Global Atlas of Autonomous Vehicles in Cities

136 Places on the Move

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Introduction

Launched in 2016, the Bloomberg Aspen Initiative on Cities and Autonomous Vehicles helped 10 leading global cities better prepare for the era of autonomous vehicles. The initiative was one of Bloomberg Philanthropies' Government Innovation programs that equips mayors and other city leaders with the tools and techniques they need to solve urban challenges and improve citizens' lives.

To support this effort, this Atlas collected the world's first inventory of how cities around the globe were preparing for the transition to a world with AVs. From October 2017 to November 2019, we cataloged 136 cities piloting and making policy for AVs. As cities sought to learn from one another, they could look to this map for information on what had been done worldwide.

The cities in this Atlas represent the vanguard of urban governments that have hosted tests, developed their own autonomous vehicle (AV) pilots, made plans and policy, and monitored developments in AV technologies, uses, and markets during the 2017-2019 period. Many of these efforts continued into 2020 and beyond.

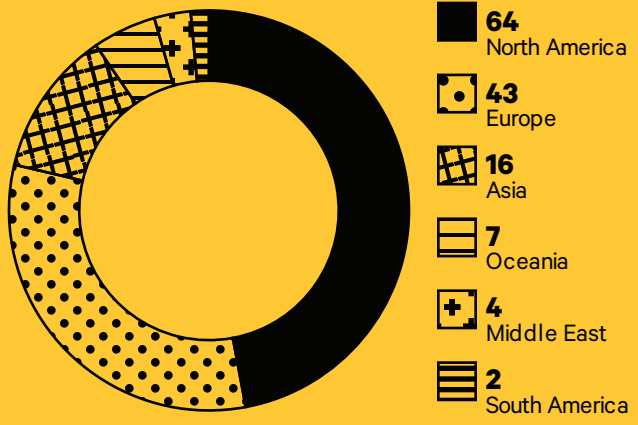
Because the focus of this project was on helping cities learn from each other, this map only covered AV pilots and policymaking efforts where city, municipal, or metropolitan governments are playing a substantial role.

We included cities where we found evidence that the city government is setting goals, mobilizing resources, and providing oversight and evaluation for AV efforts. That's why some important efforts organized by industry and national and state/provincial governments are not shown. In rare instances where a city does not meet this standard yet, but possesses a globally significant portfolio of AV innovation assets, we included it.

Findings

AV Pilots and Preparations Spanned a Range of Geographies

FIG. 1 There are 136 cities in the Atlas, representing 25 countries.

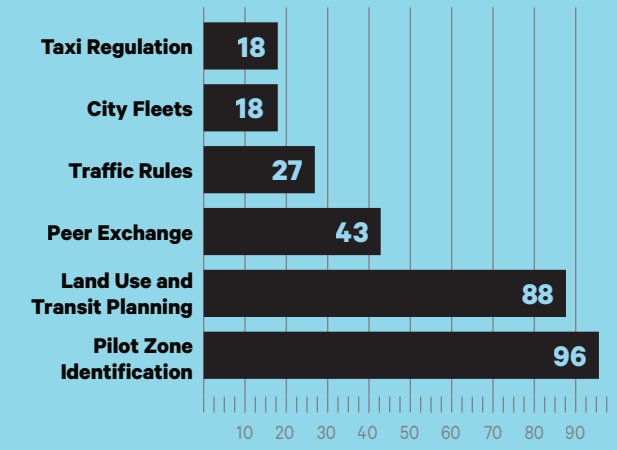


Number of cities per geographic area

Preparations for the driverless revolution during the 2017-2019 period spanned 136 cities ranging from the very large (Tokyo, JP pop. 35,385,804) to the very small (Cossonay, CH pop. 3,813). TThe overwhelming majority of cities that took part in AV policymaking, planning and pilots were in the developed world. The largest concentrations were found in North America, Europe, and East Asia. The Netherlands, Scandinavia, the United Kingdom, and the United States are particularly active. In the eastern hemisphere, Singapore, Australia, and China led the way. Just a handful of cities across the Global South began exploring the potential of AVs. **FIG. 1**

Cities' Top Priorities for AVs included Pilot Zone Identification and Land Use and Transit Planning

FIG. 2 Most cities have more than one priority.

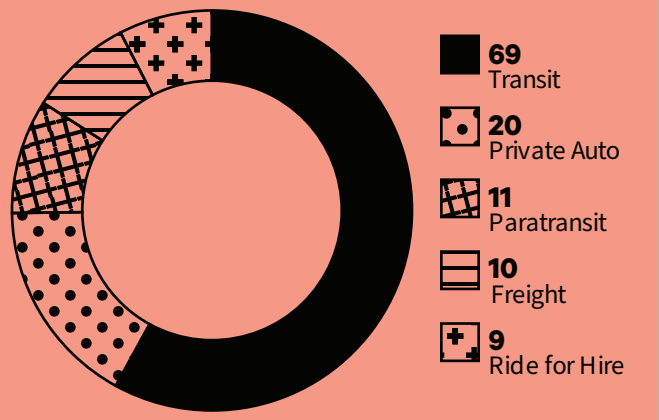


Number of cities citing this topic as one of their priorities

Nearly every city in the Atlas worked to identify locations for safe and effective testing of AVs. These efforts were almost universally guided by existing mobility goals, and exploring how automated vehicles could fill gaps in transit networks was an almost universal priority. In cities with additional capacity for AV planning and policymaking, a second tier of widely shared priorities included sharing information with other cities, reviewing road safety rules, updating taxi regulation, and automating city fleets. **FIG. 2**

Pilots Focused on Pilot Zone Identification and Land Use and Transit Planning and Featured Diverse Test Sites

FIG. 3 Cities are piloting a variety of AV use-cases, in some cases multiple.

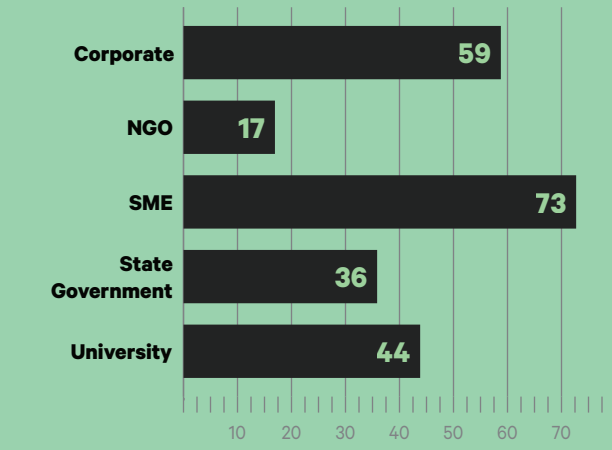


Cities envisioned a variety of AV-based solutions, from transit to taxis to freight. But the lowest-hanging fruit was "last mile" connectivity. AVs are widely anticipated to help provide new solutions in the stubborn gaps at the edges of transit systems, a crucial link that planners call the "last mile." Since the launch of the Atlas in 2017, on average more than half of the pilots tracked focused on last-mile applications that ranged from connectors between rail stations and employment centers to shuttles circulating within large campuses.

AV pilot zones took many forms but were limited in scope. Cities partnered on tests of a variety of AV products, including retrofitted autos and brand new types of vehicles like conveyors (small, cart-sized AVs that travel on sidewalks). But there was far more variety in the places cities chose for tests. These included technology parks, college campuses, urban renewal districts, and former Olympic park sites—places that made it easier to isolate AVs from the rest of the city. So while trials were increasingly happening in cities, they did not tackle the full challenge of navigating complex urban environments. **FIG. 3**

Cities' Preferred Partners Were State and Provincial Governments, But Corporations, SMEs, NGOs, and Universities All Played Important Roles

FIG. 4 Partners are essential for cities to deliver effective AV pilots.

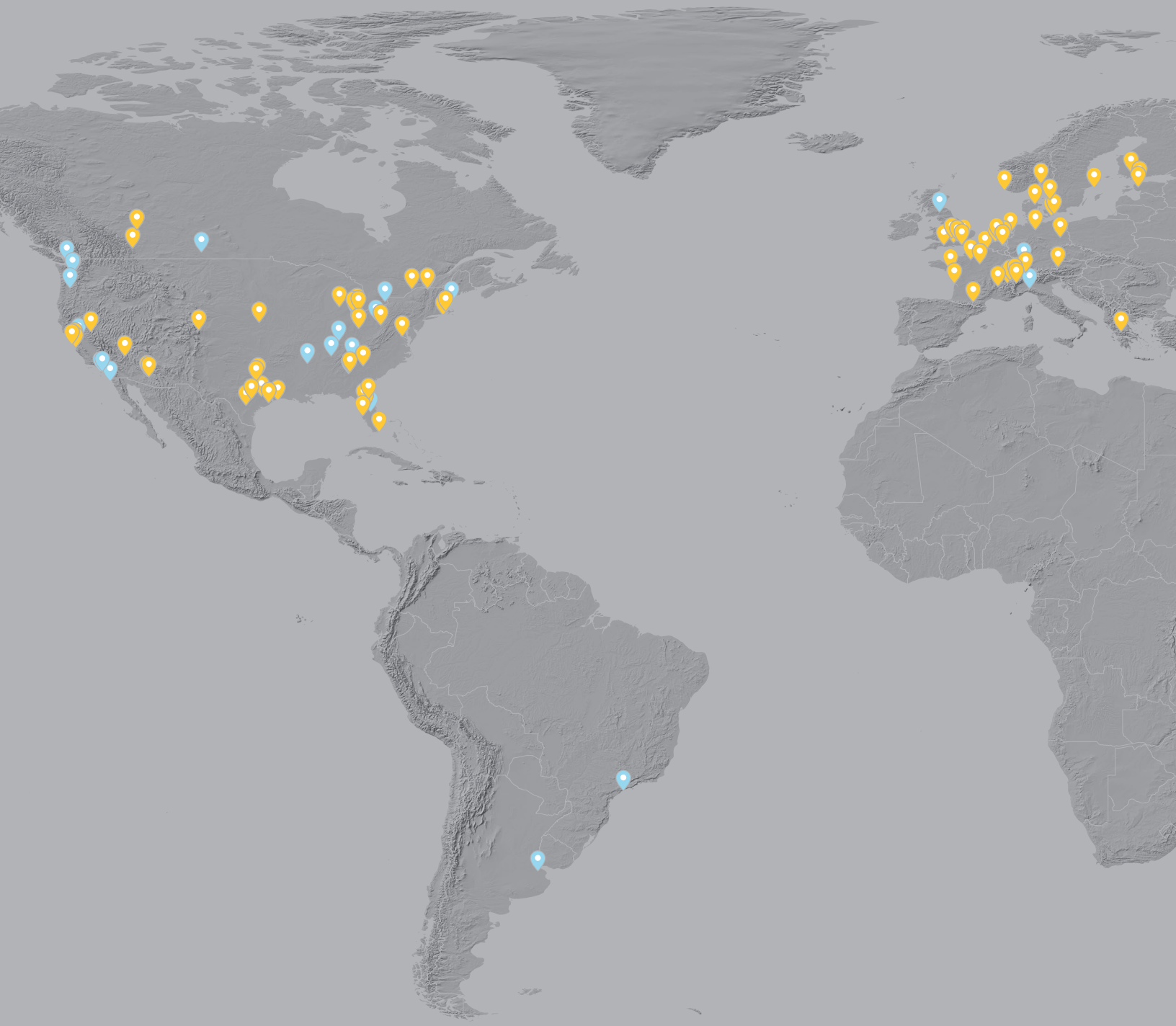


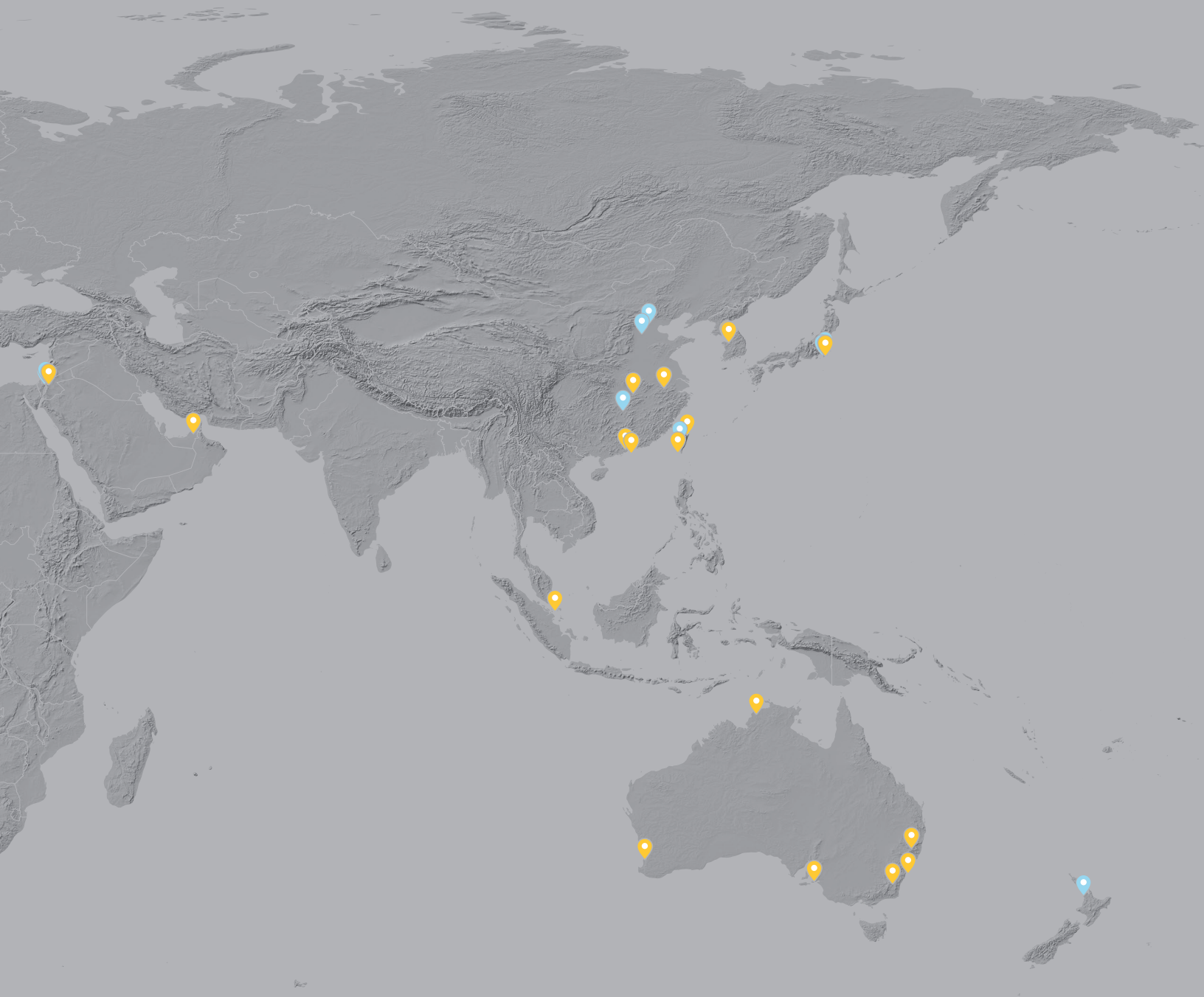
While cities took the lead in setting goals, none had the technical or financial resources to deliver AV pilots alone. All relied extensively on partners, including other levels of government, large corporations, startups, non-governmental organizations, and university-based researchers.

State and provincial governments were the most important partners for cities. Typically, they supplied seed funding and the regulatory authority changed rules to permit AV tests on public lands and roads. However, large technology corporations and automakers, as well as a vast array of startups were also essential to supply AV technology. NGOs and universities primarily provided a source of expertise in public outreach, oversight on issues of impact and governance, and evaluation of test results. **FIG. 4**

Cities

Piloting City Preparing City





96 Cities
are piloting AVs or have committed to do so.

Aalborg, DK

Policy & Planning Priorities

Land Use and Transit Planning

Pilot Zone Identification

Partners

Corporate

SME

University

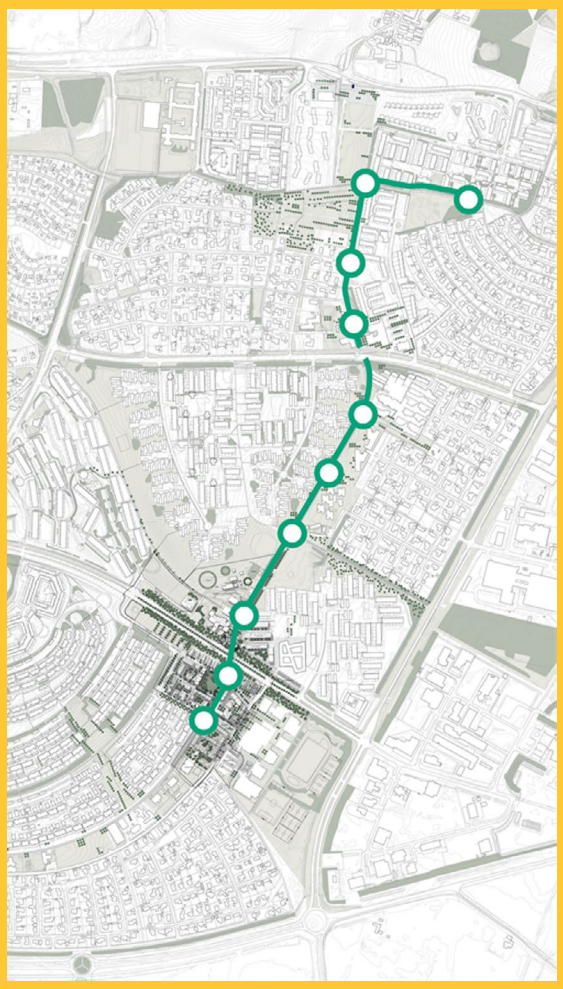
Piloting AVs for

Transit

Paratransit

Aalborg Øst, the easternmost district of Denmark's fourth-largest city, was the site of a 2.1 km driverless shuttle route along Astrupstien, the suburb's main arterial road sharing the path with cyclists. Ten wheelchair-accessible stops throughout the historically disadvantaged area—at an assisted living facility, library, and shopping center, among other locations—expanded access to the existing transit system. The service began in late summer 2019 and was scheduled to run for two years once the project receives approval from national legislators.

The public-private partnership is led by the city and Holo, an AV operator. Following kick off, Aalborg University and transport provider Nordjyllands Trafikselskab conducted a qualitative evaluation of the service's impact on people's everyday lives and the surrounding urban area.



Aalborg's AV shuttles will run along a shared path with cyclists (Credit: Aalbork Kommune)

Adelaide, AU

Policy & Planning Priorities

Traffic Rules

Land Use and Transit Planning

Partners

State Government

Corporate

SME

University

Piloting AVs for

Transit

Freight

Adelaide was center stage for the state of South Australia's $10 million Future Mobility Lab Fund, which helped kickstart city AV solutions focused on people with limited mobility and catalyze the creation of a new industry in the region. Ten pilots were planned through 2019, including:

- A driverless shuttle to connect Adelaide Airport's terminal with long-term parking facilities
- An AV minibus route on the campus of Flinders University
- A self-driving cargo service to operate within the 150-acre Tonsley Innovation Precinct, a redevelopment area located on a former car factory site, involving pod vehicles modified to transport standard freight containers.

An international array of technology partners were recruited: RDM (UK), AutonomousStuff (US), and a variety of shuttle makers (e.g. NAVYA, Easy Mile, Local Motors). Adelaide became the first city in Australia to introduce legislation allowing on-road trials of AVs which helped streamline reporting requirements and monitoring of all AV pilots in the country.

Milestones

2018-01-05: RDM Group announced the arrival of two new PodZero AVs to begin tests for a driver-less cargo service within the Tonsley Innovation District tests in March.

2018-02-15: Local Motors announced a 6-month AV shuttle trial in Glenelg waterfront starting in September.

UK-based RDM will supply AV pod vehicles for both passenger and freight pilots at the Tonsley Innovation District. (Credit: Government of South Australia, Department of Planning, Transport, and Infrastructure)

Ann Arbor, US

Policy & Planning Priorities

Pilot Zone Identification

With a large population of early adopters and ample test facilities, Ann Arbor is attracting lots of attention from AV product and service companies. (Credit: Ford Motor Company)

Home to the University of Michigan's MCity, a sprawling 32-acre ghost town purpose-built as a proving ground for connected vehicles, Ann Arbor staked an early claim as the US auto industry's key hub for AV innovation. The New York Times described the grounds as "a one-of-a-kind, living laboratory for the technologies that will pave the way" to the driverless future.

Initially, fully-autonomous driving in Ann Arbor was confined to MCity. However, the University of Michigan began exploring the deployment of up to 50 on-demand shuttles on its North Campus, operating on university-controlled roads. And Ford Motor Company and Domino's Pizza are simulating how people might interact with AV-enabled services. The two companies conducted a month-long pizza delivery test using AV-capable vehicles accompanied by a human safety engineer in the driver's seat.

Milestones

2018-01-04: MCity researchers developed cyber-security scenarios and solutions for autonomous vehicles.

2018-06-04: Two driverless shuttles began a last-mile service for staff and students at the University of Michigan North Campus.

2018-09-30: MCity published a case study on the US' first driverless shuttle project by encapsulating nine key lessons from the pilot.

Arlington, US

Policy & Planning Priorities

Land Use and Transit Planning

Pilot Zone Identification

Partners

SME

Piloting AVs for Transit

Arlington's Milo driverless shuttle pilot provides a vital linkage between sports and entertainment venues, utilizing public right of way in an existing park. (Credit: City of Arlington)

Arlington, Texas is home to a major General Motors SUV assembly plant, and residents have rejected mass transit in the past. City officials were hopeful AV technology could change the equation and drive mobility innovation for this city of nearly 400,000. A September 2017 transportation vision, Connect Arlington, called for the use of driverless shuttles as favor long-term solutions for congestion on a number of key road corridors in the city.

Those recommendations came hot on the heels of the launch of a one-year pilot program that employed two leased Easymile EZ10 shuttles in the city's Entertainment District. This program made Arlington the first municipal government in the United States to offer autonomous shuttle rides to the general public on a continuous basis. The shuttles carried passengers on a fixed 13-minute journey on a paved trail through a linear riverfront city park. The Milo Shuttle completed the one-year pilot in August 2018, after serving over 110 events, educating the public about AV technology, and allowing the City to learn valuable lessons about the use of AVs. In October 2018, the city began a six-month AV shuttle pilot in the Entertainment District. The partnership with drive.ai saw vehicles operating in mixed traffic at speeds up to 35 miles per hour.

Milestones

2018-08-17: Two Marble Delivery Robots began mapping streets and sidewalks of the city after gaining approval from the City Council in June.

2018-08-22: Beginning in October, citizens will be able to book rides in one of drive.ai's fleet of self-driving shuttles. The city of Arlington signed a one-year contract with the startup to test their service in predefined geofenced locations. Pilot is funded by the city and a $343,000 federal grant.

2019-03-29: Arlington expands its fleet of self-driving vehicles to seven. City officials looked to explore new routes in the area connecting downtown to the University of Texas.

Armidale, AU

Policy & Planning Priorities

Land Use and Transit Planning

Partners

State Government

Corporate

SME

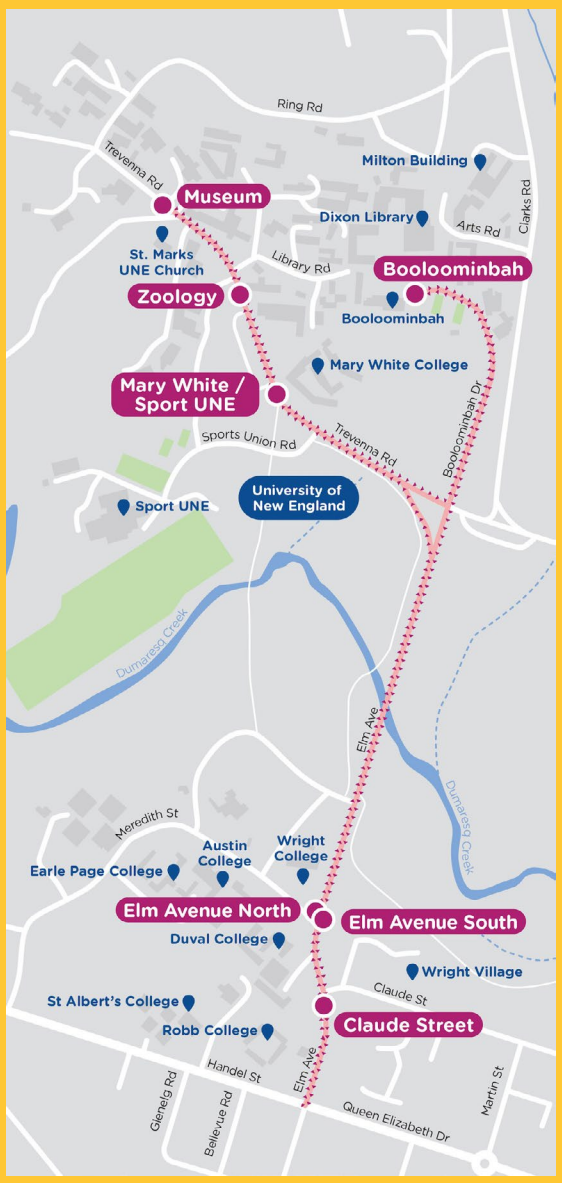
University

Piloting AVs for

Transit

In 2019, Australia's longest driverless shuttle route opened for business the city of Armidale, a town of 31,000 located halfway between Brisbane and Sydney. The 5-km pilot began in February on the University of New England (UNE) campus. In July, the pilot expanded to include a route covering the central business district and New England Regional Art Museum, where the shuttles interacted with mixed traffic and roundabouts.

The effort was organized under the Armidale Regional Driverless Initiative (ARDi), a partnership between Transport for NSW, Armidale Regional Council, EasyMile, Transdev, WSP, UNE, QBE Insurance and Edwards Buses. The partnership also conducted a survey to gather customer feedback (https://www.ardi-bus.com.au/feedback) on the service.



Self-driving shuttle route for the first phase of the ARDi pilot. (Credit: ARDi)

Auburn Hills, US

Policy & Planning Priorities

- Land Use and Transit Planning
- Pilot Zone Identification

Partners

- State Government
- Corporate
- SME
- University

Piloting AVs for

- Transit

Site of a former Nike Missile Air Base, Oakland University's Campus will play host to a self-driving shuttle. (Credit: Spalding DeDecker)

Motor City's suburban neighbor, Auburn Hills, played host to a living lab for the study of self-driving shuttles. Partnering with Oakland University, Continental, and City of Auburn Hills, EasyMile announced plans to use the venue for the first field test of its Zonar technology, a real-time vehicle inspection platform powered through RFID technology. The effort was funded in part by a $103,600 grant from PlanetM, a program of the Michigan Economic Development Corporation dealing with the future of mobility.

The partnership employed students to determine the best route for the EasyMile shuttle. In addition, students and faculty from Oakland University's Engineering and Computer Science were expected to participate in shuttle operations as part of their STEM education.

Austin, US

Policy & Planning Priorities

- Taxi Regulation
- Traffic Rules
- Land Use and Transit Planning
- City Fleets
- Pilot Zone Identification
- Peer Exchange

Partners

- Corporate
- University

Piloting AVs for

- Transit
- Private Auto

In 2015, the Texas capital became the first test site outside California for Google's self-driving car project, which was spun out the previous year as Waymo. Focusing on Mueller, a 700-acre transit-oriented development built on the site of the city's old airport, Google deployed 8 custom-built pod cars and 6 Lexus SUVs fitted for autonomous operation. In one of the most transformative AV demonstrations yet, the company transported a visually-impaired Austin resident from his home to a medical appointment and back again. Waymo would continue to expand its Austin testbed with a high-precision mapping survey as the city began selection of locations for future tests of a last-mile service utilizing driverless shuttles.

In August 2017, Austin City Council passed a resolution authorizing "personal delivery robotic devices" (or conveyors). The law included a provision limiting vehicle weight to 300 pounds, a substantially higher level than earlier testing restrictions in Washington and San Francisco.

The city's went on to publish their strategic mobility plan addressing electric and autonomous vehicles.

Milestones

2018-07-04: City of Austin partnered with Capital Metro and RATP to launch a driverless shuttle pilot.

2018-07-17: Committed to the safe and effective deployment of AVs, Austin joined 7 other cities to pilot INRIX's AV Road Rules Platform. The platform enabled the digitization of local rules, speed limits, and school zones, among others.

2019-03-21: Austin sought funding from USDOT for a self-driving shuttle pilot in the downtown corridor. In addition, the city proposed the development of a multi-city Open Data Commons to share frameworks, protocols, and best practices. Participating cities include: Detroit, Kansas City, and Washington, D.C.

