



SAAM
Swiss Association for
Autonomous Mobility

Report

Intermodality and automated vehicles:

Closing today's mobility gaps with tomorrow's solutions

Published by SAAM in collaboration with FHNW and the participants of the SAAM Day on intermodality

Workshop date: 10 March 2026 | Report: 26 August 2026

Authors: Oliver Nahon (SAAM) & Caroline Bethmann (SAAM)

Co-author: Alexander Erath (FHNW)

Reviewers: Jamie Townsend (movinno), Martin Zahn (VBZ), Rémy Chrétien (SAAM)

Project funded by



Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra
Swiss Confederation

Federal Department of Economic Affairs
Education and Research ERAR
State Secretariat for Education,
Research and Innovation SERI



Co-funded by the
European Union



Summary

Intermodality, meaning the seamless integration of different modes of transport within a single journey, is central to sustainable mobility in urban and rural areas. Yet today's systems remain fragmented: there are no open interfaces through which providers can connect to existing systems for booking and payment, the cost of a complete intermodal journey cannot easily be determined or compared with the cost of driving one's own car, apps are not compatible with one another, first- and last-mile connections are at times unreliable, and freight transport runs into difficulties at city boundaries. This report focuses on Switzerland, including journeys that start or end here and cross a national border. It summarises the main findings of the SAAM Day on intermodality of 10 March 2026 in a working paper for further discussion. Rather than a comprehensive policy analysis, it offers a structured starting point: an overview of the challenges identified at five expert tables, together with a set of approaches to how automated mobility could help address them.

Key insights from the workshop:

The workshop led to a set of consistent conclusions spanning five different mobility sectors. Rather than isolated, sector-specific problems, the participants identified a set of shared systemic gaps that automated mobility can close in part, though not entirely.

Key findings:

- First- and last-mile connections are the critical weak point of every intermodal journey examined, in both urban and rural areas.
- The obstacles to a solution are primarily organisational and regulatory, not technological: data is siloed, booking systems do not communicate with one another, and while national initiatives such as SKI+ and MODI/NADIM were intended to address parts of the problem (deliberation on the Federal Act on Mobility Data Infrastructure, MODIG, was politically rejected on 17 April 2026), no single actor has both the mandate and the incentive to integrate booking and price queries for end users across public and private providers from end to end.
- Automated vehicles (AVs) offer real added value in two distinct roles: as high-frequency feeder services on corridors where demand is insufficient for conventional buses, and as on-demand services for irregular trips. These are, however, different operating models that require different governance and funding frameworks: the high-frequency feeder is a licensed scheduled service, commissioned and compensated by the public sector, while the on-demand service is a demand-responsive service regulated at cantonal level, with no entitlement to compensation. Given the shortage of drivers and the demand for higher bus frequencies, automation may also be relevant to conventional scheduled bus operations; the feeder role complements these.
- In urban logistics, dynamic handover points between delivery vans and e-bikes for the last mile, coordinated by automated vehicles, represent a credible alternative to fixed micro-hub infrastructure, provided their locations are agreed with the municipalities concerned, and they reduce the volume of heavy vehicles in city centres.

Key recommendations:

- Transport companies should first identify and document the corridors in their networks with gaps in first/last-mile connections, and then trial high-frequency feeder services with automated vehicles on the two or three most promising corridors. This requires the public transport commissioning authorities to support the trials and secure their follow-on funding.

- Mobility and logistics service providers should agree on a common data standard covering timetables, real-time status, availability of vehicles and of loading and stopping areas, and price queries, and contribute to a shared data infrastructure building on existing national platforms such as SKI+ and MODI.
- The Confederation, cantons and municipalities should set the framework conditions that the industry cannot create on its own: mandatory open interfaces for booking and price queries, public space for dynamic micro-hubs and, following the decision of the Council of States' Committee for Transport and Telecommunications (KVF-S) of 17 April 2026, voluntary rules in the short term and binding rules in the medium term for sharing mobility data.

