ANNEX 2: SUMMARY EXPLORATORY DISCUSSIONS INNOVATION ASSIGNMENTS FOR AUTONOMOUS VEHICLES IN PUBLIC TRANSPORT

PREFACE

The Ministry of Infrastructure and Water Management (IenW) announced in September 2025 the introduction of innovation assignments for autonomous public and collective transport and autonomous freight transport in the Netherlands. In preparation for the necessary procurement procedure thereto, exploration discussions were held with a broad spectrum of stakeholders. The aim being to determine a realistic outlook on the possible scope of these innovation assignments and their preconditions.

To obtain as fair overview of the current potential, the selection of interview partners was aimed at balanced representation of different types of organisations. The interviewed interviewees were categorised as follows:

- public authorities, including concession-granting authorities;
- public transport and taxi companies;
- software developers;
- vehicle manufacturers;
- mobility providers;
- business parks / corporate sites;
- other relevant actors.

This document provides a summary of the insights obtained by IenW which is shared with all interested candidates in the tender procedure to guarantee a level playing field.

The Ministry has used the insights from these conversations to design the applicable procurement process. The summary is structured according to the thematic topics in the pre-distributed questionnaire listed below.

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1. Societal effects and learning questions.
2. Design of innovation assignments: preparation, feasibility, and operational bottlenecks.
3. Organisation: cooperation and required investments.

1. Societal effects and learning questions

Nearly all interviewees connect autonomous transport to existing challenges in the public transport domain. These include operational issues, such as driver shortages and limited availability of drivers at desired times, as well as strategic issues, such as limited accessibility to certain areas (such as sparsely populated areas). In most interviews, autonomous transport is explicitly not viewed as a goal in itself, but as a means to effectively address these challenges.

Autonomous transport as a response to the accessibility of areas

Many interviewees expect that, in the long term, autonomous transport can improve accessibility within and between different types of areas. Opportunities are particularly seen in three contexts: urban, (semi-)rural and economic clusters.

- *urban areas*: public authorities, companies and transport operators see opportunities for first-/last-mile connections between stations, campuses, residential neighbourhoods and economic clusters, often on dedicated bus lanes or in urban areas with limited interaction with other traffic. In busy city centres, with many cyclists and pedestrians, few short-term opportunities are envisioned for autonomous transport.
- *(semi-)rural areas*: some interviewees see autonomous transport as a means to improve connections between village centres, essential services and mobility hubs, potentially 24/7. This is especially relevant in areas where traditional public transport routes have been scaled back and alternative transport is absent. Opportunities are foreseen in both fixed-route lines and on-demand systems. Several interviewees also advocate for a broader approach under the banner of 'public and collective transport' ('publieke mobiliteit' in Dutch).
- *economic clusters*: several interviewees mention business parks and economic clusters as promising areas – for example large scale (industrial) areas around an airport, port areas and large employment sites with dispersed working hours. They primarily envision opportunities to improve lastmile accessibility to such locations, as an addition to the existing transport system. For locations with shift work, some interviewees see opportunities for flexible deployment of autonomous transport, which is often not economically viable today with drivers.

Autonomous transport as a response to driver shortages

Driver shortages are explicitly mentioned in nearly all interviews as a key reason to explore autonomous transport. Interviewees associate this to longer waiting times for on-demand services, cancellation of trips and limited availability during peak times when demand is high.

Various interviewees are exploring scenarios in which autonomous vehicles take over routine tasks – such as moving vehicles around a depot, movements between depots and the first/last stop, or predictable routes – allowing drivers to be deployed on more complex or busy lines.

Some public transport operators expect no reduction in the total number of drivers in the long term, but rather a shift of their work towards the more complex routes. Interviewees also note that new roles will emerge and in mixed systems, such as control room operators, supervisors, dispatch staff and clearing specialists.

Autonomous transport as a response to financial challenges

Many interviewees view the elimination of driver-related costs as the main source of savings, as drivers currently constitute the largest cost component in public transport operations. Interviewees mention several potential effects on the operation:

- the possibility to achieve higher frequencies or extend operating hours with the same budget;
- long-term operational cost reduction, with some interviewees expecting approximately 25–35% savings;
- more efficient fleet deployment by better matching supply and demand through on-demand systems, enabling more flexible management of vehicles across different routes.

