

# CI11032: Creating Surface Models from Point Clouds

Presenter: Ben Coady

Title: CAD Technician

Email: [ben.coady@ramboll.co.uk](mailto:ben.coady@ramboll.co.uk)

Website: [www.ramboll.co.uk](http://www.ramboll.co.uk)

# Key Speaker: Ben Coady

- Transport CAD Technician for Ramboll UK
- 2 years experience in Transport and 3 years in a Mechanical Discipline
- BTEC Level 3 in Mechanical Engineering & HNC in Civil Engineering from Southampton Solent University
- Previous Scholar of the Institution of Civil Engineers
- Been involved in both large and small projects
- Surface Modelling Champion



[www.ramboll.co.uk](http://www.ramboll.co.uk)

# Co-Speaker: Chris Bargent

- Technical Associate with Ramboll UK
- Manages a Large Team of Highly Skilled Technicians
- 25 years experience in delivering large infrastructure projects and high profile architectural bridges
- Extensive experience in numerous software platforms and expert in CAD and BIM management, automation, customisation and application connectivity



[www.ramboll.co.uk](http://www.ramboll.co.uk)



# Ramboll in brief

- Independent engineering and design consultancy and provider of management consultancy
  - Founded 1945 in Denmark
  - 13,000 experts
  - Over 300 offices in 35 countries
  - Significant presence in the Nordics, North America, the UK, Continental Europe, Middle East, Asia, Australia, South America and Sub-Saharan Africa
  - EUR 1.1 billion revenue
  - Owned by Ramboll Foundation
- Services across the markets:
    - Buildings
    - Transport
    - Planning & Urban Design
    - Environment & Health
    - Water
    - Energy
    - Oil & Gas
    - Management Consulting





# Ramboll Geographical footprint



- Ramboll markets
- Ramboll main office
- Ramboll office



# Class summary

- This class will show you how to convert scan data into a usable format and manipulate it. It will show you how to import that data into AutoCAD 2016. This class will also show you how to create a surface model of existing elements and how to further work with the surface model within Autodesk Inventor.

# Key learning objectives

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

- Understand the process of converting original scan data into a useable format and manipulate the data.
- Be able to import data into AutoCAD 2016
- Be able to create a surface model of existing elements.
- Be able to import a surface model into Autodesk Inventor for addition of proposed elements

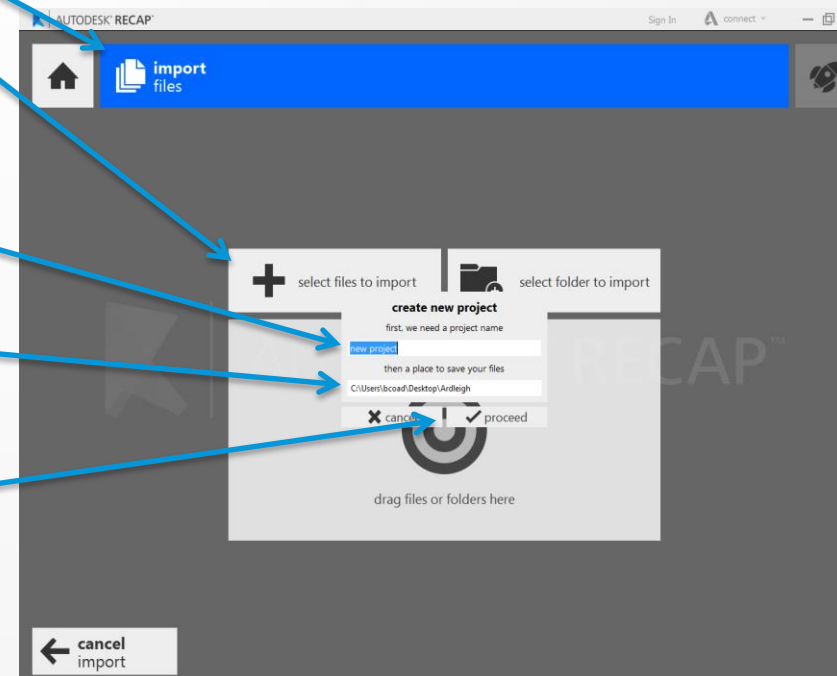
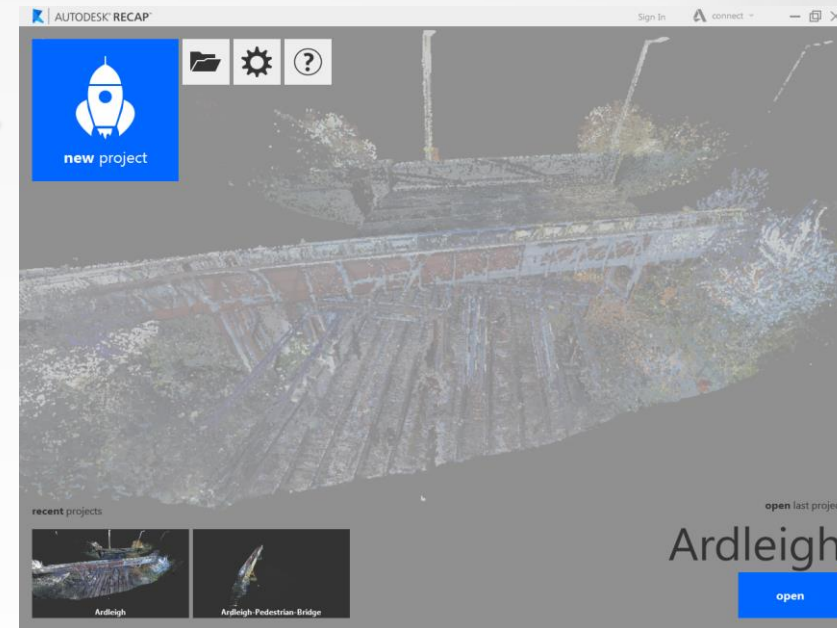
# Learning Objective 1

**Converting laser scanned data  
into a usable format**



# Converting Original Scan Data

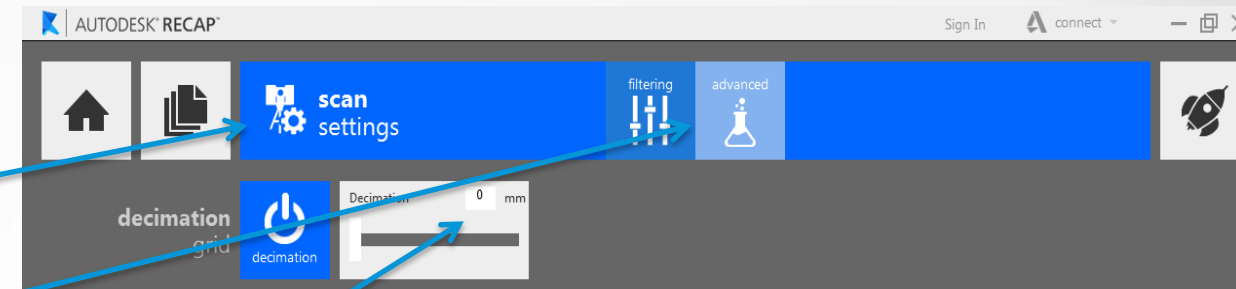
- Open Autodesk ReCap
- Select “New Project”
- Select “Select Files to Import” to import original data
- Specify Name of New Project
- Choose a Location where the file needs to be saved
- Select “Proceed”



# Adjusting Scan Conversion Settings

Scan settings can be changed within ReCap to enhance the point cloud

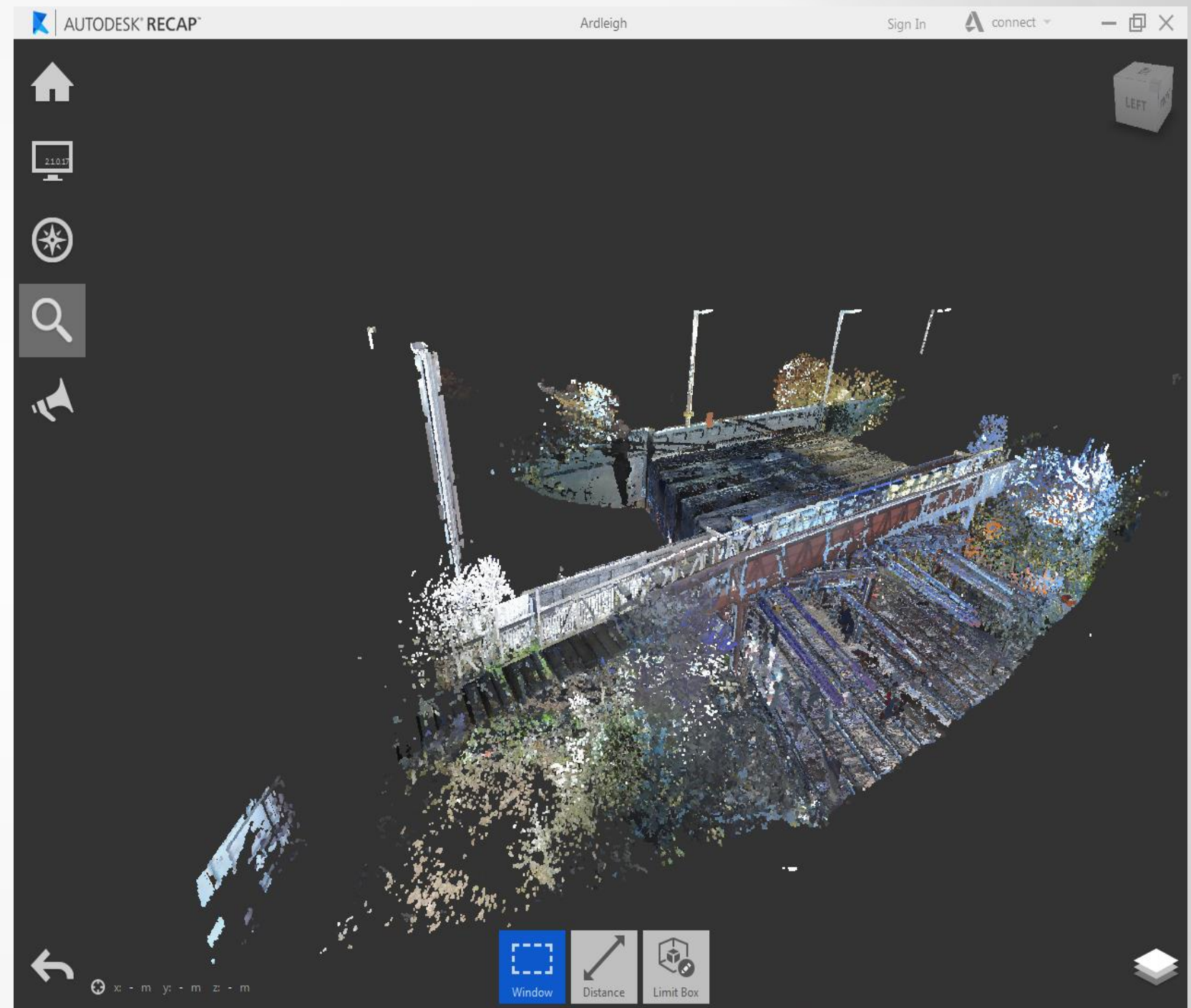
- Select “Scan Settings”
- Select “Advanced”
- Change Decimation Grid to 0
- Select “Launch Project”



# Manipulating the Point Cloud in ReCap

Data has been converted into a point cloud and you can now complete the tasks below

- Orbit in 3D
- Take measurements
- Adjust Visual Settings
- Clipping of Point Cloud to reveal important elements

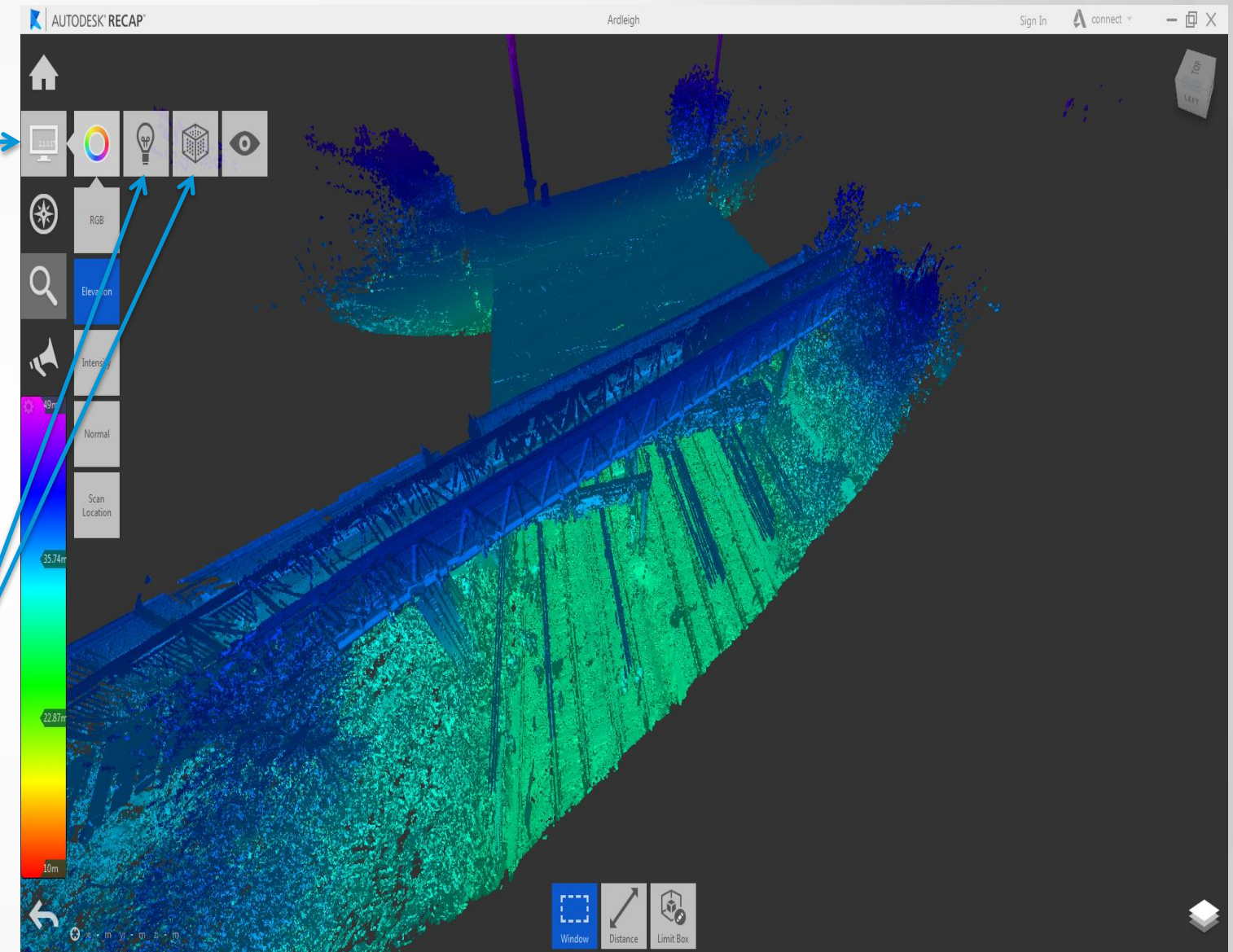




# Manipulating the Data: Visual Settings, Orbiting and Measurements, Clipping

Visual Appearance can be changed by selecting the Desktop Icon and choosing different settings

You can also adjust lighting settings by selecting the light bulb icon and point size by selecting the cube icon

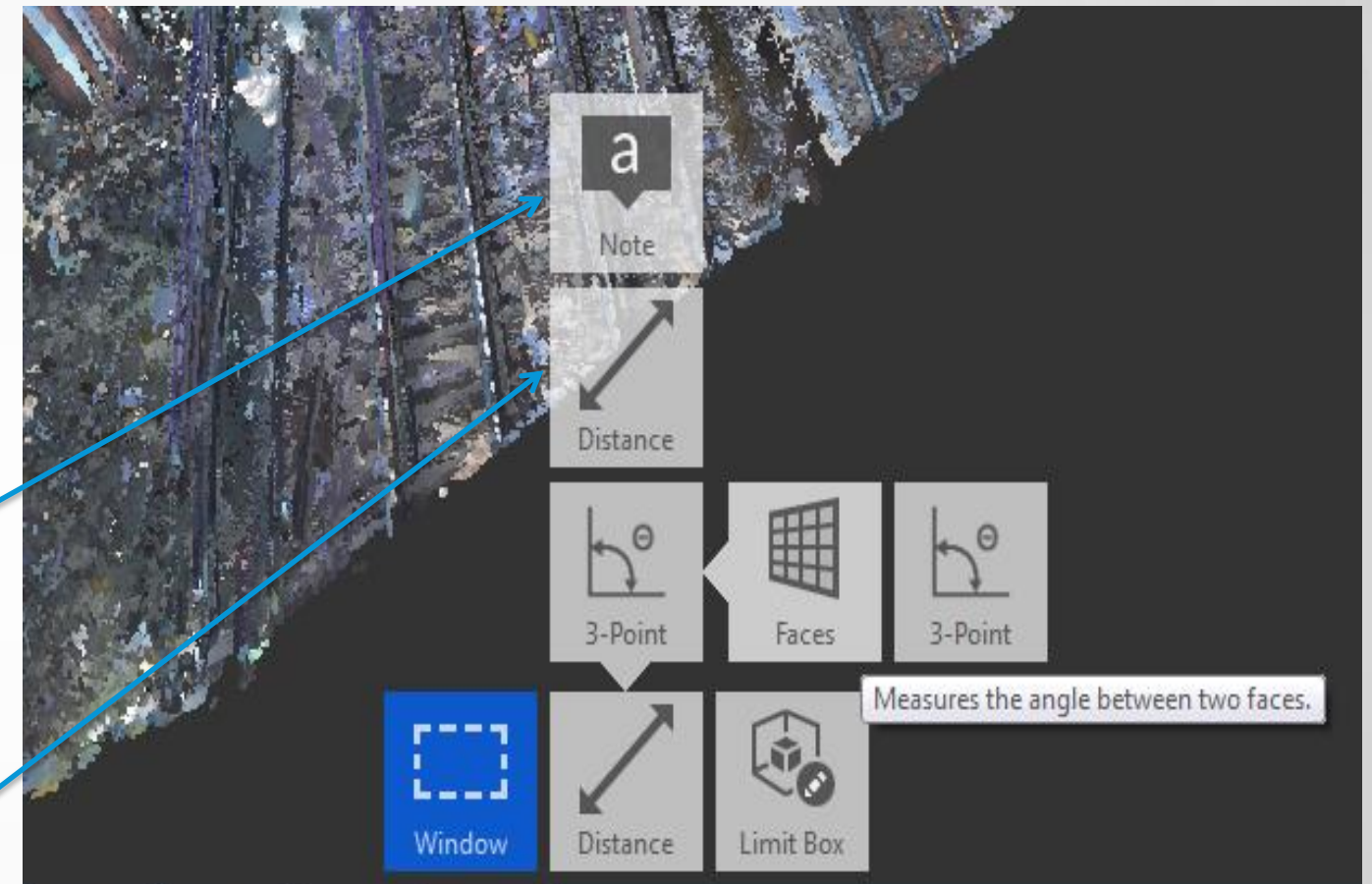




# Manipulating the Data: Visual Settings, Orbiting and Measurements, Clipping

Orbiting the 3D is an effective way to interrogate and take measurements

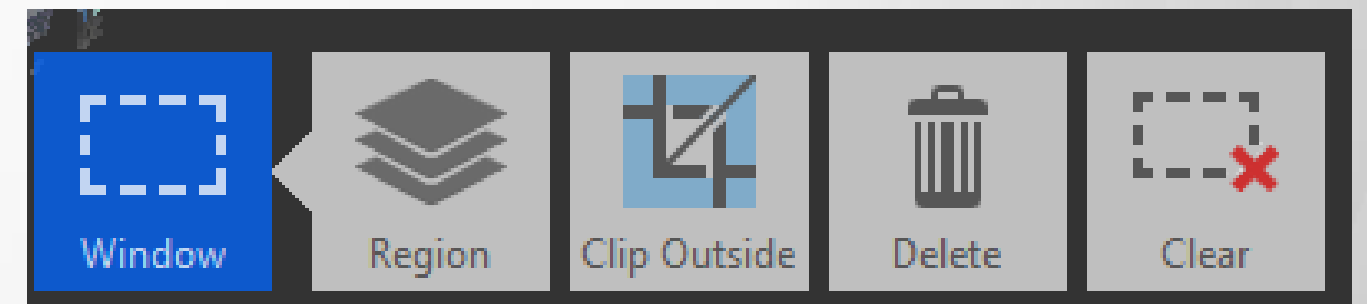
- To orbit hold down the “Shift Key” and click the “mouse wheel” at the same time
- You can also add text/notes
- To take a measurement select the distance icon, choose required distance type, select the elements that you require measuring



