2021

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RP 1st results 2021 N°18

AUTOMOBILE DEPENDENCE FOR COMMUTING TO AND FROM WORK

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Summary

Faced with the issue of greenhouse gas emissions and fair access to jobs, it's of interest to report on daily commuting and, in particular, the use of different modes of transport, especially in the Luxembourg context where reliance on the private car is historically and culturally important. Here, we explore the length, duration and modes of commuting for the employed, as reported in the 2021 census. We also attempt to identify any significant changes in travel practices since 2011, given Luxembourg's significant demographic growth. In 2021, the car remains by far the main mode of daily commuting. However, there are significant differences across the territory: travel varies according to place of residence, and therefore mainly according to the socio-demographic characteristics of the different locations.

Introduction

Luxembourg is one of the European countries with the highest level of car ownership per capita (678 per 1,000 inhabitants according to Eurostat in 2022[1]). As in many other Western countries, urbanization has occurred at the same time as car ownership and the development of the (auto-)road network, creating a snowball effect that reinforces car dependency. Against a backdrop of climate change, in which the transport sector is one of the main sources of greenhouse gas emissions, the challenges are manifold. Research shows that the cities that best adapt and respond to these challenges are those that plan their transport system and urbanization in an integrated way (Gerber et al. 2018). Indeed, the ability to limit car use in favor of a shift to public transport, soft mobility, or at least multimodality, requires not only the provision of these transport infrastructures, but also the reduction of urban sprawl and its fragmentation. This involves planning urban developments, residences and places of activity, in a dense and targeted manner over the territory, as suggested under the terms of «Transit Oriented Development» (Calthorpe 1993)[2] or more recently the quarter-hour city (Moreno et al. 2020)[3]. Beyond the environmental aspects, there are also numerous socio-economic issues at stake: access to modes of transport and living patterns, for example, can reflect inequalities in access to jobs or schools, or even segregation phenomena within the territory.

1 https://ec.europa.eu/eurostat/web/products-eurostat-news/w/ddn-20240117-1

2 The concept of transit-oriented development (TOD) aims to encourage the use of public transport and car-sharing. Areas designed according to this concept are centered (400 to 800-meter radius) around a station or transit hub (bus, metro, tramway) and surrounded by buildings of decreasing density towards the periphery.

3 The quarter-hour city is a development concept for a city in which all essential services are within a quarter-hour walk or bike ride (Carlos Moreno, 2015).

Like many European countries, Luxembourg has experienced a number of major shocks over the past two decades (global financial crisis, COVID-19), but seems to have bounced back without experiencing any slowdown in investment in its transport infrastructure. The last decade has seen a substantial improvement in public transport provision, with the introduction of the tramway, the development of P+R (park and ride) facilities, the reorganization of the RGTR bus network and the introduction of free public transport. Mobility is monitored on an ever-increasing scale (through a number of surveys[4], the digital mobility observatory[5], etc.), as are political measures to encourage the use of public transport[6] (MoDu 2.0, PNM 2035, PDAT 2035).

This clear commitment and monitoring has led to the emergence of new mobility behaviours, such as increased use of bicycles as daily transport, public transport, multimodality (the use of several modes of transport) and increased telecommuting. It should be remembered, however, that the context is also one of strong demographic growth, accompanied by at least partial modification of the characteristics of the population. It is therefore important to assess any change in mobility in the light of demographic or spatial changes. Understanding mobility and travel is essential to significantly improve the quality of daily mobility planning, and to ensure that every individual is able to reach the places where they work. We need to update our knowledge of mobility behavior, especially as the question of modes of transport has not been addressed in census publications since 2001, and the 2021 census more specifically addresses the issue of multimodality. Our objective here is therefore to analyze commuting behavior in Luxembourg, taking into account demographic and employment trends between 2011 and 2021.

Methodological insert 1

The 2021 census offers a new perspective on modes of transport. For the first time, residents of the Grand Duchy of Luxembourg were able to provide information on multiple travel mode choices[7]. Indeed, although home-work journeys are generally characterized by a main mode for the longest part of the journey, a home-work journey can be made by multiple modes, each with different distances and durations, which were able to be recorded in 2021. Nevertheless, as the last census was carried out at the time of the health crisis, some declared behaviors may be altered, misrepresented or even under- or over-represented. Insofar as these changes may blur the responses, a selection was made among the working population on the basis of travel time, distance and speed, in order to exclude atypical behaviors.

In this publication, we look at the various characteristics associated with the journeys of employed people working in a Luxembourg municipality. We analyze distances, times, modes of transport used and the characteristics of individuals at their place of residence. It should also be noted that, as with all publications relating to population census data, and despite their numerical importance and impact on internal daily mobility, incoming cross-border commuters will be excluded from these analyses.

In 2021, Luxembourg will have 287,067 employed residents, of whom just over 270,000 will be working in Luxembourg. Of these, 188,221 provided information about their daily commute to work. We made a further selection of these individuals, based on the consistency of their answers, both in terms of mode, duration of journey (less than or equal to 2 hours), and/or distance (less than or equal to 100 km). We thus consider 172,357 employed people in our analysis.

4 To give just two examples: the introduction of LuxMobil 2025 (https://transports.public.lu/fr/planifier/luxmobil2025.html), updating LuxMobil 2017 with a survey in CATI (Computer Assisted Telephone Interview) format, the MMUST transport simulation platform which, following the INTERREG project (2018-2022) of the same name, is being updated to 2025, and a new INTERREG project (2025-2028): MMUST +.

5 https://transports.public.lu/fr/planifier/odm.html

6 MoDu 2.0: https://transports.public.lu/fr/publications/strategie/modu-2-brochure-fr.html
PNM2035: https://gouvernement.lu/fr/dossiers/2022/pnm2035.html
PDAT: https://amenagement-territoire.public.lu/fr/strategies-territoriales/programme-directeur.html

7 The question asked in the 2021 census was: «Which means of transport do you normally use for a one-way trip on the same day to your place of work or study?». For each means of transport, please indicate its duration in minutes.

