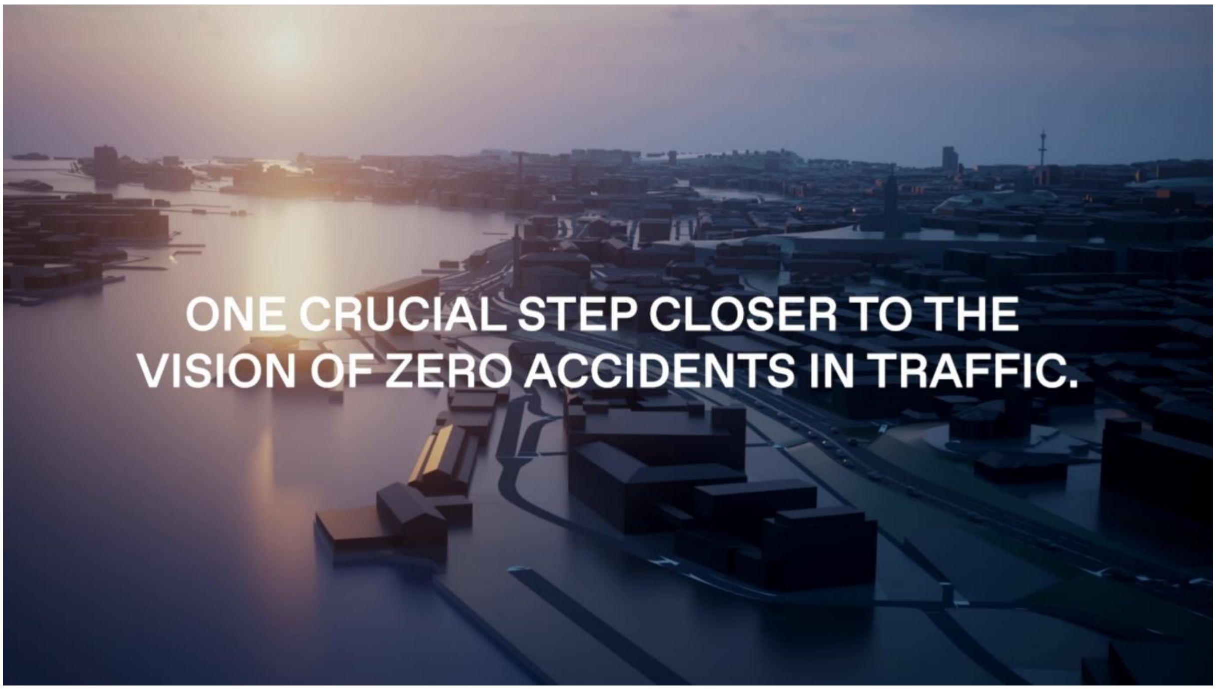
AI Aware

AI Powered Awareness for Increased Traffic Safety

V1.1



Executive Summary

The project: "AI Powered Awareness for Increased Traffic Safety", has explored how multiple traffic- and road-related datasets can be analyzed using AI algorithms to identify roads with an elevated accident risk. Massive real-time data streams as well as large historic datasets have been evaluated by the project and then used to feed the AI algorithm. The ability to turn huge, but currently under-utilized, datasets into specific and quantified accident risk predictions may be used for proactive traffic management that ultimately could prevent accidents to occur. This would be a huge gain in the efforts to create a safer traffic system and the project has laid the foundation for this.

Vehicle companies, map, and location data providers as well as traffic management authorities have been collaborating in the project to provide their knowledge, innovative concepts, and technology. Volvo Cars together with Zenseact created a data fusion platform that applies an AI algorithm for continuous accident risk evaluation on a road segment level. HERE made their "HERE Platform" available for the project, used both as a plentiful data source for Volvo Cars/Zenseact's AI algorithm as well as a communication layer to forward predicted accident risks to a Central Traffic Control (CTC) cloud.

The CTC cloud was provided by Carmenta using the Carmenta TrafficWatch™ platform with the purpose to collect and compile traffic situation data from various online sources and from a central level dispatch relevant traffic hazard warnings to connected organizations. The accident risks were transmitted from the CTC cloud to the Drive Sweden Innovation Cloud managed by Ericsson. The Innovation Cloud is a platform for business-to-business data and insights sharing, thus adding even more options for other organizations to share the accident risk predictions originating in the Volvo Cars/Zenseact data fusion platform.

The Swedish Transport Administration and City of Gothenburg made huge contributions throughout the project, adding the traffic management authority perspective. At a workshop, traffic safety experts from Swedish Transport Administration, presented the latest findings and current guiding policies around traffic safety issues in Sweden and elaborated around Sweden's "Vision Zero" initiative. Very important input for assessing how project findings and results can benefit a more pro-active traffic management.

The project has successfully met its goals and not only implemented a first version of an AI-powered data fusion platform but also established and tested an end-to-end data flow mechanism to make the accident risk predictions immediately available to many connected organizations. All project members sees great potential in continuing the exploration of predictive awareness for increased traffic safety within their own organizations.

Most likely the successful outcome of the "AI Powered Awareness for Increased Traffic Safety" project will lead to future follow-up projects.

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Project participants

Volvo Cars

Volvo Car Corporation has high ambitions when it comes to sustainable mobility solutions, especially within electrification and autonomous drive. Volvo Cars believes autonomous drive can generate significant potential road safety benefits for society as a whole when all cars are autonomous. Until that moment, the technology can offer customers a better driving experience by taking away mundane tasks such as stop-start driving in traffic jams. Our work on autonomous driving builds upon 90 years of safety know-how.

Ericsson

Ericsson is a global leader within communication systems and services. Now, Ericsson is leading the development towards a Networked Society, where everything that benefits from being connected will be connected. The Transport sector will benefit extensively from becoming connected, cooperative, and automated. Ericsson is now developing and implementing communication services and cloud services to support this development. The next generation of mobile networks, 5G, is now being developed to fully support connected automation and new mobility services. Drive Sweden is a key engagement for Ericsson, with its contributions to the Innovation Cloud being a very important building block.

Carmenta

Carmenta is a privately held Swedish company, founded in 1985, with offices in Sweden, Germany, France, and United Kingdom. Carmenta supplies software for mission-critical systems in which superior situational awareness is the key to success. Carmenta provides high performance software products, develop client specific solutions, and offer a wide range of services that help some of the world’s most technologically advanced customers to optimize their operations by using extensive and up-to-date geospatial information. Carmenta’s customers are found globally with a concentration in Europe. Carmenta Automotive provides off-board command and control technology for connected and autonomous vehicles, which helps organizations to improve their traffic control and increase operational safety.