1. Current challenges in intermodal mobility

The workshop brought together experts from five mobility fields: active mobility, public transport (PT), private transport, logistics and public authorities. Rather than discussing intermodality in the abstract, each group was asked to map out a concrete user journey, identify weak points and propose solutions. The six challenges below come directly from these user journeys: they are not theoretical constructs, but weak points that the practitioners encountered and documented during the session.

1.1 Fragmentation of information and services

On journeys that involve several modes of transport or cross regional boundaries, fragmented apps and ticketing systems become a real obstacle. The workshop illustrated this with an international suburb-to-suburb journey from Muttenz to Unterföhring, on which a traveller has to consult Google Maps, a national rail app and a ride-hailing app, each providing only partial and sometimes contradictory information. In such multimodal contexts, the cognitive effort creates a strong bias in favour of the car, which offers a single, predictable interface regardless of the complexity of the journey.

1.2 Gaps in first- and last-mile connections

The greatest structural weakness of public transport is not the main line, but the access and egress legs. The core network is rarely the problem; it is the stretches between the front door and the first stop, and between the last stop and the destination, that are usually not served at all, and this is precisely where intermodal journeys most often fail, as even short distances can be slow, unsafe or impassable for travellers with luggage, children or reduced mobility. In rural areas, for example on the return journey from Winterthur to Oberneunforn after 8 pm, there is simply no bus service; the 4 km gap between Ossingen station (the last stop with night services) and Oberneunforn becomes a significant barrier. In suburbs, where S-Bahn trains, trams and buses often run every 7 to 15 minutes at peak times, the problem is less the local timetable than the chain reaction triggered by a small delay: this pattern is set out in section 1.3 using the daycare scenario.

1.3 Rigidity of fixed timetables and low service frequency

Fixed timetables make intermodal travel fragile. As one workshop scenario showed, a morning commute that includes taking the children to daycare requires day-to-day flexibility in the mobility chain: the drop-off happens on two days a week but not on others; the weather affects whether cycling is feasible; the time the drop-off takes varies. Combined trip chains are possible in principle, for example taking the children to daycare by car and then switching to public transport at a station. Without reliable park-and-ride capacity and predictable connections, however, users are in practice left with only a rigid strategy: either drive the entire way or risk missing a connection. Neither outcome is satisfactory from a sustainability or user-experience perspective.

1.4 Cost perception and pricing complexity

Group trips by public transport are almost without exception perceived as more expensive than car journeys, even when the full costs of car ownership, fuel and parking are taken into account. Workshop participants noted that pricing for group and leisure travel is often perceived as complex and expensive compared with car travel, suggesting that current fare structures may not be optimally designed for these use cases. More generally, intermodal pricing may require the purchase of several products from different providers, an obstacle that discourages use and reinforces car dependency.

1.5 Urban logistics and last-mile freight

The logistics sector faces intermodal challenges of its own. Goods arriving in large vehicles cannot easily complete the last mile in the city, because pick-up and drop-off points (PUDO zones) are lacking or poorly managed, kerbside space is limited and there is no shared data platform. Micro-hubs (transfer points where goods are moved from large vans onto cargo bikes or small electric vehicles) make sense conceptually, but require the allocation of public space and a digital coordination layer that does not yet exist at scale.

1.6 Inclusion and accessibility

People with reduced mobility face multiple disadvantages: transfers that pose no problem for an able-bodied traveller can become difficult when timetable buffers are tight or the physical infrastructure is inadequate. The scenario presented at the workshop, a family outing to Kandersteg with a family member recovering from a leg injury, illustrates that while accessibility in public transport is required by law and has been implemented in many places, and travel apps allow longer transfer times to be set, the end-to-end intermodal chain is still treated as an exception rather than a basic planning requirement.

2. How automated vehicles address these challenges

Automated vehicles do not solve every one of the challenges above, but they close specific gaps that current systems cannot easily close. The table below maps each challenge cluster to the corresponding AV alternatives that address it. The following sections explain the four main mechanisms in more detail.

