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Managing future cross-border daily mobility pressures in the Greater Region

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This policy brief is related to the European Interreg project MMUST (2018-2022) and the follow-up European agreement MMUST-b (2023-2025) within the consortium of several stakeholders in France, Luxembourg and Belgium.

By 2040, the cross-border functional region of Luxembourg will be faced with a defining challenge: how can it transport more people over greater distances without disrupting the flow of traffic? Disparities in living standards between Luxembourg and neighbouring regions are likely to continue widening, which is expected to increase cross-border commuting flows. However, infrastructure, land use and governance remain fragmented across borders. Without careful planning, congestion could worsen and become systemic, affecting not only motorways, but also local roads, public transport and stations, as well as park-and-ride facilities. The MMUST model provides a unique, integrated perspective on this future. By simulating mobility patterns between 2024 and 2040, it helps to identify areas of potential pressure, potential investment shortfalls and opportunities for coordinated action.

The cross-border area surrounding Luxembourg presents a uniquely complex mobility challenge. Rather than being simply a metropolitan area or a national transport system, it is a multi-country labour market spanning Luxembourg, and its neighbouring regions in southern Belgium, north-eastern France and contiguous German parts. With 232,320 cross-border workers in the last quarter of 2025, Luxembourg has been the main destination of an increasing number of daily commutes. This system is already under strain, and all projections indicate that the pressure will increase until 2040.

Moreover, the demand for mobility is not growing evenly. While Luxembourg is expected to experience stronger economic and demographic growth, neighbouring regions are expected to grow more modestly – or even stagnate in some areas.[1] This creates structural imbalances: most of the jobs are concentrated in one country, while housing and labour supply are distributed across several. This results in an ongoing increase in longer-distance commuting, particularly from France to Luxembourg, as nearby labour pools have already been largely mobilised.

In such a context, traditional planning approaches based on incremental adjustments or single-country perspectives are insufficient. Policymakers need to understand not only how many people will travel and where, but also how they will travel and where congestion will occur. They must also consider how infrastructure and behaviour will interact over time. This is precisely where modelling becomes indispensable.

Platform MMUST (www.mmust.eu) simulates future scenarios in a controlled and comparable way. While it cannot predict the future with certainty, it provides a structured framework to explore 'what if' questions. For instance: What impact would an increase in road capacity have on congestion? How much modal shift can be expected from investments in rail or tram systems? Where might bottlenecks emerge in stations, park-and-ride facilities or on local roads? How sensitive are the outcomes to demographic or economic assumptions?

These questions are important because mobility systems are closely linked. Changes to one part of the system, such as the construction of a new motorway or tram extension, can have a domino effect elsewhere. For example, increased road capacity may reduce local congestion but induce additional traffic. Improved rail services may attract new users, but they can also lead to overcrowding at key stations. Without a system-wide perspective, such dynamics remain invisible until problems arise.

The MMUST model addresses this issue by integrating multiple dimensions and their evolution over time, including population growth, employment distribution, transport infrastructure and user behaviour. It enables planners to test a 'reference scenario' for 2040, taking into account expected developments, and to compare alternative strategies against this baseline.

Crucially, the model reveals that congestion is not solely a consequence of inadequate infrastructure. It is also the result of spatial planning choices, pricing mechanisms and behavioural responses. For instance, when main roads become congested, drivers may divert onto secondary routes, causing congestion in areas not designed for heavy traffic. Similarly, if park-and-ride facilities reach capacity, potential public transport users may instead drive the entire length of their commute.

Therefore, the goal of modelling is not only to quantify future congestion, but also to understand the factors that shape it. This provides insights for more effective and coordinated policies. In a cross-border region where decisions are made by multiple authorities, this shared evidence base becomes essential. Ultimately, the MMUST model addresses a fundamental yet pressing need: the transition from reactive to proactive mobility planning. Rather than responding to congestion after it occurs, policymakers can anticipate where and why it will arise and act accordingly.

The MMUST model: key hypotheses

At its core, MMUST is a decision-support tool designed to simulate how people move across a large, cross-border area. It combines data on (synthetic) population, employment, infrastructure, and travel behaviour (Delloye et al. 2026) to generate different virtual representations of daily mobility patterns (e.g., estimation of where individuals live and work, and how they

1 Please see https://www.iba-oie.eu/fr/themes/demographie/projections-de-la-population

choose to travel, indicators such as traffic volumes). This allows planners to test how the system might evolve under different conditions.

The strength of MMUST lies in its ability to integrate these elements into a coherent system. Rather than analysing roads, railways, or demographics in isolation, it considers how they interact. For example, an increase in jobs in Luxembourg would lead to more commuting, thereby increasing demand for both roads and railways and affecting travel choices and congestion.

