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ID 1467 | MOBICAMPUS-UDL: COMBING WEB-BASED TRAVEL SURVEY AND SMARTPHONE APP DATA COLLECTION TO UNDERSTAND AND MANAGE URBAN MOBILITY BEHAVIOUR

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ABSTRACT: Reducing car dependence in general and driving alone in particular has become an important public policy issue. Universities are recognised as special generators in transportation planning processes. Large university campuses contribute in a variety of ways to the travel demand. However, university populations are underrepresented in travel behaviour studies in particular regular household travel surveys. The aim of MobiCampus-UdL research is to understand Lyon's university communities daily travel behaviour characteristics not just from a travel demand modelling perspective but as well to help campuses managers in planning coherent measures prioritising various range of mobility management strategies/urban design solutions appropriate to the diverse mobility needs and fulfil sustainability goals. The data used specifically was generated by an online travel survey conducted among several higher-

education institutions. Another issue of the project is exploring the potential of smartphone travel data collection. As we know university populations are tech-savvy, that was a good opportunity to plan a panel recruitment of voluntary participants who will respond to the first wave of the web survey. The objective of this experimental approach is to verify if this new method of data collection can improve quality/accuracy in temporal and spatial data. This paper aims to report on first findings from and experiences gained in the conduct of a comprehensive travel survey at University of Lyon (UdL). The paper offers a very preliminary results of an ongoing research project MobiCampus-UdL. A detailed description is dedicated to research method and data collection. Preliminary analysis on surveyed campuses shows when compared to the employees from the same university, university students are more likely to share favourable modal split towards active transport modes that include public transport and sustainable travel modes.

KEYWORDS: Lyon, student travel behaviour, mobility management, travel survey, planning, policy, transport regulation and urban planning, sustainable accessibility planning, active transport

1 INTRODUCTION

As education and employment destinations, universities are important generators of travel demand on local transport networks. Understanding travel behaviour is essential to informing transport management and planning (Akar, et al., 2012). Travel survey is often adopted as a method to understand individual travel behaviour. However, university students' mobility patterns are weakly investigated in conventional household travel surveys (HTS) surveys (Khattak, et al., 2011).

This paper investigates travel behaviour of the students, faculty and staff of the UdL campuses. A first experiment was undertaken by research team in spring 2015 among ENTPE-ENSAL Vaulx-En-Velin campus' population. The aim of the survey was to contribute to the reflection in the campus redevelopment framework in particular accessibility and parking issues. Insights gained from this pilot study served as a springboard for the next step with the ambition to set up a permanent "mobility observatory" on overall UdL's community by collecting longitudinal data including socio-economic, demographic, spatial and travel activity data.

The remainder of the paper is organized as follows. Section 2 describes the background of the project by a presentation of the research context. A detailed description is dedicated in Section 3 to research method and data collection. Section 4 presents some very preliminary results while Section 5 concludes and gives perspectives for the next research objectives.

2 BACKGROUND

Considered as the main French higher-education and scientific centre outside the Paris metropolitan area, The Université de Lyon (UdL) is a so-called ComUE (community of universities and higher-education institutions), federating 26 institutions of higher education and research (12 members and 14 associate members), located in the cities of Lyon (about 1.3 million) and Saint-Étienne (400,000 inhabitants) and spread over 7 campuses with different urban settings (Figure 1). Over the past several years, UdL has experienced considerable growth in enrolment and this growth has contributed to substantial increases in travel demand. An estimated population of 150,000 students & staff attend different UdL' campuses.

In an attempt to increase their environmental sustainability, part of UdL's campuses are beneficing since 2008 of an important program of energy-efficient renovation known as Lyon Cité Campus. Strategies aimed at reducing the dependence on private cars and at increasing the use of alternative transport modes are also part of UdL's sustainability goals as car-traffic is considered a major source of CO2 emissions in particular campuses presenting a high car-oriented environment. As legislation has changed, the Energy Transition for Green Growth Act (2015) made it compulsory for businesses and public institutions (with at least one hundred employees working at a single site) to set up a mobility scheme to support behaviour changes and encourage use of alternative modes.

