SAFETY, SIMULATION AND DATA

Mili Naik, Zenzic
Michael Orgill, Horiba Mira
Jason Zhang, Warwick Manufactuing Group

MIRA
A HORIBA COMPANY

MIDLANDS FUTURE MOBILITY

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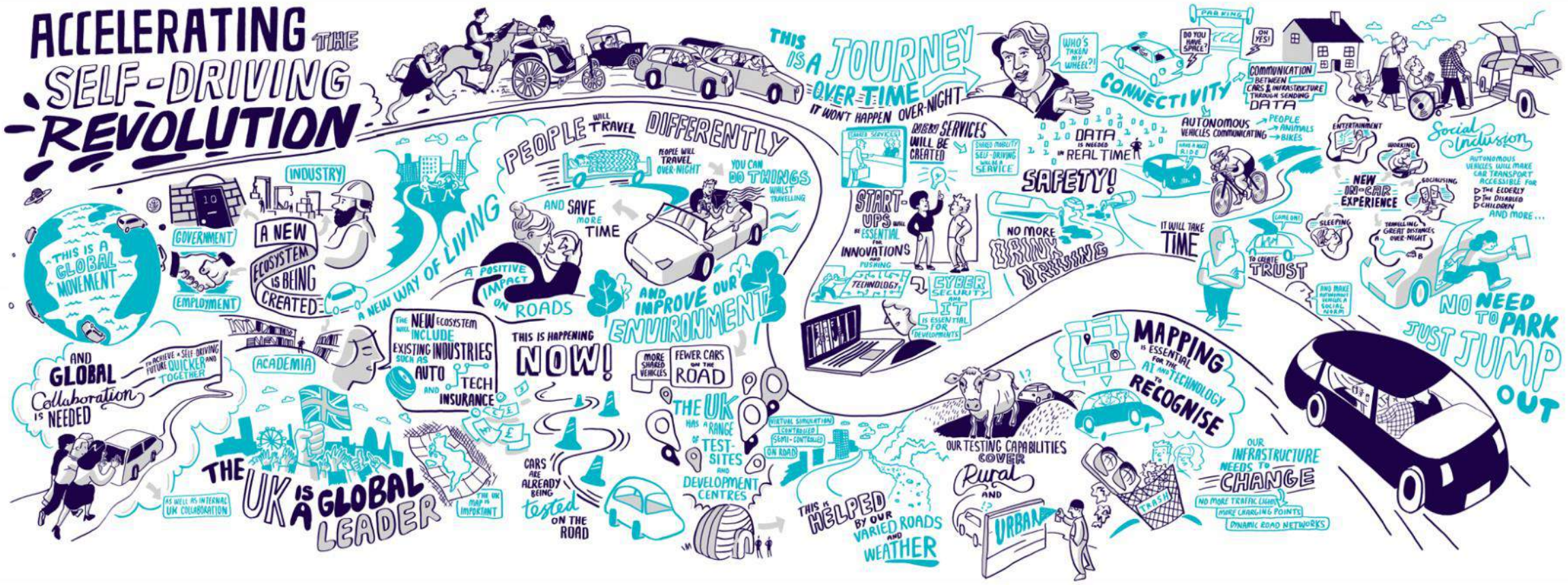

Centre for Connected & Autonomous Vehicles

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UK CAM Roadmap to 2035: Infrastructure & Data Services

Mili Naik

Technical Delivery Lead


ZENZIC
UK CAM Roadmap to 2035 – Infrastructure and Data Services
April 2024
zenzic.io
United Kingdom

WHY? WHAT? HOW?

WHY?

- Build Trust & Confidence
- Build the UK CAM Supply Chain
- Developing and maintaining skills in the UK

WHY?

01 Real-time decision making

02 Vehicle-to-Vehicle (V2V) and Vehicle-to-Infrastructure (V2I) communication

03 Mapping and navigation

04 Monitoring and maintenance

05 Fleet management and optimisation

06 Data sharing and collaboration


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WHY? WHAT? HOW?

DATA SERVICES

Data collection and sensing	Data processing and analysis	Communication and connectivity
Web services and cloud computing	Data and Cybersecurity	Service delivery and usage
Decision-making and control systems	Maintenance and support	In-vehicle Infotainment

Infrastructure

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WHY? WHAT? HOW?

Key Categories Identified

- Data standards and cooperative data sharing
- Federated data architecture
- National coverage plan
- Digital infrastructure
- Physical infrastructure
- Skills and education

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Key priorities for CAM Infrastructure & Data Services to 2035

- Identify use cases and stakeholders for data packages
- Creation of data standards and data sharing frameworks
- Understand the current planned coverage and infrastructure strategy
- CAM inclusion in the National Digital Twin programme
- Standardisation and maintaining HD-maps in real-time
- Collaboration with different stakeholder groups
- Identify the gap in skills

Thank you

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Project Harlander

***Zenzic* Webinar, April 2024**

Michael Orgill, *Project Engineer*

April 26, 2024

AGENDA

- Rapid Intro:
  - Who am I?
  - What is Project Harlander?
- HORIBA MIRA's SAE Level 4 Safety Case Lifecycle
- In-Person Route Review in Belfast | February 2024
- V&V Testing:
  - Simulation
  - ASSURED CAV

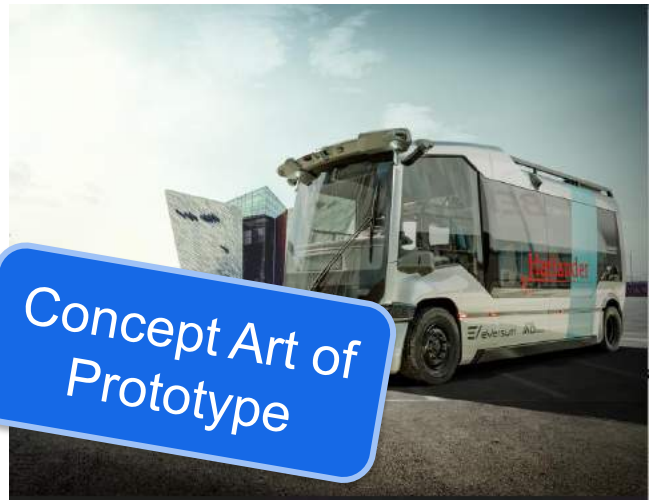
A Bit About Me | Michael Orgill *MSci (Hons) MIET MInstP*

- 2020: Theoretical Physics MSci, University of Birmingham.
- Ever since: HORIBA MIRA's Connected & Autonomous Vehicles (CAV) team
- Commercial and CR&D Projects including:
  - US & South-East Asian Start-Ups
  - European OEMs
  - Construction & Mining machinery
  - **Innovate UK Consortia**

Project HARLANDER

- **Attended Trial** of a **Level 4 ADS** around part of the **Belfast Harbour** Estate.
- ~ **2 km** route **to and from the train station** via,
  - for **commuters**: industrial buildings, workpl
  - for **students**: the local college
  - for **tourists**: the Titanic Museum, the Giants' Ice Hockey Stadium

Trial: Q1 2025
Only halfway through

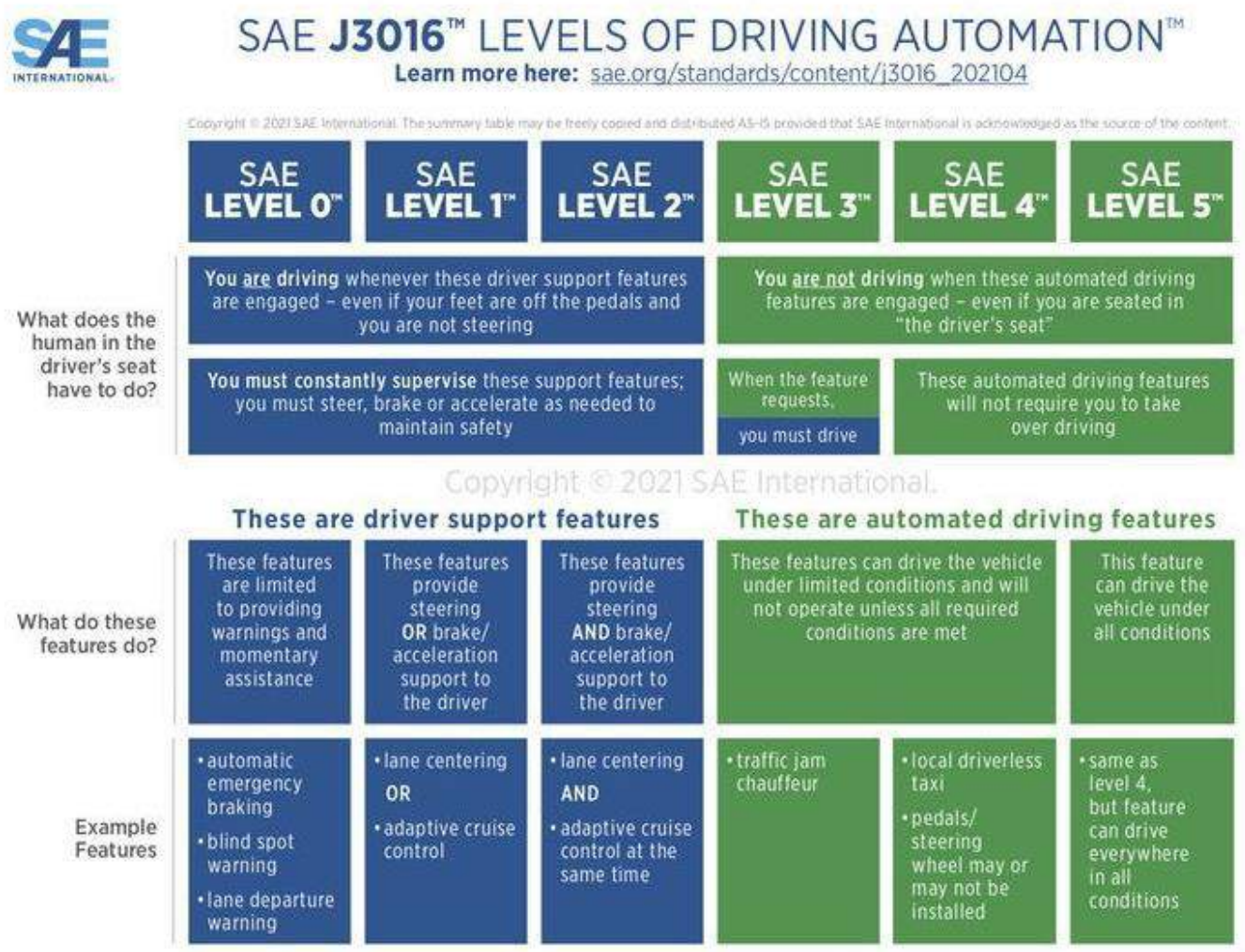


Concept Art of Prototype

Harlander

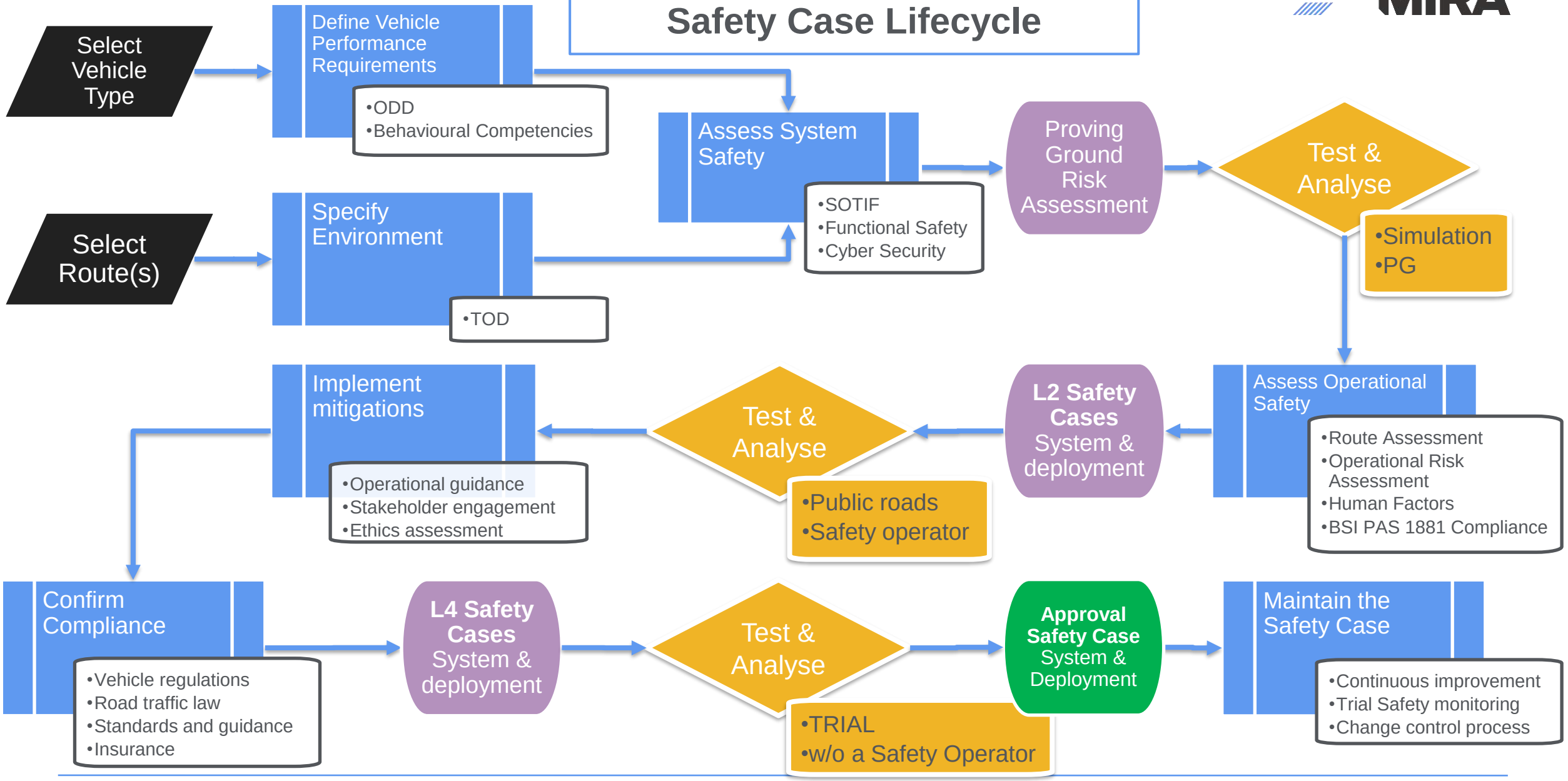
Belfast Harbour · BT · MIRA · ANGOKA · OXA · eVersum

SAE Six Levels of Autonomy | J3016C Taxonomy (2021)



Source: SAE International, J3016C Taxonomy, 2021, sae.org/standards/content/j3016_202104

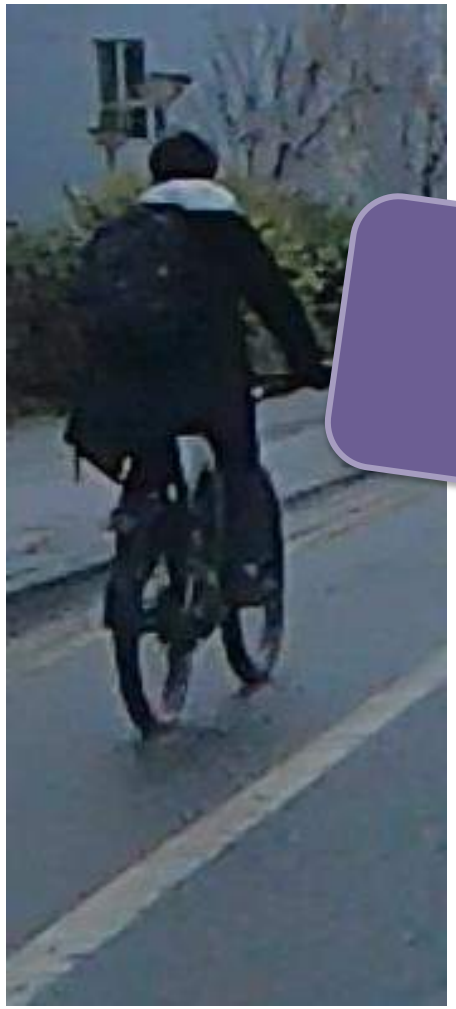
HORIBA MIRA's SAE Level 4 Safety Case Lifecycle



