

# 3D Solutions

## News on The Use of Laser Scanning Technology

### Haag 3D Solutions

A division of Haag Engineering Co., Forensic Engineers & Consultants since 1924, is a technology and services company specializing in the application of 3D imaging and BIM Technologies.



## Understanding Real World As-Built Documentation in the New 3D Environment

Only truly reliable survey as-built data inventory will provide safe and cost-effective construction, operation and maintenance of building infrastructure. With the technology advancements in 3D Laser Scanning (3DLS), high speed survey scanning in building and mechanical systems is becoming the new surveying standard for clearance profile analysis, variant studies in the planning process and inventory documentation. The unique combination of a precise track measuring system and high-performance imaging scanner facilitates new, more comprehensive and cost-effective surveying analysis processes of structural facilities.

Haag 3D Solutions' approach to all building and design projects is to assign highly skilled survey personnel utilizing the most current 3D Laser scanning technology in order to meet the designs teams schedule, providing highly accurate as-built documentation necessary for a successful project design.

The tools of the trade today include various instruments capable of capturing complex imagery and measurements in 3D. Perhaps one of the most significant advancements is HDS (High Definition Survey) 3D Laser Scanning.

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Laser scanning for BIM (Building Information Model) requires close collaboration among team members and an in-depth understanding of the client's needs.

### Events:

- February**  
New Jersey  
SAWJ Meeting, Robert Ashley to present "Applications of 3D Laser scanning in The Forensic World"
- March**  
New Orleans  
Chris Zmijewski & Rob Ashley invited speakers at The XL Insurance Conference, on the Impacts of 3D Laser Scanning & BIM Technologies in the industry.
- March**  
Look for the published Article by Kevin Kianka PE, "Survey Control in the 3D Environment" In GEODATAPOINT.com web site in March.
- April**  
Houston  
SPAR International Conference, April 15-18<sup>th</sup>, as a member of the SPAR International Advisory Board, Chris Zmijewski will be co-hosting the Pre-Conference Tutorial sessions.



## 12 Story Tower at 8<sup>th</sup> & Walnut Streets, Philadelphia, PA



Liberty Property Trust and the University of Pennsylvania's medical complex plan to build a medical office tower that will rise 260 feet from the southwest corner of 8th and Walnut Sts. atop the existing Parkway Corp. garage, adding at least 12 stories to the five-story parking center. L.F. Driscoll Company, LLC was awarded the contract to construct the tower and retained the services of Haag 3D Solutions to perform 3D Laser Scanning to verify existing as-built conditions of the existing parking garage prior to commencement of construction.

H3DS completed 3D Models from the scan data, identifying the location of the façade, slabs, and existing structural elements within the design coordinate system. The as-built model was then compared and coordinated with the design model to identify potential areas of concern or conflict. After complete review the as-built model was utilized for final construction coordination of the model.

Staff from H3DS also participated in model and BIM coordination meetings with LF Driscoll, the Design Team and the Construction subcontractors, to review the use of the model and identify coordination issues prior to the fabrication of materials or the mobilization of equipment and personnel to the site.

# HAAG

## Engineering

### Attending Philadelphia Conference



Nearly 10,000 risk professionals will gather in Philadelphia to explore the emerging technologies, trends, services and products that will help transform their risk programs. RIMS '12 Exhibit Hall offers everything relating to risk management: captive management, disaster recovery, property/casualty services, workers compensation and more. Representatives from Haag Engineering Co. as well as Haag 3D Solutions will be present to meet and review their services. A great opportunity to discover the latest products and services, ask questions and build your network.



## The Leica HDS 7000

Ultra-high Speed Laser Scanning with Extended Range

Within the practice of using 3D laser scanners to remotely capture detailed, "as-is" geometry of structures, sites and scenes, phase-based scanners are known for their ultra-high scan speeds and their high level of detail. Adding to this basic speed capability (> 1 million points / second), the HDS7000 phase-based scanner provides important "next level" performance features for demanding professionals, making it the industry's best phase-based scanner.

Haag 3D Solutions is proud to announce the addition of the new Leica HDS 7000 to their existing scanning equipment portfolio. Haag 3D Solutions is committed to providing the newest technology and equipment to maximize productivity for their clients.