Zenseact

In 2017, Volvo Cars co-founded Zenuity with Autoliv, (later Veoneer). Zenuity was recently split in two parts and Zenseact was created, as a Volvo Cars subsidiary. The company’s plan is to build upon and further develop the software developed by Zenuity in order to create a platform for real-life autonomous driving and safer journeys.

HERE

HERE Technologies Since the first digital map for cars 1985 HERE has been the market leader. Today, a company of over 8000 employees all focused on the concept of location and the potential it has to radically improve the way we do business, the way we get around and the way we live, HERE is shaping the future by redefining what was formerly known as a map.

Swedish **Transport Administration**

Swedish Transport Administration is responsible for the overall long-term infrastructure planning of road, rail, sea, and air transport. Their assignment also includes the construction, operation and maintenance of state roads and railways, and are developers of society planning for a holistic integration of the entire transport system. Swedish Transport Administration works with long-term infrastructure planning in close dialogue with regions and municipalities. To ensure that this infrastructure is used effectively and that it promotes safe and environmentally sound transportation.

City of Gothenburg

City of Gothenburg’s mission is to offer its citizens sustainable mobility and a city where they want to work, stay, and meet in.

Introduction

The project: “AI Powered Awareness for Increased Traffic Safety” (called the “AI Aware project” in this report) has explored the idea of fusing multiple data sets (both new and existing) from the traffic system in a city and applying AI algorithms and other new pattern recognition technologies for identifying and predicting different events in the traffic system. Focus has been on identifying different types of hazards that could cause accidents and disturbances.

- By collaborating between traffic authorities, traffic management providers, map and location data providers and OEMs an increased level of predictive awareness has been reached.
- By aiming beyond real-time the project has started the exploration of predictive safety.

A collaborative cloud infrastructure has been used for communicating warning messages and thereby proving the technical feasibility of the project idea. The project could reuse and extend the cloud-based AD Aware Central Traffic Control designed and developed through a series of previous Drive Sweden projects

Visions for Traffic Safety

The new dimension explored in this project has a huge potential to solve the problem of unforeseen events causing accidents, lost lives, and disturbances in the traffic system. The logic for realizing this potential is based on the following capabilities having been explored in the project:

- Identifying patterns in data from the traffic system representing hazards.
- Predicting accident risk level.
- Predicting hazardous road conditions such as low friction.
- Preventing accidents through preemptive warnings.

The project further has provided new knowledge, technology, and concepts when it comes to applying AI for predicting events in a traffic system and using collaborative cloud solutions for preventing accidents to occur. By going beyond real-time intervention the project has contributed to the exploration of proactive preemptive measures as a new tool managing mobility in a Smart City.

Traffic Safety Workshop with Swedish Transport Administration

A workshop was held on October 5, 2021, under the theme “Safe System Hypothesis”. Invited, beside project members, were traffic safety experts from Swedish Transport Administration that presented the latest findings and current guiding policies around traffic safety issues in Sweden. Their presentation is summarized below:

The Swedish national transport system shall assure good accessibility and Swedish roads shall be designed to avoid serious or fatal injuries. A “Vision Zero” initiative has brought new traffic safety policies to work towards these goals and the foundation for any traffic safety analysis is the availability to data. On a national Swedish level, the responsibility to collect, store and make available traffic-related data is divided between:

- *The Swedish Transport Administration: for fatal crashes investigation, conducted in cooperation with police, fire brigade, car manufactures and other relevant contributors.*
- *The Swedish Transport Agency: for a coordinated database for injury crashes (STRADA) that gathers accident data from the police and hospitals.*

Although the number of fatalities in traffic crashes have been significantly reduced since 1998-1999, there are still many excessively violent crashes happening. Neither improved road design nor speed limitations have been enough to protect drivers or passengers from serious traffic crashes. So, instead of trying to reduce all types of crashes in the transport system the focus in Sweden is to minimize those resulting in serious or fatal injury. This means that an increased number of “lighter” crashes caused by deliberate road design can be preferred if the number of crashes with fatal outcome or serious injuries are lowered. A typical scenario here is when a car crashes into a wire fence resulting in material damage but avoids potentially serious injury caused by a head-on crash.

The workshop then discussed the project’s scope and ambition to predict route crash risks through excessive analysis of historic and dynamic data. Some take-aways from this discussion were:

- The project hasn't focused on predicting the "seriousness" of crashes but rather to setup and test a technological framework to minimize route accident risks in general. Further refinement of the project methods and technology could be done to align with the Swedish "Vision Zero" initiative.
- Technology from the project could potentially be used to decide when, and on which roads, autonomous or highly automated driving is suitable/possible.
- General mobility would be improved if technology from the project could be used to adjust and regulate the speed of traffic without compromising safety and environmental aspects
- It should be possible to use AI-based accident risk analysis as developed in the project to do changes in the road Infrastructure, such as extending merging lanes, build median barriers and increase lane markings.
- All kinds of vehicles and ways to travel, as well as pedestrians, must be added to the analysis and would also benefit from receiving guidance and advice from the systems
- Traffic authorities as well as traffic management systems differ a lot between countries' and from city to city. This must be taken into consideration and planned for when scaling up the technology to cover more countries. The future mobility industry is aiming for global and standardized solutions but have very often to consider and adapt to local rules and regulations.
- Traffic management is an obvious domain to receive and use crash risk predictions for both short term planning and a more proactive guidance.

Volvo Cars Zero Accidents vision

Volvo Cars sees great potential in the exploration of data analysis and data fusion for the purpose of improving traffic safety. The AI Aware project has shown that it is possible to collaborate with multiple parties for the purpose of fusing data and deriving insights relevant for increased traffic safety. The ever-increasing data made available by the traffic system and the increasing processing capacity both in cloud and on the edge will create new possibilities for further improved traffic safety. Volvo Cars will therefore continue exploring this area even after the end of the AI Aware project. This work will be an important part of Volvo Cars vision of Zero Accidents.

The AD Aware Central Traffic Control system

In a series of previous Drive Sweden projects, a cloud-based AD Aware Central Traffic Control (CTC) system have been designed, implemented, and extended in an iterative way. The AD Aware CTC system follows a loosely coupled systems-of-systems design and has proved to be a very efficient and easy to extend platform to test, evaluate, and demonstrate methods for sharing traffic-related information among different organizations. Through the current AI Aware project, the AD Aware CTC system has been further improved by adding an AI-driven predictive awareness module to the system. To set the current project into the AD Aware CTC context, a short summaries of the previous Drive Sweden projects are presented below.

