Analysis of Mobility patterns in selected University Campus Areas

E. Vlahogianni[1], P. Papantoniou[2], G. Yannis[3], M. Attard[4],
A. Regattieri[5], F. Piana[6], F. Pilati [7]

[1]Assistant Professor, National Technical University of Athens, elenivl@central.ntua.gr
[2]PhD, Research Associate, National Technical University of Athens, ppapant@central.ntua.gr
[3]Professor, National Technical University of Athens, geyannis@central.ntua.gr
[4]Professor, University of Malta, maria.attard@um.edu.mt
[5]Professor, University of Bologna, alberto.regattieri@unibo.it
[6]Researcher, University of Bologna, francesco.piana2@unibo.it
[7]Researcher, University of Bologna, francesco.pilati3@unibo.it

Abstract

The objective of the present research is to better understand mobility in university campus areas, using local and transnational data, policies and planning instruments. This analysis looks at integrating student's mobility flows to/from and inside Campus areas with urban mobility. Within this framework, a survey was developed for seven Southern European universities including a mobility questionnaire on current mobility, desired mobility, mobility problems, proposed measures/policies/tools as well as demographic characteristics of the participants which were mainly undergraduate students, post graduate students, academic/faculty members and administrative staff. For the purpose of the survey, 1,090 questionnaires were collected and further analyse. Regarding the mobility to / from the city, campuses are further distinguished into those that are inside and outside the city. Results highlight differences in the policies that are most critical based on the location of each University. More specifically, for campuses located inside urban area, the most important transport measures include public transport and environmental issues. On the other hand, for mobility in campuses located outside urban areas, results indicate that measures should address public transport and road infrastructure, to help accessibility to and from the campus areas.

Keywords: University Campus, Sustainable Urban Mobility Plan, Policies, Mobility Measures, Tools

1   Background and Objectives

Sustainable Urban Mobility Plans (SUMPs) define a set of interrelated measures designed to satisfy the mobility needs of people. They consist of an integrated planning approach and address all modes and forms of transport in cities and their surrounding areas (1). Focusing on university campuses, a special characteristic concerns the fact

that universities are unique places functioning in specific contexts (2,3,11). Universities are characterized by the fact that they represent a cross section of the population from different socio-economic backgrounds and ages, generate irregular schedules and the constant movement of people throughout the day. This is even more noticeable in university campuses located in suburban settings: Daily commuting of the university population, longer distances travelled, and the predominance of private car use over non-motorised means of transport (4).

A key parameter which affects the entire mobility system of a campus is whether it is located in the city center, in the suburbs or outside the urban area. Most campuses located to the city centers face mobility problems, due to the city's congestion, the lack of space for parking, active modes of transport, but also have advantages on the accessibility as they are easily accessed by public transport and soft modes (5). In the last decades, there has been a tendency to move universities outside cities, based on the worldwide trend to establish new or relocate campuses to city outskirts or rural areas, in an effort to move away from congested city centers (6). Such decentralized locations offer advantages, such as additional space for facilities and infrastructure, and an environment of improved quality to members, suitable for research and academic endeavors. Throughout the years, these institutions have been transformed into independent communities with the size, infrastructures, and activity levels of small cities (6).

Several plans and practices in universities have been conducted aiming at enhancing the general quality of urban areas in terms of mobility using several strategies and initiatives adapted and inspired by local characteristics and mobility needs. A prevailing example is the sustainable urban mobility plan of the University of Barcelona, which is supported by the recurring University Community Mobility Habits survey (4). In Milan, the "Mobility Management in the university system of Milan" project intended to identify, to define and to test intervention policies to reduce environmental impacts joined to the mobility of working and students in the University of Milan. The output of the plan was to elaborate and to implement mobility action plans in the various university sites in order to control and to optimize the flows and to develop a methodology to the approach to the mobility management problems (7). Through the MOST project, in 2002, a mobility management plan in University of Catalonia was implemented and achieved to improve the access of the Catalonia University through specific measures that encourage people to use sustainable transport modes (8). Furthermore, Roma Tre University managed to reduce the use of private car in favor of collective transport modes, to offer solutions and sustainable ways to move such as collective public transport, to implement of low environmental impact means such as bicycles or electric motorcycles and to develop an application of car-pooling and car-sharing within the university (7).

