

Computational Design for Civil Engineers

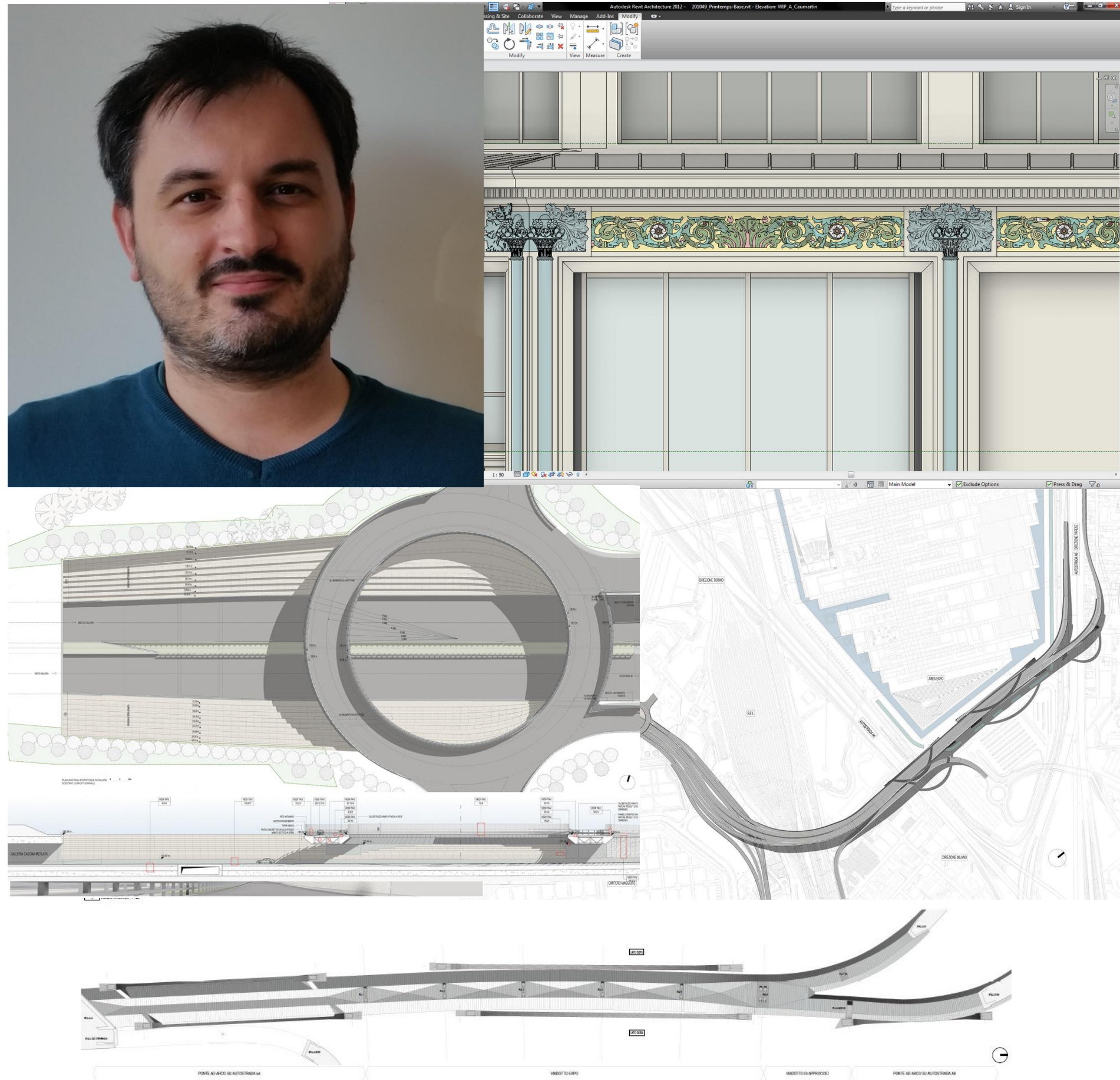
Paolo Emilio Serra

Autodesk

Safi Hage

Autodesk





Paolo Emilio Serra

Implementation Consultant, Autodesk

2008 – 2014 BIM Manager

2013 – Revit API & Dynamo

2014 – Autodesk Consulting

paolo.serra@autodesk.com

[@PaoloESerra](https://twitter.com/PaoloESerra)

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Safi Hage

Designated Support Specialist, Autodesk

Is a structural engineer by trade. Since 2014 he is a Designated Support Specialist at Autodesk working with enterprise priority customers worldwide focused on the AEC industry. Before joining Premium Support Organization, he was an Autodesk Technical Consultant BIM for 6 years.

