



Conference on
Sustainable Urban Mobility 2018
24 - 25 May 2018, Skiathos Island - Greece



Programme		Programme	
Location: THE SKIATHOS PALACE HOTEL		Location: THE SKIATHOS PALACE HOTEL	
Date: Thursday, 24/5/2018		Date: Thursday, 24/5/2018	
Room: "Lalaria"		Room: "Kechria"	
08:00-09:00	Registration	08:00-09:00	Registration
09:00-11:00	Session 1A: Social networks and traveller behavior I Moderators: Odile Heddebaut, Piyushimita Thakuriah The walkability of Thessaloniki: citizens' perceptions - <i>Roxani Gkavra, Dimitrios Nalmpantis, Evangelos Genitsaris and Aristotelis Naniopoulos</i> Perception of smartphone applications about transportation among university students - <i>Charis Chalkiadakis, Rallou Taratori, Socrates Basbas and Ioannis Politis</i> Social networking and Driving. A study about young Greeks - <i>Theonymphi Xydianou, Pantelis Kopelias, Christos Marios Polymeropoulos and Elissavet Demiridi</i> Crowdsourcing and visual research methodologies to promote data collection for sustainable mobility planning - <i>Efthimios Bakogiannis, Maria Siti, Konstantinos Athanasopoulos, Avgi Vassi and Charalampos Kyriakidis</i> Megatrends, a way to identify the future transport challenges - <i>Vladislav Maras, Mirjana Bugarinovic, Eleni Anoyrkati and Alba Lina Avarello</i> Unveiling the potential of C-ITS: market research analysis - <i>Ivan Zaldivar, Eleni Anoyrkati, Alexis Garcia-Pérez, Alba Lina Avarello, Viara Bojkova, Xavier Leal and Victor Corral</i> Tactical urbanism: Reclaiming the right to use public spaces in Thessaloniki, Greece - <i>Margarita Angelidou</i> How big data affects the design of urban furniture: An approach from the perspective of industrial design - <i>Selim Hikmet Şahin and Füsün Curaoğlu</i>	09:00-11:00	Session 1B: Public transport and demand responsive systems I Moderators: Antonio Polimeni, Mihails Savrasovs Evaluation of probabilistic demands usage for the online dial-a-ride problem - <i>Athanasios Lois, Athanasios Ziliaskopoulos and Tsalapatas Spyros</i> Understanding taxi travel demand patterns through Floating Car Data - <i>Agostino Nuzzolo, Antonio Comi, Enrica Papa and Antonio Polimeni</i> Critical Moment for Taxi Sector: What should be done by traditional Taxi sector after the TNC disruption? - <i>Kaan Yildizog and Prof. Dr. Murat Celik</i> Predictive maintenance for buses: Outcomes and potential from an Italian case study - <i>Maria Vittoria Corazza, Daniela Vasari, Enrico Petracci and Luigi Brambilla</i> Electrification of public transport: lessons from the ELIPTIC project - <i>Yannick Bousse, Maria Vittoria Corazza, Jan Kowalski, Gerhard Sessing, Diego Salzillo Arriaga and Marjorie De Belen</i> Conjoint Analysis for the optimization of a potential flexible transport service (FTS) in the region of Zagori, Greece - <i>Alexandros Tsooukanelis, Evangelos Genitsaris, Dimitrios Nalmpantis and Aristotelis Naniopoulos</i> Theoretical view on the designing of prototype of business model for a transport company - <i>Oksana Skorobogatova and Irina Kuzmina-Merlino</i>
11:00-11:30	Coffee Break	11:00-11:30	Coffee Break
	Keynote Speakers Session Moderator: Eftihia Nathanail "A Geospatial Perspective on Sustainable Urban Mobility in the Era of Big Data" - <i>Prof. Bin Jiang</i> "Exploring social and economic implications of big data for mobility" - <i>Prof. Piyushimita Thakuriah</i> "ECO Driving: Strategies and Impacts" - <i>Prof. Alexander Skabardonis</i>		
13:30-14:00	Sponsors Session Moderator: Eftihia Nathanail "Attica Tollway Traffic Operations. Enhancing Road Safety with the use of new technologies" - <i>ATTIKI ODOS: Dr. Dimitris Serbis</i> Capabilities and applications of ArcGIS" - <i>Marathon Data Systems</i>		
14:00-15:00	Lunch	14:00-15:00	Lunch
15:00-17:00	Session 2A: Traffic emissions and environmental impacts I Moderators: Fotini Kehagia, Dimitris Serbis Development of a methodology, using Multi-criteria Decision Analysis (MCDA), to choose between full pedestrianization and traffic calming area (woonerf zone type) - <i>Ioannis Vasileiadis and Dimitrios Nalmpantis</i> Influence of traffic emissions on urban air quality: a case study of a medium sized city - <i>Aggelos Aggelakakis, Afroditi Anagnostopoulou, Alkiviadis Tromaras and Maria Boile</i> Cycling as a key component of the Athenian sustainable urban mobility plan - <i>Efthimios Bakogiannis, Maria Siti, Georgia Christodouloupoulou, Christos Karolemeas and Charalampos Kyriakidis</i> Assessment of CO2 footprint of the new Athens Metro line 4 during the operation phase - <i>Aristidis Giakoumis, Fotini Kehagia and Efthimios Zervas</i> Considerations on sustainable mobility: The contribution of cycling to the shift of transportation behaviour - <i>Elias Papastavrinidis, George Kollaras, Vasiliki Kollarou and Antonia Athanasopoulou</i> Modelling travelers' behavior in the presence of reward schemes offered for green multimodal choices - <i>Amalia Polydoropoulou, Ioanna Pagoni, Athena