REPORT ON TEST SITE MOBILITY ANALYSIS

VERSION 1.0

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December 2020

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About ERA-Net Smart Energy Systems
ERA-Net Smart Energy Systems (ERA-Net SES) is a transnational joint programming platform of 30 national and regional funding partners for initiating co-creation and promoting energy system innovation. The network of owners and managers of national and regional public funding programs along the innovation chain provides a sustainable and service oriented joint programming platform to finance projects in thematic areas like Smart Power Grids, Regional and Local Energy Systems, Heating and Cooling Networks, Digital Energy and Smart Services, etc.

Co-creating with partners that help to understand the needs of relevant stakeholders, we team up with intermediaries to provide an innovation ecosystem supporting consortia for research, innovation, technical development, piloting and demonstration activities. These co-operations pave the way towards implementation in real-life environments and market introduction.

Beyond that, ERA-Net SES provides a Knowledge Community, involving key demo projects and experts from all over Europe, to facilitate learning between projects and programs from the local level up to the European level.

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About the EVA project
The EVA project aims to support urban and regional institutions to steer the transition towards electric, connected and autonomous vehicles exploring innovative territorial infrastructures capable of effectively supporting this transition. The project started in September 2019 and the project consortium has three partners: SUPSI from Switzerland, EURAC from Italy and AICO from Austria; and one affiliate partner: MINES ParisTech from France. For more detailed information we invite you to visit the project website evaproject.eu

About this deliverable
This deliverable is one output of the work package 2 – Pilot regions. The work package 2 is the starting point of the research work of the project EVA and aims to provide a detailed picture of the current mobility in the two pilot regions (Ticino in Switzerland and South Tyrol, in Italy) of the project, that will serve as baseline for the mobility scenarios of the work package 3 and the simulations of the work package 4.

This deliverable reports the main characteristics of the two project test sites (Ticino and South Tyrol). Firstly, the two tests sites are presented and analysed and afterwards the two sites are compared.
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INTRODUCTION

“Mobility – the movement of people and goods – is generally not an end in itself. Its value lies in the accessibility it provides and how this contributes to the functioning and quality of people’s lives, as individuals and as a society. Mobility is vital to the efficient movement of people and goods that underpins our economy” (Government Office for Science - UK, 2019).

It has been observed that mobility of people and goods is correlated with the economic flourishing of regions (Veiga Simão, 2014). For example in the EU-28, GDP and number of kilometres travelled have continuously grown until the economic crisis of 2008, when GDP shrank and number of kilometres travelled decreased as well (Figure 1). From there on, the GDP and number of kilometres travelled have continuously grown and despite of the COVID-19 pandemic that will for sure negatively impact GDP and mobility demand, past observations allow us to assume that the tendency for the years to come will be a quick recover and a continuous growth of both GDP and mobility demand.

![Figure 1 - Evolution of GDP and mobility demand 1995-2017 (European Commission, 2019)](image)

Considering only the movement of people, the passenger car has been by far the most important mode for passenger transport in all EU28-EFTA-Turkey countries, as shown in Figure 2. In Lithuania and Portugal passenger cars accounted for close to 90% of all passenger transport in 2016. Slovakia, Czech Republic, Switzerland, Hungary and Turkey were the countries were the shares of passenger cars were below 75%. For Turkey, this was reflected in the highest share of motor coaches and buses (28.5%) among the EU28-EFTA-Turkey countries. While in Switzerland, this was reflected in the highest share of trains (19.8%) among the EU28-EFTA-Turkey countries (Eurostat, 2019).
How people move and their respective modal split varies from country, region and agglomeration and depends on many factors, such as for example the existing infrastructures and the quality of public transport. Therefore, in this Deliverable a detailed analysis of the movement of people in the two pilot test sites of the project (South Tyrol and Ticino) is performed. The analysis for both pilot site focusses in the following indicators:

1. Mobility infrastructures and public transport offer;
2. Main travel flows;
3. Car ownership, driving licenses and public transport passes;
4. Modal split;
5. Trip purposes;
6. Local current projects promoting more sustainable mobility;
7. Future local game changer projects.

Such analyses allow to draw general considerations for both pilot tests; to conclude, a comparison based on the aforementioned indicators is presented.
1. SOUTH TYROL – ALTO ADIGE

South Tyrol-Alto Adige is an Autonomous Province in northern Italy located in the Alpine Space. This territory, jointly with the Autonomous Province of Trentino, constitutes the Trentino Alto Adige Region. Its official trilingual denomination is Autonome Provinz Bozen – Südtirol in German, Provincia autonoma di Bolzano – Alto Adige in Italian and Provincia autonoma de Bulsan – Südtirol in Ladin, reflecting the three main language groups to which its population belongs. The Province is the northernmost of Italy, the second largest, with an area of 7’400 square kilometres (2’857 square miles) and has a total population of 533’439 inhabitants (Figure 3). Its capital and largest city is Bolzano (German: Bozen; Ladin: Balsan or Bulsan).

South Tyrol-Alto Adige is characterized by the presence of the TEN-T Corridor: Scandinavian-Mediterranean (Figure 4 and 5) and by an economy based mainly on tertiary sector [commerce, transport and tourism] (Figure 6).
Figure 4 - TEN-T Corridors (European Commission, 2020)

Figure 5 - Province of South Tyrol-Alto Adige (Source: own elaboration adapted from TEN-T Corridors (European Commission, 2020))
This Province has been selected to be a Pilot in the EVA-project due to its particularly conducive features for the market uptake of EV and hydrogen fuel cell vehicles at EU level. According to Isetti, et al. (2020) high environmental quality and political autonomy that contributes to promote the adoption of renewable energy systems;

- high share of electricity produced in the region from hydro-power (91.6%) that guarantees the availability of renewable electricity for EVs;
- high commitment to reduce CO$_2$ emissions in the transport sector stated in the Provincial Climate Plan that foresees:
  o a reduction of 1.5 tons per year per capita by 2050;
  o to reach a share of 60% of vehicle-km travelled by zero-emission vehicles in 2050;
  o an incentive scheme to support EV purchases;
  o the commitment to improve charging infrastructures, to offer test drives and tax reductions to the citizens and companies purchasing EV.
1.1. Mobility infrastructures and public transport offer
This section provides a brief description of the road and rail infrastructure and the public transport offer available in South Tyrol – Alto Adige.

1.1.1. Infrastructure (roads, railways, cycling lanes and shared mobility stations)

Road network
In South Tyrol, there is an extensive network of highways, provincial and other types of roads as depicted in the figure 7. The total extension of the network is 2'173 km and length by typology of road is shown in the Table 1 (ACI, 2018).

<table>
<thead>
<tr>
<th>Highways (km)</th>
<th>Provincial roads (km)</th>
<th>Unclassified roads (km)</th>
<th>Total (km)</th>
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<tr>
<td>116</td>
<td>1'234</td>
<td>823</td>
<td>2'173</td>
</tr>
</tbody>
</table>

Table 2 shows the main indicators of the road network in South Tyrol (ACI, 2018).

<table>
<thead>
<tr>
<th>Km of roads/surface km2</th>
<th>Km of roads/population</th>
<th>Km of roads/vehicles*100</th>
<th>% Highways on total network</th>
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</thead>
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<td>0.29</td>
<td>0.43</td>
<td>0.81</td>
<td>5.35%</td>
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</table>
Figure 7- Road network of South Tyrol-Alto Adige (Amministrazione Provincia di Bolzano, 2020)
**Railway network**

In South Tyrol 79.38% of the 291 Km of railway is electrified (ASTAT, 2019). Figure 8 depicts the railway network of South Tyrol-Alto Adige.

*Figure 8 - Railway network of South Tyrol-Alto Adige (Source: Eurac elaboration from Geokatalog, 2020)*

The railway network is owned / managed by three companies:

1. RFI (Rete Ferroviaria Italiana) owns the lines: Salorno-Brennero (line 100 in Figure 8), Bolzano-Merano (line 200 in Figure 8) and Fortezza-San Candido (line 400 in Figure 8) (RFI, SIA | IAA, 2020);
2. SAD (Società Autobus Alto Adige) owns the Renon line (Renon Train in Figure 8) (SAD, 2020);
3. STA (Strutture Trasporto Altoadige SPA) owns the Val Venosta railway line (line 250 in Figure 8) (STA, 2020).

**Cable cars**

In South Tyrol-Alto Adige most of the ropeways have been built to serve the ski tourism during the winter season. However, in recent years some of the ropeways started being used also during the summer. In 1980 the number of ropeways in Alto Adige was 438. As shown in Figure 9, the number of ropeways dropped in the last thirty years, with only 364 functioning today (ASTAT, 2019).
Cycling lanes

In South Tyrol-Alto Adige there are around 500 kilometres of cycle paths. The territory is crossed by three long-distance cycle paths (Green Mobility, 2020).

1. Via Claudia Augusta which connects part of the Po Valley (Valle del Po) with southern Germany;
2. Alto Adige which connects 7 South Tyrolean cities;
3. Munich - Venice which passes through the Val Pusteria.

Figure 10 shows the main cycle paths sorted by length.

<table>
<thead>
<tr>
<th>Number</th>
<th>Name</th>
<th>Path Name</th>
<th>Length (Km)</th>
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<tr>
<td>1</td>
<td>Bruneck - Salurn</td>
<td>Bruneck - Sabbona</td>
<td>136,7</td>
</tr>
<tr>
<td>2</td>
<td>Vinschgau - Bozen</td>
<td>Val Venosta - Bolzano</td>
<td>112,6</td>
</tr>
<tr>
<td>3</td>
<td>Pustertal</td>
<td>Val Pusteria</td>
<td>76,3</td>
</tr>
<tr>
<td>4</td>
<td>Passerental</td>
<td>Val Passiria</td>
<td>17,8</td>
</tr>
<tr>
<td>5</td>
<td>Tauerfer Ahmadi</td>
<td>Vals di Tures e Aurina</td>
<td>13,9</td>
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<tr>
<td>6</td>
<td>Fraesental</td>
<td>Val di Fiemme</td>
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<tr>
<td>7</td>
<td>Bozen - Kaltern</td>
<td>Bolzano - Caldaro</td>
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Source: Ufficio provinciale Trasporti e Sicurezza

Figure 9 – Ropeways in South Tyrol-Alto Adige (Source: Provincia di Bolzano, 2017)

Figure 10 – Main cycle paths in South Tyrol – Alto Adige (ASTAT, 2019)
Figure 11 gives an idea of extension the network of the main cycling lanes (dark green), including the mountain bikes paths (in light green).

