

AIIT 2nd International Congress on Transport Infrastructure and Systems in a changing world
(TIS ROMA 2019), 23rd-24th September 2019, Rome, Italy

“You study, you travel free”: when mobility management strategies meet social objectives

Giuseppe Inturri^a, Salvatore Fiore^b, Matteo Ignaccolo^c, Salvatore Capri^d, Michela Le Pira^{c*}

^aDepartment of Electric, Electronic and Computer Engineering, University of Catania, Via Santa Sofia 64, Catania 95125, Italy

^bFerrovia Circumetnea, Via Caronda 352/A, Catania 95128, Italy

^cDepartment of Civil Engineering and Architecture, University of Catania, Via Santa Sofia 64, Catania 95125, Italy

^dAzienda Metropolitana Trasporti Catania S.p.A., Via Sant'Euplio, 168, Catania 95125, Italy

Abstract

This paper presents the case of Catania, a medium-sized city (300,000 inhabitants) located in southern Italy, where University students are experiencing Fare-Free Public Transport (FFPT) since October 2018. This strategy is one of the main results of a strict collaboration between the Mobility Management office of the University of Catania, and two local PT operators, providing bus and metro transport services in the city. Traffic congestion, limited PT use, little cycling and walking for systematic trips, are among the main critical issues of mobility in Catania. FFPT for students goes beyond the mobility issues, and can be regarded as a social policy of the University of Catania aimed at improving the welfare and the quality of life of its students. First results based on a survey show the big impact of this policy on students' behavior, and pave the way for future steps, where a constant monitoring of PT level of service, together with students' experience, will be fundamental to improve PT and promote a paradigm change in transport.

© 2020 The Authors. Published by Elsevier B.V.

This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>)

Peer-review under responsibility of the scientific committee of the Transport Infrastructure and Systems (TIS ROMA 2019).

Keywords: public transport; travel demand management; sustainable mobility; economic incentives; University mobility; travel behaviour

* Corresponding author. Tel.: +39-095-738-2221.

E-mail address: mlepira@dica.unict.it

1. Introduction

Promoting a shift from private to public transport (PT) is one of the main challenges that policy-makers face to foster sustainable mobility. In this respect, Mobility Management or Transport Demand Management (TDM) (Meyer, 1999; Inturri and Ignaccolo, 2011), based on easy to implement strategies aimed at influencing user behavior, proved effective to guide them towards a more efficient use of transport resources. Economic incentives are, among others, a good solution to foster a behavior change in transport. The policy of abolishing fares in PT is a case in point. Though it exists in full form in nearly 100 cities worldwide, it remains highly controversial.

Brown et al. (2001) report on the “Unlimited Access” program by which universities in USA gave all students the right to ride PT without paying a fare. They found the program produced many benefits for universities, transit agencies and society. Kębłowski (2019) provides a useful analysis on the economic impact, contribution to sustainability and the social potential of FFPT. Despite the fact that from this analysis it emerges that the number of FFPT initiatives are continuously growing in Europe in the last years, especially in France and Poland, in Italy the situation is quite different, recording only one case of FFPT in Bologna, which is not active anymore.

Based on this premise, this paper presents the case of Catania (Italy), where University students are experiencing FFPT since 2018. The term FFPT or “free transit” might be misleading in this case, since the University pays a “shadow fare” to the transit operators for each regularly enrolled student that has unlimited access to the entire PT urban network (bus and metro lines). This strategy is one of the main results of a strict collaboration between the Mobility Management office of the University of Catania, and the two local PT operators, providing bus and metro transport services in the city. FFPT for students goes beyond the mobility issues, and can be regarded as a social policy of the University of Catania aimed at improving the quality of life of its students. In the following, the rationale of this strategy will be presented, by first contextualizing it in the framework of Mobility Management strategies in a University environment. Then, the strategy will be described and first results presented based on a survey, together with information campaign and acknowledgments, and next steps, based on a monitoring strategy of PT quality of service.

2. Mobility management in a University context

The professional role of the Mobility Manager has been established in Italy by law in 1998 with the so-called “Decreto Ronchi” (Ministero dell’Ambiente, 1998), one of the main Italian law on sustainable mobility. It requires enterprises with more than 300 employees to adopt a home-to-work travel plan, following the TDM approach, including strategies to reduce the use of cars and related energy consumption (Ison and Rye, 2008; Litman, 2003; Ignaccolo et al., 2006). They are effective in reducing transport energy by acting on the demand and, therefore, changing users’ behavior (Ignaccolo et al. 2016).

