

# Civil Excavation with InfraWorks and Civil 3D

B.S.E Salvatore Macrì

Technical Sales Specialist AEC Infrastructure







## About the speaker

Salvatore Macrì is a Technical Sales Specialist for Autodesk Infrastructure Solutions and is responsible for the Italian market. He is based in Milan.

He has a Bachelor's degree in Environmental Engineering and more than 15 years experience including a mix of different profiles such as Surveyor, GIS Specialist, Designer and CAD Manager.

Before joining Autodesk in 2016 he worked as a BIM Specialist and Trainer in the VAR Channel helping customers to implement the BIM process and to adopt AutoCAD Civil 3D, InfraWorks, Revit and Navisworks.

He was a Subject Matter Expert for the translation into Italian of InfraWorks and co-author of the Italian Country Kit for AutoCAD Civil 3D.



<https://www.linkedin.com/in/salvatore-macrì-7278b323>



# Why Excavation ?

Any removal of rocks and / or earth from the original location necessary for the creation of slab, cavities, part or all building/Infrastructure of appropriate shapes and sizes, necessary for construction.





# Excavation for Building







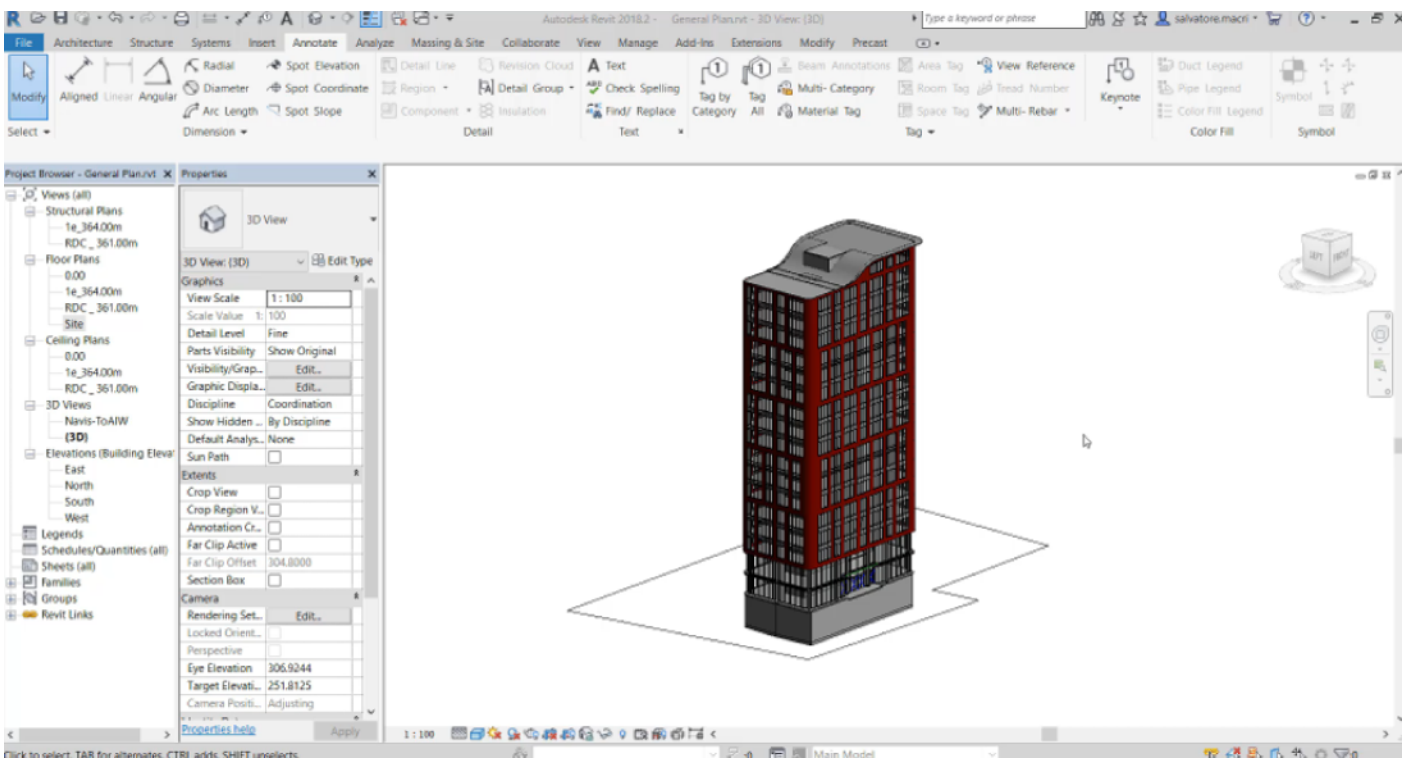
# Basic Workflow for Building



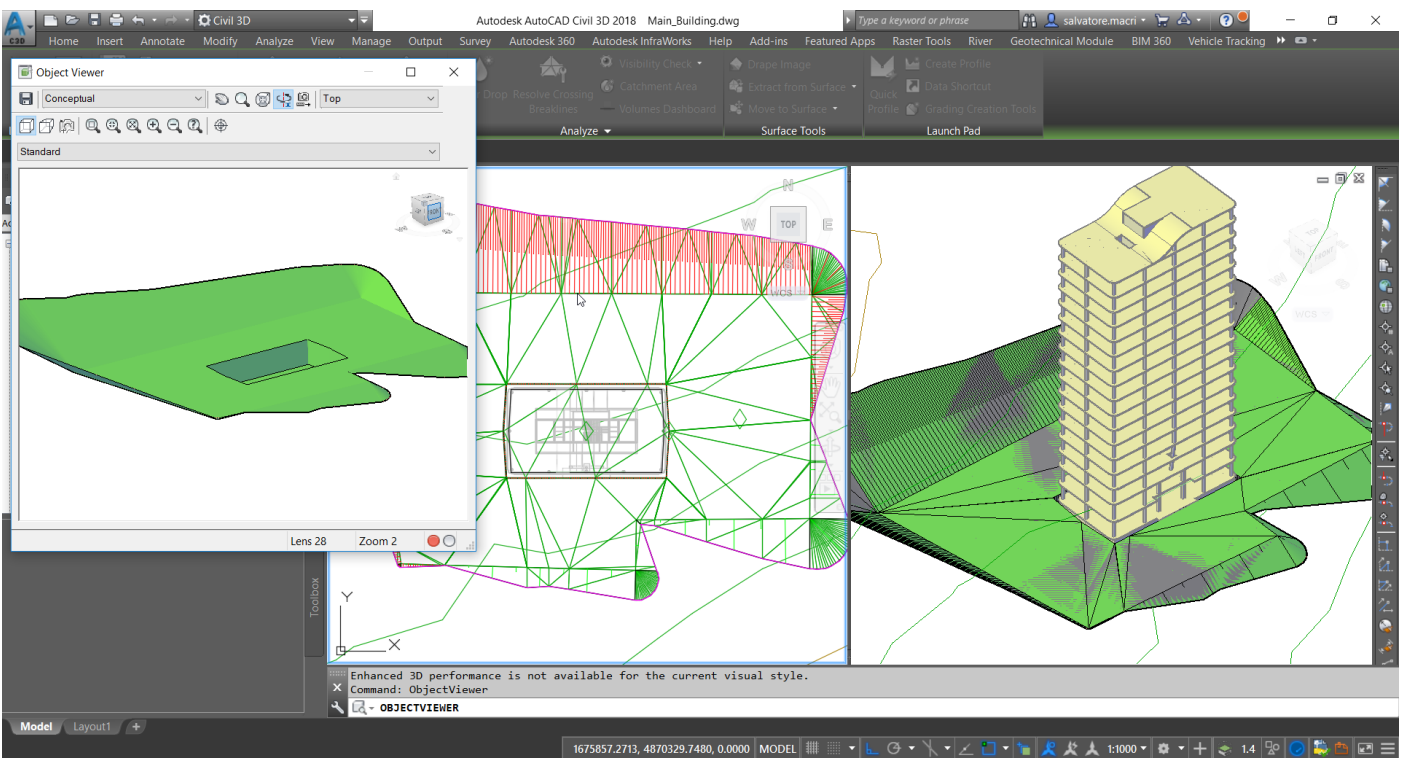
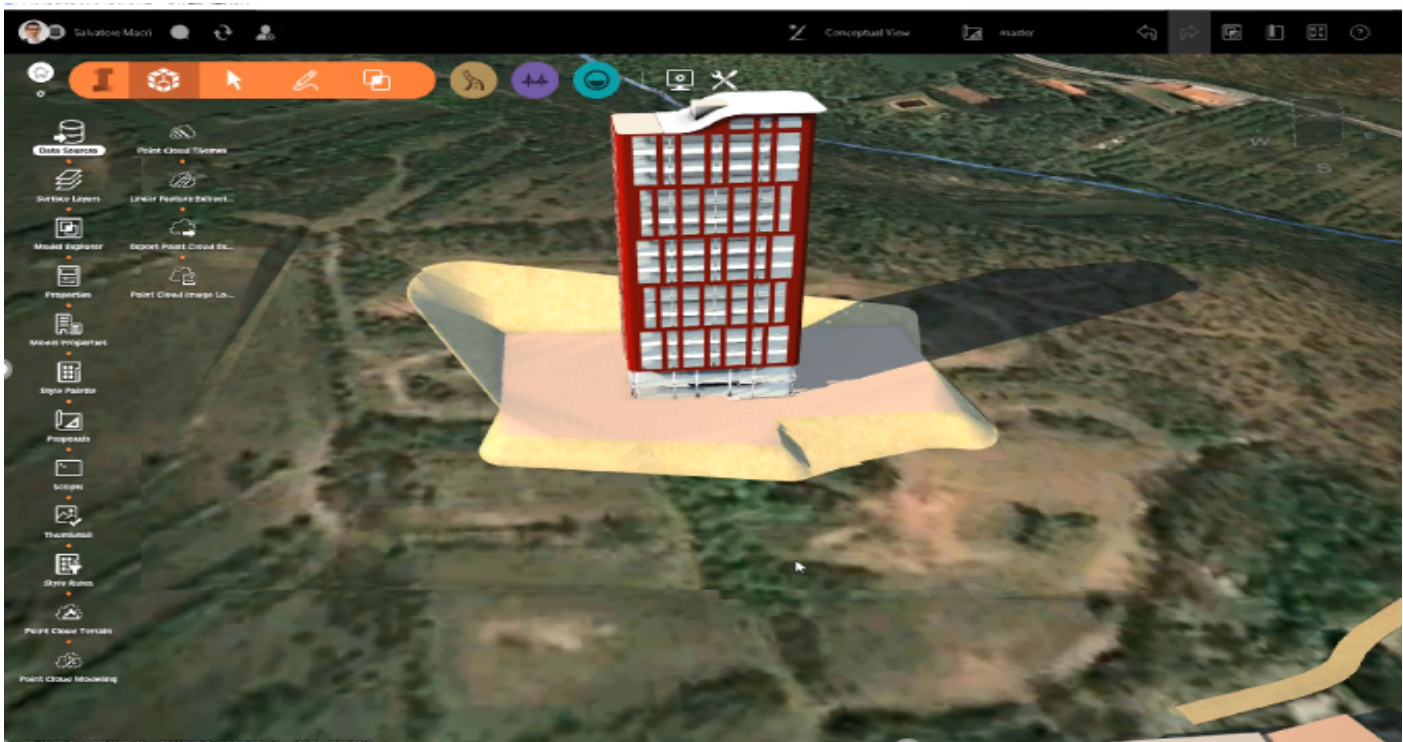
Create, edit and manage Building



Create model on real context  
Preliminary Excavation  
Quick Volume Calculation

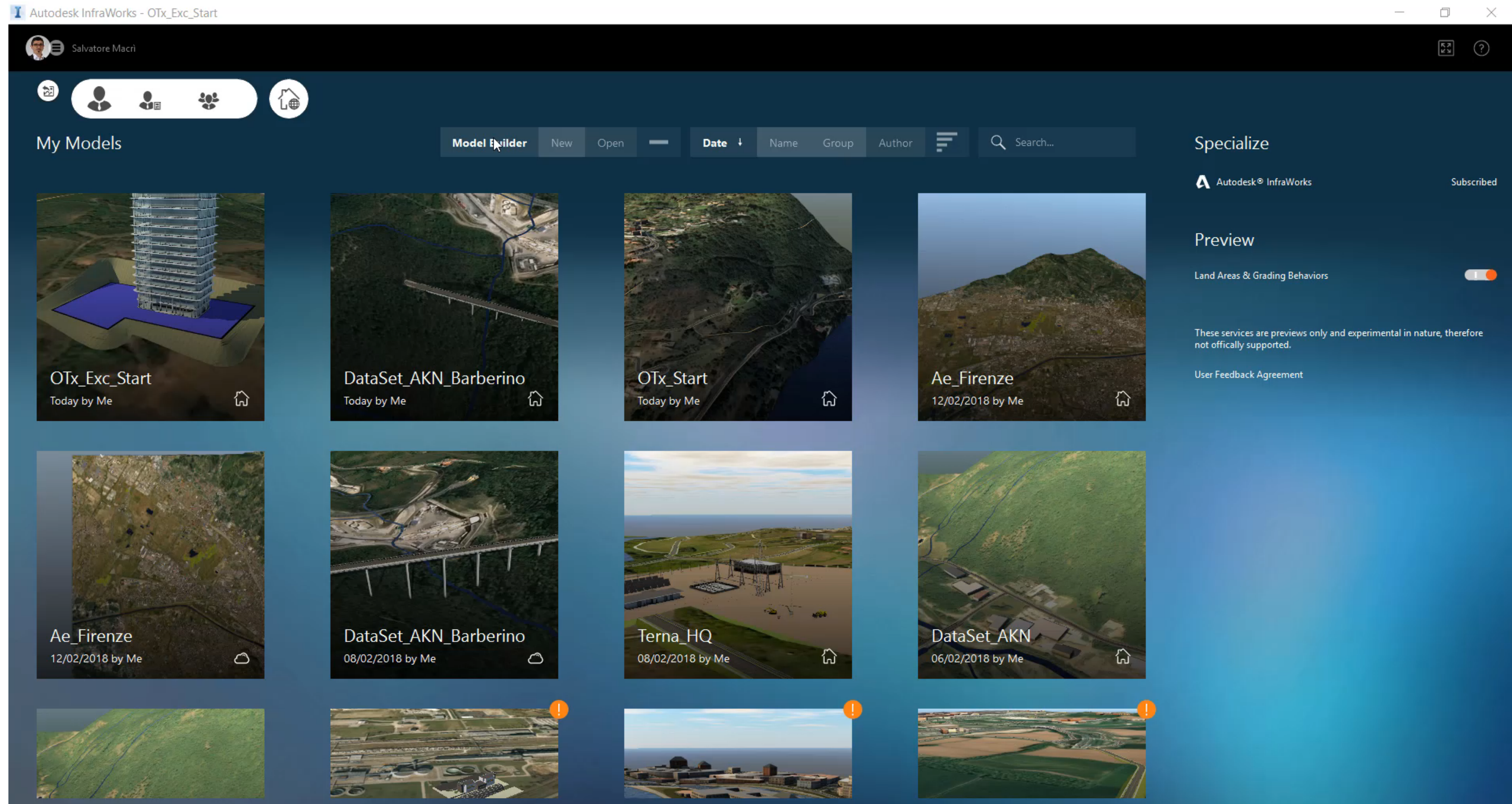


Build, Edit and Manage Excavation  
Evaluate Volume  
Evalutate Stock Volume for site construction





# Infraworks – Model Builder





# Infraworks – Build Platform

Autodesk InfraWorks - OTx\_Exc\_Start

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Conceptual View

master

DATA SOURCES

Group by: Feature Type Show: All

| Name           | Source Type | Status   |
|----------------|-------------|----------|
| Buildings      |             |          |
| buildings      | Vector      | Imported |
| Coverage Areas |             |          |
| landuse        | Vector      | Imported |
| Ground Imagery |             |          |
| imagery        | Raster      | Imported |
| Roads          |             |          |
| roads          | Vector      | Imported |
| Terrain        |             |          |
| Water Areas    |             |          |
| waterareas     | Vector      | Imported |
| waterways      | Vector      | Imported |

Hide Details

Data Source Details

Name: Border\_SM\_Work - MyS

Description: <Empty>

Source type: Civil3DDwg

Connection string: \\pdesk FlashHouse SB\Border\_SM\_Work.DWG

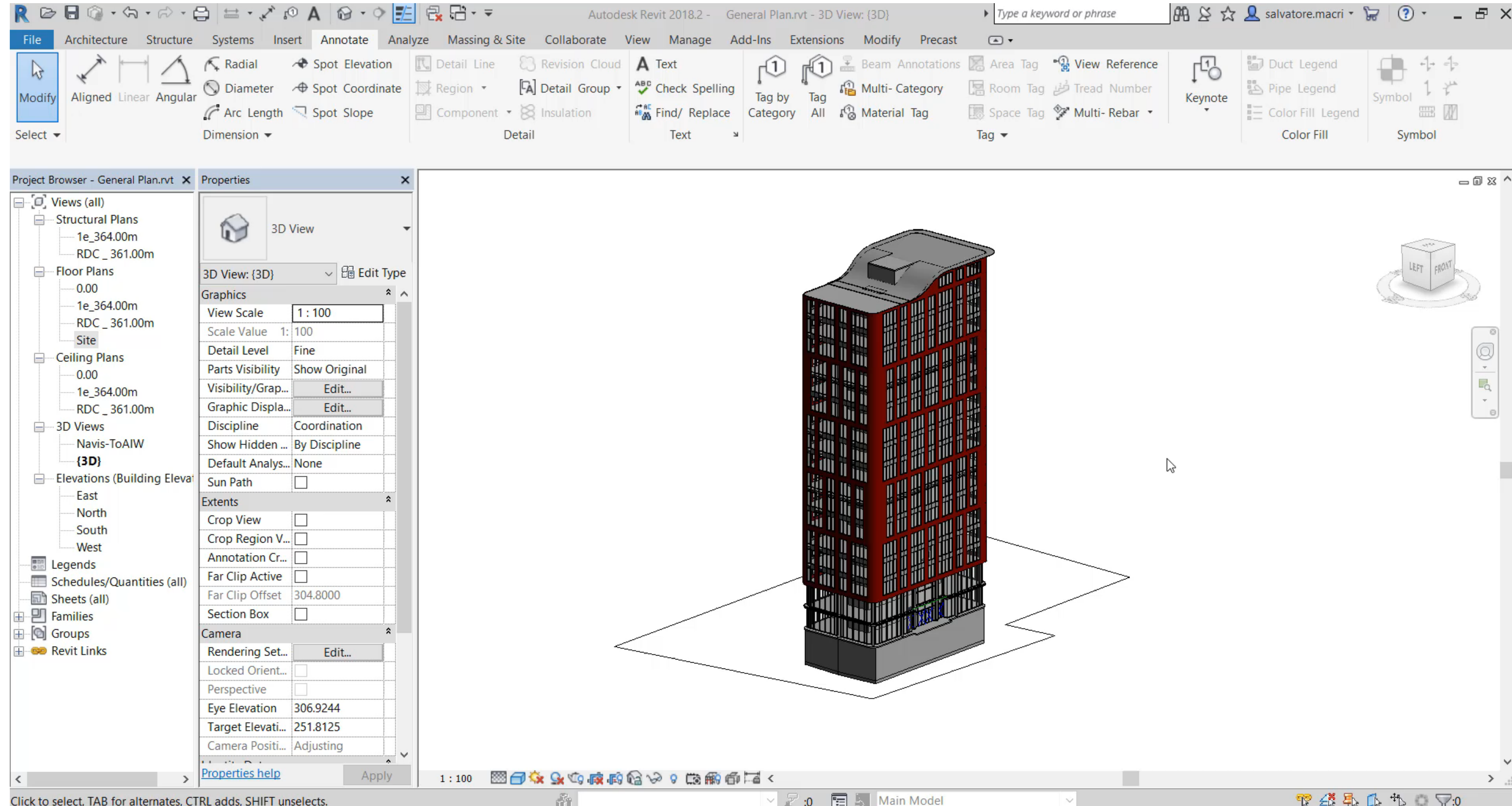
Coordinate system: e 1940 datum; Gauss-Boaga, W of 12 deg E

