Stadium Station Revit Infrastructure case Studies

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BIM Manager
@infraBimGis

Key learning objectives

During this class you will gain insight into how a highly technical rail project integrated BIM.

Topic Covered:

- Using a cloud based Common Data Environment (CDE) for multiple site collaboration.
- Using Dynamo for construction tasks, setting out and modelling
- Benefits of Modelling Complex Reinforcement.
- Open file formats and Revit

Stadium Station Overview

PRISM Alliance

Perth Rail Infrastructure & Station Management

Public Transport Authority

AECOM

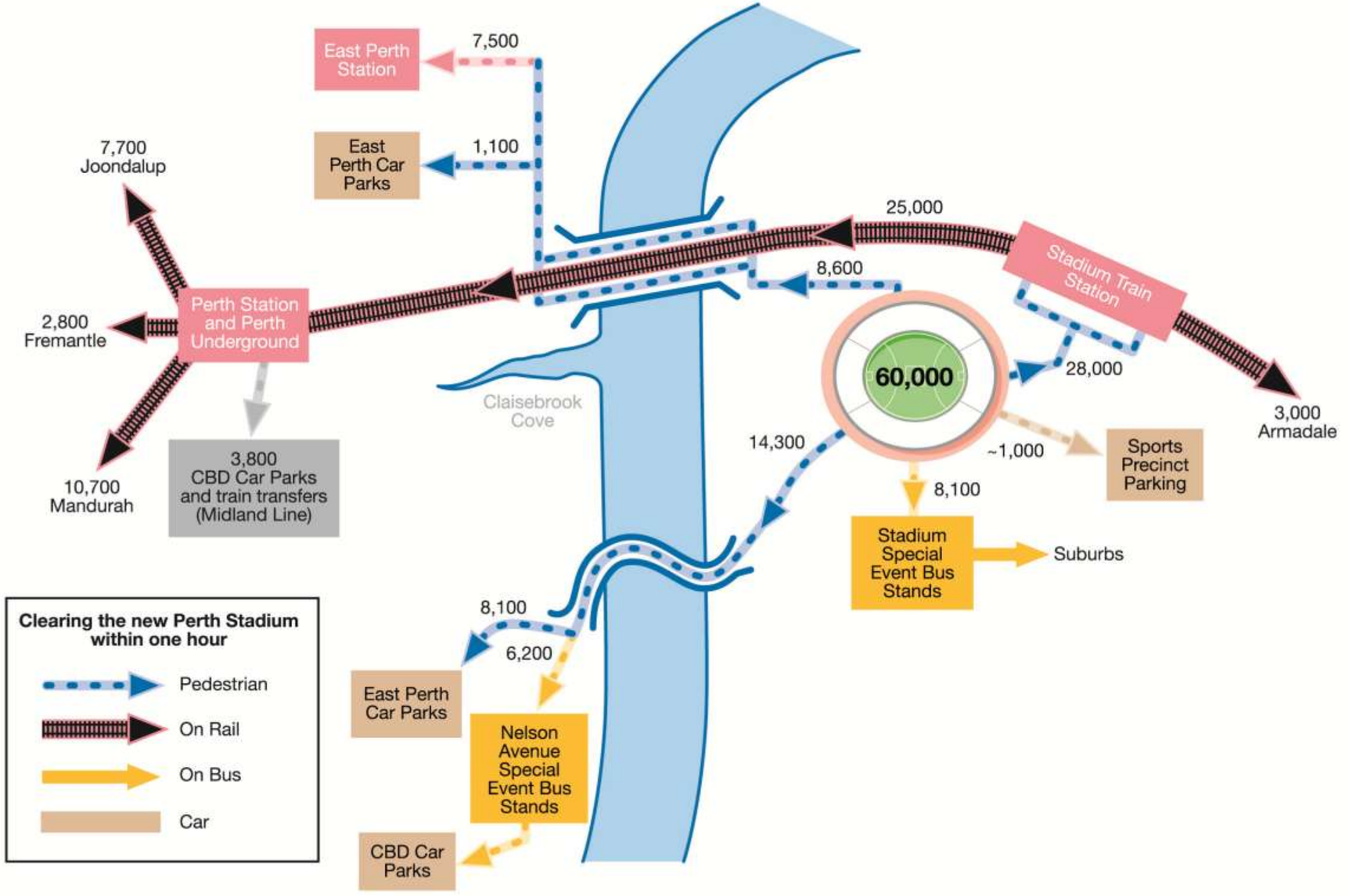
LAING O'ROURKE

Project Location

#justanotherdayinwa

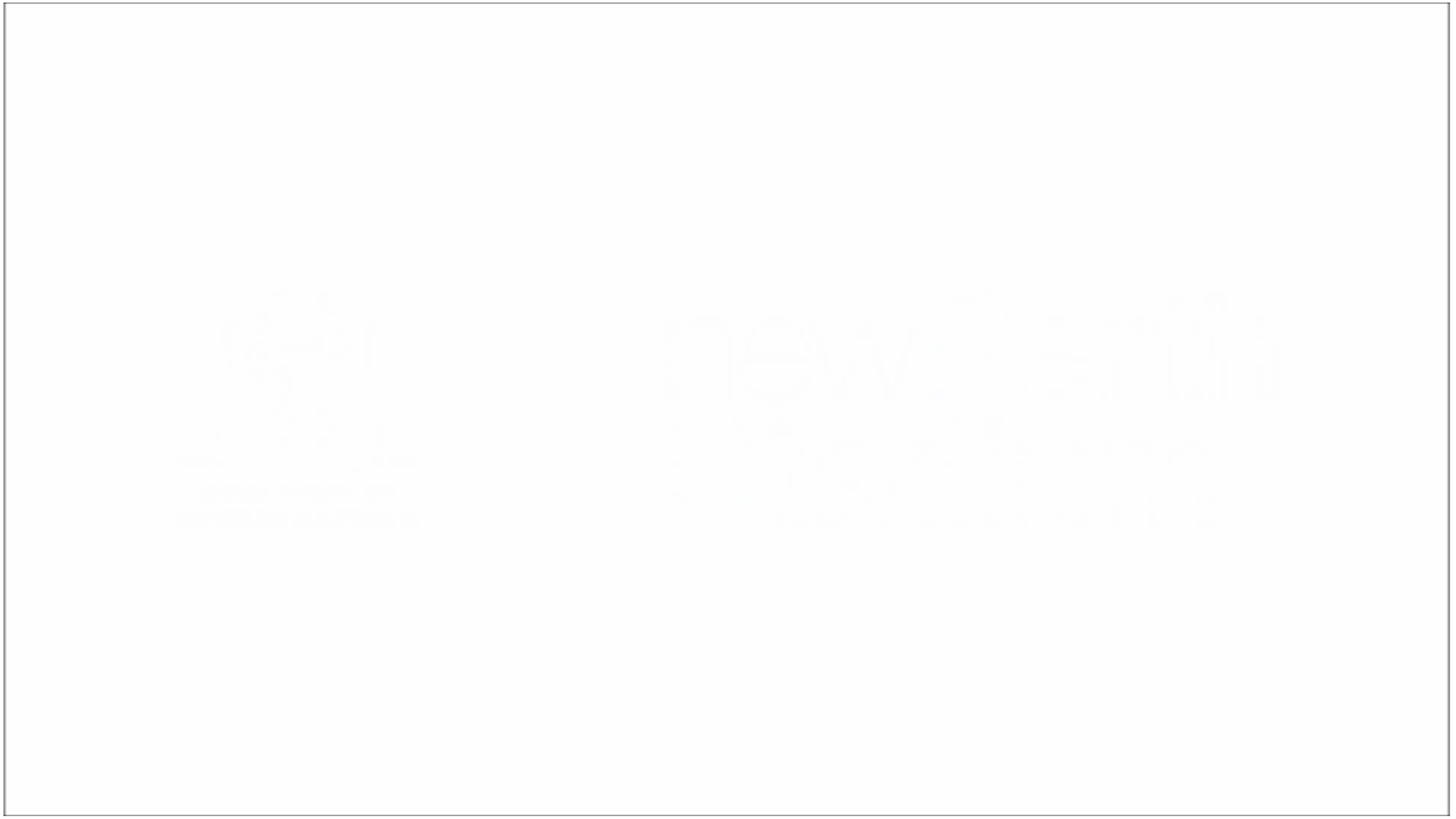
Stadium Station Location

Stadium Station Function

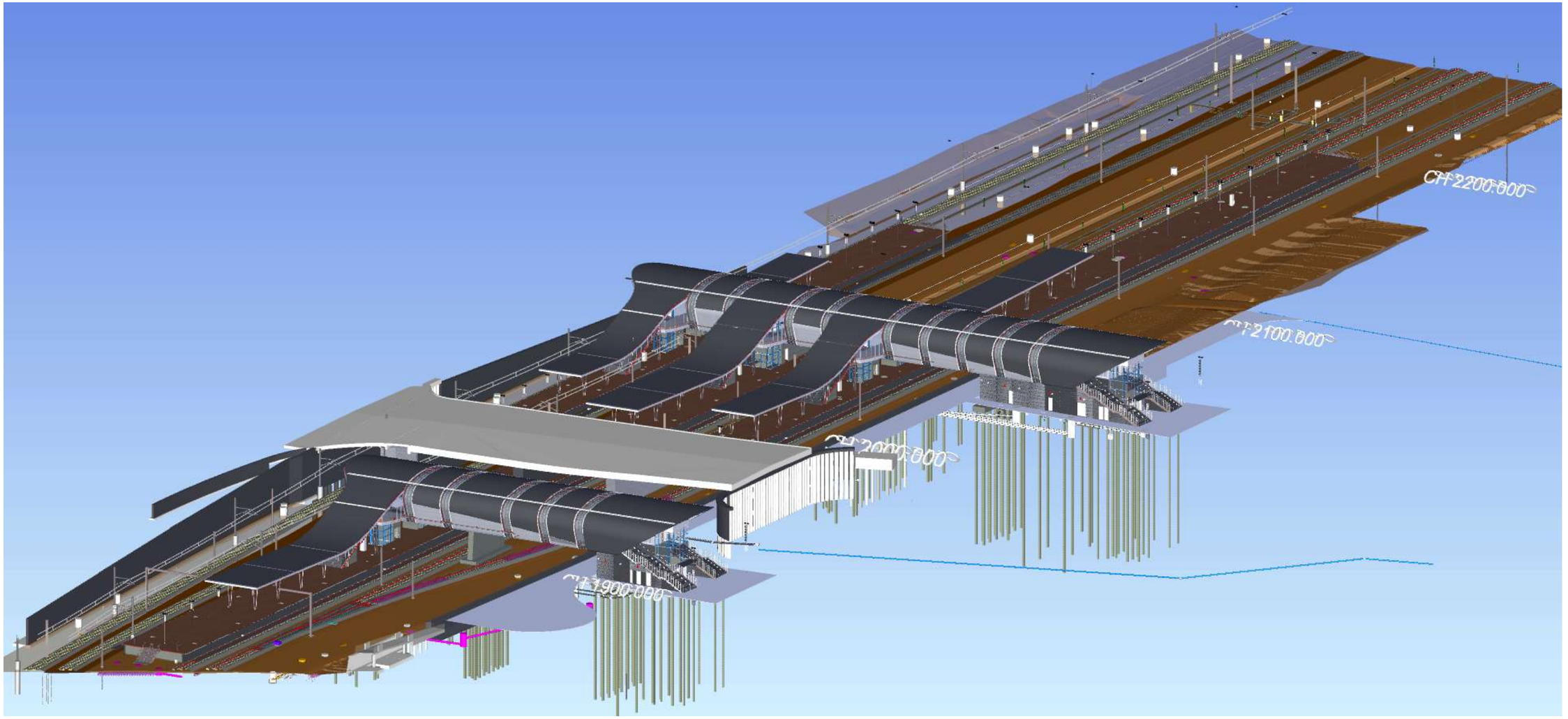


Stadium Station Overview

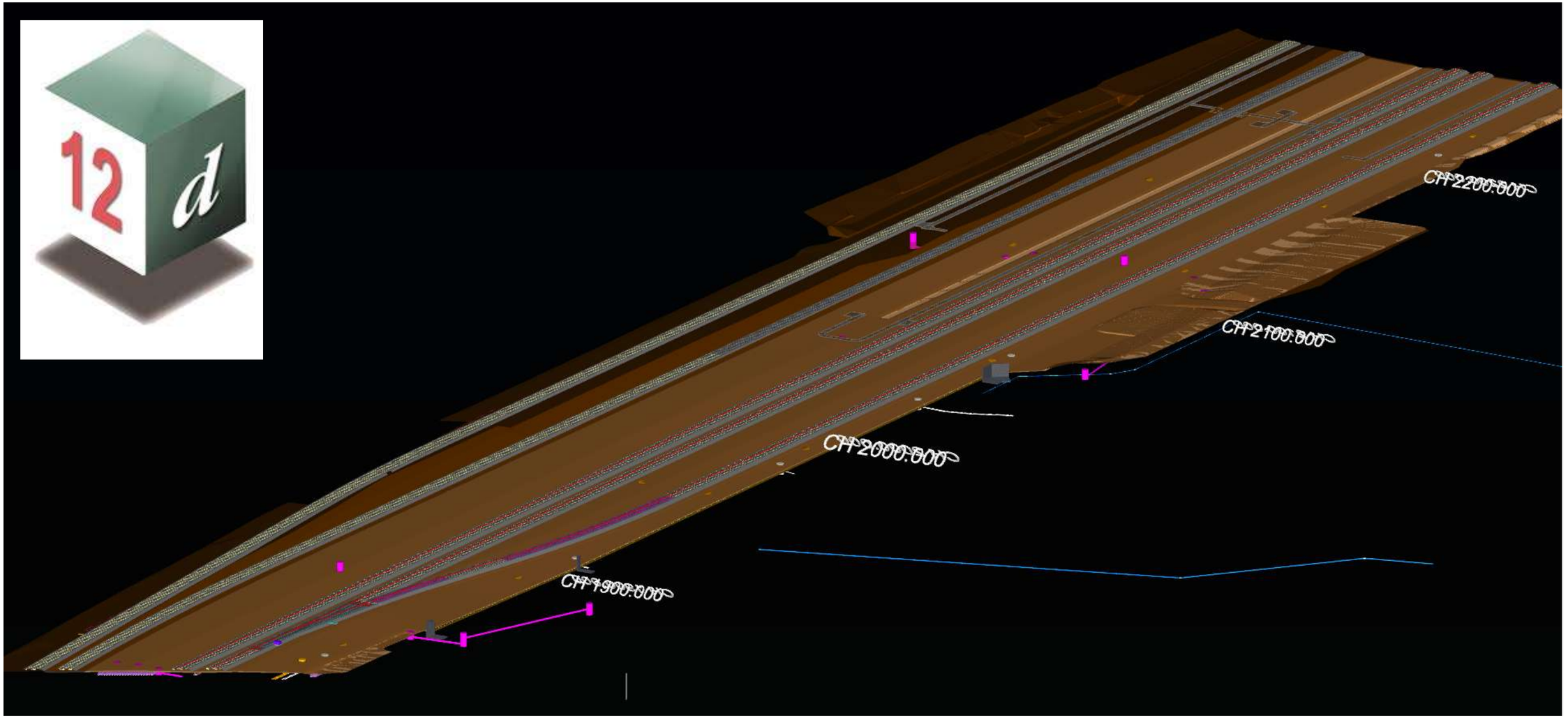
Overview



Linear Infrastructure Model



Linear Infrastructure Model



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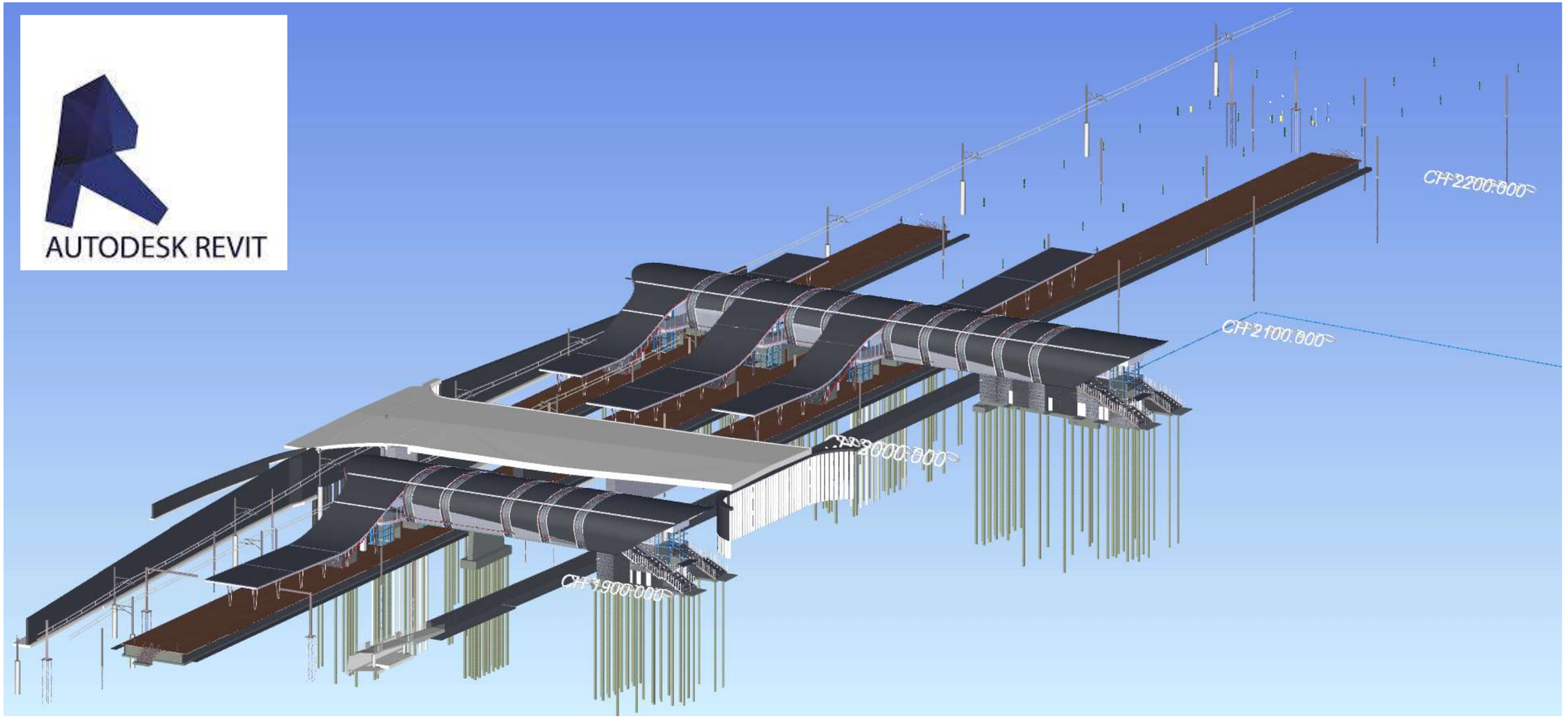
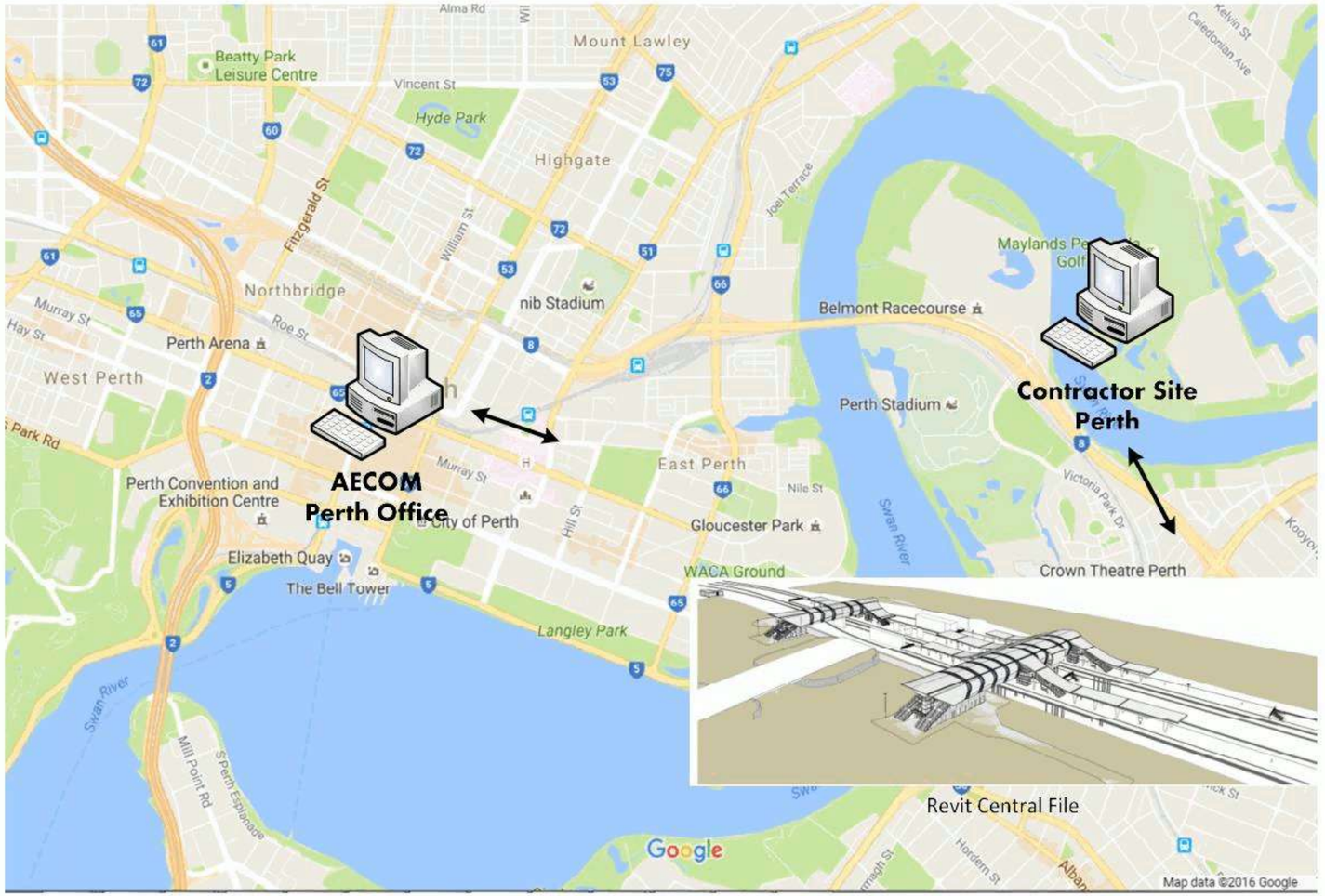