# Manipulating the Data: Visual Settings, Orbiting and Measurements, Clipping

Clipping of existing elements is important for ease of surface modelling in AutoCAD

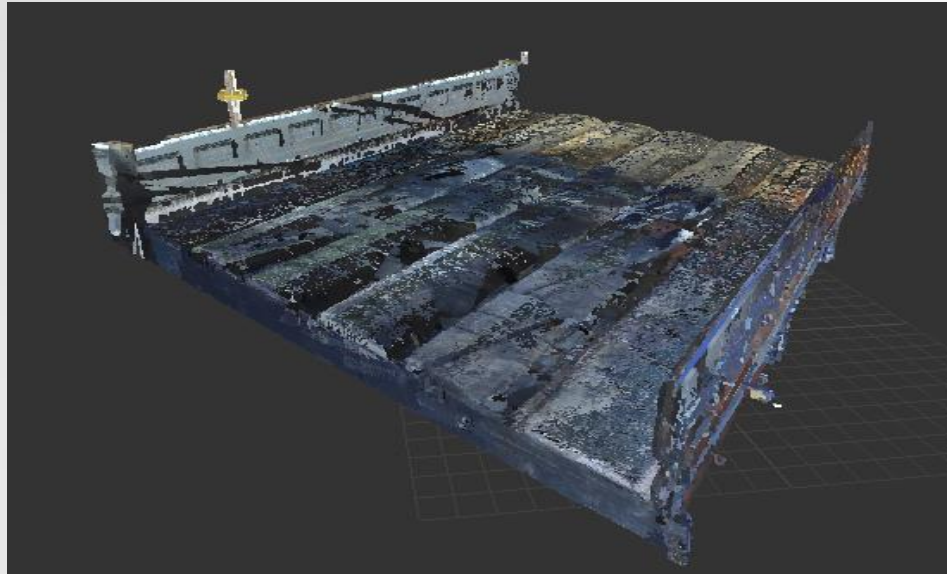
- To clip hold down “left mouse button” and drag a window across the piece of cloud you want to delete
- Select “Delete” from the tool bar or press “Delete” on your keyboard
- Create a Save As of the existing element



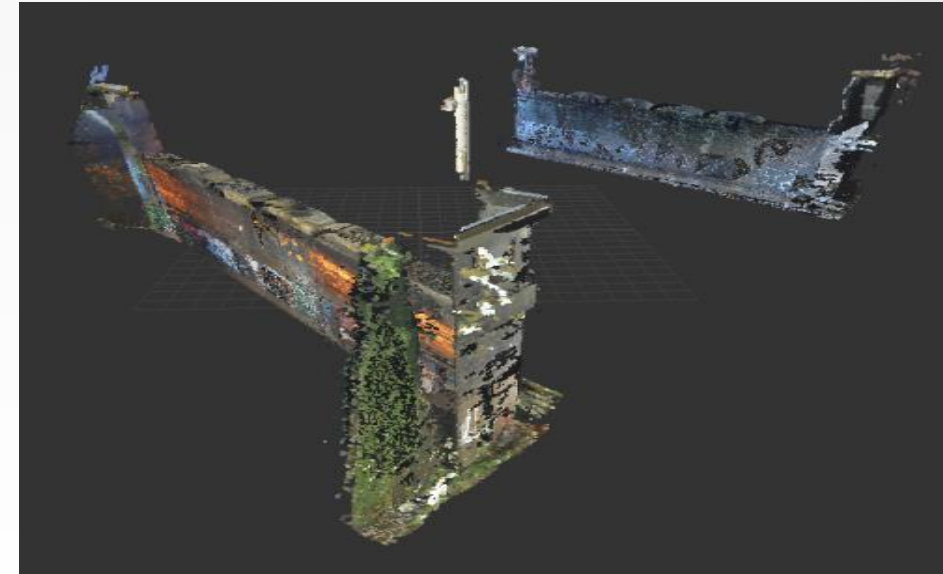


# Manipulating the Data: Clipped Point Clouds

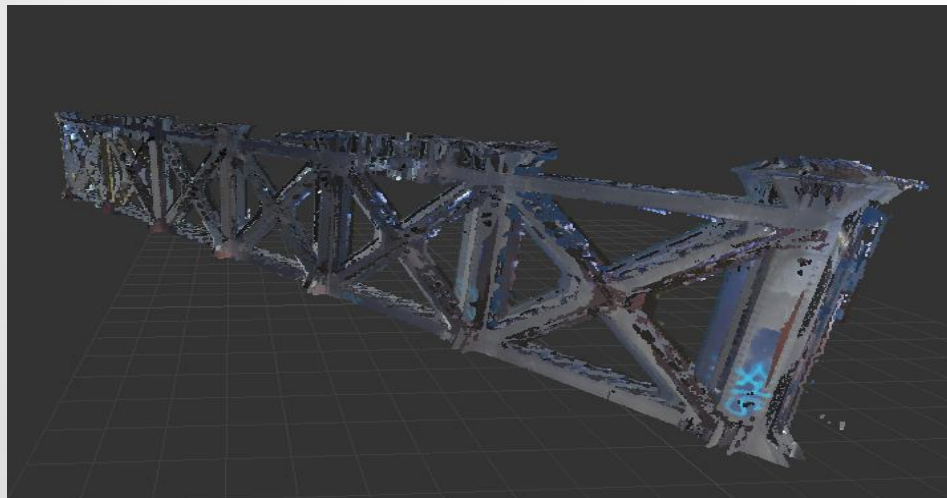
Bridge Deck



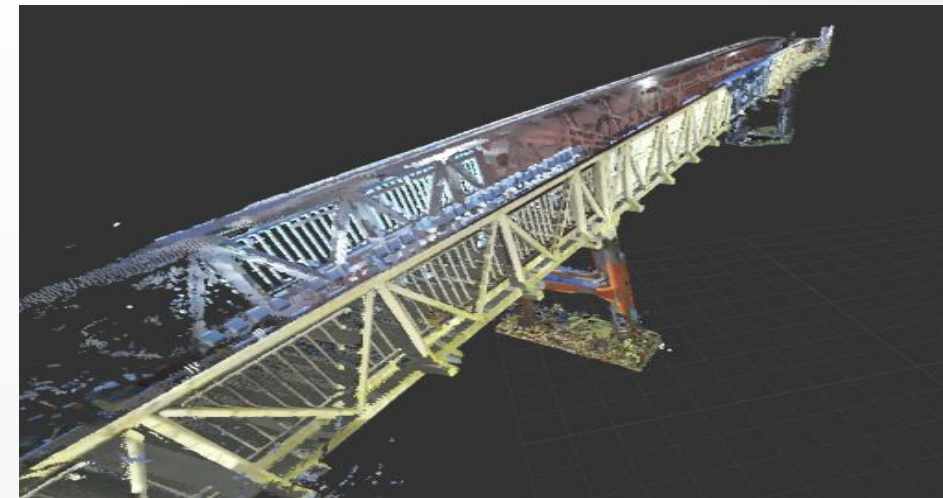
Abutment Walls



Steel Truss



Pedestrian Bridge



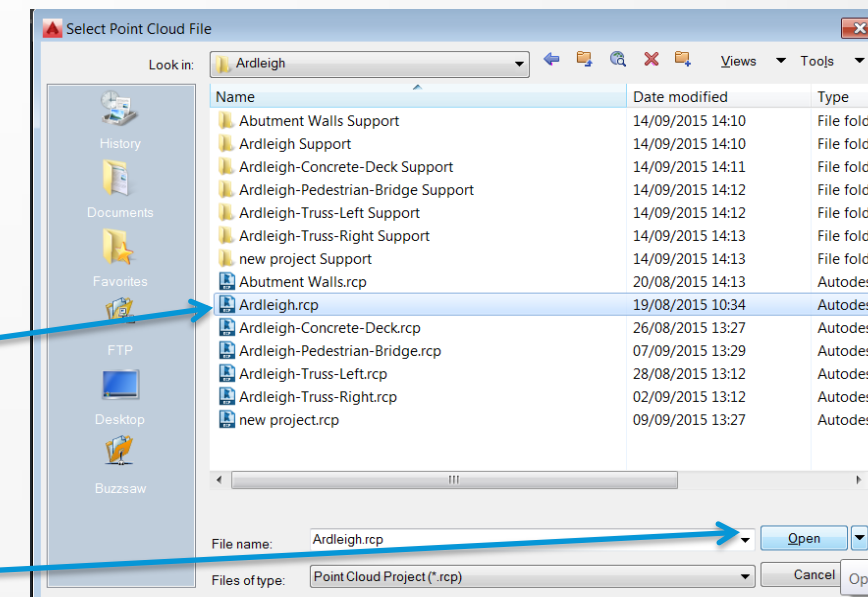
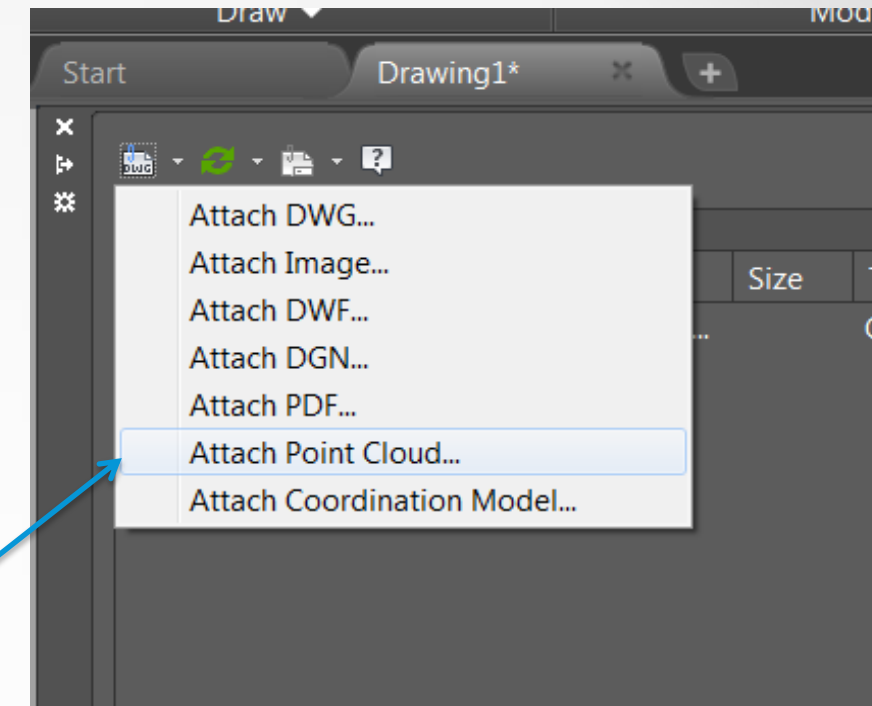
# Learning Objective 2

## Importing Point Clouds into AutoCAD 2016 and Adjusting Visual Settings



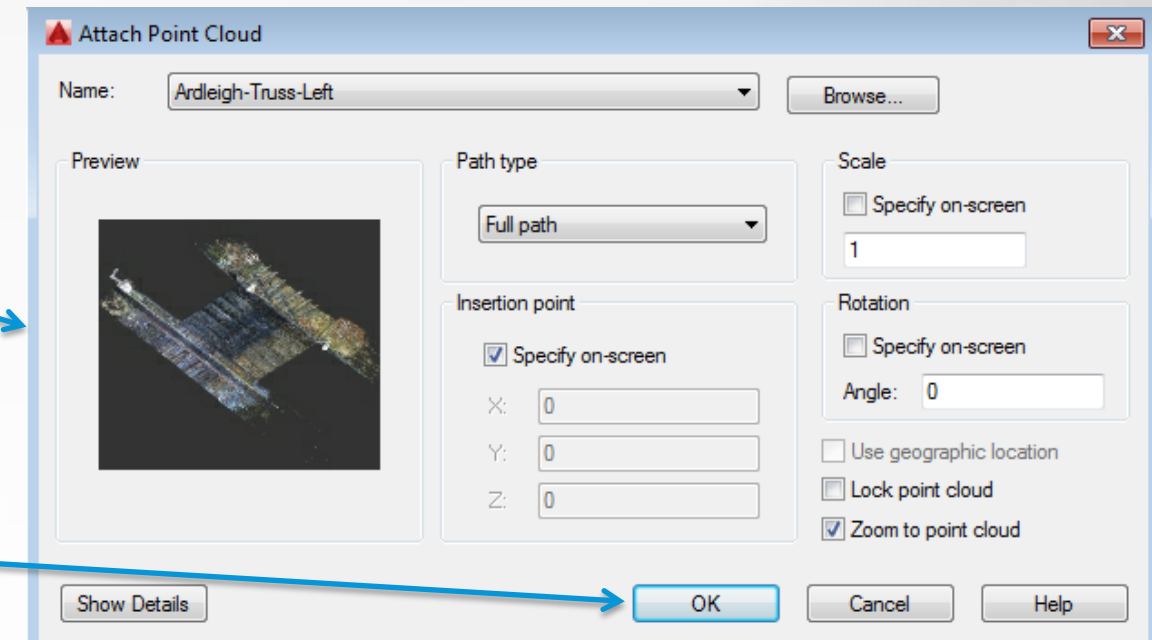
# Importing Data into AutoCAD 2016

- Open AutoCAD 2016
- Ensure AutoCAD is in World Coordinates, this is done by typing “UCS” then “World”
- Type “XR” to bring up the external references manager
- Select drop down and select “Attach Point Cloud”
- Select the .RCS or .RCP that you require
- Select “Open”

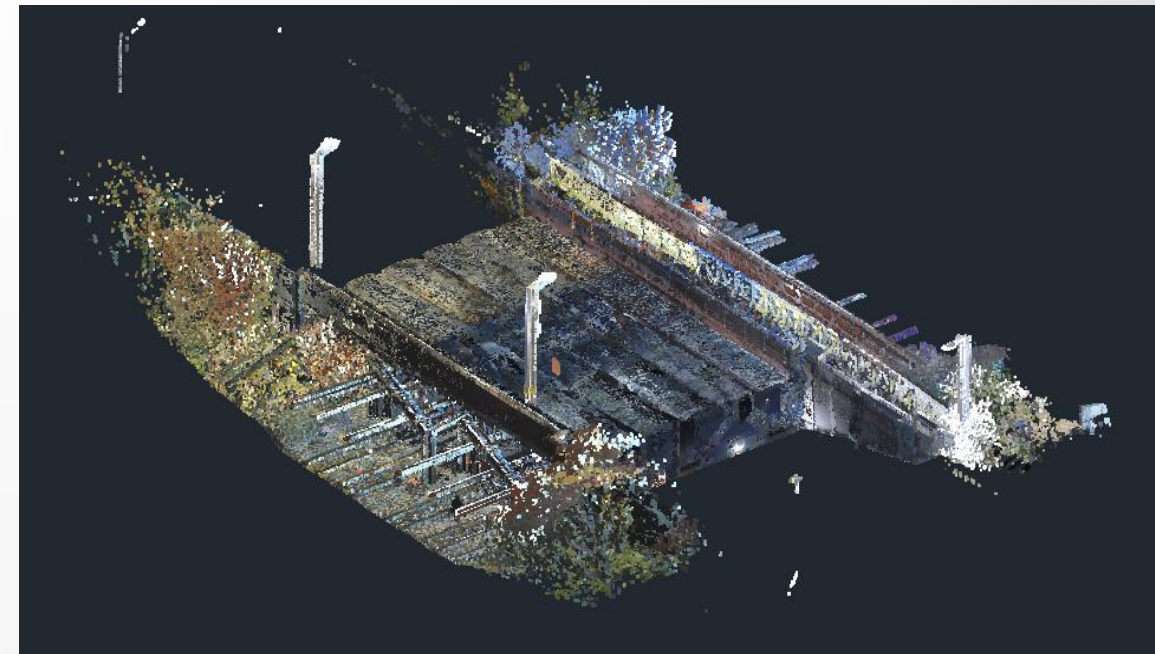


# Importing Data into AutoCAD 2016

- Ensure your insertion settings are correct
- Select “OK” to insert your point cloud



