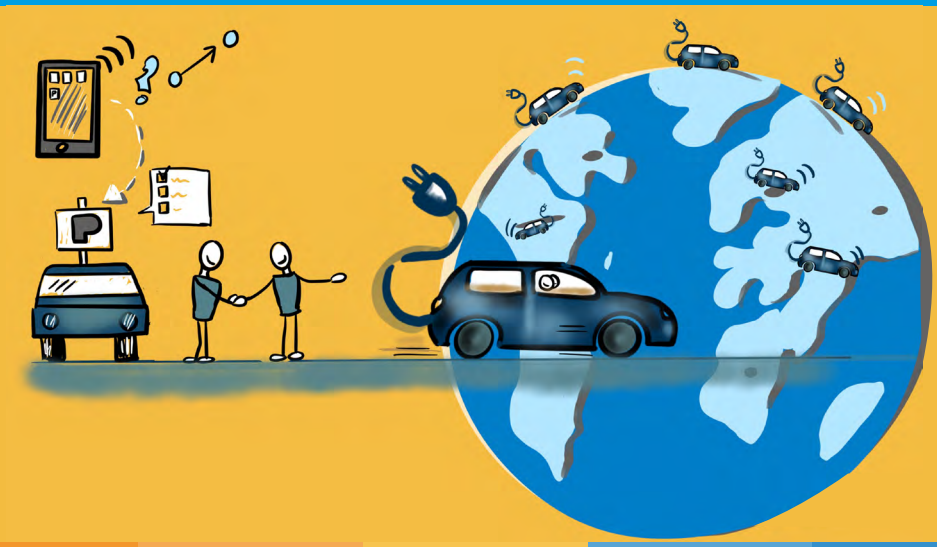
SMART MOBILITY

• smart • social • sustainable



DATA-DRIVEN | VEHICLE INNOVATION | DATA AND CONNECTIVITY | USER | INFRASTRUCTURE | = SMART LOGISTICS | POLICY IMPLICATIONS

FOREWORD | BACKGROUND | PROJECTS AND INITIATIVES

Connekt

SMART MOBILITY: FOREWORD

The world of mobility is rapidly evolving. The advent of smart mobility, driven by technological advancements, digitization of services, and increasing demand for smart modes of mobility, has caused government agencies to ask themselves: What is our role in all this, and how much should we be guiding developments?

Last year, I was asked to plan and give shape to the development and implementation of a Mobility and Infrastructure Test Center (MITC) for Flevoland Province, a public-private initiative in keeping the 'Smart Mobility, Dutch Reality' goal.

Our plans with the development of the MITC, as anchored in the Northern Flevoland Regional Deal parliamentary document, are both ambitious and connected to similar national and international initiatives.

Closer to home, we believe smart mobility can bring many advantages and opportunities in terms of better accessibility, up-to-the-minute trip information, efficient parking policy, intelligent access and enforcement policy, and sustainable and efficient freight transport

Yet, in order to oversee all the chances and opportunities for the Province, and tie into initiatives already underway elsewhere in the country, it is important to establish a common starting position. To help us arrive at that starting position, we turned to Connekt, an independent platform for smart, sustainable, and social mobility.

Our request to Connekt was for them to outline for Flevoland Province the various developments and trends playing out nationally and internationally. The result is a reference work that we believed might also be interesting for other members of Connekt, hence this publication. We hope it provides you as much information and knowledge as it did us and helps you, too, in making decisions or making connections with the initiatives currently underway.

Jan Hendrik Sweers
Janhendrik.sweers@flevoland.nl

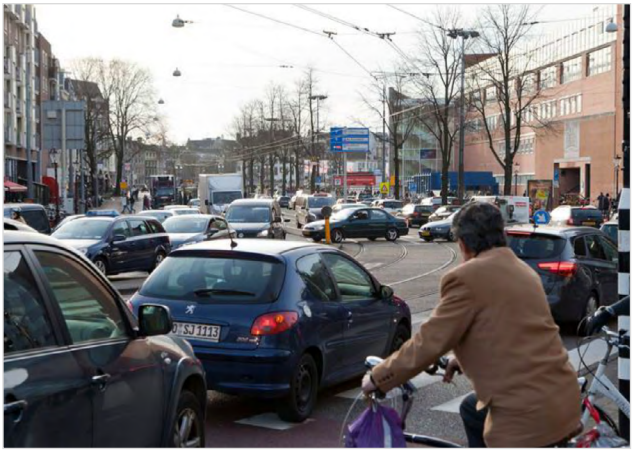
PROVINCIE FLEVOLAND

SMART MOBILITY: BACKGROUND

Connekt, Delft, november 2019

Present and future mobility is under tremendous strain. Issues related to accessibility, circulation, livability, enforcement, and privacy are a major daily concern.

Meanwhile, the demand for mobility continues to rise, and with it, the pressure on the supply chain, while at the same time there is a scarcity of logistics personnel and an ongoing shortage of space in the Netherlands. Climate demands exacerbate the challenges and require new organizational paradigms.



All of the negative consequences of mobility come together in this perfect storm. This raises the question: What could a competitive answer be to the mobility challenges of today and tomorrow?

Smart mobility is often cited as a solution. But what, exactly, does that concept mean? What developments are we talking about, and which challenges do they address?

In this report, Connekt, the independent platform for smart, sustainable, and social mobility, sketches a picture of the playing field and various developments and trends. This document does not pretend to be all-encompassing. We do hope, though, that it provides insight and serves as a prelude to possible future policy and initiatives.

