

How 3D Data Capture (Laser Scanning) Has Changed How EPC Organizations Execute Capital Projects



Introduction to Becht Dimensional Technology Services



- Established in 2009.
- 3D data capture (laser scan), dimensional control / inspection, and digital asset management services.
- 300+ total years of experience working with laser scan and dimensional measurement information.
- Executed over 2000 laser scan projects for the Industrial EPC and Owner-operators.
- Over 500,000 laser scans collected.

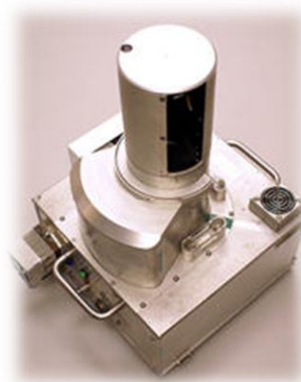


**How many here today are
familiar with or used laser scan
point cloud technology?**



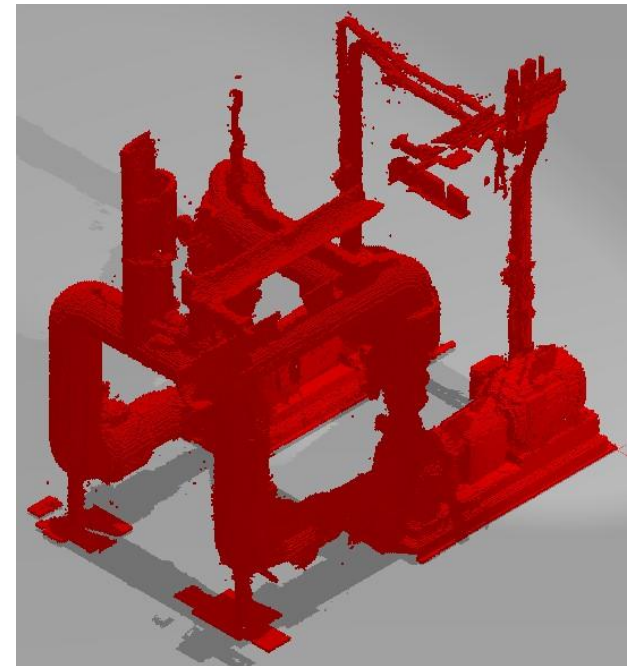
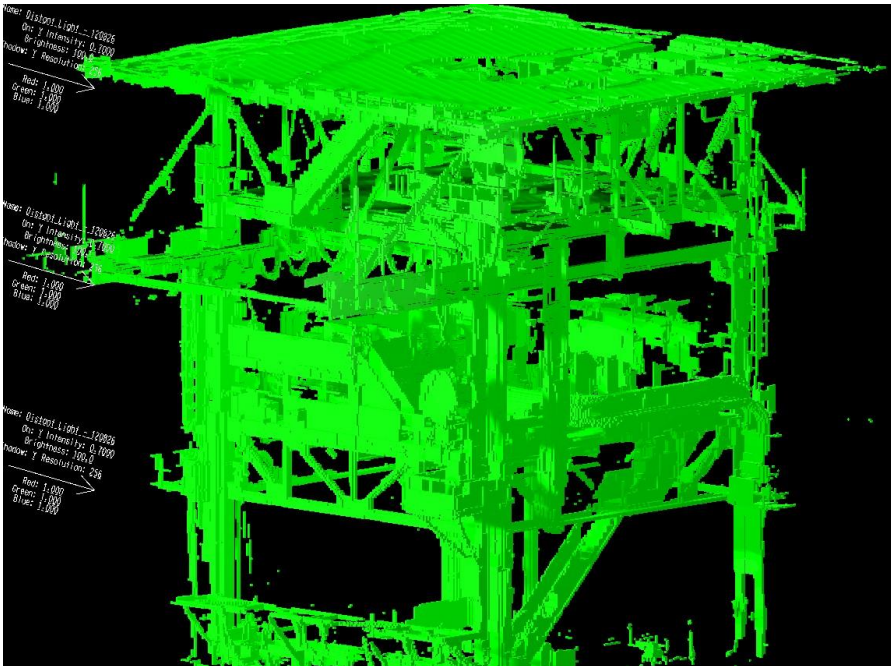
3D Data Capture Technology