Point cloud has now been inserted into AutoCAD 2016

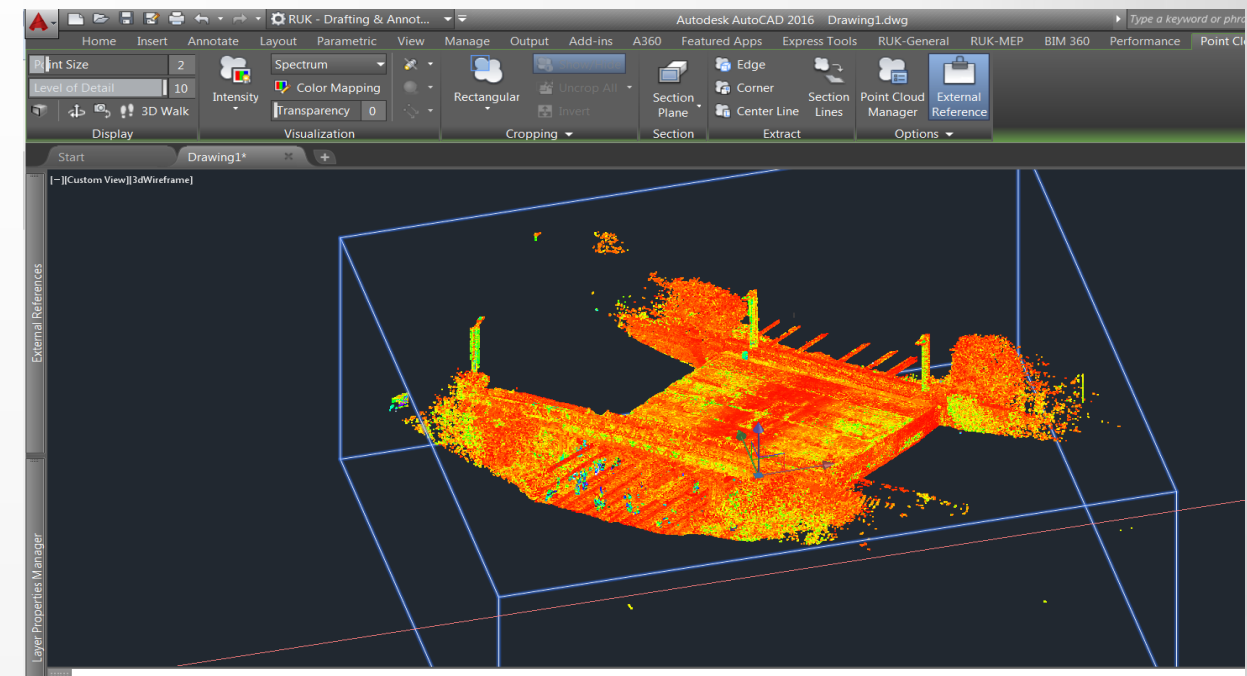
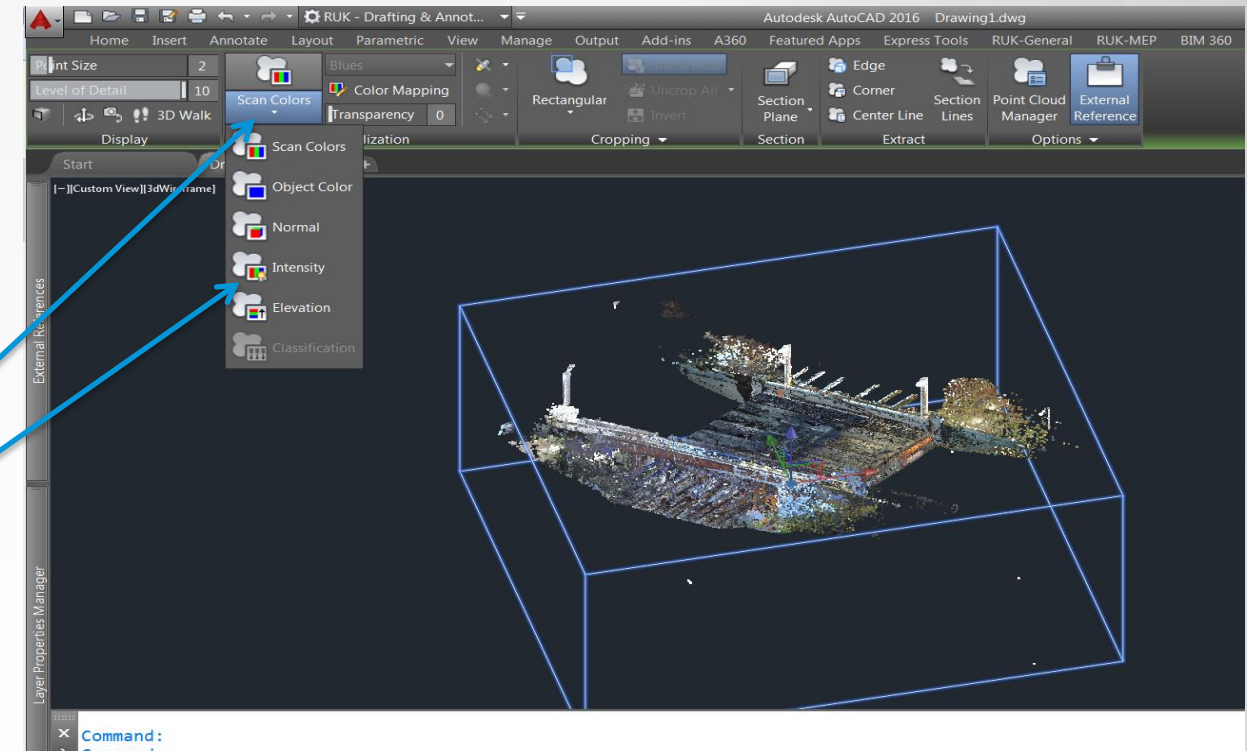


# Importing Data into AutoCAD 2016 – Adjusting Visual Settings

Like ReCap, you can also adjust visual settings in AutoCAD

- Select the Point Cloud
- Select the “Scan Colours” drop down then select the required setting

Helpful when working with darker point clouds



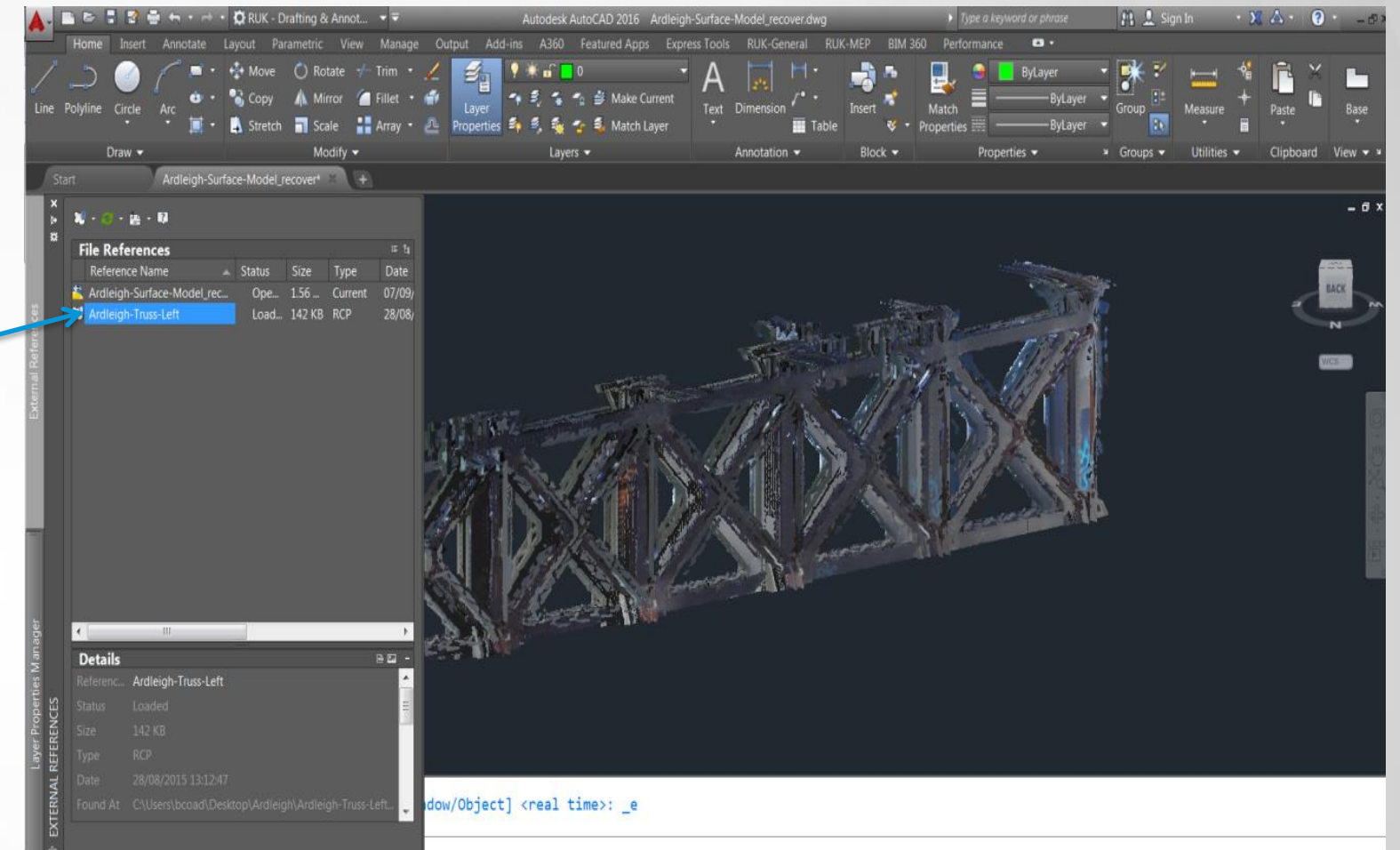
# Learning Objective 3

**Create a Surface Model of Existing Elements**



# Insertion of Point Cloud and Placement of Planes

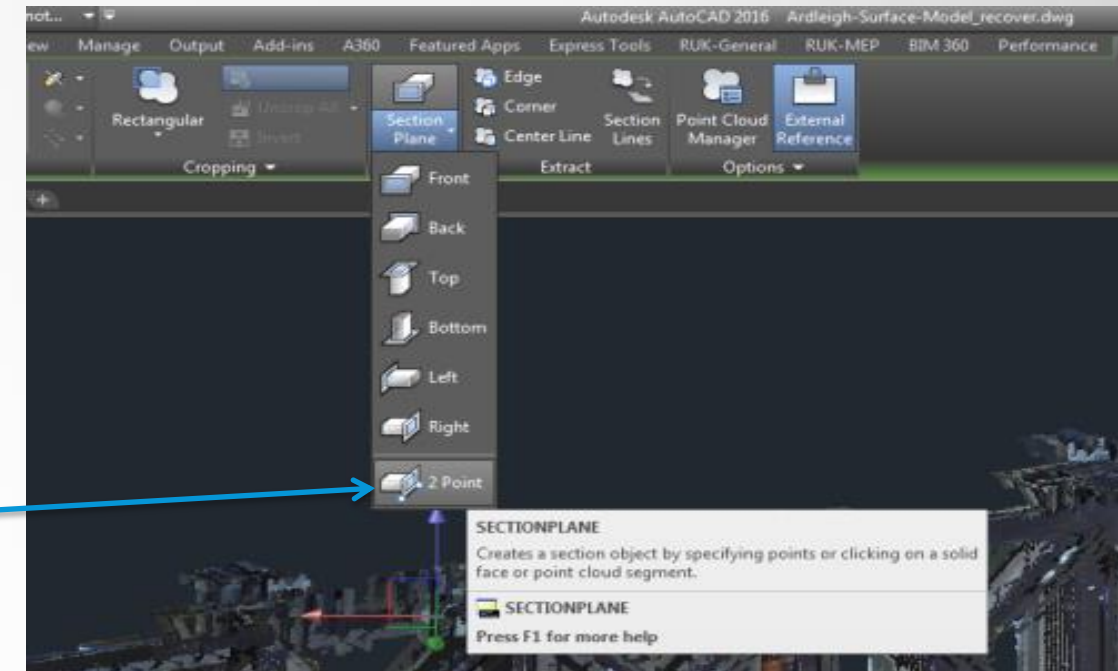
- Repeat the insertion process as previously shown
- Insert a file containing piece of sectioned cloud



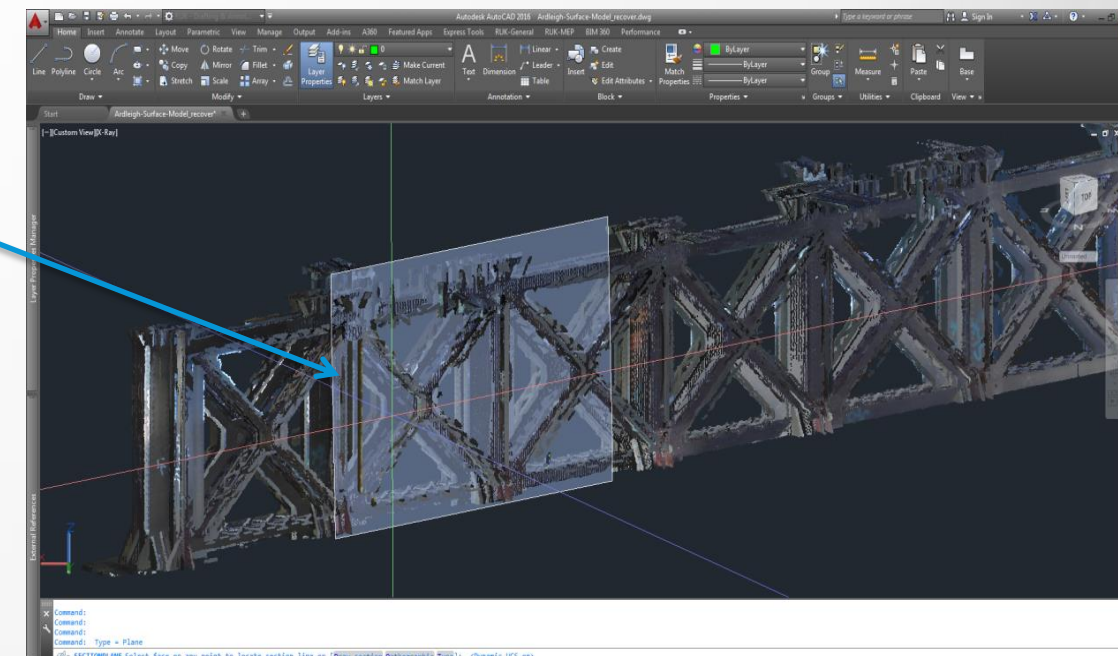
# Insertion of Point Cloud and Placement of Planes

New AutoCAD 2016 functionality allows the user to place planes of the faces of point clouds

- Select the point cloud and then select the “2 point” plane option

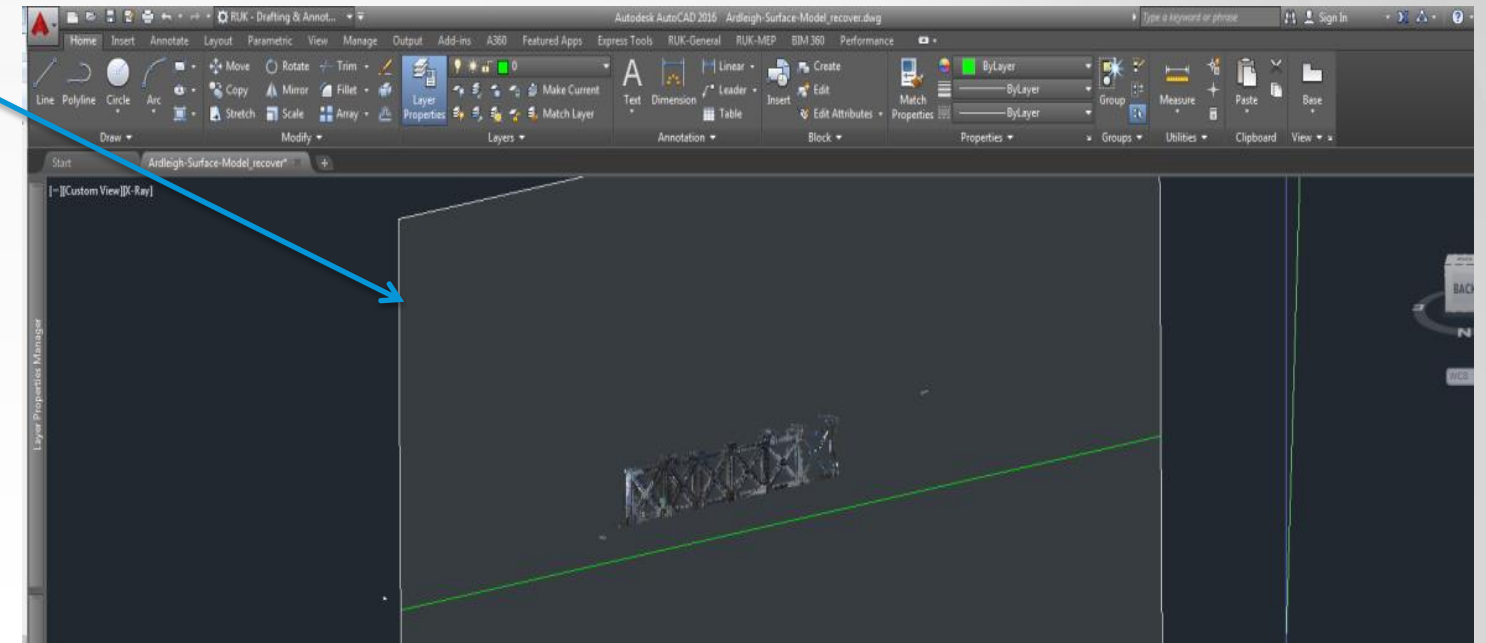


- Select the face where you would like to place the plane
- Ensure that your Dynamic UCS function is turned ON