Nico Anten

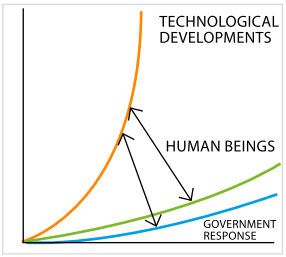
Veronique Meines

SMART MOBILITY: DATA-DRIVEN

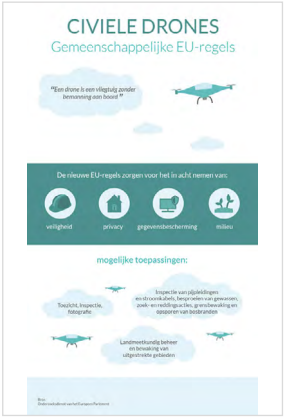
Smart mobility is often described as the digitization of mobility: as a result of advancements in vehicle technology, data, and connectivity, users, vehicles, and infrastructure are increasingly better aligned. This, in turn, creates new mobility modes and services for passengers and freight. Examples include self-driving vehicles, smart traffic lights, and handy travel apps that allow people to plan, book, and pay for a trip door-to-door.

BUT: Smart mobility is about more than technology. A confluence of organizations, people, goods, and vehicles is making mobility smarter, more efficient, more convenient, and safer than ever. **AND BEAR IN MIND:** The data-driven nature of these developments is already producing a situation in which platform monopoly holders have tremendous influence and power. The question is whether you, as the government, want to facilitate a competitive market - or rather establish a framework and leave the HOW up to the market.

The use of technology to solve complex problems leads to a recurring phenomenon: the technology advances more quickly that any accompanying legislation. Current vehicle innovations alone have produced major challenges for the Netherlands as a legislative body: legal-based versus risk-based.



Technological developments are skyrocketing, but human beings lag behind. Their abilities for learning and adoption are limited and slower, as is the government's ability to adapt: drafting legislation has a long lead time. The gaps between technology, people, and government probably cannot be bridged. How, then, should we address it? By way of illustration: drone technology is advancing incredibly fast. Yet, it was not until recently that the European Union Aviation Safety Agency (EASA) presented an overview of new European rules for drone users. Before that, each EU country had its own rules. The new EU rules take effect between April and June of 2020. Accordingly, the Dutch Ministry of Infrastructure and Water Management is now busy interpreting this EU legislation so as to enforce it.



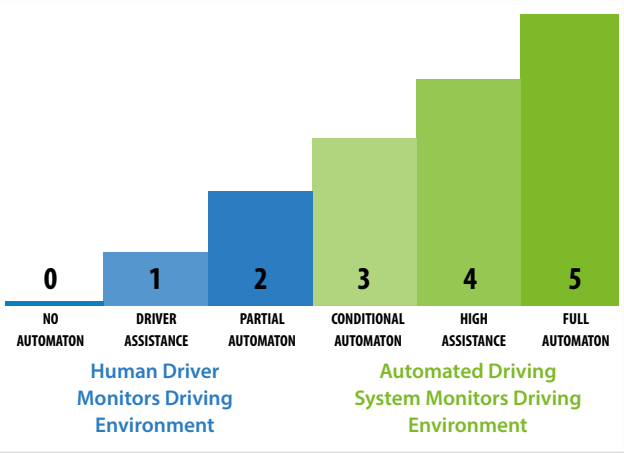
Regulation of civilian drones.

Layers of the mobility system
Source: van B naar Anders

SMART MOBILITY: VEHICLE INNOVATION

Apart from the legislative challenges, what are the vehicle innovations that we are talking about? We can break down developments toward fully automated vehicles into five levels. The latest vehicle models currently available are at Level 3: the vehicle is capable of assuming some driving tasks.

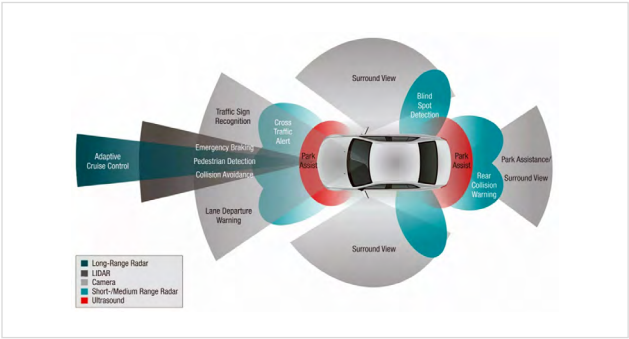
This, too, raises questions: What might the value of the generated data be? Whose data is it, actually? And how do you translate all that data into operational policy? How do you organize the data? What do you, as a province, want to receive/control/monitor/promote?



ADAS: Advanced Driver Assistance Systems

Systems that help people drive more safely:

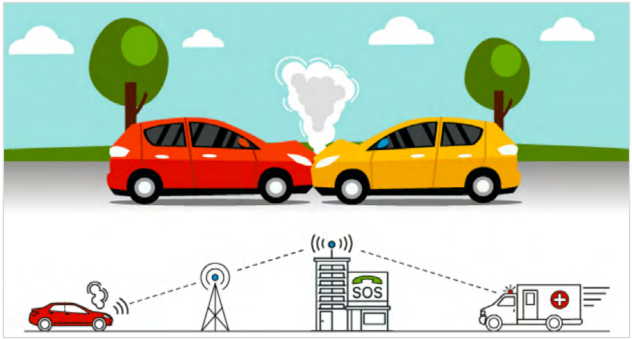
- Lane Departure Warning
- Adaptive Cruise Control
- Autonomous Emergency Braking
- Adaptive Light Control
- Driver Drowsiness Detection
- Automatic Parking
- Blind Spot Detection
- Intelligent Speed Adaptation



eCall: Emergency Call

This safety system in cars, introduced on April 1, 2018, automatically places an emergency services call after an accident. The eCall system provides:

- The exact location of the accident
- The direction of travel
- The number of passengers
- The type of vehicle
- The type of fuel in use



SMART MOBILITY: VEHICLE INNOVATION

In addition to self-driving cars, advancements in vehicle electrification are having a big impact on fleets in the Netherlands and elsewhere. The recently unveiled climate agreement contains numerous measures aimed at promoting smart, intelligent mobility. The accompanying table lists some of these ambitions, along with a time frame.

