CITY OF THESSALONIKI

2050CliMobCity – 2050 Climate friendly Mobility in Cities

Interregional Learning Report

2050 CliMobCity
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Contents

Abbreviations

Municipality of Thessaloniki (MoT)
Thessaloniki Regional Unit (TRU)
Region of Central Macedonia (RCM)
Sustainable Urban Mobility Plan (SUMP)

1. Thessaloniki overview

Municipality of Thessaloniki (MoT) consists of two former Municipalities, those of Thessaloniki and Triandria, which are now Municipal Units. It belongs to the Thessaloniki Regional Unit (TRU) of the Region of Central Macedonia (RCM) and is the largest municipality, gathering over 29% of the population of the TRU and over 17% of the population of RCM. It covers an area of 19,292 square kilometers and a population of 325.182 inhabitants (results of the 2011 census). It mainly includes the historic center of the city and the neighboring areas, as well as the neighborhoods that extend to the east side of the city. Inside the boundaries of MoT the most important sights and monuments of Thessaloniki are located.

The MoT gathers most of the economic, administrative and cultural activities of the TRU and it is considered as the leader in the field of the further regional, environmental, economic, and cultural development of the whole Region.

Figure 1: Municipality of Thessaloniki and the rest Municipalities of the Urban Area

The Municipality of Thessaloniki consists of six (6) Municipal Units:

- **Municipal Unit A**: Includes the historic center and the area of Areos Field (AUTh & Thessaloniki International Fair - TIF)
- **Municipal Unit B**: Includes the area beyond the Byzantine northwestern walls and the area of Dodeka Apostoloi
- **Municipal Unit C**: It includes the areas of Ano Poli and Eptapyrgio (Byzantine Acropolis)
- **Municipal Unit D**: It includes the area of Toumpa
- **Municipal Unit E**: Includes the densely populated areas of Faliro, Charilaou, Analipsi, Depo, Ippokratio, Salamina, Kifissia, Byzantium, Trohiodromikon, Nea Elvetia, Allatini, Uziel Settlement
- **Municipal Unit of Unit (F)**: It includes the district of Triandria. Until 1982 Triandria was a local community, in 1983 it was recognized as a Municipality and in 2011 it was integrated into the Municipality of Thessaloniki.

Figure 2: Municipal Units of Thessaloniki

2. Policy backgrounds to the current situation

The purpose of this chapter is to collect, evaluate, and utilize all relevant studies and institutional texts at European, national, regional and local level concerning the study area. More specifically, the data collection aims to record existing and future data of the study area, in order to identify any weaknesses / obstacles and opportunities that should be initially taken into account for the preparation and implementation of the project's action plan. The evaluation of the above allows the identification of opportunities and problems of the intervention area, as well as the understanding of the existing plan of the future development of the city.

The following Table 1 summarizes the content of each study / text at regional and local level, that is being examined and at the same time identifies the most important strategic and political principles that are adopted by the Municipal Services.

Table 1: Priorities and aims according to Regional and Local Policies

Regional and Local Policies	Qualitative and quantitative objectives-priorities and proposed Actions
Operational Programme of the Region of Central Macedonia (RCM) 2014 – 2020 (regional)	**Qualitative objective: Supporting the transition to a low carbon economy in all sectors** The RCM sets as priority (among others) the promotion of integrated interventions for urban mobility with the ultimate goal of reducing CO_2 emissions and other pollutants such as PM10, SO2 and NO2, in the metropolitan area of Thessaloniki and other urban centres, including the promotion of sustainable multimodal urban mobility and the adaptation of measures to reduce its impact to the environment. Quantitative objectives regarding mobility and the environment: ● reduction in energy consumption: 20% up to 2030 ● reduction in GHG emissions: 20% up to 2030 ● increase of public transport share from 25% to 50% up to 2030 **Indicative actions in the mobility sector** ● Traffic management with intelligent transport systems (e.g. Traffic Management Center) - Promoting interoperability between Traffic and Public Transportation Management Center but also intermodality between transport modes (parking, sidewalks, bike paths, etc.) ● Introduction of particulate filters in public diesel vehicles ● Introduction of natural gas to more buses, exploration of its utilization in other public heavy vehicles - Further encouragement of the use of hybrid vehicles in public transport ● Fuel emission reduction technologies, promoting "clean" fuels with low sulfur content such as biodiesel and bioethanol ● Infrastructure for the development and expansion of urban maritime transport in the Thermaikos Gulf ● Implementation of bicycle paths, sidewalks and light traffic streets
Sustainable Urban Development Plan of the Metropolitan Unit of Thessaloniki - Implementation Progress (2019) (local)	**Support of the transition to a low carbon economy in all sectors** ● Promoting low carbon strategies for all types of areas, especially urban areas, including promoting sustainable multimodal urban mobility and adaptation measures to reduce mobility's impact to the environment **Protection of the environment and promotion of resource's efficiency** ● Preservation, protection, promotion and development of the natural and cultural heritage ● Actions to improve the urban environment, regenerate cities, revitalize degraded areas, reduce air pollution
Sustainable Urban Mobility Plan of Thessaloniki (2021) (local)	**Quantitative targets** • Buffer zones for multimodal sustainable mobility • Development of local centres and redistribution of public space • Partial exclusion of city centre • Restructuring of the public bus network

	• Creation of tourist routes • Pedestrian routes • Emblematic intervention of Egnatia Avenue • Road opening • Walking of road sections • Low traffic zones (20–30km / h) • Creation of a Low Traffic Zone in the area of Rotonda • Expansion of the existing bike path network in the road sections • Parking management (creation of park & ride, telematics supervision of parking on selected roads and integration of surveillance for cargo slots in Thessaloniki's controlled parking system) • Promotion of electromobility • Organization of urban distribution system

Thessaloniki 2030, Strategy for urban resilience (2019) (local)	**Quality objectives:**
	• A sustainable city where mobility and urban systems serve its inhabitants
	  ○ A mobility system that promotes urban development
	  ○ Developing a smart urban supply chain
	  ○ Clean energy for transport

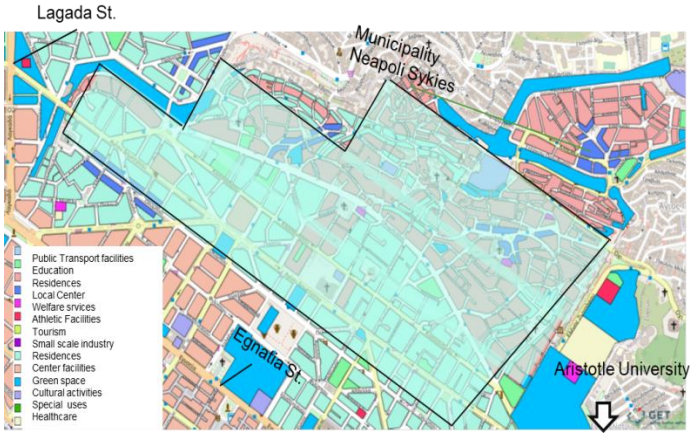
Sustainable Energy Action Plan (2016) (local)	The goal set by the Municipality through the Sustainable Energy Action Plan is to reduce carbon dioxide emissions by 500,000 tons, i.e. 20% by 2020.
General urban plan of the municipality of Thessaloniki (2019) (local)	**Quality objectives:** The spatial organization proposal aims at: • Strengthening of the center and its diffusion to the west • Linear development to serve residential areas in the east • Retention of housing and attraction of new settlers, especially of the Historic Center • Improvement of visiting conditions for visitors and living conditions of residents • Investigation of securing open free spaces in the urban fabric The target year is 2030 and the planning population is 360,000 inhabitants

3. Urban organization

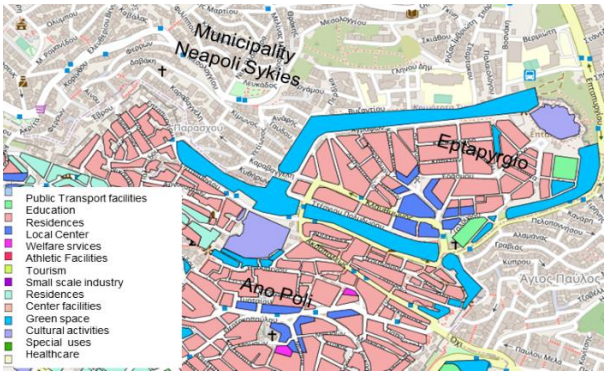
3.1 Model of spatial organization of the Municipality

In the urban fabric of the Municipality of Thessaloniki there are areas that show special characteristics and play a specific role in the development of the city. These areas create 4 distinct spatial units which are presented below:

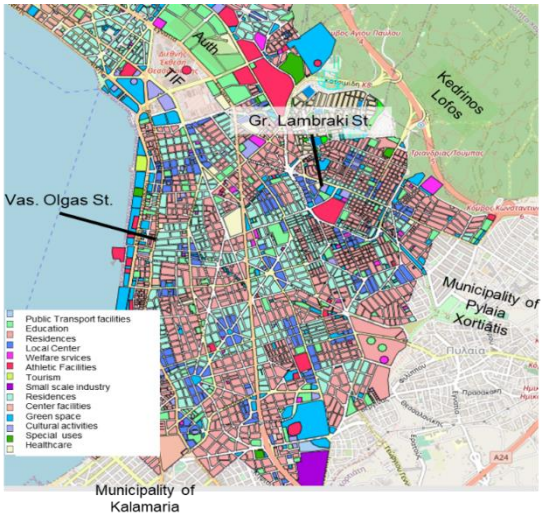
*The distinct area of the **Shopping Center** of the Municipality of Thessaloniki, which is defined, **from Egnatia Street to the sea front and from Lagada Street to the West Walls and Eleftherias square.** In that area the majority of the central functions (commercial, public, municipal, educational, cultural, entertainment services), of supra-local importance are located, to serve both the Municipality but also the metropolitan area. There is also, to a much smaller extent, the use of the residence, from the first floor of the buildings and up, mixed with offices.*



The main land use of the area ***north of Egnatia Street to the boundaries of the Municipality and west of the University up to Lagada Street, is housing****. There are also activities of the tertiary sector mixed with the houses, mainly on the ground floor of the buildings.*

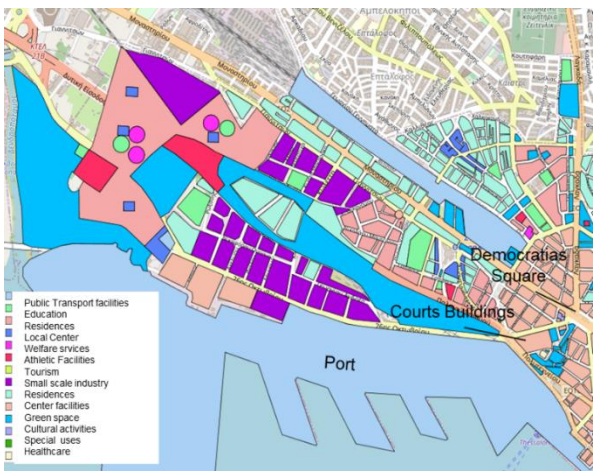


The north-east part of the Municipality includes the district of ***Ano Poli and Eptapyrgio, which is of historical and cultural importance.***



At the eastern part of the Municipality defined by the ***Aristotle University of Thessaloniki (AUTh) – Thessaloniki International Fair (TIF) – Young Men's Christian Association (YMCA)*** *up to its* ***borders with the Municipalities of Kalamaria and Pylea - Chortiatis*** *and from the forest of* ***Kedrinos Lofos*** *to the sea front, the main land use is* ***housing****. However, recently a network of central functions has been developed along the main roads (****V. Olgas, Mpotsari, Gr. Lambraki, etc****.) with metropolitan impact, such as* ***tertiary sector*** *activities that serve the needs of the residents not only at the local level but also at the city level.*

The western part, from ***Democratias Square and the Courts Buildings*** *up to the western borders of the Municipality, is an area of* ***business activities and central functions****. In this part of the city there is a mixture of land uses, such as* ***central functions, workshops, warehouses, entertainment, while scattered housing can be detected*** *mainly in areas on either side of the west entrance. Secondary sector and wholesale trade are gradually being eliminated (due to the economic crisis and new trends in economy) or are being moved out of the city. It is also the hinterland of the Port, with unstructured areas but with primary main roads.*



3.2 Population densities

For the base year 2018, the population of the Municipality of Thessaloniki and as well for the rest Municipalities of the Urban Area (Figure 3) is estimated taking into account the data of Greek Statistics Authority of 2011 as shown at the Table 2[1]:

Table 2: Population of the Municipalities of Thessaloniki Urban Area

Municipality	2011	2018 (base year)	2030
Thessaloniki	325.182	313.000	330.000
Kordelio - Evosmos	101.753	97.941	97.941
Pavlos Melas	99.245	95.527	95.527
Kalamaria	91.518	88.090	88.090
Neapoli Sykies	84.741	81.566	81.566
Ampelokipi - Menemeni	52.127	50.174	50.174
Pylea - Xortiatis	70.110	67.484	67.484
Urban Area	824.676	793.782	810.782

For the 2030 time horizon, assuming a restraint of the population decrease reported for the period 2011-2019, the population of the Municipality of Thessaloniki reaches 330,000 inhabitants[2], marking an increase of 6%, when the population of the wider metropolitan area is approaching 810,000 inhabitants.