Automation

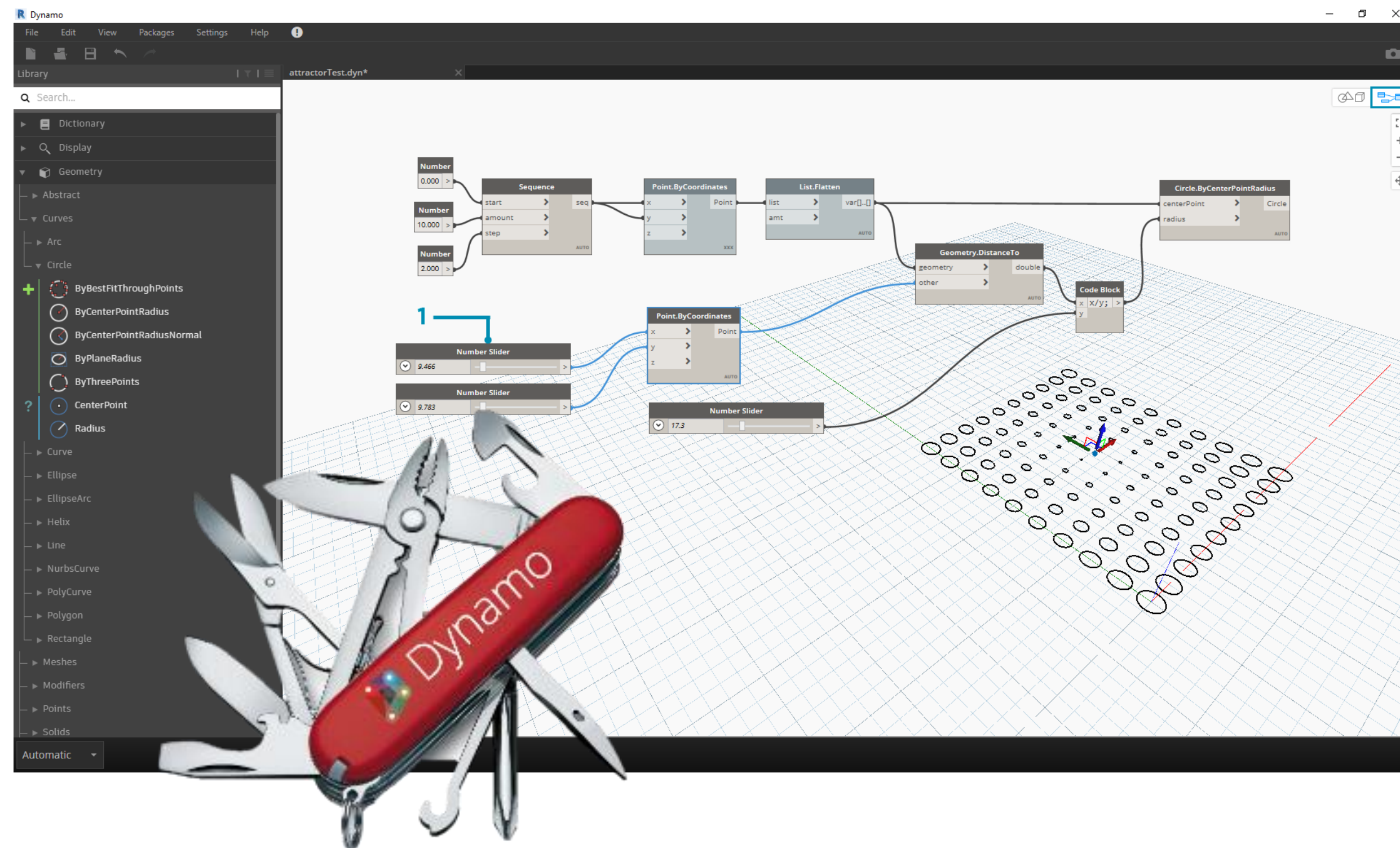


Design Automation with Dynamo

Complex Modeling | **More**

Model Data Consistency | **Better**

Automate Repetitive Tasks | **Less Effort**



C++

C# .NET

Python



Dynamo

Interactive
Tools

Pencil + Clay

The Journey

Traditional Design

Recording decisions

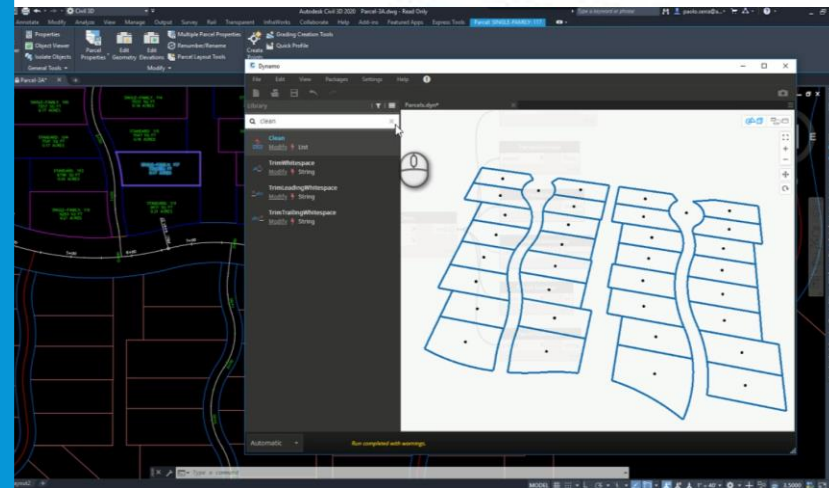
Generative Solutions

Describing goals + constraints for computation

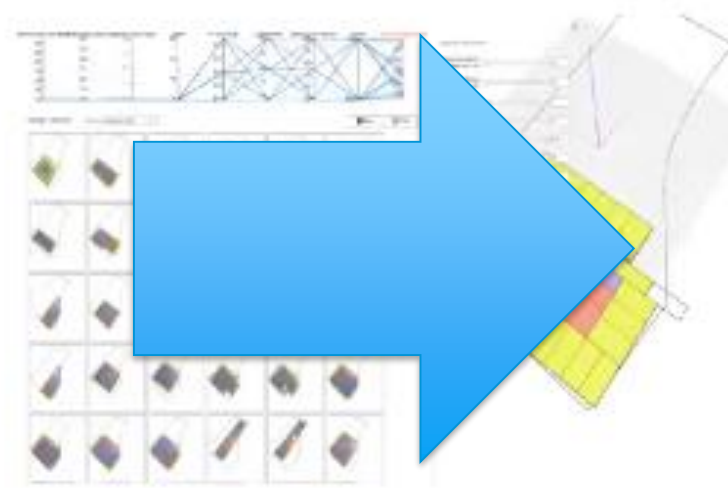
Parametric
Modeling



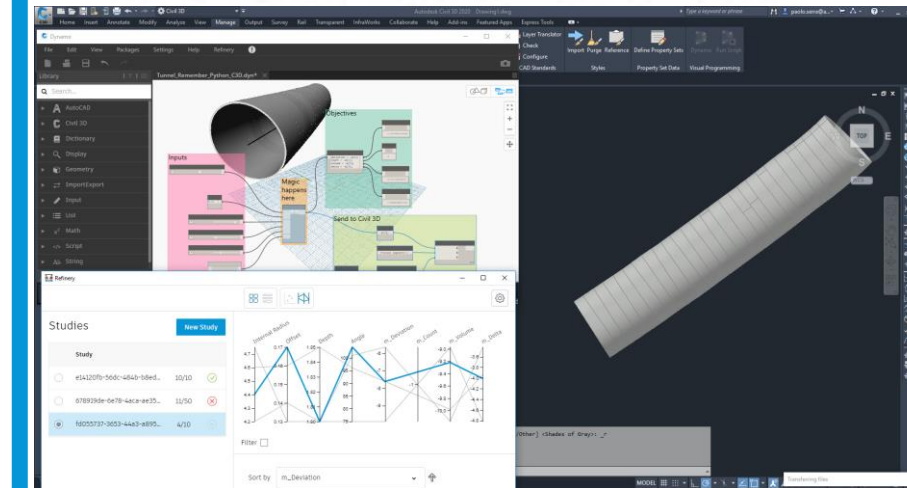
Visual
Programming



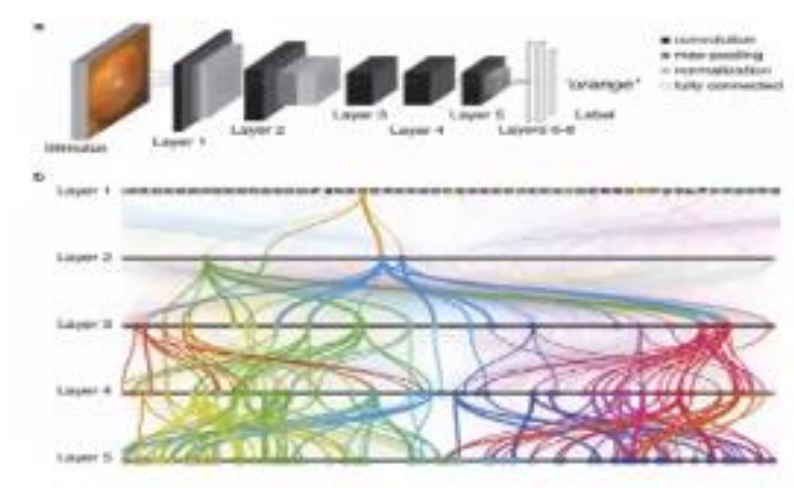
Option
Generation



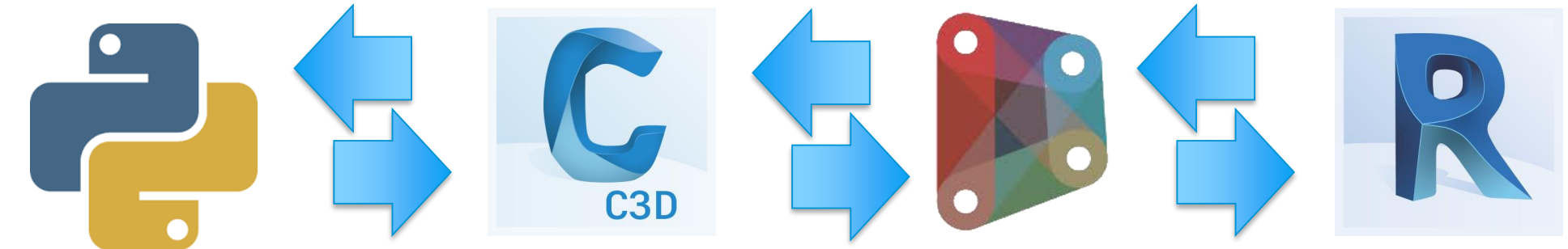
Design
Optimization



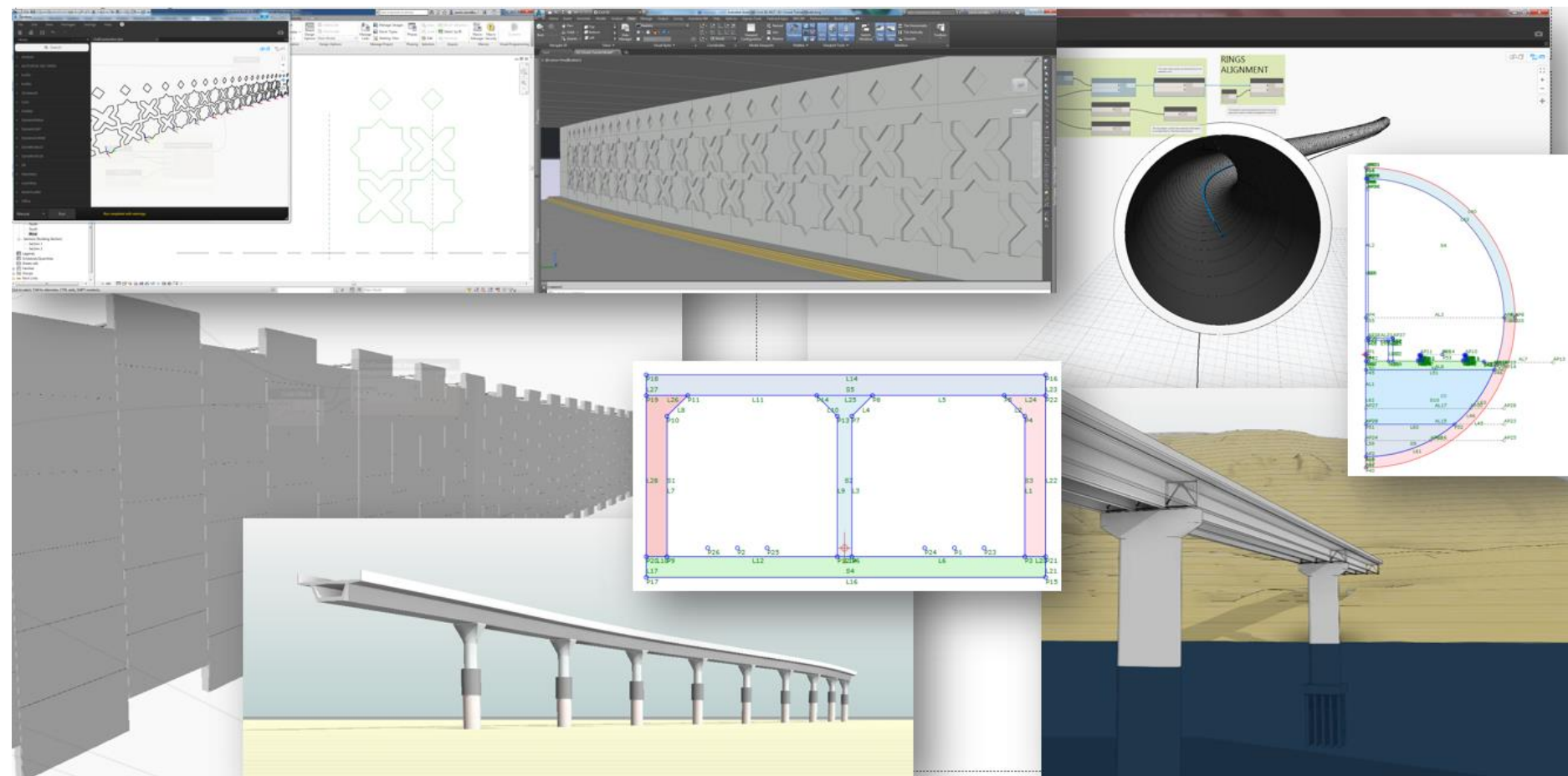
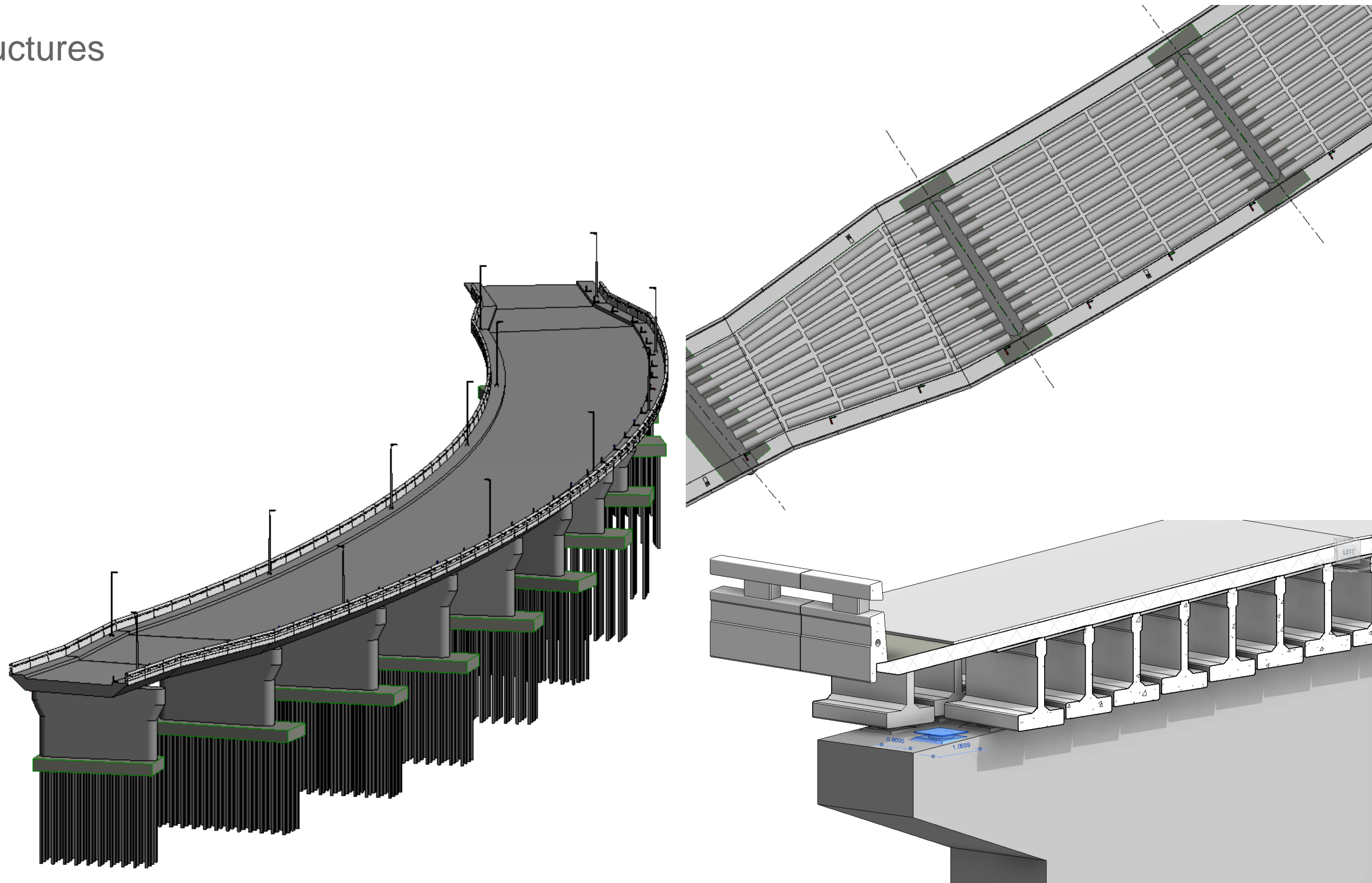
Machine
Learning



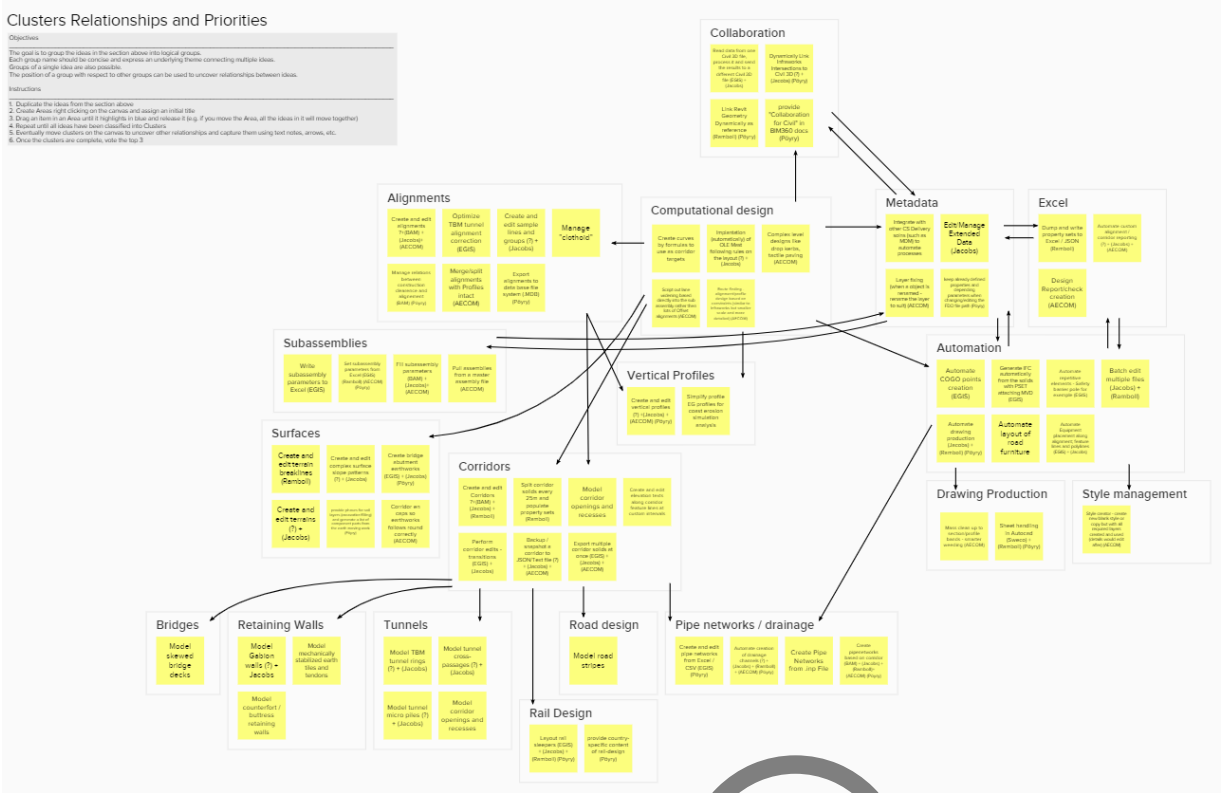
CivilConnection & CivilPython



- Connects Civil 3D and Revit
- Computational design toolkit for infrastructures
- On Dynamo Package manager
 - [Open Source & customizable](#)
 - [Link to Customer Success Stories](#)

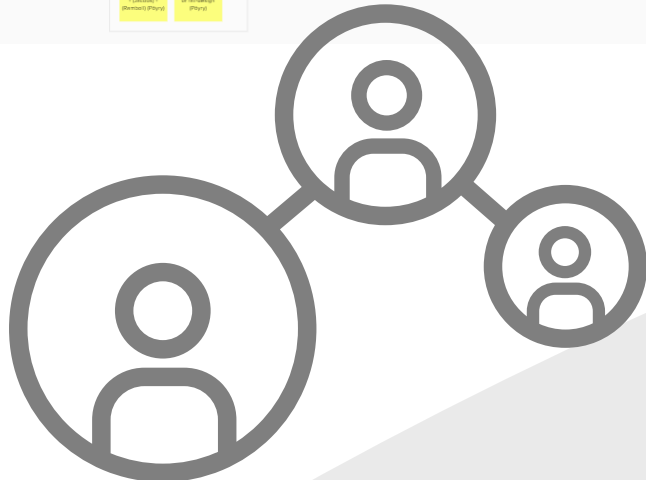


Dynamo for Civil 3D



September 2018
CRUX team
develops a POC

October 2018
Consulting shared
CivilConnection
use cases with
product team



November 2018
Dynamo for Civil
3D is announced
at Autodesk
University



December 2018
Nigel Peters and
CRUX Team in
China start
development

February 2019
Dynamo for Civil 3D
is launched on the
Beta website



April 2019
Dynamo is
available at
product global
launch

AUTODESK FEEDBACK COMMUNITY

Autodesk Civil 3D Futures Portal | User Forums | Dynamo for Civil 3D

Search Project | User Forums | Search

Dynamo for Civil 3D (28 Topics)

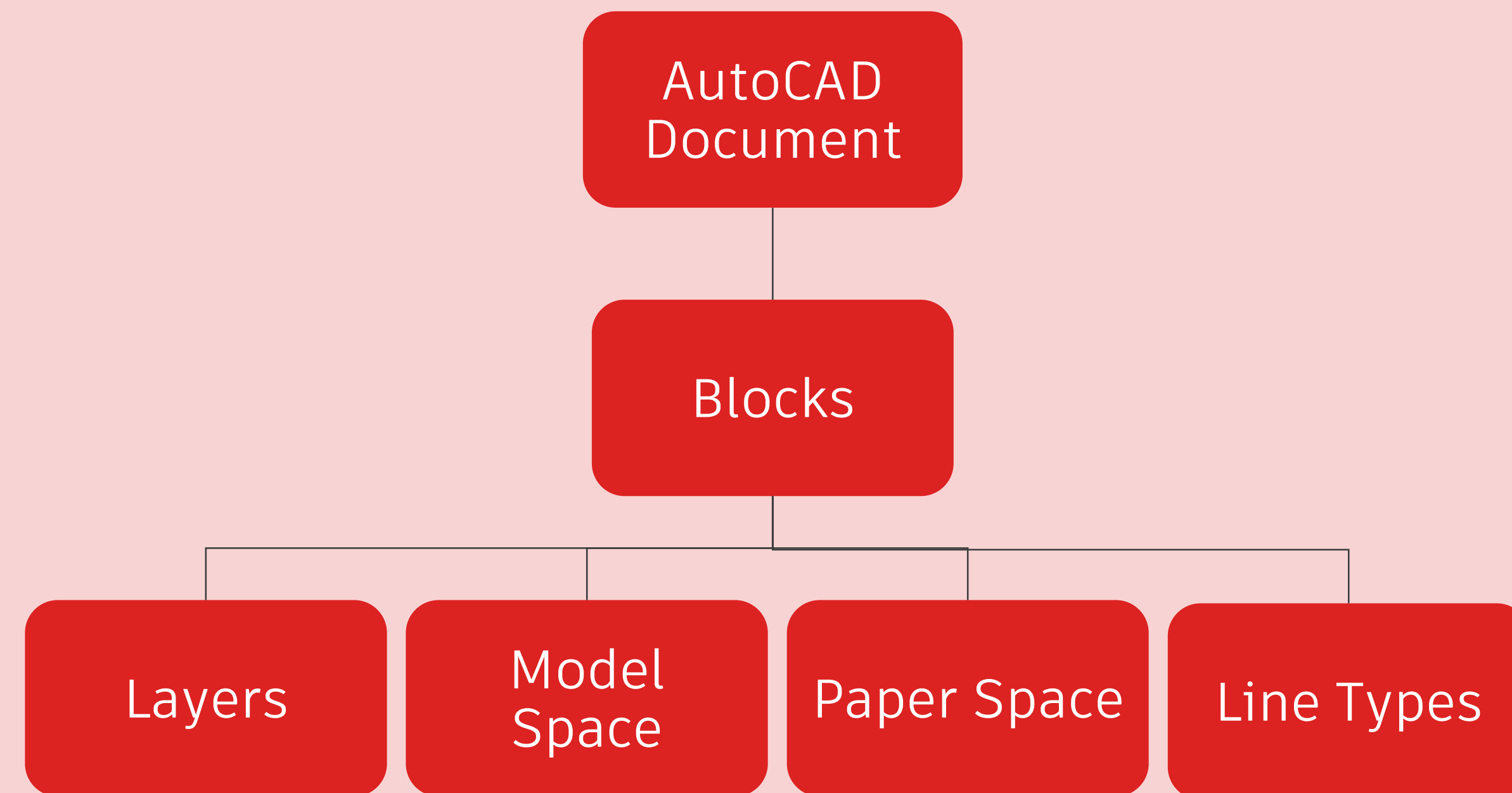
Displaying all Topics.

