Urban Planning and
Transportation
(2024-2025 / UEEN0004-1)

Case study and suggestion

for Sainte-Walburge neighborhood

Groupe 11 : Lee, Marine & Ben

Table of contents

1. Introduction and geographical context of Sainte-Walburge

Sainte-Walburge is a residential area located northeast of the Meuse River, near the centre of Liège. It has a general hospital and several schools (mainly kindergarten and primary schools). The area also has business zones to the northeast and northwest that provide jobs. Because of these jobs, as well as the hospital, the population in this area is steadily growing. Many residents are likely to commute to the nearby city centre of Liège because it is very close.

Sainte-Walburge is located between the E25 highway and Liège city centre, which causes a lot of by-pass traffic. This traffic overlaps with local car travel, including people going to the hospital, creating traffic jams. Traffic congestion is especially bad during morning and evening rush hours, making it harder for residents to get around and causing economic losses.

The current traffic system in Sant-Walburge is not good for cyclists or pedestrians because of too many cars and poor infrastructure. Public transport also struggles to run on time because of the traffic.

Our project will work to improve the transportation system in Sainte-Walburge. We aim to create a more sustainable urban environment by encouraging different types of transportation. We also want to make travel safer for residents, improve public transport reliability, and increase the quality of life in the community.

2. Takeaways from Plans & Policies documents (task 1)

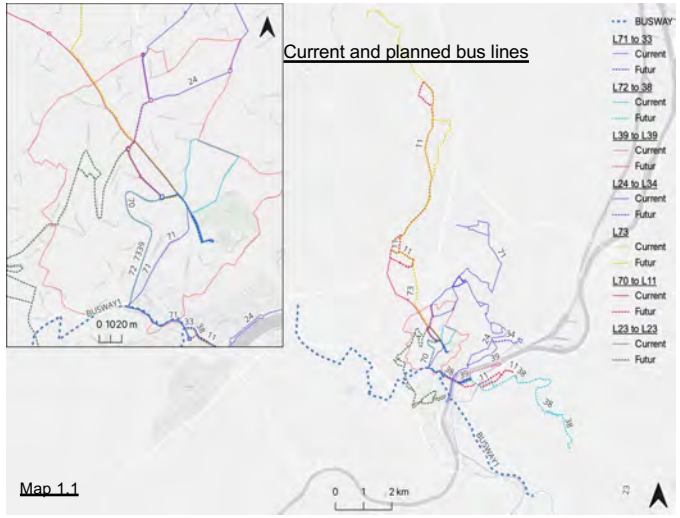
Current Situation and Problems

- The concentration of activities in the city centre leads to traffic congestion.
- The traffic flow is concentrated from the outskirts to the city centre : a transit area (mainly municipal transit).
- Private cars account for a high share of transportation + a strong parking pressure.
- Road congestion and infrastructure problems make it difficult to maintain the punctuality of public transportation.
- No efficient Transit line connecting the « ARC NORD » (business parks) with the city centre
- No efficient cycling infrastructures

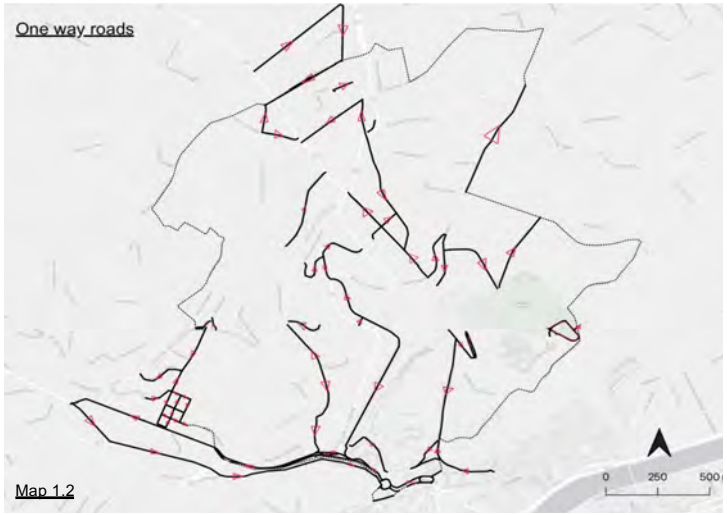
Ambitions

- Low-carbon urbanism.
- Linking urbanization and public transport supply.
- Implement proactive traffic demand management strategies, etc.
- Enhancing pedestrian mobility and developing micro-mobility solutions (Pursuing an ambitious cycling policy).
- Promote connections between different modes of transportation (P+R, Tram+Bus) and so between neighborhoods.
- Cable-car project between Sainte-Walburge (CHR)l and the Historic town centre

References : *Urban Mobility Plan for the Liège Agglomeration* (PUM), *Municipal Mobility Plan* (PCM), *Development Territorry Plan* (SDT), *Liège Territory Project* (PTL), *Development plan for the Liège district* (SDAL), Presentation of the committe : *mobility plan (février 2022)*



Map 1.1



Map 1.2

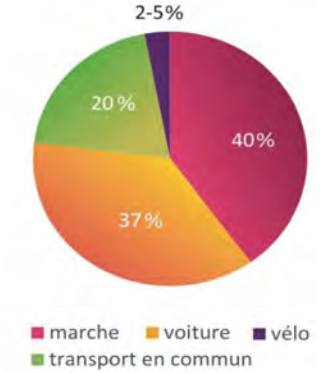
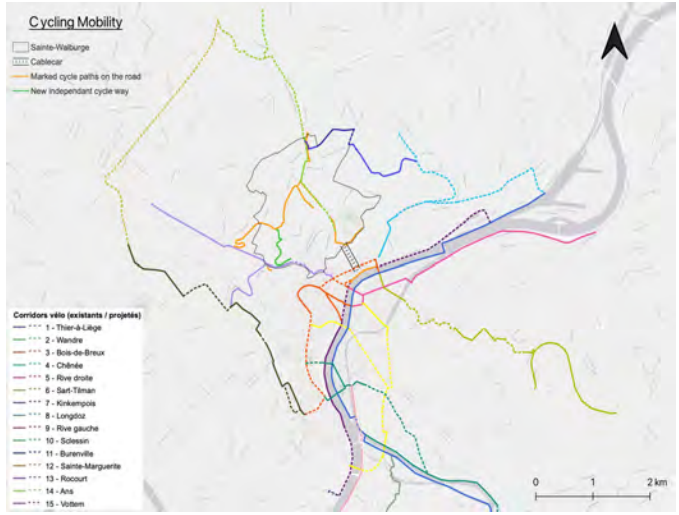
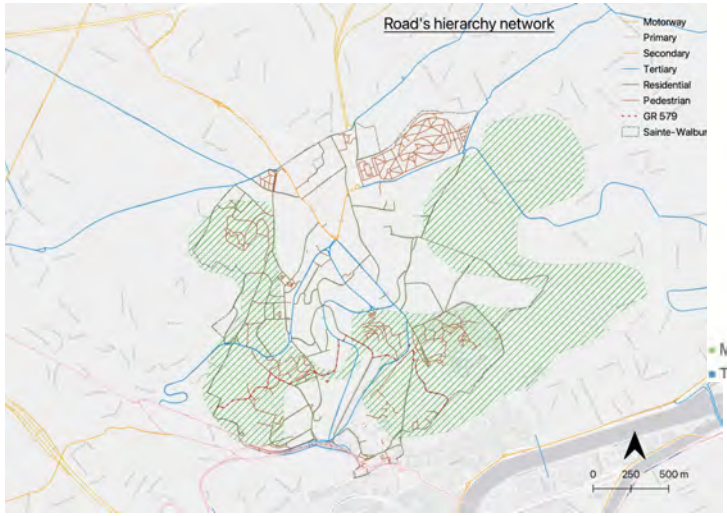


Chart. 1.1. Current modal share in Liege (PCM from BELDAM 2010)



Map 1.3



Map 1.4

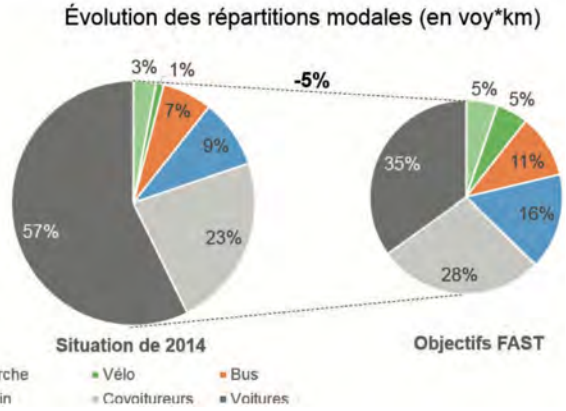


Chart. 1.2: Change in modal share. (From PUM and FAST VISION 2030).

The current situation and the problems identified take into account the situation of the neighborhood between the highway and the city centre. Like it was presented by the committee of Sainte-Walburge, and the way our group postures on it, this neighborhood is a transit zone to link the both points : highway and city centre. For instance, the "municipal transit" is a transit by Sainte-Walburge with O/D in Liège or from outside Liège but the destination is the city centre, an important attractive area.

Map 1.1 : Current and planned bus lines

7 bus lines. Most current bus routes serve the district via Montagne Sainte-Walburge, rue Sainte-Walburge, Boulevard Jean de Wilde and rue de Campine. Except for Boulevard JdW which is referenced as a 'secondary' network route, the other streets are 'tertiary' roads.

No major modifications about the future lines. It's mostly extensions on the left with bus 73 (Glons train station) and the right banks of Meuse with bus38 (Bruyères Hospital)

The project of the BUSWAY1 "Transurbaine" is a high level service line linking the north and south of the Liège Agglomeration. The Transurbaine has its own right-of-way that provides a real alternative to the car. It's one of the four busway planned to complement the Tram (Coronmeuse – Sclessin). The development of a such busline near Sainte-Walburge is a priority for the economic development near the norther motorway arc (business park Hauts-Sarts). The Busway 1 will serve several train stations (Chênée, Angleur, Saint-Lambert, Ans) and will be able to answer to the increase of the mobility demand along this axe (sector plan housing zone and land potential are important in these area)

Map 1.2 : One way roads and M**ap 1.4** : Road's hierarchy network

Many roads categorised as residential (from OSM file) are one-way. These one-way roads have the goal to avoid a by-pass traffic or at least reduce it. Since 2022, the committee took a mobility plan "Xhovémont" and a security road plan after they identified streets like Rue de Campine, Montagne Sainte-Walburge or Avenue Victor-Hugo as "transit street" to joined the city centre, and streets like Rue Xhovémont, Rue Auguste Donnay as "local transit", a transit linked to the neighborhood

The greenbelt is important. Sainte-Walburge is a green neighborhood. As we can see on the map 1.4, some green spaces are easily accessible on foot while others are more difficult to access in gentle mode.

Map 1.3 : Cycling mobility

Current bicycle infrastructures existed but are very limited and it does not exist a continuity cyclepath. The PCM has the project to create many "Corridors vélo" from existed infrastrucutres such as marked cycle path or independent cyclepath. These corridors will make it possible to develop the cycle network in Liège and connect the two banks of the Meuse. Sainte-Walburge will be able to link up ith the city and Ans, Rocourt, Coronmeuse thanks to these corridors

Chart 1.1 : Current modal share in the city centre of Liège and Chart **1.2** : Change in modal share (voy*km)

In 2010 the BELDAM mobility survey published some conclusions at the regional level. The fig 1.1 has been created from this survey and is valid for a journey within Liege (O/D in Liège). In 2010 (unfortunately no more recent survey and conclusions for City Centre), in the city centre of Liège, quickly accessible from Sainte-Walburge, the main modal share is the walk with 40% of journeys, than the car (37%) and bus (20% = high percentage because of an important bus network in the city). The bicyle is used only for 2-5% of the journeys. We must keep in mind that if we want to linked better the City centre to/from Sainte-Walburge and also reduce the car use, the promotion of bicycle and most of that the infrastructures for must be improved either in the neighborhood and the centre. On the fig 1.2, the target of FAST VISION 2030 for Wallonia compared to the modals share repartition in 2014 for the city of Liège and so Sainte-Walburge, is to reduce car use by 20% in favour of increased walking, cycling and public transports by 5%. The car use reduction is an ambitious reduction (comes from European goals as GES reduction and regional goals)and to achieve these objectives the urban planning and transportation must be reviewed.

3. Mobility demand and Main attractors (task2)

- **The characteristics of the population and socio-economic status in terms of modal share.**

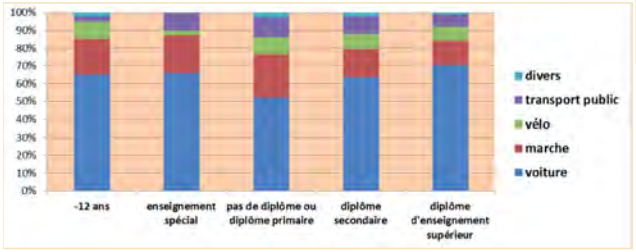


Chart 2.1: Modal shares (main mode) by **degree** in Belgium (BELDAM, 2010)

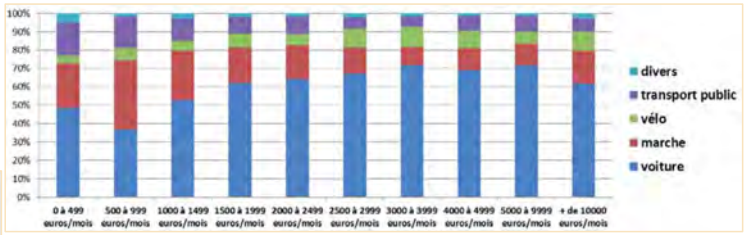


Chart 2.2: Modal shares (main mode) by **household income** in Belgium (BELDAM,2010)

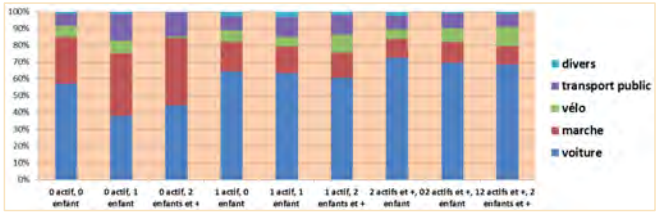


Chart 2.3: Modal shares (main mode) by **household type** : active people and number of children. In Belgium (BELDAM,2010)

