Using Aimsun as a traffic generation tool within a full motion driving simulation experiment.

Richard Romano, Andrew Tomlinson
iCAV Simulation Interest Group, 29/1/2019
Driving simulators are regularly used to test new road designs, new HMIs, and new vehicle designs.

Driving simulators experiments compare the performance and behavior of the driver between different configurations and conditions.

Driving simulators can also be used as an assessment device and training device.

Assessments can help shape policy decisions.
The University of Leeds Driving Simulator (UoLDS)

- Best in the UK and ranked in top 5 worldwide for Human Factors research.
- The simulator is supported by an interdisciplinary team of researchers investigating driver behaviour and transport safety.
- An experienced in-house development team can tailor scenarios and experiments to specifically address new research questions.
- The people are therefore key to the flexibility of our simulators and the complex research that they can support.
- 25 years of experience
• Funded by Innovate UK, under the Connected and Autonomous Vehicles (CAV2) programme.

• To build an autonomous vehicle with human-like natural control and path planning by 2020

**UoLDS Experimental Challenge:**

• 20 kilometre simulated route (the Cranfield Loop)

• Geo-specific

• Realistic traffic conditions

**Experiment Purpose:**

• To inform the development of an automated vehicle risk model, based on real driver preferences and expectations
Geo-typical databases are quite often used in driving simulator experiments because they allow a counter-balanced design and can capture a diversity of conditions.

Geo-specific databases can capture a variety of nuances with respect to road way geometry that are typically ignored when developing a geo-typical world.

Geo-specific environments can be used to compare driving behavior in the real-world with that in the simulated equivalent.

- Does speed and lane position match?
- Provide data for the risk model
Pre-inspection and editing of OSM prior to import.

Spin-off benefit: Quality improvement of OSM data
Sectional Lane Widths, Number of Lanes transitions, Short Links, Intersection Interpretation: Allowed Turns
Import Issues - Example

Sometimes the significance in OSM/Aimsun does not correspond to reality.

Google Streetview

Open Street Map (corrected)

Aimsun import
Fine Tuning + Perfect Correlation

- Both Trian3d and Aimsun use same Open Street Map reference
- Creates general correlation between the two representations, but some mismatches remain
- Fine tuning performed by manual editing of Aimsun road network using overlay generated from Trian3d model
Add Buildings and Other Features

Building Extrusions Based on GIS Footprints, Type and Height from OSM
Resulting Database

Is it good enough? Must test drivers and compare their behavior in the simulator and the real world.
Adding Traffic

- Aimsun start/stop and scenario selection controlled from UoLDS
- Aimsun running at 10Hz, 0.1s in advance of visual representation
- Correlation of vehicle lengths
- Also reports traffic light state
Lessons Learned

What went well:
• Robust data pipeline
• Reduced development cycle
• Use of pre-existing traffic model
• Realistic driving tasks
• Easy manipulation of traffic patterns/densities

What could be improved:
• Open Street Map
• Compromises between real network and simulated behaviour
• Vehicle lane change trajectory
• ‘Lost’ vehicle lane change behaviour
• Interpretation of driven vehicle intention
• Scripting interface/creation of specific events
• Reliable real-time behaviour

Takeaway Message
• Aimsun well aligned to support driving simulation
• Only limited improvements needed to achieve closely coupled integration