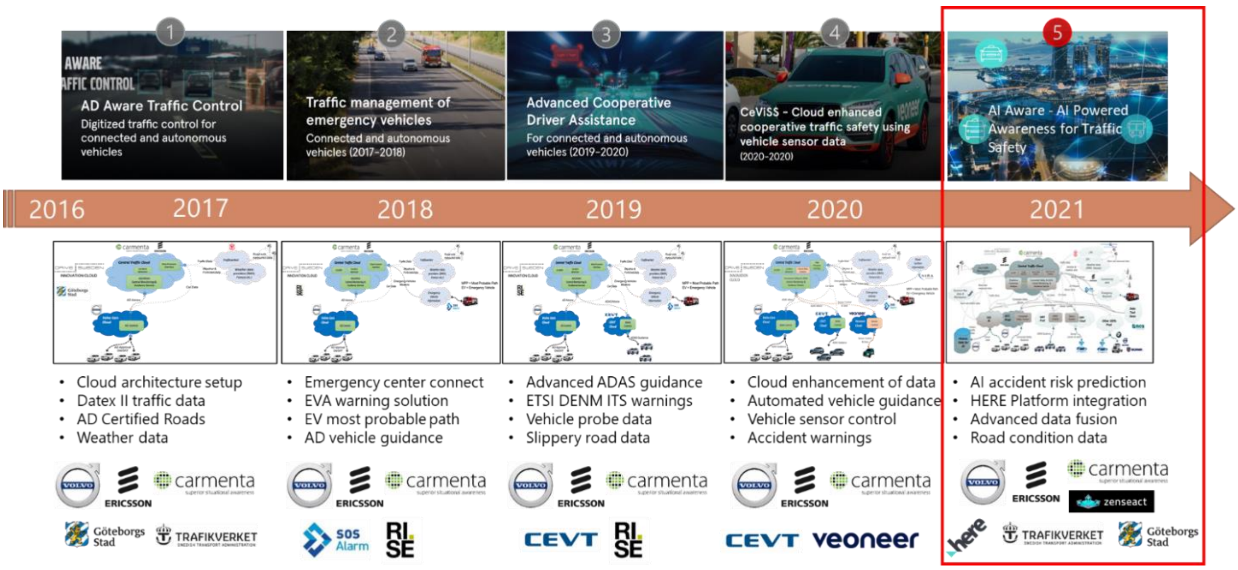


Figure 1. Overview showing the series of AD Aware CTC Drive Sweden Projects.

AD Aware Traffic Control – Digitized traffic Control for connected and Autonomous Vehicles
The first Drive Sweden project laid the foundation for the AD Aware CTC platform and introduced the concept of using a central control system in the cloud to collect, fuse and send traffic-related data to connected organizations. The project defined the concept "advice" to dispatch customized messages to connected OEM vehicles, specifically to Volvo Cars Autonomous Driving (AD) test vehicles. Important results of the project were:

- Cloud architecture design, implementation, and evaluation
- Using the DATEX II traffic messaging standard and extending it for sending AD Advice
- Testing and verifying the concept of a shared CTC/OEM view of AD Certified Roads
- Added and adapted weather data from online data sources to the AD Advice model

Autonomous Drive Aware Traffic Control – Traffic Management of Emergency Vehicles
The second project focused on situations where emergency vehicles on rescue missions approach vehicles driving in AD mode. Real-time mission data from the Swedish 112 center was sent to the AD Aware CTC for analysis resulting in Emergency Vehicle Approaching (EVA) warnings to Volvo Cars AD test cars. Live tests were performed and some of the project results were:

- Emergency centers connect
- EVA warning solution
- Most probable path analysis of rescue vehicle routes for a precise dispatch of AD Advice
- AD vehicle advice to go from AD to manual driving and back

Advanced Cooperative Driver Assistance – For connected and Autonomous Vehicles
In the third project the CTC platform was extended to facilitate OEM to OEM communication over the central cloud. Live tests were done where alerts from one OEM (Volvo Cars) were sent to another (CEVT) and vice versa. A new connection was also added for near real-time road friction data (NIRA Dynamics). Live OEM alerts were then fused with the friction data for sending enhanced Hazardous Location Warnings (HLWs). The project resulted in more CTC platform capabilities, such as:

- Advanced ADAS guidance
- Supporting both DATEX II and ETSI DENM warnings and conversion from one to the other
- Collection and analysis of Vehicle probe data
- Slippery road data from NIRA Dynamics

CeViSS – Cloud-enhanced Cooperative Traffic Safety using Vehicle Sensor Data
In the fourth project functions were added to study and demonstrate how the CTC platform could be used to collect data from vehicle sensors (Veoneer), enhance it in real-time in the central cloud and share it with the two project OEM partners: CEVT and Volvo Cars. Tests were also done where the CTC had direct control of the vehicle on-board cameras to record live video when arriving to an accident scene. This could give 112 operators and first responders a better understanding of the accident before arriving to the scene. Some project results were:

- Cloud enhancement of vehicle sensor data
- Remote (cloud) control of the vehicle sensor platform (e.g., turn on/off sensor video)
- Accident location warnings
- Automated vehicle guidance

The Central Traffic Cloud (CTC) is designed to serve any number of OEM clouds with connected AD and ADAS vehicles by aggregating data of interest, including information about traffic, weather, and ongoing rescue missions. The CTC's central function is to monitor the overall traffic situation, and with automation support, trigger alerts to the OEM clouds if there are hazardous events detected in the road network.

The CTC implements a Publish/subscribe and Request/response mechanism for data exchange based on messaging following the DATEX II and/or ETSI DENM standards. The figure below gives an overview the system setup including the additions from the current project such as the Volvo Cars/Zenseact AI cloud, the HERE Platform, and the Drive Sweden Innovation Cloud.