In-Person Route Review | February 2024

- **3** HORIBA MIRA Engineers
- **By car** (on road), as well as **on foot**

Wide Single Lane Driving Two Abreast



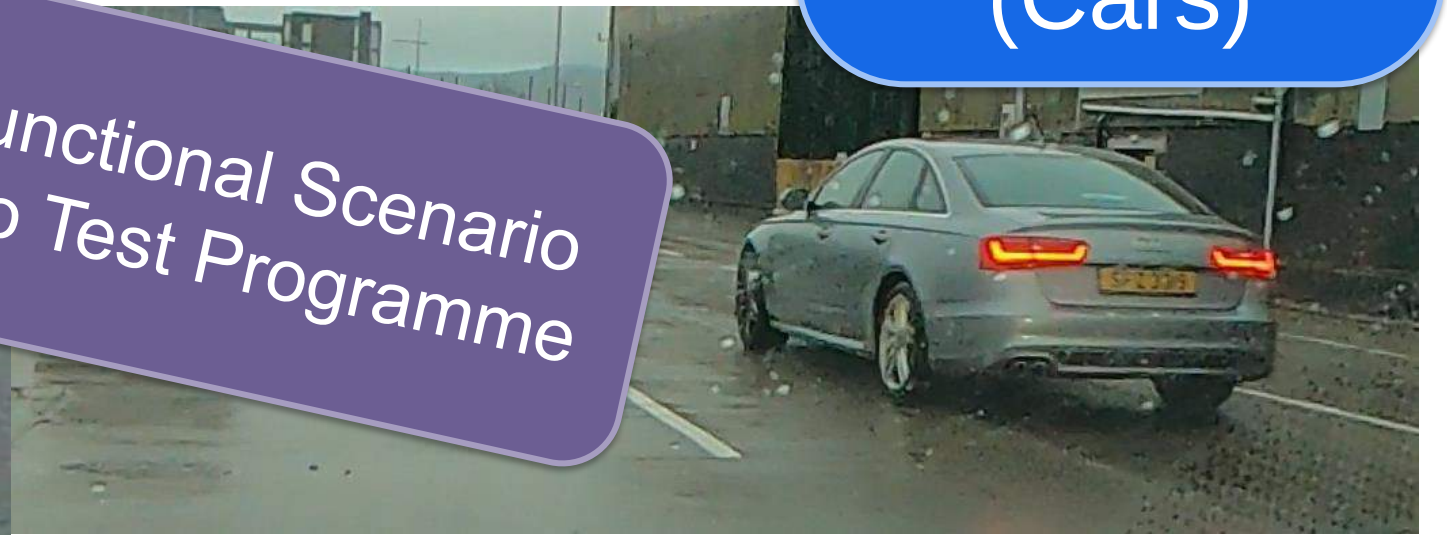
Cyclists

Added to TOD

Examples of Attire inform the Logical Scenario Parameters

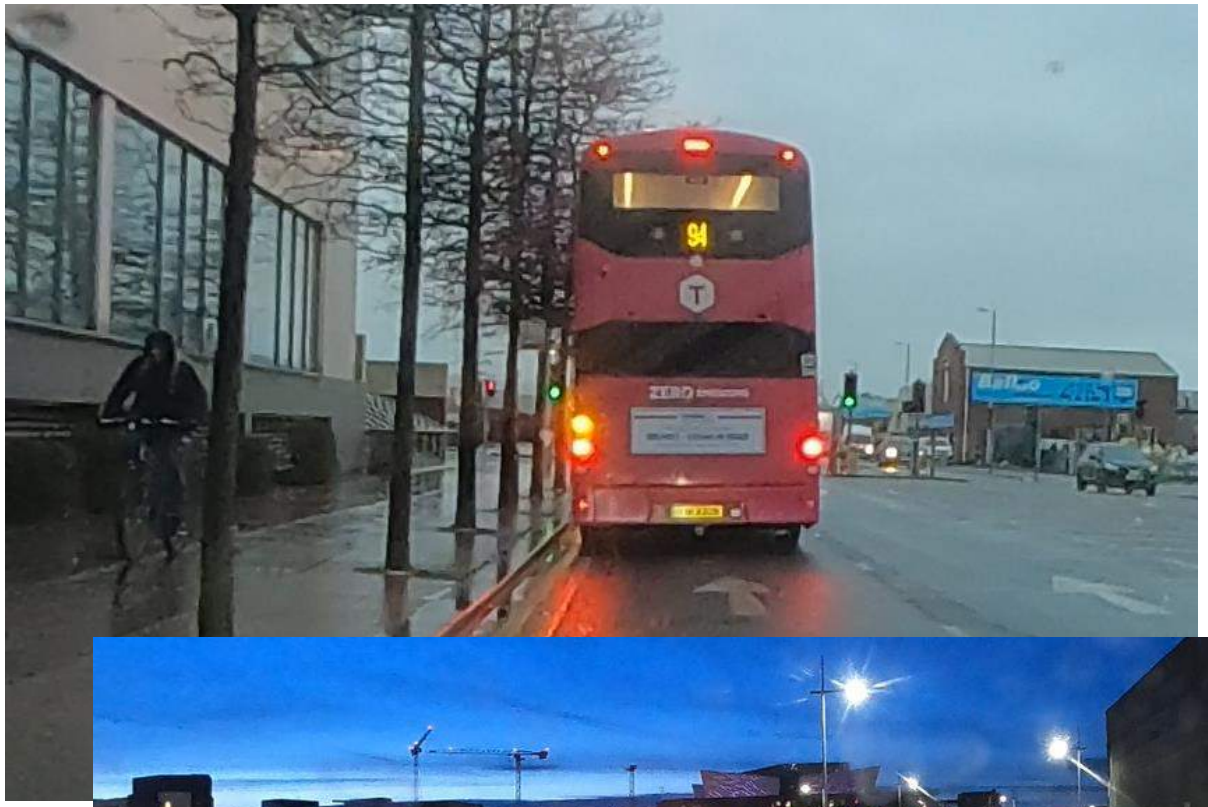
In-Person Route Review | February 2024

Parked or Queuing Small Vehicles (Cars)



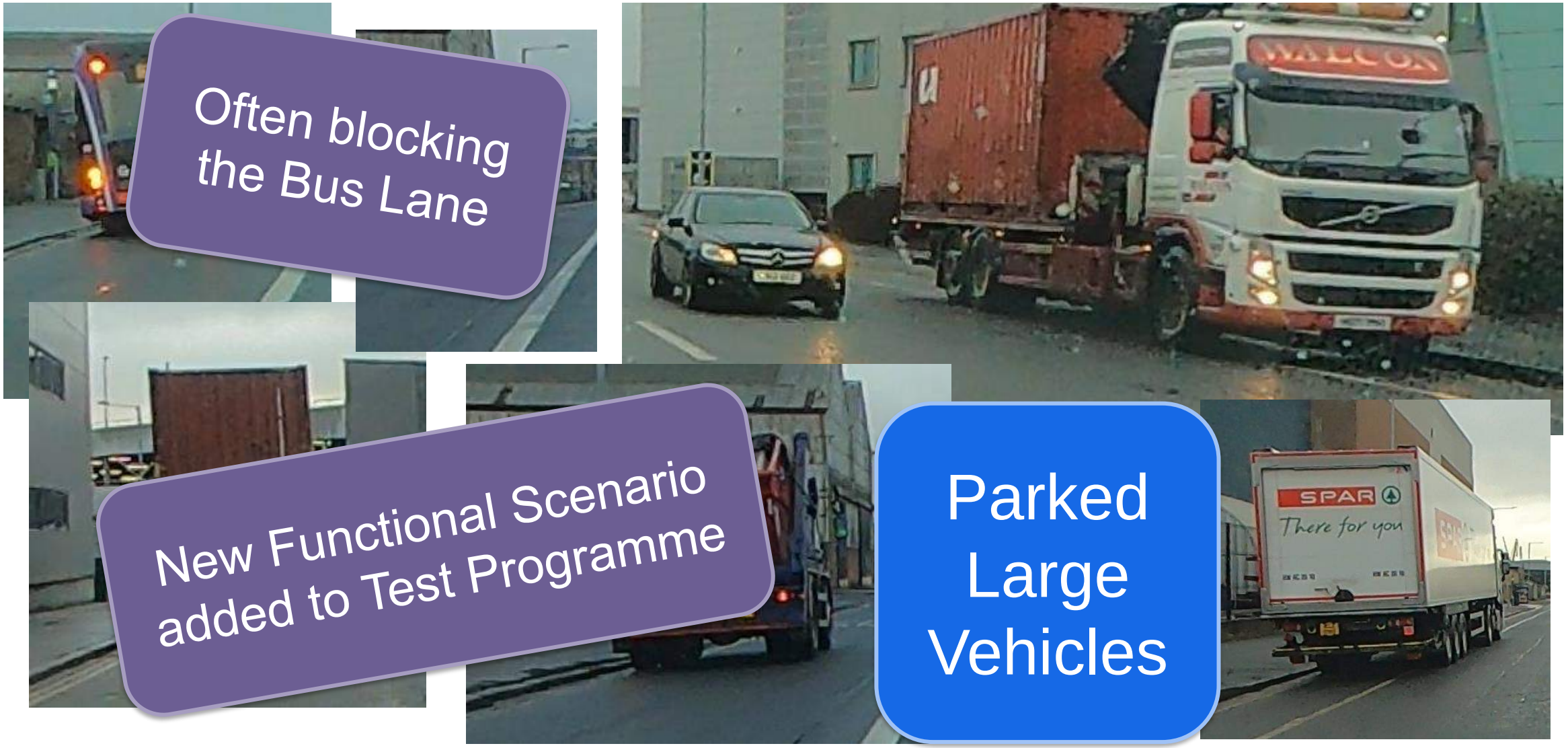
New Functional Scenario added to Test Programme

In-Person Route Review | February 2024



Amazon Depot is a unique factor in this **TOD**

In-Person Route Review | February 2024

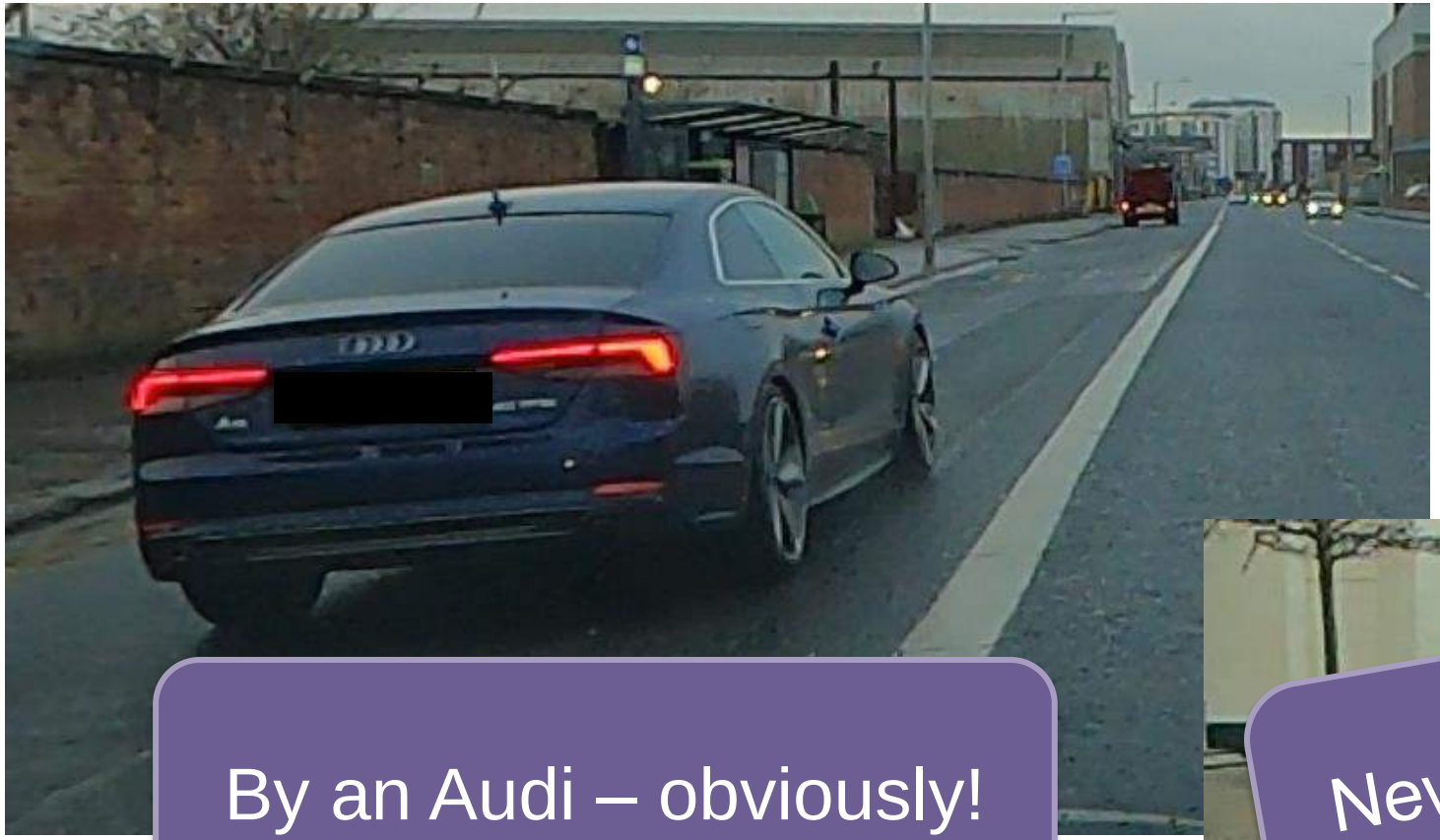


In-Person Route Review | February 2024

We observed *how* the **behaviour** of other **actors** changed in the presence of these vehicles

"Unique" Vehicles

In-Person Route Review | February 2024



Undertaking in a Bus Lane

By an Audi – obviously!

