SYSTEMS FOR ACCIDENT PREVENTION AND AUTOMATED DRIVING

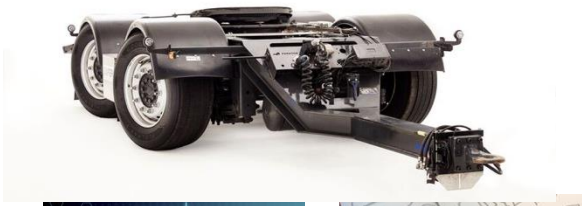
The overall question for the area during the past three years has been: how can active systems and automation predict and prevent collisions? SAFER's approach has been, and will be, **focused on the thorough understanding of the different aspects needed to ensure a maximized benefit** from a safety perspective, based for instance on field data analysis and accident information. This research area covers in brief:

- Understanding of basic principles relevant for safety performance of collision avoidance and mitigation systems.
- Principles of sensors and algorithms relevant for safety performance in more complex conflict scenarios.
- Verification and validation of active safety systems, semi-autonomous and fully autonomous vehicles and connected transport systems where infrastructure, vehicles and vulnerable road users interact to enhance safety.

SYSTEMS FOR ACCIDENT PREVENTION AND AUTOMATED DRIVING

Key highlights Stage 4

- SAFER takes on the **safety perspective** and **tool chain aspects** in the research and technology development in automation.
- **Increased focus** – the project portfolio is growing. Examples:
  - Self-driving trailers in Viared industrial park, AD level 5 (idolly).
  - Use of SAFER's unique databases with NDD for development of simulation tools (Realsim for AD).
  - Stakeholder dialogue – how can AD bring values in cities (Cocreation lab).
  - AD level 4 in challenging city traffic and changing weather conditions (COPPLAR).
  - Methods for development and testing of cooperative systems (VICTig).
- **Starting up activities within AI** and established links to AI Innovation of Sweden. Further developed the infrastructure for:
  - Tool chains, methodology, etc., which utilizes Big data / AI / Machine learning.
  - Support for development, testing and verification in research projects.



SAFER
VEHICLE AND TRAFFIC SAFETY CENTRE AT CHALMERS

HEADSTART

Harmonised European Solutions for Testing Automated Road Transport

One of the main challenges for the implementation of self-driving vehicles is the testing and validation.

The project takes on the challenge to **define testing and validation procedures** of functions including its key enabling technologies, i.e. communication, cyber-security, positioning, by cross-linking of all test instances such as simulation, proving ground and real-world field tests to validate safety and security performance according to the needs of key user groups, e.g. technology developers, consumer testing and type approval).

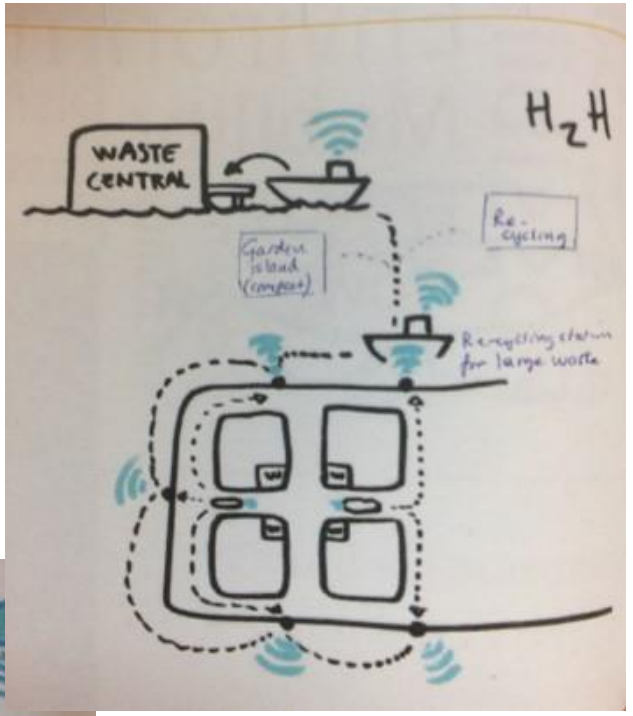
Partners: SAFER is in this project the joint research unit and its partners RISE, Chalmers, AB Volvo, Autoliv are involved in the project.

SAFERs role: SAFER will set up the requirements for testing and perform demonstrations at AstaZero.