Tsirimpa and Ioannis Tsouros</i> Densification of cities or improved transport technology to curb CO2 emissions? - <i>Harald Nils Rostvik</i> Traffic and environmental rehabilitation of the Agioi Anargyroi square of the Municipality of Agioi Anargyroi – Kamatero - <i>Christina Margariti, Efthimios Zervas and Dimitrios Nalmpantis</i>	15:00-17:00	Session 2B: Public transport and demand responsive systems II Moderators: Umberto Crisalli, Ioannis Politis Investigating potential synergies among social entrepreneurship and public transport through experts' consultation in Greece - <i>Afroditi Stamelou, Evangelos Genitsaris, Dimitrios Nalmpantis and Aristotelis Naniopoulos</i> Modeling transit user travel time perception in a post-economic recession era: The case of Athens, Greece - <i>Athanasios Kopsidas, Konstantinos Kepaptsoglou, Eleni Vlahogianni and Christina Iliopoulou</i> The aesthetic integration of a tramway system in the urban landscape- evaluation of the visual nuisance - <i>Christos Pyrgidis, Antonios Lagarias and Alexandros Dolianitis</i> Redefinition of public transport in the Alto Minho region, Portugal – an overview - <i>Sara Baltazar, Luís Barreto and António Amaral</i> A criteria-based evaluation framework for assessing public transport related concepts resulted from collective intelligence approaches - <i>Evangelos Genitsaris, Afroditi Stamelou, Dimitrios Nalmpantis and Aristotelis Naniopoulos</i> A concept for smart transportation user-feedback utilizing volunteered geoinformation approaches - <i>Benjamin Dienstl and Johannes Scholz</i> Operating resilience of severely disrupted urban transport systems - <i>Sofia Bouki, Alexandros Deloukas, Efthymia Apostolopoulou and Anna Anastasaki</i> Public transport in transnational peripheral areas: challenges and opportunities - <i>Federico Cavallaro and Giulia Sommacal</i>
17:00-17:30	Coffee Break	17:00-17:30	Coffee Break
17:30-19:30	Session 3A: Data security and legal issues Moderators: Antonio Comi, Pantoleon Skayannis Major limitations and concerns regarding the integration of autonomous vehicles in urban transportation systems - <i>Panagiotis Fafoutellis and Eleni Mantouka</i> Data protection in smart cities: application of the EU GDPR - <i>Maria Stefanouli and Chris Economou</i> Connected and autonomous Vehicles – Legal issues in Greece, Europe and USA - <i>Elissavet Demiridi, Pantelis Kopelias, Eftihia Nathanail and Alexander Skabardonis</i> Implementing a blockchain infrastructure on top of vehicular ad hoc networks - <i>Anargyros Gkogkidis, Nikolaos Giahoudis, Georgios Spathoulas and Ioannis Anagnostopoulos</i> Shared autonomous electrical vehicles and urban mobility: a vision for Rome in 2035 - <i>Agostino Nuzzolo, Luca Persia, Antonio Comi and Antonio Polimeni</i> Do urban transport planning principles apply to Norwegian medium-sized sprawling city regions? The case of Stavanger region - <i>Daniela Mueller-Eie</i> Health related benefits of non-motorised transport: an application of the Health Economic Assessment tool of the World Health Organisation to the case of Trikala, Greece - <i>Pantoleon Skayannis, Marios Goudas, Diane Crone, Sonja Kahlmeier, Nick Cavill and Vasilena Mitsiadi</i> Autonomous vehicles and blockchain technology are shaping the future of transportation - <i>Panagiota Georgia Saranti, Dimitra Chondrogianni and Stylianos Karatzas</i>	17:30-19:30	Session 3B: Application of big data technologies in transport Moderators: Spyridon Vougiaris, Irina Yatskiv Applying unsupervised and supervised machine learning methodologies in social media textual traffic data - <i>Konstantinos Kokkinos, Eftihia Nathanail and Elpiniki Papageorgiou</i> Making big data real in upcoming future: the dynamic toll prices in the Portuguese highways - <i>André Ramos, Alexandra Rodrigues, Sónia Machado, Filipa Antunes, Pedro Ventura, Artur Martins and Akrivi Vivian Kiousi</i> Assessment of dynamic geo-positioning using multi-constellation GNSS in challenging environments - <i>Stella Strataki, David Bétaille and Urs Hugentobler</i> A thorough review and analysis of journey planners - <i>Dimitrios Sourlas and Eftihia Nathanail</i> Investigating multiple areas of mobility using mobile phone data (Smartcare) in Chile - <i>Paul Elliott and Romain Deschamps</i> The contribution of open big data sources and analytics tools to sustainable urban mobility - <i>Stavros Samaras-Kamilarakis, Petros Angelos Vogiatzakis, Teti Nathanail and Lambros Mitropoulos</i> Beyond travel time savings: Conceptualizing and modelling the individual value proposition of mobility - <i>Giuseppe Lugano, Zuzana Kurillová, Ghadir Pourhashem and Martin Hudak</i> Future technologies in the EU transport sector and beyond: an outlook of 2020-2035 - <i>Alkiviadis Tromaras, Aggelos Aggelakakis, Merja Hoppe, Thomas Trachsel and Eleni Anoyrkati</i>
20:30-23:30	Gala Dinner @ My Ithaki Restaurant	20:30-23:30	Gala Dinner @ My Ithaki Restaurant