Laser Scan Technology is Not New



3D Data Capture Technology

Laser Scan Output



Point Cloud Visualization

3D Data Capture Technology



Laser Scan Point Cloud Overlay within 3D CAD Environment

3D Data Capture Technology

3D Data Capture Technology Today



Terrestrial Laser Scanners



Handheld Imaging Systems



**Combination Survey and
Scanning Systems**



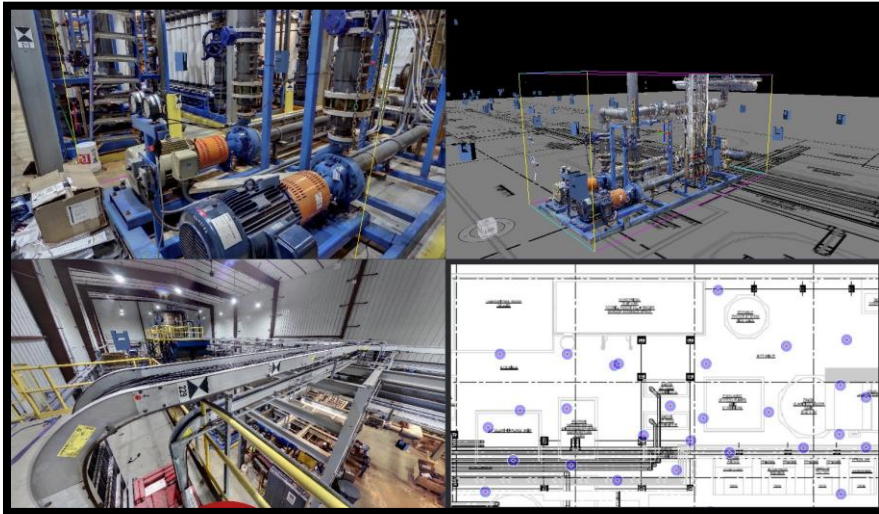
Mobile Lidar Scanners



**Aerial Image Capture
& Lidar Scanners**

3D Data Capture Technology

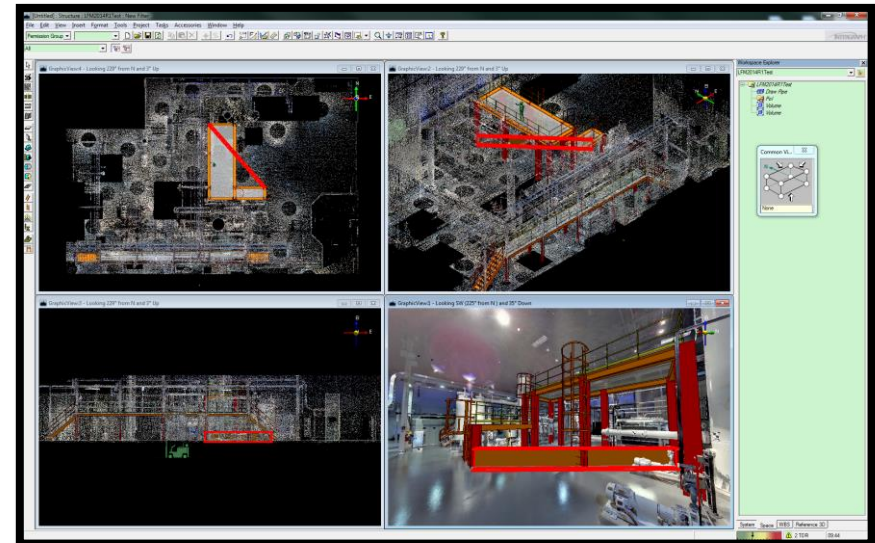
Laser Scan Output



**Laser Scan Point Cloud, Integrated Imagery
Visualization, and Measurement Tools**

3D Data Capture Technology

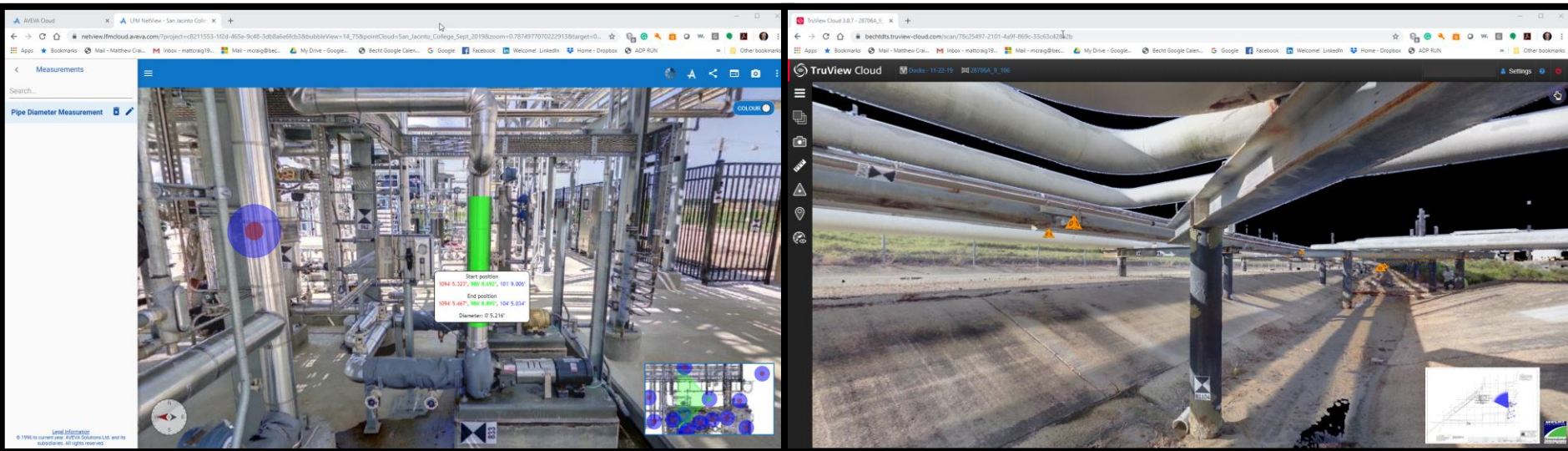
Laser Scan Output



Laser Scan Data Integration with Plant Design Software

3D Data Capture Technology

Laser Scan Output



Laser Scan Data Integration with Cloud Based Applications



Okay, So What?

How Does 3D Data Capture Technologies Bring Value to My Organization?



Where 3D Data Capture Technologies Can Bring Value?

- Re-work Costs Can Run from **2% to 20%** of Project's Total Contract.
- Estimated Cost for Re-Work is **\$15 Billion Dollars** a Year.
- Contributors to Re-Work are Scheduling, Material and Equipment, Engineering and Design, and Cutting Costs.



ENR – December 2012 – “Contractors Confront the Growing Costs of Re-work”

Issues During Project Execution



Fundamental Root Cause



Measurement

Fundamentals About Measurement

- Every Measurement Has Uncertainty.
- All Measurements Are Not the Same.
- Different Measurement Technologies are Required to Achieve Specific Accuracy Results.
- For Every Measurement That is Made the Fundamental Process that Should Always Be Applied is...



"Measure Twice and Average the Results"

Perception Versus Reality at the Construction Site Regarding Measurements

- **75% of Construction Layout** Will Be Measured Off of Something Existing.
- **80% of Errors** that Occur in the Field is From Inconsistent Measurement Documentation
- **35-40% of Field Measurements** are Verified
- Measurement Accuracy Tolerances are Typically Within $\pm 1"$ (25mm)

