

Automated buses in Europe

An inventory of pilots: Version 1.0

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An electronic version of this technical report is available at <http://repository.tudelft.nl/>.

Cover picture: Opening shuttle ESA ESTEC. Picture: Irene Zubin



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Abstract

Automated bus systems are a promising means of future first- and last mile public transport solutions, and can even possibly become a regular part of the public transport network. Therefore, many projects appear throughout Europe to pilot the feasibility of automated bus system implementation on various locations. Keeping up with the rapidly increasing pace in which these pilots appear, this report aimed to provide an overview of past, currently on-going, and concretely planned pilots with automated bus systems in Europe. Via extensive internet searches, exhausting personal networks, and gathering information from other sources, a detailed overview was developed. 118 pilots were found which were characterized by vehicles with predominantly low speeds, low capacities, and short operation routes. The search in itself proved to be difficult due to the often lacking detailed information of pilots, which was argued to be due to most scientific pilots are of recent years, and therefore often still on-going, and have consequentially not published any information yet on their research. Another difficulty arose due to the rapid increase of occurring pilots with automated buses, which leads to the report already being out-of-date as this report is being written. Therefore, this report will be updated early 2021. Currently, the vast majority of automated bus system pilots occur with the presence of a steward on board, due to legislation, technological challenges, as well as passengers requesting them, raising concerns regarding (e.g., economic) efficiency. Although there are a few automated bus systems that actively show efficient operation without on-board stewards, this still appears to be a future development.

Acknowledgements

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1. Introduction

As is becoming increasingly apparent, driving is turning into a task for an automated system instead of a human being. Public transport is considered as one of the more suitable candidates to benefit from automating driving tasks (Shladover et al., 2016). Henceforth, an increasing number of automated (mini)bus systems is entering our roads, often driving in mixed traffic environments including cyclists and pedestrians. As a result, projects involving automated public transport systems are appearing with accelerating pace, and keeping up to date about their current developments is becoming increasingly cumbersome. A comprehensive overview of all these projects would provide valuable insights. Overviews like this do exist, but are not always (kept) up-to-date and usually lack the detailed information needed for research purposes. For instance, the Bloomberg.org Group created an interactive map on current and planned projects involving autonomous vehicles (Bloomberg.org Group, 2020), and Connected and Automated Driving Europe's website gives an overview of European projects in the field of automated road transport (Connected and Automated Driving Europe, 2020), but these are not exhaustive, and detailed information is often not provided. When narrowing down to automated bus systems, finding an exhaustive and up-to-date overview of completed, running, and planning projects becomes even more challenging. From a technological, energy efficiency, and legality perspective, a recent overview article investigated predominantly European completed and ongoing automated bus projects (Ainsalu et al., 2018). It is important to keep an even pace with technology, and, if we want to have the consumer (keep) using promising novel technology, maintain an up-to-date knowledge base of how humans (prefer to) interact with such technologies as automated bus systems. As a first step, an inventory of what has been done, is going on, and will be investigated in the near future, appears therefore warranted.

Henceforth, in the present document we present an inventory of real-life projects with automated bus systems in urban settings. This work was conducted as part of the Autobus project <https://www.toi.no/autobus/> funded by the Norwegian Research Council. The inventory is not complete, mainly because many new pilots and demo's pop up all the time, and many of those are not well documented. Pilots and projects in countries represented in the Autobus consortium (Norway, the Netherlands, Belgium, & Sweden) are probably more complete than those in other countries. We have attempted to collect as much information as possible in a systematic way. One more update of the inventory is foreseen in January 2021.

Within the Autobus project, also other studies are conducted. Recently, two systematic reviews have been performed. One with a focus on passenger experience and road user interaction (Heikoop et al., 2020) and another on empirical studies from interviews, focus group discussions, surveys, and (video) observations directly addressing the interactions between cyclists and autonomous vehicle (AV) shuttles (Hagenzieker et al., 2019). Findings of these reviews include that:

- Public and passengers are generally enthusiastic about the AV shuttles,
- The AV shuttles are not mature; they stop when any object (e.g., road users, static object, etc.) is within a certain distance from the bus,
- The AV shuttles' speed is slow; often slower than the speed of cyclists and other surrounding traffic,

- AV shuttles often drive on existing infrastructure, sharing the road with cyclists, or use the cycle track,
- Infrastructural characteristics (e.g., markings, shared or separate road) influence observed interactions, which appear to be more risky on shared narrow roads,

Other studies within the project, also focusing on the interaction of road users with automated bus systems, are in progress. These involve surveys among passengers, pedestrians, and cyclists related to their interaction with automated bus systems driving in Norway and analyses of real-life observations on various routes where automated bus systems interact with other road users. First preliminary findings (Bjørnskau et al., 2019) show that:

- Cyclists' opinions and safety perceptions become more positive after having interacted with AV shuttles,
- Cyclists seldom force the bus to stop, but interactions change: cyclists give less often way to the AV shuttles over time, whereas pedestrian behaviour does not seem to change,
- Cyclists cross having a very short distance ahead of the AV shuttle,
- The AV shuttles' abrupt breaking can cause the cyclist to perform unexpected moves,
- Slowness of bus leads to many overtakings by cyclists (and by motor vehicles),
- A common observation is that cyclists ride alongside (left or right) or overtake the AV shuttle, which can cause abrupt braking (too short distance to shuttle).



Figure 1 – WePod and cyclists in the Netherlands. Picture: Delft University of Technology



Figure 2 – Automated shuttle in Oslo, Norway. Picture: Marjan Hagenzieker



Figure 3 – Automated shuttle in Frankfurt, Germany. Picture: Roberto Giraldi



Figure 4 – Automated shuttle in Appelscha, the Netherlands. Picture: Reanne Boersma

2. Methods

In- and exclusion criteria

The aim of this research was to inventory pilots and projects with automated bus systems throughout Europe that are, will be, or have been running, to present an as complete picture of the current state-of-the-art involving automated bus systems in Europe. This therefore excludes demos or showcases, as those are often not well documented, and operating in optimal conditions and do not give a realistic view of long term implementation of the vehicle. Although this research did not actively searched for short-term demos or showcases, some can be included when they are deemed relevant to present in this overview, for instance due to the abundance of information, or it being a landmark demo or showcase ushering in new possibilities. This research was specified to find automated bus systems operating on public roads with mixed traffic. Pilots on closed roads can be included, however, when they are (similar to above) deemed relevant enough for presentation in this overview. The vehicle type was narrowed down to a vehicle that was able to transport people as public transport. That excludes private automated cars such as the (concept) cars presented by Google, Tesla, Volvo and Mercedes. Pilots that did not take place, such as the Citymobil project in Rome (Delle Site, Filippi, & Giustiniani, 2011), were excluded from the report. The entire research took place between January and March 2019 and between November 2019 and January 2020.

Step-by-step methodology

For the development of this report, several steps have been taken. First, several main online sources were utilized (see Table 1), and complemented with other relevant online sources such as university- and news websites. Second, a semi-structured review was conducted. Third, the results from this review were analysed for relevant content. Fourth, this relevant content was used for both forward- and backtracking of other relevant content (i.e., finding relevant citations leading to other pilots or projects, and finding additional information through searching for keywords found in news articles). Lastly, personal networks were broached to supplement the resulting data base with pilots and/or projects that are not (easily) retrievable through an online research.

Table 1 – Main sources of the online research used for developing the overview of pilots and projects with automated bus systems in Europe.

Title	Reference	Type
Implementing Automated Road Transport Systems in Urban Settings	Alessandrini, 2018	Book
State of the art of automated buses	Ainsalu et al., 2018	Review journal article
Initiative on Cities and Autonomous Vehicles	Bloomberg.org Group, 2020	Online inventory
Cybercars	Parent, 2019	Blog
SPACE UITP	SPACE UITP, 2020	Project website
AVENUE	Avenue, 2020	Project website
Easymile	Easymile, 2020	Company website
Navya	Navya, 2020	Company website

The semi-structured review was performed using various search engines, namely Google Scholar, Web of Science, ScienceDirect, Scopus, and ResearchGate. Narrowing down the scope of the research, keeping the method both valid and viable, the search was restricted to only pilots and projects on automated bus systems in Europe. Next, a set of search terms was determined, seen in Table 2, which, combined, formed the search queries that were used for this research. The results from this research were consequently filtered for relevant topics, meaning that the content should be on public transport vehicles only, cover pilots or projects (i.e., not demos or showcases), indicating (quasi-)long-term employment of the automated bus system, and provide ample information for filling out at least most of the relevant details for the overview table of this report.

From these results, other relevant sources were extracted, namely references found in reference lists and keywords from news articles. These sources were used as keyword search terms for a follow-up online search, after which its results were added to the rest of the results.

The final method used in this research was utilizing the authors’ personal networks, meaning that the authors gathered information by attending relevant conferences, project meetings, and workshops, conversed with other relevant researchers and stakeholders, and took their own personal experience into account. These results were also added to the rest of the results.

Table 2 – Overview of terms used for the online search, complemented with the languages in which the searches were conducted.

Synonyms of automation	Synonyms of vehicle	Languages
Automated	Vehicle	English
Autonomous	Bus	Dutch
Driverless	Shuttle	French
Self-driving	People mover	Norwegian
	Public transport	Italian
	Public transport solution	Spanish
	Road transport system	German ¹
Cybercar²		
Cybernetic transportation system²		

3. Results

Please note that at the time of finalising this research (November 2019 to January 2020) all the website links used for this research were available. Information in this overview may be outdated at the time of publication. Even though the authors tried to get a complete overview, some pilots might not be mentioned because many new pilots keep coming up and many of those pilots are not well documented. Please feel free

¹ Only limited use.

² “Cybercar” and “Cybernetic transportation system” were separate entries in the online research.

to share your information about pilots and projects in Europe if you have any (the authors can be contacted via A.M.Boersma@tudelft.nl). The authors intend to update the inventory table early 2021.

The following presents a narrative of the pilots and projects found in this research. Its focus is to illustrate the development of automated bus systems in Europe, based on the findings from this research. The overview (in table form) of the found pilots and projects from this research can be found as appendix.

The idea of enhancing public transport systems with automated bus systems originates back to the 1990s from the concept of the so-called 'cyber cars', which are in essence a low-passenger-capacity, flexible on-demand service on dedicated infrastructure forming Cybernetic Transport Systems (CTS; Parent, 2019). A demonstration and implementation of such a transport mode, named ParkShuttle, was realized in 1997 in the parking area of Schiphol airport, the Netherlands, which stayed operational until 2004 (2getthere, 2019; Parent, 2019).

Since the early 2000's, a series of research projects (CyberCars, CyberMove, CyberCars2, CityMobil, CityMobil2, etc.) have been focusing on development, improvement, and testing of technology for automated bus systems. From cyber cars with simple obstacle detection system (scanner, laser, and safety bumper) on dedicated closed track (Delle Site, Filippi, & Giustiniani, 2011), it matured into more advanced automated bus systems with complex sets of internal and external sensors for vehicle positioning and navigation, to potentially allow for driving in mixed traffic (Ainsalu et al., 2018). Examples of the latter vehicles are EasyMile's EZ10, Navya's Arma, Local Motors' Olli, and the 3rd generation of ParkShuttle. The only significant difference between the vehicles is that ParkShuttle uses artificial landmarks (i.e., magnets) which are embedded in the roadway for positioning (Boersma, Mica, van Arem, & Rieck, 2018).

One of some landmark pilots and projects actually involved a one-day trial in Svalbard, which was in 2019 the first autonomous vehicle operating in the arctic circle. Even though the methodology of this research aimed at excluding short-lived trials like these, the contributory factor of this trial made it relevant enough to include in this report, and is thus consequentially included in the overview to be found in the appendix.

Pilot descriptives

At the time of writing, a total of 118 pilots and projects have arisen, based on the results from this research. Unfortunately, the information about the earliest trials and pilots is scarce, as most of the links to the projects' websites are not working anymore. Wherever possible, the pilots and projects that could be described in enough detail are taken into account in this research, and are presented in the overview (see appendix).

The 118 pilots and projects took place in 18 different countries. The amount of the projects per country is shown in Figure 5, with France (32 projects), Germany (12 projects), and Norway (9 projects) being the three leading countries. Note that the name of the organizing party(ies) or the purpose of the project were used as an indicator of the country of the pilot, as the project itself was often not a clear enough indicator for its location.

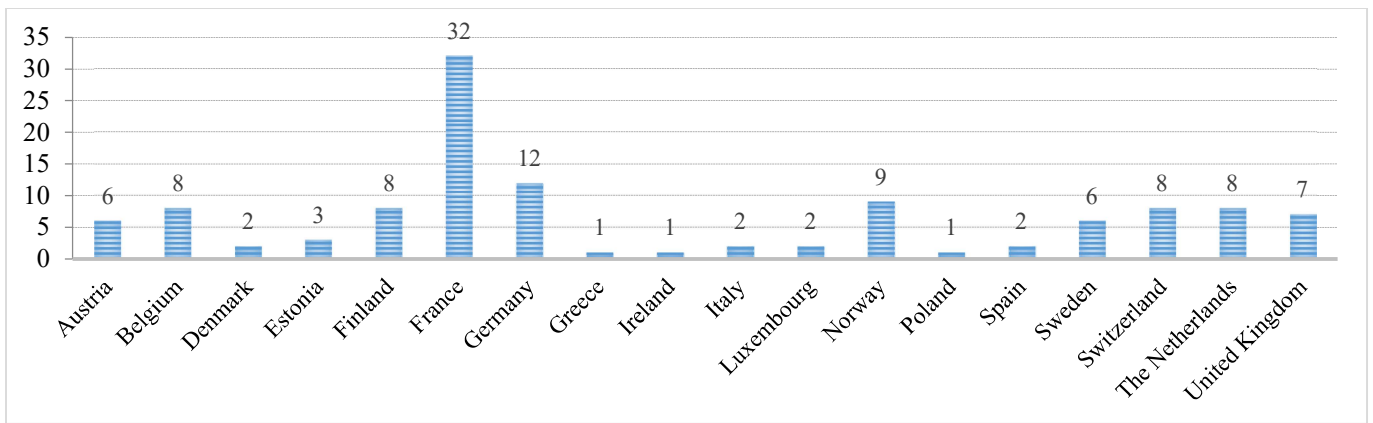


Figure 5 – Amount of pilots per country, listed alphabetically.

