



European Union
European Regional
Development Fund



OPTITRANS BASELINE STUDY



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Baseline study

The study summarises available statistical data and provides answers to the following questions:

- 1) What challenges does public transport face today in rural and nearby hinterlands of the city of Tartu (infrastructure, demographic issues, changing demand, economic issues, modality)?
- 2) Which kind of support (financial) is available to maintain or even upscale public transport services?
- 3) Who/which are the main driving forces?
- 4) What is the modal split of passenger transport?

The baseline study comes with the following annexes:

- Annex 1: Interviews with stakeholders
- Annex 2: Questionnaire survey with citizens (rural, suburban areas)

1. General information on the research area

This baseline study is concentrated on the city of Tartu and its surrounding municipalities: Tartu (centre: Kõrveküla), Ülenurme (centre: Ülenurme), Luunja (centre: Luunja), Tähtvere (centre: Ilmatsalu), and Haaslava (centre: Kurepalu). In addition, the city of Elva has been included in the study (Figure 1). All seven administrative units¹ are situated in Tartu county, taking up approximately 26.5% of the total area of the county. In 2015, the share of Tartu county in the national GDP was 10.2%, the share of the city of Tartu was 8.1%².

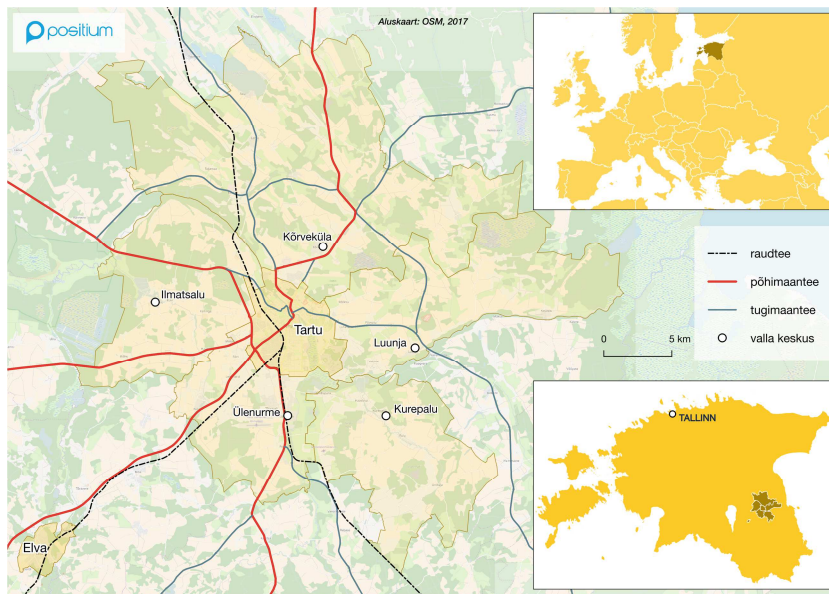


Figure 1. Research area of the baseline study and its location in the European Union and in Estonia

The research area is located near the eastern border in the periphery of the European Union. The area can be characterised as a strong unicentral region. The city of Tartu is the second biggest city in the country after the capital city of Tallinn, the municipal centre of Tartu county, and the regional center of South Estonia. As a result of the administrative reform, the city of Tartu was merged with Tähtvere municipality from 1st of November of 2017.

The city of Tartu is an important education, science and medical centre on a domestic level. The suburban zone, where significant development of dwellings and more functional connectivity to the city has occurred in over the last 15 years, remains 5km wide overall, with sporadic rays stretching out 10km from the municipal borders³. The city of Tartu is approximately at the same distance from Estonia's capital Tallinn and Latvia's capital Riga. Tallinn-Tartu-Võru-Luhamaa(-Riga) and (St. Petersburg-Narva-) Jõhvi-Tartu-Valga(-Riga)

¹ Remark: Estonia is divided into administrative divisions: counties (1st level administrative units) and into municipalities and cities (2nd level administrative units).

² Source: Statistics Estonia (NAA0050: GROSS DOMESTIC PRODUCT BY COUNTY (ESA 2010)). **Remark: here and thereafter the references are made according to the recent available statistics or research results.**

³ Source: Tartu linnapiirkonna jätkusuutliku arengu strateegia 2014 – 2020

highways which pass through Tartu are significant in for international and national highway transport. A railway also passes through the city. The railway station in close proximity of Central Tartu connects three domestic railway lines: Tallinn-Tapa-Tartu, Tartu-Põlva-Koidula-Piusa, and Tartu-Elva-Valga. In the municipality of Ülenurme, approximately 10km from Central Tartu, there is an airport servicing private, charter and scheduled flights. Regular international air traffic is organized between Tartu and Helsinki (capital of Finland).

Table 1. Characteristics of administrative units within the research area.

Municipality	Population ⁴	Area (km ²)	Residential land ⁵		Transport land ⁶		Profit yielding land ⁷		The distance between Tartu city and the municipality centre
			km ²	% of total	km ²	% of total	km ²	% of total	
City of Tartu	96904	38,8	11,8	30,4	7	18	0,4	1	-
Tartu municipality	7299	298,7	9,1	3	5,8	1,9	262,2	87,8	12 km
Ülenurme municipality	7449	86,4	7,8	9	4	4,6	60,2	69,7	6 km
Luunja municipality	4251	134	5,9	4,4	1,9	1,4	102,3	76,3	11 km
Tähtvere municipality (former)	2609	114,8	4,4	3,8	2,6	2,3	101,5	88,4	11 km
Haaslava municipality	2186	110	4,9	4,5	1,6	1,5	94,6	86	7 km
City of Elva	5741	9,92	2,8	28,2	1,4	14,1	0,7	7,1	27 km

Based on the land registered in the land cadastre the biggest percentage (82.7%) in Tartu county (2993 km²) is under profit yielding land, of which about 25% falls in the research area (Table 1). In the research area, profit yielding land forms approx. 78.5% of the total area. The plots under residential buildings are dominant in the city of Tartu (30.4% of the city area), transportation land makes up about 7 km² (18% of the city area). Profit yielding land makes up a total of approx. 1% of the total area of the city. Profit yielding land is dominating in the investigated municipalities. In general, in the rural municipalities the share of residential land is about 3-4.5%, in the Ülenurme rural municipality the residential land accounts for 9% of the municipality's area.

⁴ Remark: data from Estonian population register (1. january 2017). Source: Kohalike omavalitsuste portaal

⁵ Remark: residential land is an area of land for buildings intended for permanent or seasonal habitation and the land for garages. Source: Statistics Estonia (EN73: LAND REGISTERED IN THE LAND CADASTRE BY INTENDED PURPOSE AND REGION/ADMINISTRATIVE UNIT). Year: 2016.

⁶ Remark: transport land is an area of land used for traffic and transport together with the land under construction works designated for ensuring the maintenance and security of this area and the land for servicing these construction works. Source: Statistics Estonia.

⁷ Remark: profit yielding land is an area of land used for agricultural production and forestry and the land with the potential for agriculture or forestry. Source: Statistics Estonia.

The population of Tartu county is concentrated into urban centres and their immediate hinterlands. 64.5% of the county's 150167 inhabitants live in the city of Tartu, a total of 80.4% of the county's population, including those in hinterland municipalities, lives in the Tartu conurbation. 3.8% of the county's population lives in the city of Elva. About 10000 people⁸ have moved from the city of Tartu to neighbouring municipalities over the last decade due to urban sprawl. Mainly it is the middle-class families who are moving out of the city. Net migration has remained positive in Ülenurme and Tartu municipalities mostly due to immigration⁹. Although generally Tartu city's neighbouring municipalities can be characterized by population growth, the population in the municipality of Tähtvere has been in decline over the years. In the city of Elva, population is decreasing. According to the prediction of Statistics Estonia, the number of citizens in Tartu will remain around hundred thousand for the next 20 years¹⁰. A slight increase in population is foreseeable in Tartu county. According to the same prediction, the population of Estonia will decrease by 11.7% by 2040.

Based on data from Statistics Estonia, the population development of the city of Tartu and its neighbouring municipalities can be characterized by a rather positive birth rate and high ratio of youth (ages 18 and under) to elderly (ages 65 and over). Natural birth rate in the city of Elva is negative. The ratio of youth to elderly is relatively even in the age pyramid. While there are more women than men in the cities of Tartu and Elva, the sex ratio in Tartu's surrounding municipalities is more in balance according to Statistics Estonia.

Relative poverty¹¹ in this region was most prevalent in the city of Tartu, reaching 15% in 2011 (although lower than the Estonian average (17.6%) and county average (15.8%)). The best standard of living was in Ülenurme municipality, where relative poverty was measured at 9.5%. The rest of the researched municipalities' degree of relative poverty remained between 11.7%-14.3%. The municipality of Haaslava remained an exception with 20.8%.¹²

Entrepreneurship in Tartu county (including the city of Tartu) has been relatively high in comparison to the rest of Estonia. In 2015, there were about 79 economically active businesses¹³ per 1000 inhabitants in the city of Tartu, following closely behind the capital Tallinn (102 per 1000). A large portion (14.9%, or 1311) of businesses in Tartu included in the Statistics Estonia statistical profile¹⁴ are in the science and technology industry,

⁸ Source: Arengu strateegia Tartu 2030

⁹ Source: Tartu linnapiirkonna jätkusuutliku arengu strateegia 2012-2020

¹⁰ Source: Statistics Estonia (PO092: POPULATION PROJECTION BY COUNTY, AGE GROUP AND SEX (BASED ON THE POPULATION FIGURE AS AT 1 JANUARY 2012))

¹¹ Remark: at-risk-of-poverty rate describes the share of persons with an equalized yearly disposable income lower than the at-risk-of-poverty threshold. Source: Statistics Estonia (HHS50: MODEL BASED AT-RISK-OF-POVERTY RATE AND GINI COEFFICIENT BY ADMINISTRATIVE UNIT). Year: 2011.

¹² Remark: the data about Haaslava municipality has been summed up with data about Võnnu municipality.

