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1 Introduction

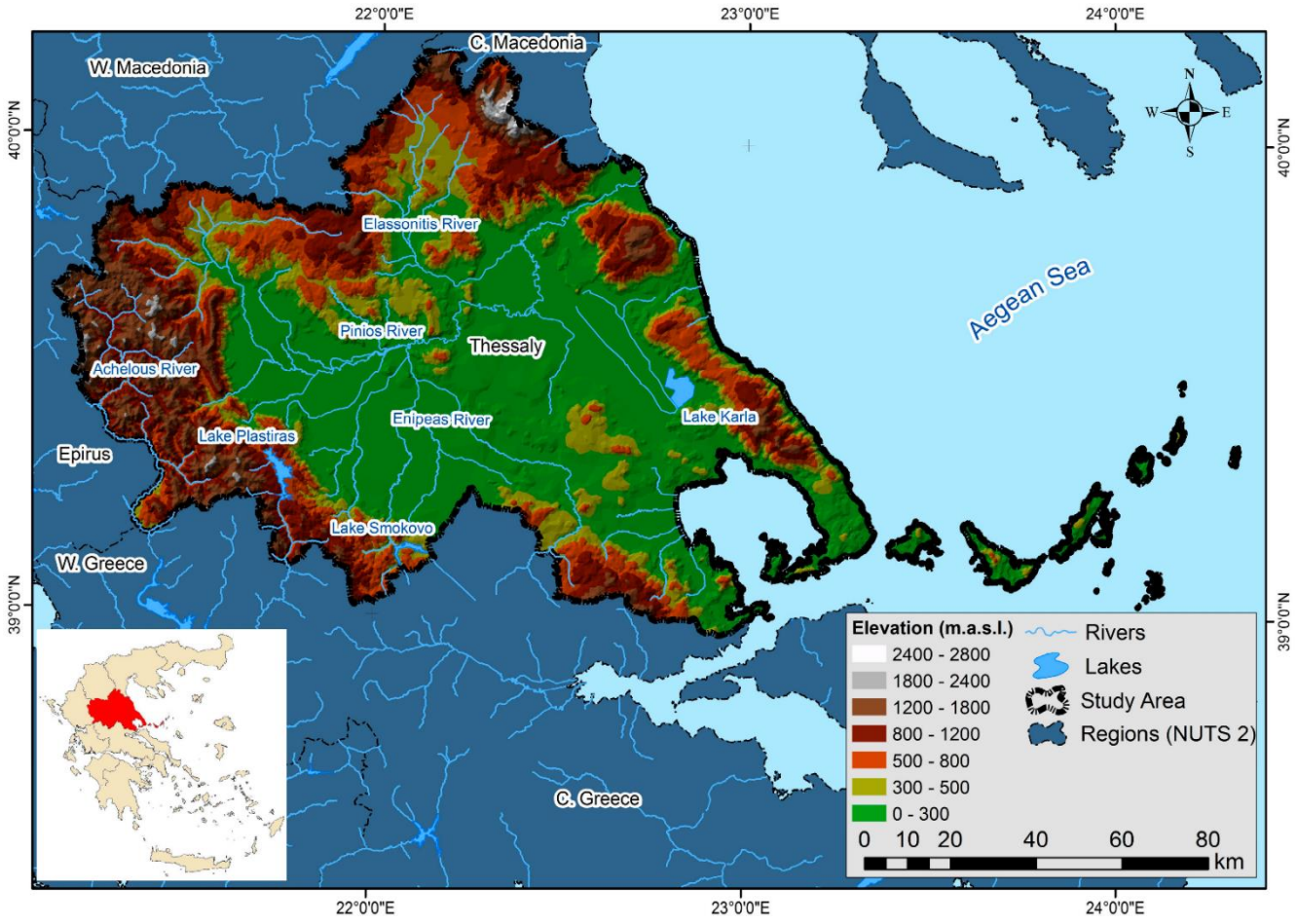
The purpose of this baseline study is to present the region of Thessaly by opposing basic information in the context of the Interreg Europe Project "OptiTrans: Optimisation of Public Transport Policies for Green Mobility". The present report is in fact an analysis of the existing mobility and public transport situation in the region of Thessaly. The study presents key figures, infrastructure maps, policy approaches and it provides a comprehensive overview of the current conditions in order to propose policies and measures toward eco-mobility.

The baseline study is developed mainly through in house collection and analysis of data from several sources. In reality, the report examines existing statistics, reports and development plans. In order to fulfil the purpose of a baseline study this report is organized in the following four parts, each of them covers a specific topic providing crucial information regarding the existing conditions in the region of Thessaly:

- **Population and Territorial Characteristics** – an overview presenting the geography and topography of the area, demographic development and transport infrastructure;
- **Mobility and Transport Infrastructure** – information, key figures and statistics concerning the available transport infrastructure as well as the transport demand per mode (modal split);
- **Public Transport in Urban Areas**– information about the legislation, the organizational framework and the provided services of the public transport system in Thessaly;
- **SWOT Analysis** –it includes a brief SWOT Analysis regarding the challenges, threats and opportunities for the region of Thessaly related with the project's objectives.

2 Population and Territorial Characteristics

The Region of Thessaly occupies the central eastern part of continental Greece. It borders on the north with the regions of West and Central Macedonia, on the south with the region of Sterea Ellada, on the west with the Region of Epirus and on the east with the Aegean Sea. The total area is 14,036km^2 and represents about 11% of the total area of the Greek territory. The ground, in terms of its formation, is 50% mountainous and semi-mountainous and 50% flat, and within its borders is the plain of Thessaly, the largest plain and granary of the Greek territory, which flows through the east-west axis from the river Pinios, the third largest river in the country. The subsoil of the Thessaly region has mineral wealth, mainly chromate, sulphide ores, asbestos, ilmenite and lignite deposits. The Region consists of all kinds of terrain, mountainous areas, islands, valleys, and coastline areas as presented in Figure 1[1].



[1] Manakos I, Chatzopoulos-Vouzoglanis K, Petrou ZI, Filchev L, Apostolakis A. Globalland30 Mapping Capacity of Land Surface Water in Thessaly, Greece. *Land*. 2015; 4(1):1-18.

Figure 1. Region of Thessaly geomorphological landscape [1]

The population of the region of Thessaly is 732,762 (2011 national census) and represents 6.8% of the total population of Greece, from which 44% is urban, 40% agrarian and 16% semi urban. Larissa, the capital of Thessaly, is home to more than 200,000 people. The active population of Thessaly accounts for 298,900 people, of which 28,1% works in the primary sector, 19,2% in the secondary sector and 49% in the tertiary sector. The unemployment rate of the region accounts to 10,2% of the population. The immigration flow has increased by a large scale during the last two decades, offering a considerable potential of low skilled and wage workers. Almost half of the immigrants (47,9%) are employed in agriculture and 18,2% in constructions, allowing certain rural and urban economic activities to survive. The economy of Thessaly based mostly on activities related to the tertiary sector, which accounts for 60.9 % of the regional GDP. The most important segments of the services economy gravitate around tourism, retail and wholesale trade and transportation services, while the services to the enterprises is not developed to an important degree. The Region accommodates important tourist resources that are situated mainly in the eastern coastal area, the islands and the mountainous areas.

The Region of Thessaly is one of the 13 regions of Greece. It covers a part of Central Greece and consists of four Regional Units, (Larissa, Karditsa, Magnesia, Sporades and Trikala). Apart from the long agricultural tradition of the Region, there also exist many protected areas, either due to their natural beauty, or due to the existence of protected species. Such areas are the National Park of Mount Olympus, the National Sea Park of Alonissos, the rock complex of Meteora, where many old Christian convicts exist, the island of Piperi in the heart of Marine Park in Alonissos and many other areas in the Region.

The Region is served by three (3) airports, two (2) heliports, one (1) major port and a satisfactory public road network, including a big part of the national highway connecting Athens to Thessaloniki (PATHE). Furthermore, there is one (1) main railway line passing through the Region, connecting Athens to Thessaloniki (double track electrified line) and two (2) secondary lines connecting the first Larissa to Volos and the second connecting Palaiofarsalos to Kalampaka (both single tracks non electrified).

The deindustrialization of the last decade has perceptibly shrunk the secondary sector, which is nowadays consisted mostly by units scattered along the axis formed by the cities of Volos and Larissa. Their activity concentrates in the medium to low technology sectors, such as the food and beverages, textiles and wearing apparel, manufacture of furniture, manufacture of wood and of products of wood, manufacture of basic metals and manufacture of fabricated metal products.

The Region of Thessaly has four main urban centers: the cities of Larissa, Volos, Trikala and

Karditsa, capitals of Larissa, Magnesia, Trikala and Karditsa Regional Units respectively, with Volos and Larissa being the most developed ones. All four cities have urban buses that satisfy the needs of the inhabitants for urban transportation, within the center of the city and the suburbs. The Intercity Bus Companies (KTEL) is servicing the rest of the towns and villages. There is a different bus company servicing the inhabitants of each Regional Unit as regards their transportation, either within the Regional Unit or from one Regional Unit capital to another or even to destinations outside the Region of Thessaly (e.g. Athens, Thessaloniki, Patra). A strict legal framework is in effect until 2019, which does not allow bus drivers to pick up passengers from another Regional Unit, even if they do not need to deviate from their regular course to do so. However, the Greek government is working on a legislative and regulatory framework that will allow competition earlier than foreseen (2015).

This strict legal framework does not help the cooperation between the Intercity Bus Companies of different Regional Units. There is no supportive legal framework and that is the main obstacle for the cooperation between Bus Companies and the Rail Company in a form of a multimodal transportation service. The Region of Thessaly is in a privileged position concerning the rail services that can be provided to citizens, since the main rail axis of Greece is running through the Region.

The Region of Thessaly has a small military-civilian airport in New Anchialos, near the city of Volos and close to the highway connecting Athens with Thessaloniki. The airport services in the Region are active during spring, summer and autumn months, with domestic and European flights. In addition, the city of Volos has an important passenger-freight port connecting the islands of North Sporades with the mainland. The port is transporting a big number of passengers, especially during the summer months, since Sporades Islands, Skiathos, Skopelos and Alonissos, are international tourist destinations.

The role of the region in the transportation sector is vital since it is crossed by the main growth axis in Greece, also included in the wider European Network of Transports. Moreover, contact with the Western – European Area has been facilitated by the recent operation of the airport in Volos.

Due to the recent economic crisis, many people are moving towards the cities lowering even more the population of villages, causing the Bus Companies to respond with even lower frequencies to transportation demand on rural areas. On the other hand, this alerted state and people to focus on new ideas and projects towards sustainable transport. Sustainable transport projects are required mainly between rural areas with low population, where the main problems exist, and not so much between villages and the capitals of each Regional Unit.

Region of Thessaly through selective actions (Action 4e) incorporated into the “Regional

Operational Programme of Thessaly 2014 – 2020" aims to achieve: a) the reduction of greenhouse emissions (CO_2) in all areas of the region, focusing however in urban areas, including the promotion of multimodal sustainable mobility and b) the restriction of the consequences by applying specific measures. Towards these objectives, the Region of Thessaly has foreseen specific budget to fund projects in order to achieve:

- Promotion of sustainable mobility and elimination of problems at the transport infrastructure.
- Support of the regional mobility by connecting the regional transport networks with the TEN-T networks including multimodal transport hubs and nodes.
- Operational upgrade of the interregional road networks in order to be connected with the intraregional road network.
- Upgrade of the existing infrastructure at the ports of the region.
- Connection of specific areas (rural areas) and areas of touristic and cultural interest with the main road network and the TEN-T corridors.

Specifically, for the reduction of the greenhouse emissions the Region of Thessaly through selective actions estimates that will be able to reduce them in terms of CO_2 equivalents by the year 2023 by 2,538 tons.

2.1 Regional Unit of Larissa

Larissa is one of the regional units of Greece and is part of the Region of Thessaly. Its capital is the city of Larissa. The total population of the region unit according to the latest national census in 2011 is 284,325 residents.

Larissa is the second largest regional unit in Greece, exceeded only by Aetolia-Acarnania. It covers about one-third of Thessaly. It borders the regional units of Kozani to the northwest, Pieria to the northeast, the Aegean Sea to the east, Magnesia to the southeast, Pithiotis to the south, Karditsa to the southwest and Trikala to the west. The tallest mountain in Greece, Mount Olympus (2,917 m) is situated in the northeastern part of the regional unit. Mount Ossais situated in the east, at the Aegean coast. The lower stretch of the river Pinios flows through the Vale of Tempe, between Olympus and Ossa. The northern part is covered with forests, but most of the regional unit is fertile land, the Thessalian Plain. The regional unit of Larissa is subdivided into 7 municipalities: Agia, Elassona, Farsala, Kileler, Larissa, Tempi and Tyrnavos.

The region is directly linked to the rest of Europe through International Airport of Central

Greece located in Nea Anchialos in a small distance from Larisa (26 kilometers). Through the territory of the regional unit of Larissa, several highways and motorways pass through. The most important of them are the following:

- Greek National Road 1/E75
- Greek National Road 3
- Greek National Road 6
- Greek National Road 13
- Greek National Road 26
- Greek National Road 30
- Larissa-Karditsa Road
- Grevena-Elassona Road
- Larissa-Melivoia Road

According to FEK3350B/2012 of the Central Government, the number of TAXI (Public Use Passenger Vehicles) for the Regional Unit of Larissa was decided to be in 2012, and still remaining the same, 409 vehicles. Of those vehicles, 265 vehicles (≈65%) serve the Municipality of Larissa and the rest 144 vehicles (≈35%) the rest of the Regional Unit areas. For the Municipality of Larissa, there is 1 TAXI per 613 inhabitants, while for the rest areas, as an average, the ratio is 1 TAXI per 605 inhabitants.