The self-driving car explores transit-oriented development in Austin's Mueller neighborhood. (Credit: Waymo)

2019-09-25: Ford announced plans to bring a self-driving taxi and delivery service to Austin beginning in 2021. The company could begin mapping the city's streets as early as November 2020.

2019-10-01: Local transport provider Capital Metro released"Project Connect", a proposal for two autonomous rapid transit lines on dedicated lanes to serve citizens by 2020. Capital Metro Board is expected to vote on the proposal before the end of the year.

Bad Birnbach, DE

Policy & Planning Priorities

Land Use and Transit Planning

Pilot Zone Identification

Partners

State Government

Corporate

SME

Non-Governmental Organization

Piloting AVs for

Transit

Deutsche Bahn, Germany's national rail operator chose this Bavarian spa resort town for its first experiments with driverless shuttles. Under the banner of ioki, a subsidiary focused on digital mobility services, the company partnered with shuttle maker EasyMile, industrial safety watchdog TÜV SÜD, and the rural district government of Rottal-Inn to pilot a 700-meter AV transit route linking the Neuer Marktplatz square and the Rottal Terme spa. An extension to the city's central railway station was added in October 2019.

Milestones

2018-04-25: Germany's first AV trial on public roads began with the official launch of Bad Birnbach's driverless shuttle pilot.

What happens when a rail operator experiments with driverless shuttles? (Credit: Deutsche Bahn)

Beaumont, CA

Policy & Planning Priorities

Land Use and Transit Planning

Pilot Zone Identification

Peer Exchange

Partners

Corporate

SME

Piloting AVs for Transit

Beaumont's route was chosen because of its light traffic, no parking along sides and close to proximity to ELA garage for charging and storage. (Credit: City of Beaumont)

Following earlier successful demonstrations in Calgary and Edmonton, the Electric Autonomous shuttle (ELA) program launched its longest pilot route to date in the city of Beaumont, a suburb of Edmonton, featuring an EasyMile EZ10 driverless shuttle. This 6-month pilot run by Pacific Western Transportation was the first time ELA was integrated on a public roadway and in mixed traffic. An initial 1.3 km loop was later extended to 1.7 km.

ELA operated 5 days of the week (Thursday through Monday), and served over 6,200 passengers, logging more than 2,000 km through April 2019. ELA was part of the city's larger Economic Development Framework that hopes to attract investment, industry, and jobs to the city. City Council approved a $200,000 budget for this "strategic economic development investment initiative".

Berlin, DE

Policy & Planning Priorities

Land Use and Transit Planning

Pilot Zone Identification

Partners

State Government

Corporate

SME

University

Piloting AVs for Transit

Germany's first urban test bed for AVs is located between historic Brandenburg Gate and Ernst Reuter Platz. (Credit: Flickr / Gary McNair)

In 2018, this once-divided city celebrated a unique historic milestone: on February 5th, the Berlin Wall had been gone longer than it had stood: some 28 years. Later that year Berlin will begin a three-year project transforming the 6.3 km Diplomatic Route from Ernst Reuter Platz to the Brandenburg Gate into the country's first urban test bed for autonomous vehicles.

The DIGINET-PS project tapped no fewer than three city agencies, making it one of the most multifaceted in the world in terms of intra-governmental coordination: Berlin Partner Network (an economic development organization focused on technology and innovation), the city's public transport agency, and the city's department of environment, transport, and climate protection. The project secured over 5 million euros in funding and special permission from the German national government to allow public tests of autonomous cars.

Several tests of AVs on private streets and campuses had already taken place in Berlin since 2016, utilizing driverless shuttles made by Local Motors and EasyMile.

Milestones

2018-04-01: Deutsche Bahn (DB) and Berlin's Department of Transport (BVG) launched a pilot on-demand driverless shuttle service at the EUREF Campus business park with plans for future testing on nearby public roads.

2019-01-30: BVG partnered with Charité hospital for a series of pilots in two Charité sites: Virchow-Klinikum and Charité Mitte. The project ran until the spring of 2020, and has secured over 3 million euros in federal funding.

Boston, US

Policy & Planning Priorities

Traffic Rules

Land Use and Transit Planning

Peer Exchange

Partners

SME

Piloting AVs for

Private Auto

Taxi

Boston's vision for future transportation—"Zero deaths, zero injuries, zero disparities, zero emissions, zero stress"—set the stage for its AV testing program, launched in 2016. This effort focused on South Boston's Flynn Marine Park, a 191-acre waterfront industrial district occupying the site of a former military base tasked with "creating and protecting jobs that pay decent wages for people at a variety of skill levels". There, the Boston Transportation Department and the Mayor's Office of New Urban Mechanics, a special innovation unit created in 2010, conducted two pilots with local startups using a multi-stage permitting approach.

Startup firm nuTonomy, which was also conducting a trial of an AV taxi service in Singapore, logged more than 300 test miles in the industrial zone, and received city approval to expand AV testing in a wider area in the Seaport and Fort Point neighborhoods. In June 2017, ride-hail giant Lyft announced a partnership with nuTonomy claiming it could soon put "thousands" of AVs onto Boston-area roads.

Optimus Ride, another MIT spin-out company, worked on an AV-based last-mile solution moving passengers between the district's cruise ship docks and other transportation nodes.

Boston recently expanded its containment zone for AV testing, giving nuTonomy a longer leash in the Seaport Innovation District. (Credit: WBUR, City of Boston)

Milestones

2017-12-01: nuTonomy announced the successful completion of its first two-week round of passenger trials in Boston's Seaport Innovation District.

2017-12-28: Lyft and nuTonomy conducted a self-driving ride-for-hire pilot in Boston's Seaport district.

2018-06-27: The City of Boston permitted nuTonomy's driverless cars to expand their test runs city-wide.

2018-06-28: Fourteen municipalities signed an MOU allowing the expansion of AV testing in the state of Massachusetts with a single application.

2018-06-30: World Economic Forum and the Boston Consulting concluded a three-year partnership that explored autonomous urban mobility using Boston as a case study.

2019-03-21: The city's Office of New Urban Mechanics led a proposal to pilot an AV paratransit service for aging and mobility impaired people.

Bristol, UK

Policy & Planning Priorities

Pilot Zone Identification

Partners

University

SME

Corporate

Piloting AVs for

Private Auto

Bristol was the first city to approach AVs from a distinctly user-centered perspective. This happened through an R&D consortium, Flourish, set up in 2015 to focus on AV products and services for senior citizens. The multi-year effort was funded in part by a $7.25 million grant from Innovate UK, bringing together several local universities, Bristol City Council, and AXA, an insurer. The consortium used a mix of simulators and vehicles to understand how people may behave in AVs, and while drawing lessons for vehicle design, operation, and insurance. Venturer, another UK-government backed effort situated in Bristol, conducted three trials using prototype vehicles on city streets beginning in the summer of 2016. The project concluded with a final report published in December 2018.

Researchers hope that AV simulators can unlock a better understanding of human factors that could lead to improved interiors and insurance products. (Credit: VENTURER)

Bryan, US

Policy & Planning Priorities

Land Use and Transit Planning

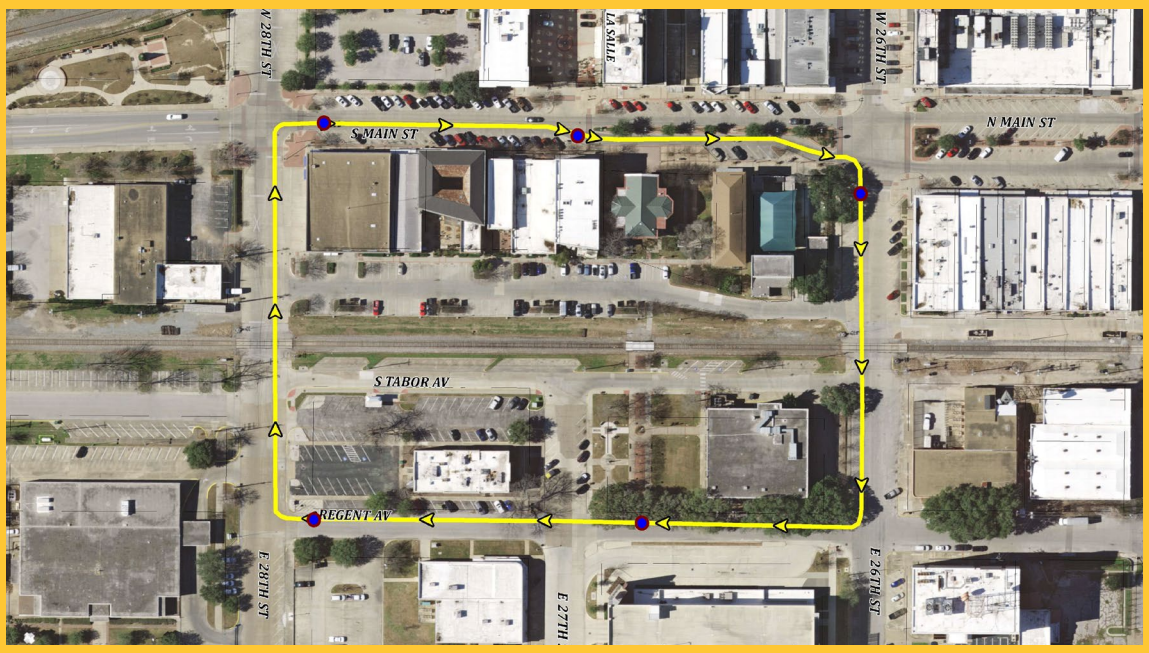
Partners

State Government

University

Piloting AVs for

Transit



The route's five pick-up/drop-off points include: Roy Kelly parking Garage, 28th Street, South Main Street, 26th Street, and Regent Ave. (Credit: City of Bryan)

The university town of Bryan, Texas launched a pilot driverless shuttle route in October 2018. The tests were monitored by Texas A&M's Engineering Experiment Station together with the support of the same university's Transportation Institute, who will help evaluate feedback from future shuttle riders. An initial deployment of two vehicles running on scheduled service along a 0.8 mile downtown loop was expected to be expanded as the project continued. Additional research focused on technical aspects of vehicle deployment as well as exploring future mobility options for the city's public transit system. The project was backed by the Governor's University Research Initiative and the City of Bryan.

Calgary, CA

Policy & Planning Priorities

Pilot Zone Identification

Peer Exchange

Partners

University

Piloting AVs for Transit

Canada's third-largest municipality undertook a multi-pronged approach to preparing for autonomous vehicles. In May 2017, Calgary officials published a comprehensive report surveying the potential role of emerging technologies in the city's transportation network. The study included a full chapter on autonomous vehicles identifying potential scenarios, impacts, future mitigation measures, and next steps.

After that, Calgary has partnered with the University of Alberta and the city of Edmonton on a multi-city AV pilot, creating an information sharing network between the two largest cities in the province of Alberta. Calgary's planned tests were to involve a month-long last-mile driverless shuttle link between TELUS Spark, the city's recently renovated science center, and the Calgary Zoo train station. The project launched in September 2018.

To coordinate future industry AV testing efforts, the city has created an intake process and single point of contact within the Economic Development unit.

Driverless shuttles will test last-mile connections between Calgary Zoo LRT and the TELUS Spark Science Center. (Credit: TELUS Spark)

Cambridge, UK

Policy & Planning Priorities

Land Use and Transit Planning

Pilot Zone Identification

Partners

SME

Piloting AVs for

Transit

Guided busways, first introduced in the 1980s and 1990s, utilize mechanical, optical, or radio sensors to steer buses along a dedicated track. By allowing for automated navigation along a narrow right of way, this technology in many ways is a harbinger of what may be possible when AV technology and Bus Rapid Transit schemes come together in the future. Meanwhile,AV makers are exploring how busways, like the Cambridgeshire Guided Busway could be used by driverless vehicles to fill gaps in current transit services. Launched in 2011 as the world's longest busway, this unique transport link connects Cambridge, Huntingdon and St. Ives.

The idea of using the busway for AV testing got traction with the release of a 2015 study conducted by the University of Cambridge. Initial feasibility tests were led by Coventry-based RDM Group and feature the same PodZero vehicle being tested at Milton Keynes. In 2018, the city closed a successful £3.2million bid for to develop the UK'S first driverless shuttle service . Officials anticipated deployment of a small fleet by 2020 running a roughly 3-mile route along the busway between Cambridge Station, the Cambridge Biomedical Campus, and the Trumpington Park and Ride.

As in many other cities looking at AV-enabled transit, the main priority was to plug existing gaps in transit service, not replacing conventional vehicles. As RDM's director of autonomous mobility argued, "Research has shown that there is demand for hundreds of journeys in the hours when the buses do not run. This is simply due to the cost and the pods can offer a solution that is cheaper to run...this is not replacing the existing service, just complementing it with a practical and effective solution during quieter times of the day." City officials expressed interest in expanding the trial to another section of the city that is underserved by transit: Wellcome Genome Campus and Whittlesford Parkway Railway Station.

RDM's PodZero takes to the Cambridgeshire Guided Busway alongside a dedicated cycle path in early testing. (Credit: Cambridge 105 Radio)

Canberra, AU

Policy & Planning Priorities

Pilot Zone Identification

Partners

SME

University

Piloting AVs for

Private Auto

In 2018, the Australian capital played host to one of the world's largest on-road urban tests of Level 3 autonomous vehicles. The CANDrive Automated Vehicle Trial, scheduled for two years, was a partnership between the Australian Capital Territory (ACT) government, local startup Seeing Machines, the University of Canberra and the Australian National University. The project's goal was to study human behavior in AVs, initially focusing on how quickly drivers can assume control of the car when required. ACT has invested $1.35 million and employed Level 3 AVs in the trial. Some 40 drivers from the city participated in the studies. Findings from ACT is expected to inform future AV policy and regulation, as well as raise public awareness of self-driving technology.

Milestones

2018-06-30: Authorities released CAN Drive Trials first public report.

Canberra is one of only a handful of cities hosting pilots of partially-automated vehicles. (Credit: ACT Government)

Candiac, CA

Policy & Planning Priorities

Land Use and Transit Planning

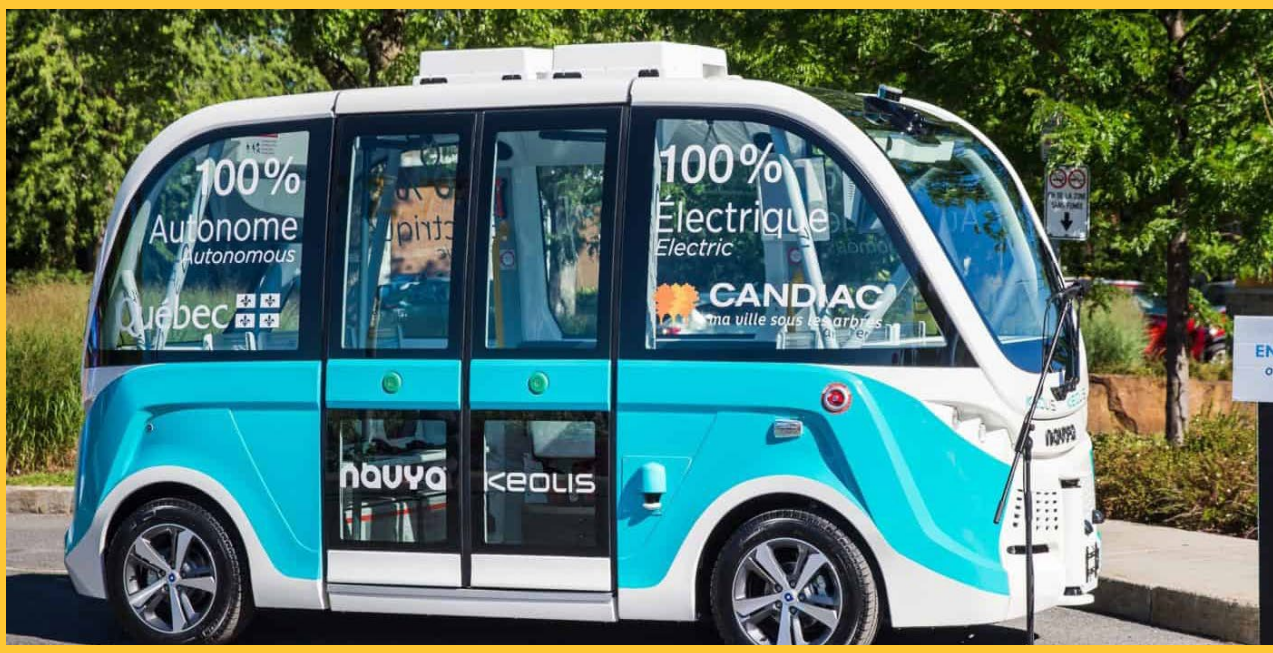
Partners

State Government

Corporate

SME

Piloting AVs for Transit



Canada's first test of a driverless shuttle on a public road will take place outside Montreal. (Credit: City of Candiac)

Candiac, a planned city and a suburb of Montreal, was formed in 1957 through the pairing of Canadian and European investors.

For 12 months beginning in September 2018, residents enjoyed free access to a single Navya driverless shuttle running a two-kilometer route. The shuttle connected André-J.Côté Park, City Hall and the Chartwell's Montcalm Retirement Complex, a senior home. The project cost $750,000 and the Government of Quebec shouldered close to half the amount. Other partners included Keolis Canada, Propulsion Quebec, Cluster for Electric and Smart Transport, and Technopole IVEO.

Chandler, US

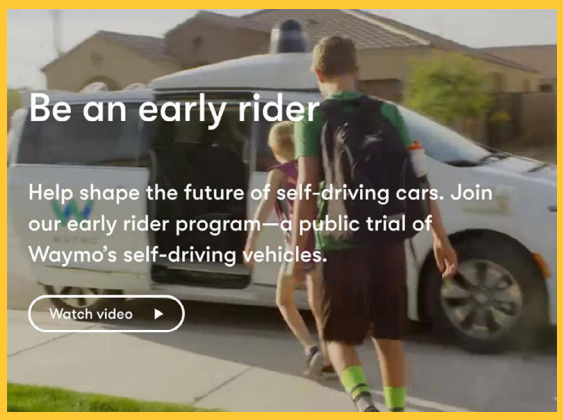
Policy & Planning Priorities
Traffic Rules

Partners
Corporate

Piloting AVs for
Private Auto

Home to some of Intel's most advanced chip making facilities—as well as the company's Advanced Vehicle Lab and AV test fleet—this suburban community of 250,000 people was the epicenter of a fast-growing collection of "offshore" AV pilots in the Phoenix metro area. What is the region's appeal for AV inventors? It's close enough to Silicon Valley for day trips, but outside the reach of California regulators, offering Arizona's laissez-faire approach to AV testing instead.

The first major infusion of AV testing came in December 2016, when Uber staged a dramatic overnight redeployment of a fleet of six self-driving Volvo SUVs that it had been testing in San Francisco. After a standoff with California officials over the company's failure to seek permission for the pilot, Arizona provided a quick getaway. Then in April 2017, Waymo announced a hunt for 500 families to be "early riders" in four Phoenix suburbs, including Chandler. Over the course of the program, participants had everyday access to Waymo's fleet of self-driving minivans managed by Avis.



Some 500 Phoenix-area families will be the first to experience the benefits of private AV ownership. (Credit: Waymo)

Milestones

2017-11-07: Waymo announced that parts of its Phoenix-area AV fleet will operate in full self-driving mode without human attendants.

2018-02-17: Arizona officials granted transportation network company (TNC) status to Waymo, paving the way for launch of public self-driving taxi service.

2018-04-27: Chandler's Planning and Zoning Commission introduced zoning code amendments as it anticipates increased use of ride-sharing and self-driving cars.

2018-07-26: Waymo announced key partnerships and test pilots with Walmart and Ahwatukee Foothills Towne Center, a shopping center, to provide self-driving taxi connections for customers in lieu of driving and parking private vehicles on-site.

2019-06-24: City of Chandler began a pilot allowing select employees to hail Waymo vehicles for off-site meetings.

Chiba City, JP

Policy & Planning Priorities

Pilot Zone Identification

Partners

SME

University

Piloting AVs for

Freight

Chiba is combining its unique position as host to industry giants like Rakuten and high-tech research hubs at Chiba University to become Japan's Silicon Valley. (Credit: Japan External Trade Organization)

With easy access from nearby Narita Airport, the Tokyo region's international gateway, this city is a natural test ground to explore the future of drone delivery. Since the city was designated as a National Strategic Special Zone for drone deliveries in 2016, the Chiba city government has formed partnerships with national government agencies and firms including Japanese e-commerce giant Rakuten.

In November 2016, a drone conducted a flight demonstration in which it flew over the water to complete a delivery from a distribution center on the shore of Tokyo Bay. In this experiment, a test operator used a smartphone app to order goods, triggering a drone to automatically take flight and make the 700-meter trip along the coastline to complete delivery. The drone was developed by Autonomous Control Systems Laboratory, a Chiba University spinout with $6.4m in backing.

Future tests will involve an actual live customer delivery from a distribution center on the coast of Tokyo Bay to the high-rise apartment complexes in Makuhari New City's Wakaba Residential District 10 km away.

Columbus, US

Policy & Planning Priorities

Pilot Zone Identification

Peer Exchange

Partners

Corporate

Piloting AVs for

Transit

After beating out 77 other American cities in 2016 to win the U.S. Department of Transportation's Smart City Challenge competition, Columbus, Ohio emerged as the key arena for rethinking the future of transportation in mid-sized American cities. The city leveraged some$40 million in federal funding, over $430 million in total commitments were also secured for a variety of tech-enabled mobility innovation efforts. The campaign's Connected Electric Autonomous Vehicles experiment hopes to launch in 2020 and involve six driverless shuttles operating on three fixed routes in mixed traffic at the Easton Town Center, an outdoor retail, residential and jobs center in the city's northeast.

Easton Town Center, which underwent a major expansion in 2013, will be a key AV proving ground for the city's federally-funded Smart Columbus initiative. (Credit: Steve Brady/Easton Town Center)

Milestones

2018-01-30: Students at Ohio State University explored the impact of AVs in Downtown Columbus, forecasting a "25% adoption rate of full, self-driving vehicles by 2035, and a 10% reduction in the need for parking in Downtown."

2018-07-04: Columbus officials released an RFP for a self-driving shuttle to begin operation along the Scioto Mile waterfront in October.

2018-09-21: In December, three self-driving shuttles began a year-long operation along the Scioto Mile in Columbus. The route connected riders to COSI, the National Veterans Memorial and Bicentennial Park. Partner organizations include Smart Columbus, ODOT's Drive Ohio, and Michigan-based May Mobilty.

Concord, US

Policy & Planning Priorities

Pilot Zone Identification

Partners

SME

Piloting AVs for Freight

In May 2017, the city of San Francisco considered a bill to ban sidewalk delivery robots. But that did not stop startups from testing in other Bay Area cities.

In July, Starship Technologies shifted its sights to Concord, California, the largest city in nearby Contra Costa County where it began testing a dozen pint-sized AVs. Under an agreement with the city, the company paired each bot with a human handler for the first year of operation. Less than three months later, competitor Marble Robotics struck a similar deal to test in Concord.

Concord is no stranger to AV tests, though this is the first time such experiments took place on city streets. The city is home to GoMentum Station, the nation's largest secure testing facility for autonomous and connected vehicle technology, which counts among its clients companies such as Uber, Baidu, Honda, Toyota, and EasyMile.

Concord is fast becoming the San Francisco Bay Area's go-to pilot community for last-mile AV delivery startups. (Credit: City of Concord)

Copenhagen, DK

In May 2017, Danish company Autonomous Mobility tested a driverless shuttle at the DTU Lyngby campus. (Credit: DTU)

Nobina, which operates bus systems across the Nordic region, announced in November 2017 plans to launch a pilot involving four autonomous buses in the Greater Copenhagen area for three years beginning in mid-2018. Two test areas were selected: in Lyngby, at the Technical University of Denmark campus (The university opened its own drones and autonomous vehicles testing facility in November 2017), and in the western suburb of Albertslund.

In June 2018, the EU AVENUE Project chose the North Sea Quarter at Nordhavn, a new waterfront city district, as one of four sites to host a large scale urban AV trial. AVENUE is a four year project supported by the EU's Horizon 2020 Research and Innovation Programme and backed with €22 million budget. The Nordhavn pilot featured feature three Navya Autonom Shuttles and served as a connection for residents and workers to/from a nearby train station.

Cossonay, CH

Policy & Planning Priorities

Land Use and Transit Planning

Partners

SME

Piloting AVs for

Transit

Cossonay's century-old funicular, the mountain village's lifeline to the valley below, was automated in 1969. Now, driverless shuttles provide last-mile links from the funicular's summit to destinations around the old town. (Credit: Flickr / Isabelle Duperrex)

The funicular railway of Cossonay provides an important link between this Alpine town (elev: 1,800m), and its main railway station located in the valley below. The funicular is an inclined railway service where a cable helps the tram-like vehicles ascend and descend by counterbalancing each other. Cossonay-Ville's funicular station, operated by local transit authority MBC, opened in 1897 and automated its services in 1969.

Driverless shuttles extended this connection from the funicular station to key attractions in the old town. The shuttles, operated in conjunction with BestMile and Navya, traveled on two different 1.7 km loops, each featuring 8 stops. Initial plans to integrate the service into the town's public transport network by December 10, 2017 were pushed back to further refine shuttles performance in the city's steep roads.

The two shuttles began their public service in March of 2018 between Beer Station and Gottaz Mall.

Darwin, AU

Policy & Planning Priorities

Land Use and Transit Planning

Pilot Zone Identification

Partners

State Government

Corporate

Piloting AVs for

Transit

In 2017, the capital of Australia's Northern Territory conducted two pilots of driverless shuttle service serving over 6,000 passengers. During the first phase, AVs operated on open public roads between Stokes Hill Wharf and the Darwin Waterfront. Phase two shifted testing to a network of pedestrian paths serving restaurants and retail shops on Kitchener Bay.

The project was a joint initiative between the Department of Infrastructure, Planning and Logistics of the Northern Territory Government and the Darwin Waterfront Corporation. Findings of both phases are expected to inform future plans for transport services in the city. An evaluation summary released after the first trial reported an 88% acceptance rate among riders.

The second phase of the Darwin Waterfront trials will explore the AV shuttle operation in a dedicated pedestrian environment. (Credit: NorthernTerritory Government)

Denver, US

Policy & Planning Priorities

Pilot Zone Identification

Otto's self-driving truck en route to Denver on I-25 during the first commercial AV freight delivery in October 2016. (Credit: Otto)

For Denver, the heart of a high-tech region set against dramatic natural beauty, AVs represented an opportunity to create a new kind of city, designed around people rather than cars, and to maximize mobility while minimizing inequality. The city laid the foundation for AV innovation primarily via a connected vehicle pilot, carried out through a federal grant, to establish a robust infrastructure and governance system that would accommodate future AV-generated data. As it planned and implemented this platform, the city carefully considered best practices for policies, interoperability standards, collection, storage, analysis and distribution, and enabling data exchange.

Milestones

2017-12-04: Following a successful demonstration in December, in partnership with Panasonic, regional and state transport authorities launched a last-mile service connecting the A-Line commuter rail and the company's Denver Airport area campus.

Detroit, US

Policy & Planning Priorities

Pilot Zone Identification

Partners

SME

Piloting AVs for Transit

Detroit's first AV pilot will employ a 6-passenger electric shuttle vehicle manufactured by Minnesota-based Polaris Industries, and equipped for AV operation by Ann Arbor-based May Mobility. (Credit: May Mobility)

The Motor City entered the driverless era via a combination of private investment in an AV pilot and city investment in innovation leadership. In October 2017, a five-day trial was conducted by May Mobility, a University of Michigan spinoff based in nearby Ann Arbor. Two six-passenger electric shuttle vehicles, outfitted by May Mobility for autonomous operation, ferried employees of billionaire tech and real estate mogul Dan Gilbert's Bedrock LLC on a mile-long route between the First National Building and the city's Bricktown Car Garage.

Coordinating the city's involvement in planning and evaluation of the pilot was the city's first-ever Director of Mobility Innovation, appointed in November 2016. The purview of this new leadership position includes spearheading a variety of experiments, developing a comprehensive mobility plan, and developing funding sources for new initiatives.

Milestones

2017-12-14: Ford announced it will consolidate more than 200 employees in its autonomous vehicle and electric vehicle business and strategy teams at a historic factory in Detroit's Corktown district by the end of 2018.

2018-06-20: Ford began work to transform Michigan Central Station into a global center for autonomous driving and mobility innovation.

2018-06-26: After the 2017 trial, May Mobility's driverless shuttles became the first commercial fleet to begin regular operation in Detroit's central business district.

2018-09-18: Knight Foundation awarded a grant allowing city officials to explore a pilot for a self-driving shuttle that will connect Detroiters to/from bus stops to employment hubs.