People expect the market for both passenger and freight transport to continue to grow. Through a combination of Intelligent Transport Systems (ITS) and electrically powered vehicles, mobility will become increasingly smarter and more sustainable.

	2019-2030	2030-2050
Cleaner (modalities)	Electric passenger vehicles become competitively priced (around 2025). Further rollout of charging infrastructure for electric vehicles, incl. possible grid modifications.	Zero emissions are the norm; self-driving vehicles take over.
	Rapid growth of electric vans, public transit buses, and light commercial vehicles (zero-emissions zones in many city centers by 2025).	Zero emissions are the norm; self-driving vehicles take over.
	Growing number of electric alternatives in use even for heavy-duty vehicles (battery-electric and hydrogen fuel cell). Temporary use in heavy-duty vehicles of sustainable, synthetic biofuels/biokerosene/bioLNG in transitioning to zero-emission energy sources. Preference for sustainable biofuels in modalities that lack other alternatives (shipping and aviation). Also: Rise in electric (incl.hydrogen); modifications to charging and fueling infrastructure.	Zero emissions become dominant (hydrogen, electric) and standard in freight traffic; self-driving vehicles take over; electric power and synthetic fuels used to create hybrid standards.
Smarter	Passenger transport: Zero-emission modalities become ever-more attractive and meld increasingly well together. 'Smart charging' becomes standard for electric vehicles and thus an ordinary part of the electric system. Information systems dictate travel behavior to an increasing degree. Sustainability and accessibility criteria become of prime importance in spatial planning.	Dominant: Clean mobility is a service; modes of transportation are easily accessible; personal vehicle ownership (especially in urban areas) less of a necessity and less attractive. Mobility criteria structurally incorporated into urban spatial design. Cities designed for optimum accessibility with particular attention paid to walking, cycling, and public transit.
	Logistics: Urban zero-emissions zones really take off, as does the bundling of supply transport flows to and within urban areas through supply chain coordination and innovative logistics systems.	Supply chain coordination and innovative zero-emissions concepts are standard.
Other	Passenger transport: Travel behavior becomes more context-dependent. More frequent combination of modalities with greater use of public transit and bikes. More working from home and telecommuting.	Digital innovations and self-driving cars lead to entirely new, difficult-to-predict mobility behavior.
	Logistics: Bigger role for multimodal hubs.	Multimodal hubs play a pivotal role in logistics and supply chains.

Source: Climate agreement draft.

SMART MOBILITY: DATA AND CONNECTIVITY

Apart from all the issues surrounding privacy and ownership of data, developments move swiftly, with new applications following on each other's heels at a rapid pace. Yet, the following applies for all applications: the data must be secure and reliable.

Only then can you use smart apps for such things as:

- Overviews of road closures
- Bridge operations
- Environmental zoning
- Enforcement
- Roadworks
- Traffic flow

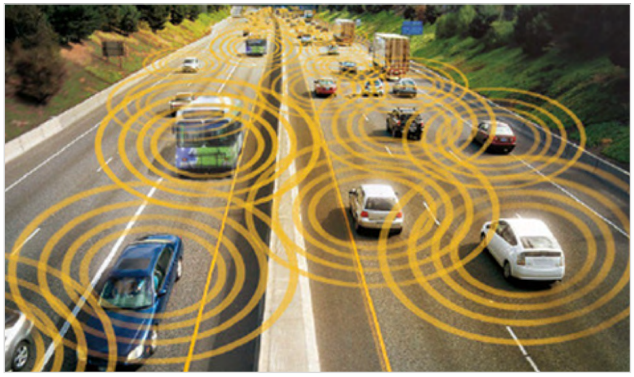
See the ivriviewer

Some of the more interesting applications are the intelligent traffic management systems (iVRI's in the Netherlands) that not only transmit data to vehicles and cyclists, but also receive data back from them and make adjustments accordingly. This offers possibilities for giving certain road users priority over others, such as first responders or public transit. New national procedures were recently launched for consolidating and administering standards for these systems.

Connectivity is critical in this regard.

- Connectivity via towers: 3G/4G/5G
- Connectivity via boxes along the roadside: G5 via WiFi-p

There is also a difference here between short-range and long-range connectivity. While this is often presented as an either–or choice, the two types of systems actually complement each other. Each has its advantages and disadvantages, and it is important to make sure these do not cancel each other out, but rather reinforce one another.



Connectivity is critical in this regard:

- **Connected vehicles:**
  Vehicles are connected to a wireless network
- **Coperative vehicles:**
  Route and speed can be adjusted based on information from other cars or from the roadside
- **Automated vehicles:**
  Fully or partially self-driving vehicles.

SMART MOBILITY: USER

Mobility as a Service represents a transition in mobility, in which the consumer purchases mobility instead of investing in means of transport. One of the essential changes in this transition is the concept of thinking in terms of service levels. New services will provide a combination of public transportation, demand-driven transportation, and private vehicles.