All Topics | All Statuses | Any Time | Filter

Create Topic | Print Forum | Mark All Read | Subscribe

| Topic | Created By | Replies | Unread | Views | Last Post |
|---|------------------------------------|---------|--------|-------|------------------------------------|
| Dynamo for Civil 3D Feedback | Yesterday by Tim Yarris | 1 | 0 | 20 | 18 Hours ago by Kevin Woodward |
| Post Requests for Additional Nodes Here (112) | 2 Months ago by Tim Yarris | 25 | 5 | 395 | 18 Hours ago by Rad Lazic |
| Dynamo for Civil 3D Survey | 2 Months ago by Tim Yarris | 3 | 0 | 174 | Last Month by Nigel Peters |
| how to Create Civil 3D Alignment, profile and corridor using Dynamo CiciL 3D. | Yesterday by Praveen Reddy Yaruva | 0 | 0 | 12 | Yesterday by Praveen Reddy Yaruva |
| Missing link to Revit | Last Month by Yngve Kvinesland | 2 | 0 | 35 | 2 Days ago by Rad Lazic |
| exploit xml files with ElementTree and Xpath | Last Week by Bogdan-Gabriel ROT... | 0 | 0 | 11 | Last Week by Bogdan-Gabriel ROT... |
| Exploring Subassembly Composer | 2 Weeks ago by Andrea Trincado | 1 | 0 | 25 | 2 Weeks ago by Nigel Peters |
| SubassemblyParameter.Value - dropdown list | 2 Weeks ago by Andrea Trincado | 1 | 0 | 24 | 2 Weeks ago by Nigel Peters |

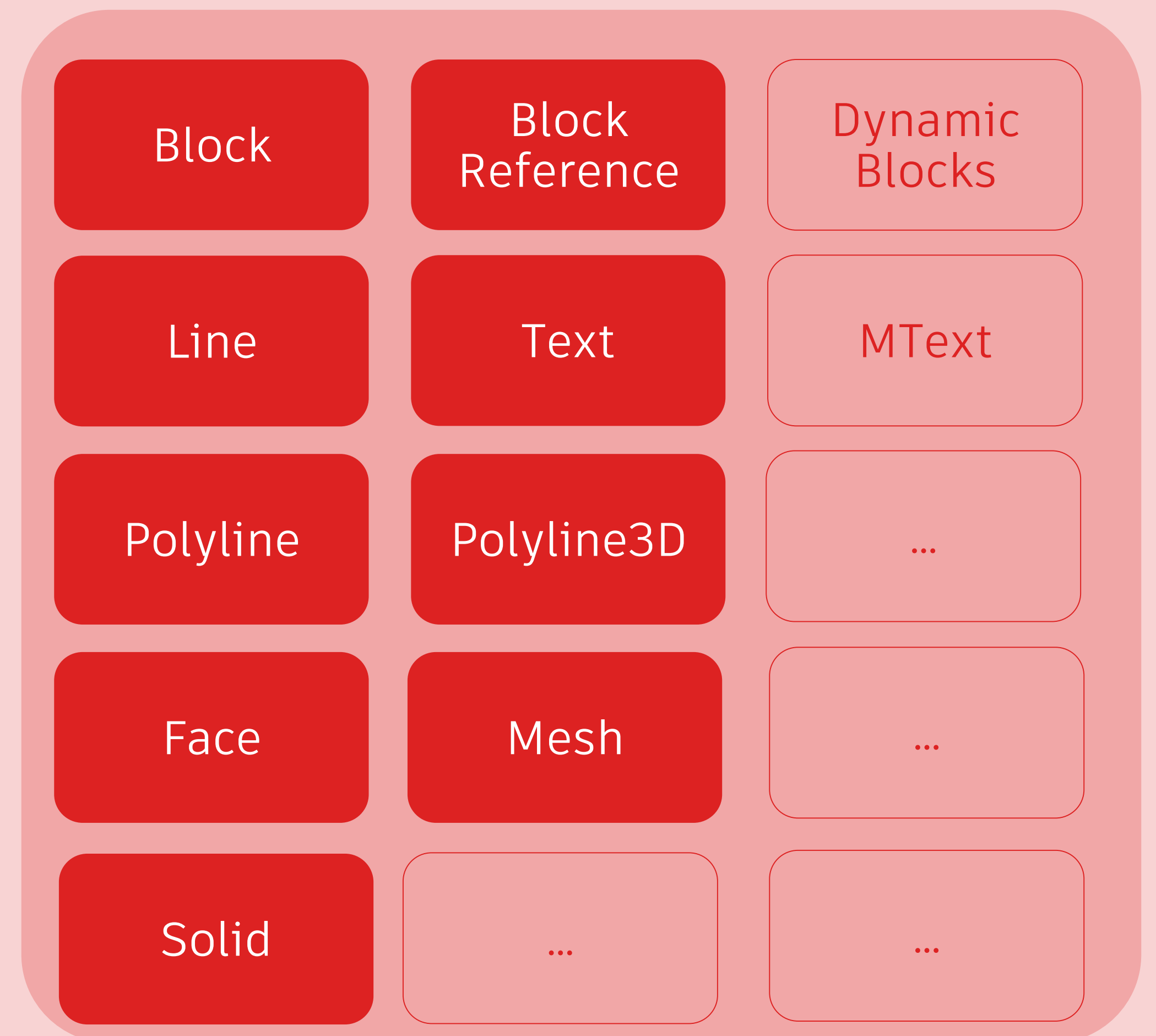
Dynamo for Civil 3D | AutoCAD Nodes



Document

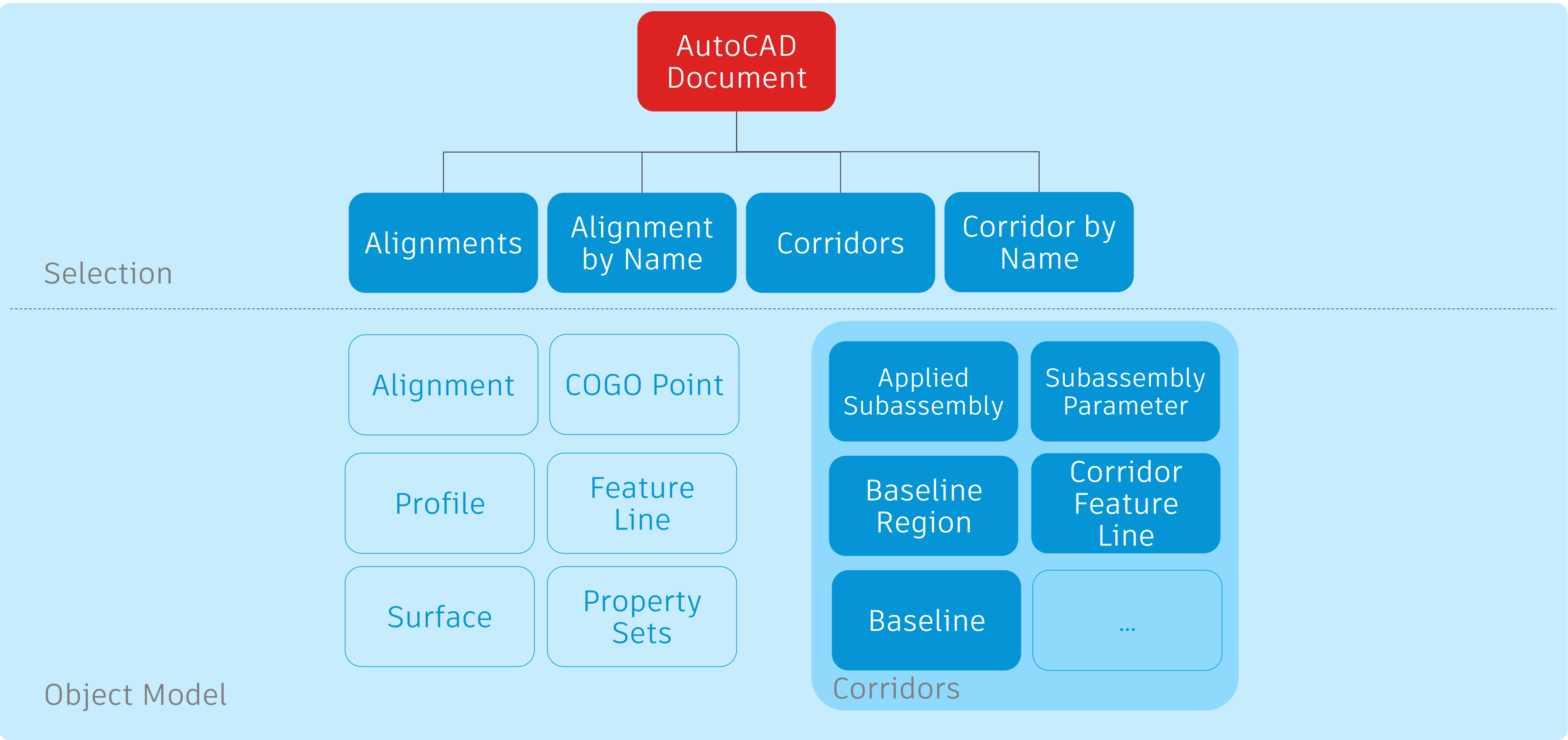


Selection

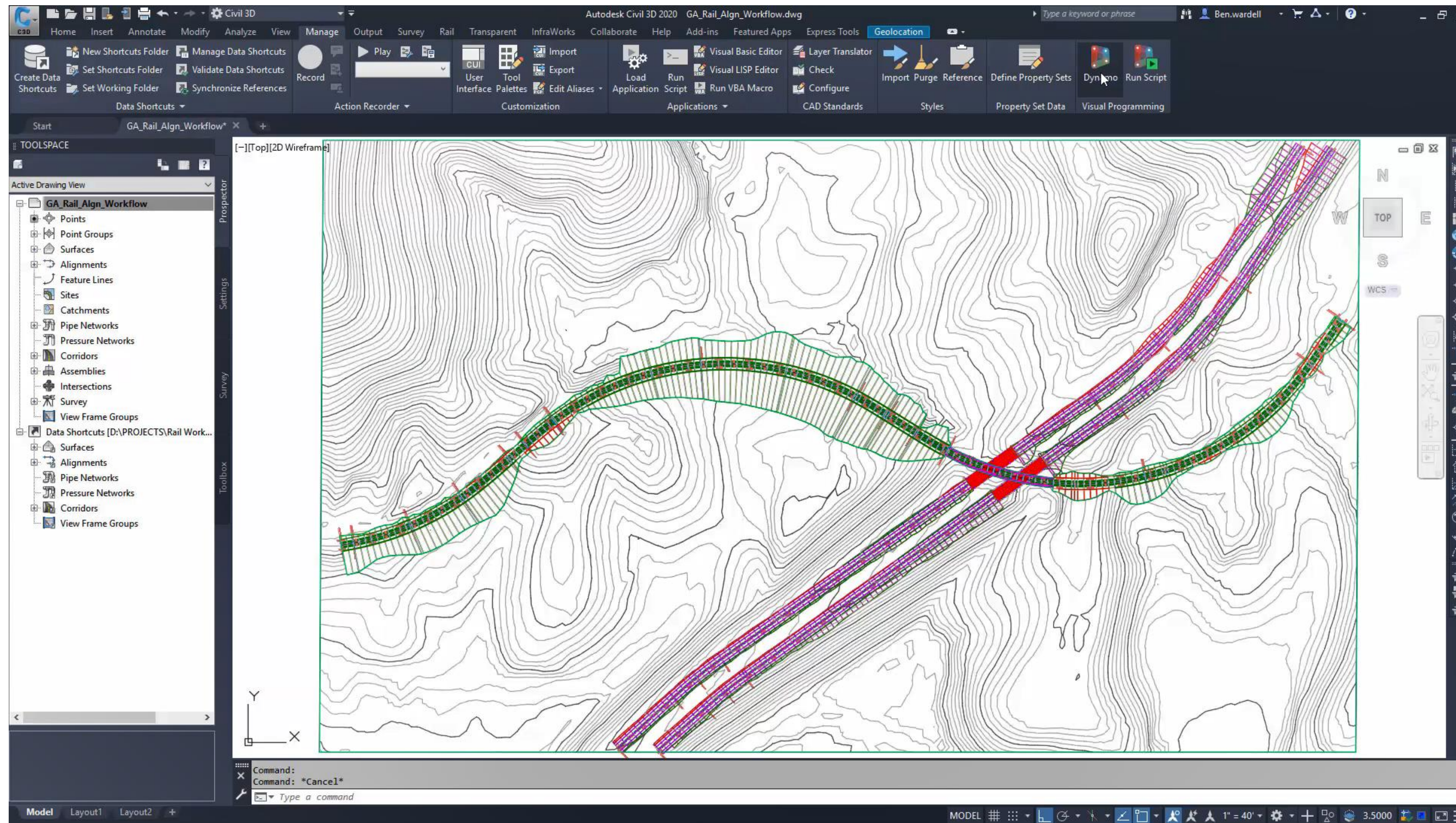


Object Model

Dynamo for Civil 3D | Civil 3D Nodes



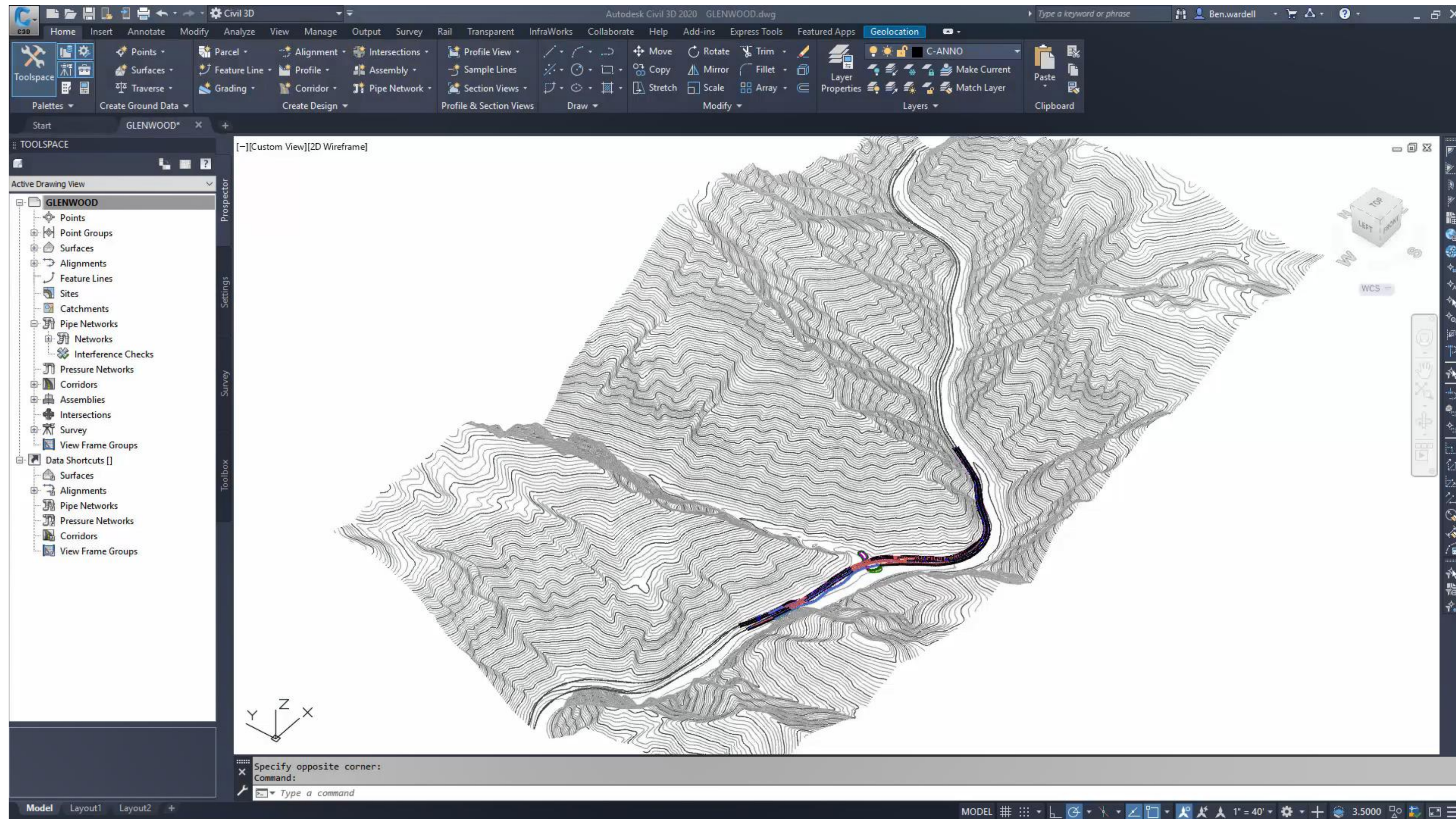
Rail



Concrete ties, masts and overhead catenary systems wires, Credits to Ben Wardell

[Link To Video](#)

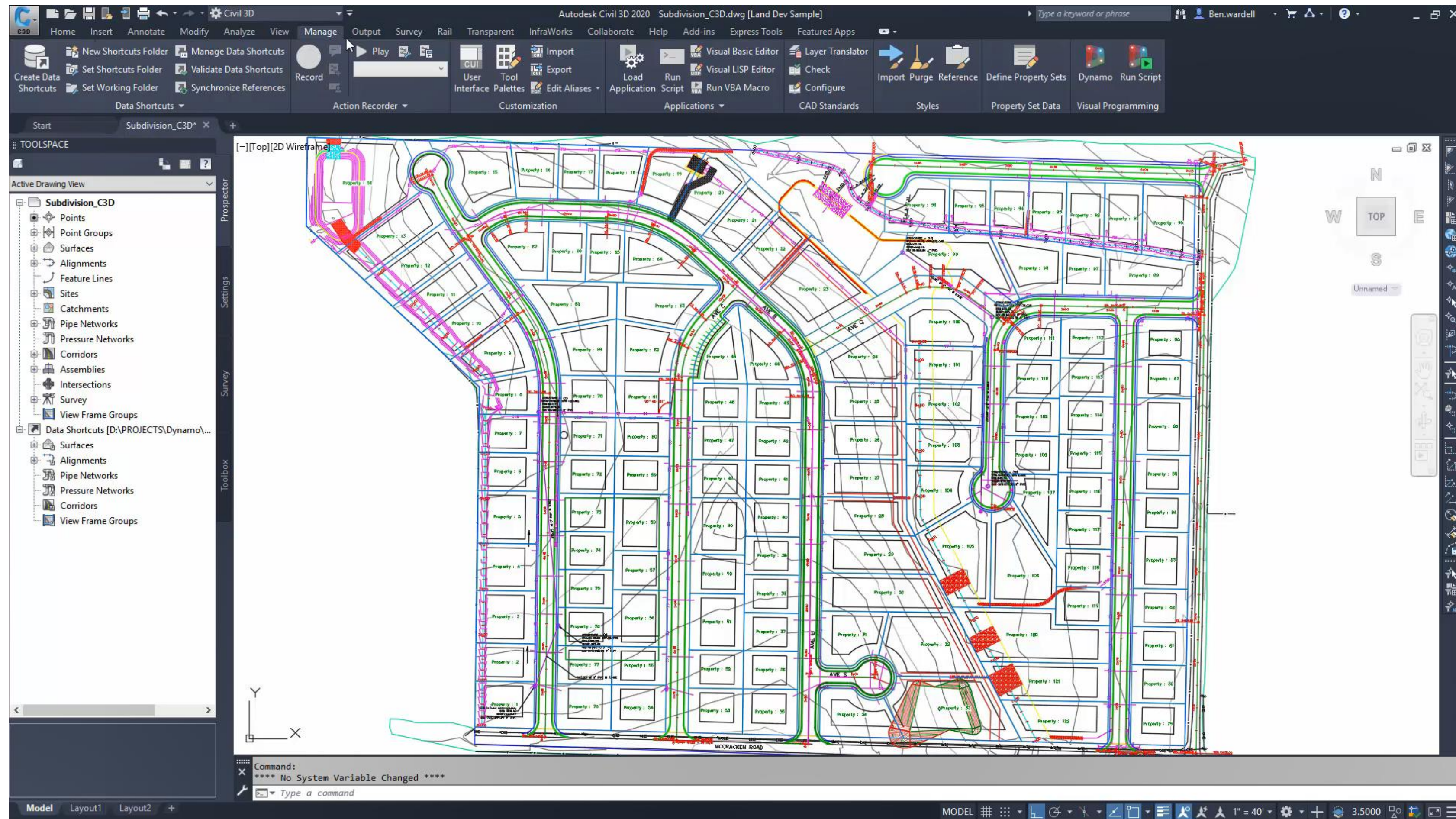
Road



Barriers, signals and lighting posts, counterfort walls, Credits to Ben Wardell

[Link To Video](#)

