PNM 2035

National
mobility plan

Infrastruktur effikass notzen

PNM 2035

National mobility plan

National mobility plan 2035 developed by:
Ministry of Mobility and Public Works (MMTP),
Department of Mobility and Transport,
Directorate of Mobility Planning

Based on data provided by:
MMTP, Directorate of Mobility Planning,
Digital Observatory of Mobility (OdM)
Ministry of Energy and Spatial Planning (MEAT),
Department of Spatial Planning,
National Institute of Statistics and Economic Studies (STATEC)

In close cooperation with:
MMTP, Department of Public Works
MMTP, Department of Mobility and Transport
MEAT, Department of Spatial Planning
National Roads Administration (APC)
Administration of Public Transport (ATP)
Luxembourg National Railway Company (CFL)
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This is a translation of the original in French.

Preface

How should mobility be organised and which projects need to be launched now to accommodate 40% more trips compared to 2017?

The National mobility plan 2035 provides answers to these questions.
If the development of the Grand Duchy turned out to be faster than expected, the solutions recommended by the PNM 2035 would need to be in place a few years sooner. If it turned out to be slower, they would be required a few years later. The important thing is to set in motion the paradigm shift advocated by the Modu 2.0 strategy for sustainable mobility: Let's stop relocating traffic jams with successive road works and let's implement instead a comprehensive concept that will meet the future demand for mobility.

Obviously, we can neither channel 40% more cars through our towns, nor can we accommodate them in our metropolitan areas. It is equally clear that we cannot extend the road network by 40% – not in ten years, and not in fifty years. Neither our budgetary resources nor our built and natural heritage allow for this.

We need to make more efficient use of our infrastructure.
This is particularly true for the road network. We must follow the example of other countries and ask ourselves the following questions for each segment of road: What is its function in the multimodal network? Is it meant to carry significant motorized transit traffic? Or is it a gateway to a metropolitan area where the priorities are ensuring attractive travel times for buses, a safe route for cyclists and a comfortable setting for pedestrians, while providing motorists with access to their neighbourhoods? This 'multimodal road network' approach is the key to transporting more people with fewer vehicles – particularly at bottlenecks in the network.

Making more efficient use of infrastructure also means planning transport networks that function not in isolation from each other, but rather operate in the service of a multimodal system. This principle was applied during the development of the PNM 2035. Based on data provided by the new Digital Observatory of Mobility, there was unprecedented collaboration between the Ministry and various stakeholders.

A mere accumulation of solutions to local mobility problems will not result in a comprehensive solution for the country. Nor does the National mobility plan aspire to solve every local mobility problem. Once the PNM 2035 has set the national framework, collaborating with the affected municipalities will be the best way to find solutions adapted to the local situation.

Photo: Sophie Margue

While preparing the PNM 2035, it became clear that some of the pieces of the multimodal puzzle were still missing. Therefore, the PNM 2035 puts forward a few new infrastructure projects. Above all, though, it aims to create consistency across projects that are already known, whether these involve motorized individual traffic, railways, trams, buses or cycling.

The National mobility plan does not have statutory force. The Chamber of Deputies will pass legislation on new projects. I call on politicians not to debate until 2035 the projects that must be in place by then. Realistically speaking, it takes at least ten years between the planning of a major piece of infrastructure and its inauguration.

The National mobility plan proposes a coherent multimodal concept. The measures it advocates will have to be refined in the years to come. The momentum that has been created will enable successive governments to make a course correction every five years by issuing a new National mobility plan that covers the subsequent fifteen years. This is how our very dynamic country will move from a logic of catching up to a logic of anticipation, as far as mobility is concerned. And that is how we will remain mobile.

François Bausch
Deputy Prime Minister
Minister for Mobility and Public Works

Executive Summary

The National mobility plan 2035 puts forward a concept that allows for 40% more trips to be taken than in 2017. It implements the approaches advocated by Luxembourg's strategy for sustainable mobility Modu 2.0, specifically: transitioning from a logic of catching up to a logic of anticipating future demand; determining the number of people who will need to travel to a given place, so as to strengthen the modes of transport best suited to the particular context; and finally, mobilising the four stakeholders of mobility – the State, municipalities, employers and citizens.

The **first chapter** lays out the key topics for mobility until 2035. It analyses the current situation and explains how mobility demand can be predicted. It identifies three challenges and five opportunities. The three challenges consist in organising traffic flows in relation to the city of Luxembourg, prioritizing urban transport modes in the three metropolitan areas and apprehending mobility in rural areas in a differentiated manner. The opportunities are the success of high-quality mobility offers, the popularity of cycling, public transport capacity, carpooling on cross-border motorways, as well as parking regulation and management. These findings make it possible to ascertain the modal shares required for a sound mobility offer in 2035.

The **second chapter** illustrates how the different transport networks will need to be developed if they are to accommodate the traffic flows projected for 2035. Intermodality will play a key role in this respect. Rail service will be broadened and the tram network will be expanded. A well-structured bus network will round out the public-transport offer. Every available opportunity should be seized to improve walking conditions. Particularly In urban areas, cycling will need to have an infrastructure worthy of a fully fledged mode of individual mobility. The most fundamental transformation will involve the road network. The method of functional classification will make the road network truly multimodal, so that it can transport substantially more people.

The **third chapter** reviews the three metropolitan areas and ten transport corridors that structure the country. It describes the regional characteristics of mobility and illustrates the change in modal shares that will be required. The maps presented in this section do not cover all existing projects or infrastructure, but only the elements necessary for an understanding, on a regional scale, of the organisation of multimodal mobility as recommended for 2035.

The **fourth chapter** draws attention to the key role of parking. The regulation and management of parking by municipalities and employers will either accelerate or slow down the needed transformation of mobility.

Non-infrastructural measures will also either foster or counteract the evolution put forth in the PNM 2035. The examples provided in **chapter 5** include territorial development, the flexibilisation of work schedules and places, and financial incentives.

By their nature, technological innovations are unpredictable. They are frequently presented as 'silver bullets'. **Chapter 6** presents a checklist for assessing whether an invention would contribute to achieving the goals of mobility policy in Luxembourg.

The planning of multimodal mobility at the national level must take into account the evolution of society and keep anticipating travel needs. It takes ten to fifteen years to put the necessary infrastructure in place. The **seventh chapter** explains the PNM process and provides initial ideas for the PNM 2040, to be commissioned by the next government.

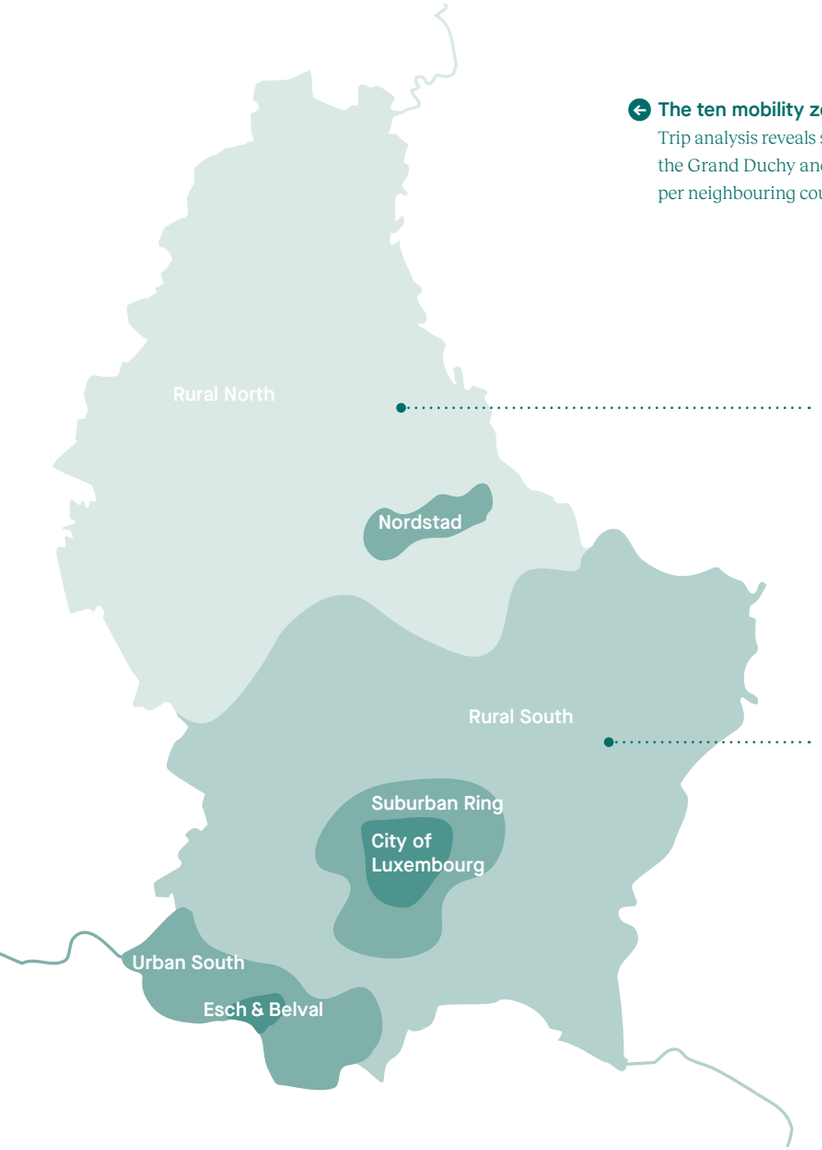
Chapter 1

Key topics for mobility in 2035

What modal shares will allow the Grand Duchy to sustain 40% more daily trips as compared to 2017?

What is the current situation (2017–2020)?

How does mobility behaviour vary throughout the national territory?



The ten mobility zones

Trip analysis reveals seven distinct mobility zones within the Grand Duchy and one additional cross-border zone per neighbouring country.

Rural North

Beaufort, Beckerich, Boulaide, Bourscheid, Clervaux, Colmar-Berg, Ell, Esch-sur-Sûre, Feulen, Goesdorf, Grosbous, Hobscheid, Kiischpelt, Lac de la Haute-Sûre, Larochette, Mertzig, Nommern, Parc Hosingen, Préizerdaul, Putscheid, Rambrouch, Redange sur Attert, Reisdorf, Tandel, Troisvierges, Useldange, Vallée de l'Ernz, Vianden, Vichten, Wahl, Weiswampach, Wiltz, Wincrange, Winseler

Rural South

Bech, Berdorf, Betzdorf, Bissen, Biwer, Bous, Consdorf, Contern, Dalheim, Dippach, Echternach, Fischbach, Flaxweiler, Frisange, Garnich, Grevenmacher, Heffingen, Helperknapp, Junglinster, Kehlen, Koerich, Lenningen, Lintgen, Lorentzweiler, Mamer, Manternach, Mersch, Mertert, Mondorf-les-Bains, Reckange-sur-Mess, Remich, Roeser, Rosport-Mompach, Saeul, Schengen, Schuttrange, Stadtbredimus, Steinfort, Steinsel, Waldbillig, Waldbredimus, Weiler-la-Tour, Wormeldange

Trips that are internal to the municipality represent the largest share of trips in each of the Grand Duchy's 102 municipalities. The city of Luxembourg is the second destination for 64 municipalities and the third, fourth or fifth destination for 31 municipalities.

Rural North

This mobility zone covers 46% of the national territory and includes many weak and disperse traffic flows. Towns with secondary schools emerge as centres of attraction. Nordstad is the destination or point of origin for 11% of trips. At 25%, the share of trips in relation to the city of Luxembourg and its suburban Ring is the lowest across all zones. 31% of trips to or from the rural North are longer than 25km; one third of these trips extend beyond 50km.

Rural South

Across a territory that covers 37% of the country, mostly small and diffuse flows are predominantly oriented towards the city of Luxembourg and its suburban Ring. While modal shares are nearly identical to those of the rural North (1% bicycle, 10% walking, 15% public transport and 74% motorized individual transport), the rural South differs from its northern neighbour by its greater share of trips of less than 15km (58% versus 54%) and a lower share (21% versus 31%) of trips exceeding 25km.

Nordstad

Municipalities of Schieren, Ettelbruck, Erpeldange-sur-Sûre, Diekirch and Bettendorf. Major destination for the rural North mobility zone. 34% of all trips to and from Nordstad are shorter than 5km. Although the Nordstad's topography is conducive to cycling, the modal share of trips between 1 and 5km taken by car is the same (74% as in the rural North and the rural South). At 18%, the modal share of public transport is the second largest in the country, second only to the city of Luxembourg.

City of Luxembourg

Main urban centre for the Grand Duchy and the Greater Region. Luxembourg City attracts significant traffic flows from all mobility zones. The high urban density results in a high density of rather short trips: 15% of all trips are shorter than 1km and 25% cover distances between 1 and 5km. The modal shares of public transport (21%) and of cycling (2% in 2017) are the highest in the country. One in seven trips taken in the Grand Duchy takes place entirely within the territory of Luxembourg City.

Suburban Ring of the city of Luxembourg

This mobility zone consists of the municipalities that adjoin the city of Luxembourg (Bertrange, Strassen, Kopstal, Walferdange, Niederanven, Sandweiler, Hesperange and Leudelange) and of two towns (Mamer and Steinsel) that are part of the same urban fabric. In this zone, mobility is strongly oriented towards the city of Luxembourg, most trips covering only 1 to 5km (24%) or 5 to 15km (35%). The modal share of cycling does not exceed 2%. At 9%, the share of trips that are shorter than 1km, and the modal share of walking (5%), are the lowest of all mobility zones. This is characteristic of commuter towns and is amplified by the fact that the majority of jobs located in these municipalities are not held by people who live there. **Of all the zones, the suburban Ring has the highest car usage (81%).**

Esch-sur-Alzette and Belval (hereafter referred to as 'Esch & Belval')

This is the main urban centre in the south of the country. Its high urban density produces traffic flows of high volume and over comparatively short distances: 27% of trips do not exceed 1km, 23% extend to between 1 and 5km. Esch & Belval has the country's highest modal share of walking (14%). The modal share of car travel (70%) is higher than in the city of Luxembourg (61%).

Urban South

While less densely populated than Esch & Belval, this zone is composed of large municipalities that form a nearly contiguous urban fabric (Pétange, Käerjeng, Differdange, Sanem, Mondercange, Schiffange, Kayl, Rumelange, Dudelange and Bettembourg). Esch & Belval may be the main point of interest, but there are also significant traffic flows between the other towns in this mobility zone. At 67%, the urban South holds the record for the highest share of trips below 15km. 44% of trips do not even stretch beyond 5km. The modal share of walking (13%) is similar to that in the city of Luxembourg (12%); this suggests that neighbourhoods in the urban South are more vibrant than those in the suburban Ring of Luxembourg City. The modal shares of public transport (13% for the urban South and 13% for Esch & Belval) and cycling (1% for the urban South and for Esch & Belval) equal those of rural areas. This reveals a lack of infrastructure prioritizing public transport and cycling.

France

In 2017, 37% of the daily 192,000 cross-border trips were in relation to the city of Luxembourg, 15% were to and from the suburban Ring of the city, and 22% connected France to the urban South.

Germany

95,000 cross-border trips per day (2017 figures), of which 44% in relation to the rural South, 25% in relation to the city of Luxembourg and 11% in relation to Luxembourg City's suburban Ring.

Belgium

In 2017, of the total 94,000 daily cross-border trips with Belgium, 29% had the city of Luxembourg as their destination or origin, 12% the suburban Ring of the city, and 29% the rural North.

The 'Luxmobil' survey of 2017

21,837 residents and 9,925 cross-border workers answered the following questions: 'Where do you travel to?', 'At what time of day?', 'What is the reason for your travel?' and 'What modes of transport do you use?'. This survey generated representative data for each municipality in the Grand Duchy. Given the small size of many villages and towns that make up these municipalities, collecting representative information for each individual town would have not have been compatible with data-protection regulations.

Modal shares by mobility zone

The zone-by-zone modal shares extracted from the Luxmobil 2017 survey take into consideration all trips 'in relation' to the mobility zone in question, i.e. trips at least originating or ending there.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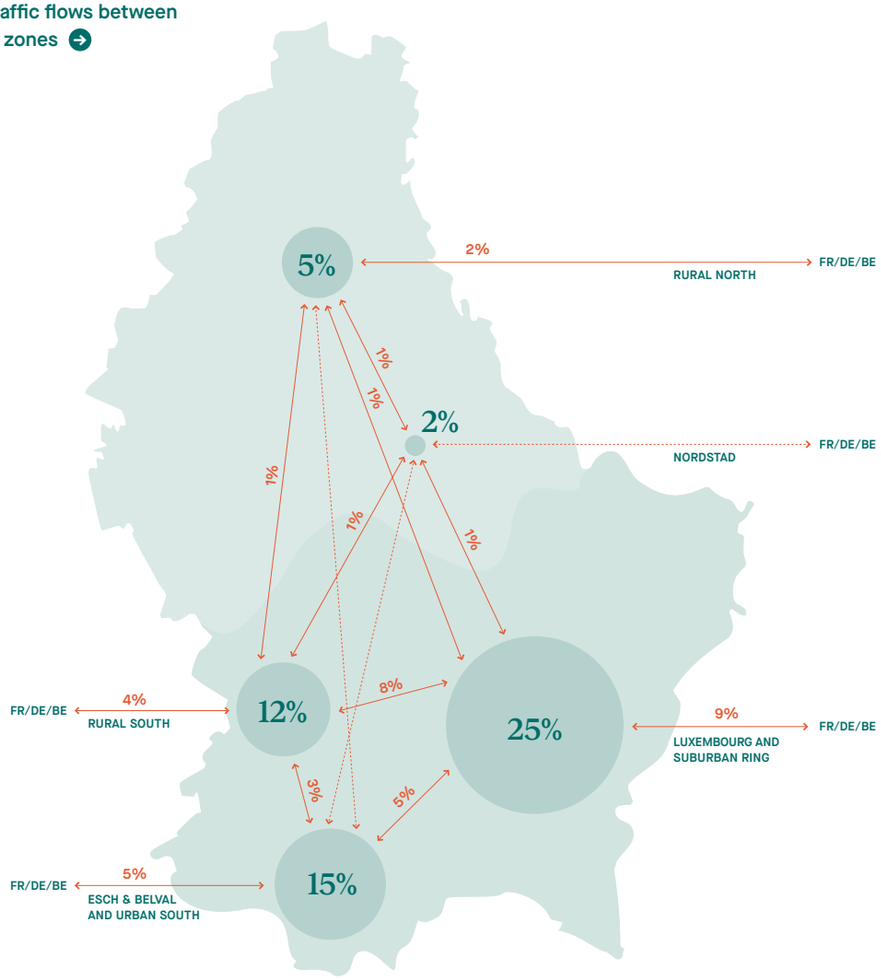
How do trips spread across the territory?

Breakdown of traffic flows between the ten mobility zones



In this figure:

- An arrow between two sectors symbolises a flow, not a specific mobility infrastructure. For example, the 1% between rural North and rural South represents all trips having one of these two mobility zones as an origin and the other as a destination – regardless of the road, railway line or cycle route used.
- Each link indicated by a dotted line represents less than 1% of total daily trips in the Grand Duchy.
- Spheres represent internal trips. For example, 12% of all daily trips in Luxembourg stay within the rural South mobility zone, which extends from the Moselle river to the Belgian border.

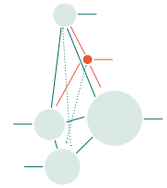
From or to the metropolitan area of Luxembourg City

49% of all trips at least originate or end in the metropolitan area of the city of Luxembourg with its suburban Ring.

From or to the metropolitan area of the South

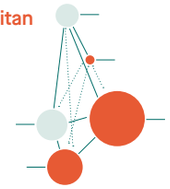
26% of all daily trips at least originate or end in the metropolitan area of Esch & Belval and the urban South.

From or to Nordstad



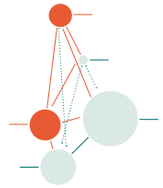
5% of all daily trips at least originate or end in Nordstad. (2% are internal to Nordstad and 3% are diffuse flows in relation to other zones, mainly the rural North.

Within metropolitan areas



42% of all trips in the Grand Duchy stay within one of the three metropolitan areas: **25%** in the city of Luxembourg with its suburban Ring, **15%** in Esch & Belval with the urban South, and **2%** in Nordstad.

From or to rural areas

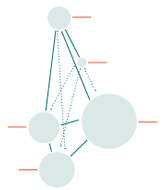


38% of all trips concern the rural areas of the country, i.e. they at least originate or end there.

Within rural areas

26% of all trips occur exclusively in rural areas, i.e. they neither originate nor end in one of the country's three metropolitan areas. **12%** are taken within the rural South and **6%** do not leave the rural North. These figures reflect the accumulation of a large number of small traffic flows scattered throughout the rural territory.

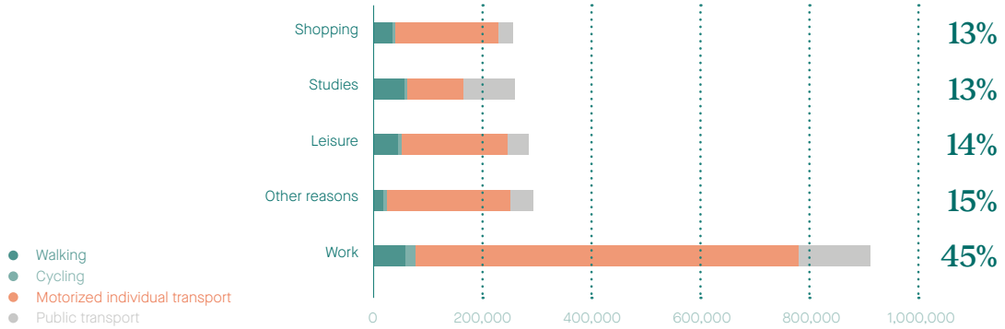
Cross-border



20% of all trips are cross-border, meaning they either originate or end outside the Grand Duchy.

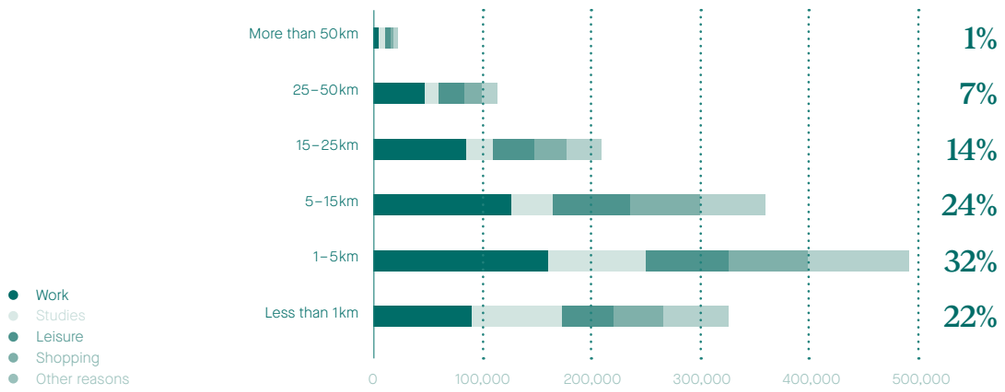
What characterizes these trips?

Reasons for travel – residents and cross-border employees
(trips taken in the Grand Duchy per working day)



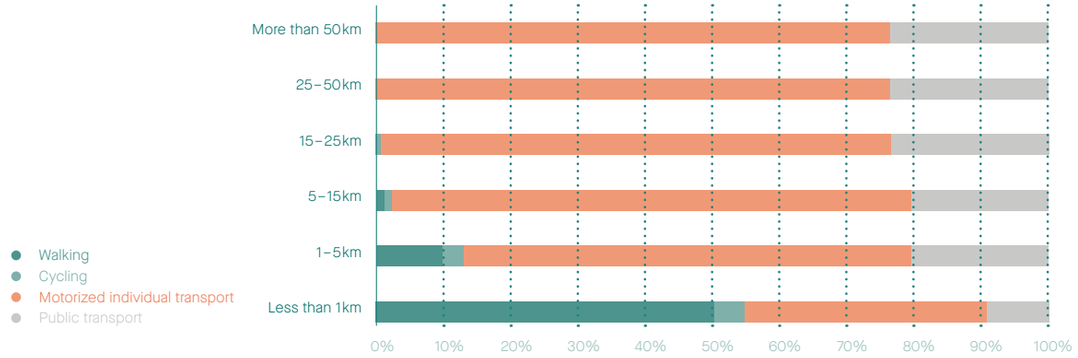
58% of trips are taken for the purpose of work or studies.

Travel distances by reason – residents
(trips taken in the Grand Duchy per working day)



69% of trips taken by residents to commute from home to the place of studies, **49%** of trips taken to commute to work and nearly **50%** of trips taken for other reasons are shorter than 5km. All in all, **54%** of all trips taken by residents are shorter than 5km. **78%** of trips taken by residents are less than 15km.

Modal shares by distance category – residents



One-third of trips of less than 1km and **two-thirds** of trips covering between 1 and 5km are taken by car. For trips that are longer than 1km, the modal share of public transport holds fairly constant at around **20%**.

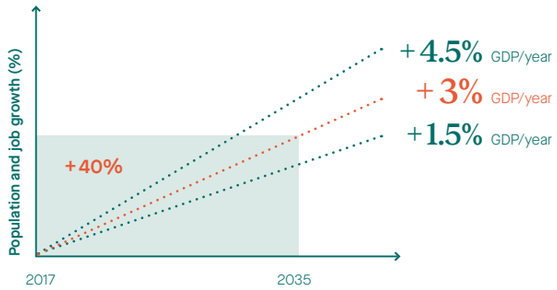
For supplemental figures from the Luxmobil 2017 survey, cf. chapter 1 of Modu 2.0 at www.modu2.lu

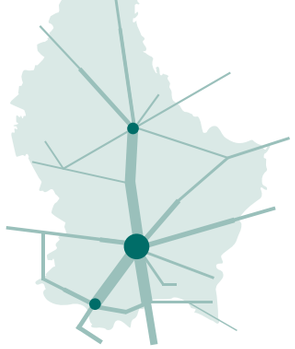
How to predict mobility demand in 2035?

1 Analyse the mobility patterns revealed by the Luxmobil survey in 2017.

2 Calculate the number of additional residents, jobs and cross-border workers based on STATEC's 'intermediate' growth scenario.

(Projections macroéconomiques et démographiques de long terme, 2017)





3 Distribute the population and jobs forecast for 2035 across the national territory in accordance with the urban hierarchy of the Master Programme for Spatial Planning (PDAT, DATer).

4 Quantify the mobility demand for the various national and cross-border flows in 2035.

What if these projections turned out to be wrong?

If growth turned out to be faster than forecast, the solutions recommended by the PNM 2035 would need to be implemented a few years sooner. If growth turned out to be slower, the same projects would be required a few years later. The successive National Mobility Plans will be based on updated projections (see Section 7).

What are the challenges for 2035?

By 2035, a mobility offer will have to be in place that can accommodate 2,8 million daily trips (2 million in 2017), that maintains a high quality of life and respects environmental and budgetary constraints. This objective presents three challenges.

First challenge:

To organise traffic flows in relation to the city of Luxembourg

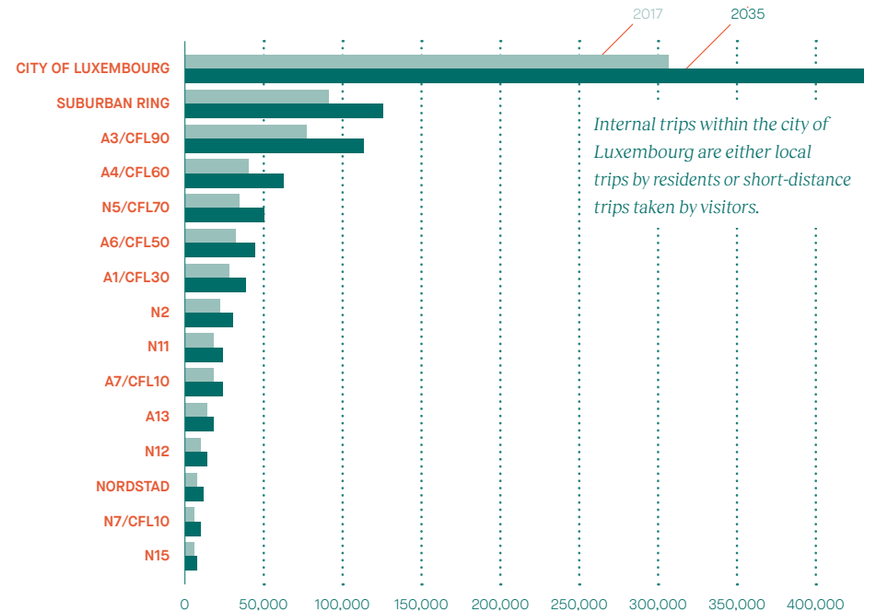
The city of Luxembourg will remain the main economic hub of the country and the Greater Region.

Luxembourg City's transport network will have to manage not only an additional 172,000 entries and exits each day (on top of 420,000 in 2017) but also 123,000 additional trips taken within the city itself (on top of 309,000 in 2017).

For trips connecting other mobility zones to the city of Luxembourg, the main rail, road and cycling routes will have to have sufficient capacity to accommodate that many travellers. Right from the outset of such longer trips, priority will have to be given to those modes of transport that are at the same time compatible with the city's urban environment. These modes will then need to be prioritized upon entering the suburban Ring as well as the city itself.

This approach will reduce traffic congestion in the capital by making public transport, carpooling and cycling the most attractive options for getting into the city from another mobility zone. Implementing this approach will call for concerted and integrated planning of transport offers on the part of the State and Luxembourg City.

Traffic flows related to the city of Luxembourg, by mobility corridor

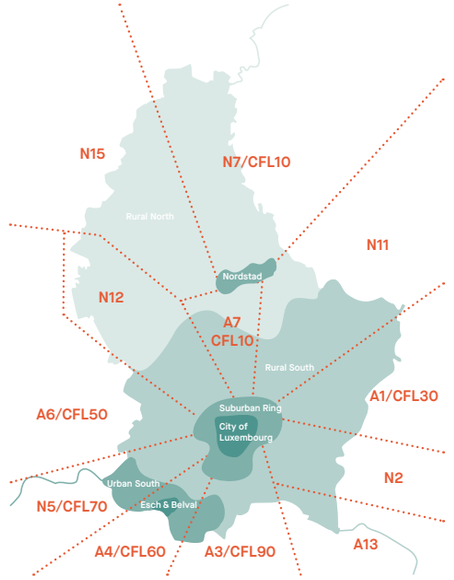


Number of daily trips in relation to the city of Luxembourg

Mobility corridors towards the city of Luxembourg

A 'mobility corridor' is defined here as a region that mainly relies on the same road and/or rail route to reach the city of Luxembourg.

To the South of the Nordstad, traffic flows involving corridors N15 and N7/CFL10 should be added to the flows of the A7/CFL10 corridor. Similarly, when approaching Luxembourg City, the flows from corridor A13 overlap with those of the A3/CFL90 corridor.



Second challenge:

To shift to urban mobility in metropolitan areas

The three metropolitan areas are already clearly discernible in aerial photographs taken in 2020 and in analyses of residents' trips in 2017. Indeed, the residents of the city of Luxembourg and its suburban Ring leave this particular metropolitan area for just 9% of their trips. 80% of trips taken by residents of Esch & Belval and the urban South stay within the southern metropolitan area; for Nordstad, this figure is 78%.

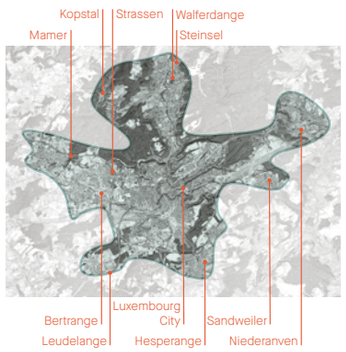
By 2035, the metropolitan area of Luxembourg City with its suburban Ring will see the number of internal trips increase from 491,000 to 686,000 (+ 195,000 per day), the southern metropolitan area will go from 273,000 to 430,000 (+ 157,000 per day) and in Nordstad, the number will rise from 42,000 to 65,000 (+ 23,000 per day).

It will not be possible to accommodate these 1,181,000 mostly short- or medium-distance urban trips with the current mode shares.

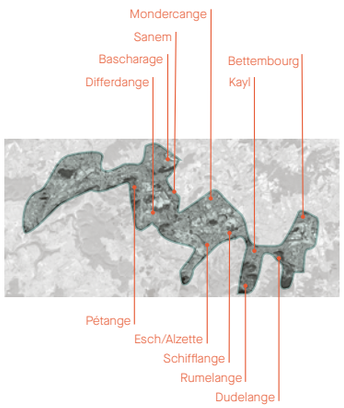
An approach to urban mobility that systematically prioritizes public transport, cycling and walking while maintaining residents' access by car to their respective neighbourhoods will not only maintain the current quality of life, but improve it in a sustainable way.

This will require considering each of these metropolitan areas as a whole and rethinking the function of each section of their respective road networks (see also chapters 2 and 3).

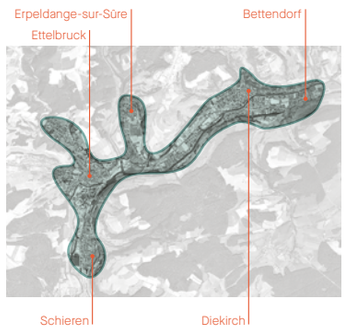
CENTRAL METROPOLITAN AREA



SOUTHERN METROPOLITAN AREA



NORDSTAD



Third challenge:

To apprehend mobility in rural areas in a nuanced way

The two rural sectors cover 83% of the national territory. By the year 2035, they will generate 657,000 strictly rural trips per day (+ 162,000 versus 2017) and 382,000 trips to or from the three metropolitan areas (+ 104,000 per day).

Due to real estate prices, population and job growth in rural areas are driven by two distinct phenomena. On the one hand, some households prefer to live and work in a rural setting rather than in a metropolitan area, and some employers set up business there in view of a particular talent pool or customer base. On the other hand, these areas are increasingly popular with families and employers whose employment or customer base is located in a metropolitan area, but who cannot afford the desired residential or commercial space in that metropolitan area.

This distinction is significant from a mobility point of view, as it results in different types of traffic flows. While the first group generates small and scattered traffic flows that rural transport infrastructure – primarily roads – can easily accommodate, the second group produces long-distance trips to metropolitan areas during peak hours. In rural areas, only the most efficient transport routes, in particular those with an attractive public transport offer, are and will be capable of handling such high volumes of long-distance trips.

This is one of the reasons why a nuanced understanding of mobility in a rural environment is paramount.

The only way to avoid a general overload of the road network in rural areas is to locate functions that generate many long-distance trips as close as possible to the most attractive public transport stops. Such functions are institutions of national importance, organisations employing large numbers of cross-border workers, major housing projects that appeal to people with jobs in metropolitan areas, etc.

Still, a very large share of the trips taken by the residents of rural areas cover distances of less than 5km (44% in the rural North and 50% in the rural South). While in rural areas, traffic congestion is not yet the main driver for providing pedestrian and bicycle infrastructure within and between towns, improving this infrastructure will contribute to the quality of life of the rural population, as well as to bicycle tourism.

What are the opportunities for 2035?

The following opportunities will make it possible to take up the challenges that have been identified for 2035. They need to be seized without delay.

First opportunity:

High-quality transport offers

As the experience of recent years has shown, residents and cross-border workers are not attached to any particular mode of transport. They embrace all high-quality transport offers.

Some examples of this are the ever growing use of the tramway in the city of Luxembourg, the success of an attractive new rail offer (e.g. the Paffenthal-Kirchberg station), the attractiveness of consistent prioritization of bus travel (e.g. the Arlon-Strassen route), the popularity of proper cycling infrastructure along a major axis (e.g. the cycling bridge beneath Adolphe Bridge) or of strategically placed Park-and-Rides (P+R) (e.g. P+R Mesenich at the German border).

The observation that the best-quality offer gains the highest modal share also explains the current popularity of car travel. For many households, the car is indeed the only means of individual transport for which there is an uninterrupted infrastructure between their home and any other destination within the Greater Region, whether this is the primary school in the next village, the nearest railway station or the workplace.

The current road network is the result of more than 60 years of coherent planning carried out with the sole objective of optimising motorists' convenience. This planning, which prioritizes the same mode of transport in all situations, has since become the victim of its own success. It has led to a host of inconveniences such as traffic congestion, noise and deteriorating air quality, poor road safety for pedestrians and cyclists, the consequences of which are detrimental not only to mobility itself but also to quality of life in towns and metropolitan areas. Once the use of the road network is rebalanced between the different modes of road transport, more people can be moved with fewer vehicles.

Some mobility offers are underused not because residents and cross-border commuters reject alternative forms of travel but because they expect high-quality offers. Examples of half-hearted measures are a carpooling lane that only runs along the motorway at the beginning of a traffic bottleneck, a bus rolling at a snail's pace in traffic, a discontinuous cycling infrastructure or pedestrian paths cluttered with obstacles.

Second opportunity:

The popularity and intermodality of cycling

Across all regions and in all age groups up to the age of 60 (37% among those older than 60), a majority of residents – 58% overall – cycled in 2020. Two-thirds of households own at least one bicycle (two on average). 13% have an electric bicycle. To cycle more on a daily basis, cyclists call for the following improvements:

Percentage of residents who cycled in 2020 and find these factors 'decisive' for cycling more on a daily basis. (MMTP and TNS-ILRES, 2020)

People living in the Grand Duchy would like to cycle more. What is lacking is high-quality cycling infrastructure.

The substantial potential of cycling as a mode of individual transport is illustrated by the combination of the following facts: 58% of the population cycle. A large majority of people using a bike would like to do so more regularly. 56% of trips within Luxembourg are shorter than 5km, but the modal share for which cycling accounts among these short trips was just 3% in 2017. It is not a matter of forcing anyone to cycle but rather of making cycling safer for the large share of the population that would like to ride their bicycle more.

The technical expertise for integrating high-quality cycling infrastructure into the typical streetscape of the Grand Duchy is there. Guidelines that have adapted international best practices to the luxembourgish context have been published (www.veloplangen.lu).

By linking residential neighbourhoods ('first mile') and employment hubs ('last mile') with secure bicycle parking near public transport stops, cycling infrastructure offers an effective way to promote intermodality. In fact, 99.5% of residents live within a kilometre of a public transport stop.

Third opportunity:

The spare capacity of public transport

Along major axes and in metropolitan areas, the capacity of public transport can be increased.

This will be done by optimising the rail network and using longer trains, by completing the tram network of the city of Luxembourg with, among other lines, its ‘fast tram’ extension to Esch-sur-Alzette and Belvaux, and by prioritizing buses along arterial roads.

In rural settings, the uptake of spare capacity on the train and bus networks can be increased by better intermodality: more reliable connections, better passenger information at stops, improved accessibility of public transport stops by bicycle and P+Rs where they are needed.

Fourth opportunity:

Carpooling on cross-border motorways

The opportunity to bypass the daily traffic jam by using a carpooling lane will motivate many employees to carpool.

This would put to use some of the 250,000 empty car seats that entered the city of Luxembourg every morning in 2017 (calculation based on four-seater cars).

Fifth opportunity:

Parking management

Each car trip has a parking space as its destination. This makes parking management one of the most effective levers for influencing people’s choice of a transport mode. As parking in the Grand Duchy is often regulated but rarely managed with the intent of promoting the most effective use, municipalities and employers have considerable leeway on this topic.

Managing parking does not necessarily mean limiting it; it means putting each parking space to the use with maximum utility.

For example, a retail business benefits more from three metered parking spaces that are free to use for only the short duration of an errand than it does from five unmanaged parking spaces, three of which are regularly blocked by cars parked there long-term.

How to offer good mobility in 2035?

Given the challenges and opportunities identified for 2035, it makes sense to target different modal shares based on the context of a trip and the distance to be travelled.