# High-Definition laser scanning aids disaster investigations

By Chris Zmijewski

When catastrophe strikes--especially in a highly populated construction site or urban environment, rescue workers, city officials, police officers, OSHA, onlookers and others throng to the spot, often knowingly and unknowingly altering the exact conditions of the site. Those conditions, however, are key evidence for a forensic engineer like Jim Wiethorn of Haag Engineering, who has faced this situation at numerous construction accident sites over the years.

"Invariably, that's going to happen, and people will be moving evidence," says Wiethorn, "and we're sitting there gritting our teeth."

But this situation is now avoided thanks to the speed and accuracy of high-definition 3D laser scanning. With the technology of laser scanning it has allowed Wiethorn and his team to get onto the site quickly, collect the information they need and begin piecing the puzzle together before the cleanup effort disturbed valuable investigative engineering information.

## Time Saving Technology

In the past, says Wiethorn, survey crews working on his projects first would put down a grid in the debris field and then measure in two dimensions where everything was located, entering all of the data points into CAD drawings. The process required just to complete the field measurements could take up to two weeks. "That system was so time-consuming, you'd only include the critical items," he says, "but you'd always miss something and later wished you had it."

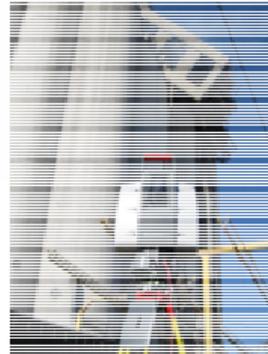
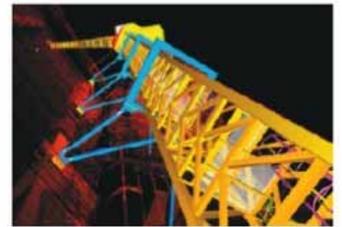
Using 3D laser scanning, the survey crew can step right in, scan the site and have usable 2D and 3D products of the entire scene, usually within 24 hours.

## Detail and Accuracy

Another benefit of using laser scanning in forensic work is the accurate detail it provides of every aspect of a site, along with its spatial relationships. Traditionally, forensics specialists take photos of all angles of a site and piece them together to recreate the positions of key items on the scene, but that technique requires a degree of interpretation. 3D laser scanning avoids that element of guesswork, however small it might be, by representing spatial relationships that are exact and can be rotated to view every possible vantage point.

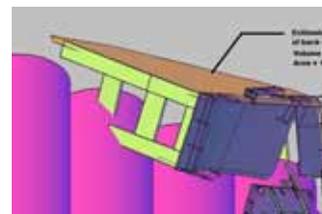
*"And we're sitting there gritting our teeth"*

*Jim Wiethorn PE, on attempting to gather the evidence before it's disturbed.*



"Invariably, you can use animations and modeling, but when you use the exact field data with that high degree of accuracy, it eliminates a lot of the challenges you might run into," says Wiethorn.

"When you're on the stand [in a courtroom] or in a deposition and they ask you how you determined particular dimensions, you have the data right there and know it's accurate."

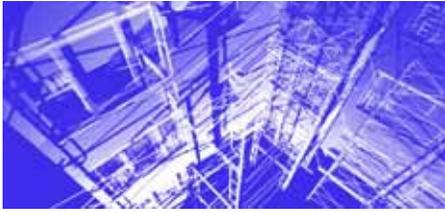


## The Deliverables

Perhaps most important to users like Wiethorn is the resulting variety of products the 3D laser scans generate. Not only do they produce rotating 3D scans of a site, but they also can be converted quickly into 2D drawings that are compatible with engineers' in-house CAD systems. In other words, one scanning session using 3D laser scanning can provide 3D images that can be manipulated to show all points of view, 2D AutoCAD drawings that the engineers can work from, and 3D models that can be used for stakeholder presentations, public participation events, litigation and court proceedings, and other purposes.

"Preservation of evidence is so important in our line of work. That's why, companywide, we are so excited about the formation of Haag 3D Solutions," says Jim Wiethorn.

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A laser scanner is a high-end laser measuring device capable of capturing hundreds of thousands of points per second, each having an X, Y and Z value. The resulting points form what is referred to as a "point cloud." The point cloud can then be processed to produce either 2D or 3D deliverables. 2D documentation typically takes on the form of floor plans, reflected ceiling plans, roof plans, exterior elevations, building sections, etc. and is often created using programs such as Autodesk's AutoCAD. More recently we've been seeing a transition towards 3D documentation such as 3D AutoCAD and Building Information Modeling (BIM) authoring tools like Revit, Bentley and Archicad. Unlike 3D AutoCAD which represents geometry in 3D, BIM authoring tools also add intelligence that can be used to perform complex analysis. BIM tools can be thought of as a graphical database. In addition to 2D drawings or 3D models, other means of documentation can include photo imagery such as Quicktime spherical .jpps or Leica's measurable TruView imagery which is derived from laser scanned point cloud data.