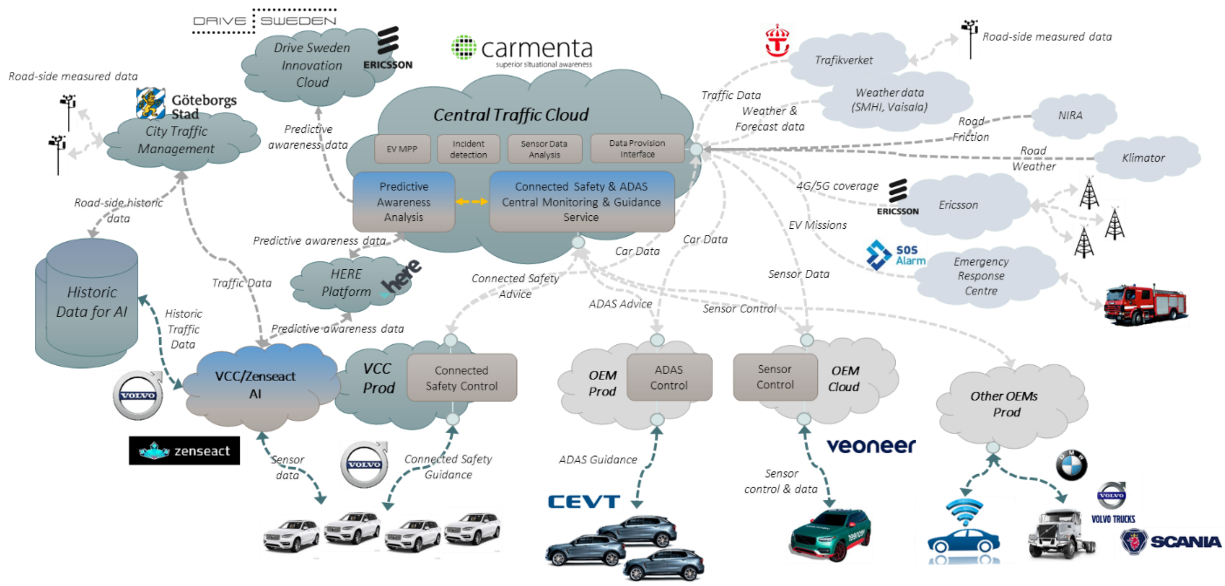


Figure 2. AD Aware CTC overview with additions as the VCC/Zenseact cloud, HERE Platform and the Drive Sweden Innovation Cloud.

In the “Systems part of the cloud-to-cloud data interchange” section below, the additions to the AD Aware CTC system developed and tested in this project, as well as the data exchange, is described in more detail.

The AI Aware Predictive Awareness Solution

The risk for a particular driver to be in an accident is not evenly distributed in time. Rather, it depends on covariates such as friction, traffic flow, speed limits, curvature, precipitation, temperature, wind speed, wind direction, etc. At the same time, it is not a feasible solution to encourage drivers to lower their driving speed uniformly, as this will be inefficient as an intervention tool. The reason is both that drivers won’t comply, but also that the perceived “cost” in terms of time to complete a route exceeds the gain in lowered accident risk. To this end, there is a need to maximize the utility of the intervention in terms of accident risks. More specifically, we want to be able to find the optimal travel velocities which minimizes the accident risk for a route, given constraints such as total travel time.

As part of the AI Aware project, Zenseact has developed a system for estimating the intensity (in a Poisson sense) for traffic accidents, given various covariates such as friction, traffic flow, speed limits, curvature, precipitation, temperature, wind speed, wind direction, etc. As an extension to this problem, and based on its output, we have developed a technology which minimizes route accident risks based on these estimated accident intensities. This means that we can calculate the optimal travel velocities throughout a route which minimizes the accident risk for that route, given constraints such as total travel time. It is also possible to directly quantify the effect on accident risk of altering constraints, such as the required total travel time or speed limits. The technology is based on analytically tractable mathematics as opposed to “black-box” technology, which makes it particularly suitable for safety critical systems such as the present one which aims at minimizing accident risk.

Based on this technology, we can develop software which both minimizes accident risks per route, but also helps the driver or AD to choose which route to take. Further, it can help decide when to engage an AD/ADAS system. The advantage with this solution from a practical perspective is that the car can then potentially warn the driver about particularly dangerous situations and sites in advance, before he or she comes there, lowering accident risk at an almost negligible cost in travel time.

There are to the best of our knowledge no previous solutions to the present problem. The reason is probably the recent surge in AI technology and Data Science. that the data and models required to build the system are quite new and were developed recently within AI Aware.

Systems part of the project cloud-to-cloud data exchange

The data exchange between the different systems from partners in the project constitutes an end-to-end flow of messages originating in the Volvo Cars/Zenseact Accident Risk Prediction module and ending up in the Drive Sweden Innovation Cloud. The figure below illustrates the data flow and the systems it passes. Following in this chapter are more detailed descriptions on each systems part of the data interchange.

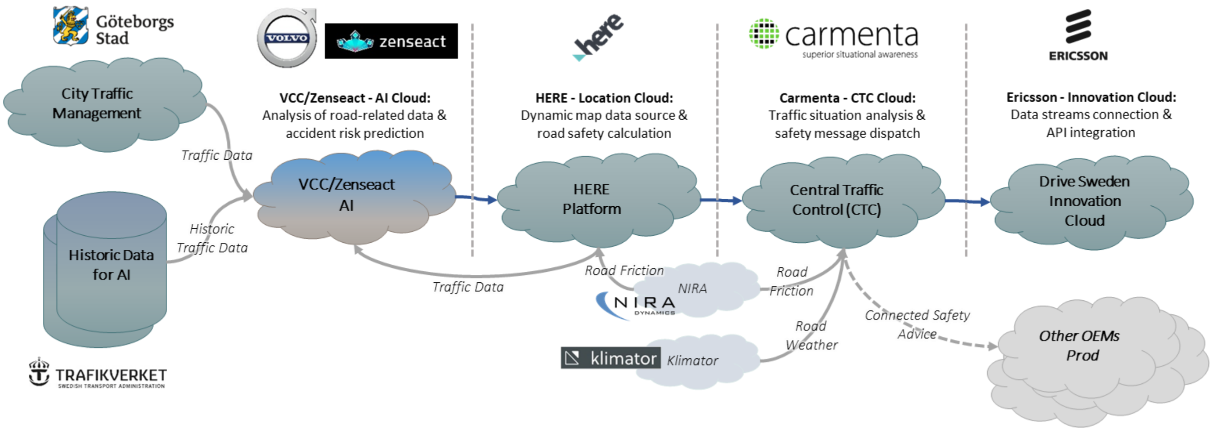


Figure 3. Schematic view of the cloud-to-cloud data flow established and tested in the project. The blue arrows show the transmission of the Accident Risk Predictions (ARAs) calculated by the Volvo Cars/Zenseact AI module (see below).

The Volvo Cars Predictive Awareness AI

Volvo Cars together with Zenseact have created a data fusion platform which consumes different real time data streams from the traffic system, applies an algorithm for accident intensity evaluation and provides a continuous evaluation of risk level for all monitored road segments. Input data streams among other are predicted road friction, actual measured road friction (when available), weather forecast, traffic flow, hazard warnings and road attributes. Data is consumed through the Here Platform and integrated with the VCC cloud.

A lot of time and effort has been spent on establishing knowledge of what data is available, what data is relevant, getting legal and technical access to data, and to transform different data sources to compatible and useful formats. Due to the explorative research nature of the project a trial-and-error approach has been applied. Architectural and technical reworks have been needed to accommodate new datasets and new formats. The quantity and frequency of data have forced the project to rework initial technical implementations.