Date loaded: mer feb 21 2018

X: 1677945.835104 Y: 4870074.251297 Z: 296.999764 m



# Infraworks – Import Revit Model





# Infraworks – Import Revit Model

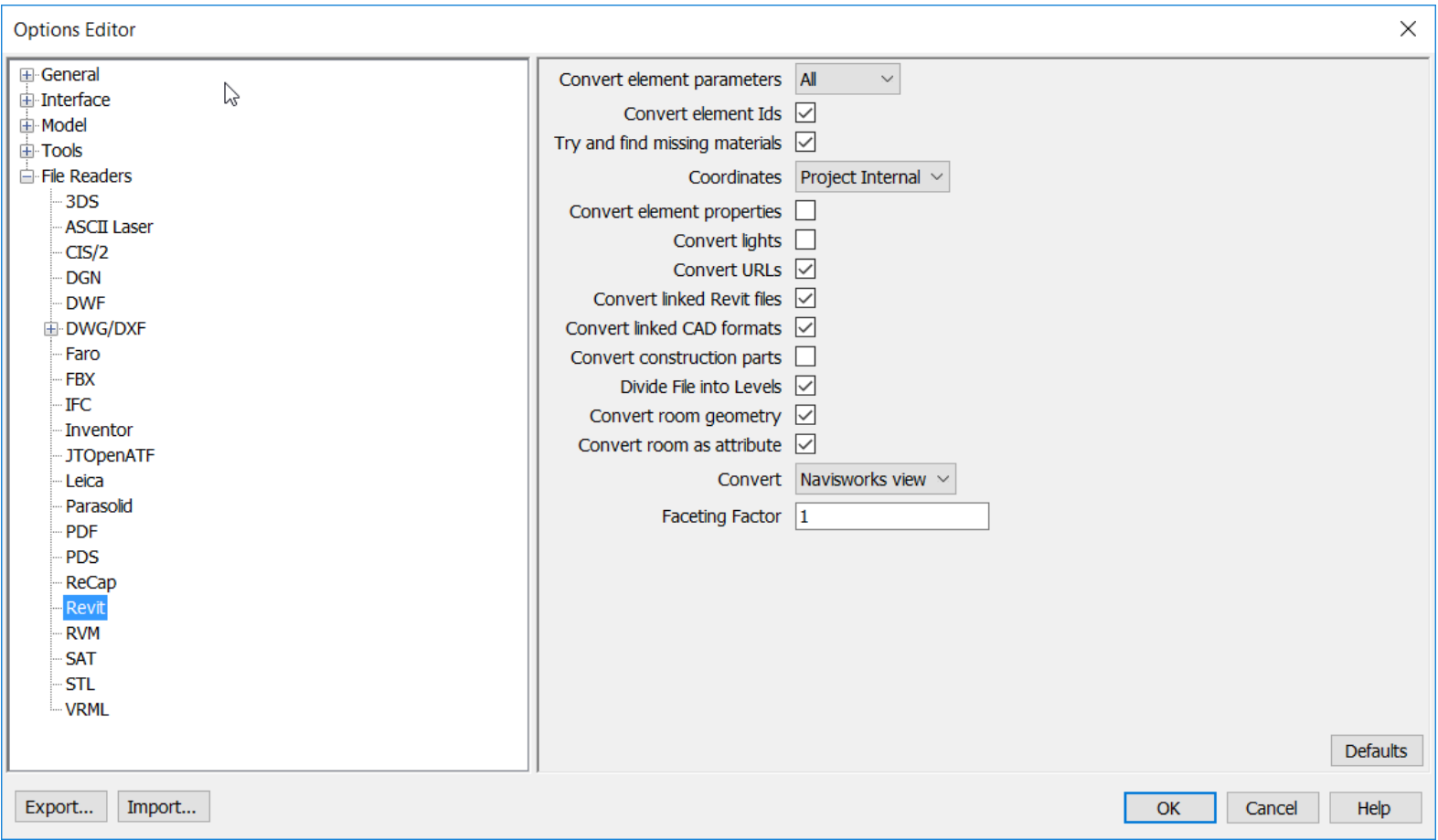
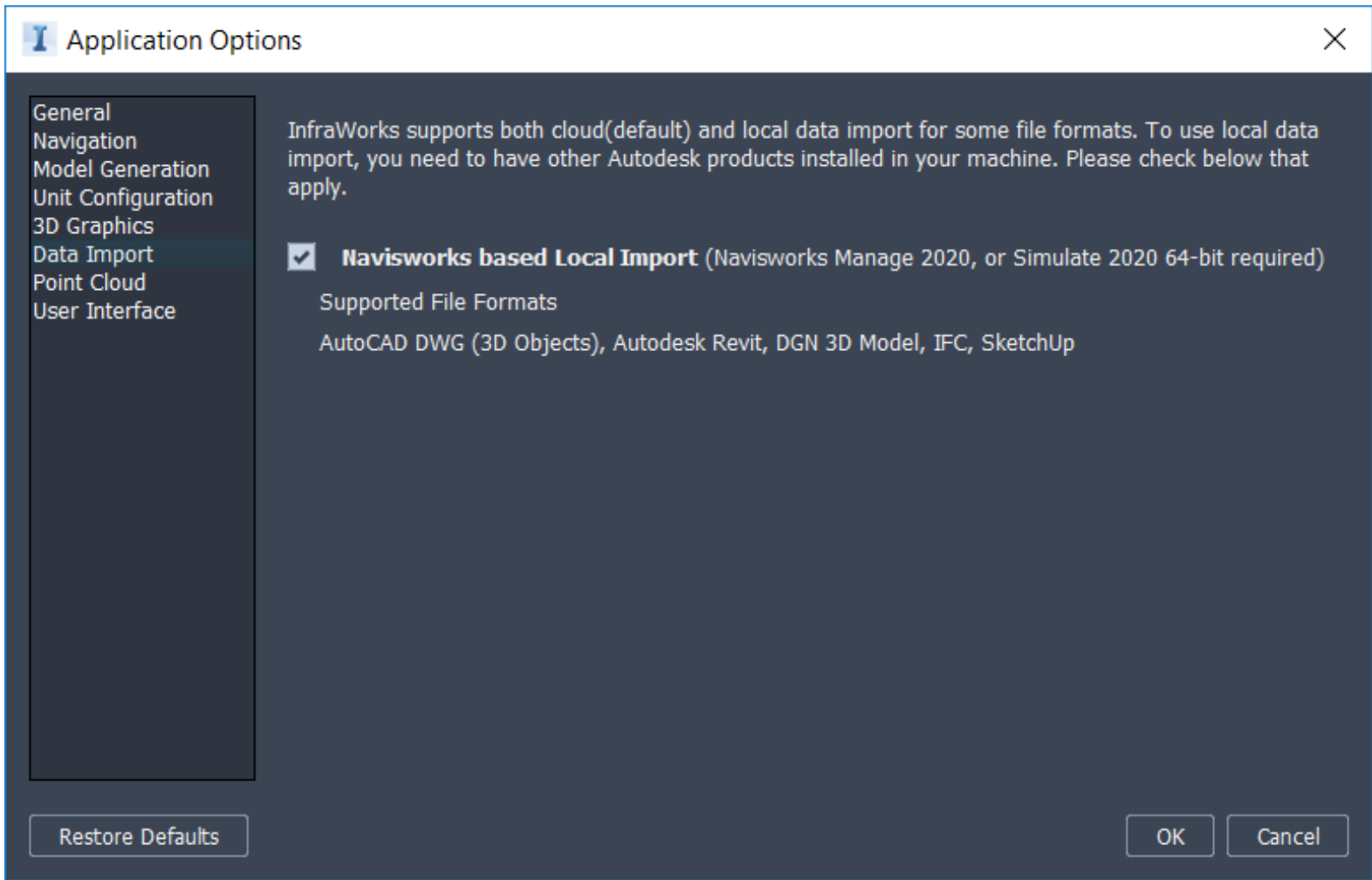
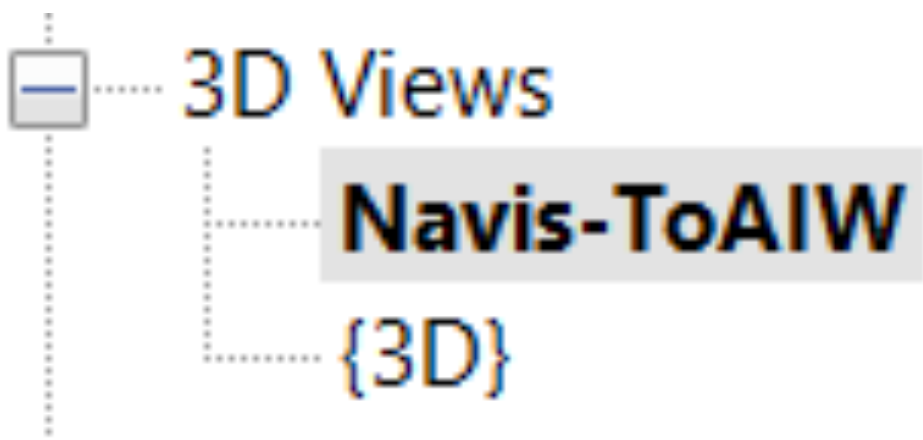
## Important Setting



Add one 3D View named:

➤NAVIS\_ToIW

➤Prefix NAVIS is mandatory





# Infraworks – Sketch Excavation for Building

Autodesk InfraWorks - OTx\_Exc\_Start

Salvatore Macri

Conceptual View

master

Data Sources

Model Explorer

DATA SOURCES

Group by: Feature Type Show: All

| Name               | Source Type | Status   |
|--------------------|-------------|----------|
| Buildings          |             |          |
| General Plan       | 3D Model    | Imported |
| buildings          | Vector      | Imported |
| Coverage Areas     |             |          |
| landuse            | Vector      | Imported |
| Ground Imagery     |             |          |
| imagery            | Raster      | Imported |
| Points of Interest |             |          |
| PLIMITS            | Vector      | Imported |
| Roads              |             |          |
| roads              | Vector      | Imported |
| Terrain            |             |          |
| Water Areas        |             |          |
| waterareas         | Vector      | Imported |
| waterways          | Vector      | Imported |

Hide Details

Data Source Details

Name: General Plan

Description: <Empty>

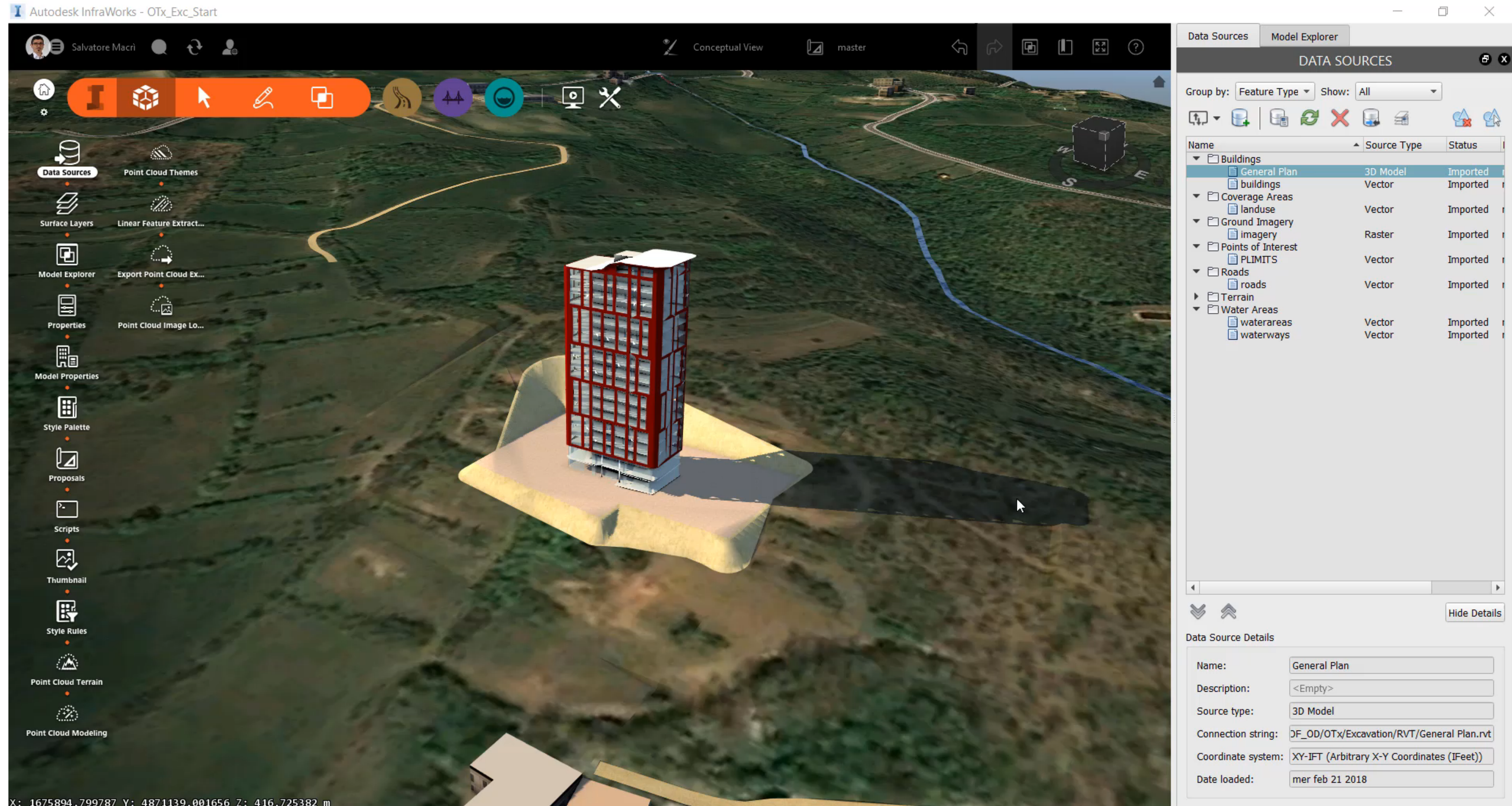
Source type: 3D Model

Connection string: OF\_OD/OTx/Excavation/RVT/General Plan.rvt

Coordinate system: XY-IFT (Arbitrary X-Y Coordinates (IFeet))

Date loaded: mer feb 21 2018

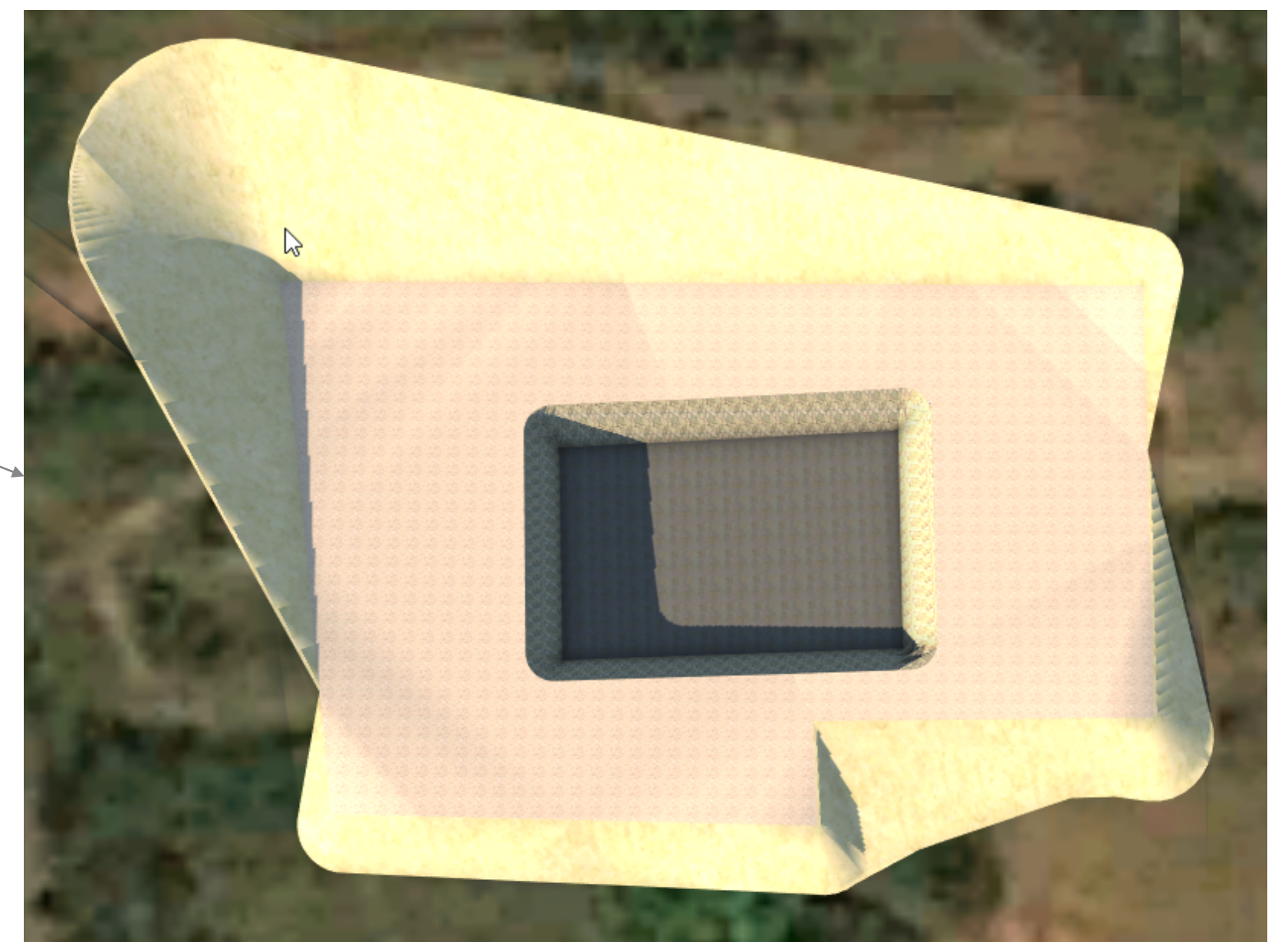
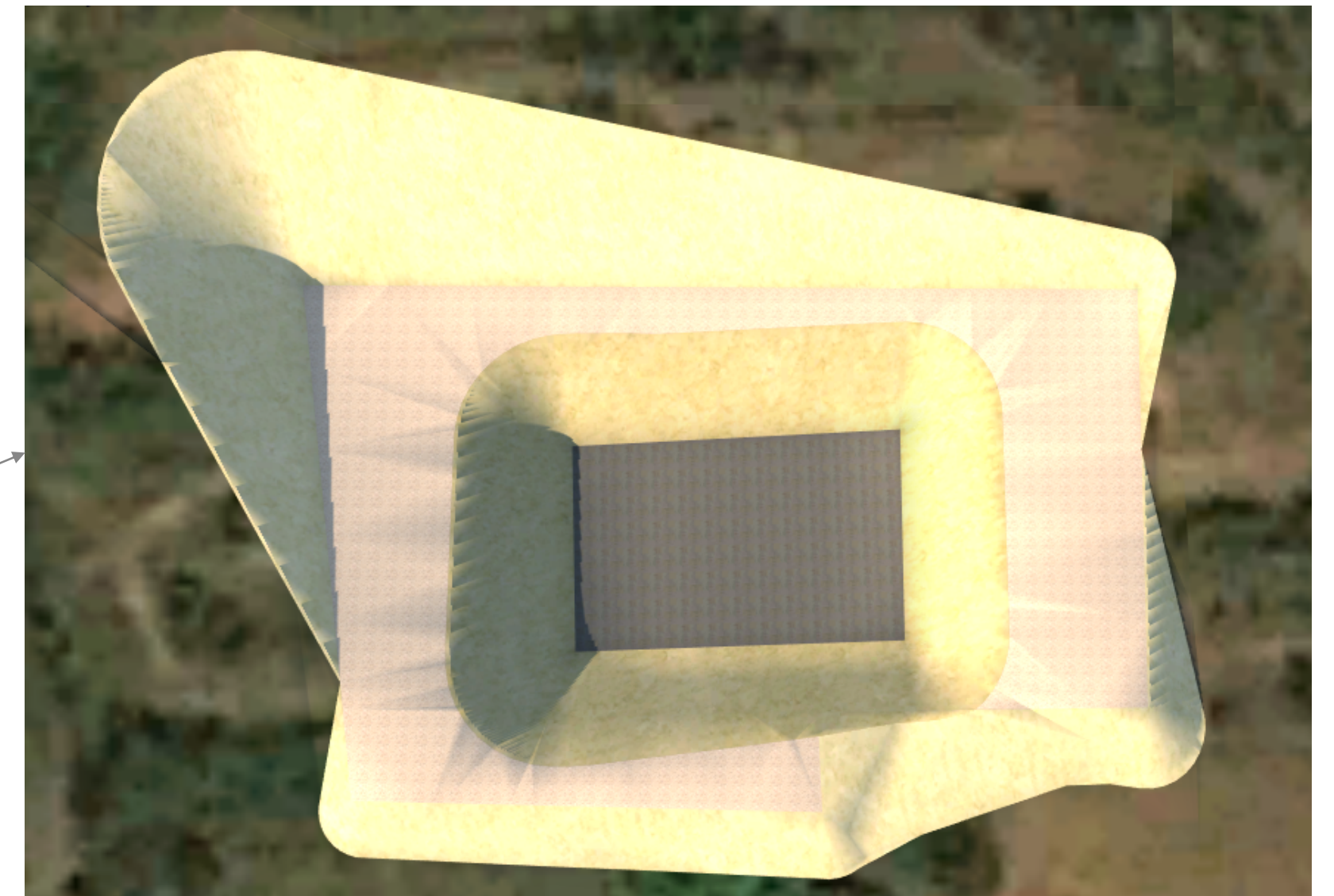
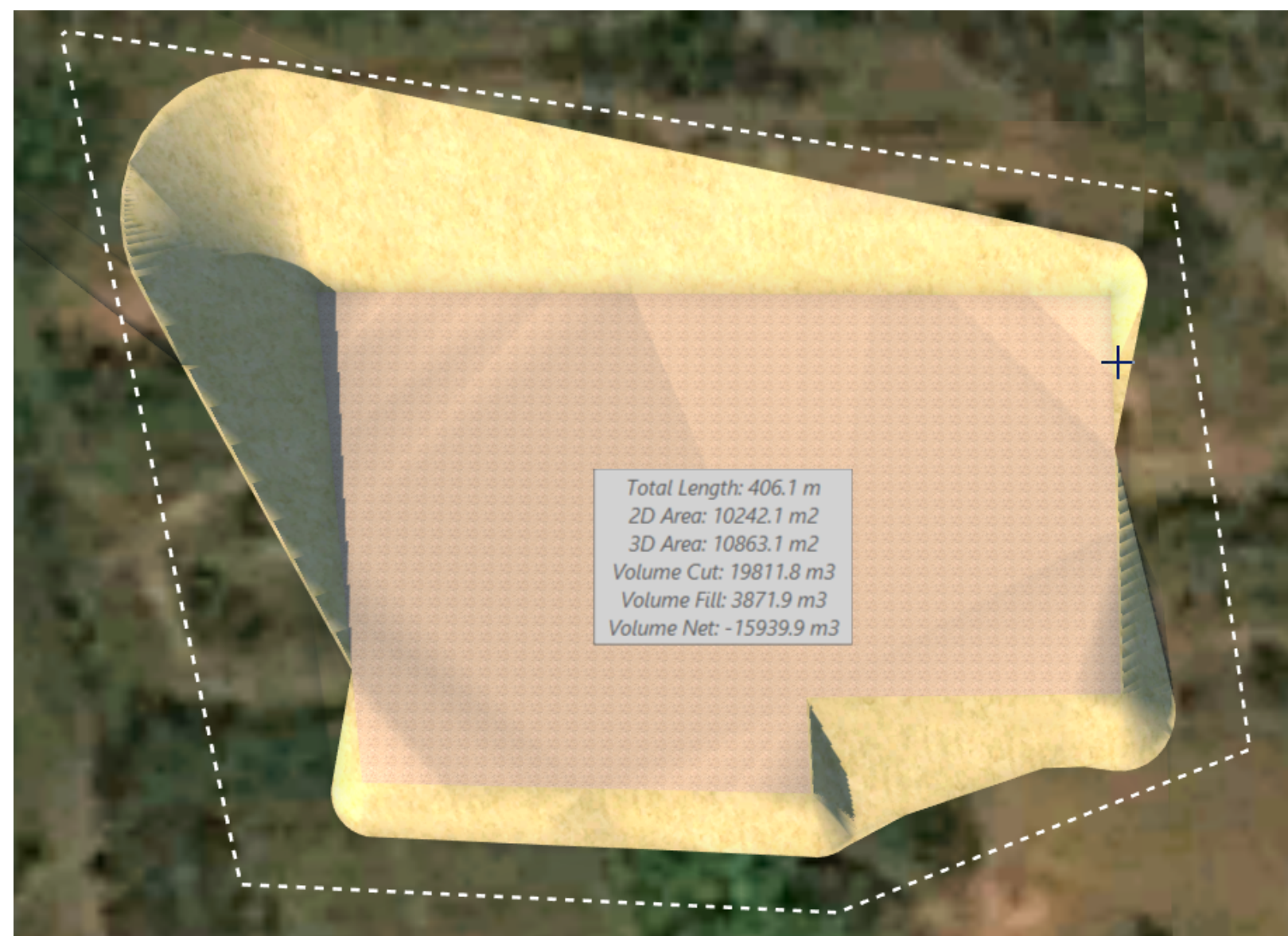
X: 1675894.799787 Y: 4871139.001656 Z: 416.725382 m





