ANNEX 3: SUMMARY EXPLORATORY DISCUSSIONS INNOVATION ASSIGNMENTS FOR AUTONOMOUS VEHICLES IN FREIGHT TRANSPORT

PREFACE

In 2025, the Ministry of Infrastructure and Water Management announced the arrival of autonomous transport innovations in the Netherlands, in both the public transport and logistics sectors. The Ministry now intends to implement these innovations through a dialogue-based Innovation Partnership public procurement. This structure allows the government to collaborate intensively with selected parties to develop and implement innovations within a single, integrated, phased process, from development to actual implementation. This structure allows for the selection of multiple (consortia of) public and private parties.

In preparation for the dialogue-based procurement, preliminary interviews (so-called "Sonderingsgesprekken") were held with a wide range of parties, with the aim of gaining a realistic understanding of the envisaged innovations and the associated preconditions.

For the innovations around **autonomous freight transport**, interviews were held with 15 parties such as deep-sea and inland ports, vehicle manufacturers and Automated Driving System (ADS) technology providers, logistics operators, industry associations, and knowledge institutes.

The interviews sought to enhance the Ministry's understanding where autonomous freight transport can create societal value, what operational design domain (ODD) and application usecases are foreseen and realistic, how to design the dialogue-based procurement and what it takes to move from controlled trials to pre-deployment at scale between 2026–2029.

A separate interview report was prepared for each interview and submitted to each interview partner for approval. This present document anonymously summarizes all discussions held, intended to be published as a procurement document to ensure a level playing field for all interested parties.

Please note, the views and/ or facts expressed in this document do not necessarily reflect the views of the Ministry but are intended to closely capture the perceptions and statements of the interviewees.

The Ministry has used the insights from these discussions to shape and inform choices in the public procurement. This document also offers interested parties the opportunity to enhance their knowledge and gain insight into the playing field, with a view to future participation in the public procurement.

Structure of the interviews

The summary is structured based on the themes of the pre-sent questionnaire, which also guided the interviews. The topics discussed are listed below; the full questionnaire is added below.

A. Societal value and use-case fit
B. ODD definition and operational concept
C. Technical maturity and readiness to deploy

D. Governance, approvals and legal route (practical feasibility)
E. Collaboration and consortium structure
F. Financing, co-financing and capacity constraints
G. Risk management, liability, insurance and public acceptability
H. Data exchange and learning commitments
I. Closing: most important enabling conditions and timeline

A. Societal value and use-case fit

Across the board, stakeholders see hub-to-hub shuttles and port/terminal drayage as the most realistic early applications, especially in industrial areas and highway/ motorway corridors that avoid complex urban settings. Several parties emphasize short, repetitive lanes (from a few hundred meters to low tens of kilometres) with high frequency 24/7 transport as prime use case candidates. Others promote a cross-border, port-to-port motorway corridor (~100 km) as a symbolic and scalable "dot on the horizon", provided approvals and operational integration are in place. Night windows are considered a strong enabler for feasibility and safety, but warehouse/terminal opening hours can be the limiting factor for end-to-end value.

Interviewees consistently expect contributions to driver-shortage mitigation, reliability, off-peak capacity use, safety, and emissions and noise reduction (provided electric drivelines are used). Regarding the ongoing driver shortage interviewees noted that autonomous freight transport can take over driving tasks on repetitive transport missions at night benefitting from uncongested infrastructure. At the same time, this would take human drivers out of unhealthy nighttime work conditions. Interviewees noted that these human drivers will be redeployed to environments where autonomous driving is not viable such as inner-city driving, while at the same time provide a healthier environment for drivers driving in daytime operations.