Insights in the form of **Accident Risk Alerts (ARAs)** are sent back to the HERE Platform and shared with Carmenta's CTC Cloud through the Volvo Cars workspace on the Here Platform. The predictive awareness capabilities are still at an early stage and performance will improve over time with more data flowing through the platform. The conceptual functionality is seen as a success.

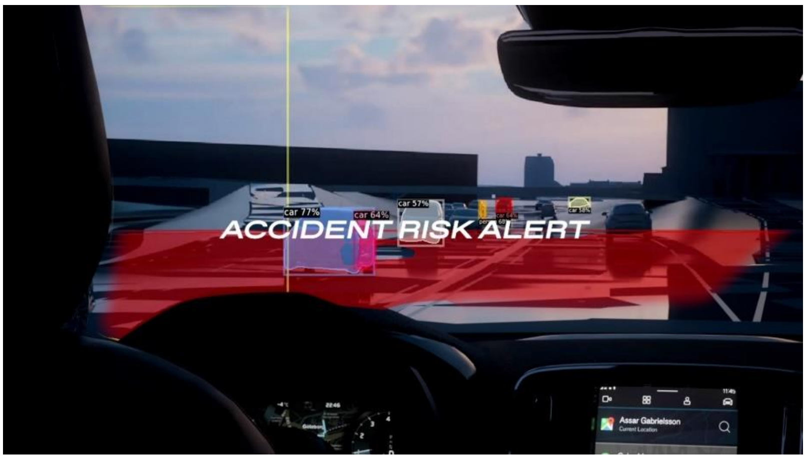


Figure 4. Snapshot from the AI Aware film depicting the moment when an ARA reach a Volvo Cars vehicle.

The HERE Platform

The HERE platform enables customers to build and scale location-based products, services, and applications in a secure, cloud-based environment. It consists of the largest collection of location related static and dynamic data such as maps, traffic, road signs, software tools to visualize, analyze, process such data, and services to manage and operate such data.

Volvo Cars used the HERE platform to derive the real-time road safety score for each road element in Gothenburg. This score describes the near-term risk of an accident on a road segment and is updated every 15 minutes.

To do so Volvo Cars ingests their own road friction data into the platform. This dataset is derived from sensor data of their fleet of vehicles in Gothenburg. They use HERE algorithms to relate it to the highly fresh HERE Map Content. Then they combine this data with other attributes from the HERE Map Content, HERE Real-Time Traffic, HERE Hazard warnings and NIRA Dynamics road friction data. As a side note, the latter is also built on the HERE platform. Finally, Volvo applies a machine learning model to this combined data to derive the road safety score. They operate all these steps continuously in HERE's stream processing pipelines.

The prior training of the machine learning model happens on Volvo's side and uses as ground truth accident incidents (e-call) from the HERE Hazard Warnings data set.

The following screenshot shows ARAs generated by Volvo Cars as a "Volatile Layer" using the HERE platform's Data Inspector tool.

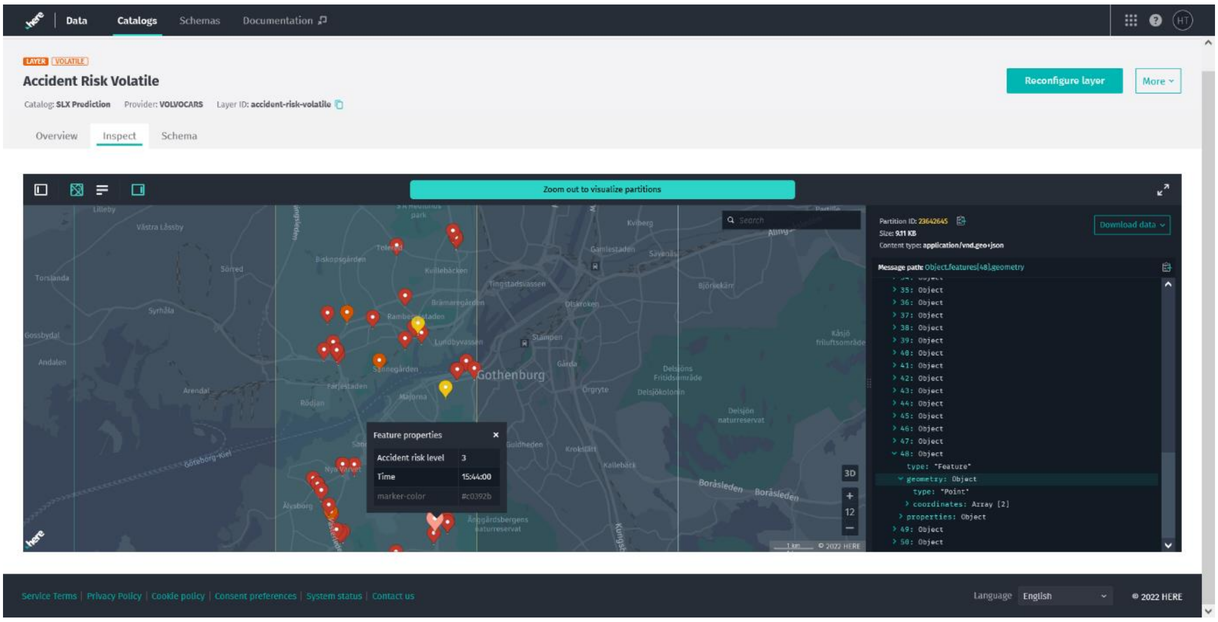


Figure 5. ARAs from Volvo Cars as a "Volatile Layer" viewed through the HERE platform's Data Inspector tool.

In the context of the AI Aware project, only data in and around Gothenburg was processed. However, the HERE platform is designed to operate location related data products at scale and on a global scope. So, with the change of a few lines of code, the road safety score could be calculated for the whole of Sweden, Europe, or the world.

The Central Traffic Control cloud/Carmenta TrafficWatch™

The main capability a Central Traffic Control (CTC) cloud is to compile and maintain an aggregated traffic situation picture and through connected online data sources automatically detect traffic incidents that may result in hazardous situations for AD and ADAS vehicles driving in an operation area. Depending on the nature and seriousness of the situation the CTC then has functions to dispatch guidance and/or warning messages to connected entities such as vehicle OEMs. The CTC backend system as well as the CTC Operator UI is based on Carmenta TrafficWatch™ modules and benefit from many capabilities that is part of the product.