Challenge	Solution through automated vehicles
First- and last-mile gaps	AV ride-pooling and ride-hailing services, which can be deployed on demand with short response times, directly close gaps where scheduled services are absent or infrequent.
Rigid timetables	AV shuttles (4–8 seats) running at high frequency replace fixed timetables on these routes and adapt dynamically to real-time demand, including fluctuations at midday. To keep connections to the next mode secure, the departure point and departure time must be shown to travellers in real time and coordinated with the timetable of the connecting service.
Information fragmentation	Automated vehicles integrated into a MaaS platform covering different modes of transport offer a single interface for booking, payment and journey planning. Automatic rebooking of connections in the event of delays becomes technically possible. The prerequisite is that such a platform with open interfaces exists at all, which is not the case in Switzerland today.
Kerbside friction	Automated vehicles equipped with on-board sensors act as mobile scouting and verification vehicles for available PUDO zones, feeding data into a real-time digital twin of urban infrastructure and thereby enabling automated check-ins at micro-hubs.

Challenge	Solution through automated vehicles
Logistics hubs in dense city centres	Dynamic meeting points between automated delivery vehicles and small electric vehicles or e-bikes can partly replace fixed micro-hub infrastructure and reduce heavy goods vehicle traffic entering city centres. The permissible areas must be agreed with the municipalities; the AVs are dispatched only within these areas.
Cost and pricing complexity	AV fleets repurposed as group shuttles (e.g. “Family & Friends” weekend services) lower the cost per person through higher occupancy. For the feeder legs of an intermodal journey (not for routes operated end to end by a single provider, where that provider’s own app is sufficient), integrated billing within a MaaS platform replaces the purchase of multiple tickets. Whether group trips are offered at a lower price remains a decision for the respective service provider.
Accessibility and inclusion	AV services offering door-to-door service and specific accessibility features remove the need for physically demanding transfers and serve people with reduced mobility without them having to rely on separate, specialised transport services. This requires suitably equipped vehicles, which are not yet available today.

In light of the challenges listed in the table, sections 2.1 to 2.4 below show where automated vehicles offer real added value and which conditions must be met for this added value to materialise.

2.1 AVs as first- and last-mile feeders to rail

One promising short-term role for automated vehicles in an intermodal context is as a feeder to rail. In suburban and rural corridors where passenger volumes are too low to justify public transport services, an automated shuttle bus could in the longer term be operated at significantly lower marginal cost than a conventional, driver-operated bus service; when this will be the case in Switzerland cannot be foreseen at present. This application requires no new road infrastructure and can be integrated into existing ticketing systems under the responsibility of regional transport companies. What matters is that connections to rail can be secured in both directions, which requires coordination with the timetable and reliable real-time information.

2.2 AVs as a dynamic layer of urban mobility

In urban areas, two distinct demand patterns emerge from the workshop’s user journeys, and automated vehicles could prove particularly cost-effective in serving both. The first is steady, high demand along a fixed corridor, well suited to a minibus running so frequently that passengers do not need to plan their departure in advance; a timetable nonetheless remains necessary to secure connections. Removing the driver as a cost factor could make this frequency viable on routes where passenger numbers would not otherwise justify it.

The second pattern is irregular, unpredictable demand, such as shopping, leisure or appointment trips at times that change from day to day. Here, demand-responsive dispatching without a fixed route is better suited, with the automated vehicle called only when needed. In this case, automation lowers the marginal cost of guaranteeing a fast response (e.g. under 8 minutes), without driver idle time undermining the economics. This pattern applies to corridors with a dense range of connections; with an hourly service, the connection itself remains the limiting factor.

The two models complement each other: fixed-route AVs cover predictable demand, on-demand AVs the variable remainder. A single MaaS platform allows users to switch between the two models depending on the trip.

2.3 The automated vehicle as an intelligence layer

In urban freight transport, automated vehicles perform a dual function: as last-mile delivery vehicles and as data-collection devices that monitor and report infrastructure availability. In principle, AVs in passenger transport can take on the same sensing function.

