Routes Study

3Cs CYCLING CAMPUS & CITY

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1. Introduction

In order to ascertain the most frequently used streets, GPS tracks of the movements of students, professors and university staff were collected during two mobility challenges organised as part of the project, using the MUV Game app between February 2024 and April 2025.

The challenges enabled participants to accrue points for both commuting between home and university and for leisure travel. In order to isolate the streets that could be considered access routes to the university campuses from all the recorded traces, a filter was applied to remove all traces with a starting or ending point which is not the campus. Due to GPS recording variability, the campus location is defined as a circle on the map of user-defined radius, depending on the size of the building. The resulting map facilitates the visualisation and analysis of this subset of traces, thereby providing insights into the number of trips that commenced or terminated in the designated area, the most prevalent means of transportation, the average distance travelled, and the average duration of these trips.

Following the identification of the streets most frequently used by the university community, a detailed analysis was conducted. This analysis examined the streets in terms of their connection to the city's cycling network, prevailing traffic conditions, accessibility, and other pertinent factors. On-site inspections were also carried out to gather up-to-date and detailed information, particularly to identify potential interventions to improve active mobility along these routes.

The following sections, after an overview of the gamification approach implemented with MUV, present the main results for the key campuses analysed at the University of Montpellier Paul Valéry, the University of Turin, Universidad Camilo José Cela Madrid, and the University of Coimbra.

MUV Game in the 3Cs Project: promoting sustainable mobility in European universities

Within the context of the 3Cs project the MUV game platform played a crucial role in actively engaging university communities from four European institutions in promoting sustainable mobility. The main objective was to encourage students, professors, and university staff to adopt ecological means of transport for home-university journeys through an innovative approach based on gamification.

The MUV Game Platform

MUV Game is a gamification and data analysis platform designed to actively engage employees and customers by making the adoption of sustainable mobility habits fun and measurable. The CO_2 emissions calculation algorithm is validated according to the ISO14064-2 standard, ensuring data reliability. The platform has demonstrated its effectiveness with an average 32% reduction in CO_2 emissions per active user during competitions.

The operation is based on three simple actions: PLAY (vehicle selection), SWITCH (mode change during the journey), and STOP (arrival at destination). This basic mechanism allows the development of game dynamics through competitive challenges, collaborative challenges, and team tournaments.

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The Participating Universities

The 3Cs project involved four European universities:

- Université Paul Valéry (Montpellier, France): 218 total users, 122 actives
- Universidade de Coimbra (Portugal): 424 total users, 262 actives
- Universidad Camilo José Cela (Madrid, Spain): 275 total users, 149 actives
- Università di Torino (Italy): 695 total users, 472 actives

Overall, the project involved 1,612 registered users, with 1,005 active users who actually participated in the activities.

Individual University Challenges

Université Paul Valéry Challenge (March 2024)

The first challenge took place from March 13 to April 10, 2024, involving 117 registered users with 72 active participants. During the 28-day competition, 19,602 km were covered, saving 201 kg of CO_2. The winners received Decathlon vouchers worth 30€.

Universidade de Coimbra Challenge (June 2024)

The Portuguese challenge, held from May 13 to June 9, 2024, recorded 94 users with 63 active participants. A total of 7,380 km was covered with savings of 283 kg of CO_2. Notable was the gender balance (56% male, 44% female) achieved in this competition.

Universidad Camilo José Cela (October 2024)

The Spanish competition (September 16 - October 14, 2024) involved 163 registered users with 91 active participants. A total of 16,222 km was covered and 323 kg of CO_2 were saved, with a higher male presence (60%).

Università di Torino Challenge (October 2024)

The Italian challenge, concurrent with the Spanish one, recorded the highest engagement rate with 132 registered users and 108 active participants (82% engagement). A total of 29,082 km was covered, saving 242 kg of CO_2.

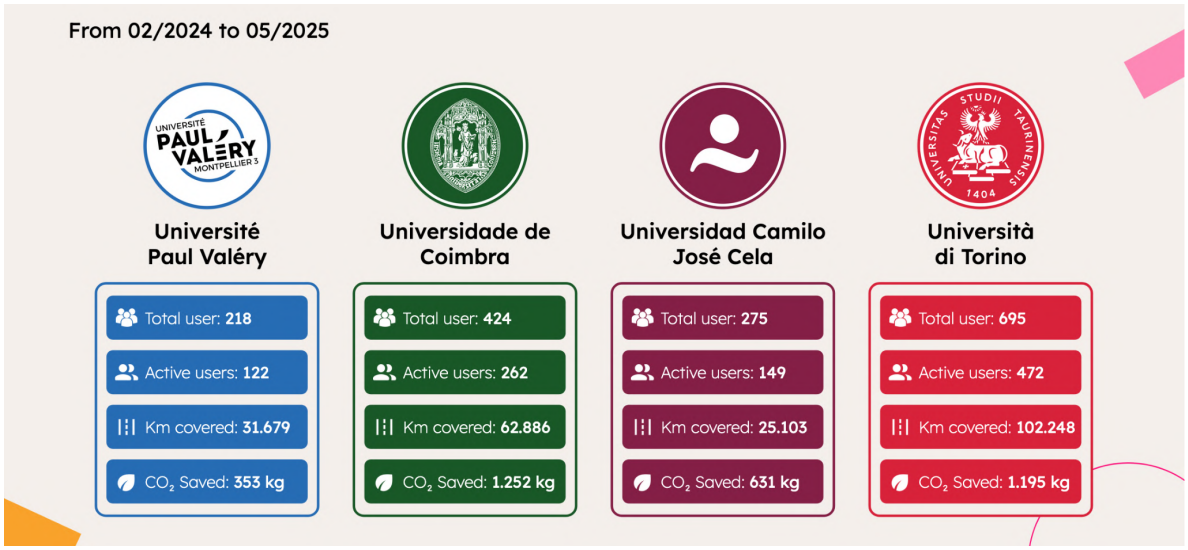

Figure 1.1 – Universities comparison

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The 3Cs Tournament

The culmination of the project was the international tournament held from March 3 to April 14 2025 (6 weeks) which saw the four universities compete directly. With 645 registered users and a 40% activation rate, the tournament generated significant results:

- Total kilometers covered: 38,596 km
- Total CO_2 saved: 1,445 kg

Tournament results by university:

- Università di Torino: 22,821 km, 365 active users, 709 kg CO_2 saved
- Universidade de Coimbra: 9,950 km, 193 active users, 605 kg CO_2 saved
- Université Paul Valéry: 4,658 km, 32 active users, 81 kg CO_2 saved
- Universidad Camilo José Cela: 1,167 km, 55 active users, 50 kg CO_2 saved

The tournament followed a structured format with divisions and playoffs, culminating in the University of Turin's victory in both the elimination phases and the final.

MUV Dashboard: A Strategic Analysis Tool

A fundamental aspect of the project was the web dashboard provided by MUV, which proved to be an essential analysis tool for the universities. Through this platform, institutions were able to monitor the progress of competitions in real-time and gain comprehensive insights into their community's mobility patterns.

The dashboard enabled universities to track key metrics such as user engagement, distance covered, CO_2 savings, and participation trends over time. At the end of the tournament, this tool provided a clear and precise overview of how students and staff moved to and from the various campuses throughout the initiative.

The analytical capabilities of the dashboard allowed universities to identify peak activity periods, understand mobility flows within their territories, and assess the effectiveness of their sustainable mobility promotion strategies. This data-driven approach proved invaluable for future planning and policy development regarding campus mobility.

Community Growth

The project demonstrated consistent growth of the involved university communities. Comparing data from October 2024 to May 2025, significant increases were recorded:

- Total users: from 701 to 1,612 (+130%)
- Active users: from 428 to 1,005 (+135%)
- Kilometres covered: from 85,764 to 221,916 km (+159%)
- CO_2 saved: from 1,213 to 3,431 kg (+182%

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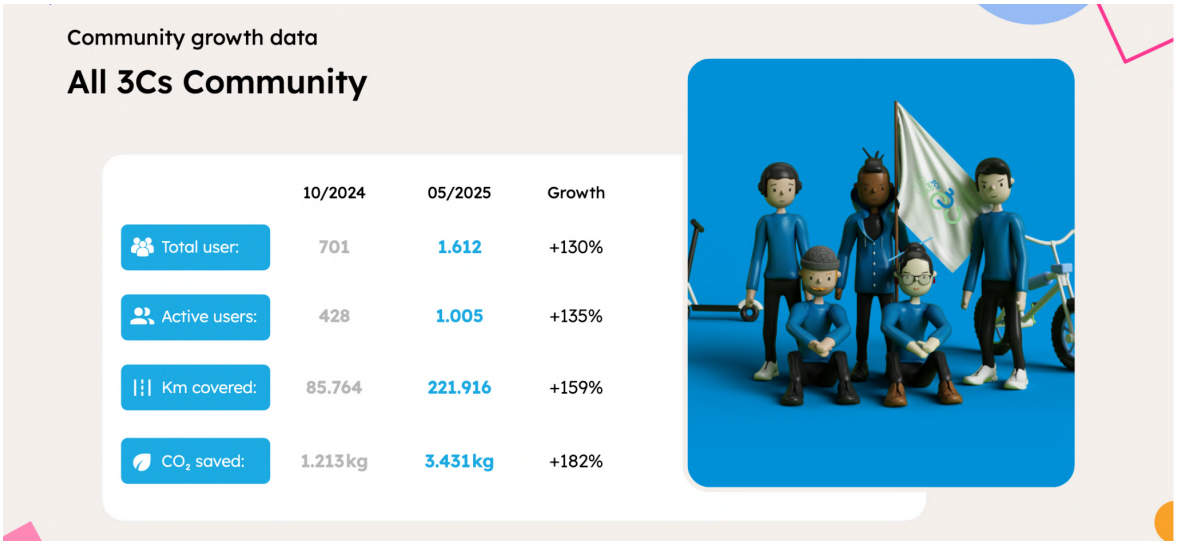

Figure 1.2 – Community growth data

Geographic Coverage and Mobility Patterns

The project's mapping functionality revealed extensive coverage of urban territories around each university. The visualisation of trips showed how the initiative effectively influenced daily mobility behaviours, creating comprehensive networks of sustainable transportation routes connecting campuses to residential areas.

Each university's map displayed unique patterns reflecting local geography and transportation infrastructure, providing valuable insights into how different urban contexts influence sustainable mobility adoption.

Université Paul Valéry | Universidade de Coimbra | Universidad Camilo José Cela | Università di Torino

Figure 1.3 - Universities maps

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Impact and Sustainability

The 3Cs project with MUV Game demonstrated the effectiveness of a gamified approach in promoting sustainable mobility in university settings. The results achieved - over 220,000 km covered in sustainable modes and more than 3,400 kg of CO_2 saved - represent a concrete contribution to sustainability goals and the reduction of urban mobility's environmental impact.

The gender distribution varied among different universities, with some (like Coimbra) achieving greater balance while others showed predominant male participation, highlighting the importance of targeted engagement strategies.

Conclusions

MUV Game's experience in the 3Cs project demonstrates how technology and gamification can be effective tools for promoting sustainable behaviours in university communities. The high participation rate (over 1,600 users involved) and tangible results in terms of emission reductions confirm the potential of this approach for future sustainable mobility initiatives in academic and urban contexts.

The project laid the foundation for a European network of universities committed to promoting active mobility, creating a replicable model for other educational institutions that want to actively contribute to the transition toward more sustainable transportation systems.

The comprehensive data analysis capabilities provided by the MUV dashboard proved essential not only for monitoring progress but also for understanding complex mobility patterns and informing evidence-based policy decisions. This combination of engagement and analysis tools positions the 3Cs project as a benchmark for future sustainable mobility initiatives in the academic sector.

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2. University of Montpellier Paul Valéry

This study analyses urban mobility patterns around the two main campus of University of Montpellier Paul Valéry, using GPS traces collected during two mobility challenges organized via the MUV Game app. The focus is on identifying route preferences among users employing sustainable transport modes, particularly in the context of a recent infrastructural redevelopment project involving the installation of a tramway line.

Data were collected during two periods of mobility challenge participation, the first (February-March 2024) encompassing a variety of sustainable transport modes (walking, cycling -including electric bikes, scooters and e-scooters, public transit and e-cars), the second (March-April 2025) being restricted to cycling and walking. At the time of data collection, the area surrounding the campus was undergoing extensive construction to prepare for a new tramway line. While recent photographs suggest the project is now complete, the works were likely a major deterrent to route usage at the time—especially for cyclists who are more sensitive to disruptions and detours.

Route de Mende campus

The Route de Mende campus of the University of Montpellier Paul Valéry (Figure 2.1) is situated in the north-eastern sector of Montpellier, within the Hôpitaux-Facultés district. This location positions the campus at the interface between the urban core and the more suburban and natural surroundings of the city. The campus spans approximately 10 hectares and serves as the primary site for the university's faculties of arts, languages, and social sciences. The campus includes multiple lecture halls, teaching and research buildings, administrative offices, a central library, and dining facilities run by the CROUS (Regional Centre for University and School Services).

The campus is accessible by public transport via several nearby lines. Tramway Line 1 (stop "Saint-Éloi") lies approximately 800 meters southwest of the campus and offers direct connections to the city centre and the main train station. From this stop, most students access the campus via a newly developed pedestrian plaza (parvis March Bloch) located in front of the Atrium Library, which serves as the primary entrance for pedestrians and cyclists. Bus lines 10 (stop "Moulin de Gasconnet") and 15 (stop "Faculté de Pharmacie") provide additional access routes. Three secondary entrances for pedestrians and cyclists are located at the west and north of the campus. For those arriving by car, three parking areas are available within campus, though motorized access is restricted to university staff. The main entrance for motor vehicles is located on Avenue du Val de Montferrand to the east. Parking lots are located along the roads surrounding the campus but are chargeable.

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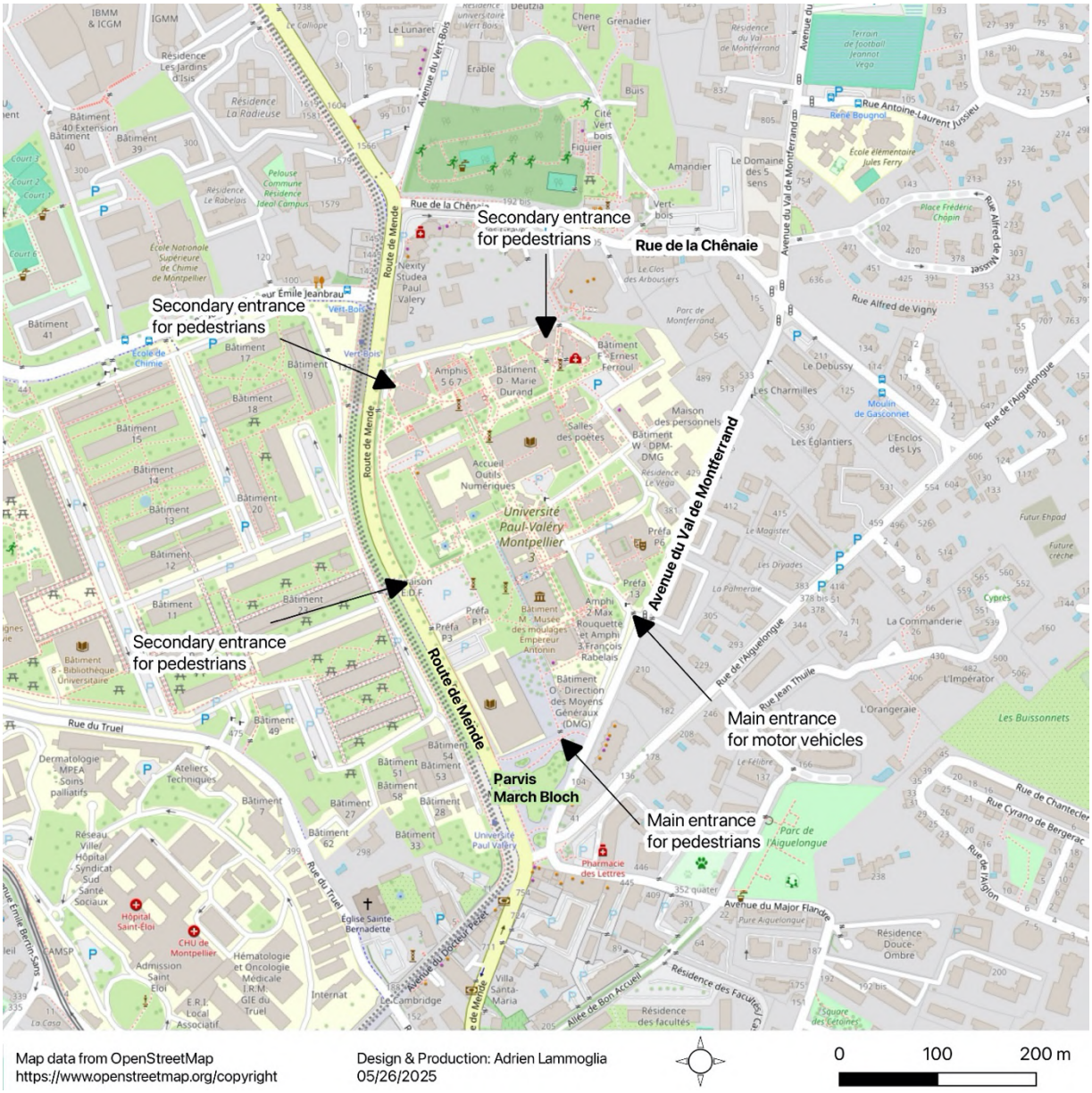

Figure 2.1: Aerial view of the Route de Mende campus located between Route de Mende to the West, Rue de la Chênaie to the North and Avenue du Val de Montferrand to the East (Source: Google Maps)

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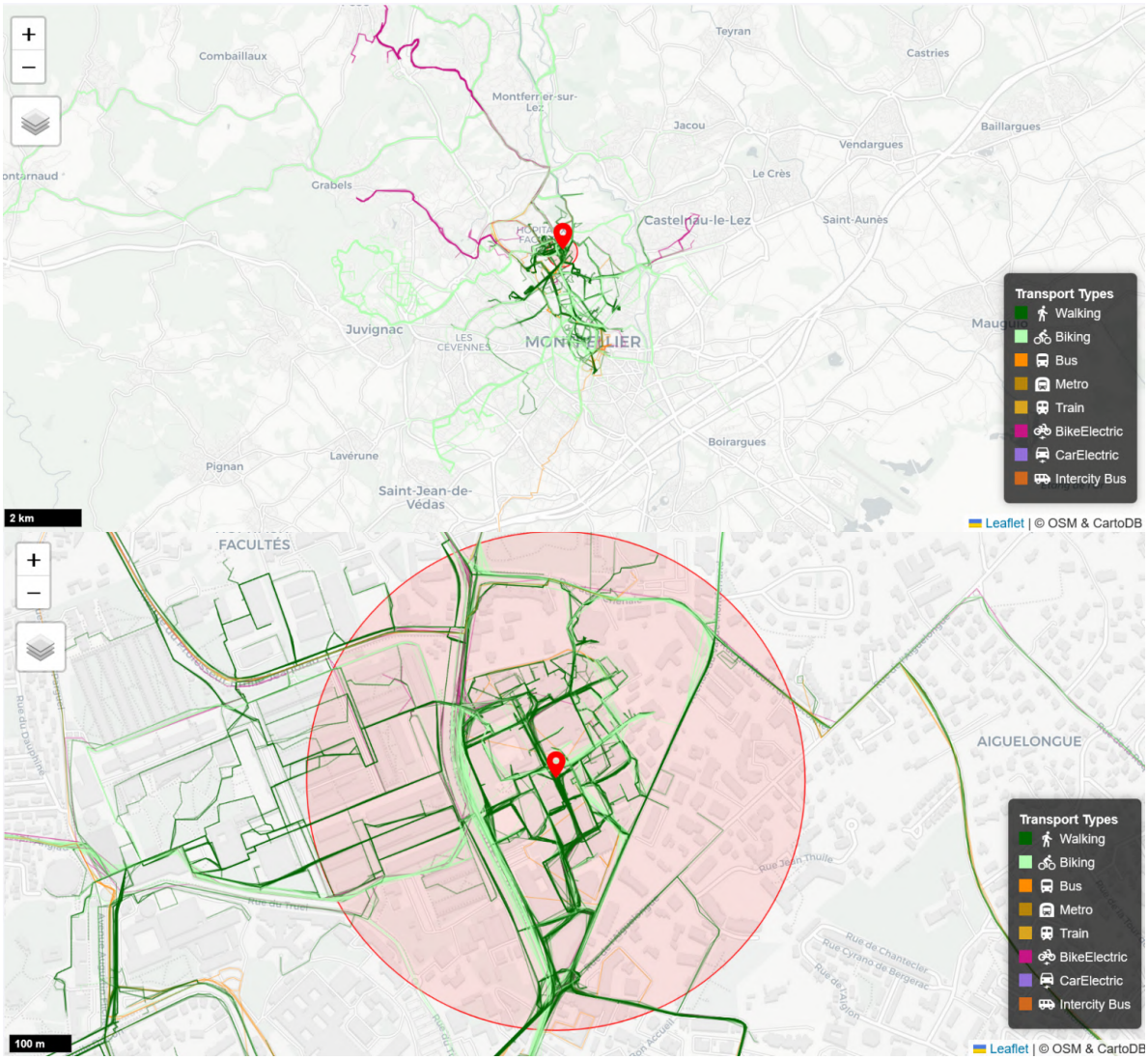

Figure 2.2: Modal breakdown of trips around the Route de Mende campus (Source: MUV,2024/2025)

The dataset includes 1930 trips, all terminating within a 400-meter radius around the route de Mende campus centre (Figure 2.2).