Meanwhile, an important part of Mobility as a Service is ITS, which links together all of the elements of multimodal transportation: passengers, freight, vehicles, information and communication technology, infrastructure, etc.

Future of Mobility video

MaaS as an alternative for less-profitable public transit lines and an option in rural areas with few services.

SMART MOBILITY: INFRASTRUCTURE

Smart mobility requires high standards with regard to infrastructure.

Think of:

- Road design
- Roadway markings
- Signage
- Separation of slow and fast traffic
- Charging infrastructure

This will require a comprehensive, long-term vision that includes coordination and cooperation with other regions, particularly adjacent ones.

Source: RWS Innovation expo.

There are many new innovations in the area of infrastructure:

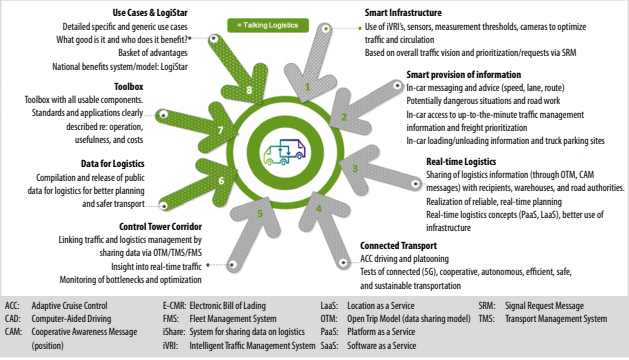
- **SolaRoads:** an innovation that incorporates solar panels into bike paths
- **Circular roads:** optimizing use of materials and resources. This means that raw materials and resources are constantly used/reused in applications that have the highest value for the economy and create the least damage to the environment.

In addition, roadways are becoming ever 'smarter' through the connectivity with the roadside and the towers.

SMART MOBILITY: = SMART LOGISTICS

Smart City Challenge Urban Logistics video

Alongside the volumes of passenger transport on a daily basis is a tremendous amount of logistical transport: across long distances, between cities and regions, and across short distances, the so-called last mile into and out of cities.



Source: Connected Transport Corridors.

The above figure illustrates the developments and challenges in terms of logistics. The trend is for cities to increasingly become centers of both living and working. This influx to cities is causing a shortage of space, which becomes ever more vital. Moreover, besides nice living and working environments, city inhabitants want more: safe and clean streets, peace and quiet, green space, quick and easy access from A to B, and a high level of service to be able to obtain the items and services they want when they want them.

This represents a considerable challenge for both city governments and businesses: to provide more service with less nuisance in ever-tighter space. The trick is to use all the space there is very intelligently and to assign the right priorities in using that space. Here, too, arises a need and desire to develop a system that can deliver individually customized access to the city through smart technology. One way to offer customization is through multiple use of space: a loading zone in the morning that offers bike parking during the day and becomes a cabstand at night. This would include a reservation system so that the site could be occupied by different suppliers.

Another idea is a system through which the freight traffic near a school might be rerouted at times of peak bike and pedestrian traffic to and from that school. The system could be constantly updated to take school hours, holidays, and ocal conditions into account, that is, per day and per transporter. Another example might be a zero-emissions zone in which accommodations could easily be made for the occasional exception (special vehicles such as cranes, special events, safety and care needs, etc.).

The technology needed for this is developing at hyper-speed. Of course, a major issue is how companies and municipalities will fulfill their roles. Standardization and economies of scale naturally provide great advantages, but at the same time it is important to allow room for local policy-making and accommodate local particularities. Finally, issues such as the speed with which technological innovation can be adapted and how to ensure privacy need to be considered.

Smart logistics =

- Collaboration
- Bundling services
- Promoting synchromodality
- Sharing data, NLIP, iSHARE
- Innovations such as hyperloop

SMART MOBILITY: POLICY IMPLICATIONS

Coalition Agreement

> *A safe, smart, and sustainable traffic and transportation system whose individual parts interlink seamlessly and reinforce one another*

Dutch Lower House Parliamentary Document: 'Smart Mobility, Dutch Reality'

The coalition agreement articulates quite a few goals for smart mobility. The parliamentary document issued by the Dutch Lower House translates many of those ambitions from the coalition agreement into concrete action.

A couple of passages:

> *To strive for a smart, sustainable transportation system whose individual parts interlink seamlessly*

> *In designing, building, and maintaining infrastructure, we must accommodate self-driving vehicles and the requisite systems embedded in or alongside the roadway.*

Parliamentary Document on Mission-driven Top Sectors and Innovation Policy

EIn late April 2019, State Secretary Keijzer of the Dutch Ministry of Economic Affairs and Climate Policy (EZK) elucidated the mission-driven top sectors and innovation policy. Cooperation with regional governments is an indispensable element in this policy. One of the missions is care-free mobility for everyone and everything by 2050: no emissions and outstanding accessibility available to young and old, rich and poor, able-bodied and less able-bodied. Affordable, safe, comfortable, easy, and healthy.

Smart, sustainable, compact cities with an optimal circulation of people and goods. Nice, livable, and easily accessible regions and villages, with mobility forming the link between living, working, and recreation. Effectively implementing these ambitions will require a bundling of forces - even beyond our borders. Various high-level meetings and data task force projects are taking place at both the European and international (UN) level. The telecom and auto industries are also working closely together to develop standards. Closer to home, the Socrates 2.0 project is experimenting with smart traffic information and navigation services.

