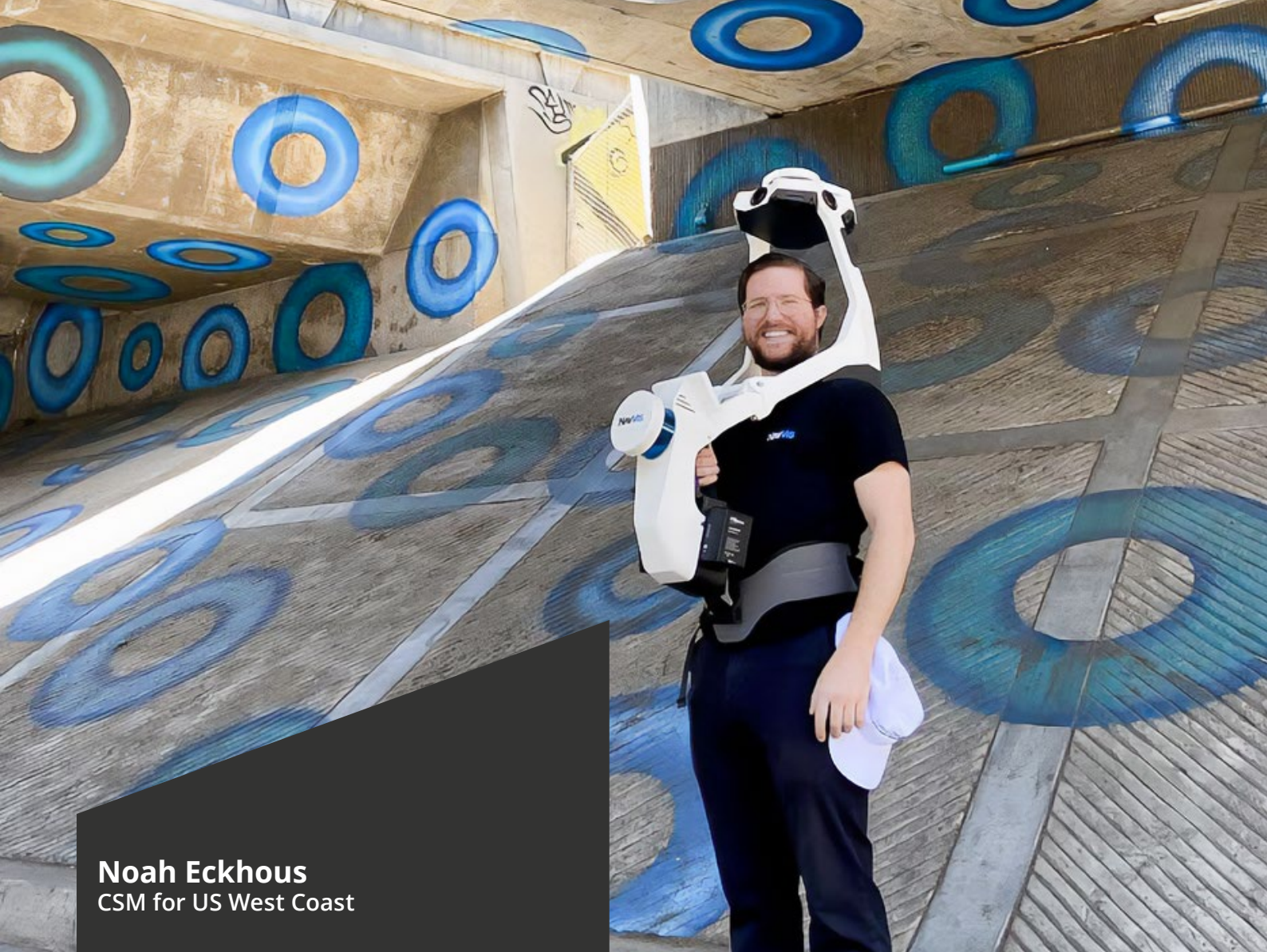


Beyond Boundaries: NavVis VLX in the field

A compilation of firsthand accounts from project sites worldwide, as told by NavVis Customer Success Managers.



Noah Eckhous

CSM for US West Coast

DEMO: MULTIDISCIPLINARY SURVEYOR

This story focuses on a successful demo Eckhous performed for a surveyor experienced in many survey types, including:

- **prefab** – locating bolts and tie-in points for the installation of components or elements built offsite
- **commercial and residential** – capturing building or land boundaries, providing floorplans and space usage data
- **legal** – defining the location of property lines, easements, and corners for legal documentation

TRADITIONAL TOOLS: TOTAL STATION, TLS

Like most surveyors, this customer traditionally used total stations for every job. In recent years, they purchased a terrestrial laser scanner (TLS) to add virtual survey workflows to their toolbox.

Where traditional total station surveys require slow, point-by-point capture of location data, virtual survey workflows can be extremely fast. The principle is simple: The surveyor establishes a control network using the total station, then scans the survey area with the TLS. Next, they return to the office, load the point cloud in specialized software, lock it to the control network, and place virtual survey points as needed. This gives them everything they need to generate a final, high-accuracy survey deliverable.

WHY NAVVIS VLX 3?

Virtual survey with TLS is fast but virtual survey with NavVis VLX 2 and 3 is even faster. This can help surveyors expand their businesses in two primary ways. They can either:

- complete more jobs in the same time frame, with the same resources
- capture extra data on each job site, then use it to offer new value-add services and products



If you wanted to perform a similar survey with a total station, you would have to choose a small subset of the features and capture just those



Noah Eckhous
CSM for US West Coast, NavVis

TESTING ENVIRONMENT: THE CUSTOMER'S OFFICE

Eckhous performed the NavVis VLX 2 demo at the customer's office, two buildings on a half-acre plot. He chose the site because it closely resembles the high-end commercial and residential job sites that the customer commonly works on. "Here, they could emulate the surveys they usually do on a site they're familiar with."

The customer prepared by laying out 31 control points, both inside the office and around the property. "That's way more than NavVis VLX needs in this environment," notes Eckhous, "but it meant we could skip a majority of those points during optimization and use them for what we could call a verification point. All extra control points then became true residuals, which we could use to benchmark the accuracy of the scan."

EXPECTATIONS

Like many surveyors, the customer was drawn to the speed of mobile mapping but unsure about its data quality.

