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Stockpile Measurement and Reports With Drone Surveying



No matter what industry you're working in, measuring and reporting on your stockpiles is crucial to successful operations.

This ebook will cover how drone surveying can improve the accuracy of stockpile measurements and make stockpile reports easier than ever. Not only is surveying with a drone faster and more affordable than traditional methods, but it's also significantly more user-friendly. You don't need the same kind of special training and education, so existing staff can do the surveying themselves. Further, drone surveying software platforms like Propeller, render everything in 3D, so you can view your site as it actually is. We make the 3D survey as close to the real world as possible.

It'll come as no surprise, but stockpile measurement and reports account for the most frequent use case for drones on worksites. People use drone surveying and software to get accurate volumetrics more than anything else.

It can make or break your budget to oversell or undersell material, and you need to have accurate measurements of your stock on hand to do your job right. Here, we'll be explaining how to get those numbers, and:

- Stockpile measurement methods with drone surveying
- How stockpile volume measurements work
- What drone stockpile measurement software you need
- Stockpile reports using measurement software
- Stockpile report costs using drones

Before we can get into the ways to use stockpile measurement data to improve efficiency on your site and spot problems before they become expensive, we need to understand how drones and software actually measure your stockpiles, and this means photogrammetry.







### **Stockpile** measurement methods with drone surveying

Before you can take a single measurement of your stockyard, you need to fly your drone to capture site data. There are a few ways to do this. "Drone surveying," at its core, means using a drone to take aerial photos of your site and some form of GPS and ground control to tie the images down.

With recent technological advancements, there are two major workflows to get the job done: GCP-based drone surveying and PPK drone surveying.

### Drone surveying with traditional ground control

For this workflow, you need a sufficient number of known points to verify and pin your drone imagery to the ground. This is because a drone without on-board GPS correctional processing capabilities is only a vehicle for capturing site imagery. Its position in the sky is not accurately geotagged, so you don't get reliable positional data from its hardware alone; that accuracy comes from ground control.

Having multiple GCPs on your site when surveying ensures 1/10 foot accuracy or below, but they can be time consuming to set up on a large worksite. There are a couple ways to set up traditional ground control:



Known-point method.

A surveyor has to physically walk your site, shoot the points with a rover, and mark them for visibility.

Using AeroPoints.

AeroPoints are smart GCPs you drop in an optimal distribution across the entire surveyed area.

As recently as a few years ago, the planning, risk assessment, and legwork associated with setting up ground control has been a necessary, if unwanted, sacrifice. Drone surveying with onboard differential GPS has reduced the amount of ground control needed



PPK drones are able to accurately geotag and correct their GPS data. While there are different kinds of GPS correctional processing technology, we'll be covering PPK here.

(If you want to learn more about RTK, check out our Drone Surveying Explained: <u>From GCPs to PPK ebook.</u>)

PPK stands for "post-processing kinematic." With PPK capability, the drone geotags X, Y, and Z coordinates to each images based on its GPS unit. While this is happening, a base (be it a base station, an AeroPoint, or the CORS network) on the ground is also recording positional information, but with much more accurate triangulation.

After the flight is completed, those two sets of GPS data are matched up using a timestamp, which is recorded

when the drone takes a picture. Now that we know the offset after the fact, the initial, less-than-accurate on-board GPS data is then overwritten, giving precise geotags for the imagery.

Due to its ease-of-use and reliability, we recommend a PPK workflow for drone surveying on any site—from mines to landfills and every construction site in between.



# Drone photogrammetry: turning your site data into a 3D survey

When that data is processed into the final product—a 3D site survey powerful processing engines are crunching numbers for many, many images and using photogrammetry to stitch them all together.

At its most basic, "photogrammetry" is measuring via photos. It might sound dry and complicated, but its inner workings define the way you fly. We can't overstate the importance of steady, consistent flight in getting these photos right for drone photogrammetry.

(The best way to achieve that is with a flight planning app. We recommend DJI's Ground Station Pro for drone systems that don't have integrated devices and flight planning software.)

## How the science of photogrammetry works

Essentially, if you see the same feature from three or more known positions, you can triangulate its location in space (get those exact X, Y, and Z coordinates). A feature is any visually distinct point in an image.

If you took an average image from your survey, you'd easily be able to pick out many "features" between images. The more features you match, the better you can relate images to each other and reconstruct objects within them. This is exactly what photogrammetry software does for one feature, and the next, and the next, and so on, until it's covered your entire site.

