Regional Action Plan

Study the possibility of extending existing car-sharing solutions to resort remote areas Birštonas town and Druskininkai town (Lithuania)

December 2020

Content

Introduction

Lithuanian team performs a case study in the two resort areas of Lithuania – Birštonas, and Druskininkai. An idea of the VGTU research team is to evaluate the possibilities to implement the car-sharing system in these Lithuanian resorts, especially the most popular among inhabitants of Lithuanian largest cities Vilnius and Kaunas.

Birštonas is a small spa town located in the central part of Lithuania. The distance from the capital Vilnius is about 100 km, 46 km from the second biggest city Kaunas, 45 km from Marijampolė, and 35 km from Alytus. There are five sanatoriums in Birštonas, which operate the whole year. Druskininkai is located in the south of Lithuania, close to the Belarus and Poland border. The distance to Druskininkai from Vilnius and Kaunas is about 130 km, 90 km from Marijampolė, and 60 km from Alytus. According to the Lithuanian Department of Statistics data, there were 2,369 inhabitants in Birštonas town and 12,209 in Druskininkai in 2019. Locations of Birštonas and Druskininkai resorts are presented in Figure 1. Both considered resorts are on the bank of the biggest Lithuanian river Nemunas.

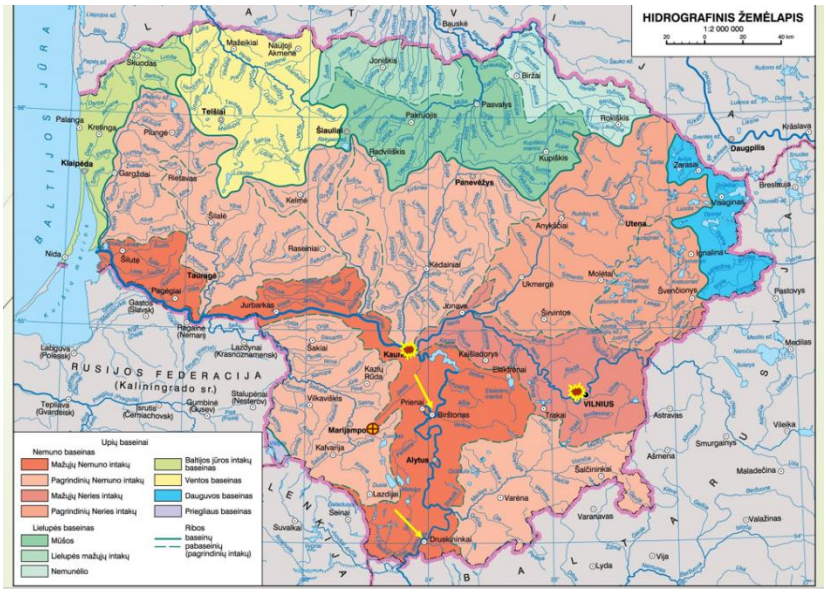

Figure 1. Location of Birštonas and Druskininkai resorts

International highway „Via Baltica" is the most important transit road, which crosses Lithuania territory from South to North. The length of this road is more than 970 km, which is a part of European Route E67 and links Poland (Warsaw) and the Baltic States (Tallinn). Route E67 passes four Lithuanian cities: Marijampolė, Kaunas, Kėdainiai, and Panevėžys. These cities are quite big

transport hubs, especially Kaunas with a railway station and international airport. Marijampolė town is located 45 km far away from Birštonas and 90 km from Druskininkai. The foreign guests and tourists use Marijampolė bus station as a transferring point to choose another transport mode (service operator) to reach Birštonas or Druskininkai resorts. Another significant highway (route A16) "Vilnius-Marijampole" crosses the Birštonas municipality area.

VGTU research team decided to compare the possibilities of car-sharing system implementation in both chosen resorts and to identify which one is more suitable for this new transport mode.

Transport planning – national and regional level regulations

All matters of territorial planning in Lithuania are regulated by the "Law of the Republic of Lithuania on Territorial Planning" (The 12th December 1995, No. I-1120. /As last amended on the 27th Septembers, 2016. No. XII-2643) (hereafter – the Law). The territorial planning documents at three different levels must interact and be in a common ideological/ jurisdictive environment. The flowchart of this interaction presented in Figure 2.

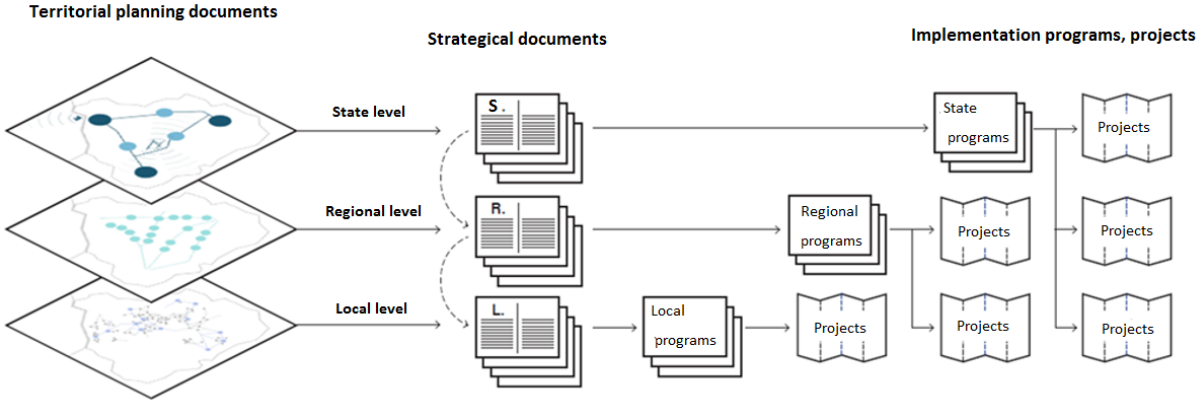

Figure 2. Three levels of territorial planning in Lithuania
(The Decree of Lithuania Seimas on Approval of Spatial Development … 2020)

Local level of territorial planning are parts of the territory of a municipality are planned: cities (or parts thereof), towns (or parts thereof), villages and steadings (comprehensive plans of separate urbanised territories or territories under urbanisation are prepared at a scale of 1:2,000–1:10,000, detailed plans at a scale of 1:500–1:1,000 and documents of special territorial planning at a scale of 1:500–1:10,000).

The preparation of documents of municipal-level and local-level territorial planning shall be organised by the Director of municipal administration, except for the territorial planning documents specified of cases controlled by Institutions authorized by the Government (State level; protected areas; and specified by other laws) and the cases when other laws specify other organizers of special territorial planning.

The solutions of documents of state-level complex territorial planning, documents of territorial planning of projects of importance to the State, documents of special territorial planning approved by the Government and subsoil use plans shall be of higher legal validity than the solutions of documents of municipal-level and local-level complex and special territorial planning and shall apply on a mandatory basis to municipalities when preparing, amending or adjusting the documents of municipal-level and local-level territorial planning. The solutions of the documents of territorial planning of projects of importance to the State shall be mandatory for documents of state- and lower-level territorial planning. When applying the solutions of the documents of territorial planning of projects of importance to the State, the solutions of the documents of state- and lower-level territorial planning shall apply to the extent they do not contradict the solutions of the documents of territorial planning of projects of importance to the State.

Managers and users of the land shall act in compliance with documents of lowest level complex territorial planning valid in a planned territory, and in case of un-urbanized territories and territories not under urbanization – with documents of special territorial planning.

The following documents shall be attributed to documents of complex territorial planning: the comprehensive plan of the territory of the State and the comprehensive plans of parts of the territory of the State (prepared at the state level); the comprehensive plans of municipalities (prepared at the municipal level) or the comprehensive plans of parts thereof (prepared at the local level), and detailed plans (prepared at the local level).