Car sharing
A car-sharing service is available in South Tyrol for private customers, companies and tourists that are registered with Deutsche Bahn (Flinkster) service. The car-sharing fleet in South Tyrol counts 21 stations distributed in 9 municipalities (Figure 12). The affiliation to Deutsche Bahn (Flinkster) and network partners extends the car-sharing accessibility also to Trento, Brescia, Rovereto, Riva del Garda, Germany and Switzerland for a total amount of 3’000 vehicles available in the network, around 25 of them in service in South Tyrol.
1.1.2. Public transport offer (rail, road and cable transport)

Road public transport
The road public transport is managed by SAD Trasporto Locale Spa in agreement with the Province of Bolzano, with a fleet of about 280 buses of various types (SAD, 2020). The fleet circulating in South Tyrol is divided in:

- 230 buses with a length of 12 meters long, and a capacity of 70-80 passengers;
- 32 “City buses” (small buses) are used for some lines, with a capacity of 25-30 passengers;
- 6 buses of reduced length (9 meters) used to reach places such as mountain passes;
- 10 buses designed for the “Metrobus system”, that are already in circulation, with a length of 18 meters and a capacity of 133 Passengers each.

Trains
The trains circulating in South Tyrol belong to the following companies:

- SAD;
- Trenitalia;
- OBB Österreichische Bundesbahnen (Austrian Federal Railways).

Figure 13 compares the distances traveled by electric trains with diesel ones, for Trenitalia and SDA companies. It shows that only 20% of the kilometers traveled in one year were covered by diesel-powered trains. OBB Company only runs electric trains but the data on the distances traveled by the OBB fleet cannot be retrieved.

<table>
<thead>
<tr>
<th>TRAIN OPERATOR</th>
<th>Railway kilometres travelled by type of power supply</th>
<th>Total</th>
<th>TRAIN OPERATOR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Electric</td>
<td>Diesel</td>
<td></td>
</tr>
<tr>
<td>Trenitalia</td>
<td>2,661.582</td>
<td>27.386</td>
<td></td>
</tr>
<tr>
<td>SAD</td>
<td>1,480.452</td>
<td>1,065.901</td>
<td>2,546.333</td>
</tr>
<tr>
<td></td>
<td>4,142.014</td>
<td>1,093.267</td>
<td>5,235.301</td>
</tr>
</tbody>
</table>

(a) Railway kilometers refer exclusively to regional traffic

Figure 13 – Railway kilometres travelled by type of power supply (ASTAT, 2019)

Cable cars / Funiculars
In South Tyrol there are three cable car services that function as a regular public transport service. Table 3 details the service provide.
### Table 3 - Regular public cable car services in South Tyrol

<table>
<thead>
<tr>
<th>Service</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mendola pass funicular</td>
<td>The funicular offers 37 round trips per day; one in three runs has an immediate connection to the valley station through the bus to/from Bolzano. Each ride lasts 12 minutes.</td>
</tr>
<tr>
<td>Renon cable car</td>
<td>This is the first cable car system in Italy with double load bearing cable and automatic clamping (“3S” system). These features allow up to 8 cabins with 35 seats each to be continuously in service, with a frequency of departures of up to 4 minutes and a transport capacity of over 500 passengers/hour in each direction.</td>
</tr>
<tr>
<td>San Genesio cable car</td>
<td>It offers 16 round trips per day with a journey time of only 9 minutes. Inaugurated in 1937, it has been modernized several times; most recently in 2000, when work was carried out on the engines and ropes.</td>
</tr>
</tbody>
</table>

### Interoperability service

All public transport modes in South Tyrol are Figure 14 thanks to the integrated system of Alto Adige (Altoadige Mobilità, 2020) that allows travelers to access mobility services with the just one card, called Alto Adige pass Figure 15.
Figure 14 - Map of integrated public transport system in South Tyrol

Figure 15 – Alto Adige pass example
1.2. Travel Flows and modal usage

The capital of South Tyrol – city of Bolzano - is the major site for commuting from the neighboring cities and valleys on a daily basis. Figure 24 shows commuting flows based on the direction.

Such high level of commuting creates a significant traffic pressure on the main arterial entrances in the city (Figure 17). According to data from the Mobility Department of the Province, 4'100 bus users and 25'000 cars move daily between Oltradige and the capital: 33% of travelers on public transport and 25% of cars in the morning are on the move within just 60 minutes.
1.2.1. **Train passenger use**

In 2017, 9’900’244 tickets have been obliterated for the train use. This corresponds to 27’151 tickets per day, with an increase of 2.7% compared to previous year (ASTAT, 2019).

1.2.2. **Road public transport use**

As described in paragraph 1.2, the bus is the most used public transport. There were 40’543’795 passengers traveling on an urban or suburban bus (related to single tickets, value cards, Alto Adige Pass, Abo + and Abo65 + passes and leisure tickets -Mobilcard). An analysis of the geographical distribution and by group of lines gave the following result (Figure 18): in first place we find the urban lines of Bolzano with 11’647’837 obliterations (28.7%); many passengers also use the urban lines of Merano with 2’274’848 obliterations, and the buses of the area of Lana, Marlengo, Lagundo, Parcines with 2’381’033. These lines are followed by the Brunico-Campo Tures-Valle Aurina line with 1’697’076 obliterations, the buses in the Oltradige area (1’518’294), in the Altopiano dello Sciliar area (1’364’372), in Val Gardena (1’156’431) and Citybus Bressanone (1’116’020). 38.5% of all obliterations on buses occur in the urban zones in Bolzano, Merano, Bressanone and Brunico. As in the 2016, it appears that in Burggraviato there was once again a considerable use of "leisure" tickets (Mobilcards), very popular with tourists: 38.0% of Mobilcards’ obliterations were made in this area. The graph below relates the lines to the obliterations (ASTAT, 2019).

![Figure 18 – Obliterations on bus lines-2017 (ASTAT, 2019)](image)

At the end of 2013, Bolzano became part of the few European cities in which hydrogen buses circulate. Since fuel cells have a much higher energy capacity than batteries, fuel cell buses usually have a much longer range than ordinary electric buses. In addition to hydrogen buses, Bolzano also has electric buses with special charging infrastructures.
1.2.3. **Cable car use**

South Tyrol has always been at the forefront of the ropeway sector. The first ropeway ever built in Europe dates back to 1908 and connected Bolzano to the Colle. Some of the reasons for the spread of ropeways in South Tyrol are related to its orography, tourism, and the existence of a local company specialized in this kind of infrastructure.

As previously reported, in 2017 only five ropeways of the Integrated Transport South Tyrol were analyzed (ASTAT, 2019): two that go from Bolzano to Renon and San Genesio, the one that goes from Postal to Verano, the one from Vilpiano to Meltina and the cable car from Rio di Pusteria in Maranza. In 2017, a total of 1’379’591 passengers of these ropeways obliterated a ticket (single ticket, value card, Alto Adige Pass, Abo +, Abo65 + or leisure ticket Mobilcard). Most of them used the Renon ropeway: 935’349, or 67.8%. This ropeway has an average of 2’563 obliterations per day.

1.2.4. **Road vehicles use and flows**

In South Tyrol, private vehicles cover an average of 50 km per day with a travel time of about 1.1 hours (Pasaoglu Kilanc, et al., 2012).

The total number of passenger cars trips per day (due to personal and business model) is on average equal to 2.5 and the day with higher daily trips is Thursday (about 3 trips per day). From Monday to Friday, these trips are distributed as follows: during the week, 22% of trips take place before 9h00 am; around 19% of trips between 9h00 and 12h00; around 17% of journeys take place between 17h00 and 19h00; and about 10% after 19h00.

![Figure 19 – Car trips distribution by time windows in the day](image)

Instead, on holidays and weekends, most trips are concentrated in the central hours of the day (Figures 20-21).
In 2017, compared to the previous year, traffic has increased in half of the road network in South Tyrol (ASTAT, 2019). Considering the data acquired by the monitoring stations operating all year round, the most significant increase in the average daily traffic was registered in Mules on the main road 12 (figure 22) and in Salorno (Roveré della Luna station) on the main road 21 (+9.0% in both cases) and the largest contraction, in percentage terms, in Ponte Gardena on the main road 12 (-6.2%).

The motorway A22 also registered an increase in traffic in 2017 on all sections between S. Michele (TN) and Brennero. The largest relative increase were registered between Bressanone Industrial area and Bressanone (+4.9%) and between Chiusa and Bressanone Industrial area (+4.7%).

The busiest state-road in South Tyrol is the MeBo (the brown line in Figure 19), with an average of more than 30 thousand vehicles per day at the Sinigo counting point (the busiest point is normally the Frangarto but for most of 2017 was inactive), followed by the state road 42 of the Tonale and the Mendola (in Maso Pill, green line in Figure 19) and from the Brennero state road 12 (in Pineta di Laives, the blue line in Figure 19).

On the highway A22 (red line in Figure 19), on the other hand, the highest traffic on average is recorded in the S. Michele - Egna section with 42,825 vehicles per day.

In 2017, 1’655 road accidents with personal injury were recorded in South Tyrol, with an average 4.5 accidents per day. The number of deaths was 30 and the number of injured people was 2’164 (ASTAT, 2019).
1.2.5. Cycling flows

In South Tyrol the bicycle plays a fundamental role both as an alternative mode of transport to the car and as a touristic attraction. In 2017, 462 km of cycle paths and several mountain bike trails were mapped.

