AD Aware Traffic Control Cloud - Emergency Vehicle Information

Presentation & Demonstration 2018-08-29

Agenda

- Introduction – High Level Project Goals
- Autonomous Drive (AD) in general
- Recap – What is AD Aware Traffic Control
    - Certified Road Concept
    - Cloud based AD Traffic Control
    - Innovation Cloud
- AD Aware Traffic Control – Emergency Vehicle Information
    - Details
- DEMO
    - Simulated Scenario
    - Movie – World Premier!
- Break (14:15-14:30)
- Project Results so far
- Evaluation period fall 2018
- Conclusions and next step – a future outlook
- Q & A end 15:00

Introduction - Project details

- Participants
  - Volvo Cars (Driver)
  - Ericsson
  - Carmenta
  - RISE Viktoria
  - SOS Alarm

- Time frame
  - Start – 2017-09-01
  - End – 2018-12-15

- Budget and Funding
  - Total budget – 8,75 MSEK
  - Vinnova funding – 4,375 MSEK

AD Aware Traffic Control – Emergency Vehicle Info

- The project aims to **further develop** the AD Aware Traffic Control platform with automated cloud services for sharing Emergency Vehicle (Fire Brigade and Ambulance) information between AD Vehicles (i.e. Volvo Cars' Drive Me-cars) and Emergency Vehicle Coordinators (i.e. SOS Alarm.

- AD Vehicles share position with Emergency Vehicle Coordinators and receive information about Emergency Vehicles' positions and/or Most Probable Path (MPP). Allowing AD Vehicles or OEM Traffic Control to take appropriate action: either revoke AD Approval or, in the future, guide AD vehicles to move out of the MPP so the Emergency Vehicles can pass.
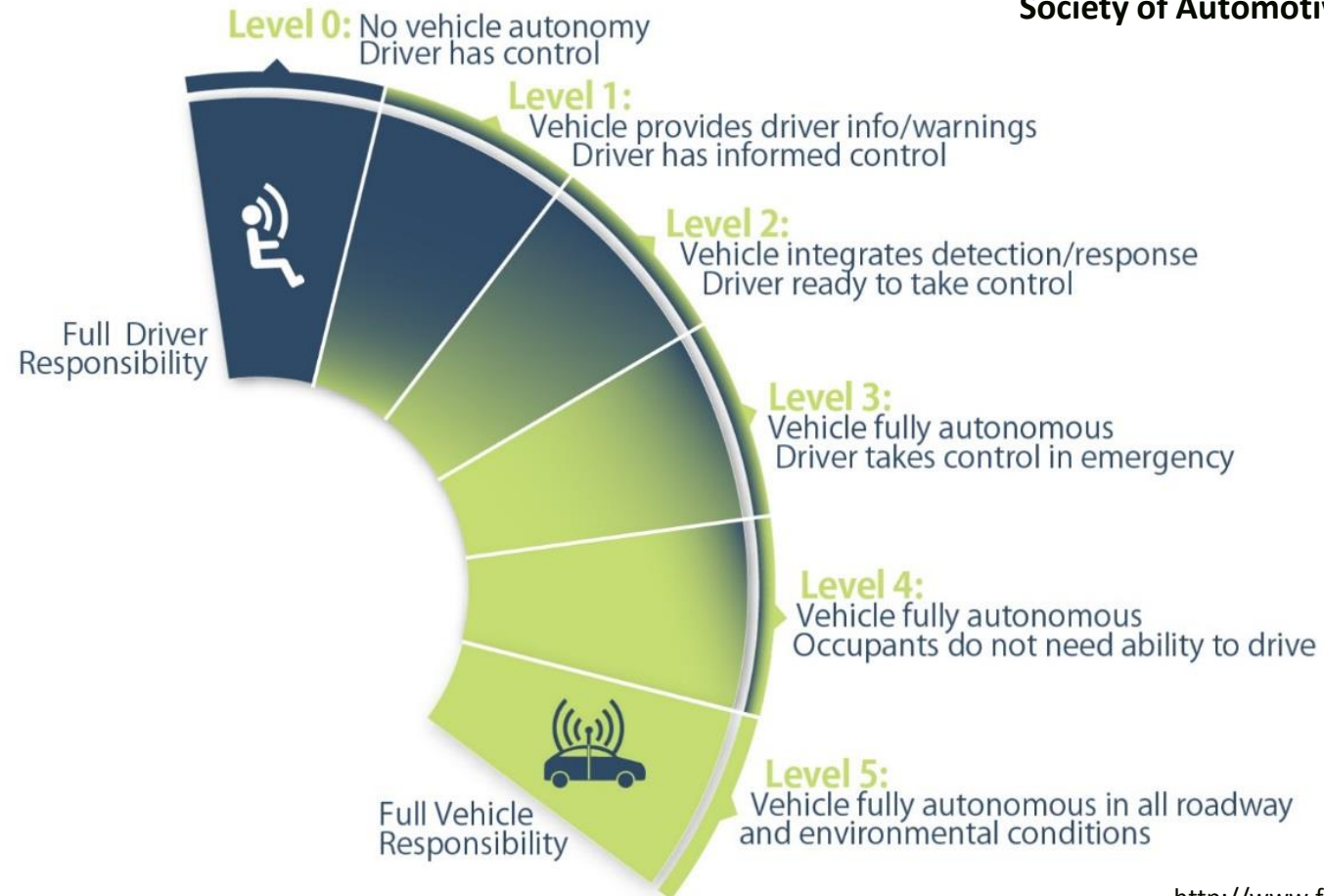
Project Purpose and Goal

- The project's purpose is to **improve the AD Advice to AD Vehicles** by utilizing information about **Fire Brigade and Ambulance** Emergency Vehicles' MPP. It is an extension of the AD Aware Traffic Control platform's functionality covering more situations.

- The goal is to build an **end-to-end information flow** between OEMs and Emergency Vehicle Controllers utilizing the AD Aware Traffic Control platform infrastructure, **to demonstrate the improved AD Advice functionality** and to provide **a report outlining societal impact, opportunities and risks and recommendations for future work**.

Project Potential and Benefit

- To provide a **quicker and safer traffic situation for Emergency Vehicles** in a future where most, if not all, vehicles are AD Vehicles.

- The applicability of the Emergency Vehicle information is not limited to AD Vehicles and could be used as **another way of alerting drivers to make way** (as a complement to sirens and lights).
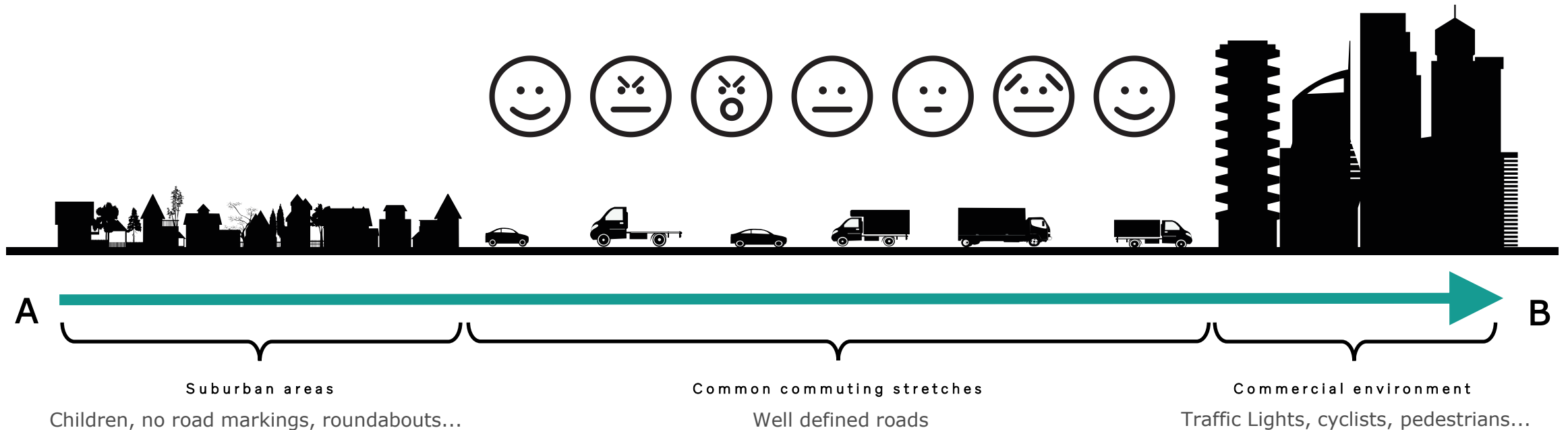
Level of autonomous driving

Society of Automotive Engineering standard J3016

Level 0: No vehicle autonomy
Driver has control

Level 1:
Vehicle provides driver info/warnings
Driver has informed control

Level 2:
Vehicle integrates detection/response
Driver ready to take control

Level 3:
Vehicle fully autonomous
Driver takes control in emergency

Level 4:
Vehicle fully autonomous
Occupants do not need ability to drive

Level 5:
Vehicle fully autonomous in all roadway
and environmental conditions

Full Driver
Responsibility

Full Vehicle
Responsibility

http://www.fehrandpeers.com/autonomous-vehicles/

Common commuting patterns

- Customer Value

- Simplification

- Risk Management

A → B

Suburban areas
Children, no road markings, roundabouts...

Common commuting stretches
Well defined roads

Commercial environment
Traffic Lights, cyclists, pedestrians...

