European CCAM Outlook 2026

A strategic guide to AV service models, governance and deployment pathways for European public transport

Interreg Europe
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NEXT RIDE

More information

Authors

Madeleine van der Poort, Provincie Noord-Brabant
Lars Meijer, Provincie Noord-Brabant
Nuria Meerschaert, Bax Innovation
Christian Riester, Bax Innovation

Contributors

Jorgen Kjer, Ruter
Liisa Andersson, Ruter
Andrea de Candido, European Commission
Suzanna Kraak, European Commission
Elsa Lanaud, French Transport Ministry
Romain Pessia, French Transport Ministry
Laura Babío, POLIS
Dr. Patrick Dittmer, Ministry for Traffic and Mobility Transition Hamburg

And the rest of the NEXT RIDE partnership:

Koen Schietecatte, De Lijn
Martin Schiefelbusch, NVBW
Patricia Liberatore, NVBW
Luke Genuis, Transport for Malta
Ritianne Buhagiar, Transport for Malta
Anton Hagen, Association Energy Efficient Cities of Ukraine (UA)
Viktor Zagreba, Association Energy Efficient Cities of Ukraine (UA)
Alexandrina Kiss, Cluj Metropolitan Area
Maja Piškur, Municipality of Hrpelje-Kozina

Design

Mathis FAY, Bax Innovation

Find out more at:

https://www.interregeurope.eu/next-ride

European Commission

French Transport Ministry

Ruter

Polis

Provincie Noord-Brabant

Ministry for Traffic & Mobility Transition Hamburg

De Lijn

NVBW

Municipality Hrpelja-Kozina

Cluj Metropolitan Area

Association Energy Efficient Cities of Ukraine (UA)

Transport Malta

Bax Innovation

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1. Introduction

This study is intended to support European public transport authorities and operators (PTAs/PTOs) as autonomous vehicle deployment moves from isolated pilots towards real service, policy and procurement decisions.

For European public transport, the central question is no longer simply whether the technology works, but how autonomous mobility should be governed, integrated and scaled in ways that support public transport objectives such as accessibility, network efficiency, coverage, affordability and sustainability.

By examining where AV deployment has moved beyond experimentation into repeatable public-facing service, the study identifies the governance choices, service models, procurement implications and regulatory conditions that matter most for European PT actors.

Its purpose is to help PTAs and PTOs make more informed decisions about the role AVs could play in their future networks, and under which institutional, operational and commercial conditions.

Scope of the report

The study provides a strategic review of the global and European AV landscape, tailored specifically to the needs of the public transport sector. It does not aim to be a scientific paper or an exhaustive market census. Instead, it brings together practical input from different sources to extract the most decision-useful lessons for European PTAs and PTOs.

These sources include the authors' own observations from international study trips (e.g. to Beijing, Guangzhou and Shenzhen in 2025), notes and discussions from industry events such as ITS Europe 2025 and the Smart City Expo / Tomorrow. Mobility 2025, interviews with stakeholders like the European Commission, Ruter, Hamburg's mobility administration, POLIS, the French Transport Ministry and NEXT RIDE partners, as well as desk research.

In this context, the report focuses in particular on operating models, governance structures, financing and risk allocation, regulatory readiness, and the practical realities of integrating AV services into wider transport systems. It looks at international frontrunner regions such as the United States, China, the Middle East and Asia-Pacific not to provide a full technology scan, but to clarify what is most relevant and transferable for European public transport.

Within Europe, it examines both emerging commercial robotaxi activity and PT-integrated autonomous shuttles and buses, before turning to three leading flagship initiatives in Europe.

The report also includes a partner-oriented regulatory thought exercise that translates the broader discussion into a practical question for European PT actors: what would a PTO or PTA actually need to do, check and prepare in its own regional context to move from interest in AVs to a real deployment pathway?

About NEXT RIDE

This report was developed in the context of the NEXT RIDE project, which is funded by Interreg Europe and focuses on helping European regions prepare for the integration of Cooperative, Connected and Automated Mobility (CCAM) into future public transport policy.

In this sense, the report provides practical strategic guidance for regions and public transport organisations that need to translate AV developments into policy, planning and implementation choices.

ADS	Automated driving systems
AVs	Autonomous vehicles
BW	Baden-Württemberg
CCAM	Connected, cooperative and automated mobility
DPIA	Data protection impact assessment
EC	European Commission
EP	European Parliament
EU	European Union
FSD	Full self-driving
GDPR	General data protection regulation
GSR	General safety regulation
HD	High definition
KPIs	Key performance indicators
L4	Level 4
MoU	Memorandum of understanding
ODD	Operational design domains
OEM	Original equipment manufacturer
PT	Public transport
PTA	Public transport authority
PTO	Public transport operator
R&D	Research & development
RDW	Rijksdienst voor het Wegverkeer
SUV	Sport utility vehicle
TBD	To be decided
UAE	United Arab Emirates
UnGTRs	United Nations Global Technical Regulations
UNECE	United Nations Economic Commission for Europe
US	United States

2. Global AV deployment patterns and operating models

Autonomous vehicle technology has moved beyond experimentation in a limited number of global markets and is beginning to operate as a repeatable public-facing service. Meaningful progress is concentrated in a small group of frontrunner regions, most notably the United States and China, with early commercial deployments also emerging in the Middle East and more methodical public-transport-oriented pilots go ahead in parts of Asia-Pacific. While Europe remains largely at pilot stage, understanding which elements of these international deployments are actually transferable into a European public transport context is crucial.

2.1. Where AV progress is real, beyond hype

It is easiest to distinguish progress from hype when autonomous vehicles have become an actual service that can be used by the public: customers can order a ride through a mainstream app, and the service operates day after day within a defined operating domain. The operator can also demonstrate continuous, driverless rides. Globally, only a few markets have reached this level of maturity. The patterns below highlight the main players, the observable signs of maturity, and the types of service that are currently operating.

2.1.1. United States: operational robotaxi scale exists, but it remains narrow and capital-intensive

In the United States, one company has successfully developed a large-scale, paid driverless ride-hailing service: **Waymo** (backed by Alphabet). Through app-based ordering, its operations e.g. in Phoenix, San Francisco and Los Angeles, as well as its expansion into additional markets, have moved the US discussion from 'technical pilots' to an operational reality with strong demand.

As of March 2026, Waymo reported 500,000 fully autonomous paid trips per week across its active markets. The company's own safety dashboard also reports 127 million rider-only miles and through September 2025. Waymo reported **>1,500 vehicles** across its main markets in 2025; while late-2025 reports placed the fleet at **~2,500**. While the service type is straightforward (urban ride-hailing), the signal of maturity is less about the vehicle and more about the operating system, encompassing areas such as dispatch, charging, cleaning, incident handling, customer support and the safety case work required for expansion into additional cities.

Tesla is the most visible 'alternative path' in the US, but it is important to distinguish between its consumer products and its robotaxi operations. Full Self-Driving (Supervised) is marketed as an advanced driver-assistance feature, and Tesla explicitly states that active driver supervision is required and that the vehicle is not autonomous. In parallel, Tesla began a limited robotaxi trial in Austin in June 2025, operating a small fleet of around ten vehicles alongside a front-seat safety monitor and remote monitoring. Communications from late 2025 indicate an ambition to remove in-vehicle monitors as confidence and regulatory comfort increase. However, this remains an early-stage trial rather than a mature, public, driverless service. Regulatory scrutiny continues to be a significant constraint, including federal investigations into FSD performance.

Zoox (backed by Amazon) is another US programme that matters because it is developing a purpose-built robotaxi vehicle and a staged early-rider launch strategy. It has been offering free rides to selected passengers in specific areas (initially in Las Vegas and subsequently in parts of San Francisco) and has announced plans to begin charging for rides in Las Vegas in early 2026, with the Bay Area expected to follow later. In other words, Zoox is transitioning from a controlled access model to commercialisation, though it is not yet operating at a scale comparable to Waymo.

Beyond these three categories, the broader US field is increasingly divided between:

1. Large-scale, fully driverless robotaxi operations.
2. City and campus-oriented deployments that prioritise controlled operating environments and integration with existing mobility services.

May Mobility is a notable example in the latter category. It has developed a range of municipal and district services and is now expanding through collaborations with major platforms, including a robotaxi pilot service launched with Lyft in Atlanta in September 2025 and a multi-year agreement with Uber to integrate May Mobility AVs into the Uber platform, beginning in Arlington, Texas. In Arlington, the AV fleet has been integrated into the city's on-demand transit service, including the booking process and fare payment.

This offers a concrete example of how AVs can be embedded into public mobility services rather than being operated as standalone tech demonstrations.

2.1.2. China: mature environment for robotaxi scaling, enabled by city-led governance and rapid cost reductions

China remains one of the most mature ecosystem for scaling robotaxi services because the operating model is industrialised alongside the vehicle. Authorities typically permit operations through geofenced operating domains, staged expansions, and formal oversight requirements, creating a predictable pathway from trial to wider service (see for example the Beijing High-Level Autonomous Driving Demonstration Zone).

Baidu's Apollo Go is the clearest indicator of maturity. In Q3 2025, Baidu reported 3.1 million fully driverless rides; by late October 2025, this figure had risen to over 250,000 per week. Disclosures in November 2025 indicated that cumulative rides provided to the public had surpassed 17 million, with services spanning 22 cities. While the service type remains primarily ride-hailing robotaxis, the differentiator lies in the system context: cities act not only as regulators, but also as integrators of rules, data reporting and operational oversight.

China also illustrates why unit economics are becoming the decisive battleground. Baidu has publicly stated that the unit cost of its RT6 robotaxi has fallen to around 250,000 yuan (approx. €30k as of Feb 2026, down from approximately 480,000 yuan / €60k for the previous model, without VAT and cost of the battery!), which is an example of how purpose-built platforms and domestic supply chains can reduce capital costs.

Other leading Chinese operators are progressing in parallel. **Pony.ai**, for example, received the first citywide permits for fully driverless commercial robotaxi operations in Shenzhen in late 2025, with initial operations in selected districts and planned expansion citywide (apart from signing new collaboration agreement e.g. with Bolt in Europe). **WeRide** continues to expand operations across several markets (including outside China) and is increasingly visible through partnerships that use mainstream ride-hailing platforms like Uber.

For European PTAs/PTOs, China's most transferable learning is the combination of governance instruments (clear permit structures, stage-gated ODD expansion, central monitoring expectations) and cost-down dynamics that make scaled service plausible. This also explains why Chinese firms are preparing international expansion, including announced partnerships and preparations for European market entry subject to regulatory approvals.

2.1.3. The Middle East: the Gulf is shortening timelines via public sponsorship and "sandbox-to-scale" permits

The Middle East, and especially the Gulf, is emerging as a relevant region for AV deployment because it combines strong political sponsorship, structured permitting pathways and a high public-sector willingness to accelerate market formation. Unlike in more market-led environments, AV deployment in the Gulf is typically not left to private operators alone. Transport authorities actively shape the conditions for rollout through strategic roadmaps, trial permits, formal partnerships and staged pathways from supervised pilots to commercial service.

The UAE illustrates this model most clearly. In Dubai, the Roads and Transport Authority (RTA) is pursuing a long-term strategy to increase the share of smart and driverless transport, supported by a dedicated legal framework for AV operations and a series of partnerships with major operators including WeRide, Baidu Apollo Go and Pony.ai. In Abu Dhabi, the Uber–WeRide partnership has already moved from supervised service into fully driverless public commercial operations in selected areas. The significance of these examples lies less in the exact launch chronology than in the institutional setup: public authorities are not only permitting AV services but actively organising the regulatory and operational pathway for scaling them.

Saudi Arabia is following a similar logic through national regulatory preparation, flagship projects such as NEOM, and strategic capital backing for AV players. Here too, the model is characterised by close alignment between policy ambition, regulatory enablement and investment capacity. Across the Gulf, AV deployment is therefore best understood as a government-led market-making process rather than a purely commercial rollout.

For European PTAs and PTOs, the main lesson is that deployment timelines can be shortened significantly when public authorities combine political commitment, clear permit structures and active sponsorship of early service models. At the same time, this approach depends on governance conditions, institutional powers and public risk appetite that may not be directly transferable to Europe. The Gulf is less a template to copy than a clear demonstration of how strongly deployment speed depends on public-sector intent and regulatory choreography.

2.1.4. Asia-Pacific: methodological PT integration and stepwise enabling regulation

Asia-Pacific offers a useful contrast to the more commercially driven AV trajectories seen in the United States and China. The region's most relevant examples are characterised less by rapid robotaxi scaling and more by methodical public transport integration, regulatory discipline and conservative rollout. For European PTAs and PTOs, this makes Asia-Pacific particularly relevant: it shows how AV deployment can be advanced through tightly managed, step-by-step introduction into existing mobility systems rather than through immediate large-scale commercialisation.

Singapore is the clearest example of this approach. Its AV strategy is closely tied to public transport operations and supported by a structured regulatory framework for testing, safety evaluation, insurance and operational approval. The planned introduction of autonomous buses on live public routes from 2026 illustrates a model in which AVs are treated as part of the regulated transport system, operating alongside conventional services and under staged safety oversight. The emphasis is not on disruptive market entry, but on controlled integration into an existing PT offer.

Japan reflects a similarly cautious but purposeful trajectory, shaped by demographic pressures and rural mobility needs. Its Level 4 deployments remain small-scale, low-speed and tightly bounded, but they are embedded in a national logic of gradual replication. The significance lies in the creation of a repeatable operational and regulatory model for underserved areas. This shows how AVs can be framed not only as an innovation agenda, but also as a pragmatic response to structural mobility challenges.

South Korea adds a third variation: structured urban pilots linked to designated operating zones and mainstream digital mobility platforms. Services such as Seoul's late-night autonomous taxi trials remain limited and closely validated, but they demonstrate how AVs can be introduced through familiar customer interfaces while regulators retain a cautious, stepwise approach to expansion.

For European PTAs and PTOs, the main lesson from Asia-Pacific is that AV deployment does not have to begin with a race for commercial robotaxi scale. A credible pathway can also be built through conservative operating domains, strong regulatory gatekeeping and gradual integration into public transport and wider mobility systems. In that sense, Asia-Pacific provides some of the most institutionally transferable lessons for Europe, even if its deployments remain more measured than those of the main global frontrunners.

2.1.5. Europe: strong governance, but services are still mostly pilot-stage

Europe's AV ecosystem is characterised by strong engineering capacity and rapidly maturing legal frameworks (notably in Germany and France), but the service reality is different from the US and China. Deployments remain largely dominated by supervised pilots, limited operating domains, and public-transport-oriented shuttle or bus use cases rather than large, paid, fully driverless ride-hailing. At the same time, several credible "inbound" announcements point to 2026 as a transition year, with planned tests and platform integrations by major global players and European partners. The European context will be explained in more detail in part 3 later.

What the frontrunners have in common

Despite major differences in regulatory systems and service models, the markets that have moved beyond AV hype into repeatable public service operations show a similar set of enabling conditions:

1. Services are deployed within clearly defined operational design domains (ODDs), with staged expansion based on accumulated evidence rather than open-ended rollout.

2. Permitting is structured progressively, allowing operators to move from supervised trials to wider commercial operations under formal oversight.

3. Success depends not only on vehicle technology, but on industrialised day-to-day operations, including dispatch, remote support, charging, cleaning, maintenance and incident handling.

4. Responsibility for safety is clearly allocated, both for routine operations and for changes such as software updates or ODD expansion.

5. Scaled deployment is typically supported either by strong private capital backing or by active public support and policy commitment.

6. Services are made accessible through mainstream customer interfaces, such as large ride-hailing apps or integrated public transport channels, rather than remaining isolated demonstrations.

7. Frontrunners are increasingly focused on unit economics, recognising that long-term viability depends not just on technical performance, but on whether AV operations can be repeated at acceptable cost.

2.2. From pilots to service models: governance, financing and risk allocation

Once autonomous vehicle deployments move beyond one-off demonstrations, the central issue changes. The question is no longer simply whether the vehicle can operate autonomously in a defined setting. What matters now is whether the service around that vehicle can run reliably, be governed transparently and remain operational when problems occur. Supervision arrangements, incident response, charging and depot routines, customer support, data access and the rules for expanding the operating domain all become part of the real deployment model.

This is why international AV progress is increasingly best understood through service models rather than through the vehicle types being deployed. Similar technologies can lead to very different outcomes depending on who controls the operation, who owns the customer interface, what data is available for oversight, and how financial and operational risks are distributed between the public and private sectors. In practice, these choices shape whether AVs emerge as a commercial ride-hailing product, a contracted public service, a publicly controlled fleet, or a hybrid model mediated through platforms.

For European PTAs and PTOs, this distinction is critical. Europe is unlikely to scale AV services through a single dominant pathway. Public-service obligations, procurement rules and political expectations will produce a more mixed landscape in which different service models may fit different use cases. The relevant question is therefore not whether AV deployment is – simply put – public (as in "AVs in public transport") or private (as in "private robotaxis").

The following sections set out five operating models that can already be observed internationally. They are not rigid categories, and real deployments often combine elements from more than one model. Still, they provide a useful framework and discussion basis for understanding how AV services are being organised today and what the main implications are for European public transport authorities and operators.

2.2.1. Five operating models observed as of early 2026

Across the international deployments reviewed in this document, AV services are beginning to cluster around a limited number of operating models.