2.2 Regional Unit of Trikala

Trikala is one of the regional units of Greece, forming the northwestern part of the region of Thessaly and its capital is the town of Trikala. The total population of the unit is 131,085 residents (national census 2011). The regional unit includes the town of Kalampaka and the Meteora monastery complex. The regional unit of Trikala is subdivided into 4 municipalities: Farkadona, Kalampaka, Pyli and Trikala.

There are a number of highways and the main railway from Volos to Meteora crosses Thessaly. The region is directly linked to the rest of Europe through International Airport of Central Greece located in Nea Anchialos in a small distance from Trikala. In the 1980s, the Trikala Bypass was opened and between 1998 and 2006, the Via Egnatia was under construction with tunnels and bridges; the first section was opened in 2002, and the final section in 2006.

- Greek National Road 6
- Greek National Road 15
- Greek National Road 30

According to FEK3458B/2012 of the Central Government, the number of TAXI (Public Use Passenger Vehicles) for the Regional Unit of Trikala was decided to be in 2012, and still remaining the same, 172 vehicles. Of those vehicles, 102 vehicles (≈59%) serve the Municipality of Larissa and the rest 70 vehicles (≈41%) the rest of the Regional Unit areas. For the Municipality of Trikala, there is 1 TAXI per 798 inhabitants, while for the rest areas, as an average, the ratio is 1 TAXI per 710 inhabitants.

2.3 Regional Unit of Karditsa

Karditsa is one of the regional units of Greece. It is part of the region of Thessaly and its name is derived from its capital Karditsa, a small city of approximately 40,000 people. Karditsa borders the regional units of Trikala to the north, Larissa to the east, Phthiotis to the southeast, Evrytania to the south, Aetolia-Acarnania to the southwest and Arta to the west. The main rivers are Megdovas in the south, the Pinios in the north, and the Enipeas in the east. The Plastiras Dam and Lake Plastiras, located to the west of the city of Karditsa, supply water to the plains and the central part of Greece.

Located in south-western Thessaly, it is primarily an agricultural area. Farmlands dominate the central and the eastern part, which belongs to the Thessalian Plain. The western and southern part of the regional unit is mountainous, notably the Pindus mountains. The Agrafa region, straddling the border with Evrytania, is well known for its resistance against Ottoman rule and its harsh landscape.

The regional unit Karditsa is subdivided into 6 municipalities: Argithea, Karditsa, Lake Plastiras, Mouzaki, Palamas and Sofades. The Public Market of Karditsa is one of UNESCO's protected cultural monuments. The city is also an important knowledge centre, supporting the Faculty of Veterinary Medicine of the University of Thessaly, the Faculty of Wood and Furniture Technology, and the Faculty of Forestry Technology of the Technological Educational Institute of Larissa. There is also a Police Academy.

There are a number of highways E75 and the main railway from Volos to Meteora crosses Thessaly. The region is directly linked to the rest of Europe through International Airport of Central Greece located in Nea Anchialos in a small distance from Karditsa.

- Greek National Road 30
- Karditsa - Larissa road
- Karditsa Bypass

According to FEK313B/2013 of the Central Government, the number of TAXI (Public Use Passenger Vehicles) for the Regional Unit of Karditsa was decided to be in 2013, and still remaining the same, 149

vehicles. Of those vehicles, 81 vehicles (≈54%) serve the Municipality of Karditsa and the rest 68 vehicles (≈46%) the rest of the Regional Unit areas. For the Municipality of Karditsa, there is 1 TAXI per 700 inhabitants, while for the rest areas, as an average, the ratio is 1 TAXI per 835 inhabitants.

2.4 Regional Unit of Magnesia

Magnesia, deriving from the tribe name Magnetes, is one of the regional units of Greece. It is part of the region of Thessaly and its capital is the city of Volos. About 70% of the population of Magnesia live in the Greater Volos area, which is the second-largest city in Thessaly and the third busiest commercial port in Greece. According to the most recent census (2011), the population stands at 190,010. The regional unit hosts 2,000,000 tourists annually.

A prominent geographic feature of Magnesia is the Pagasetic Gulf, a bay of the Aegean Sea. The Pelion mountain range closes off the Gulf on the east and south side, leaving only a narrow channel near Trikeri. The highest peak of the wooded Pelion is Pourianos Stavros or Xeforti, (altitude 1,624 metres or 5,328 feet). On the south edge of Magnesia peninsula Tisaio mountain is found.

Mt. Maurovouni (1,054 metres or 3,458 feet) is the north eastern mountain of the regional unit and extends to the neighboring regional unit of Larissa. The southwest border of Magnesia is formed by the Othrys, with its highest peak Gerakovouni (1,726 metres or 5,663 feet). The interior of Magnesia has two plains. The plains southwest of the Pagasetic Gulf are called Almyros plains, while the plains northwest of the Gulf are called the Volos-Velestino plain. The hydrological network of Magnesia is not particularly rich and is characterized by the absence of big rivers. The waters coming from Pelion shape the rivers Anavros, Platanorema, and Xirias.

In the North section of Magnesia, Lake Karla was formerly found. Lake Karla was drained in 1962, but attempts have been made for its partial restoration. On the bight of Sourpi, next to Amaliapolis a coastal wetland is located, with various species of migratory birds. This wetland together with the forest of Kouri – an infrequent lowland of Oak tree forest close to Almyros – is included in the list of the protected regions of the European Network Natura 2000.

The regional unit Magnesia is subdivided into 5 municipalities: Almyros, Velestino, Argalasti, Volos and Zagora. The regional unit is directly linked to the rest of Europe through International Airport of Central Greece, located in Nea Anchialos, a short distance from Volos. The airport includes a terminal which can serve 1,500 passengers per hour. The regional unit's road network includes:

- Greek National Road 1/E75
- Greek National Road 6
- Greek National Road 30

According to FEK2047/2017 of the Central Government, the number of TAXI (Public Use Passenger Vehicles) for the Regional Unit of Magnesia was decided to be in 2017, and still remaining the same, 306 vehicles. Of those vehicles, 180 vehicles (≈59%) serve the Municipality of Magnesia and the rest 126 vehicles (≈41%) the rest of the Regional Unit areas. For the Municipality of Magnesia, there is 1 TAXI per 666 inhabitants, while for the rest areas, as an average, the ratio is also 1 TAXI per 666 inhabitants.

2.5 Regional Unit of Sporades

The (Northern) Sporades are an archipelago along the east coast of Greece, northeast of the island of Euboea in the Aegean Sea. They consist of 24 islands, four of which are permanently inhabited: Alonnisos, Skiathos, Skopelos and Skyros. They may also be referred to as the Thessalian Sporades.

As a part of the 2011 Kallikratis government reform, the regional unit of Sporades was created out of part of the former Magnesia Prefecture, region of Thessaly. The regional unit is subdivided into 3 municipalities. These are: Skiathos, Skopelos and Alonnisos. The island of Skyros with a few uninhabited islands of its area is part of the regional unit of Euboea and the administrative region of Central Greece.

3 Mobility and Transport Infrastructure

Located at the central area of Greece, Thessaly connects North, South, East and West. In terms of transportation, Thessaly is an important transport hub for Greece. Through the Thessalian territory

segments of the primary national road and rail networks pass through, being at the same time parts of TEN-T core networks. Furthermore, the only seaport, the one of Volos, is part of TEN-T comprehensive network. There are three (3) airports, at Larissa, Volos and Skiathos. The one at Larissa is used only for military purposes for the last 20 years, however a recent study has been implemented and a strategic plan is prepared in order a civil airport to be operational by 2020 in Larissa. The airports at Volos and Skiathos serve both domestic and international flights.

3.1 Road Transport

The road network of Thessaly is consisted by a significant segment of the national motorway, Motorway 1 also known as PATHE (Patra – Athens – Thessaloniki – Evzonoi) which passes through almost the entire mainland and parts of the primary and secondary national road network, as well as parts of regional and rural network. The majority of the network is in satisfactory level although upgrading operations are always planned and implemented. Just recently, in 2017, one of the most dangerous segments of PATHE passing through the valley of Tempe has been bypassed by the completion of T2 tunnel, total length of 6km, upgrading thus the road safety level and at the same time, reducing travel time. Figures 2 & 3 present road network of Thessaly's region (based on Google © digital background)[2] while Tables 1 - 3 present several statistical information concerning road transport. Furthermore, a small segment of Egnatia Odos Motorway passes through the territory of Thessaly, near Malakasi village, where a grade-separated junction exists.

Inside the territory of Region of Thessaly and along the national motorway there are three frontal toll stations installed: Pyrgetos, Markyhori and Moschochori stations. According to the data provided by the administrator of the toll stations (Aegean Motorway SA), the transit traffic volume (both directions) for the time period 01/2017 – 12/2018 regarding bicycles and passenger vehicles is the following:

- Pyrgetos toll station
  - Category 1 (bicycles): 5,743
  - Category 2 (light vehicles): 724,935
- Makryhori tolls station
  - Category 1 (bicycles): 49,912
  - Category 2 (light vehicles): 6,304,136
- Moschochori toll station

[2] Google Maps, 2018

- Category 1 (bicycles): 38,840
- Category 2 (light vehicles): 4,665,934

Finally, there is another toll station installed along E65 highway, Sofades toll station between the cities of Trikala and Lamia. The data provided regarding the transit traffic volume (both directions) for the time period 01/2018 – 12/2018 is the following:

- Sofades toll station
  - Category 1 (bicycles): 5,361
  - Category 2 (light vehicles): 675,551

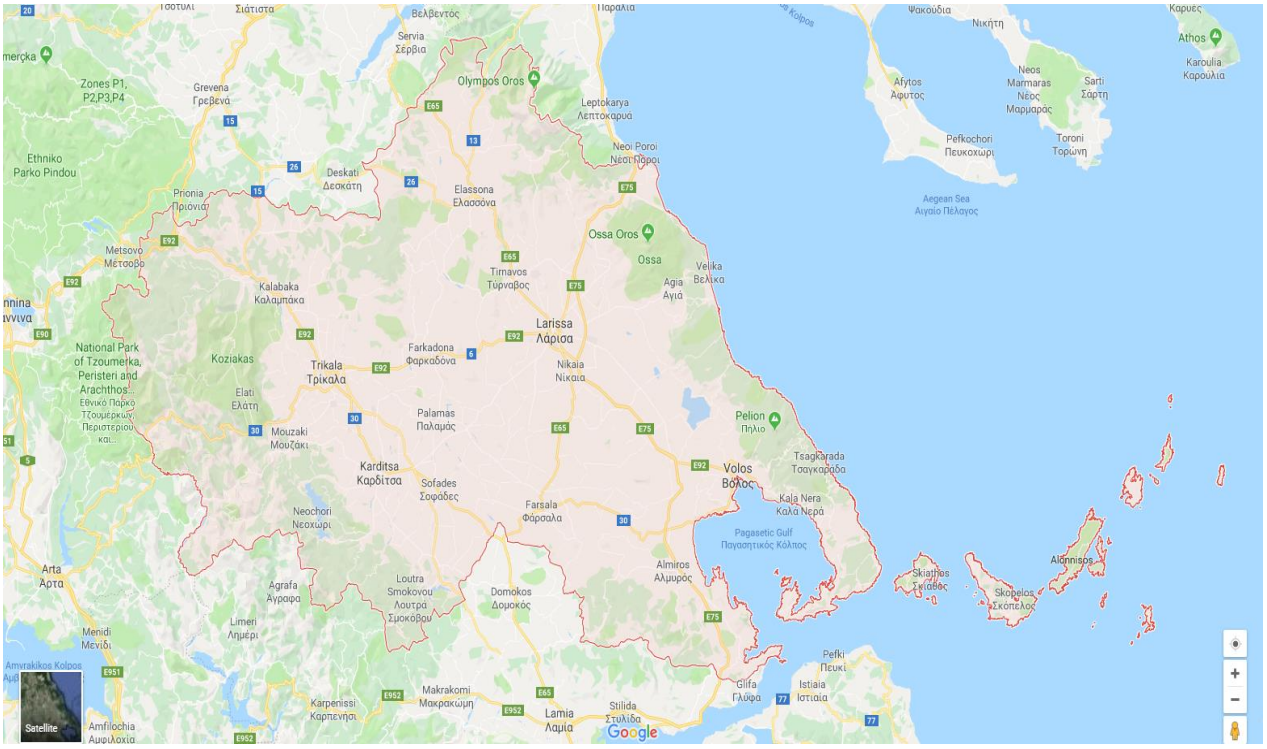


Figure 2. Road network of Thessaly (Google © digital background)