Doraville, US

Policy & Planning Priorities

Land Use and Transit Planning

Pilot Zone Identification

Partners

SME

Piloting AVs for

Transit

On the outskirts of Atlanta, a site whose history has been shaped by the automobile has been reimagined by developer Integral Group as a transit-focused, mixed-use community with driverless shuttles providing a key link in local mobility. From 1947 to 2008 GM's Doraville Assembly plant churned out Buicks, Oldsmobiles, and Pontiacs.

Development of the new Assembly District was first earmarked by city officials and community members in Doraville's most recent 20 year comprehensive plan.

In 2017, Integral tapped Navya to run the last mile service to and from MARTA's Doraville Station. The shuttles tested both fixed route and on-demand services.

With an additional 1.3 million square feet of space set to open in the next 22 months, Assembly Yards announced a partnership to bring Navya Autonom Shuttles to the development. (Credit: Assembly Yards)

Dubai, UAE

Policy & Planning Priorities

City Fleets

Pilot Zone Identification

Partners

Non-Governmental Organization

SME

Corporate

Piloting AVs for

Private Auto

Transit

Taxi

In 2016, Dubai set an ambitious goal—to shift 25 percent of passenger journeys to AVs by 2030.

One tool the country hoped will accelerate its efforts is the World Challenge for "Self-driving Transport", a multi-year challenge organized by the Dubai Road and Transport Authority. The innovation contest's launch edition focused on first/last-mile solutions with $5 million in prize money offered in three separate categories to established industry leaders, startups, and students. The process culminated in October 2019 when Dubai hosted the World Congress for Self-driving Transport. French AV manufacturers Navya and EasyMile, including Finnish startup Sensible 4 came out on top of their respective categories.

Dubai's Autonomous Transportation Strategy, published in April 2016, was the world's most comprehensive AV plan and forecasts slashing transportation costs by 44 percent, reducing accidents by 12 percent, and saving 396 million person-hours from reduced congestion.

Initial efforts to implement this program included a driverless shuttle demonstration with Emaar, a leading real estate developer, the Dubai Taxi Corporation's acquisition of 200 Autopilot-equipped Tesla S sedans, and establishment of a partnership with OTSAW, a Singaporean robotics firms, to develop an AV police car fleet. Long-term plans will see a driverless shuttle service to link the 2020 World Expo site on man-made Bluewaters Island to the mainland. Dubai has also signalled its interest in developing an AV air transport network with pilot tests from German-based Volocopter and EHang, a Chinese drone maker.

The German-made Volocopter takes it maiden flight over Dubai in September 2017. (Credit: Government of Dubai)

Milestones

2018-01-22: Diamond Developers, creators of the 500-home mixed use Sustainable City tract within in the country's massive Dubailand theme park project announced they will work with the country's Road and Transport Authority to create an AV testbed and infrastructure.

2018-10-29: RTA announced finalists for all categories participating in the Dubai World Challenge for Self Driving. An intensive testing period will begin before winners are announced during the Dubai World Conference for Self-Driving Transport in October 2019.

Edmonton, CA

Policy & Planning Priorities

Land Use and Transit Planning

Pilot Zone Identification

Peer Exchange

Partners

State Government

Corporate

University

Piloting AVs for Transit

A historic district located south of the city center, Old Strathcona hosted a week of tests for the self-driving shuttle. (Credit: City of Edmonton)

The city known as "Canada's Gateway to the North" began a series of self-driving shuttle trials in October 2018. These trials came on the heels of a comprehensive planning effort launched in 2016 when the city's Department of Sustainable Development released Planning for Automated Vehicles in Edmonton, a study that identified public perception as key area of concern for the city's AV efforts. In 2017, a follow up Strategic Transport Action Plan proposed locations for a possible pilot across Alberta's capital city.

Edmonton officials evaluated the results of the first wave of trials as they prepared to request an extension of the program from city council. In 2019, one self-driving shuttle operated by the Pacific Western Transport Group completed two-week trials in four of Edmonton's neighborhoods. This included an airport redevelopment site, historic downtown area, and the ACTIVE-AURORA Testbed at the University of Alberta where researchers tested the bus' cold-weather adaptation and cybersecurity.

Prior to the trials in Edmonton, ELA (Electric Autonomous Vehicle), the self-driving shuttle, completed a one-month trial in Calgary's TELUS Science Park.

Eindhoven, NL

Policy & Planning Priorities

Peer Exchange

Partners

SME

State Government

University

Piloting AVs for Private Auto

Amber's shared electric cars on standby at a corporate campus. (Credit: Amber Mobility)

Eindhoven played host to an ambitious effort to deploy electric AVs specifically designed for car sharing. Amber Mobility, a local startup, which already provided an electric car share service to business customers in the region using BMW i3 cars designed for an ultra-long lifespan of up to 1.5 million kilometers (930,000 miles). Amber Mobility planned to launch a subscription car share service for €33 ($37) per week.

Eindhoven also participated in the MobilitymoveZ.NL project, an initiative of the North Brabant provincial government. Along with the neighboring cities of Helmond and Tilburg, Eindhoven was part of an Urban Mobility Testing Area for testing AV and other technologies.

Espoo, FI

Policy & Planning Priorities

Land Use and Transit Planning

City Fleets

Pilot Zone Identification

Partners

State Government

Corporate

SME

University

Piloting AVs for transit

Espoo, Finland's second largest city, began a pilot of a driverless shuttle service in June 2019. Gacha, the shuttle designed by Japanese firm Muji in partnership with Finnish firm Sensible 4, served the Otaniemi-Keilaniemi area, a high-tech innovation cluster. Two shuttles ran Tuesday-Thursday from 10:00-14:00 on a three-stop 2 km route connecting passengers disembarking from Aalto University Metro Station to nearby apartments and offices. The long-term goal, however, was to build towards a year-round permanent bus service by 2021.

This was the Gacha bus' first public trial. The 4WD all-weather electric vehicles had a capacity of 16 (10 sitting, 6 standing), a maximum speed of 40 km/h in autonomous mode, and wireless charging capability. Additional Gacha deployments are planned in several other Finnish cities: Hämeenlinna, Vantaa and Helsinki.

The Gacha shuttles operate in mixed traffic along the 2km route. (Credit: Sensible4)

Fribourg, CH

Policy & Planning Priorities

Land Use and Transit Planning

Partners

State Government

Piloting AVs for

Transit

The Marly Innovation Center, a startup-focused business park, is Fribourg's first deployment of AV-enabled public transit. (Credit: Navya)

Fribourg was home to Switzerland's first autonomous transport service, featuring two Navya driverless shuttles operating on a 1.3 km route with four stops. The service provided a last mile connection between local transit lines and the Marly Innovation Center, a district boasting over 100 startups.

The project cost approximately $700,000. The canton (e.g. state) of Fribourg paid for one shuttle, with the other financed by the Marly Innovation Center. Initial operating costs during a fare-free test period starting in August 2017 were supported by the city of Fribourg, with Fribourg Public Transport (TPF) assuming costs once fares were introduced in December 2017.

Frisco, US

Policy & Planning Priorities

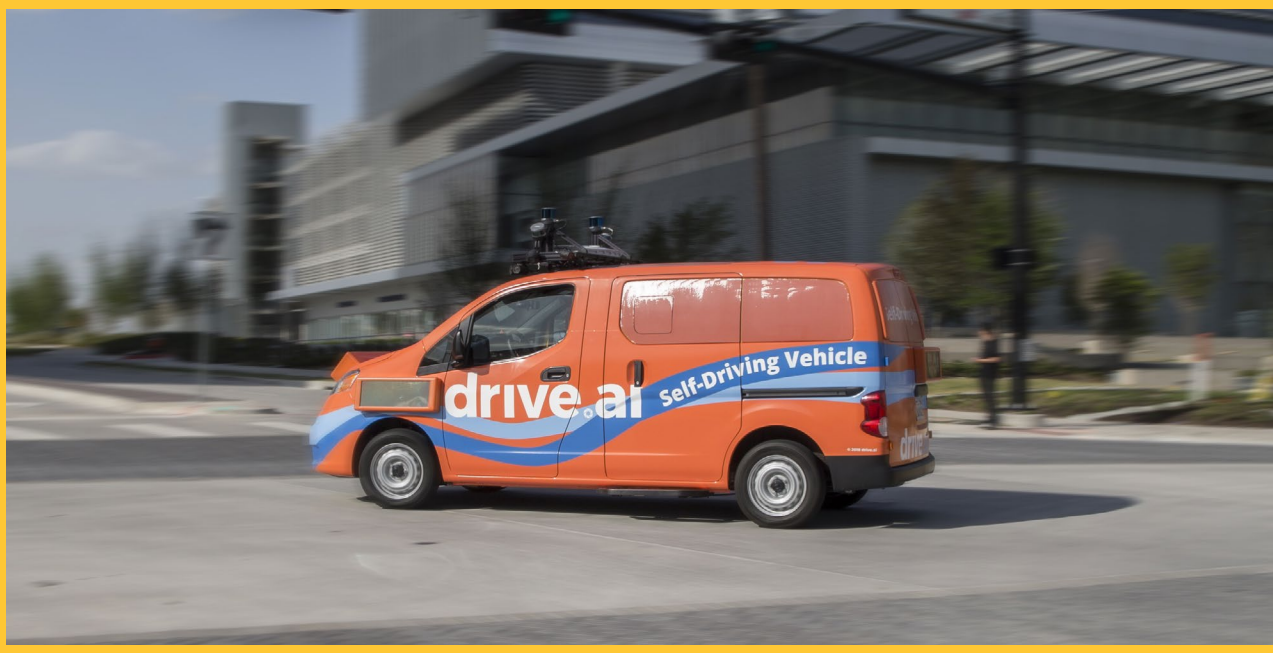
Land Use and Transit Planning

Pilot Zone Identification

Partners

SME

Piloting AVs for Transit



The City of Frisco is teaming up with public and private partners to launch a Texas' first self-driving shuttle service. (Credit: Drive.ai)

Frisco, located within Dallas-Fort Worth metropolitan region, began driverless shuttle service in July 2018. This pilot marked the first on-demand, self-driving transportation service operating on public roads in Texas. It was conducted in partnership with Drive.ai, a California-based firm, in a geo-fenced area in the city's North Platinum Corridor. Employees in the district were able to request rides using their smartphone to six designated drop-off points in the corridor from 10:00 am to 7 pm. Drive.ai's seven level 4 autonomous Nissan NV200 vans were outfitted with outward-facing display panels designed for easy communication to approaching passengers. The six-month pilot connected a business park to The Star, a 91-acre premier sports and entertainment district, and with planned expansion into Frisco Station.

Gainesville, US

Policy & Planning Priorities

Land Use and Transit Planning

Pilot Zone Identification

Partners

State Government

Corporate

University

Piloting AVs for Transit

In partnership with the University of Florida and public transit giant Transdev, Gainesville launched a driverless shuttle service in 2018. Named in honor of the University of Florida's mascot, GATORS (Gainesville Autonomous Transit Service) transported students between the campus and downtown Gainesville. The route was serviced by four driverless shuttles and will run daily from Monday to Friday during the three-year pilot. Funding came from the Florida Department of Transportation via a $2.7 million grant.

This marks the first AV project in North America for Transdev, one of the world's largest transit operators, which also operates driverless shuttle systems at a business park in Rotterdam and at a nuclear power station in Civaux, France. The company's North American arm runs some 200-plus systems and takes in more than $3 billion in annual revenues.

An autonomous shuttle will begin a three-year trial between University of Florida and Downtown Gainesville in 2018. (Credit: University of Florida Transportation Institute)

Milestones

2018-10-13: Gainesville's driverless shuttle service was delayed as operators await clearance from National Highway Traffic Safety Administration (NHTSA) officials.

Geneva, CH

Policy & Planning Priorities

Land Use and Transit Planning

Pilot Zone Identification

Partners

State Government

SME

University

Piloting AVs for

Transit

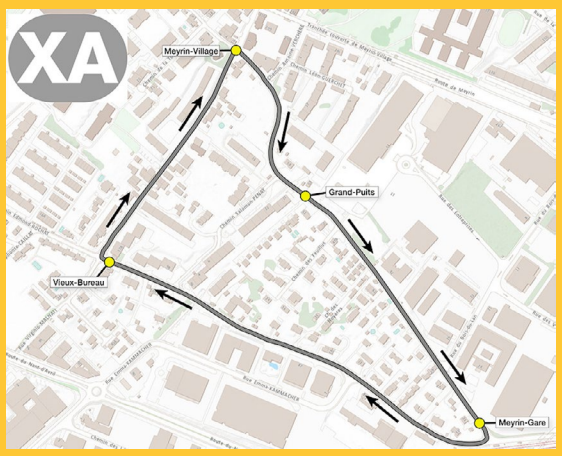
Initial efforts to pilot AVs in the Geneva region focused on the municipality of Meyrin, north-west of the city center. Meyrin is home to the European Council for Nuclear Research, known as CERN, one of the world's leading centers for science and home to the largest and most powerful particle accelerator ever built, the Large Hadron Collider.

A single Navya Arma driverless shuttle operated on a 2.3 km, 3 -stop route. Extensions linked to the Les Verges Ecoquarter, a 1200-unit sustainable housing cooperative, as more vehicles were delivered to Geneva's Public Transport Department. Navya's shuttle worked alongside a conventional bus on a regular schedule.

Geneva was chosen as one of four testing sites of the EU AVENUE Project. The large scale urban demonstrations are backed by a € 22 million budget from the EU Horizon 2020 Research and Innovation Programme. Other partners include the University of Geneva, State of Geneva, Best-Mile, and MobileThinking.

Milestones

2019-07-01: For the second year of the pilot, officials were set to deploy an additional 3-4 AVs and begin new trials increasing vehicle speed and offering new services. The Belle-Idee Hospital was also been chosen as a possible candidate for service area expansion.



Line XA begins at the Meyrin-Gare railway station and makes three additional stops in the immediate area. (Credit: Geneva Public Transport)

Gothenburg, SE

Policy & Planning Priorities

- Traffic Rules
- Land Use and Transit Planning
- Peer Exchange

Partners

- Corporate
- University
- Non-Governmental Organization
- SME

Piloting AVs for

- Private Auto
- Transit

Headquarters to the Volvo Group since its founding in 1927, Gothenburg's fortunes have long been rooted in the automotive industry. Another turn in this long partnership was DriveMe, an AV pilot launched by Volvo Cars (a separate company sold to China's Geely group in 2010) in 2017. This research effort involved 100 families, selected in consultation with local university experts and the Swedish Transport Administration, which was set to receive Level 4 Volvo hybrid SUVs. The pilot envisioned to shed light on key assumptions about the benefits, infrastructure requirements, safety, and public perception of private AVs. Following negotiations stretching back to 2013, a 31 mile (50 km) loop of highways linking downtown and outlying suburbs was designated for the tests, which the partners considered as the beginning of a "long transition period when AVs and conventional vehicles will co-exist".

In 2018, another AV pilot led by RISE Viktoria, a transportation research institute saw a regular weekday shuttle run between Chalmers University, Johanneberg Science Park, and the library. An appropriate route for a second pilot in Lindholmen Science park is still being selected.

Milestones

2017-11-20: Gothenburg published two use cases for AVs it will study as part of the EU-funded CoEXist project: operating in shared spaces with cyclists and pedestrians and the use of AVs during construction projects that disrupt street networks.

2017-12-14: Gothenburg's City Planning Office announced a year-long study on AVs to help inform the city's long-term sustainability goals.

2017-12-18: Volvo delivered the first two AVs for DriveMe trial but significantly pushed back project timeline.

Volvo's DriveMe proving ground covers a variety of popular commuter roads in the Gothenburg region. (Credit: Volvo Cars)

2018-05-03: RISE Viktoria, a partnership of 15 organizations and companies, launched a one-month driverless shuttle trial at Chalmers University, with plans to extend the test to a 6-month pilot at Lindholmen Science Park.

2018-09-14: Transport Styrelesen, the Swedish Transport Agency and authority on self-driving experiments, issued Volvo's DriveMe project the first permit to test passenger cars in and around Gothenburg's public roads.

2019-06-13: Vera, a modular AV by Volvo Trucks, began to tests its capabilities between DFDS logistics centre in Gothenburg to an APM container terminal.

Grand Rapids, US

Policy & Planning Priorities

Land Use and Transit Planning

Partners

Corporate

SME

Piloting AVs for

Transit

Paratransit

The Grand Rapids Autonomous Mobility Initiative brought together a consortium of 9 entities including the City of Grand Rapids and shuttle manufacturer May Mobility to test four self-driving shuttles for one year beginning in March 2019. The shuttles connected riders along a 3.2 mile loop running side-by-side with the city's West Route Bus Service linking parking lots to museums, sports arenas, and community spaces in downtown Grand Rapids, and the business district. The Grand Rapids pilot was the third for Ann Arbor, Michigan-based May Mobility, which had already tested driverless shuttles in Detroit and Columbus, Ohio.

According to Crains Detroit, the city committed $250,000 of dedicated funding to the project. Notably, and unlike most cities, the city had identified three specific learning goals at the outset of this pilot. First, understand the feasibility of AVs and impacts on "existing urban structures". Second, address accessibility issues, with a particular focus on the elderly and people with disabilities, "and explore solutions around design of interiors and the urban environment to facilitate accessibility." Third, "prepare the local community and neighborhoods for the effects of autonomous mobility. This is a priority for the initiative and will include open sessions for community stakeholders for community visioning, goal setting, plan making and recommendations for public investments."

Grand Rapids' first self-driving tests will see shuttles operate alongside the West Route Bus Service. (Credit: May Mobility)

Greenville, US

Policy & Planning Priorities

Land Use and Transit Planning

Pilot Zone Identification

Partners

Non-Governmental Organization

SME

University

Piloting AVs for

Transit

Greenville is located in the Upstate region of South Carolina, which became a major global hub for auto manufacturing. BMW operates its largest plant worldwide there, employing some 8,000 workers. Two-thirds of the plant's output is exported. Volvo and Mercedes are also setting up operations in the Palmetto State. Clemson University's 250-acre International Center for Automotive Research (CU-ICAR), located in Greenville, was established in 2003 and hopes to become a major center for autonomous vehicle research and development.

That dream took a big step forward in October 2017, when Greenville County secured a $4 million federal grant to fund implementation of plans laid out in one of the most detailed studies of a regional AV-based transit system. The federal grant funded three phases of development for a pilot network that begins to realize this vision. Phase 0 tests will link the CU-ICAR campus and the nearby Center for Manufacturing Innovation (part of Greenville Technical College), employing self-driving electric carts developed by Robotic Research, a Maryland-based firm that supplies autonomous software to the U.S. Army. This route will be extended to other nearby locations including "Hubbell Lighting, TD Regional Banking Center, an apartment complex, two hotels, a restaurant and the Whole Foods shopping center." Phase 1 will expand the test to Verdae, a master planned residential community using 2 to 6 larger, custom-manufactured AVs. Verdae has committed $1 million to build a mobility center linking the AV service to other modes of transport. Phase 2, slated to begin in late 2018, seeks to extend tests to 'nationally significant problems' including non-emergency medical transportation and first/last mile in a low-density, low-income neighborhood.

Verdae, a gated residential community, could soon become one of America's largest test beds for automated vehicles under a new federally-funded research project. (Credit: Verdae Development)

Groningen, NL

Policy & Planning Priorities

Land Use and Transit Planning

Pilot Zone Identification

Peer Exchange

Partners

State Government

Corporate

SME

Piloting AVs for

Transit

Paratransit

The ambitious "AT-North" or "@north" consortium brought together the three provinces of northeast Holland—Groningen, Fryslân, and Drenthe—to market the region as an integrated pilot region for automated transport "on the road, by rail, by air", and "on the water".

The first effort, Groningen's self-driving shuttle pilot, got underway in August 2018. A Navya shuttle ran from the Scheemda Village bus stop in Oldambt Municipality to the Ommelander Ziekenhuis Hospital entrance. The pilot was extended to run until the end of 2019 one leg of the route offers an additional shuttle with wheelchair transport services to visitors. This project was a collaboration between Province of Groningen, the Ommelander Ziekenhuis, Arriva, and the RDW (the Dutch Vehicle and Driver Licensing Authority).

The year-long pilot connects commuters to/from the Ommelander Ziekenhuis Hospital. (Credit: Autonoom Vervoer Noord NL)

Guangzhou, CN

Policy & Planning Priorities

Taxi Regulation

Pilot Zone Identification

Partners

SME

Piloting AVs for

Taxi

With a population surpassing 50 million people, the Pearl River Delta is the world's largest urban agglomeration, as well as its most important manufacturing region. It has powered China's remarkable export-led manufacturing growth over the last four decades, and the region now leads the country's transition to high-tech.

In 2018, two pilots in the regional capital of Guangzhou highlighted the growing number of local startups working on AV technology. Running from March through May, both took place in special economic zones focused on export processing. In the Nansha district where the company's headquarters is located, Pony.ai operated a 6-vehicle fleet within a 30 square kilometre area. JingChi, another AV startup, launched a similar pilot at the BioTech Island on 1.8 square kilometer area. JingChi executives saw the trials as a step towards an initial production run of 500 to 1,000 vehicles by the end of 2018. JingChi and Guangzhou city jointly launched a $1.5 billion AV industry fund backed by financial investors, according to China Daily.

Two Chinese startups will use Guangzhou as a test bed for their on-demand self-driving pilots. (Credit: Flickr / wallace_Lan)

Haarlem, NL

Policy & Planning Priorities

City Fleets

Partners

Corporate

Non-Governmental Organization

Piloting AVs for Transit

Daimler's Future Bus with CityPilot automated bus travels down the road without the intervention of a human driver. (Credit: Daimler)

The province of Noord-Holland is home to the longest bus rapid transit (BRT) line in the Netherlands, linking the city of Haarlem with Amsterdam's Schiphol Airport. In 2015, Daimler Buses—a division of Mercedes-Benz and the world's largest manufacturer of buses—tested a self-driving bus with Level 3 capabilities along the 12.5 mile (20km) route. CityPilot, the company's name for the vehicle's autonomous driving system, was a repurposed version of products previously tested on long-haul trucks. It relies on radar and cameras to detect other vehicles, pedestrians, and to interpret traffic signals. Daimler announced up to €200 million ($225 million) in future R&D commitments for bus technologies.

In September 2017, Noord-Holland hosted a hackathon focused on creating a traffic information system for self-driving cars throughout the province.

Hamburg, DE

Policy & Planning Priorities

Land Use and Transit Planning

Pilot Zone Identification

Partners

State Government

Corporate

Piloting AVs for

Transit

Freight

IAV's minibus can travel up to 50 km/h and carry up to 10 passengers. (Credit: IAV)

Rising on the former Port of Hamburg - Hafencity was Europe's largest urban renewal project. For four years, starting in the autumn of 2018, the district will host a trial of driverless shuttles as part of the Hamburg Electric Autonomous Transportation (HEAT) project. HEAT will be led by HOCHBAHN AG, the city's public transport provider, along with an array of state and industrial partners including Siemens and the German Aerospace Center, and was supported by a total of €3.7 million in local and state funding. Hamburg was already leading the conversion of German city bus fleets to electric transport by 2020, and the ERTICO Network reported that zero-emission self-driving shuttles would be developed especially for the city.

Hamburg's partners unveiled the AV shuttle produced by German automaker IAV in August 2019. The five-meter long electric powered shuttles began trials and started to accept passengers in mid-2020. For now, the shuttles' on-board sensors will be augmented by roadside sensors, according to IAV.

Milestones

2018-10-04: The City of Hamburg partnered with Volkswagen AG to launch a series of tests for automated trucks at the Hamburg Hafen, Europe's third largest port.

Helsinki, FI

Policy & Planning Priorities

- Taxi Regulation
- Traffic Rules
- Land Use and Transit Planning
- City Fleets
- Pilot Zone Identification
- Peer Exchange

Partners

- Corporate
- University

Piloting AVs for

- Transit

A global leader in the smart city movement, Helsinki grabbed headlines in late 2016 with the SOHJOA "robot bus" pilot. The pilot featured an Easymile EZ10 bus traversing a 1/4-mile route on the city's Hernesaari waterfront district, which helped the city increase public awareness of AV technology.

The next phase of automated bus tests, called Helsinki RoboBusLine, ran for three years under the EU-funded mySMARTLife research program, a multi-city project aimed at reducing carbon emissions. In the meantime, Helsinki did not only innovate via technology but also the way government will create the capacity to drive innovation: the city's Chief Design Officer, a position created in 2016, will oversee cross-cutting efforts to integrate AVs into the urban environment.

Milestones

2018-05-14: Helsinki's self-driving shuttle (94R) began regular service between a regular Helsinki Bus Line Stop and Kivikko Sports Park.

In Helsinki, signs alert drivers to the presence of robotic vehicles. (Credit: SOHJOA)

Houston, US

Policy & Planning Priorities

City Fleets

Pilot Zone Identification

Partners

State Government

University

Piloting AVs for Transit

Cities like Houston are beginning to capitalize on the DOT's AV proving ground designation through a driverless pilot in Texas Southern University. (Credit: Wikimedia Commons / Carol M. Highsmith)

Houston's Metropolitan Transit Authority of Harris County (METRO) chose Texas Southern University as the city's first test bed for a self-driving pilot. METRO'S board approved a $250,000 budget for the first phase of the trial slated to begin in the Fall of 2018. On top of standard safety tests that METRO conducted, they also explored workforce development opportunities for the shuttle's operators, according to METRO's Chief Innovation Officer Kimberly Williams on Houston Public Media.

The partnership banked on the expertise of TSU's Center for Transportation Research when the vehicles began operation on mile-long Tiger Walk. Partners included the City of Houston, Houston-Galveston Area Council, and the Texas DOT.

Milestones

2019-06-17: Nuro and Domino's partner to bring pizza to Houston residents using autonomous delivery vehicles.

Jacksonville, US

Policy & Planning Priorities

City Fleets

Few people have ever ridden in an autonomous automobile, but most of us have at some point ridden in a fully-automated transit vehicle. 'People movers', as these grade-separated networks are known, are commonly found at airports, theme parks and a number of downtown districts. The Jacksonville Skyway, an extensive downtown people mover system which opened in 1989, carries more than 1 million people per year along a 2.5-mile, 8-station network

Unlike today's autonomous vehicles which combine advanced sensors and image processing (so-called 'machine vision'), these older systems simply followed fixed tracks or radio beacons. But as Jacksonville contemplated the future of its aging people mover (4 of 10 trains are out of service because replacement parts are no longer being made), and the need to expand its reach to connect to existing transit and under-served neighborhoods, the city's transportation authority believed "t his can be achieved by utilizing investment in the existing elevated Skyway, expanding the area it serves, and employing autonomous transit technology."

The Ultimate Urban Circulator (U2C) project, which is in early planning stages, called for converting the existing elevated Skyway lines to a driverless shuttle guideway. This would allow for individual or virtually linked trains of vehicles to provide demand-responsive service. The JTA anticipates 50 percent reductions in construction costs for AV-based network extensions (75 percent where tracks can be run at surface level), and 25 percent reductions in operating costs). In February 2017, JTA's board adopted the AV approach and greenlighted the next step of project development.

Planners believe that converting the Jacksonville Skyway to a driverless shuttle guideway could be done with a single closure of just 18 months. (Credit: Jacksonville Transportation Authority)

Milestones

2017-12-20: Jacksonville Transport Authority began a two-year public trial of driverless shuttles in the Brooklyn neighborhood in preparation for eventual retirement of Skyway trains in four to five years.

2018-03-29: The U2C project announced a number of public demonstrations and showcases of the EasyMile EZ-10 vehicle purchased for future pilots.

2018-08-23: Local agencies in Jacksonville team up to submit a $25 million proposal to the Department of Transportation for the Bay Street Innovation Corridor. BUILD or Better Utilizing Investments to Leverage Development Transportation Discretionary Grants program is worth approximately $1.5 billion and is aimed at improving surface transportation infrastructure across the US.

Jerusalem, IL

Partners
Corporate
SME

Piloting AVs for
Private Auto

Nestled on a plateau between the Mediterranean Sea and the Dead Sea, Jerusalem - a relic of our past and ancient civilization became the choice pilot zone for a fleet of autonomous vehicles in June of 2019. The test was the first pilot to be carried out by Intel and its subsidiary Israeli-based Mobileye, with plans to put some 100 cars in operation across the capital.

Despite its reputation as a city of aggressive driving and haphazard traffic enforcement, Amnon Shashua, Senior Vice President of Intel and CEO of Mobileye, writes that Jerusalem was the ideal place to prove the Mobileye-Intel solution and "to demonstrate that the technology can work in any geography and under all driving conditions." Mobileye's AV Fleet aimed to balance the conflicting goals of safety and assertiveness using a formal safety-envelop developed by Intel called the Responsibility-Sensitive Safety Model. This was intended to allow vehicles to be assertive without causing dangerous situations on the road.