The concept of a digital twin for specific zones, continuously updated with sensor data from automated vehicles and for which responsibility (municipality, canton or a national platform) is still to be determined, would significantly reduce the information asymmetry that today forces delivery drivers to circle entire blocks in search of a parking space. The regulatory prerequisite for this is mandatory data sharing by operators of automated vehicles with a shared platform managed by public authorities. Such an obligation cannot currently be achieved politically: on 17 April 2026, the KVF-S recommended not entering into deliberation on the MODIG. In the short term, data sharing will therefore have to rely on voluntary agreements.

2.4 AV-enabled dynamic micro-hubs

Automated vehicles can also reduce the space required for physical infrastructure in urban logistics. Instead of fixed micro-hub sites competing for scarce public space, automated delivery vans can create temporary, ad hoc meeting points with e-bikes or small electric vehicles for the last mile, by identifying a suitable kerbside parking space in real time and briefly handing over the goods before moving on.

As a result, the micro-hub changes from a permanent facility into a temporary event that can move location depending on traffic conditions or delivery volumes. The benefit is twofold: heavy vehicles can stop at the edge of the city instead of entering city centres, and cities avoid having to reserve permanent kerbside space for fixed hubs in every district. The model relies on the same prerequisites as described in section 2.3: a shared real-time data platform and a regulatory framework for safe, short handovers on public roads.

3. Proposed next steps for automated vehicles

Sections 1 and 2 analysed intermodal journeys and showed where automated vehicles can close gaps. This section translates that analysis into four concrete next steps that follow the same logic. They are intended as starting points for discussion rather than finished proposals: they reflect the authors' interpretation of the workshop results.

3.1 AV feeder services to rail: from ongoing pilots to scale-up

A priority step for the near future is to identify two to three suburban or rural corridors where the first/last-mile gap is documented and where a regional transport company, together with the responsible commissioning authority, is prepared to add an automated feeder service to its offering. A pilot on such a corridor would provide the passenger and operational data needed to assess feasibility before a wider roll-out is decided. With iamo, AmiGo and tpgFlex automatisé, projects pursuing exactly this aim already exist in Switzerland; the next step is therefore less about additional pilots than about systematically evaluating and scaling up the ongoing ones.

3.2 Two AV operating models: clarifying the business case

Every pilot programme should explicitly test both operating models identified in section 2.2, in order to determine the demand thresholds and cost structures that decide which model is used where, and to avoid conflating two distinct regulatory regimes: licensed scheduled services under the Passenger Transport Act on the one hand, and demand-responsive taxi and ride-pooling services under cantonal law on the other.

3.3 MaaS integration: laying the foundations for governance

Since fragmentation of information was identified as the most widespread obstacle across all five sectors, mobility providers, tariff networks and authorities must agree on a minimum viable data standard for cross-platform booking and billing. The key question to be resolved is whether integration is mandated by the authorities or achieved through voluntary commercial agreements. Equally explicit clarification is needed on who operates the MaaS platform and its associated app, and how its development and operation are funded.

3.4 Dynamic micro-hubs: a logistics pilot

A time-limited pilot in a defined city district should test dynamic handover points between delivery vans and e-bikes for the last mile, coordinated by automated vehicles, in collaboration with a logistics company and a city authority. KPIs should be used to measure heavy-vehicle penetration of the city centre, handover duration and conflicts over kerbside parking. The permissible locations of the handover points must be agreed in advance with the municipalities concerned; the AVs are then dispatched only within the approved areas.

4. Recommendations for individual stakeholder groups

The recommendations below (see table) are organised by stakeholder group and follow the structure of the report: the challenges identified in section 1, the AV mechanisms examined in section 2 and the next steps proposed in section 3. The recommendations are to be understood as proposals for discussion and not as expectations of individual actors; they indicate which contributions the workshop participants consider effective for each group.