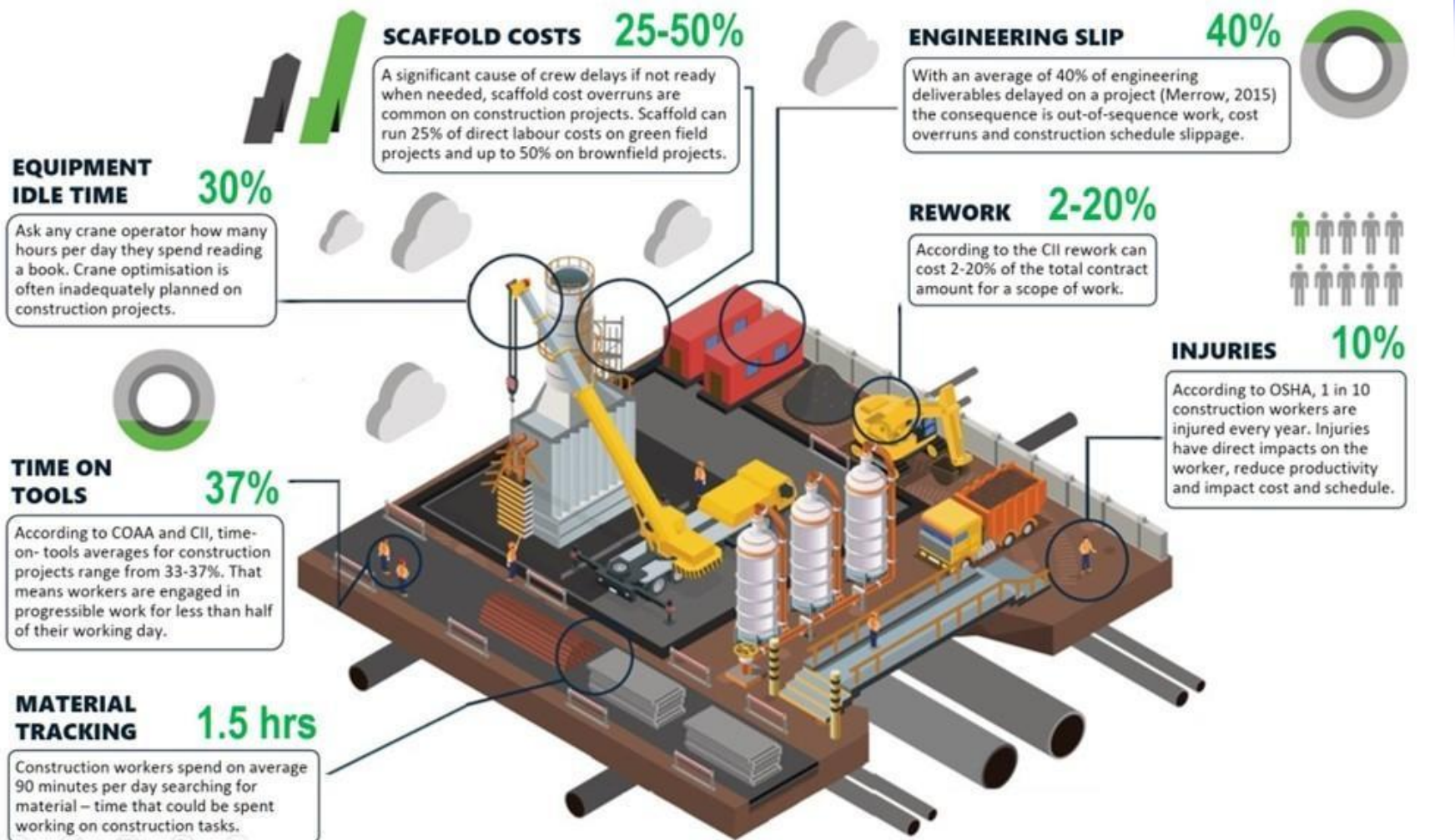


How is Measurement Activities Impacting Re-work?

- Measurement activities during engineering, fabrication, and construction are not tracked as a separate work breakout cost code.
- Tolerances are no longer documented due to drawing extractions from the 3D digital model.
- Independent dimensional inspections are reduced or eliminated due to cost reduction.
- Accuracy assumptions are made because of the dependency of the 3D digital model.
- Manual measurement methods (e.g. tape measures, chalk lines, etc...) are still being used in Construction.