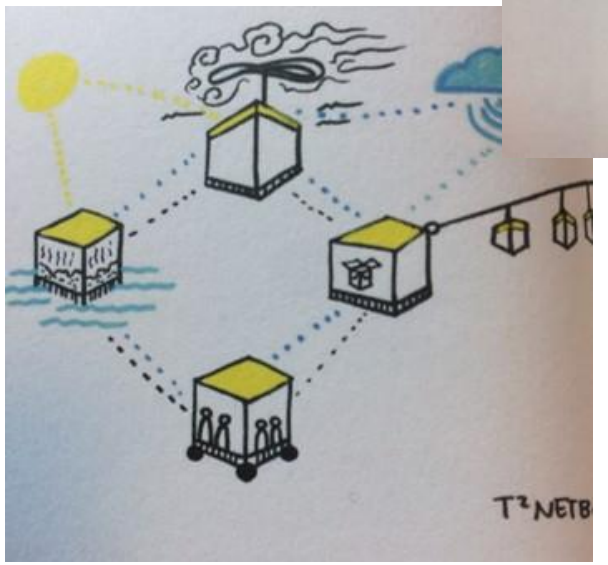
Duration: The project starts in 2019 and will last for three years.

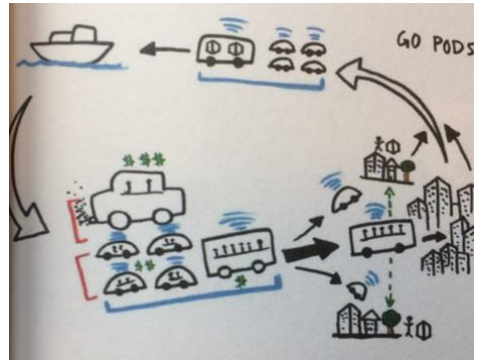
CO-CREATION LAB

How can autonomous transport systems bring value in cities? So far, discussions and projects concerning autonomous vehicles have mainly been related to technology, technical systems, internet services and legislation. There is very little material on how autonomous vehicles affect the city's infrastructure, traffic, environment, city life and people's everyday lives.



Stakeholders from various professions and backgrounds gathered in these co-creation workshops, where they through creative exercises developed new ideas and concepts related to autonomous transport systems in specific urban contexts. The purpose was not to create ideas for implementation, but to explore hidden values and identify the competence gaps to free them.





VICTIg I & II - Vehicle ICT Innovation Methodology

The successful SAFER project VICTIg I -has now been finalised after five years of research. The project has been aiming to find methods for efficient development and test of the software intense ICT functions that enable active safety functions for automated and assisted vehicles. The project was so successful that it now continues in a VICTIg II. The method developed in the first stage of VICTIg vill now be used in the next stage, VICTIg II. The project will look into safety evaluation of highway platooning under a cut-in situation, using simulation.

SHORT FACTS

Project title: VICTIg - Vehicle ICT Innovation Methodology PART II

Project type: Associated project

Research area: Systems for accident prevention and AD

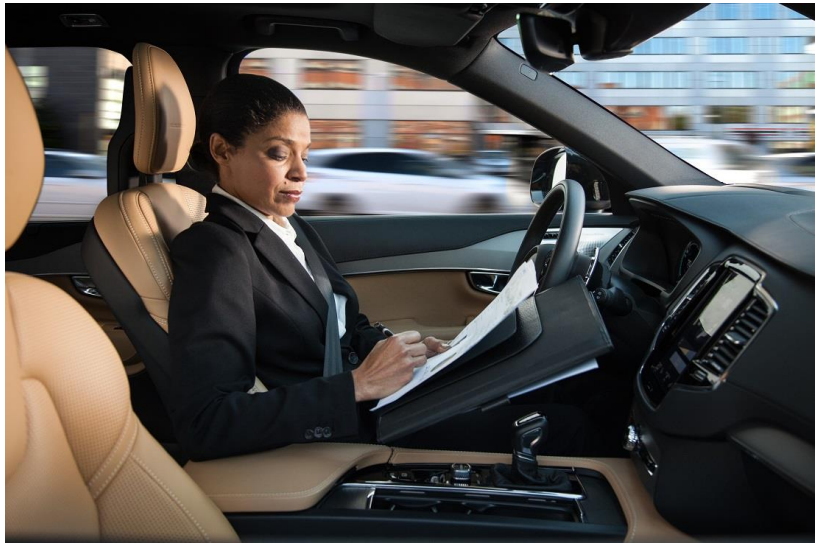
Financier(s): VINNOVA, Halmstad University, VTI

Partner(s): VTI, Halmstad University

Period: 2018-05-01 - 2018-12-31

ESPLANADE

One of the key issues investigated in the project is how the **communication between the car and the driver will be set up**, for example, by clarifying who is responsible for conveying the vehicle in different situations. The ESPLANDE project aims at providing a methodology that can be applied to increasingly complex tasks in order to ensure a safe introduction of more and more advanced self-driving vehicles.