# Infraworks – Sketch Excavation for Building

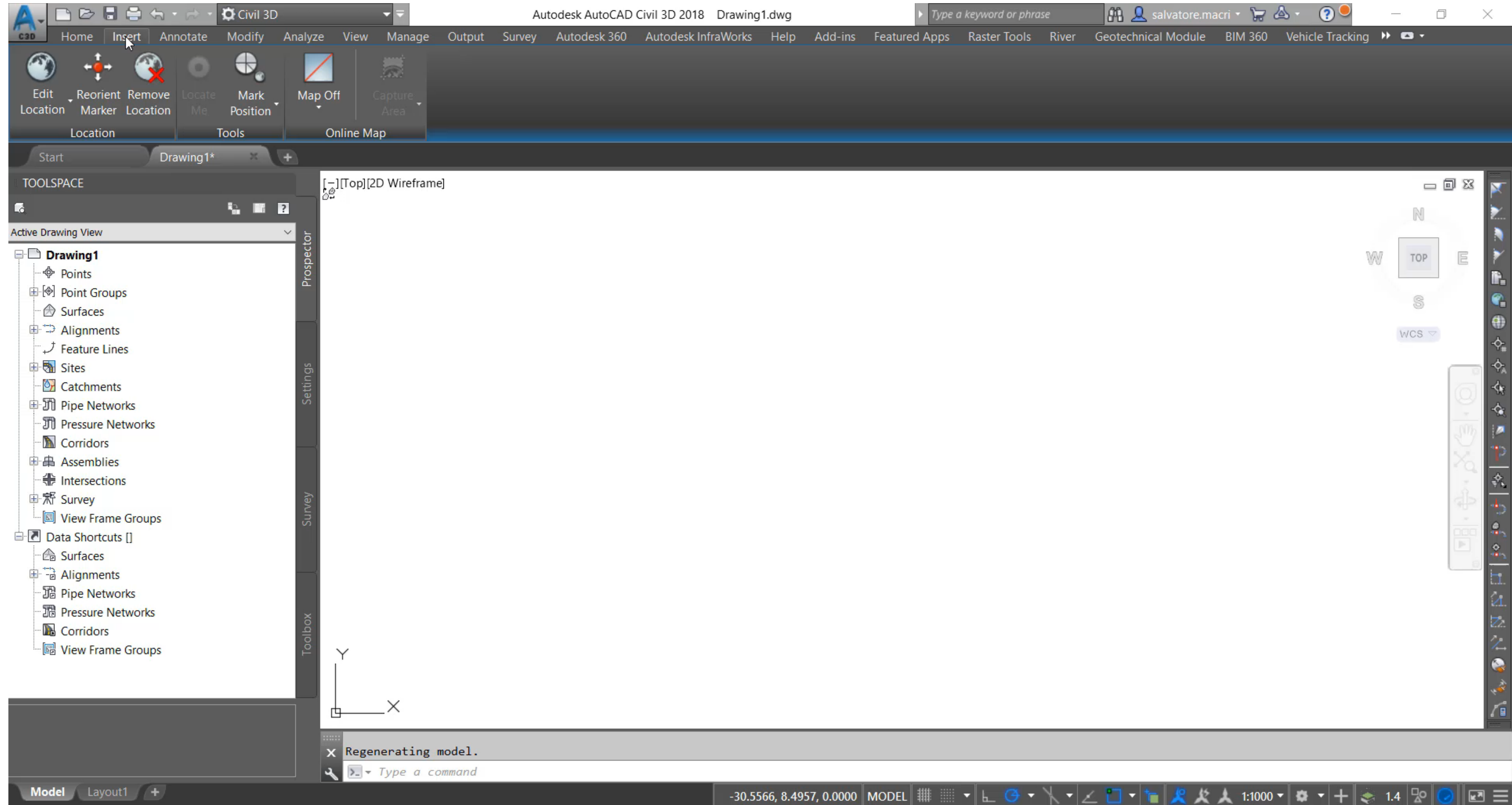
How to get volume





# Civil 3D – Detailed Excavation

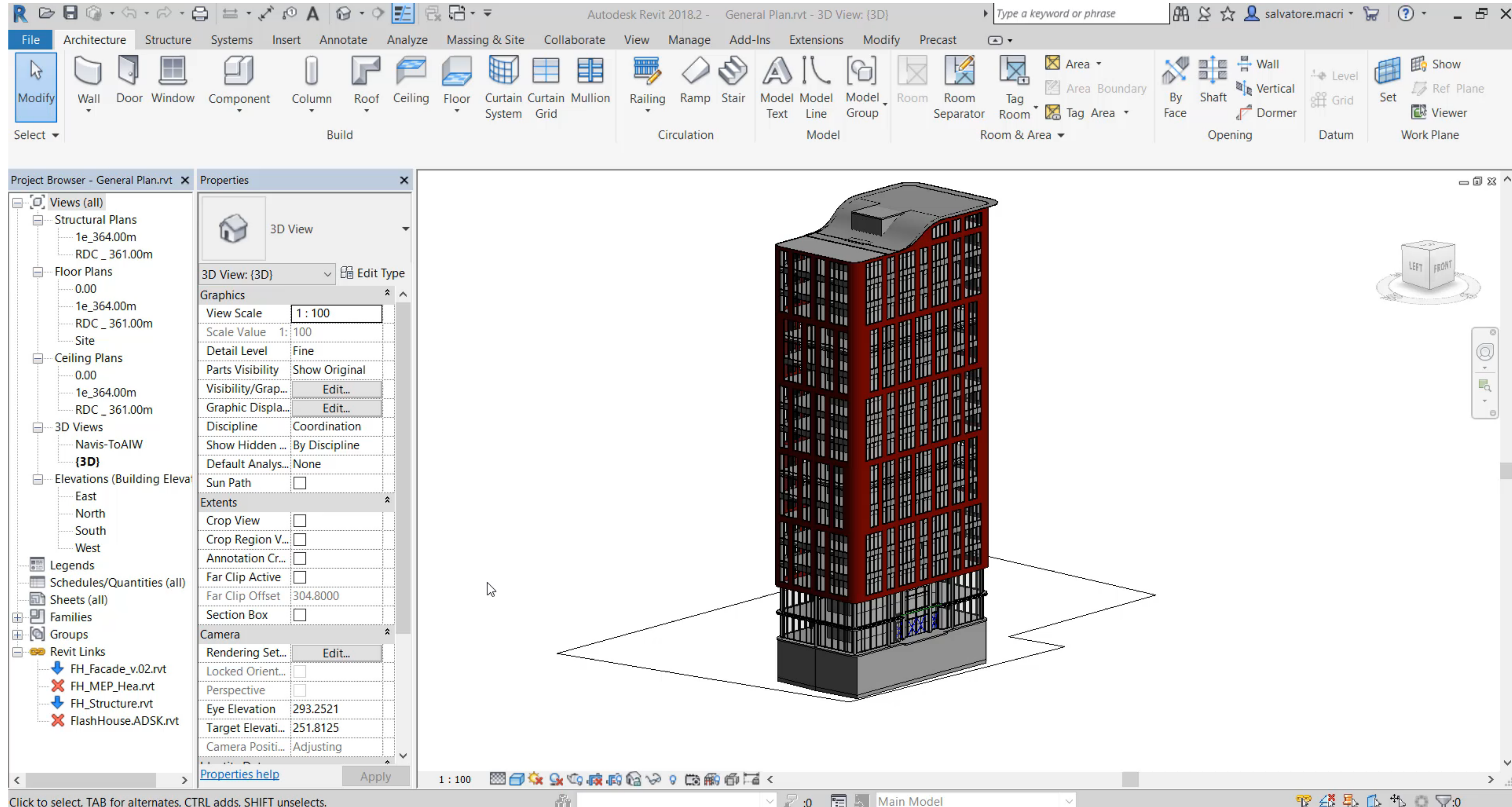
## How to Import Infraworks model in Civil 3D





# Civil 3D – Detailed Excavation

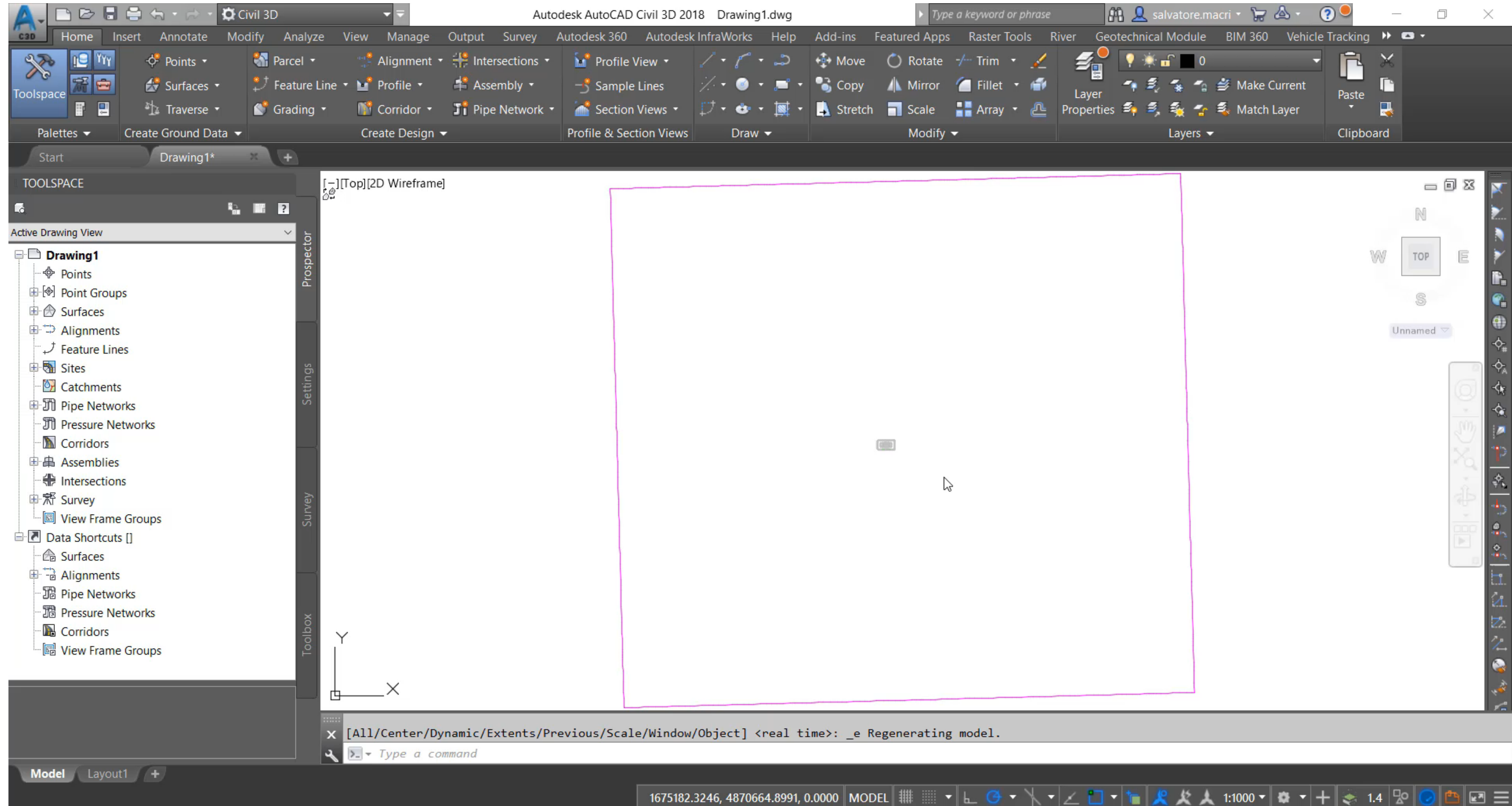
## How to Import Revit model in Civil 3D





# Civil 3D – Detailed Excavation

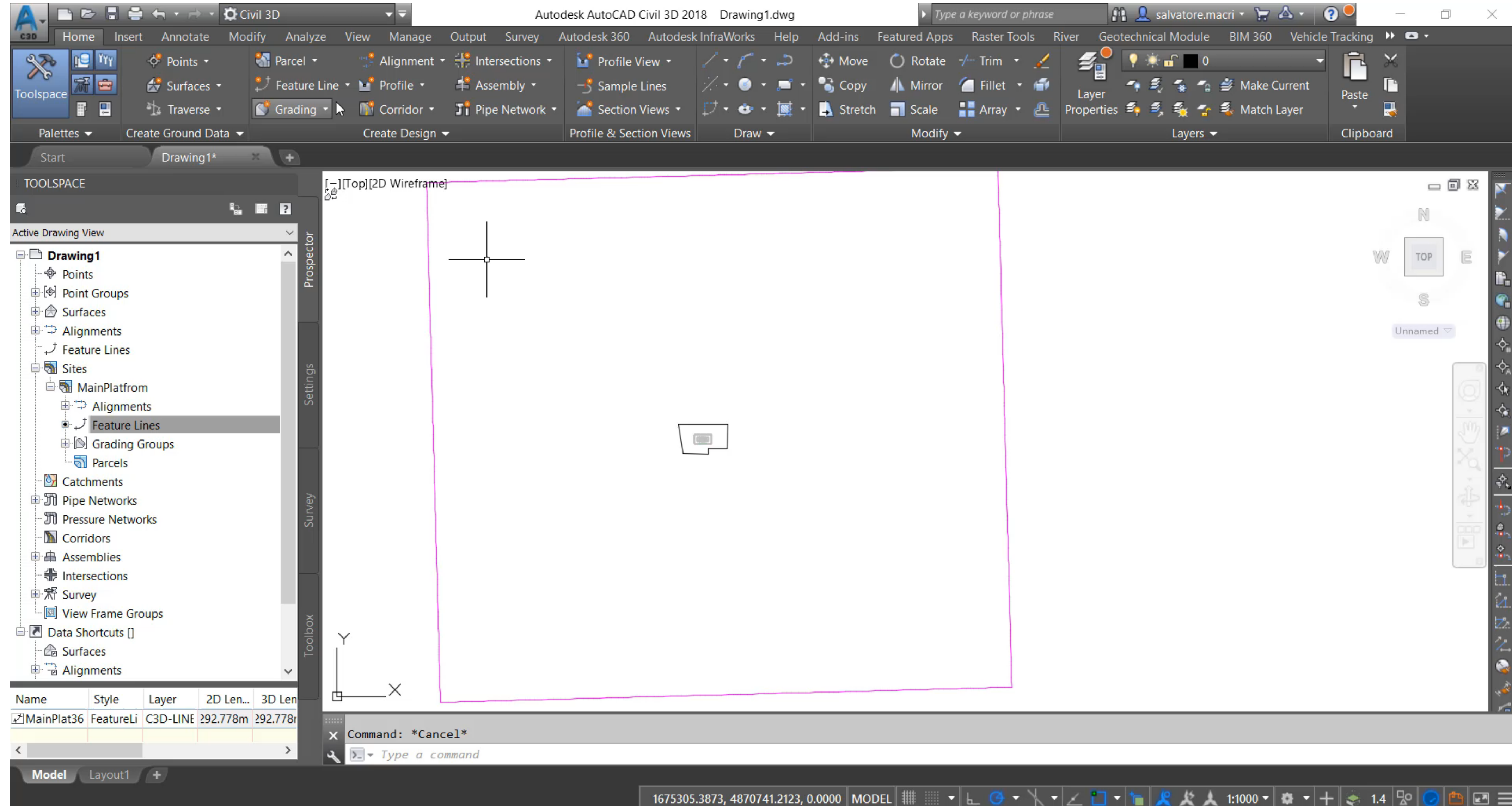
## How to Design Main Platform – Feature Line





# Civil 3D – Detailed Excavation

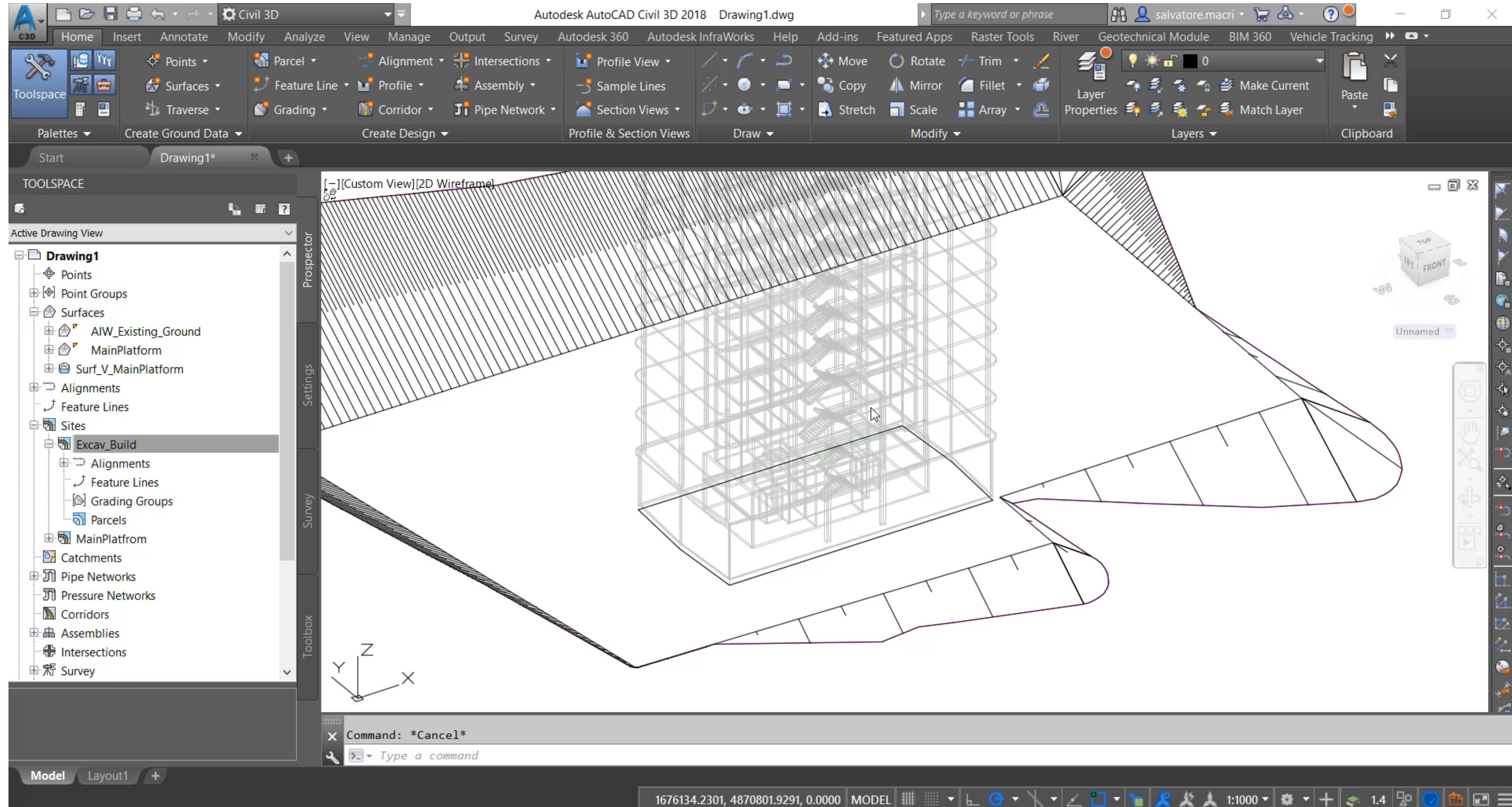
## How to Design Main Platform – Grading and Volume





# Civil 3D – Detailed Excavation

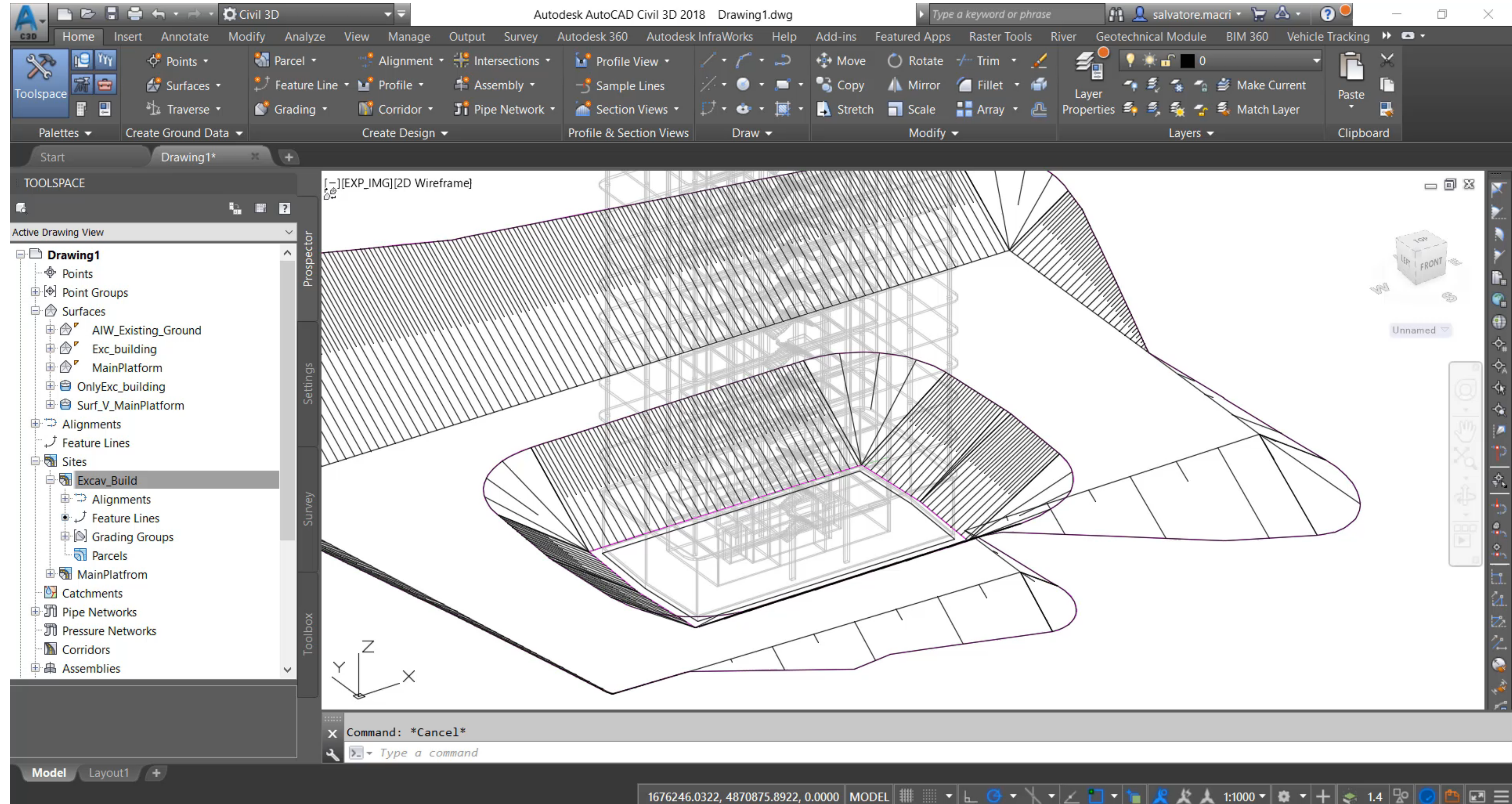
## How to Design Excavation for Building – Feature Line, Grading and Volume





# Civil 3D – Detailed Excavation

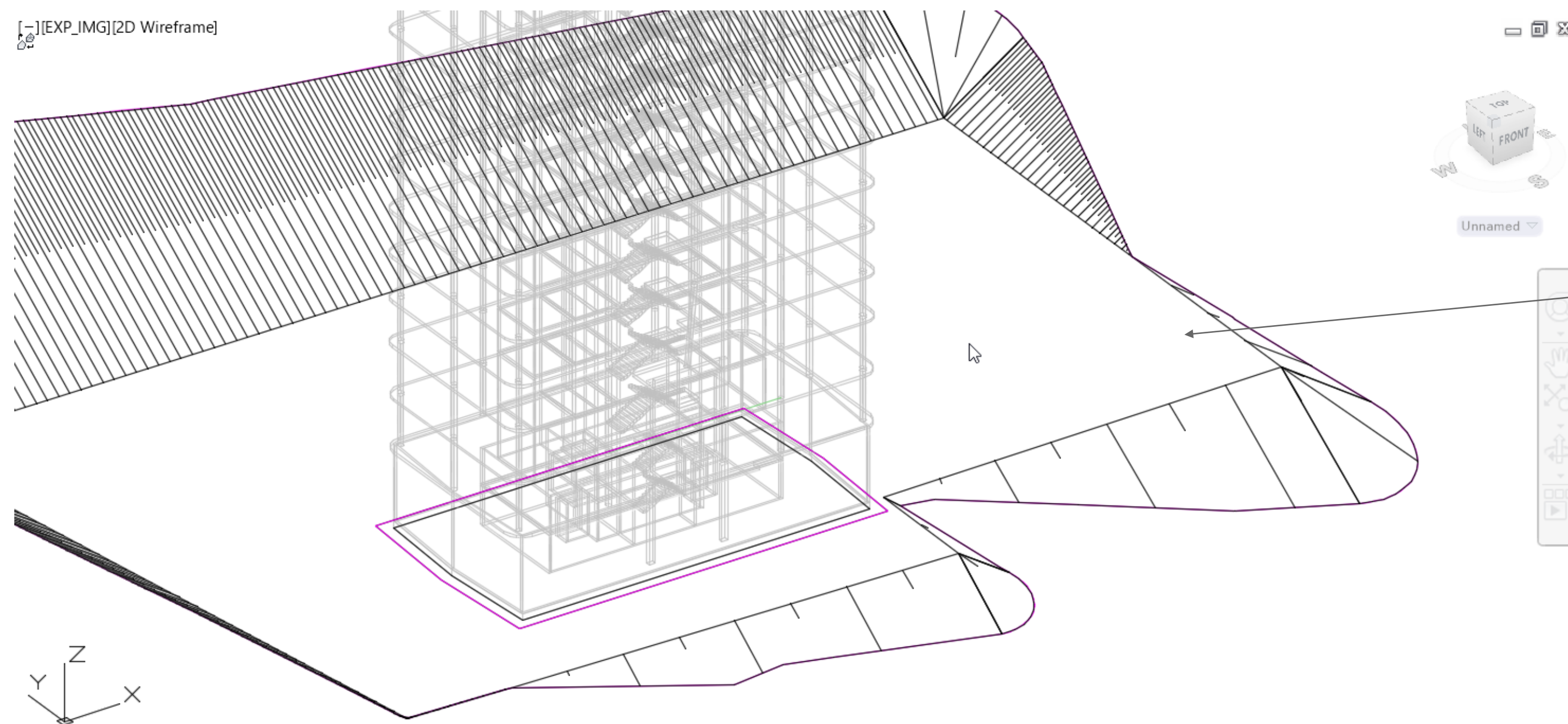
## How to Design Excavation for Building – Feature Line, Grading and Volume