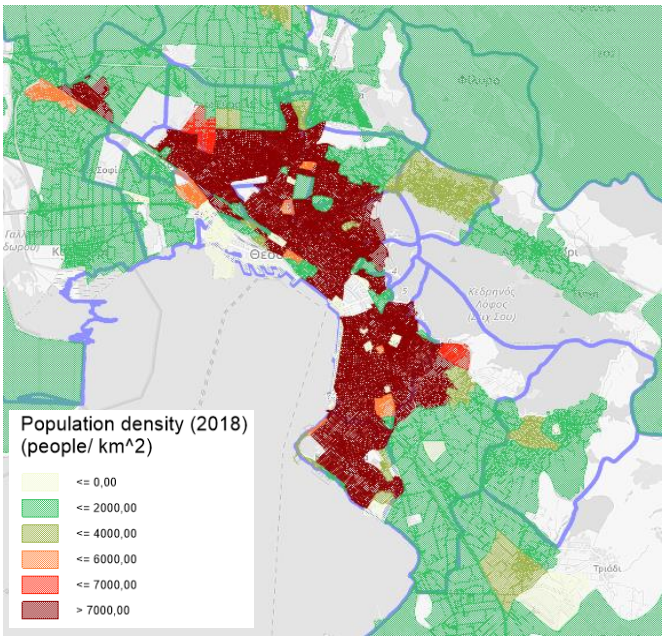


Figure 3: Population density data in the Municipality of Thessaloniki and in the wider metropolitan area (base year 2018) (Source: CERTH/HIT model, applied for SUMP of MoT 2021)

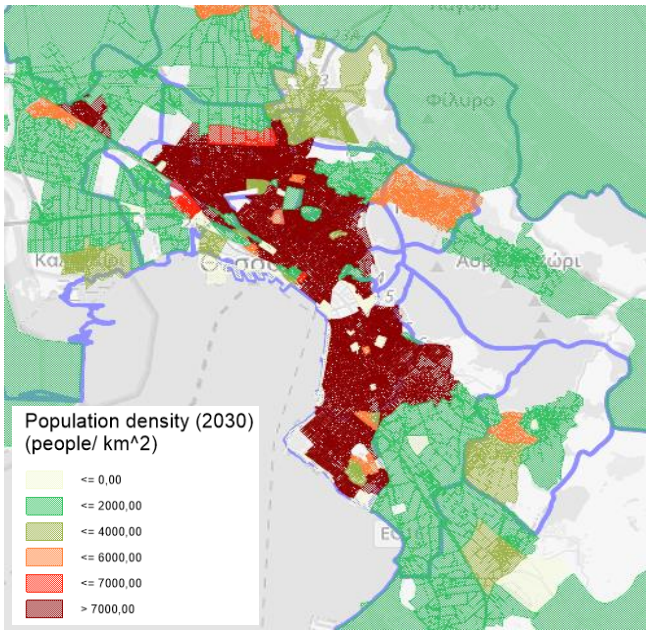


Figure 4: Population density data in the Municipality of Thessaloniki and in the wider metropolitan area (2030) (Source: CERTH/HIT model, applied for SUMP of MoT 2021)

[1] It is calculated based on the type of interest. If Px is the population at the start year and Py is the population at the end year, the average annual change of population between the years x and y is calculated based on the formula Py = Px * (1 + r)^x-y. Taking into account a moderate reversal of the declining population trends (applied to an order of magnitude 4% for the Municipality of Thessaloniki for the period 2011-2018, thus estimating the population of the Municipality at approximately 313,000 inhabitants)

[2] Taking into account a moderate reversal of the declining population trends (applied to an order of magnitude 4% for the Municipality of Thessaloniki for the period 2011-2018, thus estimating the population of the Municipality at approximately 313,000 inhabitants) a design population of 332,000 inhabitants for 2030 was used. It corresponds to an annual change index equal to 0.5% between base year (2018) and planning year (2030). This planning population is approaching scenario B of the GIS of the Urban Plan of Thessaloniki, which envisages halting the population decline by balancing it at the levels of the 2011 census (325,182 inhabitants), however it gives an increasing dynamic to avoid under-planning.

As shown in **Figure 3** and **Figure 4**, the highest population densities are located within the Municipalities of the urban complex. The farther we move from the central areas, the lower the population density. Comparing the two-time horizons (2018 and 2030), no significant changes can be identified.

3.3 Work places

High number of employees are located in the historic center of the city and in various areas where commercial stores and office buildings exist in the neighboring Municipalities of Pavlos Melas, Thermi and Pylea - Chortiatis.

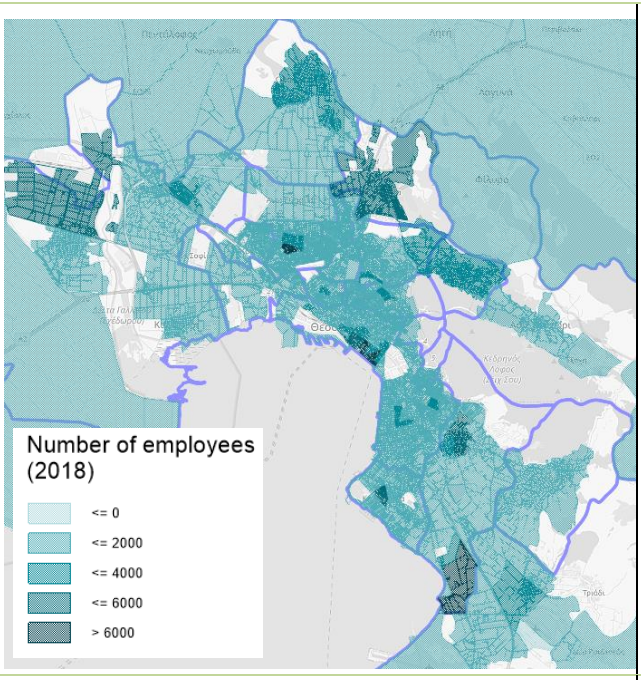


Figure 5: Employee data in the Municipality of Thessaloniki and in the wider metropolitan area (base year 2018) (Source: CERTH/HIT model, applied for SUMP of MoT 2021)

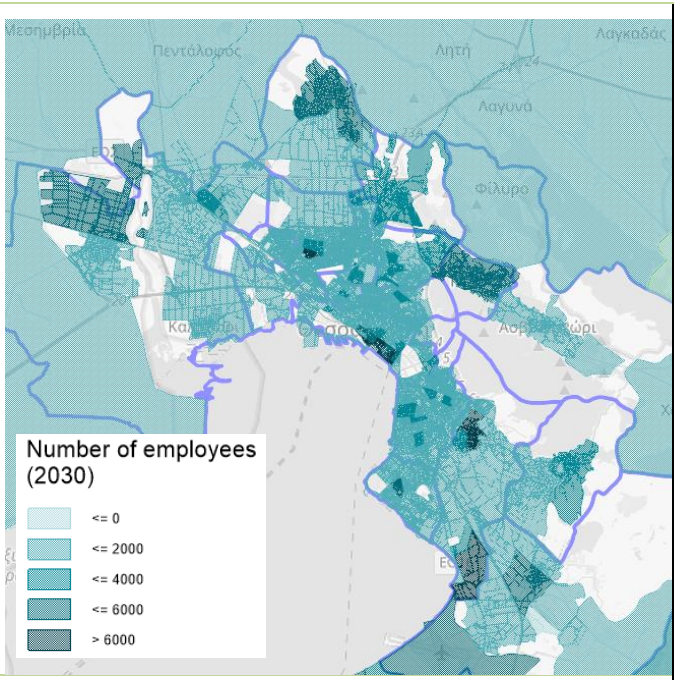


Figure 6: Employee data in the Municipality of Thessaloniki and in the wider metropolitan area (2030) (Source: CERTH/HIT model, applied for SUMP of MoT 2021)

In terms of working places, the historic center of the city maintains high densities mainly due to the shops, public services and office buildings that are located there as well as at the areas of Thermi, Pylaia and Pefka. As in the case of the population densities, no significant changes in workplaces are expected.

3.4 Land uses and points of interest

The land uses presented in the map of Figure 7 are characterized by high traffic. Areas/points of interest are identified and recorded through various sources (e-poleodomia.gr, Municipality gis, land use maps GIS / General Urban Plan, google). Indicatively, such spaces may be:

- Public buildings / Services
- Places of tourist interest / Typical landmarks
- Parks, important common areas
- Shopping malls
- Public transport areas (railway stations, buses' terminal station, port, airport, etc)

Figure 7: Land uses (Source: Municipal Electric Vehicle Infrastructure Charging Plan, 2021)

The future urban planning of the city includes the emblematic interventions shown in Figure 8.

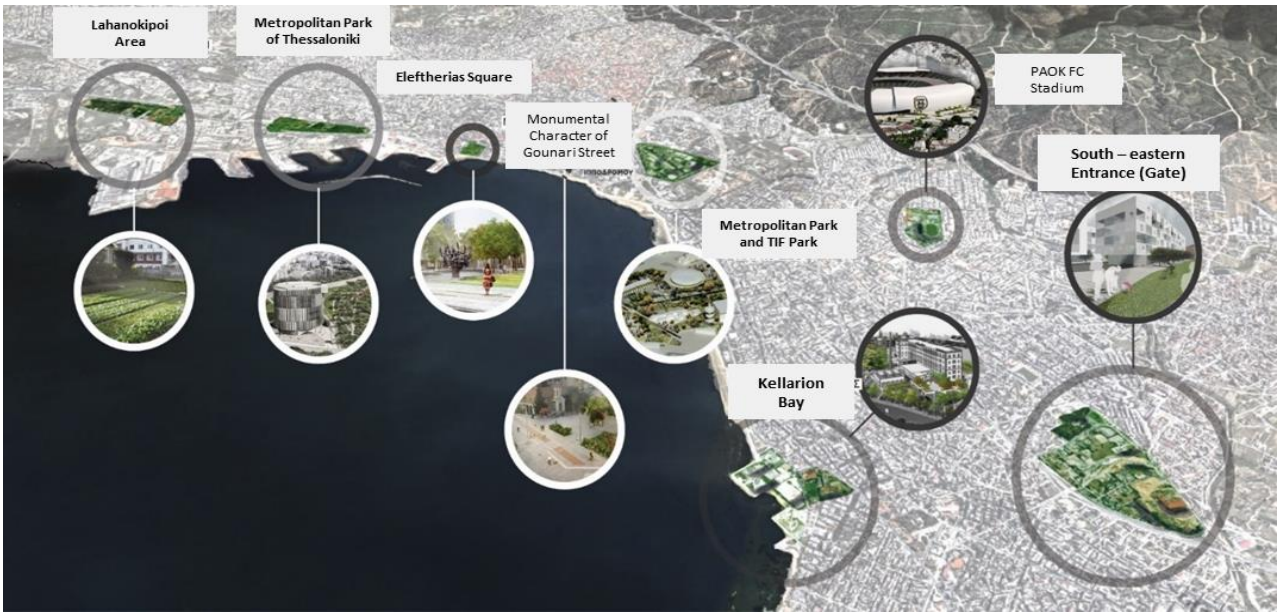


Figure 8: Future city emblematic land use interventions (Source: SUMP of MoT, 2021)

4. Current mobility situation

4.1 Road network

The road network of the Municipality of Thessaloniki, according to a review of the SUMP of MoT 2021 of the wider centre of the Municipality of Thessaloniki, is ranked as shown in Figure 9 below:

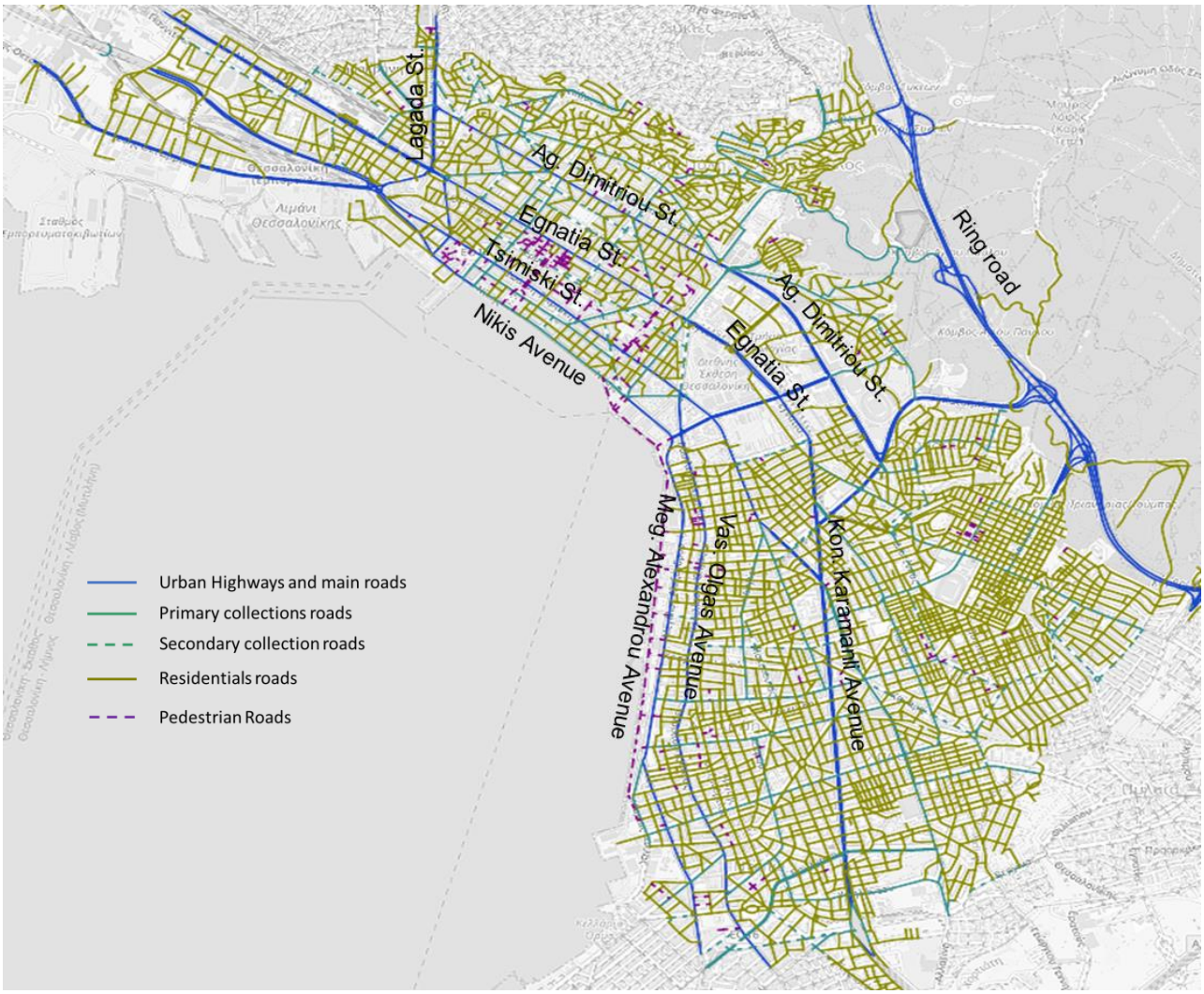


Figure 9: Current road network of the Municipality of Thessaloniki and its classification (Source: CERTH/HIT model, applied for SUMP of MoT 2021)

With **blue colour** the main roads of the network are visualized, such as Ag. Dimitriou St., Konstantinou Karamanli St., Egnatia St., Lagada St., Vas. Olgas Avenue, Tsimiski St, Nikis Avenue and Meg. Alexandrou Avenue, which actually collect the majority of the traffic within the city. It is worth mentioning that, during the last decade, MoT has implemented a network of low traffic roads of more than 2km in the city centre.

4.2 Road network performance

According to the analysis of the level of service of the road sections that were investigated in the SUMP of Municipality of Thessaloniki (based on the average daily speed of traffic recorded), a low level of service was observed at the following intersections of the road network:

1. **26 Oktovriou – Polytechniou – Karatasou – Palaiou Stathmou**: It is considered the most important western entrance – exit in the City Centre. Important points of interest are located nearby such as Office Blocks, Hotels, Courthouse, Harbour Facilities and moreover collects the majority of the traffic heading to the Western Industrial Area.
2. **Agiou Dimitriou – Panepistimioy – Ethnikis Aminis**: This intersection is considered the north entrance of the city centre and very close to the Campus of Aristotle University. Moreover it collects the traffic arriving to the city centre from the Ring Road.

