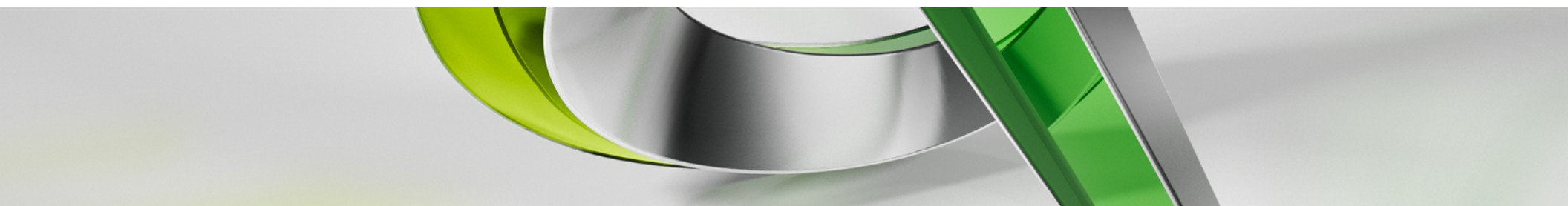




# Lidar Data & Point Clouds: From Scanning to Planning & Beyond

Matt Miyamoto  
Application Specialist  
@MattM\_PE



# Class summary

- **CI1870** This class is designed for the surveyor, engineer, planner and architect who is interested in finding out more about incorporating the use of LiDAR data into their project lifecycle using products from Autodesk® Infrastructure Design Suite Ultimate 2014. The class focuses on the key workflow processes for incorporating LiDAR data from data collection and review to planning and design.
  - Lidar Data processing, review and editing with Autodesk® ReCap Studio and ReCap Pro
  - Photo-based Point Clouds with Autodesk® ReCap Photo online service
  - Planning & Preliminary design with Autodesk® InfraWorks
  - Survey and Civil design with Autodesk® AutoCAD® Civil 3D®
  - Architectural renovations with Autodesk® Revit

# Key learning objectives

At the end of this class, you will be able to:

- Gain a better understanding of the capabilities of Autodesk® ReCap and where it can be used in the project workflow process
- Understand how LiDAR data can be processed & edited prior to importing into primary design software.
- Learn how LiDAR data can be incorporated into high level Planning stage visualizations in Autodesk® InfraWorks
- See how the imported point cloud can be used to generate existing ground models in Autodesk® AutoCAD® Civil 3D®.
- See how processed data can be imported directly into Autodesk® Revit for building design

## Presenter Bio

Matt Miyamoto, P.E., ACI  
Application Specialist – Ideate, Inc.

- 10+ Years in AEC Industry
- 5+ as an Application Specialist
- Autodesk Certified Instructor (ACI)
- Autodesk Certified Professional
  - ✓ Autodesk AutoCAD
  - ✓ Autodesk AutoCAD Civil3D
- Autodesk Certified BIM Specialist
  - ✓ Road and Highway Solution
- Training, Consulting, Technical Support



# Agenda

- Overview of Lidar Data & Data Collection Methods
- Pre-2014 Autodesk Software & Lidar Data
- Autodesk ReCap & Autodesk ReCap Photo
- Planning & Preliminary Design Workflow with Autodesk® InfraWorks
- Survey & Civil Design Workflow with Autodesk® AutoCAD® Civil3D®
- Architectural Design Workflow with Autodesk® Revit

“Companies that do not make their products intelligent may find themselves driven out of business by their competitors that do.”

-Michio Kaku



# A Brief Overview of Li.D.A.R. Data



Autodesk, Inc.



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 AUTODESK.

# Li. D. A. R.

## Light Detection And Ranging

Two standard methods of data measurement

- Time of Flight
- Phase Shift

Three standard methods of data collection

- Aerial
- Mobile
- Ground Based



# Data Collection Methods



Autodesk, Inc.