360-Degree View of an autonomous vehicle traveling in Jerusalem. (Credit: Intel Newsroom)

Kaohsiung, TW

Policy & Planning Priorities

Land Use and Transit Planning

Partners

SME

Piloting AVs for

Transit

Kaohsiung was the first Taiwanese city to do a public AV demonstration in June 2017, with two more follow-up tests in October and November. Operated by 7Starlake, a Taiwanese startup, these tests served a total of 8,000 passengers. The initial test route of just 250 meters were expanded over the course of the tests, culminating in a kilometer-long route linking the EcoMobility World Festival 2017 in the city's New Bay Area to the Siziwan mass rapid transit station. Kaohsiung was interested in expanding these trials to allow driverless shuttles on the road as an extension of the tram and metro system.

This year's EcoMobility World Festival featured a driverless shuttle providing a last-mile connection for attendees between the conference center and nearby mass transit. (Credit: EcoMobility World Festival 2017)

Køge, DK

Policy & Planning Priorities

Land Use and Transit Planning

Pilot Zone Identification

Partners

State Government

SME

Corporate

Piloting AVs for

Transit

Paratransit

The world's first healthcare-focused AV trial took place—indoors—in May 2018 at Sjælland University Hospital Outpatient Clinic in Køge, a seaport town southwest of Copenhagen. A driverless shuttle ran for 65 days taking some 6000 patients and visitors between four fixed stops within the complex's sprawling interior spaces.

The test was the first of a three-stage trial led by Movia, Denmark's largest transport provider. Two more pilots took place in 2019. In neighboring Slagelse Hospital, shuttles hit the roads to test an on-demand ride-hail service aimed at transporting people between hospital departments. The final phase of the project saw the shuttles return to Køge to provide first-mile/last-mile connections on two routes between Ølby station and Køge Hospital.

Project partners included Holo (formerly knowns as Autonomous Mobility), Region Sjælland, the Capital Region, and Metroselskabet.

Phase 3 of the project will see the driverless shuttle transport patients to and from Ølby Station to the Køge Hospital. (Credit: Movia)

La Rochelle, FR

Policy & Planning Priorities

- Traffic Rules
- Land Use and Transit Planning
- Pilot Zone Identification
- Peer Exchange

Partners

- Non-Governmental Organization
- Corporate
- SME

Piloting AVs for

- Transit

RoboCITY was the first type of driverless shuttles manufactured for the EU's CityMobil2 project. (Credit: Wikimedia Commons)

In 1973, La Rochelle became the first town in France to pedestrianize its center and in 1976 it was the first to launch a public bike share. In 2014, it also became one of the first in the world to explore the potential of driverless shuttles, hosting one of three large-scale demonstrations funded through the EU's CityMobil2 program. Over a four-month pilot, six vehicles manufactured by the French company Robosoft operated along a 1.9-km route carrying 15,000 riders. While the final route, as implemented, left out a planned stop linking the route with a major rail station, and vehicle's design was criticized for poor accessibility for disabled people, the project was widely celebrated as a success.

Las Vegas, US

Policy & Planning Priorities

Land Use and Transit Planning

Peer Exchange

Partners

SME

Piloting AVs for

Transit

The AV loop is set to cater to over 1.5 million people that visit the convention center campus annually. (Credit: Las Vegas Convention and Visitors Authority)

In 2011, Nevada became the first U.S. state to adopt laws specifically permitting the operation of autonomous vehicles. In similar fashion, the state's largest city, City of Las Vegas, held the first public trial of an AV transit vehicle in January 2017 in the city's newly designated Innovation District. Over a two-week period, a 12-passenger NAVYA ARMA vehicle provided free daytime rides on a three-block stretch of Fremont Street connecting Las Vegas Boulevard and Downtown Container Park, the epicenter of a tech-driven revitalization in the city's aging core. In November 2017, the city announced a partnership with AAA, Keolis, Regional Transport of Southern Nevada extending the trial into a year long pilot covering the same 0.6 mile route in mixed traffic.

In May 2019, the Las Vegas Convention and Visitors Authority announced plans for a 0.8 mile, three-station Loop Mass Transit System for the Convention Center Campus. At a cost of $49 million, The Boring Company will install the high-speed underground public transportation system in which passengers are transported via compatible AVs at up to 155 miles per hour. This is the company's first major contract after its inception some 2 years ago. Future extensions could extend to McCarran International Airport, hotels on the Las Vegas Strip, downtown Las Vegas, Las Vegas Stadium, and, in the long term, Los Angeles.

Milestones

2017-11-07: Las Vegas became the first North American test site for the Autonom Cab, a six-seat driverless taxi.

2018-05-07: After an initial test serving attendees of the Consumer Electronic Show in January, Lyft and Aptiv launched a public ridesourcing service with 30 self-driving taxis.

Lausanne, CH

Policy & Planning Priorities

- Land Use and Transit Planning
- Pilot Zone Identification
- Peer Exchange

Partners

- Non-Governmental Organization
- Corporate
- SME
- University

Piloting AVs for

- Transit

The summer of 2015 witnessed both the potential and limits of electric-powered, driverless shuttles, as the EU-funded CityMobil2 program, built on earlier success in La Rochelle, France. When the six-vehicle fleet of EasyMile EZ-10 minibuses relocated to the Swiss Federal Institute of Technology (EPFL) Campus, a new on-demand app serviced more than 1,000 bookings during the test period in addition to regularly scheduled services. But a summer heat wave proved to be the EZ10's biggest challenge. The shuttles required permanent air conditioning, a limitation that its batteries were not yet prepared for, severely limiting operations.

Lausanne's trial featured an on-demand booking system. (Credit: CityMobil2)

Lille, FR

Policy & Planning Priorities

Land Use and Transit Planning

Partners

Corporate

SME

University

Piloting AVs for

Transit

The University of Lille holds a unique claim in the history of automated transport—it was here that the world's first automated metro system was designed by a team of engineers led by Professor Robert Gabillard, in 1970.

More recently important transport work continued with a pilot of a self-driving shuttle on the same campus.

Beginning in December 2018, two Navya self-driving shuttles began serving a 1.4 km route on the university's Scientific Campus during weekdays providing students and faculty with connections to two metro stations: Cité Scientifique and 4 Cantons.

The city chose the local academic partner in a bid to meet its goals of 10% reduction in energy consumption by 2020, set out by their Climate-Territorial Energy Plan (PCET) adopted in 2013. The city committed €230 000 for the project's first full year of service.

The campus shuttle in Lille is a small branch of a more ambitious set of energy transition goals set by the local government. (Credit: University of Lille)

Lincoln, US

Sixty years ago, just outside Lincoln, Nebraska on a 400-ft strip of Route 77, RCA (Radio Corporation of America) and the State of Nebraska conducted one of the first tests of an electronically-guided car using circuits buried under the highway. This test led to another demonstration in Princeton, New Jersey in 1960, which The New York Times reported as evidence that a new nationwide system for guiding cars on highways was just 15 years away.

In 2017, Lincoln (pop. 280,000) enlisted the help of an engineering consultant, HDR Inc., to explore the feasibility of a driverless shuttle. According to the Lincoln Journal-Star, "the study will look at the latest technology, describe a potential pilot project, provide business models for future service, and look at insurance and necessary law changes" and identify best practices in other cities. The nearly $100,000 price tag for the feasibility study was shouldered by Lincoln with hopes of attracting private funding or a public-private partnership to begin a pilot project in the downtown area. Results would feed into the city's Green Light Lincoln Project, which is upgrading Lincoln's traffic management system. Moreover, the city expects to use the feasibility study as a tool to shape a more future-proof, AV-ready design for the new infrastructure.

Lincoln has commissioned a major consulting study of AV pilot possibilities, amidst ongoing traffic signal upgrades. (Credit: Wikimedia Commons)

Milestones

2018-02-13: A bill introduced in Nebraska state legislature would authorize an AV pilot project in Lincoln.

2018-02-01: Lincoln released a multimodal technology vision, detailing a potential AV pilot.

2018-05-18: Lincoln's on-demand AV pilot secured a $100,000 from 2018 Bloomberg Philanthropies Challenge.

2018-10-28: Following a successful trial as one of Bloomberg Philanthropies' Champion Cities, Lincoln explored opportunities to continue its driverless shuttle project.

London, UK

Policy & Planning Priorities

- Taxi Regulation
- Traffic Rules
- Land Use and Transit Planning
- City Fleets
- Peer Exchange

Partners

- Corporate
- SME
- Non-Governmental Organization
- University

Piloting AVs for

- Private Auto
- Transit
- Paratransit
- Taxi

Currently home to a varied collection of AV pilots, London has become a bellwether for the future of urban AVs. The GATEway project (Greenwich Automated Transport Environment), funded by the UK government, concluded in 2017 after three years in operation. During that period the project saw three live AV trials including a driverless shuttle, an automated grocery delivery pod, and an AV valet parking service. Earlier in 2017, Nissan chose London as its first location in Europe for road tests of its AV technology.

Not long after these early tests come to a close, a new array of pilots were jumpstarted with renewed funding by the British government. A partnership led by AV software maker Oxbotica, received £8.6 million ($11.1 million) to examine insurance and safety implications for fleets of AVs deployed in urban areas and on motorways, culminating in an end-to-end journey from London to Oxford. A group led by FiveAI, another software firm, launched a supervised trial of an autonomous vehicle fleet service as an alternative to private cars on London roads in 2019 with £12.8 million ($16.5 million) in public support. Finally, AECOM undertook a $5 million effort to test technology and business models for an end-to-end AV pod-based mobility service. The service debuted at London's Queen Elizabeth Olympic Park in September 2019. (NAVYA conducted an initial trial of driverless shuttles at this site during the month of September 2017.)

In October 2017, a consortium led by TRL, a contract research outfit, was awarded a £13.4m ($17.4 million) grant by the UK government to create the Smart Mobility Living Lab, a connected and autonomous vehicle test environment spanning sites in Greenwich and the Olympic park.

The DRIVEN consortium led by Oxbotica which started on 1 July 2017 has already begun testing AVs on the roads in Oxford. The trial will come to London in 2018. (Credit: Oxbotica)

Milestones

2018-02-01: London Mayor's Transport Strategy outlined the foundation for the city's vision for autonomous vehicles: "The Mayor's overall approach to these changes is to ensure the right transport services, using the right vehicles, in the right places."

2018-02-28: London Assembly, an elected body created in 2000 to scrutinize and hold the seated Mayor accountable, responded to 2018 Transport Strategy. Among other recommendations, the assembly calls for a review of the potential impact of autonomous bus technology on the current public transport system.

2018-10-22: Addison Lee, a luxury car service, signed a deal with Oxbotica to develop and deploy an autonomous taxi fleet in London by 2021. In November, Oxbotica began mapping the city's more than 250,000 miles of public roads.

2019-10-01: DRIVEN and FiveAI robotaxis started commuter research trials in London.

Lyon, FR

Policy & Planning Priorities

Pilot Zone Identification

Partners

SME

Piloting AVs for

Transit

In Lyon, hometown of driverless shuttle maker NAVYA, AVs are helping provide last mile mobility along a resurgent industrial waterfront. (Credit: NAVYA)

Lyon, a city with one of the largest multimodal transport networks in Europe, led the way in integrating driverless shuttles into their grid. In September 2016 the city launched a free, public microtransit service in the Confluence district, a 350-acre mixed-use redevelopment of the city's old industrial waterfront. The 1.35 km line featured five stops as a showcase for NAVYA, a local startup founded in 2014 that has grown into the world's largest maker of AV minibuses. Following an administrative reshuffling that created a new metropolitan government in 2015, local authorities took their cue from the 2013 French Industrial Plan and embraced AVs as both a transport and economic development priority.

Moving into the opportunity created by this policy shift, and exploiting its early success in Lyon, NAVYA grew and its vehicles are now used in cities around the world. The company quickly secured a new round of $34 million in venture funding, valuing the company at nearly a quarter-billion dollars, from a group of investors that included Keolis, France's largest public transport operator.

Milestones

2018-06-05: The EU's AVENUE Project, which will spend more than $25 million over four years, announced Lyon's Confluence District as one of four large scale urban AV trial zones.

Miami, US

Policy & Planning Priorities

Pilot Zone Identification

Partners

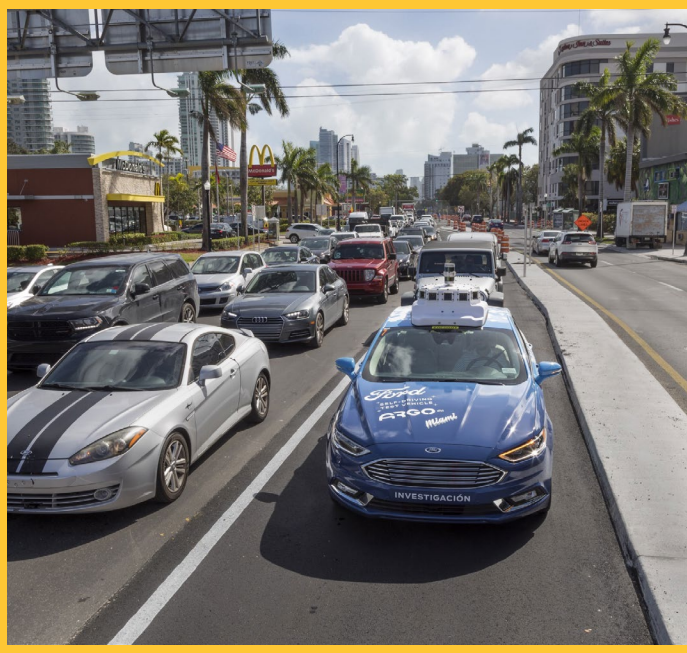
Corporate

Piloting AVs for Freight

The Miami area's unique political geography puts transportation in the hands of the Miami-Dade County Mayor, who is responsible for a spread of some 3 million people in the city proper and surrounding communities. The region was already a leader in the use of technology solutions. In 2017, the county installed automated crash avoidance systems on 10 buses for a 6-month test, and later issued a $1.1 million solicitation for a multimodal transport study to assess the impact of AVs to the county's current transportation infrastructure.

This testbed provided a welcoming environment for an automated vehicle pilot launched earlier that year by Ford Motor Company, Domino's Pizza, Lyft, and Postmates, an on-demand delivery service. Following successful tests carried out by Ford and Domino's during July 2017 in Ann Arbor, Michigan, the Miami pilot allowed Ford to test how self-driving vehicles' respond to complex urban traffic situations. "We're going to see what an AV would do when it encounters double-parked cars where it needs to go,"Ford's vice president of autonomous vehicles and electrification, Sherif Marakby, told CityLab in February.

In August 2019, Waymo announced it would begin testing their Jaguar I-Pace vehicles on Miami's public roads and highways during the May-September high-rainfall season.



After a testing period in Ann Arbor's MCity, Ford's self-driving delivery vehicles will be making their way to the streets of Miami. (Credit: Ford Motor Company)

Milestones

2018-09-18: Miami became one of five cities to share in a $5.25 million funding round from the Knight Foundation to develop a people-centered self-driving vehicle pilot. The city would explore the possibility of developing on-demand shuttles as an alternative to fixed route buses.

2018-11-14: Ford expanded its self-driving program by taking on new delivery partnership with Walmart in Miami.

Milton Keynes, UK

Policy & Planning Priorities

- Taxi Regulation
- Land Use and Transit Planning
- Peer Exchange

Partners

- Corporate
- SME
- Non-Governmental Organization
- University

Piloting AVs for

- Private Auto
- Paratransit

Modern meets postmodern - the Lutz Pathfinder at Milton Keynes Central rail station. (Credit: UK Transport Systems Catapult)

Fifty years in the making, Milton Keynes is the last and most successful of Britain's post-war new towns. But as this community grappled with the potential doubling of its population of 260,000 in the coming decades, it turned to AVs to retrofit its modernist, car-centered transportation scheme, which left many residents isolated or stuck in traffic. To that end, two pilots were commissioned in autumn 2016 under the UK Autodrive project, an umbrella effort involving 16 government, private-sector, and academic organizations. The first futuristic scheme featured 40 four-passenger pod vehicles running on vehicle and fleet management software designed by a Coventry-based firm, RDM. Pods are designed to operate on a network of pedestrian paths at "a brisk walking pace" in central Milton Keynes. A second program aimed to tap on seven traditional passenger autos supplied by Jaguar Land Rover, Ford, and Tata, to operate their vehicles with Level 3 autonomy on city streets.

Milestones

2018-04-24: Aurrigo's self-driving pods conducted a year long trial in Milton Keynes.

2018-11-14: Anon-demand delivery pilot featuring Starship conveyors was made available to Milton Keynes residents located within a 2-mile radius of the Starship warehouse.

Montréal, CA

The City of Montreal will test two driverless shuttles in a dense urban environment boarding passengers from the Olympic Park Station to Maisonneuve Market. (Credit: Transdev Canada)

After a successful demonstration of driverless shuttles at the UITP Global Public Transport Summit in May 2017, Montreal's AV work focused on establishing a substantial R&D base for both automated (AV) and connected vehicle (CV) technology. In keeping with recommendations in the city's Transportation Electrification Strategy 2016-2020, in April 2017 the city committed $3.6 million for the creation of the Institute of Electrification and Intelligent Transportation. The new center will develop transportation technologies and solutions, manage AV and CV pilots, and establish a test corridor within the city. Montreal also created an internal working group to coordinate policymaking and planning around AVs across city agencies, and formulate an agenda for the city.

In October 2018, Montreal conducted a successful test of 2 driverless shuttles at the Olympic Park site, city officials moved to organize a larger pilot for the Summer 2019. The 6-week pilot extended the previous route and covered a distance of 1.4km between Olympic park Station and Maisonneuve Market. The city secured a $5 million grant from Quebec's Ministère des Affaires municipales et de l'Habitation as part of the province's Sustainable Mobility Policy. Partners include TransDev Canada, EasyMile, and Urban Planning, Mobility and the Montreal Public Advisory Office of the Executive Committee.

Oslo, NO

Policy & Planning Priorities

Pilot Zone Identification

Peer Exchange

Partners

Corporate

SME

Piloting AVs for Transit

Oslo's transit authority is exploring an AV-enabled extension of its network. Shown here in are the shuttles on new route in Kongens Gate. (Credit: Letsholo)

Norway has quietly moved to the forefront of the push for electric vehicles - more than one-third of new cars there are fully electric or plug-in hybrid models. Oslo, the capital, hoped to extend that momentum into leadership in autonomous vehicles as well. After an initial driverless shuttle demonstration in autumn 2016, the Public Transport Authority for Oslo, Norwegian Public Administration, and Akershus (Ruter AS) began plans for Norway's largest AV microtransit pilot.

As envisioned, the service would involve up to 50 vehicles in a three-year trial spanning pilot areas in the city center, city districts and the more rural areas in Akershus, integrated with existing fixed-route transit. Holo, a Danish transport provider, was chosen after a series of vendor workshops in 2017. Final routes were being discussed as an authorizing law for the project works its way through the national legislature.

Milestones

2018-02-02: Ruter, which operates public transport in the greater Oslo region, has engaged COWI, a consulting firm, to develop a comprehensive behavioral model to evaluate driverless transport plans and policies.

Ottawa, CA

Policy & Planning Priorities

Pilot Zone Identification

Partners

State Government

Corporate

SME

University

Piloting AVs for

Private Auto

Ottawa made Canadian history in October 2017 with what local officials claim to be the nation's first test of an AV on public roads in the suburb of Kanata. The demonstration featured a Lincoln MKZ retrofitted with self-driving technology developed by Blackberry's QNX division, in partnership with Delphi, a major auto parts maker.

The test route, planned in coordination with city government, circumscribed what local and provincial leaders are touting as a world-class R&D cluster for driverless technology, the Kanata North Technology Park. The area is already the home of Ford Canada's AV research group, involving 300 employees and hundreds of millions of dollars of investment. The surrounding area encompasses an emerging network of some 70-plus firms (40 of them in Kanata North alone) that are collectively being promoted as the Ottawa AV Cluster.

The Ottawa AV Cluster wraps an on-street AV test route around a technology park that's home to more than fifty companies working on self-driving technology. (Credit: Kanata North Business Association)

Milestones

2018-05-05: Ottawa received $5 million in funding from Ontario Government to continue AV testing in the city.

2018-08-29: City of Ottawa and two non-profit organizations received $265,000 in federal funding from the Program to Advance Connectivity and Automation in the Transportation System to help prepare citizens for the era of connected and automated vehicles.

Oxford, UK

Policy & Planning Priorities

City Fleets

Pilot Zone Identification

Partners

Non-Governmental Organization

SME

University

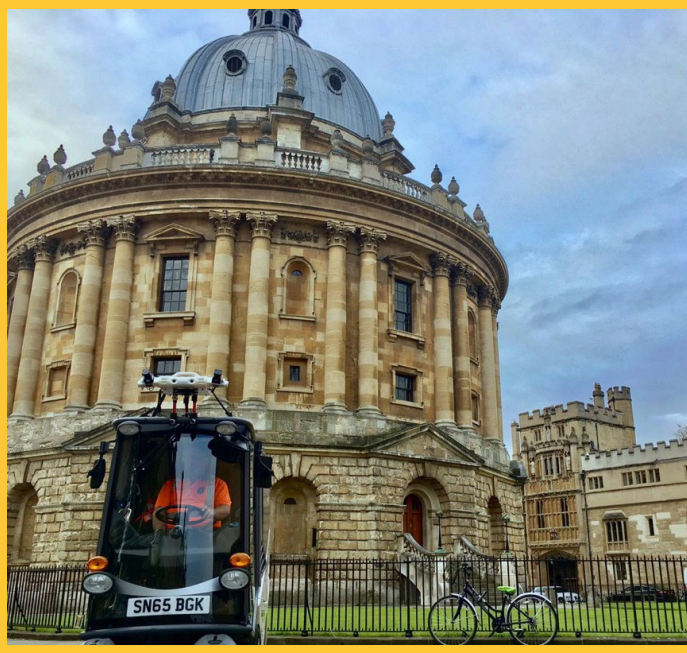
Piloting AVs for

Private Auto

Oxford and Oxfordshire (county) were the first local authority in the UK to address autonomous vehicles in official transport plans. Efforts to prepare for AVs spearheaded by the June 2016 Science Transit Strategy included a massive LIDAR mapping effort leveraging street cleaning vehicles and technology provided by the University of Oxford's Robotics Institute (ORI).

Thanks to a rich ecosystem of university spin-offs, the city played a central role in the UK's AV development plans. Some of the early ventures include Oxbotica, founded by two ORI professors, which is perfecting an AV operating system called 'Selenium'. StreetDrone, a smaller firm, is developing an open source AV R&D toolkit aimed at the higher education market.

AV piloting in Oxford took place through the DRIVEN project, a consortium involving the city, Obxotica, Oxford University, think tank TRL, and Transport for London. With some £8.9 million ($11.8 million) in UK government funding, DRIVEN planned to deploy a fleet of Level 4 autonomous vehicles for public road testing in Oxfordshire in summer 2018. The project culminates in 2019 with a series of end-to-end journeys on the M40 motorway between London and Oxford. Oxbotica will be providing most of the hardware and software for the trial.



Project Endeavour adds a new set of research partners that will focus on the development of a new safety assurance to streamline future AV deployments. (Credit: Oxbotica)

Milestones

2018-02-26: A 2.5-year pilot, funded by £2.5 million InnovateUK grant, will link the Didcot Parkway transport hub to Milton Park, a business center, with the goal of achieving a 50 percent mode share using electric, autonomous pod vehicles.

Paris, FR

Paris took a coordinated citywide approach to AV planning, spearheaded by the city's Electric Mobility Agency. In 2017, a pilot with AV minibus maker EasyMile tested driverless shuttles on several routes, including a dedicated lane crossing the 800-foot (250m) span of the Charles de Gaulle Bridge.

Later in the year, Paris carried out a more extensive six-month pilot in the La Defense commercial district utilizing three driverless shuttles providing last-mile connectivity on a 2-km route between La Grande Arche Monument, a community garden, and a tram stop. The pilot was a partnership involving Ile-de-France Mobilités, the public transit authority; Keolis, a for-profit transit operator; and vehicle maker Navya. All told, 40,000 people used the service, with surveys indicating a 93 percent satisfaction rate, according to authorities.

The city then undertook an self-driving shuttle trial in Vincennes. Two EasyMile Shuttles and Navya Shuttle began weekend operations in Nov 2017 between Château de Vincennes station and the nearby Bois de Vincennes park. The trial boasted a "convoy-style" operating mode where shuttles were connected and travel closely together.

A third demonstration, which began in March 2018, focused on bus parking automation at the RATP Lagny bus depot in Paris. EasyMile was tasked to supercharge the 12-meter long, 100 passenger capacity Iveco bus with AV software. With the advanced driving systems bus drivers would no longer need to worry about negotiating tough parking garage spaces. Some €2.5 m was earmarked for the project, which is co-financed by the European Union. A prototype of the autonomous bus is set to arrive in 2021.

Two shuttles at Bois de Vincennes park awaiting passengers. (Credit: RATP Group)

Peachtree Corners, US

Policy & Planning Priorities

Pilot Zone Identification

Partners

State Government

Corporate

SME

University

Piloting AVs for Transit

Peachtree Corner's autonomous test bed will run between Spalding Drive and Peachtree Parkway. (Credit: City of Peachtree Corners)

Peachtree Corners was created in the 1960s by developer Paul Duke, who saw opportunity in the brain drain that—at the time—meant Georgia Tech grads typically headed North and West in search of jobs. Duke's planned community attracted firms like General Electric and Scientific Atlanta (which was bought by Cisco Systems in 2005).

In 2019, city officials capitalized on the advent of the driverless revolution to appeal to a new generation of talent and companies. Peachtree Corners upgraded 1.5 miles of Technology Parkway, the city's main street, to pilot a driverless shuttle service. Together with its partners, Prototype Prime, a city funded tech incubator, Partnership Gwinnett, and engineering firm Atkins, the city began its search for a vendor. Some $2 million was earmarked for the design and procurement process.

Milestones

2019-09-20: Two self-driving shuttles were tested on Technology Parkway before city officials welcome the first public riders in October.

Phoenix, US

Policy & Planning Priorities

Land Use and Transit Planning

Pilot Zone Identification

Partners

Non-Governmental Organization

SME

Piloting AVs for

Paratransit

Taxi

Self-driving taxis line up in Waymo's Operations Center in Chander. (Credit: Waymo blog)

A week after announcing that their self-driving cars have driven some 8 million miles on public roads and over 5 billion on simulators. Waymo began a two year partnership with Valley Metro, Phoenix's Regional Transit Provider. Beginning in August, employees of Valley Metro could call on Waymo's self-driving cars to take them to and from public transit. The pilot subsequently expanded to Valley Metro's RideChoice travellers, a program providing discounted rides to seniors and persons with disabilities.

Waymo posted on their blog that, "This project will form the basis of joint research to evaluate the adoption of Waymo technology, its impact, and its long-term potential to enable greater access to public transit."

Pittsburgh, US

Policy & Planning Priorities

Taxi Regulation

Traffic Rules

Land Use and Transit Planning

Peer Exchange

Partners

State Government

Corporate

Piloting AVs for

Private Auto

Pittsburgh is home to one of the world's oldest hubs of research on self-driving vehicles at Carnegie Mellon University, as well as its newest: ride-sourcing giant Uber's Advanced Technologies Group Center. Beginning in September 2016, Uber began tests with a fleet of 4 Volvo SUVs prowling the city's downtown, Strip District, Uptown, Oakland, and Southside neighborhoods, with the intent to eventually outfit a fleet of 100. Despite technical success, a mutually cooperative relationship between the City and Uber never formed, making it a 'cautionary tale' as reported by The New York Times in May 2017. Meanwhile, the city has continued to attract investment from a wide range of automakers and their partners, including GM, Delphi, Audi, and BMW, who conducted limited Level 3 AV trials on city streets.

What have Pittsburgh's leaders learned? According to our survey, city officials highlighted the need to formulate pilots around city objectives, data sharing, regular check-ins with companies, and tight coordination with state regulators. Pittsburgh has since prioritized the knot of opportunities and challenges surrounding AVs and parking - which in the future could allow broader reclamation of space on the city's usually narrow historic streets, but could also call into question future flow of parking fees which generate a staggering 15 percent of city revenues.

Pittsburgh welcomed Uber's early pilots for its self-driving taxis. (Credit: Flickr / iwasaround)

Milestones

2018-09-18: Pittsburgh was awarded a grant from the Knight Foundation shared with 4 other American cities. The funds would be used to curb single-occupant vehicle trips in AVs.

2019-03-04: Mayor Bill Peduto issued the Pittsburgh Principles, which outlines the city's objectives and expectations for AV testing in the city.

2019-03-06: Pittsburgh city officials sought funding from USDOT to turn Liberty Avenue, a major thoroughfare, into an urban testbed for AV infrastructure.

