Suite'en It Up with Autodesk® ReCap™

Chad Studer – ADSK Solutions

RC3165

Static and mobile laser scanning technologies capture millions of points and provide photorealistic interactive virtual sites known as point clouds. With Autodesk ReCap 2014 software, you can work with millions of points to extract vital information. Autodesk ReCap provides a streamlined approach to processing and preparing reality capture data. Join Chad Studer and 2 other Reality Capture experts as they demonstrate the most common and advanced innovative technology-led workflows with real-world examples. We use Autodesk® Building Design Suite to illustrate scan-to-BIM workflows, CFD analysis, and rapid energy modeling. In Autodesk® Factory Design Suite, we use point clouds for interactive equipment layout in Autodesk® AutoCAD® Architecture software and Autodesk® Inventor® software and for clash detection in Autodesk® Navisworks® software. In Autodesk® Infrastructure Design Suite, we demonstrate importing a project into Autodesk® InfraWorks™ for conceptual site design.

Learning Objectives

- Reality Capture introduction to ReCap Studio, PRO and Photo

- Make use of streamlined workflows that go from raw scanned data to deliverables with Autodesk ReCap 2014

- Interact with point clouds in a plant environment with Factory Design Suite for construction verification and clash detection

- Apply scan-to-BIM workflows in Building Design Suite

- Use point clouds for design, calculating volumes, structure analysis, compelling presentations, and stakeholder approvals in Infrastructure Design Suite.

About the Speaker

Chad Studer has over 23 years of AEC experience. He is the founder of ADSK Solutions, an AEC solutions provider, and the author of PointcloudGURU.com. As an early adapter to Laser Scanning, Chad's experience began in 1998. He has acquired data with 15 different Scanners in more than 30 states. Chad contributes most of his time implementing, researching and testing new scanning technology while working with clients to perfect workflows to effectively extract data directly from the point cloud to ensure it is utilized to the extent of its capabilities. With over 15 years' experience capturing data, Chad is a leader, respected source, and innovator in the 3D Laser Scanning industry. He consults directly with Autodesk and other scanning manufacturers to streamline the advancement of workflows and innovative technologies. Chad presents all over the country and has been recognized as top rated speaker 4 years in a row at Autodesk University.

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Co-Speaker

Steve Schuchard is a Technical CAD Manager at Production Modeling Corporation. Steve supports their Layout Design Teams and is a Technical Consultant for Factory Design Suite and Laser Scanning. Previously, he was CAD Manager at General Motors where he developed, applied, and supported 3D Plant Layout processes, procedures, and related technology for North America.

In 2011 he received the Progressive Manufacturing Award for Innovation for his accomplishments. Steve has been working in the 3D Layout Technology Area since 1998

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Special Guest Speaker

Autodesk Reality Capture very own Dr. Aaron Morris

ReCAP and Reality Capture methods

Capture and integrate reality directly into your design process with ReCap™ reality capture software. ReCap point cloud and image-based 3D modeling software and services work seamlessly with Autodesk design and creation suites, so you can start your design with accurate dimensions and full photo-quality context rather than a blank screen.

3D Laser Scanning

A 3D Laser scanner is a device that analyzes real-world objects or environment to collect data available from line of site; on its shape and eve the appearance (i.e. color). The collected data can then be used to construct digital, three dimensional models. Virtual models are made up of millions of xyz coordinates known as a point clouds.

Mobile and Kinematic 3D laser scanning

Mobile mapping is the process of collecting geospatial data from a mobile vehicle,[1] typically fitted with a range of photographic, radar, laser, lidar or any number of remote sensing systems.

Camera

A camera is an optical instrument that records images that can be stored directly, transmitted to another location, or both. These images may be still photographs or moving images such as videos or movies.

Aerial Survey

Aerial photography is the art of capturing photographs of the ground from an elevated position. Cameras may be hand held or mounted, and photographs may be taken by a photographer, triggered remotely or triggered automatically.

LiDAR capture is a remote sensing technology that measures distance by illuminating a target with a laser and analyzing the reflected light.

Sensors

Structure sensor is another path for the future of collecting data. Simply point and capture   with your iPAD. Whatever you AIM at becomes digital in your computer. You probably own a device like this already. Did you know the technology came from the XBOX Kinect?

Autodesk ReCAP

Autodesk ReCap provides the engine for indexing, viewing and real time navigation of point clouds in most Autodesk products. This engine is provided in each Autodesk Design Suite and provides direct interaction with the most comprehensive design software solutions for all industries.

POINTCLOUDS

Point Clouds provide an unparalleled opportunity to leverage existing as-built data in a new, innovative, interactive design. Point Cloud data provides a 3D, photo realistic, virtual site, representing millions even billions of accurate X,Y,Z points. This data is captured from line of site utilizing static, mobile, lidar, kinematic 3D scanning data, photographs and sensors.

Collaborating with a visual model of existing conditions is instrumental to complete innovative design. Elevations and measurements can be easily confirmed. This data can be used to create the existing model of the existing conditions from 2D and 3D views. Autodesk ReCap has made point clouds a reality and now provides a seamless approach and workflow for all Autodesk 2014 products.

