

# Advanced driving simulator



- CARRS-Q operates Queensland's first advanced driving simulator.
- The simulator progresses Australian road safety research by enabling the study of human behaviour in different driving conditions, with a high degree of realism, but free of crash risk.



## State of the Road A Fact Sheet of the Centre for Accident Research & Road Safety - Queensland (CARRS-Q)

### A QUEENSLAND FIRST

- Queensland's first state-of-the-art advanced driving simulator is operational at the Centre for Accident Research and Road Safety - Queensland (CARRS-Q).
- Based at the Queensland University of Technology (QUT) in Brisbane, the simulator advances Australian road safety research and provides new insights into driver behaviour, and ways to reduce road trauma.
- CARRS-Q's driving simulator has been in part funded by the Australian Research Council, QUT, University of Queensland, Department of Transport and Main Roads, RACQ, Motor Accident Insurance Commission, and General Motors Holden.

### WHAT IS CARRS-Q'S ADVANCED DRIVING SIMULATOR?

- The \$1.5 million project incorporates a complete Holden Commodore vehicle with working controls and instruments. The advanced driving simulator uses SCANeR™studio software and operates with eight computers, three projectors and a six degree of freedom (6DOF) motion platform that can move and twist in three dimensions.
- When seated in the simulator vehicle, the driver (and up to four other occupants) is immersed in a virtual environment that includes a 180 degree front field of view, simulated rear view mirror images, surround sound for engine and environment noise, real car cabin and simulated vehicle motion.

For many safety-critical situations, the simulator facilitates research that would be otherwise difficult, costly and often unsafe to obtain in a real on-road setting.

### HOW IS IT BEING USED?

- The simulator brings together researchers from several disciplines including road safety, optometry, psychology, mathematics and physiology.
- It provides researchers with new opportunities to study driver behaviour in different driving conditions, with a high degree of realism, but free of crash risk. A driving scenario can be created to select specifications - for example, specific environmental and traffic conditions (eg. inclusion of pedestrians, traffic, weather and road conditions) and situational changes (eg. the sudden appearance of obstacles).
- The innovative technology allows researchers to influence, observe and record drivers reactions and skills in a controlled, safe environment with precision accuracy.
- For many safety-critical situations, the simulator facilitates research that would be otherwise difficult, costly and often unsafe to obtain in a real on-road setting.
- To view CARRS-Q's research publications utilising the Advanced Driving Simulator, visit [www.eprints.qut.edu.au](http://www.eprints.qut.edu.au) and search "CARRS-Q Advanced Driving Simulator".

### WHAT TYPE OF RESEARCH BENEFITS?

- The simulator can be used for any form of road safety research which requires an understanding of driver behaviour. Given that most crashes involve driver error, understanding driver behaviour is essential.
- CARRS-Q's simulator has been critical for completed research, and future research into:
  - impaired driving (eg. fatigue, vigilance decline, driver distraction by phone or other devices, alcohol and drug-impaired driving, whiplash);
  - road conditions (eg. visibility of line markings in poor weather);
  - road environment (eg. behaviour on road curves, in tunnels and on railway crossings, and driver responses to signage changes);
  - in-car technology (eg. fatigue sensors, audible warnings, vehicle-to-vehicle communications, internet-enabled devices, future driving assistance devices);
  - at-risk road users (eg. older drivers, young novice drivers);
  - human behaviour (eg. emergency reactions and interactions with vulnerable road users such as cyclists, pedestrians and motorcycles);
  - Human machine Interface (eg. multi-modal interface to improve drivers social connectedness, feedback mechanism for eco-safe driving); and
  - Human acceptance of connected semi-automated vehicles.

## WHY IS THIS SIGNIFICANT?

- Road crashes are still the major cause of traumatic death and injury in Australia with an economic and social cost estimated at over \$17 billion a year.
- With a greater understanding of human behaviour in high-risk driving scenarios, effective interventions and safer technology can be developed to prevent crashes and save lives.
- CARRS-Q's simulator facilitates road safety research that could not otherwise be safely conducted on roads.
- It provides controlled and repeatable virtual environments from which we can gather highly accurate driving behaviour data.
- Driving behaviour, as observed in a driving simulator, correlates to actual driving on real roads.
- Most research studies are highly costly to conduct, and some are cost-prohibitive. For example, for a study on how drivers behave in a new tunnel, it is significantly cheaper and easier to use a simulator than to actually build the tunnel.
- Simulator-based research provides a cost-effective opportunity to explore research questions that would otherwise remain unanswered.