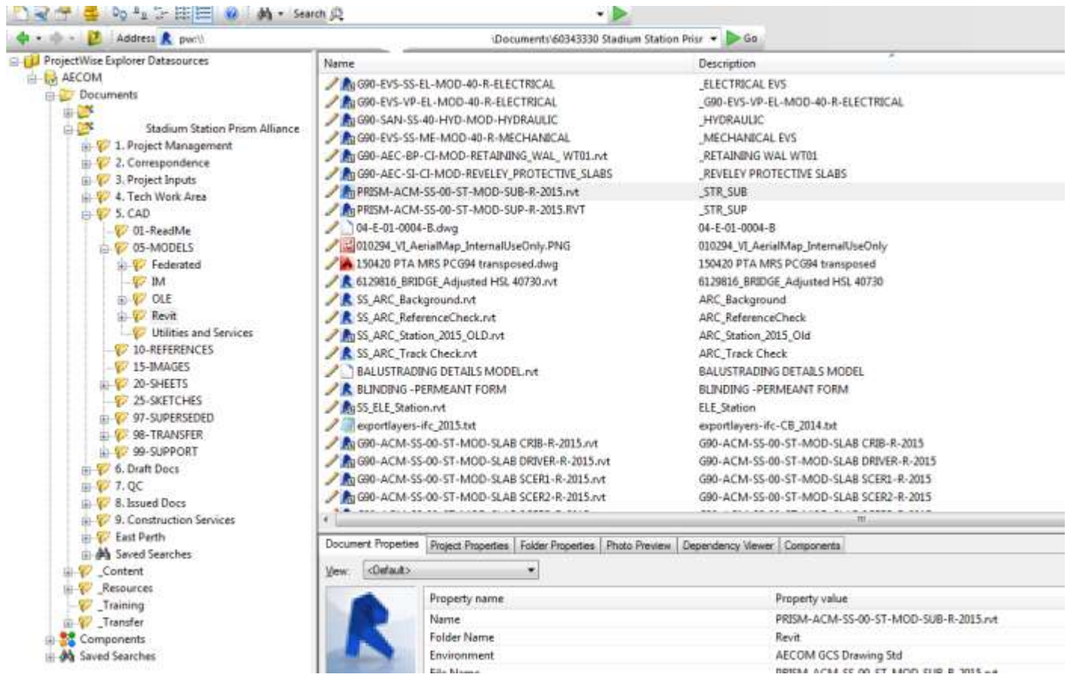
Common Data Environment – (CDE)

Common Data Environment



Common Data Environment - CDE

ProjectWise V8i



BENTLEY SYSTEMS, INC.

ProjectWise Application Integration for Revit

Frequently Asked Questions

Prepared by Bentley Professional Services
10/10/2012
Version 1.3

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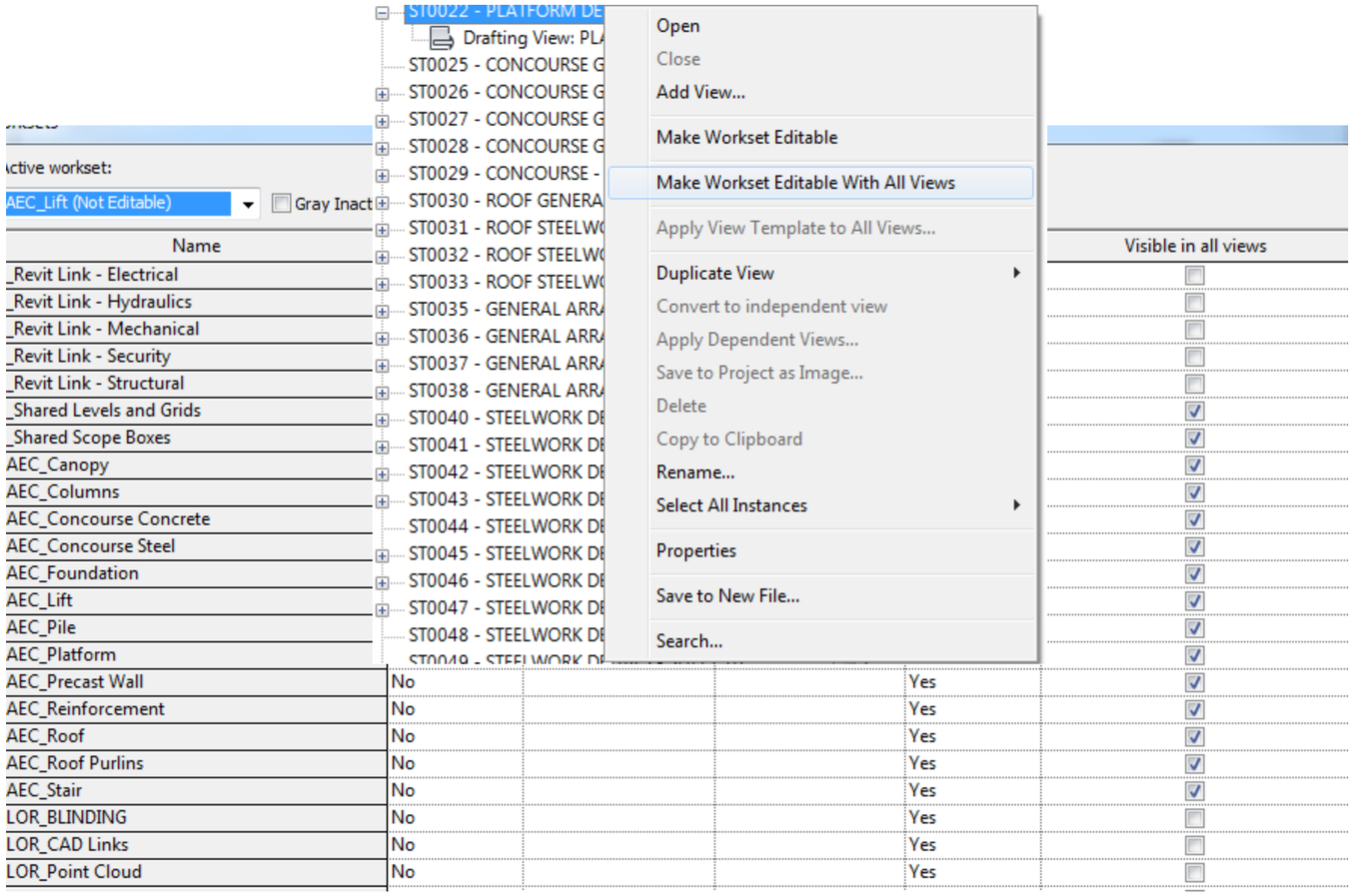
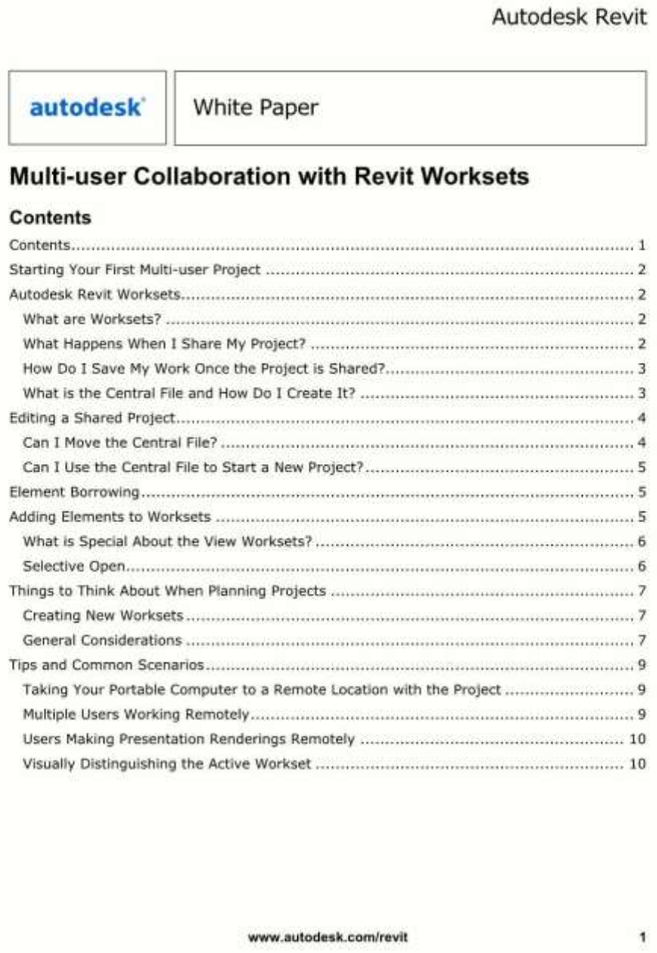
Common Data Environment - CDE