¹³ Source: Statistics Estonia (RE071: ECONOMICALLY ACTIVE ENTERPRISES BY ADMINISTRATIVE UNIT); Kohalike omavalitsuste portaal

¹⁴ Remark: statistical profile is the database of economically active units (companies, sole proprietors, institutions, non-profit associations). Statistics Estonia uses this database as a sampling frame for all economic statistics. Source: Statistics Estonia (RE031: ENTERPRISES IN THE STATISTICAL PROFILE BY ADMINISTRATIVE UNIT AND ECONOMIC ACTIVITY (EMTAK 2008)). Year 2016.

employing more than half of Estonia's research and development workers¹⁵ (according to a 2013 study). The same study states that these R&D businesses generate more than half of the industry's profit in Estonia.

Despite the high number of R&D businesses, most of the businesses in Tartu are more traditional. In 2016, the majority of businesses (18.5%, or 1623) in the statistical profile were in the retail and wholesale industry. The beverage industry was the most important, constituting for about half of the industry's added value in Estonia while employing a quarter of this industry's workers. The city of Elva follows a similar distribution of industry activities, although the number of businesses is smaller than in Tartu. A big portion of businesses in the surrounding municipalities operate in agriculture, construction, and retail and wholesale.

Table 2. Persons employed by the place of residence and location of job (Population and Housing Census 2011).

Location of job	City of Tartu	Haaslava municipality	Luunja municipality	Tartu municipality	Tähtvere municipality	Ülenurme municipality	City of Elva
Place of residence							
City of Tartu	32 770	52	457	568	225	729	223
Haaslava municipality	420	150	6	9	6	39	0
Luunja municipality	1071	3	327	27	18	27	3
Tartu municipality	1620	0	30	666	18	57	18
Tähtvere municipality (former)	834	3	9	15	258	33	6
Ülenurme municipality	2253	12	21	51	21	567	21
City of Elva	564	0	6	15	12	21	1068

In 2016 in Tartu county, the most employed persons were in the tertiary sector (70.8%), followed by secondary (25%) and primary (4.2%) sectors¹⁶. 31.6% of workers were employed in the public sector. According to a 2014 study, 87% of jobs were concentrated in the city of Tartu¹⁸ and its surrounding municipalities. In 2011, 32770 citizens and 6762 people from other investigated municipalities (Table 2) were working in the city of Tartu¹⁷.

¹⁵ Source: Tartu ja Lõuna-Eesti konkurentsivõime ja kasvualade analüüs

¹⁶ Source: Statistics Estonia (ML241: EMPLOYED PERSONS BY PLACE OF RESIDENCE)

¹⁷ Source: Statistics Estonia (PC0161: PERSONS EMPLOYED IN ESTONIA BY THE PLACE OF RESIDENCE AND THE LOCATION OF JOB). Year: 2011.

The most workers from surrounding municipalities came from Ülenurme (33.3%, 2253), followed by Tartu municipality (24%, 1620) and Luunja (15.8%, 1071).

Businesses have created jobs outside the city's perimeter. In 2014, a tenth of Tartu's and its surrounding municipalities' 46000 jobs were located up to 10km from the administrative perimeter¹⁸ of the city, half of them employing locals. This is supported by earlier data from the end of 2011, when 2031 citizens of Tartu worked in nearby the city, 35.9% working in Ülenurme and 28% in Tartu municipality.

Statistics Estonia data suggests that Tartu county holds the lowest unemployment rate in Estonia – 3,3%, (3,4% in city of Tartu¹⁹). In the municipalities, unemployment varies between 1.4%-2%. Haaslava municipality had the highest relative unemployment, while city of Elva had the lowest. Demographic labor market pressure index is below one (0.75)²⁰ only in Tähtvere municipality. In the other researched neighbouring municipalities and cities, the index falls between 1-1.57, which indicates that over the next decade there will be more people entering the labour market than people leaving it.

¹⁸ Source: Tartu linnapiirkonna jätkusuutliku arengu strateegia 2014-2020

¹⁹ Remark: employment rate describes the share of the employed in the working-age population. Source: Statistics Estonia (ML442: UNEMPLOYMENT RATE BY COUNTY)

²⁰ Source: Statistics Estonia (PO06: DEMOGRAPHIC LABOUR PRESSURE INDEX BY REGION/ADMINISTRATIVE UNIT)

1.1. Infrastructure development, acceptance of public transport services by population.

Indicators	2010	2011	2012	2013	2014	2015
Percentage of the <u>service</u> sector from GDP, % (Tartu municipality; city of Tartu) ²¹	71,7% 76,3%	69,6% 74,8%	69,3% 75,4%	69,4% 76,4%	69% 75,8%	70,2% 77%
Percentage of workforce working in the <u>transportation and storage</u> sector, % ²²	n/a	4,8%	n/a	n/a	n/a	n/a
Number of public level transport companies (road) ²³	1	2	2	2	2	2
Number of public level transport companies (railroad)	1	1	1	1	1	1
Investments for national roads, €	n/a	n/a	n/a	n/a	n/a	42 121
Investments for regional roads, €	n/a	n/a	n/a	n/a	n/a	0
Investments for local roads (City of Tartu; other research area) ²⁴	11 946109 n/a	12 339588 n/a	13 018713 866 000	12 984983 1 400 600	12851582 1 830700	13 002 562 1 707 100
Investments for railroads, €	n/a	n/a	n/a	n/a	n/a	n/a
Number of public level transport lines (city of	25 83 (2009 y.)	25 n/a	25 n/a	25 n/a	25 n/a	26 391

²¹ Remark: detailed data is not available. Source: Statistics Estonia (NAA0051: GROSS DOMESTIC PRODUCT BY COUNTY AND ECONOMIC SECTOR (ESA 2010)). Data by economic sector: Services.

²² Remark: detailed data is not available. Source: Statistics Estonia (PC0147: EMPLOYED PERSONS BY ECONOMIC ACTIVITY). Data by economic activity: transportation and storage.

²³ Remark: **as commercial lines are not a subject to reporting obligations, only public carriers are being analyzed.**

²⁴ Remark: in case of Tartu city, Ülenurme and Haaslava municipality the data about the investments are collected from municipalities. Otherwise the data source is: Statistics Estonia (GF301: LOCAL BUDGETS EXPENDITURE BY REGION/ADMINISTRATIVE UNIT). Data by indicator: road transport.

Tartu; other research area) ²⁵						
Public transport rides (road) (city of Tartu; other research area) ²⁶	n/a n/a	n/a n/a	n/a n/a	n/a n/a	n/a n/a	(2017 y.) Ca 280 000 Ca 56 000
Public transport rides (railroad) ²⁷	n/a	n/a	n/a	n/a	1 902	2 190
Line kilometers (road) (city of Tartu; Tartu region)	n/a n/a	3,6 mln n/a	3,6 mln n/a	3,6 mln n/a	3,6 mln n/a	3,6 mln 3,4 mln
Line kilometers (railroad) ²⁸	n/a	n/a	n/a	n/a	60 517	56 201,454
Number of passengers (road) (city of Tartu; other research area) ²⁹	11946109 n/a	12339588 n/a	13018713 n/a	12984983 n/a	12851582 n/a	13002562 1984226
Number of passengers (railroad) ³⁰	n/a	n/a	n/a	n/a	36000	46000
Modal Split of passenger transport in the city of Tartu ³¹	n/a	 29,7%  28,6%  40 %  1,7%	n/a	n/a	n/a	(2016 y.)  28,2%  26,6%  40,4%  4,8%

²⁵ Sources: number of public level transport lines in the city of Tartu – Tartu in figures; number of public level transport lines in other research area - Tartu maakonna sotsiaalse infrastruktuuri ja ühistranspordi analüüs (2009), AS Ridango (2015). Remark: Counting remaining (other than Tartu city's) research area's public level transport lines, only those lines have been taken into account which have had at least one stop in the administrative units, linking them with the city of Tartu.

²⁶ Remark: counting remaining (other than Tartu city's) research area's public level transport rides, only those rides have been taken into account which have had at least one stop in the administrative units, linking them with the city of Tartu. Source: peatus.ee.

²⁷ Remark: Public (rail) transport rides between the city of Elva and Tartu.

²⁸ Remark: line kilometers in railline: Tartu-Valga. Source: Raudtee reisijateveo avaliku teenindamise leping

²⁹ Remark: counting remaining (other than Tartu city's) research area's public level transport passengers, only those rides have been taken into account which have had at least one stop in the administrative units, linking them with the city of Tartu.

³⁰ Remark: the number reflects only passengers who are using Elva train station for commuting. Approximately 80% of them are commuting between Elva and Tartu. There is no information on how many passengers are actually traveling to Tartu or vice versa, because in the given statistics there are also passengers who head from Elva to Tallinn / Tapa / Tamsallu / Jõgeva. Source: AS Elron.

³¹ Source: 2011 – Tartu linnatranspordi arengukava 2012-2020; 2013 – Arengustrateegia Tartu 2030; 2015 – Tartu city's webpage

Rail Network, km (thereof electrified) ³²	≈34+16 (0)	≈34+16 (0)	≈34+16 (0)	≈34+16 (0)	≈34+16 (0)	≈34+16 (0)
Car ownership in Tartu municipality ³³	57664	61055	64225	66808	67001	60037
Accessibility of Supply Centers	For the citizens of Tartu, convenience stores are easily accessible, often located up to a 10-minute walking distance from people's homes. There is not enough data for Tartu's surrounding municipalities to make a regional evaluation of the availability of services in the urban area.					