Municipal institutions shall:

1) implement state policy in the field of territorial planning when preparing documents of municipal-level and local-level territorial planning,
2) carry out the monitoring of the implementation of solutions of municipal-level and local-level comprehensive plans;
3) provide information to the public on the process of territorial planning and decisions adopted in the process and enable the public to participate in the process of territorial planning.

The Law provides the Public discussion on a territorial planning document, which means a territorial planning publicity procedure during which, after the public has familiarized themselves with the prepared territorial planning document following the set procedure, a public meeting is held to consider the solutions of the document and their alternatives and proposals submitted.

The main mandatories of the Law considering the Comprehensive plans of municipal-level and local-level:

I. Comprehensive plans must be prepared for the territory of each municipality and shall be valid for an indefinite period.
II. Local-level comprehensive plans shall be prepared for priority development territories specified in municipal-level comprehensive plans-towns and parts thereof and territories of

villages and steadings or following a decision of the municipal council to prepare the comprehensive plan of a part of the municipality in a respective part of the municipality.

III. Local-level comprehensive plans shall be valid until the preparation and approval of the same level territorial planning documents amending them.
IV. Municipal-level and local-level comprehensive plans shall be mandatory for state and municipal institutions and shall entitle them to act while planning the funds and preparing detailed plans. The municipal-level and local-level comprehensive plans shall be mandatory for all natural and legal persons or other organisations operating in a territory that has been planned, where detailed plans have not been prepared.

The tasks of municipal-level and local-level comprehensive plans are these: to form the directions of the functional and spatial development of a territory consistent with the level of planning; to optimise the urban structure of the planned territory, its' social and engineering infrastructure; to provide for measures for rational preservation and use of subsoil resources, agricultural land, forests and other natural resources, the use of the nature frame and ecologically sound land, the formation of territorial structure, preservation of natural and immovable cultural heritage, landscape and biodiversity; and to detail solutions of respective documents of higher-level complex territorial planning.

Having assessed the specific needs of the public, social and economic characteristics of a planned territory, strategic planning documents and the level and scale of the comprehensive plan being prepared, the organiser of planning shall establish in the programme of planning works a planned period not shorter than 10 years and additional legislation-based planning tasks.

The Law on Territorial Planning of the Republic of Lithuania establishes the following tasks for the preparation of the general plan of the country's territory (Paragraph 3 of Article 11), among which: 3) to optimize the state urban structure, engineering and social infrastructure systems, recreational and other territorial structures; Article 12 (Paragraph 1) of the Law states that general plans at the state level shall establish mandatory provisions for state and municipal institutions. Of these, the following are important for the development of settlements: 2) the system of residential areas of the state territory - the system of urban centers and their functional relations, the perspective of the development of urban canters; <...>. 5) development of main roads of state significance and other transport infrastructure of state significance ..." In 2002 the approved General Plan of the territory of the Republic of Lithuania (hereinafter - the General Plan) is the main planning document regulating the long-term strategy for the use and management of the territory of the country.

The latest (2020) regulation of territorial planning in Lithuania is the Decree of Lithuanian Seimas (Parliament) on the Approval of the Spatial Development Directions of the State Territory of the General Plan of the Territory of the Republic of Lithuania and the Functional Priorities for the Use of the Territory (The 4th June 2020 No. XII-3021).

The 2nd Clause of this Decree is „Sustainable agriculture sector and lively rural areas". Mobility is defined as a service and a human right. The main aim is to create, optimize and ensure the availability of regional public transport and efficient services in line with the state urban policy and creating a sustainable travel structure, increase the interaction of intermodal transport, private and public transport for everyday travel, ensure a simple and common payment system.

Emphasis is placed on the absolute set of rural/ remote area transport infrastructure that meets the needs of disabled and elderly people (pedestrian, bicycle infrastructure system, public transport system, buildings, structures, public spaces, objects providing international services and their infrastructure).

The vision of sustainable people mobility structure and changing the priorities of the main components of the mobility system is presented in Figure 3:

Figure 3. Vision of prioritizing the components of the people mobility system

Noticeable, that a prerequisite and condition for a sustainable travel structure is that territorial planning must generate short, walking, or non-motorized journeys.

Description of the region and existing mobility models/offers

The territory of Birštonas municipality is located in the eastern part of the regional park Nemunas Loops. Birštonas is oriented on a tourism service and is the regional significance centre. The development of Birštonas Regional Park of river Nemunas Loops and Birštonas Resort City is closely interlinked. Perspective provisions and specified solutions for their improvement should be harmonized mutually. The view of the surroundings of Birštonas Regional Park is presented in Figure 4.

Figure 4. Surroundings of Birštonas Regional Park (author Vaidotas Grigas)

Druskininkai is also one of the largest tourist, holiday attraction centres in Lithuania, located in a convenient geographical location, with deep recreational, and sanatorium traditions, preserved natural health resources, and formed a modern attraction infrastructure. The view of the surroundings of Druskininkai is presented in Figure 5.

Figure 5. The surrounding area of Druskininkai (source: 15min.lt)

At the beginning of 2019, 4,117 people lived in the whole Birštonas municipality, of which 2,369 (57.5%) were in Birštonas town, and 1,748 people (42.5%) were rural residents. During 2014-2019, the population of Birštonas municipality decreased by 252 people or 5.77%. The number of people in Birštonas decreased by 106 people (4.28%). The rural population decreased by 146 (7.71%).

According to the data of the Department of Statistics of Lithuania, at the beginning of 2019, the population of Druskininkai municipality reached 19,360, most of which (about 63%) lived in Druskininkai town. It is the largest resort in Lithuania in terms of population, ¼ surpassing Palanga city municipality, and 4-5 times – Neringa and Birštonas municipalities. However, as in the whole of Lithuania and in the absolute majority of the country's municipalities, the population of Druskininkai has been decreasing for a long time (Table 1).

Table 1. Basic information about population

Region	Total population	Population		Population change person per 1,000 inhabitants (2014-2019)	Population		
		town	village		0-14 years	15 – 64 years	over 64 years
Birštonas municipality	4 117	2 369	1 748	-57.7	12.9 %	62.7 %	24.4 %
Druskininkai municipality	19 360	12 209	7 151	-75.6	13.2 %	63.1 %	23.7 %

Comparing the area, the town of Druskininkai is almost twice as large as Birštonas (24 km2 and 13 km2, respectively). Between municipal areas, the difference is even greater - more than 3.5 times. Assessing the population density in the resort area, Birštonas is also less densely populated than the Druskininkai town. However, from the perspective of hard paved roads per 100 km2, it can be seen that Birštonas has a better-developed road network of this type (72.6 km / 100 km2 in Birštonas and 47.6 km / 100 km2 in Druskininkai municipality). All the basic information about both municipalities and towns presented in Table 2.