## HOW IS THE SIMULATOR BEING USED?

A number of projects involving the simulator are already completed, including studies on:

- Driver distraction by in-car devices (including mobile phone usage (hand held

and hands free), simulated GPS, simulated driver information device);

- Driver response to different railway level crossing treatments;
- Driver performance when recovering from a whiplash neck injury;
- Driver interaction with other road users (specifically motorbikes and bicycles);
- Driver performance when taking prescription medication;
- Driver response to different highway signage options;
- Driver behaviour related to aggressive driving;
- Encouraging safe driving behaviour using socially inspired gamification techniques; and
- The development of a prototype that allows a driver to control a car with a Brain Computer Interface.

Studies are about to start, or are in planning for a number of other projects, including:

- Driver performance and response to social information conveyed with a new type of Heads Up Display (e.g. google glass);
- The attitudes, fears and reactions of vulnerable road users to self-driving cars;
- How drivers and passengers react inside connected semi-automated vehicles; and
- How people with varying stages of dementia would cope with connected semi-automated vehicles.

The simulator is especially useful for the study of driver behaviour in a safe and repeatable environment, and is flexible to allow a range of studies and research tools. In addition to information on specific driving behaviour (such as steering wheel movements, brake and accelerator pedal usage, interactions with other vehicles and traffic signals), different researchers may choose to collect additional information on items such as:

- Driver eye gaze direction, blink rate and duration;
- Physiological information such as heart rate and EEG; and
- Sound or video record of driver comments (e.g. safety perception) or actions during the drive.

## WHO CAN USE THE SIMULATOR?

The Centre provides a venue for researchers to design, implement and test their scenario on a driving simulator at several levels of fidelity, ranging from very high (6DOF motion, 180° visual, real car cabin) to medium or low fidelity (desktop).

**CARRS-Q's simulator is available for use by any researchers and industry through contract or collaborative arrangements.**

## FOR MORE INFORMATION

### Simulator project enquiries

Dr Sebastien Demmel

Tel: +61 7 3138 7783

Email: [sebastien.demmel@qut.edu.au](mailto:sebastien.demmel@qut.edu.au)

### Media enquiries

Marketing & External Relations  
Coordinator

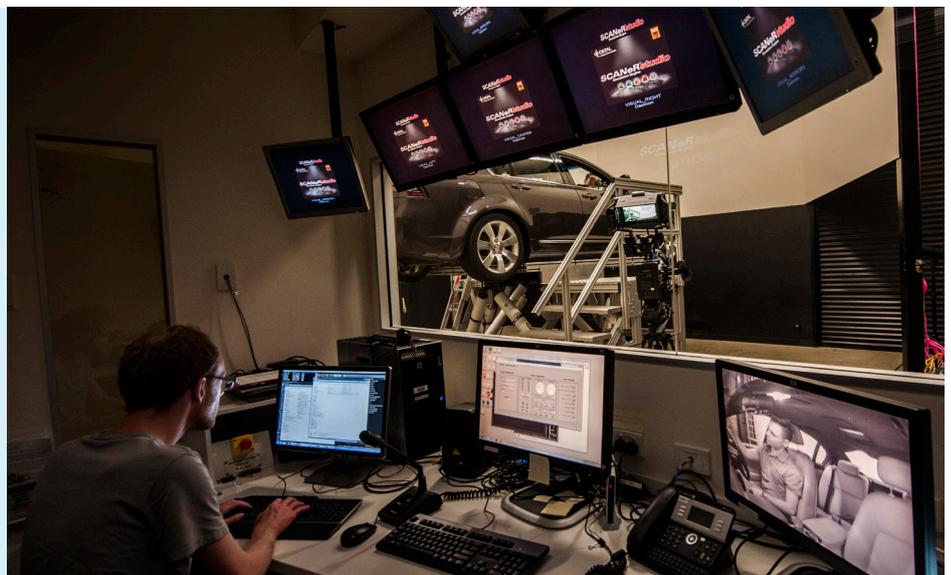
Phone +61 7 3138 4568

Email [marketing.carrsq@qut.edu.au](mailto:marketing.carrsq@qut.edu.au)

### Information

visit

<https://research.qut.edu.au/carrsq/services/advanced-driving-simulator/>



STATE OF THE ROAD is CARRS-Q's series of Fact Sheets on a range of road safety and injury prevention issues. They are provided as a community service and feature information drawn from CARRS-Q's research and external sources. See the reference list for content authors.

## FOR MORE INFORMATION

Marketing & Events Officer, CARRS-Q  
Queensland University of Technology  
130 Victoria Park Road  
Kelvin Grove QLD 4059 Australia

Phone +61 (0)7 3138 4568

Fax +61 (0)7 3138 7532

Email [marketing.carrsq@qut.edu.au](mailto:marketing.carrsq@qut.edu.au)

Twitter @CARRS\_Q

Facebook [www.facebook.com/carrsq130](http://www.facebook.com/carrsq130)



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