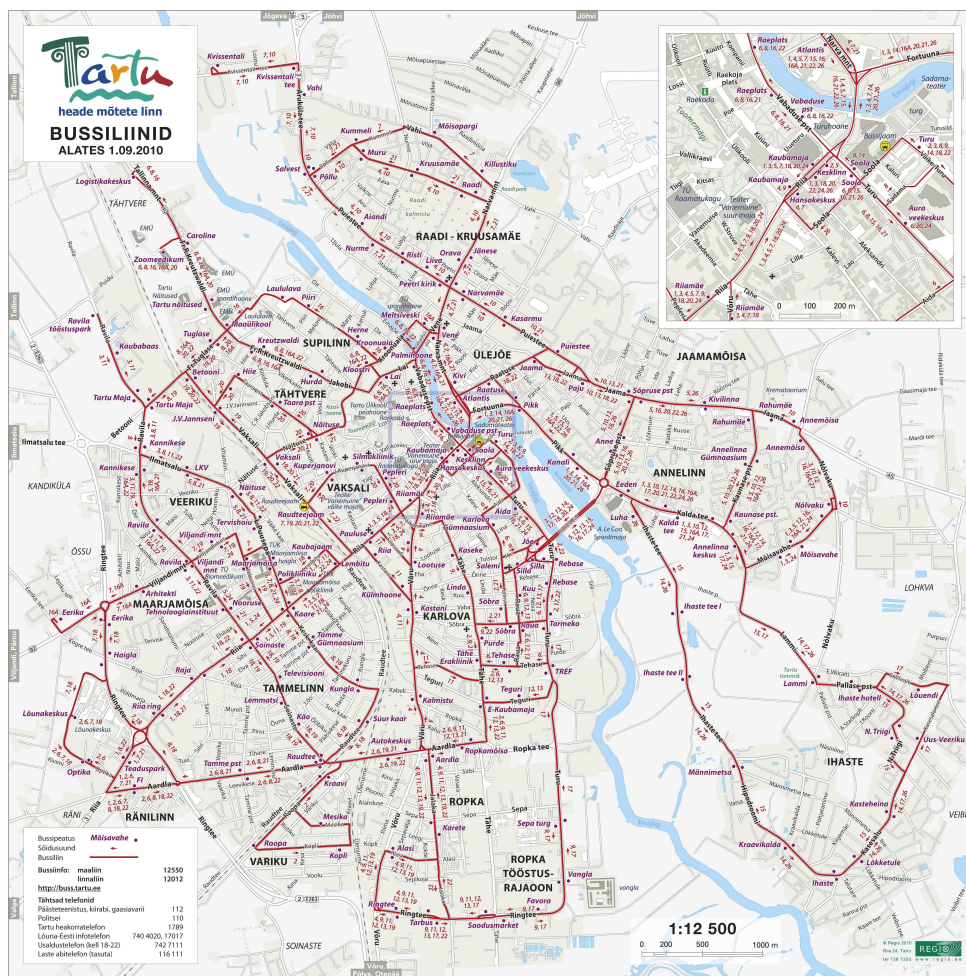
2. Characteristics of public passenger transport of each region

In Estonia, public transport includes taxi service, occasional service, and regular services, the latter including local, regional, and long-distance traffic. Bus services are organized on both commercial and public levels. Regular services are organized by municipal, city, and local governments, Estonian Road Administration, Ministry of Economic Affairs and Communications, and the Estonian Government in accordance with the Public Transport Act, cooperating with municipal unions, carriers and carrier unions, and by establishing regional public transport centres.

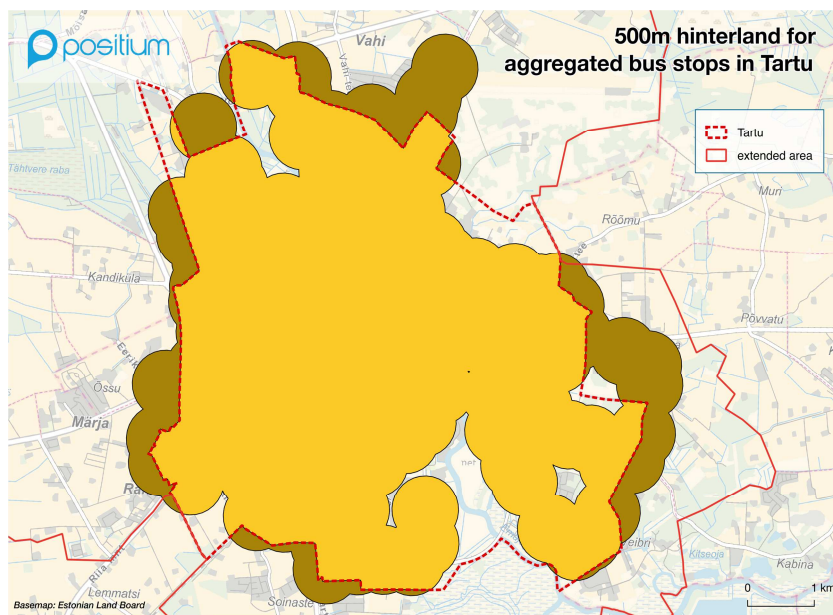
Local public transport (in cities and municipalities) is organized by the local government, who is responsible for guiding and coordinating the development of public transport, evolving development plans, which are usually funded from municipal and state budgets. According to the Public Transport Act, municipal governments are responsible for developing the bus route network in their respective area. The local government either operates a public transport service (a municipal company) or organizes a public procurement to find a transport service provider. To provide regular passenger carrier services in a city or municipality, it is necessary to apply for a permit.

³² Remark: Rail Network in the city of Tartu and in other research area (summed up) + the length of the railroad to the city of Elva.

³³ Source: Statistics Estonia (TC320: VEHICLES BY ADMINISTRATIVE UNIT)



The public transport (bus) network in the city of Tartu (Figure 2) is one of the biggest in Estonia, following Tallinn. In Tartu, public passenger transport is bus-based. The public transport network service capacity (2017) is 3 950 000 kilometres per year. According to 2017 data, there are 27 active public bus routes in the city with a route total of 518 kilometres. In 2011, Estonia's first five environmentally friendly buses that run on compressed natural gas began service in Tartu. Natural gas will be used as fuel at first, but when biogas(biomethane) will be available on the market, biogas will be used as fuel instead. One of the goals of the city of Tartu is to increase the use of gas-powered buses in public transport. The new procurement (for the period from 1 July 2019 to 30 June 2029) focuses on the quality of transport services and environmental protection. According to the new procurement, there must be 64 new low-level buses. Also, the carrier must have articulated buses. Buses must run on methane gas as fuel.



Public transport route accessibility in Tartu can be considered good. 99.6% of the city's inhabitants live within the 500m buffer zone of bus stops (buffer zone covers approx. 90.6% of the city's area) (Figure 3).

In addition to public bus routes, passengers have access to commercial transport, currently operating between the city centre and a peripheral shopping centre (one of Estonia's largest). Public transport is also present in the form of taxi services, with the number of taxis in Tartu being 463 in 2016. The number of taxis slightly increased in 2017 and is near to 500 by the end of 2017.

Rural municipalities primarily use local public transport for students or for access to social services.

The County Governments were responsible for guiding and coordinating the development of public transport in the county level, evolving development plans, which are usually funded from municipal and state budgets. In their jurisdiction was also confirming county bus routes schedules, while keeping in mind the long-distance routes' and municipal and city routes' schedules. Due to the Administration Reform and termination of the operation of The County Governments at the end of 2017, The Public Transport Center of Tartu County took over the organization of public transport within the Tartu county. The City of Tartu is interested in contributing to the organization of the county's bus traffic in order to ensure more convenient and flexible connections between the city (incl. city transport) and the neighboring municipalities. Arranging public transport within the city of Tartu will remain as the responsibility of the city. Despite of the establishment of The Public Transport Center, current public transport arrangement will remain until the expiry of the current contracts (until 2022).

National public transport is based mainly on commercial services. The bus route network is formed according to carrier applications, processed by the Estonian Road Administration

Department of Public Transport. The Estonian Road Administration gives out route permits for bus transport on national long-distance routes and confirms their schedules, as well.



Figure 4. Inter-county public transport connections (blue) and national public transport lines (red) in Tartu County. The figure shows 2009 data. Source: Tartu maakonna sotsiaalse infrastruktuuri ja transpordivõrgu analüüs.

The route network thereby formed is quite dense. The neighbourhoods of the city of Tartu are mainly connected via public (bus) routes (Figure 2). The city is connected to surrounding and other municipalities via public and commercial bus services, mostly through inter-county routes, and also through national routes (Figure 4).

An alternative to buses is railway connection. The Ministry of Economic Affairs and Communications coordinates passenger transport via railway, takes part in creating appropriate fiscal policies, and makes public service agreements with railway passenger carriers. The national railway is subsidized from the state budgets. In the research area, passengers are transported with diesel powered trains. Trains are not used in inner city commuting in Tartu, and have marginal importance in commuting between Tartu and nearby municipalities. Considering regional commuting, a train route between the cities of Tartu and Elva is seen as the most promising.

Estonia's National Transport Development Plan states that to improve commuting a hierarchy should be followed, starting from pedestrians, then cyclists, followed by bus and trolleybus transport, railway transport, and ending with automobile transport. When establishing connectivity, transport modes listed first in the hierarchy are the priority. The hierarchy also shows investment priorities and preferences, if it is possible or necessary to have many transport modes in the same area. In practice, the transport modes listed in front are easier to

implement in densely populated areas. The development plan emphasizes the importance of interaction between the different modes of transport – modality.

The main factors shaping the development of the region's public transport are connected to the city of Tartu as an important centre, where agencies, institutions, service providers, and employers are concentrated.

- **Tartu as a centre of education.** The city's status is in connection with universities. With a great number of students, it is a favourable region for developing environmentally friendly means of transport. During the 2016-2017 year, there were 33765 students in the city of Tartu. Hence it is important to connect educational institutions with residential and campus areas. However, it is difficult to analyse and predict education-related mobility as the students' place of residence is often temporary. Because many students go to school on a daily basis from nearby municipalities³⁴, it is important to focus on educational mobility of the surrounding municipalities as well as inner city public passenger transport networks.
- **Location of jobs.** The jobs are concentrated in the city centre of Tartu and its surrounding area, as well as industrial neighbourhoods in the city's periphery. The transport demand is also influenced by big employers, who are not concentrated with other employers, vastly affecting traffic near their location. On one hand it is important to provide inner city connectivity between residential and work areas, but at the same time it is necessary to pay our attention to cross-administrative-border mobility. The National Transport Development Plan envisages larger scale use of public transport for commuting to work. According to the study (held in 2017)³⁵, most of the movements made by bus between place of residence and place of work were connected with the City Center area of Tartu. The main traffic flows were between the large apartment building areas and the City Center, and between the city outskirts and the City Center of Tartu. The development plans of the neighbouring municipalities have highlighted the significant role of the City of Tartu in the life of the municipality inhabitants. For example, in the development plans of Ülenurme and Haaslava municipality, it has been noted that good public transport makes it possible to manage the municipalities' favorable position to the city of Tartu in more effective way. The national transport plan foresees for an increase in the share of public transport use among work-related movements.
- **Important development projects and institutions with spatial affect,** outside the city centre, affecting heavily on the traffic in the area. Ensuring safety and accessibility for commuters, and prevention of transport problems is often up to the local government. In Tartu is Lõunakeskus in the city border generating high traffic flows.
- **City centre as lifeblood.** The core of the city of Tartu is its city centre, where, in addition to educational institutions and workplaces, public and private businesses, shopping centres, and the bus station are concentrated. The share of people heading downtown on a

³⁴ Source: Tartu linnapiirkonna jätkusuutliku arengu strateegia 2014 – 2020

³⁵ Source: Ühistranspordi liinivõrgu modelleerimise metoodika koostamine. Etapp II raport – andmete kogumine

daily basis is vast. Approximately a third of all city bus traffic during the workweek goes through the city centre bus stops³⁶. In modeling the public transport network in 2017, it became evident that most of the movements between the residential and secondary (not work related) sites were associated with the bus terminals in the Tartu city center. Highest traffic flow occurred between the city center and the largest living area of the city - Annelinn.