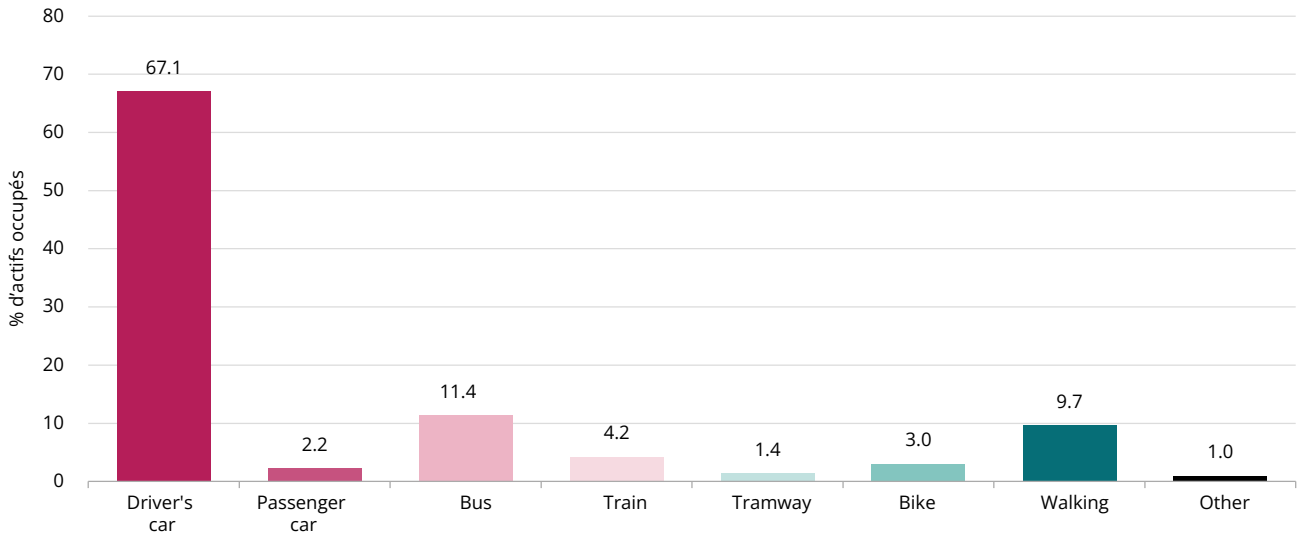
1.
Cars still predominate

In this first section, we look at the distribution of the main mode of transport and its evolution. As indicated in methodological insert 1, the 2021 census distinguishes between the main mode when it is used alone (single mode) or when it corresponds to the mode used for the longest part of the journey. We consider them together here.

In 2021 (Figure 1), the car will continue to be the preferred mode of transport to work for more than two out of three working people (around 67% as a driver, to which must be added 2.2% as a passenger). Public transport accounts for most of the remaining third: over 11% of working people use the bus, followed by the train (less than 5%) and then the tramway (less than 2%), whose use as the main mode remains limited given its limited geographical coverage. Soft modes of transport are divided between walking (nearly 10%) and cycling (3%).

The percentages linked to car use remain particularly questionable, both in view of the development of public transport, but also in view of the share of passengers (only 3.2% of the total car share) taking into account the low vehicle occupancy rate in Luxembourg[8] and despite efforts to promote car-sharing and car-pooling. Such car use also raises questions, given that a large proportion of the population is concentrated in the capital and its outskirts, or in the southern conurbation. In principle, these densely populated areas with their multiple functions should encourage the use of public transport, especially as we have observed a polarization of flows mainly towards these two poles (Ferro, Y. et al., 2024).

Figure 1: Distribution of employed residents by main mode of transport to work in 2021



Source: STATEC RP2021

Note: this graph refers to employed people who indicated that they worked in a known Luxembourg commune and provided information on their daily commute (N = 172,357).

8 https://transports.public.lu/fr/mobilite/transports-individuels/voiture.html

However, it is possible to observe a proportional decline in car use for commuting over the intercensal period from 2011 to 2021 (Table 1). Thus, still considering the main mode of transport (even if the comparison is not easy for several reasons, see methodological insert 2), the car's share has begun to fall by a few percentage points in ten years, from 72.3% in 2011 to 69.3% in 2021. This slight decline is essentially due to soft modes (walking, cycling) and does not seem to benefit public transport. More precisely, walking and cycling see their share increase between 2011 and 2021, from 8.4% to 12.7%, while the share of public transport remains unchanged at 17.6%, despite the undeniable improvement in the offer and the introduction of free public transport. While the decline in the share of car use remains tangible, it should be remembered that the number of working residents preferring the car will continue to rise between 2011 and 2021. The proportional decline in other modes of transport does not compensate for the increase in the number of working residents linked to the Grand Duchy's economic growth.

Methodological insert 2

The comparison between the 2011 and 2021 censuses needs to take several factors into account. The first is the arrival or development of other modes of transport, such as tramway, scooters or electric bikes, implying changes in behaviour linked to these new transport offerings. The second factor is the design of the census questionnaire, with the question on modes of transport changing in 2021. Indeed, it has been possible to enter several modes of transport for a home-work trip, as well as their characteristics (duration, number of trips, etc.). These design changes in 2021 make it easier to take multimodality into account when counting modes of transport. Lastly, Covid, having disrupted the behavior and characteristics of different journeys, may result in partial or situational information. As the 2021 census is the reference year, we replicate the same selection rules for 2011. Thus, for the sake of consistency and relevance, for the analyses that follow, we define specific categories including:

- soft modes (walking, cycling)
- public transport (bus, pick-up service, train, tramway),
- individual vehicles (passenger cars, drivers and mopeds),
- other modes (scooter, skate, roller, etc.).