SHORT FACTS

Project title: ESPLANADE

Project type: Associated project

Research area: Systems for accident prevention and AD

Financier(s): VINNOVA

Partner(s): Autoliv, Comentor, Delphi, KTH Royal Institute of Technology, Rise, Semcon, Systemite, Volvo Car Corporation, Volvo Group, Qamcom

Period: 2017-01-01 - 2019-12-31

DRIVE ME

Drive Me is one of the world's first full-scale pilot projects with autonomous cars, real customers and testing on public roads. SAFER is represented in the **Drive Me project management and as the academic partner** in Drive Me. This will strengthen the project's scientific dimension, which includes independent research and programmes for educating new experts. In December 2017, the first two families, the Hains and the Simonovskis, received their Drive Me cars.

Sweden4platooning

The objective of the project is to **demonstrate feasibility of CACC (Cooperative Adaptive Cruise Control) on public roads**, with trucks from Scania and Volvo at the haulage company Schenker. Further will platooning (lateral and longitudinal control of trucks) be demonstrated at suitable test sites. The goal is to make **V2V communication viable for commercial vehicles** and thereby connective safety. This is the first project for cross brand communication (V2V) and applications among SAFER partners; an important enabler for connected safety.

Partners: Scania, Volvo, Royal Institute of Technology, SICS Swedish, ICT, Schenker AB, and Trafikverket.

SHORT FACTS

Project title: Sweden4Platooning

Project type: Associated project

Research area: Systems for accident prevention and AD

Financier(s): VINNOVA

Partner(s): Scania, Volvo Group, KTH Royal Institute of Technology, Others (see project description)

Period: 2017-01-01 - 2019-12-31

AUTOPILOT SITE TO PLANT

The purpose of the project is to build **a safe and efficient fully automated transport system that is capable of operating in narrow spaces, such as a mine, and on public roads.** The material from the mine will thus be transported without a driver in the vehicle all the way from the mining area to the enrichment plant. The system should be able to work both with and without support from various infrastructure systems, such as GPS, WiFi and 4G. It is essential for SAFER to engage in confined area automation since it is in this environment that research and technology development will take place before it evolves into the public road domain.

SHORT FACTS

Project title: ASP – Autopilot Site to Plant

Project type: Associated project

Research area: Systems for accident prevention and AD

Financier(s): VINNOVA

Partner(s): Volvo Group, Combitech, Boliden, Chalmers University of Technology

Period: 2017-09-01 - 2019-03-31

Drive Sweden Test Site Automated Highway III

SAFER was leading this project, that started in 2017, to accelerate the implementation of autonomous vehicles and digitized transports. The purpose was to **create test beds for the development, evaluation and demonstration of autonomous and digitalized transports, focusing on rural roads and highways.** The project also helped improve visibility and coordination between actors and between projects that demonstrate and test autonomous regional and long-distance transport of goods and people.

The project was completed in 2018 and the result was a **number of joint project applications** for further research and collaboration.

SHORT FACTS

Project title: Drive Sweden Test Site Automated Highway III

Project type: Project

Research area: Systems for accident prevention and AD

Financier(s): VINNOVA

Partner(s): Chalmers University of Technology, Volvo Group, Scania, Ericsson, Autoliv, PostNord

Period: 2017-11-01 - 2018-10-31

IDOLLY

self-driving trailers without drivers on public roads

Half an hour's drive on the highway east of Gothenburg Viared Industrial Park is located. Within soon, **self-driving trailers will drive from the transshipment terminal to the various companies** in the industry park. The **semi-trailer will be transported without a driver by means of a so-called dolly.** A dolly can be connected to the front of a trailer and hence give the trailer a front axle. In this case, the dolly is equipped with its own electric motor, steering, different types of sensors and an advanced control system. This allows the dolly-trailer combination to drive autonomously, without a human driver.