By actor type, there was convergence on the following:

- Ports: Prioritize (cross-border) motorway and port-area shuttles with enough volume to matter, encourage nighttime operations to relieve daytime congestion.
- Logistics operators (carriers/terminal operators): Favor short, high-frequency industrial shuttles (e.g., a few kilometres, dozens to >100 movements/day) where driver scarcity and predictability gains are tangible.
- Vehicle manufacturers: See small, short distance, low-speed, repetitive drayage / hub-to-hub operations as viable step in Europe. Parties stress that logistics process redesign often yields more immediate value than automating the driving function alone. Interviewees note that long-haul hub-to-hub operations at higher speeds are feasible and are already operational in other parts of the world. For the Netherlands, parties foresee to start with sharply bounded ODDs with repeating operations.
- ADS Technology providers: Advocate tight ODDs where driver-out becomes feasible sooner, to reach a viable business case; mixed-traffic experience exists on private property.
- Industry associations: Broadly supportive with emphasis on mitigating driver shortage. Parties stress need for clear business case for their members before meaningful uptake.

B. ODD definition and operational concept

Stakeholders converge on an initial ODD that is narrow and predictable such as private property driving in mixed traffic conditions or very limited highway/ motorway segments on controlled port and industrial roads with limited junction types, low speeds, and (ideally) the least amount of required competent road authorities to simplify governance. Most foreseen applications are heavy-duty trucks; however, some stakeholders consider light-commercial vehicles with constrained ODDs such as autonomous driving to/from electric chargers on motorway service stations. Similarly, restrained ODDs are mentioned in the context of smart dollies autonomously docking and coupling/ uncoupling on a yard area.

Operationally, most expect to start with a safety driver employing autonomous shadow-driving and evolve toward remote supervision to enable driver-out. ADS technology providers stress to move towards driver-out as soon as possible in very constrained ODDs to make the business case work in fewer years for return-on-investment.

Parties agree that pre-deployment innovation needs to cover dependencies outside the vehicle, especially where drivers are involved: terminal/hub processes (e.g., documentation, brake/twist-lock checks, door/ gate handling), vehicle dispatch integration and customs clearance, connectivity network coverage, curb and traffic management, and possibly roadside sensors at conflict points for independent perception redundancy. Incident scenarios to plan for include breakdowns, roadworks, unexpected stops, emergency/Police stops, and loss of connectivity.

By actor type, there was convergence on the following:

- Ports, vehicle manufacturers & logistics operators: Emphasize logistics integration (gates, loading/ unloading, using parking buffers) as critical to success. Successful deployment is not just automating the driving task from A to B, but end-to-end process integration.
- Vehicle manufacturers: Support staged autonomy (driver-in to remote supervision with driver-out) and highlight scenario-based testing and EU regulatory alignment for ODD evolution.
- ADS technology providers: Prefer smaller ODDs to remove the safety driver sooner.
- Port and ADS technology providers: experience suggests rigid trucks are operationally simpler than articulated vehicles (such as autonomous terminal tractors or tractor-trailer vehicles). Therefore, there is a practical preference to begin with rigid trucks in constrained ODDs.

C. Technical maturity and readiness to deploy

Readiness is uneven across functions. ADS technology providers report years of mixed-traffic operations on private premises and certification under machinery regimes, while interviewees consider full public-road deployment to be awaiting a legal framework.

Vehicle manufacturers have building blocks and partnerships proven abroad. In Europe and the Netherlands specifically, they seek regulatory clarity first before any meaningful effort for testing in the Netherlands is undertaken, even while their customers are getting impatient with the lack of progress in NL and EU.

Vehicle manufactures and ADS technology providers select their testing partners (logistics operators) based on digital maturity as a prerequisite (paperless flows, system integration capabilities), which is typically present in large multinational carriers and less so in small-or-medium sized logistics companies.

Logistics operators envisage a staged deployment path from simpler, existing (electric) terminal-tractor operations toward public-road shuttles (that is, continuous, roundtrip repeating 'shuttle' operation).

Early deployments are expected to be small (e.g., 2-3 vehicles), with industrialization around ~20 units. During the foreseen runtime of the program, the number of vehicles deployed may be double digits. Prototype unit cost is typically high, and driver-out economics become attractive only when the ODD allows it.

By actor type, there was convergence on the following:

- Vehicle manufacturers & ADS technology providers: align on start-small and prove the value quickly. Parties acknowledge that driver-out requires either very tight ODDs or regulatory progress.
- Industry organizations and logistics operators: warn that technology may be ahead of regulation/business models and that the transition towards zero-emission is already burdensome for the sector and approval authority RDW, leaving limited capacity for innovation of autonomous freight transport.