The traffic situation picture established step by step in previous projects is composed of the following parts:

- A detailed background map (from HERE).
- The geometry and characteristics of the physical road network (from Swedish Transport Administration /NVDB and HERE).
- Real time traffic information (from Swedish Transport Administration and HERE).
- Geolocation and most probable path for emergency vehicles driving to accidents (from SOS Alarm).
- Geolocation of accidents (from SOS Alarm).
- OEM AD & ADAS vehicle hazard light events (from Volvo Cars and CEVT).
- Weather data including road conditions (from Swedish Transport Administration, SMHI and Vaisala Digital (former Foreca))
- Low friction road segments (from NIRA Dynamics).
- Geolocation of sensor-detected objects such as large animals, pedestrians, and still-standing cars (from Veoneer)
- Geolocation of license plates with specific numbers (from Veoneer)

All the above have been used for lives tests well as in several demonstrations. In the current AI Aware project, the following data types have been added and evaluated to the CTC:

- **Geolocation of road segments where slower speed than allowed is predicted for the next half hour.** Based on data from the HERE Platform traffic flow API. See figure below of the AI Aware CTC Operator UI Situation Map with a layer showing road segments with a predicted speed significantly lower than the allowed speed. The speed predictions are updated every half hour.

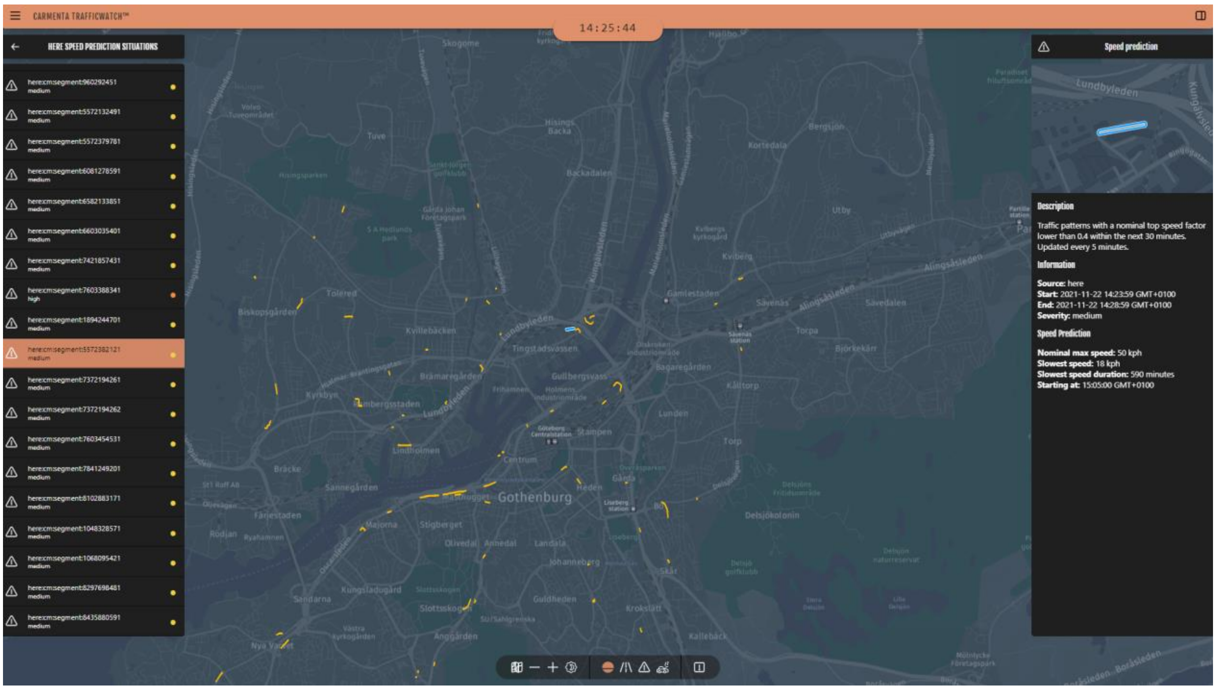


Figure 6. Road segments with a predicted slow speed (yellow lines). Metadata on the selected slow speed situation is shown in the details panel to the right.

- **Geolocation of road segments with a predicted, increased accident risk level (ARAs)** Based on the Zenseact AI analysis developed in the project by Zenseact. The AI Aware CTC use a dedicated microservice to retrieve ARAs through a streaming layer in the SLX catalog in HERE platform. This streaming layer acts as a message queue and the microservice continually polls the queue via a HERE platform REST API. As new risk predictions are added to the layer, and are read by the microservice, they are converted to Carmenta TrafficWatch "Accident Risk Situations" and sent to the CTC Operator UI for visualization. For test purposes the ARA road segments are also sent to a demo instance of the Drive Sweden Innovation Cloud to be shared among its on-boarded parties and viewed as a dynamic map layer in the Innovation Cloud Map UI.

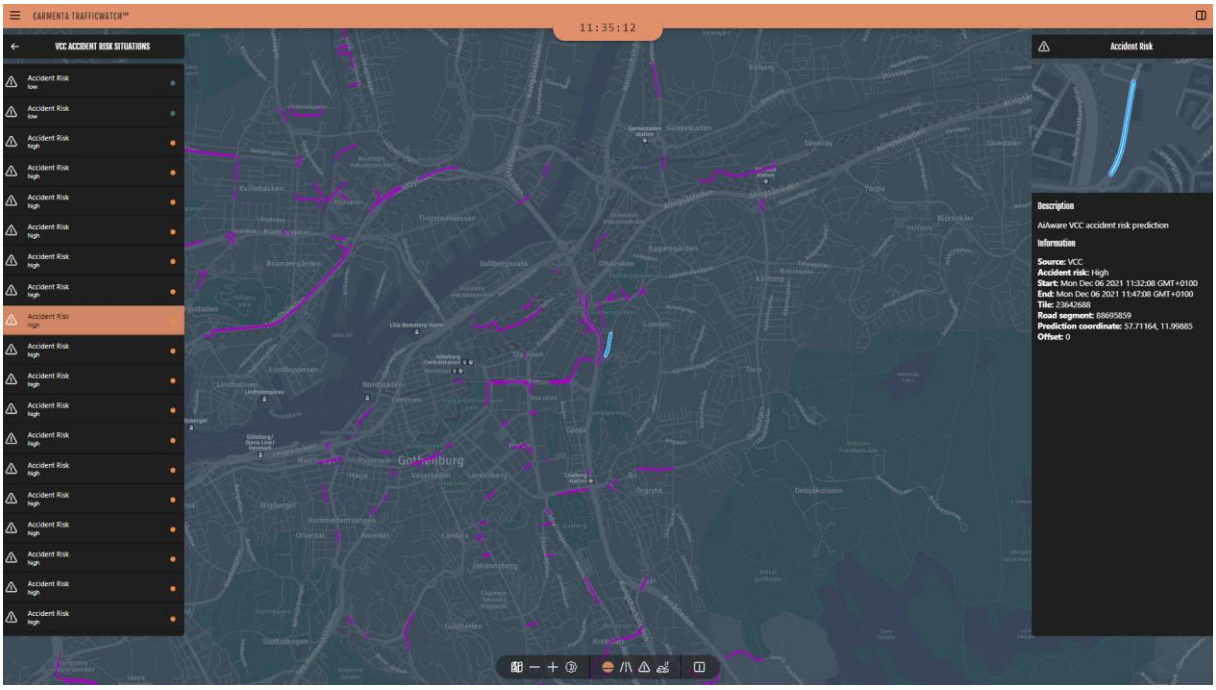


Figure 7. ARAs with an increased predicted accident risk (purple lines). Metadata on the selected ARA segment is shown in the details panel to the right.