Programme			
Location: THE SKIATHOS PALACE HOTEL			
Date: Friday, 25/5/2018			
Room: "Lalaria"			
09:00-11:00	Session 4A: ALLIANCE Special Session Moderators: Irina Kuzmina-Merlino, Irina Pticina Integrating logistics and transportation simulation tools for long-term planning - <i>Ioannis Karakikes, Wladimir Hofmann, Lambros Mitropoulos and Mihails Savrasovs</i> Development and simulation of priority based control strategies of ground vehicles movements on the aerodrome - <i>Iyad Alomar, Juri Talujew and David Weigert</i> Design and prototyping of IoD shared service for small and medium enterprise - <i>Aleksandrs Avdeikins and Mihails Savrasovs</i> Comparing the customer use and satisfaction in two Latvian transport Interchanges - <i>Irina Yatskiv and Vaira Gromule</i> Investigating the accessibility Level in Riga's International Coach Terminal: A comparative analysis with European Interchanges - <i>Evelina Budilovich, Vissarion Magginas, Giannis Adamos, Irina Yatskiv and Maria Tsami</i> Impact of critical variables on economic viability of converted diesel city bus into electric bus - <i>Kristine Malnaca and Irina Yatskiv</i> Shopping malls accessibility evaluation based on microscopic traffic flow simulation - <i>Mihails Savrasovs, Irina Pticina and Valery Zemljanikins</i>		
	11:00-11:30	Coffee Break	
	11:30-13:30	Session 5A: Data-driven infrastructure management Moderators: Socrates Basbas, Alexander Skabardonis Performance evaluation of GLOSA-algorithms under realistic traffic conditions using C2I-communication - <i>Michael Kloeppel, Jan Grimm, Severin Strobl and Rico Auerswald</i> Have information technologies forgotten pedestrians? to what extent can it/its improve pedestrian's mobility and safety - <i>Hector Monterde-I-Bort, Socrates Basbas, Charlotta Johansson, Lars Leden and Per Garder</i> Trip generation rates for a University campus: the case of the Aristotle University of Thessaloniki, Greece - <i>Socrates Basbas, Konstantinos Takatzoglou, George Mintsis, Christos Taxiltaris and Ioannis Politis</i> An analysis on drivers' self-reported questionnaire responses, regarding aggressive driving, attitude toward cyclists and personal values - <i>Kyriakos Andronis, Nikolaos Mavridis, Alexandros Oikonomou and Socrates Basbas</i> Redesigning the seafront area of Pafos - <i>Spyridon Vougias, Konstantina Anastasiadou and Giorgos Vergas</i> Development of an aggregate indicator for evaluating sustainable urban mobility in the city of Xanthi, Greece - <i>Anastasis Tsiropoulos, Apostolos Papagiannakis and Dionisis Latinopoulos</i>	
		13:30-14:30	Lunch
		14:30-16:30	Session 6A: City logistics systems Moderators: Athanasios Galanis, Daniela Mueller-Eie A new gold mine? Identifying crucial factors affecting the potential of a freight tram for urban freight distribution - <i>Katrien De Langhe, Hilde Meersman, Christa Sys, Eddy Van de Voorde and Thierry Vanelslander</i> Development of a smart picking system in the warehouse - <i>Raitis Apsalons and Genadijs Gramovs</i> A conceptual framework for planning transshipment points for cargo bikes in last mile logistics - <i>Tom Assmann, Evelyn Fischer and Sebastian Bobeth</i> SWOT analysis for the introduction of night deliveries policy in the Municipality of Thessaloniki - <i>Efstathios Bouhouras and Socrates Basbas</i> Design of a digital collaborative tool to improve mobility in the Universities - <i>Ariela Goldbard, Ana Velazquez, Rodrigo Rebollo, Erick López, Octavio Mercado and Felipe Victoriano</i> The implementation of environmental friendly city logistics in south Baltic Region cities - <i>Stanislaw Iwan and Kinga Kijewska</i>
16:30-17:00			Coffee Break
17:00-19:00	Session 7A: NOVELOG Special Session Moderators: Giannis Adamos, Harald Nils Rostvik Environmental aspects of urban freight movement in private sector - <i>Afroditi Anagnostopoulou and Maria Boile</i> Assessing traffic and environmental impacts of smart lockers logistics measure in a medium-sized municipality of Athens - <i>Vasileios Kiousis, Eftihia Nathanail and Ioannis Karakikes</i> Adaptability/transferability in the city logistics measures implementation - <i>Stanislaw Iwan and Kinga Kijewska</i> Does the implementation of urban freight transport policies and measures affect stakeholders' behavior? - <i>Eftihia Nathanail, Giannis Adamos, Ioannis Karakikes and Lambros Mitropoulos</i> An agent-based simulation of retailers' ecological behavior in central urban areas. The case study of Turin - <i>Elena Maggi, Elena Vallino and Elena Beretta</i> Diagnostic of the European logistics and road freight transportation sector - <i>Georgia Aifadopoulou, Iraklis Stamos, Monica Giannini and Josep-Maria Salanova</i> Urban traffic management utilizing soft measures: A case study of Volos city - <i>Maria Karatsoli, Ioannis Karakikes and Eftihia Nathanail</i>		
	19:00-19:15		Conference closure End of CSUM2018

