

This 3D model demonstrates what the Matterport system is able to produce

Such is the scale of change in the field of surveying that it would help to have some high-tech surveying equipment to capture the full picture.

Thomas Allen reports



# Surveying change

Theodolites and levelling rods could soon be relegated to museums, as construction relics of a bygone age.

At least, they might become redundant on large jobsites, since technology is shifting the job of surveying out of the hands of humans and onto machines.

For instance, a lot of tier-one contractors in the UK were said to have started deploying Matterport's 3D scanning system, according to Charles Hill and Karl Pallas, co-directors of Immerse UK, a local reseller of the system.

Hill said, "It is a camera device that records light and depth data to quickly generate an accurate photo-realistic 3D model of a space."

The device is moved to a number of positions around the site, with each scan rotation taking about 30 seconds to complete.

"The raw scan data is uploaded to the cloud to quickly generate a complete, dimensionally accurate 3D model, which can either



Matterport's camera device records light and depth data to generate an accurate, photo-realistic 3D model of a space

be downloaded as a point cloud file (the same output as a laser scanner), as a coloured texture map mesh file, or viewed in a web browser," Hill added.

Currently in use on a number of large UK projects, including the King's Cross redevelopment, the Thames Tideway and the Farringdon Crossrail station, the Matterport system can be used to keep a record of work before trades exchange.

This ability to keep record and add tags to the 3D model that link back to the document control system removes the need to take lots of photos and minimises the potential for dispute.

Looking to the future, Pallas said, "In construction, it may be possible to compare 3D CAD (Computer-Aided Design) or BIM (Building Information Modelling) models with Matterport models to automatically identify where changes from the original design have occurred, rather than spend money on a professional engineer to do as-built drawings."

## CAD models

On the subject of CAD models, Leica recently introduced its new DX Office Vision, which is utility post-processing software for mapping ground penetrating radar data from the field into a CAD drawing.

Leica's new DX Office Vision software was said to ease the process of mapping ground penetrating radar data from the field into a CAD drawing



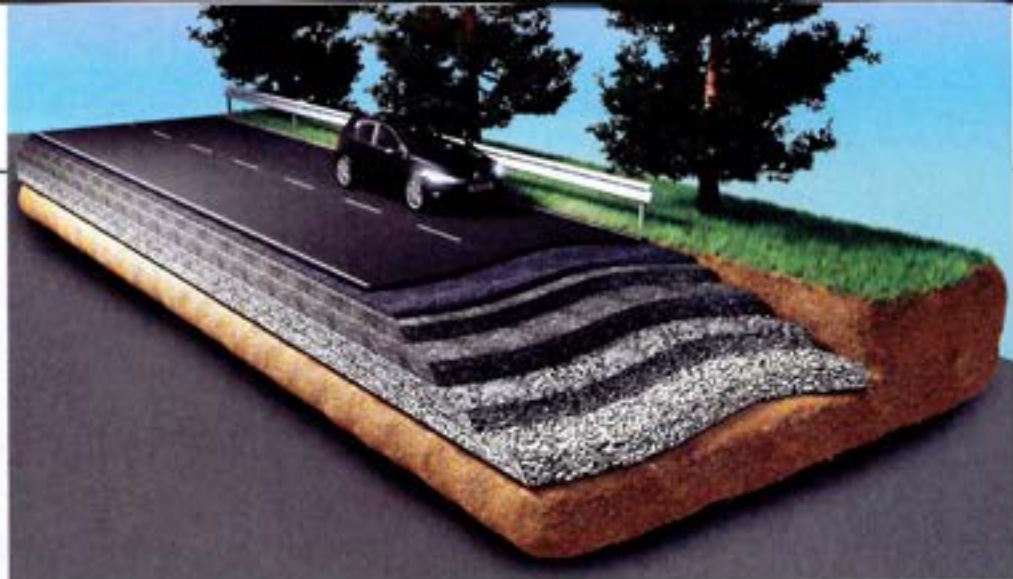
## SURVEYING

### The new **Pave-TM** system from Moba automatically measures layer thickness for road construction

Due to its intuitive interface, DX Office Vision was said to allow even inexperienced users to obtain professional 3D CAD drawings, with minimal training.