New Functional Scenario added to Test Programme

In-Person Route Review | February 2024

New Functional Scenario added to Test Programme

Late or abandoned pulling out by actors

In-Person Route Review | February 2024

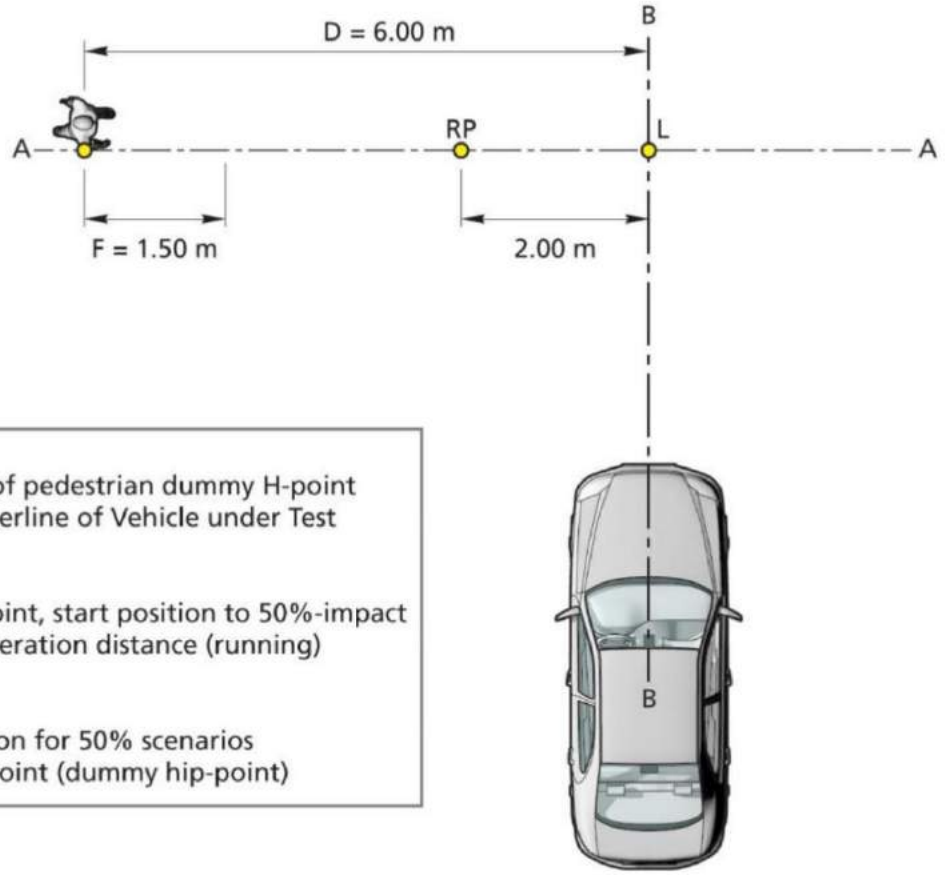
In-Person Route Review | February 2024

New Functional Scenario added to Test Programme

Large or Long Vehicles Turning-in-the-Road

In-Person Route Review | February 2024

6LM | PEGASUS | Example



Axes
AA – Trajectory of pedestrian dummy H-point
BB – Axis of centerline of Vehicle under Test

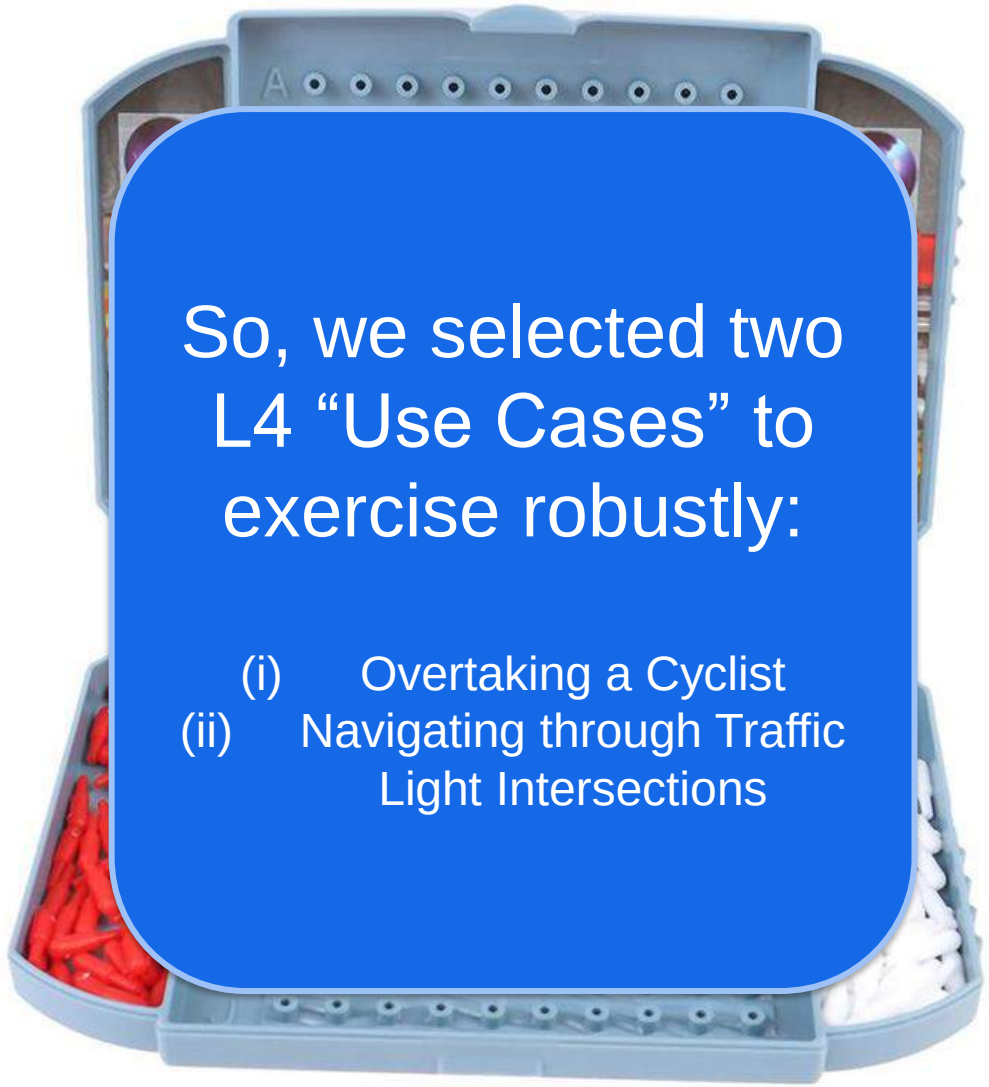
Distances
D – Dummy H-point, start position to 50%-impact
F – Dummy acceleration distance (running)

Points
L – Impact position for 50% scenarios
RP – Reference Point (dummy hip-point)

Figure 9a: CPFA-50 scenario, Adult running from Farside

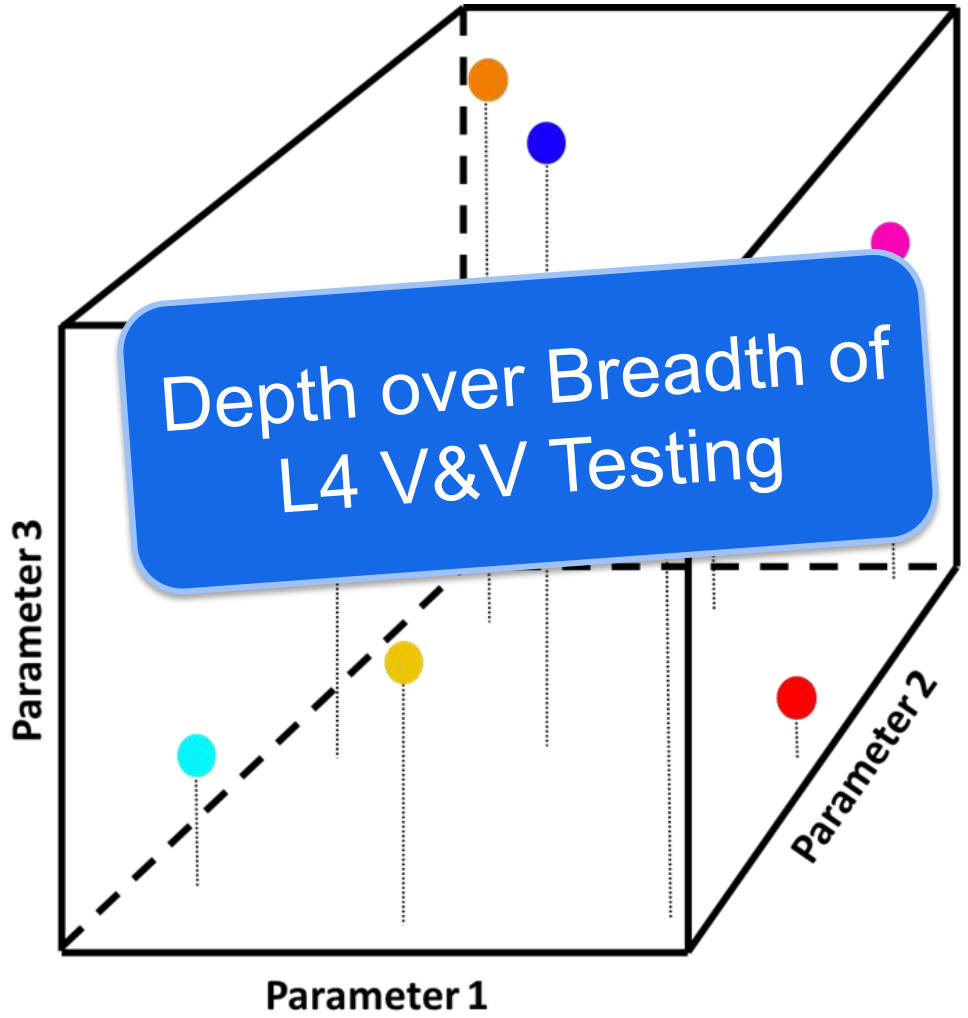
- **Ego**
  - Ego Velocity
- **L1: Road level**
  - Road Surface
  - Road Markings
  - Geometry & Topology
- **L2: Traffic Infrastructure**
  - Traffic Lights, Junctions
  - Roadside / Street Furniture
- **L3: Temporary**
- **L4: Objects**
  - Actor Type
  - Appearance
  - Actor Kinematics (time)
- **L5: Environment**
  - Weather
  - Illumination (Ambient + Artificial)
- **L6: Digital**
  - V2X

Battleships Analogy

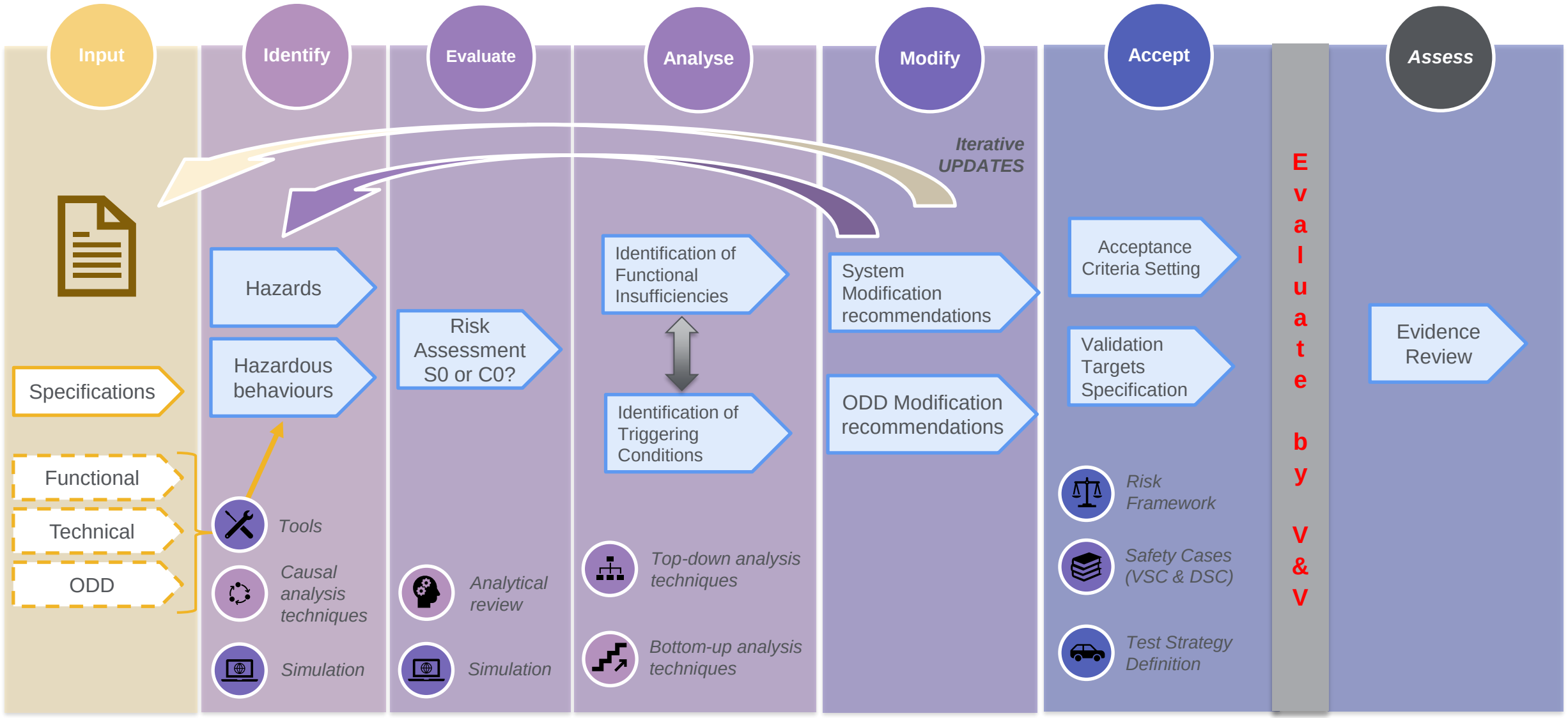


So, we selected two L4 “Use Cases” to exercise robustly:

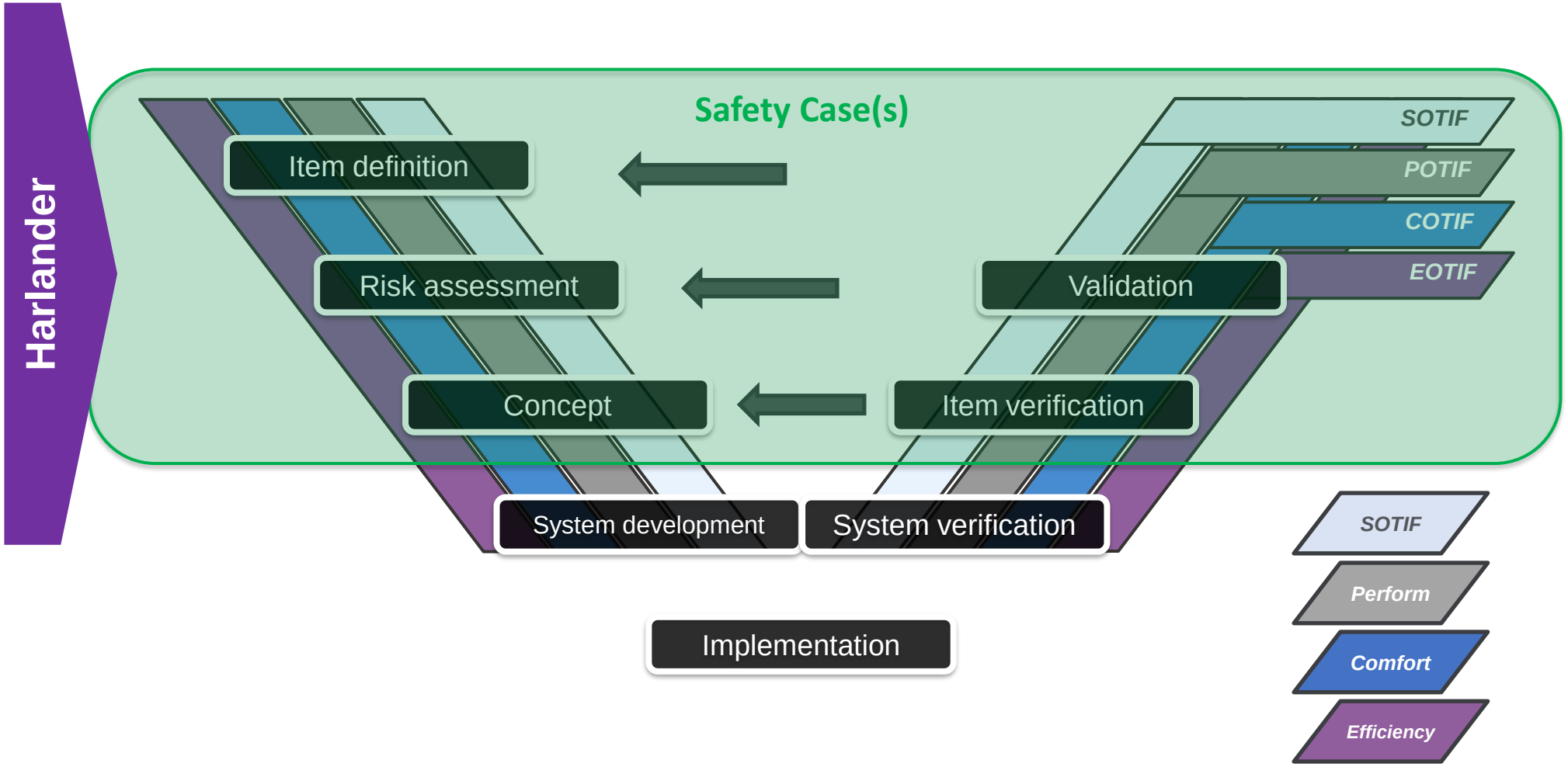
(i) Overtaking a Cyclist
(ii) Navigating through Traffic Light Intersections