Certified Road / Segments / AD Service

The Certified Road is broken down into smaller parts referred to as Segments. These Segments allow for a more granular approach to be taken for the control and management of the conditions and situations that can affect AD

The Volvo Cloud will act as an extra sensor to the AD cars and will provide an OK/NOK signal to each car indicating whether the conditions for autonomous driving are available, and thus if the option to drive in AD mode is made available to the driver

The roads where we believe the conditions allow for... these roads in total are called the Certified Road

Autonomous Driving
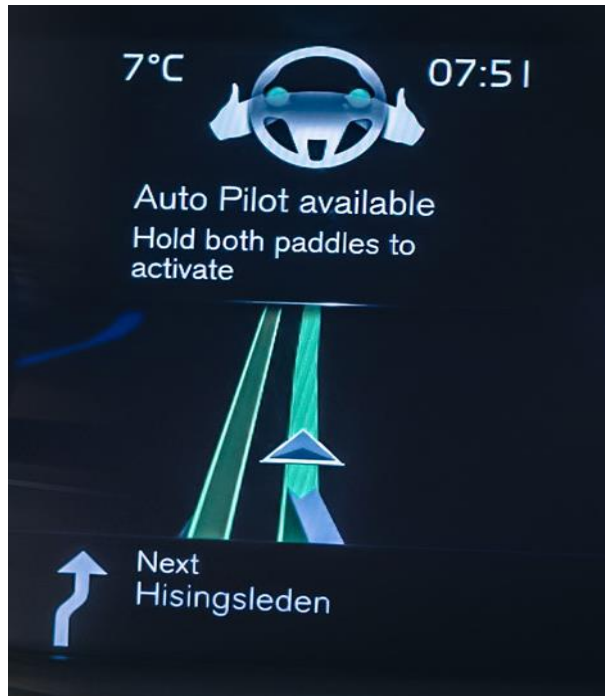
SOS Alarm, a hub in Swedish collaboration and crisis management,
Emergency number, information number and important messages to the public
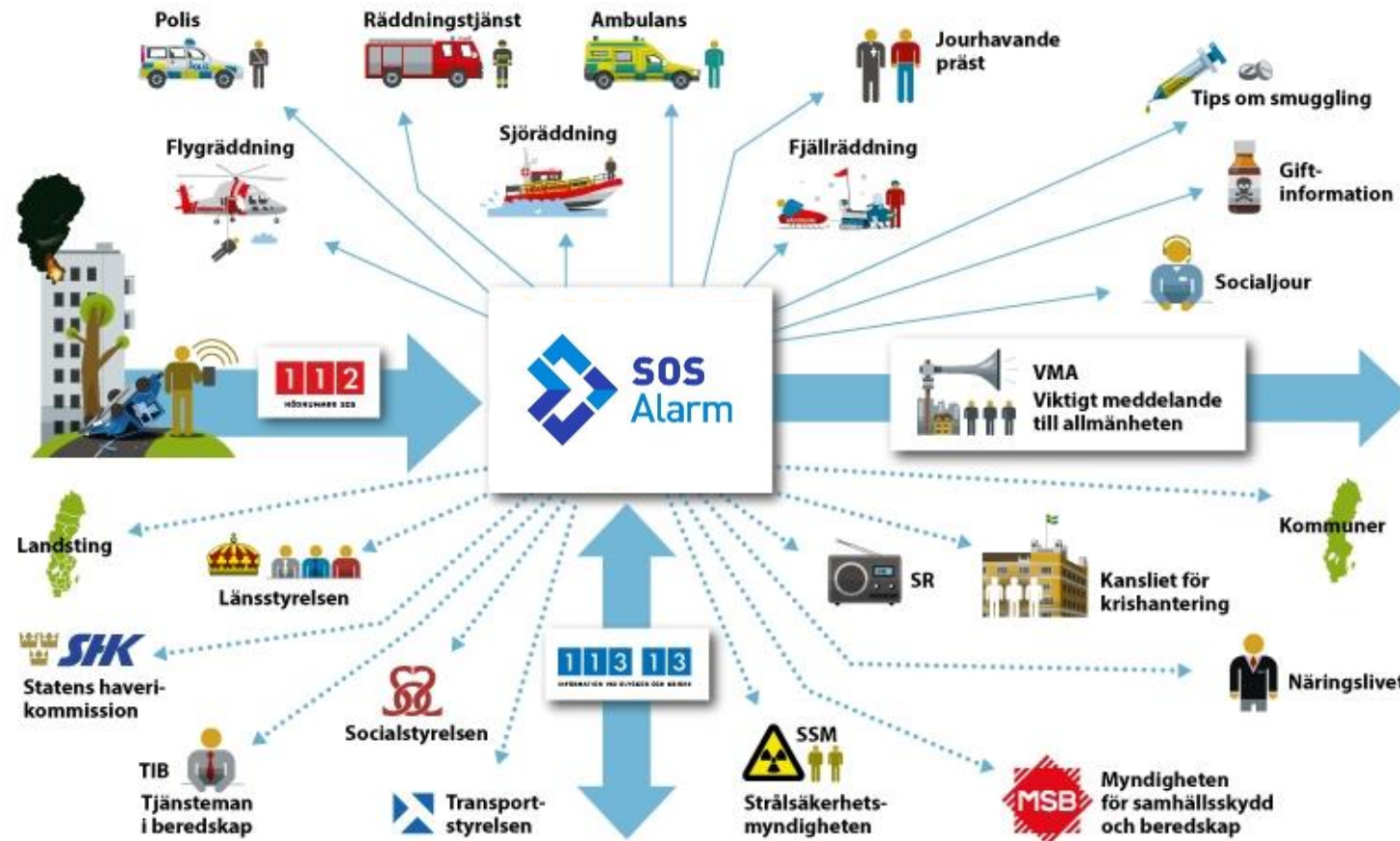
Model for alerting rescue resources, ambulances and police

Police

Alarm transferred to the police from the emergency operator over radio communication (Rakel). The police do not participate in the interview.

Rescue resource

112, emergency operator   Collaborative interview, SOS

Healthcare (nurse)   Possibility to give advice

Send out resources

System Overview – AD Aware Traffic Control
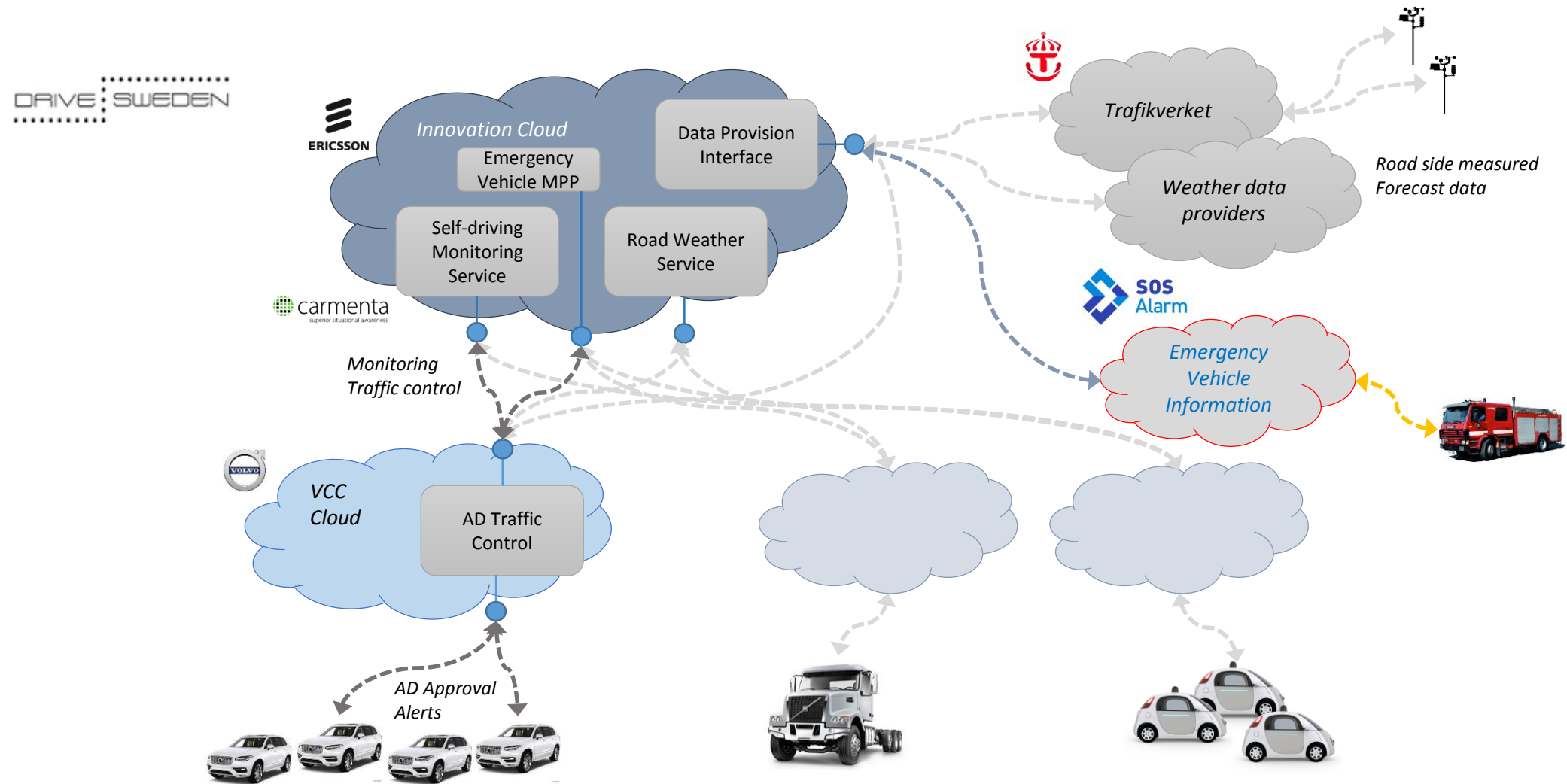
MPP = Most Probable Path (of the emergency vehicle)

DRIVE SWEDEN
INNOVATION CLOUD

Is in reality a data center……

Clouds

Scaling

Development

Staging

Production

Innovation cloud

https://innovationcloud.ericsson.net

Ericsson Cloud billing

CTC Solution Overview

Volvo Sensus cloud
- Monitoring
- Backend System
- AMQP Client

Central Traffic Cloud

Maintenance and Operation

Ericsson
- Broker App
- Bin/Lib
- Docker Engine
- Operating System
- Hypervisor

Request image →
← Download image

Container Registry
- Repository

Ericsson DevOps
- Monitoring

Push Images
Maintenance

Carmenta
- Carmenta TrafficWatch Apps / Services
- Docker Engine
- Operating system
- Hypervisor

Carmenta Ops
- Monitoring

Operation

AMQPS
AMQPS
MQTT/ HTTPS
HTTPS
HTTPS
AMQPS

Trafikverket
Weather Services
SOS Alarm

Complete EVI data flow – System of Systems

OEM

- EV positions
- Status messages

- EV Missions

- AD Advice
- AD segment on/off

- AD on/off

Rakel
(TETRA Radio)

CoordCom

CTC
Carmenta TrafficWatch

VCC
Volvo Sensus Cloud
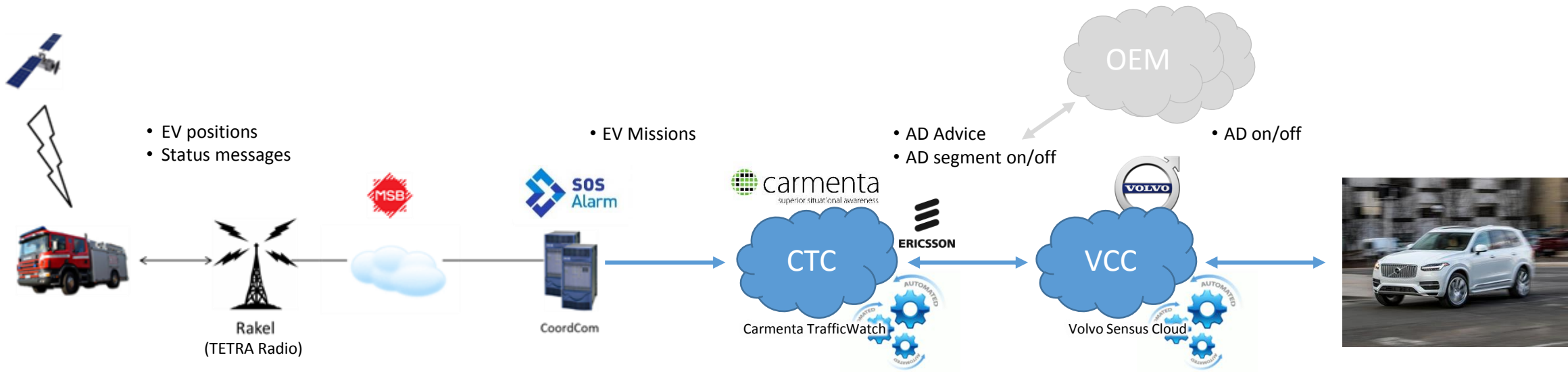
- Emergency Call-taking
- EV Dispatch
- EV Mission Prep & Send