These models differ mainly in four respects: who owns the vehicles and enabling assets, who carries the commercial risk, who controls the passenger interface, and how much influence public authorities keep over service design and data access.

For European PTAs and PTOs, these distinctions matter because they shape far more than procurement structure. They determine what can be steered in practice, how resilient the service is over time, and where financial, operational and political exposure lies.

The purpose is to clarify the trade-offs each model creates for public authorities and operators: control versus flexibility, public oversight versus speed of deployment, and lower capital exposure versus weaker influence over customer access, service design and strategic data.

Independant Commercial Operator	Managed Service Contract	Public Fleet with Licensed Automation	Regulated Market-Entry Model	Platform Aggregator Model
Private entity assumes full asset & commercial risk. Operates independantly, no direct public role. **Example:** Waymo One.	Public authority defines service parameters. Private firm contracted for delivery; public retains control. **Example:** Hamburg ALIKE.	Public sectors owns fleet & infrastructure. Licenses automation software from technology vendor. **Example:** Fixed-route shuttles.	Authority grants operating permit under specific rules. Private operator manages commercial risk. **Example:** Abu Dhabi / Dubai.	Digital platform connects users to third-party fleets. Platform owns customer interface and data. **Example**: Uber + Waymo.

Model	Vehicle / Asset risk	Commercial (fare/ utilisation) risk	Passenger interface and data control
Model 1: Independent Commercial Operator Model	Private	Private	Operator / proprietary app (sometimes distributed via platforms)
Model 2: Managed Service Contract Model	Private (typically)	Public	Public transport channel / app by design
Model 3: Public Fleet with Licensed Automation Model	Public	Public	Public transport channel / app
Model 4: Regulated Market-Entry Model	Private	Private (within public constraints)	Concessionaire under public rules, often co-branded
Model 5: Platform Aggregator Model	Private (third party fleets)	Private (shared across platform and fleet operators)	Platform controls booking, payment and customer relationship

2.2.2. Model 1: Independent Commercial Operator Model

Under the Independent Commercial Operator Model, a private AV operator launches and scales a service on public roads within general licensing and safety frameworks. No public authority acts as a direct counterparty for service delivery. Capital risk, operating risk and commercial risk therefore sit primarily with the operator, while public agencies have limited contractual leverage over service design, coverage and data access.

In the United States, Waymo One remains the clearest large-scale reference point for this model. In its core own-app markets (Phoenix, San Francisco and Los Angeles) Waymo operates a fully autonomous public ride-hailing service that users access directly through the Waymo app.

What makes this model important is not only that the vehicles drive without a human behind the wheel, but that the surrounding service has become operationally repeatable. Fleet logistics, uptime, charging, cleaning, customer support and incident handling become the real constraints once the technology moves beyond pilot stage.

Some operators now combine this model with platform-based distribution in certain cities. Waymo's arrangements with Uber in Austin and Atlanta illustrate that shift: there, customer access sits within Uber's app rather than the operator's own channel. That hybrid setup is better treated under Model 5, because the platform then controls the primary passenger interface and dispatch layer.

From a public transport perspective, the defining feature of Model 1 is that the passenger relationship and most commercially relevant data remain proprietary by default. Authorities typically receive what regulation requires (for example safety reporting and incident disclosures) but not full access to operational logic or detailed trip data. The service is therefore shaped above all by the operator's commercial priorities: where demand is strongest, where utilisation is highest and where service expansion is easiest to justify economically.

Public financial exposure is low under this model because no direct subsidy or fleet investment is required. The main public risks sit elsewhere:

- Kerbside and traffic-management impacts that can affect bus operations and street use;
- Limited ability to steer coverage, accessibility or integration outcomes;
- Growing dependence on private operators if AV adoption accelerates in commercially attractive corridors.

Figure 4-2. Model 1 at a glance

Who owns the vehicles	Private AV operator (fleet on operator balance sheet)
Who pays for operations	Private operator (fare revenue supplemented by corporate funding)
Who controls dispatch and customer interface	Operator app by default; sometimes platform-mediated distribution for scale
What public authorities typically receive	Regulatory reporting and incident disclosures; limited operational OD data
Main implication for European PT	Low public capex, but limited control over integration, data and network effects

2.2.3. Model 2: Managed Service Contract Model

In the Managed Service Contract Model, a PTA or PTO defines the public service outcome. This includes where and when the service runs, the intended role in the wider network, and the expected quality level. In this model, a private partner or consortium delivers the service for a contracted fee. Vehicles usually remain privately owned, and day-to-day delivery sits largely with the contracted operator. Public control is exercised mainly through the contract: service specifications, KPIs, reporting obligations and penalties for underperformance.

This model is institutionally attractive in Europe because it fits familiar public-service contracting logic while avoiding early public ownership of fast-evolving AV assets. At the same time, the number of live, passenger-facing examples remains limited. A stronger current reference point is **Ruter's autonomous on-demand pilot in Groruddalen (Oslo)**. Ruter describes the service as part of its work on shared, autonomous demand-responsive transport integrated into public transport, states that the pilot was opened to everyone on **3 February 2025**, and notes that it is operated together with its R&D supplier **Holo**. In December 2025, Ruter also announced an updated agreement under which Holo continues to operate the pilot while **MOIA** supplies vehicles, software and the customer interface for the next phase from 2026.

The financial logic is usually close to a **gross-cost model**. Fare policy and revenue responsibility remain with the public side, or the service is embedded in a subsidised public offer, while the private partner is paid for service output and reliability, for example through vehicle hours, kilometres, availability or trip completion. In the early stages, costs often remain high because staffing and supervision are still intensive. Contracts therefore need enough flexibility to accommodate a changing operating concept as evidence builds and labour intensity gradually falls. This is one of the model's main strengths: it allows authorities to shape the service while preserving room to adapt the delivery model over time.

For European PTAs and PTOs, the main advantage is that fleet ownership and much of the technology-upgrade risk can stay off the public balance sheet, while service design, branding and public-service obligations remain controllable/adaptable through the contract. The main vulnerability is the delivery chain. If a key operator or technology supplier underperforms, withdraws or collapses, service continuity can be difficult to protect unless the contractual setup is robust from the outset. This model works best when a few conditions are built in from the start:

- Clear performance metrics tied to availability, trip completion and reliability;
- Defined reporting obligations on operations and incidents;
- Workable step-in, replacement or transition provisions if a supplier fails; enough contractual flexibility to reflect the likely evolution from conservative early operations to lower-touch supervision over time.

Figure 4-3. Model 2 at a glance

Who owns the vehicles	Private partner (operator and/or manufacturer)
Who pays for operations	PTA/PTO pays a contracted fee tied to service output and availability
Who controls dispatch and customer interface	Publicly shaped by design, though the operational back-end may sit with the supplier and the user interface may initially run through a dedicated service app
What public authorities typically receive	Service-performance and ridership reporting; deeper technical logs often remain with the supplier unless access is specified contractually
Main implication for European PT	Strong alignment with PT objectives without owning early-generation assets, but resilience depends heavily on contract design and continuity protection

2.2.4. Model 3: Public Fleet with Licensed Automation Model

In the Public Fleet with Licensed Automation Model, automated vehicles are treated as part of the regulated public transport offer. The PTA and/or PTO retains control over service design, branding, passenger obligations and day-to-day operating logic, while the automated driving capability is procured as a technology layer rather than as a fully outsourced end-to-end service. This gives the public side the highest degree of control, but it also places more financial and organisational responsibility on the public side.

The defining procurement logic is a **hardware-software split**. Vehicles and supporting assets such as charging infrastructure, depot adaptations and fleet IT are planned as long-term public transport assets. The automation stack is then procured through licensing, support and upgrade arrangements that can, at least in principle, be renewed, adjusted or replaced over time. In practice, that separation is not always clean yet. Still, it is the direction that makes this model strategically attractive for public authorities seeking long-term integration without full dependence on a single supplier.

A stronger current reference point is **Singapore's autonomous bus pilot**. In October 2025, the Land Transport Authority awarded a contract for the pilot deployment of autonomous buses on two public bus services, with **six autonomous buses** to be introduced from the second half of 2026 for an initial **three-year period**. LTA states that these buses will run alongside existing manned buses as part of a **hybrid fleet**, with the **same fares as the public bus service**, and that **SBS Transit** will be involved operationally while LTA monitors the buses in real time. This does not prove a perfect procurement split between vehicle and automation layer, but it is a strong illustration of a public-authority-led model in which AVs are being incorporated into the regulated bus system rather than procured as a separate outsourced mobility product.

A European analogue is **De Lijn's autonomous bus deployment in Leuven**. De Lijn presents the service as part of its public transport offer: passengers can ride the autonomous bus on **line 16**, the service follows a fixed route of about **4 kilometres** between **Leuven station and Heverlee**, and users access it through De Lijn's normal public transport channels such as the route planner, app and standard ticketing options including app- and SMS-based tickets. That makes Leuven a useful example of public-facing PT integration.

This model is still emerging in practice because it requires capabilities that many authorities are only now beginning to develop. These include:

- safety assurance governance over time, rather than only at the start of a pilot;
- operational routines that integrate remote support into existing control-centre structures;
- procurement approaches that preserve substitutability and reduce long-term vendor lock-in.

The financial logic sits largely on the **public balance sheet**. The PTA/PTO carries capital investment, utilisation exposure and much of the lifecycle risk. That creates clear upsides: better integration with network planning and customer service, less duplication of depots and operational processes, and stronger public control over branding, fares and service obligations. The downside is that technology-upgrade risk can shift to the public sector if sensor, computing or software requirements evolve faster than expected, or if a supplier exits the market. This model becomes materially more robust when procurement protects future flexibility through clear data access, defined interfaces and, where possible, multi-supplier options.

Figure 4-4. Model 3 at a glance

Who owns the vehicles	PTA/PTO (vehicles treated as part of the regulated fleet)
Who pays for operations	PTA/PTO, either directly or through contracted operations under public control
Who controls dispatch and customer interface	Licensed ADS and support services on time-bound or renewable terms, rather than a fully outsourced mobility service
What public authorities typically receive	Public transport channels by design (fares, passenger policies, communications)
Main implication for European PT	Maximum control and integration, but higher exposure to capital cost and technology upgrade risk; robustness depends on avoiding vendor lock-in

2.2.5. Model 4: Regulated Market-Entry Model

In the Regulated Market-Entry Model, a public authority does not directly contract the AV service, but it actively shapes the conditions under which private operators are allowed to enter the market. The core instrument is not a public-service contract or a classic concession. It is a structured framework of permits, licences, operating conditions and staged approvals. The private operator provides the fleet and runs the service at its own risk, while the authority defines where, how and under what conditions commercial operations may begin and expand.

This model is most visible in the Gulf. The UAE examples show a clear pattern: public authorities are not just granting generic permission for AV activity; they are organising a managed process from testing to supervised public service and then, in selected cases, to fully driverless commercial operations. In **Abu Dhabi**, WeRide secured a federal permit for fully driverless robotaxi commercial operations in October 2025, after which the Integrated Transport Centre granted WeRide and Tawasul the first operational licence for a fully driverless commercial robotaxi service. Public commercial operations then began on **Yas Island** on the Uber platform in November 2025. In **Dubai**, Uber and WeRide launched public robotaxi rides in December 2025 in partnership with the Roads and Transport Authority, starting in **Umm Suqeim and Jumeirah** through the Uber app. Earlier in 2025, Dubai's RTA had also signed an MoU with **Pony.ai** for pilot trials and granted test permits to **Apollo Go, WeRide and Pony.ai** for on-road trials in urban Dubai. These cases show authority-led rollout through permits, operational licences and staged approvals. They do not yet clearly demonstrate a classic concession structure with a formal award of exclusive market rights and a fully specified package of long-term commercial obligations. In some jurisdictions, this type of model may evolve into something more concession-like over time.

The financial logic sits largely on the **private balance sheet**. Capital expenditure, operating costs and most commercial risk remain with the operator or its partners, while fare revenue is retained on the private side. The authority's leverage comes from the conditions attached to entry and expansion: operating domains, safety reporting, approval stages, service rules and, in some cases, access to kerb space or designated operating zones. In the early phase, authorities can therefore shape the market without directly funding the fleet.

From a public transport perspective, the attraction of this model is speed. It can produce visible AV services without immediate public capex and allows authorities to influence rollout through licensing and operational conditions. The risk is that public control remains only as strong as the permit framework and its enforcement. If authorities do not define service conditions clearly enough, commercially attractive corridors may be served first while wider integration, accessibility or data-sharing objectives remain weak.

For European PTAs and PTOs, direct replication would be difficult. European procurement, competition and public-service rules leave less room for discretionary authority-led market making of this kind. Still, the model is strategically relevant because it shows how much deployment speed depends on clear public approval pathways, staged expansion logic and active regulatory choreography. In Europe, comparable approaches would more likely take the form of transparent permit regimes, controlled trial-to-service pathways, or market-entry conditions linked to an existing public-service framework (similar to how micromobility services like Lime were managed).

Figure 5-5. Model 4 at a glance

Who owns the vehicles	Private operator or consortium
Who pays for operations	Private operator, recovering costs through commercial service
Who controls dispatch and customer interface	Defined operating domains, permits, licences, staged approvals and operating conditions
What public authorities typically receive	Safety and operational reporting, compliance with permit conditions, and oversight leverage through expansion approvals
Main implication for European PT	Rapid visible service with limited public capex, but outcomes depend heavily on the strength of the regulatory framework and its compatibility with European legal constraints

2.2.6. Model 5: Platform Aggregator Model

In the Platform Aggregator Model, a digital platform controls the customer-facing layer: booking, payment, customer support and, in many cases, dispatch. The platform usually does not own the automated vehicles itself. Instead, it matches demand to one or more third-party fleets and can combine AV supply with conventional ride-hailing vehicles when AVs are unavailable, outside their operating domain, or not yet scaled sufficiently.

What makes this model strategically important is simple: the platform becomes the main **organiser of demand**. Operational responsibility can vary by arrangement. The AV operator may retain control over the automated driving system, safety case and vehicle technology, while fleet management may sit with yet another partner. But from the passenger's perspective, the platform is the service. That gives the platform strong control over customer access, payment flows and a large share of the commercially relevant trip data.

This model is becoming more visible because it solves a scaling problem for both sides:

- **AV operators** gain access to a large existing user base without having to build their own consumer channel in every city;
- **Platforms** can introduce autonomous rides without taking on full fleet ownership risk.

The clearest current examples come from **Uber**. In **Austin and Atlanta**, Uber and Waymo structured the service so that autonomous rides are available only on the Uber app, with Uber managing and dispatching the fleet while Waymo provides the AV system. Riders requesting standard Uber trip categories can be matched with a Waymo vehicle for eligible journeys.

The same logic is visible in the Middle East: in Abu Dhabi, Uber and WeRide launched fully driverless commercial robotaxi operations on the Uber platform in November 2025, while in Dubai they launched robotaxi rides through the Uber app in December 2025, with Tawasul providing fleet management services. These cases also illustrate the regulated market-entry model discussed in Model 4; they are included here because the platform layer (Uber's control of customer access and booking) is the defining feature for this model.

The financial logic is **asset-light platform, asset-heavy fleet**. Fleet owners or fleet partners bear most vehicle and operating costs, while the platform earns through commissions, revenue shares or related platform economics. That creates a strong incentive for platforms to maximise paid utilisation and expand rapidly where demand is dense and profitable. Fleet operators, by contrast, remain under pressure to minimise downtime through charging, cleaning, maintenance and operational readiness.

From a public transport perspective, this model creates a clear governance challenge. Passenger relationships and transactional data are concentrated with the platform by default. Even when public authorities support AV deployment, the main user interface may sit entirely outside the public transport system. As a result, integration with PT does not happen automatically. It has to be required through regulation, permit conditions or specific partnership agreements covering data access, service rules and wider network integration.

Public financial exposure is usually low. Strategic exposure can be high. Platform aggregation can accelerate AV uptake in commercially attractive corridors such as airport links, tourist zones and dense urban districts, but it may also weaken public influence over coverage, multimodal integration and the long-term passenger interface. For European PTAs and PTOs, this model offers a fast route to visible AV deployment, but usually as a parallel ride-hailing layer rather than as an integrated public transport service.

Figure 5-6. Model 5 at a glance

Who owns the vehicles	Third-party fleets (AV operators and/or fleet partners)
Who pays for operations	Fleet owners carry most costs; platform captures commissions or revenue share
Who controls dispatch and customer interface	Platform controls booking, payments and customer relationship; AV operator controls the driving system
What public authorities typically receive	Varies widely; often limited unless data-sharing and reporting are mandated
Main implication for European PT	Fast scaling channel, but high risk that the passenger interface and key data sit outside public transport governance by default

2.2.7. Strategic implications for European PTAs and PTOs

The international deployments that persist are those that have been turned into repeatable services, with workable contracts, clear operating responsibilities and improving unit economics. For European PTAs and PTOs, automation is therefore moving out of the realm of stand-alone innovation projects and into the domain of procurement, service design and operating strategy.