SOCRATES2.0

This is a European project in which public and private partners are creating smart traffic information and navigation services in Amsterdam, Munich, Antwerp, and Copenhagen. In addition, the public–private partners in SOCRATES2.0 are developing and testing various models for mutual cooperation. Through sharing and integrating all the available information from road managers, service providers, and road users, it becomes possible to obtain a complete, consistent picture of the existing and expected traffic conditions. This also paves the way for developing a common strategy for traffic management. And that will allow for smarter, more reliable traffic information and navigation services to be offered to road users, resulting in better traffic circulation, safer traffic conditions, and fewer emissions of hazardous substances: *fast, safe and green.*

SOCRATES 2.0
FAST SAFE GREEN

SMART MOBILITY: POLICY IMPLICATIONS

Safe introduction of the new generation of vehicles is critical.

Law Governing the Experimental Use of Self-driving Vehicles

The Dutch Law Governing the Experimental Use of Self-driving Vehicles came into effect on July 1, 2019. This law made it possible for the first time for companies to obtain a permit to conduct tests on public roads with self-driving cars that do not have a driver onboard. What is unique is that no driver need be present in an autonomous test vehicle. It is now permitted for the 'driver to be outside the vehicle at some distance away,' according to the Upper House. The car could thus, for example, be driven from a central control room.

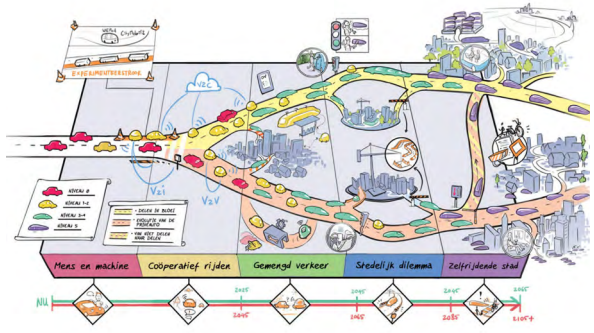
Driver's Licenses for Self-driving Cars

If, in coming years, self-driving cars are permitted on the roads, they will first have to take a driving test. Should an autonomously driven vehicle satisfactorily pass that test, it will receive a Class S driver's license, whereby the 'S' stands for 'software.'

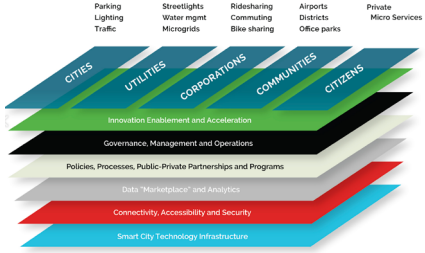
The intention at this point is to establish the driver's license nationally first, followed by an international admissions process. In the future, the CBR (Dutch license-issuing body) wants to use the digital assessment methodology not only for intelligent machines, but possibly also for human drivers.

Security framework:

Responsible introduction of the new generation of vehicles.



Source: www.kimnet.nl



Source: StrategyofThings.io

PROJECTS AND INITIATIVES

PROJECTS AND INITIATIVES
IN THE NETHERLANDS

PROJECTS AND INITIATIVES
IN BRUSSELS

EUROPEAN AND INTERNATIONAL
PROJECTS AND INITIATIVES

PROJECTS AND INITIATIVES IN THE NETHERLANDS

N205 CACC

THE RDW TEST CENTER

5G

AUTONOMOUS TRAINS

NORTH NETHERLANDS AUTONOMOUS TRANSPORTATION

AMSTERDAM PRACTICAL TRIAL

SCHEEMDA AUTONOMOUS BUS

DAIMLER SEMI-AUTOMATED CITY BUS

CLEANTECH REGION

INTERCOR

WEPOD EDE-WAGENINGEN

HAGA SHUTTLE

SMARTWAYZ.NL

AUTOMATED DRIVING RESEARCH LAB

HELMOND AUTOMOTIVE CAMPUS

ROTTERDAM MOBILITY CAMPUS

THE TRAFFIC INNOVATION CENTER, HELMOND

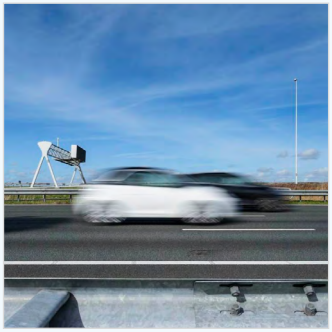
RIVIUM PARKSHUTTLE

TALKING TRAFFIC

BLAUWE GOLF VERBINDEND

VAALS-AACHEN SHUTTLE

PROJECTS AND INITIATIVES IN THE NETHERLANDS

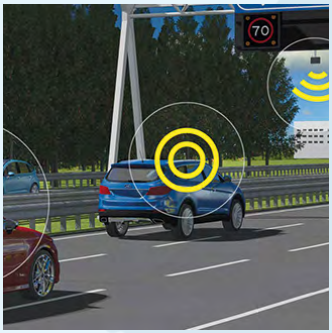


SMARTWAYZ.NL

Ease of accessibility is essential for the smartest region in the world - for the business climate, international trade, and livability. Under the banner of SmartwayZ.NL, government agencies, market and knowledge actors, and other stakeholders are working closely together to improve both accessibility and the economy in the southern Netherlands, using everything from smart mobility to widening highways and modernizing transport hubs.

THE RDW TEST CENTER

The RDW Test Center is an independent test laboratory for vehicle technology that provides a unique combination of services and products under one roof. It is capable of conducting the most advanced testing. The center meets strict requirements, and tests can be performed there following various regimens.



