FUNCTIONAL SPECIFICATION

The world's first purpose-built facility for the development, testing and validation of Intelligent Transport Systems (ITS) and Telematics technology.

Test Track layout

innovITS ADVANCE provides a comprehensive road network designed to replicate an urban driving environment with numerous junctions, intersections and multi-lane highways.

Roadside architecture including traffic signals and gantries complement a sophisticated range of functional specifications to give an unrivalled testing environment.

- Road layouts designed to simulate an urban driving environment (Figure 1)
- 2km outer circumference of test track
- Multi-lane highways over 300m in length
- European specification conforming road surfaces
- Network of junctions and intersections
- Sequential series of roundabouts
- Full 'urban' road markings
- Bi-directional traffic flow
- Power ducting and access points across the entire track
- Comprehensive ducting under track surfaces
- User-defined Traffic Signals (supporting both left and right hand driving) with red / amber / green and red /green signal heads)
- Catwalk style gantries conforming to HA specification allowing installation of specific technology
- Multiple road surfaces

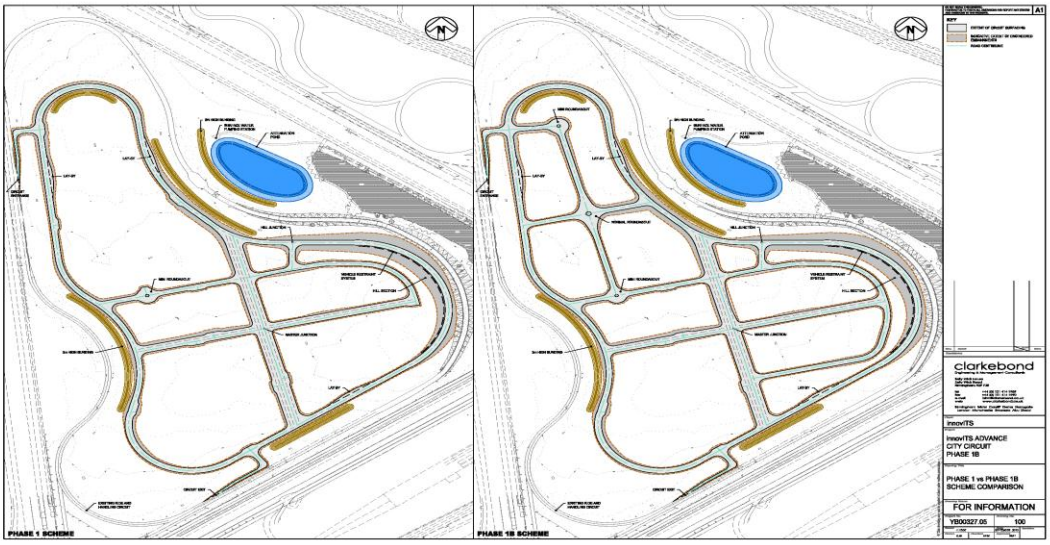


Figure 1. Showing the original layout of innovITS ADVANCE (left) and the new revised layout (right).

Telecommunications

innovITS ADVANCE features an open architecture of multi-zoned 3G, GPRS and GSM mobile systems, as well as a configurable wide-range Wi-Fi network. A web-enabled control system offers an environment where new developments can be tested according to precise specifications. Meanwhile, adjustable road conditions and communications access enable the replication of almost any conceivable urban scenario.

3G connectivity

- System users can degrade communication to simulate real-world operating environments and demonstrate urban effects in a straightforward and controllable manner
- 3G network access is obtained via a cluster of 'closed access' femtocells which facilitate handovers between 'on-site' base stations and transmitters. This allows vehicles to pass in and out of 3G range with pre-defined or spontaneous connectivity changes
- Flexible coverage is offered across the entire facility (120,000 sq. m)

GSM/GPRS connectivity

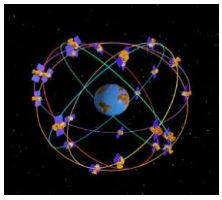
- Private stand-alone, multi-cell voice and data telecoms system (including SMS support) replicating the specification and functionality of a public cellular (GSM/GPRS) network
- Standard cellular communications equipment used to provide enhanced cellular telecoms coverage within the site perimeters
- 12 base transceiver stations provide blanket GSM coverage across the site
- Each base transceiver station is directional, enabling specific enhancement or degradation of regional site coverage
- Cellular GSM network supports voice and data services
- Multi-cellular architecture provides cell-to-cell handover of voice and data calls

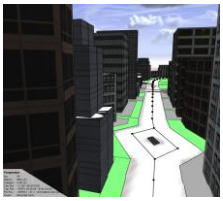
- Data transfer between fixed and mobile equipment supported to replicate normal network characteristics for standard GSM, GPRS and 3G
- Trace failed voice and data calls with time, data and location calibration
- Directional antennae allow users to define handover locations – onto a specific road junction or the entire track