The city centre of Tartu is a magnet for the whole of South Estonia. The city centre is also important to people living in Tartu's hinterlands. The central bus station connecting regional and national bus routes makes running errands easy for people coming from outside the city's administrative border.

- Places of residence. **Population density** affects significantly on traffic flows. More densely populated areas (such as apartment building areas) enable to offer better connectivity via public transport. At the same time on the edge of the city, where population density is smaller, the population is growing and distances between residential and working areas, and service areas are growing.

Population density is a determinant for creating connections between the central city and nearby regions. Often the problem is low demand, and keeping the route going can prove to be economically expensive. According to the Transport Development Act, public transport is preferred in areas with a larger population. However, regional public transport should be organized in a way that every area has access to social infrastructure, and people could go to work in the central area. In addition to the aforementioned factors, there are a number of factors that highlight the need to pay more attention to the development of public transport:

- **Increasing motorisation** driven by the negative image of public transport
 - bad reputation of public transport
 - inconvenience of regional bus routes for people with special needs and families with small children
 - inconvenience of commuting with public transport
 - Slowness. Bus schedules get delayed during rush hour traffic. The connectivity speed is affected by the lack of public transport priority systems (such as bus lanes), as well as bus stops being located too close to one another (one every 500m in the city).
 - Route networks, organization of transport (schedules) do not meet expectations. There is not an accurate overview of public transport passengers' main routes of mobility. Due to the lack of information, it is difficult to change the route network so that it would meet the needs of passengers, and correct the bus schedules. The problem is relevant in both city and nearby area. When developing new residential areas in immediate proximity of Tartu, too small attention is turned to public transport connectivity with the city. The bus routes in Tartu generally reach the

³⁶ Source: Tartu linna transpordi arengukava 2012-2040

city's administrative borders, although function-wise, the population reaches beyond the city borders. Inhabitants of those areas are forced to depend on cars, driving to the city for work or services on a daily basis. Such uncontrolled development³⁷ in the hinterlands of the city of Tartu worsens the urban traffic, diverting away from the city's goal of creating "a city with an inspiring living environment"³⁸.

- Little integration between means of transport. In Tartu, to get from the train to a county bus line, or vice versa, one will need to use, for example, public city transport as a link. At the same time, the current bus route network does not provide adequate access to the train station. Often the city bus schedules do not match, nor do they match those of trains or long-distance bus routes.

The little integration causes inconveniences when doing a transfer of between means of transport and takes up extra time. Using public transport is not fostered as the so called last-mile issue remains unsolved.

- **Political decisions – wish to reduce CO₂ emissions.**

- The Transport Development Act foresees the reduction of greenhouse gas emission amounts from transportation. One way could be through the use of biomethane in transport (the use of biomethane in public transport is supported by the National Development Plan of the Energy Sector). The production and usage of biomethane is promoted by establishing an appropriate infrastructure and supporting the use of public transport vehicles.
- Changing parking arrangements (reducing parking spaces, increasing parking fees) could direct people to prefer public transport.

Important social and infrastructural developments have lately been related to establishing cycling roads. In recent years, the city of Tartu has done a lot to develop cycling roads. When in 2010 the number of cyclists made up 1-1.5% of all commuters, then in the end of 2017 the percentage had risen to 4.7%. **In 2017, over 10km of a new cycling roads have been constructed.**

To liven the use of bicycles, the city of Tartu will soon open a **bicycle sharing service**, connecting it to other means of transport. The aim is to have a cleaner urban environment, promote light traffic (bicycles, pedestrians), use environmentally friendly transport, and develop a smart city. The city has planned to establish bicycle sharing over the next two years, connecting 60-80 rental points with 600-800 rental bicycles.

³⁷ Remark: Local authority organizes planning work in its own area (city, municipality), therefore other (e.g. neighboring) authorities do not have control over the developments happening in ones territory.

³⁸ Remark: The inspirational living environment is one key word in Tartu City Development Plan (2018-2025). The goal is to create an inspirational, interoperable and safe city that is used and developed on a sustainable basis. The emphasis is placed on the economical infrastructure, which also supports the goal of creating an environmentally friendly environment that takes all forms of mobility into account and is integrated into the international transport network.

Tartu is striving towards a cleaner and human friendly living environment. In the 2017 was in use already **eight buses fuelled by compressed natural gas**. The aim is to replace all the city route buses with methane gas alternatives by 2019. Along with the gas buses came the need for a methane gas filling station, which in turn increased the number of gas-powered vehicles in the city.

Promoting electric vehicles also helps reduce fossil fuel consumption and promote an environmentally friendly way of living. To foster the use of electric vehicles, these vehicles are allowed to park for free in parking areas owned and operated by the city of Tartu (need to apply for a permit), while parking in general was made more difficult through the reduction of parking lots and setting higher fees. In addition city is planning to install in the city centre in 2018 4 EV fast-chargers for public use.

3. Main stakeholders in public transport

The Public Transport Center of Tartu County is the official body to manage relations between county municipalities. The institution will be involved in discussions of the integration of public transport between Tartu and surrounding municipalities.

The Ministry of Economic Affairs and Communications is responsible for Estonia's National Transport Development Plan 2014-2020 that describes the country's main goals in the development of the transport sector and henceforth the framework under which the Transport Development Plan of Tartu City is implemented and further developed.

The Environmental Board is an environmental advocacy group promoting sustainable public transport.

Local communities are everyday users of public transport services and good local experts.

Associations and unions are experts for special needs (disabled people etc.).

4. Regional and national policy: drawbacks and initiatives for sustainable public transport

How public transport is linked to the regional innovation strategy for smart specialisation (RIS3) or other strategies?

The smart specialization guide by the European Commission categorizes Tartu into the periphery, according to the region typology, where there is a lack of strong fields of study and limited international connectivity³⁹. In such regions, the main goal of action plans is making global connections, which is why local politics needs to support international cooperation.

Estonian regional development strategy has set a goal of increasing the international competitiveness of the urban area of Tartu (the city of Tartu and its neighbouring municipalities) as a knowledge-based economic centre, specializing in fields such as biomedicine, biotechnology, and ICT. To strengthen the influence of Tartu's urban area in the whole region (South Estonia, NUTS3), the strategy brings forth a need to turn greater

³⁹ Source: Guide to Research and Innovation Strategies for Smart Specialisations (RIS 3). European Commission, 2012.
http://ec.europa.eu/regional_policy/sources/docgener/presenta/smart_specialisation/smart_ris3_2012.pdf

attention to better connecting the urban area of Tartu to the rest of the region with transport (and collaboration in development).

For Tartu, international communication is important due to the city's status as a centre of internationally competitive higher education, medicine, and research and development. **Tartu county development strategy** highlights the accessibility of Tartu county on an international level and improving the county's road and transport connections. The reconstructed airport enables international flight connectivity, although currently connecting only one international destination (Helsinki). Tartu does not function as an international railway station. The Rail Baltica high-speed train will not be passing through Tartu. The renewed railway infrastructure is between Tallinn and Riga, but does pass through Tartu and then onto Riga. The development strategy states that the limited international transport connectivity is due to low demand and low payoff. Therefore, the short-term development needs to make international connections does not require new investments, but better solutions to use the already constructed infrastructure.

Smart development strategy of Tartu and South Estonia emphasizes the importance of international communication in inclusion in international markets and increasing interest of foreign labour force, as well as promoting health tourism. The latter is deemed as a potential field of development in the region. The strategy emphasizes the need for improving the communication networks of the city of Tartu, particularly international air traffic and fast train connection between Tallinn and Riga. This is supported by the **state-wide plan "Estonia 2030+"**, which highlights Tartu as an important innovation and research centre that needs international flight connectivity. In the future, it may be possible to open new regular airlines to distant destinations. At the same time, quick and frequent passenger train traffic could begin to replace short-distance flights.

In addition, the smart specialization strategy of Tartu and South Estonia foresees the creation of innovative e- and m-services in various parts of Tartu's urban life, and their development through the e- and m-cities solutions cluster (Smart City Lab). One of the fields of focus in the cluster is smart (public) transport.

Status of digital development - national regional policy, strategy and/or action plans related to the EU White paper on public transport, how they help to promote public transport?

The Transport Development Act refers to the fact that technological development enables to use smart solutions in transport - making different means of transport more convenient and attractive by connecting them with infosystems, info sharing, and simpler paying for the service. When planning transport and drawing up projects, solutions based on up-to-date ICT are preferred. In addition, the development of integration between different modes of transport and/or additional services' integration with trip planning is also supported. To ensure integration, attention should also be turned to web-based infosystems which support using many modes of transport - intermodality. The goal is to develop existing solutions, using and developing further best practices from other countries, and creating innovative solutions. Attractive ICT-solutions could improve the reputation of public transport.

Today there is a working real-time public bus transport monitoring infosystem in place in Tartu, buses have tracers and screens to give passengers information. Many bus stops are equipped with electronic information signs which show info on arriving buses. The RFID ticketing system and contact-free payment system are in place. Buses have been equipped with counters. A pilot project has been initiated to set up electronic information signs based on e-ink technology in bus stops.

