HEAVY-VEHICLE CASES (HVC)

From real-world heavy-vehicle operations to structured scenarios for testing and validation
Heavy-Vehicle Cases (HVC) is an *early-stage project exploring how real-world operational experience from professional heavy-vehicle driving can be transformed into structured scenarios that may support ADAS/ADS testing, validation and research.*

The idea began to take shape after attending Automotive Testing Expo Europe in Stuttgart and speaking with professionals working across automotive testing, vehicle development and automated driving.

These conversations raised a simple question:
How much valuable operational knowledge from professional drivers never reaches the people developing and testing automated vehicle systems?

Professional drivers encounter unusual, complex and safety-relevant situations every day. Many of these events never become accidents, incident reports or formal datasets. The driver recognizes an emerging risk, anticipates what may happen next and adapts before the situation develops into an incident.
As a result, potentially valuable information about these situations can remain largely invisible outside the transport industry.
HVC aims to capture that knowledge and explore how it can be translated into a form useful for engineering.

WHERE RISKS EMERGE

Heavy-vehicle situations rarely result from one isolated factor.
HVC currently considers three primary risk domains:

ENVIRONMENT

Road geometry, weather, infrastructure, visibility, traffic conditions and other road users.

HUMAN & OPERATIONAL

Driver behaviour, operational decisions, cargo handling, inspections, loading processes and human intervention.

VEHICLE & TECHNOLOGY

Vehicle and trailer dynamics, component failures, sensors, perception, ADAS/ADS behaviour and technical limitations.
The most interesting cases often emerge at the intersection of these domains.

For example, a secured component or part of a load may become loose during a long journey.

Wind, vehicle movement, securing conditions and the absence or presence of periodic human inspection can gradually combine into a serious road hazard.

In another situation, a passenger car may accelerate past a heavy vehicle already using a motorway acceleration lane and cut directly into motorway traffic in front of another truck. Road geometry, the behaviour of several road users, limited acceleration capability and the dynamics of heavy vehicles combine within only a few seconds.

Individually, these factors may appear manageable.

Together, they create compound risk.

FROM A REAL EVENT TO A VALIDATION SCENARIO

The starting point of HVC is not a synthetic scenario.

It is a real event, observation or operational problem.

The proposed process is:

1. Observe

Capture a real-world event or recurring operational situation involving a heavy vehicle.

2. Describe

Document the environment, vehicles, actors, sequence of events, driver observations, early warning cues and operational context.

3. Structure

Classify the case according to its primary risk domain, contributing domains and scenario tags.

4. Analyse

Identify the relationships between environmental, human/operational and vehicle/technology factors.

5. Translate

With AI-assisted structuring and input from testing and validation specialists, convert the operational case into a more systematic scenario description.

6. Verify

Review the scenario with relevant domain specialists before it is considered suitable for engineering use.

7. Apply

Explore its use in simulation, scenario-based testing, validation, research or training.
AI is therefore intended as an assistant for classification, structuring and knowledge organisation — not as the final authority. Human verification remains an essential part of the concept.

WHY REAL-WORLD DRIVER KNOWLEDGE MATTERS

Professional drivers do considerably more than control a vehicle.

They continuously interpret weak signals: the behaviour of surrounding traffic, road geometry, wind, trailer response, unusual sounds or movement, cargo condition, infrastructure and changes in vehicle behaviour.

They also perform operational tasks outside the driving function itself — including visual inspections of the truck, trailer and load.

Much of this knowledge is experiential and rarely documented in a structured form.

As automated driving develops, an important question therefore becomes:

What operational knowledge must not disappear when the human leaves the cab?

HVC explores whether part of this knowledge can be captured before it is lost and translated into scenarios that engineers can work with.

WHO COULD USE HVC?

The primary potential users are:

OEMs and Tier-1 suppliers — additional real-world heavy-vehicle scenarios for development and validation.

ADAS/ADS testing and validation teams — operational cases that can complement existing scenario sources.

Simulation and scenario-development teams — structured real-world situations that may be translated into virtual testing environments.

Research organisations — access to operational observations and less-visible heavy-vehicle risk patterns.

In the future, selected cases could also support professional driver training and Code 95 education, particularly for rare or difficult situations that are hard to reproduce safely in training.

MVP

The first practical version of HVC is intended to be a curated and searchable case library.

Each case could contain:

Real event → Operational context → Early cues → Risk factors → Driver response → System perspective → Structured scenario

Cases would be classified by risk domains and scenario tags, allowing users to search for relevant operational situations.

The initial objective is deliberately limited: not to build another complete testing platform, but to determine whether real-world heavy-vehicle operational knowledge can provide useful input to existing testing, validation and research workflows.

POTENTIAL VALUE

HVC could complement established scenario-based approaches rather than compete with them.

Its proposed value lies primarily in its starting point:

the everyday operational reality of heavy vehicles.

Many situations are known intuitively to experienced drivers but may be difficult to discover through accident databases, conventional datasets or purely synthetic scenario generation.

HVC aims to make some of this knowledge visible, structured and accessible.

BUSINESS MODEL

The concept is still being validated.
Possible future models include:

SaaS access to the case library, enterprise licensing, pilot projects, custom scenario research and, later, selected training applications.

At this stage, however, validating the usefulness of the underlying information is more important than fixing the final commercial model.

VISION

The long-term vision is to create a bridge between:

drivers who experience complex heavy-vehicle situations in the real world

and

engineers who develop, test and validate the systems expected to handle them.

HVC already has the first part of that equation:

real-world heavy-vehicle experience and a growing collection of cases.

The next step requires stronger input from the technological side.

I am therefore particularly interested in connecting with ADAS/ADS developers, testing and validation engineers, simulation specialists and researchers who can help answer questions such as:

Which information from a driver's observation is technically relevant? How should it be represented? Which parameters are required to transform an operational case into a useful test scenario? And how can these scenarios complement existing validation methodologies?

The goal is not to replace established engineering approaches.

It is to bring another source of knowledge into them.

Real roads. Real operations. Structured knowledge for better testing.