ReCap Studio

Autodesk ReCap is not prejudges and imports a wide range of 3D laser scanning manufactures. The point cloud appearance can be modified by using lighting, shading, and color ramps. Data can be cleaned managed utilizing limit boxes, regions, view states and scan locations.

Scan data complements of NEDERVELD Associates. Headquartered in Grand Rapids, MI 616.575.5100
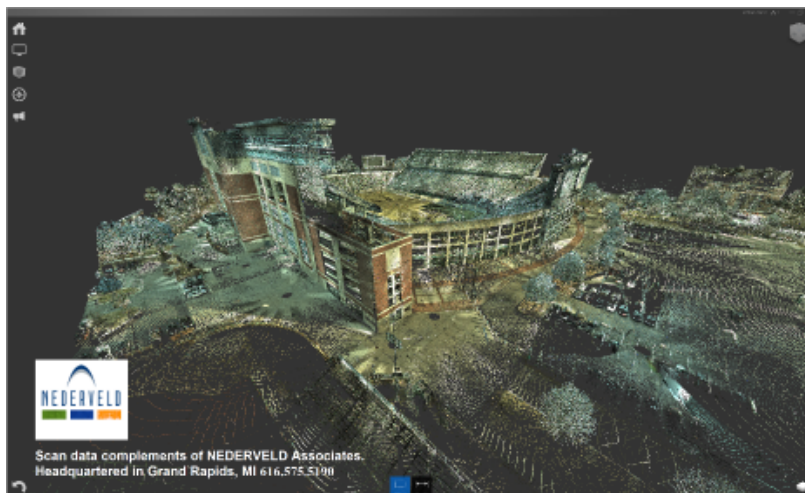
Autodesk ReCap PRO

ReCap Pro provides the ability to register multiple scanning locations together WITHOUT targets to create one overall point cloud. Traditional workflows included setting targets throughout the entire scan area and acquiring 6 targets in each scan. This Reality Capture workflow can cut project time by more than 50% without compromising data accuracy.
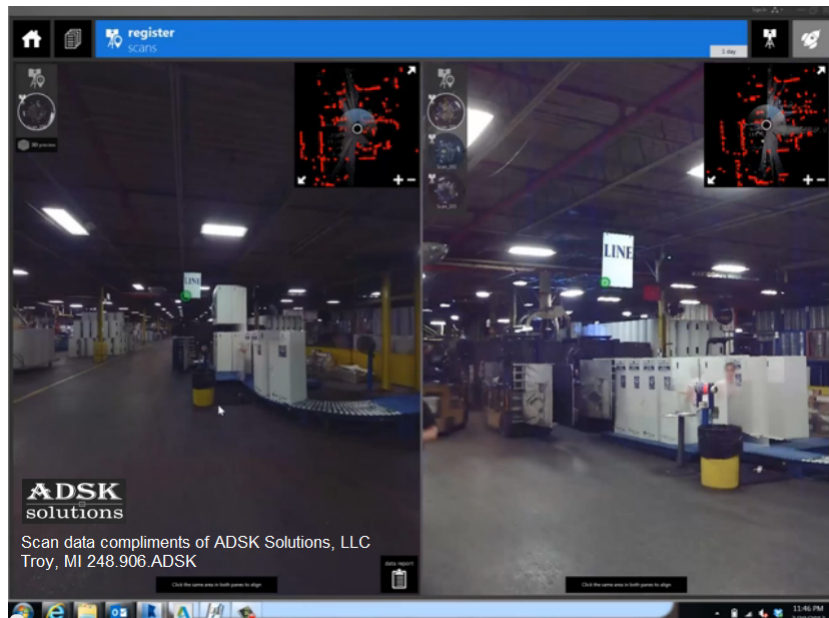