- EV Mission Monitoring
- EV MPP Calculation
- EV MPP / AD Road Conflict
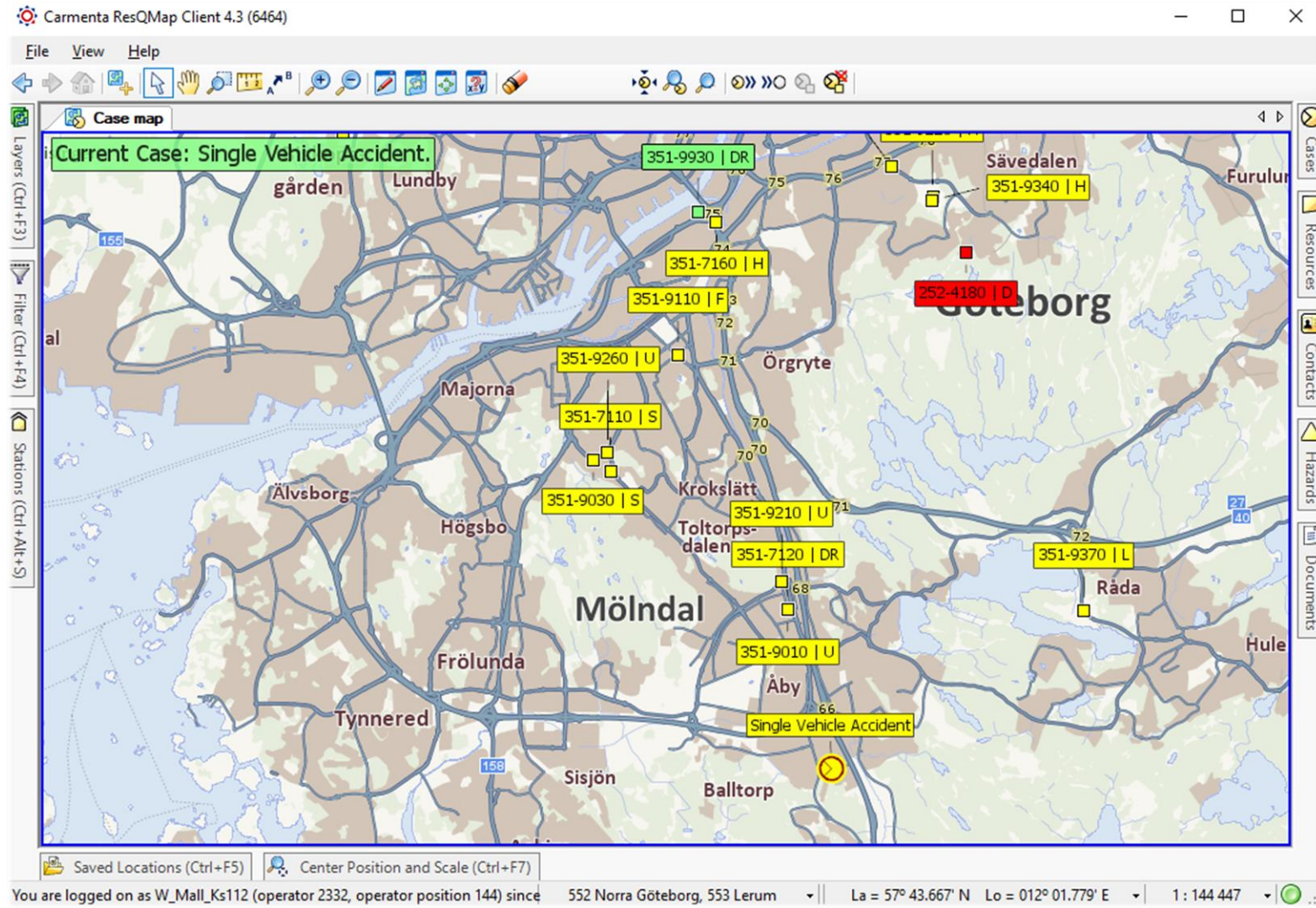- AD Advice Prep & Send
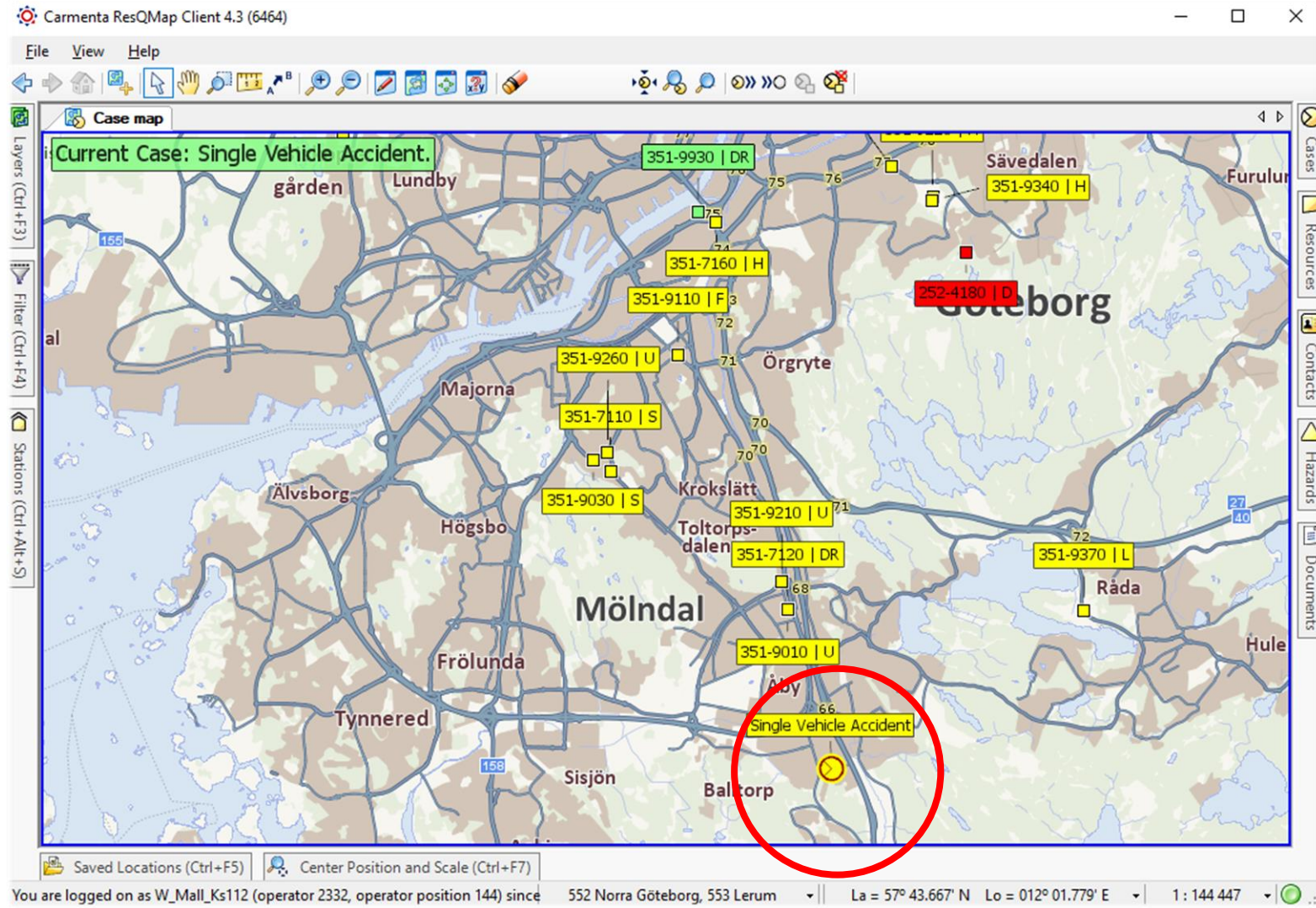
- AD Advice reception
- AD control
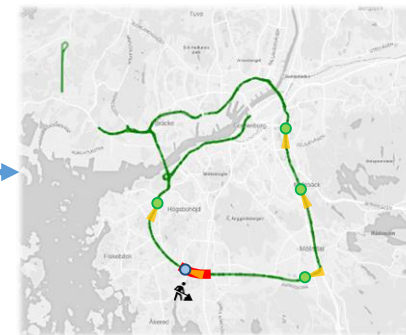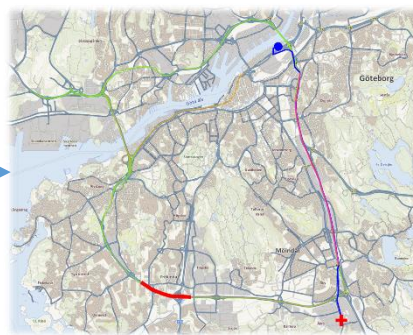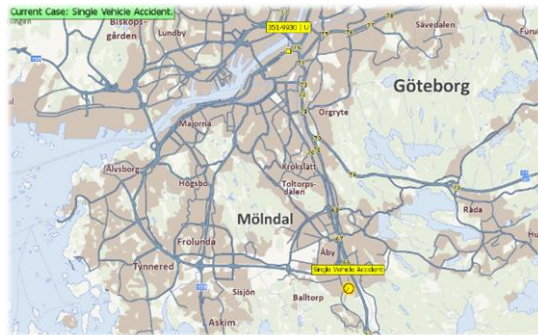
Privacy Protection

