ClearEdge3D

presents

33 Expert Tips, Tactics & Best Practices for As-Built BIM Project Success

Inside this report, you'll get:

✓ 7 Bidding/Project Planning Best Practices

✓ 8 On-Site/Data Collection Tactics

✓ 16 Data Processing/Modeling Tips

✓ 2 General Tips, Ideas, Best Practices, Lessons Learned

✓ Plus Audio Streams with Interviews and Commentary From the Experts

EdgeWise Verity

Meet the Experts

Matthew Byrd
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- ✓ 8 years survey experience
- ✓ Extensive laser scanning background
- ✓ Specialty in Oil & Gas Industry.
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- ✓ Founded HALE TiP in 2014
- ✓ Specialist in Revit, Navisworks, Scanning and Mobile Technology
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- ✓ Experienced Architect and 3D Modeling Expert
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- ✓ 14 years survey experience
- ✓ Multitude of scanning projects and scanner types
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In the following pages, when you see an icon like the one above, click on it to hear that expert speaking about the best practice in further detail.

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Seven Bidding/Project Planning Best Practices

#1: Visit the site!

Seeing is believing. If at all possible, spend several hours walking the site. Requesting access from the Owner or Operator may be the only way to gain access, but the extra time you spend will pay dividends—and the larger the project, the more critical this step. Make note of anything that's unique. Bring your camera and take pictures so that you can reference them later. When you get back into the office, make a plan to handle any of the unique challenges discovered.

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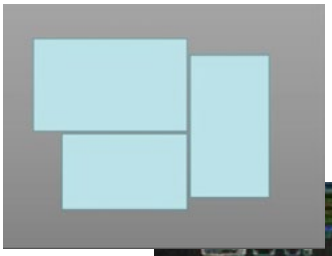
- Matthew Byrd



Site based on client description... useless for project planning.

Actual site layout.

#2: Clearly Define Project Scope of Work

Even today, a defined Scope of Work often isn't part of a standard pre-project agreement. Be sure to take this opportunity to help the client define the project and its deliverable specifications. There are a lot of variables in an as-built project; the client will appreciate your guidance and give you an opportunity to convey your expertise in a consultative way. Here are a few questions to cover:

- What exactly is to be scanned?
- Will color mapping and imagery be needed?
- What coordinate systems will be used?
- What's the level of detail required for the model? (LOD-100, 200, 300, etc.)
- How will the delivered scan and model be utilized for the project?

Click to Listen

- Mark Hanna

#3: Communicate Early and Often with the Client

Don't take your industry (and technology expertise) for granted. Not everyone's a savant when it comes to identifying site lines, planning camera positions, and moving data in and out of varied software platforms. Achieve a deep understanding and consensus with the client on important considerations like the scope of the deliverable, how the model will be used, the stages of the project, any required system shut-downs, how and how long will your team occupy the site and, most importantly, the level of detail. When in doubt, err on the side of over communicating.

Click to Listen

- Michael Pfaff

#4: Obtain Existing As-built Drawings

Design drawings are inaccurate almost as soon as construction begins. However useful data can be gleaned from them. For example, they can help your modelers determine nominal pipe sizes under insulation. They can also assist in verifying pipe types and systems. Or they may be useless. But always request the design or as-built docs—more often than not you will find them useful.

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- Mark Hanna

#5: Scope Creep Happens

You've landed a large client with the potential for much more work. After the contract is signed, they begin adding to the requirements and expanding the deliverables, to which you agree (for good customer relationship management). This ***isn't*** good relationship management—it's a potential train wreck. Be sure to address the issue of the client increasing your scope of work upfront in your contract. The more specific the contract language, the better!

Click to Listen

- Michael Pfaff

#6: Prepare a Data Management Plan

In almost all cases, client expectations will dictate that the scan data is part of the deliverable. Most laser scanners produce data in the manufacturers proprietary scan format, which is often unreadable by the client. You should plan to convert it into a format that's more universally available like E57 or Autodesk RECAP. Scan files can be massive and unruly, which is why it's best to deliver files by external hard-drive to avoid upload/download issues as well as any security concerns on the client-side. Remember, you're responsible for protecting the client's data: use caution when handling sensitive files and information. If you're contracted to deliver a model in addition to the scan data, determine which modeling software they support and the version they have to ensure compatibility.

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- Mark Hanna

#7: Create a Scan Plan Before Work Begins

Even a medium-sized scanning/modeling job can be overwhelming. Pre-plan how you're going to scan it by developing a scan location map and work schedule. You may need to coordinate with the client to schedule access to certain areas of the building or neighboring structures. Consider staffing and equipment requirements such that you can deliver the project on time and on budget. Having a scanning plan gives you a roadmap to help ensure a smooth data acquisition phase of the project.

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- Mark Hanna

Eight On-site Data Collection Tactics

#8: Understand Project Conditions Prior to Arrival

Not every scanner excels in every environment and no two projects are the same. Vibration, reflectivity or airborne debris could threaten the accuracy of your data or even sink the project. Become familiar with various types of scanner technologies and their optimal operating environments. Have contingencies in place (like access to alternate scanners) before you begin the data collection process. If certain building elements are blocked, pipe runs above a dropped ceiling for example, determine with the client who is responsible for removing ceiling tiles in advance. Minimize noise by scanning during non-peak hours. Properly understanding and accounting for site conditions can be ***the*** difference-maker in project success.

Click to Listen

- Mark Hanna

9: Always Have 2-3 Measuring Devices for "Control"

While scanners are usually the most accurate and efficient measurement device, inaccuracies can creep into your workflow causing major problems downstream. Having a second or third measuring device to validate a few of the scanner outputs is always a good idea. A total station is idea for this or even a disto if the project is small. Choose one or two of the longest measurement points and check your scanner result against your total station output. If they match, you're in great shape. If there is a discrepancy, you will need to track down which instrument need recalibration.