Developing and implementing ICT-based services is dependent on the openness of the society to technological solutions, and infrastructure. **The Development Act of Information Society** emphasizes the need for an infrastructure that considers residents' needs and allows them to use fast Internet at any time. Technical Regulatory Authority measured speeds of 30 Mbit/s mobile internet in 99% of 1500 data collection spots, and 100 Mbit/s in 37% spots⁴⁰ over Estonia in 2016. It is wished that Estonian people would have sufficient ICT knowledge to better their welfare. According to 2016 statistics, 17% of Estonian people aged 16-74 do not use internet. 65.5% of people had used internet away from home or work using a portable device, such as a mobile phone.

Based on a 2014 study, the most users of transport e-services are 16-34 years of age, Estonians, highly educated, and living in the Tallinn and Tartu regions⁴¹. 24% had not used – services at all. Most non-users were among 50-74-year-olds, people of other ethnicities, and people with vocational secondary education. Three most used e-services were: Tallinn public transport trip planner (soiduplaan.tallinn.ee), national public transport planner (peatus.ee, incl. mobile app), and the Elron e-service (app “Rongiajad”, which enables to view train schedule times from a mobile phone). In 2014, 71.5% of internet users aged 16-75 had heard of the national public transport planner (peatus.ee), but only 37.8% had used it⁴².

Furthermore, the The Development Act of Information Society foresees making better decisions using ICT, which would ensure that decisions are thought through and based on knowledge. One action proposed is using ICT-solutions which promote analytical thinking. Research into real-time data monitoring and predictions from advanced analytics and big data trends is deemed important. The Transport Development Act also states the need to develop infrastructure to collect real-time data. In addition, there is a wish to establish development or pilot projects in collaboration with the private sector and scientists in the fields of data analysis to create innovative solutions for Estonia's needs.

The city of Tartu is conducting a public bus route network analysis and modelling a new route network. WSP Finland OÜ and Positium LBS OÜ (University of Tartu spin-off company) are collaborating in optimizing the current bus route network. The result of this will be a route network proposal consisting of three scenarios. The optimization of the route network is based on mobile positioning data analysis, which enables to position people's everyday movements (i.e. between work and home). Bus card validation data, and students'

⁴⁰ Source: Elektroonilise side ülevaade – I kvartal 2017. Tehnilise Järeelvalve Amet. https://www.tja.ee/sites/default/files/content-editors/Sideulevaated/elektroonilise_side_ulevaade_i_kv_2017.pdf

⁴¹ Source: Kodanike rahulolu riigi poolt pakutavate avalike e-teenustega 2014. TNS Emor. https://www.mkm.ee/sites/default/files/avalikud_e-teenused_2014_lopparuanne_tns_emor_korrigeeritud05022015.pdf

⁴² Source: Statistics Estonia (IC392: INTERNET USERS AGED 16-74 BY PLACE OF RESIDENCE AND E-SERVICE OF PUBLIC AUTHORITIES). Year: 2014.

and kindergarteners' place of residence data is also used in the study. In May and June (2017), working groups with stakeholders were conducted to get input from transport users.

Iniciatives to promote public transport.

The Tartu City Government has signed the Memorandum of Understanding (other parties include the Ministry of Economic Affairs and Communications, Road Administration, AS Eesti Liinirongid) to create a contact-free payment system according to international standards in public transport.

The city of Tartu is a member of the International Association of Public Transport. It is an international network connecting municipalities, transport companies and specialists. The aim of the association is to improve quality of living and economic welfare by supporting sustainable city transport all over the world.

In addition, the city takes part in the international car-free day, where car drivers can use public transport for free with their driver's license. The goal of this day is to direct more drivers to use public transport.

Legal constraints. Obstacles created by legislation which hinder public transport development.

The Tartu County Development Strategy indicates that current legislation does not foster cooperation in local and regional bus route development. School buses funded by municipalities, worker transport organized by employers, state funded public bus transport, and commercial bus transport are all operating on a local level. The development strategy sees the establishment of a regional public transport centre in cooperation with municipalities and the state as a possible solution. The task of this centre would be to arrange all bus routes. This is supported by the Transport Development Act, thereby highlighting that institutions managing public transport need to turn more attention to route network and schedules' coordination. Integration of county bus route network and workers' transport organized by employers should be fostered.

What challenges do public transport providers face?

The Transport Development Act highlights the lack of bus drivers as a major issue of bus transport companies, which might become critical in a few years. The act foresees that to ensure the supply of bus drivers, state-organized bus driver training needs to continue. The same act states that due to an increase the use of cars, the number of passengers on regional bus routes has decreased, which in turn has reduced ticket sale profits and it is no longer possible to increase the services offered. People's needs for mobility have changed, but the regional bus network has not adapted to this change (it was built to connect to regional centres), which is why it is easier for people to use cars instead. On the other hand, there is a problem with regions where demand is decreasing due to decreasing population. In such regions, increasing services provided is not feasible. The Transport Development Act emphasizes that the aim of public transport is to provide minimal means of mobility to those who for some reason cannot or do not wish to drive a car. The act states that the bus route

network needs to be reorganized according to people's needs. One suggested solution for sparsely populated areas could be implementing a flexible public transport solution (bus on demand, social transport).

Which kind of support is available to public transport businesses to upscale their services?

According to the Transport Development Act, the public sector must provide a stable framework (including infrastructure) to support service quality, so that transport service providers could offer and develop their service. Local public transport is organized and financed by the local municipality, setting service standards if necessary. The state supports investments, which fulfil the goals set by the state (i.e. integration of route networks, achieving environmental goals). Local municipalities will be supported by the European Union Structural Fund to prepare and carry out sustainable urban mobility projects. Constructing central bus stations is one preferred activity, which is eligible for sustainable urban mobility funding from EU structural funds. Purchasing environmentally friendly vehicles will also be supported to the extent by which the cost of the environmentally friendly vehicle exceeds that of a diesel powered vehicle.

Costs related to the transport system will be covered by the public sector along with consumers (passengers using the service). For the public sector, the highest costs will be in relation to road maintenance and allocations for public transport. Regional and national public transport is subsidized by the state⁴³. Local bus transport is subsidized by the local municipal budget. Supporting long-distance public transport (mostly commercial) can have exceptions if an important connecting route cannot be maintained commercially (low payoff), and if said route is essential for providing regional mobility or reaching a set service standard. When organizing regional bus transport, the plan is to continue contracting a service from bus operators (who will be paid by the route kilometre contracted). However, the paid sum will be dependent on keeping to the quality criteria, which should support those bus operators who wish to increase their service quality.

Which are the main driving forces in the development of rural public transport?

The local public transport is formed by the local municipality, regional transport by the State and The Public Transport Center of Tartu County (until 31.12.2017 by County Government). In rural areas, transport development is affected by **demand**. The Transport Development Act states that there are those sparsely populated areas where providing public transport which would compare to the convenience of car transport is not feasible. However, mobility should be provided as a base service, which means that means of transport will be provided to people who currently do not have the possibility of using their personal vehicle. Public transport

⁴³ Remark: In 2015, the cost of one Tallinn-Tartu trip with a diesel train was around 1800€. The state financed about 72% (1300€) of this amount. The remaining part (500€) was paid by travelers through a ticket purchasing. The cost of the ticket was therefore around 10€, while the actual cost per passenger was about 36€ (source: postimees.ee).

must enable access to central areas (cities, municipal centres), or stations connecting to central areas. The Tartu County Development Strategy follows the principle that the county centre Tartu must be connected to the region through public transport (daily, at least 3 times a day). The aim is to ensure quick and frequent connection between the county and Tartu city through an integrated public transport network. Students should have the possibility of taking public transport to the county centres (Tartu city) to go to school.

Due to low demand and the small number of departure caused by demand in sparsely populated areas, it is often not possible to provide suitable public transport schedules for everyone. The national plan “Estonia 2030+” sees flexible bus routes, or other smart solutions, instead of regular routes as a possible solution for the quickly changing demand.

It is only feasible to develop a service focused on reducing the use of cars in towns with more than 3000 inhabitants. In such regions it is possible to offer public transport in a cost effective manner. However, the current public transport often **does not meet the needs** of people (unsuitable route, connection speed or schedule). At the same time the constant changes in population distribution and land use make adapting the public transport network difficult.

A respectable number of families have settled in the hinterlands of the city of Tartu. Developments in the hinterlands affect city traffic greatly. People travel daily to the central city for work, to use services and other public amenities. Because public transport is not taken into account when constructing new residential areas in the immediate vicinity of the city, people living there are dependent on their personal vehicles, hence affecting the traffic in the city. Although public transport is organized by the municipal government, it is important for municipalities to **cooperate** with one another. For example, the city of Tartu has an agreement with Luunja municipality to extend one city bus route to the municipality's territory. At the same time, in the development plan of the Luunja municipality, it has been noted that the neighbouring settlements of the city are developing and growing, but newly built areas lack public transport connections with the city of Tartu. Thus, Luunja's development plan sees the development of public transport with Tartu as an important developmental trend. A similar bus route is in place in cooperation with Tartu municipality, which, according to the municipality's development plan, has significantly increased the value of the region as a living environment. The development plan of the municipality of Tartu outlines the desire to connect its areas close to the City of Tartu with its public transport system.

Other neighboring areas of Tartu City also emphasize in their development plans the need for more effective connections with the city. The development of public transport allows better realization of the favorable position of rural areas to the city of Tartu. For example, in the development plan of the Ülenurme municipality, the favorable impact of high-quality public transport on labor mobility is introduced. The city of Tartu as an important work center is also emphasized in the Tartu municipality's development plan, so it is important to strengthen the public transport links between the municipality and the city of Tartu.

When planning cycling roads, the city of Tartu has cooperated with neighbouring municipalities and the Road Administration. For example, the city of Elva emphasizes in its

development plan the creation of comfortable connections with larger cities and municipalities, as well as developing light traffic routes between Elva and Tartu.

According to the Transport Development Act, to realize the strategies and development plans supporting regional public transport it is necessary to provide a convenient public transport service without forgetting the **so-called last-mile mobility**. Connection between different means of transport needs to be ensured. The development act brings forth a solution of driving a car to the train station, where from it is possible to take the train to bigger centres (in this case, to the city of Tartu). Upon reaching the centre, one should be able to use, for example, bicycle rental to reach the destination. The Tartu county Development Strategy sees a possibility to establish bicycle rental stations in regional bus stops, and that nearby municipalities would be connected with a network of cycling roads. Currently such bicycle rental stations have not been created by most regional bus stops. Cycling roads supporting the accessibility of public transport are partially developed.