Privacy Protection

Emergency Situation Map - SOS Alarm System

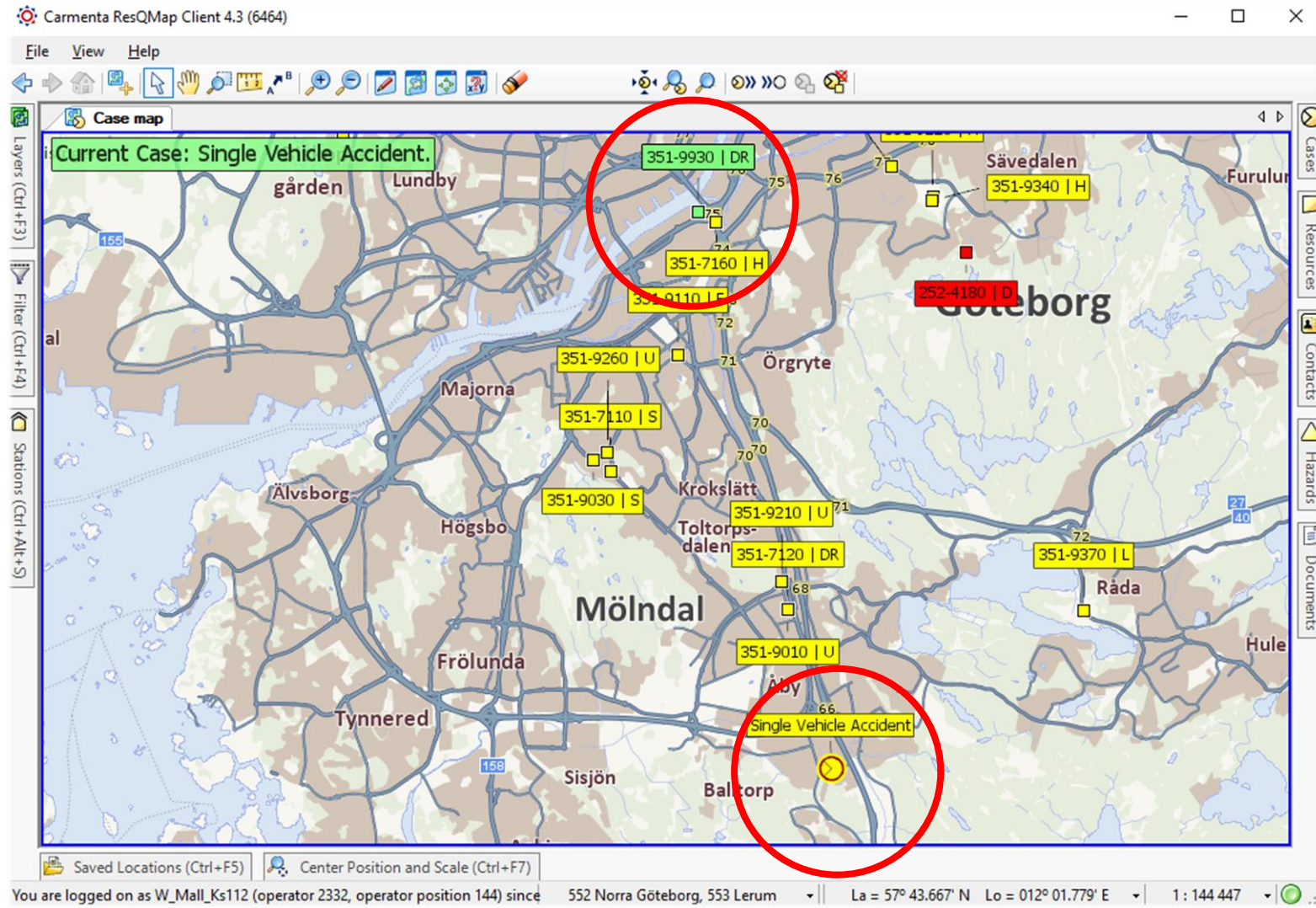All emergency vehicles are tracked and displayed on the situation map

Emergency Situation Map - SOS Alarm System

All emergency vehicles are tracked and displayed on the situation map

Accidents are shown on map as they are handled by the system

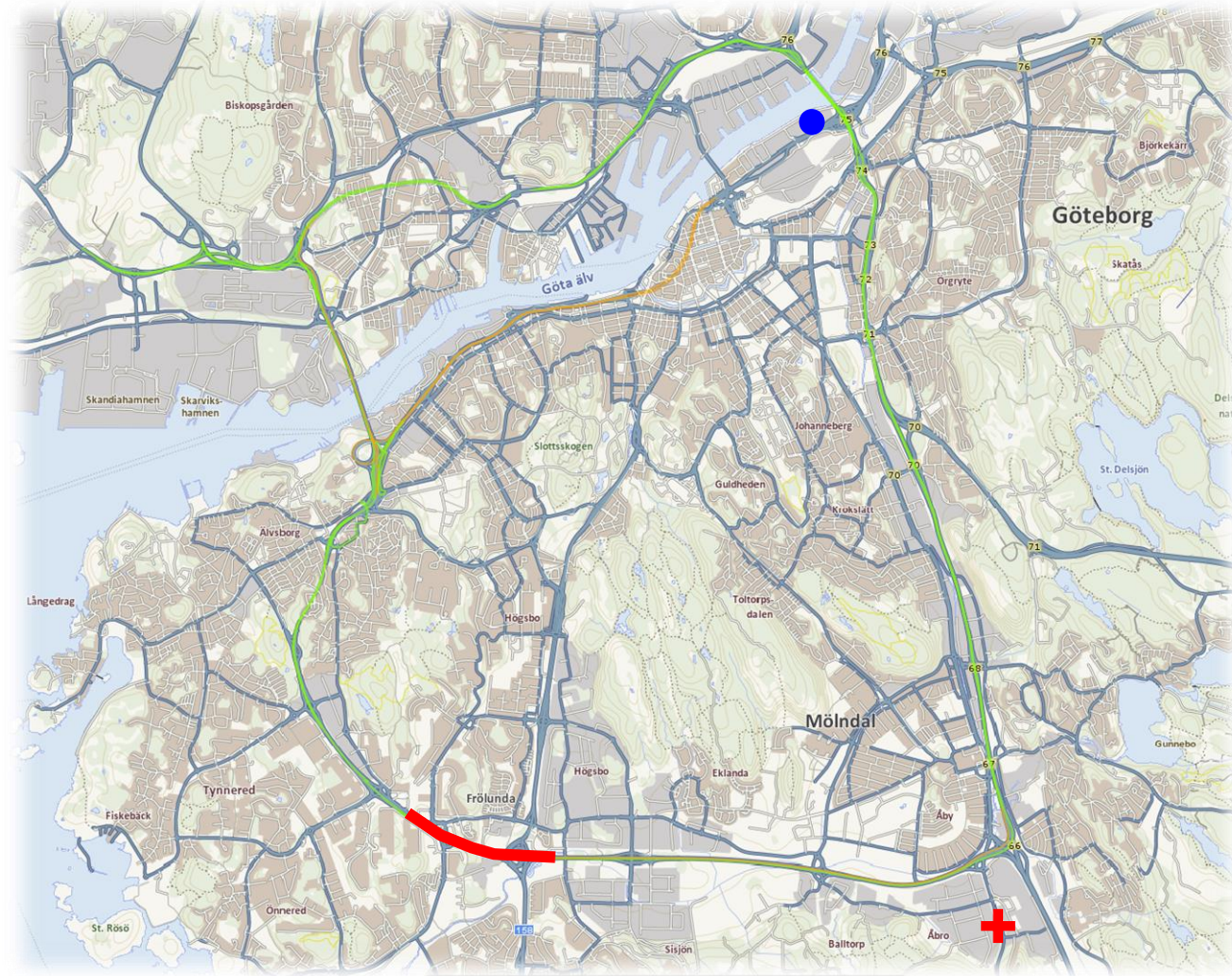# Emergency Situation Map - SOS Alarm System

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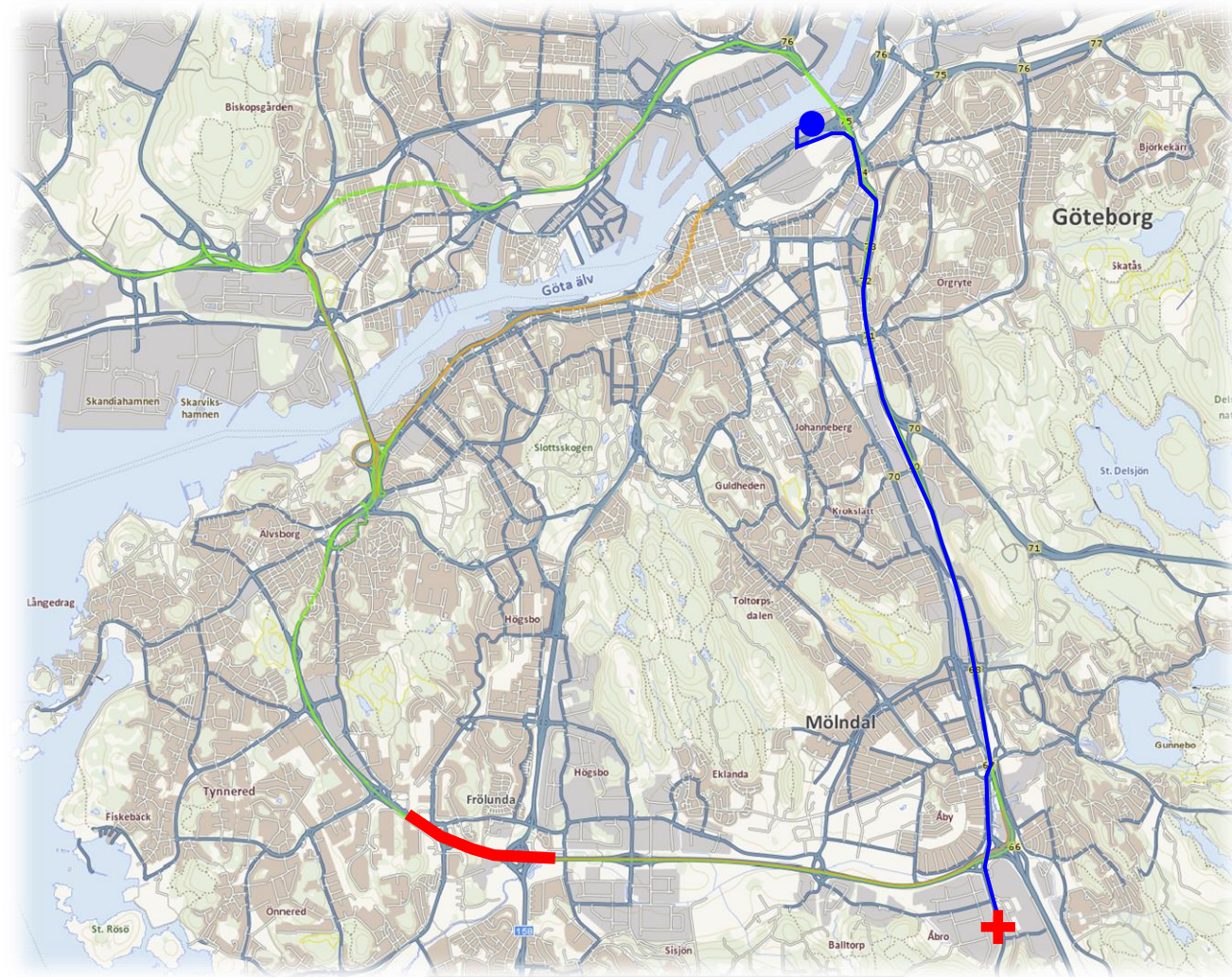Accidents are shown on map as they are handled by the system

