

Sustainable transport and mobility solutions

Explore smart and sustainable transport and mobility solutions. Green Gothenburg – a part of Smart City Sweden.

GOTHENBURG GREEN CITY ZONE

Gothenburg Green City Zone is a zone where new technology for both vehicles and infrastructure is tested. The aim is to achieve 100 per cent emission-free transports by 2030, in a functioning infrastructure that enables climate-neutral transportation choices and facilitates everyday life for businesses as well as residents and visitors, in an attractive urban environment.

With Gothenburg Green City Zone, Gothenburg will become the first region in the world to develop fully zero-emission as well as scalable transportation solutions at the system level. And everyone is welcome to join in!

The initiative was taken jointly by the City of Gothenburg (through Business Region Göteborg), Volvo Cars, and RISE Research Institutes of Sweden. It also involves Chalmers University of Technology, the School of Business, Economics and Law at the University of Gothenburg, the Swedish Exhibition and Congress Centre, the City of Mölndal and Johanneberg Science Park.

AUTOMATION

Automation is the process of enabling vehicles to operate independently, without human contact. Examples include drones and self-driving cars. Automated technology is already being used in vehicles today in the form of active safety systems and increased automation will improve traffic safety even more. It also has the potential to improve traffic management flows and reduce congestion.

[More information](#)

[The test site AstaZero](#)

[The research facility Revere](#)

World leading testing facility for vehicle safety systems and automated driving

AstaZero is the world's first full-scale independent test site for future safety on the road. Unique environments make it possible to develop, test and certify advanced safety systems for all kinds of vehicles and in all aspects of automated driving and active safety, in one place. AstaZero is an international open arena for vehicle manufacturers, suppliers, legislators, and universities from around the world.

Partners: RISE, Chalmers University of Technology, Volvo Group, Volvo Cars, Scania, FFI, Veoneer, The Swedish Transport Administration, Region Västra Götaland, Borås Stad, Tillväxtverket and Test Site Sweden.

Drones deliver defibrillators and save lives

For the first time in the world, drones have been used as a fully integrated part of emergency dispatch. A drone system delivering Automated External Defibrillators (AEDs) to the scene of cardiac arrests has been available to residents in the Gothenburg area as part of a clinical study. The drone

system was deployed by Everdrone, which develops technology for autonomous drones and focuses on civil applications for commercial drones, primarily for use within the healthcare and emergency response sector.

Partners: Everdrone AB, Sweden's national emergency call centre (SOS Alarm) and The Centre for Resuscitation Science at Karolinska Institutet (KI).

Research platforms for self-driving vehicles

Revere is a research facility focusing on self-driving vehicles, active safety and vehicle dynamics. The aim is to provide research platforms based on real vehicles to be used for testing in real or conditioned traffic environments. It also aims to increase cooperation between researchers from different universities, research institutes and industry. Recent projects include tests with automated long vehicle combinations and automated driving within terminal areas.

Partners: Chalmers University of Technology, Volvo Cars and Volvo Trucks. Funding from Region Västra Götaland.

360° film description

Here is a short 360° clip of a fully autonomous truck as it drives itself around a corner at AstaZero test track.

How a self-driving vehicle works

A self-driving vehicle needs many different sensors to function. Different sensors give different sensory impressions. Cameras can be used to read traffic signs, traffic lights and identify other road users. Radars emit sound waves and lidars use laser beams, and both sensors help to build a 3D image of the surroundings. This is especially important when it's dark as it's harder for the cameras to see. With the help of GPS, the vehicle finds the right route.

All these impressions are collected simultaneously and timed with an accuracy down to a millionth of a second. A computer interprets these impressions in real time and then calculates how the vehicle should act.

This test was carried out at the test track AstaZero.

Photo description

An illustration of all the different components needed to control a self-driving truck, and where they are located on the vehicle.

360° film description

A 360° view inside the cab of a self-driving truck, as it navigates through snow and icy roads at the AstaZero test track.