Providence, US

Policy & Planning Priorities

Land Use and Transit Planning

City Fleets

Pilot Zone Identification

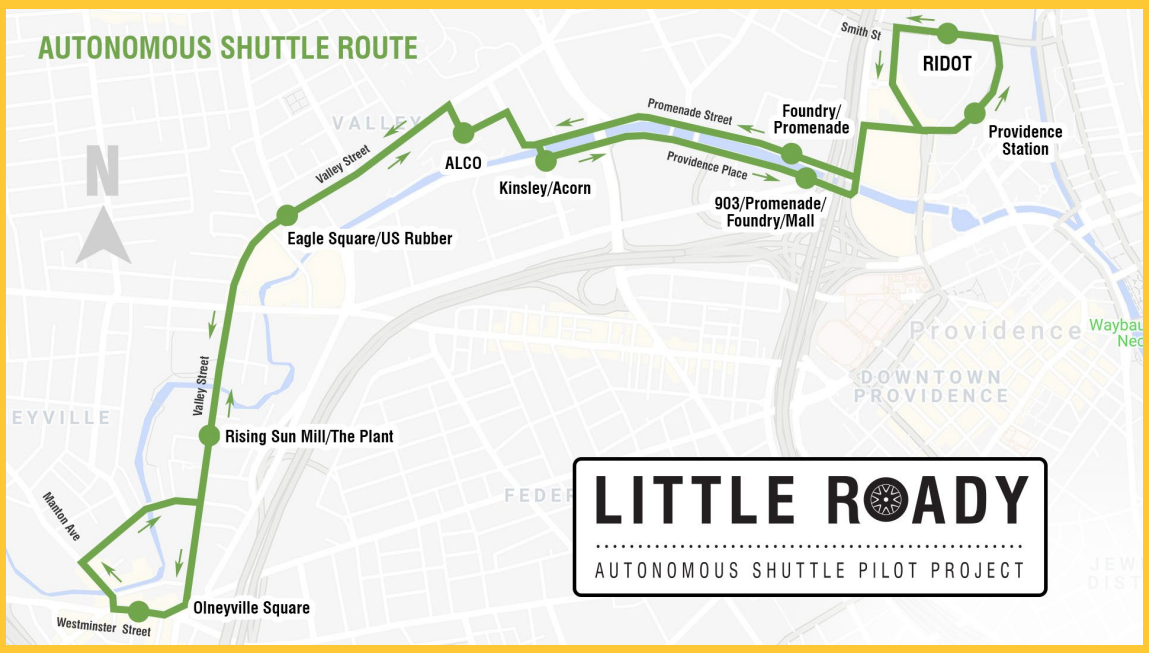
Partners

State Government

Corporate

SME

Piloting AVs for Transit



Providence's 5.3 mile route is the longest active public route in the world with 12 stops between Olneyville Square and Providence Station. (Credit: Rhode Island Department of Transportation)

Rhode Island's capital used driverless shuttles as part of a bold, multi-decade plan to revive the city's oldest industrial district, a corridor stretching Woonasquatucket River through the Olneyville, Valley, and Smith Hill neighborhoods. With at least $1.2 million secured for the first year of operation, a multi-agency effort brought six AVs built by Ann Arbor-based May Mobility.

"Little Roady", as the pilot was called, open to the public in May 2019, funded through the Transportation Innovation Partnership (TRIP), an initiative launched by the Rhode Island Department of Transportation (RIDOT), convening public and private entities in an effort to use new technologies as part of the state's future mobility solutions. The TRIP consortium included Rhode Island's Public Transit Authority, City of Providence, Quonset Development Corporation, and the Amalgamated Transit Union Local 618.

Notably, TRIP has committed to extensive study and evaluation of the project, issuing call for community survey proposals in January 2019.

Independent research firms were engaged to work together with local academic partners to collect feedback from a broad set of parties impacted by this new service.

Rennes, FR

Policy & Planning Priorities

Land Use and Transit Planninge

Partners

Corporate

SME

Piloting AVs for

Transit

An old automobile manufacturing hub and home to one of the first technoparks established outside of Paris, the City of Rennes began a 6-month pilot of two Navya driverless shuttles in the Beaulieu Campus of the University of Rennes.

Line 100 had a special 1.3 km line that runs alongside the C-4 bus network from Monday to Friday. Following the completion of the pilot in mid-June plans to extend the service to connect to the Beaulieu-University train station were proposed.

Project funding came via the Territories of High Ambitious Innovation, a 10-year €450 million initiative spearheaded by the French National Government. Partners included the City of Rennes and Keolis, a transport provider.

Rennes' AV shuttles serve 6 stops between Beaulieu Campus administration building and the dining hall. (Credit: University of Rennes)

Reno, US

In 2018, Proterra unveiled battery-electric buses to begin serving Reno's Rapid Transit Service. (Credit: Proterra)

Before AV buses can learn to run, they need to learn how to walk. Or, in the case of Reno's partnership with Proterra, a manufacturer of electric buses, and the University of Nevada, Reno - they must first learn how to see. Between 2017 and 2019,the Washoe County Regional Transportation Commission worked with researchers to study in-service transit vehicles operating on a three-mile route along the city's Virginia Street casino corridor to test the effectiveness of both LIDAR and infrared sensors in detecting vehicles and pedestrians. Later stages of the project involved the development of software to fuse all sensor data collected during the pilot, in addition to exploring prospects for commercialization.

Rotterdam, NL

Policy & Planning Priorities

City Fleets

Peer Exchange

Partners

State Government

SME

University

Piloting AVs for Transit

The ParkShuttle, linking Rotterdam and the neighboring town of Capelle aan den IJssel, is a reminder that automation in public transit had a long history before the autonomous vehicle arrived - in people movers operating at subways, airports, and resorts in cities across the globe. Since opening to the public in 2005, this 1.1 mile (1.8 km) route has carried some 2,500 people each business day from the Kralingse Zoom station to the Rivium business park.

With its familiar-looking minibuses, five grade crossings where vehicles come into direct contact with traffic, mix of on-demand and scheduled service, and electronic track-following technology, ParkShuttle was a transitional technology between conventional approaches to automation, which rely on road infrastructure dedicated to direct vehicles, and autonomous operation that uses on-board sensors and computing power. The next phase of ParkShuttle's evolution completes that transition, converting the system to fully autonomous vehicles and extending the line from the existing separated carriageway along public roads.

Milestones

2017-12-22: Parkshuttle's operators signed a final agreement with technology supplier 2getthere to complete conversion to fully autonomous vehicles by 2019.

A dedicated on-road lane will extend Rotterdam's automated people mover with autonomous vehicles. (Credit: Amsterdam Economic Board)

Rouen, FR

Policy & Planning Priorities

Taxi Regulation

Land Use and Transit Planning

Pilot Zone Identification

Partners

State Government

Corporate

SME

Piloting AVs for

Taxi

Europe's first on-demand autonomous mobility experiment will take place in Technopole du Madrillet over the next two years with four autonomous taxis and one autonomous shuttle. (Credit: Transdev)

The capital of France's Normandy region hosted to Europe's first test of fully on-demand, autonomous mobility services. Following a trial in October 2017, a two-year pilot launched in spring 2018, featuring four Renault ZOE compact electric vehicles equipped with autonomous driving technology supplied by Transdev. Rouen Normandy Autonomous Lab, as the project is called, had 17 stops on its three circuits where passengers could book their rides on a dedicated smartphone application. The test area focused on Technopole du Madrillet, a business campus that is home to engineering laboratories, research centers, and schools. The project was led by the Métropole Rouen Normandie, together with Transdev, Normandy Region, and the impact accelerator group Caisse des Dépôts. Future plans included integration of a driverless shuttle to the on-demand fleet.

San Antonio, US

Policy & Planning Priorities

Pilot Zone Identification

Peer Exchange

Partners

State Government

Non-Governmental Organization

University

Piloting AVs for

Transit

San Antonio, Texas's second largest city, was one of the fastest-growing cities getting a head start on AVs. With a population that is expected to nearly double by 2040, the city eagerly looked for alternatives to single-passenger vehicles. San Antonio was one of five key municipal partners in the Texas AV Proving Grounds Partnership, itself part of a network of 10 regions designated by the US federal government in January 2017 as Automated Vehicle Proving Grounds.

Subsequent AV pilots focused connecting the booming downtown's South Texas Medical Center corridor along Fredericksburg Road. Key goals include extending and improving safety on the 12-mile, 12,000-passenger per day VIA Primo bus rapid transit (BRT) line, which links downtown San Antonio and the South Texas Medical Center. The Southwest Research Institute, a locally based defense think tank with more than 2,800 employees, will anchor the consortium's R&D along with the University of Texas at Austin's Center for Transportation Research and Texas A&M's Transportation Institute.

Two VIA Metropolitan Transit buses, a Primo bus on the right and an express bus on the left, waiting at the VIA stop on the University of Texas at San Antonio (UTSA) Main Campus. (Credit: Wikimedia Commons / happy5214)

Milestones

2018-02-28: San Antonio opened a call for proposals for a self-driving car pilot on Fredericksburg Road in June.

2018-07-20: City officials sought proposals for a short-term AV pilot as a gap-filling solution in a larger multimodal transportation plan adopted in 2016.

San Francisco, US

Policy & Planning Priorities

Land Use and Transit Planning

Peer Exchange

Partners

SME

University

Piloting AVs for Transit

SOM's ambitious redevelopment plan for Treasure Island will have to deal with swarms of AVs in 2030. (Credit: SOM)

San Francisco's approach to AVs centers on filling gaps in transit networks and overnight service. The first planned pilot focused on Treasure Island, a former naval base being redeveloped to have 8,000 housing units and rebranded as "San Francisco's newest neighborhood." (The island was created as a landfill for the city's 1939 World's Fair.) With support from a $2 million federal transportation grant, San Francisco planned to test three driverless shuttles connecting existing bus stops, a planned ferry terminal, and other commercial and recreational destinations around the island. Delivery of vehicles for initial testing is expected by the end of 2019, with a full launch of passenger service planned for 2020.

Milestones

2018-05-03: San Francisco's Transport Authority released a draft report outlining the range of services operating in San Francisco (from ride-hailing to autonomous vehicles and micro-transit) and evaluates how these services align with the City's Guiding Principles.

2019-03-21: The city's Transit Authority sought funding from USDOT to expand TransBASEsf.org, a repository of safety-related transportation data, to include information on the number of crashes, disengagements, and citations that self-driving vehicles are involved in.

San Jose, US

Policy & Planning Priorities

Taxi Regulation

Traffic Rules

Land Use and Transit Planning

Peer Exchange

Partners

Corporate

SME

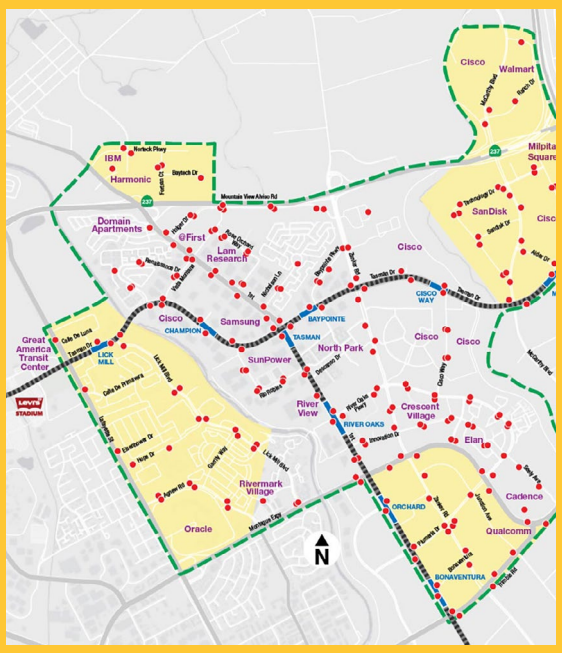
Piloting AVs for

Transit

Paratransit

With a projected population growth of 40 percent by 2040—some 470,000 additional residents—San Jose looked at AVs as a tool to free up land currently used for roads and parking for new housing. Located in the heart of Silicon Valley, San Jose has long struggled with the impacts of its own success. City residents suffer from a lack of affordable housing, long commutes, and a high number of traffic fatalities despite the city's Vision Zero traffic safety initiative. In June 2017, city officials announced an RFI to solicit ideas for AV pilots at a handful of locations, including the three-mile corridor connecting San Jose Airport to Diridon train station, as well as the Transportation Innovation Zone just west of the massive Cisco Systems campus in North San Jose and a shelter for homeless veterans.

In the same year, Intel opened its Autonomous Driving Garage in San Jose, a showcase for the chip giant's massive new campaign around self-driving technology and a harbinger of things to come.



The Transportation Innovation Zone, created in 2014, fast-tracks tests for innovations like the Flex on-demand shuttle, and soon, AVs. (Credit: Santa Clara Valley Transportation Authority)

Milestones

2017-12-08: San Jose announced the results of its AV RFI process, and its intent to move forward with two AV transit and paratransit pilots.

2018-09-18: With a grant from the Knight Foundation's initiative for a people-centered self-driving vehicle program, San Jose aimed to create a pilot to connect residents between transit hubs to jobs, retail and nightlife destinations.

2018-11-14: The City of San Jose worked with Daimler Mercedes Benz and Bosch to pilot self-driving cars on city streets. The on-demand ride-hailing service would supplement existing transit along the San Carlos/Stevens Creek corridor in downtown San José.

San Ramon, US

Policy & Planning Priorities

Land Use and Transit Planning

Pilot Zone Identification

Partners

SME

State Government

Piloting AVs for Transit

A driverless shuttle pilot linking a commuter rail station and a major East Bay business park will test whether AVs can increase the convenience of first/last mile connections to mass transit. (Credit: City of San Ramon)

In June 2018, when they begin shuttling BART commuters at Bishop Ranch, a 500-acre business park in the East Bay community of San Ramon, two EasyMile driverless shuttles became California's first AV transit system. Taking on this first/last mile pilot were the Contra Costa Transportation Authority, the City of San Ramon, California DMV, and Concord, Calif. AV proving ground GoMentum Station.

Bishop Ranch is home to more than 30,000 employees, and AT&T's West Coast headquarters and GE's software division. The existing, manned shuttle route ran on a circular route making more than a dozen stops. In the future, officials hoped that a larger fleet of driverless shuttles could provide direct service on individual routes that "fan out like the spokes of a wheel".

Schaffhausen, CH

Route 12, Schaffhausen's driverless shuttle service, operates beside local VBSH buses in Neuhausen. (Credit: Swiss Transit Lab)

The Swiss Transit Lab, a public-private partnership, began testing of a driverless shuttle service in the tourist town of Neuhausen (home to Europe's largest waterfall) in March 2018. The group was composed of local transport authorities VBSH, the canton's development agency, software provider Trapeze, and its autonomous mobility subsidiary AMoTech. In addition, ETH Zurich was recruited to conduct a year long public perception study and stakeholder roundtables.

The shuttle's regular service, named Route 12, took small steps to integrate with Schaffhausen's public transport system. It extended a 500-meter route near the Rhine Falls Basin to a longer 1500 meter loop during the busy summer months. Plans were in place to further extend shuttles service in 2019 with officials currently considering a first/last mile application with passengers booking rides through an app.

Milestones

2018-07-30: ETH Zurich published the first public opinion on Neuhausen driverless shuttle route.

2019-04-23: ETH Zurich found increasing acceptance of AV shuttle service in the second round of public surveys.

Seongnam, KR

Policy & Planning Priorities

Pilot Zone Identification

Partners

State Government

Corporate

Piloting AVs for

Private Auto

Transit

Where else to build the AV city of the future than a tear-down megaproject atop the former headquarters of your country's highway construction authority? That's the Korean approach at least. Just over the mountains on the southern edge of Seoul's world-renowned Gangnam district, the city of Seongnam was home to Korea's first special district for AV testing. This experimental zone overlaid the Pangyo Second Techno Valley, a new real estate development taking shape on a 125-acre site housing the former headquarters of the Korea Expressway Corporation, that will eventually house up to 600 companies and 40,000 jobs.

Accommodations for AVs included: three lanes allocated to AVs on the main roads, reserving a fourth lane exclusively for manually-driven vehicles; the nation's second-only 5G wireless network providing vehicle-to-vehicle data rates up to 2.3 Gbps; and a dedicated traffic management facility. BMW, a partner in the effort, is expected to set up a lab to put the testbed to use. In September 2018, a second AV project, Zero Shuttle, began a two-month test linking Pangyo Techno Valley to the subway station 5.5 km away.

Pangyo Techno Valley, a leading hub for digital innovation in South Korea, could soon see dedicated road lanes for AVs. (Credit: Gyeonggido-Korea)

Milestones

2017-12-07: City officials announced the Zero Shuttle will begin its 5.5km loop from Pangyo Zero City to Pangyo Station before the end of the year.

2018-01-09: SK Telecom gained national government approval to road test 45-seat bus in Pangyo Zero City later this year.

Seoul, KR

Policy & Planning Priorities

- Traffic Rules
- Land Use and Transit Planning
- City Fleets
- Pilot Zone Identification

Partners

- SME
- University

Piloting AVs for

- Freight

In 2019, Seoul's first self-driving testbed was launched at Digital Media City (DMC), a decade-old new town built on the site of a former landfill in Seoul's Sangam district. Partners included South Korean Ministry of Land, Infrastructure, and SK Telecom, South Korea's largest mobile operator. The district, a technology hub, is home to over 800 information technology, media, and entertainment companies employing more than 60,000 people. The year-long test of a fleet of self-driving delivery vehicles began in October 2019. The four-wheeled flat-tray vehicles were produced by local startup Unmanned Solutions and featured a 200 kilograms capacity. The company was one of a pair of startups funded through Seoul's $100 million innovation incubator.

City officials told the Korea Times the service initially tested the feasibility of last-mile commercial freight deliveries "shipping supplies from freight trucks near the main road to restaurants and shops in car-free zones inside the DMC area."

Rising from the ashes of Nanji-do landfill, Sangam's Digital Media City, is one piece of a national initiative established in 2000 focused on ubiquitous computing. (Credit: Flickr / travel oriented)

Shenzhen, CN

Policy & Planning Priorities

Land Use and Transit Planning

Pilot Zone Identification

Partners

SME

Piloting AVs for Transit

Shenzhen's 14,000 electric-powered buses could soon feature self-driving capabilities. (Credit: Flickr / tomislav domes)

Since China opened its doors to the world in 1980, Shenzhen has been the most visible symbol of the country's astonishing economic growth. The city's population exploded from just 60,000 in 1980 to more than 10 million. The built-up area expanded five-fold alone in the 1980s.

In 2017, Shenzhen took on a new role as China looks to re-engineer its cities in a greener, cleaner image. The city began the conversion of the entire fleet of 14,000 city buses to electric propulsion by the end of 2017. And the ambitious Alphaba project logged some 8,000 km in tests of self-driving technology for the upgraded fleet.

AV planning and pilots focused on the city's Futian district, a new free trade zone, Shenzhen's AV bus pilots are using vehicles that are more akin to traditional city buses than the pint-sized driverless shuttles being tested in cities across the globe. The Chinese-made buses, which feature self-driving technology supplied by Shenzhen Haylion Technologies, operate at speeds of up to 20 mph carrying up to 20 passengers. Currently, four buses serve a 1.2 km route with 3 stops.

Milestones

2018-11-01: Shenzhen's city transport commision opened 19 roads in nine administrative districts to self-driving tests.

Singapore

Policy & Planning Priorities

- Taxi Regulation
- Traffic Rules
- Land Use and Transit Planning
- City Fleets
- Pilot Zone Identification
- Peer Exchange

Partners

- SME
- Corporate
- University

Piloting AVs for

- Transit
- Paratransit
- Private Auto
- Taxi

Singapore is one of the world's most active laboratories for experimentation with automated vehicles and AV-friendly infrastructure. Under the guidance of the Committee on Autonomous Road Transport for Singapore (CARTS), formed in 2014, the tiny city-state pursued a variety of AV pilots. In January 2015, one-north, a science and technology campus which opened in 2002, was chosen as the test bed for AV trials. The initial 6 km-long test network expanded to more than 55 km in June 2017. Four more AV tests were conducted, including a six-vehicle AV taxi service pioneered by nuTonomy. The company, based in Cambridge, Mass., grew out of an earlier research collaboration between MIT and the National University of Singapore (NUS) at another new town in Singapore's Jurong Lake District. In August 2017, nuTonomy announced its intent to launch a commercial AV taxi service in Singapore, potentially with ride-hail partner Grab.

Singapore was also one of a handful of cities testing full-size AV buses. In March 2019, Singapore's Land Transport Authority and Nanyang Technological University (NTU) announced a partnership with Volvo to deploy one bus to the NTU campus, and a second vehicle inside a bus depot operated by public transport provider SMRT.

While Singapore's linking of new technology and new towns is a demonstration of economic strength that has attracted interest from China, India, and other quickly urbanizing countries, it also reflects great anxiety about the island's long-term prospects. With little undeveloped land remaining, Singapore's long-term strategy looked to exploit potential opportunities for AVs to help reduce the number of automobiles and reclaim land currently used for parking and roads.

Volvo's 12-meter autonomous electric buses has a capacity of 80 passengers. (Credit: Nanyang Technological University)

Milestones

2017-11-22: Singapore government identified three towns to pilot autonomous buses and shuttles starting in 2022.

2017-11-22: Singapore announced the opening of the country's first AV test centre in the Jurong Innovation District, a new town development focused on urban innovation.

2017-12-8: Plans to implement a 2-year, 10-vehicle driverless shuttle service on the Singapore resort island of Sentosa were announced.

2018-01-11: Volvo Buses and Nanyang Technological University signed an agreement to trial two autonomous buses beginning in 2019.

2019-09-19: Singapore's begins first year-long trial of an AV shuttle in mixed traffic conditions on the NUS Kent Ridge Campus.

Sion, CH

Policy & Planning Priorities

Land Use and Transit Planning

Pilot Zone Identification

Partners

Corporate

SME

University

Piloting AVs for

Transit

In the shadow of the Matterhorn, the French-speaking Swiss town of Sion boasted one of the world's longest-running AV pilots, dubbed SmartShuttle. Employing a pair of Navya Arma driverless shuttles, the two-year pilot linked major downtown plazas and two historic sites, Valère and Tourbillon castles, via scheduled fare-free service.

The pilot is a collaboration between the city government, PostBus Switzerland (the nation's leading bus transit operator), and startup BestMile, a spinoff founded in 2014 by graduates from Lausanne's Federal Institute of Technology (EPFL). For PostBus, the pilot was specifically designed to supplement existing transit services, rather than replace or compete with them. As BestMile co-founder Raphaël Gindrat told news site Swissinfo.ch, "We are proposing to go where it's complicated, where the roads are too narrow or where financially it is too expensive for the state."

With an initial two-year pilot phase that closed in mid-2018, Swiss Post (PostBus's parent company) indicated it plans to continue service following a survey about the attitude of the public towards the use of AVs for public transportation.

As they traverse the city's historic downtown, PostBus's driverless shuttles precisely navigate many obstacles including single-lane bridges and narrow tunnel passages. (Credit: PostBus Switzerland)

Milestones

2018-03-01: Sion's driverless shuttles shared roads with public traffic for the first time as they begin regular service between Gare Sion and Place du Midi.

South Perth, AU

Policy & Planning Priorities

Land Use and Transit Planning

Partners

Non-Governmental Organization

State Government

SME

Piloting AVs for

Transit

The world's only AV trial spearheaded by a motorists' advocacy group, the Royal Automobile Club of Western Australia (RAC), the Intellibus driverless shuttle carried over 5,000 passengers in its first year of service. The shuttle traversed a 3.5 km route along the bay of the Swan River on the South Perth Esplanade between the Old Mill and Sir James Mitchell Park. RAC chose the site after an assessment and analysis of over 20 sites across the Perth Metropolitan area.

The trial began in February 2016 with three phases and was not open to the public until September 2016. The Royal Automobile Club of West Australia (RAC) led the test with the support of the City of South Perth, Western Australia State Government, and AV manufacturer Navya. The project was primarily seen as a tool to raise public awareness about the potential safety benefits of driverless vehicles. In November 2017, the pilot was extended for another two years with nearly AUD 1m in federal government funding.

South Perth's RAC Intellibus has racked up over 6,000 km with the riding public since its launch in September 2016. (Credit: RAC)

Milestones

2017-12-04: RAC tested Navya's new 6-passenger Autonom Cabs in South Perth.

Stavanger, NO

Policy & Planning Priorities

Land Use and Transit Planning

Pilot Zone Identification

Partners

SME

Piloting AVs for

Transit

Located at the intersection of the municipalities of Sandnes, Stavanger, and Sola, Forus Næringspark AS is an industrial park built on a former airport site and houses more than 3,000 businesses and 40,000 employees. In partnership with Kolumbus AS, the region's public transport provider, and AV maker EasyMile, Forus began testing a driverless shuttle service in January 2017. The two-year project featured three phases, culminating in the deployment of a circulator service operating on a 4 km route throughout the park. Officials hope that the pilot project will provide valuable input as Norway shaped its laws regarding autonomous/unmanned vehicles. The project wrapped up in December 2018.

Kolumbus AS is expanding their network of 450 buses and 3 ferries to include two autonomous shuttles in the Forus Næringspark, a major industrial park. (Credit: Forus Næringspark)

Stockholm, SE

Policy & Planning Priorities

Land Use and Transit Planning

Pilot Zone Identification

Partners

Corporate

University

Piloting AVs for

Transit

Stockholm launched a 6-month public pilot of driverless shuttles in mid-January 2018. Autopiloten, the first service of its kind in Sweden. The test was managed out by Nobina, an operator of bus systems throughout the Nordic region, including Stockholm. The project was part of Test Site Stockholm, a research program based at KTH Royal Institute of Technology's Integrated Transport Research Lab. Partners include the City of Stockholm, telecoms giant Ericsson, and many other organizations.

After receiving approval in January 2018, the first phase of the project saw the driverless shuttle in Kista Science City. Three shuttles spent 6 months transporting the public on a 1.5 km route between Kista Galleria and Victoria Tower. Operators expanded the original fleet of three shuttles to six in 2019. A second pilot phase extended to Barkarby City, a new district located Northwest of the Stockholm region. Touted as a "living city", Barkarby City will have some 18,000 new homes, 140 neighborhoods and 10,000 new jobs. Together with Swedish Transport Authorities, Nobina announced a pilot of two Scania full-length self-driving buses serving Barkarby City and Akalla metro station. The 5 km route included a total of four stops.

Stockholm's 6-month driverless shuttle trial could be the first step in the integration of AV shuttles into the region's transit system. (Credit: Nobina)

Sydney, AU

Policy & Planning Priorities

Land Use and Transit Planning

Pilot Zone Identification

Partners

SME

University

Piloting AVs for Transit

Transport officials hope to use the redevelopment of Sydney's Olympic Park as a laboratory for driverless transit applications that can be expanded citywide in the future. (Credit: Flickr User Andrew Xu)

Olympic villages, both future and past, have been favorite sites for cities to explore the AV opportunity in a future-friendly, sequestered setting. In Sydney's case, the plan incorporated a driverless shuttle pilot into an ongoing redevelopment approved in 2010 and slated to be completed by 2030. The project involved the construction of a new community with over 10,000 homes, 30,000 jobs, and 100,000 square meters of retail space. Transport for North South Wales (NSW), in partnership with the Sydney Olympic Park Authority, under the authority of the state of New South Wales, conducted a two-year trial of a Navya AV minibus to transport office workers around the site. The trials were intended to help officials better understand the tech and infrastructure needed to extend autonomous vehicles into the broader transport network of the city.

Taipei, TW

Policy & Planning Priorities

Land Use and Transit Planning

Pilot Zone Identification

Partners

SME

University

Piloting AVs for

Transit

In 2018, Taipei had but a single Easymile EZ10 driverless shuttle under testing in Xinyi District, the country's seat of finance and government power. But local entrepreneurs, like 7Star-Lake which backed the pilot, saw the city as a springboard to export autonomous minibuses throughout Taiwan and the whole of Asia. Taipei, and Taiwan more broadly, had much to offer as an AV test site:

First, there was an abundance of appealing AV test sites - the island nation possessed a profusion of self-contained communities where AVs can be cordoned off from regular traffic - "more than 150 universities and colleges, 100-plus industrial parks and 15 theme parks" according to a report by the The New York Times. Taipei alone has more than 20 such sites.

Second, Taipei's mayor worked closely with the company to integrate AVs into future transit plans even as the city face hurdles in gaining approval from the central government. Legislation was lagging behind but the country's politicians are hopeful that the city and the country can focus their AV efforts on public transportation initiatives.

Finally, Taiwan is already home to a massive auto parts industry, which 7StarLake wants to leverage as it begins building vehicles locally under license from Easymile by 2019. "We hope to manufacture autonomous cars with more than 50 percent local content over the coming years," 7Starlake general manager Martin Ting said, according to Taipei Times. The company believed this could cut vehicle costs by as much as one-third by avoiding import tariffs.