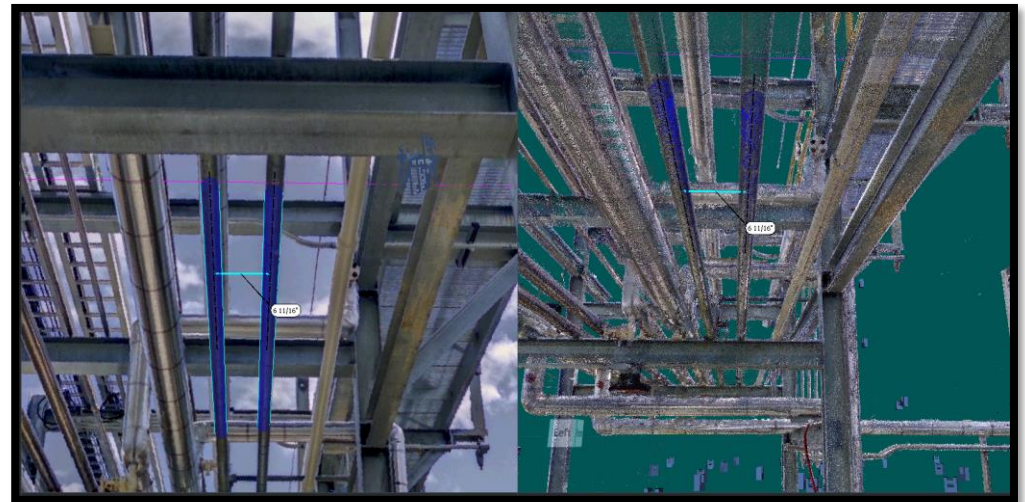


What Impact Does Poor Measurement Practices Have During Construction?



Realizing Value from Technology

- Does it Improve Quality?
- Does it Reduce Execution Time?
- Does it Reduce Cost?
- Does it Improve Safety?



“Better, Faster, Cheaper, and Safer”

Value Principles Applied to Laser Scan Technology

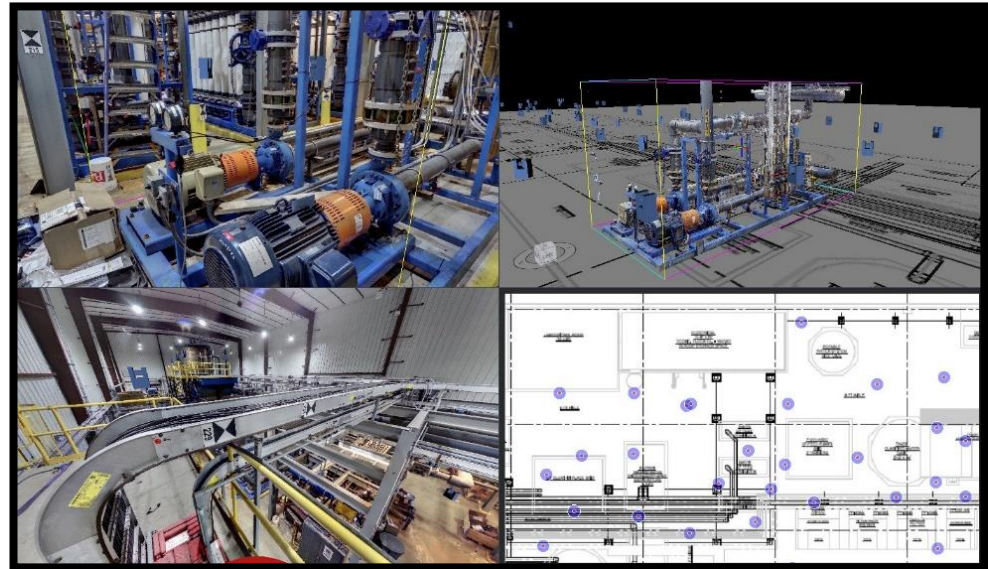
- Laser scan technology consistently provides higher quality visual measurement information.
- Laser scan technology is the fastest method to capture dimensional measurement data of the as-is conditions.
- Laser scan technology is more cost-effective than traditional methods of capturing measurement information.
- Laser scan technology will reduce the exposure time inside hazardous conditions.



“Better, Faster, Cheaper, and Safer”

Documented Benefits Using Laser Scan Technology

- Site Visits reduced as much as **90-95%**
- TIC reduced on project as much as **5-7%**
- Contingency for rework can be reduced to less than **2%**
- Engineering Schedule Reduction down as much as **10-15%**
- Construction Schedule Reduction down as much as **5-10%**
- Reduce Design Re-work **1%-3%** compared to **6%-20%** with traditional methods of collecting measurement information.