2.1. The context: a University in a congested city

Catania is a medium-sized city (300,000 inhabitants) located in the eastern part of Sicily (Italy) (Fig. 1a). Its transport system suffers from critical issues including road traffic congestion, low public transit ridership, little diffusion of cycling and walking for systematic trips, and high levels of fuel consumption and greenhouse gas emissions per capita. It is one of the Italian cities with the highest rates of motorization, recording 70 circulating private cars each 100 inhabitants in 2017. Tailored strategies to improve modal share and the overall urban mobility should be aimed at reducing energy consumption, increase accessibility by PT and reduce social exclusion (Fichera et al., 2018; Bonotti et al., 2015; Giuffrida et al., 2017). Catania can be considered a “student city”, with one of the oldest Universities in Italy. In this respect, the University of Catania (UNICT) was founded in 1434, and counts about 40,000 students, 1,000 professors and researchers, 1,000 staff, 17 departments, 100 degree courses, and 18 PhD courses. University sites are clustered in two big poles, the Science and technology campus in the north of the city and the Social Science and Humanities departments in the city centre (Figure 1b). MoMACT (Mobility Management Ateneo CaTania) is the office that promotes the culture of sustainable mobility among students and employees and proposes alternative solutions to private car for home-to-university travels. It is headed by the Rector Deputy for the Mobility Management, which operates in strict cooperation with municipality managers and urban transport operators.

In 2009, the home-to-university travel plan (MOMACT, 2009) was issued, whose main contents are the analysis of the *status quo* of student and staff mobility, the identification of the main critical issues, of the main objectives and the proposal of some mobility management measures to improve the present situation (Le Pira et al., 2015).

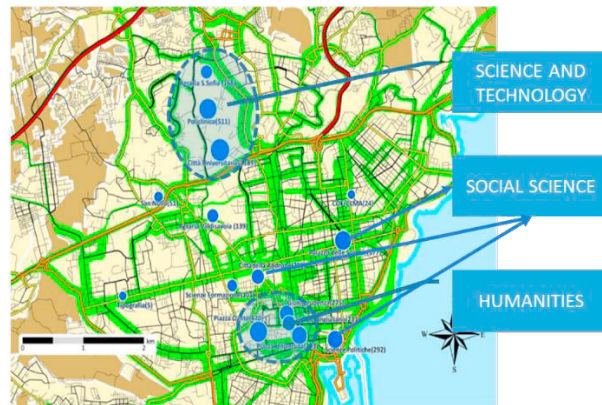


Fig. 1 Maps of University sites.

2.2. Strategies towards sustainable mobility

One of UNICT missions was to increase the accessibility of University sites by PT. In this respect, accessibility is a widely spread indicator to foster sustainable mobility planning (Rubulotta et al., 2013; Inturri et al., 2017). To this purpose, UNICT cooperated with the Municipality of Catania for the design and implementation of the first Bus Rapid Transit (BRT) line (Fig. 2) serving the campus located in the northern part of the city. It started its service in 2013 and today it is the most used bus line by students with maximum flow of 700 students per hour in the peak hour.



Fig. 2. BRT line.

In 2017, a new metro station opened near a high-demand district, including the abovementioned campus, other University sites, health-care services and a park-and-ride (P&R) facility serving the University dwellers and residents, though hardly accessible due to a high slope and poor pedestrian infrastructures. UNICT, the municipality of Catania and the metro company operator made a deal to cover the last mile by a Metro Shuttle (MS) bus service (Fig. 3). It runs every 10 minutes in coordination with the metro schedule. Today, 3,600 students use the combination Metro plus Metro Shuttle to reach the university destinations. A crucial factor for the definition and implementation of these

initiatives is an intense work of stakeholder engagement, recognizing its fundamental role in transport policy-making (Le Pira et al., 2017). In this respect, UNICT has often assumed the role of facilitator for the involvement of decision-makers and mobility actors with respect to the requests coming from the active social responsibility for sustainable mobility.

