



CASE STUDY

Drones Save Balfour Beatty VINCI £5 Million on HS2 Development

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SUMMARY

HS2 is the largest infrastructure project in Europe. The £106Bn development will create high-speed rail links between London, The Midlands and the North of England.

Joint venture Balfour Beatty VINCI (BBV) is designing and building the largest section of HS2's first phase - covering about 90km.

CHALLENGES

- Conducting regular and efficient surveys for progress updates and monitoring earthworks
- Staying on-budget and on-schedule, with Phase 1 due for completion between 2029 and 2033
- Keeping on-site personnel safe
- Traditional survey methods are potentially dangerous;









APPROACH

BBV has digitised the project - using drones to conduct faster, safer and more cost-effective surveys.

BBV has upgraded to the new Mavic 3 Enterprise - replacing the Phantom 4 RTK. The Mavic 3E has cut drone surveying times by 50% thanks to its longer battery life, larger sensor, and more rapid interval shooting rate. heliguy™ has supported BBV's adoption of the Mavic 3E, including survey-specific training.



RESULTS

-  Estimated £5million cost-savings over five years by deploying drones.
-  10-20 minutes to measure a stockpile with a drone, compared to at least half-a-day using traditional methods.
-  DJI Mavic 3 Enterprise halves drone surveying time compared to Phantom 4 RTK: Mapping 9.3km in a single 12-minute flight, compared to 29 minutes, over two flights, with the P4 RTK.
-  Mavic 3 Enterprise's improved camera creates detailed, high-resolution digital assets.
-  20-25mm survey-grade accuracy with Mavic 3 Enterprise, without GCPs.
-  800 'working at risk days' removed by deploying drones.
-  Number of site visits reduced, cutting carbon emissions.
-  Centralised data for remote monitoring, and improved collaboration / decision-making.

BACKGROUND

An aerial photograph of a large-scale construction site for the HS2 high-speed rail line. The central focus is a long, rectangular concrete structure with a corrugated metal roof, likely a bridge or viaduct section. The structure is surrounded by extensive areas of cleared land, some of which are covered in gravel or sand. Various construction vehicles, including trucks and cranes, are visible around the site. Safety barriers and fencing are in place to delineate the work area. The terrain appears to be a mix of natural ground and prepared construction surfaces.

HS2 is Britain's new high-speed rail line, bringing new levels of accessibility - connecting major cities, businesses, and 30million people, and reducing travel times. The first phase, costing around £45Bn, will feature 134 miles of dedicated track between London and Birmingham. It is scheduled for completion between 2029 and 2033. Further phases are to follow, including West Midlands to Crewe, then on to Manchester.

BACKGROUND

BUSINESS CHALLENGE

BBV is designing and constructing the northern section of the first phase. The £4.8Bn scheme - the largest section of Phase 1 - stretches from Long Itchington, in Warwickshire, to Birmingham, and then into Handsacre, in Staffordshire. The development includes:

37 viaducts, 72 overbridges, 56 culverts and other underbridges, 63 embankments; Building four motorway crossings and structures to accommodate existing railway;

The size and scale of the development poses several challenges for BBV, including:

- Conducting regular and efficient surveys over a 90km stretch;
- Keeping the project on-schedule and on-budget - especially as traditional survey techniques can be time-consuming and labour intensive;
- Sharing, storing, and centralising masses of data;
- Reducing the project's carbon footprint;
- Ensuring on-site staff safety, considering traditional methods of monitoring stockpiles and earthworks are potentially dangerous;

Drones alleviate these issues: Data is collected quicker, safer, and more cost-effectively, and can be shared team-wide and accessed remotely. BBV is deploying the Mavic 3 Enterprise, upgrading from the Phantom 4 RTK - and is achieving greater efficiencies.



RESULTS

"Drones are a game-changer,"

admits Lee Johnson, Senior Survey Manager for BBV.

He continues: "Drones allow us to cover large areas very efficiently and we can survey far more safely from a remote position, removing people from potentially dangerous areas. By deploying drones on the HS2 development, the cost-savings will be substantial."



RESULTS

GREATER EFFICIENCY

A drone stockpile survey takes 10-20 minutes. Manually measuring stockpiles and calculating transport requirements can take a full day.