Across the five models, one trade-off appears again and again: **the lower the public capital exposure, the weaker the default public grip on service design, passenger access and data**. Models that rely primarily on private capital can bring visible services to market quickly. They also tend to leave the passenger interface, pricing logic and operational data in private hands unless public conditions are imposed early. Models that give public authorities stronger control can align AV deployment more closely with network planning and public-service obligations, but they also require stronger capability in procurement, contract management, safety governance and service continuity.

That matters because PTAs and PTOs do not fully control whether market-led AV services appear in their cities. If the legal framework allows it, private operators and platforms may enter on their own terms. **The real strategic question is therefore whether AV deployment is simply allowed to take shape around private market logic, or whether public authorities define the conditions under which it connects to the wider transport system.** Early choices matter. Once users become accustomed to booking autonomous rides through one dominant channel and one operating logic, changing the setup later becomes much harder.

A second lesson is that resilience matters as much as launch. The AV supplier landscape is still evolving, and service continuity cannot be taken for granted. Authorities that want AVs to play a lasting public-mobility role need contracts, permit structures and procurement setups that can cope with underperformance, supplier change or technology refresh without forcing the service back to zero.

At the same time, deployment speed will often be determined by practical basics: pick-up and drop-off rules, charging access, depot throughput, and the ability to organise new operational roles around supervision, customer support and fleet readiness.

No single model is the answer in all contexts. In practice, the most useful approach is to treat the models as a **portfolio of tools**, each suited to different service types and policy objectives.

Service context	Common fit observed	Why this fit tends to appear
High-frequency, PT-oriented services (fixed routes or strong network integration)	**Model 3:** Public Fleet with Licensed Automation	Strong integration needs, clear passenger obligations and a case for public control over fares, branding and service continuity
Coverage and feeder services (lower-demand areas, first/last mile, DRT-like operations)	**Model 2:** Managed Service Contract	Flexibility, bounded commitment and the ability to adjust service design without stranding public fleet assets
High-demand zones with clear commercial value (airports, tourist districts, event corridors, dense urban areas)	**Model 4:** Regulated Market-Entry Model and/or **Model 5:** Platform Aggregator Model	Commercial demand can support private investment, while authorities can still shape behaviour through permit conditions, curb access and data requirements
Purely commercial urban ride-hailing expansion	**Model 1:** Independent Commercial Operator Model	Fastest route to private AV rollout where market conditions are attractive and regulation permits it, but with limited default integration into PT

For European PTAs and PTOs, the implication is straightforward: AV strategy should begin with the intended **service role**, not with the vehicle. The key questions are which parts of the network require strong public control, where private market entry is acceptable or even useful, and which conditions must be fixed early on around data, passenger access, operational coordination and service continuity.

While these five operating models provide a framework based on global frontrunners, Europe's own AV passenger landscape is taking a distinct shape.

Using these five operating models as a lens, the next chapter examines how Europe's own AV passenger landscape is beginning to take shape.

3. AV passenger deployments in Europe

3.1. Europe: a real movement, but still an early and uneven market

From the perspective of the five operating models introduced earlier, Europe's current AV passenger landscape is better understood as a set of emerging institutional pathways than as one mature market. At the time of writing, the sector remains early-stage, fragmented and highly (pilot) project-based. While there is clear momentum, it is concentrated among a limited number of cities, operators and technology companies rather than within a broad, mature commercial market.

What sets Europe apart is that AV deployment is not taking shape through one dominant logic. Some of the clearest near-term developments come from moves to enter the commercial robotaxi market, platform-led partnerships and announced launches in major cities. At the same time, many of the most relevant ongoing European cases remain closely tied to public service goals, controlled pilots, or PTA/PTO-shaped deployment models. Europe currently shows a mixed landscape of early commercial market formation in some places and public mobility integration in others.

Because this landscape is moving quickly, the overview below should be read as a snapshot rather than a static report. Between drafting and publication of this report, launch dates, approval status, fleet scope, operating areas and partner configurations may change.

3.2. Key actors shaping Europe's AV passenger landscape

Europe's AV passenger market is still narrow enough that a small group of companies accounts for most of the visible momentum. They matter for different reasons: some signal short-term **commercial robotaxi entry** into major cities, while others are more relevant because they are already embedded in **PT-linked, authority-shaped deployments**. (Waymo)

Waymo

Waymo is the clearest benchmark for a mature commercial robotaxi model entering Europe. After expanding mainly in the US, it has announced a **London launch in 2026** for its fully autonomous ride-hailing service, giving Europe a direct reference point for what a proven US robotaxi operator may look like in a major European city. Waymo as a technology leader operating thousands of Jaguar vehicles in the US (reaching half a million weekly paid rides in March 2026). Their system uses a combination of lidar, cameras, radar, and high-definition (HD) mapping, which takes a few weeks to a month to prepare for a new city. Waymo does not rely on 5G or external signals for safety-critical decisions; they use their own onboard cameras to independently read traffic lights rather than trusting external data. (Waymo)

WayveWayve plays a different role. It is a **London-based AV software company**, and is most relevant as Europe's most visible local autonomy stack in the robotaxi conversation. Wayve uses mapless AI to navigate using only cameras, but their commercial vehicles actively integrate radar and LiDAR as supplemental real-time sensors to enhance perception and safet (not for traditional HD mapping). Using fewer/no LiDARs and avoiding HD mapping makes their technology potentially faster and cheaper to deploy elsewhere. They have a partnership with Uber to launch **public-road Level 4 trials in London**, which positions it as a technology supplier within a platform-led market-entry model rather than as a service operator. (Wayve)

MOIA

As Volkswagen Group's mobility subsidiary, MOIA is establishing itself as a provider of turnkey autonomous mobility solutions for cities and public transport operators. Its offering combines the ID. Buzz AD operating software and customer interface, while Mobileye (a US/Israeli company, with a majority share owned by Intel) supplies the self-driving system. MOIA can therefore be seen as a service integrator, bringing together vehicle, software and operator support, than as a standalone AV developer. In Europe, MOIA is involved in several pilot and pre-commercial projects, including the ALIKE project in Hamburg, the NoWeL4 project in Berlin and the selection of MOIA by Ruter and Holo for the next phase in Oslo from 2026. At the same time, these cases also show that their implementation remains at an early stage: in Hamburg in particular, deployment is still best understood as a pilot and testing environment. (Volkswagen Group)

ADASTEC / Karsan

The Turkish ADASTEC and Karsan are relevant actors in Europe's **automated bus** segment. ADASTEC supplies the **flowride.ai Level 4 driving software**, while Karsan provides the **8-metre Autonomous e-ATAK** bus platform. Their most significant deployments are visible in **Stavanger (since 2022), Burgdorf/ Hannover (Project albus), Arbon and Rotterdam The Hague Airport.** At the Rotterdam launch in July 2025, Karsan referred to experience from **13 projects in 12 countries.** This makes the pair a strong reference point for Europe's more PT-shaped, authority-linked AV path. Their operations generally require a software engineer to be present onboard alongside a safety driver to monitor safety and performance.

WeRide

WeRide already appears across several European deployment types and is the only player currently offering fully automated public transport vehicles, which makes them highly significant. The company says it operates in **more than 40 cities across 12 countries** and offers **five product lines: Robotaxi, Robobus, Robovan, Robosweeper and ADAS**. In Europe, it is already present in different countries. In Belgium, together with Flemish PTO De Lijn, in France through the driverless beti/Renault/Macif robobus deployment, in **Spain** through Barcelona trials with Renault, and in Switzerland through other pilots and test programmes. Renault also states that it is working with WeRide to develop **Level 4 automated public transport solutions in Europe**, with a view to offering **an electric miniBus platform before 2030**. (weride.ai)

Baidu Apollo

Baidu Apollo is the Chinese actor and **large-scale robotaxi platform entering Europe through partnerships**, rather than through PT-led shuttle pilots. Baidu reported that Apollo Go delivered **more than 2.2 million fully driverless rides in Q2 2025** and had surpassed **14 million cumulative public rides by August 2025**. In Europe, its main signal is the agreement with **Lyft** to deploy Apollo Go vehicles i**n Germany and the UK from 2026**; at the same time, it is also tied into the **PostBus/AmiGo** initiative in eastern Switzerland, showing that the same stack can also enter through a PT-complementary on-demand model. (Baidu Inc)

Pony.ai

They are Chinese technology leader that spend heavily on R&D. Pony focuses mainly on robotaxis, with a smaller secondary focus on autonomous trucking. It has established a **European hub in Luxembourg**, received a **Level 4 robotaxi testing permit** there, and is testing in partnership with **Emile Weber**. It also partnered with **Bolt** in late 2025 to prepare autonomous ride services in Europe, and in March 2026 announced a **Zagreb launch with Uber and Verne**, positioned as Europe's first commercial robotaxi service. Pony.ai therefore matters as a fast-moving entrant combining multiple access routes: local fleet partners, platform partnerships and an early commercial launch market. (Pony AI Inc.)

3.3. Selected deployment cases in Europe (that stand out)

The cases below have been identified to be the most informative deployments and near-term launches at the time of writing: cases that either represent the most advanced live services, signal likely commercial market entry, show distinctive public-transport integration models, or clarify how specific technology providers are entering Europe. For a comprehensive list of all AV pilots mapped in Europe, we refer to the Test Sites Map, published by the The Knowledge Base on Connected and Automated Driving (CAD), see here: https://www.connectedautomateddriving.eu/test-sites

The cases below are grouped using the five operating models defined in the global chapter:

Model 1: Independent Commercial Operator
Model 2: Managed Service Contract
Model 3: Public Fleet with Licensed Automation
Model 4: Regulated Market-Entry
Model 5: Platform Aggregator

This makes one point immediately visible: Europe does not yet have one dominant AV deployment logic. Instead, the market is split between a small number of emerging commercial robotaxi entry moves and a larger group of PTA-shaped or public-transport-led deployments.
At the time of writing, the strongest European evidence sits around Models 2, 3 and 5. Model 1 is only beginning to appear, while Model 4 remains limited and only weakly visible in current passenger AV deployments.

3.3.1. Deployments that follow the Independent Commercial Operator Model

In the global framework, Model 1 means the operator carries both the **vehicle / asset risk** and the **commercial fare / utilisation risk**, while controlling the passenger interface through its **own proprietary app or channel**. In Europe, this model is still rare. The clearest near-term example is Waymo's planned London entry.

London: Waymo

Waymo is set to launch its fully autonomous ride-hailing service in London, the first major expansion of the Alphabet-owned company into Europe. Fully driverless, operations open to the public are planned for 2026. The service will use all-electric Jaguar I-PACE vehicles and aims to integrate into London's transport network by offering 24/7 autonomous, app-based rides. This will follow a supervised and mapped testing period, which began in late 2025.[1]

[1]**Image:** Waymo vehicle in London.

Feature	Details
Service Concept	Open commercial robotaxi and ride-hailing.
Operator & Interface	Waymo operates the service directly; passengers will hail rides exclusively using the consumer-facing Waymo app.
Vehicle Platform	Specially equipped, all-electric Jaguar I-PACE test fleet (utilizing left-hand drive vehicles imported from their US fleet).
Autonomous System	Operated by the Waymo Driver (their proprietary, self-developed AI platform and 6th-generation hardware suite).
Fleet Manager	Moove, a global mobility company, handles day-to-day operational logistics, including charging infrastructure, vehicle maintenance, and fleet cleaning.
Regulatory Framework	Operating under the UK national framework (Automated Vehicles Act of 2024), working closely with the Department for Transport (DfT) and Transport for London (TfL).
Number of Vehicles	An initial fleet of roughly 24 vehicles is deployed for testing, mapping, and data collection. Numbers for the final commercial scale-up have not been publicly specified.
Safety Status	Currently operating with trained human safety drivers to comply with the UK government's code of practice. The commercial launch will transition to fully driverless operations without onboard specialists.
Model Fit	Waymo keeps the customer interface, bears the commercial risk, and enters Europe under its own brand.
Deployment Timeline	**Late 2025:** Initial mapping and preparation of London streets utilizing vehicles with human safety drivers. **April 2026:** Launch of a supervised passenger pilot service under the UK government's proposed piloting scheme to begin advanced testing. **Late 2026 (Q4):** Target for the fully autonomous, driverless commercial service to be made available to the general public.

3.3.2. Deployments that follow the Managed Service Contract Model

In Model 2, private partners typically supply the AV system, vehicles and operational layer, but a public transport authority or public-service objective shapes the service concept, commercial risk and, by design, the passenger interface. This is currently one of the clearest and most common patterns of AV deployment in Europe.

Oslo: Ruter – Holo – MOIA Autonomous Public Transport
The Oslo deployment is one of Europe's most strategically important cases of autonomous vehicles because it is explicitly presented as an extension of municipal public transport rather than a premium private ride-hailing service. Primarily taking place in the Groruddalen and Søndre Lørenskog suburbs, the project operates as follows: PTA Ruter defines the mobility requirements and provides the customer interface; Holo operates the vehicles; and Volkswagen subsidiary MOIA provides the vehicles, and software ecosystem.[2]

[2]**Image:** Moia (2025). Ruter and Holo enter partnership with MOIA for next phase of autonomous public transport in Oslo. Moia news. https://www.moia.io/en/news/ruter-and-holo-enter-partnership-with-moia

Feature	Details
Service Concept	Shared, on-demand autonomous public transport (demand-responsive transit).
Customer Interface	The MOIA app and software platform, fully integrated within Ruter's public transit service offer.
Operator	Holo (handling the day-to-day operation of the self-driving pilot).
Vehicle Platform	Volkswagen ID. Buzz AD (purpose-built electric vans designed specifically for shared mobility).
Autonomous System	Mobileye Drive™ (utilizing the Mobileye EyeQ™ 6H system) delivered via MOIA's turnkey solution.
Regulatory & Planning Role	Ruter (the public transit authority) anchors the service, integrating it into broader public transport planning and ensuring it meets municipal sustainability goals.
Number of Vehicles	Six new ID. Buzz AD vehicles have been announced for the upcoming phase.
Safety Status	Currently operating with safety drivers on board. MOIA is working toward EU type approval for Level 4 driverless operation, targeted for 2027, which would allow the removal of safety operators.
Model Fit	The service is shaped entirely by public transport logic, while the vehicles, automation AI, and physical operations are delivered through specialist private partners.
Deployment Timeline	**2023 – Early 2026:** Initial testing and public pilot phases utilizing first-generation NIO vehicles to gather data in harsh Nordic winter conditions. **Spring 2026:** Commissioning phase for the new fleet of MOIA ID. Buzz AD vehicles. **Summer (June) 2026:** Official launch of the next-phase passenger pilot, introducing the new ID. Buzz AD vehicles and the MOIA app interface to the public. **2027 (Target):** Anticipated EU Level 4 type approval, paving the way for fully driverless, scaled-up operations.

Cantons Zurich & Aargau: iamo (PostBus – Apollo Go)

In Switzerland, the iamo (intelligent automated mobility) project in the Furttal region is an example of a public-transport-complementary robotaxi deployment.

Designed explicitly as a public-mobility use case, it operates strictly as an extension of the existing transit network.

Led by the Swiss Transit Lab (STL) in collaboration with Swiss Federal Railways (SBB) and the cantons of Zurich and Aargau, the initiative tests automated on-demand passenger cars across a large semi-rural operating area.

The project strategically combines WeRide's commercial robotaxi technology stack with strong public-sector oversight. It outlines a clear, phased transition from supervised testing to fully driverless, remotely monitored public operations.[3]

[3]**Image:** Swiss Transit Lab (2026). Iamo Furttal. Swiss Transit Lab. https://www.swisstransitlab.com/projekte/iamo-furttal

Feature	Details
Service Concept	On-demand autonomous passenger-car service complementing public transport, specifically targeting first/last-mile and lower-density travel needs.
Customer Interface	Dedicated ioki booking app, designed to integrate seamlessly with the existing public transit network.
Operator	Swiss Transit Lab (STL) leads the pilot on behalf of SBB and the cantons of Zurich and Aargau.
Vehicle Platform	Nissan Ariya electric passenger cars.
Autonomous System	WeRide (for the L4 autonomous driving software and hardware suite).
Fleet Manager & Operations	ioki provides the digital fleet management, routing, and pooling algorithms. Eurobus operates the central support center for the remote supervision of driverless operations.
Regulatory Framework	Strong public-sector alignment involving SBB, the local cantons, and the Swiss Federal Roads Office (FEDRO/ASTRA), which officially granted the project a driverless permit.
Number of Vehicles	2 vehicles are currently in the live training phase. The official full rollout will feature 3 autonomous passenger cars serving the Furttal network, with plans to add minibuses in later phases.
Safety Status	Testing is operating on public roads with an onboard safety driver. Following FEDRO approval in late 2025, the project is actively transitioning toward fully driverless testing.
Model Fit	The service is heavily shaped by public actors and a PT-complementary mobility objective. Specialist private partners provide the operational and digital layers, meaning the public sector sets the transit goals while licensing the automation.
Deployment timeline	**August 2025:** Mapping phase started; manual driving was utilized to create high-definition digital maps of the 110-kilometer Furttal operating area. **November 2025:** FEDRO officially grants the driverless permit. Training drives in live traffic begin with an onboard safety driver to adapt the AI to Swiss traffic rules. **First Half of 2026 (Target):** Launch of the fully driverless public passenger service, allowing users to book fare-paying rides via the ioki app.