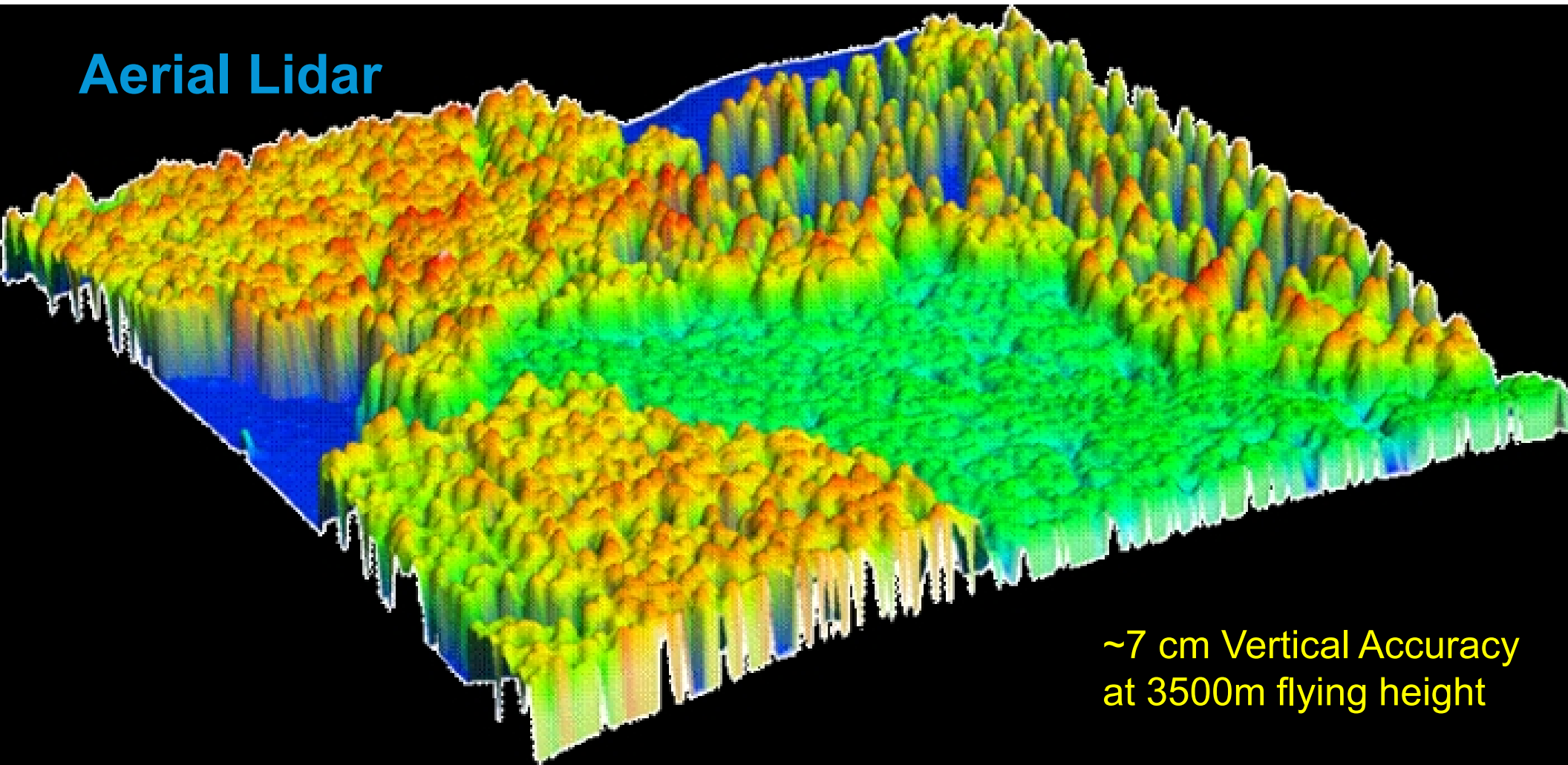


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# Aerial Lidar



~7 cm Vertical Accuracy  
at 3500m flying height

# Aerial Lidar

- Large & Inaccessible Areas
- Filtered datasets provide “Bare Earth” returns
- Temperature, Humidity, Vibration all impact data accuracy  $\sim \pm 10$  cm