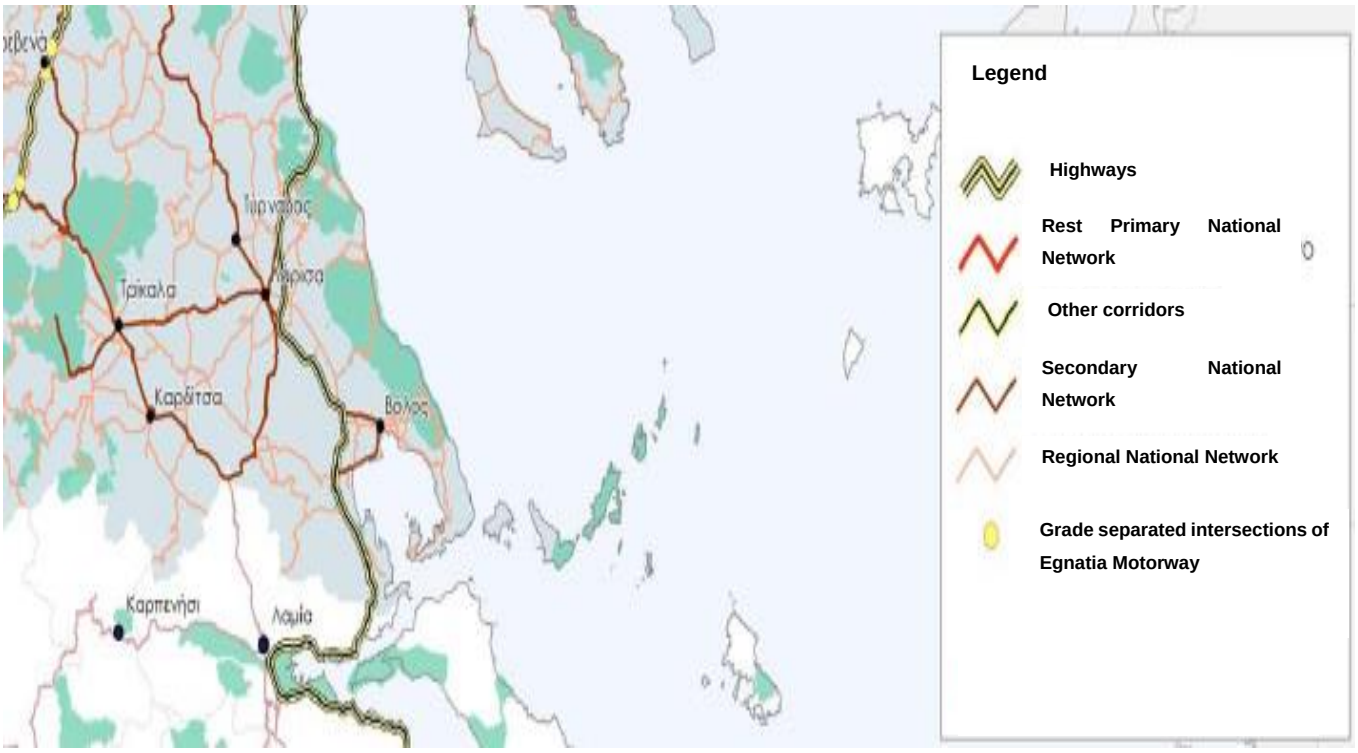


Figure 3. Road network of Region of Thessaly per type

Table 1. Roads Network in Region of Thessaly (km) in 2009

ROADS NETWORK IN THE TARGET TERRITORY (Km) (2009)		
Type of road	Region of Thessaly	Overall country
One carriageway road	2,459	4,230
Dual carriageway road		
Toll-free motorways	582	
Toll highways	150	2,005
Source	Egnatia Observatory	Greek-motorway.net

Table 2. Roads Network in Region of Thessaly per type and per 1,000 inhabitants (2009)

ROADS NETWORK IN THE THESSALY REGION km/ 1.000 inhabitants (2009)	
Type of road	Km/ 1,000 inhabitants in Thessaly Region

One carriageway road	3.365
Dual carriageway road	
Toll-free motorways	0.796
Toll highways	0.206
Source	Egnatia Observatory

Table 3. Number of vehicles per type and per regional units at Region of Thessaly in 2011

NUMBER OF VEHICLES IN REGION OF THESSALY IN 2011				
Regional Units	Passenger Cars	Motorcycles and mopeds	Trucks and vans	Buses
Karditsa	31,853	9,699	19,139	198
Larissa	101,670	21,117	37,631	417
Magnesia	69,737	31,454	24,828	367
Trikala	44,420	15,001	21,628	298
Statistical source	EL.STAT.(Hellenic Statistical Authority)			

3.2 Rail Transport

Through the territory of Thessaly passes through the main railway line connecting north and south Greece. There are also two branches connecting the main line with urban centers of the region of Thessaly. The first one starts from the station of Palaiofarsala towards the cities of Karditsa, Trikala and is ending to Kalampaka. The second one connects the cities of Larissa and Volos, as presented in Figure 4. From the city of Volos towards Milies a touristic route is operational as well.

The line from Palaiofarsala to Kalampaka according to the Network Statement of the infrastructure's administrative authority (TRAINOSE SA) is a single track of total length just over 80km. The line from Larissa to Volos is as well a single track of total length just over 60km. The main line passing through Thessaly from Athens to Platy and then Thessaloniki is a double track line of total length almost 160km (Larissa – Thessaloniki via Platy).

The most recent existing data regarding passengers' traffic (number of passengers) concern the period 2005-2010 for rail stations of Larissa and Volos according to the information provided by TRAINOSE SA in October 2012 as extracted by the on-line ticketing system, as presented in Tables 4 &

5. The data concern the number of passengers served by those two rail stations and cannot be distinguished as arrivals and departures.

Table 4. Number of passengers served by Rail Stations of Larissa and Volos the period 2005-2010[3]

Rail Station	Year						Change (%)		
	2005	2006	2007	2008	2009	2010	2005-2007	2007-2011	2005-2010
Larissa	1.146.225	1.135.040	1.216.224	1.218.912	1.078.397	1.020.038	6,11	-16,13	-11,01
Volos	417.641	376.495	419.189	419.197	343.044	308.253	0,37	-26,46	-26,19

Table 5. Number of Passengers' Transport by Rail in the Region of Thessaly for the years 2010 and 2011

NUMBER OF PASSENGERS´ TRANSPORT BY RAIL IN REGION OF THESSALY (2010 & 2011)	
	Train Passengers in the territory during year analyzed (nº)
High speed train users (2011)	175,000 (Kalampaka-Athens) 110,000 (Kalampaka-Thessaloniki)
High speed train users **(2010)**	188,969 (Larissa-Athens) 331,530 (Larissa-Thessaloniki)
Conventional train users (2011)	46,000 (Palaiofarsalos-Kalampaka) 371,000 (Volos-Larissa)
Suburban train users (2011)	152,056 (Larissa-Thessaloniki)
Total	1,374,555
Source	Rail company(TRAINOSE)

[3] Egnatia Odos Observatory, SET06 Factsheet 2015, Retrieved from: https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=2&cad=rja&uact=8&ved=2ahUKEwjsh_bAmszeAhVFLewKHZ6EBnIQFjABegQIABAC&url=http%3A%2F%2Fobservatory.egnatia.gr%2Ffactsheets%2Ffs_2015%2FSET06_factsheet_2015dec.pdf&usg=AOvVaw2q6C1XsT8ubvr-4TVS70OQ

Figure 4. Railway network inside the territory of Thessaly[4] (TRAINOSE SA)

3.3 Sea Transport

The main seaport located at mainland of Thessaly is the one of Volos. Because Region of Thessaly includes the Sporades islands there are three (3) seaports located to the islands of Skiathos, Skopelos and Alonissos. However, those seaports are significantly smaller than the one of Volos and serve the connection of those islands with the rest of Greece (mainly with Volos).

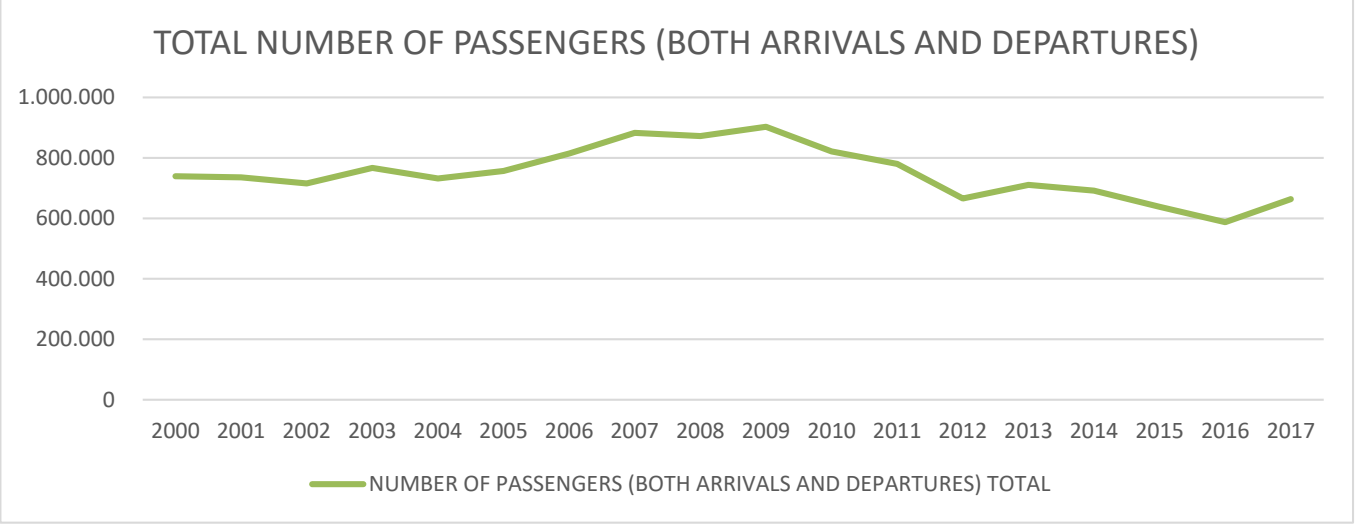
The port of Volos serves both passenger and freight traffic. The passenger traffic concerns trip between Volos and the Sporades islands and cruising since the port can host cruisers. The passengers' traffic (both arrivals and departures) for the period 2000-2017 are presented in Table 6.

Table 6. Total passenger traffic (both departures and arrivals) passed through Volos' port for the period 2000-2017[5]

YEAR	NUMBER OF PASSENGERS (BOTH ARRIVALS AND DEPARTURES)		
	USING FERRIES	USING FLYING DOLPHINS	TOTAL
2000	616.199	123.087	739.286
2001	608.278	127.167	735.445

4 Network Statement 2019, Hellenic Railways Organisation SA
5 Volos Port Authority SA Retrieved from: https://www.port-volos.gr/cgi-bin/pages/index.pl?type=list&arlang=Greek&argenkat=Στατιστικά%20στοιχεία

YEAR	NUMBER OF PASSENGERS (BOTH ARRIVALS AND DEPARTURES)		
	USING FERRIES	USING FLYING DOLPHINS	TOTAL
2002	584.203	131.137	715.340
2003	630.508	136.329	766.837
2004	603.791	128.045	731.836
2005	608.628	148.093	756.721
2006	659.087	155.485	814.572
2007	716.735	166.154	882.889
2008	720.230	151.648	871.878
2009	753.268	149.451	902.719
2010	685.857	135.297	821.154
2011	659.404	120.425	779.829
2012	574.323	91.543	665.866
2013	638.222	72.293	710.515
2014	606.013	85.417	691.430
2015	555.339	83.030	638.369
2016	515.217	72.009	587.226
2017	589.709	74.100	663.809



3.4 Air Transport

3.4.1 Larissa Airport

Larissa State Airport "Thessaly" was built in 1912. It was the commercial airport of Larissa until 1997 when it closed for civilian traffic. Currently the airport is being used only by military aircraft of the Hellenic Air Force,

3.4.2 Volos Airport

Nea Anchialos National Airport with code VOL began its operation in 1993 and is a modern airport that covers the needs of central Greece serving domestic/international and charter flights from/to the biggest cities in Europe. The airport is located 3 km after the exit of Almyros Interchange on Highway E75. Exploitation of Nea Anchialos National Airport belongs to the Civil Aviation Authority and its main features are presented in the Aeronautical Information Publication of Greece (AIP Greece). The airport is connected to the city of Volos by the Magnesia Intercity Bus. Taxis are also available outside the terminal.

The airport serves both domestic and international flights. Figures 5 and 6 present the passengers traffic for the period 1999-2010[6]. It is clear that for the domestic traffic there is a progressive increase of the number of passengers using the Volos airport. However, for the international passengers' traffic the best year in terms of total numbers was 2002. After, that year the numbers were decreasing since 2007 and afterwards there was an explosion of traffic demand with 2010 being up to that point the best year for the Volos' airport.