Bicycles reduce traffic problems and, combined with public transports, contribute to significantly reduce emissions. We can identify two main contexts where bicycles are used: the city and the mountain context. While in the urban areas it is a well established means of transport, outside of the cities, and particularly in the mountains, is used much less. E-bikes can overcome some physical obstacles related to the geographical characteristics of the territory (differences in altitude, particularly high slopes), possibly contributing to the spread of bicycles also outside the urban areas.
The graphs below highlight the flows of bicycles along four routes in 2017:

1. Brennero-Salorno path (orange line in figure 23), with three stations (Vipiteno, Varna and Egna)
2. Val Pusteria path (the pink line in Fig 23), with three stations (Rio Pusteria, Casteldarne and Brunico);
3. Bolzano Resia path (the green line in Fig 23) with one Station (Ciardes)
4. Dobbiaco-Cimabianche (the purple line in Fig 23) with one station (Lago di Dobbiaco)

To highlight the high number of bicycles registered at the Ciardes counting point, in the Venosta valley, towards Bolzano (178'556 bikes have crossed this counting station in 2017 (ASTAT, 2019)).

Figure 20 – Main cycle-roads in South Tyrol (in brown inhabited centers) and relevant counting stations (Source EURAC RESEARCH, elaboration from (Geokatalog, 2020))

Figure 21 – Bicycles passed at the counting points by direction Salorno Brennero - 2017
Figure 22 – Bicycles passed at the counting points by direction Prato alla Drava- Bressanone – 2017

Figure 23 – Bicycles passed at the counting point by direction Bolzano Resia – 2017

Figure 24 – Bicycles passed at the counting points by direction Dobbiaco Cimabanche – 2017
1.3. Ownership of vehicles, driving licenses and public transport season tickets

Ownership of Vehicles
According to the Provincial Institute of Statistics of South Tyrol (ASTAT, 2019) the number of motor vehicles registrations from 2013 to 2017 increased by about 28%, going from 396’021 to 574’623 registered units. In the same period, motorcycles registrations grew by 11% (from 49’327 to 54’534). Overall, vehicles registration grew by 41.7%.

Evaluating the type of engine, there was a significant reduction in the petrol vehicles (from 65% in 2006 to 30% in 2017) in favor of diesel vehicles (from 30% in 2006 to 65% in 2017).

Today, 43.6% of the total registered vehicles in South Tyrol are Euro 6, 19.7% are Euro 5, 19.8% are Euro 4 and about the rest (Euro 0, Euro 1, Euro 2) with a percentage of about 17%.

The map in the Figure 25 represents the spatial distribution of the vehicles registered at the Italian Public Automobile Register (PRA). It is worth to highlight that the municipalities with a greater density than 60 cars / 100 inhabitants are located in the south of the Province (Basso Atesina) and between Salto Scillar and Burgraviato. The municipalities with a density of less than 50 units per 100 inhabitants are located in the central part of the Province (Valle di Isarco) and to the east, in Val Pusteria and in the Bolzano area.

![Figure 25 -- Map of the Cars registered in the Public Automobile Register (PRA) every 100 inhabitants per municipality (ASTAT, 2019)](image)

Driving licenses
An evaluation of the number of driving licenses (MIT, 2020) issued between 2013 and 2017 suggests a gradual increase in the number of novice drivers. Indeed, the number of new drivers possessing a “driver licence B” (to drive a passenger car) went from 7’200 in 2013 to 8’578 in 2017 (Figure 26) representing the 1.40% and the 1.63% of the total population respectively.
Deliverable No. 2.2 | Test sites mobility analysis and comparison

Public transport season tickets
In South Tyrol there are different types of seasonal tickets for public transport. The travel passes of the Integrated Transport South Tyrol include magnetic tickets (single tickets, value cards and Mobilcards) and personal travel documents with chips (Alto Adige Pass, ABO + and ABO65 +). Below there is a brief description (Altoadige Mobilità, 2020):

- **Alto Adige Pass**: It can be requested by all citizens of the European Union and Switzerland (in possession of the Italian tax code) or by those who work or study in the province of Bolzano.
- **Abo65 +**: people from 65 years of age residing in the province of Bolzano, and South Tyroleans over 65 who live abroad.
- **Abo +**: children and young people who have not yet reached the age of 27 as of December 31 of the year of submission of the application. They need to reside in South Tyrol and/or attend a school or carry out study activities or basic training at work in the social sector.
- **Mobilcard**: The Mobilcard is available in three versions and in the "adult" and "junior" variants, while children below 6 years of age travel for free: South Tyrol Mobilcard 1 day; South Tyrol Mobilcard 3 days; South Tyrol Mobilcard 7 days

In 2017, 51’833’636 obliterations referred to single trips. They have been registered including single tickets, pre-paid tickets, Alto Adige Pass, Abo +, Abo65 + and with the various types of leisure tickets (i.e. Mobilcard). Figure 27 shows that out of the total, 78.2% used city and suburban buses, 19.1% the train and 2.7% the cable cars (ASTAT, 2019).
In the 27.5% of obliterations (14’250’947) the Alto Adige Pass was used, in 31.6% (16’357’795) the Abo + (students), in 17.2% (8’908’235) the Abo65 + (older people) and in 13.7% (7’113’595) leisure tickets (Mobilcard).

The available mobility statistics presented is limited to the journeys made with travel tickets of the Integrated Transport South Tyrol\(^1\).

This database includes: public transport of buses, railways and some cable cars within the province of Bolzano, the Trento-Innsbruck and Fortezza-Lienz railway lines and some neighboring areas of North Tyrol, East Tyrol and the canton of Grisons (Swiss), Trentino and Veneto.

This database excludes: single tickets issued by the Italian railways TRENITALIA and the Austrian ÖBB and Germanic DB railways.

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\(^1\) In the case of travel ABO + (students), ABO65 + (elderly) and mobilcards do not know the travel destinations as these titles are to be validated only at the start of the journey, without indicating the destination.
1.4. Modal Split

From 2001 to 2016, the use of public transport in South Tyrol increased significantly. The number of people using city buses every day almost doubled (from almost 20'000 to almost 35'000). “Semi-regular” users on trains increased as well considerably: from 29’000 to 72’000 (ASTAT, 2017).

In March 2016, ASTA conducted 1355 interviews on a sample of 600 families, regarding the means usually used to go work or school. Sampling is probabilistic because the names were extracted from the registry offices (ASTAT, 2017). The following multiple choices question was asked (created by ISTAT):

“Which of the following modes do you use?”

1. Train
2. Tram
3. Bus, trolley bus (within the municipality)
4. Coach, bus (between different municipalities)
5. Business or school bus
6. Private car (as driver)
7. Private car (as a passenger)
8. Motorcycle or moped
9. Bicycle
10. other modes

The results obtained were shown in the graph in figure 32. Nevertheless, the use of private cars remains the most frequent option among the inhabitants of South Tyrol, mainly to go to the workplace or to school. In Bolzano city, however, within the last few years, a radical change in behavior occurred, with the share of private car usage dropping to 27% in 2016. In smaller municipalities instead the share remains high (42.8%).

In 2016, the train was used to go to school or work by 6.2% of the inhabitants of South Tyrol (ASTAT, 2017).
Figure 28 – Means usually used to go to work or school, by size of the municipality (ASTAT, 2017)

Figure 29 (TPS, 2018) represents the share and locations of the modal split (public transport vs private transport) in the territory of South Tyrol, during a typical winter working day. The flow of public vehicles (buses, trains) and private vehicles (passenger cars) was automatically measured in 13 locations, selected in order to represent the 16% of the O/D inter-municipal relations in the whole South Tyrol.

A pie-diagram was created for each location: the percentage of trips by public means is shown in red, while the percentage of trips by private means is shown in yellow. The total flows are also illustrated, according the radius of the diagram and the scale in the legend.

The province has been divided into 8 macro-areas: Val Venosta, Burgraviato, Alta Valle di Isarco, Valle di Isarco, Salto Scillar, Bassa Atesina, Bolzano and Val Pusteria. Each station represents the flow in a corridor of South Tyrol, during a winter weekday:

- Station 1-2: corridor inside Val Venosta
- Station 3: corridor between Burgraviato and Val Venosta
- Station 4: corridor between Burgraviato, Bassa Atesina and Salto Scillar
- Station 5: corridor between Burgraviato, Bassa Atesina and Salto Scillar
- Station 6: corridor between Bolzano and Salto Scillar
- Station 7: corridor inside Salto Scillar
- Station 8: corridor inside Alta Valle di Isarco, very close to Salto Scillar and Valle di Isarco
- Station 9 and 10: corridor inside Val Pusteria
- Station 11 and 12: corridor between Valle di Isarco and Salto-Sciliar
- Station 13: corridor between Valle di Isarco and Val Pusteria

The highest flows occur in locations 4 and 6, with a total number of 44’313 and 38’814 vehicles. In most locations, journeys by public transport account for only 10% of total journeys. Public transport is mostly used in location 13 and 6 (TPS, 2018).

Figure 29 – Private VS Public modal split along the main corridors for a winter working day (TPS, 2018)

Figure 30 evidences that the points where the public journeys are more than 25%, follow the highway A22 line (red), overlapping the railroad 100 and the state road (SS12). The only location outside this line is the number 7 representing a station inside Salto Sciliar on the road SS508.
1.5. Trip purposes

Figure 31 shows travel purposes in South Tyrol from 2015 to 2018 on a sample of 100 people.

In each of the years considered, the predominant trip purposes are: the Leisure Holidays (around 60%) and visiting friends and family (around 20%). These are followed by shopping trip, with a percentage around 8%. Business purposes represent only 2% of the trips.

From 2015 to 2018, the share of residents traveling for leisure and holiday purposes increased from 60% to 64% (Statistica, 2020).
1.6. Local current projects promoting more sustainable mobility

Several local mobility projects implemented in the Province aim to address sustainability, commuting behavior, accessibility, interoperability and safety of mobility and transport in the region.

The major initiative promoting and coordinating sustainable mobility projects was created by the Province administration itself:

- "Green Mobility" is an initiative of the Autonomous Province of Bolzano and is coordinated by STA - Structures for Transport Alto Adige SpA. The project was born with the aim of making South Tyrol a model region for sustainable alpine mobility. Green Mobility deals with all forms of sustainable mobility, connects them to each other, prepares the ground for innovation and launches new projects. In this sense, the main points are the sectors of electromobility, cycle mobility and intermodality (Green Mobility, 2020). The projects coordinated by “Green Mobility” range from awareness raising campaigns to roadshows, mobility management courses and vehicle test days.