A driverless shuttle prowls downtown Taipei's Xinyi District at night. (Credit: Focus Taiwan)

Tallinn, EE

Policy & Planning Priorities

Pilot Zone Identification

Partners

Corporate

SME

Piloting AVs for

Freight

Estonia's capital was the birthplace of the conveyor, a novel type of automated vehicle that many believe could transform how goods are delivered in future cities. Conveyors made by a growing array of startups now come in an increasing variety of flavors, but all share key characteristics: they are small enough to travel in pedestrian areas without risk to human safety, have limited range, and carry less than 50 pounds of cargo. In Tallinn, conveyor R&D was spearheaded by Starship Technologies, started in 2014 by two Skype co-founders Ahti Heinla and Janus Friis.

Starship's first public trials took place in 2016 in Tallinn, with startup food delivery partner Wolt, logging more than 1,000 km of test travel in the first year. By July 2017, Starship took another leap forward, carrying out a summer-long test involving small packs of conveyors ferried from distribution hubs to neighborhood dispatch points by a mothership, dubbed the Robovan. The pilot, in partnership with Omniva (an arm of the Estonian postal service), and Mercedes-Benz, focused on Tallinn's Kakumae, where they tested new solutions for last-mile delivery logistics.

Although Starship has since expanded their offices to London, Hamburg and the USA, Tallinn is still their engineering headquarters.

A student at Tallinn University of Technology (which is also developing its own driverless shuttle) receives one of the first-ever food deliveries by a robot in Tallinn in autumn 2016. (Credit: Wolt)

Milestones

2017-11-13: Following the successful temporary deployment of two driverless shuttles during tram reconstruction in the summer of 2017, Tallinn began a year long test of a driverless shuttle in city traffic in 2018.

Tampa, US

Policy & Planning Priorities

Land Use and Transit Planning

Pilot Zone Identification

Partners

State Government

Corporate

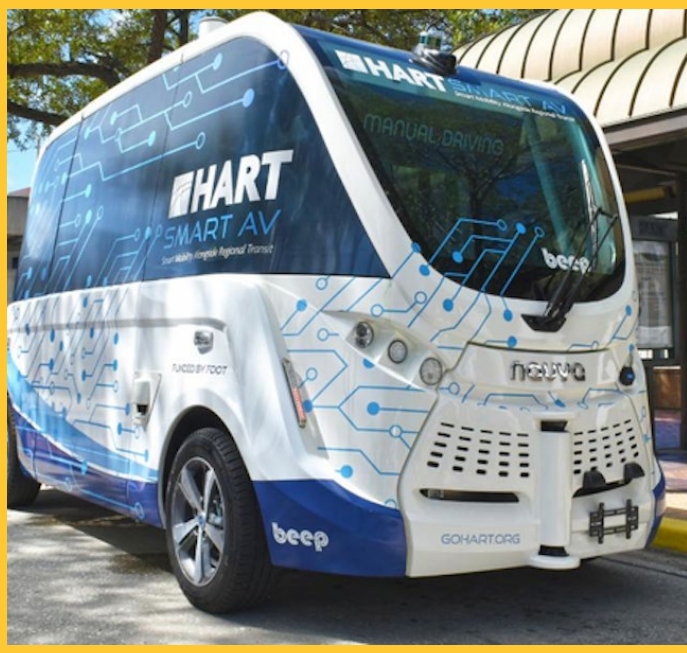
SME

Piloting AVs for Transit

Florida communities have long experimented with new mobility technologies to increase their appeal to both visitors and retirees, and Tampa was fast becoming a focal point for AV innovation in the Sunshine State. In 2016 and 2017, the city hosted the Florida Automated Vehicles Summit (which celebrated its fifth annual meeting in 2017), setting the stage for an upcoming driverless shuttle pilot.

Tampa's plans were to put a single driverless shuttle into transit service along a one-mile stretch of the city's Marion Street corridor. While the thoroughfare is restricted to bus and emergency vehicles during daytime hours, officials tout the pilot wold be the first ongoing deployment of shared AVs on public roads in mixed traffic.

The project is a partnership between HART, the Tampa area's transit authority, and the Florida Department of Transportation, which is providing $500,000 in annual subsidies. HART hoped that the service act as a catalyst for further automation of Tampa's transit system, which currently boasts some 200 full-size conventional buses. Project design and management will be provided by Stantec, an engineering services firm, with vehicles provided by Coast Autonomous of Pasadena, California.



HART's self-driving shuttle began traversing downtown Tampa in October 2020. (Credit: American Public Transportation Association)

Milestones

2018-01-08: The Tampa Bay Times reported that HART officials have suspended the driverless shuttle project pending resolution of a dispute with contractor Stantec.

Tampere, FI

Policy & Planning Priorities

- Traffic Rules
- Pilot Zone Identification
- Peer Exchange

Partners

- Non-Governmental Organization
- State Government
- Corporate
- SME
- University

Piloting AVs for

- Transit
- Private Auto
- Freight

As Finland's second largest city, Tampere is seated in the middle of the country's industrial region which includes the birthplace of IT-giant Nokia and the spinoff Nokian Tyres. The city is no stranger to having advanced mobility technology on their streets. In 2013 Tampere participated in Drive C2X, a connected vehicle research project funded in part by the European Commission. Three years later the Technical Research Center of Finland (VTT) chose Tampere to establish UrbanAutoTest, an AV pilot zone. The steering committee comprised of the City of Tampere, HERE (another Nokia spinoff), the Finnish Transportation Safety Agency (Trafi), and a handful of SMEs, making this a decidedly nordic cross-sector collaboration.

UrbanAutoTest aimed to lay the groundwork for others by designing a platform for connected and autonomous vehicle innovation. The road trials featured three test vehicles, including an "all terrain vehicle" with tank tracks for off-road testing, and a shared data format for vehicle-to-everything (v2X) communication. In addition to fostering knowledge transfer to the local tech industry, UrbanAutoTest hoped to work with municipalities and authorities to develop and refine a certification process for AVs. This activity made use of a 40 kilometer test circuit that ran through public highways, intersections, local streets, and Finland's longest automotive tunnel. In the future they hope to take advantage of their natural climate to become a "four season" test bed allowing AVs to grapple with the demands of snow and ice.

Marilyn 2.0, a Citroen C4 retrofitted with AV technology, cruises around the snowy streets of Tampere's UrbanAutoTest. (Credit: VTT)

The Villages, US

Policy & Planning Priorities

Pilot Zone Identification

Partners

SME

Piloting AVs for

Taxi

Although the retirement community is classified as a private development, it's scale spread out across three separate counties in Central Florida makes it comparable to some small to medium cities in the US. (Credit: Voyage Medium Blog)

In early 2018 self-driving startup Voyage announced the launch of a door-to-door self-driving taxi service in The Villages, a retirement community with over 100,000 residents - the largest in the US. The Villages started as a small mobile house park in 1980s and has grown to encompass more than 750 miles of roads, 40 square miles of land, a 500,000 thousand square-foot town center, and a dozen grocery stores.

Voyage's initial tests featured a fleet of Ford Fusions outfitted with company's self-driving technology. The fleets were supported by 3D mapping technology from Carmera, a Brooklyn-based location intelligence startup. In June 2018, Voyage entered into a second partnership with car rental company Enterprise to deploy a fleet of Chrysler Pacific mini-vans at The Villages.

Before making their way to the sunshine state, Voyage conducted a groundbreaking pilot in 2017 in a San Jose retirement community with some 4,000 residents.

Toulouse, FR

Policy & Planning Priorities

Land Use and Transit Planning

Pilot Zone Identification

Peer Exchange

Partners

Non-Governmental Organization

State Government

SME

Piloting AVs for

Transit

Paratransit

In 2017, driverless shuttle maker EasyMile's hometown joined the growing list of cities showcasing this new transit technology. Two trials demonstrated how AVs could supplement the traditional public transport network.

The first test, lasting six months, took place in Pibrac, a suburb of Toulouse, where the self-driving shuttle served a 350-meter route. A second phase focused on the city center, traversing a pedestrian highway connecting residents to/from Palais de Justice Tram Station to the Grand Rond Public Garden 850 m away.

An array of partners included: the City of Pibrac, transport authorities Tisséo Collectivités, the Regional Office for Competition, Consumption, Labour and Employment, and the investment arm of French National Government, Caisse des Dépôts.

Some 18,000 passengers were carried and 5,000 km covered as the city began further evaluation of future experiment locations. After completing these trials, Toulouse commissioned a study on the opportunity of AVs hoping to learn more about multimodal transport, environmental and accessibility benefits that AVs could bring. Going forward, AV initiatives will be advanced under Open Metropolis, Toulouse's 2018 masterplan, which outlined a strategic focus on mobility and experimentation, based on 3 key principles and 5 ambitions.

Toulouse-based EasyMile provided the shuttles for the year-long pilot. (Credit: Toulouse Metropole)

Trikala, GR

Policy & Planning Priorities

- Land Use and Transit Planning
- Pilot Zone Identification
- Peer Exchange

Partners

- SME
- University

Piloting AVs for

- Transit

Trikala was the world's first test of autonomous transit vehicles operating in mixed traffic on city streets. (Credit: City of Trikala - CityMobil2)

The EU-funded CityMobil2 project ran from 2012 to 2016. With a budget of over €15 million and ten municipal partners, it was the world's first multi-city test of AVs for urban transit. CityMobil2 tests involved some 60,000 passengers across Europe, with 12,000 alone in Trikala.

In Trikala, one of three cities where large-scale tests were undertaken, AV minibuses were tested on city streets in mixed traffic under the auspices of a new Greek law. (Lausanne, Switzerland and La Rochelle, France were the other two large-scale test sites.) The service ran on a 2.5 km route for four months between September 2015 and January 2016, with six Robosoft driverless shuttles operating on a dedicated lane.

Wageningen, NL

Policy & Planning Priorities

Land Use and Transit Planning

Partners

State Government

SME

University

Piloting AVs for Transit

WEPods will allow Wageningen University visitors to summon a shuttle by app for pickup at the train station. (Credit: Wikimedia Commons / ArjanH)

In January 2016, the Dutch university town of Wageningen launched what was arguably the world's first driverless shuttle pilot operating on public roads in mixed traffic. The WEpods trial consists of two Easymile EZ10 vehicles circulating between the city's railway station and the Wageningen University & Research campus, a Dutch university focused on the life sciences. City officials reported that this experience, which was several years in the making and is fully funded through 2019, highlighted the need for cities to get clarity about their learning goals for AV pilots, glean and communicate value from experimental failures as well as successes, and be transparent about findings.

This all reflected the city's strong desire to take a leading role in AV development, rather than let industry set the agenda. This approach has helped prioritize unexplored opportunities for assisted mobility for elderly and disabled persons. It also highlighted the city's interest in pursuing connected vehicle technology to reduce AVs' tendency to carve out their own "safety bubbles" through overly cautious driving.

Washington, DC, US

Delivery robots are rolling out across Washington, DC, confined for now to sidewalks and crosswalks. (Credit: Flickr / joewarminsky)

In March 2017, the American capital oversaw the launch of the world's largest urban AV freight pilot, with up to a dozen conveyors (small, self-driving electric cargo carts) providing last-mile deliveries between local businesses and residential customers in a partnership with Starship Technologies and delivery aggregator Postmates.

By February 2018, the city announced its first AV RFI soliciting ideas for a pilot on 10th Street SW (also known as L'Enfant Plaza), a three-block corridor linking the National Mall and The Wharf, a recently completed $2.5 billion mixed-use waterfront development. The Southwest Business Improvement District is the partner for the AV pilot. The city also announced the establishment of an AV Working Group comprised of District agencies focused on transportation, disability rights, environmental issues, and public safety.

Milestones

2018-05-07: Reaffirming its commitment to AV testing, the D.C. Council extended Starship's delivery robot trial. The law removed previously held geographic limitations and allowed for more than 5 robots to operate on the street at the same time.

2018-10-22: Ford announced it will begin testing its self-driving vehicles in DC's 8 wards as it works towards the deployment of a commercial service by 2021. In addition, the company is set to collaborate with DC Infrastructure Academy, a workforce training center, potentially training citizens as vehicle operators or technicians.

2018-10-31: The District's Autonomous Vehicles Working Group published a Principles Statement to guide autonomous vehicle policy making efforts. The principles include safety, equity, efficiency, and sustainability.

West Midlands, UK

Policy & Planning Priorities

Pilot Zone Identification

Peer Exchange

Partners

Corporate

SME

Non-Governmental Organization

University

Piloting AVs for

Private Auto

The British auto industry is poised to make a new global name for itself in AVs. (Credit: Flickr / Jaguar Land Rover)

Encompassing the cities of Birmingham and Coventry, the West Midlands has played a crucial role in England's commercial and industrial development since the Middle Ages. As part of the UK Autodrive program, partners enlisted AVs as a tool for reinvigorating the local economy, in a series of tests that will parallel the pilots at Milton Keynes. In 2017, preliminary trials were conducted at the City Circuit test facility, operated by HORIBA MIRA, an engineering and test services outfit, outside the town of Nuneaton. Future plans include the selection of an urban route in Coventry.

Milestones

2018-11-22: West Midlands authorities secured £19 million to continue research and development on connected and automated vehicles in 2019.

Wuhan, CN

Policy & Planning Priorities

Pilot Zone Identification

Partners

Corporate

Piloting AVs for

Private Auto

The capital of Hubei province opened China's first AV test zone in 2016, a 2-km lakeside stretch within the Sino-French Wuhan Ecological Demonstration City, a development stemming from a 2014 Sino-French agreement to develop sustainable districts in three Chinese cities. Already home to the nation's second-largest carmaker Dongfeng, this test site was chosen to strengthen Wuhan's ability to leverage AVs for future industry expansion. Initial tests involved a variant of the Renault Zoe EV, built in China under a Renault-Dongfeng joint venture.

Milestones

2018-06-28: The Chinese national government named Wuhan as one of 6 cities designated as testing zones for AVs.

2019-09-23: Wuhan's government issued operating licenses to three self-driving vehicle companies, including Baidu. Residents will be able to book rides along a 28-km demonstration zone.

A Renault electric vehicle travels along a demonstration track at the Sino-French Wuhan Ecological Demonstration City. (Credit: Government of Hubei and Cloud Vision)

Wuhu, CN

Policy & Planning Priorities

Pilot Zone Identification

Partners

Corporate

Piloting AVs for

Paratransit

Private Auto

Taxi

China has set an ambitious target of full autonomy for 10 percent of all vehicles by 2030. Search giant Baidu hopes to play a big role in making it happen. In May 2016, the company announced a long-term partnership to work with the city of Wuhu to establish the country's first autonomous testing zone. Baidu first launched its self-driving car project in 2014, and carried out its first public road tests in Beijing in December 2015.

The first pilot in Wuhu involved a driverless bus running a 2 km route between an auto plant and R&D center owned by Wuhu-based Chery, China's largest exporter of passenger cars. The buses are made by Chery and further plans are to add a number of electric vehicle models to the program. The five-year plan called for a growing expansion of the test zone and phasing in of passenger service as safety tests are completed.

Wuhu is the first of 10 cities Baidu engaged in its AV development efforts.

Some 500 people die everyday in China in motor vehicle crashes, putting pressure on government and leading tech companies like Baidu (shown here) to develop new safety solutions. (Credit: Xinhua)

40 Cities
are preparing for AVs by undertaking long-range surveys of regulatory, planning, and governance issues.

Amsterdam, NL

Policy & Planning Priorities

- Taxi Regulation
- Traffic Rules
- Land Use and Transit Planning
- Pilot Zone Identification
- Peer Exchange

Partners

- University

ROBOAT will test the potential of automated barges to move people and goods through Amsterdam's historic canal system. (Credit: MIT Senseable City Lab)

Amsterdam approached AVs pragmatically to preserve its hard-won accomplishments in sustainable transport, which emphasized innovations to increase cycling and walking. In 2017, the city's Smart Mobility Action Plan 2016-2018 allocated €100,000 ($112,000) for ongoing assessment of self-driving technologies. Two subsequent reports elaborated on the city's exploration of short-term action and long-range strategy around AVs:

- Autonomous Transport Action Plan outlined a set of principles emanating from the city's DNA of freedom, entrepreneurship, and creativity. This included establishing a Community of Practice comprising a broad range of stakeholders to monitor developments and advise on time-critical interventions for the city.
- Autonomous Vehicles in Amsterdam: Future Scan featured a set of recommendations for potential courses of action and four scenarios on the impact of autonomous transport in the city.

The city was also played testbed for one of the world's largest academic research efforts focused on AVs, the Spatial and Transport Impacts of Automated Driving (STAD)—a €7.5 million ($8.4 million) behavioral and design research effort co-housed at the University of Amsterdam and the Amsterdam Institute for Advanced Metropolitan Solutions (AMS) helped inform the city's efforts. STAD, a collaboration between Delft University of Technology and MIT, focused onAVs' implications on travel and location choices, and impacts on the design of cities and roads. Another AMS effort is the world's only autonomous water transport pilot.

Ashdod, IL

Port City of Ashdod enters the AV race with a partnership with ST Engineering. (Credit: Wikimedia Commons)

Ashdod, Israel's 6th largest city, has been a center for Israel's smart city ambitions since 2014. That's where ST Engineering, a Singaporean smart cities firm, planned to deploy a self-driving bus in 2019. As two small countries surrounded by hostile neighbors, Singapore and Israel have long maintained a common zeal for technology solutions and close military and economic ties.

This effort saw that cooperation extend to the realm of AVs. Straits Times reports that ST Engineering will also develop the city's intelligent fleet management system in addition to a new research and development center.

Atlanta, US

Policy & Planning Priorities

Pilot Zone Identification

Ponce City Market is at the center of Atlanta's urban renewal project and the North Avenue Smart Corridor Project (Credit: Wikimedia Commons / williamcasey)

Atlanta took its first step into the driverless age in September 2017 with an on-road test of an Autopilot-equipped Tesla and a driverless shuttle along North Avenue, which links the campus of Georgia Tech and historic Ponce City Market. The demonstration focused attention on a recent $3 million investment to implement a 'smart corridor' along the five-mile stretch of road, paving the way for future AV tests and deployments.

Authorities hope that the North Avenue demonstration will also lead to more in-depth discussion on the future of the city's transportation infrastructure including regulation of AVs. Downtown Atlanta 2041, a design study by Georgia Tech graduate students, re-imagined the city's streets with the dawn of AV fleets and robotaxis.

Going forward, the city's AV efforts are coordinated by Renew Atlanta, the agency charged with overseeing some quarter-billion in infrastructure spending approved by city voters in 2015, with $188 million earmarked for transportation projects (including the smart corridor project).

Milestones

2018-03-09: Waymo to begin pilot tests of self-driving trucks in the Atlanta area delivering goods to Google's Data Center in Douglas County.

Auckland, NZ

Policy & Planning Priorities

Pilot Zone Identification

Auckland began looking at the opportunities and risks associated with AVs early on. In October 2015, the city published a set of detailed scenarios considering future possibilities for automated transport systems. The study, which was prepared by experts at University College London and the University of Auckland, looked at four possible futures:

- Modest overall uptake of AVs having a limited impact
- Successful rollout of shared AVs, which become the dominant mode for urban travel
- Market-driven conversion of private vehicles to AV operation, resulting in a long transition and falling demand for public transport
- Thorough exploitation of AV technology in public transport systems, improving and expanding service substantially

In its 2016 Technology Strategy, Auckland Transport committed to the development of a "Connected and Autonomous Vehicle Strategy."

Auckland is charting alternate futures as it shapes policy for AVs. (Credit: Flickr / sxbaird)

Baoding, CN

Policy & Planning Priorities

Pilot Zone Identification

A collection of prototypes powered by Baidu's open source Apollo AV were on display at the December 2017 launch of China's first "AI City" in the Xiongan New Area special economic zone, outside Beijing. (Credit: Baidu, Inc.)

Hot on the heels of news in October 2017 that Google sister company Sidewalk Labs hopes to build an AV-powered urban innovation district on the Toronto waterfront, Chinese search giant Baidu announced its own smart city project. The "AI City" seeks to exploit artificial intelligence to deliver innovations in a wide range of urban systems with a central focus on autonomous vehicles. Baidu's AV efforts built on the early success of the company's Apollo platform, an open source autonomous driving software system that attracted some 70 companies including Daimler, Ford, and NVIDIA following launch in April 2017.

This ambitious project took shape in Xiongan New Area, a new special economic zone that Chinese leaders believe will be as crucial to the country's future development as Shenzhen's Special Economic Zone and Shanghai's Pudong New Area were over the last three decades. Located in Baoding, 100km southwest of Beijing, Xiongan serves as a growth pole and demonstration site for new technologies, market reforms, and urban governance innovations.

Milestones

2019-06-03: Robo-delivery shuttles owned by Chinese startup Neolinx began trials in the Xiongan economic zone.

Beijing, CN

Policy & Planning Priorities

Pilot Zone Identification

Beijing is the first Chinese city to authorize AV testing on public roads. (Credit: Flickr / Stan Wiechers)

In December 2017, Beijing became the first city in China to authorize testing of autonomous vehicles on public roads. Regulations adopted by the city's Municipal Commission on Transport are likely to become a model for other Chinese cities. The government of the Chinese capital also announced the creation of an instrumented AV test zone in the Yizhuang suburb, home to Beijing's largest Economic and Technical Development Area.

Milestones

2018-03-23: Baidu granted license to test self-driving cars on 65 miles of suburban roads in Beijing.

2018-07-06: Daimler becomes the first foreign automaker to be granted a license to test AVs in Beijing's city center.

2018-11-26: Baidu tests its new technology including an self-driving shuttle named Apolong in a smart park in the Haidian District, located northwest of the Forbidden City.

2019-01-11: Operating some 26,363 buses and over 1,221 routes, Beijing's Public Transit Corporation has partnered with Intel-owned MobilEye to bring self-driving buses to Beijing by 2022.

Bellevue, US

Policy & Planning Priorities

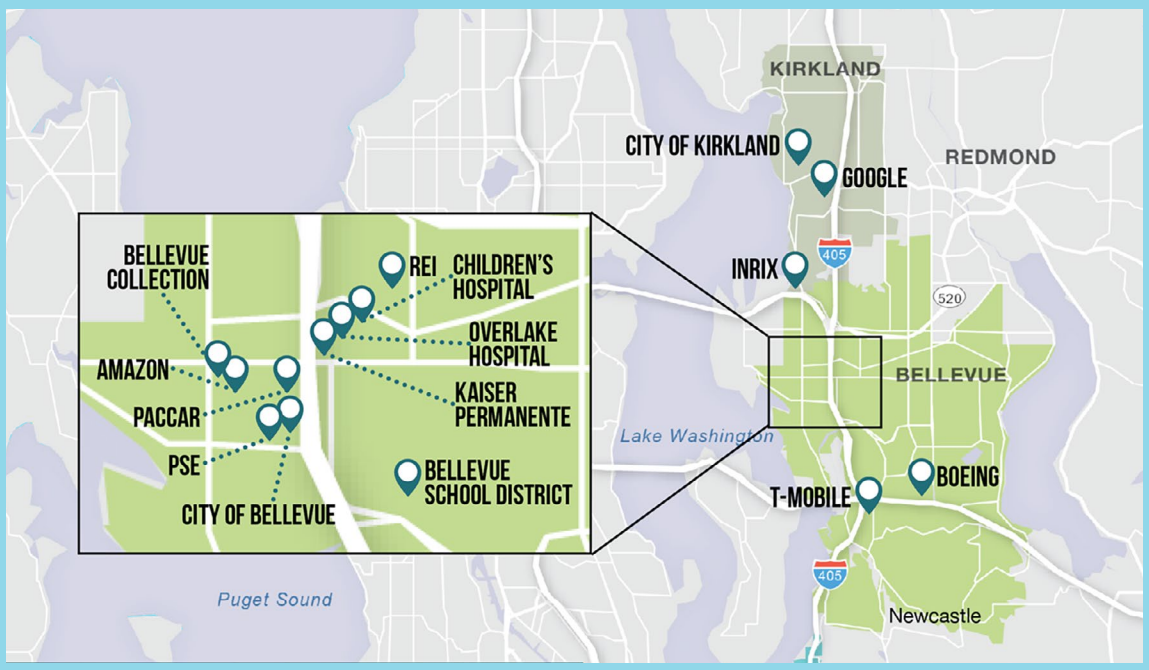
Land Use and Transit Planning

Pilot Zone Identification

Partners

Corporate

SME



Officials in Bellevue and Kirkland are proposing to give King County's largest commuter van program an upgrade by creating a flexible, electric, autonomous commutepool network. (Credit: City of Bellevue and Kirkland, Washington)

Seattle is one of just a handful of American cities where transit continues to gain market share, and the city's suburbs—including the city of Bellevue, home to Amazon and other tech companies- saw the arrival of AVs as a chance to join the trend but with a high-tech twist. In 2019, the city government and the Bellevue Chamber of Commerce developed a large employer-sponsored network of driverless shuttles serving local corporate campuses.

The first phase of this ambitious project was expected to begin in fall 2019 with a short test route of 1 to 2 miles in and around downtown Bellevue. More than $3 million in federal funding was requested to help fund this $9 million effort.

The project's bold, long-term vision called for hundreds of driverless shuttles—similar to King County Metro's existing vanpool program, the country's largest—but with on-demand flexibility rather than pre-scheduled rides. The system would achieve critical mass by focus on a corridor where along I-405 where multiple companies large employ thousands of workers each. At the time, it was hoped that such a system would be up and running before 2024, when bus rapid transit (BRT) rolls out along I-405, which cuts through Bellevue, to provide first and last mile connections.

Buenos Aires, AR

Roborace tested their automated race cars in Buenos Aires in January 2017. (Credit: Roborace)

Buenos Aires entered the AV age at high speed. On February 18, 2017, the city hosted the world's first autonomous auto race, dubbed the Roborace. With two high-performance DevBot driverless vehicles occupying the test track together at the same time, an oversteering error sent one of the racers into a wall in the world's first driverless wipeout. Beyond the racetrack, Buenos Aires proceeded with caution, however. The city is focused on legalizing ride sharing and creating a solid foundation for the anticipated commercial introduction of AVs in the coming years.

Cambridge, US

Policy & Planning Priorities

Land Use and Transit Planning

Peer Exchange

Taxi Regulation

Home to MIT and Harvard University, Cambridge is one of the world's leading centers for computer science, AI, and robotics research. The city's burgeoning AV cluster included many startups developing AVs and AV components (e.g. nuTonomy), auto industry research labs (e.g. Toyota Research Institute), and the US government's largest transportation engineering research center. City policy making and planning work were focused on opportunities for shared mobility solutions, with a heavy emphasis on improving safety and mobility for vulnerable users and persons with disabilities.

Milestones

2018-04-06: Joining a regional and statewide testing program already in place, Cambridge City Council voted to allow autonomous vehicle testing on city streets.

A team from the MIT Media Lab prepares an autonomous tricycle for a 2016 test. (Credit: MIT Media Lab)

Chamblee, US

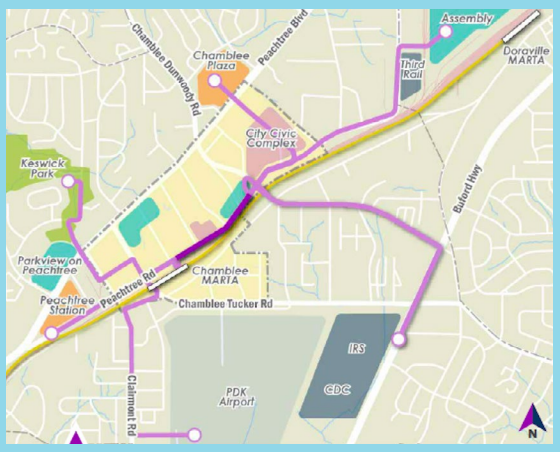
Policy & Planning Priorities

Land Use and Transit Planning

Pilot Zone Identification

In 2017, Chamblee, Ga. (pop: 28,000) began exploring the possibility of a shared autonomous vehicle pilot to provide first/last mile connections at the city's MARTA rail station. The $45,000 study was conducted by Stantec, an engineering firm, whose Urban Studio was engaged in several AV projects throughout North America. The completed feasibility study, which involved community group discussions and an online survey was adopted by city council in March 2018, proposed a number of possible driverless shuttle routes serving the city's main throughway of Peachtree Road, including employers such as the Center for Disease Control, Internal Revenue Service, and the Peachtree-Dekalb Airport.

City officials secured funding for Phase II of the study with funding from Georgia Tech's Smart Communities Challenge. Project looked to expand on the initial findings, specifically to explore the potential for AVs to be the seed of a large innovation ecosystem in the area, improving infrastructure to support multimodal transit, and greenhouse gas reduction goals.