As the adoption of BIM (Building Information Modeling) and Laser Scanning accelerate, an inevitable conflict between the two will take place pitting the real world accuracy of laser scanning against a parametric modeling tool that prefers to work in an ideal orthographic projection.



Building Information Models are intelligent by nature. Consider them a graphical database of information about a building and its systems. More than just a three dimensional representation of the physical elements, the BIM actually contains information about those elements (also referred to as families). For instance, a wall is more than just a series of geometric lines. In a BIM, a wall has properties that allow the various materials that make up the wall assembly to be quantified and analyzed. The wall knows it is comprised of 3 5/8", 20 gauge metal studs at 16 inches on center, with R-11 batt insulation and 5/8" Type 'X' gypsum board on each side. As a result, quantities for all of these materials can easily be obtained when needed.

Laser scanning captures real world elements in three dimensions and represents them with millions of data points (a point cloud). There is no real intelligence in a point cloud. However, these points represent the real world coordinates of the surface of the object the laser scans across. As a result, the laser scanner is capturing elements as they exist. If something is not straight or plumb or level, the scanner will capture it that way.

When laser scanning is used to capture and document real world conditions from which its point cloud data will be translated into a BIM, we begin to see the conflict arise surrounding the LoA (Level of Accuracy).



## Formation of New Organization

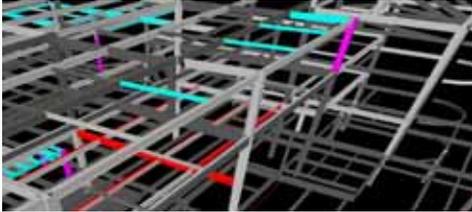
Haag 3D Solutions, a Founding Donor and member of the USIBD, is proud to announce that Kevin Kianka (Director of BIM/Modeling Programs at H3DS) has been appointed to the Executive Membership and Standards Committee of USIBD. "The U.S. Institute of Building Documentation (USIBD) is a non-profit organization dedicated to furthering excellence of building documentation by promoting, educating, guiding and supporting stakeholders with an interest in the built environment in a way that cultivates networking and information sharing."

The USIBD was founded to promote and facilitate:

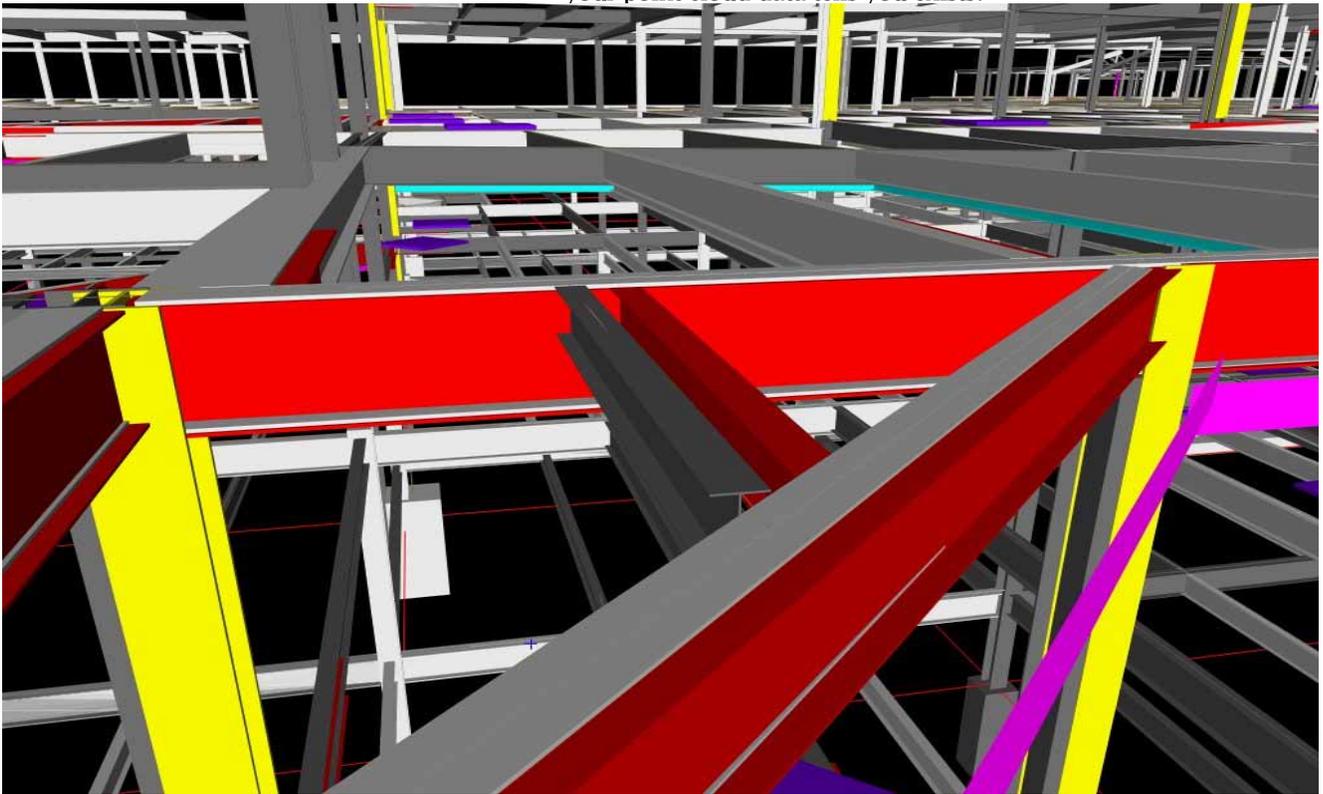
- Building Documentation as a distinct industry; establishing standards, guidelines and best practices to foster excellence in the productivity, quality and safety of the documentation process
- The codification of ethical practices to support and further the growing network of professionals dedicated to Building Documentation
- Cooperation and the exchange of information among documentation professionals who are responding to growing interest in Building Documentation by owners/operators, service providers, government agencies, and the public
- The establishment and promotion of "Certified Building Documentation Professional" certification (CBDP)
- The institution of a core educational resource dedicated to the pioneering technology of the Building Documentation industry
- Recognition of individuals for outstanding dedication and service to the Building Documentation profession

Haag 3D Solutions proudly supports and promotes the USIBD, its initiatives and members in the furthering of building documentation

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BIM software is, by nature, an orthographic modeling tool. These tools represent walls as being straight, parallel and orthogonal, which is also how architects and engineers typically like to design. If you are a surveyor who has been contracted to provide an as-built BIM and you are using laser scanning to document the real world conditions, how will you resolve the inevitable discrepancies of what the BIM modeling tool will allow you to represent and what your point cloud data tells you exists?



For example, above is an image of a building that was modeled from 2D design drawings. It was later laser scanned while it was under construction. The point cloud data and the building model were brought together for comparison. The gray steel structural elements represent the original model, the color steel members are the actual scanned location of the structure.

Upon close examination we can see where the real world conditions captured in the laser scan data and the model do not match up.

These are the types of things that need to be discussed and defined up front. The current BIM authoring tools do not like to represent real world conditions such as this. Until functionality is built into the BIM tools to model directly to the point cloud data, it is important to understand the limitations of both technologies and accept the fact that an acceptable Level of Accuracy may not be defined by an exacting unit of measure, but rather whether it meets the fidelity of intent to represent the actual real world conditions.

Look for more on the subject of 3D Laser Scanning and its intergration into BIM models in the upcoming issues of 3D Solutions.



Haag Engineering Co., Forensic Engineers & Consultants since 1924, is excited to announce the establishment of a new company division, **Haag 3D Solutions, LLC**. **Haag 3D Solutions** is a technology and services company specializing in the application of 3D imaging and BIM technologies, delivering highly accurate and reliable as-built documentation for both public and private sector clients. **Haag 3D Solutions** was created to provide professional 3D geospatial solutions for all types of design and construction projects.

Centered in the northeast, The **Haag 3D Solutions** division is headquartered in Mt. Laurel, New Jersey, and will complement the entire Haag Engineering team and offices throughout the United States.



Office Locations:

- Dallas, TX
- Houston, TX
- Austin, TX
- Los Angeles, CA
- Minneapolis, MN
- Tampa, FL
- Denver, CO
- Mt. Laurel, NJ

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