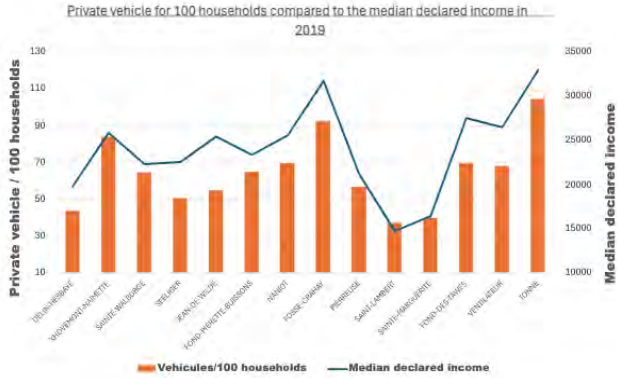
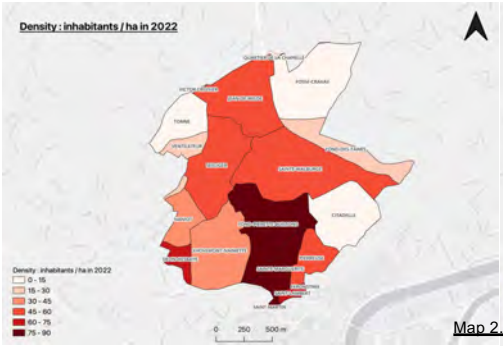
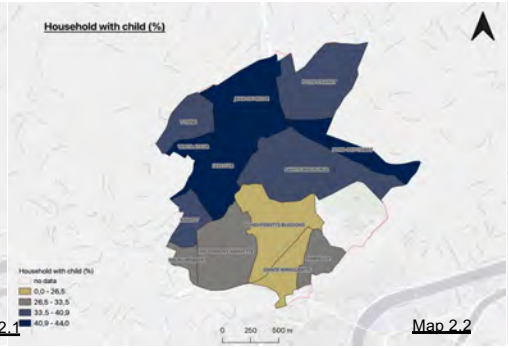


Chart 2.4 : Vehicle/100 households and median declared income in Sainte-Walburge neighborhood in 2019 (Statbel,2022)

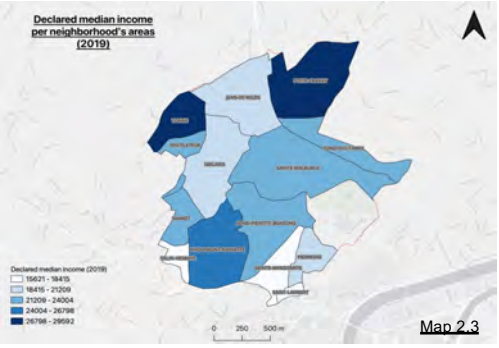
- **The characteristics of the study area**



Map 2.1

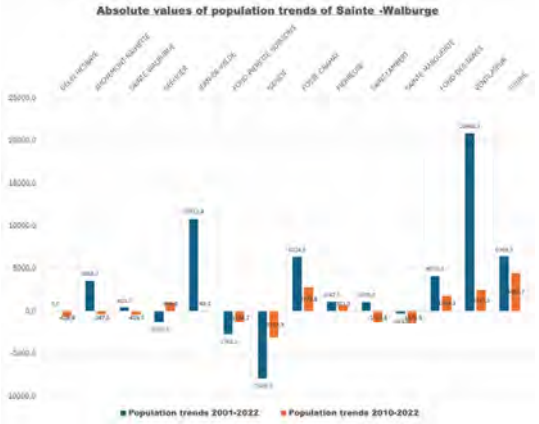


Map 2.2



Map 2.3

Chart. 2.8 : Population trends (Statbel, 2022)



- **Evaluation of the future mobility demand**

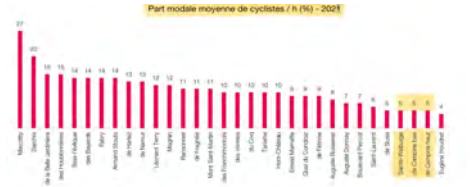


Chart 2.5. Cyclists modal share / hour in 2021 (%) (PCM – monitoring 2022)

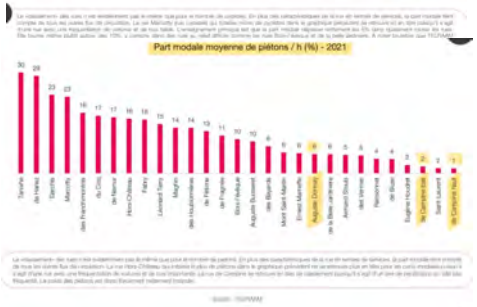


Chart 2.5.1 Pedestrian modal share / hour in 2021 (%) (PCM – monitoring 2022)

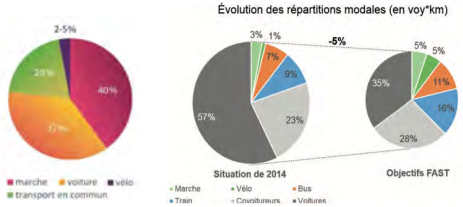


Chart. 2.6 Modal Share in Liege centre (BELDAM, 2010 and FAST vision 2030)

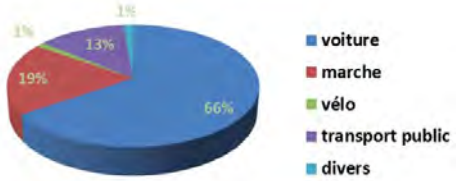


Chart 2.7 Modal shares (main mode) for journeys made by residents of the Liège Agglomération (BELDAM 2010

Chart 2.9 : population growth expected based on SDALg (2015) and Statbel (2022)

Socio-economic status and the modal share

Chart 2.1 : **modal share by degree and chart 2.3 : modal share by household type**

The socio-economic profile of Sainte-Walburge demonstrates conditions that influence the demand for private vehicle transportation. In Belgium, the **education levels** play a significant role to prefer cars as the main modal share. We can link this to the workers who commute to and from work daily (chart 2.1) but also by the main importance of **car company**. Indeed, having a company car is an incentive to travel by car : from statbel in 2010, 91% of employees benefiting from this advantage drive their company car to work place.. The high reliance on personal vehicles and the high demand are also notably affected by **family dynamics**, with larger families, particularly those with children and active people, showing an increased propensity to use private vehicles. Conversely, walking accounts for a large proportion of journeys made by people who are not active (conversely to workers for instance) with more than 2 children which rely more on buses or walking (Chart 2.3).

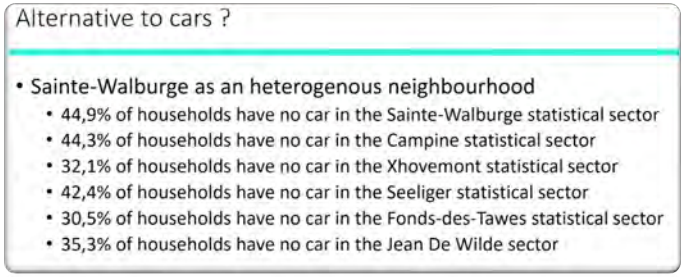
Chart 2.2 : modal share by household income and chart 2.4 : Vehicle/100 households and the median declard income in Sainte-walburge neighborhood in 2019

In Belgium (all three regions) whatever the average monthly income, the car is still the most used mode of transport. It should be noted that at incomes above 2,500, more people travel by bicycle. Regarding chart 2.4, if we compare vehicle ownership (private vehicle) per 100 households, a higher median income goes hand in hand with a greater number of private vehicles per 100 households, in contrast to neighbourhood areas where income is lower. Whether at local or regional/national level, there is a correlation between car use and/or ownership and household income.

The characteristics of the study area

Map 2.1 : density (2022); Map 2.2 : household with child ; map 2.3 declared median income (2019)

If we superimpose the three maps to analyse the characteristics of the area, it is clear that Sainte-Walburge is not a homogenous district. Where population density exceeds 45 inhabitants/hectare (**map 2.1**), we find a higher percentage of household with children - over 33.5% - (**map 2.2**). There are, however, exceptions: Sainte-Walburge, Sainte-Marguerite and Delin-Hesbay show a density higher than 60inhab/ha (**map 2.1**) but a small % of household with children = less than 33,5% (**map 2.2**). The explanation for this is linked to the greater presence of single person households such as young workers, couples without children or students. Finally, as shown on **map 2.3**, where median declared incomes are high (above 24,004 euros/year) these areas are characterised by lower density (**map 2.1**) and by a landscape with more spacious houses close to major roads (boulevards leading to the motorway) or areas with less public transport access, with single-family dwellings. Once again, there are major differences between the two areas of Sainte-Walburge and Sainte-Marguerite. As shown in **chart 2.4**, these two parts of the district have <70veh/100 households (Sainte-Walburge) and <50 vehicles/100 households. We therefore suggest that this population makes greater use of soft modes of transport such as walking or cycling, as well as public transport, which serves these areas to a greater extent. We back up these figures with the ones presented by the Committee, as shown in the table below. Moreover, the Beldam Report (2012) demonstrated that the proximity to a public transport stop plays a role in the mode of travel chosen "*When you are less than 250m from such a stop, you use the car much less and more not only public transport but also active modes of transports (walking, cycling)*" (p114)



Population growth and evaluation of the future mobility demand

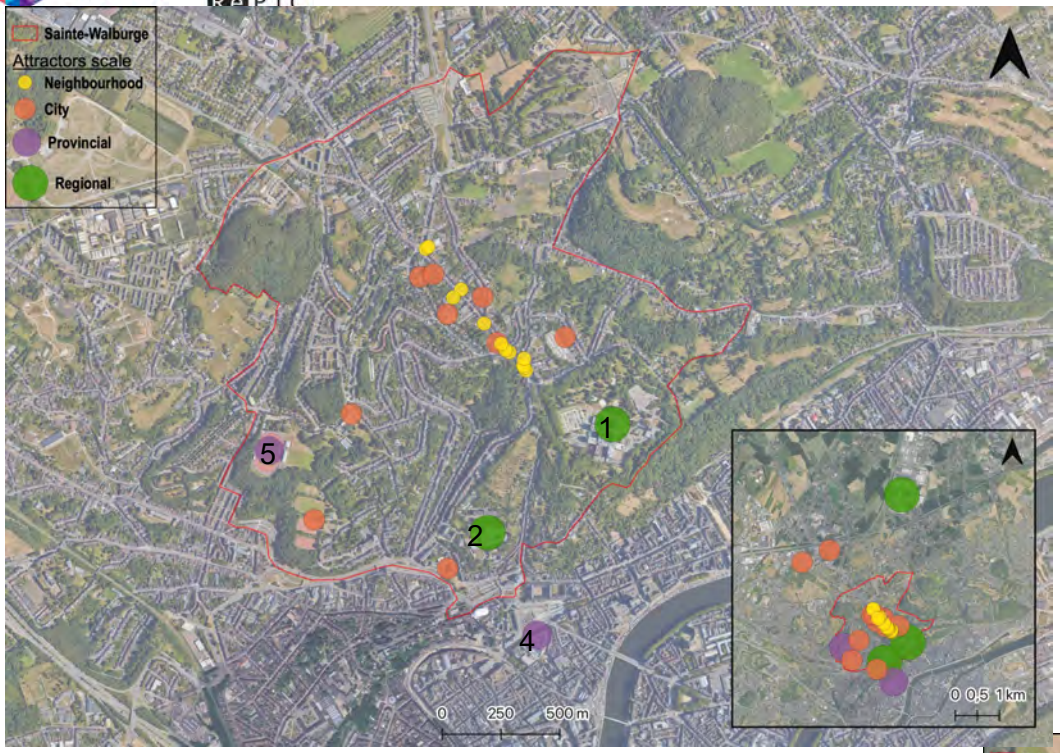
The total population of the study area, i.e. the extended Sainte-Walburge district (including parts of Sainte-Lambert, Sainte-Marguerite, Tonne and Delin-Hesbay), is estimated at 22,964 residents in 2022. To calculate the past population and population growth for 2045, we have based ourselves on the demographic growth of Liège (arrondissement excluded). This population has a growth rate of +- 5% every 10 years (based on Bureau Federal du Plan - SDALg projections - 2015). We applied the same rate to the population of Sainte-Walburge (**chart 2.9**)

Population growth remains relatively stable. Some of neighborhood's area loose population between 2001-2022 like Naniot and Fond-Pirette-Buissons, while area like Ventilateur and Jean-de-Wilde presents an important population trends for the both periods (**chart 2.8**). These areas have recently undergone urban renewal and/or the construction of new housing.

As identified above, some areas are already highly densified, while others have a lower density. These less densely populated areas are generally located close to major roads or are less well served by public transport. As the population grows, the less dense areas will take in more residents, and the mobility needs of these people will have to be met. The FAST vision (**chart 2.6**) also presented in Task 1 applies to our study area. The modal share of the car will have to decrease by 22% over the next 6 years in favour of walking, public transport and cycling. One positive point in Liège and the Liège agglomeration (**charts 2.6 and 2.7**) is that, since 2010 and 2014, walking has become a main mode of transport in the centre of Liège. This is partly due to political decisions such as the introduction of pedestrianised areas and a cycle network along the quays (cf. PCM monitoring Novembre 2022). Policies that need to be applied in the neighbourhood, which is just a few minutes from the centre.

The need is to improve the modal parts of walking and cycling, currently less than 6% /hour for both in some streets of the neighborhood (**charts 2.5 and 2.5.1**) to improve them and meet the FAST target of 5% growth in modal share by 2030 (**chart 2.6**).

Finally, since the Covid-19 crisis, we have also seen a reduction in the number of people commuting between home and work. We need to capitalise on this by making it easier to use public transport or a structured cycle network when travel is essential.



REGIONAL ATTRACTORS

1. **CHR Hospital** located at the Citadelle.
   - Total number of beds : 860
   - Total number of workers : 3.300 (2023)
   - **Daily flow of vehicles from/to Citadelle per day : >15.000** (2016)
     = The main regional attractor in the east of the neighborhood with the biggest impact on the traffic in the area.