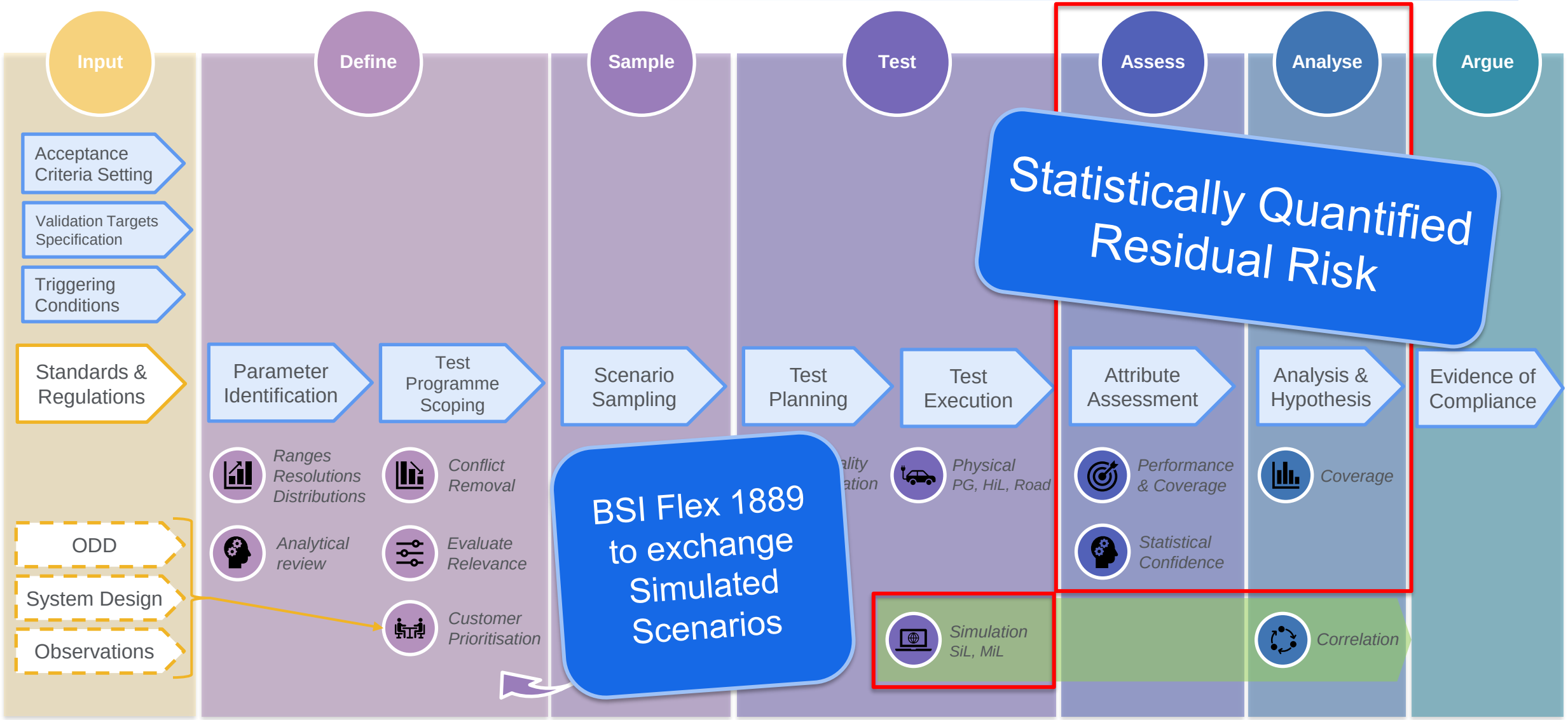
Gearing up for the Safety Case | a Framework



Extrapolating the SOTIF Principles | ISO 21448



Explore, Justify, Mitigate | the SC Evidence



Questions, Comments & Discussion

5 minutes

Scalable Simulation-based Safety Assurance Framework

Dr Jason Xizhe Zhang
Simulation Lead (Principal Engineer),
Verification & Validation,
WMG, University of Warwick, UK

26 April 2024

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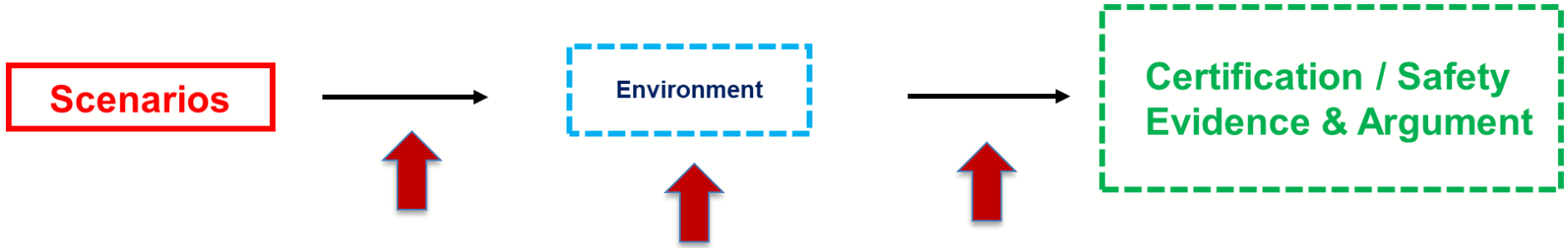
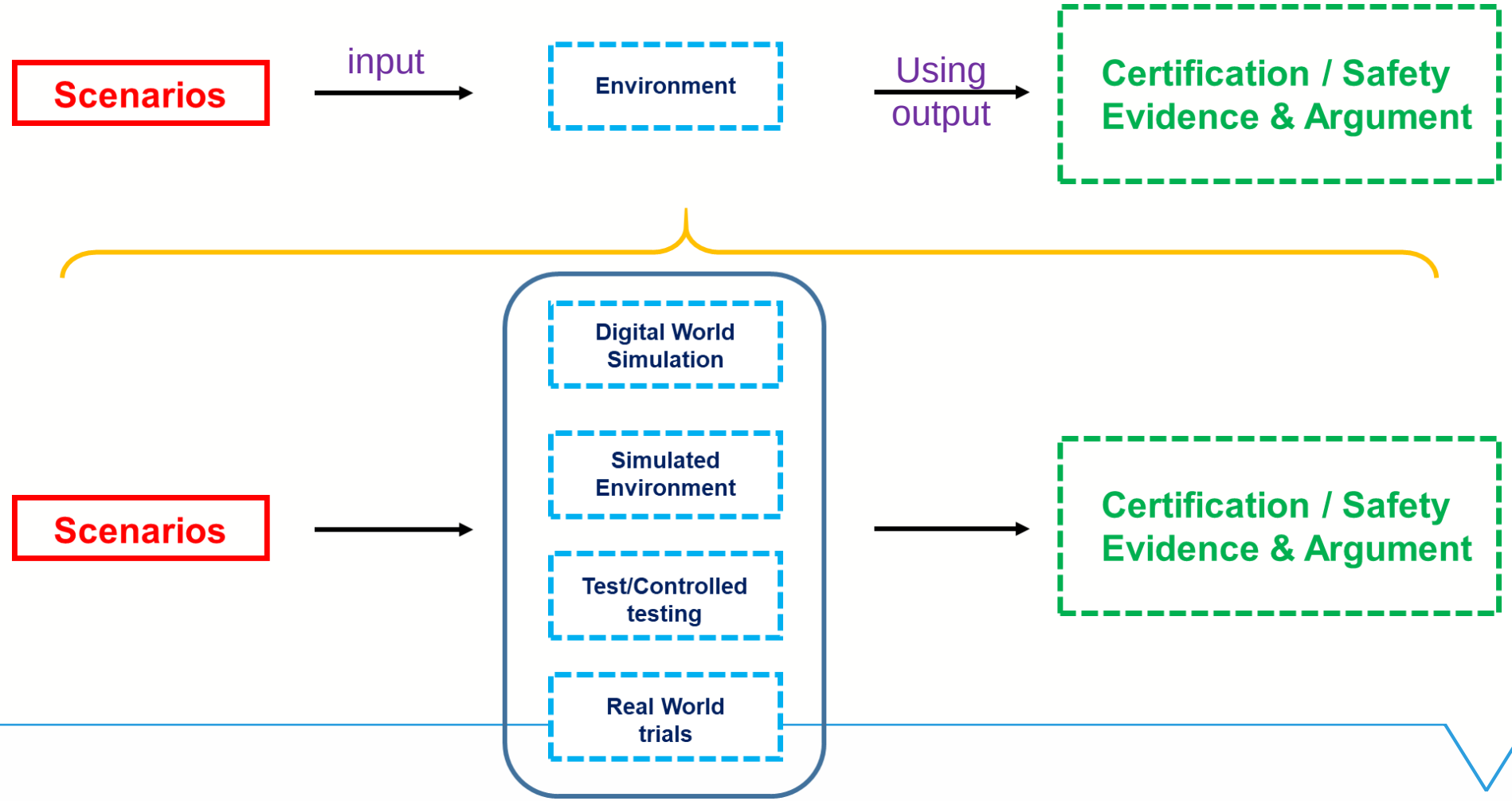
THE UNIVERSITY OF WARWICK

V&V Continuum

V&V Continuum



V&V Continuum



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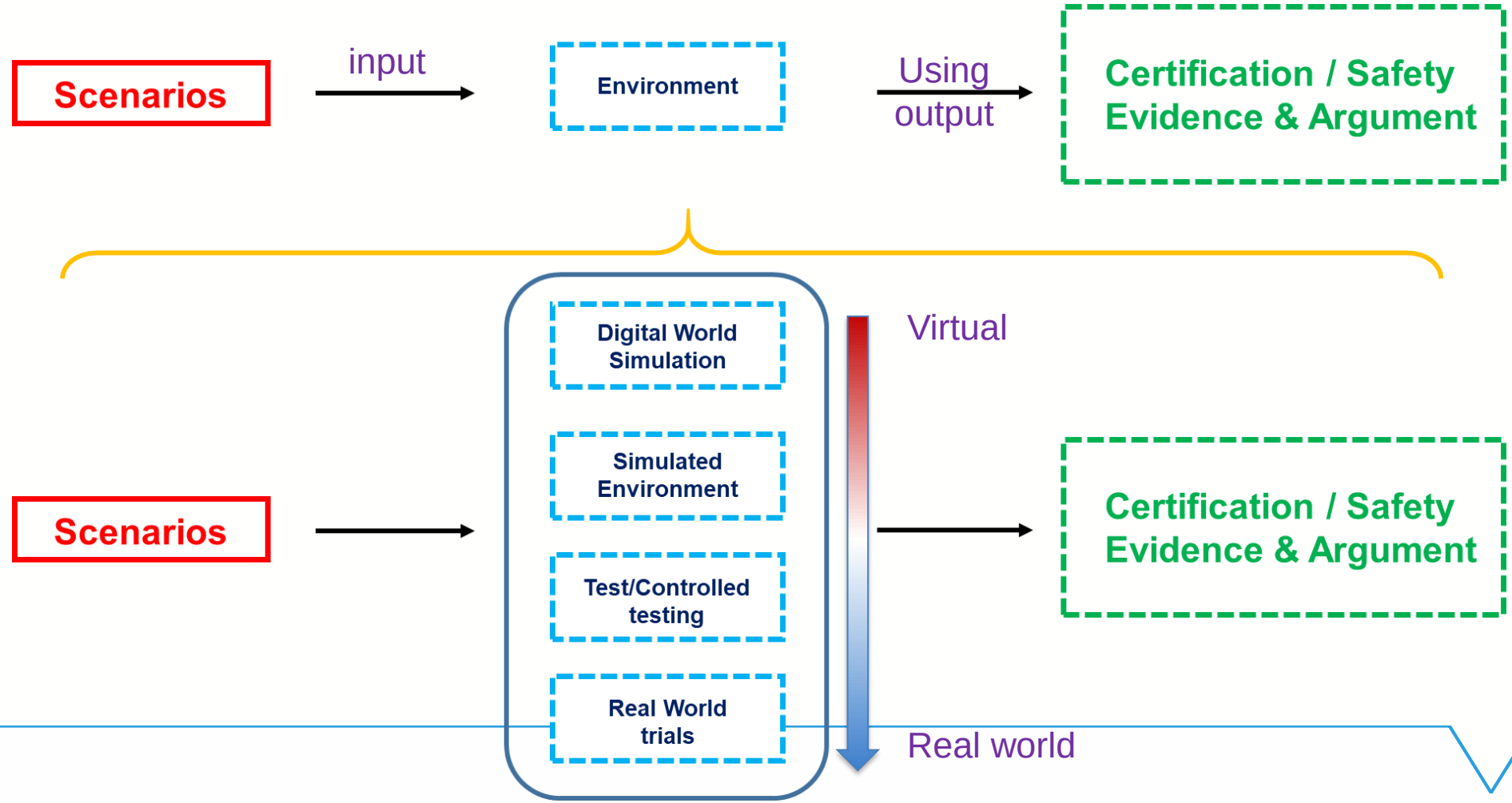

