Interreg North-West Europe

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CAMINO

PTO BUDGET AND RESOURCES GUIDE FOR AMOD DEPLOYMENT D.1.3.3

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

DELIVERABLE NUMBER AND TITLE

D.1.3.3 - PTO Budget and Resources Guide For AMoD Deployment

WORK PACKAGE NUMBER AND NAME:

Work package 1 - Developing AMoD deployment strategies for PT that stimulate a modal shift and reduce GHG emissions

ACTIVITY NUMBER AND NAME:

Activity 1.3 - Preparing PTAs and PTOs for AMoD deployment in NWE

LEAD AUTHOR:

Interreg
Co-funded by the European Union
North-West Europe
CAMINO

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INTRODUCTION & DEFINITION OF AMOD

AMoD (Automated Mobility on Demand) is the name of independently driving vehicles for public transport. Rather than relying on traditional bus routes with drivers and timetables, AMoD offers efficiency and reliability. Automated buses only operate when a journey is requested, picking up passengers and stopping only at the locations required.

There have been multiple automated transport projects in Europe over the last twenty years. The first such project, named ParkShuttle, began operating on a dedicated lane, separated from traffic, in the Netherlands in 1999. This fully automated bus connects a metro station in Rotterdam with a remote business park. Every day, 1,850 passengers use this system. During peak hours, the ParkShuttle operates on a fixed timetable, running every 2.5 minutes. Outside of these times, it operates on demand. You must reserve online at least 15 minutes before you wish to use the service.

In the long term, automated mobility could form the core of public transport networks in Northwest Europe. It will ensure the future reliability, sustainability and profitability of the network. The network will be less vulnerable to disruption due to staff shortages. Around 60% of the total costs of a public transport network consist of labour costs. Without drivers on every vehicle, the profitability of a network would rise substantially. Another benefit of introducing AMoD is that it provides first and last-mile options for servicing low-density neighbourhoods. These areas cannot always be connected cost-effectively to classical city networks with a high service level. AMoD with small, on-demand shuttles can fill this gap and provide an acceptable level of service at an acceptable cost.

ABOUT THIS GUIDE

As part of the Interreg NWE Project CAMINO, the public transport operator (PTO) De Lijn was responsible for creating a guide on automated mobility on demand. The guide is intended to help PTOs define, design and evaluate potential AMoD use cases. Based on a detailed analysis of the Leuven use case, it provides a broader overview of AMoD deployment scenarios. It considers service designs and local mobility needs, and provides practical advice on integrating AMoD into strategic plans.

02 PTO'S RESPONSIBILITIES

GENERAL RESPONSIBILITIES

The Public Transport Operator (PTO) is the organisation responsible for managing the day-to-day operations of public transport services. Appointed through a tender process by the Public Transport Authority (PTA), the PTO plays a key role in ensuring the smooth and efficient delivery of transport services.
Its core responsibilities typically include recruiting, training, and managing qualified personnel to operate the transport services; deploying and maintaining vehicles within the network; and establishing both online and offline ticketing systems. In essence, the PTO is entrusted with the practical execution of the public transport system on a daily basis.

RESPONSIBILITIES FOR AMOD

When implementing AMoD services within the mobility system, the PTO takes on a range of new responsibilities to ensure effective integration and operation. These include overseeing the deployment and maintenance of automated vehicles, managing dynamic fleet scheduling and routing based on real-time demand, and ensuring the system integrates seamlessly with existing public transport services. The PTO is also responsible for the recruitment and training of staff, including the preparation of safety operators to monitor and support automated operations. In addition, the PTO must implement the automated system within the designated operating area, ensuring it is tailored to local conditions and infrastructure. They are further tasked with establishing safety protocols, maintaining regulatory compliance, delivering a user-friendly digital interface for trip booking and payments, and ensuring equitable, accessible, and optimised service coverage.

03 RESOURCES NEEDED

Integrating an AMoD service into the public transport system requires specific resources across staffing, technology and operations, to ensure safe and effective service delivery.