Stantec's proposal includes a set of alternative routes that could be expanded from the initial pilot area on Peachtree Road. (Credit: Stantec and the City of Chamblee)

Changhua, TW

Policy & Planning Priorities

Land Use and Transit Planning

Pilot Zone Identification

Changhua County is located along Taiwan's urbanized west coast between the island nation's two biggest cities, Taipei and Kaohsiung. The region hoped to combine existing efforts to develop sustainable energy, which includes the largest of Taiwan's 21 offshore wind farms, with an ambitious program of AV pilots. The partners focused on an 8.8 km smart corridor connecting the 123-acre Changhua Fitzroy Gardens, one of Taiwan's largest parks, to a nearby high speed rail station. The corridor planned to feature an 8-vehicle driverless shuttle transit service with up to five stops, powered by 300 small wind turbines located along the route. Bidding for the $1 million project opened in early 2018.

In the meantime, two demonstrations took place within the park, with vehicles provided by Taiwanese startup 7Starlake. The first phase saw a half-kilometer demonstration route connects the park's tourist center with a green energy exhibit. A second phase extended the route to 2.2 km in length, looping in additional destinations inside the park.

Changhua is combining AV pilots with a growing investment in renewable energy to create sustainable, autonomous transit routes. (Credit: Changhua County Government)

Changsha, CN

Located at the heart of the Chinese mainland, Changsha's AV pilot hopes to bring a variety of new services to its residents. (Credit: Flickr / Philip Roeland)

Google left China in 2010, but web search wasn't the only business it left for Baidu. The Chinese search engine also followed its rival's lead into automated mobility, with a fleet of 100 autonomous taxis set to take to the roads of Changsha, the capital of Hunan Province.

Powered by Baidu's Apollo platform, which claims to be the largest open-source autonomous driving platform in the world, the Apolong bus was made available to residents in selected geo-fenced locations across the city. The bus was manufactured by Fujian-based King Long Industries.

Apollo represents a challenge to closed AV software schemes built by Waymo, GM, and others. More than 50 partners were enlisted in its ecosystem including industry heavyweights Nvidia, Microsoft, and Velodyne.

The birth province of PRC's founder-leader Mao Zedong, Changsha was established as one of China's first high-tech industrial zones in 1988. The zone is now home to some 800 industries, 200 of which are foreign-owned.

Milestones

2019-09-30: Baidu began trials of 45 Level 4 Apollo self-driving taxis.

Dublin, US

Policy & Planning Priorities

Pilot Zone Identification

The Transportation Research Center is a critical proving ground for the auto industry, that many hope will be a key center for AV research and development. (Credit: Ohio Department of Transportation)

Since 1974, the city of Dublin, Ohio has been home to the Transportation Research Center (TRC), a 4,500-acre proving ground operated by a non-profit organization and owned by Ohio State University (OSU). The nation's largest independent test facility is used by all major automakers with nearly 1,000 different customers. As TRC looks to double its business over the next five years amidst the self-driving boom, the group has partnered with Intel's Internet of Things-focused subsidiary Wind River, OSU, and the City of Dublin to collaborate on AV and connected transportation technologies throughout the larger Columbus metropolitan area. Doug McCollough, Dublin's chief information officer (CIO), said the effort "can be a benchmark for the nation in the area of intelligent research to improve safety and increase mobility, as well as address environmental challenges via more efficient transportation."

The state of Ohio has committed $45 million to expand OSU's 540-acre SMART Center, a research hub on the TRC campus, and in 2017 deployed fiber optic cables and sensors along a 35-mile stretch of a nearby highway, U.S. 33, where Uber's self-driving truck group Otto has already carried out tests.

Milestones

2018-10-22: Dublin City Council entered into a Memorandum of Agreement with DriveOhio and the Ohio Department of Transportation to begin testing AVs within city limits.

Edinburgh, UK

Policy & Planning Priorities

Land Use and Transit Planning

Pilot Zone Identification

Partners

Non-Governmental Organization

Corporate

SME

Project CAV Forth is one of 3 public pilots that secured a part of £25 million government grant. (Credit: Alexander Dennis Limited)

Scotland's second-largest city has long sought an outsized impact in its public works. When it opened in 1964, the Forth Road Bridge was the longest suspension bridge on Earth outside the U.S. In 2020, testing was set to begin for an AV bus fleet scheduled to go into service the following year, and would be the largest in the world.

An initial pilot involving 5 Alexander Dennis Enviro200 buses was to be funded by a £4.35m grant from the UK government and more than £1.5m from corporate partners including software firm Fusion Processing, Transport Scotland, and busmaker Alexander Dennis. The buses were set to travel along a 14-mile route linking the Ferrytoll Park & Ride in Fife and the Edinburgh Park train and tram station.

Milestones

2019-03-21: Trials of the full-sized autonomous bus, expected to launch in 2020, start at Sharston Depot in Manchester, UK.

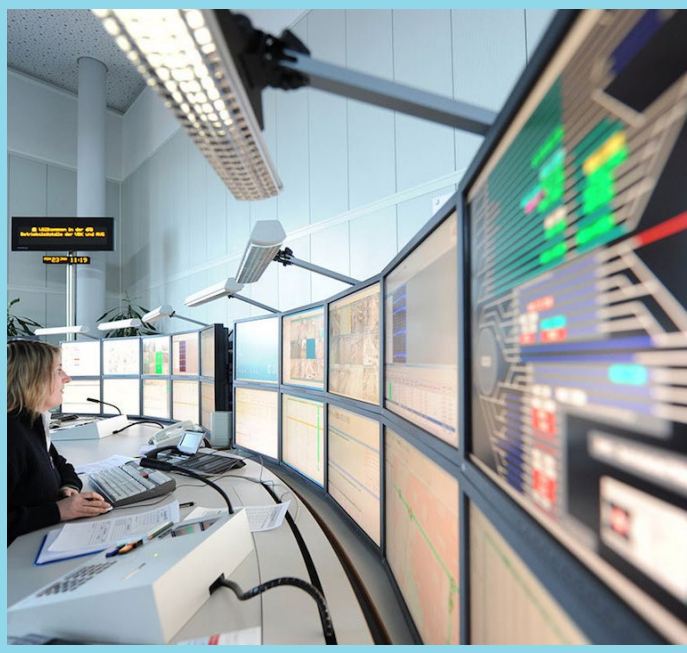
Karlsruhe, DE

Policy & Planning Priorities

Pilot Zone Identification

The German city of Karlsruhe is no stranger to science and technology innovation. Karlsruhe Institute of Technology (KIT) has produced the likes of Karl Benz, Karl Braun and Heinrich Hertz. This legacy, and the city's high tech manufacturing economy (which includes companies like Siemens and Bosch), make it an ideal location for Germany's largest urban AV test zone.

Planning for Testfeld Autonomes Fahren ("Test Area Autonomous Driving"), funded by a €2.5 million grant from the state of Baden-Württemberg Ministry of Transport. With a special interest in supporting R&D by small and medium-sized businesses, the project envisions a network of zones including the Oststadt district of Karlsruhe, the city's rail station, KIT's three campuses, and sections of roadway linking the city with Stuttgart and Heilbronn. The project is led by KIT's FZI Research Center for Information Technology, in partnership with the Karlsruhe Transport Authority (KVV), and will run for five years.



Karlsruhe has gathered a consortium of state, private and academic partners to launch a collection of AV testing zones in 2018. (Credit: Test Area Autonomous Driving Baden-Wuerttemberg)

Knoxville, US

Policy & Planning Priorities

Pilot Zone Identification

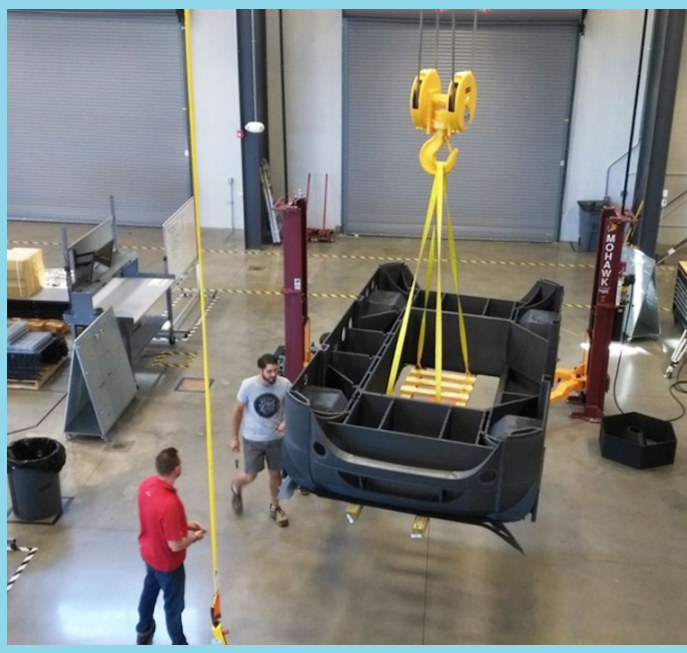
Partners

SME

In 2019, some 2 years after initial talks to bring Olli buses to Knoxville, city officials confirmed they were no longer actively pursuing the project. “T he city hit the brakes on self-driving buses,” read the Knoxville News Sentinel headline. Two buses were set to hit the roads in Spring 2018 but negotiations between the Visit Knoxville and Local Motors stalled in May 2018.

Knoxville emerged as a testbed for connected and autonomous vehicles thanks to a cluster of resources that includes startup GRIDSMART Technologies, a 3-d printing ‘microfactory’ operated by startup automaker Local Motors, the University of Tennessee, and the nearby Oak Ridge National Laboratory.

Visit Knoxville, the city’s convention and visitors Bureau, hoped to begin operations of a driver-less shuttle pilot on a downtown loop serving popular tourist venues. Employing Local Motors eight-passenger Olli shuttles, the route would stop at venues such as the 1982 World’s Fair Park, Chilhowee Park and the Exposition Center.



In 2014, Local Motors microfactory based in Knoxville partnered with the Department of Energy’s Oak Ridge National Laboratory to produce the world’s first 3-D printed car. (Credit: Local Motors)

Los Angeles, US

Los Angeles entered the AV age with a clear vision and set of goals, spelled out in a groundbreaking strategic plan published in September 2016. Urban Mobility in a Digital Age: A Transportation Technology Strategy for Los Angeles recognized the need to "prepare for an automated future" as one of five strategic priorities. Other major policy recommendations include:

- Collaborating with other governments to achieve regional interoperability,
- Creating a task force to look at monetizing AV data, and
- Advocating new approaches to financing infrastructure that enable and exploit AVs.

Short-term actions included developing a business plan for a city AV fleet and improving lane markings to enhance the effectiveness of vehicle-based computer vision systems. The road map's ten-year plan called for the development of an AV road network, as well as the conversion of the public transit fleet to full automation.

In October 2017, the city moved its AV campaign forward by hosting its first citywide AV working group meeting, drawing in officials from multiple departments and agencies. The group re-convened in January 2018 to assemble a joint budget package to fund a transportation technology strike team. A separate meeting brought together companies interested in working with the city on AVs and other innovative technologies, the first step in vendor pre-qualification for future pilots. More than 200 people representing large companies, startups, and NGOs participated, advancing the city's goal of building a diversified network of potential partners.

The city's Department of Transportation published Autonomous Los Angeles in April 2018. This business plan outlines a strategy to deliver a "people-focused, agile, multimodal, and operationally efficient" city.

Los Angeles has set an ambitious goal of full transit automation in the next decade. (Credit: Flickr / Jonathan Riley)

Milestones

2018-06-12: The city published a Strategic Implementation Plan for goals initially outlined in the 2016 Urban Mobility Playbook.

2019-03-20: Access Services, a public paratransit agency in charge of 45 fixed route agencies in Los Angeles County, sought funding from the USDOT for an AV paratransit pilot in West Los Angeles.

2019-03-21: In response to solicitations from the FHWA's Automated Driving Systems Demonstration Grants, LA County's Metropolitan Transport Authority (Metro) proposed an Autonomous Bus Transit Service.

2019-10-07: Waymo announced it will deploy 3 of its Chrysler Pacifica Vans to begin a 3D Detailed Map of Downtown LA and the Miracle Mile.

Louisville, US

Policy & Planning Priorities

Land Use and Transit Planning

Pilot Zone Identification

In 2003, Louisville became the largest US city in more than three decades to consolidate city and county governments, a move that has allowed it to address transportation needs more comprehensively. With initial funding from Bloomberg Philanthropies Innovation Team program, Metro Louisville created the Office of Performance Improvement & Innovation in 2012.

In 2017, the Office of Performance Improvement and Innovation started, in partnership with Louisville Forward and the Public Works Department, the Mobility Innovation Team. The team described itself as "a cross-functional group that meets regularly to prepare Louisville Metro for potential disruptive changes to our transportation system. The team discusses emerging issues in transportation focused on how new technology and innovations could impact how people and goods move in our community. The goal of the team is to incorporate new innovations in our transportation system in ways that allow us to accomplish to our larger community goals of reducing vehicle miles traveled (VMT) and improving safety and equity for our residents."

In 2018, the Mobility Innovation Team outlined its approach to AVs in an AV Playbook highlighting five future plays:

(1) Ensure that major infrastructure decisions focus on moving people and consider the effects of AVs.

(2) Forge public and private partnerships to prepare for new regulatory and technological challenges, anticipate emerging technologies, and establish best practices.

(3) Prepare for fundamental shifts in parking demand

(4) Ensure AV technology strengthens mass transit

Although no longer an active rail line, Union Station in Louisville is still a vital centerpiece to Louisville's transportation community as the HQ of Transport Authority of River City. (Credit: Flickr / David Kidd)

(5) Develop and maintain transportation technology and data infrastructure to encourage innovation and promote accountability.

Memphis, US

FedEx's SameDay Delivery bot is expected to travel on sidewalks and crossings with pedestrians. The bot is equipped with multiple wheels allowing it to climb up stairs and curbs. (Credit: FedEx)

In summer 2019, FedEx's hometown of Memphis hosted a large-scale test of autonomous delivery vehicles designed by inventor Dean Kamen. Following in the line of the self-balancing Segway scooter and iBot, a stair-climbing wheelchair, Kamen's SameDay Bots were custom-built for FedEx and had a top speed of 10 miles per hour. The pilot put the bots to work transporting packages between the company's multiple locations in Memphis, including the FedEx Logistics innovation skunkworks located in the historic Gibson Guitar Building. Upon pilot completion the company hoped to deploy the droids to retailers as part of its SameDay Service.

Milan, IT

Policy & Planning Priorities

Traffic Rules

Land Use and Transit Planning

Pilot Zone Identification

Claiming to be “the world’s first neighborhood planned for self-driving cars”, MIT professor and architect Carlo Ratti’s winning masterplan for the 2015 Milan World Expo site was a major milestone in how cities are thinking about autonomous vehicles. The reenvisioned site will serve as a science and technology innovation campus, with 10 million square feet of offices, research centers, universities, residences and cultural spaces, as well as areas for urban agriculture. The plan called for phasing in restrictions on human-driven vehicles throughout the new district, beginning with the 1.5km-long Decumanus mall, the site’s central pedestrian spine. The project will be developed in partnership between Australia’s LandLease and Arexpo, a publicly-owned corporation that controls the Expo site.

A new masterplan for Milan’s World Expo site envisions a pedestrianized district served only by shared, autonomous vehicles. (Credit: Carlo Ratti Associati)

Nashville, US

Policy & Planning Priorities

Peer Exchange

Can Nashville leverage AVs to speed along its Vision Zero pedestrian safety campaign? (Credit: Wikimedia commons / Rebajae)

Nashville saw AVs as essential to two key ambitions:nurturing the region's large and growing automotive sector, which led the state's post-recession recovery, and restructuring its transportation system. The city's mobility action strategy, Moving the Music City, built on earlier plans and laid out an agenda through 2020. It outlined the city's vision for AVs as "shared, electric, and carefully integrated to buttress mass transit so these technologies can address concerns around urban livability, such as the ability for elderly populations to age in place or providing mobility for those who can't drive (children and the disabled)."

Plans for Nashville's first AV demonstration of driverless shuttles supporting low-income college students were uncertain as the city faced efforts from the state legislature to prohibit cities from regulating AV testing in Tennessee.

Orlando, US

Policy & Planning Priorities

Pilot Zone Identification

SunTrax, located 1 hour outside Orlando, will provide AV developers with extensive test facilities in a controlled environment. (Credit: City of Orlando)

Florida made headlines in the summer of 2016 when it updated its law regulating AV tests to allow completely unattended operation on public roads, doing away with requirements that a human backup driver be physically present. Orlando is at the forefront of cities across the state, which are moving quickly amid the biggest real estate boom in a decade to radically rethink how AVs can enable improvements in mobility and land use. The city partnered with the Florida Turnpike Enterprise and Florida Department of Transportation to form the Central Florida Automated Vehicle (CFAV) partnership.

The group planned a three-phase approach to AV research and testing. The first phase focused on simulation, tapping the world's largest cluster of computer modeling talent at more than 100 companies and research organizations. The second phase leveraged a network of test facilities including Florida Polytechnic University's 400-acre SunTrax testing facility; the grounds of NASA's Kennedy Space Center; and eventually local highways and regional bus and rail networks. With more than 68 million visitors per year, Orlando could be a key site for improving public awareness and generating support for AV technology.

Milestones

2017-12-21: Orlando announced a $300,000 planning study assessing the potential automation of city bus and shuttle transit services.

2019-03-19: Orlando sought funding from USDOT to demonstrate a full-size autonomous BRT service on the historic Orange Line, a 2.5 mile and 14-station route. The project is focused on improving mobility for seniors and other physically challenged riders.

Palo Alto, US

Policy & Planning Priorities

Pilot Zone Identification

AV test vehicle sightings are commonplace in this California city, home to Stanford University. A hothouse of AV development, Palo Alto is home to stealth startup Zoox, as well as the Silicon Valley outposts of Ford, Toyota, and Mercedes-Benz, among others. While AV tests were being conducted independent of city government, in a November 2016 vote, the City Council voted to make official the city's designation as an AV testing zone, one of four top priorities it would push in state-level lobbying efforts.

Milestones

2018-11-01: Waymo's Chrysler Pacific Vans hit California's roads after receiving the state's first permit to test fully driverless vehicles in California.

2018-11-30: Palo Alto authorized the City Manager to oversee operations of delivery AVs for one-year period.

At the heart of Silicon Valley, Palo Alto's streets became a testing zone for a full spectrum of AVs. (Credit: Palo Alto Public Art)

Portland, ME, US

Policy & Planning Priorities

Land Use and Transit Planning

Pilot Zone Identification

A proposed state law would establish a legal framework for state-city partnerships to conduct AV transit pilots in Portland and other towns and cities throughout Maine. (Credit: Flickr / Corey Templeton)

For most American cities, state legislatures have worked at cross purposes to municipal interests on both transit and autonomous vehicle policy. Portland, however, is providing an example of what might be possible when state and city get aligned on these key transportation issues.

According to the Portland Press-Herald, it was Portland city manager Jon Jennings' interest in the potential of AV-based transit that set the stage for a proposed state law authorizing towns and cities to undertake pilot AV transit projects in partnership with state agencies. A bill passed in March 2018 under the sponsorship of Rep. Heather Sanborn, D-Portland, would provide a five-year window through March 2022 for municipalities to put the needed agreements in place. Meanwhile, the governor established an Advisory Committee that also seeks to oversee AV pilots within the state.

In Portland, city officials were most interested in providing transit connections across the I-295 corridor, which cuts through the city's historic downtown. One potential route would run between Portland's Transportation Center to the Corridor Street Waterfront, serving both tourists and commuters.

Milestones

2018-07-17: Committed to the safe and effective deployment of AVs, Portland became one of 7 cities piloting INRIX's AV Road Rules Platform. The program achieved this by enabling the digitization of local rules, speed limits, and school zones, among others.

Portland, OR, US

Portland, Oregon has been a leader in mobility innovation, but has also aggressively pushed back against companies such as Uber when corporate and city goals have diverged. With AVs, the city worked to consolidate home rule authority by regulating key aspects of AV use within city limits, despite repeated attempts in the Oregon state legislature to preemptively limit local control.

In April 2017, Portland's transportation agencies committed to launching AV pilots under the Smart Autonomous Vehicles Initiative, which proposed to "implement testing and piloting of AV technology, while advancing public safety, protection of the environment, and transportation access for everyone, regardless of income." The program prioritized shared and electric AV solutions, encouraged testing technologies that benefit low- and moderate-income residents, and promote high-value trips such as freight and public transit. The initiative also included a public engagement component focused on consulting local stakeholders in shaping the "rules of the road" for AVs in Portland. The city issued an RFI for AV pilots in June 2017.

Portland has proposed creating an "Autonomous Technology Zone" at the Oregon Museum of Science and Industry and Portland Community College. (Source: Flickr / pdx_rollingthunder)

Milestones

2018-06-31: Portland's City Council adopted a Connected and Automated Vehicles Policy under the existing Transportation System Plan. The policy established priorities and directed the development of specific strategies for AVs and road safety (e.g. Vision Zero), transportation system efficiency, pollution and GHG emissions, equity, and data sharing and connected infrastructure.

Regina, CA

Policy & Planning Priorities

Land Use and Transit Planning

Officials in Regina City are keen on exploring the impact of AVs to their city's transit infrastructure. (Credit: Flickr User Daniel Paquet)

Regina, the capital of the Canadian province of Saskatchewan, took the first steps to prepare for the age of AVs. January 2018. That's when the city council unanimously voted to begin monitor AV industry and research, looking at the potential impacts that AVs could have for the city. A final report was published in mid-2019, and will be used to shape future transport planning, policy initiatives, and infrastructure plans.

Sacramento, US

Policy & Planning Priorities

Pilot Zone Identification

The success of America's most high-tech stadium, Sacramento's Golden 1 Center, could pave the way for a world-class AV test bed. (Credit: Golden 1 Center)

Scaling the number of AVs city- or nation-wide will require entire new network and computing infrastructures. Sacramento's Autonomous Transportation Open Standards Labs (ATOS) envisioned to bring out an open source approach to developing AV technology with deployment and scale in mind. ATOS described itself as a "public-private consortium", with support from Sacramento's mayor, local Congressional representatives, and Silicon Valley software veteran (and Sacramento Kings owner) Vivek Ranadivé. The group's stated mission includes development of standards, policy advocacy on AV regulation, and collaboration with university partners to study the broader "ripple effects caused by the introduction of AVs to the world at scale." The group identified some 100 miles of local roads and highways as candidates for AV testing. The region hoped to leverage its status as a 5G pilot city for wireless giant Verizon, providing early access to next-generation vehicle and infrastructure connectivity.

Milestones

2017-12-18: California State University, Sacramento led discussions for an AV shuttle to transport students from 65th street light rail station to campus along a dedicated track, with an anticipated pilot launch in 2019.

2018-08-01: Sacramento earmarked $100,000 to create a live map of the city's cellular networks, which it hopes to eventually use to teleoperate self-driving cars.

San Diego, US

Policy & Planning Priorities

Pilot Zone Identification

In 1997, the San Diego region gave the world its first look at what a self-driving future might look like. That's when a series of tests called Demo 97 marked the culmination of a 4-year federally-funded effort to prove the technical feasibility of automated highways. The $650 million project ultimately failed to spur a wider public effort, but helped spark further efforts that would lead directly to the autonomous driving breakthroughs of the mid-2000s.

A decade later in January 2017, San Diego would once again play an important role in automated transportation systems innovation, after being designated as one of ten Autonomous Vehicle Proving Grounds by the U.S. Department of Transportation. The San Diego proving ground is a partnership between the San Diego Association of Governments (SANDAG), a regional planning organization; Caltrans (the state transportation agency); and the city of Chula Vista (pop. 267,172). Three test zones were proposed: a 20-mile segment of I-15 (the same used in 1997), 10 miles of the South Bay Expressway, and city streets in Chula Vista, which passed a resolution in June to allow AV testing.

In October 2017, the triumvirate held its first Proving Ground planning meeting, which was attended by more than 40 organizations.

Twenty years after a widely-hailed 1997 demonstration of automated highway technology, San Diego is again tapping I-15 as a proving ground for autonomous vehicles. (Credit: SANDAG)

Santa Monica, US

The Santa Monica-based RAND Corporation has been a pioneer in AV policy research. (Credit: Shaw Construction)

For Santa Monica, AVs hold the promise of expanding access and preserving the pedestrian character of the vibrant downtown that has fueled the city's ongoing success. Originally developed in the early 20th century as a seaside resort, Santa Monica has become a talent magnet in the digital media age—the city is home to companies like Activision, LionsGate, and Universal Music Group.

As the city assessed AV developments, it was keen on understanding the impacts on parking, as well as the threat of increases in vehicle traffic that could result. The city actively networked with several other municipalities in California to share information. Notably, Santa Monica is also home to the RAND Corporation, one of the world's most influential think tanks, which has a substantial research program on autonomous vehicles.

São Paulo, BR

São Paulo's battles over transportation network companies, like the taxi driver protest shown here, gave rise to a distance-based ride tariff that could set a progressive precedent for AVs in the future. (Credit: Flick / Diego3336)

More populous than Mexico City, but with a metro system just one-third the size, São Paulo has long struggled with the economic and human cost of poor mobility, relying heavily on the largest bus fleet in the world (over 15,000 vehicles). Research and development on AVs got an early start due to the metropolitan area's status as the hub of Brazil's automotive industry. The first on-road trials date back to October 2013, and a number of the city's technical universities, in partnership with global automakers such as Scania, are spearheading the ongoing development of a variety of AV trucks, taxis, and passenger cars.

As the city navigates Brazil's ongoing political and economic crises, which have direct impacts on the municipal budget, planning for AVs has inevitably taken on a new pragmatism. The city looked to its earlier efforts to regulate transportation network companies (TNCs) for an edge, including a 2016 law that imposed a distance-based tax on TNCs and formally distinguished rideshare from private taxi service. Both rules are set to be extended to the AV realm and will provide leverage to foster higher occupancy use for AVs.

SeaTac, US

Policy & Planning Priorities

Land Use and Transit Planning

SeaTac's officials are looking to expand transit options for the city's residents. (Credit: Flickr / Michael B.)

With the goal of making itself 'a center of municipal excellence in AVs', the city of SeaTac, Washington commissioned a feasibility study to identify routes and services for AV transit connections. The study conducted by the Center for Advanced Transportation and Energy Solutions (CATES), a Seattle-based transportation think tank identified missing links in local transit networks where driverless shuttles could provide new alternatives for SeaTac residents. Preliminary recommendations outlined in a September 2017 status report on the study includes focusing on services linking major employers like Boeing's global parts distribution hub, light rail stations within city limits, and an elder care center. The preliminary report further recommended providing service to the SeaTac Airport employee entrance, but not its passenger terminals.

The Final Action Plan prepared by CATES and published in April 2018, recommended "the deployment of an automated electric on-demand shuttle micro-transit franchise operation delivered by a qualified public or private organization meeting a provable City of SeaTac residents' mobility demand and working within a framework of sustainable long-run economics."

Seattle, US

Seattle's new electric bus fleet could be a stepping stone to transit automation. (Credit: Wikimedia Commons / SounderBruce)

Many cities have seen grassroots campaigns to remove urban expressways, but Seattle is the first place where government outsiders rallied to create AV-only highways. In September 2016, a local venture capital group enlisted by Microsoft research head Craig Mundie published a proposal to convert portions of the I-5 corridor to AV-only use over the next 10-15 years.

Meanwhile, the city's New Mobility Playbook, published in September 2017 outlined a far more progressive AV policy framework with a broad mandate. The plan's three directives: (1) continue prioritized walking, biking and transit, (2) support of AV pilots, and (3) the establishment of additional policy parameters to align AV developments with the city's core mobility goals.

Tel Aviv, IL

The Tel Aviv region has rapidly emerged as a world-leading hub for digital automotive technology innovation. Sources of new inventions include homegrown startups like AV powerhouse Mobileye, a supplier of computer vision systems, as well as a constellation of new research centers set up by Japanese, American, and European automakers. Following Intel's acquisition of Mobileye in early 2017, the Israeli government announced its intent to fast-track regulations to accelerate AV testing nationwide.

For Tel Aviv, whose long tradition of car dependency dates back to its 1929 city plan, this innovation boom came just in time. After a decade-long rise in Israelis' auto use by more than 50 percent, fully 80 percent of daily trips in Tel Aviv are now made by car.

MobileEye took U.S. Ambassador Daniel Shapiro on a test ride through Tel Aviv in February 2016. (Credit: Flickr / usembassyta)

Tokyo, JP

Policy & Planning Priorities

Land Use and Transit Planning

Pilot Zone Identification

As one of the world's largest, wealthiest, and most technologically-advanced cities, all eyes are on Tokyo in anticipation of what is expected to be a major demonstration of autonomous vehicles during the 2020 Summer Olympic Games. With more than 30 million visitors expected, a city long known for its pristine taxis and tuxedoed drivers faces a rapidly aging and shrinking workforce. At least one Tokyo taxi company, Hinomaru Kotsu, has announced a partnership to deploy AV technology within some portion of its 600-plus vehicle fleet.