INTERCOR

InterCor is an ITS project recently launched under the European Union's CEF call. The project is being led by Rijkswaterstaat. Its aim is to synchronize services across borders, and it links together existing corridors and initiatives in the Netherlands, France, England, and Belgium. The project adopts hybrid communications, so both long-range (cellular 3/4G LTE) and short-range (WiFi-p) systems. As part of the Netherlands component, the project builds upon services already developed in Rijkswaterstaat's C-ITS Corridor project (Roadworks Warning, Probe Vehicle Data, and In-vehicle Signage).

AMSTERDAM PRACTICAL TRIAL (PPA)

The Amsterdam Practical Trial is a large-scale test using the latest innovations in cars and road technology. Nowhere else in the world is intelligent technology in the field of traffic management being tested under daily traffic conditions on such a large scale: in other words, on real cars and road users in the busy Amsterdam region.

PROJECTS AND INITIATIVES IN THE NETHERLANDS

RADD

The Delft Automated Driving Research Lab (Dutch acronym of RADD) on the campus of TU Delft has the space for conducting automated transportation experiments in real-life situations. Automating the transport of people and goods could help make traffic and transportation more efficient, more accessible, and safer. A great deal of research is still needed, though, to make automated transportation possible in everyday use - not only in terms of technology, but also on such issues as user acceptance, interaction with other traffic, response to unexpected situations, and integration into the mobility system. Much of the research can be performed using computer models and in test labs, but to acquire truly useful insights, testing must also be done under real-life conditions.

N205 CACC

Cars that communicate with one another and the traffic signals pass through intersections more quickly than other cars. That is one of the findings from a study by the Province of North Holland along Route N205 (the Netherlands' first smart roadway). In September 2018, seven cars specially equipped with 'cooperative adaptive cruise control' drove amongst the regular traffic for the first time.

NORTH NETHERLANDS AUTONOMOUS TRANSPORTATION

The provinces of Groningen, Drenthe, and Friesland form a living lab comprising over 11,000 km^2 with almost 2 million residents, similar to, for example, Amsterdam, The Hague, and Utrecht. These northern provinces provide space and opportunity for specific pilots. They have adopted a flexible attitude that makes innovative projects possible. Moreover, the North provides a calm and safe environment for developing and testing concepts in both urban and rural settings, after which they can be applied elsewhere in comparable situations. They view self-driving transportation as a way to preserve and improve accessibility and livability in these shrinking regions. They have teamed up to become the region for autonomous transportation and call on transportation companies, manufacturers, and research institutes to come up with affordable, smart, flexible, and sustainable transportation concepts for road, rail, water, and air.

PARKSHUTTLE RIVIUM

In 1999, the first generation of an autonomous bus, the ParkShuttle, was introduced at the Rivium business park. This small-scale public transit system is unique in the world. It is still the only self-driving system without a steward onboard that intersects other traffic. Efforts are now underway to renovate the transportation system and expand the infrastructure. The route is currently being extended to the Nieuwe Maas River. The greatest challenge in that project is having the ParkShuttle drive on public roads in a mixed traffic setting. A Rivium Transportation Hub is going to be built at the new terminus on Schaardijk. There, people will be able in future to transfer to the Waterbus. Three GoBike stations are also going to be installed at Rivium, allowing people to combine their shuttle ride with electric bike-sharing.

PROJECTS AND INITIATIVES IN THE NETHERLANDS

WEPOD EDE WAGENINGEN

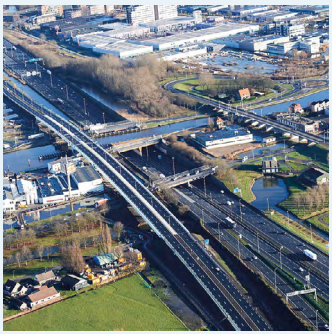
The WEpod will soon be shuttling between Ede-Wageningen train station and the ROC (regional training center) in Ede. This is part of the Interregional Automated Transport project, in which 22 Dutch and German companies and institutes are combining their expertise in the field of automated transportation.

5G

With 5Groningen, North Groningen becomes a prominent testing grounds for the latest generation of mobile internet technology. Entrepreneurs and non-profit organizations will be working together with experts to test 5G applications. The effort has been dubbed the 5G Field Lab.

THE TRAFFIC INNOVATION CENTER

The Traffic Innovation Center was set up in the regional traffic management center in Helmond. It is a place where companies can perform experiments with smart cars. Rijkswaterstaat makes the roads available and also puts its cameras and even the expertise of traffic engineers at the center's disposal.



BLAUWE GOLF VERBINDEND

Open bridges can cause delays. Blauwe Golf is a project aimed at providing better information for waterway authorities and users and road users. This will lead to better traffic circulation overall.

AUTOMOTIVE CAMPUS

At the Automotive Campus in Helmond, some 1,250 people, including 600 students, are working on mobility solutions for the future. All this takes place among a network of leading companies, research institutes, innovative start-ups, and educational institutions working in the automotive field. The organizations on the campus make successful connections with the Dutch high-tech sector's leaders and those of other sectors, as well, such as ICT, energy, and infrastructure.

MOBILITY CITY CAMPUS

Rotterdam is getting an international Mobility City Campus. This will be the place for international companies and other important actors to collaborate on the mobility concepts of the future. By bringing together all the relevant players from Europe and elsehere in a single physical location and having them partner with the local innovative ecosystem, the hope is to create a world-class mobility ecosystem. According to city councilwoman Kathmann, the Mobility City Campus also has the potential to become a flywheel for further boosting the greater Rotterdam economy. 'To be ready for the future, we must transition from old to new times. That includes a new economy that's digital, sustainable, and circular. Mobility is one of the first themes bringing this new economy to the fore.'