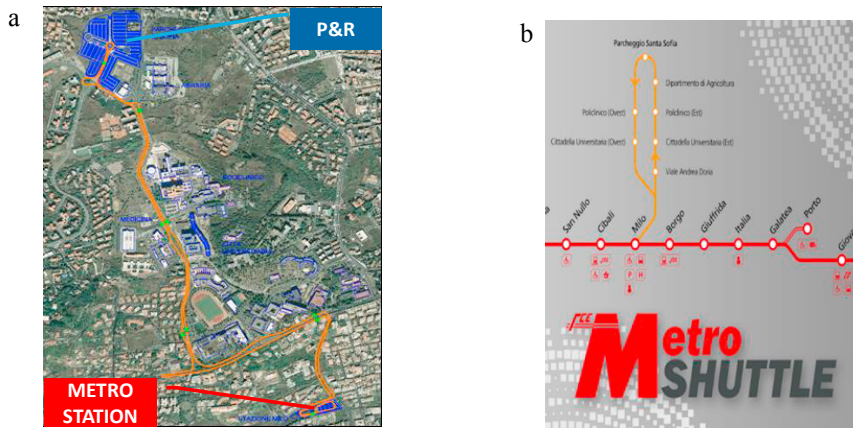


Fig. 3. (a) Route of the metro shuttle line; (b) metro shuttle map (yellow line) and metro line (red).

3. Fare-free Public Transport: a policy beyond mobility issues

In October 2018, the last and most important effort of UNICT so far was to allow unlimited access to all 40,000 regularly enrolled students to all the urban public transport network (50 bus lines, 1 metro line, 1 shuttle service and 3 park-and-ride facilities), both weekdays and weekends with accesses reserved at each metro station (Fig. 4). PhD students, Erasmus students and trainee doctors are also included in the programme.



Fig. 4. Each metro station has an access reserved to University students

The right to access high education now encompasses access to sustainable and affordable mobility. In this respect, this initiative should be considered as a social strategy, in addition to a transport strategy contributing to reducing emissions, pollution and congestion. PT becomes an essential part of student right to study. Besides, it can be regarded as the first step to adhere to UN Agenda 2030 objectives for Sustainable Development.

The initiative has been awarded as best practice for urban sustainability at the “Ecomondo Expo” organized by Legambiente for the green and circular economy, in Rimini, Italy, 2018 Nov. 9th (Fig. 5a), and in the Contest of “Best Practices on Sustainable Mobility at Universities”, by U-MOB project (<https://u-mob.eu/>) partners during the “II European Conference on Sustainable Mobility at Universities” (Cracow, March 14th -15th 2019) (Fig. 5b).



Fig. 5. (a) Ecomondo award; (b) U-MOB award.

3.1. Indicators and monitoring strategy

UNICT totally supports the initiative with an amount of 125 € per each student. The transport operators made a strong break on the price of the annual season ticket, which is compensated by a guaranteed income.

A joint technical committee with members of UNICT and of the transport companies has been established to monitor student ridership and satisfaction and to address substantial changes towards a continuous quality improvement of the transit service. An on line survey was conducted, collecting 3,400 forms filled by students, containing information on their mobility habits and on their opinions on public transport quality.

The most important indicator is the distribution of students according to the prevalent mode of transport used to access university sites. Analyses of the data collected in 2019 (Fig. 6b) show that public transport share is 46.3% (including half of the answers that state the combined use of car and public transport), while using the data of a similar survey made in 2016 (450 respondents in that case), we report only 27.0% of public transport (Fig. 6a). Private car use has dropped from 50% in 2016 to 26% in 2019. This impressive output is due to the combination of a relevant improvement of the transit supply (metro extension and related shuttle services) and, more recently, to the fare free initiative. All citizens of Catania - and the environment as well – will benefit for this car ridership reduction.

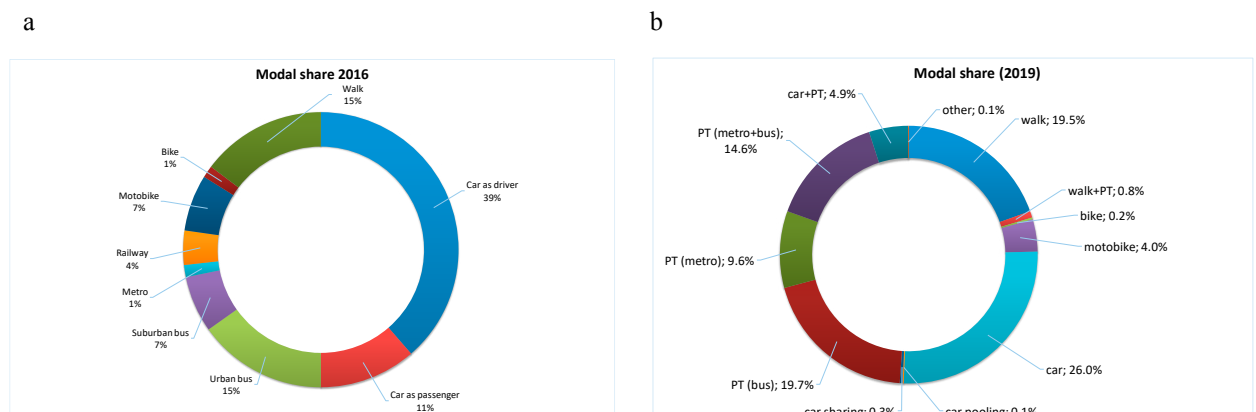


Fig. 6. Modal share to access university in 2016 (a) and 2019 (b)