Socio-demographic and economic hypotheses – The model's results are based on a set of assumptions about how the region will evolve by 2040. These assumptions are not predictions, but rather plausible scenarios that are based on existing trends and official projections.[2]

One of the most prominent features of the scenario is the uneven distribution of population and jobs. Luxembourg is expected to experience strong population growth of around 32%, as well as substantial job growth of around 46%. In contrast, France and Belgium are expected to experience more moderate population growth and, in some areas, stagnation or decline in employment. This imbalance has profound implications. Luxembourg will require a large number of additional workers, but its domestic labour supply will not be sufficient. As a result, cross-border commuting is expected to increase, particularly from France. In our scenario, the number of daily commuters from France to Luxembourg could rise from around 104,000 to 163,000 in 2040 (figures provided by the Ministry of Mobility and Public works and STATEC). This would create a structural dependency on long-distance commuting and put increasing pressure on transport systems connecting residential areas in France and Belgium to employment centres in Luxembourg.

Spatial development assumptions – Our scenario also assumes changes in the way the MMUST territory is developed. Housing growth is expected to be more closely aligned with transport infrastructure, with a focus on mixed-use areas and improved connectivity. These changes reflect policy objectives aimed at reducing urban sprawl and promoting more sustainable mobility patterns. Nevertheless, despite these improvements, the overall increase in demand is significant. The model estimates an 18% rise in total travel demand across the region by 2040, with particularly strong growth in areas directly connected to Luxembourg's labour market. This demand could result in a very modest modal shift across the entire area: the share of public transport could increase from 11% to 12%, while that of cars fell from 75% to 74%. However, these averages mask significant disparities. For example, public transport systems between France and Luxembourg could gain 7 percentage points, thanks to rail improvements and park-and-ride facilities, primarily at the expense of single-occupancy vehicle use.

Assumptions on transport infrastructure – A key component of the model is the inclusion of planned infrastructure projects. These include investments in both road and public transport. On the road network, major projects include:

- The widening of key motorways (such as the A3 in Luxembourg and A31 in France) to increase capacity;
- New connections and bypasses of Hesperange and Käerjeng to improve traffic flow and reduce congestion in urban areas, widening of A4 in Pétange;
- Additional links are also planned to facilitate cross-border travel.
- At the same time, significant investments are planned in public transport:
- Expansion of the rail network around Luxembourg City, with increased frequency and improved travel times;
- Extension of tram systems within Luxembourg City, and a creation of a major link between Esch-sur-Alzette and Luxembourg City;
- Development of 8 new park-and-ride facilities to encourage multimodal travel.

These investments aim to provide alternatives to car travel, particularly for long-distance commuting. The model assumes that these projects will be fully implemented by 2040.

2 Meanwhile, in April 2026, Luxembourg's National Institute of Statistics revised its sociodemographic projections for the coming decades. The trend suggests a period of sustained population growth through the middle of the century, followed by a gradual slowdown. Here, the projections used for 2040 in this report date from January 2022.

Behavioural assumptions – The model was calibrated using Revealed and Stated Preferences data with the Biogeme software (Bierlaire 2023). Validation was performed using various sensitivity analyses, as no data were available for backcasting and the sample size was not large enough to set aside a portion for validation purposes. The model incorporates the assumption that individuals make travel choices based on factors such as travel time, cost, and convenience. For example, as public transport improves, it is expected that some users will switch from car to train or tram, particularly for longer journeys.

Main findings

The model should be interpreted as indicating overall trends rather than giving precise forecasts. It provides insights into how the mobility system may evolve (Godefroy et al. 2026). Although planned infrastructure investments will improve in some areas, they will not be sufficient to offset the overall growth in demand. Despite these improvements, the overall increase in demand is important. The model estimates an 18% rise in total travel demand across the region by 2040, with particularly strong growth in areas directly connected to Luxembourg's labour market.

Limited but significant shifts in modal choices – One of the key questions is whether increased investment in public transport will lead to a significant reduction in car use. The results suggest that such a shift will occur, but it will remain relatively modest overall. Across the entire region, the share of public transport use increases slightly (from around 11% to 12%), while car use decreases marginally (from around 75% to 74%).

However, these averages mask important variations. On cross-border routes between France and Luxembourg, for example, the shift is more pronounced, with public transport gaining several percentage points. This reflects the effectiveness of rail and park-and-ride investments for long-distance commuting in a context where road congestion remains at a very high level (see next point).