- **Geolocation of road segments with forecasted bad weather conditions.**
  The project has also connected to, and evaluated, a road weather service provided by Klimator that gives information about the local weather on a road segment level, from the current time and 72 hours ahead. In the AI Aware CTC, the Road Condition classes are mapped into Situation Severity levels ranging from Low to Highest where roads with a medium severity level and higher are shown in the Operator UI. See figure below.
  Road weather parameters available through the Klimator online REST API. These include:
    - Road Condition: dry, moist, wet, light snow, snow, drifting snow, sleet, frost, heavy frost, ice, freezing rain.
    - Surface temperature, Dew point, Residual salt and more.

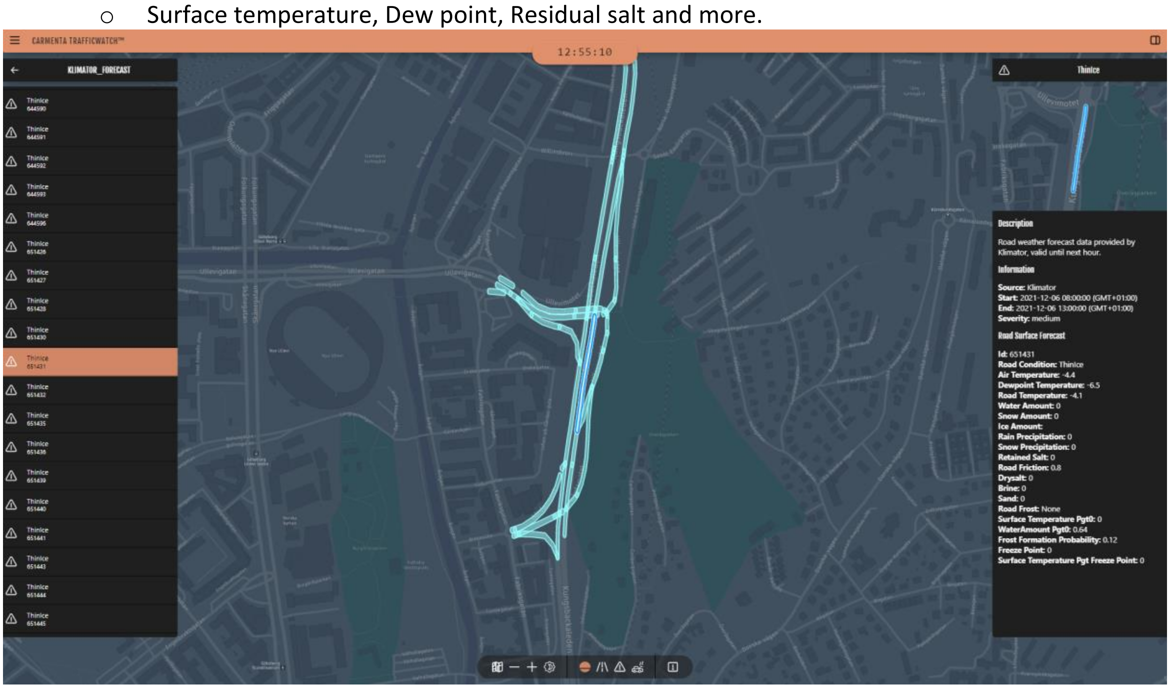


Figure 8. Detail from the Situation Map showing road segments with forecasted hazardous weather conditions read from the Klimator online REST API.

The Drive Sweden Innovation Cloud

The Innovation Cloud is a platform for business-to-business data and insights sharing. It allows organizations to connect data streams and integrate APIs. The flip side is that it also allows organizations to consume data streams by subscribing to different sources from the marketplace. An insight consumer can also choose to become an insight creator by subscribing to one or more data streams, adding intelligence and connect the enriched data back to the platform. Innovation Cloud dashboard allows to visualize data points enriching the business stories with charts, maps, and tables.

In this project, Innovation Cloud provides configured MQTT message broker for publishing ARA warnings. Consumers can subscribe to the corresponding data offering in the marketplace. ARA data has visual representation on the Innovation Cloud map and in notification panel (see figure below).

Figure 9. Road segments with predicted ARA's shown on the Innovation Cloud map and in the notification panel.

As part of the project, Ericsson has also performed analysis of historical traffic accidents and identified hazardous areas, the spots where the traffic accidents occurred more frequently. The corresponding geometries and the time series registering the number of traffic accidents per cluster are integrated in the API which is available in the Innovation Cloud marketplace. A visual representation of hazardous areas is available on Innovation Cloud map. The results might be helpful for traffic authorities for planning and traffic management.

Results and Findings

Conclusions

- Volvo Cars sees great potential in this project and will pursue the work with gathering, fusing, and analyzing more data. The goal is that the concepts explored in the AI Aware project will lead to increased traffic safety and eventually Zero Accidents. An anticipated additional effect is better traffic flow in general which will have positive effects for both personal health, the economy, and the environment.
- The AD Aware Central Traffic Control system developed and refined through a series of Drive Sweden project proved again to be a very efficient technical framework to share data between different types of organizations.

Volvo Cars specific findings

- Volvo Cars is highly satisfied with the project outcome and will pursue the exploration into this field.
- Privacy and GDPR regulations are important factors that has large impact on the data made available for new exploratory use cases.

Carmenta specific findings

- Carmenta found the project very rewarding as the Carmenta TrafficWatch product, acting as the AI Aware CTC cloud, was extended to receive and handle Accident Risk Alerts for further dispatch as traffic warnings to connected organizations.
- Accident Risk Alerts channeled through a centralized traffic control system and dispatched to vehicles to avoid particularly risky parts of the roads have a great potential to prevent accidents.
- Very positive how straightforward new data types, such as Volvo Car's Accident Risk Alerts as well as Klimator's Road Condition forecasts, could be added to the cloud-to-cloud data flow following the AD Aware CTC architectural design.