Table 2. Basic information about region

Region	Area of the region (km2)	Number of inhabitants	Density of population (number of inhabitants per km2)	Hard paved public roads per 100 km² in km	Cars registered per 1000 inhabitants	Bicycle paths (km)	Geographical location/local border traffic/ connectivity to transport hubs (airports, ports)	Access to railway/buses/ waterways	Number of holiday and other short-stay accommodation (with more than 10 beds)
Birštonas municipality	124 (Birštonas town – 13)	4 117 (Birštonas town – 2 369)	33.7 (Birštonas town – 182.2)	72.6	549	20.3	Located in the South of Lithuania. International Kaunas airport – 60 km International Vilnius airport – 92 km	Railway – Bus + Waterways -	37
Druskininkai municipality	453.9 (Druskininkai town – 24)	19 360 (Druskininkai town – 12 209)	42.7 (Druskininkai town – 508.7)	47.6	518	65.6	Located in the South of Lithuania in the close proximity to Belarus and Poland. International Kaunas airport – 137 km International Vilnius airport – 125 km	Railway – Bus + Waterways -	74

Birštonas resort specializes in health treatment, cognitive tourism, and recreational tourism in nature (Fig. 6 (a)). Spa treatment and leisure tourism are envisaged as the dominant sector in the local economy. The territory of Birštonas municipality includes 13 natural and 33 cultural landscape objects of the regional park Nemunas Loops. Due to the improvement of the infrastructure of the district municipal centre, a significant increase in the number of visitors is observed. The total number of overnight guests increased by more than 20,000 people in the period from 2013 to 2015, and the number of foreigners increased 1.5 times.

There are enough places to visit in Druskininkai municipality as well: natural monuments (e.g., Devil's Stone, Raigardas Valley, Nature Museum, etc.), historical (for example, Grūtas Park of Communist-era sculptures) and cultural monuments (Leipalingis Cemetery, House of the famous compositor and artist M. K. Čiurlionis, etc.). The total number of which exceeds 63 and most of which (48) are protected by the state. The most important economic activities in the tourism sector are accommodation and food services (including the provision of beverages) as well as the provision of leisure activities (Fig. 6 (b)). In Druskininkai municipality, the infrastructure of these services stands out both quantitatively and qualitatively.

Figure 6. Touristic activities in Birštonas (a) and Druskininkai (b) towns
(*source: (a) Birštonas municipality, (b) https://www.akvapark.lt/*)

The tourist attractiveness of the resorts is summarized in Table 3.

Table 3. Touristic attractiveness about region

Region	Touristic attractiveness
Birštonas municipality	Birštonas municipality is located in a large recreational area of high potential in southern Lithuania. It develops top-level, (nationally important) recreational systems. The territory of Birštonas municipality includes 13 natural and 33 cultural landscape objects of the Nemunas Loops Regional Park. The resort and the municipality focus on resort recreational activities, which also include resort tourism. Two water tourism (kayak, boat) routes are identified in the municipality. The opportunities for the better development of winter (ski) tourism are limited due to the unstable snow cover.
Druskininkai municipality	The municipality has a developed tourism service infrastructure and a network of this type of entities (from accommodation to recreation and entertainment organization). There are enough places to visit in its territory: natural monuments (eg Devil's Stone) and historical and cultural monuments (Leipalingis Cemetery, M. K. Čiurlionis House, etc.), the number of which exceeds 63 and most of which (48) are protected by the state. Seasonal leisure activities availability. Nevertheless, the main factor in the attractiveness of Druskininkai municipality is health resources and well-developed infrastructure.

Passenger mobility functions in Birštonas and Druskininkai towns and their related territories are performed by non-motorized (walking and cycling) and road (public transport and private cars) transport. The attractiveness of individual modes of transport depends on the distance travelled during the journey. As cars and public transport perform transportation of passengers over longer distances compared to non-motorized transport, these modes of transport are competitive. When the distance travelled is less than 3 km, for some people, bicycles become a more attractive alternative to cars and public transport. Walking trips usually are chosen when the length of the trip does not exceed 1 km. The modal split in Birštonas and Druskininkai is presented in Figure 7.

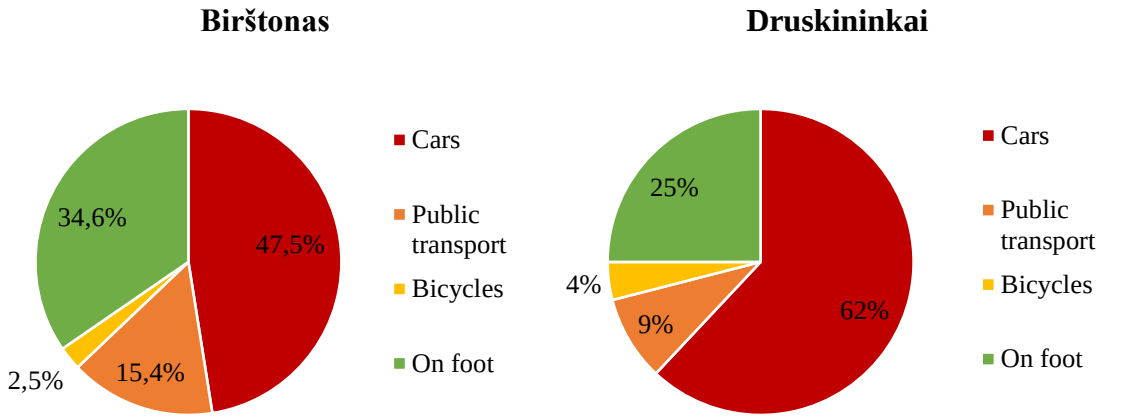

Figure 7. Modal split in Birštonas and Druskininkai (Data source: SUMPs' of the chosen towns)

Based on complex studies of traffic intensity, passengers carried by public transport and cars, monitoring of non-motorized transport infrastructure, population, and the number of visitors, the distribution of the number of trips between different modes of transport has been defined. The current modal split of Druskininkai is compounded, it is found that 62% of trips made by private cars, 25 % on foot, 9% by public transport, and 4 % by bicycle.

Urban public transport routes in Druskininkai carry 67% more passengers compared to the suburbs. The total number of passengers increases by 2.2% on average per year. The network of public transport stops is sufficiently well developed, accessible to city residents and tourists.

In Birštonas resort, about 47.5% of the residents use privately owned cars for daily trips, 34.6% make daily trips by foot, 15.4% by public transport, and 2.5% by bicycle. Such modal split is determined by the relatively small area of the resort and the short distances between the residents' daily travel destinations. The Sustainable Urban Mobility Plan (SUMP) in Birštonas town (Darnaus judumo … 2017) states that the majority of the residents make 2-4 trips per day with a distance of

up to 5 km. This facilitates the development and promotion of non-motorized transport (cycling and walking). The general plans for transport and communication systems of both resorts are presented in Figures 8 and Figure 9.

