TRANSPORT
— A CHALMERS
AREA OF ADVANCE
Areas of interaction between research, innovation and education at Chalmers resulting in scientific excellence and a potential to improve sustainability.

The Areas of Advance are strong, challenged driven thematic platforms for strategy and long-term collaboration that hunt down specific challenges, often directly relevant for industry and society. Here, participants from different corners of society gather around common objectives. The mobilisation integrates interdisciplinary research, education and innovation, and the aim is the creation of a sustainable future.

Chalmers’ Areas of Advance
Transport
Energy
Building Futures
Information and Communication
Technology
Production
Life Science Engineering
Materials Science

Founded in 1829
2 Campus
3 000 Staff
240 Senior faculty members in Transport research

10 000 Students
40 MSc program
2 600 Master’s students
900 International students
Mobility of people and transport of goods are fundamental parts of the modern society and generates tremendous economic and social value. However, growing transport volumes pose challenges such as climate change, environmental pollution and traffic accidents.

Improvements in vehicle efficiency, the implementation of new drive-lines, and improved efficiency of transport systems have so far proved insufficient in our efforts in proceeding towards sustainable transport and logistics systems.

**RESEARCH FOR A SUSTAINABLE FUTURE**
The difficult task we face is to create the potential for sustainable, safe transport systems and, at the same time, increase effectiveness and efficiency. Future development cannot be conducted by a single industrial, public or academic actor. Mitigating climate impact and reducing risks in the transport sector are serious challenges that require collaboration between various stakeholders, including industry actors and the society as a whole. Addressing these challenges is an important part of reaching the Sustainable Development Goals set by the United Nations.

To approach the problems we need to simultaneously address several levels in and perspectives on the transport system, taking into consideration the interaction of vehicles and vessels, networks of infrastructures and the demand and supply of transport and logistics services.

We do this in the research areas identified within our excellence profiles. The areas are further promoted in three cross-disciplinary themes; *Electromobility*, *Autonomous transports* and *Transition to future transport systems*.

**TWO UNIVERSITIES JOINING FORCES**
University of Gothenburg is an integrated part of Area of Advance Transport. Together with the university’s core research group of logistics and transport management, there is a wide range of researchers in fields such as applied IT, law, economics, global studies, psychology, marketing, organisation, human geography and chemistry, which complement the research groups at Chalmers.
Well-functioning transport systems are essential for the effectiveness and efficiency of logistics systems, and vice versa. Thereby, their mutual adaption is important for the competitiveness of firms as well as mobility for people and quality of life. The profile includes two highly interrelated areas, reflecting two main perspectives, where researchers meet to jointly develop multidisciplinary research, education and innovation. These areas are demand for transport and logistics and supply of transport and logistics.

The two areas address challenges related to designing, enabling, managing and maintaining efficient, flexible and sustainable transport and logistics systems; as well as understanding the interplay – and facilitating coordination and cooperation – between actors in supply chains, operations and transport networks.

A growing awareness of the relationship between transport efficiency and the environmental consequences of different logistics and transport solutions also spurs the development of the research.

**Traffic Safety**

Sweden was the first country to express a Vision Zero (no fatalities or severe injuries in traffic accidents) thus making safety a systemic issue. Traffic safety research includes efforts to better understand real traffic environments, countermeasures to avoid accidents and prevent injuries, and actions to mitigate their consequences. Increasing worldwide efforts to develop connected and self-driving vehicles pose new challenges. The emerging technologies bring high hopes for a new paradigm in traffic safety with expectations on a dramatic decrease of accidents. Traffic safety is also a boundary condition for the automated transport system.

Research, innovation and education are targeting high achievement within three areas:

*Field data collection and analysis* aims at developing a holistic understanding of occurrence and effects of incidents and accidents; including the assessment of risk and benefit in automated systems compared to the safety levels of human drivers.

*Accident avoidance and automation* aims at developing new technologies and safety systems as well as developing better understanding of human factors, human behaviour and driver models.

