# Report on THE mobility observation

Interreg Sudoe
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**Partner Responsible**
UT3 - Université Toulouse III - Paul Sabatier

**Authors:**
Marie-Pierre Gleizes, Mame Samba Gueye, Christine Régis (UT3)
Jose Almeida Silva, Afonso Conçalves Lamy (FCUL)
Yacine Ghamri (ULR)



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# E2.2.1 – Report on the mobility observation

# 1. FCUL

## I. Motivations

The Portuguese transport sector accounts for about 25% of greenhouse gas emissions, reducing GHG emissions in this sector will play a crucial role in the path to environmental sustainability, especially in a country where most of the population still uses its own car for much of its travel (EMNAC 2020-2030, 2019). Making Portugal a country in need of investment in sustainable mobility. Despite Lisbon having a more sustainable mobility profile than the national average, there is still a low use of soft mobility modes if one excludes pedestrian travel. This scenario is expected to change in the near future. Regarding public transport, the greater service offer in Lisbon is one of the factors leading to its high use rate (Unterstaller, 2019).

Increasing the use of soft mobility modes has several benefits. It can induce an increase in the physical activity of the population and have a positive impact on public health. Replacing car traffic by soft modes can contribute to a reduction of road accidents and improve road safety. Reduction of traffic jams, improvement of the air quality in the cities, and cutting down mobility-related greenhouse gas emissions are other potential gains of using soft mobility transports.

It is essential to define a strategy to analyze the use of soft transport modes to better understand how an increase in its utilization can be fostered, with a special focus on mobility modes that favor the use of public transportation and other soft mobility mechanisms.

## II. Objectives

This study aims to diagnose the access and use of soft mobility modes by members of the FCUL community. The study will then serve as a basis for planning measures to promote the use of soft mobility modes in the FCUL community. Throughout this study, the use of personal and shared soft mobility transportation was analyzed. Initially, the monitoring equipment to use was selected and the distribution of the sensors by the campus accesses was defined. Later, is possible to characterize the use of mobility modes by the faculty community in terms of typology and frequency. In parallel, an online survey of mobility behavior of the members of the FCUL community, done in the context of national survey to the high education institutions, was analyzed.

## III. Method

The method for analysing the soft mobility flow at the FCUL started by identifying the main campus entrances, and the location of the parking spaces for this type of transport on the FCUL campus and in its proximity. Then, the monitoring technology and equipment to be used were selected, and the location of the monitoring posts was defined in order to count the entries and exits of the soft mobility devices.

## IV. Mobility observations

### FCUL campus description

Located in Campo Grande, in Lisbon, the FCUL campus is characterized by not having strict physical borders and having high public transport access. The campus has three main access points, three parking docks of the shared municipal bicycles (GIRA) nearby, and two bicycle parking facilities inside the perimeter (Figure 1).

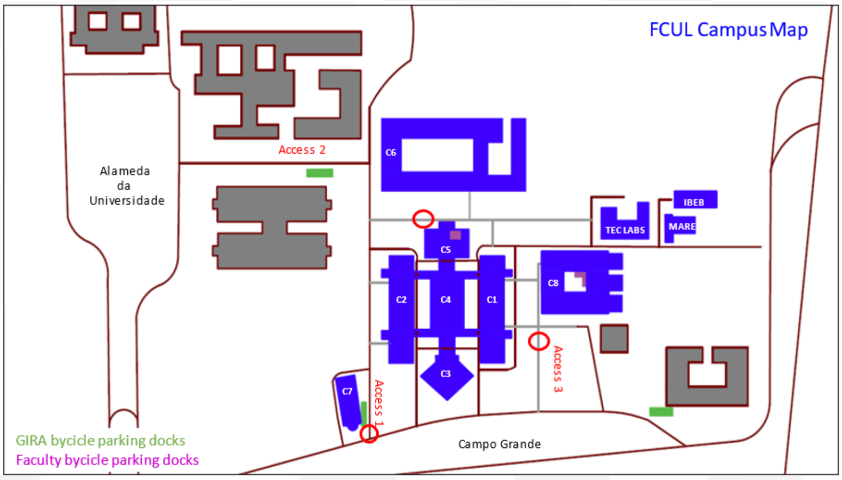



Figure 1 – FCUL campus map with the identification of the main road accesses

### Access 1 - Rua Interior à Alameda da Universidade

The Rua Interior à Alameda da Universidade, from now on referred to as Access 1, is characterized as a two-way street that allows motorized vehicles and soft mobility mechanisms to pass through. On this access is located the GIRA 480 station, with 25 GIRA parking docks. As can be seen in Figure 2, this street has at in its eastern entrance, a crossing for soft mobility vehicles that is connected to a bicycle track.


Figure 2 – Eastern entrance of Access 1

### Access 2 - Rua Professor Oliveira Marques

The Rua Professor Oliveira Marques, Access 2, is an access road that leads to C6 faculty building. The road has two directions, allowing motorized vehicles and soft mobility mechanisms to pass.

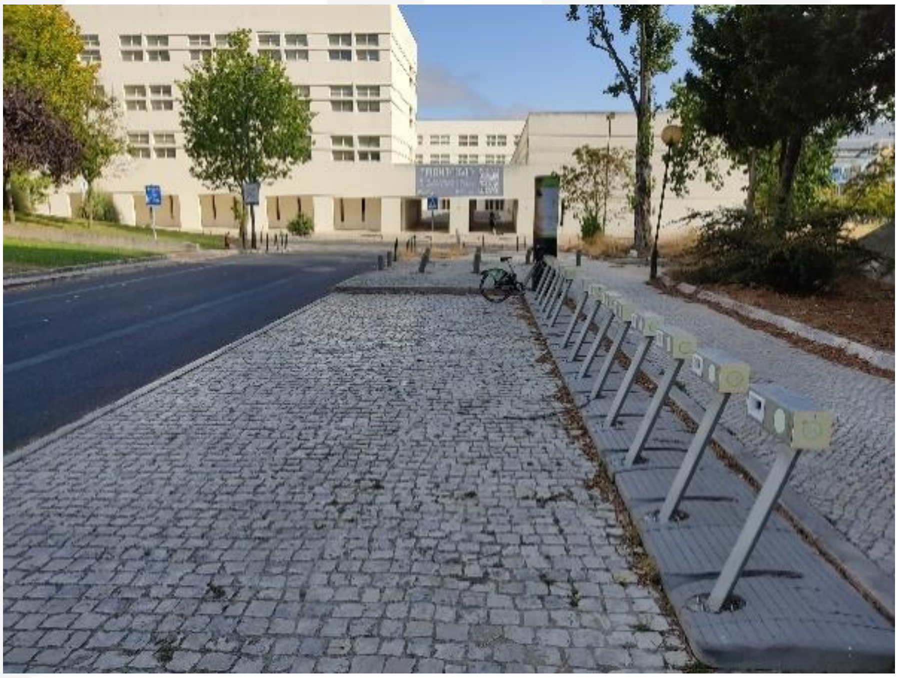


Figure 3 – GIRA 479 station, on Access 2, near C6 building of FCUL

GIRA station 479, with 13 GIRA parking docks, is located at this access. Figure 3 shows the location of GIRA station 479 with the C6 building behind.

### Access 3 – Access of the Lisbon Museum – Palácio Pimenta's

The Access 3 is at the intersection of the access road to the Palácio Pimenta's parking, this area allows the circulation of pedestrians and soft mobility vehicles. Figure 4 depicts the walkway and cycle path for Palácio Pimenta's premises, which flows to Access 3. And Figure 5 shows the access to FCUL.

Figure 4 – Pedestrian and cycle path leading to Access 3

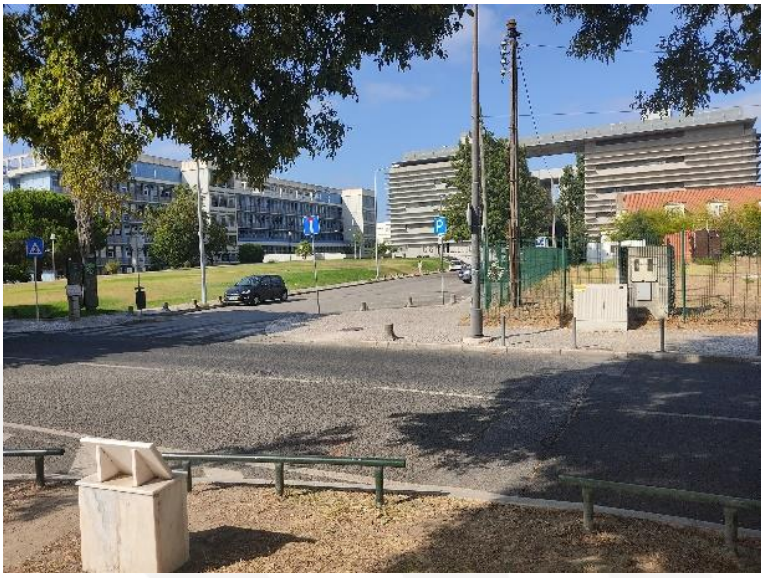


Figure 5 - Gateway to the faculty

On the access road to the Palacio Pimenta is located the GIRA 481 station, with 20 parking docks. Figure 6 shows the spatial layout of the GIRA 481 station and the parking of shared scooters in the public soft mobility parking docks located on the pavement across the access road.

Figure 6 - Shared bicycle and scooter parking docks at Access 3

## Mobility behavior survey

In the context of a national survey organized by the mobility group of the Network of Sustainable Campus (RCS, 2023), the faculty members were invited to participate in a mobility survey. The questionnaire had 741 responses (Rauli et al., 2022), which considering the fact that faculty members were 6558 in 2022(FCUL, 2022), means that the response rate of FCUL was 11,3%, one of the highest in all the institutions involved in this study.

It was concluded that the average travel distance to and from FCUL is 15,4 km, and the most popular mode of transportation is the car (30%). The most common reason for that choice is the time a person takes to get to the faculty. In terms of the use of other mobility methods, 20% use train, 14% subway, 21% bus, 1% boat, 7% bicycle, and 5% e-scooter. The typical arrival time is after 10 a.m., and the typical exit time is before 5 p.m. 55,7% of survey participants in the poll takes advantage of the trip to participate in other activities.

## FCUL campus instrumentation

When choosing the sensorial equipment, the main criteria were that it could be used to perform counts of both bicycles and scooters, that it was easy to install and use and required little maintenance. Also, it was important that it could be used for periods of three months to one year, on any kind of pavement. Based on these criteria, after conducting a market survey, the Eco-Counter pneumatic tubes (Figures 7-9) supplied by the company UpNorth, were selected. In an initial stage the counts were done manually, in order to collect a preliminary set of data that allowed a more efficient installation of the pneumatic tubes.

It was decided that for the purposes of this work, the focus of the study would be the analysis of bicycle and e-scooters traffic. Whether they were for personal use or shared, powered only by human locomotion, or supported by low-power electric motors.

Figure 7 – Pneumatic tubes, which allows the detection of the passage of bicycles and e- scooters, installed at Access 1

Figure 8 - Pneumatic tubes, which allows the detection of the passage of bicycles and e- scooters, installed at Access 2

Figure 9 - Pneumatic tubes, which allows the detection of the passage of bicycles and e- scooters, installed at Access 3

## Deployment and data collection

For the preliminary study, the manual counts were made on the main access roads to the Faculty of Sciences: Access 1, Access 2, Access 3. Access 1 has GIRA 480 station, Access 2 has GIRA 479 station and Access 3 has GIRA 481 station. The flow of soft mobility vehicles to and from FCUL was analyzed by counting the passages of bicycles and scooters between 8:00 a.m. and 7:00 p.m., in the three checkpoints. For each access, two days of counting were conducted, both during the second semester and during the exam period. In parallel, during the same period as these counts, the variation in the presence of personal and shared bicycles and scooters throughout the day was monitored through hourly observations combined with the consultation of several digital mobile applications of the different soft transport rental services circulating on campus for four weeks, two weeks during the normal second semester academic period and two weeks during the exams season.

The pneumatic tubes were installed on 16 of November of 2022, in the places marked with a red circle (Figure 1), in order to cover the two bicycle parks of the faculty and the GIRA bicycle station, that the manual counts proved to be the most used. In this way, it is estimated that most of the soft mobility flow accessing the campus is covered by the sensors, since the alternative routes either have gates delimiting the private car park of the faculty or are not so convenient for soft mobility modes circulation due to the presence of stairs, steep terrain elevations, or even because they are pedestrian-only areas.
It´s expected that they will be functioning in this desired location for at least six months in order to cover the period of classes, the exams period, and the breaks in between.

## End-user implication

Near each counter were placed several billboards such as the one in Figure 10. The billboards warn the faculty users to the location of the sensor and direct them to a website (https://transnet.rd.ciencias.ulisboa.pt/) where they can have access all the relevant information on this mobility project. As the data is collected, the website is updated with the last counts. The availability of this information allows an interactive experience with the users, in the framework of the Living Lab.


Figure 10 - Information billboard

Until now the website has received 26 visitors per week on average. In order to assure that the bicycle or scooter users were really going to the faculty, poll campaigns were made, where people parking their vehicles were asked if they were going to FCUL, and if they were using this type of devices daily.