Programme			
Location: THE SKIATHOS PALACE HOTEL			
Date: Friday, 25/5/2018			
Room: "Kechria"			
09:00-11:00	Session 4B: Traffic emissions and environmental impacts II Moderators: Apostolos Papagiannakis Investigating mobility gaps in University campuses - Panagiotis Papantoniou, Eleni Vlahogianni, George Yannis, Maria Attard, Pedro Valero Mora, Eva Campos Diaz and Maria Tereza Tormo Lancero Big and open data supporting sustainable mobility in smart cities – the case of Thessaloniki - <i>Georgia Aifadopoulou, Josep-Maria Salanova, Panagiotis Tzenos, Iraklis Stamos and Evangelos Mitsakis</i> Economic cost of urban freight GHG mitigation - <i>Christophe Rizet and Tu Thi Hoai Thu</i> Road traffic noise reduction and sustainable transportation: A case survey in the cities of Athens and Thessaloniki, Greece - <i>Vassilios Profillidis, George Botzaris and Athanasios Galanis</i> Sustainable urban mobility plans in Mediterranean port-cities: The SUMPORT project - <i>Marios Miliadou, George Mintsis, Socrates Basbas, Christos Taxiltaris and Antonia Tsoukala</i> Cooperative intelligent transport systems as a policy tool for mitigating the impacts of climate change on road transport - <i>Evangelos Mitsakis and Areti Kotsi</i> Analysis of mobility patterns in selected University campus areas - <i>Eleni Vlahogianni, Panagiotis Papantoniou, George Yannis, Maria Attard, Alberto Regattieri, Francesco Piana and Francesco Pilati</i>		
	11:00-11:30	Coffee Break	
	11:30-13:30	Session 5B: Social networks and traveller behavior II Moderators: Francesco Viti Investigating the role and potential impact of social media on mobility behavior - <i>Maria Karatsoli and Eftihia Nathanail</i> Campaigns and awareness-raising strategies on sustainable urban mobility - <i>Vissarion Magginas, Maria Karatsoli, Giannis Adamos and Eftihia Nathanail</i> A comparison of bicyclist attitudes in two urban areas in USA and Italy - <i>Nikiforos Stamatiadis, Giuseppina Pappalardo and Salvatore Cafiso</i> Behavior and perceptions of University students at pedestrian crossings - <i>Socrates Basbas, Andreas Nikiforiadis, Evaggelia Sarafianou and Nikolaos Kolonas</i> Influence of ICT evolution and innovation on travel and consumption behaviour for determining sustainable urban mobility - <i>Odile Heddebaut and Anne Fuzier</i> ProMaaS - Mobility as a Service for Professionals. Integrated sectorial business platform for multimodal cross border mobility - <i>Christophe Feltus, Adnan Imeri, Sebastien Faye, Gerald Arnould and Djamel Khadraoui</i> TRACE – Cycling & walking tracking data for planning and policy - <i>Pasquale Cancellara, Giacomo Lozzi, André Ramos</i> The use of social computing in travelers' activities preference analysis - <i>Charis Chalkiadakis, Panagiotis Iordanopoulos, Evangelos Mitsakis and Eleni Chalkia</i>	
		13:30-14:30	Lunch
		14:30-16:30	Session 6B: Big data and transport modelling Moderators: Vitalii Naumov, Nikiforos Stamatiadis New indicators in the performance analysis of a public transport interchange using microsimulation tools - The Colégio Militar case study - <i>André Ramos and João de Abreu E Silva</i> Improving the assessment of transport external costs using FCD data - <i>Livia Mannini, Ernesto Cipriani, Umberto Crisalli, Andrea Gemma and Giuseppe Vaccaro</i> A big data demand estimation framework for multimodal modelling of urban congested networks - <i>Guido Cantelmo and Francesca Viti</i> Exploring temporal and spatial structure of urban road accidents: some empirical evidences from Rome - <i>Antonio Comi, Luca Persia, Agostino Nuzzolo and Antonio Polimeni</i> Modeling demand for passenger transfers in the bounds of public transport network - <i>Vitalii Naumov</i> Microsimulation modelling of the impacts of double-parking along an urban axis - <i>Katerina Chrysostomou, Achilleas Petrou, Georgia Aifadopoulou and Maria Morfoulaki</i> Problems, risks and prospects of ecological safety's increase while transition to green transport - <i>Irina Makarova, Ksenia Shubenkova, Vadim Mavrin, Larisa Gabsalikhova, Gulnaz Sadygova and Timur Bakibayev</i> Short-term prediction of the traffic status in urban places using neural network models - <i>Georgia Aifadopoulou, Charalampos Bratsas, Kleonthis Koupidis, Aikaterini Chatzopoulou, Josep-Maria Salanova and Panagiotis Tzenos</i>
16:30-17:00			Coffee Break
17:00-19:00	Session 7B: Transport data and analytics Moderators: Konstantinos Kokkinos, Agostino Nuzzolo Measuring the spatial accessibility of public transport: the case of the new urban rail systems in the city of Thessaloniki, Greece - <i>Ioannis Baraklianos, Konstandina Karagouni and Apostolos Papagiannakis</i> TAToo – A Tracking for pLanning Tool applied to cycling and walking data - <i>André Ramos and João Bernardino</i> Combining land use, traffic and demographic data for modelling road safety performance in urban areas - <i>Efthymis Papadopoulos and Ioannis Politis</i> Urban form and transportation infrastructure in European cities - <i>Poulicos Prastacos and Apostolos Lagarias</i> Assessing the impact of changes in mobility behaviour to evaluate sustainable transport policies: case of university campuses of Politecnico di Milano - <i>Samuel Tolentino, Alberto Bertolin, Paolo Beria, Eleonora Perotto, Fabio Carlo Guerreschi, Paola Baglione and Stefano Caserini</i> Neural network-based road accident forecasting in transportation and public management - <i>Georgios N. Kouziokas</i> Assessment of drivers' perception of quality of service on urban roundabouts - <i>Maria Perpina, Efterpi Damaskou and Fotini Kehagia</i> Luminance adaptive dynamic background models for vision-based traffic detection - <i>Nazmul Haque, Md Hadiuzzaman, Md Yusuf Ali and Farhana Mozumder Lima</i>		
	19:00-19:15		Conference closure End of CSUM2018

