



Robot Buses and Automated Public Transport: Regulation, Operations and the Transition from Pilots to Permanent Services

Robot Bus Panel – The Finnish Regulatory Perspective

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Executive Summary

This report summarises the main themes and observations arising from a two-hour discussion between three Finnish mobility specialists: two specialists in automated vehicles (AVs) and one mobility generalist. The discussion focused particularly on robot buses, automated taxis, regulation, remote operation, public transport services and the transition from pilot projects to permanent operations.

The discussion suggested that automated public transport should not be viewed simply as a technological development. Its eventual significance will depend equally on regulation, responsibility, procurement, business models, infrastructure, connectivity, public-sector organisation and safety.

Robot buses were considered a particularly interesting cleantech case. If automated buses and taxis become widely adopted, they could reduce the empty kilometres and parking requirements associated with privately owned cars. Since automated vehicles are generally expected to be electrically powered, automation and electrification may reinforce each other.

At the same time, the discussion emphasised that the concept of the “driver” is undergoing a fundamental change. Under the emerging regulatory framework, responsibility may increasingly move away from an individual physically present in the vehicle towards organisations responsible for the automated driving system, the vehicle and remote-operation services. The distinction between *driving* and *supervising or controlling* an automated vehicle was considered particularly important.

The Finnish experience was seen as potentially enabling the transition. The Tampere/Lintuhytti robot-bus operation was discussed as an example of a service moving beyond the conventional pilot model. Publicly available information subsequently confirmed that, from 24 June 2026, the robot bus on Tampere's line 301 began operating without a safety driver while being remotely monitored.

The discussion nevertheless identified a major gap between technical demonstrations and scalable public transport services. Cities currently have few established models for procuring automated bus services. Without appropriate procurement models, pilots may remain dependent on project funding rather than becoming part of ordinary public transport.

The specialists also considered the future development of automated taxis and buses. Robotaxis are currently more visible internationally, particularly in the United States and China, but the participants considered automated buses potentially more significant in the European context because public transport plays a much larger role in European urban mobility.

Finally, safety was considered the strongest long-term argument for automation. Although individual failures and unusual situations will inevitably occur, automation could potentially reduce the number of accidents caused by human error and improve both passenger security and traffic safety at system level.



The overall conclusion of the discussion was cautious but broadly optimistic: **the automation of transport is unlikely to arrive as a single technological revolution. Rather, it is likely to spread gradually through clearly defined operational domains, beginning with services where automation offers a practical economic or operational advantage.**

Note. Robot Buses as a Cleantech and Mobility Case

Robot buses and robotaxis can be regarded as a cleantech case in two complementary ways: through automation and through electrification.

If automated buses and taxis become widely adopted modes of transport, they could potentially reduce some of the inefficiencies associated with privately owned cars. In particular, automated shared vehicles could optimise vehicle utilisation and reduce the “empty kilometres” and long-term parking requirements that are often unavoidable when people use private cars.

The environmental case is therefore not simply that the vehicle itself is electric. The more fundamental question is how automation changes the utilisation of vehicles and the organisation of mobility.

Most automated buses and taxis are expected to use fully electric powertrains. Automation and electrification could therefore develop together, producing a transport system in which vehicles are both more efficiently utilised and less dependent on fossil fuels.

The discussion nevertheless suggested that the benefits should not be assumed automatically. The actual environmental and mobility impacts will depend on how automated services are integrated into public transport, whether they replace private-car journeys or existing shared transport, and how intensively the vehicles are used.

This makes robot buses particularly interesting as a public-transport application. A small automated bus operating as a feeder service, for example, may be economically viable in an area where conventional bus operation with a driver is difficult to justify.

The Tampere/Lintuhytti case was discussed in precisely this context.

1. Regulation and the Changing Concept of the Driver

1.1 Who is the “driver”?

One of the central issues discussed was the legal status of the driver.

Finnish legislation has traditionally been based on the assumption that a vehicle has a natural person as its driver. However, the physical location of that person becomes increasingly difficult



to define when a vehicle is capable of driving itself and may be supervised or controlled remotely.

This question also has an international dimension. Finland is a party to the 1968 Vienna Convention on Road Traffic, developed under the auspices of the United Nations Economic Commission for Europe (UNECE). The Convention seeks to harmonise road-traffic rules and facilitate international road transport by establishing common legal principles.

The development of automated driving has required these principles to evolve. **Article 34 bis**, concerning automated driving, represents an important development because it recognises that the conventional requirement for every moving vehicle to have a driver can be satisfied while an automated driving system is operating, provided that the system complies with applicable technical regulations and the domestic legislation governing its operation.

