

Issue 4/March 2026

Weather Aware X-in-the-Loop: Testing Automated Driving in Extreme Conditions

p. 3

Demonstration 4: Heavy-Duty Autonomous Driving in Action

p. 5

ROADVIEW webinar: X-in-the-Loop

p. 8

Welcome to the ROADVIEW Newsletter, Issue 4

Dear Reader,

Welcome to the fourth edition of the ROADVIEW newsletter. In this issue, we present two major milestones that demonstrate the maturity and real-world relevance of the ROADVIEW ecosystem. We begin with the successful demonstration of the Weather Aware X-in-the-Loop test system, a fully integrated validation environment that brings extreme weather conditions into the laboratory. This achievement marks a significant step towards robust, repeatable and safe testing of automated driving functions under adverse environmental conditions.

Next, we report on Demonstration 4, where ROADVIEW technologies were validated on a heavy-duty FORD F-Max truck at a closed highway test track in Turkey. The demonstration showcased the harmonisation of perception, sensor fusion, HD mapping, V2X communication and weather-conditional decision-making within a unified automated driving architecture. The results confirm that the ROADVIEW approach is scalable and applicable beyond passenger vehicles, addressing the specific challenges of autonomous heavy-duty transport.

Finally, we invite you to join our upcoming ROADVIEW webinar on X-in-the-Loop technologies, taking place on 17 April 2026. Leading experts from research and industry will discuss weather-aware validation environments, next-generation XiL test benches and AI-based virtual validation and homologation for future AD/ADAS systems.

We hope you enjoy this edition and look forward to your participation in the webinar.

We hope you enjoy the read!
accelopment on behalf of the project consortium



Weather Aware X-in-the-Loop: Testing Automated Driving in Extreme Conditions

At the end of 2025, ROADVIEW successfully demonstrated its fully integrated Weather Aware X-in-the-Loop test system — a major step towards making automated driving safer in extreme weather conditions.

Automated vehicles rely on sensors such as cameras, radars and lidars (laser-based sensors that measure distance) to understand their surroundings. These sensors act as the vehicle's "eyes", observing lane markings, other vehicles, pedestrians and obstacles. The information they collect is sent to the vehicle's control unit — the car's "brain". This central computer interprets images and three-dimensional data from the sensors and then sends commands back to the vehicle, instructing it how to steer, brake or accelerate.

Much of this process depends on artificial intelligence (AI). AI systems learn from large amounts of data and help the vehicle recognise objects and situations. Because these systems make safety-critical decisions, they require extensive testing to ensure they behave reliably under all conditions.

In clear weather, today's automated systems often perform well. However, just as human drivers can struggle in heavy rain, dense fog or snow, automated vehicles also

face difficulties. Rain can blur camera images, fog can reduce visibility, and snow can alter how sensors perceive the road. Testing the limits of these systems is essential to define the conditions under which automated driving can operate safely.

Testing such extreme and unpredictable weather situations on real roads is difficult, costly and sometimes unsafe. The Weather Aware X-in-the-Loop test system addresses this challenge by bringing extreme weather into the laboratory.

The idea behind "X-in-the-Loop" can be explained with a simple comparison. Imagine a pedestrian wearing virtual reality (VR) glasses. Although the person is physically standing in a room, the glasses display a digital world — perhaps a busy city street. The pedestrian sees virtual cars or obstacles and reacts to them as if they were real.

The X-in-the-Loop principle works in much the same way. The "X" is a placeholder and can represent different real components: for example, the vehicle's control unit — its "brain" — or even a complete vehicle. "In-the-Loop" means that this real component is connected to a virtual driving environment. Like the pedestrian wearing VR glasses, the real

hardware or vehicle perceives virtual traffic, roads and weather conditions – and reacts to them in real time. From its perspective, the digital world feels real.

Outcomes of Demonstration 3

During the demonstration, both individual electronic systems and entire vehicles were placed “in the loop”. This enabled engineers to evaluate how the vehicle’s perception systems – its ability to detect and interpret its environment – respond when exposed to simulated rain, fog and snow.

One of the highlights was the virtualisation of four real test tracks in France, Germany, Turkey and Finland. These proving grounds were digitally recreated in detail, making it possible to test vehicles across Europe from a single laboratory. The vehicle’s sensors were carefully modelled in the simulation, and disturbances caused by adverse weather – originally measured in real-world conditions – were incorporated into these models. This allows the system to realistically reproduce how poor weather affects what the vehicle “sees”.