2. **ISoSL - Hôpital Agora and hôpital du Péri** : psychiatric institution
   - Total number of beds : 40
   - Total of workers : +- 300

3. **Business Park - Zoning industriel des Hauts-Sarts (SPI)** (Herstal)
   - 350 companies and industries
   - Near the highway node in the north of Liège ("arc nord") with many connexions to Antwerp, Brussels, France, Luxembourg, Germany and Netherlands
   - Total of workers : >10.000

PROVINCIAL ATTRACTOR

4. **City Centre of Liège :** many shops and restaurants, high schools, colleges and university (total = >70), employees of all administrative bodies in the city of Liège and the Province
   - Total of workers : > 40.000

5. **Athletics Center Naimette (Province Naimette Arena)**
(host an international meeting once a year)

CITY ATTRACTORS

City scale = Arrondissement de Liège au sens du SDALg

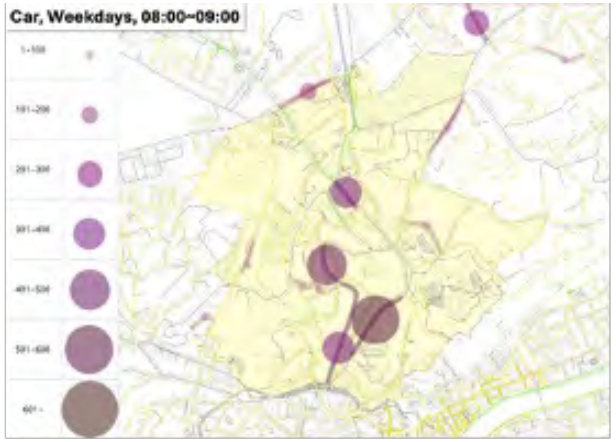
6. **Shopping center "CORA"** , **Kinepolis** (movie theater), **Old Club Liège Hockey** (sports infrastructures)
   - Shopping center :
     - Cora supermarket + shopping center of ≥75 shops = 5 millions customers/year
     - 1.200 workers

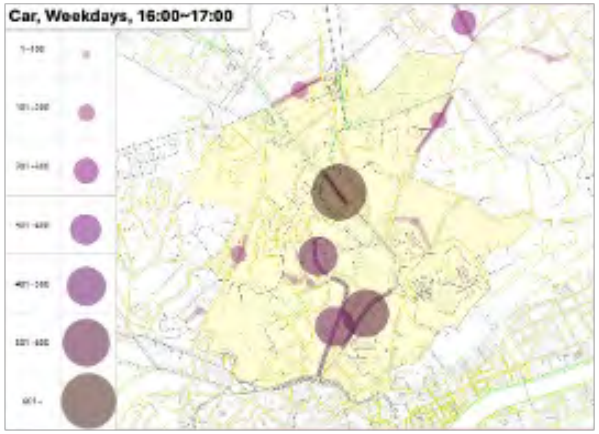
The rest of the orange circles : **nursery, kindergarten and elementary school + Beaux-Arts de Liège :** Ecole supérieur des Arts (the only graduate-school in the neighborhood)

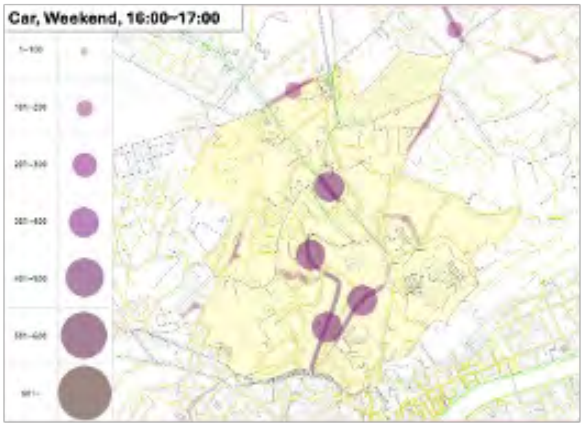
NEIGHBOURHOOD ATTRACTORS

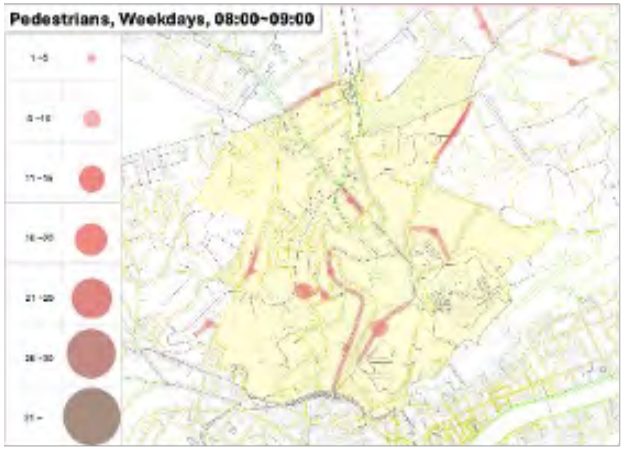
The church and convenience stores located in rue Sainte-Walburge

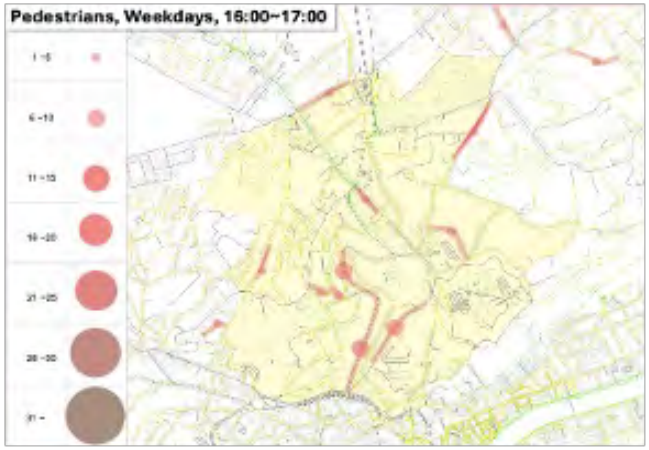
4. Modal share mobility flows in the neighborhood : Telraam data analysis compared to mobility flows counting (task3)

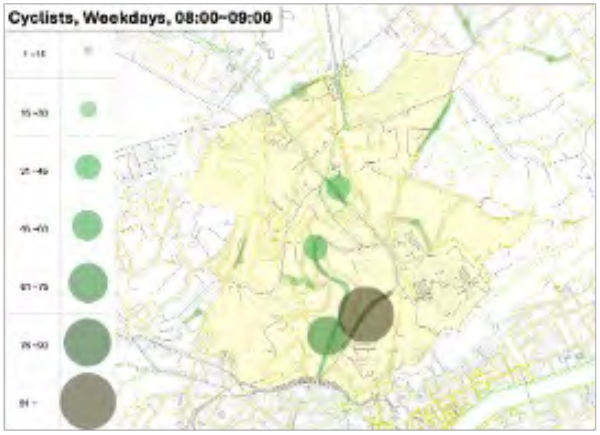


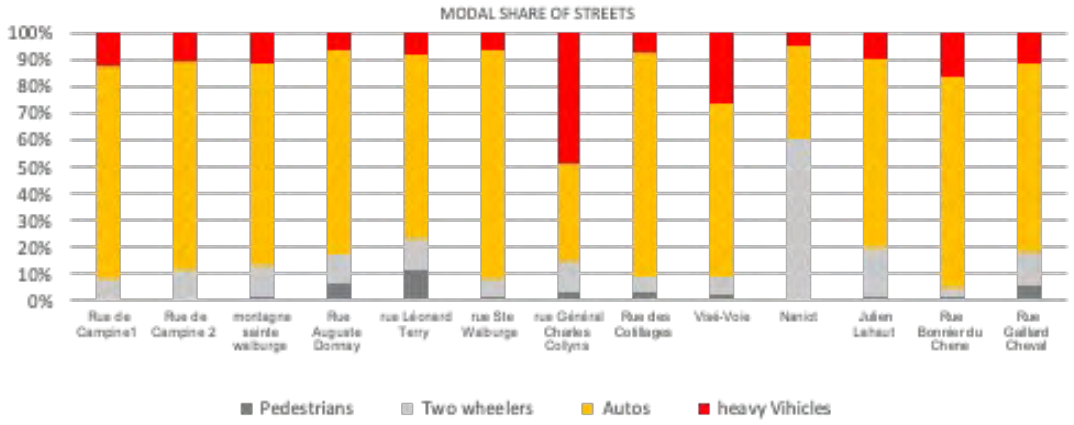


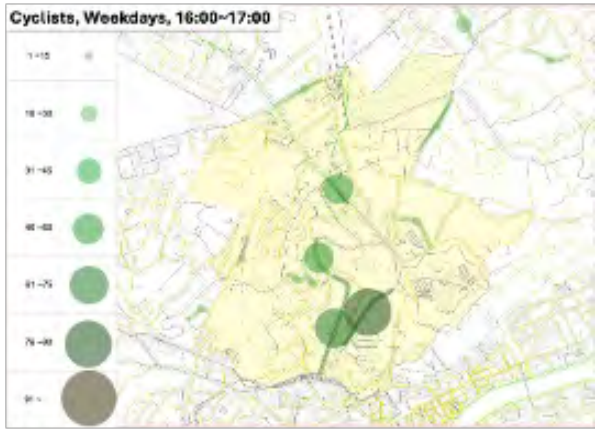












Telraam Data Analysis

To develop a rational traffic plan for the study area, it is essential to analyze continuously collected mobility statistics. These statistics are closely linked not only to the travel demand in the area but also to the **types of transportation used, time-based usage patterns, and the daily lives of residents**. Since the goal of traffic planning is to improve the quality of life for the local community, such analysis is crucial and highly beneficial for creating effective plans.

The data used for this analysis was sourced from TELRAAM (https://telraam.net/en#9/50.6333/5.5667). **The analysis covers the period from July 7, 2024, to May 10, 2024, excluding certain routes where data collection was inconsistent. This study focuses specifically on 13 key roads within the study area**

In the study area, **vehicle traffic is concentrated on the major north-south roads.** This is likely due to the wide road widths and their strategic location, connecting the highway with the city center, resulting in significant by-pass traffic. Additionally, high traffic volumes are observed near attractors located on major roads such as **Rue de Campine, Montagne Saint Walburge, and Rue Saint-Walburge.**

Particularly, Rue Saint-Walburge experiences relatively high traffic volumes during weekday peak hours. This is likely driven by the demand for school-related trips due to the presence of nearby educational facilities. Furthermore, **the significant volume of vehicles traveling to hospitals and the city center** highlights the need for expanded public transportation options to serve these attractors effectively.

Weekend traffic patterns are somewhat similar to those on weekdays, although by-pass traffic volumes are lower. This suggests that not only during the week but also on weekends, vehicles traveling to the city center often use the roads in the study area to reach their destination.

Pedestrian traffic patterns closely resemble those of vehicle traffic. Roads near major attractions experience high levels of pedestrian activity, while most other roads see very low pedestrian traffic. During morning and afternoon peak hours, pedestrian volumes on most roads are analyzed on a scale of 0 to 10, with many roads scoring at the lower end.

This indicates that the current pedestrian infrastructure is not well-suited for pedestrian mobility. It also suggests that many residents prefer using cars over walking, likely due to the lack of safe and convenient walking routes.

The analysis of cycling patterns shows that while bicycle usage is relatively lower compared to vehicle traffic, it is higher than pedestrian traffic. **Bicycle use is mainly observed on major roads leading to hospitals, schools, and the city center**. In some areas, the number of bicycle trips during peak hours exceeds 90, which is a promising trend considering that Sant-Walburge is a hilly region.

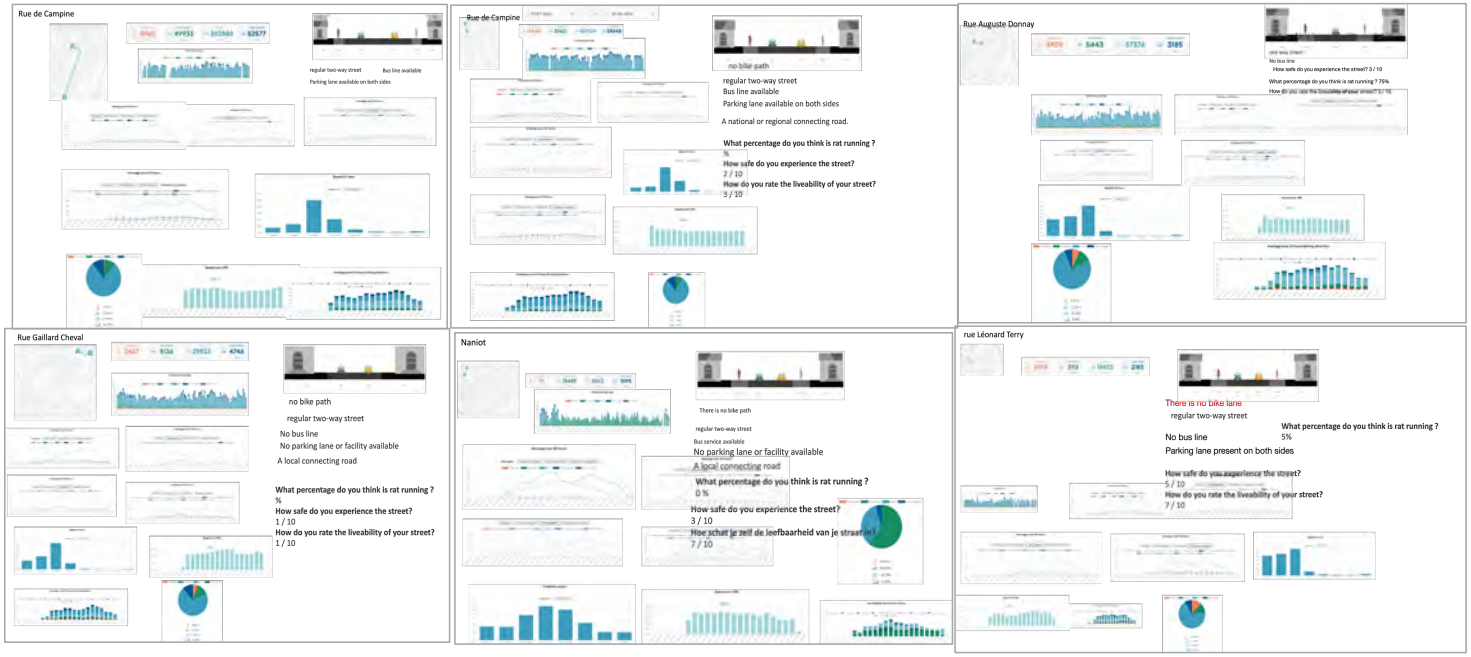
This finding highlights the importance of carefully incorporating bicycle infrastructure into future plans for the study area. It underscores the potential for increasing bicycle use and the need for a well-thought-out strategy to promote cycling as a viable mode of transport.

The **modal share analysis of the roads** within the study area shows that **vehicle traffic accounts for the majority on most roads, followed by bicycle traffic, while pedestrian traffic remains very low.** This pedestrian volume is significantly lower compared to the pedestrian traffic share (approximately 40%) reported in the BELDAM dataset. These findings suggest that the walking environment in the study area is likely inadequate.

On certain roads, the proportion of bicycles or large vehicles appears relatively high, but this is likely due to the low overall traffic volume on those specific roads.