To speed deployment of AVs, Tokyo's Metropolitan Government has created a Self-Driving Technology Center to streamline issuance of test permits for corporations. Nissan, which recently demonstrated a new AV sedan during a 12-mile test ride on Tokyo highways, "hopes to roll out the new tech in time for the Tokyo Olympics in 2020."

Meanwhile, the Japanese national government planned a number of efforts to roll out AV mobility services at the 2020 Games. One was a massive road surveying mapping effort, which began almost as soon as the Rio games concluded in 2016. These base maps will cover more than 18,600 miles of expressways and 789,000 miles of roads nationwide, at a cost in the hundreds of millions of dollars, and support development of Olympic-related services as well as the broader AV industry. SIP-adus, a cross-ministry R&D effort, also developed an autonomous transit planning framework dubbed Advanced Rapid Transit which outlines a highly-automated bus rapid transit scheme focused on mobility needs of the country's aging population.

Japan's taxi fleet will be expanded and potentially extensively automated in the run up to the 2020 Summer Olympic Games. (Credit: Flickr / picturecorrect)

Milestones

2018-01-08: Japanese revealed plans to demonstrate the e-Palette, a multi-purpose autonomous delivery vehicle, during the 2020 Tokyo Summer Olympic Games.

2018-08-27: A self-driving taxi began operation along a 5.3km route between Tokyo Station and the Roppongi District with trips costing approximately 13.5 USD. These tests are part of Japan's intensifying efforts to bring autonomous services into full commercial operation by the Summer Olympic Games in 2020. The pilot project was partly financed by Tokyo's Metropolitan Government.

Toledo, US

Policy & Planning Priorities

Land Use and Transit Planning

Pilot Zone Identification

Partners

State Government

A rendering of TARTA's future downtown transit hub opening in 2019. (Credit: TARTA)

Once a center for glass and automobile manufacturing, Toledo hoped to bring a driverless shuttle by 2019, but plans are on hold indefinitely as TARTA awaits to receive the $1.8 million funding secured from the US Federal Highway Association. Toledo's Regional Transit Authority (TARTA) officials secured the grant together with the Ohio Department of Transportation and the Toledo Metropolitan Area Council of Governments covering the shuttles and subsequent operation over a three year period. TARTA's vision and foundational plan was outlined in their 2018 strategy document, MoveToledo.

Toronto, CA

In 2015, Toronto was one of the first cities to conduct an in-depth look at the long-term prospects for AVs. Driving Changes: Automated Vehicles in Toronto, a study conducted by the University of Toronto's Innovation Policy Lab, concluded that near-total conversion of the city's private vehicle fleet to AVs by 2030 could save $6 billion annually (4 percent of the city's economic output), eliminate 16,000 road injuries annually, and improve the mobility of 75,000 disabled senior citizens. Considering the uncertainty of AVs, the City took a calculated and technologically agnostic approach to AV adoption. An Interdivisional AV Working Group, a three-year work plan, and a temporary staff position were established in 2016 to coordinate work across city departments and agencies, with local stakeholders, and with other communities in the region and beyond.

In October 2017, the public agency that oversees the city's lakefront, Waterfront Toronto, announced the selection of New York City-based Sidewalk Labs as lead partner for the creation of what the company claims "is likely to be the first large autonomous vehicle-only district in the world" at Quayside, a redevelopment area.

Milestones

2018-01-16: Toronto Transportation Services released a Divisional Workplan summarizing work undertaken over the last three years to develop a cross-divisional policy position for AVs in the city.

2018-07-04: Toronto announced plans to launch a driverless shuttle pilot in 2020 pending approval from the public works committee and city council.

2018-08-10: Groups in Greater Toronto area, including the City of Toronto, received over $1.3 million in federal funding to research connected and automated vehicles.

A proposed design for the redevelopment of Toronto's Quayside waterfront district by Sidewalk Labs, part of Google's Alphabet family, will feature a subterranean network of AV freight conveyors. (Credit: Sidewalk Labs)

2018-12-01: The Toronto Transit Commission (TTC), in partnership with Metrolinx and the City of Toronto, issued a request for information on automated transit shuttles and supporting services.

2019-07-21: The City's draft AV Tactical Plan, which synthesizes a two-year effort, is now open for feedback.

2019-10-29: Toronto's city council adopted the AV Tactical Plan.

Tsukuba, JP

Policy & Planning Priorities

- Land Use and Transit Planning
- Pilot Zone Identification
- Peer Exchange

Partners

- State Government
- Corporate
- University

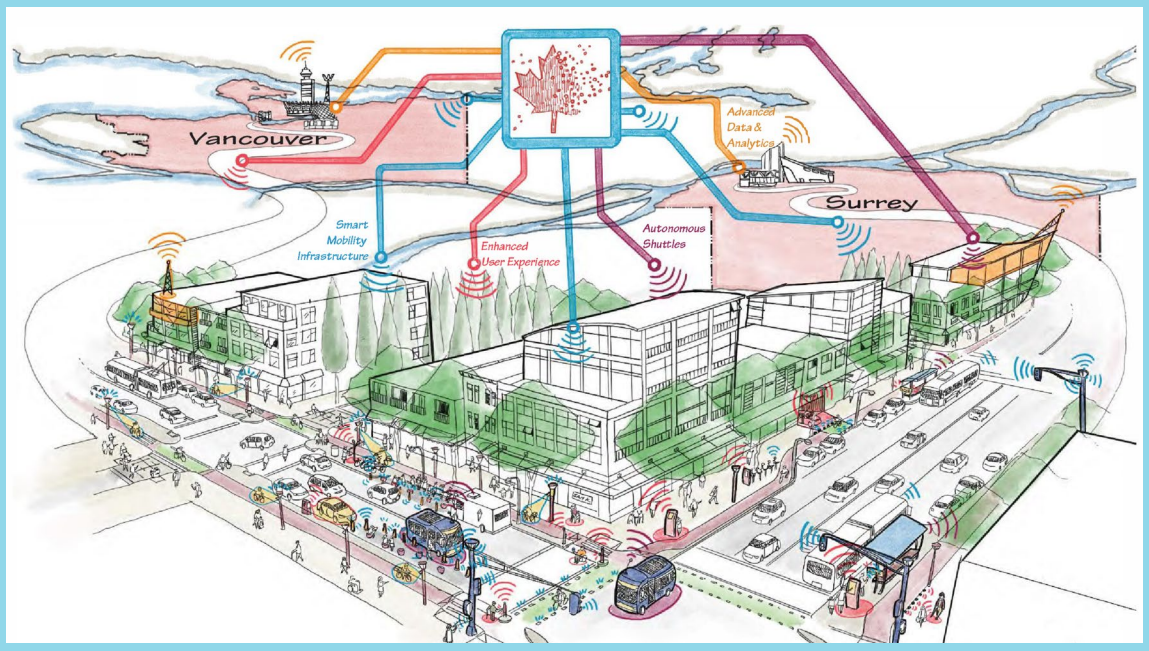
Tsukuba's fuel-cell-powered self-driving buses will set the standard for the future public transport initiatives. (Credit: Flickr / Keiichi Yasu)

The world's first successful test of autonomous vehicle technology took place at University of Tsukuba's Mechanical Engineering Lab in 1977. In 2019, some 42 years later, the city of Tsukuba planned to pilot a system of single-seat electric cars and self-driving buses, according to the Nikkei Asian Review.

This system was aimed at Japan's aging population, with self-driving cars transporting people from their homes to a bus station where they would transfer onto fuel-cell-powered self-driving buses running fixed inner-city routes, or onto ones making long-distance trips to Tokyo Station or Narita Airport.

The 3-year experiment began with preliminary research to identify congested areas using a combination of satellite imagery, street-side sensors and artificial intelligence. The city's plans included partnering with the University of Tsukuba, one of the country's oldest research universities, and Toyota Motors.

Vancouver, CA



Concept drawing for the autonomous corridor in Vancouver and Surrey a finalist for Canada's Smart City Challenge. (Credit: #Smartertogether)

Vancouver, Canada's largest port and industrial city, received over $386,000 in federal funding to research the impact of self-driving cars over a three-year period from 2018 to 2021. Transport Canada, the funding agency, earmarked nearly $3 million to support Canadian cities and provinces in anticipation of the driverless era through Program to Advance Connectivity and Automation in the Transportation System.

Earlier in 2018, Vancouver teamed up with Surrey, second largest city in British Columbia, for a joint entry to Canada's Smart City Challenge. The four-month public consultation led to an entry focused on mobility. #Smartertogether proposes Canada's first two collision-free multimodal transportation corridors, leveraging autonomous vehicles and smart technologies. This initiative followed Vancouver's earlier research work in 2016 The Future of Driving: The Policy Implications for Automated Vehicles and New Mobility Services in Metro Vancouver.

Weymouth, US

Policy & Planning Priorities

Land Use and Transit Planning

Partners

SME

University

A street view rendering of Union Point served by Optimus Ride's self-driving shuttles. (Credit: LStar Ventures)

Union Point, a 1500-acre mixed-use development slated for the Boston suburb of Weymouth, could be home to one of the largest deployments of AVs if an 18-month pilot of self-driving shuttles announced in November 2017 bears fruit.

The project, sited on a former airbase turned smart city development, has hitched its vision to the smart cities movement—its stated mission: "to enhance the human experience through the ideals of technology, sustainability, architectural beauty, education, creative arts, culture and inclusivity." To that end, developer LStar Ventures brought in MIT spinout Optimus Ride, founded by a team of DARPA Urban Challenge competitors. The company has previously tested technology at Boston's Seaport District and secured state and city testing permits in June 2017.

Optimus Ride's shuttles could serve some 2,000 residents already living at Union Point with further plans to extend service to the nearby South Weymouth Rail Station.

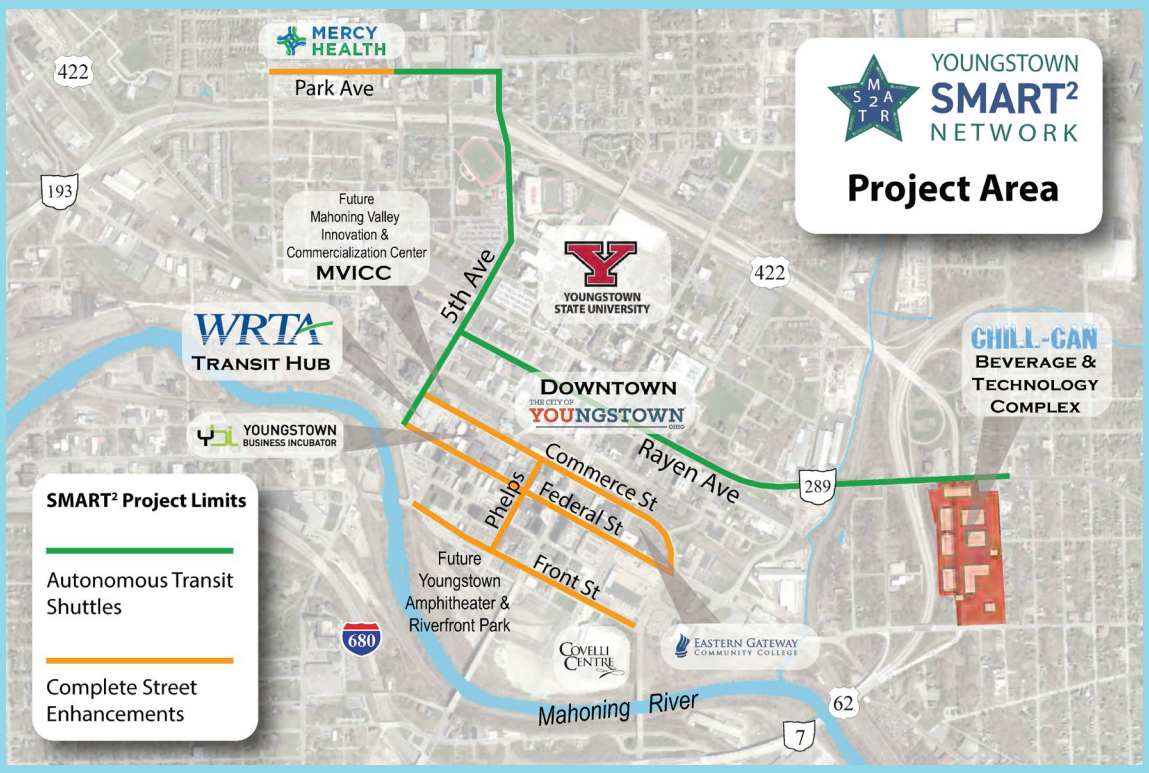
Youngstown, US

Policy & Planning Priorities

Land Use and Transit Planning

Pilot Zone Identification

Peer Exchange



Youngstown's SMART2 Project will feature a self-driving circulator on the city's main throughway. (Credit: City of Youngstown)

Once part of the industrial stronghold of the Rust Belt, Youngstown had hemorrhaged jobs and population for years. Then in 2019, the General Motors' Lordstown Assembly Plant, which had been one of the largest employers of the area in the last 5 decades closed its doors in March.

One big step to realign the city's economy was Youngstown's SMART2 initiative, a multi-modal transportation project which promised to transform the city's main throughway, Fifth Avenue Corridor. The $22 million project, funded in part by a $10.8 m grant from the U.S. Department of Transportation's BUILD Program, included a self-driving circulator. This service hopes to connect residents from Federal Station bus terminal to the city's major employers—Youngstown State University, Mercy Health, Youngstown Business Incubator, and Eastern Gateway Community College.

Local partners, including Youngstown State University, the city of Youngstown, the Western Reserve Transit Authority and Mercy Health-Youngstown, raised nearly $11 million to match the DOT grant. Youngstown's project was also supported by DriveOhio, a state-wide initiative supporting smart mobility projects in 20 cities and towns, including many involving autonomous and connected vehicles.

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City	Country		US State	Member	Piloting	Preparing	Pilot Area: Transit	Pilot Area: Paratransit	Pilot Area: Taxi	Pilot Area: Private Auto	Pilot Area: Freight	Partners: NGO	Partners: State Government	Partners: Corporate	Partners: SME	Partners: University	Policy: Taxi Regulation	Policy: Traffic Rules	Policy: Land Use and Transit Planning	Policy: City Fleets	Policy: Pilot Zone Identification	Policy: Peer Exchange	Population	Page
Aalborg	**DK**	Denmark			●		●	●						●	●	●			●		●		<500K	7
Adelaide	**AU**	Australia			●		●				●		●	●	●	●		●	●				1M–5M	8
Amsterdam	**NL**	Netherlands				●										●	●	●	●		●	●	1M–5M	104
Ann Arbor	**US**	United States	MI		●																●		<500K	9
Arlington	**US**	United States	TX		●		●								●				●		●		<500K	10
Armidale	**AU**	Australia			●		●						●	●	●	●			●				<500K	11
Ashdod	**IL**	Israel				●								●					●		●		<500K	105
Atlanta	**US**	United States	GA			●															●		<500K	106
Auburn Hills	**US**	United States	MI		●		●						●	●	●	●			●		●		<500K	12
Auckland	**NZ**	New Zealand				●															●		500k–1M	107
Austin	**US**	United States	TX	●	●		●			●				●		●	●	●	●	●	●	●	500k–1M	13
Bad Birnbach	**DE**	Germany			●		●						●	●	●				●		●		<500K	14
Baoding	**CN**	China				●															●		5M+	108
Beaumont	**CA**	Canada			●		●							●	●				●		●	●	<500K	15
Beijing	**CN**	China				●															●		5M+	109
Bellevue	**US**	United States	WA			●								●	●				●		●		<500K	110
Berlin	**DE**	Germany			●		●						●	●	●	●			●		●		5M+	16
Boston	**US**	United States	MA		●				●	●					●			●	●			●	500k–1M	17
Bristol	**UK**	United Kingdom			●					●				●	●	●					●		500k–1M	18
Bryan	**US**	United States	TX		●		●						●			●			●				<500K	19
Buenos Aires	**AR**	Argentina		●		●																●	1M–5M	111
Calgary	**CA**	Canada			●		●									●					●	●	1M–5M	20
Cambridge	**UK**	United Kingdom			●		●								●				●		●		<500K	21
Cambridge	**US**	United States	MA			●											●		●			●	<500K	112
Canberra	**AU**	Australia			●					●					●	●					●		<500K	22
Candiac	**CA**	Canada			●		●						●	●	●				●				<500K	23
Chamblee	**US**	United States	GA			●													●		●		<500K	113
Chandler	**US**	United States	AZ		●					●				●				●					<500K	24
Changhua	**TW**	Taiwan				●													●		●		<500K	114
Changsha	**CN**	China				●							●	●					●	●	●		5M+	115
Chiba City	**JP**	Japan			●						●				●	●					●		500k–1M	25
Columbus	**US**	United States	OH		●		●							●							●	●	500k–1M	26
Concord	**US**	United States	CA		●						●				●						●		<500K	27
Copenhagen	**DK**	Denmark			●		●							●					●		●		1M–5M	28
Cossonay	**CH**	Switzerland			●		●								●				●				<500K	29
Darwin	**AU**	Australia			●		●						●	●					●		●		<500K	30
Denver	**US**	United States	CO		●																●		500k–1M	31
Detroit	**US**	United States	MI		●		●								●						●		500k–1M	32
Doraville	**US**	United States	GA		●		●								●				●		●		<500K	33
Dubai	**AE**	United Arab Emirates			●		●		●	●				●	●					●	●		1M–5M	34
Dublin	**US**	United States	OH			●															●		<500K	116
Edinburgh	**UK**	United Kingdom				●								●	●				●		●		500k–1M	117
Edmonton	**CA**	Canada			●		●						●	●		●			●		●	●	1M–5M	35
Eindhoven	**NL**	Netherlands			●					●			●		●	●						●	500k–1M	36
Espoo	**FI**	Finland			●		●						●	●	●	●			●	●	●		<500K	37
Fribourg	**CH**	Switzerland			●		●						●						●				<500K	39

							Pilot Area					Partners					Policy							
City	Country		US State	Member	Piloting	Preparing	Transit	Paratransit	Taxi	Private Auto	Freight	NGO	State Government	Corporate	SME	University	Taxi Regulation	Traffic Rules	Land Use and Transit Planning	City Fleets	Pilot Zone Identification	Peer Exchange	Population	Page
Frisco	**US**	United States	TX		●		●								●				●		●		<500K	39
Gainesville	**US**	United States	FL		●		●						●	●		●			●		●		<500K	40
Geneva	**CH**	Switzerland			●		●						●		●	●			●		●		500k–1M	41
Gothenburg	**SE**	Sweden			●		●			●				●	●	●		●	●			●	1M–5M	42
Grand Rapids	**US**	United States	MI		●		●	●						●	●				●				<500K	43
Greenville	**US**	United States	SC		●		●								●	●			●		●		<500K	44
Groningen	**NL**	Netherlands			●		●	●					●	●	●				●		●	●	<500K	45
Guangzhou	**CN**	China			●				●						●		●				●		5M+	46
Haarlem	**NL**	Netherlands			●		●							●						●			<500K	47
Hamburg	**DE**	Germany			●		●				●		●	●					●		●		1M–5M	48
Helsinki	**FI**	Finland		●	●		●							●		●	●	●	●	●	●	●	1M–5M	49
Houston	**US**	United States	TX		●		●						●			●				●	●		<500K	50
Jacksonville	**US**	United States	FL		●															●			500k–1M	51
Jerusalem	**IL**	Israel			●					●				●	●								500k–1M	52
Kaohsiung	**TW**	Taiwan			●		●								●				●				1M–5M	53
Karlsruhe	**DE**	Germany				●															●		500k–1M	118
Knoxville	**US**	United States	TN			●									●						●		<500K	119
Køge	**DK**	Denmark			●		●	●					●	●	●				●		●		<500K	54
La Rochelle	**FR**	France			●		●							●	●			●	●		●	●	<500K	55
Las Vegas	**US**	United States	NV		●		●								●				●			●	500k–1M	56
Lausanne	**CH**	Switzerland			●		●							●	●	●			●		●	●	<500K	57
Lille	**FR**	France			●		●							●	●	●			●				1M–5M	58
Lincoln	**US**	United States	NE		●													●			●	●	<500K	59
London	**UK**	United Kingdom		●	●		●	●	●	●				●	●	●	●	●	●	●		●	5M+	60
Los Angeles	**US**	United States	CA	●		●											●	●	●	●		●	1M–5M	120
Louisville	**US**	United States	KY			●													●		●		500k–1M	121
Lyon	**FR**	France			●		●								●						●		1M–5M	61
Memphis	**US**	United States	TN			●					●			●	●			●	●		●		500k–1M	122
Miami	**US**	United States	FL		●						●			●							●		<500K	62
Milan	**IT**	Italy				●												●	●		●		5M+	123
Milton Keynes	**UK**	United Kingdom			●		●	●		●				●	●	●	●		●			●	<500K	63
Montréal	**CA**	Canada			●												●	●	●	●	●	●	1M–5M	64
Nashville	**US**	United States	TN	●		●																●	500k–1M	124
Orlando	**US**	United States	FL			●															●		<500K	125
Oslo	**NO**	Norway			●		●							●	●						●	●	1M–5M	65
Ottawa	**CA**	Canada			●					●			●	●	●	●					●		1M–5M	66
Oxford	**UK**	United Kingdom			●					●					●	●				●	●		500k–1M	67
Palo Alto	**US**	United States	CA			●															●		<500K	126
Paris	**FR**	France		●	●		●							●	●		●	●	●	●		●	5M+	68
Peachtree Corners	**US**	United States	GA		●		●						●	●	●	●					●		<500K	69
Phoenix	**US**	United States	AZ		●		●	●	●						●				●		●		1M–5M	70
Pittsburgh	**US**	United States	PA		●					●			●	●			●	●	●			●	<500K	71
Portland	**US**	United States	ME			●													●		●		<500K	127
Portland	**US**	United States	OR			●												●		●			500k–1M	128
Providence	**US**	United States	RI		●		●						●	●	●				●	●	●		<500K	72
Regina	**CA**	Canada				●													●				<500K	129
Rennes	**FR**	France			●		●							●	●				●				500k–1M	73

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Reno	**US**	United States	NV		●		●							●				●	●				<500K	74
Rotterdam	**NL**	Netherlands			●		●						●		●	●				●		●	1M–5M	75
Rouen	**FR**	France			●				●				●	●	●		●		●		●		500k–1M	76
Sacramento	**US**	United States	CA			●															●		500k–1M	130
San Antonio	**US**	United States	TX		●		●						●			●					●	●	1M–5M	77
San Diego	**US**	United States	CA			●															●		1M–5M	131
San Francisco	**US**	United States	CA		●		●								●	●			●			●	500k–1M	78
San Jose	**US**	United States	CA		●		●	●						●	●		●	●	●			●	1M–5M	79
San Ramon	**US**	United States	CA		●		●						●		●				●		●		<500K	80
Santa Monica	**US**	United States	CA			●											●	●	●			●	<500K	132
São Paulo	**BR**	Brazil		●		●											●					●	5M+	133
Schaffhausen	**CH**	Switzerland			●		●						●	●		●			●				<500K	81
SeaTac	**US**	United States	WA			●													●				<500K	134
Seattle	**US**	United States	WA			●											●	●	●	●	●	●	500k–1M	135
Seongnam	**KR**	South Korea			●		●			●			●	●							●		500k–1M	82
Seoul	**KR**	South Korea			●						●				●	●		●	●	●	●		5M+	83
Shenzhen	**CN**	China			●		●								●				●		●		5M+	84
Singapore	**SG**	Singapore			●		●	●	●	●				●	●	●	●	●	●	●	●	●	5M+	85
Sion	**CH**	Switzerland			●		●							●	●	●			●		●		<500K	86
South Perth	**AU**	Australia			●		●						●		●				●				<500K	87
Stavanger	**NO**	Norway			●		●								●				●		●		<500K	88
Stockholm	**SE**	Sweden			●		●							●		●			●		●		1M–5M	89
Sydney	**AU**	Australia			●		●								●	●			●		●		5M+	90
Taipei	**TW**	Taiwan			●		●								●	●			●		●		1M–5M	91
Tallinn	**EE**	Estonia			●						●			●	●						●		500k–1M	92
Tampa	**US**	United States	FL		●		●						●	●	●				●		●		<500K	93
Tampere	**FI**	Finland			●		●			●	●		●	●	●	●		●			●	●	<500K	94
Tel Aviv	**IL**	Israel		●		●												●			●	●	<500K	136
The Villages	**US**	United States	FL		●				●						●						●		<500K	95
Tokyo	**JP**	Japan				●													●		●		5M+	137
Toledo	**US**	United States	OH			●							●						●		●		<500K	138
Toronto	**CA**	Canada				●												●	●			●	5M+	139
Toulouse	**FR**	France			●		●	●					●		●				●		●	●	1M–5M	96
Trikala	**GR**	Greece			●		●								●	●			●		●	●	<500K	97
Tsukuba	**JP**	Japan				●							●	●		●			●		●	●	<500K	140
Vancouver	**CA**	Canada				●											●		●		●	●	1M–5M	141
Wageningen	**NL**	Netherlands			●		●						●		●	●			●				<500K	98
Washington	**US**	United States	DC	●	●		●				●				●			●	●			●	500k–1M	99
West Midlands	**UK**	United Kingdom			●					●				●	●	●					●	●	1M–5M	100
Weymouth	**US**	United States	MA			●									●	●			●				<500K	142
Wuhan	**CN**	China			●					●				●							●		5M+	101
Wuhu	**CN**	China			●		●	●	●	●				●							●		1M–5M	102
Youngstown	**US**	United States	OH			●													●		●	●	<500K	143

Members Indicate city participating in the Bloomberg Aspen Initiative

Credits

Global Atlas of Autonomous Vehicles in Cities
2017-2019

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136 Cities are Preparing to Pilot or currently Piloting Autonomous Vehicles

Aalborg, DK
Adelaide, AU
Amsterdam, NL
Ann Arbor, US
Arlington, US
Armidale, AU
Ashdod, IL
Atlanta, US
Auburn Hills, US
Auckland, NZ
Austin, US
Bad Birnbach, DE
Baoding, CN
Beaumont, CA
Beijing, CN
Bellevue, US
Berlin, DE
Boston, US
Bristol, UK
Bryan, US
Buenos Aires, AR
Calgary, CA
Cambridge, UK
Cambridge, US
Canberra, AU
Candiac, CA
Chamblee, US
Chandler, US
Changhua, TW
Changsha, CN
Chiba City, JP
Columbus, US
Concord, US
Copenhagen, DK
Cossonay, CH
Darwin, AU
Denver, US
Detroit, US
Doraville, US
Dubai, UAE
Dublin, US
Edinburgh, UK
Edmonton, CA
Eindhoven, NL
Espoo, FI
Fribourg, CH
Frisco, US
Gainesville, US
Geneva, CH
Gothenburg, SE
Grand Rapids, US
Greenville, US
Groningen, NL
Guangzhou, CN
Haarlem, NL
Hamburg, DE
Helsinki, FI
Houston, US
Jacksonville, US
Jerusalem, IL
Kaohsiung, TW
Karlsruhe, DE
Knoxville, US
Køge, DK
La Rochelle, FR
Las Vegas, US
Lausanne, CH
Lille, FR
Lincoln, US
London, UK
Los Angeles, US
Louisville, US
Lyon, FR
Memphis, US
Miami, US
Milan, IT
Milton Keynes, UK
Montréal, CA
Nashville, US
Orlando, US
Oslo, NO
Ottawa, CA
Oxford, UK
Palo Alto, US
Paris, FR
Peachtree Corners, US
Phoenix, US
Pittsburgh, US
Portland, ME, US
Portland, OR, US
Providence, US
Regina, CA
Rennes, FR
Reno, US
Rotterdam, NL
Rouen, FR
Sacramento, US
San Antonio, US
San Diego, US
San Francisco, US
San Jose, US
San Ramon, US
Santa Monica, US
Schaffhausen, CH
SeaTac, US
Seattle, US
Seongnam, KR
Seoul, KR
Shenzhen, CN
Singapore
Sion, CH
South Perth, AU
Stavanger, NO
Stockholm, SE
Sydney, AU
São Paulo, BR
Taipei, TW
Tallinn, EE
Tampa, US
Tampere, FI
Tel Aviv, IL
The Villages, US
Tokyo, JP
Toledo, US
Toronto, CA
Toulouse, FR
Trikala, GR
Tsukuba, JP
Vancouver, CA
Wageningen, NL
Washington, DC, US
West Midlands, UK
Weymouth, US
Wuhan, CN
Wuhu, CN
Youngstown, US