For shorter journeys, however, the car remains dominant. Its flexibility and convenience continue to make it the preferred option, particularly in areas with limited public transport coverage. The result is a dual system: In our scenario, public transport is becoming more attractive for long-distance commuting in highly congested areas, whereas the car remains dominant for all other situations (local and short-distance travel, areas with less significant congestion).

Persistent and widespread road congestion – Despite significant investment in road infrastructure, congestion remains a major issue. In fact, the model predicts substantial increases in traffic volumes in many areas, particularly in Luxembourg and along key cross-border corridors, related to areas with high economic activity, and with spillover effects onto secondary and local roads (Figure 1).

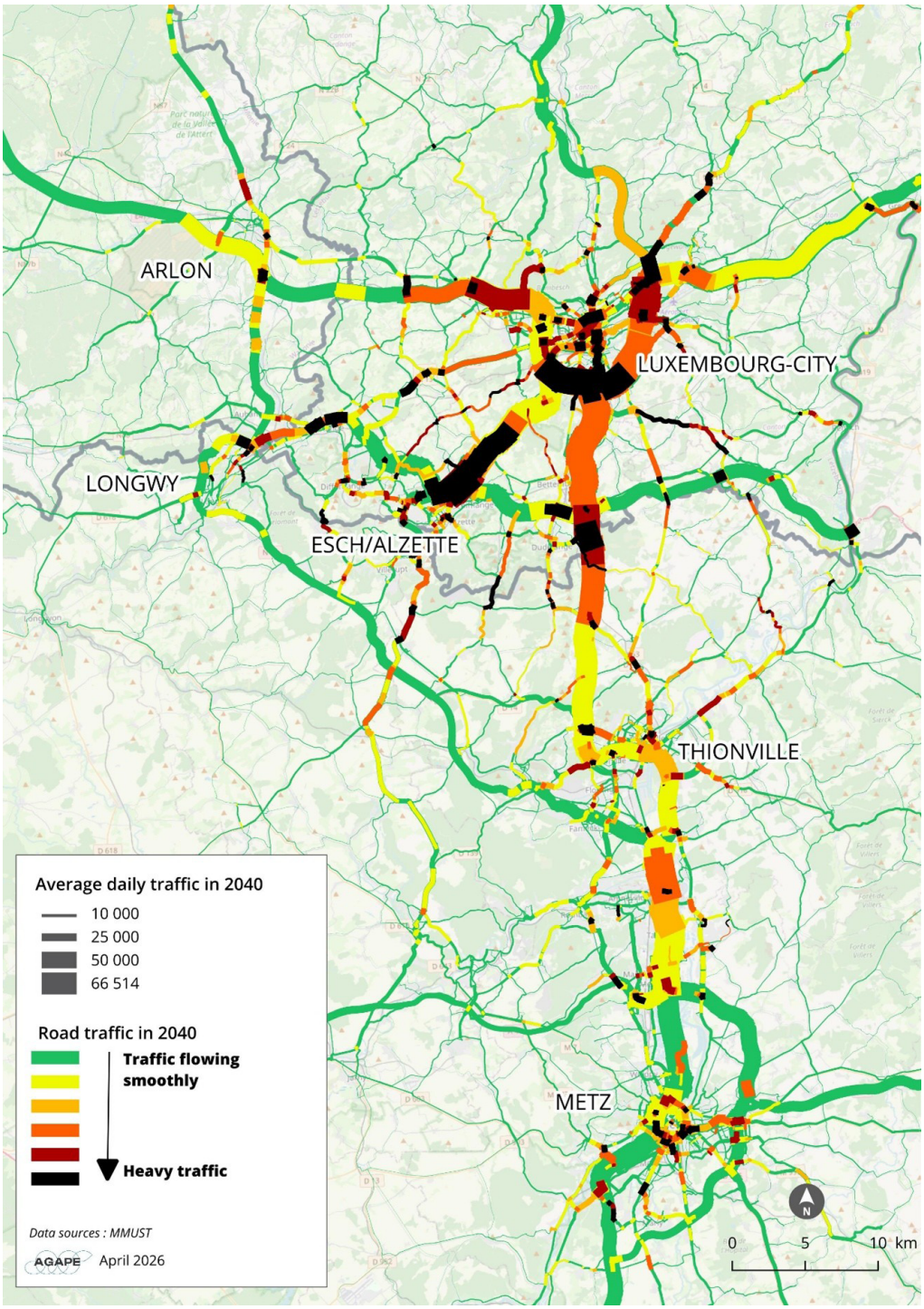
In some cases, new infrastructure provides temporary relief, but this is quickly offset by increased demand. This phenomenon, often referred to as 'induced traffic', means that additional capacity can lead to more traffic rather than less congestion. Several key corridors are expected to operate beyond their theoretical capacity during peak hours by 2040, with demand exceeding capacity by 20–30%. This would result in recurrent congestion, particularly on routes connecting France to Luxembourg. Moreover, congestion is not limited to major roads. As drivers seek to avoid congestion, they increasingly use alternative routes, creating new bottlenecks and affecting residential areas. This has implications for both travel times and quality of life.