Autodesk Proof of Concept project

Capture approx. 200,000 sqft manufacturing building in less than 48 hours utilizing 3 scanners (Leica P20, Z&F 5010c and Faro Focus 3D) and complete registration while onsite with only Autodesk software. Below is an image of all 3 registrations from multiple scanning manufacturers in one overall point cloud.
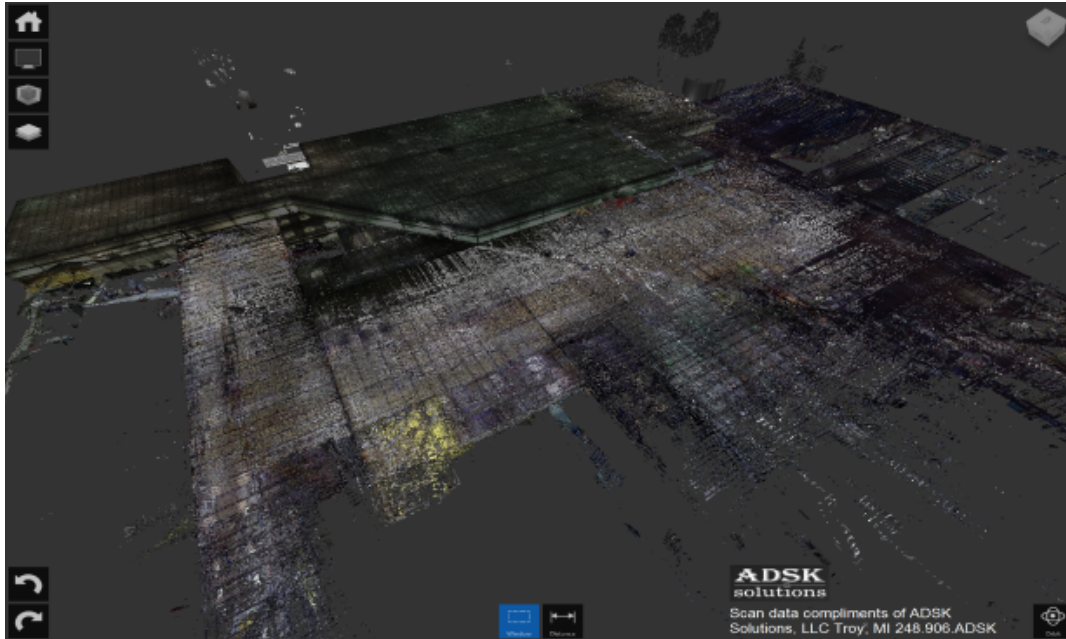
In less than 48 hours, 3 different laser scanners were used to perform 180 individual scans. Scans were registered in the field as scans were performed. Three registered point clouds were created and completed within 10 minutes after the final scan in the facility. The image below was the only as-built data that was available for the plant.
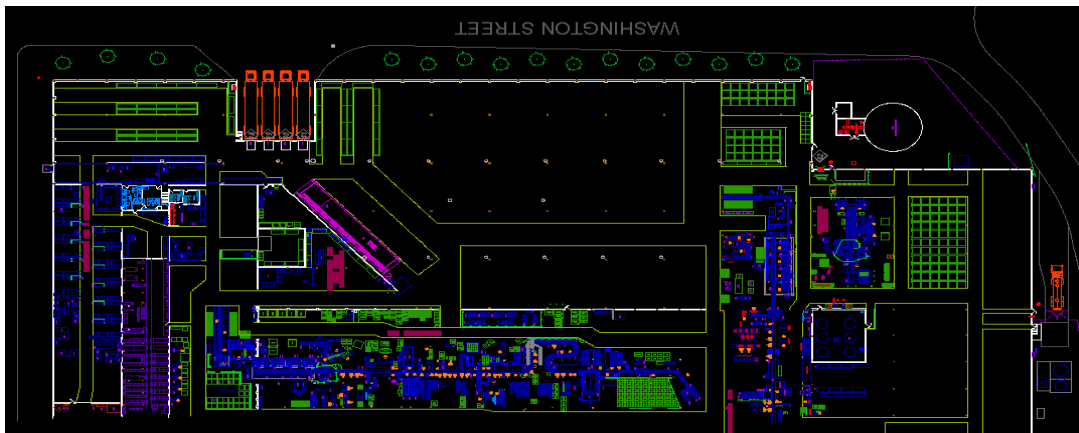
Now the 200,000 sqft facility has accurate 3D as-built data. This point cloud data provide a virtual site to visualize machine and layout design. Verification and clash detection can be performed from the comfort of an office and shared with multiple team members in seconds. New as-built data is displayed below. What would you prefer?
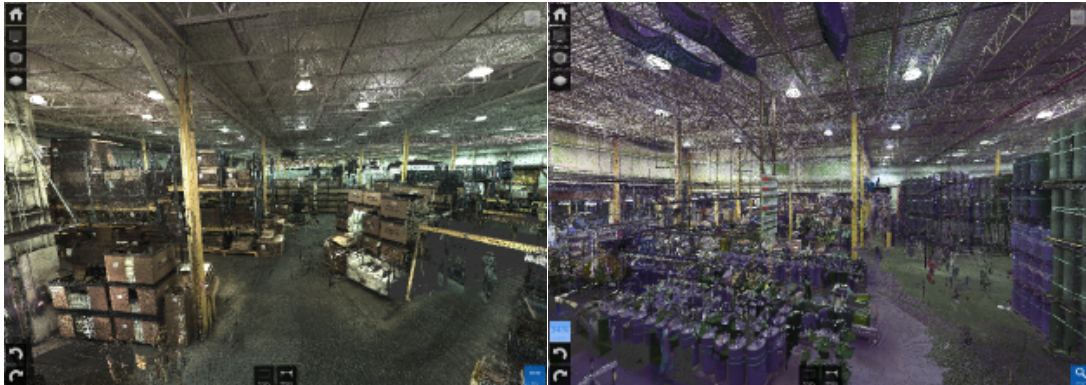
Factory Design Suite

With Steve Schucard

AutoCAD

AutoCAD is the most widely used tool for Plant layout. Utilizing Scan data can work for both 3D and 2D users. Use of simple commands and ingenuity makes for some interesting possibilities.