A modal breakdown (Table 2.1) reveals a predominant reliance on walking (1410 trips), with significantly fewer trips by bicycle (421) and e-bike (62). The average cycling trip spans about 7.5 km, while walking trips are shorter but still represent a significant time commitment (average 22.7 minutes). The data suggest a preference for specific access routes to the campus—such as Avenue du Val de Montferrand—over others like Rue de l'Aiguelongue.

	Average distance (in km)	Average time (in min)	Number of trips
All modes	2.95	25.3	1927
Bike	7.50	34.4	421
e-Bike	7.70	28.4	62
Walk	1.34	22.7	1410
Bus and tram	4.57	13.1	32
e-Car	11.82	26.3	2

Table 2.1: Average distance, time, and number of trips by transportation mode for Route de Mende campus

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Despite being geographically proximate and featuring infrastructure comparable to more heavily used roads, Rue de l'Aiguelongue shows virtually no usage by cyclists. This underutilization is not correlated with the infrastructural issues highlighted in the 2021 Cyclability Barometer (Figure 2.3), nor is it supported by recent photographs (Figure 2.4) indicating no apparent deficiencies in safety or accessibility. In contrast, Avenue du Val de Montferrand, which shares similar physical characteristics, is notably busier, while their slopes and infrastructures are again comparable (+/- 20% difference in altitude). It seems that this is mainly a difference in the use of the areas to which these roads provide access: the Aiguelongue district is an isolated residential area, while the surrounding roads provide access to other centres in the metropolitan area.

Figure 2.3: Location of improvement points (marked in green) and vigilance points (in red) around the Mende road campus (Source: 2021 Cycling Cities Barometer, Bicycle Users Federation)

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Figure 2.4: Photographs of Rue de l'Aiguelongue (Source: Le Texier, 2025) on the left and Avenue du Val de Montferrand (Source: Le Texier, 2025) on the right. Shot from the south of the campus on Route de Mende

To accommodate the future Line 5 of the Montpellier tramway (starting in December 2025), the Route de Mende has been restructed and the university-city connectivity strengthen. The redesign includes the installation of tram tracks, safer crossings, and improved cycling and pedestrian infrastructures, thereby reinforcing the campus's accessibility and its integration into the wider urban mobility network (Figure 2.5). The university, through its annual mobility barometer, will soon be able to quantify the impact of these changes on the mobility behavior of its staff and students.

Figure 2.5: Panoramic view of the Southern part of the campus from route de Mende on the left to rue de l'Aiguelongue on the right (Source: Le Texier, 2025)

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Campus Albert 1er Saint Charles

The Saint Charles campus of the University of Montpellier Paul Valéry is a smaller site located in the centre of Montpellier. It is primarily dedicated to research, administration, and certain master's programs. The campus also hosts doctoral schools, making it a significant location for advanced studies and research activities within the university.

The Saint Charles campus of the University of Montpellier Paul Valéry is accessible via the Place Albert 1er tram stop on line 1, which is located right in front of the campus. Additionally, the Albert 1er / Cathédrale tram stop on line 4 is approximately 300 meters away. Both tram lines provide convenient access to key locations in Montpellier, including the Gare Saint-Roch, the city's main railway station.

The Saint Charles campus is well-connected to Montpellier's cycling network, with a Vélomagg' bike-sharing station located approximately 100 meters away, providing easy access to bicycles for short-term use. Additionally, the campus is situated along several key bike lanes that integrate into Montpellier Métropole's extensive cycling infrastructure, facilitating safe and efficient travel by bike throughout the city.

Figure 2.6: Bike path on Avenue Buisson Bertrand (top) and Place Albert 1er (bottom) (Source: Poisson, 2025)

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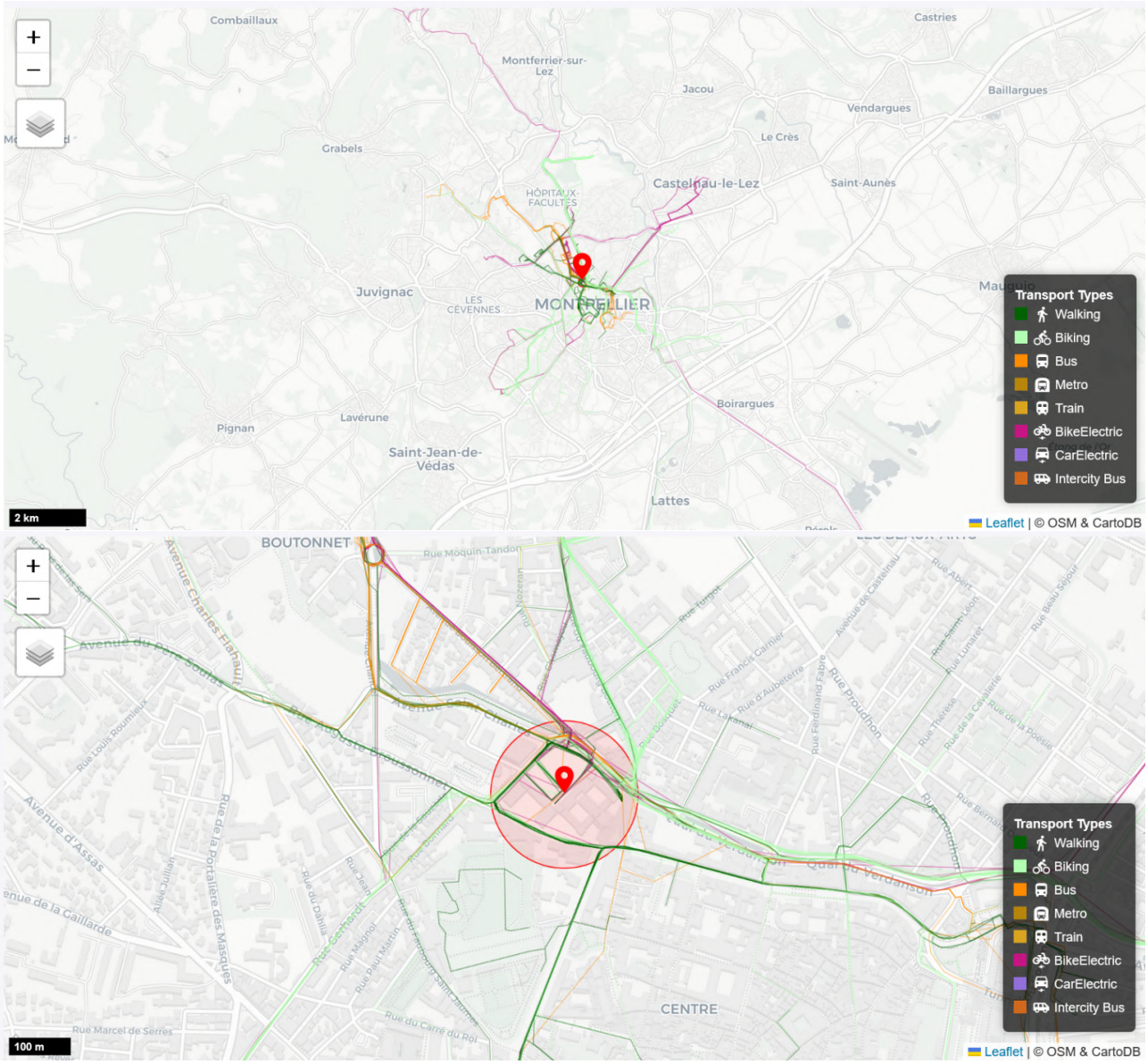

Figure 2.7: Modal breakdown of trips around the Saint Charles campus (Source: MUV, 2024/2025)

The dataset includes 277 trips, all terminating within a 120-meter radius around the route de Mende campus centre (Figure 2.7).

Comparing the distance and travel time between the two campuses raises points of analysis (Tables 1 and 2). Cycling is faster for the Saint-Charles campus than for the Route de Mende campus, and the distances traveled by bike are shorter. Cycling traffic conditions in the central parts of the metropolis seem to favour better traffic speeds. It is also possible that the greater spatial ranges lead cyclists to reduce their average speed in order to better distribute their energy expenditure. Conversely, the electric bike is slightly faster for the Route de Mende campus, despite a longer distance, which seems to indicate that the maximum speeds allowed by the electric bike are more difficult to achieve in the city centre, where cycle paths are heavily used and regularly cross pedestrian paths (or are used by pedestrians). More surprisingly, walking is faster around the Saint-Charles campus. It is possible that the roadworks around the Route de Mende campus is the cause of these differences, with numerous obstacles on pedestrian paths and for road crossings.

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The relatively low number of recorded walking journeys, however, requires caution in interpretation, since it is possible that this is a bias linked to the walking speed of the participants, some preferentially frequenting the Route de Mende campus and others that of Saint-Charles. Finally, buses and trams appear to be faster for the Saint-Charles campus, probably because the proportion of journeys made by tram is even higher on the Saint-Charles campus than on the Route de Mende campus.

	Average distance (in km)	Average time (in min)	Number of trips
All modes	2.96	19.6	277
Bike	3.67	20.5	140
e-Bike	3.58	29.3	39
Walk	1.34	17.8	70
Bus and tram	2.54	6.4	28

Table 2.2: Average distance, time, and number of trips by transportation mode for Saint Charles campus

Conclusion

The analysis of urban mobility patterns around the Route de Mende and Saint Charles campuses of the University of Montpellier Paul Valéry reveals distinct preferences and challenges associated with different modes of transportation. The Route de Mende campus, situated in a more suburban area, shows a reliance on walking (notably from the tramway station Saint-Eloi) and cycling, with significant underutilization of certain routes like Rue de l'Aiguelongue despite its comparable infrastructure to more frequently used roads such as Avenue du Val de Montferrand. Conversely, the Saint Charles campus, located in the city center, benefits from shorter travel distances and times, particularly for walking and cycling, due to its central location and better integration with the public transport network. The analysis indicates that electric bikes are slower at the Saint Charles campus, likely due to the high density of pedestrian and cycling traffic, as well as frequent interactions between different types of road users. Implementing dedicated cycling lanes that are physically separated from pedestrian pathways could help reducing conflicts between cyclists and pedestrians, allowing for smoother and faster cycling, particularly for electric bikes.

Both campuses will be directly connected to the tramway in December 2025, the mobility behaviour of their users will certainly become more uniform, even if the off-centre location of the route de Mende campus and the central location of the Saint-Charles campus led to constraints in modal choices that will persist for some.

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3. University of Turin

The University of Turin (UniTo) is a large athenaeum (around 85,000 individuals) scattered among over one hundred locations in the metropolitan area and Piedmont municipalities. The university locations are diverse: large complexes built specifically for the university are flanked by sites in buildings, including historic ones, as well as structures with mixed functions, such as hospitals housing faculties of medicine. This route study analyses two locations, Campus Luigi Einaudi and the School of Management and Economics, where over 22,000 people study and work, representing over 30% of the University of Turin's total population. Data were collected during two periods of participation in the mobility challenge: the first in October 2024 and the second in March-April 2025.

Luigi Einaudi Campus

The Luigi Einaudi Campus is one of the main sites of the University of Turin. Built in 2012 on a former industrial area along the Dora River, it covers a total surface of approximately 45,000 square meters and is located in a semi-central area. The modern campus houses the departments of social sciences, law, and economics, accommodating around 15,500 people including students and staff. The campus offers 318 bicycle parking spots, located at street level and in the underground parking lot, as well as 427 car spaces and 58 motorcycle spaces.

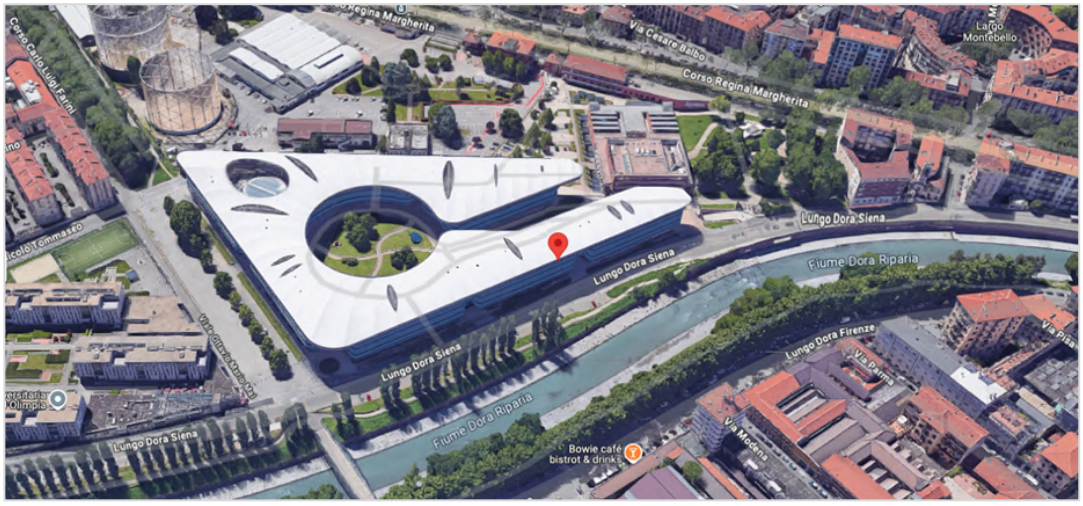

Figure 3.1 – Campus Luigi Einaudi

The Campus is easily accessible by local public transport — 9 urban bus lines and 2 suburban bus lines have stops within a 500-meter radius of the campus — and numerous shared bicycles and scooters are also commonly available in the area.

Figure 3.2 shows that the Luigi Einaudi Campus is well connected to the city's cycle network. There are five cycle paths within a 500-metre radius: the Viale Primo Maggio/Viale Partigiani cycle and pedestrian path, which connects to the Lungo Dora Siena cycle path; the Lungo Dora Firenze cycle and pedestrian path; the Corso Regina Margherita cycle path; and the new Corso Verona cycle path. In addition to the cycling infrastructure, the presence of 30 km/h zones in the surrounding areas toward the city centre further supports bicycle mobility by providing an additional connection to the south.

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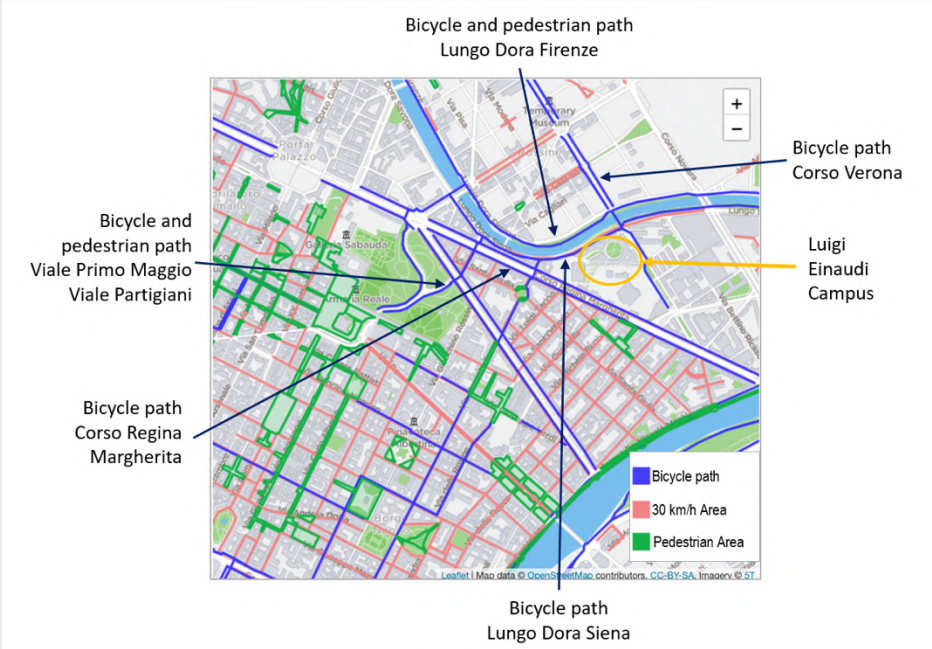

Figure 3.2 – Map of bike lanes, 30 km/h zones, and pedestrian areas

Main cycling and walking trips

The dataset of routes recorded with the MUV App includes 857 trips that start or end within a 250-meter radius around the Luigi Einaudi Campus.

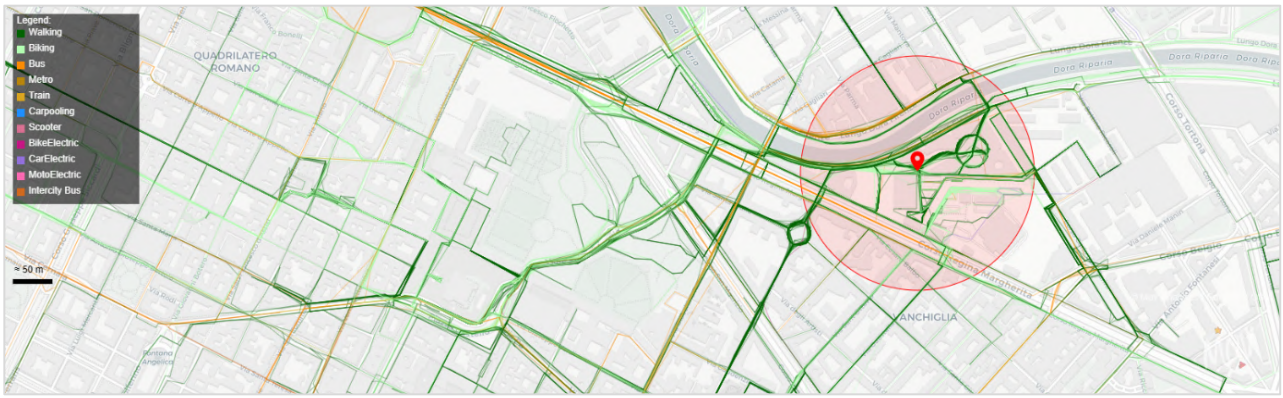

Figure 3.3 - Modal shift of trips around Luigi Einaudi Campus

	Number of trips	Average distance (in km)	Average time (in min)
Walk	457	1.77	35.5
Bike and *e-Bike*	326	6.48	66.9
Bus and tram	72	4.10	21.0
e-Car	2	67.94	79.3
All modes	857	3.91	46.3

Table 3.1 - Number of trips, average distance, and average travel time for the Einaudi Campus

The modal split shows a predominance of walking trips (53%), followed by a significant share of bicycle trips (38%), and only a residual share of trips by public transport (8%). The average bicycle trip covers approximately 6.4 km, while walking trips are shorter, averaging 1.77 km, with an

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average duration of about 22.7 minutes.

Figure 3.4 shows that pedestrians travel to the Einaudi Campus primarily from the city centre, where several other university facilities are also located. The most frequently chosen routes are the most direct ones: the pedestrian and bike path from Piazza Castello along Viale Primo Maggio and Viale dei Partigiani through the Royal Gardens, as well as Montebello and Rossini streets, are used to reach both the entrance on Corso Regina Margherita and the main entrance on Lungo Dora Siena. Pedestrians coming from the area north of the Campus, across the Dora River, tend to concentrate on Via Modena, then follow a short stretch of the pedestrian and bike path along the river (Lungo Dora Firenze), and use the pedestrian and bike bridge to access the main entrance of the Campus.

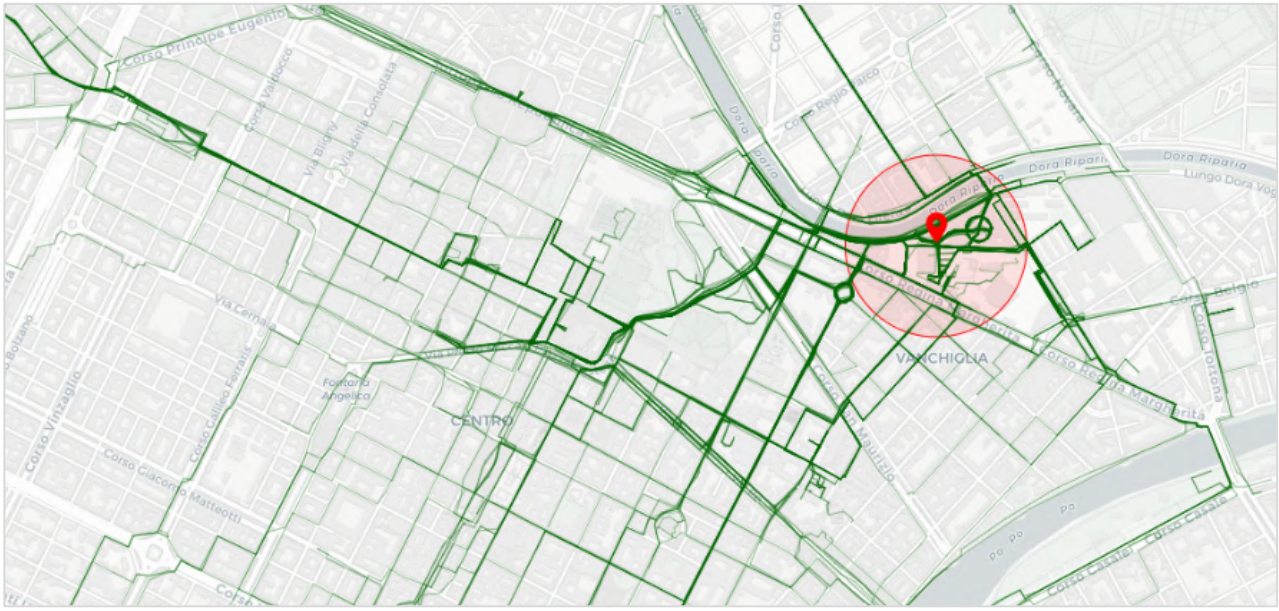

Figure 3.4 - Most frequently walked streets around the Luigi Einaudi Campus

Figure 3.5 shows that cyclists prefer the cycle routes around the campus, particularly the cycle paths on both sides of the Dora River (Lungo Dora Siena and Lungo Dora Firenze), the cycle route to the city centre (Viale Primo Maggio/Viale dei Partigiani), and the cycle route on Corso Regina Margherita. These paths are described below, indicating the improvements needed.

