Computational Design for Civil Engineers

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AUTODESK.

Agenda

- What is Computational Design
- What is Dynamo
- Consulting Experience CivilConnection
- Dynamo For Civil 3D
- Use Cases
  - Rail
  - Roads
  - Land Development
- Next Steps
- Q&A

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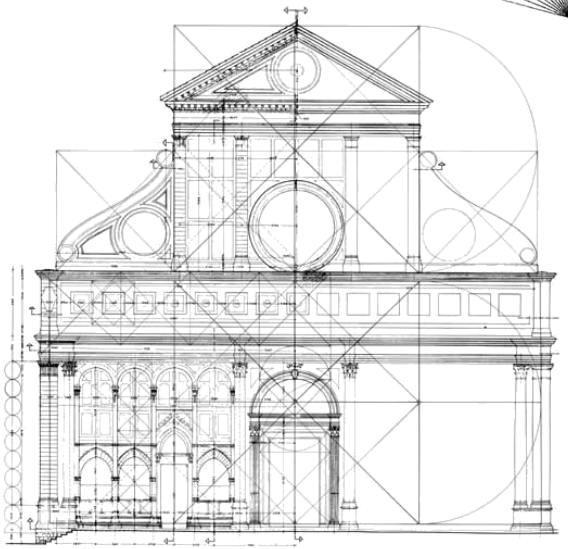
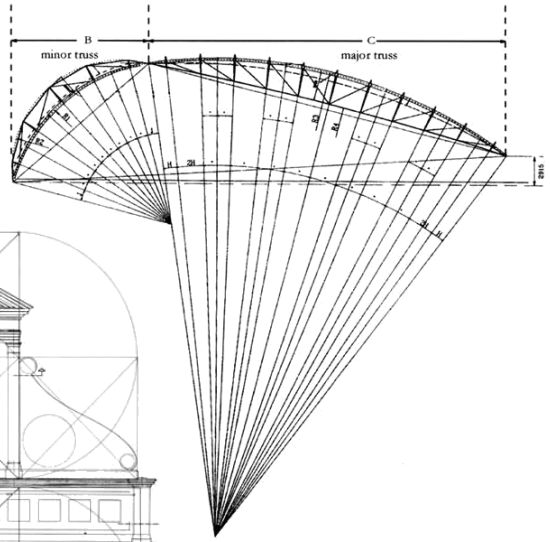
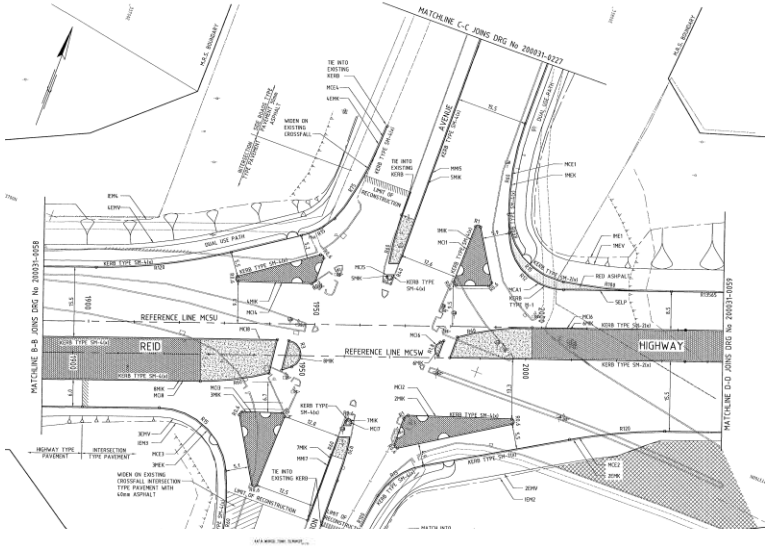
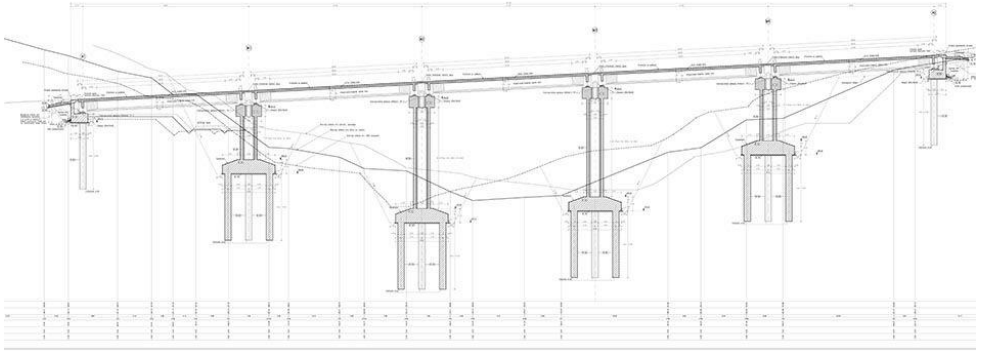
Computational Design

Design Intent with Sketching







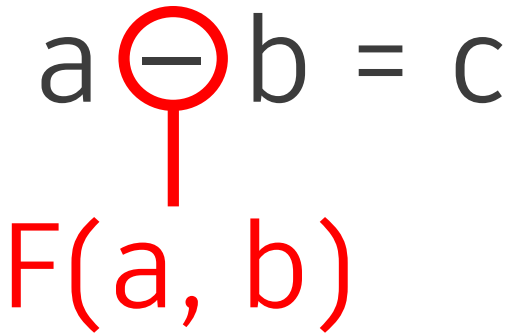


Computational Design

Define Data Relationships

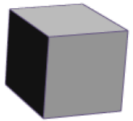
$$a = 4$$

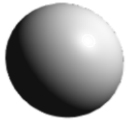
$$b = 1$$



Computational Design

Define Data Relationships

a = 

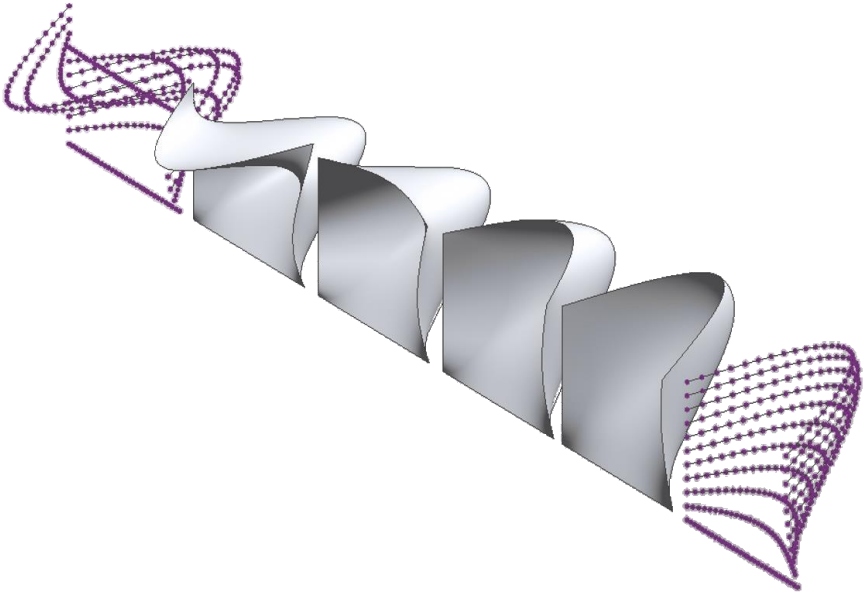
b = 

a – b = 

F(a, b)

