The HIKER Lab

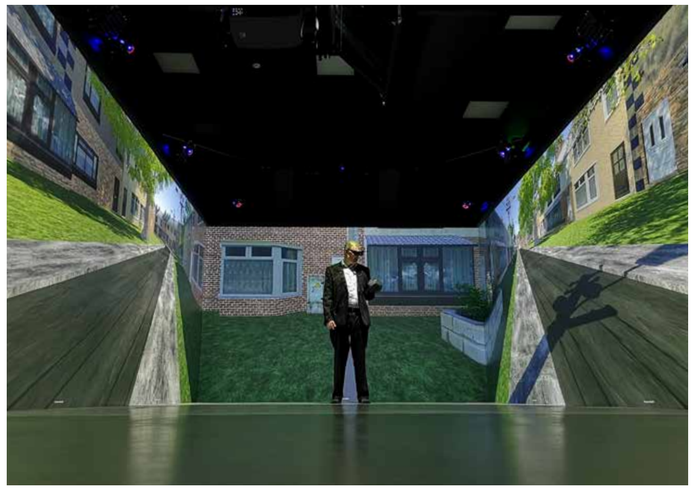
The HIKER Lab

The Highly Immersive Kinematic Experimental Research (HIKER) lab, funded by the UK Engineering and Physical Sciences Research Council, is the largest, 'CAVE-based' pedestrian simulation environment of its type in the world. The HIKER lab allows participants to interact with different urban environments and vehicles, with a level of real-world performance that is not possible to achieve using head mounted virtual reality equipment alone.

The HIKER lab contains a 9x4m walking space. The walls are plate glass with rear projection from an array of 4K projectors. The whole scene responds to the participant's head position and gaze. The result reproduces VR without the need for research participants to wear a VR headset, the use of which might undermine experiments that need to capture fine movements in real time. A notable example of this is the need for accurate, split second, measurement of the interaction of people and vehicles in life threatening situations. Safe pedestrian interaction with autonomous vehicles is a key current example of the research contribution of the HIKER lab.

The HIKER lab supports safe experimental research in an affordable and repeatable fashion, where a range of variables can be changed to address a choice of research questions – including automated vehicle design and human interaction, warning system design, and road crossing and intersection configuration. One key contribution will be knowledge on design options for future, sustainable cities, meeting the needs of future populations.

This brand new and unique research asset provides our partners and collaborators with an opportunity to explore innovative and imaginative research applications.



Get in touch

To find out more about how you can participate in Virtuocity and benefit from its unique combination of facilities and expertise, please contact us:

Professor Richard Romano
Chair in Driving Simulation
0113 343 8466
R.Romano@leeds.ac.uk

Professor Natasha Merat
Chair in Human Factors of Transport Systems
Leader, Human Factors and Safety Group
0113 343 6614
N.Merat@its.leeds.ac.uk

Dr Erik Thomasson
Research and Innovation Development Manager
07910 647626
e.n.thomasson@leeds.ac.uk

Dr Andrew Tomlinson
Simulator Facilities Manager
0113 343 7193
A.Tomlinson@leeds.ac.uk

www.leeds.ac.uk/virtuocity

Printed on recycled material.

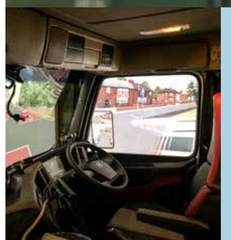
UNIVERSITY OF LEEDS

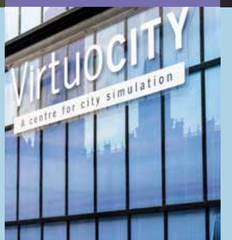
University of Leeds
Leeds, United Kingdom
LS2 9JT
www.leeds.ac.uk

UNIVERSITY OF LEEDS

VIRTUOCITY **FACILITIES**

A CENTRE FOR CITY SIMULATION





Our vision for Virtuocity

Virtuocity is a unique research and innovation environment, proving ground and accelerator for the design and testing of mobility systems, products and places.

A unique programme

Virtuocity is a unique programme for city simulation and co-design. It provides an immersive, 'human-in-the-loop' simulation and visualisation facility. This is powered by the latest knowledge, software, tools and expertise in modelling and simulation techniques, and is managed by an interdisciplinary team of renowned academics, with an extensive track record in human factors and mobility research.

Led by the Institute for Transport Studies (ITS) – an internationally-recognised centre for transport research (7th for Transportation Science and Technology, ShanghaiRanking's Global Ranking of Academic Subjects 2018) – Virtuocity leverages research and innovation expertise from across the University. The programme has links with a wide range of external partners and stakeholders – allowing Leeds to be a world player in simulation and virtual prototyping, providing solutions to current and future challenges in urban mobility and urban dynamics.

environment.leeds.ac.uk/transport

Research impact

Our research has informed the design of current and future transport systems, including smart motorways and advanced driver assistance systems, such as Intelligent Speed Assistance technology, which will feature in all new vehicles by 2022. Recent key contributions in this context include innovative methods for measuring and evaluating user response to autonomous vehicles.