Fleet and Vehicle Resources:

- **Automated Vehicles**: Purpose-built or retrofitted vehicles that meet safety and operational standards for AMoD.
- **Vehicle Maintenance Infrastructure**: Facilities and equipment for inspecting, servicing, and updating automated vehicles.
- **Charging/Refueling Infrastructure:** Especially for electric or alternative-fuel automated vehicles.

Digital Infrastructure:

- **Fleet Management Software:** For dynamic routing, dispatching, and fleet optimisation based on real-time demand.
- **Booking and Ticketing Platform**: An integrated digital platform (mobile app and/or web-based) for user interaction, trip planning, booking, and payments.
- **Data Systems:** Real-time data collection and analytics systems for monitoring performance, safety, and service quality.
- **Cybersecurity Tools**: To protect user data, vehicle systems, and communication networks.

Human Resources:

- **Trained Staff**: Personnel to manage operations, oversee vehicle performance, and respond to incidents.
- **Safety Operators**: Trained individuals who monitor automated vehicles either on-board or remotely, depending on the operational design domain (ODD).
- **Technical Specialists**: Engineers and IT professionals for system integration, software updates, and maintenance.
- **Customer Service Staff:** To handle passenger support, complaints, and accessibility needs.

Regulatory and Safety Frameworks:

- **Compliance Protocols**: Resources to ensure the service adheres to local, national, and international laws and standards. (Belgium)
- **Safety Protocols and Incident Response Plans:** Tools and trained staff to respond to emergencies or system failures.
- **Insurance and Liability Coverage**: Tailored for automated operations and multi-stakeholder environments.

04 COST OF AMOD FOR PTOS

COST STRUCTURE

When implementing an AMoD service, it is essential to account for a range of costs, typically divided into two main categories: Capital Expenditure (CAPEX) and Operational Expenditure (OPEX). CAPEX includes the initial investments required to launch the service, such as the purchase of automated vehicles and any necessary infrastructure adaptations (e.g., charging stations, road modifications). OPEX refers to the ongoing, recurring costs associated with daily operations, which are typically borne by the PTO. This includes expenses such as vehicle maintenance, insurance, energy consumption, and staffing.

The table 1 outlines the full range of cost components associated with AMoD deployment. However, given that there are currently no fully operational AMoD services on public roads in Europe—and that deployment approaches vary significantly by country—no standardised cost estimates are available at this time. Actual costs will depend on factors such as the choice of technology, the provider, national regulations, and the size and scope of the vehicle fleet.

CAPEX
Vehicle Purchase
Vehicle Set up and Testing
Charging Stations
Infrastructure Modifications
OPEX
Operator Training
Safety Operator (on-site)
Safety Operator (remote)
Maintencance
Insurance
Parking
Electricity Charging

Table 1: CAPEX & OPEX

For PTOs, the primary responsibilities lie in managing initial purchases and setup costs, which include vehicle acquisition, and the training and employment of safety operators. Once these initial investments are made, the focus shifts to covering operational costs. These operational costs are typically shared between the passenger fare and a fixed price that the public transport authority (PTA) pays for each kilometer driven by the vehicle.

Looking at the developments in automated vehicles, the cost of the vehicles has already dropped in recent years and is expected to continue decreasing in the future. As technology advances and becomes more reliable, insurance for automated vehicles are expected to fall as well. This is due to the fact that automated driving is statistically safer than human driving, reducing the risk of accidents and the resulting claims.

MODEL SWITCH

Integrating automated vehicles into the public transport system will transform how people utilise mobility services. A De Lijn study has explored these shifts, focusing on the impact of AMoDs on private car usage and bus ridership. The introduction of AMoDs is expected to make transport more cost-effective, particularly for those who travel long distances. As annual mileage increases, the cost per kilometre of using an AMoD decreases, making it a more affordable option than owning a private car.

In the context of public transport, the rise of AMoDs could lead to a reduction in the number of people using traditional buses, as passengers may prefer the convenience, flexibility and lower costs associated with AMoDs. This could significantly impact bus routes, particularly those serving less densely populated areas, where AMoDs could offer a more efficient solution. However, this change also presents an opportunity for public transport operators. By integrating AMoDs into their fleets, operators could provide more flexible, on-demand transport services, particularly in areas or on routes where buses may no longer be cost-effective.