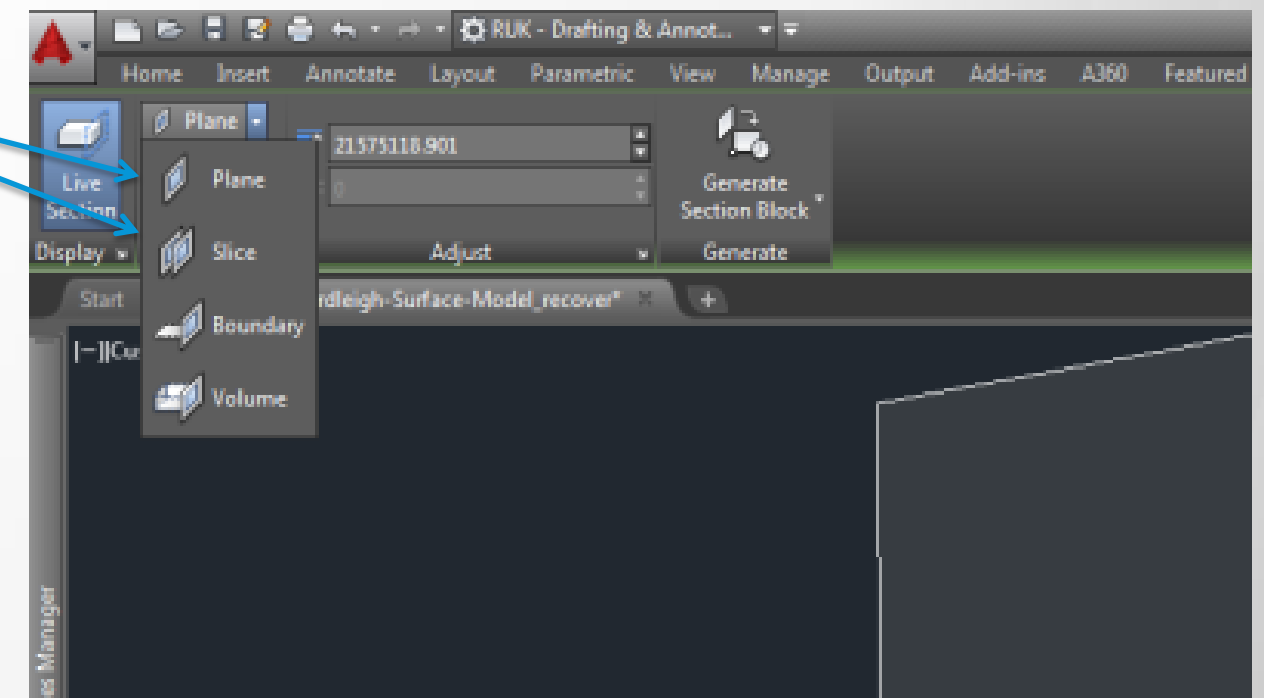


# Insertion of Point Cloud and Placement of Planes

The plane has now been placed and when select the plane you are presented with numerous options



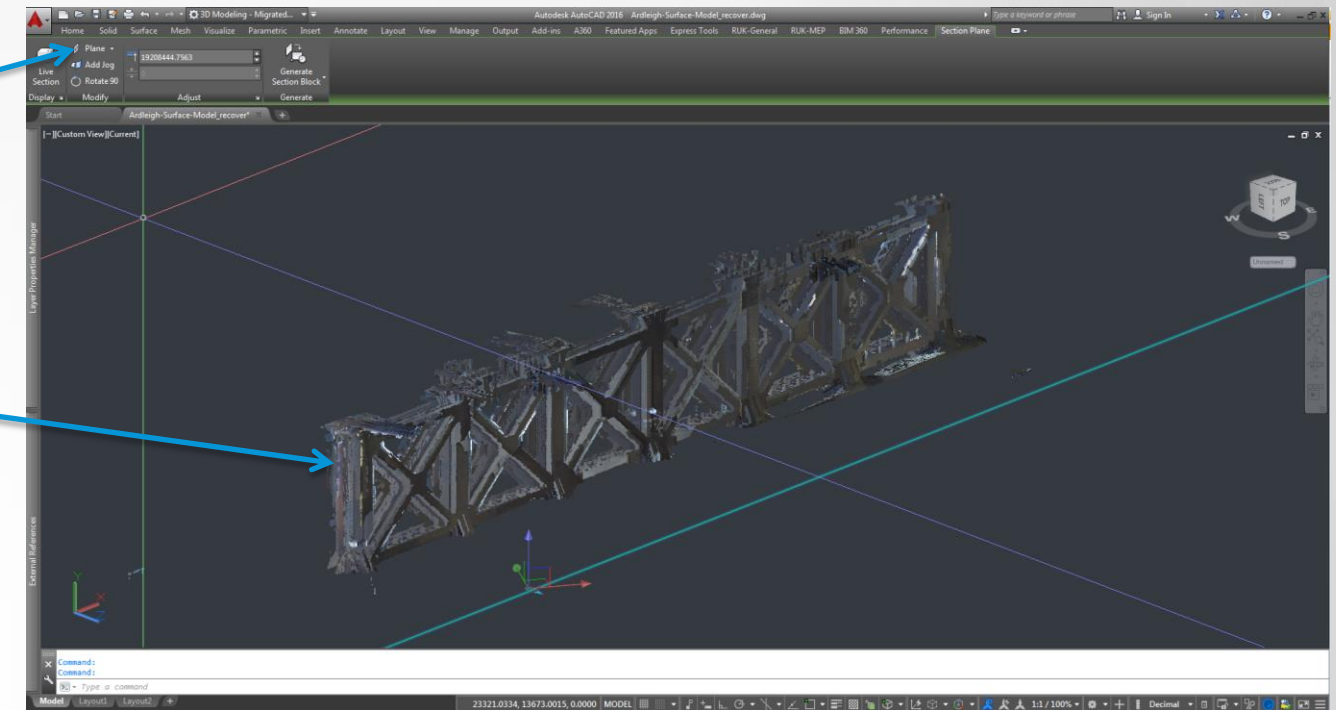
Using the “Plane” and “Slice” options are particularly helpful



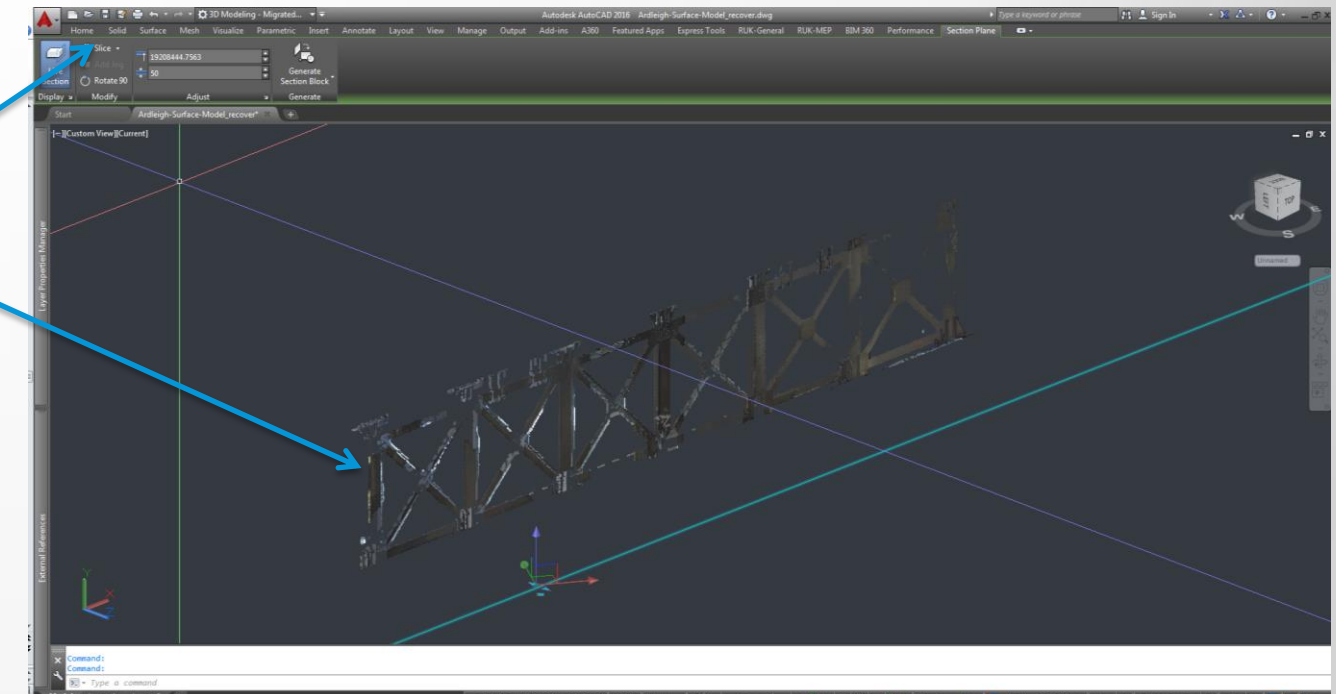


# Placement of Planes – Plane and Slice Option

Plane option shows  
all of the point cloud



Using the “Slice” option allows you to  
specify a thickness of the point cloud



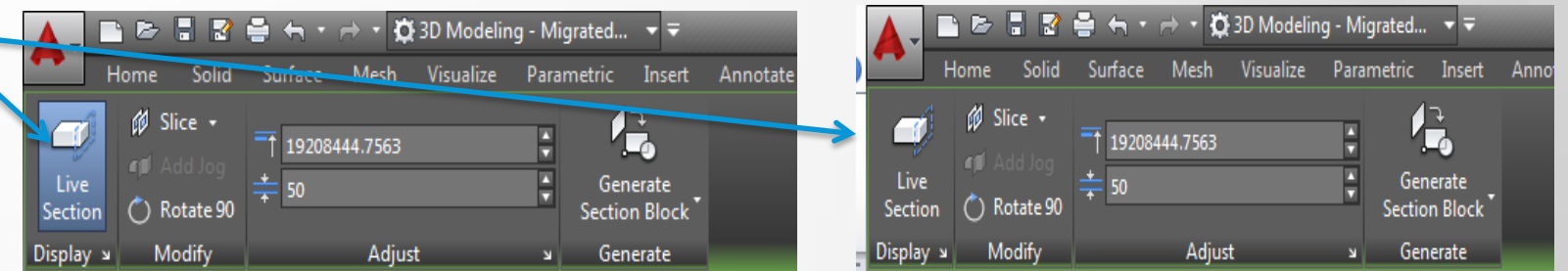
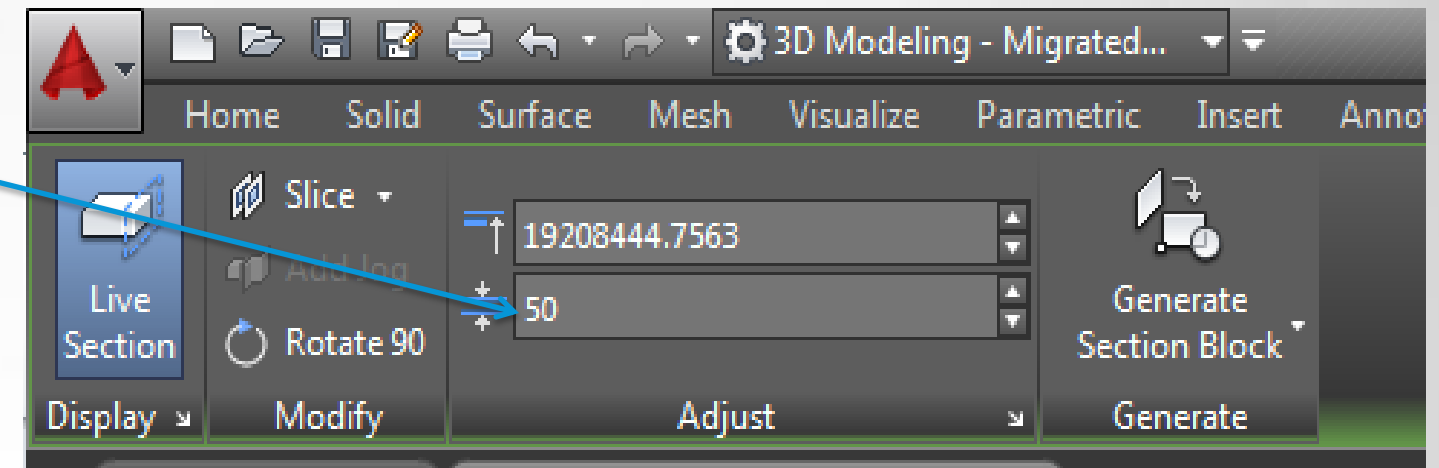


# Placement of Planes – Slice Option

You can adjust the thickness of the “Slice” to give you more and less information

Typically the thinner your slice the more accurate your surface modelling will be

“Live Section” will allow you to toggle the “slice” on and off, to see the slice  
“Live Section” MUST be turned on

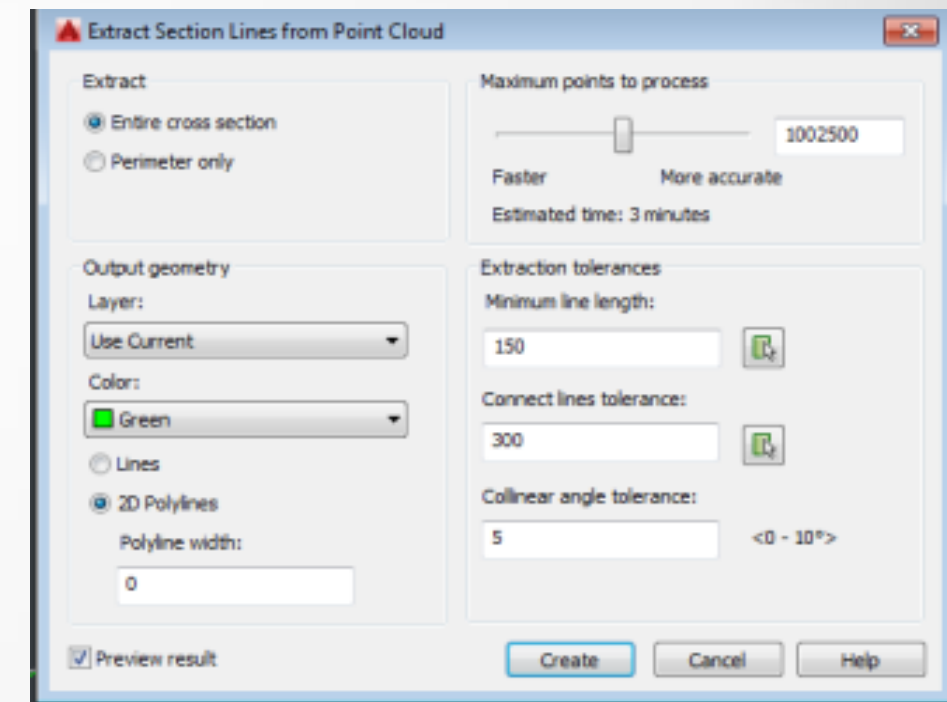
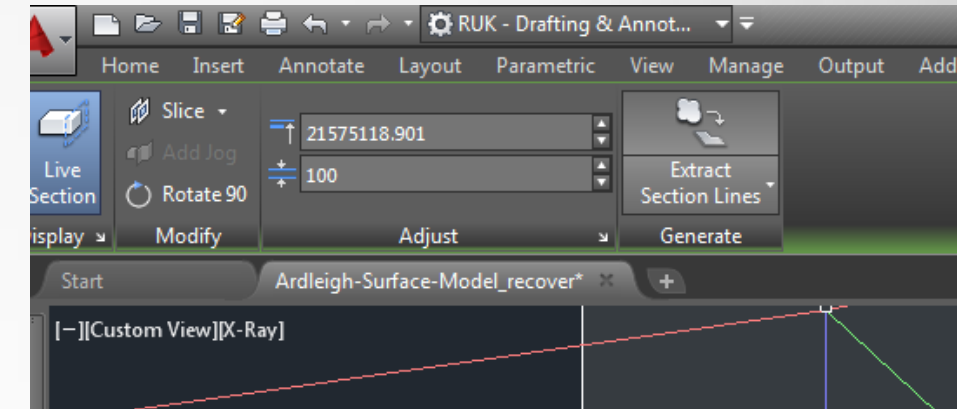


# Extracting Section Lines

AutoCAD's new functionality will effectively draw the section lines for you when a plane is placed

Doesn't give a complete closed geometry loop needed for lofting between geometry to create 3D geometry

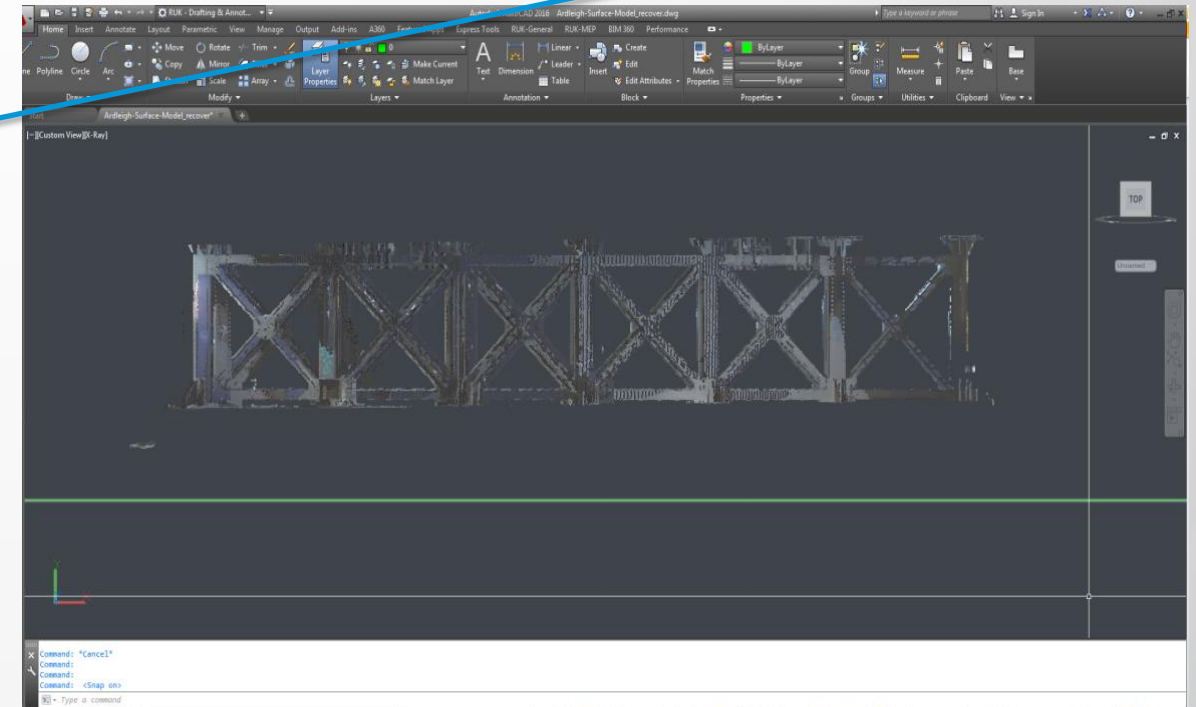
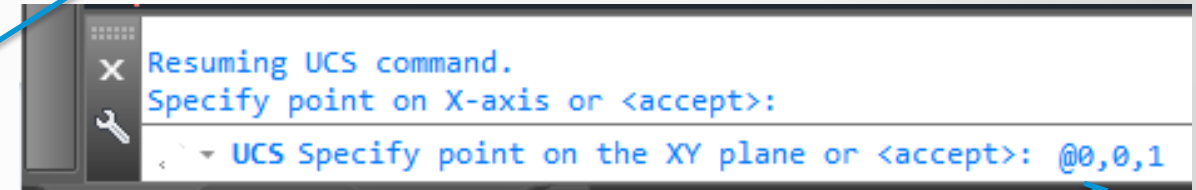
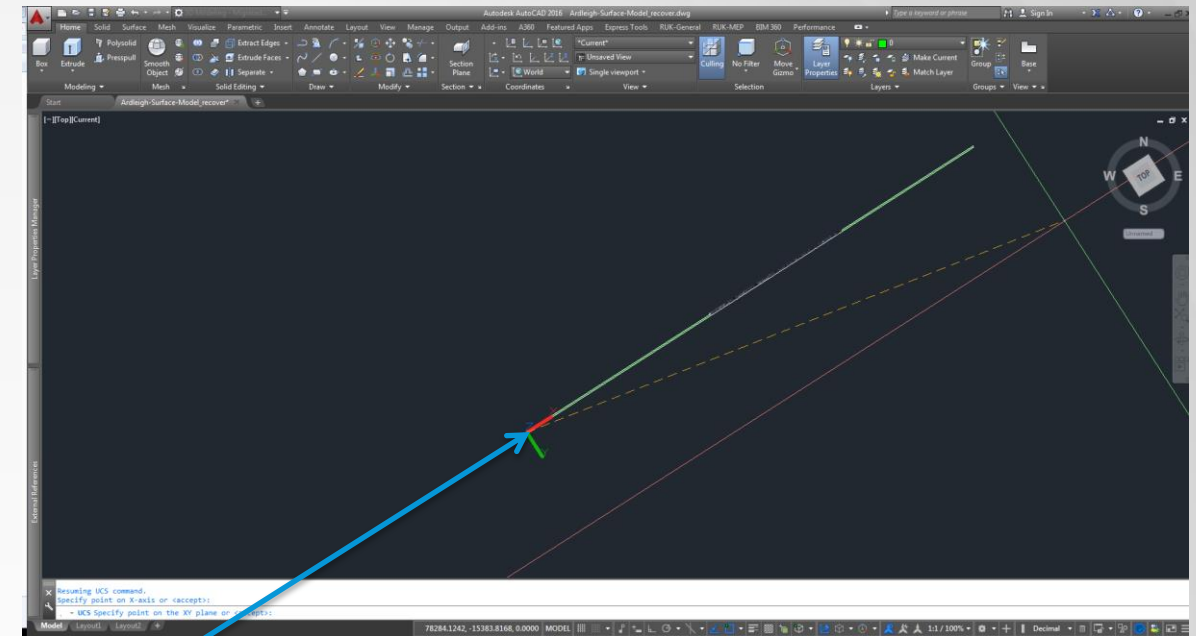
Takes a long time to process even with minimum points being used