# Mobile Lidar

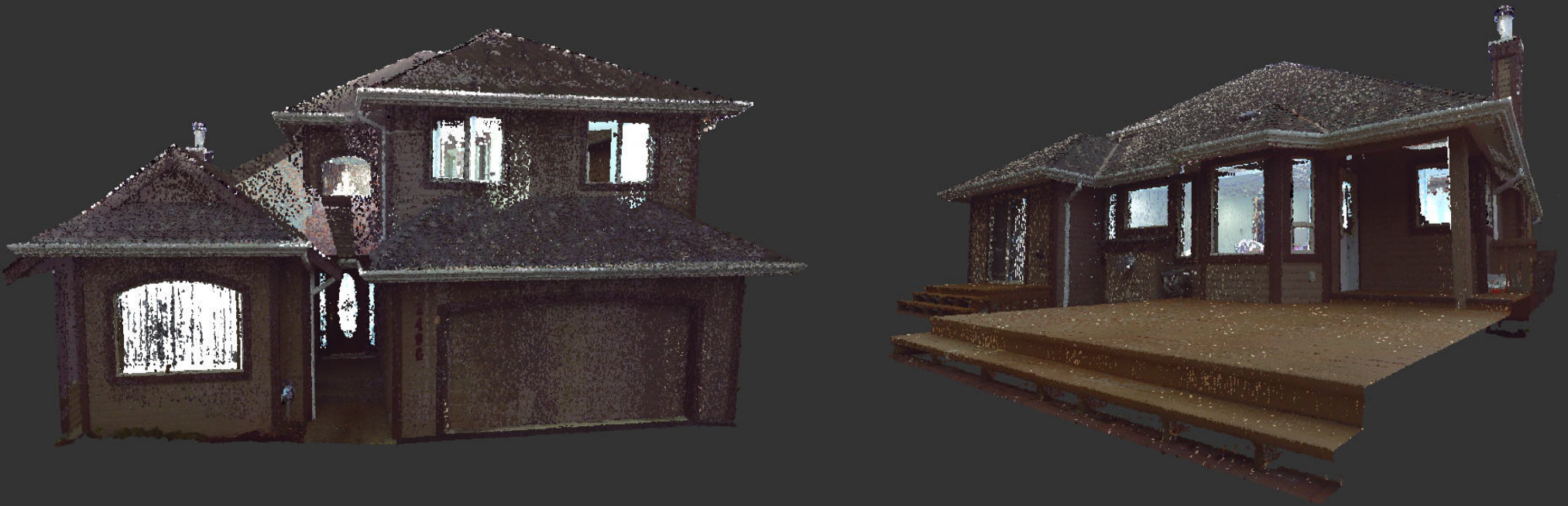


SSI - Surveying Solutions, Inc. (<http://www.ssi-mi.com>)

## Mobile Lidar – Vehicular Mounted

- Roadways & Rail Corridors
- Tunnel Mapping
- Coastal / Marine Mapping
- ~600,000 points per section at highway speeds
- Survey Grade Accuracy (speed dependent)

# Ground Based Lidar



Surface & Edge 3D Laser Scanning (<http://www.surfaceandedge.com>)

