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
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
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
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 ~ ±10 cm
Mobile Lidar
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
Pre-2014 Autodesk® Software
vs.
2014 Autodesk® Software
## 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**

### Limited Editing Capabilities

<table>
<thead>
<tr>
<th>Product</th>
<th>Can I process (index) Lidar Data?</th>
<th>What Sources are available?</th>
<th>Can I import/attach a Point Cloud?</th>
</tr>
</thead>
<tbody>
<tr>
<td>AutoCAD LT</td>
<td>YES</td>
<td>LAS, XYB, FLS, FWS</td>
<td>YES</td>
</tr>
<tr>
<td>AutoCAD MEP</td>
<td>YES</td>
<td>LAS, XYB, FLS, FWS</td>
<td>YES</td>
</tr>
<tr>
<td>AutoCAD</td>
<td>YES</td>
<td>LAS, XYB, FLS, FWS</td>
<td>YES</td>
</tr>
<tr>
<td>AutoCAD Civil 3D</td>
<td>YES</td>
<td>LAS, ASCII XYZ, Geo-TIFF, USGS DEM, ESRI Shape, ESRI KML, ERDAS IMAGINE Geo-ID, Geo-RS, Geo-ESRI, Geo-ADF, ENZ, Autodesk Uploadable File (AUF), NEZ, XYZ, Intensity, PENZ, PENZD, PNE, XYZ_RGB, PNEZ, PNEZD, XYZ_LIDAR Classification, Custom.PCG Formats</td>
<td></td>
</tr>
<tr>
<td>Revit Architecture</td>
<td>YES</td>
<td>LAS, ASCII XYZ, Geo-TIFF, USGS DEM, ESRI Shape, ESRI KML, ERDAS IMAGINE Geo-ID, Geo-RS, Geo-ESRI, Geo-ADF, ENZ, Autodesk Uploadable File (AUF), NEZ, XYZ, Intensity, PENZ, PENZD, PNE, XYZ_RGB, PNEZ, PNEZD, XYZ_LIDAR Classification, Custom.PCG Formats</td>
<td></td>
</tr>
<tr>
<td>Revit MEP</td>
<td>YES</td>
<td>LAS, ASCII XYZ, Geo-TIFF, USGS DEM, ESRI Shape, ESRI KML, ERDAS IMAGINE Geo-ID, Geo-RS, Geo-ESRI, Geo-ADF, ENZ, Autodesk Uploadable File (AUF), NEZ, XYZ, Intensity, PENZ, PENZD, PNE, XYZ_RGB, PNEZ, PNEZD, XYZ_LIDAR Classification, Custom.PCG Formats</td>
<td></td>
</tr>
<tr>
<td>Revit Structure</td>
<td>YES</td>
<td>LAS, ASCII XYZ, Geo-TIFF, USGS DEM, ESRI Shape, ESRI KML, ERDAS IMAGINE Geo-ID, Geo-RS, Geo-ESRI, Geo-ADF, ENZ, Autodesk Uploadable File (AUF), NEZ, XYZ, Intensity, PENZ, PENZD, PNE, XYZ_RGB, PNEZ, PNEZD, XYZ_LIDAR Classification, Custom.PCG Formats</td>
<td></td>
</tr>
<tr>
<td>Navisworks</td>
<td>YES</td>
<td>LAS, ASCII XYZ, Geo-TIFF, USGS DEM, ESRI Shape, ESRI KML, ERDAS IMAGINE Geo-ID, Geo-RS, Geo-ESRI, Geo-ADF, ENZ, Autodesk Uploadable File (AUF), NEZ, XYZ, Intensity, PENZ, PENZD, PNE, XYZ_RGB, PNEZ, PNEZD, XYZ_LIDAR Classification, Custom.PCG Formats</td>
<td></td>
</tr>
</tbody>
</table>

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

---

*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.*
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
Autodesk® ReCap Point Cloud Workflow

1. Data Collection
2. Create a Project
3. Import Scans
4. Review & Edit
5. Export modified dataset
<table>
<thead>
<tr>
<th>Ground Models</th>
<th>Existing Structures/Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Create Surface in Autodesk® AutoCAD ® Civil3D®</td>
<td>1. Process Point Cloud in Autodesk® ReCap</td>
</tr>
<tr>
<td>2. Export to .IMX File</td>
<td>2. Export to .RCS File</td>
</tr>
<tr>
<td>3. Open/Create Autodesk InfraWorks Project</td>
<td>3. Open/Create Autodesk InfraWorks Project</td>
</tr>
<tr>
<td>4. Import .IMX Data Source</td>
<td>4. Import Point Cloud (.RCS) Data Source</td>
</tr>
<tr>
<td>5. Import Aerial Images for Overlay</td>
<td></td>
</tr>
</tbody>
</table>
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
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!

[QR Code]