A distinction is made among three categories of distance (less than 5km, between 5 and 15km, more than 15km) and the following three trip contexts:

The three trip contexts

1

PRINCIPAL CENTRE
- City of Luxembourg mobility zone
- Esch & Belval mobility zone

2

SECONDARY CENTRE OR MAJOR TRANSPORT AXIS
- Nordstad mobility zone
- Urban South mobility zone
- Suburban Ring of the city of Luxembourg mobility zone
- Towns in the rural North, rural South or cross-border mobility zones that are located along a major road axis or that feature a railway stop

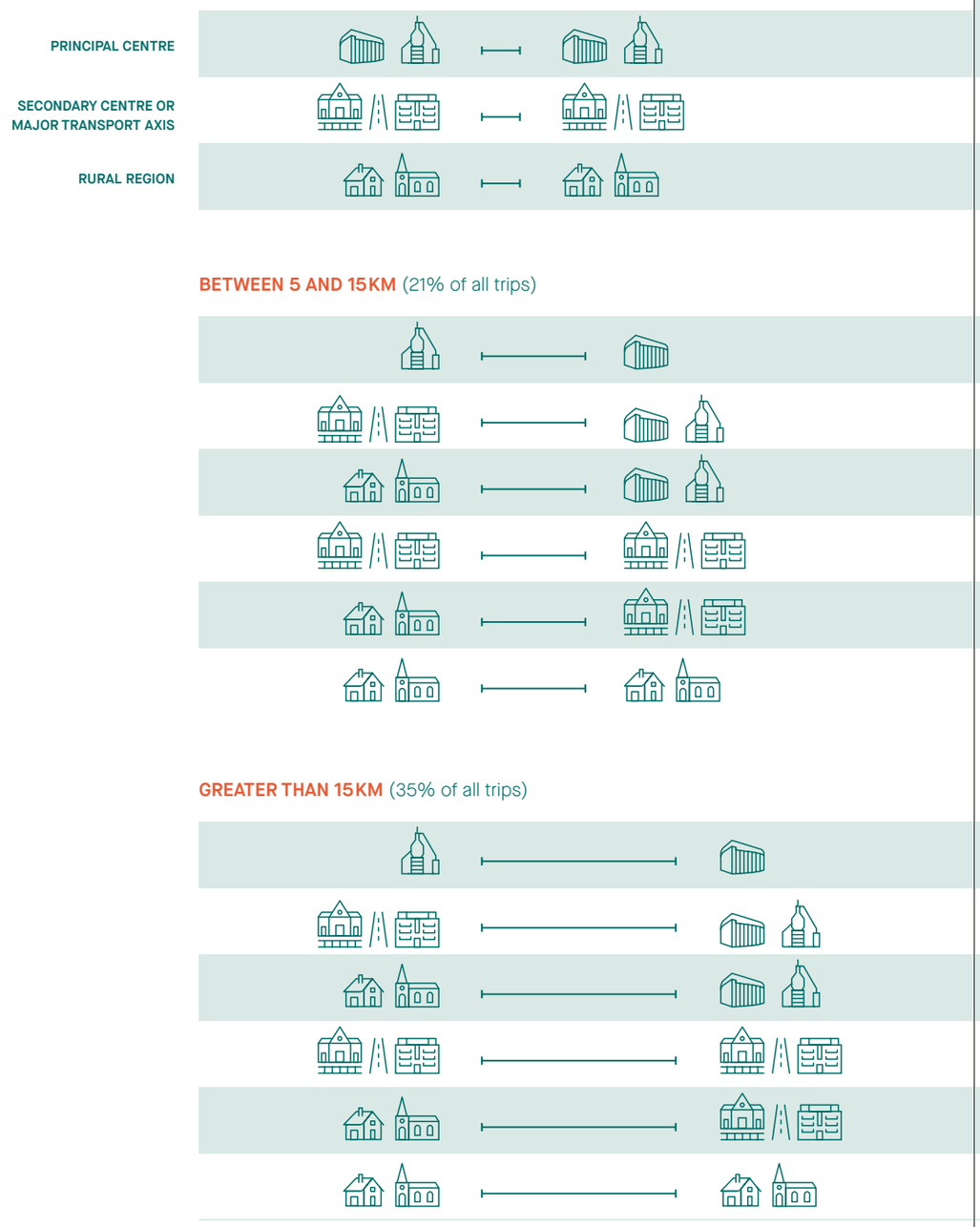
3

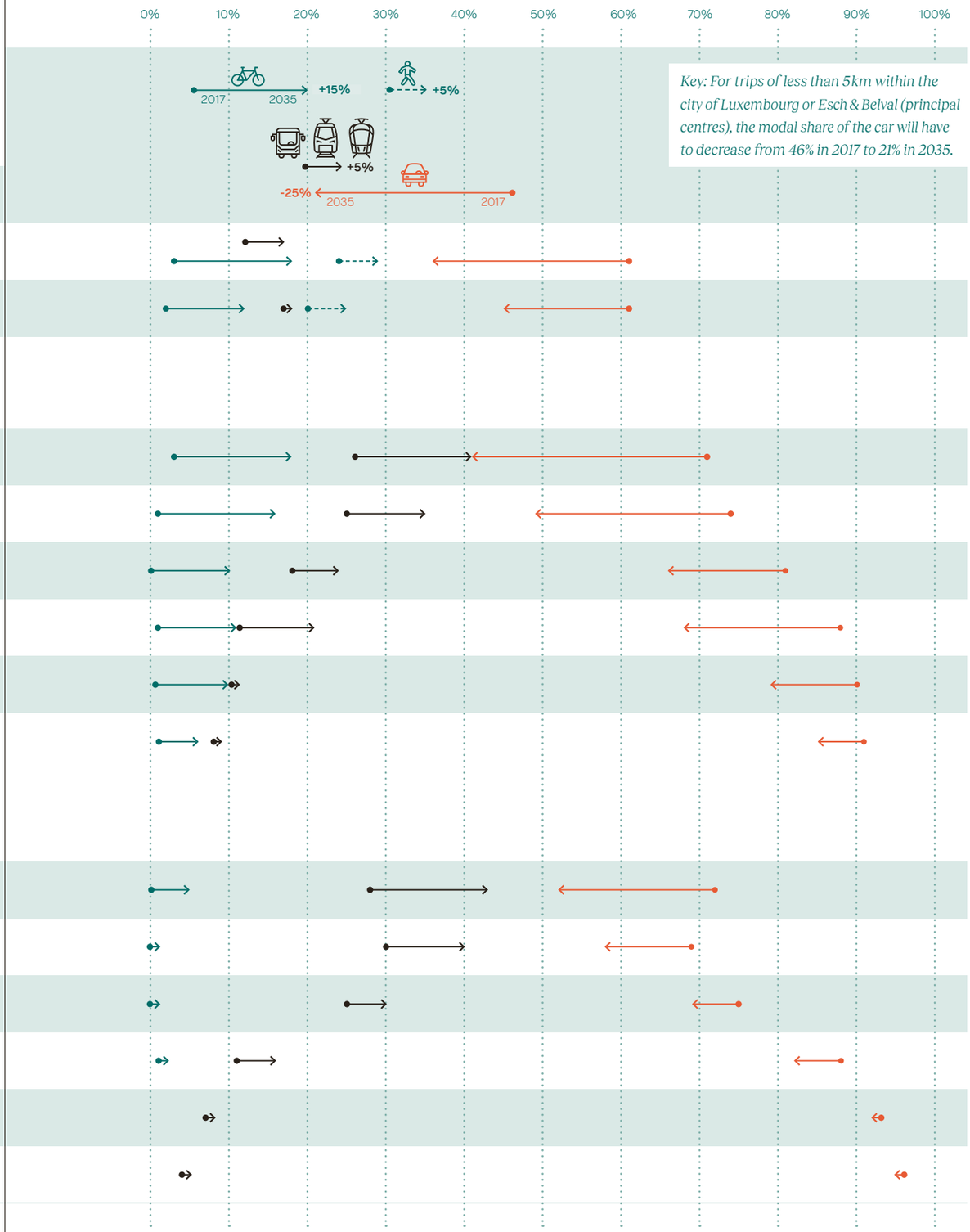
RURAL REGION
- Towns in the rural North, rural South or cross-border mobility zones that are located at a certain distance from a major road axis or railway stop

What if we do not change our mobility habits?

It would be an illusory objective to increase the capacity of the road network – in terms of number of vehicles, not people – in keeping with Luxembourg's pace of demographic and economic growth. This would be impossible from a budgetary point of view, unrealistic in terms of acquiring the needed land and obtaining environmental permissions, impracticable in terms of the number of road works that would criss-cross the country, and with no effect other than to increase road congestion along the many bottlenecks imposed by the country's natural or built heritage.

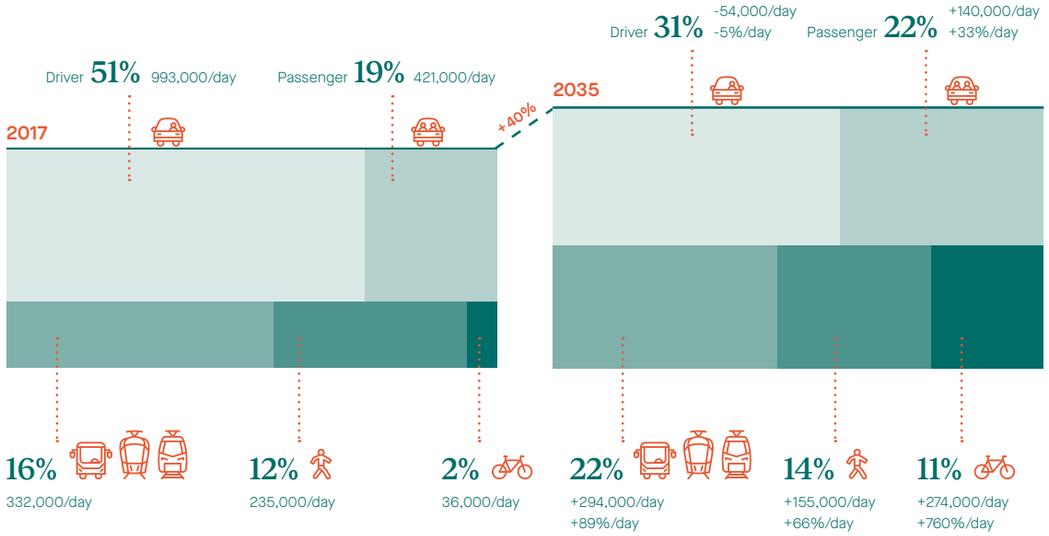
Minimum targets for the shift in modal shares between now and 2035 as a function of trip distance and the departure and destination context





Applied to the number of trips projected for each of the 15 trip types shown in the preceding graphic, the detailed minimum targets for 2035 will result in the following overall modal shares.

Overall modal share targets



Key: In 2017, 332,000 trips per day were taken with public transport, representing a modal share of 16%. In 2035, an additional 294,000 daily trips will have to be taken in this way. This represents an 89% increase in the use of these modes versus 2017. As a result of 40% overall growth, the modal share of public transport will increase by just 6% and will stand at 22% in 2035.

Are the objectives of the Modu 2.0 strategy still valid?

The objectives of the Modu 2.0 strategy with regard to the modal split for 2025 for commuting from home to work and home to school are still valid. They are in line with the objectives of the PNM 2035 that have been set as a function of trip distance and context, regardless of the reason for travel (work, leisure, studies, shopping or other).

These objectives, which are both necessary and attainable mean that by 2035:

The number of people taking a trip by car will increase by 86,000 per day (+6%). An average occupancy rate of 1.5 people per vehicle on motorways that will have a carpooling lane will however reduce by 5% the total number of cars on the road compared to 2017.

Cars will have to be used less in metropolitan areas or for short trips but will continue to be widely used in rural areas for medium- and long-distance excursions.

Passenger numbers in public transport will have to increase by at least 89%. This will be made possible by a broadened offer of railway connections, the tram network, prioritization of buses and improved intermodality.

Town centres, neighbourhoods and areas around schools will need traffic calming measures as part of an effort to make walking safer and more pleasant for nearby errands.

Systematically integrating cycling infrastructure in all road projects will help cycling realize its potential as a fully viable, individual transport mode that is particularly efficient for short- and medium-distance travel.

Chapter 2

Transport networks in 2035

How do transport networks need to be developed in order to accomodate the modal shares targeted for 2035?

Network intermodality

In 2035, the possibility of linking several modes of transport, otherwise known as 'intermodality', will be key for many trips. The various transport networks should not be planned independently, but from their points of contact, i.e. public transport stops, particularly P+Rs and interchange hubs.

This approach gives rise to a multimodal network composed not only of main lines and axes that concentrate major traffic flows, but also of distribution lines and secondary axes that provide access to all towns and neighbourhoods.

Target for 2035

For all major traffic flows, offer mobility chains in public transport that can compete with motorized individual transport in terms of reliable travel times.

Make interchange hubs and public transport stops more attractive

The main interchange hubs, and train stations in particular, will need to be planned not just as transport infrastructure but also as points of interest integrated into the urban fabric. Retail and services tailored to local demand will make transfer time useful and pleasant for the traveller. Even bus stops should be of high quality. Users appreciate shelter from the weather, easy-to-understand real-time information about connections at the particular stop, seating options and well-lit surroundings.

Limit the number of transfers between public transport vehicles

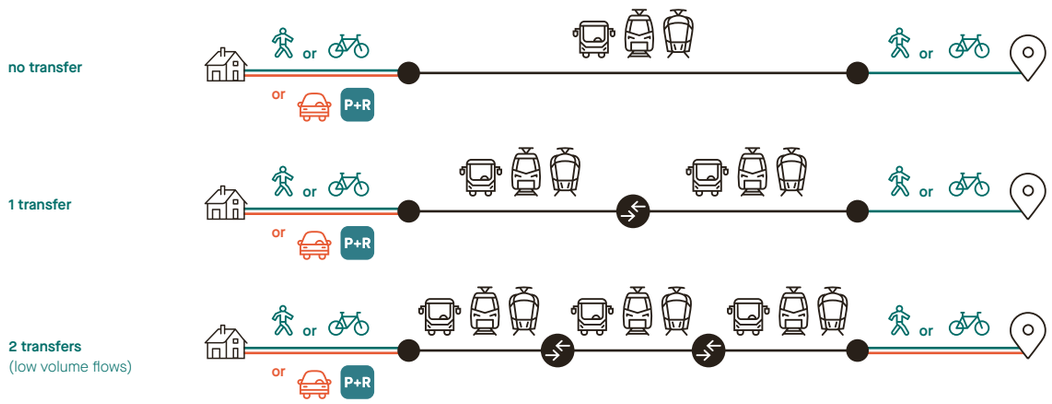
Users of public transport prefer direct connections. For each transfer imposed on them, up to 40% of potential users switch to an individual transport mode, which generally boosts car traffic. Connections are less accepted if they are multiple, required on a relatively short journey or unreliable, oblige the traveller to switch to a less comfortable vehicle, imply a relatively long waiting time or occur at a place where waiting is unpleasant.

Nevertheless, direct connections cannot be guaranteed for each travel need, regardless of volume, origin or destination. The capacity of interchange hubs in metropolitan areas is limited. Direct connections must therefore be reserved for the high-volume flows. To ensure that as many people as possible benefit from efficient public transport, housing and jobs should be concentrated around the stops of the most attractive bus and train lines, or such stops should be equipped with a P+R.

Even for some important flows in relation to the principal centres, i. e. Luxembourg City and Esch & Belval, a transfer to urban transport may be necessary. This will be the case if the final destination in the metropolitan area is too far from train stations or interchange hubs served by the regional train or bus line in question.

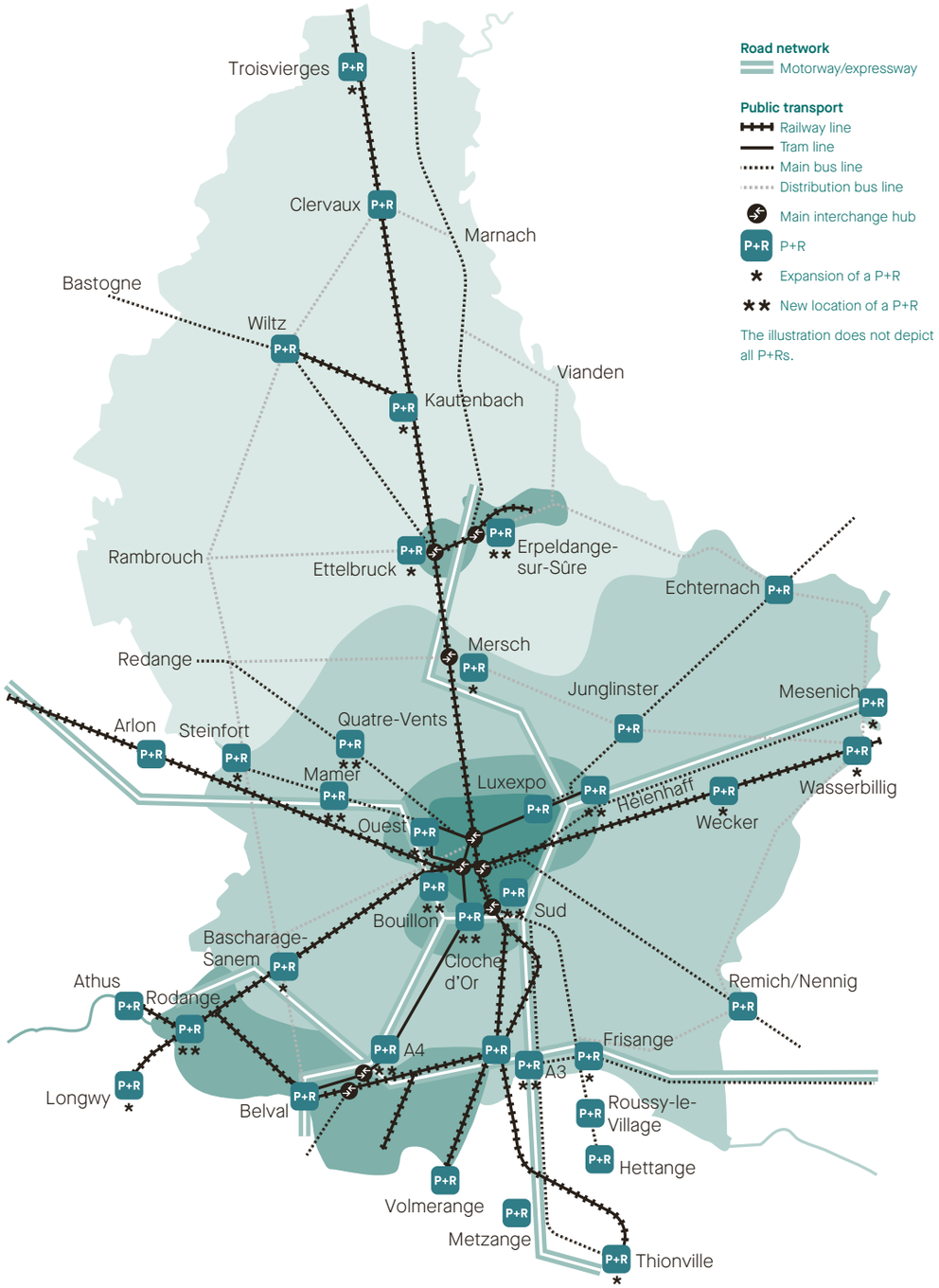
Low-volume mobility demand, especially between less-populated rural areas and a more distant metropolitan area, may require two transfers: a distribution bus line provides a connection to a train or a main bus line that, in turn, provides access to urban public transport in a particular metropolitan area. Users will accept this scenario only if, on the return journey, the connection between the train or the main bus line and the distribution bus line is guaranteed.

Mobility chains – examples



Structural elements of the multimodal network

Regional maps with greater detail are presented and explained in chapter 3.



Complementarity of CFL and bus networks

Trains and regional buses will connect rural and metropolitan areas. The main lines of the bus network will be organised along arterial roads to complement the rail network. To maximise connections, information on train delays will be automatically relayed to buses.

P+Rs at strategic points of contact

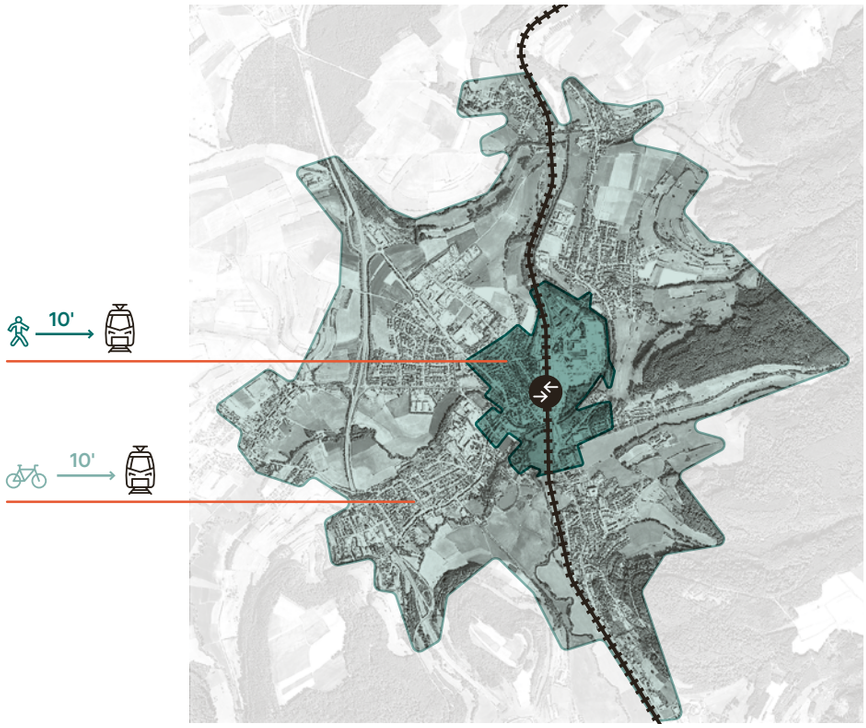
In the regions (including cross-border regions) and at motorway exits at the edge of metropolitan areas, regional P+Rs will provide a link to the train, main bus lines or tram. Smaller, local P+Rs will complete this offer.

Cycle access to stations and stops

The main public transport stops should be safely accessible by bicycle from a radius of at least 2.5km. This distance corresponds to a travel time of approximately ten minutes.

Outside Luxembourg City, **60% of residents** live **within less than ten minutes** by bicycle from a CFL station, and thus from direct access to Luxembourg City and other major destinations.

Cycle accessibility of stops




007

The railway network

As railways are capable of transporting a very large number of people to the heart of the metropolitan areas independently of the road network, they are set to gain between 10% and 15% of the modal share on certain medium- and long-distance routes.

In the short and medium term, projects currently under way (see Modu 2.0, pages 74–78) will improve aspects such as safety, passenger information, timetable reliability and transport capacity. Additional projects that will shorten trip times or improve intermodality have been identified for 2035.

Targets for 2035

Shorten journey times and improve the mobility offer connecting the country's three main metropolitan areas.

Relocate or add railway stops in order to serve very large urban development projects or to strengthen an interchange hub.

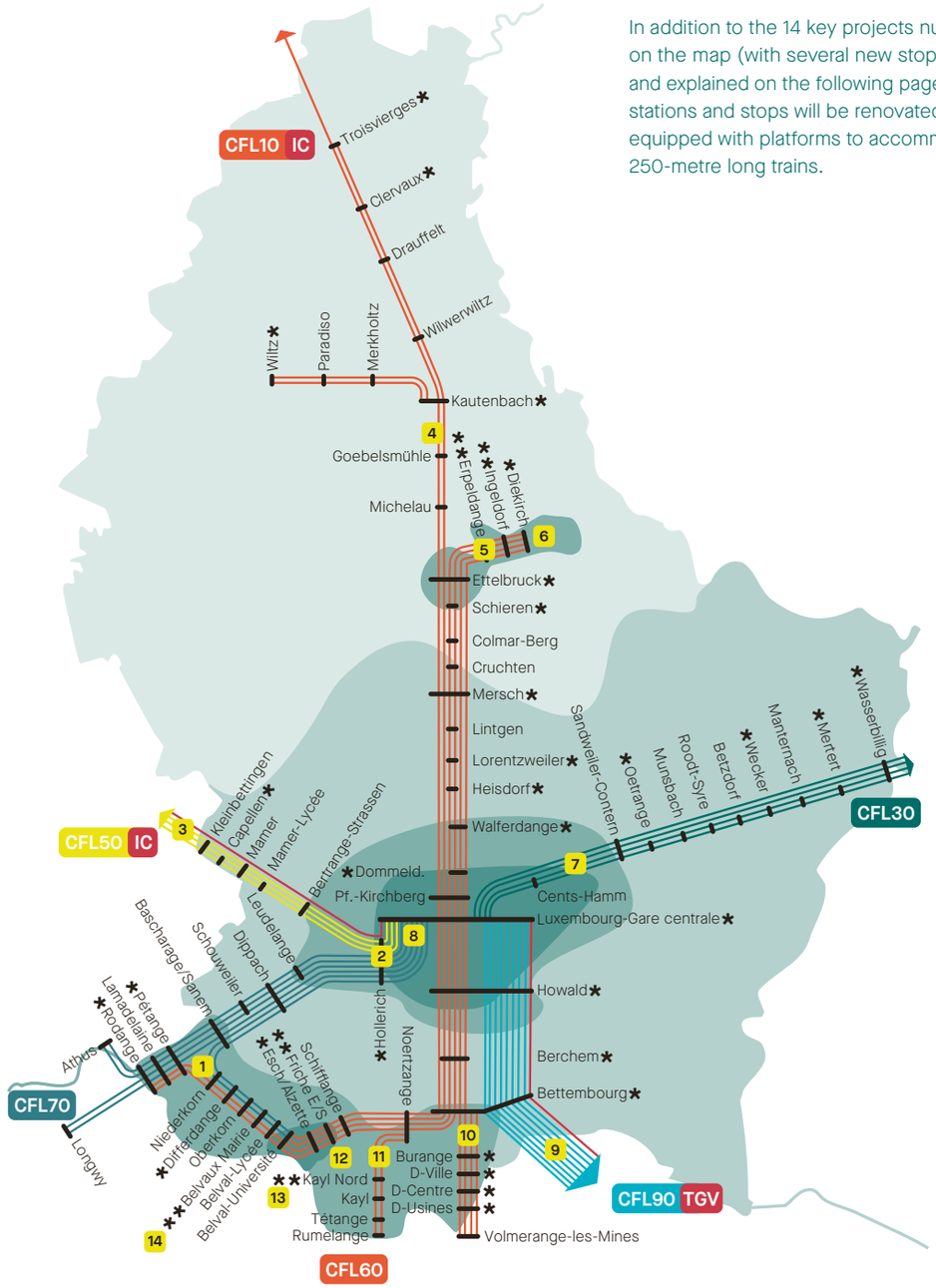
Work with neighbouring countries to improve and broaden international rail links with Luxembourg.

Improving international rail links

In addition to keeping and improving the existing TGV links to Paris and the south of France as well as trains to Brussels (with a reduced journey time) and Liège, the aim is to increase the frequency of the Luxembourg-Düsseldorf link starting in 2026. The creation of direct links to Strasbourg, Frankfurt and Basel, or even Zurich, will be studied in partnership with the authorities in the neighbouring countries. As far as night trains are concerned, besides connections with transfer possibilities in Liège, Koblenz, Metz or Saarbrücken towards the north and east of Europe, the commissioning of direct night trains between Luxembourg and the south of France and Spain, as well as the north of Italy, will be explored.

Railway offer in 2035

Each line represents one train per hour.



In addition to the 14 key projects numbered on the map (with several new stops **) and explained on the following pages, many stations and stops will be renovated (*) and equipped with platforms to accommodate 250-metre long trains.

Key railway projects

1 Creation of a triangular railway junction between the line linking Pétange and Luxembourg (CFL70) and the line from Pétange to Esch-sur-Alzette (CFL60)

Two direct connections per hour via the CFL70 line will reduce the travel time between Differdange, the country's third-largest municipality, and Luxembourg Central Station by 15 minutes.

2 Conversion of the Hollerich peripheral train station into the fourth CFL interchange hub serving the city of Luxembourg

Linking the trains of the Kleinbettingen (CFL50) and Pétange (CFL70) lines with tram and bus services will improve accessibility via public transport to the Cloche d'Or, Hollerich and other neighbourhoods of Luxembourg City. Some travellers will no longer need to transit through Central Station.

3 Reduction in travel time between Brussels and Luxembourg

Improvements on the Belgian network will make it possible to reduce travel time to about two hours.

4 Modernisation of the northern line and its branches

Digital control centres with simplified signalling will help improve punctuality and continuity of service.

5 Creation of a CFL interchange hub in Erpeldange-sur-Sûre including a P+R for the B7 expressway

The new Erpeldange-sur-Sûre stop will become one of the most attractive interchange hubs in the north of the country. Located at the point of contact between the Diekirch railway branch, the B7 and Nordstad's central road axis, this stop featuring a large P+R will be served by four trains per hour and direction, and by all local and regional buses that pass through Nordstad.

6 Relocation and strengthening of the Nordstad railway branch

As part of the reorganisation of Nordstad's road network, the central axis (currently N7) between the future Erpeldange-sur-Sûre interchange hub and Diekirch station will be freed from motorized individual traffic. Relocating the railway branch line to the edge of the Goldknapp embankment will facilitate the urbanisation of this part of Nordstad, which will have a new Ingeldorf railway stop. As the tracks will be doubled, this stop and Diekirch station can be served by four trains per hour, including two express trains to Luxembourg City and the South.

7 Increased rail service between Luxembourg and Trier

Double-tracking the section between Sandweiler and Oetrange will increase the service between Luxembourg and Trier Central Station or Trier-West to four trains per hour, including two express trains.

8 Adding a platform at the Central Station for trains from Differdange

The new trains from Differdange on the CFL70 line will require a new platform in the Central Station.

9 Improved offer on the Lorraine corridor

Once the CFL projects (new Bettembourg-Luxembourg line) are operational in 2028, the projects on the French side provided for in the government agreement of March 20th 2018 (see Modu 2.0, page 78) will make it possible to increase service between Thionville and Luxembourg Central Station to eight trains per hour (in addition to the TGV). The extension to Nancy or even Strasbourg of some of the trains currently terminating in Metz is being considered.

The Lorraine corridor between Thionville and the Luxembourg border is the most frequented line of the SNCF network. In France, only the Parisian RER transports more travellers.

10 Strengthening of the Dudelange railway branch

The two direct trains per hour already scheduled for 2028 between Volmerange-les-Mines and Dommeldange will be extended to Diekirch. This will make the P+R at Volmerange-les-Mines and the future neighbourhood of Neischmelz all the more attractive. The removal of all level crossings in Dudelange and the opening of a new siding in Dudelange-Burange will make it possible to add a half-hourly rail shuttle, thus providing a quarter-hourly service between Volmerange-les-Mines and Bettembourg.

11 Strengthening of the Kälbaachdall railway branch with terminus in Rumelange

In the narrow valley of the Kälbaach, the long-term operation of the freight line and the impossibility of a consequent prioritization of buses on the N33 call for reinforcement of the rail shuttle between Rumelange and Noertzange. Improvements to this branch line will allow for an improved connection to Noertzange at half-hour intervals. An additional stop will serve the future Kayl-Nord neighbourhood. In a second phase, if demand along the branch justifies it, some trains at peak hours could be extended to Luxembourg City. This would however come at the expense of freight train paths between Noertzange and Bettembourg and would require the procurement of additional passenger trains.

12 Addition of a railway stop for the new brownfield district of Esch-Schifflange

As soon as the new Esch-Schifflange district will be sufficiently developed, the trains of the CFL60 line will serve a new stop where two high-performance bus corridors (CHNS, see page 65) will also intersect. As this new stop is located near the current station in Esch-sur-Alzette (with only one train length between platform ends), once the slag heap at Terres-Rouges has been urbanised, consideration can be given to relocating the Esch-sur-Alzette station to a modern building at the western end of the pedestrian zone. Such an arrangement of railway stops would offer optimal accessibility both from the historic centre and from the new districts.

13 Replacement of the Audun-le-Tiche railway branch with a high-performance, cross-border bus corridor (CHNS)

In order to increase the number of destinations in the Grand Duchy that residents of French municipalities in the Upper Alzette Valley will be able to reach with not more than one transfer, the 2.6km railway shuttle (two trains per hour) between Audun-le-Tiche and Esch-sur-Alzette will be replaced by a cross-border bus corridor with a high level of service ('cross-border CHNS'). This corridor will be used approximately every five minutes by buses linking the various residential districts, several P+Rs and the CFL stations in Esch-sur-Alzette and the new Esch-Schifflange district, the fast tram and numerous other bus lines.

14 Consolidation of two railway stops in Belvaux into a single interchange hub with the fast tram and the high-performance bus corridor

The redevelopment of the town centre of Belvaux with a high-performance bus corridor (CHNS) and the fast tram terminus will present an opportunity to combine the outlying stops of Belval-Rédange and Belvaux-Soleuvre into a new CFL interchange hub at Belvaux Mairie. The accessibility of this interchange hub from all the other neighbourhoods of Belvaux will be optimised.

Some questions about the railways

Why do some rail crossing gates remain closed longer than others?

In addition to the case where two trains from opposite directions follow each other in a time interval too short for the gate to open between the two crossings, some crossings routinely remain closed longer than others because they are located in close proximity to a stop. Indeed, the rules of railway safety require that a certain distance beyond a stop be kept free from all obstacles or other trains in the event that the train entering the station does not brake as planned. As the time in station is too short for the gate to open between the stop and the departure of the train, motorists will find themselves at a closed gate for an extended period of time before the train passes.

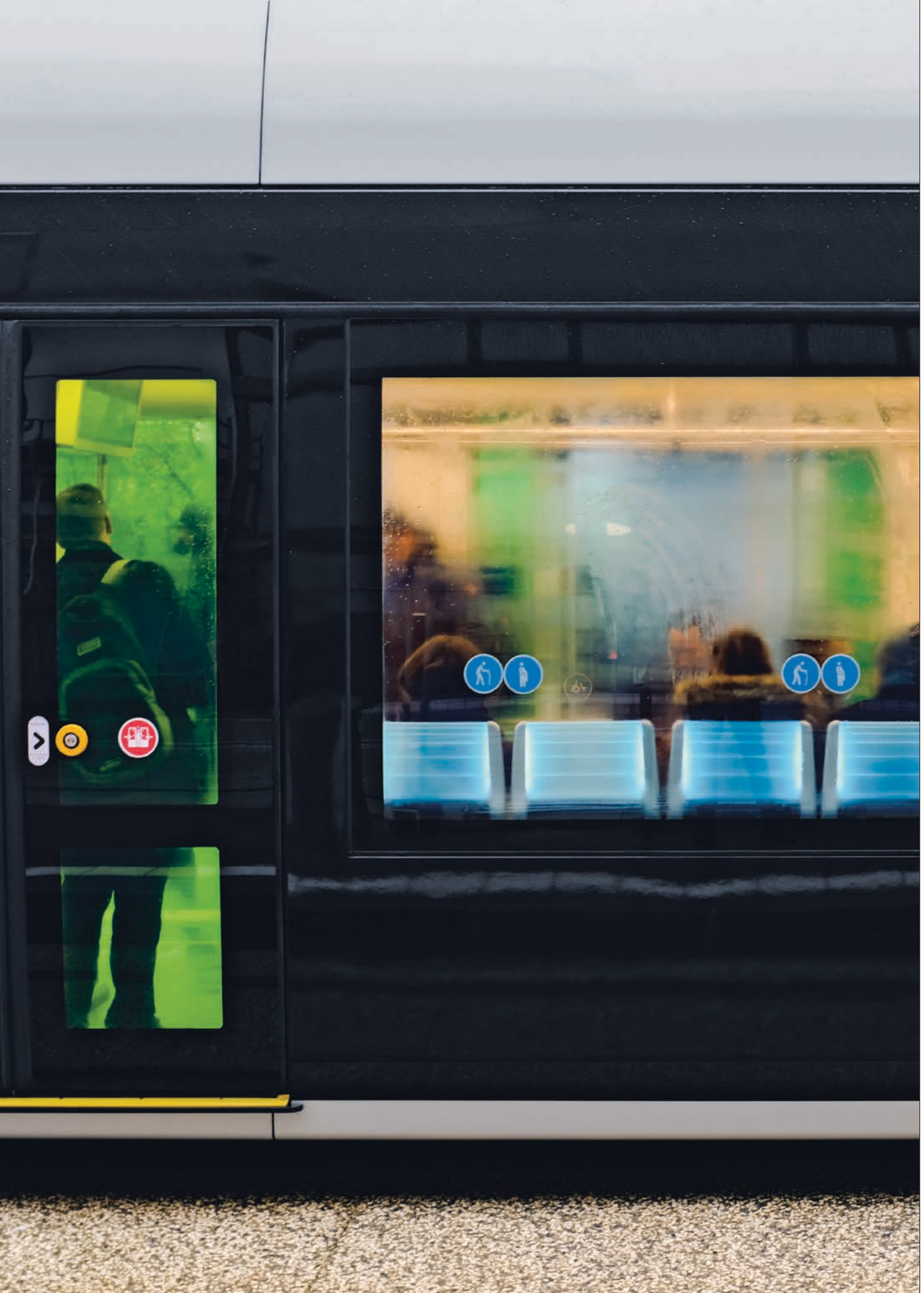
The aim is to remove all level crossings. Especially in urban areas, the difficulty lies in finding the necessary land to create attractive alternatives for pedestrians, cyclists and motorized traffic.

Why are some decommissioned railways not being reactivated?

As explained in the Modu 2.0 strategy (page 47), the multimodal public transport network is designed in such a way as to transport as many people as possible with as few transfers as possible while using vehicles, the capacity of which is tailored to the local passenger potential. On some of the decommissioned tracks, not only does potential demand fall far short of the criteria that would justify providing a train, but the frequency of the train involved, and above all the impossibility of incorporating it into the rail network, would make it unappealing even to these few potential users.

Why don't trains accept more bicycles during peak hours?

The primary purpose of trains is to transport a large number of people during peak hours. The rolling stock in Luxembourg has bicycle compartments mainly intended for cycle tourists. As in the Netherlands, where trains do not accept bicycles during peak hours, Bike and Rail in Luxembourg is based on the secure parking of bicycles at train stations. Rather than board a train with their bicycle, commuters drop it off safely in the morning at the departure station, take the train and then, if desired, use a second bicycle - private or rented - at the destination station. Use of bicycle cages is free of charge. The same principle applies to buses, trams and interchange hubs.



The tram network

The tram is an urban mode of transport. The fast tram meets a unique demand in the Grand Duchy, as it connects the country's two principal centres: the city of Luxembourg and Esch & Belval.

With a passenger capacity greater than that of a high-performance bus corridor, the tram is suitable for flows of several tens of thousands of passengers per day. In addition to being the structuring public transport for residents of the principal centres, the tramway distributes commuters into these urban areas.

Between Esch & Belval and the city of Luxembourg, the fast tram and the CFL60 line complement one another. While the railway connects the historic centre of Esch-sur-Alzette to Luxembourg's Central Station and the peripheral train stations of Howald and Pfaffenthal-Kirchberg, the fast tram connects the northern districts of Esch to other districts of Luxembourg City and to the airport. The two lines will connect at the interchange hubs of Belvaux Mairie and Pfaffenthal-Kirchberg and will be located within walking distance at the site of Belval and at the new district of Esch-Schifflange.