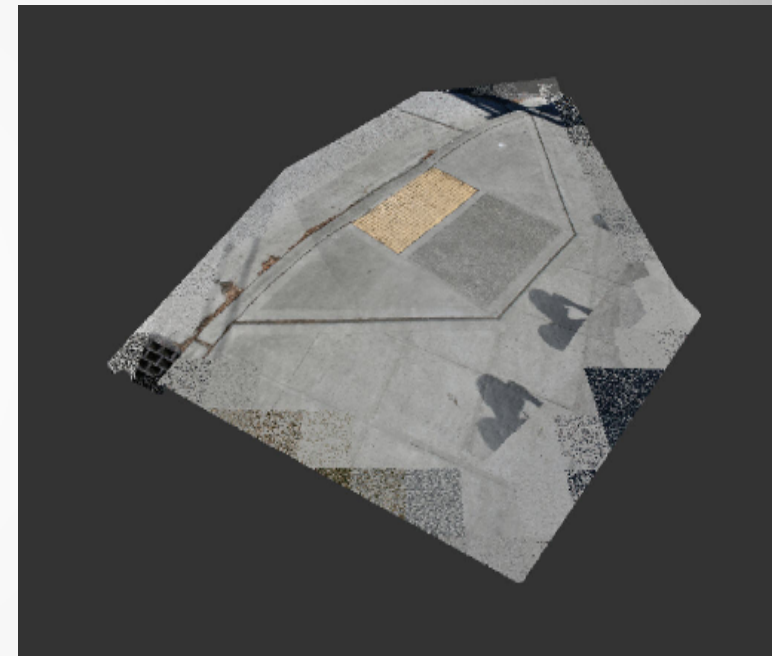
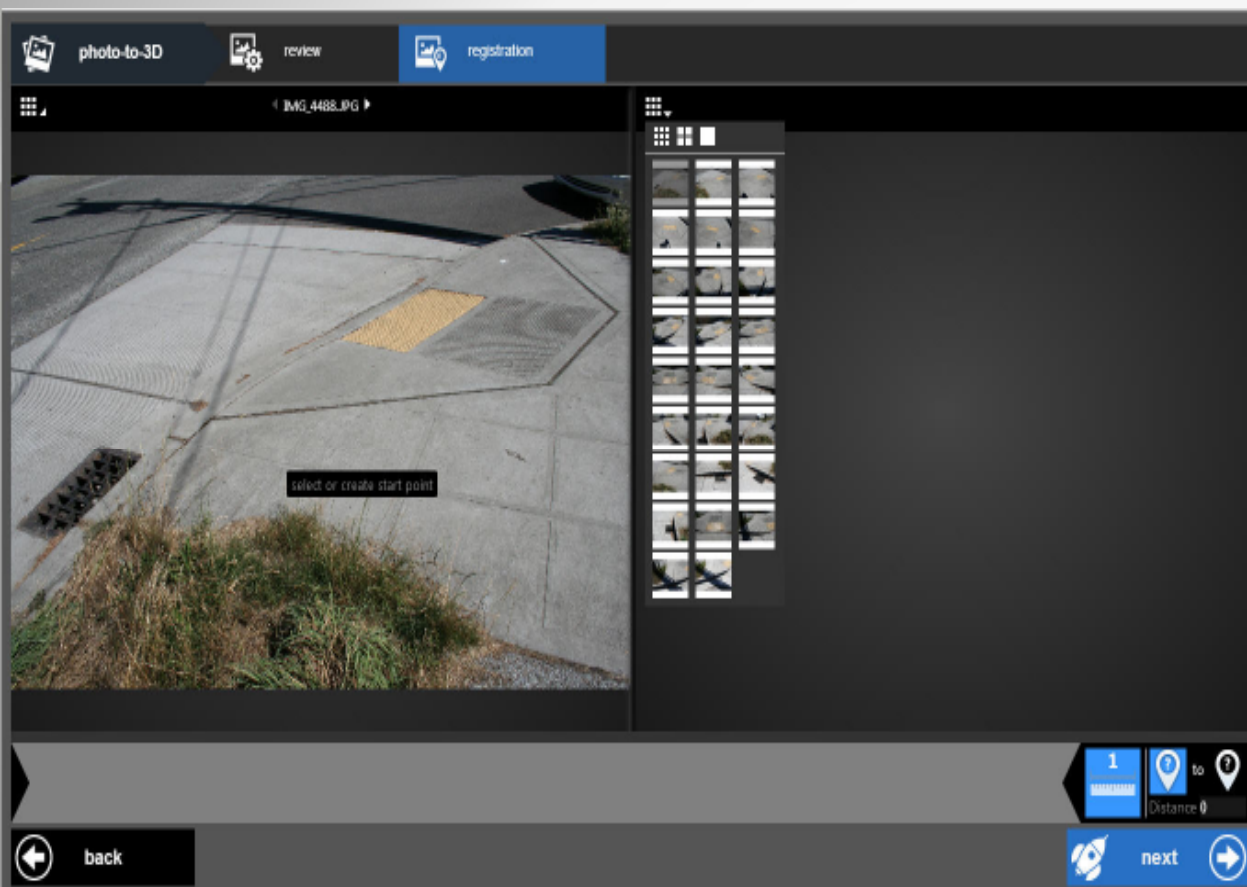
# Ground Mounted (Ground Based) Lidar