Click to Listen

- Larry Kleinkemper

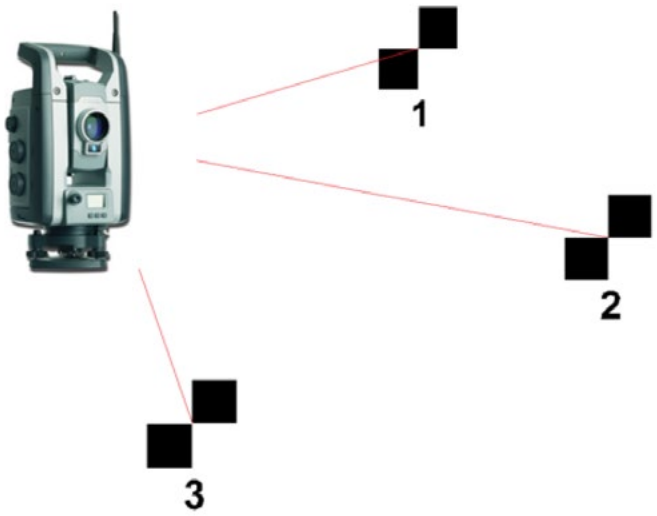
A total station or even a disto are ideal supplementary measurement devices

#10: Focus in Field on Quality Control

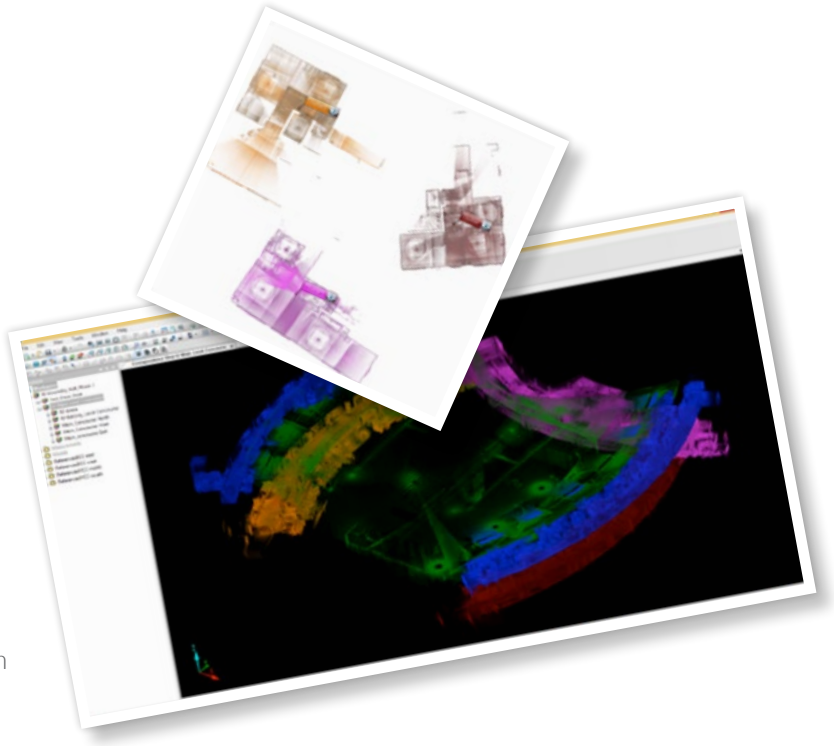
You are ultimately responsible for the quality of your deliverable. While technology is making enormous strides, establish good processes by building quality control measures into your standard operating procedures. Check and recheck your data to ensure that you're delivering a model within the specified level of detail or tolerance. Establish survey control, pre-plan your locations where you'll use external survey references in combination with your overlapping scans and targeting, utilize target stickers to reestablish targets if needed, and make sure your scanning equipment is well maintained and regularly calibrated. Provide your client with a Registration Report to confirm that the project has met the intended project specification.

Click to Listen

-Mark Hanna



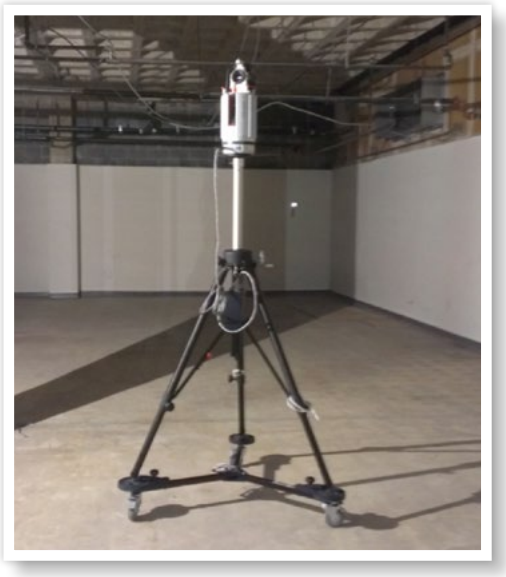
#11 Divide Your Project Into Manageable Sections



On large projects, such as stadiums or airports, it is best to divide and conquer. Use survey control to tie each section together. For the largest projects, register multiple scans together in clusters and then register clusters to each other. This reduces the potential for accidentally omitting areas, which often result in costly re-visits. It also makes management of the data much easier and helps the survey team and other downstream data consumers.

Click to Listen *- Mark Hanna*

#12: Stabilize Your Equipment with Quality Gear



You've spent $35,000 to $120,000 on an expensive scanner. Why on earth would you put it on a cheap tripod? Remember, in the scanning world, movement and vibration are your enemy, so invest in a decent tripod with stabilizer pads or lockable wheels.

Click to Listen *- Michael Pfaff*

#13: Run Multiple Scanners if Possible

Some projects, such as complex MEP, can benefit greatly by you using multiple scanners. One scanner can be deployed to capture targets for registering the data and the other, more lightweight rig, can be used to capture the above ceiling elements. Knowing the strengths and weaknesses of the different rigs can help you determine if two are indeed better than one.