An available emergency vehicle is assigned to the accident

Tracking the Emergency Vehicle – Carmenta TrafficWatch

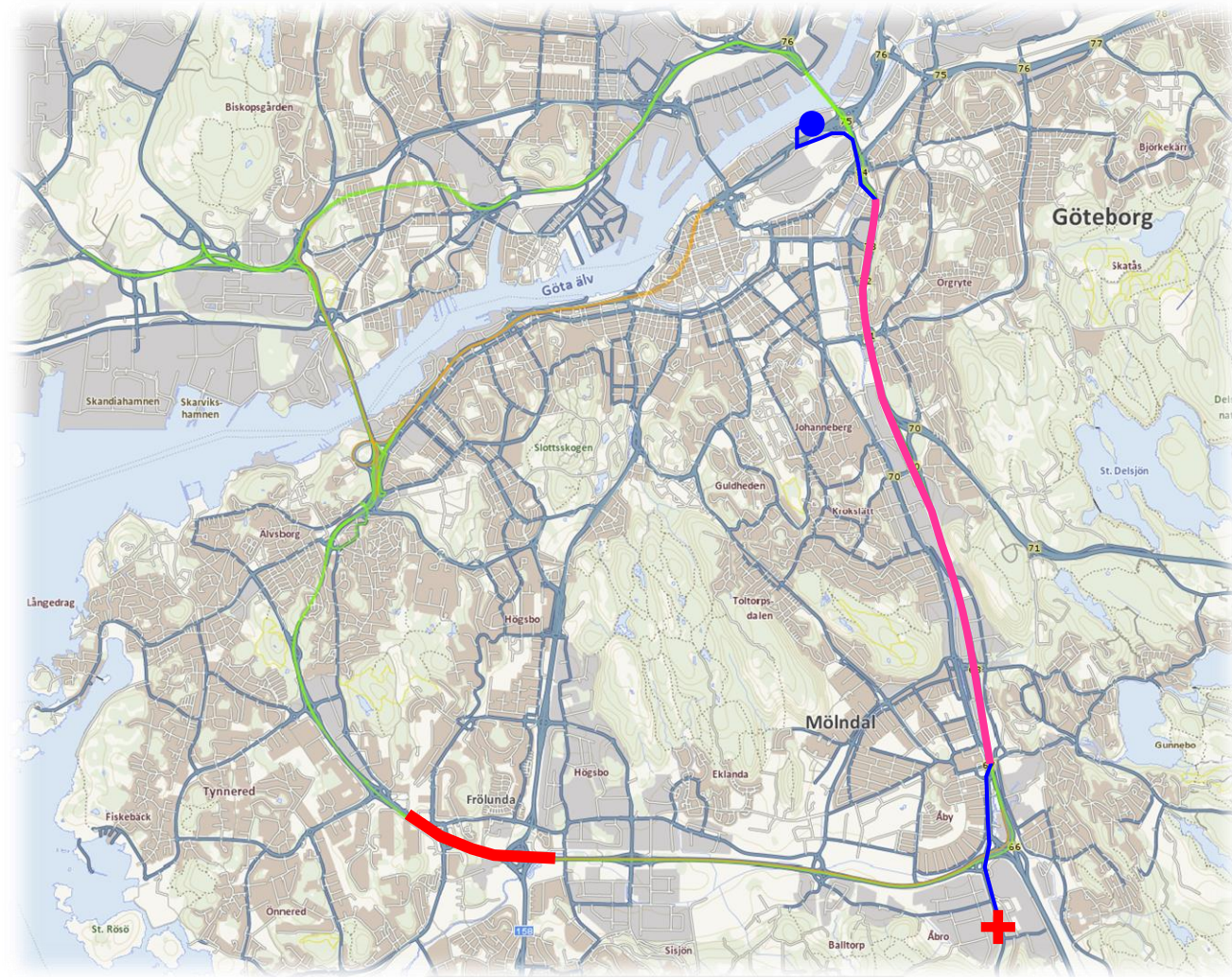Emergency Vehicle position and destination recieved from SOS Alarm

Tracking the Emergency Vehicle – Carmenta TrafficWatch

Emergency Vehicle position and Destination recieved from SOS Alarm

A Most Probable Path (MPP) for Emergency Vehicle is calculated

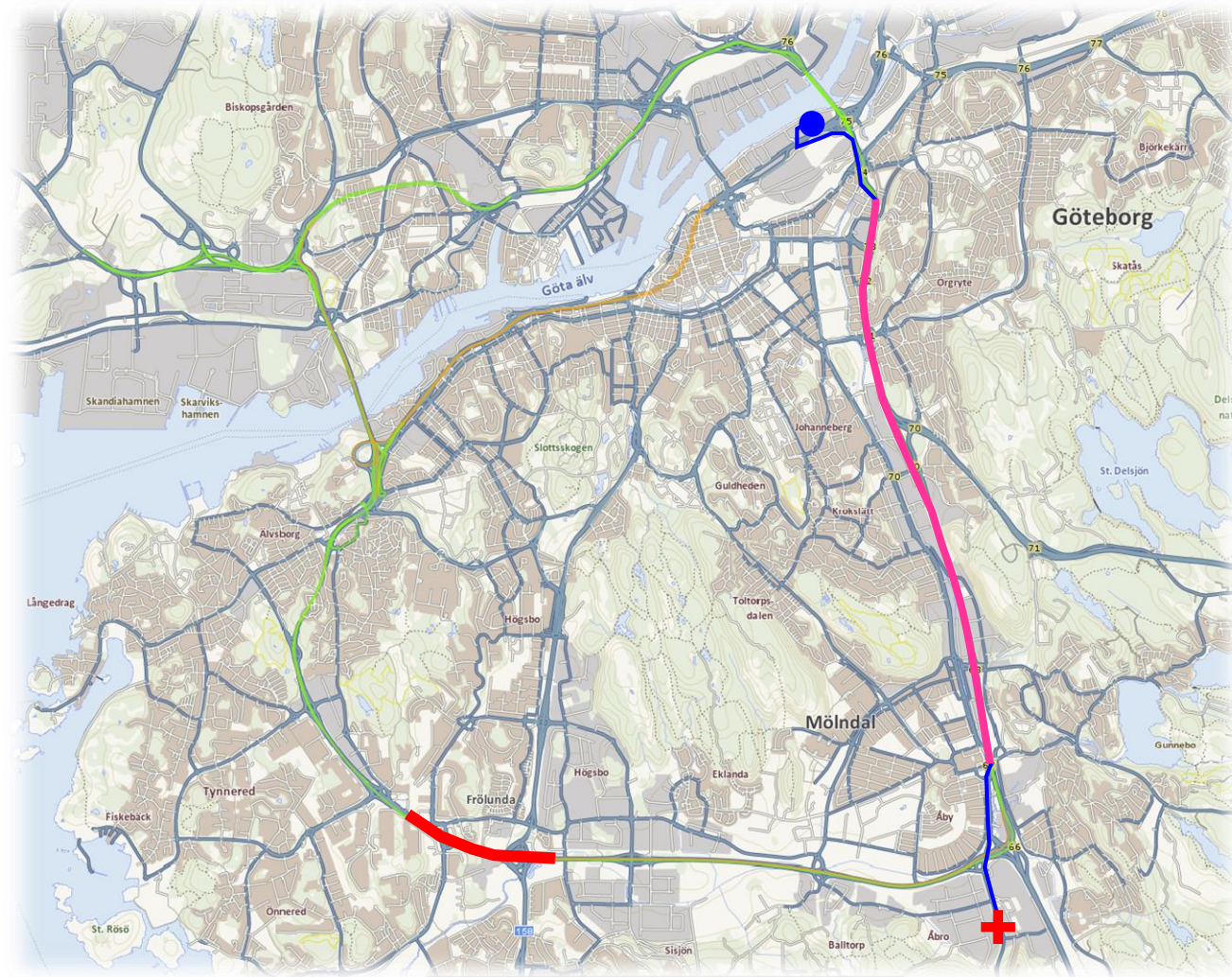# Tracking the Emergency Vehicle – Carmenta TrafficWatch

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An interference between Emergency Vehicle MPP and certified roads is detected

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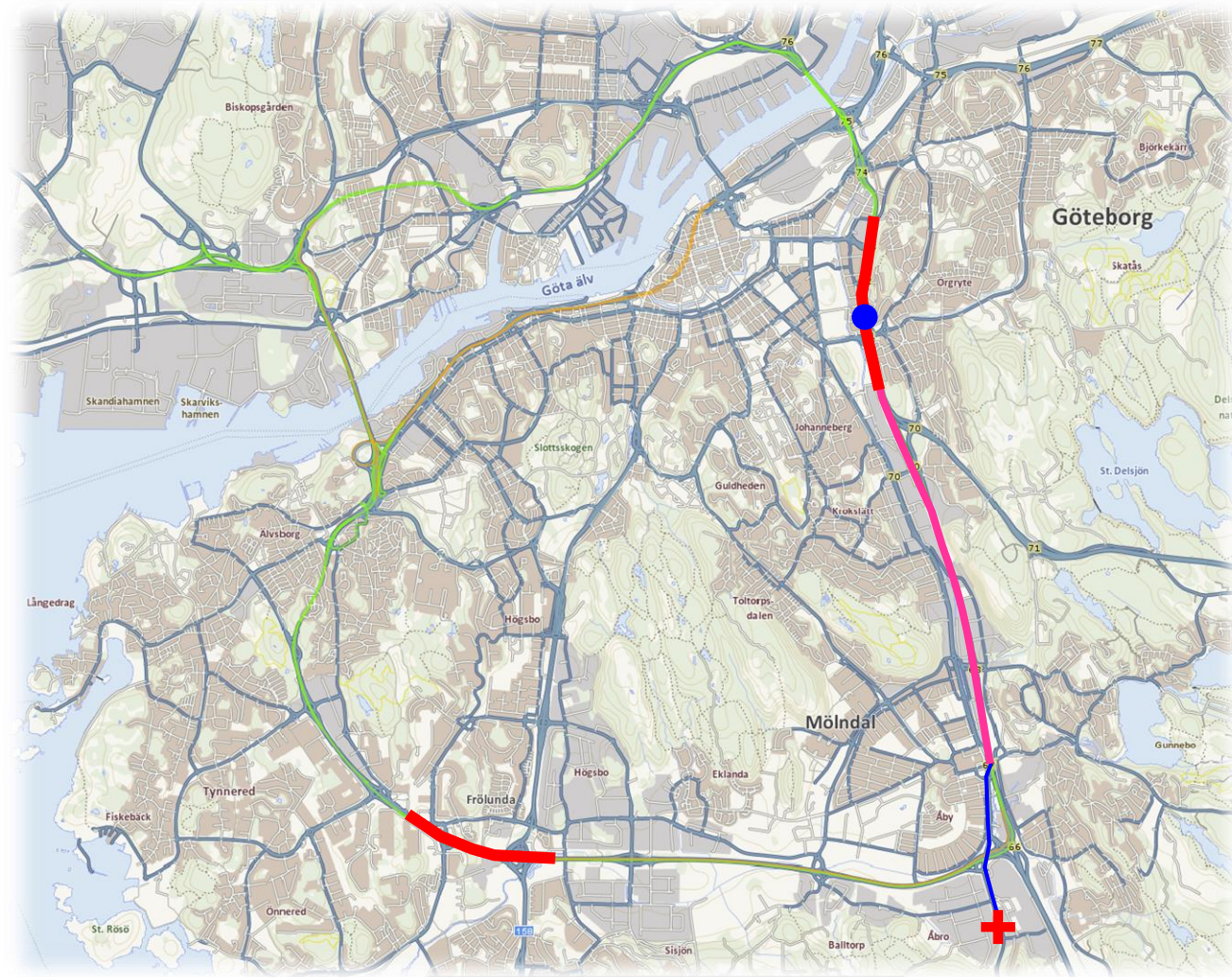Emergency Vehicle position and Destination recieved from SOS Alarm
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An AD Advice is sent to VCC