A little context: When Eckhous reached out two years ago, he says, the surveyor had rebuffed him immediately. They said, "Well, that data looks very nice, but it's not accurate enough for what I do."

Even when NavVis VLX accuracy improved, and Eckhous sent the customer a whitepaper demonstrating that the mobile system could do even better with control, "We got pretty much the same feedback. That all changed when he went to an event where using NavVis VLX 2 for survey was one of the hotter topics, and they said, 'OK, I'll give you a chance.'"



RESULTS: PROJECT

Eckhous says he has never seen someone purchase a system so quickly after the demo ended.

High speed vs TLS

Using NavVis VLX 2, Eckhous captured the whole office site — including the half-acre property and all 3200 sq ft of interior space — in about 40 minutes. A surveyor with a TLS would have needed at least four hours to capture the same data.

High accuracy

After processing the scan, Eckhous provided the surveyor with the full point cloud. They ran through the residual control points, checking their positions one at a time against the total station data. Every point landed exactly where it should have been, within a quarter of an inch.

The client said, “All right, this convinces me.”

“The data was really crisp, low noise, and beautifully colorized.”



Noah Eckhous
CSM for US West Coast, NavVis

Crisp data

Eckhous credits the sale to the “absolutely great” data that NavVis VLX 2 produced. And it wasn’t just the accuracy that left the potential customer impressed.

“The data was really crisp, low noise, and beautifully colorized. They didn’t have to guess where the corner of a building was, or a curb, or any other important points. Those are the sorts of spots they were checking for accuracy tolerance, and each feature was instantly recognizable in the data.”

More complete data vs total station

The mobile mapping system was able to capture a much more complete picture of the site than traditional methods.

“If you wanted to perform a similar survey with a total station,” says Eckhous, “you would have to choose a small subset of the features and capture just those. A floor plan alone would probably take four hours of traversing, adding in windows, furniture, and architectural detail. That would turn it into a two-day job. That’s unfeasible.”



RESULTS: BUSINESS

During the demo, the customer quickly saw how NavVis VLX could help them expand their offerings.

Value-add services

As Eckhous explains, “A lot of customers see NavVis VLX as a way to get more work by driving the cost of jobs down. But surveyors — who are not typical laser scanning professionals — have strict standards to uphold and are legally responsible for their surveys. So massively expanding the number of jobs is not the right decision for all situations.”

This surveyor saw that NavVis VLX could help them increase their profit in a different way. During a survey, they could dedicate a little extra time to the whole site and then use the expanded data set to offer value-add services and products.

“They know that if they’re on site for half a day performing a survey, it only takes another 20-30 minutes to capture the rest of the site, using control they’ve already set. Compared to TLS, NavVis VLX makes the cost of scanning so low that it’s worth it for them to just go collect that data just in case. Then, they can show it to their client in NavVis IVION and say, ‘I don’t know if you noticed, but we’ve got all this extra information as well. We can do floor plans, we can do topo surveys, and a lot more.’”

Eliminating returns to site

The customer also saw that if they captured the whole site with NavVis VLX, they could also respond very quickly when a client asked them to capture survey data that wasn’t in the original spec.

Using the point cloud they already have, the surveyor can perform a digital survey, update the documentation, and send it over quickly. This enables them to offer their clients an extremely valuable service — all without leaving the office.

Ease of use

After 12 hours of sessions over three days, Eckhous says, the whole organization was up to speed on mobile 3D scanning. “They understood how point clouds work and grasped how the SLAM algorithm works by a method almost identical to survey principles they already knew.”

“Since then, they’ve all been able to produce really good work with NavVis VLX. Even the client’s sons, who haven’t graduated from university yet, can use the device to get survey-grade results. Anyone who has a spatial mind was able to learn fast.”



Morten Hellemann

CSM for Nordics

PROJECT: TOPOGRAPHIC SURVEY

A topographic survey involves measuring and mapping both natural and man-made features of a particular area such as roads, buildings, bridges and other outdoor environments and structures. A detailed representation of the terrain provides accurate and comprehensive data about the landscape which is essential for various engineering, architectural, construction, and land development projects.

Topo surveys are often commissioned as the first stage of a construction project. They are so common that Morten Hellemann calls them "bread and butter" work for most survey firms.

A trained surveyor begins a topo survey by capturing the surface details of the project site. The surface details can vary according to the client's needs but often include the curb, the center line of the road, trees or other vegetation, and assets like traffic signals. After capture, the surveyor will produce a 3D CAD file representing accurate site dimensions for downstream project applications.

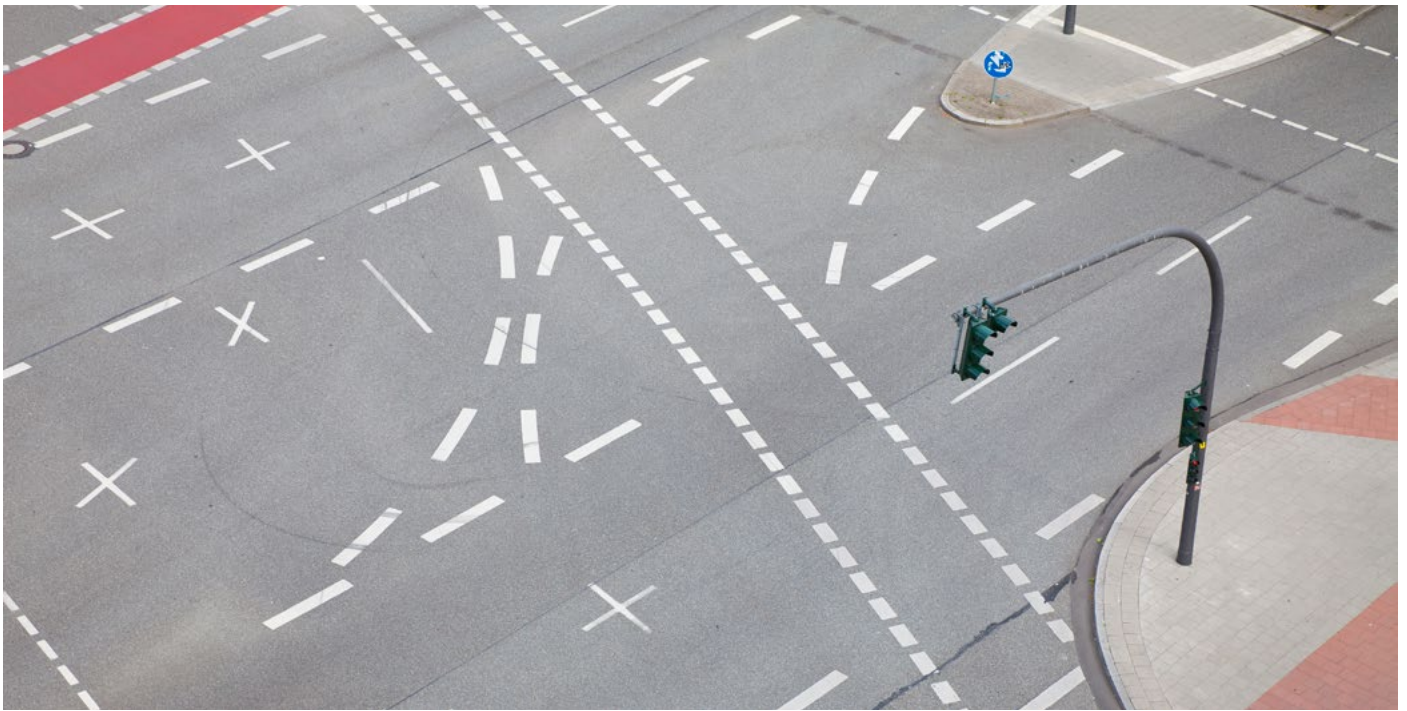
TRADITIONAL TOOLS: GNSS, TOTAL STATION, TLS