How to apply Scanning in AutoCAD:

1. 3D CAD modeling (traditional conversion)
2. 2D Plant drawing updating – use the point cloud to update the 2d layout by clipping the point cloud.
3. 2D elevations – use the clipping command to reveal a clean elevation for conversion or printing to DWF.
4. Create proposal drawings consisting of multiple scan databases. If you have multiple plants and want to duplicate or "what if" a process, you can use ReCap and AutoCAD to generate ideas and review them in Navisworks.

Application Tips:

1. Use AutoCAD Xref to attach a point cloud. Note that AutoCAD has a limit of point display of 2 billion. It will not display anymore even when multiple files are loaded. Only attach files which need to be displayed.
2. When inserting, place the Point Clouds on layers to aid in visibility control.
3. Use Node Osnap to snap to a point.

4. AutoCAD automatically switches to 3D Wireframe view to shade the point cloud. To improve performance, return to 2D Wireframe.
5. Select the point cloud to view the context sensitive menu to control density.
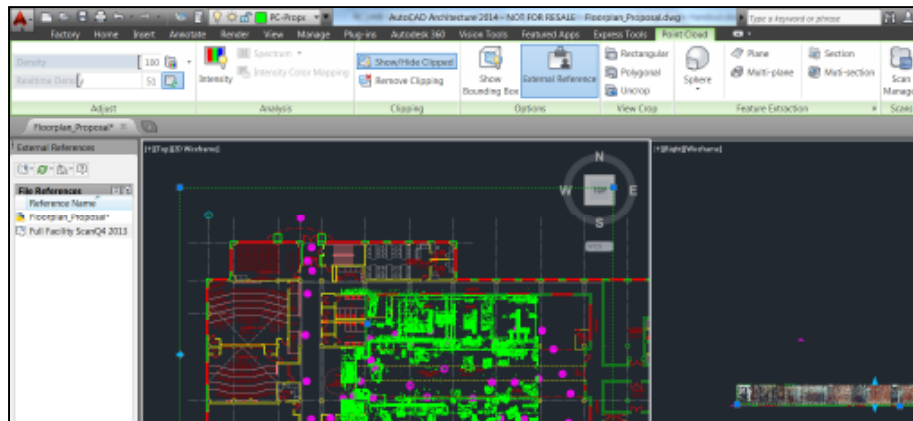
6. When Clipping, try using the *"Clip"* command, then select *"Clipping Box"*. It will provide a simple box to be used for cropping. Select the grips on each corner as well as the sides to change the point cloud display. For easy manipulation consider using 2 viewports.
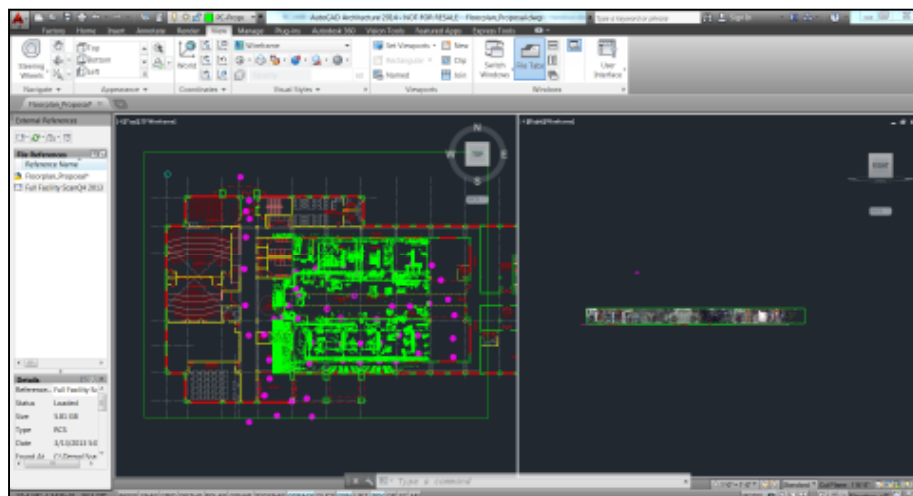