Cycling as a key component of the Athenian Sustainable Urban Mobility Plan

Efthimios Bakogiannis¹, Maria Siti¹, Georgia Christodouloupoulou¹, Christos Karolemeas¹ and Charalampos Kyriakidis¹

¹ Sustainable Mobility Unit, National Technical University of Athens

Abstract. The Athenian Strategic Plan for Sustainable Urban Mobility (SUMP) aims to support the most efficient ways of daily commuting towards mitigating limited public spaces, pollution and delays, while increasing individual cycling use and bike sharing services. Bicycle is a major issue in terms of promoting and implementing a robust urban mobility strategy. Improvement of existing infrastructure, development of new networks and specialized lanes, adaptation of the traffic code, awareness raising and integration of technology are among the key aspects of such a strategy. The inclusion of an integrated and coherent cycling network in the Athenian SUMP is the fulfillment of a key strategy, aiming at the development of cycling policies and infrastructure within the overall priorities of a SUMP (i.e. promotion of walking, cycling and public transportation). The promotion and integration of cycling as a bold commuting mode could address a range of mobility problems, making Athens' transportation environment equivalent to other European capitals' that are healthier, functional, safe, productive and attract residents, visitors and investors. This paper presents the methodology of designing the Athenian cycling network, within a new concept of mobility management promoting coexistence rather than the conventional separation standards, while at the same time adjusting vehicle speeds in the various street types. Several elements regarding road safety enhancements are reported, as well as the specific terms of introducing cycling in the current network and bus lanes, sidewalks and pedestrian streets. Lastly proposals regard the supplementation of the existing traffic code and other institutional issues of cycling.

Keywords: cycling, sustainable urban mobility plan, cycle path network, public transport, walking

1 Introduction

The integration of a unified and coherent cycle path network in the evolving Sustainable Urban Mobility Plan (SUMP) of the Municipality of Athens is tantamount to fulfilling the basic criteria set by the strategic directions of Sustainable Urban Mobility in Athens with the aim of promoting cycling and developing its infrastructure in the network of the city, as part of a more general change in priorities that will make the capital city a city of public transport, bicycle and walking.

This paper presents the criteria for the integration of cycle paths in the Athenian network as they result from the analysis of: The Strategic Plan for Sustainable Mobili-

ty in the Municipality of Athens, formulated by the Sustainable Mobility Unit of the NTUA [3] and the main Strategic texts and plans that have been developed and proposed for Athens, over the last five years.

The objective is to establish the corresponding criteria for the cycling network, which will be met according to the Athenian mobility strategy, and also match the activities, proposed actions and projects developed by the SUMP Working Group in all work stages of the project. Cycling in the center of Athens when all interventions will have been completed, will address a wide range of commuting issues, helping the city to become a real European capital, healthy, functional and productive, with a high standard of living, able to attract visitors and investors.

2 Issues related to the integration of bicycle into the Athenian urban transportation system – Theoretical Approach

According to Vlastos [10], pedestrians and cyclists are known to be the best consumers because they have advantages in terms of their increased accessibility in various activities. Their number increases where the conditions for walking and cycling are favorable. New businesses, commercial and recreational activities as well as offices are encouraged to be reallocated to the city center. According to Visitors' Satisfaction Survey & Attica Hotel Performance 2016-2017 [2], foreign visitors prefer hotels located in the historical center of the city and close to museums and shopping streets. A city like Athens, well-known all around the world, should enhance what the visitor wishes to see and enjoy managing to prolong his/her stay with attractive routes linking its key elements and monuments. This means that the whole city, besides its historic center, should be attractive, safe and easily accessible through various means.

Pedestrians and cyclists have direct contact with the space due to their low speed. It is up to them to decide how quickly or slowly they move, or when and for how long they stop according to their surroundings. This is not the case for car or motorcycle drivers who are following the rhythm and speed of the flow. Pedestrians' and cyclists' senses are vivid; hearing, vision, smell and touch allow them to immediately perceive and communicate to the physical and social environment of each trip. They have every reason to be interested and claim a city that is beautiful and rich in stimuli and incentives. These needed qualities differ to those of people who are isolated in the enclosed space of their cars.