Autodesk Revit

autodesk | White Paper

Multi-user Collaboration with Revit Worksets

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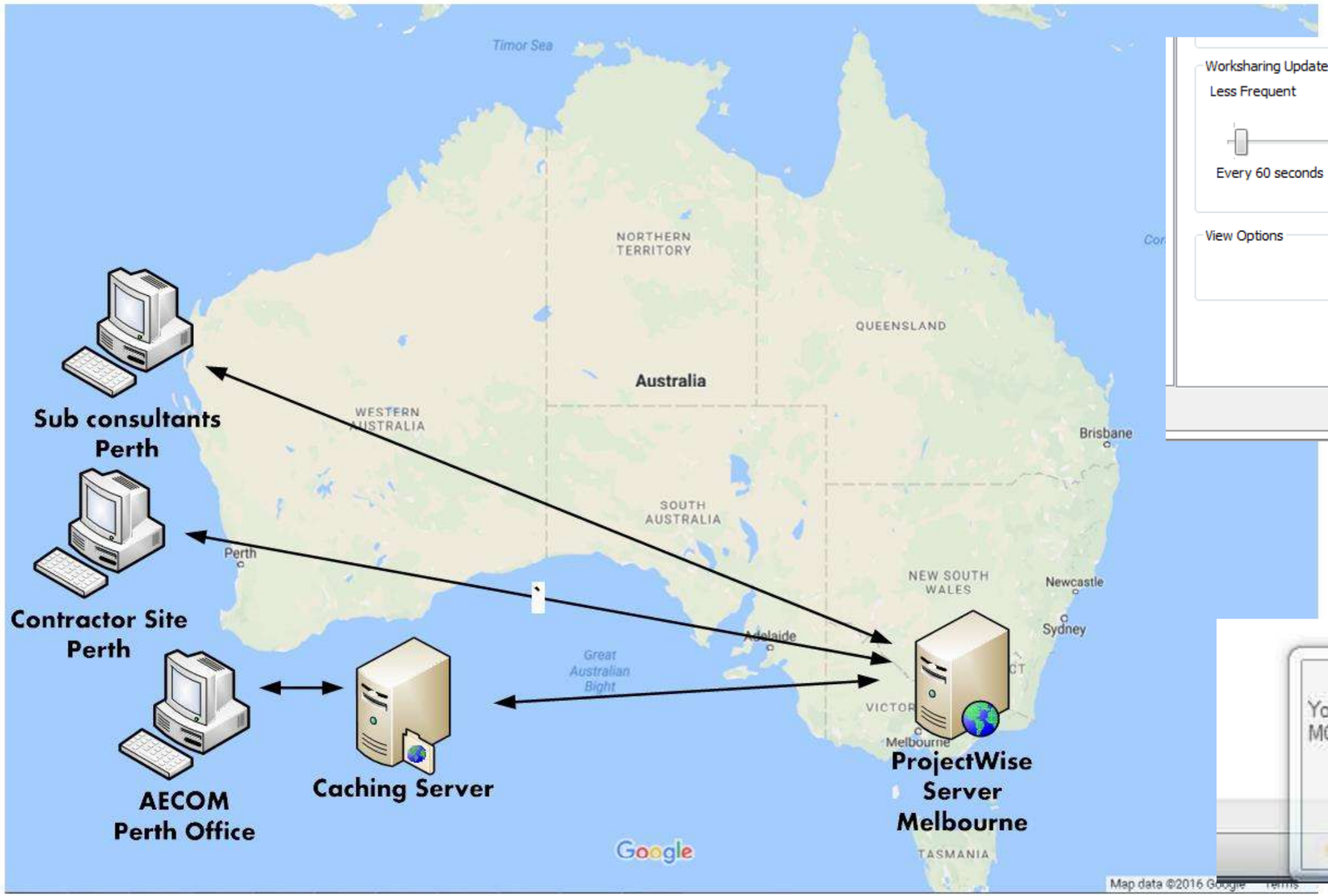
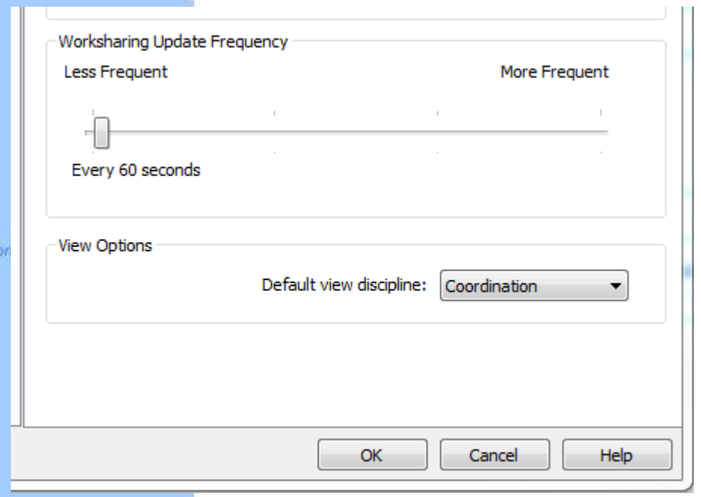
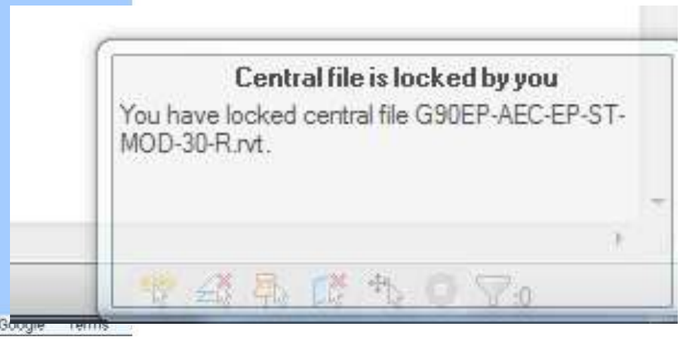
www.autodesk.com/revit 1

Common Data Environment





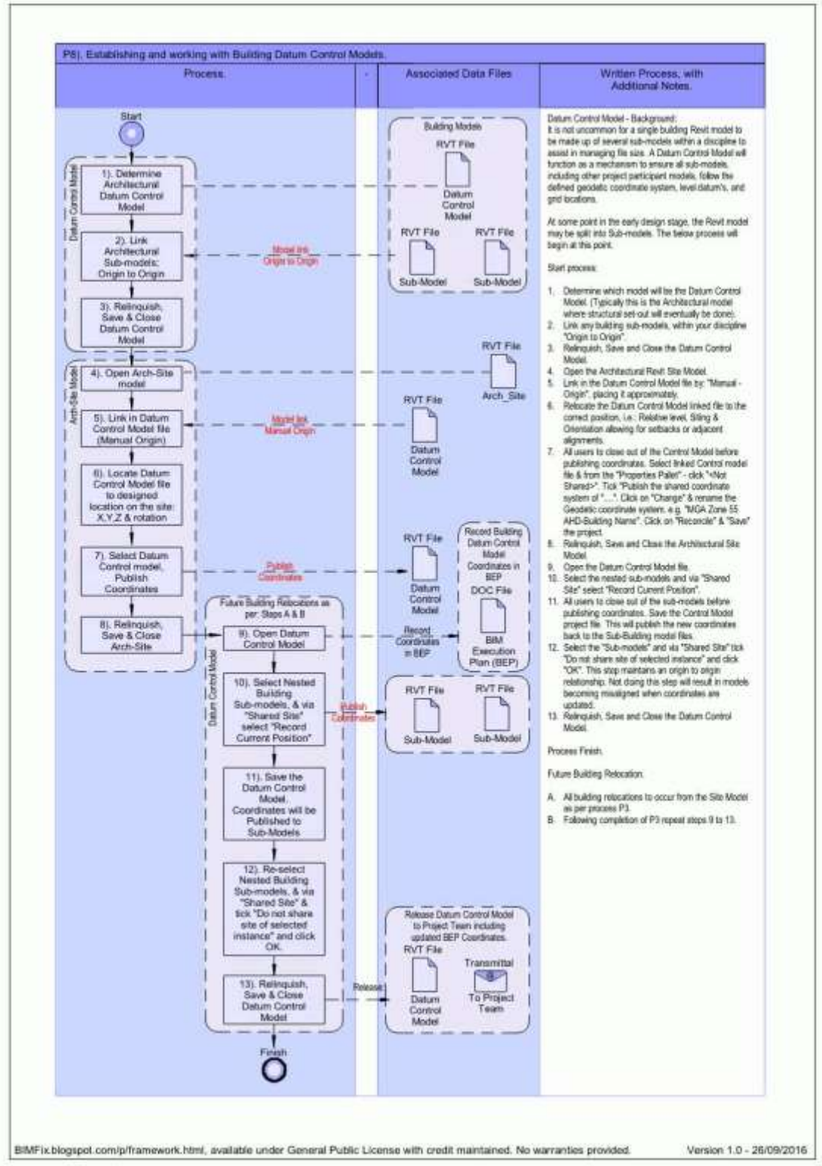


Shared coordinates

The Importance of setting up Shared Coordinates.

- Basic requirement of successful multi discipline spatial coordination.

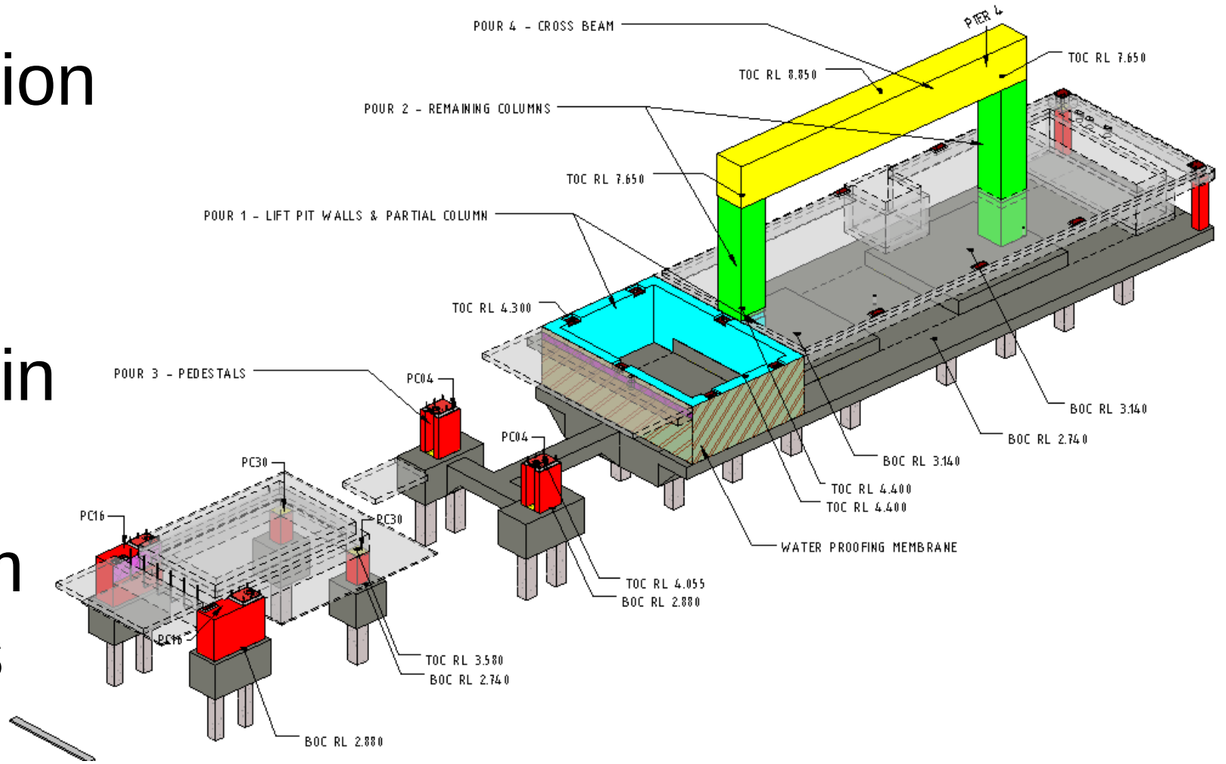
BIMFix Shard Coordinates is essential for setting up strong workflow for coordinates.
http://bimfix.blogspot.com.au/p/framework.html