7. Try to print points to a DWF file. Why:
   a. DWF is now a 2d version of the point cloud. Consider using for sections and slices of the scan to reveal 2d plans.
   b. Easy to share.
   c. You can still snap to the points in the DWF.
   d. Warning: only works in top view.
   e. Use large paper size for increased resolution.
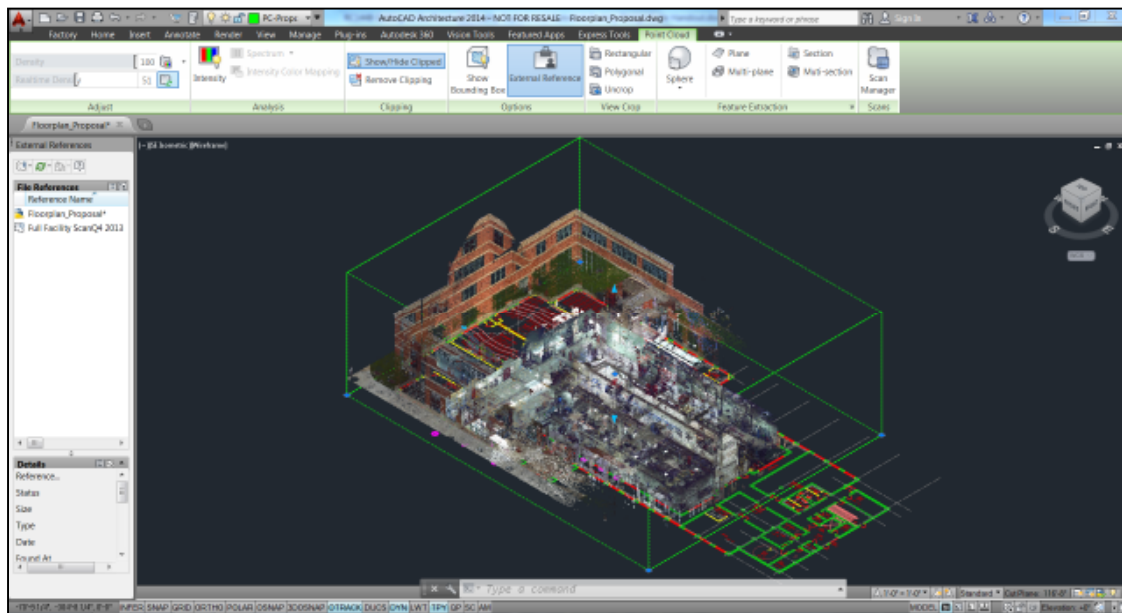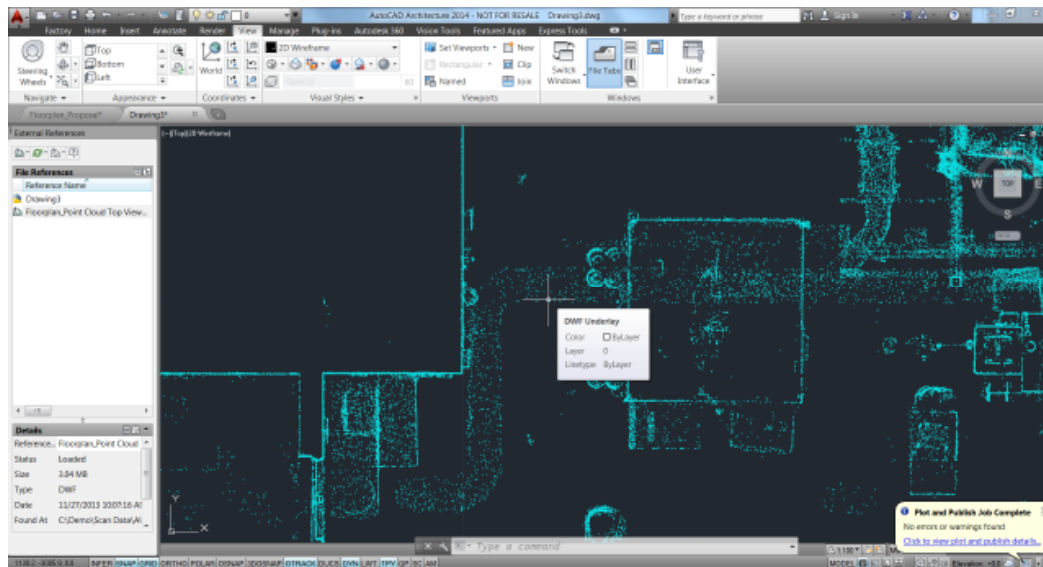
Inventor

Displaying points in Inventor is easy as long as you have prepared the data into small pieces using ReCap. Ability to manipulate the point cloud is limited in Inventor but provides enough to allow you a powerful combination in Factory Design Suite.
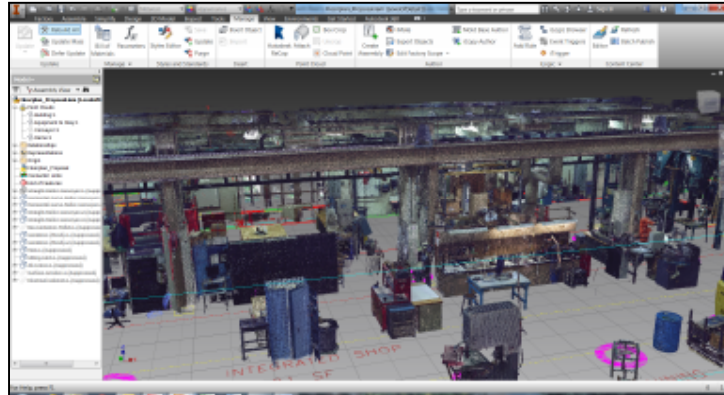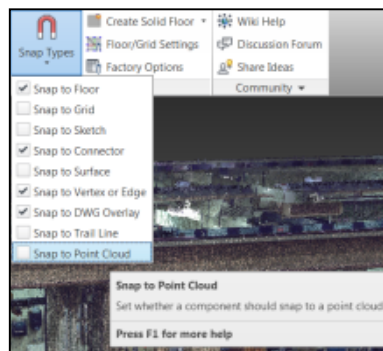