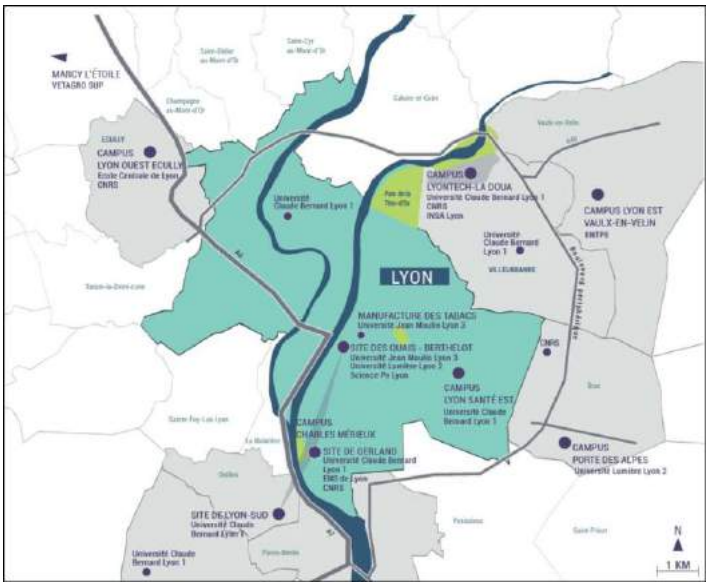


Figure 1 - Location of the different campuses part of Université de Lyon

In this paper we will focus on Lyon's university campuses, actually Jean Monnet University located in Saint-Étienne has already drawn up a mobility plan to increase the level of sustainable accessibility of its campuses. At present two campuses were object of the first wave of MobiCampus travel survey:

LYONTECH-LA DOUA CAMPUS

As one of the largest campus in the city of Lyon (about 25 000 students), LyonTech-la Doua campus has an objective to reduce the campus's energy consumption by 40% by 2021. The campus is located in dense urban settings and well serviced by a various public transport options: two tram lines are connecting the campus with the city centre with 5 stations on campus. There are also 3 bus routes connecting the campus with the rest of the city.

Actually the campus in engaged in an ambitious rehabilitation project jointly sponsored by the Metropole de Lyon and the UdL. The project involves the rehabilitation of some 20 buildings on 140,000 m² and 100 hectares. Due to the rehabilitation project the campus will face a severe parking shortage during and after works. About 25% of the actual parking capacity (4650 places) will have to be removed.

VETAGRO SUP CAMPUS:

The veterinary campus of Lyon is located in Marcy-l'Étoile a western suburban area in metropolitan Lyon approximately 16 km from the city centre. The campus is hosting about 1200 students & staff and accommodates academic, hospital and residential functions for students.

3 RESEARCH METHOD

DEVELOPMENT OF THE SURVEY INSTRUMENT

The questionnaire was developed by MobiCampus research group. Questions were then adapted to better fit the populations of interest and to be more relevant to different UdL's urban campus setting. We perform a web-based survey to collect the dataset to understand travel patterns to, from and on campus. This survey mode (web) was chosen because it is attractive to the target population (students) and the costs are lower than other survey modes (face-to-face or phone survey). There have been a few studies in the recent past focusing on measuring and analysing university students' mobility behaviour. Greene, et al., (2013) provide a meta-analysis of three separated university population travel surveys, include a survey of eight universities and colleges in Arizona, Utah and a survey of Texas A&M University and Blinn Junior College in Texas. Insight from this analysis conclude that the web-based instrument was the most successful technique to collect travel data

One of the challenges associated with a web-based online survey is that the survey administration team has no direct contact with the survey respondents. Thus the survey should meet appropriate standards and be compliant to specificities of a university environment to improve the quality of data collected, encourage participation and reduce participant burden. To ensure that erroneous and miscoded data are minimised, review, refinement, error checks and logical consistency checks were built into the survey instrument during the test of the beta version. Also, to minimise the non-response rate, our questionnaire was configured to allow respondents to skip questions they don't wont to answer, expect those that are crucial for mobility analysis such as travel patterns and socio-demographic characteristics.