Table 1: Distribution of employed residents by main transportation mode in 2011 and 2021

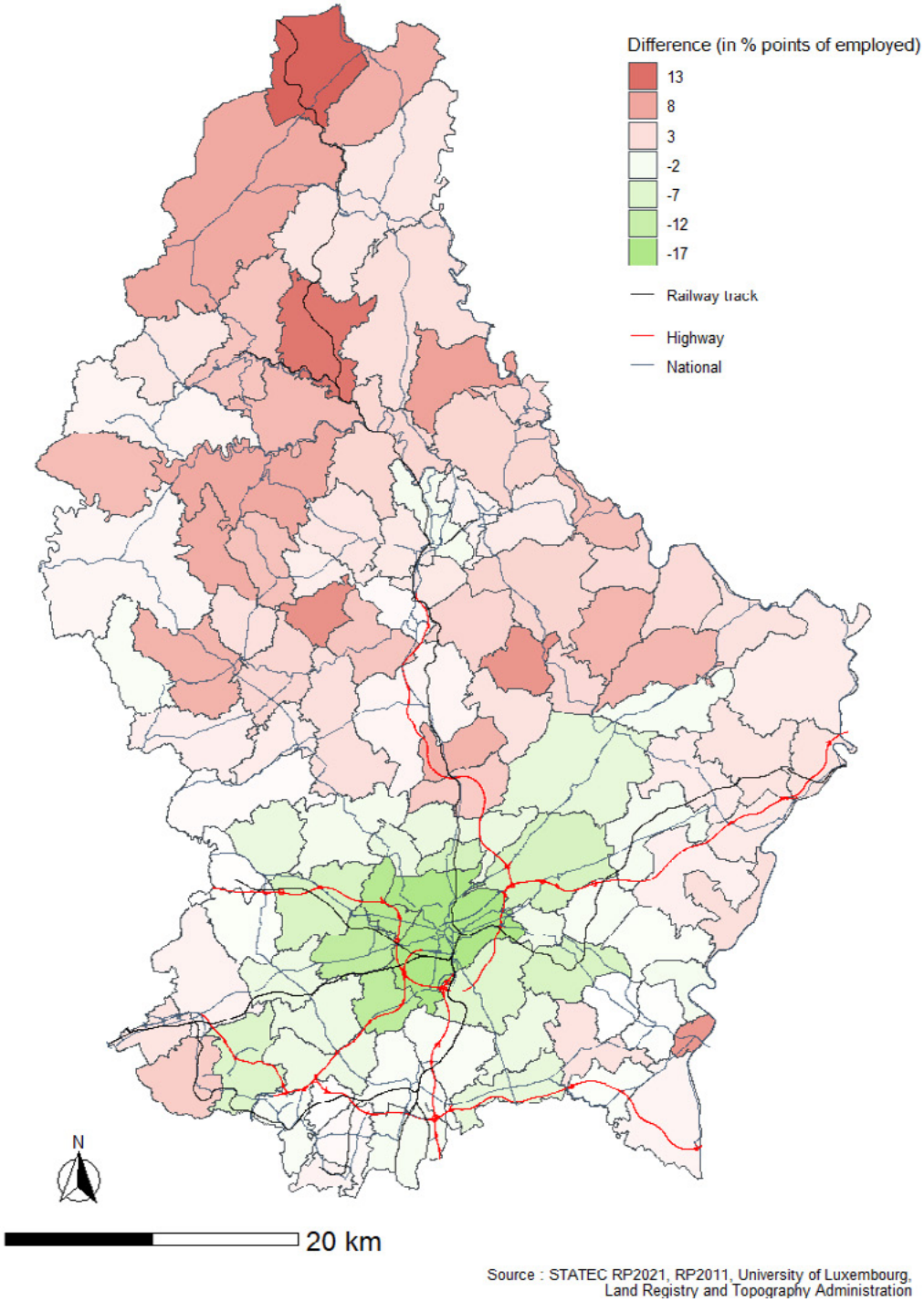
Main mode	Share of workers	
	2011	2021
Private vehicles (mopeds, cars with driver + passenger)	72.3%	69.3%
Public transport (Train, Bus, Pick-up service) + Tramway in 2021	17.6%	17.6% (16.2% + tramway 1.4%)
Soft modes (Walking, Cycling)	8.4%	12.7%
Other modes (scooters, skateboards, etc.)	1.7%	0.4%
Total	**100%**	**100%**

Source: STATEC RP2021, RP2011

Note: This table concerns employees who indicated that they work in a known Luxembourg commune and who provided information on their daily commute.

While there has been a national decline, the map below shows which communes have seen the biggest changes in car use.

Map 1: Change in the proportion of working people mainly using the car to commute to work between 2011 and 2021, by municipality of residence

