SAFER ANNUAL REPORT 2019

YEAR 1/5 IN STAGE 5
APRIL 1 – DEC 31, 2019

SAFER'S 14TH
OPERATIONAL YEAR

SAFER
VEHICLE AND TRAFFIC SAFETY CENTRE AT CHALMERS

SAFER Vehicle and Traffic Safety Centre at Chalmers is a competence centre where 35 partners from the Swedish automotive industry, academia and authorities cooperate to make a centre of excellence within the field of vehicle and traffic safety.

Research at SAFER spans a broad base, covering several disciplines and encompassing both safe mobility and vehicle safety in real environments. The centre's activities engage the very elite in the field of safe transport solutions, and the results contribute to increasing the competitive advantages of the partner companies and organisations. Chalmers University of Technology hosts the centre. By using the multidisciplinary scientific competence available within the centre, we make it a hub for excellent research and knowledge dissemination.

SAFER conducts borderless research to save lives!


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CONTENT

1. INTRO-DUCTION

Welcome to our annual report! The purpose of this report is to present the effects and outcome of the first operational year in SAFER's fifth stage, extending between April 1st 2019 and December 31st 2019.

IT WAS IN FESTIVE FORMS that we celebrated that we started this stage and SAFER's 14th operational year. On April 10, the results of the previous three years of life-saving vehicle and traffic safety research were presented to partners, and others interested, in a lunch mingle with our achievements expressed in an exhibition. We also celebrated that 35 partners had signed up to continue to build multidisciplinary scientific competence for five years.

Basically, SAFER as a centre of excellence in research has not changed, but further developed during the past year. Prior to the new stage, we agreed on a direction that we hope will contribute to give even more value back to our partners and the SAFER community. To mention an example, we have begun the work of utilizing the ecosystem with related and relevant research around SAFER smarter and more efficiently, for example at Lindholmen Science Park, the Swedish hub for future mobility. You can read more about our ecosystem and progress with this part of the strategy on page 16.

Research has always - of course - been the largest and most important part of our activities and in this new phase we want to sharpen the focus on research excellence even

further. Therefore, we have created concrete research targets for 2024 that we now gather the SAFER partners around. You can read more about our research targets and how we got started with the work to find answers to our common research questions during this year on page 24. We have also strived for our reference groups to better facilitate cross-cutting projects, which span several research areas, and stimulate increased cooperation between the groups. We have therefore set up a Scientific Council that has started off to contribute to this work. We feel that we have built a strong and efficient structure around SAFER as well as modernized and simplified our joint processes, a good foundation for a growing and stronger project portfolio.

We have engaged in the formation of EU's forthcoming research funding program Horizon Europe. SAFER continues to participate in the work in various platforms and settings to provide input. Also, a road map on Road Safety in Europe has been developed together within ERTRAC (European Road Transport Research Advisory Council), which is a useful tool and basis for the constructive dialogue with both the commission and other stakeholders. The road map gives a consistent message to deliver when showing the importance of traffic and road safety research in Europe. Together, we are creating the conditions for good opportunities for strong funding of research later in this phase.

It was also with great pleasure we were able to launch the first call for our pre-studies during the autumn. Finally, we have an effective measure in place to get started with strategic knowledge creation that can be leveraged e.g. by using a unique, new competence as a basis for national funding or an entry ticket to prestigious international collaborations. Funding will also be released for research and other SAFER-enhancing activities as a result of a reduced area for our premises. We will continue to offer access to our analysis rooms for work with confidential data as well as meeting rooms, networking areas, fully equipped workplaces for partners to use certain periods as well as touch down desks for work between meetings. Since September we share kitchen and entrance hall with other companies and organisations at Lindholmen Science Park open arena, which works fine. We aim to further strengthen our network by getting closer together, which in turn can generate even more collaboration and knowledge exchange.

The life at SAFER has carried on unabated with interesting seminars, project presentations, project applications, new grants, conferences and dissertations. It is impressive and gratifying to see all the research that is taking place within the broad community of SAFER. We are a unique organisation, well positioned to conduct collaborative research that is of great value for national and international stakeholders as well as its industrial partners. We have a strong commitment for a continuation of SAFER throughout the fifth stage and we look forward to continue to deliver on the strategic workplan and new research activities.

Best Regards,
SAFER Board and Management team

2. THE MANIFESTO

The Manifesto presents our human-centric vision, mission and what SAFER's partners want to achieve together.

SAFER IS CONTINUOUSLY on a bold journey towards zero fatalities and injuries in road traffic. This is achieved through open, collaborative research projects where traffic safety is key for the creation of a safe, sustainable, connected and, where suitable, automated, transport system. SAFER's holistic traffic safety approach covers people, vehicles and infrastructure. This also means that SAFER is part of a bigger societal project: the design and realisation of smart, sustainable transport systems in the cities and beyond. SAFER's role is to be a thought leader in safe mobility of people and goods, offering world-leading knowledge. SAFER creates knowledge and value beyond what a single partner can achieve on its own.

VALUES AND IDENTITY

SAFER has a unique identity with clear values such as openness, mutual respect, curiosity and joy of discovery. We are passionate to make a difference, contribute to society, build relevant knowledge and we understand the benefits from interdisciplinary expertise and talents. Collaboration is a hallmark and thrives on diversity in all aspects and borderless networks seeking and attracting expertise where it is to be found.

OVERALL OBJECTIVES

Together, we want to create new knowledge and research findings that enable people and goods to be transported safely, effectively and sustainably. Vision Zero is our guiding star and we want to make significant contributions to this bold vision and save lives and reduce traffic injuries. Our research has a human centric approach. Protecting people is our primary goal, although there are secondary positive effects of our research that also contribute to a sustainable society, for example, reducing the number of traffic accidents contributes to lower environmental impact and more cost-effective freight transport. During SAFER Stage 5 we aim to fulfil our defined research targets, as well as work according to the four cornerstones in our strategy.

SAFER'S VISION

All road users travel safely in the road transport system.

SAFER'S MISSION

We bring people together to create research and knowledge that save lives, prevent injuries and enable safe mobility for people and goods.

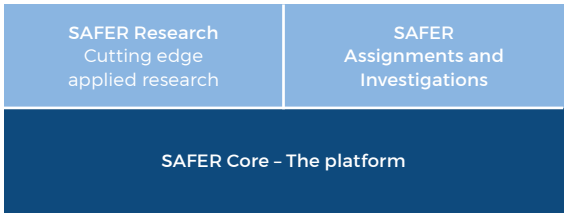
STRATEGY

To significantly contribute to the vision and mission as well as being a well renowned international centre of excellence, SAFER will deliver results, build competence and create strong networks in selected areas. Furthermore, SAFER shall create value for the partners beyond what a single partner can achieve on its own.

SAFER's strategy consists of three different conceptual parts – SAFER Core, the SAFER Research and project portfolio and SAFER Assignments and investigations, see figure 1. SAFER Core is the name for the driving function of SAFER with its operational team including communication and support systems, research areas and their reference groups, the connected research resources, networks and the physical working and networking environment.

To realise our vision, our strategy is based on four inter-linked cornerstones that direct our actions: *Create and share knowledge, Express identity and influence as a thought leader, Utilize the multi-disciplinary research platform, Connected research resources.*

FIGURE 1: OUR STRATEGY



Cornerstones in SAFER Core
1. Create and share knowledge
2. Express identity and influence as a thought leader
3. Utilize the multi-disciplinary research platform
4. Connected research resources

1. CREATE AND SHARE KNOWLEDGE

The basic task for SAFER is to create and share knowledge and to further develop the strong academic base. New knowledge and relevant facts should be made available and visualized. Furthermore, networks should be created and maintained to the benefit of all partners. SAFER should be promoting project generation and coordination and act as a catalyst for joint projects. By creating strong connections to world class research environments and nurturing an international reputation for outstanding collaboration between industry, society and academy, it is possible to influence the international research agenda. The research results should help facilitate innovation at our partners.

2. EXPRESS IDENTITY AND INFLUENCE AS A THOUGHT LEADER

The name SAFER should mean excellence in vehicle and traffic safety research and be of value to all partners. This identity is built, expressed and made visible through different ways – seminars and conferences, the office and facilities, website, and other activities. By communicating what SAFER represents and the achieved results we will attract international stakeholders, collaboration projects and funding. As a thought leader, SAFER should define strategic research agendas based on needs and trends, create and drive SAFER's research projects and develop road maps. The conclusions and needs of the SAFER community should be made visible and known.

3. UTILIZE THE MULTI-DISCIPLINARY RESEARCH PLATFORM

A cornerstone in the strategy is to have a multi-disciplinary, research environment that serves as a physical meeting place, open to all partners. The networks and meeting place we create together will provide added value to partners. The community will generate new knowledge and project ideas as well as develop the people involved, both on a professional and personal level.

4. CONNECTED RESEARCH RESOURCES

The concept of connected research resources is a hallmark for SAFER and we facilitate the access and utilization of different assets available within the network. In 2019, these comprise the following:

THE COLLABORATION SETUP with the physical environment providing work spaces, meeting and analysis rooms, support for seminars etc.

FIELD DATA, with databases of real-world data including their collection, storage and analysis tools are strong assets and SAFER will further develop business models to maintain them.

REVERE – RESOURCE FOR VEHICLE RESEARCH, the full-scale vehicle laboratory at Chalmers, which is increasingly important for active safety research, automated driving and a connected, sustainable transport system.

THE ASTAZERO TEST ENVIRONMENT, co-owned by RISE and Chalmers which provides a world class facility where SAFER supports research activities.

SIMULATORS of different kinds exist in the network, most notably at the Swedish National Road and Transport Research Institute (VTI).

THE GLOBAL GOALS
For Sustainable Development

THE UN SUSTAINABLE DEVELOPMENT GOALS

CREATING A SUSTAINABLE TRANSPORT SYSTEM THROUGH A MORE HOLISTIC SYSTEM PERSPECTIVE

The Sustainable Development Goals are the blueprint to achieve a better and more sustainable future for all. They address the global challenges we face, including those related to poverty, inequality, climate, environmental degradation, prosperity, peace and justice.

SAFER supports the UN goals and will continue to integrate these important perspectives in the research and strategic work. In May a first workshop was held to start mapping our contributions and find gaps. A more in-depth work will continue in 2020. The aim is, in addition to the obvious contribution to a holistic approach to sustainable mobility, to find new perspectives, create awareness, find new research questions and open up for dialogues in closely connected areas, e.g. health, climate change and spatial planning. By doing so, there is also a potential for increased funding and new areas of collaboration.

Below is a short summary of the goals that are most relevant for SAFER.

GOAL 3: GOOD HEALTH & WELL BEING: Ensuring that people can move safely in the road transport system without any risk for injuries and death is in line with SAFER's overall mission.

GOAL 9: INDUSTRY INNOVATION AND INFRASTRUCTURE: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.

GOAL 11: SUSTAINABLE CITIES AND COMMUNITIES: Make cities and human settlements inclusive, safe, resilient and sustainable.

GOAL 17: PARTNERSHIPS FOR THE GOALS: Working together, shoulder by shoulder, towards the same vision to help save lives and reduce injuries in traffic is also one of our centre cornerstones.

INDICATORS FOR THE FIRST YEAR IN SAFER STAGE 5
(APRIL 1 – DEC 31 2019)

52	Total number of projects ongoing[1]
12	New projects
21	Finalised projects
59	Publication volume
49	Number of seminars and other knowledge sharing activities[2]
7	Number of visits by external stakeholders
10	Invitations to international projects
18	Visability/references in conferences[3]
22	Number of connections to other research centres[4]
12/13	Gender balance in SAFER Board and management team (women/men)
No.	Number of SAFER partners per project, see figure 5 on page 25
7	Partners on Level 1
13	Partners on Level 2
15	Partners on Level 3
–[5]	Partner satisfaction index

[1] Read more about our project portfolio on page 25 and all the projects are listed in appendix 6.
[2] See complete list of activities in appendix 7.
[3] See complete list of conferences in appendix 8.
[4] See complete list in appendix 5.
[5] A survey was performed prior to the set-up of SAFER Stage 5, no index is set for the first nine months.

MONITORING PROGRESS AND KPI:S

A number of criteria will help prioritise our research efforts and how we should work to reach SAFER's objectives.

01. IMPACT: The added value for the SAFER partners as well as the society as a whole is a key to our continued success and is an integral part of the strategic plan. This is primarily created through collaborative work where different partners contribute according to their needs and competence, the result is that we conduct excellent and relevant research with real-life applications and impact.

An example is SAFER's project portfolio, to which e.g. 12 new projects have been added during this operational year.

02. CONTINUOUS RELEVANCE: In the ever-changing landscape of road transport systems, new types of vehicles, new types of ownership etc, it is of utmost importance that SAFER understands the needs and the context in which we work in order to put the focus on the right topics and issues. SAFER is continuously requested to contribute both on a national and an international level.

For example, during 2019 we have provided input to, and participated in the presentation of, a joint ERTRAC roadmap on Road Safety where several of SAFER's research targets are included in the descriptions of the research needs. Also, a workshop co-chaired by SAFER was held with the European Commission in Brussels in November, 2019.

03. COHERENCE WITH THEMATICALLY RELATED INITIATIVES: The global research environment in which we operate is changing continuously and new initiatives are created to which we need to relate to and make sure to benefit from and provide input to when applicable. By doing so, we are perceived as a major player in sustainable and safe transport, we consider safety as one of the main prerequisites. We are well-connected to, and cooperate with, other relevant organisations.

For example, during 2019, a strong link has been re-established with DriveSweden, the strategic innovation programme on future mobility through the inclusion of two SAFER management team members in the DriveSweden programme committee.

04. EFFICIENCY: Our operation needs to be efficient in order to use our limited resources as efficiently and effectively as possible; we need to be experts in streamlined working processes and our multi-disciplinary research platform enhances research, networking and make work easier for our partners.

Based on the fact that the Vehicle Safety unit from Chalmers is no longer co-located in the SAFER offices, this has been a major task during 2019. This led to a thorough assessment of the SAFER setup in order to provide a continuously strong basis for the SAFER operations through its board, management team and operational team (secretariat), but also in using the facilities as efficiently as possible through a new, more compact and optimised layout at Lindholmen Science Park.

The overall objectives and criteria are regularly monitored and evaluated. Also, the key performance indexes and measures help the Shareholders to evaluate the strategic and operational workplan.

3. THE FRAMEWORK

The framework is the context in which we work; the agreement, the operational plan, financing, working processes, the operational team, partnerships and connected research resources.

ORGANISATION AND MANAGEMENT OF THE CENTRE

SAFER'S VEHICLE and traffic safety research is completely based on partnership. The partners govern SAFER via the shareholders meeting and the Board, consisting of eight members. The Board meets 5-6 times a year including at least one dedicated strategy meeting. At Chalmers, SAFER is the core of the research profile Traffic Safety within the Transport Area of Advance. The daily operation is run by the director, the secretariat and the management team. These teams consist of a few persons paid by SAFER and some partner employees' in-kind. Four Research areas create the formal arena for partners to meet and identify key issues and initiate needs-driven research. Each group is led by a Research area director, who is also a member of the Management team, and is supervising the project portfolio. The Competence networks, led by respected scientists, gather SAFER partners to share and develop new knowledge within their respective field. This ensures contact with centres and organisations with similar or complementary research, both nationally and globally. See appendix 2, 3 and 4 to read more about the Board, Management team, and Competence networks. More information about the four Research areas and their research result during the first year of SAFER Stage 5 can be found in chapter 4.

SAFER focuses primarily on pre-competitive research and projects including several partners. It is a multidisciplinary and diverse meeting place where the persons involved come from academia/institutes, industry and society. This means that those working at SAFER are employed by one of the partners. During this year, there have been about 350 researchers active in the community. In a creative and open research environment, diversity is an important aspect and a conscious concern. Other diversity aspects at organizational level include partners of different sizes, maturity in subject, etc. At individual level, diversity aspects of importance and present at SAFER include gender, multiculturalism, mixing senior and junior researchers, etc. SAFER consciously promotes a good gender balance and SAFER Management team as well as the SAFER Board are close to a 50/50 balance.