Land Development

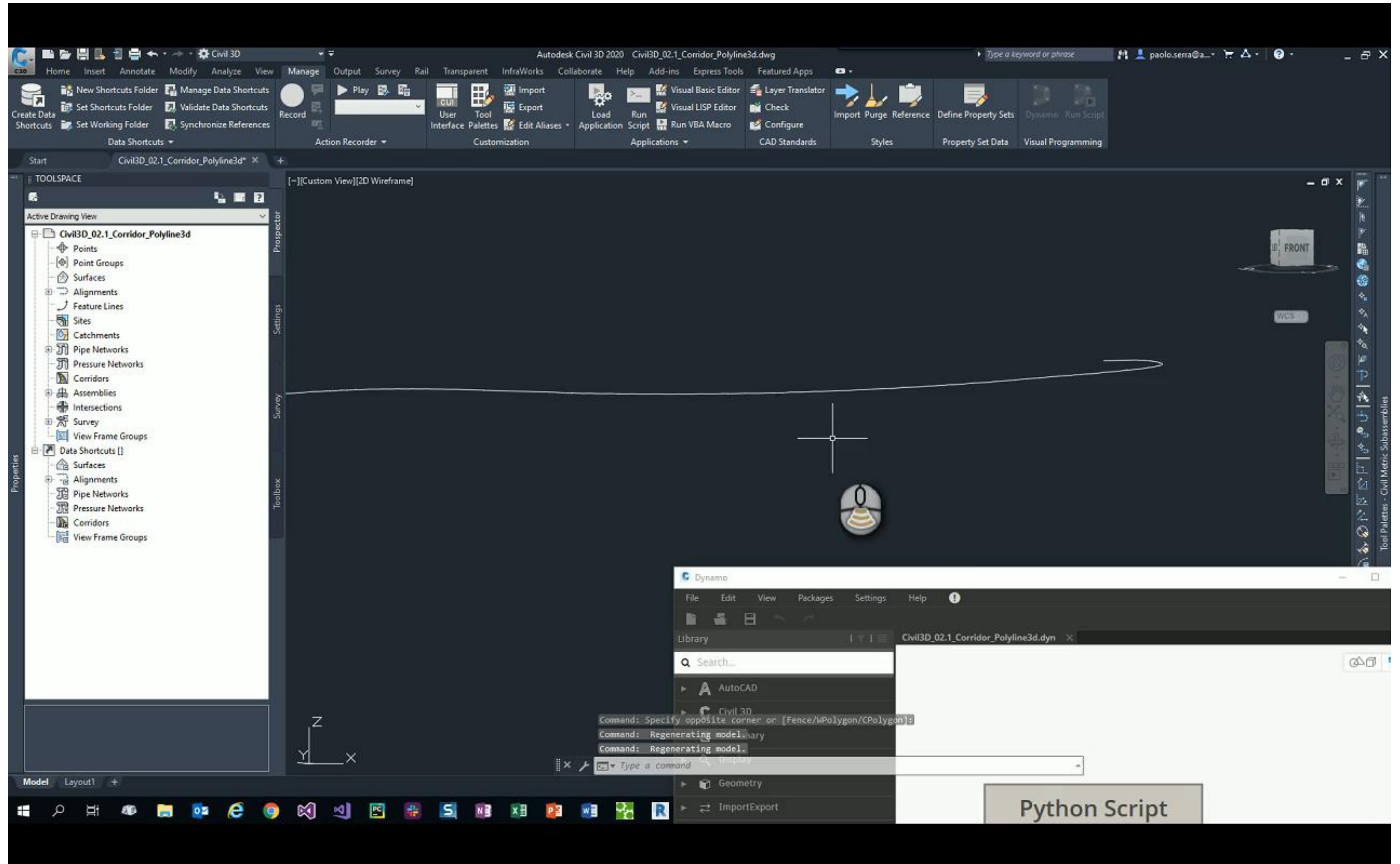


Ramps, Cogo points, curb report, Credits to Ben Wardell

[Link To Video](#)

Python | Corridor from Polyline 3D

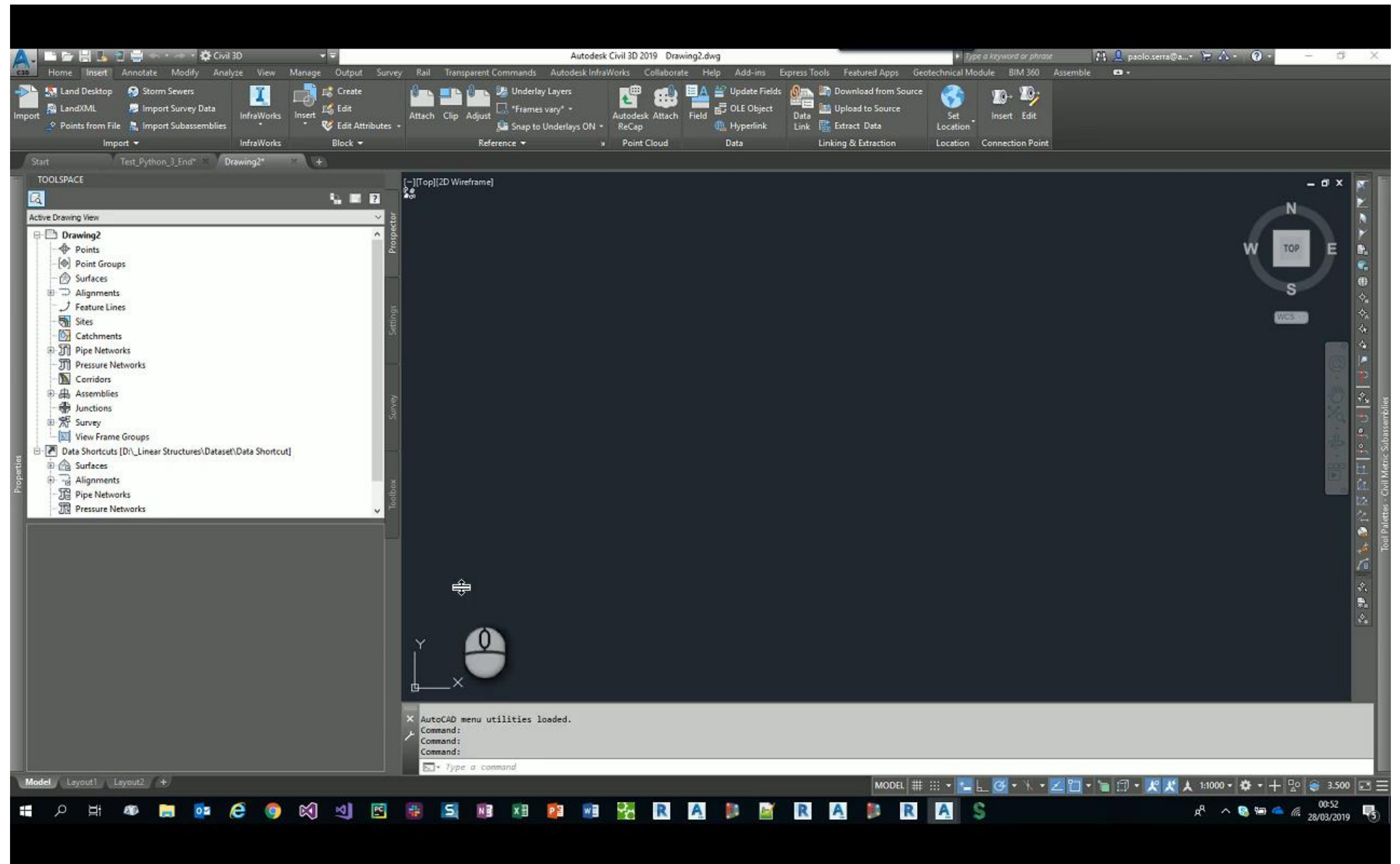
- Polyline 3D to Alignment
- Polyline 3D to Profile
- Stock / Custom Subassemblies



[Link to video](#)

Python | Corridors from LandXML

- Alignments
- Break lines with code assigned
- Simple subassembly with target parameters



[Link to video](#)

Civil 3D Toolkit

- Extend OOTB functionalities
- Enable workflows beyond transportation
- Support Collaboration

Add-ons

▼  Autodesk

└─ ▼ Civil3DToolkit

└─ ▶ AutoCAD

└─ ▶ Collaboration

└─ ▶ GIS

└─ ▶ LandDevelopment

└─ ▶ PipeNetworks

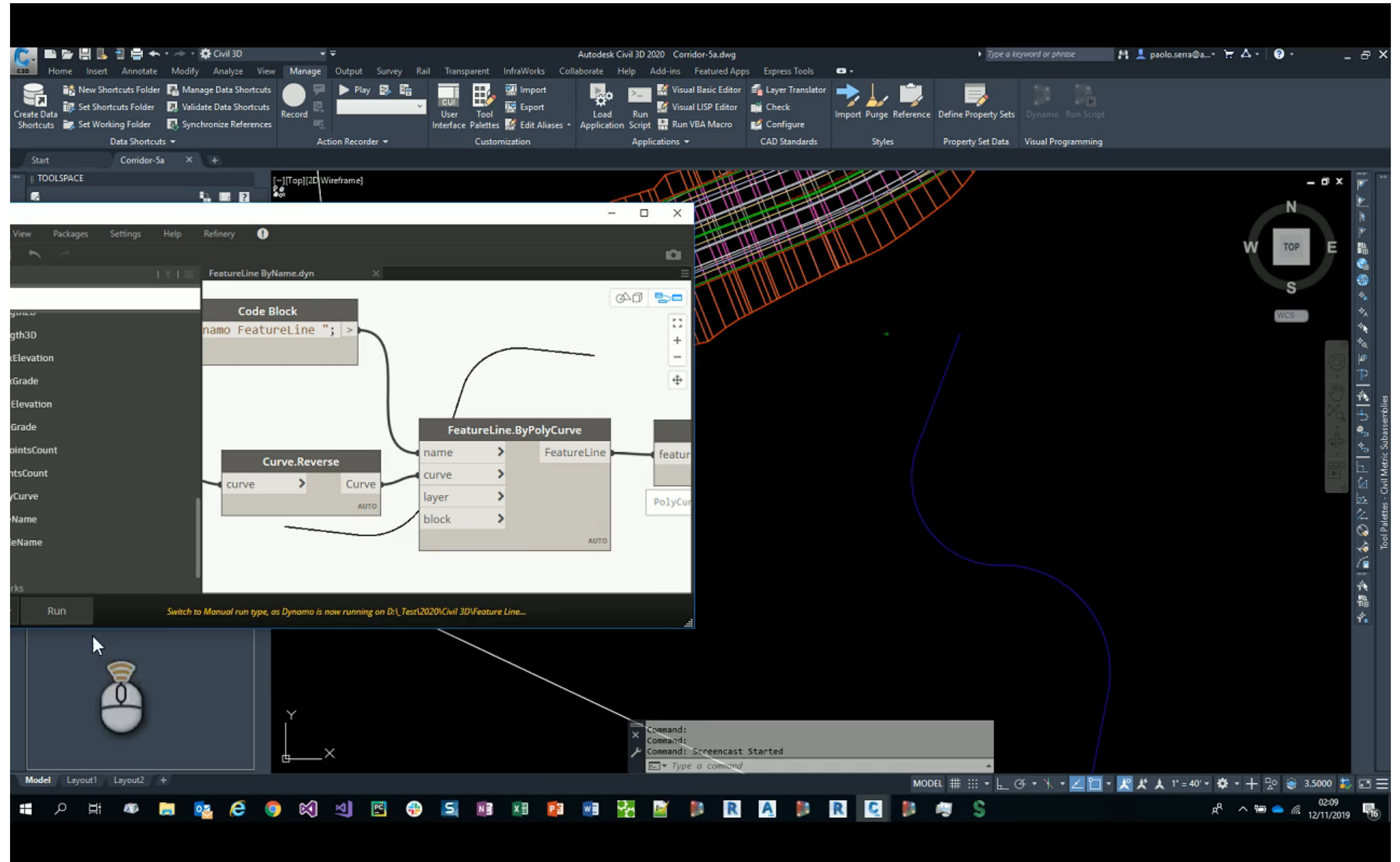
└─ ▶ Tunnel

Civil 3D Toolkit Use Cases



Feature Lines | More

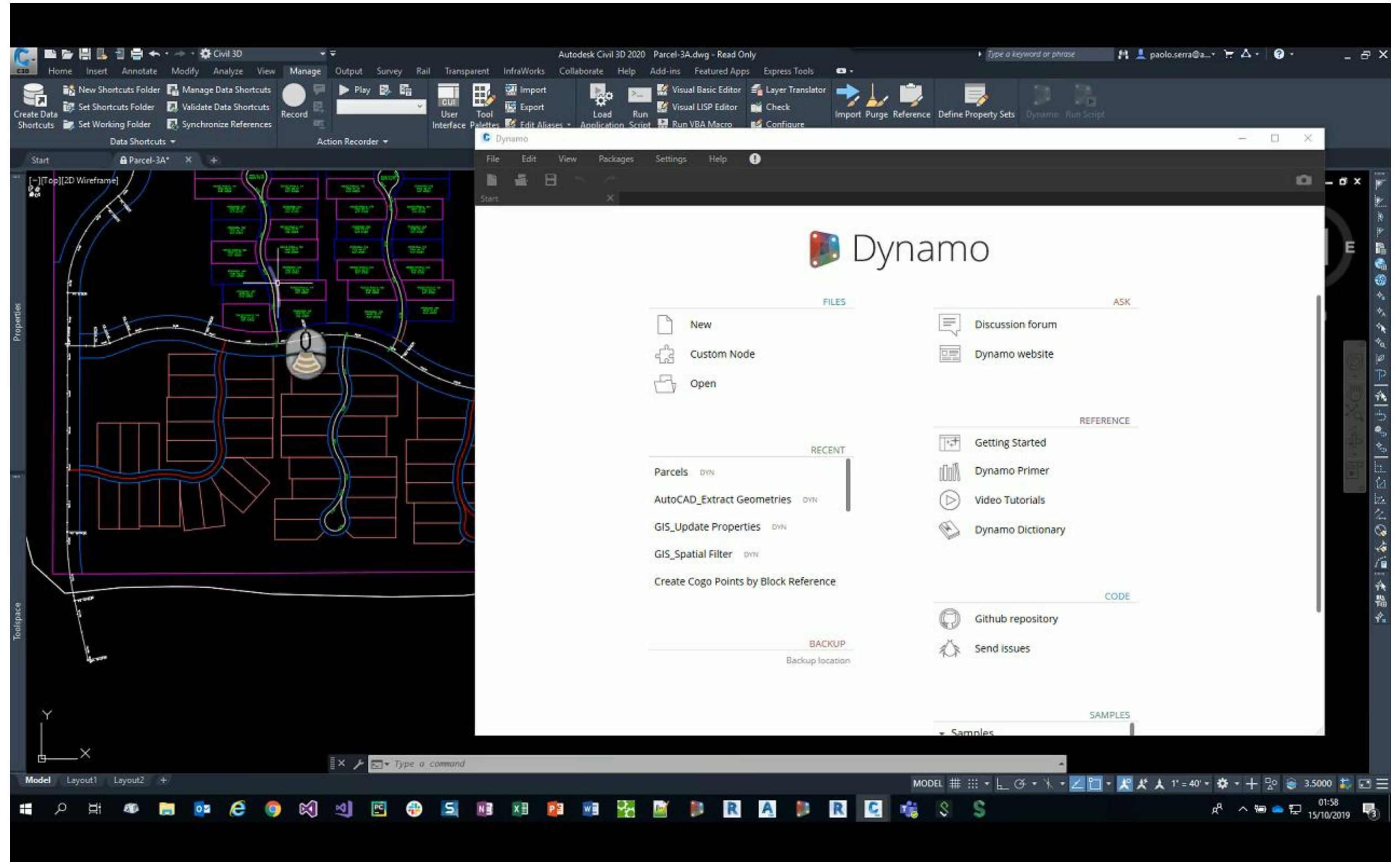
- Read & Write Feature Lines
- Access Geometry data
- Access Style and Name