In the latest survey, students were asked to indicate the most used transit lines. Multiple choices were possible. Analyzing the distribution of answers, we found that only 9% never use public transport, 43% are users of the metro line, often in combination with the metro-shuttle services and the remaining 48% is composed of bus travelers (Fig. 7a). Bus riders are clustered on a relatively few numbers of lines: 20% of the lines accounts for 70% of all answers and one out of three reports the use of the BRT line (Fig. 7b).

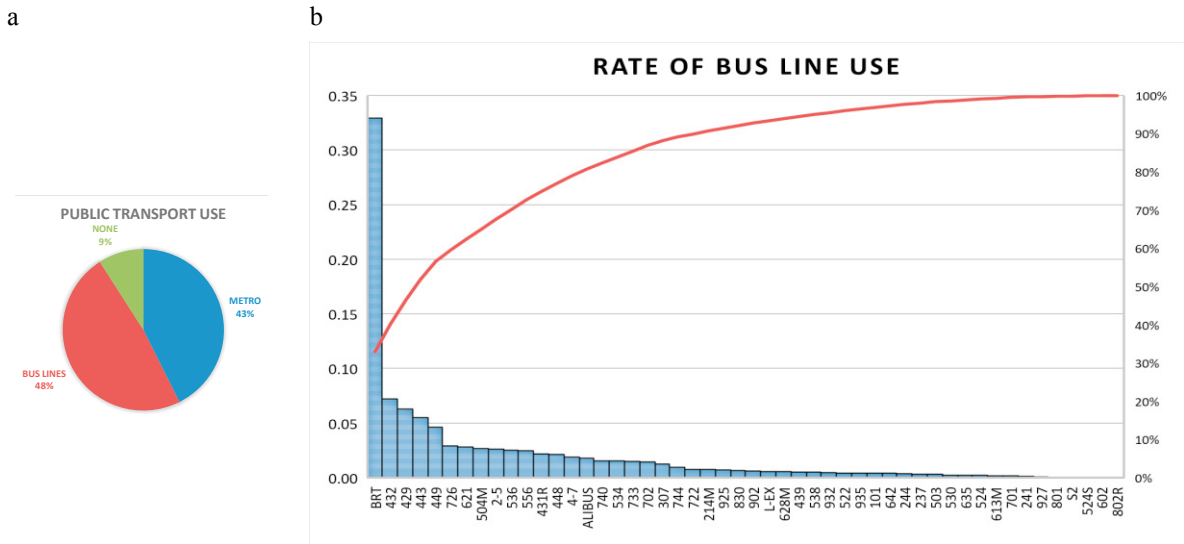


Fig. 7. (a) Public transport use; (b) Bus lines use.

A new set of indicators is under definition, both for demand and supply side, the former referred to transit ridership and perceived quality of PT service, and the latter focused on the provided quality of operation (Le Pira et al., 2018). Quality can be assessed by user satisfaction, in terms of gap between expected and perceived quality, and by the service providers, in terms of gap between service quality scheduled and delivered. The European reference standard for PT service quality is the norm UNI EN 13816 (2002).

3.1.1. Monitoring of perceived service quality

As far as demand is concerned, perceived quality can be derived from the analysis of the survey results with 3,400 answers. In particular, respondents were asked to express their level of satisfaction on a 1-5 scale (from low to high) for the overall service, and for specific quality criteria, i.e.: (1) lines availability, (2) frequency, (3) reliability, (4) directness, (5) customer information, and (6) travel comfort. The main results are summarized in Table 1:

Table 1. Average values of customer satisfaction for the overall sample, by departments, and most frequently used PT services