The test – autonomous steering with a Volvo FH16

One way to push development is to test different driving scenarios and situations that could arise in traffic, which a self-driving car must deal with. Developing basic steering functions is one example. In this particular test, sensor data from radars and GPS are used to develop algorithms that are then able to control the vehicle with the help of, among other things, GPS. Although, there are many factors to consider. For example, the truck must be able to calculate and follow a specific trajectory. As you can see in the film, the steering is a little shaky, which in this case is due to the steering algorithm creating instability. For it to be more stable and reliable, various parameters need to be fine-tuned. Gradually, you can add more factors and build on the complexity of the test. The two people in the cab are safety drivers who monitor the test and can intervene if necessary.

MOBILITY AS A SERVICE

Cars not only create congestion and air pollution, but also account for a significant part of any city's CO₂ emissions. The more people can be enticed to use public transport, ride a bike or share transport, the cleaner and more livable a city can become. In Gothenburg, a number of start-ups and initiatives are looking at ways of using connectivity to access multiple transport services from one platform. The intention is to make it easier for people to find, book and pay for travel services, and by extension easier to travel in a more sustainable way.

More information

[The LIMA project](#)

[The IRIS project](#)

Innovative solutions for car-free housing

The Riksbyggen Viva housing association has been built without any private parking spaces. For residents to cope with everyday life without owning a car, innovative solutions are required. They are therefore offered several mobility services that are booked via a single app, EC2B. Among them there is a carpool with electric cars and a bicycle pool with both ordinary electric bicycles and electric box bikes. The app also includes public transport.

Partners: Riksbyggen, OurGreenCar, GoRide, EC2B, IRIS Smart Cities

A smart, shared mobility service

The LIMA project is running a pilot with a smart, shared mobility service for sustainable travel. Test users working at Lindholmen have access to a variety of transportation modes and can easily decide if they or their employer should pay for the trip, all in the same app. The app shows available services and traffic in real-time, and there are several mobility hubs offering different alternatives for the users. The project is part of the Swedish Government's innovation partnership program, "The next generation's travel and transport" and is funded in part by Vinnova, Sweden's innovation agency, through Drive Sweden.

Partners: Lindholmen Science Park, IUS Innovation, Ubigo, RISE, Smart Resenär, Ericsson, Veridict, Carmenta, Viscando, Snapp Car, Move About, Holmgrens Bil, Göteborgs Stads Parkering AB, Västtrafik, Älvstranden Utveckling, OKQ8, Karlastaden, Atrium Ljungberg and Chalmers University of Technology.

Film description

A short film describing how the LIMA shared mobility service works and its benefits.

SCIENCE PARKS AND LARGE INITIATIVES

In Gothenburg, there are no less than three science parks - Lindholmen Science Park, Johanneberg Science Park and Sahlgrenska Science Park. Through a unique collaboration between business, academia and the public sector, they create unique conditions for innovation and leading development projects in their areas of strength: future mobility, sustainable urban development and life science.

More information

[Lindholmen Science Park](#)

[Johanneberg Science Park](#)

[Sahlgrenska Science Park](#)

[The innovation program Drive Sweden](#)

[The national arena CLOSER](#)

[Collaboration hub MobilityXlab](#)

[The test bed SEEL](#)

Smart transport for smart cities

DenCity is a collaborative project that develops innovative solutions for sustainable transport in dense urban areas. The expectation is that smarter and more sustainable surface efficient transports can support the development of liveable dense cities. The project takes a holistic approach to both passenger and freight transport, and is led by CLOSER at Lindholmen Science Park.

Partners: CLOSER, The Swedish Transport Administration, Region Västra Götaland, Region Jönköpings län, The City of Gothenburg, The City of Stockholm, IMCG, Postnord, Citymail, Volvo Group, Ericsson, Bring, Renz, Älvstranden Utveckling, Coop, Svensk Digitalhandel, Göteborgs stad parkering, Riksbyggen, HBV, Framtiden, Karlstad, Urban Services, DB Schenker, Göteborg Energi, Södra Munksjön Utveckling, Amido, Jernhusen, DHL, Freelway, Chalmers University of Technology, SSPA, Sustainable Innovation, RISE, University of Gothenburg, Lindholmen Science Park and Vinnova.

Drives a mobility eco-system for the future

Drive Sweden is one of Sweden's 17 Strategic Innovation Programs focusing on future mobility for people and goods that are sustainable, safe and accessible for all. Drive Sweden forms an eco-system of over 150 representatives from business, society and academia. Together they develop, test and implement efficient, connected and automated transport solutions. Drive Sweden is funded by Vinnova, FORMAS, The Swedish Energy Agency and Lindholmen Science Park is the host of the program.