[Link To Video](#)

Read Parcels | More

- Read Parcels
- Access geometry data
- Access Style and Number

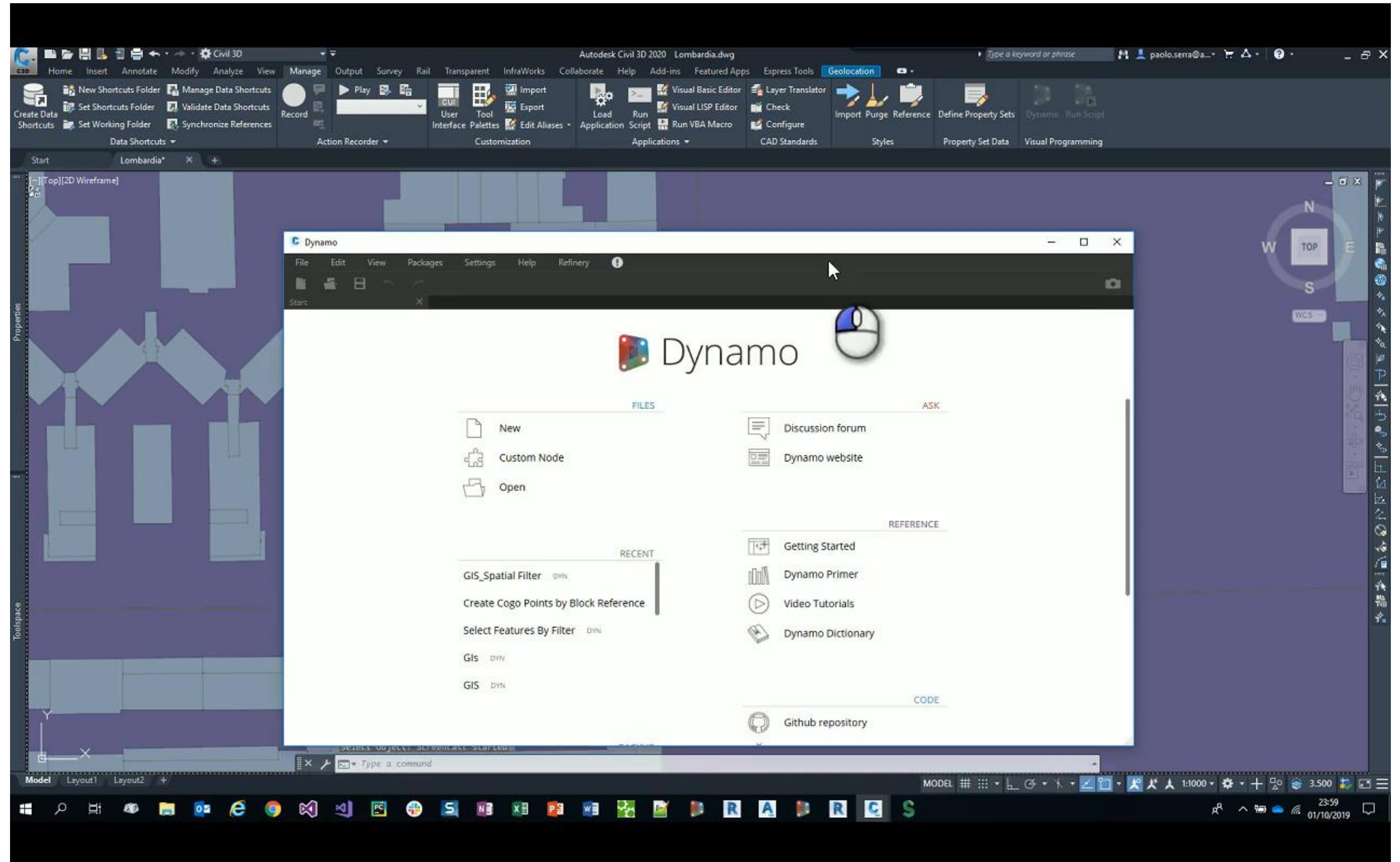


[Link to Video](#)

Filter Map Features | More

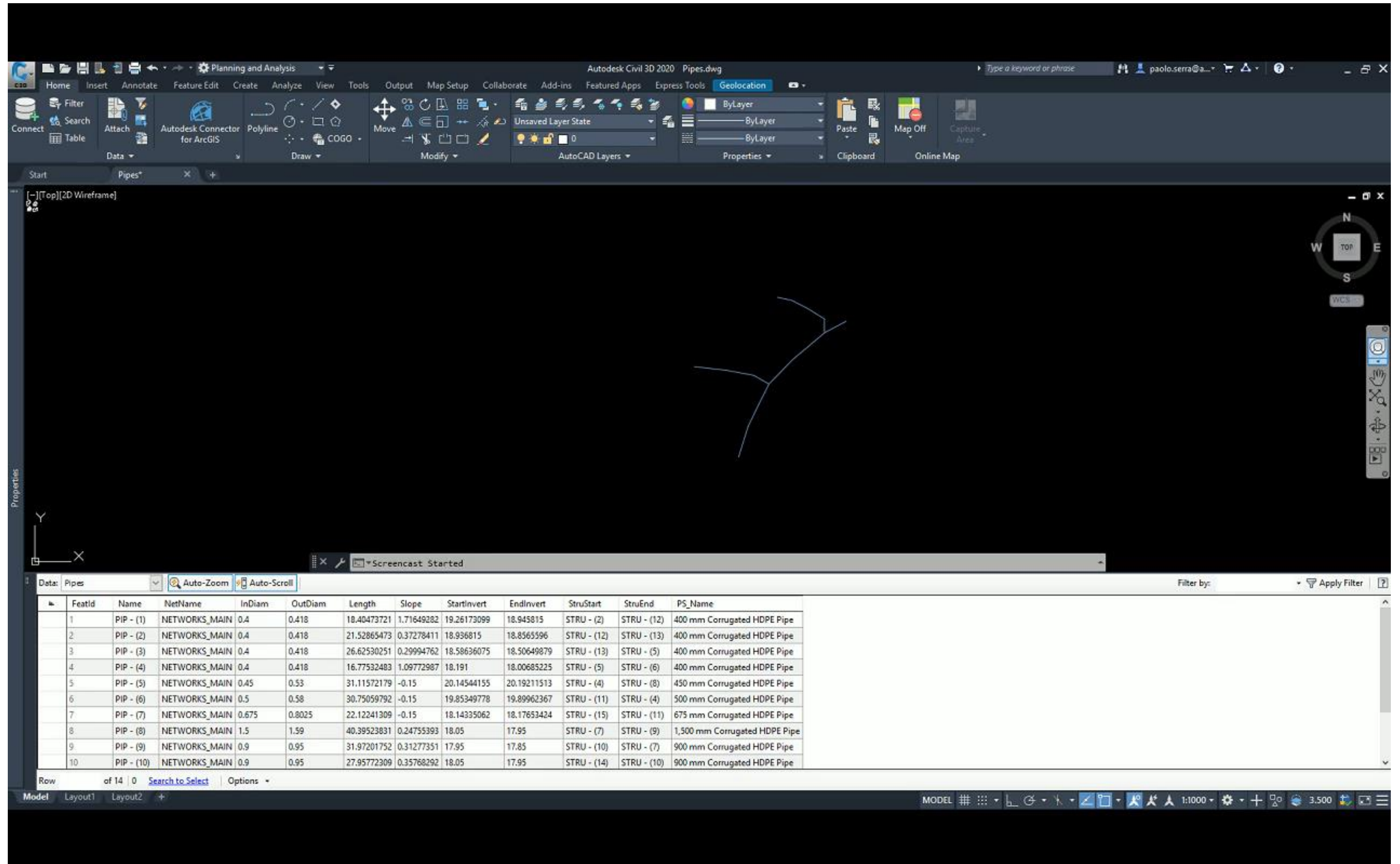
- Access Map Features
 - Properties
 - Geometry
- Spatial Filters
- Edit Features Properties

[Link To Video](#)



Edit Features Properties | Less Effort

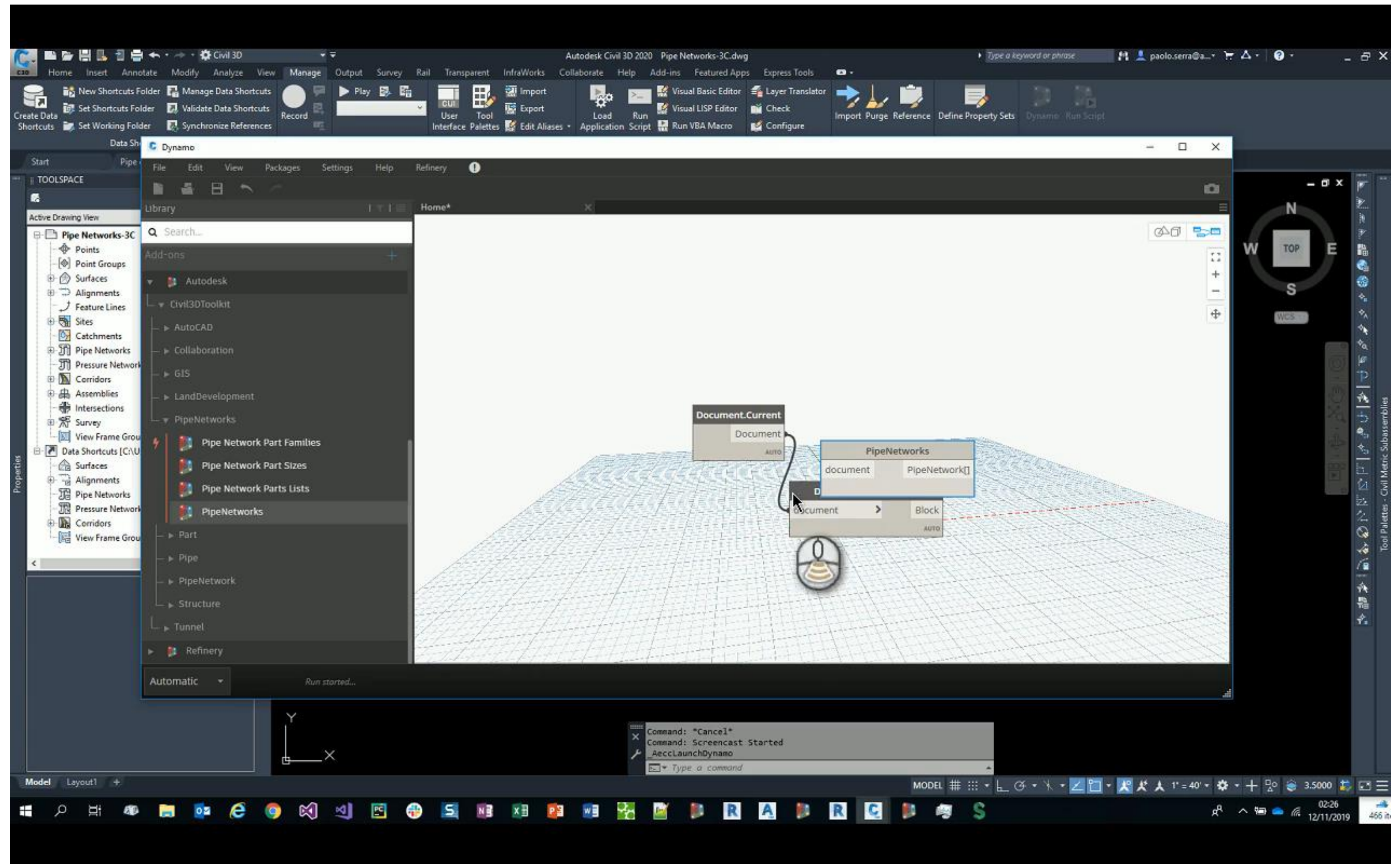
- Access Map Features
 - Properties
 - Geometry
- Spatial Filters
- Edit Features Properties



[Link To Video](#)

Pipe Networks | More, Better

- Read & Write Pipe Networks
 - Pipes
 - Structures
- Extract Properties & Geometry
- Get / Set Part Data



[Link To Video](#)

Tunnels | More

- Universal ring library

- RingType
- Ring
- RingSegment

Segmental lining



| Ring.NextRingByKeyPosition | |
|----------------------------|---|
| Ring | > |
| KeyPosition | > |
| AUTO | |

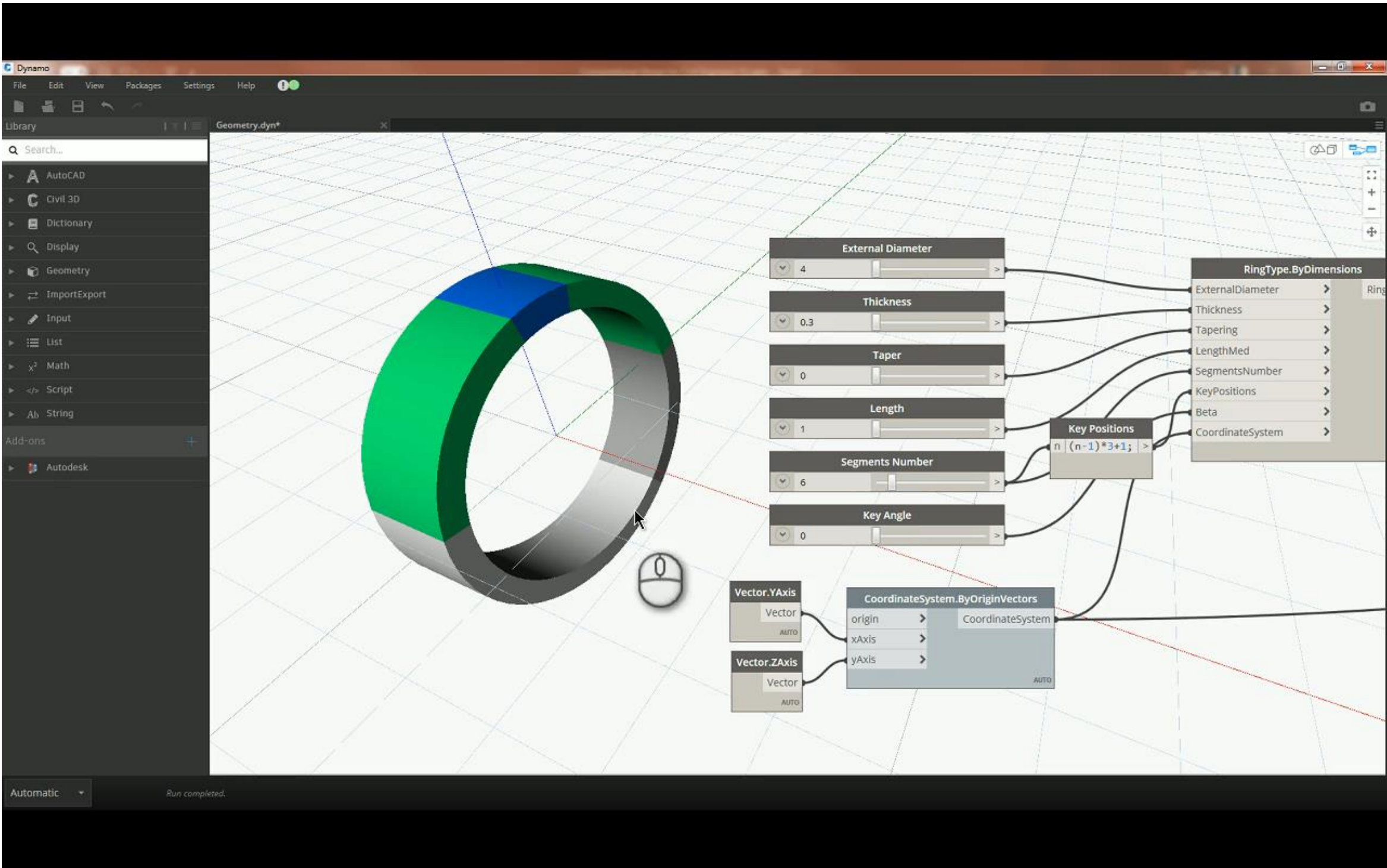
| Ring.ByTypeAndAxisAndKey | |
|--------------------------|---|
| RingType | > |
| Axis | > |
| ParameterOnCurve | > |
| KeyPosition | > |
| AUTO | |

| RingType.ByDimensions | |
|-----------------------|---|
| ExternalDiameter | > |
| Thickness | > |
| Tapering | > |
| LengthMed | > |
| SegmentsNumber | > |
| KeyPositions | > |
| Beta | > |
| CoordinateSystem | > |
| RingType | |
| AUTO | |

| |
|-------------------|
| ▼ Civil3DToolkit |
| ▶ AutoCAD |
| ▶ Collaboration |
| ▶ GIS |
| ▶ LandDevelopment |
| ▶ PipeNetworks |
| ▼ Tunnel |
| ▶ Ring |
| ▶ RingSegment |
| ▶ RingType |