- Mark Hanna Click to Listen

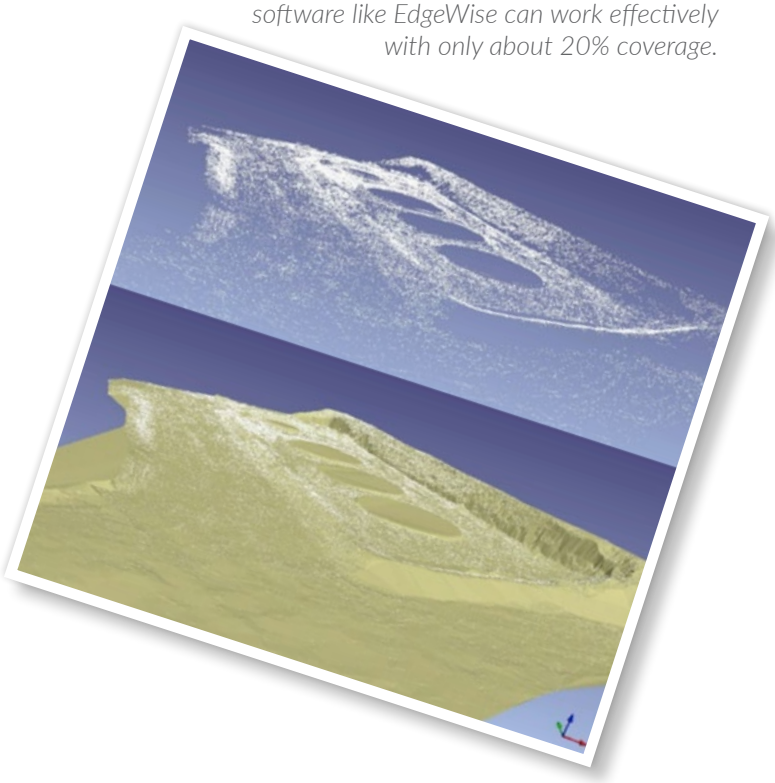
#14: Use Proper Scanner Settings, Based on the Deliverable Type and Details

Higher resolution scans may be required for smaller objects at greater distances. Be familiar with scanner terminology such as coverage (area of the scan) and density (number of points in an area). Key questions to help determine coverage and density are:

- Are you using feature extraction software? Often feature extraction software such as EdgeWise doesn't require as much coverage or density as you think.
- How small are the items you're looking to pick up? Smaller items almost always require denser scans.
- How will the client be using the data? If the ultimate deliverable is a solid model, then the density of the scans is less of an issue.

- Matthew Byrd

Automated feature extraction technologies in software like EdgeWise can work effectively with only about 20% coverage.



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#15: SCAN DATA: Better to Have Too Much, Than Not Enough!

When in doubt, scan too much. It's easy to delete a scan once you're back in the office. Conversely, in the circumstance where you don't have enough data, you have to request that the client provide you with access to a specific location again. Try to avoid this costly re-work whenever possible by over-scanning.

- Matthew Byrd

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Sixteen Data Processing/Modeling Tips

#16: Target-less, Targets, or Survey Control? It Depends!

Choose proper control for your project. Common options include target, target-less, or survey control to register your scans. Use a combination of targets and survey control on large projects to achieve the highest level of accuracy. Target-less registration is gaining in quality and popularity. When applying target-less registration, an increase in scan overlap will similarly increase registration accuracy.

- Matthew Byrd

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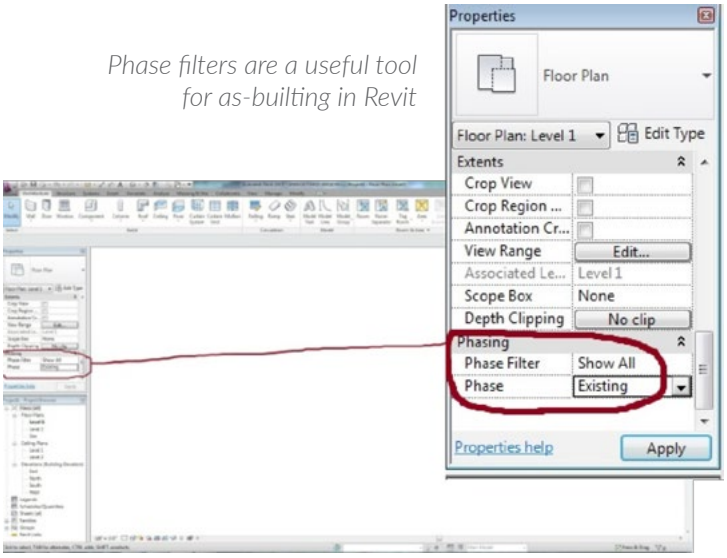
17: Start By Changing Phase Filters for All Views to "Existing" Before You Start Inserting or Drafting

Before you import scans to Revit or begin any modeling, change all views to the "Existing" Phase in the Phase Filter menu. This makes it easy for the designers of the new elements to virtually "demo" the existing model or separate their work from the as-built. It also enhances your ability to send model updates that are more useable for the design team.

- Larry Kleinkemper

Phase filters are a useful tool for as-builting in Revit



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#18: Filter & Cleanup Scan Data

Inevitably, the laser scanner will record a small amount of unintended noise or artifacts in the form of stray points within the point cloud. One example of an artifact may be a factory employee who walked through a scene during the scan. Once the files are registered, clean up the data by selecting and deleting those stray points. The resultant file will be more useful downstream, especially if you're using feature extraction software like EdgeWise to speed the transition into an intelligent model.