Innovative power for Sweden

Lindholmen Science Park strives towards the vision to strengthen Sweden's competitiveness with focus on future mobility for people and goods. In addition to being a dynamic and creative area, it is also an arena for collaboration across geographical borders. Several of Sweden's leading development projects are being run within this arena, based on societal challenges and a shared need for new knowledge.

A creative space for uniting global companies with small start-ups

MobilityXlab was founded in 2017 by six global companies as a collaborative space for creating and developing new innovations within future mobility – both with each other and with new start-ups. In its first three years, it has supported 40 start-ups and initiated 54 collaborations. To date, this has resulted in nine commercial contracts between start-ups and one of the founding partners.

Partners: CEVT, Ericsson, Veoneer, Volvo Cars, Volvo Group & Zenseact. MobilityXlab is hosted by Lindholmen Science Park with support from Vinnova and Region Västra Götaland.

Advanced research infrastructure for electromobility

SEEL (Swedish Electric Transport Laboratory) is a test and research centre for safe electromobility that is expected to be operational by 2023. The purpose of the initiative is to create a common laboratory platform for the automotive industry, universities and research institutes, as well as the aerospace and maritime industries.

Partners: Chalmers University of Technology and RISE.

ELECTROMOBILITY

Transportation today creates noise and air pollution and is a major contributor to a city's CO₂ emissions. By enabling all forms of transport to run on electricity, electromobility has the potential to make cities greener, cleaner and more livable. Gothenburg is home to a number of leading projects within electromobility, and the city has already made significant progress in electrifying its public transport. The aim is to have a fossil-free transport system by 2030 and electrification is leading the way.

More information

[The ElectriCity project](#)

[Public transport provider Västtrafik](#)

[Test beds](#)

Demo arena for electrified transport

The ElectriCity project develops, tests and demonstrates solutions for tomorrow's electrified transport, including buses, ferries and heavy vehicles. Since 2015, electric buses have been operating on a bus route in the centre of Gothenburg, in conjunction with multiple research projects. The tests have paved the way for a wider introduction of electric buses by the public transport provider Västtrafik. Western Sweden now has the highest number of electric buses in the Nordics.

Partners: Volvo Group, Region Västra Götaland, Västtrafik, City of Gothenburg, Chalmers University of Technology, Swedish Energy Agency, Johanneberg Science Park, Lindholmen Science Park, Göteborg Energi, Keolis, Transdev, Älvstranden Utveckling, Akademiska Hus, Chalmersfastigheter, Ericsson and ABB.

Film description

Footage of Gothenburg's electric buses utilising an indoor bus stop.

Film description

A short film about the ElectriCity project and Gothenburg's electric buses, where various interviewees explain what the technology means for the city when it comes to transportation, sustainability and future urban planning.

Test bed for automation and electric vehicles

In a large area at the old airport in Säve, a cluster for innovation and sustainable transport and mobility is rapidly growing under the wings of property owner Castellum. It is a test bed for autonomous and electrified vehicles. Among several sustainable initiatives is the development of an electric passenger aircraft. Over the next few years, the area will also grow into a flexible logistics hub with an infrastructure based on transshipment and gradually electrified and autonomous transport.

Partners: Castellum, Heart Aerospace, CEVT, Volvo Technology.

Electric ferry part of public transport system

Elvy is Gothenburg's first electric hybrid ferry. It can carry up to 300 travelers and 90 bicycles on its route across Göta älv. The ferry is part of the regular public transport system that operates the river.

Partners: Västtrafik, Styröbolaget part of Transdev

Film description

Footage of Elvy, an electric hybrid ferry, as it carries commuters across the Göte Älv river in Gothenburg.

360° film description

This 360° video clip was taken on board Elvy, Gothenburg's first electric hybrid ferry, as it travels down the city's main river, Göta Älv.

New electric ferry provides greater environmental gains

Investment in the electrification of public transport in Gothenburg continues. Västtrafik, which is responsible for public transport in Region Västra Götaland, has ordered a new electric hybrid ferry which will start operating on Göta älv in 2022. The new ferry will have an improved battery pack and will be able to run longer in electric operation compared to the current ferry in operation, Elvy, thus providing greater environmental benefits.