Other international cooperation projects also promote sustainable mobility solutions:

- MOBSTER (Interreg ITA-CH): The project aims at an innovative application of the tools already in use in the field of electric mobility to increase the tourist attraction of cross-border places with strong tourist appeal. Installation of electric vehicle and e-bike infrastructures is one of the goals of the project. (Mobster, 2020);

- MENTOR (Interreg ITA-CH): As part of the MENTOR project, the "Mobility-as-a-Service" concept will be trialled for the first time in Merano and Brig, Switzerland. The aim is to counteract the growth in motorised city traffic made up of individual persons. This will be achieved by a more efficient public transport service, which will be able to react more flexibly to individual needs by using on-demand vehicles, sharing services, and by increasing bicycle usage. In addition, MENTOR will set the course for the dissemination of the "Mobility as a Service" concept in the entire Alpine area. The heart of the mobility project is a real-time platform integrating all sharing and transport services and which will suggest the best route and choice of transport to the user (Mentor, 2020);

- LIFEALPS (LIFE IP): This project aims at transforming South Tyrol into an Alpine model region for zero emission mobility. To reach this ambitious goal, partners from different areas of South Tyrol have decided to join forces and to develop the infrastructure for e-mobility and H2-mobility, to bring pilot fleets on the streets and to create zero emission services (e.g. taxi, shuttle service, transport of goods) (LIFEalps, 2020);

- JIVE (Horizon2020): The 12 fuel cell buses deployed in South Tyrol offer the same operational flexibility as the conventional diesel buses but without any harmful exhaust fumes. The technology represents a competitive solution to the problems of both urban air pollution and greenhouse gas emissions from city transportation, contributing significantly to the decarbonisation of public transport in South Tyrol. (JIVE, 2018).
1.7. Future local game changer projects

1) MetroBus

To alleviate the pressure that commuting to Bolzano generates, since 2015 the Province started financing the project of the METROBUS with a budget of 19.1 million Euro. Through a gradual implementation on the route, the project is expected to reduce the journey time and traffic by 33%, improving residents’ quality of life and decreasing noise pollution harmful emissions. (Figure 36)

![Figure 36 - METROBUS route with implemented (red), planned (yellow) and feasibility study level (blu) parts](image)

2) Brenner Base Tunnel

The construction of the tunnel at the base of the Brennero Pass will directly affect the logistics and mobility in South Tyrol, providing the area with a strategic infrastructure at European level that will ease rail connections between Italy and Austria. The Brenner Base Tunnel is the heart of the Scandinavia-Mediterranean TEN Corridor from Helsinki (Finland) to La Valletta (Malta). The European Union is promoting the expansion of this transnational multimodal corridor and considers this work to be of high priority. The Brenner Base Corridor, as a cross-border project linking Austria and Italy, is particularly important.

The Brenner Base Tunnel (BBT) is a straight, flat railway which will run for 55 km between Innsbruck (in Austria) and Fortezza (in Italy). Passenger and freight trains along this stretch will therefore not only travel through the Brenner Base Tunnel, but for a few kilometres, through the Inn valley tunnel as well. This line, totalling 64 kilometres, will become the longest underground railway connection in the world (Figure 37).
Between 2016 and 2020, 50% of the costs for the exploratory tunnel (about 303 million Euro) and 40% of the costs for the two main tunnels (approximately 880 million Euro) were covered by the EU. The remaining 50-60% are borne by Austria and Italy on a 50-50 basis. This means that the BBT is the European project with the highest level of co-financing.

A key aspect is the radical reduction of the maximum slope gradient: this will be restricted to a maximum of 6.7‰ in the Brenner Base Tunnel, and to 12‰ on the Fortezza-Verona line, where the existing infrastructure shows slope gradients that reach 26‰ in the pass and 22‰ between Fortezza and Verona, limit train speed to 60km/h on the most windy sections. The construction of the new infrastructure will enable the separation of freight and passengers flows as well as of long-distance and local trains, with enormous advantages to people who travel.

Local public transport will continue using the historic line in a more efficient, fast and regular way. The new tunnel section from Fortezza to Innsbruck will be 20 km shorter than the existing route and will make Italian and Austrian railway lines compatible, making it possible to avoid changing the locomotive. This will bring to a reduction of the journey time of one third: from 75 minutes, to 25 minutes.

For freight transport, the line specialisation will mean a traffic increase in the traffic from the North to the Verona Hub. This will also have a significant impact on the rail/road Quadrante Europa intermodal terminal, which is increasingly important to the Italian and European logistics system as it lies at the intersection of two European TEN-T corridors, the Scandinavian-Mediterranean and the Mediterranean, as well as the two motorways, the Brenner (heading North-South) and the Serenissima (heading East-West).
The technical-construction characteristics of the new rail link, which are especially linked to the drastic restriction of the gradients and the underground section of the line between Verona and Innsbruck, will allow mitigation of the sound impact from heavy goods traffic, as well as reducing locomotive energy consumption by 40%, with a parallel reduction in CO₂ emissions.

The qualitative and quantitative improvement in railway freight transport, together with the greater accessibility of the terminals in Northern Italy through the new railway lines, will contribute to the goals set by the European Union White Paper on Transport: the transfer of 30% of freight traffic deliveries of over 300 km on rail, with 50% by 2050.
2. TICINO

Canton Ticino is the southernmost canton of Switzerland and it is the only Swiss canton totally at the south of the Alps. Population-wise, the Canton is relatively small, with 353’343 permanent residents in 2018 (FSO, 2020) equal to 4.2 % of the entire Swiss population (Ufficio di Statistica, 2020). It has an area of 2’812.46 km², equal to 6.8% of the entire Swiss territory.

The cantonal territory is largely delimited by the international border with Italy (provinces of Verbano-Cusio-Ossola in Piemonte, Varese and Como in Lombardy), with which it borders to the east, the west and the south. To the north-west it borders with the Canton of Valais, to the north with the Canton of Uri, and to the north-east with the Canton of Graubünden. Ticino is divided in 8 districts: Bellinzona, Blenio, Leventina, Locarno, Lugano, Mendrisio, Riviera and Vallemaggia (Figure 32). Its capital is the city of Bellinzona.

![Figure 32 - Canton Ticino geolocation and districts (OnTheWorldMap, 2020)](image)

The areas of the valleys, below 500 m a.s.l., represent approximately 14.5% of the cantonal surface and roughly host 90% of the resident population and jobs. There is a disparity in the distribution of the population: the northern districts are less populated (Blenio 5’682 inhabitants, Vallemaggia 5’970; Leventina 9’113; Riviera 10’335) and the southern are more populated (Mendrisio 50’865; Bellinzona 55’711; Locarno 64’075; Lugano 151’592). In fact, the two southern districts of Lugano and Mendrisio host around 57% of the population (Repubblica e Cantone Ticino, 2019).

Regarding the characteristics of its economic system, Ticino has 39,019 companies, of which 90% are micro companies (less than 10 employees), 8% are small companies (10-50 employees), and less than 2% are either medium size companies (50-250 employees) or large companies (more than 250 employees). Ticino has an overall work force of 230’736 employees. Just over a quarter of all workers are cross-border workers (62’496 employees), who live in the neighbouring Italian provinces. The majority of the Ticino’s work force is employed in the tertiary sector (76.2%); 22.4% in the secondary
sector and only 1.4% in the primary sector (USTAT, 2019). Figure 33 depicts the geographic zones where the population and jobs are concentrated.

**Figure 33** – On the left population geographic distribution and on the right employment geographic distribution (Federal geographical information, 2020)

In the next subchapters the mobility phenomenon in Ticino will be briefly described. For more detailed information, one can refer to the following cantonal reports (in Italian):


Furthermore, throughout the next chapters data collected by the SMTC (Swiss Mobility and Transport Census will also be exploited). The SMTC survey delivers statistics about the mobility behaviour of the Swiss population and takes place every 5 years. The most updated data refers to 2015. The SMTC information that will be reported in this document concerns the 2’492 Ticino residents surveyed in 2015.
2.1. Mobility infrastructures and public transport offer

This section provides a brief description of the road and rail infrastructure and the public transport offer available in Ticino.

2.1.1. Infrastructure (roads, railways, cycling lanes and shared mobility stations)

There is a civil airport in Agno, near Lugano, that currently has no commercial flights and is presently being dismantled. The canton is near the major Italian airport hub of Malpensa (1h from Lugano) and not so far away from the biggest Swiss airport hub of Kloten, Zurich (2h30 from Lugano), which makes an airport in Ticino noncompetitive.

The transport infrastructure (road and railways) in Ticino has a widespread coverage, though it is more developed in the valley zones of the Canton. In 2018, there were 3’150.3 km of public roads in Ticino. Of those, a small portion (138.9 km) are national motorways and expressways. The National motorway A2 crosses the Canton from north to south, coming from the canton Uri through the Gothard tunnel to the Italian province of Lombardy. This motorway connects the major cities in Ticino: Chiasso, Mendrisio, Lugano and Bellinzona. The national expressway A13, not totally completed, crosses the canton from east to west, from the Canton Graubünden to the Italian province of Piedmont. The cantonal roads account for 1’054 km, and the large part of the roads are municipal roads (1’957 km) (USTAT, 2020). Figure 34 depicts the national roads in green and the cantonal roads in red.

The railways are almost parallel to the national motorways and expressways roads. In 2016, the Gotthard Base Tunnel was opened, that reduced journey times between the German-speaking part of Switzerland and Ticino, being around 25-40 minutes shorter (depending on the route) (SBB, 2016). In early 2021, the opening of the Ceneri Base Tunnel will reduce by 15 minutes the time to cross the canton from north to south and vice-versa (SBB, 2016). Figure 34 depicts the railways present at Ticino.
By December 2018, the Ticino cycling paths network, of cantonal responsibility, had 365 km. The cycling path network in Ticino is expected to reach 560 km by 2025/30 (TI Sezione Mobilità, 2018). Figure 34 illustrates the cycling paths of the cantonal network. The figure includes the national cycle routes n. 3 Basel-Chiasso and n. 6 Bellinzona-Chur, the cantonal routes n. 31 of the Vallemaggia and n. 36 of the Blenio Valley, and the regional route n. 311 between Castione and Riazzino. In Ticino there are seven fixed bicycle counting stations, also illustrated in Figure 34.