Scripting

Define a sequence of instructions via text



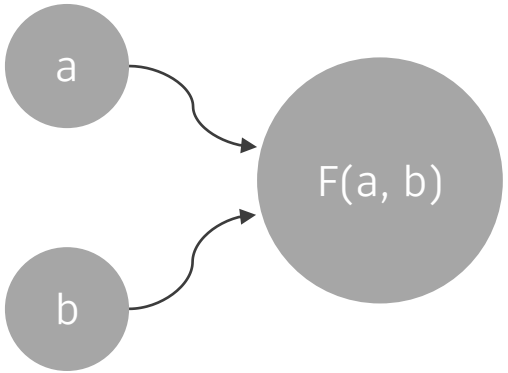
CreateSurface.py - Notepad

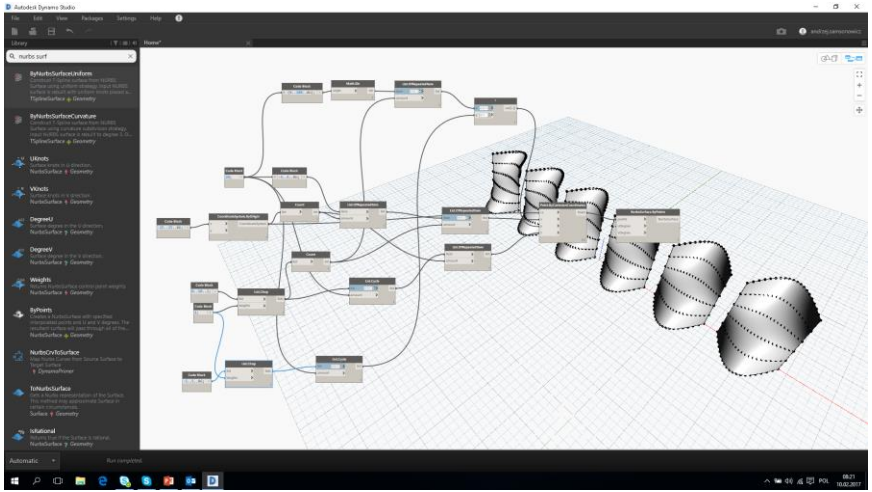
File Edit Format View Help

```
#Create ReferenceArrayArrays
refarar = ReferenceArrayArray()

#Do some math to place points
z = 0
detail = 10
while (z <= detail):
        x = 0
        refptsarr = ReferencePointArray()
        while (x <= detail):
                x = x
                y = (math.sin(x/3)*10) * (math.sin(z*.19))
                z = z

                #Create Points that are appended to an array
                refptsarr.Append(doc.FamilyCreate.NewReferencePoint(XYZ(x,y,z)))

                #Increment x
                x= x+(math.pi/detail)

        #Increment z
        z = z + 1
```