Based on the above, the objective of the present research is to retrieve quantitative data for mobility across a number of university campus areas. For this purpose, a questionnaire has been developed in which 1,090 participants from seven Southern European Universities participated. The paper is structured as follows. In the next chapter, the methodological approach of the research is presented including details regarding the implementation of the survey and the universities that participated. Then analysis

results are presented, general conclusions are stated as well as proposals for further research.

2 Methodological approach

The questionnaire was developed within the framework of the CAMP-sUmp (CAMPus sustainable University mobility plans in MED areas) project, a European research project co-financed by the European Regional Development Fund aiming to improve sustainable urban mobility planning instruments through innovative mobility strategies for students' flows inside the MED Area University Campus and their integration with the urban areas. The survey took place in the following universities: University of Catanzaro, National Technical University of Athens, University of Malta, University of Valencia, University of Split, University of Cyprus, University of Bologna

2.1 Questionnaire design

Self-reports and especially questionnaires present several advantages. They are less expensive than studies using an instrumented vehicle or a driving simulator, they provide quite more detailed information than observations, and they can reach quite a large number of people in a short time. Representativeness of the sample is easy to establish and can be measured with direct statistical comparisons to driver population. Moreover, due to large samples, detailed and complicated statistical analyses can be conducted (9). It is clearly vital that a survey should be carried out using the correct sampling procedures, but also that the questionnaire used should be clear and unambiguous for both the interviewers and the respondents (10).

For the purposes of the present research a mobility questionnaire was developed including questions on the following topics:
- Current mobility - to present current mobility of the participants both regarding mobility from/to and inside the Campus
- Desired Mobility - to present the desired mobility of the participants both regarding mobility from/to and inside the Campus
- Mobility problems - to identify the mobility problems both regarding mobility from/to and inside the Campus.
- Proposed measures/policies/tools - to evaluate specific measures, policies and tools that are already implemented regarding the mobility from/to and inside the campus
- Participant information including age, gender, affiliation etc.

Universities were asked to collect questionnaires based on the following sample criteria.
- Faculty members: 10%
- Administration personnel: 20%
- Students – postgraduate: 20%
- Students – graduate: 50%

The above percentages were decided in order to achieve a representative sample in all universities with focus on the affiliation of the participants. The questionnaire's data

collection took place approximately 1 month and the overall results per University are summarized in the following table:

Table 1. Campuses characteristics

	University	Location	Area (m²)	Students	Questionnaires
1	University of Catanzaro	Outside	260.000	11.000	104
2	National Technical University of Athens	Outside	1.000.000	13.500	124
3	University of Malta	Inside	194.452	11.500	250
4	University of Valencia (1 campus)	Outside	1.000.000	10.000	227
5	University of Valencia (2 campuses)	Inside	400.000	35.000	100
6	University of Split	Inside	245.000	24.000	100
7	University of Cyprus	Outside	1.200.000	7.000	85
8	University of Bologna	Outside	6.570.023	85.000	100

3 Results

In the present section, an overall synthesis of the findings is presented divided in three sub-sections. In the first section, the selection of mode of transport is presented in order to provide a clear picture of the mobility status of campuses located inside and outside urban areas. In the second section an evaluation of the mobility problems is presented while in the third section the most valuable mobility policies/measures/tools desired to be implemented are presented and analysed.

3.1 Mobility status

In Figure 1, the selection of mode of transport (1: car, 2: public transport, 3: motorcycle, 4: bicycle, 5: walking) for the mobility from/to the campus per trip duration, campus location and frequency of the traveling is presented.
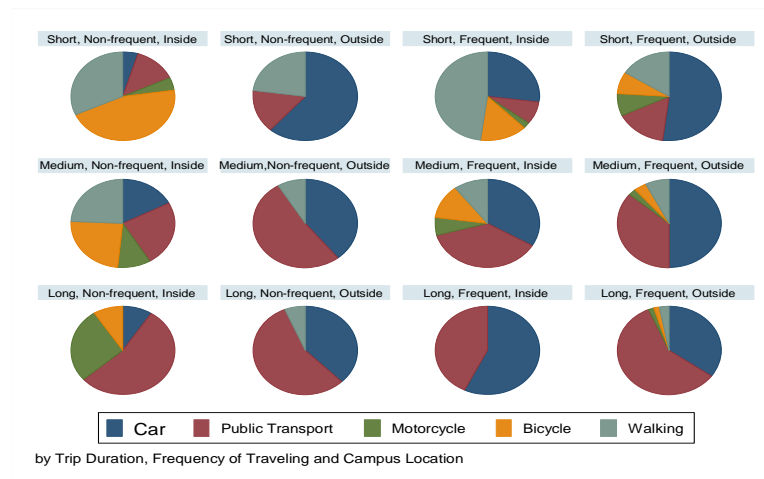
Figure 1: Mode of transport for the mobility from/to the campus per trip duration campus location and frequency of traveler