- Urban & High Density Areas
- Complex Corridors & Intersections
- Multiple Scans Linked through data registry
- Safer than conventional survey
- Survey Grade Accuracy
- User specified areas for scanning



Geoline, Inc.

# Digital Photos...





# Pre-2014 Autodesk® Software vs. 2014 Autodesk® Software



Autodesk, Inc.



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# Pre-2014 Autodesk® Software & Lidar Data

## Autodesk® Applications\* Supported Lidar Data & Point Clouds

### Product Dependent File Type Support for Indexing

### Two Primary Point Cloud Formats for Inserting and Attaching

➤ .PCG & .ISD Files

|                                    | AutoCAD/LT         | AutoCAD<br>Architecture | AutoCAD<br>MEP     | AutoCAD<br>Map 3D  | AutoCAD Civil 3D                                                                                                                                                                                                                                                  | Revit<br>Architecture                  | Revit MEP                              | Revit<br>Structure                     | Navisworks<br>Manage |
|------------------------------------|--------------------|-------------------------|--------------------|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|----------------------------------------|----------------------------------------|----------------------|
| Can I process (index) Lidar Data?  | YES                | YES                     | YES                | YES                | YES                                                                                                                                                                                                                                                               | YES                                    | YES                                    | YES                                    | **                   |
| What Sources are available?        | LAS, XYB, FLS, FWS | LAS, XYB, FLS, FWS      | LAS, XYB, FLS, FWS | LAS, XYB, FLS, FWS | LAS, ASCII XYZ, Geo-TIFF, USGS-DEM, ESRI<br>Shapefiles, FBX, Topojson, CLM, Topojson, ESRI<br>ADF, ENZ, Autodesk Uploadable File<br>(AUF), NEZ, XYZ_Intensity, PENZ, PENZD, PNE,<br>XYZ_RGB, PNEZ, PNEZD, XYZ_LIDAR<br>Classification, *Custom Point File Formats | LAS, XYB, FLS, FWS, XYZ, PTG, PTS, PTX | LAS, XYB, FLS, FWS, XYZ, PTG, PTS, PTX | LAS, XYB, FLS, FWS, XYZ, PTG, PTS, PTX | **                   |
| Can I import/attach a Point Cloud? | YES                | YES                     | YES                | YES                | YES                                                                                                                                                                                                                                                               | YES                                    | YES                                    | YES                                    | **                   |
| What Sources are available?        | PCG, ISD           | PCG, ISD                | PCG, ISD           | PCG, ISD           | PCG, ISD                                                                                                                                                                                                                                                          | PCG                                    | PCG                                    | PCG                                    | **                   |

### Limited Editing Capabilities

\*Point files can be converted to space delimited, and additional point file formats can be created if necessary

\*\*Navisworks Manage 2012 is the only product that supports Lidar data. Although it is also produced by Autodesk, it is primarily a review tool rather than a design or modeling application. In this case, Navisworks will open many types of laser scanned files for review in the Navisworks drawing. Unlike the other Autodesk products, there are no Attach or Index commands in Navisworks. Laser scanned files are opened through the open dialog box, like any other compatible file type. Once the point cloud is processed, the scanned object appears on screen and in the Selection Tree.