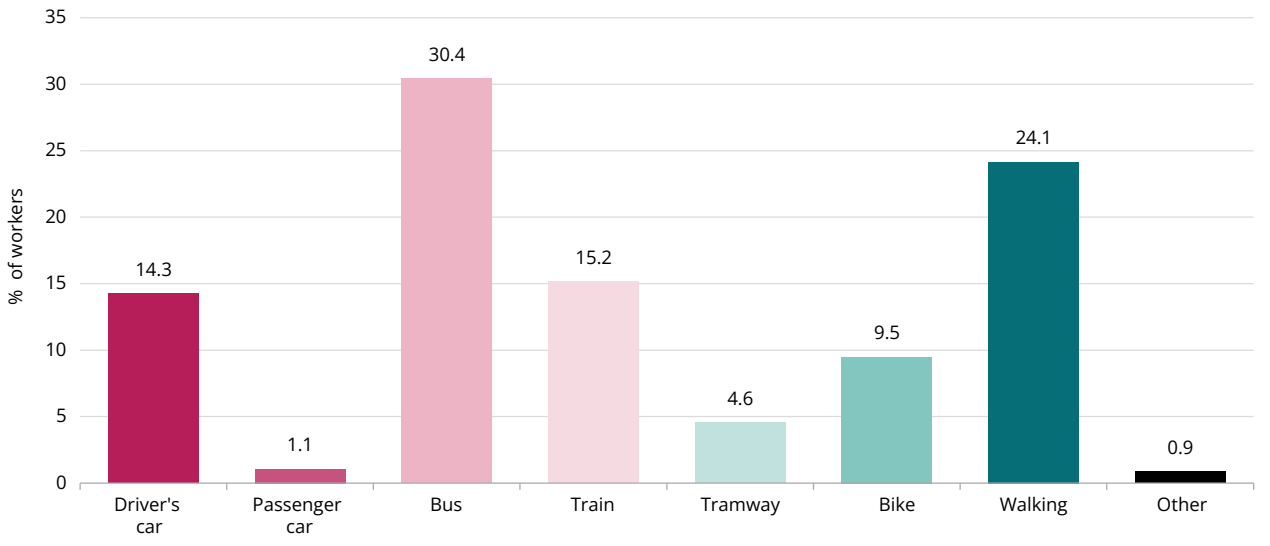


The biggest drop in the number of working people using the car as their main mode of transport (17 percentage points) is in Luxembourg City (from 55.6% to 38.5%), which is considerable given that this share is now relatively comparable to that of Paris (Atlas des mobilités, 2022). The communes around the capital are not left behind, with some showing a drop of between 5 and 15 percentage points in the number of working people. In the country's urban and suburban centers, the public transport offer is becoming more attractive and more developed, while at the same time concentrating more new residents travelling on foot, by bike or by public transport. On the other hand, in many municipalities in the north and along the borders, the proportion of working people using the car to commute to work has increased: up to 14 percentage points in Troisvierges and 12 in Kiischpelt. Despite a well-developed and free rail network, and in view of the growing population, these municipalities are seeing an increase in car use. On the one hand, this may suggest that, as people move further away, modal shift (switching to a mode of transport other than the car) is increasingly difficult to achieve for reasons of time or flexibility, since work is only one activity in a chain of daily activities, and the time available within 24 hours is limited. This may also suggest a change in the polarization of workplaces within these communes, with the arrival of a population working in potentially more distant locations and more dependent on the car. Finally, it may also point to a greater distance of new housing from stations and bus stops, and thus a more dispersed recent urban sprawl.

We also take a closer look at the issue of multimodality. Less than 20% of employed people use at least two modes of transport to get to their place of work, i.e. 34,460 people according to the 2021 census. Figure 2 shows in more detail how these 20% are distributed according to the mode used for the longest part of the journey.

Buses top the list for 30.4% of working people using several modes of transport, followed by walking (24.1%) and trains (15.2%). Buses and especially trains are generally complemented by walking. Cars are still widely used, at 14.3%, ahead of bicycles (9.5%) and trams (4.6%).

Figure 2: Main mode of transport used by workers who use at least two modes of transport to commute to work



Source: STATEC RP2021

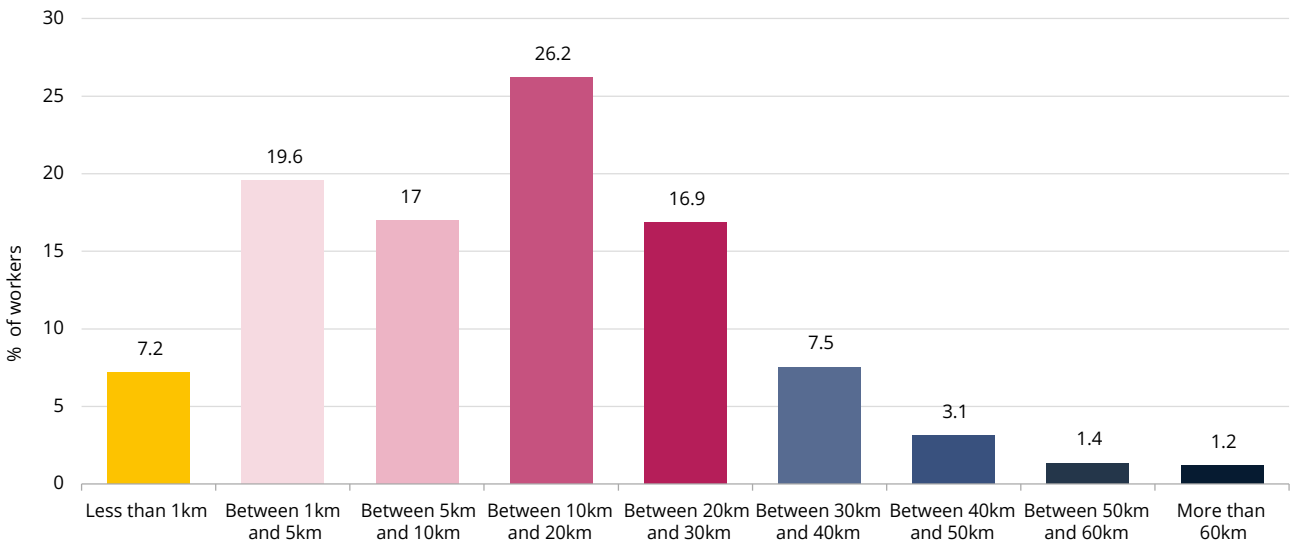
Note: this graph concerns only working people using at least two modes of transport, who indicated that they work in a known Luxembourg commune and who provided information on their daily commute (N = 34,460).

2.
Distance and time to jobs, revealing residential preferences

In a context of substantial population growth, polarization of work flows towards the main hubs (Ferro et al., 2024) and high residential costs, but decreasing with distance from Luxembourg-City, the question of distance to work is paramount. It is therefore particularly interesting to observe the distribution of the population according to the main mode used and the distance to work. Let's start by looking at the distribution of distances travelled[9] (Figure 3).

In terms of distance to work, the working population is distributed as follows: 70% of employed people live within 20 km of their place of work, 86.9% within 30 km and 94.4% within 40 km. This distance, as previously suggested, partly dictates the mode of transport used (Figure 4), and even its evolution, as does the urban structure (for example, the distance class between 10-20 km corresponds in particular to the many trips between the capital and Esch-sur-Alzette).