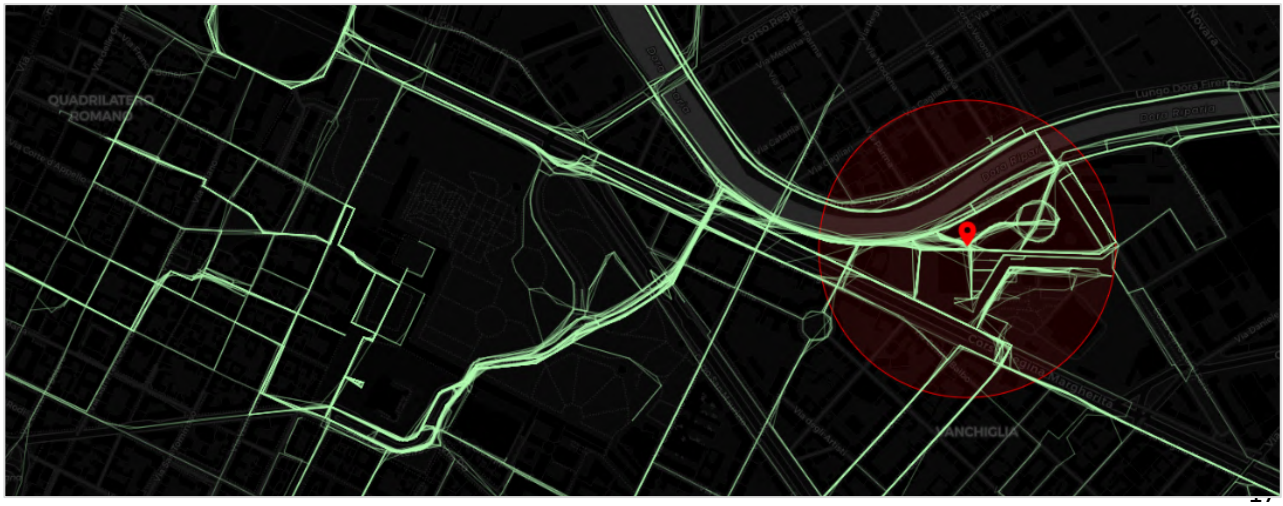

Figure 3.5 - Most frequently cycled streets around the Luigi Einaudi Campus

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The Cycle path Viale Primo Maggio – Lungo Dora Siena

The cycling connection from the central Piazza Castello to the Einaudi Campus represents the fastest and most direct route between the city center—and the many university buildings located in the historic buildings of the city center—and the university campus.
The route is divided into two parts: the first is a shared pedestrian and bicycle path (from Piazza Castello – Viale Primo Maggio/Viale dei Partigiani to Corso San Maurizio), created by sharing the sidewalks under the tree-lined Royal Gardens; the second part (from Viale Partigiani/Corso San Maurizio to the Campus on Lungo Dora Siena) features a protected two-way cycle lane, separated from the roadway by horizontal signage and curbs that discourage cars from encroaching, and also distinct from pedestrian sidewalks.

Figure 3.6 – Cycle path Viale Primo Maggio – Lungo Dora Siena

The main critical issue in the first section (Figure 3.7) is the absence of horizontal signs clearly separating the space for cyclists and pedestrians. Shared use of the route is indicated only by vertical signs. This creates conflict situations and significantly increases the risk of accidents, especially given the slope of the path, which increases the speed of cyclists who are forced to slalom between pedestrians convinced (not entirely wrongly) that they are on a traditional pavement.

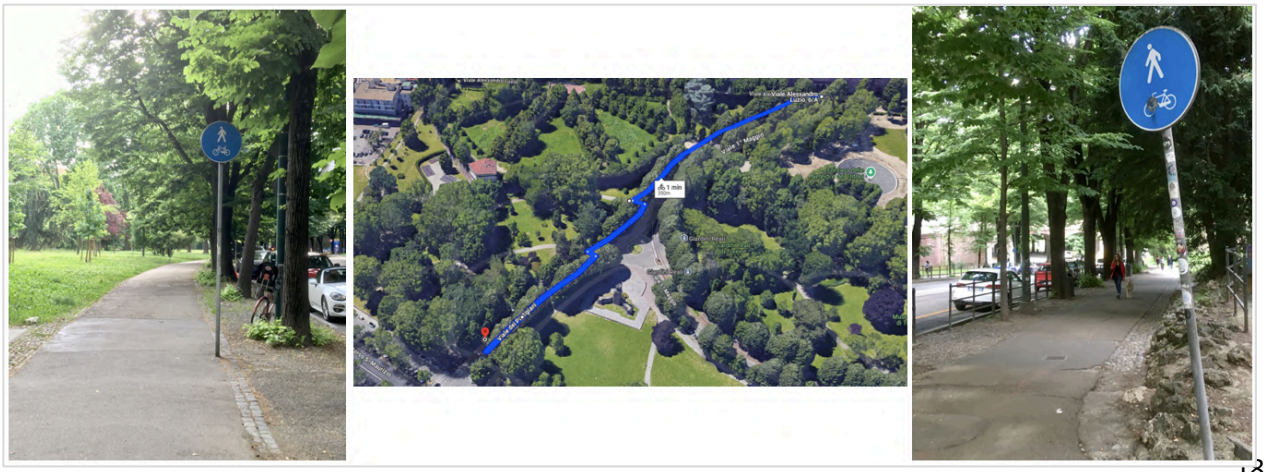

Figure 3.7 – Viale Primo Maggio/Viale Partigiani cycle-pedestrian path

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In the second section, along the cycle path of Lungo Dora Siena which extends to Colletta Park, the main issues concern the maintenance of the cycling infrastructure: the curbs show significant signs of wear, and the road markings are dangerously faded and barely visible. This greatly reduces cyclist safety, especially at intersections with roads that experience heavy vehicular traffic, such as Corso Regina Margherita (Figure 3.8).

Figure 3.8 – Lungo Dora Siena cycle path – wear and tear on road signs

A particularly critical point is the main entrance of the campus, which connects the pedestrian and cycle bridge linking the campus with the neighborhood on the opposite side of the river and the cycle path along Lungo Dora Firenze. Figure 3.9 shows, on the left, the severe fading of the road markings in front of the main entrance to the campus toward the bridge over the Dora River, and on the right, the recently implemented pedestrian and cycling crossing on the opposite side of the river at the end of the bridge. It is hoped that a similar intervention will be carried out on the campus side to significantly increase the safety of cyclists and pedestrians.

Figure 3.9 - Cycle-pedestrian crossings on each side of the river walkway.

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Overall, the Lungo Dora Siena cycle path represents one of the city's main cycling corridors, as confirmed by the City of Turin's bicycle flow monitoring system[1]: one of the 12 city counters is located on the Lungo Dora Siena cycle path, approximately 250 meters from the Einaudi Campus, recording an average of 790 daily passages and a total of 1,741,921 since monitoring began in 2019 (Figure 3.10). Restoration work on the road markings and the curbs separating the cycle path from the roadway is therefore both important and urgent.

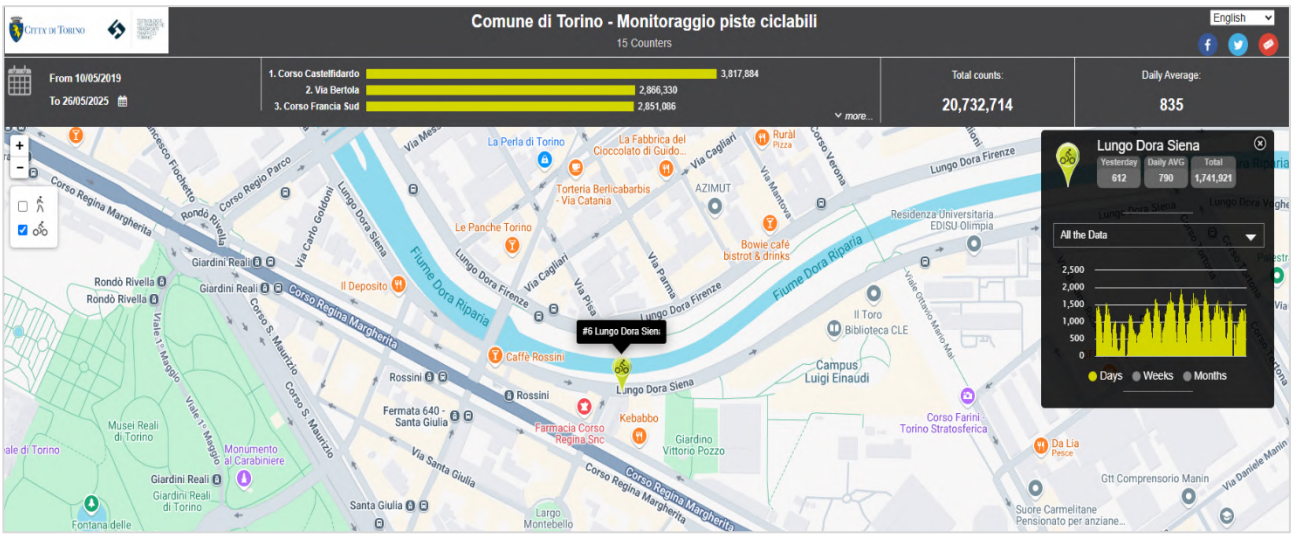

Figure 3.10 - Municipality of Turin's monitoring of cycling flows on cycle paths

The Pedestrian and Cycle Path along the Dora River (Lungo Dora Firenze)

The pedestrian and cycle path connects two major city parks (Parco Dora and Parco Colletta) and stretches for nearly 6 km along the bank of the Dora River. Relative to the Einaudi Campus, the path is located on the opposite side of the Dora River and is connected to it by the aforementioned footbridge that leads directly to the main entrance.

Figure 3.11 - The Pedestrian and Cycle Path along the Dora River

[1] https://data.eco-counter.com/ParcPublic/?id=6771

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The path is separated from the roadway, and in recent years, measures have been implemented to improve coexistence between pedestrians and cyclists and to enhance safety: in many sections, horizontal signage has been improved to distinguish between pedestrian and cycle lanes, separate pedestrian and cycle crossings have been created, and conflicts with public transportation stops have been reduced by widening sidewalks. However, cyclist-pedestrian coexistence still requires attention, especially during peak hours.

Although there are no particularly problematic elements, there is still room for improvement, particularly with regard to the horizontal signage. It is therefore necessary to maintain and strengthen the road markings both in areas where the pedestrian and cycle paths are clearly separated, and above all, in areas where such separation is absent due to narrowing of the route and the space temporarily becomes shared again (Figure 3.12).

Figure 3.12- Separate (left) and shared (right) cycle-pedestrian paths

Additionally, consistent and regular maintenance of horizontal signage at street intersections is essential, particularly where the paving is made of stone rather than asphalt, which further reduces cyclist stability during crossings. In some intersections, there are already significant signs of wear that reduce the visibility of the cycle crossing, posing clear safety risks (Figure 3.13).

Figure 3.13 - New cycle and pedestrian crossing a and old one to be restored

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Cycle Path on Corso Regina Margherita

Figure 3.14 - Cycle Path on Corso Regina Margherita

The cycle path along Corso Regina Margherita runs along the service roads of one of the city's main traffic arteries. It is marked by horizontal and vertical signage but lacks physical barriers, exposing cyclists to the risk of intrusion by motor vehicles. To promote coexistence between vehicle traffic and cyclists, the speed limit is set at 20–30 km/h, and vertical signage designates the road as “shared” (Figure 3.15).

Figure 3.15 – Shared road and bike boxes in Corso Regina Margherita

At some intersections, "bike boxes" are also present—red-painted areas with a bicycle symbol placed ahead of the vehicle stop line. These allow cyclists to position themselves visibly at traffic lights and start ahead of cars when the light turns green, thus improving safety. By positioning themselves in front of the vehicles, cyclists also avoid inhaling exhaust fumes from idling engines.

Due to the narrowness of the service roads, it is difficult to install physical barriers to separate the cycle lane without removing parking spaces on one side of the street—an area already affected by significant parking issues. As a result, the choice to reduce speed limits appears reasonable.

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However, the poor maintenance of horizontal signage (Figure3.16) compromises the visibility of the bike lane and the reduced speed limits.

Figure 3.16 – Faded and poorly visible road markings

To make the road truly shared between vehicles and bicycles and improve safety, a comprehensive restoration and enhancement of horizontal signage (lane markings, arrows, bicycle symbols) is necessary, along with improved vertical signage to increase the visibility of the path. Some localized interventions are currently underway, but not in the sections of the cycle path near the Campus.

Cycle Path on Corso Verona

Figure 3.17 - Cycle Path on Corso Verona

A new cycle path has been built on Corso Verona, connecting the northeastern areas of the city with the Luigi Einaudi Campus and the pedestrian and cycle path along Lungo Dora Firenze. It is a bidirectional cycle path separated from the roadway and located on the tree-lined median, which has been redeveloped by removing vehicle parking. Pedestrians have separate sidewalks, set apart from the cycle path. The clear separation from both the road and pedestrian areas ensures safety and comfort for cyclists.

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The new path, inaugurated just a few months ago, does not currently require any improvements. However, it is worth noting that it was constructed along a street not characterized by heavy vehicular traffic and which did not appear to have an urgent need for a protected route. At present, the Corso Verona cycle path is not heavily used by cyclists, as shown by the complete absence of usage data from the university community survey. This may be due to a lack of awareness of the new cycling infrastructure, but also to the fact that it does not seem to provide a direct connection to the broader cycling network in the northern part of the city (for example, there is an 850-meter gap in the connection to the cycle path on Corso Novara).

Economics and Management Campus

The Campus of Economics and Management is housed in a renovated and expanded historic building, covering an area of approximately 25,000 square meters. It consists of a central body and four lateral wings. Located in the southern area of Turin, it has its main entrance at Corso Unione Sovietica No. 218-220 and a rear entrance at Via Filadelfia No. 73, which leads to the newly developed section.

The Campus offers 128 bicycle parking spaces near the entrances on Corso Unione Sovietica and Via Filadelfia, as well as 200 unguarded car parking spaces available free of charge for staff.

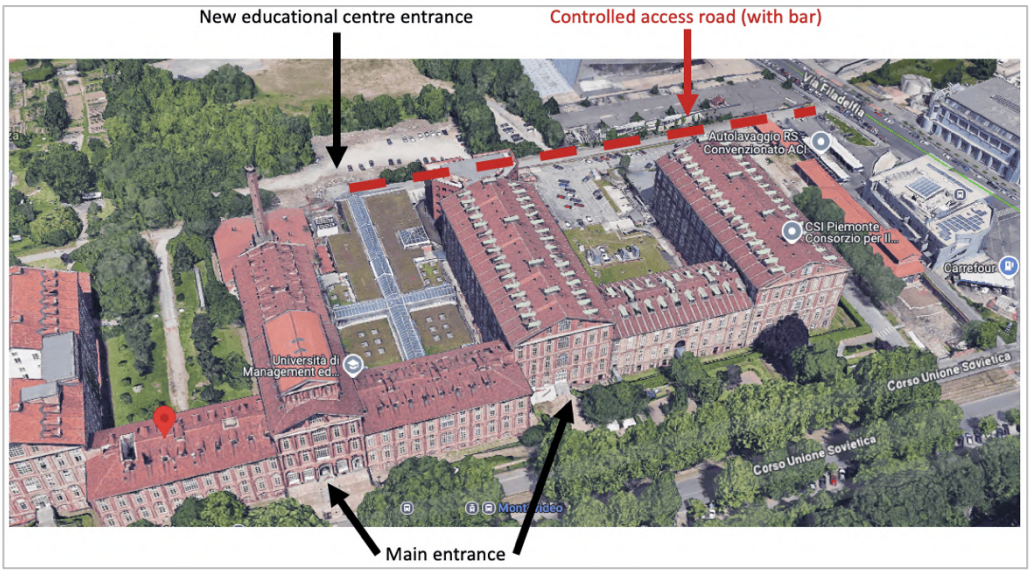

Figure 3.18 - Economy and Management Campus

The accessibility and transportation options of the Economics and Management Campus are adequate. The campus is quite accessible by local public transport - 2 city bus lines and 2 suburban bus lines have stops within 500 metres of the campus - and shared bicycles and scooters are also quite available in the area.

Pedestrian access is ensured by sidewalks and pedestrian crossings near the entrance of the facility.

Cycling access to the Campus is good, thanks to the presence within a 500-meter radius of major bike lanes along Via Filadelfia, Corso Giovanni Agnelli–Corso IV Novembre, Corso Cosenza, and the cycle-pedestrian path on Corso Galileo Ferraris, which connect to the city's cycling network (Figure 3.19).

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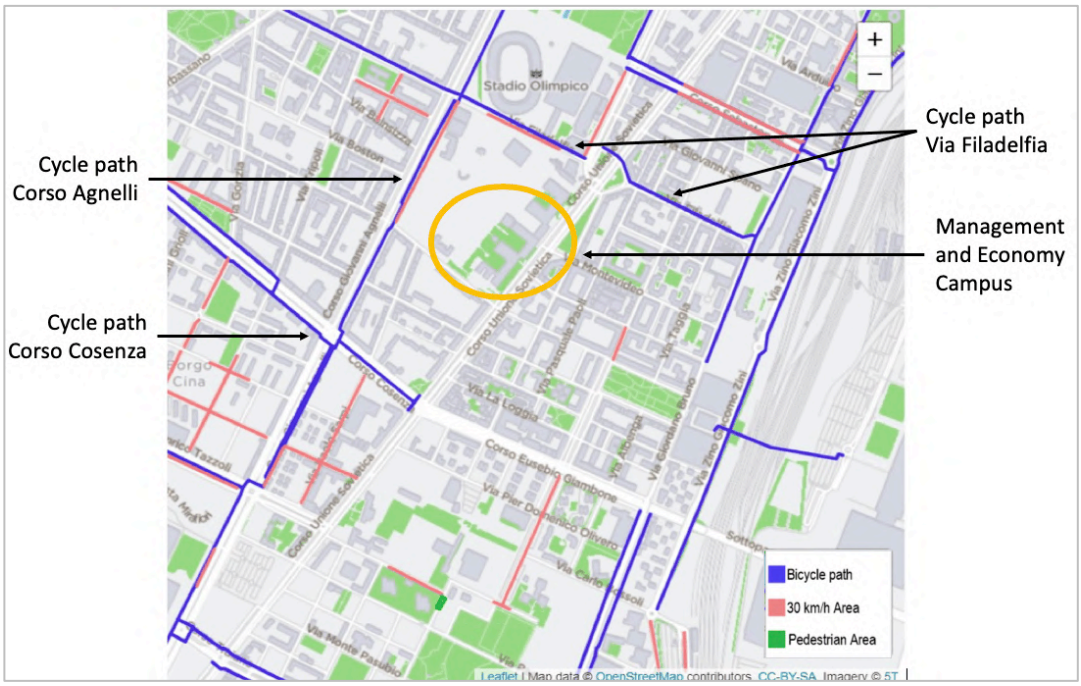

Figure 3.19 – Map of bike lanes, 30 km/h zones, and pedestrian areas

Main cycling and walking trips

The dataset of routes recorded with the MUV App includes 260 trips that start or end within a 250-meter radius around the Economy and Management Campus.

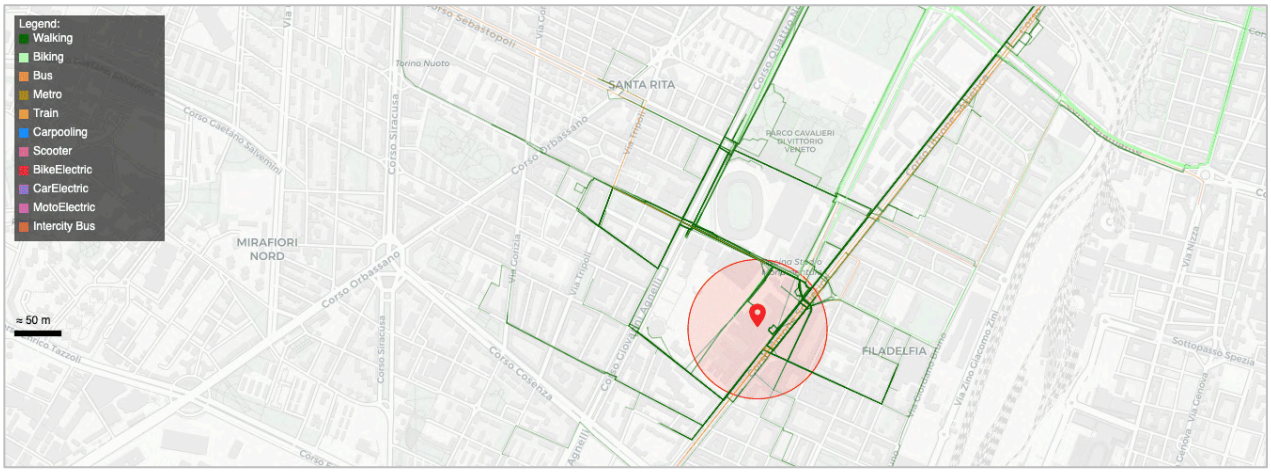

Figure 3.20 - Modal shift of trips around Economy and Management Campus

	Number of trips	Average distance (in km)	Average time (in min)
Walk	181	1.25	16.9
Bike	65	3.17	36.6
Bus and tram	14	2.33	11.9
All modes	260	1.79	21.5

Table 3.2 - Number of trips, average distance, and average travel time for the Economy and Management Campus

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The modal split shows a predominance of walking trips (70%), followed by a significant share of bicycle trips (25%), and only a residual share of trips by public transport (5%). The average bicycle trip covers approximately 3.17 km, while walking trips are shorter, averaging 1.25 km, with an average duration of about 16.9 minutes.

