

# Just one test for an automated vehicle?



An interview with  
James Long  
and Ollie Howes

## If clients could only do one test at SMLL, what would it be, and why?

Over coffee, the engineering team at SMLL are talking about testing connected automated vehicles (CAVs) and their various on-board systems. One of them lays down a challenge: If we limited clients to do only one test, what would it be and why?

The first suggestion is to pit the CAV against the humble mini roundabout at Plumstead in South London, part of the London testbed managed by SMLL. This provokes a roar of laughter, as this particular mini roundabout is very special. And is likely to see any CAV fail to navigate it successfully at a first attempt. It's a bit like watching the contestants on Week One of Strictly Come Dancing. They've had four weeks to learn their left foot from their right and count to four, but they can't really tango.

The SMLL testbed is a route around London chosen deliberately because it has many features that are highly representative of highways in the UK – it has virtually every kind of junction for instance. But this one mini roundabout offers good “bang for your buck” because a CAV has to deal with lots of features in one location.

The mini roundabout was invented in Britain. This particular one on the SMLL test route is an excellent example for a variety of use cases because it has a particular set of features, where unusual local behaviours can be expected. It is typically a-typical of British roads, in that it is both highly representative of many normal features and behaviours to be found in towns all over the country, but

typical also of quirky features and associated behaviours also commonly experienced by drivers. This makes it perfect for testing a vehicle or service developed in the US, which is destined for export to the UK, precisely because the roadscape is different, the rules of the road are different, the driving styles are different. This mini roundabout is different to the US and also different to other “normal” British mini roundabouts.

Explore the Plumstead mini roundabout on [Google Maps](#)

What3Words:  
[hung.amount.courier](#)



To appreciate what makes this particular mini roundabout so special, it's best to take a peek on the [Streetview setting of Google](#). The SMLL test team spend hours watching it from a suite of cameras. It's a soap opera with an everchanging cast. They witness many unusual driving behaviours (as in, it would be a fail in a driving test, although many manoeuvres are fairly typical for mini roundabouts). For instance, people drive in a straight line over the top of it, they do not observe true lane discipline on approach or exit. Bus routes go off all four arms of the roundabout, with the buses taking strange driving lines depending on whether they are taking exit 1, 2 or 3. The mini roundabout is at the top of a hill, so it is out of sight when approaching uphill, with many drivers caught by surprise when it materialises in front of them. It has several different road surfaces and textures – indeed, one part of the road surface is raised so that when approaching it uphill, a camera feed or lidar sees all sky before it suddenly dips down to show the roundabout immediately ahead, sending situational awareness algorithms into freefall. So this 50ft gem has lots of physical and geometry complexities. But there are also behavioural aspects which confuse human drivers: there is a school nearby so "lollipop ladies" jump into the road with an array of gestures, and the other road users respond in

a wide variety of ways, some braking hard, some swerving and driving around, some clearly don't know how to react at all. How much of that sounds familiar as a regular driving experience?



**"It's our favourite bit of the test route" admits James Long, Chief Technologist at SMLL, "but the question really should be whether it's an appropriate test for a CAV. The point of testing at SMLL is to expose the CAV to a real world environment in order to provide confidence to insurers, investors, end users etc that it works in a realistic location".**

"The OEM developers of CAV and the software brains within them need to know how good they are, how safe they are" explains Ollie Howes, Head of Automation. "To do this, they start by understanding the journey environments in which their vehicles and systems will be operating. So they need test locations which mimic those intended operating domains. And ideally, for efficiency and assurance, it helps to use real world test locations which are the most extreme version of that possible domain. For example, if testing an automated service that just runs from A to B along a dual

carriageway, a test plan needs to be looking at where it stops, how close it stops to the kerb, how it responds to traffic lights, how well does it communicate with a bus stop and so on. But if the intended CAV is going to be doing last mile deliveries to the door, it would be pointless testing it on a dual carriageway, it needs to be tested on zebra crossings, mini roundabouts, negotiating bus pull ins and cars parked in unexpected places and so on".

"A successful test involves quantifying the characteristics of your intended operating domain, and measuring the interactions that matter" says James. "It's not the length of the testbed that is important, or how many features it has, it's about the ability to measure what is happening along that route. At SMLL there are 10 cameras per mile tracking and recording everything that happens. This intensity of monitoring, alongside other information from the vehicle and other infrastructure, gives us the ability to measure multiple data points for performance and behaviour. Our mini roundabout example is all about that 'bang to buck' ratio because it has such a concentrated set of features and we have eyes on all angles of it, so vehicles can do repeated loops at a single location, generating lots of lovely performance data, and we can measure everything that's happening".

The four arms of the mini roundabout at Plumstead, as seen from the centre of the junction



The same four approach roads to the mini roundabout



Collecting terabytes of data is all a bit pointless though unless you know what "good" or "safe" looks like, or what the acceptable margins are. This particular mini roundabout is a complex location and may not make a good test location for most of the CAVs and automated services planned for early deployment, points out Ollie.

"Real world testing has to be done responsibly" he asserts. "The objective is to measure how well the CAV is performing, in an evidence based way, in the environment in which it

is designed to be operating. Before a vehicle would, in all reality, be pitted against the infamous mini roundabout, it would need to prove it had been through the appropriate stages of preparation, testing at increasing levels of complexity (probably at other testbeds with controlled and semi-controlled environments), and the test regime is based on a thorough understanding of the test environment".

This is where the idea of the CAM TestbedUK "passport" scheme

comes in. Like crossing borders, CAVs need a visa to enter the SMLL mini roundabout and interact with other road users.

“

**"We can only control so much in the real world", says James. "However, what we can do is measure things, even the things beyond our control. This is what the testbed is for".**