Preconditions

The RDW approval process and the prototype regulation ('prototyperegeling' in Dutch) for temporary admission on public roads are widely viewed as critical, time-consuming and costly bottlenecks for the innovation assignments themselves as well as the right to scale up. Legal uncertainties regarding operation without a driver and liability issues are also frequently mentioned as constraining factors.

Presence of a safety driver

Many interviewees state that as long as an in-vehicle safety driver is required, the business case remains unviable and the "non-profitable portion" remains large. They therefore see a clear learning question regarding phasing: when and under which conditions can the safety driver be removed? Removing the safety driver is seen as crucial for both the business case and for the structural integration of autonomous transport into the public and collective transport system.

RDW approval and prototype regulation

A recurring concern relates to the RDW approval procedure. Several interviewees experienced long lead times, high and initially unclear costs and extensive documentation requirements based on past experience. Examples were mentioned of higher costs in the Netherlands compared to other countries (for instance in Germany and Belgium), prompting mobility providers, software developers and vehicle manufacturers to consider innovating elsewhere.

Public authorities, software developers and vehicle manufacturers propose to partially or fully covering RDW approval costs from public funding. They also express a need for greater transparency regarding the total RDW costs and processes to better estimate the foreseen expenses and approval

steps. Some suggest using part of the communicated budget for innovation assignments to cover RDW-related costs.

Several interviewees note that the current prototype regulation only allows for a temporary approval, thus no certainty for scaling up or continuity afterwards which has an adverse impact on the business case.

Need for long-term, programmatic approach

Multiple interviewees refer to the electrification of bus transport, where an administrative agreement, long-term programmes and joint investments enabled a transition from innovation to standard practice. For autonomous public transport, they note that such a long-term trajectory is not yet fully developed but is needed to avoid fragmentation and isolated experiments.

Creating more legal flexibility

Authorities recognise the prototype regulation and the legislature for experimentation as relevant instruments but find their current practical usability limited (few real-life examples, temporary nature, limited scale). A broad group of interviewees recommends creating (temporary) legal opportunities –via (additional) laws for experimentation or sandbox environments – for testing without a driver and for the development of a framework on liability towards autonomous transport.

Some interviewees also raise potential tensions within the legal framework ('Wet personenvervoer 2000', Wp2000 in short) between transport forms that formally fall under taxi legislation and the desire to deploy autonomous vehicles in public transport without fixed timetables.

Several interviewees call for changes to the Wp2000 and the 'Wegenverkeerswet' to structurally allow autonomous vehicles without a human driver.

Learning needs of interviewees

There is broad consensus that societal effects and learning needs must be the central point of focus; innovation assignments should not be limited to mere technical demonstrations. Many interviewees further state that an innovation assignment with only one vehicle has little added value, given demonstrations already carried out or expected soon both domestically and abroad.

Learning needs mentioned include: social acceptance, technical performance in practice, interaction with other road users, legal possibilities and constraints, and new operational concepts (control rooms, dispatch organisations). Technical learning needs were also identified.

In addition to the necessary legal flexibility interviewees indicated that they also have several legal and operational learning needs. These relate, among other things, to the application and further development of:

- application and further development of the Wegenverkeerswet, Wp2000 and taxi legislation;
- liability and insurability of autonomous vehicles;
- future division of responsibilities between driver, vehicle, control room and concession holder.

In addition, multiple interviewees mentioned learning needs concerning social safety, accessibility and customer experience, such as:

- *Social safety*: interviewees want to learn how passengers respond to fully autonomous vehicles without a driver – both in busy neighbourhoods and in remote or relatively unsafe areas, including evening/night scenarios.
- *User experience*: interviewees want to understand user interaction with the payment system (check-in/check-out), information needs of users and requirements around seat belt use.
- *Accessibility*: questions arise about accessibility for people with disabilities and the role of drivers in providing assistance (wheelchairs, strollers, help with boarding/alighting, payment issues).
- *Broader behavioural effects*: some interviewees want to learn whether people will leave their cars at home, how they perceive convenience and comfort, and what the impact may be on social participation (e.g., attending social activities in rural areas).