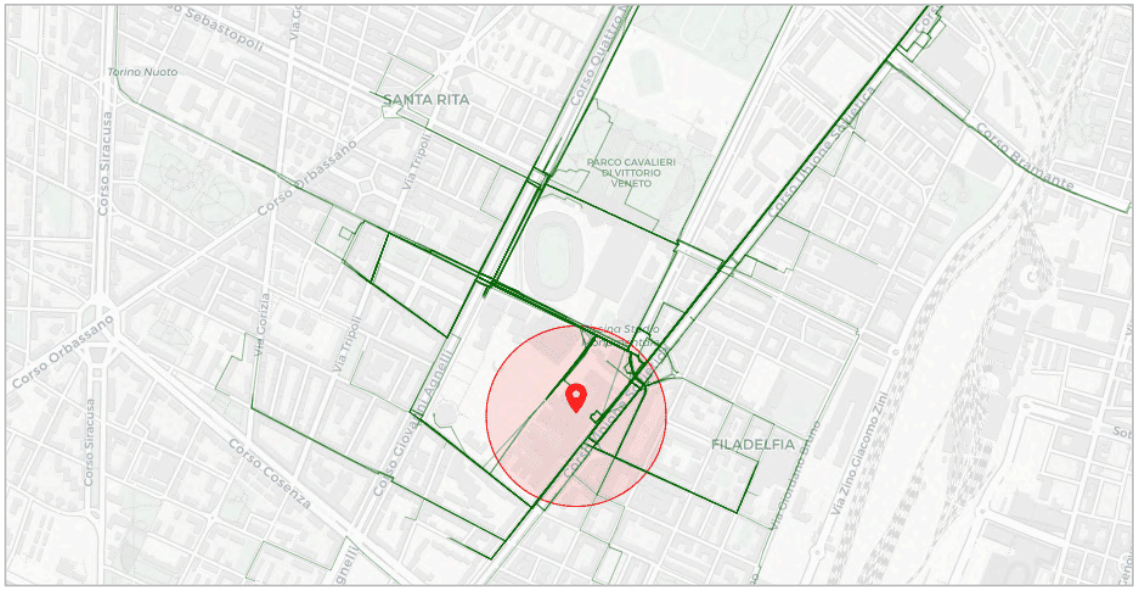

Figure 3.21 - Most frequently walked streets around the Economia and Management Campus

Figure 3.21 shows that the majority of people attending the Campus of Economics and Management move northwards towards the city centre. The streets with the most foot traffic is Via Filadelfia, likely due to its connection with public transport stops at the intersection with Corso Giovanni Agnelli, Corso Unione Sovietica and Via Montevideo, which leads directly to the main entrance. Numerous routes are also recorded on both sides of the Cavalieri di Vittorio Veneto Park. The map highlights a preference for major roadways, while pedestrian mobility on secondary neighbourhood streets is very limited.

The cycling routes most commonly used by the university community head almost exclusively north of the campus, toward the city centre (Figure 3.22). Most recorded routes follow the bike lane on Via Filadelfia to reach one of two cycle-pedestrian paths that extend for about 1 km along the sides of the large Parco Cavalieri di Vittorio Veneto (Piazza d'Armi). These cycle-pedestrian paths are quite wide and, although they do not have a clearly marked separation between cyclists and pedestrians, they do not present significant issues of space conflict between the two user groups.

Cyclists who follow the side of the park along Corso Galileo Ferraris reach the bicycle overpass at Corso Bramante at the end of the green area, reconnecting to the bike lane along Via Nizza. Those who follow the opposite side of the park, along Viale IV Novembre, continue onto Corso Tirreno.

A smaller number of cyclists reach the Economics and Management Campus via Corso Unione Sovietica, Via Tunisi, or the bike lane on Via Giordano Bruno. The latter also take the Corso Bramante overpass and then the bike lane along Via Nizza.

It is therefore not surprising that, between the two entrances to the Economics and Management Campus, cyclists tend to use the Via Filadelfia entrance more than the main entrance on Corso Unione Sovietica.

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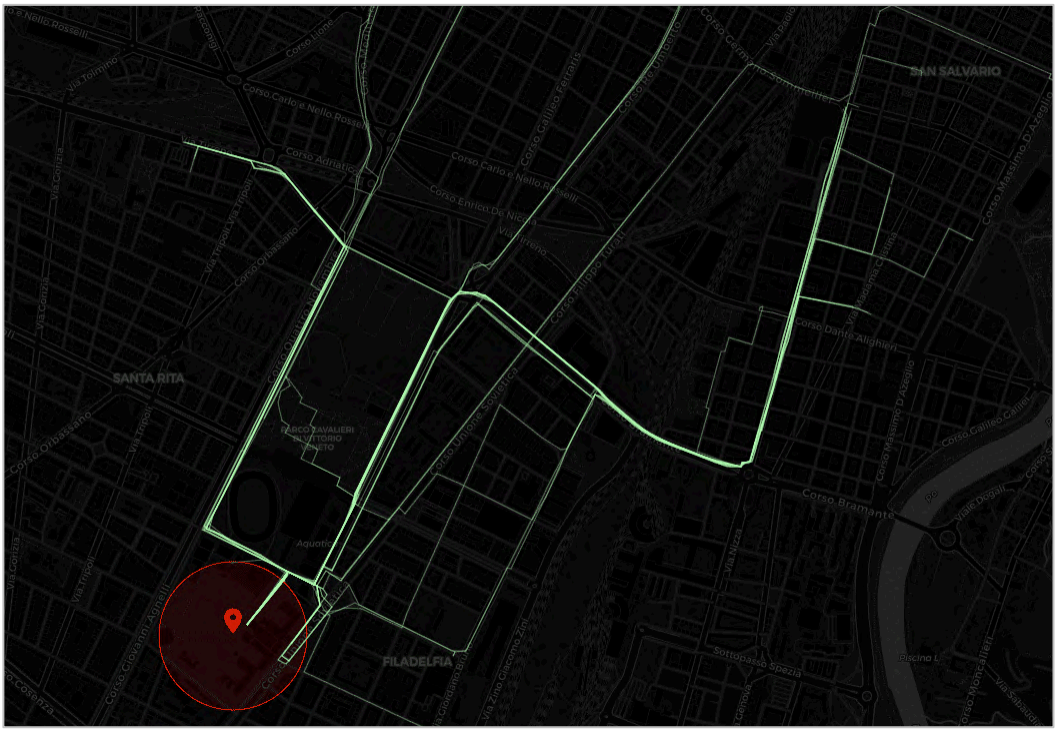

Figure 3.22 - Most frequently cycled streets around the Luigi Einaudi Campus

Cycle path Via Filadelfia

The bike lane on Via Filadelfia, in the stretch closest to the Campus, runs along the road that separates the university from the Olympic Stadium. Around the stadium area, there are fences that can be closed during sporting events.

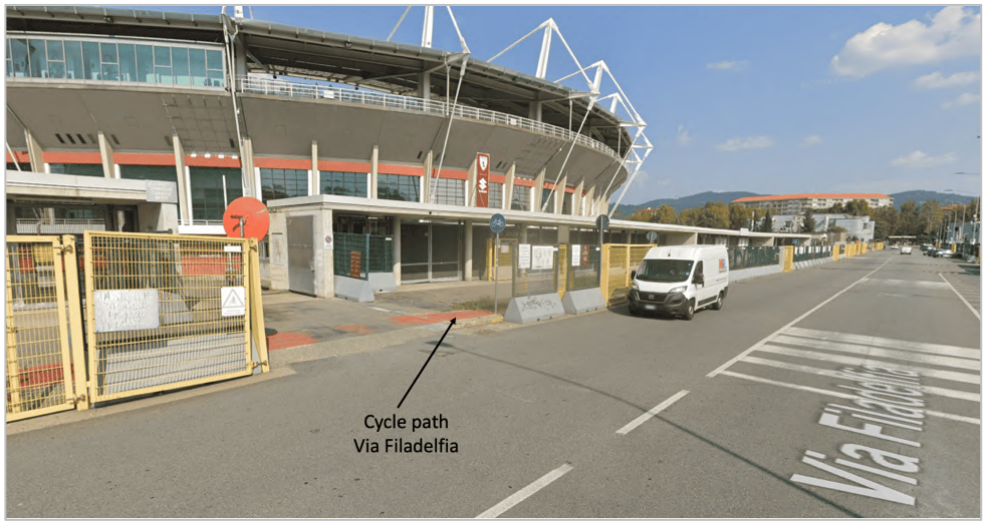

Figure 3.23 – Via Filadelfia cycle path

These fences separate the road from the bike lane, and cyclists often cross Via Filadelfia diagonally to reach the road leading to the Campus entrance (Figure 3.24). This crossing is not safe, as there is no dedicated signage and the fences obstruct drivers' visibility of cyclists.

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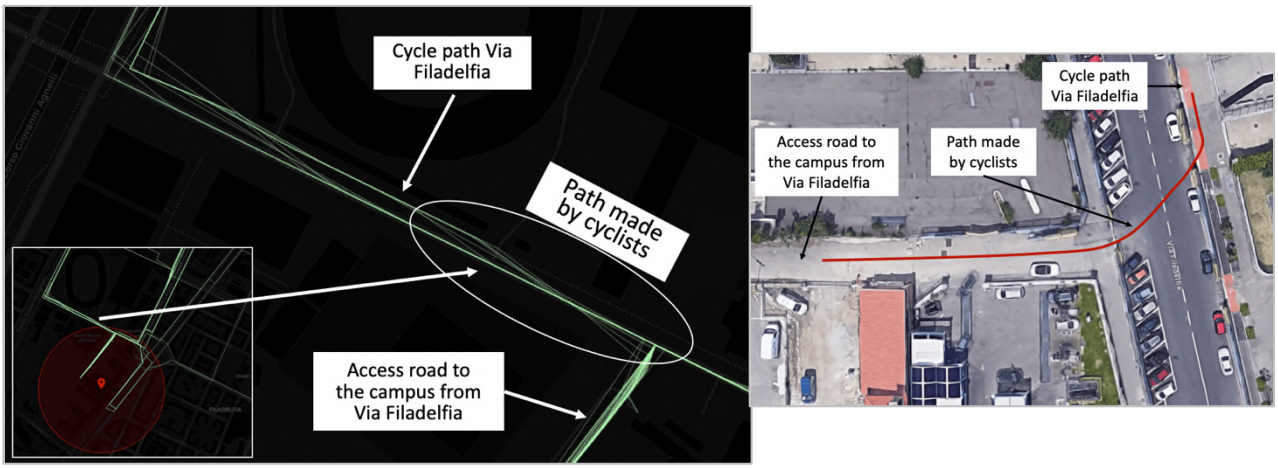

Figure 3.24 – Cyclists crossing in via Filadelfia

As part of a project to improve connections between the railway stations and the university campus, the City Council and the Metropolitan City of Turin are currently carrying out the redevelopment of the Via Filadelfia cycle path.

The redevelopment work involves resurfacing the track from Via Giordano Bruno to Corso Siracusa and includes widening the track, adding landscaping and ensuring the crossings are safe. Ideally, a solution should be found to enable safe crossing of the street from the cycle track to the access road at the rear of the university campus.

Figure 3.25 – Suggested new cycle stretch for the Economics and Management Campus

As part of the improvements to the Via Filadelfia cycle lane, work is also planned at the intersection with Corso Unione Sovietica (Piazzale di San Gabriele da Gorizia). It would also be desirable to create a 200-metre cycle lane leading to the main entrance of the Economics and Management campus (Figure 3.25).

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4. Universidad Camilo José Cela Campuses

Villafranca Campus

Location and characteristics

Situated on an area of 100,000 m², the Madrid-Villafranca campus is located in the Villafranca del Castillo development, which belongs to the municipality of Villanueva de la Cañada. The urbanization has only two entrances, both for motorized traffic and active mobility: one from the north, from the road connecting Majadahonda and Villanueva del Pardillo, and another from the south, from the road connecting Majadahonda with Villanueva de la Cañada. It is a predominantly residential neighborhood, with single- family homes on large independent plots and high incomes.

The campus' location, far from urban areas with larger populations and access designed only for motorized transport, reduces the possibilities of walking to the campus in a reasonable time. Therefore, the pedestrian trips that occur to access the campus are the initial or final journeys of people using public transport. There are several bus lines that connect the campus with the city of Madrid and the most important neighboring municipalities. We can differentiate between the lines that pass through the Villafranca urbanization and have a stop at the main entrance to the campus (less than 300 meters away). These are lines 623 (Madrid → Las Rozas → Urb.Villafranca), 626 (Las Rozas → Majadahonda → Villanueva de la Cañada), 627 (Madrid → Villanueva de la Cañada → Brunete), and the night line N907.

Additionally, there are other lines that only stop on the M-509 road: 641 (Madrid (Moncloa) → Villanueva del Pardillo → Valdemorillo), 642 (Colmenar de Arroyo → Navalagamella → Valdemorillo → Villanueva del Pardillo → Madrid), 643 (Villanueva del Pardillo → Madrid), 626A (Majadahonda (FF.CC. Station) → Villanueva del Pardillo), and the night line N908.

To access from the M509 stop, is necessary to walk about 20 minutes (1.5 km).

Constraints for walking trips

Main pedestrian trips: ccording to surveys conducted, most pedestrian trips are made to access bus stops. The route is along Av. de Los Castillos and C. Castillo de Alarcón.

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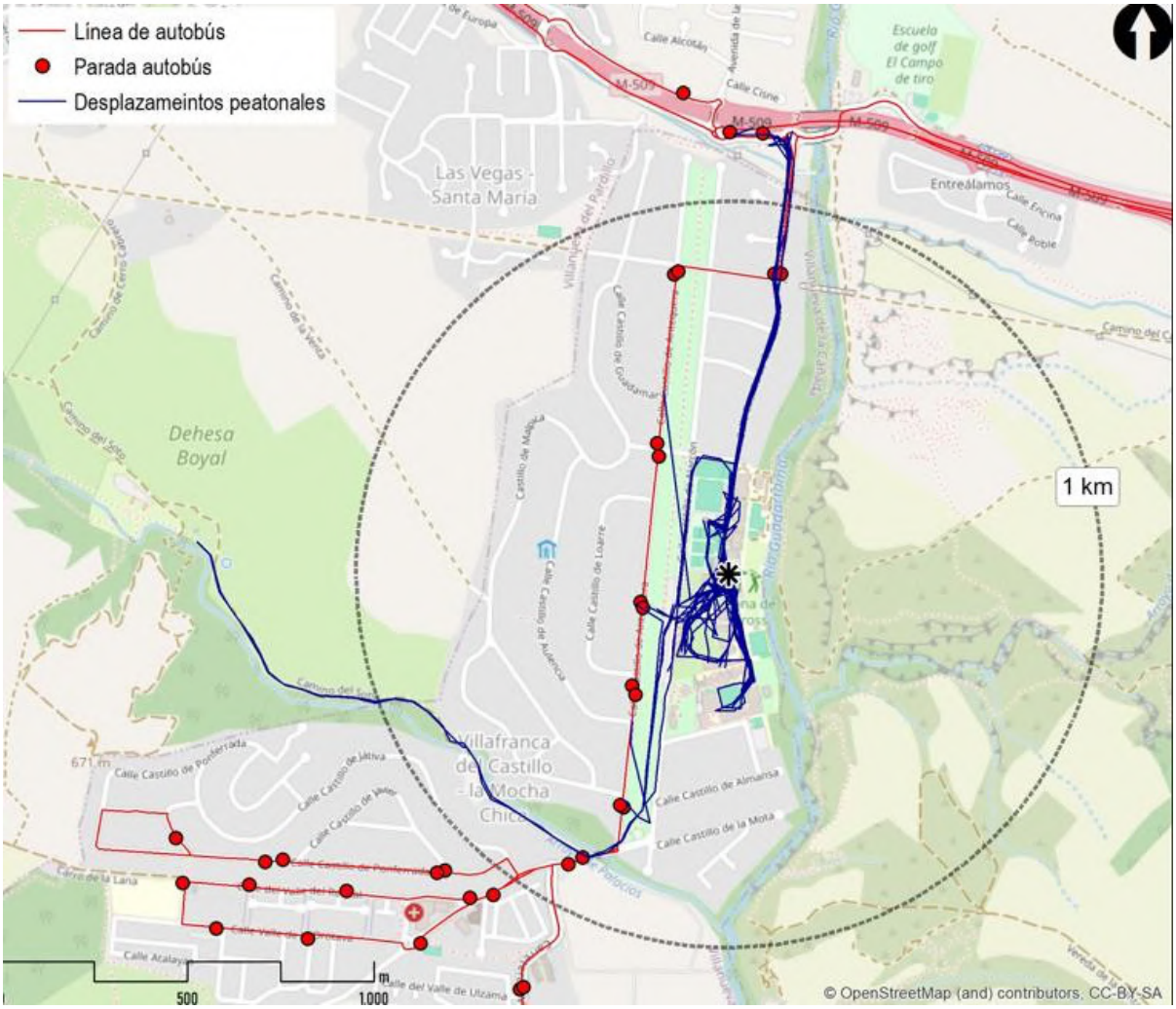

Figure 4.1 - Main pedestrian trips according to MUV surveys conducted

Regarding the conditions for making these walking trips, several problems have been detected: the access from the nearest stops, located on C. Castillo de Antequera, is not located on the street that provides access to the campus, but on the parallel street. Additionally, the layout of the pedestrian path to access the campus is not direct; instead, when reaching the parking lot located in front of the campus, one must make a detour that unnecessarily increases the length of the pedestrian route.

Figure 4. 2 - Pedestrian route from the bus stop to the main entrance of the campus

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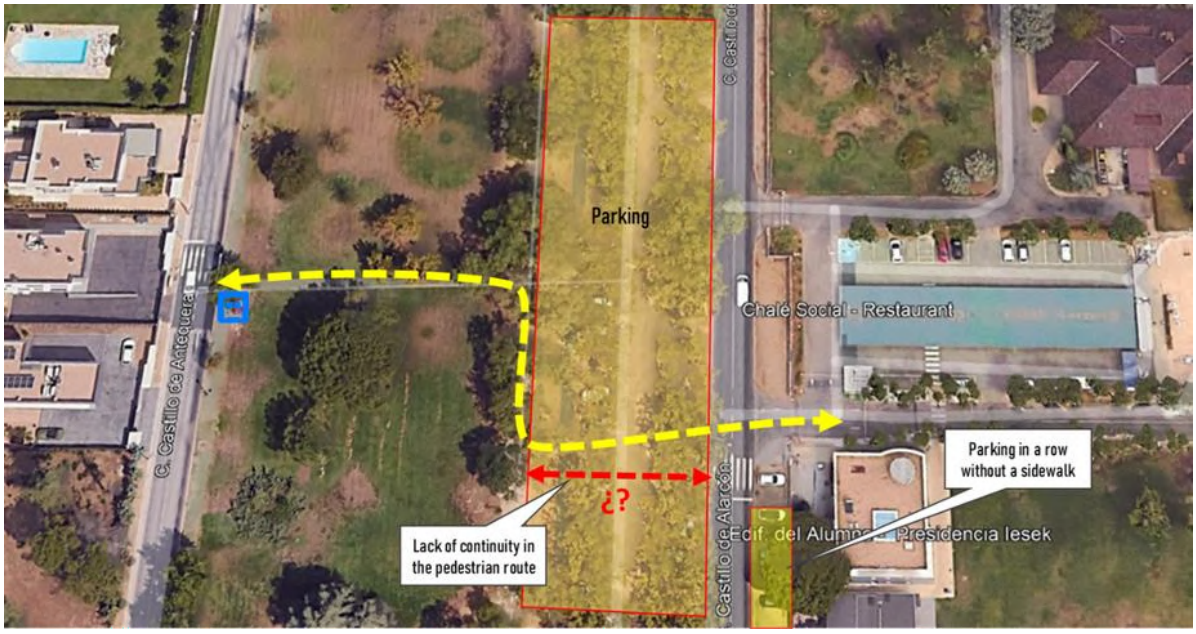

Figure 4.3 - Detected Problems on the pedestrian route from the bus stop to the campus main entrance

Regarding the walkability from the bus stops located on the M509 road, the following problems have been detected:

- Narrow sidewalks (between 1.50 and 1.80 meters)
- Bus stop without a shelter.
- Lack of trees.
- Oversized roadway.
- High air pollution and noise.
- Winding layout and pedestrian crossings with significant setbacks.
- Pedestrian crossings without refuge (when there are 2 lanes)

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Figure 4.4 - Diagram of the layout of pedestrian routes to access the bus stops located on the M-509 road

Finally, regarding the main pedestrian routes within the urbanization to access the campus, the following problems have been detected:

- Narrow sidewalks (between 1.50 and 1.80 meters)
- Streets without usable sidewalks (C/ Castillo de Guadalcázar)
- Lack of trees.
- Obstacles on the sidewalks (streetlights)
- Discontinuity of pedestrian routes at intersections.

