



D.2.3.1

4 AMOD INVESTMENT PLANS FROM THE 4 PTAS OF ARTMED WITH INPUT FROM THE AMOD IMPACT ASSESSMENT TOOL

PROVINCE OF BRESCIA

PROVINCE OF MANTOVA

PP05 – ALOT



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OVERVIEW

Project full title: Planning for autonomous mobility on demand in the Euro-MED area

Project acronym: ArtMED

Programme priority: Greener MED

Specific objective: RSO2.4: Promoting climate change adaptation and disaster risk prevention, resilience, taking into account eco-system based approaches

Project duration: 27 months

Project mission: Promoting green living areas

Project category: Test project (Thematic Project)

Work package: WP2 – Transferring the AMOD impact assessment tool to ArtMED PTAs to plan autonomous mobility on demand

Activity: Act.2.3 – Using the AMOD impact assessment tool to develop local investment plans for autonomous mobility on demand.

Deliverable: D.2.3.1 – 4 AMOD investment plans from the 4 PTAs of ArtMED with input from the AMOD impact assessment tool.

Partner in charge (author): PP05 ALOT

Partners involved: LP Postojna, PP04 TML, PP06 PF

Dates of production: 2024.12



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TABLE OF CONTENTS

0

EXECUTIVE SUMMARY

Vision & Mission

1

INTRODUCTION

Objective

Challenges

Governance

Analysis of market demand & Supply

2

MAIN RESULTS OF THE VISION STATEMENTS

Brescia: Monte Isola & Collebeato

Mantova: Oltrepò mantovano & Curtatone

3

STRATEGY & IMPLEMENTATION

Targets for the Investment Plan

Responsibilities

4

ROADMAP TO IMPLEMENTATION

Timeline

Costs

Funds

Impacts

Monitoring



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EXECUTIVE SUMMARY

4 AMOD investment plans from the 4 PTAs of ArtMED with input from the AMOD impact assessment tool. Each investment plan entails different investment stages for 2 local use cases per PTA. It determines the amount of vehicles to be purchased/hired, staff and maintenance cost, possible revenue streams and the resulting required public investment.

PP05 ALOT Investment Plans will be developed for 2 territorial areas of the Lombardy Region:

1. Province of Brescia (BS): Municipality of Monte Isola; Municipality of Collebeato
2. Province of Mantova (MN): Oltrepò Manovano – Destra Secchia; Municipality of Curtatone.



To redefine mobility by providing a transportation solution that is autonomous, safe, eco-friendly, and easily accessible, creating a future where everyone can move freely and without barriers

Develop strategic investment plans for PTAs through in-depth analysis of data provided by the AMOD impact assessment tool. Each plan will be designed to cover various local use cases and will include



1

INTRODUCTION

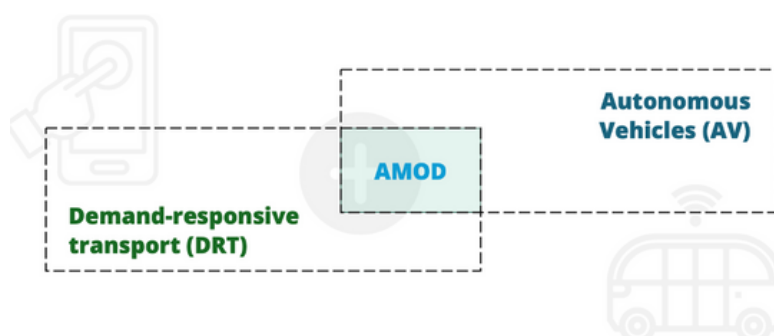
Public transport (PT) accessibility in sparsely populated Euro-MED areas is often poor or non-existent (ESPON Policy Brief, 2020). This leads to 40,6 million people in Euro-MED that are either poorly connected with social networks and basic services (education, medical service, commerce, culture, etc.) or heavily depending on private cars to access them (IEMED, 2021). Reliance on private cars causes significant CO₂ emissions. An example of this private car dependency is seen in the surrounding villages of Postojna, Mali Otok, Veliki Otok, and Stara Vas, which are currently not connected to the urban centre by public transport.

The root cause of the lack or low quality of PT connections in these areas is the high operating costs required to sustain good service frequency and area coverage, given the lack of paying passengers per kilometre. Typically, 85% of bus operators do not break even when offering PT services in these areas (World Economic Forum, 2021).