The first set of questions involved collecting information about the academic institution affiliation of the respondents. Participants were asked to identify the campus where they went to study or work (primarily). They were also asked to identify their mean residential and work locations (both on-campus and off-campus for students) and mean frequented places linked to their activity. A user-friendly map-based interface (Google Maps API) was integrated to the online questionnaire to identify locations using point-and-click features. Locations could also be identified by typing an address, cross streets, or landmark if participant do not want to use the map-based interface. The deployment of the survey through a web-based interface made it possible to implement complex skip patterns and logic flows without unduly burdening the respondent. A second set of questions concerns basic information about usual travel to and from campus. Participants were asked to provide the usual mode of travel, travel time, departure and arrival times and parking location for their regular daily travel. A third set of questions concerns detailed socio-economic and demographic information about themselves and their households. Data was collected on such items as personal income (household income if living with family, parents, or guardians), race, gender, age, living arrangements, driver license holding, and public pass pass holding. Some additional questions were asked to determine whether the respondent could also be part of a qualitative interview or/and participate to a GPS mobility tracking experiment.

SAMPLING PROCEDURE

The student travel survey's reference population comprises all active students, faculty and staff attending targeted campuses. These lists of active students and staff was provided by the participating academic institutions through the support of UdL staff. A list of students, faculty and staff email addresses was drawn by Information system staff by processing complete and recent data from HARPEGE and APOGEE tools (respectively human resources and student management softwares). A confidentiality agreement was signed with each academic institution to insure rules of use and guarantee protection of personal data transmitted for the sampling purpose. The administration of a survey to the entire university community can be accomplished only with the cooperation and consent of the considered academic institution and its various administrative units. A confidentiality agreement was signed with each university to insure rules of use and guarantee protection of personal data transmitted for the sampling purpose.

SURVEY ADMINISTRATION AND RECRUITMENT OF PARTICIPANTS

To ensure that the university community was informed about the purpose of the survey and encouraged to participate, the initiative was advertised through multiple forms of university media and announcements were placed on the university weekly newsletters and student's web portal. The administration of a travel survey to the entire university population requires close coordination with university administrative authorities. A deliberate and collaborative process-oriented approach is actually followed by the project team to ensure that all constituents are engaged and supportive of the effort specially to enhance response rates. To give the survey good exposure advertising was designed in partnership with communications department, with a strategy developed that included a visual branding design which was publicised across campus using digital teasers and paper flyers (Figure 2). The IT department was also informed to authorized to send out mass e-mail messages requesting participation in the survey.

Figure 2 - example of publicity materials used during the survey advertising

The survey was hosted on our own reliable and high power server to facilitate ease of access and retain greater control of the online survey system by the project team. The email message provided a brief description of the survey and the ways in which the data would be used by our project team and the university administration for mobility planning and analysis. The message included a link to the survey instrument (LimeSurvey software), requested participation from community, assured respondents of the safety and privacy of all information provided, and furnished contact information if anyone have comments or concerns about the survey.

A first wave of the web-survey was carried out from January to May 2017. Successive waves will be achieved in the next 3 years with the aim to establish reliable travel behaviour data for the university community across all UdL's academic institution members. The 1st wave of the survey was deployed by a mass-email to a stratified sample belonging to the following institutions:

- VetAgro Sup: during 6 weeks from January to February 2017;
- UCBL University[1]: during 8 weeks from March to May 2017;
- UdL (staff): during 5 weeks from May to June 2017; (ongoing survey)

As our survey questionnaire collect data about travel means used the day before or the last time for joining the campus/workplace, the survey mailing process was spread over weekdays (from Tuesday to Friday) applying a proportionate stratified sampling method thanks to the R statistical software and its package 'SamplingStrata'. As in the survey questionnaire we are asking respondents about their usual mean of transport to access their mean studyplace/workplace, we wanted also to verify trough the survey if there is any variation in preferred modal choice linked to period of the survey administration.

SAMPLING RATES

As expected we found that response was higher among some role groups (faculty & staff) and lower among others (students). Table 1 shows that sampling rates for the students vary from 7 to 25 % between the two surveyed campuses. It is important to note that for our survey, no incentives were offered. In general, university student populations are younger aged and may not be fully engaged with survey processes compared to staff & academic members. As such, they are more likely to ignore surveys for which they do not personally identify and see an immediate or direct benefit to themselves. Furthermore, and according to UCBL's Communication Department, students used to be checking less their academic email compared to their personal email account. This was not the case of VetAgro Sup students who

[1] UCBL University welcomes more than 40,000 students and represent the largest university in number of students enrolled in the Lyon's metropolitan area and the region.

joined the survey with a relatively high response rate (25%). It appears that reminder messages did have an appreciable impact on the response rate for staff & faculty community group.