Parking and park-and-ride congestion – Another key finding relates to park-and-ride (P+R) facilities. These facilities are designed to encourage drivers to switch to public transport by providing parking near stations or transport hubs. The model shows strong growth in the use of P+R facilities, reflecting an increase in intermodal travel, as many users combine car (for the first or last miles) with public transport within the same journey.

However, this success creates new challenges. By 2040, most P+R facilities will be operating at or near full capacity. In some areas, particularly on the French side, there will be a clear shortage of parking spaces. Even large facilities in Luxembourg will reach occupancy rates of over 85%. This situation has important consequences. If users cannot find a space, they may abandon public transport altogether and continue their journey by car. In this way, insufficient capacity at P+R sites can undermine efforts to promote modal shift.

Strong growth but capacity constraints in public transport – The model predicts an increase in public transport usage, particularly on rail and tram networks.

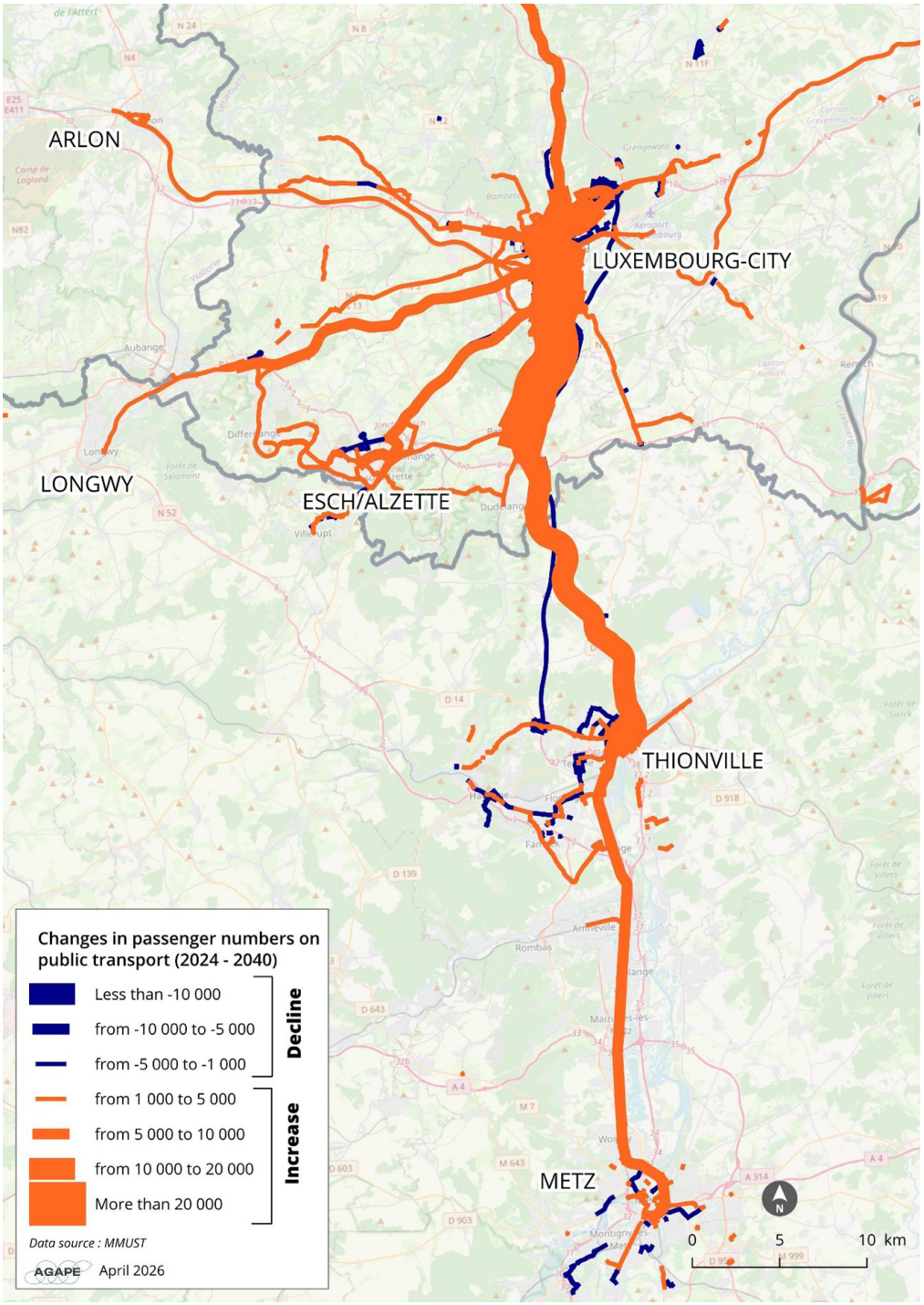
Figure 1 – Daily traffic on the road network estimated in 2040