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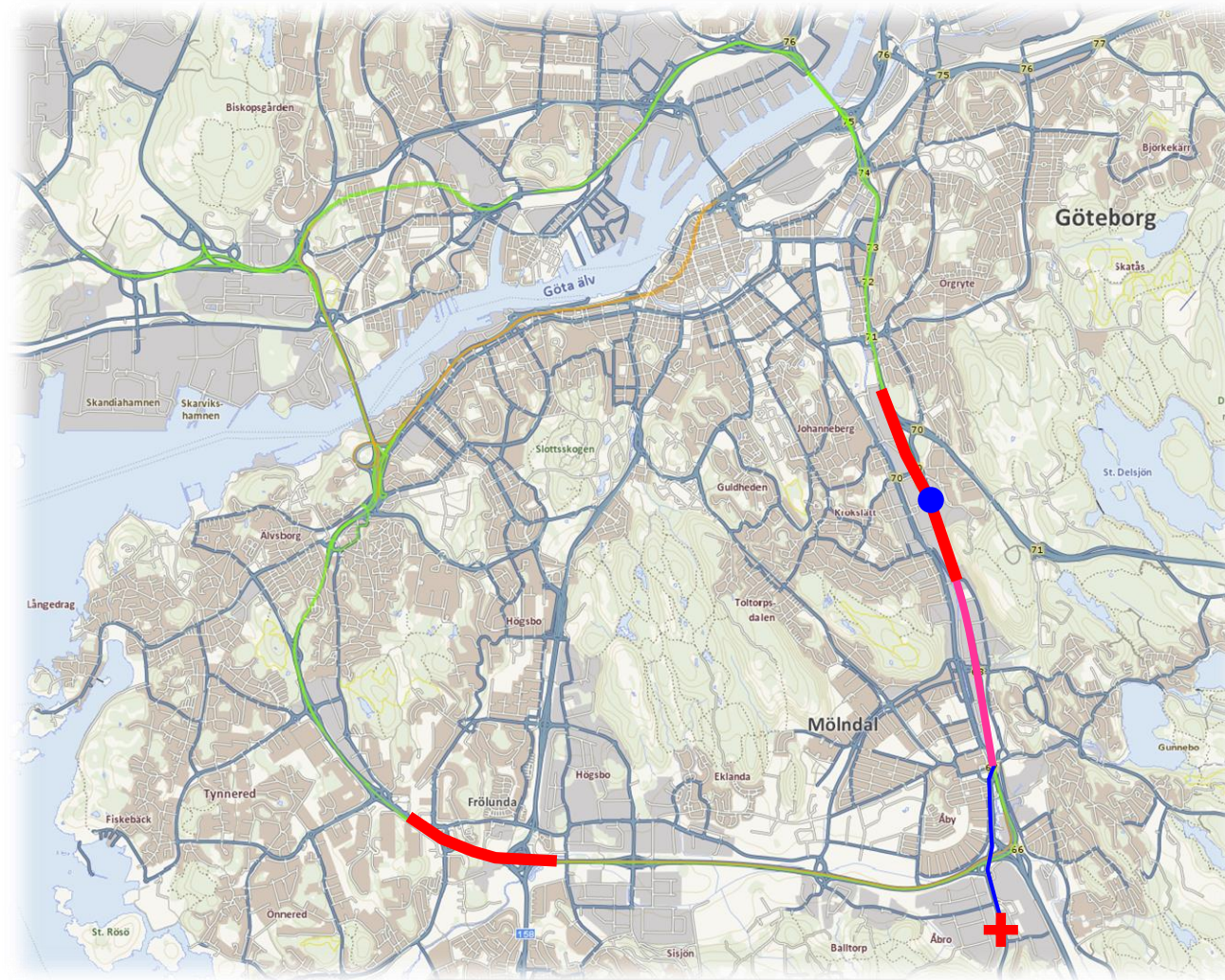Emergency Vehicle position and Destination recieved from SOS Alarm
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VCC disables the AD segment and the Emergency Vehicle is tracked as it follows the MPP

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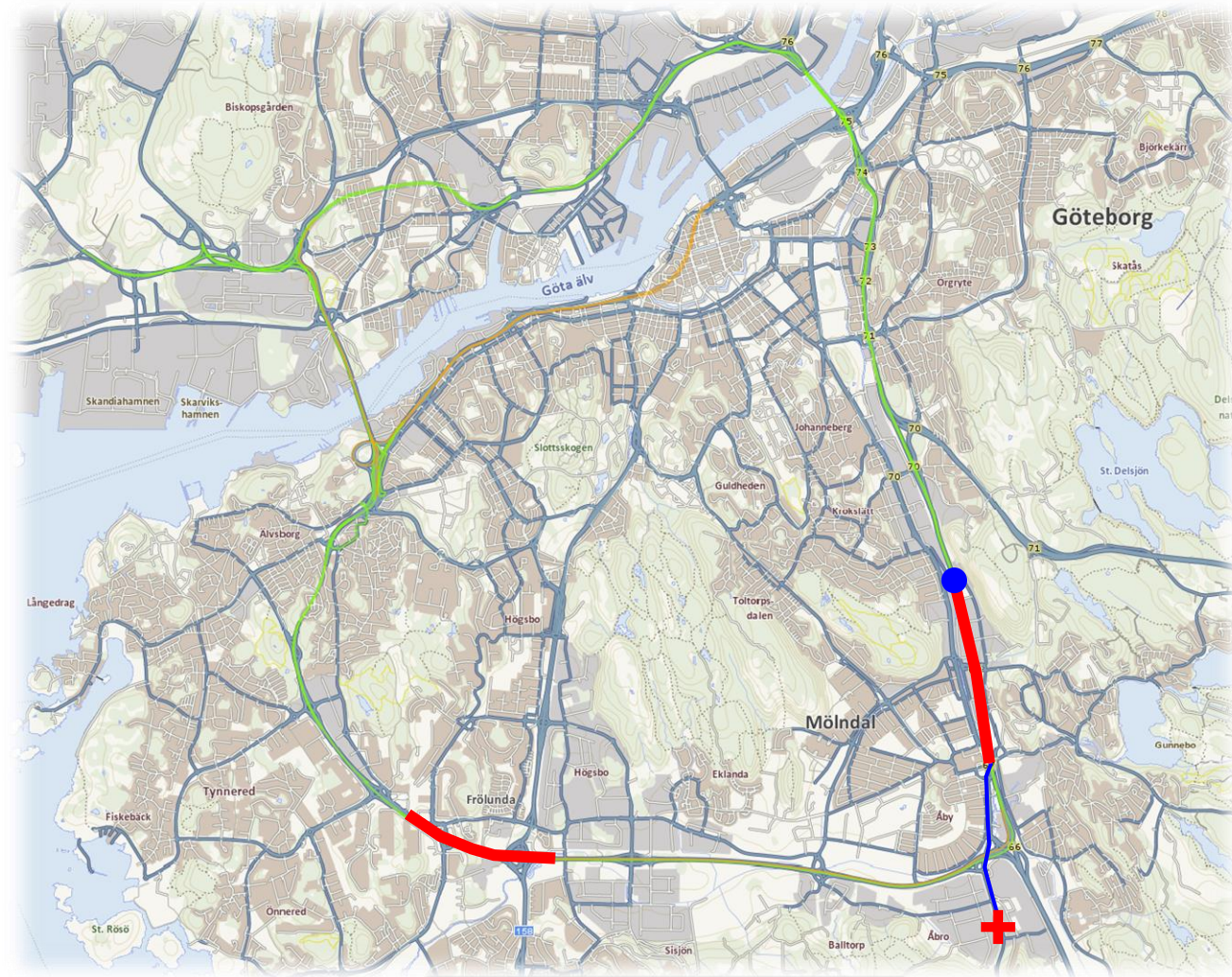Emergency Vehicle position and Destination recieved from SOS Alarm

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An AD Advice is sent to VCC

VCC disables the AD segment and the Emergency Vehicle is tracked as it follows the MPP