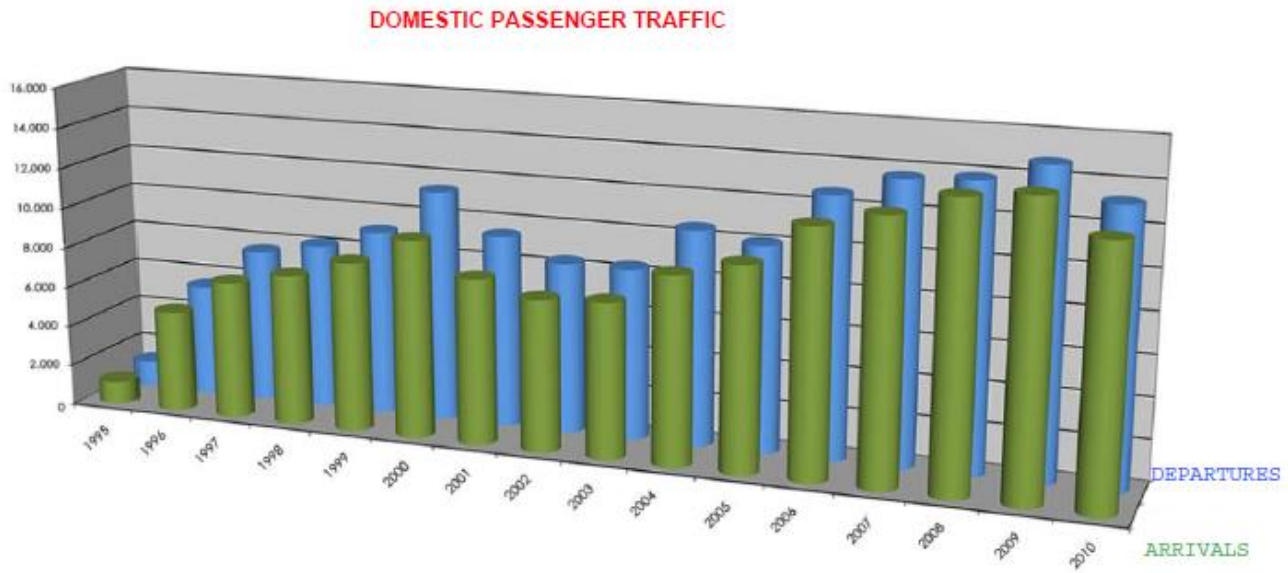


Figure 5. Domestic passengers' traffic served by the Volos airport for the period 1999-2010 (Volos Airport Official Site – Statistics)

[6] Volos Airport Official Site – Statistics

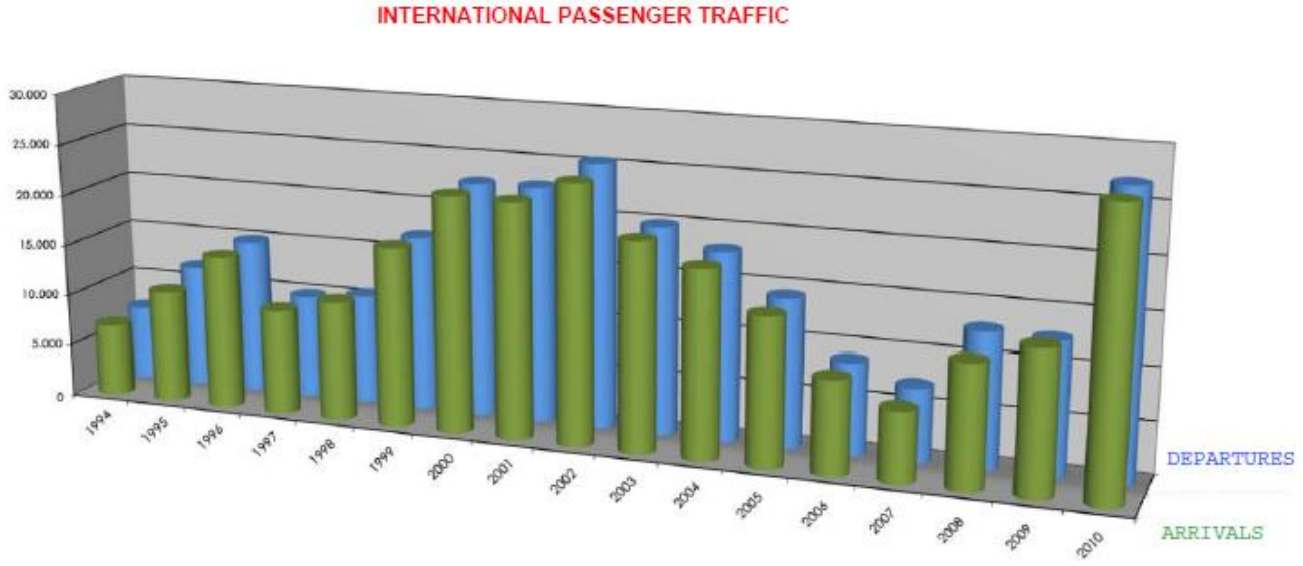


Figure 6. International passengers' traffic served by the Volos airport for the period 1999-2010

3.4.3 Skiathos Airport

Skiathos airport (JSI) "Alexandros Papadiamantis" is located at the island of Skiathos. Because of the uneven terrain on the island of Skiathos, Skiathos Airport was created by reclaiming land from the sea between Skiathos island and the smaller island of Lazareta (a former leper colony) effectively joining the two islands into one larger island. The airport's short runway and its proximity to an adjacent public road have made it a popular destination for hydroplanes (seaplanes).

A passenger terminal and a new control tower was constructed in the late 1980s. The new and the current passenger terminal, which opened in 2002, to better, accommodate the growing number of passengers. Skiathos Airport has no jet ways, meaning that you have to walk the short distance from the aircraft to the terminal building. From 2014, there was extension to the runway and a new taxiway was introduced. Skiathos Airport is located 4.5 km from the city of Skiathos and is accessible from either Skiathos ring road or the coast road. The journey to and from the city centre takes about 10-15 minutes, depending on traffic. 24/7 metered taxi service is available outside the Skiathos Airport Terminal building.

Table 7 presents the passengers' traffic (both domestic and international) for the years 2016 and 2017 as hosted at the airport's official site[7]. It is clear that the airport's peak months are during summer

[7] Skiathos airport official site

time and specifically from May to September, as it was expected because the island of Skiathos is a famous touristic destination.

Table 7. Skiathos' airport domestic and international passengers' traffic for the years 2016 and 2017

Passengers	Domestic		International		Total	
Month	2017	2016	2017	2016	2017	2016
JANUARY	623	426	0	8	623	434
FEBRUARY	811	590	0	0	811	590
MARCH	1.358	692	0	0	1.358	692
APRIL	1.724	1.381	0	182	1.724	1.563
MAY	2.928	2.698	32.106	29.817	35.034	32.515
JUNE	6.262	5.929	70.265	60.731	76.527	66.660
JULY	9.981	10.553	94.868	91.683	104.849	102.236
AUGUST	9.624	11.606	102.644	101.397	112.268	113.003
SEPTEMBER	6.127	7.347	73.925	71.028	80.052	78.375
OCTOBER	2.200	1.592	6.558	5.172	8.758	6.764
NOVEMBER	1.036	626	0	0	1.036	626
DECEMBER	1.066	769	0	0	1.066	769
TOTAL JSI	43.740	44.209	380.366	360.018	424.106	404.227

3.5 Identified stakeholders

The identified stakeholders for the needs of the OPRTITRANS project in the Region of Thessaly are the following:

- Region of Thessaly
- Local Authorities
- Road Public Transport operators in urban areas
- Road Public Transport operators in rural areas
- Railway operator
- Ports' Authorities
- Representatives of TAXI syndicates

- Airports' Authorities
- Universities and Research Institutions

3.6 Public Transport in Rural and Sub-Urban Areas

There are two transport means providing rural transport services to the passengers at the hinterland of the Region of Thessaly. These are **a)** railway and **b)** public buses.

Railway in Greece since the start of the financial crisis (government – debt crisis) in 2010 has been in a transitional phase. At the beginning in an effort by the government to reduce the operational, as well as the overall cost, railway has faced several and important changes. Several trips had been suspended and a significant part of the infrastructure has not been used for passenger transportation services. The public company TRAINOSE SA, which was founded on 19 December, 2005, was at the time of its formation a 100% subsidiary of OSE SA Since January 1st, 2007, following the completion of the branch separation process and its transfer by the parent company OSE SA, TRAINOSE SA has taken over the operation and utilization of all transport (passenger, freight, etc.). Since then, it has been operating as a fully independent company with separate administration and organization, in accordance with the requirements of Community law. In December 2008, OSE SA transferred all the shares it held in the share capital of TRAINOSE SA to the Greek State, which as of 31 December, 2008 held the total shares (100%) of the company. On 18 January 2017, the contract for the sale of 100% of TRAINOSE SA to Ferrovie dello Stato Italiane Group (FSI) was signed by the CEO of HRADF and the CEO of FSI. On 14 September 2017, the sale and transfer of 100% of the shares of TRAINOSE SA to FSI were completed and it joined the Italian group. TRAINOSE SA is the main provider (until now the only one) of rail transport for passengers and freight. The Company provides rail services using the network and the railway infrastructure in general owned by OSE (paying the corresponding network access charges). TRAINOSE SA performs 342 routes (passenger and commercial trains) a day. In 2016, a total of 15.6 million passengers were transported, of which 10.1 million used the suburban lines and 5.5 million the national network. A total of 1.1 million tonnes of goods were also transferred[8].

The new operator has launched a strategic plan for the development of railway in Greece, emphasizing in upgrading the infrastructure so that the modernisation of the Greek railway main corridor Patra-Athens-Thessaloniki-Idomeni/ Promahonas (PATHEP) will allow it to be linked to the main Trans-European Corridors. For this to be achieved is required amongst others, a modern signaling and automatic

[8] TRAINOSE SA official site

train protection system. However, the train protection system installed in Greece is of ETCS Level 1 type and requires the prior existence of signaling along the line.

The other choice passengers have in order to be transported in the hinterland of Region of Thessaly are public buses. According to the Greek legislation, intercity transportation services within the country are offered and provided by public buses run by KTEL SA or KTEL of individual operators in isolated islands where KTEL is not present (law 2963/2001)[9]. KTEL (Common Bus Receipts Funds) are specific character transport companies that serve all public regular road transports of our country (except for the urban transports of Athens, Thessaloniki and part of Rhodes). It should be noted that KTEL or KTEL SA provide:

- Intra-region intercity bus services in the regional unit where they are based.
- Public transport from each regional unit capital to Athens and Thessaloniki.
- Other, inter-regional intercity service.

At the Region of Thessaly, the KTEL SA operating and offering transport services are the following:

- KTEL Larisa, which is based at the city of Larisa and with a fleet of 118 public buses provides intra-regional transportation services inside the borders of the regional unit of Larisa (former prefecture of Larisa) and inter-regional transportation services from the city of Larisa to Athens, Thessaloniki, Trikala, Karditsa, Volos, Katerini and Ioannina[10].
- KTEL Magnesia, which is based at the city of Volos. The company provides both intra-regional and inter-regional transportation services. Specifically, there are routes from the city of Volos to Athens, Patras, Agrinio, Lamia, Trikala, Larisa, Ioannina, Kozani and Thessaloniki[11].
- KTEL KARDITSA SA, which is based at the city of Karditsa. The company provides both intra-regional and inter-regional transportation services depending the period (winter, summer). Specifically, there are routes from the city of Karditsa to Athens, Thessaloniki, Patras, Larisa, Volos, Trikala, Ioannina, Aidipsos, Lamia during summer time and during winter are the same except route to Lamia which is replaced by a route to Grevena[12].
- KTEL TRIKALA SA, which is based at the city of Trikala. The company using a modern fleet of 108 buses connects Trikala and Kalampaka-Meteora with every region in Greece and specifically

[9] Ministry of Infrastructure, Transport and Networks, Hellenic Republic, 2018
[10] KTEL LARISA, 2018
[11] KTEL MAGNESIA, 2018
[12] KTEL KARDITSA SA, 2018

to and from Athens, Thessalonica, Patras, Ioannina, Corfu and Volos[13]. The last years the company is focus to improve its services in the level of human transport and at the same time in developing new activities. The total investment plan of construction a new complex that include bus station, a modern hotel, stores with various commercial - entertaining activities, parking has already been completed.

However, it must be noted that according to law 2963/2001 there are several articles defining the provided services by KTEL or KTEL SA which create misunderstandings. Specifically in Article 9 are noted the following[14]:

- In Paragraph 1 is noted that regarding intra-regional routes as well as inter-regional routes connecting the capital of regional units (form prefectures) or municipalities or municipal communities between neighboring regional units, the transportation services concern common routes. Along these routes, passengers can embark/ disembark to/ from the public bus of KTEL "A" (based in another regional unit) from/ to any bus station/ stop only if there is no urban public transport serving the specific trips of these passengers; or if there is a bus route of the regional KTEL with a time gap of two (2) hours before and after the bus of KTEL "A" passes through.
- In Paragraph 2 is noted that the inter-regional routes connecting capital cities or other cities with Athens, Thessaloniki and other regional unit's capital cities or cities, concern "fast" and "superfast" routes.
- In Paragraph 3.a is noted that those routes of Paragraph 2, embarking of passengers inside the territory of a regional unit in which KTEL is based and their disembarking at the capital cities or other major cities of regional units located along these routes. Furthermore, passengers are allowed to embark to buses serving these routes of Paragraph 2, from bus stations located at capital cities of major cities of regional units located along these routes and they can disembark at bus stations inside the territory of the route destination's regional unit or other intermediate bus stations located at capital cities or major cities only if these passengers cannot be served by public buses of KTEL based at the intermediate regional unit with a time gap of two (2) hours before and after the buses serving these "fast" or "superfast" routes pass through.
- In Paragraph 3.b is noted that while a KTEL's public bus returns to its basis through a "fast" route, the ability of embarking passengers along this route is limited inside the boundaries of the regional unit's destination. Furthermore, along this route, passengers can disembark only at stations

[13] KTEL TRIKALA SA, 2018
[14] Law 2963/ 2001 (A268), Hellenic Republic, FEK 268, 23/11/2001

located inside the boundaries of the regional unit that the KTEL's bus has its base. Also, passengers can embark at stations located at capital cities or major cities or intermediate regional units of which the bus pass through and at the same time passengers can disembark either at stations inside the boundaries of the regional unit in which KTEL' s bus has its base, or at bus stations/ stops at capital cities or major cities located at intermediate regional units, if there is a bus route of the regional KTEL with a time gap of two (2) hours before and after the bus of the above mentioned KTEL passes through.

- Finally, in Paragraph 4 is noted that concerning "superfast" routes, passengers are allowed to embark and disembark only at the origin and destination points/ stations of this route.

Based on the above, it is rather clear that the current legislation is confusing for the passengers and especially for those located at rural and suburban areas. As a result, many passengers select to move, usually by car, to the nearest bus station in order to travel.