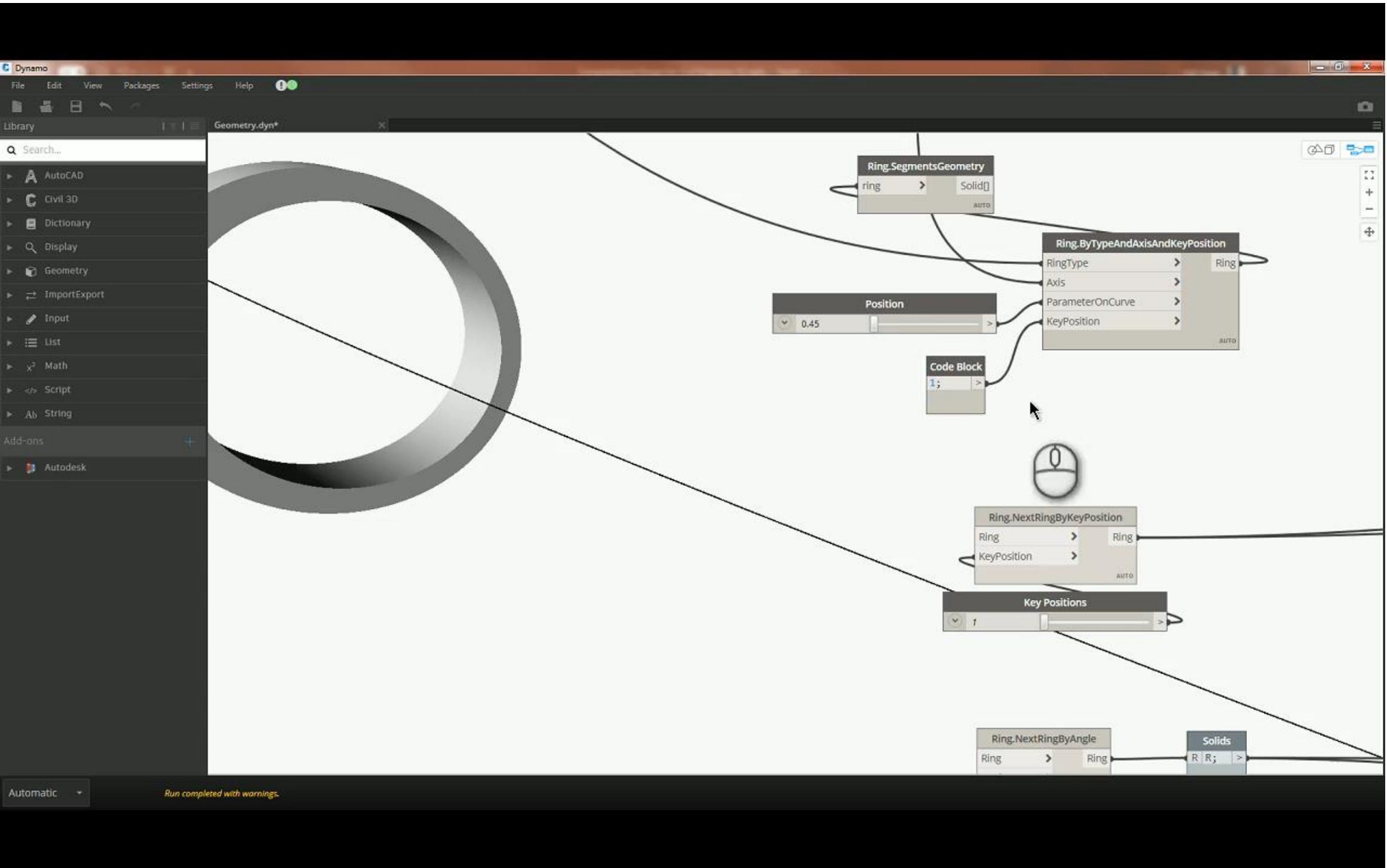
Universal ring | More

Geometry



• [Link To Video](#)

Position



• [Link To Video](#)

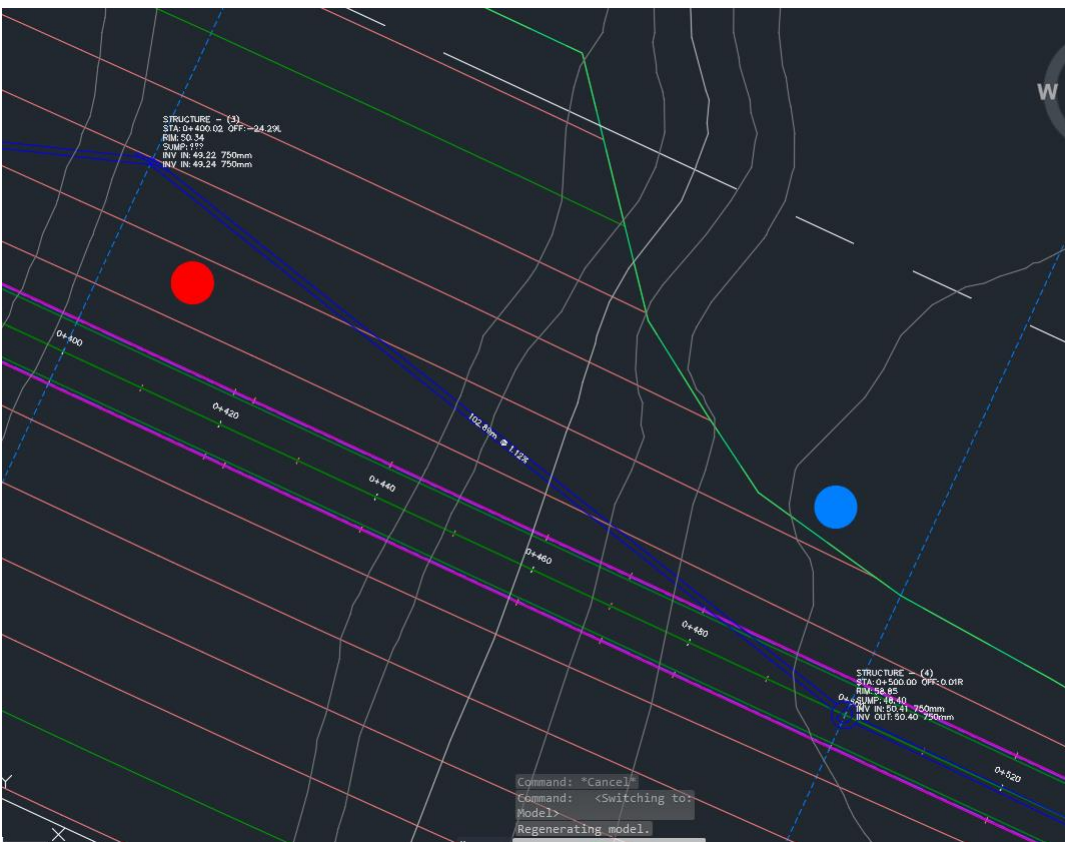
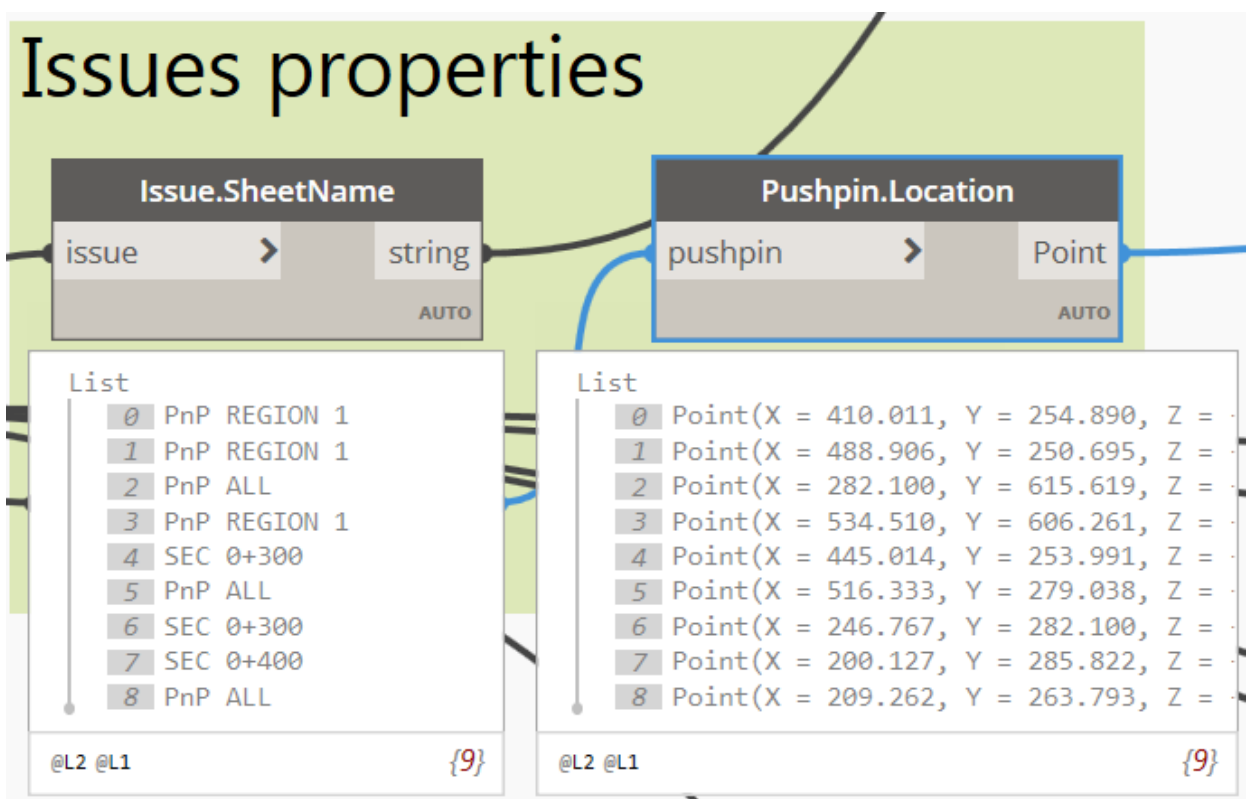
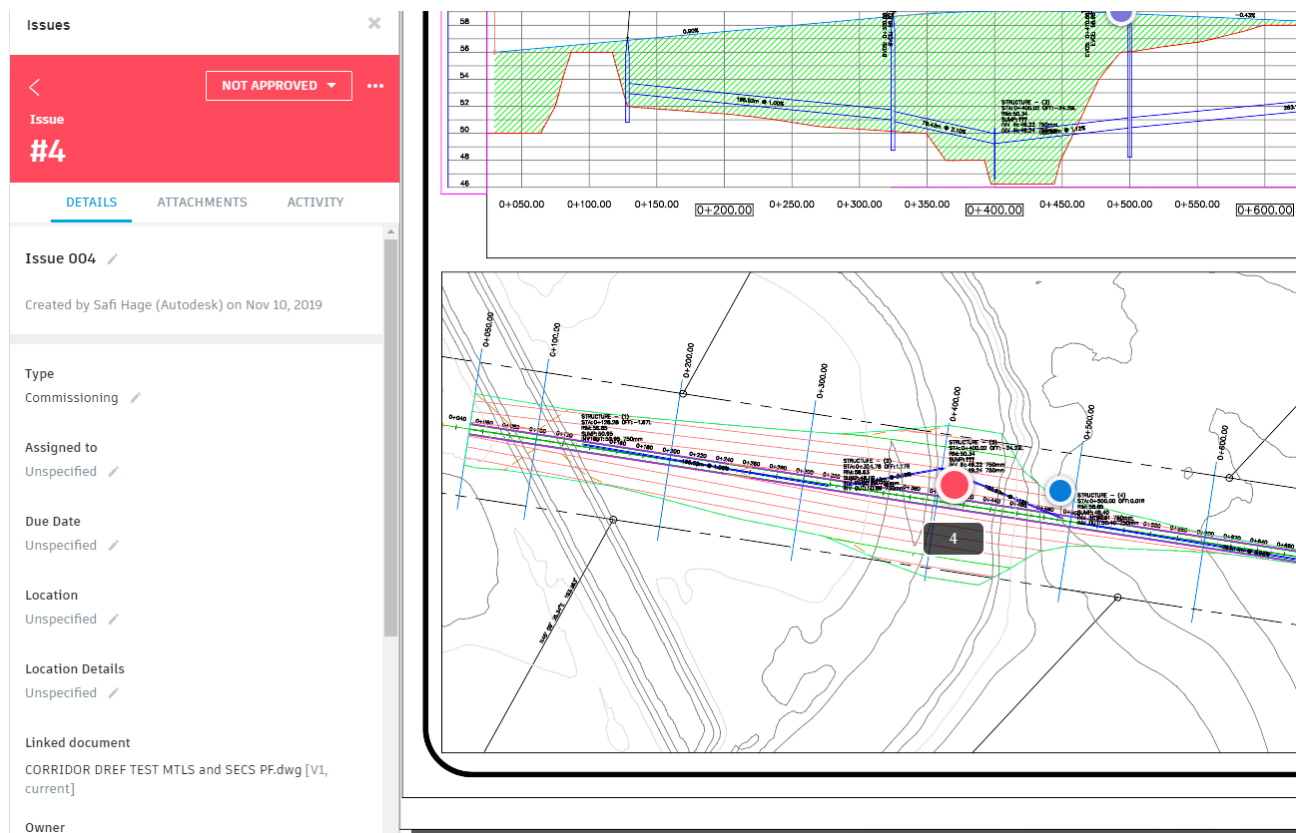
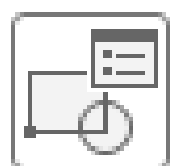
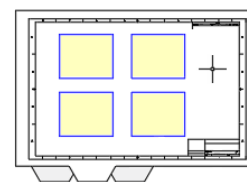
BIM360 Issues | More



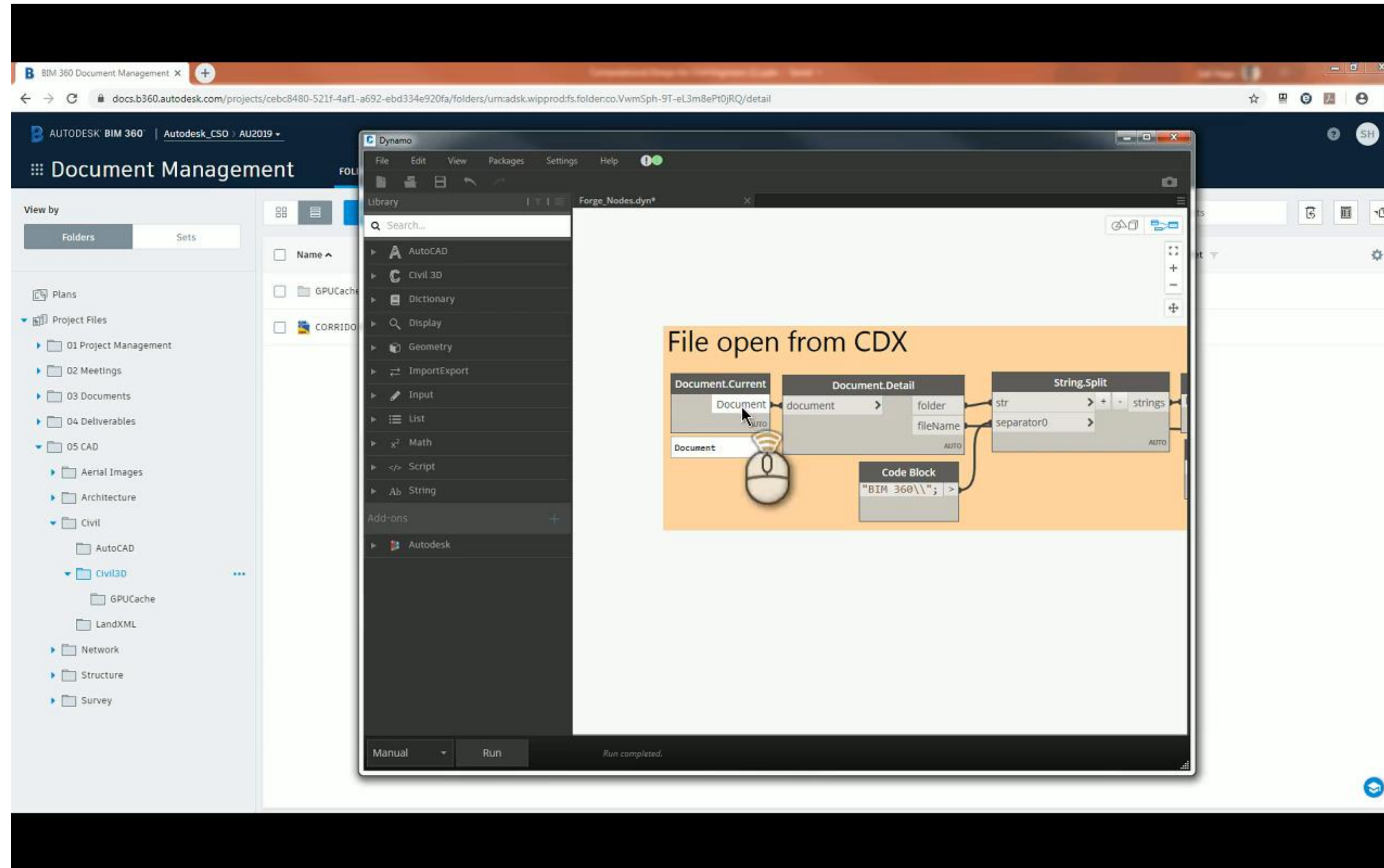
- Access token
- Hub & Project
- BIM360 file
- Issue attributes