- Mark Hanna

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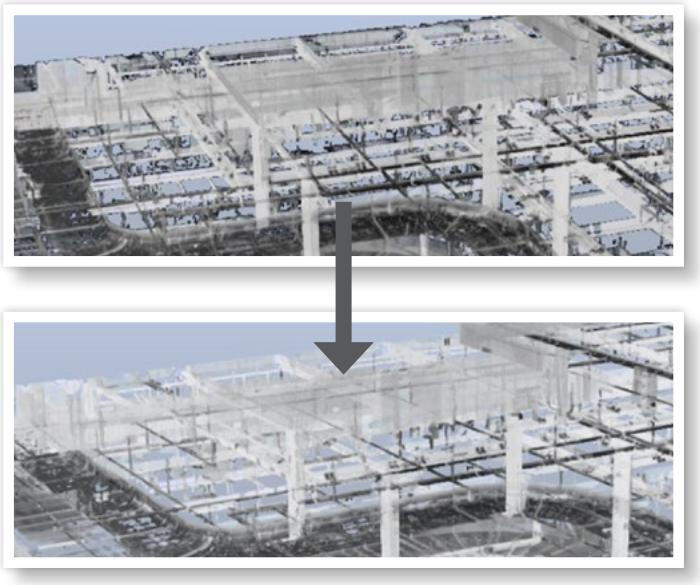

#19: Remove Unnecessary Scan Data for CAD Reference but Maintain Full Scans for Client Visualization

Numerous circumstances might require a modeler to link scan data into modeling software like Autodesk AutoCAD or Autodesk Revit. Design tools like the aforementioned aren't purpose-built for point cloud files and may produce results that are visually confusing to extended team members or clients. Remove or unlink the point cloud data in the modeling software once you're done referencing it or before you deliver the DWG, RVT, etc., to the client.

- Greg Hale

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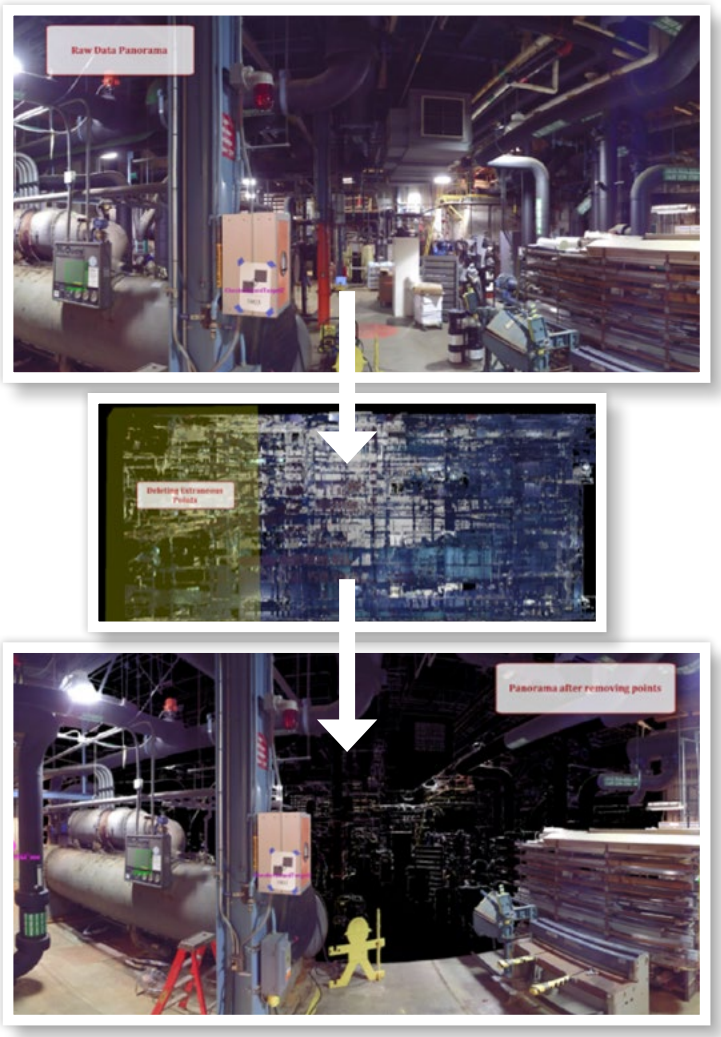
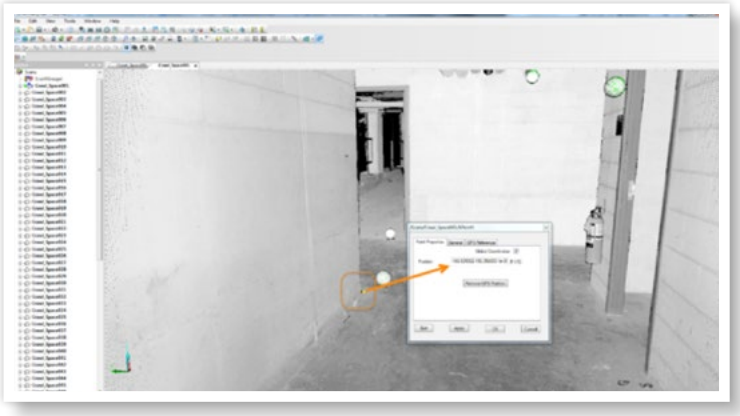
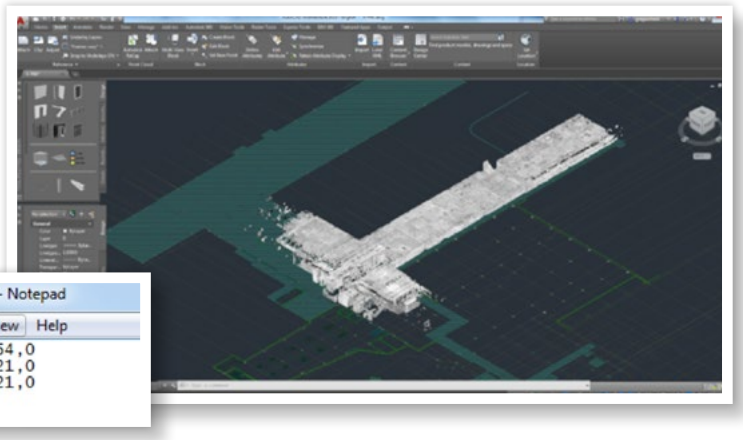


Clients love the high definition visualization of EdgeWise's ClearView or Leica's TruView.