Eastern Switzerland: AmiGo (PostBus–Apollo Go)

The 'AmiGo' project in eastern Switzerland is one of the most interesting autonomous vehicle projects in Europe because it successfully integrates a large-scale global robotaxi technology stack with a highly trusted, publicly anchored Swiss mobility network. Run by PostBus (Swiss Post's public transport subsidiary) in partnership with Baidu's Apollo Go, the service has been designed to supplement existing public transport in rural areas with low frequency and off-peak services, offering app-based, shared, on-demand journeys. Rather than operating as a disruptive stand-alone commercial competitor, this deployment shows how European transit authorities can use AVs to add a targeted, sustainable service layer.[4]

[4]**Image:** PostAuto (2025). "AmiGo": PostBus brings autonomous vehicles to Eastern Switzerland. Postauto press releases. https://www.postauto.ch/en/about-us-and-news/news/2025/amigo-postbus-brings-autonomous-vehicles-to-eastern-switzerland

Feature	Details
Service Concept	On-demand, pooled autonomous vehicle service (ride-pooling) designed to complement traditional scheduled public transport.
Customer Interface	Mobile app booking integrated within a public-service mobility offer.
Operator	PostBus (managing local physical operations, customer service, and transit network integration).
Vehicle Platform	Apollo Go RT6 (purpose-built, fully electric robotaxis adapted for the AmiGo service, featuring seating for four and a detachable steering wheel).
Autonomous System	Baidu Apollo Go (providing their Level 4 autonomous driving technology and large-scale operational expertise).
Regulatory Framework	Features strong, multi-level institutional support from the Swiss Federal Office of Transport (FOT), Federal Roads Office (FEDRO), and the cantons of St. Gallen, Appenzell Ausserrhoden, Appenzell Innerrhoden, and Thurgau.
Number of Vehicles	Final commercial expansion aims to operate a fleet of up to 25 vehicles, making it one of the largest planned AV fleets in Europe.
Safety Status	Initial mapping and testing are currently being conducted with human safety drivers on board. The final regular service is designed to operate completely driverless.
Model Fit	The passenger offer is public-transport-complementary and authority-shaped, while the core AI and AV capabilities are supplied by an external global technology partner.
Deployment Timeline	**December 2025:** Initial mapping and test runs commenced on Eastern Swiss roads using a pilot fleet with human safety drivers and no public passengers. **Mid-to-Late 2026:** Expanding pilot operations to a select group of public users (still accompanied by safety drivers), followed by fully driverless closed trials later in the year. **Early 2027 (Q1 Target):** Official launch of the permanent, regular, fully driverless public service.

3.3.3. Deployments that follow the Public Fleet with Licensed Automation Model

In Model 3, the public sector assumes both asset and commercial/service risks, while a specialist technology provider licenses or supplies the automation layer. There are not yet many mature examples of this model in Europe, but automated bus deployments come closest because they are embedded in conventional public transport structures rather than being platform-led or branded robotaxi services.

The Leuven deployment is an informative and integrated autonomous vehicle projects because it incorporates driverless shuttles directly into a live public transport network, as first step of a wider expected roll-out of AVs in Flanders. Two WeRide Robobuses, operated by De Lijn (PTO), now run on Line 16, a busy urban loop connecting Leuven Station to the suburb of Heverlee. After securing Belgium's first federal Level 4 test permit for an autonomous shuttle, the vehicles underwent street testing at the end of 2025, before officially opening to paying passengers on 22 January 2026. It is one of the clearest examples in Europe of a public transport operator integrating externally supplied AV technology into its own services, operating structure and passenger interface, rather than procuring a fully outsourced managed/operated service.[5]

[5]**Image:** WeRide (2025). WeRide Enters Belgium as Autonomous Robobus Rolls into Leuven. WeRide. https://ir.weride.ai/news-releases/news-release-details/weride-enters-belgium-autonomous-robobus-rolls-leuven

Feature	Details
Service Concept	Public-transport-integrated autonomous shuttle / feeder service (officially operating as De Lijn's Line 16).
Customer Interface	Standard De Lijn public transport channels. Passengers use a digital subscription or buy a standard ticket in advance via SMS or the De Lijn app (no onboard scanners are used).
Operator	De Lijn (managing the public operation, scheduling, and passenger integration).
Vehicle Platform	WeRide Robobus (two fully electric, 8-passenger shuttles capable of speeds up to 40 km/h).
Autonomous System	WeRide (supplying the L4 autonomous driving software and sensor suite).
Fleet & Operations Partners	De Lijn operates the service, WeRide supplies the hardware/software, and mobility consultancy Espaces-Mobilités coordinated the procurement, approvals, and training.
Regulatory Framework	Features strong public-sector alignment involving De Lijn, the City of Leuven, the Flemish government, and the Belgian federal mobility authority.
Number of Vehicles	2 shuttles currently deployed on an approximately 8-kilometer loop with 9 designated stops.
Safety Status	Currently operating as a pilot-phase passenger service with a trained De Lijn safety driver remaining on board for supervision. The long-term goal is fully driverless operation.
Model Fit	De Lijn operates the service under its own PT channel and procures the vehicles directly, while the core automation stack remains an externally supplied technology.
Deployment Timeline	**September 2025:** WeRide receives Belgium's first-ever federal Level 4 test permit; shuttles begin extensive public road testing and mapping in Leuven without passengers. **January 22, 2026:** Official launch of the passenger service on Line 16, fully integrating the autonomous shuttles into the daily transit schedule for afternoon commuters and students. **Future (TBD):** Planned transition to fully unattended, driverless operations, on more locations in Leuven and Flanders.

[6]**Image:** Karsan (2022). Karsan's autonomous E-atak set to be the first autonomous bus in Europe's urban line! Karsan. https://www.karsan.com/nl/pers/actueel-nieuws/karsans-autonomous-e-atak-set-to-be-the-first-autonomous-bus-in-europes-urban-line-nl

Stavanger: Kolumbus – Karsan – ADASTEC

The Stavanger deployment is one of Europe's reference cases for integrating automated buses directly into real-world public transport networks. Operated under the local transit authority, Kolumbus, the project utilizes an 8-meter Karsan Autonomous e-ATAK bus powered by ADASTEC's Level 4 automation software. After becoming Europe's first automated bus to carry ticketed passengers on public roads (Line 18) in 2022, the deployment has since progressed to the more demanding Line 19, navigating heavy mixed traffic, roundabouts, and an 800-meter tunnel. It serves as a vital blueprint for cities looking to blend ordinary public transport objectives with advanced automation.[6]

Feature	Details
Service Concept	Automated fixed-route public bus service.
Customer Interface	Standard public transport channel (integrated seamlessly into the Kolumbus transit network for ticketed passengers).
Operator	Operated as a public transport service under Kolumbus, with the transport company Vy handling direct traffic management and on-board hosting.
Vehicle Platform	Karsan Autonomous e-ATAK (an 8.3-meter, 52-passenger fully electric midibus).
Autonomous System	ADASTEC flowride.ai (Level 4 automated driving software platform).
Fleet & Operations Partners	Applied Autonomy (providing the xFlow® control center for fleet monitoring and remote assistance), alongside Vy.
Regulatory Framework	Kolumbus acts as the Public Transport Authority (PTA), with commercial operation permits and approvals granted by the Norwegian Public Roads Administration and TÜV NORD.
Number of Vehicles	Single-vehicle route deployment in its initial and current phases.
Safety Status	Human oversight (a safety driver and engineer) is currently on board during operations. Adastec officially announced plans to remove the safety driver and initiate fully driverless operations by Q3 2026.
Model Fit	The service sits entirely inside a public-transport structure and uses an external automation stack licensed onto a procured bus platform, rather than operating as a privately branded commercial AV service.
Deployment Timeline	**Spring 2022:** Public service officially launched on Line 18 in downtown Stavanger, eventually carrying over 20,000 ticketed passengers along the harbor route. **December 2023 / Early 2024:** Service progressed to Line 19, a more complex 2.2-kilometer route featuring higher speeds (40 km/h), lane changes, and an 800-meter tunnel. **Q3 2026 (Target):** Planned initiation of fully driverless operations, permanently removing the onboard safety driver from the vehicle.

3.3.4. Deployments that follow the Regulated Market-Entry Model

In Model 4, a public authority would create a controlled market for AV services, rather than operating them itself or leaving them to operate fully commercially. A private operator would be granted the right to run a service within defined public parameters, including service area, minimum coverage, branding, fares, data sharing and safety conditions. The operator would still carry fleet and commercial risk, but within a framework similar to a concession. In Europe, this remains more of a future possibility than an established practice.

3.3.5. Deployments that follow the Platform Aggregator Model

In Model 5, the customer relationship sits primarily with a **mobility platform**, while the AV technology and fleet operation sit behind that interface. The platform acts as the commercial gateway, even when it does not own the AV stack or the fleet. This is one of the most important emerging pathways in Europe.

Zagreb: Verne – Uber – Pony.ai Robotaxi Deployment

Announced in March 2026, the strategic partnership between Verne (a Croatian mobility startup backed by Rimac), Uber, and Chinese autonomous driving leader Pony.ai brings fare-paying commercial robotaxis to Europe. Starting in Zagreb, Croatia, the deployment utilizes a highly specialized, multi-party commercial structure: Pony.ai supplies the autonomous technology, Verne owns and operates the vehicles, and Uber provides the global ride-hailing platform to drive customer demand alongside Verne's own app.[7]

[7] **Image:** Uber, Pony.ai and Verne's commercial robotaxi

Feature	Details
Service Concept	Open commercial robotaxi and ride-hailing service.
Customer Interface	The global Uber app, operating alongside Verne’s proprietary customer-facing platform.
Operator & Fleet Manager	Verne acts as the fleet owner and manages day-to-day physical operations (cleaning, charging, maintenance).
Vehicle Platform	Arcfox Alpha T5 (an electric SUV produced by China's BAIC). Note: Verne's originally announced purpose-built, steering-wheel-less pod remains in development for future use.
Autonomous System	Operated by Pony.ai’s 7th-generation (Gen-7) autonomous driving system.
Regulatory Framework	Verne is leading the local process for securing market readiness and necessary European regulatory approvals.
Number of Vehicles	The exact initial test fleet size is not specified, but the partners aim to scale to thousands of robotaxis across multiple European cities over the next few years.
Safety Status	Public-road validation and testing are already actively underway in Zagreb; preparations for fully driverless, fare-charging commercial operations are currently in progress.
Model Fit	Uber provides the demand channel and global scale, while fleet ownership, local operations, and AV AI capability sit with specialized partners.
Deployment Timeline	**March 2026:** Official strategic partnership announced; public-road testing and validation already actively running on the streets of Zagreb. **Near-Term (2026):** Launch of the fare-charging commercial service in Zagreb (official public launch date is currently listed as "soon"). **Long-Term:** Gradual scale-up and expansion of the multi-party model into additional European cities and international markets.

London: Uber – Wayve

With backing from a substantial $1.5 billion funding round secured in early 2026, Wayve and Uber have partnered to launch Level 4 commercial robotaxi trials in London. This collaboration is one of the most significant autonomous vehicle partnerships in Europe because it brings together a global ride-hailing company and a UK-based AI company at the forefront of "mapless" autonomous driving technology. Instead of Wayve manufacturing its own branded vehicles, Uber will own and operate the fleet, utilising Wayve's software in the background.

[8] **Image:** Silicon (2025). Uber, Wayve to Trial Robotaxis in London In 2026. Silicon.co. https://www.silicon.co.uk/e-innovation/green-it/uber-wayve-to-trial-robotaxis-in-london-in-2026-617946

Feature	Details
Service Concept	Platform-led commercial robotaxi trials scaling into a full ride-hailing service.
Customer Interface	The global Uber app.
Operator & Fleet Manager	Uber (Uber will directly own and operate the Wayve-powered fleet).
Vehicle Platform	L4-capable vehicles from a "global OEM partner." (Note: The specific vehicle model for London is not yet publicly confirmed, but Wayve's strategic investors and OEM partners include Nissan, Mercedes-Benz, and Stellantis).
Autonomous System	The Wayve AI Driver (utilizing their mapless, end-to-end "Embodied AI" / AV2.0 approach).
Regulatory Framework	Operating under the UK Secretary of State for Transport's newly accelerated framework for self-driving commercial pilots, working closely with Transport for London (TfL).
Number of Vehicles	The exact London pilot fleet size is not specified, but Uber plans to scale Wayve-powered vehicles to more than 10 markets globally.
Safety Status	Approved for public-road Level 4 trials in London.
Model Fit	Uber holds the customer access layer and fleet operations, while Wayve supplies the driving intelligence entirely in the background.
Deployment Timeline	**Spring 2026:** Target launch for supervised Level 4 public-road trials on the streets of London.

3.4. Key takeaways from Europe's deployments

Europe's AV passenger landscape is already more diverse than the usual debate suggests. The real split is not simply between **"AVs in public transport"** and **"private robotaxis"**. The cases in this chapter show several different ways in which AV technology can enter the market, depending on who controls the passenger interface, who carries the fleet risk, and how closely the service is tied to public mobility objectives.

The market is mixed, and not every pathway serves public goals equally well

Some of the most visible short-term commercial signals are clearly market-led. **Waymo in London** points to a classic robotaxi entry under the operator's own brand. **Uber–Wayve in London** and **Uber–Verne–Pony.ai in Zagreb** suggest a slightly different route, in which the platform controls customer access while the AV stack and fleet sit behind it.

> From the perspective of European public transport and city policy, the relevant question is not just whether these services enter the market, but also on what terms. Robotaxis do not facilitate the transition to more sustainable forms of mobility or reduce car dependence. If they mainly operate as an additional, convenience-focused ride-hailing service (e.g. Waymo, Uber), they could increase vehicle kilometres, focus on commercially attractive routes (usually around urban centres where already plenty of other mobility options exist) without solving any transportation issues, weaken PT integration, and put pressure on urban street space.
>
> They only make a positive contribution where services are pooled, well regulated and connected to wider public mobility objectives, such as reducing private car use, improving shared mobility options and strengthening the overall transport system (similar to what Ruter aims to achieve, see chapter 5.3). As discussed earlier, the key issue is not the presence of robotaxis per se, but rather the operating model, regulatory conditions, and degree of public control under which they are introduced.

At the same time, other cases show a very different logic. **Oslo, Leuven and Eastern Switzerland** are not open commercial robotaxi plays but attempting to use AVs within a public mobility context: as shared on-demand transport, feeder services or PT complements. The **PostBus–Apollo Go** case is good example here. It shows that a leading robotaxi technology provider does not have to enter Europe only through a private ride-hailing model; but instead collaborate with a public transport operator for public services.

Europe still has limited evidence of open commercial scale

What does **not** yet exist in Europe is equally important. The region still has very few examples of AV passenger services at meaningful open commercial scale (that go beyond piloting and demonstrating). **Waymo London, Uber–Wayve and Zagreb** may become important turning points, but at the time of writing they are still launch signals rather than established scaled services.

Europe also has only weak evidence so far for a true **concession-based AV market**, in which a city or region defines a regulated service framework, and private operators compete to run it. For now, the stronger evidence sits with **authority-shaped deployments, public-service bus operations, and company-led market-entry moves.**

Why the operating-model perspective matters
This is why discussing deployments through the operating models is useful. The same AV technology can be inserted into the market through very different institutional arrangements.

That distinction matters because it shapes:

- Who owns the passenger relationship
- Who carries asset and commercial risk
- Who controls service design and data access
- Whether AVs strengthen the PT system or grow alongside it as a separate market

Without that lens, very different cases risk being grouped together simply because they all involve autonomous vehicles.

What PTAs and PTOs should do now

The main lesson for European public transport providers is to define early on what role AV services should play in their mobility system. A key policy decision is whether these services should develop as a distinct ride-hailing market or be designed to contribute to broader public objectives, such as reducing car dependency, increasing pooling rates, and strengthening integration with public transport.

The European cases suggest that this flexibility is a strength. Europe does not need to copy the US robotaxi pathway exactly. It has the opportunity to shape AV deployment in ways that fit its own transport institutions, public-service logic and partnership models.

A practical next step is to define a position on five questions:

1. What problem should AVs solve first?
Feeder trips, low-density coverage, late-night service, business parks, or something else?

2. Who should control the passenger interface?
The PTA/PTO, a contracted operator, or a mobility platform?

3. Who should own or lease the vehicles?
The public operator, a private fleet partner, or a mixed structure?

4. What data and operational rights must stay public
This includes service data, performance data, safety reporting and integration into wider PT systems.

5. What procurement and regulatory route makes sense?
Managed service, direct procurement, pilot authorisation, framework contract, concession-like structure, or a staged mix?

4. Navigating the regulatory landscape for AVs

As the previous chapters demonstrated, the deployment of autonomous vehicles is no longer just a question of technical maturity. For public transport operators, the more relevant issue is how AV services are governed, authorised, procured and integrated into real transport systems, both globally and in Europe. The next question for European PTAs and PTOs is therefore practical: if a region or operator wanted to progress from observing AV developments to preparing an actual deployment pathway, which legal, regulatory and organisational conditions would need to be addressed?

This chapter addresses this question in two steps:

1. It sets out the current regulatory landscape, from the United Nations to the European Union and national levels.

2. It then translates this framework into implementation reality by conducting a thought exercise with NEXT RIDE project partners, asking from the perspective of a PTO what rules, approvals, responsibilities and gaps would matter in their own regional context.