3. **Kon. Karamanli – Katsimidi – Ioanninon**: This intersection collects the majority of the traffic heading to the City Centre from the high populated area of Toumpa (Municipal Unit D) and the Eastern areas of the City (Municipal Unit E).

Figure 10: Intersections with low level of service and Road Sections with high traffic volumes. (Source: CERTH/HIT model, applied for SUMP of MoT 2021)

The road sections with the higher traffic volumes are located in the City centre and are illustrated with red in the map above (Figure 10) and are Ag. Dimitriou St., Egnatia St., Tsimiski St., Nikis Avenue and Stratou St.

The percentage of heavy vehicles in the road sections that were investigated, ranges from 2% to 7%. The highest values were presented in the road sections of Mitropoleos, Ermou and Egnatia, road sections with several bus lines, as well as loading and unloading vehicles. As MoT is placed at the centre of the Metropolitan Unit of Thessaloniki, its road network also serves a high "through" traffic (trips having both ends outside MoT, but passing through its network). Table 3 presents the percentages of the daily "through" traffic flows in main arterial roads of the city centre, indicating an average of 35% through traffic, of the total daily traffic.

Table 3: Percentage of daily "through" traffic flows in main arterial roads for 2018 (Source: CERTH/HIT model, applied for SUMP of MoT 2021)

Street	%
Egnatia (to the west)	31
Egnatia (to the east)	35
Tsimiski (one way, to the west)	25
Nikis Avenue (one way, to the east)	42
Agiou Dimitriou (in its one way sections, to the east)	31

As far as the vehicle kilometres run within the city network are concerned, a transport model analysis has been made for the morning peak hour (08:00 – 09:00) at the level of both the MoT and the city centre (Figure 11

and Figure 12), resulting in 126,000 and 45,000 vehicle kilometres respectively. The historical centre undertakes a significant percentage (35%) of the overall municipal vehicle kilometres, further indicating the need for interventions that would prevent private car usage.

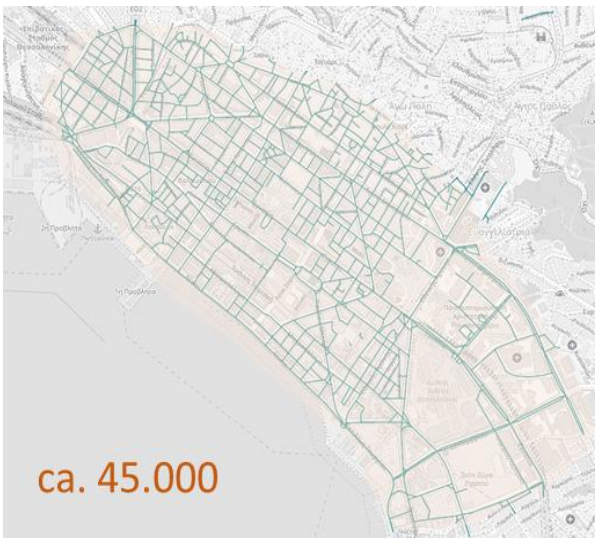


Figure 11: Vehicle kms of morning peak hour for the central area (historical center) of the MoT- 2018 (Source: CERTH/HIT model, applied for SUMP of MoT 2021)

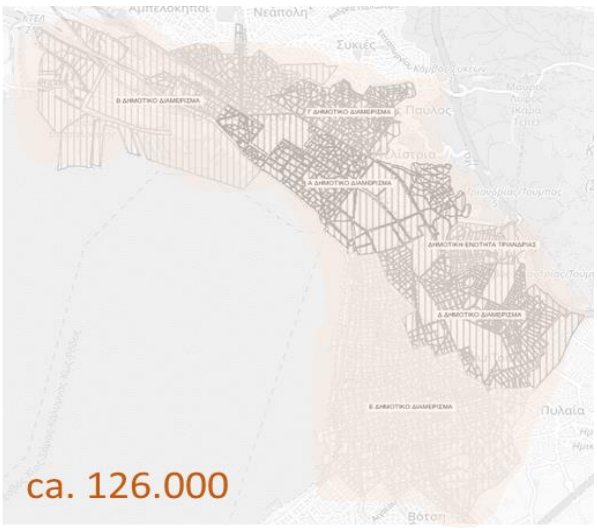


Figure 12: Vehicle kms of morning peak hour for the MoT – 2018 (Source: CERTH/HIT model, applied for SUMP of MoT 2021)

4.3 Pedestrian and bicycle infrastructure

Today, the existing network of pedestrian roads in MoT, reaches a length of approximately 18km, with high-density pedestrian roads in the areas of city centre (Ladadika, Aristotelous Square, Athonos Square, etc.). The road sections that have the highest pedestrian flows are the following:

1. Tsimiski – Palaion Patron Germanou
2. Aristotelous - Ermou
3. Egnatia - D. Gounari
4. Ag. Sofias - Ag. Theodoras
5. Tsimiski - Gounari
6. Tsimiski - Aristotelous
7. Egnatia - Ag. Sofias
8. Mitropoleos - Aristotelous
9. Egnatia - Anagenniseos

Most of the road sections mentioned above are part of the Tsimiski and Egnatia Streets. The intersections of Tsimiski street with the pedestrian street of Aristotelous (the most central pedestrian street of the city) also have very high loads. Finally, important flows are observed at the pedestrian street of Agia Sofia. Regarding the level of service, for most of the road sections that were studied, there were no low levels of service, as they ranged from A to C. Regarding the geometric characteristics of the study area, utilizing the topographic background of the study area and taking into account the line of the curb and the line of the building line, the width of the sidewalk was calculated and it is divided into classes as the map of Figure 13 shows. From the figure arises the fact that although in the central areas sidewalk's width is more than efficient, as we move away from the centre to more residential areas, the width is shortened resulting in infrastructure discontinuities that discourage pedestrian movements. It is worth mentioning, that based on the travellers satisfaction survey carried out during MoT's SUMP, 11% (out of total 2.600 pedestrians) replied that they are not satisfied at all with their pedestrian trips, while 28% percent being a little satisfied and 39% averagely

satisfied. This conclusion arises from the fact that although from a first glance, the map below shows a rather positive situation regarding sidewalks, this is away from the reality, where on top of the inadequate sidewalk length we have illegal parking, inappropriate location of green infrastructure and leisure infrastructure.

Figure 13: Sidewalk's width (Source: Municipal Electric Vehicle Infrastructure Charging Plan, 2021)

The mapping of the cycling infrastructure was based on data that exists in the cartographic Portal of the Municipality of Thessaloniki, and was updated after autopsies and data provided by the Municipality of Thessaloniki. The network of bicycle lanes has been increased recently [3] through the implementation of a bicycle lane (one-way in each stream) on Konstantinou Karamanli Street, which extends from Kaftantzoglou Street to Voulgari Street and a two way bicycle lane on Nikis Avenue. Also, in the "study of the implementation of the optimization of the existing bicycle infrastructure and its extension" (2019), the construction of a bicycle road on Papafi and Kleanthous streets is proposed. The network of bike lanes is presented on the map of Figure 14. Existing bicycle lanes have a length of 13km, while around 100 bicycle stations are located within MoT, offering more than 700 bicycle parking places around the city, especially in the city centre.

[3] Temporary due to the Covid – 19 pandemic situation

Figure 14: Bike network of Municipality of Thessaloniki (Source: Municipal Electric Vehicle Infrastructure Charging Plan, 2021)

Regarding the bicycle flows, they were particularly low in all parts of the existing bicycle network, but also in the road sections where there is no bicycle infrastructure. Bicyclists that have responded to a travellers' satisfaction survey carried out during MoT's SUMP (451 questionnaires in total), replied at a percentage of 58% that are not at all satisfied with bicycle infrastructure.

4.4 Public Transport System

The service area of the public transport covers most of the Regional Unit of Thessaloniki, combining inner city and some suburban bus connections. The basic lines of the Thessaloniki Urban Transport Organization are 81 and consist exclusively of bus lines. These lines are divided into subcategories depending on the route and the service area, ending up to be a total number of 233 bus lines of different categories. The total number of stops is 3.659, and 201 of them are connected to the telematic system. The highest speeds are noticed on lines, whose major route takes place outside the core of the city of Thessaloniki and which connect suburban areas to the centre. For the other lines the average speed is 20 km / h and below.

The following map (Figure 15) shows the public transport terminals, bus lines and their stops, as well as the metro lines that are to be implemented and pass through the Municipality of Thessaloniki.

Figure 15: Public Transport system of the Thessaloniki

Regarding the frequencies, according to the Table 4, the largest percentage of scheduled itineraries, over 80%, is characterized by a programmed frequency ranging from 6 to 20 minutes.

Table 4: Table: Frequency distribution per hour

Frequencies (min)	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00
1-5							0.02%	0.07%	0.21%	0.14%	0.08%	0.07%	0.06%	0.08%	0.09%	0.02%	0.02%	0.04%	0.02%	0.03%	0.08%	0.04%	0.01%	
6-10	0.02%					0.05%	0.77%	2.26%	2.95%	2.63%	2.35%	2.33%	2.30%	1.87%	1.57%	1.59%	1.64%	2.08%	2.36%	2.37%	2.35%	1.81%	0.69%	0.22%
11-15	0.13%					0.16%	1.47%	1.83%	1.92%	2.09%	2.20%	2.06%	2.10%	2.18%	2.03%	1.82%	2.06%	2.21%	2.15%	2.19%	1.90%	1.59%	1.22%	0.45%
16-20	0.28%					0.14%	0.86%	0.81%	0.50%	0.54%	0.62%	0.61%	0.63%	0.79%	0.68%	0.79%	0.77%	0.69%	0.61%	0.59%	0.66%	0.70%	0.84%	0.85%
21-25	0.20%	0.01%			0.01%	0.04%	0.19%	0.20%	0.20%	0.20%	0.21%	0.25%	0.26%	0.22%	0.31%	0.24%	0.27%	0.24%	0.22%	0.21%	0.21%	0.28%	0.40%	0.33%
26-30	0.34%	0.02%	0.01%	0.02%	0.01%	0.01%	0.14%	0.21%	0.18%	0.21%	0.16%	0.15%	0.16%	0.14%	0.14%	0.30%	0.22%	0.11%	0.12%	0.18%	0.17%	0.16%	0.34%	0.44%
31-35	0.06%	0.01%					0.09%	0.09%	0.12%	0.10%	0.14%	0.08%	0.11%	0.11%	0.13%	0.13%	0.15%	0.11%	0.12%	0.12%	0.10%	0.09%	0.13%	0.12%
36-40	0.06%						0.03%	0.09%	0.07%	0.05%	0.05%	0.07%	0.07%	0.08%	0.05%	0.06%	0.08%	0.10%	0.04%	0.07%	0.09%	0.11%	0.05%	0.13%
41-45	0.07%						0.02%	0.04%	0.03%	0.03%	0.05%	0.05%	0.04%	0.05%	0.07%	0.05%	0.05%	0.05%	0.03%	0.06%	0.02%	0.05%	0.08%	0.06%
46-50	0.01%						0.02%	0.06%	0.06%	0.06%	0.05%	0.04%	0.07%	0.02%	0.03%	0.04%	0.03%	0.02%	0.06%	0.05%	0.07%	0.02%	0.03%	0.01%
51-55	0.02%						0.01%	0.04%	0.02%	0.01%	0.02%	0.02%	0.03%	0.04%	0.02%	0.03%	0.04%	0.02%	0.02%	0.01%	0.02%	0.02%	0.00%	0.02%
56-60							0.03%	0.04%	0.07%	0.06%	0.04%	0.05%	0.07%	0.07%	0.05%	0.04%	0.06%	0.04%	0.04%	0.02%	0.06%	0.06%	0.04%	0.07%
61-90	0.01%						0.01%	0.07%	0.10%	0.09%	0.12%	0.10%	0.09%	0.11%	0.12%	0.14%	0.09%	0.07%	0.11%	0.13%	0.09%	0.07%	0.10%	0.07%
91-120								0.03%	0.03%	0.06%	0.04%	0.05%	0.05%	0.02%	0.02%	0.04%	0.02%	0.06%	0.05%	0.06%	0.04%	0.06%	0.02%	0.01%
>120											0.03%	0.05%	0.02%	0.02%	0.05%	0.07%	0.07%	0.05%	0.04%	0.07%	0.04%	0.04%	0.03%	0.02%

However, it should be noted that the aged fleet and the inability to invest during the transition from the private to the nationalized operator resulted in a significant reduction in public transport supply. For those living in the outskirts there is limited possibility to reach the city centre without using the private car, especially at night, because public transportation does not operate after midnight. This fact is also reflected in the results of a survey carried out during MoT's SUMP regarding the public transport users satisfaction, which show that 15% (out of total 1.935 users) replied that they are not satisfied at all with the Public Transport system, while 42% percent were only slightly satisfied.

4.5 Current demand

The Municipality of Thessaloniki attracts/ produces around 560.000 daily trips from the rest of the Municipalities of the Urban Area of Thessaloniki, which actually correspond to the 47% of the overall trips

attracted/ produced in the Urban Area. The daily intra-municipal trips (both ends in the Municipality) are 260.000, which represent 22% of the overall daily trips within the Urban Area, underlining the role that Thessaloniki plays in the overall Area. The following diagram (Figure 16) shows the modal split for trips that have at least one end in the Municipality and is the outcome of CERTH/HIT's model, which has been calibrated from data of the mobility survey and the stated preference survey.

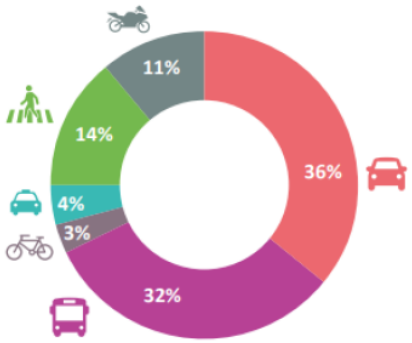


Figure 16: Modal split for 2018 (Source: CERTH/HIT model applied for SUMP of MoT 2021)

Table 5 presents the percentages and absolute values of the daily trips between the Municipalities of the Urban Area of Thessaloniki for 2018 and their modal split to car and public transport (PuT).