The starting and ending dates for each pilot were gathered, which are presented in the overview to be found in the appendix. Some pilots report two different starting and ending date; in those cases, more pilots were carried out for the same project in different times. Looking at the starting year of the pilots, the increasing interest in automated bus systems starting from 2016 can be seen, with 2018 and 2019 as peaking years (Figure 6). Those two years mark the introduction of a new collection of automated bus systems, such as the minibuses I-Crystal (developed by Transdev and Lohr), Gacha (Miju and Sensible4), MILLApod (Intelligent Systems For Mobility), and HEATbus (IAV), as well as the full-size buses Citywide LF (Scania) and Enviro200 (ADL). This consequentially explains the fact of the dominance of the vehicle types EZ10 (EasyMile) and Arma (Navya), with 59 and 35 pilots, respectively, utilizing these types of vehicles, as those two types have been around much longer (since April and September 2015, respectively). Notably, all vehicles used in the pilots found in this research were fully electric, apart from one: the Mercedes-Benz Future Bus, which operated between Schiphol Airport and the city of Haarlem.

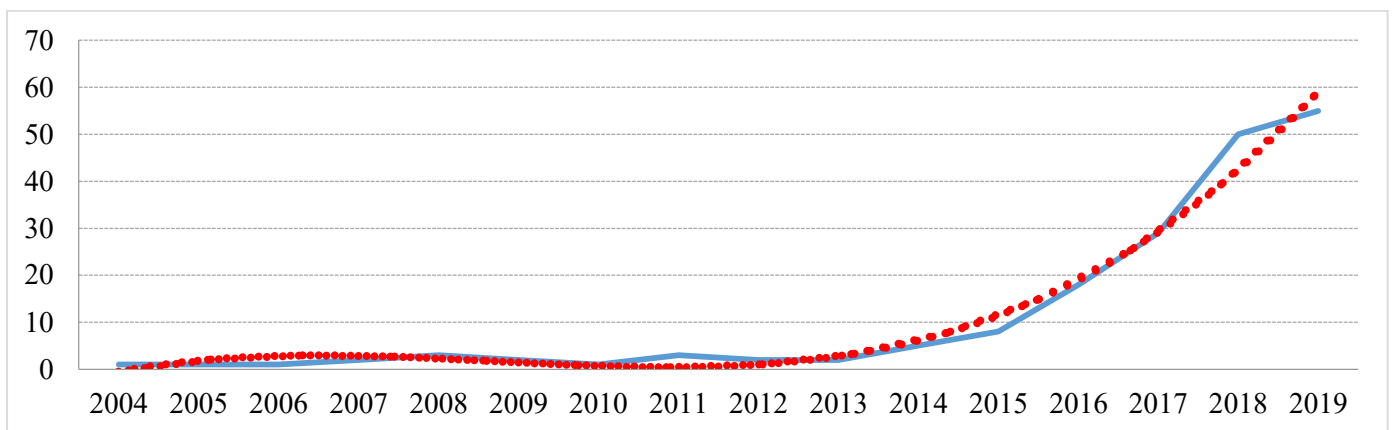


Figure 6 – Distribution of running pilots per year. Trend line in red dots. Note: the duration of each project is considered; hence, if a project lasts for 2 years, the same project is added to both respective years.

Passengers

Public transport is per definition intended to transport public. Therefore, this research evaluated the characteristics the pilots have in light of its passengers. Although the maximum passenger capacity of automated bus systems is usually higher, the number of allowed passengers is almost always limited to seated places, with one place reserved for the steward. An overview of the maximum amount of passengers that is allowed in the vehicle is seen in Figure 7. The presence of the steward is mandatory in all projects except for the ParkShuttle (Rotterdam, the Netherlands). This procedure is mostly done for safety reasons, since the automated driving technology is still developing. However, two private trials took place in Oslo, Norway and in Salzburg, Austria without steward on board (see appendix' comments column for more information). For 23 pilots it was not possible to find the maximum allowed seats; these pilots are therefore not included in Figure 7. Of those pilots for which this data could be found, the vast majority (96%) would only hold less than 20 passengers, while over 70% would not take more than 12 passengers at a time. The three exceptions are one in Sweden and two in the United Kingdom (numbers 92, 116, and 118 in the appendix), of which only one (#118) has been running.

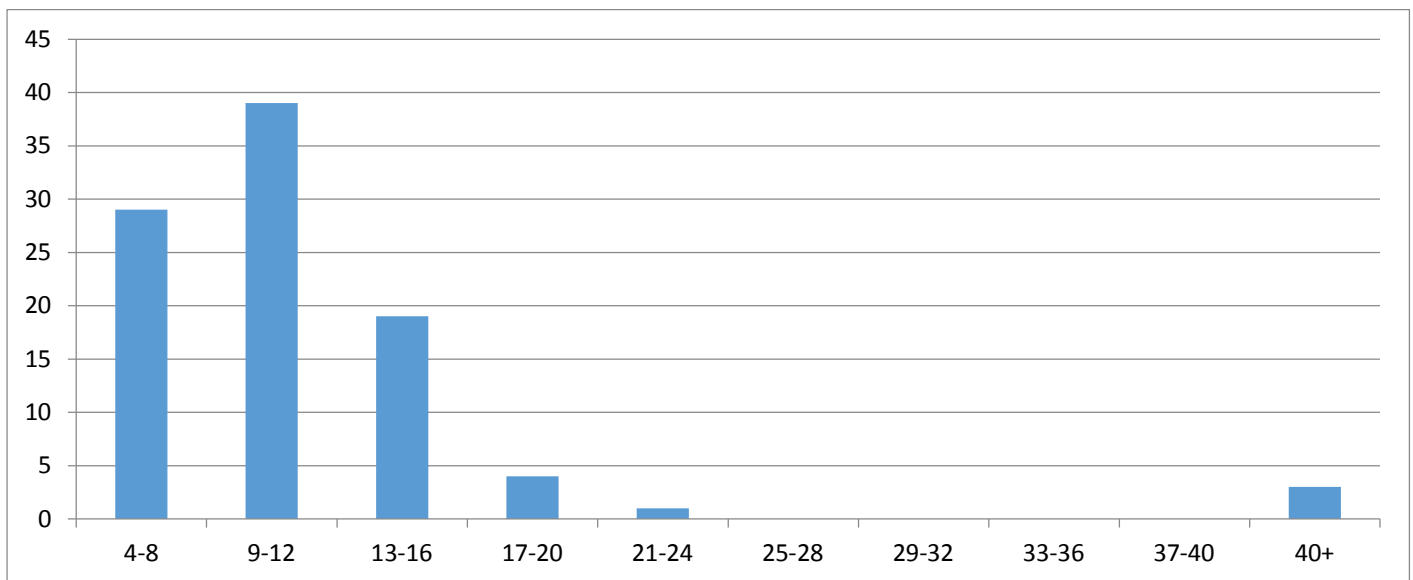


Figure 7 – Maximum allowed passengers in the vehicle

Vehicle- and infrastructural characteristics

The infrastructural adaptations for the automated bus systems mostly include road markings and warning signs, installation of the equipment for V2X communication (sensors, systems to communicate with a control room and traffic lights), and temporary platforms for bus stops.

On the same line of reasoning of the available seats, the allowed speed of the automated bus systems is usually lower than the design speed. Most pilots therefore report two different speed values: one referring to the maximum allowed speed and one to the average operational speed. As with the information regarding capacity, information regarding (operational) speed was not always present. Therefore, only the pilots who reported information regarding operational speed of their automated bus system are taken into account (82 of 118 pilots). Figure 8 shows the average operational speed distribution of the considered pilots. As with the capacity (Figure 7), the average operational speed is low (below 21 km/h) for the vast majority (78%) of the pilots. Only two pilots exceeded 40 km/h (numbers 61 and 110 in the appendix).

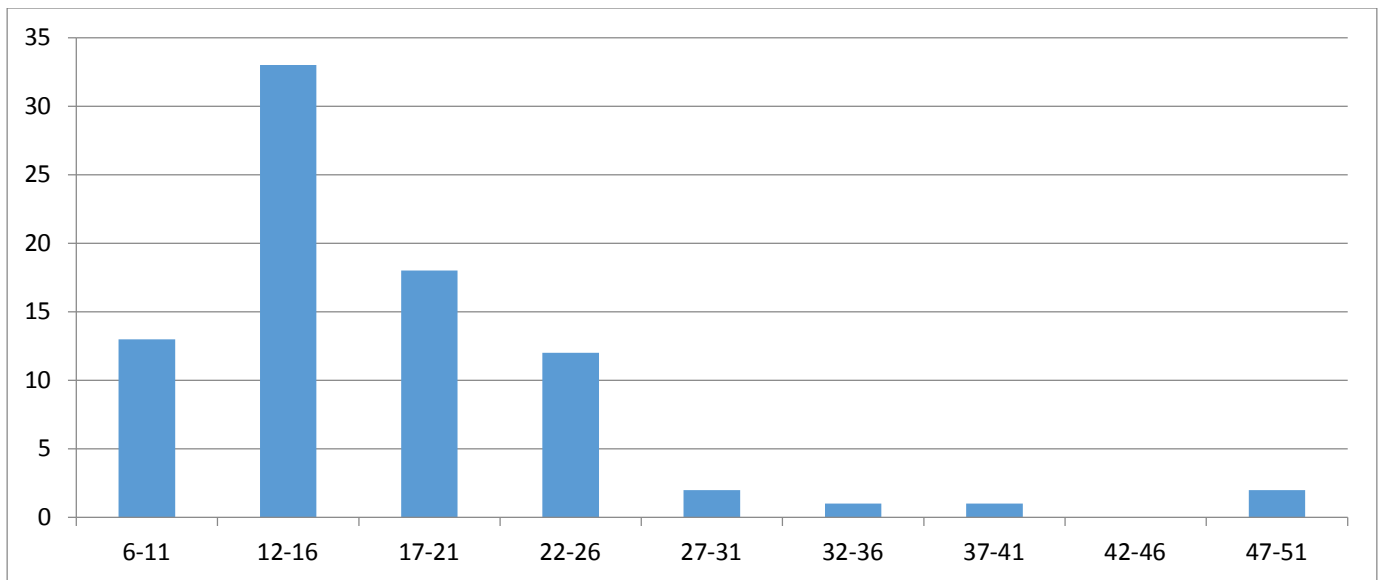


Figure 8 – Number of pilots per average operational speed of the automated bus system in kilometers per hour

The application cases of the automated bus systems are mostly fitting into the concept of first/last mile transport solutions, to provide connections between public transport stops or stations and university campuses, business/shopping districts, or within airports, parking facilities or city centres. A total 88 pilots reported their route length, of which 50% was below 1500m (Figure 9). Five pilots were longer than five kilometres (numbers 46, 49, 88, 92, and 116 in the appendix).

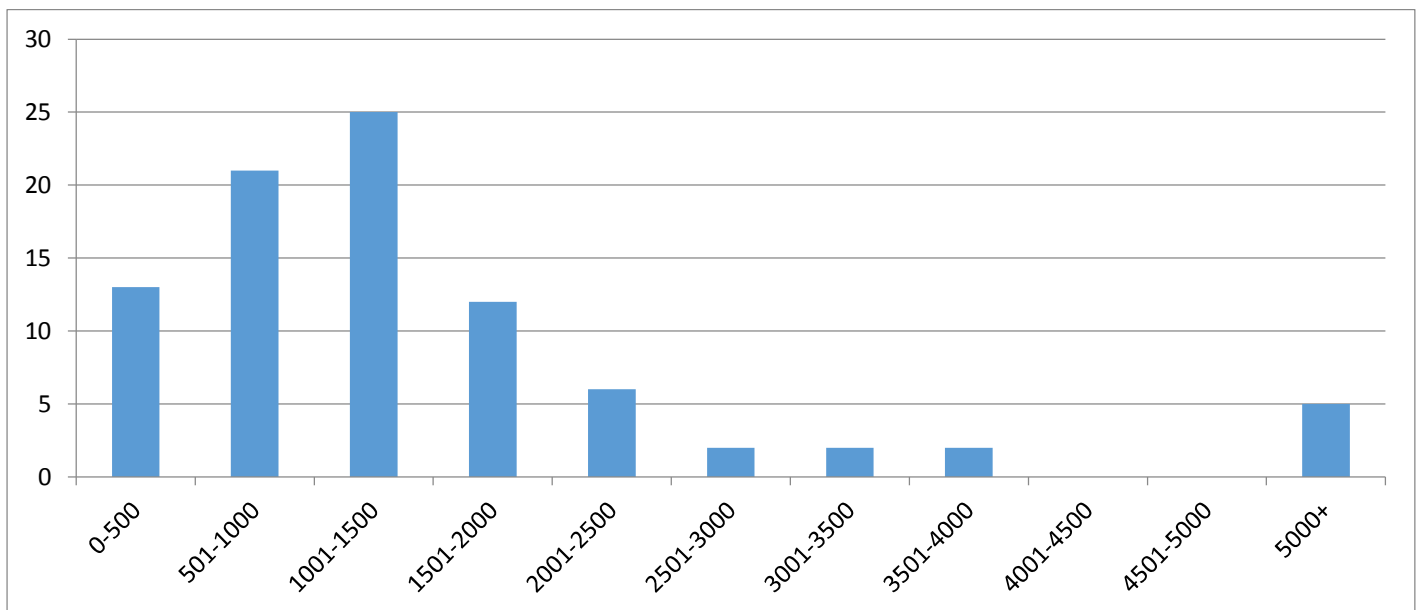


Figure 9 – Number of pilots per route length in meters

4. Discussion and conclusions

The development of automated transport systems is growing explosively, and is therefore difficult to keep track of. This report was aimed at creating an overview of pilots with automated bus systems in Europe that have occurred, are currently running, and will soon be started in the near future. Recent approaches (e.g., Ainsalu et al., 2019; Bloomberg.org, 2020) were either incomplete, had a different scope, or are not updated regularly. Through an extensive search base, including Google and various academic search engines, 118 demonstrations of automated bus systems have been found throughout Europe. The results in this report, and its accompanying overview table (to be found in the appendix) are intended to be updated early 2021, allowing for (another) up-to-date overview of the current state-of-the-art.