Developed by utility surveyors, the software was created to reduce the post-processing time and eliminate unnecessary steps to convert data or choose parameters. As a result, no add-on or third-part software is required.

Tughan Telatar, product manager of construction tools for



Pix4D's crane camera has been used in Denmark to monitor progress on a large hospital project that has 13 cranes and multiple sub-contractors working on it

Pix4D's crane camera captures 2D perspective-free, scaled orthophotos, which can then be stitched together to create orthomosaics

Leica, said, "DX Office Vision is so simple to learn that anyone from the crew can take over data processing into professional CAD drawings in five steps and it is 50% faster than traditional methods."

Also looking underground, Moba has revealed its Pave-TM, a system for automatically measuring layer thickness for road construction.

Said to be the world's first non-contact system of its kind, the company suggested that Pave-TM makes for better quality asphalt paving by reducing the risk of human error and increasing safety. Altogether, it was said to lower costs.

The high-end controller, MPC-120, calculates layer thickness in real-time, working in conjunction with Sonic-Ski Plus, which comprises four high-precision ultra-sound sensors.

After one initial adjustment, the system continuously displays the current thickness of the paving, be it surface course, base course or binder course. This was said to make for better-quality asphalt paving since layer thickness is a key determinant of paving quality.

Due to Moba's close cooperation with Dynapac, the machine manufacturer's SD series pavers are Pave-TM-ready as standard. The system can also be fitted retrospectively, meaning that pavers of any age and type can be upgraded.

### Crane camera

Going in the opposite direction, high above the ground, Switzerland-based Pix4D's crane camera has been used in Denmark

## ShapeDo shortlisted for accolade

Software company in the running for London Construction Awards

Israeli-based construction software company ShapeDo has been chosen as a finalist for the Technological Innovation of the Year award by the London Construction Awards panel.

The company provides management software centred around automatic drawing overlay and comparison, allowing project managers to identify differences and react to design changes in real time.

Ari Isaacs, CEO of ShapeDo, said, "We were seeing hundreds of unnoticed changes in drawings stretch projects out by months and cause them to run grossly over budget. By using ShapeDo to identify these changes, construction professionals gain an unprecedented level of control over their projects and, therefore, costs."

This shortlisting comes on the back of ShapeDo winning the NEX People Innovation of the Year award in June.

In Israel, ShapeDo has been used in projects including the Ramon International Airport, the Tel-Aviv light rail, the Route 6 highway, and the Haifa port, with reported profit increases of up to 1.5% of project scope.

**With ShapeDo's software, project managers can identify differences and react to design changes in real time**



to monitor progress on a large hospital project that covers more than 15ha.

Developed in collaboration with Liebherr, the weather-proof and vibration-proof camera has been automatically collecting as-built data on a day-to-day basis, in order to help the project managers keep track of what is a complex jobsite with 13 tower cranes and multiple sub-contractors operating on it.

The purpose of the camera is to generate 2D perspective-free, scaled orthophotos of the site, so having it point straight down is important for ensuring better orthomosaics, where by the photographs are stitched together.

On the Danish site, the project team decided to set up the camera at the end of the jib on a 65m rail-mounted tower crane before installing it on site. This apparently took the team less than 30 minutes to do.

Since the camera is powered by the crane and is equipped with a mini computer, as well as GPS and movement sensors, the system can run independently.



**Texo DSI has introduced a UAV integrated survey-grade LIDAR system that offers an accuracy of one to three millimetres**

Data collection can be controlled remotely or run automatically. On the hospital site, it was

set up to automatically collect images every day at the same hour and for the same period of time.

The images are then uploaded to the cloud, where it takes a couple of hours to be processed into 2D and 3D models.

Pix4D software uses advanced image analysis and photogrammetric algorithms to process the images. Due to the fact that the images are orthographic, they can be compared with CAD and BIM drawings used on the site.

### Mapping with drones

Also up in the air, Pix4D has been working on mapping software for drones.