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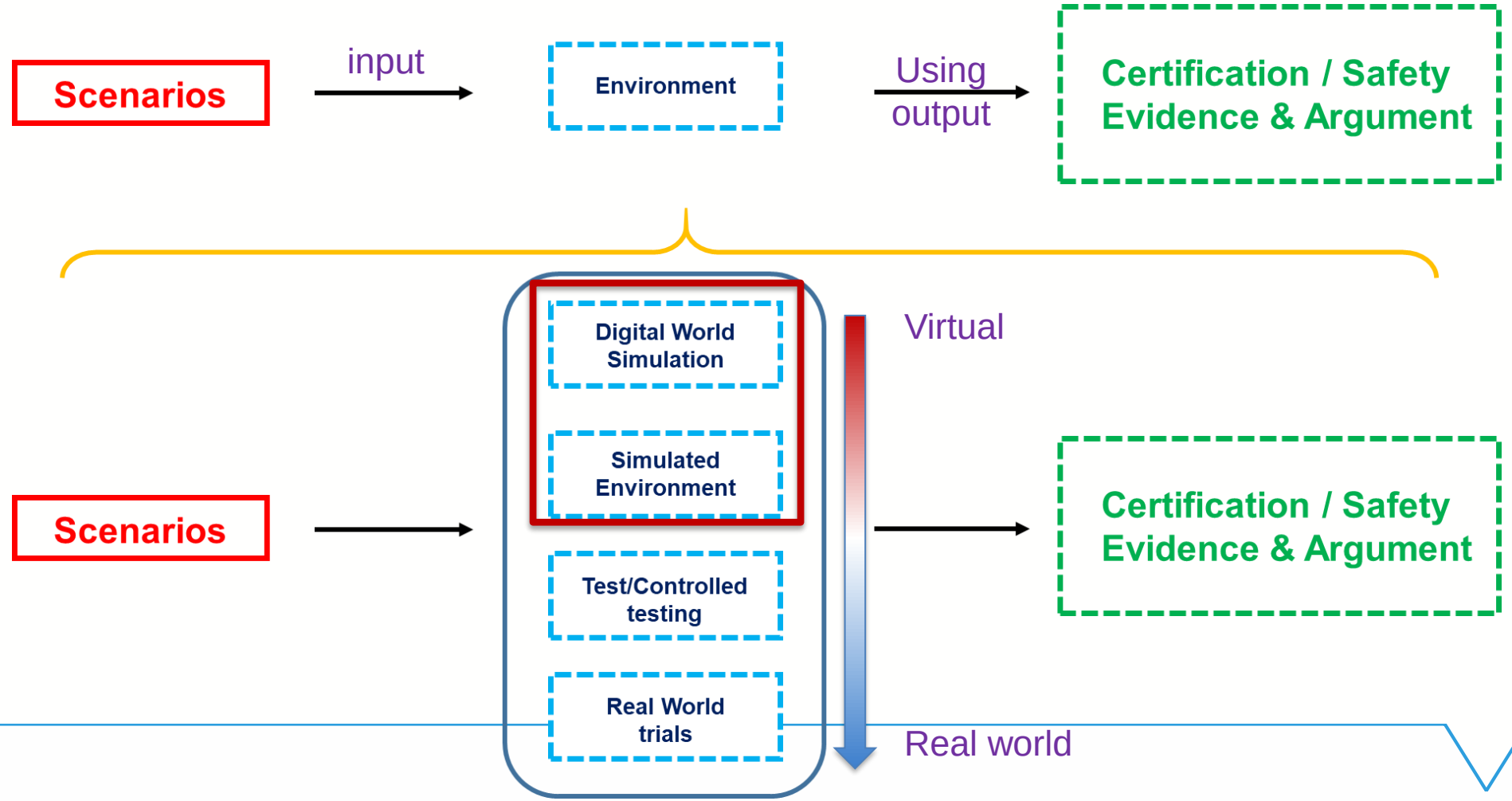
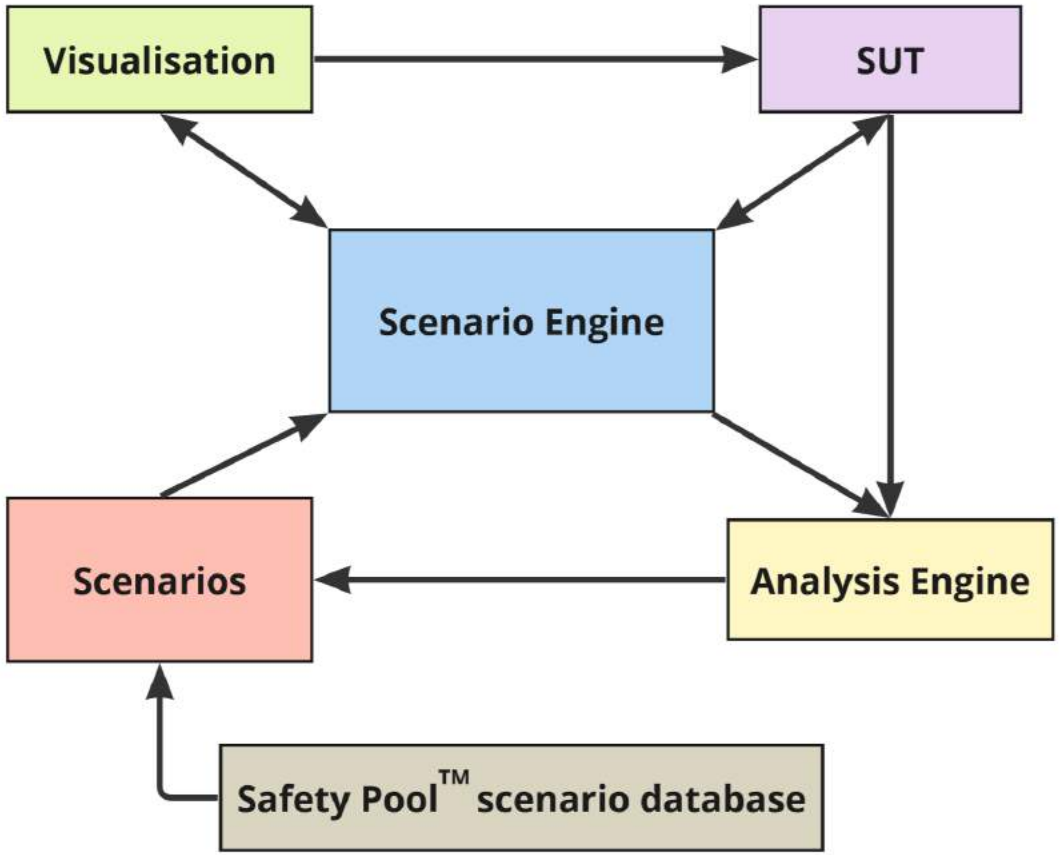
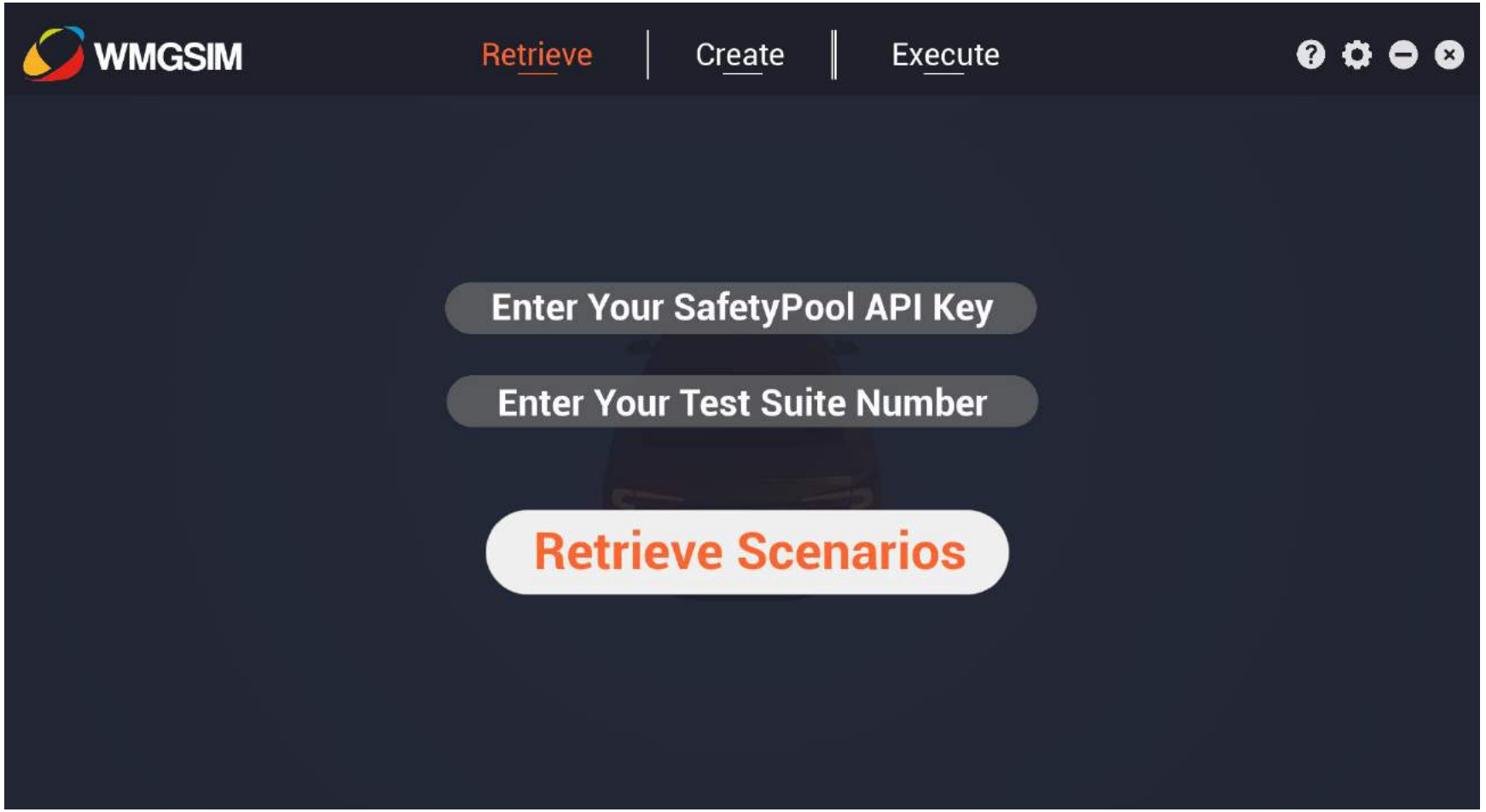
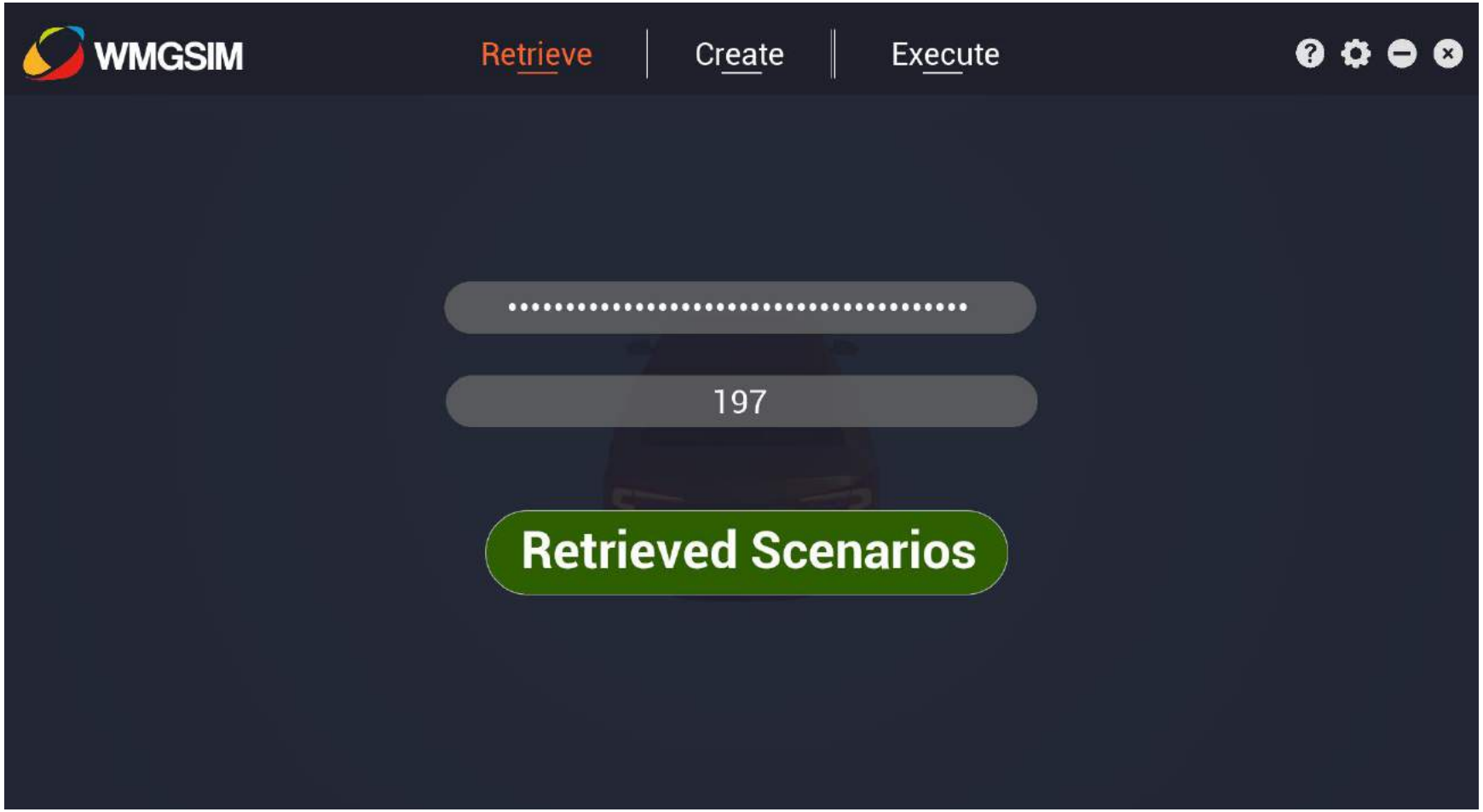
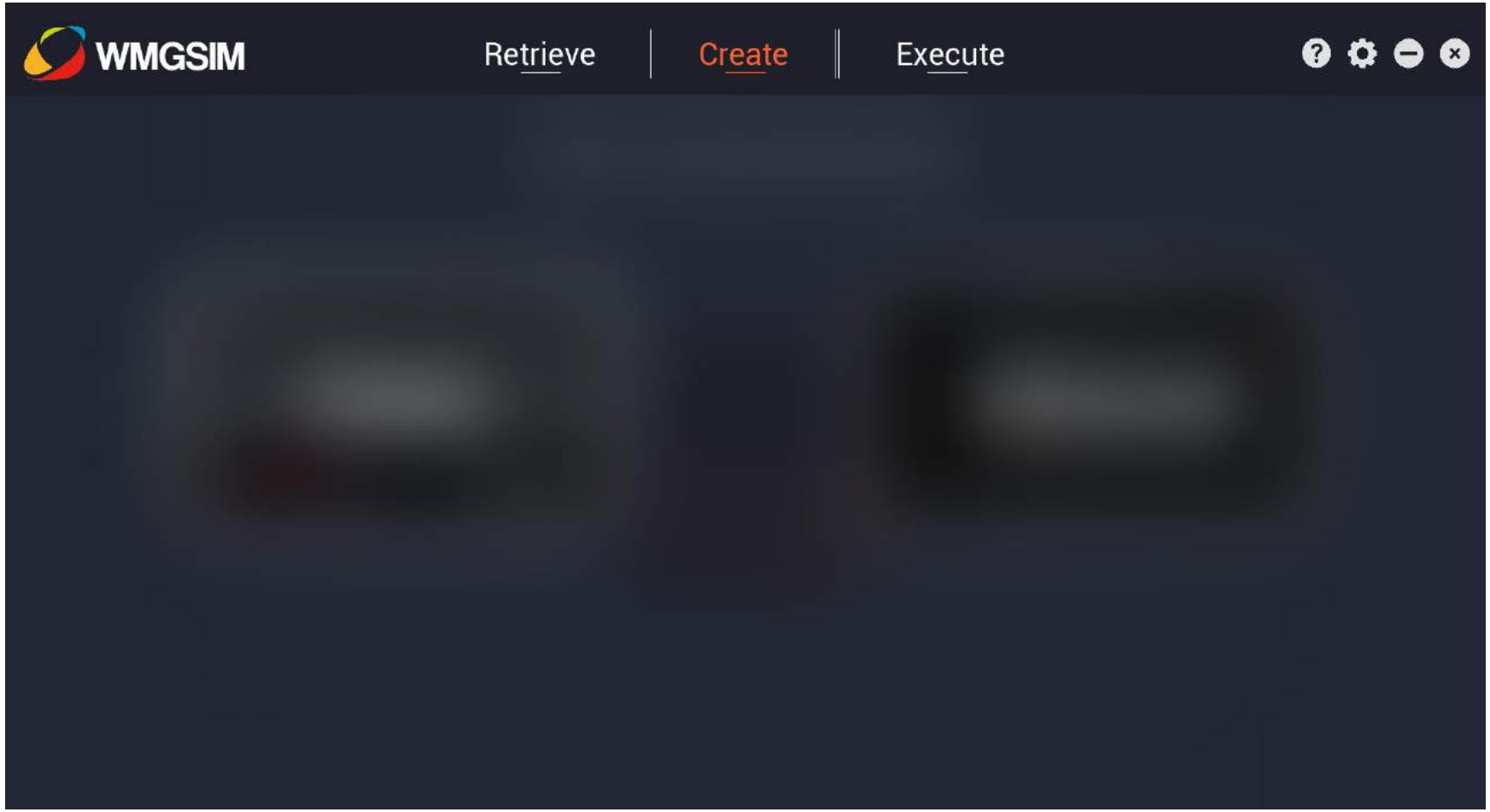