# Civil 3D – Detailed Excavation

## How to Design Excavation for Building – Understanding Fill Volume

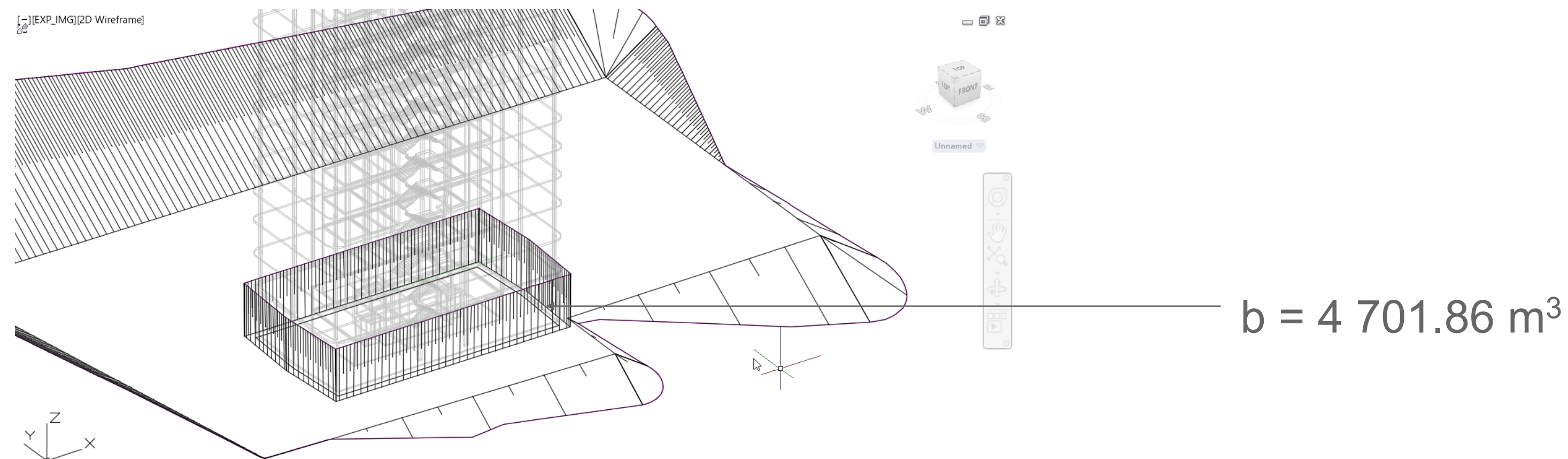
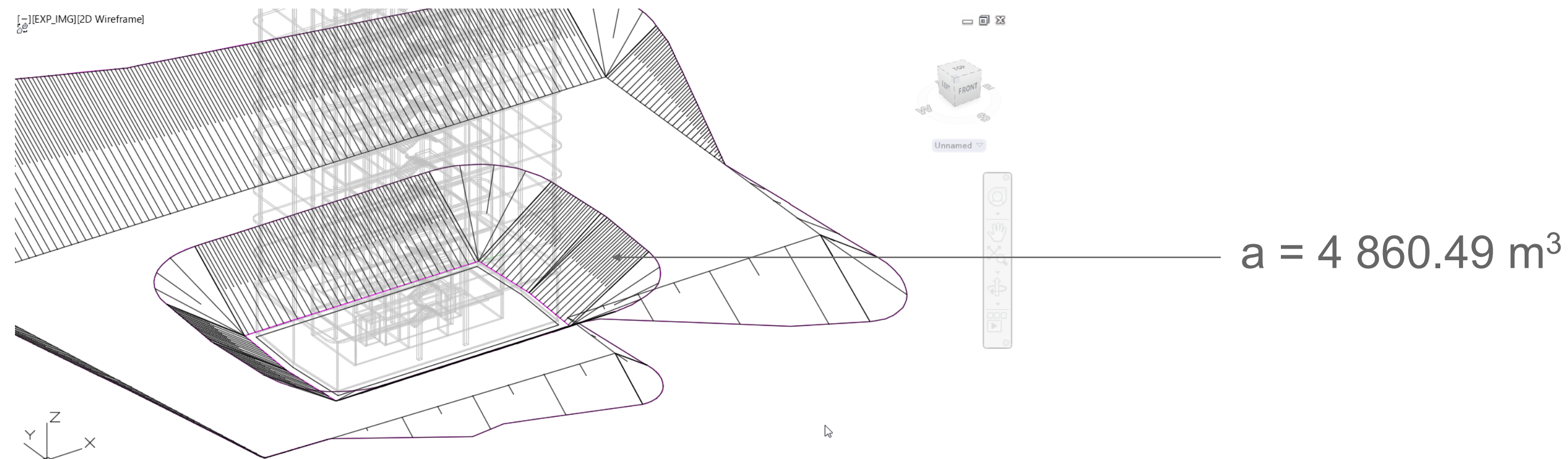


$V_{tot} = 27\,111.64 \text{ m}^3$



# Civil 3D – Detailed Excavation

## How to Design Excavation for Building – Understanding Fill Volume

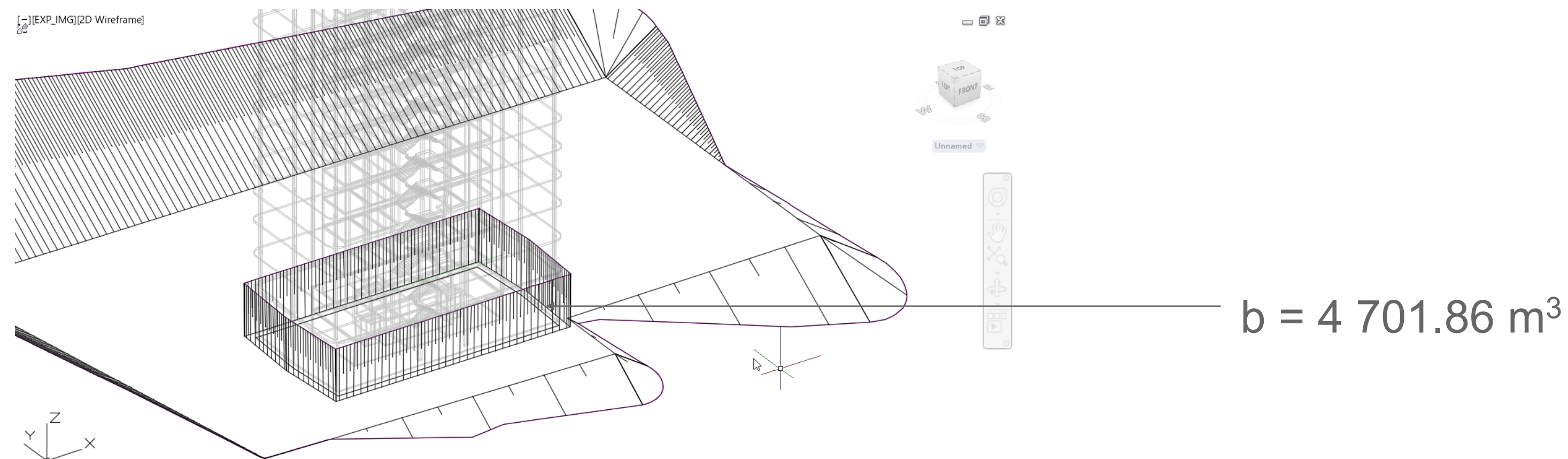
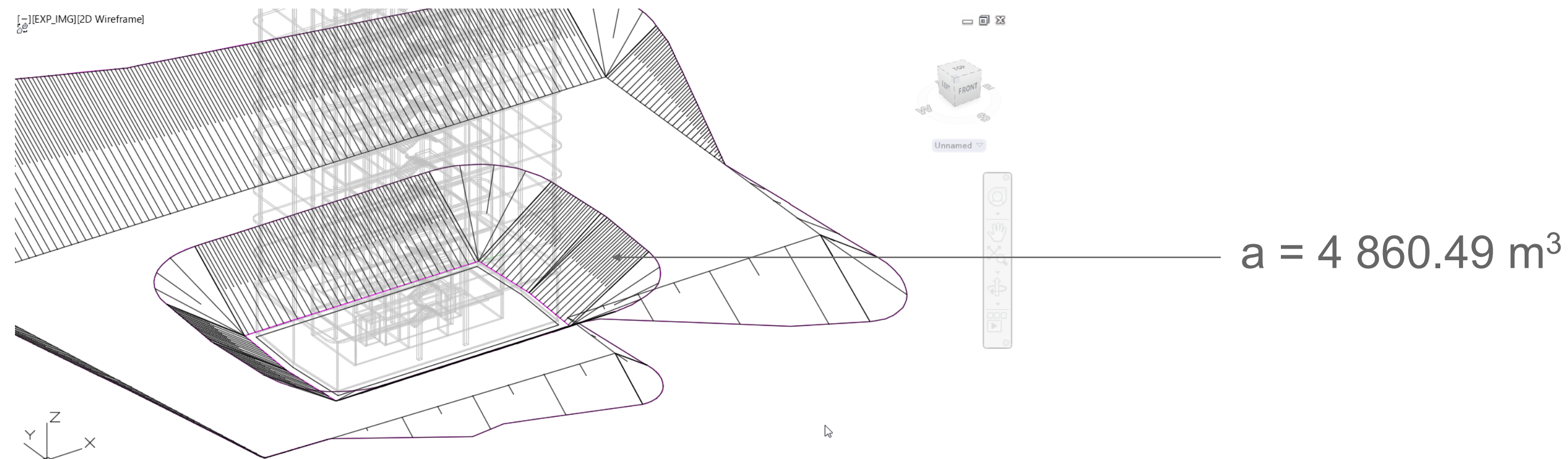


$\Delta V = a - b = 158.63 \text{ m}^3$   
need to fill the excavation



# Civil 3D – Detailed Excavation

## How to Design Excavation for Building – Understanding Fill Volume



$\Delta V = a - b = 158.63 \text{ m}^3$   
need to fill the excavation

+

Main Platform

$27\,111.64 \text{ m}^3$

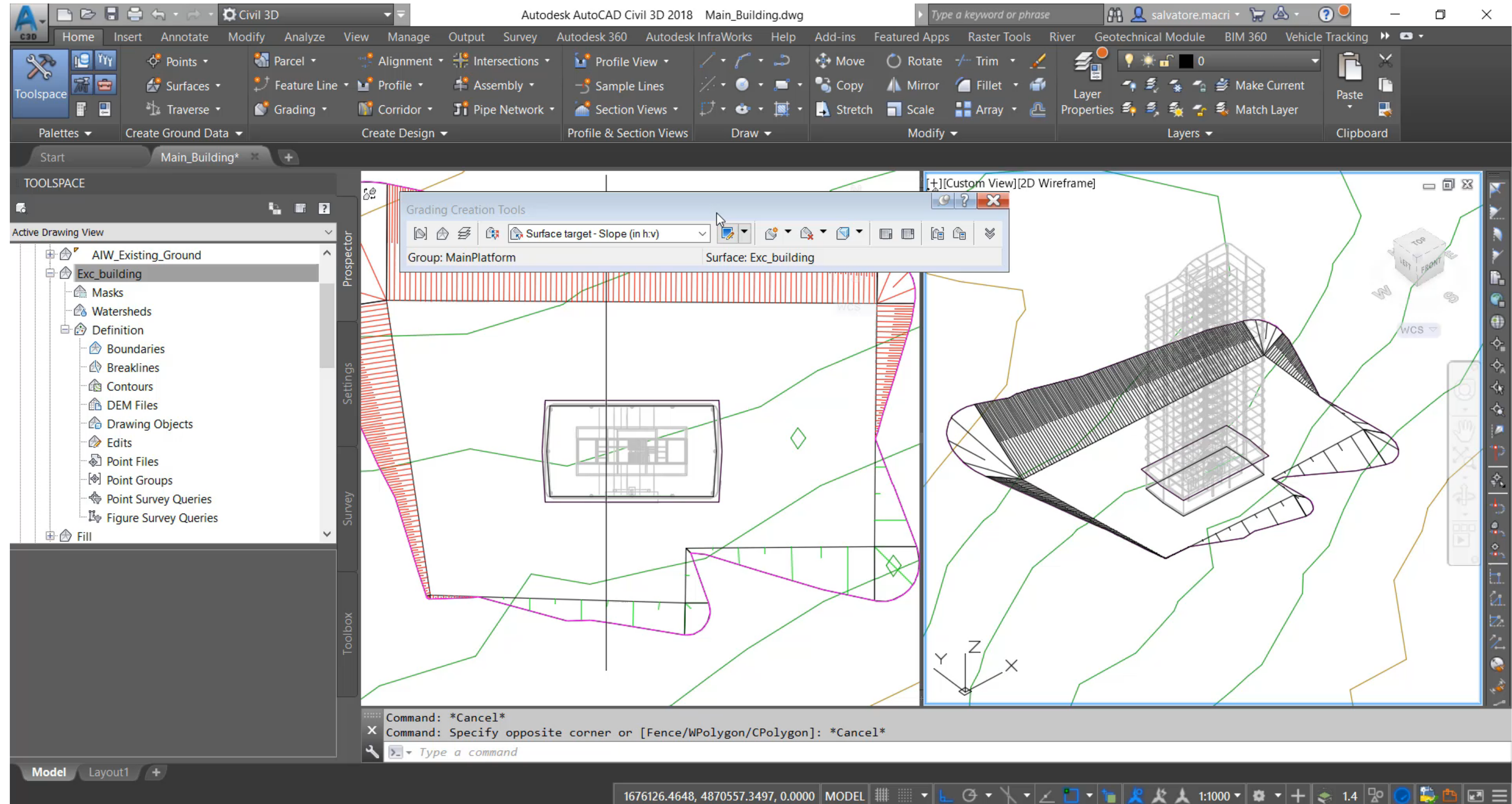
=

$V_{\text{tot}} = 27\,270.27 \text{ m}^3$



# Civil 3D – Detailed Excavation in 1 Step AUTODESK® CIVIL 3D®

## How to Design Excavation for Building – One Step





# Civil 3D – Detailed Excavation in One Step

How to Design Excavation for Building – One Step

The screenshot displays the Autodesk AutoCAD Civil 3D 2018 software interface. The main workspace shows a 3D model of a building on a green terrain. A detailed excavation grid is visible, with red lines indicating the excavation boundaries and green lines showing the grid structure. An Object Viewer window is open on the left, showing a top-down view of the excavation area. A data table is overlaid on the top right, providing details for the excavation surface.

| Name        | B | Mid-Ordina... | Cut Factor | Fill Factor | Style  | 2d Area(sq.... | Cut(adjusted)(... | Fill(adjusted)(Cu. M.) |
|-------------|---|---------------|------------|-------------|--------|----------------|-------------------|------------------------|
| Surf_V_M... |   |               | 1.000      | 1.000       | Border | 7732.21        | 31813.50          | 1722.85                |

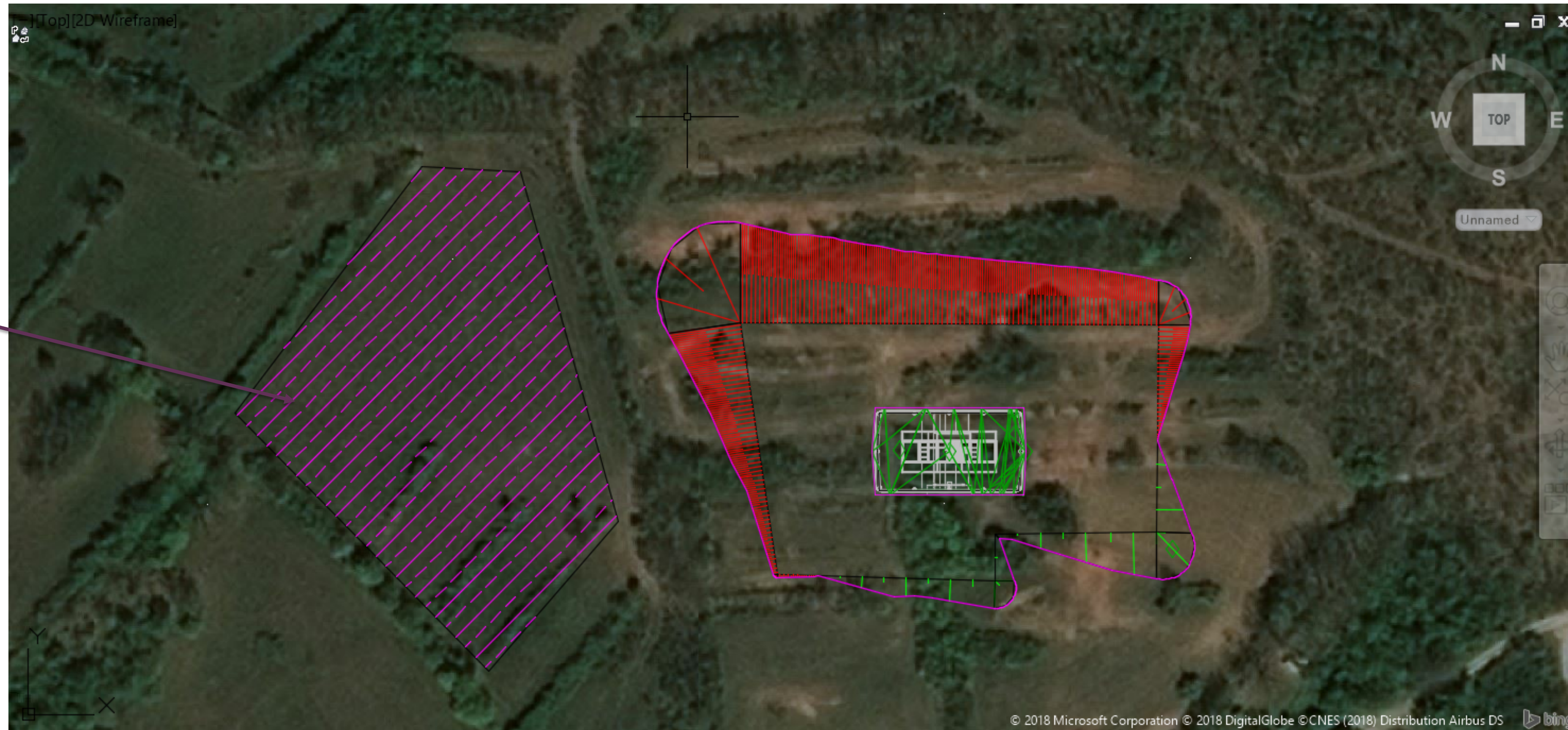
Enhanced 3D performance is not available for the current visual style.  
 Command: ObjectViewer  
 OBJECTVIEWER



# Civil 3D – Detailed Excavation in One Step

How to Design Excavation for Building – Stock the terrain

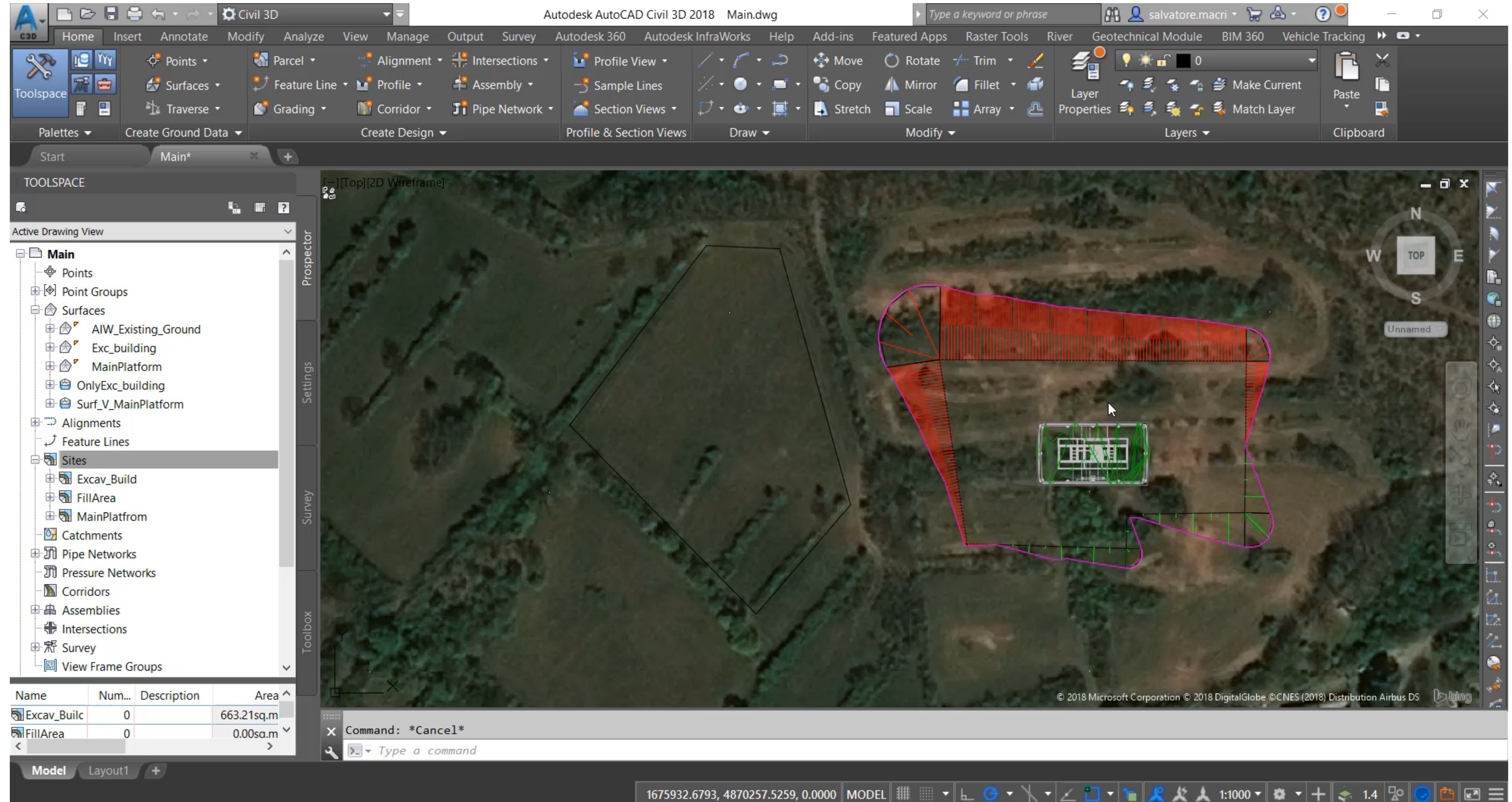
Temporary  
Stock Area for  
 $V_{tot} = 27270.27 \text{ m}^3$