Terminology

Delegated and implementing acts	Non-legislative EU acts, usually adopted by the EC, that supplement or help apply legislative acts.[9]
Directive	A binding legal act that sets objectives which Member States must implement through their own national law.[10]
Legislation	A general term for binding laws adopted through a legislative process.[11]
Ratification	The act by which a state gives it definitive consent to be bound by a treaty (upon its entry into force).[12]
Recommendation	A non-binding act that provides guidance or suggests a course of action.[13]
Regulation	A binding legal act that applies directly across the EU, without needing national transposition.[14]
Signing	The act by which a state expresses its interest in a treaty and its intention to become a party. Signature alone does not make the state fully bound.[15]
Transposition	The process by which a Member State converts an EU directive into national law.[16]

[9] https://eur-lex.europa.eu/EN/legal-content/summary/the-european-union-s-secondary-law.html
[10] https://eur-lex.europa.eu/EN/legal-content/summary/european-union-directives.html
[11] https://eur-lex.europa.eu/EN/legal-content/glossary/legislative-acts.html
[12] https://www.coe.int/en/web/conventions/glossary#Ratification
[13] https://eur-lex.europa.eu/EN/legal-content/glossary/recommendation.html
[14] https://eur-lex.europa.eu/EN/legal-content/glossary/regulation.html
[15] https://www.coe.int/en/web/conventions/glossary
[16] https://eur-lex.europa.eu/EN/legal-content/glossary/transposition.html

4.1. Current regulatory framework

4.1.1. UN Regulations

The 'highest' level to start from when trying to analyse the different existing general regulations is the United Nations (UN). More specifically, the United Nations Economic Commission for Europe (UNECE) will be examined. UNECE develops vehicle regulations under two frameworks: UN Regulations under the 1958 Agreement, and UN Global Technical Regulations (GTRs) under the 1998 Agreement. The 1958 Agreement currently has 60 contracting parties, while the 1998 Agreement has 40, which explains why UN Regulations are more widely applied globally than UN GTRs. Furthermore, while UN GTRs only provide harmonized technical requirements, UN Regulations also have provisions for Contracting Parties to issue "type approvals" to these Regulations for vehicles, parts or equipment, which allows any approved product to be placed on the market of all countries of the 1958 Agreement with no need to change product characteristics or to undergo testing several times.

Looking at what UNECE is doing is essential when discussing EU regulation of autonomous vehicles because the EU and its member states are parties to the UNECE's World Forum for Harmonization of Vehicle Regulations (WP.29). This means that many EU vehicle approval rules are based on, or incorporate, UNECE standards. UNECE decisions thus directly shape EU law in this area. A key reason for UNECE-EU alignment is harmonisation. By aligning EU regulations with UNECE regulations, regulatory fragmentation and manufacturing costs are reduced alongside the promotion of global consistency.

WP.29 sometimes adopts guidelines, resolutions, or recommendations to discuss best practices before drafting legally binding law. However, all such documents considered in WP.29 other than UN Regulations or GTRs remain non-binding. For example, the proposal on cyber security and the Cyber Security Management System (ECE/TRANS/WP.29/2020/79) was adopted as UN Regulation No. 155 on Cybersecurity and Cybersecurity Management Systems, and the proposal on software updates (ECE/TRANS/WP.29/2020/80) was adopted as UN Regulation No. 156 on Software Updates and Software Updates Management Systems; while both Regulations are binding, the interpretation documents to these regulations (ECE/TRANS/WP.29/2021/59 and ECE/TRANS/WP.29/2021/60) are not.[17]

4.1.1.1. WP.29

WP.29 is the global UNECE platform where countries develop common vehicle regulations. By harmonising rules, it promotes safer vehicles, advanced technologies, lower emissions, and easier international trade.[18]

WP.29 – Permanent Working Parties (GRs)

Working Party	Focus Area
GBRP	Noise and Tyres
GRE	Lighting and Light-Signalling
GRPE	Pollution and Energy
GRVA	Automated and Connected Vehicles
GRSG	General Safety Provisions
GRSP	Passive Safety

1958 Agreement (E/ECE/TRANS/505/Rev.3)

The 1958 Agreement is a legally binding WP.29 framework (used by 60 countries) for developing UN Regulations covering:

- Vehicle safety (including automated driving systems, cybersecurity, etc.)
- Environmental performance and energy efficiency
- Anti-theft performance
- Other technical requirements

Each UN Regulation (e.g., UN R155 on Cybersecurity, UN R157 on Automated Lane Keeping Systems) is an annex that becomes binding only if a country chooses to apply it.

Obligations when a country applies a UN Regulation

- Recognition commitment
  Accept type-approvals from all other Parties applying the same Regulation (mutual recognition).

- Implementation commitment
  Incorporate the Regulation into the national type-approval system.

1998 Agreement (ECE/TRANS/132)

The 1998 Agreement (used by 40 countries) provides the framework for developing **UN Global Technical Regulations (GTRs).** These regulations:

- Do not automatically become national law
- Require each country to transpose them domestically
- Do not include mutual recognition of approvals

[17] https://unece.org/transport/vehicle-regulations
[18] https://unece.org/wp29-introduction

- Harmonise standards globally but with weaker obligations than the 1958 Agreement

Example: UN GTR No. 8 on Electronic Stability Control

- Adopted under the 1998 Agreement
- Implemented separately by the EU (via the General Safety Regulation)
- Implemented separately by the U.S. (via FMVSS 126)

→ Same underlying technical requirements as those of UN Regulation No. 140, but no mutually recognised certificates.

Difference in legal force between the 1958 & 1998 Agreement

Aspect	1958 Agreement	1998 Agreement
Produces	UN Regulations	UN Global Technocal Regulations (GTR)
No. of countries	60	40
Mutual recognition	Yes, automatic	No, none
National adoption	Binding once a Regulation is applied	Must be transposed into national law
Legal nature	Strong, harmonised	Flexible, process-based
Example	UN R155, UN R157	GTR No. 8

In short:

1958 → approve once; accepted everywhere
1998 → common technical basis, but national laws remain separate

4.1.2. EU Regulations

4.1.2.1. Overview of EU law making

The following graph illustrates the basic process of how EU law is made and how different types of legislation work. Important to note here is that European law always has primacy over national law. This means that if an EU regulation and a country's regulation conflict, the EU rule is the one that applies. The European Commission initiates the process by drafting proposals, but it does so within limits set by the EU's legislators, it cannot create entirely new laws on its own. A proposal only becomes EU law once both the European Parliament and the Council of the EU agree on the final text. Regulations and directives are two forms of EU legislation. Regulations apply directly in every member state and take precedence over national law, while directives set common objectives that each country must implement through its own legal system (transposition).[19]

EU Legislation

EC: drafts & submits legislative proposals
EP & the Council: must agree on final text before it becomes law

EU Regulation

→ Binding legislative act which becomes **immediately enforceable as law** in all member states simultaneously

→ **The Council can delegate law-making power to the EC**

Directives

→ **Sets a goal for all member states,** which must then translate it into national law through "transposition" by a set deadline

4.1.2.2. Relevant EU regulations

EU Vehicle Type-Approval Framework Regulation – Regulation (EU) 2018/858[20]

This regulation is the backbone for all the newer vehicle rules, the GSR, as mentioned above, is built on this. Regulation 2018/858 is the framework regulation for the EU type-approval system and sets the overall system and procedures for how vehicles, components, and systems are type-approved in the EU. It looks at who approves, how approvals are issued, how market surveillance works, recalls, tests, oversight, etc. For AVs, this means that this regulation establishes the **legally binding** requirement to obtain EU type-approval before they can be placed on the market, and it obliges national authorities to carry out ongoing monitoring to ensure vehicles continue to comply during real-world operation. It also provides the framework through which the UN Regulations adopted in the EU (such as R155, R156, R157, etc.) are enforced.

In particular, Table 2 of Annex II to (EU) 2018/858 provides the applicable regulatory acts for the approval of fully automated vehicles produced in small series (up to 1 500 vehicles registered per year in the Union). Until the Regulation is modified (completion expected in late 2026), it is not currently possible to approve automated vehicles in large series in the Union, except those equipped with Automated Lane Keeping Systems (UN Regulation No. 157).

[19] https://european-union.europa.eu/institutions-law-budget/law/types-legislation_en

[20] https://eur-lex.europa.eu/eli/reg/2018/858/oj/eng

Impact for PTOs

PTOs must procure AVs that hold valid EU type-approval under Regulation 2018/858 (unless they hold a valid national approval), comply with the GSR, and meet all relevant UN Regulations (such as R155, R156, and R157). They are also responsible to monitor recalls and software updates to ensure that their fleet remains compliant. Using vehicles that are non-compliant can expose their organisation to enforcement actions or liability.

Impact for PTAs

Regulation 2018/858 clarifies the approval responsibilities across Member States, giving PTAs a consistent legal basis when assessing whether vehicles proposed for public transport services meet EU-wide requirements. It enables PTAs to rely on approvals issued by any EU type-approval authority, which simplifies coordination with operators and reduces uncertainty during procurement or authorisation processes. The framework also supports PTAs in aligning service specifications, safety expectations, and compliance checks across different operators within their region.

What is type-approval?

Type-approval is the official procedure to certify that a vehicle or component design complies with legal requirements, allowing it to be mass-produced and sold. Under the 1958 Agreement, approvals are mutually recognized between countries that apply the same UN Regulations. If Country A and Country B both apply the same UN Regulation, then Country A's type-approval certificate is automatically valid in Country B. No need for repeat testing or national re-approval.

Type-approval in the EU

In the EU, type-approval operates through a single Whole Vehicle Type-Approval (WVTA) system. Once an EU Member State's authority certifies that a vehicle model, system, component, or technical unit meets all EU safety, environmental, and production standards, it can be placed on the market across all 27 Member States without requiring any additional approvals.

General Safety Regulation (GSR) – Regulation (EU)2019/2144

This regulation sets mandatory safety rules for motor vehicles, by listing both the minimum mandatory UN and EU technical regulations all vehicles must comply with (e.g., UN R155 has been made mandatory by the GSR since July 2024 for all new registrations of vehicles), and the applicable regulations for optional systems such as automated driving systems (e.g., if a vehicle is equipped with an automated driving system, it must comply with Regulation (EU) 2022/1426) . It can be seen as the EU's bridge between WP.29 standards and the EU type-approval system by integrating those international rules into **binding** EU law.

Impact for PTOs

The GSR sets the baseline safety and technical requirements that their vehicles must meet before they can receive EU type-approval. The procedures to get this EU type-approval are outlined in Regulation (EU)2018/858. If a vehicle is EU type-approved, it can be placed on the market and operated anywhere in the European Union without needing additional national approvals.

Impact for PTAs

The GSR provides PTAs with a clear and harmonised technical baseline for the vehicles that may operate within their public transport networks. By relying on EU type-approval, PTAs can ensure that any vehicle procured through tenders or authorisations already meets the required safety, cybersecurity, and automated-driving standards, without needing additional local assessments. This helps PTAs set consistent technical requirements across operators and reduces administrative burdens when approving new or innovative services.

Commission Implementing Regulation – Regulation (EU) 2022/1426[22]

Once an EU law is passed, such as the General Safety Regulation, it may need updates to reflect new developments or to ensure it is applied consistently. In such cases, the European Parliament and the Council can authorise the Commission to adopt delegated or implementing acts. This allows the Commission to specify the detailed procedures that all Member States must follow, without requiring separate national rules. This specific Implementing Regulation is **legally binding** and sets the detailed technical requirements for automated driving systems (ADS), i.e. the systems that are in charge of performing the driving task in an autonomous vehicle. This act contains both performance requirements (ensuring that an ADS safely controls the vehicle) and testing requirements (how it is ensured that an ADS is safe before it can be placed on the EU market).

[22] https://eur-lex.europa.eu/eli/reg_impl/2022/1426/oj/eng

It should be noted that UNECE is currently drafting a UN Regulation on ADS, which is expected to be adopted in June 2026 and integrated into the GSR by early 2027, eventually replacing this implementing act.

Impact for PTOs

PTOs are not the primary audience of this regulation, manufacturers are. However, these rules shape the vehicles that PTOs operate, meaning that PTOs must adapt procurement, maintenance, digital security practices, and operational procedures to comply with the new EU standards. A PTO therefore does not need to define technical requirements for the procurement of automated vehicles, as the implementing act already provides the framework to define the minimum acceptable level of safety for the ADS.

Impact for PTAs

Although primarily aimed at manufacturers, this regulation helps PTAs by ensuring that vehicles proposed for public transport services already meet harmonised EU requirements for safe automated driving. This allows PTAs to align tender specifications with clear EU standards: a PTA can safely accept any approved automated vehicle on their roads without any need for additional local technical checks. Depending on the national deployment framework for automated road transport services, additional checks might be required not for the ADS itself, but for its integration into the local transport network.

Commission Implementing Regulations
= explains exactly how to apply the law in practice

Commission Delegated Regulations
= adds or updates technical parts of the original law

General Data Protection Regulation (GDPR) – Regulation (EU) 2016/679[23]

This Regulation is **legally binding** and governs the processing of personal data, meaning any information that can directly or indirectly identify an individual. It applies across all sectors, including autonomous vehicles, and sets the rules for how such data must be collected, used, protected, and shared. GDPR also defines the responsibilities of organisations handling personal data and grants individuals enforceable rights over their information.

Impact for PTOs

GDPR is directly relevant for PTOs operating autonomous vehicles, since AVs inevitably process personal data about passengers, staff, and other road users. As data controllers, PTOs must ensure that all data processing is lawful, transparent, and secure, and that appropriate safeguards, policies, and technical measures are in place to protect individuals' rights.

Impact for PTAs

GDPR shapes how data must be handled within the public transport services that PTAs oversee. They must ensure that tender requirements and contracts with operators include compliant data-protection practices, clarify roles and responsibilities (e.g., controller vs. processor), and safeguard passenger and operational data across the services they authorise. This safeguards that AV deployments meet EU data-protection standards from the outset.

Guidance on vehicle data, accompanying Regulation 2023/2854 (Data Act)[24]

This Guidance is **non-binding** and is published by the European Commission to help stakeholders understand how the legally binding Data Act applies to vehicle-generated data. It clarifies concepts such as data holders, data users, and the practical meaning of 'product-generated data'. The Guidance explains how data should be made accessible, how sharing agreements should work, and how these rules interact with other frameworks like GDPR and cybersecurity regulations. Although it does not create legal obligations, it supports consistent implementation of the Data Act across the EU.

Impact for PTOs

For PTOs operating autonomous vehicles, this Guidance helps to interpret how the Data Act affects access to and use of vehicle data (for example, maintenance data, operational data, and user-generated data). It can help PTOs better understand what data they are entitled to obtain from manufacturers, what data they may need to share with third parties, and how to manage data-sharing agreements. While it is not legally binding, the Guidance can influence best practices and support PTOs in aligning their data governance, procurement, and operational processes with the Data Act.

Impact for PTAs

The Guidance clarifies how the Data Act applies to vehicle-generated data in public transport services. It helps PTAs shape tender requirements, ensure fair access to operational and maintenance data, and define data-sharing expectations between operators, manufacturers, and third parties. Although non-binding, it supports PTAs in setting consistent and transparent data-governance conditions for AV deployments.

[23] https://eur-lex.europa.eu/eli/reg/2016/679/oj/eng

[24] https://digital-strategy.ec.europa.eu/en/library/guidance-vehicle-data-accompanying-data-act

Product Liability Directive (EU) 2024/2853[25]

This Directive is **legally binding**, but it will only apply once EU Member States transpose it into national law by 9 December 2026. It modernises the EU's product-liability framework to reflect today's technologies, including products with digital elements such as software, connectivity features, and embedded electronics. The Directive makes it possible for liability claims to arise not only from physical defects but also from failures in digital components, for example software or update-related issues. Because Member States implement the Directive individually, the precise scope of what counts as a 'defect' in complex systems such as autonomous vehicles may vary across the EU.

Impact for PTOs

Manufacturers remain the main actors responsible for defective products, but PTOs may need to review procurement contracts, clarify responsibilities for software updates and maintenance, and document vehicle operation more thoroughly to manage potential liability risks. The Directive may also influence insurance arrangements and risk-sharing between PTOs, manufacturers, and service providers, particularly in situations where software or other digital components play a central role in vehicle performance.

Impact for PTAs

For PTAs, the Directive supports clearer allocation of liability across the supply chain, which can inform how they structure tender requirements and service contracts. It enables PTAs to set expectations around software maintenance, update responsibilities, and documentation standards, helping ensure that operators and manufacturers manage digital-component risks appropriately within public transport services.

4.1.3. How UN rules become binding in the EU

When the EU, as a Contracting Party to the 1958 Agreement, decides to apply a UN Regulation, that Regulation becomes binding EU law (via the Type-Approval Framework, supported by the GSR). This also means that all EU Member States must conform to it automatically. Incorporation via the GSR is necessary to make it mandatory law for all EU Member States, before it is just a political/legal decision by the EU. National type-approval authorities must check vehicle compliance against these incorporated UN rules. And once any authority issues an EU type-approval certificate, it is automatically valid in all 27 Member States. No country can refuse it or add extra requirements, as the EU internal market law guarantees mutual recognition.