# Setting of UCS

Reset the UCS to ensure all traced geometry will be placed in the correct location

- Type “UCS”
- Select centre point at one end of the placed plane (green line) and then the other end
- Type “0,0,1”
- Type “Plan” and press “Enter”



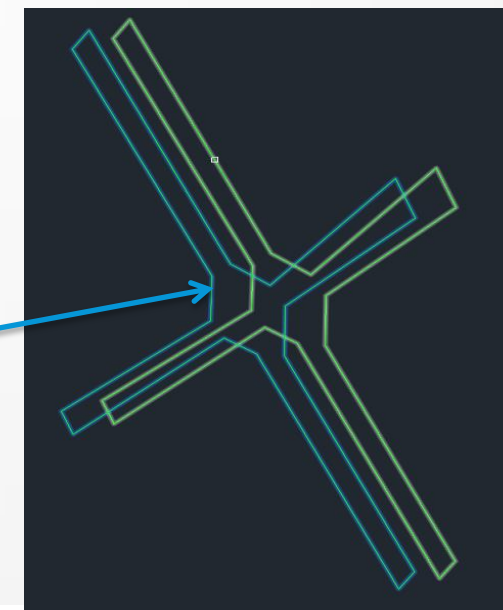
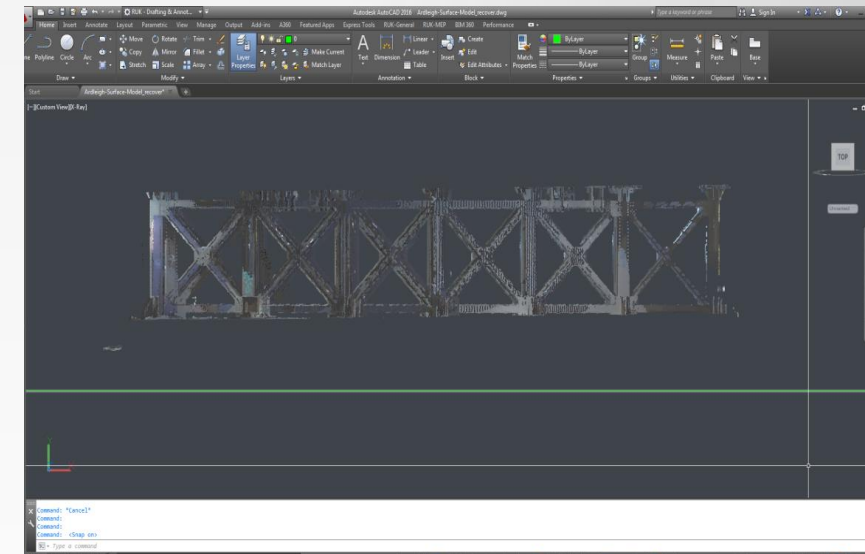
# Tracing of Point Cloud

To create 3D geometry you effectively now need to trace the point cloud and then “Loft” the geometry

Trace the element you would like to surface model

You can copy the drawn geometry backwards and loft or you can repeat the plane placement process on the other side

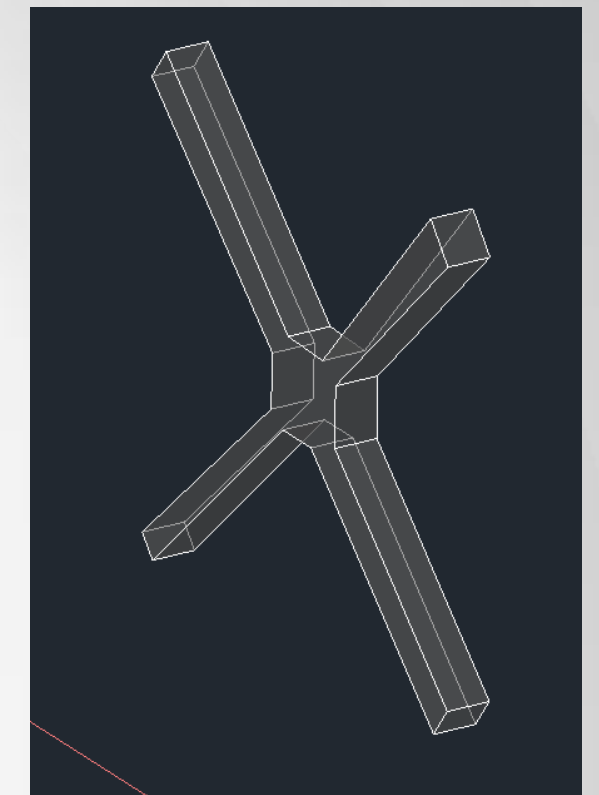
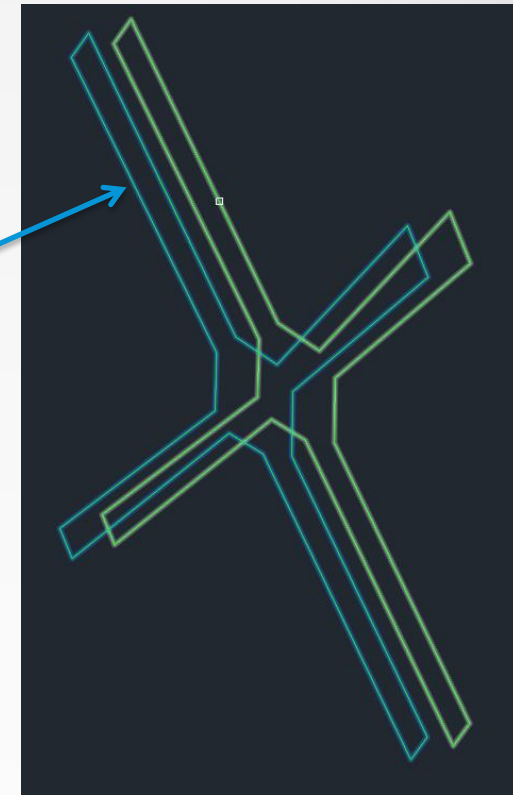
Here, I copied the geometry backwards because I knew the thickness of the element



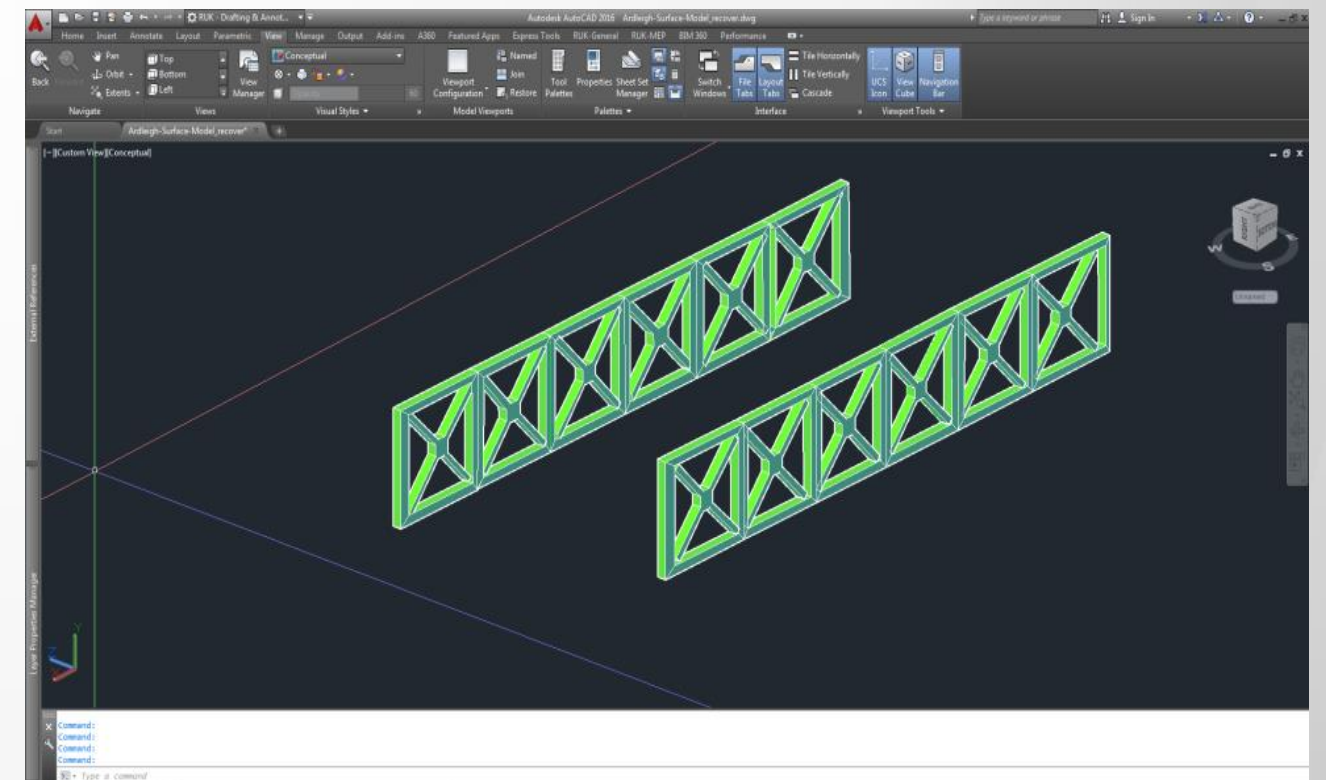


# Lofting to Create a 3D Surface

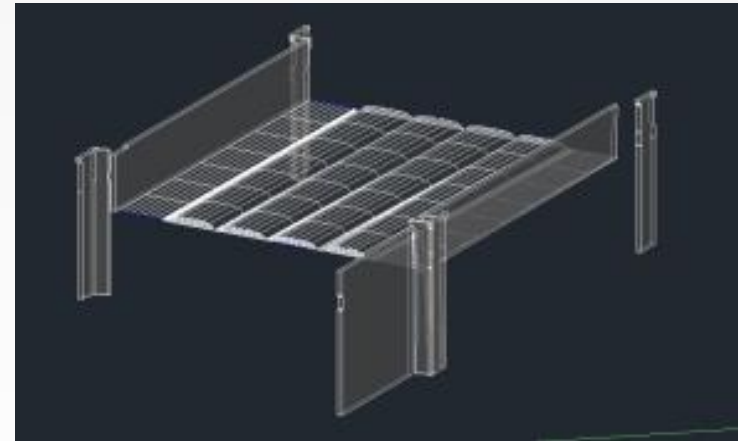
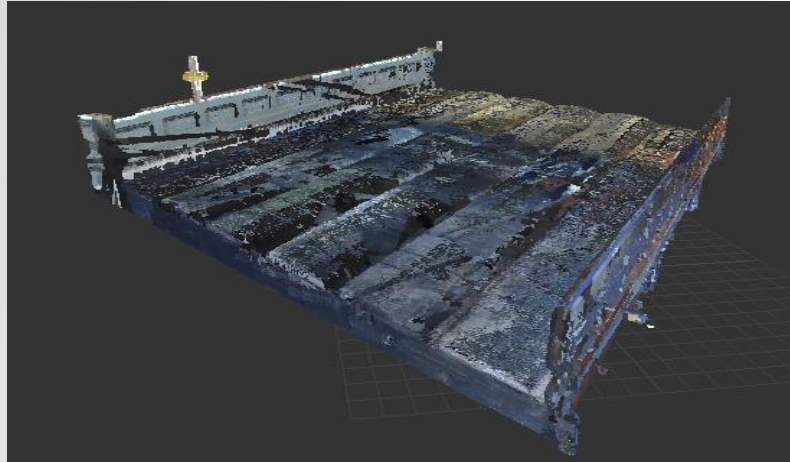
- Type “Loft”
- Select both pieces of geometry
- Press “Enter” then “Enter”



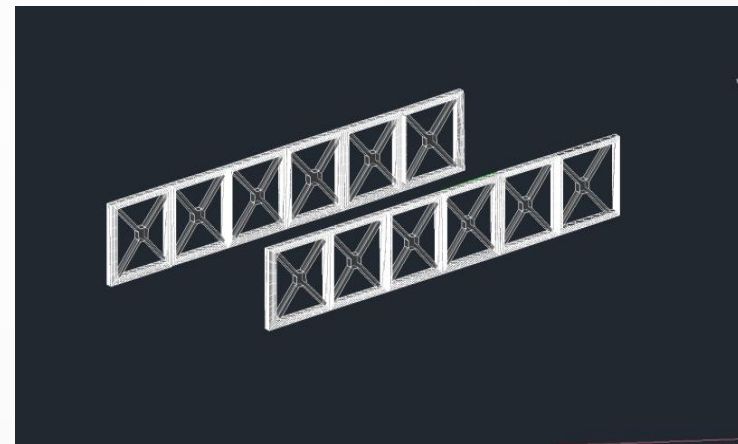
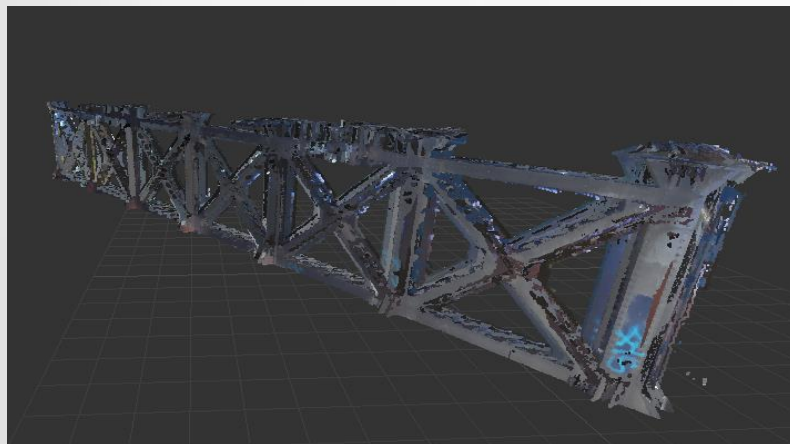
Repeat the plane placement, setting of UCS, tracing of point cloud and lofting tasks to build up your 3D surface model



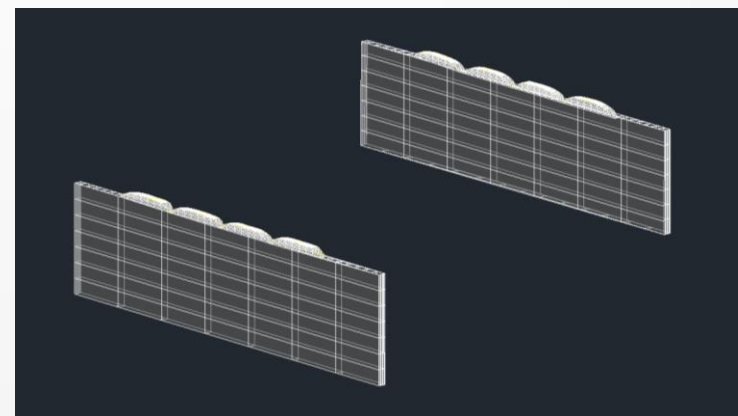
# Point Cloud/Model Comparison – Individual Elements