## V. Results

### 1. Preliminary conclusions

**Daily frequency of using soft mobility modes**

Figure 11 shows the results obtained for the average daily entries of shared and personal bicycles and scooters for the school term and examination season. The results from the shared soft mobility mode data were based on passage counts, while the personal soft mobility mode data were based on hourly observations of the soft mobility vehicles parked in the faculty campus.

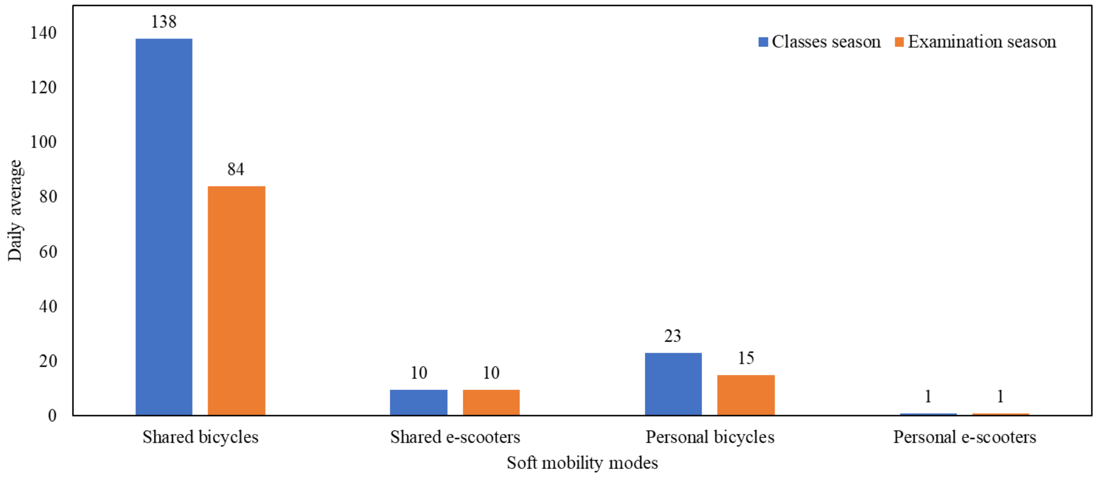



Figure 11 – Daily average of each soft mobility mode, for the class period and exams season

Analyzing the figure, it is possible to estimate the number of people using each mode of light transport in a typical day. It is estimated that during the school term, 172 modes of soft mobility enter the FCUL daily: 161 bicycles and 11 e-scooters. During the exam season, 110 vehicles enter FCUL daily: 99 bicycles and 11 e-scooters. It is also observed that more than 85% of the soft modes used correspond to shared means of transport and there is a preference for the use of shared bicycles (89%) over shared scooters (11%). Comparing the results obtained with the use of cars, which based on the entries in the parking lot is estimated to be around 450 cars per day, it is estimated that for the academic period, the use of soft mobility modes was 3 for every 8 cars, while in the examination season, it was 1 for every 4 cars.

Since it is not easy to obtain a daily figure for campus use, it is difficult to accurately assess the importance of the use of soft mobility mechanisms. However, it´s possible to make some estimates.

To seek to estimate the average number of people attending the faculty, the number of individual daily accesses to the local Wi-Fi network (Eduroam) was analyzed, assuming that in their majority, the attendees are users of the Eduroam network. It was observed that the average number of frequenters in the faculty with a device connected to Wi-Fi is lower in the exam season than in the academic period, which is expected since in the exam season, students not having classes don´t need to be in the faculty as much. The average number of connections to Wi-Fi in faculty during the counts taken in the academic period was 2056 connections, and in the exam season, it was 1258 connections. Finally, comparing the use of 172 soft mobility modes per day during the academic period and 110 during the examination season with the average daily connections to the Eduroam network during the counting periods, we can estimate that 8% of those attending chose to travel to the FCUL using any soft mobility mechanism during the academic period and 9% during the examination season under analysis.

**Average arrivals and departures of shared-use soft mobility modes**

In order to identify the access routes most used by soft mobility mechanisms, the average daily flow of arrivals and departures of shared soft mobility modes was calculated for each checkpoint. It was verified that there is a particular affluence of shared soft mobility means in the access to the FCUL space through Access 1 (Access 1 - 68%, Access 2 - 14%, Access 3 - 18%). There was also a preference for the use of shared bicycles (89%) over shared scooters (11%).

## 2. Pneumatic tubes results

The biggest advantage of using this type of sensor, is that it counts 24/7 and after installation it does not require any labor to make the acquisitions. Until now, we got a total of 13471 soft mobility modes counts. Being 83% of Access 1, 14% of Access 2 and 3% of Access 3. Below in Figure 12, the daily traffic is represented, for each day counted. It can be observed that the highest number of entries in a day was 290. We can also see that in most days, the number of exits is lower than the number of entries, which means that the users of this soft mobility modes are choosing other routes when exiting the campus.

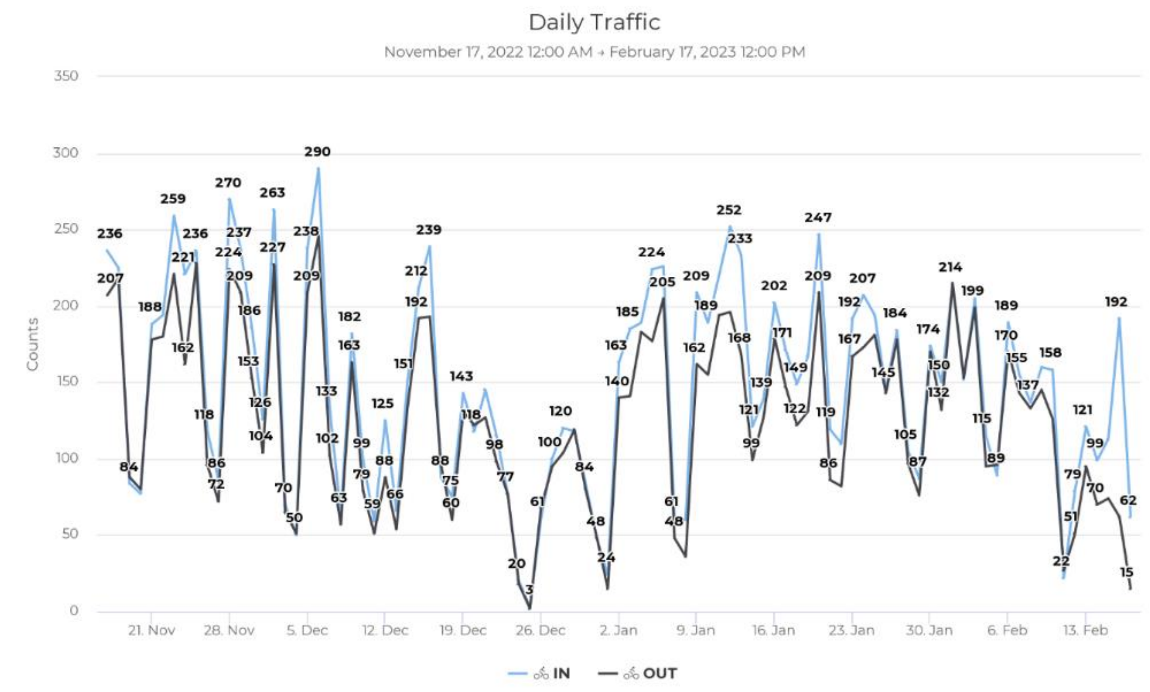



Figure 12 - Daily traffic of soft mobility modes combined

Figure 13 shows the daily average profile for the three accesses. Since Access 2 and Access 3 are routes to the interior of the faculty, only personal bicycles and e-scooters cross it. In contrast, Access 1 is close to a GIRA station, the detector will count the pass of the shared bikes going this station, which as previously observed represent most of the soft modes used. Therefore, the counts in Access 1 are significantly higher than for the others accesses.

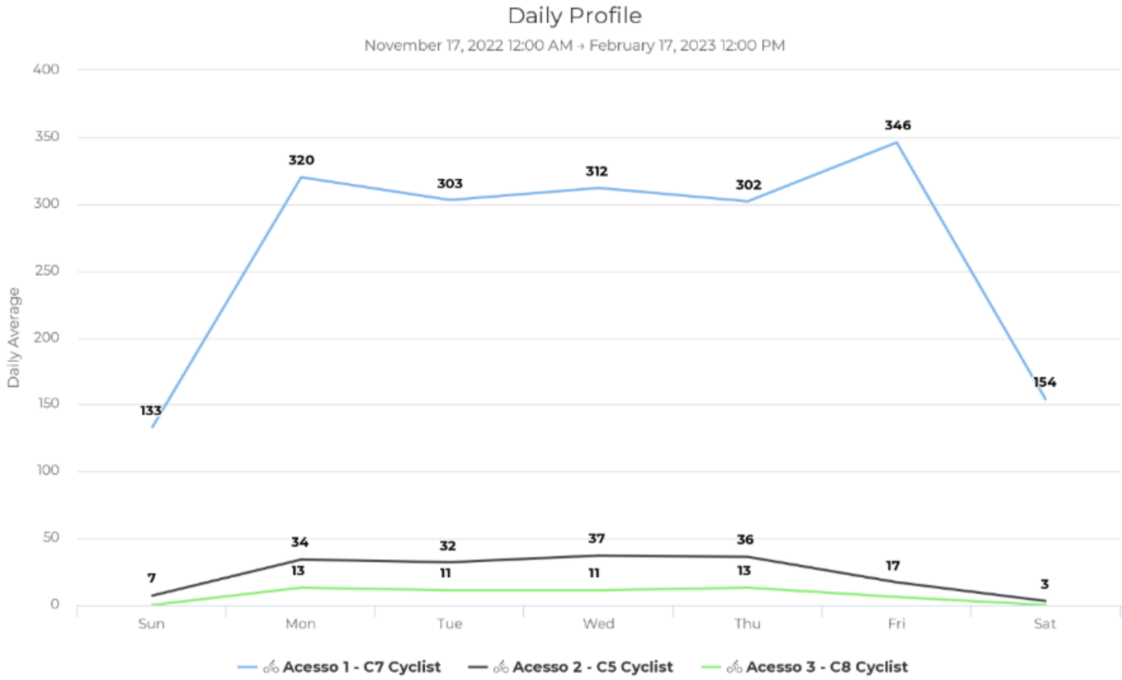



Figure 13 - Daily average profile.

Figure 14 gives us the hourly average profile for the weekdays. With this analysis, we can observe the hours of the day where we have more traffic. It can be observed that around 9 AM there is an increase in traffic of soft mobility modes, as these are the usual hours when users start to frequent the faculty. From 2 PM to 6 PM, the use of soft mobility modes reaches its peak on Access 1.

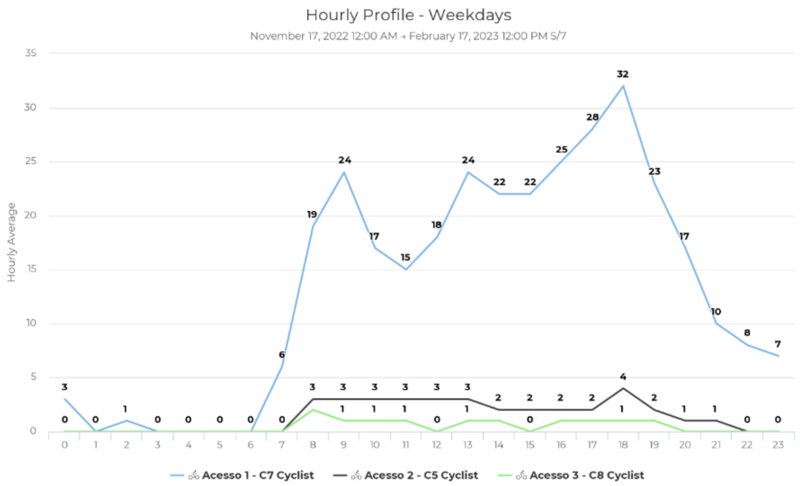



Figure 14 - Hourly average profile for the weekdays.

## 3. Mobility behaviour evolution

**Comparison of the frequency of use of GIRA shared bicycles between the year 2020 and the year 2022**

A comparison was made between 2020 and 2022 of the average hourly variation in GIRA bike presence around the faculty. To do so, we consulted (EMEL, 2020) and obtained, for the year 2020, the hourly data for the stations GIRA 480, located in Access 1, and GIRA 481, located in Access 3. The station, 479, currently located in Access 2, was not yet in service.

The characterization of the frequency of GIRA bicycle use can be defined by whether there are more or fewer bicycle entries and exits from the stations. Comparing these parameters suggests that between 2020 to 2022, there was an average 19% increase in GIRA bicycle use around FCUL.

## 4. Developments in activities

Pneumatic tubes are portable, easy to install, and low-cost. This type of sensor operates 24/7 without requiring human intervention to acquire the data. The number of soft mobility mode counts to date, 13471, proves that this equipment was the best option for this study. Its parallel use with the Eco-Vision software from Eco-counter allows us to perform analyses of the use of soft mobility modes in the Faculty of Sciences at the University of Lisbon in a dimension that would not be possible without this type of equipment. The fact that there was a nearly 20% increase in the use of GIRA bicycles between 2020 and 2022, shared-use bicycles whose operating model is shared by the municipality of Lisbon through its participation in the public-private company EMEL, proves that this type of research is crucial to accompany the evolution of our cities towards greener and more sustainable spaces.