Figure 4.5 - Characteristics of the main pedestrian routes to access the campus

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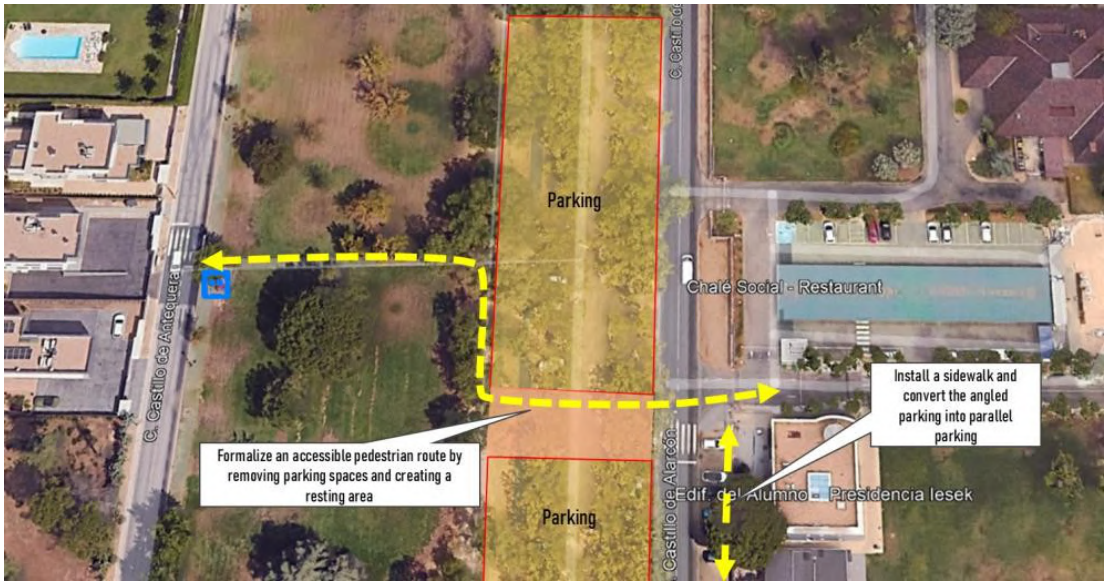
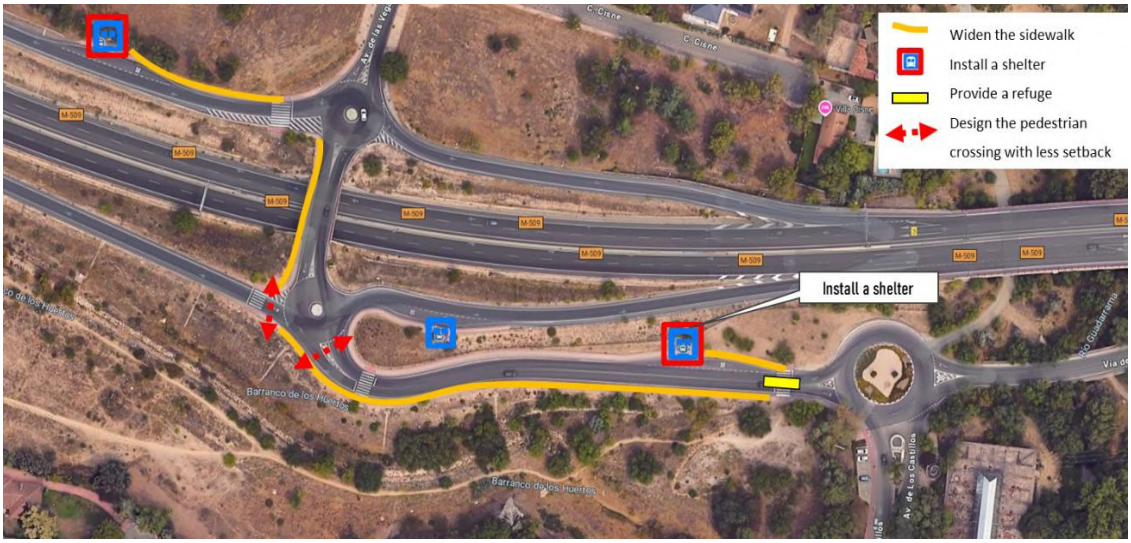
Proposals to improve walkability

a. Place the bus stops in front of the campus entrance and relocate the car parking or at least design a direct pedestrian route.



b. Improve the pedestrian routes to access the bus stops located on the M-509 road.



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c. Improve the internal pedestrian routes within the urbanization to access the campus:

- Section 1 (Avda. de los Castillos): Remove a row of parking spaces to widen the sidewalk and add a row of trees.
- Section 2 (Calle Castillo de Guadalcázar): Reduce the width of the roadway and widen one sidewalk.
- Section 3 (Castillo de Barcience): Widen one of the sidewalks and add a row of trees, leaving the roadway at 6.00 meters

d. Improve pedestrian connections with the urban center of Villanueva del Pradillo.

Currently, there is no pedestrian access from Villanueva del Pradillo to the Villafranca campus, despite the distance being just 2 km. It is proposed to enhance the Villafranca Path / path that connects after a fork with Calle Castillo de Barcience. The basic condition is to remove the access gate to the urbanization. Additionally, it is advisable to improve the pavement, install streetlights, and add trees to make walking (or cycling) to the campus more attractive.

The second measure involves the informal paths that run parallel to the M509 and create a new access to the linear park. Although this new access is not essential, the reduction in distance to be covered is significant, and the route would be more attractive than via Avda. de los Castillos.

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Constraints for Cycling

Due to the location, mobility model, and infrastructure design, the current use of bicycles to access the campus is minimal. The areas near the campus are few and of relatively low density, with high-capacity infrastructures designed for motorized traffic dominating the territory, and the terrain is hilly.

There is no specific bicycle infrastructure either on the campus or nearby, although there are several paths that are theoretically suitable for cycling. As shown in the following figure, within a 3 km radius, there is no cycling route to facilitate access to the university campus. Some surrounding municipalities have implemented dedicated cycling paths, but these are not part of a network; some are isolated segments, while others are leisure-oriented and not very functional for daily commuting.

Additionally, the cyclability of the main access roads to the campus/Villafranca urbanization (M509 and M503 roads) is very low, given the high traffic volumes and speeds, and the design of the main intersections (large roundabouts) is very dangerous for cycling.

An added problem is that paths crossing the territory, which could theoretically facilitate access to the campus, have been closed for public safety reasons.

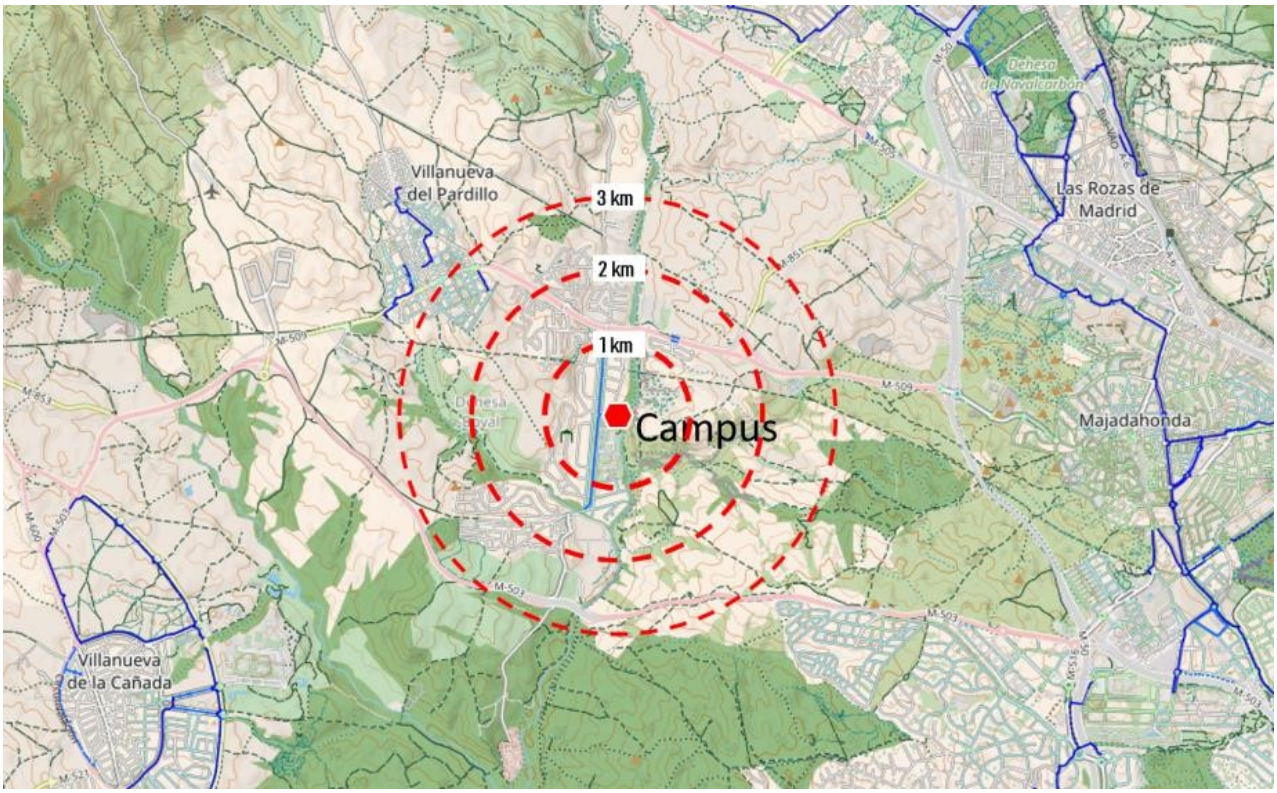

Figure 4.6 - Bicycle Infrastructure Around the Villafranca Campus

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Additionally, the nearest railway stations are quite far away, and, combined with the lack of good bicycle infrastructure, this discourages intermodality between the train and the bicycle.

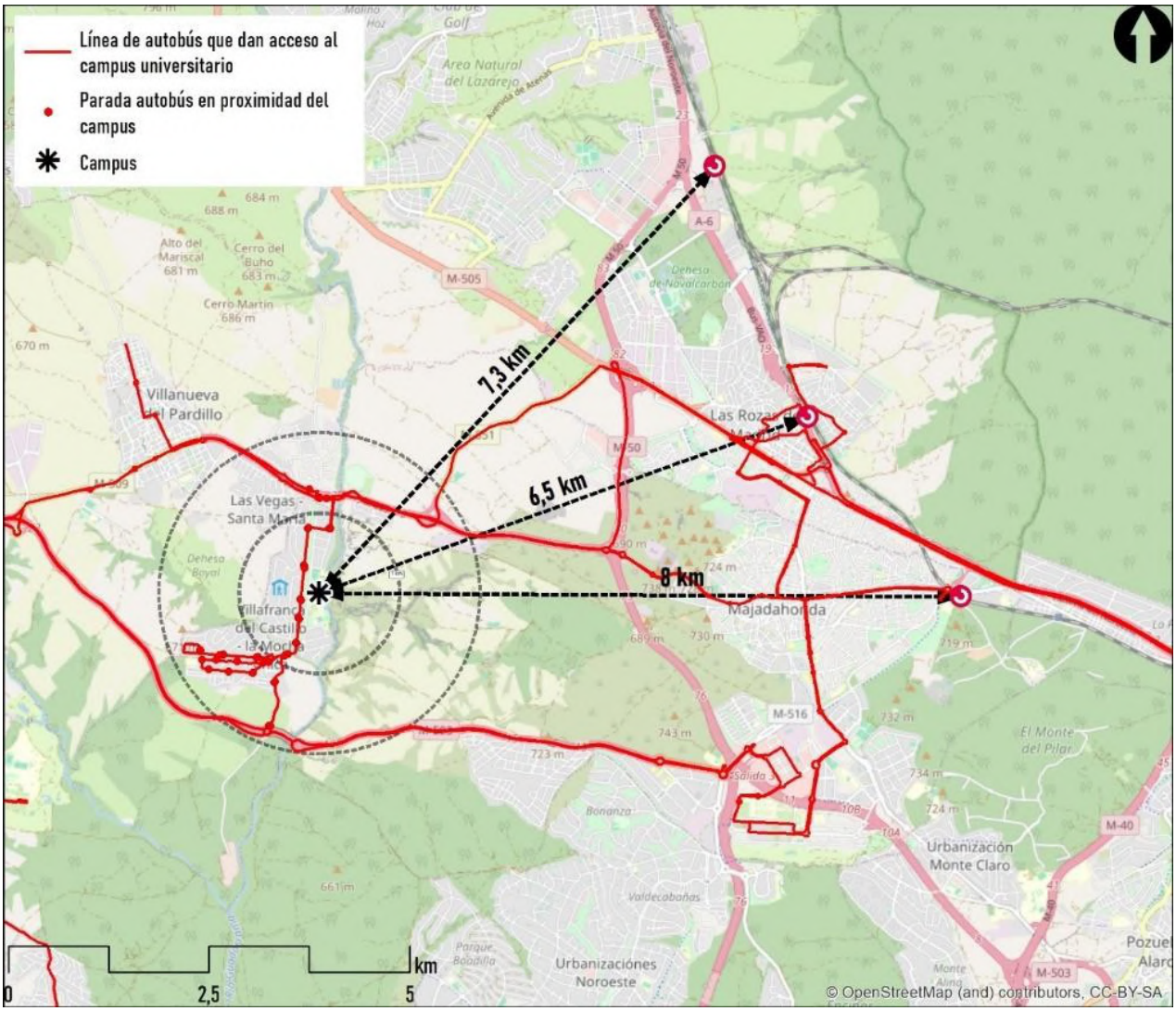

Figure 4.7 - Distances from the Villafranca campus to nearby train stations

Main Bicycle Trips

According to the MUV survey, there is only one recorded journey: a trip of just 900 meters originating from the urbanization itself. This suggests that either the person lives there or uses a car or bus for the main part of the journey and then cycles around the campus

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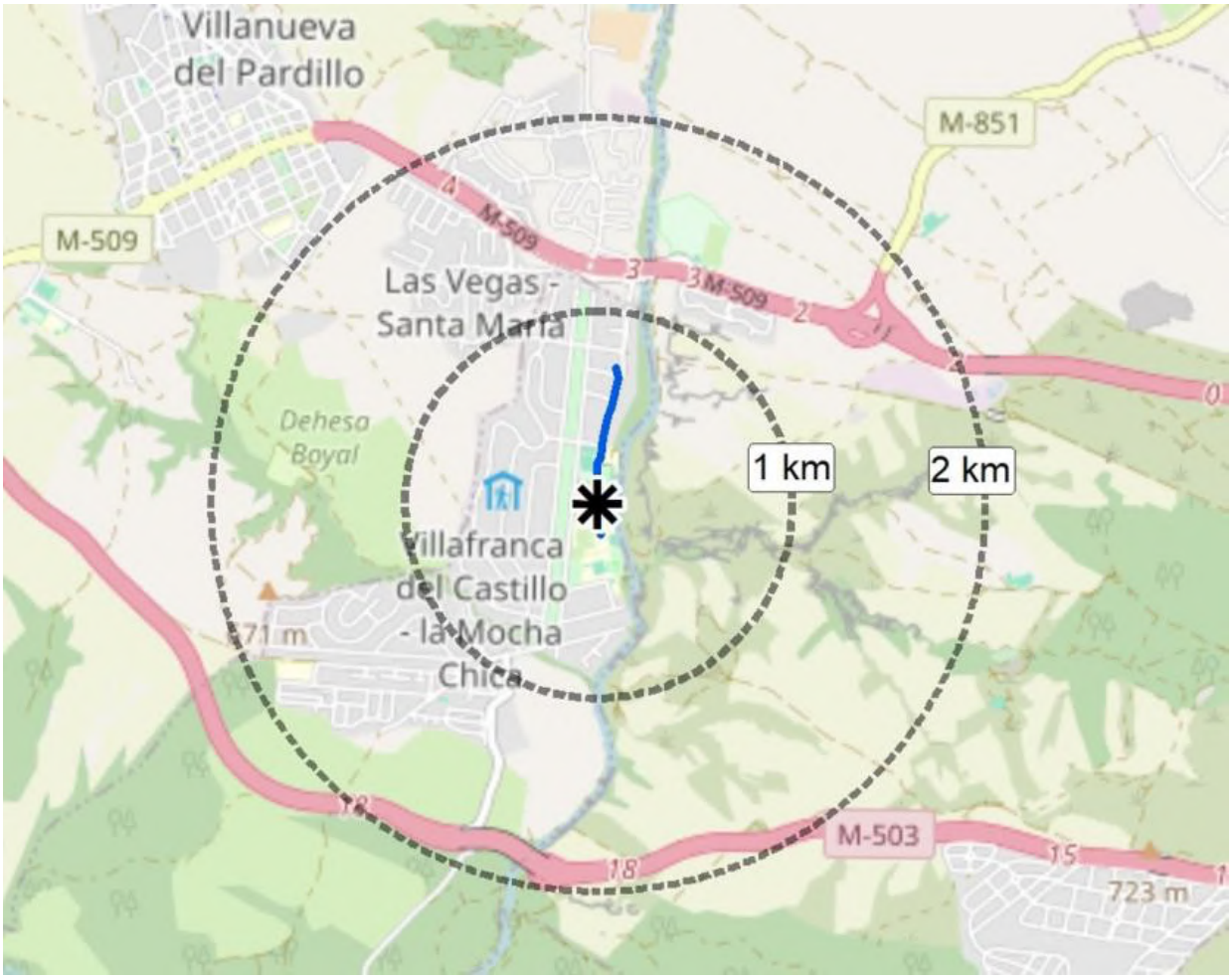

Figure 4.8 - Main bicycle routes around the Villafranca campus according to the survey conducted

The only positive aspect regarding current cyclability is that the internal roads of urbanization are quite favourable, as they have little slope and low traffic volumes and speeds. Therefore, even though there are no specific segregated bicycle lanes, sharing the roads can be considered safe, comfortable, and attractive.

Proposals to Improve Bicycle Access to the University Campus

As explained in the previous sections, measures to improve bicycle accessibility should focus on enhancing connections from outside and linking the campus with the existing or planned cycling network. A priority measure should be to connect the university campus with the urban centres of Villanueva de la Cañada and Villanueva del Pardillo, as well as with the Alfonso X El Sabio University located in the same municipality (connections 1, 2a, and 2b).

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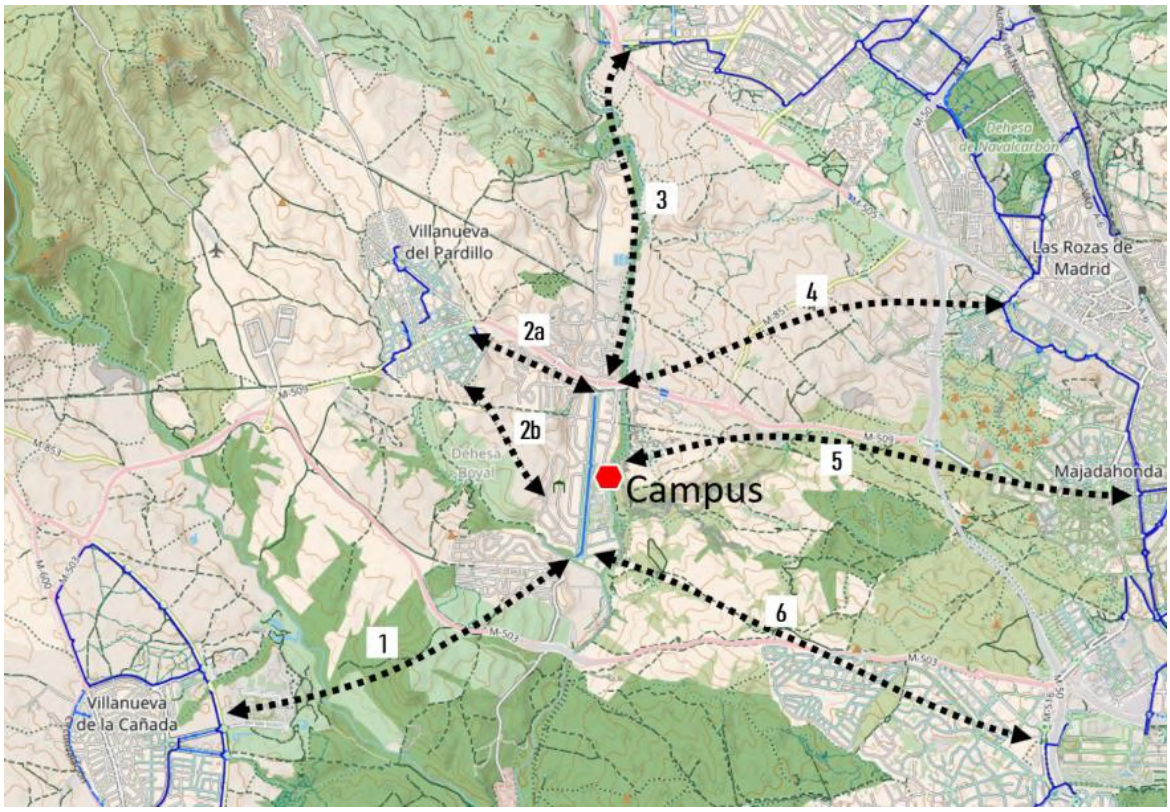

Figure 4.9 - Proposed cycling routes to enhance bicycle access to the campus

Connection 1 uses a series of existing paths in the area, including a trail called "Senda Botánica La Vilanosa," which crosses the Aulencia River and connects both urban centres. To enhance bicycle use, it is advisable to improve certain aspects such as the pavement and remove steps or other irregularities along the path.