Supported file types include: ASCII Laser (ASC or TXT), FBX, Leica (PTS or PTX), Faro (FLS, FWS, iQscan, iQmod, iQwsp), Reigl (3DD), Trimble (ASCII format), Z+F (ZFC or ZFS)

NOTE: In Navisworks Manage 2012, there were some issues encountered when working with different versions of PTS files. There is a current issue logged with Autodesk development regarding Leica v6 PTS files in which not all of the laser scanned points are processed and appear in the drawing.

\*Applies to Currently Supported Software Versions (2011-2013 releases)

# 2014 Autodesk® Software & Lidar Data

## Enhanced Autodesk® Application Lidar Data & Point Cloud Support

Updated Processing Engine (all products)

New Application → Autodesk® ReCap

Enhanced Capabilities

New File Types

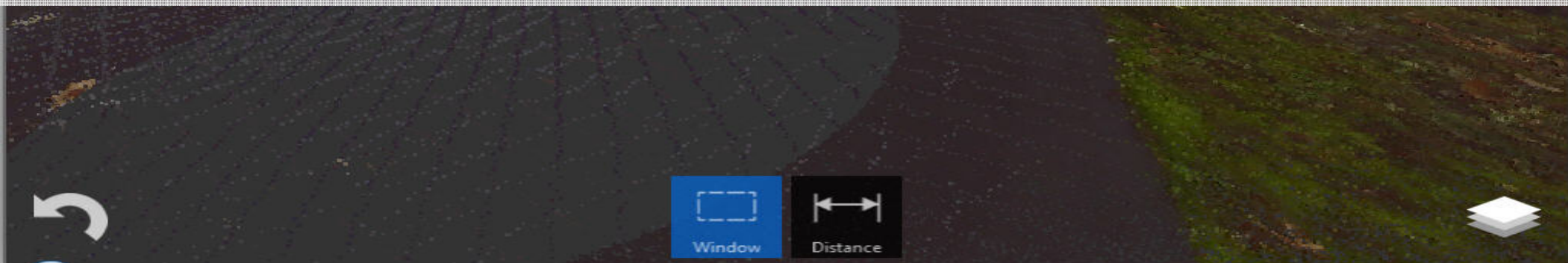
- .RCS (ReCap Scan)
- .RCP (ReCap Project)

# New Workflow for Incorporating Lidar Data

1. Create a Project in Autodesk® ReCap
2. Process, Review & Edit Lidar data in Autodesk® ReCap
3. Export Dataset to .RCS File Format
4. Open Primary Design Application
  - ❖ Autodesk® InfraWorks → Planning & Preliminary Design
  - ❖ Autodesk® AutoCAD® Civil3D® → Surveying & Civil Design
  - ❖ Autodesk® Revit → Architectural Design
5. Import .RCS File

