



**CONSTRUCTING
EXCELLENCE**
South West

Using the digital data from drone **technology** on construction projects

Advice Note **4**



Embracing change

Construction firms are starting to embrace change, technology and new construction methods to increase their margins and deliver a superior product and service to the end client. They are starting to embrace new digital technologies such as drones, terrestrial laser scanning, BIM, data analytics, and offsite manufacturing.

The construction sector is beginning to realise that digital or reality capture data is now becoming an essential part of conducting business because of the many benefits this technology brings. Drone surveys can be used within the construction sector to produce accurate 2D/3D digital or reality capture data for the entire length of a project with global RMS accuracies between 20 and 30mm.

The digital data outputs created using drone technology and photogrammetry/LiDAR enables both the developer and the contractor improve the digital management of their projects while providing deeper data insights, better collaboration on the project, improved data deliverables to clients while reducing costs and risks.

The digital outputs that can be produced from drone technology include:



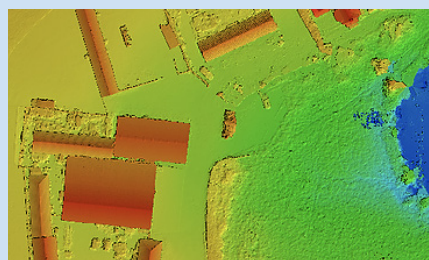
3D Textured Model



2D Orthomosaic



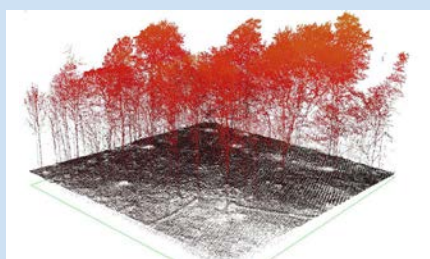
3D Point Cloud



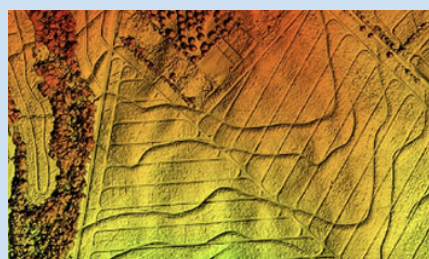
2.5D Digital Surface or Terrain Models (DSM/DTM)



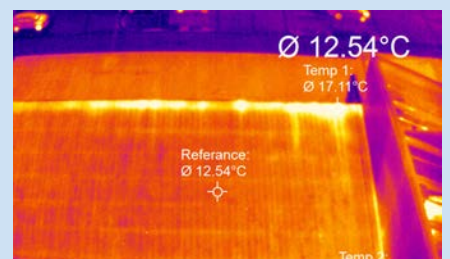
2D Google KMZ



LiDAR



2D Contour Map



Thermal imaging

Digital data

The 2D/3D maps and models can be produced on small, medium or large construction projects and includes items or objects such as roads, footpaths, open spaces, boundary lines, landscaping etc. The data can be produced very quickly and usually within one to three days of capturing the data onsite. What used to take weeks can now be done in days. All of the digital outputs can be tied to the OS or a local grid and can additionally be used to create 3D Building Information Models in software such as Autodesk Revit, a process known as Scan to BIM.

A digital representation of a construction project can be regularly created to keep pace with changes onsite and used as follows:

- Help surveyors, engineers, designers, project managers and senior management understand progress related to the design models
- Manage earthworks with cut and fill volumetric measurements

- Enable progress monitoring of the project at all stages of construction against the design models and as-build
- Quality assurance checks of construction materials used onsite
- The high resolution imagery can be integrated and used in BIM
- Evidence regarding the amount of work carried out
- Combining aerial video with 3D animation/augmented reality for master planning, community engagement, internal planning, marketing, health & safety, planning applications and project concept.
- Legal disputes – a major challenge in legal disputes is trying to establish what the facts were on site. Retrieving data has traditionally relied on paper-based site diaries, which are often not updated or filled with inappropriate information. Sourcing an accurate record of activities carried out and progress of the works after the

event is a common problem, but also often the key to unlocking such disputes. The use of 2D and 3D digital data from drone technology throughout a project to record work could be invaluable in such a situation, particularly where both parties buy into, and agree on drone use at the outset of a project (including the frequency of the surveys, the data to be gathered etc.). Where such records are created, it will be harder for the parties to dispute these down the line, this could, in many cases, help avoid disputes in the first place.

- The digital outputs can be used in Virtual Reality (VR) or combined with BIM.
- 2D/3D digital outputs can be integrated into existing workflow processes as the data can be produced in various CAD, BIM and GIS formats e.g. dwg, dxf, xyz, las, laz, obj, geotiff, e57 etc.