Concrete Deck Comparison



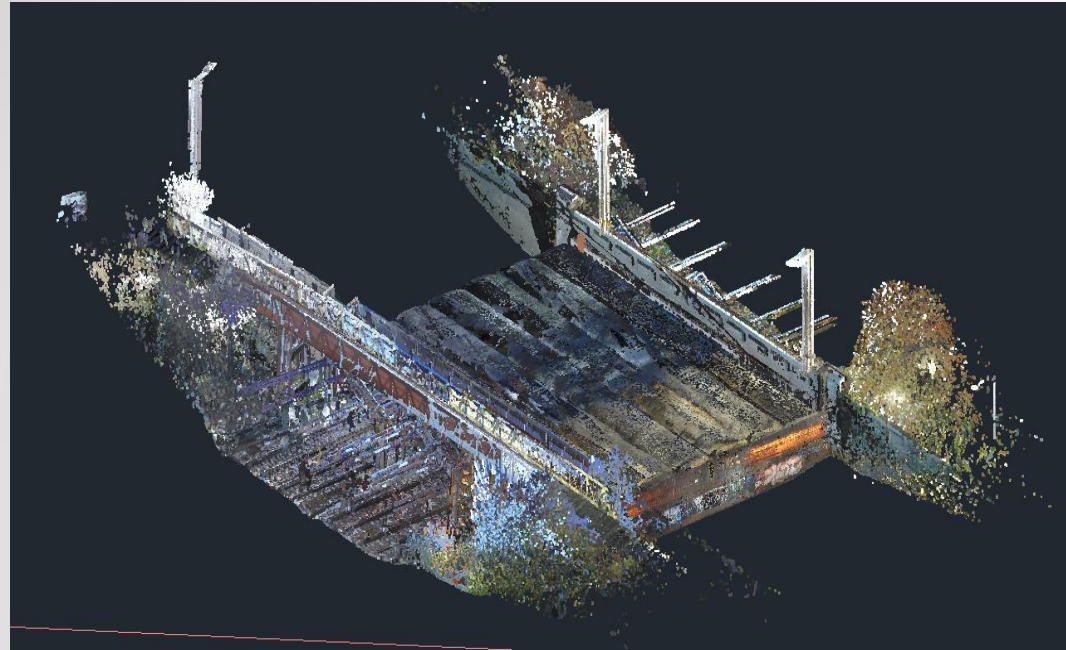
Steel Truss Comparison



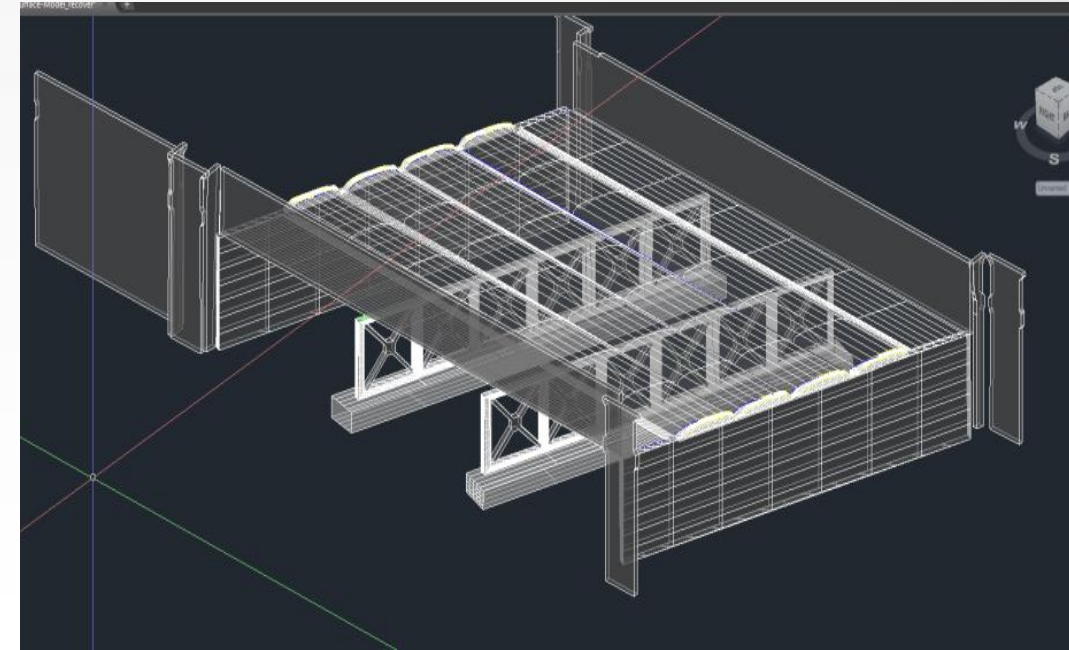
Abutment Walls Comparison



# Point Cloud/Model Comparison – Full Structure

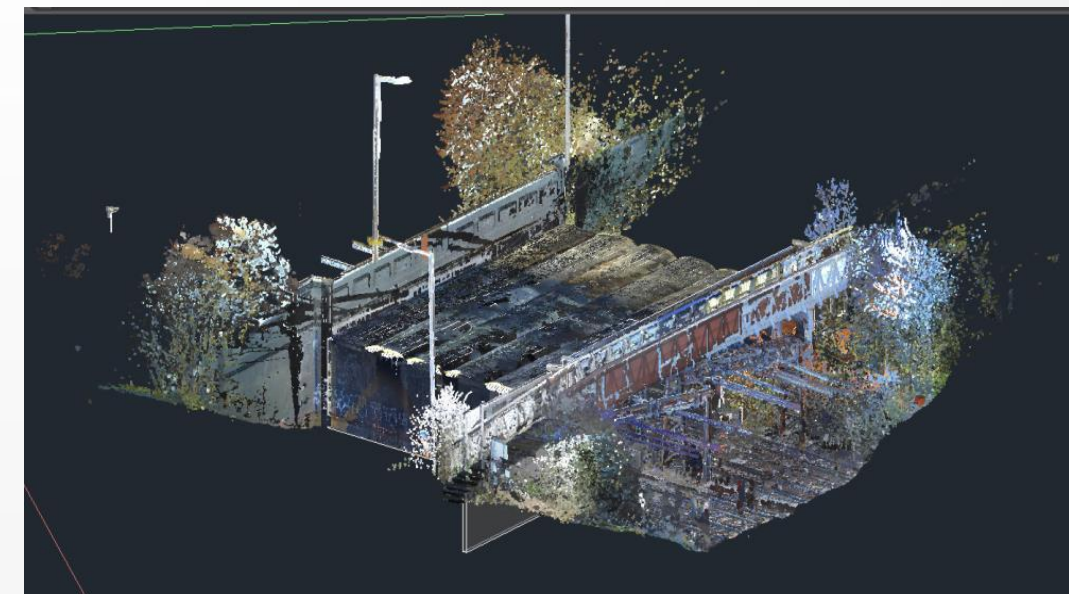


Full point cloud



Full 3D surface model

surface model overlaid  
onto point cloud



# Learning Objective 4

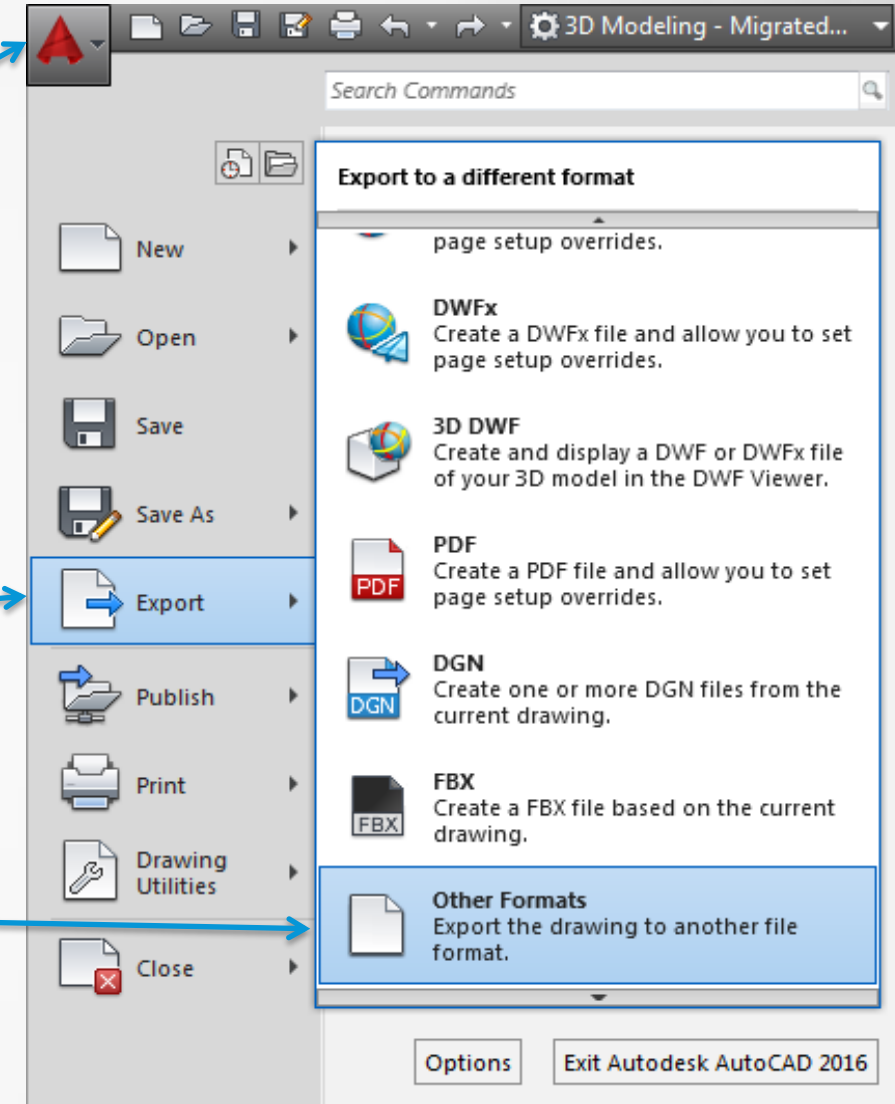
## Importing & Adding Additional Elements in Autodesk Inventor



# Export the Surface Model from AutoCAD

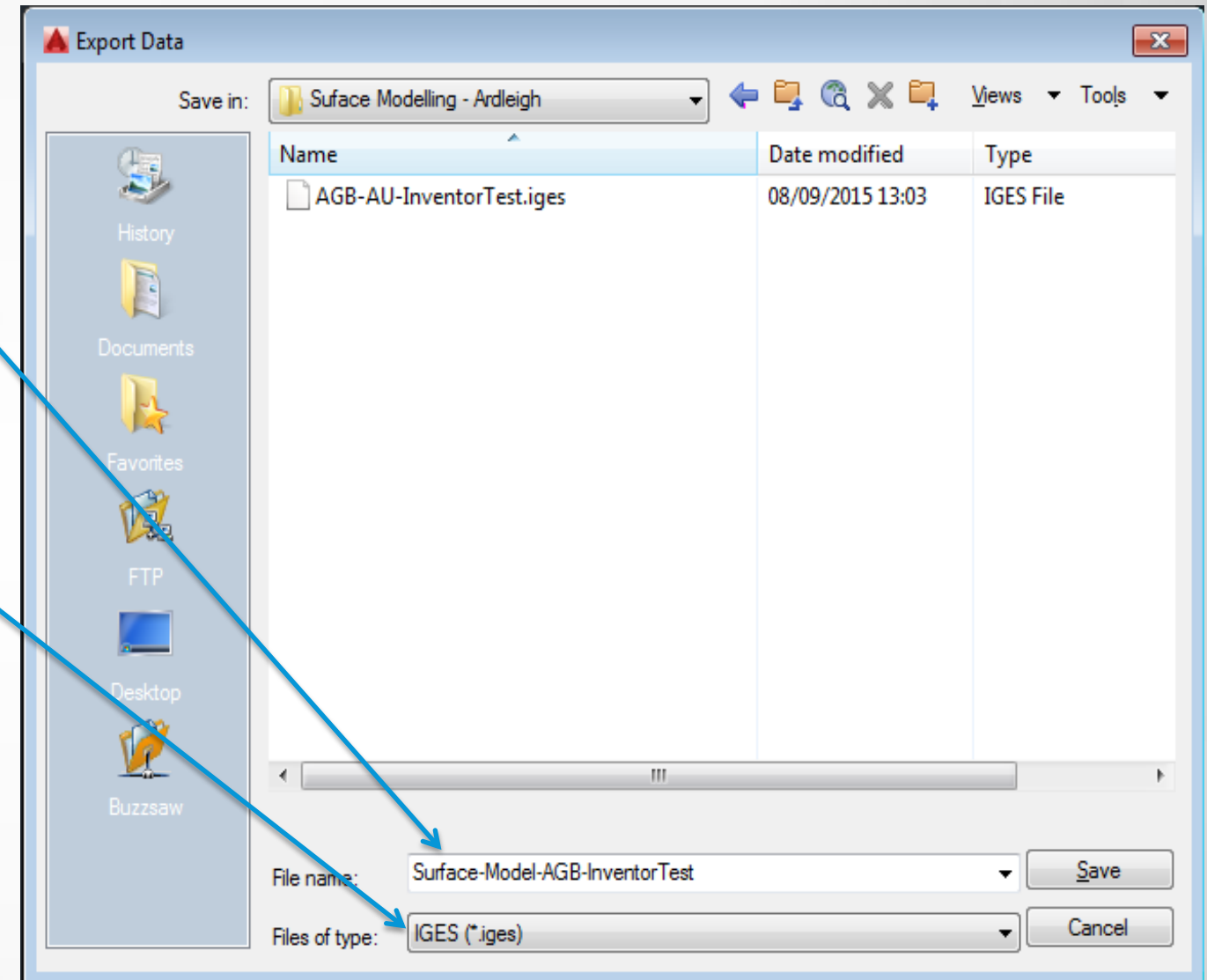
First we need to export the surface model into a format that Inventor can recognise

- Select the AutoCAD symbol
- Move down to “Export”
- Select “Other Formats”



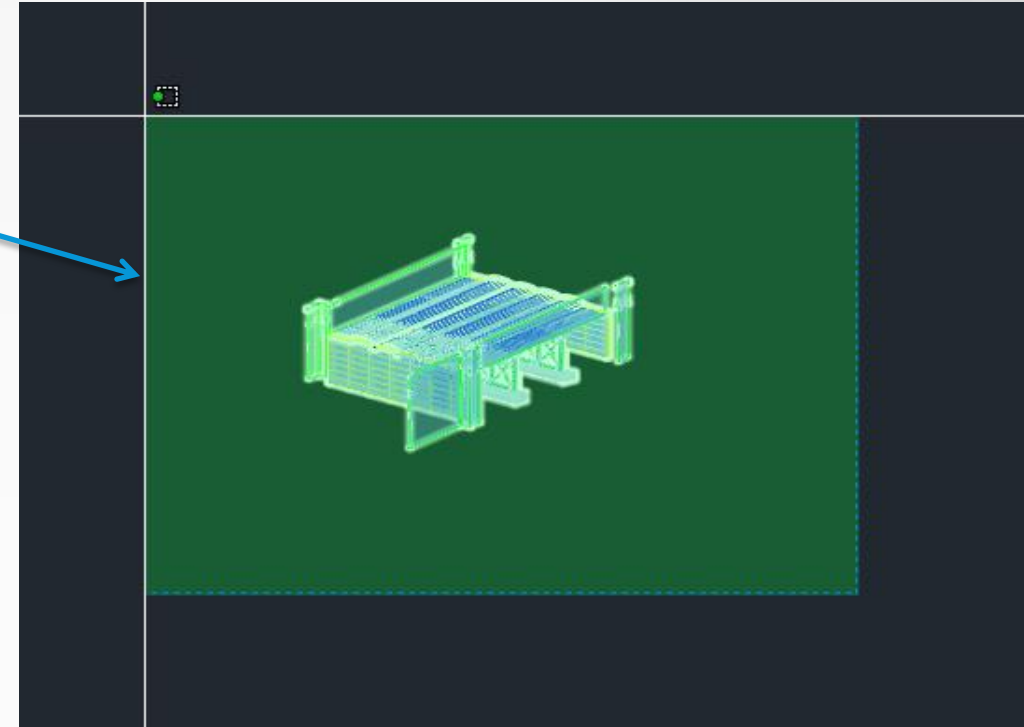
# Export the Surface Model from AutoCAD

- Create a Suitable File Name
- Select a Save Location
- Change Type of File to IGES (\*.iges)
- Select “Save”

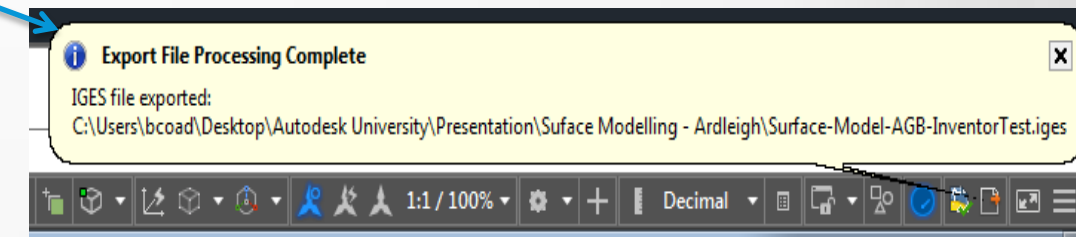


# Export the Surface Model from AutoCAD

- To export the surface model, hold “Left Mouse Button” and create a crossing window covering the entire surface model



- When the surface model has finished exporting you will be presented with the following message

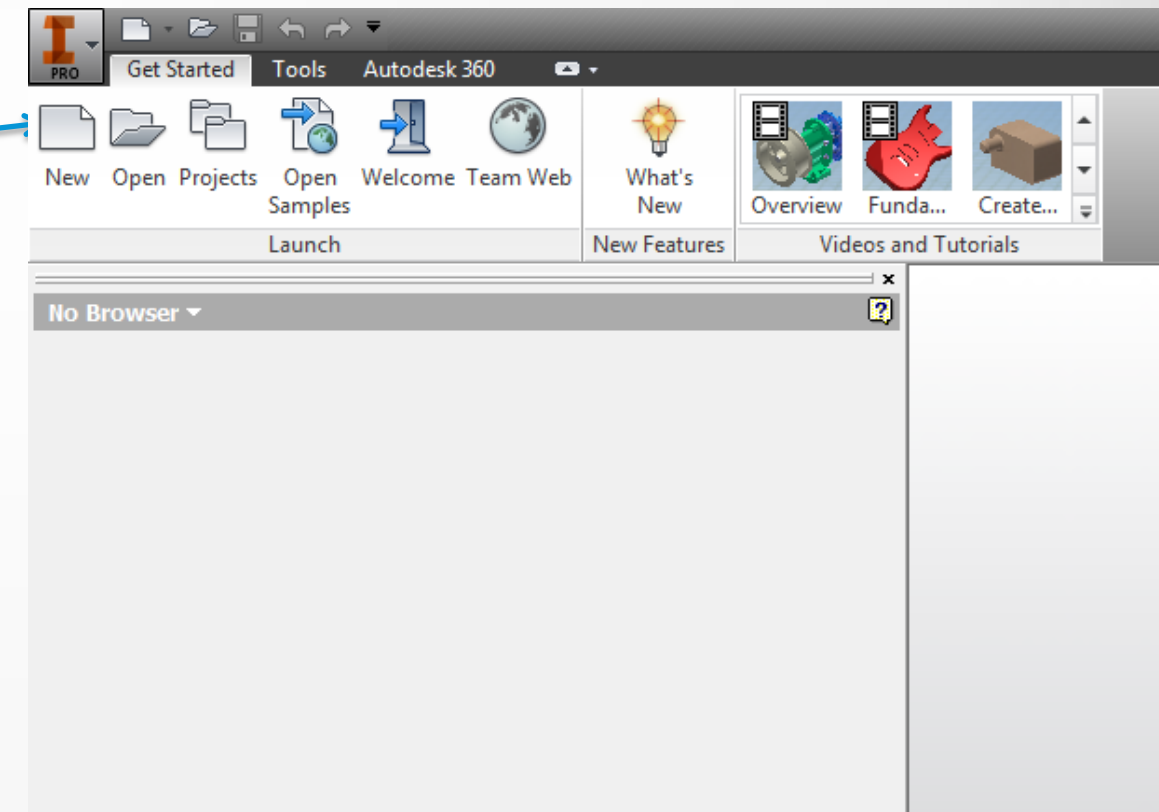


# Import the Surface Model into Inventor

- Open “Autodesk Inventor”