Table 5: Percentage (%) and absolute values of daily trips between the Municipalities of the Urban Area of Thessaloniki for 2018 and their split to Car and PuT (Source: CERTH/HIT model, applied for SUMP of MoT 2021)

	Amp.Men		*Thessaloniki*		*Kalamaria*		*Kord.Evosmos*		*Neap.Syk.*		*P. Mela*		*Pyl.Xort*		***SUM***	
Amp.Men	2.800 (0,2%)		28.000 (2,4%)		4.600 (0,4%)		6.600 (0,6%)		5.100 (0,4%)		5.400 (0,55)		5.100 (0.4%)		**57.600 (4.9%)**	
	Car	PuT	Car	PuT	Car	PuT	Car	PuT	Car	PuT	Car	PuT	Car	PuT	**Car**	**PuT**
	26%	30%	35%	34%	53%	25%	31%	31%	36%	30%	38%	30%	59%	20%	**38%**	**31%**
Thessaloniki	28.000 (2,4%)		262.600 (22,4%)		56.000 (4,8%)		59.500 (5,1%)		51.000 (4.3%)		49.200 (4,2%)		51.100 (4.3%)		**557.400 (47,4%)**	
	Car	PuT	Car	PuT	Car	PuT	Car	PuT	Car	PuT	Car	PuT	Car	PuT	**Car**	**PuT**
	35%	34%	23%	38%	32%	37%	42%	29%	36%	31%	43%	30%	40%	30%	**32%**	**34%**
Kalamaria	4.600 (0,4%)		56.000 (4,8%)		12.500 (1,1%)		10.200 (0,9%)		8.800 (0,7%)		8.700 (0,7%)		11.500 (1%)		**112.300 (9,6%)**	
	Car	PuT	Car	PuT	Car	PuT	Car	PuT	Car	PuT	Car	PuT	Car	PuT	**Car**	**PuT**
	53%	25%	32%	37%	24%	33%	59%	19%	55%	22%	60%	20%	42%	25%	**40%**	**30%**
Kord.Evosmos	6.600 (0,6%)		59.500 (5,1%)		10.200 (0.9%)		16.300 (1,4%)		11.500 (1%)		12.500 (1.1%)		11.000 (0,9%)		**127.600 (10,9%)**	
	Car	PuT	Car	PuT	Car	PuT	Car	PuT	Car	PuT	Car	PuT	Car	PuT	**Car**	**PuT**
	31%	31%	42%	29%	59%	19%	25%	30%	45%	25%	52%	28%	66%	14%	**43%**	**27%**
Neap.Syk.	5.100 (0,4%)		51.000 (4,3%)		8.800 (0,7%)		11.500 (1%)		10.300 (0,9%)		10.100 (0,9%)		9.200 (0,8%)		**106.000 (9%)**	
	Car	PuT	Car	PuT	Car	PuT	Car	PuT	Car	PuT	Car	PuT	Car	PuT	**Car**	**PuT**
	36%	30%	36%	31%	55%	22%	45%	25%	29%	31%	37%	31%	59%	18%	**40%**	**28%**
P. Mela	5.400 (0,5%)		49.200 (4,2%)		8.700 (0,7%)		12.500 (1,1%)		10.100 (0,9%)		10.900 (0,9%)		9.200 (0,8%)		**106.000 (9%)**	
	Car	PuT	Car	PuT	Car	PuT	Car	PuT	Car	PuT	Car	PuT	Car	PuT	**Car**	**PuT**
	38%	30%	43%	30%	60%	20%	52%	28%	37%	31%	35%	34%	67%	13%	**45%**	**28%**
Pyl.Xort	5.100 (0,4%)		51.100(4,3%)		11.500 (1%)		11.000 (0,9%)		9.200 (0,8%)		9.200 (0,8%)		10.900 (0,9%)		**108.000 (9,2%)**	
	Car	PuT	Car	PuT	Car	PuT	Car	PuT	Car	PuT	Car	PuT	Car	PuT	**Car**	**PuT**
	59%	20%	40%	30%	42%	25%	66%	14%	59%	18%	67%	13%	47%	19%	**48%**	**27%**
SUM	**57.600 (4.9%)**		**557.400 (47,4%)**		**112.300 (9.6%)**		**127.600 (10,9%)**		**106.000 (9%)**		**106.000 (9%)**		**108.000 (9,2%)**		**1.174.900 (100%)**	
	Car	**PuT**	**Car**	**PuT**	**Car**	**PuT**	**Car**	**PuT**	**Car**	**PuT**	**Car**	**PuT**	**Car**	**PuT**	**Car**	**PuT**
	38%	**31%**	**32%**	**34%**	**40%**	**30%**	**43%**	**27%**	**40%**	**28%**	**45%**	**28%**	**48%**	**27%**	**38%**	**31%**

As can be seen from Table 5, for the base year, 38% of total daily trips in the Urban Area of Thessaloniki are performed by car and 31% by Public Transport. The pattern of citizens' preference to car (against public transport) can be identified for almost every Municipality. Exceptions are, the inter-municipal trips of the Municipalities of Thessaloniki and Kalamaria (those trips having both ends within the borders of MoT and Kalamaria respectively) and the trips between those two Municipalities, where a preference on the use of

public transport can be seen. Figure 17 presents the origin-destination (OD) pairs between the Municipalities of the Urban Area of Thessaloniki and their modal split to private car and public transport.

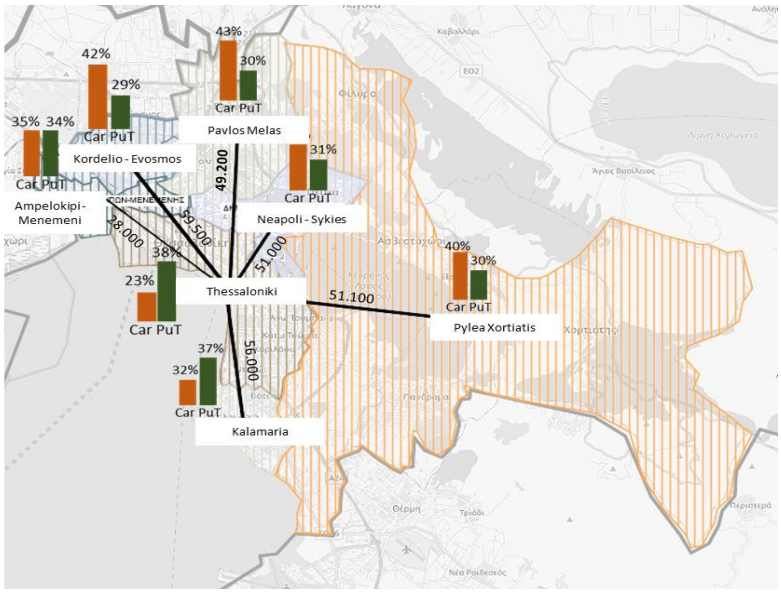


Figure 17: Daily trips attracted by the Municipality of Thessaloniki from the Municipalities of the Urban Area of Thessaloniki, 2018 (including intra-municipal trips) (Source: CERTH/HIT model, applied for SUMP of MoT 2021)

At the level of Municipal Units of the MoT, the following maps (Figure 18) present the Origin Destination pairs and percentages of production and attraction of trips between the Municipal Districts of the MoT, for all transport modes, in relation to the total inter-municipal trips for the year 2018. An analysis is done in terms of percentages of car and public transport (PuT) trips both at the level of the municipality (total daily intra-municipal trips) and at a level of each Municipal District.

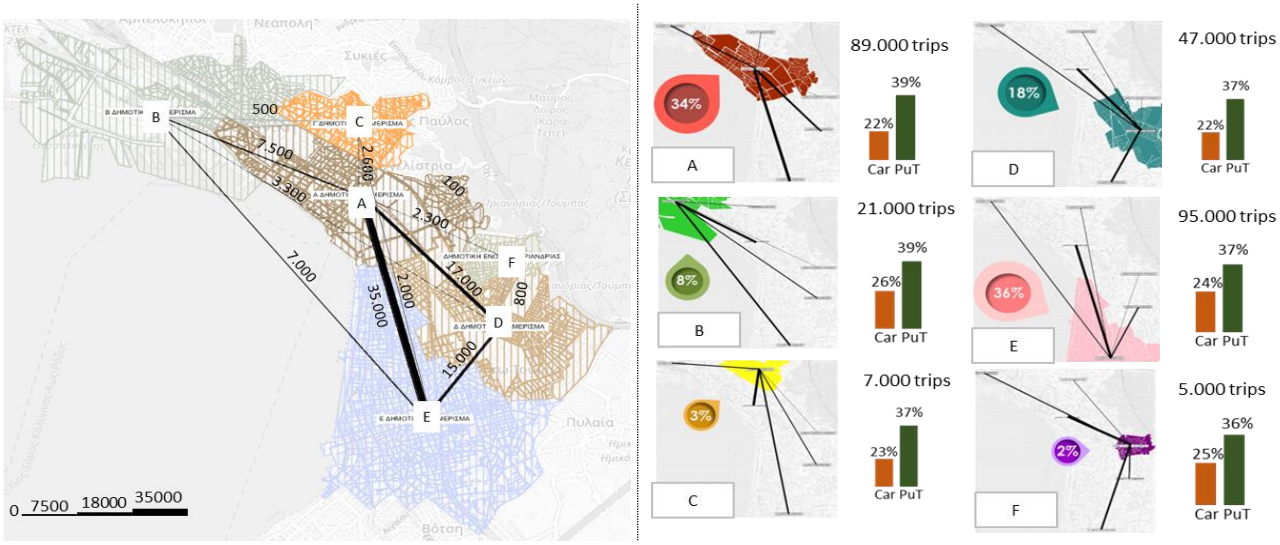


Figure 18: Daily intra-municipal trips between the municipal units (Source: CERTH/HIT model, applied for SUMP of MoT 2021)

Municipal Districts A and E are the main poles of production and attraction of intra-municipal trips, reaching a total of 70% of all intra-municipal movements. At the same time, the percentages of car and PuT trips at District level are wrapped around, with minor deviations, the percentages at the level of the Municipality (23% car and 38% PuT).

5. Future Mobility situation

5.1 Business as Usual Scenario of 2050CliMobCity (SUMP 2030)

The Municipality of Thessaloniki has already elaborated a Sustainable Urban Mobility Plan (2021) which specifies the future mobility projects and public space interventions[4]. The future strategy consists of different measure packages, each and every one of them has a specific timetable distinguished in two different time periods (2025 and 2030) and covers specific areas of mobility (as seen below). The SUMP scenarios for years 2025 and 2030 consist of the "business as usual scenario of 2050ClimobCity", as they form the basis of additional proposed actions.

Scenario (combination of interventions) testing for both time periods was examined by a 4-step multimodal transport model owned by CERTH/HIT and updated for the purposes of MoT's SUMP. The model covers the entire Regional Unit of Thessaloniki and has been used for data provision and scenario testing for Thessaloniki for the needs of 2050CliMobCity project as well.

SUMP interventions for 2030 include:

- **Regeneration of the urban environment**

- Planning of tourist routes: A common feature of these areas is the special historical interest they present and the ultimate purpose of them is to highlight their interconnection with other urban regeneration projects and upgrade the overall image of the urban environment.
- Pedestrian routes: Pedestrian routes either cross existing sidewalks, or roads with wide sidewalks or streets with a lack of appropriate infrastructure, to which the Municipality should intervene in order to implement the appropriate infrastructure (safety conditions) to secure the safe use of this infrastructure.
- Configuration of smart crossings: The purpose is speed reduction of vehicles and to facilitate the safe passage of pedestrians. The configuration of smart crossings can be achieved by raising a part of the roadway, by installing special lighting and by using intelligent technology systems (sound or visual warning systems).
- Emblematic intervention of Egnatia Avenue.
- Redistribution of public space: The aim is the reduction of private car use and therefore the limitation of the environmental impact of mobility by promoting the use of alternative means of transport by implementing the appropriate infrastructure along central road axes.
- Construction of a wooden Deck across the Old Coastline: The aim is to renovate the old seafront from the White Tower to the port, in order to create a floating free public space for citizens and visitors.
- Creation of a Low Traffic Zone in the area of Rotonda: The aim is to upgrade the quality of the urban fabric in a mixed land use neighbourhood, to manage the transparent and disturbing traffic as well as to increase the accessibility with sustainable means of transport in this area which is characterized by many and important historical monuments.
- Renovation of specific areas.

- **Improvement of road network-Traffic management**

- Redesign of junctions / signalling programs along the road axes
- One-way and Two-way Street: Redistribution of public street space and allocation of urban space to alternative forms of transport

[4] The SUMP can be found here (in Greek):
https://www.svakthess.imet.gr/Portals/0/Deliverables/PARADOTEO_P5_SVAK_THESSALONIKI.pdf

- Road openings
- Pedestrianization of road sections
- Conversion of roads to traffic calming areas with low speed limit (20–30km / h): The traffic calming areas will further facilitate the promotion of alternative and environmentally friendly strategies and will harmonize the coexistence of pedestrians, cyclists and cars
-

- **Bicycle network**

- Review and upgrade of the existing network of bike lanes
- Expansion of the existing and planned network

- **Restructuring of the Public Transport system**

The introduction of new transport modes (subway in 2023, Maritime transport and Western Suburban Railway in 2030) will create new needs for the organization and scheduling of the overall Public Transport system. For this reason, the restructure of the Public Transport bus lines is considered a necessity. The proposal for the restructure was made under the contribution of CERTH/HIT for MoT's SUMP and followed the need of having a public transport system, where all public transport modes will not compete each other, rather than be part of an integrated, multimodal system that favours sustainable combined transport for all. The restructure of the bus line network followed a robust methodology, serving main principles of accessibility, social equity, connectivity/ intermodality and sustainability. The interventions addressing the restructure of the bus network refer to: adjustments of the line routes of existing bus lines; creation of new bus lines; abolishment of parts or whole existing lines, where necessary; minimization of overlapping of the bus line routes; transfer or creation of new terminals/ starting points; transfer or creation of new bus stop points; adjustments of the bus line route schedules, where necessary. Figure 19 presents a map of the proposed restructured network.

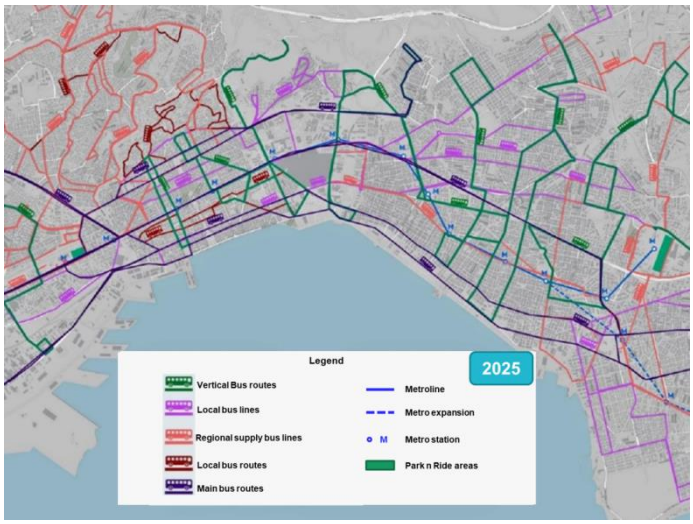


Figure 19: Proposed bus lines (CERTH/HIT proposal for SUMP of MoT 2021)

The restructured PuT network was simulated within CERTH/HIT's 4-step model and was used for MoT's SUMP future scenario testing. Furthermore, the restructured PuT network was made available by CERTH/HIT for modelling purposes and fleet scenario building as part of Thessaloniki's Bus Fleet Renewal Action Plan (study of the Ministry of Transport, "Renewal of the Urban Bus Fleets for the cities of Athens and Thessaloniki", 2021).