Lindholmen Science Park is both a dynamic area and an arena for collaboration across geographical borders. It is home to several of Sweden's leading development projects, with a focus on mobility for tomorrow. Lindholmen Science Park has become the most knowledge-intensive and expansive area in Gothenburg, and an important hub for automotive and mobility research. About 375 companies have elected to locate offices in the science park, as have two universities and six secondary schools. Some 25,000 people now spend time here every day, a figure that is expected to double over the next five years. The location is full of life and energy that allows you to meet and learn about each other's ideas.

PARTNERS

Safe mobility of people and goods in a sustainable system can only be realized when talented and dedicated people work together with a clear vision, shoulder by shoulder. The development of knowledge in vehicle and traffic safety is essential, and by applying results from collaborative research the SAFER partners create visible and measurable results in practice. The partners access – and contributes to – a unique competence and research collaboration platform. In SAFER's Stage 5, 35 partners joined the collaborative research agreement. Together, they all contribute to create new knowledge and research findings that enable people and goods to be transported safe, efficient and sustainable. See the complete list of partners in appendix 1.

ECOSYSTEM, LOCAL AND GLOBAL COLLABORATIONS

SAFER may be based in Sweden but has a truly global mindset. Our international commitment is wide, with vital partnerships with universities and traffic safety research communities all over the world. By initiating and participating in global collaborative research structures, we strongly influence the political traffic safety agenda and contribute to the development of sustainable, safe mobility of people and goods – in Sweden, and elsewhere.

LINDHOLMEN SCIENCE PARK – THE SWEDISH HUB FOR FUTURE MOBILITY

A cornerstone in the strategy is to have a multidisciplinary research environment that also serves as a physical meeting place, open to all partners. This also contributes to the development of larger clusters and SAFER is an important part in the open research and innovation eco-system around sustainable automated transport systems and smart cities. The purpose is to form an extended safety research environment, which connects researchers from academia, industry, institutes, and the public sector and which combines and enhances work carried out within SAFER with work financed through other programmes. During the past year has our previously colocated researchers from Chalmers department for vehicles safety moved to a nearby closely connected building at Lindholmen to come closer to other researchers within their department. As a result, SAFER's premises area has decreased and a further reduction is planned during 2020 to optimize the area based on the partners' needs and at the same time release funds for research and other value-creating activities. We feel that the environment at Lindholmen is right for a collaboration platform like SAFER and the venue as such is a contributing factor to our successful way of researching and collaborating across borders and between different disciplines.

SMARTER UTILIZATION OF THE ECOSYSTEM

In SAFER Stage 5 the aim is to take even more advantage of the ecosystem and world around us in order to leverage the efforts put in by the partners. In the beginning of Stage 5 a first mapping of the system was performed, see figure 2. The links will be further developed and additional established. Some examples of progress on this new strategy during the first period in SAFER Stage 5:

SAFER'S DIRECTOR is now a member of Drive Sweden's program committee. Drive Sweden is one of Sweden's Strategic Innovation Programs (SIP) financed by Vinnova, addressing opportunities and challenges with the next generation mobility system for people and goods. This, in turn, can contribute to SAFER's project creation and funding, as well as more knowledge building in the creation of a sustainable transport system in a broader perspective.

THE PROJECT PORTFOLIO within Care and Rescue, a former research area within SAFER, is now moved to PICTA, the Prehospital ICT Arena, at Lindholmen Science Park. In this context, research can be conducted more efficiently because the arena has access to more crucial community actors to achieve results. SAFER's partners still have the opportunity to conduct post-crash research through SAFER, but the project portfolio is placed at PICTA.

AT LINDHOLMEN SCIENCE PARK, a national center for AI has recently been launched, AI Innovation of Sweden, which has the task to promote the development and use of artificial intelligence in selected areas, where transport is one. AI Innovation of Sweden provides resources, knowledge, data and capabilities that will accelerate applied AI research and innovation. SAFER will contribute with traffic safety data to the center's data factory. An example is that the information collected within the project Autofreight will be stored and used for various applications.

A DIALOGUE WITH CHAIR (the recently started Chalmers centre for AI) regarding collaboration and funding opportunities for AI-projects is ongoing.

SAFER'S DIRECTOR Magnus Granström has been appointed Profile leader for traffic safety within the Area of Advance for Transport at Chalmers which supports a closer collaboration with top researchers at the university, as well as a closer link to education and students.

PROGESS IN JOINT RESEARCH WITH CHINA

CTS (China Sweden Research Centre for Traffic Safety), with the Swedish partners Chalmers, Autoliv, Volvo Cars, Volvo Group and the Swedish National Road and Transport Research Institute (VTI) and the Chinese partners Tongji University, RIOH Institute for Highway Safety, Tsinghua University in Beijing and Geely Automotive Research has also developed positively in 2019. SAFER constitutes the Swedish research platform in this collaboration. Joint projects are ongoing as well as other activities to enhance road safety in China, for instance though road mapping workshops and development of joint project proposals. In 2018, a first bilateral call for research projects was launched in both China and Sweden and during the past year no less than three SAFER projects were granted funding. A second call was held in 2019, where at the time of writing we are still waiting for the evaluation result. SAFER has also been present is the SAE China conference in October 2019 where CTS had a specific session. A new third phase of CTS is planned to begin in 2020. Generally, continued and further developed cooperation with China is important for SAFER and its partners. In China, there is a large and detailed documentation of accidents available, which is valuable for our research. In addition, there is a different traffic environment than the one we are used to researching, a completely different traffic pattern with more pedestrians, cyclists and various types of two-wheelers. Reconstruction of accidents is another area where cooperation with China can be of great value. According to our strategy, cooperation with China will be further developed during phase five, for example through the already established and positive cooperation within CTS.

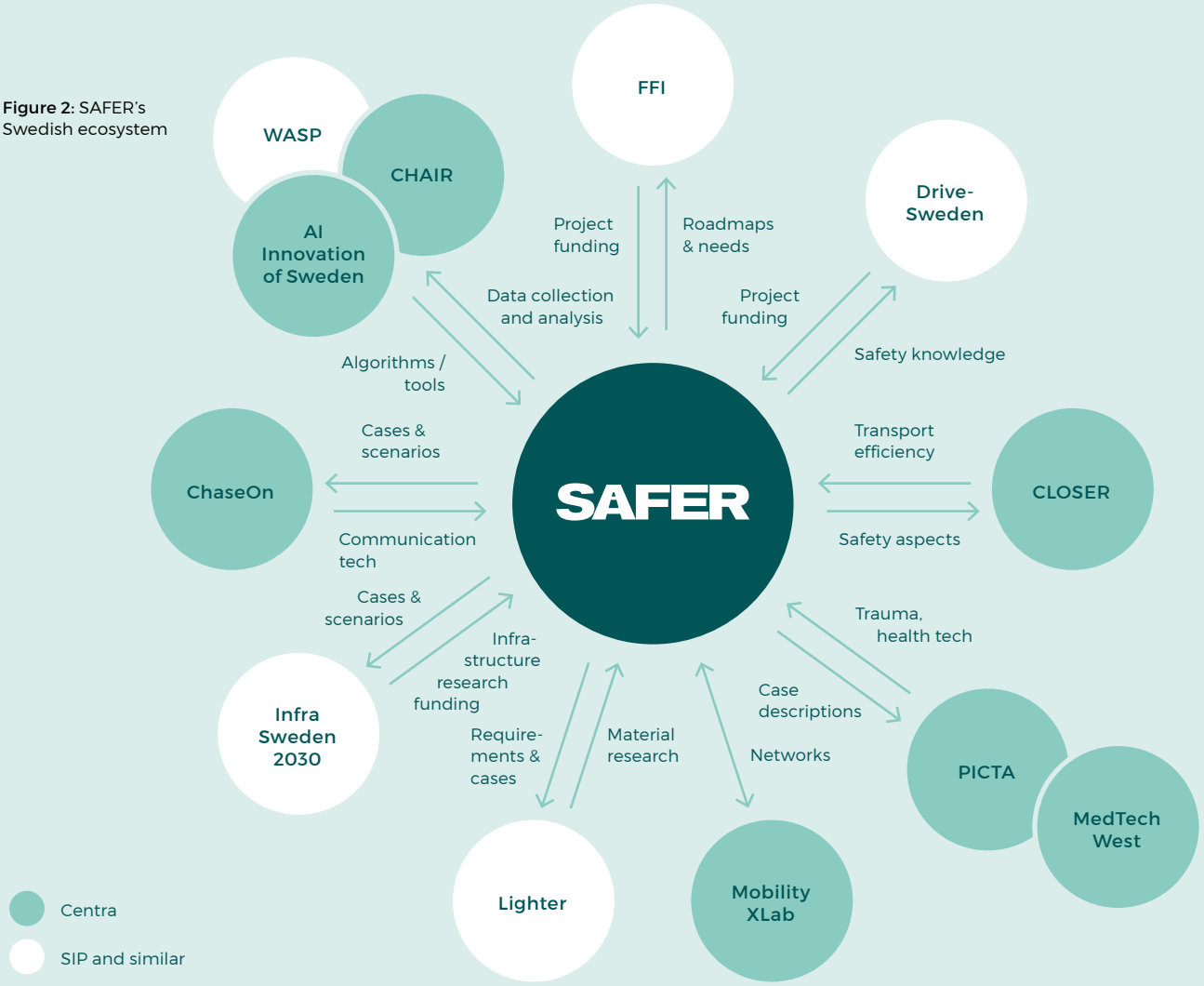
SAFER has been contributing to the ERTRAC Safe Road Transport Roadmap, a base for the forthcoming European research framework.

INFLUENCING THE EUROPEAN RESEARCH FRAMEWORK

The current research framework programme Horizon 2020 is now reaching the final phase with the last set of calls for proposals open during the beginning of 2020. SAFER has actively promoted and supported our partners to take part in proposals for the calls through a set of workshops. Proposals for at least two of the calls that had their first stage closure in January 2020 had SAFER participation (MG 2.11 and MG 2.12). Additional proposals are currently in preparation for the calls closing in April 2020.

The next framework programme, Horizon Europe, will start 2021, with the first projects starting late 2021 or early 2022. SAFER has a key role in the input to the new programme, primarily through ERTRAC (the European Road Transport Research Advisory Council) and its working groups, EARPA (European Automotive Research Partner Association) and on a national level through Vinnova. A new ERTRAC road safety roadmap was presented in April 2019 and a workshop was held with the European Commission in November to further elaborate on the identified research needs and proposed content for the first set of calls in Horizon Europe.

Figure 2: SAFER's Swedish ecosystem



Another important task relates to the Connected, Cooperative Automated Mobility platform (CCAM) where SAFER has several representatives in the EU Commission's expert group for the single platform on Cooperative, Connected Automated Mobility, outlining research and innovation needs and preparing for a partnership within the upcoming Horizon Europe framework programme, as well as providing a base for common testing, verification and regulations in this field.

STRATEGIC COOPERATION WITH INDIA IN PLACE

In the autumn, SAFER has conducted a pre-study to increase collaboration and traffic safety research with India. The activity generated result and a Sweden-India Transport Innovation & Safety Platform (SITIS) was established in December. SITIS vision is to leverage the know-how of India and Sweden to accelerate progress and deployment of safe & sustainable transport solutions and actionable policies, contributing to significant progress of Indian transport system. The ambition is also to create a partnership that fosters innovation, develops competence and assets that creates the capacity to address complex challenges and make a significant impact. The collaboration aims to become a prominent platform for applied research and innovation in the area of safe and sustainable transport. The benefits of strategic cooperation of this kind are numerous, and the collection of traffic safety information is valuable. Accident types and road user behavior differ in different parts of the world and the more we can understand about real traffic as we develop safe traffic system of the future, the more lives we can probably save. In addition, India is a country with fast pace of development and high capacity to develop technologies, concepts and solutions. India has also built a strong foundation in the IT / Data Science sector. SITIS has already embarked upon its first project which will now be the first example of a concrete bilateral collaboration between India and Sweden; "Safe and Secure Transport corridors in India". Members of this platform are companies and institutes who lead in the safety area in their respective domains. SAFER partners include Autoliv, Volvo Group, Chalmers University of Technology, RISE Research Institutes of Sweden, Swedish National Road and Transport Research Institute (VTI) and the Swedish Transport Administration.

NEW ROAD SAFETY INITIATIVES IN AFRICA THROUGH THE SAFERAFRICA PROJECT

AFTER THREE YEARS the SaferAfrica project is now successfully finalized. The aim of SaferAfrica has been to foster new initiatives addressing road safety policies, road safety management, capacity building, training and other road safety interventions at different scales. Probably the most important and innovative result of the SaferAfrica project is the set-up of a Dialogue Platform, consisting of stakeholders from Africa and Europe. The Dialogue Platform links policy makers, donors and professionals engaged in road safety to plan and design road safety actions. The Dialogue Platform is intended as an advisory body to develop new road safety recommendations for Africa, also after the project formally closed in September 2019.

METHODS FOR EFFECTIVE IMPLEMENTATION

A transferability tool has also been developed to support the discussion by appraising the potential barriers to the implementation when a measure is proposed in a different context. Innovation also came in terms of new knowledge developed. New road safety data from stakeholders' surveys on road safety management, opinions and perceptions were gathered through crowdsourcing and a survey on cultural values on road behaviours were performed. Thanks to the analyses of these data and the already available information, new evidence on risk factors and policy needs have been produced at country, trans-African corridors and regional level.

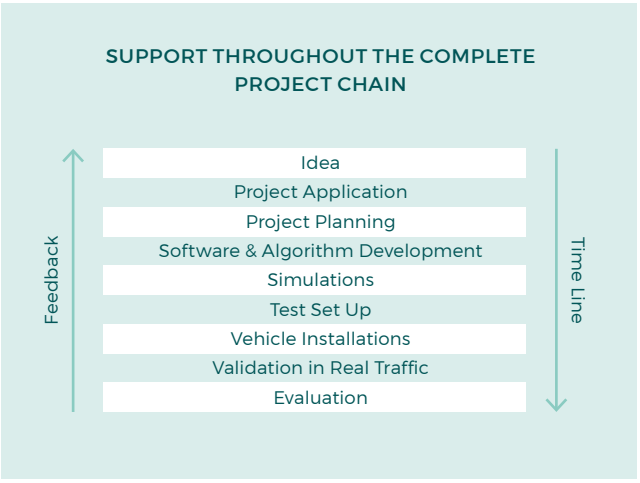
EASILY ACCESSIBLE INFORMATION

Another major result was the African Road Safety Observatory (www.africanroadsafetyobservatory.org), a participative web portal where African stakeholders can find information on road safety, such as country fact sheets, capacity reviews reports, good practices and webinars. The Observatory is the entry point to the Dialogue Platform webtool, a virtual environment for networking and discussion. Moreover, thanks to the implemented crowdsourcing functionalities, local stakeholders and citizens can report a road safety problem and solution in the African countries. SAFER have contributed among others to the review of the African Road Safety Action plan, by analysing the latest WHO accident data and by providing information to the consortium on the status of safety measures in African countries. SAFER also contributed to the vehicle safety content in an e-learning about road safety, developed by SaferAfrica on the five UN Pillars. The course can be accessed through the Road Safety Observatory.

All SaferAfrica deliverables are available at
www.saferafrica.eu/publications

SAFER AFRICA

The Revere vehicle laboratory is an important asset to SAFER's research. The research lab contains resources including vehicles, technical equipment and supporting personell.



Revere supports the researchers throughout the complete tool chain, from idea to development of algorithms, simulation to final testing and validation in real traffic environment.