Distributed simulation

Virtuocity comprises three simulation laboratories: the University of Leeds Driving Simulator (UoLDS), the Truck SIM and the Highly Immersive Kinematic Experimental Research (HIKER) Lab. These are interconnected through a new, exciting 'distributed simulation' capability, which allows research participants to interact in a single 'multi-player' environment. The potential for this facility to address the increasingly complex and disruptive mobility challenges of the future is currently unique in the world.

How can Virtuocity support you?

Virtuocity provides:

- A world-leading combination of facilities and researchers in an innovative, dynamic and multidisciplinary environment;
- Collaboration with end users, industry partners and decision makers to answer pressing questions, co-producing better and more cost-effective solutions to mobility systems and city design;
- Vast experience in using innovative tools and technology to generate reliable and robust outcomes;
- Interactive research and demonstrations, incorporating an extensive set of shared data and models;
- Encouraging and supporting safe, efficient and sustainable mobility and design solutions for the urban environment.

University of Leeds Transport Simulators

University of Leeds Driving Simulator (UoLDS)

Launched in 2006, the University of Leeds Driving Simulator (UoLDS) continues to be one of the world's most technically advanced driving simulators in use within a human centred research environment.

The UoLDS receives funding grants from UK and European governments and from industry partners. The UoLDS is typically used to study how drivers interact with new technologies before they are fully implemented on roads and in the vehicle. The UoLDS allows studies to be conducted in a safe and controllable environment, substantially reducing the costs associated with the development of systems, infrastructures or prototypes.

Features include:

- A realistic and familiar driving environment to enhance the illusion of driving a real car;
- Tactile and haptic feedback through the pedals and the steering wheel to replicate forces experienced during driving;
- A large and immersive virtual reality dome with wrap-around projection of a driver's-eye view of the virtual world being driven;
- Longitudinal and lateral movement via a 'hexapod' motion base and X-Y table that together provide a realistic perception of motion;
- The ability to record eye-tracking and other psychophysiological metrics, to understand driver states such as attention, situation awareness, workload and fatigue.

Research opportunities:

The biggest challenges currently being addressed using the UoLDS relate to the emergence of autonomous vehicles (AV) – and the need to simulate both the AV (as a virtual prototype) and to study driver behaviour at higher levels of vehicle automation. Research in both of these areas will contribute to accelerated but safe introduction of AVs.

UoLDS already has a twenty-year pedigree for executing high impact research projects, including:

- Driver situational awareness when using automated vehicles;
- Driver lane change decision making processes on the motorway;
- Using simulation for virtual vehicle prototyping;
- The effect of stress and fatigue on driver behaviour;
- Driver distraction and response to critical events;
- Development of driver friendly 'eco-driving' systems.

Results from studies conducted in the UoLDS have had substantial influence on national and international policy. For example, research on the simulator has shaped the understanding of how driver distraction affects road safety, providing guidelines for the implementation of speed advisory systems. The UoLDS system has been used to help car companies improve the handling and feel of their vehicles (a competitive advantage for UK and EU companies and researchers).

Extensive in-house expertise provides the adaptive capacity for tailoring experiments and virtual scenarios and for continuous technical development of the UoLDS to address new research challenges.

Truck SIM

The Truck SIM is an advanced commercial vehicle simulator which is based on a full-size HGV cab and a top-of-the-range commercial simulator system (AutoSim AS1300). It provides a flexible and realistic platform for undertaking advanced research investigations – including recent research to reduce fatalities caused through the interaction of HGVs with cyclists and other vulnerable road users.

Features include:

- Full-scale real HGV cab;
- Authentic instruments and brakes which feel like the real thing;
- Sound and motion systems providing a realistic driving experience;
- Computer-monitored steering wheel and haptic driver feedback system;
- Rear-view mirrors with simulated LED displays showing the actual mirror scenery during simulated driving;
- Advanced 3D eye-tracking system capture hi-fidelity information about the driver's focus and attention which can be matched to performance data from the Truck SIM driver interfaces.

Research opportunities:

As with the UoLDS, research is supported in areas such as driver behaviour, human machine interaction, driver situational awareness, vehicle handling, and road layout and design.

Clearly, the vehicle dynamics of a large commercial or goods vehicle will differ to those of a passenger car, so the Truck SIM will retain this niche function for researching interactions with HGVs.

Rail Simulation

ITS has recently been awarded new funding to enhance the simulator to support rail dynamics and passenger comfort studies.

This funding includes a new dome, two rail cabins (one passenger compartment and one driver compartment), and hardware to support interchanging the cabins on the motion base.

These facilities will be integrated with the new test equipment being built as part of the Institute for High Speed Rail and System Integration. In particular, we are working to improve how decisions are made on the design of track geometry, to help reduce the cost of constructing new lines and increase passenger comfort and safety.