*Injury prevention* aims at developing increased crashworthiness, advanced adaptive vehicle structures and protective systems. All collision types and all categories of road users are included.
SUSTAINABLE VEHICLE TECHNOLOGIES

A sustainable transport system requires new solutions for propulsion systems and vehicle concepts. The research within this profile area targets solutions for a highly energy efficient transport system, that uses renewable energy sources, has no net emissions of greenhouse gases and no other harmful emissions to the environment.

Chalmers has a long scientific tradition and a set of strong research centres in this profile area which generates competence and knowledge within the fields of hybrid vehicles, electric drives, electric energy storages, combustion engines, after-treatment systems, reduced resistance and vehicle environmental impact. All conventional transport modes are represented.

Research and innovation are mainly conducted within four areas: combustion engine research and electric and hybrid vehicles, both aiming to find sustainable solutions for how to propel vehicles in the future, vehicle concepts and design aiming at reducing propulsion resistance and vehicle environmental impact aiming at analysing factors affecting future generations of vehicle powertrains and concepts towards more sustainable vehicle technologies.

RESEARCH FOR A SUSTAINABLE FUTURE

All research performed within our excellence profiles contribute to the Sustainable Development Goals set by the United Nations. Well-functioning transports are crucial for reaching several of the goals, while transports may also affect a number of them adversely.

Our activities have a strong focus on sustainability challenges, through the development of sustainable transport systems. Transport challenges include environmental impact, traffic accidents, efficient transports, urbanisation, land use and the question of limited resources, all of which are covered by the Sustainable Developments Goals.

The research of Area of Advance Transport relates in particular to the following Sustainable Development Goals:
Collaboration between academia and industry enhances the exchange of knowledge in both directions. Chalmers has strategic long-term agreements with several large companies and organisations, and our researchers collaborate with hundreds of companies where the majority are involved in several projects. Numerous of Sweden’s leading companies as well as international companies utilize our research results.

Our senior researchers are involved in private and public organisations, both national and international, to support in setting policies and standards. Collaboration with Science Parks, the School of Entrepreneurship and other actors in the innovation system to which Chalmers is linked, creates a starting point for these efforts.

The research centres facilitate and coordinate collaboration between academic researchers and industry. In order to further enhance the impact of our research on society, we develop additional platforms of interaction with industry and society as well as new ways of stimulating innovation to foster new transport solutions. One example of this is the project DenCity, where a number of partners from private and public sector collaborate with Chalmers in developing innovative solutions for sustainable passenger and freight mobility in dense neighborhoods.

Area of Advance Transport’s major collaboration partners are listed below.
STRATEGIC PARTNERSHIPS

Area of Advance Transport is host of three of Chalmers' strategic industrial partnerships, signed by the President of Chalmers. The partnerships promote collaboration between Chalmers and the industry through research, competence provisioning, technology development and innovation. The possibilities of industrial PhD students and adjunct researchers from the industry, joint knowledge networks and access to research infrastructure and labs, make the partnerships very rewarding. Statens Vegvesen choosing Chalmers as a strategic partner, is proof of our excellence in the field of transport.

Furthermore, two strategic academic partnerships are initiated with prioritized international partner universities. Together we collaborate in research projects, exchange researchers and arrange joint workshops and conferences. Promoting the exchange of researchers and PhD students, we enable exchange of ideas and create new research possibilities.

The strategic partners of Area of Advance Transport are listed below.

- Mobility, Logistics and Automotive Technology Research Centre
  www.mobi.vub.ac.be
- University of Michigan Transportation Research Institute
  www.umtri.umich.edu
- Statens Vegvesen
  www.vegvesen.no
- Volvo Car Corporation
  www.volvocars.com
- Volvo Group
  www.volvogroup.com

RELATED RESEARCH CENTRES

SAFER – Vehicle and Traffic Research Centre
Director Magnus Granström
safer@chalmers.se
www.saferresearch.com

Northern LEAD Logistics Centre
Director Jonas Flodén
jonas.floden@handels.gu.se
www.chalmers.se/en/centres/lead

Photo: Göteborgs Hamn
Statens Vegvesen
www.vegvesen.no
Volvo Car Corporation
www.volvocars.com
Volvo Group
www.volvogroup.com
INFRASTRUCTURES AND MAJOR PROJECTS

Gothenburg is the planned site of a national electromobility lab. The facility will provide Sweden with arena for research and development of new technologies for electrified vehicles and vessels, as well as strengthening the expertise.