The majority of the information provided in the appendix table was found through overviews of upcoming or on-going pilots with automated bus systems, as these are commonly well-covered in the press. In contrast, research reports, such as academic journal articles or other types of academic dissemination, during pilots is usually either not documented or not shared. The number of pilots for which detailed documentation was found was 33% of the total amount (i.e., 39 out of 118) of pilots that resulted from the research performed in this report. This included 10 pilots with published research (8.5%), 25 pilots with project reports (21.1%) and 4 pilots with both types of documentation (3.4%), and did not include any on-going studies. Also note that it is likely that there are on-going projects the authors are unaware of. However, it is expected that most of those will become known and its information available and added in the update of this report at the end of 2020.

It must be noted, however, that many more somewhat similar demonstrations have been found, but were either too limited in their information, were technically not with automated bus systems, or did not actually go beyond the planning phase. Another note is that the authors of this report acknowledge the timeliness of this report, as it is highly likely that at the point of writing many more pilots have arisen, which is why this report will be updated early 2021. During our research, we encountered several pilots that were never realised, such as the one in Rome within the CityMobil project, in which a Robosoft vehicle was supposed to ride for 2200 meters at a maximum speed of 30 km/h, transporting passengers from a carpark to the entrance of the Rome Exhibition Centre (Delle Site, Filippi, & Giustiniani, 2011). It was decided to discard these pilots from our research, in order to provide a detailed inventory of pilots that are and were conducted in Europe, avoiding biased results for non-existing pilots. On the other hand, however, some pilots have been included in the overview, despite the fact that it did not meet the search criteria of the methodology used in this research. These exceptions were included when it was considered a landmark trial that proved invaluable for future development of automated bus systems. For instance, the Svalbard trial was included, as this marked the first trial with automated bus systems in the arctic circle; something that was deemed impossible or at least incredibly hard due to the harsh weather circumstances.

The lack of a structured search strategy was largely due to the unstructured nature of the variety of pilot goals (e.g., proof of concept, demonstration, pilot, etc.), and therefore regularly lacked a standard location of providing information of said pilots. Therefore, the authors needed to predominantly trust on their own network and expertise in the field, rather than trusting on the internet's knowledge base. It would be worthwhile to test whether a systematic literature review could come up with the same or different pilots on this topic (cf. Heikoop et al., 2020). However, during this research, it was found that the amount of lacking information was abundant, as, for instance, several pilots and/or projects would not clearly document their starting and/or ending date. Therefore, these types of missing information occur regularly in the overview

(see appendix). However, when only an ending date was missing, it was assumed that the respective pilot would run until the end of the year it was currently running.

As seen in Figure 6, pilots with automated bus systems are still on the rise. Only since 2016, there appears to be an increase in interest in pilots with automated bus systems, and this interest does not yet seem to die out. This report should therefore be seen as an initial stepping stone towards a systematically updated overview of automated bus system pilots throughout Europe. Other similar attempts have also taken place, for example specifically investigating literature on automated bus system-vulnerable road user interaction, with comparable results (Hagenzieker et al., 2019; Heikoop et al., 2020). The authors of this report therefore encourage the readers to contact the authors to provide them with additional information on this topic.

Despite abovementioned limitations, several conclusions can be made about automated bus system pilots in Europe. The first is that proper documentation and information of performed pilots is currently lacking, and any available info is distributed over many different sources. It would benefit practitioners, researchers, and designers/engineers, as well as society as a whole, if detailed information regarding occurring struggles and problems and the found solutions to those were to be provided. Furthermore, sharing results on public perception and interaction with these automated bus systems could also help improving future automated bus systems.

Second, the found pilots mostly show small buses to operate on an on-demand base and as access- and egress mode for main facilities and/or public transport lines. In order to make automated bus systems more accessible, future pilots should aim to roll out transit lines throughout larger (and denser) areas. For now, predominantly first- and last mile problems are being solved with the current line of automated bus systems, meaning technically feasible, but short route lengths and low speeds. Even though there appears to occur a shift in pilot goals, from experimental to long term development, if automated bus systems are continued to be placed and piloted at technically feasible locations instead of locations where there is actual demand for them, the future of said systems is all but certain.

Third, although it has been shown that automated bus systems can operate without a steward on board (albeit on closed tracks; see the Netherlands), most pilots still have stewards on board, due to national legislations requiring them. These legislation challenges can also be seen from the results (and Figures 7 to 9), as the passenger allowances, speeds, and route lengths are predominantly impractically slow, as current legislation, rather than technical feasibility, withholds automated bus systems from reaching their limits and therefore practical implementation and utilization. Although the policies exist for guarding the safety of passengers and other road users by limiting the possibilities of automated bus systems (as accidents do occur; see e.g., Gibbs, 2017; Porter, 2019), until countries allow more freedom to automated bus systems, the development of these systems will continue to be held back.

As a final point, it is surprising to see that even though the Netherlands is leading in automated driving technology readiness, it is being outperformed by France, Germany, and Norway, in terms of number of pilots with AV shuttles (32, 12, and 9, versus 8, respectively). Further investigation is needed to uncover why this discrepancy exists. Plainly based on these results, it appears that current national legislation does not need to hold back nationwide rollouts of automated bus systems. As has been done for this report, the authors encourage researchers and engineers from different countries to work together, to learn from each other in terms of possibilities and limitations, to facilitate a streamlined European-wide development of publicly accepted and appreciated automated bus systems on locations where the demand for them is at its highest.

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Appendix

	Country	Project	Location	Date	Vehicle	Capacity	Speed	Route	Length	Infrastructure	Research	More information	Comments
1.	Austria	auto.Bus - Seestadt	Seestadt	June 2019 - end date not mentioned	Navya Arma	Max passengers (11 seated and 0 standing)	Max 20 kmh	Test track leads from the subway station "Seestadt" via the stops "Seesteten", "Susanne-Schmid-Gasse", "Schenk-Danzinger-Gasse" and "Maria-Tusch-SträÙe" to the "FeelGood" Apartments	2000 m	Not mentioned	To follow where the vehicle is currently (as there is no timetable yet): https://www.wienerlinien.at/eport-ab3/ep/channel/View.do?pageType=Id/6653/channelId-4400687	1. https://www.at.at/en/news-events/single-view/detail/5318?ho_catche=1 2. https://de.wikipedia.org/wiki/Autonomer_Bus_(Wien)	
2.	Austria	Digibus© 2017	Koppl (Salzburg area)	April 2017 - November 2017	Navya Arma	Max passengers (11 seated and 0 standing)	Max 16 kmh	Public road with mixed traffic in a rural area.	1400 m	Read mostly lacking road markings, varying inclines, varying mobile network coverage, varying quality of GNSS and correction signals, other road users driving at speeds up to 60 kmh per hour or varying weather conditions	Salzburg Research Forschungsgesellschaft	1. https://www.digibus.at/en/news/ 2. https://arrr.springeropen.com/articles/10.1186/s12544-018-0326-4	
3.	Austria	Digibus© Austria	Koppl (Salzburg area)	2017-2019	EasYmile EZ10	Max passengers (6 seated and 6 standing). Max 9 passengers in test operation	Max 20 kmh	City center	650 m	V2X base stations along the test track (transmission of correction data for high-precision satellite positioning via ITS-G5), communication stiles with passengers	Ways of communication with passengers and technical infrastructure	1. https://www.digibus.at/en/news/ 2. https://salzburg.wirtschaftszeit.at/wirtschaftsnews-detail/article/digibus-koeppl-austria-mit-neuen-technologie-n-voerbereitung-antennen-an-bord-des-autonom-fahren-shuttles	
4.	Austria	Digibus© Austria	Wiener Neustadt, Niederösterreich	May 2019 - September 2019	EasYmile EZ10	Max passengers (6 seated and 6 standing). Max 9 passengers in test operation	Max 20 kmh	Wiener Straße between Hauptplatz and St. Peter an der Sperr, at the Lower Austrian State Exhibition "WORLD IN MOTION" in the centre of Wiener Neustadt	560 m	Not mentioned	Salzburg Forschungsgesellschaft	https://www.digibus.at/en/news/	
5.	Austria	Digibus© Austria	Teesdorf	13 th of November 2019 2019/2020 (without passengers)	EasYmile EZ10	Max passengers (6 seated and 6 standing). Max 9 passengers in test operation	Max 20 kmh	OAMTC Verkehrstechnikzentrum Teesdorf	Not mentioned	Not mentioned	Salzburg Forschungsgesellschaft	1. https://www.digibus.at/en/news/ 2. https://www.salzburgresearch.at/en/evert/digibus-demos-days-at-ocamtec-verkehrstechnikzentrum-teesdorf/	Testing during winter. Non-public tests. Networking meeting for trade visitors and demo rides with the Digibus® including demonstration of newly developed and proven technologies for passenger communication, V2X incident management, capacity management etc.
6.	Austria	Digibus© Austria	Salzburg	September 2019	EasYmile EZ10	Max passengers (6 seated and 6 standing). Max 9 passengers in test operation	Max 20 kmh	Salzburg Ring	Not mentioned	Not mentioned	Salzburg Forschungsgesellschaft	1. https://www.digibus.at/en/news/ 2. https://www.salzburgresearch.at/en/presseausendung/der-selbstfahrende-digibus-fahrt-erstmal-fahrtort/	Non-public tests - without a steward on 19 th of September 2019 (supervision from control room only) with 16 volunteers in a test ride

Country	Project	Location	Date	Vehicle	Capacity	Speed	Route	Length	Infrastructure	Research	More information	Comments
7. Belgium	ALIEES (Autonomous Logistics Electric Entities for city distribution)	Mechelen	25 th of May 2018	Easymile EZ10	Not applicable – transportation of goods in this demo	Not mentioned	City centre (shopping street De Brui) of Mechelen	Not mentioned	Operating in existing/pedestrian area. No infra changes but guided by motorcycle/car (see video in link)	Logistic distribution. Develop possible applications, use cases, technical framework conditions and tests. Fraunhofer IML	1. http://www.easymile.com/ales-project-autonomous-logistics-electric-entities-for-city-distribution/ 2. https://www.inl.fraunhofer.de/en/news_articles---autonomous-logistics-electric-entities-for-city-distribution.html 3. https://www.zelfrijdendvervoer.nl/spécial2018/5/3/0/autonomie-voertuig-biedt-oplossing-voor-winkeldistributie-mechelen/ 4. https://vli.be/project/ales/	VIL report (in Dutch) available in VIL webshop (see link 4. in More information column)
8. Belgium	Test Easymile	Formule 1-parcours Francorchamps Spa	2017	Easymile EZ10	Max 12 passengers (6 seated and 6 standing)	11 km/h	On circuit	Not mentioned	Not mentioned	Vias Institute	1. https://www.vias.be/nl/newsroom/erste-test-in-belgie-van-een-autonome-shuttle-zonder-bestuuder/ 2. https://www.zelfrijdendvervoer.nl/spécial2017/10/03/belgie-test-voor-het-eerste-zelfrijdende-shuttle/ 3. https://www.verkeersnet.nl/smart-mobility/27370/eerste-zelfrijdende-shuttle-op-entourage-weg-van-belgie-rijdt-in-han/	
9. Belgium	Test Navya	Han-Sur-Lesse	2018	Navya Ama	Max 15 passengers (11 seated and 4 standing)	25 km/h	From the parking lot to the entrance of the tourist attraction "Caves of Han".	500 m	Warning signs	Vias Institute	https://www.verkeersnet.nl/smart-mobility/27686/wedde-test-met-shuttle-in-belgie-stuk-uitgebouwd/ 2. https://www.vias.be/nl/newsroom/buysse-zonder-bestuuder-rijdt-over-centraal-tract-van-mer-dan-2-kilometer-aan-de-leuwe-van-waterloo-/ 3. https://mobiliteit.be/nl/news/nieuwsberichten/2019/ten-nieuwe-schap-genomene-ontwikkeling-van-autonome-shuttles	Test organized by Vias Institute & FOD Mobility and Transport; both shuttles were coordinated by Besmile software
10. Belgium	Test Navya	Eigenbrakel	2018	Navya Ama	Max 15 passengers (11 seated and 4 standing)	Max 18 km/h Average 15 km/h	From Leeuw van Waterloo to Hoeve van Hoogmont.	2400 m	Not mentioned	Vias Institute		
11. Belgium	Test during salon "Smart City Wallonia"	Marche-en-Famenne	24 th of September 2019	2 shuttles from different brands - Navya and Easymile - drove on the same route simultaneously	Not mentioned	Not mentioned	Not mentioned	Not mentioned	Not mentioned	Not mentioned		
12. Belgium	Health Campus University (VUB)	Brussels	23 rd of August 2019 – February 2020	Easymile EZ10	Not mentioned	Average 10-15 km/h	University hospital campus, between the student residences and the main building of the Faculty of Medicine and Pharmacy	Not mentioned	Not mentioned	Free University Brussels (VUB) & ULB	https://www.koninkrijk.be/article/first-met-zelfrijdende-bus-op-zakenhuis-campus-in-jette.28745	Research focus on human-machine interaction
13. Belgium	Zaventem airport shuttle	Zaventem Airport, Brussels	Planned for mid 2020	2gether GRT vehicle	Max 22 passengers (8 seated and 14 standing)	Max 20 km/h	Between the airport terminal and the cargo business zone and parking areas in mixed traffic	Not mentioned	Fixed route that's equipped with magnets. Local modifications may be needed to reduce traffic complexity. In mixed traffic	Not mentioned	1. https://www.2gether.eu/brussels-airport-autonomous-shuttle/ 2. https://www.2gether.eu/maiden-trip-at-brussels-airport/	
14. Belgium	TRIB	Brussels	28 th of June – 22 nd of September 2019	Easymile EZ10	Max 12 passengers (6 seated and 6 standing)	Max 10 km/h	In Parc de Woluwe	1800 m 5 stops	Fixed tracking elements (posts) are installed along the route and at the stops with removable platforms	Not mentioned	1. https://amacity.brussels/news-678-stb-tis-autonomous-voitures-from-28-6-until-22-9-in-parc-de-woluwe 2. https://easymile.com/stb-trials-the-ez10-autonomous-shuttles-in-parc-de-woluwe-brussels/ 3. https://www.themayor.eu/en/stb-tis-autonomous-buses-in-brussels-region 4. http://www.stb-mvb.be/article.html?fr=&_ga=2.10666677.4076937710.190497.8038095acc7	