VCC enables AD on passed segments and disables segments in front

Tracking the Emergency Vehicle – Carmenta TrafficWatch

Emergency Vehicle position and Destination recieved from SOS Alarm
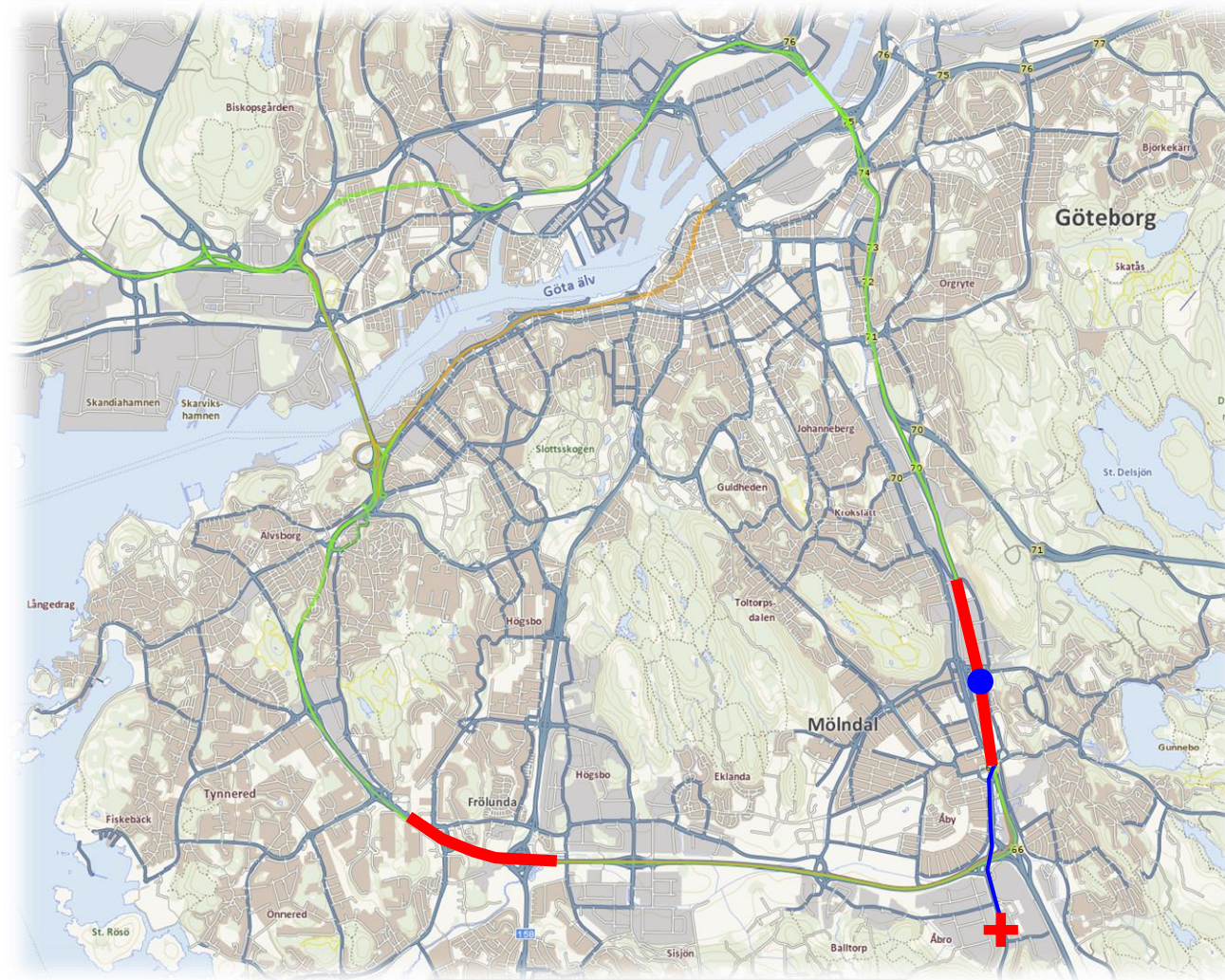A Most Probable Path (MPP) for Emergency Vehicle is calculated
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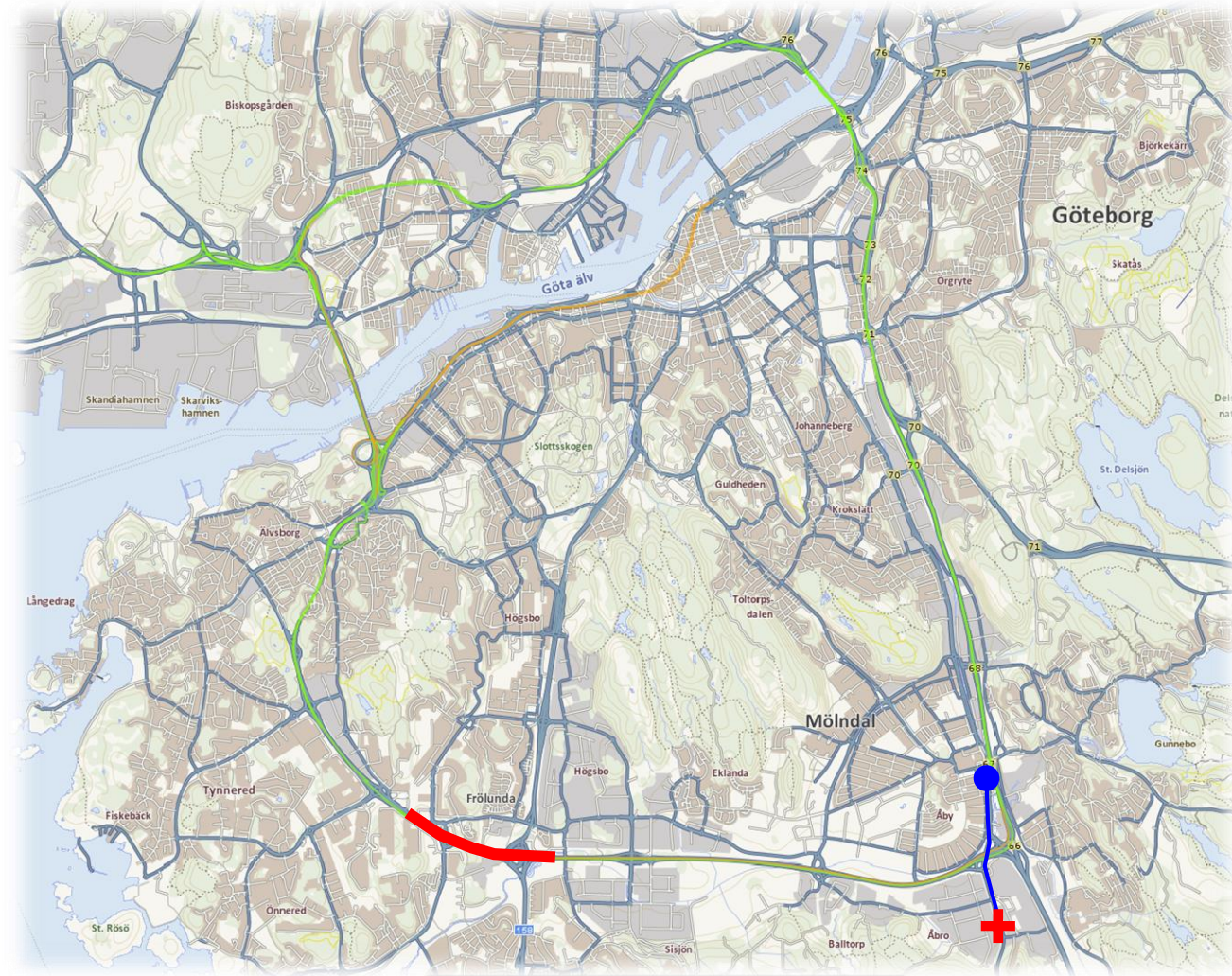A Most Probable Path (MPP) for Emergency Vehicle is calculated

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VCC disables the AD segment and the Emergency Vehicle is tracked as it follows the MPP

VCC enables AD on passed segments and disables segments in front

Emergency Vehicle leaves certified roads and the interference is over

Tracking the Emergency Vehicle – Carmenta TrafficWatch

Emergency Vehicle position and Destination recieved from SOS Alarm

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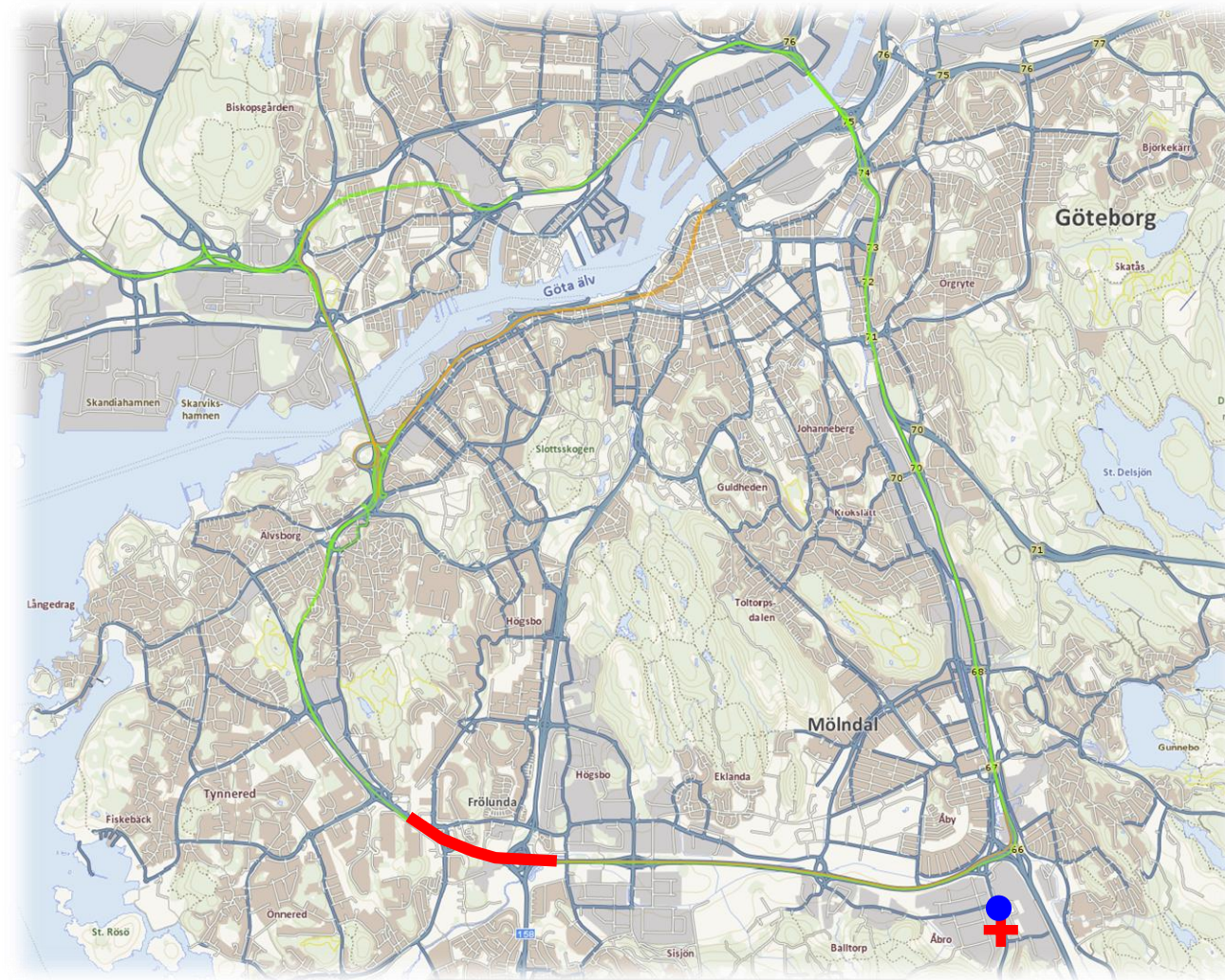
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VCC disables the AD segment and the Emergency Vehicle is tracked as it follows the MPP

VCC enables AD on passed segments and disables segments in front

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Demo

Project results, so far

Carmenta view

- Based on work done in first AD Aware project – re-using technology, successful integration of (existing) systems through innovation cloud

- Working solution based on fully automated decision support

- Tested "in the field"

- Safer operations through shared information.