5. SWOT analysis

• **Strengths(inner):**

1. There is generally a well functioning public transport system, the route network is covering the entire territory.
2. The city of Tartu has a convenient and accepted ticket system that favors frequent travelers. A favorable bus ticket price.
3. The Tartu city lines are serviced by new, modern, low-floor and environment-friendly buses. A methane gas station has been built.
4. Digital systems (real-time bus systems, ticketing systems) are in use. There is a mobile app for sharing passenger information.
5. The city is compact and the distances are relatively short.
6. Tight bus stops network. Public transport (bus stops, bus station, railway station) is easily accessible.
7. Growing network of light traffic routes. Support for bicycle use (N: support for building parking lots).
8. Good parking arrangement for vehicles in the city.
9. High-quality road and street network.
10. Bikeshare system to be created soon.
11. Active communities (unions, associations).
12. The long-term strategies and goals that support national goals are formulated, both at the Tartu county and Tartu city level. Activity in transport issues (including the Light Traffic Commission).

• **Weaknesses(inner):**

1. Insufficient rail and river crossing points. Conflict crossings by railway.
2. Public transport speed is too low, bus intervals are too long.
3. Bus routes are not linked to residential areas in the vicinity of the city.
4. Road and street pavements in poor condition.

5. A large part of the traffic flows in Tartu through the city center.
6. There are no sidewalks in some streets.
7. Inadequate maintenance of light traffic routes.
8. County bus lanes are not suitable for disabled people.
9. Low overall traffic culture.
10. Light traffic have too low priority.
11. The parking arrangement of large vehicles (trucks, buses) in Tartu is unsatisfactory.
12. Different ticket and payment systems in different modes of transport.
13. Tartu bus- and railway stations are weakly interconnected.
14. The dependence of public transport on other transport (missing priority systems).
15. Light traffic road network is intermittent.
16. Planning activities unsatisfactory.
17. Missing communication.

- ***Opportunities(external):***

1. The administrative reform creates prerequisites for strengthening transport cooperation with other municipalities in the region (optimizing the public transport network, developing intermodality, extending city lines).
2. The creation of a cross-border public transport center supports cross-sectoral cooperation (transport, planning activities) in the region.
3. Technological development creates the prerequisite for maximizing the potential of the information society. The digital literacy of people is relatively high, people are open to new technologies, ICT resources are widespread among the population. In addition, ICT-enabled solutions allow for better analytical capacity and, thus, the quality of planning activities. Testing and deployment of new technologies.
4. The emergence of new residential areas fosters the development of demand transport and the introduction of sharing solutions (car sharing, bike sharing).
5. Strengthening train services provides the opportunity to better connect rail and bus traffic.
6. Urban sprawl provides an opportunity for the development of light traffic and public transport and for better interconnection between different modes of transport.
7. Car traffic growth is beneficial for the development of public transport and light traffic.
8. Free bus transport for users on county lines can increase the number of public transport users.
9. The concentration of the regional public transport organization in the Tartu County Public Transport Center has a good impact on planning activities and facilitates the organization of transport.
10. Administrative reform has reduced the number of decision-makers and the coordination of activities between different municipalities could improve.

- **Threats(external):**

1. Political decisions - reduction of subsidies, changes in transport priorities, changes in taxes.
2. Continuing growth of car traffic (even when conventional vehicles are replaced by electric vehicles). There are no changes in people's attitudes. Investments in the developing of public transport and light traffic will not be feasible.
3. Demand reduction due to the departure of people from the area. The concentration of jobs in the metropolitan area, the differences in income levels between the capital and the rest of the regions, making the metropolitan area for more attractive living environment.
4. Increasing demand may reduce the quality of public transport services (overcrowding of public transport).
5. With the increase in the number of passengers, the pressure on Tartu Bus Station will increase (for already narrow conditions). Existing infrastructure does not meet the expected changes in human habits.
6. Possible shortage of bus servicing personnel.
7. The possible increase in maintenance costs of infrastructure (ie roads) and inability to ensure the proper maintenance of infrastructure.
8. The use of cars is too comfortable and inhibits the development of more sustainable modes of transport.
9. Badly functioning public transport (over-execution, failure to observe schedule, long intervals, dirty vehicles) diminish the reputation of public transport.
10. When improving the quality of public transport, pedestrians and cyclists (not car users), will begin to use it more.
11. Fluctuations in the prices of motor fuels cause unexpected additional costs and pressures on public transport fares.
12. Sustainable transport solutions compete with each other.
13. Low traffic culture is an obstacle to the development of light traffic.

SWOT Conclusions:

- The level reached in public transport (quality, ticket prices) deserves to be maintained and further developed. It is necessary to integrate ticket systems, coordinate timetables and direct efforts to introduce demand-side solutions. One of the ways to regulate bus occupancy is to change the ticket system, where the peak season is more expensive and cheaper at other times.
- The existing network of bus lines in Tartu has to be extended to suburban areas (residential areas) and to adjust the network so that it corresponds to existing and future developments in urban areas and in the vicinity of the city.
- A good network of roads and streets (including the Idaringtee) allow direct traffic around Tartu downtown, giving more space in the city centre for light traffic.
- Involving active citizens, stakeholders and communities in traffic-based discussions will provide solutions for wider use of sustainable mobility modes. In cooperation with stakeholders, it is possible to effectively develop a variety of sustainable solutions: demand transport system and sharing (car, cycling) solutions.

- More active and systematic communication activities will increase the traffic culture and help increase the image of sustainable mobility (walking, cycling, public transport).
- It is necessary to strengthen cooperation with municipalities in the region and transport managers in order to ensure a sustainable, seamless and coherent transport system in the long term. Integrated planning, the deployment of new ICT systems and the targeted development and integration of existing ones will improve the ease of use of public transport.
- Efforts / investments that have already been made and are needed to develop public transport and light traffic are prerequisites for changing people's patterns of behavior, reducing car traffic and increasing the use of sustainable modes of transport.
- Co-operation with interest groups can effectively improve the traffic culture, plan a more user-friendly infrastructure and implement innovative transport solutions.
- The city center of Tartu should be opened up to a greater extent to light traffic (Riia-Turu intersection, Vabaduse blv), Which improves the possibilities of light traffic, reduces car traffic and creates the prerequisite for the construction of a city bus terminal, which in turn increases the attractiveness and priority of public transport.
- Planning activities based on well-considered and clear priorities (light traffic, public transport) can, in the long run, achieve a sustainable and human-friendly transport system.
- The city of Tartu must cooperate with neighboring municipalities in order to harmonize the conditions for planning new real estate developments. It is important that in larger plans public transport requirements are taken into account and residential areas can be linked to the public transport system of Tartu city.
- It is advisable to draw up a joint sustainable mobility plan for the Tartu region (county).

6. Analysis and identification of main regional experiences and lessons learnt/ Good practice assessment (local practices already implemented; TOP 5 from other partners)

6.1. Assessment of own selected good practices

In 2010 was carried out a procurement (starting from January 2011) for public transport services in the city of Tartu. The aim of the procurement was to rise a quality level of public transport system and thus increase the number of users of city public transport system. There was set many different requirements to fulfil by operator. The most important requirements where: all buses must be brand new and low-floor buses fulfilling requirements of standard EURO5. Among other conditions there was required to introduce at minimum 5 CNG buses. As a result of the implementation of new buses and the improvement of the quality of public transport, the number of public transport users increased by about 10% in 2011-2012. Thanks to the introduction of CNG buses, the city also had a public gas station, which provided a significant boost to the use of gas-fuelled vehicles.

Tartu is a rather compact city territory and most of the destinations are easily accessible by foot or by bike. If the percentage of pedestrians has been fairly high (about 40%), the proportion of cyclists is quite small (up to 3% of all movements). In order to increase the proportion of light traffic from everyday movements and to improve connections between

downtown and suburbs (including surrounding municipalities), it was decided to build new bicycle roads. The planning of roads was based on the principle that a logical network of bicycle paths would be created and all the main directions going out of town would be covered. Along with the creation of new bike roads, existing roads were also repaired and bicycle traversing opportunities for more than 100 kilometres on the roads were improved during the project. As a result, the share of cycling in everyday movements has grown by more than 6%.

Most European cities are looking for ways to reduce motor vehicle traffic in the city centre and reduce the environmental impact of motor vehicles. Since 2009 is allowed free parking for electric cars and electric hybrids in the paid parking areas of Tartu city. In 2017 was reformed paid parking policy in the city: reduced categories of parking areas, constructed free parking areas in the border of the city centre and increased parking fees. As a result, there are significantly less cars parking in the streets of the city centre and significantly increased the number applications for parking of electric cars and electric hybrid cars for free in paid parking areas. Lower traffic loads and wider usage of cleaner vehicles has led to cleaner urban air and helps to reduce the noise pollution in the city. About 15% of parking lots in the city centre are vacant after the implementation of practice. Applications for free parking (electric vehicles, electric hybrid vehicles) is increased up to 30% from all applications.

6.2 Selecting good practices from other OptiTrans partner regions

Baia mare – “Extension of the public transport from the Baia Mare Municipality to the Baia Mare Metropolitan Area”. The implementation of this project aimed to improve the accessibility and mobility of the population within the metropolitan area, by extending the public transport from Baia Mare to the level of its metropolitan area, which includes six neighbouring localities. New routes and tariffs for the routes were set for the metropolitan area. New means of transport has been purchased at high quality standards to operate in Baia Mare and the existing fleet of MERCEDES CONNECTO buses has been allocated for operating in the metropolitan area.

The project can be a good practice model in terms of increasing the mobility of residents and reducing pollution, based on the extension of public transport to metropolitan areas, thus encouraging its use instead of using personal means of transport.

Baia mare - „Upgrade and extension of the public transport system in Cluj - Metropolitan Area - stage I”. The sustainable development of the public transport system in Cluj Napoca Municipality was realised through:

- modernization of public transport stations, bringing them to international standards (in terms of technical and operational parameters), creating an appealing design for the stations. Also ensuring lighting system in the stations. Mounting display panels that provide information on the estimated time of arrival of the public transport in the station.
- Increasing the comfort of passengers by implementing hourly tariffs and the possibility of using travel titles on any means of public transport and for a certain period of time, regardless of the route travelled.