Country	Project	Location	Date	Vehicle	Capacity	Speed	Route	Infrastructure	Research	More information	Comments
15. Denmark	Autonomous mobility	Aalborg Øst	December 2019 – end date not mentioned (planned to run for 2 years)	Navya Arma	Max 15 passengers (11 seated and 4 standing)	Max 18 km/h	On the Astrup Trail connecting residential area with other local transportation. 10 stops	Newly designed area with shared road for AV and cyclists. Pedestrians and vehicles are separated.	Aalborg University involved https://venue.umgcgch/portal/0-copenhagen	1. https://nordjyske.dk/nv/heder/aalborg/af-fale-chaufforene-bifor-smidt-af-bussene/53f6970-01f1-4157-a1d4-cdfb81e7743d 2. https://www.k2nord.dk/aalborg/fore-ris-busser-slat-herre-finde-vej 3. https://www.k2nord.dk/aalborg/nusker-de-groent-lys-til-selvkoerende-busser	Planned for mid-2018 (delay because of need for permissions, finally obtained in December 2019)
16. Denmark	Avenue	Nordhavn, Copenhagen	2019 – 2022	Navya Arma	Max 15 passengers (11 seated and 4 standing)	Max 25 km/h Average 10-15 km/h (expected)	Circulating residential/business area connecting parking/metro in Nordhavn. No exact route available as authorities approval is not received	Not mentioned	Not mentioned	1. https://h2020-avenue.eu/portal/for-copenhagen 2. https://h2020-avenue.eu/wp-content/uploads/2019/04/h2020-avenue-deliverable-42.16-final.pdf https://www.cavertjournal.com/article/show/8713/near-misses-for-tallinn-driverless-buses	
17. Estonia	Marking Estonia's presidency of the Council of the European Union	Tallinn	August 2017	Easymile EZ10	Max 8 passengers	12 km/h	From the city centre to the Kultuurikatel	Not mentioned	Not mentioned	https://www.cavertjournal.com/article/show/9823/estoniae-driverless-buses-are-back-on-the-road-in-tallinn	
18. Estonia	Not mentioned	Tallinn	April 2018	Easymile EZ10	Max 8 passengers	12 km/h	1. Between bus terminals in Tallinn's Old Port 2. From Mustamäe to the North Estonian Regional Hospital and Lepstiku	Not mentioned	Not mentioned	https://www.cavertjournal.com/article/show/9823/estoniae-driverless-buses-are-back-on-the-road-in-tallinn	
19. Estonia	Sohjoo Baltic project	Tallinn	August 2019 – end date not mentioned	Navya Arma	Max 15 passengers (11 seated and 4 standing)	Not mentioned	The route connects the Kadrioru tram stop to Kumu Art Museum and follows Weizenbergi Street to Kumu, then Mäekalda, Kõrvala and Poska Streets back to Weizenbergi Street	Not mentioned	Not mentioned	https://www.cavertjournal.com/article/show/9823/estoniae-driverless-buses-are-back-on-the-road-in-tallinn	
20. Finland	CityMobil2	Vantaa	July 2015 – August 2015	Easymile EZ10	Max 10 passengers (6 seated and 4 standing)	Max 13 km/h	In new suburban centre Krivisto, from the housing fair area to Krivisto station (Ring Rail Line)	Route was segregated by fence, clear and identifiable marking of the route (incl. warning signs). There was a 100 m-long tunnel on the route	Part of CityMobil2 project	1. https://www.isanovaa.org/wordpress/wp-content/uploads/2016/07/Day1-2-Demonstration_Vantaa-Gilbert_Koskela.pdf 2. https://www.sciencefire.com/science/article/pii/S0967070X1750286X	
21. Finland	Sohjoo Baltic project	Helsinki	June 2019 – September 2019	Navya Arma	Max 11 passengers (11 seated and 0 standing)	Not mentioned	From Vuosaari (Cirrus) metro station to Aurinkolahti beach in Vuosaari district	Not mentioned	Metropolia University of Applied Sciences	1. https://www.sohjoo.fi/626/helsinki-vuosaari-aurinkolahti/ 2. https://www.eprssi.com/tiedotteet/lo-gistikke-ja-likenne/robotibuss-vie-umaramallihelsingin-vuosaarassa.html https://www.mdpi.com/2071-1050/11/3/588	
22. Finland	Sohjoo Baltic project	Estoo	October 2017 – November 2017	Easymile EZ10	Max 10 passengers (6 seated and 4 standing)	Max 12 km/h	Between Otanieni underground station and campus of Aalto University in Otanieni business district	At intersections other vehicles were guided with manually controlled traffic lights	Aalto University	https://www.mdpi.com/2071-1050/11/3/588	
23. Finland	Sohjoo	Helsinki	October 2018 – November 2018	Easymile EZ10	Max 6 passengers (6 seated and 0 standing)	Max 12 km/h	In the Hemesaari district from sauna/restaurant to other restaurants	Not mentioned	Metropolia University of Applied Sciences	1. https://www.sohjoo.fi/ 2. https://www.metropolia.fi/en/about-us/news-and-events/?tx_ttnews%5BID%5D=5936&tx_ttnews%5Btitle%5D=ed6891ddaf03e	

Country	Project	Location	Date	Vehicle	Capacity	Speed	Route	Length	Infrastructure	Research	More information	Comments
Finland	Sohjoo	Helsinki	April 2018 - end date not mentioned (31 st of May 2018 end of Sohjoo project)	Easymile EZ10	Not mentioned	Not mentioned	From the gate of Savilihti cultural centre - via Stadin Paimio to Sönnäisten rantatie	Not mentioned	Along with other traffic and in narrow alleys, without clear road traffic driving lines	Metropolia University of Applied Sciences	1. https://www.sohjoo.fi/ 2. https://forum.viinum.fi/en/robot-bus-taking-over-new-areas-in-helsinki-2/	
Finland	Sohjoo	Tampere	November 2016 – end date not mentioned (31 st of May 2018 end of Sohjoo project)	Easymile EZ10	Max passengers	11 km/h	The route in the Hervanta district runs from the Tampere University of Technology campus to Shopping Centre Diao	500 m	Not mentioned	A particular focus is placed on the way that self-directed buses find their place within the wider traffic system	1. http://www.tut.fi/interface/articles/2016/2/robot-bus-in-operation-on-campus 2. https://www.sohjoo.fi/	
Finland	Robobus (follow-up from Sohjoo)	Kivikko Helsinki	1. May - November 2018 2. May - November 2019	Navya Anna	Max passengers	18 km/h	1. (2018) From Kivikko's sports park to bus stop Kivikonke, 2 stops. 2. (2019) Circular route by the Redi shopping center to the Isoisänstia bridge, in in Helsinki Kalasatama	1. 1.000 m 2. not mentioned	Not mentioned	Metropolia University of Applied Sciences	1. https://www.helsinkirobobusline.fi/en-en/glsak/ 2. https://globo.newswire.com/news-releases/2018/05/14/1501889/0/en/Sel-f-driving-Bus-on-Helsinki-Robobus-Line-Goes-to-Scheduled-Service.html 3. https://forum.viinum.fi/en/robobus2019/	
Finland	Not mentioned	Estoo	September 2019	Gecha (Mujit and Sensible4 minibuses)	Max passengers (10 seated and 6 standing)	Max kmh 25	On Nokia's campus	1500 m	Not mentioned	Not mentioned	1. https://www.care77.com/posts/87813/Muji-Autonomous-Shuttle-Bus-Debuts-in-Finland 2. https://www.sensible4.fi/gecha/ 3. https://www.laxturim5g.com/news-blog/2019/10/the-pilot-for-self-driving-shuttle-bus-gecha-begins http://www.advancedtransit.org/wp-content/uploads/2011/08/ParkShuttle-IF-Review-of-the-Antibes-Experiment-A.-Alessandrini-es-.pdf	
France	CyberMove	Antibes	June 2004	ParkShuttle II	Max passengers	Max kmh 14 32km/h (demo only)	On the Verdun Avenue	320 m (2x) 3 stops	Not mentioned	Part of CyberMove		
France	CityMobil	La Rochelle (Showcase)	18 th of September – 28 th of September 2008	CRF's (only in this one passengers) and TNO's Advanced city cars, INRIA's and Robosoft's cyberscars	Not mentioned	Max kmh 10	Circuit in city centre, from the quay of the electric "passer" to the University	800 m 5 stops	A test track was arranged, area was fenced. Other arrangements are not mentioned	Part of CityMobil	1. http://www.citymobil-project.eu/downloads/Newsletter%20Jan%20Lefflers/CityMobil_Fin_al_brochure%20Nov-2011.pdf 2. http://www.citymobil-project.eu/downloads/Deliverables/D1.5.1.6-PU-First%20Advanced%20city%20cars%20showcase%20at%20rochelle-CityMobil.pdf	
France	CityMobil	La Rochelle (Demo)	2011 (3 months)	Yamaha-based electric prototype cyberscars (renamed "Cybus")	Max passengers	Max kmh 10	Circuit in city centre, from the quay of the electric "passer" to the University	800 m 5 stops	Wi-Fi transponders were installed at the stops. Operating in pedestrian area	Part of CityMobil	1. http://www.citymobil-project.eu/downloads/Newsletter%20Jan%20Lefflers/CityMobil_Fin_al_brochure%20Nov-2011.pdf 2. http://www.isimova.org/wordpress/wp-content/uploads/2016/07/Day1-6-Demonstration_1.a_Rochelle-Mathieu_Graindorge.pdf	
France	CityMobil2	Sophia Antipolis	January - March 2016	Easymile EZ10	Max passengers (6 seated and 0 standing)	Max kmh 13 Average 7-8 kmh	Sophia Antipolis business park	950 m 5 stops	Clear and identifiable marking of the route (incl. warning signs), semi-segregated lane w/ pedestrians, bicycles	Part of CityMobil2 project	1. http://www.citymobil-project.eu/downloads/Newsletter%20Jan%20Lefflers/CityMobil_Fin_al_brochure%20Nov-2011.pdf 2. http://www.isimova.org/wordpress/wp-content/uploads/2016/07/Day1-6-Demonstration_1.a_Rochelle-Mathieu_Graindorge.pdf 3. http://www.isimova.org/wordpress/wp-content/uploads/2016/07/Day1-6-Demonstration_CASA-Guillaume_Direaux.pdf	