Visual Programming

Define a sequence of instructions via nodes and connectors



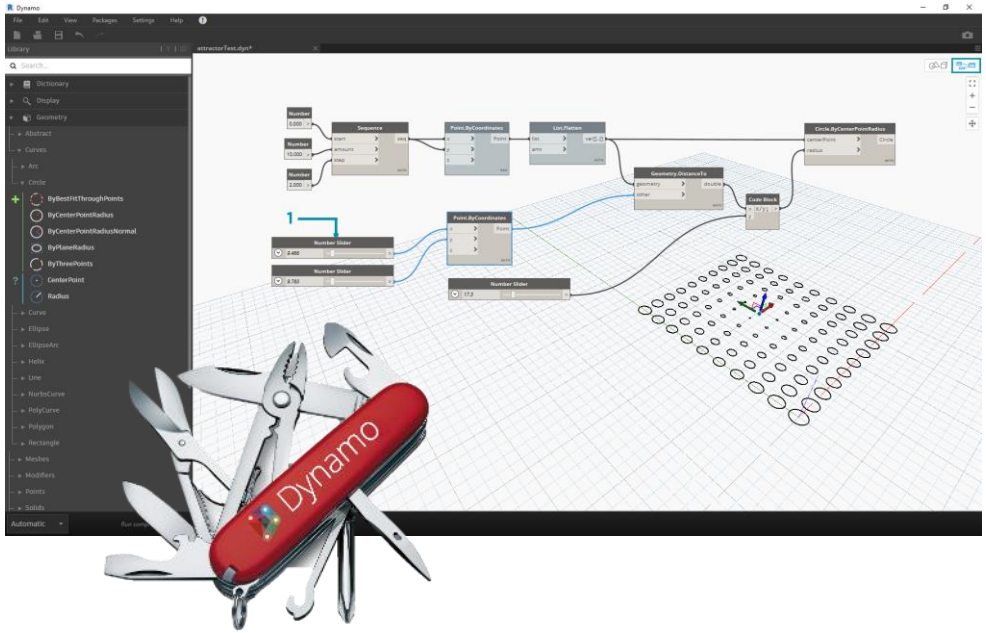


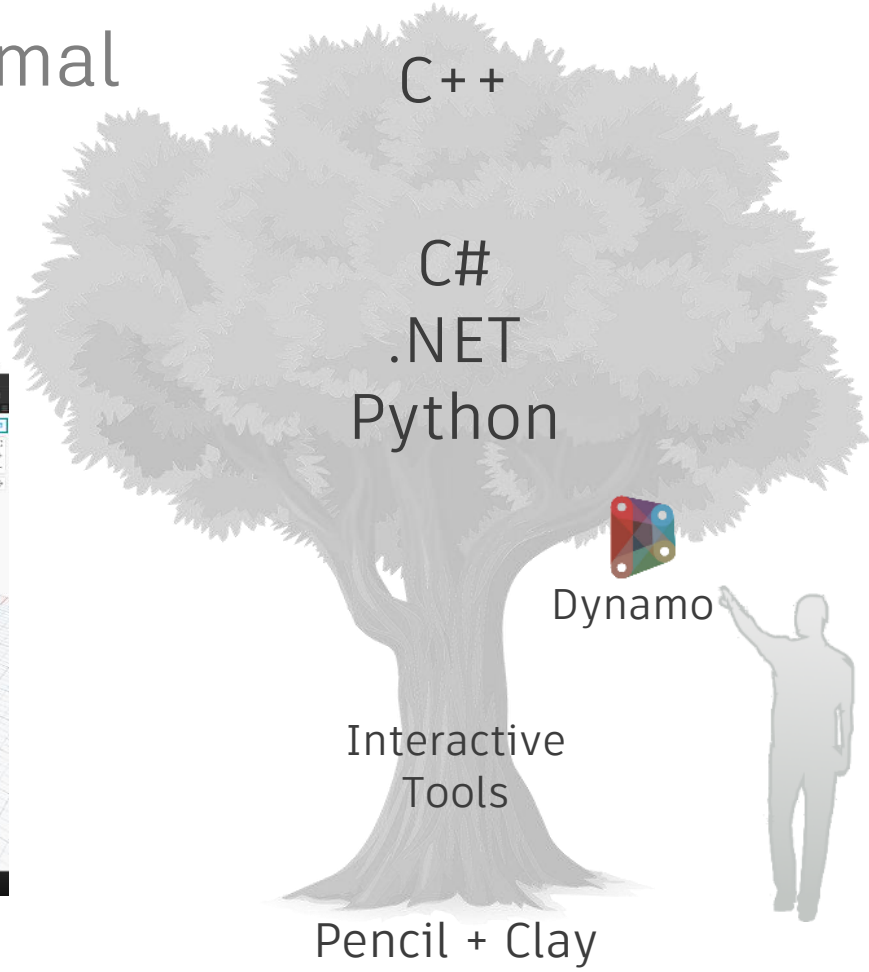
Dynamo

Automation | The New Normal

Automation Is the Disruptor

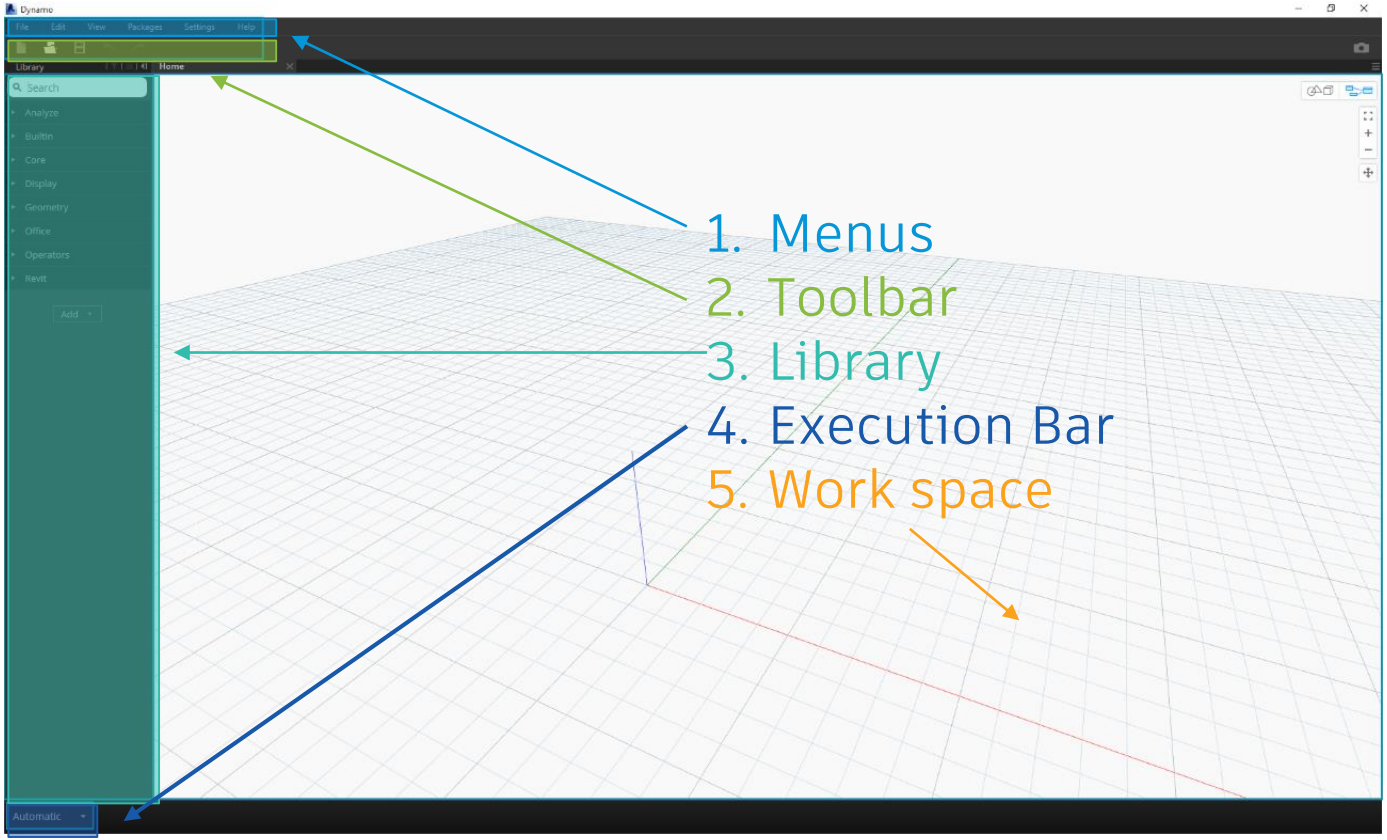
- Visual interface to construct logic routines





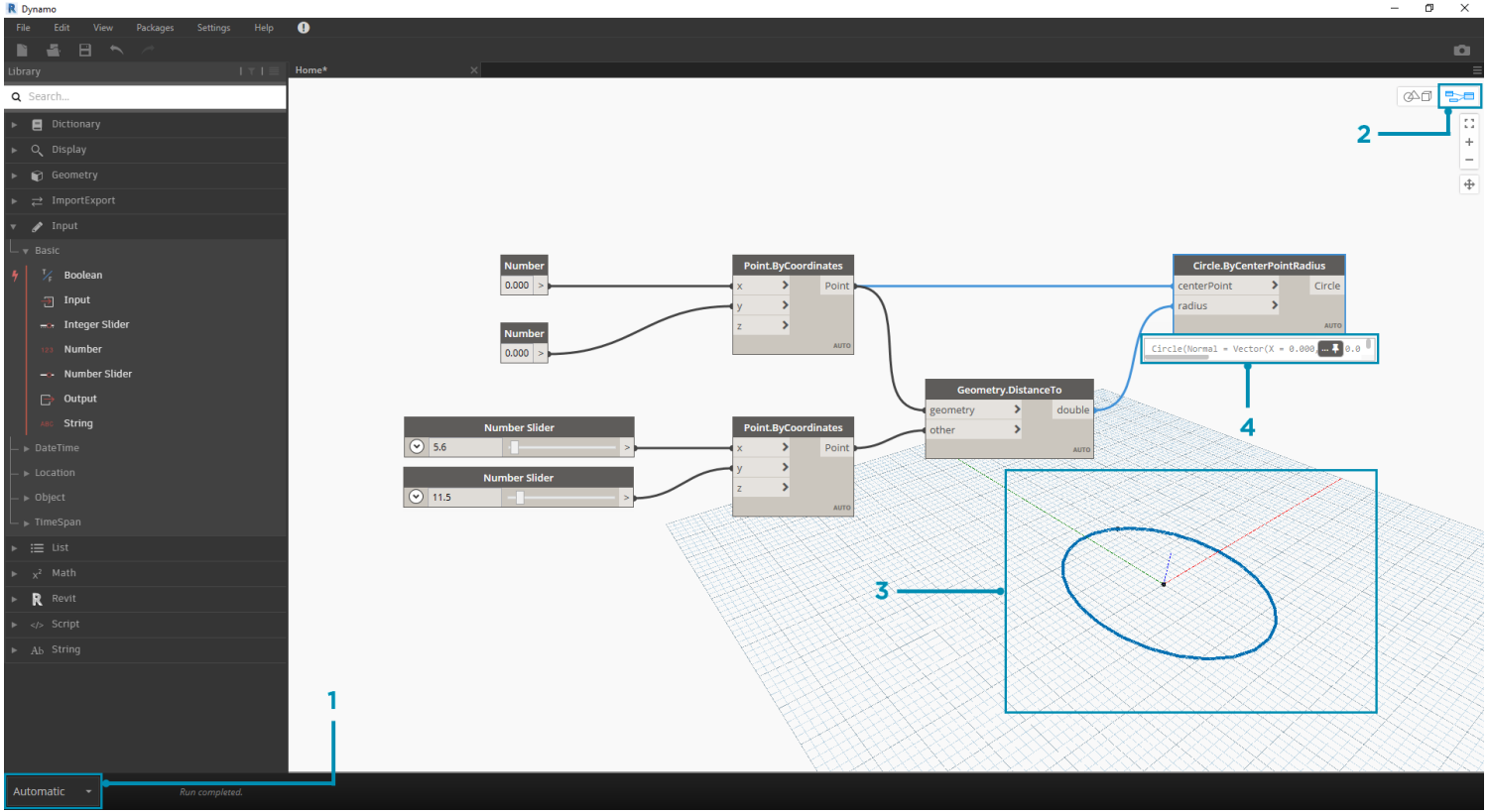
Dynamo | Getting Started

User Interface



Dynamo | Getting Started

Follow the data flow



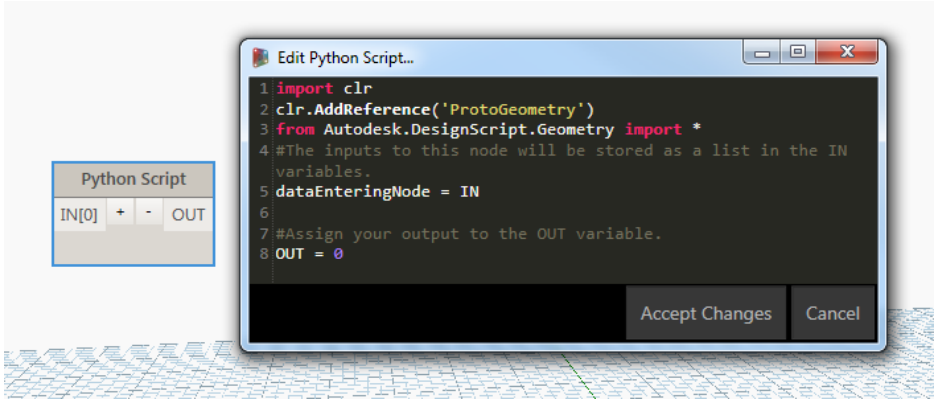
Where can you find Dynamo

https://dynamobim.org/download/

- Advance Steel
- Alias
- Civil 3D
- FormIt
- Revit
- Sandbox

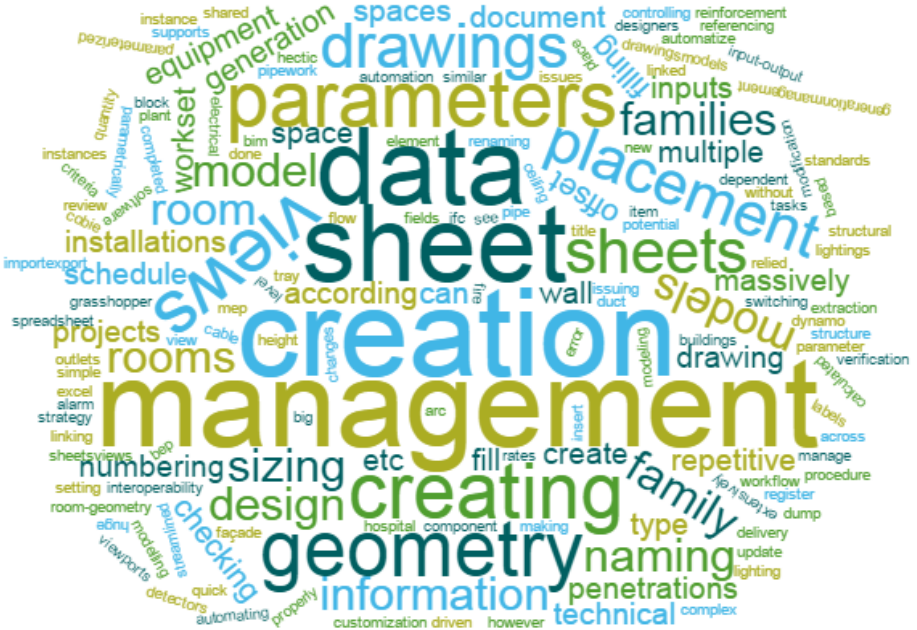
Iron Python | .NET Compatible

- Interpreted Programming Language (no need to compile)
- IronPython 2.7 installed with Dynamo
- .NET capabilities (e.g. Revit, Civil 3D, Navisworks, etc.)