The principle is nevertheless territorial. Recognition of an automated driving system under the relevant national framework does not, by itself, mean that the same system can operate under identical conditions in another country.

This is particularly relevant to Europe, where automated mobility services will need to operate across regulatory systems that are increasingly being harmonised but are not yet completely uniform.

The regulatory landscape is still evolving. In 2026, UNECE moved towards a new global regulatory framework for fully automated driving systems, while the EU has also continued to develop its type-approval framework.

The discussion therefore treated regulation as an enabling framework that is still under development rather than as a finished system.

1.2 From the individual driver to organisational responsibility

A fundamental change may occur when there is no longer a natural person responsible for driving the vehicle in the conventional sense.

The discussion suggested that responsibility could instead become distributed among several actors, potentially including:

1. the automated vehicle itself as a registered vehicle;
2. the provider of the automated driving system or service;
3. the provider of the remote-operation or remote-supervision service;
4. the vehicle manufacturer; and
5. potentially the public transport operator.

This creates a very different legal and operational structure from conventional driving.

A company cannot, of course, be imprisoned in the way an individual driver can. Consequently, administrative sanctions and financial penalties may become important instruments for ensuring that organisations comply with their responsibilities.



The precise allocation of responsibility remains an open question. It may be possible for one company to provide the complete vehicle, software and operational service. Alternatively, three or more separate actors may provide the vehicle, automated-driving technology and remote-operation service.

The resulting contractual and regulatory relationships could therefore become as important as the technology itself.

The discussion noted that Finnish authorities, including Traficom and the Ministry of Transport and Communications, have been considering these questions. The participants' understanding was that the future framework is likely to require the relevant vehicles and service providers to be identifiable in national registers.

The central point was clear: **once the human driver disappears from the vehicle, responsibility does not disappear; it has to be redistributed.**

1.3 Human or artificial intelligence in the control room?

The discussion also distinguished the Finnish approach from some developments in the United States.

The participants perceived Finnish thinking as still placing relatively strong emphasis on human remote supervision. In the United States, by contrast, companies such as Waymo have been developing increasingly automated approaches to fleet supervision, with artificial intelligence supporting operational decision-making.

The distinction is important, however. Artificial intelligence does not necessarily replace human involvement altogether.

A remote-control centre may involve:

- AI-supported monitoring;
- human supervision;
- route definition;
- definition of operational areas;
- intervention in exceptional circumstances;
- re-routing;
- problem-solving; and
- direct vehicle control in exceptional situations.

The human operator may therefore not be a “driver” in the traditional sense. Rather, the operator may supervise the system and intervene only when necessary.

This distinction becomes especially important when considering how many vehicles one person can supervise. The ratio may eventually be very high if intervention is required only occasionally.



The discussion referred to a figure of approximately one control person for 40 vehicles in the Waymo context, although this was an observation from the discussion rather than a figure independently verified for this report.

The participants also noted that remote supervision need not necessarily take place close to the vehicle. In principle, a person supervising an automated vehicle in California could be physically located in another country, provided that connectivity, regulation and operational arrangements permit it.

This raises an important distinction between *remote supervision* and *remote driving*. Actual vehicle manoeuvring requires much more stringent communication performance than many supervisory activities.

1.4 Enabling regulation

The Finnish regulatory environment was viewed as an important enabler of experimentation.

The discussion highlighted the role of the Finnish testing-permission framework, including the so-called 116a permissions, which have enabled automated vehicles to be tested in normal road traffic while allowing certain exemptions from conventional structural, equipment and registration requirements.

The participants recalled that hundreds of such permissions had been issued since 2016, although the precise number mentioned in the discussion requires verification and is therefore not treated here as an established figure.

The broader point is more important than the precise number: **Finland has developed a regulatory mechanism that has allowed developers and research projects to test automated vehicles in real traffic rather than only in closed environments.**

This type of enabling regulation may prove essential during the transition from experimentation to commercial services.

1.5 Steering versus controlling

An important conceptual distinction emerging from the discussion was between **steering** and **controlling** an automated vehicle.

Actual remote steering may be relatively rare. Much of the activity in a control room may instead involve:

- monitoring;
- identifying problems;
- resolving exceptional situations;



- re-routing vehicles;
- defining operational areas; and
- providing support to the automated system.

In an extreme situation, a remote operator may take direct control of the vehicle, for example when the vehicle has encountered a situation it cannot resolve itself.

This distinction has practical consequences. A remote-operation centre may not need to be continuously “driving” vehicles. Instead, it may provide a safety and operational back-up function.