Stakeholder group	Key measures
Confederation, cantons and municipalities	■ Introduction of dynamic mobility pricing based on demand on the road network, with the revenues reinvested in sustainable mobility. ■ Provide public urban space for dynamic urban micro-hubs, which, unlike fixed micro-hubs, do not require permanently reserved areas, and which enable the transfer from large delivery vehicles to electric cargo bikes and small electric vehicles. ■ Ensure data sharing by AV operators on loading zones and PUDO infrastructure: in the short term through voluntary agreements, as a sharing obligation cannot currently be achieved following the KVF-S decision of 17 April 2026, and in the medium term through binding regulation. ■ Invest in safe infrastructure for cyclists and pedestrians, because an AV feeder only relieves the last mile if the remaining distance between the virtual stop and the destination can be covered safely on foot or by bicycle. ■ Require transport companies, their sales and distribution organisations and private providers (including micromobility such as e-scooter and bike-sharing services) to provide open interfaces for unified booking and billing. The requirement already applies in public transport and has largely been implemented; the gap to be closed is with private providers.
Public transport companies	■ Examine automation where driver shortages and driver costs currently prevent higher service frequencies: on busy corridors as a complement to conventional scheduled bus operations, on low-demand corridors as a feeder with small vehicles. Recognise driver availability as a limit to expansion in its own right: automated vehicles do not remove every obstacle to higher frequencies, but they remove the most immediate one. ■ Identify the corridors in their own network with documented gaps in first/last-mile connections and prepare the two to three most promising ones, together with the public transport commissioning authorities, for pilot operation within 18 months. ■ Simplify and reduce group and leisure fares in order to compete with the perceived cost of private car journeys. ■ Set up virtual stop networks with dense PUDO points to shorten access distances in suburban and rural areas. The spacing between points is to be chosen so that it remains economically viable. ■ The requirements of the BehiG (Disability Discrimination Act), in particular independent boarding and alighting by wheelchair users, cannot easily be met at virtual stops. Workable solutions must therefore be developed together with the Federal Office of Transport (FOT) and the transport companies. ■ Extend the real-time delay information, already largely available, to the entire public transport offering and make it available for integration on a non-discriminatory basis, so that automatic rebooking of intermodal connections becomes possible once MaaS platforms exist.

Stakeholder group	Key measures
Private mobility	■ Introduction of a common data standard for price queries, timetables and route availability across all providers' apps, aligned with public transport, to which the same requirement applies. ■ Build or join a MaaS coalition to offer a "One App, One Journey" product that integrates public transport, micromobility and other mobility providers with automated vehicles (AVs) for first- and last-mile legs. ■ First clarify the legal permissibility of ride-pooling: in many cantons, taxi companies are currently prohibited from pooling trips. Only then do commitments on waiting times (for example under 8 minutes in the areas served) make sense. ■ Show total prices for group trips transparently, so that they can be compared with the full cost of a car journey.
Logistics service providers	■ Carry out pilots with automated delivery vehicles in collaboration with city administrations, for use cases at urban micro-hubs and dynamic meeting points. ■ Provide real-time data on the availability of loading zones and kerbside parking to a shared urban infrastructure platform, and help build it as long as it does not exist. ■ Use e-bikes and small electric vehicles for last-mile delivery, coordinated with automated delivery vans at dynamic handover points, to limit heavy vehicle access to city centres. ■ Cooperation with authorities to define open interfaces (APIs) for reserving fixed and temporary micro-hub space.
Research and academia	■ Provide selection and evaluation criteria for AV feeder corridors and provide scientific monitoring of the transport companies' pilot corridors. ■ Support the development of a cross-platform data standard for booking and billing with research input. This directly addresses the information fragmentation identified in section 1.1 and the governance gap raised in section 3.3, including the open question of whether integration should be mandated by the authorities or achieved through voluntary agreements between competing providers. ■ Development of evaluation frameworks for automated vehicle pilots, including indicators on accessibility, occupancy, emissions and system reliability. ■ Follow-up research on mobility pricing models suited to the Swiss regulatory context. ■ Continuation of the "Design Thinking" workshop series with subject-matter experts and power users, in order to identify new challenge archetypes.

5. Conclusion

The SAAM Day on intermodality showed that the obstacles to seamless multimodal mobility are well understood, cross-sectoral and surmountable, but require coordinated action by actors who currently do not operate within a common framework. Automated vehicles are not a panacea: while they close certain gaps (e.g. in the first/last mile, with dynamic demand or in logistics infrastructure) that current systems cannot close cost-effectively, they depend on data interoperability, regulatory framework conditions and integrated platforms to realise their full potential.