- Installing an automatic, non-stop, system for issuance of travel tickets. The placement of automatic machines for the issue of non-stop travel passes in areas with an important passenger traffic.

The means of public transport are equipped with dual validators that interact with contactless cards of passengers and paper tickets as well as with board computers that remember the type of ticket purchased and function as a buffer for validators to the data points at the ends where the data collected on the route is entered into the automated system.

The project can be a good practice model in terms of increasing the mobility of the inhabitants, based on the introduction of modern taxation and tariff integration systems.

Thessalay - CityMobil2 is setting up a pilot platform for automated road transport systems. Automated transport systems are made up of vehicles operating without a driver in collective mode. They are deemed to play a useful role in the transport mix as they can supply a good transport service (individual or collective) in areas of low or dispersed demand complementing the main public transport network.

The project can be a good practice model for the development of metropolitan areas as well as increasing mobility of residents and reducing pollution. CityMobil2 partners can teach how to safely implement last mile automated transport services.

Thessalay - European Smart Mobility Resource Manager. MyWay investigates, develops and validates an integrated platform, the European Smart Mobility Resource Manager, including cloud-based services and facilities to support community supplied information collection and processing.

The project can be a good practice model as the purpose is to holistically address the efficient and seamless integration and use of complementary, capacity-limited mobility services in the overall urban travel chain, including all transport modes (motorised and non-motorised, EVs, public transport, flexible services such as transport on-demand) and mobility sharing schemes. This approach gives priority to the egocentric vision of the user, finding the right compromise for each single traveller and offering a solution closest to his personal needs and preferences, making the frequent use of it (as an alternative to an ideal but not always practical solution) a main contribution to the sustainability of urban transport.

Thessalay – Move on green. The aim of the project was to improve policies on sustainable transport in rural areas. Since the population densities of regions participating in MOG are all under the EU average, all experiences and policies implemented to render sustainable transport feasible in these areas will be replicable in all rural areas of Europe, many of which do not suffer from extreme situations. In many of the project partner regions, depopulation has been severe for many years now so policy makers have developed interesting solutions for mobility. Many of the best practices on the part of the partners already identified during the preparation stage of MOG are highly innovative. Practices (e.g Public Transport Modelling and Optimization, Demand related public transport systems) can be found from: <http://www.euromontana.org/en/project/move-on-green-2/mog-good-practices/>

7. Conclusions

At the present, the modal split of Tartu City is as follows: private cars 28%, public transport 27%, pedestrians 40%, cyclists 5%. The statistics of recent years show that the use of public transport is in slight increase in Tartu. By contrast, the use of private cars is also increasing – especially for transport between the urban centre and the expanding city outskirts and surrounding municipalities. This leads to congestions on major traffic routes and threatens Tartu's ambitions to reduce CO₂ emissions within the city.

The city of Tartu has set a goal of increasing the share of public transport users (including bus traffic), pedestrians and cyclists. To do this, it is adamant to take people's need into account when organizing public transport. The main problem is with the sparse bus schedules. Routes are usually long, and combined with a sparse schedule, it makes using public transport more time consuming than commuting with private vehicles. The time consumption is increased by the lack of integration between different modes of transport. To ease the transport demand of people living on the outskirts of the city, which today cannot be done by county bus routes, collaboration with neighbouring municipalities to lengthen urban bus routes into living areas near to city border of surrounding municipalities should be considered. In addition, it is advisable to integrate county and city bus routes by establishing comfortable switching opportunities from county buses to city buses in the bus stops located in the city border. Through this there would be the potential of reducing the dependency of residents in urban sprawl on their private vehicles. At the same time, though, using public transport should not become more inconvenient or time consuming for the citizens of Tartu. Efforts should be made to speed up the integration of the regional centers (in particular, the city of Elva) with Tartu.

The expansion of cycling roads and their conjunction will help create a greener living environment. The people of Tartu are open for cycling and value the current efforts of the city government highly. The residents of the region think that having safer roads would foster higher use of bicycles. In addition to cycling roads, people wish to see the development of other parts of the infrastructure (such as bicycle parking facilities).

Today, the city had begun in order to grow the share of public transport users, cyclist and pedestrians by optimizing the public transport network, using the latest technology for communication bus route info and to make using public transport more convenient. A bicycle rental system will be soon launched. The recently built cycling roads have already increased the percentage of cyclists in traffic.

The region's relatively high digital skill, spread of ICT tools, and openness to new technologies makes it easier to implement change despite the small population. Universities and companies originating from it offer modern smart solutions to better the everyday living environment and make it more knowledge-based. The city of Tartu as a magnet of South Estonia has the potential to develop into a city with an inspiring living environment, which emphasizes the transport system and the integration of different means of transport because of its citizens' mobility needs. Thereby it is possible to reduce the negative environmental impact of transport, which will lay the foundation of creating a better living environment.

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8. List of stakeholders interviewed

Tõnu Ints - Tartu City Council
Kadri Leetmaa – Tartu City Council, University of Tartu
Jüri Ginter – Tartu City Council
Jüri-Ott Salm - valimisliidud
Avo Rosenväld - Tartu City Council
Arno Arukask - Tartu City Council
Toomas Kapp – Tartu Veevärk AS
Rein Haak – Tartu City Government
Mati Raamat – Tartu City Government
Viljar Nurme – IB Foor OÜ
Erki Lipre – Ridango AS
Madis Sassaid – GoSwift OÜ
Aare Remmelga – IB Foor OÜ
Tarmo Schmidt – Mobi Lab OÜ
Kirke Williamson – Estonian Road Administration
Peep Margus – Tartu City Government
Jaanus Tamm – Tartu City Government

Annex I: Interviews with stakeholders.

How do you rate today's use of public transport in rural areas?

The main obstacles to the use of public transport are three: unfavorable line network, line scheduling and integration between modes. As the possibilities for using public transport are limited, it has a detrimental effect on the usage of public transport.

What are the main factors preventing the use of public transport in rural areas?

The problem, in particular, is that public transport does not meet the needs of users. The discussions highlighted the poor connection of the rural areas with the city's public transport network. It was pointed out that the development of route network should be based on the location of new residential areas, especially in terms of education-related movements (ie, schoolchildren). At the same time was pointed out that buses stop working too early at evening times on routes. The county lines do not allow comfortable use of bus transport of people with special needs.

The discussion of the so-called last mile problem appeared: "The railway station (in the city of Tartu), as the city's logistics center, should be connected to all city districts, it is very uncomfortable to reach the railway station using city buses. Then I miss the train variant or drive a car / taxi. " It was also pointed out that schedules of city buses do not match train times. In addition the problem of urban lines in keeping with the schedule makes it difficult for travelers to plan their journeys, especially if it is necessary to reach, for example, using city buses to reach the county line, when the latter are characterized by a rather thin graph.

What should be done to make public transport more competitive?

At times there are very long intervals between buses, so it was found that schedules of buses should be considered in terms of frequency. At the same time, it was emphasized that for help could also be an extension of the bus lines, which would help to reorganize the network and improve the accessibility of public transport.

A disruptive factor was the difference in the "system" of county lines and city lines. The county lines do not provide within the city bus service for those who would like to travel inside the city. Namely, the county lines, which, upon reaching the city, duplicate the city bus routes.

As mentioned, the lines will stop their work too early. In the evening time, it is not possible to access the city or return back using public transport (except taxi service).

How do you rate public transport subsidies?

The discussion pointed out that if transport has already been largely subsidized, then why can not public transport be fully subsidized and thus provide public transport free of charge.

What are the in-kind opportunities for increasing the share of light traffic and public transport in rural areas?

In order to increase the share of light traffic, it would be necessary to extend and interconnect light traffic roads between the city of Tartu and its neighborhoods municipalities, while paying attention to the connection of important areas, objects (including access to bus terminals through secure light traffic routes). Also should be considered broader extension of city bus lines to the periphery of the city. More attention needs to be paid to informing people to be aware of the existing alternative solutions to car transport. Information on the light traffic network and public bus lines must be easily accessible.

Annex II: Interviews with residents in the area.

The study was conducted in 2017. in September.

The survey was conducted in and around the important hubs of Tartu: Railway Station, Küüni Street, Market / Bus Station, Eeden Shopping and Recreation Center, Lõunakeskus, Nõlvaku Prisma. Questionnaires were selected from the most visited areas and nodes to include different target groups and places where residents of Tartu and the surrounding area are moving. At each point 20 people were interviewed and men and women were equally involved in different age groups.

The web-survey was conducted over the course of the week on the website www.tartu.ee.

In total, 1526 people participated in the survey, of which 1406 completed a web survey, 120 people were interviewed on the streets of Tartu. The final sample was made up of 440 men and 1086 women.

Residence/Age	Up to 11 years	12-24 years	25-39 years	40-64 years	Above 65 years	Total
Tartu city	7	143	535	331	40	1056
Tartu rural municipality		6	53	25	1	85
Luunja municipality	1	4	31	17	1	54
Haaslava municipality		1	5	5		11
Ülenurme municipality		6	100	43		149
Tähtvere municipality (former)	4	13	47	38	7	109
Tartu county (ohter areas)		7	27	27	1	62
Total	11	180	798	487	50	1526

Since the number of respondents varies according to administrative units (Table 1), the answers by local governments are not compared and the questionnaires of respondents from the Tartu city neighborhoods are treated from their perspective.

• How often do you use public transport / bicycle / walking?