BBV can survey 1km of mainline in about 45-60 minutes - flying at 50m altitude at low speed. Surveying the same stretch on foot can take a full shift.

Despite the time savings, BBV is obtaining 20-25mm accuracy without ground control points.

IMPROVED SAFETY

Manually inspecting stockpiles involves clambering over large quantities of material that is potentially unsafe underfoot. Some HS2 stockpiles can be 10 metres high! Drones enable this data to be collected from a remote and safe position.

Drones reduce People Plant Interface - one of the top fatal risks in the construction industry. Previously, some surveys were excluded from being too close to plant, or surveys were conducted when the plant was not operational, resulting in downtime. Drones eliminate this.

COST-SAVINGS

Drones will save BBV an estimated £5 million over the next five years, including £20,000 a year on monthly progress surveys, and £30,000 a year by removing 800 'working at risk days' by enabling better monitoring of aggregate stockpiles.

MAVIC 3 ENTERPRISE ALLOWS MORE EFFICIENT SURVEYS



The Mavic 3 Enterprise helps BBV collect accurate data in half the time compared to the P4 RTK, and it can fly for longer, covering larger areas in a single flight.

The table shows how fast the M3E has mapped sections of BBV's vast 55-acre Kingsbury compound - one of the most important hubs in the construction of HS2 Phase 1.

Location	Flight Time	Battery Remaining
Ponds Area (4.8km)	Mavic 3E: 8 mins P4 RTK: 16 mins	Mavic 3E: 71% P4 RTK: 33%
Office Area (9.3km)	Mavic 3E: 12 mins P4 RTK: 29 mins	Mavic 3E: 64% P4 RTK: 20% & 56% (two flights)



Used for stockpiling materials and producing concrete for railway infrastructure, the Kingsbury compound - pictured below - is the size of 74 football pitches. So, the M3E's ability to survey more efficiently - covering larger areas, more quickly - is essential.



MAVIC 3 ENTERPRISE ALLOWS MORE EFFICIENT SURVEYS

The Mavic 3 Enterprise is a more efficient solution than the Phantom 4 RTK because it has:



The Mavic 3E's larger pixel size (3.3 μ m vs 2.4 μ m) and intelligent low-light mode offer improved performance in dim conditions - extending the window to conduct drone surveys.

MAVIC 3 ENTERPRISE REDUCES THE RISKS OF SITE ACCIDENTS AND ITS MORE PORTABLE

BBV is finding further benefits of the Mavic 3 Enterprise, compared to the P4 RTK.

Improved Safety Features - Reducing The Risk of Accidents

The Mavic 3 Enterprise has state-of-the-art obstacle sensing and navigation systems. This includes DJI's new Advanced Pilot Assistance System (APAS 5.0), which combines data from six vision sensors and two wide-angle sensors to detect obstacles in all directions - particularly useful for navigating around the HS2 site, which features infrastructure such as cranes and silos.

	M3E	P4RTK
Obstacle Avoidance	Omnidirectional binocular vision system; Infrared sensor at bottom of aircraft	Forward/Rear/Downward binocular vision system; Infrared sensors at two sides
Advanced Return To Home	Yes	No
APAS 5.0	Yes	No

Enhanced Portability

The Mavic 3E is a foldable, lightweight and more portable drone than the Phantom 4 RTK. Lee says: "The Mavic 3E is a smaller drone, making it easier to transport around site, and quickly deployable."

	M3E	P4RTK
Weight	935g (inc RTK Module) Max Take-off: 1,050g	1,391g
Foldable	Yes	No
Propellers	Integrated with aircraft, detachable	Needs to be installed every time

INTERPRETING DRONE DATA

BBV processes the drone data in Esri SiteScan - a cloud-based drone flight management and image processing software.

BENEFITS INCLUDE:

- High-definition imagery and 3D terrain models for project monitoring, construction progress surveys, tracking vehicle and earth movements, and volumetric calculations; Showing compliance with design tolerances in built structures against BIM and CAD models;
- Speeding-up design cycles, particularly in earthworks and excavations; Monitoring the installation of utilities;
- Rapid and centralised data, shared with multiple stakeholders and various teams;



INTERPRETING DRONE DATA

Indika Seneviratne, Project
Surveyor at BBV, says:

"The improved camera on the Mavic 3 Enterprise provides good quality images to create detailed orthomosaics which can be used by various departments, including engineers and designers."