D. Governance, approvals and legal route (practical feasibility)

The dominant concern for autonomous freight transport innovation is a predictable, timely exemption approvals pathway. Stakeholders cite the need for exemptions/ prototype approval and welcome a dialogue-based Innovation Partnership where (scarce) capacity from vehicle approval and road authorities is secured as part of the procurement.

Interviews also state that a "delta-assessment" approach (where incremental evidence may be added to exemption safety cases without restarting from scratch each time) has proven effective elsewhere in Western Europe and Scandinavia and is considered essential to scale and avoid pitfalls from earlier exemption applications in the Netherlands.

Cross-border harmonization and mutual recognition of exemption (between member states) should cover technical assessment, safety evidence, and reporting, while road authorization/enforcement remain national. Even when starting local, actors want a European-consistent roadmap for approvals and operations so solutions can travel, and this shapes investment and R&D choices of vehicle manufacturers and ADS technology providers. The proposed alignment with European Testbed and Automotive Action Plan was welcomed across many stakeholders.

ADS technology providers highlight misalignment between machinery and on road vehicle legislation frameworks, proposing either category expansion or targeted exemptions to unlock driver-out in constrained domains, especially with regard to terminal tractor units (vehicle category U).

By actor type, there was convergence on the following:

- All actors: Seek clarity, speed, and continuity from approval bodies. Strict exemption applications are acceptable if the process is predictable and scalable, based on "delta-assessment".
- Ports, vehicle manufacturers: consensus that RDW should be allowed to learn during the process but also needs to be an independent assessor. This squeeze has not been solved in the Netherlands, but Sweden/ Nordics seem to be able to handle this better.
- ADS technology providers: Ready to insure equipment but will not assume full public-road liability until the legal basis is in place.
- Almost all actors: many non-successful experiences with exemption applications for novel vehicles in the past in the Netherlands.

E. Collaboration and consortium structure

Stakeholders have noted that innovation for autonomous freight transport is not only about automating the driving task, but to automate the full range of activities. Therefore, tender candidates or consortia should focus on including the end-to-end transport ecosystem. A candidate/ consortium should ideally include transport buyer (e.g. shipper/ consignee), carrier, OEM/ADS provider, terminal/port operator, competent road authority. Insurance firms and data/ connectivity partners are thought to improve the strength of a collaboration. Broad agreement exists that transport buyers must be included, and committed for multi-year, operational volumes as a stable base. Compatible (long-term) validity of underlying exemption/ approval is considered crucial.

Industry associations see themselves as neutral towards tender candidate and aim to support the procurement (Innovation Partnership) with communication, matchmaking, and neutral brokering, provided their neutrality is safeguarded. Regional/ public bodies can convene and co-fund enabling works.

Research/consultancy partners can contribute cost-benefit tools and learning frameworks. Public authorities should enable, but not operate, the innovation by setting conditions, facilitating approvals, and co-owning the learning agenda.

By actor type, there was convergence on the following:

- Many stakeholders: broad support for a dialogue-based procurement process, yet also unfamiliarity with the Innovation Partnership procurement models.
- Industry associations: Will inform and mobilize members, possibly act as neutral ecosystem facilitators, but preferably not take on operational coordination or project management roles.
- Ports: desire to work together rather than compete, as challenges for European ports are very similar and port CEOs encourage collaboration between ports in proximity.
- Logistics operators and vehicle manufacturers: logistics operators need to have sufficient scale, have long-term collaboration or assignments in place, have and have a certain level of digital maturity to be able to pull-off successful innovation.
- Vehicle manufactures and technology operators: successful projects typically had participation of government entities/ road operators, preferably at the level of province of national road authority or above.

F. Financing, co-financing and capacity constraints
Stakeholders anticipate material CAPEX/OPEX for first deployments (prototype vehicles, safety validation, control centres, integration). Safety-driver costs erode the business case if maintained beyond 2 to 3 years, which is considered a threshold return-on-investment horizon; hence the pressure to tighten ODDs.