3.6.1 KTEL Larisa SA

KTEL of Larisa is based at the city of Larisa. It operates as an Anonymous Transport, Tourist & Trade Company under the distinctive title YPERASTIKO KTEL Larisa SA. There are 20 bus lines serving the needs of the passengers inside the borders of the Regional Unit of Larisa and also there are 14 bus lines connecting the Regional Unit and specifically the city of Larisa with other destinations (Thessaloniki, Athens, Karditsa, Trikala, Volos, Katerini and Ioannina).

There are 118 buses in total serving approximately 1mo passengers per year. The total number of routes per year are approximately 135,000.

3.6.2 KTEL Magnesia SA

KTEL of Magnesia is based at the city of Volos and was established under its current form in October 1st 2003 (National Law 2963/2001). It operates as an Anonymous Transport, Tourist & Trade Company under the distinctive title YPERASTIKO KTEL Magnisias SA. There are 18 bus lines serving the needs of the passengers inside the borders of the Regional Unit of Magnesia and also there are 9 bus lines connecting the Regional Unit and specifically the city of Volos with other capital cities of Greece (Thessaloniki, Larissa, Athens, Karditsa – Trikala, Patra, Ioannina, Kozani, Agrinio and Lamia).

There are 82 buses in total (8 of them are owned by KTEL Magnesia SA and the rest are private owned). Table 8 presents the number of passengers used KTEL Magnesia SA from and to the cities of Athens and Thessaloniki and Table 9 presents the number of passengers used KTEL Magnesia SA from and to Larissa, Trikala and intraregional (Regional Unit of Magnesia) for the years 2016 and 2017.

Table 8. Number of passengers served by KTEL Magnesia SA for the years 2016 and 2017 from and to the cities of Athens and Thessaloniki (Source: KTEL Magnesia SA)

	Volos - Athens	Athens - Volos	Volos - Thessaloniki	Thessaloniki - Volos
January	9.096	8.100	6.073	5.458
February	9.705	9.215	6.849	6.679
March	10.253	9.751	7.276	7.155
April	11.750	11.583	8.478	8.505
May	9.523	9.066	7.908	7.736
June	10.552	10.178	7.787	7.757
July	12.182	12.694	8.484	8.352
August	12.944	12.637	8.588	7.759
September	11.464	10.367	9.125	8.270
October	11.209	10.670	9.261	8.661
November	10.362	9.863	8.098	7.908
December	12.465	12.270	8.386	8.409
2017 in total	***131.505***	***126.394***	***96.313***	***92.649***
2016 in total	***128.554***	***123.002***	***90.292***	***86.130***

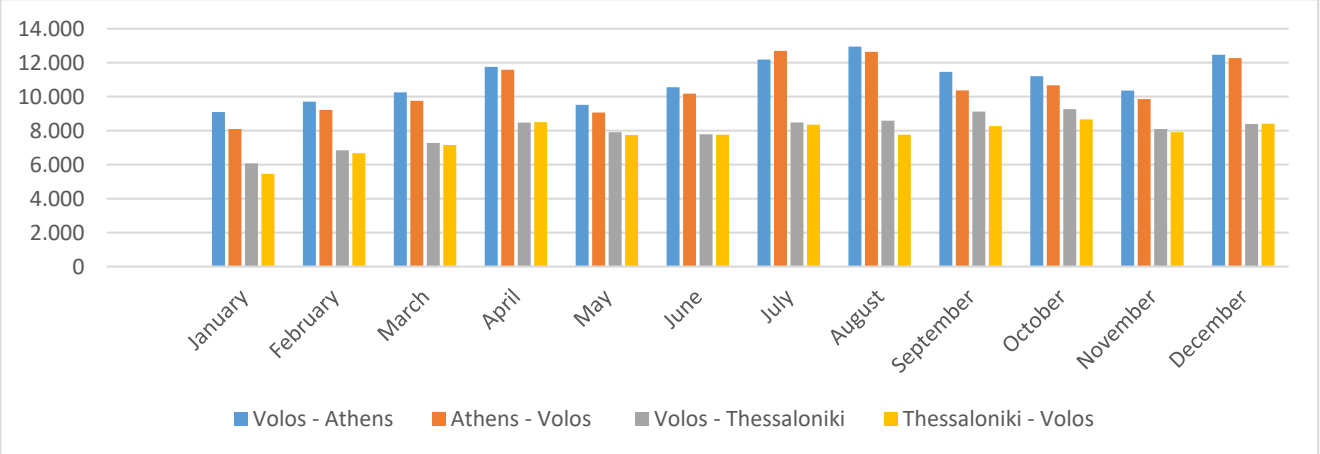
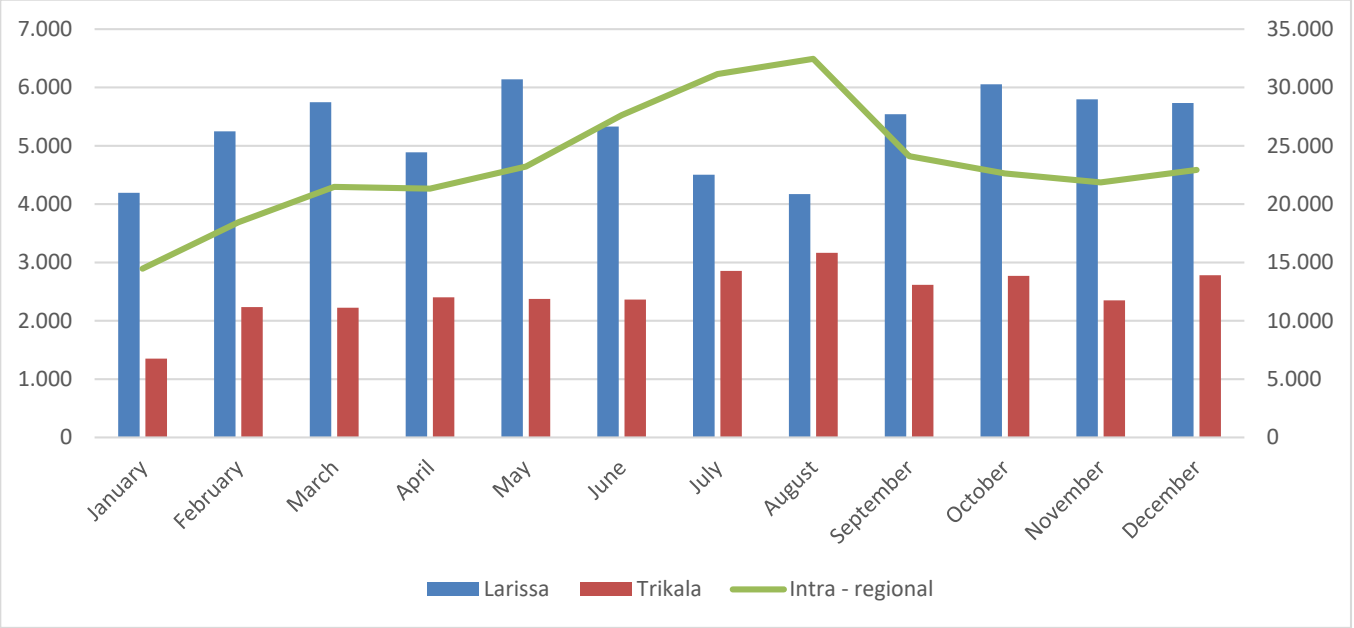


Table 9. Number of passengers served by KTEL Magnesia SA for the years 2016 and 2017 from and to the cities of Larissa, Trikala as well as intra-regional (Regional Unit of Magnesia) (Source: KTEL Magnesia SA)

	Larissa	Trikala	Intra - regional
January	4.195	1.351	14.467
February	5.247	2.235	18.449
March	5.747	2.223	21.483
April	4.888	2.401	21.321
May	6.140	2.374	23.216
June	5.329	2.363	27.619

July	4.505	2.855	31.150
August	4.173	3.165	32.448
September	5.542	2.616	24.110
October	6.053	2.769	22.628
November	5.797	2.351	21.864
December	5.732	2.780	22.932
2017 in total	***63.348***	***29.483***	***281.687***
2016 in total	***69.363***	***29.935***	***293.368***



3.6.3 KTEL Trikala SA

In 1952 according to the Law concerning Transport, the bus owners formed local organizations and they created the first form of organized transport in every prefecture, the so called KTEL. The KTEL of Trikala was created with the participation of 67 owners, who until that time had been conducting separate transports. The various agencies united, started working as one. In 1959 the Bus Station was built in the city center and after adding buses that reached isolated areas the bus fleet included 103 buses. In 2003 the KTEL of Trikala was made a public limited company under the name KTEL of Trikala Public Limited Transport, Touristic and Commercial Company. Today, the central station of the KTEL of Trikala SA is a modern complex in the ring road Larissa-Karditsa in Rizario. The station is a part of a 600 square meters' complex, owned by KTEL of Trikala SA, which also includes a shopping centre, a hotel and conference center and a parking space. The central station coordinates the route to every destination, both for arrivals and departures. The personnel help the travelling public by providing information and issuing and buying tickets.

Booking and issuing of tickets are totally computerized. Travelers can be informed through KTEL's telephone exchange and information leaflets that are issued very often. Moreover one can browse KTEL's website www.ktel-trikala.gr for information and online tickets. Communication is also available via e-mail to the following address: info@ktel-trikala.gr . KTEL of Trikala SA has also agencies in the city center as well as in other cities of Trikala's prefecture for the better service of its clients.

The main goals of KTEL of Trikala SA are the improvement of its services, its modernization and the development of new activities. It is developing through a bunch of marketing and communication activities aiming at differentiation, the managing of the existing dynamic (4.200 people daily) as well as the developing of a new increasing interest. Moreover, it is located in a constant developing part of Central Greece, West Thessaly, where indexes (especially in tourism- Meteora, mountainous region) are always positive, since they attract not only Greek but also thousands of foreign tourists. In 2017, 1.2m passengers used the services of KTEL Trikala SA (almost 70% concerned intraregional transport (Regional Unit of Trikala) and 30% interregional). There are 30 bus lines covering the needs of intraregional transport and 8 lines concerning interregional. The fleet of KTEL Trikala SA is consisted by 103 buses of which the average age is 10 years.

3.6.4 KTEL Karditsa SA

Karditsa KTEL SA, with a history of more than fifty years in the sector of passenger transportation, has always been trying to improve its services by regularly renewing the fleet of buses, by building a modern passenger station, while at the same time it has carried out large social work, having greatly contributed to the local economic and social development.

Karditsa KTEL operated for the first time in 1950, in order to meet the needs of passengers, with small buses of twelve and fourteen seats. In 1952 the 16th Karditsa KTEL was re-established, having its registered office at Kolokotroni str and offices in Mouzaki, Palamas, Sofades, as well as in Larisa and Trikala, and remained with this form until the end of 1967. In 1968 the 15 intercity Continental Greece and Crete KTEL were merged in eight KTEYL (Intercity Bus KTEL). The 4th KTEYL was established in Thessaly, with its seat in Larisa, and Karditsa KTEL was merged with the KTEL of Larisa, Trikala, Magnisia and Pieria. This merger lasted for five years as the operation of KTEYL institution presented serious problems, forcing the relevant services of the Ministry of Transports to proceed with preparing a new plan.

In 1973, by virtue of the Legislative Decree 102, Karditsa KTEL was re-established, with the operating scheme that we see until 2003. In November 1994, the state-of-the-art KTEL station at Dimokratias Ave. was inaugurated. This facility remains the central office of KTEL until this day. In

September 2003, KTEL became a Societe Anonyme (SA Company) by the implementation of Law the 2963/2001. In April 2017 KTEL opened a ticket office in town (ticket counter and passenger information office). Tickets are issued for all routes.

Those routes are distinguished as: **a)** Intercity Summer, **b)** Intercity Winter, **c)** Local Winter and **d)** Local Summer (see Table 10). It must be defined that as intercity routes are meant those routes connecting the Regional Unit of Karditsa with capital cities of other regional units and as local those routes connecting areas inside the borders of the Regional Unit of Karditsa.

Table 10. Intercity routes served by Karditsa KTEL SA per time period (Source: Karditsa kTEL SA Official Site)

Intercity Summer	Intercity WInter
Karditsa - Athens	Karditsa - Athens
Mouzaki – Karditsa – Athens	Mouzaki – Karditsa – Athens
Karditsa – Thessaloniki	Karditsa – Thessaloniki
Karditsa – Patra	Karditsa – Patra
Karditsa – Palama – Larissa	Karditsa – Palama – Larissa
Karditsa – Volos	Karditsa – Volos
Karditsa – Trikala	Karditsa – Trikala – Winter routes
Karditsa – Ioannina	Karditsa – Ioannina
Karditsa – Aidipsos	Karditsa – Aidipsos
Karditsa - Lamia	Karditsa – Lamia
	Karditsa - Grevena

The total number of passengers served during 2017 was 459,959, of whom 132,473 (28.8%) used the local routes and the rest 327,486 (71.2%) used the intercity routes. The fleet is consisted by 85 buses of which a specific number each year is replaced. Each day, there are 122 bus trips covering the needs of the passengers concerning the local routes and 78 trips for the intercity routes.