Most surveyors perform topo surveys using a robotic total station and a prism. They walk the site, place the prism at each point they need to survey, and capture measurements manually. GNSS is also common in areas with no high-rise buildings.

Some surveyors have adopted the use of terrestrial laser scanners for topo surveys. They capture a point cloud of the environment, then import the data into specialized survey software when they return to the office. This software enables them to perform measurements virtually and semi-automatically generate a CAD deliverables.

WHY NAVVIS VLX 3?

The construction industry is growing rapidly in several global markets, increasing demand for topo surveys. NavVis VLX 3 can help existing survey firms meet this demand by enabling them to produce more high-quality topo surveys in less time — and maximize their profit.



In the past, if you captured the middle white line of a road, you had to place the total station safely on a walkway, out of reach of people, while moving and placing the prism on the objects that needed to be surveyed.



Morten Hellemann
CSM for Nordics, NavVis

TESTING ENVIRONMENTS: DENSE URBAN AREAS

Hellemann and his team have tested the NavVis VLX 3 extensively for topo survey, putting it to work in several environments, including:

- road intersections
- public squares
- parking garages
- warehouses
- construction sites
- production facilities
- and several other highly technical environments

EXPECTATIONS

Hellemann was confident that NavVis VLX 3 would perform well in all the test environments listed above. Here's why:

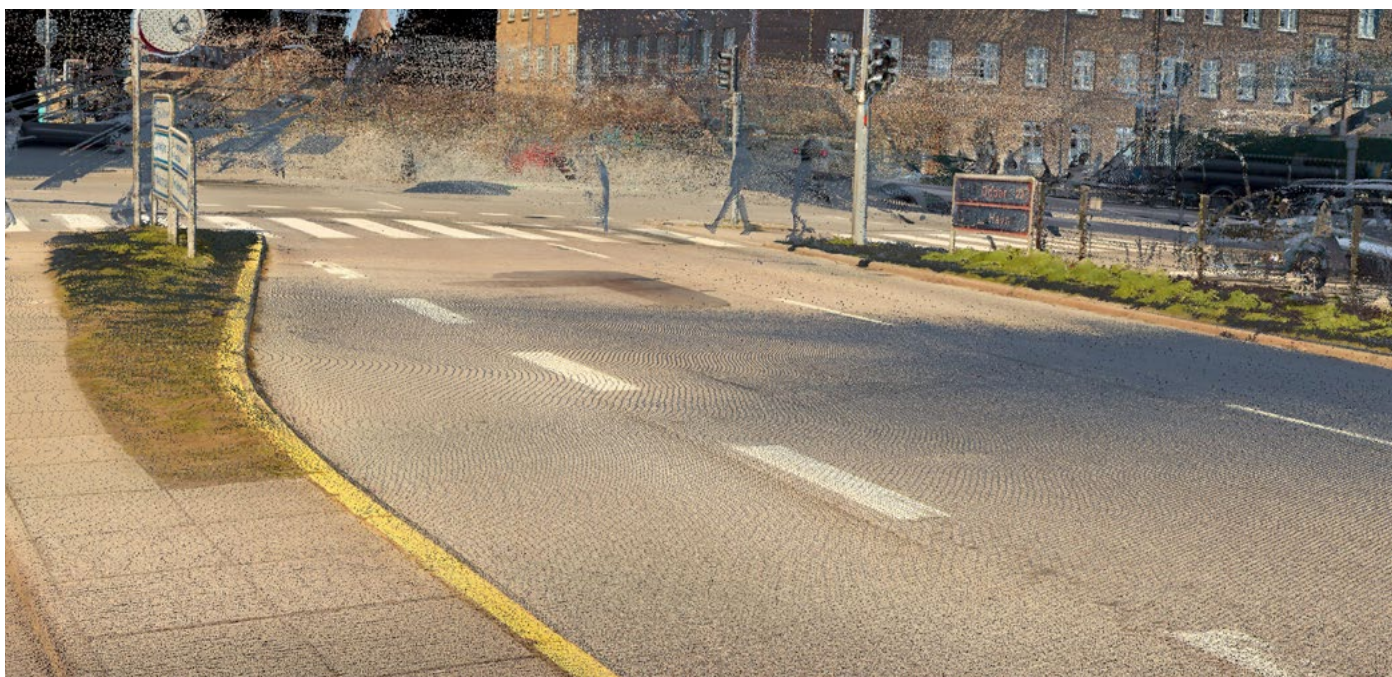
NavVis VLX 2 is field-tested

Several innovative survey companies already use NavVis VLX 2, meaning the scanner's SLAM algorithm has proven itself in dense urban environments. NavVis VLX 2 is already known as a reliable choice for topo survey applications.