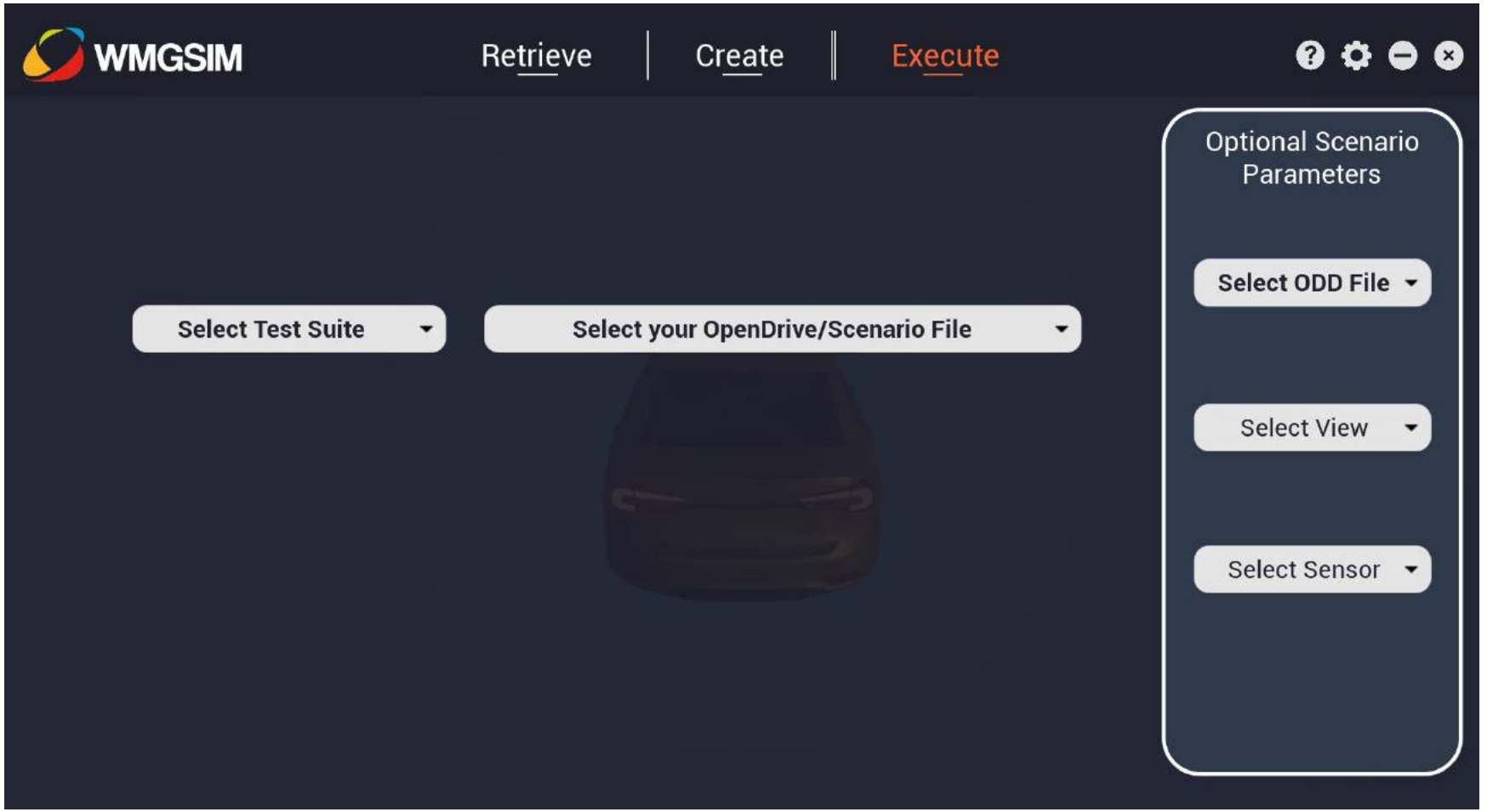
Simulation Framework at a Glance

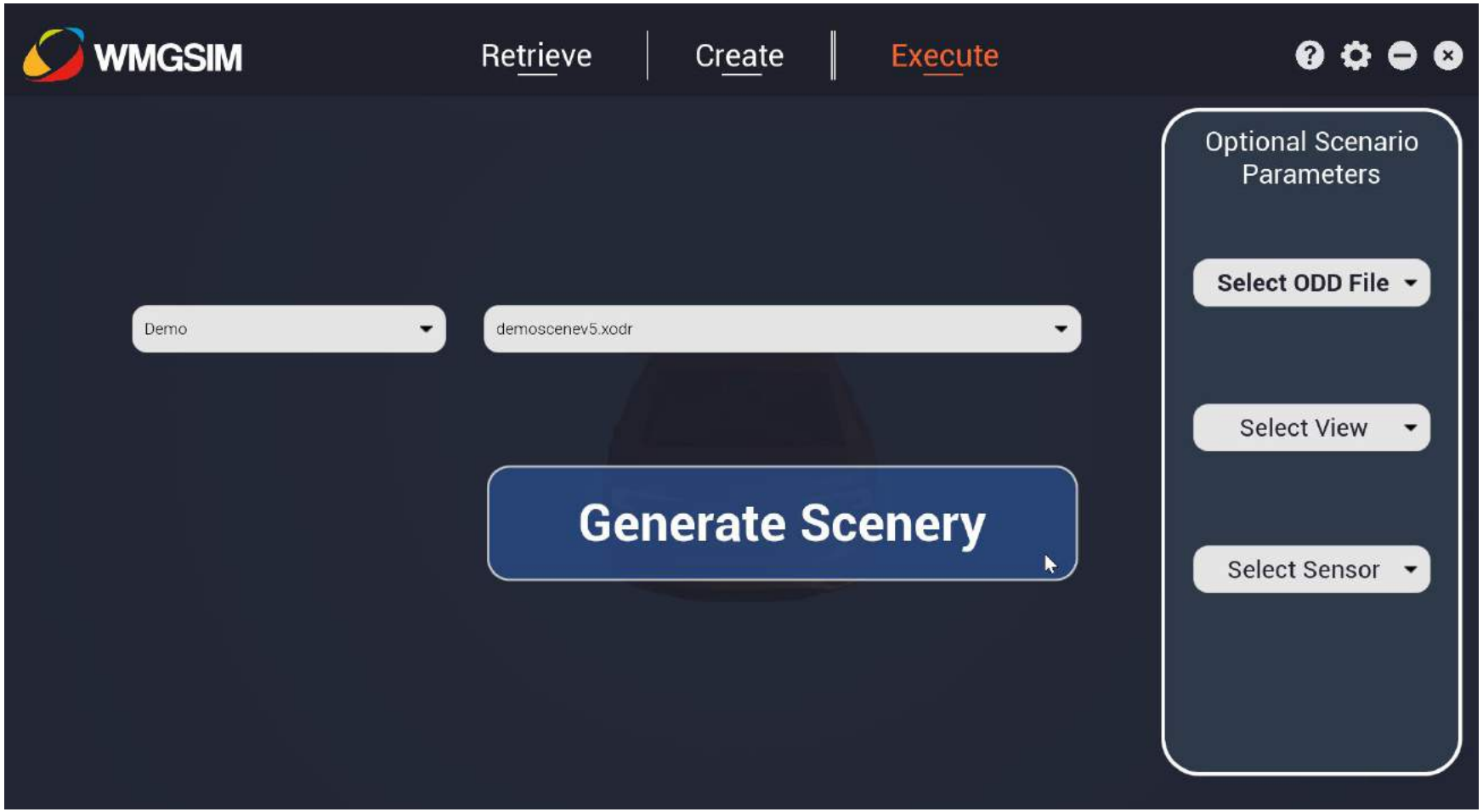


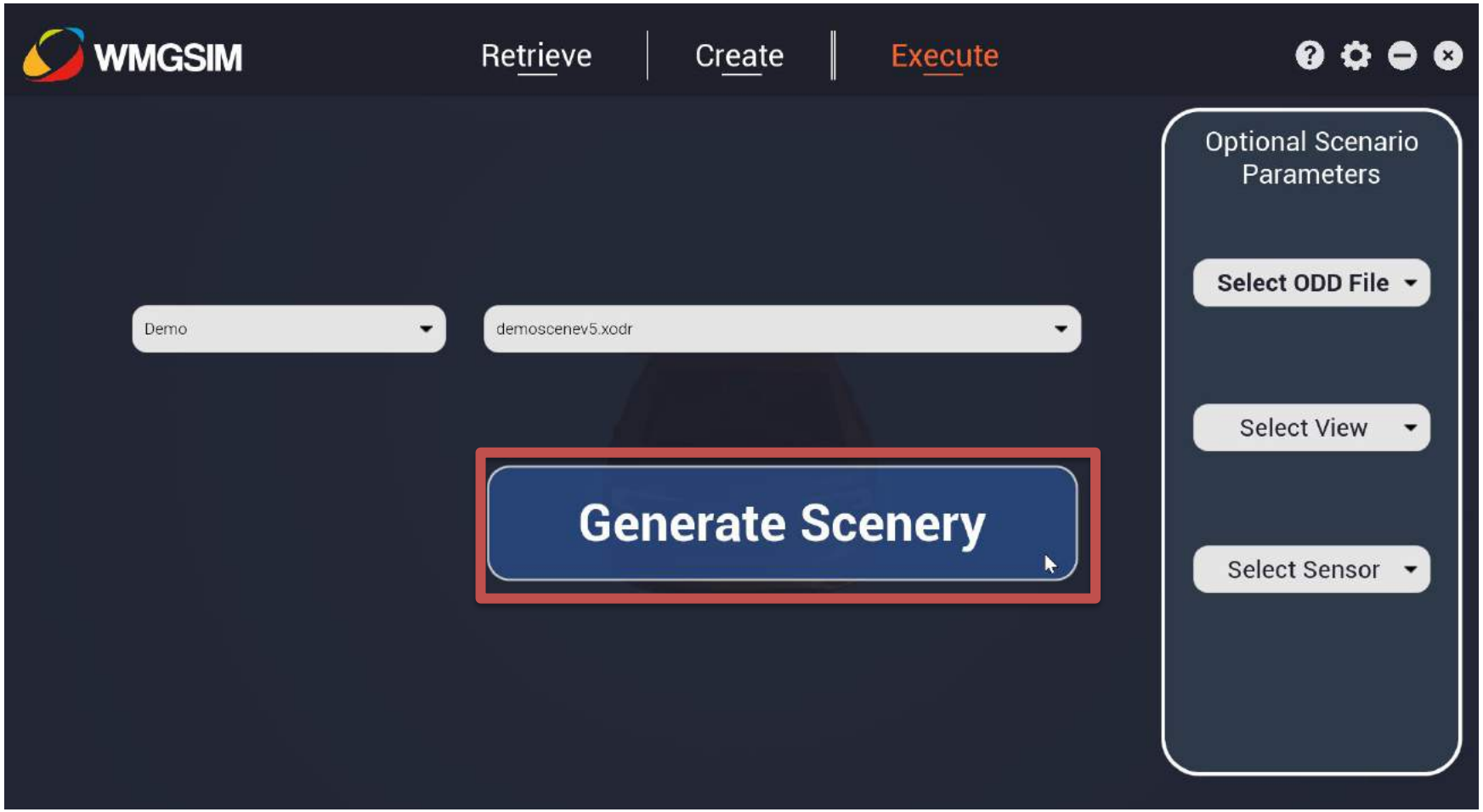


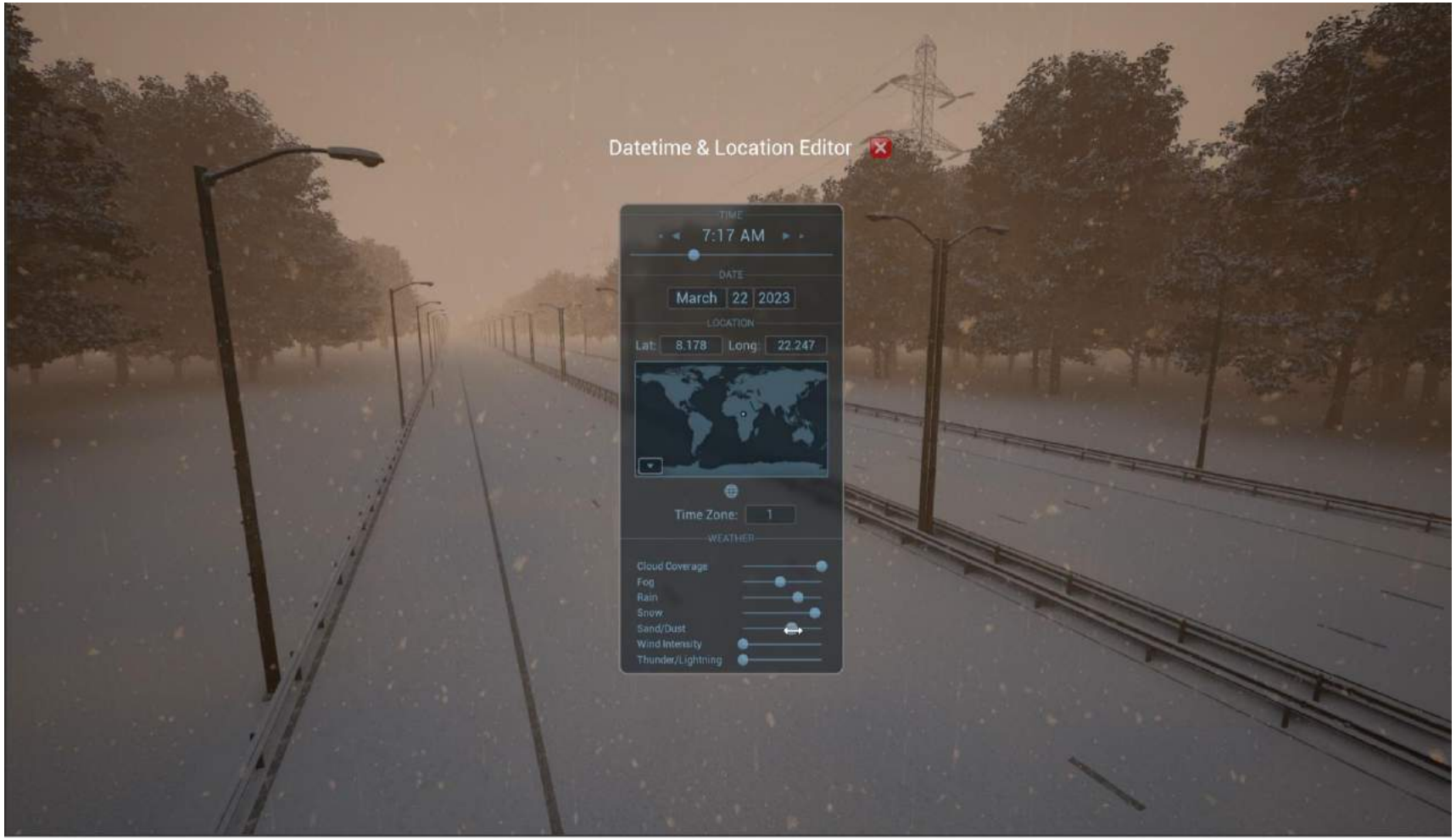


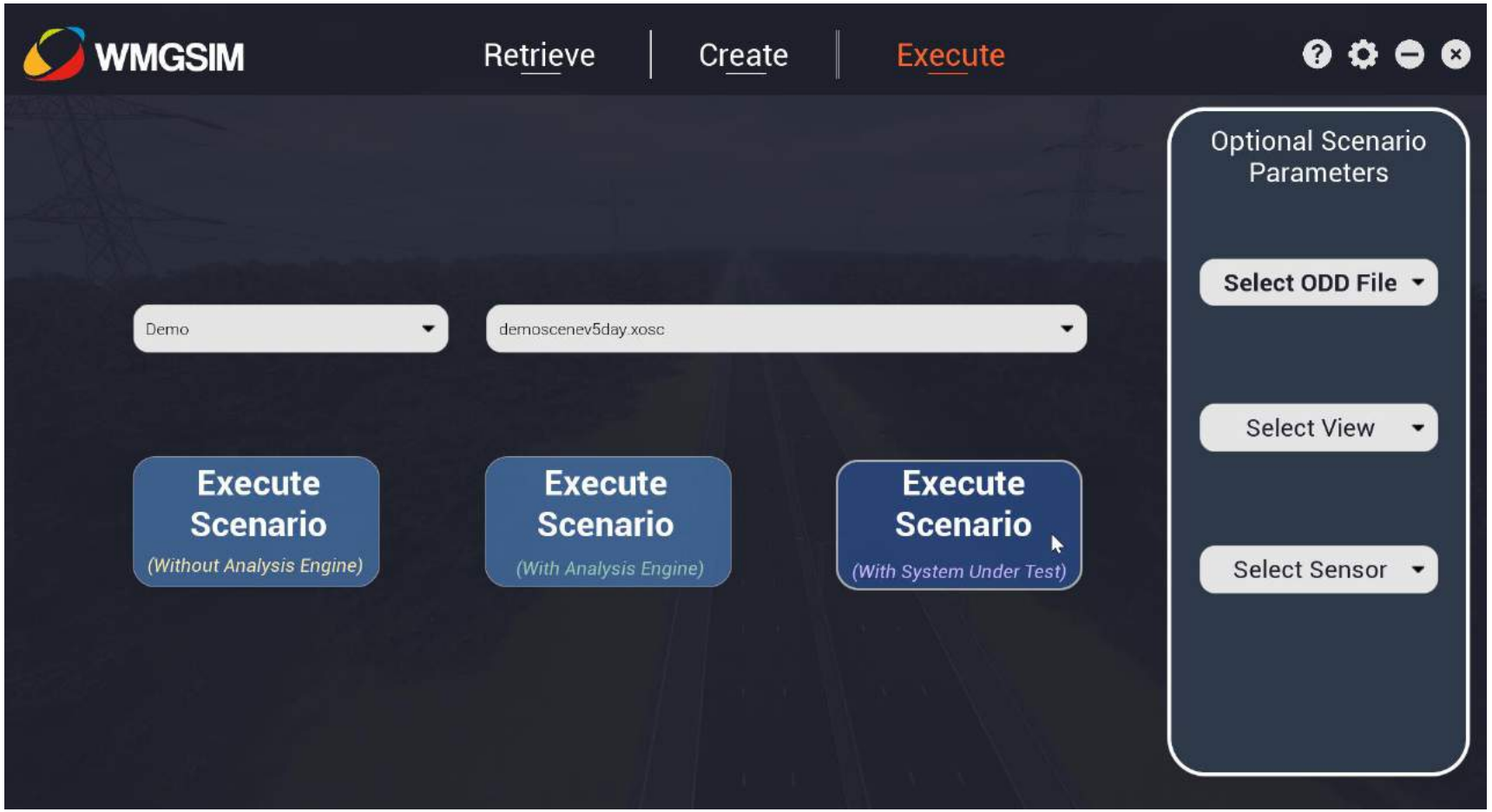


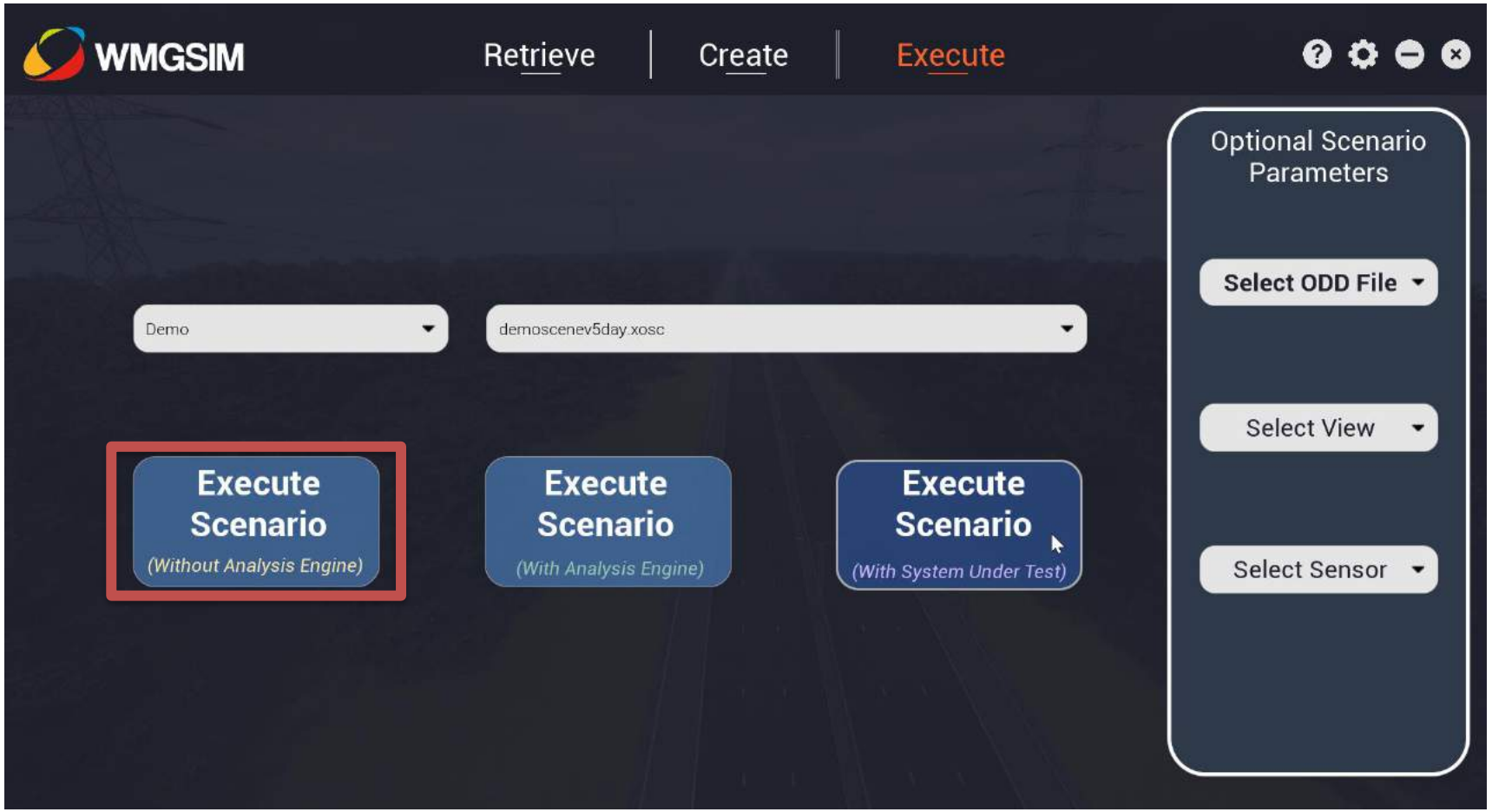


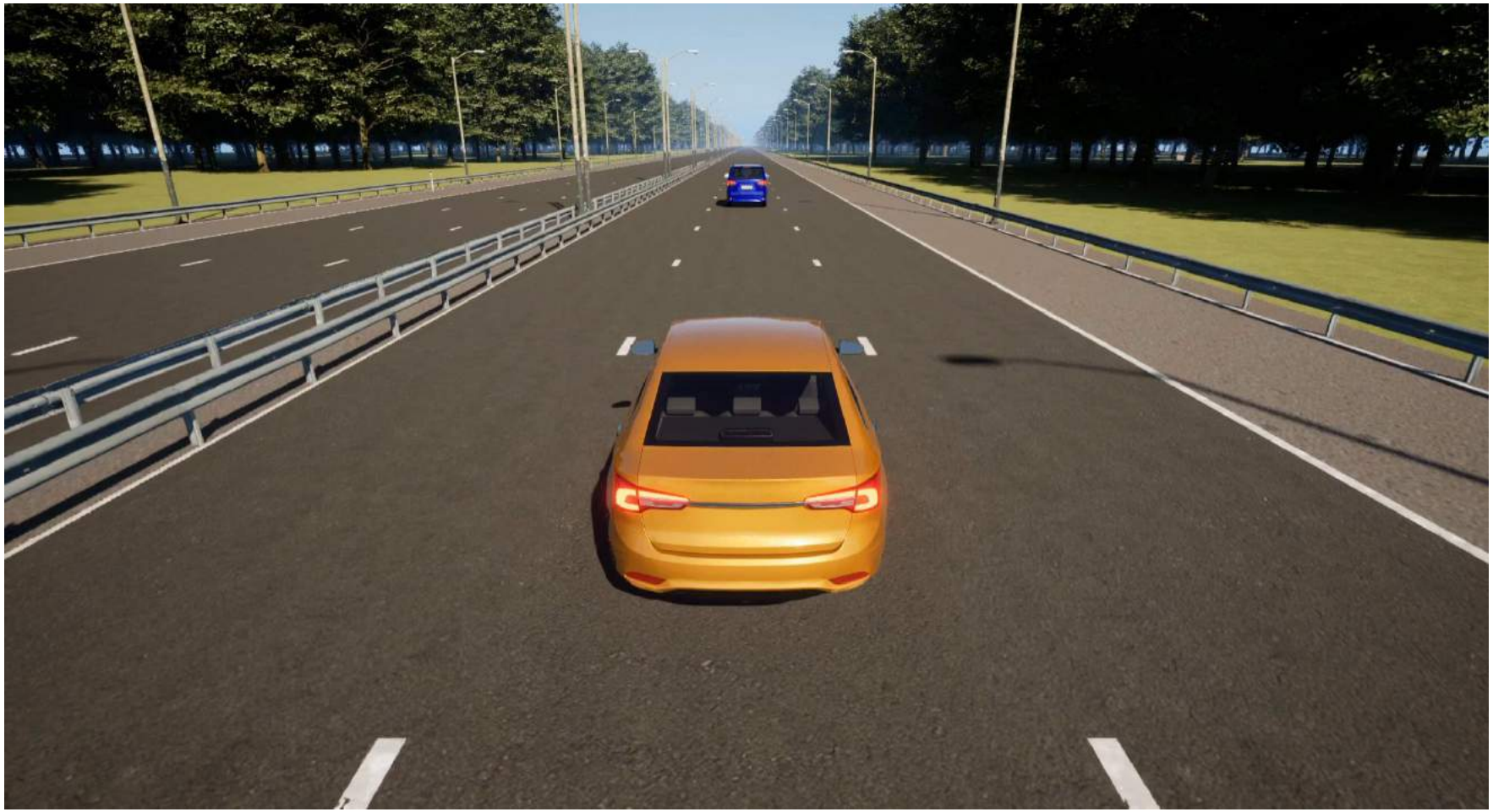