3.7 Public Transport in Urban Areas

3.7.1 Larissa[15]

LARISSA URBAN KTEL has been walking parallel to the city of Larissa for the last 50 years, contributing essentially to the development, progress and prosperity of this city. The first buses circulated in 1939 for a short time, they were two (2) in number equipped with 19 seats. The war soon ended their

[15] LARISSA URBAN KTEL Official website

circulation and they reappeared at the end of 1948 and beginning of 1949 by individual owners who, by virtue of a police permit, were executing itineraries with 14 buses of 32 seats by choosing the lines that were considered to be more efficient. In 1952, under the Law 2119, the KTEL Companies were founded and the first effort to organize the passenger transportation was made, which was completed by the Legislative Decree 102/1973 and recently by the Law 2963/01.

In 2004 LARISSA URBAN KTEL S.A. being socially responsible, proceeded to the full fleet renovation by introducing new buses of latest model with air-conditioning and low floor, fitted with entrance ramp designed to be used by people with disabilities (AMEA), sparing no pain, time and expense and raising the bar higher for the benefit of the passengers.

LARISSA URBAN KTEL continuing the effort to update the business by making use of new technologies, aiming always at the more qualitative and efficient passenger service, is under the process of a project completion with title “Integrated Telematics System for Passenger Dynamic Information and City Bus Automatic Ticket Issuance of LARISSA URBAN KTEL S.A.” The project includes the implementation of a fleet tracking system of URBAN KTEL with the possibility of passenger information through Telematics Intelligent Stops about the expected time of arrival of buses as well as a website with the possibility of travel planning by using means of urban transportation and a SMS service that offers bus arrival time estimation are also available. LARISSA URBAN KTEL is equipped with fifty-three (53) buses, which are the following:

- 8 Articulated buses
- 4 Minibuses
- 4 Midibuses
- 37 regular buses that are 12m long
- 35 buses of this fleet are accessible to people with disabilities (AMEA).

3.7.2 Volos[16]

The first urban buses were presented in the city of Volos in the 30’s. In 1952, under the Law 2119, the KTEL Companies were founded and the first effort to organize the passenger transportation was made, which was completed by the Legislative Decree 102/1973 and recently by the Law 2963/01. In 1952 there were twenty-nine (29) urban buses and gradually they were increased to forty-four (44) and

[16] VOLOS URBAN KTEL Official site

lately to fifty-one (51), including two (2) minibuses (it is recently decided that three (3) more minibuses will be acquired).

Nowdays, VOLOS URBAN KTEL serves twelve (12) bus lines with its new bus fleet, covering the entire Metropolitan area of Volos as well as New Ionia, as presented in Figure 7.

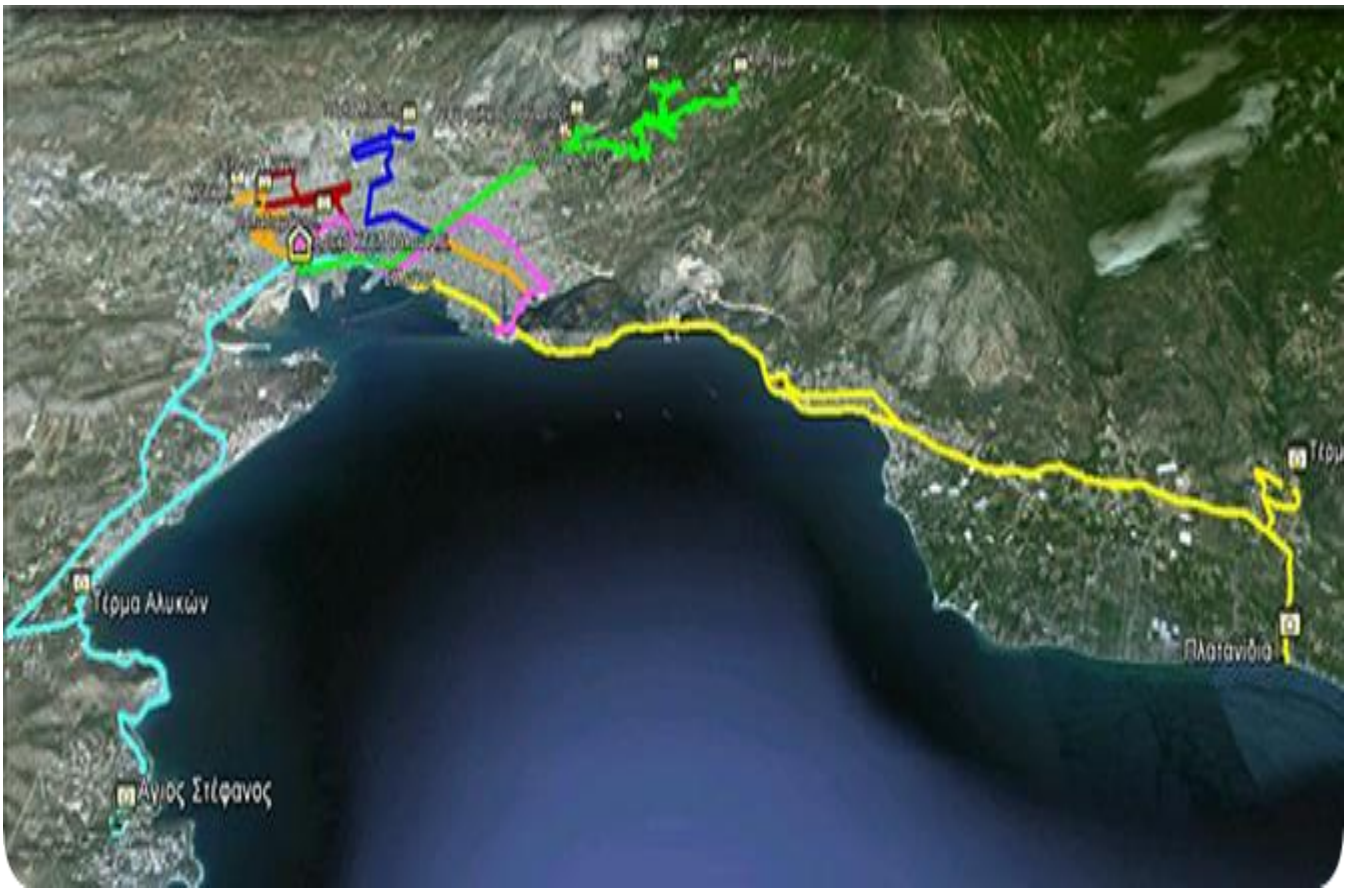


Figure 7. All bus lines served by VOLOS URBAN KTEL (Source: https://astikovolou.gr/index.php?option=com_content&view=article&id=23&Itemid=182)

3.7.3 Trikala[17]

TRIKALA URBAN KTEL is based in the city of Trikala and was established in 1957. Now days, the company serves nineteen (20) bus lines including a special bus line serving passengers exclusively to and from the TRIKALA KTEL SA station.

[17] TRIKALA URBAN KTEL Official website

3.7.4 Karditsa[18]

KARDITSA URAN KTEL serves four (4) bus lines with a fleet of eleven (11) buses including one (1) minibus, providing to passengers high-level services.

3.8 Implementation of ICT solutions and tools at road public transport

In the framework of the project and in order to increase the level of knowledge regarding the implementation of ICT solutions and tools at the road public transport sector (if implemented, which solutions and tools and by whom), it was decided to perform a questionnaire based survey, addressed to the public transport operators (city and intercity buses). Therefore, a questionnaire was developed which was divided into two parts: a) information regarding the ways the passengers are informed and served and b) ITS solutions and tools concerning the drivers and the vehicle (bus).

The questionnaire as mentioned on the above was addressed to the road public transport operators and due to the different nature of the provided services, two types were developed (city and intercity public transport operators). The feedback provided through this survey is presented in Tables 11 & 12.

Table 11. Feedback provided through the questionnaire based survey addressed to urban road public transport operators

Urban KTEL			Magnesia	Karditsa	Larissa	Trikala
1	Passengers informed by/ through	Telephone	√	√	√	√
		Internet/ Official website	√	√	√	√
		Green Your Move	√			
2	E-ticketing	Yes	√		√	
		No		√		√
		Comments	*It will be applied in the next 12 months*			*Estimated to be applied before 2020*
3	Informing passengers concerning buses' position in real time	Yes			√	`

[18] KARDISTA URBAN KTEL Official website

		No	√	√		√
4	Offers/ Discounts for regular users	Yes	√		√	√
		No		√		
5	GPS on buses	Yes	√		√	√
		No		√		
6	Equipment on buses recording driving behavior	Yes	√			√
		No		√		
7	Panic/ emergency button	Yes	√			
		No		√	√	√
8	Equipment for automatic entrance to special areas	Yes				
		No	√	√	√	√
9	Wi Fi onboard	Yes	√		n.a.	
		No		√		√
		Comments	*30MB/ user*			
10	Charging docks onboard	Yes				
		No	√	√	√	√

Table 12. Feedback provided through the questionnaire based survey addressed to interurban road public transport operators

Interurban KTEL			Magnesia	Karditsa	Larissa	Trikala
1	Booking via phone	Yes	√	√	√	√
		No				
2	Booking via internet	Yes	√	√	√	√
		No				
3	Passenger able to choose specific seat	Yes	√	√	√	√
		No				
4	Passengers informed regarding timetables and routes by/ through	Telephone	√	√	√	√
		Internet/ Official website	√	√	√	√
		Other	√	√ (Flyers)		√
5	E-ticketing	Yes	√	√	√	√
		No				

6	Informing passengers concerning buses' position in real time	Yes		√		
		No	√		√	√
7	Passengers embarking on route pay their ticket using	Cash	√	√	√	√
		Credit/ Debit card				
		E-ticket/ QR code	√	√	√	√
8	Offers/ Discounts for regular users	Yes	√	√	√	√
		No				
9	GPS on buses	Yes	√	√	√	√
		No				
10	Equipment on buses recording driving behavior	Yes				
		No	√	√	√	√
11	E-Pass (Tolls)	Yes	√	√	√	√
		No				
12	Panic/ emergency button	Yes				
		No	√	√	√	√
13	Equipment for automatic entrance to special areas	Yes	√	√		
		No			√	√
14	Wi Fi onboard	Yes	√	√	√	√
		No				
		Comments	*Speed and MB restrictions on half the buses*	*Speed and MB restrictions on half the buses*	*None*	*50MB/ user*
15	Charging docks onboard	Yes				
		No	√	√	√	√
16	Infotainment on board	Yes				
		No	√	√	√	√

The analysis of the provided data, regarding urban (city) road public transport, reveals that although the operators (City KTELs of Larissa, Magnesia, Trikala and Karditsa) have implemented both ICT and ITS solutions and tools, the level of implementation both in terms of quantity and quality.

All operators are able to inform the passengers regarding timetables and routes by telephone and via the internet through their official websites. However, the operator of the city of Volos (R.U. of Magnesia) provided this ability to the passengers/ users through the “Green Your Move” website/ tool (the specific

tool is presented thoroughly in Chapter 4.4). Another issue is that only the passengers/ users in Volos and Larissa (R.U. of Larissa) are able to buy and pay their tickets electronically. On the other hand, this ability is not provided to the passengers/ users in Karditsa (R.U. of Karditsa) and Trikala (R.U. of Trikala, although the willingness to apply such service was mentioned before 2020). Another interesting finding is that only the operator in Larissa informs the passengers in real time regarding the position of the buses along the road network, an information quite often important in order the passengers/ users to schedule properly their trips and especially their departure time from their point of origin, although GPS devices are installed at the buses of the operators in Volos, Trikala and of course Larissa. Only the operator of Karditsa has not mentioned such service provided. The level of implementation of equipment of special features (recording the driving behavior, panic/ emergency buttons, etc.) is low, as low is the level of provided services concerning internet access at the buses (only the operator in Volos mentioned such service provided).

Concerning interurban public transport operators, the provided services related to how the passengers/ users are informed and able to book their tickets, several ways are offered (telephone, internet, flyers). Furthermore, the users can be informed in real time about the buses' position by one operator (KTEL S.A. Karditsa) while the rest do not provide such service, although all buses are equipped with GSP devices. Moreover, all operators offer discounts to the users depending their policy. However, the buses are not equipped with devices recording crucial data (driving behavior, eco-friendly driving, etc.) or devices in order to inform for emergency situations (panic button). All operators provide wireless internet connection to the passengers (however different policies are followed) without in any way providing the necessary infrastructure for charging mobile devices (laptops, smartphones, tablets). Finally, no infotainment services are provided to the passengers regardless the type of the route (inter or intra regional routes).

4 Innovative practices implemented at Region of Thessaly

The last years at the Region of Thessaly several innovative practices have been implemented concerning transport. At the city of Larissa, ten digital information boards and ticket vending machines have been installed in the most crowded bus stations. Also, commuters, who have smartphones, are able to find the nearest bus stations and be informed about the arrival time of the buses. Moreover, through the application "Build your route" not only citizens but also visitors can move easily and reliably with the city buses in the city. At the city of Trikala, the ITS include digital information boards, which have been

installed at all bus stations, information boards, which provide information about parking places and spaces, monitoring system of the municipal vehicle fleet and state – of – the art inductive loops for the study of city's traffic data. At the city of Volos, there are digital information boards and ticket vending machines in the bus stations of the city centre. However, the most significant is that citizens and visitors are able to plan their transports from one point of the city to another through the web application "Volos routes" by combining walking and the use city buses. Finally, at the city of Farkadona, one "smart bus stop" has been created, that offers Wi-Fi connection, operates as routes info-point, tablet and smart-phone charger as well as bicycle parking for those that wish to continue their travel via bus (participating to the CIVITAS Project). The most important of these policies as parts of research projects in which Region of Thessaly participated, are presented in the following.

