



ITS United Kingdom Connected (but not autonomous) Vehicle Scale

The ITS (UK) Connected Vehicles Forum has developed a “scale of connections for Co-operation of Connected vehicles”, to mirror the SAE scale for automated ones. This scale shows that connection and co-operation between existing and future vehicles and roads is very different from automation.

It aims to explain to non-technical readers what services they might expect from a new vehicle or smartphone and highlight that work is still needed to make roads ready for connectivity, even if vehicles and communications are.

It has deliberately not focussed on technology. It reflects the “HD ready” approach that was used for digital TV switchover to help users understand what would be possible without needing to understand the detail.

The scale uses letters instead of numbers as in the SAE scale. A service only reaches that level when widely available (e.g. an app is published) rather than a demo or research project shows it working (as this scale is customer focussed).

The SAE level is very simple to understand but has nuances, and so will this scale. It also starts in the real world of minimum connectivity with Level A and level B to capture every vehicle today but then looks at short term connectivity and opportunity, rather than long term automation.

It will be reviewed periodically to take account of the rapidly changing landscape. For example, when V2I and V2V plans mature, level E may be split further but currently there are different views re V2V and V2I timing.

Currently all vehicles are at Level A, and with a smartphone can get to C. Level D would take the services many of us work on today in research and demonstrations and make them more widely available and used, as the first step “connected roads ready” allied to existing communications and vehicles. All new vehicles today with connections to head units would be level D but the roads and communications are not yet at the level. This reflects HD TV rollout when HD TVs became available before HD programmes.

Level E vehicles are not yet available, but maybe soon.

	Co-operation examples		
Connected vehicle level	Connection to a moving thing or user	Connection from moving thing or user	Comment
A	Eyes and ears	Tooting Horn. Flashing Lights. Waving.	Minimum level – almost all road users today
B adds to A	Radio adds traffic news	Mobile phone for speech / text when parked or accident e.g. cashless parking by text, ring 999	Almost every vehicle today with a user with a phone
C adds to B	Connected sat nav/ smartphone giving traffic routes and some in vehicle information e.g. congestion.	Smartphone data or fleet management/ pay as you go insurance device gives location and speed. New data sources being exploited e.g. potholes, road condition, parking spaces. Bus priority from vehicle data. eCall and bCall data for emergencies. Some emissions data. Driver behaviour monitoring. Data from cycles, HGVs and pedestrians not just cars.	Many users today especially with a linked smartphone or a new vehicle, but also with OBD2 devices fitted in older vehicles. Many projects in the UK already researching links to existing vehicles using existing communications – scaling them up makes level D.
D adds to C	Next generation smartphone-based services – for smart parking and kerbside services, in vehicle signing, roadworks warning and GLOSA to tell drivers when signals will turn green. Notification of speed limits for Intelligent Speed Adaptation services	Wide use of data harvested from all types of vehicles to at scale improve road network management and maintenance, e.g. better signal setting, priority to vehicle types, queue detection, road safety	Connected roads level 1 – uses existing communications to add wide coverage of a wide range of new services, for users of both existing and new vehicles. Most vehicles today are level 1 ready, as are smartphones. But the roads data isn't fully ready yet to support this
E adds to D	Uses new communications technology to connect into and from moving things, in three ways: <ul style="list-style-type: none"> - Vehicles to Infrastructure (V2I) – adding new services fully integrated into the vehicle using data from the road (e.g. queue warning, GLOSA) that can add to or replace roadside information - Vehicles to pedestrian (V2P) – linking vehicles and pedestrians for awareness for safety (also cyclists etc) - Vehicles to Vehicles (V2V) – data exchange between vehicles for immediate queue warning and services like platooning, deployed by vehicle makers Some services may also use next generation smartphones		Connected roads level 2 – new communications technologies allowing additional services for new vehicles with some retrofit via future smartphones. Needs much investment in roads and resources to make “roads ready” for V2I. Some new vehicles may be Level 2 ready next year.
F adds to E	Links vehicles to everything (V2X) to support autonomy, future mobility services and safety. New data includes hi definition mapping of the road network		Connected roads level 3 – new vehicles and new technology for communications as well as significant investment in roads.

Some notes:

- “moving thing “reminds us that cyclists, horses, motorbikes, tractors, trucks plus pedestrians and older vehicles can be connected, not just new cars
- Head units and smartphones can be linked in mass market existing vehicles already, to reduce safety concerns and improve integration (e.g. Google maps via Android Auto)
- Speech is replacing screen interaction for many applications e.g. sat nav and links to the head unit make this customer friendly and safer than a standalone smartphone
- Emphasis made on the need for vehicles AND communications AND roads/ infrastructure to all be at the same level – as for digital TV switchover

Glossary:

eCall: System in all newly type approved cars from 2018 reporting location when airbag enabled to police, and with manual SOS function

bCall: System in many new cars reporting location and fault cause when vehicle breaks down

Connected roads ready: A level of capability to receive / transmit co-operatively to be ready for services (like HD ready for TV) to help consumers adopt the right vehicle/ phone/ PAYGI / Dongle and roads operators to provide the data and if required communications to support this

PAYGI: Pay as you go insurance, maybe by smartphone, OBD2 dongle or “black box”

OBD2 Dongle: A device plugged into the On-Board Diagnostic port of any post-1996 vehicle for fleet management, bCall, PAYGI etc

V2V: vehicle to vehicle communications (eg messages about stopping vehicles sent to following ones)

V2I: Vehicle to/ from infrastructure communications (eg messages about virtual signs, reports of queues...)

V2X: Vehicle to anything (vehicle, infrastructure, pedestrian....)

GLOSA: Green Light Optimized Speed Advisory - telling drivers how best to go through signals at green/ when lights will turn green