Figure 35 – Ticino cycling paths (Dipartimento del territorio, 2019)

Ticino hosts two forms of shared mobility: car-sharing and bike-sharing. While the car-sharing is operated by only one company, called Mobility, the bike-sharing operators are multiple and not interoperable. All forms of shared mobility in Ticino work in a station-based model. These services again are mainly available in the principal agglomerations of the Canton. Figure 36 depicts the stations and the companies offering the related bike-sharing service.
The two largest bike-sharing companies are Publibike and Velospot. PubliBike operates in the southern districts of the Ceneri Mountain (Lugano and Mendrisio), while Velospot operates mainly in two northern districts of the Ceneri Mountain (Locarno and Bellinzona). These two companies overall operate 1’012 bikes in Ticino. More than half (57%) of these bicycle fleet is electric (figure 8).

The car-sharing company, Mobility, indicates that, to the present day, they operate in Ticino 55 vehicles distributed in 20 stations. Furthermore, the number of clients in Ticino by the end of 2019 was 1’789.
2.1.2. Public transport offer (rail and road transport)

The cantonal public transport network is structured on two main pillars: rail and road transport services. In Ticino there are 12 public transport operators (Table 4) that are integrated in a single tariff platform, called Arcobaleno, which allows passengers to travel in all local transport companies using a single ticket.

Table 4 – Public transport companies operating in the canton Ticino (Arcobaleno, 2020)

<table>
<thead>
<tr>
<th>Road Transport</th>
<th>Rail Transport</th>
<th>Rail and Road Transport</th>
</tr>
</thead>
<tbody>
<tr>
<td>Autolinee Bleniesi (ABL)</td>
<td>Swiss Federal Railways (SBB)</td>
<td>Ferrovie Autolinee Regionali</td>
</tr>
<tr>
<td>Autolinea Mendrisiense (AMSA)</td>
<td>Regional Trains Ticino</td>
<td>Lombardy (TILO)</td>
</tr>
<tr>
<td>Autolinee Regionali Luganesi (ARL)</td>
<td>Ferrovie Luganesi (FLP)</td>
<td></td>
</tr>
<tr>
<td>AutoPostale Svizzera SA - Regione Ticino</td>
<td>Funicolare Locarno - Madonna del Sasso (FLMS)</td>
<td></td>
</tr>
<tr>
<td>Società Navigazione del Lago di Lugano (SNL)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ASF Autolinee s.r.l.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The rail transport offer in Ticino consists of 12 train lines that connect local villages to cities and local cities to German-Swiss and Italian cities. Figure 38 schematizes the local train offer and Table 5 summarizes all the 12 train lines.
Table 5 – Description of the train lines in Ticino

<table>
<thead>
<tr>
<th>Line</th>
<th>Operator</th>
<th>Origin - destination</th>
<th>Main city stops in Ticino</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>S10</td>
<td>TILO</td>
<td>Bellinzona – Como (IT)</td>
<td>Bellinzona, Lugano, Chiaso</td>
<td>1 each hour (2 every hour in the morning and afternoon rush hours)</td>
</tr>
<tr>
<td>S11</td>
<td>TILO</td>
<td>Chiasso – Milan (IT)</td>
<td>Chiasso</td>
<td></td>
</tr>
<tr>
<td>S20</td>
<td>TILO</td>
<td>Biasca – Locarno</td>
<td>Biasca, Bellinzona, Locarno</td>
<td>1 each hour (2 every hour in the morning rush hour)</td>
</tr>
<tr>
<td>S30</td>
<td>TILO</td>
<td>Cadenazzo or Bellinzona – Gallarate (IT)</td>
<td>Bellinzona, Cadenazzo</td>
<td>1 each 2 hours</td>
</tr>
<tr>
<td>S40</td>
<td>TILO</td>
<td>Como (IT) – Varese (IT)</td>
<td>Chiasso, Mendrisio</td>
<td>1 each hour</td>
</tr>
<tr>
<td>S50</td>
<td>TILO</td>
<td>Bellinzona – Maplensa Airport (IT)</td>
<td>Bellinzona, Lugano, Mendrisio</td>
<td>1 each hour</td>
</tr>
<tr>
<td>RE2 10</td>
<td>SBB</td>
<td>Erstfeld (Canton Uri) – Milan (IT)</td>
<td>Airolo–Bellinzona–Lugano–Chiasso</td>
<td>1 each hour</td>
</tr>
<tr>
<td>S60</td>
<td>FPL</td>
<td>Lugano – Ponte Tresa</td>
<td>Lugano</td>
<td>1 each 15 minutes</td>
</tr>
<tr>
<td>Linea 620</td>
<td>FART</td>
<td>Locarno – Domodossola (IT)</td>
<td>Locarno</td>
<td>1 each hour</td>
</tr>
<tr>
<td>EC3</td>
<td>SBB /Trenitalia</td>
<td>Zurich (canton Zurich) – Milan (IT)</td>
<td>Bellinzona, Lugano, Chiaso</td>
<td>1 each 2 hours</td>
</tr>
<tr>
<td>IC4 2</td>
<td>SBB</td>
<td>Zurich (canton Zurich) – Lugano</td>
<td>Bellinzona, Lugano</td>
<td>1 each 2 hours</td>
</tr>
<tr>
<td>IC3 21</td>
<td>SBB</td>
<td>Basel (canton Basel) - Lugano</td>
<td>Bellinzona</td>
<td>±1 each 2 hours</td>
</tr>
</tbody>
</table>

The road public transport offer can be divided in two major groups (Ufficio di statistica del Cantone Ticino, 2020):

- local urban bus routes, that offer high frequencies and are concentrated in the four cantonal agglomerations (Bellinzona, Locarno, Lugano and Mendrisio/Chiaso),
- regional bus routes, that connect most of the towns in the canton, collecting and distributing users from the periphery to urban centers, and vice versa.

Is worth to mention that the Flixbus and Eurolines medium-long range bus companies stop in some Ticino cities and are direct to Italian and German cities as Malpensa airport, Milan, Munich, Stuttgart, and Turin. These medium-long buses are not included in the Arcobaleno tariff scheme and have a very low frequency. Furthermore, in order to avoid competition with the railways, if one person hops on in a Swiss city, she cannot hop off in another Swiss city, being mandatory to hop off in a city in another country.

The federal office for spatial development ARE has created the indicator that presents the quality level of service by public transport (ARE, 2020). This indicator makes possible to identify the places with good PT coverage and places

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2 RE - RegioExpress
3 EC – EuroCity
4 IC - Intercity
Deliverable No. 2.2 | Test sites mobility analysis and comparison

where the PT coverage is lagging behind. For Ticino is possible to observe that the main four agglomerations (Bellinzona, Locarno, Lugano e Mendrisio/Chiasso) are well covered by public transport, but many parts of the canton, mainly in the northern districts, have a poorer quality PT. Such a lower quality of the service is mostly due to a lower mobility demand, strictly connected with lower population and presence economic activities.

![PT service quality classes](image)

*Figure 39 - Quality level of service by public transport in Ticino (Federal geographical information, 2020)*

### 2.2. Travel Flows

This section briefly analyses the major mobility flows in Ticino. First, it will analyse the flows that are quantitatively measured by sensors directly installed in the transport means themselves or in the infrastructure. In Ticino, these data are available for public trains and buses that are equipped with a sensor that measures the occupancy, and for some roads and cycling paths where counting points have been installed. Flows measure by sensors allows to analyse and identify which spatial segments and time periods present higher mobility demand; however, they do not provide information on the trip purpose. Secondly, this section will provide an estimate of the potential flows due to work commuting, by considering the routine commuting trips between home and work addresses, which are collected by the local authorities.
2.2.1. Train passenger flows

In 2018, regional trains in Ticino (S10, S20, S30, S40, S50 RE10, S60 and Linea 620) carried a total of 14.4 million passengers, travelling the equivalent of 268.0 million passenger-kilometer (pkm) (USTAT, 2020). Table 6 shows the number of passengers travelling in 2018 using the regional trains in Ticino.

Table 6 – Regional trains in Ticino commuting passengers in 2018

<table>
<thead>
<tr>
<th>Line</th>
<th>Operator</th>
<th>Origin - destination</th>
<th>Passengers in Ticino (million passengers per year)</th>
<th>Passenger-kilometer in Ticino (million pkm)</th>
<th>Delta of passengers 2017-2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>S10</td>
<td>TILO</td>
<td>Bellinzona – Como (IT)</td>
<td>9.31</td>
<td>121.0</td>
<td>- 2.2%</td>
</tr>
<tr>
<td>S20</td>
<td>TILO</td>
<td>Biasca – Locarno</td>
<td></td>
<td>60.5</td>
<td>+0.3 %</td>
</tr>
<tr>
<td>S30</td>
<td>TILO</td>
<td>Cadenazzo or Bellinzona – Gallarate (IT)</td>
<td></td>
<td>1.1</td>
<td>- 12.5%</td>
</tr>
<tr>
<td>S40</td>
<td>TILO</td>
<td>Como (IT) – Varese (IT)</td>
<td></td>
<td>5.9</td>
<td>+ 21.2%</td>
</tr>
<tr>
<td>S50</td>
<td>TILO</td>
<td>Bellinzona – Maplesensa Airport (IT)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RE10</td>
<td>SBB</td>
<td>Erstfeld (Canton Uri) – Milan (IT)</td>
<td>2.10</td>
<td>53.6</td>
<td>+ 30.3%</td>
</tr>
<tr>
<td>S60</td>
<td>FPL</td>
<td>Lugano – Ponte Tresa</td>
<td>2.48</td>
<td>18.8</td>
<td>- 3.6%</td>
</tr>
<tr>
<td>Linea 620</td>
<td>FART</td>
<td>Locarno – Domodossola (IT)</td>
<td>0.5</td>
<td>7.0</td>
<td>- 16.1%5</td>
</tr>
</tbody>
</table>

From 2004 to 2018, overall passenger-kilometers on the TILO lines in Ticino increased from 75.6 to 188.6 million, an increase of 149.4%. However, in 2018 there was a slight drop of 1.1% compared with 2017. For the FPL line, the same tendency is observed: a strong growth in passenger-km occurred from 2004 to 2018 (from 9.69 to 18.82 million pkm, + 94.2%), while a drop of 3.6% was recorded in 2018 compared to 2017 (USTAT, 2020).