# Civil 3D – Detailed Excavation

## How to Design Excavation for Building – Stock the terrain





# Excavation for Infrastructure





# Basic Workflow for infrastructure



Create model on real  
context

Preliminary Excavation

Quickly Volume



Build, Edit and Manage  
Excavation

Evaluate Volume

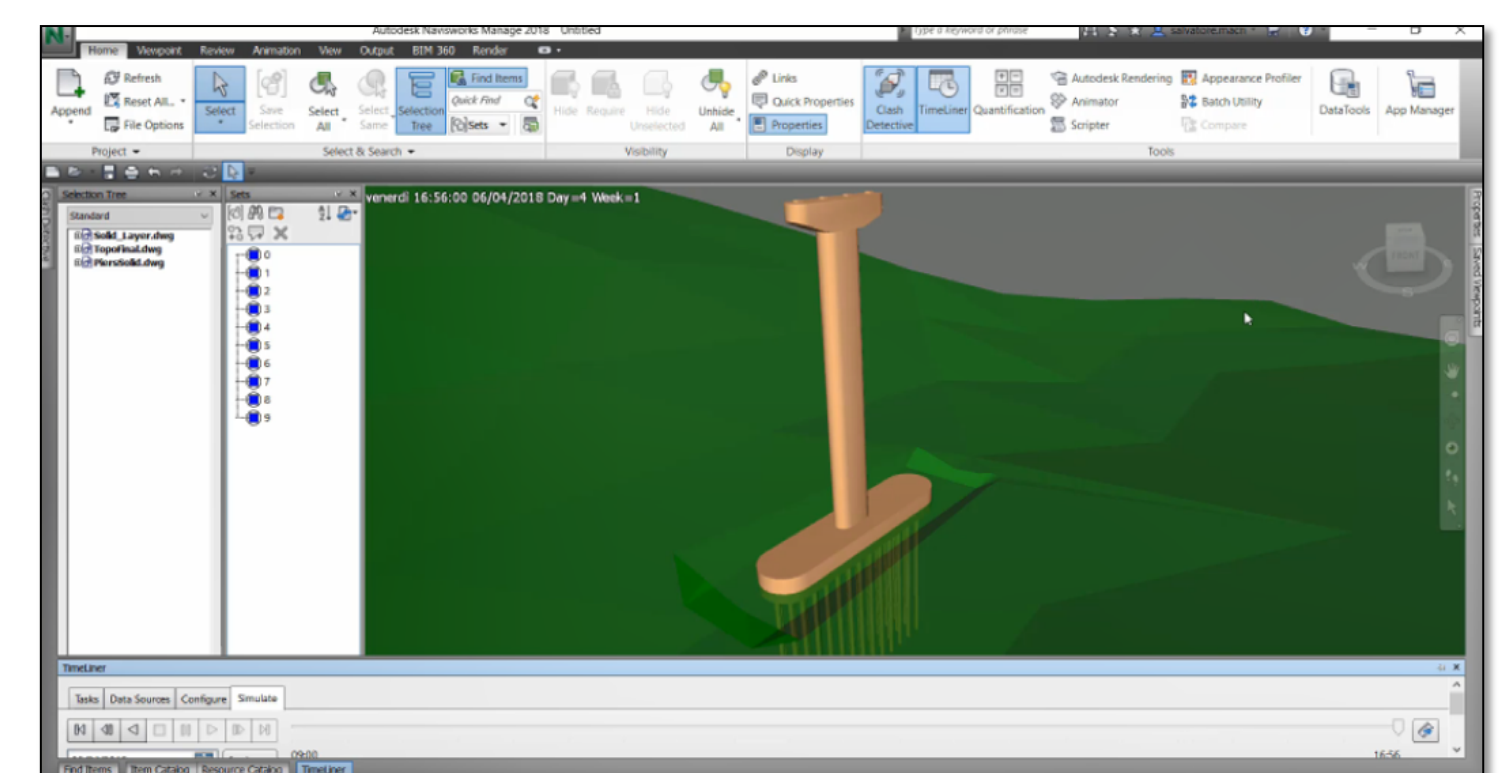
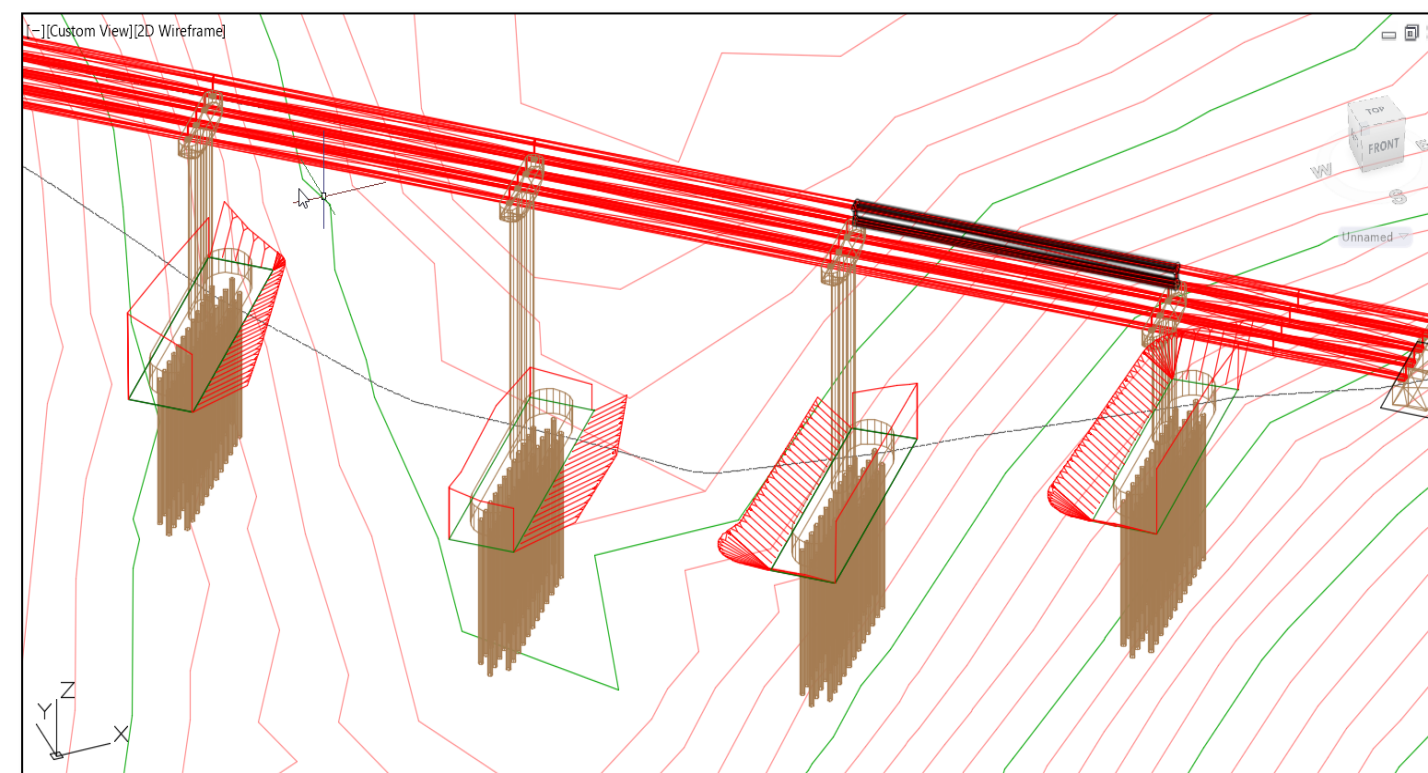
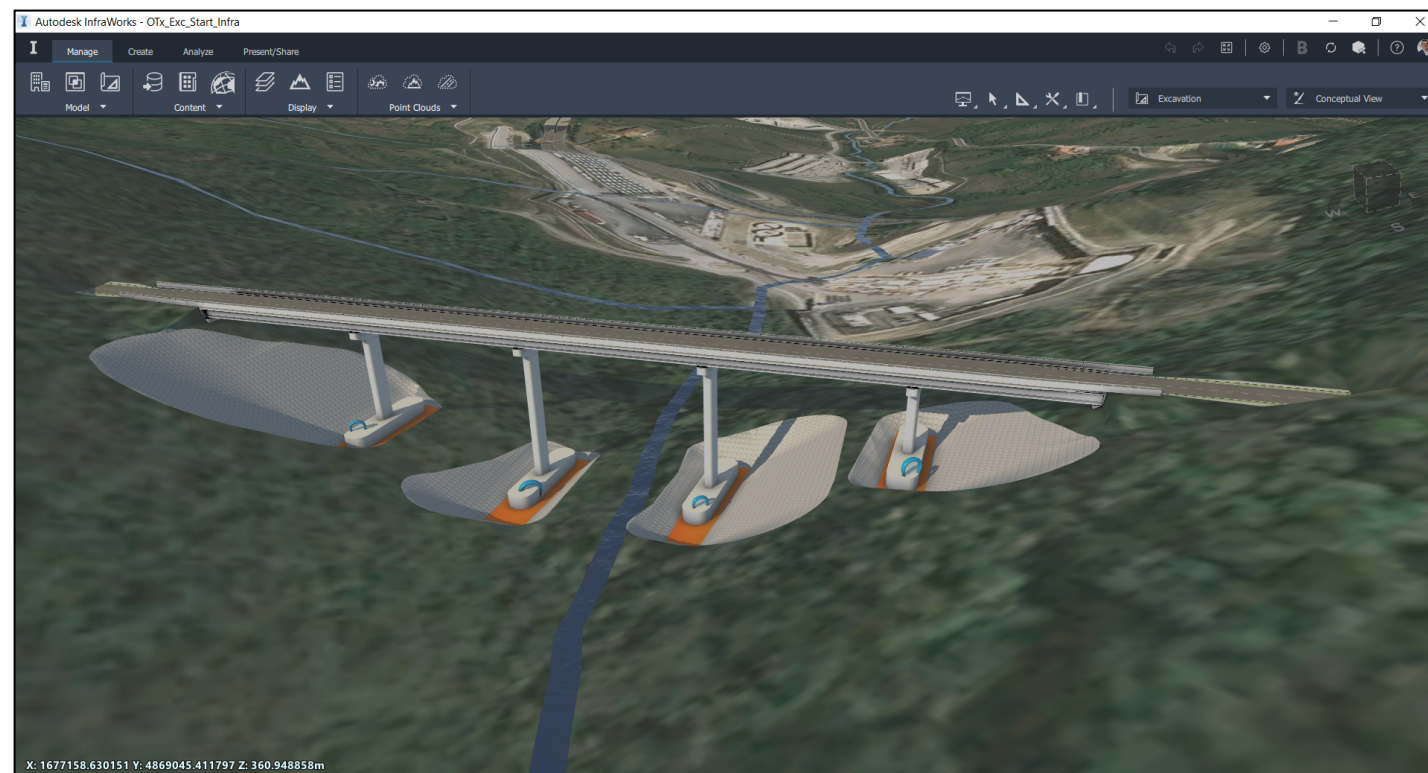
Evaluate Stock Volume for site  
construction



Aggregation of several  
model

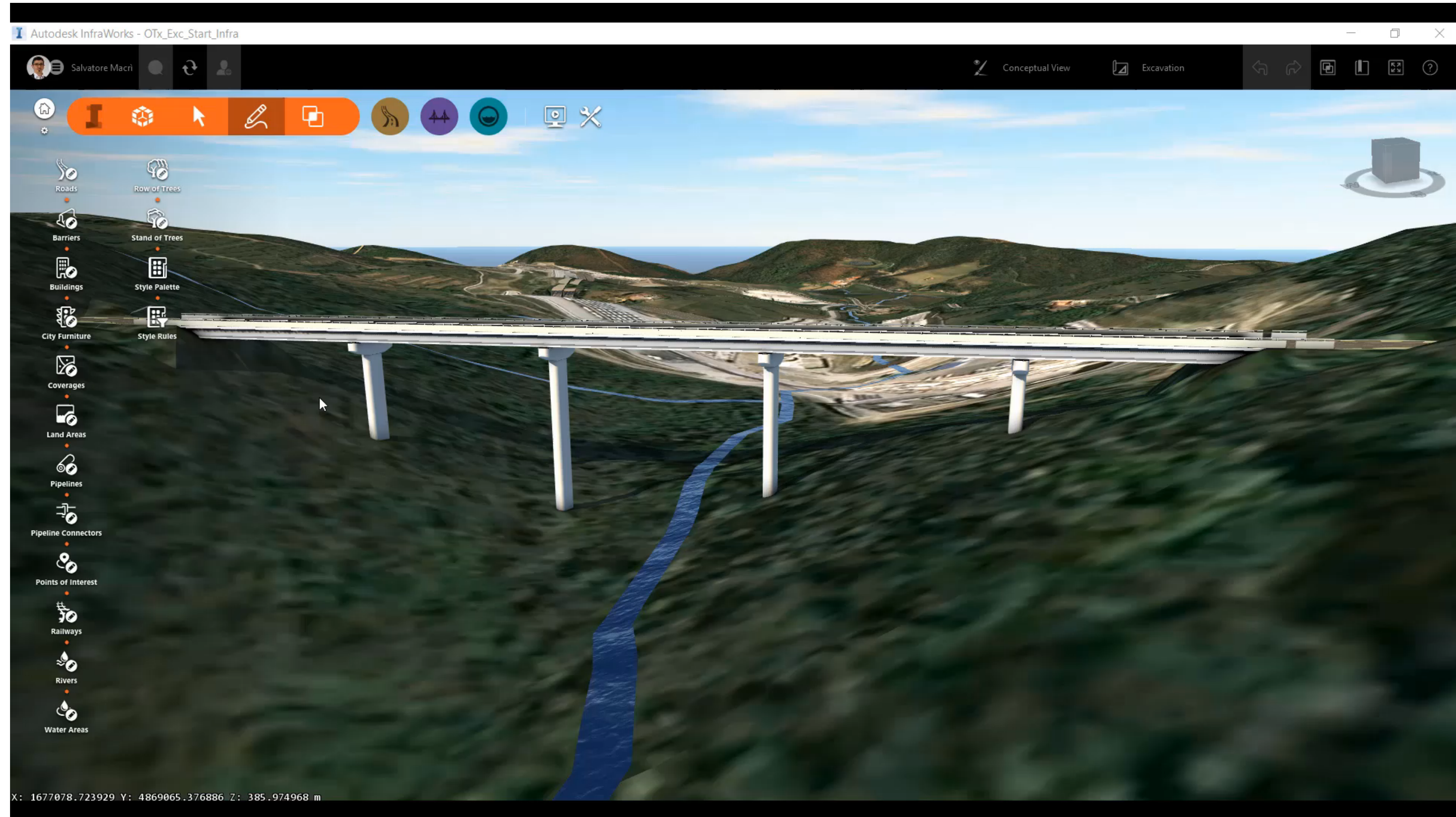
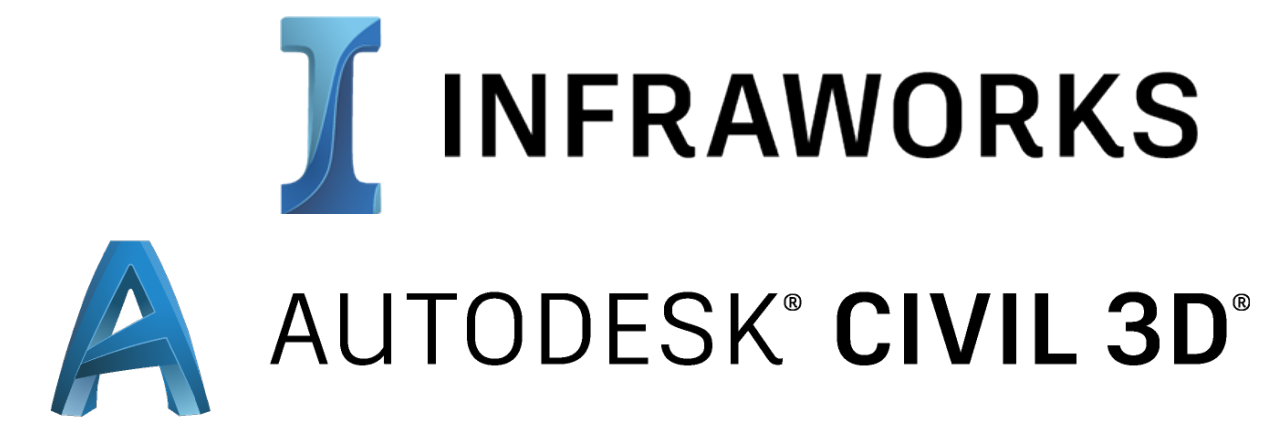
General coordination

Timeliner



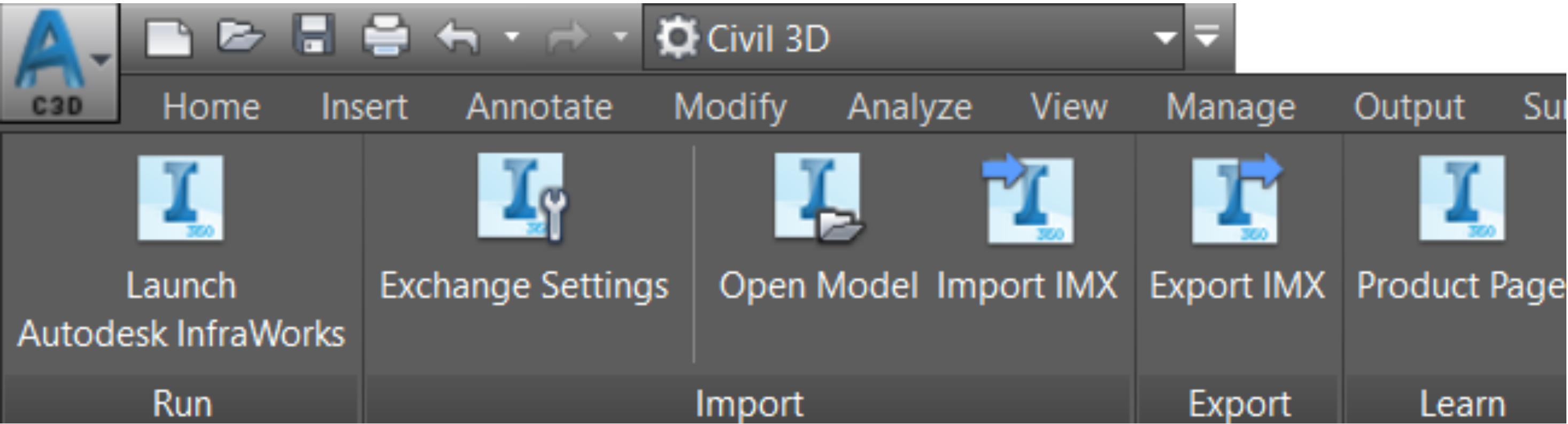
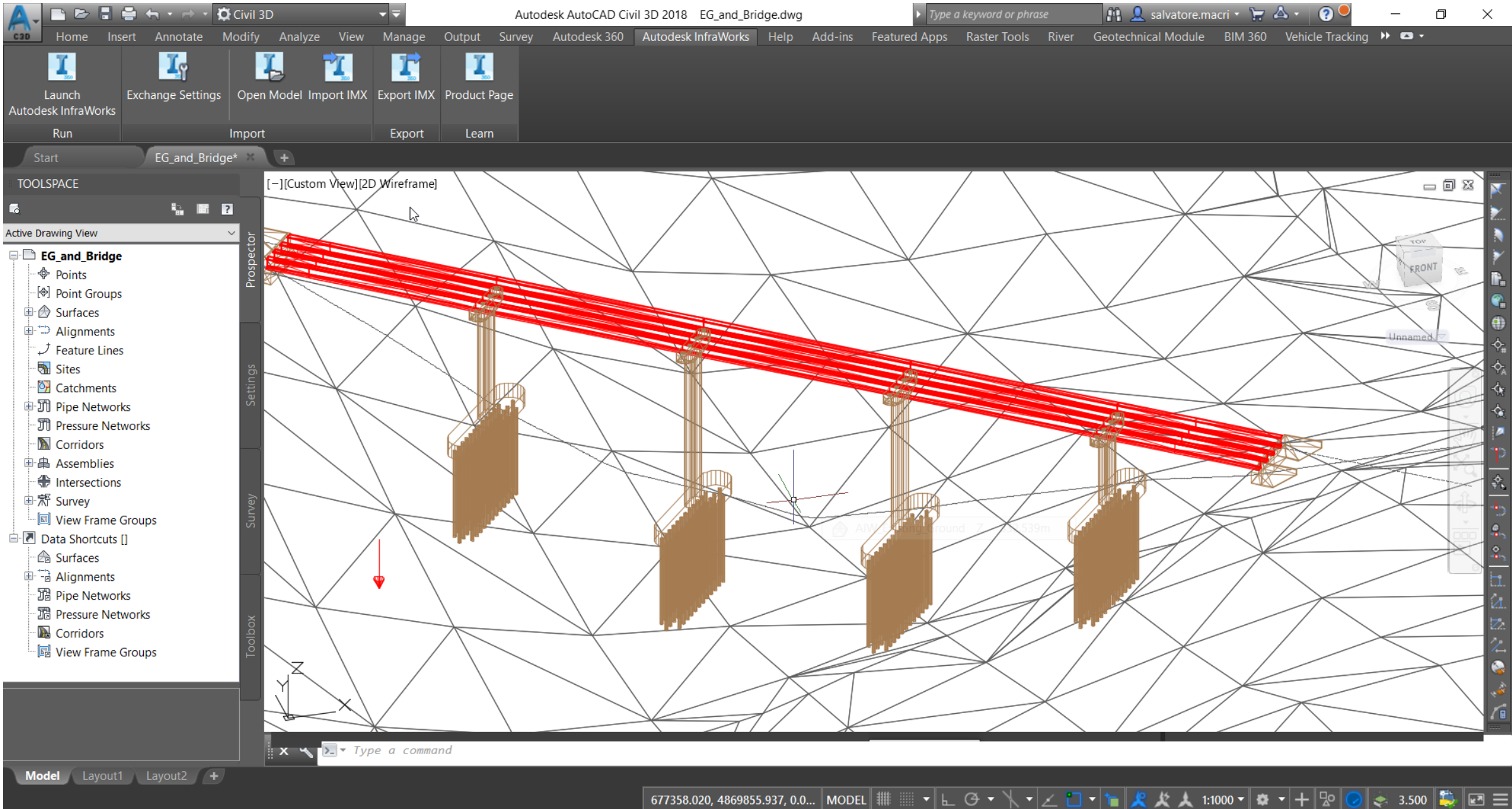
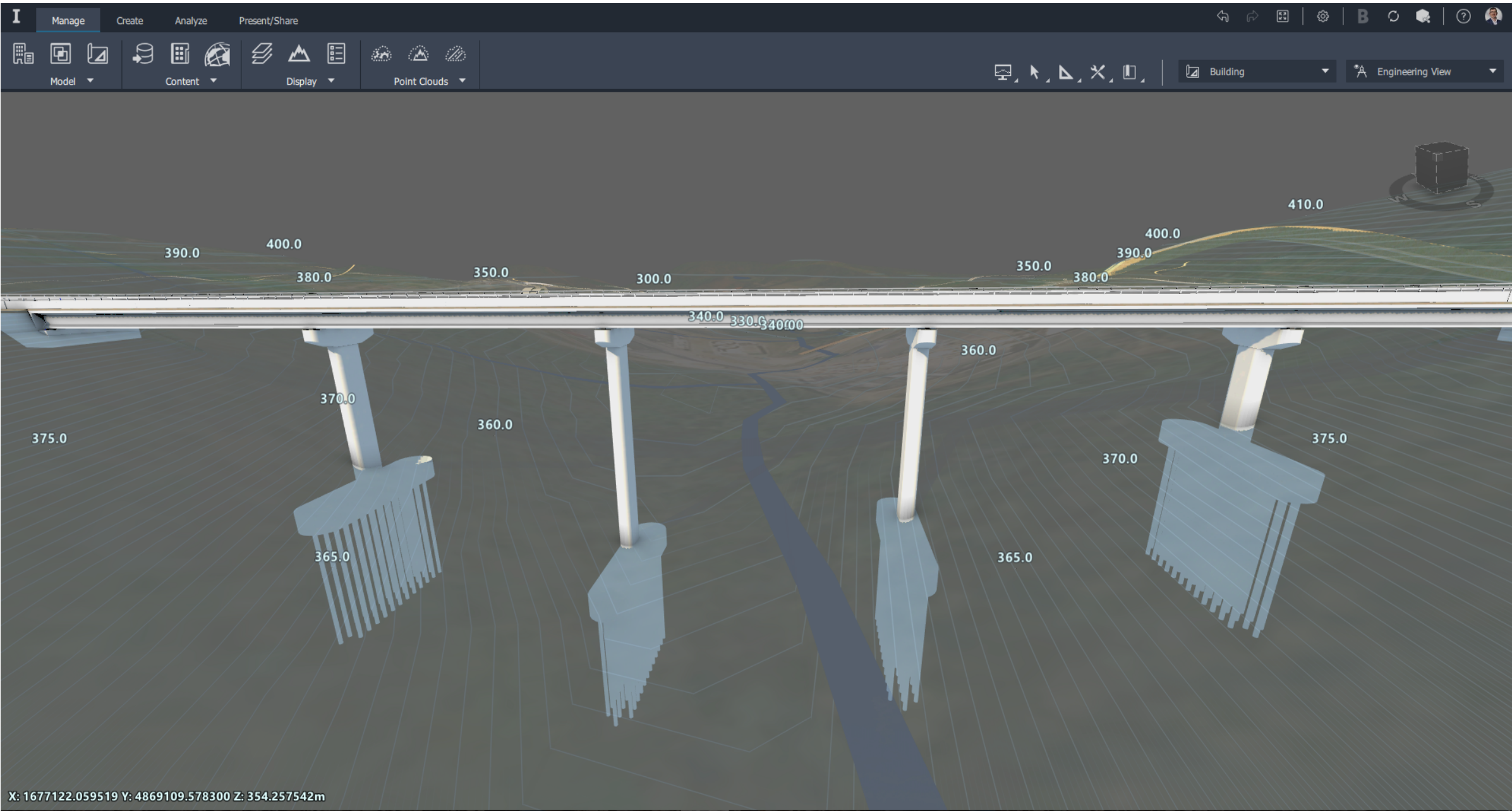
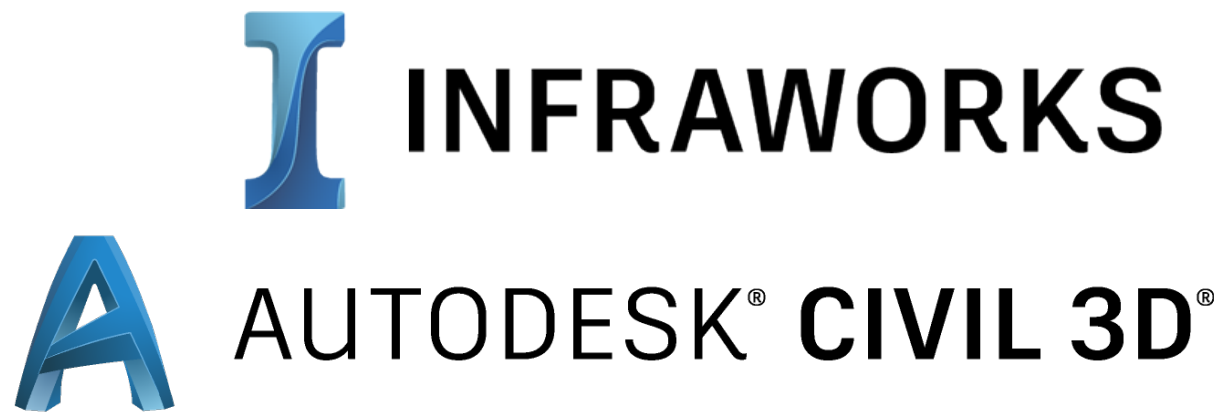