Why Use Dynamo

- Complex Modeling | More
- Model Data Consistency | Better
- Automate Repetitive Tasks | Less Effort

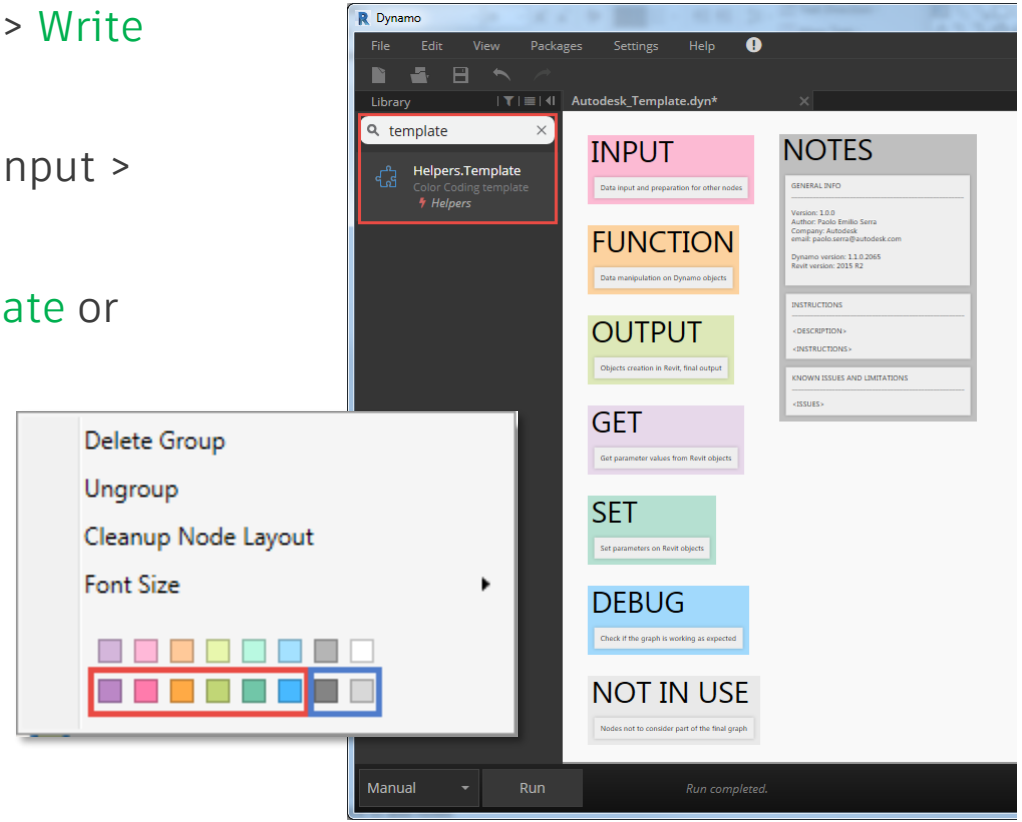


- Resources
  - Dynamo BIM
  - Dynamo Primer
  - Dynamo Forum
  - Autodesk Consulting Dynamo guide
  - Autodesk University

Dynamo Workflows

Dynamo High-Level Workflows

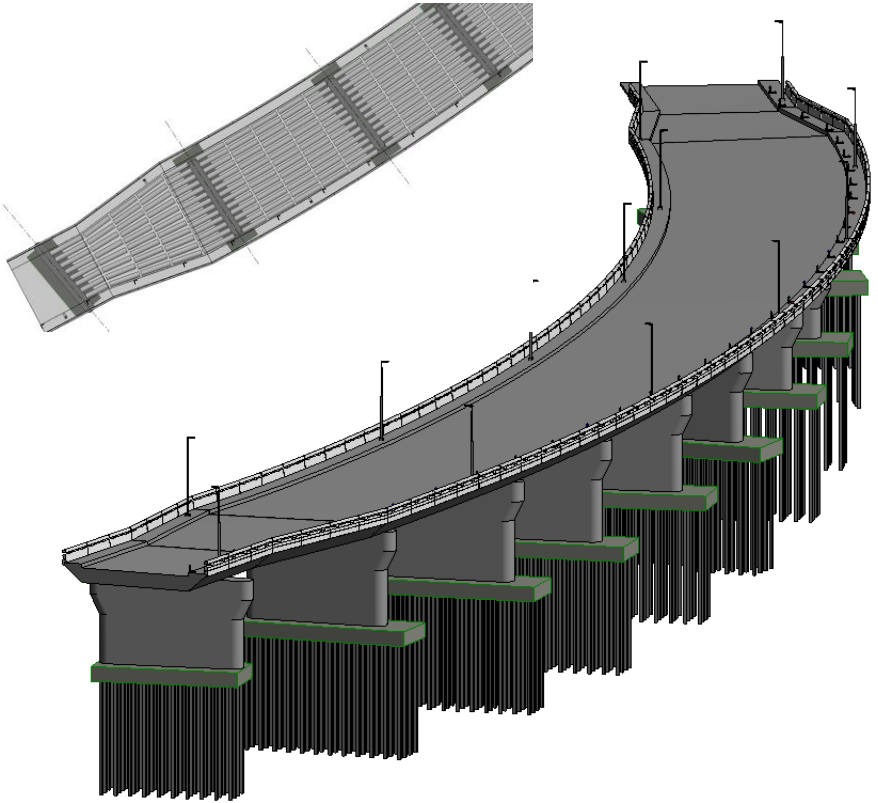
- Select objects > Get properties > Write values to an external file
- Select objects > Read external input > Modify object properties
- Input data > Process data > Create or Update objects