Wi-Fi (DSRC) connectivity

- On site Wi-Fi conforming to 802.11 b/g/n/p which replicates narrow beam (tag and beacon) roadside for passing vehicles and general site coverage
- Compatible with 802.11p/CALM & M5/WAVE
- Supports CALM FAST and UDP routing
- SAFESPOT and CVIS co-operative awareness messages can be implemented
- Configurable device drivers to support every 802.11p implementation need
- Wi-Fi access network includes secure wireless data transfer from infrastructure / vehicles / the test track to the Control Hub and Control Centre
- Wi-Fi provides 6 access points covering a mapped out zone - effectively 6 zones covering the entire track with Wi-Fi -802.11b/g/n/p signal
- Each access point can be controlled 'step-wise' (by throughput and transmission power) via a control interface offering complete communication denial

GNSS Denial






GNSS location services are being increasingly used for non-critical applications like SatNav, as well as for safety and payment applications. As a result, the ability to simulate urban canyons, tunnels, jamming and spoofing through GNSS-denial has grown fundamental in testing applications.

By uniquely simulating operating conditions for testing GNSS-based devices and systems, the innovITS ADVANCE GNSS-denial system can host complex test scenarios and a diverse range of applications.

- Simulate GNSS signal obstruction, multipath, RF interference and jamming
- Simulate reception environments using a 3D digital model
- Customise 3D city models with model creation, editing and importing tools
- Test factory fitted in vehicle GNSS based telematics systems, after-market solutions, portable nomadic devices, mobile phones and other user terminal equipment
- Replicate GPS, EGNOS (SBAS) and Galileo signals with upgrade paths to simulate future signals (i.e. Glonass, COMPASS, QZSS)
- Respect existing Interface Control Documents for GNSS signals
- Provide realistic and consistent outputs (quality, content, signal/noise ratio) for use with commercial GNSS receiver equipment
- Attenuate GNSS signal provided to vehicle on-board or nomadic devices for location based services
- Simulate ‘urban canyons’ – vital for location-based systems operating in modern cities where satellite obscuration and multipath propagation compromise signal

GNSS Denial Continued

The system has been created to support the development of next-generation automotive and telematics solutions and services. These might include:

- eSafety
- emergency services
- advanced driver assistance systems
- cooperative safety systems
- autonomous driving
- road pricing and pay-as-you-drive
- stolen vehicle recovery and remote immobilisation systems
- vehicle diagnostics and accident reconstruction

A 3D model of the test site creates a "virtual" signal reception environment, which could include a customised cityscape, and is then combined with GPS signal data received by the system. This computes GPS signals that would have been obstructed in a real-world scenario and removes them from the raw GPS signal.

Signals affected by multipath can also be modified, retransmitting these signals (with minimal latency) into the in-vehicle GPS receiver.

The innovITS ADVANCE GNSS denial system is a portable system developed to operate with a range of GPS-based systems. It can be used with factory fitted systems or after-market systems, and offers a number of integration interfaces.

Mapping and positioning

Accurate measurement is critical in the testing and validation of ITS and Telematics solutions. Ground Truth incorporates all the precision measurement technology required to collate a highly credible set of data.

This is achieved firstly by performing surface observations and taking measurements of track features, before comparing coordinates of the ground resolution cell – taken using GPS technology – with coordinates of the artefact being studied through remote sensing software. These comparisons afford rigorous scrutiny, leading to a superior understanding of location errors and how they might affect a particular study.

Additional state-of-the-art camera facilities are also strategically positioned across the site to provide comprehensive data for each test.

Ground Truth

- Information collected "on location" relates image data to real features and materials on the ground, enabling the calibration of remote-sensing data
- Precision object tracking cameras and equipment measure vehicle positions on intersections with accuracy of 5mm at 5ms
- Camera locations can be reconfigured and repositioned to suit specific test needs
- Log files for site and customer use can be provided including an input for the location display system to show where objects are being tracked and located
- Access to time-stamped camera output to view and match with other data

CCTV

- Multiple, strategically located ‘Pan Tilt Zoom Day / Night’ cameras cover the entire track
- GUI-based control system and visual suite for viewing images
- Video outputs supplied to customers for off-site viewing
- MPEG4 digital format recorded for playback and editing

Test system & Control


innovITS ADVANCE has been designed to put the user in complete control. All test technologies can be closely monitored through a user-friendly GUI which connects the track to the control room, giving a cost effective method for data collection and analysis.

Control

- Supports equipment designed to use the core GSM 1800 frequency
- Technology interface through a purpose built, temperature controlled control sub system
- Test equipment whilst applying specific customisable network and operational effects/situations
- On-site 'Track office' with meeting facilities for set up, break down and data analysis
- Communication settings can be predefined for denial-based testing or adapted in real time
- Control Hub links to a Control Centre for off-site data generation, authentication and analysis
- Multiple data access points offer a customisable http graphical interface for setting and viewing communications parameters
- Integrated system tools capture, process and analyse real-time data generated during testing

Contact

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