Country	Project	Location	Date	Vehicle	Capacity	Speed	Route	Length	Infrastructure	Research	More information	Comments
France	CityMobil2	La Rochelle	November 2014 - April 2015	Robosoft Robacity	Max 12 passengers (12 seated and 0 standing)	Max 12 kmh	Tourist route in the Mirames district, partly with vehicle traffic on the route and pedestrians	1710 m 7 stops	Clear and identifiable marking of the route (incl. warning signs) Installation of stations Traffic lights at 6 crossings giving priority	Part of CityMobil2 project	<ol style="list-style-type: none"> http://www.isimova.org/wp/press/wp-content/uploads/2016/07/Day1-6-Demonstration_La_Rochelle-Mathieu_Graindorge.pdf https://www.sciencedirect.com/science/article/pii/S2352146516302435 https://www.sciencedirect.com/science/article/pii/S2352146516302536 	
France	EDF Civaux	Civaux	Spring 2016 - not mentioned	Navya Amma	Max 11 passengers (11 seated and 0 standing)	Max 25 kmh	On site of EDF nuclear power plant	Not mentioned	On private road	Not mentioned	<ol style="list-style-type: none"> https://navya.tech/wp-content/uploads/2017/09/NAVYA_Brochure_Print_EN_Website.pdf https://www.busworld.org/articles/detail/2789/autonomous-navya-arma-shuttles-run-on-the-edf-nuclear-powerplant-in-civaux https://www.transdevna.com/services-and-modes/autonomous-mobility/ 	
France	AVENUE	Lyon	2019 – 2022	Navya Amma	Max 15 passengers (11 seated and 4 standing)	Max 25 kmh	From tram station Délices Grand Large to the Groupama Stadium	1350 m 4 stops	Public road, but prohibited for cars.	Part of Avenue project	<ol style="list-style-type: none"> https://h2020-avenue.eu/portfolio/item/lyon/ https://h2020-avenue.eu/wp-content/uploads/2019/04/h2020-avenue-deliverable-d2.1.6_-_final.pdf 	
France	Koolis	Villeneuve d'Ascq	December 2018 – December 2019	Navya Amma	Max 15 passengers (11 seated and 4 standing)	Not mentioned	Route on campus between two metro stations	1400 m 4 stops	Route included a roundabout.	Not mentioned	<ol style="list-style-type: none"> https://www.intelligenttransport.com/transport-news/7430/electric-autonomous-shuttle-france/ https://www.koolis.com/en/media/newsroom/press-releases/koolis-deploys-electric-autonomous-shuttles-two-university-campuses 	Pilot was initially planned till June 2019
France	Intelligent Mobility	Rennes	November 2018 - ongoing	Navya Amma	Max 15 passengers (11 seated and 4 standing)	Not mentioned	For the area around the campus of Rennes university Route on public road and on a road reserved for soft modes, such as cyclists and pedestrians.	1300 m 6 stops	Not mentioned	Not mentioned	<ol style="list-style-type: none"> https://www.koolis.com/en/media/newsroom/latest-news/autonomous-vehicles-start-running-university-campus-rennes https://navya.tech/en/the-koolis-autonomous-shuttles-put-into-service-with-in-the-terms-campus-1-on-open-road/ 	
France	Intelligent Mobility (continued)	Rennes	November 2019 – end date not mentioned	EasMile (Gen 3 shuttle) - in addition to Navya Amma	Max 15 passengers (11 seated and 4 standing)	Not mentioned	For the area around the campus of Rennes university Route on public road and on a road reserved for soft modes, such as cyclists and pedestrians.	1300 m 6 stops	Interoperability between different manufacturers under single supervision	Not mentioned	<ol style="list-style-type: none"> https://www.koolis.nl/over-ons/acties/koolis-versa-ontwikkeling-in-autonomie-mobiliteit https://en.symile.com/easymile-launches-new-ez10-driverless-shuttle-featuring-innovative-safety-architecture-and-enhanced-passenger-experience/ 	
France	Koolis	Paris	July 2017 - May 2019	Navya Amma	Max 15 passengers (11 seated and 4 standing)	Max 7 kmh	La Defense business district	2000 m	Clear markings of the route	Not mentioned	<ol style="list-style-type: none"> https://www.koolis.com/en/media/newsroom/press-releases/koolis-starts-operation-autonomous-electric-shuttles-defense-paris https://space.utpp.org/initiatives/paris-la-defense-av-france https://innovationorigins.com/self-driving-buses-paris-ends-experiment-after-two-years/ 	Pilot was initially planned for 6 months

Country	Project	Location	Date	Vehicle	Capacity	Speed	Route	Length	Infrastructure	Research	More information	Comments
France	Keolis	Paris	April - July 2018	Navya Arma	Max 15 passengers (11 seated and 4 standing)	Max 25 km/h	Within the Roissy-Charles de Gaulle Airport, connecting the RER train station to the Groupe ADP's headquarters	700 m	Road infrastructure system that uses traffic signals to communicate dynamically with the shuttles	Not mentioned	1. https://navya.tech/en/the-autonomous-shuttles-are-in-service-at-paris-charles-de-gaulle-airport/ 2. https://navya.tech/en/presse/groupe-adp-lance-les-premier-train-d-autonomie-a-paris-charles-de-gaulle-airport/ 3. https://www.adentis.fr/de/navy-tes-autonomie-a-la-demande-a-versailles/	If successful route will be extended
France	Last mile shuttle	Versailles	10 th of December 2018	Easymile EZ10	Not mentioned	Max 10 km/h	From Cité des adresses bus stop to Les Ailes des Maramonts	1000 m	Create smart infrastructure by installing sensors for communication with the vehicles	Vedecom Institute: test with various AV's and infrastructure. Research how to modify existing infrastructure for AV's	Not mentioned	
France	Navy (Keolis)	Lyon	September 2016 - December 2017	Navya Arma	Max 15 passengers (11 seated and 4 standing)	Max 20 km/h	On the banks of the River Saone in the Confluence eco-district, between the shopping centre and the southernmost point of the district	1350 m 5 stops	Not mentioned	Not mentioned	1. https://navya.tech/wp-content/uploads/2017/09/NAVYA_Brochure_Print_EN_Website.pdf 2. https://www.keolis.com/en/mediawebcom/latest-news/navy-first-public-transport-service-by-autonomous-electric-shuttle 3. https://www.keolis.com/en/mediawebcom/latest-news/successful-first-year-world-first-conducted-by-keolis-and-navya	
France	Caisse des Dépôts, laide and Transdev Part of Caisse des Dépôts demos	Paris	September - December 2017	Easymile EZ10	Max 12 passengers	Not mentioned	Route on the open road in the laide Park of Orly-Rungis to connect the Auguste, Robert Schuman and Gustave Eiffel stations. For the employees of Rungis Business Park	1250 m	None, uncontrolled intersection	Not mentioned	1. https://www.transdev.com/wp-content/uploads/2018/05/Yearbook-1.pdf 2. http://www.mobilities.com/011-6457-Transdev-experimente-un-service-de-navette-autonome-en-voie-ouverte-a-Rungis.html	
France	Renault Trucks	Lyon	24 th of October - 23 rd of November 2016	Navya	Max 15 passengers (11 seated and 4 standing)	Not mentioned	For employees of Renault on industrial site of Saint Priest	Not mentioned	Not mentioned	Not mentioned	1. https://navya.tech/wp-content/uploads/2017/09/NAVYA_Brochure_Print_EN_Website.pdf 2. https://corporate.renault-trucks.com/en/presse-releases/2016_14_11_renault_trucks_celebrates_the_100th_anniversary_of_its_lyon_site.html	
France	TLD Sorigny	Sorigny	November 2018 - end date not mentioned	Easymile EZ10	Max 12 passengers	25 km/h	TLD's industrial site	1500 m	Not mentioned	Not mentioned	https://www.aviatompros.com/news/1242271/td-deploie-autonomie-bus https://presse.mutual.fr/file/105200/Dossier-de-presse-Rouen-Normandy-Autonomous-Lab-2017.pdf	
France	Seine Quayside	Rouen	December 2016 - January 2017	Easymile EZ10	Not mentioned	Not mentioned	Along the banks of the Seine	1600 m	Not mentioned	Not mentioned	1. http://transdev.ca/services-and-modes/autonomous-mobility/ 2. https://www.zelfrijdenvervoer.nl/tes/2018/06/15/autonomie-voertuigen-op-openbare-weg-in-rouen/ 3. https://www.transdev.com/en/presse-release/final-testing-before-the-rouen-normandy-autonomous-lab-on-demand-mobility-service-opens-to-the-public/	
France	Rouen Normandy Autonomous Lab	Rouen	September 2018 - end date not mentioned	T-Crystal (Transdev with Lohr)	Max 16 passengers	Not mentioned	Connection of Rouen's Technopole du Madrillet, tech business cluster, with city's public transportation system	10 000 m in total (3 loops) 17 stops	Not mentioned	Not mentioned	1. http://transdev.ca/services-and-modes/autonomous-mobility/ 2. https://www.zelfrijdenvervoer.nl/tes/2018/06/15/autonomie-voertuigen-op-openbare-weg-in-rouen/ 3. https://www.transdev.com/en/presse-release/final-testing-before-the-rouen-normandy-autonomous-lab-on-demand-mobility-service-opens-to-the-public/	

	Country	Project	Location	Date	Vehicle	Capacity	Speed	Route	Length	Infrastructure	Research	More information	Comments
47.	France	So Mobility as part of the "Grand Paris de la Mobilité" (Greater Paris Mobility) initiative	Issy-les-Moulineaux	March – April 2017	EasyMile EZ10	Not mentioned	Not mentioned	Circuit in the Saint-Germain Park between the car park and the T2 tram station	600 m	Not mentioned	Not mentioned	https://www.transdev.com/en/newsroom/inauguration-of-the-autonomous-shuttle-at-issy-les-moulineaux/	
48.	France	SESNA	Saclay	13 th of February – 30 th of March 2018	EasyMile EZ10	Max passengers (6 seated and 6 standing)	Not mentioned	On the open road at the private Saclay Nuclear Research Centre (CEA) facility	2600 m 7 stops	The route includes intersections and pedestrian crossings and speed ramps	Not mentioned	https://www.transdev.com/en/press-release-paris-saclay-autonomous-lab/	
49.	France	Paris-Saclay Autonomous Labs	Saclay	15 th of May 2019 – end date not mentioned	1-Crystal (Transdev with Lohr)	Max passengers	Not mentioned	Night collective transportation service for the Saclay Plateau neighborhoods between the Massy station and the Camille Claudel bus station in Palaiseau to serve four stops Massy Palaiseau, Palaiseau Ville, La Vallée, Camille Claudel.	6000 m 4 stops	On public bus rapid transit lanes	The University of Paris-Saclay	https://www.transdev.com/en/press-release-paris-saclay-autonomous-lab/ https://media.group.renault.com/job-al-en-gb-group-renault/media/pressreleases/21725791/paris-saclay-autonomous-lab-de-nouveaux-services-de-mobilite-autonome-electrique-et-partage	
50.	France	RAFP Group	Boulogne-sur-Mer	5 th of April – 8 th of May 2017	EasyMile EZ10	Max passengers	Not mentioned	On Quai des Paquebots	300 m	Not mentioned	Research to obtain passenger opinions with improvement suggestions. Information regarding performance, reliability and operating safety will also be collected.	https://www.rafp.fr/en/groupe-rafp/newsroom/mobility-new/driverless-shuttlesrap-group-announces-new-experiments-adler https://www.transdev.com/en/referenc es/france-boulogne-sur-mer-bus-car	
51.	France	RAFP Group	Paris	23 rd of January – 7 th of April 2017	EasyMile EZ10	Max passengers (6 seated and 0 standing)	Max 20 km/h	On the Charles de Gaulle bridge between the Gare d'Austerlitz and Gare de Lyon railway stations	250 m	On dedicated lane	Not mentioned	http://www.rafp.fr/en/groupe-rafp/newsroom/mobility-new/driverless-shuttlesrap-group-announces-new-experiments-adler http://roundherings.com/site/A_59718/Title_Very-Promising-Results-for-Autonomous-Shuttles-Experimentation-on-the-Charles-de-Gaulle-Bridge/292/Articles https://www.wired.com/2017/01/tesla-dinky-self-driving-shuttle-madges-paris-future/#	
52.	France	RAFP Group	Paris	November 2017 – end date not mentioned	EasyMile EZ10	Max passengers (6 seated and 6 standing)	Max 12 km/h	Between the station Château de Vincennes (metro line 1) and the Parc Floral de Paris (12th district in Paris)	2000 m	Not mentioned	Not mentioned	http://www.rafp.fr/en/groupe-rafp/news-types-mobility/news-forms-mobility-adapting-a-changing-society https://www.apur.org/en/our-works/driverless-vehicles-what-their-future-paris (in maps to download) https://www.polisnetwork.eu/wp-content/uploads/2019/06/4a_maiacet.pdf	
53.	France	Smart City	Toulouse	January – May 2018	EasyMile EZ10	Max passengers (6 seated and 6 standing)	Average 13-14 km/h Average 7-8 km/h (taking into consideration the duration of the intermedial y stop)	Following Allées Jules Guesdès from « Palais de justice » Metro/Tram station to Grand-Rond public garden	850 m 3 stops	In pedestrian zone	Not mentioned		