CONNECTED RESEARCH RESOURCES – STRONG ASSETS FOR REAL-WORLD TRAFFIC SAFETY RESEARCH

As a SAFER partner you get access to SAFER's open research arena and, through relevant projects, research resources available within the network. Also, expertise to use these research resources is available within the community. The overall idea - and one of our strategic cornerstones - is that research should be easier, better and more efficient through collaborative partnerships. This unique set of platforms includes full-scale road traffic safety test environments, simulators and a research lab for active safety and autonomous driving. SAFER also provides physical work areas as well as a world-class naturalistic driving data platform. Together, these resources allow borderless research with outstanding opportunities of real-world testing and validation. SAFER strives for additional platforms within the network to benefit partners and the common research.

REVERE – RESOURCE FOR VEHICLE RESEARCH

Revere contains a research lab with resources including technical equipment, several test vehicles, both light and heavy, and supporting personnel. The vehicles can be fitted with different types of sensors, equipment for data logging, communication technologies and other testing equipment. The Revere laboratory provides a complete research platform for development and verification of theoretical models, algorithms and technologies both in real traffic environments and in simulators. Tests in different traffic environments can be carried out in close cooperation with the test facility AstaZero and on public roads. Real vehicle tests provide more credibility for the researcher's theories and Revere's set-up helps support interaction between researchers from different disciplines. The opportunity for researchers to be offered a stepping stone with cutting-edge expertise between theoretical models or simulators and full-scale tests is extremely important for efficient and successful research. One of the successfully projects completed at Revere during the period is the development of Autofreight's logging equipment, read more on page 22. The project will provide a unique and valuable platform with naturalistic driving data.

REVERE'S HIGHLIGHTS

THE GROWING INTEREST from students, researchers, and practitioners in the Revere lab and its vibrant environment resulted in the installation of additional office and meeting space to provide more work and meeting space.

REVERE INCREASED its visibility abroad among other researchers and universities; besides a 6-months research visit from a PhD student from Spain last year, several students from France visited the lab to run their internships at Revere.

REVERE CONTRIBUTED with a demonstration of automatic attachment and disconnection of trailers at the leading international symposium in the area of ground vehicle dynamics - the 26th IAVSD International Symposium on Dynamics of Vehicles on Roads and Tracks.

RESULTS AND EXPERIENCES from one of Revere's projects, AutoFreight, made the lab a crucial partner in a newly formed Swedish-Indian consortium for a pilot project for large-scale data collection on public roads in India.

REVERE IS AGAIN HOUSING the Chalmers Formula Student Driverless Team for 2020.

THE LAB HAS STARTED TO EXPAND its activities to the growing interest of automation in the maritime sector where the lab is now supporting three autonomous boat platforms for various ongoing projects related to autonomous on-water control and perception.

SAFER NATURALISTIC DRIVING DATA PLATFORM

The SAFER Naturalistic Driving Data platform is a secure, world-class platform for handling data from naturalistic driving data collection. Providing state-of-the-art data management, several large datasets and a leading research competence regarding naturalistic driving data, this platform gives unique access to naturalistic data derived from 7.5 million driving kilometers. The SAFER partner researchers also have access to the in-depth crash database INTACT and IGLAD.

Since summer, a work to transform the SAFER Naturalistic driving data database to a more modern architecture has started. SAFER has been granted research funding for a major investment in developing the FOT databases by adding e.g. better eye tracking and body position features, to understand human behavior in vehicles. The development will be conducted with the help of machine learning - powerful computers will track different driver states and behavior in the database, instead of a real person doing the work. The result will thus be obtained faster, and probably also with a more precise result. These new features are needed to evaluate some of the research questions in L3Pilot (read more about L3Pilot on page 35). When the upgrade is completed, the database will be able to support research to a much higher degree than today, e.g. to validate safety systems in future vehicles that keeps track of the driver's attention and drowsiness.

During the past year, a discussion with AI Innovation of Sweden and CHAIR regarding collaboration and funding opportunities has started up. The potential for SAFER to contribute with data for utilizing of applications developed within these centers is considered high and the dialogue intends to continue in 2020.

In the traffic accident area, SAFER has applied for funding to add valuable pre- and post-crash variables to the Swedish National Accident Database, "STRADA". The project will conduct a pilot study to investigate how data can be used to develop a national in-depth database for traffic accidents. The plan is for the in-depth studies to cover not only fatal accidents but also serious injuries (AIS2 +). This will create opportunities for better follow-up of the traffic safety situation in Sweden. The data format that will be developed will be designed to be able to make comparisons with existing European and global accident databases.

IGLAD (Initiativ For The Global Harmonisation Of Accident Data) was initiated in 2010 by European car manufacturers and is an initiative for harmonisation of global in-depth traffic accident data to improve road and vehicle safety. A database containing accident data according to a standardised data scheme that enables comparison between datasets from different countries is every year extended with around 900-1000 cases. At the end of 2019, the consortium agreed to continue the project during a fourth phase. In addition, SAFER was elected as continued administrator for the project for three years. The advantages for SAFER in participating in the initiative are the access to the accident data on a global scale and the network with the 23 partners from all around the world. SAFER partners in the consortium are Autoliv, Volvo Cars and Chalmers.

ASTAZERO REAL-WORLD PROVING GROUND

AstaZero is the world's first full-scale test environment for a safe, sustainable and connected automated road traffic future. Different traffic environments make it possible to test advanced safety systems and their functions for all kinds of traffic and traffic situations – in city environments as well as on rural, multi-lane and high-speed roads. This enables a broad range of research, development and validation. AstaZero also serves as an international testing area open for stakeholders within the industry, the society and the academia. AstaZero is owned by RISE Research Institutes of Sweden and Chalmers University of Technology. SAFER, together with AstaZero, has since 2017 conducted a program to make the test track available for curiosity research. SAFER is responsible for the coordination of calls for open academic research that need to use the AstaZero facilities in research projects. SAFER will continue to coordinate open calls for curiosity research of this kind throughout stage five. The aim is to attract international researchers to the test facility and also connect the research to SAFER's project portfolio.

DEFINING TESTING AND VERIFICATION IN HEADSTART

Many of SAFER's project use the AstaZero test facility, one example is the HEADSTART project. One of the main challenges for the implementation of self-driving vehicles is the testing and validation. Therefore, it was appropriate that SAFER as joint research unit (JRU) was granted funds under the Horizon 2020 framework program to conduct HEADSTART (Harmonised European Solutions for Testing Automated Road Transport). 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. SAFER is in this project the joint research unit and its partners RISE, Chalmers, AB Volvo, Veoneer and AstaZero are involved in the project. The SAFER team will set up the requirements for testing and perform demonstrations at AstaZero. The project started in 2019 and will last for three years.

SIMULATOR SIM IV

Sim IV at the Swedish National Road and Transport Research Institute has an advanced motion platform system and permits significant linear movement along both x and y axes. It is useful when simultaneous longitudinal and lateral acceleration is important or if a wide field of vision is prioritised. Cabs, bikes and passenger compartments can be exchanged quickly. The simulator's imaging system has a camera-based calibration system, making it easy to switch between different driver positions.

SAFER'S RESEARCHERS PAVE THE WAY FOR SELF-DRIVING TRUCKS THROUGH ADVANCED DATA COLLECTION

MAKING A TRUCK completely self-driving is not easy. But SAFER's researchers are working hard to make this possible by gathering data to better understand and "train" the automated systems of the future to drive safely. The purpose is to reduce traffic accidents, save lives while also operating vehicles more sustainably.

One of the difficulties for the researchers who develop the technology of the future is to ensure that the vehicle is operating safely in all possible conditions. When using machine learning (ML)-based approaches, the vehicle's decision-making system needs to be trained to know how to do it right in each individual situation. And for that, large amount of information is needed from real traffic so that systems can be created based on real-world conditions. It is this information, which will then form the basis for building a safe and reliable software, which can make vehicles self-driving in the future. The Vinnova FFI project "Autofreight" is now building a completely unique information bank by collecting data from real traffic on highway 40 between Gothenburg's harbor and the Viared industrial park outside Borås.

Christian Berger from the Department of Computer Science & Engineering, a shared department between Chalmers and Gothenburg University, who also is a researcher within SAFER's collaboration platform and leads the software development in the project, says:

"We will collect huge amounts of highly qualitative data with our unique equipment. Every day for at least six months, the truck will run a couple of times a day between the Gothenburg harbor and Viared's Industrial Park, a stretch of about 75 kilometers one way".

This means that an exact road section will be captured in many various driving and weather conditions; sun, rain, ice and darkness and with different types of vehicles around. Estimations indicate that over 100TB of data will be collected. The information processing platform is completely unique of its kind and will help researchers to take big steps forward in the development of reliable automated systems with this large-scale dataset. One example is that the researchers, as a next step, can apply machine learning approaches to teach the vehicle to find other vehicles and road-signs in the traffic environment and to act appropriately.

"Today, researchers usually use already collected data; however, systematically collecting data from the same route on a daily basis under many various conditions that we now create within the project is enabling further research. The quality, such as the resolution of videos, can in many cases be deficient. In our project, we have advanced high-resolution cameras and other high-performance equipment that ensure that the material we collect can pave the way for real products", says Christian.

The project runs until the beginning of 2020 and has a budget of about 50 million SEK. FFI accounts for 21 million SEK and the project partners stand for the rest. The project partners include SAFER Vehicle and Traffic Safety Centre at Chalmers, Volvo Technology, Combitech, City of Borås, GDL Transport, Volvo Bus, Speed Group, Ellos, Kerry Logistics and The Swedish Transport Administration (Trafikverket).

FINANCING

SAFER has two main types of financing, one being SAFER Core which is the base for the core activities in terms of the secretariat, the office and open research area and base funding for the seminar and dissemination activities, the other being the project financing for research and project activities.

SAFER CORE – THE CENTRE FINANCES

SAFER Core is financed through funding from Västra Götalandsregionen and partner cash contributions according to the overall partner agreement for the fifth stage of SAFER. The framework agreement stipulates an annual contribution of:

LEVEL 1: A total contribution to SAFER Core amounting to 1 MSEK per year, 650 kSEK in cash for industrial and public partners and 125 kSEK for other universities and research institutes. The remaining amount is provided through in-kind contributions. Chalmers, as the host of the centre, has a commitment of 1 MSEK in cash and 450 hours in-kind.

LEVEL 2: Contribution to SAFER Core funding in an amount of minimum SEK 125 KSEK in cash contribution per year for industrial partners and public partners. Other universities and institute partners contribute with 75 KSEK/year.

LEVEL 3: The cash contribution is 10 KSEK/year.

The contribution from Västra Götalandsregionen (VGR) is 2,5 MSEK per year. This sums up to about 40,5 MSEK cash and minimum 25000 in-kind hours for the entire stage five (April 1, 2019 to December 31, 2023). Given the size of the project portfolio, the proactive ambitions, the number of partners and external collaborations and the size of the core team, which is perceived as "SAFER dedicated staff" (e.g. director, controller, communications, project coordinator), is competitively lean.

Partners on level 1 contributes with 450-950 hours per year in-kind to SAFER Core, depending on type of partner. The roles / functions are e.g. Research area directors, Competence network leaders and other management group members. The in-kind is an important tool to ensure competence contributions from all partners.

The result for the SAFER Core finances for the first operational year in SAFER Stage five (April 1, 2019 to December 31, 2019) is shown in figure 3. The budget determined by VGR spans between 2019-2020 and the planned deficit from 2019 is balanced by the surplus of 2020 and both should be taken into account to get a fair overview. For 2019 the planned result was budgeted to -427 KSEK.

The revenue for 2019 is lower than budgeted due to the reporting period to VGR; we have during this reporting period got funding for April to September and the remaining three months will be posted to the 2020 budget. Also, the accounting of a few partner contributions will be posted to year 2020.

Figure 3
The expenses and income of SAFER..

EXPENSES (KSEK)	
Personell	3 045
Premises	1 587
Running costs office	105
IT costs	67
Knowledge sharing and communication activities	183
Other costs, e.g. travel etc	26
Indirect costs Chalmers	559
Sum	**5 572**

INCOME (KSEK)	
SAFER Partner cash contribution	2 644
Funding from Region Västra Götaland (April to September)	811
Sum	**3 455**

RESULT	**-2 117**

The expenses for 2019 was lower than expected and it comes from the fact that planned cost for office downsizing didn't occur during 2019, but will need to be handled during 2020. Also, some activities were postponed to 2020 and the budget has been adjusted accordingly. In total, the operation follows the plan for SAFER Stage five. The cash resources for SAFER are governed by the Board, who has continuously monitored the budget and decided on changes in expenditure when required.

PROJECT FINANCES

The project financing comes from a variety of sources, primarily national programmes such as the FFI programme (Strategic Vehicle Research and Innovation), different strategic innovation programmes funded through Vinnova, Stiftelsen för Strategisk Forskning (SSF) and others, but also internationally through EU's Horizon 2020 programme and similar sources. In addition to this, internal funding from all partners play an important role, whether it's academic, institute or industry partners. The overall budget for the projects in SAFER's first year of Stage five sums up to 1.200 MSEK for all project partners and 410 MSEK for SAFER partners. That clearly shows the benefit for the partners to join in the SAFER projects that generally have a high hit rate in the competitive programmes. Also, the leveraging factor of collaboration projects is clear, especially when accessing the knowledge and financing power on the European arena.

4. THE RESEARCH

Entering Stage 5, we focus our research primarily in four areas, representing world-class, multi-disciplinary research – all with the single-minded vision to save lives, prevent injuries and enable safe mobility:

- Systems for accident prevention and automated driving
- Road user behaviour
- Human body protection
- Safety performance evaluation

Our research areas also create an open arena where our partners meet and identify key issues to initiate new research, based on real-world needs.

RESEARCH SCOPE

SAFER'S RESEARCH includes road traffic, for example, pedestrians, cyclists, various vehicles and goods services. However, rail traffic is not included in our scope of work. We cover a "complete-travel-perspective", from door to door, in which a human is interacting with a vehicle in the road traffic environment. For example, our research does not generally include single pedestrian accidents. However, there is no obstacle if there are a number of partners who want to start a project that is beyond the scope of the above.

LAUNCH OF SAFER PRE-STUDIES

One of the news in the collaboration agreement for SAFER Stage 5 is that we offer research funding to pre-studies and seed-projects. The aim is to support strategic knowledge creation that can lead SAFER forward and contribute to the continued development of the joint collaboration platform. The ability to bring together a strategic group of collaborating partners to create unique, new competence as a basis for e.g. national funding or an entry ticket to prestigious international collaborations has been longed for. The goal is to offer funding for 6-8 pre-studies per year, to a total value of about 600 KSEK. In 2019, the first call was opened, which generated two pre-studies that will be completed in 2020: "Smart-Loop (Design of multi-modal human-machine-interaction system for keeping the driver in-the-loop in automated driving systems)" will study various combinations of HMI modalities in different driving-contexts involving Advanced Driver Assistance Systems and fully-automated driving system. The aim is to explore the potential of haptic and kinesiologic feedback, i.e. motion cues and the best combination of these modalities with audio-visual channels to achieve higher driver/passenger engagement and situation awareness. The pre-study "Human factors related to remote control of automated heavy vehicles" will increase knowledge on potential safety challenges regarding remote control of automated trucks and help framing a larger research project that will explore these challenges in more detail and develop solutions for them.

THE PROJECT PORTFOLIO

The project portfolio is the base for the SAFER collaboration, comprising of different types of project, but all focusing on one or more of the issues addressed in the roadmaps and other strategy documents, created through the multidisciplinary research. The project portfolio is created, maintained and developed through the joint efforts in the research areas and among the partners and throughout the year the focus has been to secure a solid foundation of projects and related activities through various sources of funding. The research areas have had to focus even more on suitable available funding from various national and international (primarily EU) research and innovation programmes.