Application Tips

1. Note that any Point Cloud data inserted in Inventor will not be displayed in any other application when accessed (e.g. Navisworks). Be sure to utilize the point cloud breakdown process to display on the point cloud data that is of value.
2. Point Cloud Insertion commands can be located on the *manage* tab.
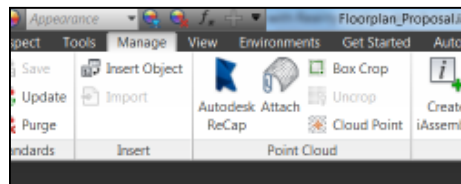

3. You can create a constraint to a point cloud by first placing a cloud point, then constraining data to that point.
4. Point Clouds cannot be moved in Inventor. They can only be moved by manipulating the insertion point coordinate values.
5. Point Cloud Snapping is an option that can be toggled on and off in the Snap Type pull-down. When working with point cloud, only enable it when you need to snap to a point cloud.
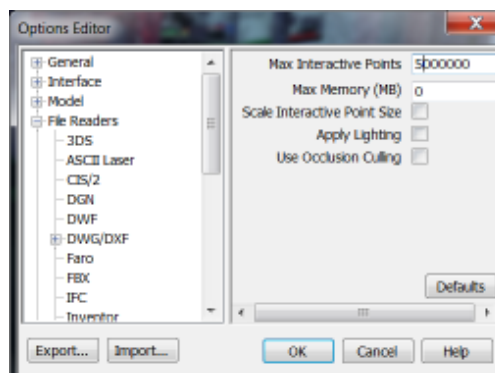
Navisworks

Navisworks does a great job at displaying Point Cloud data. It simply looks and performs the best in this application.
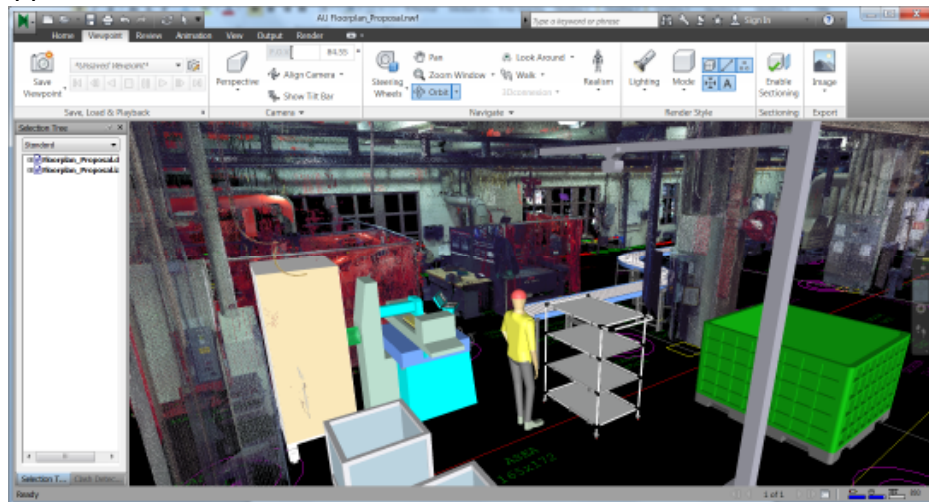

Application Tips

1. Use the Classified Point Clouds process to maintain consistency of file structure in each application.
2. To control some of the interaction and display of the ReCap files, go to Global options and select the File Reader:
   a. ReCap > View Preferences – Turn off Scale interactive sizes and set how many points to visualize during movement.