Results indicate that **passenger car** is the preferable mode of transport in campuses located outside urban areas regardless of trip duration. On the other hand, in campuses located inside the city the percentage of walking and cycling is significantly higher. Finally, public transport is more often reported on long trip durations in campuses located outside urban areas.

3.2 Mobility problems

In table 2 the evaluation of mobility problems is presented under eight mobility areas. Participants were asked to rank these problems in their campus for which level 5 indicated the highest level of the problem and level 1 the lowest.

Table 2. Assessment of mobility problems

| Mobility problems	Campuses inside area		Campuses outside area	
	From/To	Inside	From/To	Inside
Parking management	4.1	3.7	3.0	3.3
Walking	3.4	3.7	3.4	3.3
Cycling	3.3	3.4	3.6	3.6
Public transport	3.8	2.9	3.9	3.7
Road Infrastructure	3.8	3.6	3.3	3.5
Environmental / Energy	3.8	3.5	3.4	3.6
Mobility management	3.7	3.5	3.5	3.6
Freight management	3.2	3.1	2.8	3.1

Table 2 indicates that in campuses located inside urban areas parking management is the most problematic concern. On the other hand, with focus on campuses located outside urban areas public transport is ranked as most problematic, with stakeholders pointing out this as an important measure for future intervention.

3.3 Mobility policies/measures/tools

As mentioned earlier, a section of the questionnaire concerned an evaluation of proposed measures/policies/tools. Within this scope, participants were asked to reply the following question "How important do you consider the following measures/policies/tools regarding mobility from / to your Campus in a scale from 1 (not important) to 5 (very important)". Figures 51 and 52 present the results.
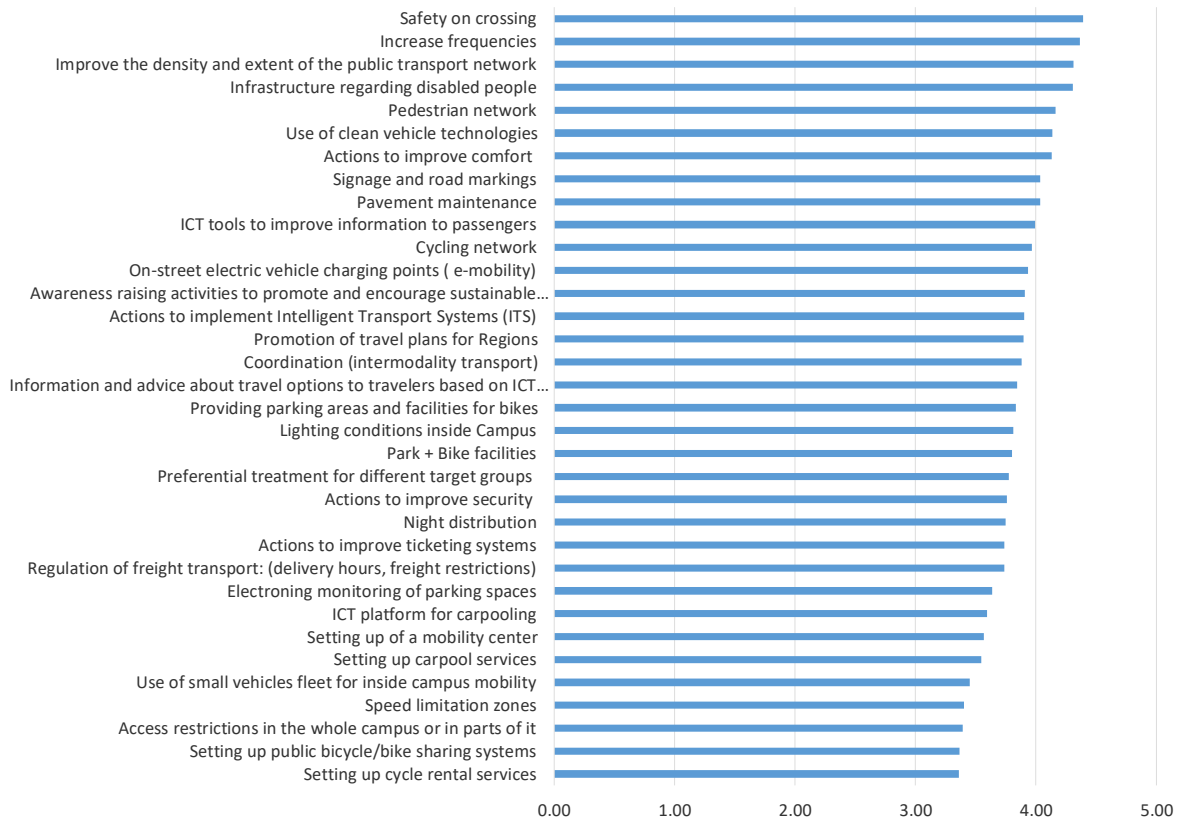
Figure 2: Evaluation of measures for the mobility in campuses located inside urban areas
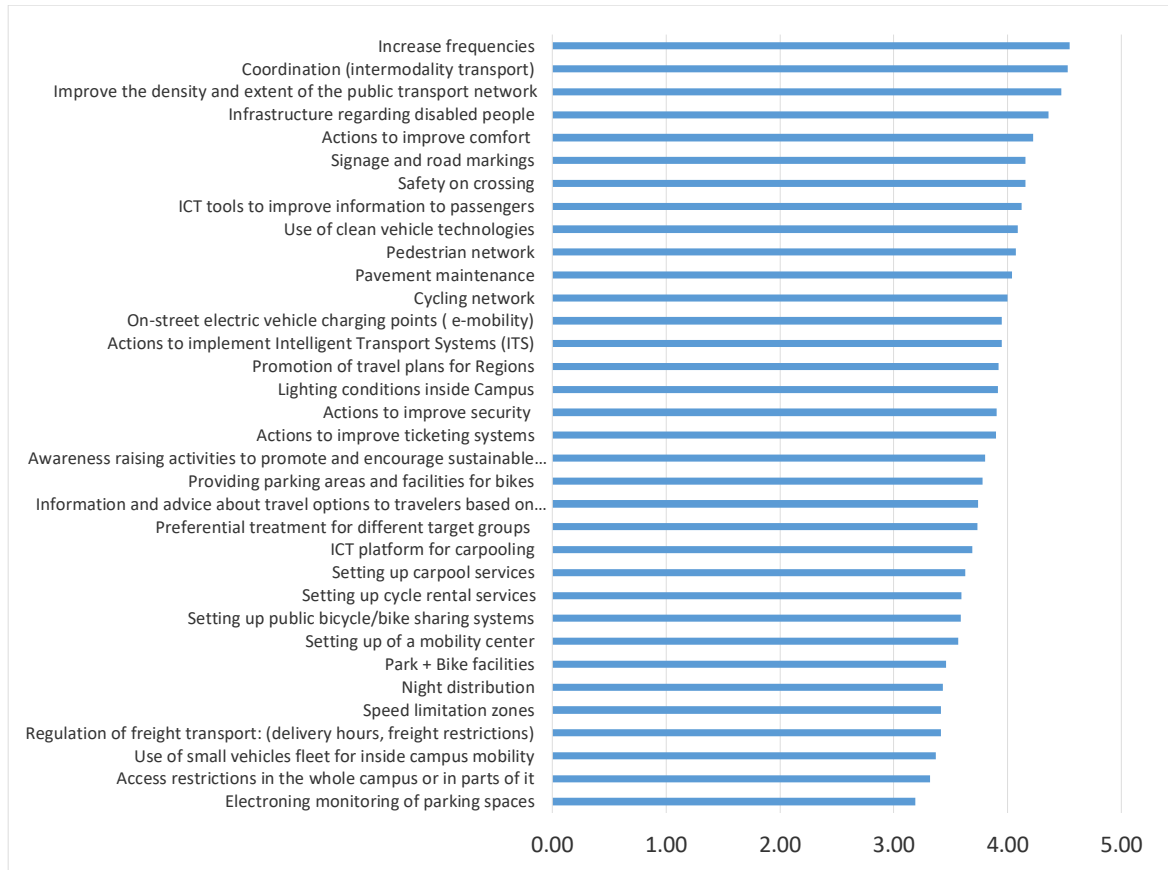
Figure 3: Evaluation of measures for the mobility in campuses located outside urban areas