#20: Coordinate CAD File Origins and Orientation Before Finalizing Registration and File Translation





Importing scan data into CAD/BIM software is a common downstream use. Synchronize CAD coordinate systems before finalizing registration. Doing so will ensure quick and easy placement of scan files within CAD and makes coordination with the team more fluid.

- Greg Hale

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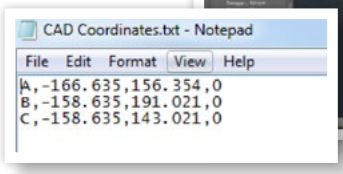
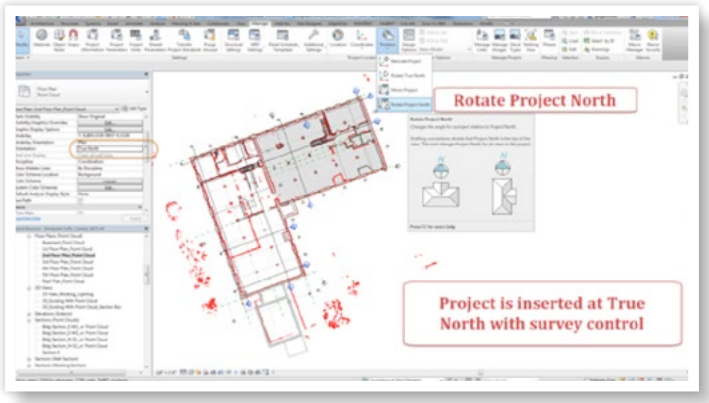
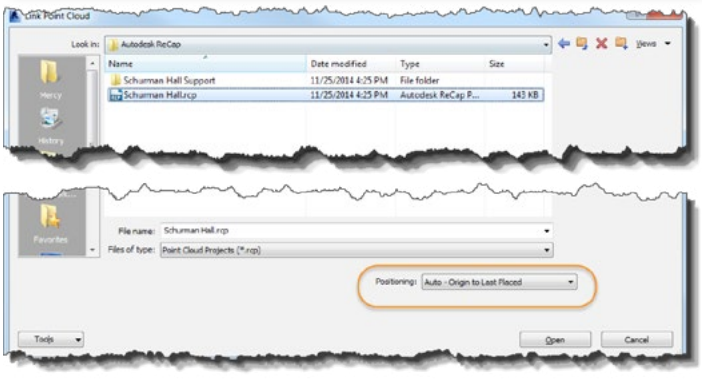


#21: Files Can Be Repositioned Within Revit…But Be Careful!





Proceed with caution: manually repositioning linked files in Revit should only be used as a last resort! However, unique circumstances may necessitate such a decision. One such scenario may be where you've been contracted to verify as-built conditions against a design model. In this circumstance, the design model may not be referenced to a geo-referenced coordinate system. In this scenario, manually positioning the as-built model can be managed locally within Revit. Additional scans can be inserted using the "Auto-Origin to Last Placed" position. Be aware that if you attempt to merge any data from other scanning applications, such as Edgewise, the resulting insertion point will not be correct. Import all data before repositioning.

- Greg Hale

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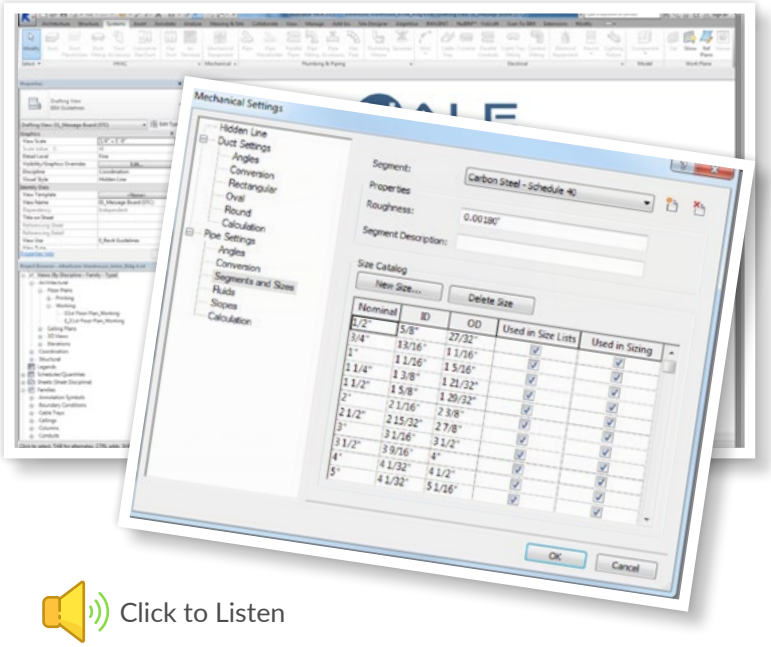
#22: Start with a Good Revit Template and Sometimes the Client's Template

One way to make a good impression with a client is to deliver the as-built model within the guidelines of their unique CAD/BIM standards and guidelines. It's a simple request and will be much appreciated. Just ask that they provide you with their Revit template at the onset of the project. Then say "hello" to repeat business!