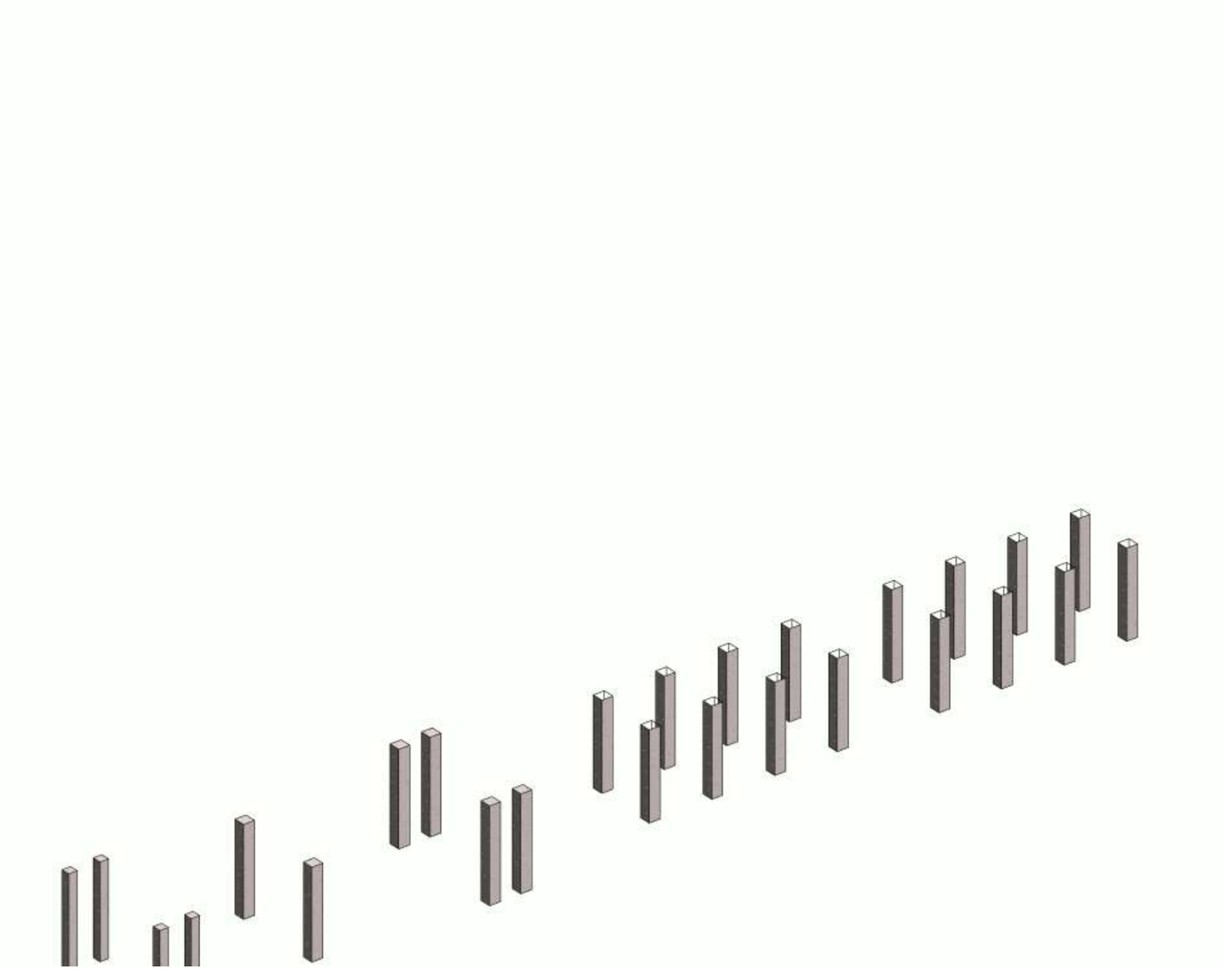


Complex Modelling for Construction

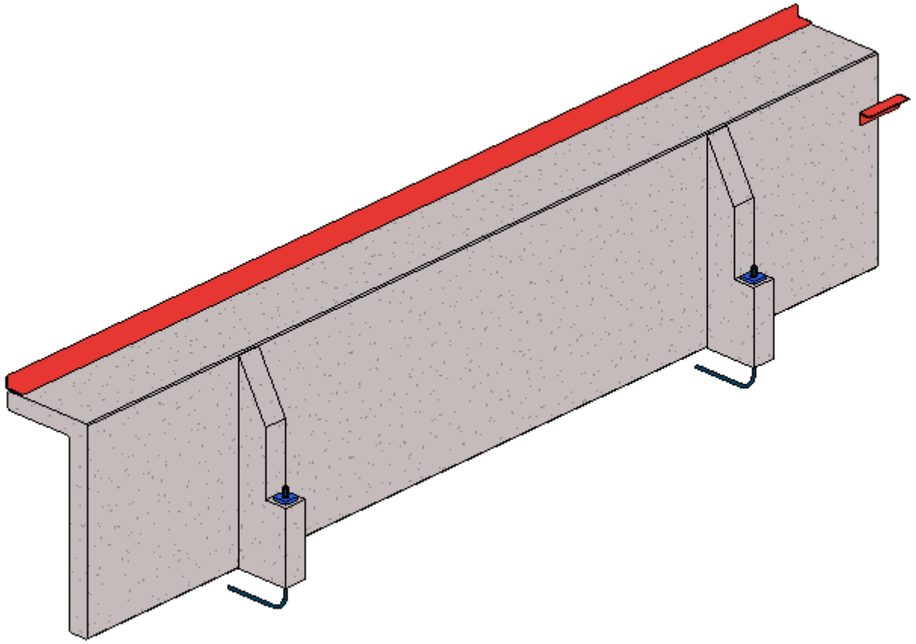
BIM Requirements

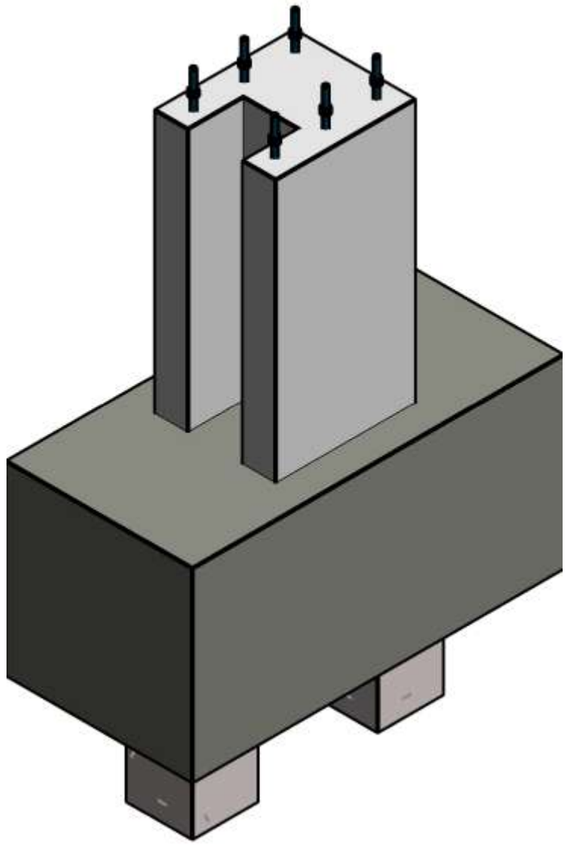
- Modelled as per construction methodology
- Formwork Area
- Set Out Location, all cast-in elements INSITU
- Data Input for downstream workflows and documents