b. AutoCAD > Convert Cloud – Turn this on so you can open a DWG and have Navisworks automatically loads the files that need to be viewed.
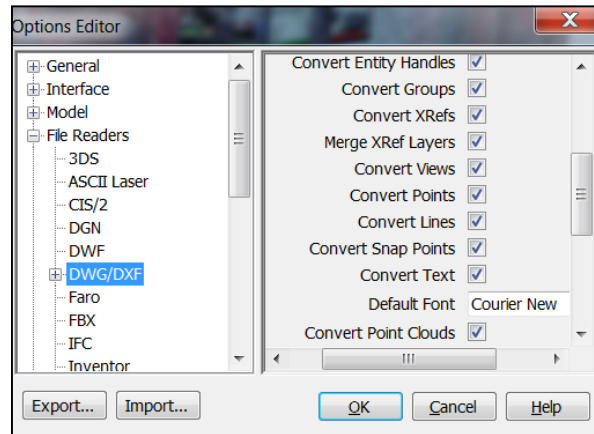
c. Change Viewpoints Settings to save the visibility state of Point Cloud data.
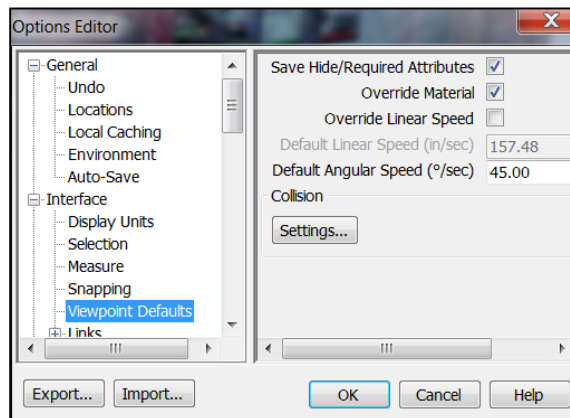
3. On the Viewpoint tab, enable Sectioning and use the box to data outside of the box. This is a great way to control display and performance when loading large models.
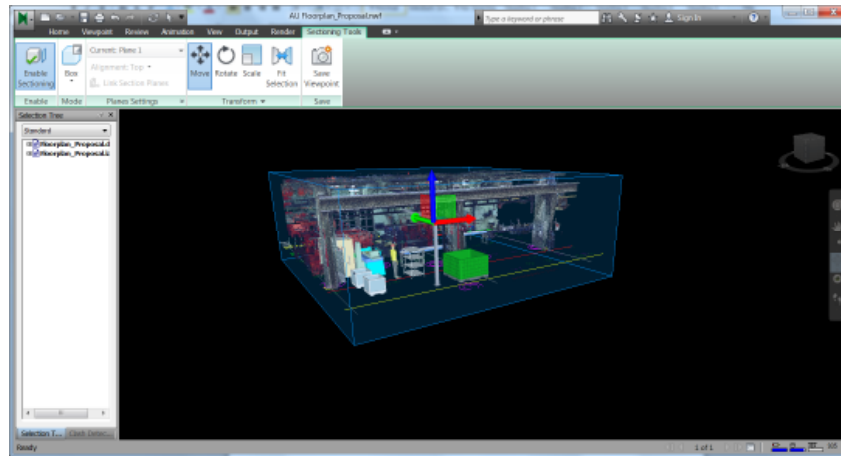
4. You can use Navisworks Freedom to view ReCap files. Your consumers will be able to interact with the point cloud. Note, the Publish or save as NWD function does not save the point cloud when in ReCap format.

Autodesk ReCap Photo

Stitching photos together to develop point clouds.
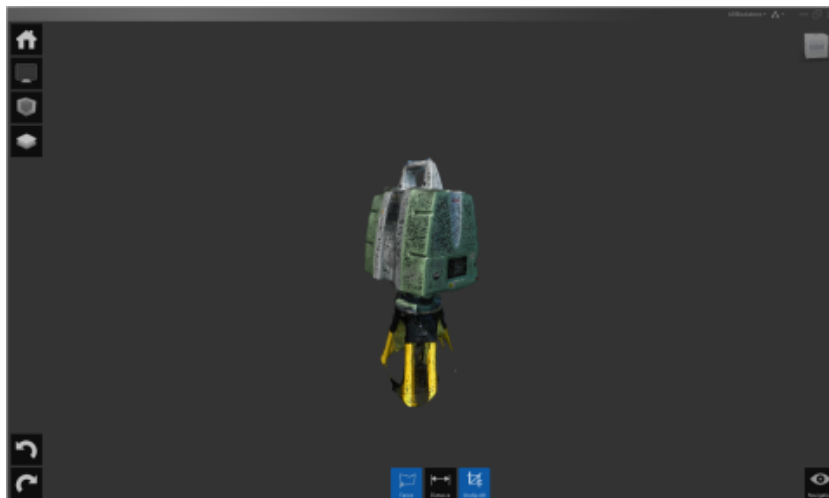
Building Design Suite

BIM (Building Information Model) advantages

Creating a BIM model for new construction provides an obvious solutions. It allows design firms and contractors to collaborate visually in a 3D model before construction begins. Cost of construction is estimated accurately and change orders are minimized.
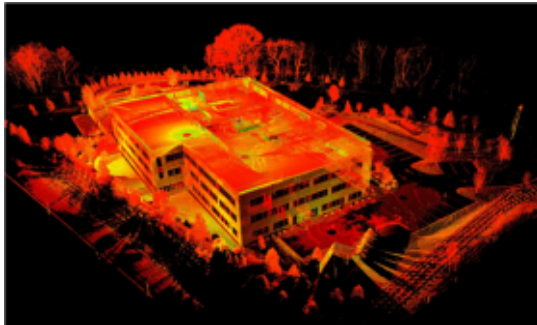
SCAN to BIM (Building Information Model) advantages

What about existing structures? How are measurements taken and shared throughout existing structures? What are the exact measurement that are required?

Recognize the advantages of SCAN to BIM by utilizing High Definition Scanning. 3D laser scanning provides a simple solutions to capture exiting data quickly. Take a look at the room or building that you are in. 360 degree scans can be performed in 1 ½ min. Typically you can estimate 5 min per scan, that 12 scans an hour and 120 per 10 hour day. Once the data is captured, and registered a full interactive model of accurate x,y,z points create a point cloud. Point Clouds can be utilized to visualize the entire structure including MEP and structural data. Renovations and retrofits can use existing virtual model to visualize new design.