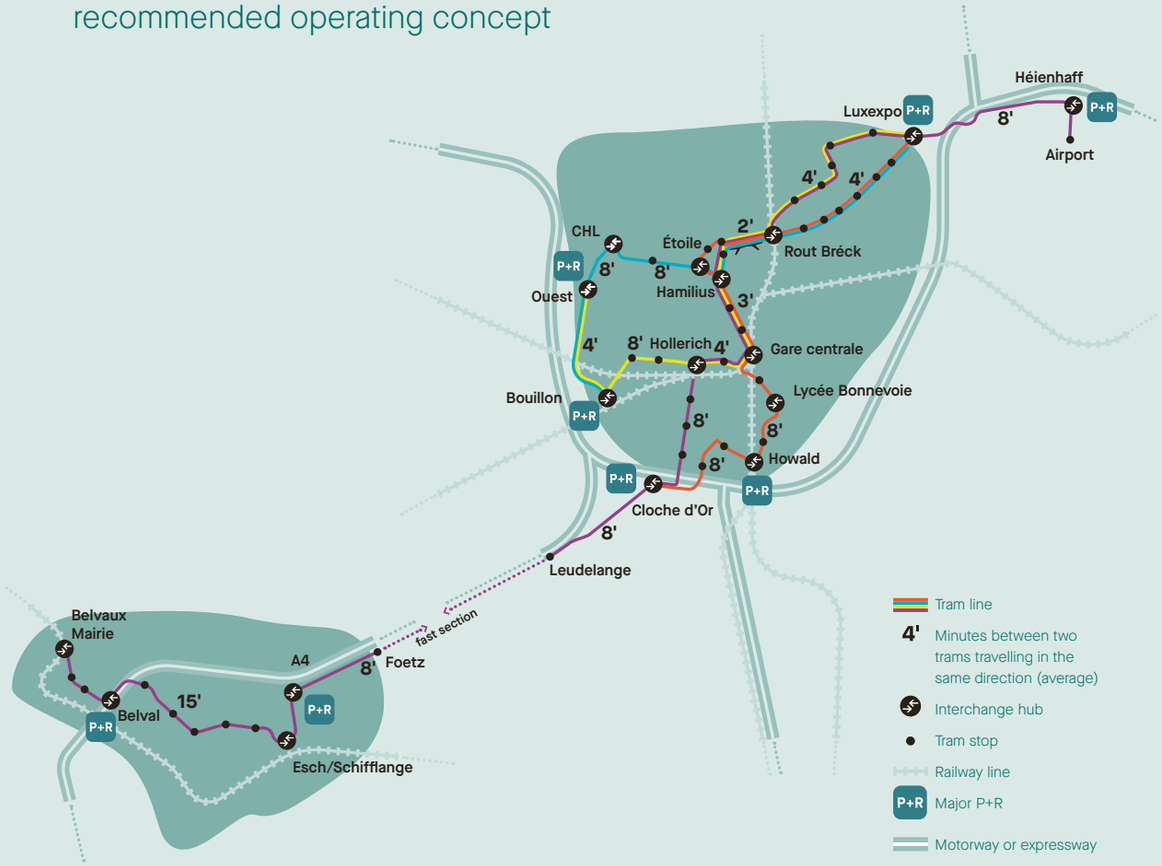
Targets for 2035

To Line 1, which links Cloche d'Or to the airport, add extensions to new neighbourhoods and interchange hubs to be built by 2035, namely:

- via Hollerich to the new Ouest interchange hub;
- via route d'Arlon to the new Bouillon interchange hub;
- via route d'Esch in Luxembourg City to the new Belvaux Mairie interchange hub;
- a second line serving the 'Laangfur' and 'Kuebebierg' districts in Kirchberg.

Bringing these extensions into service by 2035 will require accelerating network development to 2 to 3 km per year as compared to the 1.5 to 2 km per year achieved between 2016 and 2021.

The tram network in 2035 – recommended operating concept



CLOCHE D'OR – LUXEXPO LINE

Operational between Luxexpo and Central Station since 2020, Line 1 will run between the Cloche d'Or and Luxexpo in 2035. It will link eight interchange hubs with today's three main points of interest – John F. Kennedy Avenue at Kirchberg, the city centre and Ban de Gasperich. It will also serve the airport until the fast tram comes into service.

OUEST – LUXEXPO VIA CENTRAL STATION LINE

This line will pass through new neighbourhoods in Hollerich and Kirchberg, serving five interchange hubs.

BOUILLON - LUXEXPO VIA CHL LINE

Reorganisation of the road network between the Strassen and Helfent motorway interchanges will offer an opportunity to set up a multimodal interchange hub with P+R to the west of Luxembourg City. This tram line will connect the Ouest and CHL interchange hubs as well as the new Stade neighbourhood with the city centre and Kirchberg.

ROUTE D'ESCH AND FAST TRAM LINE

In 2035, taking advantage of its fast (100 km/h) section between Foetz and Leudelange, the fast tram will connect Belval, the northern districts of Esch-sur-Alzette and the new Esch-Schifflange neighbourhood with Luxembourg airport. Within the city of Luxembourg, this line will serve the many workplaces and residential areas along Route d'Esch. During this initial phase, it will pass through Avenue de la Liberté.

Some questions about the tram

How to develop an efficient tram network?

Developing a tram network involves much more than laying rails in the desired direction. The constraints of an efficient operating concept have to be added to criteria that make the overall public transport offer attractive – such as reducing the number of transfers for a maximum number of potential passengers. To be successful, the tram network must be reliable, i.e. the causes of disruptions must be eliminated at the source or at least reduced as much as possible.

- **Dedicated lane:** *In contrast to some historical tram networks that predate the widespread use of the private car, an attractive tram system must operate apart from individual traffic. Exceptions are only conceivable along an extremely short stretch of a heavily used section (e.g. AVL buses using the tram bed between the Adolphe Bridge and the Hamilius stop), or on a longer stretch subject to very little tram traffic. Adding a tram line to an existing road usually involves removing lanes for other modes (6.50 m wide).*

- **Double track:** *While the two cabins of a funicular are connected to each other by a cable and therefore always cross at exactly the same spot, the crossing point of two trams varies according to their timetable and punctuality. A single-track section (as practiced temporarily during the annual Schueberfouer fair between the Étoile and Théâtre stops) not only compromises the punctuality of the tram lines that use it, but also leads to a chain reaction affecting all the other lines in the network. Single-track sections should therefore be avoided – except at the end of a line with very few trams per hour.*

- **Maximum frequency:** *A three-minute gap between two trams that follow each other means that the second tram is not burdened with every slight delay of the first. Intervals as brief as two minutes are conceivable on a relatively short bottleneck in the network, such as the Grand Duchess Charlotte Bridge (Rout Bréck). On some foreign tram networks, even higher frequencies are practiced, but they require flawless prioritization of each of these numerous trams at every junction and are therefore only compatible with particularly low levels of motorized traffic. This constraint limits the number of lines that can be superimposed on the same section.*

- **Minimum frequency:** *Up to a certain frequency (about six to eight minutes), the passenger, knowing that the average waiting time will be quite short, goes to the tram stop without checking the timetable. However, the lower the passenger potential, the further apart the trams will be spaced. For intervals exceeding 15 minutes, a higher-frequency bus service is generally not only sufficient, but also more attractive to travellers.*

- **Network resilience:** *A network is resilient if a major incident blocking a particular section causes little disruption to the overall operation. Parallel routes connected by triangular junctions allow for a diversion of impacted lines. The resilience of the network is all the more important as the public transport offer of a city depends on the smooth running of the tram.*

Are other isolated tram networks conceivable in the Grand Duchy?

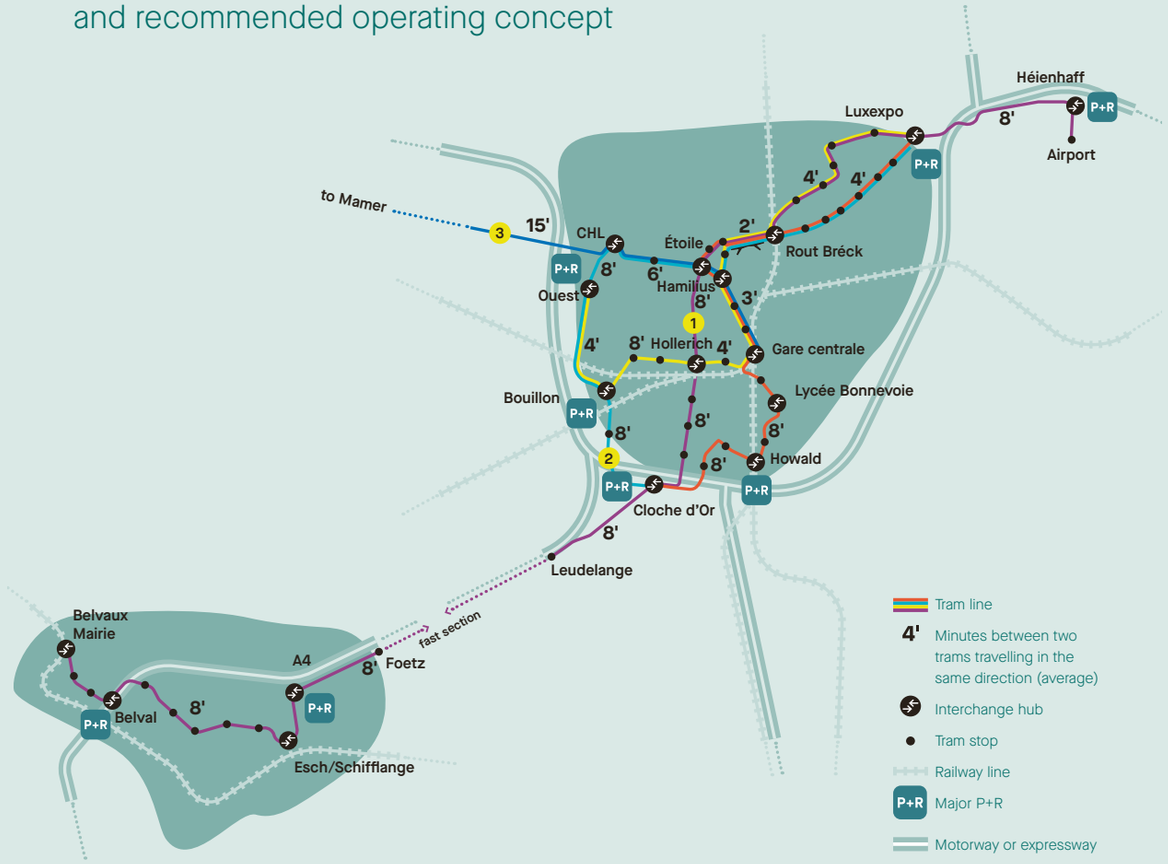
Since a new tram network requires a maintenance and storage facility, rolling stock and an operator, it only makes sense if it carries more than 100,000 passengers per day while adding value to the existing multimodal offer, i.e. more capacity and fewer transfers for the main passenger flows. Luxembourg City and its fast tram extension to Belvaux is the only such case in the Grand Duchy.

What other extensions of Luxembourg City's tram network are imaginable?

Because of its urban context in Luxembourg City's metropolitan area and its ability to be inserted into the network, the only extension that should be analysed in detail in the coming years with the municipalities concerned is the one towards Mamer. The advantages of this line – which would connect an interchange hub near the future Mamer/Capellen motorway interchange with the city centre and Central Station – will need to be weighed against several disadvantages: very low frequency (15 minutes) compared to the bus corridor that it replaces; stops twice as far apart as bus stops; a journey time of about 35 minutes between the future Mamer interchange and the Hamilius stop and the need for a new alignment of the facades on many sections of Route d'Arlon.

Whether due to passenger potential (too low, too scattered or too distant) or topography, there are many reasons to conclude that, apart from a possible extension to Mamer, all other mobility corridors would be better served by an attractive bus service.

Post-2035 extensions to the tram network and recommended operating concept



1 ROUTE D'ESCH AND FAST TRAM

Ensuring the resilience of the tram network in the event of a major incident on Avenue de la Liberté or Pont Adolphe, providing service to the Belair and Hollerich neighbourhoods, reducing the travel time of the fast tram and allowing the addition of a tram line towards Mamer would all require a direct connection between the Hollerich and Étoile interchange hubs.

2 CLOCHE D'OR – LUXEXPO LINE VIA CHL

Should the future Boulevard de Cessange be urbanised, the new neighbourhoods would be served by extending this line to the Cloche d'Or interchange hub.

3 MAMER – CENTRAL STATION LINE

The aforementioned doubling of the north-south axis between the Étoile and Cloche d'Or interchange hubs would allow the insertion of a low frequency line from Mamer on Avenue de la Liberté.

With this operating concept, each tram stop and thus each interchange hub at the outskirts of Luxembourg City would provide a direct tram line to at least three of the four main centres of attraction: the city centre and Central Station, Kirchberg, Ban de Gasperich and the new districts in the western part of the city.

The bus network

Because buses use the road network, they are more flexible than rail-based public transport systems. However, the quality of the bus service depends largely on its prioritization at road traffic bottlenecks.

Buses fulfil several purposes:

- For the main mobility flows, they complement the rail and tram offer in order to make public transport competitive with the private car.
- The bus network covers the territory to provide all towns and villages with public transport.
- Buses provide so-called 'special' services, such as school transport or the transport of people with special needs.

Whereas 'special' services are regularly adapted to demand (on a daily or an annual basis) and distribution lines with the mission of interconnecting the territory are occasionally modified to serve a new neighbourhood or the expansion of a business park, the main bus lines must be determined once and for all and then stabilised.

The main bus lines are as important to the public transport network as the train and tram lines. Like the latter, they require specific infrastructure.

Target for 2035

Provide interchange hubs and bus prioritization at the entrance to and the crossing of metropolitan areas. This is a prerequisite for operating an attractive and reliable bus network that is appealing compared to car travel.

With an average vehicle occupancy rate of 1.2 people per private car, a bus carrying 54 passengers will replace a queue of 45 cars.

The role of the bus network across the territory

While the role of ‘special’ services, such as school transport and transport for people with special needs, does not vary across the territory, the bus network for the general public has specific regional characteristics. From a user’s point of view, it consists of four types of lines. They differ by their mission – whether ‘main’ or ‘distribution’ – and by their context: rural for some, urban for others.

Main lines

Main line in a rural area

Main line in a metropolitan area

Mission
For the main traffic flows, to be complementary to the train and tram offer in order to make public transport competitive with the private car during peak hours.

Characteristics
Direct, fast and reliable. Only serve the main stops. Each additional detour or stop reduces the attractiveness of public transport for a whole region or part of a metropolitan area upstream. Can provide cross-border service.

Infrastructure
Prioritization of buses at the entrance to and through metropolitan areas, on motorways and at traffic bottlenecks. Stopping and waiting places reserved at interchange hubs. Cycle infrastructure for the ‘first mile’ and ‘last mile’ around stops.

Distribution bus lines

Distribution bus line in a rural area

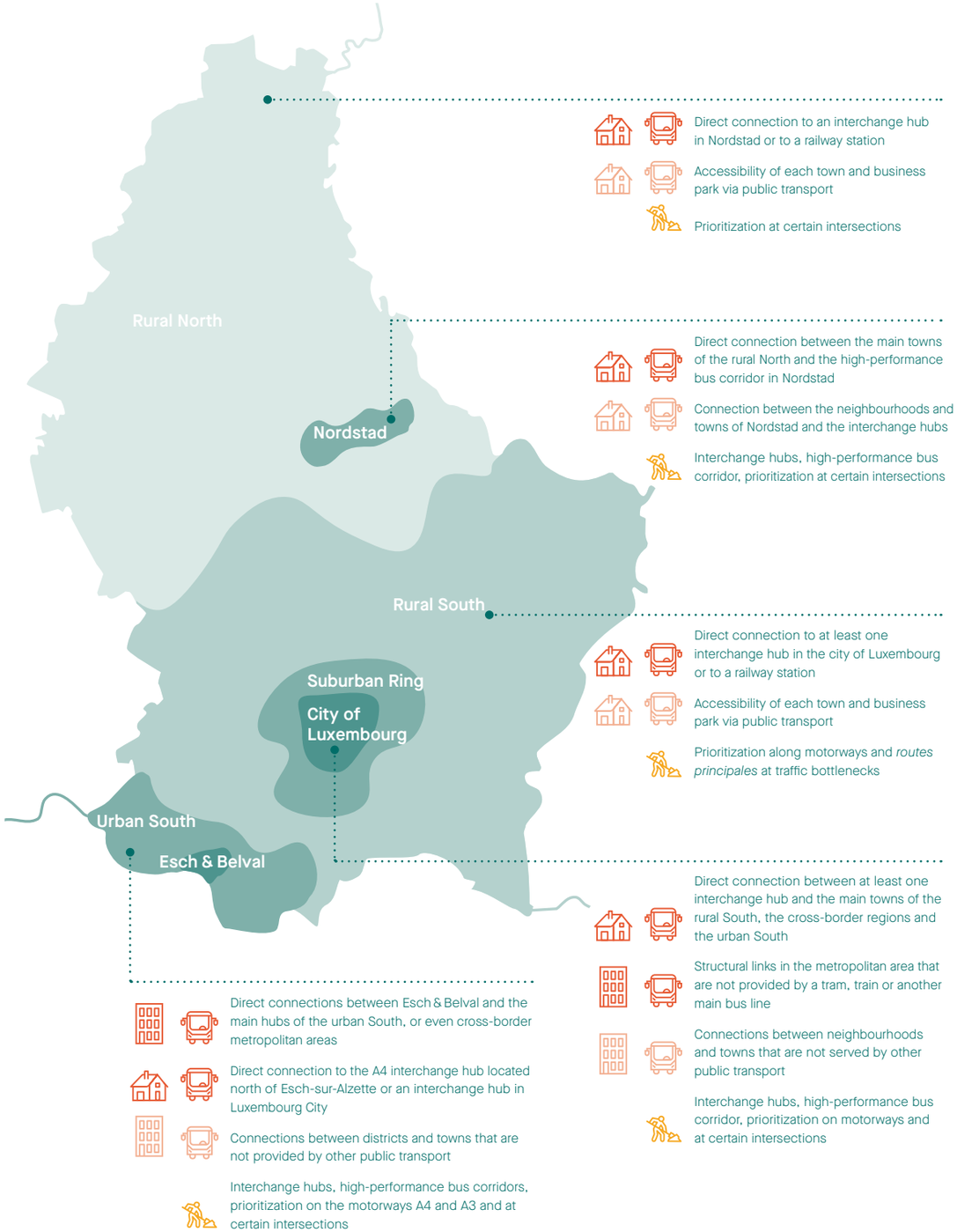
Distribution bus line in a metropolitan area

Mission
Provide nationwide public transport coverage by serving towns, neighbourhoods and business parks that do not have a train or tram stop or a main bus line.

Characteristics
Frequent stops along routes with medium or even low mobility demand. Connections to a train, tram or main bus line.

Infrastructure
Prioritization of buses at certain intersections.

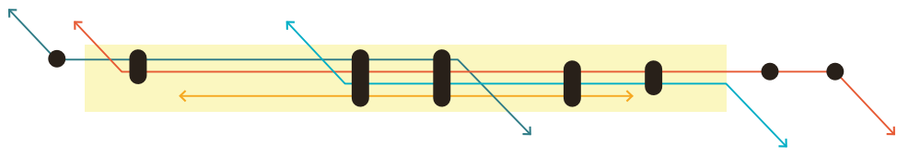
The role of the bus across mobility zones
‘Special’ services are not shown, as they do not vary throughout the country.



Key aspects of bus networks in metropolitan areas

In order for the main bus lines, whether rural or metropolitan, to be attractive in 2035, some key prioritizations will have to be put in place in metropolitan areas. The multimodal mobility concepts for the three metropolitan areas are illustrated in chapter 3.

In each of the country's three metropolitan areas, there are one or more corridors in which a large number of bus lines converge. To ensure reliable service and speeds that are competitive with car traffic, buses must travel separately from individual traffic as much as possible and be systematically prioritized at intersections. In the following, a prioritized section that is shared by many main bus lines is referred to as a **high-performance bus corridor (CHNS)**. The high level of service benefits not only passengers that are in transit, but also those using stops along such a section. These stops are characterised both by a high frequency of buses and by the large number of reachable destinations. As is the case throughout the network, the bus models using a CHNS are selected according to the number of passengers to be transported on the different lines.



Bundle of bus lines benefiting from a high-performance bus corridor (CHNS)

Why speak of 'high-performance bus corridors' (CHNS) and not of 'bus rapid transit' (BHNS)?

The term 'bus rapid transit' (BHNS) is confusing because the high level of service depends less on the vehicle than on the infrastructure. In the Grand Duchy, a network of regional and urban buses links scattered points of departure in rural or suburban areas to destinations and interchange hubs in metropolitan areas. The best way to meet this kind of demand is not by a particularly long bus shuttling back and forth between the two edges of a metropolitan area, but by means of high-performance bus corridors (CHNS) from which passengers of a whole cluster of bus lines benefit. The superposition of multiple lines using normal-sized buses along a prioritized corridor offers a high level of service to users, whereas a bus running in mixed traffic or in traffic-calmed mixed-usage streets can neither guarantee high speed nor good reliability, regardless of the size of the vehicle.

Nordstad

Channeling motorized individual through traffic towards the new *contournements de proximité* of Ettelbruck and Diekirch and the widened 2×2 B7 expressway will allow the creation of a high-performance bus corridor between the centres of Diekirch and Ettelbruck. This will benefit not only the many rural main bus lines that will use it, but also the inhabitants of the Nordstad. They will have a particularly well-rounded and reliable bus offer for trips both within Nordstad and to the region.

Nordstad CHNS

Esch & Belval

Reorganising the road network, introducing the fast tram, urbanising the brownfield in Esch-Schifflange and replacing the railway branch line between Esch-sur-Alzette and Audun-le-Tiche with a bundle of cross-border bus lines will permit substantial improvements of the bus network in the urban South. It will benefit from several high-performance bus corridors:

- between Audun-le-Tiche and the interchange hub in the new district of Esch-Schifflange,
- between the A4 interchange hub and Belvaux via Raemerich, and
- between the Raemerich interchange hub and Schifflange via Esch-sur-Alzette City Hall and the new district of Esch-Schifflange.

CHNS of the Esch & Belval mobility zone

City of Luxembourg and suburban Ring

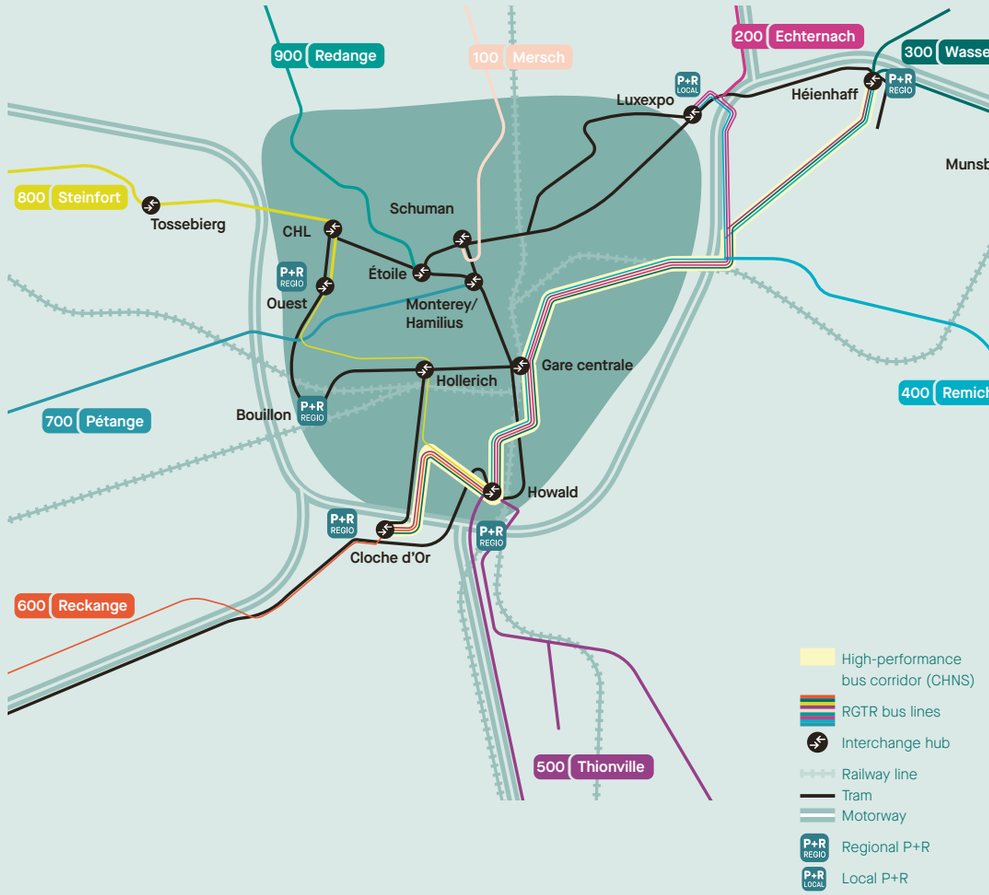
To achieve the minimum modal share targets and prevent widespread road congestion, the number of public transport trips within the metropolitan area formed by the city of Luxembourg and its suburban Ring will need to increase from 220,000 per day in 2017 to 400,000 per day in 2035.

Luxembourg City is both the home for its population and the main employment centre of the Grand Duchy and the Greater Region. City residents want to benefit from efficient urban public transport without seeing their neighbourhoods overrun by vehicles coming from outside. If they are to abandon the car in large numbers, residents of the rest of the country and the Greater Region, starting with those of the suburban Ring, must be offered public transport that takes them quickly and without inconvenience to their main destinations in Luxembourg City: the city centre and Central Station, Kirchberg, Cloche d'Or and Ban de Gasperich. Aligning these variables depends on the complementarity between the tram network and the main bus lines in rural and metropolitan areas.

1. Main bus lines in rural areas (extending beyond the suburban Ring)

Some commuters who have to travel to the metropolitan area of Luxembourg City have already made one transfer in a rural area to access their main bus line. Others have a destination in the city that is not well served by the tram from the first interchange hub of their bus line. To connect as many rural departure points as possible to as many main destinations as possible in the city in the most attractive way possible, while keeping regional buses away from the city centre, the RGTR *(Régime Général des Transports Routiers)* network will be organised as illustrated on page 67. Depending on the local layout of the road network, the main bus lines of an RGTR corridor will serve either a single interchange hub located near the city centre, or at least two interchange hubs located on the outskirts of Luxembourg City. These buses will use state roads that border rather than cross residential neighbourhoods. This logic results in the need for a high-performance bus corridor connecting the Cloche d'Or, Howald, Central Station and Héienhaff interchange hubs by 2035. The capacity of this CHNS, which passes through mostly wide arterial roads (Boulevard Raiffeisen, Boulevard de Kockelscheuer, Rocade de Bonnevoie, N2, N2A and N1) will be determined by optimisations in the Rue du Laboratoire area.

RGTR corridors and tram interchange hubs in 2035

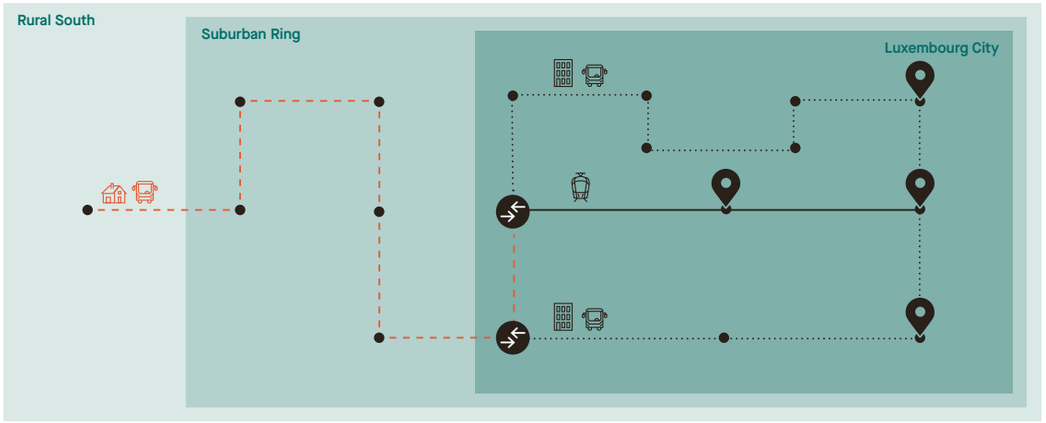


2. Main bus lines in metropolitan areas (serving the suburban Ring)

Trips between the suburban Ring and Luxembourg City, 75% of which cover distances shorter than 9km, will increase from 92,000 in 2017 to 143,000 per day by 2035. In 2017, 74% of these trips were taken by car.

Meeting this demand will require not only a more efficient cycling network but also a perfectly coordinated bus service between the main lines in rural areas and those in metropolitan areas. Indeed, the suburban Ring is the intersection of the RGTR and AVL bus networks. As shown in the two diagrams below, the overall bus offer is more attractive if the suburban Ring is served by main metropolitan lines (option 2) rather than main rural lines (option 1).

Option 1: Serving the suburban Ring with rural lines



Main line in a rural area

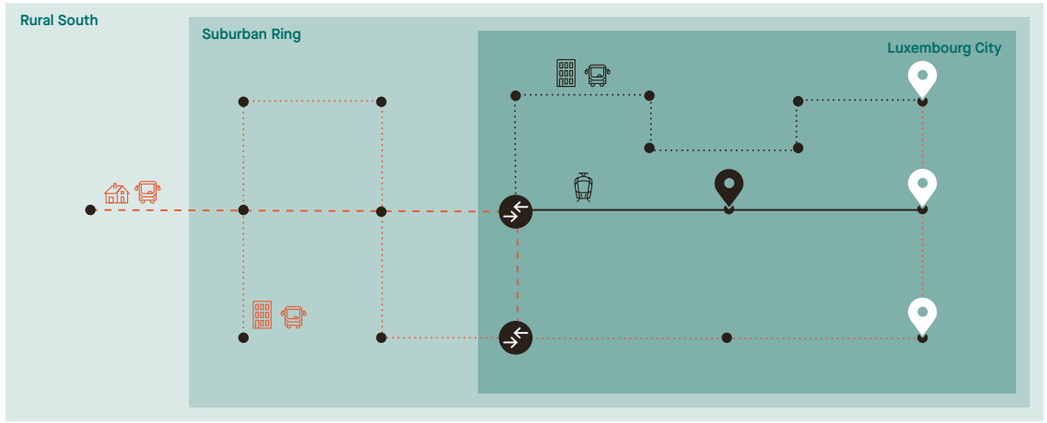
Distribution line in a metropolitan area

Interchange hub

Destination with transfer from the suburban Ring

Service to the suburban Ring by buses originating in the rural South is neither attractive for the latter nor for the suburban Ring. Indeed, before arriving at the interchange hubs of Luxembourg City, passengers from rural areas are delayed by detours and additional stops in the suburban Ring. As for trips between the suburban Ring and Luxembourg City, which are only a few kilometers long, a transfer is imposed regardless of the destination in the city. Such a service in the suburban Ring provides little incentive for residents of the rural South or the suburban Ring to travel to the city by bus rather than by private car.

Option 2: Serving the suburban Ring with metropolitan lines



Main line in a rural area

Main line in a metropolitan area

Destination without transfer from the suburban Ring

Interchange hub

Distribution line in a metropolitan area

Destination with transfer from the suburban Ring

Service to the suburban Ring by the main metropolitan bus lines benefits both the rural South and the suburban Ring. In this case, the main rural lines directly serve the interchange hubs of Luxembourg City, with only a few important stops in the suburban Ring. This service to the suburban Ring is supplemented by services from the main metropolitan lines. These lines offer direct connections between the towns of the suburban Ring and key destinations in the city. They are all the more attractive and faster if they take a direct route through the city.

The pedestrian network

Walking is the most natural way of getting around. It is an essential part of life in the public space and key for the success of local shops. Every trip begins and ends on foot.

The pedestrian network typically falls within the jurisdiction of the municipalities. Neighbourhoods that prioritize walking over driving will reduce the excessive share (35%) of trips of just a few hundred metres made by car in 2017.

Target for 2035

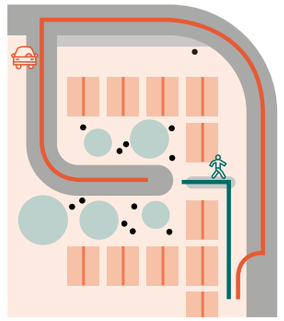
Make walking the most attractive option for short-distance trips. To this end, short, direct, comfortable and safe pedestrian routes should be systematically integrated into any new neighbourhood project or the redevelopment of streets and junctions in urban areas.

Four questions to ask at each urban development or road project

First question:

Does the project offer a shortcut for pedestrians and cyclists?

Do the shortcuts make walking attractive in terms of travel time for local trips? Almost every urban development project offers this kind of opportunity.



Pedestrian shortcut

Second question:

Does the project make it possible to improve pedestrian safety and comfort at intersections?

Pedestrians mainly ask for segregation from cyclists and for pedestrian-friendly intersections (TNS-Ilres and MMTP, 2020). Technical brochures cover topics such as road safety, lighting, layouts for people with reduced mobility and cycling infrastructure at intersections.

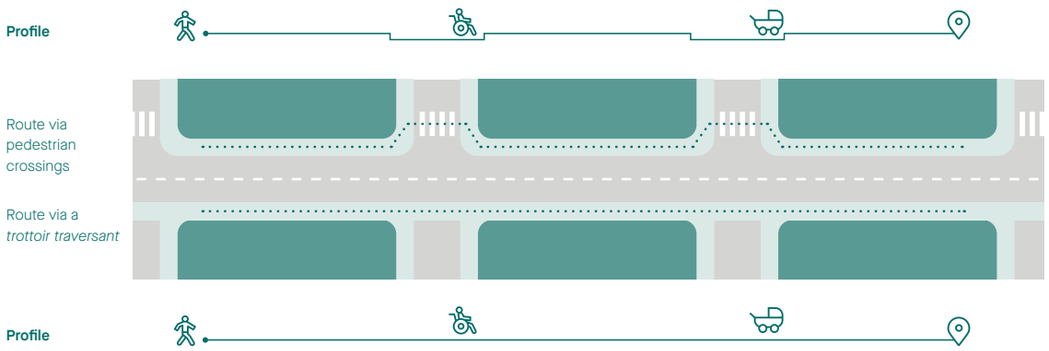
The number of kerbs pedestrians must cross and detours from their desire line should be kept to a minimum. The *trottoir traversant* is a particularly attractive feature for pedestrians. After all neighbouring countries, it was introduced to the *Code de la Route* in 2018. It inverts the typical logic of an intersection, which consists of the pedestrian passing through the space reserved for motorized traffic. The *trottoir traversant* gives pedestrians the opportunity to continue along their route in a straight line without leaving the pavement. It is thus the motorized vehicle that crosses the space dedicated to the pedestrian with the obligation to give way first to the pedestrian and then to the vehicles travelling on the intersecting road. The *trottoir traversant* may be set up at the outlet of a road with a maximum authorised speed of 30 km/h or less.

The *trottoir traversant*

Pedestrian's perspective

Motorist's perspective

Compared to a conventional pedestrian crossing, which is set back by a car's length from the road it runs alongside, every *trottoir traversant* saves the pedestrian two changes of direction, a ten-metre detour and the crossing of two kerbs.



Third question:

Does the project remove obstacles and make the route more interesting for pedestrians?

The attractiveness of walking is determined by the sum of 'microsituations' pedestrians encounter along their way. On the one hand, this means providing the widest possible passage free from obstacles, by moving bus shelters, posts, plantings, technical cabinets, construction site installations and waste bins out of the way. Another objective is to make the route less monotonous by creating interactive points of interest (book box, pavement garden, fountain, square, etc.) and encouraging local residents to vitalize their front yards. These constitute an important, often neglected, part of the streetscape as perceived by pedestrians.

When planning a pavement, imagine the pedestrian as a person on wheels (wheelchair, walker, child's scooter, rolling satchel, etc.) who wants to be distracted by something other than obstacles or people travelling at the speed of a bicycle.

Fourth question:

Does the project reduce pedestrian waiting times at traffic lights?

Through the frequency and duration of the green phases, traffic lights determine the respective attractiveness of two intersecting flows. Traffic-signal cycles can be programmed to promote either walking and cycling or motorized traffic, depending on the urban context of an intersection and the mobility policy of the competent authority. Waiting times of more than 40 seconds, or a traffic light preventing pedestrians from crossing an empty street may not be respected by pedestrians who are in a hurry. There are alternatives such as loops embedded in the road surface through which a car – not a pedestrian – requests a change to green, or a phase during which the lights at all pedestrian crossings of an intersection change to green simultaneously. Following the example of the city of Drachten in the Netherlands, more and more pilot projects show that in some situations, eliminating traffic lights altogether improves both road safety and traffic flow.

The cycling network

Cycling is the transport mode that needs to progress the most in the coming years. Otherwise, individual mobility in metropolitan areas is set to deteriorate considerably.

Cycling is an individual mode of transport accessible to all age groups. It is perfectly suited to the constraints of the urban environment in terms of space, noise and pollution. While the car, although available only to a large part of the adult population, has advantages for long-distance travel and walking is mainly suited to short distances, the bicycle can cover between four and seven kilometers in a quarter of an hour. In 2017, 33% of residents' work commutes were shorter than 5km, as were 37% of trips to secondary school and 78% of trips to primary school (see Modu 2.0, page 12).

Target for 2035

Make cycling a fully fledged individual mode of transport, allowing safe and comfortable access to any place in the Grand Duchy, while being at least as efficient as the car for journeys in metropolitan areas.

The minimum targets for the modal share of cycling as outlined on page 35 may seem ambitious. As a matter of fact, they would only bring Luxembourg's metropolitan areas to the current level of cities such as Frankfurt, Bonn or Munich, which are aiming for much higher modal shares by 2035. In Luxembourg, targets for modal share will be easy to achieve once everyone who wishes to travel more by bicycle is presented with a high-quality cycling infrastructure.

Turning cycling into a fully fledged individual mode of transport means integrating it systematically into every state road, municipal road and building project, as it has been done for the car for the past 60 years.

The national cycling network

The national cycling network will cover the territory with a mesh size of about 10 km. Other cycling infrastructures can be connected to it. In addition to this function of territorial coverage (not shown on the map), the national cycling network will fulfill two specific purposes:

- Providing direct and fast cycle routes to the heart of metropolitan areas from a radius of at least 15km. Achieving this will require **instituting high-performance cycle routes** that will allow for a smooth flow of traffic. Infrastructure that meets the following criteria will be labelled as 'cycle highway': close to no stops for cyclists, turns and gradients adapted to a speed of 25km/h and segregation from pedestrian flows. This quality is envisioned for the three routes that will connect the three metropolitan areas.

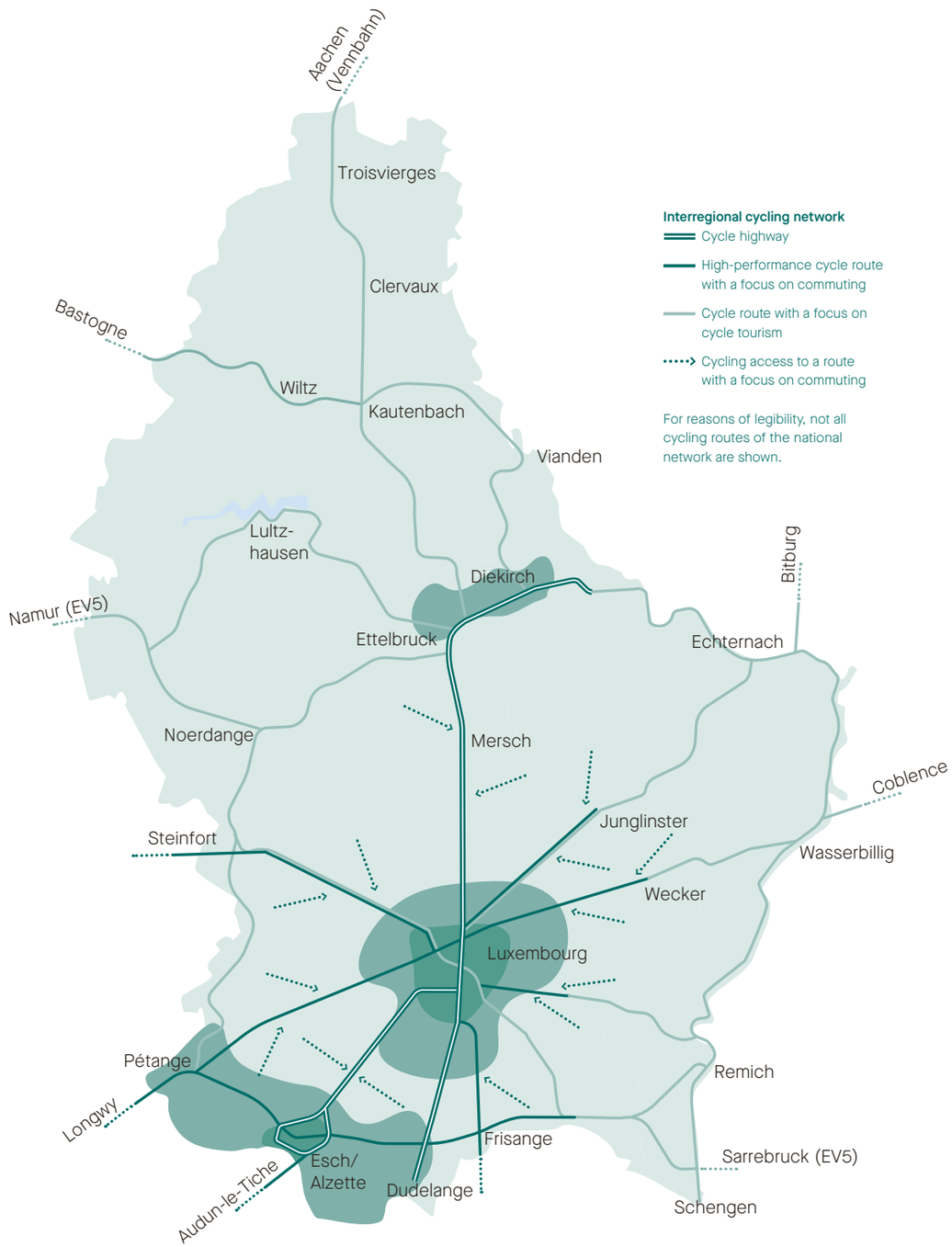
- Providing cycling access to all tourist regions throughout the country and connecting them to **international cycle tourism routes**, including the Vennbahn and the EuroVelo 5 route. In addition to the touristic interest for the towns and landscapes crossed, the main criterion for the quality of these cycle tourism routes will be their suitability for novice cyclists.