Figure 3: Distribution of residents by distance to work (one-way)

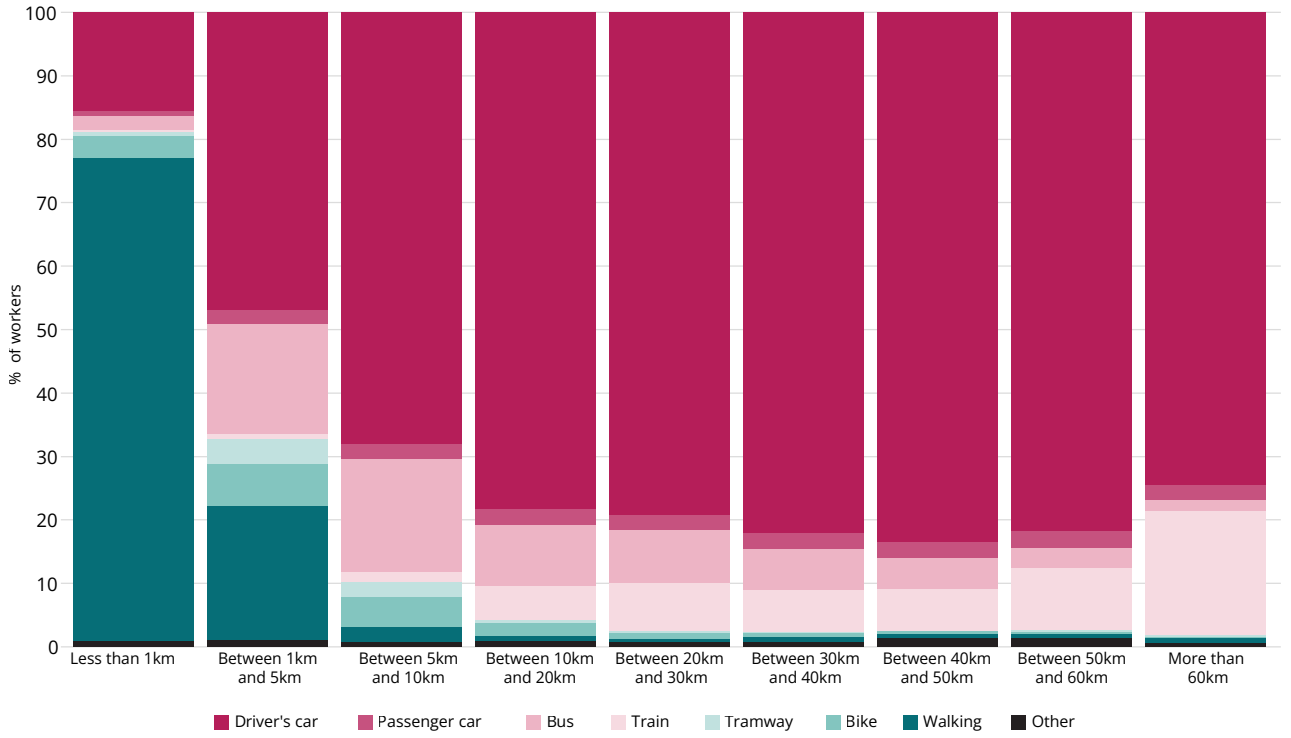


Source: STATEC, RP2021

Note: This graph concerns employees who indicated that they work in a known Luxembourg commune and who provided information on their daily commute (N = 172,357).

9 These are the distances indicated by the respondents, for a one-way trip.

Figure 4: Residents' main mode of transport by distance travelled to work



Source: STATEC, RP2021

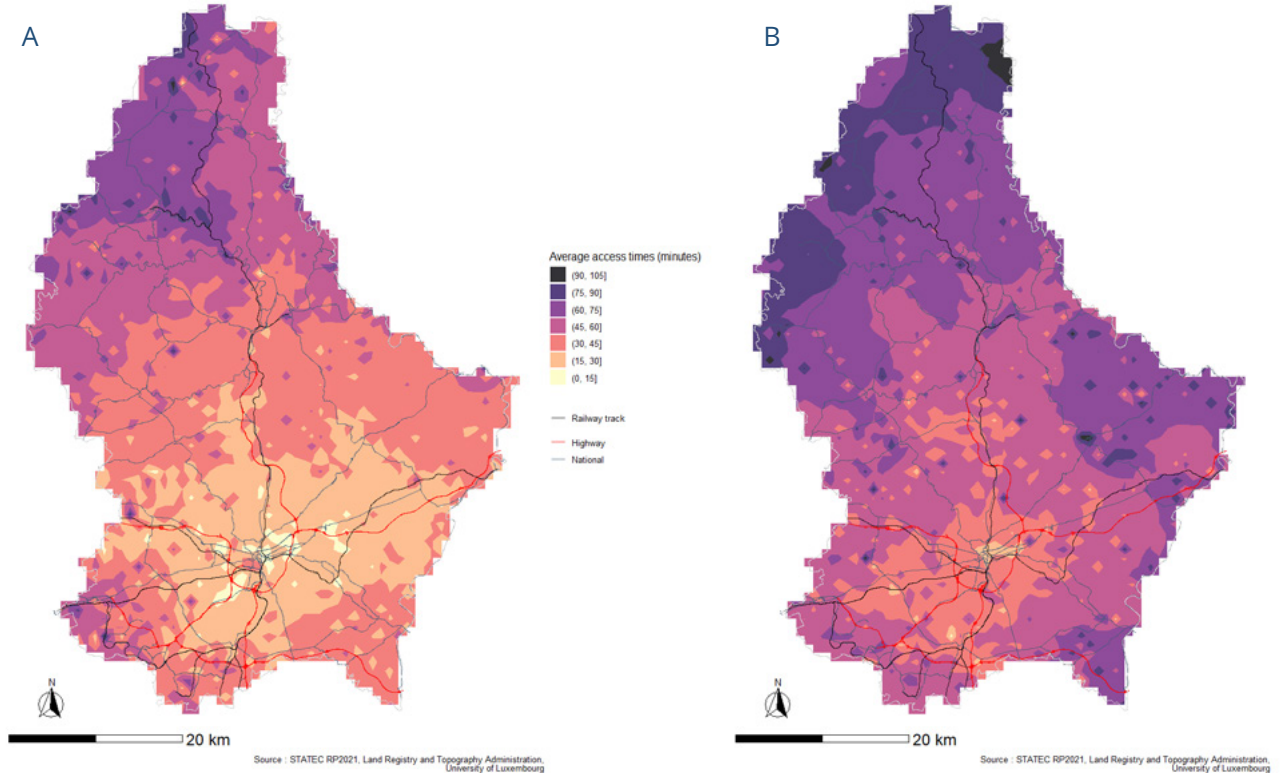
Note: This graph concerns employees who indicated that they work in a known Luxembourg commune and who provided information on their daily commute (N = 172,357).

Note for the reader: 78.3% of working people who travel less than a kilometer to work walk and 15% drive.