360° photo description

A 360° view inside the electric hybrid ferry Elvy's battery room, where two battery packs help power the ferry in conjunction with an internal combustion engine.

Battery operation reduces emissions

The ferry's two battery packs have a combined energy capacity of 1,008 kWh. Fully charged, the batteries can be used for approximately six hours of electric operation. They can either be charged during operation by the internal combustion engine or overnight in dock from the fixed power grid. Battery operation reduces emissions of carbon dioxide, nitrogen oxides and particles by about two-thirds per year.

360° photo description

A 360° view inside the electric hybrid ferry Elvy's motor room.

Technology that saves fuel

Being a hybrid ferry means that Elvy's internal combustion engine shares capacity with two battery packs. The diesel-electric generator is switched off and on during the day to optimize battery life and performance. With this new technology, fuel savings will be up to 45 per cent compared to similar ferries.

DIGITALIZATION & 5G

The introduction of 5G is set to accelerate digitalization as it delivers internet speeds up to 100 times faster than the previous 4G network. This enables a whole new level of real-time communication and data processing that in turn will open up a host of new possibilities when it comes to digital services and concepts.

One example of such a service is geofencing, which is currently being used to reduce air pollution and noise levels in designated areas of Gothenburg. New concepts – made possible by 5G – are also being trialled on the city's public transport network.

[More information](#)

[The national arena CLOSER](#)

[The ElectriCity project](#)

[The ITxPT project](#)

Smart public transport with 5G

As part of the ElectriCity project, several actors are collaborating using 5G technology to develop smart and safe public transport for the future. The ITxPT (IT for Public Transport) project is testing new solutions for on board IT systems to communicate better with each other and a lab has been established at the Lindholmen Science Park.

Introducing 5G technology enables multiple new use cases to be tested, e.g. higher precision when positioning buses. Faster, real-time data is used to provide up-to-date status on 'last mile' solutions that are nearby. Additionally, due to the incredible amount of data and high responsiveness needed to ensure traffic safety, 5G technology is a crucial part of enabling self-driving vehicles in the future.

Partners: Ericsson, Volvo Group, Consat, Telia, Transdev and Västtrafik.

Geofencing – a tool for creating sustainable cities

Today's vehicles are for the most part connected, which means that geofencing is becoming an important tool for creating more sustainable and safe cities. Geofencing defines a digitized geographical zone within which set characteristics, such as speed, of connected vehicles can be managed. Geofencing can also be used to restrict access to specific zones or areas. The research and innovation programme for geofencing will drive development and is coordinated by CLOSER (the national arena for collaboration within transport efficiency) at Lindholmen Science Park and is financed by The Swedish Transport Administration.

Partners: Scania AB, Volvo Group, Volvo Cars, Veoneer, City of Stockholm, City of Gothenburg and The Swedish Transport Agency.

WASTE MANAGEMENT

Every day large quantities of waste and refuse need to be transported from homes and businesses to recycling and refuse processing centres. This is almost always done by trucks, which generates CO2 emissions, noise and air pollution. However, in Gothenburg the city's refuse trucks are powered by renewable fuels including HVO, biogas and electricity.

[More information](#)

[Recycling company Renova](#)

[Floating recycling centre](#)

Fossil-free vehicle fleet handles waste

The waste and recycling company Renova was the first in the world to operate a fossil-free vehicle fleet. Since 2015, all the company's garbage trucks are powered by renewable fuels. One of them is

an electric garbage truck which is in operation in central Gothenburg, and a fuel cell-powered garbage truck refueled with hydrogen is on its way.

Renova has also developed a prototype for a self-driving garbage truck where the driver operates the vehicle by remote control. The garbage truck is primarily intended to improve traffic safety and the driver's working environment, but also reduces fuel consumption and emissions through optimized gear-shifting, steering and speed.

Partners: Renova is owned by ten municipalities in western Sweden including The City of Gothenburg. Other partners are Volvo Trucks, PowerCell Sweden, Scania and JOAB.

[Film description](#)

Footage of a full-electric garbage truck in operation.