Connectivity nevertheless remains critical. If communication between the vehicle and control centre is lost, many of these functions cease to operate. For that reason, the participants considered the location and reliability of the control infrastructure important, particularly during the early stages of deployment.

The discussion also raised the question of how control centres and associated rescue services will be organised as the number of automated vehicles increases. Some of these services may eventually be subcontracted, making the overall operational chain increasingly complex and potentially difficult for public authorities to monitor.

2. From Pilot Projects to Permanent Public Transport Services

Robot buses are ultimately a form of public transport. In Europe, public transport is typically organised or commissioned by public authorities, even when the actual services are provided by private operators.

This means that the transition from pilot projects to permanent automated services cannot be achieved by technology providers alone.

Public authorities will have a central role in determining:

- where automated services operate;
- how they are procured;
- how safety is demonstrated;
- how performance is monitored;
- who carries responsibility;
- how passengers pay; and
- how automated services are integrated into the wider public transport network.

The discussion therefore focused heavily on the need to move beyond the pilot-project mentality.



2.1 The need for new procurement models

At present, cities and municipal authorities generally procure public transport routes and specify requirements for the vehicles and services. Demand-responsive transport (DRT) remains relatively marginal in many Finnish cities.

The participants considered this procurement model poorly adapted to automated bus services.

Cities would benefit from clear and standardised models for procuring automated transport services. Ideally, similar principles could be applied across different cities, reducing the need for every municipality to develop its own procurement model from scratch.

Without such models, introducing an automated bus route can become an unusually laborious administrative exercise. From the perspective of a city administration, continuing with conventional procurement may simply be easier.

This creates a risk that pilot projects remain pilots because they are financed through temporary project funding rather than becoming part of ordinary public transport.

The discussion suggested that public funding may therefore be required not only for technology development but also for the development of **procurement models, contractual frameworks and operational guidelines**.

Such guidelines should consider not only the technology but also the structure of the emerging supplier market.

For example:

- Will large companies offer complete automated transport services?
- Will large transport operators subcontract the automated-driving technology?
- Will smaller specialist companies provide remote-operation services?
- Could service providers based outside Finland or elsewhere in Europe enter the market?
- Who will ultimately be responsible for the complete service?

These questions may determine the shape of the market as much as technological development itself.

2.2 From closed environments to public transport

The discussion considered whether companies that have developed automated vehicles for closed environments—such as ports, mines, logistics centres or construction sites—might eventually move into urban public transport.

The participants considered this possible but not particularly likely in Europe.

The European public-transport market has a distinctive institutional structure: public authorities generally procure or organise services, while private operators provide them.



A more likely development may therefore be that existing public-transport operators gradually incorporate automated and demand-responsive services into their portfolios.

The economics could also change over time. If the costs of automated operation fall sufficiently, automated services may become commercially attractive in situations where conventional bus operation is expensive.

Driver shortages and driver labour costs could reinforce this development.

2.3 Paying passengers

The discussion suggested that the transition from pilot to paid passenger service involves several regulatory steps.

A commercially operated public transport service would normally require an appropriate operator licence, registered vehicles and the relevant vehicle approval or type-approval.

At the time of the discussion, automated buses were considered not yet fully integrated into the conventional type-approval framework in the same way as ordinary buses.

Nevertheless, the regulatory framework has been developing. EU rules governing the type approval of fully automated vehicles were amended in March 2026.

The discussion therefore saw the next few years as an important transitional period in which the regulatory and commercial conditions for passenger-carrying automated vehicles will be clarified.

3. The Spread of Robotaxis and Robot Buses

The next few years may be particularly significant for automated passenger transport.

At present, robotaxis have attracted considerably more public attention than robot buses. The participants considered this understandable: the passenger-car market is vastly larger than the bus market, and consequently there are stronger commercial incentives to develop automated passenger cars.

Robotaxis are already becoming a visible spearhead of automated mobility, particularly in the United States and China.

Europe is different. Public transport has a much stronger institutional and cultural role, which could eventually give automated buses greater significance than their current level of publicity suggests.



The discussion referred to the expected expansion of automated taxi services in Europe, including developments involving companies such as Bolt, Waymo and the UK-based Wayve. The participants considered it likely that robotaxis will become increasingly visible in European cities and that this could influence the development of automated buses.

The relationship between the two markets is therefore worth watching.

The software developed for automated passenger cars may increasingly become applicable to buses. Conversely, buses provide an interesting environment for automation because they often operate on defined routes and can be introduced first in relatively limited operational domains.

The discussion suggested that automated buses may consequently develop “under the hood”, receiving less publicity than robotaxis while gradually becoming more relevant to public transport.