- Greg Hale



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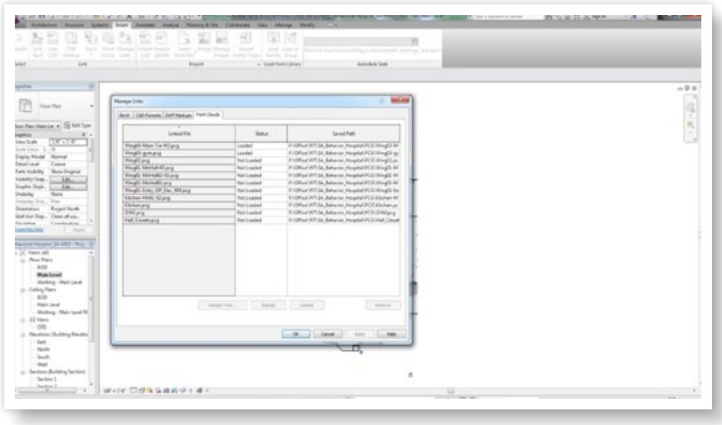
#23: In Revit…Manage Links is Best to Load and Unload Point Clouds as Needed.

If you are working with very large point cloud files use the "manage links" utility to load and unload the point cloud when needed. If you don't, the size of the scan files make bog down the performance of your computer as your processors manage all that scan data.

- Larry Kleinkemper



Manage links is the best way to handle large point clouds in Revit

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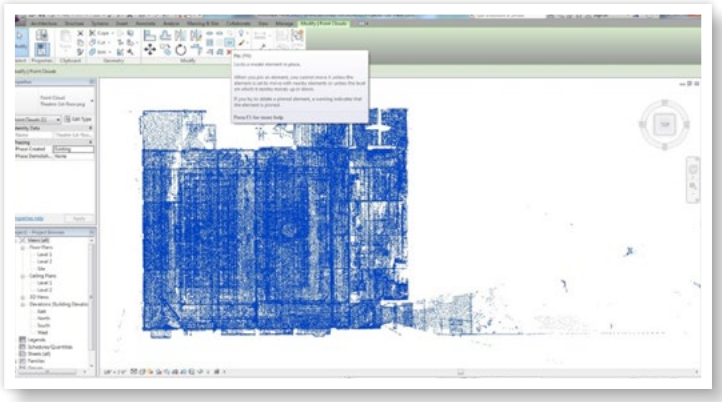
#24: Once Scans are Imported and Positioned Correctly in Revit–Pin Them!

Never, ever move your scans to fit your model…I'm serious…never! Doing so can lead to so many downstream problems and has the potential to blow your project. Don't do it!

- Larry Kleinkemper



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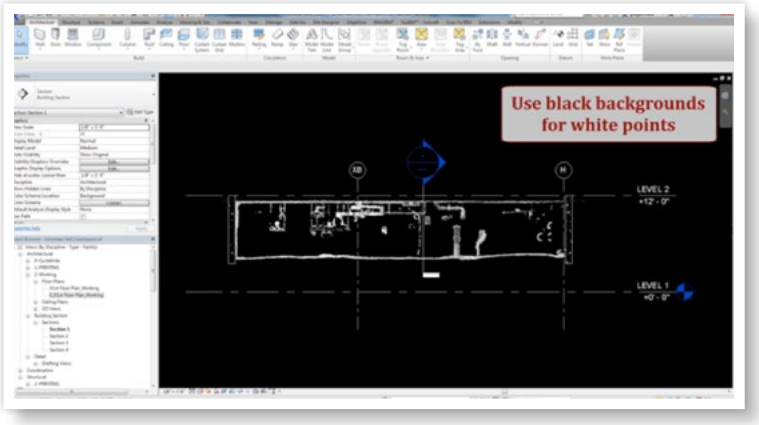
#25: Don't be Afraid to Show Your Dark Side—Use Black or Dark Backgrounds for Light Point Clouds



Working with point clouds will strain your eyes. Change your workspace background to a dark color to reduce strain and improve visibility.

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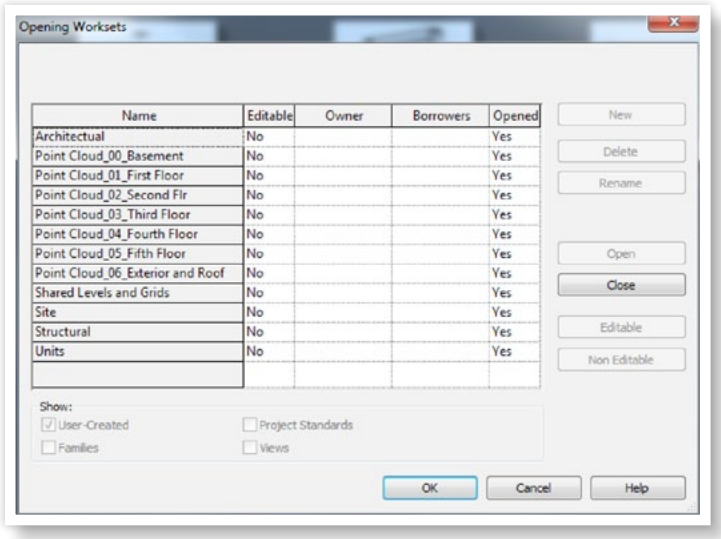
- Greg Hale

#26: Place RECAP Files on Their Own Worksets to the Client



Managing visibility settings in Revit is part art and part science. Place RECAP files into their own workset allowing you to standardize which views show the point cloud by default. Due to the size of point cloud files, your computers RAM and processor will thank you.