Logically, as distance increases, the proportion of working people using walking decreases. For example, 78.3% of working people who travel less than 1 km do so on foot. This figure drops to 21.5% when the distance is between 1 and 5 km. Unfortunately, within 5 km of the workplace, which is just about the limit of the «quarter-hour city» by bicycle, the car is already used by half of working people (49%). For the majority of the population living more than 5 km from their workplace, motorized modes of transport dominate, particularly the car and bus (more than 70% of working people between 5 and 10 km). From 10 km upwards, train use increases, while bus and car use decreases, the main reason being the speed performance of these two modes, and therefore time. The tramway is in an intermediate position, being used mainly for journeys of 1 to 10 km, while walking, car and bus remain the preferred modes for journeys of less than 5 km, and car and bus for journeys of more than 5 km.

If distance helps explain the choice of the main mode of transport used, journey time is also an explanatory factor. This is undoubtedly all the more true in Luxembourg, given the size of the territory and the distribution of its population, and given that the country is particularly well served by transport infrastructures. As an example, we focus on the travel times reported by employed residents of the Agglomération-Centre (Ferro et al. 2024) (see Maps 2).

Maps 2: Average journey time to the Agglomération-Centre by car (A) and by public transport (B)



Thus, although public transport infrastructure is fairly extensive in Luxembourg, the choice of the car can be explained by travel time (maps 2A and 2B). Looking at the isochrones (geographical zones plotted according to travel time), differences emerge, with travel times by car systematically lower than those by public transport: according to information provided by working people in the last census, users take an average of 41.5 minutes by car to get from their home to their workplace (located in the Agglomération-Centre), compared with 59.7 minutes by public transport[10]. These differences in access times to the Agglomération-Centre are all the more apparent from the communes on the outskirts of Luxembourg-City. Access times by car are also shorter (than those by public transport) from Steinfort, Mersch and Grevenmacher. Although the road infrastructure in the southern conurbation is well-developed, car journey times are still quite high, due to the density of the population and inbound commuters, and thus to congestion, which drastically extends the journey time for internal workers. Finally, the vast majority of communities north of the Nordstad can be reached by car in at least 45 minutes, and by public transport in at least 60 minutes. However, it should be pointed out that, on average, this is only a quarter of an hour difference. And that's more time lost by car than by public transport.

10 These travel times correspond to the declarations of individuals. They are therefore affected by memory, perception, etc.

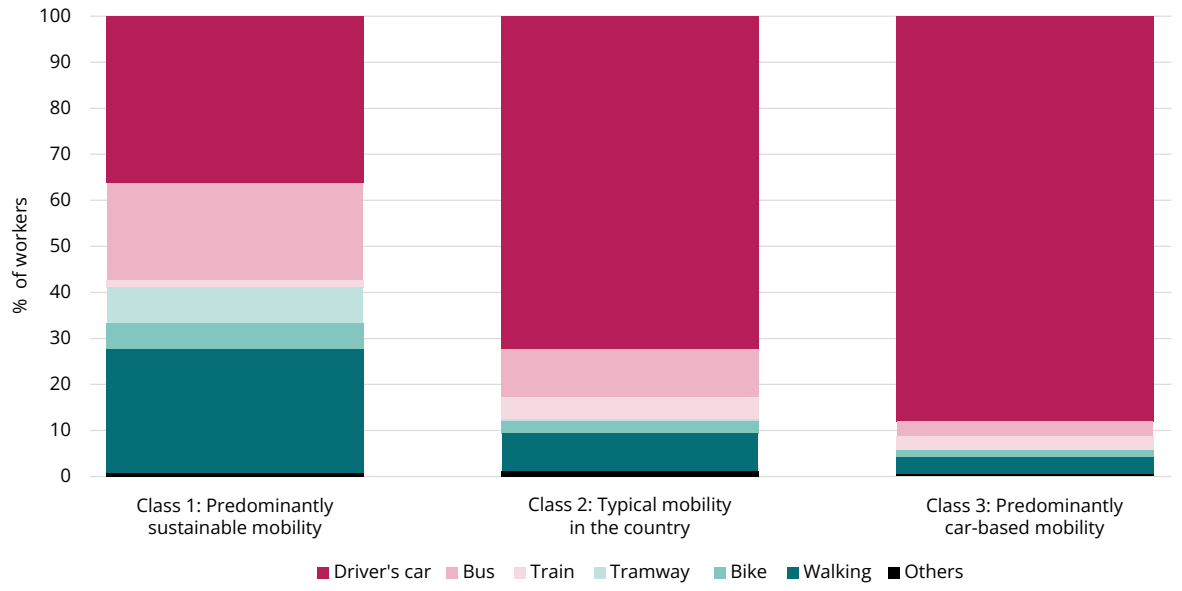
3.
Modal choice induced by residential location

In addition to travel distance and time, mode use is also implicitly linked to place of residence and workplace accessibility. Taking into account the main modes used for commuting, we have established a typology of 1 km² inhabited cells. The statistical technique used (hierarchical ascending classification) automatically groups cells progressively according to their similarity in terms of the share of the workforce using each mode of transport. This technique highlights the main types of mobility present in the area. After several tests, we have chosen a three-class spatial typology (see Figure 5 and Map 3).

The three classes that emerge from this analysis are :

- Class 1 corresponds to "Predominantly sustainable mobility", with more users of soft modes and public transport (63% in total), while car use is in the minority, but still significant, at 36.3% of working people.
- Class 2 corresponds to «Mobility typical of the region», as it is close to the national averages observed in section 1 of this publication for modal shares (figure 1). Car use predominates for three-quarters of the working population concerned (72.4%), with the remainder using soft modes and public transport (26.6%).
- Class 3, called «Predominantly car-based mobility», is characterized by the «hegemony of the car», with almost 88.1% of working people using the car to get to work, and very few using other modes.

Figure 5: Relative share of main modes according to spatial mobility typology



Source: STATEC, RP2021

Note: This graph relates to people who indicated that they work in a known Luxembourg commune and provided information on their daily commute (N = 170,222).

Note for the reader: 88.1% of working people living in class 3 cells travel to work by car.