NavVis VLX 3 is a step up

The new scanner features upgraded lidar sensors with a widened field of view and increased range to be able to capture double the number of points per second. Raw point clouds are then twice as dense compared to NavVis VLX 2 point clouds.

These upgraded sensors give the field-tested SLAM algorithm even more data to work with, says Hellemann. That's why he expected NavVis VLX 3 to produce better data, and handle even more challenging urban environments than NavVis VLX 2. Also, due to the higher data acquisition speed of NavVis VLX 3, Hellemann says he was able to walk faster than previous scanning projects with NavVis VLX 2 and save additional time.



RESULTS: PROJECT

NavVis VLX 3 performed very well in all test environments. When Hellemann looked closely at the data, it was clear that the scanner offered several benefits from a project perspective.

10 mm accuracy (and often better)

When the team placed control points every 25-30 meters and applied best practices for outdoor scanning in highly trafficked areas, NavVis VLX 2 achieved global accuracy better than 10 mm. During testing, Hellemann found that NavVis VLX 3 can achieve local relative accuracy at 5 mm.

And most of the time 10-15 mm is more than good enough for detail surveys.



Morten Hellemann
CSM for Nordics, NavVis

5X faster in the field than a total station

Hellemann says a survey that took five days with a total station could be completed in one day with a mobile mapping system. The workload is moved from the field to the office, giving the possibility to outsource some of the man hours and enable your crew to be able to take on more projects at the same time.

More coverage than a total station

A traditional survey of a curb line might mean capturing a single data point every 20 meters. "Fair enough," says Hellemann. "But you don't know what's happening between those points. Did someone miss a gully? A utility hole? We can't see." NavVis VLX 3 captures exceptionally dense and detailed data, with measurements spaced out by millimeters rather than meters — solving this problem completely. Everything is captured and can be found in the dataset without going back to the site.

"Far superior" coverage vs. TLS

A TLS also presents coverage issues. When capturing a dense urban environment for a topo survey, these devices will likely leave gaps in the point cloud due to occlusions — simply put, the scanner can't capture what it can't "see." The NavVis VLX solves this problem by enabling surveyors to quickly move around occlusions and fill in gaps. That makes it easy to capture every data point they need for a comprehensive virtual survey.

Data that compares well to TLS & other SLAM-based scanners

Hellemann says he captured the same intersection with NavVis VLX 3 and then a TLS. When he overlaid the two data sets, he found that the "data was very, very close." And compared to other SLAM-based laser scanners on the market, he says that the NavVis VLX 3 exports a "very nice, clean, and crisp as-built point cloud."



RESULTS: BUSINESS

Hellemann saw that NavVis VLX 3 offered the same fast workflow as NavVis VLX 2 but produced better quality point clouds and worked in more challenging environments. These advantages bring several business benefits.

A viable option for most topo surveys

NavVis VLX 3 produces excellent data — even in environments that could challenge NavVis VLX 2, like extremely busy roads or packed pedestrian paths. Based on the extensive testing he performed, Hellemann estimates that NavVis VLX 3 could replace a total station in 95% of topo surveys in urban environments.

Much faster projects

By cutting down the duration of fieldwork by 5X, NavVis VLX 3 enables surveyors to perform 5X as many projects.

Easy learning curve

If you already know how to use a mobile scanner — and you come from a survey background — Hellemann says you can be up and scanning with NavVis VLX 3 in under an hour. If you've never touched a mobile scanner, training should only take about a day.

Safer workflows

NavVis VLX 3 also keeps surveyors out of harm's way during fieldwork. "In the past, if you captured the middle white line of a road, you had to place the total station safely on a walkway, out of reach of people, while moving and placing the prism on the objects that needed to be surveyed," Hellemann says. "Now, you can just walk by it on the curb — it's much safer that way."

Better QA

NavVis VLX 3 offers comprehensive data and detailed, photorealistic walkthroughs in NavVis IVION. These easy-to-use visual records make it much simpler to QA data during the virtual survey phase and further reduce the need to revisit sites.



Piet Zwinkels CSM for Benelux

PROJECT: AS-BUILT DOCUMENTATION, OIL & GAS

When an engineering firm rehabs or builds onto an existing oil and gas facility, the first step is to document the as-built conditions on site.

This process aims to capture accurate and precise measurements for building 3D models and 2D drawings for the project design and engineering stages, depending on the severity.

TRADITIONAL TOOLS: TLS

To capture as-built documentation, an engineering firm will most commonly use a terrestrial laser scanner. A laser scanning professional moves throughout the facility, setting up the device and performing a scan in each area they need to capture.

When occlusions create gaps in the data, the operator moves the scanner to capture behind the occluding object. After capture, they will register the individual scans together to create a comprehensive point cloud of the site.

WHY NAVVIS VLX 3?

As in many industries, projects in the oil and gas industry are especially time-sensitive, so companies are always pushing for higher workflow speeds. NavVis VLX 2 and 3 expedite timelines with mobile capture and cloud-based post-processing workflows. This makes them much faster than TLS for comprehensive site documentation, with comparable accuracy and better overall data quality.

NavVis VLX 3 adds even more value by producing denser, more detailed documentation than NavVis VLX 2. This makes it better suited for documenting complex facilities full of small details.



How fast can you deliver the project to an engineering team that needed it yesterday? That's the most important thing.