# Infraworks: Fast Cut and Fill





# Infraworks to Civil 3D



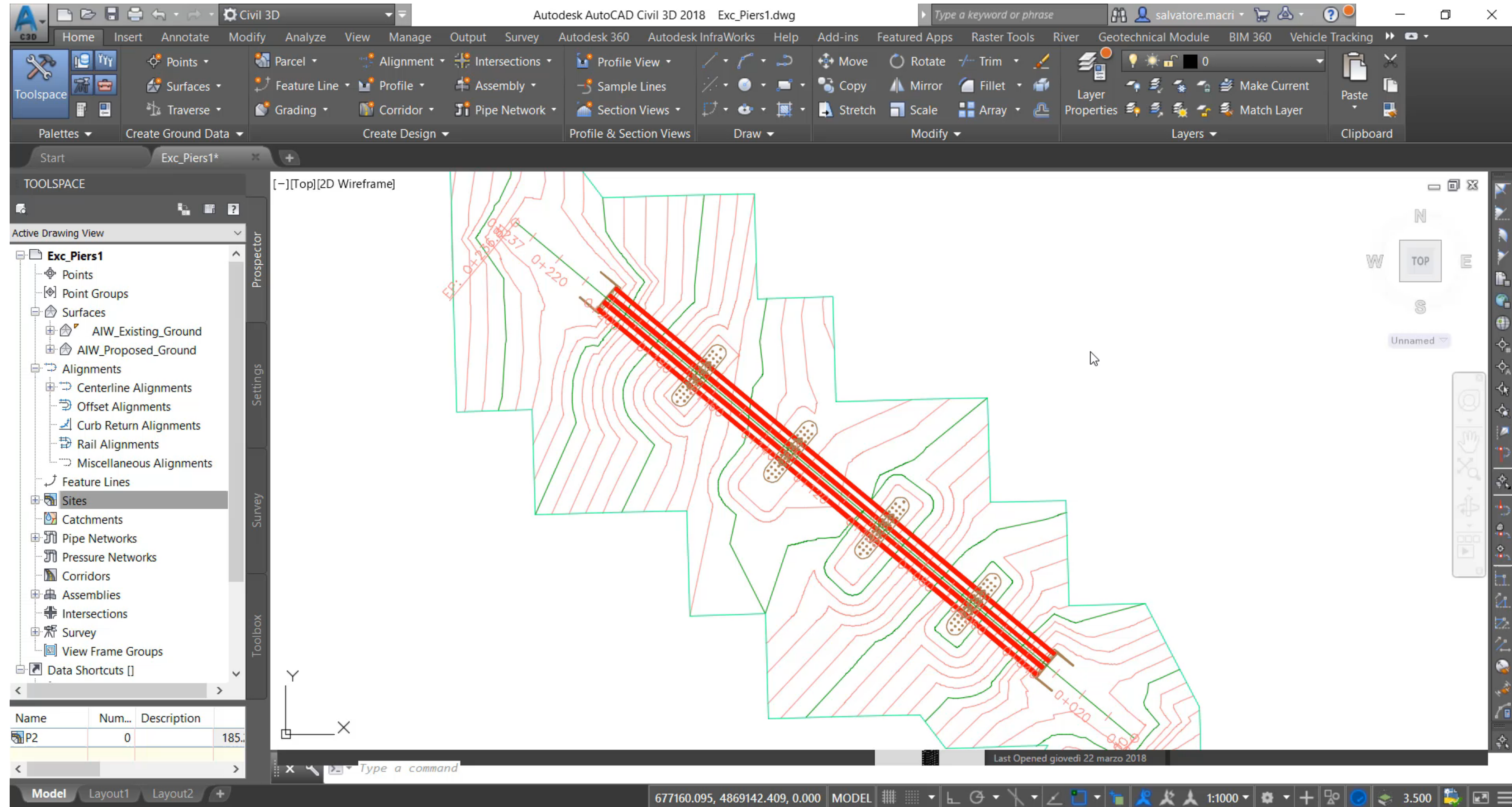


# C3D: Import InfraWorks Model





# C3D: Design with Grading – Slope 3:2







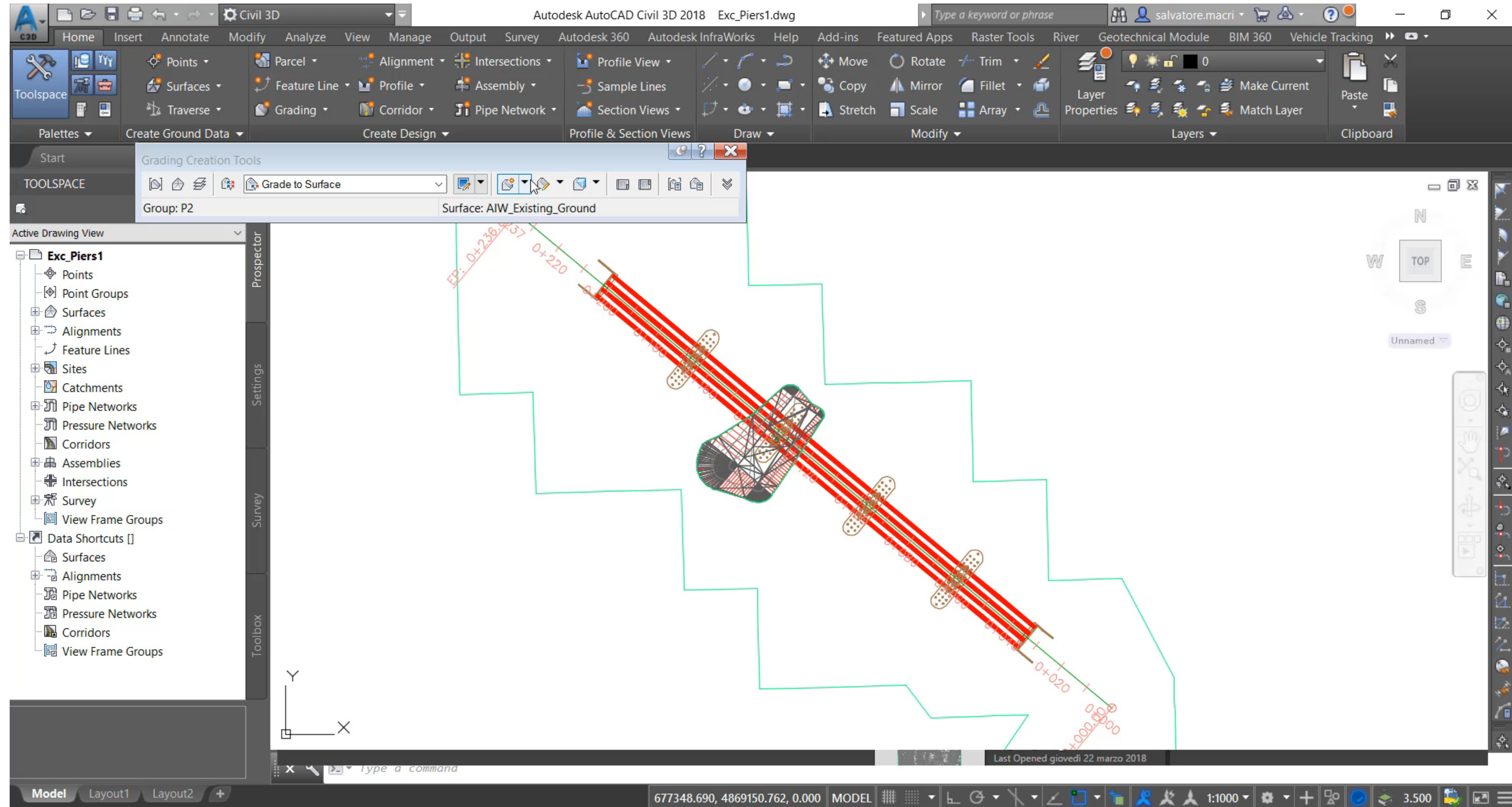
**INFRAWORKS**


$$\Delta V: 1492.6 - 1523.20 = 30.6 \text{ m}^3$$

About 2% of 1523.20 m<sup>3</sup>



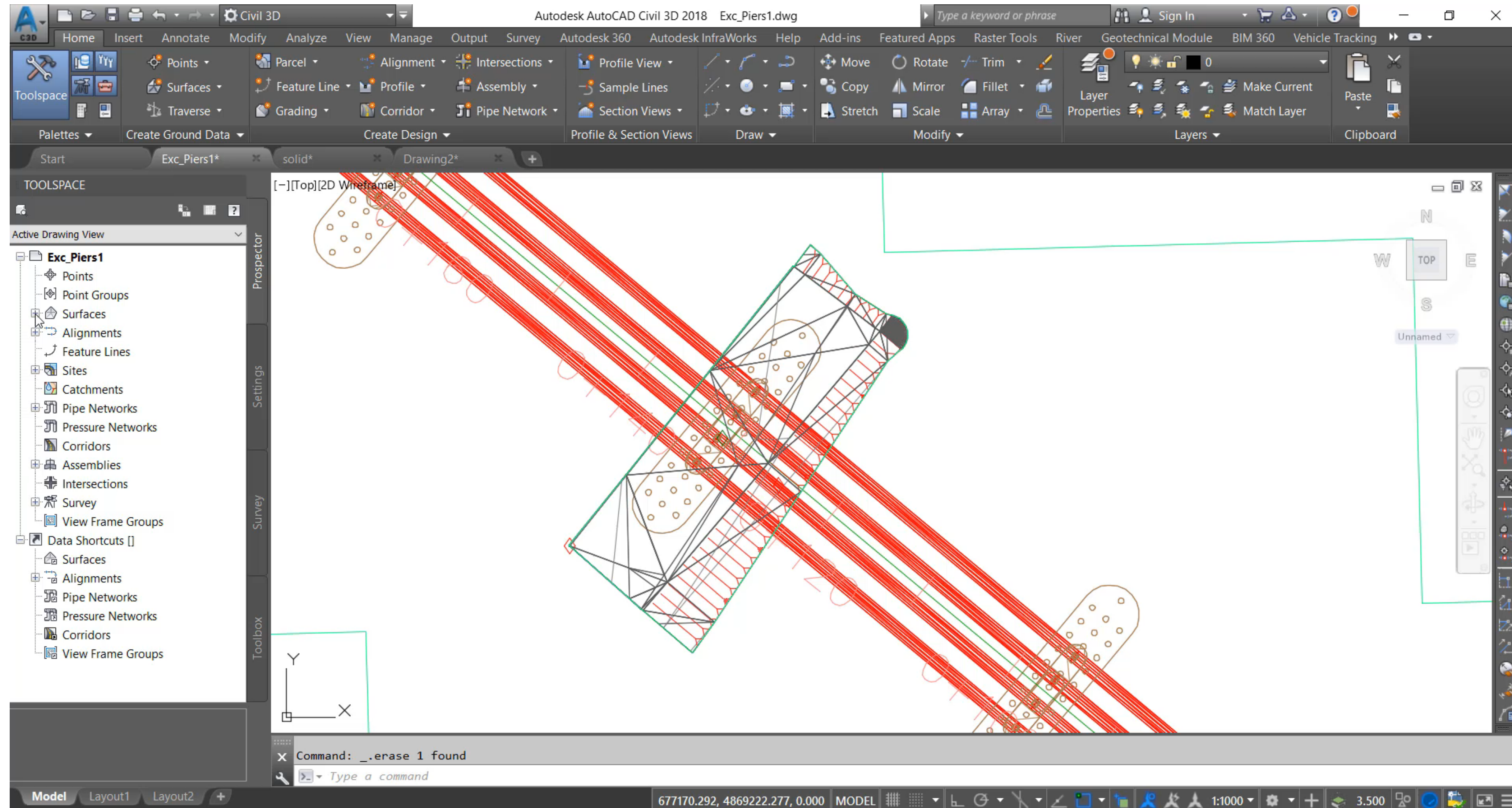
# C3D: How is the real shape ?





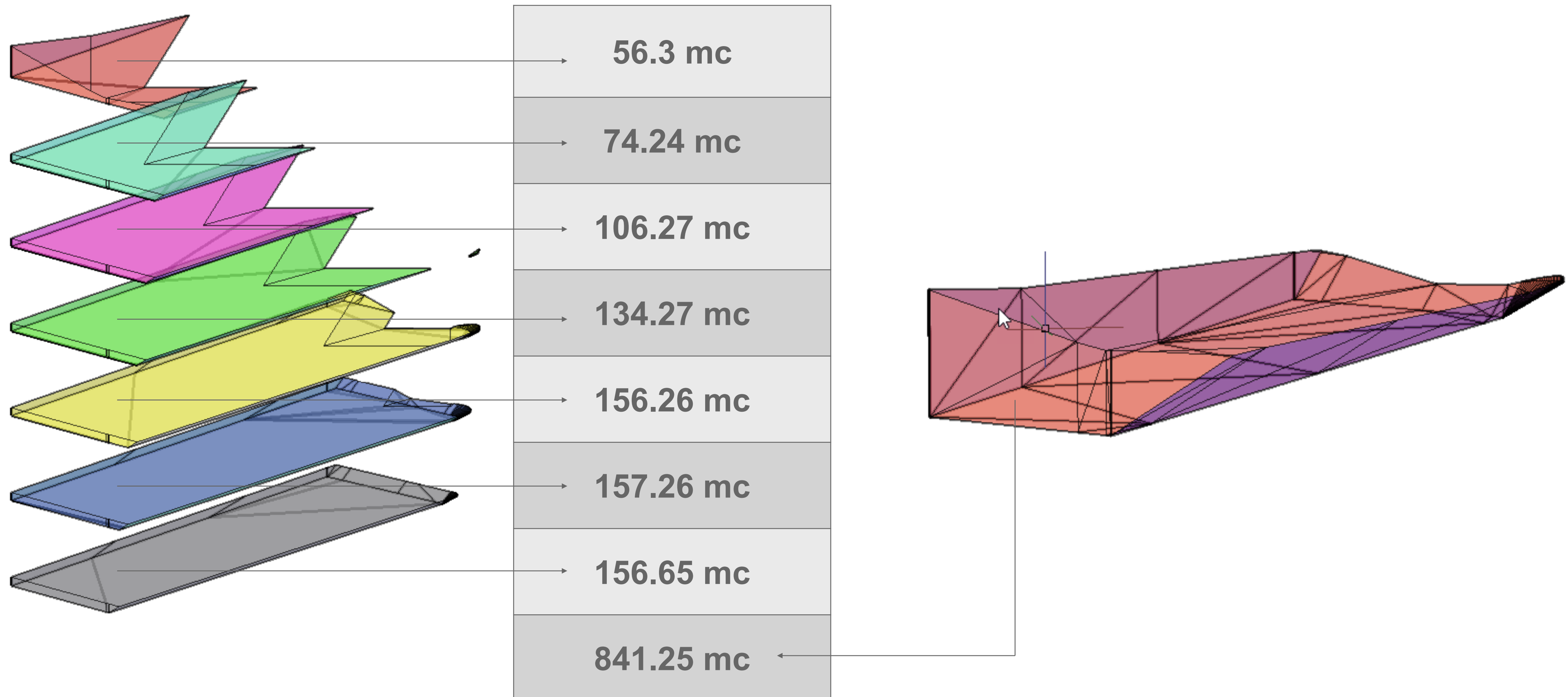
# C3D: How is the real Quantification ?

## Different layer for specifics depth



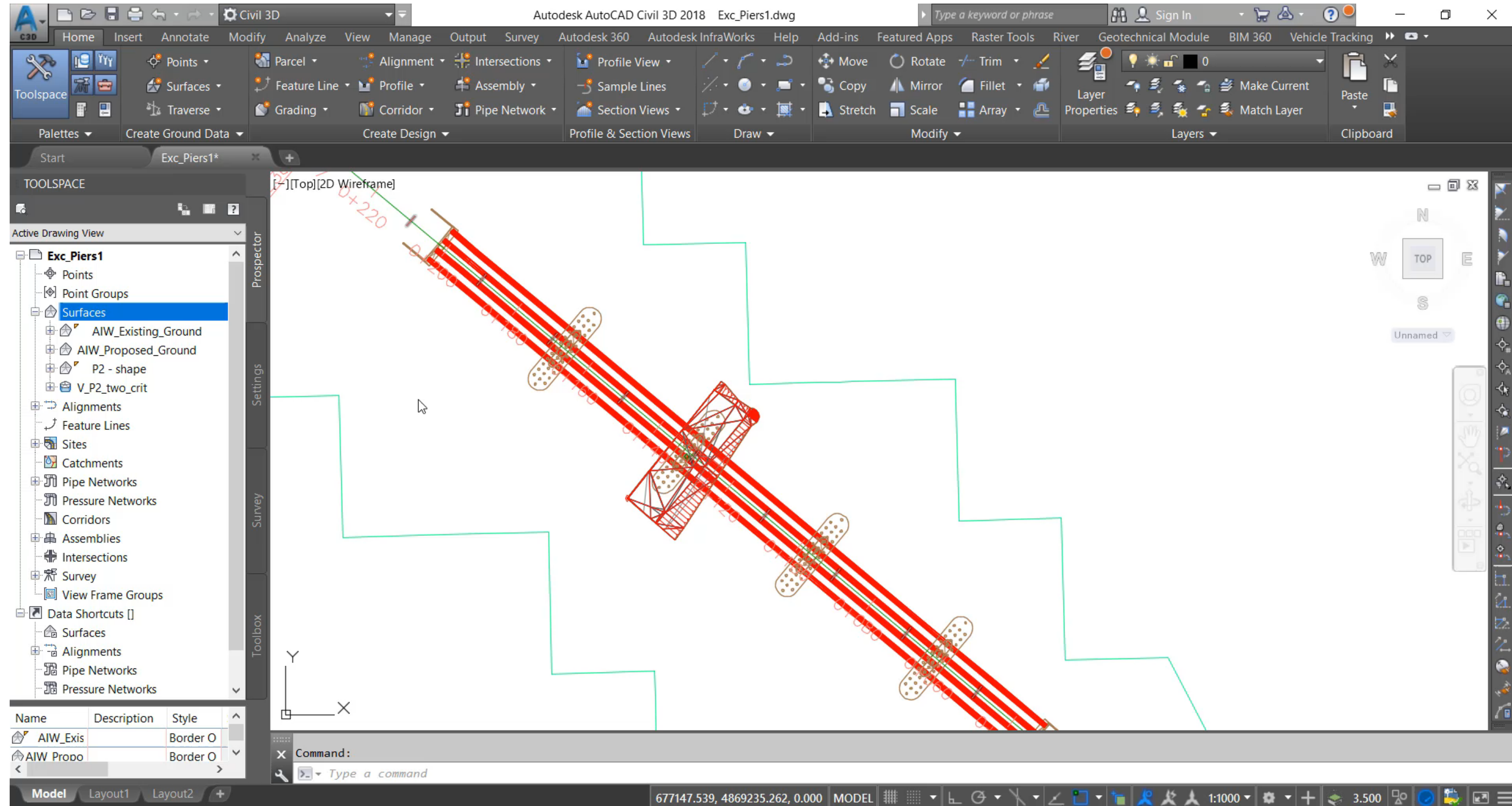


How is the real Quantification ? Different layer for specifics depth



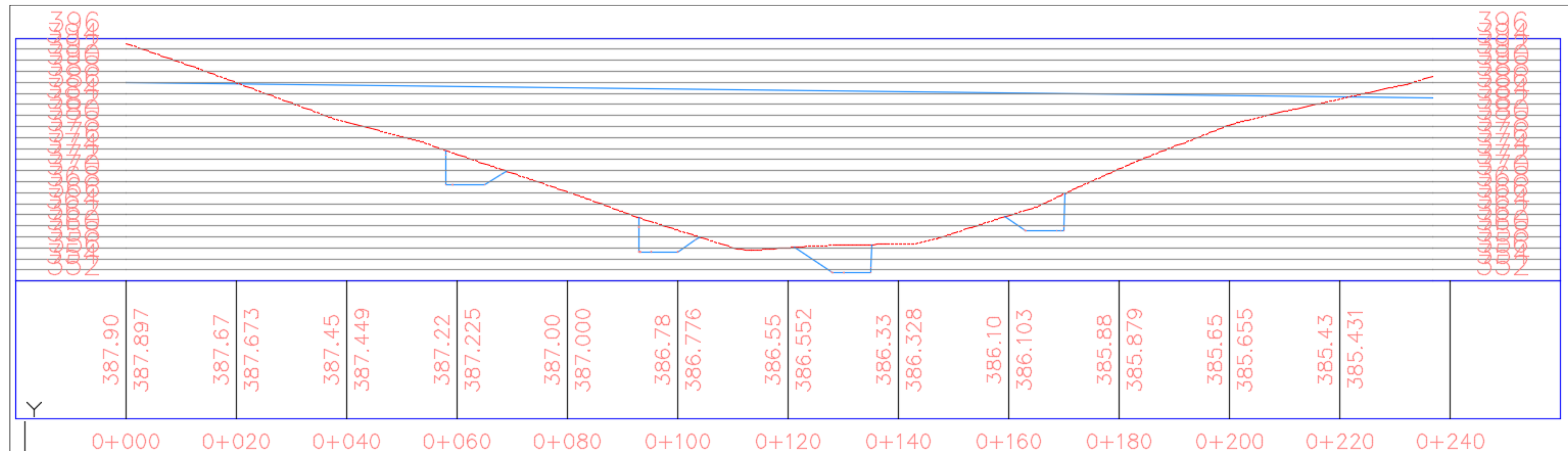
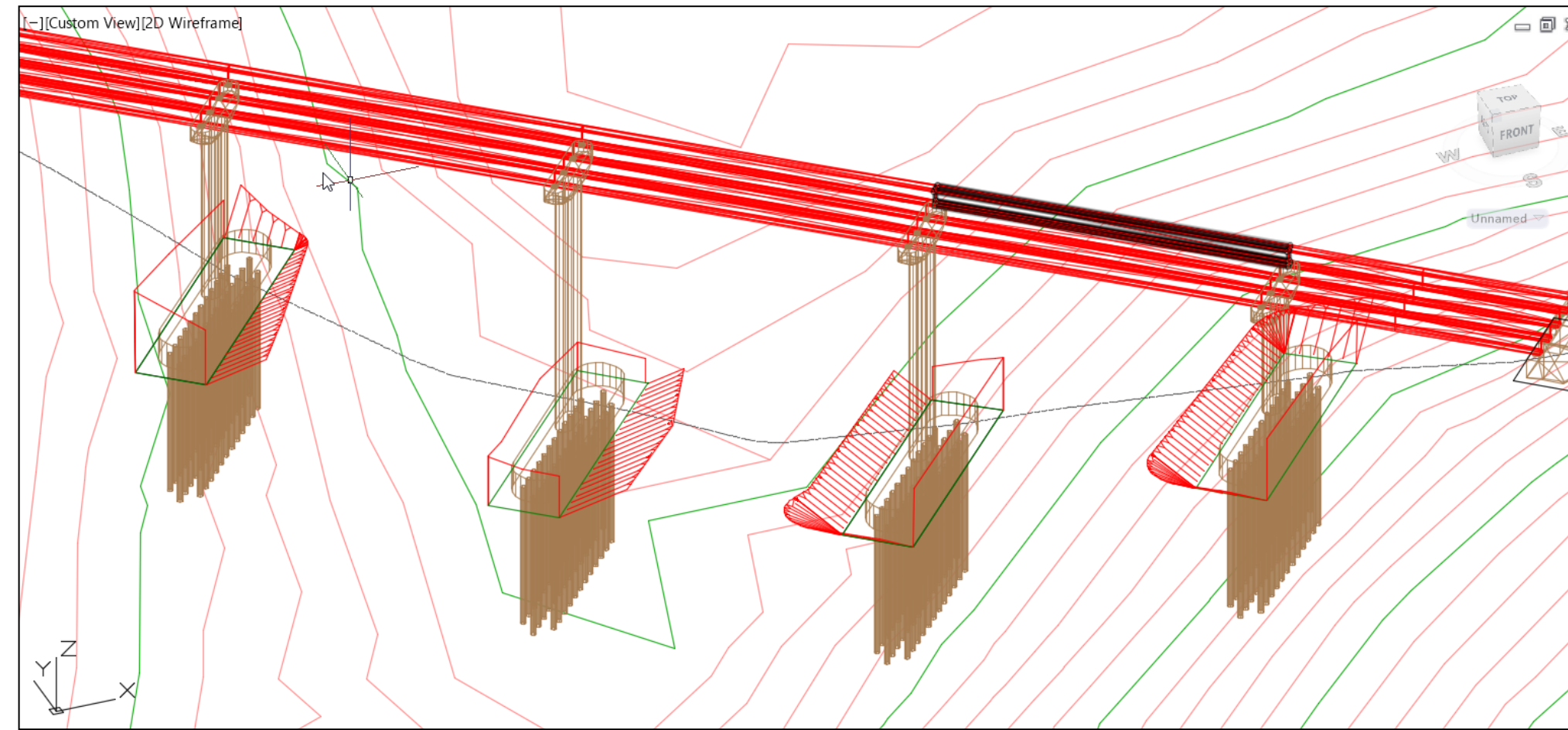