- **Parking management**

- New Park & ride infrastructure in public transport terminals

- **Supporting measures**

- Promotion of electrification
- Parking management: subsidies for the use of parking spaces in selected areas located near the metro terminal facilities
- Organization of sustainable urban logistic plan
- Parking management

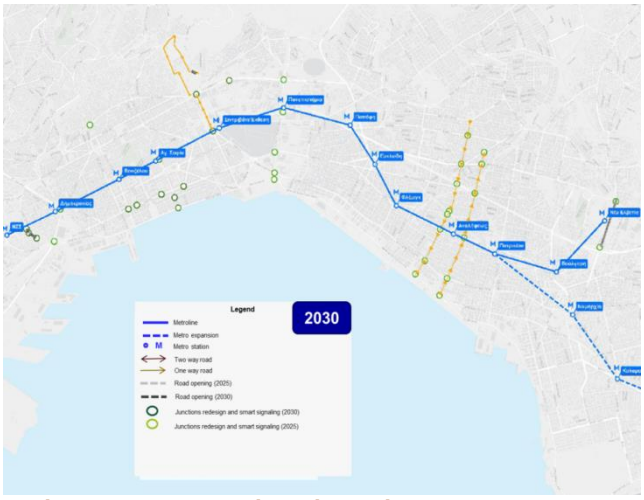


Figure 20: Proposed road openings, one-way, two-way and interventions at junctions and road sections (SUMP of MoT 2021)

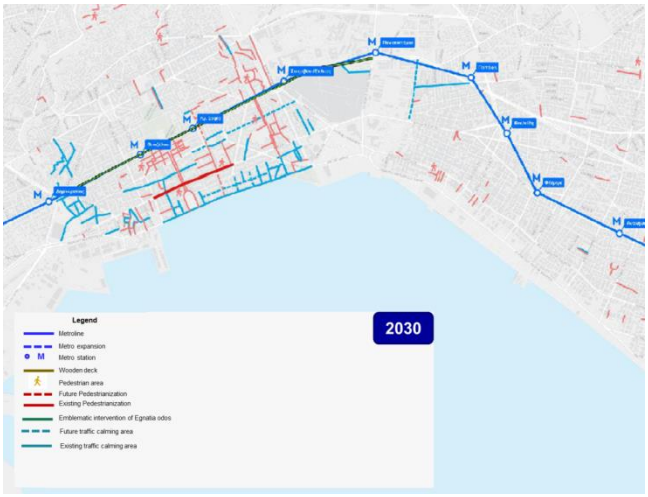


Figure 21: Proposed sidewalks and traffic calming areas and routes (SUMP of MoT 2021)

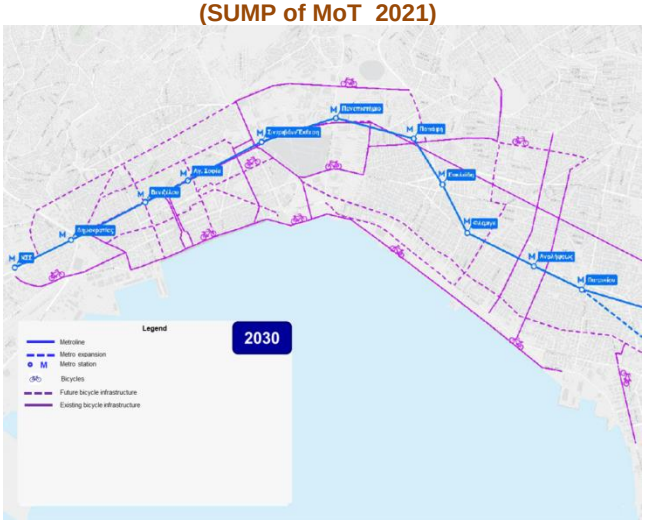


Figure 22: Proposed bicycle infrastructure (SUMP of MoT 2021)

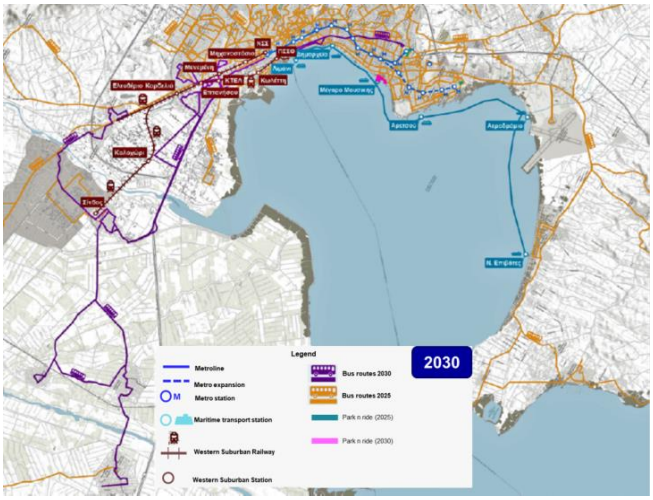


Figure 23: Proposed bus lines and public transport schemes (SUMP of MoT 2021)

5.2 Alternative scenarios

As part of 2050CliMobCity project, and leveraging on the city's existing SUMP (2021) strategy and interventions, the project team has developed a mix of measures and strategies for reducing GHG emissions on the basis of:

- Enhancing and further elaborating measures considered by the SUMP of the City which is also the result of a consultation procedure between the Municipality, the local stakeholders and the citizens
- Elaborating accompanying measures, mainly related to Thessalonikis citizens' behaviour changes

The measures are pillared on the intervention areas defined by 2050CliMobCity project, namely:

- Modal shift
- Innovation
- City logistics and
- Energy

The proposed 2050CliMobCity measures are presented per pillar in Table 6, along with the existing SUMP measures and interventions that are considered under each pillar as already tested and accepted.

Table 6: 2050CliMobCity measures included in the SUMP scenarios for Action Plan validation

Scenario reference	A. Modal shift pillar	B. Innovation pillar	C. City Logistics pillar	D. Energy pillar
SUMP 2018 (base year)	Current (2018) mobility status for comparison before & after	Current (2018) mobility status for comparison before & after	Current (2018) mobility status for comparison before & after	Current (2018) mobility status for comparison before & after
SUMP 2030 intermodal public transport strategy & scenario (BAU scenario for 2050CliMobCity)	• Pedestrianization and public space reallocation in the city • METRO operation • Bus Network reorganization & redesign • Maritime Public transport • New Bike infrastructure (total 46 km of bike lanes) • West Suburban railway	• Advanced traffic management & Control • Park & ride (1500 places) •	• New supervision to the parking slots for deliveries • Development of SULP	
2050CliMobCity scenario for 2030 (Electromobility and awareness raise campaigns)	• Shared electric mobility introduction scenario considered from municipality participation to MOMENTUM project) (2030) • Triggering behavioural changes through awareness campaigns for citizens' mode choice and the, associated to the choice, impact for the environment, the city and the individuals	• Electric fleet in bus network (2030 & 2050) • Cooperation with and use of THESSM@LL services for fact-based and data-driven decision making in sustainable mobility management and planning	• Electrification of the Municipal fleet	• Energy savings from street lighting
Final Scenario of 2050CliMobCity Project for 2030 (Combination of 1st and 2nd scenarios)				

5.2.1 Scenario A: Modal shift

5.2.1.1 Shared electric mobility introduction (a.1)

This scenario, builds upon CERTH/HIT's modelling tools developed under the Horizon project "MOMENTUM – Modelling Emerging Transport Solutions for Urban Mobility", in which both CERTH/HIT and the Municipality of Thessaloniki are involved as partners, testing new mobility services (car- and bike- sharing, MaaS solutions and the management and control of congestion). For the prediction of the demand of electric shared mobility in the Municipality of Thessaloniki, car sharing supply and demand models were developed within the framework of the MOMENTUM project. The scenario for shared electric mobility run for 2050CliMobCity is based on the establishment of 17 electric car sharing stations, 13 placed within the borders of the Municipality of Thessaloniki (including the Aristotle University of Thessaloniki, the New Railway Station, Thessaloniki's International Fair, the new metro line terminal in Nea Elvetia, etc.) and 4 in the neighbouring Municipalities of Kalamaria and Pilea-Hortiatis, where points of interest (i.e., the mall "Mediterranean Cosmos" and the shopping centre of IKEA) or terminals of the new metro line (Nea Mikra) are located. The 17 stations are presented in red dots **in Figure 25**. Orange-coloured areas display a radius of 500 metres of walking distance around the location of the stations, in which the TAZ[5] centroids are picked up by the model as the zones where the users of the service are beginning/ ending their trips.

[5] Traffic Analysis Zone

For the operation of the electric car sharing scheme two (sub-) scenarios are presumed regarding the available electric car fleet:

- **Sub scenario 1**: 100 electric car vehicles and the stations operate with 5 parking slots each
- **Sub scenario 2**: 200 electric car vehicles and the stations operate with 10 parking slots each

The electric car sharing trips are assigned between the stations (station-based car sharing scheme) and mostly serve the Municipality of Thessaloniki. Of course, some connections are established with the nearby Municipalities of Kalamaria and Pilea-Hortiatis.

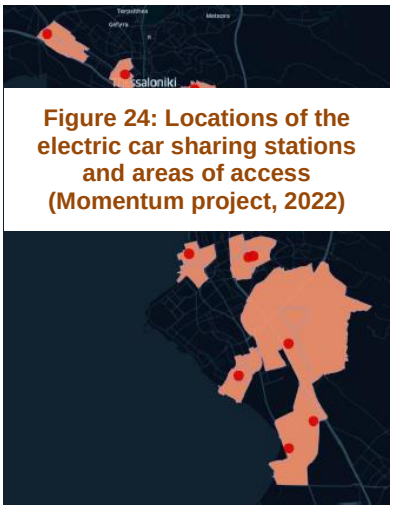


Figure 24: Locations of the electric car sharing stations and areas of access (Momentum project, 2022)

5.2.1.2 Awareness raise campaigns (a.2)

Awareness raising and information of the citizens must concern all sectors of mobility and in order to increase their effectiveness an integrated approach is needed. All these relevant campaigns and actions should not be fragmented, but should be repeated on a regular basis in order to achieve in a progressive way the development of sustainable mobility behaviours and patterns for all citizens. The awareness raising and action plan is encouraged to include information-education activities and events, such as seminars, speeches, and presentation, as well as participatory actions and promotion activities, (e.g. hiking promotion). Indicative promotional mobility change activities are:

- Promotion of the development of car-pooling and car-sharing systems for citizens
- Participatory planning workshops on mobility issues
- Raise student awareness campaigns in schools on road safety issues.

5.2.2 Scenario B: Innovation

5.2.2.1 Electrification of public bus fleet (b.1)

As already mentioned, the re-designed public bus network of Thessaloniki was the basis for CERTH/HIT's study for the "Renewal of the Urban Bus Fleets for the cities of Athens and Thessaloniki" (2022). As part of this study, CERTH/HIT made a proposal for the electrification of bus lines, upon the following assumptions:

- maximum bus range of 130 daily kilometres for depot-charging and up to 290 daily kilometres for opportunity charging
- Total 100 passengers' capacity of electric buses, thus limiting the vehicle type choices to midi (total capacity of 45 passengers) and standard vehicles (total capacity of 100 passengers). Lines operating with articulated buses and mini buses were excluded from the proposal.

For the purposes of the 2050 CliMobCity Action Plan, the most "optimistic" scenario of electric bus vehicle penetration has been examined, based on the above mentioned restrictions, and a further analysis of the vehicle kilometres run from the buses of the proposed electric lines has been conducted. Thus, a "geographical clustering" was carried out, taking into account the area of operation of each bus line, resulting in the following categories:

1. Bus lines operating at the "heart" of the Municipality of Thessaloniki (historical centre)

2. Bus lines operating at the level of core urban areas, having a part running within/ through the geographical borders of the Municipality of Thessaloniki
3. Bus lines operating outside core urban areas, having, though, a part running within/ through the geographical borders of the Municipality of Thessaloniki

For case 1 mentioned above, all the vehicle kilometres run by the buses are allocated within the Municipality of Thessaloniki and were estimated by the model. For cases 2 and 3 above, only the vehicle kilometres run within the borders of the Municipality of Thessaloniki were estimated by the traffic model for the purposes of this deliverable.

5.2.2.2 Cooperation with and use of THESSM@LL services for fact-based and data-driven decision making in sustainable mobility management and planning (b.2)

Dynamic and real-time information is one of the key features of a "Smart City". It is a communication channel between the city and its residents that can change their behaviour and decision making concerning mobility. With real time information, citizens can schedule their activities more effectively and make decisions about the most suitable transport mode, the selection of a shorter path etc. in order to save time and resources. More specifically, real time information can reduce unnecessary movements of cars in order to find an available parking slot and therefore reduce congestion in the road network. In addition, dynamic information enables the system administrator to inform people about emergencies in the network, such as an accident, extreme weather conditions or even protests and suggest alternative paths for bypassing that kind of obstacles in the network. Thessaloniki Smart Mobility Living Lab (THESSM@LL) is one of Europe's largest Living Labs. The entire city of Thessaloniki is a platform for testing technological and innovative solutions for mobility, cooperative and autonomous vehicles and will soon be extended to freight transport. Thessaloniki is now in the list of smart cities in the mobility sector, and this would not have been possible without the involvement of stakeholders that make up the ecosystem of the city, which has been created over the last decade and is constantly growing. In this ecosystem, various stakeholders, such as local institutes, businesses and public transport operators are involved in providing data or expertise to create the right conditions for the exploitation of this infrastructure in benefit of citizens. Thessaloniki Smart Mobility Living Lab includes, among others:

- Real time traffic data in Thessaloniki
- Short-term predictions of traffic conditions from multiple sources
- Exporting and formulating mobility and activity patterns
- Extended Internet of Things (IoT) equipment

5.2.3 Scenario C: City Logistics

5.2.3.1 Electrification of the Municipal fleet (c.1)

There is an existing future planning of the department of Business Planning & Monitoring of Development Programs of the Municipality, regarding the withdrawal and future procurement program of municipal vehicles. Despite these initiatives, according to the yearly average traffic data of the fleet, 80% of the vehicle kilometres will come from diesel vehicles, 12% from gasoline vehicles and only 8% from vehicles using electricity by the year 2030. As a result and in order to improve the environmental efficiency of the fleet, a

new strategy is needed in order to be aligned with the EU Directive 2019 /1161[6] . Therefore, according to this directive, an electric vehicle penetration index is adopted as follows:

- 25,3% of clean light vehicles on the total number of the municipal fleet to be electric by 2030
- 10% of clean heavy vehicles on the total number of the municipal fleet to be electric by 2030
- 47% of clean buses on the total number of the municipal fleet to be electric by 2030

5.2.4 Scenario D: Energy

5.2.4.1 Energy savings from street lighting (d.1)

According to the planning of the Municipality, all future lighting (100%) will be of LED technology until 2030, and the power supply will come totally from the underground network. With these interventions, a reduction of 51% in energy consumption is estimated compared to 2021. However, the Municipality of Thessaloniki in order to improve the energy efficiency of the street lighting system, should investigate the possibility of implementing a smart lighting system. Smart street lighting – known as adaptive lighting – includes smart illumination solutions based on efficient, remotely controlled, LED public illumination. The light of the lamp is dimming when the sensors detect no movement, and brightens when there is activity. It can be set up to suit only road traffic, or can be combined with monitoring of vehicle traffic, the weather and the amount of natural light that is available. Intelligent street lighting can reduce energy costs immediately up to 35% due to intelligent on/off switching, to targeting progressive dimming and to efficient management of the energy consumption. At the same time overall operational costs are reduced by up to 42%.