4   Conclusions

The development and implementation of the questionnaire lead to several interesting conclusions that are presented in this study. More specifically, with focus on the measures that are evaluated by the participants, results highlight differences in the measures that are most critical based on the location of each University. More specifically, regarding campuses located inside urban areas, the most important measures concern walking, public transport, road infrastructure and environment. Safety at crossings is the most critical action to be taken, followed by measures on public transport such as an increase in frequencies and the improvement of the density and extent of the public transport network.

On the other hand, regarding mobility in campuses located outside urban areas, results indicate that measures should be taken with a focus on public transport and road infrastructure, to help the accessibility to the campus. The most critical measures con-

cern public transport (increase of frequencies, coordination and intermodality, improvement of the density and extent of the public transport network and actions to improve the comfort), proving that public transport is the key mobility issue in campuses located outside the city. Another key measure that is evaluated by the users is improvement in the infrastructure regarding disabled people. The above proposed measures confirm the results on the mobility problems that have been identified from the participants in the respective parts of the questionnaire and are in line with the findings in the literature on similar sustainable mobility plans in university campuses. In the next steps of the research statistical analysis will be carried out in order to extract more information from the survey.

Acknowledgement

References

1. Wefering, F., Rupprecht, S., Bührmann, S., Böhler-Baedeker, S.: Guidelines. Developing and Implementing a Sustainable Urban Mobility Plan. European Platform on Sustainable Urban Mobility Plans, European Commission (2014)
2. Tolley, R.: Green campuses: cutting the environmental cost of commuting. Journal of Transport Geography, 4 (3), 213–217 (1996)
3. Balsas, C.: Sustainable transportation planning on college campuses. Transport Policy 10, 35–49 (2003)
4. Miralles-Guasch, C., Domene, E.: Sustainable transport challenges in a suburban university: The case of the Autonomous University of Barcelona, Transport Policy17, 454–463 (2010)
5. Lah, O., Shrestha, S., Hüging, H., Decker, B., Gyergyay, B., Marhold, K., Mendez, G., Boile, M., Sdoukopoulos, E., Kressler, F., Rizet. C., Dablanc, L.: Transferability of sustainable urban transport solutions. CODATU2015 Conference, Istanbul, Turkey (2015)
6. Tsirimpa, A., Gkotsis, I., Kepaptsoglou, K., Vlahogianni, E., Polydoropoulou A. and Karlaftis, M.†: Policies for Enhancing Mobility in Academic Campuses: The case of CERN, International Conferences Presented to the 7th Conference on Transport Research (2015)
7. Silva, J., Ferreira, D.: European Best Practice on Sustainable Mobility in University Campus, T.aT. - Students Today, Citizens Tomorrow, Report (2008)
8. MOST project.: Mobility management strategies for the next decades, Final Report (2002)
9. Lajunen, T., Ozkan T. B. Porter's Handbook of traffic psychology, Chapter 4 (2011)
10. Grosvenor, T.: Qualitative Research in the Transport Sector. Resource paper for the Workshop on Qualitative/Quantitative Methods, Proceedings of an International Conference on Transport Survey Quality and Innovation. Transportation Research E-Circular (2000)
11. Gamberi, M., Bortolini, M., Pilati, F., Regattieri, A. Multi-Objective Optimizer for Multimodal Distribution Networks: Carbon Footprint and Delivery Time. Using Decision Support Systems for Transportation Planning Efficiency, 330. (2015).