# 2. ULR:

## I. Motivations

Mobility is a high-stakes sector regarding climate change because it is the leading source of greenhouse gas (GHG) emissions in France. Mobility accounts for 30% of national GHG emissions, half of which (15% of total emissions) are linked to the use of personal cars.

One of the French climate objectives within the European framework is to reduce the carbon footprint of each person to 2 tons equivalent of C02 equivalent/year by 2050, compared to the current average of 10 tons of CO2 equivalent/ for a French citizen. Our emissions must therefore drop from today, by 5% per year for all activities combined, to stay on the path of limiting the rise in the average temperature of the atmosphere by +2°C by 2100.

In the framework of the AGREMOB project, a project started slightly before Tr@nsnet and running in parallel with Tr@nsnet, La Rochelle University launched among the La Rochelle University community, a survey on mobility habits. This one was launched at the very beginning of the Tr@nsnet project. The objective within Tr@nsnet is to share the outcomes and understandings from the analysis of this survey in order to help replicate this survey on other Campuses. More precisely, the results of the analysis of this survey were shared with the Tr@nsnet project partners in order to help develop similar across participating Campuses.

The results of this initial survey are presented below.

## II. Objectives

The survey aims to support the inhabitants of La Rochelle in changing their habits towards a softer mobility.

Its objective is to understand what motivates the mobility choices of university users for their home-university journey today. It also aims to identify the desires, needs and expectations of these users. In this way, measures aimed at changing habits towards softer mobility can be facilitated.

This survey was distributed within the university community in order to take stock of practices and understand what motivates the mobility choices of students and staff members for their home-university journey today.

## III. Methodology

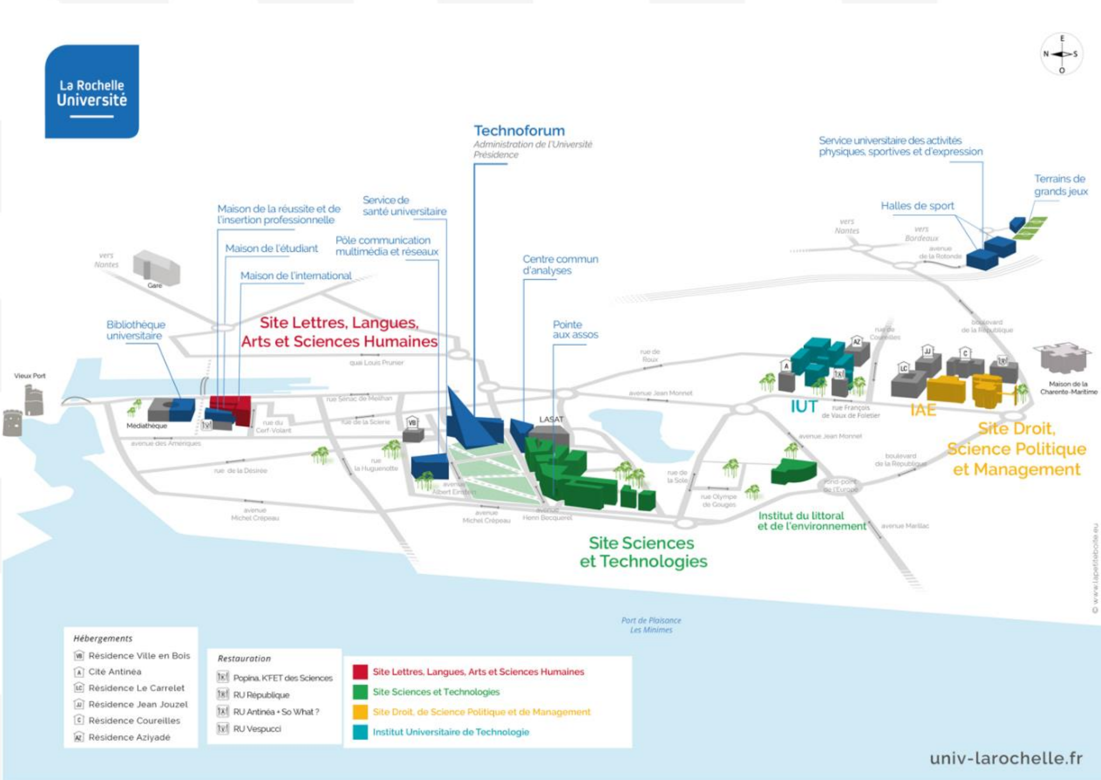
The followed methodology is based on the use of association tests. An association test is used to determine whether or not there is a link between two variables. To say that there is a link between two variables is to say that when one varies, the other also varies more or less strongly. The "strength" of the link can be characterized by different correlation coefficients, the choice of the latter depending on the type of test used and the nature of the data. On the other hand, it should be noted that an association test does not provide information on the causal links between variables: it is not because two variables are linked that one is the cause of the other.

The survey was designed to allow for such association tests.

## IV. The mobility observatory

### 1. ULR campus description

La Rochelle University is located in the heart of the city of La Rochelle, more precisely in one of its newest districts, Les Minimes. As depicted hereafter, it is an open campus (i.e. mixed with other city's buildings / activities) spread over multiple poles / sites within this district.



Below, the travel time between these different sites, the city center as well as the railway station are given by the following figures:

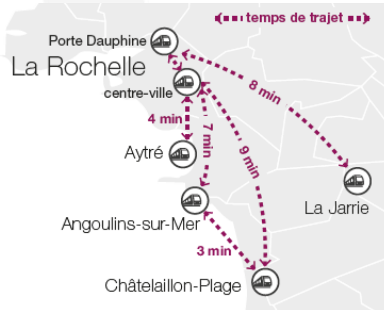
| DEPART ------------------ ARRIVEE | Technoforum | | | Site Sciences et Technologies | | | LLASH - BU | | | IUT | | | IAE - Droit | | | Plage des Minimes | | | Centre ville | | | Gare SNCF | | | SUAPSE | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | [walk] | [bike] | [car] | [walk] | [bike] | [car] | [walk] | [bike] | [car] | [walk] | [bike] | [car] | [walk] | [bike] | [car] | [walk] | [bike] | [car] | [walk] | [bike] | [car] | [walk] | [bike] | [car] | [walk] | [bike] | [car] |
| Technoforum | | | | 4 | 1 | 7 | 5 | 2 | 8 | 10 | 5 | 8 | 15 | 7 | 10 | 21 | 7 | 12 | 15 | 6 | 14 | 12 | 5 | 9 | 19 | 7 | 10 |
| Site Sciences et Technologies | 4 | 1 | 7 | | | | 9 | 3 | 8 | 9 | 4 | 9 | 15 | 7 | 9 | 16 | 6 | 11 | 20 | 7 | 15 | 17 | 6 | 11 | 20 | 8 | 11 |
| LLASH - BU | 5 | 2 | 8 | 9 | 3 | 8 | | | | 14 | 6 | 10 | 19 | 9 | 11 | 26 | 9 | 13 | 10 | 4 | 14 | 8 | 3 | 9 | 23 | 9 | 12 |
| IUT | 10 | 5 | 9 | 9 | 4 | 9 | 11 | 5 | 8 | | | | 5 | 2 | 8 | 20 | 7 | 11 | 25 | 10 | 15 | 21 | 8 | 11 | 11 | 4 | 10 |
| IAE - Droit | 15 | 7 | 10 | 15 | 6 | 9 | 19 | 8 | 11 | 5 | 3 | 8 | | | | 22 | 8 | 11 | 30 | 12 | 15 | 25 | 11 | 12 | 10 | 5 | 8 |
| Plage des Minimes | 21 | 7 | 12 | 16 | 5 | 11 | 26 | 9 | 13 | 20 | 7 | 11 | 22 | 9 | 11 | | | | 36 | 13 | 18 | 34 | 12 | 14 | 28 | 10 | 13 |
| Centre ville (quai Duperré) | 15 | 9 | 11 | 20 | 8 | 12 | 10 | 4 | 13 | 25 | 10 | 12 | 30 | 12 | 12 | 36 | 14 | 15 | | | | 9 | 2 | 9 | 33 | 11 | 10 |
| Gare SNCF | 12 | 5 | 9 | 17 | 6 | 10 | 8 | 3 | 11 | 21 | 8 | 10 | 25 | 10 | 11 | 34 | 12 | 13 | 9 | 2 | 11 | | | | 24 | 8 | 11 |
| SUAPSE | 19 | 7 | 10 | 20 | 8 | 11 | 23 | 8 | 12 | 11 | 4 | 9 | 10 | 4 | 8 | 28 | 9 | 12 | 33 | 11 | 14 | 24 | 8 | 11 | | | |

LEGENDE

**à noter: le temps de trajet de la voiture comprend le temps de se garer qui est d'environ 6 minutes**

Estimation des temps de trajet faite avec l'application Modalis

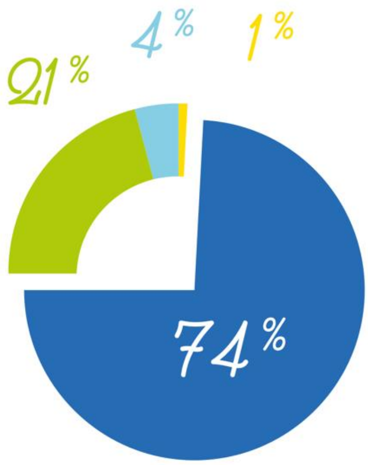
Train travel times to some neighboring cities, within the La Rochelle community, are also given in the picture above.




It should be noted, however, although two new railway stations have been established in La Rochelle community in the past years, many students and staff live outside the reach of a train station, either inside or outside the community.

## 2. Questionnaire Analysis

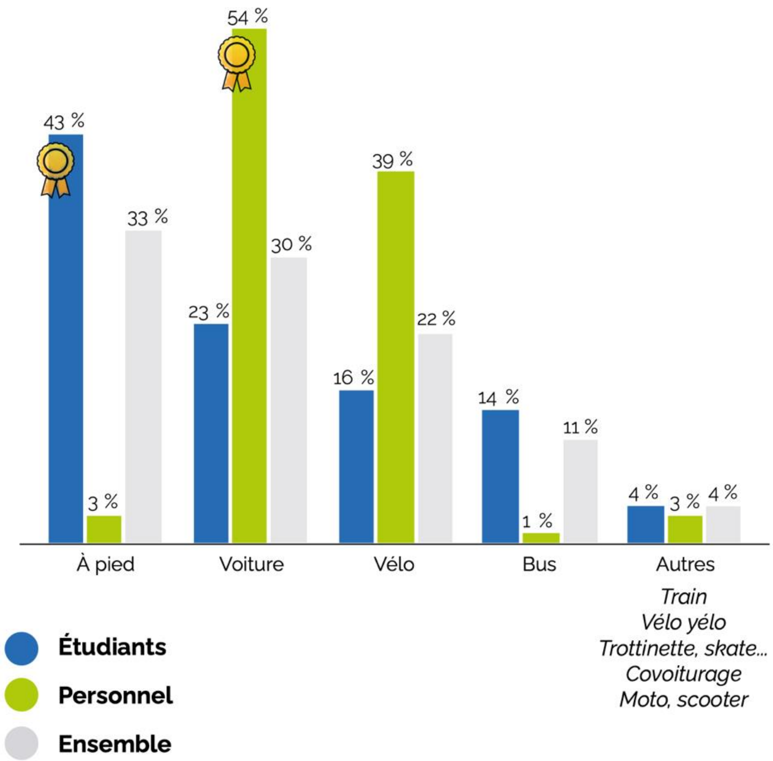
1798 exploitable records were retrieved from the survey, corresponding to 19% of the total students and 33% of the total university staff. Of all respondents, 74% were students in initial training, 21% were university staff members, 4% were work-study students and 1% were temporary teachers. The distribution of education levels follows that of the original population for students, while for university staff the highest category is slightly under-represented, which was somehow surprising.



Regarding association tests, in this survey, from the first association test, between mobility and status, we detected a strong link. In order to minimize the increase in the risk of error due to the effect of covariances between explanatory variables, we chose to test students and staff separately for the rest of the tests. Therefore, given the very low proportion of staff members who walk and take the bus, we also exclude these two modes in the tests conducted on staff.

The main outcome of the survey are as follows:

**Transport Habits:** The very wide variety of multimodal mobility does not allow to express any specific trend for this population. Thus, the following analyses were limited to the unimodal population only. For students, walking is the most used mode of transportation (43%); for staff, the first place is occupied by the car (54%). Also, 55% of respondents occasionally use another mode of transportation. In this case, the preference is for the car, followed by the bus, the pedestrian mode and the bicycle, respectively.




