



# Q&A

## CIVIL ENGINEERING



### Q1: What is a mobile LiDAR system?

**A:** LiDAR stands for **Light Detection and Ranging** - it's a type of technology that uses light to make superaccurate distance measurements. A LiDAR device works by sending out a thin beam of very bright light, which hits an object then bounces back. The device measures the time it takes for the bounced-back light to return, and uses that data to work out a precise measurement. In this way, LiDAR scanners are a little like a cross between a torch and a camera - although LiDAR devices can fire over 100,000 light pulses per second, and collect millions of individual measurements. This point data can be combined by surveyors to create 3D computer models and maps of objects and environments.

When a LiDAR device is mounted to something that can move, it becomes a mobile LiDAR system. The moving thing could be as high-tech as a drone or an automated robot, or as low-tech as a backpack! You could find a LiDAR scanner on the top of a car or a boat, or on the belly of an aeroplane. And because the devices can be fitted to such a wide range of mobile vehicles, they can be used to collect measurements over large areas and in hard-to-reach places, like forests, busy cities with lots of skyscrapers, and even at the peaks of mountains!

### Q2: How many mobile LiDAR systems can you see?

**A:** One LiDAR device has been attached to the nose of the Reigl helicopter in grid D,5. The Monsen Engineering drone in grid reference C,2 does not have a LiDAR device, but it does carry a camera on its belly that is used for **photogrammetry**: a process of taking measurements from photographic images.



**Q3: Can you find any mobile LiDAR systems in the air? How many are there?**

**A:** Two LiDAR devices have been attached to flying vehicles: one is on the belly of the Monsen Engineering drone in grid reference C,2; the other has been attached to the nose of the Riegl helicopter in grid D,5.



**Q4: Look at the compass and discuss which direction the mobile lidar vehicles are heading in.**

**A:** CAT Surveys (E,1), ESP (G,2), Topcon (B/C,4) and the Monsen Engineering drone (C,2) are all moving in a south-west direction.

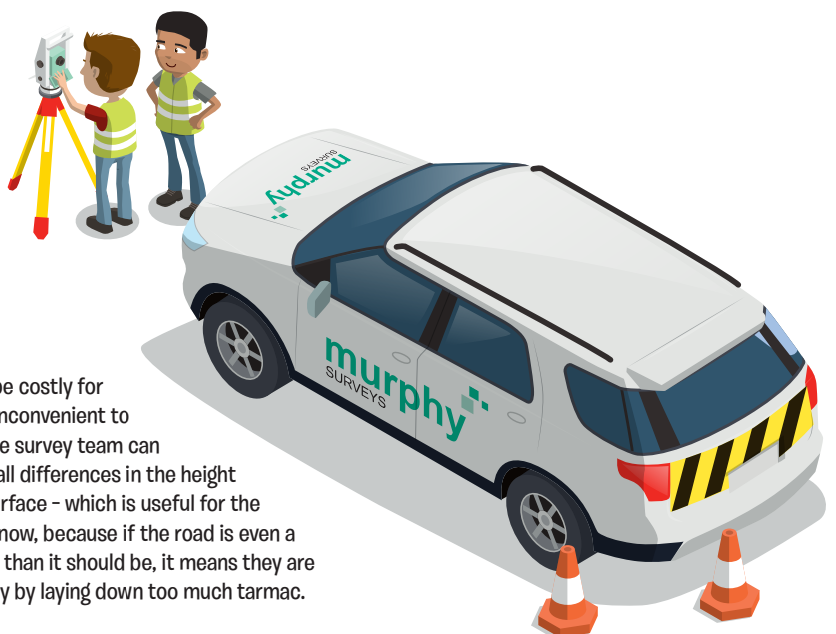
Leica (H/I,4), Riegl (aerial, D,5), Geocurve (B/C,1) and Seiler (E,6) are all moving in a south-east direction. Riegl (land, I,1) is moving in a north-west direction.



**Q5: Which surveyor is measuring the size of the hole where the UFO is?**

**A:** She's standing in grid 4G, with an understandably surprised look on her face! Surveyors have been known to find all kinds of interesting things on survey sites around the world, but an alien spacecraft might well take the top spot for most flabbergasting find! The surveyor is

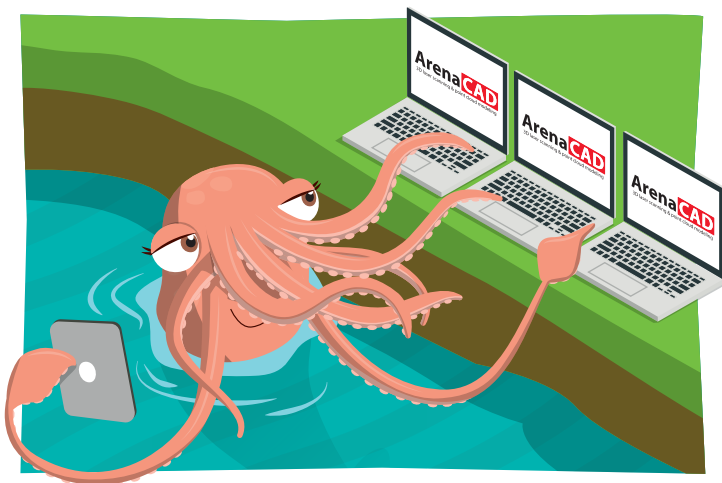
using a Trimble SX10 scanner, mounted on a tripod so that she can carry it around between jobs. However, while the surveyor is using the scanner, it has to be fixed in one place - that's why it's called a static scanner.