5.2.5 Final Scenario

The final scenario is the combined implementation of all the actions described in Table 6. This approach is selected, as none of the proposed actions, actually, operates against each other resulting in discontinuities in the transport planning of the Municipality. Therefore, the combined implementation of all the proposed actions is selected, in order to achieve the best results for the efficiency of the transportation system of the Municipality of Thessaloniki. These actions are:

- Shared electric mobility introduction (a.1)
- Awareness raise campaigns (a.2)
- Electrification of public bus fleet (b.1)
- Promotion of THESSM@LL for Real time information of citizens (b.2)
- Electrification of the Municipal fleet (c.1)

[6] Minimum procurement target for the percentage of clean light vehicles in relation to the total number of light vehicles covered by contracts at Member State.
The following applies to Greece:
From August 2, 2021 to December 31, 2025, the goal is 25.3% and from January 1, 2026 to December 31, 2030, again 25.3%
Minimum procurement goals in terms of the percentage of clean heavy vehicles on the total number of heavy vehicles covered by contracts at Member State level:
The following applies to Greece:
Trucks (vehicle category N2 and N3): From 2 August 2021 to 31 December 2025, target 8%, From 1 January 2026 to 31 December 2030, target 10%
Buses (vehicle category M3): From 2 August 2021 to 31 December 2025, target 33%, From 1 January 2026 to 31 December 2030, target 47%

- Energy savings from street lighting (d.1)

5.3 Traffic simulation model results for 2030

5.3.1 Future demand (SUMP 2030)

In the year 2030, Municipality of Thessaloniki will attract/ produce around 590.000 daily trips from the rest Municipalities of the Urban Area of Thessaloniki, which actually correspond to the 47% of the overall trips attracted/ produced in the Urban Area. The daily intra-municipal trips (both ends in the Municipality) are 260.000, which represent 22% of the overall daily trips within the Urban Area, underlining the role that Thessaloniki plays in the overall Area. Table 7 indicates the future (2030) modal split, as estimated from the CERTH/HIT transport simulation model applied for MoT's SUMP, in relation to the base year (2018) modal split.

Table 7: Modal split of daily trips that have at least one end within the Municipality of Thessaloniki for the base year and the time horizon 2030 (CERTH/HIT model, applied for SUMP of MoT)

Modal split	Base year 2018	2030[7]
	Share (%)	Share (%)
Car	*36,0*	*24-28*
Public Transport	*32,2*	*38-40*
Bicycle	*3,3*	*3-4*
TAXI	*3,9*	*3-4*
Pedestrians	*13,7*	*16-17*
Bikes	*11,0*	*10-11*
Total	*100*	

The restructured public transport network (including the new modes of public transport), as well the SUMP interventions that lead to reduction of road network capacity, may have an important impact in a sustainable modal shift, as a decrease of even 12% in private vehicles and an increase of up to 8% in public transport and 4% in alternative modes can be achieved (as can be seen from the table above).

Table 8 presents the percentages and absolute values of the daily trips between the Municipalities of the Urban Area of Thessaloniki for 2030 and their modal split to car and public transport (PuT).

Figure 25 displays the Origin - Destination (OD) trips at the level of the 7 Municipalities of the Urban Area of Thessaloniki for the year 2030.

At the level of Municipal Units of the MoT, Figure 26 presents the Origin Destination pairs and percentages of production and attraction of trips between the Municipal Districts of the MoT, for all transport modes, in relation to the total intra-municipal trips for the year 2030. An analysis is done in terms of percentages of car and public transport (PuT) trips both at the level of the municipality (total daily intra-municipal trips) and at a level of each Municipal Unit.

[7] For the year 2030 a range of modal split estimates is provided, based on various public bus fleet frequency scenarios and various "tensions" of exclusion of the city center from private vehicles. The most optimistic transport model estimation reach a total share of PuT, walking and cycling of up to 615 at the level of the MoT

Table 8: Percentage and absolute values of daily trips between the Municipalities of the Urban Area of Thessaloniki for 2030 and their split to Car and PuT (Source: CERTH/HIT model, applied for SUMP of MoT 2021)

	Amp. Men		Thess/niki		Kalamaria		Kord. Evosmos		Neap. Syk.		P. Mela		Pyl. Xort.		SUM	
Amp. Men	2.600	0,2%	27.000	2,2%	4.300	0,3%	6.000	0,5%	4.900	0,4%	5.200	0,4%	5.600	0,4%	55.600	4,5%
	Car	PuT	Car	PuT	Car	PuT	Car	PuT	Car	PuT	Car	PuT	Car	PuT	Car	PuT
	24%	31%	30%	37%	39%	41%	27%	33%	31%	33%	31%	35%	48%	30%	32%	35%
Thess/niki	27.000	2,2%	284.700	22,7%	56.000	4,5%	59.000	4,7%	52.000	4,2%	56.000	4,5%	62.500	5,0%	597.200	47,8%
	Car	PuT	Car	PuT	Car	PuT	Car	PuT	Car	PuT	Car	PuT	Car	PuT	Car	PuT
	29%	37%	18%	42%	26%	44%	34%	37%	28%	35%	34%	35%	30%	39%	24%	40%
Kalamaria	4.300	0,3%	56.000	4,5%	11.700	0,9%	9.800	0,8%	8.700	0,7%	9.900	0,8%	13.500	1,1%	113.900	9,1%
	Car	PuT	Car	PuT	Car	PuT	Car	PuT	Car	PuT	Car	PuT	Car	PuT	Car	PuT
	39%	41%	27%	44%	23%	33%	43%	37%	41%	37%	44%	35%	34%	33%	32%	39%
Kord. Evosmos	6.000	0,5%	59.000	4,7%	9.800	0,8%	14.800	1,2%	11.200	0,9%	12.400	1,0%	12.500	1,0%	125.700	10,1%
	Car	PuT	Car	PuT	Car	PuT	Car	PuT	Car	PuT	Car	PuT	Car	PuT	Car	PuT
	27%	33%	35%	36%	44%	37%	24%	32%	35%	36%	33%	37%	52%	27%	35%	35%
Neap. Syk.	4.900	0,4%	52.000	4,2%	8.700	0,7%	11.200	0,9%	10.300	0,8%	10.500	0,8%	11.200	0,9%	108.800	8,7%
	Car	PuT	Car	PuT	Car	PuT	Car	PuT	Car	PuT	Car	PuT	Car	PuT	Car	PuT
	31%	33%	29%	34%	41%	37%	35%	36%	24%	34%	30%	34%	46%	29%	32%	34%
P. Mela	5.200	0,4%	56.000	4,5%	9.900	0,8%	12.400	1,0%	10.500	0,8%	11.500	0,9%	12.000	1,0%	117.500	9,4%
	Car	PuT	Car	PuT	Car	PuT	Car	PuT	Car	PuT	Car	PuT	Car	PuT	Car	PuT
	32%	35%	35%	34%	45%	35%	33%	37%	31%	34%	29%	36%	53%	25%	36%	34%
Pyl. Xort.	5.600	0,4%	62.500	5,0%	12.916	1,0%	13.500	1,1%	12.500	1,0%	11.200	0,9%	12.000	1,0%	130.216	10,4%
	Car	PuT	Car	PuT	Car	PuT	Car	PuT	Car	PuT	Car	PuT	Car	PuT	Car	PuT
	47%	31%	31%	38%	34%	33%	51%	27%	45%	30%	53%	25%	34%	33%	37%	34%
SUM	55.600	4,4%	597.200	47,7%	113.316	9,0%	126.700	10,1%	110.100	8,8%	116.700	9,3%	129.300	10,3%	1.252.462	100,3%
	Car	PuT	Car	PuT	Car	PuT	Car	PuT	Car	PuT	Car	PuT	Car	PuT	Car	PuT
	32%	35%	25%	39%	31%	39%	35%	35%	32%	34%	36%	34%	37%	34%	30%	37%

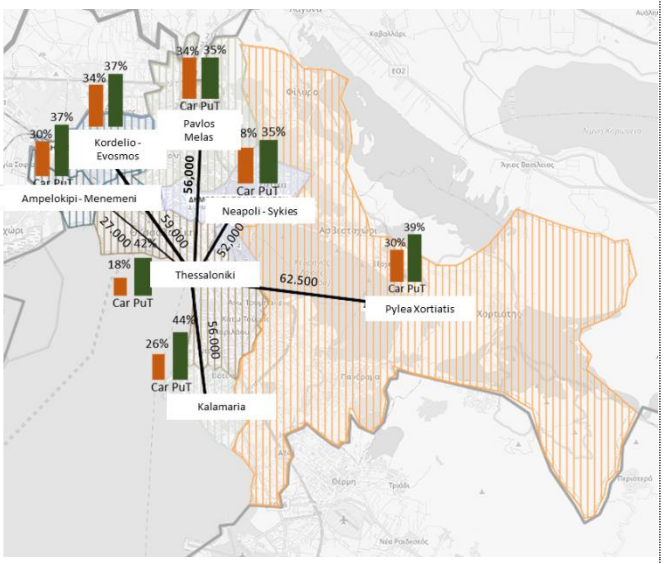


Figure 25: Daily trips attracted by the Municipality of Thessaloniki from the Municipalities of the Urban Area of Thessaloniki, 2018 (including intra-municipal trips) (Source: CERTH/HIT model, applied for SUMP of MoT 2021)

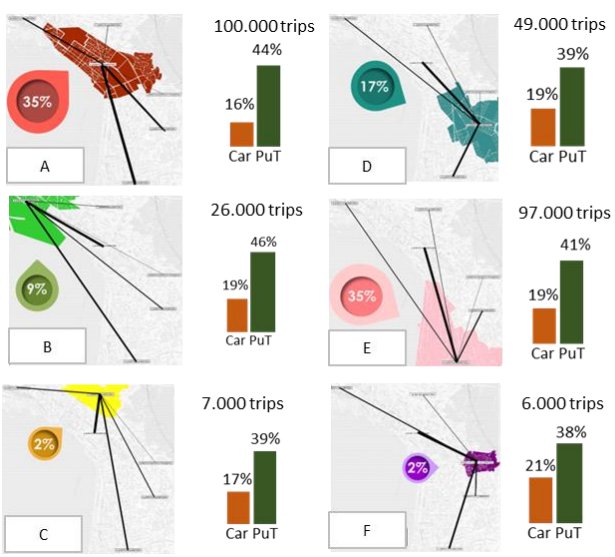


Figure 26: Daily intra-municipal trips for 2030 (Source: CERTH/HIT model, applied for SUMP of MoT 2021)

Table 8 indicates the increase of Public transport for the entire Urban Area, as the percentage of cars is reduced from 38% (2018) to 30%, while the percentage of Public Transport increases from 31% (2018) to 37%. This trend is observed for all the OD pairs as well as the intra-municipal trips (284.700 in total). This modal shift is attributed to both the introduction of the new public transport modes, in combination with the restructuring of the public bus network, as well as to all SUMP interventions that increase the "impedance" in the use of private car (i.e. pedestrianizations, reduction of road capacities due to redistribution of road space,

etc.). It is worth mentioning that concerning the intra-municipal trips between the Municipal units of the Municipality of Thessaloniki no significant changes can be notified for the time horizon 2030, therefore A 'and E' Municipal District continue to attract and produce the majority of the daily trips.

5.3.2 Future road network (SUMP 2030)

The road network, after the implementation of the proposed measure packages as described in the previous pages, is presented in the following map (Figure 27).

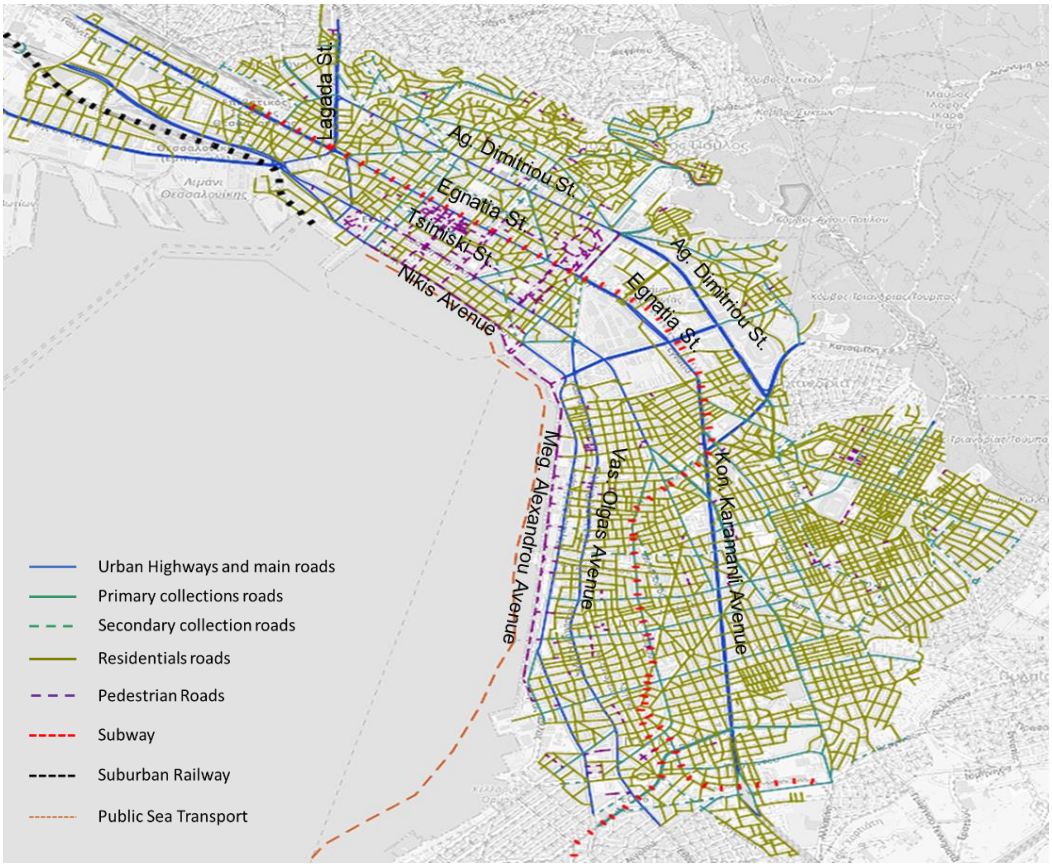


Figure 27: Future road network of the Municipality of Thessaloniki and its classification for year 2030 (Source: CERTH/HIT model, applied for SUMP of MoT 2021)

Most important changes in the road network concern the redistribution of public space to Egnatia Street (emblematic intervention) and main roads (i.e. Vasilisis Olgas, Vasileos Georgiou, Ethnikis Aminis, 25 Martiou), traffic calming of Nikis Avenue and interventions in favour of cyclists and pedestrians and car access restrictions to part of Tsimiski street (section between El. Venizelou and P.P. Germanou. Figure 27 also illustrates the new public transport modes and most specifically the subway (red dots) , the suburban railway (black dots) and public maritime transport (orange dots).