The AVENUE (H2020) and MultiDEPART (EIT UM) projects successfully developed methodologies to assess local impact of AMOD. Currently, these methodologies cannot easily be applied by PTAs outside of these projects. Therefore, the primary objective of ArtMED is enable PTAs to plan for AMOD by transferring methodologies from École Centrale de Lyon (AVENUE) and CARNET (MultiDEPART) to 4 PTAs in Slovenia (PO), Portugal (TML), Italy (ALOT), Greece (PF) and beyond through jointly optimising and implementing a publicly accessible AMOD impact assessment tool in a transnational approach.

The tool will support PTAs in ArtMED to analyse the potential AMOD impact for local use cases and develop: 4 vision statements (for political support), 4 investment plans (for budgeting) and 2 transport model designs (for planning AMOD systems).

As AMOD hardly exists yet in Euro-MED, ArtMED is the first project to make state-of-the-art insights available to PTAs through a user-friendly tool, that assesses AMOD impact to plan for more accessible, inclusive, and sustainable public transport for people in sparsely populated areas.



Objective

To promote an **autonomous, sustainable, and inclusive mobility system** that:



Enhances access to essential services for residents and tourists in the critical areas



Reduces the environmental impact of public transport



Encourages territorial integration between urban, rural, and tourist areas.

Challenges

Accessibility

Pilot areas face difficulties in connecting to major public transport hubs. Reliance on private mobility limits social inclusion, especially for elderly and young populations.

Sustainability

Reducing CO2 emissions and noise pollution through a more efficient transport system.

Innovation and Regulations

Overcoming the slow adoption of regulatory frameworks at the European level. Ensuring safety and data management in autonomous mobility systems.



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Governance

Governance plays a crucial role within an investment plan for the development and implementation of autonomous public transportation solutions. Its importance unfolds across several levels:

- **Definition of Strategic Vision**
- **Development of Laws and Regulations**
- **Planning and Allocation of Resources**
- **Integration of Infrastructure**
- **Engagement of Stakeholders**
- **Monitoring and Evaluation**
- **Communication and Transparency**
- **Promotion of Innovation**

Governance provides the structure, coordination, and support needed to transform a vision of autonomous public transportation into reality, ensuring that investments are effective, sustainable, and embraced by society. Key aspects are represented below:

- **Local and Provincial Administrations:** Central role in planning and supervision.
- **Public Transport Agencies:** Operational implementation of the proposed solutions.
- **Private Stakeholders:** Technological partners for autonomous vehicles and digital infrastructure.
- **Community Engagement:** Promoting dialogue with citizens and associations to ensure project success.



Analysis of market demand supply

The analysis of market demand and supply plays a fundamental role within an investment plan for the development and implementation of autonomous public transportation solutions. This analysis provides essential data to guide strategic decisions and maximize the effectiveness of the project. Below are the key aspects of its role:

Assessing Mobility Demand

- Identifying user needs:
- Demand segmentation
- Demand growth projection

Evaluating Existing Transportation Supply

- Mapping current solutions
- Competitiveness analysis
- Integration with existing systems

Identifying Market Opportunities

- New market segments
- Innovative business models

Summary of the Analysis of market demand supply

Monte Isola – Province of Brescia

- Demand focused on tourists during the high season and local residents.
- Limited supply relying on traditional transport modes with fixed routes.

Collebeato – Province of Brescia

- Demand driven by commuters (students, workers) and local residents.
- Temporary shuttle service lacks long-term sustainability.

Oltrepò Mantovano Destra Secchia – Province of Mantova

- Fragmented demand requiring flexible solutions for small towns.

Curtatone – Province of Mantova

- Heavy use of private vehicles for trips to Mantova.

Territorial framework



Province of Brescia

- A. Municipality of Monteisola
- B. Municipality of Collebeato

Province of Mantova

- C. Oltrepò Mantovano, Destra Secchia
- D. Municipality of Curtatone



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MAIN RESULTS OF THE VISION STATEMENT: FUTURE BENEFITS

Monte Isola

- Improved mobility connections on the island for tourists (and for residents)
- Improved efficiency and frequency of LPT on the island

Collebeato

- Introduction of temporary shuttle to substitute the bus currently out of service

Oltrepò Mantovano Destra Secchia

- Increased public transportation in the 10 municipalities located east of the Secchia River
- Improved connections with the main nodes of the automobile and railway networks located in the conterminous municipalities (Suzzara, San Benedetto Po, Ostiglia)

Curtatone

- Expanded public transport network from the terminus points of the urban area services to the center of Mantua
- Improved the distribution on the last mile



STRATEGY & IMPLEMENTATION



RESPONSABILITIES

Investment Plan Objectives:

- **Coverage:** Extend public transport services to reach underserved areas.
- **Efficiency:** Implement autonomous mobility technologies to reduce operational costs.
- **Inclusivity:** Provide accessible transport for vulnerable groups (elderly, students, people without private vehicles).

