

Anlage 3: Summary

FE-Projekt 70.0969

‘Integration of automated means of transport into the urban public space’

**On behalf of the Federal Ministry for Digital and Transport Affairs (BMDV),
Urban Transport Research Programme (FoPS)**

Responsibility for the content lies exclusively with the author.

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The manual ‘Autonomous driving in public transport. A handbook with suggestions for implementation in municipal practice’ was developed as part of the Urban Transport Research Programme (FoPS) of the Federal Ministry for Digital and Transport Affairs (BMDV). It sheds light on the introduction of autonomous and connected driving (av) for passenger transport in road-based public transport. It looks at the use of publicly accessible vehicles with SAE Level 4 automation functions, i.e. minibuses and standard buses that do not require human assistance for driving tasks within a localised operating area. The handbook facilitates the introduction to the topic of autonomous driving in public transport.

The handbook adopts an interdisciplinary perspective and focusses on strategic and operational aspects associated with the introduction of av. In particular, it provides the necessary planning and process steps as well as basic knowledge.

Addressees of the handbook

The handbook is intended to support municipalities, public transport authorities and transport providers in utilising the positive effects of operating autonomous, networked public transport services.

The handbook is intended to enable municipalities, mobility providers and transport associations to develop their own strategy with regard to automation and networking in public transport. The handbook also provides assistance in setting up the operation of av vehicles in public transport.

This handbook thus presents the entire goal-orientated planning and implementation process: from preparation to strategy development, the establishment of an operation of av vehicles in public transport through to implementation including success monitoring.

The manual is aimed at

- local authorities in their role as public transport authorities, road authorities and possible transport authorities,
- to mobility providers who operate co-financed regular and scheduled services or commercial occasional services,
- to transport associations as an organisational and legal association of local authorities and/or transport companies in order to carry out public transport jointly and in a coordinated manner,
- to other service providers who provide individual services, such as the provision of platform-based mobility services, and
- to all persons and institutional players who are interested in using the av.

Function of the handbook

The handbook answers typical questions about the introduction of av in local public transport, such as the establishment of vehicle deployment and fleet operation. It helps local authorities to find their own position and to develop their own vision and strategy for automated driving in public transport. The handbook can thus help to categorise the topic within the municipality. Specifically, the handbook can form the basis for the evaluation of a possible vehicle deployment, a fleet renewal and the necessary infrastructure adaptations. Municipal employees, including those from transport and urban planning, traffic management and representatives of municipal companies and transport companies, as well as transport associations, can use the handbook to enable early and intrinsic planning and, as a result, long-term orientated action.

The basis for the design options and recommendations for action derived in the handbook is a systematic compilation and analysis of previous approaches. Building on this, the handbook provides recommendations for the necessary prerequisites for the safe and sustainable design of public transport and identifies possible regulatory and design options for the integration of automated and connected vehicles and transport facilities. In addition, the handbook contains recommendations for the development of rules for networked and automated transport for adaptation to local conditions. The handbook serves as a guide for municipal stakeholders in actively shaping the safe and sustainable use of automated and connected vehicles and supports them in assuming their role as mobility providers and operators of transport infrastructure and in setting targeted framework conditions for further mobility services.

The handbook describes the status quo as well as future developments on the way to the use of driverless vehicles and offers recommendations and design options for the safe, efficient and environmentally friendly use of connected and automated vehicles in local public transport. New business models and the possible integration of other commercial providers of passenger transport are taken into account.

In order to ensure the best possible applicability and user-orientation as well as the highest level of technical correctness and topicality, an expert group was set up with representatives from the industry and science, which provided targeted advice on questions relating to the handbook in several workshops. In addition, interested municipalities were included as addressees of the handbook at the beginning and during the course of its development in order to define objectives and assess its practical suitability.

The handbook was developed in three main stages: a comprehensive literature and internet analysis, several workshops with experts and addressees of the handbook as well as numerous expert discussions. In the course of an interlocking, mutually learning and mutually scrutinising iterative procedure, we derived content and recommendations.

Literature & Internet analysis

Firstly, a very detailed search and analysis of relevant national and international specialist literature on the subject of avF and its use, including strategic and operational planning, was carried out. For this purpose, scientific papers, project reports on research and demonstration projects, press releases and articles as well as websites of federal and state ministries, avF test centres and test fields and manufacturers of avF vehicles were consulted. Several hundred relevant documents, mainly in German and English, were analysed. When selecting the sources, great importance was attached to reliability, topicality and applicability in German practice.

Participation process

The development of this handbook was accompanied by a comprehensive participation process. Workshops were held with representatives from local authorities and transport companies as well as with experts and stakeholders from politics, industry, science and associations.

From the outset, the aim was to closely align the handbook with the needs of the municipalities. For this reason, the involvement of future addressees and users in the content and structure of this handbook was a central component of the development phase. Municipalities and municipal umbrella organisations as well as transport companies were involved from the outset, in order to jointly reflect on the objectives and practical relevance of the handbook.

Target group workshops on the requirements of the municipalities

At the first workshop on 28 September 2021, even before the writing process began, the structure, content priorities and the development process of the handbook were discussed with local authorities and transport companies. The aim was to discuss the ideas and requirements of the municipalities and to have the planned content reviewed and concretised. Municipalities that already had experience with the use of avF at that time were also invited to report on this. This workshop provided valuable initial information for the target group-orientated content of the handbook.

In a second target group workshop, representatives from local authorities and transport companies were again invited to discuss an existing draft extract of the manual and review it according to their requirements. Once again, cities and municipalities of different sizes as well as municipalities with and without experience with the use of avF were invited. The focus was on optimising the manual by testing its utility value. Here, too, the authors received valuable feedback that helped to make the manual more user-friendly.

The involvement of the target group made a significant contribution to ensuring the practical relevance and usability of the handbook. Existing networks and contacts were also utilised and integrated. These include the National Competence Network for Sustainable Mobility (NaKoMo), the German Association of Cities, the German Association of Towns and Municipalities and the work of the National Platform Future of Mobility. These networks and associations have made a decisive contribution to the success of the participation process.

Expert workshops for the professional qualification of the handbook

In addition to the target group workshops, four expert workshops were held as part of the development process, each focussing on specific questions in the handbook. The aim was to regularly involve the expertise of these stakeholders throughout the entire development process and thus ensure a high level of technical quality. As a result, new developments and technical innovations were regularly incorporated into the manual's development process, as were the latest research findings.

In order for the targeted integration of automated and networked means of transport into both the existing range of public transport services and the public space to succeed, it is necessary to systematically bring together and co-operate very different specialist areas and interest groups. For this reason, a group of experts was set up to map the various facets of this process.

The expert group came together for a total of four meetings. The aim of these meetings was to develop clear recommendations for municipalities and mobility providers on specific issues. The experts commented on the assessments of the project partners, discussed open questions and aspects and contributed their own ideas. The following topics were covered in the four workshops:

- ▶ Expectations of automated, networked passenger transport
- ▶ How can municipalities achieve modal shift effects through automated, networked public transport services?
- ▶ Special requirements of automated, connected driving for the municipal infrastructure in public spaces
- ▶ Final meeting of the expert group: final discussion of the technical content of the handbook and formal conclusion of the participation and development process

In addition to the meetings of the expert group, 10 qualitative expert interviews were conducted with individual representatives. They were used to analyse the influencing and impact factors of automation and

connectivity in public transport and to discuss and validate the changes, adaptation requirements and options for action identified for local authorities and transport providers.

The results of the individual discussions and workshops were incorporated into the development of the handbook and contributed significantly to its quality, completeness and user-friendliness.