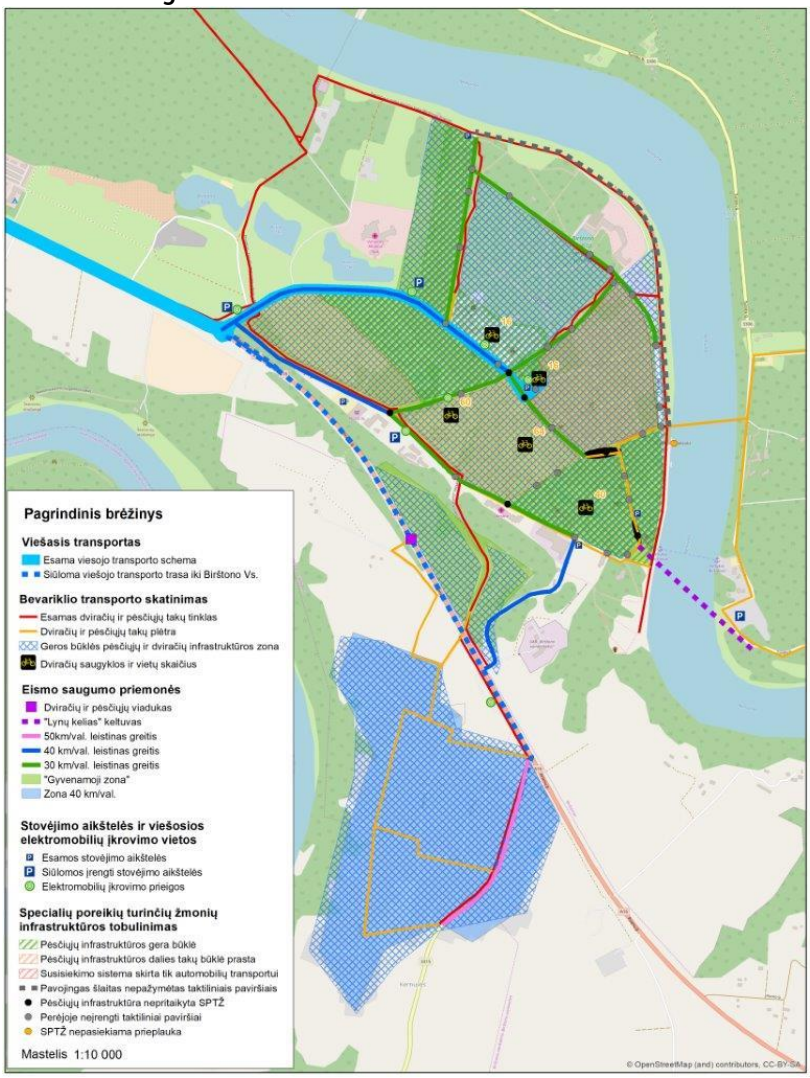

Figure 8. Transport and communication system of Birštonas resort
(Data source: SUMP of Birštonas)

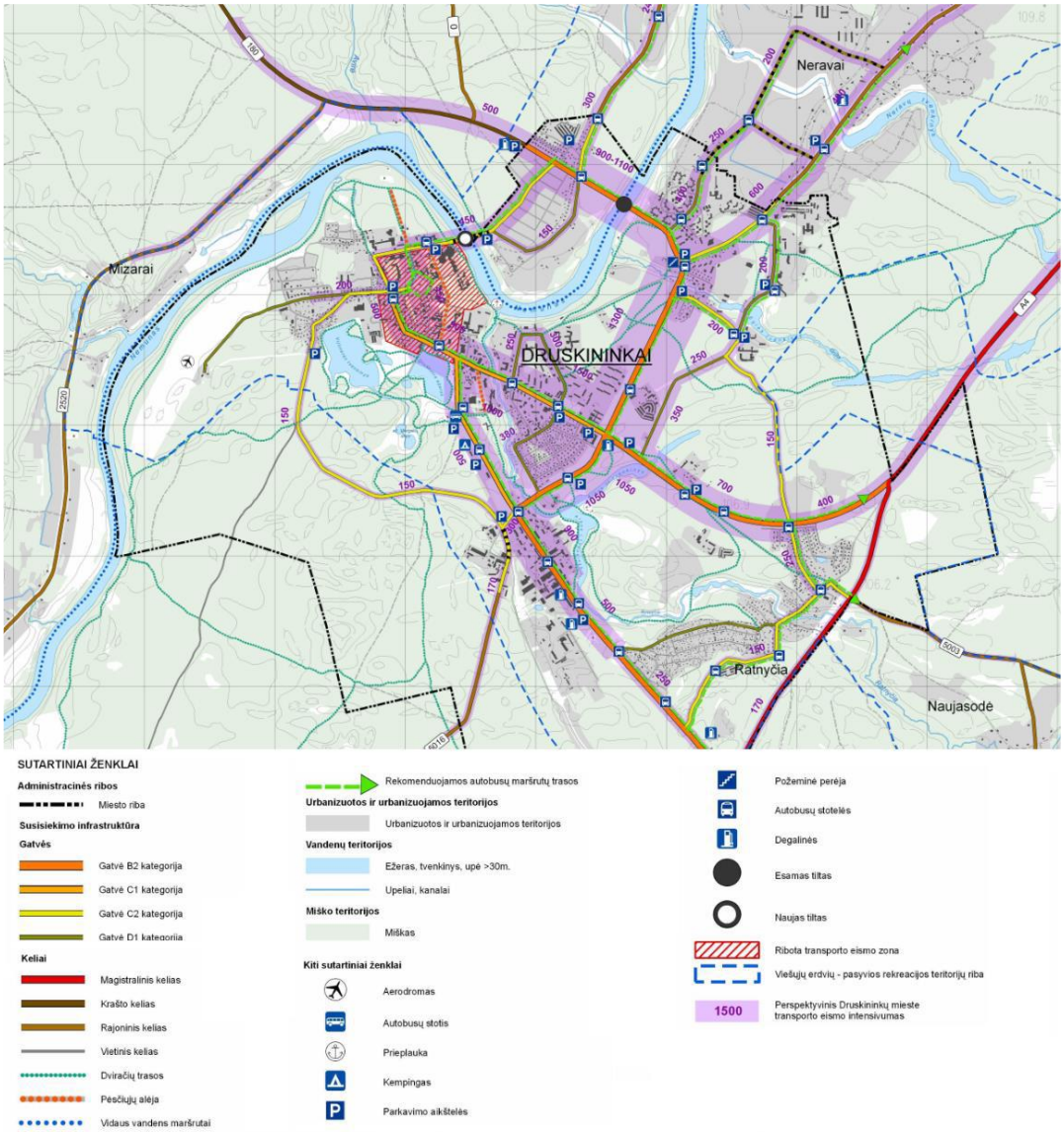

Figure 9. A fragment from the Master plan of Druskininkai municipality for the communication system of the city
(Data source: *SUMP of Druskininkai*)

It is important to mention, that there is no local public transport, which would serve only the territory of Birštonas. Birštonas municipality is served only by intercity public transport buses, which ensure communication with Prienai (Kaunas), Vilnius, and other areas. On average, 28 buses depart from Birštonas to Kaunas city, 9 to Vilnius, 4 to Marijampolė every day. Therefore, this type of transport does not meet the internal transport needs of the town. Druskininkai is serviced by 16 local and 4 suburban bus routes to reach the nearest villages and towns.

There is no railway connection with Vilnius and Kaunas in both considered resorts (Birštonas and Druskininkai). The main problem of mobility and accessibility identified in both regions presented in Table 4.

Table 4. Main problems of mobility and accessibility of region

Region	The main problems of mobility
Birštonas municipality	• Private cars domination and quite intensive traffic along the town forms an unattractive image of the resort, increases noise and air pollutions, deface the background of surroundings of the resort town. • Insufficient connectivity with the large cities and international airports. Limited choices of transport modes to reach the resort – only intercity buses and private cars. • Challenge of the touristic seasonality with the peaks on Easter, Christmas, New Year and other Holiday celebration. • Insufficiently developed network of bicycle paths (tracks). • Lack of efficient integration of bicycle transport with public transport. • No public transport in the town.
Druskininkai municipality	• Private cars domination and quite intensive traffic along the town forms an unattractive image of the resort, increases noise and air pollutions, deface the background of surroundings of the resort town. • Insufficient connectivity with the large cities and international airports. Limited choices of transport modes to reach the resort – only intercity buses and private cars. • Challenge of the touristic seasonality with the peaks on Easter, Christmas, New Year and other holiday celebration. • Absence of sufficient connection by public transport with Poland and Belarus • Lack of efficient integration of bicycle transport with public transport. • The dominance of the private cars in the modal split.

The use of non-motorized transport means is attractive in both resorts, because of the accessibility possibilities. The networks of walking and cycling paths in Druskininkai and Birštonas are quite well-developed as a tourism or leisure infrastructure rather than daily transportation needs. Although both resorts do not have the bike sharing infrastructure, the number of bicycle rental services, which is provided by local businesses, is mostly sufficient to meet the needs. However, it is important to notice that, unlike in Birštonas, the Sustainable Urban Mobility Plan of Druskininkai supports the development of a bike sharing infrastructure in the resort.