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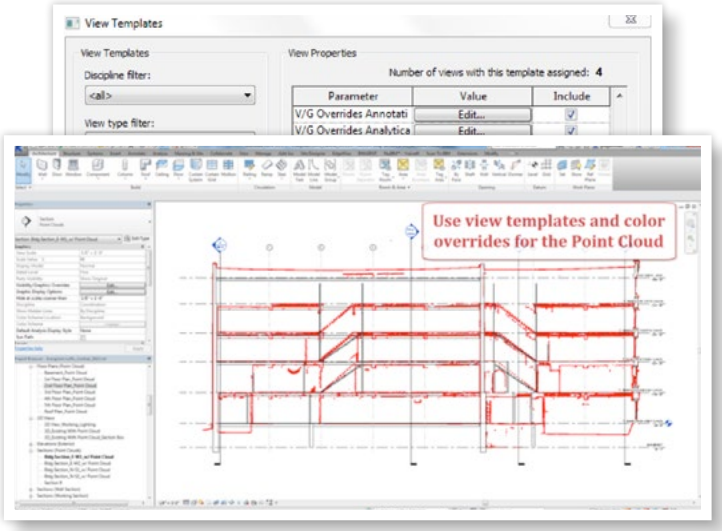
- Greg Hale

#27: Create and Utilize View Templates for Plans, Elevations, Sections, and 3D Views



Use View Templates to optimize view settings for displaying scan data in Revit. It will save time when creating new views and also ensure view consistency across your drawings, etc.

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- Greg Hale

#28: Create Camera Views, Using Edgewise Clearview, from 3D Positions for Visualization of Model vs. Point Cloud

Scan data produces compelling visuals. To create the best visual, assume the perspective of a scan position, using features like the EdgeWise ClearView or Cyclone's TruVuew. Doing so will produce optimal point density and an image with the fewest number of gaps.

- Greg Hale

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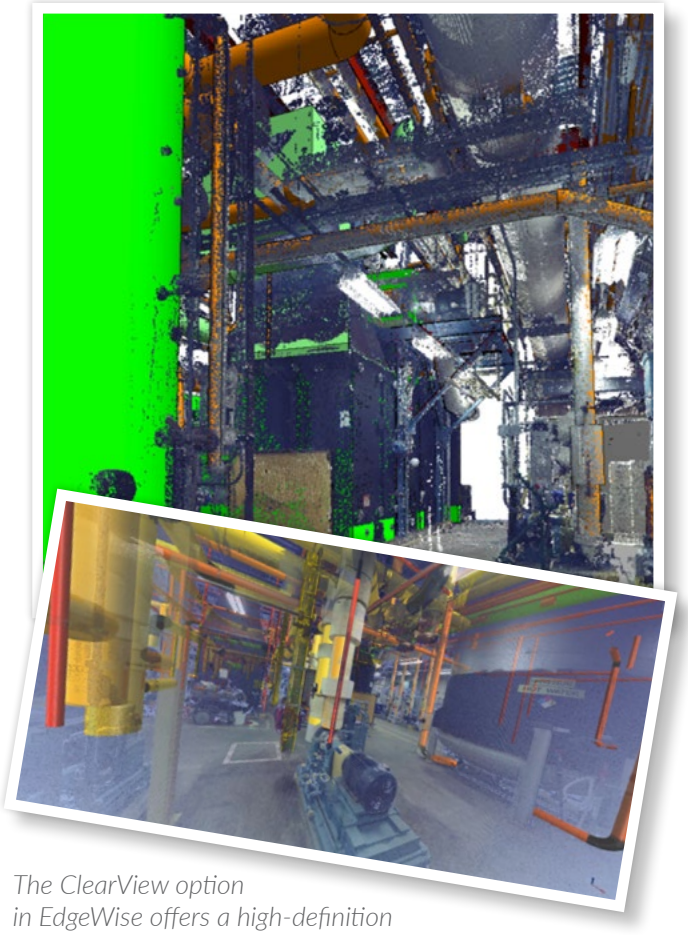
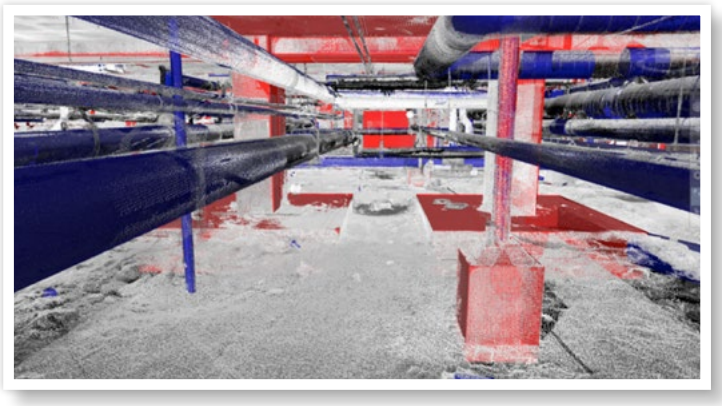


The ClearView option in EdgeWise offers a high-definition view of the point cloud.

#29: Check Work by Doing a Walkthrough for Your Client with Navisworks Using Color Overrides



Autodesk Navisworks is a great tool for aggregating and overlaying data. Once imported into Navisworks, walk through the model to find errors and omissions within the model. Incorporate this step into your delivery process to ensure a high quality product.

- Greg Hale

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#30: Use Feature Extraction Software to Speed the Modeling Workflow!

Feature extraction software like ClearEdge3D EdgeWise can speed the production of an intellegint model from point clouds. EdgeWise uses a combination of automated feature extraction, assistive modeling tools, and model checking technology to ensure accuracy.