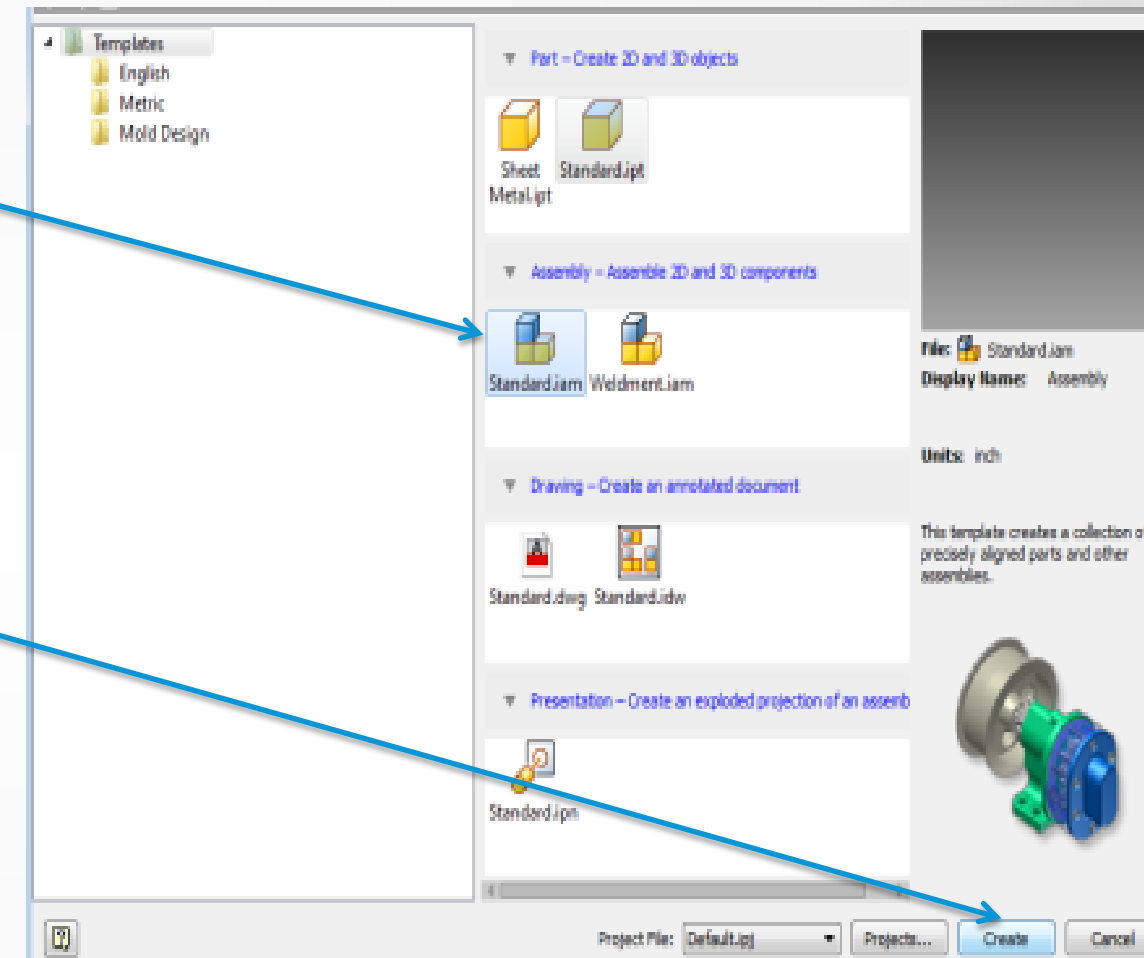
- Select “New”





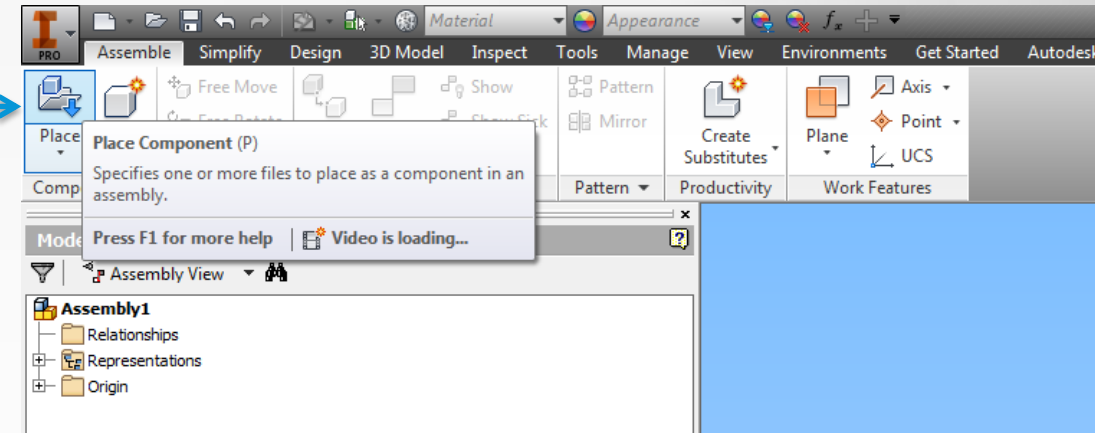
# Import the Surface Model into Inventor

- Select the assembly file “Standard.iam”
- Select “Create”

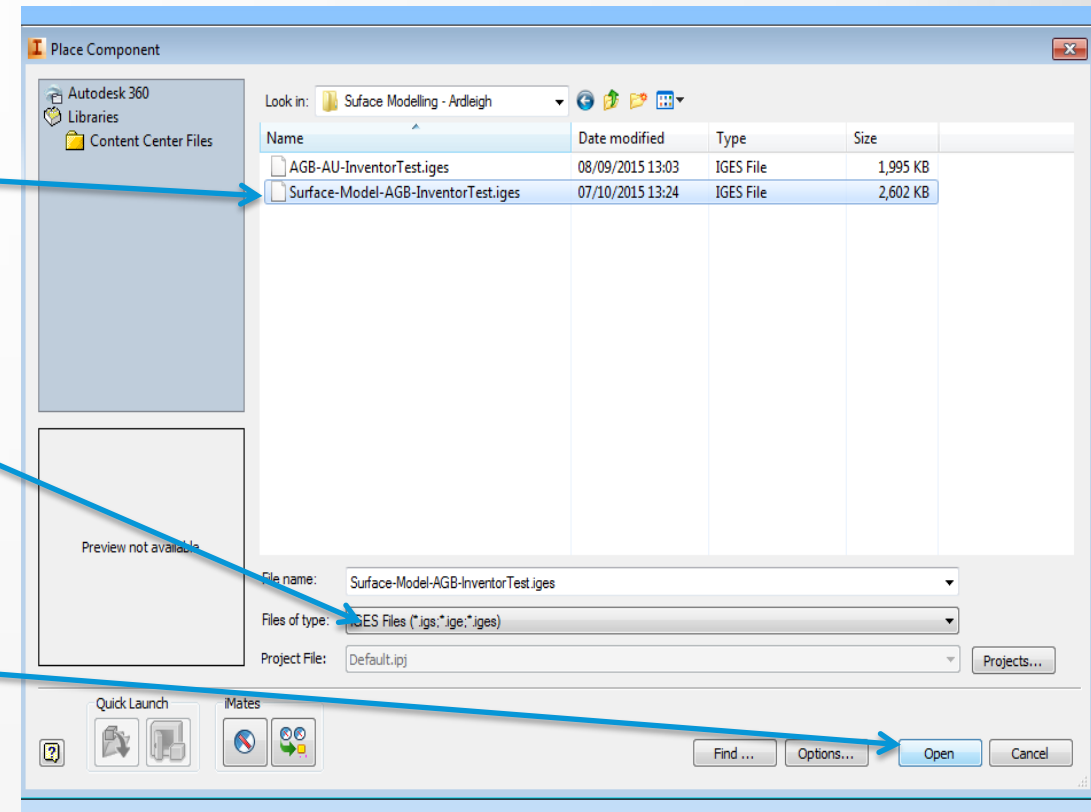


# Import the Surface Model into Inventor

- Select “Place Component”



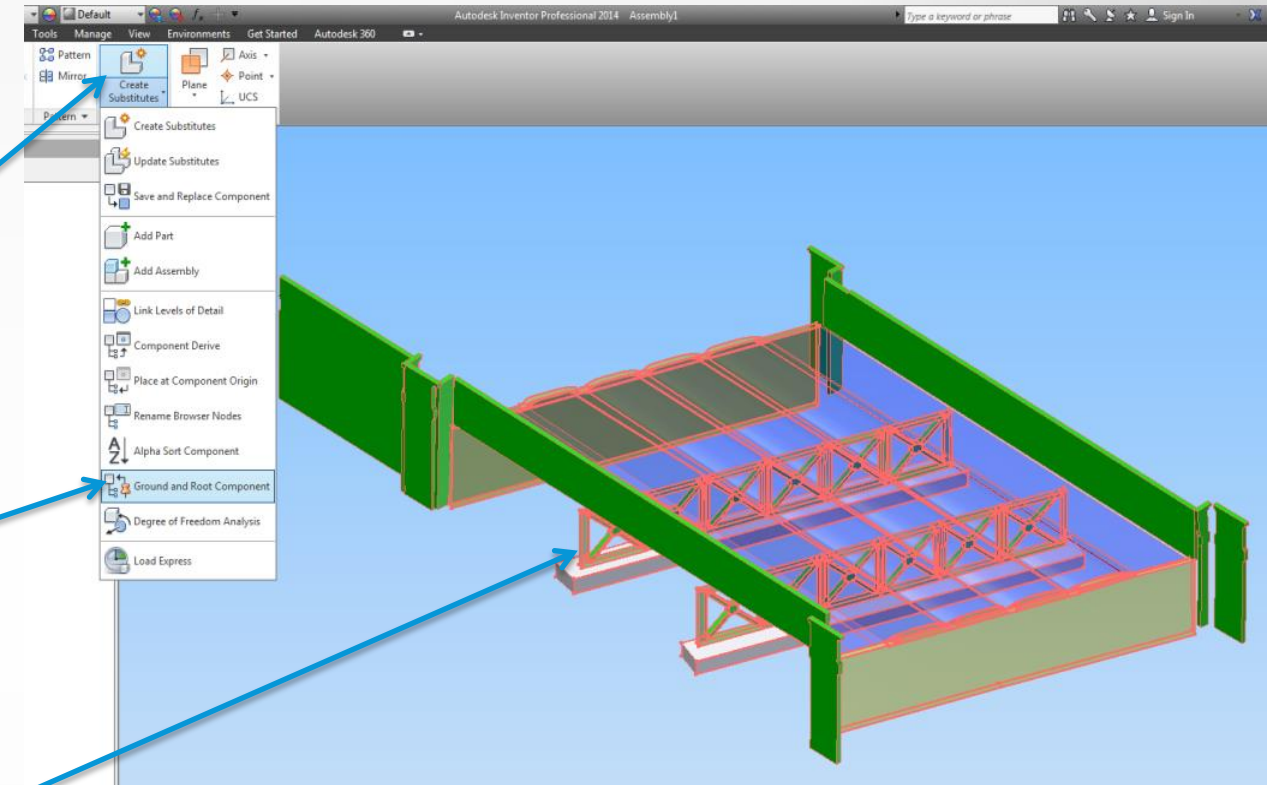
- Select the Exported .IGES file
- Ensure file type is set to IGES Files
- Select “Open”



# Import the Surface Model into Inventor

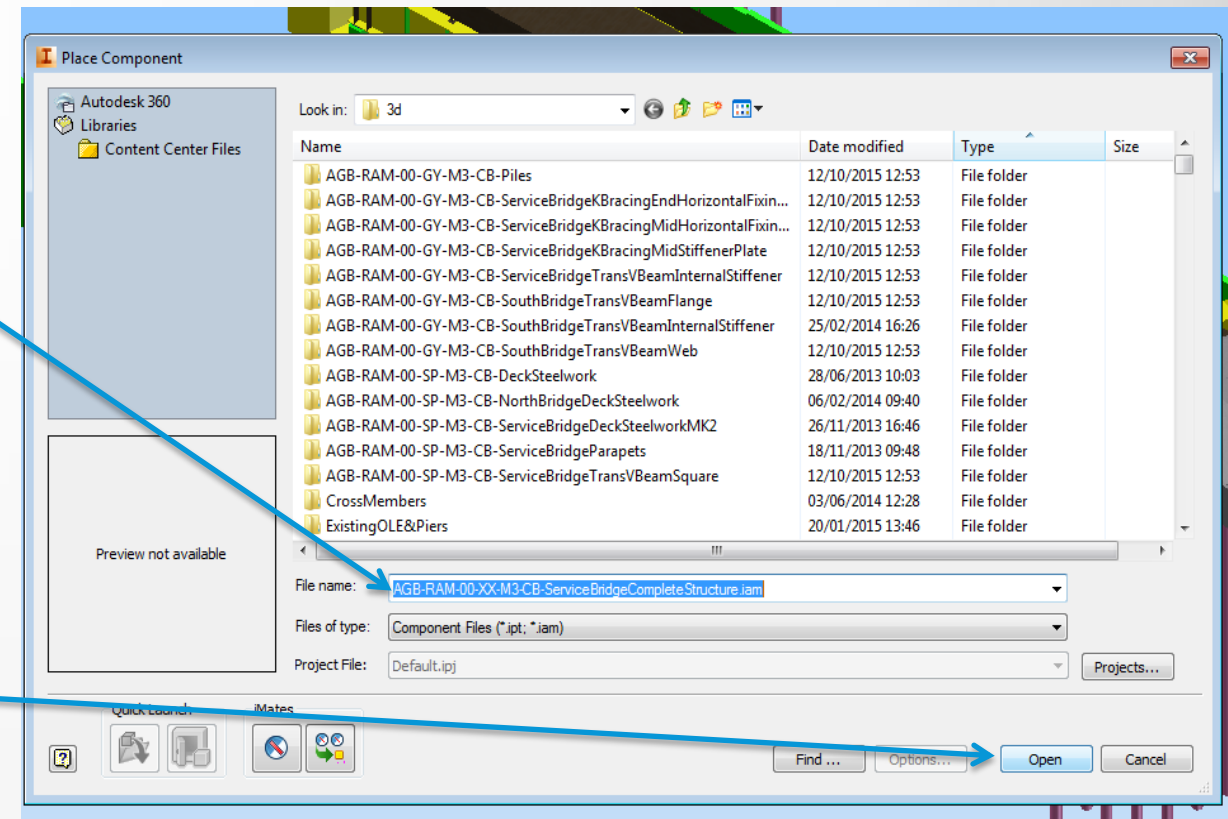
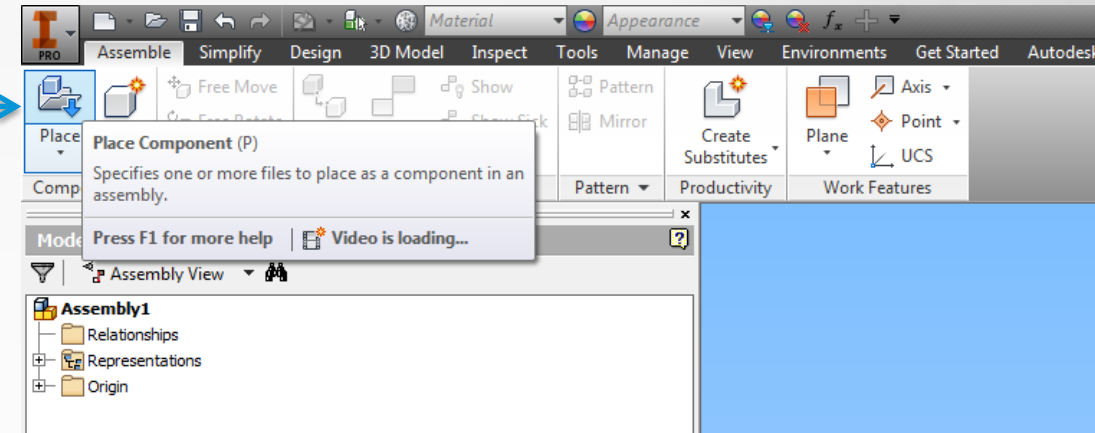
Ground and root the surface model to lock it in place

- Select the “Create Substitutes” drop down
- Select “Ground and Root Component”
- Select the Surface Model



# Adding Additional Elements

- Select “Place Component”
- Browse to the additional element you want to insert and select the file
- Select “Open”