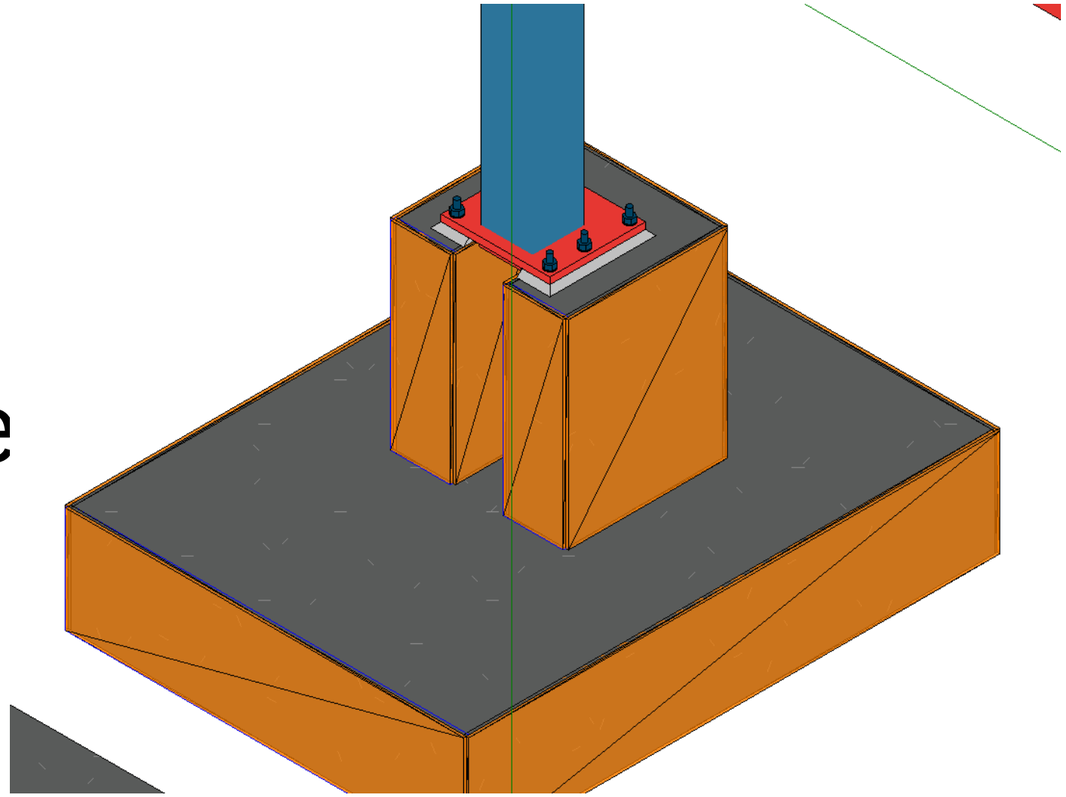
Complex Modelling for Construction





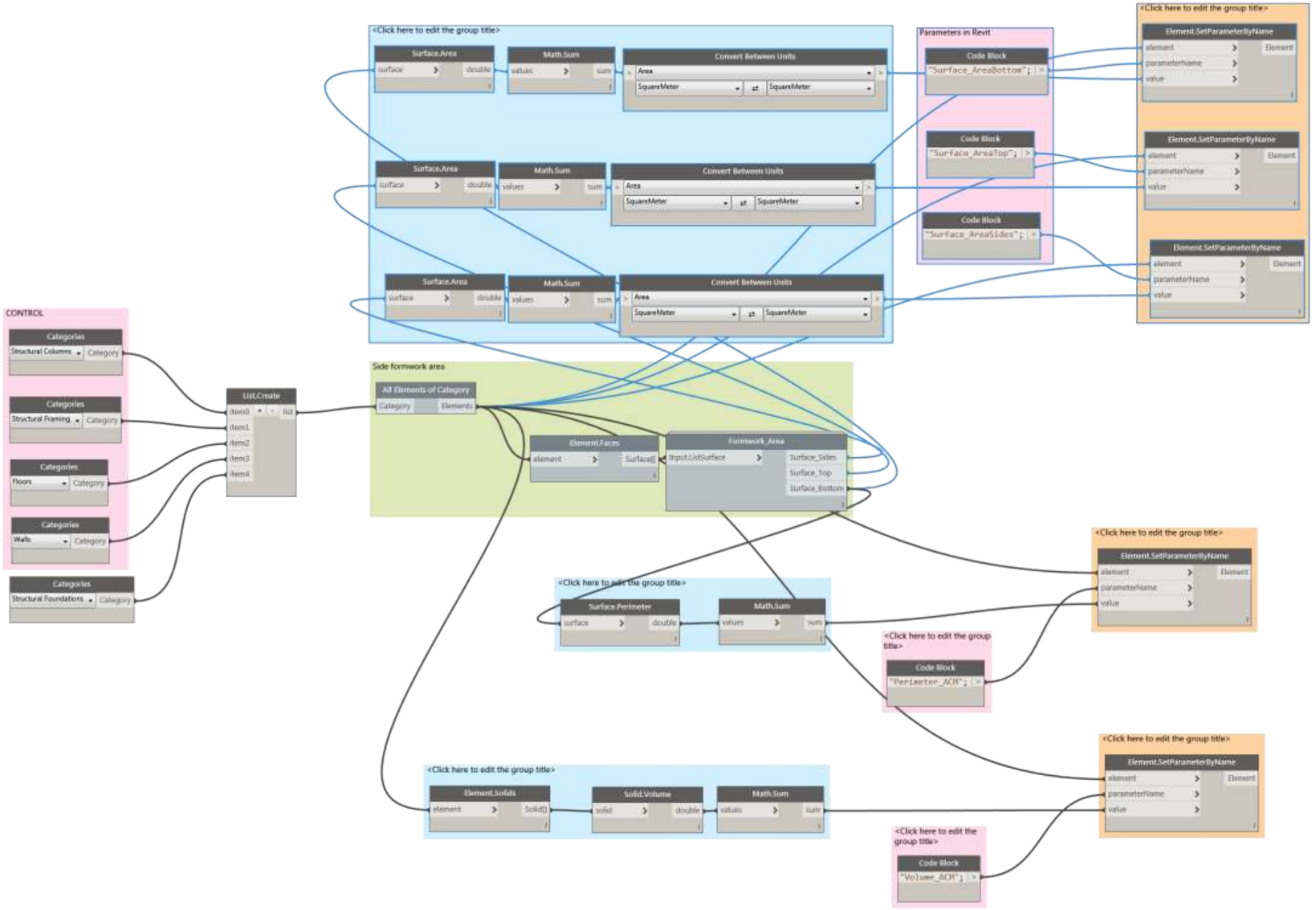
Formwork Areas

- Model requirement for concrete element's to have Form Work Areas
- Revit doesn't have a simple solution to calculate Form Area?