Figure 38 shows the Ticino’s railway network average daily loads (the cumulative number of passengers that were inside a train) registered in the weekdays of 2018. As expected, passenger loads are concentrated in the southern districts of the canton, where the population and jobs are concentrated.

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5 In 2018, the line 620 was closed for 2 months due to a landslide.
In Ticino the rail segment that presents a higher daily load of passengers is the one from Bellinzona to Chiasso, registering a daily minimum of 6’032 passengers, having the peak of occupancy between the Lugano and Lugano Paradiso stations (11’144 daily passengers).

Another highly loaded segment is between Bellinzona and Locarno, registering a daily minimum of 6’461 passengers in its full length, and having the peak of occupancy between the Giubiasco and Sant’Antonino stations (8’512 daily passengers).
At last, the other heavy loaded segment in Ticino is the S60 line, between Lugano and Ponte Tresa: registering a daily minimum of 3`031 passengers in the entire length, it has the peak of occupancy between the Serocca and Agno stations (9`663 daily passengers).

FFS (2017) expect that the daily loads in the Ticino railways will double by 2030, compared with the loads registered in 2016. Figure 41 depicts the network loads revealed in 2016 and the projection for 2030, from all types of passenger trains circulating in Ticino. To accommodate this expected increase the rail demand, the FSS is gradually increasing its offer in Ticino. In fact, from 2021 there will be a major increase of the offer due to the opening of the new Ceneri base tunnel. Section 2.8 presents and discusses the potential impacts of the opening of this tunnel on overall mobility in Ticino.

![Image of railway network with load diagram](image_url)

**Figure 41 - Railway network, daily load diagram (weekdays): data collected in 2016 compared with simulations for 2030 (FFS & TI, 2016)**

### 2.2.2. Road public transport flows

In 2018, public road transport (local and regional buses) recorded a total volume of 31.1 million passengers (stable compared to 2017), totaling 116.6 million passenger-kilometers (-1.1% compared to the previous year). The average number of users transported per day was 104’524 units (a stable result compared to 2017) (USTAT, 2020).

The major part of the passengers transported by buses was in the Lugano district (Luganese) with an average of 60’254 daily passengers on weekdays, 32’262 on Saturdays and 17’420 on Sundays/holidays. Followed far away by the Locarno district (Locarnese) with 18’710 daily passengers on weekdays, 14’386 on Saturdays and 8’733 on Sundays/holidays (USTAT, 2018). Figure 42 presents the average number of daily passengers transported in the weekdays by public buses from 2010 in the different districts of Ticino.
2.2.3. Road vehicles flows

The road traffic monitoring system in Ticino has more than 100 counting stations, located in the most significant sections of the motorway, expressway and cantonal roads network and it is managed by the canton Ticino in collaboration in the federal authorities FEDRO (Federal Roads Office).

The information concerning only the total kilometers travelled in the motorways and expressways network in Ticino is not available. But at the national level, the total kilometers travelled on motorways and expressways in 2018 remained almost unchanged: compared to the previous year, the change was + 0.1%. There is a trend that the annual growth rate decrease year by year (2017 + 2.0%, 2016 + 2.4%), but still present a growth every year (USTAT, 2019). Even though data about the total kilometers is not available, the FEDRO releases statistics on the annual average daily traffic (AADT, in italian TGM – traffico giornaliero medio) registered in the Ticino’s counting stations (Figure 43). The figure shows that the main traffic load is observed between Chiasso and Bellinzona, with more than 50’000 daily vehicles.
The traffic on the cantonal roads shows different behaviours, depending on the district in consideration:

- in the Lugano district, seven out of eleven counters show a decrease in vehicle load or stabilization, while four indicate a slight increase. The most marked decrease, equal to -4.9%, is found in the area of Agno - Strada Regina (AADT: 18’508), while the largest increase of 0.5% is observed in the Vezia- Via San Gottardo south area (AADT: 20’649).

- in the Locarno and Vallemaggia districts only five out of ten counters properly collected data in 2018. Of these five, four show a downward trend. Compared to 2017, the most
significant drop (-2.4%) was found in the Losone - Maggia old bridge (AADT: 19'153). The most loaded point of the cantonal roads in this area, the Maggia new bridge, also registered a decrease of -1.9% (AADT: 34'925 units).

- Concerning the Bellinzona and the Tre Valli districts (Blenio, Leventina and Riviera), counters show a decrease in traffic: in the Castione-Claro area, with -3.2% (AADT: 8.909), and in the southern Lavorgo area, with -9.3% (AADT: 1.961). On the Magadino plain (right bank), in the Gudo Progero area, the TGM settles at 14,770 units: stable compared to 2017 (+ 0.2%). At the meter in the Monte-Ceneri area there is the most important increase: + 2.8% (TGM: 12.974) compared to 2017.

2.2.4. Cycling flows

The flows of cycling are difficult to report, since there are only 7 counting stations active in Ticino and all of them are installed in predominantly touristic points. Nonetheless, the canton authorities are planning to install 15 more counting stations in strategic points, that would enable to have a border picture of the cycling paths usage (Dipartimento del territorio, 2019).

Considering the data collected by the counting stations illustrated in Figure 44 (average daily counting during the twelve months of the year 2018), all the stations show seasonal variations, with significantly higher averages in the summer months than in the rest of the year. The counting station of Locarno, installed on the walk bridge that crosses the Maggia River, between Locarno and Ascona, presents the highest bicycle crosses. This counting station registered its daily maximum peak of 3,628 bikes on April 22, 2018, which reflect the importance of the connection, both for tourist/leisure purposes and for utilitarian purposes (home-school and home-work trips). The counting stations of Locarno and Monte Carasso, positioned at the entrance to Locarno and Bellinzona respectively, show a commuting trend: incoming peaks at 8:00 and 13:00 and outgoing peaks at 12:00 and 17:00 and more popular on workdays compared to the weekend (Dipartimento del territorio, 2019).

![Figure 44 – Average daily bicycle counting in the Ticino counting station (Dipartimento del territorio, 2019)](image)
2.2.5. Flows for work commuting

In Ticino the leisure is the main reason people take trips: it was estimated that 41.7% of the average daily distance done by Ticino’s residents within Switzerland borders was covered in connection with leisure activities, while work-related traffic accounted for 19.6%, and shopping trips for 17% (FSO, 2015). Travelling for leisure is unique in several ways: it is primarily based on choice and preference spatially dispersed across a territory and non-routine in nature (Nessi, 2017), therefore modelling leisure trips would require systematic monitoring campaigns aimed at collecting the origin and destination of such trips on a representative sample of citizens. For work related travels, instead, estimating the origins and destinations is easier, since this kind of trips are routinely performed and the data about home address and work address is collected by cantonal authorities.

USTAT (2019) shows 34.6% of the commuters residing in Ticino remain within the border of municipality where they live, 63.2% of them work in a municipality in Ticino different from the one in which they live, and only 2.2% work in another canton or abroad (Figure 45).

At the district level, Figure 46 shows that the most important flows for work remain within the district itself (depicted by the horizontal lines), in all districts, including the less urban ones. The absolute amount of commuters is directly proportional to the demographic dimensions of each district, varying from 614 work commuters in the Blenio district to 46,862 work commuters in the Lugano district (USTAT, 2019).
Furthermore, one third of all work commuting originated in Ticino, in 2017, took place within the Lugano district alone (46'862 work commuters out of 128'334, namely 36.5% of the Ticino work commuters). Therefore, it should be taken into account that the flows in Ticino are strongly determined by what happens in the Lugano area.

Commuters who leave their district tend to move to the nearest urban district. These "proximity trips" are not only valid for the more rural areas (from Vallemaggia to Locarno; from Blenio, Riviera and Leventina to Bellinzona) but also for urban areas: from Locarno to Bellinzona (and in vice versa) and from Mendrisio to Lugano. The district of Lugano is an exception to the rule, since, besides generating a great amount of commuting flows within itself, it welcomes commuters not only from neighbour districts, but also from more distance ones.

Figure 47 summarizes the work commuting balance for the eight districts: outgoing commuters, incoming commuters and commuter balance (for the sake of comparison, intra-district commuters are also represented, even if their number does not intervene in calculating the balance).

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Note that this total number is different from the total number of workers in Ticino. This number only includes working commuters whose origin-destination are known and whose commuting travel starts in Ticino.
The Figure shows again that the most part of the work commuting in Ticino is done intra-district. Furthermore, the only two districts with a markedly positive commuter balance, characterized by more incoming than outgoing commuters, are Lugano and Bellinzona. Despite of the different demographic and job dimensions of these two districts, the commuter balance has similar orders of magnitude: 11’000-12’000 incoming, 8’000-8’500 outgoing, for a positive balance of around 2’700 units for Bellinzona, and 3’500 for Lugano. On the other hand, the other two urban districts of Mendrisio and Locarno have a negative commuting balance - which is quite surprising, if we consider that they are the second and third districts for jobs in Ticino (respectively representing 19.4% and 14.0% of total jobs in the canton). This is due to the presence of cross-border workers from Italy: the Mendrisio and Locarno districts are the second and third destination of employment for cross-border commuters, after Lugano. Therefore, if the border commuting were added, commuting balances would be very different: Locarno and Mendrisio would pass from a negative balance to an evidently positive one (approximately +4’500 for Locarno, while Mendrisio would exceed +20’000 units). Furthermore, the balance of the district of Lugano, which is already positive, would increase by 10 times (from +3.500 to +35.000 approximately). These results have to be read with caution, since the data related to cross-border commuting is provided by a different source, the Cross-border Commuters Statistics (CCS) (USTAT, 2019). Anyway, they provide an indication of the general trends. Specifically regarding cross-border work commuting, Figure 48 shows that the number of cross-border workers is growing each year, and confirms that the main destination of such a work-force is located in the districts of Lugano and Mendrisio.
2.3. Ownership of vehicles, driving licenses and public transport season tickets

As reported in the first deliverable of this project, in 2019, there were 223’373 passenger cars registered in Ticino and in the last two years the growth of matriculated passenger cars has been negative (-0.3% in 2018 and -0.5% in 2019) (Zubaryeva, Veiga Simão, Grotto, & Cellina, 2020).