Scientific Relevance of Demonstration 3

The advantages are clear. Extreme and potentially dangerous weather situations can now be reproduced safely and repeatedly. Engineers can systematically analyse how automated driving systems respond to sudden heavy rain or dense fog, identify weaknesses and improve performance – without waiting for the next storm.

With this successful demonstration, ROADVIEW shows how advanced laboratory testing can help automated vehicles prepare for real-world challenges. By combining real components with a virtual environment, the project brings extreme weather into the laboratory and moves one step closer to safer automated mobility.



Figure 1. (From top to bottom) Digital Twins of CEREMA Weather Chamber (France), CARISSMA Test Track (Germany), Lapland Proving Ground (Finland) and Public Highway (Turkey)

Useful link:

- **Demonstration 3 video:**
[Click here](#) to watch the demo 3 video: Weather-Aware XiL Test Environment

Demonstration 4: Heavy-Duty Autonomous Driving in Action

Moving from simulation to the real road is the ultimate test for any autonomous driving technology. The stakes rise dramatically when the platform is not a compact vehicle, but a highway-scale heavy-duty truck, a multi-axle system carrying immense mass and responsibility. In late summer 2025, the ROADVIEW project took a major leap forward with Demonstration 4, conducted at a closed highway test track near Istanbul Airport, Turkey.

Led by Ford Otomotiv Sanayi A.S. (FORD), this demonstration focused on validating the integration of the project's diverse technologies onto the FORD F-Max platform. The primary goal was to prove that complex perception, mapping, and decision-making systems could work in harmony to control a massive vehicle at highway speeds, bridging the gap between virtual development and real-world deployment.

To navigate safely, the truck was equipped with a comprehensive, heterogeneous sensor suite designed to eliminate the massive blind spots inherent to heavy vehicles. The configuration included long-range and short-range LiDARs to capture high-fidelity 3D geometry up to 200 meters ahead while covering the near-field environment. These were complemented by radars to ensure resilient tracking of surrounding vehicles even in adverse conditions and surround cameras to provide a semantic understanding of traffic objects. Finally, a high-grade GNSS/IMU system was employed to ensure centimetre-level localization accuracy.



Figure 1. Demonstration vehicle - FORD F-Max is on the test track

Outcomes of Demonstration 4

Demo 4 resulted in the successful harmonization of hardware and software modules from multiple partners into a unified automated driving architecture. The demonstration showcased how these technologies handle core highway functions.

Halmstad University (HH) validated the 3D-OutDet module directly on the vehicle. This novel AI-based filter acts like noise-canceling headphones for the truck's eyes, removing data artifacts caused by rain or snow in real time while preserving critical roadway elements such as lane boundaries, road edges, and safety barriers.

Building on this, FORD demonstrated a robust sensor fusion and object detection framework that unifies these diverse data streams. The system seamlessly integrates 2D detections from the camera suite with depth information from the LiDAR point clouds. By cross-referencing these inputs in real-time, the fusion engine assigns unique track IDs to surrounding vehicles and obstacles. This allows the truck to maintain a stable,

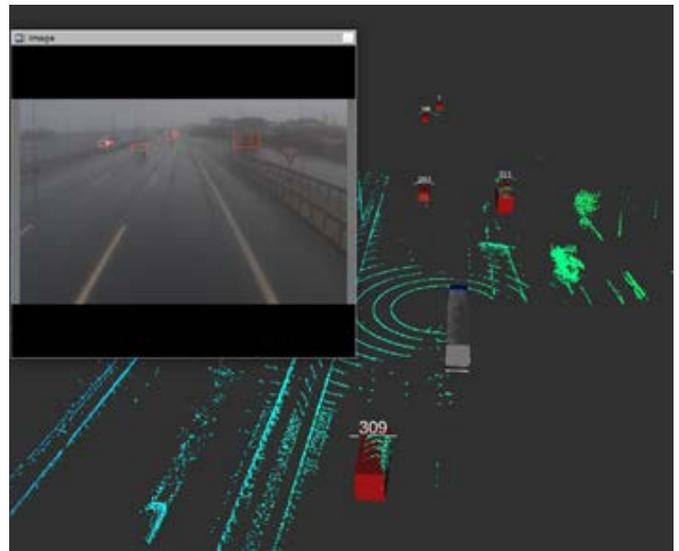


Figure 3. FORD's sensor fusion and object detection framework output

continuous understanding of dynamic objects and their trajectories, ensuring reliable situational awareness even in complex traffic environments.