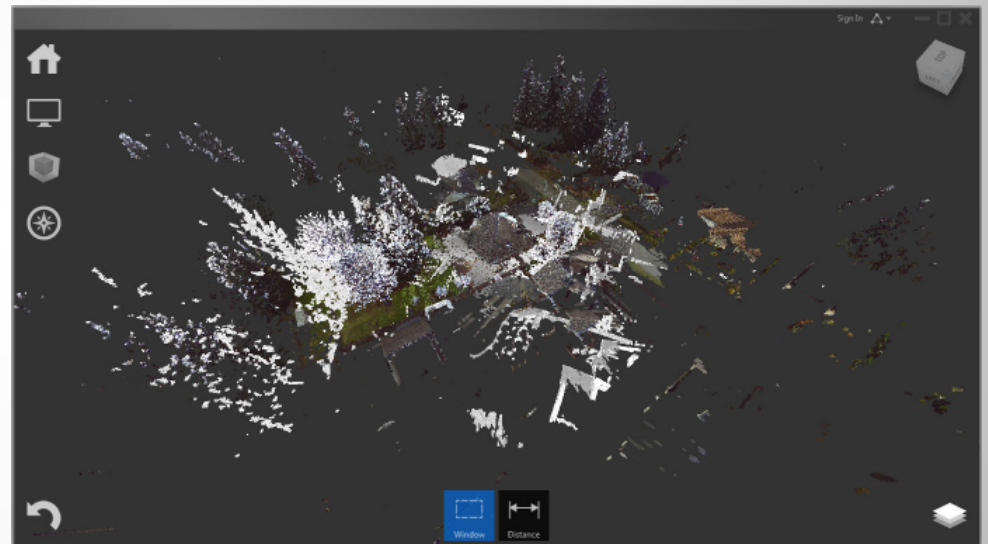


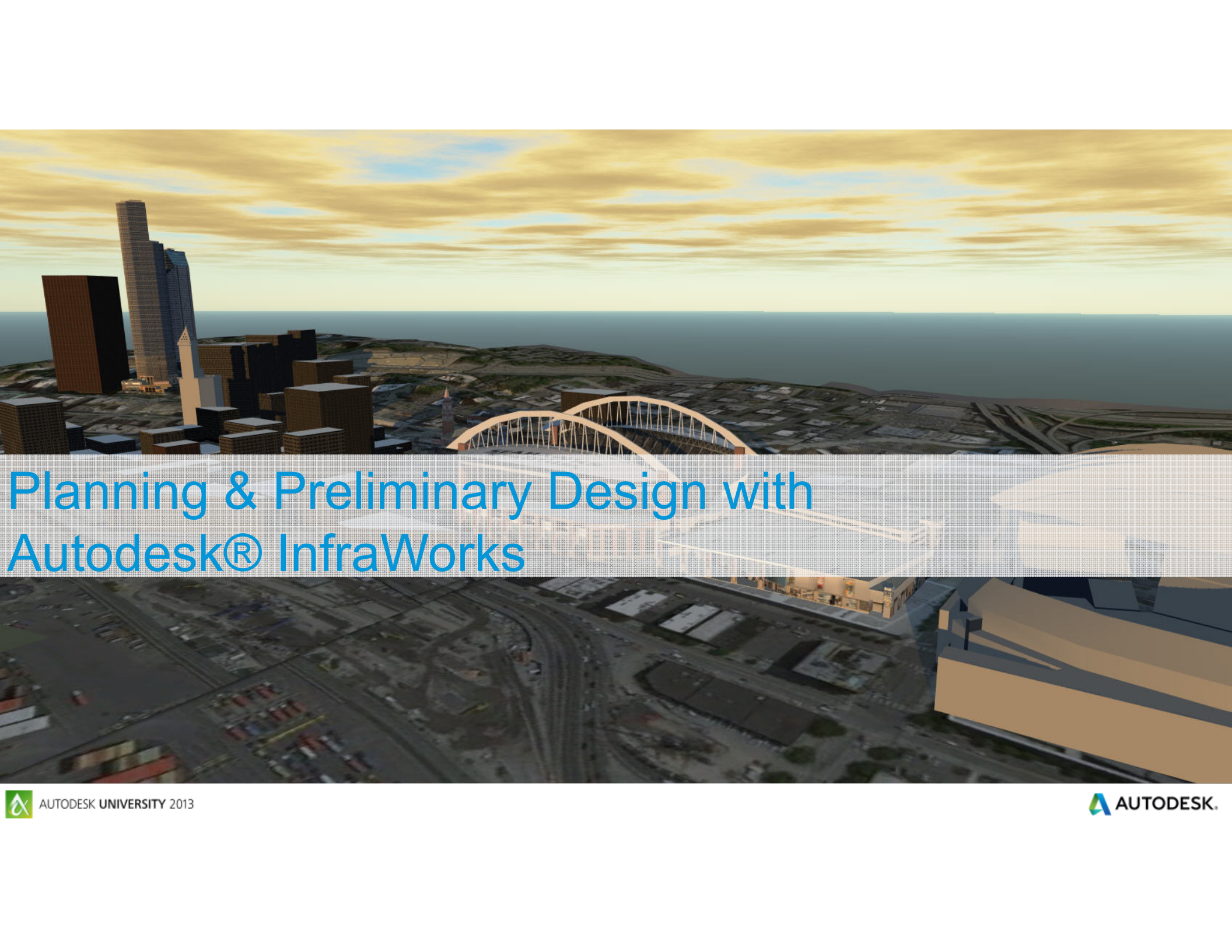
# Data Processing & Review with Autodesk® ReCap