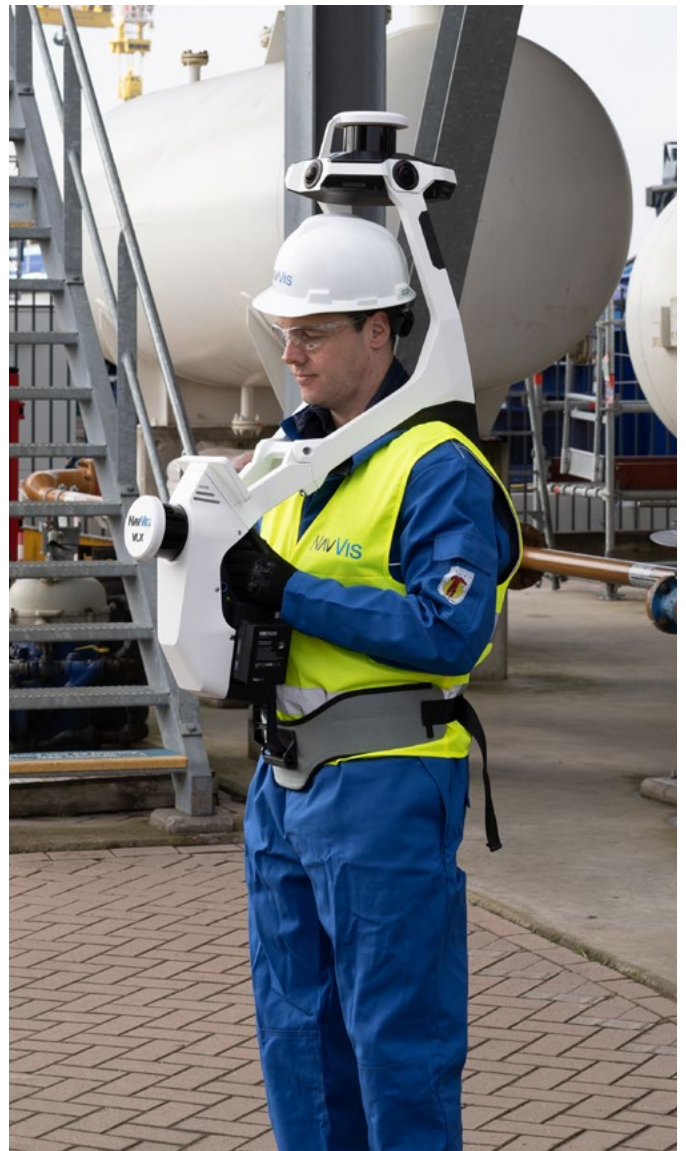


Piet Zwinkels
CSM for Benelux, NavVis

TESTING AND EXPECTATIONS

Zwinkels and a few of his customers have tested the NavVis VLX 3 for as-built capture in oil and gas, putting the device to work in several plants and processing facilities.

Before testing, Zwinkels was confident that NavVis VLX 3 would match the speed of NavVis VLX 2, while producing higher-quality data. That's because NavVis VLX 3 features upgraded lidar sensors that capture at a higher range than that of NavVis VLX 2. The sensors also capture more points per second, generating point clouds twice as dense as NavVis VLX 2 point clouds.





RESULTS: PROJECT

NavVis VLX 3 performed well in all test environments, offering significant benefits over TLS and NavVis VLX 2.

8X faster capture than TLS

As expected, the NavVis VLX workflow was much faster than the TLS workflow. "I would say the NavVis VLX is about eight times faster," says Zwinkels. "It depends on the project, of course. NavVis VLX really shines in the bigger sites."

More detailed data than NavVis VLX 2

The captured data from NavVis VLX 3 included a better definition of small objects when compared to NavVis' other mobile mapping systems. "I checked by looking at the railings," says Zwinkels, "because that's where mobile mapping systems can have trouble. In the NavVis VLX 3 data, the railings were crisp with a clean line. It's good, detailed data. I could even zoom in on an individual bolt."

I would say the NavVis VLX is about eight times faster.



Piet Zwinkels
CSM for Benelux, NavVis

High accuracy

Like many users of 3D data, engineering firms in oil and gas are concerned about accuracy — and NavVis VLX 3 delivers on this front. In testing, the device offered global accuracy better than 5 mm when using control points and best practices. "Combine that with the density and detail of the data, and I'm excited to see how far customers will push it," says Zwinkels.

More complete data than TLS

Coverage is another crucial factor in data quality — after all, accuracy doesn't matter if the data isn't recorded in the first place. Here, NavVis VLX 2 and 3 are superior to TLS.

Zwinkels says that TLS data often leaves gaps in the documentation since the operator can't move the device freely to scan around occlusions. "You have to position it on a tripod and leave it, so you can't always get all angles needed. That's how you get 'shadow corners' in the data." NavVis VLX 3 (and NavVis VLX 2) virtually eliminated this problem by enabling operators to move around occlusions and fill in gaps quickly.

Easy hybrid workflows

NavVis VLX mobile mapping systems can lock the scan data down to control points. This improves data quality but also makes it easy to register a TLS point cloud to the NavVis VLX point cloud.

Hybrid workflows like this help firms to get the highest possible accuracy without sacrificing speed. Zwinkels offers an example: "Think of a tie-in, when they would need to connect a new pipe with existing flanges and bolt holes. They can do the overall scan of the facility quickly with NavVis VLX, then bring in a TLS for a more focused scan at the tie-in points where they need higher accuracy. That's better than taking so much time to capture everything with a TLS."



RESULTS: BUSINESS

Zwinkels says that the project benefits of the NavVis VLX 3 add up to some significant business benefits for engineering and oil and gas firms.

Much faster turnaround time than TLS

NavVis VLX doesn't just capture faster. It also reduced the number of scans needed to cover the site and uses cloud-computing software to accelerate processing. That sped up the whole workflow — a crucial gain for an industry dependent on quick reactions.

"How fast can you deliver the project to an engineering team that needed it yesterday? That's the most important thing. With NavVis VLX, we could scan one week and have the data to engineering the next. That's unheard of with a TLS."

Highly detailed panoramic images for asset management

With the improved data quality offered by NavVis VLX 3, Zwinkels says it makes an ideal option for asset management. "Compared to point clouds, the panoramic images produced by NavVis VLX are much better suited for use by non-engineers. They can easily step through the data in NavVis IVION, and flag areas of interest like a corroded bolt."

Training and knowledge transfer

The point clouds produced by NavVis VLX 3 are so clear and detailed that they "look like the actual site." That means companies can use them to perform virtual training, which helps experienced employees transfer their knowledge to new employees. "They can open the data in NavVis IVION to train the new people to work in a hazardous environment and pass their knowledge down before they retire."

Easy learning curve

Whether you already know how to use a mobile scanner or you are a complete beginner, training should only take about a day, both in-person or using NavVis' online training program.



Jay Ure
Senior CSM

PROJECT: CAPTURE AND SURVEY FOR RENOVATION PROJECT

When Jay Ure began renovating and landscaping his new house, he saw an opportunity to field test NavVis VLX 2.