This reflects increased demand and improvements in service quality. Notable changes include doubling passenger numbers on key rail corridors such as Thionville–Luxembourg, increases in tram usage, particularly in Luxembourg City, and a shift from bus to rail and tram as users prefer faster, more reliable modes (Figure 2).

However, these changes lead to capacity constraints. Several parts of the public transport system will certainly be under pressure by 2040. Major stations, such as those in Luxembourg City and Thionville, experience very high passenger volumes. The configuration of platforms, access points and interchange areas should be verified with these volumes and eventually adapted,

Figure 2 – Evolution of the daily number of public transport passengers between 2024 and 2040



otherwise they could become congested during peak hours. Some services operate at or near capacity, which reduces comfort and reliability.

In addition, access to public transport becomes a bottleneck. The increased number of passengers requires improvements in station design, pedestrian access, cycling infrastructure and last-mile connectivity. Without such improvements, the effectiveness of public transport investments may be limited. Overcrowding and poor accessibility can deter users and diminish the appeal of these modes of transport.

Implications for where and how to invest to limit congestion

The MMUST model suggests that congestion in the cross-border region is likely to remain a structural issue by 2040, despite significant planned investments, largely reflecting Luxembourg's sustained economic attractiveness. Therefore, the first priority for decision-makers is to intensify a genuinely cross-border perspective. Greater coordination between countries, regions, and transport authorities is essential to ensure infrastructure, services, and policies work together as a coherent system, rather than as a patchwork of local solutions.

A second point to consider is the shortfall of future road network capacity. The model shows that these capacity gains are often quickly absorbed by growing demand. Moreover, the results hint to an increased congestion on local areas. As major corridors become congested, traffic is diverted onto secondary and residential roads, creating new congestion hotspots and negatively impacting quality of life. Therefore, addressing congestion cannot be limited to main infrastructures; it must also consider the broader network and its impact on communities. So that the main benefit becomes to allow (more) people to have full flexibility in their destination choice (workplace but also shopping places, etc.) rather than to alleviate congestion.

Public transport will play a central role in any effort to reduce congestion, particularly for long-distance commuting. However, the model also indicates that success will bring new challenges, such as overcrowding on trains and trams and at major stations. Therefore, decision-makers should pay close attention not only to network expansion, but also to the capacity and functioning of key nodes, such as stations and interchanges. The quality, reliability and accessibility of the system will be crucial in sustaining a shift in modes of transport over time.

Furthermore, intermodality emerges as a critical concern. While the increasing reliance on park-and-ride facilities reflects changing travel behaviours, the saturation of these sites poses a potential bottleneck. If access to public transport is restricted at these entry points, the effectiveness of the entire system will be reduced. Therefore, ensuring that these interfaces function efficiently is an important condition to preserve the efficiency of the intermodal journeys and reduce the overall road traffic.

Finally, the model highlights the close link between mobility, land use and spatial development. The location of housing and employment is a key driver of travel demand, particularly in regions characterised by strong cross-border commuting. If growth continues to concentrate jobs in one area and housing in another, transport systems will remain under sustained pressure. A more balanced and coordinated approach to land use planning is therefore crucial in shaping long-term mobility patterns. Land Use Transport Interaction (LUTI) models could help decision-makers plan their actions regarding daily mobility forecasts, as decisions related to households' residential choices are fundamental to the management of transportation modes. This aligns with the goal of the new Interreg MMUST+ project. [3] Its consortium is currently developing a residential relocation model that will be integrated with the updated MMUST daily travel model. Moreover, these factors must also be balanced against the daily activities residents perform, considering, e.g., teleworking and varying levels of satisfaction with their environment or their regular trips.

Taken together, these points highlight that reducing or modifying congestion is a systemic challenge requiring a systemic response. It requires attention to governance, demand management, infrastructure capacity, intermodality, and spatial planning – all within a shared, cross-border framework.

3 https://interreg-gr.eu/project/mmust-fr-2/

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