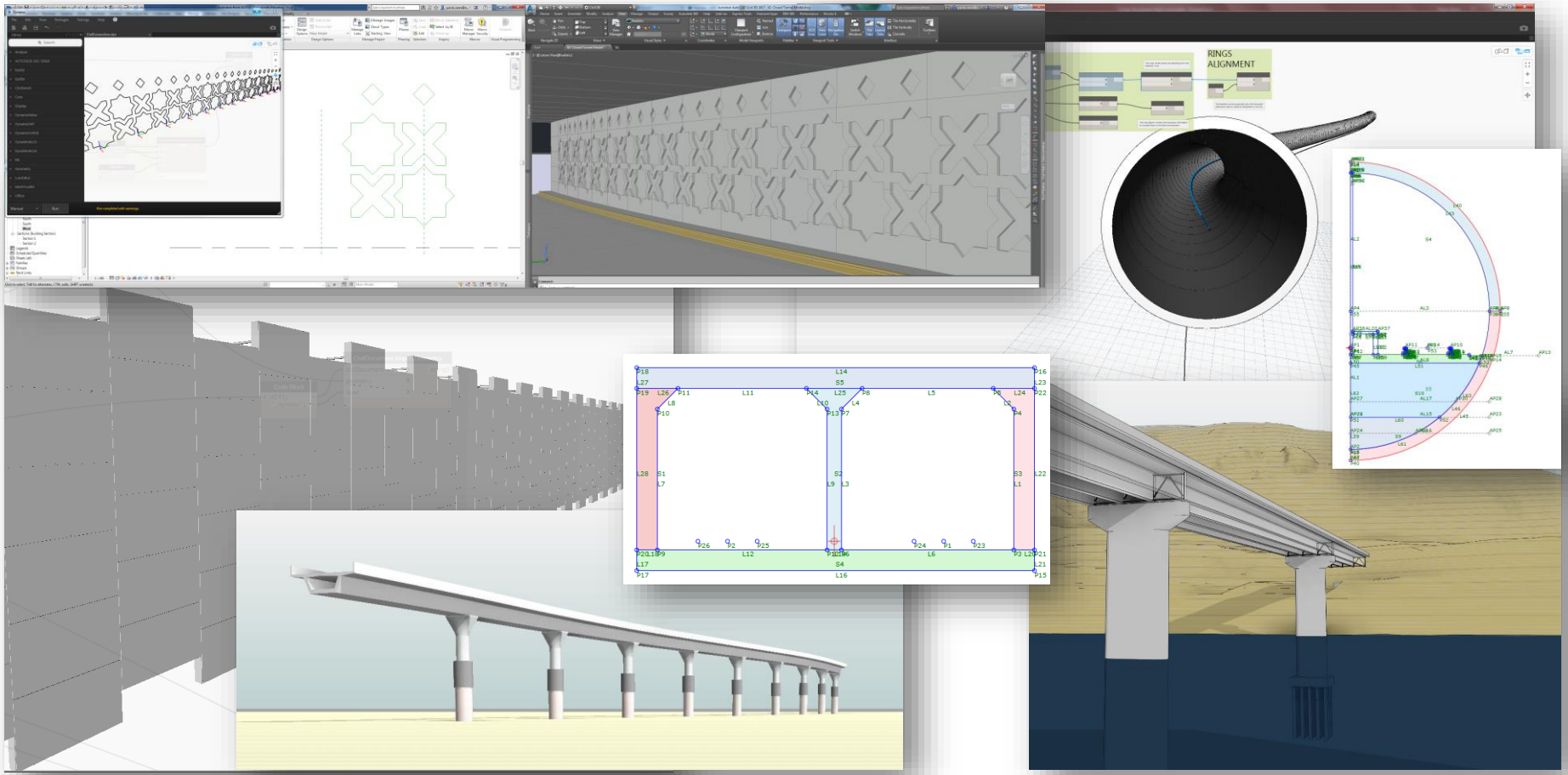
CivilConnection

CivilConnection

- Bidirectional flow of information between Civil 3D and Revit
- Toolkit to leverage computational design for infrastructures
- Complementary to InfraWorks Civil Structures workflows and for detailed design
- On Dynamo Package manager
- Open Source & customizable
- Link to Customer Success Stories

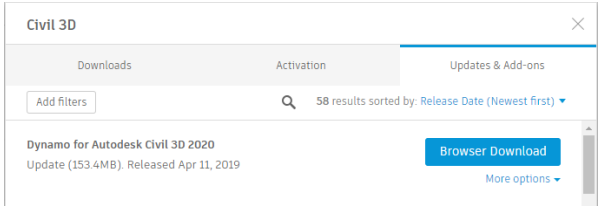


CivilConnection | Use Cases

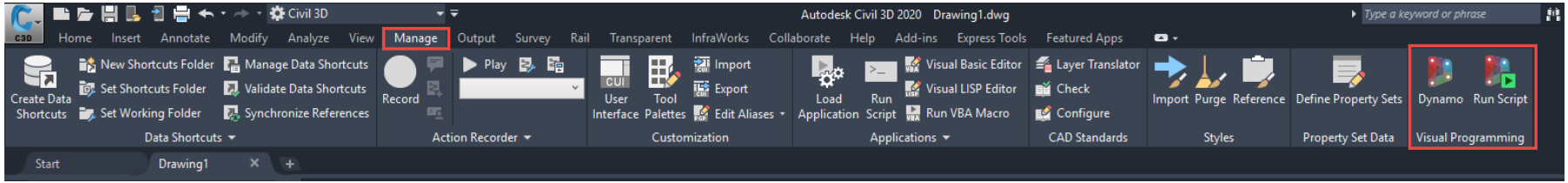


Dynamo for Civil 3D

How To Get Dynamo for Civil 3D

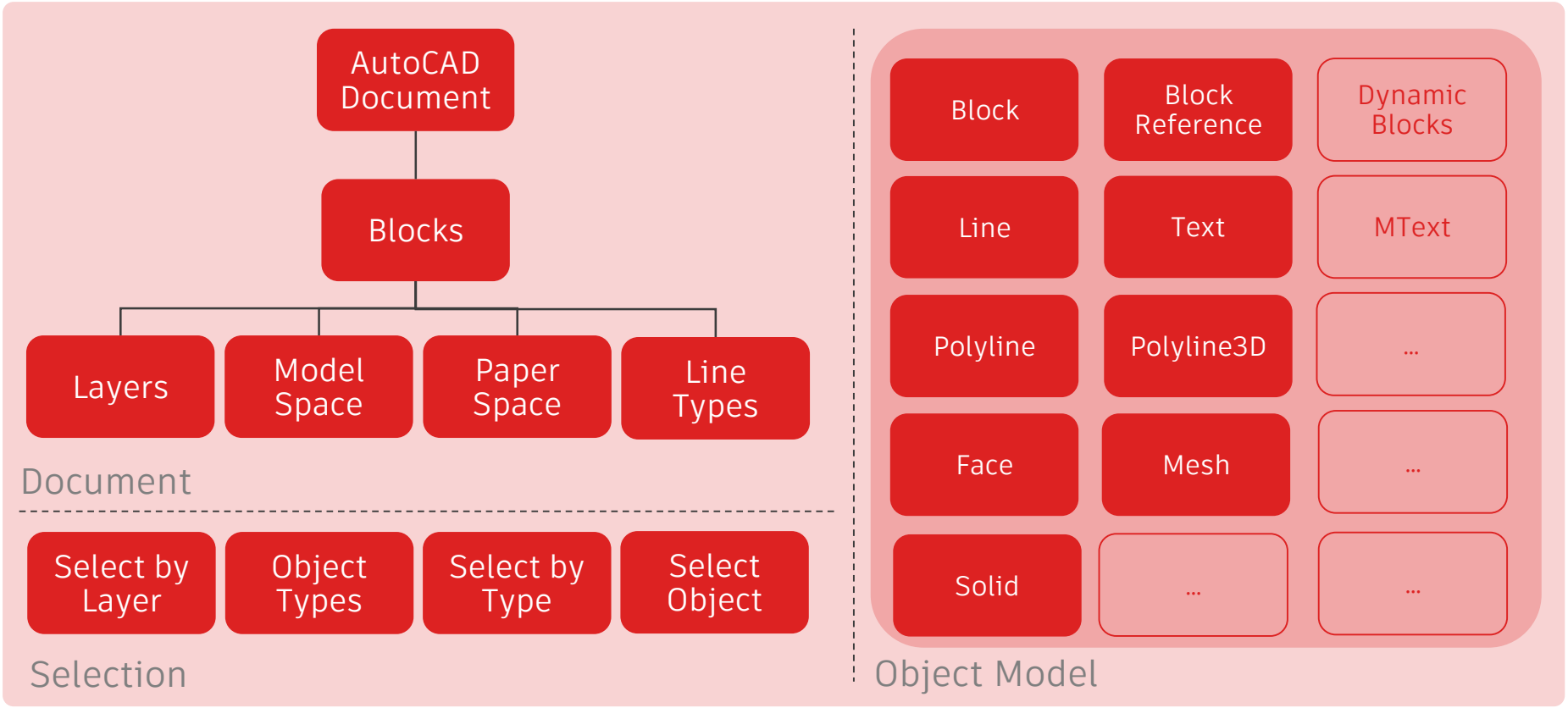


- Separate installer on Autodesk account
- New panel in the ribbon Manage > Visual Programming