SHORT FACTS

Project title: iDolly

Project type: Associated project

Research area: Systems for accident prevention and AD

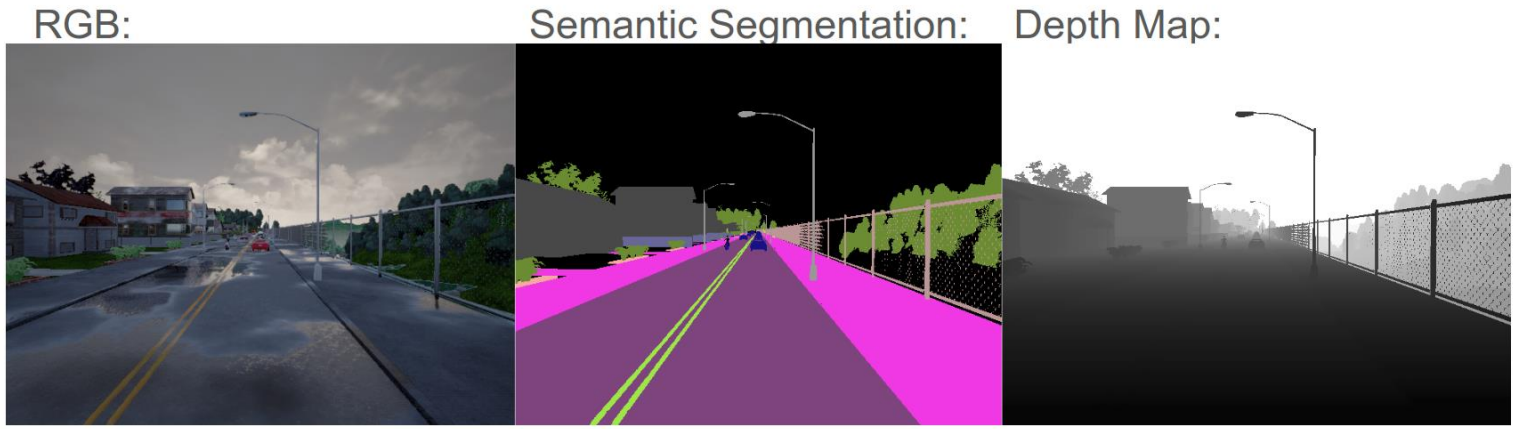
Financier(s): VINNOVA

Partner(s): Volvo Group, Chalmers University of Technology, VBG, Ellos, Kerry Logistics, Speed Group, Borås Stad

Period: 2017-09-01 - 2020-08-31

REALSIM FOR AD

One of the main problems when developing autonomous vehicles is the availability of real-life driving data and testing of the new functions. Therefore, in SAFER's new project "RealSIM for AD", **tools for simulation, based on SAFER's unique databases with real-life driving data, will be developed.** A digital environment of the City of Gothenburg will also be developed. The challenge is to make simulation tools look similar to the reality, and here are SAFER's databases, which contain more than 5 million kilometers of data, an important asset.



SHORT FACTS

Project title: RealSIM

Project type: Project

Research area: Systems for accident prevention and AD

Financier(s): VINNOVA

Partner(s): AstaZero, Chalmers University of Technology, Data Intelligence, Wiretronic, Volvo Group

Period: 2017-11-01 - 2019-12-31

AUTO FREIGHT

Automated trucks between Gothenburg and Viared

The overall objective with the project is to **create conditions for self-driving trucks along highway 40** between Gothenburg harbor and Viared, a distance of about 75 kilometers. The vision is that the driver will drive the truck manually from the port to highway 40 and then activate the autonomous mode. The project will also review existing legislation for high level automation. Image processing is another important area in the project where a camera with the ability to classify different objects has been used.

SAFER's infrastructure ReVeRe (Resource for Vehicle Research) will build the test vehicles and conduct the tests.

SHORT FACTS

Project title: Auto Freight

Project type: Project

Research area: Systems for accident prevention and AD

Partner(s): Volvo Group, Combitech, Chalmers University of Technology, Others (see project description)

Period: 2017-04-01 - 2020-02-29

Auto Freight
Highly Automated Freight Transports

Borås
Göteborg

COPPLAR

Campus Shuttle cooperative perception and planning platform

The COPPLAR project started in 2016 and aims to take the first step towards the **vision of an autonomous vehicle that can handle city traffic and challenging weather conditions**. The focus is on using cooperation between vehicles to safely navigate complex inner-city scenarios. In this project we will build prototype vehicles (research platforms) capable of handling the most prioritized scenarios and demonstrate cooperative self-driving in a controlled environment at the AstaZero test track.

Great steps have been taken regarding development of functions, e.g. in situation awareness and integration of functionality for cooperative perception. The project has developed as anticipated and the final results will be presented in 2019.