3.1 Automation will probably arrive incrementally

The participants did not expect transport automation to arrive everywhere at once.

Instead, automation is likely to spread through relatively simple and clearly defined applications:

- last-mile services;
- feeder services;
- demand-responsive transport;
- geographically limited operational areas;
- environments where conventional public transport is economically difficult to provide; and
- services where driver availability is a significant constraint.

The Tampere/Lintuhytti service was regarded as a good example of this incremental development.

Public information indicates that the line 301 service between Hervantajärvi and Lintuhytti moved to operation without a safety driver from 24 June 2026, while continuing to be remotely monitored. Tampere described this as the first robot-bus operation in a commercially implemented Finnish public-transport system to operate without a safety driver.

This is significant because it represents a shift from an experimental vehicle operating in a transport environment towards an automated service embedded in the public transport network.

By contrast, Helsinki was viewed in the discussion as having been relatively passive in recent years, despite earlier pilots in areas such as Aurinkolahti and Viikki. The participants suggested that economic pressures affecting the Helsinki Region Transport system may partly explain this, although automation nevertheless remains an important topic for the organisation.



3.2 Longer-term changes to the road system

The discussion also extended beyond robot buses to the possible long-term transformation of the road system.

One speculative scenario was that automated vehicles might eventually be given dedicated road space—for example, an initial lane on motorways and, over a much longer period, an increasing proportion of road capacity.

This remains highly speculative.

The more immediate conclusion was that automated vehicles are unlikely to transform traffic and public transport markets rapidly. Their effects are more likely to become substantial over the longer term as the technology, regulatory framework, business models and public acceptance develop together.

4. Infrastructure, Operational Domains and Connectivity

A major theme of the discussion was the changing relationship between automated vehicles and infrastructure.

Earlier Finnish thinking about automated driving placed considerable emphasis on connectivity between vehicles and external systems. Between approximately 2015 and 2020, the assumption was that extensive connectivity, and roadside infrastructure would be required to make automated driving possible.

The experience of leading automated-driving developers has since challenged some of these assumptions.

The vehicle itself is becoming increasingly capable of observing and interpreting its environment.

For example, the discussion referred to Waymo's practice of mapping new operating areas in considerable detail before deploying its vehicles. Other developers may use more straightforward approaches, such as physically walking routes before introducing automated vehicles.

The broader lesson is that automation may not require every aspect of the road environment to become digitally connected.

Instead, automated vehicles may increasingly construct their own understanding of the operational environment through sensors, maps and onboard computing.

This does not mean that connectivity is unimportant. It means that its role may be different from what was originally expected.



4.1 From closed automated systems to open urban environments

Automated vehicles have already demonstrated strong potential in closed or semi-closed environments such as:

- ports;
- mines;
- logistics centres;
- industrial areas; and
- construction sites.

These environments are comparatively straightforward because the operational domain can be tightly controlled.

Urban public roads are fundamentally different. Pedestrians, cyclists, human-driven vehicles, roadworks and unpredictable behaviour cannot simply be excluded from the system.

The discussion suggested that leading robotaxi operators nevertheless attempt to make the urban environment manageable by effectively creating a highly detailed digital representation of the operating area.

This can be understood as creating a kind of **digital twin of the operational domain**.

The environment is not actually closed, but the automated system attempts to model the elements that are necessary for safe and efficient operation.

This may represent an important intermediate step between automation in fully closed environments and automation in genuinely open traffic systems.

5. Safety as the Central Rationale

Safety was regarded by all participants as the most important argument for automated passenger transport.

The discussion acknowledged that automated vehicles will inevitably experience individual failures and unusual situations. The relevant question is therefore not whether an automated vehicle can operate without ever making a mistake, but whether automation can produce a safer transport system overall.

The participants referred to the widely used estimate that the overwhelming majority of serious road crashes involve human error, with the discussion citing a figure of approximately 90 per cent.

If this underlying assumption is correct, reducing the role of human driving could have a major long-term effect on road safety.



The Tampere robot bus provides a practical example of how an automated system can enforce certain safety behaviours. The participants noted that the vehicle does not leave the bus stop until passengers are wearing seat belts.

Automated taxis can similarly incorporate safety procedures into the operation of the vehicle rather than relying solely on passenger behaviour or driver judgement.

Safety also extends beyond collisions.

The discussion raised passenger security as another potential advantage. If passengers know that a robot bus is continuously monitored and that incidents are recorded, this may discourage aggressive or inappropriate behaviour.

The participants also considered the possibility that some passengers—particularly women travelling alone—may perceive an automated taxi as safer because there is no human driver who could behave inappropriately.