**Mobility Choices:** Respondents were asked to select from a list of criteria those that best explained the reasons why they chose their primary mode of transportation. Overall, pedestrians explain their choice by the fact that it is more economical and more ecological (to a lesser extent by the independence it gives them and the fact of being able to keep fit). Cyclists use the same selection criteria, but add the speed of bike mode. Bus users say they chose it because they often cannot do otherwise (to a lesser extent because it avoids exposure to bad weather, it is more economical and more ecological). Finally, car users mainly explain their choice by the fact that this mode is faster, more practical, more comfortable and gives independence. This should be related to other dimensions, in particular travel times and distances.

**Route:** In terms of travel distances, pedestrians and cyclists mostly travel short distances, with averages of around 1 km and 3 km respectively (4 km for staff). The bus is a transport of longer distances, with an average of 9 km but a high standard deviation. The car, on the other hand, is undoubtedly the long-distance transport mode, with an average distance of 19 km. As such, the car is faster than the bus over long distances, with a lower average travel time of 28 min, compared with 36 min for the bus. The average travel times for pedestrians and cyclists are equivalent (around 12 min) and confirm that cycling is more efficient over short distances. We can note that the proportion of students using the car without making a stop (shopping or other) is 15% for trips of less than 5 km and 33% for journeys of less than 10 km. For staff, these figures are 9% on trips of less than 5 km and 21% on trips of less than 10 km.


**Change of Mobility Habits:** Respondents were asked about the criteria that would encourage them to change their mode of transportation. This essentially reveals coercive criteria as well as the need to remove environmental and situational obstacles (ex. existence of a public transport service, frequency of transport, etc.). Students using cars mention reduced travel time, too much traffic jam and a trip that has become too expensive as the main reasons for a change. The staff using car also cited travel time and traffic jam, but replaced the cost of the travel with the need for more convenient public transport schedules and frequencies.

## V. Mobility behaviour evolution

From the above-mentioned survey, we can learn that most university users use non-motorized modes of transport (essentially walking and cycling), to travel between home and university. These mobilities are characterized by short travel times and distances. We can also observe a significant proportion of cyclists making "medium" trip distances: 5 to 10 km, 5 km corresponding to the University - Beaulieu shopping center* trip. The choice of these types of mobility is explained by economic, ecological and health criteria (avoiding stress, staying in shape).

Conversely, motorized mobility is characterized above all by long travel times and distances. The choice is explained very differently depending on the engine: for the car, these are comfort criteria; the bus is particularly suffered or at least chosen by default.

The choice is obviously explained by other criteria. In view of the analyzes overviewed here, we can suggest that among users of La Rochelle University, the choice of mobility is also linked to the distance and travel time between home and university, as well as to the status (students/staff).

The higher use of the car by staff than by students could possibly be explained by the higher purchasing power, but also by the higher frequency of stops on the route, of various kinds (in particular bringing children to school and shopping).

Other elements are more difficult for us to access, such as the role played by respondents' sensitivity and/or knowledge of climate/environmental issues in their choice.

Respondents with motorized mobility seem today, for various reasons related to what is explained above, reluctant to change. In addition, the instability of the bus mode raises fears, when the opportunity arises, that the modal transfer of this population will consequently be to the car (which is undesirable). This underlines the importance of setting up a change management project. The objective of such a project must also be to ensure the sustainability of more sustainable behaviors, particularly by continuing to raise awareness and guarantee a good experience of non-motorized mobility. Since this survey, multiple actions have been undertaken by the university to accelerate the transition to a low-carbon daily mobility. Among these are:

The establishment of incentive measures to for remote working: this mode has been fashionable since the COVID19 crisis. It has only a limited impact on the reduction of GHG emissions, in particular because of its low emission reduction potential and the multiple rebound effects revealed by literature. Nevertheless, it stays under consideration by the University.
The implementation of a soft mobility and car-sharing package. While the former clearly reduces GHG emissions, it might have limited coverage within the university staff, the latter is clearly "a facilitator of multimodality and a trigger for demotorization".

Both actions mentioned above were implemented for the university staff, as they are the main car users. Other actions need to be undertaken for students as well.

After the implementation of these measures as well as targeted communication to increase awareness and/or knowledge of climate/environmental issues, a new survey was conducted in early 2022 to evaluate the impact on changing mobility behavior.

# 3. UT3:

## I. Motivations

Mobility is an essential component of our territories' capacity to adapt to climate change. Knowing this means understanding it and acting on it to achieve sobriety. In France, transport is responsible for 28.7% of national greenhouse gas emissions in 2020. This figure was 31.1% in 2019. This drop can be attributed to the Covid crisis, which led to a decrease in household travel with their private vehicles and in the transport of goods during the lockdown. However, it should be noted that since 1998 the transport sector has been the leading emitter of greenhouse gases in France (SDES, 2022). Commuting to and from work is a major contributor to these emissions, as 74% of employed people use their car to get to their workplace (Insee, 2021). Universities are no exception to this alarming observation, as they are generators of mobility given the large proportion of employees. Because of their size, university campuses face the same challenges as small towns. It is therefore urgent to rethink the mobility of the university community by encouraging more soft mobility, as their younger population prefigures in a way the population of tomorrow, and their mobility behaviour, as well as the habits they have acquired, give us a head start on the behaviours of tomorrow.

## II. Objectives

The aim of the mobility observatory is to gain a better understanding of mobility behaviour on the campus, in order to facilitate, anticipate and guide changes in travel, while building databases on actual traffic on university sites and research centres, in order to improve knowledge of active and multimodal mobility. It also makes it possible to identify the uses and needs of the university community in terms of travel.

## III. Methodology

The setting up of a mobility observatory is based on a well-defined methodology. In the context of this action, the methodology followed by UT3 is divided into four main stages:
First of all, we need to find the means to reach and to invite end-users to participate in the project. We meet with the Soft Mobility Group UT3. It is a set of end-users who pursues several actions to promote soft mobility on campus. We have decided to work together on the mobility observatory.
Then, a field diagnosis carried out by CEREMA in order to characterise the campus infrastructures, i.e. car parks, bicycle parks, shared bicycle stations and public transport stops. This diagnosis made it possible to characterise the modes of transport available on the campus, to map their location and to evaluate their capacity and interactions. In addition, it provided the basis for the types of measurements needed to better assess mobility on campus.
This step is followed by the implementation phase with the involvement of all the actors of the activity 2.2 composed by the Soft Mobility Group UT3, the scientific managers, the project leader and CEREMA, the action provider. This team work aims at defining both the observation sites and the counting equipment. It is the longest and requires several tasks, namely:
Selection and purchase of metering equipment
Applying for and obtaining permissions from the EMS
Installation and validation of equipment
Data collection, monitoring and processing
In order to complete the data from the sensors, a questionnaire for campus users is being put online to find out about their commuting practices, their motivations and perception of their trips as well as the means of transport they use.
In summary, the methodology of the mobility observatory can be divided into the four steps presented in in the following diagram:

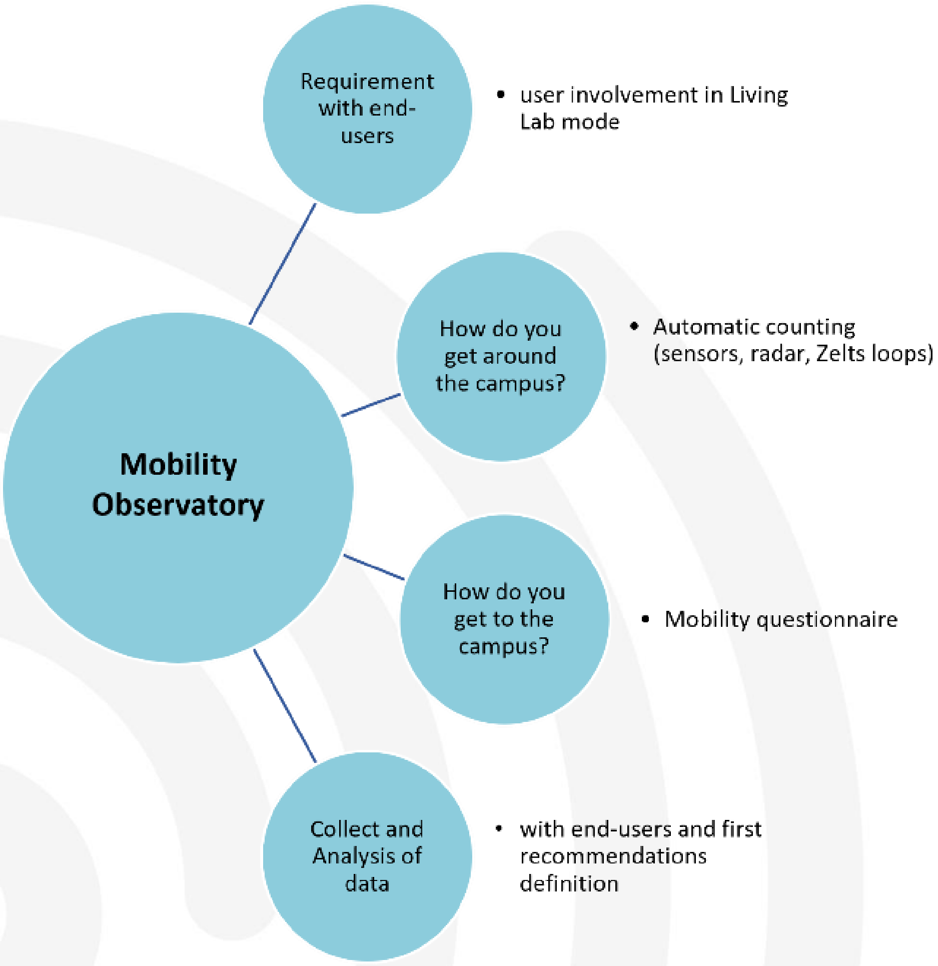


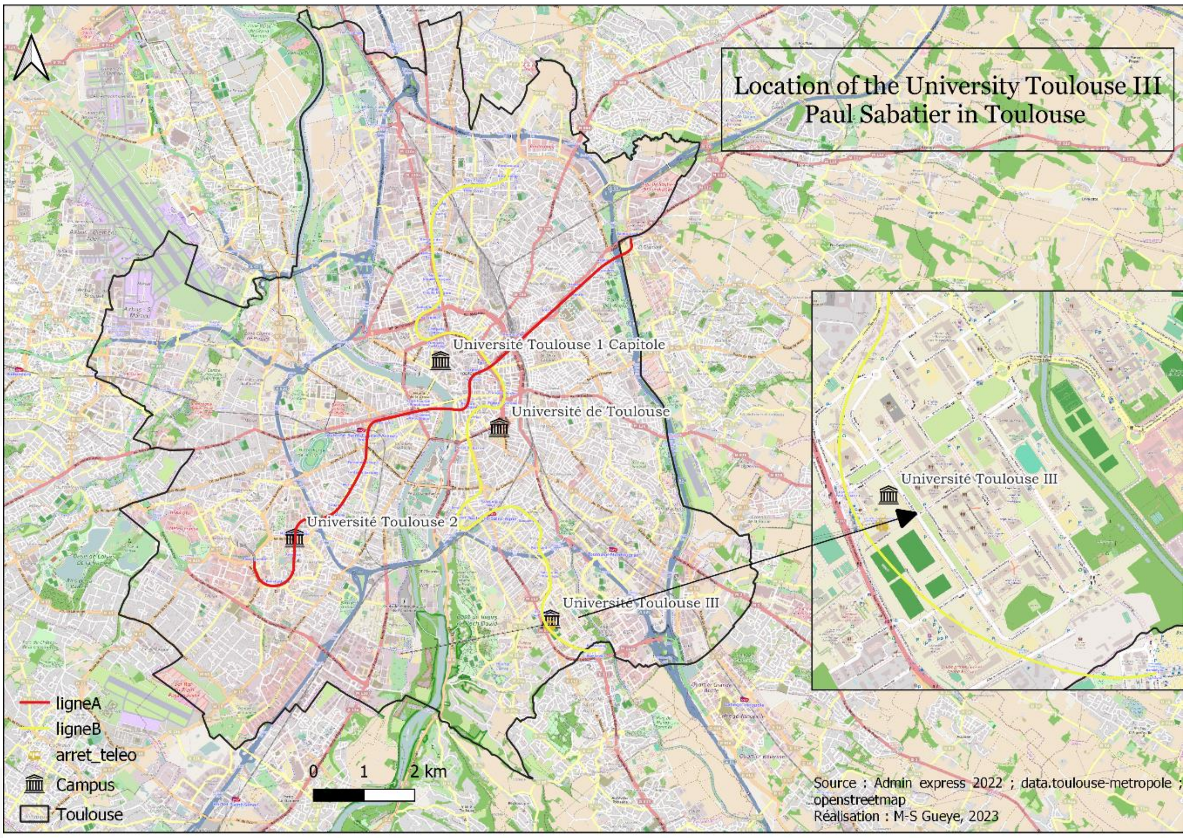

*Figure 1: Methodology in four steps*

## IV. Characteristics of the infrastructure

### 1. UT3, an innovative campus

UT3 is a public scientific, cultural and professional establishment (EPSCP), with legal personality and educational, scientific, administrative and financial autonomy. It has 35,000 students and 4,300 staff members.