Zenseact specific findings

- Zenseact is very excited about the project and its outcomes.
- From our perspective, there is a very high potential in the technology developed within the project.
- Zenseact intends to continue to develop the models and concepts that originated within AI Aware and has already assigned resources to it.

Ericsson specific findings

The Innovation Cloud can be successfully used to share the data and insights between producers and consumers, providing a self-onboarding service, online tools for data producers and consumers as well as a dashboard allowing to explain complex data in a visual way.
Summary of findings:

- The Innovation Cloud can be used as a platform that meets the needs of producers and consumers or various data types, providing a set of the online tools and visualization dashboards.
- Traffic accidents often happen on the same segments of the roads, there is also correlation with the specific time periods. These dependencies can be the subject of the further study.
- It is necessary to collect data on traffic accidents for subsequent analysis and identification of hazardous patterns.

HERE specific findings

HERE learned in this project how they can improve the platform to speed up analytics and development of such use cases and similar ones. HERE will simplify the learning of location related data processing and extend the support for Python in the platform to address data scientists' needs.

Future Work

Volvo Cars sees great potential in continuing the exploration of predictive awareness for traffic safety. There seems to be great potential for simultaneous gains for society and individuals alike. Volvo Cars will continue the work and will probably initiate future follow up projects.

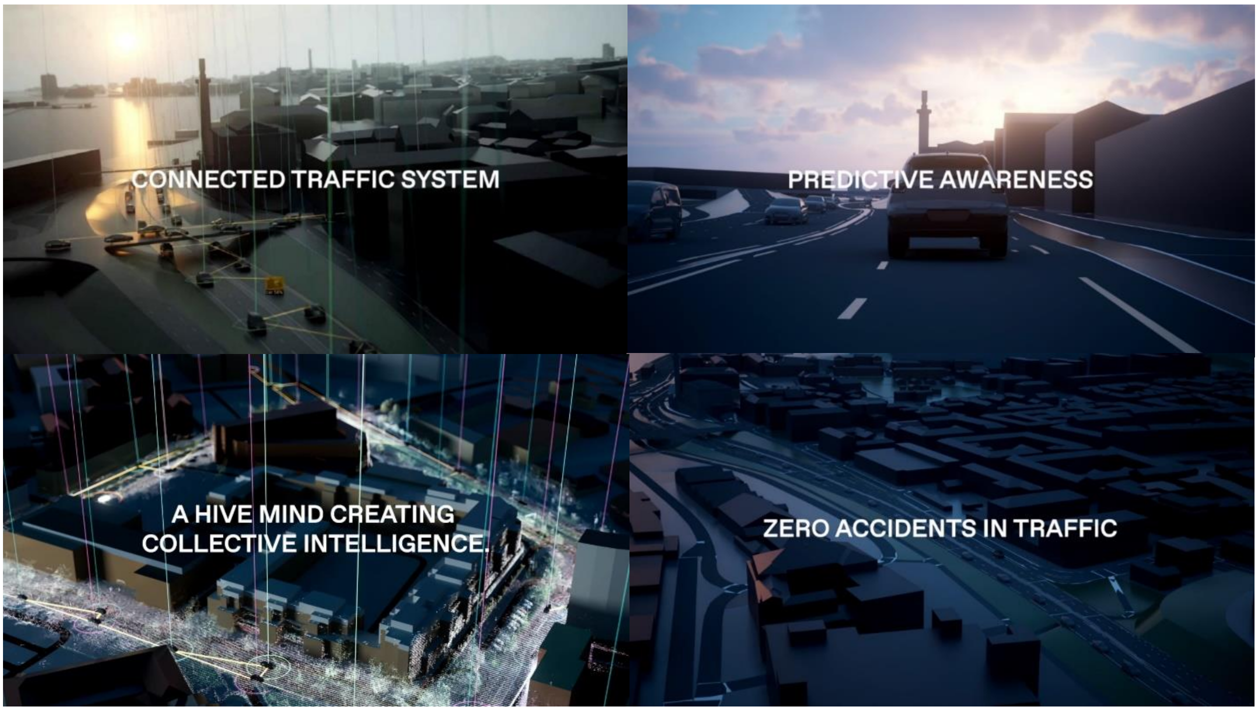
Next Step

The project parties shall consolidate the findings from the AI Aware project and continue the exploration and let systems and algorithms feed on more data. Possibly a follow-up project will be launched.

Deliverables

The “AI Aware film”

One of the AI Aware project deliveries is a short film that summarize the project and its scope. Below is a collage of snapshots from the film.



Following is a short summary on how the project was executed with a description of deliverables per WP.

WP1 – Base system setup

Volvo Cars set up a new cloud hosted IT environment to host the data storage and data pipelines needed for this project. Microsoft Azure and Here Platform Workspace were used. Specific access restriction was set up to ensure that specific users had access to specific data. Through this base set up Volvo Cars, Zenseact and Here could collaborate in the same environment. Through this setup, Carmenta and Ericsson could also directly integrate the new insights being an output of the data fusion pipeline.

WP2 – Bilateral collaboration

Work was done throughout the project to get a Singaporean consortium in place. Although positive signals and high-level contacts were engaged no Singaporean consortia was created and the bilateral part of the project did not execute.

WP3 – Data retrieval and connection

A large part of the project has been dedicated to identifying, getting legal access to and technically integrating data sources to the project. Data has been provided both by actors in the project such as Here, Swedish Transport Administration and Volvo Cars and from external parties such as NIRA Dynamics and Klimator. Since data is considered a valuable intellectual property, asset legal restrictions have often been applied to data and the project has had to manage both commercial, legal, and technical challenges connected to data. Harmonization of data in different formats and with different location referencing has demanded a lot of effort.

WP4 – Training and testing of AI

A predictive awareness algorithm has been developed by Zenseact based on data from a training system. Due to difficulty in getting access to certain data sources important as reference data the training and testing of the algorithm is yet to be completed. This is seen as a natural step in the development of AI algorithms and the work will be pursued once access to the data source in question is possible.

WP5 – Accident prediction

The entire project has led to a first conceptual version of an Accident Risk Alert function. Due to the algorithm still being in an initial phase the precision and granularity of the accident prediction has potential to improve.

WP6 – Flashflood prediction

This work package was intended to be deployed in Singapore and since the bilateral part of the project did not execute this work package did not execute.

WP7 – Evaluation & Demo

An AI Aware Central Traffic Control Operator UI was developed, tested, and evaluated in the project. The UI presents a constantly updated traffic situation map where all roads with an elevated Accident Risk in the form of ARAs were shown as a map layer. The Operator UI was used through the project for various demo purposes.