INTERPRETING DRONE DATA

PROGRESS MONITORING

Drone maps and models are valuable for tracking project progress, helping schemes stay on schedule, and enabling teams to spot mistakes and identify issues earlier.

For instance, these orthomosaics show a side-by-side comparison of progress as part of work to extend the Bromford Tunnel from Birmingham into Warwickshire.

BBV conducts monthly progress monitoring at various locations of the development.

Lee says: "Regular site updates are required and drones are a much more safe and efficient way of collecting this data. The orthomosaics can be viewed remotely, reducing the need for office-based staff to visit the site in-person, which also helps to reduce the carbon footprint during the development."

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JANUARY 2023



INTERPRETING DRONE DATA

VOLUMETRIC CALCULATIONS

BBV uses drone data to monitor stockpiles and earth movements, providing insights on:

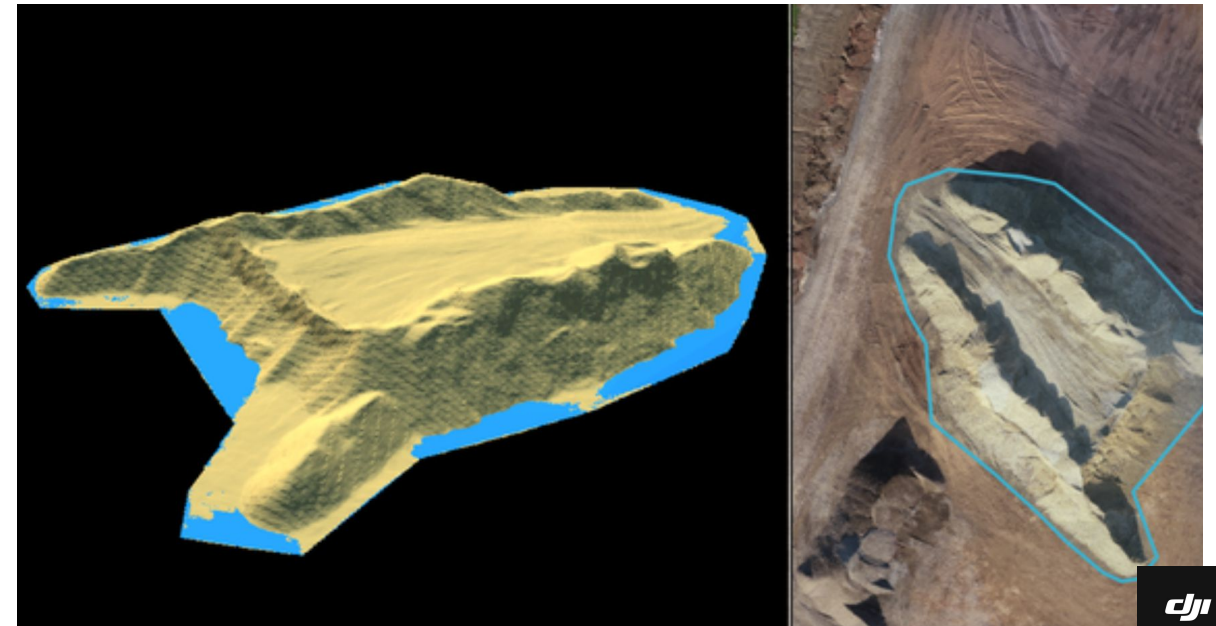
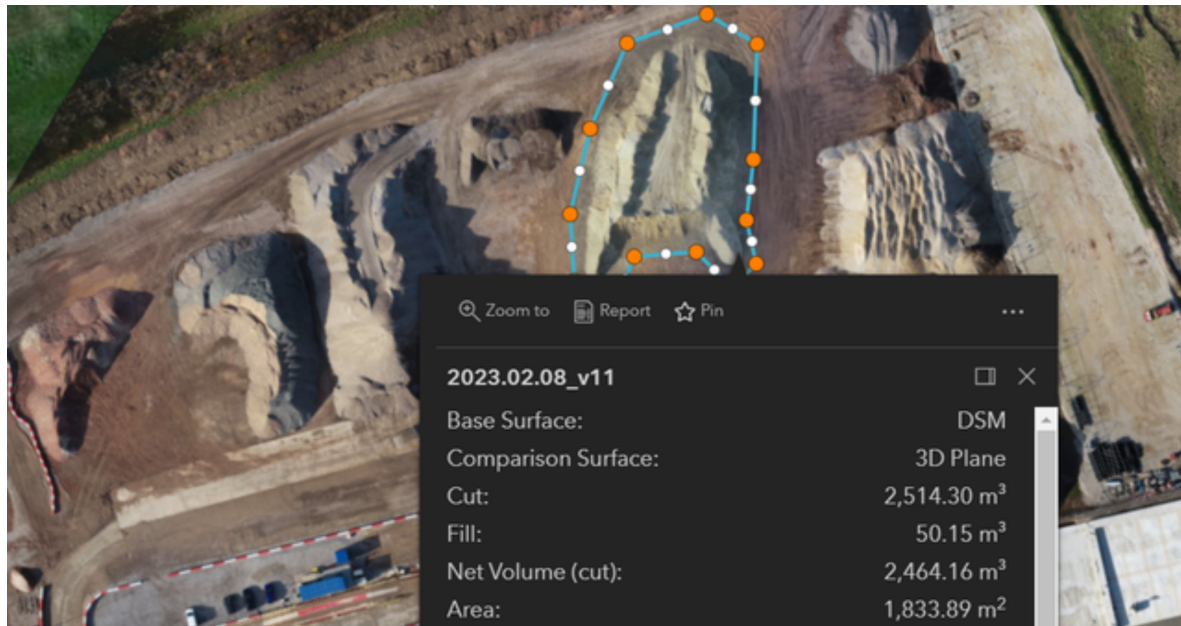
- Size, length, height, and volume of a stockpile;