A question about cycling

Why are 'speed pedelecs' not allowed to use cycling infrastructure whereas electric scooters are?

This is a matter of road safety. Differences in speed between vehicles travelling in the same direction on the same roadbed is a cause of accidents. This is why agricultural vehicles and bicycles are prohibited on motorways and why electric scooters and pedelecs limited to 25km/h are allowed on cycling infrastructure, but not on pavements, etc. Most of the cycle routes in the Grand Duchy, particularly those located outside of town, are also used by pedestrians of all ages. For many people, walking is a time for relaxation. A pedestrian moves at a speed of between two and five kilometers per hour. Even when pedestrians have to share a space with cyclists travelling at speeds of 20 to 30km/h, both parties view this as a source of stress. When a speed pedelec travelling at 45km/h approaches a pedestrian moving at 5km/h and rings its bell from a distance of 30 metres, the pedestrian has less than three seconds to move out of the way, whereas he has six seconds with a bicycle approaching at 25km/h. In the event of a collision, the impact between the pedestrian and the speed pedelec is twice as strong. Allowing speed pedelecs on bicycle infrastructure not intended for pedestrians (bicycle paths and lanes) would create the same kind of risk of accidents between speed pedelecs and bicycles. This is why riders of speed pedelecs – or 'pedelec45s' – have the same rights and obligations as motorcyclists and not cyclists. It is true that, especially outside metropolitan areas, cyclists who are in particularly good physical shape travel at speeds in excess of 40km/h, even on the flat. For this reason, these cyclists generally avoid cycle infrastructures used by pedestrians, which the Code de la Route allows them to do.

National cycling network – key routes



The role of cycling in road projects

As an individual mode of transport, cycling requires an adequate infrastructure, enabling it to reach any destination in the country.

Arguing that 'there's no need for a second cycle route in town, as there already is one' makes no more sense than saying 'my neighbourhood does not need another street, as there is already a road a few kilometers from here'. Cycling must be considered in every road project, not just in the context of the national cycling network. The website **ww.veloplangen.lu** shows which layout or speed limit provides the right conditions for cycling based on the available street space and the flow of motorized traffic. This requires both dedicated cycling infrastructure and traffic-calmed residential neighbourhoods, wich are free from motorized traffic that could use another route. A first step should be to remove car traffic from the vicinity of schools.

The 'cycling to every address' approach is an integral part of the 'multimodal road network' and functional classification of public roads as explained and illustrated starting on page 80.

Particular attention should be paid to the accessibility by bicycle of the main public-transport stops. Such measures benefit everyone, especially secondary-school students. Every child should be able to cycle to their primary school or sports activity, even if this means travelling to the neighbouring village. This will require creating cycling connections between towns and providing safe access to these routes from town centres. For children and adolescents aged 6 to 17, who make up one-eighth of the population, cycling is the only individual mode of transport. 94% of children aged 6 to 12 and 77% of adolescents aged 13 to 17 rode bicycles in 2020 (MMTP and TNS-Ilres, 2020).

A town is only truly 'bikeable' if children can safely cycle there on their own.

The role of cycling in building projects

The most important mobility decision of the day is made in the morning before leaving home.

As the cycling network becomes more widely available to serve any location in the country, residents will cycle more. They will demand secure bicycle parking in a convenient location, both at home and at their destination.

The best location for secure bicycle parking is on the pedestrian's path between the building lobby and the pavement. Secure bicycle parking can be provided inside or outside a building. In residential buildings, it is advisable to provide **one bicycle space per room**.

Andres Lejona and MMTP

The multimodal road network

The road network is the most heavily frequented transport network in the Grand Duchy. While it serves as an infrastructure for several transport modes, for 60 years it has been designed primarily for the car.

Since users choose their mode of transport based on the quality of the offer, the car – the mode occupying by far the most space per person transported – enjoyed such success that not only have other transport modes (tram, bicycle, walking and bus) been successively pushed out of the street space, but network saturation during peak hours has become a major concern of the population and employers alike.

As it is impossible to increase the amount of traffic and parking space at the rate of population growth, the modal shift necessary to meet future mobility demand requires above all a more efficient use of the existing road network.

Use of the road network by the different modes of transport must be rebalanced to create a genuinely multimodal network. This transformation, which has already begun in recent years, will be the main challenge for mobility in the coming decades.

Targets for 2035

Maintain accessibility by car to each destination, respectively the nearest parking spaces. Channel traffic to the main road network and **provide P+Rs** at the outskirts of metropolitan areas.

Make carpooling more attractive, especially for work commutes.

Prioritize buses at major bottlenecks throughout the road network, particularly on motorways, at the entrances to metropolitan areas and along high-performance bus corridors.

Develop a continuous, comfortable and safe cycling network that allows cyclists to find their way to any destination without having to ride in mixed traffic along large flows of pedestrians or motor vehicles.

Develop a comfortable, continuous and safe pedestrian network allowing pedestrians to access all destinations without detours.

In nearly all cases, the street space is not wide enough to best meet the needs of each transport mode. Rebalancing the road network thus requires a choice of modes to be prioritized based on the local context. This trade-off must be made for each road section, based not on current modal shares but rather on the types of trips that are to take place there (see page 35).

Functional classification of the road network

Functional classification of the road network is the tool that puts the road network at the service of mobility as a whole.

Each road section, whether state or municipal, can be assigned one of the eight functions listed below. Each function is associated with specific transport modes to be prioritized as well as specific design features.

Road network outside built-up areas

- Highway/Expressway/Interchange
- *Route principale* and primary intersection
- *Route de connexion*
- *Chemin cyclable*
- Farm track

Road network in urban areas

- *Route de liaison*
- *Route de distribution*
- *Rue de desserte locale* without motorized transit

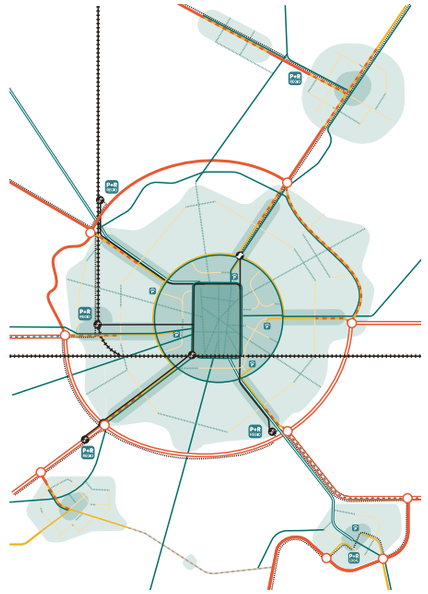
Cycling network

- Cycle highway
- Primary cycle route
- *Chemin cyclable*
- Cycle shortcuts in urban areas

The cycling network is an integral part of the multimodal road network. Depending on the classification of the road, bicycles will travel in mixed traffic, on an exclusive route alongside the road, or on exclusive infrastructure away from the road.

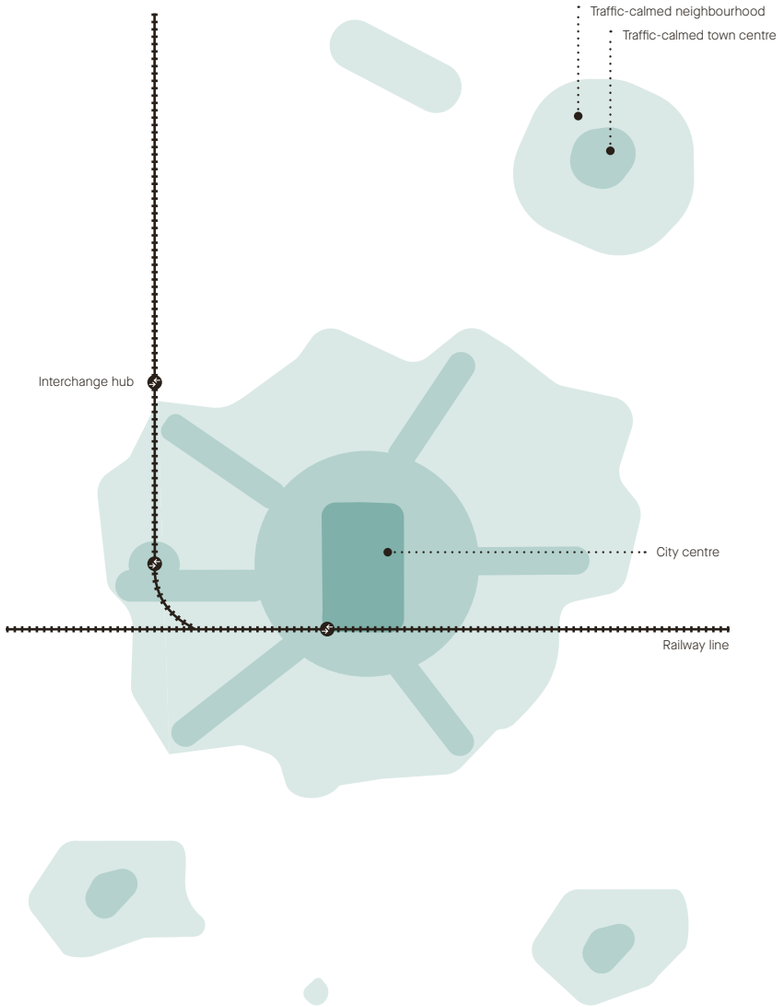
Example of functional classification of a model road network

This example is used to explain the functional classification of the road network. In chapter 3, functional classification is proposed for the country's three metropolitan areas and its main road axes.



Urban context

Inside towns, mobility must be adapted to three types of urban areas: **the city centre**, the **traffic-calmed town centre** and **traffic-calmed neighbourhoods**. The largest cities have a city centre. Villages of a purely residential nature consist mainly of traffic-calmed neighbourhoods.



City centre

- found in the largest cities
- includes a pedestrian zone spanning several streets
- well connected to public transport with stops located at the outskirts
- cyclists transit along a route that is clearly identifiable on the ground
- shops are accessible by bicycle
- public parking is based on indoor car parks, with road parking reserved for taxis, deliveries, people with reduced mobility and bicycles
- motorized traffic is limited to deliveries and access to garages and parking facilities
- a system of dead-ends and one-way streets prevents transit by car

The traffic-calmed town centre

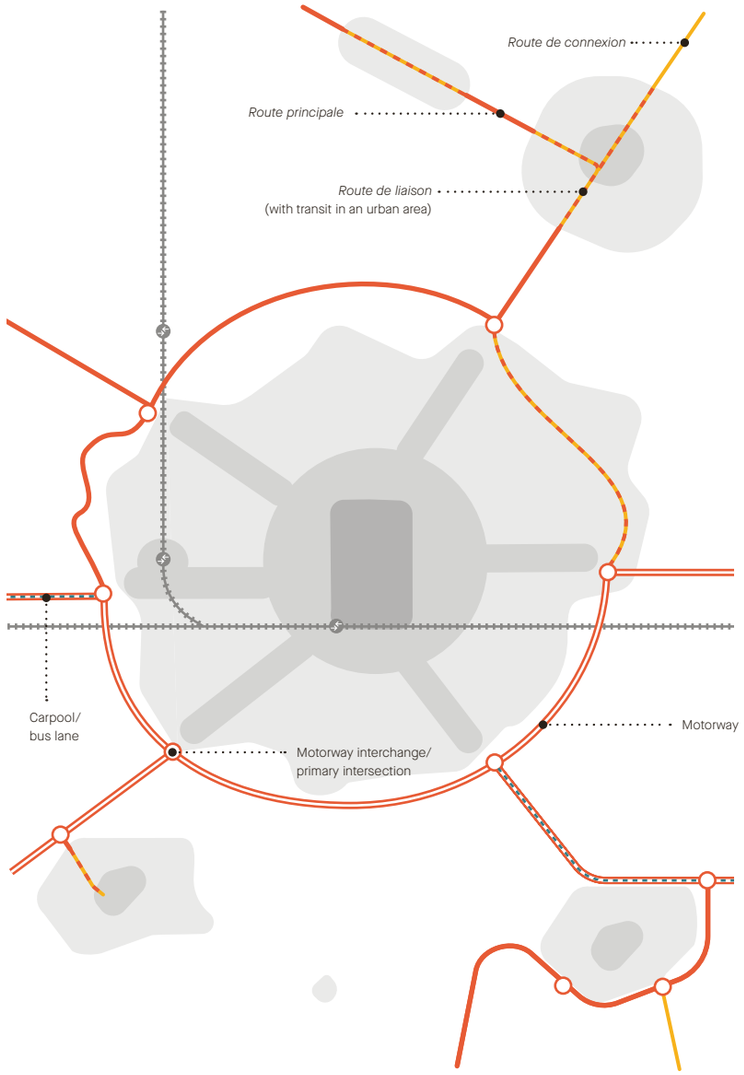
- found in towns with a city centre, a small pedestrian area or a cluster of points of interest frequented by the local population
- typically, a blend of housing, services and shops
- streets are designed for local traffic, making transiting unattractive and in some cases impossible except for buses and cyclists
- public parking is organised as in the city centre, with the added possibility of on-street parking for residents who have no alternative

The traffic-calmed neighbourhood

- found in all towns
- predominantly residential area or area with a high concentration of service sector jobs
- traffic-calmed streets with no possibility of motorized transit, except for buses
- traffic-calmed neighbourhoods are connected by a network of pedestrian and cycling routes permitting walking and cycling along the shortest path between these neighbourhoods and to the centre
- business parks are a special case, as they accommodate a large number of heavy goods vehicles, which requires special safety measures for cycling and walking routes

Motorized individual transit

One of the main objectives of functional classification is to direct individual motorized transit towards a single, clearly defined route. In other words, it is a question of keeping through traffic away from streets whose sole function is to provide access to the various neighbourhoods. In some cases, the road intended for heavy through traffic needs to be transformed with this purpose in mind.



Motorways, expressways and routes principales

- located outside of built-up areas
- provide the country with a structural road network and its main connections to neighbouring countries
- are intended to concentrate transit traffic and distribute motorized traffic in the region
- adapted to accommodate high volumes of motorized traffic
- prioritize public transport (and carpooling on motorways) at points where a loss of time during peak hours is to be expected
- direct cycle route away from motorized traffic
- no parking
- occasional or temporary calming possible (70 km/h or 90 km/h)
- automatic counting stations at road intersections to monitor the evolution of motorized traffic

Routes de connexion

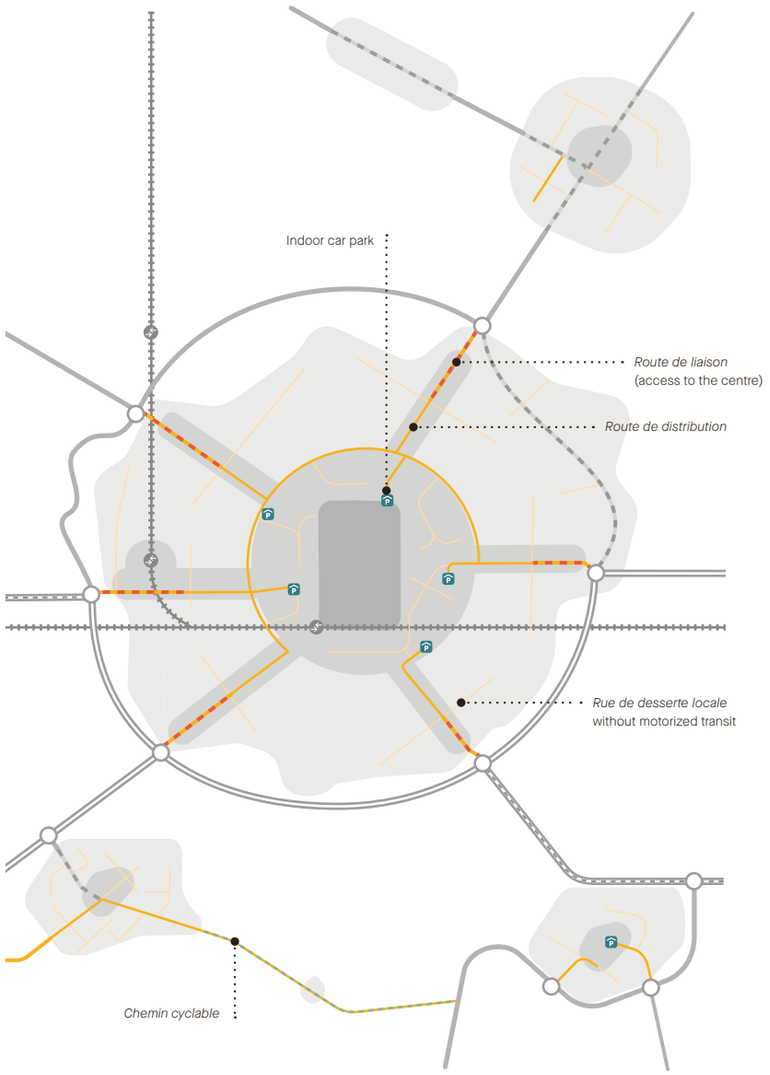
- located outside of built-up areas
- connect towns to major traffic axes to which they direct transit
- adapted to local motorized traffic (2 × 1 lane)
- prioritize public transport at points where a loss of time during rush hour is foreseeable
- direct cycle route away from motorized traffic
- no parking
- occasional traffic calming possible (70 km/h)

Routes de liaison
(with transit in an urban area)

- located in built-up areas where there is no bypass for through traffic
- adapted to accommodate high volumes of motorized traffic
- typically 2 × 1 lane plus bus prioritization
- physical separation between cycle route, motorized and pedestrian traffic
- avoid parking along streets
- 50 km/h traffic with the possibility of traffic calming down to 30 km/h or 20 km/h in central areas

Access to neighbourhoods with private motor vehicles

In built-up areas, public space is living space that must favour urban transport modes. Apart from unavoidable transit routes, the issue is not the fluidity of individual motorized traffic, but simply accessibility. Every traffic-calmed neighbourhood and every car park located near the town centre is accessible by car via a route designed to discourage transit through other neighbourhoods. To this end, roads with a distribution or local access function must be made particularly unattractive or even impassable to transiting cars and trucks.



On *routes de liaison* and on *routes de distribution*, the fluidity of public transport takes precedence over that of individual motorized traffic.

Routes de liaison

(with access to the centre)

- located in town if there are significant traffic flows towards the neighbourhoods and the centre
- typically 2×1 lane plus systematic bus prioritization
- physical separation between cycle route, motorized and pedestrian traffic
- parking along streets should not be allowed
- 50km/h traffic with the possibility of traffic calming down to 30km/h or 20km/h in central areas

Routes de distribution

- located in built-up areas
- distribute traffic in neighbourhoods
- have no transit function, except for public transport and bicycles
- prioritize public transport at intersections
- physical separation between cycle route, motorized and pedestrian traffic
- residential on-street parking possible, but preferably in indoor car parks
- 50km/h or 30km/h traffic with the possibility of traffic calming down to 20km/h in central areas

Rues de desserte locale

(without motorized transit)

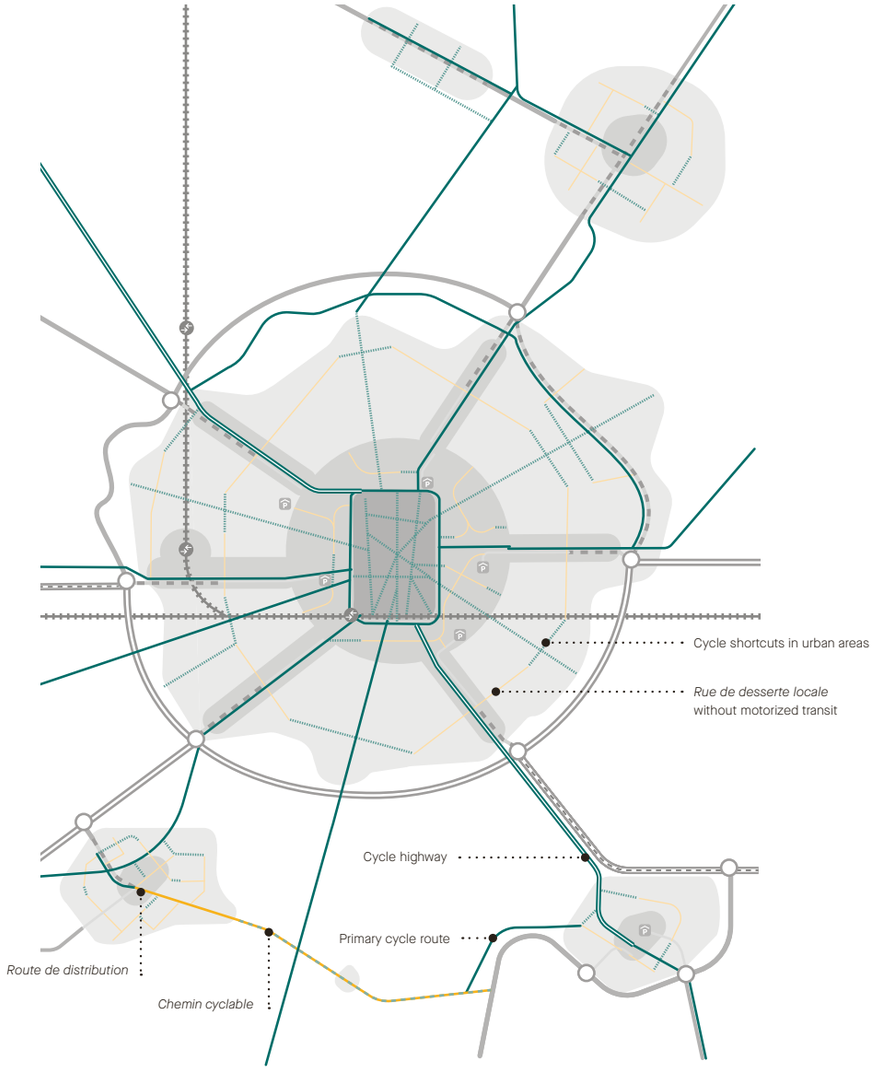
- located in built-up areas
- provide access to all destinations on the street
- transit is impossible, except for pedestrians and cyclists
- designed to ensure good road safety for cyclists in mixed traffic
- street space promoting neighbourhood life
- residential parking possible
- 30km/h or 20km/h speed limit

Chemins cyclables

- located outside of built-up areas
- major axis for the cycling network but minimal importance for motorized traffic
- 50km/h traffic with a wide advisory cycle lane clearly identifiable as such on each side

Bicycle access to towns and neighbourhoods

Cyclists must be able to reach any destination safely, directly and comfortably. Outside of town, cyclists must have separate routes from any motorized traffic travelling at speeds exceeding 50km/h. In town, shortcuts between traffic-calmed neighbourhoods and to the city centre offer travel times at least as fast as those of the car.



For the quality of the cycle network, traffic calming measures in the neighbourhoods are just as important as dedicated cycle routes along roads with motorized transit.

Primary cycle routes

- cycle routes of a relatively long distance
- provide the same connections as motorways, *routes principales* or *routes de connexion*
- outside of built-up areas, away from motorized transport, but without excessive detours
- in town, along *routes de liaison* and *routes de distribution*, physically separated from motorized and pedestrian traffic
- automatic counting stations to monitor the evolution of bicycle traffic

Cycle highways

- special case of primary cycle routes, intended to accommodate the main traffic flows
- maximum fluidity of bicycle traffic thanks to cycling-friendly curves and slopes and above all thanks to reduction to a strict minimum of situations where the cyclist might have to stop along the way
- as direct a route as possible
- even outside of town, separate infrastructure for any pedestrian flows

Cycle shortcuts in urban areas

- a series of shortcuts for pedestrians and cyclists offering direct routes between neighbourhoods and into the centre, away from motorized traffic
- long greenways between neighbourhoods or short connections between two dead-end streets
- separation of pedestrians and cyclists on long-distance sections or on sections with high pedestrian flows

Rues de desserte locale

(without motorized transit)

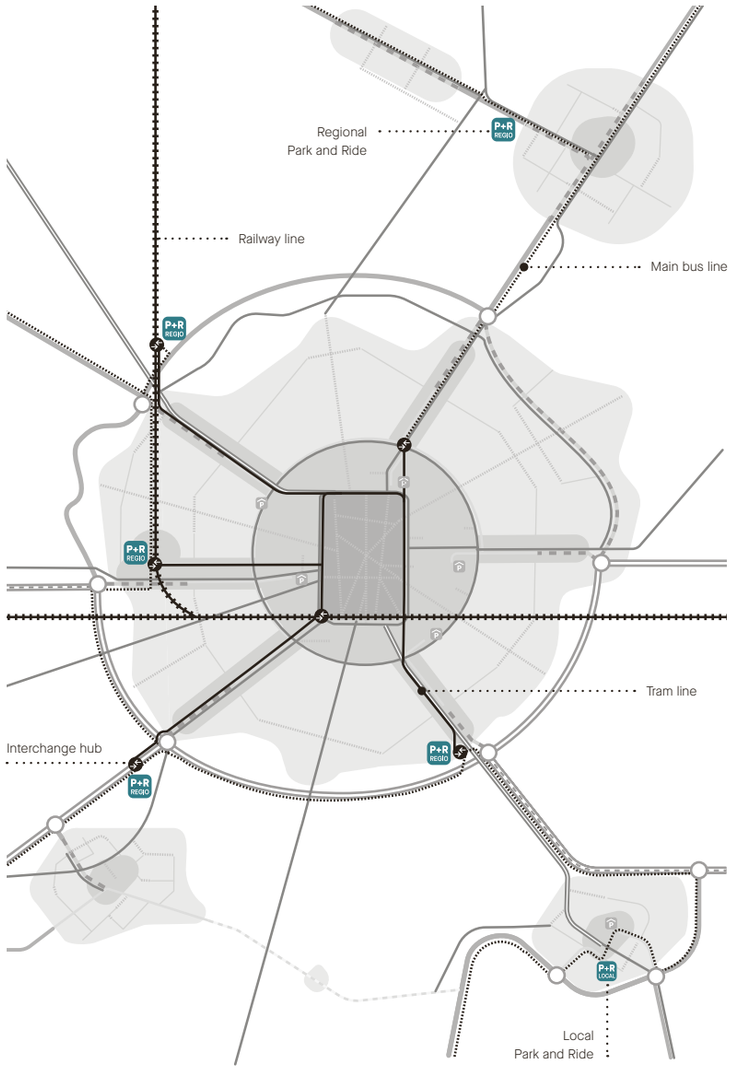
- mixed traffic with very low levels of motorized traffic
- provide cycling access to different destinations within the neighbourhood
- may be designated as a 'bicycle street' if they constitute a link in a particularly important cycle route

Chemins cyclables and chemins ruraux

- round out the cycling network outside of built-up areas
- cohabitation between cyclists and very low-intensity motorized traffic, which in some cases is limited to agricultural traffic
- maximum permissible speed: 50km/h

Access via public transport

The attractiveness of public transport depends on reliable and competitive journey times compared to car travel during peak hours. The network must be planned in such a way as to link, with not more than one transfer, the main points of departure – including P+Rs – to the main destinations, including city and town centres. Unlike individual motorized traffic, public transport must be able to pass through traffic-calmed town centres.



How to implement functional classification?

Classification of the multimodal road network provides a coherent long-term vision of regional mobility. Developed with the competent authorities, it identifies the measures required on the various road sections and the phasing of their implementation.

The three stages of functional classification of the multimodal road network

First stage:

The region

Questions:

- At the regional level, which routes should be used by motorized through traffic and which other routes should be kept free of such traffic?
- How should public tranport in the region be organised?
- Where are prioritizations of buses, interchange hubs and regional P+Rs needed?
- What primary cycling routes connect all of the towns, business parks and school campuses?

State authorities analyse multiple scenarios. Using a traffic model, they develop the scenario that best meets the objectives of a multimodal road network and identify the necessary infrastructure and regulatory measures.

The goals of functional classification of the road network, the scenarios analysed and the arguments in favour of the recommended solution are presented to the municipal authorities. Relevant requests and proposals in line with the objectives of functional classification are integrated into the solution. Phasing of the measures is determined.

Second stage:

The metropolitan area or municipality

Questions:

- At the level of the metropolitan area or municipality, which routes should be used by motorized through traffic and which other routes should be kept free of such traffic?
- How should public transport service in the metropolitan area or municipality be organised?
- Where are bus priority facilities, interchange hubs, local P+Rs and indoor car parks needed?
- Which primary cycling routes make it possible to link all the main destinations in the metropolitan area or municipality?
- Which access route for motorized traffic should be preferred for each neighbourhood, and which shortcuts should be reserved for pedestrians, cyclists and public transport?

In line with the functional classification of the regional road network, state authorities or municipalities develop several scenarios for the metropolitan area or municipality. These scenarios are refined in close cooperation with state and municipal authorities. The impact of the different scenarios is estimated based on experiences from similar projects. Complex situations can be analysed using a traffic model.

The objectives of functional classification of the road network, the scenarios analysed and the arguments in favour of the recommended solution are presented to the public. Relevant suggestions consistent with project objectives are incorporated. A timeline for implementation of the measures is established.

Third stage:

The neighbourhood

Questions:

- Once the traffic pattern to prevent motorized transit through the neighbourhood has been established, which local traffic calming measures, street improvements and parking rules contribute most to improving local residents' quality of life?

In accordance with the functional classification of the road network at the metropolitan or municipal level, municipal authorities draw up proposals for the design of the various public spaces in the neighbourhood. At the neighbourhood level, early involvement of local residents, including children, brings much more satisfactory results for the neighbourhood than just a public presentation of a project that has already been decided on.

The tools for functional classification of the multimodal road network

Urban planning

By concentrating town development not along the main through road but rather away from it, urban planning creates ideal conditions for the emergence of calm neighbourhoods and town centres.

Channeling through traffic

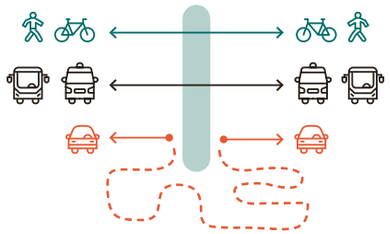
When a town's road network offers multiple routes for through traffic, the management of traffic lights together with road signalling prioritizing the desired flow of traffic, make it possible to channel this transit to the route where it creates the least nuisance. Hence, the conditions for a calmed city centre are met – a situation that benefits all the inhabitants of the town.

Modal filter

A modal filter is a physical obstacle that allows only certain transport modes to pass through a specific point of the road network. It is a doubly effective tool for traffic calming. Firstly, individual motorized traffic, whether through traffic or local traffic, is forced to take an alternative route. Secondly, by reserving a shortcut for walking, cycling and, where appropriate, public transport, a modal filter promotes the desired modal shift for in-town trips. Access to rescue services will be guaranteed by means of physical or electronic keys. As the road is public, this arrangement serves to properly separate transport modes, regardless of their user, and not to reserve a shortcut for local motorists.

Modal filter

Schroeder & Associés

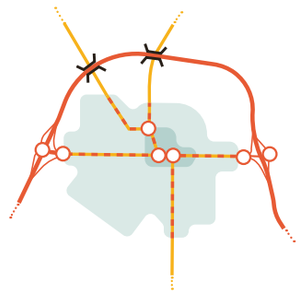


Contournement de proximité

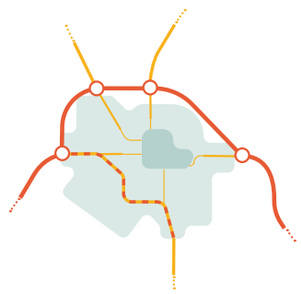
A classic bypass road is designed as an attractive and additional offer for motorized transit. To maximise traffic capacity, this type of bypass road avoids intersections with other local roads that enter the town. Hence, the crossing through town must remain possible, as the bypass road does not offer an alternative for all traffic flows. This situation not only prevents a fundamental redesign of the arterial road but also maintains it as an option for through traffic. The slightest disruption on the bypass, or its saturation due to higher traffic loads, restores the original traffic in the town centre.

The *contournement de proximité* is adjacent to the town and connects to each penetrating road it crosses. It thus serves as a road not only for 'others' who are in transit, but also for local residents who wish to travel by car to a nearby neighbourhood. This allows for fundamental and permanent traffic calming in the town centre. Such calming encourages modal shift, since on the one hand, the shortest route is reserved for buses, cyclists and pedestrians, and on the other hand, the significant reduction in motorized traffic makes travelling on foot and by bicycle safer. While it is true that some car journeys between neighbourhoods in the same town become marginally longer in terms of distance, they do not necessarily become longer in terms of travel time.

The classic bypass road and the *contournement de proximité*



Classic bypass road



Contournement de proximité

Combining a *contournement de proximité* with one or more modal filters sustainably calms the town centre and changes travel patterns within the town.

Traffic models

A traffic model (or multimodal trip model) is a software suite that simulates the impacts of different projects or assumptions on traffic flows. As with any tool of this type, the results provided are directly related to the input data. Depending on the user's mobility policy, the traffic simulation and the interpretation of the results can be used either to perpetuate current modal shares – which is not an option in the Grand Duchy by 2035 – or to implement a proactive approach such as the multimodal road network. There are two types of traffic models:

'Macro' models estimate the volumes of traffic flows and their distribution across the various sections of a multimodal transport network. Such a model is used in particular to size transport infrastructure and public transport services. When implementing functional classification, the input data will be the target modal shares (page 35), the travel demand and the projects of the PNM 2035. At local bottlenecks identified by the model, additional measures compatible with the objectives of the PNM 2035 will have to be developed.

'Micro' models use traffic flow volumes stemming from traffic counts or a macro model to simulate the functioning of one or more intersections. Specifically, they determine waiting times for the various traffic flows – cars, buses, pedestrians and cyclists. A micro simulation therefore makes it possible to size the intersection and, if need be, to program traffic lights in such a way as to prioritize some transport modes over others. When implementing functional classification of the multimodal road network, the modes to be prioritized will be determined based on the type of road in question. Care will need to be taken to ensure that the traffic loads captured in a micro model are compatible with the macro model approach and in particular the objectives of the PNM 2035. Indeed, the sizing of an intersection or section of road is a self-fulfilling prophecy. If maximum public space and green phases are reserved for a particular transport mode, that mode will experience the greatest success, as the other modes will lack space or be systematically delayed.

Induced traffic and evaporated traffic

Macro models work based on the assumption that people, like a river, will always opt for the route that offers the least resistance. This assumption effectively makes it possible to simulate the distribution of a fixed number of trips in a given transport network. In the medium term, however, human behaviour is more complex than that of a river, as habits, reasoning and speculation come into play. This is why traffic models can only partially estimate the medium- and long-term impacts of commissioning or decommissioning a major transport infrastructure. When a bottleneck is replaced by an infrastructure with higher capacity, households and businesses decide to locate farther out along this axis, especially because of real estate prices. Ultimately, the new infrastructure will induce up to 50% of additional journeys, which will create new congestion. Conversely, when traffic lanes are removed in an urban environment, it is systematically observed that 10% to 40% of trips do not transfer to other modes or routes, but simply evaporate. The people in question have either decided to combine multiple trips or to change their travel needs. The phenomena of induced or evaporated traffic are well documented (see European Conference of Ministers of Transport, 'Infrastructure-Induced Mobility', 1998) and must be factored in whenever attempting functional classification of a road network.

Communicating functional classification of the multimodal road network

The understanding that the road network is intended for all transport modes – collective or individual, motorized or not – has been lost in recent decades. As a symbol of social success since the 1950s and a mode of transport structuring towns and the territory since the 1960s, the car is considered by a large part of the adult population to be synonymous with mobility and hence freedom, sometimes even as the only possible way to access a shop. A participatory approach, together with communication based on visuals and positive experiences, make it possible to show that reclassifying certain roads to the disadvantage of motorized through traffic is exactly what is needed, in the interests of mobility and local activities, to maintain acceptable traffic conditions in the long term.

Illustrating solutions

Images are the best way to communicate a change in public space. Illustrations and video clips help the public to visualise and understand the proposed solution. Historical photographs remind us that well-known public space has already undergone changes in the past (see pages 100 and 101).

Benefiting from construction works and pilot projects

Road works offer insights into the impact – often overestimated in urban areas – of reducing the vehicle capacity of a particular road section. Pilot projects lasting at least six months help to evaluate and refine a redesign project. If arguments are to be based on objective data, it is useful to count the various traffic flows (cars, pedestrians, cyclists, etc.) and to measure noise and air quality prior to and following the transformation.

Visiting and dialoguing with pioneering cities or neighbourhoods

Destinations close to the Grand Duchy that show the positive consequences of functional classification of the road network include the city of Ghent ('Circulation Plan' of 2017), the Eurométropole of Strasbourg (reorganisation of the network since the 1990s) and the Netherlands ('Categorisering wegen', since 1997).

Grand-Rue in Luxembourg – view from Rue Aldringen towards Place du Puits-Rouge

Archives nationales de Luxembourg (ANLux), ICO-3-1-02960
Title: 'Luxembourg - La Grand-Rue', Author: Nic Sibenaler, CC (BY-NC-ND), Photographic collection of the du Service Gouvernemental d'Expansion Economique et Touristique, 1950 (approx.) - 1970 (approx.) (Sous-fonds)

Chapter 3

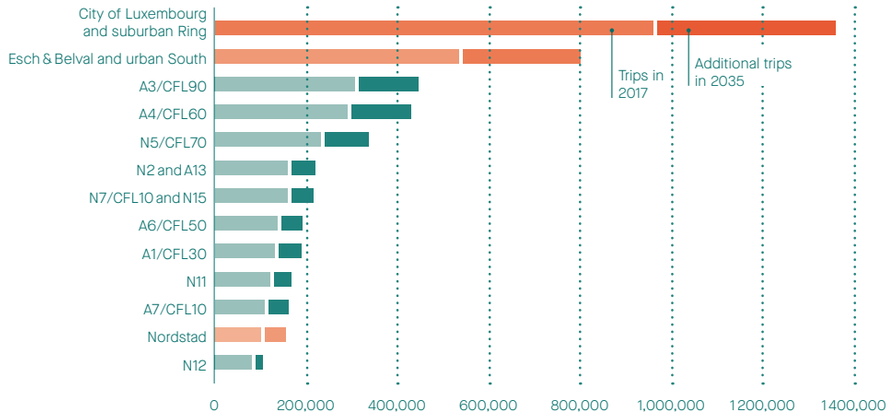
Mobility by region in 2035

How will multimodal mobility be organised along the various mobility corridors and in the country’s three metropolitan areas?

Metropolitan areas and mobility corridors

Mobility in the Grand Duchy is structured in three metropolitan areas and ten mobility corridors. By way of introduction to the sub-chapters specifically dedicated to each one of them, it is useful to recall the common characteristics of both metropolitan areas and mobility corridors.

Total trips by metropolitan area or mobility corridor in 2017 and in 2035



A trip is ascribed to a metropolitan area or mobility corridor if it has its origin or its destination there. For example, a journey of one person travelling from Nordstad to Mersch is taken into account once for the Nordstad metropolitan area and once for the A7/CFL10 corridor. This is why the sum of the trips shown in this graph exceeds the two million daily trips recorded in 2017 and the 2.8 million forecast for 2035.