# C3D: Final Surface



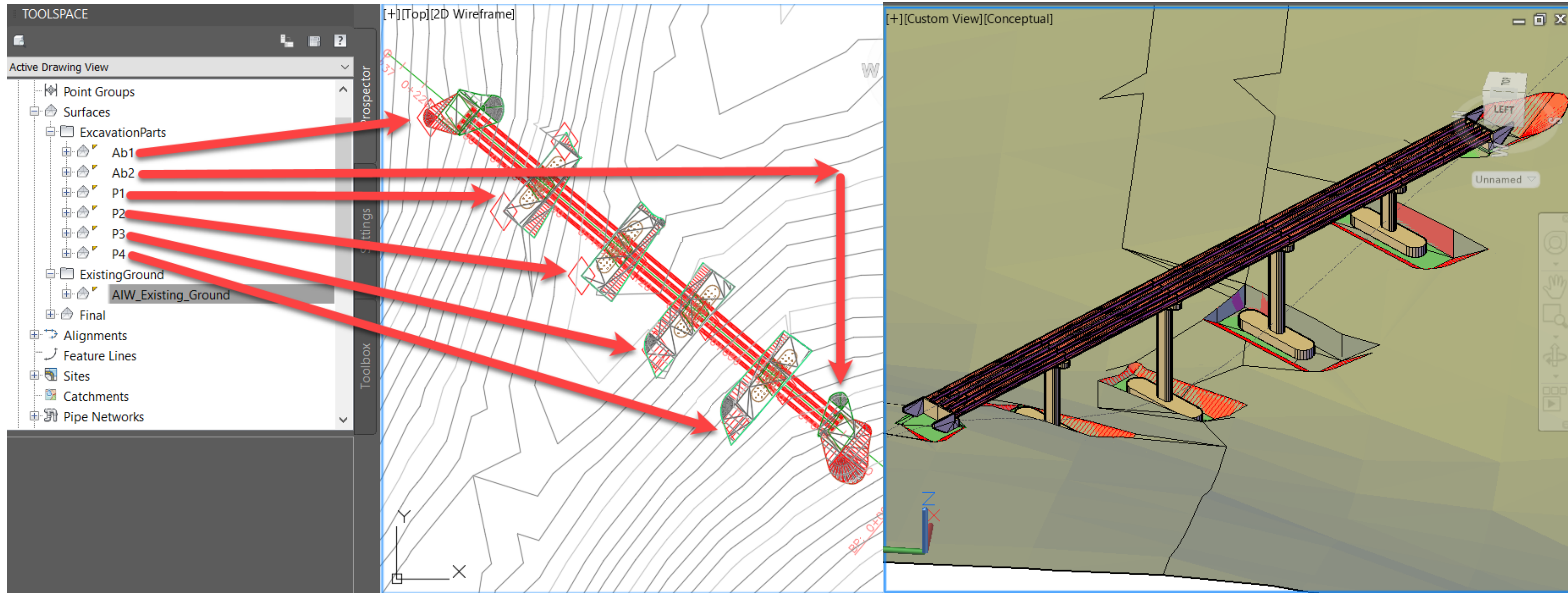


# Civil 3D, and more ...



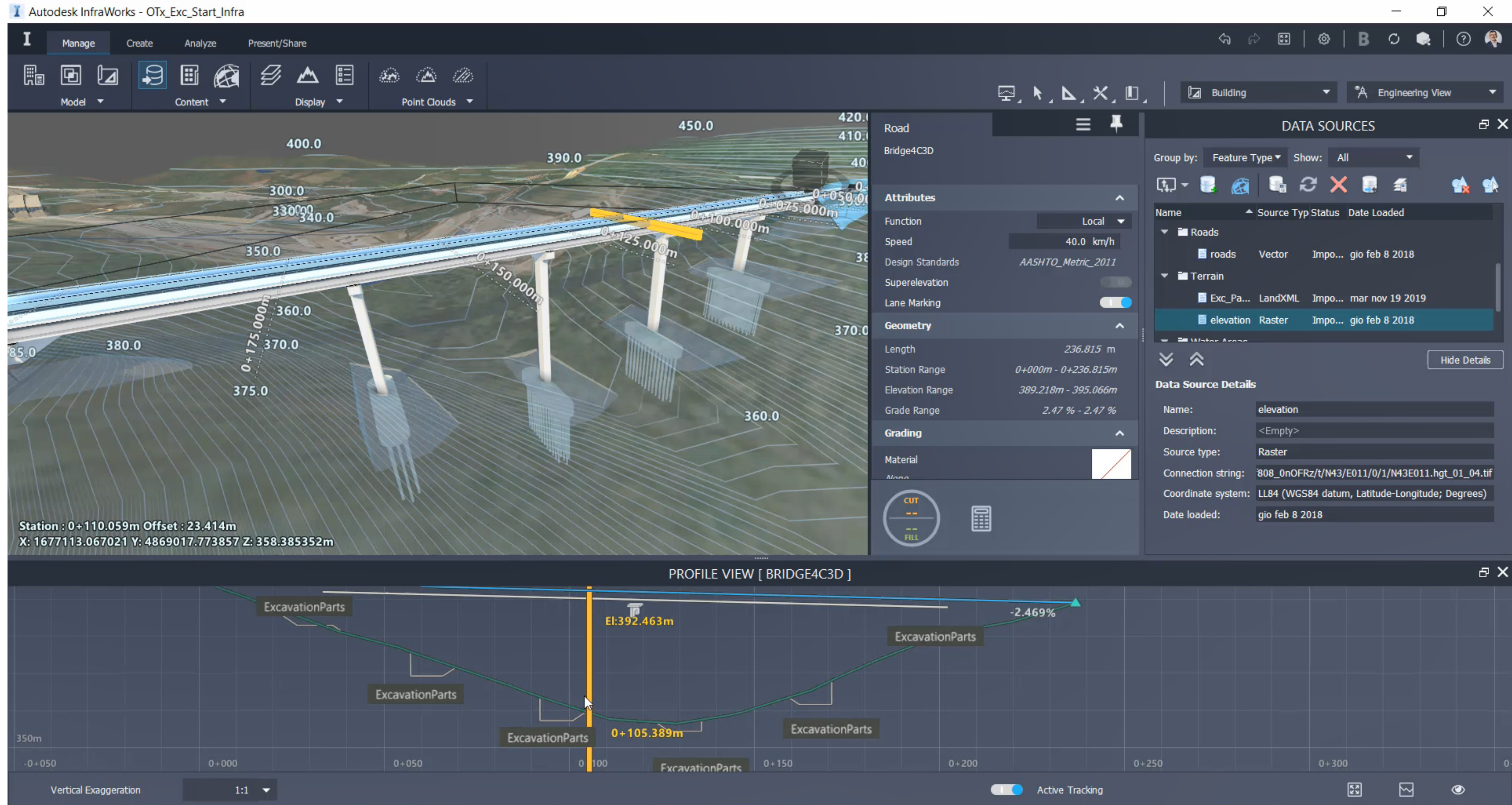


# Civil 3D, and more ...





# C3D to Infraworks





# Civil 3D - Autodesk Subassembly Composer

AU\_RetainWall\_Fill15.pkt - Autodesk Subassembly Composer for AutoCAD Civil 3D 2018

File Edit View Help

Tool Box

Search

- Geometry**
  - Point
  - Link
  - Shape
- Advanced Geometry**
  - Intersection Point
  - Curve
  - Surface Link
  - Daylight Round
  - Get Mark Point
  - Fillet Arc
  - Offset Geometry
  - Loop Geometry
- Auxiliary**
  - Auxiliary Point
  - Auxiliary Link
  - Auxiliary Surface
  - Auxiliary Interse
  - Auxiliary Mark P
- Workflow**
  - Flowchart
  - Sequence
  - Decision
  - Switch
- Miscellaneous**
  - Set Output Para
  - Define Variable
  - Set Variable Val
  - Set Mark Point
  - Report Message

Subassembly

Flowchart

Properties

Preview

Preview geometries in Roadway mode

Codes Comments Fit to Screen

| Name                  | Type      | Preview Value | DisplayName           | Enabled In Previe                   |
|-----------------------|-----------|---------------|-----------------------|-------------------------------------|
| WallProfile           | Elevation | 1.053         | WallProfile           | <input type="checkbox"/>            |
| FoundationBaseProfile | Elevation | -9.277        | FoundationBaseProfile | <input type="checkbox"/>            |
| LFoundation_InSide    | Offset    | 3.959         | LFoundation_InSide    | <input type="checkbox"/>            |
| LFoundation_OutSide   | Offset    | -3.159        | LFoundation_OutSide   | <input type="checkbox"/>            |
| FoundationTopProfile  | Elevation | -7.471        | FoundationTopProfile  | <input type="checkbox"/>            |
| EG                    | Surface   | -5.33         | EG                    | <input checked="" type="checkbox"/> |

Create parameter

Packet Settings Input/Output Parameters Target Parameters Superelevation Cant Event Viewer



# Civil 3D - Autodesk Subassembly Composer

AU\_RetainWall\_Fill15.pkt - Autodesk Subassembly Composer for AutoCAD Civil 3D 2018

File Edit View Help

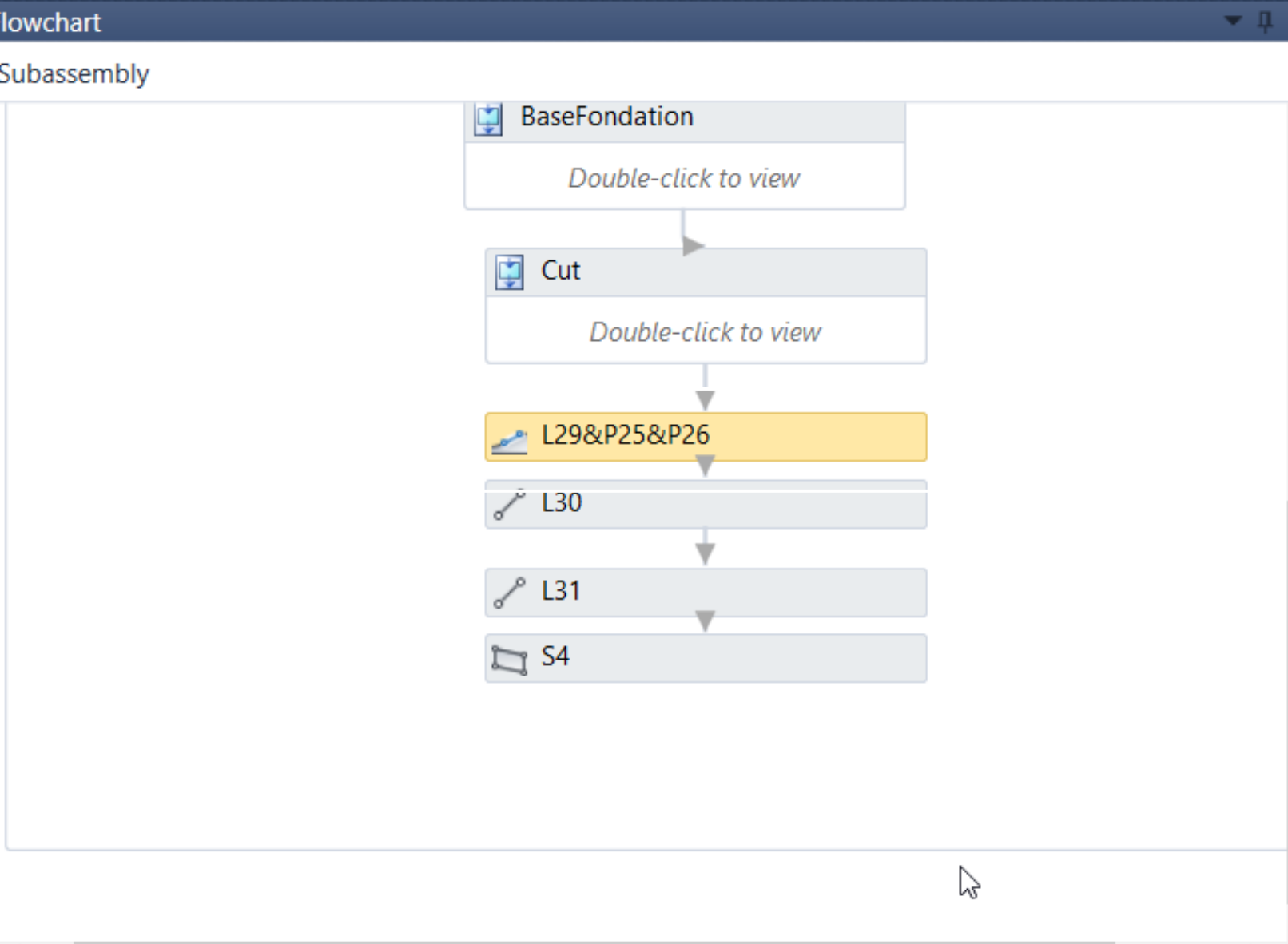
Tool Box

Search

- Geometry**
  - Point
  - Link
  - Shape
- Advanced Geometry**
  - Intersection Point
  - Curve
  - Surface Link**
  - Daylight Roundi
  - Get Mark Point
  - Fillet Arc
  - Offset Geometry
  - Loop Geometry
- Auxiliary**
  - Auxiliary Point
  - Auxiliary Link
  - Auxiliary Surface
  - Auxiliary Interse
  - Auxiliary Mark P
- Workflow**
  - Flowchart
  - Sequence
  - Decision
  - Switch
- Miscellaneous**
  - Set Output Para
  - Define Variable
  - Set Variable Val
  - Set Mark Point
  - Report Message

Flowchart

Subassembly

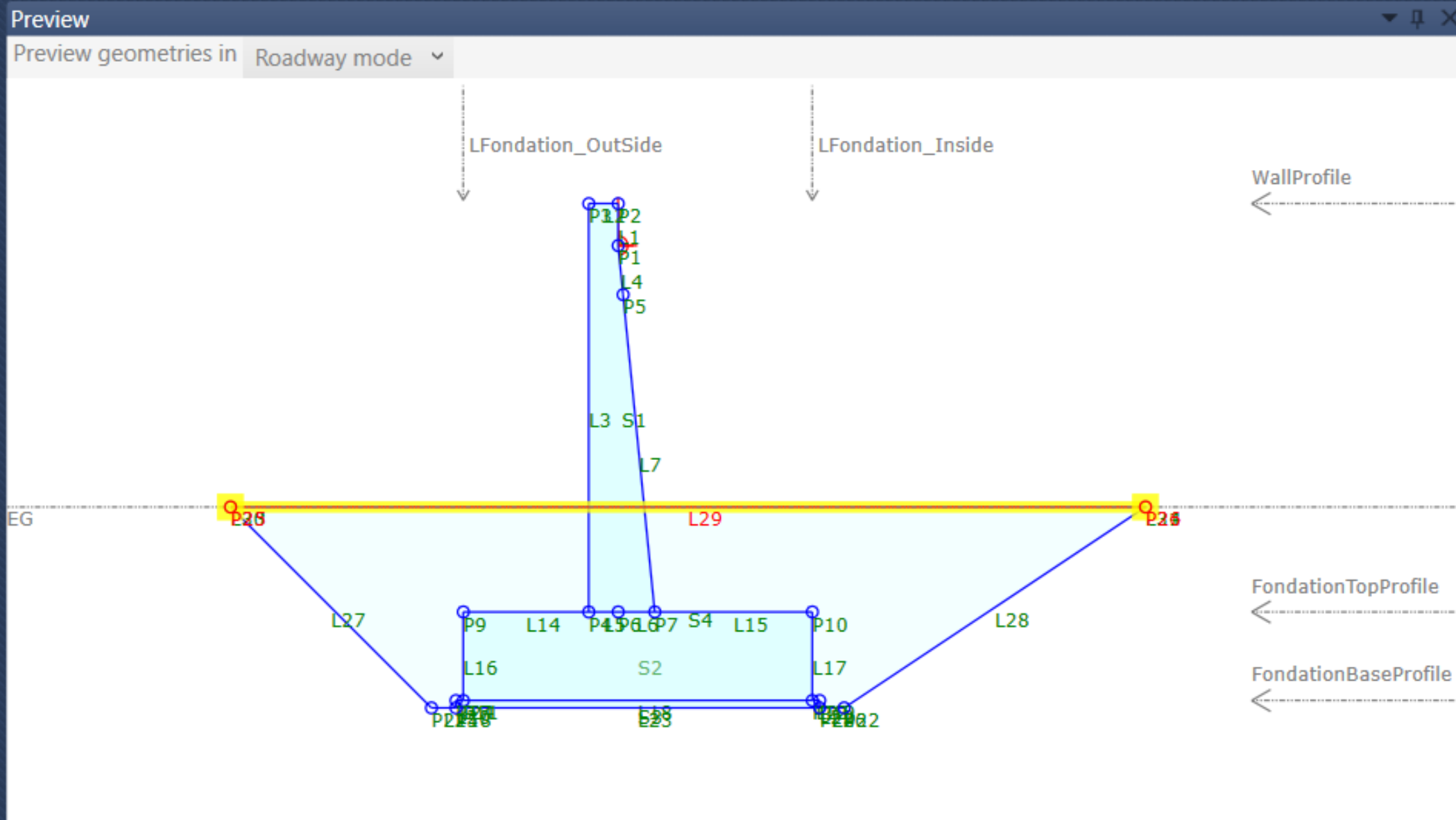


```

graph TD
    BaseFoundation[BaseFoundation] --> Cut[Cut]
    Cut --> L29_P25_P26[L29&P25&P26]
    L29_P25_P26 --> L30[L30]
    L30 --> L31[L31]
    L31 --> S4[S4]
  
```

Preview

Preview geometries in Roadway mode



Properties

**Link**

Link Number: L29

Link Codes: "TopScavo"

**Geometry Properties**

Surface Target: EG

Start X: P23.X

End X: P24.X

Start Offset Target (overrides Start Offset): None

End Offset Target (overrides End Offset): None

Depth: 0

Target Parameters

| Name                  | Type      | Preview Value | DisplayName           | Enabled In Previe                   |
|-----------------------|-----------|---------------|-----------------------|-------------------------------------|
| WallProfile           | Elevation | 0.856         | WallProfile           | <input type="checkbox"/>            |
| FoundationBaseProfile | Elevation | -9.277        | FoundationBaseProfile | <input type="checkbox"/>            |
| LFoundation_InSide    | Offset    | 3.959         | LFoundation_InSide    | <input type="checkbox"/>            |
| LFoundation_OutSide   | Offset    | -3.159        | LFoundation_OutSide   | <input type="checkbox"/>            |
| FoundationTopProfile  | Elevation | -7.471        | FoundationTopProfile  | <input type="checkbox"/>            |
| EG                    | Surface   | -5.33         | EG                    | <input checked="" type="checkbox"/> |

Create parameter



# Civil 3D - Autodesk Subassembly Composer

AU\_RetainWall\_Fill15.pkt - Autodesk Subassembly Composer for AutoCAD Civil 3D 2018

File Edit View Help

**Tool Box**

Search

- Geometry**
  - Point
  - Link
  - Shape
- Advanced Geometry**
  - Intersection Point
  - Curve
  - Surface Link**
  - Daylight Round
  - Get Mark Point
  - Fillet Arc
  - Offset Geometry
  - Loop Geometry
- Auxiliary**
  - Auxiliary Point
  - Auxiliary Link
  - Auxiliary Surface
  - Auxiliary Intersection
  - Auxiliary Mark Point
- Workflow**
  - Flowchart
  - Sequence
  - Decision
  - Switch
- Miscellaneous**
  - Set Output Parameter
  - Define Variable
  - Set Variable Value
  - Set Mark Point
  - Report Message

**Flowchart**

Subassembly

```

graph TD
    A[BaseFoundation  
Double-click to view] --> B[Cut  
Double-click to view]
    B --> C[L29&P25&P26]
    C --> D[L30]
    D --> E[L31]
    E --> F[S4]
    
```

**Preview**

Preview geometries in Roadway mode

Codes Comments

Fit to Screen

**Properties**

**Link**

Link Number: L29

Link Codes: "TopScavo"