4.1 CityMobil2[19]

CityMobil2 (Cities Demonstrating Automated Road Passenger Transport) was a research project co-funded by the European Commission. The project, comprising a consortium of 45 partners from research organisations, universities, industry, SMEs and cities, was funded under the EC's 7th Framework Programme for Research and Development. The project started in September 2012 and finished in August 2016, and was coordinated by the Universities of Rome and Florence. CityMobil2 was the follow-up of the CityMobil project (2006-2011). CityMobil had demonstrated how automating road vehicles could lead to different transport concepts (partly automated car-share schemes, CyberCars, PRT and BRT), which could make urban mobility more sustainable. However, CityMobil had also highlighted a number of barriers to the deployment of automated road vehicles: the implementation framework and the legal framework. The main purpose of CityMobil2 was to remove the barriers identified by the CityMobil project. Concerning implementation, CityMobil2 aimed at removing the uncertainties hampering the procurement and implementation of automated road transport systems (ARTS). The project brought together 12 cities (or city-type environments), each of which investigated where ARTS could deliver a beneficial transport service. The seven best cases were selected. In parallel, the project procured two sets of automated road vehicle systems and delivered them to the cities for the 3 to 6 month demonstrators in each selected city.

Region of Thessaly was represented by E-TRIKALA SA and thus stakeholders and beneficiaries of the project were the citizens of the Municipality of Trikala. CityMobil2 was setting up a pilot platform for automated road transport systems, which would be implemented in several urban environments across

[19] CityMobil2 Project, Good Practice Template

Europe. Automated transport systems were made up of vehicles operating without a driver in collective mode. They were 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. A dozen local authorities or equivalent sites were in the bidding to be one of the five sites to host a 6-month demonstration. All recognised the potential of vehicle automation as part of their public transport network. Two sets of six vehicles each for the demonstrations were about to be supplied by two of the five manufacturers within the project. The project would procure the vehicles and make them available to the selected pilot sites for the duration of the demonstrations.

In addition to the pilot activities, research was foreseen to be undertaken into the technical, financial, cultural, and behavioural aspects and effects on land use policies and how new systems could fit into existing infrastructure in different cities. The legal issues surrounding automated transport were also addressed, leading to a proposed framework for certifying automated transport systems.

The main project achievements, besides having the vehicles operational and the passengers transported, were to have defined the “safe way” to integrate automated transport in urban streets; not relying on the vehicle technology only but relying on a continuous cooperation with the infrastructure. Through the implementation of the project, the following results were achieved:

- An automated road transport service running for at least six months at five sites across Europe;
- Guidelines to design and implement an automated transport system;
- Improved understand of the interaction between automated vehicles and other road users;
- A legal framework proposal for certifying automated road transport systems in Europe;
- Showcases at numerous sites across Europe;
- Technical specifications for interoperable automated road transport systems, including a communications architecture.

4.2 MyWay[20]

For many decades, urban planning and transport evolved around the private car, which has resulted in problems such as congestion, noise, pollution, etc. To tackle these adverse impacts and improve the liveability of European cities, citizens can benefit today, next to the private vehicle, public transport and non-motorised modes, from a variety of new sustainable and complementary mobility schemes, including dynamic vehicle sharing, real-time carpooling, demand-responsive transport, Electric

[20] MyWay Project, Good Practice Template

Vehicles (EVs) sharing, etc. The interaction between users and the transport environment prior to and during travel has also greatly improved. More and more, travellers are able to access online dynamic traffic and transport information, use sophisticated journey planning services to organise their trips and get detailed navigation support while on the move.

MyWay project investigated, developed and validated an integrated platform, the European Smart Mobility Resource Manager, including cloud-based services and facilities to support community supplied information collection and processing. Region of Thessaly was represented by E-TRIKALA SA and thus stakeholders and beneficiaries of the project were the citizens of the Municipality of Trikala. The MyWay platform and its services were tested in three European areas providing a variety of urban scenarios and characteristics: a capital city and its surrounding regional transport context, Barcelona and Catalonia Region (ES); a capital city and its metropolitan area, Berlin (DE); a small-size town equipped with initial smart city services, Trikala (GR). Three Living Lab demonstrations are correspondingly set up in the sites, involving local users and various stakeholders. The approach pursued by MyWay prioritised the "egocentric vision" of the user: trying to find the right compromise for each single traveller offering a solution closest to his/her personal needs and preferences, making the frequent use of such personalised mobility solution (as an alternative to an ideal but not always attractive solution) a main contribution to the sustainability of urban transport.

The purpose was 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 (e.g. car sharing, motorbike sharing and carpooling). The platform was tested in three Living Lab demonstrations in Barcelona and Catalonia Region (ES), Berlin (DE), and Trikala (GR) involving local users and stakeholders. This approach gave priority to the egocentric vision of the user, finding the right compromise for each single traveler 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.

The MyWay basic objectives were to:

- Enable a better balance between mobility offers by facilitating the seamless integration of public transport and other sustainable public and private transport modes in users' personal mobility choices.
- Stimulate service cooperation and market development by providing tools and technical solutions

for transport service providers and operators to help improve service offer, interoperability and acessibility in the overall multimodal service chain.

- Enhancing the personalisation and user adaptation of mobility services by increasing the cooperation between users and the transport system through incorporating user experiences, social networking and crowd sourcing in service planning and use.
- Foster ICT transformative technologies in smart mobility by providing and validating in real-life conditions innovative technological solutions for the next generation of smart mobility services.

MyWay was expected to boost the travelers' usage of greener mobility services by enabling the consideration of all available resources, both public and private, and their appropriate allocation to journey plans, thus enhancing the attractiveness, comfort and efficiency of the transport networks and minimizing the GHG emissions as users will be stimulated to switch to more sustainable mobility choices and behavior. Concrete project success indicators for MyWay were:

- At least 5% improvement in mean journey times.
- 10% shift in travel choice from private modes (cars/motorbikes) to collective (public transport) and flexible modes (flexible transport, shared e-scooters, bikes).
- 5% congestion reduction.

4.3 Move On Green[21]

Sustainable transport is vital to maintaining the environmental and economic health of rural areas, as well as to ensuring the access of both inhabitants and potential visitors to key services such as employment, education and healthcare. Rural areas policy-makers have come to realise that the lack of sustainable mobility schemes is a cross-cutting element which affects every development strategy implemented in rural territories; no matter how much effort is expended on areas such as education, promotion of tourism or development of new economic initiatives, the lack of a sustainable (from the environmental, social and economic perspectives) transport pattern has severely hampered every development initiative. MOVE ON GREEN's overall objective was to improve the design and effectiveness of regional policies on sustainable transport in rural areas, through an exchange of experiences aimed at fostering sustainable mobility from the environmental, social and economic points of view. The project was started in January 2012 and ended in December 2014 and stakeholders and beneficiaries were the citizens of the Region of Thessaly.

[21] Move On Green, Good Practice Template

MOVE ON GREEN's overall objective was to improve the conception and efficiency of regional policies regarding sustainable transport in rural areas, through the exchange of experiences aimed at fostering sustainable mobility from the environmental, social and economic perspectives.

The aim of the project was to improve policies on sustainable transport in rural areas, in order to foster mobility patterns which:

- Reduce emissions and waste and minimize the impact on both the environment and local landscapes.
- Allow the basic needs of both individuals and society to be met safely and in a manner consistent with human and ecosystem health.
- Support competitive economy options as well as balanced development in rural areas.
- Are affordable, operate efficiently and offer a number of transport alternatives.

In order to achieve its overall objective, MOVE ON GREEN has established the following sub-objectives:

- To identify, describe, exchange and share those relevant best practices implemented in partner areas.
- To develop policy recommendations for European rural areas, in order to help them ensure both environmental protection and access to basic services for their population through sustainable transport patterns.
- To integrate the results achieved in the project into the regional policies of partner regions.
- To achieve widespread dissemination of MOVE ON GREEN outputs to target groups in partner areas, as well as in the rest of Europe's rural areas (target groups in dissemination activities will be mainly regional and local authorities), in order to increase results.
- To raise awareness at a European level regarding the environmental, economic and social importance of sustainable transport patterns in rural areas.

In the long term, MOVE ON GREEN aimed to:

- Reinforce overall environmental protection in Europe by establishing green transport patterns in rural regions throughout Europe.
- Reinforce cohesion and sustainability in rural areas by promoting mobility-related sustainable development policies.
- Help maintain a critical mass in rural areas, thanks to the existence of efficient and sustainable transport schemes which make it possible for people to live in rural areas with a good quality of

life, having access to places, goods and basic services.

- Encourage a positive attitude in the population and institutions regarding alternative mobility and transport patterns.

The improvement of regional policies and strategies for sustainable transport in the partner regions through the integration of the best practices and policies were learned during the project:

- 12 policy instruments (1/region) were addressed and at least 5 were expected to be improved as a result of MOG.
- New knowledge and skills on the topic were directly acquired by at least 39 members of the staff from partner entities involved in MOG (3 pax/region; 13 regions).
- At least 39 politicians became more sensitive to and capable of designing policies for sustainable transport (at least 3 politicians/institution).
- 3,700 contacts were beneficiaries of the project outputs (3,000 contacts provided by Euromontana, the remaining 700 provided by the other 12 partners).
- A minimum of 5 of the best practices identified were expected to be transferred successfully.

4.4 Green Your Move[22]

GreenYourMove (GYM) was a European Research Project co-funded by LIFE, the EU financial instrument for the environment - LIFE14 ENV/GR/000611. Six partners from Greece (University of Thessaly, AVMap GIS S.A., TRAINOSE S.A. and EMISIA S.A.), Czech Republic (CHAPS spol. s.r.o.) and the Netherlands (Stichting Plannerstack) collaborated under the coordination of the University of Thessaly for the project's deliverables.

The project started in September 2015 and ended in August 2018. GreenYourMove main objective was the development and promotion of a co-modal journey application that minimizes Green House Gas (GHG) emission in Europe (web application and smart phones application). GreenYourMove developed a multi-modal transport planner (both routing & ticketing system) considering all kinds of urban public transportation (urban and sub-urban buses, metro, tram, trolley, and trains), where the user could get alternative routes combining more than one transport modes if necessary. The routes are the environmentally friendliest ones, since emissions are calculated for different scenarios. The platform is of particular scientific interest, as it introduces standard route optimization methods. The mathematical algorithms that were developed focus on the minimization of GHG emissions deriving from the use of

[22] GreenYourMove Project, https://www.greenyourmove.org

public transport means. The platform gives the passengers the opportunity to combine different public means of transport and also to always follow the shortest and environmentally friendliest route.

For the first time in Greece, GreenYourMove mapped the entire public transport network (train, metro, tram, bus, trolley, suburban, KTEL) in the 16 biggest Greek cities (Athens, Thessaloniki, Alexandroupolis, Chalkida, Florina, Ioannina, Katerini, Komotini, Lamia, Larissa, Patras, Serres, Thiva, Trikala, Volos, Xanthi – 3 of them are located in the Region of Thessaly), its itineraries, stops and any other relevant information, as presented in Figure 8. GreenYourMove solved the problem regarding the lack of digital transport data in Greece. All geospatial datasets that were developed for major Greek cities were designed to cover the entire network of mass transportation means, and to be open and comply with the European INSPIRE Directive and the GTFS protocol. The web-based GYM platform is operational (http://www.greenyourmove.eu). Within the consortium's long-term goals was the expansion of GYM platform in neighboring to Greece countries and, further, the development of a pan-European co-modal Journey Planning platform that respects the environment.

Public transport network

Train & Suburban	*Metro*	*Tram*	*Bus*	*Trolley*	*KTEL*
City					
Athens	✓	✓	✓	✓	✓
Thessaloniki			✓		✓
Alexandroupolis			✓		✓
Chalkida			✓		✓
Florina					✓
Ioannina					✓
Katerini			✓		✓
Komotini			✓		✓
Lamia			✓		✓
Larissa			✓		✓
Patras			✓		✓
Serres			✓		✓
Thiva					✓
Trikala			✓		✓
Volos			✓		✓
Xanthi			✓		✓

Railroad network of entire Greece (&)

Figure 8. Public transport network of Greek cities that were included in GreenYourMove platform (Source: https://www.greenyourmove.org/public-transport-network)

5 SWOT Analysis

SWOT analysis is a very useful tool for analyzing and evaluating decision-making processes and strategic planning. In order the existing Public Transport System in the Region of Thessaly to be evaluated, a SWOT Analysis has been performed to identify strengths, weaknesses, opportunities and

threats. In Table 13, the strengths and weaknesses represent existing conditions while opportunities and threats signify possible future conditions.

Table 13. Comparing the trip from Larisa to Volos using available transport modes

	Larissa → Volos		
	Car	**Public Bus (KTEL)**	**Railway**
Distance	60km	60km	60km
Time	51'	60'	48'
Cost	11,81 €	5,90€	5,10 €
	4,00€ = Tolls	*12 itineraries per day Monday - Friday*	*9 itineraries per day*
	*7,81€ = Consumption**	*10 itineraries per day Saturday – Sunday*	
*	Average cost of petrol/ lit at national level retrieved by http://www.fuelprices.gr/files/deltia/IMERISIO_DELTIO_PANELLINIO_20_11_2018.pdf for the 20st of November 2018 = 1,579€/ lit		
Source	viamichelin.com	KTEL LARISSA Official website	TRAINOSE official website & TRAINOSE Network Statement 2019

Based on the scale of Region of Thessaly and the characteristics of the available transport modes, it is decided that SWOT analysis (see Table 14) will be focused on road transport. This is also due to the problems described on the above concerning railway, sea and air transport and furthermore because road transport is the system serving the majority of the region's residents and visitors and at the same time several innovative policies have been implemented at urban level.