Public co-financing is deemed useful for covering exemption approval costs, safety validation and monitoring, and targeted infrastructure (e.g., digital/ C-ITS at conflict points), not for fully commercial operations. Given limited approvals capacity, prioritization should avoid stalling multiple credible consortia.

Interviewees note there is a strong desire for longer-running projects. The discussed 4 years program was welcomed, yet parties indicate that the more time the ecosystem innovation has room to grow, the better. Longer-term joint innovation is preferred to one-off 'vuurpijl' demos. Private co-financing is feasible where multi-year testing operations and clear learning potential exist.

By actor type, there was convergence on the following:
- Ports & public bodies: Favor modest seed funding to de-risk top-cost items and cover exemption application costs; oppose 100% subsidies.
- Vehicle manufacturers & ADS technology providers: Note high unit costs at low volumes; ~20 units is a common threshold for industrialization effects.

G. Risk management, liability, insurance & public acceptability
Top risks mentioned are safety incidents, legal uncertainty, reputational damage, operational reliability, and cybersecurity. Stakeholders mentioned mitigation strategies such as narrowing down ODDs, pretested incident response, and transparent performance reporting to authorities.

Insurability is improving, but clear responsibility chains and legal footing are prerequisites for underwriting driver-out operations. Broad user/ societal acceptance requires early engagement with ports, local authorities, residents, and road users, with emphasis on night-time noise management, traffic interactions, and benefits framing (reliability, safety, reduced peak congestion).

By actor type, there was convergence on the following:
- ADS technology providers: Can share operational telemetry data (missions, events, interventions) while protecting internal control messages (e.g., CAN data). Parties support aggregated public reporting.
- Industry organizations: Encourage clear insurance and liability doctrines to unlock member participation.

H. Data exchange and learning commitments
There is broad willingness to share proportionate data for public learning and oversight: kilometres, trips, ODD adherence, disengagements/interventions, incident & near-miss logs, basic load state (e.g., loaded/unloaded), trip durations, and anomaly/event flags useful to road authorities. For transparency, actors accept regular reporting & audit, provided commercially sensitive internals (e.g.,

low-level vehicle messages) remain protected. Public sharing is acceptable in the form of anonymized performance indicators and lessons learned to preserve a level playing field.

By actor type, there was convergence on the following:

- All actors: Agree on structured data exchange, and standardized formats to ease learning and scale.

Closing: most important enabling conditions and timeline

Top three enabling conditions for a 2026 start are identified as:

1. Predictable legal/ exemption approvals with dedicated capacity at authorities, including incremental ("delta") assessments and cross-border alignment of evidence and reporting. Especially, predefined/ 'pre-approved' routes are welcome, such that no effort is lost in deep analysis of route ODDs which will not be granted anyway.

2. Sharply bounded ODDs and robust high frequency/ high repeatability operational Use Cases that integrate autonomous driving with human driver tasks (gates, documentation, checks etc.) and leverage night/off-peak windows where practical and feasible.

3. Committed, multi-year consortia with transport buyer involvement for 24/7 and/or very high frequency operations, with compatible long-term validity of exemption/ approval.

Indicative timeline & critical path

Stakeholders understand that a Request to Participate and a dialogue-based Innovation Partnership are planned for early spring, with selection in summer 2026 and operations starting thereafter, subject to approvals. Some actors can start on private grounds sooner and scale to public-road shuttles in 2026–2027. The critical path runs through approvals capacity, consortium formation with committed buyers, vehicle readiness & integration, and logistics process adaptation for 24/7 viability.

Discussion questions (standardized)

The following questions will be asked to all stakeholders; relevance may vary. Interviews may involve shippers/consignees, carriers, logistics service providers, terminal operators, ports, OEMs/ADS providers, road authorities, insurers, and public partners.

A. Societal value and use-case fit

1. Which automated freight applications does your organisation consider viable within the next few years, and in which operating contexts (e.g., hub-to-hub, port drayage, motorway corridor, terminal-to-terminal)?
2. Which societal outcomes could this realistically improve (reliability, safety, emissions, congestion relief, driver shortage mitigation, resilience of supply chains)?
3. What would “success” look like in measurable terms for you (service reliability, kilometres, number of vehicles, incident rates, emissions reduction, cost impacts)?
4. Which transport flows (volume, frequency, lane/pattern) are most suitable for scaling in the Netherlands, and why?
5. To what extent is night-time operation relevant or necessary for feasibility and safety in your view?