Many interviewees recommend explicitly including social safety, accessibility and user experience as learning questions and monitoring topics in the innovation assignments.

Finally, various interviewees highlight the technical maturity of autonomous transport and note that improving this is a key objective of the innovation assignments. In this regard, learning needs such as the following were mentioned:

- *Complex traffic situations*: how autonomous vehicles can operate safely and reliably in complex traffic situations, such as those involving fluctuating traffic flows and unexpected events;
- *Interaction with infrastructure*: understanding how autonomous vehicles respond to elements of the infrastructure, such as smart traffic lights. According to various interviewees, effective coordination between vehicle and infrastructure is a prerequisite for enabling deployment on a larger scale.

2. Design of innovation assignments: preparation, feasibility and operational bottlenecks

Interviewees outline two broad approaches for shaping innovation assignments. Most see a phased approach starting in simple ODDs (Operational Design Domains) with a limited number of vehicles, expanding gradually to more complex environments. Considerations include technical maturity, vehicle choice, scale, lead time, RDW approval, embedding in concessions and development of a robust business case.

Many interviewees envision a phased approach beginning on closed sites or depots without passengers, followed by depot-to-stop routes, then passenger-carrying services on dedicated bus lanes or business parks, and eventually operations in mixed urban traffic.. A few interviewees are already focusing on short-term deployment in mixed traffic, albeit in simple forms.

These interviewees generally view 10- to 12-metre buses as the reference for innovation assignments, depending on line capacity, available infrastructure and intended use cases. Articulated buses (15–18 metres) are not seen as promising during the period of the innovation assignments due

to existing technical challenges. A vehicle manufacturer notes that the articulation joint significantly complicates autonomous driving. Manufacturers and software developers are therefore not yet developing such autonomous buses.

Some interviewees state that the innovation assignments should start with a limited number of vehicles before scaling up. Starting with two to four vehicles is viewed as a safe scale for the validation of the innovation assignment.

Budget considerations reinforce this cautious approach: larger fleets increases financial risks, for example if the trajectory proves unviable (and surplus vehicles remain). Moreover, developing a robust business case should be part of the innovation assignment. Determining the business case requires driving without a safety driver and clarity on how many vehicles a single control room operator can monitor and manage. This is considered essential before being able to scale up.

Some interviewees, such as concession-granting authorities, manufacturers and operators, prefer converting existing bus models (add-on or redesign) rather than developing entirely new autonomous vehicles, due to cost and scalability considerations.

Mobility providers in particular indicated that innovation assignments based on a small number of autonomous vehicles will not provide sufficient outcome – neither financially nor in terms of lessons learned. According to these interviewees, only large-scale deployment can provide answers to learning questions related to operations, (social) safety, accessibility and user experience. They mentioned fleet sizes starting at thirty vehicles as the minimum needed to make an innovation assignment financially attractive and to address these learning questions. In doing so, they advocate to primarily focus on the deployment of small four-seater vehicles.

In addition, mobility providers outlined scenarios in which autonomous transport partially overlaps with commercial transport concepts, such as ride-pooling, robotaxis and hybrid services. They indicated that these services can be operated commercially if and when sufficient scale is reached.

However, some other interviewees expressed concerns that large-scale robotaxi systems could create negative effects by competing with other modes (like public transport, cycling or walking) and can result in additional congestion in urban areas.

Technical maturity and choice of vehicle types

Several commercial interviewees positioned systems for autonomous driving as already sufficiently mature for large-scale deployment (TRL level 4 and the focus should be on driverless operation and scaling up. At the same time, several public interviewees emphasised that the technology is still in a development phase and that testing and improving the systems should also be an objective of the innovation assignments. Various public interviewees questioned the technology, considering it not yet sufficiently mature for large-scale deployment and therefore viewed increasing technical maturity as an important objective of the innovation assignments.

Origin of the vehicles & software

The origin of vehicles (EU, US, China) came up in the discussions. Geopolitical, data-related and privacy aspects play a role, but views differ on how restrictive these factors should be. Some public authorities expressed caution regarding vehicles from China, referring to the geopolitical situation and concerns about data security.