An internal trip is defined as one that originates and terminates in the same corridor or metropolitan area. It is assigned only once to the metropolitan area or mobility corridor in question.

The sum of all trips associated with a mobility corridor should not be mistaken for the counts made on a transport infrastructure for which the corridor is named. For example, the sum of trips attributed to the N12 corridor far exceeds the counts made on the N12 national road, since that sum also includes journeys such as pedestrian trips taken within Beckerich or Useldange. As compared to the illustration on page 23, two pairs of corridors (N7/CFL10 and N15 to the north and N2 and A13 to the south-east) have been clustered and shown together.

The metropolitan areas

42% of trips in the Grand Duchy are internal to one of the three metropolitan areas. A further 5% should be added to this for direct trips between the metropolitan area formed by Luxembourg City and its suburban Ring and the metropolitan area formed by Esch & Belval and the urban South, as well as 1% for trips between Luxembourg City with its suburban Ring and the Nordstad. After adding the 28% for traffic flows between metropolitan areas and mobility corridors, it turns out that more than three-quarters (76%) of all trips involve a metropolitan area (see pages 16–17). This is why two of the three main mobility challenges identified for 2035 (see pages 22–24) consist of organising traffic flows to the city of Luxembourg and promoting the evolution towards urban mobility in the metropolitan areas. Indeed, for a very large number of people to be able to move around comfortably in the confines of a metropolitan area, urban modes of transport must be used. These take up very little public space per person transported, in contrast to the private car, which is more useful for daily trips in rural areas (see Modu 2.0, pages 46–47).

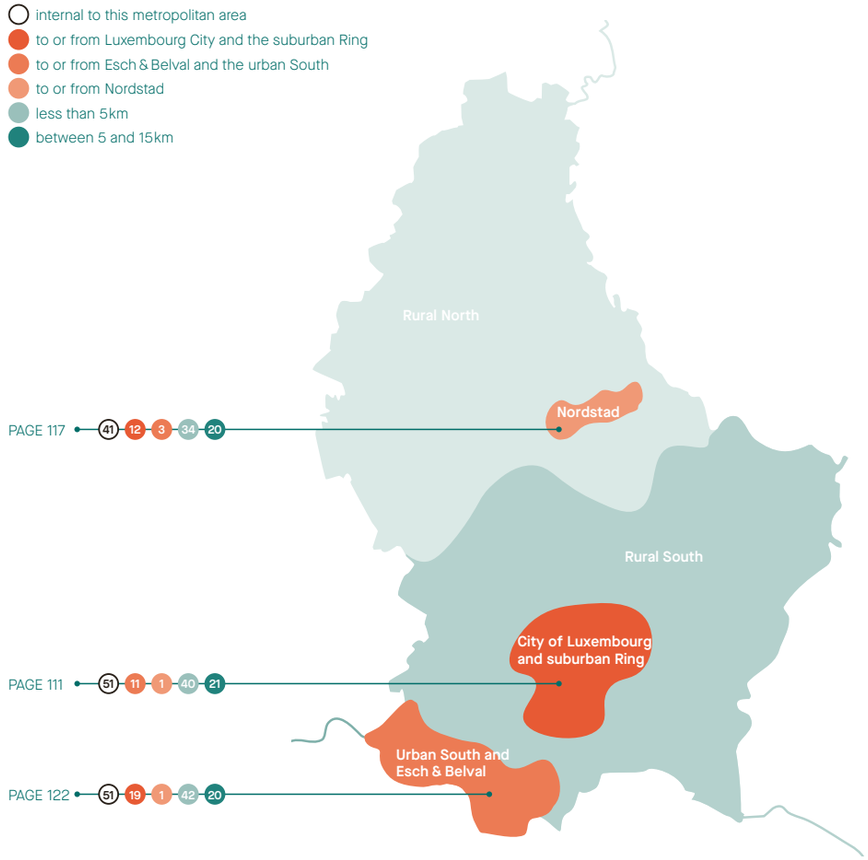
Common aspects of mobility organisation in the metropolitan areas in 2035

- For journeys within the metropolitan area that cannot be made on foot, urban public transport (bus and tram) and cycling should become more attractive than the car. Similarly, regional public transport (bus and train) in combination with P+R or 'Bike and Ride' offers need to become more attractive than the private car for trips from the surrounding region into a metropolitan area.
- Functional classification of the road network in metropolitan areas will be the key to this transformation. If motorized private transit traffic and traffic between neighbourhoods is to be channelled away from city centres, the primary road network may have to be reorganised and strengthened in some places. This measure will allow sustained calming of the city centre and neighbourhoods. Public space and road capacity will be freed up for safe and continuous cycling as well as pedestrian networks and for efficient urban public transport. These will be the only means of transport transiting through the centre (see pages 54 and 63–99).
- Parking management, especially by municipalities but also by employers, will be the accelerator or brake of this transformation (see pages 174–177).
- If the bicycle is to play its role as an individual transport mode for more people of different age groups, every road, town-planning or construction project will have to be used to create travel and parking conditions that are both convenient and safe for cyclists (see pages 75–79).

Metropolitan areas – overview

Distribution of trips (%)

- internal to this metropolitan area
- to or from Luxembourg City and the suburban Ring
- to or from Esch & Belval and the urban South
- to or from Nordstad
- less than 5km
- between 5 and 15km



Level of detail on the maps of the metropolitan areas

The maps shown on pages 115–131 do not depict all existing transport infrastructure or all the projects; instead, they illustrate only the elements needed to understand how multimodal mobility should be organised in 2035 at the scale of a metropolitan area. The details of the functional classification of the multimodal road network (traffic flow diagram, positioning of modal filters, main bicycle routes, etc.) will be determined in close collaboration between state and municipal authorities or will in some cases be the sole responsibility of the municipality (traffic calming in neighbourhoods, parking management, etc.).

Mobility corridors

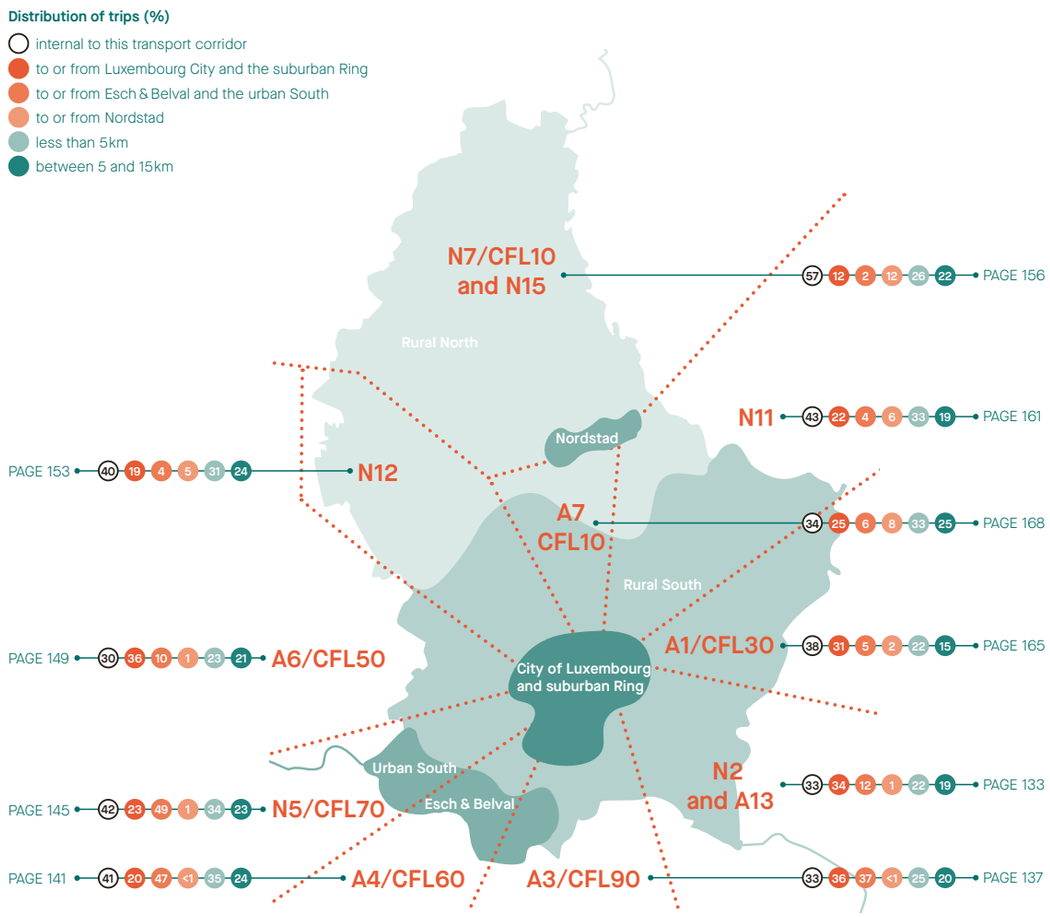
In the PNM 2035, the term ‘corridor’ refers to a region whose inhabitants use one or several specific transport routes to get to the metropolitan area in the Grand Duchy with which this region has the greatest number of exchanges. With the exception of the A7/CFL10 corridor, all mobility corridors are cross-border. Beyond the territory of Luxembourg, the PNM 2035 is only concerned with cross-border traffic flows. Obviously, there are not only flows between corridors and metropolitan areas, but also between different corridors. However, as the tangential flows between corridors are much weaker than the radial flows between regions and metropolitan areas, the former will not be decisive for transport networks in 2035.

Functional classification of the multimodal road network in the metropolitan areas (see page 106) will also affect mobility in the corridors. As long as it remains more attractive to travel to the metropolitan area by car, rural areas will suffer from increasing through traffic, especially during peak hours. For this reason, one of the three main mobility challenges identified for 2035 (see page 25) will be to look at mobility in the countryside in a nuanced way. As the metropolitan areas will not be able to accommodate more cars and bus lines in 2035, it will be in the regions’ interest to concentrate those activities – housing, employment, trade – that will require sustained exchanges with metropolitan areas near the most attractive public transport stops.

Common aspects of mobility organisation in mobility corridors in 2035

- Public transport, which is still largely underutilised for trips inside the regions, will have to be promoted both through continuous awareness campaigns (presentation of bus lines in municipal publications, etc.) and through high-quality public transport stops.
- Functional classification of the road network in rural areas will make it possible to channel through traffic towards the main roads and to relieve towns, or at least town centres, of excessive traffic. As counter-intuitive as it may seem, much of the cut-through driving done in rural areas owes not to a lack but to an over-supply of roads. At the expense of slight detours, reorganising local traffic patterns could reserve certain roads for vehicles that have their destination there.
- Even in rural areas, more than a quarter of all journeys are shorter than 5km and therefore suitable for cycling. Traffic calming in neighbourhoods, the redesign or traffic calming of through roads and the establishment of inter-municipal cycle routes will offer people in rural areas an attractive alternative to the private car.
- As it becomes increasingly difficult to travel to work by car and to find parking once there, it will be useful to offer P+Rs near important public transport stops and parking for carpools at key locations along main roads.

Mobility corridors – overview



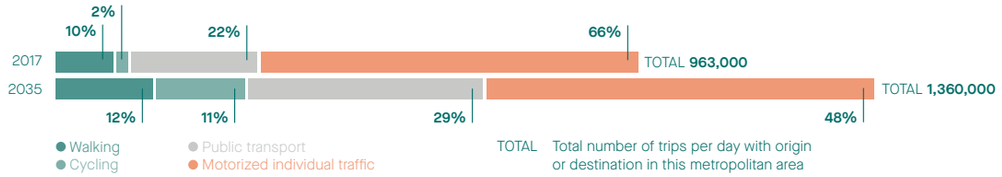
Level of detail on the maps of mobility corridors

The maps shown on pages 135–171 do not depict all existing transport infrastructure or all the projects; instead, they illustrate only the elements needed to understand how multimodal mobility should be organised in 2035 at the scale of a mobility corridor. The details of the functional classification of the multimodal road network will be determined in close cooperation between the state and municipal authorities according to the approach outlined on pages 94–95.

City of Luxembourg and suburban Ring

This metropolitan area consists of the city of Luxembourg and its neighbouring municipalities, namely Bertrange, Strassen, Kopstal, Walferdange, Niederanven, Sandweiler, Hesperange and Leudelange. Additional towns in the urban continuum, such as Mamer and Steinsel, can also be considered part of the metropolitan area in terms of mobility.

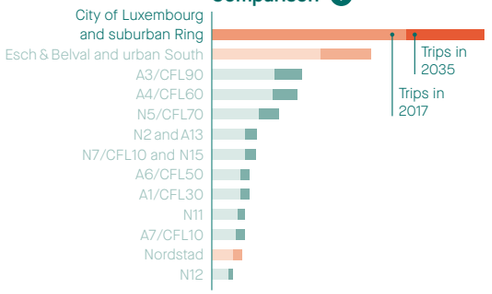
Evolution of modal shares – minimum targets



Distribution of trips (%)

- 51 internal to this metropolitan area
- 11 to or from Esch & Belval and the urban South
- 1 to or from Nordstad
- 40 less than 5km
- 21 between 5 and 15km

Comparison



Characteristics

- With approx. 235,000 jobs and 184,100 residents in 2021, the metropolitan area constituted by the city of Luxembourg and its suburban Ring is the main economic centre of the Greater Region. All mobility corridors converge towards this metropolitan area and every fourth trip in the Grand Duchy takes place within it.
- 51% of all trips are internal. Their daily number will grow from about 491,000 in 2017 to 686,000 in 2035. In 2017, 19% of these internal trips connected the suburban Ring to the city of Luxembourg.
- The number of trips taken between the metropolitan area and the rest of the country and the Greater Region will increase by 200,000 and will stand at 674,000 trips per day in 2035. From all corridors, the three main destinations within the city of Luxembourg are, in comparable proportions, Kirchberg, Ban de Gasperich and the city centre including the district of the Central Station. The suburban Ring has high concentrations of jobs in the business parks of Leudelange, Bertrange, Strassen, Howald and Findel.
- The main challenge for the years ahead will be to coordinate mobility planning at the metropolitan level while creating the conditions required to guide external visitors towards urban transport modes well in advance of their arrival in the city.
- With 74,400 boardings and alightings (b+a) recorded per working day in 2019 (outside of school holidays), the Central Station is by far the busiest in the Grand Duchy. The success of the multimodal approach is illustrated by the new peripheral stations of Pfaffenthal-Kirchberg in the north (7100 b+a) and Howald in the south (1600 b+a) – the latter not yet connected to the tram network as of 2022. To the east, the stops at Munsbach (360 b+a) and Cents-Hamm (170 b+a) offer prospects for growth if they are served by urban bus routes which are of particular interest to potential users of the CFL30 line. To the west, the Hollerich stop (1400 b+a) possesses all the necessary features to become a major peripheral railway station.
- The bus service is organised by two separate operators: the *Autobus de la Ville de Luxembourg* (AVL) and the *Régime Général des Transports Routiers* (RGTR). The arterial road linking Kirchberg to the city centre and Central Station is the first on which the tramway (carrying up to 75,000 passengers per day in 2021) has replaced a congested bus corridor. As the extensions of the tramway progress, RGTR bus routes will be adapted to offer attractive service either to a single central interchange hub, or to several interchange hubs located on the outskirts of Luxembourg City, all of which are connected to the tram.
- The 92,000 trips (2017 figure) between the suburban Ring and Luxembourg City – of the order of only a few kilometres – will be a major challenge in the years to come. The excessive modal share of the car (74%) is a sign of an abundance of parking and a lacking offer for cycling and bus travel. The main bus lines in the metropolitan area, currently known as 'lignes coordonnées', will play a key role. They will be a competitive alternative to passenger cars in that, once inside the city, they will take direct and well prioritized routes to destinations of particular importance to residents of the suburban Ring.

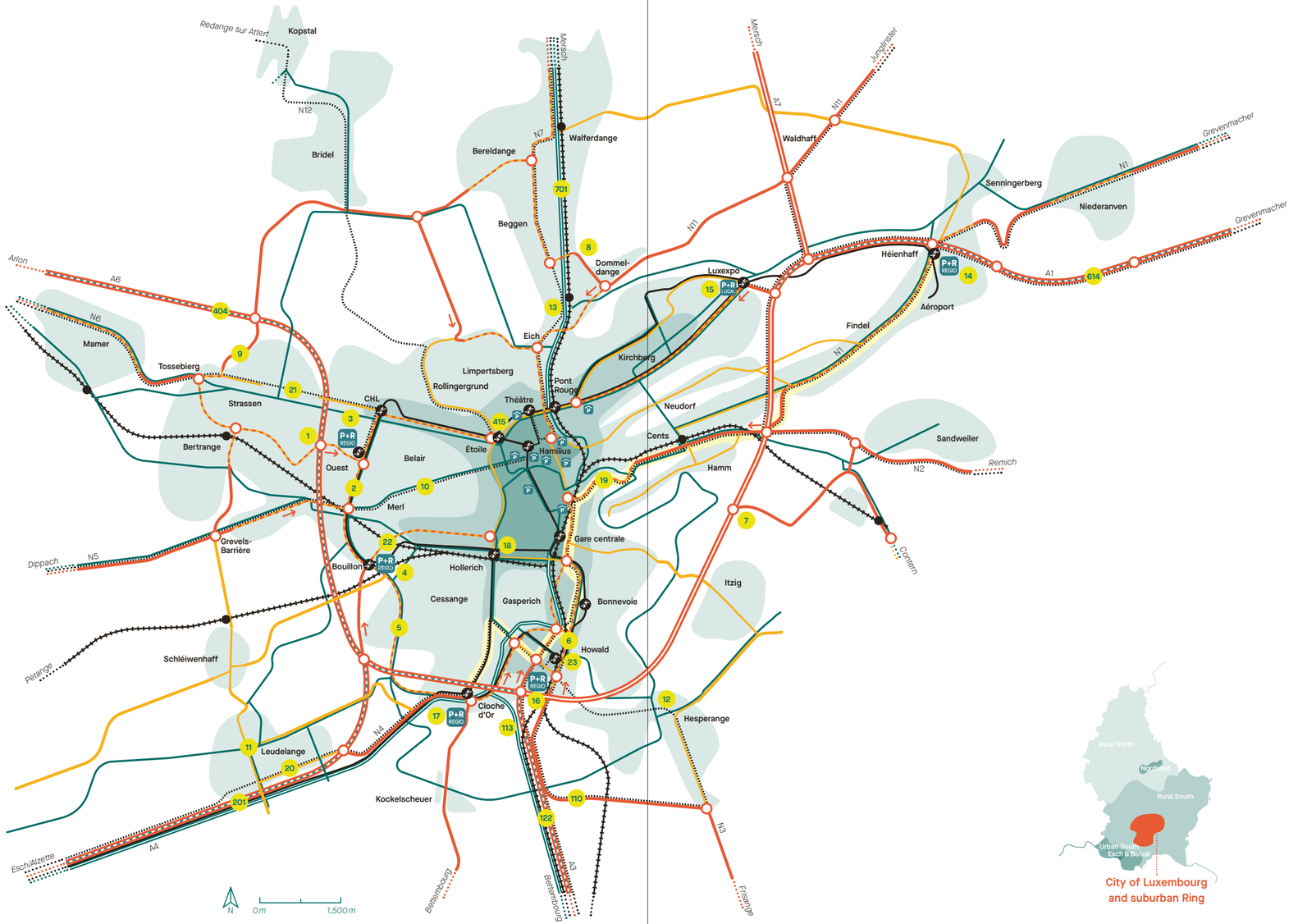
- With its two relatively flat topographical levels – the city centre on the one hand and the Alzette valley on the other – the metropolitan area has great potential for cycling. This is evidenced by the increasing use of bridges, urban lifts and the funicular that connect the various neighbourhoods.
- In its current configuration, the road network attracts high levels of motorized individual traffic through and into the city centre. Transit through the centre remains an attractive option for many important traffic flows. In 2021, of the fifteen roads centred on the city, only the A4/B4 from Esch-sur-Alzette was linked to a major P+R. Even at the level of this P+R Bouillon, however, the capacity of the B4 towards the centre remains unchanged. All incoming roads either flow onto roads that are designed to carry a lot of traffic to the centre, or into residential areas through which transit to the centre remains possible. In the core of the metropolitan area, these roads lead to car parks (Monterey, Hamilius, Saint-Esprit, Glacis, etc.), but they are also interconnected by national roads intended for transit: the boulevard Royal, the René Konen tunnel, the boulevard Grande-Duchesse Charlotte, etc. With its indiscriminate prioritization of car traffic, this set-up is not adapted to the mobility demand in 2035. The redevelopment of avenue de la Liberté for the benefit of urban transport modes has gone through the three typical phases of a reorganisation of this kind. After a planning phase characterised by worries of a loss of accessibility and mobility in the city, the construction phase remains the most difficult, as neither the old nor the new mobility offer is fully operational, and construction work itself makes access more difficult, indeed. However, once the new urban mobility offer is in place, the feared traffic problems do not arise, and the area around the old arterial road can be turned into a lively neighbourhood.

Organisation of mobility in 2035

The various elements of the road network will be classified in such a way as to make transit through the city centre unappealing for motorized individual traffic. For access to the centre and the districts by car, the right *route de liaison* will have to be chosen on the approach to the city. The network of roads to which car traffic will be channelled will have to be strengthened or adapted in several places:

- In line with the prioritization of buses and carpools along the various motorways leading to the city of Luxembourg, the hard shoulder will be widened along the segments of the motorway bypass that permit it 122 201 404 614.
- To unburden the complex crossroads of Helfenterbruck, allow for traffic calming of route d'Arlon in Strassen and set up a large P+R and interchange hub to the west of Luxembourg City, the Helfent and Strassen motorway interchanges along the A6 will be merged into a new one near the Burmicht business park 1.
- From this motorway interchange, and from the N5, traffic towards the city will be distributed via the new boulevard de Merl 2. With a layout to accommodate the tramway, this boulevard will connect route d'Arlon to the north with the new P+R West 3 and with the relocated P+R Bouillon 4 to the south.
- The boulevard de Cessange 5 will be the extension of the boulevard de Merl. Also designed to accommodate the tram, it will connect with the N4 from Esch-sur-Alzette near the Cloche d'Or P+R.
- The Alzingen bypass road 110 and the new N3 in Howald 6 will accommodate traffic coming from Réiserbann.
- A new motorway interchange north of Itzig 7 will provide relief to the Robert Schaffner roundabout (Irrgarten) from some of the traffic generated by the Contern and Sandweiler business parks.
- At Dommeldange, traffic on the N7 towards Kirchberg will be directed towards the N11 (route d'Echternach) by a new cut-and-cover tunnel connection with outlets near the Chinese and Russian embassies 8.
- Through traffic will be directed away from the residential neighbourhoods of Strassen by a new connection between the motorway interchange and route d'Arlon 9.

The objective of these selective reinforcements of the primary road network is to permit traffic calming in favour of urban transport modes along the following artery roads of the metropolitan area: route de Longwy 10 between Helfenterbruck and the city centre, the through road 20 and the centre of Leudelange 11 along with the closure to individual traffic of the Leudelange-Sud motorway interchange, the crossing of Hesperange 12, the N7 between rue de la Cimenterie in Beggen and place Dargent in Eich 13, route d'Arlon in Strassen 21 and the B4 expressway, which will be transformed into an urban boulevard starting from the new Bouillon P+R 22.



It will be essential to interconnect, through efficient interchange hubs, the train and the P+Rs on the one hand and the tram and the main bus lines on the other. This is the only way to make the city of Luxembourg accessible to a greater number of people, while at the same time reducing traffic nuisance in the neighbourhoods.

- The city of Luxembourg will have a ring of P+Rs providing access to the tram for motorists coming from the various corridors: the Héienhaff P+R 14 for the A1 and N1, the Gernsback (Luxexpo) P+R 15 for the A7, N7, N11 and N2, the P+R Sud in Ban de Gasperich 16 for the A3, the Cloche d'Or P+R 17 for the N4, the Bouillon P+R 4 relocated towards the new boulevard de Merl for the A4 and N5, and the P+R Ouest 3 for the A6 and N5, N6 and N12.
- With the extensions of the tram network (see page 54), the peripheral train stations of Pfaffenthal-Kirchberg, Howald and Hollerich 18 will become more important.
- The main metropolitan bus lines will complement the tram network. They will provide direct connections across the metropolitan area between the suburban Ring and the main destinations in the city.
- The main rural bus lines from other mobility zones (see page 67) will not pass through the calmed town centre, but will serve either a single interchange near the city centre (Étoile, Théâtre or Monterey) or at least two interchange hubs at the edge of the traffic-calmed town centre (CHL, Ouest, Bouillon, Hollerich, Cloche d'Or, Howald, Bonnevoie, Gare centrale, Luxexpo or Héienhaff).
- Bus journey times will be reduced by diverting through traffic from a number of roads (N6 in Strassen, N5 in Merl, N4 in Leudelange and Cloche d'Or, N3 in Alzingen and Hesperange, N7 in Eich) as well as by a high-performance bus corridor (CHNS) 19 running between Héienhaff and Cloche d'Or.

Within the metropolitan area, walking (for short distances) and cycling (for all other journeys) will have to play a much greater role in individual mobility.

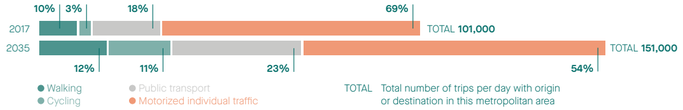
- According to the principles illustrated on page 91, the functional classification of the road network will create the conditions for the development of a safe and efficient urban cycle network between neighbourhoods and along arterial roads.
- In all directions, the urban cycling network will be connected to national cycle routes, starting with the cycle highways that lead from Esch-sur-Alzette 201, Dudelange 113 and Nordstad 701.

Please turn this page

Nordstad

Nordstad is located at the confluence of the rivers Alzette and Sûre and includes the municipalities of Schieren, Ettelbruck, Erpeldange-sur-Sûre, Diekirch and Bettendorf.

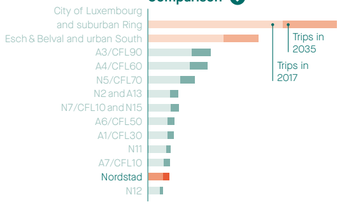
Evolution of modal shares – minimum targets



Distribution of trips (%)

- 41 internal to this metropolitan area
- 12 to or from Luxembourg City and the suburban Ring
- 3 to or from Esch & Belval and the urban South
- 34 less than 5km
- 20 between 5 and 15km

Comparison



Characteristics

- With 23,720 inhabitants and some 14,800 jobs in 2021, Nordstad is the smallest of the country's three metropolitan areas. It is however destined to develop considerably.
- As the most important hub in the north of the country, Nordstad is served by CFL's Line 10 and its railway branch to Diekirch. With 6,800 daily boardings and alightings (b+a) in 2019, Ettelbruck station is the fifth-busiest in the Grand Duchy. The stations in Diekirch (1,600 b+a) and Schieren (380 b+a) are not served by express trains.
- Many of the region's road axes converge in Nordstad: the N7/B7 from the north, the N15 from Bastogne, the N14 from Larochette, the N17 from Vianden and the N19 from Reisdorf. This situation leads to daily traffic congestion in Diekirch and Ettelbruck and along the segment of the N7 between these two cities known as the 'central axis'.
- Nordstad has the highest concentration of secondary schools north of Luxembourg City. Other major employment hubs include the ZANO business park on the Fridhaff plateau, the hospital in Ettelbruck and the business parks along the Alzette river between Schieren and Ettelbruck.
- Nordstad has a topography that is well suited to cycling. Its longest extension, between Schieren and Moestroff, is only 14 kilometres long. Hence cycling lends itself to all of Nordstad's internal trips, which account for 41% of traffic flows.

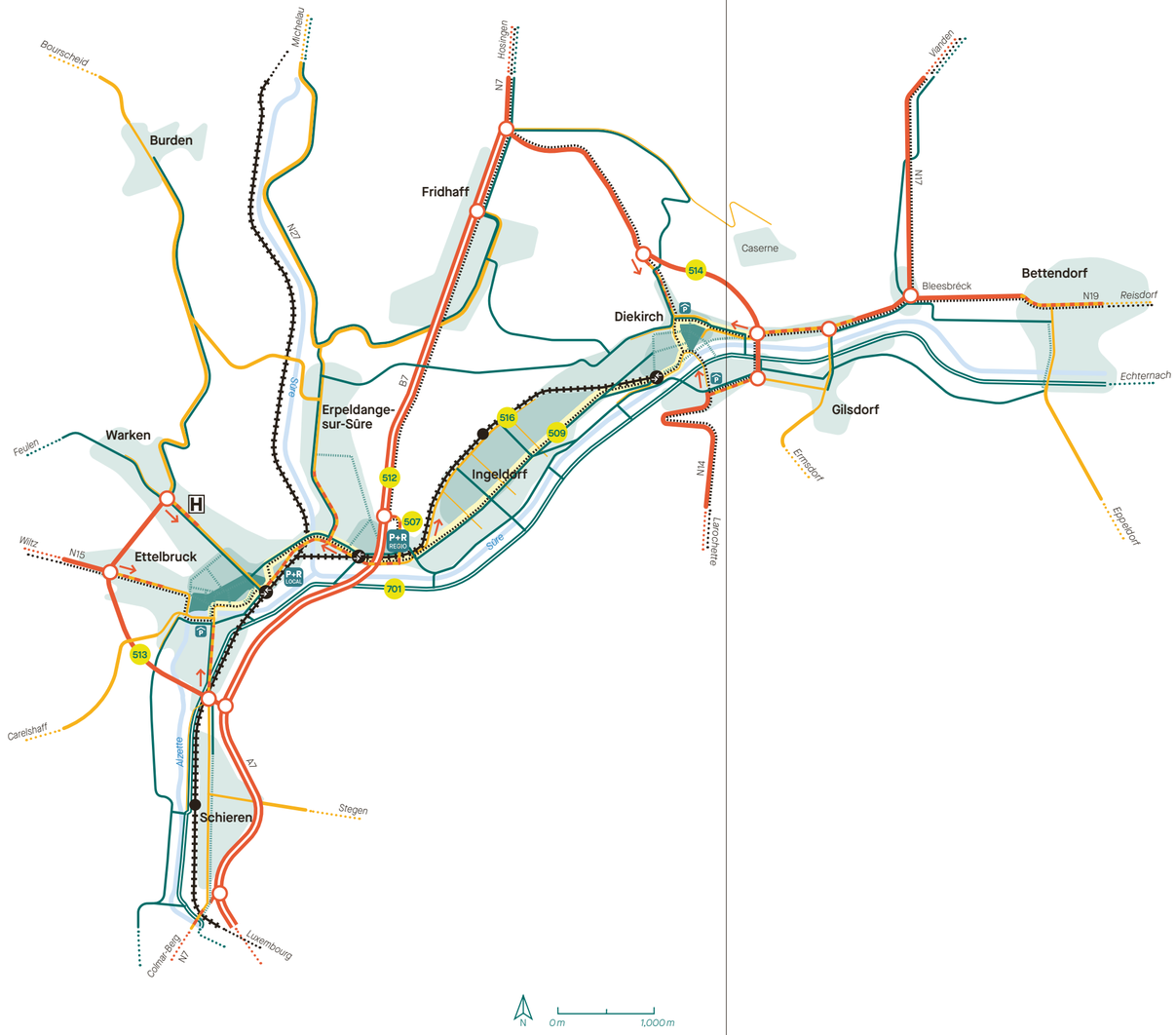
Organisation of mobility in 2035

In order for Nordstad to develop as an urban centre, its central sector between Ettelbruck and Diekirch must be freed from motorized individual transit, whether regional or concentrated between the towns located on the outskirts of Nordstad. This traffic will be directed towards the following three major axes:

- Ettelbruck's *contournement de proximité* 513 will connect the N15/route de Bastogne with Warken and the B7 expressway interchange between Schieren and Ettelbruck.
- Diekirch's *contournement de proximité* 514 will move the junction between the N14 (Larochette) and the N7 (Bleesbréck and Fridhaff) towards the east of the town centre.
- The B7 expressway will be widened to 2×2 lanes 512 between the Fridhaff roundabout and the motorway interchange situated between Schieren and Ettelbruck. In addition to the traffic connecting the North to the centre of the country, this section will have to absorb the traffic of the current N7 between Diekirch and Ettelbruck.

This massive reinforcement of the primary road network will make it possible to implement substantial and sustained traffic calming:

- In Ettelbruck, the neighbourhoods, the various car parks, the hospital and the secondary schools will remain accessible either from the B7 interchanges located in Ingeldorf and between Schieren and Ettelbruck, or from one of the intersections of the *contournement de proximité* located on the route de Bastogne or in Warken. The city centre can be reserved for local traffic, deliveries and urban transport modes.
- The one-way loop around Diekirch city centre will be replaced by a traffic pattern oriented towards the intersections of the *contournement de proximité*. The latter will provide access to the various neighbourhoods and car parks in the city centre. Only buses, bicycles and pedestrians will pass through the city centre.
- Between Diekirch station and the B7 interchange in Ingeldorf, the N7 will disappear once Diekirch's *contournement de proximité* and the widening of the B7 south of Fridhaff are in operation. The current Ingeldorf/Walebroch business park will become a residential neighbourhood without motorized through traffic. This area will be accessible by car from the B7 interchange in Ingeldorf.
- Cut-through driving via Goldknapp (CR351) between Diekirch and Erpeldange-sur-Sûre will be made impossible. Traffic along the through road of Erpeldange-sur-Sûre can be calmed, as it can be in the town centres of Schieren, Bettendorf and Gilsdorf.



- The Diekirch railway branch will be moved to the Goldknapp embankment 516, double-tracked and service will be increased to four trains per hour. In addition to the two omnibus trains that will continue to run between Diekirch, Luxembourg City and Rodange, there will be two express trains. These will serve the new Ingeldorf and Erpeldange-sur-Sûre stops and will then continue to Ettelbruck, Mersch and Walferdange before entering the stations of Luxembourg City. The same trains will run between Luxembourg City and Volmerange-les-Mines via Dudelange (see pages 47–49).
- The bus lines connecting Nordstad to the towns in the rural North will use a high-performance bus corridor (CHNS) between Ettelbruck and Diekirch 509 (see page 64). Given the large number of such lines, this corridor will provide the residents of Nordstad with a very high level of service for their local travel.
- While Ettelbruck station will remain the main interchange hub between trains and buses in Nordstad, the new Erpeldange-sur-Sûre stop will feature a particularly attractive P+R, as it will be directly accessible from the B7 expressway.

Its topography and size make Nordstad ideal for cycling.

- The cycle highway 701 along the Sûre and the Alzette leading up the Alzette valley to Mersch and Luxembourg City will form the backbone of the cycling network.
- It will connect numerous national cycle routes from different directions, namely the Attert valley, the Haute-Sûre lake, the Vennbahn, the N7 plateau, Vianden, Echternach and Larochette. Nordstad will become a centre for bicycle tourism, an advantage that its residents will be the first to benefit from.
- The residents of Nordstad will be able to use the bicycle for their daily journeys in the many traffic-calmed neighbourhoods and town centres. The local cycling network will be complemented by high-performance urban cycle routes, particularly along the central axis, which will be reserved for cyclists and the high-performance bus corridor (CHNS). New footbridges in Schieren, Ingeldorf and Diekirch, as well as a direct cycle route between Bettendorf and Bleesbréck will shorten journeys significantly.

While the various car parks will remain accessible, pedestrians and local shops will benefit from traffic calming in the town centres.

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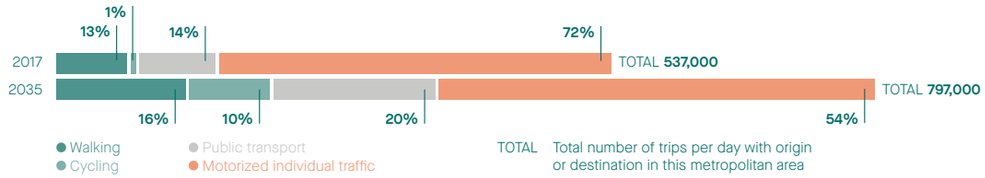
Urban South and Esch & Belval

The urban South includes the municipalities of Pétange, Käerjeng, Differdange, Sanem, Mondercange, Schifflange, Kayl, Rumelange, Dudelange and Bettembourg. As a principal centre, Esch & Belval is the dominant point of interest in the southern metropolitan area. It consists of the city of Esch-sur-Alzette and the most urban parts of the municipality of Sanem.

Mobility in the urban South and Esch & Belval is highly interdependent and cannot be understood separately. Below, the characteristics of the two mobility zones are presented together. The projects are then presented for the urban South in general and for Esch & Belval in particular.