UT3 is a complex area which presents a strong mobility challenge due to its strong connection with the Toulouse metropolis and its large area. The campus is served by metro line B, the Teleo cable car, 8 bus lines and 3 coach lines. Its micro-city character and surface area mean that the last kilometre of internal travel needs to be carried out in soft modes (walking, cycling, EDP – personal transport vehicles e.g., scooter, skateboard, rollerblades – etc.)




*Map 1. Location of UT3*

## 2. The questionnaire

One of the objectives of the mobility observatory is to study the evolution of users' mobility behaviour. To meet this objective, a questionnaire is set up to survey mobility practices. This raises the following question:

**How can knowledge of mobility behaviours on campus enable us to anticipate and better orientate changes in the travel patterns of UT3 community?**
**What is the place of active and multimodal mobility in the daily travel of the university community?**
**How do users perceive their means and modes of daily travel?**
In order to answer this question, a questionnaire with 5 headings and 57 questions was developed.

Presentation of the headings:

**Initial information:** this section allows us to know the professional status of the respondent, his/her campus of affiliation, the level of study (if student)
**Places of activity (study-work):** provides information on the respondent's main place of work, their work pace and the practice of remote working.
**Mobility practices between home and work (study-work):** this is the most important section of our questionnaire because it is the focus of our study. It includes 20 questions allowing us to identify all daily mobility practices, from **commuting to work** with the means of transport used, the duration of the trip and the number of kilometres travelled, to **intermediate trips** and **inter-site and lunchtime trips**.
**Perceptions and motivation:** this part questions the respondent's feelings about these practices in order to find out what might lead the user to change his or her behaviour and what are the main indicators to be considered for this.
**Respondent information:** this section allows us to get to better understand the respondent.

In addition to this questionnaire, which was put online at the beginning of February, UT3 participated in 2021, as part of the Capari project (from Shared Campus to Intelligent Region), in a study that considers campuses as "experimental medium-sized cities in which devices and applications can be tested..." (Capari, 2021). Within the framework of this project, a questionnaire was set up to question the mobility practices of the UT3 community. In this sense, the questionnaire registered 979 respondents, a fairly representative sample to assess mobility practices in its territory.
On the question of the means and modes of travel used to get to the campus, as well as the travel time of students and university staff, we observe practices oriented towards the use of public transport, dominated by the metro, which is the most used means of transport by the UT3 university community. This mode of travel is followed by the car, which is the second most popular choice for university staff.

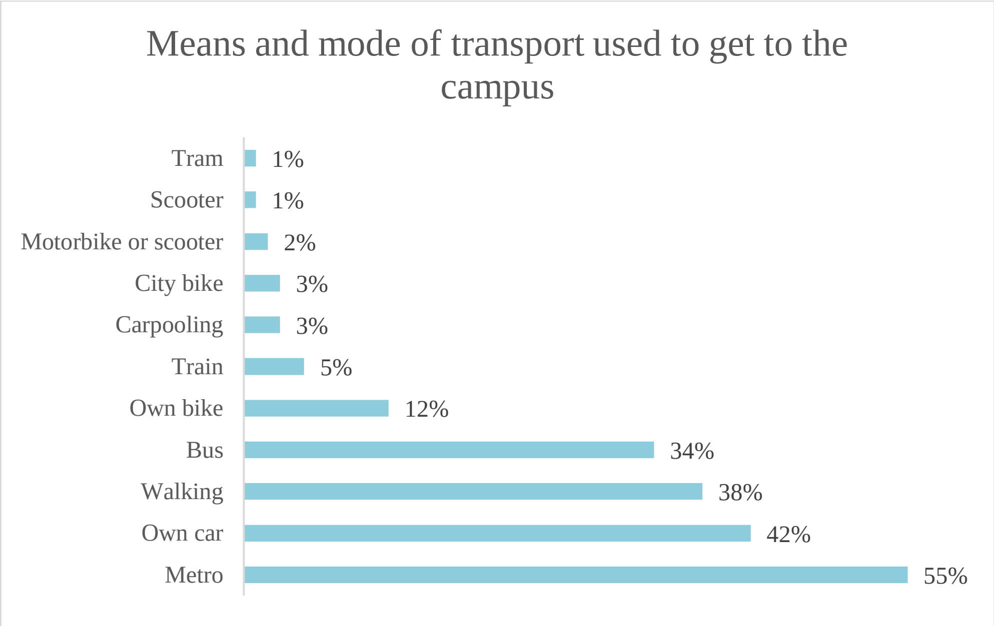



*Figure 2: Means and modes of travel*

## 3. User implications

In the context of the Living Lab approach, the involvement of users is crucial in the design process. UT3 has therefore worked in close collaboration with the Soft Mobility working group, which represents campus users in terms of mobility practices. The goal of the Soft Mobility working group is to encourage the university community to use softer modes of transport.

- **Choice of sensors and location**

As stated, the developers of Activity 2.2 (mobility observatory) worked with the Campus Soft Mobility Working Group and CEREMA as a service provider to identify both the best performing equipment on the market and the appropriate location to better assess campus flows.
The idea here is to deploy different sensors from those deployed in FCUL in order to be able to compare their use.

As regards the choice of equipment, with the expertise of CEREMA, it was agreed to opt for a mix of equipment by combining robust but intrusive and fixed technology such as the magnetic loops of the company Eco-compteur, with proven technology that can be moved from one site to another, such as the radars of the company TagMaster.
Considering the performance and innovation of the equipment available on the market, the choice of the mix of devices was based on two ZELT loops (fixed technologies), two Pyro-Box evo and two radar counters from the TagMaster company (i.e. four movable

ones) installed in strategic sites of the campus to evaluate the flows of the university community.

The positioning of the sensors was defined following field visits in the presence of representatives of UT3, the CEREMA representative and the Soft Mobility Group. During these visits, the Soft Mobility Group highlighted its knowledge of the campus and its mastery of information on the routes most frequently used by soft mode users; on the other hand, CEREMA, in addition to its expertise in the field of mobility, is currently working on the implementation of an observatory of active mode mobility on a national scale. This knowledge of the field and the study area has enabled four sites to be selected for the installation of sensors. It should be emphasised that the Campus Management and Operations Service (called in French Service de Gestion d'Exploitation) supported this approach by issuing the necessary authorisations for the installation of the equipment. We selected 4 sites (see Figure 3) that were areas of interest for mobility observation, but subsequently instrumented only 3 sites due to lack of budget.

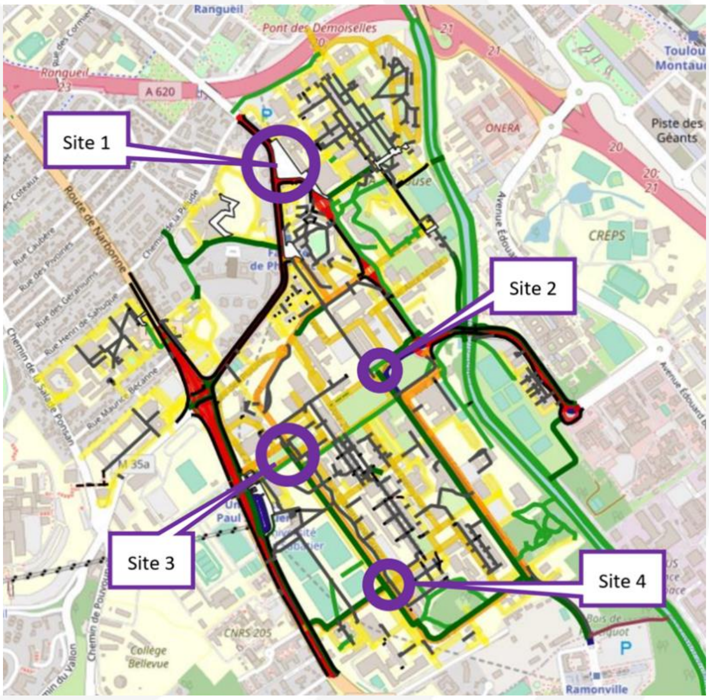



*Figure 3: Site identified in the implementation phase*

*Source: State of play and recommendations document*

**Site 1: IUT-informatics**

Several modes of transport are present on this site (pedestrians, bicycles, motor vehicles and public transport). There are also several types of transit and local service traffic. For soft modes, the IUT square is a place where transit traffic and local traffic are intermingled. A pavement overlooks this square to the north (black line) and dedicated soft mode lanes to the south (green). Some flows cross the square (in white), others go towards the IUT Rangueil bus stop (close to the roundabout on the map) or towards the Faculty of Pharmacy (not shown on the map, further south). On the roads used by motorised traffic, motorised vehicle/bicycle interactions are possible at the intersection and roundabout of this axis.


*Figure 4: Zooming in on the site of the IUT-informatic*

**Site 2: Chemin Georges Mignonac (Food Truck)**

On this site, active mode flows cross on the North-West / South-East axis (Chemin de Mignonac / Allée du campus de Rangueil) and North-East / South-West axis (Allée Huguette Delavault / Rue Hypathie) using non-dedicated lanes (esplanade, up the blue TCSP axis), particularly during the day and mid-day. Motorised vehicle traffic flows are more likely to be from local services to the parking pockets.

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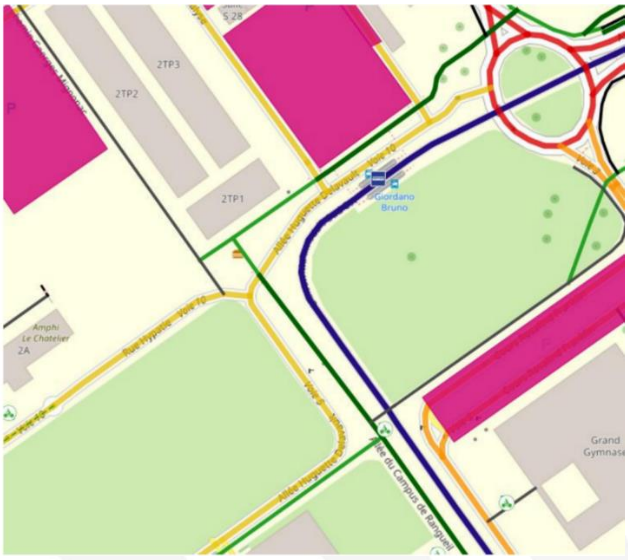


*Figure 5: Zooming in on the George Mignonac Road site (food truck)*

**Site 3: Administration**

On this site, active mode flows intersect on the South-West/North-East axis (Allée Louis Lareng), mainly from the metro, and motorised vehicle flows from Allée Louis Lareng and Cours des Sciences. These flows are significant, particularly in the morning rush hour and mid-day (university restaurant nearby)


*Figure 6: Zooming in on the Administration site*



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# V. Deployment and data collection

## 1. Description of the sensors

In order to set up a mixed mobility observatory (active and motorised mobility), we have installed four types of sensors to collect data related to active modes of transport and the car. The installation of this equipment meets several objectives.

- Equip the campus, which is a testing ground for new technologies, as part of the perpetuation of the living lab
- Assess travel on campus in order to gain detailed knowledge of the mobility of the university community
- Complete mobility survey data from 2021 (Capari) and 2023 (Tr@nsnet)
- Build up a database in the implementation of the University's 2025 Sobriety Plan and the data feed to the autOCampus platform

### *1.1 TagMaster equipment*

Installed on the site of the IUT-informatics, the **CityRadar** and the **TrafficRadar** are products of the company TagMaster which is specialised in the development and the supply of solutions aiming at improving the operational efficiency of the transport networks. Within the framework of the Tr@nsnet project, we purchased these two products in order to observe, analyse and guide the evolution of travel on campus.

The CityRadar is a radar counter designed for the evaluation and counting of active modes (bicycles, scooters and pedestrians). It is characterised by the **simultaneous detection of pedestrians and bicycles** up to 8 metres away with a counting accuracy of more than 90%. It is able to distinguish between two-wheelers and pedestrians, which allows for the classification of bicycle and pedestrian traffic without intrusive ground sensors. However, it is important to note that Cityradar does not distinguish between a bicycle and a scooter, it classifies all types of two-wheelers as bicycles.

*Photo 1. Cityradar*

**Cityradar for pedestrian and bicycle counting**

The TrafficRadar is a 2-lane radar counter able to handle both uni-directional and bi-directional traffic flows depending on the settings. It works in the same way as the CityRadar in terms of setting up and retrieving data. However, unlike CityRadar which has a radar range of 8 metres, TrafficRadar has a range of up to 15 metres. The TrafficRadar also makes it possible to classify vehicles and motorised two-wheelers. In this sense, three categories are distinguished:

- Light vehicles
- Heavy goods vehicles
- Motorised two-wheelers

*Photo 2. Trafficradar: motor vehicles*

As far as data is concerned, the TrafficRadar and CityRadar counters collect accurate, real-time data on the flow of pedestrians, bicycles and motor vehicles. For the TrafficRadar, it records the number of detections, i.e. the volume of the flow, length, speed and direction of vehicles and motorised two-wheelers. As for the CityRadar, it presents pedestrian and bicycle data in a differentiated manner, highlighting the flow, speed and direction of pedestrians and bicycles, which makes it possible to characterise the entrances and exits at the level of the IUT-informatique site.