HAGA SHUTTLE

In May 2019, The Hague became one of the first large Dutch cities with a self-driving minibus: the Haga Shuttle. It serves as a supplement to the public transit system, ferrying visitors and patients of the Haga Hospital the last few hundred meters from the public transit stop on Leyweg to the entrance of the hospital for free. Over the next four years, project managers plan to use what they learn from this initiative to further develop and implement so-called last mile solutions with self-driving minibuses elsewhere in the Netherlands.

SCHEEMDA

The trial with a self-driving shuttle running between the main entrance of the Ommelander Hospital and the nearest bus stop in Scheemda was extended through the end of 2019, a decision taken midway through the year based on its initial success. Over 3,000 people have used the self-driving shuttle. Passengers were enthusiastic about the continuation; they feel the shuttle provides a valuable service in their trip to the hospital.

CLEANTECH REGION

In the march toward autonomous transportation, a host of Intelligent Transportation Systems (ITS) aimed at improving accessibility in busy regions now are being developed and rolled out. Cleantech Region is one of the forerunners when it comes to creating innovative transportation measures. The first solutions are already in operation, and a new phase is dawning.

AUTONOMOUS TRAINS

It is becoming busier and busier on the railroads. And that means that even more trains will be running on the existing tracks over the coming years. Automated trains could prove a smart, innovative solution for this. Railroads are ideal for automated transportation because the vehicles on the tracks already follow a fixed path. Initial tests were conducted in March 2019 with a passenger train traveling between Groningen and Zuidhorn.

TALKING TRAFFIC

Road users, signage alongside or over the roadway, traffic management centers, and traffic signals all communicate with one another. This produces, among other things, up-to-the-minute, individualized trip information. The Talking Traffic Partnership develops easy-to-use services for this. Yet, behind the advice provided via dashboard, navigation system, or smartphone lies a world of complex systems. A world where quality, reliability, and safety matter above all. That is why the Dutch Ministry of Infrastructure and Water Management has joined with the Talking Traffic partners to draw up collective procedures for extensively testing various systems. This means the tests are the same for all parties, must all meet the same high standards, and must be reproducible. All of the partners test their products and services in three phases using the same structure and methods. An independent, external firm then also performs random audits of these tests.

DAIMLER SEMI-AUTOMATED CITY BUS

On Monday, July 18, 2016, a largely automated bus traveled on the bus lane between Schiphol Airport and Haarlem. The bus obtained speeds of up to 70 km/hr. during the test along this Zuidtagent route. The bus communicated with stoplights along the way and could thus adjust its driving behavior. It did have a driver onboard who could intervene if needed. No specific location in the Netherlands.

VAALS-AACHEN SHUTTLE

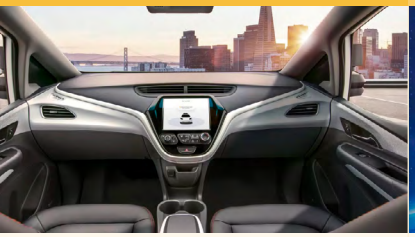
The border crossing between the German city of Aachen and Dutch city of Vaals is serving as a year-long test route for a trial with autonomous passenger transport on public roads starting January 1, 2019. A WEpod self-driving electric shuttle with room for fifteen passengers is running between Aachen University Hospital and the center of Vaals.

EUROPEAN AND INTERNATIONAL PROJECTS AND INITIATIVES

USA	SPAIN	UNITED KINGDOM	FRANCE	GERMANY	AUSTRIA	SWEDEN	FINLAND
SLOVENIA	HUNGARY	AUSTRALIA	GREECE	SINGAPORE	JAPAN	CHINA	SOUTH KOREA

Source: Connected Automated Driving Road Map, ERTRAC 'Connectivity and Automated Driving' Working Group

USA



The U.S. has a long history of sharing ITS knowledge with Europe and Japan. This was formalized in 2010 with a number of trilateral deals concerning architecture and standards, human factors, truck platooning, and applications and rollouts. The basic premise is to share knowledge and learn from one another. The U.S.'s own Department of Transportation introduced federal guidelines in 2018 for policy in this area based on six principles:

- Prioritizing safety
- Remaining technology-neutral
- Modernizing regulations
- Encouraging a consistent regulatory and operational environment
- Preparing proactively for automation
- Protecting the freedoms Americans enjoy

A total of 100 million dollars is to be spent on autonomous transportation starting in 2018, 38 million on research and 60 million on demonstrations. It should also be noted here, that European investment includes that done through OEMs and universities.

SPAIN

The Spanish research and development strategy is entirely in line with the priorities outlined in the Horizon 2020 program. In addition, Spanish industrial companies and research firms are actively involved in various European R&D projects and even play a coordinating role.
These projects are related to:

- Connectivity and self-driving
- Truck platooning
- Certification
- Infrastructure safety
- Driver monitoring
- Cybersecurity

UNITED KINGDOM

The United Kingdom adopted a fairly flexible, instrumental approach starting in 2015. Regulations related to testing were eased, and the conditions set are easily achievable. Matters such as insurance and liability in the event of an accident are clearly articulated. Starting in 2018, there was a strong push in three particular areas, with the aim of having a viable commercial autonomous service operational in London and Edinburgh by 2021. Two restricted-access and two public test locations were established as an ecosystem for experimenting with all of the aspects of autonomous driving. In addition, there was a great focus on cybersecurity and public acceptance and need.

FRANCE

After first adopting a National Strategy for the development of autonomous vehicles, France also created an attendant legal framework that explicitly addresses test conditions and aspects surrounding safety, the environment, and public acceptance. Since then, some 10,000 km of test roads have been made available and more than 60 test projects launched. Close cooperation between public authorities and the manufacturing industry should lead to experiments on the public roads and a framework for autonomous public transportation from 2019 on.