Using automated vehicles to improve intermodality, and thereby to benefit society as a whole, requires sustained political will to implement mobility pricing, entrepreneurial courage to share data between competing providers, and operational discipline in building and maintaining integrated systems over a period of several years.

SAAM is well positioned to drive this coordination forward. The workshop format has demonstrated its value in surfacing concrete, practical challenges across different stakeholder groups. The logical next step is to convert this energy into structured pilots, common data standards and policy recommendations.

The goal is a mobility ecosystem in which the decision to use public transport, take a ride-hailing service or cycle is at least as easy, reliable and affordable as driving one's own car. Automated vehicles, if properly integrated, bring this goal significantly closer.

Funded by the European Union under the CHORUS project (Grant Agreement No. 101202981) as part of the European Union's Horizon Europe research and innovation programme. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or CINEA. Neither the European Union nor the granting authority can be held responsible for them.

Annex: Workshop overview

The SAAM Day on intermodality took place on 10 March 2026. Participants were divided into five expert-led working groups, each focusing on a specific sector of the mobility ecosystem.

Sector	Group leader	Focus
Active mobility	Dominik Bucheli (Fussverkehr)	■ Reference journey: trip from Winterthur to Oberneunforn, with no bus service after 8 pm and a distance of 4 km to the nearest stop with night services. ■ Core challenge: the trade-off between distance and service frequency in rural areas, compounded by safety concerns for pedestrians and cyclists. ■ Proposed solutions: car sharing and e-bike sharing, taxi and ride-hailing services, and automated feeder vehicles to bridge the gap to the main rail network.
Public authorities	Alexander Erath (FHNW)	■ Reference journey: morning commute combining taking the children to daycare with travel from a metropolitan area to a workplace in the city. ■ Core challenge: day-to-day variations in the mobility chain (frequency and duration of the daycare drop-off, and weather conditions) make planning cognitively demanding and lead users to fall back on the car as the only reliably flexible option. ■ Proposed solutions: AV ride-pooling with a response time of under 8 minutes, high-frequency AV minibus lines with virtual stops, and private use of AVs for the entire trip chain, subject to mobility pricing to limit empty runs.
Private transport	Stefanie Berliner (HOLO)	■ Reference journey: international suburb-to-suburb trip from Muttentz to Unterföhring involving several apps, operators and national borders. ■ Core challenge: lack of price transparency between modes, unreliable cross-border information, and difficulties with luggage and transfers when changing modes. ■ Proposed solutions: AVs as first- and last-mile links, integrated into a seamless MaaS system; it remains unresolved who governs the integration and how data protection and interoperability between competing providers are ensured.
Public transport (PT)	Marco Schärli (ZVB)	■ Reference journey: family leisure trip from Muttentz to Kandersteg, with one family member recovering from a leg injury and no car available. ■ Core challenge: higher perceived cost of public transport for group travel, physical demands at transfers and on last-mile legs, fixed timetables that limit spontaneity, and low awareness of the intermodal options available. ■ Proposed solutions: ride-pooling with automated vehicles both for the first mile to the station and for the last mile from the main line to the final destination, removing the physically demanding sections and making the journey feasible for all members of the group.

Sector	Group leader	Focus
Logistics	Anna Baschung (Planzer)	■ Reference journey: urban last-mile freight delivery, with kerbside parking management identified as the central bottleneck. ■ Core challenge: loading zones are often occupied, disorganised or too small, forcing drivers to improvise and increasing dwell times and congestion. ■ Proposed solutions: a digital twin of urban loading infrastructure, continuously updated with sensor data from automated vehicles, allowing vehicles to book and verify available spaces in near real time; extended in this report to include dynamic micro-hubs as temporary handover points between delivery vans and e-bikes for the last mile, coordinated by automated vehicles.

The workshop conclusions were summarised by the FHNW team and form the empirical basis for this position paper.