- The current modal share is far from the targets set by Liège for sustainable transportation. To achieve these goals, the proposal will include an analysis of the causes behind the existing traffic patterns and practical solutions to shift the modal share toward more sustainable levels.

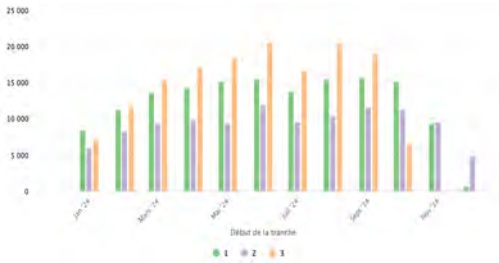
Telraam Data Analysis



	For all street	Rue de Campine
Structural feature	-No bike path -Just one lane for a direction -One way, both direction way -Narrow and discontinous of pedestrian road (in width) -No bus bay (Buses stop in the middle of vehicle lane)	-Regular two-way street -Bus service -No bike path -1.5m pedestrian road
Functional feature	-Morning peak time, afternoon peak time -Continuous traffic in daytime -Peak time near noon in weekend -Connected to national road or local road -Bus service is available (some of them) -Park in everywhere which has a place beside of road -Bike use same lane with bus	-30~40km/h speed
Modal shares	-Normal car take 70~80% of modal share. -Pedestrian take under 10% -Bike user take under 10% -Heavy vehicle takes more than 15%	-Pedestrian : about 1% -Bike user 7~10%
Others	-Unsecure of safety for bike rider and pedestrian.	-Satisfaction level of safety is relevantly low.(20%)

Examples of TELRAM data Analysis per each Road (6 of 13 Roads)

Rue de Campine (1) : 22.06.2024 – 28.06.2024 (TELRAAM DATA)



Cyclists counted every month (Jan 2024 to Nov 2024) at the different points in the city of Liège (*Open Data Liège*)

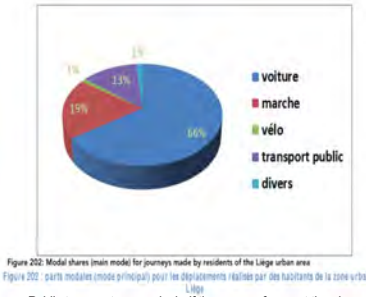
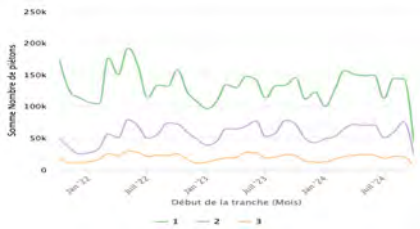


Figure 202: Modal shares (main mode) for journeys made by residents of the Liège urban area

Public transport one and a half times more frequent than in Wallonia as a whole. To compensate, the car (as a driver) is used less.



The total number of pedestrians for each counting zone *(Open Data Liège)*

To analyze the modal share and usage patterns of transportation in the study area, it is essential to also examine the patterns of connected roads. This approach acknowledges the continuity of road networks, which plays a critical role in understanding overall traffic flow. For this purpose, we analyzed the physical characteristics, modal share, and usage patterns of 13 roads in the study area using accumulated TELRAAM data over a specific period. The analysis includes Traffic volumes by mode of transport during the study period, Daily traffic volumes, including weekdays and weekends.:

- Weekday hourly average traffic volumes by mode of transport
- Weekend hourly average traffic volumes by mode of transport
- Comparisons of hourly average traffic volumes between weekdays and weekends
- Average vehicle speeds and the V85 speed of cars
- Directional traffic flow patterns by time of day,
- Modal share, Cross-sections, physical characteristics of roads, and user satisfactions.

This comprehensive approach provides detailed insights into the transportation system in the study area, supporting the development of more effective and sustainable traffic management plans.

- Tow points to bear in mind when analyzing Telraam data : the study area and the streets studied are part of a “transit zone” between city centre and highway. Secondly, Telraam sensors do not operate continuously and are sometimes positioned high up, which distorts cyclist and pedestrian counts. Their number are therefore underestimated*

A review of the structural characteristics of all 13 roads in the study area reveals the **absence of dedicated bicycle lanes**. This presents a significant disadvantage for cyclists and highlights the need for bicycle infrastructure to promote higher cycling rates. The roads are generally single-lane per direction, with some designed for two-way traffic and others as one-way routes. These directional configurations seem to have been determined based on the existing road widths and community usage patterns. Future community road planning may require reconsidering or adjusting these directions to align with evolving mobility needs.

Sidewalks in the study area are mostly 2 meters wide or narrower, often consisting of block paving. **Their widths are inconsistent, and there are very few stretches with continuously wide sidewalks**. This irregularity appears to be the result of retrofitting sidewalks, roadways, and parking spaces around pre-existing housing. Consequently, the lack of continuous and adequately wide sidewalks poses significant challenges, particularly for vulnerable pedestrians such as parents with strollers, wheelchair users, and the elderly. These conditions not only compromise pedestrian safety but also act as a barrier to promoting walking as a viable mode of transport.

Another key feature is the absence of bus stops on the main routes used by buses. **Buses stop directly on the carriageway**, which can cause traffic jams during the morning and afternoon rush hours. This practice is partly attributed to the local driving culture, as when the bus pulls off the road, private vehicle drivers often do not give way to buses as they try to re-enter the traffic flow, a common feature of Belgian transport dynamics. This practice needs to be retained to impact car traffic and encourage private drivers to leave the car behind and take the bus.

From a functional perspective, the major roads are aligned in a north-south direction and serve as thoroughfares connecting the highway in the north to the city centre in the south. These roads also accommodate bus routes, making them critical for public transport connectivity. **An analysis of hourly average traffic volumes on these major roads shows consistent activity from 7:00 AM to 6:00 PM, with distinguishable morning and afternoon peak periods**. However, traffic volumes during midday remain steady, indicating the inclusion of these roads as part of the primary route connecting the northern highway and the city centre.

Parking is predominantly **on-street along both sides of most roads.** This reliance on roadside parking is likely due to the lack of dedicated parking spaces within residential properties in the area. Parking availability is an essential concern for local residents and must be carefully addressed in future planning to ensure that any changes to parking policies align with community needs. **In terms of modal share, over 70% of road users are private vehicles, while pedestrians and cyclists account for approximately 10% each.** While there are variations depending on the road’s location and structural characteristics, most roads follow this general pattern. Overall user satisfaction levels were reported as low, with safety being a significant concern, indicating the need for adjustments in the area’s transportation plan.

An analysis of Rue de Campine, a major road in the study area, revealed usage patterns like those of other roads. However, pedestrian and bicycle usage rates were exceptionally low*. User satisfaction was notably poor, with only 20% of respondents indicating satisfaction, reflecting relatively low levels of perceived safety or comfort. The average vehicle speed on Rue de Campine was recorded at 40 km/h, which is within the typical range for urban roads. When comparing the time-series cumulative data for Rue de Campine to national data for Belgium, it is evident that pedestrian traffic volumes are significantly lower. Additionally, bicycle usage and public transport utilization rates on Rue de Campine are also relatively low*.

→ This highlights the need for new counts and targeted measures to improve sustainability, comfort and safety in the study area, in line with wider sustainable transport objectives.

5. Flow surveys, infrastructures and parking audit (*task 4, 5 and 6*)

We conducted on-site traffic volume surveys during weekday peak hours and weekends to gather comprehensive data. Our primary node, Node 9, serves as a critical junction where five roads converge, making it a key focal point for the analysis. Additionally, we examined the current status and utilization rates of parking facilities, along with the structural and physical conditions of bicycle lanes and sidewalks. This integrated approach allowed us to assess the overall infrastructure and its alignment with current and future mobility needs.

- Date of Flow survey and infrastructure

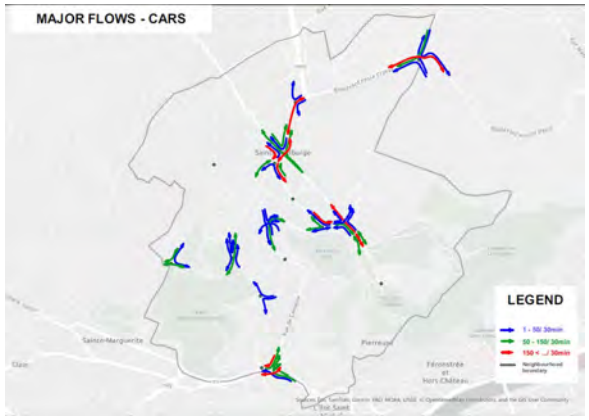
Weekday : 16.10.2024 (08:30~09:00 and 16:15~16:45)
Weekend : 19.10.2024 (15:15~15:45)
Location : Around Node no.9

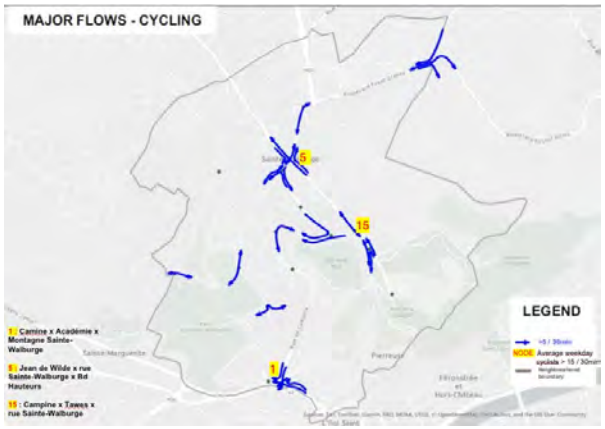
- Date of survey for infrastructure and parking audit

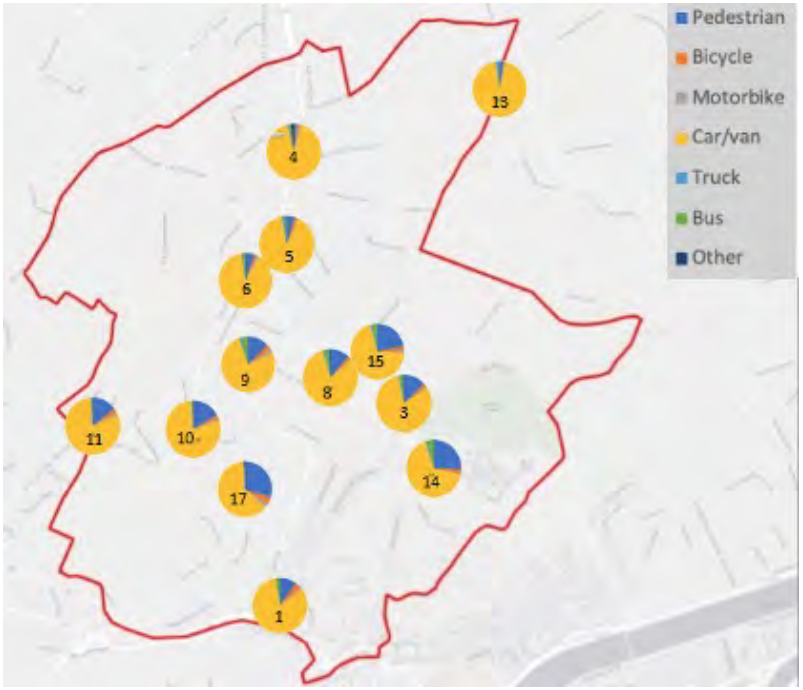
Weekend : 19.10.2024 (14:00~16:00)
Location : Rue du Limburg, Rue Jean Riga,
Campine, Rue Valère Hénault`

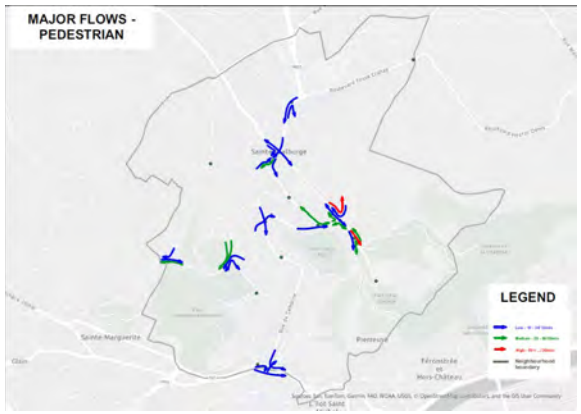
Group	subpoint ID	Vaverage [veh/h]	Wt [m]	W1 [m]	Wl [m]	%OSP [%]	fp	fb	Wb [m]	Ws [m]	Vmax [veh/h]	SPD [km/h]	SQ-walk	SQ-bike		PLOS		BLOS	
11	61	144	4,5	0	2,5	0	yes	no	0	0,5	177	30	medium	medium		3,81	D	2,95	C
11	62	52	4	0	2,5	10	yes	no	0	2	105	50	good	medium		1,9	A	3,51	D
11	63	52	4	0	2,5	5	yes	no	0	1,5	105	50	medium	medium		2,53	B	3,43	C
11	64	52	6	0	1	25	yes	yes	4	4	105	30	medium	medium		0,98	A	2,67	B
11	65	52	6	0	2	10	yes	no	0	2	105	30	good	medium		1,67	A	2,46	B
11	66	52	3,2	0	3	90	yes	yes	0	1,5	105	30	good	medium		1,89	A	3,48	C
11	67	166,3	4	0	2	80	no	no	0	1,5	232	30	medium	medium		2,65	B	3,82	D
11	68	166,3	4	0	2	80	no	no	0	1,5	232	30	medium	medium		2,65	B	3,82	D
11	69	166,3	3	0	1,5	25	yes	no	0	1,5	232	30	medium	medium		2,87	C	3,68	D
11	70	24	3,5	0	0	0	no	no	0	1,5	25	30	medium	medium		2,3	B	1,87	A
11	71	166,3	3	0	1,5	80	yes	no	0	1,5	232	30	medium	medium		2,86	C	3,93	D
11	72	166,3	3	0	1,5	80	yes	no	0	1,5	232	30	medium	medium		2,86	C	3,93	D
11	73	166,3	3	0	1,5	75	yes	no	0	1,5	232	30	medium	medium		2,86	C	3,92	D
11	74	166,3	3	0	1,5	75	yes	no	0	1,5	232	30	medium	medium		2,86	C	3,92	D
11	75	0	5	0	1,5	30	yes	no	0	2	0	30	medium	medium		1,97	A	1,89	A

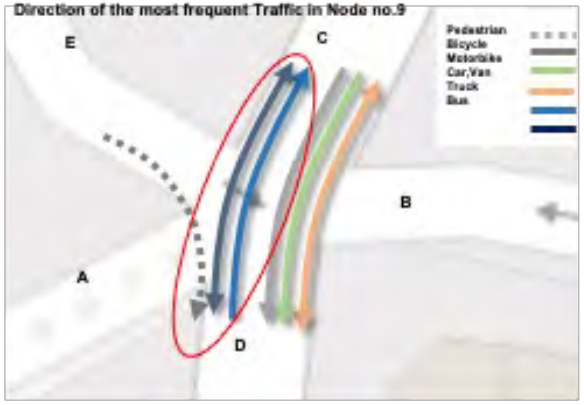
5. Flow surveys, infrastructures and parking audit (*task 4, 5 and 6*)











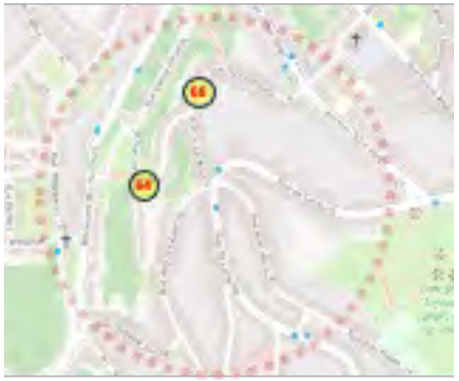
Infrastructure and Parking Audit

parking ID	Ppub	Ppriv	Pres	Pprm
91	102	0	14	1
92	110	0	8	0
93	101	0	10	2
94	80	0	0	0

Pturn Rate

parking ID	91	92	93	94
Average of Pturn Rate(%)	13,55	40,58	6,38	24,58

Barriers in the section



Level of Service

Analysis of the Flow surveys, Infrastructure and parking audit

To compare reported traffic volume data and actual conditions, we conducted two field surveys during weekday peak hours and weekends. The primary survey site, Node 9, is a critical intersection where Rue de Campine, Rue Jean Haust, Rue Auguste Donnay and Rue du Limbourg, forming a five-way junction. This location is key to understanding the traffic characteristics of the study area, as it connects by-pass traffic from the E25 highway to the city centre and facilitates diverse traffic flows from residents.