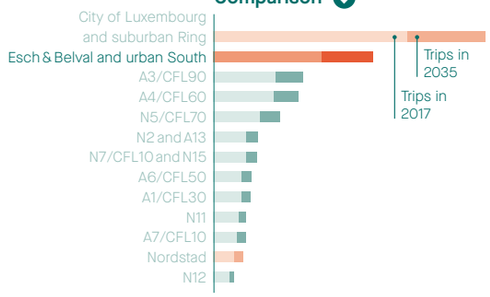
Evolution of modal shares – minimum targets



Distribution of trips (%)

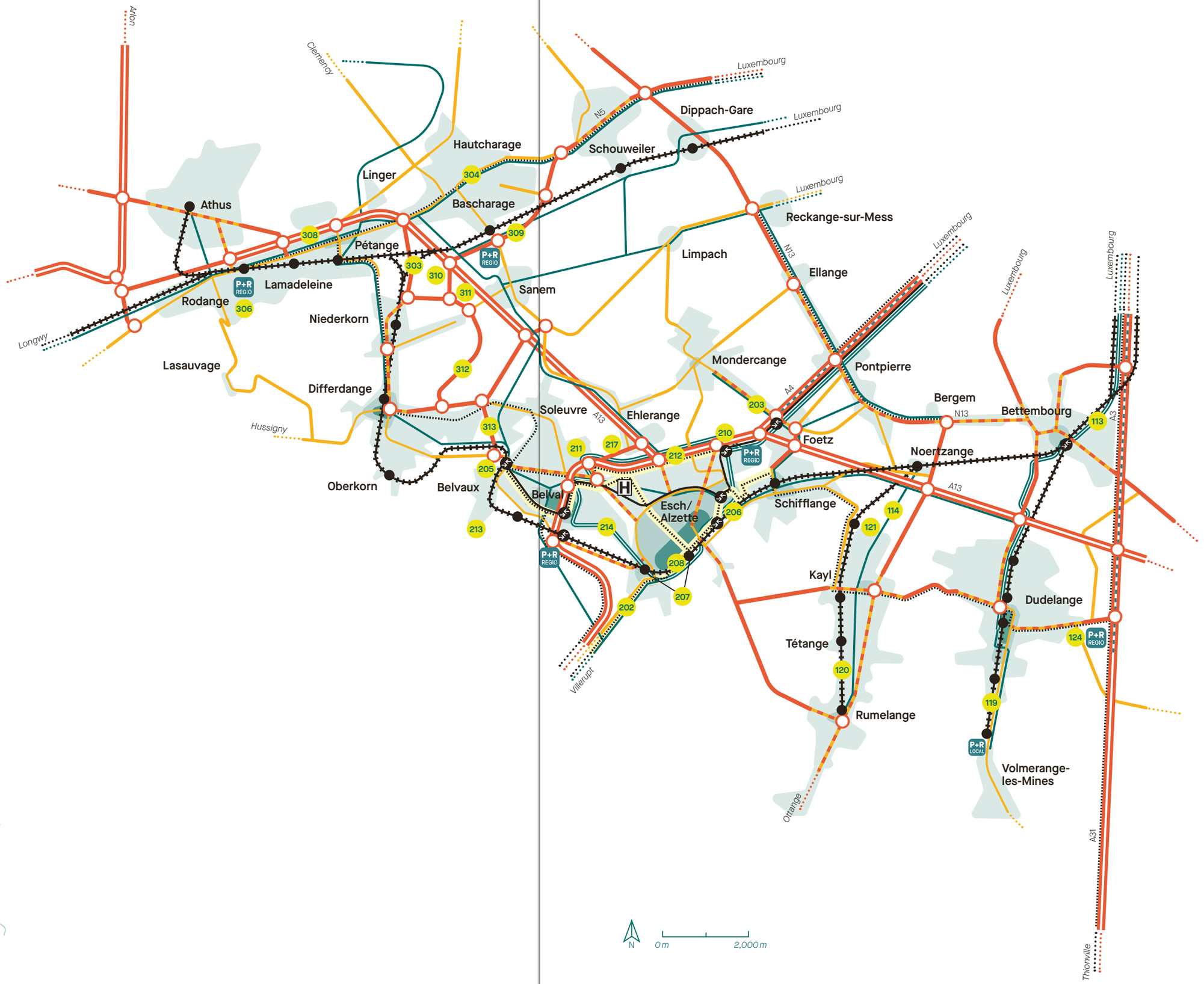
- 51 internal to this metropolitan area
- 19 to or from Luxembourg City and the suburban Ring
- 1 to or from Nordstad
- 42 less than 5km
- 20 between 5 and 15km

Comparison



Characteristics

- With 179,000 residents and some 95,000 jobs on the Luxembourg side, the urban South and Esch & Belval constitute the second largest metropolitan area in the Grand Duchy. This metropolitan area is characterised by a partially segmented urban space, but it encompasses many towns of a relatively large size.
- It is the only metropolitan area in Luxembourg with cross-border urban continuity. Already clearly identifiable between Athus in Belgium, Longwy in France and Rodange in the Grand Duchy, this specific feature will develop between Esch & Belval and the municipalities of the Haute Vallée de l'Alzette and, at a smaller scale, between Rumelange and Ottange as well as between Dudelange and Volmerange-les-Mines. While some cross-border traffic flows only pass through the metropolitan area along the various corridors that link it with the city of Luxembourg, 16% of trips originating or ending in the urban South or in Esch & Belval are cross-border themselves, i. e. around 87,000 journeys per day recorded in 2017.
- 51 % of all trips in connection with the urban South and Esch & Belval are internal to these mobility zones. Residents of the municipalities in this metropolitan area leave it for only 20% of their trips. 42% of trips are shorter than 5km; 20% of them cover a distance of 5 to 15km. These figures highlight the importance and the potential of urban mobility.
- 19% of trips involving these mobility zones are related to the city of Luxembourg and its suburban Ring. Schools and workplaces are the main destinations.
- Given its mining history and pronounced industrialisation, the south of the country has inherited a rail network with a 'freight transport' orientation, as revealed by the winding path of the CFL60 line and the remarkable number of more or less short railway branches. The CFL60 line provides connections both within the metropolitan area and between it and the country's two other main economic centres. With 10,500 boardings and alightings (b+a) per working day in 2019, the Esch-sur-Alzette and Bettembourg train stations share the rank of the second busiest station in the country. Belval-University (6,000 b+a), Pétange (6,000 b+a), Rodange (5,700 b+a), Differdange (3,600 b+a) and Schifflange (2,700 b+a) are among the eleven busiest stops. On the CFL60 line, the Belval-Rédange (250 b+a) and Belvaux-Soleuvre (310 b+a) stops, both on the fringe of Belvaux, register the fewest boardings and alightings per day.
- The distribution bus lines within this metropolitan area are operated by TICE *(Syndicat pour le Transport Intercommunal de personnes dans le Canton d'Esch-sur-Alzette)*. The main lines and distribution lines in rural areas, including those that are cross-border, are run by RGTR *(Régime Général des Transports Routiers)*. The two operators work closely with the Ministry of Mobility and Public Works to develop an offer that is coherent from the user's point of view and adapted to a changing demand, including one for main cross-border lines in metropolitan areas.
- The main road axis is the Collectrice du Sud A13. In the municipality of Pétange, the avenue de l'Europe (N31) links this axis to Belgian and French expressways. Congestion along this segment, as well as between the Lankelz and Foetz interchanges, where the A13 and the A4 highways overlap, are the cause of considerable cut-through traffic in the towns of the rural South that are located between the urban South and the suburban Ring of Luxembourg City.


Arlon
Clemency
Luxembourg
Dippach-Gare
Schouweiler
Hautcharage
Linger
Bascharage
Athus
Pétange
Lamadeleine
Rodange
Longwy
Niederkorn
Sanem
Limpach
Reckange-sur-Mess
Ellange
Lasauvage
Differdange
Hussigny
Soleuvre
Ehlerange
Mondercange
Pontpierre
Bergem
Bettembourg
Foetz
Noertzange
Oberkorn
Belvaux
Esch/
Alzette
Schifflange
Kayl
Dudelange
Tétange
Rumelange
Volmerange-
les-Mines
Oltange
Villerupt
Thionville
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A13
A4
N5
N13
P+R REGIO
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Rural North
Nordstad
Rural South
Suburban Ring
City of
Luxembourg
Urban South

Organisation of mobility in 2035

Functional classification of the multimodal road network will be of fundamental importance for the development of a more urban mobility in the urban South. Selective reinforcement to the main road network will only accomplish its aim of removing individual motorized transit traffic from the city centres if it is systematically accompanied by substantial traffic-calming measures in the towns involved.

- The opening of the Liaison Micheville 211 and the easing of traffic flow on the A4/A13 between the Lankelz and Foetz interchanges 212 will provide Esch & Belval with an efficient *contournement de proximité*. These measures will make it possible to reorganise the urban road network as described on page 130.
- Boosting the road capacity of avenue de l'Europe (Pétange bypass road) 308 between the Belgian border and the Biff roundabout will pave the way for a redesign of the current arterial road in Rodange and Pétange.
- Two projects will allow for substantial traffic calming in Sanem and Bascharage, namely the *contournement de proximité* of Bascharage and Sanem 309 as well as the connection of this new road to the A13 via a new interchange 310. This provides direct access to the Gadderscheier 311 business park, which will allow for the removal of the current Sanem interchange.
- This new motorway access to Gadderscheier and, as its continuation, a new connection to Fousbann 312 and Belvaux 313, will make it possible to calm traffic in Niederkorn, Differdange, Oberkorn, Soleuvre and Belvaux. As for Belvaux, the opening of the Liaison Micheville 211 will make it possible to close the CR178 to cross-border motorized traffic 213.

- In this metropolitan area, with its particularly high number of short trips (see page 122), the additional 40% of trips forecast for 2035 cannot be accommodated without substantially better conditions for cycling. High-quality bicycle infrastructure will need to be put in place in and between all neighbourhoods.
- For longer journeys, the cycle network will be structured from east to west by two transversal routes, one practically running along the A13 motorway, the other crossing the towns located to the south of this motorway. These two axes will be linked by cycle routes directed towards the city of Luxembourg, specifically between Rodange and Bascharage, between Niederkorn and Sanem, between Belvaux and Sanem and between Belval and Foetz.
- In the portion of the cycling network located in the urban South, the PC103 cycle highway 113 will be key for trips within Dudelange and Bettembourg, as well as between these two towns. Improvements to the cycle route between Rumelange and Noertzange station 114 will pursue a similar aim in the Kälbaach valley. The cycle highway PC104 214 will provide a quick bypass of Esch-sur-Alzette as well as access to the different neighbourhoods (see page 130).

While the main objective of the rail network reinforcement is to improve relations with Luxembourg City, travel within the southern metropolitan area will also benefit.

- The new triangular railway junction between Niederkorn and Bascharage 303 will provide direct links between Bascharage/Sanem and the stops of the CFL60 line.
- The consolidation of the two CFL stops in Belvaux into a new stop Belvaux Mairie 205 (see page 50) will benefit a larger number of residents and make it possible to provide quarter-hourly services to the various stops between Niederkorn and Bettembourg.
- The creation of the Esch-Schifflange 206 and Kayl-Nord 121 stops will provide these new neighbourhoods with direct train access.
- With reliable connections in Noertzange and Bettembourg, a half-hourly service in the Kälbaach valley and a quarter-hourly service in Dudelange will make the train more attractive for destinations that are close to a station in the urban South or in Esch & Belval.

The bus network will be reorganised to take advantage of the following opportunities:

- The fast tram and its new interchange hubs, particularly the one on A4 at Monkeler 210, which will become the last stop for the bus lines that currently use the A4 towards Luxembourg City;
- The high-performance bus corridors (CHNS, see pages 63 and 65) and a reduction of through traffic on other axes used by buses;
- Significant demand for cross-border bus lines oriented not only towards the city of Luxembourg and the interchange hubs, but directly towards the main destinations in the urban South, such as the business parks.

In addition to their value for traffic flows towards the city of Luxembourg, a number of important P+Rs will also prove valuable for an interchange towards the towns of the urban South and Esch & Belval. This will be the case in particular for the P+Rs at Rodange 306, Belval, Bascharage/Sanem 309, A4 at Monkeler 210 and A3 near the upgraded Dudelange-Centre motorway interchange 124.

Esch & Belval

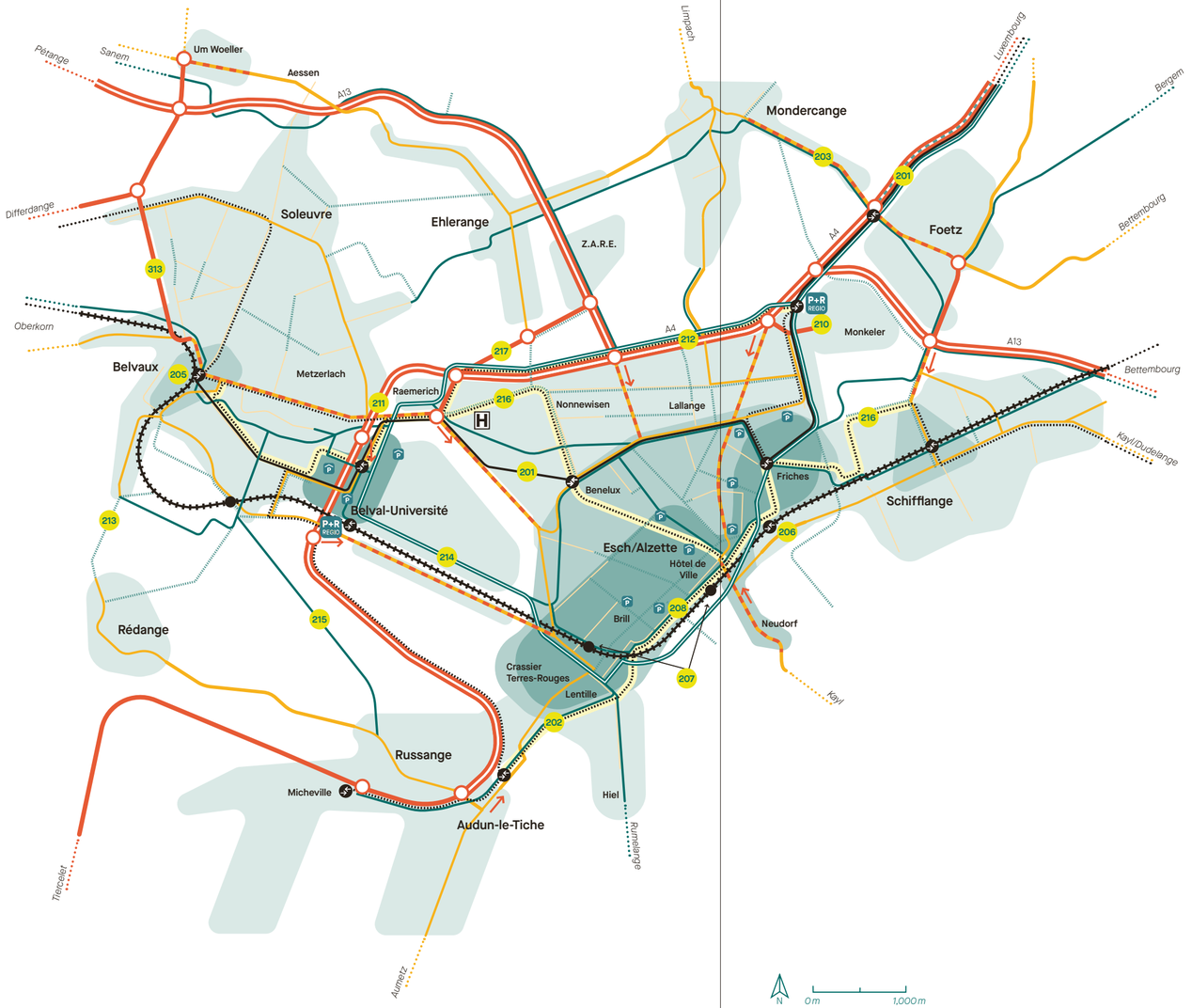
The city of Esch-sur-Alzette and the new neighbourhoods of Belval located on a former brownfield constitute the country's second principal centre.

Organisation of mobility in 2035

- On the *contournement de proximité* formed by the Liaison Micheville 211 and the A4, which will feature additional traffic lanes and bus corridors between the Lankelz-Ehlerange and Foetz 212 motorway interchanges, each exit or motorway interchange will provide access to a given neighbourhood of Esch-sur-Alzette or Belval, and, where applicable, to one of the car parks in the city centre. With its substantially increased capacity, this bypass road will also be used by residents who wish to travel by car from one neighbourhood of Esch to another.
- On avenue J. F. Kennedy in front of Esch-sur-Alzette station, buses and bicycles will constitute the only through traffic. Avenue Grande-Duchesse Charlotte, a substantial width of which will be set aside for the tram, will no longer be suitable for motorized individual through traffic, but only for distributing local traffic to nearby neighbourhoods.
- To prevent any cut-through driving in Esch-sur-Alzette and the residential neighbourhood in the north of Schifflange, the only connection that will remain open to motorized private transport between Esch-sur-Alzette and Schifflange will be the one along the southern side of the railway tracks.
- The extension of the N37 to the Raemerich motorway interchange 217 will free route d'Ehlerange from motorized through traffic. A new footbridge over the motorway will be reserved for pedestrians and cyclists.

- As a compact student town with a generally flat topography and existing and planned high-density housing areas, the country's second principal centre is destined to become a cycle-friendly city. The diversion of motorized through traffic to the Liaison Micheville and the A4 (see above) will facilitate continuation of the policy of traffic-calmed neighbourhoods, particularly the installation of a high-quality bicycle infrastructure along all arterial roads and at all intersections.
- The PC104 cycle highway 214 will bypass Esch from the north and south, crossing two new neighbourhoods: the urbanised Esch-Schifflange brownfield and Lentille Terres-Rouges. Europe's longest bicycle bridge will connect Belval to the city centre.
- This cycle ring must provide access to the different neighbourhoods and a means of passing through the city of Esch along several key routes segregated from motorized traffic: along avenue J.F. Kennedy in front of the station, between Raemerich and the new district of Esch-Schifflange via boulevard Grande-Duchesse Charlotte, between Hôtel de Ville and Südspidol, etc.
- The cycle routes to Audun-le-Tiche 202 and Russange 215 will contribute to the development of a cross-border metropolitan area.

- The current position of some train stops is not consistent with the urban development in this mobility zone. This is why the two outlying and relatively underused stops in Belvaux will be merged to create a new Belvaux Mairie interchange hub 205. The new neighbourhood on the brownfield in Esch-Schifflange is focussed on public transport and will have a new railway stop 206. Located in the continuation of the pedestrian axis of the city centre, this stop will be located just a few hundred metres from the current railway station of Esch-sur-Alzette. The urban development of Crassier Terres-Rouges at the western end of rue de l'Alzette and the possible renovation of the viaduct may offer an opportunity to replace the current station – quite enclosed between the Gaalgebierg embankment and a built front – with a new, more attractive station at this more western location 207.
- In addition to providing a fast connection to the city of Luxembourg that is complementary to the train, the tram 201 will play the role of a main urban line. It will connect Belvaux Mairie, the residential neighbourhoods of Belval, the university, place Benelux, the residential neighbourhoods on both sides of avenue Grande-Duchesse Charlotte and the interchange hubs of Esch-Schifflange, of A4 near Monkeler and of the Foetz business park.
- The bus will play a key role, both for urban trips and for connections to other towns in the urban South as well as to cross-border areas. Two high-performance bus corridors (CHNS, see pages 63 and 65) will offer attractive and reliable travel times on all regional and local lines that use them. From east to west, a first corridor 216 will prioritize buses between the northern entrance of Schifflange and the Belvaux Mairie interchange hub. It will first pass through the new neighbourhood of Esch-Schifflange to connect with the tram and the train before continuing through the city centre, passing place Benelux to offer a second interchange with the tram, cross the Nonnewisen district, with a stop at the new Südspidol hospital, serve the university and finally pass between the Belval-Nord and Belval-Sud neighbourhoods. On a second axis, which will be superimposed on the first in the Esch-Schifflange district, buses will be prioritized, or even operated on exclusive infrastructure, for cross-border connections. Travelling via avenue J.F. Kennedy, which will be freed from through car traffic 208, these buses will use the current railway bed between the new Lentille Terres-Rouges district and Audun-le-Tiche station. Extending prioritization for buses to Micheville would benefit a number of lines. This cross-border high-performance bus corridor will substantially improve the offer of public transport between the French municipalities of Haute Vallée de l'Alzette and various regional and local destinations in the Grand Duchy.
- Linked to regional and local public transport, the two major P+Rs in this mobility zone – at Belval-University station to the west and at the A4 interchange hub to the east 210 – will also facilitate access to Esch & Belval.



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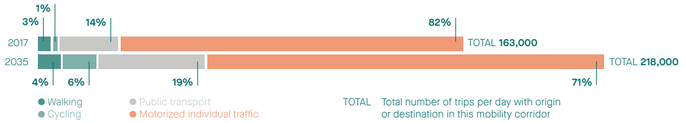
N2 and A13 corridors

This corridor comprises the south-eastern part of the country with a portion to the north centred around national roads N28 and N2 'route de Remich' and an area to the south around the A13 Saar motorway, which then joins the A3/CFL90 corridor.

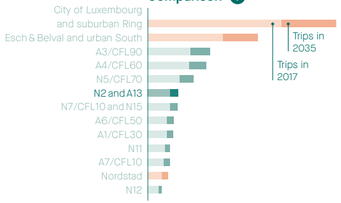
Evolution of modal shares – minimum targets



Distribution of trips (%)

- 33 internal to this mobility corridor
- 34 to or from Luxembourg City and the suburban Ring
- 12 to or from Esch & Belval and the urban South
- 1 to or from Nordstad
- 22 less than 5km
- 19 between 5 and 15km

Comparison

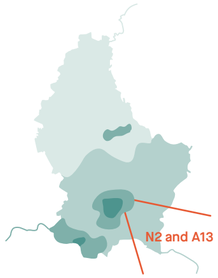


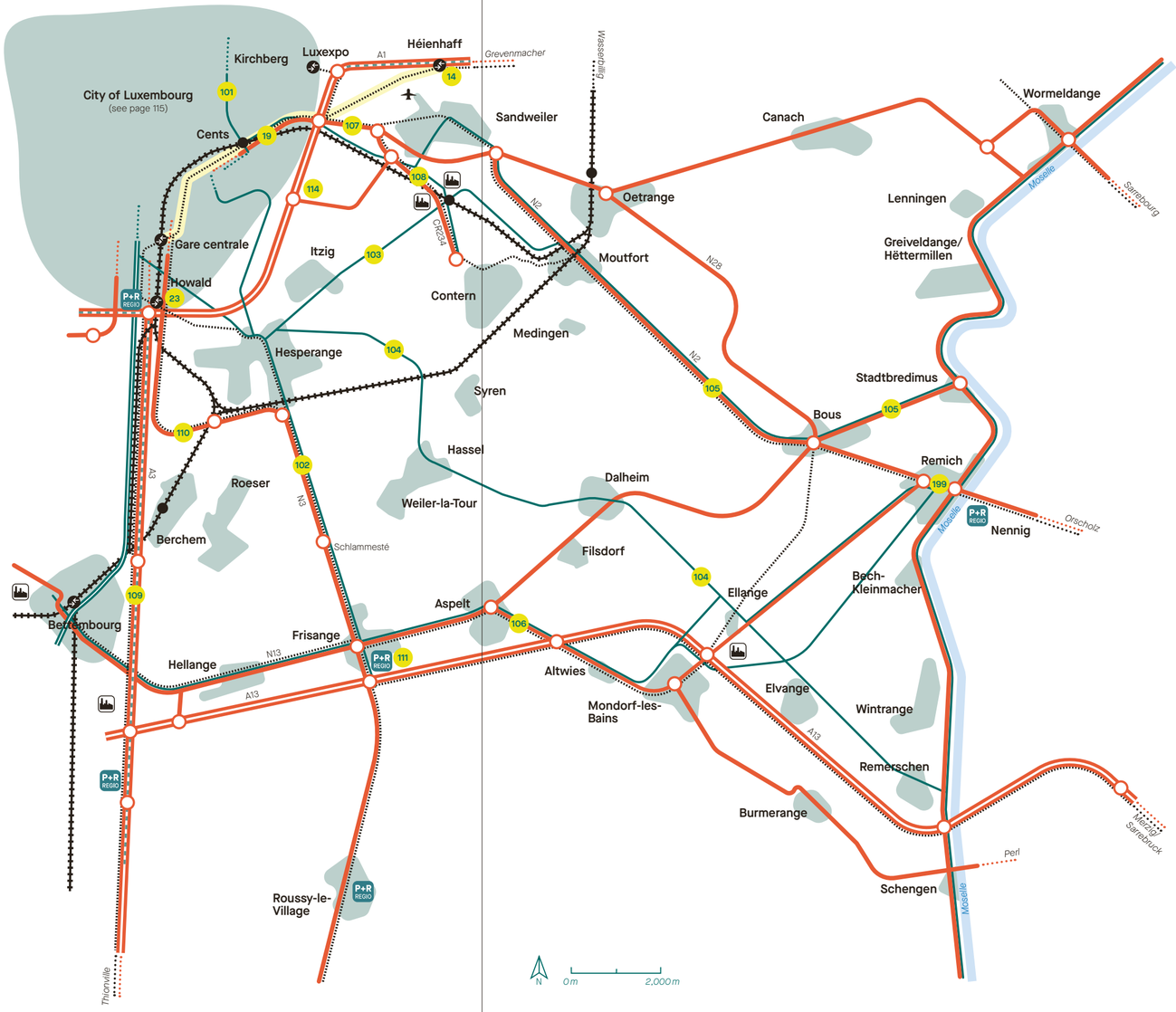
Characteristics

- Despite a dual road axis to the north (N2 and N28) of interest for trips to Kirchberg and an efficient road axis along the French border (A13) that gives access to the south of the country and the city of Luxembourg, this corridor is characterised by scattered traffic flows.
- Many towns located between N2 and A13 are subject to considerable through traffic. This situation can be explained on the one hand by the fact that the main axes lead to road congestion at the Robert Schaffner roundabout (Irrgarten), respectively at A3 and N3, and on the other hand by an abundance of secondary roads on which through traffic is not prevented.
- The business parks located away from the main roads, specifically on both sides of CR234 between Contern and Scheedhaff, attract cross-border traffic from Germany and France.
- The through road of Remich, with its cross-border bridge leading to the town centre and the chain of service stations characteristic of Luxembourg border towns, is often congested.
- From the towns located near the suburban Ring of the city of Luxembourg, the cycle routes that connect the city of Luxembourg to the Moselle – a very popular destination for cycling tourism – also have great potential for work commutes by bicycle.

Organisation of mobility in 2035

- Cycling can play a more important role, even beyond a distance of 5km, for journeys to or from the city of Luxembourg. This will be helped by the cycle routes between Sandweiler and Cents 101, Frisange, Hesperange and Howald 102 as well as Hesperange and the Contern business park 103. These links will be complemented by cycle-tourism routes linking the city of Luxembourg to Schengen via Hasselt (Eurovelo 5) 104 and Dalheim and PC25 between Sandweiler and Stadtbredimus 105. To the south, PC6 106 will link towns with one another while providing access to other cycle routes to the city of Luxembourg and the municipalities of the urban South.
- Given the high density of the road network in this corridor, systematic functional classification, both within and between towns, will provide numerous opportunities for traffic-calming measures that will make cycling safer.
- The main bus lines will in principle use the N2, A13 or N13. This offer will be supplemented by distribution bus lines serving the towns located away from these axes.
- Some of the main bus lines coming from Remich will have their last stop and interchange hub with the tram at Kirchberg (Luxexpo) or at Héienhaff 14; others will use the high-performance bus corridor 19 to stop at the Rocade (Central Station) and at the Howald interchange hub. Buses will benefit from prioritization along the N2 199 in Remich and at Irrgarten 107, respectively along the CR234 for lines 108 serving the Contern business park.
- The bus lines of the A13 corridor will use either the prioritization lane on the A3 109 or the Alzingen bypass road 110 and the redesigned Hesperange through road. This will significantly reduce and stabilise travel times. The Howald interchange hub 23 will be the first contact that these lines will have with the city. They will then continue on towards their last stop, whether at Cloche d'Or, at Luxexpo or at Héienhaff near the airport.
- Three P+Rs – those of Frisange 111 in the Grand Duchy, Roussy-le-Village in France and Nennig in Germany – will allow cross-border flows of this corridor to be shifted from cars to buses.
- The creation of a carpool lane on the A3 109, the construction of the bypass road at Alzingen 110 and the addition of a motorway interchange near Itzig 7 offering access to the Contern business park will alleviate significant bottlenecks.
- This strengthening of the main road network will offer an opportunity to rethink the role of many other roads in the corridor (not shown on this map), with the aim of relieving towns of through traffic by channelling it towards the main axes.





Road network
- Motorway/expressway
- *Route principale* or *Route de liaison*

Cycle network
- Cycle highway
- Primary cycle route

Public transport
- Railway line and station
- Main bus line
- Interchange hub
- High-performance bus corridor (*CHNS*)

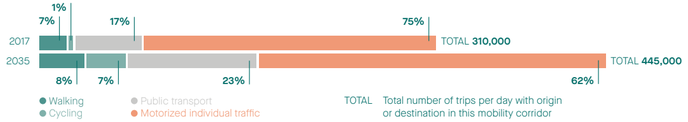
Parking and carpooling
- Regional P+R
- Local P+R
- Carpool/Bus lane
- Business park

The map does not depict all of the business parks and infrastructure.

A3/CFL90 corridor

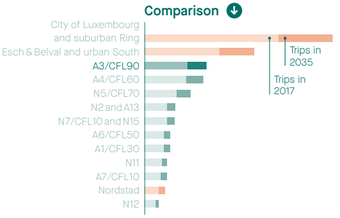
This corridor spans the triangle formed by the city of Luxembourg to the north, Frisange to the south-east and Rumelange to the south-west. Its main traffic flows, notably on the A3 'autoroute de Dudelange' and the railway line, extend to the Thionville and Metz metropolitan areas in France.

Evolution of modal shares – minimum targets



Distribution of trips (%)

Comparison



Characteristics

- This is the corridor that accommodates the most daily trips. By 2035, there will be approximately 115,000 trips per day to or from Luxembourg City alone.
- With 10,500 boardings and alightings per day in 2019, the station in Bettembourg – like Esch-sur-Alzette – is the second-busiest station in the Grand Duchy.
- 45% of all trips in relation to this corridor are cross-border.
- In addition to the metropolitan areas of Thionville and Metz, the cross-border territory also includes areas with scattered urbanisation. The residents of these areas enter the Grand Duchy via alternative routes, such as the N3 in Frisange or the CR184 between Volmerange-les-Mines and Dudelange.
- 37% of traffic flows in the corridor originate in or are destined for the urban South or Esch & Belval. The measures in relation to these traffic flows are explained on pages 122 – 131 in the sub-chapters dedicated to this metropolitan area.

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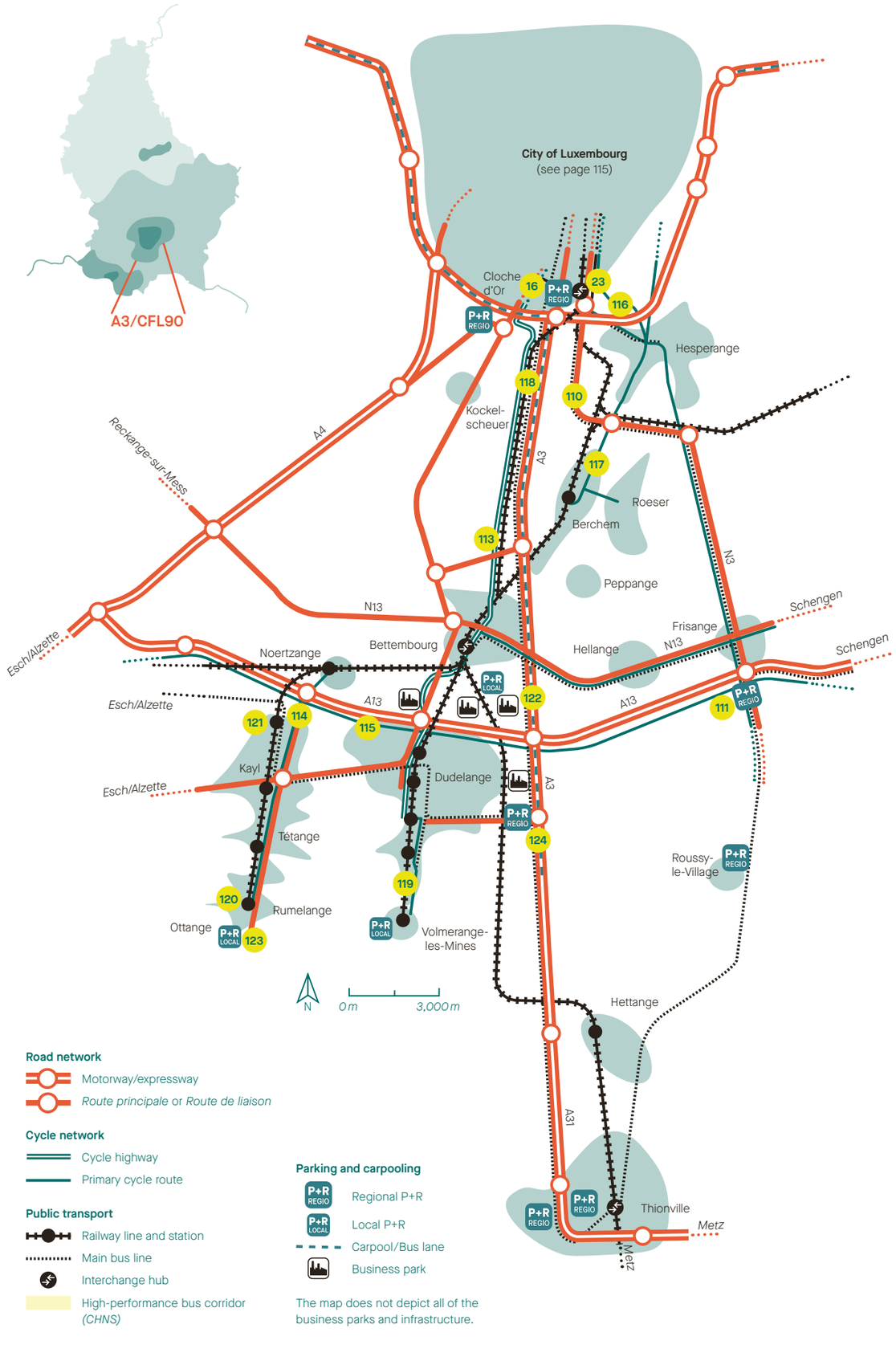


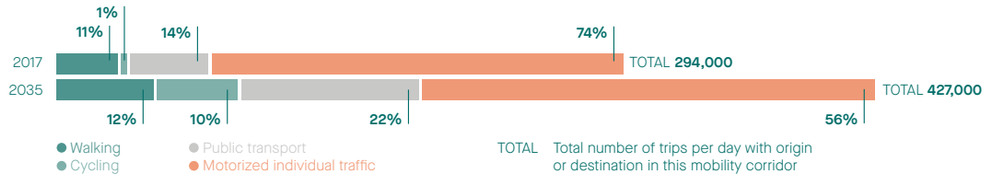
Organisation of mobility in 2035

- The cycle highway PC103 113 linking Dudelange with the city of Luxembourg will form the backbone of the cycling network for this corridor.
- The upgrading of the cycle route PC6 between Rumelange and Noertzange 114 as well as along the A13 motorway 115 will provide additional access to PC103 and to the railway stations.
- Along with the bypass road at Alzingen 110, additional cycle routes to the city of Luxembourg 116 and 117 will be put in place.
- With up to 32 trains per hour, Bettembourg station will become a major 'Bike and Rail' hub.
- The completion of the new Bettembourg-Luxembourg line 118 will strengthen cross-border rail service. This line will accommodate up to nine passenger trains, including a TGV, per hour and per direction.
- Two direct trains per hour will connect the P+R of Volmerange-les-Mines and Dudelange not only to Howald, the Central Station and the Pfaffenthal-Kirchberg stop, but also to Nordstad 119. Two train shuttles per hour between Volmerange-les-Mines and Bettembourg may supplement this offer.
- The Kälbaach valley railway branch will have a regular half-hourly service between Rumelange and Noertzange 120 with a new stop at Kayl-Nord 121.
- Bus lines will serve zones located away from railway stations on both sides of the border. Buses will be prioritized along the A3 122. Along the N3, prioritization around Frisange, as well as the bypass road at Alzingen 110, will improve the reliability of bus travel times.
- A large number of P+Rs will promote intermodality. In Ottange 123, in Frisange 111, near the upgraded Dudelange-Centre motorway interchange 124 (which will also become accessible from France), and near Croix de Gasperich 6, extensions or new P+Rs will be added to the existing P+Rs in Thionville, Metzange, Hettange-Grande, Volmerange-les-Mines and Roussy-le-Village.
- In this busiest of corridors, the imperative of focussing on transporting as many people as possible, rather than as many vehicles as possible, seems most obvious. To increase passenger transport capacity along the A3 motorway, the third lane 122 will be set aside for buses and carpools in the event of road congestion.
- The bypass road at Alzingen 110 will make it possible to relieve the Hesperange through road in favour of transport modes that are better-suited to the metropolitan area formed by the suburban Ring and the city of Luxembourg.

A4/CFL60 corridor

This corridor links the two primary centres of the Grand Duchy, namely the city of Luxembourg and the Esch & Belval mobility zone. Traffic flows from a vast cross-border territory converge in Villerupt and Audun-le-Tiche. The corridor also includes a small area of the rural South between Foetz and Leudelange. The main transport axes are the A4 ‘autoroute d’Esch’ motorway and the railway line serving Esch-sur-Alzette and the urban South.

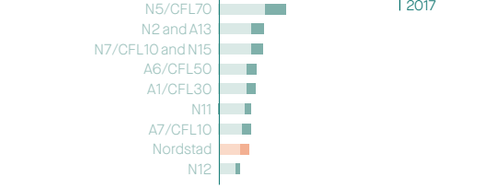
Evolution of modal shares – minimum targets



Distribution of trips (%)

- (41) internal to this mobility corridor
- 20 to or from Luxembourg City and the suburban Ring
- 47 to or from Esch & Belval and the urban South
- <1 to or from Nordstad
- 35 less than 5km
- 24 between 5 and 15km

Comparison

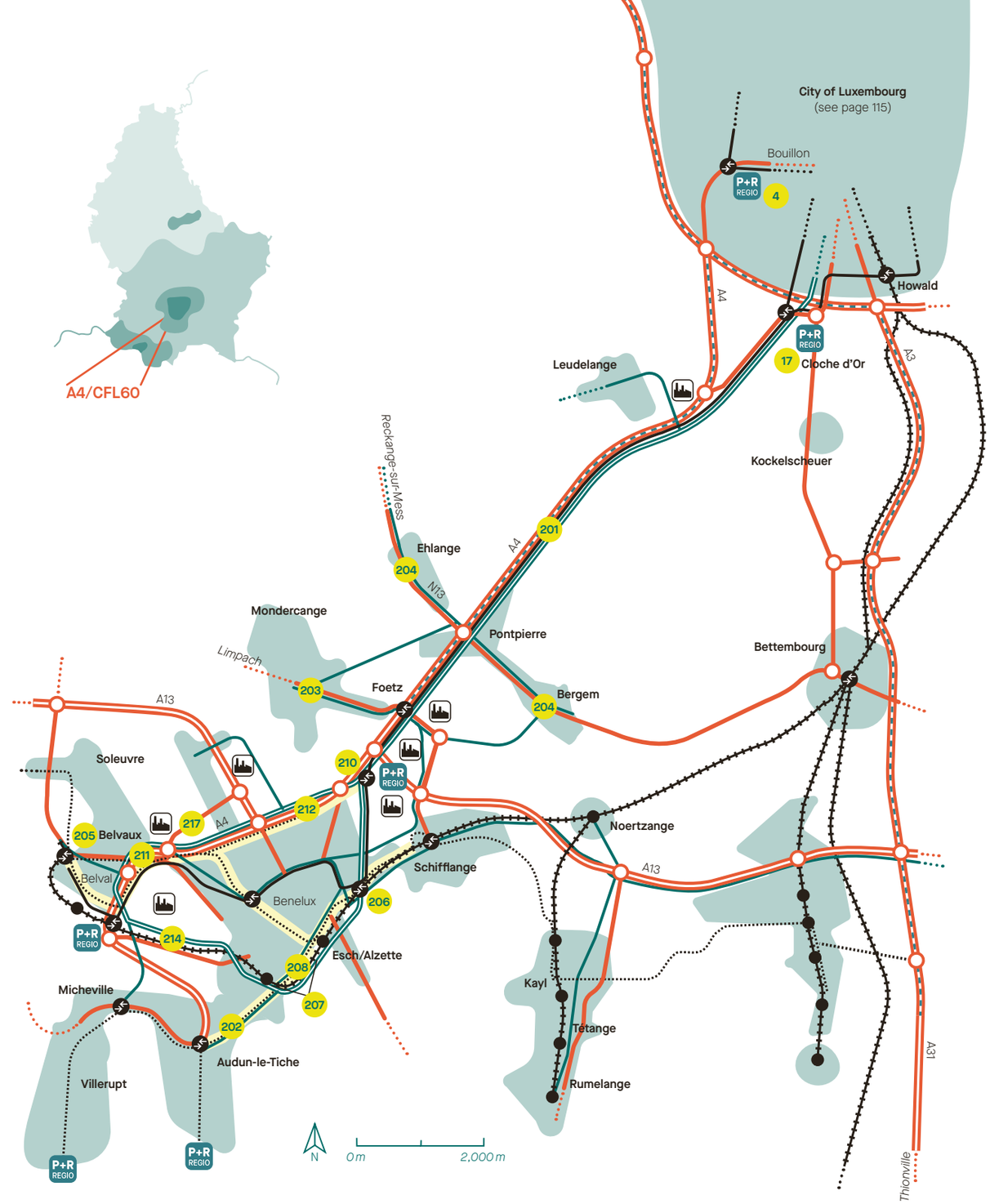


Characteristics

- A significant share of the trips taken in this corridor are urban: 17% are internal to the Esch & Belval mobility zone, and 41% have their origin or destination in the urban South.
- 21% of traffic flows within the corridor (90,000 trips per day in 2035) are in relation to the city of Luxembourg and its suburban Ring.
- The main challenges are to improve links with the city of Luxembourg and to promote urban transport modes for trips in the urban South. The measures designed to facilitate these trips are explained on pages 122–131 in the sub-chapters dedicated to the urban South and Esch & Belval.