Responsibilities

Municipalities and Provinces:

Execution and local coordination roles.

Municipality of Monte Isola
 Municipality of Brescia
 Municipality of Collebeato
 Municipality of Suzzara, San Benedetto Po, Ostiglia,
 Municipality of Curtatone
 Municipality of Mantova
 Province of Brescia
 Province of Mantova
 Consorzio Oltrepò Mantovano

Public Transport Agencies:

Management of fleets and routes.

Agenzia TPL Brescia
 Brescia Mobilità - Brescia Trasporti
 Agenzia TPL Mantova e Cremona

Technological Partners:

Provision of vehicles and service management platforms

Arriva Italia
 APAM

ROADMAP TO IMPLEMENTATION

INTERVENTIONS & TIMELINE

Phase 1

Duration: 0-1 year

Objective: feasibility studies, SHs engagement, initial deployment

Phase 2

Duration: 1-3 years

Objective: pilot testing and supporting infrastructure development

Phase 3

Duration: 3-5 years

Objective: full implementation of services, continuous monitoring

Feasibility Studies:

- Detailed assessments of mobility needs in each cases studies
- Evaluating the technical and financial viability of proposed solutions.

Stakeholder Engagement:

- Workshops with local authorities, public transport agencies, and community groups.
- Creating a communication plan to inform residents about the project.

On demand Service

Deployment:

- Introduction of shuttle services in Collebeato and Oltrepò Mantovano to address immediate mobility needs.

Regulatory Alignment:

- Ensuring compliance with regional, national, and European regulations for autonomous mobility.

Pilot Testing of on demand services:

- Deployment of on demand shuttles in cases studies.
- Testing DRT systems in Oltrepò Mantovano and Monte Isola.

Infrastructure Installation:

- Setting up charging stations and digital platforms for fleet management.
- Integrating new services with existing public transport systems.

Community Feedback and Adjustments:

- Collecting and incorporating user feedback to refine routes, schedules, and service features.

Training and Capacity

Building:

- Training LPT operators and staff on autonomous systems and digital platforms.
- Awareness campaigns to familiarize residents with autonomous services.

Full Deployment of Services:

- Expanding autonomous mobility solutions to additional areas based on pilot results.
- Ensuring integration with regional and intercity transport systems.

Optimization of Services:

- Refining operational models based on monitoring data.
- Scaling the use of real-time data for route optimization

Monitoring and Reporting:

- Continuous performance evaluation
- Public dashboards to provide real-time updates on service performance.

Sustainability Planning:

- Securing long-term funding for service maintenance and upgrades.
- Establishing a roadmap for future expansions and technology upgrades.



COSTS

A comprehensive **analysis of costs and funding sources** is essential to ensure that the project is sustainable and financially feasible. This chapter describes cost estimates, major cost items, potential funding sources, and management of funds, based on the Tool developed within the ArtMED project. Below an overview of the Total cost of service for the cases studies of the Province of Brescia: Monte Isola and Collebeato.

SV = single vehicle

EF = entire fleet

Monte Isola

Capital Expenditures

	ICE Bus
Technology and Infrastructure EF	40,000.00 €
Facilities EF	150,000.00 €
Charging/Fueling Infrastructure EF	50,000.00 €
Total	240,000.00 €

Operating Expenditures

	ICE Bus
Vehicle Costs EF	90,000.00 €
Personnel Costs EF	160,000.00 €
Operational costs EF	290,000.00 €
Total	540,000.00 €

Externalities

	€ pass/km	€ veh/km
Accident costs	0.006 €	0.119 €
Airpollution costs	0.010 €	0.190 €
Noise costs	0.009 €	0.169 €
Congestion costs	0.029 €	0.567 €
Climate change costs	0.005 €	0.100 €
Well-to-thank emissions costs	0.002 €	0.043 €
Habitat damage costs	0.001 €	0.017 €
Total	0.06 €	1.20 €