The request for a '4km/h architecture' argues the need for infrastructure addressed to pedestrians and cyclists, and spaces that have an identity and are in direct dialogue with people, in contrary to the common demand of those locked within their car passing through the city. The 'architecture of 50 or 80 km/h' is empty of details and silent in communication terms; it is an architecture to watch from a distance while driving through the places. It would not be an exaggeration to argue that sustainable mobility perspective paves the way while also directs the aesthetic reformation of the center of Athens. Sustainable mobility cannot exist in an urban environment which is architecturally indifferent as pedestrians and cyclists need an upgraded environment in terms of public space aesthetics and level of comfort. Cycling shall be integrated progres-

sively in the Athenian streets, starting from where the conditions are already friendly, such as the pedestrianized historical center. It is also important for further cycling integration to be included in all future regeneration plans for the urban and environmental rehabilitation of Athens.

3 Methodology on implementation sustainable mobility strategies for cycling

The Strategy seeks to develop a cycling promotion policy. The development of exclusive cycling infrastructure is the most conventional way of cycling enhancement and, for some, the safest way to do so. However, very few European cities have such infrastructure and most have acquired recently. However, this seems still not enough to convince residents to get on their bicycles. Many of their commuting trips rarely match with the few kilometers of separated bicycle paths that were built, due to the high cost of it or the street geometry. This is the case for the countries that do not have the necessary culture and courtesy to respect cyclists and just 'build' a bicycle lane with a white line on the road. It is very natural that these countries are reluctant to risk integrating cyclists in roads where flows and speeds are high.

"City bikes" appear as an alternative to the car, but also as an incentive to move in city centers, which are the most congested with various destinations in relatively close distances. They are also an incentive for residents of the suburbs to use public transport to get to the center and then use the bicycle to easily reach their specific next destinations. Shared bicycles and public transportation can function in ideal cooperation, as allies in helping citizens and cities to become less car-dependent. With regard to the traffic parameter, the presence of bicycles is a proof of prevalence of sustainable mobility conditions. Segregated infrastructure with high cost is not necessary. There is a rich experience of cities with high bicycle rates thanks to horizontal road signaling. In these cities however, there is road courtesy. That is why the Municipality of Athens should not underestimate the importance of education and awareness raising for both children and adults. In order for cycling to be enhanced, the number of on street cars (either moving or parked) shall be reduced along with their speed.

In Europe, bicycle infrastructure solutions are provided by simply drawing special lanes on the road, or by building separated bicycle paths (different surface levels), or even by extending pedestrian zones and building traffic calmed areas where no exclusive infrastructure is required. In the case of a single bike lane, a white line is easily drawn on road, quickly and without cost. However, this is not the solution to the hostile behavior of the Greek driver. This is why the Sustainable Mobility Unit of the National Technical University of Athens [11, 12], after studying road conditions in dozens of Greek cities and playing an active role to the dissemination of bicycle use, has proposed the reallocation of bike lanes from the roadway to a special lane on the sidewalk, through widening it accordingly. This was the solution that was systematically applied due to its advantages related to enhancing pedestrian convenience as many cities lacked the needed minimum sidewalk widths. However, this seemed to be the optimal solution for several cases before the Greek economic crisis and today it

would be absurd to keep on with the same practice. The current optimal solution would be to develop bike lanes on road and put weight on education and training policies for drivers and motorcyclists to drive with caution.

A complete solution is to create traffic calmed zones, with a maximum speed of 30 km/h in order to protect pedestrians and cyclists. Cyclists in such zones do not demand specialized infrastructure as they can safely move along with cars in low speeds. Such zones, although very common in European cities, are quite rare in Greece. The Strategic Plan for Sustainable Mobility in the historical center of the Municipality of Athens should have traffic calmed areas at its planning core .

In addition to the above policies, the rapid growth of electric bicycle rental systems in Europe in the recent years is quite interesting [8]. They are a direct incentive that function as an alternative to the use of cars, especially in the central areas, which are the most congested with various destinations in relatively close distances. They are also an incentive for suburban residents, when they need to reach different destinations within the city center. Indeed, the electric bicycle, when public transportation is inadequate in the center, gives them a radical solution. Electric shared bicycles and public transport can function in ideal cooperation, as allies in helping citizens and cities to become less car-dependent. For visitors, e-bike rental systems are part of the city's infrastructure, a means of approaching the details and exploring the city. The installation of electric bike rental systems gives a clear boost to the first rides in an environment that is fairly considered hostile. However, it demands some key elements to be considered safe; pedestrianized streets, some bicycle lanes, pedestrianized historical centers etc. But, is this space enough? Obviously, system users will use conventional roads, and this shall progressively make drivers more cautious in every way, since the bike network is completed.

4 The case of Municipality of Athens: Integrating cycling in transportation planning

The Athenian Strategic Plan for Sustainable Mobility and Transport [5] aims to support the most efficient ways of commuting through the city, towards the issue of limited public space, and put an emphasis on strengthening the use of bicycles, both private and shared ones. Bicycle is a key pillar of the sustainable mobility strategy. It needs infrastructure improvements, several adaptations to the Road Traffic Code (RTC), raising awareness and mobilizing citizens, as well as technology upgrades. It is important to emphasize to the positive characteristics of the bicycle and its vulnerability in terms of road safety and to clearly define the conditions of its circulation on street, on bus lanes, on sidewalks and pedestrianized streets roads. Moreover, speed limits shall be redefined in various streets, on the basis of coexistence, rather than exclusion or separation.