A research project at SAFER relates to one or several of the four research areas. Projects that cover multiple research areas or focus on general questions are called Competence projects. The distribution of projects between the research areas is illustrated in figure 4. The primary forum for initiating and discussing projects at SAFER is the research areas, which recommend project proposals to the Management team and Board for decision. The agenda covers new project ideas, project reports and final results as well as strategic issues like input from all partners on research areas and on conferences, seminars and international collaborations and calls. The Reference groups include representatives from all level 1 and 2 SAFER partners and are the base for establishing world class competitive project portfolios. Each Research area hosts a mix of projects; pre-studies for future projects, small and large national and international projects. Based on these factors, and others, projects are either "own" or "associated". A project present at SAFER can be initiated at SAFER and/or funded by SAFER ("own") or started by SAFER partners in another context and brought in to the SAFER environment ("associated") where it can thrive and benefit from the presence of other projects and researchers. A SAFER associated project can also be an externally funded larger projects that has had a previous succesfully performed pre-study, financed by SAFER.

Since interdisciplinary collaborative research is a key approach to excellence and successful dissemination, we encourage projects to involve at least two partners, preferably from different stakeholders. Some projects, however, have only one part for natural reasons, e.g. PhD students' projects and special investigations and assignments. The majority of the projects involve 2-4 SAFER partners and some 15 % involve 5 or more, see figure 5.

During operation year 14, 12 projects with external funding have been added to the project portfolio adding up to a total of 52 projects that have been ongoing during the year. 42 of them belonged to one of the four research areas (complete list in appendix 6) whereas 10 projects were competence projects. 19 of the project have been successfully finalized during the year and SAFER will enter its 15th operational year with about 36 ongoing projects.

Figure 4
Ongoing projects during stage 5, year 1. The distribution of projects between the research areas.

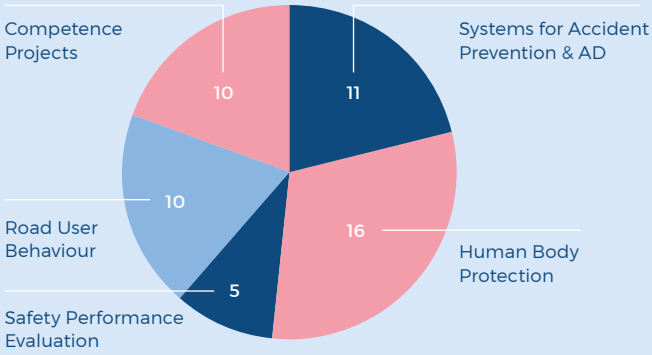


Figure 5
The number of partners in SAFER's projects.

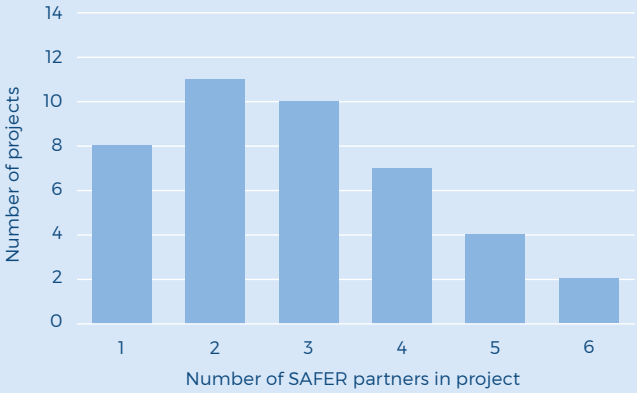
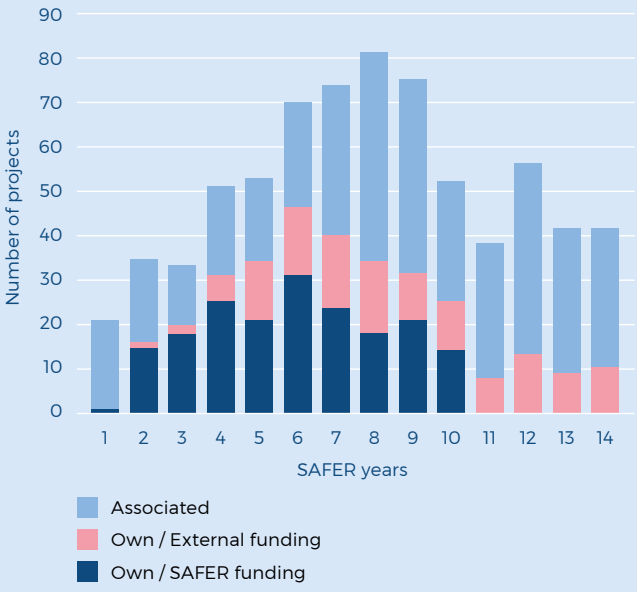
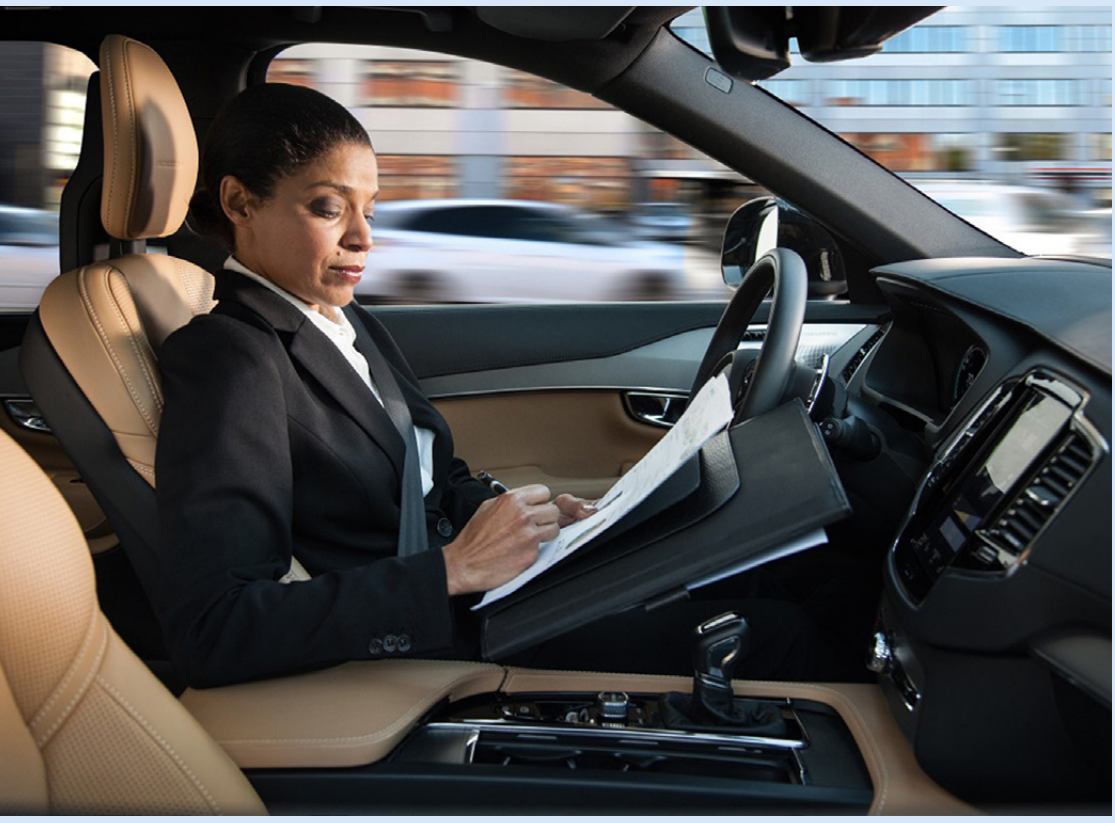


Figure 6
Number of projects in SAFER's project portfolio.



You can read more about SAFER's project on www.saferresearch.com/projects

RESULTS FROM THE RESEARCH AREAS



One of the key issues investigated in the project ESPLANADE is how the communication between the car and the driver will be set up in an autonomous vehicle, for example, by clarifying who is responsible for conveying the vehicle in different situations.

SYSTEMS FOR ACCIDENT PREVENTION AND AUTOMATED DRIVING

THE CHALLENGE OF putting self-driving vehicles on the roads is enormous. Automation affects everyone and the potential social benefits are huge, partly through increased traffic safety, but also increased efficiency. Everyone in the system must collaborate and take the steps forward in the process together. It is not just technology that needs to work, but also the conditions for implementation, such as the regulations and public acceptance.

Some of the most important research challenges we work with at SAFER are to:

UNDERSTAND THE ROLE of the driver or rider.
DESIGN AND PROVE sufficiently safe technology.
SCALE APPLICABILITY from somewhere / sometimes to everywhere / always.

During the past year we have been working to strengthen the expertise in this research area, meeting the challenges ahead of us regarding safety aspects of vehicles, road users and infrastructure when we are moving towards higher degrees of automation, in most cases in a mixed environment. Also, the scientific base for verification and validation is of utmost importance in order to ascertain that correct methods are used in an area that is much more complex than previously. This base is also required to create a foundation for future standardization of test methodologies. Another important area we have focused on developing is our connection to Artificial Intelligence, which is gaining momentum in society. Among other things, we have worked to build knowledge about how AI can be applied in the area of road safety and mapped our partners' initial needs in this area.

BUILDING COMPETENCE THROUGH A VALUABLE NETWORK

Of course, joint collaborative projects are important, but not only. Co-learning and discussing important issues in depth is just as important. Especially when the issues are new and complex, as for self-driving vehicles. Then the value of talking to each other can sometimes be as important as researching together. This is perhaps why there has been such great interest in SAFER's latest competence network; **Automotive safety assurance.**

The newly established network, led by Fredrik Sandblom, also Research area director for Systems for accident prevention and Automated driving, has kept together a valuable discussion about methods and nomenclature for how to show that autonomous vehicles are tolerably safe. The network has been the "place to go" for SAFER partners to discuss how to make safe automated vehicles and to show that they are. The targets are to attracting experts from as many actors as possible in order to cover multiple perspectives and creating joint understanding of important technical concepts and how to use them, e.g. Operational Design Domains (ODDs). The group wants to identify areas that are not addressed properly enough and figure out a way to do it.

KEY HIGHLIGHTS FROM PROJECTS

ESPLANADE

The ESPLANADE project will be finalized in March 2020 and has been targeting the complex question of showing that an autonomous road vehicle is safe. 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 aimed 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. A continuation of ESPLANADE is currently being discussed.

SEBRA

SEnsor for Bicycle's impRoved Awareness (SEBRA) will identify the most relevant traffic safety related use-cases that involve bicycles. Then, a radar-based safety system for bicycles is developed with both sensors and human interface. Finally, the system is evaluated in relevant traffic situations. The research questions the project will investigate are:

WHAT SAFETY ISSUES can be addressed by a radar-based safety system mounted on bicycles?
WHAT PERFORMANCE REQUIREMENTS (field-of-view, computational capacity, power consumption, etc.) should such a system fulfil?
HOW SHOULD THE INTERACTION with the bicyclists be designed to give a high level of safety and user experience?

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 project "Real-SIM for AD", tools for simulation, based on SAFER's unique databases with real-life driving data, has been developed. The challenge has been to make the simulation tool look similar to the reality, and here have SAFER's databases, which contain more than 7.5 million kilometers of data, been an important asset. The results indicate that synthetic data is highly useful, but will probably not replace the logged data completely. Cost and time savings from using a subset of synthetic data can be huge; it is possible to generate about 2000 synthetic images with annotations for the same cost as one manually logged and annotated image.

SWEDEN4PLATOONING

Sweden4Platooning has delivered two trucks from two Swedish brands in the first European interoperable platoon, running on open road and in real operation. Late in 2019, a one month pilot with CACC (automated longitudinal control) was performed with trucks from Volvo and Scania. The pilot was driven on roads between Malmö and Jönköping and was carried out together with the haulage company Nordanå Transport. Data from the pilot will be analyzed to better understand CACC performance on public roads. In December 2019, a demonstration was provided to project stakeholders at AstaZero. This demonstration included platooning with both longitudinal and lateral control automated.

The SEBRA project investigates the possibilities to equip a bicycle with active safety systems.

Research objectives for Research area Systems for accident prevention and automated driving

We can evaluate different ways to act in the traffic situation and decide upon how to progress safe and efficiently.

We have developed a methodology to verify and validate assisted and automated systems in cooperation with international researchers in this area.

We have obtained knowledge essential for development of new perception components that enable high-performance, reliable information about the vehicle environment and the driver/riders in the vehicle.

We have developed prediction models for human cognition and behaviour in the areas of "driver engagement", transitions between manual and automatic driving, and interaction between humans and Advanced Driver Assistance.

Demonstration of the Sweden4platooning project on public roads.

ROAD USER BEHAVIOUR

HOW DO PEOPLE BEHAVE in traffic and how can they be stimulated to a safe behaviour? In an era where traffic complexity is increasing as quickly as the technology is evolving, answering this question becomes vital. Taking a broad multi-disciplinary approach, the research area Road User Behaviour at SAFER focuses on developing scientific methods and attractive solutions that facilitate safe behaviour in traffic. It covers a variety of topics, from understanding pedestrian behaviour to developing algorithms that enable assessment of vehicle occupant behaviours, as well as exploring safety implications of new mobility means such as electric scooters.

ENRICHED PROJECT PORTFOLIO WITH SEVEN NEW PROJECTS

The research area Road User Behaviour was formally created in early 2017, and since then it has hosted over 20 projects. These projects have been of both national and international character and have typically involved several SAFER partners from industry, society, academia and research institutes. During the past year, the focus has been on enriching the project portfolio with new exciting projects. Similar to the previous years, automated driving has received a lot of attention. However, the interest in safety aspects of other new mobility vehicles is also increasing among our partners.

Two of the recently started Horizon2020 projects, **MEDIATOR** and **Drive2theFuture**, explore driver interaction with and acceptance of advanced driver support systems (ADAS) and automated vehicles. In MEDIATOR, a system is being developed that will constantly evaluate driving context, driver state and vehicle automation status in order to personalize its technology to the driver's general competence. The Drive2theFuture project, on the other hand, models the behaviour of different automated vehicle "drivers" and predicts acceptance for various driving scenarios. The FFI-project **Scale-up** is another example yet focusing on the interactions with automated vehicles. However, the focus is on validating online crowdsourcing as a tool for large scale evaluation of external interfaces on automated vehicles. These interfaces, in turn, aim at ensuring safe and smooth interactions between automated vehicles and other road users such as pedestrians and bicyclists in their vicinity. This is basically a continuation of the previous SAFER-project AVIP that has successfully demonstrated the role of such interfaces, published several well-cited papers as well as contributed to the standardization activities.

The project portfolio has also been enriched by two associated projects addressing safety of new electric vehicles for personal mobility (ePVMs), **Characterizing and classifying new ePMVs** (funded by Trafikverket via Skyltfonden) and **SAFE-ePMVs** (funded by Chalmers Transport Area of Advance). As implied by its name, the first one aims at evaluating and comparing different new e-vehicles for personal mobility in an exploratory study. The vehicles will be equipped with loggers and various sensors and compared to bike and e-bikes in relation to their stability, maneuverability and comfort. The SAFE-ePMVs leverages on the interdisciplinary approach and the complementary methodologies to study the safety needs of e-PVMs users and non-users. Notably, the main objectives of the project are to: 1) support the design of infrastructure and regulations, and 2) guide the technological development of e-PVMs. These objectives will be achieved through three main activities: a) analysis of e-PMVs' crashes in STRADA database, b) quantitative evaluation of the stability and manoeuvrability of e-PVMs in field trials, and c) qualitative assessment of the safety and ease-of-use of e-PVMs.

Last but not least, the portfolio is hosting two pre-studies funded by SAFER. One of them is named **Design of multi-modal human-machine interaction systems** and aims at exploring the potential of haptic and kinesiologic feedback (i.e. motion cues) and the best combination of these modalities with audio-visual channels to achieve higher driver and passenger engagement and situation awareness in automated vehicles. The other one, **Human factors related to remote control of automated heavy vehicles,** is devoted to gathering theoretical and practical experiences and knowledge on human factors related to remote control, both from the area of automated vehicles and from other domains. The ultimate goal is to identify research gaps in this increasingly important area.