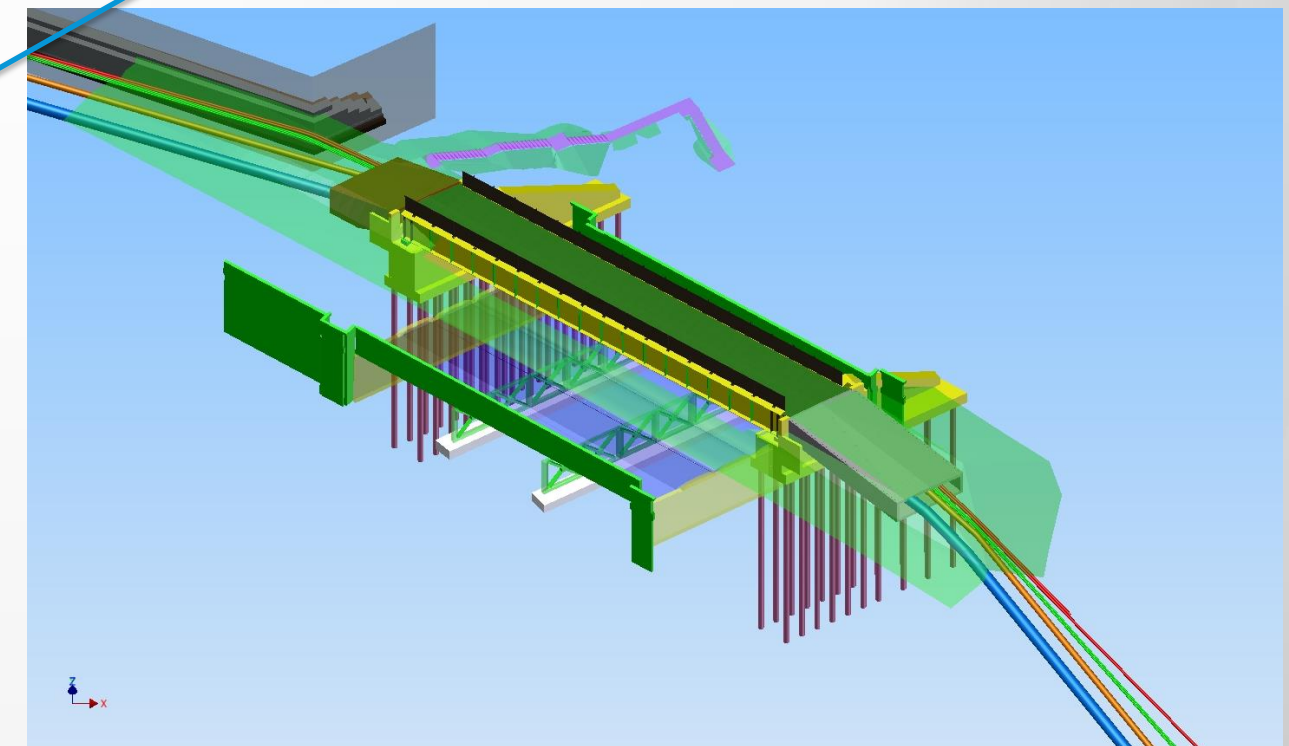
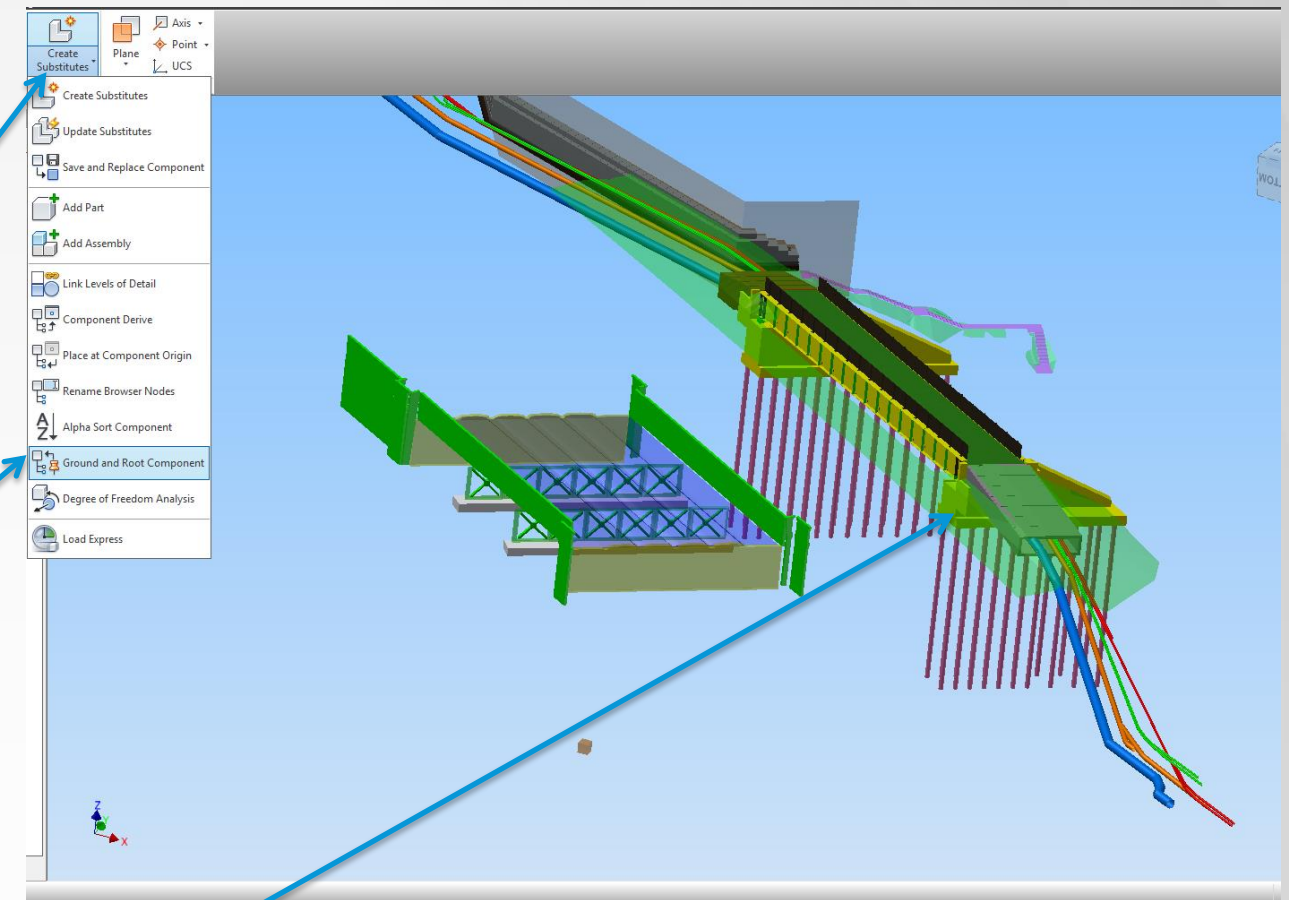




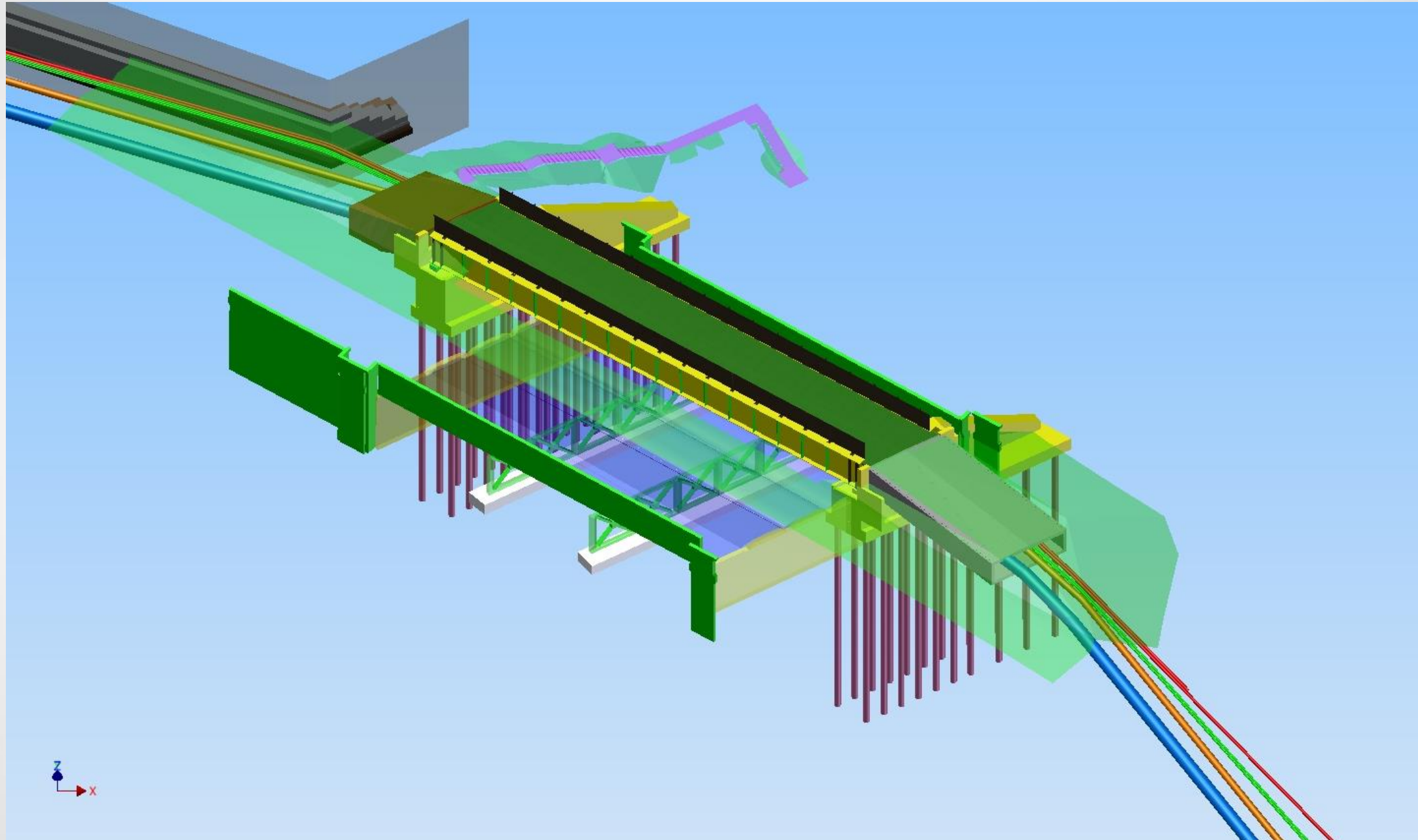
# Adding Additional Elements

Ground and root the additional element to lock it in place

- Select the “Create Substitutes” drop down
- Select “Ground and Root Component”
- Select the Additional Element

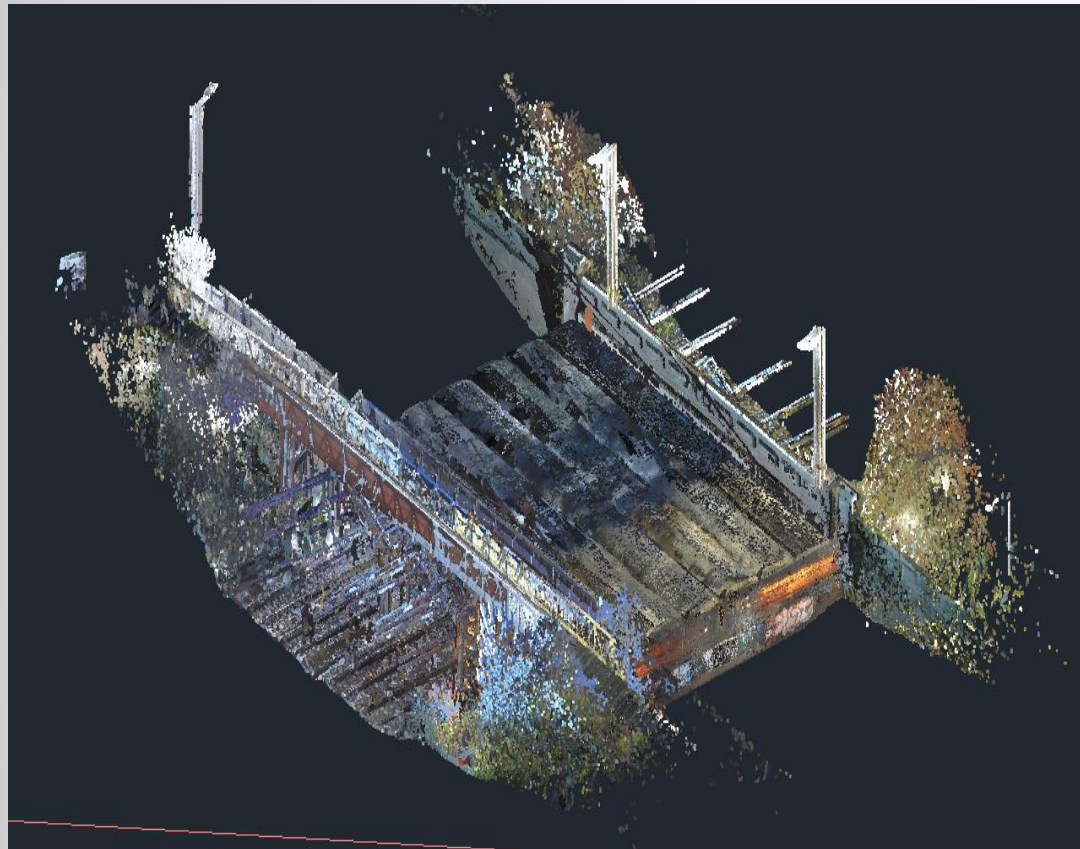


# Finished Surface Model with Additional Elements

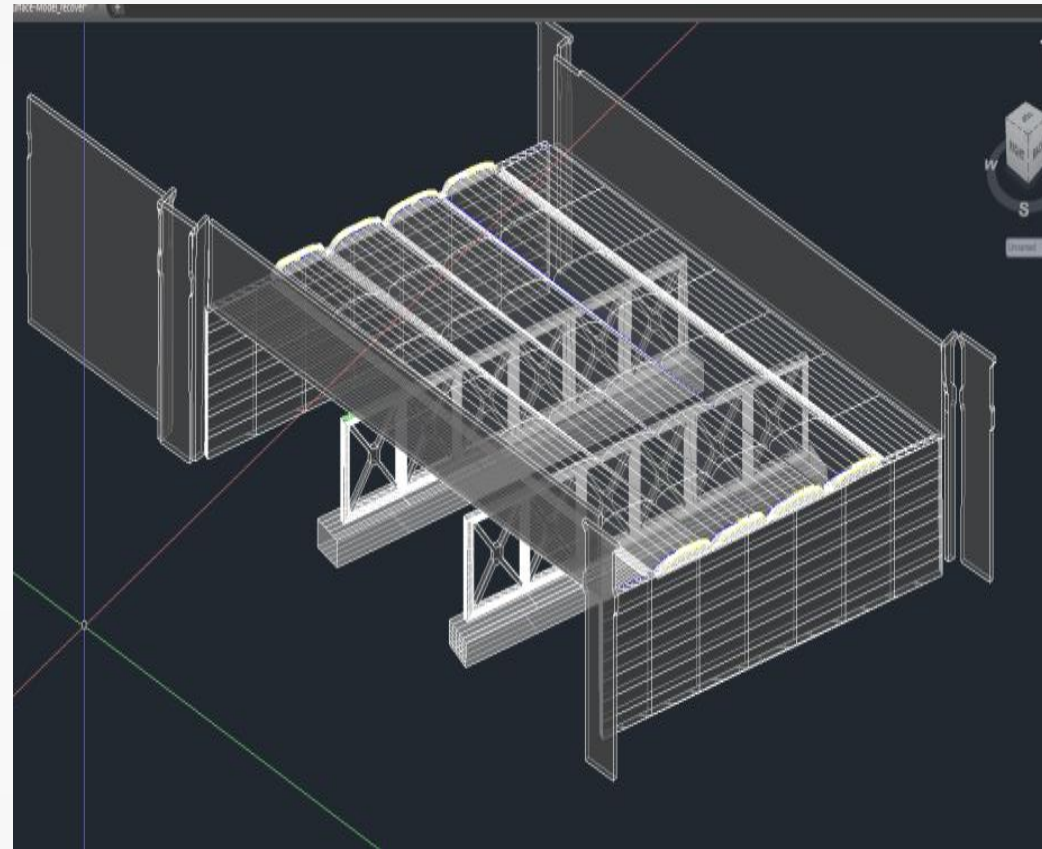




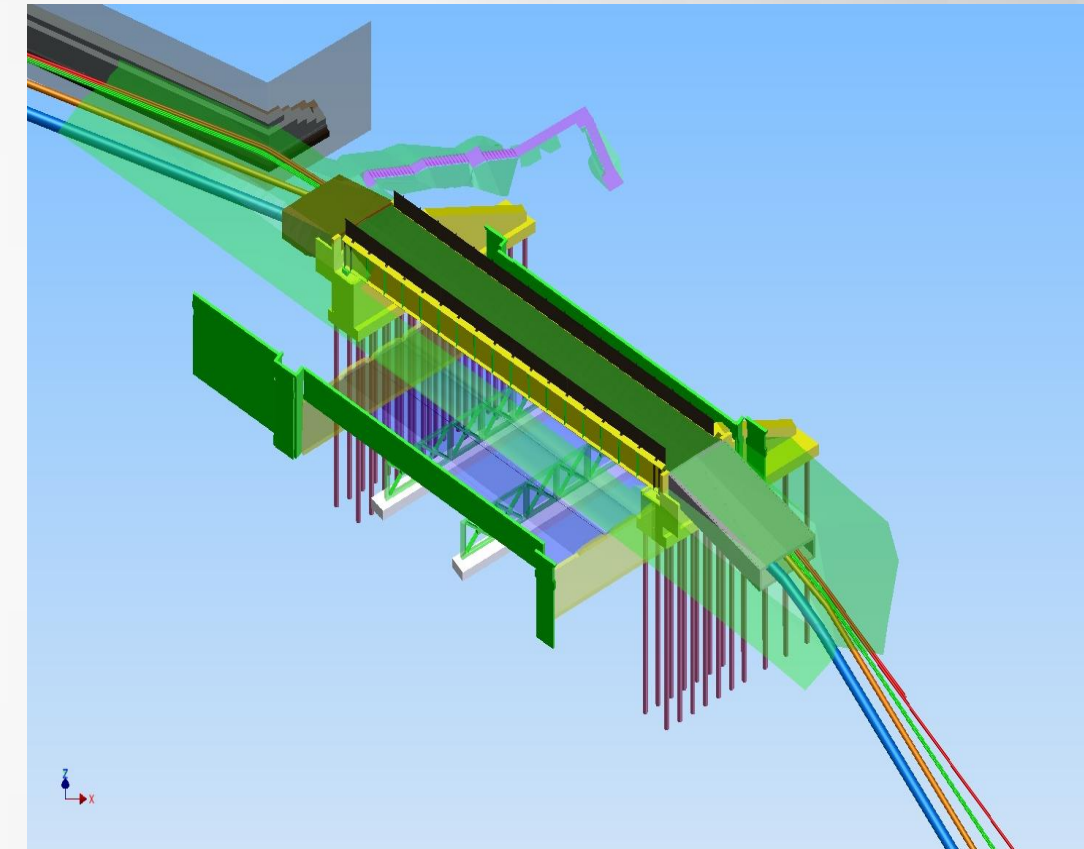
# From Start to Finish



Point Cloud



Surface Model



Surface Model w/  
additional elements

# Summary – Benefits of Surface Modelling from Point Clouds

- Quick and easy to create
- Can be used to detect any possible clashes between existing and proposed elements
- Detect possible design implications
- Reduce costs that can be incurred by design implications



- If you have ANY feedback (Good or bad) please use the computers outside or the app to submit feedback!!!
- Please note this presentation will be available for download after AU2015.



[www.ramboll.co.uk](http://www.ramboll.co.uk)

# Thank you!

## Any Questions?

Contact: [ben.coady@ramboll.co.uk](mailto:ben.coady@ramboll.co.uk)  
[chris.bargent@ramboll.co.uk](mailto:chris.bargent@ramboll.co.uk)

Website: [www.ramboll.co.uk](http://www.ramboll.co.uk)



[www.ramboll.co.uk](http://www.ramboll.co.uk)