Other interviewees, including public authorities, transport operators and mobility providers, also acknowledged these geopolitical concerns but argued that cooperation with non-European suppliers is necessary to deploy high-quality technology on the road in the short term, and that risks can be managed contractually and technically, referring to both Chinese and American suppliers. Some interviewees also noted that Chinese buses are already widely used due to the focus on fleet electrification.

Concessions, procurement and development budgets

Interviewees described different ways of positioning innovation assignments relative to existing concessions. In some regions, innovation assignments are deliberately kept outside the concession (separate contracts for flexible services or shuttles) to maintain flexibility and allow fallback options to regular bus services. Other interviewees noted that concessions often allow space for innovation, provided that development budgets or other specific arrangements are included in the concession.

Across several interviews, interviewees signalled that autonomous transport cannot yet be included as a strict requirement within concessions, but it can be a topic for bilateral consultation and a potential future criterion – similar to the transition route adopted for electric buses.

Insurance and liability

Some interviewees provided examples from within the Netherlands and abroad where autonomous vehicles are already insured. However, they reported uncertainty regarding the allocation of responsibilities (owner, supplier, operator, safety driver) and the scalability of insurance arrangements for larger fleets. Several interviewees noted that there is no standardised process for obtaining insurance and that customised agreements are, at this time, required.

3. Organisation: cooperation and required investments

Interviewees outline an ecosystem in which public and private interviewees must work together over an extended period; no single party can or wishes to take on implementation alone. They describe autonomous public transport as part of a broader ecosystem involving multiple public and private actors. They suggested a division of roles between the ministry, the RDW, provinces, municipalities, transport authorities, concession holders, technology and vehicle suppliers, insurers, knowledge institutions, and major employers. In addition, they addressed investment needs, cost distribution and the necessity of a long-term programmatic approach.

There is broad support for transparent agreements on data, intellectual property, and knowledge sharing, with enough attention towards protecting commercial interests and the ability to utilise the societal learning benefits. Several interviewees highlight the need for a long-term policy (15–20 years) and a programmatic approach, similar to the electrification of bus transport.

Roles of interviewees in the innovation assignments and the ecosystem

In various interviews, the ministry's role is described as follows:

- providing a clear legal and regulatory framework (Wp2000, 'Wegenverkeerswet', liability, room for experimentation);
- removing or reducing barriers in approval processes and steering towards predictable and transparent procedures at the RDW. Interviewees indicate uncertainty regarding approval

lead times. They describe it as a highly complex and time-consuming procedure, where the uncertain lead time and complicated process make it difficult to gain in advance a clear picture of the total anticipated costs;

- stimulating knowledge sharing and preventing regions from developing isolated innovation assignments without structural follow-up. Possible measures include: connecting new innovation assignments to existing programmes and/or initiatives, organising partnerships in which multiple interviewees jointly participate in an innovation assignment, and creating preconditions that allow innovation assignments to grow towards structural implementation.

Public authorities, including concession-granting authorities, position themselves as coordinators, concession grantors, and initiators of regional innovation assignments, often in cooperation with municipalities and public transport operators. They describe their role as:

- selecting promising areas and use cases;
- providing development budgets within the concession and offering co-financing;
- ensuring the integration of autonomous transport into the broader public transport system (timetabling, fares, and information systems).

On the market side, a broad range of roles is described:

- private operators in public transport: the execution of services, depot management, operating control rooms, operational execution of an innovation assignment and contributing experience with existing public transport systems;
- software and vehicle manufacturers: including the development and supply of autonomous systems, the setup of control rooms, and scalability plans;
- mobility providers and large companies see opportunities for hybrid models (a mix of autonomous and driver-based services) in cooperation with transport operators, vehicle manufacturers, governments, and local partners, for example for maintenance.

Many respondents emphasise that the ecosystem depends on a limited number of internationally active technology companies with diverse business models. Some foresee that, without supporting European technology, American and Chinese technology may become dominant.