The survey revealed that the highest traffic flow occurs along Rue de Campine in the north-south direction. This is attributable to the road's strategic role and physical characteristics, functioning as a key link between the E25 highway and the city centre. The data indicates that Rue de Campine primarily serves as a by-pass traffic route, connecting vehicles traveling from the northern E25 highway to major attractors such as hospitals and returning southward.

A wider analysis of traffic flows across all nodes in the study area confirms this conclusion. The dominant flow originates from the E25 motorway to the north and heads towards key centres of attraction such as the hospitals and the city centre. Rue Sainte-Walburge, at the two ends of the latter which give access to the roundabouts linking to Avenue Victor-Hugo, is mainly characterised by a 'rectangle' of **car flows > 150 / 30 minutes.** This traffic then passes through node9 on its way to the city centre. Hospital visitors, city commuters and students travelling to educational establishments make a substantial contribution to overall traffic volumes.

As for the boulevards, the roundabout between Boulevard Fosse-Crahay and Boulevard Hector Denis is the one with the highest traffic volumes: these are vehicles coming from/going to the motorway. These observations support our view that the traffic between rue de Campine - rue Sainte-Walburge - Victor Hugo should be re-routed onto Bd des Hauteurs and Bd Jean-Théodore Radoux, so that these major roads drain the flows of vehicles travelling between the city centre and the motorway.

Cycling and pedestrian traffic are primarily concentrated near hospitals and educational facilities. Despite its narrowness, rue Sainte-Walburge attracts a large flow of cyclists in both directions. This street and this area, including Avenue Victor-Hugo, include several schools as well as all the small local shops. One of the most important nodes for the flow of cyclists is at the bottom of the rue de Campine and the Montagne Sainte-Walburge, with an **average of 31 cyclists per 30 minutes** (all three counts combined). This area is the main and shortest route to Liège city centre. However, it is almost entirely dedicated to buses and cars. It needs to be improved. However, the modal shares for bicycles and pedestrians are lower compared to city-wide averages. Despite this, the need for additional infrastructure to support cycling and walking in these areas is evident. Furthermore, overlaps between public transport and vehicle traffic flows were identified, indicating **the necessity for strategic planning to mitigate potential conflicts**.

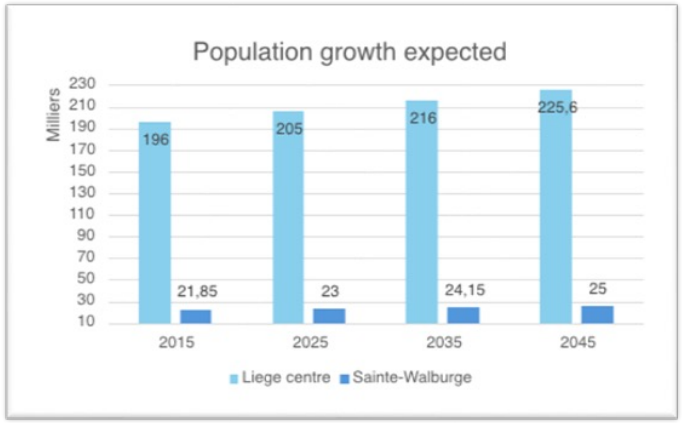
The overall traffic patterns indicate that major flows are directed toward key attractors such as hospitals, educational institutions, and the city centre. These flows **highlight the need to classify routes based on their spatial and functional roles, considering the study area's land use and location**. Distinguishing between routes used by residents and those serving attractors is essential for effective planning.

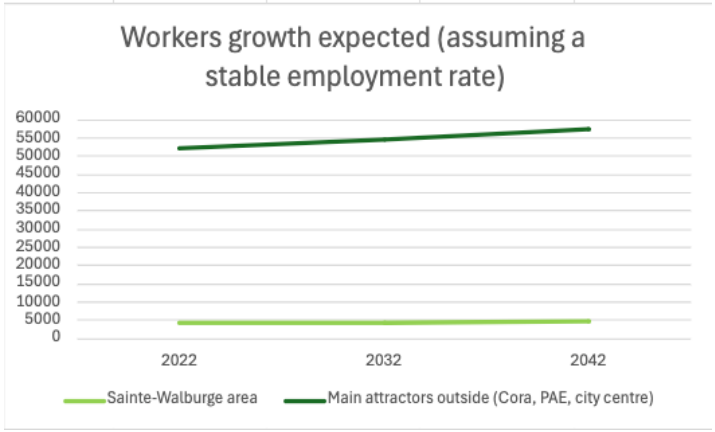
An evaluation of infrastructure and parking facilities revealed that most roads feature on-street parking, either on both sides or partially on one side. This observation aligns with prior data and reports, which attribute this pattern to the characteristics of the local housing. The parking turnover rate (Pturn rate) varied by road segment. **Roads with continuous residential housing exhibited lower Pturn rates, indicating that residents primarily park in front of their homes**. Conversely, parking areas in non-residential segments showed higher turnover rates. Most parking spaces in the study area are public, with a very limited number of spaces designated for residents or disabled parking.

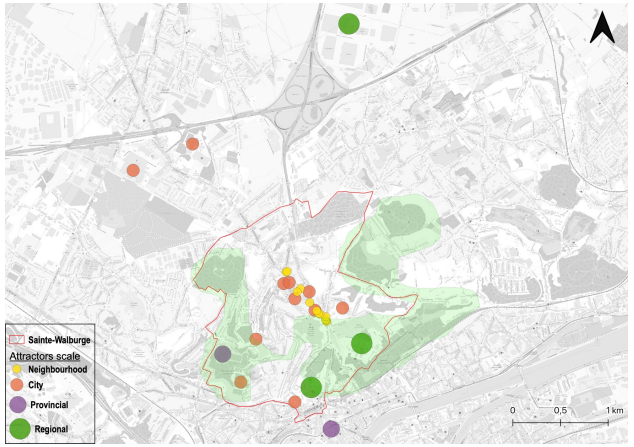
An analysis of the structural characteristics and pavement conditions of bicycle lanes and sidewalks revealed that service levels are generally low, with most roads rated at Level C or below. On Rue de Campine, the service levels for both cycling and walking were rated as C, indicating the need for targeted improvements. Higher service levels were observed on one-way roads, suggesting that implementing one-way traffic designs could significantly enhance cycling and pedestrian experiences in the area.

6. Objectives and principal for the neighborhood (*task7*)

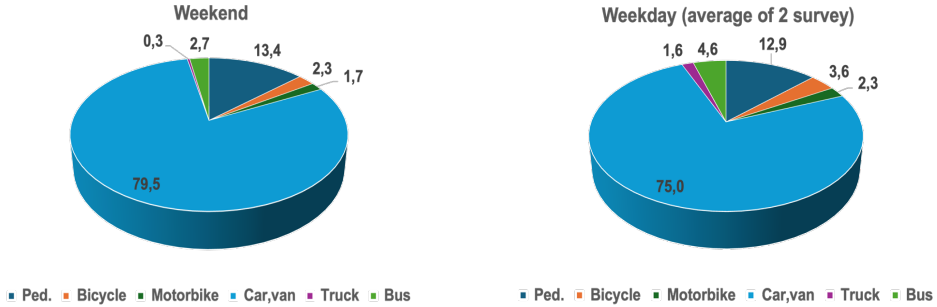
1) Population and Job Growth Objectives





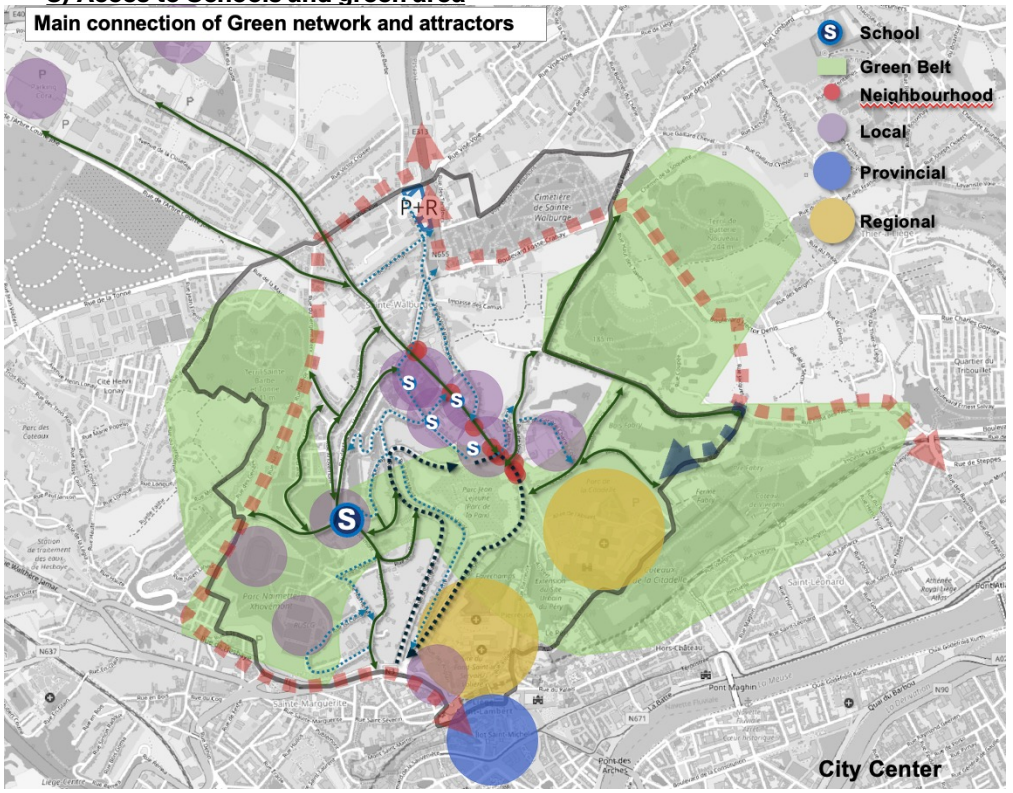


2) Modal Share Objectives



Modal share od Node No.9 (Weekday and Weekend)

3) Acces to Schools and green area



4) Number of Authorized Parking Spaces

Name of road	Number of parking lot
P91_Rue du Limburg	122
P92_Rue_Jean_Riga	118
P93_Campine	104
P94_Rue_Valère_Hénault`	85

2) Objectives and Principal based on the charts and tables

The population growth, as already presents in the task2, will be expected to grow as the same pace as for the rest of the municipality in the years to come (SDALg). The calculation is based on a constancy growing of 5% every decades. By 2025, the population of Sainte-Walburge (in the **extended study area)** could reach 25,000.

About jobs, our study area is located between 3 main attractors (Shopping Center - PAE Hauts-Sarts – City centre) and the neighbourhood counts a big one : CHR. For the projections, we assuming a stable employment rate (from 2022, our last data), we correlate the number of inhabitants in the Centre of Liège with the employment rate to projections until 2042. Almost 60.000 employes in the surrounding areas for +- 4.500 in the neighbourhood (CHR being the largest employer). The growth in the population of workers in attractive areas will have an even greater impact on traffic in Sainte-Walburge, it it retains its status as a “transit zone” to reach these employment hubs.

- **Checking the Global Goals of the Project**

User	Improvement Needs (Requirements)	How to Achieve
Residents	Amenity for Living (Safety, Less noise, Less traffic jam) Accessibility to public facilities include green spaces, hospitals, P+R, etc.	Reduce the By-pass Traffic with one-way roads
Pedestrians(including wheelchairs, strollers, Etc.)	Widening the width of the pedestrian road + quality of pavements	Ensure physical space with reduce lanes, one-way roads, etc. Smart crosswalks
Cyclist	Separate installation of bicycle lanes Create Cycle zones (near school & shops for example)	Ensure physical space with reduce lanes, one-way roads, etc. Moving the bike lane from the road to the sidewalk
Public Transportation Users	Ensuring punctuality of public transportation, convenience of use such as bus shelters	Finding or making less-congested routes by changing public transportation routes and changing purpose of roads, provision of shelters through sidewalk widening
Car user	Reduction of road congestion.	Reducing congestion by dividing the purpose of the road hierarchy

- **Checking the Issues and Suggestions**

Issue	Description	Proposed Solution
High By-pas Traffic Volume	- High traffic volume through community roads, often towards the city center and hospital. -> Severe peak-hour congestion.	- Separate by-pass traffic from local traffic to ease congestion. - Encourage alternative routes from highways to the city center and hospital with two-stage separation.
Limited Road Space for Infrastructure	- Narrow road width makes it difficult to allocate pedestrian road and bike paths.	- Convert two-way roads to one-way roads to widen sidewalks and add bike lanes, improving pedestrian and cyclist safety.
Accessibility of Public Facilities	- Narrow sidewalks compromise safe access to schools, parks, and other facilities.	- Increase sidewalk width and bike paths by converting two-way roads to one-way streets, ensuring safer access to facilities.
Public Transport Punctuality	- Inconsistent public transit schedules due to limited route and stop layout within the community.	- Redesign transit routes and stops to improve punctuality and coverage.
Additional Parking Space Needed	- Insufficient parking spaces FOR RESIDENTS ->potential to improve parking by road layout Adjustment	- Convert two-way roads to one-way streets, enabling angled parking(doubling space) or using chicanes to maintain the current count if needed.