In geographical terms, the typology adopted reveals a country with few contrasts (see Map 3). One very large class (the second, combining car and public transport) occupies most of the country. The differentiation of the territory according to the degree of use of different modes of transport is more evident in the other two classes.

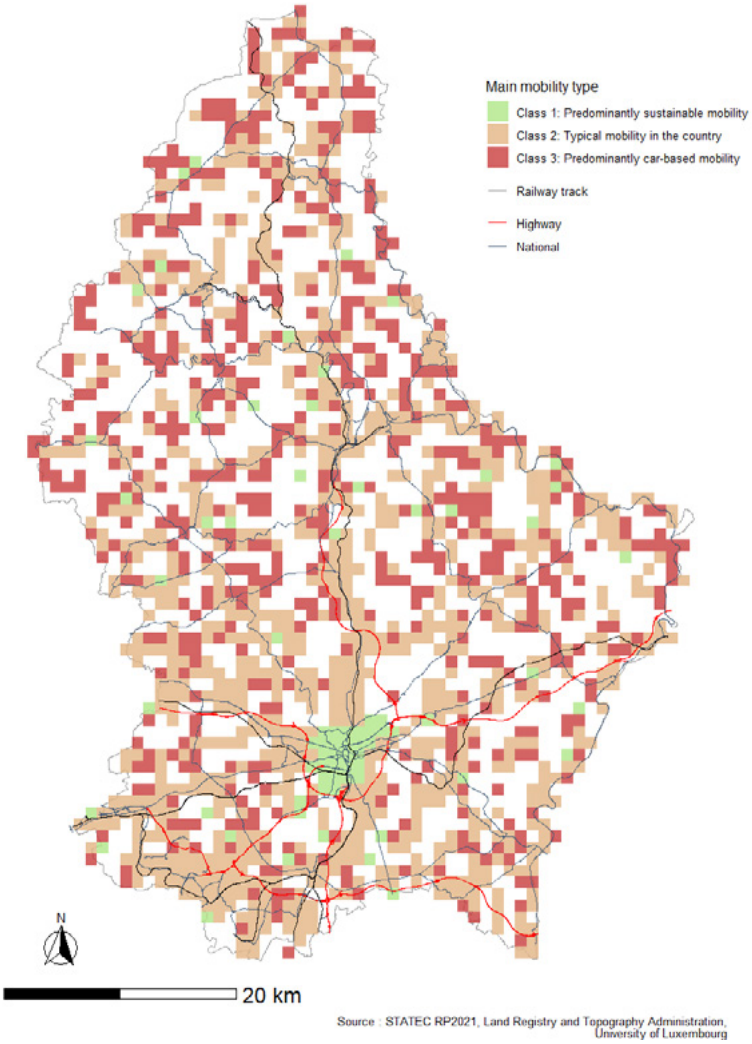
Class 1 (in green), geographically distributed mainly around the capital, comprises 75 cells with a total of 25,348 inhabitants, i.e. 14.9% of the workforce. It is therefore essentially made up of cells in the Agglomération-Centre and a few close to railway stations.

Class 2 (orange), comprises a total of 127,962 active people and 867 cells, representing 53% of inhabited cells. The cells in this class are mainly to be found in the south, in the most densely populated areas, around Luxembourg-City, along the Luxembourg-City/Ettelbruck axis and generally around the main communication routes.

Class 3 (in red) comprises 544 cells with a total population of 16,912. This is the least populated class, made up of mainly rural areas, and undoubtedly the most constrained to car use, where public transport is comparatively slower or less flexible than the car. The cells are mainly located in the north of the country or far from the main communication routes.

A gradual diversification of modes of transport can thus be observed as one moves closer to the city center and the main communication routes. However, other explanatory factors can also play a part in modal choice, namely socio-demographic and economic criteria.

Map 3: Clustering of residential cells by main mode of transport to work to get to work



Note: This map relates to people who indicated that they work in a known Luxembourg commune and provided information on their daily commute (N = 170,222).

Note for the reader: 63% of working people living in class 1 cells (green) are more likely to adopt sustainable mobility.

4.
Socio-demographic characteristics by typology class

While the location of residence, distance and access time already provide a better understanding of differences in the use of transport modes, other factors such as gender, level of education, country of birth or household type undoubtedly provide additional explanations. Table 2 below characterizes each class from a socio-demographic point of view. These classes overlap with observations made elsewhere (cf. Docquier et al., 2024, Chauvel et al., 2024), such as a higher proportion of foreigners, smaller households and higher levels of education towards the center, which also correspond, according to our first class, to less car use.

Table 2: Socio-demographic characteristics of employed workers by classification class (CAH)

Socio-demographic characteristics	3 mobility classes typology		
	Class 1: Predominantly sustainable mobility	Class 2: Typical mobility in the country	Class 2: Typical mobility in the country
Gender			
Men	52.3%	52.5%	52.3%
Women	47.7%	47.5%	47.7%
Household size			
1 person	23.7%	11.1%	7.7%
2 to 4 people	66.3%	71.8%	75.1%
5 people or more	10%	17.1%	17.2%
Country of birth			
Abroad	80.6%	49.5%	30.4%
Luxembourg	19.4%	50.5%	69.6%
Level of education			
Higher Baccalaureate	93.6%	83.4%	86.6%
Lower secondary	6.4%	16.6%	13.4%
Sector of activity			
Public administration	18.1%	37.6%	47.6%
Finance and insurance	20.6%	9.7%	6.7%
Scientific and technical	22.2%	11.2%	7.7%
Commerce	10.4%	17%	16.4%
Mode of transport			
Share of Public transport (Train, Bus, Tramway)	30.5%	15.5%	6.3%
Share of private vehicles (mopeds, cars with driver and passenger)	36.3%	72.4%	88.1%

Source: STATEC, RP2021

Note: This table refers to people who indicated that they work in a known Luxembourg commune and provided information on their daily commute (N= 170,222).

Note for the reader: In class 1, where soft mobility is over-represented, 93.6% of the people concerned have a level of education above the baccalaureate.

If we take a closer look at the proportion of people born in Luxembourg or abroad, we see that the spatial contrasts are mirrored in terms of mode use. For example, in class 3 (predominantly car-based mobility), almost 70% of working people were born in Luxembourg. Class 2 is fairly homogeneous in terms of working people born in Luxembourg or abroad. Lastly, class 1, where mobility by soft modes and public transport is more prevalent, is made up of 80% of people born in a foreign country.