	Tot sample	Science and Technology	Humanities	Social Science	Metro	Metro+MS	BRT
global satisfaction	3.09	3.17	2.87	3.07	3.23	3.38	3.17
lines availability	2.78	2.90	2.43	2.78	2.91	3.29	2.92
frequency	2.57	2.66	2.38	2.53	2.86	3.12	2.64
reliability	2.99	2.94	2.95	3.10	2.78	3.07	2.29
directness	3.12	3.09	3.10	3.19	3.15	3.36	2.93
information	3.20	3.17	3.22	3.24	2.66	2.84	2.47
travel comfort	3.07	3.05	3.02	3.14	2.48	2.78	1.92

In general, students are quite satisfied about PT service (average value of 3.09), in particular the users of metro+MS (3.38), and the most satisfactory element is customer information. This last result is confirmed when the sample is divided in the different departments, even if the overall satisfaction of students belonging to the department of Humanities is lower with respect to the other students (2.87). This can be ascribed to a lower supply of PT services, even if the department is located in the very city centre. When looking at the most frequently-used PT services (i.e. metro, metro+MS and BRT), the most satisfactory element is journey directness, which is clearly related to their high level of service due, in particular, to their protected/segregated right-of-way. In all the previous cases, there is a general tendency toward attributing lower values to global satisfaction, which is an aggregated parameter regarding their experience, and higher values to single quality attributes. In this respect, by correlating the overall satisfaction to quality criteria via multiple linear regression, the only two parameters that resulted statistically correlated to satisfaction are directness and information.

Students were also asked to rate the importance of different service characteristics, i.e. lines route, frequency, information and comfort. The most important characteristics are information and frequency, followed by comfort and lines route. These data combined with those related to satisfaction allow to derive some policy implications.

In particular, since frequency is at the same time one of the less satisfactory service characteristics and one of the most important, attention should be paid to improve PT service by increasing the frequency at least of the most used lines, e.g. BRT and metro. Information is another important aspect to improve, and this could be performed by a dedicated traveler companion assistant accounting for all the available travel options, including shared mobility services, following the concept of Mobility-as-a-Service (Le Pira et al., 2018; Ambrosino et al., 2016).

3.1.2. Next steps

In the next months, *ad-hoc* strategies will be implemented to monitor both transit ridership and supply.

As far as ridership is concerned, metro users will be recorded via the multiservice student smart card that will guarantee access to metro stations, while buses will be equipped with Bluetooth beacons capable of detecting student smartphone devices, thus recording their presence onboard.

As far as the supply is concerned, the effective provided service will be monitored thanks to Automatic vehicle monitoring (AVM) technology. Service indicators of regularity and punctuality will be monitored via AVM, like the number of effective rides with respect to the scheduled ones, actual frequency, and delays, together with other important parameters, e.g. safety, cleanliness, information services, attention the environment, level of connection with other transport modes.

Finally, data from the survey allowed to derive the student Origin-Destination (OD) matrix that, combined with a network assignment model, will allow to *ex-ante* simulate the impact of strategies aimed at improving the PT service.

4. Conclusion

This paper described the case of FFPT for University students in Catania. “You study, you travel free” program is an undergoing initiative since 2018. It has the potential to produce many benefits. It can reduce parking demand, improve students’ mobility, and reduce the cost of attending the university classes, which is quite important in areas with disadvantaged economic conditions. Transport operators increase total ridership and vehicle load factors, while reducing the cost per ride. The city benefits the reduction of traffic congestion and air pollution. However, this initiative should be appropriately monitored to record its impacts, and to understand if the benefits overcome the overall costs. In this respect, the University pays a “shadow fare” to the transit operators for each regularly enrolled student for unlimited access to the entire PT urban network (bus and metro lines). The increased use of PT fostered by the financial effort of the University strengthens the ability to ask to PT operators for a higher quality of operation and service and to local authorities for fleet renewal, new route design and implementation of complementary services.

The initiative has a social transformative potential for a transition to a sustainable society: students are encouraged to leave their private vehicles and find opportunities to socialize while travelling to and from universities, and also for leisure purposes. They will be the professional and decision-makers of the future and their experience will be spread to new generations, boosted by the multiplicative effect made possible by social network interaction and connectivity

among students. In this respect, it should be recognized a social policy, beyond the transport policy sphere. First results show the big impact of these strategies on modal share, with an increase of PT use to access university destinations, and a reduction of private vehicle use. An *ad-hoc* monitoring strategy has been defined based on different data sources, like surveys, sensors, and simulation models. First results from the student survey show that students are quite satisfied with the PT service, but improvements are needed especially to increase PT accessibility of some University departments, increase line frequency, and enhance the information related to PT service, e.g. via a dedicated app.