UdL's academic insitution	Category of population	Baseline population[3]	(%)	Sample size	(%)	Sampling rate (%)
VetAgro Sup campus	Students	707	66%	179	57%	25%
	Faculty & staff	370	34%	134	43%	36%
	Overall	**1077**	**100%**	**313**	**100%**	**29%**
UCBL University	Students	36640	90%	1917	60%	5%
	Faculty & staff	3987	10%	1279	40%	32%
	Overall	**40,627**	**100%**	**3196**	**100%**	**8%**
UCBL University LyonTech-la Doua campus[4]	Students	16,414	88%	1214	60%	7%
	Faculty & staff	2274	12%	824	40%	36%
	Overall	**18,688**	**100%**	**2038**	**100%**	**11%**

Table 1 - Population and samples for surveyed campus

Despite the best efforts and intentions of the project team, response rates for student community group has been identified to be a serious concern in student segments surveys. However, based on our own experience, email survey remains nevertheless the most effective channel of communication for our survey. We found that our survey rates of return are generally consistent with response rates from similar travel surveys:

- Université de Lille (2014): 6% (120,000 students)
- Université fédérale de Toulouse Midi-Pyrénées (2015): 8% (27,000 students)
- Université de Poitier (2010): 15% (18,600 students)

SAMPLE ADJUSTMENT

Due to the differential response rates across market segments, staff members were over-represented in the dataset while students were slightly under-represented in the dataset relative to the true university population (Table1). Therefore, we weight the responses by role (undergraduate students, graduate students, faculty, and staff), age range, gender and distribution of university population across campuses and sites for multi-sites institutions so that the proportion of respondents in each group reflects their proportion in the university population (raking ratio method, using XLSTAT 2014.5.03). Access to higher resolution data during to sampling frame step participate to improve the adjustment process.

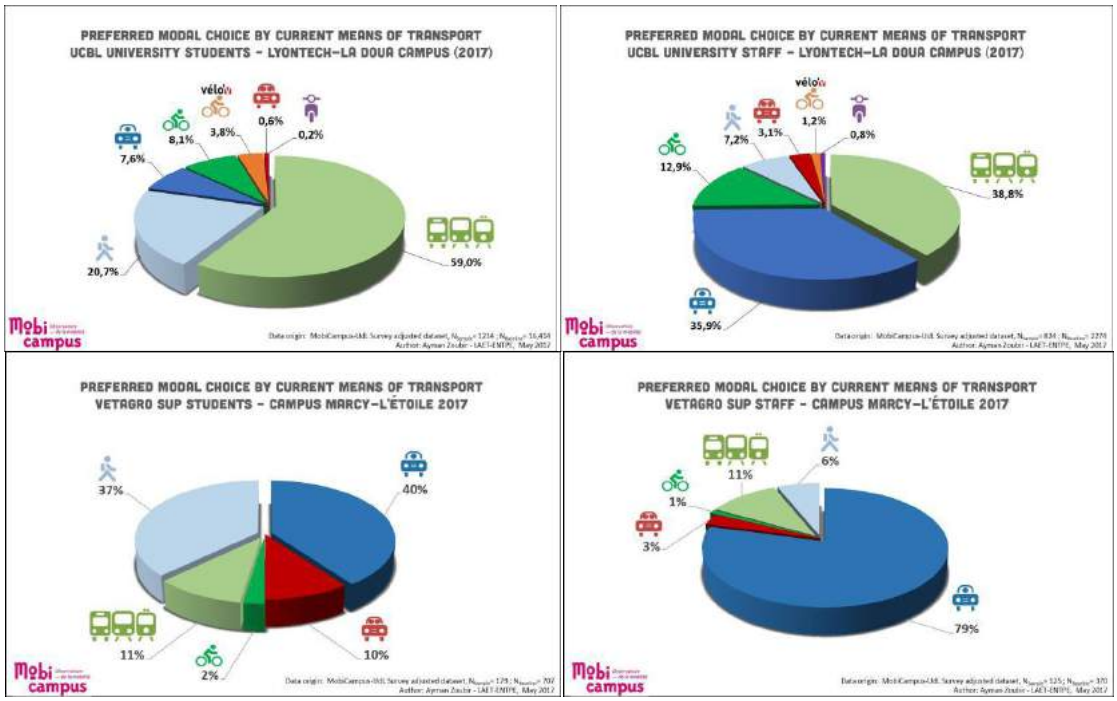
We voluntary do not include residential location as a weighting factor in the sample adjustment process. University students tend to be a mobile group with a-typical mandatory activity schedules, frequently changing their residential locations and residential living arrangements. Available data issued from university information system (APOGEE) includes generally zip codes given by students when enrolled. Important part of those zip codes are corresponding to parent's house and thus do not fit with common student's residential location during term time (Monday until Friday).