Another parameter to consider is the data file. Indeed, this file in DAT format contains information about the site, namely the site ID, the location and the GPS position. This DAT file stored in the EasySetup application can be converted into an Excel file through the TagMaster web application, **EasyAnalysis**. This web-based software allows the first analysis of the meter data.

### *1.2 Eco-meter equipment*

**The Pyro Box Evo** belongs to the Eco-counter pyro-evo range for pedestrian counting. It is equipped with passive infrared pyroelectric technology and a high-precision lens to detect the heat emitted by the human body. Easy to install and move, the Pyro-box evo performs a cross-sectional measurement of the pedestrian flow which cuts its signal. Thus, thanks to its extreme sensitivity and the power of the ORION algorithm, the PYRO sensor is able to differentiate between two people passing at close intervals over a range of 10 metres. This is an improvement in the system, as the first passive infrared counters had a range of between 1 and 4 metres (Vélo Québec, 2009). However, despite the improvement of the system and the power of the ORION algorithm, the Pyro-box evo is unable to distinguish a group of people, and the further away from the counter, the more its capacity to distinguish two or more people passing side by side or passing each other diminishes.


*Photo 3. Pyro-Box Evo: pedestrian counter*

**The ZELT**

The ZELT is a diamond-shaped electromagnetic loop counter designed for bicycle counting. It consists of several loops of conductive wire buried at a shallow depth in the road, connected to the Zelt counter. Often used in large cities on shared bus/bike/car lanes, Toulouse III Paul Sabatier University is one of the first universities to experiment with this system in the university environment. Thus, the two ZELTs with their advanced technology allows to measure the frequency of use of the **Allée Hugette Devault** and **Cours des sciences** cycle paths. They are bi-directional thanks to the lining of the loops, they measure the volume and speeds of cyclists. Each ZELT is connected to a counter equipped with a GSM chip allowing data to be collected and processed remotely. The counter is powered by a one-year battery life and is protected by a B125 sight glass.

*Photo 4: Installation of the ZELT loop: bicycle counter*

## 2. Sensor data collection

We have used two modes of data collection that are highly dependent on the equipment (sensor). One is automatic, also known as **remote transmission,** the other is **manual** and is done using an Android application developed by the company TagMaster called EasySetup.

**Method 1: Teletransmission**
The eco-counter sensors presented in the section above have the advantage of having a collection mode based on the remote transmission of data. These data arrive directly in the eco-visio software developed by the equipment supplier. Thus, they can be analysed on an hourly interval to obtain, for example, the hourly distribution over the day. Depending on the needs of the analysis and the indicators to be observed, different intervals can be chosen. For example, it is common to use 24-hour intervals to see the

daily distribution during the week or weekly intervals to have a global view during the month or the year.

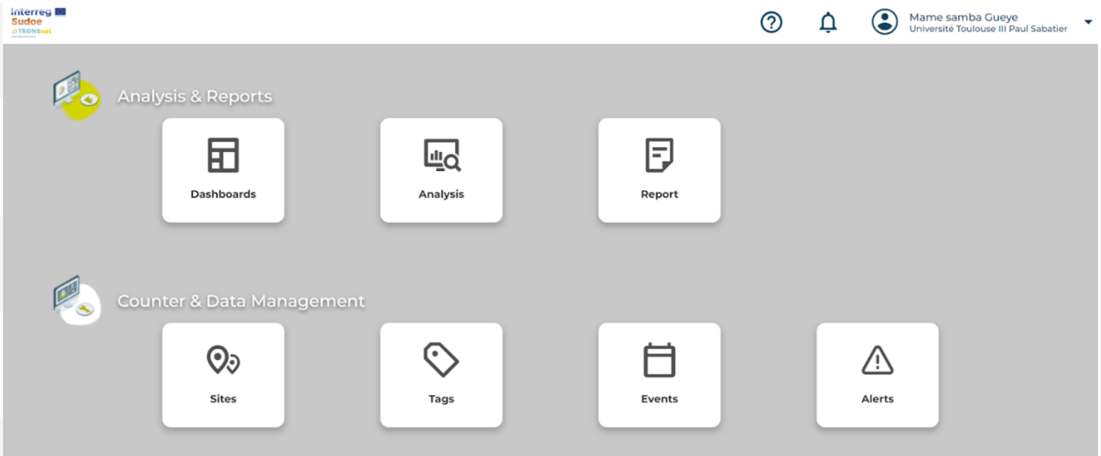



*Figure 7. The Eco-vision interface*

**Method 2: Manual collection via Bluetooth**

This mode of collection concerns the Cityradar and the Trafficradar, these radars are equipped with a Bluetooth communication to allow the manual collection of the data, the TagMaster company also developed an Android application, **EasySetup,** which has the role of the parameter setting and the storage of the meter data. Thus, once the data is collected on site by Bluetooth connection, it is stored in the application server in DAT format, this file is then transferred to the EasyAnalysis online software to convert the DAT file into an Excel file. This software also allows the analysis of the speed camera data.

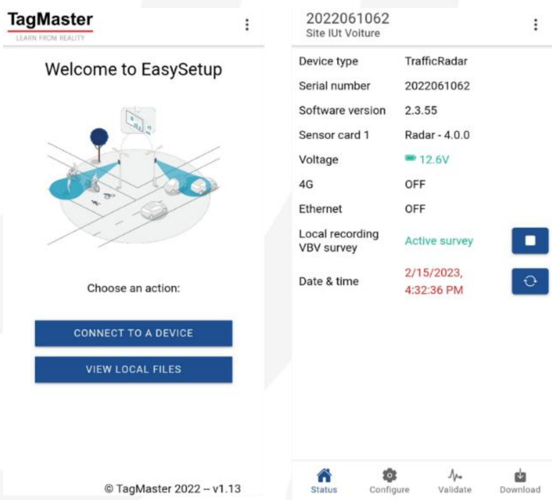



*Figure 8. EasySetup application*

## 3. Data analysis

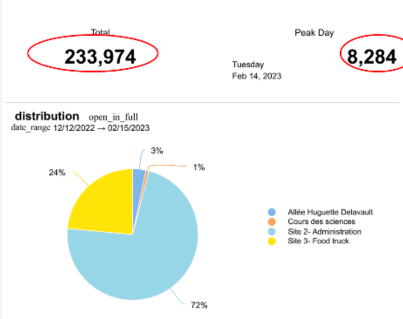
- **How do people move on campus (sensor/meter data)?**

In order to evaluate the mobility flows on the campus, we have identified three observation sites. On each of these sites, two types of sensors are installed in order to evaluate the diversity of flows on the campus.

After more than two months of counting these flows, a presentation of the results is necessary for an analysis of the flows on the campus. This presentation is based on the observation of mobility indicators set up in the working methodology. It should just be pointed out that the period of installation of the sensors is not the same for pedestrian and bicycle counts, in that we have more pedestrian flows than bicycle flows. However, the period of observation of bicycle flows reveals important results bicycle use on campus.

Over the period from December 8, 2022 to February 15, 2023, we observed 442,306 detections of all flows. The graph below shows the key figures for the sensors. These data show the importance of movements on the campus, which can reach more than 8,000 detections on a peak day such as February 14 (data from the pyro-box evo and zelt counters).

| | | | |
|---|---|---|---|
| Device Type | CityRadar | Serial Number | 2022030246 |
| Location | Site 1 IUT | GPS | 43.569147,1.465454 |
| Site ID | 0 | | |
| Survey Start | 12/8/2022, 10:56:08 AM | Survey End | 2/15/2023, 2:29:00 PM |
| Number of Lanes | 1 (North) | Number of detections | 43791 |




| | | | |
|---|---|---|---|
| Device Type | TMRadar | Serial Number | 2022061062 |
| Location | Site IUt Voiture | GPS | 43.567992,1.466279 |
| Site ID | 0 | | |
| Survey Start | 12/8/2022, 11:59:44 AM | Survey End | 2/14/2023, 5:26:00 PM |
| Number of Lanes | 2 (East / East) | Number of detections | 164541 |

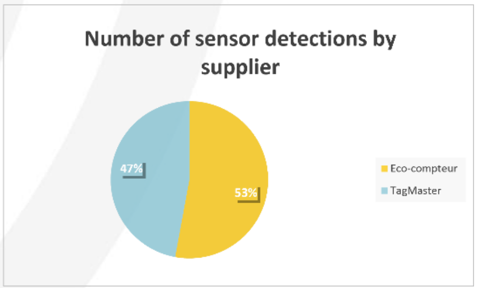



*Figure 8. Key figures of the mobility observatory*

We will now move on to the analysis of the daily use of soft modes.

**Daily frequency of use of soft modes**
Based on the results of the Capari 2021 survey, it can be seen that the majority of the university community uses the metro to come to UT3. However, walking and cycling represent a significant part of the mobility of students and university staff, including teachers, researchers, engineers, administrative, technical, social and health staff and library staff.

However, the size of the campus means that within the campus there are significant pedestrian and bicycle flows. In this section, the idea is to analyse these movements using pedestrian and/or bicycle sensors.

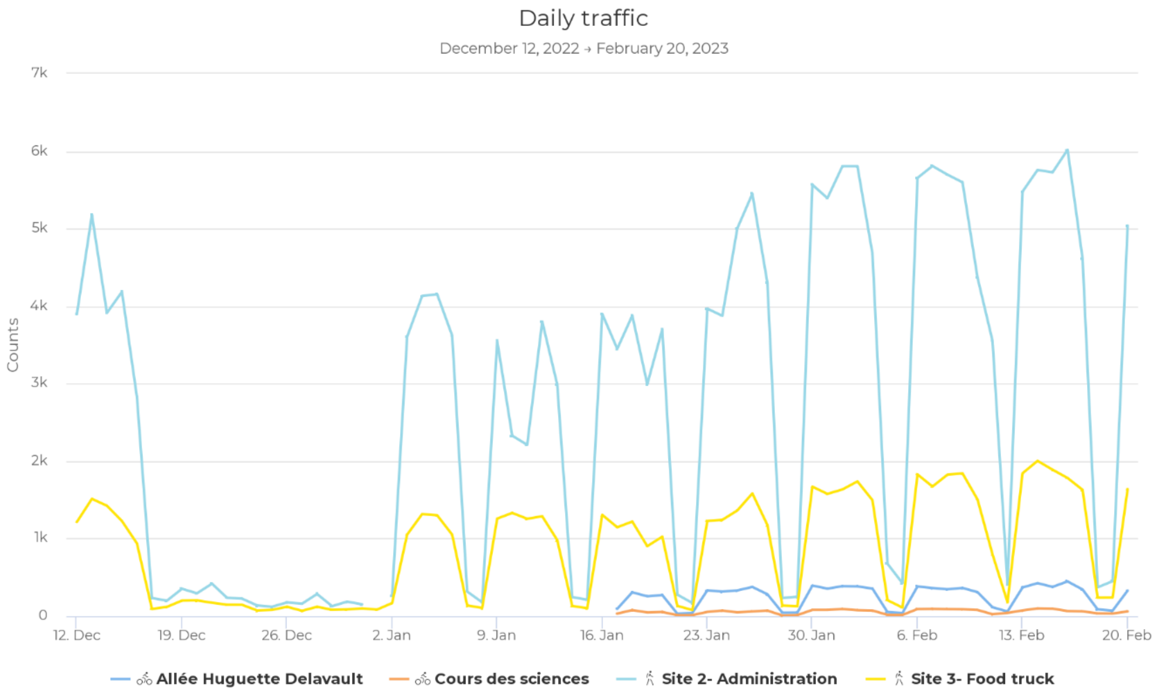



*Figure 9. Daily traffic by site*

This graph gives us an overview of the number of pedestrian and bicycle flows within the campus. This shows a high level of usage on weekdays and a dropin flows during the holidays and weekends. The temporality of the data does not allow us to study the evolution of the data or to make a comparison in the long term, but it does allow us to have a detailed knowledge of the daily flows on the campus. Concerning the bicycle flows, the counting started on 17 January, the following graphs will allow us to better understand these flows.