**Q6: Can you guess what the surveyors are measuring next to the asphalt machine, which is laying new tarmac on the road?**

**A:** The team from Murphy Surveys in grid I,4 are scanning the road to make sure that the new tarmac being laid down is level. This is important for a few reasons. If the tarmac isn't evenly spread, there will be bumps that could send innocent cyclists soaring out of their saddles, as well as dips which will collect water and might even damage vehicles that drive through them. The surveyors can also tell if the road isn't level, and likely to suffer uneven wear (and eventually close for repairs,

which would be costly for councils and inconvenient to motorists). The survey team can even spot small differences in the height of the road surface - which is useful for the workmen to know, because if the road is even a tiny bit higher than it should be, it means they are wasting money by laying down too much tarmac.



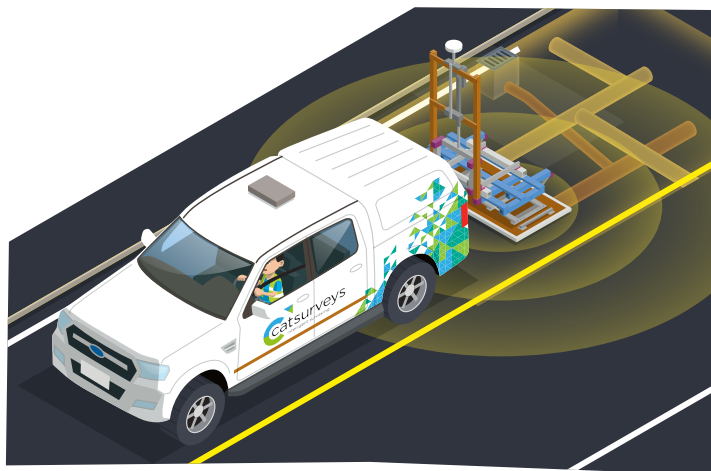
### Q7: Find Sir Scan Allot. How on earth can he type on several computers at once?

**A:** Sir Scan Allot is in grid reference C,1 – and he’s a squid! Most squid have eight arms and two tentacles; you can tell the difference between the two because arms have suckers along the whole length, but tentacles only have suckers at the tip. The tentacles are also longer in length, and they are mainly used to catch prey, whereas the arms are used to move and attach to surfaces while resting, as well as helping to grasp prey.

The squid is a member of the cephalopod group of molluscs – which also includes octopuses – and with all those arms and tentacles working together, ‘Scan the Man’ can get ‘Allot’ done in a day!

### Q8: Which scanning system is looking under the street?

**A:** The team from CAT Surveys is working across grid references E,1 and F,1 to perform an underground scan using GPR. GPR stands for Ground Penetrating Radar, which works like LiDAR, only it uses radio waves instead of light (because light can’t travel through solid objects, but sound can!). The GPR scanner measures the bounce-back time of the sound waves, then uses this data to create a picture of what it looks like underground – including hidden and buried things like cables, pipes and tunnels. This is great if you’re building something and don’t want to accidentally cut through a whole town’s water or electricity supply! It would also come in handy if your job was to check those water pipes for leaks – using a GPR scanner to find breaks from above ground instead of having to dig up the whole road just to check the pipes saves time, money and inconvenience – plus it’s much safer for the workers involved!



### Q10: Find Captain Alice. What’s she showing everyone?

**A:** You can recognise Captain Alice by her tricorn hat! She’s in grid reference E,2 – showing her map of the city to two lost surveyors and helping them get back to their job site. Lucky for them, Alice is a real-life cartographer – someone who uses survey data and other information to make maps!



### Q9: Find Elaine. (Hint: she’s wearing a turquoise jacket). What’s she measuring with her laser range-finder?

**A:** She’s hanging out in grid reference C,3, and she’s measuring the height of a tree using a nifty laser rangefinder. She might be checking the growth rate of the tree to make sure it has enough space in the middle of this urban environment – it might well be time for a trim!

### Bonus: Can you find Prof Topo and Piggie Wiggle?

**A:** They’re in grid reference I,2, and it looks like they’re having a lovely walk – taking in all the sites and spotting all the survey activity in the city!