[25] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32024L2853

WP.29 adopts a UN Regulation

The EU, as contracting party, decides to apply the UN regulation at WP.29

The EU, incorporates the UN Regulation into its internal law via the framework Regulation (EU) 2018/858 and implementation/delegated acts

The Regulation becomes binding EU law

National type-approval authorities enforce it by checking compliance when granting EU type-approval certificates

The EU type-approval certificate is valid in all 27 Member States automatically, no Member State can refuse it (EU internal market law)

Key implications for PTOs and regulators

What the current framework already solves

- Harmonised vehicle and type-approval rules across the EU
- Baseline cybersecurity and software-update requirements
- Common safety and technical standards for vehicles
- Clear compliance pathway for manufacturers

What the framework still does not solve

- Legal definition of the "driver" for Level 4 operation
- Rules for remote supervision and operational procedures
- AV-specific insurance and liability allocation
- Standardised incident-reporting and safety-data requirements

Insight Box – The procurement pivot

EU rules (GSR, 2018/858, R155/R156) mean PTOs and PTAs must now procure digital systems, not just vehicles.

Before:

- Seats, range, accessibility
- Mechanical specs

Now also required:

- Software-update obligations (incl. OTA)
- Cybersecurity requirements
- Data-access and data-sharing rights
- Clear roles for recalls and type-approval changes

The shift:
Procurement moves from buying vehicles to securing long-term digital compliance and support.

4.1.4. National road-traffic and public transport rules

National road traffic laws
Each Member State applies its own Road Traffic Act or Highway Code. These laws set the basic 'rules of the road', such as speed limits, right of way, safety requirements, and liability in case of accidents. They also determine who must be in the driver's seat and how autonomous vehicles may be used on public roads.

Public transport rules
PTOs must additionally comply with national and local public transport regulations. These include licensing and permits for passenger services, vehicle inspections and roadworthiness checks, insurance obligations, and labour law requirements that apply to drivers or staff, including personnel supervising AV fleets remotely.

Relation to EU regulations
While national road traffic laws and public-transport rules apply within each Member State, they must operate within the framework set by EU law. EU regulations on vehicle type-approval, safety, data protection, and digital elements take precedence over national rules and ensure harmonised technical standards across the Union. Member States can set their own operational rules for road use and public transport, but they cannot contradict EU-level requirements.

Insight Box – A practical lesson from Switzerland

Discussions at the European level often emphasise the need for a harmonised EU regulatory framework for autonomous vehicles. Yet a recent example from Switzerland shows that such a technical foundation already exists. Switzerland's new AV framework is built directly on the **UNECE type-approval system**, based on elements from Germany, France, and Implementing **Regulation 2022/1426**, and depends on vehicles being type-approved in Europe.

This highlights a broader point: the EU already has the **only continent-wide, legally binding technical framework** for automated vehicles. What is still lacking is confidence among national, regional, and local authorities to rely on this type-approval system when authorising deployments in their Operational Design Domains (ODDs).

Switzerland's approach demonstrates that the framework can function without additional local reassessments. Meaningful EU-wide harmonisation could therefore be advanced if Member States **apply the existing type-approval system consistently** and if authorising bodies **trust EU approvals** rather than duplicating technical evaluations. This would also reduce the burden on cities and regions to develop specialised AV expertise for every deployment.[26]

4.2. Thought exercise: what would deployment require in my region?

The thought exercise was designed to help partners systematically explore the regulatory landscape relevant to deploying autonomous vehicles (AVs) in public transport operations. Why we conducted this exercise:

- To build familiarity with regional and national regulation: for partners to get a clear understanding of the legal frameworks that shape AV deployment in their own contexts.
- To develop a step-by-step policy guide per partner: the exercise supports the creation of tailored regulatory roadmaps that a PTO would follow when introducing AV services.
- To create a practical tool for future deployments: the outcomes provide a reusable resource for planning real-world AV pilots or services.

[26] https://www.linkedin.com/posts/olivernahon_it-was-a-real-honour-to-speak-at-the-european-activity-7404832211910209536-2ZWT/

How we carried out the exercise

- Desk research: each partner reviewed existing legislation, policy documents, national guidelines, and relevant EU frameworks.

- Identification of key legislation: partners selected and summarised the national, regional, and local laws most relevant for AV deployment, including gaps or emerging rules.

- Completion of a structured template: using the provided template, partners organised their findings into a clear, comparable format.

Guiding question
Each partner approached the task from the perspective of a Public Transport Operator (PTO) asking:

> *"If I were a PTO wanting to implement AVs, which national, regional, and local policies and regulations would I need to know and comply with?"*

Partners then mapped out what deploying AVs would look like in their country or region, identifying the required legislation, approvals, permits, safety obligations, and any areas where regulation is still missing or under development.

Main topics discussed
The template asked partners to address five main topics, each supported by a set of guiding sub-questions. These five main topics and their subquestion(s) are:

A. Can we legally run driverless?

1) Does the law recognise the ADS, a technology that drives the vehicle itself, as the driver, and how does it address operation without a human occupant?

2) What is the route to operate a Level 4 automated vehicle on public roads, whether for testing or commercial service?

B. What must be in place to safely put Level 4 AVs on the road?

1) Are there mandatory safety features or data recorders for automated driving?

2) Are there any software updates and cybersecurity procedures legally mandated for the vehicle/fleet?

C. Who is responsible if something goes wrong?

1) Who carries legal liability in a crash or incident (operator, manufacturer, software provider)?

2) What insurance cover is required for a driverless public transport service? Are there any special clauses for automated operation?

3) What are the legal duties for incident reporting and investigations?

D. What must be done with data and AI?

1) What rules apply to data collection, retention, and sharing? Is a Data Protection Impact Assessment required?

E. How to operate day-to-day without a driver?

1) Is there a legal limit on the number of vehicles a remote supervisor may oversee? Are there operator qualifications that are required?

What the thought exercise revealed

The country exercises showed several cross-cutting patterns.

1. No partner country currently offers a complete, ready-to-use pathway for Level 4 deployment, with most relying on temporary pilot schemes, exemptions, or bespoke authorisations.

2. Remote supervision is not yet fully regulated anywhere except Germany, leaving uncertainty about supervision models, ratios, and required competencies.

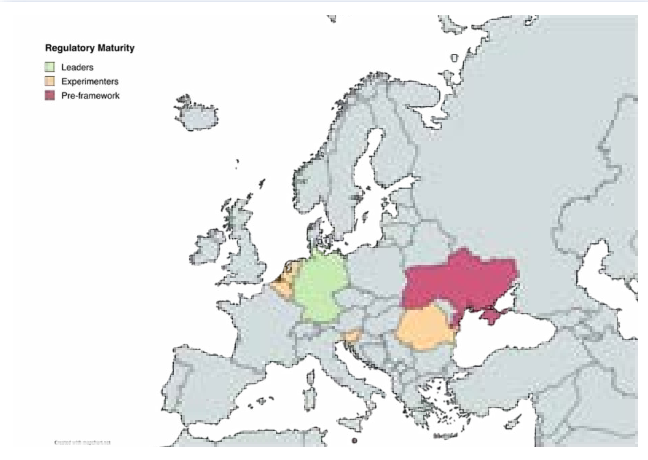
3. Data management obligations are clear in principle (GDPR, DPIAs, national privacy laws), but operational requirements for AV fleets remain fragmented or undefined.

4. Liability and insurance frameworks still depend on traditional driver-based rules, meaning AV-specific responsibilities must often be clarified project by project.

5. Testing does not automatically lead to long-term deployment, as most countries lack permanent frameworks that allow pilots to scale into regular public transport services.

4.3. Country snapshots

Across the partners, regulatory maturity ranges from leaders (e.g. Germany), with a full Level 4 framework and a defined path to market, to experimenters (Belgium, Netherlands, Romania, Slovenia), operating through pilots and exemptions, and pre-framework countries (Ukraine, Malta), where the absence of AV-specific rules means deployments rely on general traffic and insurance legislation.



4.3.1. Belgium (De Lijn)

1. ADS as the driver
Belgium regulates automated driving through an **exemption-based system** under the Royal Decree of 18 March 2018, allowing regional authorities to approve pilot projects and grant exemptions from traffic and technical rules. Testing remains restricted, with a test driver required on public roads and a test operator in low-speed public or semi-public areas.

2. Route to L4 autonomous vehicles

- 1) Submit an application to the Federal Ministry of Mobility and Transport, including insurance proof, a risk assessment, evidence of proving-ground tests, and confirmation of coordination with the road operator.
- 2) After federal approval, obtain the necessary regional, road, and local authorisations and cooperate with the relevant transport, road, and police authorities.
- 3) Notify the police at least three working days before each test and provide post-test reports, including updates to the risk management.

3. Safety features
Automated vehicles used in testing must be equipped with a data recorder that captures sensor, control, and vehicle-movement information. Regional authorities require logging of **key safety indicators**, with large projects tracking around 50 KPIs and smaller ones about 20, including metrics such as disengagements and speed.

4. Cybersecurity
There are **no specific legal rules** for cybersecurity or software updates in automated vehicles, but general safety obligations require manufacturers and suppliers to ensure high protection against unauthorised access. Testing organisations are advised to follow recognised standards such as IEC 61508 or similar principles on software reliability and cybersecurity.

5. Liability
Liability for autonomous-vehicle accidents currently **follows existing traffic, insurance, and product-liability rules**, with insurers compensating victims under Article 29bis of the WAM Act regardless of fault. If a defect caused the accident the manufacturer may be liable, and in pilot projects a safety steward's employer can also bear liability if the steward makes an error.

6. Insurance
Driverless public transport and all automated-vehicle tests must be covered by **standard vehicle insurance** and meet general legal obligations. Applicants must submit proof of insurance during the approval process, but no specific clauses for automated operation are required.

7. Legal duties for incident reporting
Incidents causing significant material or physical damage must be reported **within three working days**, and authorities may request all relevant data, including video.

8. Data
Automated test vehicles must record **essential operational data**, with any missing data requiring justification in the application. Personal data is subject to the **Belgian Privacy Act of 8 December 1992**,

meaning it must be processed lawfully and securely, retained only as necessary, and ideally supported by a recommended (but not mandatory) Data Protection Impact Assessment.

9. Supervision & training
Supervision ratios are set **case by case, with no fixed limit**. Test drivers or operators must hold the correct licence, ideally have several years' experience, and complete training on system operation, safety procedures, and manual–automated transitions.

4.3.2. The Netherlands (Noord-Brabant)

1. ADS as the driver
The ADS is **not legally recognised** as the driver, so operation without a human attendant is not allowed; only Level 2 systems are permitted with the driver fully responsible. Levels 3-4 may operate only in tightly controlled pilot projects, with broader legal authorisation expected around 2027/2028.

2. Route to L4 autonomous vehicles
Operating a Level 4 vehicle in the Netherlands requires **RDW approval**, which typically limits use to a predefined route and mandates a safety driver; public-transport applications also need approval from the relevant **Public Transport Authority**. The RDW's Admittance Procedure for Connected Automated Vehicles sets detailed requirements, including risk analyses such as FMEA and ISO 26262.

3. Safety features
There are **no clearly defined** mandatory safety-feature or data-recorder requirements, with the RDW determining needs case by case.

4. Cybersecurity
Software updates and cybersecurity measures are mandatory for new vehicles as of 1 July 2024 under **UN Regulations 155 and 156**, requiring manufacturers to maintain secure software-update management systems throughout the vehicle's lifecycle. These obligations do not apply retroactively to vehicles produced before 1 July 2022.

5. Liability
Liability may fall on the car owner under strict liability, but the manufacturer can be responsible if a system malfunction caused the accident. For self-driving functions, the **driver** is liable when manually driving, while the **manufacturer** is liable if the software triggers the crash.

6. Insurance
Driverless public transport insurance follows **standard third-party liability rules**, with owners or drivers remaining liable even when self-driving functions are used. Manufacturers **may share liability** if the vehicle was operating autonomously, but no special insurance clauses for automated operation currently exist.

7. Legal duties for incident reporting
The Netherlands has **no fully defined framework** for incident reporting in automated driving, though accidents must currently be reported to the authorities. More detailed requirements are expected to be developed with the RDW as legislation and pilot-project guidelines evolve.

8. Data
Car data is regulated under the **GDPR and the EU Data Act**, which strengthen user transparency, access, and safeguards against misuse of personal information. As part of GDPR compliance, organisations must also conduct a Data Protection Impact Assessment.

9. Supervision
There is no legislation yet on remote supervision limits, so arrangements are set **case by case** within RDW-approved pilot projects. Rules remain strict, meaning one supervisor is unlikely to oversee many vehicles, and a safety driver is still required as fully driverless operation is not yet permitted.

4.3.3. Germany (NVBW)

1. ADS as the driver
Germany recognises the **ADS as the legal driver** under the 2021 Act amending the Road Traffic Act and the Compulsory Insurance Act, enabling Level 4 vehicles to operate within defined domains. Driverless operation is permitted when a remote Technical

Supervisor can intervene, although most pilots still rely on onboard safety drivers. Complementing this is the December 2025 Teleoperation Regulation (StVFernLV), which creates a dual-track pathway. Teleoperation is not autonomous driving; instead, trained teleoperators control vehicles in real-time and remain the legal driver responsible for safety.

2. Route to L4 autonomous vehicles

1) The manufacturer must obtain a permit from the Federal Motor Transport Authority (KBA) under § 1i StVG and §§ 4 and 16 AFGBV.

2) The relevant state authority must authorise the vehicle's defined operational area after assessing whether the system can operate safely there.

3) The local registration authority issues the vehicle registration, with additional municipal permits required in some cases; approvals last up to four years and can be renewed or revoked for non-compliance.

3. Safety features

Level 4 vehicles must include defined safety features and a **mandatory data recorder** that logs system status, interventions, conditions, and incidents, with data retained for at least three years under the AFGBV. The KBA oversees safety compliance and reporting, while the BSI enforces cybersecurity requirements, ensuring the vehicle demonstrates reliable and risk-minimising behaviour. For teleoperated vehicles under the StVFernLV, vehicles transmit continuous sensor data, making reliable 5G connectivity essential, and must automatically stop in a risk minimal state if the connection fails.

4. Cybersecurity

Software updates and cybersecurity are mandatory under the **AFGBV and EU/UN rules**, requiring secure-by-design systems, documented OTA updates, and notification to the KBA when updates affect autonomous functions. The BSI oversees cybersecurity, obliging manufacturers to implement preventive and reactive protections in line with UN R155 and R156.

5. Liability

Liability for Level 4 vehicles is **shared**: manufacturers are responsible for technical malfunctions, while operators and the remote technical supervisor may be liable for human or procedural errors. The vehicle owner/operator also bears strict no-fault liability under § 7 StVG, with final responsibility depending on whether the root cause is technical, procedural, or human.

6. Insurance

Driverless public transport must carry **standard motor vehicle liability insurance**, which must also cover the actions of the required Technical Supervisor and proof of insurance must be submitted to the KBA when seeking an operating permit.

7. Legal duties for incident reporting

Incidents involving a Level 4 vehicle must be **reported immediately** by the operator or Technical Supervisor under § 1f–1g StVG and AFGBV §§ 12–15. The ADS records operational data until the vehicle reaches a risk-minimised state, and this must be provided to the KBA, which leads the compliance and cause investigation.

8. Data

Operators must record event-related data (e.g., position, speed, system status) under **§ 1g StVG and the AFGBV** and provide it to authorities when required, with retention lasting until the vehicle reaches a risk-minimised state. As this information qualifies as personal data under the **GDPR**, a **DPIA** is generally necessary, and the **EU Data Act (2025)** will further expand user rights to access and control connected-vehicle data.

9. Supervision

While Level 4 supervision ratios are expected to start at 1:1 and scale up as the technology matures and yields empirical data, teleoperation under the StVFernLV mandates a strict **1:1 operator-vehicle ratio**. This pragmatic, safety-focused regulation acts as a complement to autonomous driving, strengthening the CCAM ecosystem. It enables new service models, such as remote repositioning of shared cars and flexible rural mobility, while also serving as a fallback layer for Level 4 systems in complex situations.

4.3.4. Malta (Transport for Malta)

1. ADS as the driver

Malta does **not recognise** an ADS as the legal driver and requires a human license holder, meaning fully driverless operation is not allowed except under temporary, pilot-specific authorisations. A dedicated framework is being created only for the upcoming self-driving bus pilot and will be revoked afterward, while national rules remain unchanged despite EU type-approval regulations.

2. Route to L4 autonomous vehicles

There is **no dedicated legal framework** for automated-vehicle testing, so Level 4 operation has no standard approval route. In practice, any such deployment must proceed as a bespoke pilot agreed with the Ministry for Transport, Infrastructure and Public Works and Transport Malta.

3. Safety features
No AV-specific safety, data-logging or KPI requirements currently exist, so any Level 4 vehicle must rely on **EU type-approval rules** for mandatory systems such as event data recorders and active safety features. Pilot operations in Malta would therefore require bespoke, case-by-case conditions, negotiated with Transport Malta and other authorities, as no standing national AV framework exists.

4. Cybersecurity
Malta has no AV-specific rules on OTA updates or cybersecurity. Level 4 vehicles must therefore rely entirely on E**U type-approval obligations** (cybersecurity and software-update management under UN R155/R156), with no additional Maltese requirements beyond this general EU framework.