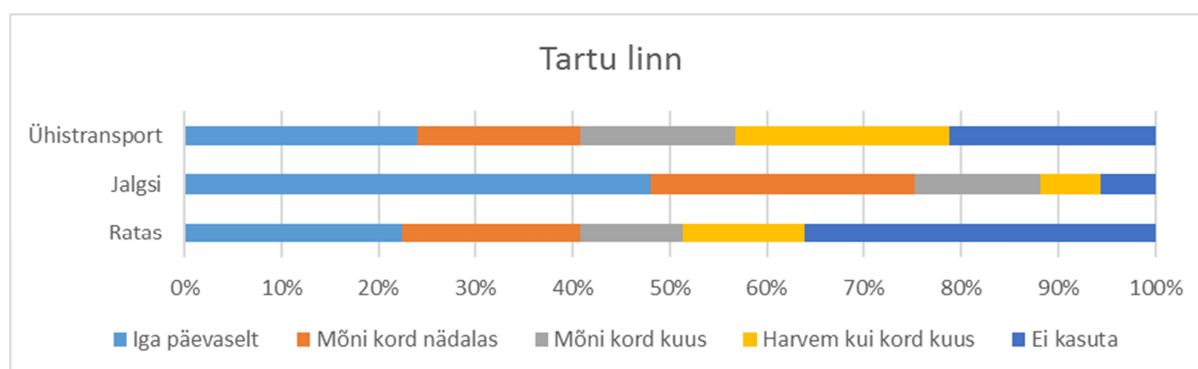


Figure 1. Frequency of use of different modes of transport among respondents, by administrative unit. 100% corresponds to the number of respondents who responded to this questionnaire. Results of Tartu city. (first row – public transport, second row – walking, third row – cycling. Blue- daily, orange-some time in week, gray-some time in months, yellow-less then once in months, dark blue-don't use at all)

Almost half of the respondents who answered the survey stated that they are moving around on different occasions (for example, work, residence) on foot (Figure 1). 75% of the respondents who answered the survey relatively often, (every day or some days in week) are walking. Relatively high is the number of users of public transport and also the use of bicycles. Just over 40% of the respondents use these mode of movement on a daily basis or some times per week. Rarely (ie monthly or less) 60% of respondents use public transport. The same can be said about bicycle use.

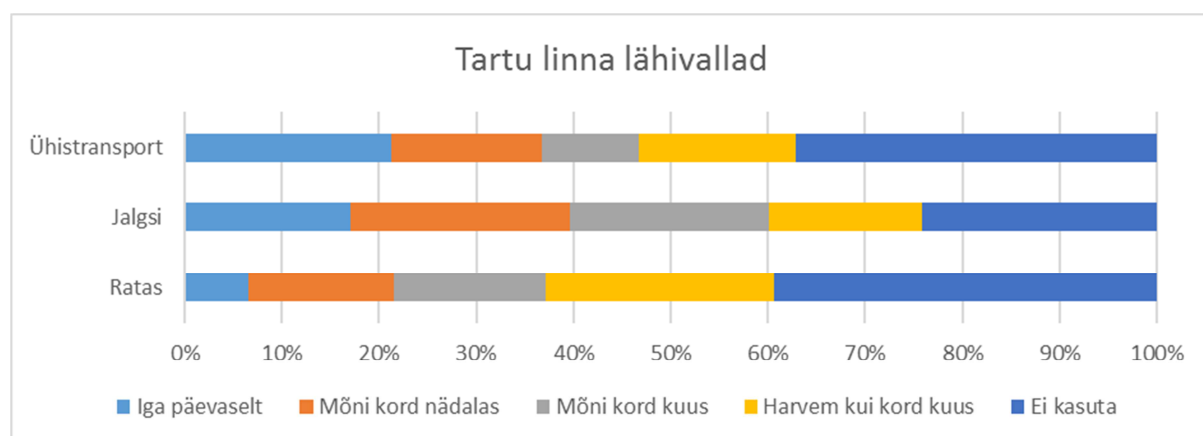


Figure 2. Frequency of use of different modes of transport among the respondents, by the residence of Tartu neighborhoods. 100% corresponds to the number of respondents to the surveyed administrative units. (first row – public transport, second row – walking, third row – cycling. Blue- daily, orange-some time in week, gray-some time in months, yellow-less then once in months, dark blue-don't use at all)

Among the respondents from the neighboring municipalities about 21% use public transport on a daily basis (Figure 2). Nearly 37% of respondents do not use public transport at all. About 7% of the respondents are daily bicycle users. Almost 24% of residents living in neighboring areas rarely (ie less than once a month) use bicycles for their moves.

About 17% of the respondents living in the neighborhood walk on a daily basis. Here it should be noted that since the poll does not reflect the positions of the respondents' jobs, it can not be assumed that the inhabitants of the neighboring municipalities, for example, go to work on foot in Tartu.

• What kind of movement do you prefer?

Among the respondents (residents of Tartu city) who answered the survey, the preferred mode of movement was the bicycle, which was favored by 29% of the participants in the survey (Figure 3). The proportion of people who prefer cars is about the same size. Walking prefers 22% of the respondents. 18% of respondents prefer to travel by public transport.

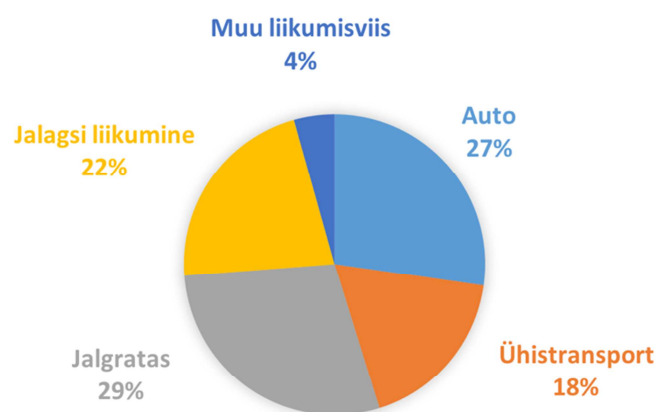


Figure 3. Preferred modes of movements of citizens of Tartu.

Among the residents of the neighboring municipalities of Tartu, the preferred mode of transportation is a passenger car (59% of the participants) (Figure 4). 20% of the inhabitants of the neighboring communities who participated in the survey favor the use of public transport and 11% prefer biking for their movements. 5% of respondents prefer walking.

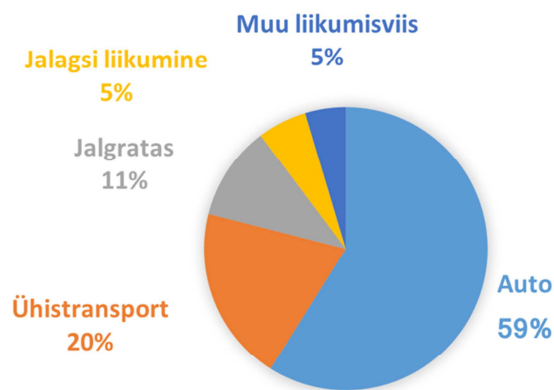


Figure 4. Preferred modes of movements of citizens of Tartu neighborhood municipalities.

• What would make public transport more attractive?

41.9% of the respondents who took part in the survey found that the schedule for bus lines is thin. Bus departures do not match with (high) school hours, even the center of the city can not be reached comfortably in "full-hours". It is also pointed out that several buses often leave one stop, followed by a 20 minute break. Many respondents point out that the problem has been going on for many years. According to city residents, they are disturbed by the fact that, if they are late at the station, they will be automatically lagged behind all the buses and the new bus will arrive too late at the stop. In connection with bus schedules, the lack of nightlines is also a problem. This is not possible to ride, for example, after the last movie séance in cinema from the city center to the suburbs by bus. Also, it is not possible to reach the city bus, for example, in the case of the arrival last long-distance buses and trains. In this respect, 2.2% of respondents pointed out a poor links between city public transport as well as different modes of transport (such as regional and long-distance bus, train and city connections).

Among the respondents in the city of Tartu 18.6% of respondents pointed out a too complicated bus line network and inappropriate routes as a problem area. 8% of the respondents who answered the survey think that speed of buses is too slow and that the problem is staying on schedule. 7.8% of the respondents think that a bus ticket can be cheaper or free of charge. 5.6% found that buses are too small, indicating on over crowded buses in rush-hours. The cleanliness of the bus seems to be a problem for 2.6% of respondents.

For 43.5% of the respondents of the neighborhood municipalities, the sparseness of the bus schedule was identified as a problem and that the schedule often does not meet the needs of users. At the same time, it was added that the county lines stop working too early. 25.5% of the respondents see the problem in unsuitable routes and suggest that urban lines could be extended further to neighboring territories. 5.1% of the participants found that the bus

connection is too slow and more comfortable is to use private car instead of public transport. 4.5% of respondents consider that the public transport fares should be lower or the public transport should be free for users.

- **Would you use the bikesharing system?**

The answers of the residents of Tartu, who participated in the survey, are almost equally divided in this section. 39 of participants (26 from Tartu city and 13 from neighboring municipalities) in the survey did not know what the bikesharing system is. Among the respondents from the neighboring municipalities of Tartu, there were somewhat more those who probably will not use the bikesharing system (216). 179 people who have responded to the polls are interested in the bikesharing system.

- **What should be changed so that people prefer walking and cycling to car driving?**

39.7% of respondents from Tartu city who responded to the survey found that more high-quality light traffic roads should be built up. In doing so, the paths for pedestrians and cyclists should be clearly distinguished. It was also pointed out that light traffic roads should be of higher quality and (even in winter) maintained. 24.3% of the respondents said that safety is important. Most respondents pointed out that light traffic tracks should be separated from car traffic.

14.1% of respondents points out that light traffic roads should form a coherent network. 11.4% emphasizes the need for secure (guarded) roofed bicycle parkinghouses. All through the questionnaires was pointed out a need for security. Many respondents also raised the problem of bicycle storage at the apartment houses. Many proposals was made by the respondents to create separate parking houses near to apartment buildings to store bicycles.

5.7% of the participants of the survey found that more campaigns would be needed to promote light traffic. There is identified two main needs, one that would help promote light traffic in general, and another which would help to improve the culture of light traffic (especially cycling). The respondents from Tartu city considered it important for the city to communicate more clearly the aim to make the city more light traffic friendly in the hope that it will reach the car drivers as well. At the same time, locals want to see clearer prioritization by the municipality and that the desire to promote light traffic would be something more then construction of roads.

4.6% of the respondents see the need to implement measures restricting car traffic.

38.3% of the respondents from neighboring municipalities found that more light traffic should be established, extending to neighboring municipalities. 13% of respondents in the neighborhood responded to the need to increase the safety of light traffic. 10.8% of respondents point out the coherence of the light traffic road network. 8.3% respondents pointed on poor lighting on roads and 4.2% of the respondents the need for roofed and safe bicycle parking facilities.