The Finnish Geospatial Research Institute (FGI) demonstrated an Environment-Aware High-Definition (HD) Mapping solution. Unlike traditional maps that require massive data storage, this approach compressed map data by approximately 70% while maintaining centimetre-level positioning accuracy, enabling the F-Max to execute precise lane-keeping manoeuvres.

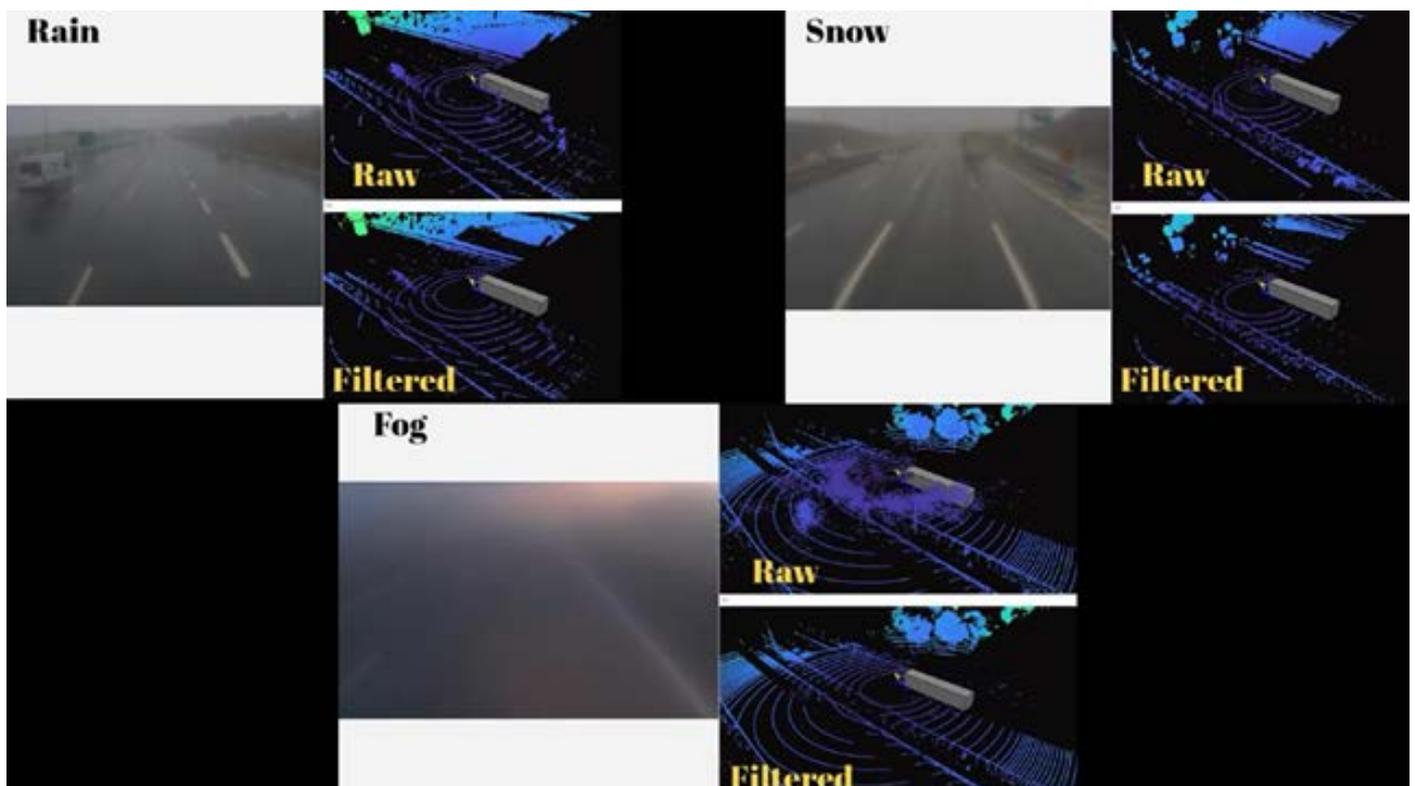


Figure 2. 3D-OutDet on recorded highway traffic data in adverse weather conditions



Figure 4. Mapping of the test track and localization of the demo 4 vehicle

Canon Research Centre France (CRF) and FORD showcased the power of V2X (Vehicle-to-Everything) communication at toll gates. Roadside sensors transmitted real-time occupancy data to the truck, enabling it to identify the least congested lanes well in advance. By guiding the heavy vehicle to the most available gate, the system optimizes traffic flow, reducing bottlenecks, and ensuring a more efficient passage through critical infrastructure.