NEW COMPETENCE NETWORK: HUMAN BEHAVIOUR

At SAFER, there are several competence networks that contribute and inspire to build and spread knowledge, capture good ideas and create cross-functional projects. Under 2019, a new competence network related to the research area Road User Behaviour has emerged. The new network is simply named Human Behaviour and is led by Dr. Giulio Bianchi Piccinini, Chalmers. This network replaces the previous networks for Human factors, Human Monitoring and Behaviour in accident causation. Combining knowledge from different disciplines, this competence network aspires to be a forum to discuss methodologies and challenges for the research on human behaviour, with the final aim to improve the safety of the road transportation system. The network has successfully started a seminar series on ethical applications and considerations in traffic safety research assessing human behaviour that will continue under the coming year. In addition, a new seminar series with focus on the embodied cognition and how it can help facilitating SAFER interactions between humans and technology is on the way.

LOOKING FORWARD: IMPRESSIVE PROJECT RESULTS AND NEW CHALLENGES

Several projects within the Road User Behaviour area ending in the coming year and we look forward new exciting results that will have large fingerprint on future traffic safety. Among them are **ADAS&ME** (developing adaptive HMI for smooth transition between different automation levels in a vehicle), **MeBeSafe** (exploring how to use nudging in vehicles and infrastructure to increase traffic safety), **HARMONISE** (harmonizing interactions between vehicle drivers and different technical systems that automate parts or entire driving task), and **SÄMO** (identifying factors that make the elderly choose the cycle before other means of transport).

There is a range of other activities that the research area Road User Behaviour is equally excited about:

WE PLAN TO INTENSIFY discussions and research activities on safe active mobility.

DOOR-TO-DOOR TRAVEL is an area with a lot of safety challenges, and we look forward addressing these.

SUPPORTING DEVELOPMENT of traffic safety in other countries such as India is also on our agenda, and we foresee plenty of improvements related to road user behaviour.

WE ARE ALSO AIMING at exploring new methods and tools that will bring us a step further in understanding road user behaviour.

KEY HIGHLIGHTS FROM PROJECTS

HARMONISE

HARMONISE is an FFI-funded project that was initiated in 2017 and that will end in December 2020. Partners are Volvo Group Trucks Technology (Volvo GTT), Volvo Cars and RISE. The main aim has been to investigate different means to simplify and manage how drivers interact with systems which offer different levels of automation throughout a journey. Up til today, the project has explored research questions in a total of four experiments. Volvo GTT and RISE have studied how different lateral support designs could be used as a means of keeping the truck drivers from switching from an active agent role to a passive observer role in two truck experiments (one on test track and one on real road). Volvo Cars and RISE conducted one on-road study in a Wizard-of-Oz car where they studied how drivers' attention shift in different levels of driving task automation. They also studied drivers' ability to complete non-driving related tasks under full automation. In addition to the concepts implemented in the truck and Wizard-of-Oz car, Volvo GTT has also built interaction concept prototypes in virtual reality (VR) and in a small simulator rig involving driver state monitoring (eye-tracking, hands-on detection), input device alternatives for automation level 2 vs level 4 application, adaptation of information depending on automation level etc. Finally, RISE has held a set of workshops together with Jessica Lindblom from Skövde University on embodied cognition and design implications to further explore the role of drivers in changing levels of automation.

Several SAFER projects have recently started to address the safety challenges related to electric personal mobility vehicles.

DRAMA

The FFI-funded DRAMA project (2018-2020) addresses knowledge building around activity identification of drivers and passengers in vehicles to improve interaction between them and the vehicle. Mapping and detecting activities at drivers and passengers is important for both user experience (UX) and traffic safety. With knowledge about activites, the HMI can be adjusted to the currently most efficient modality. If the vehicle knows the body posture of the passengers safety functions such as airbags, brakes and steering system can be adjusted by the safety systems in the vehicle. The project has developed a system that can recognize individual and interaction activities of driver and passengers in vehicles of high level of automation (SAE3+). The project studies, from literature, the most relevant activities of driver and/or passenger in highly automated vehicles in terms of safety and comfort. The developed prototype acquires input data from multiple cameras mounted in the cabin of a vehicle and classifies the detected activities according to the chosen in-cabin activities of interest. Machine learning algorithms are used to extract timeseries of activity features including: Body poses, head position/eye gaze/face landmark, objects, dense optical flow, and detected activity/interaction. The work is a collaboration between RISE AB and Smart Eye AB.

SAFE-EPMVS

Among the new transport solutions, Electric Personal Mobility Vehicles (e-PMVs) have recently become very common in many cities around the world including Göteborg, and their popularity is growing every day. However, as e-PMVs become increasingly prevalent, crashes occurring while using these vehicles are also rising. Currently, it is largely unknown what mechanisms are causing the e-PMVs crashes and what is public opinion on the safety concerns and ease-of-use of e-PMVs. These issues cannot be tackled without adopting a holistic view and looking at the problem from various perspectives. For this reason, this project SAFE-e-PMVs leverages on the interdisciplinary approach (crash prevention, human factors, and vehicle dynamics) and the complementary methodologies (analysis of crash causation mechanisms, field experiments, questionnaires and co-creation workshops) to study the safety needs of e-PMVs users and non-users. Notably, the main objective of the project is to provide advices that could support the design of policy instruments (e.g. infrastructure and regulations) and technological development of e-PMVs, to ensure a safe utilization of these vehicles. The project is conducted by three divisions at Chalmers: Vehicle Safety, Design & Human Factors, and Vehicle Dynamics.

An example of a nudge that help drivers to slow down speed by providing an illusion of lights moving towards the driver.

MEBESAFE

The last year has been the most interesting one for MeBe-Safe so far. The project has moved on from ideas and trial-and-error to large scale field testing. Large quantities of nudges have now been narrowed down to the very most promising ones. These ones have now been built in real traffic. Final results have not yet come in, but pre-studies are promising. Among them is a nudge made by lamps in the roadside, called the InfraDriver nudge. During this year, it has been built on a real-life road exit. The nudge should reduce speed by providing an illusion of lights moving towards the driver. The project has not only rebuilt the exit, but also created an intricate system determining whom to nudge. Another nudge has been built into the interior of an actual car, with the purpose of making drivers more aware of oncoming cyclists. It consists of a graphic interpretation of the intersection, as well as a highly elaborate detection and prediction system. The Gothenburg team has looked at the other end of the intersection problem between cars and bikes. Here, a nudge has been built to help cyclists reduce their speed in a particularly dangerous intersection. It consists of flat stripes getting closer together to give an illusion of speed. A similar nudge has also been built in the Netherlands. Moreover, workshops have been held in Gothenburg with three groups of people; cyclists, drivers and those a little bit of both; to understand the largest problems in traffic, which types of measure they prefer and for whom. The results showed that intersections were indeed a top priority, and nudges were preferred both for one's own group and for others. Cyclists have also been given cameras to film their journeys back and forth to work. Potential issues have been identified as well as reactions to the actual nudge. In connection to the films, cyclists have been invited to describe their actual reaction to traffic in more thorough deep interviews. The results will be very valuable to determine which route traffic safety should take in the future.

Research objectives for Research area Road User Behaviour

Study road user behaviour in their door to door travels.

Monitor driver and passenger state and position.

Diagnose driver fitness based on monitoring data.

Ensure safe interactions between automated vehicles and other road users.

Develop and evaluate novel interaction principles, including nudging.

Define and measure user experience indicators related to safety.

SAFETY PERFORMANCE EVALUATION

THIS RESEARCH AREA is critical to all the other research activities at SAFER and is a cornerstone of future safety research, i.e. SAFER uses the research area to orient future research activities. It is considered the strongest collaborative area at SAFER by the partners and is an important knowledge resource for all regarding road accident prevention. The fundamental studies determine road safety priorities and examine safety benefits through statistical analyses of road traffic data, including accident, incident, and near-miss data. Development and standardisation of methods regarding all aspects of road traffic data analysis, also recording and sharing of data, are other important tasks. It can thus be considered complementary to all SAFER research areas and is in fact integrated in many different SAFER research projects on new safety strategies. Results of the safety performance evaluation studies are critical for securing the utility of new safety systems and providing confidence in their market introduction. The safety performance evaluation area gives SAFER a strong identity and a position in the global research community. For instance, SAFER's world leading cluster of researchers connected to naturalistic data activities has an internationally acknowledged reputation to a large extent due to conscious strategic choices and activities throughout all years from the start of SAFER. The datasets available cover 7.5 million km of real-world driving in different contexts, countries and vehicle types. The databases with field data have a long history at SAFER and have continuously evolved together with the kind of data collected and the analysis to be performed. These activities have made it possible for SAFER partners to take leading roles in international research projects on data activities and SAFER has become a data node for in-depth naturalistic driving data. The main current ongoing projects are described in the following part of this chapter.

ACCESS TO AND UNDERSTANDING OF DATA

The introduction of advanced driver assistance systems has increased the need to understand how they are used and how they perform in real world traffic, and eventually understand how these systems should be improved further. The need to understand technologies for accident prevention goes together with the need to understand the underlying complex system of factors behind crashes, which has made the interest for FOT and NDS studies even stronger – an area in which SAFER is deeply committed and will continue to develop spearhead competence and leadership. These activities bring new research collaborations, which in turn is an effective mechanism for SAFER to expand its access to larger amounts of data, providing opportunities for new research insights for the partners. Data collection is expensive and is typically limited to specific regions. Hence, international collaboration makes research for instance on socio-geographical differences possible. During the past year, among other things, has a strategic collaboration with India started. Within the framework of this platform, data collection will be included, read more about this on page 17. SAFER is well positioned with multidisciplinary research to take on board new challenges regarding accident prevention, based on a profound know-how regarding all kinds of road traffic data analysis.

KEY HIGHLIGHTS FROM PROJECTS

HETEROGENEOUS TRAFFIC GROUPS COOPERATIVE DRIVING BEHAVIOURS RESEARCH UNDER MIXED TRAFFIC CONDITION

This new project started in April 2019 and is a result of the fruitful cooperation within CTS (read more on page 16). The project will develop new methods for evaluating the safety and traffic flow impact when autonomous vehicles mix with manually driven vehicles. Comparisons between Swedish and Chinese road conditions will be studied, data is to be collected in China and compared with naturalistic driving data collected in Sweden and Europe. Furthermore, the project will use tools such as advanced traffic and driving simulation for understanding these countermeasures. It will also provide an excellent opportunity for knowledge exchange and research cooperation with people exchange between China and Sweden.

ARCADE

Aligning Research and innovation for Connected and Automated Driving in Europe (ARCADE) is the continuation of CARTRE (SAFER project performed between 2016-2018) with the mission to coordinate consensus-building across stakeholders for sound and harmonized deployment of Connected, Cooperative and Automated Driving (CAD). ARCADE supports the European member states and the industry to develop a common approach to development, testing, validation and deployment of CAD. The ARCADE project will run between 2018-2021 and aims to establish a joint stakeholders forum in order to coordinate and harmonise automated road transport approaches, e.g. strategic alignment of national action plans. ARCADE organised the second European CAD conference in April 2019. SAFER has the role as task leader for the data sharing.

FOT – ENHANCED VIDEO DATASET

In 2019 SAFER was granted research funding for a major investment in developing its large databases with naturalistic driving data. The project "FOT-E Field Operational Test dataset Enrichment for the development of safety and

highly autonomous vehicle functions" aims to accelerate the development of automated vehicles and ensure that these are safe once they reach the market. Detecting the driver state and developing a better understanding of driver impairment is a key enabler to enhance existing functions as well as to identify new safety relevant factors to be considered in the development of future automated driving functions. The development will be conducted with the help of machine learning - powerful computers will track different driver states and behavior in the database, instead of a real person doing the work. The result will thus be obtained faster, and probably also with a more precise result. The goal of the project is to create an even more valuable database by using machine learning technology. When the upgrade is completed, we will be able to use the database to a much higher degree than today, e.g. to validate safety systems in future vehicles that keeps track of the driver's attention and drowsiness.

L3 PILOT: 11 COUNTRIES, 100 VEHICLES AND 1000 DRIVERS

SAFER's increasingly strong position regarding NDS data analysis is demonstrated in the European project L3Pilot (Piloting Automated Driving on European Roads), which started in September 2017 and which is the largest FOT supported by EU. The project is a common European undertaking to evaluate the potential of more than 20 different self-driving features, as well as to investigate attitudes of the drivers, and drivers in surrounding vehicles, towards self-driving cars. The project aims to demonstrate how the self-driving cars operate in a realistic environment, to identify remaining technology gaps, to shape relevant policies and to raise awareness about the true potential of the self-driving technologies. The result, and the processes developed, will help guiding the introduction of self-driving vehicles. SAFER has taken the responsibility for the data management tools and procedures, and is leading the analysis of naturalistic driving data, which is one of the key tasks in this exciting project. During the past year, the test cars collected large amounts of data and a demonstration of the project with test drive was carried out with stakeholders at SAFER in September.

Research objectives for Research area Safety Performance Evaluation

Identification of safety gaps, e.g. long-term injury types.

Identification of critical use cases, e.g. driving a heavy truck in fog among vulnerable road users.

Identification of new critical load cases, e.g. multiple impact car crash.

Evaluation of implemented safety systems performance, i.e. safety benefit analysis.

Prediction of safety benefits of new safety systems.

Prediction of future safety critical scenarios, automation included.

Determination of required safety level for automated drive.

HUMAN BODY PROTECTION

THE RESEARCH AREA Human Body Protection encompasses research needed to understand and develop countermeasures to prevent injuries in accidents. Focus is on emerging challenges in transportation, creating a knowledge base as well as a tool box for human body protection evaluations and enablers. Human body protection covers biomechanical injury mechanisms, responses and consequences, the principles for protection, including safety system usage and pre-sensing input, as well as mechanical and mathematical occupant and unprotected road user models for complete crash sequences. In addition, it includes research to develop new simulation models and methods needed for the development and assessment of novel crashworthy structures. In particular focus are new material models, efficient numerical crash simulation methods and system design optimization tools targeting lightweight vehicles, including compatibility aspects. SAFER partners have a world leading position in the area of applied biomechanics research and application; exemplified by child safety and whiplash injury research, development of crash test dummies and human body models. SAFER enables the continuity of this position. Important parts of current research comprise human kinematics and behaviour together with other influencing factors in pre-crash events, and how to model these. SAFER has pioneered this research area for car occupants and aims to continue this journey. Additionally, within the area of traffic safety related composite research, SAFER and its partners are currently one of the world-leading groups focusing on developing modelling and simulation tools for composite structures in crashes. Many aspects are still unresolved and will require significant research efforts for years to come. Future challenges include vehicles with higher degree of automation, likely leading to less accidents, but each of those accidents being more unique. This requires not only more detailed methods for evaluation, which are based on more refined biomechanics research. It also adds the complexity to the methods and tools, by including vehicle pre-crash dynamics by the automated systems; eventually also being self-driving, making all occupants to passengers and likely increasing the span of activities of those passengers within the car. The growing focus on sustainability emphasizes the importance of low-weight material, and the challenges simulating those in crashes. These targeted research objectives have been addressed through focused activities and projects, see a selection of examples presented below.

WORLD LEADING HUMAN BODY MODEL FUNCTIONALITY

Within human body modelling (HBM), SAFER provides a competence platform for SAFER partners as well as a natural contact point for external cooperation. The growing activity in human body modelling has already placed SAFER among the more well-known organisations globally, and the interest shown by other universities proves its high academic relevance. SAFER's HBM vision encompasses a scalable, tuneable, human body model with omni-directional injury prediction capabilities, including high-g and low-g events. This means a virtual human substitute that can be used for predicting injury outcome in any impact situation/direction, able to replicate a large population of people (standing as well as sitting) with humanlike kinematics in impacts as well as maneuver events. The human body models, including the knowledge obtained in the pre-competitive joint research, are used by the industry in safety developments. Today, it is used by Volvo Cars and Autoliv for collision mitigation system development, in addition to occupant restraint systems. The SAFER strategic investment more than ten years ago, together with funding mainly from the FFI programme, has helped to significantly speed up the process of industrial implementation, providing the SAFER partners with a state-of-the art human body model. The SAFER HBM research combines several projects to progress the existing SAFER HBM model towards the overall goal of performance, in addition to creating open-source models enabling a wider use. The partners have taken strategical decision to share knowledge and data between initiatives, for the benefit of safety developments.