- Matthew Byrd

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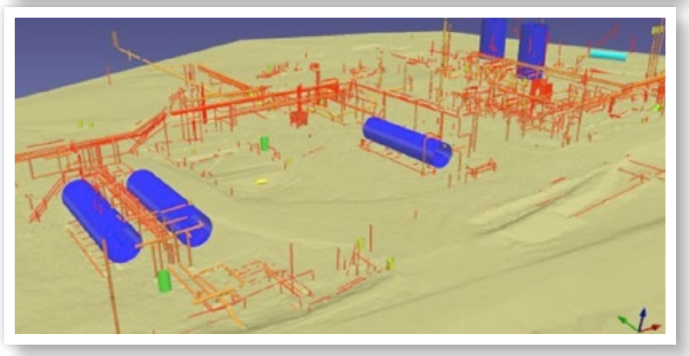

The feature extraction utility in EdgeWise can extract 80% of the pipes in a model with zero man-hours.

#31: Customer Service & Communication

Set yourself apart from your competition by treating your customers the way that you'd like to be treated. Never forget that people want to work with *people*. Be responsive and on-time. Think about each customer with a long-term perspective: build relationships and trust.

- Matthew Byrd

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Two General Project Tips & Best Practices

#32: Put Fear of New Technology Aside

Be bold. Be an innovator! Try different data capture devices such as handhelds. Explore new technology like automated modeling software. Seek people with experience...most are very willing to share knowledge. Don't forget to give back to the community by sharing your successes, knowledge, and failures!

- Alex Demogines

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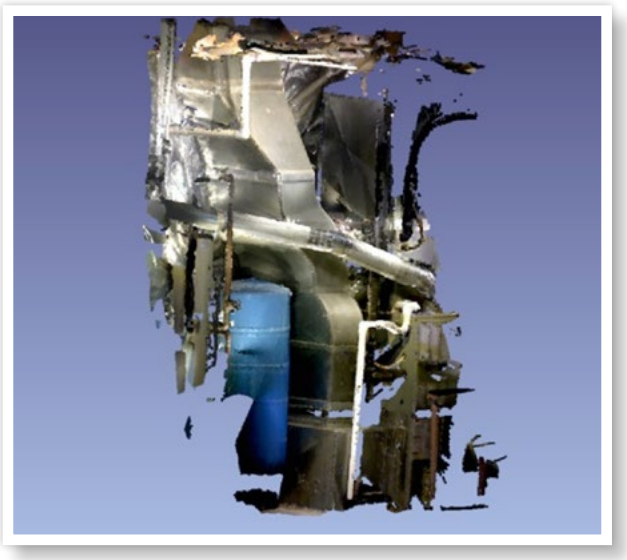

Data from a Dot Product handheld scanner being modeled in EdgeWise

33: The Biggest & Baddest isn't Necessarily the Best in Computer Hardware

Many don't realize this but Revit only uses one processing core, so if you are doing a lot of Revit work, the benefits of a high-end eight core or sixteen core workstation are lost. Where a multi-core machine comes in handy is processing large data sets in applications like EdgeWise. Four gigs of Video RAM is plenty and will deliver the best speed of zoom / pan and changing views at a great price..

- Larry Kleinkemper

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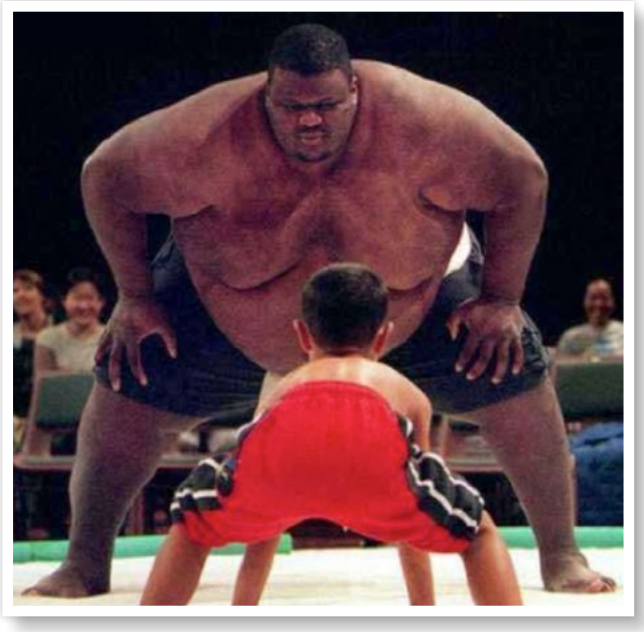

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EdgeWise

EdgeWise offers a host of building, structural, MEP and plant modeling features and tools to bring you from field-scanning to finished faster than ever before. The updated core automated feature extraction algorithms and results are amazing. Not only is the pipe extraction substantially better, we've also designed new algorithms to automate the extraction of gridded structural steel and concrete.

EdgeWise includes:

- Structural modeling tools that use advanced extraction algorithms and automated modeling technologies to accurately extract steel, concrete and wood structural elements faster than ever before.
- Pipe modeling tools with better, faster automated pipe extraction, spec-driven fitting placement, billion-point visualization, and exacting quality assurance tools.
- Duct modeling tools that can bring extracted ducting, conduit, and other mechanical, electrical, and plumbing (MEP) elements directly into Autodesk® Revit® as fully functional pipe, conduit, or duct Revit families.
- Building modeling tools use groundbreaking algorithms that can identify and extract some of the most common building features from point clouds and automatically create Revit family objects. The model will export seamlessly to Revit as an intelligent model, saving you countless hours.

Verity

$500 Billion USD. That's how much the construction industry spends each year fixing poorly constructed, out-of-tolerance work. Experts say between 5% and 12% of a project's costs are lost on expensive rework and resulting schedule delays. Verity™ software from ClearEdge3D dramatically reduces this financial impact, resulting in more profitable construction projects, more accurate as-builts, and fewer schedule delays.

How Verity works:

Verity analyzes point cloud data of construction sites and compares it to the design model, determining which elements have been installed to date and flagging out-of-tolerance or inaccurately constructed work. Verity provides unprecedented insight into and control over your construction projects.

To request a demonstration, please contact:

sales@clearedge3d.com | USA: + 1 866-944-8210 or visit clearedge3d.com.