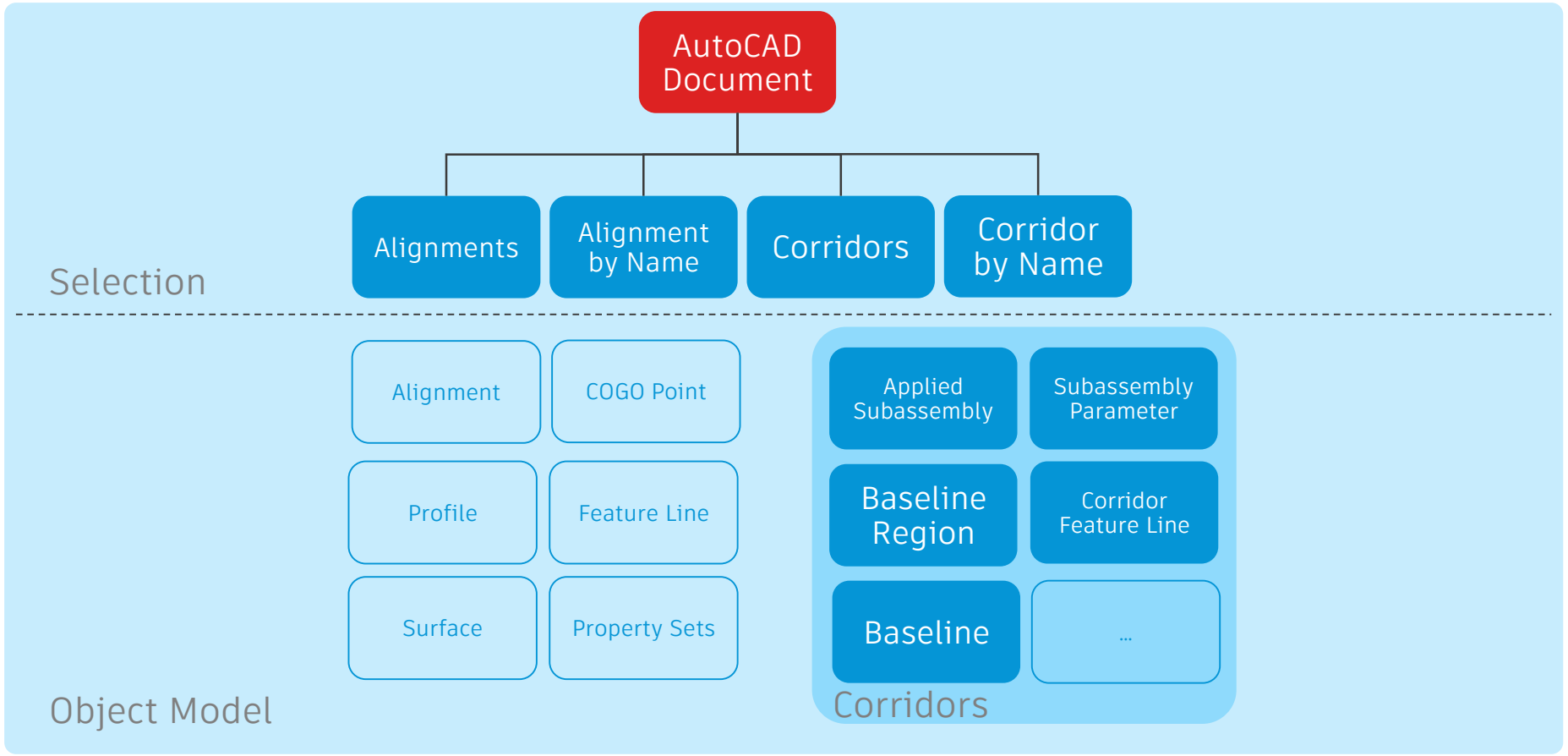


- User Interface or “Headless” Command Line Interface
- Focus on transportation workflows
- Contains 9 sample workflows
- One .NET API sample

Dynamo for AutoCAD



Dynamo for Civil 3D



Expand Automation Workflows

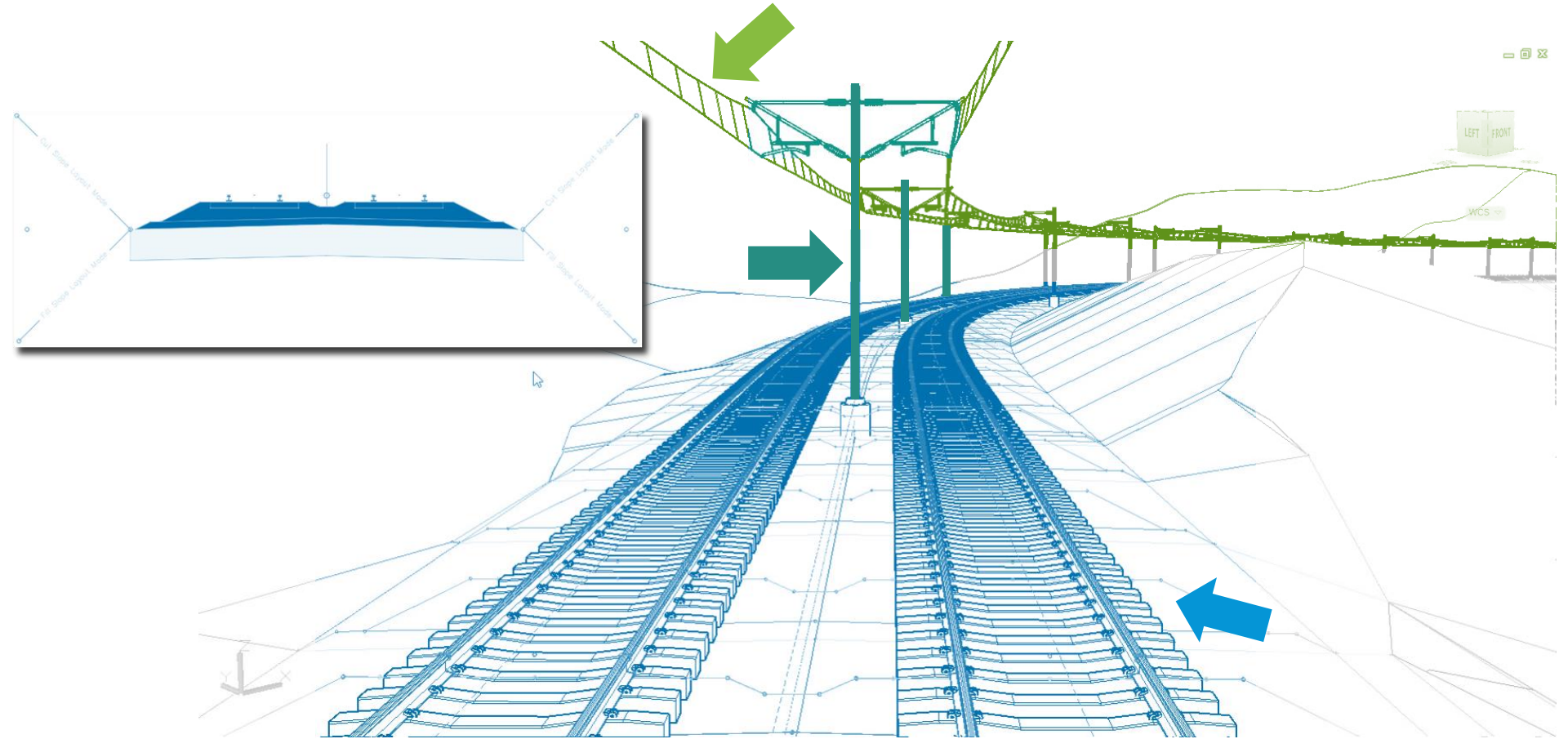
- For the workflows that are still missing in the nodes shipped in Dynamo use Python
- Create Python modules for AutoCAD and Civil 3D to be reused in Dynamo
- Leverage the full .NET API in a prototyping environment
- Look out on the Dynamo Package Manager for Civil 3D dedicated packages
- Create and share custom nodes for Civil 3D using C#