5. Liability
Liability for crashes involving automated vehicles is governed only by **Malta's general motor-insurance and civil-liability regime**, as no AV-specific rules exist. Third-party insurance remains mandatory, but current law assumes a human driver, creating a recognised 'responsibility gap' for Level 4 systems. In practice, liability may fall on the owner/operator or, if a defect is involved, the manufacturer or software provider. Outcomes are determined case-by-case under ordinary tort, contract, and product-liability principles.

6. Insurance
Standard third-party motor insurance applies, as no AV-specific insurance exists. Any driverless public transport pilot would require customised commercial policies (e.g., higher limits or product-liability extensions) negotiated for the project, since Maltese law still assumes a human driver.

7. Legal duties for incident reporting
Malta has no AV-specific incident-reporting rules, so **general road-traffic and operator-licensing duties** apply. For any driverless pilot, detailed reporting requirements and ADS data submissions would need to be set individually in the pilot agreement.

8. Data
Only **GDPR and the Data Protection Act** apply, since no AV-specific data rules exist. Identifiable vehicle or passenger data must follow GDPR principles, with access limited to legally authorised parties. Large-scale logging in a driverless public-transport pilot would almost certainly require a DPIA.

9. Supervision
Malta has no rules yet on remote-supervision ratios or qualifications, as current law assumes an on-board driver. Any AV pilot would therefore need to agree its supervision model and training standards with Transport Malta on a **case-by-case basis**.

4.3.5. Romania (Cluj-Napoca)

1. ADS as the driver
Romanian law **does not yet recognise** an ADS as the legal driver, and fully driverless operation is not permitted outside controlled or explicitly authorised pilot projects. A national framework is currently being drafted by the Ministry of Transport and academic/industry partners to define future conditions for testing, remote supervision, and eventual ADS-based operation.

2. Route to L4 autonomous vehicles
No dedicated legal pathway for Level 4 testing or commercial use exists, so any operation requires a bespoke authorisation from the Ministry of Transport, the Romanian Automotive Registry (RAR), and local authorities. Pilot projects may be approved on a case-by-case basis with a safety file and municipal permits, but testing without an on-board safety operator is not allowed, making controlled pilots with remote supervision the only current route toward future L4 deployment.

3. Safety features
Romania has no AV-specific rules for safety features or data recorders, so Level 4 vehicles must follow **EU requirements** such as the General Safety Regulation (EU) 2019/2144. In pilots, authorities typically require additional safeguards (emergency-stop functions, redundancy, remote supervision) and logging of system behaviour, with RAR able to request KPIs such as disengagements or fault rates to support safety validation.

4. Cybersecurity
There are no AV-specific rules on software updates or cybersecurity, so Level 4 vehicles must comply with **EU requirements**, including UNECE R155 (cybersecurity) and R156 (software updates). Any authorised pilot must therefore use secure, documented OTA update processes and maintain a cybersecurity risk-management plan aligned with these EU standards.

5. Liability
Responsibility for crashes currently falls under **general traffic and civil-liability rules**, with the vehicle's owner or operator remaining primarily liable even when automation is active. In pilot projects, the trial operator is typically responsible, while manufacturers or software providers are only liable if a proven technical defect caused the incident under EU product-liability law.

6. Insurance
All vehicles must carry **third-party liability insurance (RCA)**. Pilot projects typically require additional coverage for system or cyber risks, meaning the testing operator must secure comprehensive insurance until Romania adopts dedicated AV rules.

7. Legal duties for incident reporting
All incidents must be **reported immediately** to the Police, with pilot operators also notifying the Ministry of Transport and RAR. For tests, operators must provide system data, support joint investigations, and submit corrective-action reports before autonomous operations can resume.

8. Data
Data collection is governed by the **GDPR and Law 190/2018**, requiring strict purpose limitation, minimal data collection, and controlled access. A **DPIA** is mandatory for any AV deployment, and data sharing must follow anonymisation rules, with oversight by the national data-protection authority (ANSPDCP).

9. Supervision
Romania sets **no legal limits** on remote-supervision ratios; pilots define their own. Authorities approve these case by case, based on safety justifications and reliable fallback procedures.

4.3.6. Ukraine (Association of Energy Efficient Cities of Ukraine)

1. ADS as the driver
Ukraine currently has **no legislation** regulating autonomous driving, and under existing transport laws, only human drivers are recognised. Meaning Level 4 driverless public transport is not permitted.

2. Route to L4 autonomous vehicles
There is no process for approving autonomous-vehicle routes, so only the **existing public-transport rules** apply. Bus routes must be tendered under the Law on Automobile Transport (Nr.2344-III), unless launched temporarily as an experimental, non-competitive route; before tendering, a route passport must be prepared and approved by the National Police.

3. Safety features
There is currently **no legislation** or policy defining safety requirements, data recorders, or other technical standards for autonomous vehicles.

4. Cybersecurity
Ukraine has no legal requirements for cybersecurity or software-update processes for autonomous vehicles. The **general Cybersecurity Law (2163-VIII)** applies at a national level but does not address transport services or automated-vehicle systems.

5. Liability
Under the **Law of Ukraine on Road Traffic (Nr. 3353-XII)**, Article 53 assigns liability for traffic violations to the responsible legal entity or individual, and Article 53-1 makes the **vehicle owner** liable for offences captured automatically. Since these provisions assume a human-controlled vehicle, new legislation will be required to define how liability is allocated between the operator and the manufacturer in the case of autonomous vehicles.

6. Insurance
Under the Law of Ukraine on Compulsory Civil Liability Insurance of Owners of Land Vehicles (3720-IX), every motor vehicle on public roads must carry **compulsory liability insurance** linked to the vehicle and its owner, not the driver. This structure provides a suitable foundation for future insurance rules once Ukraine begins developing a legal framework for autonomous vehicles.

7. Legal duties for incident reporting
Ukraine follows **general accident-reporting rules:** drivers must stop, signal the incident, and notify the Police, with serious bus accidents triggering both criminal and technical investigations. Since no AV legislation exists, there are no AV-specific reporting duties.

8. Data
The **Law 'On Personal Data Protection'** governs any personal data generated by vehicles or transport systems, requiring transparency, purpose limitation, and appropriate security measures. Although inspired by early EU rules, it lacks GDPR-equivalent tools such as mandatory DPIAs, data portability rights, and strong enforcement.

9. Supervision
There is currently **no regulatory framework** governing autonomous vehicles, including rules for remote supervision or operator requirements.

4.3.7. Slovenia (Hrpelje-Kozina)

1. ADS as the driver
Slovenian law **does not recognise** an Automated Driving System (ADS) as the legal driver, and Article 27a of the Road Traffic Rules Act permits automated vehicle testing only with a human safety driver present and in sight of the vehicle.

2. Route to L4 autonomous vehicles
Level 4 vehicles may operate only for testing, with manufacturers required to **notify authorities** under Article 27a of the Road Traffic Rules Act and to ensure a safety driver is always present; remote or fully driverless operation is not permitted. No permit or fee is required, but manufacturers must self-assess safety, record incident data, and obtain local permissions when municipal infrastructure is involved.

3. Safety features
Slovenia requires automated test vehicles to use **data recorders** that store 30 seconds of data before and after an incident (Article 27a), which must be preserved and provided to authorities, but reporting occurs only in case of an accident, and no central monitoring system exists. **Safety relies on manufacturer self-assessment**, with no national KPIs.

4. Cybersecurity
Automated vehicles must comply with **UN Regulations 155 (cybersecurity) and 156 (software updates)**, ensuring secure OTA updates and systems to prevent, detect, and respond to cyber threats.

5. Liability
Liability for crashes involving automated vehicles generally follows **traditional driver and product liability rules**. If a human operator is present, they are usually responsible, but for autonomous operation, manufacturers or software providers may be liable for system defects, with responsibility assessed case by case.

6. Insurance
Driverless public transport must carry **standard motor vehicle liability insurance** covering third-party injury and damage, with policies often adjusted in pilot projects to address autonomous operation and potential manufacturer or technology-provider liability.

7. Legal duties for incident reporting
Incident reporting for automated vehicle testing (Article 27a) requires that **30 seconds of data before and after** any accident be recorded, preserved, and made available to authorities. Reporting is only mandatory if an accident occurs, with investigations handled by the police using the recorded data.

8. Data
Data collection, retention, and sharing for automated vehicles are regulated by the **Personal Data Protection Act (ZVOP-2), aligned with the EU GDPR**. Data must be lawfully collected, minimized, accurate, and stored only as long as necessary (typically 2–5 years), with a required Data Protection Impact Assessment, and users have rights to access, correct, or erase their data under supervision of the Information Commissioner.

9. Supervision
Slovenia has **no legal limits** on how many autonomous vehicles a remote supervisor can oversee, and teleoperation is not yet regulated. Operator qualifications and training are not formally mandated, so pilot projects rely on internal safety protocols and risk assessments.

4.4. Key takeaways for European PT actors

Across the seven countries studied (Belgium, the Netherlands, Germany, Malta, Romania, Ukraine, and Slovenia) driverless public transport is advancing within regulatory systems still largely designed for human drivers, resulting in shared structural limitations but differing levels of readiness. Germany is the only country with a fully codified Level 4 framework covering supervision roles, operational domains, data requirements, incident reporting, and liability, while the others rely on adapting conventional road-traffic and type-approval rules through pilot agreements and discretionary assessments. The same pattern appears in insurance, data governance, and operational oversight: all countries depend on traditional motor-liability models, general GDPR obligations where applicable, and pilot-based arrangements for remote supervision, with no jurisdiction offering a complete, AV-specific framework.

Because regulatory maturity varies significantly, the countries have substantial opportunities to learn from each other. Germany's structured model could guide Malta, Slovenia, Romania, and Ukraine toward more predictable approval pathways, while the flexible, innovation-oriented pilot regimes in Belgium and the Netherlands offer valuable lessons for balancing safety with experimentation. Greater alignment on insurance expectations, minimum incident-reporting datasets, data-retention rules, regulator access, and remote-supervision principles would reduce administrative burdens and support safer, more scalable deployment across all jurisdictions.

By comparing the existing EU regulations for automated vehicles with how they are applied in practice, a clear gap emerges: much of the legislation needed for full AV deployment is still missing at the European level. As a result, EU Member States would benefit from a standardised, harmonised regulatory framework that addresses key issues such as insurance, liability, and oversight - ensuring that future driverless mobility can develop consistently, safely, and at scale.

Recommendations for Regulators

To move from fragmented pilot regimes toward consistent pathways for Level 4 deployment, EU and national regulators should prioritise the following areas of harmonisation:

- Clarifying the driver definition for Level 4 services, including responsibilities when an ADS, remote supervisor, or backup operator is involved.
- Establishing common standards for remote supervision (roles, competencies, supervision ratios, permitted interventions, OCC requirements).
- Creating AV-specific insurance and liability rules, reducing the need for project-by-project negotiations.
- Introducing harmonised incident-reporting and safety-data requirements, ensuring consistent oversight across Member States.
- Clarifying data-access and retention rules for AV operations, complementing existing GDPR and Data Act obligations with AV-specific operational guidance.

Practical Actions for PTOs, PTAs and Cities

Even as national frameworks evolve, PTOs and PTAs can take practical steps now to prepare for autonomous public transport services:

- Embed AV-ready procurement practices, including software-lifecycle requirements, cybersecurity obligations, and clear arrangements for updates, recalls, and type-approval compliance.
- Develop governance for remote supervision, including early planning for OCC roles, staffing, procedures, and interaction with road-traffic authorities.
- Strengthen data governance by conducting DPIAs, defining roles (controller/processor), and setting data-access, retention, and sharing policies aligned with GDPR and the Data Act.
- Initiate early engagement with insurers, approval authorities, and national ministries to clarify liability, authorisation pathways, and operational expectations.

Even as national frameworks evolve and regulatory gaps are addressed, several European regions are not waiting to act. Frontrunners are already embedding AVs into their strategic public transport policies.

5. European flagship AV ecosystems and approaches

5.1. Baden-Württemberg: a state-led procurement and scaling approach

To address pressing structural challenges and achieve ambitious climate goals, Baden-Württemberg (BW) has launched the Joint Procurement and Implementation Initiative for Autonomous Public Transport. Through this initiative, BW has set a clear and pioneering ambition: to establish autonomous driving as a key technology for a highly efficient, future-proof, and climate-friendly public transport system (ÖPNV).

The public transport sector currently faces severe structural problems, most notably a critical shortage of bus drivers; there is already a nationwide deficit of around 20,000 drivers, with 6,000 additional vacancies emerging every year. Combined with rising operational costs and limited expansion capabilities, these challenges have prompted the state to formulate a strategic vision for a strengthened public transport network powered by autonomous vehicles. In the long term, this technology is intended to close service gaps, particularly in rural areas. Furthermore, it is expected to help realize an essential 60% expansion in public transport operational performance, which is currently required to meet climate targets in the mobility sector.

5.1.1. Why Baden-Württemberg is moving beyond isolated pilots

The initiative, led by the Baden-Württemberg Ministry of Transport (VM BW), pursues a consistently coordinated approach to enable the transition from today's isolated pilot projects to a scalable, regular operation. Previous projects, such as RABus and AMEISE, demonstrated that the path to autonomous driving is demanding and requires technical, organizational, and regulatory issues to be tackled collectively.

Acting as a catalyst, the state is pooling activities and creating shared structures to move away from fragmented solutions toward a statewide, interoperable approach. This strategy is built on the understanding that six interconnected challenges must be overcome:

- The need for adjustments in the regulatory framework and approval practices.
- Technological immaturity and dependencies.
- High vehicle and operating costs.
- A potential lack of social acceptance.
- Missing operating models and integration processes.
- The complex procurement of autonomous vehicles and system components.

Addressing these challenges efficiently requires a joint effort. A coordinated approach reduces costs and technological risks, enables standardized procurement and operating processes, and facilitates access to funding while building crucial know-how in areas like control centre integration, update strategies, and emergency management.

5.1.2. The procurement and deployment roadmap

To ensure a successful transition, the initiative's roadmap outlines a clearly structured, multi-stage ramp-up:

Phase 1: foundation and initial integration (2026-2027)
The first phase focuses on establishing necessary prerequisites, such as developing an innovative procurement model, clarifying central financing and legal questions, empowering the involved actors, and deploying type-approved vehicles in regular operation within a few initial transport networks. A major focus here is building foundational know-how, especially regarding operational organization and control centre integration.

Phase 2: expansion and modelling (from 2028)
Starting in 2028, an extended model phase will explore suitable use cases, test new operating models, and transfer the gathered experiences to a broader range of public transport stakeholders.

Phase 3: widespread rollout (from 2031)
Finally, a widespread rollout is scheduled to begin in 2031, supported by established standards, proven technical systems, and a growing number of deployable vehicle types.

5.1.3. Governance structure and wider significance

A central success factor of this model is the close cooperation of all relevant stakeholders. At the state level, the Ministry of Transport steers the overall strategy, coordinates the approach, and drives the development of the legal framework. Meanwhile, transport authorities, transport associations, and transport companies make up the operational level, taking responsibility for the day-to-day operation, integration, piloting, and ultimate implementation of autonomous lines.

The planned establishment of a central statewide procurement and competence structure is particularly noteworthy; it is designed not only to lower costs and risks but also to create a uniform technological basis for scalable operations. By combining a clear ambition, a structured procedural model, and multi-perspective stakeholder involvement, Baden-Württemberg positions itself as a European pioneer in open-technology, governance-oriented autonomous public transport. For the Cooperative, Connected and Automated Mobility (CCAM) sector, this coordinated approach serves as an exemplary blueprint for how federal systems can introduce intelligent, safe, and sustainable mobility on a massive scale.

While Baden-Württemberg is pioneering a state-wide procurement strategy, another ambitious initiative is unfolding elsewhere in Germany: the city of Hamburg is actively promoting connected, cooperative and automated mobility (CCAM) as a core element of its own broader mobility transition.

5.2. Hamburg: A city-state AV ecosystem

5.2.1. Why is Hamburg working on AV?

As a core element of its broader mobility transition, the Hamburg-Takt and the digital mobility strategy, Hamburg is actively promoting connected, cooperative and automated mobility (CCAM). The aim is to increase the number of bus and train passengers by 50%, by creating a comprehensive public transport network covering the entire city. CCAM, particularly in automated regular service, are therefore seen as a key complement to traditional bus services. The goal is to increase public transport's share of the modal split to 30%, thereby improving mobility and digitalisation while significantly reducing CO_2 emissions in the transport sector. With this new system and the integration of digital services such as app-based booking and on-demand mobility, Hamburg residents will no longer need to consider timetables, as they will be able to travel anywhere spontaneously and without waiting times.

5.2.2. Key stakeholders and roles

The CCAM ecosystem in Hamburg is characterised by strong, long-standing cooperation between public authorities, public transport operators, research institutions, and private-sector partners. Rather than being driven by a single project, CCAM development in Hamburg is embedded in a multi-actor governance model that links strategic planning, regulation, operations and research. The FAST project coordinates and unifies all existing CCAM projects in Hamburg.