5.3.3 Future Road Network Performance (SUMP 2030)

The (comparative) analysis of basic traffic indicators (i.e. speed, volume/ capacity (v/c) ratio, volumes) for years 2018, 2025 and 2030 through the traffic simulation model indicated that the interventions made in the road network affect its performance (especially in the city centre), nonetheless without making it non-functional. Indicatively and discussing on the main arterial roads that cross the city horizontally, the following can be mentioned:

- Tsimiski Street operates in the time horizon 2025 (when car vehicle restrictions do not apply yet) with a v/c ratio that even reaches 0.9 in specific road sections, and a speed ranging between 15-20 km / h, thus

serving high daily and hourly volumes. This is reversed in 2030, when car access restrictions apply (see also Table 9, indicating the severe reduction of the 'through' traffic in Tsimiski st. in 2030, in comparison to 2018). The traffic for accessing the city centre is then channelled to neighbouring low – traffic streets (Figure 28), resulting in an exceeding of their capacity and a reduction of speeds even below 10km / h.

Figure 28: Reallocation of traffic due to Tsimiki's car access restriction (Source: SUMP of MoT 2021)

- The emblematic intervention of the Egnatia St. results in the reduction of its functional lanes and therefore its capacity. In 2030, when car access restrictions apply in Tsimiski st., part of the traffic crossing Tsimiski st. is channelled to Egnatia St. lane heading west (see Table 9 and the increase of 20% of the through traffic of "Egnatia, to the west" lane). Nonetheless, the performance of the road is within acceptable levels.
- The traffic calming of Niki's Avenue, results in a lower (compared to base year) v/c (0.8), serving, however, 50% lower hourly volumes compared to the base year.
- The traffic of Ag. Dimitriou Street is increased for both time horizons (2025 & 2030) compared to the base year 2018 (with an increase of up to 12% for 2030), but the operation of the road is still satisfactory, as the load capacity ratio remains below unit for all road sections. There are however some crucial (and complex) junctions of Ag. Dimitriou that need special attention.

Table 9: Percentage of daily "through" traffic flows in main arterial roads for 2030 – comparison to 2018 (Source: CERTH/HIT model, applied for SUMP of MoT 2021)

Street	2018	2030
Egnatia (to the west)	31%	51%
Egnatia (to the east)	35%	42%
Tsimiski	25%	5%
Nikis Avenue	42%	39%
Agiou Dimitriou	31%	34%

As far as basic operational indicators of the morning peak hour are concerned (vehicle kilometres, vehicle hours, average road network speeds, average v/c ration), Table 10 presents the comparative values for 2018 and 2030, for both the Municipality of Thessaloniki and the Central Area.

Table 10: Operational indicators of the morning peak hour of Municipality of Thessaloniki and Central area for 2018 and 2030 time horizon (Source: CERTH/HIT model, applied for SUMP of MoT 2021)

	Municipality of Thessaloniki		Central Area	
	2018	2030	2018	2030
Vehicle kilometers	125.838	111.195	44.494	39.055
Vehicle Hours	3.863	3.554	1.720	1.771
Average network speed per road category (km/h)				
Urban Highways	45	48	42	44
Collection Roads	42	42	40	36
Average load / capacity ratio (V / C) per road category				
Urban Highways	51	48	52	49
Collection Roads	31	31	39	48

As can be seen from the table there is a significant reduction in the number of vehicle kilometers and vehicle hours between the base year 2018 and 2030, a fact that is justified by the shift to public transport and walking. The results of the interventions to reduce the capacity of the road network, are mainly reflected in the increase of vehicle hours between base year and 2030, but also in the reduction of the average network speed of the collection roads.

5.3.4 Public transport operation characteristics (SUMP 2030)

This chapter presents the results of CERTH/HITs Public Transport (PuT) transport model for time horizons 2018 – 2030.

Table 11: Public Transport System - key elements of supply, demand and operation (Source: SUMP of MoT 2021)

	2018	2030
Supply		
Service km	96.839	119.347
Total network capacity (passengers)	854.188	1.635.096
Required bus fleet	444	457
Number of PuT lines	79 (buses)	94 bus lines 2 metro lines 2 lines of suburban railway 1 maritime transport line
Number of daily departures of PuT vehicles (all directions)	7526	9800
Demand		
Total daily passenger km	2.091.516	4.353.529
Total daily passenger hours	127.611	178.064
Transfer rate	0,3	0,6
Percentage of trips without transfer	69%	53%
Percentage of trips with 1 transfer	28%	34%
Percentage of trips with 2 or more transfers	3%	13%
Operation		
Average travel distance (km)	7	10
Average total travel time (minutes)	43	46
Average time in vehicle (minutes)	23	21
Average walking time (for boarding to Public Transport) (minutes)	8	11
Average speed inside the vehicle (km / h)	16	24

As shown in the Table 10 above, the introduction of new public transport schemes and the restructuring of bus lines lead to an increase of the offered vehicle kilometers by 23%[8] for 2030 and almost to the doubling of the passengers capacity. This increase is mainly due to the start-up of the metro and the high frequencies of its trains. In addition, the introduction of the new transport modes and their integration to a modern public transport network increases multimodality (increase in the average number of transfers from 0.3 to 0.6). The average travel distance with Public Transport shows an increase of 43%[9] for 2030 (reaching 10 km), while the average speed increases from 16 km / h to 24 km / h, an increase due mainly to the highest speed of subway trains. Metro's share of the total daily ridership reaches around 25% for 2030, estimating daily ridership around 200,000. The daily ridership of the Western Suburban Road corresponds to 2% of the total daily ridership (approximately 19,000), while the maritime transport serves around 8,000 passengers per day (1% of the total daily ridership). New public transport modes and the restructuring of existing one's will result in the increase of public transport share in the daily trips of citizens and at the same time to the decrease in the use of private cars. This change will be beneficial to the overall vehicle kilometers reduction and therefore to CO_2 emissions reduction.

5.3.5 Fuel based reduction of Vehicle Kilometres (2050ClimobCity)

The current section provides the output of the simulation of the 2050CliMobCity alternative scenarios, as presented in section 5.2 of the current document. The results are presented in comparison with the relevant SUMP's simulation results for years 2018 and 2030.

5.3.5.1 Shared electric mobility introduction

The characteristics of demand of the shared electric car mobility scheme are presented in Table 12 as an average value of the two electric car fleet (sub-) scenarios (100 or 200 e-cars) in terms of intra-municipal car trips (car trips having their both ends within the Municipality of Thessaloniki).

Table 12: Inter-municipal car & taxi trips (source: CERTH/HIT model, applying MOMENTUM simulation tools)

	Existing situation 2018		Business As Usual scenario 2030 (SUMP 2030)		2030 after electric car sharing scheme	
	Hourly	***Daily***	***Hourly***	***Daily***	***Hourly***	***Daily***
Inter-municipal car trips	3.500	50.200	3.200	42.900	110	1.760
Inter municipal taxi trips	290	4.200	260	3.500	-	-
Total	**3.790**	**54.400**	**3.460**	**46.400**	**110**	**1.760**

Table 12 shows that from the 3.200 car trips performed on hourly basis and from 42.900 on daily basis according to the BAU Scenario for 2030 (SUMP 2030) the electric car sharing mobility scheme undertakes approximately 3% and 4% respectively (110 trips and 1.760). Comparing the penetration rate of electric car sharing scheme with the car trips of the base year 2018 the percentage of inter-municipal private car trips that become greener are 3% of the hourly and 3,5% of the daily. Table 13 presents the analysis regarding the hourly vehicle-kilometres for MoT.

Table 13: Hourly vehicle kilometres (source: CERTH/HIT model, applying MOMENTUM simulation tools)

	Existing situation 2018		Business As Usual scenario 2030		2030 after electric car sharing scheme		
	car	***taxi***	***car***	***taxi***	***car***	***taxi***	***E - car***

[8] Percentage Increase = (Final Value – Starting Value) / Starting Value * 100

[9] Percentage Increase = (Final Value – Starting Value) / Starting Value * 100

Hourly veh/kms Municipality	108.600	7.400	95.000	7.000	94.000	7.000	600

The average distance of the trips undertaken with the electric car sharing scheme is around 5,5 km, leading to a further reduction of the fuel-based car vehicle-kilometres of around 1% for the Municipality in relation to the Business As Usual scenario for 2030[10] and around 13% in relation to the existing situation of the base year 2018.[11]

5.3.5.2 Electrification of public bus fleet

Table 14 presents the daily and peak-hour (08:00 – 09:00 a.m.) public bus vehicle kms per bus vehicle category that are travelled within the borders of the Municipality of Thessaloniki for the SUMP base year (2018) and the SUMP 2030 scenario.

Table 14: Daily and peak-hour public bus vehicle kms travelled within the Municipality of Thessaloniki per bus vehicle type (2018 and 2030) (source: CERTH/ HIT model, applied for Thessaloniki's Bus Fleet Renewal Action Plan)

Bus type	Daily vehicle kilometres travelled within the Municipality of Thessaloniki		Peak-hour vehicle kilometres travelled within the Municipality of Thessaloniki	
	Existing situation 2018	BAU 2030 (SUMP 2030)	Existing situation 2018	BAU 2030 (SUMP 2030)
Articulated buses	13297	8069	846	501
Standard buses	12228	7498	808	466
Midi buses	1603	3089	109	202
Mini buses	246	434	15	31
Total	**27374**	**19090**	**1778**	**1200**

Table 14 shows that, there is already a reduction of around 31% in the daily vehicle kilometres and around 32% in the peak-hour vehicle kilometres between the base year 2018 and the Business As Usual scenario for 2030 (SUMP 2030), which is attributed to the rationalization of the re-designed bus lines (abolishment of parts or of whole existing lines, where necessary, minimization of overlapping of the bus line routes, etc.). Following, Table 15 summarizes the bus lines of the re-designed public bus network that are proposed for electrification along with the type of vehicle serving each line (mini, midi or standard), the geographical reference of the line and the total ('green') daily and peak hour vehicle kilometres run by each line within the Municipality of Thessaloniki.

Table 15: "Green" daily and peak-hour vehicle kilometres travelled within the Municipality of Thessaloniki (2030) (source: CERTH/ HIT model, applied for Thessaloniki's Bus Fleet Renewal Action Plan)

	Proposed electric bus line	Type of bus vehicle	Geographical reference	Daily veh-kms run within the Municipality	Peak-hour veh-kms run within the Municipality
1	50 (Cultural line)	Standard	Historical centre	70	9
2	56	Standard	Non-core urban areas	205	13
3	64	Standard	Non-core urban areas	112	7
4	100 (local)	Midi	Historical centre	310	20
5	111	Standard	Core urban area	761	46
6	115	Midi	Historical centre	1031	70
7	116	Midi	Historical centre	987	71
8	223	Standard	Core urban area	354	22

[10] Considering also an average distance trip with electric car-sharing within the Municipalities of Kalamaria and Pilea-Hortiati of around 1,8 kms and 8kms respectively, some fuel-based vehicle-kms "savings" can be also reported (100 veh/kms within Kalamaria and 105 veh/kms within Pilea-Hortiatis)

[11] [(V2 – V1) / V1]* 100

	Proposed electric bus line	Type of bus vehicle	Geographical reference	Daily veh-kms run within the Municipality	Peak-hour veh-kms run within the Municipality
9	226	Standard	Core urban area	181	11
10	228	Standard	Non-core urban areas	339	22
11	245	Standard	Non-core urban areas	107	7
12	258	Standard	Non-core urban areas	405	26
13	280	Standard	Core urban area	296	18
14	300	Standard	Core urban area	201	12
15	301	Midi	Historical centre	135	9
16	302	Midi	Historical centre	221	12
17	303	Standard	Historical centre	211	13
18	311	Standard	Core urban area	321	20
19	324	Midi	Historical centre	405	20
20	330	Standard	Core urban area	547	35
21	333	Standard	Core urban area	61	4
22	337	Standard	Core urban area	255	12
23	507	Standard	Core urban area	614	38
24	539	Standard	Core urban area	201	13
25	619	Standard	Core urban area	144	9
26	620	Standard	Core urban area	145	9
27	621	Standard	Core urban area	145	9
28	625	Standard	Core urban area	143	9
29	629	Standard	Core urban area	100	6
30	634	Standard	Core urban area	145	9
31	635	Standard	Non-core urban areas	124	8
			total	**9276**	**589**

The total bus vehicle kms that are becoming “green” within the Municipality of Thessaloniki are **9276** on a daily basis and **589** on a peak hour basis. Figure 29 provides the map of the proposed electric bus lines. Colour coding of the bus lines refers to categories of lines, as these defined in the re-designed bus network.