Several interviewees, including public authorities and concession grantors, advise involving multiple vehicle and technology suppliers in innovation assignments to avoid dependence on a single party and to stimulate market development. They also mention the possibility of directing stimulus funding toward European suppliers.

Knowledge sharing, data, and intellectual property

Many interviewees wish to share lessons learned and insights with other interviewees but identify limitations related to the confidentiality of RDW reports and the commercial interests of different types of suppliers.

In multiple interviews, it is noted that vehicle data could be useful for research, simulations, infrastructure planning and monitoring of traffic safety, provided that personal data and commercially sensitive information remain protected.

Some interviewees indicate that future contracts should provide clarity on system intellectual property rights, data ownership, data sharing with knowledge institutions and the publication of results made possible with public funding.

Particularly governments and representatives of business parks argue for organising innovation assignments in such a way that results do not remain isolated but are actively shared with other regions – for example via knowledge institutions, national programmes, and joint data frameworks.

Use of available budgets

Interviewees view the available innovation budget largely as an incentive, but not as sufficient for all ambitions. Additional funding from provinces, regions, public transport operators, employers, and potential EU programmes is considered necessary.

There are various views on how CAPEX (Capital Expenditures) and OPEX (Operating Expenditures) should be divided between public and private interviewees. Some interviewees emphasise that in the innovation assignments, first the non-viable cost gap should be covered. After that, operations should become budget-neutral or more cost-effective within the existing budgets of public transport, healthcare and the social domain.

Several interviewees propose allocating part of the available funds to shared facilities that benefit all projects – such as control rooms, insurance arrangements, data frameworks, and knowledge sharing on RDW approval processes – rather than solely to the innovation assignment -specific expenses.

Annex – Questionnaire for the exploratory discussions

The following standardised questions were asked to all stakeholders, although relevance varied depending on the organisation. Discussions involved concession providers, local authorities, concession holders, taxi and targeted transport providers, societal interest groups, and other relevant companies.

Societal effects and learning questions

1. Which applications of automated transport in public transport does your organisation consider viable within the next few years, and in which geographic areas?
2. What effects on accessibility in these areas do you anticipate from automated transport?
3. How many destinations in these areas would become more accessible as a result?
4. To what extent would these applications improve the efficiency of public transport (and possibly your own operations) in these areas?
5. To what extent could automated transport make existing public transport resources more effective?
6. What effect would this have on the number of drivers required?
7. What new roles do you foresee, and do you expect fewer operational personnel will be needed?
8. How does your organisation view the need for other parties (such as IenW and implementing organisations) to answer their learning questions via these pilots, and how do you see this working in practice?

Pilot Development: Preparation, Feasibility, and Challenges

9. What scale (number of vehicles) could your organisation deliver, in what timeframe, and how does this align with the pilot period (2026–2029)?
10. Which methods and techniques do you consider most suitable to measure societal effects during implementation?
11. What preparations regarding automated transport have you already made (feasibility study, political commitment, financing, infrastructure analysis)?
12. What other essential steps are needed to start a pilot?
13. What type and propulsion of vehicles do you expect to deploy, and from which manufacturers (EU, China, US, etc.)?
14. What risks do you foresee and how should they be managed?
15. Do you already have access to insured vehicles?
16. Where are the potential bottlenecks for your organisation in a pilot, and what support would you need?

17. What is the duration of the current concession, and what is the continuity of your intended participating parties?

18. Does your current concession pose a challenge to pilot implementation?

Organisation: Cooperation and investment needs

19. What does the entire ecosystem of the application(s) you consider viable look like, and to what extent are you dependent on external parties?

20. Can you give an indication of the boost your organization desires? And from whom do you expect this?

    a) Role of the ministry, granting authority, implementing organization, and other government bodies (e.g., road authorities)

    b) Business case

    c) Legislation and regulations

    d) Knowledge sharing

21. What cooperation with other parties do you envisage?

22. Looking at your answers on question 1, 9, 19 and 20: Which financial resources (CAPEX and OPEX) do you consider necessary, and how should these be distributed among actors in the ecosystem? Per vehicle and/or for the total application(s).

23. Which topics do you consider to be important to put into a contract? (e.g., intellectual property, sharing of lessons learned, data sharing)

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