	Country	Project	Location	Date	Vehicle	Capacity	Speed	Route	Length	Infrastructure	Research	More information	Comments
54.	France	Smart City	Phéne	14 th of June – 5 th of September 2017	Easymile EZ10	Max 12 passengers (6 seated and 6 standing)	Average 6.3 km/h	City centre (Esplanade Sainte Germaine)	340 m 3 stops	Not mentioned	Survey on users' opinion	https://www.polisnetwork.eu/wp-content/uploads/2019/06/4a_maiocet.pdf	
55.	France	Transdev	Verdun	29 th of May – 11 th of August 2018	Easymile EZ10	Max 12 passengers (6 seated and 6 standing)	Max 14 km/h	City centre	1400 m 5 stops	On open road	Not mentioned	1. https://www.transdev.com/en/news-center/discover-an-autonomous-city-center-shuttle-in-verdun-during-the-summer/ 2. https://www.cerema.fr/fr/centre-ressources/newsletters/transflash/ramsfash-judg-14-nov-2018-verdun-bilan-postif-navette-autonome	
56.	France	Transdev	Reims	2 nd of May – 30 th of June 2018	Easymile EZ10	Max 12 passengers (6 seated and 6 standing)	10 km/h	Between the "Bezannes Champagne Ardennes TGV" train station and the "Gare Champagne TGV" train station located on line B of the transport network Citium	400 m	On steep slope	Users' perceptions by Transdev	1. https://www.citium.fr/fr/na-avette-autonome/1010 2. https://www.transdev.com/en/news-center/news-shared-autonomous-mobility-facilitates-intermodal-transport/ 3. https://www.construction21.org/fr/na-avette-autonome-fr-service-de-transport-autonome-a-reims.html	
57.	France	ISFM	Velizy-Villacoublay	March 2019 – end date not mentioned	MILLApod (by Intelligent Systems For Mobility, ISFM)	Max 6 passengers (6 seated and 0 standing)	Max 30 km/h	From the Mozart and Le Clos neighborhoods to the R. Wagner T6 station	4000 m	In mixed traffic alongside motorists, bicycles, trams, etc. The road network will be equipped with sensors, allowing MILLA to detect priorities on the right, traffic lights, pedestrian crossings. It can be called via application	Users' opinion survey https://www.velizy-villacoublay.fr/actualite/navette-autonome-participez-a-l-experimentation	1. https://www.velizy-villacoublay.fr/actualite/millapod-navette-autonome 2. https://pole-moveo.org/pme/la-navette-autonome-milla-circule-desormais-a-velizy/	
58.	France	NASC (autonomous shuttle without driver)	Velizy-Villacoublay	1. 26 th of June 2018 (for 3 weeks) 2. September 2018	Easymile EZ10	Max 12 passengers (6 seated and 6 standing)	Max 10 km/h	Villacoublay Air Base 1. Test rides 2. To transport airmen from operational zones to the living zone	Not mentioned	Not mentioned	Not mentioned	https://www.defense.gouv.fr/actualites/commandement-et-defense/une-na-avette-autonome-sur-la-base-aerienne-de-villacoublay	
59.	France	TOTAL	Dunkirk	May 2018 – end date not mentioned (Planned for 5 years)	Navya	Max 14 passengers	Max 20 km/h	In the international training site Oclam of TOTAL between the guards' post and the training centre	800 m	In industrial environment	Not mentioned	1. https://www.lavoixdunord.fr/493289/article/2018-11-22/sur-la-voie-des-mobilites-nouvelles-total-fait-nuler-une-navette-autonome 2. https://www.travelet.net/focus/824-la-navette-autonome-navya-lancee-sur-le-site-de-total-a-dunkerque 3. https://www.lasechos.fr/2018/05/bert-bele-partie-sur-le-transport-vert-990628	Pilot planned for 5 years
60.	Germany	Continental	Frankfurt	17 th of April – 19 th of April 2018	CUBE (Continental Urban Mobility Experience)	Not mentioned	Not mentioned	On the campus of University of Applied Sciences	Not mentioned	Not mentioned	Share knowhow among Continental, EasyMile and XGF. Determine future requirements for AV's and usage models	1. https://www.continental-autonome.com/Landing-Pages/CAD/CUBE/Driverless-Mobility/Driverless-Mobility 2. https://www.continental.com/en/press/press-releases/cube-technologies-74492	

Country	Project	Location	Date	Vehicle	Capacity	Speed	Route	Length	Infrastructure	Research	More information	Comments
Germany	HEAT project (Hamburg Electric Autonomous Transportati on)	Hamburg	Phase 1: 2019-2020 (mid-2020 with passengers and steward) Phase 2: 2021 (without steward)	IAV vehicle	Max 10 passengers	Not mentioned Design speed 50 km/h	In Hamburg's HaterCity 1. Ring route along the streets Am Dammtor, Großer Grasbrook, Am Stadtpark and Am Sandtorpark. 2. On Am Kaiserhof and drive directly past Hamburg's new landmark Elbe Philharmonic Hall	1840 m 5 stops	Supplementary intelligent infrastructure along its route, including sensors and a digital communications system to communicate with control room and surrounding. There are 6 traffic lights and 9 intersections.	German Aerospace Center	1. https://www.hamburg-news.hamburg/en/renewable-energy/heat-project-launches-hamburg/ 2. https://www.hamburg.com/business/151278724.html 3. https://www.hochbahn.de/hoehbahn/hamburg/en/home/projects/expansion_and_projects/project_heat 4. https://fsuropancongress.com/2019/07/31/heat-hamburg-electric-autonomous-transportation/	61.
Germany	E-AT Interreg Deutschland Nederland (2017-2020)	1. Airport Weeze, Germany 2. Aachen (Germany)-Vlaas (The Netherlands)	1. 21 st of February 2019 – end date not mentioned 2. End of 2019	1. Easymile EZ10 from WEpod project 2. CM Mission	1. Not mentioned 2. Max 15 passengers	Not mentioned	Multiple locations - starting at Airport Weeze from departure hall to the parkinglot and airport hotel	Not mentioned	Not mentioned	TU Delft	1. https://www.i-at.nl/ 2. https://www.deutschesland-niederland.eu/nl/project/i-at-2/ 3. https://i-at.nl/iain/Living-Lab-Weeze-shuttle-voor-passagiers 4. https://i-at.nl/iain/Living-Lab-Aachen-Vlaas-opanbaar-vervoer-shuttle	62.
Germany	Südwestdeutsche Landeserke die-AG (SWEG)	Lahr, Württemberg	14 th of July – 30 th of September 2018	Easymile EZ10	Max 6 passengers (6 seated and 0 standing)	Max 15 km/h	From Otto-Hahn-Strade via Mauerweg and Schwarzwaldrade to the roundabout at Otto-Hahn-Strade	1500 m 2 stops	Mixed traffic, speed limited to 30 km/h, valid between 9 am and 4 pm (when the shuttle is operating)	Not mentioned	1. https://www.easymile.com/en/10-becomes-the-first-autonomous-shuttle-to-operate-on-public-roads-in-lahr-germany/ 2. https://vn.baden-wuerttemberg.de/ministerium/press/pressemitteilung/pd/erste-autonom-fahende-bus-in-offentlichen-strassenverkehr-rolls-in-lahr/ 3. https://www.sciencedirect.com/science/article/pii/S156920919301944	63.
Germany	NAF Bus	Schleswig-Holstem	1. August 2018 2. May 2019	Easymile EZ10	Not mentioned	Not mentioned	1. GreentEC Campus Enge-Sande (private grounds) 2. Public roads in the rural district Nordfriesland and public roads on North Sea island Sylt, Germany	1500 m	In mixed traffic conditions, within the business park	Gain insight into user experience and behavior, individual and social acceptances, risk-benefit considerations by consultancy EurA, Online opinion poll by Christian-Albrechts-Universität zu Kiel	1. https://www.easymile.com/en/10-driverless-shuttle-begins-operation-in-greentec-campus-germany/ 2. https://www.naf-bus.de/ 3. https://www.eur-ag.de/2019/10/24/the-autonomously-driving-electric-bus-current-status-of-our-project/	64.

Country	Project	Location	Date	Vehicle	Capacity	Speed	Route	Length	Infrastructure	Research	More information	Comments
Germany	Olli	Berlin	December 2016 – April 2017	Olli	Not mentioned	Max 10 kmh Average speed 8 kmh	EUREF Campus, Berlin-Schöneberg.	700 m 3 stops	Warning signs, shuttle has right of way, overtaking the shuttle was not allowed and 10m distance from shuttle was required. In mixed traffic (pedestrians, cyclists, occasional cars and trucks)	User acceptance, Sina Nordhoff, TU Delft & Innovation Centre for Mobility and Societal Change.	<ol style="list-style-type: none"> https://archiv.berliner-zentrum.de/berlin/verkehr-0lli-zentrum-ist-in-berlin-in-autonom-fahrender-bus-unterwegs-25205714 https://www.deutscheslandfunk.de/verkehr-berliner-mobilitaetszentrum-imooz-wird-aufgegeben-769.de.html?dramarticle_id=447601 https://eref.de/eref-campus/mobilitae https://www.researchgate.net/publication/319253225_User_acceptance_of_automated_shuttles_in_Berlin-Schöneberg_A_questionnaire_study https://www.zeitschrift.at.at/content/article/abs/pii/S1369847818304327 https://www.researchgate.net/publication/334803765_Passenger_opinions_of_interactions_with_an_automated_vehicle_An_accompanied_test_ride_study https://www.researchgate.net/publication/317497564_User_Acceptance_of_Driverless_Shuttles_Running_in_a_n_Open_and_Mixed_Traffic_Environment 	
Germany	Pole Position	Berlin	May 2016 – April 2019	Easymile EZ10	Not mentioned	Not mentioned	EUREF Campus	Not mentioned	Not mentioned	High-power inductive energy collector with full automated recharging combined with on-demand use and demonstration of the vehicle.	https://www.emo-berlin.de/de/projekte/pole-position/	
Germany	Ioki	Bad-Birnbach	25 th of October 2017 – still in operation	Easymile EZ10	Max 6 passengers (6 seated and 0 standing)	Max 15 kmh	From town centre to the thermal baths on public roads	700 meters Since October 2019 1400 m	Variable traffic sign system: when bus is detected, there is a change of traffic signs from 50 kmh to 30 kmh and the other vehicles must slow down. Only then the bus may drive 500 meters on the highway	Not mentioned	<ol style="list-style-type: none"> https://oki.com/en/untengegruetzt/firs-autonomous-vehicle-con-german-public-roads/ https://www.badbirnbach.de/en/stories/autonomous-minibus https://www.br.de/nachrichten/bayerische-strecke-fuer-fahrerlose-elektrobusse-in-bad-birnbach,KEH17z 	
Germany	AutoNV_O PR	Wusterhausen/Dosse, Ospringitz-Ruppin	End of 2017 – 30 th of June 2020	Easymile EZ10	Max 5 passengers (5 seated and 0 standing)	Not mentioned	From historic town centre to train station and supermarket. Possible extension to Northern part of the town.	3500 m	Mixed traffic	TU Berlin (traffic aspects) & TU Dresden (acceptance and economic/social aspects)	<ol style="list-style-type: none"> https://www.autonv.de/ https://tu-dresden.de/bu/verkehr/vs/vpsy/foerse/hung/projekte_aktuell https://innovationorigins.com/self-driving-buses-paris-ends-experiment-after-two-years/ 	

Country	Project	Location	Date	Vehicle	Capacity	Speed	Route	Length	Infrastructure	Research	More information	Comments
Germany	See-Meile	Berlin	August – end of 2019	EasyMile EZ10	Max 6 passengers (6 seated and 0 standing)	Max 15 kmh	Route between Alt-Tegel, Am Tegeler Hafen, Wilkestraße and Medebacher Weg	1200 m	Parking space and changing infrastructure	Acceptance study by Ioki	<ol style="list-style-type: none"> https://www.amexpat.de/expat-info/german-expat-news/try-berlins-new-driverless-bus-free https://innovationrigins.com/project-see-meile-berlin-experiment-with-self-driving-bus-on-public-roads/ https://ioki.com/en/news-on-autonomous-bus-in-the-streets-of-berlin/ 	69.
Germany	Projekt Stimulate	Berlin	Summer of 2017 – spring of 2020	Navya EasyMile EZ10 &	Max 11 passengers (Navya) Max 6 passengers (EZ10)	Max 12 kmh	<ol style="list-style-type: none"> Route on campus Charité Mite Klinikum Two routes on campus Virchow Klinikum 	<ol style="list-style-type: none"> 1. 1200 m 2. 800 m and 1500 m 	Mixed traffic	Acceptance and practical implications. City of Berlin in collaboration with Charité and the Institute of Medical Sociology and Rehabilitation Science	<ol style="list-style-type: none"> https://www.wir-fahren-zukunft.de/wp-content/uploads/2017/09/PM_Stimulate.pdf https://www.wir-fahren-zukunft.de/en/2018/06/13/driverless-buses-take-to-the-streets/ 	70.
Germany	Transdev	Leipzig	23th of May – 25 th of May 2018	EasyMile EZ10	Max 12 passengers	Max 20 kmh	During the International Transport Forum Summit 2018 Route along the water busins (Merkurbrunnen) leading from the vicinity of the tram line N°16 "Messelgändel" stop to the Congress Centre Leipzig main entrance hall	200 m	Dedicated track	Not mentioned	<ol style="list-style-type: none"> https://www.transdev.com/en/press-releases/transdev-presents-the-autonomous-transport-service-at-the-international-transport-forum-ift-2018-summit/ 	71.
Greece	CityMobil2	Trikala	November/December 2015 - February 2016	Robosoft Robucity	Max 12 passengers	Max 13 kmh	Trikala city centre, on a dedicated lane alongside different transport modes	2400 m 9 stops	Clear and identifiable marking of the route (incl. warning signs)	Part of CityMobil2 project	<ol style="list-style-type: none"> http://www.isimova.org/wp-content/uploads/2016/07/Day1-5-Demonstration_Trikala-Odisseas_Repts.pdf https://esexplorer.ieee.org/document/7995779 https://www.sciencedirect.com/science/article/pii/S156987816300620 	72.
Ireland	Smart Docklands	Dublin	21 st of September – 22 nd of September 2018	EasyMile EZ10	Max 15 passengers	Max 25 kmh	From Dublin convention centre to Arena on North Wall Quay	1000 m 4 stops	Designated route	University College Dublin	<ol style="list-style-type: none"> http://www.EasyMile.com/e2/0-debuts-as-first-driverless-shuttle-in-ireland/ https://www.rte.ie/news/2018/09/21/95125-driverless-cars/ https://www.rte.ie/news/2018/09/21/95125-driverless-cars/ https://osf.io/preprints/soearxiv/2zaf6 http://mural.maynoothuniversity.ie/9353/1/LH-Interface-2018.pdf 	73.
Italy	CityMobil2	Oristano	July – August 2014	Robosoft	Max 12 passengers	Max 12 kmh	Seafront of Torre Grande	1300 m 5 stops	Clear and identifiable marking of the route (incl. warning signs)	CityMobil2 project Experiments concerned vehicle performance, environmental impact application in pedestrian zones and people acceptance	<ol style="list-style-type: none"> http://www.fotovideoitalyvechi.it/guidato/primi-autobus-senza-conducente-a-oristano-city-mobil-2.html 	74.
Italy	ITC-ILO	Turin	January – May 2020	Olli	Max 12 passengers	Max 25 kmh	ICT-ILO campus	Not mentioned	Not mentioned	ITC-ILO University of Turin	<ol style="list-style-type: none"> https://www.sustainable-bus.com/smart-mobility/oli-debuts-in-italy-turin-deploys-the-3-d-printed-driverless-shuttle/ 	75.