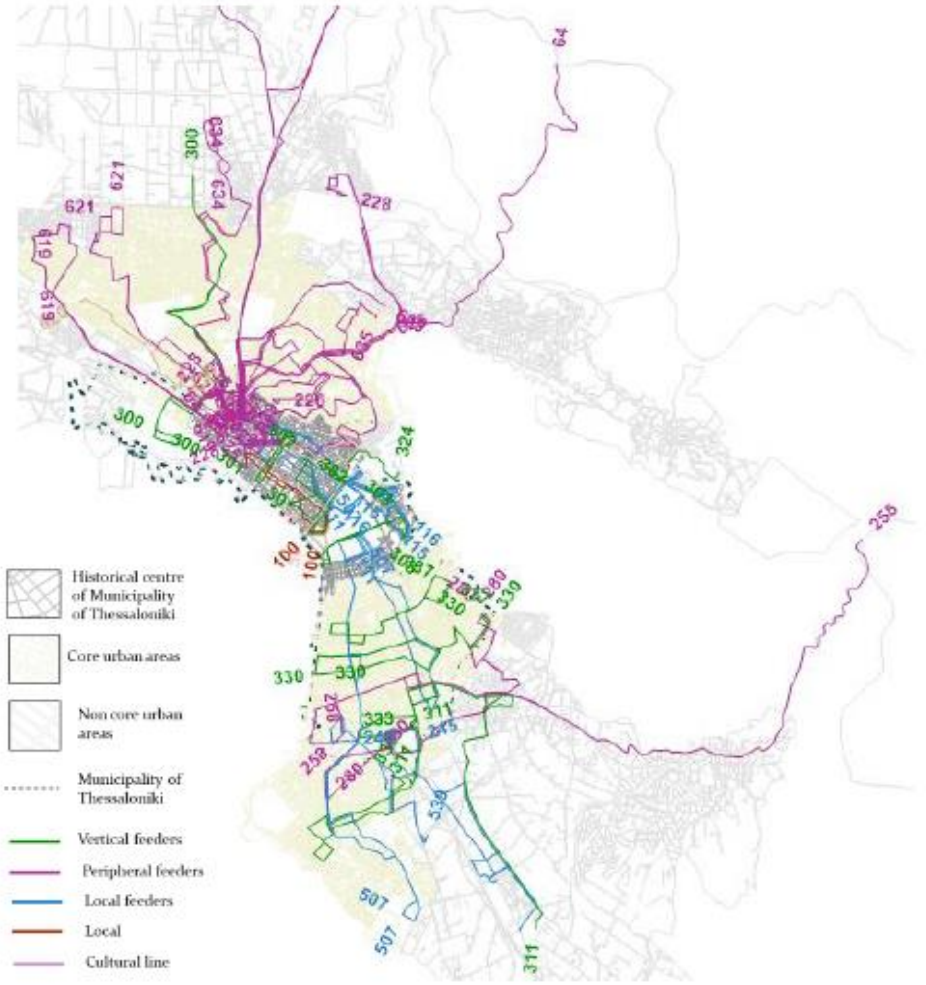


Figure 29: Proposed electric bus lines (source: CERTH/ HIT model, applied for Thessaloniki's Bus Fleet Renewal Action Plan)

The further reduction of the "fuel-based" vehicle kilometres is presented in Table 16.

Table 16 Reduction of "fuel-based" public bus vehicle kms for the Municipality of Thessaloniki (source: CERTH/ HIT model, applied for Thessaloniki's Bus Fleet Renewal Action Plan

Bus type	Daily "fuel-based" vehicle kilometres travelled within the Municipality of Thessaloniki			Peak-hour "fuel-based" vehicle kilometres travelled within the Municipality of Thessaloniki		
	Existing situation 2018	BAU 2030 (SUMP 2030)	Electrification of public bus fleet (2030)	Existing situation 2018	BAU 2030 (SUMP 2030)	Electrification of public bus fleet (2030)
Total	27374	19090 (-31%)	9814 (-49%)	1778	1200 (-32%)	611 (-49%)

Table 16 shows that:

- On a daily basis for the year 2030, between the Business As Usual scenario and the electrification of the public bus fleet, a 49% reduction in the daily fuel based vehicle kms is noted.
- Respectively, for the peak hours the reduction of the fuel based vehicle-kms is also equal to 49%.
- Compared to the current situation of 2018, the corresponding reduction of fuel based vehicle kms is 64% on a daily basis and 66% during peak hour.

6. Cost of scenarios

Table 17: Cost of measures and interventions (SUMP of MoT 2021 and 2050CliMobCity)

Interventions	Cost 2030 (€)
Business As Usual scenario 2030	**116.531.842,98**
Studies / projects with secured funding until February 2021	
Intervention of Egnatia Avenue and accompanying projects	
Vas. Olgas Street Rehabilitation	
Undergrounding of Vas. Georgiou Street	
Regeneration of Kon. Karamanli Street	
Construction of wooden deck	
Street openings	
Node operation review and / or new signalling nodes	
Remodelling of signalling nodes and signalling programs	
One-way and two-way	
Suggested pedestrianized roads	
Proposed conversions of roads to light traffic	
Review and upgrade of the existing network of bike infrastructure	
Proposed extension of the existing network of bike infrastructure	
Creating smart crossings	
Construction of Park & Ride areas	
ITS implementation	
Development of Sustainable Urban Logistics Plan (SULP)	
Installation of telematics in loading and unloading locations	
Study for the provision of specific spaces for the creation of charging infrastructures for electric car sharing schemes	
Installation of infrastructure for electric car sharing systems	
Implementation of public charging systems	
Continuous monitoring of sustainable mobility	
Interventions for the improvement of road sections with a high load / capacity ratio	
Scenario A	**3.831.250,00**
Shared electric mobility introduction (a.1) [12]	
Awareness raise campaigns (a.2) [13]	
Scenario B	**20.000,00**
Electrification of public bus fleet (b.1)[14]	
Promotion of THESSM@LL for Real time information of citizens (b.2)[15]	
Scenario C	**7.000.000,00**
Electrification of the Municipal fleet (c.1)[16]	
Scenario D	**10.000.000,00**
Energy savings from street lighting (d.1)[17]	

[12] Feasibility Study, Vehicle's procurement, Small Scale interventions in public space

[13] Awareness raising action plan and organization of three events per year

[14] The cost doesn't concern the municipal budget but Thessaloniki Transport Authority budget

[15] Promotion actions

[16] Procurement of vehicles

[17] Study of equipment upgrade, procurement of infrastructure, installation and management of smart lighting platform

7. Preliminary CO_2 emission results

According to the results of the CO_2 emissions analysis performed by the Potsdam Institute for Climate Impact Research, the following conclusions for the City of Thessaloniki are noted:

- For the Business as Usual Scenario (BaU) a slight increase of 3% in CO_2 emissions can be identified due to the population growth between 2018 and 2030. It is worth mentioning that although the BAU scenario contains extensive interventions in the road network in favour of sustainable mobility solutions and the introduction of new public transport modes, perhaps all these are not reflected in the citizens mode choice and therefore to their shift from private vehicles to public transport. Apart from that, in the BaU scenario no initiatives are taken regarding the upgrade of the technology (fuel) used from the private and public vehicles.
- On the other hand for the Final (combined: BaU and alternative scenarios) a reduction of 18% in CO_2 emissions can be identified, after the implementation of all the proposed measures, between 2018 and 2030. This result arises mostly from the extensive electrification of the public fleet and the vehicle kilometers that become “greener” within the city network.

This reduction in GHG emissions is very close to the goal of 20% reduction for the 2030 time horizon set by the Operational Programme of the Region of Central Macedonia, but way further from the goal of 42% reduction set by national policies and adopted by MoT. However, the reduction of 42% in CO_2 emissions refers to those that come from all sectors of the economy, such as industry and buildings (houses, offices etc.) and not only from transport, not to mention that as base year is considered the year 1990 (unlikely there is available data for that year). Consequently, the reduction of 18% can be considered quite sufficient for the City of Thessaloniki. Nevertheless, additional initiatives of the MoT to succeed better results from the transport sector in the field of energy consumption and CO_2 emission should focus on:

- The actual implementation of the proposed measures in the final combined scenario
- Accompanying to those measures, awareness raise campaigns for citizens, that underline the advantages and benefits of the public transport and alternative transport modes compared to private vehicles from the local economy, society and the environment
- Further initiatives regarding the fuel technology of private and public vehicles

8. Municipality of Thessaloniki Action Plan

The Action Plan of 2050CliMobCity is not only directly, but also indirectly related to the concept of the final (combined) mobility scenario for the 2030 time horizon for Thessaloniki’s Municipality.

However, the action plan should be implemented and monitored during the second phase of the project, which lasts one (1) year; **therefore there are some time constraints that should be taken into account.**

Moreover the Action plan should contain:

- Activities to support the creation or adaptation of a policy, resulting in a process
- Activities to create, improve or strengthen, elaborate or supplement policy plans, resulting in a policy plan
- Activities to achieve concrete policy implementations of measures in practice

In advance for each action of the 2050CliMobCity Action Plan should be justified:

- the way the action is linked to the project,
- the nature of the activity to be implemented,
- the timeframe,
- the stakeholders involved,
- the costs and the funding sources,

Last but not least, the actions that are going to be implemented are aiming to influence policy instruments addressed in the application form of the project, which is actually the Operational Programme of the Region of Central Macedonia and in addition the Operational Programme of the Municipality of Thessaloniki. Taking into consideration the above, a consultation procedure took place with the participation of Municipal Services (Dpt. of Operational Planning and Development Programmes Monitoring of Thessaloniki Municipality, Dpt. Of Urban Planning, Department of Urban Environment Management and Dpt. of Sustainable Mobility and Networks Sector of Transportation Planning of Thessaloniki Municipality) and the Administration Authority representatives in order to identify attainable activities in the time frame of the 2nd Phase, which are also related to 2050CliMobCIty content and are actually accompanying measures to the measure packages of the final scenario, calculated and tested by using CERTH/HIT model, and contain the initial preparation and the initial steps that should be undertaken by the City in order to be ready in the future to actually plan and implement those measures. Those actions are the following:

1. **Technical Specifications for the elaboration of the "Sustainable Urban Logistics Plan (SULP)" of the Municipality of Thessaloniki**

The first step for the elaboration of a SULP is the preparation of the Technical Specifications of the project. MoT will prepare a **Technical Report** that will describe the prerequisites, the requirements and the necessary steps for elaborating a Sustainable Urban Logistics Plan. This report will be sent to the appropriate Stakeholders (see step 3 below), in order to receive comments and be further enriched and verified. In addition a business meeting will take place with the responding stakeholders for the final verification of the Report. By doing this, the Municipality will have set the overall framework for the SULP's future development.

2. **Sign of a Memorandum of Understanding (MoU) with the Thessaloniki Smart Mobility Living Lab (ThessM@ll) for Real time information services for citizens**

Thessaloniki Smart Mobility Living Lab (THESSM@LL), one of Europe's largest Living Labs, can contribute to some of these mobility changes, in particular 1, 2 and 5. The entire city of Thessaloniki is a platform for testing technological and innovative solutions for mobility, cooperative and autonomous vehicles and will soon be extended to freight transport. Thessm@ll is operated by the Hellenic Institute of Transport (HIT) and includes, among others:

- Real time traffic data in Thessaloniki
- Short-term predictions of traffic conditions from multiple sources
- Exporting and formulating mobility and activity patterns
- Extended Internet of Things (IoT) equipment

Apart from citizens' information, the services of the Living Lab will be exploited constantly by the competent departments of MoT in order to plan targeted future mobility measures and interventions that actually solve the existing problems of the network and fit citizens mobility needs. These will result in a more effective use of the financial resources available for mobility projects. Municipality of Thessaloniki is willing to be part of ThessM@ll ecosystem which means exchanging data, directly or indirectly related to mobility, with the involved stakeholders and also exploiting the services that are being developed by the Living Lab. By doing these Municipality will be able to develop real time information services about the traffic conditions in the city's network to encourage citizens to take anytime the most sustainable choice about mobility. This service will result in the reduction of private cars share in the modal split and in the reduction of the fuel based vehicle kilometres within the city's network. Prerequisite for the Municipality to be part of the ThessM@ll is the sign of a Memorandum of Understanding (MoU). To achieve that a consultation procedure should initially begin within the Municipality in order to raise awareness of the Administrative Authority about the necessity of that action and commit them to take action. After the political commitment is succeeded, the Municipal staff members will communicate with the representatives of the Hellenic Institute of Transport, who are responsible for the operation of the Lab, in order to arrange the necessary meetings to discuss the pathway

that Municipality of Thessaloniki will become part of ThessM@ll ecosystem. The final output of the 2nd Activity of the Action Plan is the sign of the MoU between Municipality of Thessaloniki and ThessM@ll Living Lab.

3. Pilot installation of micro mobility hubs of electric sharing transport schemes in City's public space

In the city's public space and more specifically near important points of interests or work spaces, which are actually the common destinations of daily trips of the citizens and in areas with high population density, which are simultaneously the origin of those trips, will be pilot installed infrastructure where the citizens can find sharing electric bicycles or scooters and even park their private ones. The hubs will be operated by the Municipality with the cooperation of bike - scooter sharing companies. In order for the Municipality to be able to pilot implement those hubs the initial planning of the system is required in order to identify the more suitable locations for the implementation of the system and the specification of the required public space regulations that are needed for the operation of the system. Finally, the preparation of the tender notice for the procurement of the bicycle – scooters is needed.

4. MoU sign with at least one of the Universities' administration of the City Centre, part of which are targeted awareness raise campaigns for University Students' mode choice and information about its impact in the environment, the city and the individuals

This activity of the Action Plan refers to the organization and implementation of a campaign entitled "The citizens part of the solutions for sustainable mobility". The campaign will exploit the cooperation with THESSM@LL services for comparing the real cost (out-of-the-pocket money, duration trip, delays, etc.) for the citizens performing trips with private cars among city areas with the one for making the same trip with available (sustainable) modal alternatives is foreseen. The target group of that campaign will be the Students of Aristotle University and University of Macedonia aged 18-24. The Aristotle University of Thessaloniki is located at the Center of Thessaloniki with a student population of 40.000 active students. Nearby is the University of Macedonia with approximately 20.000 active students. All these students move daily from different areas of the City to the Universities Facilities occupying a significant share of the daily trips performed within the City. Taking into consideration that the Students are one of the most active, environmentally aware and open minded groups of the society, the effort to trigger behavioral changes for mode choice through awareness campaigns is of high priority, together with the fact that this group of citizens will be the policy makers of tomorrow. Also, the collaboration of MoT with the Deans of Aristotle University of Thessaloniki and University of Macedonia sealed with a Memorandum of Understanding would add an institutional value to the activity and further increase its impact to University students and therefore to Thessaloniki's citizens. The main components of the campaign are:

- Newsletters sent to the students
- Consultation events in the City Hall
- Collaboration with the Dean of the University

It is worth mentioning that the nature and thematic areas of the activities of Thessaloniki's Action Plan are based on the planning and promotion of mobility sectors that have not been yet covered sufficiently by the City's existing strategy of reducing CO_2 due to the fact that the conditions were not mature enough for their actual implementation. Therefore the proposed thematic areas are based on:

- electromobility,
- real time information services,
- sharing transport schemes,
- awareness raise,

and not so much on the implementation of bicycle and pedestrian infrastructure and public transport facilities, as all these measures have already been extensively studied in various projects in the past and are already in the planning process of the City.