During 2019, progress has been made in all the aspects of the SAFER HBM development, keeping several PhD students busy. Publications on validation of steering maneuver performance, the unique tissue-based criteria for rib fracture evaluation, in addition to first stage validation of morphed models are examples that have been presented during this year.

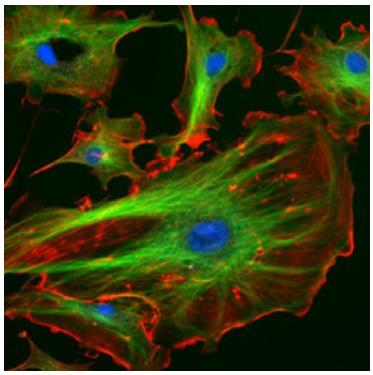
The project partners now have a competitive advantage of a unique tool to evaluate occupant protection in a crash, also taking the potential preceding maneuver into account. The human model, combining the research results from several SAFER's HBM project, is world-leading in its functionality. Likely, this is still one of the most advanced models, even the only tool or crash test dummy, that manages to recreate the movement during a turn or brake manoeuvre with a subsequent collision, in the same sequence. In addition to the work on the SAFER HBM model, the open source model (ViVA), developed in Vinnova-funded projects has taking the tools into a new dimension of sharing. The first version, comprising an open-source model of a mid-size female, targeting whiplash injuries in rear end impacts, is available online. This model is now being further developed within the EU-project VIRTUAL, also including male counterparts.

SAFER's human body model is world-leading in its functionality. Likely, this is still one of the most advanced models, even the only tool or crash test dummy, that manages to recreate the movement during a turn or brake manoeuvre with a subsequent collision, in the same sequence.

MODELLING ALSO UNPROTECTED ROAD USERS – OUTIDE THE VEHICLE

Another important area we can apply through human modelling is also the unprotected road users in traffic. Therefore, through CTS (read more about CTS on page 16) we have set up a joint project with China, **Virtual Evaluation Tools for Pedestrian Integrated Safety,** to addresses new challenges regarding safety of road users outside the vehicle. Pedestrian, cyclists, and other new personal mobility devices operate in many areas shared with motor vehicles with, and without, automation. This project will combine the expertise of Swedish and Chinese researchers to advance current safety evaluation technologies with the Swedish team focusing on the evaluation of injury assessment. The approach includes the aspects of injury mitigation (pre crash systems) and to reduce biomechanical consequences of an impact through passive safety. The aim is to establish an integrated safety systems from sensing to injury prevention with Sweden focusing on open source model development, while China addressing integrated system development. The Swedish contribution to the project is to develop open source computational mechanics tools that can be used by the automotive industry and independent researchers. These tools will facilitate new protective strategies and allow society to address changes arising as automation and an ageing society creates new traffic safety situations.

The project "In Vitro Model of Whiplash Trauma in Dorsal Root Ganglia" aims to better understand the mechanisms in the nervous system of the neck after a whiplash trauma.

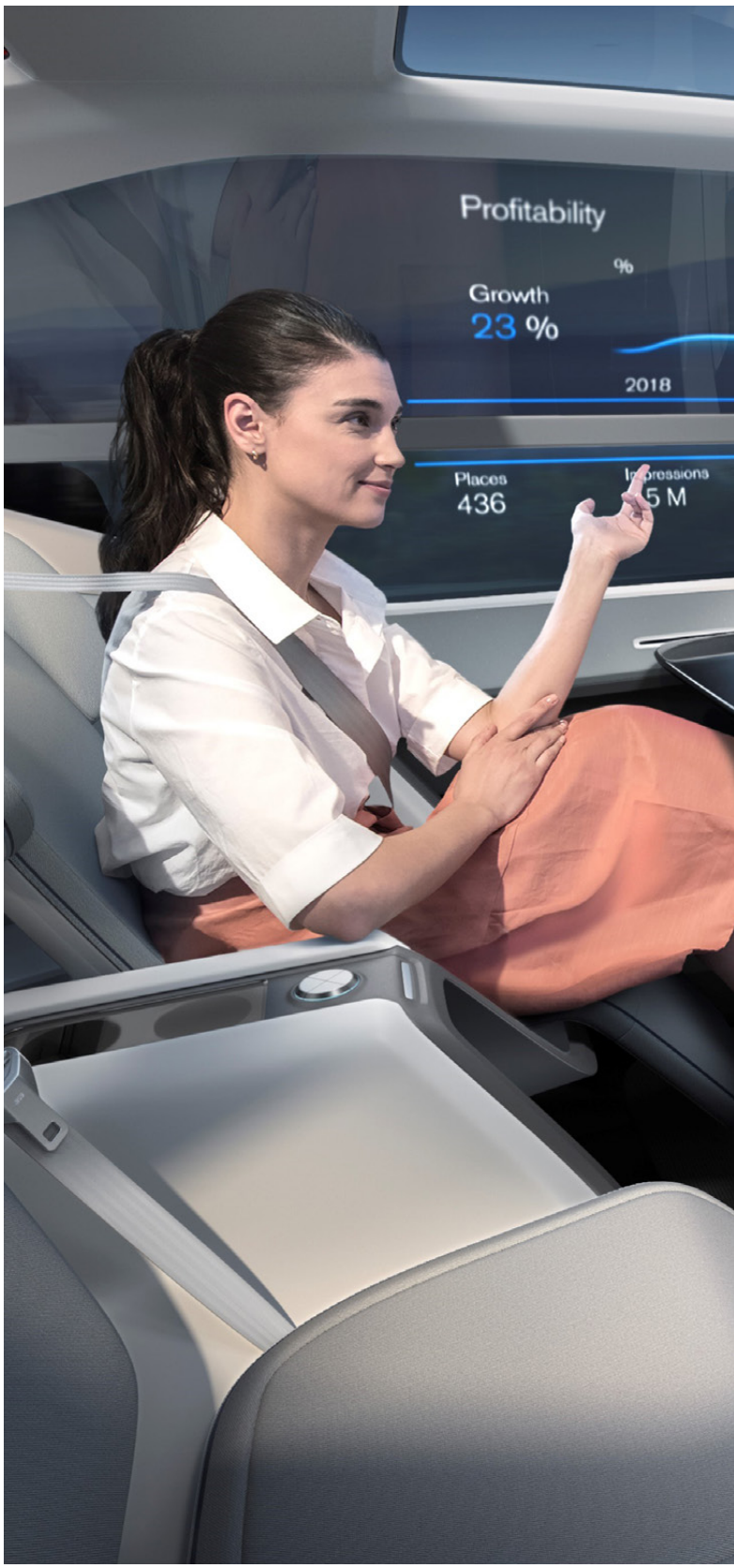


BETTER UNDERSTANDING OF WHIPLASH INJURIES

Whiplash Associated Disorder (WAD) is the most common and costly traffic injury. It can result in long lasting and debilitating pain in the neck region, and there is a lack of established and effective diagnosis and treatment. Recent developments in pain research show that inflammation in the cells of the spinal dorsal nerve root ganglia cause long term central pain sensitization. Interestingly, recent computational biomechanical research at SAFER shows how the dorsal root ganglia are deformed during a whiplash motion exposure to the neck during a trunk acceleration similar to what would occur in a car collision. Pressure transients are generated in the central nervous system and cause the deformation. These recent findings open up for a new paradigm in whiplash injury research. The aim with this project is to develop a pilot test set-up to reproduce, in vitro, the local nerve injury mechanism that occurs during whiplash exposure in vivo. Our goal is to generate results that show the feasibility of the in-vitro approach in this research field, and thus form a basis for future research projects and applications for funding. The ultimate goal is to create more efficient protection systems in cars and better diagnosis and treatment after a whiplash injury.

NEW CHALLENGES WITH FUTURE MOBILITY

In the future, cars will increasingly become more and more automated, which open opportunities for the car's seats to be placed in other ways, such as facing each other or on the diagonal. To ensure that people travel safely in various vehicle configurations, more research is needed. Higher degree of automation will also expose the occupants for a higher likely hood of pre-crash dynamics, calling for development of tools and methods to include this into the safety evaluation. Future cars will likely also to a higher degree encompass new kind of car ownership and mobility, e.g. car sharing pools. These new ways of travelling will increase the need of easy-to-use restraints even further, since they will be moved around more often and will be used in many different cars. The project "Assessment of Passenger Safety in Future Cars" addresses these challenges.



Research objectives for Research area Human Body Protection

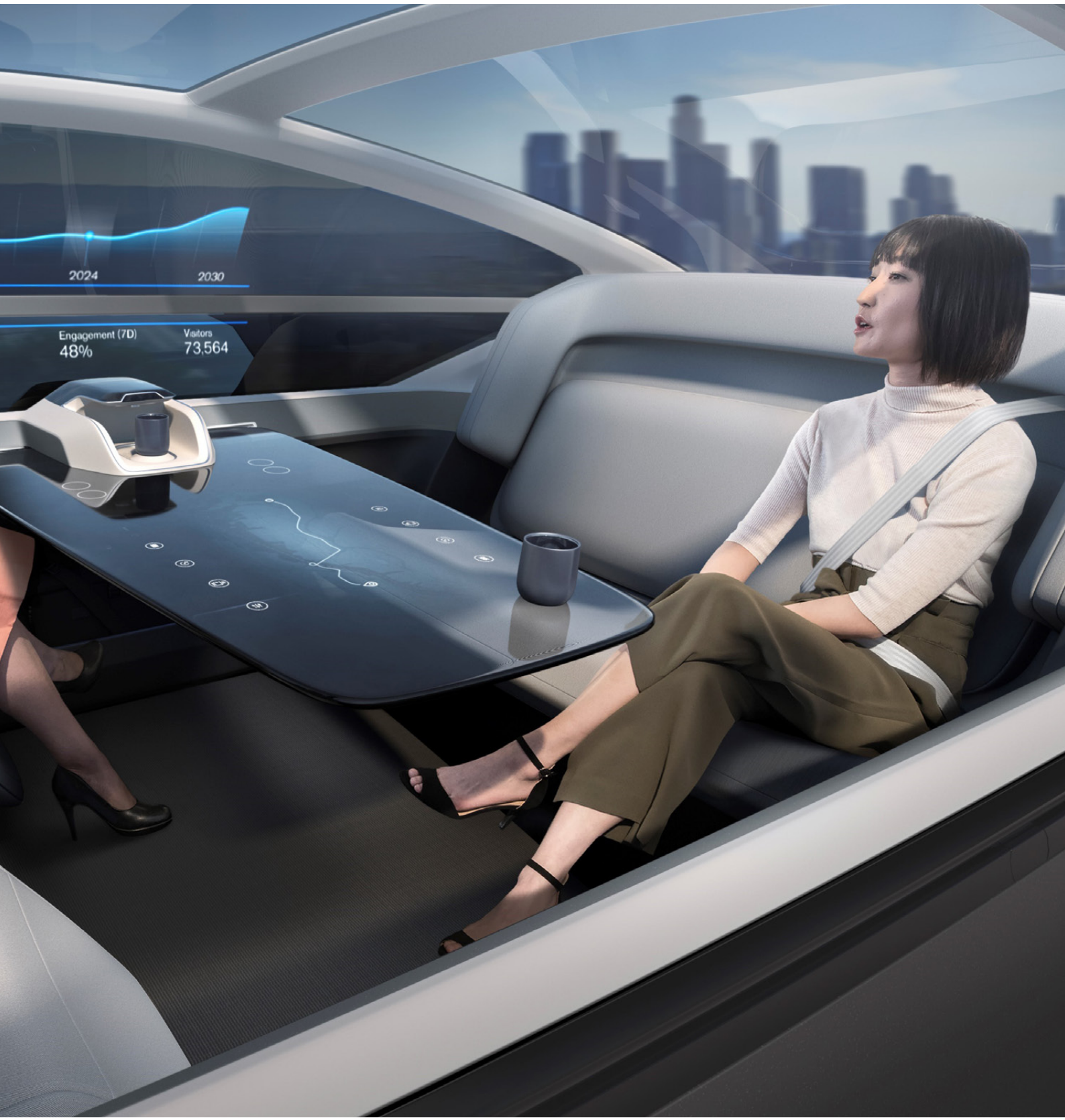
Human body models with enhanced omnidirectional injury prediction capability, and posture adjustments, capable of serving as an industrial and research tool addressing the needs in the increased automated context.

Methods to scale and tune human body models, accommodating simulation of a variety of humans in a crash, including preceding events.

An increased understanding of how pre-crash factors and individual differences influence injury outcome, by monitoring and quantifying sitting postures and behaviour in vehicles and other road users together with the research area Road User Behaviour.

Biomechanical investigations addressing future challenges which require more in-depth understanding of injury occurrence and tolerances. For car occupants, the pelvis area is one key area in which significant steps will be taken.

Modelling challenging material, e.g. fat tissues and composites.


2024
2030
Engagement (7D)
48%
Visitors
73,564

HOW CLOSE COLLABORATION CAN DRIVE THE GLOBAL CHILD SAFETY AGENDA

AN EXAMPLE OF SUCCESSFUL PROJECT DISSEMINATION AND INTERNATIONAL INTERACTION

SAFER HAS A LONG HERITAGE of successful global child safety research. Together with the necessary actors, SAFER has managed to gather a community – the SAFER child safety network - that has driven the global child safety agenda and contributed to positive changes for increased safety for children in cars. The concept of success in brief has been close collaboration, excellent and timely research, dissemination of results and together with the international driving a number of crucial issues.

CHILD OCCUPANT PROTECTION WORKSHOPS

On a regular basis international multidisciplinary workshops have been held to identify high-priority research topics and strategies toward their implementation. The workshops started in 2009 and have been held every second year in September, hosted by the child safety core team at SAFER, with support from FFI. The participants of the workshops have been worldwide leaders in the fields relevant for child occupant protection; vehicle manufacturers, child restraint manufacturers, biomechanists, epidemiologists. pediatric clinicians, government researchers. system suppliers, safety researchers, behavioral scientists, driver behavior expert and human factors specialists from US, Sweden, Europe, Canada and Australia. The overall structure for the two-day workshops has been as follows:

THE FIRST DAY INCLUDES PRESENTATION of relevant topics with the focus on 'pressing issues in child and adolescent occupant protection' in addition to reviewing progress of research priorities identified during previous workshops.

DURING THE SECOND DAY DISCUSSIONS on high priority areas as defined based on the first day discussions.

An important part has been to summarize and present the workshop discussions at the International Conference Protection of Children in Cars in Munich, enabling a wider dissemination and contributing to setting the agenda of future research and development. The 2019 workshop was presented December 5th in Munich.

MULTIDISCIPLINARY RESEARCH IS KEY

SAFER's child safety network has been active in e.g. joint publications, workshops as well as organizing a bi-annual well-attended international child safety seminar in Gothenburg. Starting in 2009, the child safety seminar has created valuable output. The open seminar is an effective way to spread recent research and to gather input to the area of child occupant protection. For each time it is clear that together we have contributed to research and knowledge building, which actually contributes to SAFER mobility for children and young adults.

Sharing knowledge about how children should travel save in cars is an important part of our work.

At this year's seminar, **Child occupant protection – Latest knowledge and challenges in future mobility,** the experts emphasized again that the child safety community need to work together, especially with the challenges in front of us with respect to increased automation and car sharing. For safe transportation, the car manufacturer, the child restraint manufacturer, researchers and the regulatory systems need to be developed hand in hand. And as always, children are not smaller versions of adults; they require dedicated protection systems. The child restraint systems should address the children's specific protection needs and should work together with the car, focusing easy to use and to bring along.