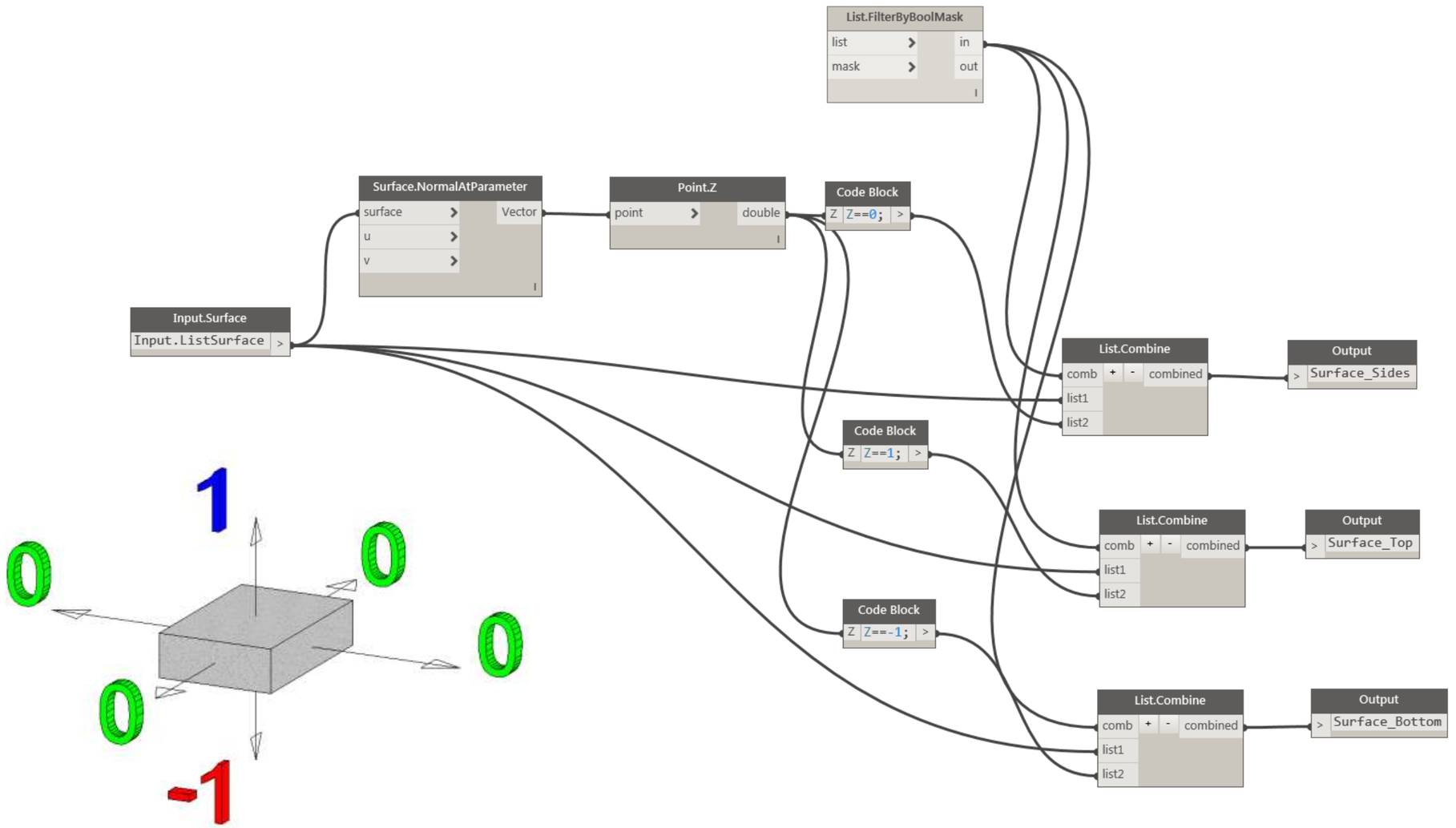
Formwork Areas

Dynamo



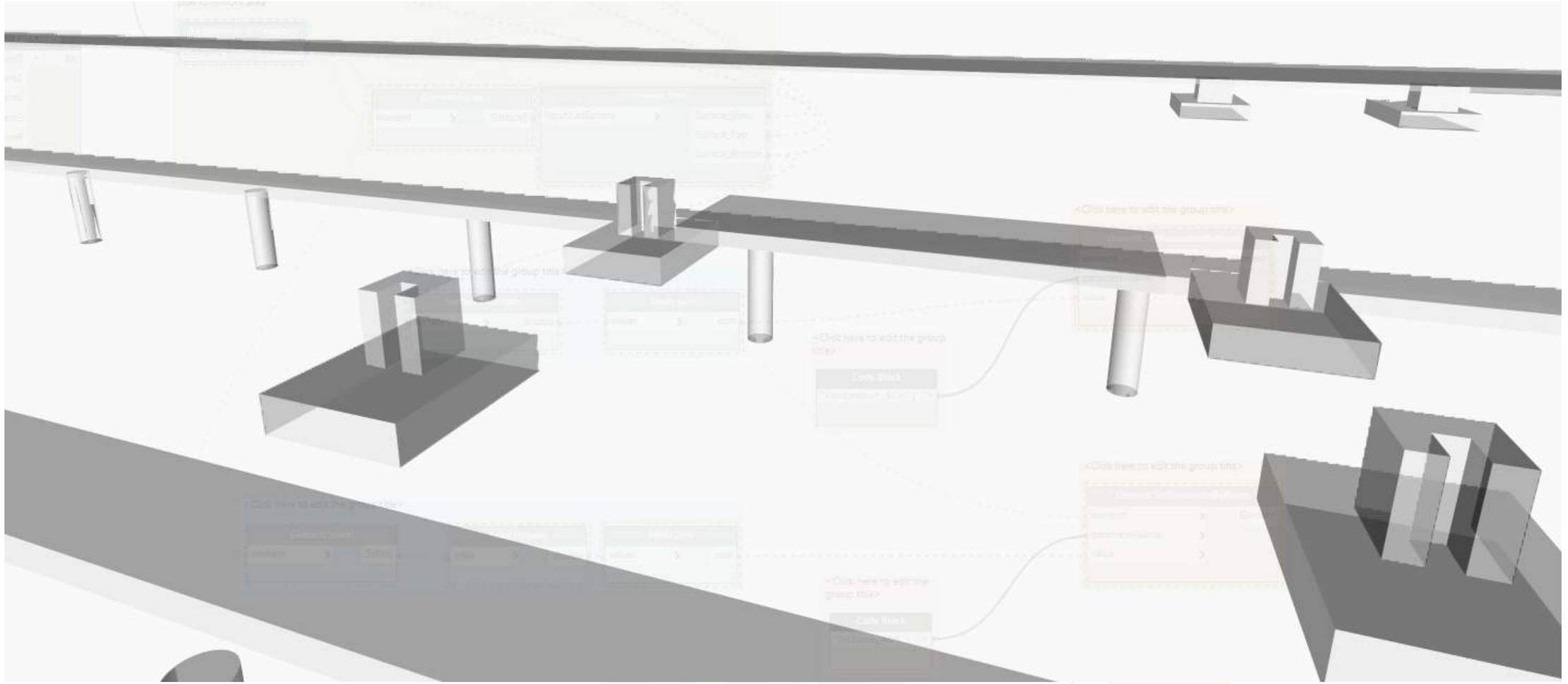
Formwork Area Node

Dynamo

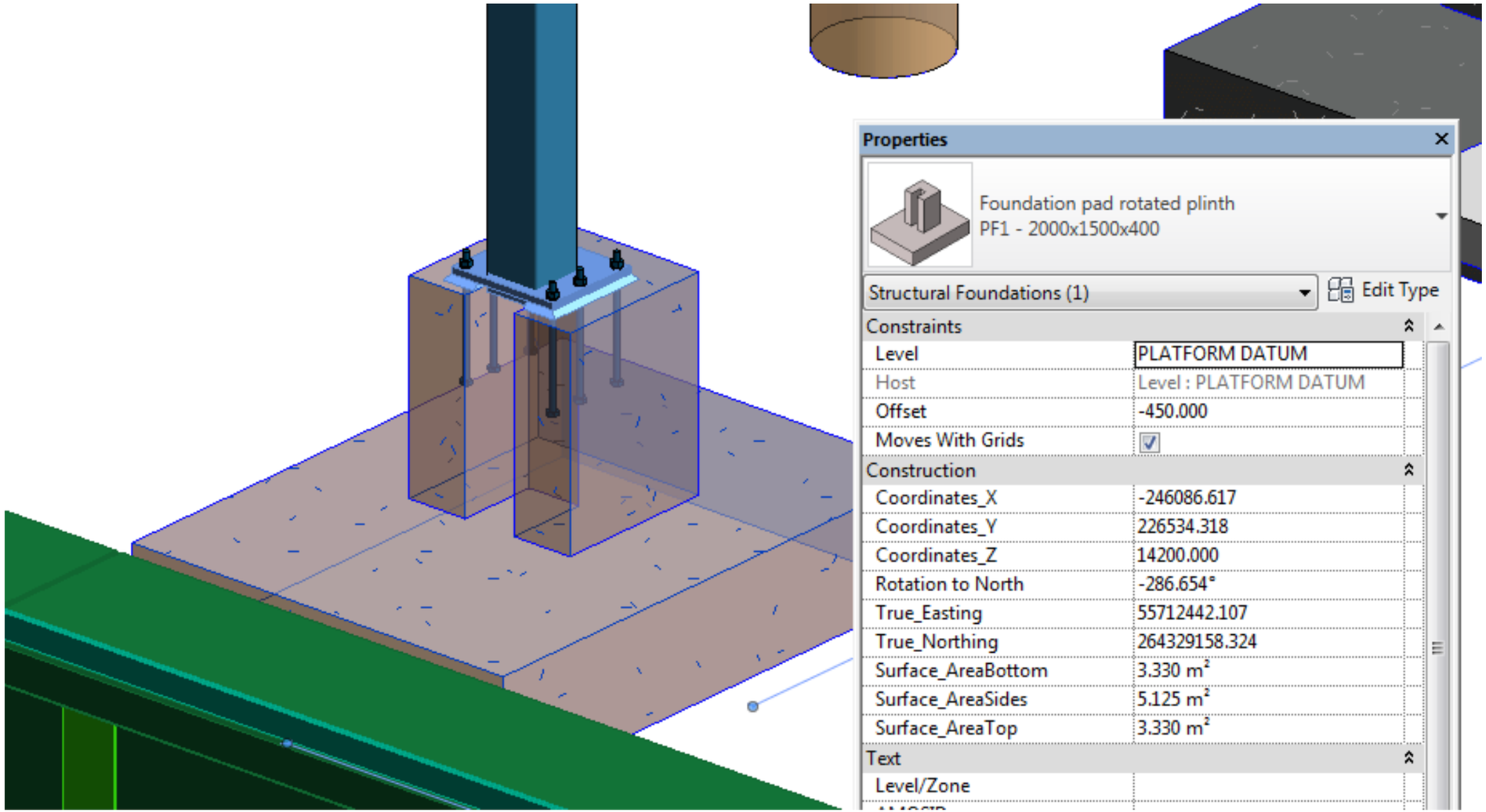


Formwork Areas - Surface

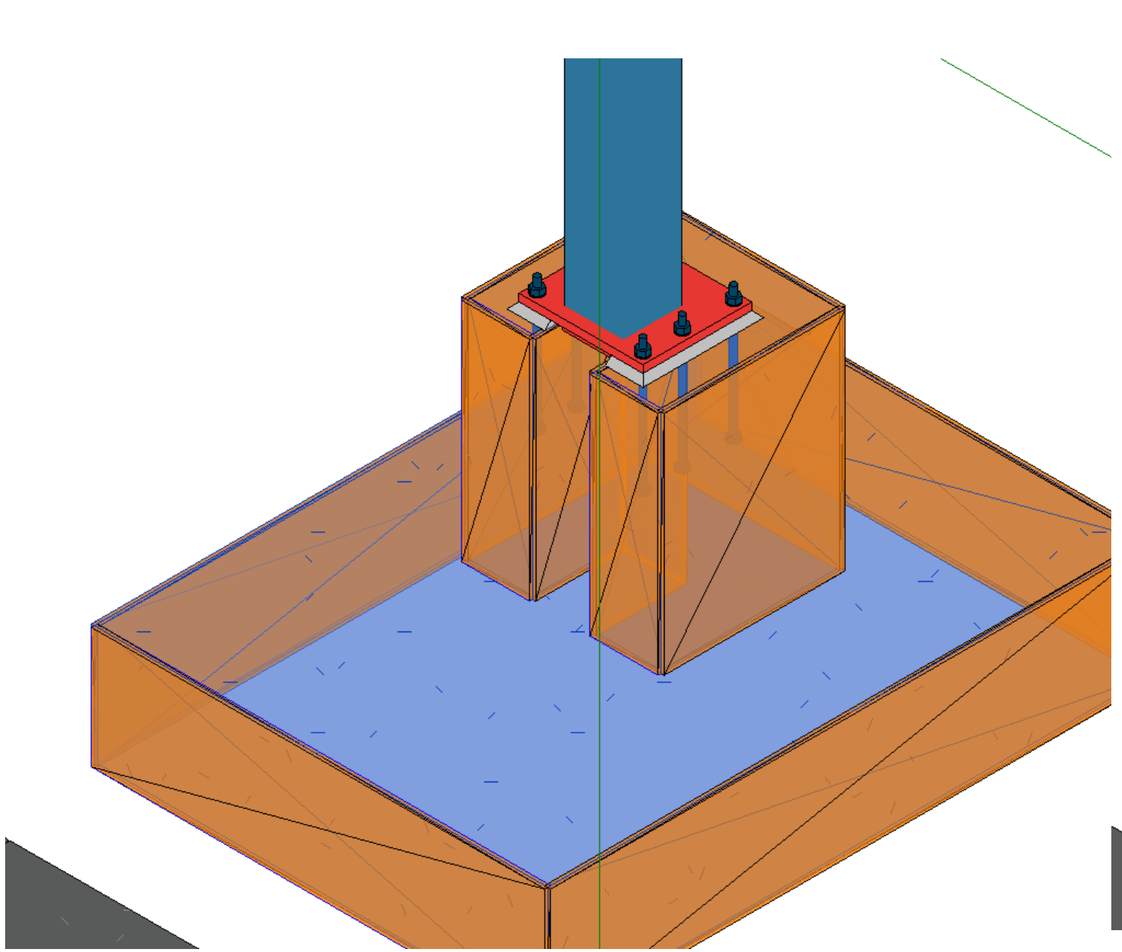
Dynamo

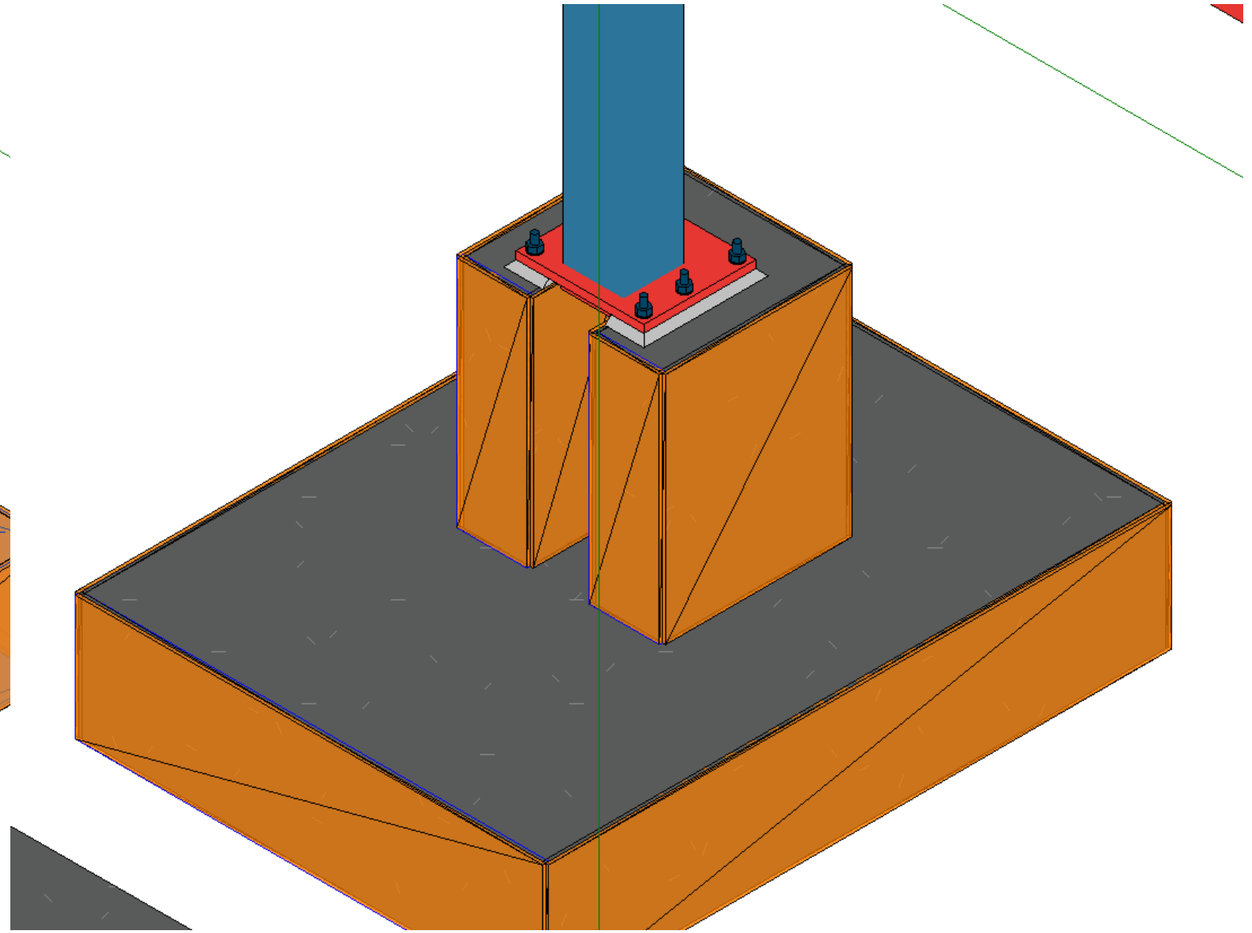


Formwork Areas



Formwork Areas





Set out Coordinates

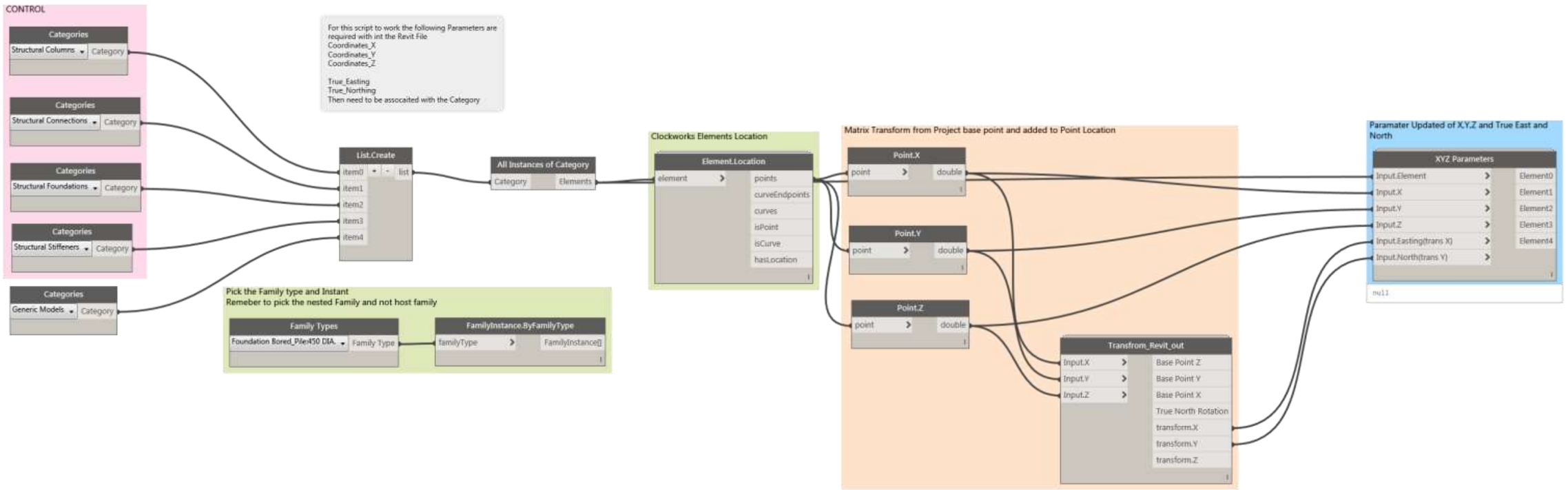
- Model requirement for Concrete Element's to have Set out coordinates and rotation.
- Revit doesn’t have automated solution for associating coordinates without customization in the Application Programming Interface (API).

<PILE SETOUT SCHEDULE>

B	C	D	E	F	G
PILE SIZE	EASTING	NORTHING	TOP OF PILE	PILE LENGTH	Rotation
0.45	55688.527 m	264257.809 m	12.310 m	1.8	73.
0.45	55741.236 m	264398.589 m	12.916 m	1.8	73.
0.45	55731.152 m	264401.610 m	12.916 m	1.8	73.
0.45	55739.514 m	264392.841 m	12.896 m	1.8	73.
0.45	55737.792 m	264387.094 m	12.876 m	1.8	73.
0.45	55736.070 m	264381.346 m	12.856 m	1.8	73.