Ticino, in 2019, had the fourth higher ratio of cars per 1000 inhabitants of Switzerland (Zug: 681; Schwyz: 646; Valais: 644; Thurgau and Ticino: 632). The ownership ratio both in Switzerland and in Ticino seems to have stabilized in the last decade, in fact the year variations over this decade in Ticino did not reach 2% (FSO, 2020). Figure 49 depicts these tendencies.

The last mobility census ran in 2015 (SMTC) shows that 84.95% of the residents in Ticino had access to a car. The data collected by this census, reported in Figure 50, suggest that more than one third of the people aged between 18 and 24 years old do not have a car available at any time they
want; from the age of 24 years old, the car availability at any time increases, but still 10% - 18% of the people do not have a car always available (SMTC, 2017).

![Car availability in Ticino](image)

*Figure 50 – Car availability at any time by age, in Ticino in 2015 (SMTC, 2017)*

Interestingly, the SMTC census 2015 reports the number of cars for household unit. It is reported that four out of five of the households (82.6%) own at least one car and on average a Ticino household owns 1.3 cars (USTAT, 2019).

In 2019, there were 256’828 valid driving licences. Considering the population residing in Ticino with more than 19 years old (the population statistics range in a 9 years step, so is not possible to use the 18 years old threshold), 89% of the people residing in Ticino that could have a driving licence has one. Furthermore, the number of valid driving licences has been stable over the last four years, having a 1% increase between 2018- 2019 (ASTRA, 2020).

![Valid driving licences in Ticino](image)

*Figure 51 – Valid driving licence in Ticino 2016-2019*
In 2019, 3’471 new driving licences were released. The number of new driving licences released each year shows instead a growing trend: over the past four years it increased every year (2016-2017: 5%; 2017-2018: 6%; 2018-2019: 4%). The majority of the new driving licences are obtained by people aged between 18-24 years old (2’908 new driving licences in 2019, corresponding to 84% of the total new driving licences) (ASTRA, 2020).

The census SMTC 2015 indicates that 81.9% of the residents in Ticino aged 18 or more have a driving license, which is comparable to the overall figure for Switzerland, equal to 81.6%. However, this census shows that more than 50% of the people aged 80 or more and 35% of those between 18 and 24 years old in Ticino do not have a valid driving license. Instead, almost all the Ticino people aged between 25 and 79 years old have a valid driving license (USTAT, 2020).

In 2018, 38’557 annual public transport passes were sold (with an increase of 3.6% compared to 2017) and 117’551 monthly public transport passes were also sold (-0.7% compared to 2017). In the last decade (2009-2018), the number of annual passes have always grown year by year and the monthly passes have grown until 2015; in the last three years the tendency is to slowly decrease (USTAT, 2019).
Moreover, the census SMTC 2015 indicates that 56.71% of the residents in Ticino has a public transport pass (this number does not discriminate the typology of the pass). The younger the age, the more likely that the person has a public transport pass. In fact, as shown by Figure 54, the large majority of the people aged between 6-17 years old has a PT pass while a little bit more of a half of the people aged 45-64 years old have it.
2.4. Daily travel distance and duration

The census SMTC 2015 shows that in average a Ticino resident travels 29.2 kilometres a day within the Swiss borders and 24.6 kilometres outside the borders, travelling an average total of 53.8 kilometres a day. To complete the daily travels within the Swiss borders a resident in Ticino spends in average 77.19 minutes (USTAT, 2019).

Ticino residents’ daily average compared with the daily average Swiss population shows that Ticino residents travel less kilometres a day (Swiss average travels 36.8 kilometers within borders and 28.9 kilometers outside borders) and spend less time travelling within Swiss borders (82.2 minutes).

Only considering the travels done by the residents in Ticino within Swiss borders (Figure 55), it is possible to note that:

- Men tend to travel 40% more than women (34.7 kilometers per day for men; 24.4 kilometers for women). The difference, however, is reduced to just over 13% if we take into account the time dedicated to travel (82.3 minutes for men; 72.7 minutes for women);

- Residents aged between 18 and 24 years old and between 25 and 44 years old tend to travel the longest distances, with about 40 kilometers per day. After the age of 44 years old, the travel distance tends to decrease, reaching 5.8 kilometers per day for the elderly (80 years or more);

- The average monthly household income has a strong relationship with the distance and daily time dedicated to travel: an increase in the wage range corresponds to an increase in kilometers and minutes traveled;

- The professional employment degree also seems to influence the kilometers traveled every day and the minutes needed to cover these distances. Residents that have a full-time job travel almost 50% more kilometers than those who have a part-time job, and more than double of those who do not have a job. These trends are also shown by daily travel times, albeit in a much less noticeable way;

- Residents living in urban areas tend to travel shorter distances than those living near urban areas (less than 10km) and even more than those living outside urban areas (less than 12 km); again, the differences in travel time are less pronounced.
Figure 55 – Ticino residents average daily travel distance and duration according to some characteristics (SMTC, 2017)
2.5. Modal Split

The private motorized vehicles are the favorite mode of the Ticino residents: the SMTC 2015 shows that almost 77% of the daily distance travelled in Ticino were done using a private motorized vehicle\(^7\) (21.69 km), followed by the use of public transport\(^8\) (4.48 km) and finally by soft modes\(^9\) (2.11 km). In terms of duration, since the soft modes have a lower speed, the daily time dedicated to travel using a private motorized vehicle and soft modes are comparable. Figure 56 shows graphically the aforementioned observations.

Average mode of transport daily use in Ticino

![Figure 56 – Average daily distance and duration, per transport mode, in Ticino (SMTC, 2017)](image)

Considering the same characteristics of the previous section, it is possible to observe that for all different characteristic the transport modes use to cover most of the daily distances are the private motorized vehicles (Figure 57).

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\(^7\) Private motorized vehicles: passenger car and motorcycles as driver or passenger.

\(^8\) Public transport: public transport bus, train, tram and metro

\(^9\) Soft modes: walking, bicycle and e-bicycle.
Interestingly, the large majority of the daily distance travelled using a car is done as a driver; just for the underage population, that is not allowed to drive, all the kilometres travelled by car are done as passengers.
Another interesting fact, is that the commuting average car occupancy level is equal to 1.07 passengers per vehicle, meaning that on average cars travel with almost 4 empty seats (Talento, 2016); the average occupancy level of the cars entering Switzerland at the Ticino borders is instead equal to 1.26 passenger per vehicle (Dipartimento del territorio TI, 2019).
2.6.  Trip purposes

In Ticino, leisure is the main trip purpose. The average travel distance and duration for this purpose respectively are 12.17 km and 40.90 min per day, representing 41.7% of the total distance and 49.2% of the total duration. Commuting represents a smaller portion of the daily average travel distance and duration, representing 19.6% of the total distance (5.72 kilometers per day) and 16.4% of the total duration (13.71 minutes per day) (SMTC, 2017).

Analyzing the trip purposes by age range, it is possible to verify that, regardless of age, the greatest number of kilometers and minutes is always for leisure. In absolute terms, young people between 18 and 24 are the ones that travel the most for leisure purposes (18.3 kilometers and 52.3 minutes per day), which is about half of the distances and durations, while in relative terms the oldest (with 80 or more years-old) are those who travel more for leisure purposes (just over 60% kilometers and minutes per day, although in absolute terms the figures are relatively small: 3.5 kilometers and 22.8 minutes per day). Figure 60 also shows the transition from the educational period to the first steps on the job market, where distance and time dedicated to travel for education purposes decreases with advancing age, in favor of travels due to work. In fact, for the youngest (6-17 years), education generates 26.2% of the total daily distance (while only 2.0% is attributable to work, whereas for the 25-44 years old range work generates 26.5% of the total kilometers (and education only 3.8%). The same observations apply to the daily duration.

![Figure 60 – Trip purpose by age in Ticino (USTAT, 2019)](image)

Taking a closer look at the time dedicated to travel in the different days of the week, leisure is responsible for most of the travel time, especially during the weekends. The home to work trips are the second purpose for travel time during the week days, closely followed by travel for shopping purposes. During the weekends, instead, work and shopping purposes invert their relative importance (Figure 61).
2.7. Local current projects promoting more sustainable mobility

There are several active projects in Ticino related to mobility. Here, we briefly report about two innovative projects aimed at promoting more sustainable mobility patterns: “Meglio a piedi” and “Mobalt”.

1) “Meglio a piedi”: Scholar mobility

“Meglio a piedi” (“better on foot”) is a project lead by cantonal authorities that aims to improve the health of underage citizens by encouraging the use of soft modes for the ir home-school trips. Within the project, municipalities and schools are invited to design and implement a School Mobility Plan (PMS). These plans analyze the current mobility patterns of the students and the available alternatives, furthermore they identify the potentially dangerous spots for walking and cycling. Taking into account these analyses, local authorities put in place a set of tools to promote the use of soft modes, such as for example walking school bus lines and low speed areas around schools (Meglio a piedi, s.d.). Currently, there are 62 active PMS, involving almost 20 thousand students (USTAT, 2019). Figure 62 shows the active PMS and the students involved by municipality in 2019.
2) Mobalt

Mobalt (which stands for "mobilità alternativa" in Italian) is a digital platform that helps to improve the home-work trips. One tool of the project is the Mobalt app that proposes personalized alternatives for the home-work itinerary. The alternatives include public transport, park & rail, carpooling, a shuttle service, e-bikes, bikes and foldable bikes. The app evaluates every available alternative based on the user preferences and returns them ordered by the best match. The app gives the possibility to explore the details of each alternative and request a reservation. A total of almost 8 Million trips using more environmental friendly alternatives were registered in the Mobalt platform. More detailed information is available on the following websites: [https://www.mobalt.ch/](https://www.mobalt.ch/) and [http://www.centralemobilita.ch/](http://www.centralemobilita.ch/)
2.8. Future local game changer projects

There are three main infrastructural projects in execution or under consultation that could change the face of the mobility in Ticino in the next decade: two are related to public transport infrastructure and one to road infrastructure.