Challenges of transportation models and recommendations for improving mobility offers in policy and planning documents

One of the strongest aspects of the current general plan of the territory of the Republic of Lithuania: to create a unified transport system of the country and to balance its development by using the existing infrastructure of various modes of transport.

The new version of the General Plan 2030 provides for a hierarchical system of urban centres and their communication.

The White Paper of the Ministry of the Interior (2017-2030) envisages:

1. Improving communication between employees and workplaces.
2. To create a system for coordination of passenger road and rail transport routes, to implement combined route and combined ticket systems.
3. To create regional public transport systems, enabling the organization of communication between urban and suburban and regional cities, crossing the administrative boundaries of municipalities (in functional regions).
4. Promote the transport-sharing economy of remote areas by setting up a billing system and involving communities and individuals in the provision of transport services.

The policy of transport structures in each region is shaped by the 2008-2012 period. General plans of all 10 counties (Alytus, Kaunas, Klaipėda, Marijampolė, Panevėžys, Šiauliai, Tauragė, Telšiai, Utena, Vilnius) were prepared in 2002. Solutions of the general plan of the territory of the Republic of Lithuania, determining the priorities of the communication system. Solutions for the development of the communication system of county general plans are valid for 10 years, strategic development directions and concepts for 20 years. In the prepared general plans of the counties, the solutions of the transport system were prepared in accordance with the sustainable development of the regions.

Since the 18th of December, 2013 The Government of the Republic of Lithuania by Resolution No. 1253 approved the National Transport Development Program for 2014–2022. The program is necessary for the sustainable development of the Lithuanian transport system, efficient management of state resources, and the use of EU structural funds, increasing the competitiveness of the transport sector. The strategic goal of the National Transport Program is to create a sustainable, environmentally friendly, competitive, and high value-added Lithuanian transport

system. Achieving the strategic goal, the transport system would ensure high-quality, efficient, uninterrupted, and sustainable mobility of members of society and transportation of goods, high-quality logistics, and postal services.

Unimplemented solutions related to increasing the speed of railway transport to 220 km/h, implementation of new railway branches. Unresolved solutions to create a balanced network of major cities, a bipolar idea. Transit roads did not become a reason for the development of urban structures, no urban formations connecting cities were formed.

The National Transport Program sets out the general objectives and targets for achieving them. The third most relevant objective of the program for mobility is to promote the sustainability of the local (urban and suburban) transport system. To achieve this goal, 5 tasks have been set:

a) encouraging cities to develop and implement sustainable urban mobility plans;
b) ensure the compatibility of the various urban and suburban public transport routes and their greater interoperability with private transport;
c) to promote the development of cycling infrastructure in cities: to create integrated cycling network systems, to integrate cycling infrastructure into the common transport system, to strive for the development of the pedestrian and cycling network to be attractive and safe for its users;
d) encourage citizens to use public transport and increase the attractiveness of public transport by upgrading vehicles, improving public transport infrastructure, implementing universal design solutions, increasing the accessibility of public transport, introducing public transport priority systems, and increasing the use of ITS solutions;
e) reducing the negative impact of transit flows on urban transport systems, developing and modernizing urban and suburban bypasses.

In 2019 General plan of territory of Birštonas municipality and General plan of Birštonas resort were approved. The main provisions.

In undeveloped areas for roads of state importance (including cities), in accordance with the construction technical regulation STR 2.06.04: 2014 "Roads of local and local significance. General Requirements" Item 4 and Article 12 of the Roads Law applicable road safety zones, i. e. construction (construction of residential and public buildings not related to transport and passenger services) near roads of state importance must be planned outside the road protection zones. In order to reduce the spread of noise and pollution, where there is no existing building, it is planned to form greenery strips.

Due to traffic safety requirements, the number of intersections (including lanes) with secondary roads on national roads is strictly limited, transport infrastructure solutions must be planned along the roads parallel to the main road (streets), ensuring access to the areas to be developed.

Connecting roads must be connected to existing, legally installed, road safety-compliant intersections (lanes) on state roads, in accordance with the Road Technical Regulation KTR 1.01: 2008 “Roads”, approved by the Minister of Environment of the Republic of Lithuania and the Minister of Transport and Communications of the Republic of Lithuania in 2008. January 9 by order no. D1-11 / 3-3, Chapter XI, Section II.

Finally, the Transport infrastructure development is financing according to resources of the Road development program of the Republic of Lithuania.

Mobility needs in the region

The research methodology consists of:

1. Analysis of SUMP in Birštonas and Druskininkai (Darnaus judumo … 2017, Druskininkų miesto …. 2017);
2. "Face to face" discussions with stakeholders: municipalities, administrators of sanatoriums and tourism information offices;
3. Preparation of questionnaires for local inhabitants of resorts and tourists/ guests;
4. Collection of the representative amount of questionnaires;
5. Analysis of the survey results;
6. Generating proposals and search for the solutions for mobility improvements according to users' needs;

Transport modal split goals for the 2030 year of Birštonas and Druskininkai are presented in Figure 10.

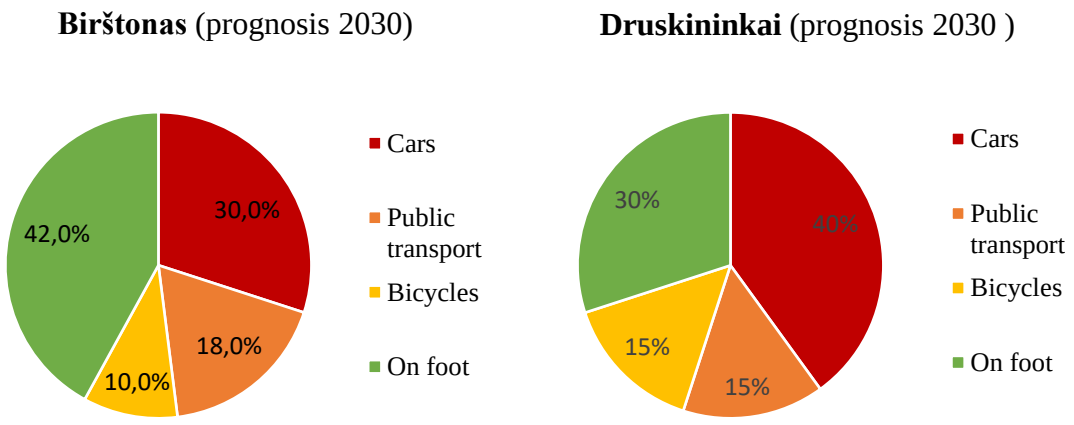

Figure 10. Future goals of the modal split of Birštonas and Druskininkai

(Data source: SUMPs' of the chosen towns)

As can be seen in Figure 10, by the year 2030, the number of trips carried by private cars should decrease from 47.5 % to 42.0% (diminish by 5.5%) in the Birštonas region and from 62.0% to 42.0% (diminish by 20%) in Druskininkai respectively. The number of bicycle journeys should grow from

2.5 % up to 10.0 % (increase in 7.5%) in Birštonas region and from 9.0% up to 15.0% (increase in 6%) in Druskininkai.

"MARA" Group of Activity GoA 2.2 aims to develop methods to map real mobility patterns and needs. The partners will make use of two sources of input:

Results from applying the stakeholder involvement tools in GoA 2.1.

Scientific methods for mapping mobility patterns such as mobile phone data.

GoA2.2 is assessing mobility solutions also from other remote areas. This comprises individual or collective, classical or alternative transport modes.

The mobility demand in touristic remote areas is, among others, affected by demographic change, inhomogeneous consumer demands, low population density and is fluctuating, partly with high amplitudes, depending on the touristic seasons. It is therefore very difficult to organize demand-driven and cost-efficient public transport services in those regions.