DATA PREPARATION AND QUALITY ANALYSIS

A very extensive filtering, cleaning and coding process of the raw data has been performed. A quality control and assurance process was implemented wherein all records were subjected to a number of consistency checks to see if the records would pass through the quality filters especially for travel patterns data. In a number of instances and with extreme care, it was able to apply logical imputation techniques and fix obvious errors, thus minimising the loss of data due to incorrect entries. As data preparation is still an ongoing step we invite to take with extreme care preliminary results presented in this paper.

4 PRELIMINARY RESULTS

Preliminary analysis on surveyed campuses shows when compared to the staff & faculty group from the same university, university students are more likely to share favourable modal split towards active transport modes that include public transport and sustainable travel modes. Figure 3 shows that students do indeed differ from other adults. This is especially noticeable in the analysis of travel patterns.



5 CONCLUSION AND PERSPECTIVES

This paper has attempted to present part of UdL's campuses travel survey design and administration, analysis of observed university community travel behaviour. However, there are some limitations to the research as the data collection and analysis still an ongoing process. At present this paper will be updated as additional data processing will be done.

ACKNOWLEDGMENTS

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ID 1499 | COLLECTIVE TRANSPORT. A SPATIAL ANALYSIS IN THE CITY OF RECIFE, BRAZIL

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ABSTRACT: Developed countries have related the lack of access to public transport to disadvantage and social exclusion, and many methods have been developed for the spatial measurement of the public transport supply aimed at equity in relation to socially disadvantaged groups, and for improvements in transport systems. These methods are still incipient in Latin America, although interventions to improve transport quality are an essential political requirement in urban governance. This paper is part of a PhD thesis, aiming the methodological development for the identification and evaluation of spatial gaps in the supply and demand of public transport causing social disadvantage in the Brazilian city of Recife. It is based on methodologies such as Needs-gap (Currie, 2010), PTAL (Transport for London, 2010), PTAI (Saghapour et al, 2016), and other methods analyzed. The objective of the paper is the critical analysis of the approaches that deal with these aspects, both in terms of social disadvantages due to the difficulty in accessing or even having public transport, as well as in the part related to the detection and analysis of spatial gaps in the supply and demand for public transport in urban areas of large cities. Based on the review carried out, it is possible to base the methodological development intended for the thesis study area, which can also be used for other cities in the world.

KEYWORDS: Public transport. Needs-gap. Social exclusion.

1 INTRODUCTION

Social inequality has been interpreted in several ways. It is most commonly explained as being the effect of income concentration and disparities in quality of life. In a study published in 2015, the OECD shows that the gap between rich and poor has widened in developed countries over the past 30 years, consolidating disparities between classes and affecting gross domestic product. What, then, can be said of the countries of Latin America that have reduced poverty, but in absolute numbers have millions of people in this situation in urban areas and high levels of unemployment strengthening informality? Considered the most urbanized region in the world, its cities are spatially and socially segregated (UN-Habitat, 2012). In Brazil, the appropriation of the urban space by private interests with the support of the State has been well-known and thus the challenge of overcoming the unequal conditions of citizenship is constant. The socially disadvantaged population moves away from the main centers of cities and the difficulty of access to public transport in carrying out basic activities such as work, school and health, compromises freedom and social progression. In view of the importance of the theme, several methods have been developed for the spatial measurement of the public transport supplied, aimed at identifying lack of equity in relation to socially disadvantaged groups.