KPIs

	ICE Bus
Cost per vehicle/km	1.42 €
Cost per passenger/km	0.07 €
Cost per vehicle/km (with ext)	2.63 €
Cost per passenger/km (with ext)	0.14 €

Collebeato

Capital Expenditures

	ICE Bus
(Vehicle procurement SV)	(280,000.00) €
Technology and Infrastructure EF	40,000.00 €
Charging/Fueling Infrastructure EF	15,000.00 €
Total	55,000.00 €

Operating Expenditures

	ICE Bus
Vehicle Costs EF	15,000.00 €
Personnel Costs EF	200,000.00 €
Operational costs EF	37,000.00 €
Technology and Infrastructure EF	5,000.00 €
Total	257,000.00 €

Externalities

	€ pass/km	€ veh/km
Accident costs	0.011 €	0.219 €
Airpollution costs	0.009 €	0.175 €
Noise costs	0.006 €	0.107 €
Congestion costs	0.023 €	0.458 €
Climate change costs	0.006 €	0.107 €
Well-to-thank emissions costs	0.002 €	0.038 €
Habitat damage costs	0.001 €	0.025 €
Total	0.06 €	1.13 €

KPIs

	ICE Bus
Cost per vehicle/km	5.29 €
Cost per passenger/km	0.15 €
Cost per vehicle/km (with ext)	6.42 €
Cost per passenger/km (with ext)	0.21 €



FUNDS

To cover the projected costs, the plan combines resources from multiple funding sources:



European Union Grants

Horizon Europe: Funding for research and innovation projects focused on sustainable mobility and smart cities.

Interreg Europe: Cross-border cooperation programs aimed at improving accessibility and territorial integration.

CEF (Connecting Europe Facility): Financing for the development of transport infrastructure.



National and Regional Contributions

Lombardy Region: Co-financing for infrastructure and technological projects aligned with regional development plans.

Ministry of Infrastructure and Transport: Funds dedicated to improving the local public transport network.



Local Authorities

Provincial Budgets (Brescia and Mantova): Support for operational and infrastructural expenses through local budget allocations.

Municipal Contributions: Funding specific initiatives, such as temporary shuttle services and community awareness campaigns.



Public-Private Partnerships

Collaboration with Transport and Technology Companies: Joint investments in developing autonomous fleets and digital platforms.

Contributions from Private Operators: Support from private stakeholders, including transport consortia and infrastructure management companies.



Other Potential Source

Carbon Credit Programs: Financing through the sale of carbon credits for sustainable mobility projects.

Tourism Taxes: Allocating a portion of local tourism taxes to fund transport infrastructure in tourist-focused areas, such as Monte Isola.

ACTIVITIES TIMELINE

Activity	Year 1	Year 2	Year 3	Year 4	Year 5
Feasibility studies	█				
Stakeholder engagement	█	█			
On demand service deployment	█	█			
Pilot testing		█	█		
Infrastrucrure installation		█	█		
Real time booking system deployment		█	█		
Full deployment			█	█	█
Continuous monitoring			█	█	█
KPI evaluation		█	█	█	█
Sustainability planning			█	█	█





IMPACT

The implementation of autonomous mobility solutions in the provinces of Brescia and Mantova will generate a **wide range of impacts**. These are categorized into **environmental, social, economic, and technological benefits**, ensuring a holistic understanding of the value delivered.

Environmental Impacts

1. Reduction in CO2 Emissions:

- Transitioning from private cars to (e) on demand vehicles will significantly reduce greenhouse gas emissions.
- Expected reduction: **30% in CO2 emissions from transportation** in the pilot areas by the end of the 5th year of deployment.

2. Reduction in Noise Pollution:

- The use of quieter e-vehicles will improve the quality of life, particularly in residential and tourist areas like Monte Isola with a **40% of noise pollution reduction**
- Positive effects are anticipated in rural areas such as the Oltrepò Mantovano, where current noise levels impact natural ecosystems.

3. Promotion of Green Mobility:

- Encouraging modal shifts from private vehicles to on demand transports could bring a **25% of private vehicles reduction** by the end of the 5th year of deployment.
- Integration of bike-sharing and pedestrian pathways with the new transport network could contribute to a greener mobility system.

4. Efficient Land Use:

- Reduced need for extensive parking infrastructure will free up urban and rural spaces for other uses.