Acknowledgements

This work has been partially financed by the University of Catania within the project “Piano della Ricerca Dipartimentale 2016-2018” of the Department of Civil Engineering and Architecture and the project “Piano per la Ricerca 2016-2018 - Linea di intervento 2” of the Department of Electric, Electronic and Computer Engineering.

References

- Ambrosino, G., Nelson, J. D., Boero, M., & Pettinelli, I., 2016. Enabling intermodal urban transport through complementary services: From flexible mobility services to the shared use mobility agency: Workshop 4. Developing inter-modal transport systems. *Research in Transportation Economics*, 59, 179–184.
- Bonotti, R., Rossetti, S., Tiboni, M., Tira, M., 2015. Analysing space-time accessibility toward the implementation of the light rail system: the case study of Brescia. *Planning Practice and Research*, 30(4), 424-442.
- Brown, J., Hess, D. B., & Shoup, D., 2001. Unlimited access. *Transportation*, 28(3), 233-267.
- Fichera A., Frasca M., Palermo V., Volpe R., 2018. An optimization tool for the assessment of urban energy scenarios. *Energy* 156, 418-429.
- Giuffrida, N., Ignaccolo, M., Inturri, G., Rofè, Y., & Calabrò, G., 2017. Investigating the correlation between transportation social need and accessibility: the case of Catania. *Transportation Research Procedia*, 27, 816-823.
- Ignaccolo, M., Capri, S., Giunta, U., Inturri, G., 2006. Discrete choice model for defining a parking-fee policy on Island of Ortigia, Siracusa. *Journal of Urban Planning and Development*, 132(3), 147e155.
- Ignaccolo, M., Inturri, G., Le Pira, M., Capri, S., Mancuso, V., 2016. Evaluating the role of land use and transport policies in reducing the transport energy dependence of a city. *Research in Transportation Economics*, 55, 60-66.
- Inturri, G., Ignaccolo, M., Le Pira, M., Capri, S., & Giuffrida, N., 2017. Influence of Accessibility, Land Use and Transport Policies on the Transport Energy Dependence of a City. *Transportation research procedia*, 25, 3273-3285.
- Inturri, G., & Ignaccolo, M., 2011. Modelling the impact of alternative pricing policies on an urban multimodal traffic corridor. *Transport Policy*, 18(6), 777-785.
- Ison, S., Rye, T., 2008. The implementation and effectiveness of transport demand management measures. An international perspective. Ashgate.
- Kębłowski, W., 2019. Why (not) abolish fares? Exploring the global geography of fare-free public transport. *Transportation*, 1-29.
- Le Pira, M., Inturri, G., Ignaccolo, M., 2018. Public transport and proactive real-time information: a survey on users' preferences and attitudes toward multimodal traveler information services. *International Conference on Traffic and Transport Engineering (ICTTE 2018) – Belgrade*, September 27-28, 2018. ISBN 978-86-916153-4-5.
- Le Pira, M., Inturri, G., Ignaccolo, M., Pluchino, A., & Rapisarda, A., 2017. Finding shared decisions in stakeholder networks: an agent-based approach. *Physica A: Statistical Mechanics and its Applications*, 466, 277-287.
- Le Pira, M., Inturri, G., Ignaccolo, M., Pluchino, A., 2015. Analysis of AHP methods and the Pairwise Majority Rule (PMR) for collective preference rankings of sustainable mobility solutions. *Transportation Research Procedia*, 10, 777-787.
- Litman, T., 2003. The Online TDM Encyclopedia: mobility management information gateway. *Transport Policy*, 10, 245-249.
- Meyer, M. D., 1999. Demand management as an element of transportation policy: using carrots and sticks to influence travel behavior. *Transportation Research Part A: Policy and Practice*, 33(7-8), 575-599.
- Ministero dell' Ambiente (1998). Mobilità sostenibile nelle aree urbane. GU n. 179 del 3-8-1998.
- MOMACT (Mobility Management Ateneo CaTania), 2009. Piano Spostamenti Casa-Università: Documento Strategico. Edited by Capri, S., Greco, A.. In: http://www.momact.unict.it/sites/default/files/MOMACT_PSCU2009.pdf.
- Rubulotta, E., Ignaccolo, M., Inturri, G., & Rofè, Y., 2013. Accessibility and centrality for sustainable mobility: Regional planning case study. *Journal of Urban Planning and Development*, 139(2), 115-132.
- UNI EN 13816, 2002. Transportation - Logistics and Service - Public Passenger Transport - Service Quality Definition, Targeting and Measurement.