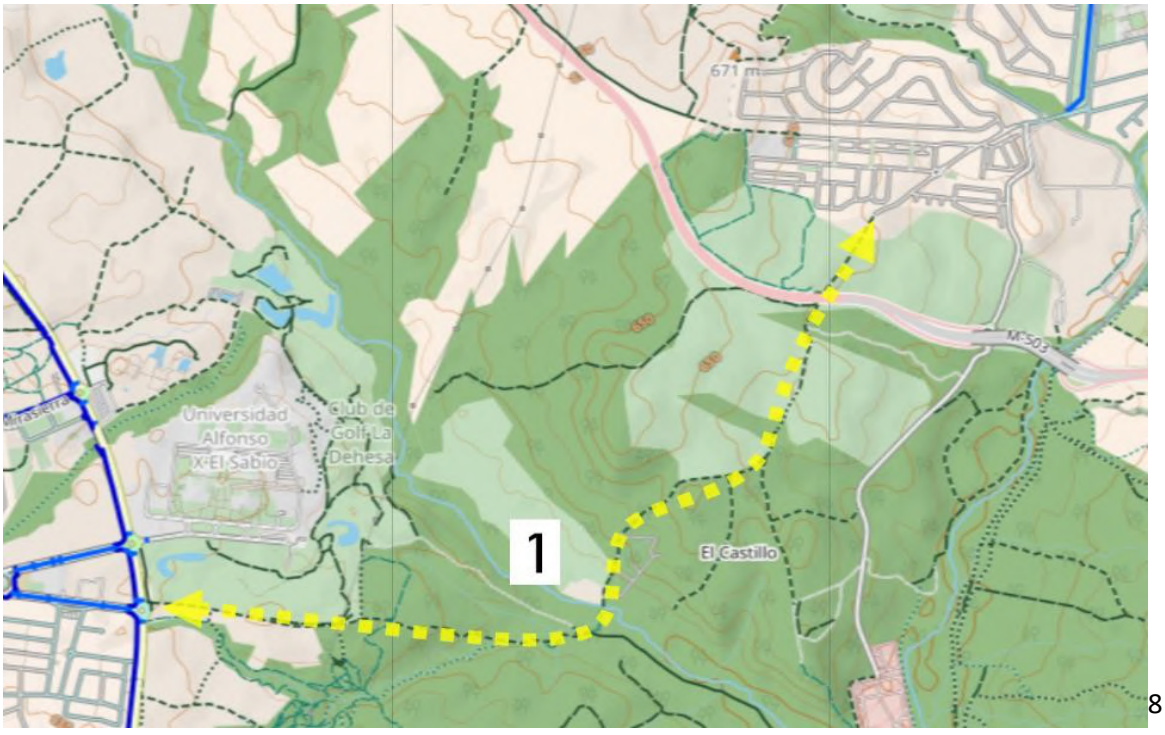

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Figure 4.10 - Indicative route of itinerary 1 (connection with Villanueva de la Cañada)

Connections 2a and 2b have been partially addressed in the section on pedestrian accessibility. These involve improving the routes that connect with the urban centre of Villanueva del Pardillo. It is necessary to enhance aspects such as lighting, pavement, and providing shade (a row of trees) to improve the cyclability of these routes and create new access points to the urbanization.

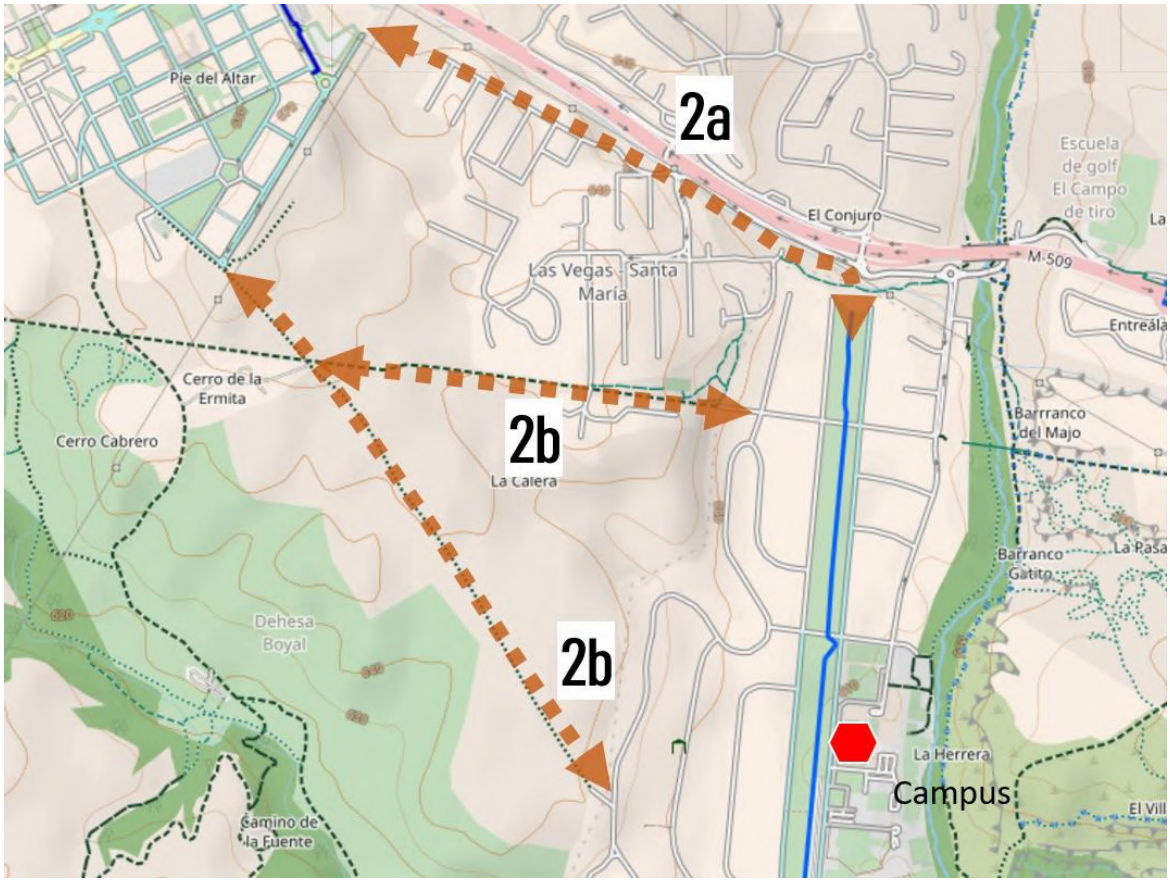

Figure 4.11 - Proposed cycling routes to access the urban centre of Villanueva del Pardillo

Castellana Campus

Location y characteristics

The Castellana Campus of Camilo José Cela University is located at 4 Juan Hurtado de Mendoza Street, next to Paseo de la Castellana, between Cuzco and Plaza de Castilla. The building has four floors and a surface area of approximately 11,300 square meters.

Due to its central location in the city of Madrid, the campus has excellent public transport connections: within a 1 km radius, there are 6 metro stations from three different lines (1, 9, and 10), and within a 500-meter radius, there are 27 bus stops. Finally, the commuter and train stations of Nuevos Ministerios and Chamartín are located 1.5 km away.

Additionally, nearly 690,000[2] people live within a 3 km radius, which means there is

[2] "Calculation carried out through the 'Tom Forth' website."

significant potential for accessing the Castellana campus on foot or by bicycle.

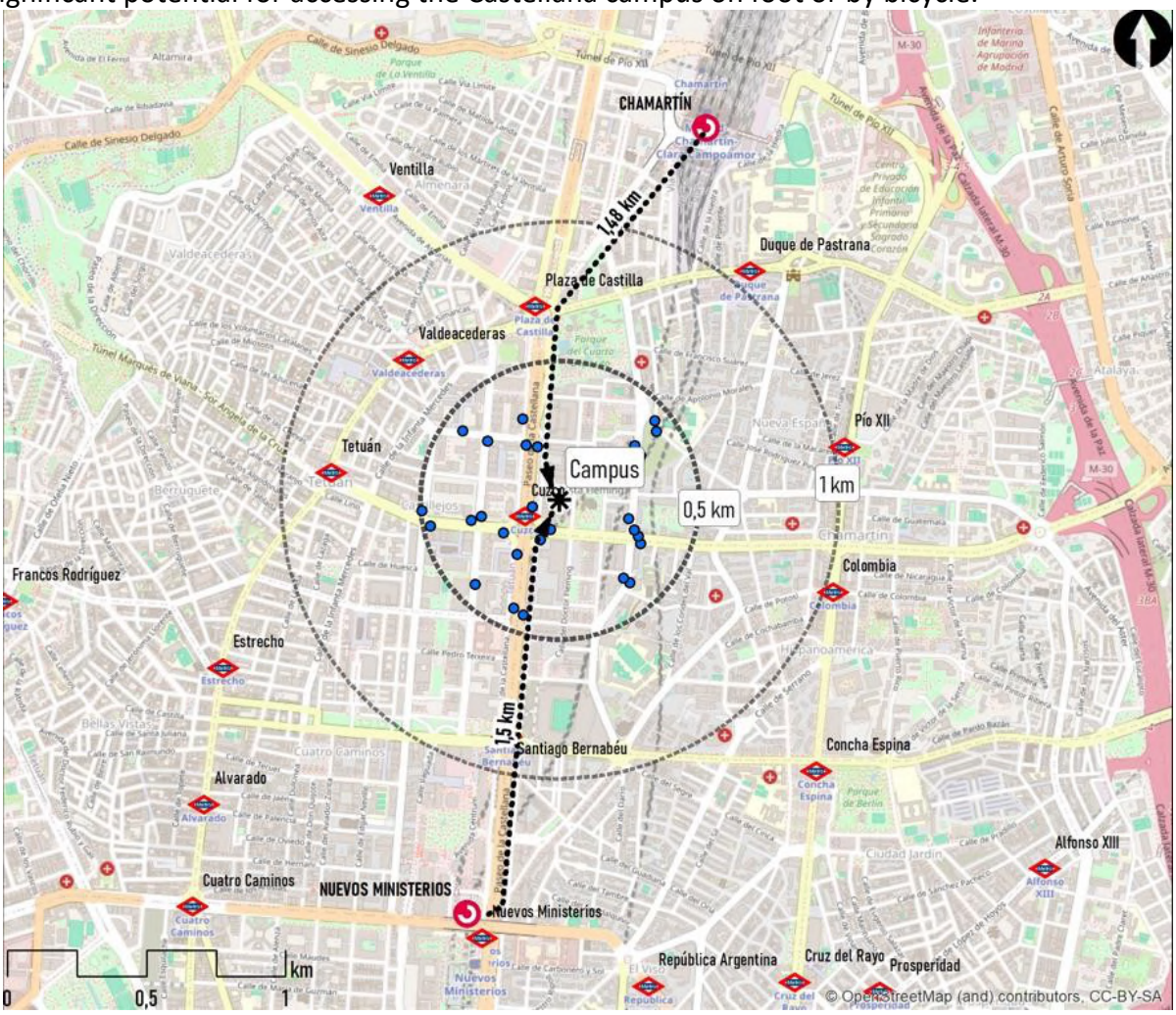

Figure 4.12 - Castellana Campus public transport connection

Constraints for Walking Access

In general, there are many facilities that make it easy to access the university campus on foot. All streets near the campus have sidewalks, some with trees, and generally meet universal accessibility standards. The main issues are related more to the attractiveness of pedestrian routes, as the high volume of car traffic in this part of the city generates significant levels of noise and air pollution. Additionally, at major intersections, waiting times can be long due to extended traffic light phases.

Main Routes

According to the MUV survey, the vast majority of trips are concentrated along the Castellana axis and the East/West axis of Alberto Alcocer Street and Sor Ángela de la Cruz Street. This is a clear indication that many people travel short distances to reach the university campus. The map also shows that most people walk along the main streets, likely because public transport stops and stations are located there, these routes are more direct, and orientation is generally easier.

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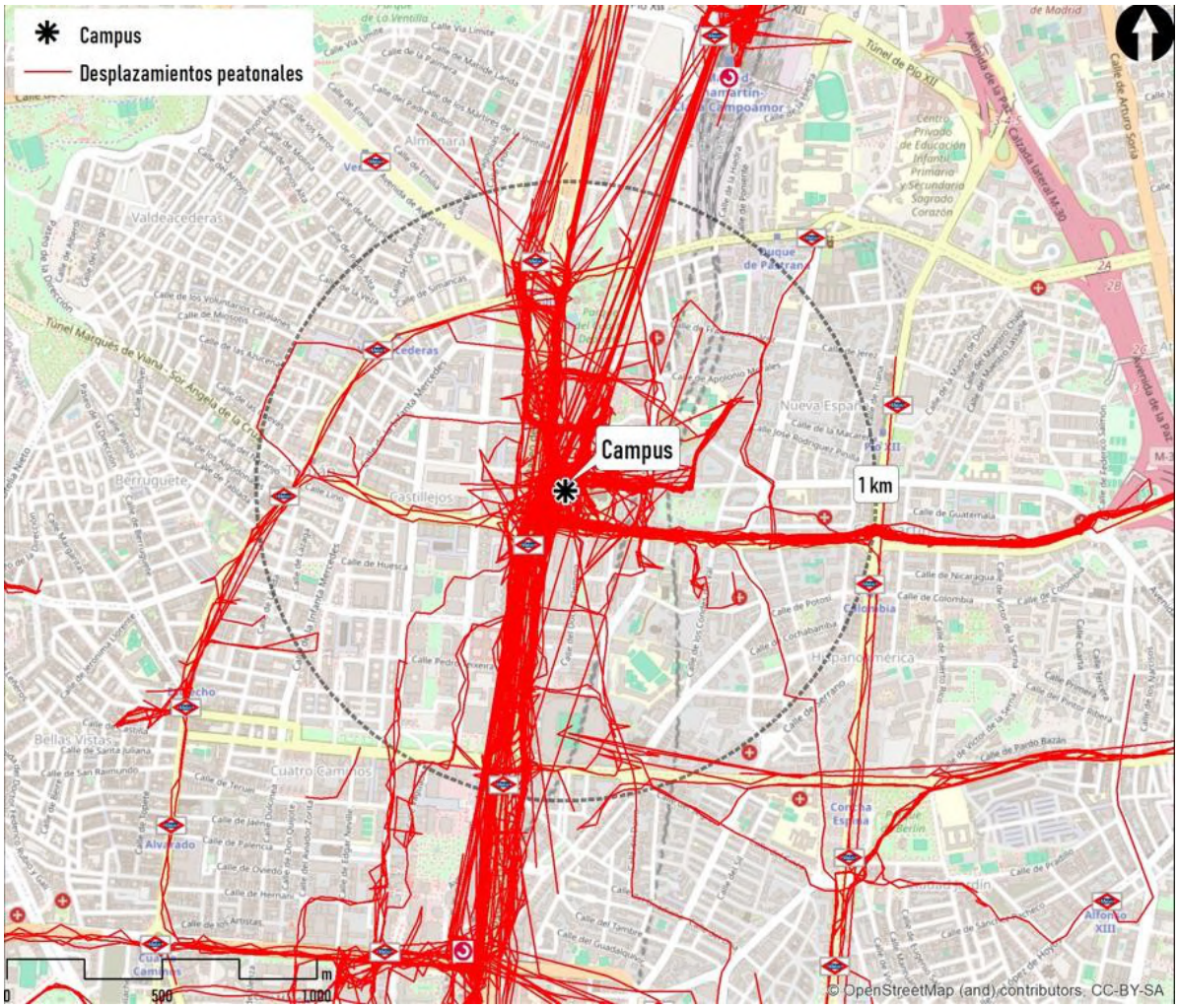

Figure 4.13- Pedestrian movements near the Castellana Campus

Walkability Analysis

The walkability analysis focused on the North/South axis of Paseo de la Castellana and the East/West axis of Alberto Alcocer Street and Sor Ángela de la Cruz Street. The main issues identified are:

- Noise and air pollution.
- Unfavorable traffic light regulation at some intersections.
- Narrow sidewalks in certain sections.
- Loss of recreational quality of Paseo de la Castellana towards Plaza de Castilla (discontinuity of the central promenade)
- Barrier effect of the Cuzco roundabout.

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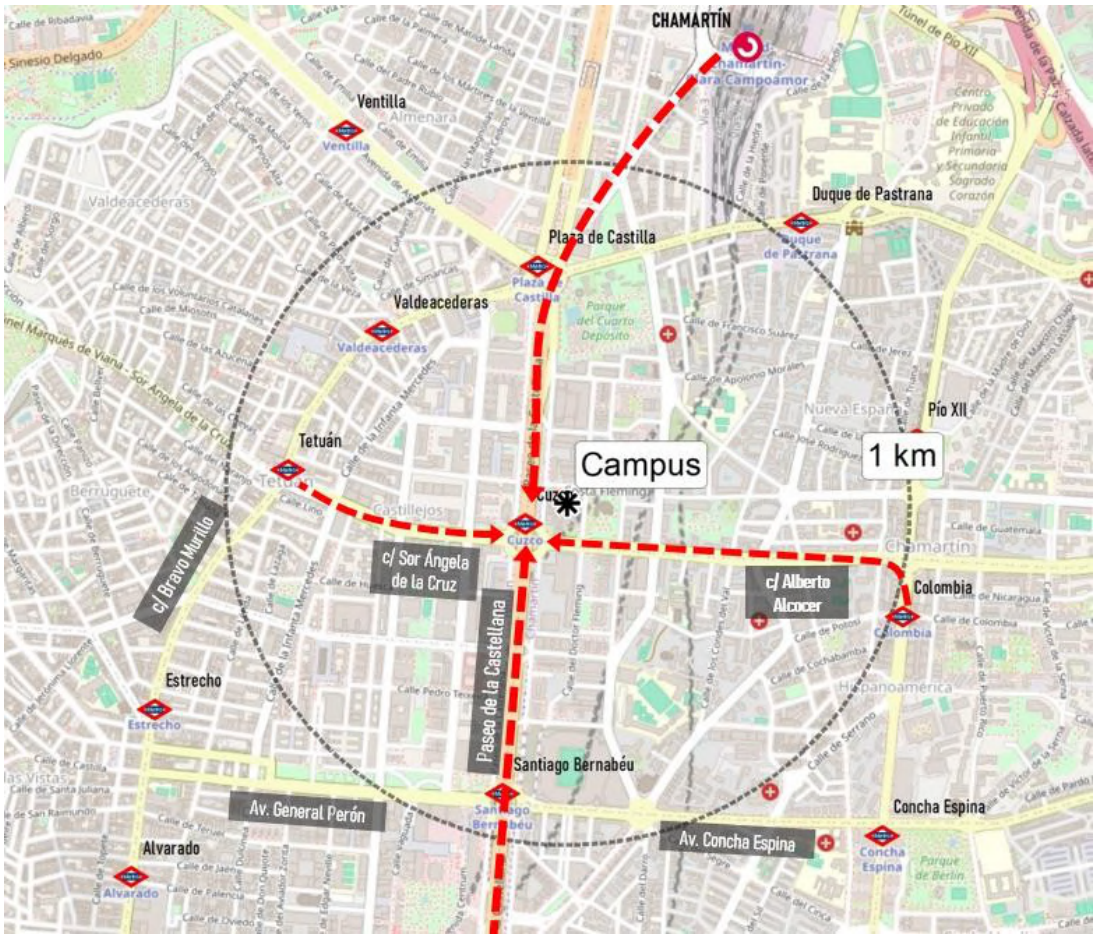

Figure 4.14 - Main routes used to access the Castellana Campus on foot

Proposals to Improve Walkability

To enhance walkability, the following measures are proposed for the two main identified axes (macro-level approach):

- **Improve the permeability of the service roads along Paseo de la Castellana:** increase the number of pedestrian crossings to access the central promenade.
- **Upgrade certain intersections,** reducing pedestrian detours, such as at the crossing with Paseo de la Habana.

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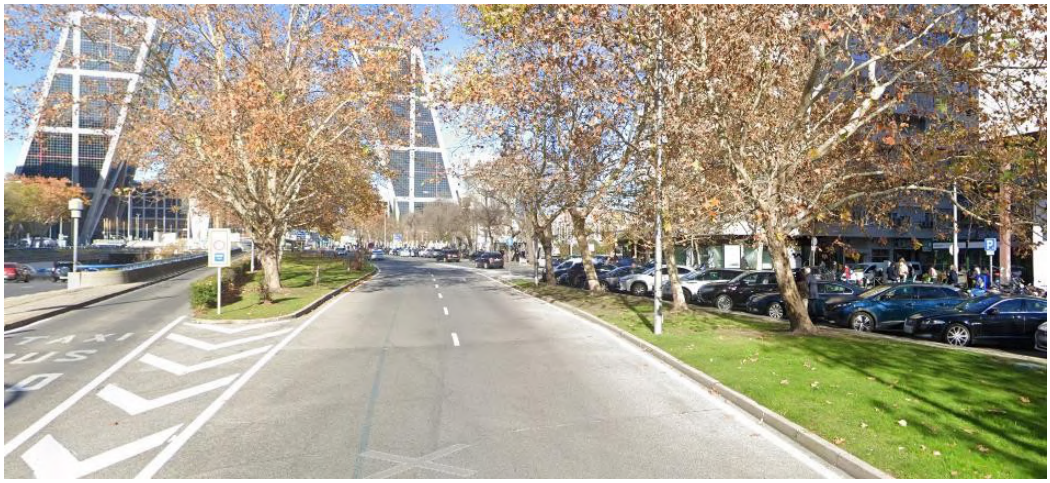
- **Widening of the sidewalk next to the AZCA area:** In the section where the side promenade is not walkable (due to the AZCA tunnel exits), it is necessary to widen the sidewalk, as its current width is insufficient for the number of pedestrians passing through daily. In this section, the sidewalk is only 3.25 meters wide, not including the row of trees.