Table 14. SWOT analysis for the Road Public Transport System in the Region of Thessaly

Strengths	Weaknesses
• Services provided at both urban and rural areas • Knowledge on implementing innovative policies based on the participation to many research projects • Strong political willingness to transform the current system to a more sustainable and environmentally friendly system • Many successful policies already implemented • Existence of alternative transport modes (railway) • Almost half of the region's residents live at rural or suburban areas • Road transport infrastructure at good level • Reduction of greenhouse emissions is one of the objectives of the "Regional Operational Programme 2014-2020" of the Region of Thessaly	• Current legislation seems confusing mainly for the users of road public transport • Railway being in a transition phase • Low level of cooperation among different transport modes • Scale of area of interest (region of Thessaly) • Low level of ITS systems implemented at railway, sea and air transport • Sea transport concerns the connection between hinterland and the islands of Sporades • Poor connection (regarding public transport means) between the only existing airport (N. Anchialos airport) in the hinterland of the Region of Thessaly and the nearest urban centre (city of Volos) • Passenger car transport represented 82% of the inland passenger-km in Greece for the year 2016 • Very low infiltrating level of electric vehicles in Greece

Opportunities	Threats
• Shift from road to other transport modes • Implementation of ICT tools and applications • E-ticketing for road public transport as a measure to attract passengers and achieve modal shift from passenger cars to road public transport • Electrification of the main railway line (Athens – Thessaloniki) • Several Municipal Authorities aim to restrict the traffic of passenger vehicles using diesel engines	• Economic crisis in Greece • Road public transport operators compete each other to increase their market share

6 Other good practices selected from other OPTITRANS regions

There are several new trends and developments implemented across Europe and especially in the regions participating in the OPTITRANS project, creating unique opportunities for a change in the choice of transport, better integration of different low-carbon transport modes, better ticketing options, use of ICT to react in real-time to fluctuating demands, timetable integration, higher passenger comfort and promoting better image of public transport.

Some of these good practices have been selected as possible to be customized and then adapted in the Region of Thessaly. It must be reminded that the Region of Thessaly is a special case due to the geographical area that it covers and the fact that rural transport is mainly served by road Public Transport. The selected good practices are the following:

- MyCicero, Abruzzo, Italy
- New concept of the Public Transport Network/ Bus, Thuringia, Germany
- Upgrade and extensions of the public transport system in Cluj, Nord-Vest, Romania
- Public transport and electronic ticketing in Tartu, Estonia

6.1 MyCicero[23]

MyCicero is a multi-channel platform - a touch-screen smartphone web - that accompanies the development of the Smart Territory. It is the place for a dynamic and transversal dialogue between the relevant stakeholders, it is the project of integrated and sustainable development of the territorial community.
In details this mobile application allows to:

1. **Find the stops and find out the timetables**: by using the app it is possible to search for stops in both the location in which the passenger is and the specified area if covered by the service. It is also possible to view all incoming or outbound races at the stop and have real-time information on advances and delays (only for enabled carriers).
2. **Search for travel solutions using public transport**: MyCicero calculates the route by compiling rushes of different vectors and provides useful information such as waiting times, changes, map

[23] MyCicero App, OPTITRANS Project

position, pedestrian path, etc.

3. **Buy travel titles**: Directly from the app it is possible to buy tickets for a specific travel solution or select them from "shelf". The purchased ticket may be displayed by entering the app 'My Tickets' section to be shown to the controller. There are two types of titles: a) ***obliterate***: they can be purchased in advance and obliterated while climbing on board by pressing the oblitera button from the ticket screen in question. b) ***automatically cancelled at the time of purchase***: they must be purchased immediately before boarding the vehicle.

The possibility to pay easily from the smartphone was conceived in order to encourage people to use public transport more intensively and that is what has actually happened. In the last years an increase of the use of local public transport has occurred.

6.2 New concept of the Public Transport Network/ Bus[24]

The main stakeholders of this concept are the county administration as the contracting body of the services as well as the bus operators as the service provider at the Saale-Hozland-County in Germany. The Saale-Holzland-County has a very inhomogeneous settlement structure; e.g. 64 of 195 villages have less than 100 inhabitants. Additionally, the number of inhabitants will decrease by 15% until 2030. The commuter flows show a strong orientation on central places. The largest intertwines exist with the cities of Jena and Gera in the neighboring counties.

The Public transport network is a “historic grown” network which is highly forked with an unstructured travel offer and a small number of users. The network is mainly driven by public transport. Main goal was to restructure the network in order to allow that “*Every citizen should have a minimum range of mobility options available by public transport, irrespective of the availability an individual car*.”

Further objectives were: **a)** reduction or at least stabilization of subsidies, **b)** direct connection of all villages to at least one central city secure connections to the regional rail transport (Intermodality) and **c)** enhancement of accessibility increase of timetable clarity and notability. The existing network was divided into a main network, a first and a second order supplementary network. The main network should guarantee an hourly tacked traffic with similar departure - and arrival - times and defined connections and transfer relations to the regional railways. Direct lines with daily services should be implemented with barrier free coaches. On the supplementary network the services will be compressed in a demand oriented

[24] New concept of the Public Transport Network/ Bus, OPTITRANS Project

way.

In Thuringia the difficulty is that road bound public transport is ordered and paid by the counties whereas rail bound public transport is ordered and paid by the federal government. This means there is a high need for coordination between different players to get an integrated schedule. The practice shows that an integrated concept for the restructuring of the public transport network proves feasible and successful even in regions with unfavorable framework conditions for public transport, above all low population density and a shrinking number of inhabitants. Concerted measures led to a significant reduction of public subsidies needed to cover the operational costs, while the level of service improved at the same time. As a result, the number of passenger increased. Experiences made in the County are an encouraging example that a well-planned and demand oriented public transport network is a valid tool to raise the modal share of public transport also in rural and peripheral areas.

6.3 Upgrade and extensions of the public transport system in Cluj[25]

The project is a good practice for the upgrade of public transport by introducing the electronic ticketing system and creating public transport stations equipped with electronic display boards, which has led to an increase in the quality of public service, having a positive impact on the quality of life for the residents of Cluj Napoca and its metropolitan area. The project can be a good practice model for other cities / regions, in terms of increasing the mobility of the inhabitants, based on the introduction of modern taxation and tariff integration systems.

The sustainable development of the public transport system in Cluj Napoca Municipality was realised through:

- Modernization of 87 public transport stations within the municipality and bringing them to international standards (in terms of technical and operational parameters) in order to bring more comfort and safety to its passengers; creating an appealing design for the stations and equipping them with benches, garbage bins and a display panel.
- Ensuring lighting system in 35 of the upgraded stations in order to provide a safe and efficient transport.
- Mounting display panels that provide information on the estimated time of arrival of the public transport in the station (74 panels).

[25] Upgrade and extensions of the public transport system in Cluj, OPTITRANS Project

- 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 61 automatic machines for the issue of non-stop travel passes in areas with an important passenger traffic; The placement of 136 validators in the stations and 327 validators in the means of public transport.

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.

6.4 Public transport and electronic ticketing in Tartu[26]

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.

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 public transport (bus) network in the city of Tartu 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

[26] Public transport and electronic ticketing system in Tartu, Baseline Study, January 2018, OPTITRANS Project

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

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. An alternative to buses is railway connection. 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.

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 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 that commuting with private vehicles.

From September 1st 2015, the City of Tartu started using a modern ticketing system. A contactless plastic chip card or a sticker must be swiped at the validator upon entering the bus. Use of the bus card is compulsory for all passengers except those travelling for free under the provisions of the Public Transportation Act. Students can use their student cards as bus card. Tartu bus cards can also be used in other Estonian cities buses.

7 Conclusions & Prospects

The case of Region of Thessaly is different than the cases above mentioned for many reasons. The scale of the area (over 14,000km^2), the topography and morphology of the area (mountainous areas as well as coastlines and islands), the distribution of the area's population (almost half of the population is located at rural and suburban areas), the density of the population (52/km^2), the mobility pattern in the region, the fact that although road, rail, air and sea transport modes are available, only road transport covers the entire region and the economic crisis in Greece are the main reasons that the Region of Thessaly is such a challenging and difficult case in terms of promoting policies alignment to the objective of the OPTITRANS project.

Based on all the above mentioned, the possible future direction towards sustainable mobility as well as greenhouse gas reduction in reference to passenger transportation could be based on the following:

- Public road and rail transport should be the corner stone on achieving modal shift from private car to other transport modes. For this to achieved, public rural road and rail transport must be performing as complementary transport modes rather than competing each other specifically for the Region of Thessaly. Furthermore, public road and rail transport modes should be linked to each other in terms of integrated ticketing systems and timetables.
- The fact that there are companies providing rural public transport services based and operating at each of the Regional Units leads to a fragmented public road transport system. The current legislation which is rather complicated intensifies this situation.
- A possible solution could be the implementation of e-ticketing for all companies providing public rural transport services. Based on a web tool (platform) developed specifically for the needs of the OPTITRANS project the users could have the ability to identify possible routes for their trips by using a multi-modal transport planner considering all kinds of urban public transportation (urban and sub-urban buses, metro, tram, trolley, and trains), where the user could get alternative routes combining more than one transport modes if necessary. After the users identify and choose their routes, through this web tool the users could have the ability to book their ticket(s) for all transport modes required for their trips from their point of origin to their point of destination inside the territory of the Region of Thessaly (and in some cases for destinations outside the Region of Thessaly, such as those destinations served by public rural road transport). At the end of this process, the users could either print their ticket(s) or save them at their mobile device through an email (as barcodes or QR codes).

Through this web tool the users could easily book their tickets by imitating the basic principles of the “One Stop” policy (even for different transport modes).

8 References

1. Manakos I, Chatzopoulos-Vouzoglanis K, Petrou ZI, Filchev L, Apostolakis A. Globalland30 Mapping Capacity of Land Surface Water in Thessaly, Greece. *Land*. 2015; 4(1):1-18
2. Google maps (2018), (Thessaly) Thessalia, Retrieved from: https://www.google.gr/maps/place/Thessalia/@39.5613529,20.4835755,7z/data=!3m1!4b1!4m5!3m4!1s0x14a7792f814128a5:0x100bd2ce2b9c5e0!8m2!3d39.6102887!4d22.047637
3. Egnatia Odos Observatory, SET06 Factsheet 2015, Retrieved from: https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=2&cad=rja&uact=8&ved=2ahUKEwjsh_bAmszeAhVFLewKHZ6EBnIQFjABegQIABAC&url=http%3A%2F%2Fobservatory.egnatia.gr%2Ffactsheets%2Ffs_2015%2FSET06_factsheet_2015dec.pdf&usg=AOvVaw2q6C1XsT8ubvr-4TVS70OQ
4. Network Statement 2019, Hellenic Railways Organisation SA
5. Volos Port Authority SA (2018), Retrieved from: https://www.port-volos.gr/cgi-bin/pages/index.pl?type=list&arlang=Greek&argenkat=Στατιστικά%20στοιχεία
6. Volos Airport Official Site – Statistics (2018), Retrieved from: http://www.thessalyairport.gr/en/flight-stats.html
7. Skiathos airport official site (2018), Retrieved from: https://www.jsi-airport.gr/el/jsi/air-traffic-statistics
8. TRAINOSE SA Official site, 2018. Retrieved from: http://www.trainose.gr/en/company/company-profile/
9. Ministry of Infrastructure, Transport and Network, Hellenic Republic, 2018. Retrieved from: http://www.yme.gr/index.php?tid=544
10. KTEL Larisa SA, 2018. Retrieved from: http://www.ktellarisas.gr
11. KTEL Magnesia SA, 2018. Retrieved from: http://www.ktelvolou.gr/el/home/
12. KTEL Karditsa SA, 2018. Retrieved from: https://www.ktel-karditsas.gr/en/
13. KTEL Trikala SA, 2018. Retrieved from: http://www.ktel-trikala.gr/?module=default&pages_id=14&lang=en
14. National Law 2963/2001 (A268), Hellenic Republic, Retrieved from: https://www.eett.gr/opencms/export/sites/default/admin/downloads/telec/elliniki_nomothesia/nomoi/N2963.pdf
15. LARISSA URBAN KTEL Official website, Retrieved from: http://ktelast-larisas.gr/indexeg.php
16. VOLOS URBAN KTEL Official website, Retrieved from: https://astikovolou.gr
17. TRIKALA URBAN KTEL Official website, Retrieved from: http://asttrik.gr

18. KARDITSA URABN KTEL Official website, Retrieved from: https://www.astikoktelkarditsas.gr
19. CityMobil2 Project, Retrieved from: https://cordis.europa.eu/project/rcn/105617/reporting/en
20. MyWay Project, Retrieved from: http://myway-project.eu/www.myway-project.eu/index.php/publications/deliverables/index.html
21. GreenYourMove Project, Retrieved from: http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=home.showFile&rep=file&fil=GYM_Press_Release_EN_.pdf
22. GreenYourMove Project, Retrieved from: https://www.greenyourmove.org
23. OPTITRANS Project, MyCicero App, Retrieved from: https://www.interregeurope.eu/policylearning/good-practices/item/109/mycicero/
24. OPTITRANS Project, New concept of the Public Transport Network/ Bus, Retrieved from: https://www.interregeurope.eu/policylearning/good-practices/item/130/new-concept-of-the-public-transport-network-bus/
25. Upgrade and extensions of the public transport system in Cluj, OPTITRANS Project
26. Public transport and electronic ticketing system in Tartu, Baseline Study, January 2018, OPTITRANS Project