Once you have a lot of these features—think millions you can create a "cloud" of points. Each point has a matched feature describing your surveyed area in that location. You can then turn your point cloud into any regular outputs used in geospatial software, like a 3D mesh or digital elevation model (DEM).



### Get the right hardware for drone surveying

Picking a the right craft can be overwhelming, but when it comes to drone type, price, camera capabilities, availability, and ease of maintenance, <u>we've found DJI's</u> <u>Phantom 4 Pro to be the best for most site surveys</u>, or its PPK counterpart, the Phantom 4 RTK.

With the exception of some size-related edge cases the Phantom 4 Pro or Phantom 4 RTK gets the job done right at a lower price point. DJI drones are widely available and mass produced. This means they have an ease of maintenance that custom or fixed-wing drones lack.

As with any other worksite tool, it's best to avoid providers who cannot guarantee quick repairs or replacements. You don't want to postpone your surveys because you're waiting on a replacement drone or part.



Phantom 4 Pro drone



Phantom 4 RTK drone

# Actually performing a survey on site

When it comes time to head out on site to capture your data, everyone's exact workflow will look a little different, but here are the basics of what you can expect.

- Preplanning
- Ground control placement
- Launching your drone
- Landing and wrap up

If you want to learn more, check out our ebook: How to Start a Drone Program on Your Site.

### How stockpile volume measurements works

Ideally, a stockpile would be something with an easy volume to calculate, like a perfect cube or cone. But even in good cases, stockpiles are an irregular shape.

What makes surveying stockpiles with a drone different is that it can capture all those irregularities and faithfully renders them in your survey, thus allowing the computer to calculate the volume of the true shape, not a rough approximation.



This accuracy starts with the imagery. Unsurprisingly, drone photos capture significantly more detail than shooting points with a rover. Photos let you see the physical details between the individual points. Both horizontally and vertically (Z values), drones are able to capture and render higher resolution data, that's just as accurate as traditional surveying. And, the better your data is, the better your model. Correctly used, drones in conjunction with ground control can produce 3D surveys with 20–50mm accuracy.

### How to measure stockpile volumes with drone survey data

There are different types of stockpiles—from ramp- and bin-style to regular—and you want to measure them accordingly. The following are a few examples of the different ways you can measure volumes in the <u>Propeller Platform.</u>



Measure volume from a reference level. Set the baseline to a desired figure and get your total volume from there up.



Measure using a smart volume, and let the computer do the work. For a smart volume, the platform extrapolates where the base of your pile is and gives you a total volume from there.



Compare volumes between two surfaces. This could be survey to survey, in order to see changes and progress over time, or measure against a design surface to see how far you have left to go.

And because these volumes are accurate, you can enter in a known material density into the Platform's on-screen calculator to get the tonnage for any stockpile.

### Find the drone stockpile measurement software right for you

Drone imagery and ground control are only half of the puzzle. Your data, no matter how good, is useless unless you can visualize it. That's where software comes in.

Beyond the digital model of your stockpiles, you want to make sure that the processing software has tools that increase efficiency and actually get you the answers you need from your data.

For the Propeller Platform, measuring stockpile volume is simple and quick. To streamline accurate measurement and reporting, there are number of templates available to create common measurements you need on site. A few of which we touched on above, but beyond that Propeller allows you to copy measurements to multiple surveys great for piles that don't move around. The real value, however, comes with calculating the material properties of your stockpiles. Using that built-in calculator you can find out the density of your material and the dollar value of your stockpile. Easily see how much money is really sitting in your stockyard.

You also want a software that allows you to automate repeated tasks. If you have dozens of stockpiles, measuring each one can take more time that you've got. Propeller has automated stockpile detection, which reduces the time it takes to calculate volumes—and thus all other measurements—by automatically spotting all your stockpiles during data processing. So when you're ready to do some site analysis, you can find all these piles in one fell swoop.

### Quarry Survey, Feb 18, 2018

Material	Density	Value (\$/T)	Volume (Cut)	Tonnage (Cut)	Total (\$)
Sand	2.50 T/m <sup>3</sup>	\$14.50/T	2 358.09 m <sup>3</sup>	5 895.21 T	\$85,480.58
10mm rock	1.80 T/m <sup>3</sup>	\$25/T	9 845.08 m <sup>3</sup>	17 721.15 T	\$443,028.83
Kryptonite	4.20 T/m <sup>3</sup>	\$1,800/T	14.01 m <sup>3</sup>	58.86 T	\$105,945.84



### Stockpile reports using measurement software

Now that you know how to get your measurements, you need to be able to report out on them easily. It does no good to have a bunch of data you cannot use and share.