These observations should be regarded as hypotheses emerging from the discussion rather than as established findings.

Nevertheless, they point towards an important distinction: **automated public transport may change not only traffic safety but also passengers' perception of personal security.**

6. Conclusions

The two-hour discussion suggests that the future of automated public transport should not be understood primarily as a question of whether the technology works.

The more difficult questions concern **how the technology becomes part of the transport system.**

Several conclusions emerged.

6.1 The concept of the driver is changing

Automated driving challenges the traditional assumption that every moving vehicle has a human driver who is physically present and legally responsible.

Responsibility will increasingly need to be allocated among the automated-driving system, vehicle manufacturer, service provider, remote-operation provider and transport operator.

6.2 Remote supervision may be more important than remote driving

The future control room may not contain people who continuously “drive” automated vehicles. Instead, people may monitor fleets, define operational areas, resolve exceptional situations and intervene only when required.



This distinction has major implications for regulation, staffing, connectivity and business models.

6.3 Regulation can either obstruct or enable deployment

Finland's experience demonstrates the value of allowing controlled experimentation in real traffic.

At the same time, the international and European regulatory framework remains under development. UNECE's work in 2026 illustrates how rapidly the regulatory environment is evolving.

6.4 The transition from pilots to services is the critical next step

The technology can be demonstrated through pilot projects. The much harder task is to integrate automated services into ordinary public transport.

This requires procurement models, contracts, operator responsibilities, safety requirements and sustainable business models.

6.5 Cities will have an unusually important role

Because public transport is generally commissioned or organised by public authorities in Europe, cities and municipal transport authorities cannot simply wait for the private market to deliver automated services.

They may need to develop new procurement models and operational guidelines themselves.

6.6 Robot buses may be more important in Europe than their current visibility suggests

Robotaxis currently attract most of the international attention. However, Europe's strong public-transport systems create a distinctive market for automated buses.

Automated feeder services, demand-responsive transport and services in areas where conventional bus operation is economically difficult may provide particularly suitable entry points.

6.7 Connectivity will remain important, but perhaps not in the way originally expected

Automated vehicles are becoming increasingly capable of perceiving and modelling their own operating environment.

This may reduce the need for ubiquitous external infrastructure, although reliable communications remain critical for remote supervision and intervention.



6.8 Automation is likely to spread incrementally

The most plausible future is not one in which all vehicles suddenly become autonomous.

Instead, automation is likely to appear first in specific operational domains where its advantages are clear. These may include last-mile services, feeder routes, demand-responsive transport and other geographically constrained services.

6.9 Safety remains the strongest long-term argument

The most compelling case for automated transport may ultimately be its potential to reduce human error and improve system-level safety.

This does not eliminate risk. Rather, it changes the nature of the risk—from the unpredictable behaviour of individual human drivers towards the design, monitoring and governance of complex automated systems.

Overall assessment

The discussion produced a cautiously optimistic view of automated public transport.

The participants did not expect the transport system of 2030 to look radically different from today's system. Indeed, the development of automated driving has already taken longer than many earlier forecasts suggested.

Nevertheless, the direction of travel appears difficult to reverse.

The likely path is **gradual automation rather than sudden autonomy**: individual services, operational domains and business models will become automated where the technology and economics make this attractive. Successful applications will then create pressure for wider deployment.

For public transport, the decisive question may therefore not be *"Can a robot bus drive itself?"* but rather:

Can an automated bus be integrated into a public transport system in a way that is legally robust, operationally reliable, economically viable and demonstrably safer than the conventional alternative?

The Tampere experience suggests that Finland is already beginning to move from the first question towards the second. The next stage will require not only further technological development, but also new approaches to regulation, procurement, service organisation and responsibility.



Note on the character and evidence base of this report

This report is a structured account of a two-hour expert discussion involving three Finnish mobility specialists. It is **not intended to constitute a systematic literature review, legal opinion or independently verified assessment of the automated-vehicle market.**

The observations, interpretations and examples originating from the discussion have been retained as such, including where the participants expressed uncertainty. They should not be read as claims that the three participants necessarily reached unanimous conclusions.

A limited web review was undertaken when preparing this version, principally to check the current regulatory context and developments in Finland. In particular, UNECE's 2026 work confirms that the international regulatory framework for automated driving is continuing to develop, while Tampere has publicly confirmed the June 2026 transition of its line 301 robot-bus service to operation without a safety driver.

Where a precise figure, incident or company practice mentioned during the discussion has not been independently verified, it has deliberately **not** been presented as an established fact. This distinction is important because the value of the discussion lies not only in factual observations but also in the specialists' interpretation of where automated mobility may be heading.