- Changes to the stockpile, such as how much material has been added and removed;

On average, BBV conducts stockpile surveys on a monthly basis, but drones do enable the team to collect this data on-demand if more frequent insights are required.

Using the orthomosaic, BBV can draw round this specific stockpile at the Kingsbury compound and measure the cut, fill, area, and net volume...

...while this image shows how the stockpile has changed over time, comparing its previous footprint (blue) to its new size (yellow). These insights enable detailed forecasting, enhanced supply-chain logistics, and reduced write-offs.

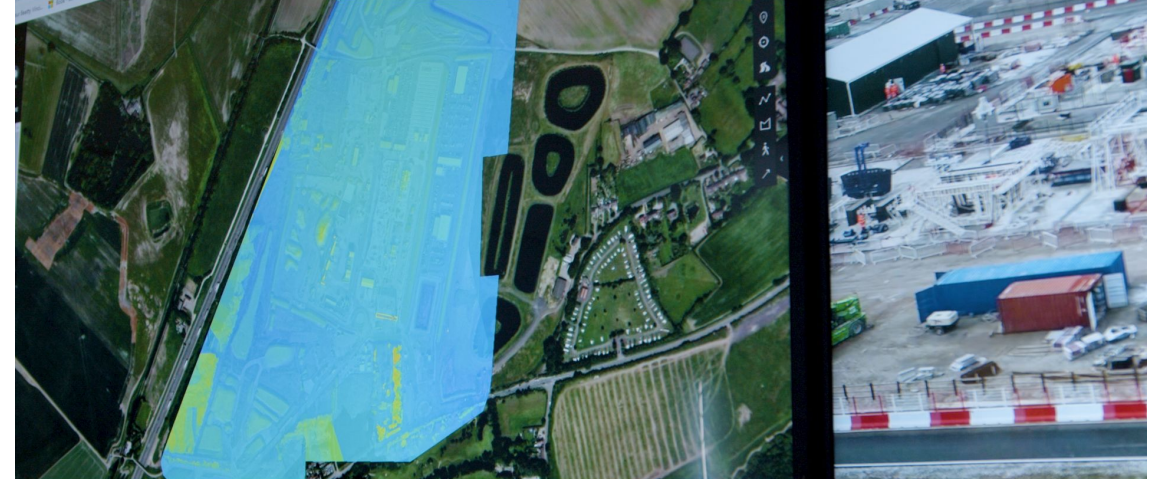


INTERPRETING DRONE DATA

CENTRALIZED DATA

Esri SiteScan enables BBV to manage an increasingly complex and varied use of drones and meet the needs of multiple teams, from logistics to site managers to engineers.