B. ODD definition and operational concept

1. How would you define a realistic ODD for a first scalable logistics pilot (roads, speed, weather limits, time windows, junction types, traffic complexity, connectivity assumptions)?
2. What operational model do you consider most robust initially (safety driver in-vehicle, remote supervision, convoy/platooning elements, staged autonomy)?
3. What are the key dependencies outside the vehicle (terminals/hubs, loading processes, dispatch, infrastructure constraints, communications coverage, traffic management)?
4. What incident scenarios are most critical (breakdowns, unexpected stops, roadworks, emergency vehicles, police stop, loss of connectivity), and what response concept would you propose?

C. Technical maturity and readiness to deploy

1. What is the technical readiness level of the solution you would propose today, and what evidence do you have (testing, deployments elsewhere, safety case maturity)?
2. What type of vehicle(s) and ADS configuration would you deploy (tractor-trailer, rigid truck, electric/hydrogen/diesel, sensor stack), and what is the expected lead time?
3. What is your view on the “minimum viable fleet” to generate meaningful learning and societal effects (number of vehicles, kilometres, months of operation)?
4. Which assumptions are essential for safe operation (HD maps, V2X, geofencing, teleoperation capabilities), and which are optional?

D. Governance, approvals and legal route (practical feasibility)

1. Which approvals/permits do you anticipate needing (vehicle approval route, road access permissions, operational permissions), and where do you expect the biggest uncertainty?
2. How do you see the role of RDW and other implementing bodies in your pathway (type approval/pre-type approval, safety assessments, oversight), and what workload do you anticipate?
3. What is your view on cross-border operations: what should be harmonised (technical assessment, safety evidence, reporting formats) and what must remain national (road authorisation, enforcement, local permits)?

4. What reporting, audit and transparency would you consider reasonable during the pilot (safety performance, disengagements, incidents, near misses, ODD compliance)?

E. Collaboration and consortium structure

1. What does the end-to-end ecosystem look like for your use case (shipper, carrier, OEM/ADS provider, terminal/port, road authority, insurer, telecom/data partners)?
2. Which partners do you already have aligned, and which are still missing?
3. What commitments can each partner realistically make (vehicles, routes, volumes, infrastructure access, operational staff, data sharing, co-financing)?
4. What would be the best role for public authorities in enabling—not operating—the pilot (setting conditions, coordination, approvals facilitation, learning agenda)?

F. Financing, co-financing and capacity constraints

1. What CAPEX/OPEX do you foresee for your proposed pilot (per vehicle and total), and what would be the cost drivers?
2. Where would public co-financing or in-kind contribution be most catalytic (e.g., prototype approval costs, safety validation, test logistics, infrastructure measures, monitoring)?
3. Given limited capacity for prototype approvals and safety assessments, how would you propose prioritisation across candidate consortia without stalling momentum?
4. What level of co-financing could you bring yourselves, and under what conditions would you commit to scale?

G. Risk management, liability, insurance and public acceptability

1. What are the top risks you foresee (safety, reputational, legal, operational, cybersecurity), and how would you mitigate them?
2. Are vehicles already insurable in your proposed set-up, and what would insurers need to see to underwrite operations?
3. What is your approach to cybersecurity and data governance (including incident response and updates)?
4. What would you need in terms of stakeholder and community acceptance (ports, local authorities, residents, road users), and how should communication be organised?

H. Data exchange and learning commitments

1. What data should be shared with public authorities to enable learning and oversight (and what are your constraints)?
2. What data could help road authorities (e.g., events, anomalies, traffic interactions), and how can we ensure proportionality and confidentiality?
3. Under what conditions would you agree to share lessons learned (public summary, anonymised performance indicators) to support a level playing field?

Closing

1. If you had to name the three most important enabling conditions to start within 2026, what would they be?
2. What would be a realistic timeline from today to first operations on public roads, and what are the critical path items?

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