“All results are dependent upon following a well-defined execution work process”

What are the Risks to Not Using Laser Scanning?

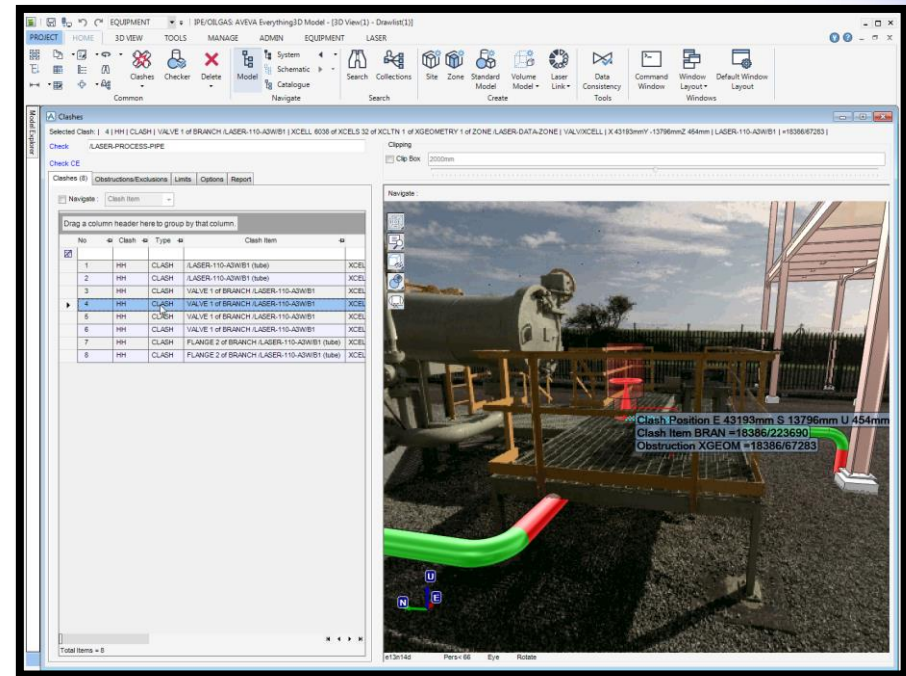
- Inconsistent dimensional measurement information.
- Potential layout errors in the field.
- Potential re-work in the field.
- Potential safety risks due to adding field personnel to perform re-work activities.
- Potential schedule delays and increased costs.



"The Dimensional Measurement Process is the Least Cost Activity on the Project, but has the Most Significant Cost Impact to the Project"

What are the Issues Implementing 3D Data Capture on a Project?

- Not planning to use early into the project.
- Not having a well-defined project scope.
- Not involving all project disciplines in defining the project scope.
- Not valuing the importance of survey control on the project.
- Choosing the wrong 3D Data Capture technology.
- Choosing a service organization based on costs alone.
- Assuming all 3D Data Capture deliverables are the same.
- Not using the 3D Data Capture deliverables to its full potential.



Considerations for EPC's Implementing Laser Scan Technology on a Project

- Evaluate if Laser Scanning is the Appropriate Technology to Use.
- Start Early in the Project to Plan the Use of Laser Scanning on the Project.
- Identify Work Process that Will Be Used to Execute the Measurement Tasks.
- Decide What Laser Scan Technology (e.g. Hardware and Software) Will Be Used to Enable the Work Process.
- Involve the Entire Project Team.
- Develop a Laser Scan Project Scope.
- Choose a Service Organization Based on Experience and Success of Projects not cost only.
- Maximize the Use of the Laser Scan Technology Tools.



What Are the Future Trends for 3D Data Capture?

- 3D Data Capture Systems will continue to become smaller, faster, better quality and more accurate.
- File sizes will continue to be reduced.
- Cloud-based 3D Data Capture applications will increase.
- Flash lidar technologies will enter the market.
- Robot based 3D Data Capture systems will enter the market.
- Automated laser scan registration methods will improve.
- Real-time 3D Data Capture Systems will enter the market.
- 3D Data Capture will become more of a critical part to the design-build and digital transformation initiatives.





Thank you