Finally, VTT Technical Research Centre of Finland Ltd (VTT) integrated a weather-conditional decision maker. Although the track conditions were dry, the team injected simulated data representing severe icy roads. Reacting to this virtual storm, the system successfully triggered a Minimal Risk Manoeuvre (MRM), autonomously slowing the truck, navigating it to the emergency lane, and bringing it to a safe stop.

Secondly, the demonstration proves that map efficiency does not require compromising localization precision, a critical factor for trucks traversing vast highway networks.

Thirdly, the demonstration established the operational safety of the “Minimal Risk Manoeuvre” for heavy vehicles. By proving that the FORD F-Max can autonomously transition from a standard cruising state to a degraded safety mode (pulling over and stopping) when weather conditions exceed its capabilities, the project validated a fundamental safety requirement for a high-level autonomy.

Furthermore, the integration of V2X for toll gate negotiation highlights that infrastructure connectivity is not merely an auxiliary feature, but a requirement for ensuring smooth and energy-efficient approaches to complex static bottlenecks. Collectively, these advancements confirm that the ROADVIEW ecosystem is robust enough to handle the physical realities of heavy-duty trucking, setting the stage for the next validation in the Arctic conditions of Finnish Lapland.

Scientific Relevance of Demonstration 4

The validation of these systems on a heavy-duty platform offers significant insights for the future of logistics and automated transport. Firstly, the integration of the 3D-OutDet algorithm highlights a crucial pathway for enhancing perception integrity in adverse weather. By employing advanced filtering strategies to distinguish real obstacles from volumetric environmental noise (such as rain or snow), the project demonstrates a vital mechanism for preventing dangerous phantom braking events.

Useful link:

- **Demonstration 4 - Playlist:**
[Click here](#) to watch all full videos from the ROADVIEW's demo 4.

ROADVIEW webinar: X-in-the-Loop

How can automated driving systems be validated reliably under adverse weather conditions? What role does X-in-the-Loop (XiL) testing play in ensuring robust perception and decision-making? And how can AI enhance virtual validation and homologation processes for future AD/ADAS systems?

If you are interested in exploring these questions, then join the next ROADVIEW webinar dedicated to [X-in-the-Loop](#) technologies. We are pleased to announce that the webinar will feature leading experts from industry and research:

- **Assoc. Prof. Eren Erdal Aksoy**, Associate Professor at the School of Information Technology of the Halmstadt University and Coordinator of the ROADVIEW project. He will guide the audience through the event and introduce the ROADVIEW project as well as the webinar series.
- **Jinjong Lee**, Head of Techways Europe Tech-Lab, who will speak about the Future of XiL test benches, focusing on standalone HILS I/O solutions and AI-driven testcase automation toolchains for next-generation validation environments.
- **Prof. Dr.-Ing. habil. Reza Rezaei**, Manager Modeling & Simulation | Intelligent Perception Functions at IAV and Adjunct Professor at the University of Alberta, who will address AI-based Virtual Validation and Homologation for Future AD/ADAS Systems.
- **Dr. Dai Araki**, Chief Specialist, Dr. Eng., Digital Engineering Center, Toshiba Digital Solutions Corporation, who will co-present on AI-based Virtual Validation and Homologation for Future AD/ADAS Systems.
- **Maikol Drechsler**, Simulation Validation Engineer at CARISSMA Institute of Automated Driving, who will present the ROADVIEW Weather Aware X-in-the-Loop test environment.



The event will take place on the
17th April 2026 from 10:00 to 11:30 CEST.

[Register here](#)

Webinar programme

Welcome and general introduction to the ROADVIEW Webinar series

Future of XiL test benches: Standalone HILS I/O Solutions and Testcase Automation Toolchains with AI

AI-based Virtual Validation and Homologation for Future AD/ADAS Systems

ROADVIEW Weather Aware X-in-the-Loop test environment

Q&A Session

Interested in ROADVIEW webinars?



Scan the QR Code or [click here](#) to learn more and register or contact us

Julia Goetz, Communication and dissemination lead, accelopment Schweiz AG
jgoetz@accelopment.com

Eren Erdal Aksoy, ROADVIEW coordinator, Halmstad University
eren.aksoy@hh.se



ROADVIEW

Robust Automated Driving in Extreme Weather



roadview-project.eu



Co-funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or European Climate, Infrastructure and Environment Executive Agency (CINEA). Neither the European Union nor the granting authority can be held responsible for them. Project grant no. 101069576.

UK participants in this project are co-funded by Innovate UK under contract no.10045139. Swiss participants in this project are co-funded by the Swiss State Secretariat for Education, Research and Innovation (SERI) under contract no. 22.00123.