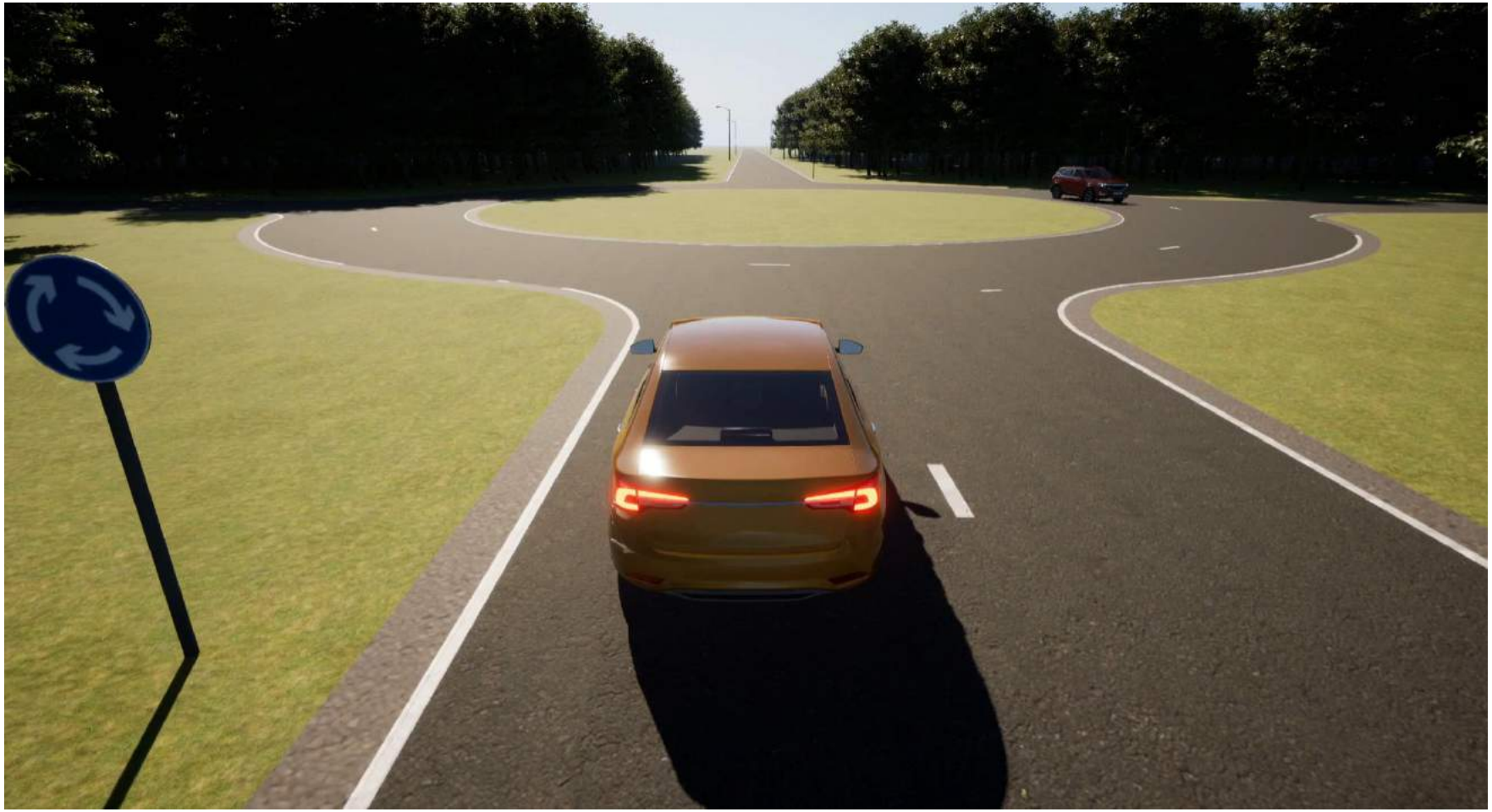


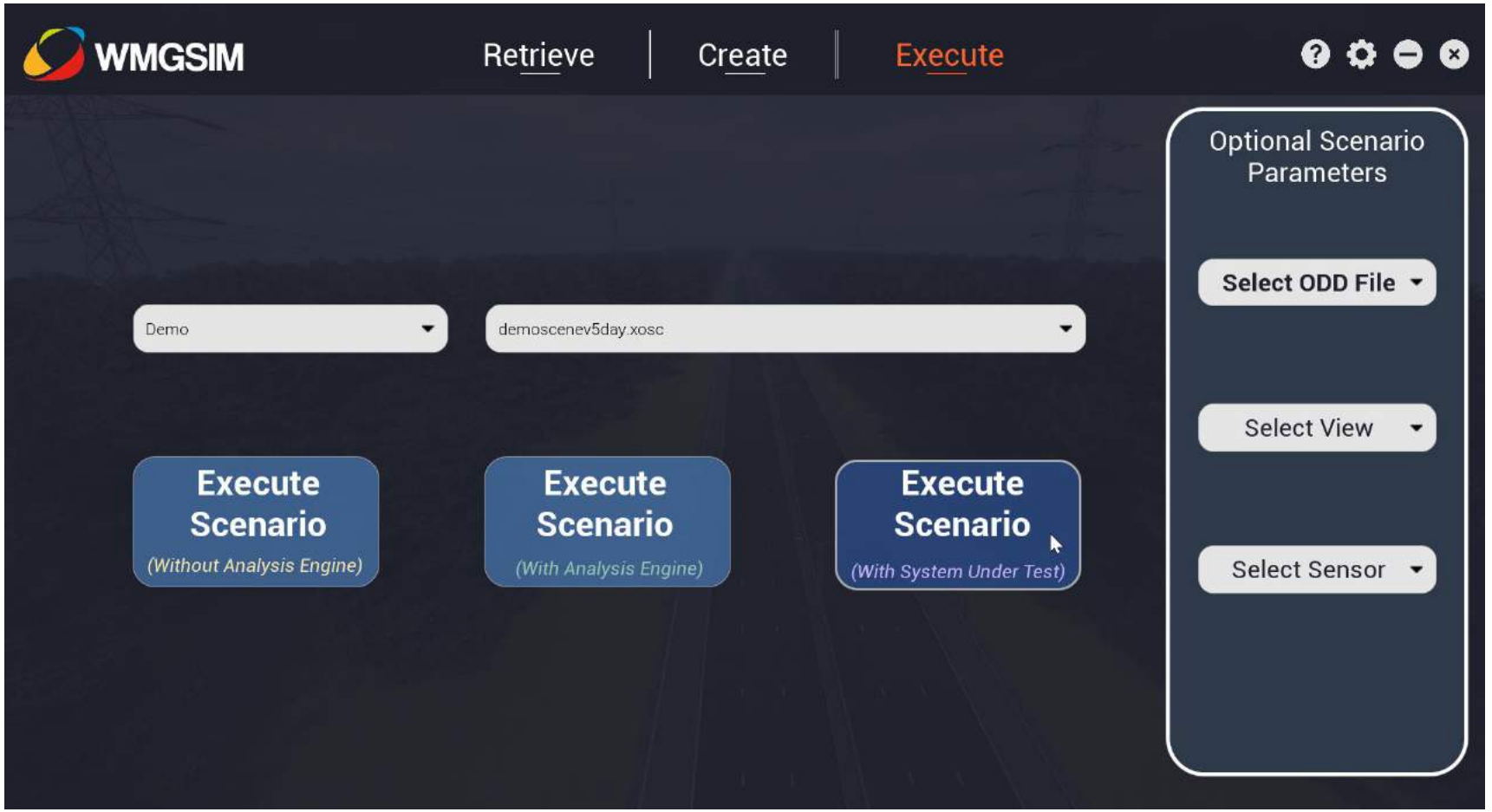


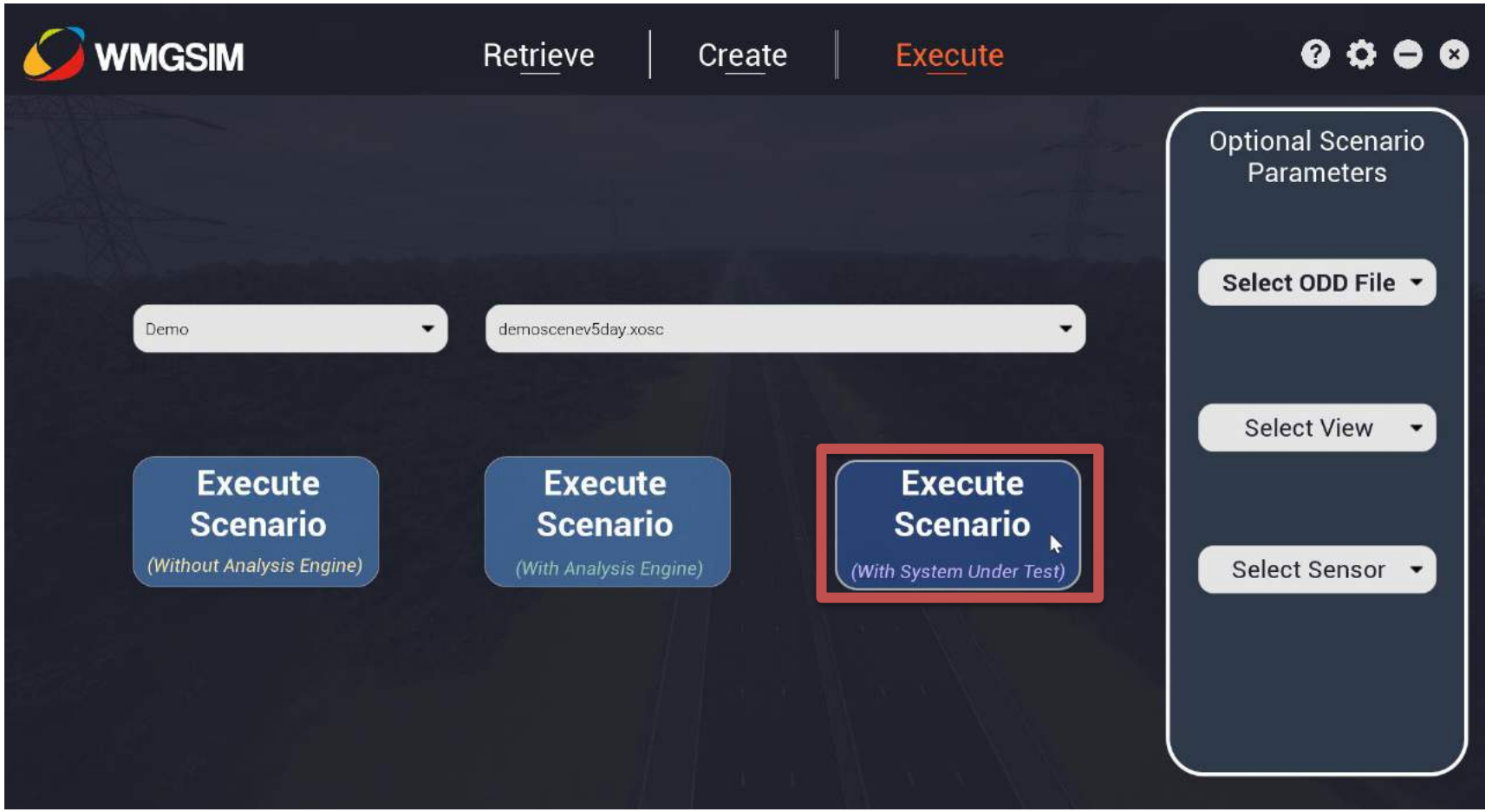






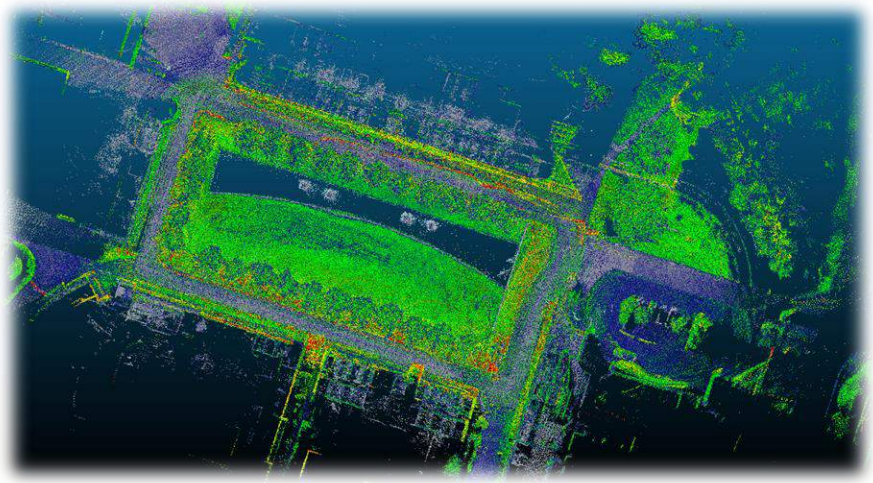




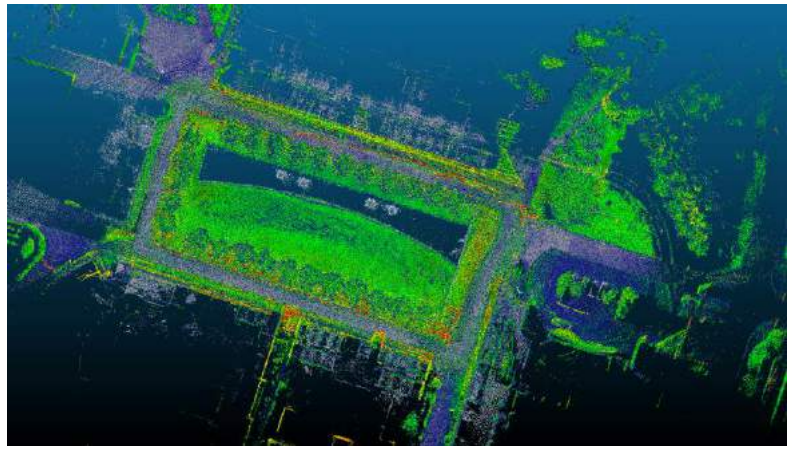


Virtual Testing at Scale (ODD, Risks etc)

Qualifying Simulation Environment (VTE)