- Layout
- Viewport
- Civil3D views
- Paper to Model space
- Block Reference

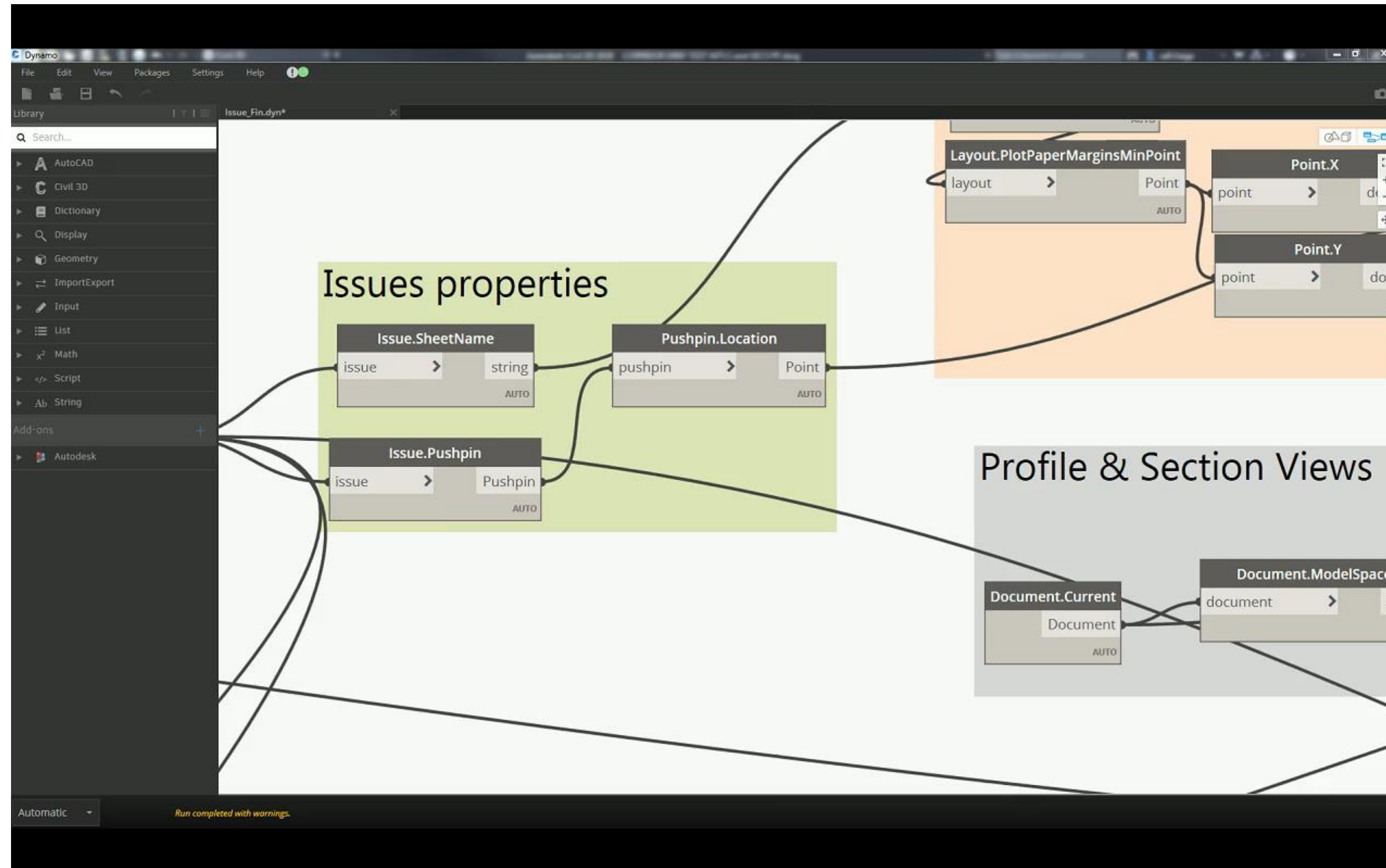


Forge nodes | More



- [Link to Video](#)

BIM360 Issues | More



- [Link to Video](#)

Photos | More

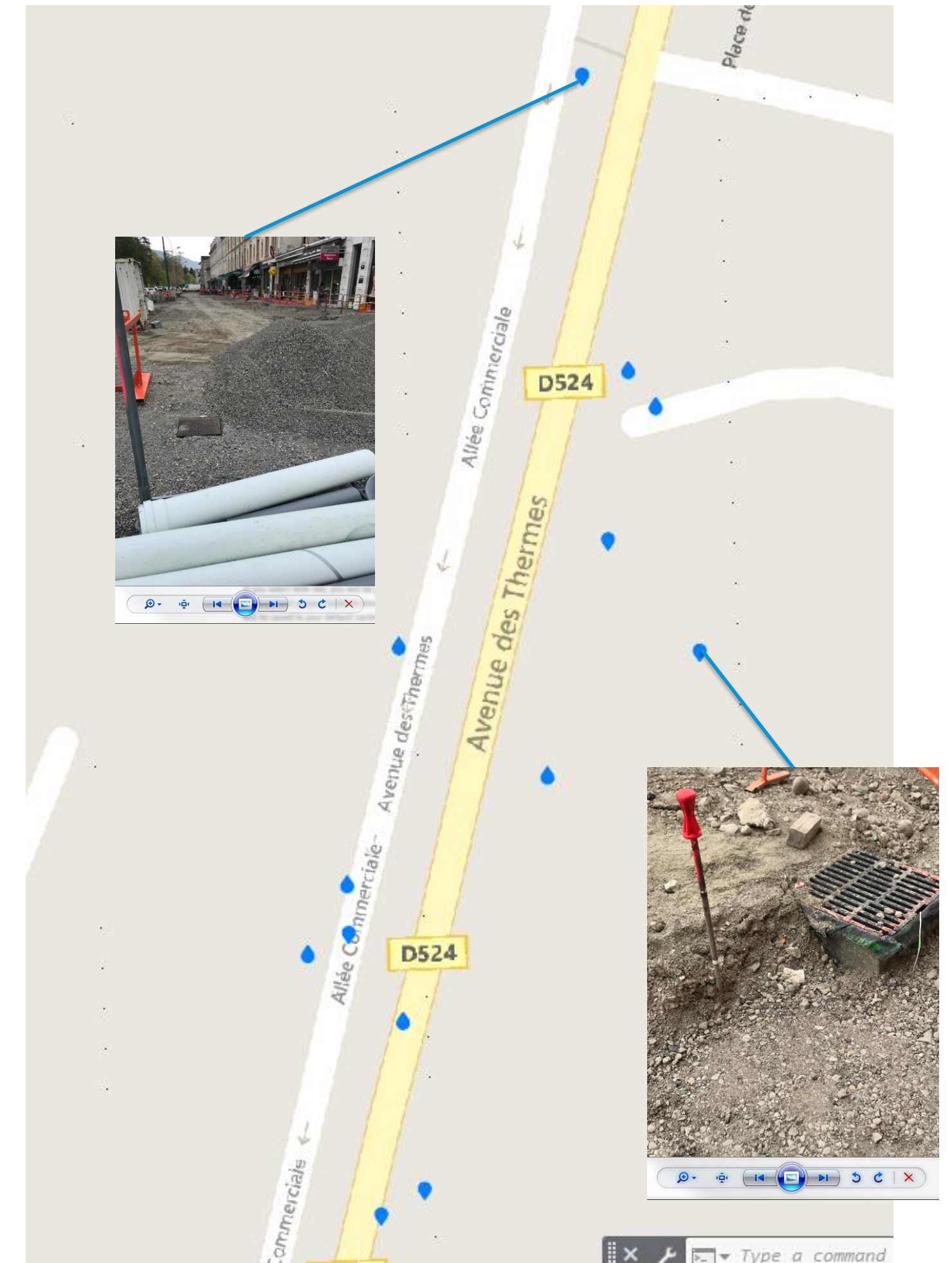


GPS

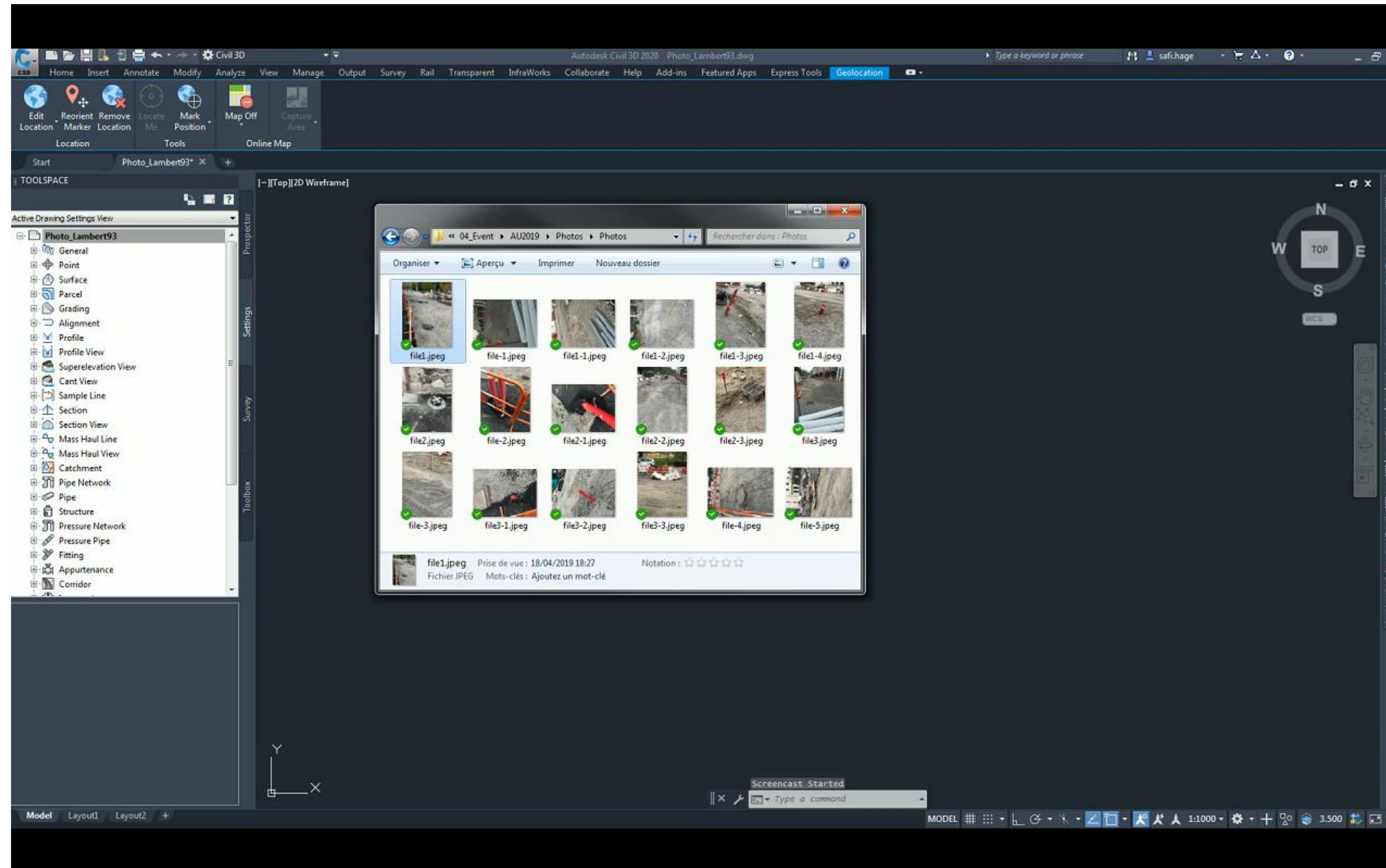
Latitude
Longitude
Altitude

45; 8; 34.3200000000006985
5; 49; 45.59999999999986
401.71083455344069

- Extract GPS data & orientation
- Convert coordinates
- Place Block Reference
- Add attributes