No matter how often you report out on your stock, you want to be able to pull those reports without too much hassle, and have them in the file formats you need. You also want the ability to customize reports depending on the intended audience. Not everybody in your organization needs to know every detail about every stockpile.. Stockpile Reports is a Propeller Platform feature that makes it simple for mine and quarry managers, landfill operators, and construction managers who regularly deal with stockpiled material to share the most relevant information about their inventory stockpiles in an easy-to-understand format.

With customizable Stockpile Reports, you can give everyone—from production supervisors on site to auditors in the head office— the data they need to make mission-critical decisions faster.

Stockpile Reports lets Propeller Platform users generate PDFs and CSVs with only the information they want to put into the report. More control and flexibility in what gets included means users can generate reports more specific to individual workers' needs.

Previously, quarry and mine managers had to spend hours cleaning up the exported CSV, manually merging it with additional data, and reformatting it to work with their other reporting systems.

Create Stockpile Report					
Select your preferred file format:					
PDF file CSV file					
Select your data to include:					
Map reference / legend	Last updated by				
Material ID	Material name				
Measurement type	Volume (fill)				
Volume (cut)	Mass (tonnes) (cut)				
Density (t/yd³)	Value (\$)				
Unit Value (\$/t)	Created date				
Created by	Last updated date				
	CANCEL CREATE REPORT				



### Sharing your reporting with stakeholders

Sharing should likewise be simple and straightforward. Propeller allows you to share your site with others through the Platform itself. All you need is an email address. You can set up permissions at a granular level for individuals or teams—from view-only to administrator.

But if you just want to share a single stockpile measurement with someone on your team or your boss, you can share those via link. Through email, chat, etc., the recipient simply clicks on the URL and it opens your site to show the measurement selected and the camera focused on that pile.

For more information on how to use your drone data, check out our suite of ebooks on drone data analytics.

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# Stockpile reporting costs using drones

As we've mentioned above, drone surveying costs less than traditional base-and-rover surveying. It's more affordable hardware-wise. It takes less time to complete, so you're not paying personnel for days or weeks of work. And when it comes to getting accessible, accurate data? That can save your business on huge write-offs that, in the past, have been accepted as the cost of doing business. While some services are ultra-specific when it comes to stockpile reporting, those usually charge you by the pile. Often they don't even return visuals, just a report that includes numbers.

But cloud-based drone data platforms like Propeller typically charge per dataset, which, of course, isn't limited to stockpiles alone. You can survey your whole site for that price and get back an interactive, visual 3D survey.

Rather than asking how much stockpile reporting costs, a better question is, "How much does stockpile reporting with drones save my business?"





## Better financial forecasting

When it comes down to it, processing platforms like Propeller allow you to accurately measure your stockpiles.

The benefits of that trickle down to even the smallest parts of your operations. Having that accurate information on hand, and shareable, lets you do better financial forecasting. No more "fluff factor" in your inventory reporting.

### Tighter supply-chain management

Knowing what you actually have on your site also allows you to tighten up supply-chain management.

See when you need more stock and how much. If you're your own supplier, you can plan out when you need to start drilling and blasting. If you use an external supplier you can plan out purchases and budget better. Don't be surprised by a big order again.

## See how much your inventory is worth

And with material property calculators built in, all the reporting you already need to complete can now show you the actual dollar value of your piles—or the money sitting in your whole stockyard. See just how much your inventory is worth with every single survey.

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Measuring and managing your stockpiles with a drone is faster, more affordable, and accurate



With all the advancements in drone surveying over the past few years, the drone has become more than a novelty, more than a tool—it's become a profit generator.

Today, surveying your stockpiles by drone is quickly becoming the industry standard when it comes to measuring and reporting on your stock.

Because you can count on accurate, exact numbers on your stockpiles and get them more frequently than ever

before, you can tighten up operations from financial forecasting to supply-chain management to accurate reconciliation.

These things aren't feasible with traditional tools, but with drone surveying "fluff factors" in inventory management can be a thing of the past.

Updated information about your stockyard is now available as often as you want to fly. And with easy-

to-share digital reporting, you can have a visual conversation with your team or your boss, and get everyone on the same page with processing platforms like Propeller.

Learn more about stockpile measurement and reporting on your site today and contact us.

### Contact us

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