Dynamo Package Manager

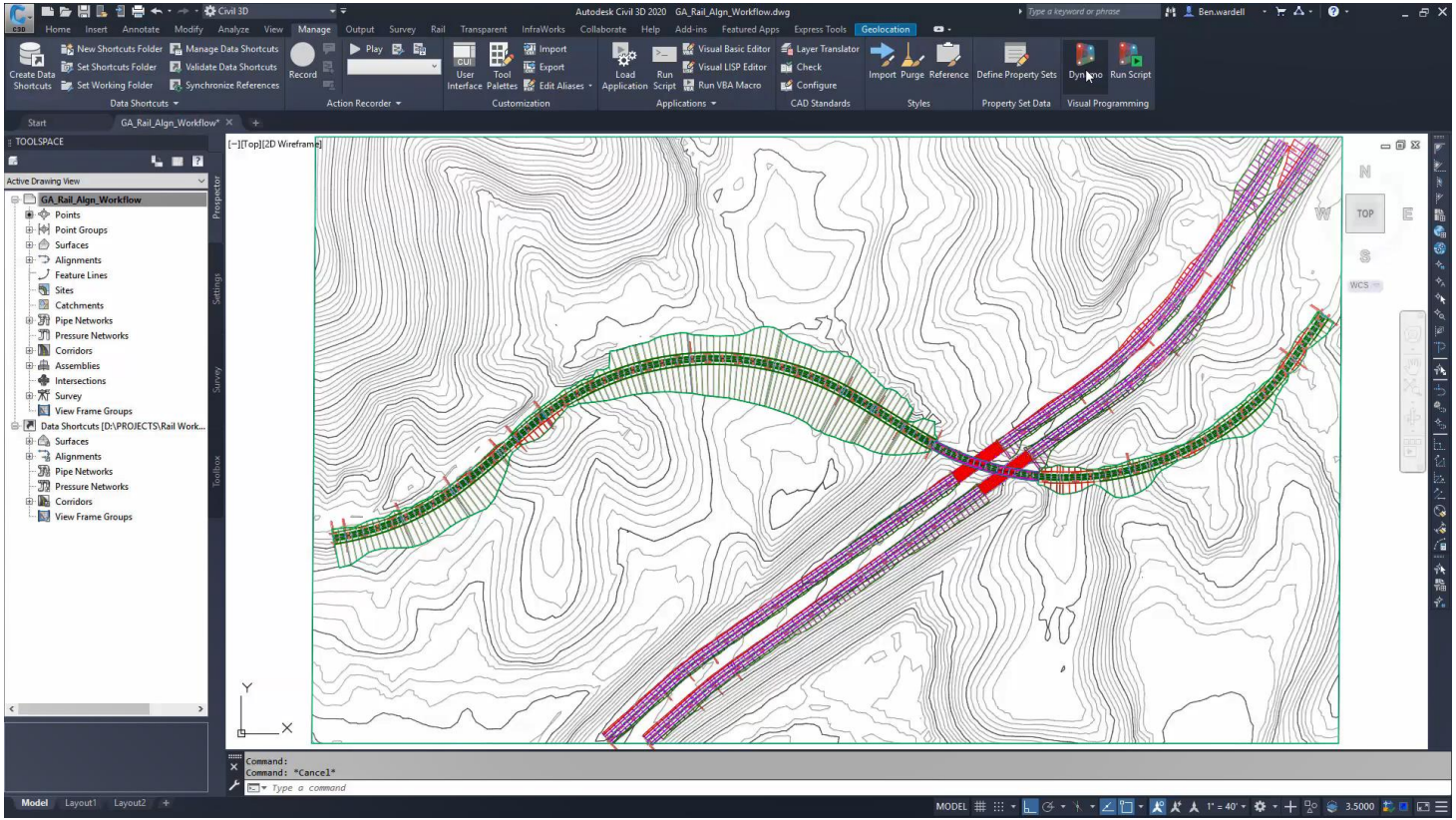
Microsoft® .NET

Rail

Rail | Concept Model & Section View



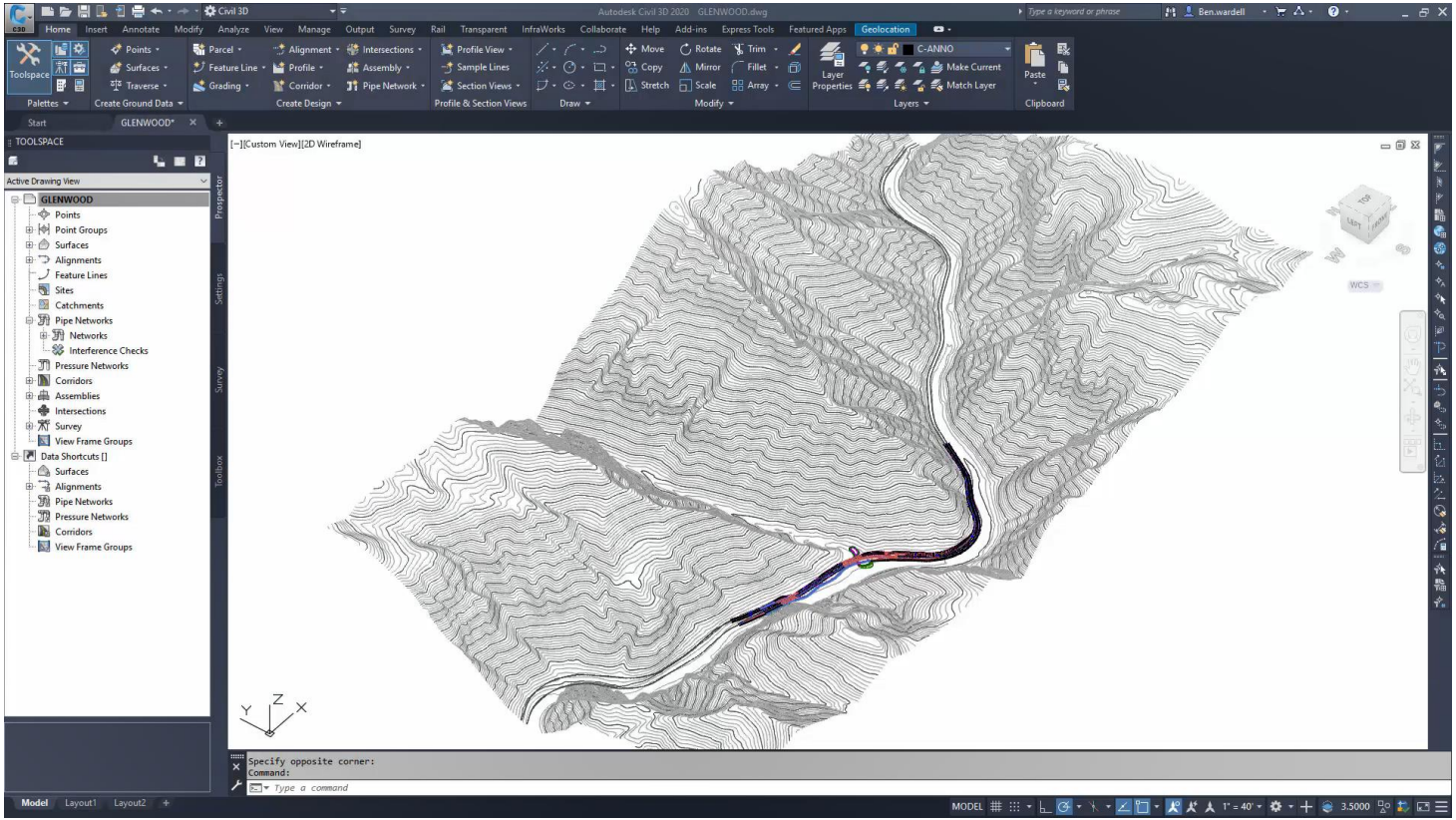
Rail | Review


Civil 3D
Autodesk Civil 3D 2020 GA_Rail_Algn_Workflow.dwg
Home Insert Annotate Modify Analyze View Manage Output Survey Rail Transparent InfraWorks Collaborate Help Add-ins Featured Apps Express Tools Geolocation
Create Data Shortcuts
New Shortcuts Folder
Set Shortcuts Folder
Set Working Folder
Manage Data Shortcuts
Validate Data Shortcuts
Synchronize References
Data Shortcuts
Record
Play
Action Recorder
User Interface
Tool Palettes
Import
Export
Edit Aliases
Customization
Load Application
Run Script
Visual Basic Editor
Visual LISP Editor
Run VBA Macro
Applications
Layer Translator
Check
Configure
CAD Standards
Import
Purge
Reference
Styles
Define Property Sets
Property Set Data
Dynamo
Run Script
Visual Programming
Start
GA_Rail_Algn_Workflow*
TOOLSPACE
Active Drawing View
GA_Rail_Algn_Workflow
Points
Point Groups
Surfaces
Alignments
Feature Lines
Sites
Catchments
Pipe Networks
Pressure Networks
Corridors
Assemblies
Intersections
Survey
View Frame Groups
Data Shortcuts [D:\PROJECTS\Rail Work...
Surfaces
Alignments
Pipe Networks
Pressure Networks
Corridors
View Frame Groups
Prospector
Settings
Survey
Toolbox
[−][Top][2D Wireframe]
N
W
TOP
E
S
WCS
Command:
Command: *Cancel*
Type a command
Model
Layout1
Layout2
MODEL
1" = 40'
3.5000

