Interreg
North-West Europe

Co-funded by the European Union

CAMINO

JOINTLY DEVELOPED LONG-TERM AMOD IMPLEMENTATION STRATEGIES FOR PTOS IN NORTH WEST EUROPE OUTPUT 1.2

Link to Camino Website

PROJECT ACRONYM:

CAMINO

PROJECT TITLE:

Blueprinting Automated Mobility on-Demand Deployment for Sustainable Public Transport

PROGRAMME PRIORITY:

Smart and just energy transition

SPECIFIC OBJECTIVE

2.1: Promoting energy efficiency and reducing greenhouse gas emissions

OUTPUT NUMBER AND TITLE

Output 1.2 - Jointly developed long-term AMoD implementation strategies for PTOs in North West Europe

PROGRAMME OUTPUT INDICATOR

2.1.O.1: Strategies and action plans jointly developed

LEAD AUTHOR:

TABLE OF CONTENT

01 EXECUTIVE SUMMARY

As part of the CAMINO project, the project partners (PPs) jointly developed a long-term deployment strategy for automated mobility on demand (AMoD) services, targeting public transport operators (PTOs) across North-West Europe (NWE). This strategy summarises all the work carried out by the PTO DE Lijn during the project, providing PTOs with a tailored framework to support the design, evaluation, and integration of AMoD solutions into existing public transport systems.

The strategy provides PTOs with practical guidance and tools to enhance the accessibility, affordability and environmental performance of their services. By facilitating the seamless adoption of AMoD, the strategy contributed to CAMINO's overarching objective of reducing reliance on private cars and reducing transport-related emissions in NWE, while promoting a more sustainable and inclusive mobility landscape.

02 WHY PTOS SHOULD INVEST IN AMOD

Investing in Automated Mobility on Demand (AMoD) offers PTOs a strategic opportunity to improve service efficiency and operational resilience. AMoD enables dynamic, demand-driven transport solutions that reduce reliance on fixed routes and timetables, which are increasingly difficult to maintain due to persistent driver shortages. Since labor accounts for approximately 70% of operational costs, automation provides a substantial cost-saving potential. By reallocating resources from traditional services to automated on-demand vehicles—especially in low-density areas where standard buses are underused—operators can maintain acceptable service levels at significantly reduced costs. Additionally, early engagement with AMoD positions PTOs as innovative leaders, enhancing their competitiveness in upcoming concession tenders where municipalities expect openness to automated services.

03 POLICIES AND REGULATIONS (BE)

In Belgium, De Lijn operates within a multi-layered regulatory framework involving federal, regional and local mobility authorities. At the federal level, the Federal Public Service (FPS) for Mobility and Transport is responsible for granting permits for automated vehicle (AV) operations on public roads. These agencies establish national standards for vehicle safety, insurance requirements and certification processes to ensure compliance with Belgian and European Union regulations.

At the regional level, De Lijn collaborates with the Flemish government, which is responsible for integrating AVs into the existing transport network. The Flemish government establishes transport policies to ensure that AV services align with regional objectives such as reducing traffic congestion, lowering emissions and improving accessibility, particularly in underserved areas. The region also provides specific safety and operational guidelines for AV testing and deployment.

Local municipalities play a vital role in the deployment of AVs, as they are responsible for engaging with local communities, issuing permits, and managing infrastructure adjustments. They ensure that AV routes are properly integrated into the local road network. De Lijn is providing the necessary infrastructure, including charging stations and traffic management systems.

In addition to these regulatory bodies, independent safety organisations such as the Belgian Road Safety Institute (BIVV) assess the safety standards of AVs. They perform vehicle inspections, test systems for reliability, and monitor compliance with safety regulations. De Lijn must adhere to these requirements, ensuring that the AVs meet the necessary safety and operational criteria.

This comprehensive regulatory framework ensures that the deployment of AMoD services in Flanders is safe, legally compliant and effectively integrated into the broader transport system. This facilitates the successful operation of automated vehicles across various urban and rural areas.