Country	Project	Location	Date	Vehicle	Capacity	Speed	Route	Length	Infrastructure	Research	More information	Comments
76. Luxembourg	Avenue	Pfaffenthal	September 2018 – March 2019	Navya	Max 18 passengers (14 seated and 4 standing)	Max 25 kmh	From Pfaffenthal lift to the cable-car and the Val des Bons Malades Cemetery	1000 m	Not mentioned	Avenue project	1. https://luxembourgpublic.lu/en/actualites/2018/09/21-cityshuttle/index.html 2. http://www.revue.lu/der-pionier-bus/ 3. https://h2020-avenue.eu/content/luxembourg-site-description	
77. Luxembourg	Avenue	Contern	16 th of September – 22 nd of September 2018	Navya	Max 18 passengers (14 seated and 4 standing)	Max 18 kmh	Connection from the train station to the industrial zone	3500 m	Not mentioned	Avenue project	1. https://h2020-avenue.eu/content/luxembourg-site-description 2. https://delano.ludd/detail/news/center-n-test-bed-driven-vertes-bus/190494 3. https://h2020-avenue.eu/content/luxembourg-site-description	
78. Norway	Applied Autonomy	Svalbard	21 st of March 2019	EasyMile EZ10	Not mentioned	Not mentioned	Airport area (Not specified)	Not mentioned	None, integrated in existing infrastructure	Applied Autonomy	1. https://delano.ludd/detail/news/center-n-test-bed-driven-vertes-bus/190494 2. https://www.youtube.com/watch?v=jTwpYCY0	First autonomous vehicle operating in the Arctic Circle
79. Norway	Fabulos	Gjesdal	Planned for spring 2020	Not mentioned	Not mentioned	Not mentioned	Not mentioned	Not mentioned	Not mentioned	Fabulos project Forum Virtum Helsinki	https://forumvirtum.fi/en/fabulos-brings-self-driving-buses-to-the-streets-of-europe/	Procurement process in 3 phases: 1. Feasibility study, 2. Development of well-defined prototypes, 3. Verification and comparison of the first end products in real-life situations.
80. Norway	Gjøvik Municipality of NTNUI Applied Autonomy	Gjøvik	20 th of July – October 2018	EasyMile EZ10 Gen2	Max 6 passengers	Max 13 kmh	From fjelhallen to centre of Gjøvik	3 stops 900m	None, integrated in existing infrastructure	Not mentioned	1. https://www.gjovik.kommune.no/nyheter/forretos-buss-i-gjovik-sentrum/ 2. https://busmagasin.net/no/?p=11283 3. https://space.tutp.org/initiatives/autonomous-city-bus-explor-gjovik-norway	
81. Norway	Kolumbus/ Forus PKI/ Autobus	Stavanger	12 th of June – 30 th of November 2018	EasyMile EZ10	Max 6 passengers	Max 12 kmh	Forus Næringspark	1200m	None, integrated in existing infrastructure	Institute of Transport Economics (TOI)	1. https://sciencenorway.no/cars-and-traffic-forskning/no/norway/driven-vertes-buses-coming-to-a-street-near-you/1413619 2. https://www.toi.no/autobus/	During the test the speed of the vehicle increased to 15 km/h
82. Norway	OBOS/Aen do	Fornebu	June – August 2018	EasyMile EZ10	Max 6 passengers	Max 12 kmh	From Fornebu S and up to Stonyodden	1500m	None, integrated in existing infrastructure	Evaluation by Ruter	1. https://horwaytoday.info/news/self-driven-bus-tested-i-fornebu/ 2. https://www.obos.no/privat/samfunnsvar/obos-innovasjon/norges-forste-self-driven-bus 3. https://www.toi.no/autobus/	
83. Norway	Ruter/ Autonomously mobility/ Autobus	Oslo Akershusstranda	May 2019 – October/November 2019	Navya Arma	Max 11 passengers	Max 18 kmh	Kontraskjæret - Vipptangen	1100m	None, integrated in existing infrastructure	Evaluation by Ruter; Institute of Transport Economics (TOI)	1. https://ruter.no/en/about-ruter/reports/projects 2. https://www.toi.no/autobus/ 3. https://horwaytoday.info/news/obos-first-bus-routel-with-driven-vertes-bus-opted/ 4. https://www.avnmagazine.nl/wp-content/uploads/2019/05/NO_Report_RUTER_Frakostmoede-410-gecomprimeerd.pdf 5. https://www.toi.no/autobus/	Self-driven buses are electric; non-public tests without steward autumn 2019 Max passenger capacity includes the steward

Country	Project	Location	Date	Vehicle	Capacity	Speed	Route	Length	Infrastructure	Research	More information	Comments
84. Norway	Ruter/ Autonomous mobility/ Autobus	Oslo Ormoya	November 2019 – end date not mentioned	Navya Arma	Max 8 passengers	Max 18 km/h	Baekkelaget - Malmoya	1400m	None, integrated in existing infrastructure	Evaluation by Ruter/ Institute of Transport Economics (TØI)	1. https://ruter.no/en/about-reports/projects-plans/autonomous-vehicles/ 2. https://www.toi.no/autobus/	
85. Norway	Sohjoo Baltic/Tests the Kongsberg/ Autobus	Kongsberg	Phase 1: 15 th of October – 26 th of November 2018 Phase 2: 2 nd of December 2018 – 23 rd of April 2019 Phase 3: 23 rd of April – onward Phase 3.1: 13 th of October 2019 – onward	2 EasyMile EZ10 Gen2 EZ10 Gen3 starting in January 2020	Max 6 passengers	Max 16 km/h	To Teknopol: Knutepunktet - Trakka - Rådhuset - Bussedalen - Sveinropa - Tekno logiparken. From Teknopol: Teknologiparken - Sveinropa - Basse dalen - Rådhuset - Gågata - Knute punkt	Phase 1: 900 m Phase 2: 2000 m Phase 3: to Technology Park 4400 m; Phase 3.1: 5500 m	None, integrated in existing infrastructure	Institute of Transport Economics (TØI), Forum Vinum Helsing	1. https://www.sohjooautobus.com/kongsberg.com/kongsberg-introduces-driverless-mimibuses/ 2. https://www.brakar.no/prosjekter/tester-prosjekt-med-selvkjørende-buss-i-kongsberg/ 3. https://www.utip.org/news/applied-autonomy-operating-autonomous-shuttles-norway 4. https://www.youtube.com/watch?v=K6IDD9YGE	2 vehicles in operation 4 hours every day; service integrated with national travel planner Lintur and Brakar travel planner & Brakar real-time viewer of the buses; commercial operation with adult ticket requirements, certain groups (e.g. children) travel for free
86. Norway	CityMobil	Tromsheim	August 2009	INRIA	Max 6 passengers	Not mentioned	From Elgeseter bridge following Falkon Jøns gate (pedestrian and cyclists street) to hospital entrance	170 m	Segregated track (fenced area)	Part of CityMobil project	https://www.youtube.com/watch?v=K6IDD9YGE	Max passenger capacity includes the steward
87. Poland	Sohjoo Baltic	Gdansk	September 2019	EasyMile EZ10	Max 12 passengers	Not mentioned	From the stop at the entrance to the ZOO, through an intermediate stop at the car park to the final stop at Spacerowa Street	Not mentioned	Not mentioned	Part of Sohjoo Baltic project	1. https://www.sohjooautobus.com/en/2019/12/12/gdansk-pilot-2019-on-video/#partners 2. https://www.sohjooautobus.com/en/2019/09/11/gdansk-pilot-started 3. https://www.themayor.eu/en/starting-today-gdansk-is-testing-an-autonomous-electric-bus https://www.citymobil-project.eu/site/en/SP1%20Castellon.php	Hybrid system of guided bus/tramway
88. Spain	Citymobil	Castellón	October 2008	Not mentioned	Not mentioned	Not mentioned	Connection between Castellón and Benicassim	40000 m	Dedicated lanes	Citymobil project	https://www.autonot20.com/wp-content/uploads/2016/11/12_AutoNe_0303_CityMobil2.pdf	1968 trips, 2362 km distance, 1918 passengers
89. Spain	Citymobil2	Donostia/ Sebastian	April – June 2016	Robosol/ EasyMile	Max 10 passengers	Max 30 km/h In operation 10 km/h	Miramon Paseo Mikelategi	1200 m 6 stops	Major infrastructural changes: car parking facilities, limit the max speed to 30 km/h, change traffic direction	Citymobil2 project	1. https://www.autonot20.com/wp-content/uploads/2016/11/12_AutoNe_0303_CityMobil2.pdf	
90. Sweden	Project S3 – Shared Shuttle Services	Göteborg	April – October 2019	Navya (operator Autonomous Mobility)	Max 9 passengers	Average 11 km/h	Two distinct routes: 1. Johanneberg, Chalmers campus 2. First/last-mile parking option for Lindholmen Science Park	1200 m	Construction and changes on the route itinerary	RISE Viktoria (mentioned in their newsletter 462). Associated research: User acceptance, open innovation, business models and road maps	1. https://www.gp.se/ekonomi/har-kan-goteborgs-miska-sjt/korande-buss-1.1471707 2. https://space.utip.org/initiatives/3-shared-shuttle-av-pilot-gobenburge-sweden	
91. Sweden	Self-driving buses in Västervik	Vararåsk	September 2019 – September 2020	EasyMile	Not mentioned	Not mentioned	Rural area	Not mentioned	Not mentioned	Swedish Transport Association/ Skellefteå municipality/ Vinnova	https://www.bussmagasinet.se/2019/04/sjt/korande-bussar-i-vasterbotensby/	
92. Sweden	Scania & Nohma	Stockholm	Planned for 2020	Scania LF Citywide electric full size bus	Max 80 passengers (25 seated and 55 standing)	Max 24 km/h	On regular bus route from residential area Barby to metro station in downtown Stockholm	Phase 1: 1000 m Phase 2: 5000 m 4 stops	Dedicated lane	Not mentioned	1. https://www.sustainable-bus.com/news/scania-partners-with-nohna-for-autonomous-bus-trial-in-stockholm/ 2. https://www.ericsson.com/en/internet-of-things-trending/driverless-buses-in-stockholm-sweden 3. https://www.bussmagasinet.se/2019/04/internationell-pris-till-barkarbyssjt/korande-bussar/	
93. Sweden	CityMobil2	Stockholm	25 th of April – 29 th of April 2016	EasyMile EZ10	Max 12 passengers	Not mentioned	Ericsen, Nohna Technology and Kista Science City	Not mentioned	Not mentioned	Not mentioned	https://www.drivsweden.net/evente-mang/kista-mobility-week	

	Country	Project	Location	Date	Vehicle	Capacity	Speed	Route	Infrastructure	Research	More information	Comments
94.	Sweden	Drive Sweden	Stockholm	January - June 2018	EasyMile EZ10	Max 12 passengers	Max 20 kmh	In Kista Science City between Victoria Tower and Kista Galleria, with a stop on the road outside of the Time building (Kistängöngen 16)	Not mentioned	Not mentioned	1. https://www.urbanicurena.se/om-artiklar/kista-today/ 2. https://www.thedocal.se/2017/12/27/stokholm-gets-scan-dnavias-first-driverless-buses-on-public-road	
95.	Sweden	Volvo automated bus (trial)	Göteborg	November 2019	Volvo, full size buses	Not mentioned	Not mentioned	Automated ride (and parking) between the parking bay and several different workstations (such as cleaning, servicing, and electric charging) at a depot used by bus operator Keolis	Not mentioned		https://dutchmobilityinnovations.com/spaces/86/dutch-mobility-innovation-starts-tests-in-geneva 2. https://hitecher.com/news/volvo-tests-self-driving-bus-prototype-in-real-conditions 3. https://www.domusweb.it/en/news/2015/11/17/citymobility_11_epfl.html	4447 trips, 6970 km distance, 7000 passengers
96.	Switzerland	Citymobility2	Lansanne	April - August 2015	EasyMile EZ10	Not mentioned	Max 12 kmh	Campus EPFL West Region, between metro station and campus working sites	Clear and identifiable marking of the route (incl. warning signs)	Citymobility2 project		
97.	Switzerland	AMoTech – Route 12 project	Neuhausen	March 2018 – end of 2019	Navya	Not mentioned	Not mentioned	Connect the centre of Neuhausen with Schöslösi, Wörth at the Rhine Falls basin	None, integrated in existing infrastructure	Conducted by ISTP at ETH research on public perceptions	1. https://www.amotech.ch/en/showroom/projekt-linie-12 2. https://www.amotech.ch/pdf/docs/nahverkehr/parxis%20-%208093ausgabe7_8-2018-interview.pdf 3. https://www.swisstransitlab.com/en 4. https://www.amotech.ch/en/reference 5. https://www.research-collection.ethz.ch/handle/20.500.1185/232577 6. https://www.semanticscholar.org/pap/af8c5c01f11e0e0a/Wikileaks-Guidon/2481e575bee733174c23f0e4d6f6e8d04ebbd3f68 7. https://www.research-collection.ethz.ch/handle/20.500.1185/339708	
98.	Switzerland	Meyrin Shortle Bestmile Avenue	Geneva	June 2018 – end date not mentioned	Navya	Max 11 passengers	Max 25 kmh	First/last mile solution for Meyrin train station, connecting three tram stops	None, integrated in existing infrastructure	AVENUE project	1. https://bestmile.com/tpg-lunches-first-autonomous-service-in-geneva-managed-by-bestmile-platform/ 2. https://h2020-avenue.eu/portfolio-item/geneva/ https://www.mobility.ch/en/news/self-driving-vehicles/	Two candidates for route expansion in 2019: 1. Belle-Idée hospital site (around 10 to 35 stops); 2. eco-neighbourhood of Verges
99.	Switzerland	Pilot Zug	Zug	25 th of March 2017 - end of 2019	EasyMile EZ10	Max 9 passengers (6 seated and 3 standing)	Max 20 kmh	From Zug railway station to Technology cluster Zug.	None, integrated in existing infrastructure	Mobility		