- **Checking the Feasibility for Achieve Goals**

• **Physical Change Feasibility**

- Large-scale changes (e.g., relocating buildings, re-routing roads) are unlikely.

- Focus on improving conditions for transportation modes within current physical limits.

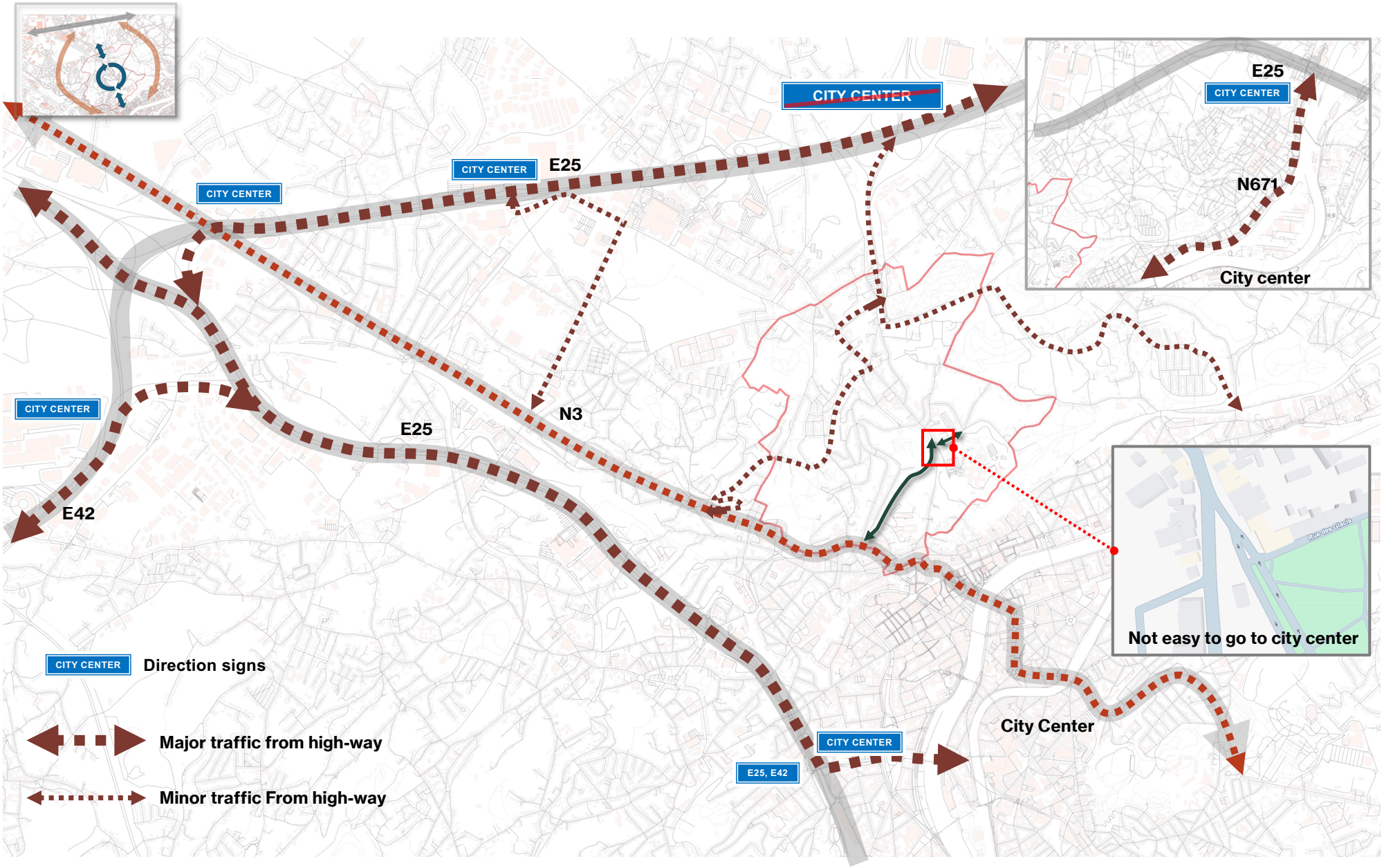
• **Institutional Change Feasibility**

- Possible adjustments: public transit routes, lane directions, road hierarchy.

- Improve traffic flow by revising rules: purpose-based road designation, one-way streets, and off-street parking modifications.

7. Mobility plan for the neighborhood : suggestions solutions to the transit zone and road congestion (*task8*)

Mobility Plan Development : Extensive Filtering of bypass traffic – *The Outer Loop*



Plan Development : extensive filtering of bypass traffic based on objectives and principal of *task7*

To establish a rational and systematic plan for the study area, we have based our objectives and principles on a thorough analysis of existing reports, data, and findings from on-site surveys.

Given the close relationship between traffic volumes and population growth, an analysis of population growth rates in Liège's city center and the study area shows an average projected increase of **5.2% to 5.0%**. The neighboring economic zones are expected to sustain consistent job creation, leading to continued social population growth. This indicates that the study area will likely experience a sustained increase in traffic volumes due to population growth.

As vehicle traffic, cycling, walking, and public transport usage rise, **the existing traffic and environmental issues in the study area are expected to worsen without effective interventions.** Moreover, Liège is actively working toward sustainable and eco-friendly urban environments by setting ambitious **modal share targets,** and the study area should align with these efforts.

Achieving a greener urban environment requires increasing the share of public transport, cycling, and walking. This necessitates improved public transport convenience and punctuality, enhanced safety for cyclists and pedestrians, and the development of **continuously connected networks.** Additionally, accessibility to residential and regional facilities must be improved to enhance the overall quality of life. **Parking facilities** also require careful consideration to maintain or expand them as needed for the benefit of residents.

To achieve these goals, we identified global objectives and key issues for different user groups in the study area and proposed concrete countermeasures and solutions. Before formulating the plan, we reviewed potential constraints to minimize waste of effort and resources.

The user groups were classified into **residents, pedestrians, cyclists, public transport users, and private vehicle users**. We identified the needs of each group and outlined realistic methods to meet those needs. Additionally, we summarized the issues identified through our research, analysed their causes, and examined solutions through cross-review to establish clear objectives and principles.

The study area is a **residential zone with well-developed educational facilities, hospitals, and shops, yet it continues to face high levels of vehicle traffic**. This issue negatively impacts pedestrian safety, cyclist safety, and overall residential amenity. Furthermore, **traffic congestion** reduces the punctuality of public transport, hindering efforts to promote its usage.

The limited physical capacity for road expansion poses significant challenges for comprehensive, transformative traffic solutions in the study area. To address this, we propose dividing the traffic flows within the study area by purpose to better manage and reduce overall congestion.

Traffic flows in the study area can be categorized into two main types: **Purpose-driven traffic and Through (by-pass) traffic.**

The **Purpose-driven traffic** includes trips to key attractors within the study area, such as hospitals and educational institutions. Purpose-driven traffic primarily consists of hospital-related trips, followed by trips to educational facilities.

The **by-pass traffic** includes vehicles traveling from the E25 highway to Liège city centre via the study area. By-pass traffic originating from the E25 highway contributes significantly to congestion, adversely affecting the convenience of public transport, cyclists, and pedestrians.

To effectively reduce congestion caused by by-pass traffic, **we propose actively diverting traffic heading from the E25 highway to the city centre**. By implementing this strategy, we expect a significant reduction in by-pass traffic within the residential community of the study area.

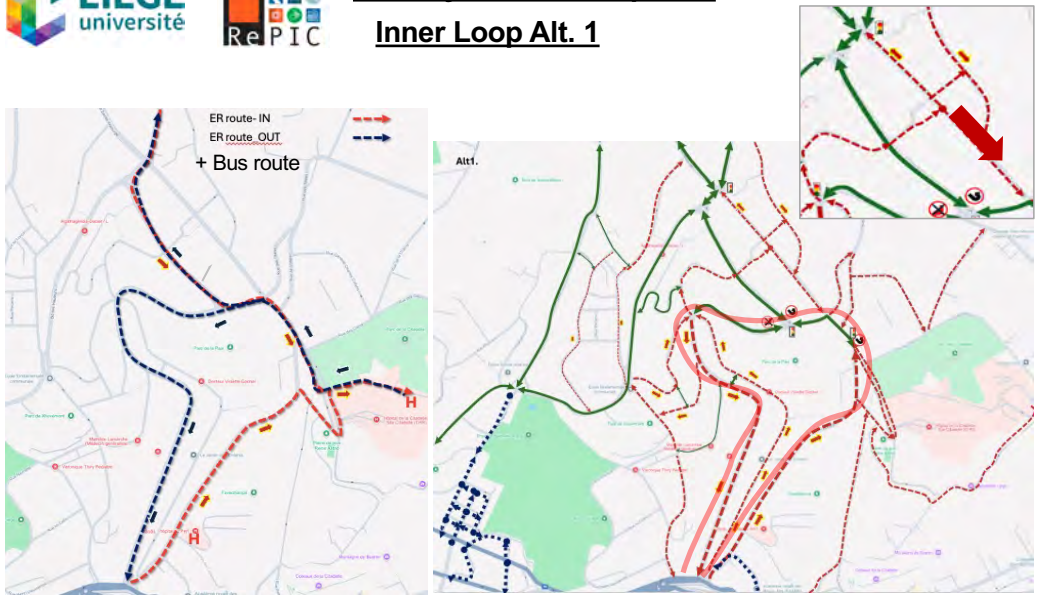
1. **Directional Signage:** Install clear and consistent signs at interchanges east and west of the E25 highway, guiding vehicles directly toward city-centre routes without passing through the study area.

2. **One-Way Streets:** Convert certain internal roads in the study area to one-way streets to make by-pass traffic less convenient than the highway routes.

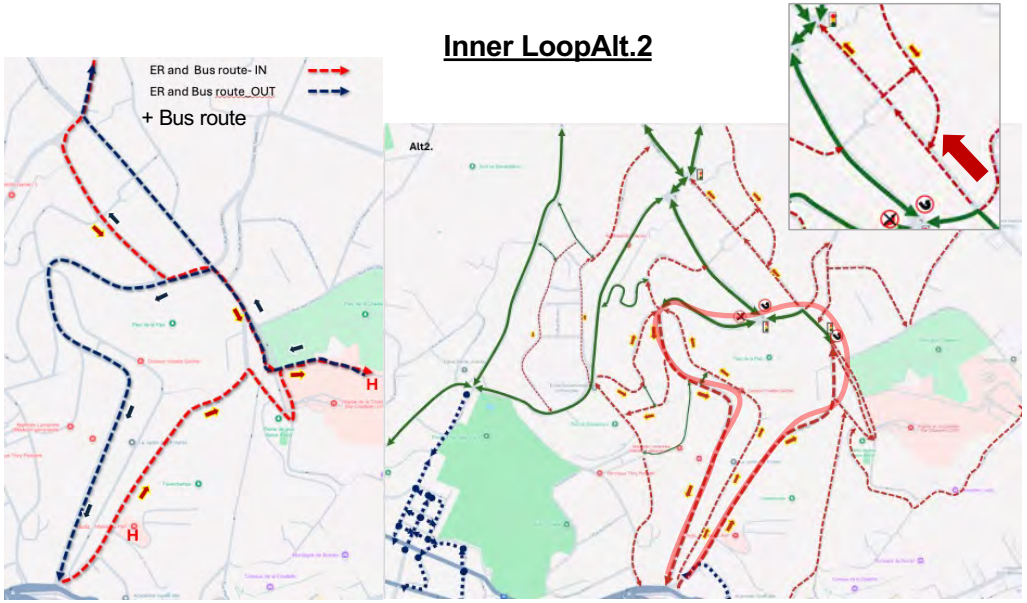
- This approach requires integrated planning that coordinates internal road networks with regional road infrastructure.

Mobility Plan Development

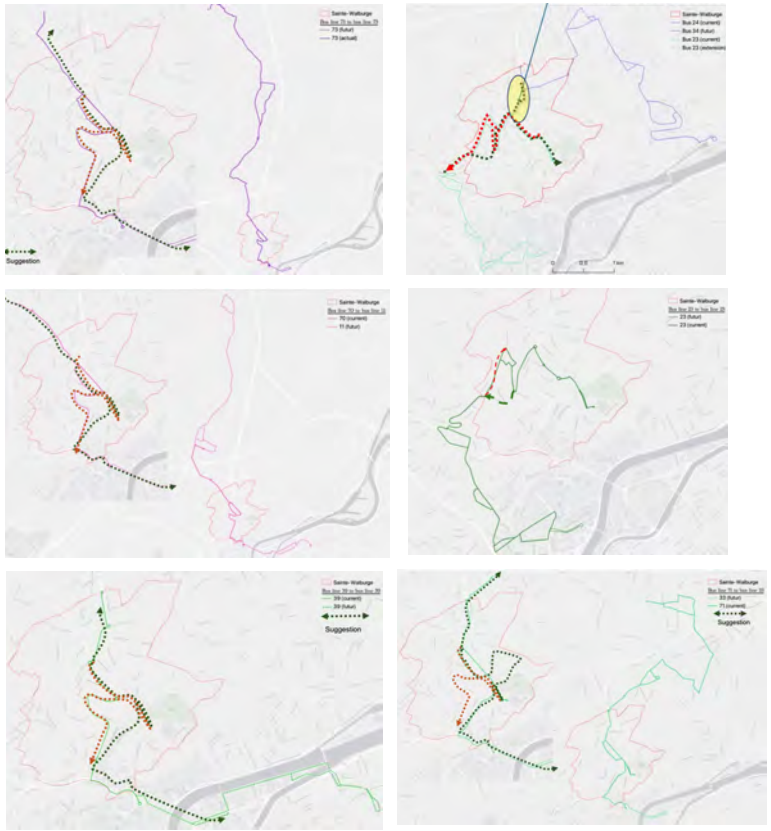
Inner Loop Alt. 1



Inner LoopAlt.2



Example of bus lines suggestion based on Alt.1



Cycling and pedestrian infrastructure based on Alt1 & Suggestion1 (node9)

1 P&R Center

Car park + Bike Station (ex : South Korea)

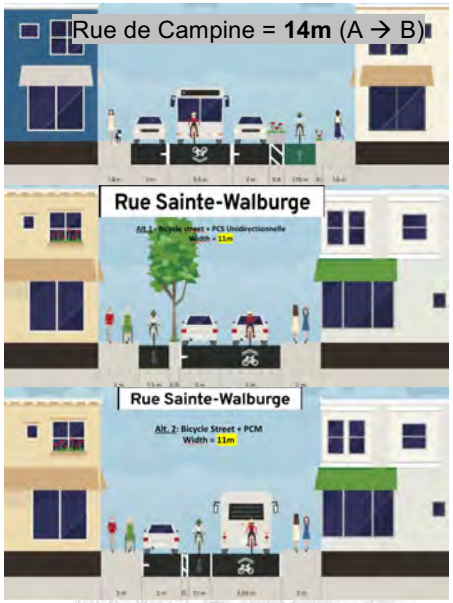
2 Bike center

Bike Shelter

3 Bike Sheltter(ex : South Korea)

Proposed plan for the main road

Rue Sainte-Walburge = **12m** (C → D)



Mobility Plan Development : two alternatives for the inner loop, bicycle suggestions infrastructures and main road of the neighborhood

As previously analysed, we proposed installing **directional signage** to encourage drivers to use two interchanges on the E25 highway to access the city centre. This approach aims to divert a significant portion of city-bound traffic from passing through the community area of the study zone. We refer to this proposed route as the **"Outer Loop."** (see the figure "**Mobility Plan Development : Extensive Filtering of bypass traffic – *The Outer Loop*** on page 17). The Outer Loop provides clear guidance for highway-to-city routes while emphasizing the inconvenience of passing through the community area

In addition to the Outer Loop, we proposed **an "Inner Loop**" utilizing key roads such as Rue de Campine and Montagne Sainte-Walburge to improve traffic circulation within the community. The Inner Loop involves **converting certain two-way roads into one-way streets to optimize internal traffic flow.** This loop connects major points within the community and supports both public transport and resident mobility.