5.2.2.1. Public Authorities:

Ministry of Transport and Mobility Transition (BVM):
BVM is shaping the future of mobility in Hamburg. As the political and planning authority, it promotes environmentally friendly alternatives and invests in modern infrastructure for all road users. Its goal is to make mobility safe, climate-friendly and efficient for everyone.

BVM has a dedicated team working on CCAM. This team is responsible for strategic alignment, regulatory oversight, approvals, and integrating autonomous services into public transport. The team also coordinates federal and EU funding.

Including the Senator of the Ministry of Transport and Mobility Transition, which provides political leadership and ensures alignment with climate targets, public transport expansion and broader urban mobility goals.

State agencies (e.g. LSBG, LGV):
The state agencies act as executing bodies, supporting the implementation of CCAM by providing expertise in road infrastructure, traffic management, geodata and the operational domain.

5.2.2.2. Public transport operators (PTO):

Hamburger Hochbahn AG (HOCHBAHN):
HOCHBAHN is owned by the Free and Hanseatic City of Hamburg, with over 6,600 employees and more than 1,000 buses. The PTO is leading the projects such as ALIKE and developing operational concepts and infrastructure, such as autonomous depots, with a focus on scalability.

New Mobility Solutions Hamburg:
NMS is a subsidiary of Hochbahn and Hamburg's in-house consultancy, coordinating CCAM strategy development, etc.

vhh.mobility
vhh.mobility is the third-largest municipal bus company in Germany. The PTO employs around 3,000 people and operates approximately 800 buses. Operates on-demand services and is the lead partner of the AHOI project, focusing on mixed fleets, first/last-mile integration, and control centre development.

hvv (Hamburger Verkehrsverbund):
Ensures the system-wide integration of autonomous services, including tariffs, passenger information, and digital platforms such as the HVV Switch app.

5.2.2.3. Research partners:

Technische Universität Hamburg (TUHH): Research into user behaviour and social acceptance.

5.2.3. Past, current and planned AV projects

5.2.3.1. Past:

- **CleverShuttle (2016):** Launched the first on-demand services in Hamburg.
- **VHH-operated ioki shuttles (2018):** First and last mile connections to public transport, expanding to areas such as Lurup, Osdorf, Ahrensburg, Stormarn, Hamburg-Billbrook and Hamburg-Harburg. From 2023 onwards, the service has operated exclusively between doorsteps and public transport stops, utilising IOKI software.
- **MOIA (2019):** Launch of a ride-pooling service with up to 500 vehicles, offering point-to-point connections and expanding the service area to 266 km².
- **The HEAT project (Hochbahn):** an early autonomous minibus demonstration in HafenCity (2019–2021) and one of the world's first urban CCAM initiatives.
- **TaBuLa Shuttles (NAVYA, 2019):** Launched in Lauenburg an der Elbe on Level 2. Followed by TaBuLa-LOG and
- **TaBuLa-LOGplus projects** for improved networking and coordination using AI.
- **RealLabHH eMoin Shuttle (Continental, VHH):** Provided insights into the acceptance of autonomous vehicles, successfully operating as an on-demand service (Level 4) at the ITS World Congress 2021.
- **BiDiMoVe project (2018–2021):** Aimed to introduce connected driving based on intelligent transport systems (ITS)

5.2.3.2. Current/ongoing:

- **FAST (Future Autonomous System of Public Transport Hamburg):** Funded by the European Investment Bank with €1.8 million, the project runs from 2024 to 2028. It serves as a broader umbrella initiative to finance the planning of CCAM projects and to prepare for future operational scaling. FAST is the project that centralises and brings together all the different ideas, concepts, and projects of the BVM. It is therefore a crucial project for the coordinated development of CCAM in Hamburg.
- **ALIKE:** Duration 2023–2027, funded by the Federal Ministry of Digital and Transport. This is an autonomous ride-pooling project testing autonomous vehicles (VW ID. Buzz AD and Holon Mover) integrated into the public transport system. Initial operations are scheduled to begin at the end of 2025, with trials for closed user groups planned in 2026.
- **ahoi:** Duration 2023–2027, funded by the Federal Ministry of Digital and Transport, with a budget of €37 million. The project focuses on the development of an autonomous L4 on-demand service and its integration into existing HVV Hop on-demand services in Harburg. Autonomous shuttles are expected to enter test and pilot operations in 2026.

5.2.3.3. Future/planned:

Beyond the current pilots, Hamburg is addressing the gap between today's pilot projects and full market maturity.

3plus3: HOCHBAHN is testing autonomous vehicles in regular scheduled service from late 2026, three RoboShuttles and three RoboMidibuses will be deployed on existing bus routes in Hamburg.

5.2.4. What makes Hamburg special

The unique selling points of Hamburg are driven by strong political leadership: the Senator of the Ministry of Transport and Mobility Transition (Bündnis 90/Die Grünen) is a firm advocate of CCAM and is actively promoting its development as part of Hamburg's long-term mobility strategy.

Consequently, Hamburg has established itself as a leader in sustainable mobility and digitalisation. A broad and well-coordinated stakeholder landscape brings together Hamburg's two primary public transport operators, Hamburger Hochbahn AG and vhh.mobility, which are spearheading the major CCAM projects ALIKE and AHOI. Public authorities, research institutions, and political decision-makers collaborate closely with these operators to achieve the shared goal of establishing autonomous public transport services. All activities are coordinated and managed under the umbrella project FAST.

5.2.5. Roadmap and timeline

Year/Phase Milestone:

2016: ITS (intelligent transportation system) strategy development, international positioning

2018: Roll-out of on-demand services (hvv hop)

2023: ahoi project with mixed fleets and autonomous operation in Harburg

2024: Publication of Hamburg's Digital Mobility Strategy

2024: FAST Hamburg as enabling and coordination framework

2025: Start of ALIKE test operations; UITP Summit showcase.

2026+: Transition from pilots to scalable autonomous on-demand and selected scheduled services.

5.2.6. Lessons for other EU regions

Hamburg demonstrates that the deployment of CCAM benefits from:

- **Embedding AVs in public transport policy** rather than treating them as standalone tech pilots.
- **Strong public ownership and coordination**, with operators involved from the outset;
- **Stepwise scaling** using mixed fleets and controlled operational domains.
- **An early focus on operations, business models and acceptance**, rather than just technology.
- **EU wide openness** and the sharing of results through EU projects, conferences and lighthouse initiatives.

Overall, Hamburg is positioning CCAM as a long-term public service innovation rather than a short-term experiment, offering a transferable model for other European metropolitan regions.

Just as Hamburg views automated services as a key complement to traditional buses, the Oslo region similarly frames AVs as a crucial part of a broader mobility transition. Driven by climate goals and pressure on conventional service capacity, the Oslo ecosystem places integration, pooling, and system efficiency at the centre of its autonomous agenda.

5.3. Oslo / Ruter: a PT-led AV ecosystem

5.3.1. Why Ruter / Oslo is working on AVs

Ruter approaches AVs as a public-transport strategy. The core question is how to offer more flexible, attractive mobility across the Oslo region while reducing dependence on private cars. Shared autonomous on-demand services are being explored as one future building block within the wider PT system.

Three drivers shape this agenda. First, Oslo's climate and urban-policy goals require fewer car trips, lower emissions and more efficient use of urban space. Second, Ruter faces long-term pressure on capacity and operating cost. Many conventional services already rely on significant subsidy, and future travel demand will be difficult to meet through traditional bus expansion alone. Third, Ruter wants public authorities to retain a strong role in shaping how AV services enter the market. A largely private, fragmented robotaxi model could pull demand away from collective transport and add traffic if left unchecked. The result is a distinctly public-service framing: AVs are being examined as part of a broader mobility transition, with integration, pooling and system efficiency at the centre.

5.3.2. Governance: who "Oslo" means in practice and who are the core stakeholders?

In this context, "Oslo" refers to a public ecosystem rather than a single institution.

- **Ruter** is the central public transport authority and the main system integrator. It defines the service vision, runs pilots, engages the market, and is likely to play the lead role in future procurement
.
- **Oslo Municipality and Akershus County Municipality** own Ruter. The company is owned 60% by Oslo and 40% by Akershus, which gives the AV agenda a metropolitan scope and a clear political anchor.
- **The Norwegian Public Roads Administration** is the main regulatory counterpart. It plays a key role in trial approvals and in shaping the framework for future driverless deployment.
- **National and European innovation programmes** support the transition from pilot to scale. Enova and Horizon Europe, including ULTIMO, are particularly relevant in this regard.

This governance set-up matters because Ruter's AV work sits inside mainstream regional transport policy, funding and institutional decision-making.

5.3.3. What makes Ruter special

Ruter stands out in several ways:

1) It has a clearly defined public-service ambition. The target model centres on pooled, shared services connected to the wider PT network and aimed at shifting trips away from private car use over time.

2) Ruter is already thinking at system scale. Its materials move beyond small shuttle demonstrations and explore what an initial deployment of 100 to 500 vehicles could require, as well as what a much larger regional system might look like later on.

3) Ruter is acting as a market shaper. The organisation is examining value chains, cost structures, financing needs, operating models and procurement routes before launching large-scale tenders.

4) Its ambitions rest on several years of operational learning. Ruter has accumulated experience with mixed traffic, winter conditions, demand-responsive operation, customer-facing pilots and the organisational implications of AV deployment.

5) A further strength lies in Norway's regulatory environment. Compared with many European jurisdictions, the national framework offers a more advanced basis for testing and preparing future driverless services.

5.3.4. Key stakeholders and their roles

Ruter
Ruter leads the vision, pilot programme, market dialogue and future service design. It wants shared autonomous on-demand mobility to become part of the regional PT offer.

Oslo Municipality and Akershus County Municipality
The owners provide political backing, budgetary legitimacy and long-term strategic continuity. Their support will shape future decisions on risk, funding and deployment pace.

Norwegian Public Roads Administration (Statens vegvesen)
This is the core regulatory actor for trials and future commercial deployment. Its role is central in moving from pilot authorisations toward a more durable framework.

Holo
Holo serves as Ruter's research and development partner and operates the current self-driving pilot in Groruddalen. The company has been closely involved in making the service work in practice.

NIO / Mobileye
The current Groruddalen phase began with NIO ES8 vehicles. The first phase also relied on Mobileye-based automated driving technology, with Holo supporting implementation and operations.

MOIA / Volkswagen
Ruter has signed an updated agreement for the next pilot phase with MOIA and Volkswagen. From summer 2026, the Groruddalen pilot is due to shift to larger Volkswagen ID. Buzz vehicles, alongside MOIA's contribution on digital services and user experience.

Other ecosystem actors
Ruter's 2026 market dialogue brought together operators, DRT software companies, AV firms, insurers, infrastructure providers, researchers and other suppliers. One message came through clearly: future delivery will likely depend on partnerships or consortia across several parts of the value chain.

5.3.5. AV projects: past, current and future

5.3.5.1. Past pilots

Ruter has built substantial AV experience since 2019. Across five pilots, it reports more than 33,000 passenger trips and over 120,000 kilometres of self-driving operation. Key pilots covered urban, island, city-centre and winter conditions, helping Ruter build practical know-how on operations, safety, customer use and mixed traffic.

5.3.5.2. Current pilot

The key live project is the **self-driving pilot in Groruddalen**, launched in 2023. It is the first area-wide demand-responsive AV pilot in Ruter's programme and is much closer to a future public transport product than earlier shuttle-style demonstrations. Phase 1 uses NIO vehicles with onboard safety operators and booking through a dedicated app. The service opened to the public in February 2025 and has focused on building operational maturity, public trust and readiness for the next step.

5.3.5.3. Next phase

From 2026, the pilot moves into a new phase with larger Volkswagen ID. Buzz vehicles linked to MOIA. This phase will give Ruter the chance to test a more mature customer experience, stronger PT integration and a gradual transition toward reduced onboard supervision.

5.3.5.4. Future direction

Ruter's wider ambition extends well beyond the pilot. The organisation is preparing the ground for a first scaled business introduction of roughly 100 to 500 shared autonomous vehicles. Its long-term framing reaches much further, with regional operations involving thousands of vehicles if the economics, regulation, procurement logic and supply chain continue to mature.

5.3.6. Strategies, studies and institutional logic

Economics white paper (Dec 2025)
This paper serves as an illustrative analytical document designed to support dialogue. Its purpose is to test whether shared autonomous on-demand mobility could become financially sustainable over time. The headline finding is clear: the early deployment phase is capital-intensive and front-loaded, while larger scale could significantly improve unit economics. In Ruter's scenario, a 500-vehicle service averages around EUR 0.92 per passenger-kilometre over ten years, whereas a 3,000-vehicle scenario could reduce this to roughly EUR 0.51. Ruter's financing material also indicates that an initial 500-vehicle launch would require major early funding before the model reaches a steadier state.

Industry briefing and dialogue conference
These materials support market shaping and pre-procurement engagement. Their role is to clarify where different actors may sit in the value chain, test assumptions on risk allocation and integration, and gather feedback on operations, regulation and commercial structure. More than 70 participants from 48 companies and institutions joined the March 2026 dialogue conference, showing that Ruter is building an ecosystem in advance of any major procurement.

5.3.7. Roadmap and timeline

Ruter's pathway can be read in four phases:

- **Phase 0 – Test and learning:** pilots in limited areas to build operational and regulatory knowledge.
- **Phase 1 – Business introduction:** first operation with hundreds of vehicles, intended to prove that the concept works as a real mobility service.
- **Phase 2 – Scaling up:** fleet expansion with the explicit aim of shifting trips away from private car ownership.
- **Phase 3 – Transformed system:** a long-term scenario in which autonomous shared mobility becomes a core element of the regional mobility system.

For the nearer term, the timeline is more concrete:

2023–February 2026: first Groruddalen phase with NIO vehicles.

March 2026–2028: next pilot phase with VW/MOIA vehicles and deeper service integration.

2026: formal market engagement through the industry briefing, dialogue conference and follow-up bilateral meetings.

By Q3 2026: Review of the feedback from the market dialogue, decide which strategic direction to take, and clarify the main conditions needed for the next step.

Late 2020s: A first larger-scale rollout could become possible, depending on progress in funding, procurement, regulation and market readiness.

Oslo therefore sits in an advanced pre-commercial phase. The city-region has moved beyond isolated experimentation and is now working through the practical design choices required for scaling.

5.3.8. Lessons for other EU regions

Ruter offers several lessons with clear relevance across Europe.

1) Start from the mobility challenge
Ruter links AV deployment to concrete policy goals: reducing car dependence, improving flexibility, and strengthening the attractiveness of collective transport.

2) Build strong institutional ownership early
Because Ruter sits at the centre of regional PT governance, it can align pilots, strategy, market dialogue and future procurement within one coherent framework.

3) Treat scaling as a system design exercise
The Oslo process shows how many elements need to come together: vehicles, depots, remote support, software, data integration, customer service, contracts, cybersecurity, insurance and regulation.

4) Use pilots to prepare organisations as well as technology.
Ruter's pilots have generated learning on operations, governance, customer journeys, authority coordination and institutional readiness.

5) Engage the market before fixing the delivery model
The 2026 dialogue process offers a strong example of structured ecosystem building ahead of procurement.

Bottom line
Ruter is one of Europe's clearest examples of a PTA working toward a publicly integrated, potentially large-scale shared autonomous mobility model. Important uncertainties remain around procurement, economics, risk allocation and supplier maturity. Even so, Oslo is further ahead than most European regions in tackling the system-level questions that determine whether AV services can move from pilot to mainstream deployment.

6. Overall conclusions

For those involved in European public transport, the central question is no longer whether autonomous vehicles are becoming a reality. In a limited number of markets, they already are. A more important question is how AV services should be introduced into European mobility systems, what their purpose should be, and what institutional conditions should apply.
The clearest lesson from the cases reviewed in this report is that AV deployment is following several different pathways, taking shape through different service models, governance arrangements, and degrees of public control.

For PTAs and PTOs, this means that their AV strategy should not start with the vehicle or the technology provider. It should start with identifying their intended service role. The objective could be to strengthen a fixed-route public transport offer, improve coverage in lower-density areas, add feeder or on-demand services, or respond to commercially attractive ride-hailing demand. Once the intended service role is clear, the more pertinent question becomes which operating model best fits it, and what procurement, contractual, data-sharing and regulatory conditions need to be established. In this respect, the deployment of AVs is as much a governance and service design challenge as it is a technical one.

The European cases in this report demonstrate that this work has already begun. Baden-Württemberg illustrates how public bodies can establish shared structures, procurement models and capacity-building mechanisms to move beyond fragmented pilots. Hamburg demonstrates the value of a multi-actor ecosystem in which political leadership, operators, state agencies and research organisations are aligned around a broader mobility transition. In Oslo, Ruter demonstrates that scaling shared autonomous mobility requires a new system design, including market dialogue, operational planning, customer integration, risk allocation, and long-term institutional ownership. These examples are important because they demonstrate that the successful integration of AVs depends on deliberate public intervention rather than passive “wait and see”.

The implications for European PTAs and PTOs are practical. They do not need to wait for a fully mature European AV market before taking action. However, they do need to act more strategically now. This involves defining the mobility issues that AVs are intended to address, determining where robust public control is necessary and where market-driven entry could be permitted, and preparing the procurement, data, regulatory, and organisational conditions that will influence future deployments.

Contact

Lars Meijer
LMeijer@brabant.nl

Christian Riester
c.riester@baxcompany.com

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