This centralised data is accessible throughout the lifecycle of the scheme.



WHAT'S NEXT FOR BALFOUR BEATTY VINCI

BBV's digitised workflows are transforming surveying practices, introducing new levels of efficiency, accuracy, and safety. On major projects, such as HS2, the ROI is significant. Deploying drones helps BBV with:

Quality Assurances

Health and safety

Planning and project control Commercial and quantity surveying Design and construction management Reduced environmental impact

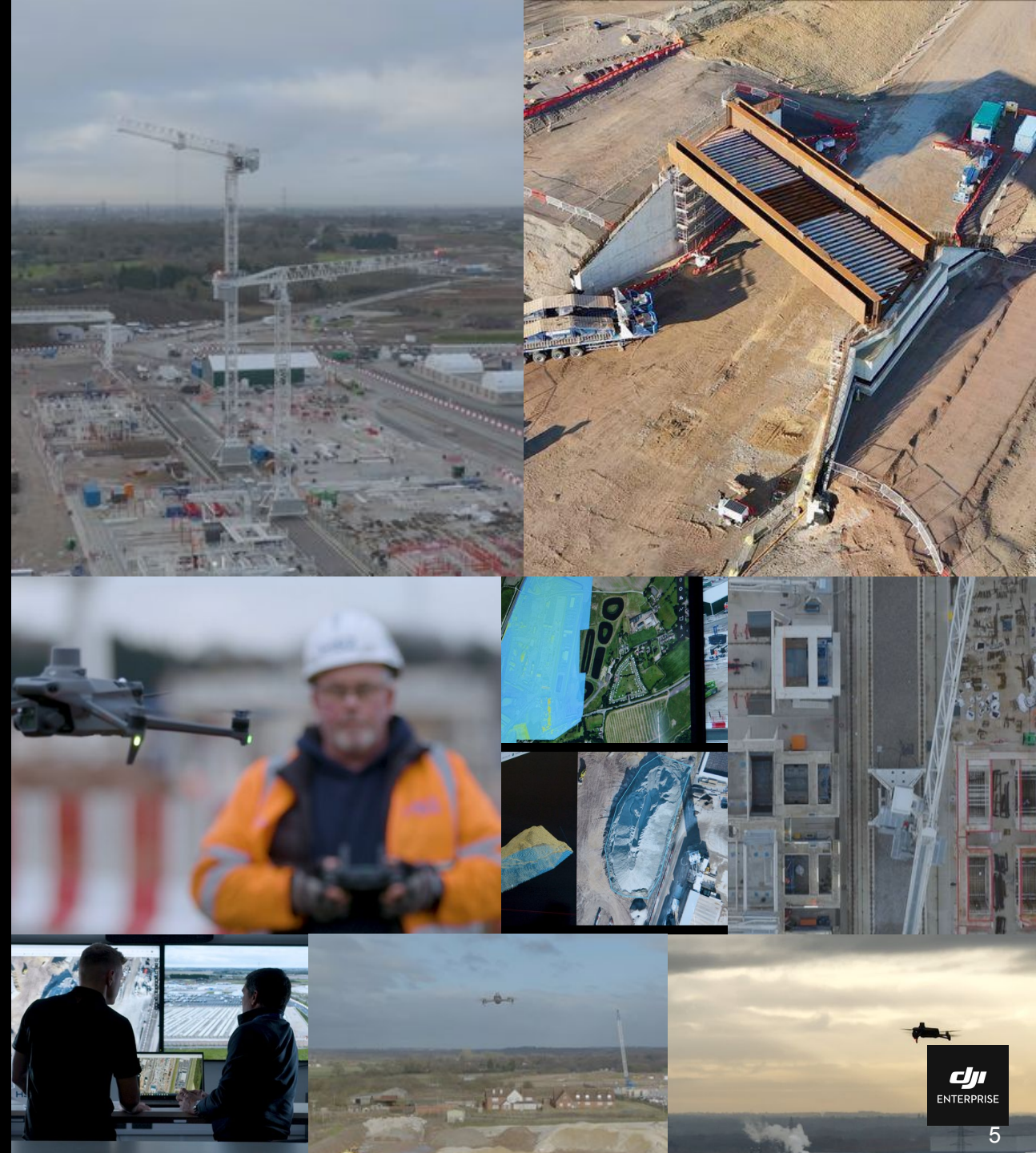
heliguyTM has supported the integration of the DJI Mavic 3 Enterprise on the HS2 scheme, providing the hardware and delivering drone and survey-specific training to help BBV's 23- strong Phase 1 pilot team realise the potential of the technology.