# Autodesk® ReCap Point Cloud Workflow

1. Data Collection
2. Create a Project
3. Import Scans
4. Review & Edit
5. Export modified dataset



An aerial view of a city skyline at sunset. The sky is filled with orange and yellow clouds. In the foreground, a large bridge with two prominent arches spans a body of water. To the left, a cluster of skyscrapers, including a very tall one, stands out. Below the bridge, a complex highway interchange with multiple lanes and overpasses is visible. The overall scene is a blend of urban architecture and infrastructure.

# Planning & Preliminary Design with Autodesk® InfraWorks

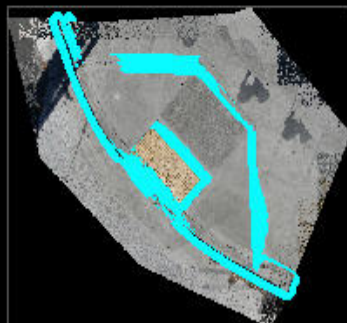
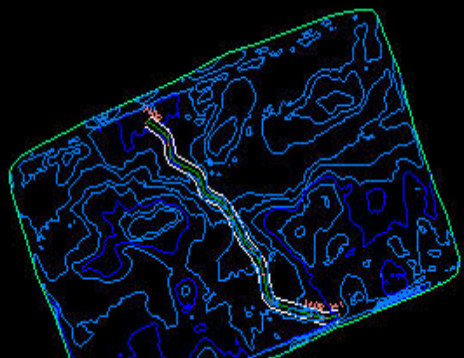
# Autodesk® InfraWorks Point Cloud Workflow

## Ground Models

1. Create Surface in Autodesk® AutoCAD® Civil3D®
2. Export to .IMX File
3. Open/Create Autodesk InfraWorks Project
4. Import .IMX Data Source
5. Import Aerial Images for Overlay

## Existing Structures/Features

1. Process Point Cloud in Autodesk® ReCap
2. Export to .RCS File
3. Open/Create Autodesk InfraWorks Project
4. Import Point Cloud (.RCS) Data Source



# Survey & Civil Design with Autodesk® AutoCAD® Civil 3D®

# Survey & Civil Design Point Cloud Workflow

## Virtual Survey

1. Process Point Cloud in Autodesk® ReCap
2. Export to .RCS File
3. Attach .RCS in Autodesk ® AutoCAD ® Civil3D®
4. Create Feature Lines using Point Nodes
5. Import features into Survey Database as needed

## Ground Modeling

1. Process Point Cloud in Autodesk ® ReCap
2. Export to .RCS File
3. Attach .RCS in Autodesk ® AutoCAD ® Civil3D®
4. Add Civil 3D Properties to Point Cloud
5. Create Surface



# Architectural Design with Autodesk® Revit®

# Architectural Design Point Cloud Workflow

## Renovations to Existing Structures

1. Process Point Cloud in Autodesk® ReCap
2. Export to .RCS File
3. Import Point Cloud in Autodesk® Revit
4. Set Elevations using Point Cloud measurements
5. Create Existing Features using Point Cloud as reference
6. Add Proposed Features to Autodesk® Revit model

“With great power comes great responsibility.”

-Voltaire

# Questions?

# Thank You!