To do this, he hired an engineer to perform a traditional topo survey of his property. Afterward, he repeated (and expanded) the survey with the mobile mapping device and then compared the results.

TRADITIONAL TOOLS: TOTAL STATION

The engineer gathered topo by setting up a robotic total station, walking to each position he needed to measure, placing a prism, and capturing elevation. Then, he returned to the office, recorded the measurements in CAD software, and produced a topo survey line drawing.

WHY NAVVIS VLX 2?

Ure knew that NavVis VLX 2 and 3 promise a much faster topo workflow than a total station while requiring minimal sacrifice in accuracy. He could simply walk around his property to capture the point cloud, process the data in the cloud, and then use specialized software back in the office to gather virtual survey measurements.

But he says that's not the only reason he wanted to use NavVis VLX for this renovation project. As a CSM, Ure knew that the point cloud and panoramic imagery produced by the system would help project stakeholders save time, reduce costs, and maybe even try an innovative approach to design.



Ultimately, the SLAM was robust enough, and there is enough geometry in this kind of project for the NavVis VLX to handle it without a problem.



Jay Ure
Senior CSM, NavVis

TESTING ENVIRONMENTS

The traditional topo survey covered the original project area, Ure's yard, a rectangular plot of about 1000 sq feet. Ure used NavVis VLX 2 to capture his own yard, the property next door, the property behind them, and the property behind them. That makes four yards total for about 4000+ sq feet surveyed.

EXPECTATIONS

Ure wanted to work with the engineer to produce a paper benchmarking NavVis VLX against traditional survey methods. But the firm wasn't interested.

"It's very hard to change their minds on new things," he says. "They don't think mobile mapping is accurate enough. Or they're not sure that it can live up to the claims. They spend a lot of time with technology, and when it doesn't go well, their projects run over. So, they try to optimize based on field experience and minimize exciting new technologies that they think might fail them."





RESULTS: PROJECT

Despite the engineer's resistance to mobile mapping technology, says Ure, the survey went as well as he could have hoped. The tool was reliable. The workflow was fast, the data accurate, and the combination of point clouds and HD panoramic images proved very useful to several stakeholders.

Robust SLAM

"I tried to break the scan while I was using NavVis VLX 2," jokes Ure, "but I did not manage to. Ultimately, the SLAM was robust enough, and there is enough geometry in this kind of project for the NavVis VLX to handle it without a problem."

Accuracy

Comparing the results from NavVis VLX 2 against the total station survey documents, Ure saw that four of the five survey points matched up within a quarter of an inch. "I performed really tight loops during my scan, so they were right where they should be."

They can open NavVis IVION and say, OK, based on other houses in the area, it should go here. They can actually get visuals and then decide, which is great for the review process.



Jay Ure
Senior CSM, NavVis

What about the fifth survey point? "We can chalk that one up to miscommunication. The NavVis VLX had enough control to lock down the scan based on the other four points. The data was good enough that it showed me he must have surveyed the wrong point."

Faster capture

The engineer took 6 hours to survey Ure's 1,000 sq ft property with a total station. Ure took only 35 minutes to scan his own property and three of his neighbors' properties with NavVis VLX 2.

Faster CAD

You might expect the speed of the CAD stage to be comparable across the two capture methodologies, and Ure says that's only true "to a degree." A mobile topo survey "gives you a point cloud, which means you can use automatic software to extract features once you're back in the office." That can speed up the CAD portion of the survey significantly.

Richer data

Remember, says Ure, when you capture a topo survey with a NavVis VLX, you're not just getting a faster workflow. You're generating panoramic images and a detailed point cloud that includes virtually all possible measurements you might need for the site. "When you capture with a prism, do you have any information that helps you relate back to the field? No. When you have the point cloud and imagery, you'll have the field on your computer screen."

This makes it easy to capture survey data after the fact (like Ure could have done with the control point that was off by 50 feet). Or, you can even dig into the imagery to grab some context during the modeling process. There are dozens of uses for this data – and we'll get into a few in the next section.



RESULTS: BUSINESS

Though the home renovation project was small, NavVis VLX offered significant workflow benefits. And the experience showed Ure how the mobile mapping tool could be a huge boon for projects of any size.

Innovative remote design

Ure sent the virtual survey document, point cloud, and credentials to a remote landscaping company, which enabled them to produce a design and schematics without stepping foot on site.

"I handed off the information, and they could use it to verify measurements, check context, and whatever else they needed to do. Then, they created 3D models for their proposal using traditional design software. I didn't even meet with a designer — I answered some questions, and they used the data to design and then sent the files back to me."

Better context

Remember how Ure captured his neighbors' yards with NavVis VLX? He says that this data could have enabled the remote architecture firm to do even more detailed design work.

"What if you asked them for a different color for your house? Maybe it's currently white, and you want it to blend in with other houses better, they couldn't know what to do just by looking at the survey document. But with a NavVis VLX survey, they have the panos and the point cloud. They can tour the neighborhood."

Valuable time savings

Ure says two architecture firms provided him with quotes based on a general house walkthrough. "They each spent four hours in

the house, using tape measures to get window widths, doorway heights, and things of that nature. That's four billable hours wasted. If they had used NavVis VLX, they'd get data for the entire house in 30 minutes."

Intuitive documentation

Where traditional survey documents may be difficult for some project stakeholders to understand, a walkthrough in NavVis IVION is intuitive enough for anyone to use, regardless of their experience with 3D data.

"That means you could send it to the landscape architecture firm like I did," says Ure. "You could send it in for permitting. Or to the city engineer, who needs to figure out where to plant the tank for water pipes. They can open NavVis IVION and say, OK, based on other houses in the area, it should go here. They can actually get visuals and then decide, which is great for the review process."

Data for every stakeholder

While working on the renovation, Ure couldn't help but think of how the data from NavVis VLX would have helped a much larger project. "Think of how a big project comprises multiple disciplines, like architects, engineers, contractors, and the owner-operator. And they all have a different perspective. They all need different kinds of data, like the horizontal component of the land or the vertical component of the inside of the house and the garage."

"All you need to do," he says, "is throw that NavVis VLX point cloud up to whatever shared service you're using, maybe it's NavVis IVION. Then, any discipline can take the data and roll with it for their specific project. With data like this, everything can get done."