During large parts of the year, the public transport system is not ideally adjusted to reflect the existent mobility demand. The aim of this GoA2. is to make use of the opportunities of digitalisation and to develop methods to map the real mobility patterns and needs in the partner regions at various times. This will provide public authorities responsible for mobility planning with maps describing the real mobility demand in their region and will thus, create the necessary capacity for developing demand-driven mobility solutions.

The Research team of Lithuania uses different data sources of residents and tourists mobility:

1. A stock takes within each project region in which the respective national partner is involved as well as local mobility of residents, tourists, local car sharing companies, spatial planners, and the municipalities.
2. The car sharing system that could be used by resorts residents and tourists: in Birštonas and Druskininkai. Analysis of questionnaire data allows to find car sharing needs for residents (travel from resort to the centres of the country, like Vilnius, Kaunas or other biggest cities, to airport, railway station or international bus stations) and for tourists who could use car sharing to reach resorts from the main transportation station and go back. All maps will be based on GIS.

Methodology

When describing the methodology, first of all, the territorial planning and strategic documents that will influence the development of the transport system of the studied region (Birštonas resort) were analysed.

A Questionnaire in two languages (Lithuanian and Russian) for residents and tourists was prepared.

An online and direct survey of residents and tourists was conducted in Birštonas and Druskininkai.

The collected information was processed, the data were summarized, and diagrams were drawn up to make it easier to understand the results obtained.

Meetings were held with representatives of the municipality and its subordinate institutions

Proposals for car, bicycle, or scooter parking lots were discussed at a meeting with representatives of the car sharing company.

The summary of the methods, used in the research is presented in Table 5.

Table 5. Research methods used to assess and analyse the needs of tourists and residents

Partner (Institution)	Methods applied																				
	Quantitative						Qualitative									Other					
	PAPI			CAWI			IDI			Case study			Desk research			Delphi method			Spatial information/ dynamic maps development and processing (including PPGIS)		
	T*	I*	A*	T	I	A	T	I	A	T	I	A	T	I	A	T	I	A	T	I	A
Transport and Logistics Competence Centre, Vilnius Gediminas Technical University (VGTU), (Lithuania)	x	x		x	x							x			x	x	x				x

*"T" – tourists; "I"- inhabitants; "A" - authorities'/tourists entities (e.g. tourist agencies), (other?)

To identify mobility needs in Birštonas resort and municipality and to assess accessibility, a survey of residents and tourists was conducted. The survey was conducted in the winter of 2019/2020 and the spring and summer of 2020. In total, two hundred and eighteen respondents took part in it. The share of the residents is 73% of all respondents, and tourists are 27%, respectively. The same type of survey was performed in Druskininkai town. In total, two 289 respondents took part in it. The share of the residents is 42% of all respondents, and tourists are 58 %, respectively. The mobility needs are provided in Table 6 and Table 7 as a result of tourists' and residents' surveys. They represent the part of respondents, who would be willing to use a vehicle-sharing system if it appears at the resorts.

Table 6. The mobility needs of tourists – main results

Region	Measure (% or other indicator)	Mobility needs (in points)
Birštonas town	23 % 32 % 18 %	➢ Scooter-sharing ➢ Bike-sharing ➢ Car-sharing
Druskininkai town	43 % 46 % 43 %	➢ Scooter-sharing ➢ Bike-sharing ➢ Car-sharing

Table 7. The main mobility needs of inhabitants – main results

Region	Measure (%)	Mobility needs (in points)
Birštonas town	47 51 32	➢ Scooter-sharing ➢ Bike-sharing ➢ Car-sharing
Druskininkai town	40 40 23	➢ Scooter-sharing ➢ Bike-sharing ➢ Car-sharing

For short distances, the resort is actually more convenient to cover trips on foot, by bike, or by low-power electric vehicles. The car becomes important when it comes to reaching places outside the town. A car-sharing system could improve the resort's accessibility to guests, while also serving locals. Compared to the residents, tourists prefer a transport-sharing system, regardless of the mode of transport, but such a system could benefit those locals, who are unable and unwilling to operate their own car or use it infrequently.

Analysing the textual explanations of why the respondents chose one or another answer about the use of the sharing system, several tendentious answers can be distinguished. Most respondents understand and accept car-sharing as a system that works within the city. Therefore, a negative

attitude towards it is being formed (from the perspective of residents) as a potential load on the town streets and parking lots and growing pollution in the resort. Others view the system positively as a potential service for tourists, as well as the possibility of easier access to Kaunas, Vilnius, the airport, and the possibility to give up a second car, which is often much less used, thus saving money on repairs, insurance, and other costs.

Disparities between the current mobility needs and the existing mobility solutions

Mobility mismatches (gaps) in Birštonas region

It should be emphasized that more than 100,000 guests visit Birštonas town every year, while the population of Birštonas is only 2,369 inhabitants. The tourism amount directly depends on seasonality, with the peaks on Easter, Christmas, New Year, and other holiday celebrations. Hence, the main challenge of improving the mobility system in Birštonas is the improvement of the connectivity with the large cities (transport arteria) and accessibility of this resort.

A big number of arrived guests/ tourists with private cars and quite intensive traffic along the town forms an unattractive image of the resort, increases noise and air pollutions, even more, deface the background of nature/ surroundings of the resort town.

The car sharing system could be used in three ways: for local peoples, tourists/guests, and in combined mode. The bike sharing system is not implemented in either resort, however, the number of rental bikes provided by local rental points is sufficient to satisfy the needs. The unique surroundings, flat landscape support the use of ecological transportation modes.

The absence of connection by railways does not guarantee the free choice of transport mode both for inhabitants and for tourists/guests. Existing car parking places near sanatoriums distort the landscape of the resort town and increase environmental pollution. Using rental e-scooters are not safe when the path is not completely separated from the motor traffic lanes and pedestrian paths.

Mismatches of mobility demand & transport service supply in Birštonas resort region:

1. Insufficient connectivity by public transport for accessibility of the largest cities of Lithuania, especially with the international airports of Vilnius and Kaunas.
2. Deficient connection with the transport hubs located on international routes: “Via Baltica” (road) and “Rail Baltica” (railway).
3. Insufficient integration of bike transport with public transport.
4. Domination of trips carried by private cars in the modal split.
5. Lacking charging stations for electric vehicles.
6. Improper mobility demands for disable people with special needs and elderly people.
7. Absence of car-sharing system inside the Birštonas region.
8. Absence of car-sharing intercity system, i. e. there is no service connection with Vilnius and Kaunas.
9. Insufficient quantity of parking places for guest cars out of sanatorium territories.
10. Deficient usage of electric vehicles.

11. The traffic of rented e-scooters is not safe when their paths are common with pedestrians.
12. Inefficiently developed network of bicycle paths.

Key findings of actions to improve the mobility in the Birštonas region:

1. The establishment (found) of own local public transport service in Birštonas region.
2. The actual integration of non-motorized transport modes with public transport.
3. Implementation of Intellectual Transport Systems (ITS) – digitalization of Birštonas region transport service, for example, to provide mobile apps, etc.
4. Need to enhance the usage of electric vehicles, development of charging stations (tax-free).
5. The necessity to study possibilities of implementation of car-sharing system in Birštonas.
6. Developing a Pilot case of implementation of the pilot car-sharing parking lot in Birštonas.

Mobility mismatches (gaps) in Druskininkai

It should be emphasized that more than 300,000 guests visit Druskininkai town every year, while the population of Druskininkai is 12,209 inhabitants. There is some seasonality of tourism flows, with the peaks on Easter, Christmas, New Year, and other holiday celebrations, a huge amount of Russian tourists arrive in the first two weeks of January. Hence, the main challenge of improving the mobility system in Druskininkai is its connectivity with the large cities (transport arteria) and accessibility of this resort town from nearby (neighbour) countries Belarus and Poland.