**Geometry Properties**

Surface Target: EG

Start X: P23.X

End X: P24.X

Start Offset Target (overrides Start Offset): None

End Offset Target (overrides End Offset): None

Depth: 0

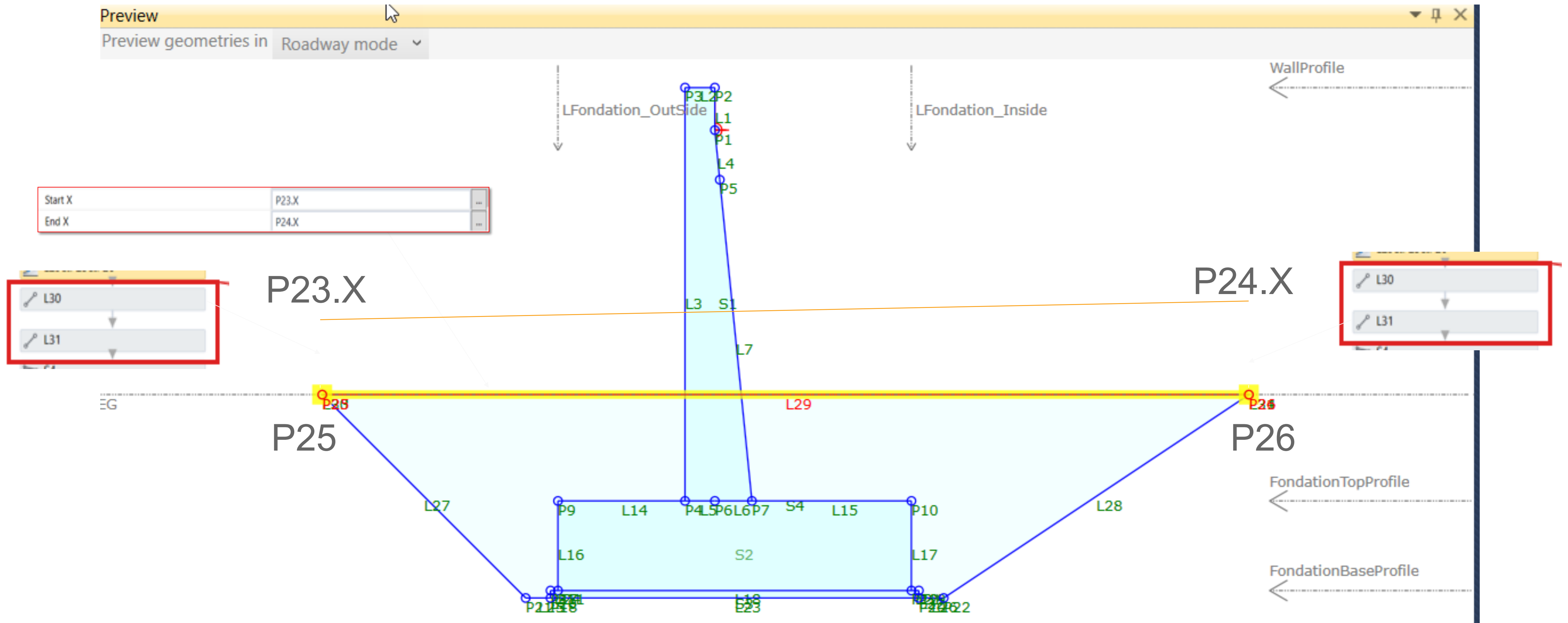
**Target Parameters**

| Name                  | Type      | Preview Value | DisplayName           | Enabled In Preview                  |
|-----------------------|-----------|---------------|-----------------------|-------------------------------------|
| WallProfile           | Elevation | 0.856         | WallProfile           | <input type="checkbox"/>            |
| FoundationBaseProfile | Elevation | -9.277        | FoundationBaseProfile | <input type="checkbox"/>            |
| LFoundation_Inside    | Offset    | 3.959         | LFoundation_Inside    | <input type="checkbox"/>            |
| LFoundation_OutSide   | Offset    | -3.159        | LFoundation_OutSide   | <input type="checkbox"/>            |
| FoundationTopProfile  | Elevation | -7.471        | FoundationTopProfile  | <input type="checkbox"/>            |
| EG                    | Surface   | -5.33         | EG                    | <input checked="" type="checkbox"/> |

Create parameter



# Civil 3D - Autodesk Subassembly Composer





# Civil 3D - Autodesk Subassembly Composer

AU\_RetainWall\_Fill15.pkt - Autodesk Subassembly Composer for AutoCAD Civil 3D 2018

File Edit View Help

**Tool Box**

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- Geometry**
  - Point
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  - Set Output Para
  - Define Variable
  - Set Variable Val
  - Set Mark Point
  - Report Message

**Flowchart**

Subassembly

```

graph TD
    Foundation[Foundation  
Double-click to view] --> BaseFoundation[BaseFoundation  
Double-click to view]
    BaseFoundation --> Cut[Cut  
Double-click to view]
    Cut --> L29_P25_P26[L29&P25&P26]
    L29_P25_P26 --> L30[L30]
    L30 --> L31[L31]
    L31 --> S4[S4]
  
```

**Preview**

Preview geometries in Roadway mode

☐ Codes ☐ Comments Fit to Screen

**Target Parameters**

| Name                 | Type      | Preview Value | DisplayName          | Enabled In Previe                   |
|----------------------|-----------|---------------|----------------------|-------------------------------------|
| WallProfile          | Elevation | 0.856         | WallProfile          | <input type="checkbox"/>            |
| FondationBaseProfile | Elevation | -9.277        | FondationBaseProfile | <input type="checkbox"/>            |
| LFondation_InSide    | Offset    | 3.959         | LFondation_InSide    | <input type="checkbox"/>            |
| LFondation_OutSide   | Offset    | -3.159        | LFondation_OutSide   | <input type="checkbox"/>            |
| FondationTopProfile  | Elevation | -7.471        | FondationTopProfile  | <input type="checkbox"/>            |
| EG                   | Surface   | -6.145        | EG                   | <input checked="" type="checkbox"/> |

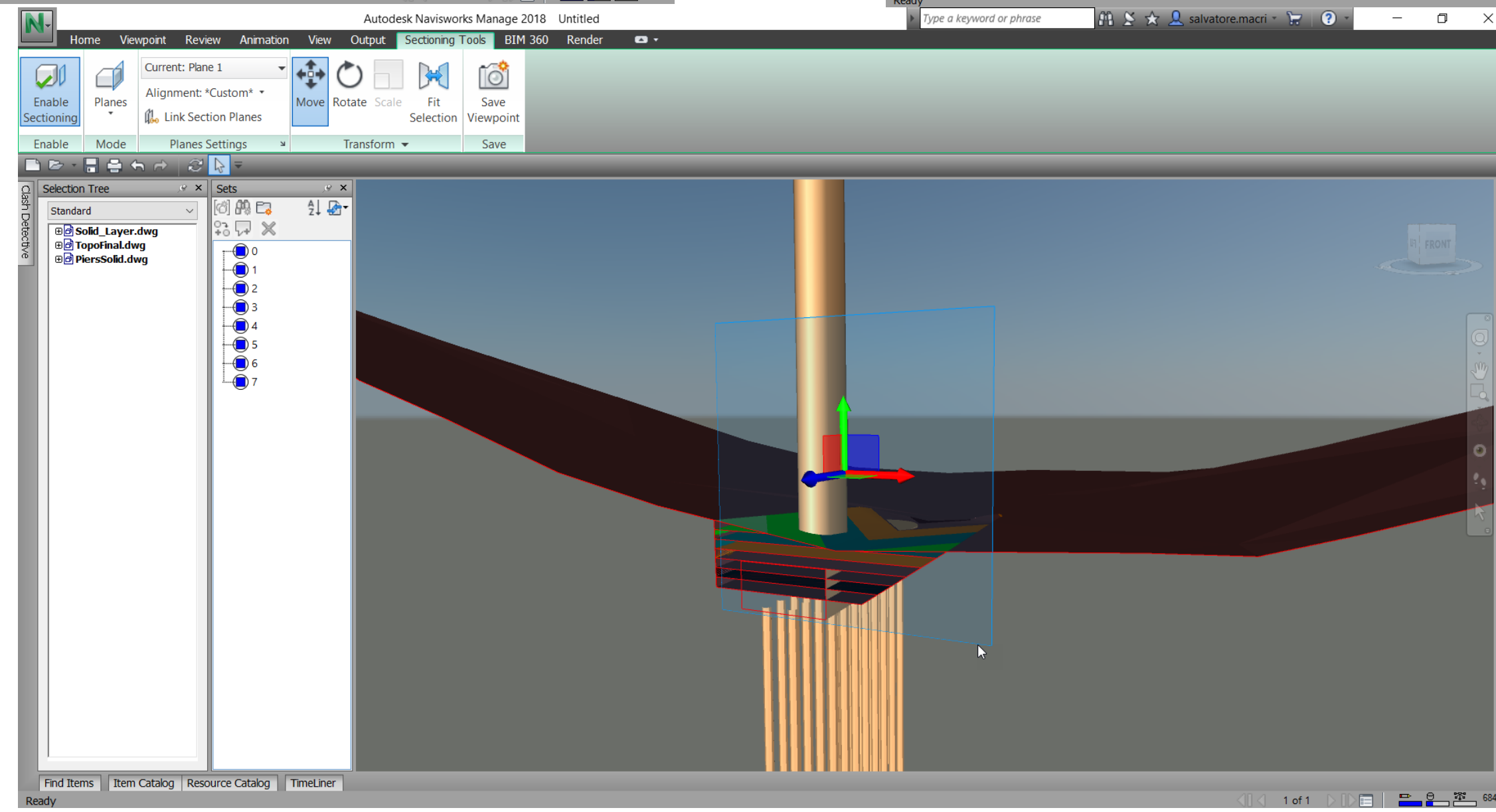
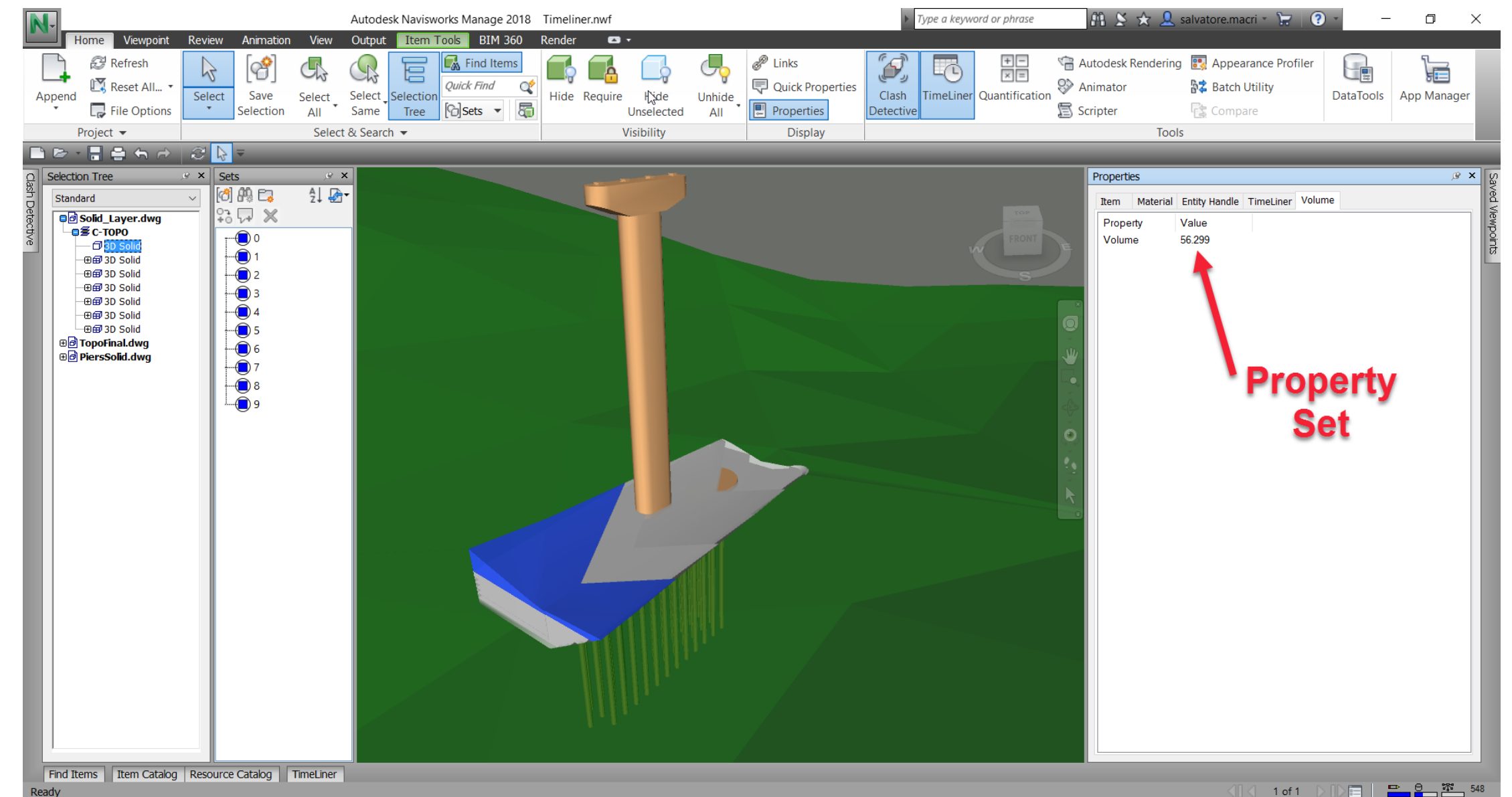
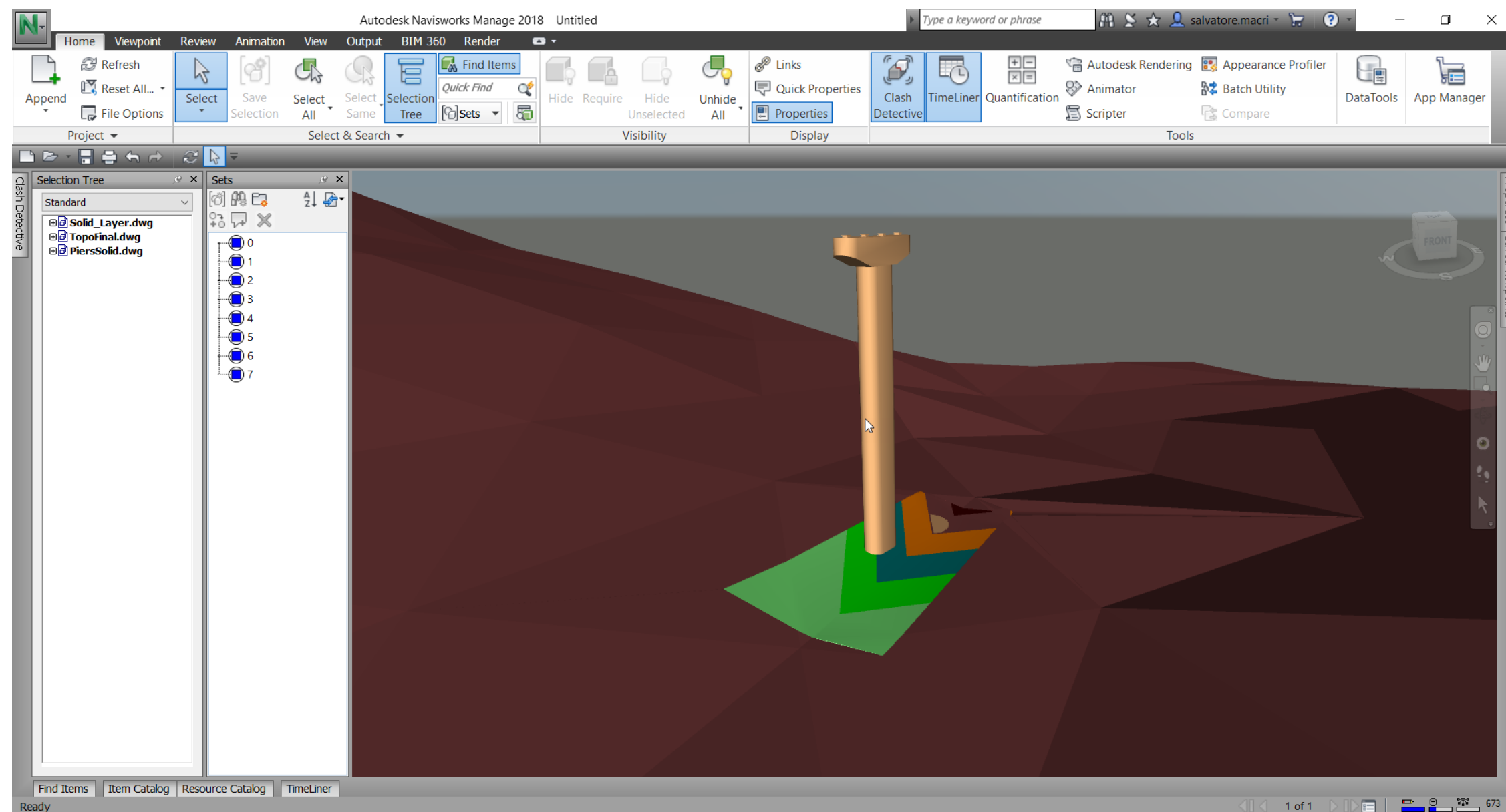
Create parameter

Packet Settings Input/Output Parameters **Target Parameters** Superelevation Cant Event Viewer

Autodesk Subassembly Composer for AutoCAD Civil 3D

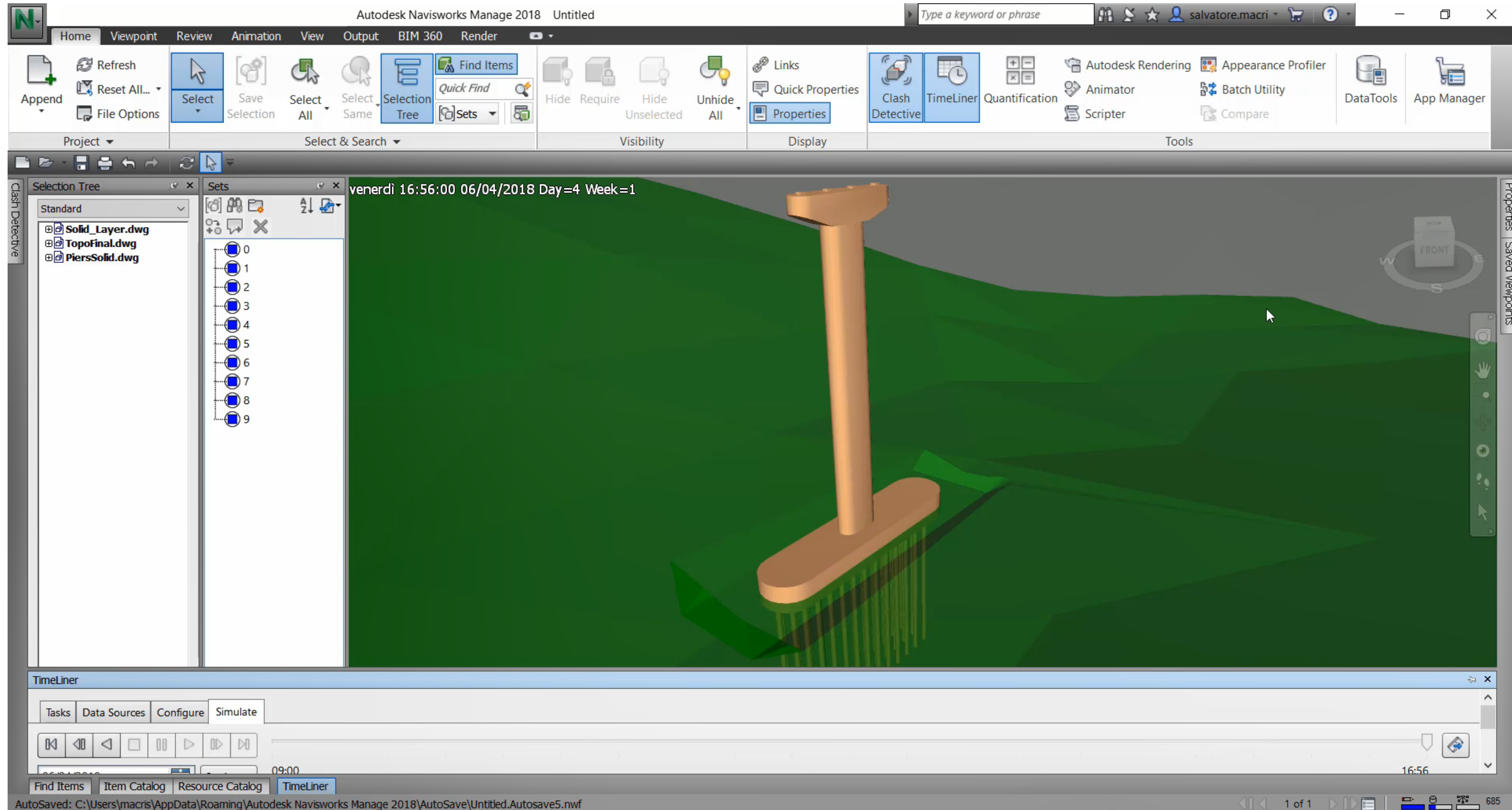


# Coordination

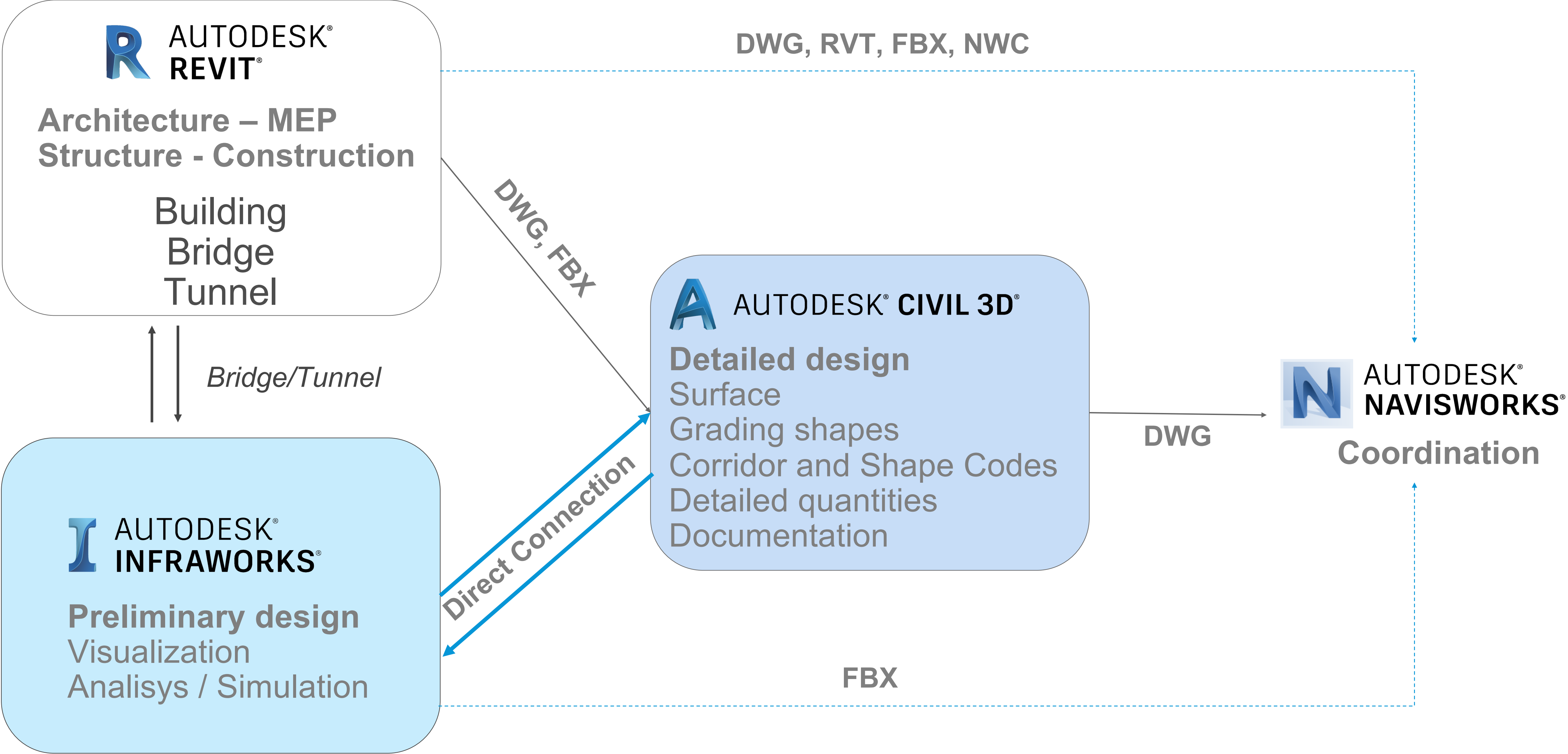




# Coordination











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