Roads

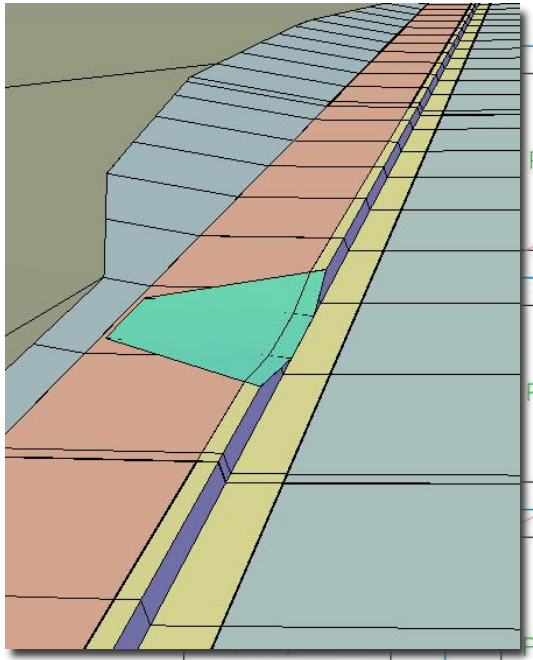
Road | Concept Model & Section View

Road | Review

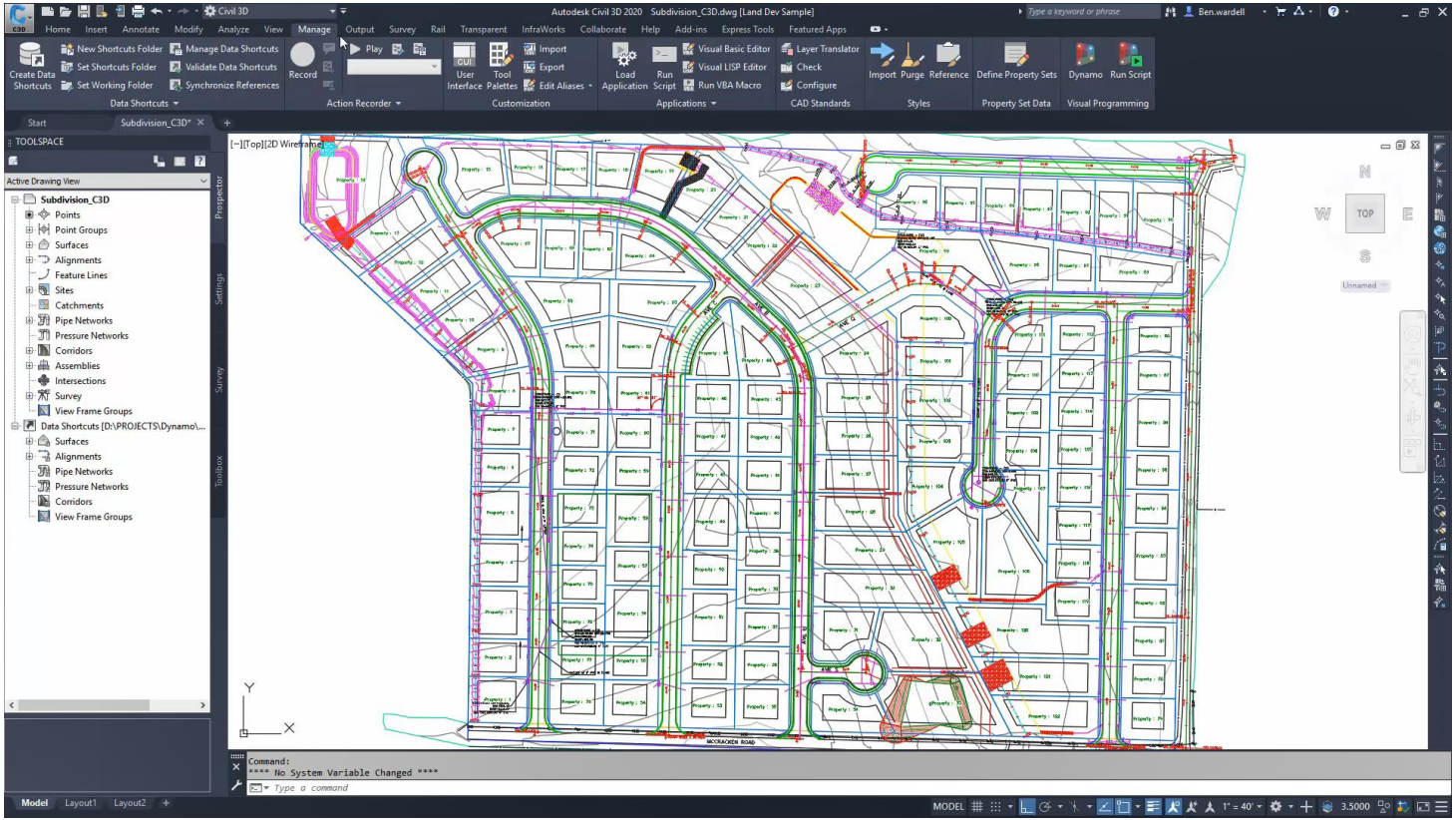

Civil 3D
Autodesk Civil 3D 2020 GLENWOOD.dwg
Ben.wardell
Home Insert Annotate Modify Analyze View Manage Output Survey Rail Transparent InfraWorks Collaborate Help Add-ins Express Tools Featured Apps Geolocation
Toolspace
Points
Surfaces
Traverse
Parcel
Feature Line
Grading
Alignment
Profile
Corridor
Intersections
Assembly
Pipe Network
Profile View
Sample Lines
Section Views
Move
Copy
Stretch
Rotate
Mirror
Scale
Trim
Fillet
Array
Layer Properties
C-ANNO
Make Current
Match Layer
Paste
Palettes
Create Ground Data
Create Design
Profile & Section Views
Draw
Modify
Layers
Clipboard
Start
GLENWOOD*
TOOLSPACE
Active Drawing View
GLENWOOD
Points
Point Groups
Surfaces
Alignments
Feature Lines
Sites
Catchments
Pipe Networks
Networks
Interference Checks
Pressure Networks
Corridors
Assemblies
Intersections
Survey
View Frame Groups
Data Shortcuts []
Surfaces
Alignments
Pipe Networks
Pressure Networks
Corridors
View Frame Groups
Prospector
Settings
Survey
Toolbox
[−][Custom View][2D Wireframe]
WCS
Z
Y
X
Specify opposite corner:
Command:
Type a command
Model
Layout1
Layout2
MODEL
1" = 40'
3.5000

Site Development

Site Development | Concept Model



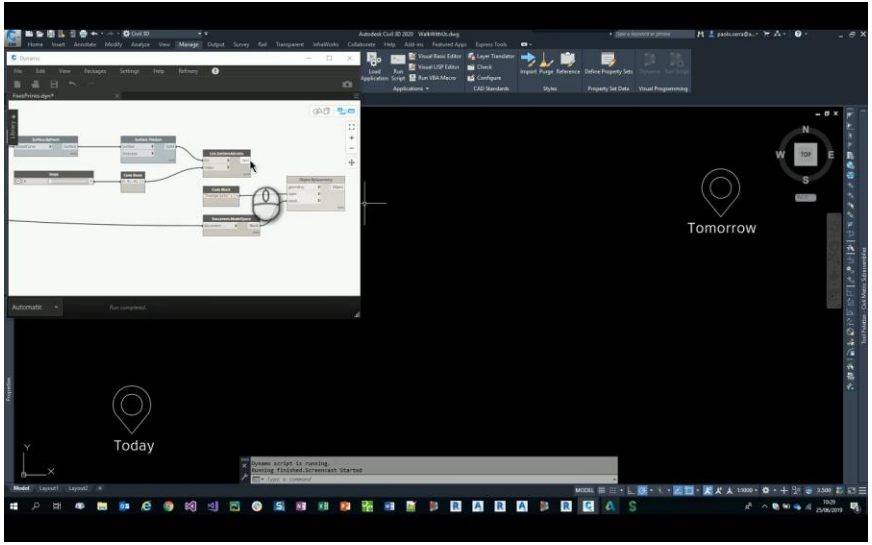
Site Development | Review



Next Steps

Walk With Us

- Download and install Dynamo for Civil 3D from your Autodesk account
- Visit Civil 3D Futures Portal to get the latest version and provide feedback
- Visit Dynamo Civil 3D forum
- https://forum.dynamobim.com/c/civil3d
- Explore the use cases shipped with the product
- Start automating your workflows!



Poll

Q&A

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