GERMANY

Germany has been exploring autonomous and connected driving since 2013. This has resulted in a number of strategies, acts, and standards for development, testing, and experimentation. The country's PEGASUS project focuses on testing and verifying highly automated driving functions, something which has not been developed to date. The standards are meant to help the 15 test locations in Germany. Germany has also teamed up with France and Luxembourg to conduct tests beyond its borders. This requires cross-border cooperation with regard to infrastructure, connectivity, safety, etc.

AUSTRIA

The government allocated 65 million euros for the 2019-2022 period to raise their autonomous transportation efforts to a higher plane. Over 300 stakeholders were consulted on how to deploy that budget. The major themes have been roughly decided, with detailed plans to follow.

SWEDEN

As in other places, public-private partnerships are important in Sweden, as underscored by two large initiatives:

- **DriveSweden** is a publicly funded platform in which over 100 parties are partnering to develop new autonomous, connected, cooperative, and shared mobility services.
- **AstaZero** is a large test location that has been built.

FINLAND

Finland, too, has adopted a liberal approach with regard to testing autonomous vehicles on Finnish roads. A 75-km-long road can be used for this, with a fully equipped section of 10 km along which various aspects of the vehicles can be monitored using various technologies. A number of Finnish cities are already experimenting with autonomous public transportation and MaaS applications. These initiatives are currently being evaluated. Pilot projects for truck platooning, autonomous transportation in cities, and 5G tests are currently being performed.

SLOVENIA

Slovenia is strongly committed to cross-border testing of electric, connected, and autonomous mobility. Although plans have yet to be finalized, the idea is to have SAE Level 4 vehicles drive from Nuremberg to Ljubljana via Salzburg. Testing the C-ITS communication infrastructure will be a vital part of this.

HUNGARY

A unique test area has been developed near Zala (ZALA ZONE) where both traditional vehicle applications and autonomous applications can be tested. A mobility platform aimed at fostering dialogue among universities, manufacturers, and government agencies has been set up to bolster developments in autonomous transportation. The goal is to create an ideal test environment for OEMs.

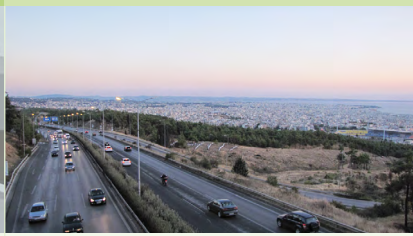
AUSTRALIA

The national policy framework for Land Transport Technology for 2016-2019 presents policy principles and governance guidelines to support implementation of Connected and Automated Driving in Australia. The document outlines a complete action plan for introducing new transport technologies and tackling major obstacles in the areas of:

- Safety
- Security and privacy
- Digital infrastructure
- Data, standards, and interoperability
- Innovation

Australia is a federation, making it possible for regulations to be set at the state level. Various states have adopted legislation to allow trials with automated vehicles.

GREECE



Experiments were conducted between October 2015 and February 2019 with 1,500 autonomous trips involving 12,000 passengers. There were no large tests after that, possibly as a result of the country's financial crisis. Greece does, however, see opportunities for the economy, in terms of both jobs and goods and services, and autonomous transportation continues to be part of the national strategy for passenger and freight transport.

SINGAPORE

In Singapore, it is the government, instead of the industrial sector, that has taken the lead in implementing Connected and Automated Driving through its Smart Nation strategy. With the goal of 'improving legislation to better support innovation, while at the same time increasing the safety of passengers,' the government instituted changes in the Road Traffic Act (RTA) in 2017. The new laws comprise design and construction rules for autonomous vehicles, as well as a requirement to record and store sensor data to be shared with the government. The Land Transport Authority (LTA) is responsible for regulating Connected and Automated Driving with the flexibility required to change rules to accommodate the rapid changes within this new field.

JAPAN

Japan's goal is to have an integrated multimodal transport system in place in both urban and rural areas by 2020 that could serve its aging population and the handicapped. These developments can then be exported to other parts of the world. A great deal of research over the past two years went into technological aspects, and the emphasis over the next two years will be on testing, with a particular focus on safety, both inside the vehicle and in the infrastructure. Regulations will also have to be developed and in place before 2020.

CHINA

China aims to achieve technological leadership in 'intelligent vehicles.' It sees this as an important mobility solution for the future and has set targets of 30% fewer traffic accidents and a more than 20% reduction in CO_2 by 2025. The China Industry Technology Innovation Strategic Alliance is working on aspects such as generic technological development, standards, tests, demonstrations, and communications in the field of Connected and Automated Driving. There are a number of Chinese research centers working on automated driving that are open to bilateral collaboration between Chinese and European OEMs, authorities, and universities. The strategy of the Ministry of Industry and Information Technology (MIIT) for the 2025 auto industry is included as part of the larger 'Made in China 2025' plan.

SOUTH KOREA

The South Korean government has designated autonomous vehicles as one of its Top 13 Industrial Engine Projects. The emphasis is on converging industries that include IT and automotive. To organize the government activities, a Smart Car Council is being established for coordinating action between ministries. The Ministry of Land, Infrastructure, and Transport has revised the laws governing admittance of vehicles onto public roads, paving the way for self-driving vehicles to be tested on designated routes on five national highways. The ministry is issuing temporary license plates to car manufacturers, universities, and research institutes.

Connekt

Connekt Ezelsveldlaan 59 2611 RV Delft | +31 15 251 65 65 | info@connekt.nl | www.connekt.nl