- **Extend the continuity of the side promenades up to Plaza de Castilla:** In the final section, the central roadway of Paseo de la Castellana passes beneath Plaza de Castilla, and the road bifurcations interrupt the continuity of the central promenades. A study should be conducted to facilitate the continuity of these promenades in order to improve the quality of public space and the comfort of pedestrian routes.



Micro-Level Approach (Cuzco Roundabout Area)

The following measures are proposed for the micro-scale environment around the Cuzco roundabout:

- Ensure continuity of the side promenades around the roundabout.
- Create a high-quality public space at the entrance to the university campus.

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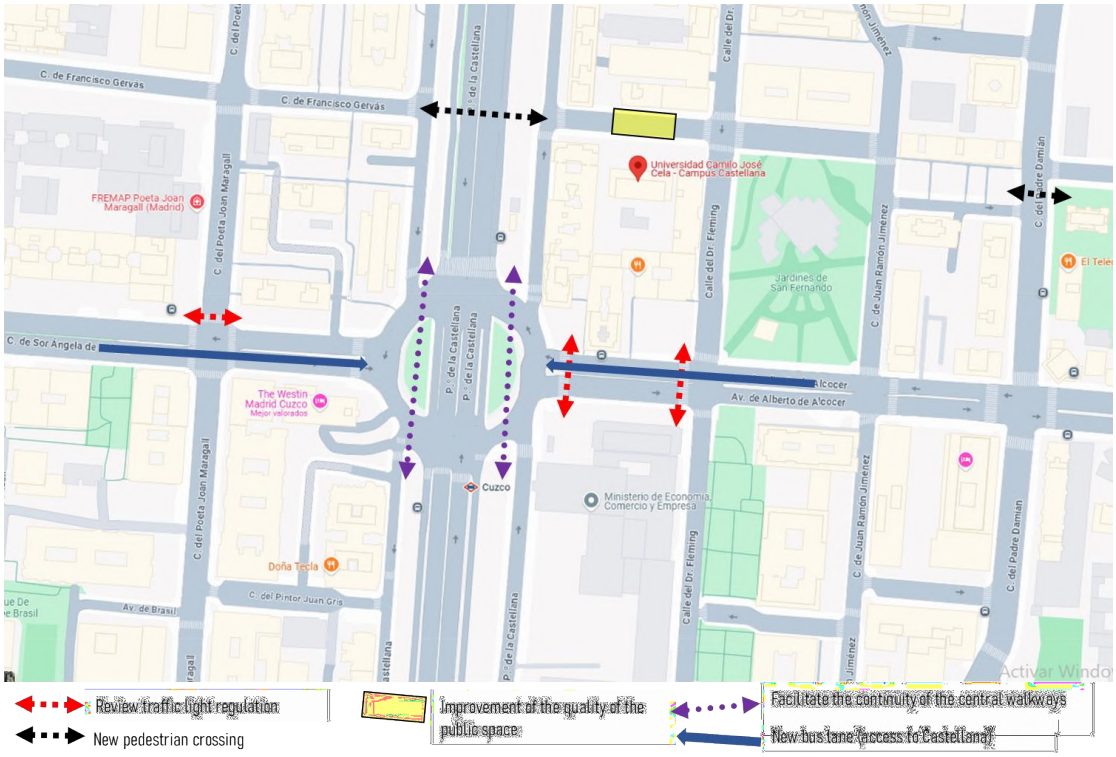
- **Enable new pedestrian crossings** to improve the permeability of the urban fabric (shorter and more direct walking routes).
- **Review traffic light regulation** to reduce pedestrian waiting times.
- **Reduce the width of the main roadways** to lower vehicle speeds and traffic volumes in the area.
- **Study the feasibility of implementing bus lanes** on Sor Ángela de la Cruz and Alberto Alcocer Streets to access Plaza de Cuzco. These lanes should preferably be located in the center of the roadway (next to the median) to avoid interfering with bicycle traffic.



Constraints for Cycling Access

Although the university campus is located in a central area of Madrid and close to high- density residential neighborhoods, the facilities for accessing it by bicycle are limited. This is partly due to the high volume of car traffic in the area, the speed of motorized traffic on certain roads, and the lack of a complete cycling network in the city center. As shown on the map, segregated bike lanes exist only along certain sections of the main road network, despite the fact that traffic volumes on these roads are generally very high.

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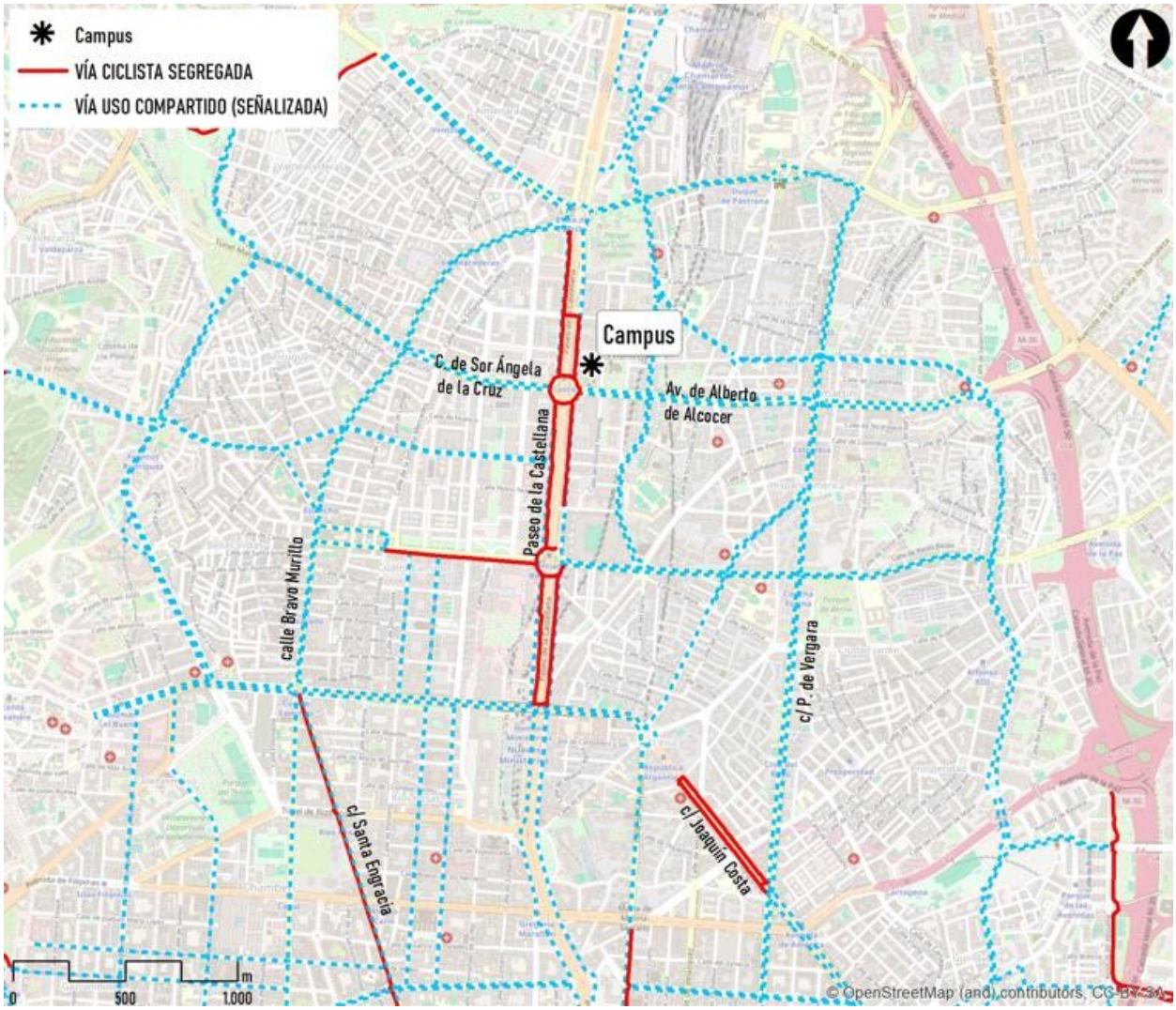

Figure 4.15: Existing cycling infrastructure in the area

Most of the cycling "infrastructure" consists of shared lanes with motorized traffic, where the speed limit is set at 30 km/h and horizontal road markings indicate the possible presence of cyclists.

Figure 4.16: Road marking of the shared lane and segregated bike lane on Paseo de la Castellana

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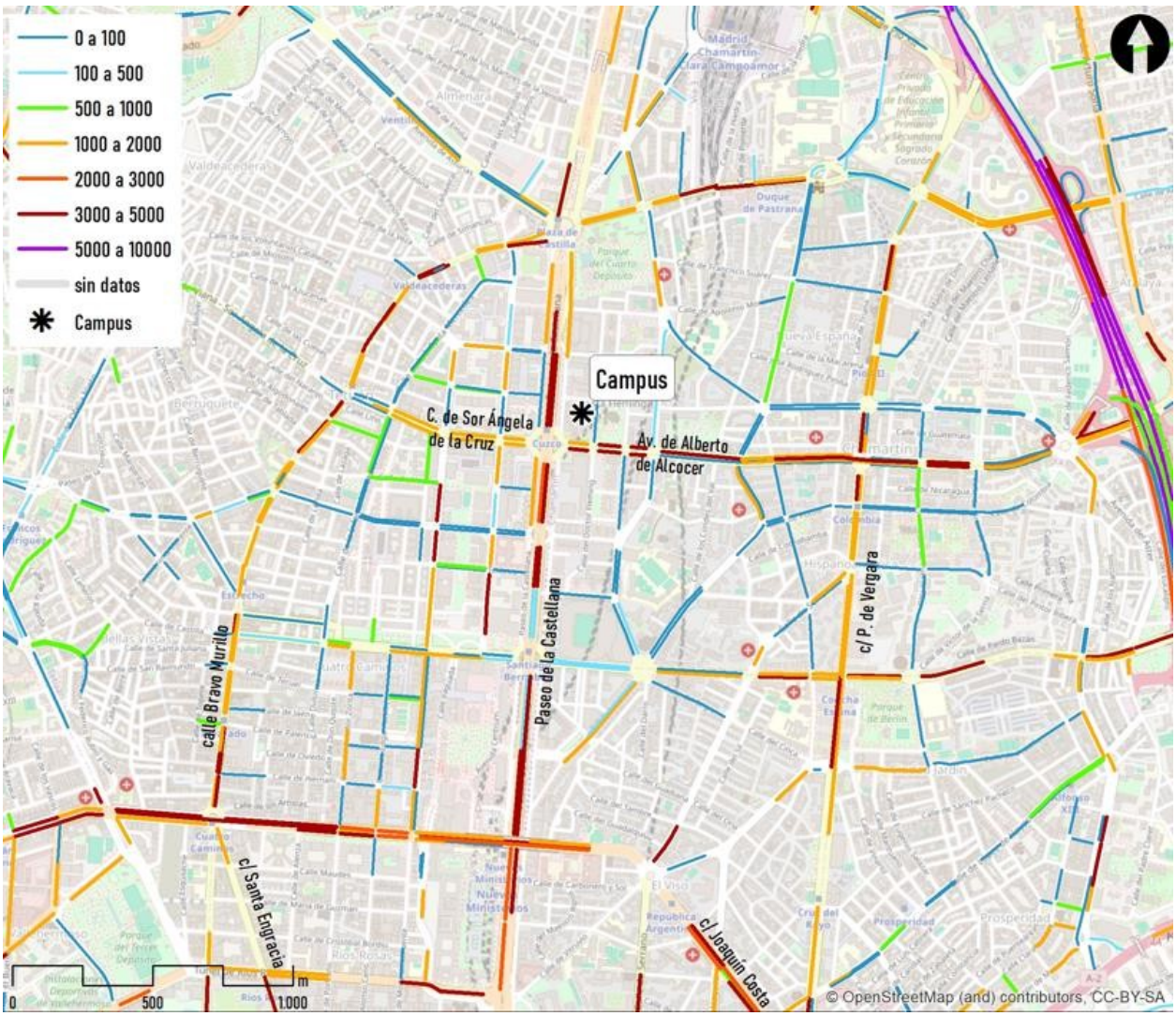

Figure 4.17: Average hourly motorized traffic volumes in the area[3]

According to the MUV survey, most trips are concentrated along the Castellana axis and the East/West axis of Alberto Alcocer Street and Sor Ángela de la Cruz Street. The results show that most cyclists use the main roads to access the campus despite the obvious drawbacks (lower safety, pollution, and noise). This may be explained by the fact that riding along main roads is faster, orientation is easier, and there is less disruption from the one-way systems that are more common on local streets.

[3] Source: Madrid City Council, 2023 data

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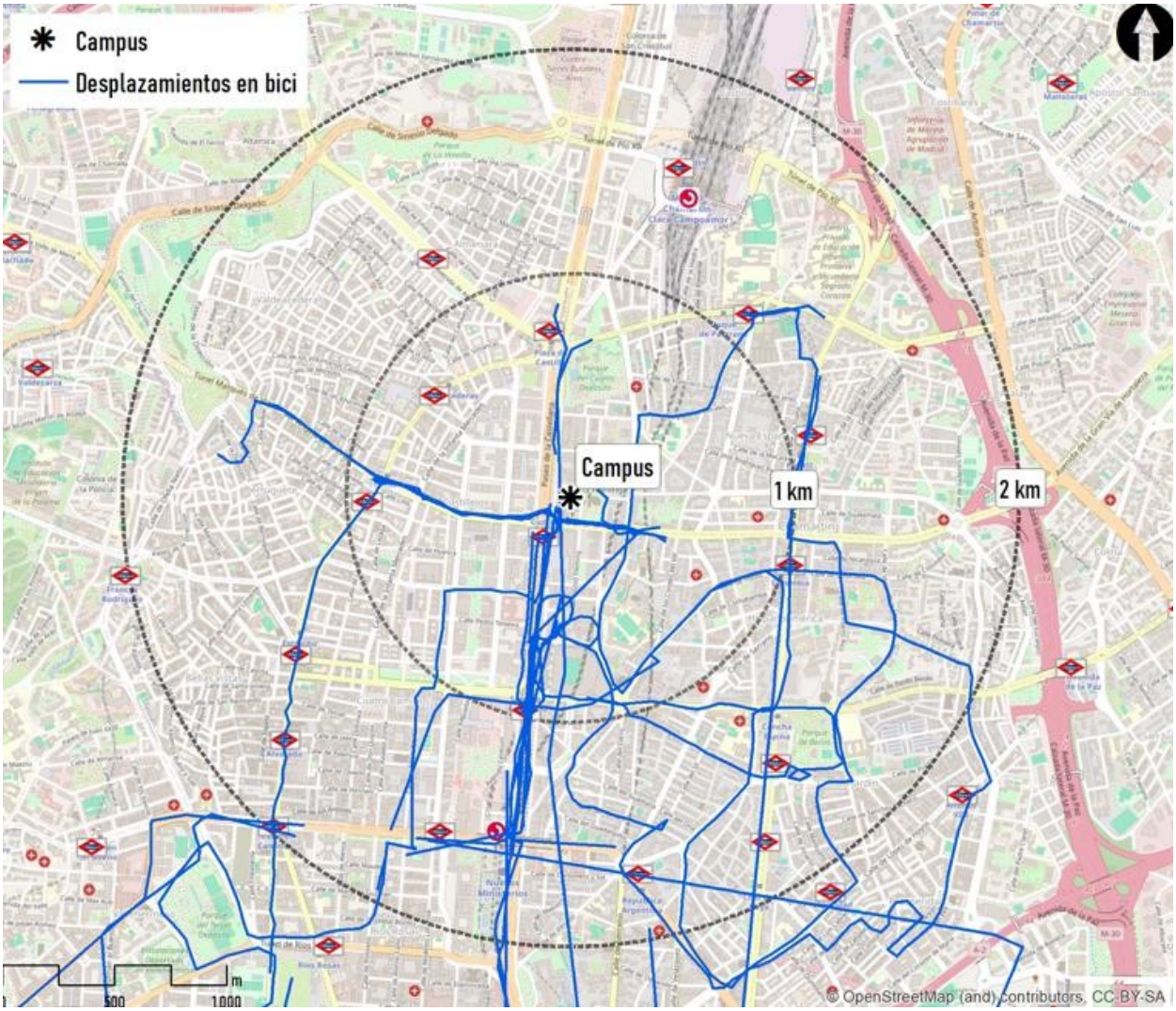

Figure 4.18: Cyclist movements near the Castellana Campus

Cyclability Analysis

The cyclability analysis focused on the North/South axis of Paseo de la Castellana and the East/West axis of Alberto Alcocer Street and Sor Ángela de la Cruz Street. The main issues identified are:

- Noise and air pollution.
- Unfavorable traffic light regulation at some intersections.
- Narrow sidewalks in certain sections.
- Loss of recreational quality of Paseo de la Castellana towards Plaza de Castilla (discontinuity of the central promenade)
- Barrier effect of the Cuzco roundabout.

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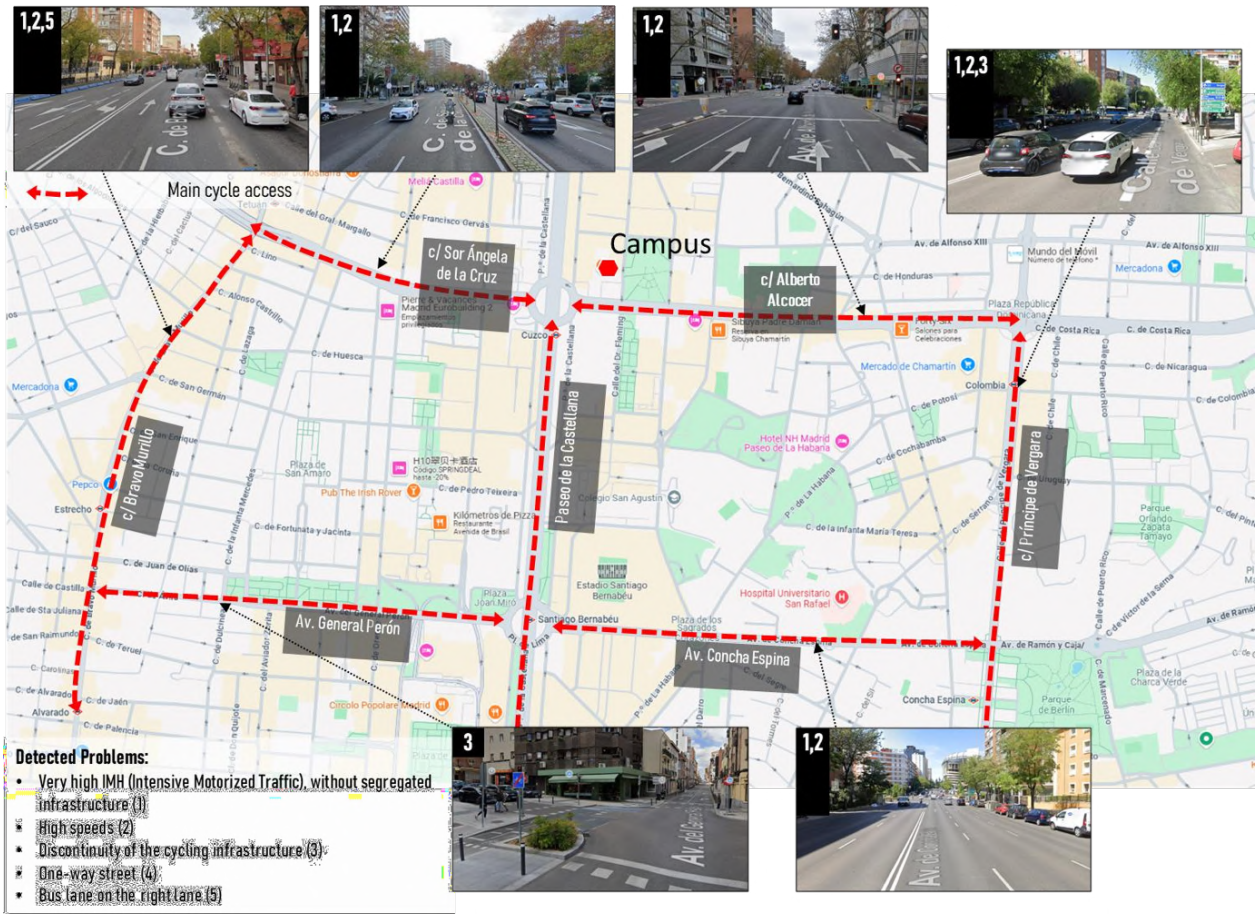

Figure 4.19: Identified issues along the main access routes to the Castellana Campus

Proposals to Improve Cyclability

To enhance cyclability, the following measures are proposed:

- Implement segregated bike lanes along all main access routes to the campus (Alberto Alcocer Street, Sor Ángela de la Cruz Street, Bravo Murillo Street, Príncipe de Vergara Street, and Avenida de Concha Espina).
- Extend the segregated bike lane on Paseo de la Castellana further south and toward Chamartín Station.
- Continue the bike lane on Avenida del General Perón through Ávila Street.
- Install bicycle parking facilities in front of the university campus.

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5. University of Coimbra

Introduction

This study describes cycling infrastructures in Coimbra in relation to some cyclists' and pedestrians' main travel demand patterns from the MUV challenge. Coimbra is exceptionally organised around four main university campuses (Polo I, Polo II, Polo III, and the Sports Faculty); the routes identified are spread throughout the city. These routes were determined using GPS traces collected during the MUV mobility challenge from a gamification perspective. The routes identified represent one of the first studies of real demand for active modes in a country where the modal share of cycling does not exceed 1% in most cities. However, as Coimbra's central area confers the potential of a 15-minute city, pedestrianisation is particularly important, accounting for around 13% of Coimbra's modal split.