04 STAKEHOLDER MAPPING

Effective stakeholder mapping is essential for developing AMoD services. It helps to identify key players, align their perspectives and foster collaboration in order to meet policy goals and community needs. The internal and external stakeholders involved in De Lijn's AMoD implementation process are listed below:

Internal Stakeholders

De Lijn's internal stakeholders include the Company Board and Strategy Department, who are responsible for setting the organisation's long-term vision for automated transport. Supporting departments such as Market & Mobility, Operations, ICT, Legal & Purchasing, and Finance play critical roles in concept design, implementation planning, digital infrastructure, compliance, and budgeting. These internal actors collaborate to pilot and scale AMoD solutions while ensuring operational efficiency, regulatory alignment, and service quality.

External Stakeholders

External stakeholders encompass key regulatory bodies such as the Federal Mobility Authority and regional governments of Flanders, which are responsible for issuing AV permits and aligning projects with transport policy. Local municipalities (e.g., Leuven) coordinate land use and infrastructure readiness, while emergency services ensure safety protocols for AV deployment. In addition, technology suppliers provide end-to-end AV systems and ongoing technical support. Independent safety assessors verify compliance, while insurance providers and research institutions contribute to legal, financial, and scientific validation. Together, this multi-level network ensures that De Lijn's AMoD services are safe, scalable, and responsive to both user needs and policy objectives.

05 IMPLEMENTATION STRATEGY

In order to future-proof their operations, PTOs will need to implement a robust AMoD strategy that covers technical, regulatory and organisational areas. The operator will be required to:

Form an AV Task Force
A cross-functional team will need to be established to coordinate legal, ICT, operations, and insurance inputs, ensuring a holistic approach to AV planning and deployment.

Select Strategic Pilot Locations
PTOs will have to identify ideal zones—low complexity, underserved by conventional transport—for early AV trials, while aligning with municipal development plans.

Develop an Integrated Digital Ecosystem
The operators will need to upgrade its backend systems to accommodate AV fleet control, dynamic routing, and customer interaction tools, ensuring seamless user experience.

Establish Regulatory Roadmaps
PTOs must coordinate with regional and federal authorities to outline a step-by-step approval process for AVs, including safety certifications and public road permits.

Prepare for Cultural and Organisational Change
The workforce will need to be prepared for automation through upskilling and role evolution, while internal processes are adapted to support agile deployment.
Evaluate and Iterate: PTOs will need to embed agile pilot evaluation processes, using performance metrics and stakeholder feedback to refine service models and plan city-wide expansion.

06 FINANCIAL INVESTMENT

In order to transition to AMoD, PTOs will need to plan and finance this strategically by incorporating future-oriented investments into their operational and capital planning. Key actions include:

Developing a Multi-Year Investment Framework
PTOs will need to outline phased capital expenditures for AV fleet acquisition, depot upgrades, and system integration with current IT and planning tools.

Engaging with Innovation Funds
The organisation will need to proactively secure co-financing from regional and European innovation programs and prepare robust business cases to demonstrate value and scalability.

Adjusting Financial Controls
PTOs will have to adapt its internal budgeting tools to handle new financial dynamics, such as licensing models for AMoD software, data services, and insurance schemes specific to automated operations.

Creating a Resilience Fund
To manage the financial risks associated with early-stage AMoD deployments - such as technical failures, low adoption, or regulatory delays - PTOs will need to establish contingency reserves or flexible reallocation options.

Embedding Cost-Benefit Analysis Protocols
Long-term viability will require the development of evaluation models that include externalities such as carbon savings, accessibility gains, and societal readiness.

For more detailed financial budget please find the PTO Budget and Resource Report.

07 SUCCESS CRITERIA

Regulatory Compliance
AV operations must meet all Belgian and EU transport laws, including vehicle certification, data privacy, and road safety regulations.

Safety Performance
Vehicles must consistently demonstrate low incident rates, effective hazard detection, and successful collaboration with emergency protocols and personnel.

Service Reliability
AV services should maintain high on-time performance, minimal service interruptions, and predictable response times, comparable to or better than existing transport modes.

Operational Integration
AVs must connect seamlessly with other public transport modes, including synchronized timetables, unified ticketing systems, and multimodal route planning tools.

Financial Viability
Projects should demonstrate cost-effectiveness through optimized operational costs, realistic revenue models, and potential for public or private funding support.