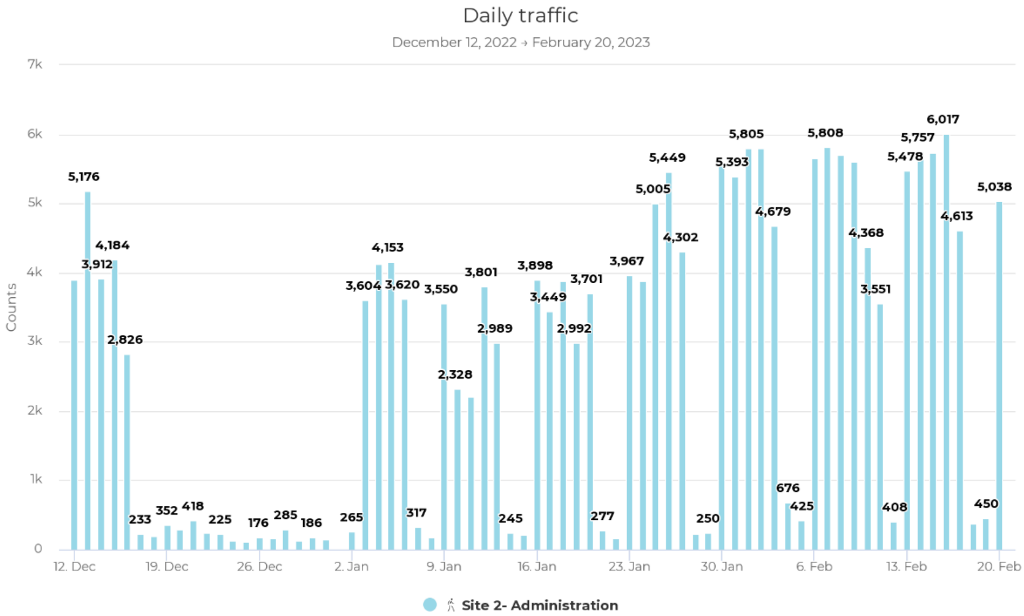



*Figure 10. Daily pedestrian traffic at the administration site*

Installed at the main entrance to the university, the pyro-box evo pedestrian counter registers more than 60% of the flows on campus. As we have pointed out, the majority of campus users arrive on the site by metro and this sensor is ideally located to detect a large majority of these flows. Furthermore, the graph allows us to differentiate three periods in the daily rhythm of the campus with a varying number of flows between each period.

- **Normal period**: this stage corresponds to the week of December 12 and the weeks from January 23 to February 13; this temporality corresponds to the period of classes when the whole university community is present on campus. During these periods, the average number of detections is over 5000.
- **Examination period**: this period corresponds on the graph to the weeks from January 2 to January 16. It is characterised by high average flows compared to the weeks of classes, however, even if we note a decrease in flows, we notice that the campus is quite animated with average flows of more than 3000 pedestrian detections.
- **Holiday period and weekend**: installed a week before the holiday periods, the evo pyro-box gave us the opportunity to see the frequentation of the campus during the holiday periods which is similar with the weekends where we note some hundred flows throughout the day.

With regard to cycling, the diagnosis showed that there are 126 dedicated cycle parking spaces on the campus. These spaces correspond to approximately 11500 bicycle parking spaces. This finding is the result of a mobility policy geared towards soft mobility that emphasises cycling. This policy is supported by the Soft Mobility Working Group, which carried out a manual bicycle count during the *Allons y à vélo* (AYAV Hiver 2023) day. They were able to count more than 500 bicycles on campus on Tuesday 14 February.

In order to observe the use of bicycles on the campus, two Zelt counters allow us to measure the number of cyclists. One is installed on the cycle track at the entrance to the campus and the other on the track that crosses the campus. It can be seen that the Cours des Sciences cycle track (campus entrance) is moderately used compared to the cycle track on the Hugette Delavault path. The particularity of the Hugette Délavault cycle track is that it runs through the campus, so the implementation of the Zelt loop helps us to account for a significant part of the cycle flows on campus. In this sense, the daily traffic is around 350 detections.

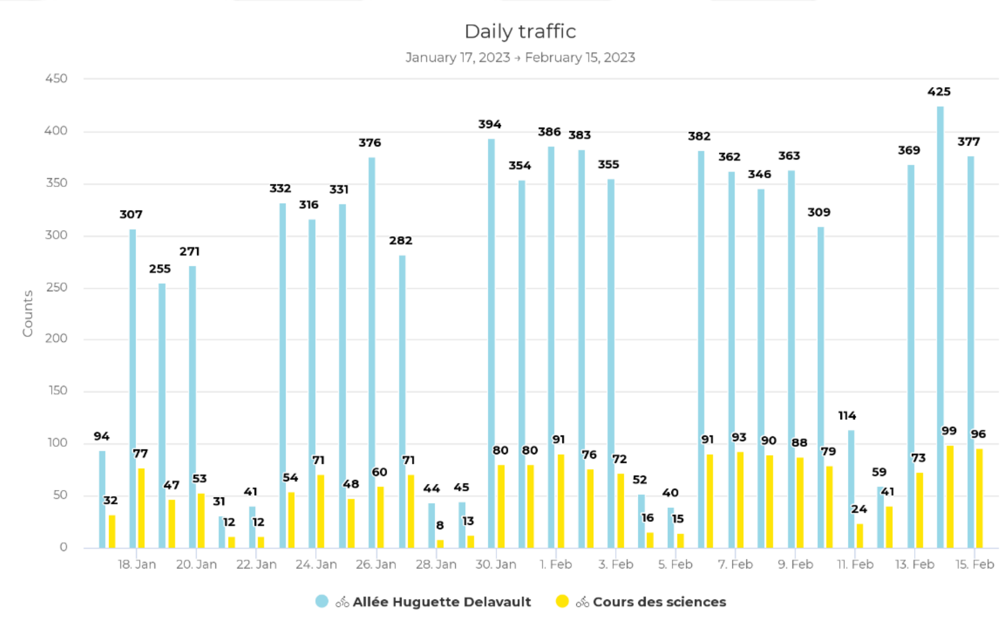



*Figure 11. Daily bicycle traffic*

The pyro-box evo and the zelt loops allow us to see in different places the practice of soft mobility of the university community. On the other hand, the cityradar has the capacity to evaluate the daily pedestrian/bicycle use of a site.

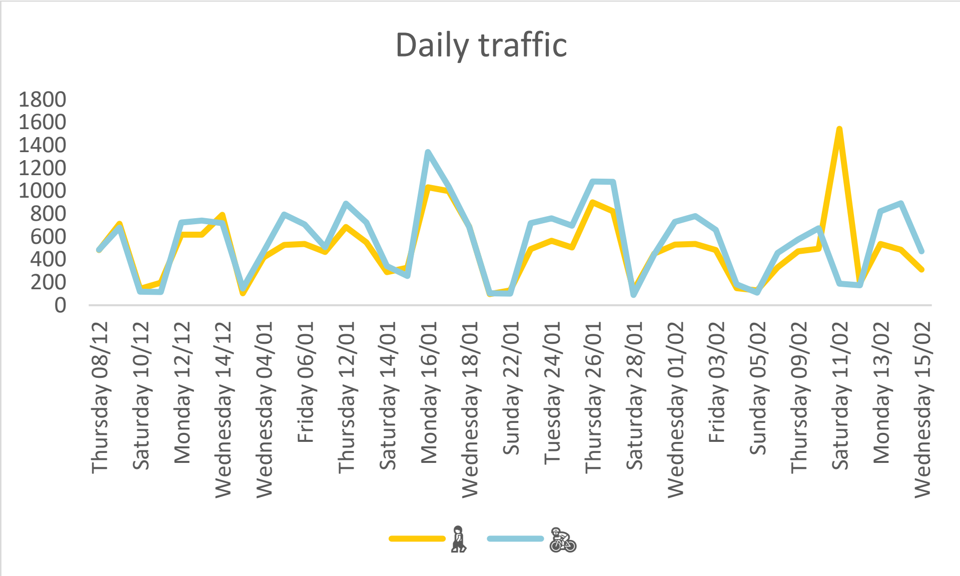



*Figure 12. Daily soft mode traffic on the IUT-informatique site*

This graph allows us to make a comparison between pedestrian and bicycle flows at the IUT site. Similar trends can be seen with some differences. This graph shows a significant use of bicycles at the campus level. It should just be remembered, as we saw in the presentation of the site, that there is indeed transit traffic which does not concern UT3 users. Another particularity underlined is the data for the day of Saturday 11/02. Indeed, as we can see on the graph, weekends often correspond to a drop in attendance, but this Saturday 11/02 is special because it corresponded to the UT3 open day, which resulted in a large flow of traffic at the IUT-informatics.

**Average daily flow of arrivals and departures of soft modes**

One of the advantages of bi-directional sensors is that they can measure the number of entries and exits at a site. Looking at the graph of entries and exits for site 2 Administration, we can see differences between these two variables. Indeed, the number of entrances is more important than the number of exits. This can be explained by the fact that the pedestrian exiting the metro takes the most accessible path to access the campus and the range of the sensor makes it possible to detect all the daily flows coming from the metro. On the other hand, coming from the within the campus, the pedestrian has more freedom movement and moves further and further away from the sensor to reach the metro. Thus, there are flows that are not considered because the range of the sensor does not allow them to be counted.

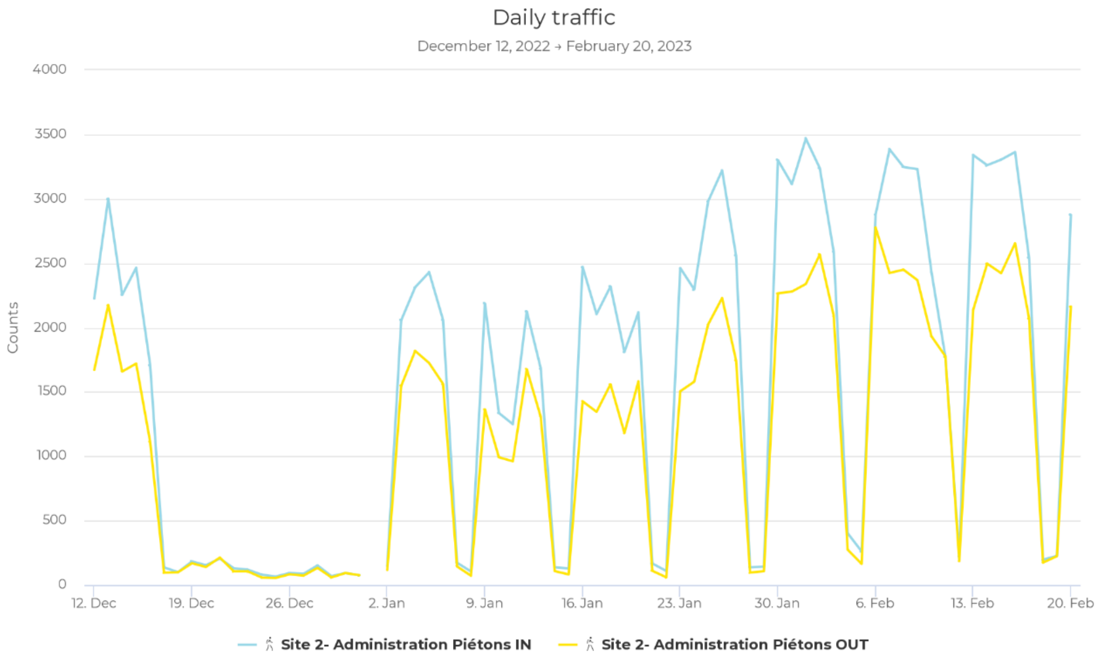



*Figure 13. Number of daily pedestrian entries and exits*

The observation is however different from one site to another. Indeed, at site 3, chemin Georges Mignonac (Food Truck), we observe that the entrances and exits are almost similar, the sensor range is long enough to cover the entire width of the road.

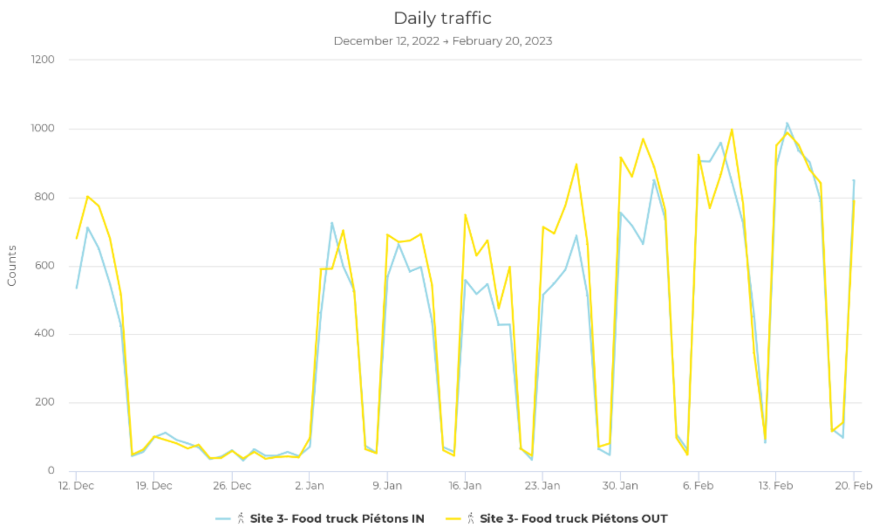



*Figure 14. Number of daily pedestrian entries and exits*

### Time profile analysis

The analysis of the time profile allows us to enrich our knowledge of the users in order to see how the cycle paths on campus are used. It also gives us information on peak times and times when mobility on campus is declining.

Cycling on campus meets a need for commuting. In fact, the graph (...) shows that the peaks of use correspond to the standard working hours between 8-9am and 5-6pm.