Country	Project	Location	Date	Vehicle	Capacity	Speed	Route	Length	Infrastructure	Research	More information	Comments
Switzerland	Smartshuttle by PostBus	Ston	June 2016 – end date not mentioned	Navya	Max 11 passengers	Max 20 kmh	Route through the city centre	3000 m	None integrated in existing infrastructure. Operational in open roads and pedestrian zone. Encounter traffic lights, intersections roundabouts and mixed traffic	Research if AV's in public areas give customer added value, if it is possible to operate AV's in public areas (pedestrian and car-free zones) or on company premises	<ol style="list-style-type: none"> https://www.postauto.ch/en/testing-station https://www.postauto.ch/en/testing-station https://www.postauto.ch/en/testing-station https://www.postauto.ch/en/testing-station https://www.postauto.ch/en/testing-station 	Route was 1500 m in the beginning and was extended to 3000m in February 2018
Switzerland	AnoTech – Trapeze operations Bernmobil	Bern	July 2019 – planned to run for 2 years	EasyMile	Not mentioned	Max 30 kmh	Between the Bärenpark and the funicular "Marzilibahn"	2000 m 6 stops	Not mentioned	Not mentioned	<ol style="list-style-type: none"> https://www.trapezegrupp.ch/news/media-release-trapeze-operations-control-system-is-ready-for-self-driving-v https://www.amot.ch/en/reference https://www.amot.ch/en/reference https://www.amot.ch/en/reference https://www.amot.ch/en/reference https://www.amot.ch/en/reference https://www.amot.ch/en/reference https://www.amot.ch/en/reference 	Fixed headway (7 mins) in-vehicle time of 7 mins
Switzerland	Transports publics Fribourgeois (TPF)/Marty Innovation Center (MIC)/Municipality of Marty/Agglomeration of Fribourg/State of Fribourg	Fribourg	August – November 2017	Navya	Max 11 passengers	Max 25 kmh	From Marty Innovation Center to Fribourg Public Transport network.	1300 m	Not mentioned	Not mentioned	<ol style="list-style-type: none"> https://www.swissinfo.ch/eng/first-autonomous-transport-service-in-switzerland-inaugurated/4341214 https://www.tp.fribourg.ch/une-nouvelle-automatisee-pour-desservir-le-marty-innovation-center 	
Switzerland	Bestmile in collaboration with Transports de la région Morges Bière Cossonay	Cossonay	July – December 2017	Navya and Bestmile	Not mentioned	Not mentioned	From the funicular station to key attractions in the old town. Two different loops	1700 m 8 stops	Part of existing PT network. Open streets and roads.	Address the challenge of first/last mile connectivity	https://bestmile.com/the-transport-de-la-region-morges-biere-cossonay-to-partner-with-bestmile-to-operate-a-unique-autonomous-shuttle-service-in-the-city-center-of-cossonay-switzerland/	
The Netherlands	Appelscha	Appelscha	13 th of September – 31 st of October 2016	EasyMile EZ10	Max 6 passengers (6 seated and 0 standing)	Max 15 kmh	From visitor centre Staatsbosbeheer to city of Appelscha.	2500 m	On bicycle track. Bicycle track goes priority at crossings during the pilot. Warning signs	STAD-project (case study)	https://www.mdpi.com/2022-06/29/11/15	
The Netherlands	Drimmelen	Drimmelen	August – September 2019	Navya	Max 8 passengers (8 seated and 0 standing)	Max 15 kmh	From bus stop to parking lot and harbour of Drimmelen	Not mentioned	Mixed traffic	Not mentioned	https://zelfrijdendeauto.com/management-drimmelen-in-vestert-in-zelfrijdende-buurtbus/	
The Netherlands	ESA-ESTEC	Noordwijk	October 2019 – 2021	Navya	Max 8 passengers (8 seated and 0 standing)	Max 15 kmh	2 phases: first on the private property of ESA-ESTEC. Second phase the route will be extended to public roads	Not mentioned	Mixed traffic	Not mentioned	https://www.omniovest.nl/news/732849/ESTEC-paasvoert-zelfrijdende-shuttles-naar-het-werk	
The Netherlands	Haga shuttle	Den Haag	Summer of 2019 – end date not mentioned	Navya	Max 8 passengers (8 seated and 0 standing)	Max 15 kmh	From busstop 'Leyweg' to the Haga Hospital.	1000 m	Lines are applied for the vehicle to navigate and to create a lane for the vehicle. Warning signs will be placed including warnings on the road surface. Part of the route is designated lane.	TU Delft (research questions not defined yet)	<ol style="list-style-type: none"> http://thefuturemobilitynetwork/den-haag-zelfrijdende-minibus/ https://www.oympro.nl/bas/2019/01/7/num-stuur-zelfrijdende-bus-in-2019-de-veg-op/?gclid=Cj0KCQj 	

Country	Project	Location	Date	Vehicle	Capacity	Speed	Route	Length	Infrastructure	Research	More information	Comments
The Netherlands	RiviumPark Shuttle	Rotterdam	2005 - still in operation	2gethere	Max 20 passengers (8 seated and 12 standing)	Max 32 km/h	From metro station to business park	1800 m	Dedicated track with regulated crossings	STAD-project case study and master thesis about passenger perception)	1. https://www.researchgate.net/publication/329782024_Driverless_electric_vehicles_at_Businesspark_Rivium_near_Rotterdam_in_the_Netherlands_for_operation_on_dedicated_track_since_2005_to_public_roads_in_2020 2. https://www.semanticscholar.org/paper/Riding-a-self-driving-bus-to-work%3A-Investigating-on-Dekker/3ac828836a7fd1407514c1706c3bb6a318b8460	No steward on board
The Netherlands	Scheemda	Ommelanders Ziekenhuis, Scheemda	6th of August 2018 – end of 2019	Navya	Max 8 passengers (8 seated and 0 standing)	Max 15 km/h	From bus stop 'Molenstraat' to the Ommelanders Hospital.	1500 m	Operating on extra wide (4 m) bicycle lane	Not mentioned	http://wp-content/uploads/2018/08/Vestiged-de-vragen-zelfrijdende-shuttle-Scheemda.pdf	If successful implementation is considered permanent
The Netherlands	Mercedes-Benz Future Bus	Schiphol airport – Haarlem	18 th of July 2016	Mercedes-Benz Future Bus	Not mentioned	50 km/h Max 70 km/h	On bus lane between Schiphol airport and Haarlem	Not mentioned	Sections of the bus lane between Schiphol Airport and Haarlem are closed off. At several stretches of the route, particularly at intersections, the bus will take the public road. Communication between the bus and 19 traffic lights. Bus is given priority	Not mentioned	1. https://www.government.nl/latest/news/2016/07/28/successful-test-with-first-self-driving-bus-on-a-public-road 2. https://www.deinigenieur.nl/artikel/pr-coef-niet-zelfrijdende-bus-tussen-haarlem-en-schiphol 3. https://media.dininter.com/nursMedia/site/en/stance/ko.x.html?oid=12776336	Non-electric vehicle
The Netherlands	WEPod	Wageningen	2014 – 2016	EasyMile EZ10; Many hard- and software added to vehicle	Max 6 passengers (6 seated and 0 standing)	Max 15 km/h	Phase 1: Around the campus of Wageningen University Phase 2: From transition Ede/Wageningen to Wageningen University	Phase 1: 2500 m Phase 2: 11000 m	Parking ban, 1 traffic light added, wi-fi-p added to existing traffic light, speed limitation, special bus stop	TU Delft, Christian University of Applied Sciences, ROC A12, HAN University of Applied Sciences, STAD project	1. https://www.researchgate.net/publication/329781953_Casestudy_WEPod_automatisch_vervoer_in_EdeWageningen 2. https://journals.sagepub.com/doi/10.3141/2542-09 3. https://ieeexplore.ieee.org/document/7986800 4. https://www.inddelft.nl/wp-content/uploads/2017/06/Paula-Rodriguez-Safety-of-Pedestrians-and-Cyclists-when-Interacting-with...pdf 5. https://stad.tue.nl/wordpress/wp-content/uploads/2017/01/CT2016_PNameZVelasco_Stockholm.pdf 6. https://virtidarchitecture.jimdof.com/ http://www.citymobil-project.eu/site/en/Heathrow%20PKT.php	Most infrastructural changes were needed for phase 2.
United Kingdom	Citymobil	Heathrow PKT	1. October 2010 – May 2011 2. May 2011 – end date not mentioned	"ULTra" developed by Advanced Transport Systems of Thornbury	Max 4 passengers	Max 40 km/h	From carpark to terminal 5	3900 m	Elevated, dedicated lane	Part of Citymobil project	1. Trials 2. Full passenger service	
United Kingdom	Citymobil	Davenport	24th of September – 5th of October 2007	INRIA vehicle	Not mentioned	Not mentioned	Not mentioned	400 m	Operating on bicycle track (4 m wide)	Part of Citymobil project	http://www.citymobil-project.eu/downloadables/Davenport%20D1.5.1.2-PU-Davenport%20Showcase%20report-CityMobil.pdf	
United Kingdom	Project Synergy	Manchester Airport	November 2017 – May 2020	Westfield electric AV pod	Max 4 passengers (4 seated and 0 standing)	Not mentioned	From Airport station to terminal 2.	500 m	Not mentioned	UK Autodrive	https://space.tup.org/initiatives/project-synergy-manufacturer-av-uk	
United Kingdom	UK Autodrive project	Milton Keynes	2015 - 2018	Pod built by RDM-group Aurigo	Max 4 passengers (4 seated and 0 standing)	Not mentioned	From railway station to city centre	Not mentioned	None, operates on pavements and other pedestrianised areas.	Not mentioned	http://www.ukautodrive.com/pods-provide-a-first-last-mile-solution-in-milton-keynes/	

Country	Project	Location	Date	Vehicle	Capacity	Speed	Route	Length	Infrastructure	Research	More information	Comments
United Kingdom	Stagecoach/ ADL/ Fusion Processing	Edinburgh	Planned for 2020	Enviro200 by ADL	Max 42 passengers	Not mentioned	From Ferryhill Park to Ride facility in Fife and the Edinburgh Park tram tram interchange	22000 m	Dedicated lanes	Stagecoach, Transport Scotland, bus manufacturer Alexander Dennis, Fusion Processing Ltd, ESP Group	<ol style="list-style-type: none"> https://www.alexander-dennis.com/media/news/2018/november/scotland-for-trial-first-autonomous-bull-sized-bus-fleet-in-passenger-service-after-435-million-a-uk-finding/ https://www.sustainable-bus.com/news/autonomous-bus-fleet-pilot-in-scotland-from-2020-by-stagecoach-and-adl/ https://www.bbc.com/news/uk-scotland-edinburgh-east-fife-46309121 	Max passenger capacity includes the steward
United Kingdom	GATEway	London	February – March 2018	Fully automated passenger shuttles (provided by a consortium of Westfield Sportscars, Heathrow Enterprises and Fusion)	Max 4 passengers	Max 15 kmh	Along the riverside path in Greenwich, London	1600 m	In a designated lane, sharing space with pedestrians and cyclists	GATEway project team	<ol style="list-style-type: none"> https://gateway-project.org.uk/ https://gateway-project.org.uk/wp-content/uploads/2018/06/DS1.7_TRL-Workshop-Findings-Report.pdf 	
United Kingdom	Stagecoach/ ADL/ Fusion Processing (trial)	Manchester	March 2019	Single-decker bus by Alexander Dennis Limited (ADL) and Fusion Processing	Max 43 passengers (43 seated and 0 standing)	Not mentioned	Within the grounds of a Sharnston bus depot in Manchester, England	Not mentioned	Not mentioned	The purpose of the trial is to test if the bus can undertake manoeuvres such as parking and moving into a washing area	<ol style="list-style-type: none"> https://www.enbc.com/2019/03/20/uk-first-self-driving-bus-begins-trials.html https://travelandnews.com/uk-stagecoach-self-driving-bus-trials/ 	