Project results, so far

Volvo view

- A method to further understand how customers expect to interact with AD cars

- Design pattern applicable to any connected car within the Volvo range

- Enhances Volvo's focus on safety
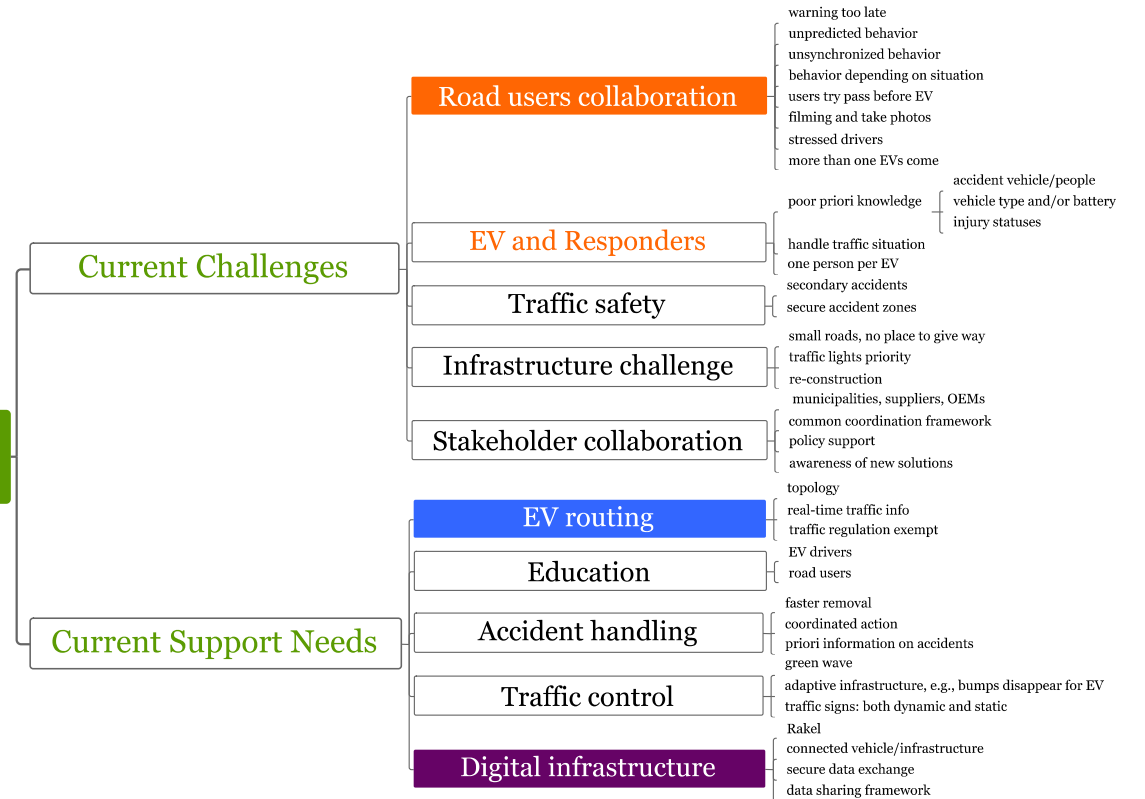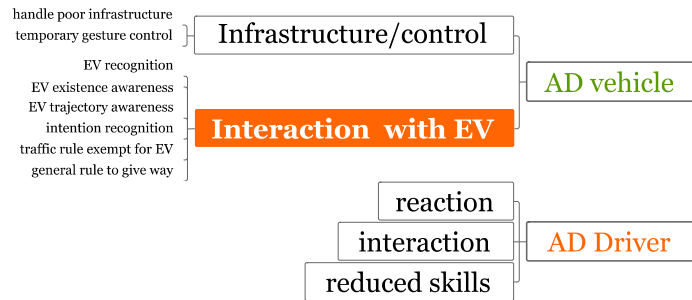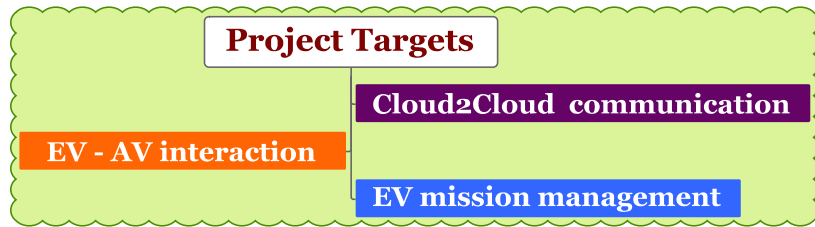
SOS Alarm's vision:
A safer Sweden for everyone

# Stakeholders interviewed

Expert Opinion

Addressing some of the key challenges and laying the technical foundations for further development of advanced emergency response solutions.

Key feedbacks

- Emergency services are rather optimized, but there may be differences between different municipalities, requiring coordinated efforts at different levels e.g., city, region, national.

- Better coordination and experience sharing between municipalities across Sweden is encouraged.

- Emergency services do not use much digital support today, thus are open to digitalization methods.

- Emergency services are positive to new connected and coordinated solutions, while requiring consideration of their specific needs at different stages of a mission.

- Data sharing could be a challenge and stakeholders are open for solutions.

- Service integration with consideration of human drivers(EV, AV and CV) is important and requires both technical deployment and public education

Technologies developed within the AD Aware Traffic Control could help to facilitate future enhancements of the emergency response in Sweden. Stakeholders are welcome and open for collaboration to drive the effort forward.

On-going system evaluation

MPP = Most Probable Path (of the emergency vehicle)
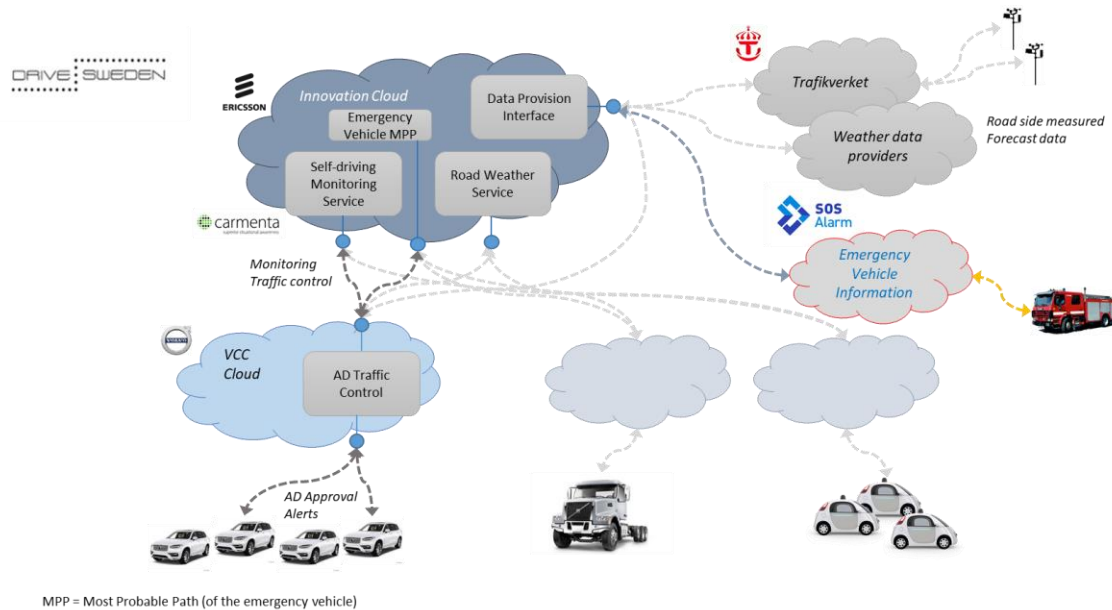
- Main system functionalities have been achieved and showcased with realistic demo occasions.

- System is expected to be online in parallel with Drive Me for realistic testing and data collection (Sep – Dec).

- System performance will be continuously analyzed for evaluation and further improvement.

- Continuous dialog with stakeholders on gap and impact analysis for fast system introduction.

Key evaluation areas

Functionality verification

- Central Traffic Cloud (CTC)
  - EV situational management
  - EV routing and Most Probable Path (MPP) prediction
  - EV/AV conflict analysis, advisory generation
  - EV/AV conflict warning and incident registration

- VCC cloud
  - AD vehicle management and status updating
  - Conflict analysis and warning to AD vehicles

- Cloud2Cloud Communication
  - SOS Alarm - CTC – VCC
  - Reliable message delivery
  - Secure EV information exchange

- Integrated system
  - Traffic control flow validation
  - DATEX II for message exchange

Performance

- Effectiveness
  - MPP
  - AD advisory

- Responsiveness (e.g., latency)
  - Communication
  - Processing and decision

Impacts

- Stakeholders
  - Suitability and adaptability
  - Needs and requirements

- Traffic and drivers
  - EV/AV/Normal drivers
  - Traffic safety effects

Conclusions

- Delivered a platform prototype for
  - Cloud2Cloud communication among stakeholders
    - Secure and reliable message delivery
  - AD Aware traffic control
    - Traffic situation aggregation with real-time traffic information, weather, and emergency vehicles
    - Path prediction with most probable path (MPP)
    - Conflict detection of MPP and Autonomous vehicles
    - Interaction between emergency vehicles and autonomous vehicles for early reaction
- Identified key factors and challenges for future emergency response
  - Stakeholders requirements, individual needs, and coordination gaps
  - Potential of emerging technologies, e.g., connected automated vehicles, infrastructure, and intelligence, for emergency response
  - Gaps and actions for emergency response

Next Steps

Near future

- Continuous technical development
  - Prove system performance
  - Improvement based on feedbacks
  - Larger scale pilot, e.g., Nordic Way 2

- Including human in the loop
  - Drive Me as a platform for evaluation
  - EV and AV drivers

Long-term

- System extension and advancement
  - AV and EV interaction
  - Integrating with connected vehicles and infrastructure
  - More OEMs
  - Part of the emerging C-ITS services
  - Additional functionalities and intelligence

- Stakeholder collaboration
  - Regional emergency response system
  - National common policy and platform
  - Data sharing and regulation
  - Public and authority readiness

- Holistic and integrated system

Questions and Answers

We will now have a general Q & A session.

Thank you for participating.