Organisation of mobility in 2035

- The cycle highway PC104 between Belval and Luxembourg 214 will be the backbone of the cycling network in this mobility corridor.
- Primary cycle routes will connect to PC104, both from Audun-le-Tiche 202 and Micheville and from Luxembourgish towns located near it, such as Mondercange 203, Ehlange, Bergem or Pontpierre 204.
- The fast tram 201 will provide a quick and direct link to the main points of interest in the city of Luxembourg, as well as local access to the neighbourhoods of Esch-sur-Alzette located near the A4.
- The rail offer will be expanded by relocating certain stops to account for the potential number of passengers. The Belval-Rédange and Belvaux-Soleuvre stops will be combined to create a central Belvaux Mairie stop that will serve as an interchange hub 205 with the fast tram and buses. The railway stop of the new Esch-Schifflange neighbourhood on the industrial brownfield 206 will later make it possible to relocate the nearby Esch-sur-Alzette station towards the western end of the pedestrian zone 207. These two stops would offer optimal coverage of both the historic centre and the new neighbourhoods of Lentille Terres-Rouges and Crassier Terres-Rouges.
- Interconnected with the distribution bus lines of the southern metropolitan area, the bus lines serving the city of Luxembourg will be organised into three clusters. Firstly, cross-border lines will use a high-performance bus corridor (CHNS) 208 between the current Audun-le-Tiche railway station, the railway stations in Esch-sur-Alzette and the fast tram stop in the new district of Esch-Schifflange. Secondly, the main bus lines that currently use the A4 motorway will switch via bus lanes 212 to the fast tram at the new A4 interchange hub 210. Thirdly, the distribution bus lines that serve the rural towns (Mondercange, Pontpierre, Bergem, etc.) located to the north of the new A4 interchange hub will benefit from bus prioritization on the A4 201 and will be connected to the public transport of Luxembourg City at the Cloche d'Or interchange hub 17.
- All along the corridor, four large P+Rs with a total capacity of approximately 8,000 cars will facilitate interchange with public transport. The Belval P+R will provide access to the train. The new P+R located at the A4 interchange hub 210, the Cloche d'Or P+R 17 and the Bouillon P+R 4, which will be relocated to the intersection of the future boulevards de Merl and de Cessange, will be served by the tram.
- The main road network will be expanded with the opening of the Liaison Micheville 211, the increase in road capacity at the A13 – A4 – A13 overlap 212, and the prioritization of carpooling on the A4 motorway 201.
- Particularly in the Esch & Belval mobility zone, this expansion of the main road network will make it possible to reclassify the road network in favour of urban transport modes.



Road network
- Motorway/expressway
- *Route principale* or *Route de liaison*

Cycle network
- Cycle highway
- Primary cycle route

Public transport
- Railway line and station
- Main bus line
- Interchange hub
- High-performance bus corridor *(CHNS)*

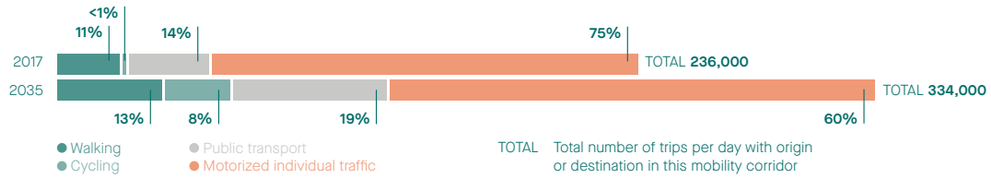
Parking and carpooling
- P+R REGIO — Regional P+R
- P+R LOCAL — Local P+R
- Carpool/Bus lane
- Business park

The map does not depict all of the business parks and infrastructure.

N5/CFL70 corridor

This corridor includes the towns around the N5 ‘route de Longwy’ and the Longwy/Athus – Luxembourg railway line. It extends as far as France and Belgium, where it includes the metropolitan areas of Longwy and Aubange.

Evolution of modal shares – minimum targets



Distribution of trips (%)

- 42 internal to this mobility corridor
- 23 to or from Luxembourg City and the suburban Ring
- 49 to or from Esch & Belval and the urban South
- 1 to or from Nordstad
- 34 less than 5km
- 23 between 5 and 15km

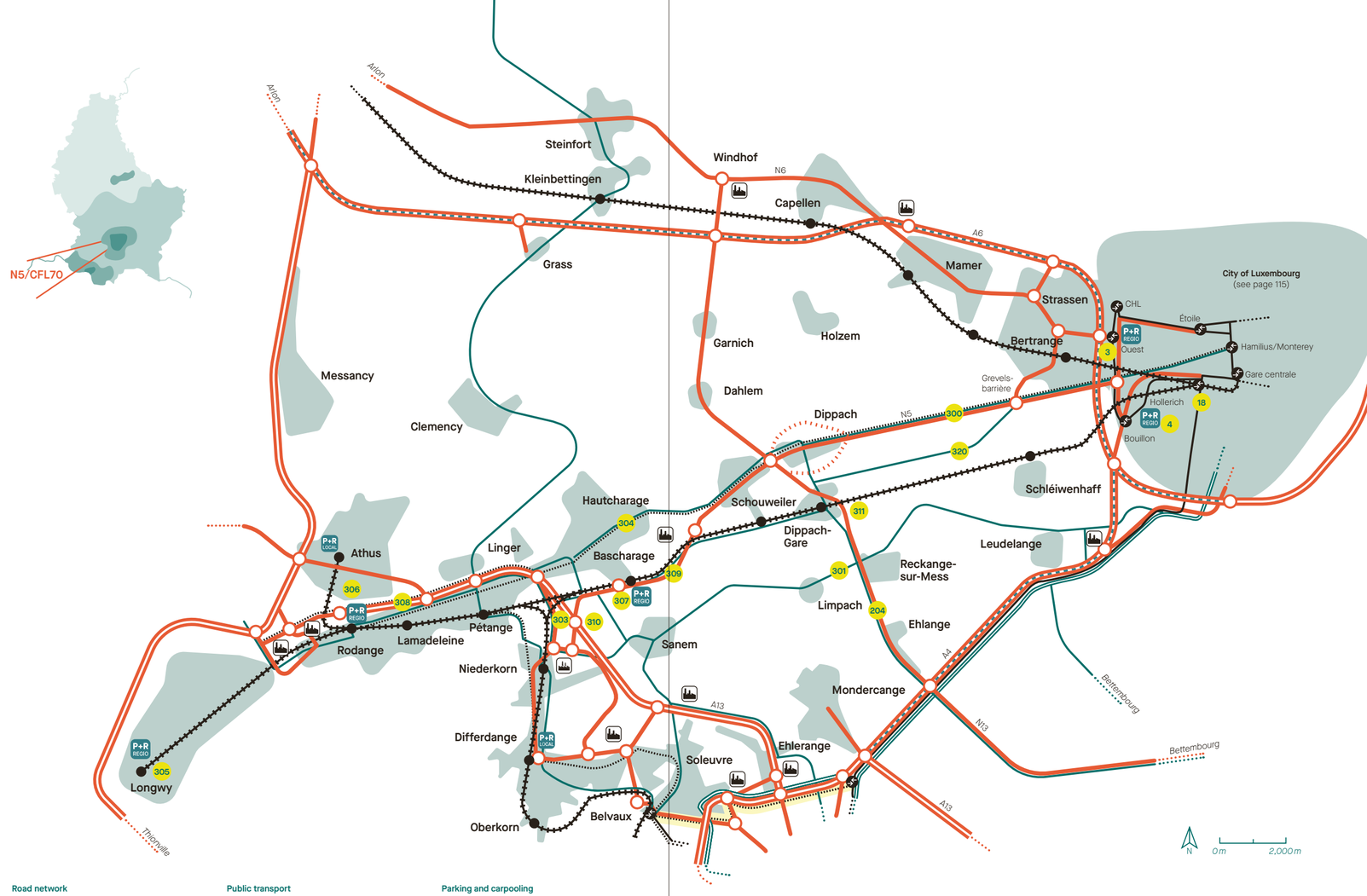
Comparison

Characteristics

- The corridor consists of an urban portion between Longwy and Bascharage and a portion in the rural South between Bascharage and the city of Luxembourg.
- 32% of cross-border trips and 65% of journeys along the Luxembourg part of the corridor do not extend eastwards beyond the urban South.
- Nevertheless, in 2035, there will be 75,000 trips per day between this corridor and the city of Luxembourg and its suburban Ring.
- It is the only corridor that has a direct railway link but no direct motorway to the city of Luxembourg. This makes travel time by train particularly competitive compared to travel time by car. The railway station in Pétange (6,000 boardings and alightings per working day recorded in 2019, outside of school holidays) and the station in Rodange (5,700 boardings and alightings) rank among the ten busiest stations in the country.
- The more rural part of the corridor (municipalities of Dippach and Reckange-sur-Mess) experiences significant cut-through traffic during peak hours.

Organisation of mobility in 2035

- A new primary cycle route will be built along the N5 300. Further south, a second cycle route 320 will follow the Bascharage/Sanem bypass road and the railway before merging with the former at Grevelsbarrière. The PC9 cycle route will be made more direct 301.
- As most of the railway stops are located at the fringes of urbanised areas, stations will need to be made more accessible to cyclists if Bike and Rail is to compete with travel by car. This will be one of the advantages of a cycle route along the route des Trois Cantons 302.
- The railway offer, which is already very appealing on the Pétange-Luxembourg line, will be expanded with the creation of a triangular railway junction between Niederkorn and Bascharage 303. With travel times reduced by around 15 minutes compared to the current situation, there will be two trains per hour linking Differdange with the Central Station.
- The Hollerich train station will be transformed into an interchange hub 18 connected to the tram. This will lead to reduced travel times for public transport, particularly towards Cloche d'Or.
- In addition to the rail service, there will be main bus lines running along the N5. They will benefit from additional prioritization along the through road of Bascharage and Hautcharage 304.
- P+Rs of regional importance will be those at Longwy 305 and Rodange 306 railway stations in the south-west, and the Bouillon P+R 4 and Ouest P+R 3 in the north-east, the latter two accessible via boulevard de Merl. The P+Rs at Athus, Pétange, Differdange and Bascharage/Sanem 307 stations will be mainly intended for residents of these towns.
- Along this corridor, the challenge is to calm traffic in town centres by diverting traffic related to Luxembourg City not to the N5 but to the A13. The doubling of avenue de l'Europe (N31) will make it possible to eliminate through traffic in the centre of Pétange 308. With its connection to the CR110, which links the two towns, the *contournement de proximité* of Bascharage and Sanem 309 will be key for reducing traffic in these two towns. The new motorway interchange 310 that will connect this new road to the A13, as well as the bypass road itself, will be designed in such a way as to discourage travellers from using the short-cut through Dippach and to use the A4 as the preferred route to Luxembourg City.
- The bypass road at the level crossing at Dippach-Gare 311 will eliminate transit traffic from this village.



Road network
- Motorway/expressway
- *Route principale* or *Route de liaison*

Cycle network
- Cycle highway
- Primary cycle route

Public transport
- Railway line and station
- Main bus line
- Interchange hub
- High-performance bus corridor (*CHNS*)

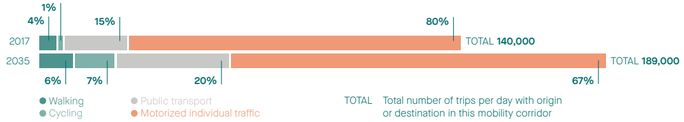
Parking and carpooling
- Regional P+R
- Local P+R
- Carpool/Bus lane
- Business park

The map does not depict all of the business parks and infrastructure.

A6/CFL50 corridor

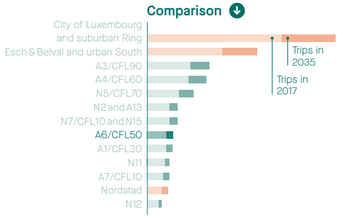
This corridor, the main axes of which are the railway line, the motorway and the national road connecting Arlon to the city of Luxembourg, consists not only of a vast cross-border territory in Belgium but also of the towns of the rural South located on or near the route d'Arlon (N6).

Evolution of modal shares – minimum targets



Distribution of trips (%)

Comparison



Characteristics

- Traffic flows are strongly oriented towards the city of Luxembourg and the suburban Ring (36%).
- From the border near Steinfort to the suburban Ring in Mamer, the neighbourhoods with the highest population and job density are closer to the route d'Arlon than to the stops along railway line CFL50.
- Travel time by bus from the majority of Luxembourg towns in this corridor is currently more attractive than travel time by train for many destinations in the city, the exception being the Central Station district. On the Luxembourg side, the railway stops with the most boardings and alightings (b+a) per working day in 2019 are Kleinbettingen (830 b+a), Mamer (750 b+a) and Bertrange-Strassen (650 b+a).
- From Arlon, the train offers competitive travel times to Luxembourg City compared to other transport modes.
- For the most part, towns located away from the transport axes have an alternative route to the city. This situation generates cut-through driving in these towns.

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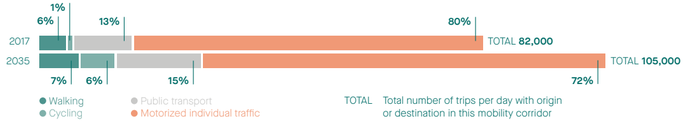
Organisation of mobility in 2035

- The corridor will have two primary cycle routes. South of the railway, the existing PC13 route will be completed and expanded 401 to provide direct access to the south of the city of Luxembourg. Along or near route d'Arlon, continuous bicycle infrastructure will be installed from place de l'Étoile in Luxembourg to Steinfort 402, with a possible extension to Arlon.
- Cycling infrastructure providing access to these two routes, or to railway stops – mostly located on the fringes or at some distance from urbanisation – will offer attractive alternatives to car travel.
- With the opening of the Hollerich interchange hub 18 and the option of transferring from train to tram, the CFL50 line will become more attractive for destinations in the south of Luxembourg City, namely Hollerich, route d'Esch and Cloche d'Or.
- Buses running at a high frequency along route d'Arlon will enjoy additional prioritization between Capellen and Mamer 403. They will connect to the tram network at the CHL interchange hub 416 before continuing their journey to a second interchange hub in the south of the city.
- Bus lines with a longer route, and cross-border lines in particular, will benefit from a prioritization lane on the A6 motorway 404 and will provide connections to the tram network at the Ouest interchange hub 3. The same will apply to bus lines that will pass from the N6 to the A6 after serving the Mamer-Capellen P+R 405.
- As the location of railway stops and motorway interchanges does not lend itself to the installation of a large P+R on the Luxembourg side, a solution for an equivalent offer will need to be found in collaboration with the Belgian authorities.
- Within the suburban Ring of the city of Luxembourg, the new P+R Ouest 3 will provide access to the tram network. More locally, the P+R at Steinfort 406 and a new P+R near the Capellen motorway interchange 405 will provide a feeder service to the bus.
- The A6 motorway will have a priority lane for buses and carpools 404, which will transition to a similar prioritization across the Belgium-Luxembourg border.
- The relocation of the Capellen motorway interchange, combined with the redevelopment of the N6 405 will make the access to the A6 motorway from route d'Arlon more secure.
- At the entrance to the suburban Ring, construction of the boulevard de Merl 2 and the new chaussée Blanche 9 will relieve route d'Arlon of car traffic heading towards the city of Luxembourg. This will allow for significant traffic calming measures on the through road of Strassen, allowing for smoother bus traffic and safer bicycle traffic.

N12 corridor

This corridor extends from the region west of lac de la Haute-Sûre to the Mamer valley. The N12 national road is its main transport axis towards the city of Luxembourg. The corridor crosses the rural North and rural South in roughly equal parts.

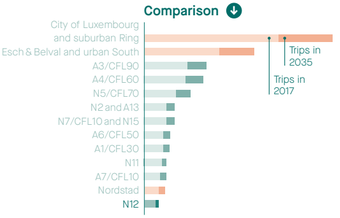
Evolution of modal shares – minimum targets



Distribution of trips (%)

- 40 internal to this mobility corridor
- 19 to or from Luxembourg City and the suburban Ring
- 4 to or from Esch & Belval and the urban South
- 5 to or from Nordstad
- 31 less than 5km
- 24 between 5 and 15km

Comparison



Characteristics

- Consisting mainly of small towns with relatively few jobs, this is the corridor that generates the fewest trips.
- The share of cross-border traffic flows originating or ending in the corridor is low (6%). Along several roads, however, the corridor hosts transversal traffic flows from west to east that reach from Belgium to the employment hubs of Nordstad, Colmar-Berg, Bissen, Mersch and Steinsel.
- In the northern half, a significant portion of traffic flows are in relation to Nordstad.
- In the southern part, long-distance travel is mainly directed towards the city of Luxembourg. Most of that travel is channelled along the N12.
- In Kopstal, which is where the N12 enters the suburban Ring, cut-through traffic from the A7/CFL10 corridor (see page 169) is added to that from the N12 corridor itself.
- The Kehlen business park, located at a certain distance from a motorway, generates heavy-goods-vehicle traffic that passes through the surrounding villages.

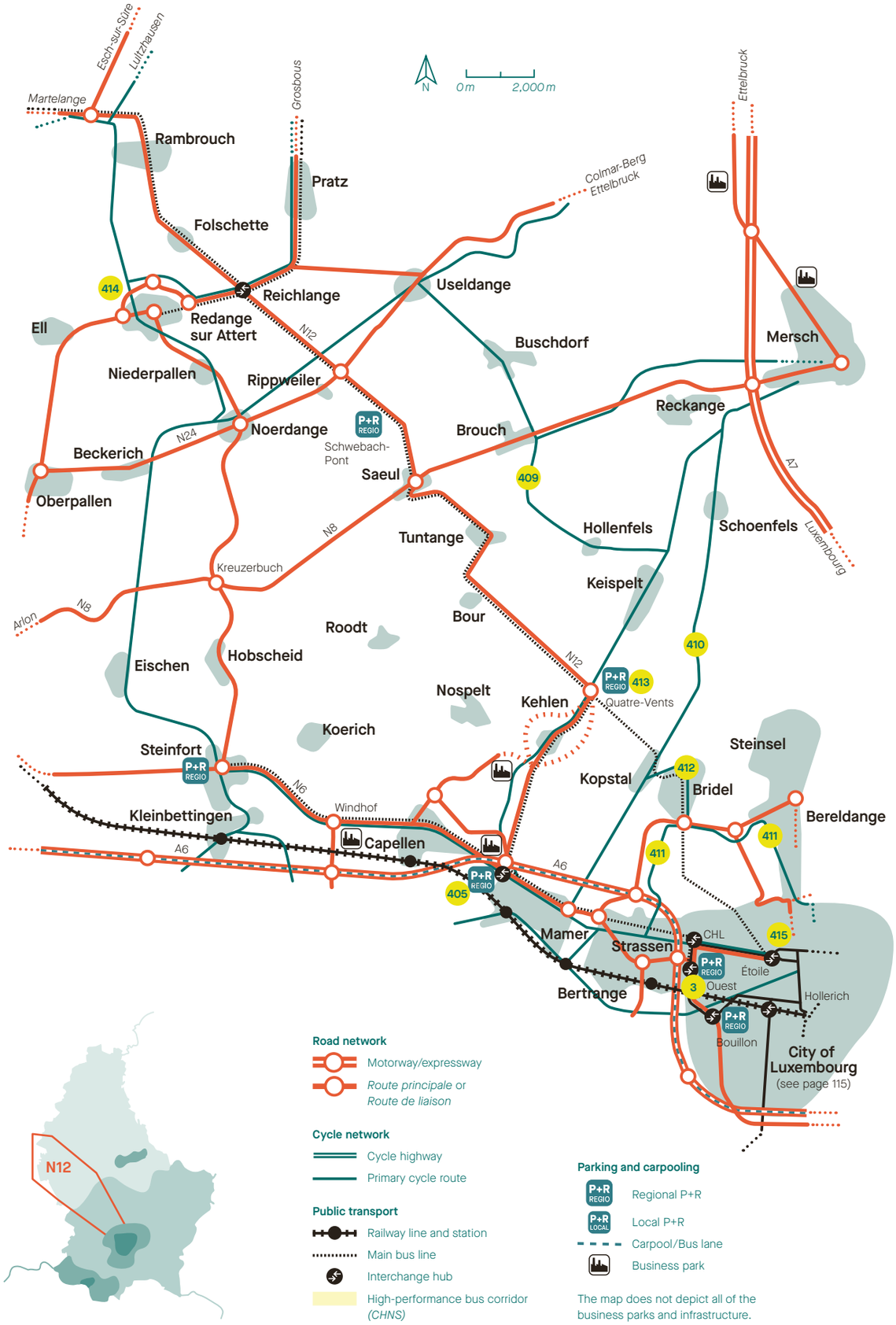
Please turn this page

Organisation of mobility in 2035

- From north to south, the cycling network will be expanded by several new national routes, namely Lultzhausen-Arsdorf, Grosbous-Everlange, Useldange-Brouch-Hollenfels-Keispelt-Mersch 409, Schoenfels-Mamer 410 and Kopstal-Bridel, with connexions towards Strassen on the one hand and to Mühlenbach and Pfaffenthal on the other 411.
- As is the case in the canton of Redange, inter-municipal collaborations could establish a denser cycling network between national routes. Improved cycling accessibility to major public transport stops, schools and workplaces will promote intermodality and cycling.

- From the northern part of the corridor, the main bus lines will be directed on the one hand towards the railway stations of Ettelbruck or Mersch and on the other hand towards the city of Luxembourg. Due to the scattered urbanisation in this zone, a transfer between a distribution bus line and a main line will be necessary where demand is particularly weak.
- In Luxembourg City, the interchange hub at place de l'Étoile 415 will be the terminus of the main bus lines of the N12 corridor.
- In order to ensure attractive and reliable travel times, substantial bus prioritization will be required in the N12 bottleneck between Kopstal and Rollingergrund 412.
- Insofar as bus travel times are competitive with those of passenger cars, the P+Rs at Schwebach-Pont and Quatre-Vents 413 will help to reduce traffic load on the N12.

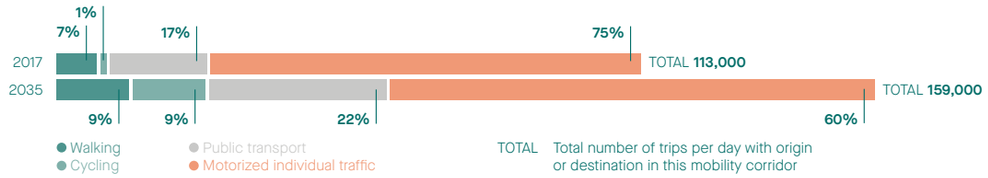
- Throughout the corridor, applying the functional classification of the road network will make it possible to channel traffic flows towards the main axes, and to plan some through roads in ways that will reduce speeding.
- More locally, a bypass 414 will replace the one-way circuit in the centre of Redange sur Attert.
- At the southern end of the corridor, a PNM 2035 regional study will need to develop a coherent response to several challenges. Firstly, buses will have to be able to cross the section between Kopstal and Rollingergrund quickly to ensure the attractiveness of public transport on the whole N12. Secondly, the number of cars passing through Kopstal and Bridel and then through residential areas in Luxembourg City (Limpertsberg), Bereldange and Strassen will have to be reduced. Thirdly, without adding through traffic in Kehlen, motorized individual taffic on the N12 will need to be directed towards the P+Rs 405 3 of the A6 that are served by bus or tram lines of the city of Luxembourg. Fourthly, access to the Kehlen business park by heavy goods vehicle traffic must be organised in such a way as not to invite cut-through transit by such traffic between the A7 and A6 motorways. The solution will be to reorganise the road network in the area circumscribed by these two motorways, N8 at Saeul and N55 at Rollingergrund.



N7/CFL10 and N15 corridors

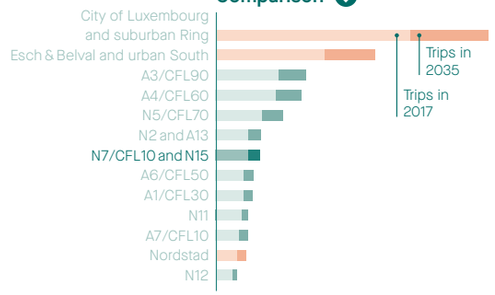
The Troisvierges-Ettelbruck railway line and national roads N7 (‘route du Nord’) and N15 (‘route de Bastogne’) converge on Nordstad. These corridors cover a large portion of the rural North mobility zone.

Evolution of modal shares – minimum targets



Distribution of trips (%)

Comparison

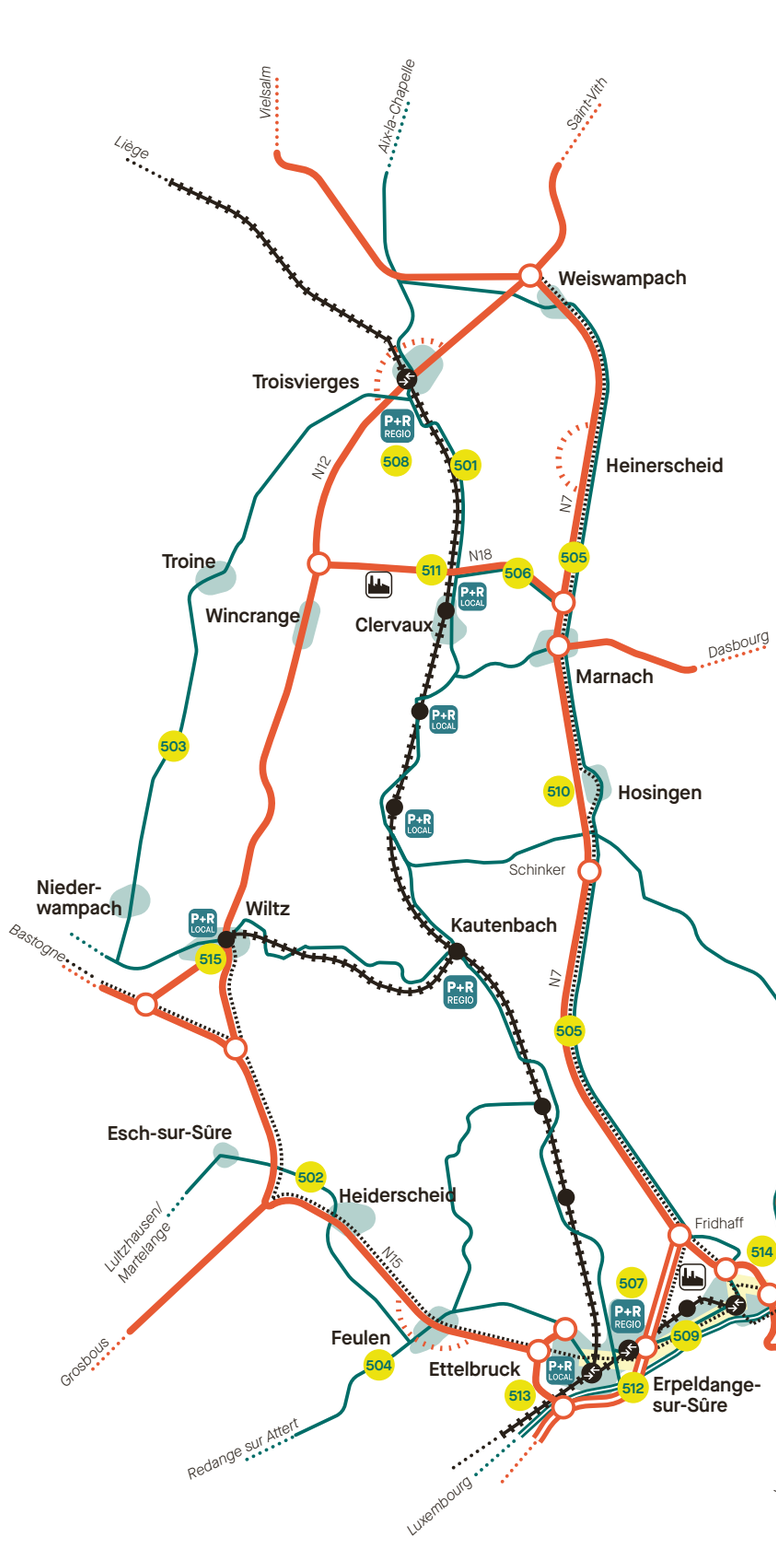


Characteristics

- These two corridors, the Luxembourg portion of which covers 25% of the national territory, constitute the point of arrival or departure for 6% of daily trips taken in the Grand Duchy.
- The jobs held by cross-border workers are concentrated in business parks that are located relatively close to the border. These cross-border traffic flows account for 16% of trips. Added to this is the transit of people and goods between neighbouring countries and the centre of the Grand Duchy.
- The area on both sides of the border is rural. Mobility demand there is too scattered and too weak for a direct bus offer to the metropolitan areas. Therefore, the feeder service to the railway stops and the main bus lines is key.
- The towns of Weiswampach, Marnach, Clervaux, Hosingen and Wiltz are all located along one of the three major transport axes of this corridor. They are served by direct bus lines to Nordstad. Indeed, the corridors N15 and CFL10/N7 have the highest rate of trips in relation to Nordstad (12%).
- The bottlenecks along the northern segment of the N7 occur in Hosingen and Fridhaff. The Ettelbruck through road represents the most congested segment of the N15.
- The CFL10 line runs every half-hour, linking the north of the country with Ettelbruck, Mersch and the city of Luxembourg. It connects with the rail shuttle between Kautenbach and Wiltz (12-minute trip). North of Ettelbruck, the busiest railway stops are Kautenbach, with 2,500 boardings and alightings (b+a) per working day in 2019 – transfers included – and Troisvierges (1,400 b+a), while the least-frequented are Goebelsmühle (150 b+a) and Michelau (120 b+a). The region has a high potential for cycling tourism. Safe access for cyclists, particularly to schools and major public transport stops, would capture some of the large number of daily trips of less than 5km.

Organisation of mobility in 2035

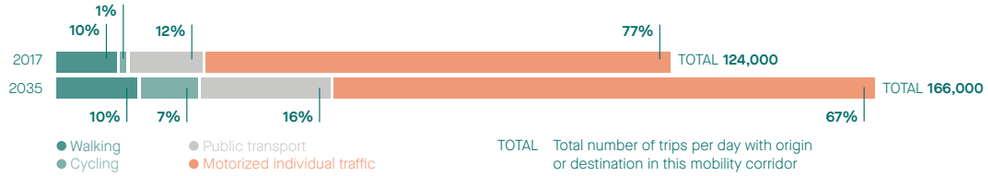
- The national cycling network will be completed by PC21 (Vennbahn) between Troisvierges and Clervaux 501, PC18 between Ettelbruck and Esch-sur-Sûre 502, PC20 between Niederwampach and Troisvierges 503, PC25 in the Wark valley 504, PC7 built as part of the project to improve road safety on the N7 505 and the connection of PC7 to Vennbahn by the Transversale de Clervaux 506 road.
- In the towns, implementation of the functional classification of the road network, and of traffic-calming measures in particular, will create the conditions required to promote daily short-distance trips on foot or by bicycle. An inter-municipal collaboration like the one carried out in the canton of Redange would make it possible to weave a cycling network that connects all the villages.
- The reliability of the CFL10 line will increase once the major railway projects between Ettelbruck and the Central Station are complete. This is essential for this line, which is largely single-track north of Ettelbruck.
- Local P+Rs as well as distribution bus lines will provide a feeder service to the rail network and, to a lesser extent, to the main bus lines on the N7 and N15. In particular, the new interchange hub with a P+R at Erpeldange-sur-Sûre 507 will serve as a feeder point for trips to Nordstad, the city of Luxembourg and the south of the country. The capacity of P+Rs located near the stations will be adapted to the extent necessary and possible, beginning with the indoor car park in Troisvierges 508.
- The main bus lines will serve the railway stops in Nordstad and will benefit from the high-performance bus corridor (CHNS) between Ettelbruck and Diekirch 509.
- Motorized individual transport will continue to play an important role for trips taken within this portion of the rural North.
- The N15 and N7 will need to be able to accommodate significant traffic volumes without attracting additional international transit. Between now and 2035, the following projects will contribute towards this objective: the road safety improvements on the N7 505, the Hosingen bypass 510, the Transversale de Clervaux road 511, upgrading the B7 expressway to 2×2 lanes between Ettelbruck and Fridhaff 512, and the *contournements de proximité* at Ettelbruck and Diekirch 513 514. These projects will allow a calming of traffic and fundamental redevelopment of the through roads in these towns.
- In Wiltz, a new access road to the station 515 will create a cycling connection between the city centre and PC20, which will pass through the new neighbourhood of 'Wunne mat der Wooltz'.



N11 corridor

This corridor, the main axis of which is the ‘route d’Echternach’ (N11/E29), mainly crosses the rural South. The inhabitants of some towns of the rural North that are located to the south-east of Nordstad use this corridor to travel to Luxembourg City.

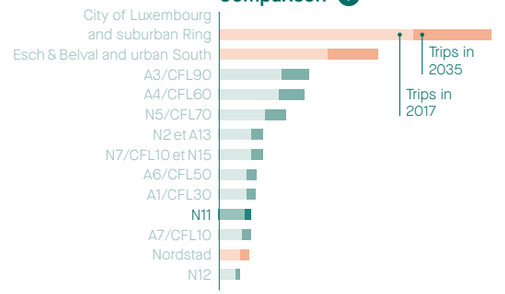
Evolution of modal shares – minimum targets



Distribution of trips (%)

- 43 internal to this mobility corridor
- 22 to or from Luxembourg City and the suburban Ring
- 4 to or from Esch & Belval and the urban South
- 6 to or from Nordstad
- 33 less than 5km
- 19 between 5 and 15km

Comparison

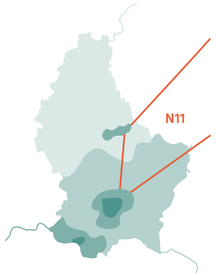


Characteristics

- The territory included in this corridor extends much further north of its main axis (N11) than to the south, where the N1 corridor, which is relatively close, is an interesting alternative for getting to Luxembourg City.
- The largest towns, Junglinster and Echternach on the Luxembourg side and Bitburg in Germany, are all located on the N11/E29.
- The residents of villages located far from this axis, especially in the north, have alternative routes for their trips to the city. These villages help create, or are crossed by, cut-through traffic that reaches N11 only in direct proximity to the suburban Ring. 6% of the traffic flows in the corridor involve Nordstad.
- The main bus lines use the N11. They serve the P+Rs of Echternach and Junglinster and enter the city at the Luxexpo interchange hub in Kirchberg.
- As they currently do not have any prioritizations, buses become blocked in the traffic congestion between Waldhaff and Luxexpo.
- Two iconic cycle routes meet in Echternach, namely PC3 of the Three Rivers and PC2, which essentially follows the route of the former Charly railway line.

Organisation of mobility in 2035

- Rather than share the road between Gonderange and Eschweiler with motorized traffic, the PC2 cycle route will be integrated into the through road of Junglinster 601 and will connect to the highschool there.
- From a tourism point of view, the national cycling network will be complemented by PC5 602, which will provide a link between Junglinster, Larochette and Moestroff, with further connections towards Diekirch and Vianden. A new cycling path 603 will link Junglinster to PC4 at Olingen.
- Projects launched through inter-municipal cooperation could create additional shortcuts in this network.
- Especially in the areas close to the N11, the introduction of bicycle connections to the main bus stops will make public transport more attractive.
- The area will be served at a high frequency by main bus lines on the N11 axis with direct links to Kirchberg (Luxexpo), Central Station and Ban de Gasperich. The other towns will be linked by distribution bus lines operating at a lower frequency.
- Buses will benefit from prioritization between Gonderange and Kirchberg 605, in Junglinster 601, Graulinster 606 and Echternach 607.
- The P+Rs of Echternach, Junglinster and the Luxexpo interchange hub will foster intermodality.
- Given the scattered urbanisation away from the N11, motorized individual transport will continue to play an important role for internal trips associated with this corridor.
- The redesign of the Junglinster crossing 601 and the *route de délestage* in Echternach, consisting of the Morgenstern link 604 and the bypass connected to the new bus terminal, will allow traffic calming in these towns.



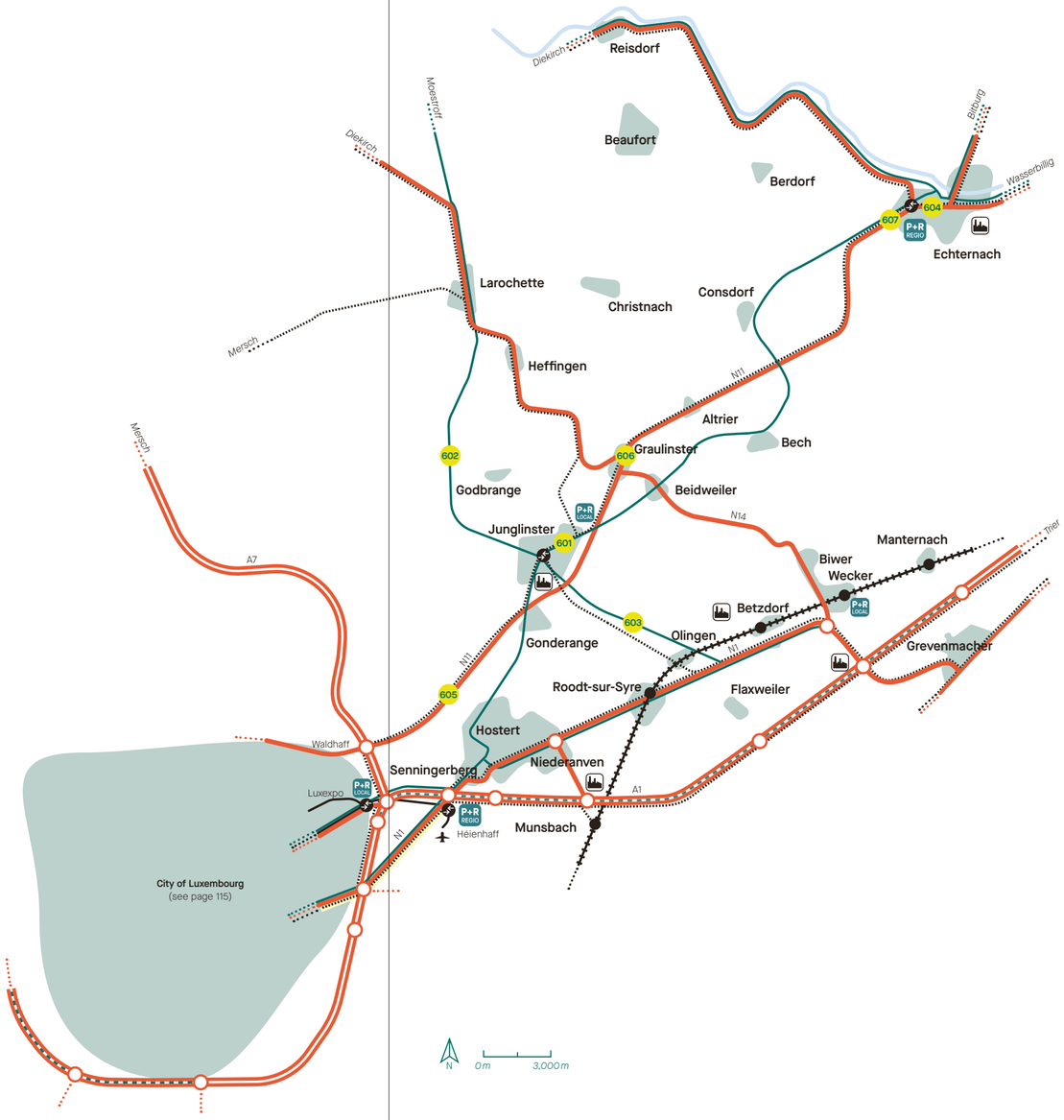
Road network
- Motorway/expressway
- *Route principale* or *Route de liaison*

Cycle network
- Cycle highway
- Primary cycle route

Public transport
- Railway line and station
- Main bus line
- Interchange hub
- High-performance bus corridor (*CHNS*)

Parking and carpooling
- Regional P+R
- Local P+R
- Carpool/Bus lane
- Business park

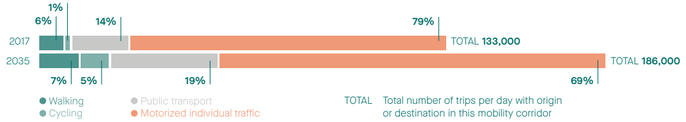
The map does not depict all of the business parks and infrastructure.



A1/N1/CFL30 corridor

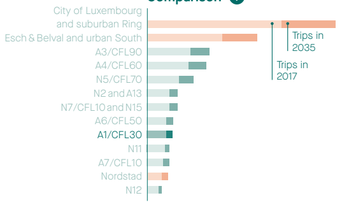
This corridor of the rural South is organised around the A1 ('autoroute de Trêves') and N1 road axes and the Luxembourg-Trier railway line.