The traffic of private cars that guests and tourists arrive with, along the town forms an unappealing image of the resort town, increases noise and air pollutions, even more, deface the landscape of nature/ surroundings of the resort town.

It should be emphasized, that the car-sharing system is absent in Druskininkai. The car-sharing system could be used in three ways: for local peoples, for tourists/guests, and in combined manner/ mode. The bike sharing system is not implemented in either resort, however, the number of rental bikes provided by local rental points is sufficient to satisfy the needs. The unique surroundings support the use of non-motorised transportation mode.

The absence of connection by railways does not guarantee the free choice of transport mode both for inhabitants and tourists / guests. Car parking places near sanatoriums distort the background of the resort and increase environmental pollution/noise. Using rental e-scooters are not safe when the path is not completely separated from the motor road traffic lanes and pedestrian paths.

Mismatches of mobility demand & transport service supply in Druskininkai resort town:

1. Insufficient connectivity by public transport with the international airports of Vilnius and Kaunas.
2. Absence of sufficient connection by public transport with Poland and Belarus.
3. Lacking municipality attempts to implement the connection with Poland and Belarus by river transport (links by river Nemunas in Belarus & Augustowo channels in Poland).
4. Lack of well-developed integration of bicycle transport with public transport.
5. The dominance of private car fleet in the modal split.
6. Insufficient use of electric vehicles (e-cars).
7. Insufficient quantity of charging stations for electric vehicles.
8. The mobility needs of disabled people and the special needs of the elderly are not fully met.
9. The absence of a car-sharing system within the Druskininkai town itself.
10. Absence of car-sharing intercity system, especially it is no steady connection with Vilnius and Kaunas city.
11. Lacking the attractive and operating car parking system (P & R).
12. The traffic of rented e-scooters is not safe when the path is common with pedestrians' paths.
13. Insufficiently developed network of bicycle paths.

Key findings of actions to improve the mobility system in the Druskininkai area:

1. The perceptible enhancement of public transport service inside the Druskininkai region area.
2. Ensuring sustainable integration of non-motorized transport with town public transport.
3. Continual implementation of the Intellectual Transport Systems (ITS) – digitalization of Druskininkai town transport service.
4. Enhancement of using electric vehicles: development of charging station (tax-free).
5. Investigation of the possibility to use "bus by demand" for meeting the needs of elderly and disabled people.
6. Examine the potentials of the implementation of the car-sharing system in Druskininkai.

Innovative solutions to improve mobility in the region

The mobility ecosystem in the region under investigation depends on tourists and residents mostly. It should be mentioned that a great part of tourists is older people who do not have a driver's license or are not able to drive a motor vehicle. For case study under investigation is an automated vehicle (AV), which will perform as transport on demand and will be the best alternative.

In the first stage, car sharing service with conventional vehicles may appear. The service may be popular among the Lithuanian tourists above 35 years. For the involvement of foreign tourists registration system of new users should be changed. On second stage electric vehicles in car sharing companies may appear, it will lead to a significant decrease in emissions and noise as well. It cannot be implemented right now (in short-terms) while the infrastructure of charging stations is not developed sufficiently. The stages of the consistent evolution of car sharing solutions are presented in Figure 11.

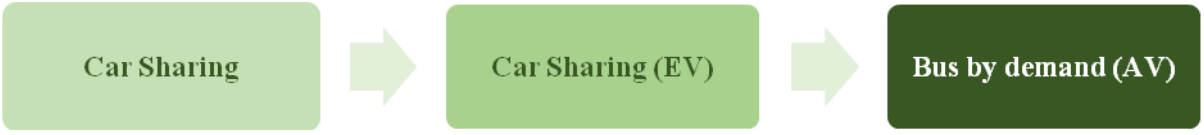

Figure 11. Evolution phases of car-sharing solutions

In the last stage, automated vehicles may appear and service will change from conventional car sharing to the bus by demand. A detailed review of AV technology is presented in the study of Skrickij et al. (2020). Automated driving is a kind of technology that can change the whole paradigm of transportation (ERTRAC 2019). However, an implementation of this technology is a complicated task and few issues and problems need to be discussed.

Technological solutions for increasing the automated driving reliability, as well as a decrease in the cost of the sensing and processing system, are necessary. The certification procedure is also a complicated task because artificial intelligence (AI) technology will affect the functional safety of the vehicle. The algorithms for neural networks cannot be described as an equation as they function as a black box. Another aspect is that the EU is a follower in the field of AI and takes the risk of losing its dominant positions in the sector of road transport if industrial companies fail to compete on the global stage.

Law and regulation are the main problems public authorities need to focus on. Numerous technological solutions for AVs are at the stage of development. The challenge is to create a regulation system for AVs, the complexity of which is the employment of the vehicle in the independent law systems in different countries, and therefore, a universal system needs to be proposed. The legal mechanism should be provided to ensure the responsibility and security of personal data and cybersecurity of both the AV manufacturer and road user.

Human-robot interaction is the next issue to be addressed in the path of new technology. This is very important for transitional automation levels. It is a challenging task solving which the results are subject to technological solutions and the law system. If user acceptance does not increase, the last two aspects need to be reviewed.

Based on the investigation of AV technology the SWOT analysis has been carried out and is presented in Table 8. Full vehicle automation will solve the problem of the non-effective public transport system in rural areas (Berger 2018). The whole sector engaged in driver management and other activities will be significantly reduced. It is a threat public authorities will need to deal with. For business, it will be beneficial in cost reduction. For end-users, it is also a positive aspect in the long-term, as the price of the service potentially will decrease. In a short time and transfer period, the price may be higher due to equipment costs. Substantial investments in infrastructure are also required, as V2X (Vehicle to Everything) communication is an integral part of the AV.

Table 8. SWOT analysis of automated vehicles in rural areas

Strengths	Weaknesses
• Increase in mobility for non drivers • Increase in safety • The decrease in the emission level • The decrease in fuel consumption • The decrease in travel time, using a call on demand function • Possibility of using optional travel time • The decrease in parking demand	• Lack of statistical data for quantitative analysis • Need for continuous research in new areas • User acceptance and Human-Robot interaction • Lagging law and regulation • Cybersecurity • High price • Lower operational speed
Opportunities	**Threats**
• New markets • Development of new technologies • New high value-added jobs • Development of smart cities • Sharing economy implementation	• The decrease in the need for traditional specialists/ drivers • Investments in infrastructure are required • Increase in personal privacy vulnerability • New forms of crimes

Technology will work globally, and plenty of new opportunities will appear. Huge demand for new technologies is faced, which means that highly qualified professionals will be required. This will provide prospects for the emergence of new companies. The car sharing model has already become popular all over the world, but the AV can flip the ratio between privately owned and shared vehicles in the fleet, which is a contribution to the implementation of sharing economy.

The main strength of AV technology is the possibility of solving the problems of the transport sector, which are difficult or even impossible to be solved, taking into consideration conventional vehicles. Due to the elimination of the human factor, an increase in safety is of utmost importance. The other strength is an increase in mobility and a decrease in parking demand, which can be achieved through the employment of optimised control strategies. Furthermore, it may lead to a decrease in fuel consumption, emission levels, and noise (in electric vehicle case). The main effect will be reached when internal combustion engines are replaced with the electric ones (Zagorskas & Burinskienė 2020). In this case, the AV will not have significant influence but may create a slight impact due to new control strategies. The transition from the vehicles powered by internal combustion engines to the electric motors is not as fast as expected previously, and thus the employment of new kind of transport will be even more complicated because of many challenges and difficulties faced nowadays. Moreover, some of the ongoing issues could be hardly predicted from the present point of view.