3) Ceneri base tunnel

The Ceneri base tunnel (CBT) is the Swiss third-largest railway-tunnel project, with 15.4 kilometres of length, and it is part of a bigger project called “New Rail Link through the Alps” (NRLA). This tunnel intends to further flatten the railway that crosses Switzerland from north to south having a big impact in the international, country, regional and local trains, largely reducing the time to cross the Ceneri mountain and improving train connections between Lugano, Bellinzona and Locarno. In fact, in connection with other smaller interventions, it will reduce the travel time between Lugano and Bellinzona from today’s 27 minutes to 14 minutes (Dipartimento del territorio TI, 2019). Furthermore, a direct rail link will be created between Lugano and Locarno, thereby reducing the journey time from today's 58 minutes to 30 minutes (AlpTransit, 2020). The vision is that the regional trains will function as a “metropolitan” service bringing closer together the major agglomerations in Ticino. The tunnel is expected to be operative by Spring 2021.

4) Rete tram-treno del Luganese

As shown in section 2.2.5, one third of all home to work travels in Ticino, in 2017, took place within the Lugano district alone. Therefore, to improve the Lugano intra-
district connectivity cantonal authorities have launched the “Rete tram-treno del Luganese” (tram-train network of the Lugano district) project. This project will connect the main mobility attractors in the Lugano district that today are not well connected. The first step of the project (shown in blue and red in Figure 64) will connect Ponte Tresa (one of the main entrances of cross-border workers) and the Vedeggio zone (where many industries and offices are located) to Lugano city centre (Dipartimento del territorio, 2020). Such a tram-train line will significantly reduce the travel time, this way, creating a real public transport alternative along the currently highly congested Manno/Bioggio/Lugano corridor.

This first step of the project is expected to be concluded by the year 2029 and has an estimated cost of 400.68 MCHF, totally financed by public authorities (72% Federal, 16% Cantonal and 12% Municipal).

The second step of the project (shown in green in the figure) will further amplify the network of the tram-train and it is expected to connect other attraction areas, such as for example the sports infrastructures located at Cornaredo, to the city center.

![Figure 64 – “Tram-treno del Luganese” network and travel times (laRegione, 2019)](image)

5) Completion of the A13 motorway

As shown by figure 3 the A13 motorway, that goes from east to west in Ticino’s territory, is not completed, having a gap between Bellinzona Nord and the Locarno airport. This gap makes the travels by road to and from the Locarno district longer and less safe. The project consists in building 11 new kilometers of motorway, 8 of which will be undergrounded to preserve the environment of the Piano di Magadino natural area. The project will reduce the road travel time from the Locarno district and the other districts in Ticino. More information about this project can be found in the following link: [https://www4.ti.ch/dt/temi/a2a13/collegamento-a2-a13/collegamento-a2-a13/](https://www4.ti.ch/dt/temi/a2a13/collegamento-a2-a13/collegamento-a2-a13/).
2.9. Final considerations - Ticino

Ticino has a highly developed infrastructure network to support the mobility in the territory, therefore it is easy and quick to move around the Cantonal territory and to reach Swiss-German and north Italian cities.

The road network arrives to every village, the motorway A2 connects the major cantonal cities Chiasso, Mendrisio, Lugano, Bellinzona, and allows to cross the canton quickly and safely from north to south. From east to west, instead, the expressway A13 is not completed in its full length, lacking the segment between Locarno and Bellinzona, somewhat isolating the city of Locarno from the other Ticino agglomerations. The road use tends to grow each year, but in the last years the growth pace is getting lower. The road segments that present a higher annual average daily traffic are on the axis that connects Chiasso to Bellinzona.

The railway is high developed as well, being almost parallel to the motorway and expressway present in the territory. Even though the number of passengers in 2018 slightly dropped compared with 2017, the tendency of the last decade is for a continuous increase in the number of passengers. Again, as for the road use, the segments that present a higher daily load of passengers are on the axis between Chiasso and Bellinzona.

Concerning the public transport offer, it is concentrated in the major agglomerations of Ticino, where the demand is in fact higher. The level of service is very good in the five most important agglomerations of the canton (Bellinzona, Chiasso, Locarno, Lugano and Mendrisio), but it lags behind in the smaller agglomerations in the territory. In 2021, with the opening of the Ceneri base tunnel, the organization and level of service of the public transport in Ticino will completely change, with considerable increase of the public transport offer all around the territory. Such changes are expected to significantly increase the use of public transport.

Differently than the road and rail infrastructure networks, the cycling paths infrastructure is underdeveloped in Ticino. Today the network has 365 km and it is expected to increase to 560 km in 2025/2030. Much has to be done, in particular inside the agglomerations in order to promote this transport mode. Furthermore, today only seven bicycle counting stations are active in all the territory, making difficult to correctly estimate the level of use of bicycles in Ticino.

Mobility sharing services are present in the territory in the form of car-sharing and bike-sharing schemes. All of these services are station-based services, making therefore travels using these schemes quite rigid, since their exploitation is bound to the presence of a station in the origin and destination areas. Furthermore, even though every agglomeration in Ticino has only one type of bike-sharing provider, the service is not interoperable between cities: if one resident has a subscription in the bike-sharing scheme of Lugano, this subscription is not valid in Bellinzona for example.

A Ticino resident travels in average 29.2 kilometres a day within the Swiss borders and spends 77.19 minutes to travel this distance. The main reason for travelling all week long is for leisure purposes (41.7% of the total distance and 49.2% of the total duration). For leisure travels, due to their unpredictable nature, any estimate of origins and destinations is highly
affected by error. On the contrary, commuting for work travels, that represent 19.6% of the total distance, are in general routinely performed; furthermore, home/work addresses are collected by the authorities, therefore the origins and destinations are known. Thus, if we only consider workers who reside in Ticino, by considering their home and work addresses it appears that the large majority of them works in the same district where they live - and one third of them even lives in the same municipality. Furthermore, note that the commuting trips within the Lugano district alone represent one third of all commuting trips. The information about cross-border work commuting is not included in these figures, but a special attention should be made to this phenomenon and its impact on road and rail traffic, since cross-border workers represent one third of the Ticino work force.

Moreover, residents in Ticino mobility heavily use private motorized vehicles, in fact 77% of the daily travel distance is done using these kind of modes. This is not surprising since Ticino presents one of the highest car ownership ratios in Switzerland (632 cars per 1000 inhabitants) and 89% of the resident over 19 years old has a valid driving license. One alarming fact is that the average car occupancy level for commuting trips is 1.07 passenger, which is well below the national average, and is confirmed by SMTC data according to which the large majority of trips made by car by over 19 years old residents are made as drivers.

Finally, three major projects can favour a significant change of the mobility patterns in Ticino: two in favour of public transport, and one reinforcing current car use. The opening of the Ceneri base tunnel will reduce the train connection time between the principal agglomerations in Ticino; the tram-train in the Lugano area will connect high traffic attractor zones in the Lugano district where today’s public transport is insufficient; and the completion of the expressway A13 will allow a quicker and safer car-based connection between Locarno and the other Ticino agglomerations.
3. TEST SITES COMPARISON

The mobility characteristics of the two test site of the project EVA, described and analysed in this document, shows more similarities rather than contrasts. In fact, for almost all aspects we have analysed, they have the same characteristics.

1) Mobility infrastructures and public transport offer:
Both test sites have a highly developed infrastructure network to support the mobility demand, with a widespread road network that connects almost every human settlements in the two regions and public transport stops and stations well-scattered in the territories. The public transport offers an overall good service in both tests sites, nevertheless dense populated settlements are better served and in rural areas these services are somewhat deficient. Furthermore, public transport offers an interoperable service, meaning that both regions allows travelers to use public transport services with just one card or one ticket. Finally, cycling paths are growing in length each year in both test sites.

2) Main travel flows:
Main travel flows occur within and to/from the major cities of the test sites. In fact, Bolzano, in South Tyrol, and Lugano, in Ticino, are the main poles attracting and generating travel. One phenomenon observed in Ticino, and not present in South Tyrol, is the presence of a considerable number of cross-border workers, that puts a high pressure on the infrastructures that support mobility in Ticino;

3) Car ownership, driving licenses and public transport passes:
Both test sites present a high rate of car ownership and the number of new driving licenses is growing each year. The tendency observed in both test sites is for a growing use of public transport passes.

4) Modal split:
Residents in both test sites heavily rely on private motorized vehicles for their trips.

5) Trip purposes:
Leisure is the main trip purpose. Even though leisure trips represent the largest share of trip purposes, they are not the ones that present the major challenges, since they are disperse in time and space. In fact, the most critical mobility issues are due to commuting trips, which are instead concentrated in time and space.

6) Local current projects promoting more sustainable mobility:
In both test sites several projects are actively promoting more sustainable mobility. The projects briefly presented in this document cover a wide range of objectives: promotion of soft modes for home/school trips; use of digital tools to help commuters find the best options; deployment of alternative powertrain buses; and development of infrastructures to accommodate zero emissions vehicles.
7) **Future local game changer projects:**
Both test sites have two similar projects that intend to significantly change the mobility patterns in favour of public transport. One is the investment in a railway tunnel that will ease and reduce the time travels using trains: the Brenner base tunnel in South Tyrol and the Ceneri base tunnel in Ticino. The other one is the realisation of a light train service in the principal agglomeration: Metro-Bus, in Bolzano and the tram-treno in Lugano. These projects have a lifetime span of several decades and may impact how future mobility scenarios will look like.
REFERENCES


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