Evolution of modal shares – minimum targets



Distribution of trips (%)

Comparison



Characteristics

- The main towns of the corridor (Wasserbillig, Mertert, Grevenmacher, Roodt-sur-Syre, Niederanven, etc.) are crossed by one of its major transport axes. Cross-border movements are channelled over a few bridges across the Moselle or the Sûre. As a result, traffic flows are sufficiently concentrated there for public transport to have a strong potential.
- On the Luxembourg side, 44% of the residents of this corridor live less than 2.5km from a CFL station; this is advantageous for trips towards the Central Station and the Contern and Syrdall business parks. With 1,400 and 820 boardings and alightings (b+a) per working day respectively in 2019, the Wasserbillig and Sandweiler-Contern stations are the busiest on the CFL30 line in Luxembourg. The Cents-Hamm (170 b+a) and Manternach (150 b+a) stops are used the least.
- 24% of cross-border traffic flows in this corridor have the corridor itself as their destination, while 41% are headed for the city of Luxembourg and its suburban Ring.

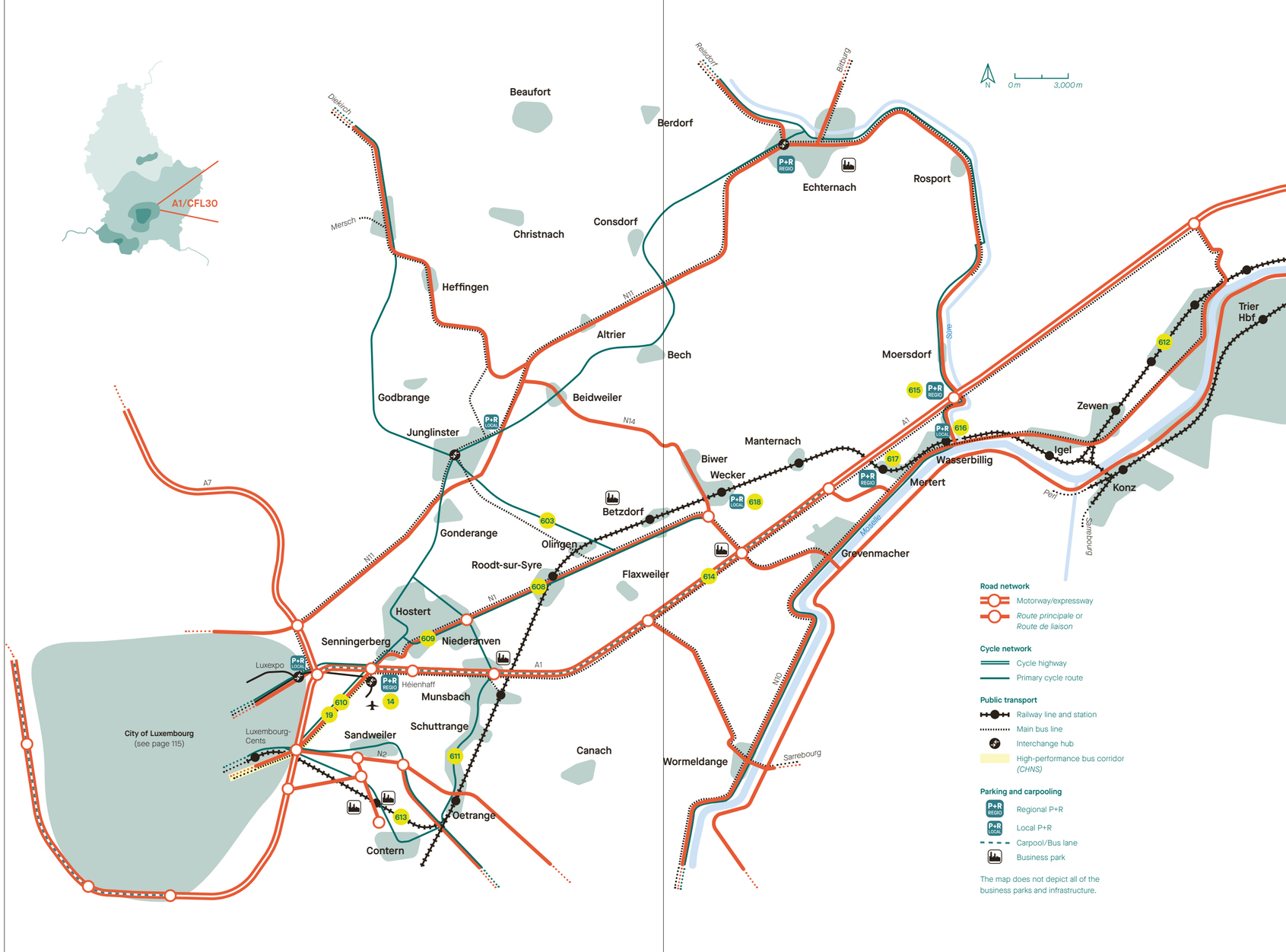
Please turn this page

Organisation of mobility in 2035

- The national cycling network will be complemented by a new connection between PC4 in Olingen and PC2 in Junglinster 603.
- Along the N1, projects such as the redesign of the through roads of Roodt-sur-Syre 608, Niederanven 609 and the section 610 between the Héienhaff and Cents interchange hubs will make this route attractive for longer distance bicycle commuting.
- The same approach will establish a transverse cycling axis between Contern, Munsbach and Niederanven 611.
- Improved accessibility for cyclists should be integrated into road and urban development projects within a radius of several kilometres of train stations.

- The rail offer on the CFL30 line will be increased to four trains per hour to Trier-West 612 and Trier-Hauptbahnhof. The fourth train will require the Sandweiler – Oetrange 613 section to be double-tracked. A bus service with a suitable frequency will connect the Munsbach train station with the tram.
- Cross-border bus lines and some main lines from Grevenmacher and Wasserbillig will be prioritized on the A1 motorway 614.
- The main bus lines will connect with the tram network at the Héienhaff 14 interchange hub. Some of them will use the high-performance bus corridor 19 that leads towards the Central Station and the south of the city of Luxembourg.
- Cross-border commuters and residents can use the P+Rs located in Mesenich 615, Wasserbillig 616, Mertert 617, Wecker 618 and Héienhaff 14 to drop off their cars and take the bus, train or tram.

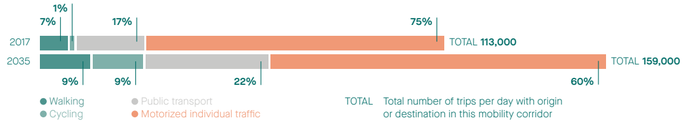
- The car will remain the predominant mode of transport for journeys to towns away from the main axes.
- The Cargocenter motorway interchange will link the large Heienhaff P+R 14 to the A1.
- Carpoolers will benefit from a carpooling lane on the A1 614.



A7/CFL10 corridor

This corridor connects Nordstad to the metropolitan area formed by the city of Luxembourg and its suburban Ring. The ‘ligne du Nord’ of the CFL and the A7 motorway known as the ‘route du Nord’ are the main transport axes.

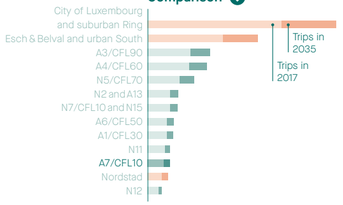
Evolution of modal shares – minimum targets



Distribution of trips (%)

- 34 internal to this mobility corridor
- 25 to or from Luxembourg City and the suburban Ring
- 6 to or from Esch & Belval and the urban South
- 8 to or from Nordstad
- 33 less than 5km
- 25 between 5 and 15km

Comparison



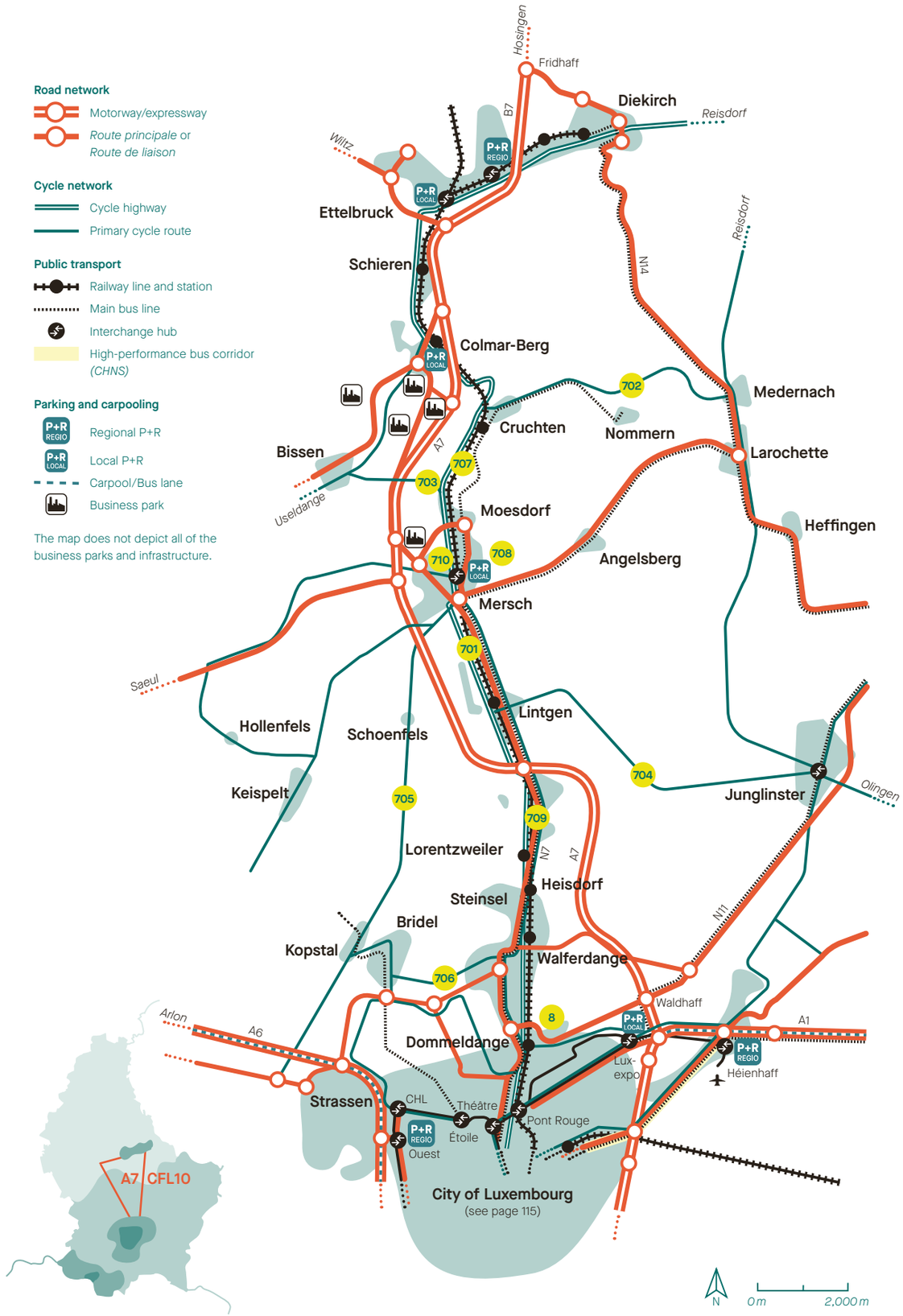
Characteristics

- Its central geographical location gives this corridor the specific feature of being crossed by traffic flows between Nordstad and the N15/N7/CFL10 corridor to the north and the city of Luxembourg and its suburban Ring to the south.
- With the A7 motorway and the CFL10 line, the corridor has the infrastructure required to accommodate a substantial mobility demand.
- Most railway stops are conveniently located in relation to built-up areas. They offer direct connections to the main destinations of the three metropolitan areas.
- Only the stops of Cruchten, with 210 boardings and alightings (b+a) per working day in 2019 outside of school holidays, and of Colmar-Berg (390 b+a) are off-centre relative to the respective town.
- Outside the three metropolitan areas, Mersch has the most complete mobility offer in the Grand Duchy. This town is served by all trains on the CFL10 line and is connected to the A7 motorway. It is located at the intersection of several regional roads and has a direct bicycle path to Luxembourg City, located just 15km away. As a significant interchange hub for regional bus lines, the train station in Mersch is the sixth-busiest station in the Grand Duchy (6,300 b+a).
- The favourable topography in the Alzette valley and closely spaced railway stops create a particularly high potential for cycling.
- There are many opportunities for reducing cut-through traffic and for traffic calming in and between towns in this corridor.

Please turn this page

Organisation of mobility in 2035

- Located between Nordstad to the north and the city of Luxembourg to the south, equipped with numerous railway stops, several highschools and a broad recreational offer, this corridor will experience strong demand for cycling and walking.
- The cycle highway that links the city of Luxembourg with Nordstad 701 will form the backbone of the cycling network. Additional cycling routes will be created between Cruchten and Medernach 702, between Mersch and the business parks of Bissen and Colmar-Berg 703, between Lintgen and Junglinster 704, between Schoenfels and Mamer 705 and between Bereldange and Bridel 706.
- Traffic calming in this corridor will need to be accompanied by cycling infrastructure that is adapted to substantial flows. Physical separation between cyclists, pedestrians and motorized traffic will be required.
- The already attractive rail service will be expanded by the addition of two express trains linking Diekirch with the city of Luxembourg and with Dudelange 707. With six trains per hour and per direction, Mersch will bolster its role as a major interchange hub 708. Here, distribution bus lines will connect to the train.
- The main bus lines terminating at the Théâtre (Glacis) interchange hub in Luxembourg City will continue to complement the train offer by serving neighbourhoods located away from the train stops as well as localities where only omnibus trains stop.
- The capacity of the P+R at Mersch train station will be increased 708. From the A7, the Gernsback (Luxexpo) P+R in Kirchberg will provide a direct connection to the tram network.
- With the main road network already well developed in this corridor, road projects will mainly consist of traffic-calming measures, beginning with redevelopment of the N7 between Rollingen and Bereldange 709. On the opposite bank of the Alzette, a substantial calming on CR123 with several access roads to the N7 will be necessary to prevent cut-through driving.
- The Mierscherbierg bypass that connects the N7 to the CR123 between Moesdorf and Rollingen 710, together with a modal filter 703 on the CR306 at the A7 wildlife crossing, will remove all transit traffic from Pettingen and lay the groundwork for a redevelopment of the N7 in Mersch.
- At the northern entrance to Luxembourg City, a new connection between the N7 in Beggen and the N11 in Dommeldange 8 will allow significant traffic calming in the Beggen, Dommeldange and Eich neighbourhoods.



Chapter 4

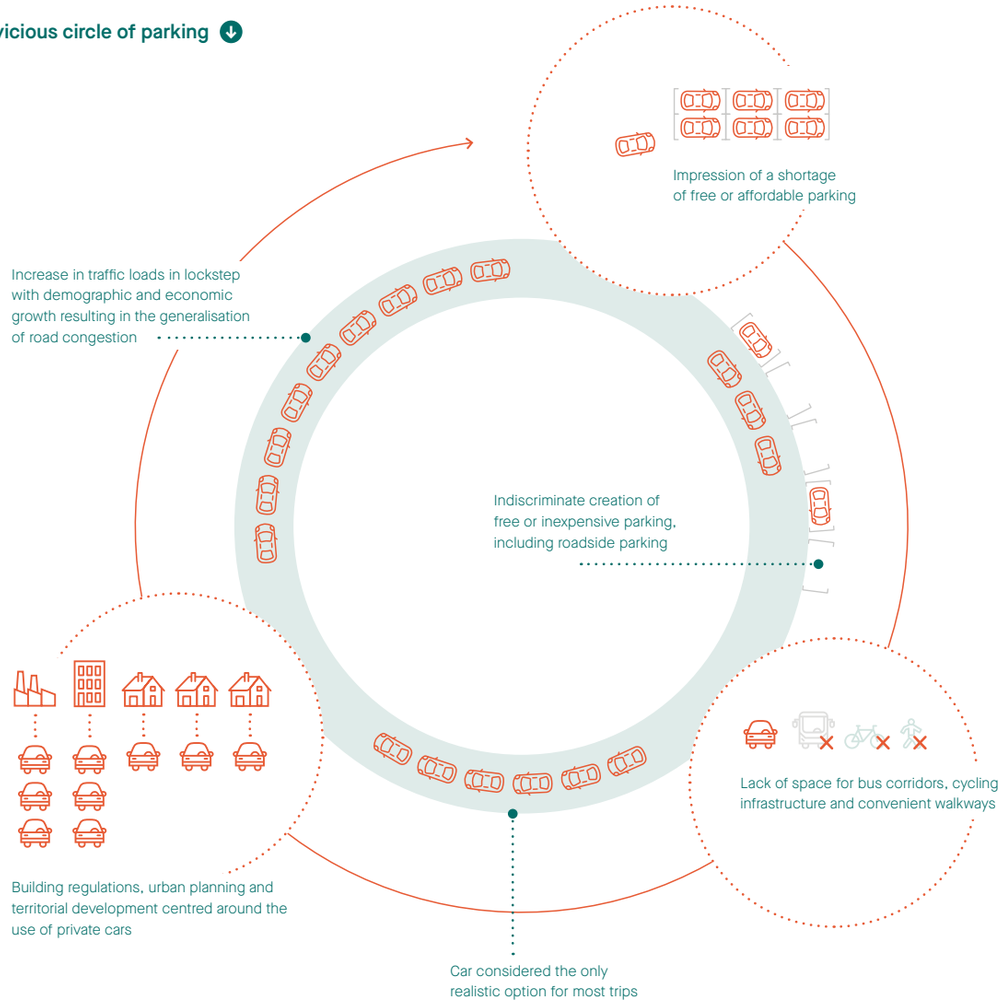
The key role of parking

How can parking regulation and management contribute towards achieving the objectives of the PNM 2035?

Parking and mobility

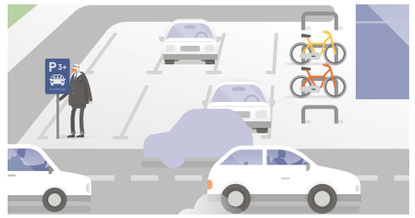
Road congestion and the indiscriminate creation of car parking are part of a vicious circle, one aspect of which is the impression that parking is in short supply.

The vicious circle of parking

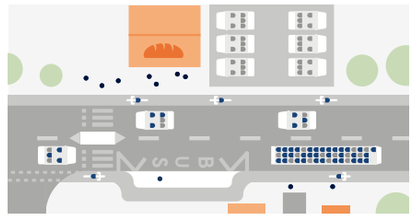


This vicious circle can be broken by taking steps at the three stages of a trip: at the destination, along the way and at the point of departure.

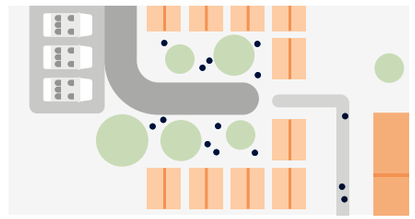
Parking and choice of transport mode



The availability and cost of parking at the destination influences the decision whether to travel there by private car or by some other means.



In an existing built-up environment, available public space is generally limited. The presence or absence of a parking strip along the road has a major impact on prospects for developing cycling or bus infrastructure in ways that would make it appealing to travel by modes of transport other than the private car.



Neighbourhoods and residential buildings planned in a car-centric fashion can be expected to generate mostly car traffic. More nuanced planning strikes a balance in terms of the attractiveness of different modes of transport and facilitates the creation of more affordable housing.

Parking regulation and management

A nuanced approach to regulation and management of parking makes it possible to address the local need for accessibility and the overall objectives of the PNM 2035 at the same time.

Bringing parking policy in line with mobility policy has beneficial effects at both municipal and national levels.

Better accessibility

A destination's accessibility by car depends not on the number of parking spaces that have been built, but on the number of parking spaces that are available. Availability can be managed by means of regulations and pricing that favour desired uses (shop visits or deliveries, drop-offs, etc.) over parasitic ones that hinder the use of coveted parking spaces.

Use of public space consistent with the public interest

Roadside public space is coveted not just to establish continuous cycling infrastructure, convenient walkways and, where relevant, bus corridors. It also needs to be planned in a user-friendly manner, perhaps even with the aim of protecting the neighbourhood from the impacts of climate change, such as heat waves and floods. All these public interest uses should take precedence over strips for long-term parking. The latter can indeed be viewed as storage of voluminous private objects in public space.

Reduced motorized traffic during peak times and in urban areas

The availability of free car parking at workplaces fundamentally influences the traffic load during peak hours. Restricting parking and charging for it compels employees and employers to consider and promote transport alternatives.

As nearly half of all trips taken are local and short, safe pedestrian and cycling infrastructure and the prioritization of bus services can lead to substantial reductions in motorized traffic in urban areas.

National parking strategy

A national parking strategy is currently being finalised. While the PNM 2035 is based on responses by some 32,000 participants to the 2017 Luxmobil survey, the national parking strategy will be based on a national inventory and on interviews with 104 people representing 82 organisations: ministries, municipalities, the police, Syvicol (the Syndicate of Cities and Municipalities), architects and consulting engineers, real estate developers and construction firms, merchants, employers, the national railway company, bus or taxi companies, providers of home services, transport companies, etc. These interviews made it possible to identify the problems to be solved and to note a broad consensus around the need to develop a comprehensive approach.

Chapter 5

Non-infrastructural measures

By what means other than transport networks can mobility demand be influenced?

Spatial planning

Mobility needs arise from the spatial distribution of workplaces, education, shopping, recreation and housing. The strategic documents of the ministry responsible for spatial planning provide information on this subject.

From a mobility standpoint, the optimal approach would be:
- to concentrate, within walking distance of a major transport hub (see page 42), those activities which attract a very large number of people from all directions on a daily basis;
- to encourage a mix of functions;
- to establish, at locations with their own access to a motorway or freight lane, activities that generate large volumes of freight on a daily basis;
- to densify housing within walking distance (300–500 m) around the main public transport stops;
- to create housing, including affordable housing, as close as possible to jobs;

Each of the four mobility stakeholders (see Modu 2.0, pages 20–53) can contribute to achieving these objectives.

Possible contributions by the four mobility stakeholders (examples)

State
Locate educational, administrative, cultural or sports services and facilities that are unique in the Grand Duchy near a major interchange hub in the centres of development and attraction defined in the PDAT (see page 181).

Municipality
Densify housing around the main public transport stops and connect local services and neighbouring towns by a cycle network.

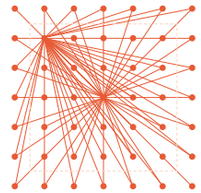
Employer
Draw up a company mobility plan, ideally prior to, but at the latest after selecting a site. This service is provided by the ministry responsible for transport.

Citizen
When choosing housing, consider whether the offer of public transport and/or of P+R is attractive enough to be used on a daily basis.

Deconcentration and mobility

Concentration

Deconcentration of an activity of regional interest



Deconcentration of an activity of national interest

Depending on the catchment area of an activity and the accessibility of the site by public transport, deconcentration can have a positive or negative impact on mobility.

The more an activity is aimed at a national or even cross-border audience, the more important it is to locate it as close as possible to an interchange hub with good connections to the entire catchment area of that activity. Many examples show the traffic problems and recurrent costs caused by the opposite approach. That approach consists of establishing a hub for employment, education, cultural attractions or sports based solely on the availability of publicly owned land, in hopes that sufficiently attractive public transport can be put in place afterwards. However, the difference between a central location and a decentralised site is precisely that only the former is well connected to its region.

The opposite approach holds true for activities geared solely to the local population. From a mobility standpoint, it is beneficial to offer basic services as close as possible to residential areas, respectively to the main stops of public transport: food, local shops, primary education and non-specialised secondary schools, family doctors, pharmacies, sports grounds, playgrounds, multi-purpose venues, etc.

The Master Programme for Spatial Planning (PDAT) and the PNM 2035

Within the framework of the new Master Programme for Spatial Planning, a territorial development strategy is proposed with the aim of offering an optimal quality of life to the entire population while taking into account the new challenges of the energy and climate transition. In its cross-sectoral coordinating function, the PDAT was developed in consultation with and in a complementary manner to the PNM 2035, as far as mobility is concerned. It should be noted, however, that the terminology used in the two documents may vary and should not be directly linked ('rural area', 'principal centre', 'metropolitan area', etc.). The PDAT also defines action areas, which correspond to functional territories including at least one centre of development and attraction, and for which integrated territorial strategies transposing and deepening the objectives of spatial planning and the PDAT will be developed.

Making work schedules and workplaces more flexible

Telework benefits mobility. However, its effect on traffic loads should not be overestimated.

The following factors frame the potential impact of telework on traffic volumes:

- In 2017, even during peak hours, work-related trips accounted for only half of all trips (53% in the morning and 44% in the afternoon).
- While 53% of jobs in the Grand Duchy are theoretically 'telework-eligible' (Becker Friedman Institute for Economics, 2020), not all of these are performed through telework.
- For the 46% of workers who are cross-border commuters (STATEC, 2021), telework is capped at 25% of working time – otherwise the employee loses affiliation to the social security system in the Grand Duchy. Cross-border workers who exceed the thresholds set by bilateral agreements are subject to income tax in their country of residence. With the exception of extraordinary rules adopted in connection with the COVID-19 pandemic, these thresholds currently account for less than 25% of working time.
- Half-days of telework do not reduce the number of trips between the home and the workplace. These arrangements do, however, make it possible to schedule at least one trip during off-peak hours.
- Although activities integrated into work commutes (dropping off a child at school, shopping, etc.) generate separate trips even during telework days, these trips are often more local.
- Telework is not necessarily performed at home. Some employers use co-working spaces or satellite offices in Luxembourg. This shortens the commute.
- Statistically, telework is not evenly spread over the days of the week.

Given the projected population and employment growth in the Grand Duchy and the current overload of some transport networks, the effect of a boom in telework would not call into question the mobility solutions recommended for 2035, but it might allow some respite before these solutions are in place.

Financial incentives

The period between now and 2035 may provide an opportunity to align financial incentives with the necessary evolution of modal shares and the need to bring housing and employment closer together.

With free public transport serving every town from 5 a.m. to 11 p.m., cycling being also virtually free and the need to reduce the modal share of the car at peak times, some reflection could be devoted to fiscal measures that currently favour choices that run counter to national mobility objectives. These measures could be replaced by schemes that would help employees find accommodation closer to their place of work, or that would encourage the practices advocated by the PNM 2035: carsharing, carpooling, cycling or using public transport. Subsidies for private car use could be reserved for specific cases, such as for people with a low income who work during hours when their workplace is not accessible by public transport.

Chapter 6

Technological progress and its promises

What kind of innovation will contribute to improving mobility by 2035?

Desired outcomes

The capacity of the transport networks envisioned by the PNM 2035 does not depend on any particular technological breakthrough. However, innovations that would make a positive contribution towards achieving at least one of the following objectives – without negatively impacting another – will be taken into account in future projects.

Goals

Decarbonisation and energy savings

IMPACT OF THE INNOVATION:
positive negative neutral

- Transition to zero tailpipe emission vehicles
- Reduction of CO_2-emission levels throughout the life cycle of the vehicle ('life cycle assessment')
- Transport of as many people as possible with a minimum use of energy

Quality of life in urban areas

IMPACT OF THE INNOVATION:
positive negative neutral

- City-centre development to ensure convenience to pedestrians and cyclists and accessibility to local retail
- Reduction of air and noise pollution
- Public parking management conducive to parking uses that are in the public interest

Contribution to the modal share targets of the PNM 2035

IMPACT OF THE INNOVATION:
positive negative neutral

- Carpooling management, including automatic detection of the number of vehicle occupants on traffic lanes or car parks reserved for car-poolers
- Services complementary to public transport that bundle trips of multiple people, particularly in rural areas
- Implementation of functional classification of the multimodal road network, specifically the prioritization of different modes of transport

Mobility for all

IMPACT OF THE INNOVATION:
positive negative neutral

- Improved accessibility for people with reduced mobility, people of certain age groups, including children, or the socially and economically disadvantaged

Road safety

IMPACT OF THE INNOVATION:
positive negative neutral

- Accident prevention and protection of people involved in a collision
- Compliance with traffic regulations, and with speed limits in particular

Data on mobility

IMPACT OF THE INNOVATION:
positive negative neutral

- Real-time information provided to travellers with regard to the public transport offer, traffic conditions and the availability and price of parking
- Demand-based mobility planning thanks to a better understanding of mobility behaviour, infrastructure use and spatial development in the Grand Duchy and the Greater Region
- Digital communication between infrastructure and vehicles or between vehicles for regulatory reasons, or to help achieve one of the other objectives on this list

Reduction in the number of unnecessary trips and their distance

IMPACT OF THE INNOVATION:
positive negative neutral

- Driver guidance pointing the way to available parking spaces
- Reduction in the number of empty runs between bus services
- Local or online services to help users avoid or combine trips or reduce the distance covered

Fiscal efficiency

IMPACT OF THE INNOVATION:
positive negative neutral

- Solutions that facilitate the creation of transport offers of comparable quality at lower cost
- Tools that improve the transparency of direct and indirect costs and benefits in the field of mobility

Realistic opportunity assessment

The following examples show that the potential of an innovation in the transport sector, whether it comes from a start-up or an established economic stakeholder, tends to be overstated at the outset. As mobility is a fundamental need with a wide range of implications, there is no such thing as a 'silver bullet'.

Autonomous driving

Autonomous driving is structured in several levels of sophistication. Whereas at lower levels the vehicle merely assists the driver, a vehicle operating at the highest level can travel along any route and under any circumstances without a driver on board. At intermediate levels, some assisted-driving systems capable of executing more complex manoeuvres such as lane changes are already available.

Until 2035, it makes more sense to imagine different degrees of assistance in specific contexts than it does to expect a general trend towards fully autonomous vehicles. The more the vehicle operates in a closed environment (motorway, railway or self-contained industrial site), the higher the level of autonomous driving can be. Still, it is difficult to imagine fully autonomous motorized individual vehicles circulating in historic city centres. On the one hand, the aim is to make urban public space accessible to people, not to make room for a new type of road congestion. On the other hand, pilot projects show that the mobility of completely autonomous vehicles is called into question by complex and unpredictable interactions, such as the crossing of a flow of pedestrians or cyclists. Indeed, the following questions should be asked:

- Will human users of public roads systematically give priority to robotic vehicles, knowing that these vehicles are programmed to avoid collisions?
- Will cities accept, above and beyond the already heavy traffic generated by vehicles transporting people, queues of empty vehicles that have dropped off a child at school, an employee at the workplace, or a customer near a shop?

Flying vehicles in an urban setting

The idea of escaping road congestion by ascending into the air is almost as old as aeronautics itself. We must not, however, lose sight of the fact that cities are first and foremost places in which to live.

- What feedback can municipalities expect from residents whose neighbourhood would be constantly overflown at low altitudes by car-sized aircraft?
- What would be the impact on daily life in the public space if it were flown over by 'flying taxis', knowing that no technology is foolproof and that there might be crashes?

At least between now and 2035, it is reasonable to imagine flying vehicles in urban settings as a niche phenomenon that will be regulated in accordance with the principles of aviation, with some predefined landing places and air corridors.

The Hyperloop

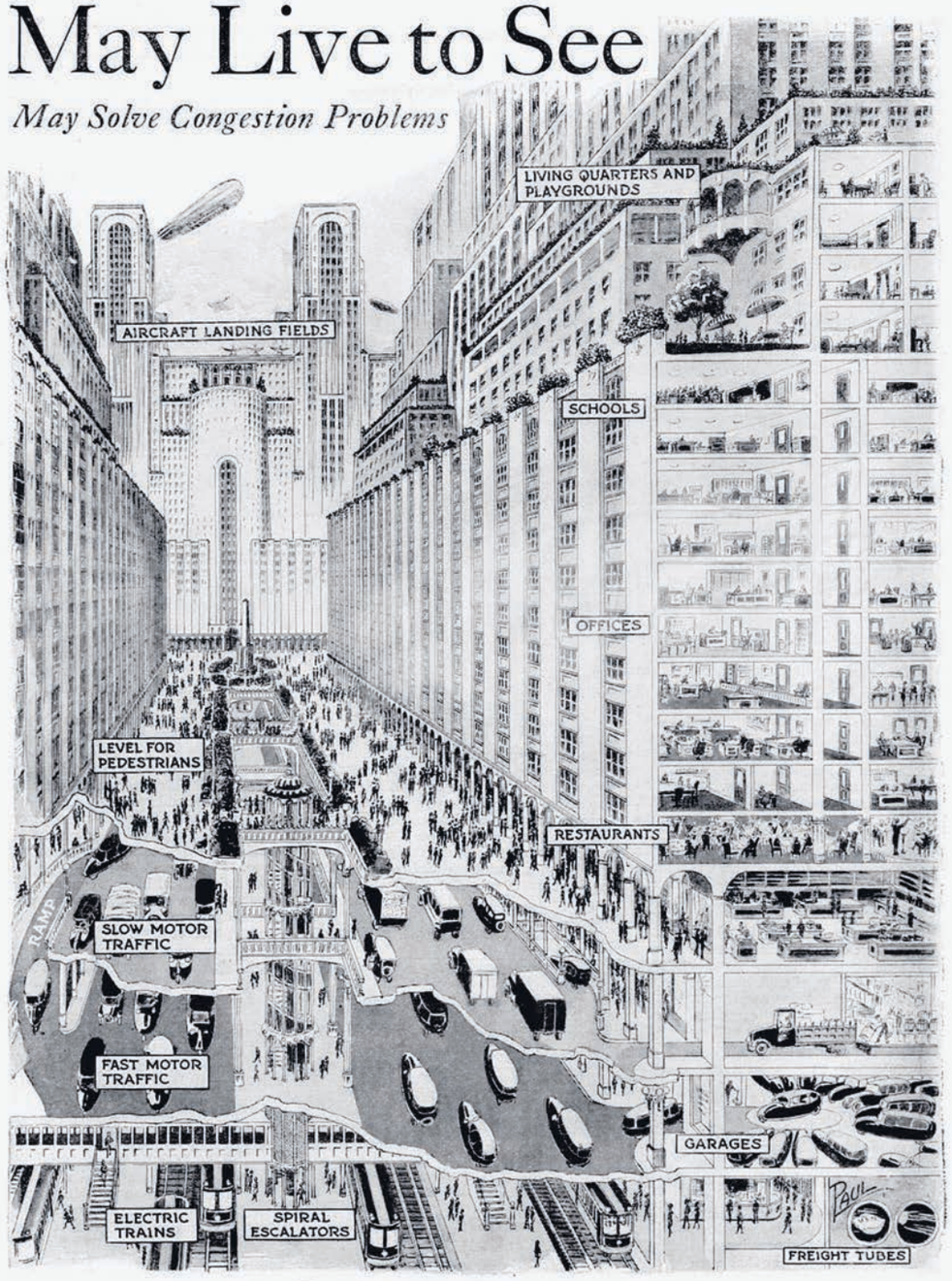
The Hyperloop is a vision of an innovative transport mode that would carry cargo or people in capsules through depressurised tubes located underground or mounted on piles, at speeds approaching 1,000 km/h. The aim is to offer an alternative to flights covering distances of between 300 and 1,500 km while emitting lower levels of greenhouse gases. In 2022, the concept is at the pilot-project stage, with tubes a few hundred meters long. In addition to the remaining technological challenges involved, from a mobility point of view, the issues include:

- Will a Hyperloop station fit into an historic city centre, or will it require termini at the outskirts of metropolitan areas, which would require additional travel time to the final destinations?
- Will the hourly capacity to carry passengers be comparable to that of a coach service or train line?
- For which door-to-door links would a Hyperloop offer substantial time savings compared to existing high-speed trains?
- When compared to other investments in transport, how acceptable will a Hyperloop route leading straight through the countryside be, considering the landscape, the environment and budgetary constraints (between 10 and 100 million euros per kilometre, according to the companies developing this technology)?

Since this is a transport mode for distances of several hundred kilometers and its technology is still at the feasibility-study stage, the Hyperloop will not have a role to play in daily mobility in the Grand Duchy.

May Live to See

May Solve Congestion Problems



How You May Live and Travel in the City of 1950

Future city streets, says Mr. Corbett, will be in four levels: The top level for pedestrians; the next lower level for slow motor traffic; the next for fast motor traffic, and the lowest for electric trains.. Great blocks of terraced skyscrapers half a mile high will house offices, schools, homes, and playgrounds in successive levels, while the roofs will be aircraft landing-fields, according to the architect's plan

How you may live and travel in the city of 1950
(1913) Harvey Wiley Corbett

Can one imagine the construction works necessary to make the utopia shown on the previous page a reality along the streets we use each day?

Chapter 7

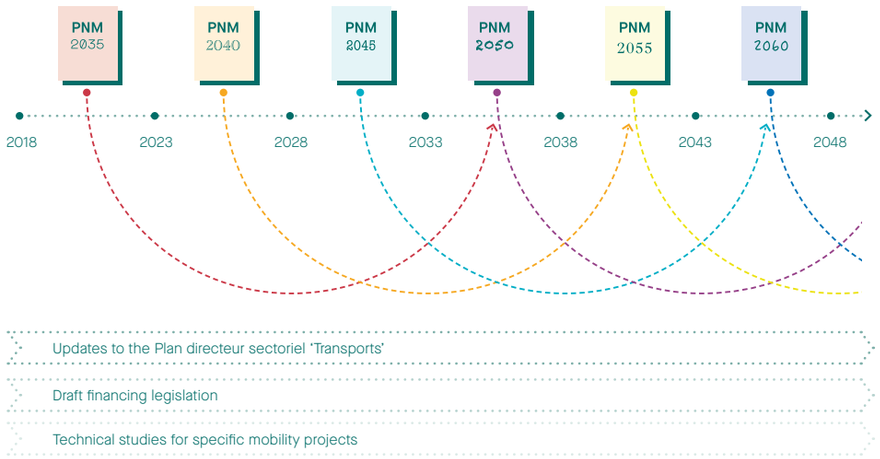
The PNM 2040

The PNM process ensures consistency in long-term planning while reflecting the priorities of successive governments.

The PNM process

The National mobility plan (PNM) is an ongoing process that incorporates political priorities, economic and demographic projections as well as the time required to implement major infrastructure projects. Every five years, the Minister publishes a master plan for the next fifteen years.

The PNM process



Since major infrastructure projects take several legislative periods to implement, successive National mobility plans will require the broadest political consensus possible. Publication of the PNM is recommended for the middle of a legislative session. This gives the technical teams an opportunity to integrate the newly elected government's priorities and allows for the political debate to occur before the election period.

Updates to the Plan directeur sectoriel 'Transports', financing legislation and technical studies for specific projects will progress in parallel to this, preferably in line with the latest National mobility plan.

Initial ideas for the PNM 2040

The National mobility plan 2040 will reflect the next government's priorities. At a technical level, preparations are under way to continuously improve the quality of mobility planning. Some opportunities and potential topics for the PNM 2040 have already begun to emerge.

- The **Digital Mobility Observatory** that has been set up by the Ministry of Mobility and Public Works (MMTP) during the 2018 – 2023 legislative period will continue to equip itself with increasingly efficient tools and increasingly complete data. On the one hand, this will facilitate an even more detailed understanding of mobility behaviour; on the other hand, it will allow for impact assessments of measures already implemented. Specifically, a Cross-border Multimodal Traffic Model (MMUST), of which MMTP is a partner, will go into operation in 2022. This tool will simulate the main flows of people throughout the Greater Region to permit cross-border impact analysis of the measures under consideration. An update of the Cellule Modèle de Transport (CMT), operated jointly by MMTP and the City of Luxembourg, will continue to enable a more detailed simulation of mobility flows on the national territory.

- Whereas the PNM 2035 focusses on metropolitan areas – where analysis must begin, as these areas are where the main traffic flows converge – the PNM 2040 could put more emphasis on mobility in rural areas. The first **regional studies for the PNM** are being drawn up and are expected to kick off in 2022. The aim will be to implement the functional classification of the multimodal road network in a way that will shunt motorized individual traffic to the main road axes, prioritize public transport, develop a dense network of cycle routes and mitigate traffic levels in towns (see pages 80 – 99).

- Topics that could not yet be addressed in the PNM 2035, such as **international transit** or **freight traffic**, could be analysed in the PNM 2040, to the extent that representative data for these flows is available by then. It will be interesting to see if motorcycle use – which for purposes of daily commuting was still marginal in 2017 – will expand, particularly in urban areas.

- The core work will continue to entail **forecasts of the demand for mobility in 2040**, evaluations of ongoing projects in light of this demand, and the effort to identify any additional projects that might be needed.

Modu 2.0

Brochure, posters and videos

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