Norway-based construction company Isachsen has been using Pix4D's drone mapping software, Pix4Dbim, in combination with desktop and cloud processing, to keep track of and manage its projects.

Isachsen is currently working on the construction of a tunnel in Drammen, Norway, and the team uses a DJI Phantom 4 Pro drone kit to get as-built updates once a week.

Trygve Almquist, a surveyor at Isachsen in charge of the drone fleet, said, "With this type of site, we need to fly a lot – more often than mining for instance – because everything changes so quickly on the ground."

With Pix4Dbim software, Almquist said he was able to process the captured images either on the cloud or on desktop and then upload results from one application to the other. However, due to the fact that 2D orthophotos and 3D point cloud outputs

## Preparing for auto mall

Topcon technology used for preliminary works on Canadian site

**C**anada-based Dilawri Automotive Group recently constructed a four-dealership automotive mall in Barrhaven, Ontario, Canada.

As the general contractor selected for the job, MB Ford Construction sub-contracted the complete preparation of the 6ha site to Rabb Construction.

Rabb had to level and grade the former stone quarry for the elevated building pads and their surrounding inventory lots and customer parking. The contract also included the excavation of three approximately one-hectare storm water runoff retention ponds and the construction of the on-site sewage systems.

Brenda Burrows-Rabb, general manager of Rabb Construction, said, "We were supplied a full set of design drawings, grading plans, storm water management plans and structural plans, which were completed by a team of consultants and designers.

"Using this design information, we developed a 3D site model to use with the Topcon GPS machine control system on our equipment. This site model was also available on our Topcon Tesla tablet data collector hand-held rover. Having field access to the site model increased our efficiency and accuracy."

The earthmoving on the project was carried out using Caterpillar crawler hydraulic excavators, including a Cat 321D equipped with the Topcon C-53i excavator system, and two dozers – a New Holland DC80 and a Cat D6R high-track dozer – both equipped with Topcon 3D-MC2 systems.

Burrows-Rabb said, "The Topcon systems helped us achieve grade on this challenging site and saved us a tremendous amount of time. We've eliminated the necessity for multiple passes and there is no need to re-visit any of our work."

**Rabb Construction has been using Cat excavators equipped with the Topcon C-53i excavator system to carry out preparatory work at a site in Canada**



**This UAV pilot is using a drone to carry out a job that used to take a group of surveyors up to ten times longer to do, according to Texo DSI**

are required, to share with the project stakeholders, many of the flights are only processed on the cloud.

In terms of the time it takes, Almquist said, "I need five to seven minutes to arrange and upload the dataset. To get the finished results, it's usually about an hour and twenty minutes."

One of the biggest advantages of



the system was said to be the fact that it facilitates work between all the project teams working on the site because the surveys can be made available to everyone.

### **Survey-grade LiDAR**

Texo Drone Survey and Inspection (DSI) has also been working on drone-related technology. The UK-based company recently introduced what it said was the world's first Unmanned Aerial Vehicle (UAV) integrated survey-grade LiDAR (Light Detection and Ranging) system.

The company's UAVs currently in operation were said to be able to deal with wind speeds of up to 15m per second, with the flexibility to carry a variety of custom payloads – Texo DSI has permits for payloads of up to 20kg. A prime example is its LiDAR survey work.

According to the company, a traditional ground-based survey typically takes ten times longer to carry out than a LiDAR survey, and comes without the benefit of high-definition images of the site or structure. It was also said that LiDAR offers a cheaper and safer alternative.

In terms of scale and accuracy, UAV surveys can cover hundreds of hectares in a single day and acquire thousands of high-definition geo-referencing aerial photographs.

LiDAR measures distances using light in a pulsed laser form, and the images are then processed to provide detailed aerial mapping and topographic surveys.

Texo DSI said the accuracy of data in a standard LiDAR survey is generally around 40mm. However, Texo DSI's new system was said to be capable of achieving an accuracy of one to three millimetres.

The system is delivered via a custom-built UAV platform that measures more than 1 million points per second, providing a reliable baseline for future surveys.

Other possible applications include thermographic surveys, optical gas imaging, and hazmat detection and hyperspectral imaging.

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