To implement the Inner Loop, we analysed the directionality, structure, and usage patterns of connected roads and proposed new traffic directions where necessary. **These changes aim to ensure that residents can easily navigate within the community while discouraging non-local traffic.** Measures such as restricted right turns, and the strategic use of one-way streets were recommended to **make bypassing the community less convenient**. This dual-layered approach allows for both primary and secondary filtering of bypass traffic.

Road direction changes must be carefully reviewed to avoid restricting access to major attractors.

- Based on this review, we proposed two alternatives.
  - The **first alternative (Alt.1)** restricts highway access for hospital visitors to a single route, effectively separating their traffic from internal community flows and controlling through-traffic heading toward the city centre. While this approach has the advantage of traffic flow separation, it may cause localized congestion within the community.
  - The **second alternative (Alt.2)** allows multiple access routes to the highway, distributing traffic more evenly but making it harder to filter non-hospital-related through-traffic. Given the expected reduction in traffic from the Outer Loop, we propose maintaining both alternatives for further consideration.

The implementation of the Inner Loop requires changes to the existing public transport routes to align with the new road directions. We analysed the compatibility between current routes and the proposed traffic flow directions. When incompatibilities were identified, we redesigned the affected routes to ensure they followed the new road directions.

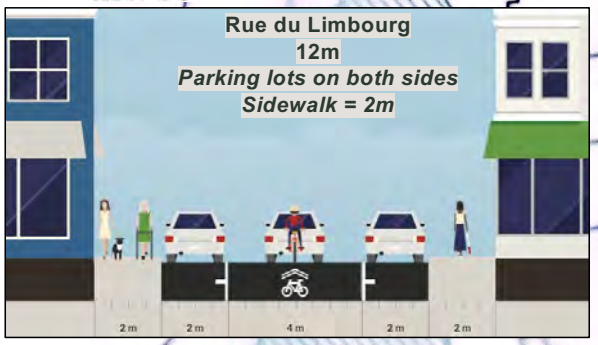
Although the current public transport system effectively connects residential areas with major attractors, a significant issue is the need for at least one transfer to reach the city centre. To address this, **we proposed extending certain bus routes to provide direct, transfer-free access to the city centre.** While these extensions are not yet reflected in the GIS data, their inclusion is critical for improving public transport connectivity.

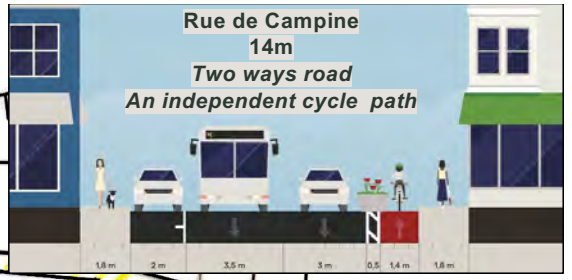
For cyclists, we proposed creating bike lanes by converting key roads into one-way streets. These lanes will connect green spaces and major attractors within the community. We also recommended establishing bike centers at the northern and southern edges of the study area, equipped with parking facilities and bicycle shelters within P+R (Park and Ride) systems. Additionally, we proposed separating bike lanes from vehicle traffic by positioning them between sidewalks and parking spaces, with a buffer area protection when it's possible enhancing cyclist safety.

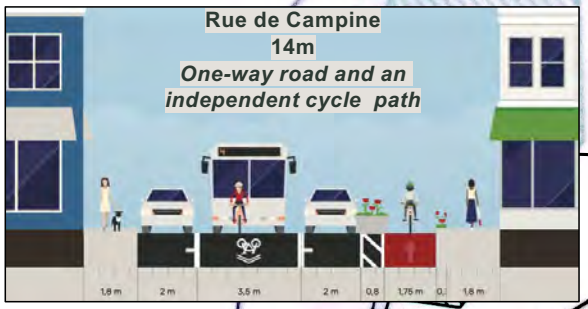
For pedestrians, we proposed widening existing sidewalks and developing a pedestrian network to improve accessibility to public facilities. These measures aim to address the irregular and narrow sidewalks currently present, enhancing pedestrian safety and convenience.

- These recommendations are expected to positively impact modal share, encourage sustainable urban development, and improve the overall quality of life in the study area. However, challenges remain in creating continuous bicycle lanes due to the close proximity of residential buildings and limitations on relocation or compensation.

8. Urban design of the node9 Suggestion 1







- **Sidewalk = at least 1.8m**
- **One-way car road = 3m**
- **One-way bus road = 3.5m**
- **Parking width = 2m**
- **One-way cycle-path (PCS) = at least 1.5m (+ buffer area 0.5 – 0.8m)**
- **Marked cycle path (PCM) = at least 1.10m**

R = Parking for residents
S = Parking for stores - shops

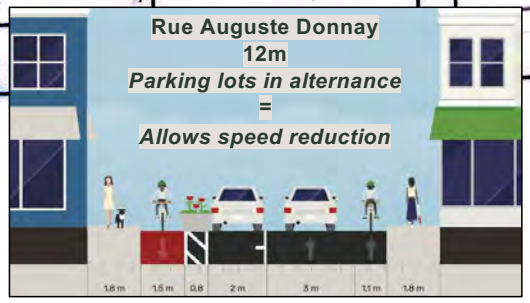
The blue U reverse = bike parking

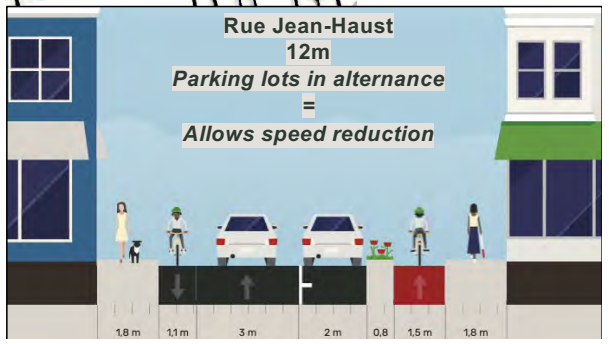
The blue rectangle = shared bike racks and bike storage (cf. suggestion 2)

Green point and triangle = small green area with shrubs in priority to avoid obstructing the view

Bike path (PCS + PCM)

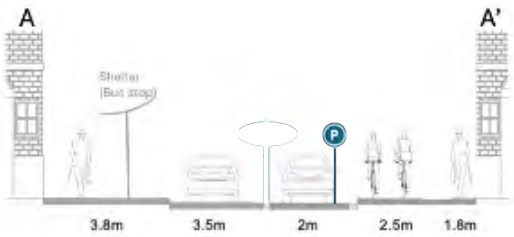
BUS STOP on the road

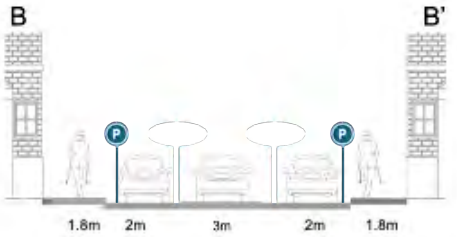


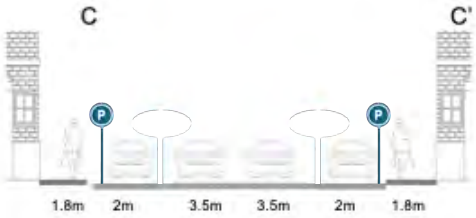


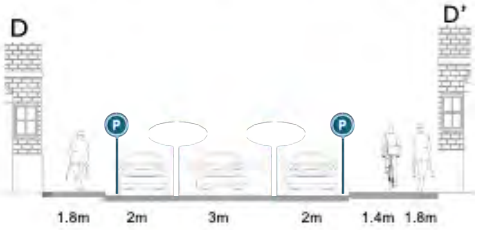
1/17/25

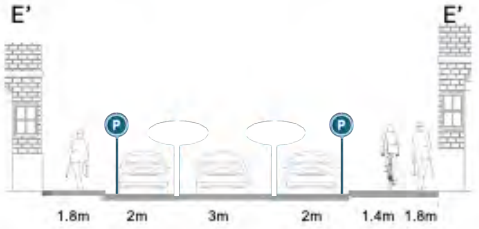
8. Urban design of the node9: Suggestion 2











Bike Station

Paving example of the mixed zone(30m)

Usage example of mixed zone(30m)

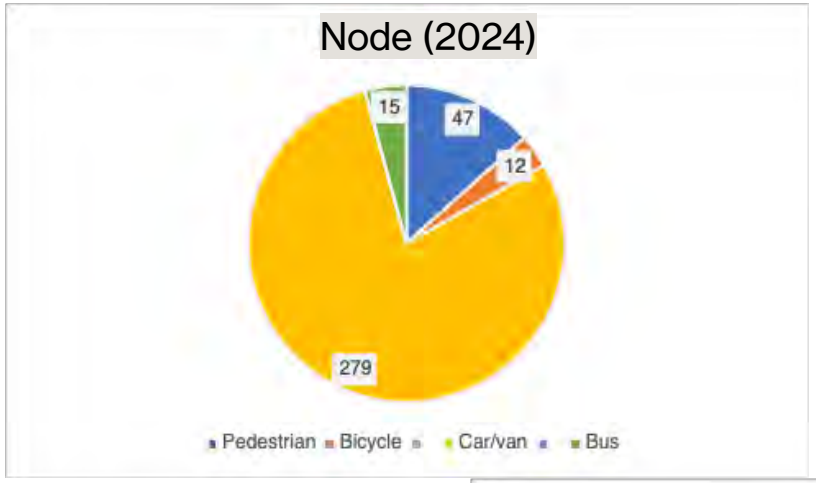
	Current situation	Suggestion 1	Suggestion 2
PROS	• A few parking spaces dedicated to customers of the carrefour's shops (drug store, pizzeria, library) • Zone served by bus • Residential streets perpendicular to rue de Campine have priority on the right • Lighting of pedestrian crossings	1. Reduction of official public parking space in favour of a **marked residential car park** on the street 2. Promotes **sustainable transportatio**n through expanded bike lanes and pedestrian-friendly spaces **3. Shared bike racks** **4. Extending the pavements around the shops** will reduce the speed of vehicles turning into the other streets **5. Continuity of safe and smart well-lit cycle paths** 6. Reduced distance between streets for cyclists and pedestrians 7. A single lane shared by bus and car with a **bus stop on the road** keeps the right of way for cars and slows down traffic → Discourages commuters from travelling to city by using this junction	1. Enhances safety for **cyclists and pedestrians** by implementing separated and elevated bike lanes. 2. Promotes **sustainable transportation** through expanded bike lanes and pedestrian-friendly spaces with vegetation 3. **Improves traffic flow** with one-way streets and well-designed road layouts. 4. Facilitates multi-modal transport with **bicycle stations and integrated public transport facilities.** 5. **Boosts community and commercial activity** by designing the central intersection as a multifunctional event space. 6**. Reduces traffic speed** with colourful pavements, speed humps, and clear lane markings, improving overall safety.
CONS	• Poor road conditions (except rue de Campine) • Pavements narrow in some places • Lack of cycle paths and facilities (no secure bicycle storage) • Dangerous right-of-way junctions • Non-compliance with the 30km/h speed limit • Heavy flow of cars (>200 / 30min) • By-pass traffic from/to highway – city centre • Only a few residential car parks • Cars parked partly on pavements • Off-street bus stop • No-vegetation	1. Challenges in ensuring smooth coexistence of bicycles and vehicles on shared roads (rue du Limbourg, some parts of rue de Campine) 2. Preservation of parking area on either side of street (rue de Campine and rue du Limbourg) : no private garage and few options for relocating existing parking spaces 3. For reasons of safety and visibility, there is little vegetation or trees	1. Potential for traffic accidents due to the complexity of the redesigned intersection. 2. Requires careful management of alternative routes during temporary road closures for events. 3. Limited parking space reduction may not fully align with sustainability goals*. 4. High implementation costs for elevated lanes, colourful paving, and additional infrastructure. 5. Challenges in ensuring smooth coexistence of bicycles and vehicles on shared roads. *To achieve the sustainable goals, we need to reduce car use and increase walking and cycling. To do this, we need to increase space for pedestrians and cyclists instead of parking lots. However, we did not reduce the number of parking lots in this plan much. As a result, we did not make a significant difference in securing space for pedestrians and cyclists.