Here we find certain socio-demographic determinants of modal choice, such as household size, level of education or sector of activity (Schwanen and Lucas, 2011), with large proportions of couples with or without children, levels of education above the baccalaureate for a large majority of working people, and sectors of activity with generally high salaries or stable situations.

Although these factors tend to show differences between the classes in the typology and help to characterize the workforce, it is then useful to focus solely on the workforce using the car and to analyze the characteristics of these users in greater depth in order to understand whether there are any significant differences in car use (Table 3).

Table 3: Socio-demographic characteristics of working people who mainly use an individual vehicle, according to CAH

Socio-demographic characteristics	3 mobility classes typology		
	Class 1: Predominantly sustainable mobility	Class 2: Typical mobility in the country	Class 2: Typical mobility in the country
Gender			
Men	56.2%	53.5%	52.2%
Women	43.8%	46.5%	47.8%
Household size			
1 person	18.5%	10.3%	7.6%
2 to 4 people	69.9%	72.6%	75.5%
5 people or more	11.6%	17.2%	16.9%
Country of birth			
Abroad	73.6%	45.8%	29.3%
Luxembourg	26.4%	54.2%	70.7%
Level of education			
Higher Baccalaureate	91.7%	83.9%	86.7%
Lower secondary	8.3%	16.1%	13.3%
Sector of activity			
Public administration	21.3%	38.5%	48.5%
Finance and insurance	16.1%	8.7%	5.9%
Scientific and technical	18.8%	10.1%	7.8%
Commerce	14.4%	17.8%	16.2%

Source: STATEC, RP2021

Note: This table only covers people who use an individual vehicle to work in a known Luxembourg commune and who provided information on their daily commute (N = 117,895).

The percentages vary only slightly from Table 2, with similar characteristics, particularly in classes where the majority use the car. Nonetheless, the growing differences reflect both the criteria that have the greatest impact on car use and the weight of working people using public transport. For example, women's shares are decreasing in classes 1 and 2, while men's shares are increasing, showing greater use of public transport by women in class 1 and 2 cells. Shares of one-person households are declining, while those of couples with children are increasing. The proportion of working people with a baccalaureate is decreasing in class 1, but increasing in classes 2 and 3, indicating that in class 1, public transport is used by working people with a higher level of education, while in classes 2 and 3, it is used more by working people with a lower level of education. The proportion of working people born in Luxembourg also increases from class 1 to class 3. Finally, in terms of sector of activity, from one class to the next, shares in public administration and commerce increase, while those in finance and science decrease.

Thus, for a given location, men, couples with or without children, people born in Luxembourg, and people working in public administration or retail are more likely to use the car. The contrast is less marked for level of education. Public transport and soft modes of transport are used more by foreign-born people living in the capital or in medium-sized towns, with a high level of education in urban centers, but relatively lower outside, working in finance or science, single and in smaller households, all of whom are located in different parts of the country.

At this stage of the analysis, it is not possible to further prioritize the explanatory factors. Without wishing to prejudge the hierarchy of criteria correlated with modal shares, it is nevertheless possible to put forward certain hypotheses that should be tested using a statistical regression model (the subject of a forthcoming publication). One of these would be that the criteria of country of birth and an «income» effect linked to level of education may emerge as a result of a specific location (cf. Docquier et al., 2024, Chauvel et al., 2024). Indeed, given average salaries, it's quite easy to own a car, while at the same time having the opportunity to live outside the capital, where rents are generally lower. This remoteness effect is also found among foreigners, depending on the year of arrival (Docquier and Szymanska, 2024). The capital is mainly home to recently-arrived foreigners, often with high incomes, who travel on foot or by public transport due to the wide range of services on offer. These foreigners tend to move to the outskirts of the city to start a family, thus reproducing a classic Luxembourg pattern (Chauvel and Le Bihan, 2024). Thus, the differences in mobility observed according to country of birth, level of education or sector of employment tend to reflect geographical location.

Conclusion

Despite a relative decline in its use for commuting, the private car remains the predominant mode of transport in Luxembourg. As a result of economic growth and a growing workforce, car traffic has not been contained. In this respect, car-sharing and public transport are still struggling to make headway. With a high motorization rate and relatively easy access to the automobile, the predominance of the car, accompanied by a well-developed road infrastructure, has for many decades now offered a wide range of residential choices, particularly in suburban communities where public transport provision is more limited than in densely populated areas. So, depending on residential location, the criteria of transport supply, distance or journey time will not be the same, with a more or less constrained choice of transport mode.

Nevertheless, the few changes observed between 2011 and 2021 are conducive to sustainable mobility, even if they are still insufficient. For example, the sharp decline in car use in the city of Luxembourg reflects a denser population (as measured between 2011 and 2021, cf. Caruso et al. 2023) and a more diverse range of facilities and jobs. This situation favors short trips, with soft modes becoming competitive with motorized modes.

However, it seems more difficult to encourage public transport, or even carpooling. And it's difficult to predict the impact of improved public transport services. The fact remains that, despite numerous efforts to improve bus and train services, set up new P+Rs and make public transport free of charge, the modal share of public transport is struggling to increase. Their performance in terms of travel time and frequency is often debated, as is the service they offer. Moreover, it's possible that a rebound effect from free public transport is driving low car-sharing use, as the incentive to share a car diminishes, since there are no public transport costs for residents and workers. What's more, households no doubt wish to retain the flexibility of the car, especially as car-sharing offers no real added value until dedicated lanes become available.

This directly calls into question the ability of public policies to proactively and optimally absorb the growing population and the resulting flows, in terms of sustainable development, land management, transport supply and infrastructure, but also in terms of preserving the right to travel and territorial equality.

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STATEC would like to thank all contributors to this publication.

TO QUOTE THIS ARTICLE

Electronic reference

RP 1er résultats 2021 N°18 "Automobile dependence for commuting to and from work" [On line], posted online on 27/02/2025, consulted on xx/xx/xx. URL : https://statistiques.public.lu/fr/recensement.html