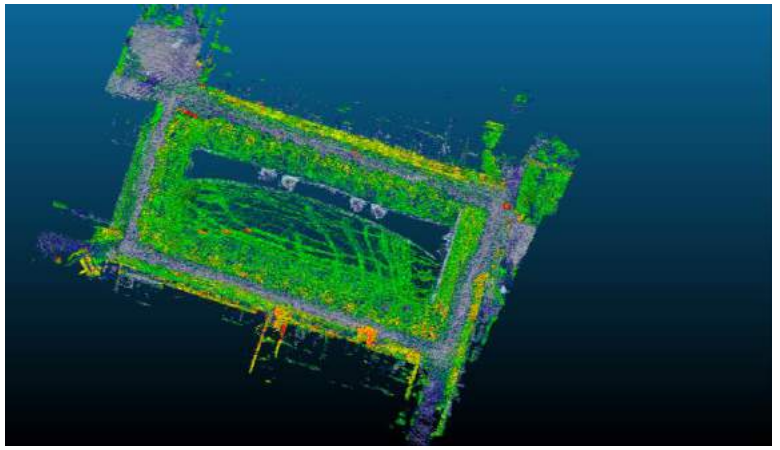


Qualifying Simulation Environment (VTE)



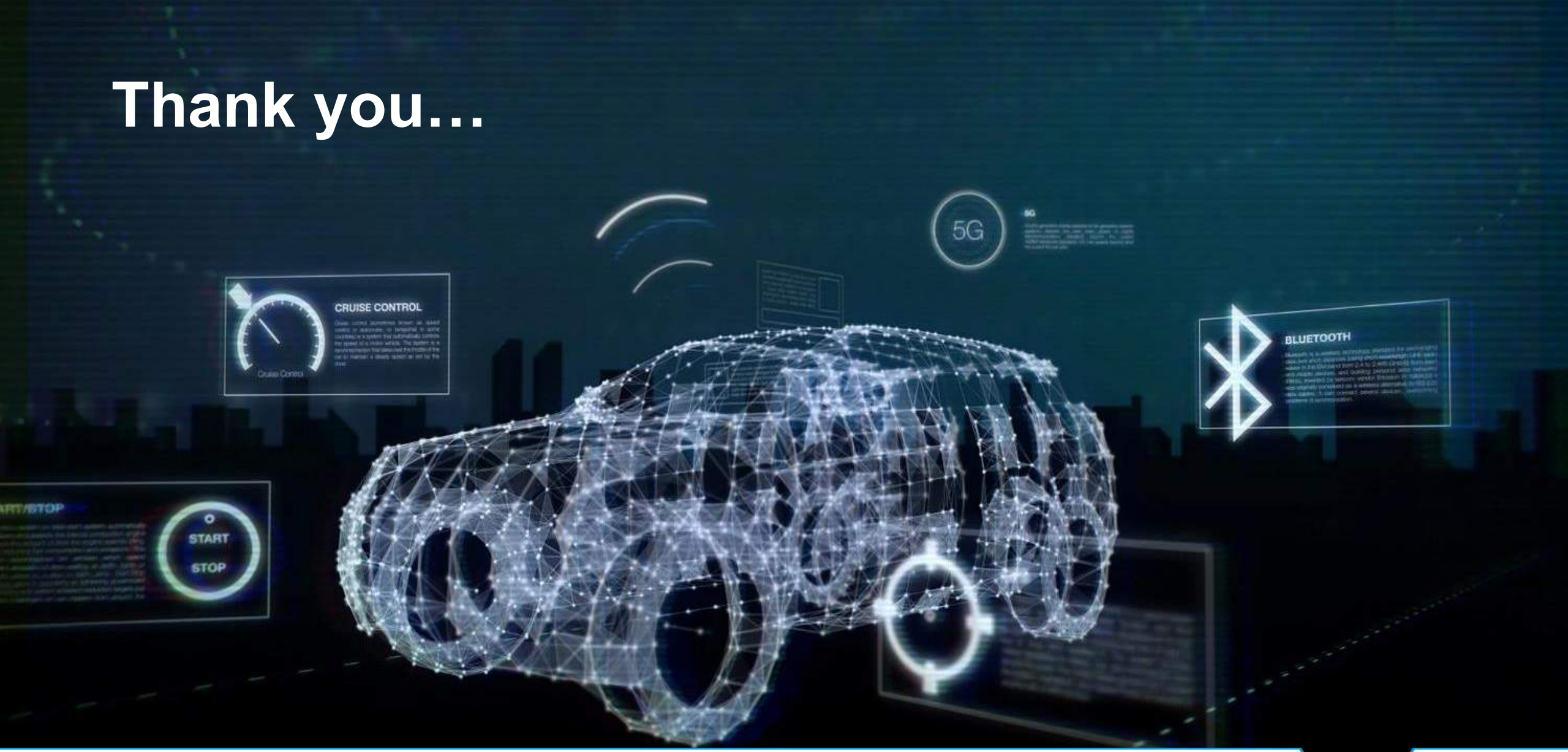
Real LiDAR Sensor Point Cloud

?



Virtual LiDAR Sensor Point Cloud

Thank you…



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Questions?

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