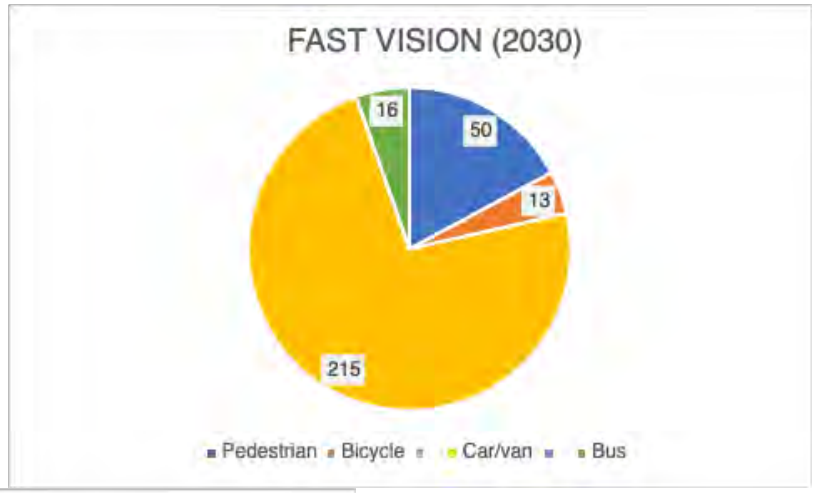
Modal share projection for 2030

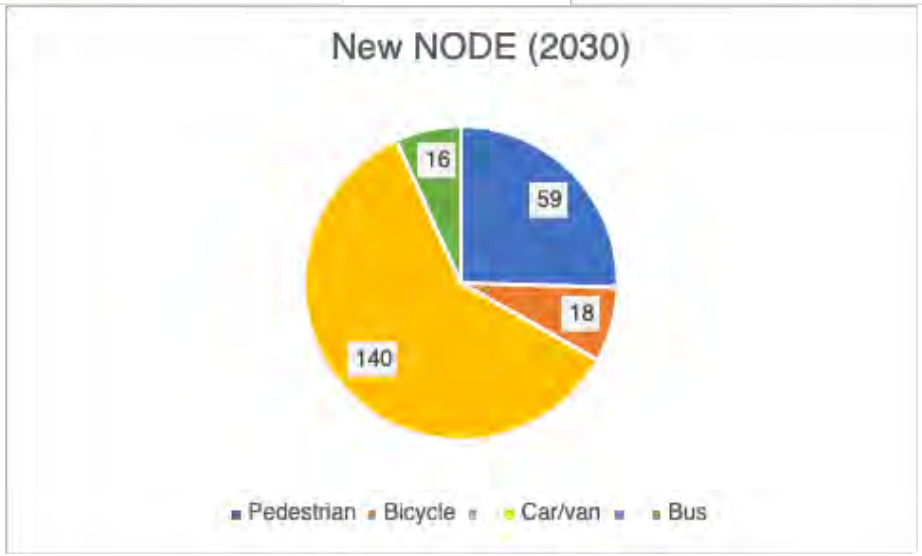
Based on suggestion1, we have attempted two projections concerning the future distribution of traffic patterns in the neighbourhood, and more specifically at junction 9.
Modal share projections are for a 30-minute period (school day and weekend combined).

1. **FAST VISION** (cf. Task 1 and task2) : 5% increase in walking, cycling and public transport. 23% reduction in car use.

2**. More ambitious FAST VISION for the new node 2030**:
- 25% increase in pedestrians
- 50% increase in cycling thanks to new facilities and continuous cycle paths
- 50% reduction in the number of cars: a ban on driving down Rue de Campine from Avenue Victor Hugo would halve the current flow of traffic. A one-way street for the lower section would also halve traffic.
- About the projected bus share in rue de Campine, we are retaining the 5% increase in the FAST vision : the current 15bus / 30min is for a two-way road but our suggestion 1 create a one-way road Rue de Campine → One flow will disappear completely. However, the ban on cars coming from Avenue Victor Hugo will allow public transport to flow more freely. The balance between the two supports our vision of FAST2030







Urban Design : Suggestion 2 (annex for the presentation)

This proposal focuses on utilizing the large intersection at Node 9, the most complex junction in the community area, to create a space specifically designed for the safety of cyclists and pedestrians. Node 9 is a five-way intersection with a paved area of 1,300 square meters within a 30-meter radius from its center. The wide road widths in this area, combined with the potential space gained by implementing one-way traffic on Rue de Campine, allow for the expansion of both bicycle lanes and sidewalks.

The structural features of the five roads connected to Node 9 are detailed as follows:

Rue de Campine (southbound) is planned as a one-way street with 1.8-meter-wide sidewalks on both sides for pedestrians. A 2.5-meter-wide bicycle lane, elevated to the same height as the sidewalk, will be added on the right side of the road, separated from motor vehicle traffic. This separation ensures cyclist safety and creates flexible usage space shared between pedestrians and cyclists due to their intermittent movement patterns.

A 2-meter-wide on-street parking lane will be placed between the bicycle lane and the motor vehicle lane, at the same level as the vehicle lane but lower than the bicycle lane. This separation provides a clear physical barrier, further improving cyclist safety and potentially increasing the modal share of cycling. The on-street parking lane preserves a sufficient number of parking spaces to meet the needs of community residents. A 3.5-meter-wide motor vehicle lane is planned, designed to accommodate both cars and buses.

In areas where buses operate, the vehicle lane width will be slightly increased to 4 meters to facilitate smooth public transport movement. Bus stops will be clearly marked to warn other vehicles and ensure safe boarding and alighting for passengers. On the left side of the road, the layout mirrors the right side, with a 2-meter parking lane, a bus stop zone (in place of parking where buses stop), and a 1.8-meter-wide sidewalk. Bus shelters and related facilities will be installed to enhance convenience for public transport users. At the intersection, a bicycle station and parking area will be added to support seamless transitions between cycling and public transport. These facilities are expected to also boost foot traffic and local commercial activity.

The northern section of Rue de Campine will remain a two-way street, with one segment planned as a shared road for bicycles and motor vehicles. Bicycle-priority markings will be added to the road surface to ensure cyclist safety. This segment, which accommodates public transport, will have a motor vehicle lane width of 3.5 meters and 1.8-meter-wide sidewalks on both sides. A 2-meter-wide on-street parking lane will be included on both sides of the road, and a bicycle station will be installed at the intersection to further support cycling. Traffic signals and raised speed humps will be added to improve pedestrian safety and reduce traffic accidents.

Rue Jean Haust is designed as a one-way road for south-to-north traffic. Since this road does not accommodate public transport, the motor vehicle lane will have a reduced width of 3 meters. On-street parking lanes (2 meters wide) and sidewalks (1.8 meters wide) will be included on both sides. To reduce congestion, traffic will be restricted to Rue de Campine, and access to Rue du Limbourg and Rue Auguste Donnay will be blocked. Rue Auguste Donnay will be a one-way road from southwest to northeast. Like Rue Jean Haust, the motor vehicle lane will be 3 meters wide, with 1.8-meter-wide sidewalks and 2-meter-wide on-street parking lanes on both sides. A 1.4-meter-wide bicycle lane will be added on the southern side, elevated to the same height as the sidewalk. This road will connect to three directions: south and north Rue de Campine and Rue du Limbourg.

Rue du Limbourg will follow a similar design to Rue Auguste Donnay, with a 1.4-meter-wide bicycle lane elevated to sidewalk height on one side. The road will be designed to ensure a uniform speed limit of 30 km/h, with a reduced limit of 20 km/h within 30 meters of the intersection to improve safety for pedestrians and cyclists.

Within a 30-meter radius of the intersection, the pavement will be distinguished with colorful materials to alert drivers to reduce speed. Major roads like Rue de Campine will have marked directional lanes to guide vehicles safely through the intersection. Speed humps with a total width of 3 meters will be installed at each road entry point to enforce speed reduction. Trees and streetlights will be placed between parking lanes and bicycle lanes to create a pleasant environment for cyclists and pedestrians.

The central area of the intersection will feature a unified paving design to provide a sense of openness. On special occasions, this area could be temporarily closed to traffic and used as a multi-functional space for community activities and events. While this design introduces a more user-friendly environment, potential challenges include managing traffic accidents at the intersection and identifying alternative routes during event-related road closures.

This proposal focuses on creating a safer and more accessible environment for all users while promoting sustainable modal share changes in the community.

9. Scientific References & Bibliography

Belgian Daily Mobility (BELDAM) 2012. (2012). SPP Politique Scientifique (BELSPO), SPF Mobilité et Transports.

Colfs, B. (2022). *Rue ou zone à trafic limité: Contrôle des signaux C3 et F103 à l'aide de caméras ANPR par les communes (Cémathèque n°54)*. SPW Mobilité Infrastructures. https://mobilite.wallonie.be/files/cematheque/cematheque_0054.pdf

En matière de mobilité, le temps compte (Time Matters). (2024, December 6). Projet Urbain. https://projeturbain.net/2024/11/29/en-matiere-de-mobilite-le-temps-compte-time-matters/

Flas, M. (2024). *Urban planning and transportation: Pedestrian flow measurement*. Département ArGEnCo, Faculté des Sciences Appliquées, ULiège.

Fluidité Accessibilité Sécurité Santé Transfert modal (FAST): Vision de la mobilité wallonne à 2030. (2019). Gouvernement Wallon. https://mobilite.wallonie.be/files/eDocsMobilite/politiques%20de%20mobilité/FAST%20Mobilite%20Wallonie%202030.pdf

Institutions de soins. (2024, October 15). SPF Santé Publique. https://www.health.belgium.be/fr/sante/organisation-des-soins-de-sante/partage-de-donnees-de-sante/institutions-de-soins

Le premier 'éclairage intelligent' de Belgique installé le long d'une piste cyclable de 22 km en Flandre. (2019, December 23). RTBF. https://www.rtbf.be/article/le-premier-eclairage-intelligent-de-belgique-installe-le-long-d-une-piste-cyclable-de-22-km-en-flandre-10392543

Le projet du téléphérique Liégeois se poursuit !. Ville De Liège. https://www.liege.be/fr/vie-communale/services-communaux/mobilite/actualites/le-projet-du-telepherique-liegeois-se-poursuit

Leclercq, A. (2020, July 16). Alimentée par le soleil, cette piste cyclable s'allume à la nuit tombée ! Une invention géniale. *POSITIVR*. https://positivr.fr/pologne-piste-cyclable-eclairage-solaire-luminophore/

Les grandes villes wallonnes: A chacune sa mobilité. (2018). SPW, DGO2, Direction de la Planification de la Mobilité. https://www.wallonie.be/fr/publications/les-grandes-villes-wallonnes-chacune-sa-mobilite

Masuy, A. *Principaux résultats de l'enquête sur la mobilité des Wallons - MOBWAL 2017: Regards Statistiques n° 5*. (2020). Institut Wallon de l'Evaluation, de la Prospective et de la Statistique (IWEPS). https://www.iweps.be/wp-content/uploads/2020/12/RS5_MOBWAL.pdf

Petit Jean, M. (2024). *Sainte-Walburge, a lively and green neighborhood in which mobility is a nightmare*. Comité de Quartier de Sainte-Walburge.

Petit Jean, M. (2022). *Plan de mobilité et de sécurité routière: Campine - Xhovémont.* Comité de Quartier de Sainte-Walburge.

Liège - Plan communal de mobilité: Actualisation novembre 2021. (2021). SPW Mobilité. https://www.liege.be/fr/vie-communale/services-communaux/mobilite/actualites/actualisation-du-plan-communal-de-mobilite

Liège - Plan communal de mobilité: Annexe - MONITORING novembre 2022. (2022). SPW Mobilité. https://www.liege.be/fr/vie-communale/services-communaux/mobilite/actualites/actualisation-du-plan-communal-de-mobilite

9. Scientific References & Bibliography

Plan urbain de Mobilité de l'agglomération de Liège (PUM de Liège). (2019). Gouvernement Wallon. https://mobilite.wallonie.be/files/PUM-LIEGE/PUM-LIEGE-rapport-final-mai-2019.pdf

Projet de territoire de Liège. (2024). Ville de Liège. https://www.liege.be/fr/vie-communale/services-communaux/sdc/le-projet-de-territoire#:~:text=Li%C3%A8ge%2C%20ville%20fertile,-Les%20conditions%20physiques&text=L'objectif%20est%20de%20changer,rend%20plus%20habitable%2C%20plus%20%C3%A9cologique.

Schéma de Développement de l'Arrondissement de Liège (SDALg). (2017). Liège Métropole, Conférence d'arrondissement des Bourgmestres et du Collège provincial de Liège A.S.B.L.

Schéma de Développement du Territoire (SDT): Optimisation spatiale. (2024). Wallonie. https://territoire.wallonie.be/storage/territoire/documents/content/publication/sdt-web-pages.pdf

SPW. *Sécurotheque*. https://securotheque.wallonie.be/home.html

Stationnement des vélos en et hors voirie: Règles et bonne pratiques. (2016). SPW, DGO1. https://ravel.wallonie.be/files/pdf/Documentation/Amenagements_cyclables/Fiche_stationnement_velo_mai2016.pdf

Stratégie Régionale de Mobilité: Volet I - Mobilité des personnes. (2019). Wallonie. https://mobilite.wallonie.be/files/eDocsMobilite/politiques%20de%20mobilité/SRM_PERSONNES_2019.pdf

Stratégie Régionale de Mobilité: Volet II - Marchandises. (2019). Wallonie. https://mobilite.wallonie.be/files/politiques-mobilite/SRM-marchandises-2020.pdf

ScienceDirect

Faherty, M., McArdle, G., & Tafidis, P. (2024). Envisioning sustainable urban mobility in Dublin: Stakeholder perspectives and system dynamics. *Transportation Research Interdisciplinary Perspectives*, *28*, 101280. https://doi.org/10.1016/j.trip.2024.101280

George, S., Salomo, K., & Helbig, M. (2024). Spatial advantages of highly educated individuals in Germany: Is sustainable mobility an expression of privilege? *Cities*, *156*, 105507. https://doi.org/10.1016/j.cities.2024.105507

La Rocca, R. A. (2010). Soft mobility and urban transformation. *TeMA*, *2*. https://doi.org/10.6092/1970-9870/12

Moslem, S., Campisi, T., Al-Rashid, M. A., Simic, V., Esztergár-Kiss, D., & Pilla, F. (2024). Greening urban mobility: Assessing environmental and functional characteristics of bicycle infrastructure in the post-pandemic Era. *Habitat International*, *153*, 103200. https://doi.org/10.1016/j.habitatint.2024.103200

Stadnichuk, V., Merten, L., Larisch, C., & Walther, G. (2024). Optimisation of mobility hub locations for a sustainable mobility system. *Transportation Research Interdisciplinary Perspectives*, *26*, 101193. https://doi.org/10.1016/j.trip.2024.101193