Utilizing SCAN to BIM (Building Information Model) advantages

If a BIM model is required the point cloud can be placed directly into Autodesk Revit. The point cloud provides accurate data that can be used to digitize directly in Revit. Revit models can also be used for Green Building Studio and CFD (Computational fluid dynamics)
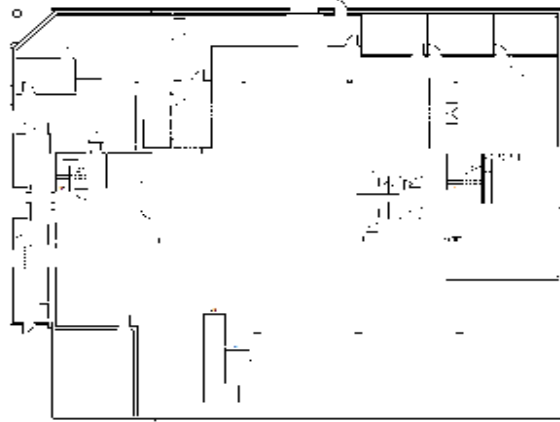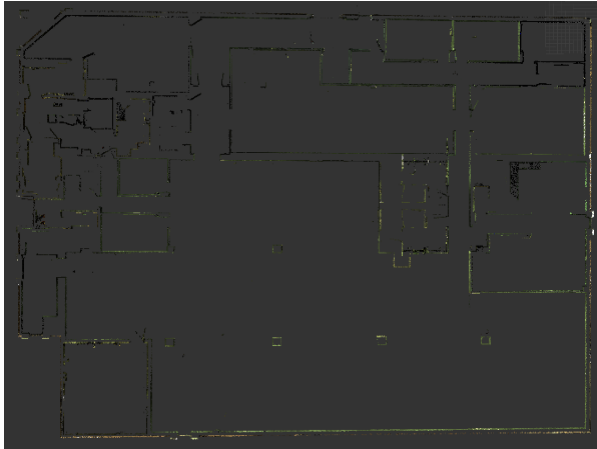
Autodesk Revit 2014

Full functionality of Revit is available for developing a model with Point Clouds.

Application Tips

1. Revit 2014 updates have been installed.
   a. Improves stability when navigating in a project which contains linked point clouds
2. Insert the point cloud origin to origin
3. Clipping the Point Cloud to display project limits.
   a. Section box
4. Point Cloud Highlights
   a. Unchecking select links will stop the point cloud from highlighting every time the cursor hovers over it.
5. Level Lines
   a. Use the Level tool to define a vertical height or story within a building. You create a level for each known story or other needed reference of the building (for example, first floor, top of wall, or bottom of foundation).
6. Preset Views
   a. Views are generated to save specific line of site locations to the Revit Model. Views provide easy navigation for review, modeling and verification with point cloud.

Navisworks

Great tool for sharing Point Cloud data with project teams and for verification between model and point cloud. Animation and renderings are developed to take advantage of the point cloud display.

Application Tips

1. Turn all display off and turn on only what is required for verification
2. Use the Classified Point Clouds to maintain consistency of file structure
3. To control some of the interaction and display of the ReCap files, go to Global options and select the File Reader:
   a. ReCap > View Preferences – Turn off Scale interactive sizes and set how many points to visualize during movement.
4. Basepoint

Autodesk 3DS MAX

ReCap is compatible with Autodesk 3DS MAX and this is another great platform that is provided to capitalize with point clouds in the Building design and Infrastructure design suites. Conceptual design for visualization of streetscapes and terrain are just the beginning. Point clouds are already a big part of the media entertainment industry.

Application Tips:

1. Install updates and 3DS MAX extension to import point clouds
2. Nvidia metal ray renderer must be active to render point clouds

Infrastructure Design Suite

Infrastructure Design Suite is a BIM for Infrastructure design solution that combines intelligent, model-based tools to help you gain more accurate, accessible, and actionable insight. Autodesk ReCap and the Infrastructure design suite is fully compatible with point clouds.

Civil 3D 2014

Point clouds can be utilized in Civil 3D for highway design, site design, calculating volumes and structure analysis.

How to apply Point clouds in Civil 3D:

1. Accurately connect points with feature lines to complete road, curb and utilities. Civil 3D points are placed to represent topographical features.
2. Building DTM surface from point clouds for contours and volume calculations
3. Perform structural analysis from point cloud data
4. Export corridors

Application Tips:

1. Civil 3D 2014 updates and apps are installed
   a. Point Cloud Scan Manager
   b. Point Cloud Feature Extraction
2. Clipping the point cloud
3. Cross sections are preformed utilizing 3DCLIP
4. Turn off auto update

Infraworks

Scan data complements of Midwestern Consulting, Inc.
Headquartered in Ann Arbor,MI 734.995.0200

Point clouds can be utilized in Infraworks for compelling presentations, and stakeholder approvals. Revit and Civil 3D data can be imported directly to Infraworks.

Application Tips:

1. Infraworks 2014 updates are installed.
2. USGS Viewer provides data to utilize with Infraworks and point cloud data
3. Organizing data for importing
4. Animations and Infraworks information

In Conclusion:

Capturing & managing data has become much easier. New technologies are available to capture large and unique areas of existing data. Autodesk ReCap provides the engine for us to utilize point clouds in our chose of design software. Familiarize yourself with new workflows to take advantage of 3D data and design for all industries.