Therefore, we assumed that almost all routes identified are used when one of the university's Polos is used. Recently, the city has been experiencing the effects of constructing a new metro bus line (BRT), but this has not yet resulted in a substantial modal split favouring active modes. In any case, Coimbra has been building different cycle lanes across the city.

The data was collected during two periods of participation in the mobility challenge: the first (February-March 2024) and the second (March-April 2025). This study examines data restricted to walking and cycling.

This study shows information about recorded routes in the central areas of Coimbra, without specifying whether one of the polos is the destination, assuming that those paths are included in the radius of influence of those polos. The maps clearly show the roads most commonly used for both modes, which are analysed briefly ahead.

This study also suggests infrastructure modifications along these routes to enhance safety/quality for cyclists and pedestrians.

Coimbra University Campuses

Modal share

A previous report concerning the city of Coimbra and based on a mobility survey done in 2006 - for the planned system of Coimbra Light Rail – contains similar information for university students (including Polytechnic and University of Coimbra): car (20%), walking (54%), bus + train (25%) and taxi (1%). However, the global modal share for the City of Coimbra presented in this 2006 study is car (69%), walking (12%), bus + train (18%) and taxi (1%). Therefore, sustainable mobility at the University of Coimbra did not significantly evolve during the last 15 years. In 2022, the Portuguese Sustainable Campus Network (RCS) promoted a survey about Sustainable Mobility in Higher Education in Portugal developed by the RCS working group on Mobility. The survey results show that the modal share for the University of Coimbra users: car (69%), car passenger (4%), walking (13%), bus (13%) and train (1%), with no relevance for the bicycle. A similar situation can be observed at the Coimbra Polytechnic Institute users: car (55%), car passenger (5%), walking (26%), bus (10%), train (3%) and motorcycle (1%). However, concerning the possibility of a modal change to the bicycle, 11% of the respondents at the University of Coimbra and 8% at the Coimbra

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Polytechnic Institute are willing to use it. However, the panorama in Coimbra is about to change with the new BRT line and many cycle lanes, existing or to be built. There are also several projects to improve pedestrian safety.

Existing cycleways

There are several cycle ways in Coimbra, already built, as it is possible to check in Figure 5.1.

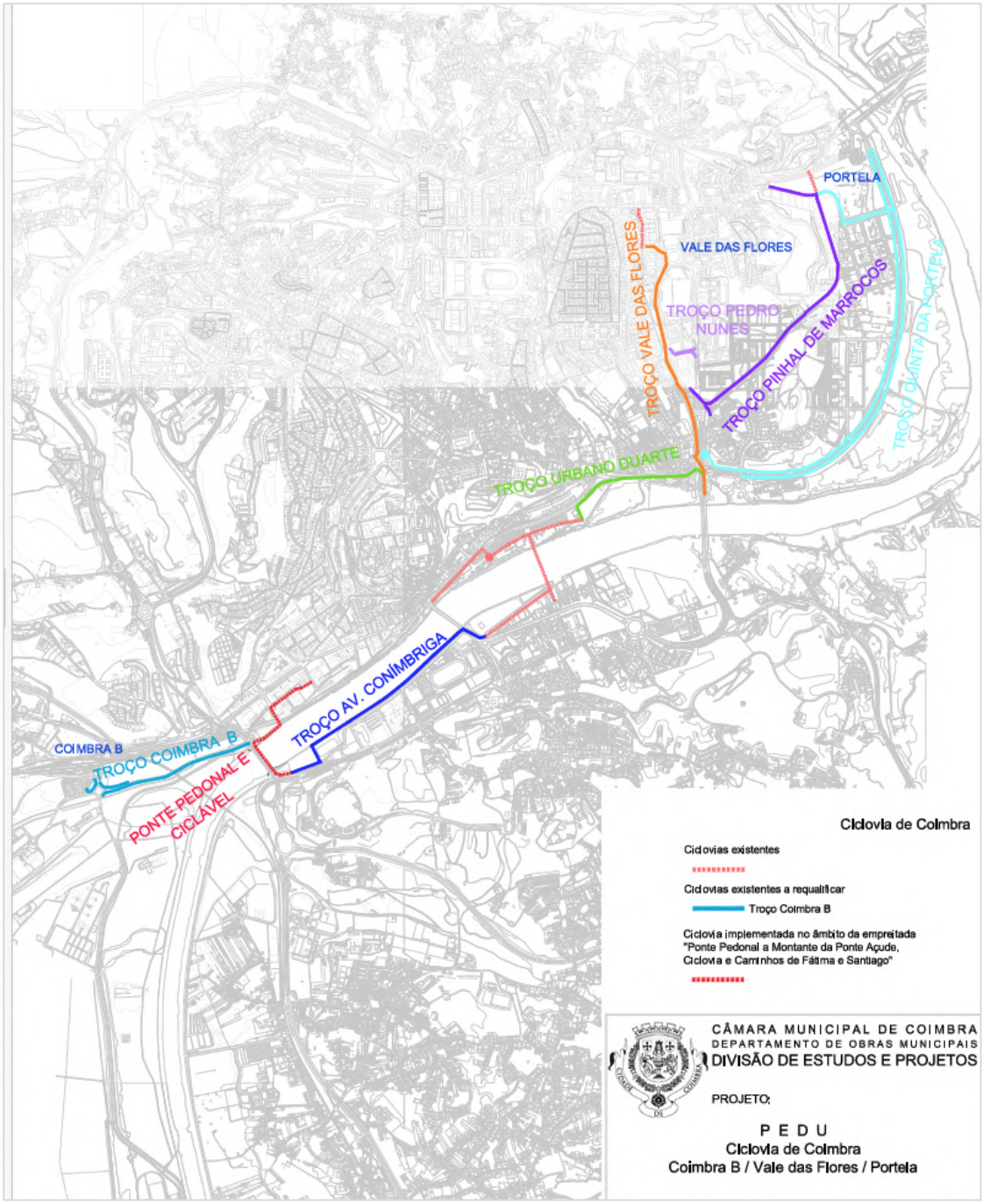

Figure 5.1 – Existing Cycleways in Coimbra

These cycleways represent quite an interesting offer for connecting the main collective transport terminals, the university campus (namely with Polo II), and residential areas, all in the lowest slope areas, close to the river Mondego. All these sections suffer from gaps in their connections, conflicts with road traffic, and conflicts with pedestrians. However, they started to be used recently.

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'**Troço Coimbra B**' – It is used for connections with the central station.

Figure 5.2 – 'Troço Coimbra B'

Recently it was built a continuity for this section, close to the river.

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Figure 5.3 – Contiguity for section 'Troço Coimbra B'

'**Troço de Conimbriga**' – Close to the river, it serves the Sports Faculty. Some sections have strong conflicts with traffic and pedestrians, and the pavement is sometimes inadequate.

Figure 5.4 – Troço de Conimbriga

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‘**Troço de Urbano Duarte**’ – Between this section and the continuity of the ‘Troço Coimbra B’ is the Green Park ‘Parque Verde Mondego’. It might be seen as a continuity, but the pavement is not adequate inside the park.

Figure 5.5 – Troço Urbano Duarte

‘**Troço Vale das Flores’ –** This section represents a good example inside a residential area and along with green parks. There is special care in the crossings with traffic roads.

Figure 5.6a – Troço vale das Flore

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Figure 5.6b – Troço vale das Flores

'**Troço Pinhal de Marrocos**'- This area suffers from several problems. Some roads are steep, and the pavements are sometimes inadequate. However, crossing is adequate in most cases

Figure 5.7 – Troço Pinhal de Marrocos

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'**Troço da Portela**' – This cycle lane serves directly the POLO II of the University, the only one that does not have the problem of too steep roads (although some roads clime a bit inside the Polo II).

Figure 5.8 – Troço da Portela

In addition to cycle lanes, the city council has implemented some bicycle parking all around Coimbra city (see Figure 5.9).

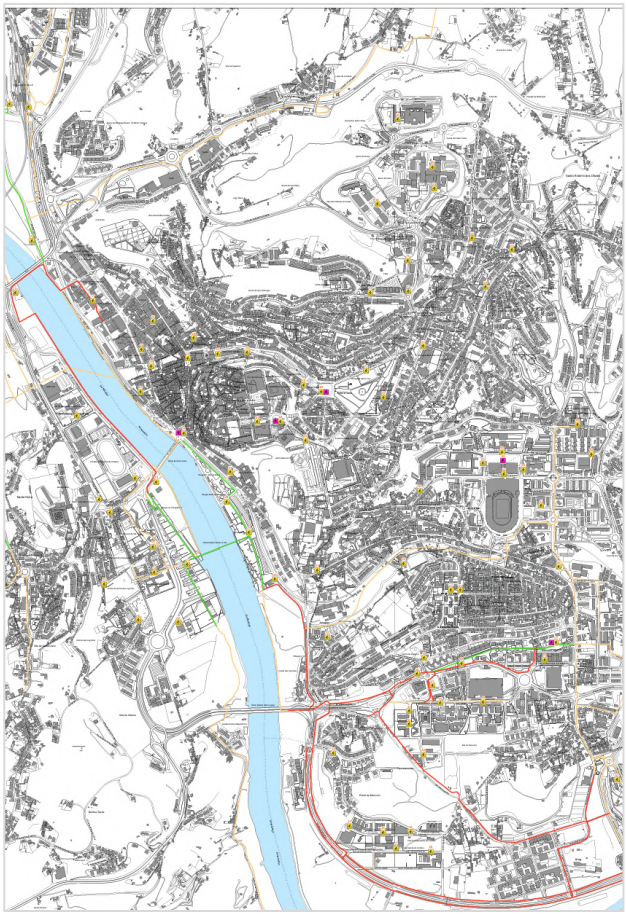

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Figure 5.9 – Existing cycleways and parking for bicycles

MUV Challenge results

This study accounted for active mobility, namely walking and biking (including electric bikes).
As can be seen in Table 5.1, most of the recorded trips are related to walking. On average, walking trips were 1,64 km in distance and 31 minutes in time, while bike trips were 5,41 km in distance and 25 minutes in time. This is related to the usual threshold acceptance for these trips, both in time and in distance (walking, 1,2km, and biking 5 km).

	Average distance (km)	Average time (min)	number of trips	%
walking	1,61	31.58	4664	91,2
bike	5,41	25.25	404	7,9
bike electric	5,34	29.24	47	0,9
all modes	1,94	31.26	5115	

Table 5.1 – Trips recorded in Coimbra though the MUV challenge

Of the recorded active mobility trips, 4664 represent walking (91%), 404 biking (8%) and 47 (1%) electric bike.

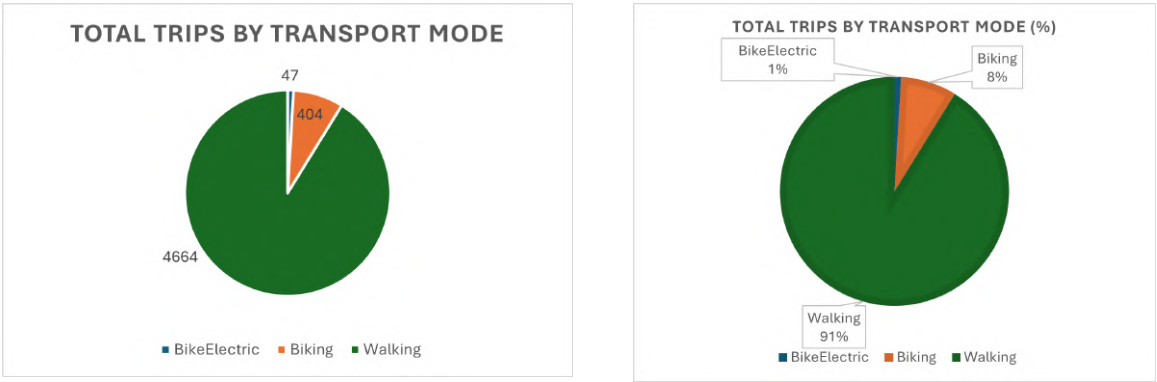

Figure 5.10 – Active Modes Mobility share

As Figure 5.11 shows, there is a relationship between the number of active trips recorded, the University Campuses in Coimbra, and existing cycleways.

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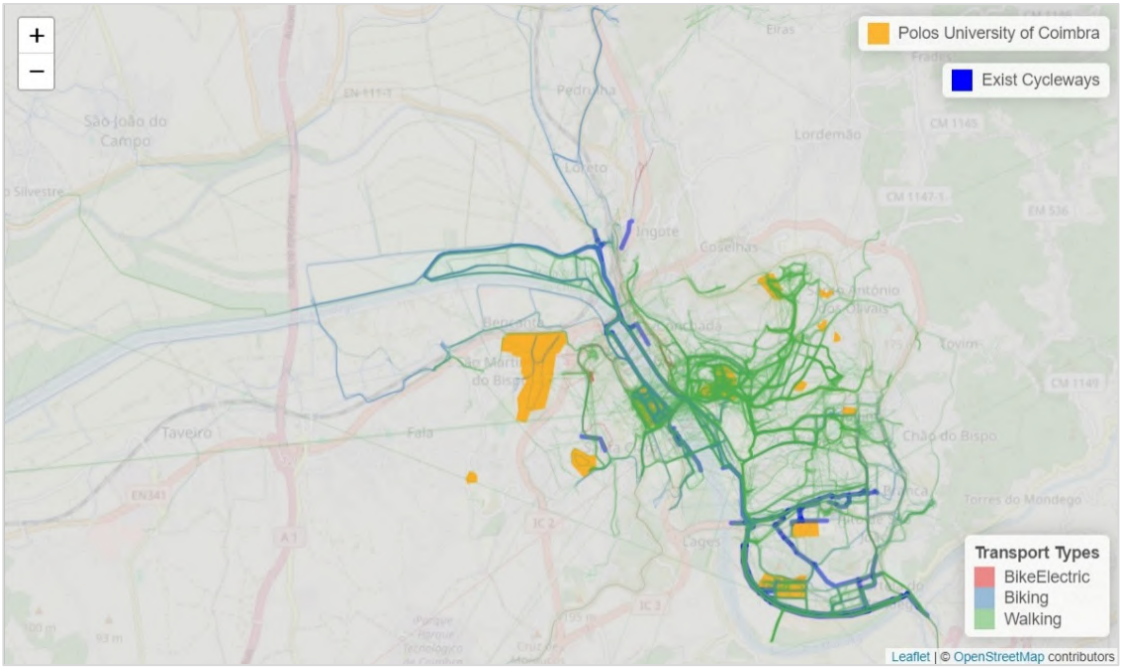

Figure 5.11 – University campus, existing cycleways and Muv recorded trips.

Looking at the active modes trip types recorded (points), walking is mainly observed in the central city area, as happens with the electric bikes. Biking shows some more extensive trips (Figure 5.12).

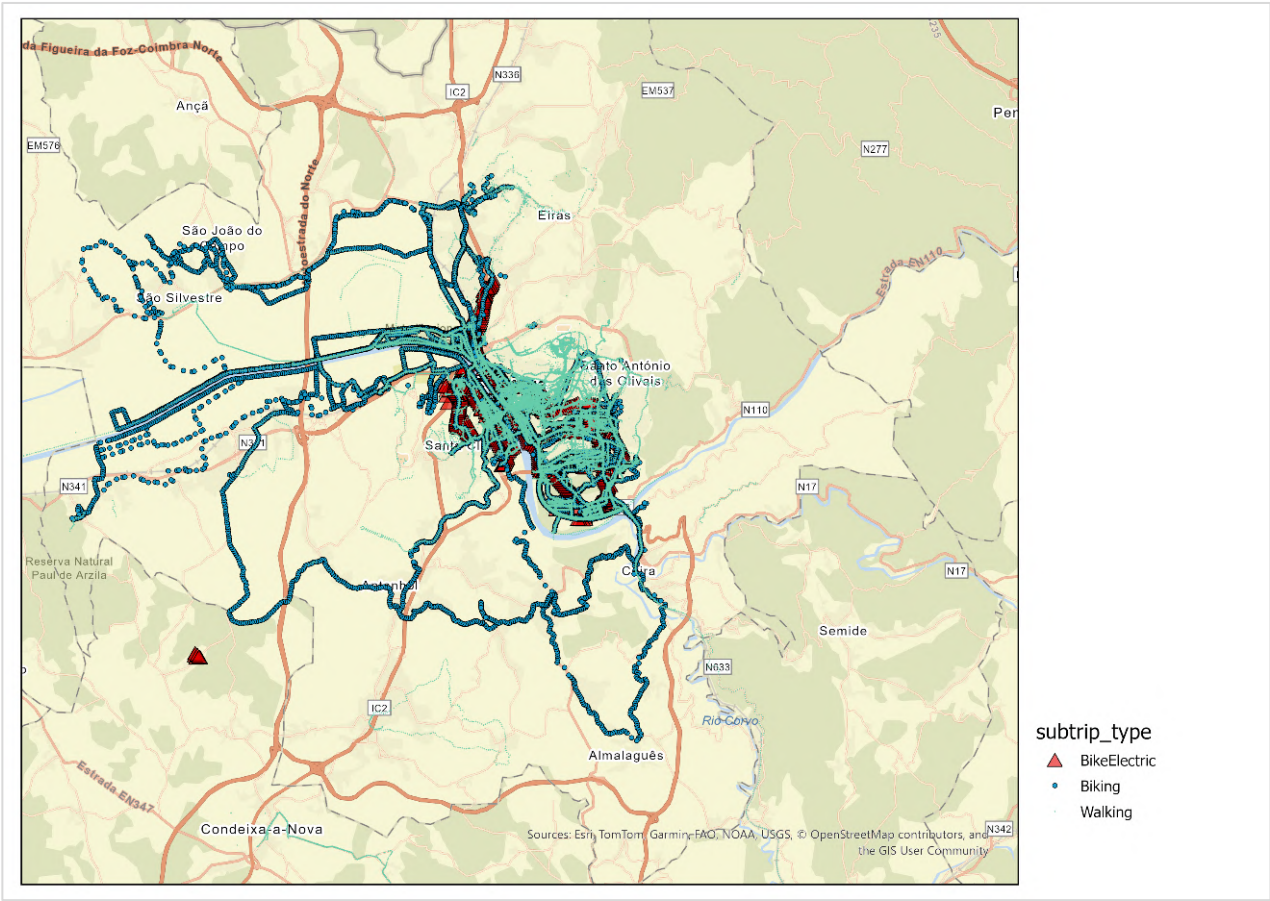

Figure 5.12 – Muv recorded trips

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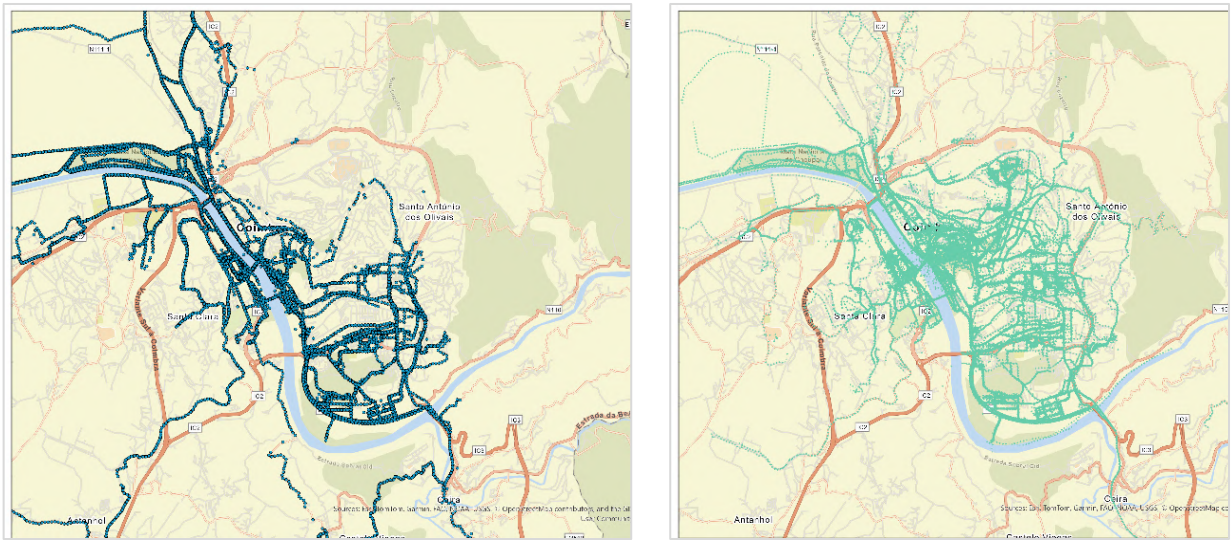

Figure 5.13 – Muv recorded trips (left biking, right walking)

By observing biking and walking separately, it is possible to state the apparent influence of the existing cycleways on biking, namely between central areas and collective transport terminals and Polo II of the University (polo II and Polo II are in high wills and therefore there are no while walking is spread all around the city, namely around all the university campuses).

Infrastructural Suggestions

The Coimbra cycling network has been implemented for several years.
There are still several gaps, mainly in their aspects:

- Continuity of the network;
- Pavement;
- Relation with pedestrians and traffic

To overcome these difficulties, we must promote continuity, solve pavement issues, and, most of all, promote a complete network that is correctly organised to solve conflicts with traffic and pedestrians.
The Coimbra City council is paying special attention to this, promoting a future cycling network that includes a system of electric bicycles to overcome slopes – this is particularly mandatory for Polo I and III of the University of Coimbra.
The design of the municipality's cycle route network must integrate with the existing and planned pedestrian and road networks and establish links to public transport, facilities, and public spaces.
Of great importance to the successful use of the infrastructure is that the network meets cyclists' requirements and expectations, which, according to the Portuguese Normative Document for application to urban streets.

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