Noah Eckhous CSM for US West Coast

DEMO: CIVIL ENGINEERING SURVEYING FIRM

Recently, Eckhous demoed NavVis VLX 2 for a very large civil engineering survey firm that serves the energy, land development, transportation, and water markets.

This customer is unique in that it performs virtually every kind of survey — and often on a single project. A typical project saw the firm documenting the Aquarium of the Pacific in Long Beach, California, where surveyors captured a wide variety of survey data, including building envelopes, surface streets, curb lines, and more.

TRADITIONAL TOOLS: VARIOUS

To ensure versatility, the firm's toolbox includes virtually every major technology for capture. Its teams are well-versed in using aerial lidar, auto-mounted lidar, drones, terrestrial laser scanners (TLS), total stations, and more.

WHY NAVVIS VLX 2?

Just before the demo, the firm was contracted to capture “virtually all of downtown Los Angeles.” The teams would scan the surface with aerial or auto-mounted mobile lidar, and then NavVis VLX 2 was used to capture the basements beneath the sidewalk to gauge operating space for utilities. The system was also used to fill in the many occlusions left behind by the vehicle-mounted lidar. Incomplete surface elements such as curbs and ramps were further scanned, and the data was then merged to generate a comprehensive, more complete scan.

Normally they would have used a total station and a TLS for the basements. But the firm knew that these methodologies would be extremely slow, especially since the project area was measured in miles rather than feet. So, the firm decided to explore NavVis VLX's extremely efficient and cost-effective workflow.



TESTING ENVIRONMENT: URBAN STREETS AND BASEMENTS

Eckhous demoed the NavVis VLX 2 in downtown Los Angeles on the project site detailed above.

First, he scanned the important surface elements like ramps, curbs, curb cuts, and road markings and handed that data set over to the firm. Next, he scanned the basements on one side of the road. For this stage, he used the control network that the firm had already established for its own capture of the space. Then Eckhous handed that data over.

EXPECTATIONS

“Essentially,” he says, “they gave us a chance because there was enough buzz about how NavVis VLX could be good enough for survey. But their baseline expectations for the demo came from years of experience with tools like Leica Pegasus Backpack. Essentially, they weren’t sure SLAM-based data could integrate with data from their high-end, large-scale capture systems.”

Every residual was below 2.5 mm. I said that it looked on par with other data captured by the device.



Noah Eckhous
CSM for US West Coast, NavVis



RESULTS: PROJECT

A week after the demo, the firm's representative sent a message to Eckhous with a few screenshots of the data. "He wanted to know if it looked right to me. After thinking about it for a bit, I realized that he was incredulous about the results."

High accuracy

The rep had generated a residual report and felt worried that the accuracy levels were too good to be true. As Eckhous explains, "Every residual was below 2.5 mm. I said that it looked on par with other data captured by the device."

The firm was so impressed by the data it decided that the device was accurate enough for use in more demanding applications. They told Eckhous, "We can even scan the street with NavVis VLX if we need, and still hit all of the tolerances for checking ADA compliance."

I was finished in 20 minutes. That speed difference really adds up when you're scanning on the scale of multiple city blocks.



Noah Eckhous
CSM for US West Coast, NavVis

Much faster than TLS

"Using a TLS, it had taken them a full day to go in, traverse down, and capture the necessary spaces," says Eckhous.

"When I demoed the NavVis VLX, I went in, checked on their control points, and scanned the basement spaces under one whole side of the sidewalk. I was finished in 20 minutes. That speed difference really adds up when you're scanning on the scale of multiple city blocks."

Seamless integration

This firm's integration needs were a bit more complex than most. In short, they were looking for a mobile system with data quality to match their million-dollar auto-mounted and airborne lidar.

"When you have data from these expensive systems, the companion system must produce dense ground data, especially on vertical surfaces," says Eckhous. "In the past, the firm had tested SLAM-based systems that weren't up to the task. But when I gave them the NavVis VLX data, they said, "This fits perfectly for normal day-to-day operations." It's nice for me to see that the mobile system can essentially replace a cumbersome TLS workflow for filling occlusions from the car-mounted system and airborne systems."



RESULTS: BUSINESS

Since making the purchase, the firm has embraced NavVis VLX as a “Swiss army knife,” or a go-to tool in their toolbox.

High ROI

Before the demo was even complete, says Eckhous, the firm started asking him how much the NavVis VLX system cost. “They assumed that it cost about three times as much as it actually did— and, again, that was based on expectations from previous systems. When I told them the cost, they said, “Wow, you guys should be charging more for this thing with the value it provides.”

Ease of use

The firm has also found NavVis VLX quite easy to use. “They haven’t needed too much guidance,” says Eckhous. “There have been some growing pains as they’ve figured out the best ways to integrate data from different methodologies. But we’ve been there to offer guidance, and once we talked them through it, it was smooth sailing. They’ve been getting excellent results.”

Ultimate versatility

Since the firm sees big benefits with NavVis VLX, their survey teams have been using it for much more than capturing basements. “They’re dragging it all over the place and getting their money’s worth,” says Eckhous.

“They use it on interiors and commercial spaces. They use it for your typical road topo survey where you scan an intersection and turn it into line work — cutting a ten-hour job down to two. They’re using it for larger-scale projects like museums that are under construction. They scan quickly and build a model for progress monitoring and other applications like that. The firm takes it out for all sorts of stuff now.”

“They bought it as a very specialized, specific tool, intending to fill in the gaps left by their auto-mounted mobile mapping system. But as soon as we put the tool in their hands, they immediately had a dozen ideas for what to do with it and where to take it. They said, ‘I wish we had this a month ago, that project would have been way easier.’ They get it now.”

Enduring value

“When our purchaser left the firm to move somewhere else,” Eckhous says, “he got in touch again. We’re about to go do a demo for him with NavVis VLX 3. He saw the value in it so much that he got to his new firm, saw the projects they were doing, and said, “I know exactly what we need.”



Kyle Hodgson

CSM for UK

PROJECT: DIGITAL UTILITY SURVEY

On almost every new construction project, some form of excavation must be carried out. However, before this can commence, underground utilities must first be located and recorded.

This workflow produces 2D drawings that contractors can reference to prevent accidental strikes during construction, and in most countries, commercial clients are required by law to provide this information to their contractors.