The child safety area is an example of where SAFER research is setting the global agenda. The research results on children's sitting postures, behavior and pre-crash dynamics have raised the communities' awareness of the challenges in real world protection for children.

The 2019 group of safety experts participating in the SAFER child occupant protection workshop at Hållö, Sweden.

5. KNOWLEDGE DISSEMINATION & RESEARCH OUTREACH

PART OF THE SAFER MISSION is to disseminate results and knowledge to the partners and be a well renowned international centre of excellence. To achieve this SAFER regularly arrange activities for knowledge sharing. SAFER has arranged and participated in a wide range of events over the year – primarily to present results and findings of the research and knowledge production activities. A complete list of engagement to share knowledge and research findings is listed in appendix 7.

SAFER SEMINARS, NETWORKING EVENTS AND INSPIRATIONAL WORKSHOPS

SAFER is acknowledged as a meeting place and the various seminars are appreciated by the partners as efficient means to share knowledge and create visibility among SAFER researchers on current topics, as well as offering great opportunities for networking. During the past year SAFER has continued to arrange seminars regularly to bring research results both to SAFER partners, to the research community and to the public. Workshops for the stakeholders to gather around a certain topic, share knowledge and get inspiration as a base for new common projects have also been conducted regularly.

SAFER has arranged lunch and networking seminars almost every Thursday from February to May and September to December, primarily for internal cross-fertilization and exchange of knowledge and ideas. The SAFER Competence network leaders, Research area directors, leaders for the connected research infrastructures and SAFER's partners have all been responsible for the content. We offer participation remotely via Skype, which has proven to be successful for researchers that want participate, but not always have the opportunity to travel.

INTERNATIONAL KNOWLEDGE SHARING

SAFER has built its strong brand through visibility and through actively participating in debates, panels and seminars at various events. Within many traffic safety areas, SAFER is now renowned to the extent that organisations frequently approach SAFER for collaboration, expert opinions, or giving talks at conferences and seminars.

SAFER's fourth stage was successfully concluded with celebrations, April 10, 2019. Vehicle and traffic safety research carried out under SAFER's umbrella during stage four, between 2016 and 2019, was presented to the partners and other interested. Nearly 150 people participated in the activity. During the event, the results of the research conducted on the collaboration platform were presented in

an exhibition. 38 partners from industry, society and academia had participated in the research. The event was also a kick-off for another five years of joint research.

Child safety experts gathered at SAFER in Gothenburg to share new insights on September 4, 2019 on the seminar **Child occupant protection – Latest knowledge and challenges in future mobility,** with the purpose to discuss and share their state-of-art safety research. It was the sixth time the seminar was arranged by SAFER. Future opportunities were discussed with the target to set the future agenda for child occupant protection. A special focus this year was how to align user expectation and the user experience with optimized safety in the context of automation and changing mobility modes.

SAFER shared knowledge at the **European Research and Innovation days** in Brussels, September 24-26, 2019. This was the first annual policy event of the European Commission, bringing together stakeholders to debate and shape the future research and innovation landscape. The idea was to provide opportunities for stakeholders to come together, deepen the dialogue and work across sectors and disciplines to help plan Horizon Europe's implementation. SAFER's Senior Advisor Ingrid Skogsmo from VTI participated as expert in the Safe Journey panel dialogue.

Many SAFER researchers participated in the annual **IRCOBI** (International Research Council on Biomechanics of Injury) in Florence, also in September. A total of 14 papers with SAFER authors, of which 9 as main authors, was presented on this important and influential event. These are linked to several different projects in SAFER's portfolio such as Assessment of Passenger Safety in Future Cars, Injury HBM, Active HBM, OSCCAR and VIRTUAL. The day before the conference, a half-day workshop was held; "Virtual Testing and Open Source Human Body Modeling; How to improve safety assessment using Virtual Testing and HBMs? - two projects, two approaches", organized by the two SAFER associated EU projects OSCCAR and VIRTUAL. Several of SAFER's researchers participated in the workshop, some of which had key roles such as Astrid Linder, VTI and project coordinator for VIRTUAL. She was also one of the two meeting leaders and presented the VIRTUAL project. Lotta Jakobsson, Volvo Cars and SAFER's Research area director for Human body protection, gave her views on "Increasing HBM application - What are the needs and bottle necks from an industrial perspective?".

November 15, 2019, SAFER co-chaired an ERTRAC workshop; **Road Safety R&I Workshop: from Challenges to Solutions – the Way forward,** in Brussels. The workshop, organized by the Working Group Road Transport Safety & Security of ERTRAC, the European Road Transport Research

Advisory Council jointly together with the European Commission's DG Move and DG RTD, brought the research and industry community together with representatives of the European Commission and road user associations. Through a fruitful dialogue, the aim was to identify how research and innovation can best help to put the EU back on track towards Vision Zero, meaning a road transport system in which human life is the paramount concern and no-one is killed or severely injured anymore. This workshop was listed as a pre-event of the 3rd Global Ministerial Conference on Road Safety.

HOST OF INTERNATIONAL CONFERENCES

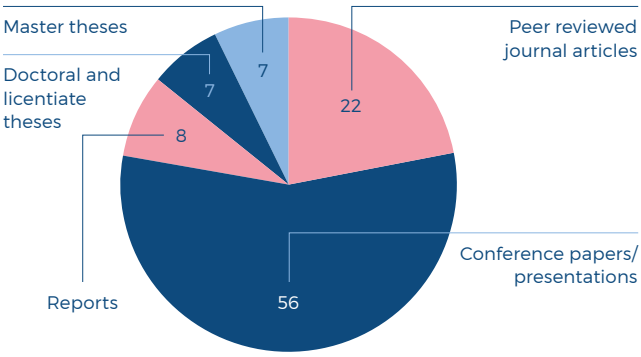
For the first time, one of the world's leading symposiums in rail traffic and road transport - 26th IAVSD International Symposium on Dynamics of Vehicles on Roads and Tracks - was held in Gothenburg between 12 and 16 August, 2019. Self-driving cars, more efficient railway traffic and safer transports were just some of the topics discussed by some 370 researchers from around the world at Lindholmen, Gothenburg. The conference was organized by SAFER's competence network Vehicle dynamics.

SAFER also has its own conference, the International conference on Driver distraction and Inattention. The conference will be arranged for the seventh time in Lyon, 12–14 October 2020. It is the primary international event on this topic, attracting delegates from more than 20 countries. It is designed to bring participants – from academia, industry and government – up-to-date on current and recent developments and trends in the field of inattention and distraction in driving. In August 2020, SAFER will also co-host another major conference; the 7th International Conference on Traffic and Transport Psychology (ICTTP), which is being held at Lindholmen in Gothenburg. Planning for these major conferences has been part of the secretariat's work during the past year.

ENGAGEMENT IN THE THIRD MINISTERAL CONFERENCE ON ROAD SAFETY

In February 2020, the world's leaders gathered on 3rd Global Ministerial Conference on Road Safety to discuss how traffic fatalities - one of the planet's health epidemics – can be decreased. The conference was co-sponsored by the World Health Organization (WHO), and minister-led delegations from more than 80 countries attended. The conference marked the end of the UN Decade of Action for Road Safety 2011–2020 and was the starting point for continued collaboration on road safety. The aim was to reach global consensus on guidelines for continued international collaboration on road safety up to 2030. SAFER was awarded the honorary task of arranging a side event to create a deeper understanding about the key mechanisms behind how to improve traffic safety through SAFER's successful collaboration model between society, industry, academia and research organisations.

Figure 7
Publication Types



REGULAR REPORTING TO STAKEHOLDERS

SAFER's partners has been kept informed about the research results and ongoing activities and opportunities through regular newsletters and social media seedings. More formal meetings with partners through the research areas has been performed five times during the period, including one Shareholders meeting. Five board meetings have been held, including a two-day strategy meeting. Regular newsletters about projects, research results and other updates have been distributed from the research centre. Communications with media has been conducted through MyNewsdesk PR tool.

PUBLICATION VOLUME

SAFER's research projects have produced more than 59 publications during the first 9 months in SAFER Stage 5, including peer reviewed journal articles (22%), conference papers and posters 56%, reports (8%), master theses (7%) and doctoral and licentiate theses (7%). Publications which are still listed as "in preparation/in press" will be made available in the near future (e.g. accepted papers of conferences that have not yet been held) are not included. In addition, these numbers also exclude publications from research conducted within SAFER but not belonging to a specific project (e.g. some PhD and post-doc research). A certain degree of underreporting should also be considered. All public publications are made available in SAFER's Knowledge Library at saferresearch.com/library.

WEBSITE AND KNOWLEDGE LIBRARY

Research results are being disseminated through the website as well as through press releases and news articles. In the SAFER Knowledge library, you'll find most of the public SAFER project publications that have been produced since the start in 2006. On our website www.saferresearch.com you can also find our research publications, evaluation reports, annual reports, brochures and other SAFER related publications.

Preparation for the global ministerial conference on road safety has kept the SAFER secretariat busy.

SAFER DOCTORS AND LICENTIATE SEMINARS

During SAFER's 14th operational year three students working in the SAFER environment have written their doctoral thesis and one has written a licentiate thesis:

PHYSICALLY BASED CONSTITUTIVE MODELS FOR CRASH OF COMPOSITES

Sérgio Costa, RISE Research institutes of Sweden and has concluded and Industrial and Materials Science at Chalmers University of Technology, September 6, 2019.
https://research.chalmers.se/publication/511618

SIMULATION OF OCCUPANT KINEMATICS USING ACTIVE HUMAN BODY MODELS

Christian Kleinbach, University of Stuttgart, Institute of Engineering and Computational Mechanics, October 23, 2019.

Christian made an internship hosted by Prof. Karin Brolin at Chalmers/SAFER during the spring 2017 as part of his PhD studies. In his PhD project, Christian used the VIVA open source human body model that was developed in the SAFER-associated project Viva. Christian has now developed a new active muscle system for the neck of the Viva model that will become publicly available.

DRIVER INTERACTION WITH VULNERABLE ROAD USERS: MODELLING DRIVER BEHAVIOUR IN CROSSING SCENARIOS

Christian-Nils Åkerberg Boda, Crash Analysis and Prevention, Vehicle Safety, Mechanics and Maritime Sciences, Chalmers University, December 18, 2019.
https://research.chalmers.se/publication/514013

LICENTIATE THESES BENEFIT ESTIMATION OF ACTIVE SAFETY FOR CYCLIST-CRASH AVOIDANCE

Jordanka Kovaceva, Crash Analysis and Prevention, Vehicle Safety, Mechanics and Maritime Sciences, Chalmers University, December 13, 2019.
https://research.chalmers.se/publication/514337

SOCIAL MEDIA CHANNELS

LinkedIn: linkedin.com/company/safer-vehicle-and-traffic-safety-centre

Facebook: safercentre

Twitter: @safercentre

AWARDS

Three SAFER related researchers, Dr. Nils Lübbe, Autoliv, Dr. Mikael Ljung-Aust, Volvo Cars and Dr. Anders Kullgren, Folksam, were honored with special awards from National Highway Traffic Safety Administration, America's primary automotive safety body. The awards were presented at the 2019 Enhanced Safety of Vehicles (ESV) Conference in the Netherlands in June.

Two SAFER projects have been honored with the Prince Michael International Road Safety Award in 2019; the Safety Cube project and SaferAfrica. The awards are presented to companies or organisations in recognition of their outstanding contribution to improving road safety. The awards were handed over to the project teams by HRH Prince Michael in December. **SafetyCube – Safety CaUsation, Benefits and Efficiency**- was a Horizon 2020 project centered around state-of-the-art evaluations of accident risk factors and safety measures based on analyses of accident data statistics and on in-depth understanding of pre-crash phases of road accidents. The project has developed a Decision Support System (SafetyCube DSS) which has the aim to guide road safety stakeholders to identify the most cost-effective measures that will address the most urgent road safety problems on the European level. You can read more about **SaferAfrica** on page 18.

6. APPENDICES

APPENDIX 1
SAFER PARTNERS

The following partners have been engaged during operational year 14:

PARTNER LEVEL 1 & 2

- Autoliv Development AB
- BETA CAE Nordic AB
- Chalmers University of Technology
- China Europe Vehicle Technology AB (CEVT)
- Combitech AB
- Folksam
- Halmstad University
- If Insurance
- Institute of Transport Economics – Norwegian Centre for Transport Research (TØI)
- MediaMobile / V-Traffic
- National Electric Vehicle Sweden AB (NEVS)
- RISE Research Institutes of Sweden AB
- Scania CV AB
- Swedish National Road and Transport Research Institute (VTI)
- Swedish Transport Administration
- University of Gothenburg
- University of Skövde
- Veoneer Sweden AB
- Volvo Group AB
- Volvo Car Corporation

PARTNER LEVEL 3 (ASSOCIATED PARTNERS)

- Aptiv
- AstaZero
- City of Gothenburg
- Cycleurope AB
- HiMinds Göteborg AB
- Jönköping University
- Malmeken AB
- The National Society for Road Safety (NTF Väst)
- Smart Eye AB
- Svanberg & Svanberg AB
- Swedish Transport Agency
- Trivector
- University of Borås
- Zenuity AB
- ÅF Digital solutions AB

APPENDIX 2
SAFER BOARD

The following members have been part of SAFER Board during the first year of SAFER Stage 5:

- Autoliv: Cecilia Sunnevång
- Chalmers: Sinisa Krajnovic and Angela Hillemyr
- RISE: Jan Jacobson
- Swedish Transport Administration: Maria Krafft
- Volvo Car Corporation: Malin Ekholm
- Volvo Group: Magnus Rilbe
- VTI: Jonas Jansson
- Independent chairperson: Karin Svensson
- Hans Fogelberg (Region Västra Götaland) and Eric Wallgren (Vinnova) has joined the Board as observers

APPENDIX 3
SAFER MANAGEMENT TEAM

The following members have been part of SAFER's management team during SAFER's operational year 14:

- Azra Habibovic, Research area director Road user behaviour
- Fredrik Sandblom, Research area director Systems for accident prevention and automated driving
- Fredrik Von Corswant, Connected research resource leader for Revere
- Hanna Youn, Controller
- Ines Heinig, Project coordinator
- Ingrid Skogsmo, Senior research advisor
- John-Fredrik Grönvall, Connected research resource leader for Naturalistic driving data
- Lotta Jakobsson, Research area director Human body protection
- Magnus Granström, Director
- Malin Levin, Communications and partnerships, Deputy director
- Mats Svensson, Chalmers profile director traffic safety
- Matteo Rizzo, Research leader for Vision Zero Academy
- Sofia Fagrell, temporary controller (from October 2019)
- Torbjörn Andersson, Research area director Safety performance evaluation

APPENDIX 4
COMPETENCE NETWORKS AT SAFER

The following competence networks have been active during the reporting period:

Automotive Safety Assurance
Focus will preliminary be around how to design L3-L4 automated vehicles such that the accident risk is tolerable, and how to prove that the risk is tolerable with sufficient confidence, and how to design with explainability at all times. Competence network leader: Fredrik Sandblom

Human behaviour
By applying an interdisciplinary approach, the scope of this competence network is to understand human behaviour in traffic and develop scientific methods and tools to create prerequisites for safe driving. It is also about the interplay between humans and technical systems in different contexts; how technical systems should be designed to achieve efficient and safe interaction with the users. Competence network leader: Giulio Bianchi Piccinini

Sensors & Communication
Sensors and communication enable technologies for a plethora of safety systems. The scope of this group is to create and share research ideas around vehicular communications, sensors systems, and signal processing. Competence network leader: Erik Ström

Vehicle Dynamics
Vehicle dynamics is creating a collaborative arena connecting vehicle dynamics research carried out in academia/ institutes and the corresponding advanced engineering activities in the automotive industry. Competence network leader: Bengt Jacobson