In addition, the Plan proposes the creation of special lanes to accommodate buses and bicycles. After the trial period of bicycle circulation in the bus lanes, results were assessed, and adjustments or improvements are proposed for the institutionalization of this solution of shared bus- bicycle lanes, allowing Athens to acquire a crucial net-

work at very low cost. The development of a Public Bike Sharing System can offer a great deal in improving mobility, and add a touch of optimism and inspiration for addressing its problems. Also, it can promote collaboration and synergy among the various institutions involved.

The Regulatory Master Plan for Athens-Attica 2021 stresses the necessity of organizing traffic at the municipal level and town planning units, based on the principles of sustainable urban mobility, with emphasis on quiet transport modes such as public transport, cycling, walking. It also emphasizes the enhancement of pedestrians' and cyclists' accessibility. As far as the bicycle is concerned, the Master Plan aims to recover public spaces by upgrading and expanding the pedestrian and bicycle network while also reallocating on-street parking to off street private spaces. In addition, it aims at building integrated networks for pedestrians and cyclists alike, between major natural, urban, transport and cultural centers. The need to extend pedestrianized zones or create pedestrian, bicycle and public transport routes on commercial roads is emphasized, following special transport studies. Pedestrian routes connecting public buildings and monuments of architectural, artistic and historical interest are also promoted. The promoted traffic related directives include the diversion of through traffic out of the central area and integrating walking and cycling areas, as well as overall cultural routes. The development of an extensive metropolitan cycling network will provide access to important areas of cultural and recreational interest, such as Elefsina, Ktima Tatoiou, Marathonas and Sounio, which if combined with local bike lanes through the surpassing municipalities can further contribute to cycling promotion in Attica basin.

The Operational Program of the Municipality of Athens (2015-2019) [7], states the various traffic issues in Athens, which seem to derive from the increase of car ownership, the lack of infrastructure and the inadequate management of the transport system. Among the most frequently encountered issues are walking and cycling inconsistencies, inadequate provision of motorbike parking (including bicycles), lack of bicycle routes, as well as the failure to make them part of the official city plan.



Fig. 1. a. Athens Metropolitan Cycling Network. b. Cycling Infrastructure in Thessalonikis Str. (Source: SMU)

The Plan for Integrated Urban Interventions [6] in the center of Athens assesses that in the city center there was no planned or constructed bicycle paths. Attempts made back in 2012 by the Municipality of Athens to implement a bicycle path connecting the archaeological sites of Kerameikos with Plato Academy were not successful, due to negative responses by the local councils of the 3rd and 4th Municipal Communities. Moreover, the plan assesses the metropolitan cycling route linking Kifissia, Athens and Faliro as divided into two sub-projects. The southern part received all necessary approvals and was eventually constructed, while the northern part connecting Gazi (Athens) to Kifissia remains unbuilt. The plan also referred to the Athens' Metropolitan Cycling Network, which was finally approved and institutionalized. The plan considers that the implementation of a pilot bicycle sharing system with 1,000 bicycles and 70 automatic pick-up and return stations, would be the lever for promoting all bike-related issues, such as cycling in bus lanes, establishing the movement of bicycles within pedestrian roads and adapting the traffic code to the new requirements for the dissemination of safe bicycle use in Greece. In line with the above, among the objectives set in this plan, the achievement of sustainable mobility conditions is also mentioned by pointing out that "the bicycle as a means of transportation in the city is friendly to the human and the environment, while its use is costless compared to the use of other private vehicles" [6]. However, the lack of appropriate cycling infrastructure creates a sense of insecurity and discourages unfamiliar citizens who would like to use the bicycle as a means of transport on a regular or occasional basis.

In order to restore the sense of safety to cyclists, a coherent bicycle network should be created to allow for integrated cycling circulation, i.e. from any desired starting point to any desired destination, with a sense of comfort and safety. Along with the development of a bike network, solutions should also be provided for safe bike parking at destinations integrated into the public spaces. Institutional problems concern the completeness and clarity of cycling in the existing institutional framework. According to the current Traffic code bicycle is a vehicle, which makes its ability to move on sidewalks or pedestrian streets to be highly questioned, while at the same time the concept of a bicycle route is not properly defined. A similar issue is also noted for the movement of bicycles within the bus lanes. The plan also states that arrangements for the common use of bus lanes should be defined together with bus operators [6]. Lastly, the activation, co-ordination and cooperation of all parts involved (Municipality of Athens, Ministry of Transport and Networks, Ministry of Environment and Energy, Ministry of Culture, Bus Operator etc.) as well as active citizens or groups of citizens and stakeholders is a task that must be conducted through information and consultation campaigns [9].