Economic Impacts

1. Cost Savings for Users:

- Shared on demand services will reduce the cost of mobility for residents by offering affordable alternatives to private car ownership.
- Reduction in travel expenses due to more efficient routes on demand services, with a range of **€500-€1000 saved per household annually**.

2. Job Creation:

- Short-term: employment in infrastructure development
- Long-term: Jobs in fleet management, maintenance, and digital service platforms.

3. Boost to Local Economies:

- Increased economic activity in pilot areas, driven by improved connectivity and accessibility.
- Tourism-related revenue growth in Monte Isola and Oltrepò Mantovano.

4. Operational Efficiency for Public Transport Providers:

- Reduced operational costs due to automated systems requiring fewer drivers.
- Expected decrease in costs: **~15-20% over traditional public transport systems**.

Social Impacts

1. Improved Access to Services:

- Expanded mobility options will connect less served areas to essential services. Curtatone residents will have improved last-mile connectivity to Mantova's urban core with a possible **increase of 40% among target populations in public transport users**

2. Enhanced Social Inclusion:

- Elderly populations, students, and those without private vehicles will benefit significantly from increased public transport options.
- Tailored solutions, such as demand-responsive transport (DRT) systems, will ensure inclusivity.

3. Tourism Development:

- Enhanced mobility in Monte Isola will attract more tourists, improving local economic activity and cultural exchange, with a possible increase of **20% of annual visits**
- Sustainable tourism practices will be promoted by providing low-impact transport solutions.

4. Quality of Life Improvements:

- Reduced traffic congestion and shorter travel times will improve daily life for commuters in areas like Collebeato and Oltrepò Mantovano
- Health benefits from cleaner air and less noise pollution.

Technological Impacts

1. Advancement of Smart Mobility:

- Introduction of real-time booking systems and data-driven transport planning.
- Use of IoT devices to optimize fleet operations and monitor performance.

2. Infrastructure Modernization:

- Deployment of digital infrastructure, such as charging stations and connectivity systems, which can be scaled for future projects.

3. Increased Data Accessibility:

- Collection and analysis of mobility data to inform urban planning and policymaking.
- Development of open data platforms for transparency and innovation.

4. Resilience Against Future Challenges:

- The AV and on demand ecosystem's flexibility will make it more adaptable to demographic changes, pandemics, or environmental disruptions.





MONITORING

The monitoring phase is essential to ensure the successful implementation, evaluation, and continuous improvement of the mobility solutions. Below is a detailed breakdown of the monitoring approach:

Monitoring Tools and Methods for the case studies:

Data Collection:

- On-the-ground sensors: Monitoring traffic, vehicle usage, and emissions in real-time.
- Surveys and Interviews: Collecting qualitative feedback from users, residents, and stakeholders.
- Digital Platforms: Aggregating data from booking systems, fleet management tools, and public transport apps.

Technological Integration:

- Autonomous Fleet Telemetry: Tracking vehicle performance, energy consumption, and safety metrics.
- IoT Devices: Measuring environmental impact (e.g., air quality sensors) in pilot areas.
- GIS Mapping: Visualizing the service coverage area and identifying gaps.

Stakeholder Engagement:

- Regular workshops with local governments, transport agencies, and community representatives to review progress.
- Transparent communication through public reports and dedicated web platforms.

Key Performance Indicators KPIs:

Environmental KPIs:



- Reduction in CO2 emissions (%) compared to baseline data.
- Reduction in noise and acoustic pollution levels in the 4 case studies
- Increase in the share of electric or autonomous vehicles used.

Operational KPIs:



- Increase in public transport coverage (km of service area extended).
- Average service response time for demand-responsive transport.
- Punctuality rate of shuttle and autonomous services.

Social KPIs:



- Increase in the number of public transport users, particularly among target groups (elderly, students, tourists).
- Improvement in user satisfaction scores through surveys.
- Reduction in the percentage of the population relying solely on private vehicles.

Economic KPIs:



- Cost per trip for users and operators.
- ROI (Return on Investment) metrics for new infrastructure and technologies.
- Jobs created in relation to the implementation and operation of services.

LIST OF ABBREVIATION

VS: Vision Statement

IP: Investment Plan

AMOD: Autonomous mobility on demand

BS: Brescia

MN: Mantova

PT: Public Transport

TPL: Local Public Transport

EU: European Union

KPI: Key Performance Indicator





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