban mobility and public transport modes.
- Introduction of the green public fleets – Local authorities will provide support to the public transport operators in order to modernize bus fleet and introduce green buses in the public transport system.
- Improvement of bus network – Local authorities will coordinate with public transport operators in order to redesign layout of public transport and to introduce new lines where necessary. The occupancy and economic impact of each line will be measured and regular updating of the network will be realized. Local authorities will invest in modernization of bus stops and station.
- Public transport integrated ticketing and tariff schemes – The integrated ticketing for all public transport operators will be realized in order to increase flow of the travel by public transport and improve convenience of passengers traveling long distances or to more than one location. Tariff schemes will be developed in order to reduce costs for passengers and stimulate use of public transport.
- Prioritizing public transport – The traffic system in the target area will be designed in order to give priority to public transport vehicles where ever possible and to reduce travel time in public transport. This measure will stimulate use of public transport.

The results of scenario “Making public transport more attractive” are influenced by realized measures of the local authorities in target area during short, medium and long term. Nevertheless, the motorization rate will continue its current trend of increase thanks to overall economic growth and in 2030 will be 350 vehicles per 1000 residents. The modal split of cars will decrease to 44,6% while other modes will increase, bus to 18,6%, bicycle to 1,1% and walking to 35,7%. The accidents with serious and fatal injuries will be reduced in comparison to the base year thanks to better land use planning and decrease of personal car use in mode share. The uptake of green vehicles will remain negligible, but thanks to support of the local authorities public buses on alternative fuels will start to emerge. Emissions from transportation (CO₂, PM, CO, NO_x and VOC) will be significantly reduced. This reduction is mostly result of the actions taken by local authorities in support of green public buses and tanks to reduced modal share of personal cars in overall traffic in addition to the technological improvements and replacement of older vehicles with newer, cleaner engines.

Impacts of “Making public transport more attractive” scenario are mostly visible in the changes of the mode split where use of car is reduced and all other modes are increased. While the main objective of the scenario is to support use of the public transport, the positive effects are showed in increase of active modes as well. Significant jump of public transport in mode split for 4,8% in 10 years is result of active policies and change in the behavior of the residents that is indicator of constant growth in future years as well. While the indicators regarding introduction of the green public fleet and increase in average bus

speed are positive, they are very limited thanks mainly to the low level of resources that local authority can invest in full realization of the foreseen measures.

6. Scenario description

This scenario is putting public transport in priority. Local authorities will co-finance the cost of public transport in large part. They will finance modernization of bus stations and introduction of green bus fleets consisting of primarily new buses. Specially designated traffic lanes for public transport will be developed. Modern technology such as an electronic map will be used, the stations will have bus time displays, Wi-Fi and LCD monitors for useful information. Buses will be used up to 10 years old. New bus lines in the urban part of the municipality will be put in place. The parking cost in the central area will increase. The use of passenger cars will be reduced. The number of passengers in public transport will increase. The negative impact on the environment will decrease.

The quality of life in the municipality will be better. The municipality will attract young people to come to live in. The total population will steadily slow its decline while the share of the population 0-14 and 15-39 and 40-64 will increase in comparison with the previous years, and the share of the elderly population (65-84 and 85+) will start to decline.

New buses with more efficient engines will be used in public transport. In long term, buses on alternative fuel such as hybrid, CNG and electric will start to be used in public transport. Intelligent Transport System will be used to inform passengers. The population will be able to use different types of payments for public transport (electronic cards, monthly and daily tickets, prepaid tickets that can be used for other modes like bike sharing etc.) Current buses that are over 20 years of age will not be used. With increase of modal split of public transport, residents will use more cycling and walking rather than personal vehicles.

This scenario is in line with the regional upper-level transport policy and the sustainable urban mobility policy of the EU. The problem is the lack of effective transport policy at the entity level that would give priority to public transport. For example, at the moment of registration of the bus, a fee for the use of the highway is paid and buses in public transport do not use the highway. For example, the state should co-finance the use of biodiesel. Public and private institutions should buy a ticket for public transportation to workers and not to pay funds to their accounts that afterwards are not used for the public transport. Thanks to increased use of public transport, overall emissions from transport (CO₂, PM, CO, NO_x, VOC) will be reduced and overall traffic in FUA will be more efficient.