APPENDIX 5
GLOBAL COLLABORATIONS

Institutes and academy
- Children's hospital of Philadelphia
- Japanese Automotive Research Institute Nagoya University
- Tokyo university of Agriculture and Technology
- University of IOWA
- University of Michigan Transportation Research Institute (UMTRI)
- Xiamen University of Technology

Collaborative organisations and research programmes
- Australia Driverless Vehicle Initiative (ADVI)
- CLEPA European Association of Automotive Suppliers
- CTS (China Sweden Traffic Safety Centre)
- Drive Sweden
- European Automotive Research Partners Association (EARPA)
- European Council for Automotive R&D (EUCAR)
- European Road Transport Research Advisory Council (ERTRAC)
- Forum för Transportinnovation
- HUMANIST
- Movéo
- Neuroscience Research Australia
- The Association for the Advancement of Automotive Medicine (AAAM)
- The Group for national cooperation (GNS Väg)
- SDNS Northern Europe (Sustainable Development Solutions Network)
- WARA-CAT (Collaborative and Autonomous Transport)
- WASP (Wallenberg Autonomous Systems and Software Program)

APPENDIX 6 / PROJECT PORTFOLIO

PROJECT	PROJECT LEADER	START	END	FUNDER	PARTNERS
Systems for Accident Prevention and Automated Driving					
AUTOFREIGHT – Self-driving trucks for smarter logistics	Fredrik von Corswant	01-04-2017	31-10-2020	VINNOVA	Volvo Group AB, Combitech, City of Borås, Chalmers
C2VC – Complete Combination Vehicle Control with automated reconfiguration	Leo Laine	01-03-2017	31-07-2019	VINNOVA	Volvo Group AB, Chalmers
COPPLAR – Campusshuttle Cooperative Perception And Planning Platform	Lars Hammarstrand	01-01-2016	30-06-2019	FFI, SAFER	Chalmers, GU, VCC, Autoliv, AstaZero
ESPLANADE – Efficient and Safe Product Lines of Architectures eNabling Autonomous DrivE	Fredrik Warg	01-01-2017	31-03-2020	FFI	Aptiv, Comentor, KTH, Qamcom, RISE, Semcon, Systemite, Veoneer, VCC, Volvo Group AB, Zenuity
HEADSTART – Harmonised European Solutions for Testing Automated Road Transport	Jonas Sjöberg	01-01-2019	31-12-2021	EU H2020	SAFER JRU, RISE, Chalmers, Volvo Group AB, Veoneer
IDOLLY – Use of i-dolly for local distribution of container trailers to logistics terminals from a dry port	Fredrik von Corswant	26-10-2017	31-08-2020	FFI	Volvo Group AB, Chalmers, VBG, Ellos, Kerry Logistics, Speed Group, Borås Stad
REALSIM – Realistic simulation of vehicles for safer, more robust and less expensive development of automated vehicles	Monica Ringvik	01-11-2017	31-10-2020	VINNOVA	AstaZero, Chalmers, Data Intelligence, Wiretronic, Volvo Group AB
SEBRA – SEnsor for Bicycle's impRoved Awareness	Jonas Andersson	01-06-2018	31-12-2019	VINNOVA and Open Research at AstaZero Program	RISE, Aptiv, LIRI AB
SWEDEN4PLATOONING	Stefan Bergquist	01-01-2017	31-12-2020	FFI	Scania, Volvo Group AB, KTH, RISE, Schenker AB, and Swedish Transport Administration
Validation of optimal motion planning for automated urban driving	Matthijs Klomp	01-02-2019	20-08-2019	Open Research at AstaZero Program	VCC, Virtual Vehicle Research Center (Graz)
Active safety for bicycles using radar to prevent and reduce the impact in car-and-bicycle collisions	Jonas Andersson	01-02-2019	01-02-2019	Open Research at AstaZero Program	RISE, Aptiv
Road User Behaviour					
ADAS&ME – Adaptive ADAS to support incapacitated drivers Mitigate Effectively risks through tailor made HMI under automation	Anna Anund	01-09-2016	31-03-2020	EU H2020	VTI, Autoliv, Smart Eye, Total: 30 partners
DRAMA – Driver and passenger activity mapping	Cristofer Englund	01-09-2016	29-02-2020	FFI	Smart Eye, RISE
DRIVE2THEFUTURE	Anna Anund	01-05-2019	30-04-2022	EU H2020	VTI, TØI
HARMONISE – Safe interaction with different levels of automation	Emma Johansson	01-01-2017	31-12-2019	FFI	Volvo Group AB, VCC, RISE
MEBESAFE – Measures for Behaving Safely in Traffic	MariAnne Karlsson	01-05-2017	31-10-2020	EU H2020	SAFER JRU (Chalmers, Swedish Transport Administration), VCC, other EU Partner
MEDIATOR – Mediating between Driver and Intelligent Automated Transport system on our roads	Anna Anund	01-05-2019	30-04-2023	EU H2020	VTI, Autoliv and Zenuity (Germany)
QUADRAE – Quantitative Driver Behaviour Modelling	Mats Petersson	01-01-2016	31-12-2020	FFI	VCC, Volvo Group AB, Autoliv, VTI, Chalmers
SCALE-UP – Crowdsourcing for scaling up evaluation of external interfaces on automated vehicles	Azra Habibovic	01-01-2016	29-02-2020	FFI	RISE, VCC
SÄMO – Safe mobility on a bicycle for sustainable aging	Helena Selander	01-03-2019	30-09-2019	Skyltfonden	Chalmers, Cycleurope, VTI, TriVector, NTF
TRUBADUR – Truck drivers braking and glance behaviour during interaction with VRUs	Giulio Bianchi Piccinini	15-01-2019	30-06-2019	Open Research at AstaZero Program	Chalmers

PROJECT	PROJECT LEADER	START	END	FUNDER	PARTNERS
Human Body Protection					
ADIPOSE TISSUE	Håkan Johansson	01-01-2014	31-12-2019	The Swedish Research Council	Chalmers
A-HBM, STEP 4 – Active human body models for virtual occupant response	Linus Wågström	01-04-2018	31-03-2021	FFI	VCC, Chalmers, Autoliv, Dynamore Nordic
Virtual Evaluation Tools for Pedestrian Integrated Safety	Robert Thomson	01-04-2019	31-03-2022	VINNOVA + MOST China Sweden call	Chalmers, VTI, Autoliv, VCC + Tsinghua University, University of Science and Technology Beijing (USTB), Geely , RIOH, Brillizance Auto
COMPCRASH 2 – Reliable crash modeling of fiber composites for lightweight vehicles	Robin Olsson	01-05-2016	31-08-2019	Energi-myndigheten	RISE, VCC, Volvo Group AB, Chalmers, Gestamp
DUCTILE COMPOSITE – Fiber composites with ductile properties	Martin Fagerström	06-12-2016	30-06-2020	Energi-myndigheten	Chalmers, KTH, Biteam, VCC
Female whiplash injury mechanisms, FusakoSato/JARI	Mats Svensson	01-01-2016	31-12-2019	JARI	JARI, Chalmers
FFI-CRASH 2 – Modelling crash behaviour in future lightweight composite vehicles	Martin Fagerström	01-01-2017	30-06-2020	FFI	Chalmers, RISE, Gestamp, VCC, Volvo Group AB, ÅF, Escenda, FS Dynamics, NEVS, DynaMore, MSC Software
ICONIC – Improving the crashworthiness of composite transportation structures	Robin Olsson	01-10-2016	30-09-2020	EU H2020	RISE + non-Swedish full partners (8) and partner organisations (5)
INJURY HBM, STEP 4 – Pelvis and spine injury predicting models for women and men in a variety of sitting postures in future autonomous cars	Bengt Pipkorn	01-04-2019	31-03-2022	FFI	Autoliv, VCC, Chalmers, GU (Sahlgrenska)
LONG TERM CONSEQUENCES – Identification and Prediction of Injuries with Long Term Consequences	Bengt Pipkorn	09-10-2017	02-10-2020	FFI	Autoliv, VCC, KTH, POC, MIPS
OSCCAR – Future Occupant Safety for Crashes in Cars	Johan Davidsson	01-06-2018	31-05-2021	EU H2020	Chalmers, VCC, Autoliv
ASSESSMENT OF PASSENGER SAFETY IN FUTURE VEHICLES	Lotta Jakobsson	15-06-2017	30-09-2020	FFI	VCC, Autoliv, Chalmers
SURVEY CRASH TEST DUMMIES	Mats Svensson	01-06-2019	30-11-2019	Swedish Transport Agency	SAFER/ Chalmers (CIT Anna Carlsson)
WHIPLASH IN VITRO MODEL – In Vitro Model of Whiplash Trauma in Dorsal Root Ganglia – A Pilot Study	Mats Svensson	01-01-2019	31-12-2019	Chalmers AoA	Chalmers, GU (Sahlgrenska)
VIRTUAL – Open Access Virtual Testing Protocols for Enhanced Road User Safety	Astrid Linder	01-06-2018	31-05-2022	EU H2020	VTI, VCC, Chalmers, TØI
ViVA II – Virtual Vehicle Safety Assessment Step 2: Open Source Digital Human Body Models and Crash Testing	Astrid Linder	01-04-2017	31-03-2020	VINNOVA	VTI, Chalmers, Folksam och VCC
Safety Performance Evaluation					
L3PILOT – Piloting Automated Driving on European Roads	John-Fredrik Grönvall	01-09-2017	31-08-2021	EU H2020	SAFER JRU, VCC, Autoliv, other EU Partner
UDRIVE Data User Group	John-Fredrik Grönvall	01-07-2017		Consortium financed	SAFER, DLR, IFSTTAR, LAB, SWOV, University of Leeds
ARCADE – Aligning Research and innovation for Connected and Automated Driving in Europe (CARTRE2)	John-Fredrik Grönvall	01-10-2018	30-09-2021	EU H2020	SAFER, Chalmers, Volvo Group AB
HETEROGENEOUS TRAFFIC GROUPS – Heterogeneous Traffic Groups Cooperative Driving Behaviours Research under Mixed Traffic Condition	Jonas Jansson	01-04-2019	31-03-2022	VINNOVA + MOST China Sweden call	VTI, Chalmers, VCC, Volvo Group AB, RIOH, Geely , Beijing Jingwei HiRain, Tsinghua University, Tongji University
HANDBOOK OF ROAD SAFETY MEASURES	Alena Hoye	01-01-2013	continuous	Norwegian Public Roads Administration	TØI

APPENDIX 7
KNOWLEDGE SHARING ACTIVITIES

Conducted SAFER seminars, conferences and other events during year 14 include:

- On every Thursday (except the summer period June–August) SAFER's lunch and networking seminars have been hosted by our Research areas, Competence networks and connected research resources
- Associate Professor lecture with Ola Benderius, Chalmers: "Sending a truck and a boat to the moon", April 3, 2019
- SAFER Stage 4 final event, April 10, 2019
- SAFER Shareholders meeting, April 10, 2019
- SAFER Research area day, April 10, 2019
- Inspirational workshop and strategy meeting for Research area Human body protection, May 28, 2019
- SAFER Seminar "Reinforcement Learning for Autonomous Driving" with Pin Wang, California PATH at UC Berkeley, June 3, 2019
- SAFER Seminar "Service Design for Human-centered AI" with Halmstad University, June 10, 2019
- Master thesis day, June 11
- Dreams4Cars workshop, June 17, 2019
- Docent lecture with Dr. Jonas Östh, Volvo Cars: "Bottom Up and Top Down: Developing and Applying Human Body Models for Safer Cars", June 26, 2019
- 26th IAVSD International Symposium on Dynamics of Vehicles on Roads and Tracks, August 12–16, 2019 - SAFER co-host
- SAFER seminar "Human Factors in Driving (Automation Systems)" with Shannon Roberts, University of Massachusetts Amherst, August 19, 2019
- Docent lecture with Dr. Giulio Bianchi Piccinini, Chalmers, "Understanding and modelling human behaviour during driving", August 23, 2019
- Research area day at SAFER, August 27, 2019
- ISO 26262 Course for SAFER partners, Sep 2–5, 2019
- Annual road safety conference in Tylösand, several SAFER related researchers presented, Sep 3, 2019
- Seminar "Child Occupant Protection - Latest knowledge and challenges in future mobility", September 4, 2019
- Dissertation with Sérgio Costa, RISE Research institutes of Sweden and Chalmers, Industrial and Materials Science, Material and Computational Mechanics, September 6, 2019
- Testers' day at Asta Zero, September 11, 2019
- SaferAfrica final event, Tunis, September 26, 2019
- Chalmers Transport Area of Advance Initiative seminar "Transportation in the Age of Digitalisation", Sep 26, 2019
- CTS session at SAECC in Shanghai, October 22-24, 2019
- Dissertation seminar "Simulation of Occupant Kinematics using Active Human Body Models" with Christian Kleinbach, University of Stuttgart, Institute of Engineering and Computational Mechanics, October 23, 2019
- Research area day at SAFER, October 23, 2019
- SAFER part of ERTRAC Road Safety R&I Workshop: from Challenges to Solutions – the Way forward, November 15, 2019. This workshop was listed as a pre-event of the 3rd Global Ministerial Conference on Road Safety, which will take place in Stockholm on 19–20 February 2020.
- Ethical applications seminar with the competence network Human behavior, Nov 29, 2019
- SAFER Seminar "Japan Automobile Research Institute: 50 years of automotive safety research" with JARI, December 6, 2019
- SAFER seminar "An Empirical Analysis to Assess the Operational Design Domain of Lane Assistant System Equipped Vehicles" with Haneen Farah, TU Delft, December 12, 2019
- Licentiate seminar "Benefit estimation of active safety for cyclist-crash avoidance" with Jordanka Kovaceva, Chalmers, December 13, 2019
- SAFER Seminar: "Vehicle Safety in the Era of Automation" with Michiel van Ratingen, Secretary General Euro NCAP, December 17, 2019
- Dissertation seminar "Driver interaction with vulnerable road users: Modelling driver behaviour in crossing scenarios" with Christian-Nils Boda Åkerberg, Chalmers, December 18, 2019
- SAFER seminar "Eye Tracking in the Wild – from Eye Movements to Gaze Behavior" with Otto Lappi, Helsinki University, December 19, 2019

APPENDIX 8
CONFERENCES

Conferences in which SAFER's research has been presented:

- AAAM 63th Annual Scientific Conference, Madrid, Spain
- 26th International Technical Conference on the Enhanced Safety of Vehicles (ESV), Eindhoven, Netherlands
- 17th International Conference Protection of Children in Cars, Munchen, Germany
- ICSC2019
- FFI Resultatkonferens inom Trafiksäkerhet och Automatiserade fordon, Gothenburg, Sweden
- AutomotiveUI '19: 11th International Conference on Automotive User Interfaces and Interactive Vehicular Applications, Utrecht, Netherlands
- Automated Vehicle Symposium, Orlando, USA
- IRCOBI conference, Florence, Italy
- The 9th IEEE International Workshop on Software Certification (WoSoCer 2019)
- The 4th International Workshop on Security and Dependability of Critical Embedded Real-Time Systems (CERTS)
- 14th IEEE International Conference on Automatic Face Gesture Recognition
- ITS World Congress, Singapore
- 7th International Conference on Hot Sheet Metal Forming of High Performance Steel
- 7th ECCOMAS Thematic Conf on the Mechanical Response of Composites. Girona, Spain
- 22nd INTERNATIONAL CONFERENCE ON COMPOSITE MATERIALS (ICCM22), Melbourne, Australia
- 1st European Conference on Crashworthiness of Composite Structures – ECCCS-1, Belfast, UK
- Svenska mekanikdagar, Stockholm, Sweden
- 26th IAVSD International Symposium on Dynamics of Vehicles on Roads and Tracks, Gothenburg, Sweden

SAFER is the open research and knowledge sharing arena where researchers and expertise work together to create safe mobility. Our traffic safety approach covers people, vehicles and the infrastructure – and together we contribute to safer road transports and smarter, more sustainable cities.

SAFER

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