[A floating recycling centre on the river](#)

A barge has been rebuilt to be used as a floating recycling center on Göta älv. The barge docks at four quays in central Gothenburg and accepts pretty much the same things that a regular recycling center would. The idea is that the recycling barge will come to people instead of them having to take the car to an existing recycling center. The pilot concept was tested for the second time in the autumn of 2020 and is part of the DenCity project. The purpose is to investigate the possibilities of shifting different types of traffic to the urban waterways.

Partners: City of Gothenburg, Urban Transport Administration, City of Gothenburg, Sustainable Waste and Water, SSPA, the City of Stockholm, Volvo Group, Göteborgs Fiskauktion, City of Gothenburg, Parks and Nature Administration, Älvstranden Utveckling AB, Eriksbergs Samfällighetsförening, Pråmkompaniet, Gothia Marine and Björk å Frihet.

LAST MILE DELIVERY

'Last mile delivery' is the final stage in a product's journey: when the goods are delivered to the end customer. It is also the most carbon intensive stage. The growth of e-commerce is leading to increased traffic congestion and CO₂ emissions from delivery vehicles. Carbon-neutral alternatives for last mile deliveries are currently being explored and some of the concepts being trialed in Gothenburg include cargo bikes and autonomous robots.

[More information](#)

[Johanneberg Science Park](#)

[The SMOOTh project](#)

[Self-driving robot delivers packages](#)

The Climate Neutral Urban Logistics project tests and evaluates new, autonomous solutions for delivering goods in cities. A self-driving robot has been tested for package deliveries at the Chalmers University of Technology's Johanneberg campus. The project also aims to generate new knowledge about how urban logistics affects the environment and how the transition to autonomous solutions affects society and infrastructure in general.

Partners: HUGO, Chalmers University of Technology, Chalmersfastigheter, The School of Business, Economics and Law at the University of Gothenburg, Johanneberg Science Park, Ernst Rosén, HSB Gothenburg, Akademiska Hus and Urban Transport Administration, City of Gothenburg

Coordination reduces heavy transport in the city centre

Urban logistics contributes to traffic congestion and deterioration of inner-city environments. And a large proportion of trucks delivering goods to the city center are often not even full. The SMOOTH project brings together industry, academia and society to jointly develop and test a system for goods transport in Gothenburg. It aims to reduce the number of goods transports in inner-city areas by 40 percent. Instead of having transport providers deliver goods using trucks with low load rates, SMOOTH will manage cargo space sharing across multiple transport providers.

Partners: Volvo Group, DHL, RISE, IVL, Pling Transport, Velove, Best Transport, The City of Gothenburg's Traffic Office, The Swedish Transport Administration, GLC and Nordstan.

Film description

Footage of a cargo bike being loaded and making deliveries in Gothenburg.

How SMOOTH works:

1. SMOOTH will receive data from multiple transport providers to help optimise distribution.
2. Goods will arrive at Urban Consolidation Centres outside the city to be consolidated and loaded onto larger and fully loaded electric trucks.
3. Trucks will arrive at a city hub where goods will be loaded onto smaller zero-emission distribution vehicles for the last mile delivery.

360° film description

This short clip from inside the Nordstan Cargo Bike Hub shows an electric cargo bike being loaded before making deliveries in central Gothenburg.

Smooth reloading to sustainable city deliveries

In central Gothenburg, there are different city hubs for reloading goods from trucks to electric cargo bikes. Either loose goods are reloaded, or entire containers are moved between the vehicles. By using a smart container system, reloading is fast and can be handled by one person.

The bikes can then easily get out into the city center for the last mile delivery. In some areas, they also pick up returns, which are then driven back to the hub to be reloaded and shipped back to different e-commerce companies.

360° film description

A 360° view from a cargo delivery bike as it travels through the streets of central Gothenburg.

Electric cargo bikes ride the last mile

Electric cargo bikes consume 87 per cent less electricity compared to electric delivery vans. The bikes are specially developed to work together with other cyclists on the cycle paths. They are only 86 cm wide and low enough for other cyclists to be able to maintain an overview of traffic.

Smart container for simple handling

The waterproof container is made of lightweight material and has a load capacity of one cubic metre and 150 kg. The container can easily be moved from truck to cargo bike and then placed far back on of the bike, thanks to four wheels located underneath.