Striking the underground utilities can be a very costly mistake and set construction back up to several months depending on the severity.

TRADITIONAL TOOLS: TOTAL STATION

Surveyors use ground-penetrating radar (GPR) or electromagnetic locators (EML) to determine the placement of underground utilities. As they move along each utility line, they then mark it at regular intervals using temporary spray paint. Next, the surveyor uses a total station and a prism to record each of these paint markings and produces a survey. They place the prism on the spray markings — and other essential features like buildings and curbs — to gather precise location data. As a final step, they record this data in computer-aided drafting (CAD) software and produce final deliverables for the contractor.

WHY NAVVIS VLX 3?

As the number of construction projects grows worldwide, the need for high-quality surveys also grows. NavVis VLX 2 and 3 enable survey companies to meet demand by completing projects faster with existing resources. For companies that decide to scale up their business, NavVis VLX can help with that too. Since these tools use a simple workflow that is easy to learn, they significantly reduce the expense and time necessary to train new staff, while reducing the opportunity for potential mistakes. Though NavVis VLX 2 and 3 both return excellent results in many applications, NavVis VLX 3 is better suited for outdoor capture. The scanner produces denser, more detailed point clouds and captures at a longer range, making it ideal for applications like utility survey.



NavVis VLX data looked the same as data from a total station, the most accurate tool out there. That means it gets the stamp of approval for me.



Kyle Hodgson
CSM for UK, NavVis

TESTING ENVIRONMENTS: RESIDENTIAL NEIGHBORHOOD

Hodgson put NavVis VLX 2 to a real-world test by surveying 1 km of road where utilities needed to be mapped in northeast England.

Since an official survey had been completed before Hodgson arrived, he tested using the pre-existing control points, spray-paint markings for utilities, and traditional CAD survey deliverables.

EXPECTATIONS

Hodgson has nearly a decade's experience using tools like robotic total stations, terrestrial laser scanners, and drones for digital survey. He had tested many mobile systems for this application and found they failed to meet expectations.

"With NavVis VLX," he says, "I thought the system could handle survey. I wanted to see what the system could do because NavVis VLX could represent a huge efficiency gain for surveyors and make their lives much easier, but only if the accuracy was high and features could be extracted from the data."





RESULTS: PROJECT

Hodgson had high hopes for NavVis VLX 2, but he “didn’t expect the system to perform as well as it did.”

High accuracy

For the first test, he overlaid the total-station survey data over the NavVis VLX data and checked the delta between the two. “I looked at the channel line, which represents where the curb meets the road. I also looked at the line for the back of the curb. The two data sets matched up perfectly. NavVis VLX data looked the same as data from a total station, the most accurate tool out there. That means it gets the stamp of approval for me.”

5X faster than total station

A traditional total station survey of this site took roughly two weeks, to collect all the topographic detail as well as utility spray markings, says Hodgson. Using NavVis VLX, Hodgson captured the entire 1 km of road in just 55 minutes. “Then I processed the data overnight using NavVis IVION Processing, our cloud processing solution, which took no effort. If I had performed a digital survey, that would have taken another day.”

With NavVis VLX, I’ve compressed a two-week project to two days



Kyle Hodgson
CSM for UK, NavVis

Valuable photographic records

As Hodgson explains, the spray paint left on the road to mark utilities is temporary. If anything goes wrong with the survey or any markings are missed on site, the markings will likely be gone when the surveyor returns to the field. They will be forced to survey the utilities again, which means extra time and expense. Even if the marks remain, this is still another trip to site versus simply loading data in the office.

“When you capture with NavVis VLX, it’s easy to grab panoramic images that show all of the lines,” says Hodgson. “You’ll have everything in the data, so you can survey digitally from the office at great efficiency and of a higher quality.”

NavVis VLX 3 superior for outdoor survey

Though NavVis VLX 2 performed very well in his testing, Hodgson says NavVis VLX 3 would have performed even better in outdoor applications such as this.

For example, when looking at the NavVis VLX 2 data, he noticed the scanner left gaps in areas like the central intersection. This was because he scanned the site while walking on the curb, and the scanner’s point density wasn’t enough to reach the center of the road. NavVis VLX 3, on the other hand, features a much greater density, so the scanner would have captured across the entire intersection with no extra effort from the surveyor or increased danger of crossing the road.

Hodgson adds that NavVis VLX 3 also captures data twice as dense as NavVis VLX 2. It produces a more detailed, complete data set, which is especially helpful for documenting complex structures like building façades.



RESULTS: BUSINESS

These benefits in the field can help surveyors do more work in less time and even grow their businesses quickly.

Easy learning curve

Teaching a total station workflow to a novice surveyor is time-consuming and expensive, and mistakes are easy to make for junior surveyors. "It can be mind-blowing how many steps and settings they need to know to set out a high-quality control network," says Hodgson. "NavVis VLX 2 and 3 are much easier. When you have new staff, you can feel comfortable sending them into the field with basic training, and 8 out of 10 times, they'll come back with a successful mission. With training, they'll succeed every time."

Safer fieldwork

With its extended range and denser data, NavVis VLX 3 can keep surveyors out of harm's way. "If I were surveying this site with a total station," says Hodgson, "I would go into the road to survey road markings. With NavVis VLX 3, I could capture dense data for the whole site from the curb. That's a massive safety improvement."

Easy scaling

Since NavVis VLX 2 and 3 are much easier to learn than a total station, Hodgson says, they make it faster and less expensive to scale a surveying business. "You can hire new, junior staff, train them to capture with NavVis VLX, and get them out into the field quickly," he says. "And then you get a bonus: You can save the expertise of senior staff for establishing high-quality control networks, project management, and quality assurance."

More intuitive data, safer work

Traditional survey deliverables are CAD files, which can be hard to read for those without survey training. "You get contractors and others on site with big paper plans trying to make sense of the survey," says Hodgson. "But the deliverables aren't easy to read, which increases the risk of striking a utility when they're digging in the ground. That could mean a fine of hundreds of thousands or even death."

With NavVis VLX data, you can give contractors access to NavVis IVION, which shows them a live map with utility information overlaid and can be accessed from any web browser, even on mobile devices. That's much more flexible than traditional deliverables and much easier to read. And this ultimately reduces the risk of fines or personal injury.



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