Scalability
Solutions must show the ability to expand efficiently across various environments, including both high-density urban centers and lower-density peri-urban areas.

Public Acceptance
Passenger satisfaction, trust in safety, and user adoption rates must show positive trends through feedback surveys and usage data.

08 RISK ANALYSIS

PTOs have to manage a range of interconnected risks to safely and efficiently provide its services:

Legal Liability
Accidents, injuries, or operational failures may lead to legal penalties or financial settlements. Proper training, clear procedures, and sufficient liability coverage help reduce this risk.

Vehicle Malfunction
Vehicle failures can compromise service delivery and passenger safety. Rigorous maintenance schedules, real-time diagnostics, and backup options help keep services running smoothly.

Cybersecurity
Cyber attacks or data breaches pose a growing threat to operations. Implementing strong cybersecurity measures and incident response plans helps protect both data and service stability.

Operational Disruption
Strikes, technical failures, severe weather, or road closures can interrupt services. Collaborative incident management and flexible routing enable faster recovery and minimize disruptions.

Staff Adaptation to Automation
Automating routines can cause uncertainty or resistance among staff. Support through training and upskilling helps foster adaptability and confidence.

External Risks
Some stakeholders may be cautious or opposed to operational innovations. Transparent communication, consultation, and demonstrating clear benefits can aid in securing their cooperation.

09 CONCLUSION

For public transport operators in north-west Europe, AMoD is not just a technological evolution; it is an opportunity to transform the delivery of flexible, efficient and resilient public transport in the coming decades. The experience of operators such as De Lijn shows that success will not come from technology alone, but from deliberate organisational change, cross-sector collaboration and long-term strategic planning. AMoD offers a practical response to pressing challenges such as labour shortages, underused routes and changing passenger expectations, yet its integration must be carefully staged. Operators must identify areas suitable for piloting automation, align with public authorities on regulatory and safety frameworks, and prepare their workforce for new operational roles. Internally, this means moving beyond experimentation and embedding AMoD into core strategy, while externally it means building trust with users and partners through reliable services and transparent governance. With sustained investment, institutional readiness and shared ambition, PTOs can lead the shift towards a more adaptive, user-focused public transport system.

10 FURTHER READING

Bösch, P. M., Becker, F., Becker, H., & Axhausen, K. W. (2018). Cost-based analysis of Autonomous Mobility Services. Transport Policy, 64, 76–91. https://doi.org/10.1016/j.tranpol.2017.09.005

de Séjournet, A., Rombaut, E., & Vanhaverbeke, L. (2023). Cost analysis of autonomous shuttle services as a complement to public transport. Transportation Research Procedia, 72, 2323–2330. https://doi.org/10.1016/j.trpro.2023.11.723

Deliverables. CAMINO. (n.d.). https://camino.nweurope.eu/deliverables

McKay, G. (2025, June 11). Goldman sees Autonomous Vehicles Transforming Insurance World. Insurance Journal. https://www.insurancejournal.com/news/national/2025/06/11/827020.htm

Bösch, P. M., Becker, F., Becker, H., & Axhausen, K. W. (2018). Cost-based analysis of Autonomous Mobility Services. Transport Policy, 64, 76–91. https://doi.org/10.1016/j.tranpol.2017.09.005

de Séjournet, A., Rombaut, E., & Vanhaverbeke, L. (2023). Cost analysis of autonomous shuttle services as a complement to public transport. Transportation Research Procedia, 72, 2323–2330. https://doi.org/10.1016/j.trpro.2023.11.723

Tran, B. (2025, May 14). Autonomous vehicles in public transport: How cities are adopting self-driving buses (latest data). PatentPC. https://patentpc.com/blog/autonomous-vehicles-in-public-transport-how-cities-are-adopting-self-driving-buses-latest-data#:~:text=The%20average%20cost%20of%20an,expenses%2C%20and%20lower%20maintenance%20costs.

Tran, B. (2025, May 14). Autonomous vehicles in public transport: How cities are adopting self-driving buses (latest data). PatentPC. https://patentpc.com/blog/autonomous-vehicles-in-public-transport-how-cities-are-adopting-self-driving-buses-latest-data#:~:text=The%20average%20cost%20of%20an,expenses%2C%20and%20lower%20maintenance%20costs.