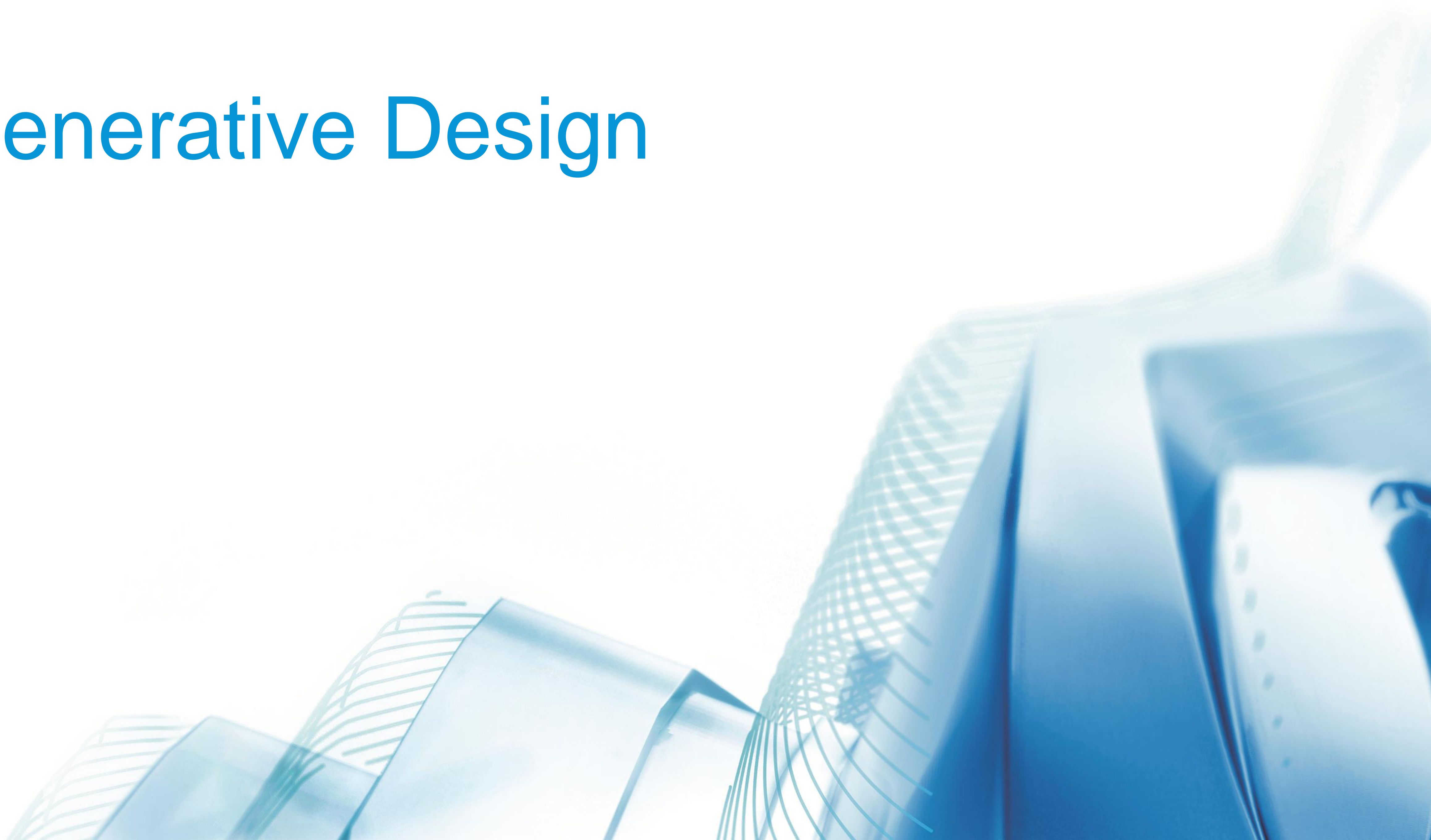


Photos | More

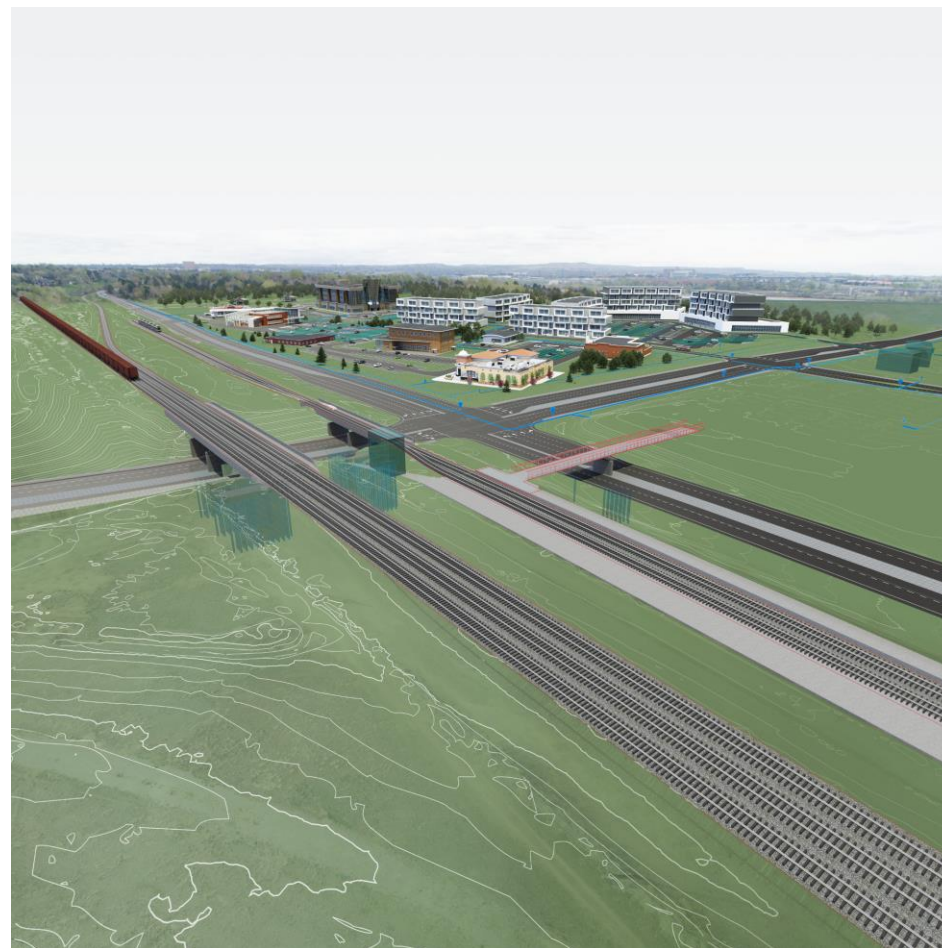


- [Link to Video](#)

Generative Design

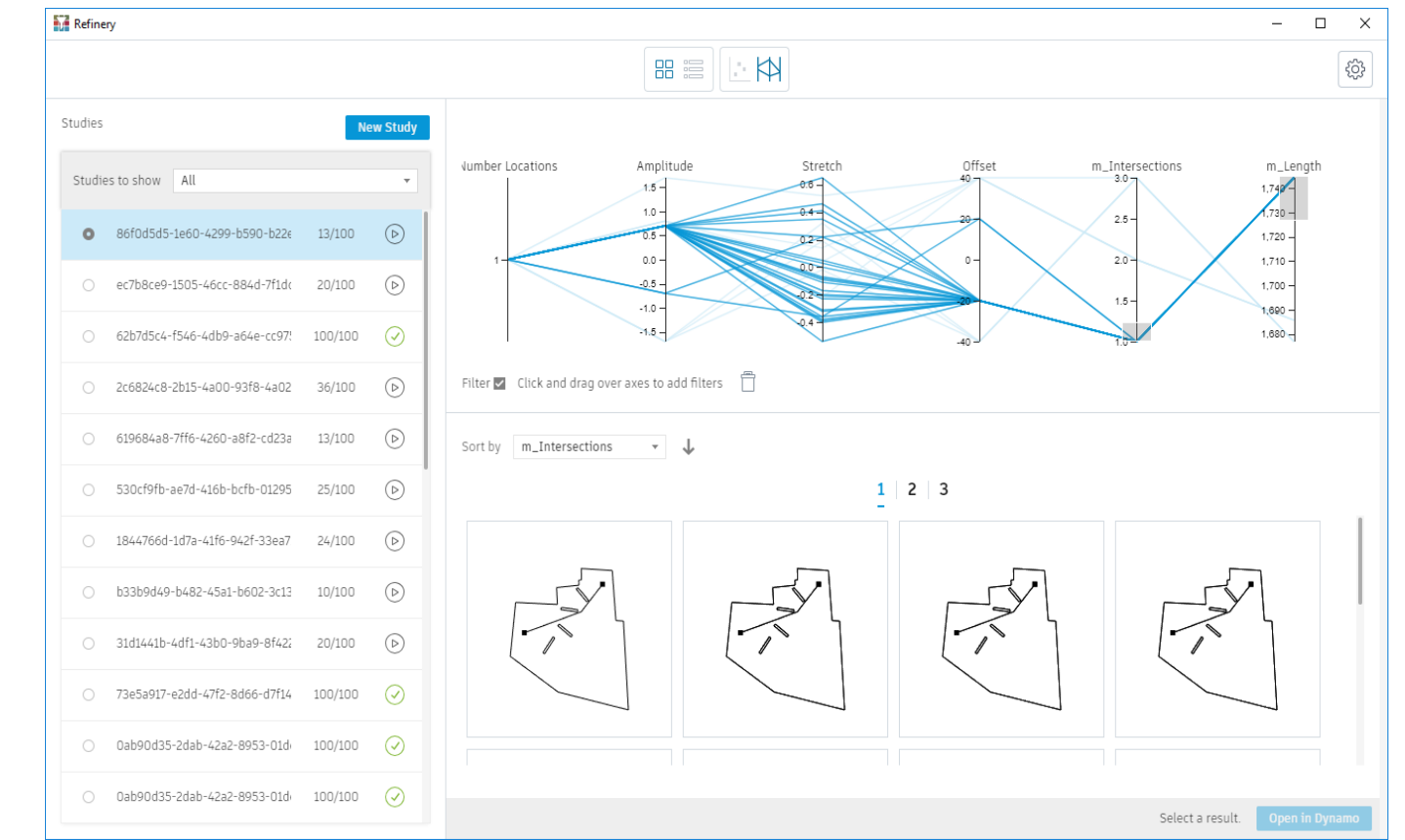


Generative Design Approach | Project Refinery



Evolve

Project Refinery



Gather Data

Generate

Evaluate

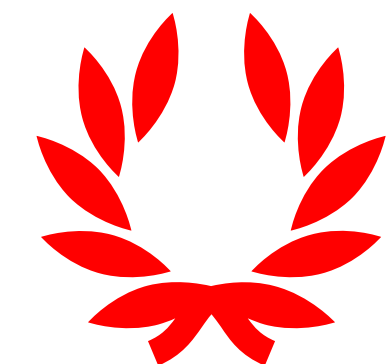
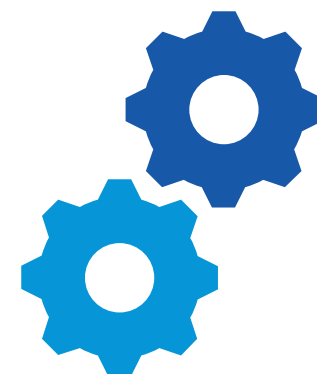
Select

Defining Model

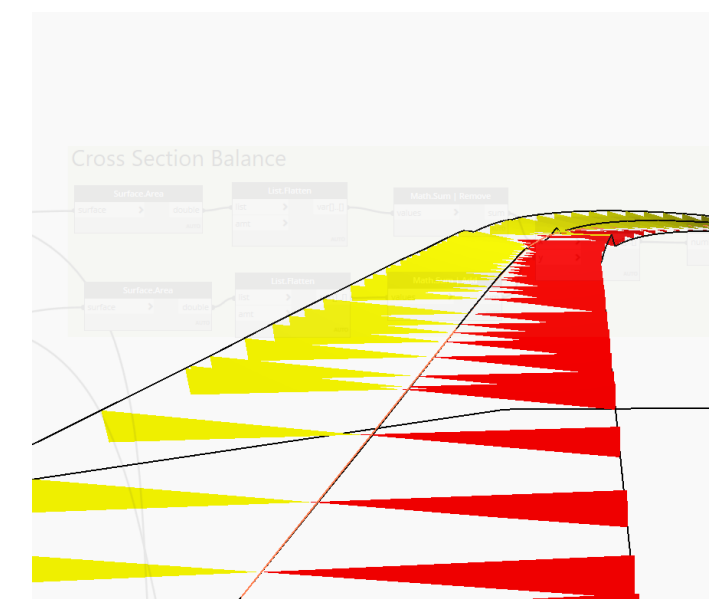
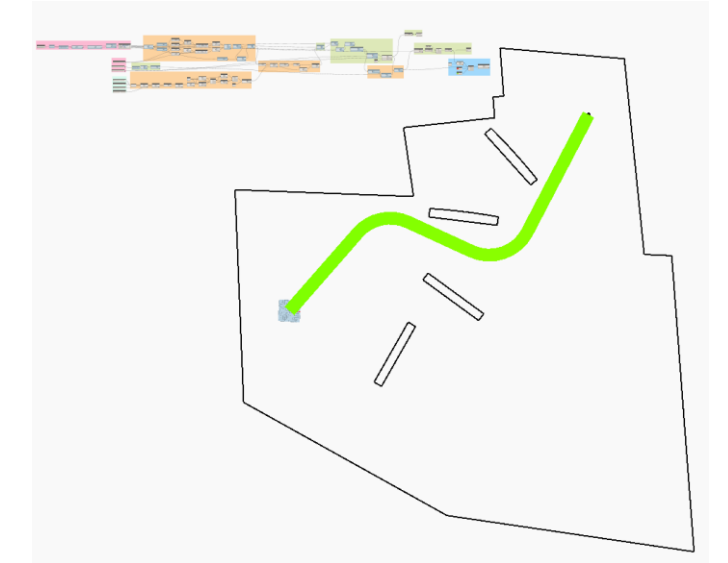
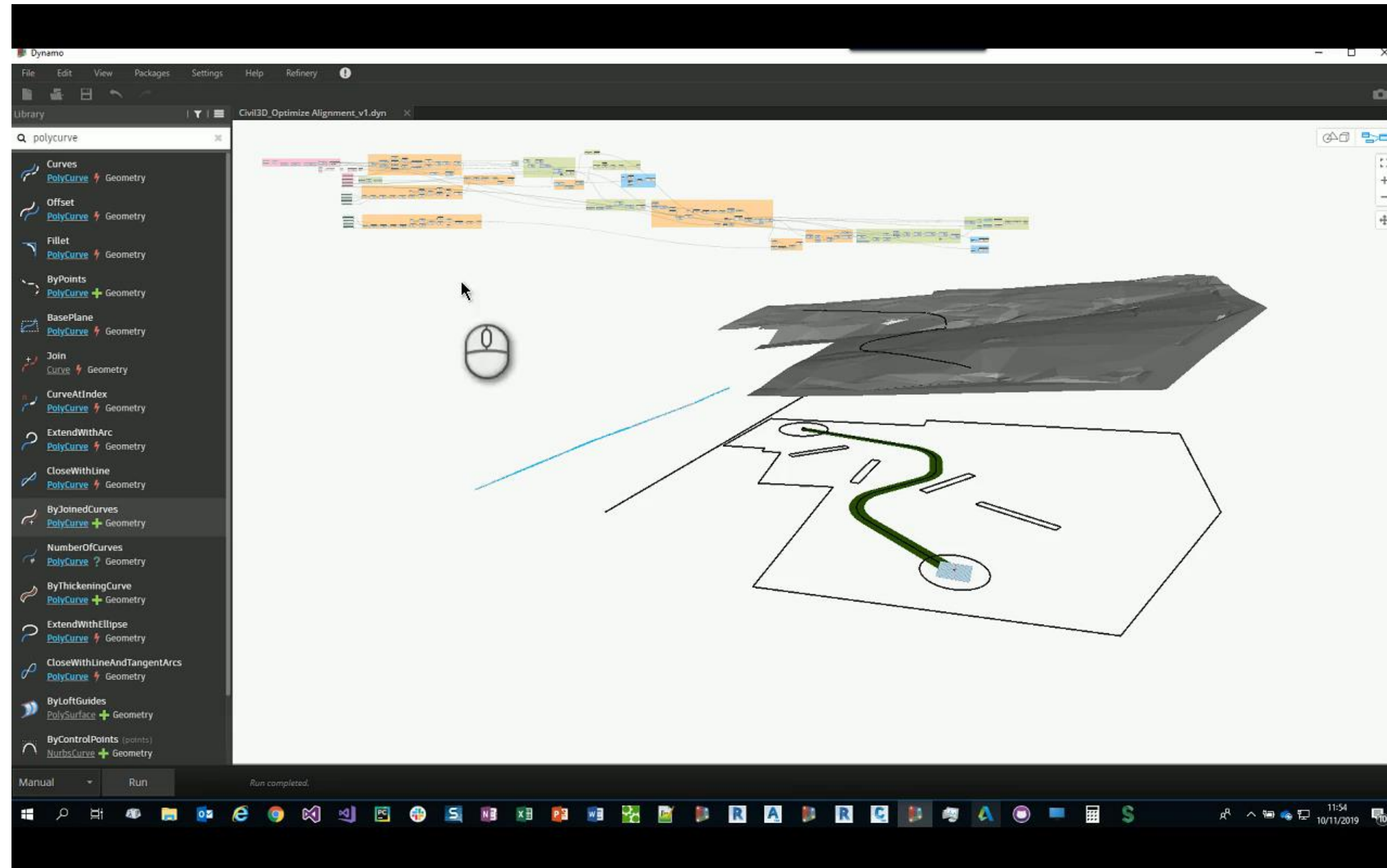
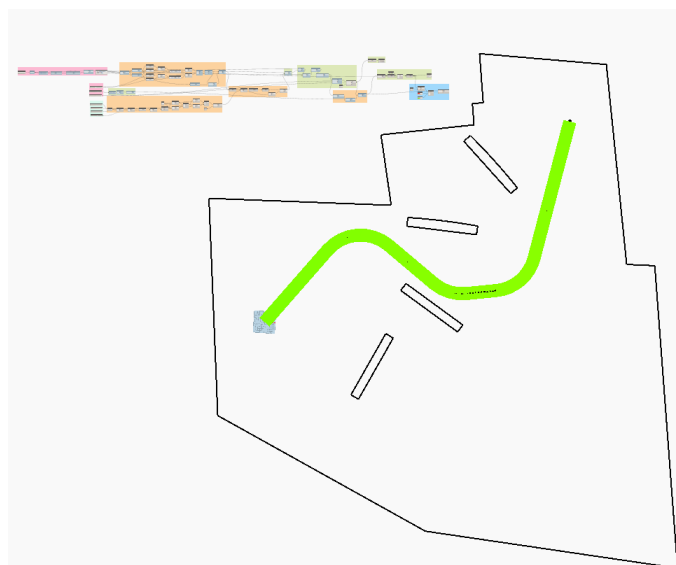
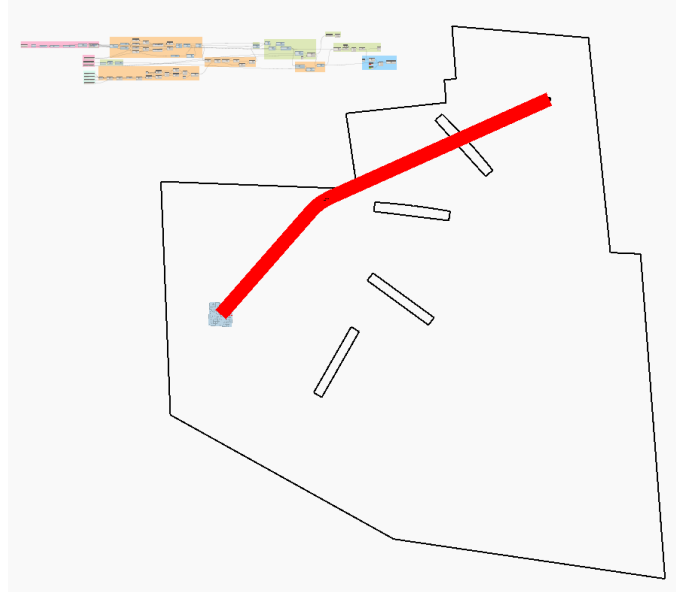
Computational Strategy

Metrics Scores

Data / Feedback Driven



Optimize Alignment



[Link To Video](#)

Learning Resources

WHERE TO FIND IT

manage.autodesk.com

Dynamo Package Manager

WHERE TO LEARN

Dynamo Primer

Autodesk University

WHERE TO ASK QUESTIONS

[DynamoBIM.org forum](https://dynamobim.org/forum) | Civil 3D category



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