In order to place Swedish vehicle and marine industry at the forefront, and make them benefit from the ongoing technology shift, the Swedish government is investing one billion kronor in the transition to an electrified transport sector. An important part of the initiative is a test lab for electromobility, to be located in Gothenburg. The lab will be a creative and competence-enhancing node for Swedish automotive industry, marine industry, research institutes and universities. Chalmers and Rise Research Institutes of Sweden will jointly build and own the facility.

The electric bus route ElectriCity gives research institutes and companies a live testbed for research and development of solutions for sustainable travel. Since 2015 several buses operate route 55 in Gothenburg, running on renewable electricity – quiet and entirely emission-free. The bus stop next to Chalmers Lindholmen is indoors.

AstaZero is the world’s first full-scale test environment for road safety. The test track is open for research, development and certification of future road safety systems, by vehicle manufacturers, suppliers, legislators, and universities. AstaZero is owned by Chalmers and Rise Research Institutes of Sweden.

The VTI simulator comprises three large, advanced driving simulators, a smaller training simulator and a rail simulator. A large part of VTI’s research concerns understanding the individual’s behaviour in the transport system.

REVERE – Resource for Vehicle Research at Chalmers has focus on self-driving vehicles, active safety and vehicle dynamics. The 400 square metre lab includes test vehicles (light and heavy vehicles), environment sensors and simulators among other vehicle-related equipment.

WASP
Wallenberg Autonomous Systems and Software Program (WASP) is Sweden’s largest ever individual research program. The program addresses research on autonomous systems acting in collaboration with humans, adapting to their environment through sensors, information and knowledge, and forming intelligent systems-of-systems. Software is the main enabler in autonomous systems, and is an integrated research theme of the program.

www.wasp-sweden.org

COPPLAR
Several research groups at Chalmers are involved in the project Cooperative Perception & Planning Platform (COPPLAR) which aims at a cooperative self-driving vehicle that can handle challenging city traffic and changing weather conditions. Other autonomous driving projects at Chalmers address aspects of human factors and engineering issues.

www.chalmers.se/transport
EDUCATION

Chalmers' digital campus ChalmersX offers moocs, open online courses. In 2018, Chalmers launched Scandinavia’s first MicroMasters® programme, on Emerging Automotive Technologies. The programme provides a holistic perspective on emerging technologies fostering sustainability and digitalization within the automotive industry through seven courses and a final capstone exam. It represents the equivalent of ca 20 credits of coursework at the Chalmers Masters programmes Automotive Engineering or Systems, Control and Mechatronics.

ChalmersX also offers moocs on Supply Chain Management and Logistics, teaching the basics of designing sound and effective systems that save time, money and energy.

...AND COMPETITION

Since many years, Chalmers runs a joint student project on BSc-level together with Penn State University and the Volvo Group. The aim of the project is to significantly enhance the global awareness of engineering students, to better prepare them to work in a global economy. The vision entails student teams at Chalmers and Penn State working together on industry supplied projects. The student collaboration mimics the operation of multinational corporate global engineering teams and is basically a non-travel based activity.

We are now planning to expand the program and start projects together with other universities and companies, in particular Volvo Cars.

Formula Student is the largest engineering competition in the world. The year-long project of building a competitive race car provides Chalmers students with immense knowledge and experience. Close cooperation with the automotive industry also gives the students access to state-of-the-art equipment, and make them highly attractive for a future career in industry.

In collaboration with University of Gothenburg, Chalmers participates in the competition in 2018.

Another educational and highly challenging student competition is the Shell Eco-marathon where students around the world compete in designing, building and driving the most energy-efficient car. In 2018, Chalmers students participate in the competition in France.
LEARN MORE
For more information of our activities, events and research in the Area of Advance Transport visit our website:

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COMMUNICATION AND SUPPORT

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