Measures under this scenario imply cheaper tickets, free tickets for people older than 65 years, cheaper tickets for student, LCD displays on bus station and in the buses with the ability to display in English, the greater use of low-floor buses and others. This will affect all demographic groups of the population as well as tourists and visitors from the region. As a result of implementation of measures in this scenario, number of accidents with severe injuries and fatalities will be reduced. Overall traffic safety for all groups will be improved.

Local governments will find financing models in order to invest in infrastructure and provide more funding in public transport based on public-private partnership. The end users will have cheaper tickets with better

service and will achieve savings thanks to lower cost of fuel, parking and vehicle maintenance. There will be a reduction in transport-related energy consumption, since use of personal vehicles will be decreased. CO₂ emission will be reduced for approximately 4600 t/year in comparison to the 2017 as the base year.

Characteristics of transport:

- travel distance per trip will be reduced to 2,8 km
- modal share of public transport will increase on 18,6%
- modal share of passenger cars will be reduced to 44,6%
- modal share of walking will increase on 35,7%
- total emissions from the transport will be reduced
- buses will be able to transport bicycles in a convenient way

Indicator/ Scenarios of mobility for the City of Gradiska	Baseline (2017)	Business-as-usual	Fostering active transport modes	Making PT more attractive	Mix of policies of fostering active and PT
Motorisation rate	275	353	350	350	348
Mode split (%)	Car: 56,6% Bus: 13,8% Bicycle: 0,9% Walk: 28,7%	Car: 57,6% Bus: 13,5% Bicycle: 0,8% Walk: 28,1%	Car: 45,0% Bus: 16,6% Bicycle: 1,7% Walk: 36,7%	Car: 44,6% Bus: 18,6% Bicycle: 1,1% Walk: 35,7%	Car: 39,6% Bus: 21,9% Bicycle: 2,2% Walk: 36,3%
Travel distance per trip (km)	3.1	3.1	2,8	2,8	2,8
Average car speed in peak hours (km/h)	36	35,7	35,5	37,5	37,2
Average bus speed in peak hours (km/h)	14,4	14,3	14,6	15,1	15,4
Vehicles-km by car conventional vehicles	109	95	80	79,4	69,2
Penetration of alternatively fuelled car vehicles	0.0% hybrid electric 0.0% battery electric 0.0% fuel cells	0,07% hybrid electric 0.0% battery electric 0.0% fuel cells	0,07% hybrid electric 0% battery electric 0 % fuel cells	0,07% hybrid electric 0.0% battery electric	0,07% hybrid electric 0.0% battery electric
Penetration of alternatively fuelled bus vehicles	0%	0,05% hybrid electric 0.0% battery electric	0,052% hybrid electric 0.004% battery electric	0,09% CNG 0,11% hybrid electric 0.0% battery electric	0,09% CNG 0,11% hybrid electric 0.0% battery electric
CO₂ emissions per year (tonnes)	48216	46376	43928	43579	41967

Indicator/ Scenarios of mobility for the City of Gradiska	Baseline (2017)	Business-as-usual	Fostering active transport modes	Making PT more attractive	Mix of policies of fostering active and PT
PM emissions per year (tonnes)	6,43	3,85	3,55	3,44	3,25
CO emissions per year (tonnes)	114	99	98	94	95
NOx emissions per year (tonnes)	143	78	74	70	67,9
VOC emissions per year (tonnes)	27	22	22	21	21
Total Accidents by severity	38 serious 4 fatal	33,4 serious 3,51 fatal	30,2 serious 3,34 fatal	30,2 serious 3,3 fatal	27,5 serious 3,1 fatal
Transport expenditure per individual per year (EUR)	758	763	747	718	782