Lee concludes: "Drones are highly-valuable for surveyors: While they won't replace traditional survey techniques, they are a complementary solution & are revolutionising the construction industry, helping to combat logistics and the sheer size of sites, like HS2.

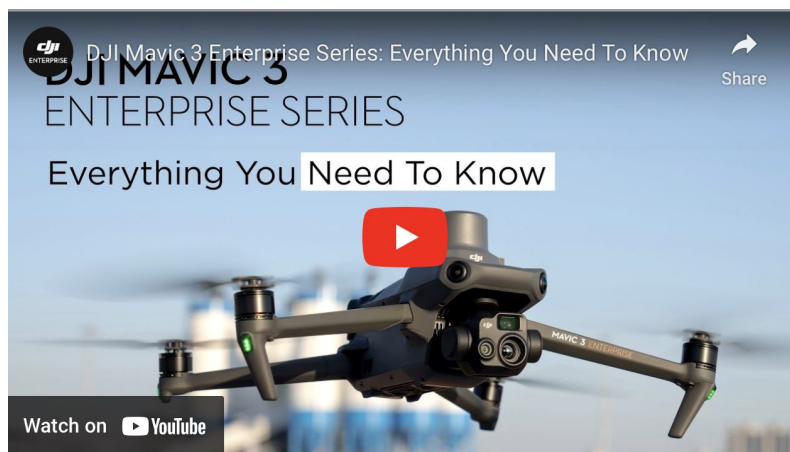
"Before we had the drone programme, surveys were conducted very traditionally - boots on the ground, walking over the land. Since deploying the BBV drone programme, we are finding many benefits going across multiple departments.

"The cost-savings are substantial, we're reducing surveying manhours, which in turn reduces our carbon footprint, while the collaborative, real-time nature of drone data improves visibility, communication, and decision-making.

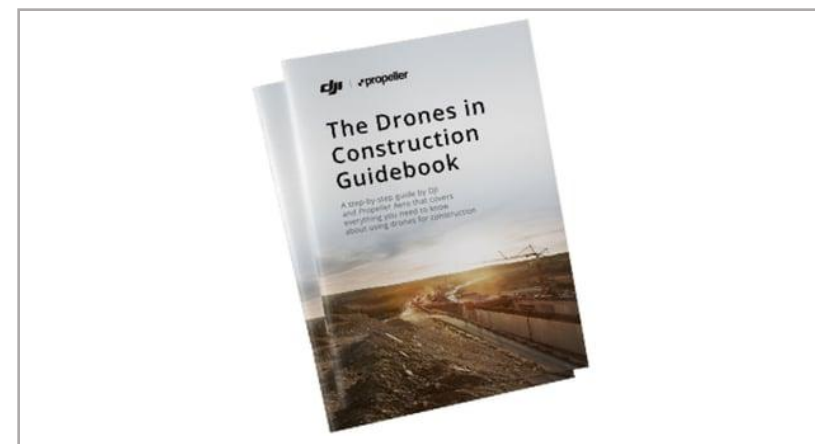
"At the centre of this is the Mavic 3 Enterprise - which collects the same reliable data in less amount of time. It is a game-changer."



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