The main challenge for public transport operators will be adjusting to this shift in demand. They will need to restructure or reduce bus routes and embrace new technologies, like AVs, to meet passengers' evolving needs. By doing so, PTOs can remain competitive and ensure that they continue to provide a reliable and sustainable service in an increasingly automated transport landscape.

05 IMPLEMENTATION PLAN FOR PTOS

The goal is to Integrate AMoD into the existing public transport network, providing efficient, flexible, and sustainable mobility services.

PHASE 1: PLANNING AND FEASIBILITY STUDY

Duration: 6–9 months

Objectives:

- Assess transport system and identify areas for AMoD integration.
- Conduct feasibility studies, including cost analysis, technology, and regulatory assessments.

Key Actions:

1. Needs assessment to identify high-demand areas and under-served routes.
2. Regulatory research to ensure compliance with local and EU regulations.
3. Cost-benefit analysis to compare AMoD vs traditional transport costs.
4. Select technology partners to provide AVs and platform solutions.

PHASE 2: INFRASTRUCTURE AND TECHNOLOGY DEVELOPMENT

Duration: 12–18 months

Objectives:

- Develop the necessary infrastructure and integrate AV technology.
- Ensure AVs meet safety and operational standards.

Key Actions:

1. Procure vehicles (AVs or AVs with safety operators).
2. Install charging stations and update infrastructure.
3. Integrate AMoD platform for scheduling, fleet management, and passenger tracking.
4. Ensure data security and implement cybersecurity protocols.

PHASE 3: PILOT PROGRAM AND TESTING

Duration: 6–12 months
Objectives:

- Test AMoD in a controlled environment to ensure safety, performance, and customer acceptance.

Key Actions:

1. Run a limited pilot in a specific geographic area.
2. Monitor safety and performance to track operational metrics.
3. Collect feedback from users to evaluate service convenience and satisfaction.
4. Evaluate financial sustainability and operational costs.

PHASE 4: FULL-SCALE ROLLOUT AND INTEGRATION

Duration: 12–24 months
Objectives:

- Expand AMoD service and integrate fully into the public transport system.

Key Actions:

1. Expand service coverage to include more routes.
2. Scale infrastructure by adding charging stations and upgrading traffic systems.
3. Monitor operational efficiency and ensure ongoing safety standards.
4. Collaborate with stakeholders and engage the public to foster acceptance.

PHASE 5: EVALUATION AND LONG-TERM SUSTAINABILITY

Duration: Ongoing
Objectives:

- Continuously improve the service based on data and feedback.

Key Actions:

1. Track key performance indicators like cost, efficiency, and customer satisfaction.
2. Evaluate financial health and adjust pricing models as needed.
3. Focus on sustainability by using green energy and exploring scalability.

06 CONCLUSION

Integrating AMoD into the public transport system is a transformative opportunity for PTOs to modernise and expand their mobility services. As previously mentioned, the PTO plays a central role in the daily operation of traditional public transport, as well as in the deployment and management of AMoD systems. This involves overseeing automated vehicle fleets, ensuring safety and regulatory compliance, developing digital platforms and managing human and technological resources.

The transition to AMoD requires substantial investment in infrastructure, staffing and digital systems. Initial and ongoing costs must be carefully planned and shared between public subsidies and passenger fares. However, as automated technologies mature, associated costs, such as vehicle acquisition and insurance, are expected to decrease, making AMoD increasingly cost-effective.

Operationally, AMoD offers an opportunity to optimise service delivery, particularly in underserved or low-density areas. Although traditional bus ridership may decline, PTOs can offset this by providing flexible, on-demand alternatives that meet user expectations for convenience and efficiency.

A phased implementation plan, from feasibility studies to full-scale rollout, ensures that the integration of AMoD is strategic, sustainable and aligned with regulatory and societal needs. Ultimately, the successful deployment of AMoD requires a proactive and adaptive approach from PTOs to ensure that future mobility systems are inclusive, safe and resilient. By embracing this transformation, PTOs can continue to fulfil their public service mission while reaping the benefits of technological innovation.

07 FURTHER READINGS

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