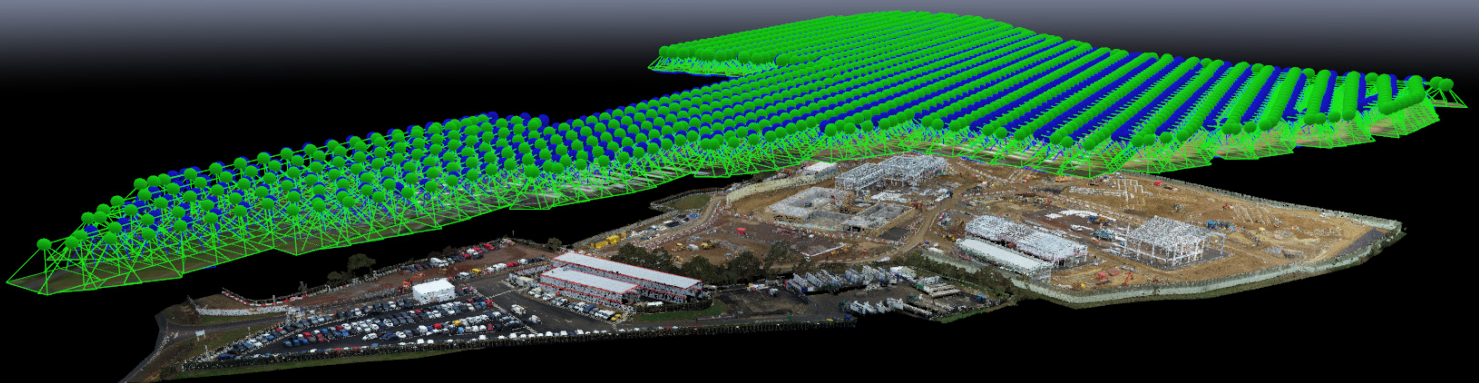
The technology has many uses within construction

- **3D Point Cloud:** a 3D point cloud contains millions of X, Y and Z points across an entire project with global RMS accuracies between 20 and 30mm. The data can be used to closely manage earthworks onsite and cut and fill volumetric calculations can be carried out from the point cloud data. The point cloud can also be used to create topographical, 2D or 3D CAD models through a non-automated process. The models can be imported into BIM or CAD software so that comparisons could be made against the design models and as-build over different time periods to track progress and ensure the project is on schedule.
- **3D Textured Model:** this visualisation solution allows users to understand more detail about their project and uses contextual data to improve decision-making. The 3D models and the underlying point cloud data can be used to take measurements, plan future modifications and it can also be brought into virtual reality (VR). 3D models bring the real world or as-build into the office and this means that the user can carry out

a number of different tasks such as: appraisal of existing conditions, monitor construction progress, carry out structural assessments and record as-built conditions. Terrestrial laser scanning technology can be used to capture digital data on the internals of buildings.

- **Orthomosaic & Orthoplane:** these are a single high resolution digital images that are orthorectified so measurements can be taken from them. They can also be tied into the OS or a local grid using ground control points for global accuracy. An orthomosaic is used for top down areas e.g. roofs, roads, walls etc. while an orthoplane is used side views e.g. facades. A CAD model can be overlaid on them and they can be used in the following ways:
 - to understand and plan the orientation of buildings, road, footpaths, services, etc. in the project design phase
 - to give unique insights to planners into the site and its surrounding area for a planning application
 - to check the as-build or project progress against plan drawings

- **Project Inspection:** drone technology can be used to capture HD imagery of the entire project to identify defects/issues or for general purposes without putting people at risk from working at height. When used in a regular capacity, the imagery can easily be analysed over time because it's geotagged. Any defects or issues can be identified before they become a problem. Prevention is better than cure.
- **Thermal Imaging:** thermal imaging cameras combined with drone technology are an ideal solution for detecting water leaks or heat loss on construction projects. A drone equipped with a thermal imaging camera can be used to detect water leaks on building roofs or heat loss during an inspection by flying over the project and registering temperature anomalies with precision.



Key benefits

A key benefit of using drone technology is that the data can be overlaid into BIM, CAD or GIS software in different file formats e.g. dwg, dxf, xyz, las, laz, obj, kmz etc. This makes integration of the 2D/3D digital data into workflow processes straight forward.

The choice between photogrammetry and LIDAR depends heavily on the exact application. LiDAR is typically used when terrain models below dense vegetation, forestry, 3D modeling of power lines or cables, 3D modeling of complex structures are required because photogrammetry has trouble generating these. Photogrammetry is good for mapping, surveys, mining, broad-coverage combined with high horizontal and vertical accuracy.

Some companies are starting to look at how they manage the digital outputs from a drone or other surveys as a large amount of digital data can be captured and sent to the onsite team for analysis. Cloud based platforms can be used to store, manage, share and analyse the digital data. This type of system allows multiple users within a company to analyse the data e.g. cut and fill calculations, compare the as-build vs design over various time periods, site diary, include annotations and then produce a PDF and/or excel report.

Managing data digitally has many benefits:

- 1 Improves team collaboration and workflow on projects
- 2 A digital record of project in time
- 3 Design models can be imported
- 4 Gives the ability to compare the as built over multiple time periods and against design models
- 5 Data can be digitally shared within the company and with contractors
- 6 Communicate with the stakeholders on works to be carried out





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ProDroneWorx
Aerial & Terrestrial Surveying, Inspection & Modelling

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