According to ERTRAC (European Road Transport Research Advisory Council) Connected Automated Driving Roadmap there will be three main types of vehicles in the cities: privately owned; urban mobility vehicles and freight vehicles. Some prototypes of urban mobility passenger vehicles are shown in Figure 12.

a) Navya

b) AuVeTech

c) Olli d) Continental CUbE

Figure 12. The prototype models of urban mobility vehicles

These AVs are only prototypes, but there is a high possibility that they will appear in our daily life in the future, and they can be used in rural areas as well. AV prototypes run slowly with maximal velocity up to 50 km/h but in reality even less (10-30 km/h). The number of passengers carried varies from 4 to 15, and such an interval is very suitable for most of the tasks in rural areas. The distance travelled on a single battery charge is about 100 km, and should be increased to at least up to 200 km.

Recommendations and operation plan for improved mobility offers

What activities shall be undertaken?

It is necessary to determine the current state of the communication system in the region how it is maintained and modified. As well as the satisfaction of the population with the transport system and their future needs. The case implementation should start with meetings with the irreplaceable stakeholders which make decisions about the development of the region. This is reflected in meetings with the resort municipality administration at both of our selected resorts. Both municipalities at Birštonas and Druskininkai resorts have expressed a desire to participate in this project and to change the reorganization of the communication system according to the expressed needs. Residents' needs and satisfaction with the existing communication system and their desire to see a new car-sharing system in the resorts were examined by compiling questionnaires for resort residents and city guests.

The next steps must reflect the needs of residents and city guests. If end-users need the new car-sharing service, the city should be involved with companies that provide that service. The well prepared new strategic business model for car-sharing companies. In our case should be involved two companies “City Bee” and “SPARK” which operates in Lithuania (Figure 13 and Figure 14, accordingly). If at least one company is interested (it may be possible for both companies to be involved in the provision of the service if the need arises), all key stakeholders need to be involved in the final preparation of the pilot project.

Figure 13. Car-sharing service provider “City bee”

Figure. 14. Electric Car-sharing provider “SPARK”

What meetings will be held?

To ensure the smooth implementation of the project meetings with the main stakeholders will be needed. Among others, these meetings are necessary:

With municipality administration:

- Initial meeting to know they wiliness to be involved in such a project
- Recurrent meetings to get acquainted with the project's current situation and additional needs to implement the project.

With Citizens:

- Introducing new possibilities
- Recurring meetings on the project implementation level on demand

With tourists:

- 1-2 meetings to understand their needs/ satisfaction on the car-sharing system in the region.

With car-sharing service run companies:

- Initial meeting to know their wiliness to be involved in such a project.
- Meeting before the pilot case implementation.
- Recurring meetings on the case study situation.

How will be the stakeholders involved in the project?

Communication system managers and operators struggle to attract all the potential users to their services. Communication system users often rely just on their usual ways of traveling and changing their habits is very difficult.

Mobility management is not a new topic in the EU, but still, all the problems and solutions are analysed and prepared just for the biggest towns and cities. It's fixed that cars were the main mode of transportation in the last fifty years, but in some smaller towns or resorts, it is not reflecting the true statement. Taking into account all type of towns, the main stakeholders' group could be defined as:

1. City municipality.
2. Citizens.
3. Town visitors.
4. PT operators.
5. Car-sharing service run companies.

Some of them are irreplaceable, like city municipality, some of them have alternatives, like Car-sharing service run companies or PT operators. Just should be kept in mind that the stakeholders with alternatives usually are commercial companies based on the profit and it's very difficult to attract them to new territories. It should be prepared a good strategic business model for their attraction. To attract for the new service all end users (town citizens or town visitors) it is impossible, but usually new communication service providers do everything to attract as many as possible. For that is necessary to reflect their needs and expectations. To understand real mobility needs, public authorities responsible for mobility planning have to involve the main communication system users (residents, tourists, local companies, etc.) and service providers directly.

Activities tailored to the needs of the region

According to a survey, which has been done in Birštonas, almost 95% have a private car and it remains the most popular vehicle among the population. Bicycles are also an important means of transport. As in larger Lithuanian cities and resorts, in Birštonas there is also a noticeable increase in the popularity of scooters. Although such measures as motorcycles, skates, skateboards, etc. are less popular among the population. But comparing the modes of travel in the city and for longer distances, it can be concluded that for the longer distances other modes of travel are less competitive in addition to the car. When proposing car-sharing, bike-sharing, scooter-sharing as one of the new modes of transport, the attitude of the population was ambiguous. Vehicle sharing is viewed positively by more than half of the population (56%), about a third have no opinion and only 8% have a negative view. But an assessment of the distribution of the population's response according to whether they plan to use a vehicle-sharing system if it appears in the resort next month, shows that the most positive attitude was towards bicycles and scooters, but not the car-sharing system. About a third of the population would use such modes of transport. More than half of the population is not interested in the car-sharing system, and about 20% of respondents would like to use it. This distribution of responses may be due to the high number of private cars in households. Up to 45% of respondents are potential car sharing users.

The operational plan of implementation of the recommendation and new or improved mobility offers in reality is presented in Figure 15.

Action name	*Defining the region for the pilot project*	*Attracting the municipalities*	*Defining the needs of Citizens' and resort visitors*	*Business Plan preparation*	*Attracting the Car-sharing service run companies*	*Implementing the pilot project*	*Defining the satisfaction of Citizens' and resort visitors*
Action to be taken	*1. Analysis of rural areas of Lithuania and defining the best areas for the pilot projects*	*1. Analyzing the needs and expectations of Municipality*	*1. Questionaring the citizens'* *2. Questionaring the town visitors* *3. Analyzing them needs and expectations*	*1. Preparation the Business Plan for the car- sharing companies* *2. Analyzing the possibilities which could be given from the municipality for the new company*	*1. analysis of the Car-sharing service run companies needs and expectations for the pilot project*	*1.Implementation of the pilot project*	*1. Questionaring the citizens'* *2. Questionaring the town visitors* *3. Analyzing them satisfaction on new implemented system*
Meetings		*Initial meeting with municipality representatives*	*Meeting with the citizens* *Meeting with the town visitors*	*Meeting with municipality enterprises to*	*Meeting with the Car-sharing service run companies*	*Recurrent meetings with the municipality and company*	*Meeting with the citizens* *Meeting with the town visitors*

Figure 15. Operational plan – how the recommendation and new or improved mobility offers will be put into practices

This could also be explained by the fact that most residents and those working in this city perceive car sharing as a system that serves internal, urban travel. Therefore, a negative attitude towards it is being formed as a potential load on the city streets and parking lots and growing pollution in the resort. And a small proportion of the population sees this system as a potential connection to major cities and their airports and train stations that can be provided to city guests. Therefore, the introduction of bicycle and scooter sharing in Birštonas town would have the most positive impact at present.

In order to assess the need for sharing of not only residents, but also to determine the attitudes and capabilities of the municipality and sharing service providing operators, the most important steps are the organization of meetings with these stakeholders.

Summarising

1. Connectivity with the largest cities of Lithuania and two international airports of both considered regions needs to be enhanced.
2. Car-sharing regulations in Lithuania for foreign customers (citizens) should be amended/ supplemented.
3. Developing a Pilot case is necessary to define the potential of implementation of car - sharing systems of both considered regions.
4. The bike paths network is well-developed in both considered resort towns and people often use this transport mode for leisure time, though not for daily mobility needs. So, the real integration of public transport with the bicycle system is needed.
5. The close integration of car-sharing parking stops location and bicycle storage places should be ensured as well.