5 Proposed actions and measures

Sustainable Urban Mobility Plans (SUMPs) are emerging as a new integrated and long-term urban mobility planning approach, that allow local authorities to develop and implement urban mobility strategies on the basis of in-depth analysis of the current situation. SUMPs provide a clear vision for the sustainable development of the

urban areas for which they are designed, including reducing energy consumption, air and noise pollution, accidents, congestion, preservation of communal areas, etc. They rely on existing planning practices and are inspired by the principles of unified design, participation and evaluation to meet the movement and mobility needs of people today and in the future, for a better quality of life in the city and its surroundings. The bicycle is one of the 3 pillars of the SUMP along with walking and public transport [3]. In Athens, a lot of effort shall be put on introducing decisive policies for the implementation of infrastructure, especially where the operation of the network is burdened by a large number of vehicles and motorcycles that sometimes move and park illegally, using/ occupying spaces that normally belong to pedestrians and cyclists. Bicycle integration will prove to be a pleasant upgrade of the city's network. This shall not be achieved independently from the overall course of the city. Integrating the bicycle, which by default is a peaceful vehicle, in everyday transport means demands traffic calmed conditions and quality spaces. The development of cycling in Athens will largely depend on projects and policies directly related to cycling integration (such as bicycle lanes, bicycle corridors), but also on projects and policies that concern the overall transportation planning system (such as traffic regulations, BRT systems, car restrictions etc.). The key priority steps include:

- solving the institutional problems concerning the use of bicycles in the city and make legislative interventions in the Traffic Code that are compatible with the recent guidelines for integrating cycling (Decree 1053 / B / 14.4.2016)
- effective cooperation of the various services and authorities during the elaboration and the maturation of the needed studies, since both the SUMP and any traffic regulations required for the integration of cycling are at the responsibility of many authorities and legal bodies apart from the Municipality.
- initiating the implementation of a coherent cycling network which shall consist of primary (inter-municipal) and local cycling routes, which will provide citizens with the desired feeling of safety and comfort to use the bicycle as the main alternative means of transport.
- developing traffic calmed areas where bicycles will coexist with cars in cycle streets according to the recent guidelines for integrating cycling (Decree 1053 / B / 14.4.2016)
- informing, educating and raising awareness for the public and all interested stakeholders regarding the conscious use of bicycle and its benefits to the city. This shall alleviate controversies and enhance the culture of coexistence and mutual respect among citizens.
- taking action to reduce the risks of negative reactions of specific stakeholders, since the redistribution of the public space will affect those who enjoy some legitimate or illegitimate 'privileges' mostly related to parking.

6 Conclusions

Athens is currently a city that has given absolute priority to the car, while public transport sharply shrinks its ability to thrive. In these conditions, cycling commuting

is struggling. However, as stated before, there are a lot to be done by the Municipality of Athens in order to change priorities in transportation planning. Residential areas, covering the vast majority of the city's surface, should be the top priority. It could be easy to convert them into traffic calmed zones at low cost, serving both the cyclists and pedestrians. The SUMP is a critical tool for promoting cycling in the city, and it is expected that in the coming years there will be major alterations in favor of sustainable mobility compared to the current city image.

References

1. Bakogiannis, E. Siti, M.: Athens Metropolitan Cycling Network. In: Velo-City Vienna "Cycling Visionary Award" (2013). http://velo-city2013.com/?page_id=2337&project_id=209 last accessed 2018/02/17.
2. Hotel Association of Athens - Attica and Argosaronikos: Visitor Satisfaction Survey and Attica Hotel Performance 2016-2017 (2017). http://www.all-athens-hotels.com/public/uploads/2017_Research-EXA.pdf last accessed 2018/02/17.
3. Sustainable Mobility Unit (SMU): Guidelines for sustainable urban mobility plans in Greece. Report A.1/B.K./Σ.01/2016/6.7 (2016). <https://www.smu.gr/2017/08/22/odigies-svak-greece/>
4. Ministry of Environment and Energy: Masterplan of Attica Region L.4277/2014 (2014). <https://nomoi.info/%CE%A6%CE%95%CE%9A-%CE%91-156-2014-%CF%83%CE%B5%CE%BB-1.html> last accessed 2018/02/17.
5. Municipality of Athens: Sustainable Urban Mobility Plans for Sustainable Mobility and Transport (2012). <http://www.cityofathens.gr/node/19684> last accessed 2018/02/17.
6. Municipality of Athens: Strategy of the Plan for Integrated Urban Intervention (2013). <https://www.cityofathens.gr/node/30078> last accessed 2018/02/17
7. Municipality of Athens: Operational Program of the Municipality of Athens (2015). <http://www.cityofathens.gr/node/22020> last accessed 2018/02/17
8. Nikitas, A., Wallegren, P. and Rexfelt, O.: The paradox of public acceptance of bike sharing in Gothenburg. In: Proceedings of the Institution of Civil Engineers – Engineering Sustainability, 169(3), pp. 101-113 (2016).
9. Somarakis G, Stratigea A.: involvement in taking legislative action as to the spatial development of the tourist sector in Greece – The "OpenGov" platform experience. *Future Internet* 6, 735-759 (2014).
10. Vlastos, Th.: Promoting Cycling in Greece in the framework of the European Strategy for Sustainable Mobility. In: Seminar Proceedings of «Mobility Planning and Management in Tourist Destinations» (2007). Ibiza.
11. Vlastos, T. Milakis, D. Athanassopoulos, K.: bike in 17 Greek Cities – Instructions for studying cities, Athens. Ministry of National Education and Religious Affairs - Organization of Teaching Books (2004).
12. Vlastos, T. Milakis D.: Urban vs Transport Planning. From Divergence to Convergence, Athens: Papasotiriou (2006).