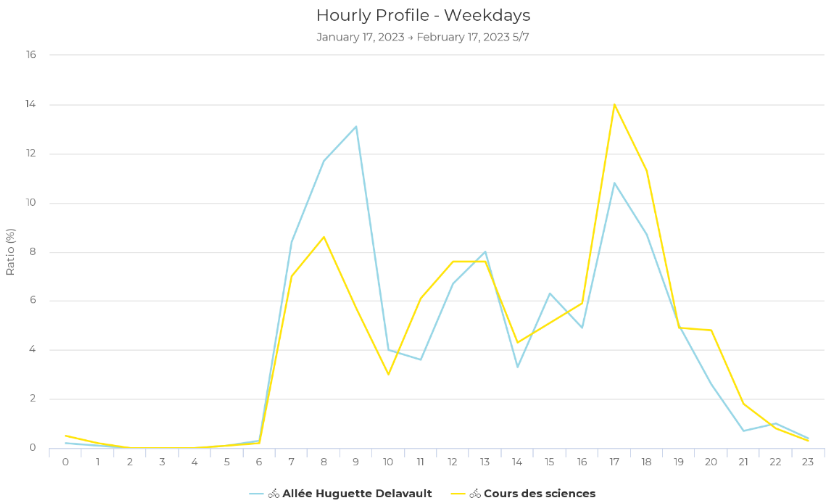



*Figure 15. Hourly profile of bicycle traffic*

Contrary to the hourly profile for cycling, where we can note three times in the evolution of the profile, the profile for pedestrians evolves in a sawtooth pattern. This evolution can be correlated with the students' class hours.

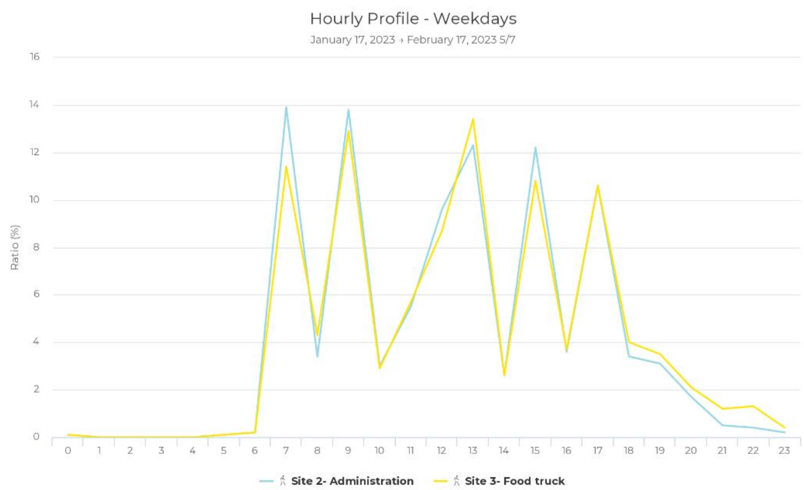



*Figure 16. Pedestrian time profile*

**Daily frequency of use of motorised vehicles**

Despite the will of decision-makers and the mobility policies implemented on the campus, the car remains one of the most used means of transport by the Rangueil campus community. The diagnosis already has reported 112 pockets of private car parking, the Capari 2021 survey ranks the car as the second most used means of transportation.

Installed at the northern entrance to the campus, the traffic radar allows the evaluation of motorised vehicle traffic entering and transiting the campus perimeter. Thus, between 08/12/2022, date of the beginning of the observation, and 14/02/2023, date of the last data collection, the traffic radar recorded 164541 motorised vehicles despite the closure of one of the roads since 09 January 2023 for reasons of works.

This graph shows the importance of car traffic on the campus. Motorised two-wheelers are used very little, while heavy vehicles are often transit traffic. There are more than 5,000 daily entries and exits.

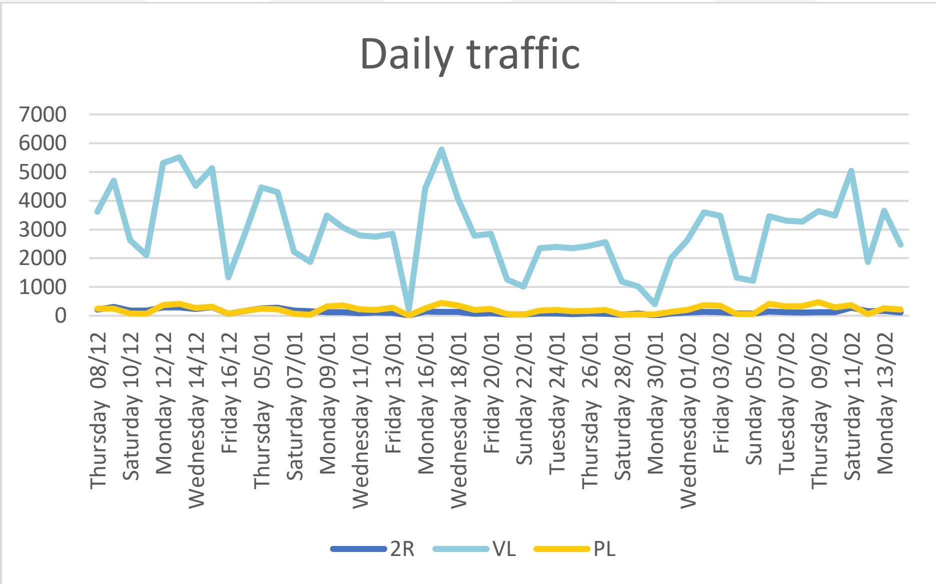
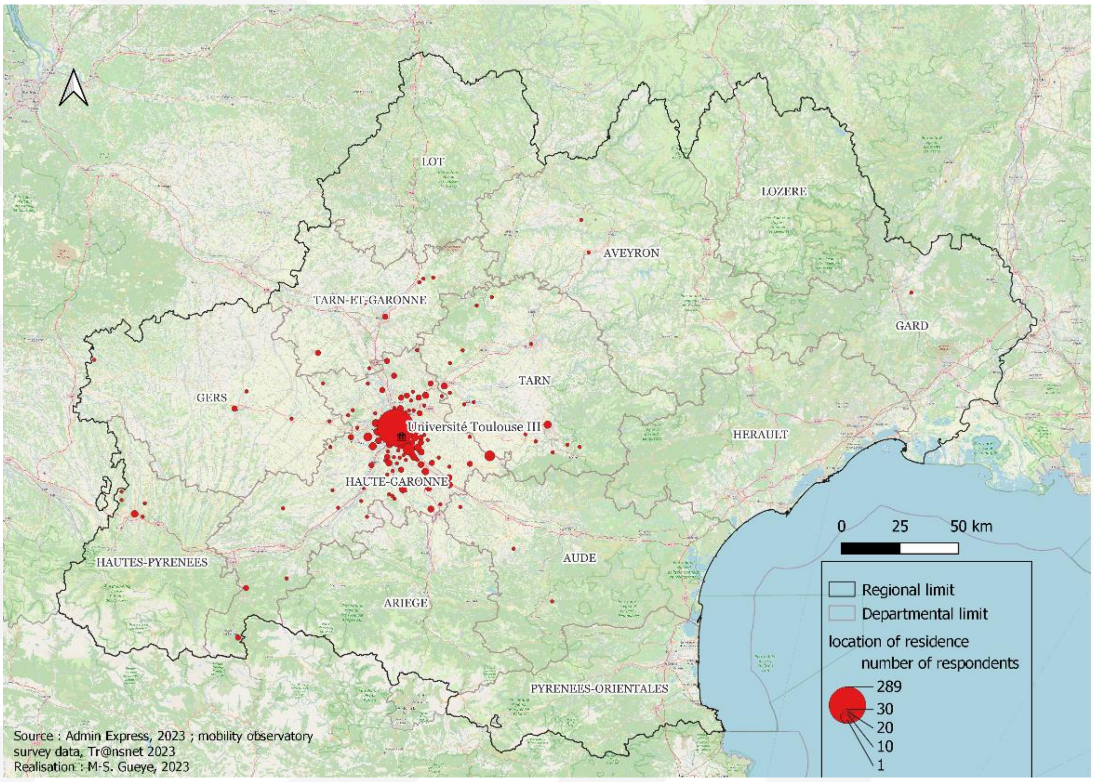



*Figure 17. Daily motorised vehicle traffic at the IUT-computer science site*

- **How do people get to the campus (questionnaire)?**

To examine the mobility between home and place of work (study-work) means first of all studying the spatial location of users in relation to this university site. The university community's place of residence is very heterogeneous, despite a strong concentration in the city of Toulouse and the outlying communes. Indeed, the spread of the Toulouse catchment area means that Rangueil campus users live further and further from the campus.

The map of the distribution of the respondents' places of residence shows the diversity and the increase in the distances between home and place of work. This has an impact on the choice of mode of transport used to reach the campus.




*Map 2. Place of residence of respondents by Insee code*

One of the objectives of the questionnaire was to find out about mobility practices and the place of active and multimodal mobility in the daily travel of the university community. In this regard, out of 1150 respondents, 770 (67%) have a single mode of daily travel and 380 (33%) use multimodal travel for their home-workplace (study-work). However, in terms of mobility practices, there is a difference between those who are unimodal and those who have two or more modes of travel. The two figures above show different practices depending on whether one uses a single mode of transport or several modes.

In fact, two trends emerge for people who have only one mode of transport: **an appetite for soft mobility[1] 38%** and **an important place for the private car 31%.**
Among those who use two or more modes of transport, 52% use public transport. This can be explained by the good public transport links on campus, the metro and the park-and-ride facilities, which encourage inter-modality. In this sense, we can see a decrease in the share of the private car in favour of the metro.

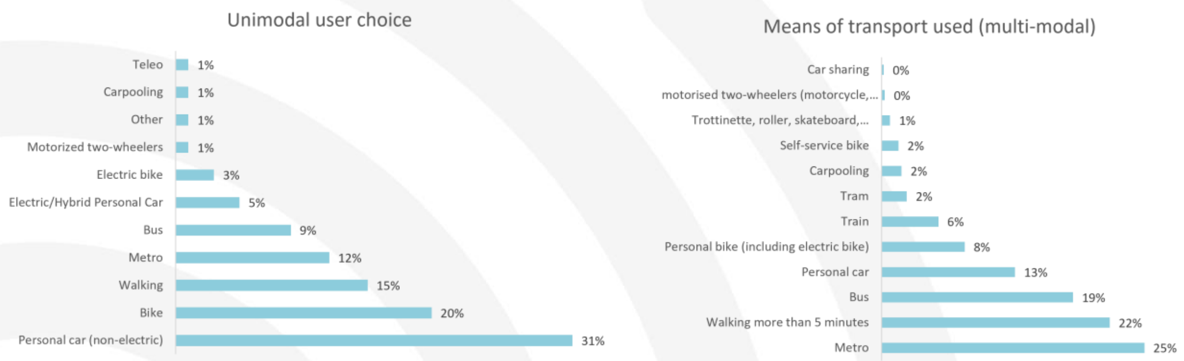



*Figure 18. Modes and means of transport used to get to UT3*

**Developments in activities**
UT3 has always been interested in knowing the mobility practices in its territory, which is considered a micro-city. Already in 2020, it had data on the modes and means of travel of its university community (Capari, 2021). In this sense, the mobility observatory will enrich the database on travel by focusing on mobility flows within the campus thanks to the installation of sensors for counting pedestrians, bicycles and motorised vehicles at the beginning of 2023.

In addition, UT3 is the only university in Toulouse to have a position of soft mobility officer with the aim of promoting soft mobility. This soft mobility referent's mission is to promote soft modes of transport. He or she advocates the installation of secure bicycle parking facilities in each laboratory and department and guarantees access to showers for all (laboratories, departments and students).

In the end, the mobility observatory will be of vital interest to the implementation of the University's 2025 sobriety plan, which aims to reduce the University's energy consumption by 10%. Indeed, it will provide detailed knowledge in terms of the mobility practices of the university community. In addition, it will allow us to evaluate the needs and expectations of this community concerning soft mobility and alternatives to the car (car-soloing). For example, 58% of respondents to our survey believe that safe facilities on their commute could be an incentive to cycle to work.

[1] The share of cycling, walking and e-biking has been aggregated

## Conclusions

The development of soft mobility modes is thought to be a means of reducing air and noise pollution, reducing traffic, and improving road safety. With this type of investigation, we can define strategies to analyse the use of soft transport modes in order to better understand how to increase their use, with a special focus on mobility modes that have a low environmental impact, are low cost, and are a viable option for accessing the public transport network, besides benefiting to the health of users.

Allowing us to guide changes in commuting patterns and to start building databases of actual traffic on university sites and research centres to improve knowledge of active and multimodal mobility. These models of operations can then be expanded or transferred to other environments, like entire cities.

Implementing measures, such as discounts for regular users of shared mobility devices, or even packages where public transport users have a discount from the total rental price of shared soft mobility devices, if they intend to be regular users, should be explored to find the best options for each city that want to increase the use of soft mobility modes.

In addition, the involvement of users in the process has given an innovative approach to the mobility observatory which is not only limited to collecting data but allows users to define their needs.

The idea in this mobility observatory was also to choose slightly different sensors from one campus to another in order to have feedback on all sensors available on the market. This approach helped to enrich the living lab model in which the mobility observatory is integrated. Thus, all the sensors used at CFUL and UT3 share a common point, the ability to count users 24/7.

However, given the size of UT3, the sensors deployed on its campus are more numerous and more diverse. Indeed, UT3 has opted for mixed equipment to be able to count both pedestrians and cyclists at all the entrances to the campus, whereas CFUL has opted for manual counting of pedestrians

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