0.45	55734.348 m	264375.598 m	12.836 m	1.8	73.
0.45	55732.627 m	264369.851 m	12.816 m	1.8	73.
0.45	55729.183 m	264358.356 m	12.775 m	1.8	73.
0.45	55727.461 m	264352.608 m	12.755 m	1.8	73.
0.45	55725.739 m	264346.860 m	12.735 m	1.8	73.
0.45	55724.017 m	264341.113 m	12.715 m	1.8	73.
0.45	55722.296 m	264335.365 m	12.695 m	1.8	73.
0.45	55720.574 m	264329.618 m	12.674 m	1.8	73.
0.45	55718.852 m	264323.870 m	12.654 m	1.8	73.
0.45	55717.130 m	264318.122 m	12.634 m	1.8	73.
0.45	55715.408 m	264312.375 m	12.614 m	1.8	73.
0.45	55713.687 m	264306.627 m	12.594 m	1.8	73.
0.45	55711.965 m	264300.880 m	12.574 m	1.8	73.
0.45	55710.243 m	264295.132 m	12.554 m	1.8	73.
0.45	55708.521 m	264289.384 m	12.533 m	1.8	73.
0.45	55706.799 m	264283.637 m	12.513 m	1.8	73.
0.45	55705.077 m	264277.889 m	12.492 m	1.8	73.
0.45	55703.356 m	264272.142 m	12.463 m	1.8	73.
0.45	55701.634 m	264266.394 m	12.424 m	1.8	73.

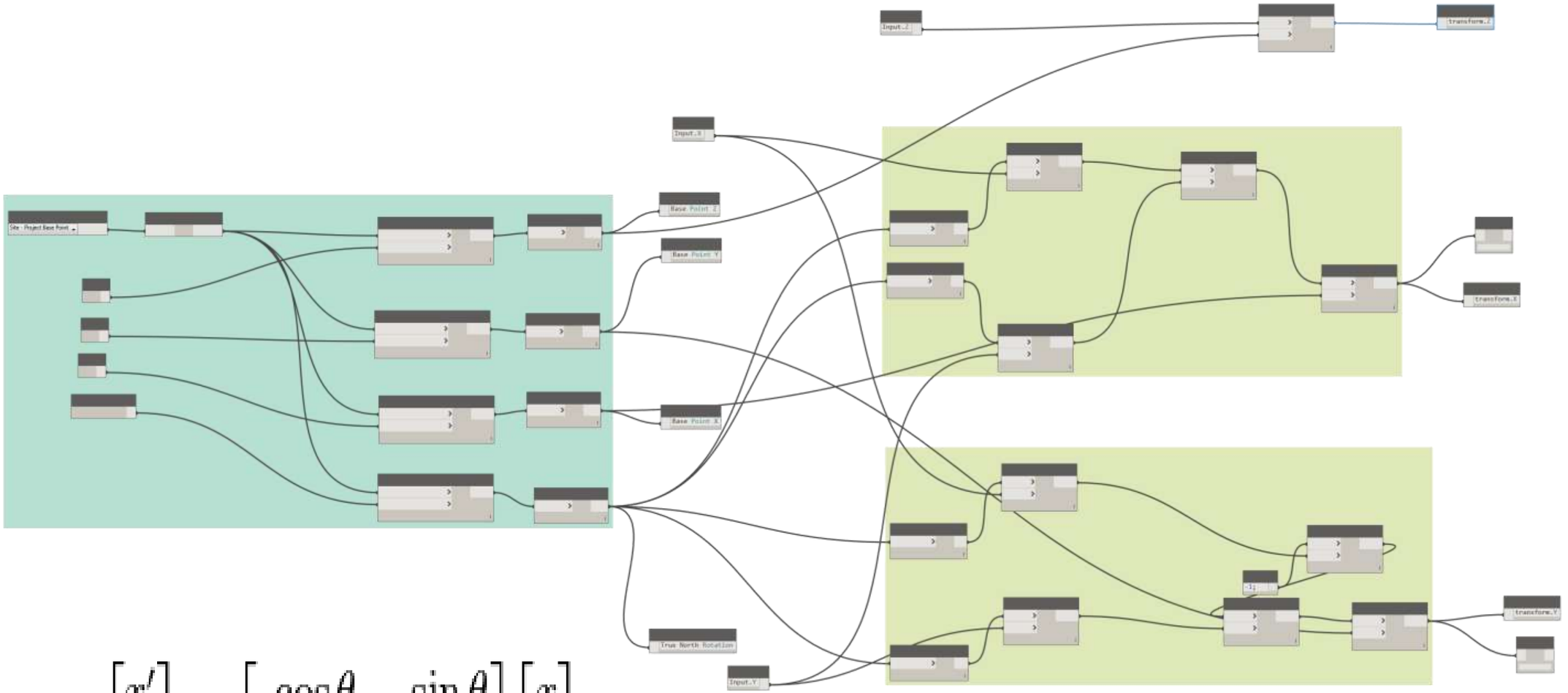
Set out Coordinates

Dynamo



Transform Matrix - Dynamo

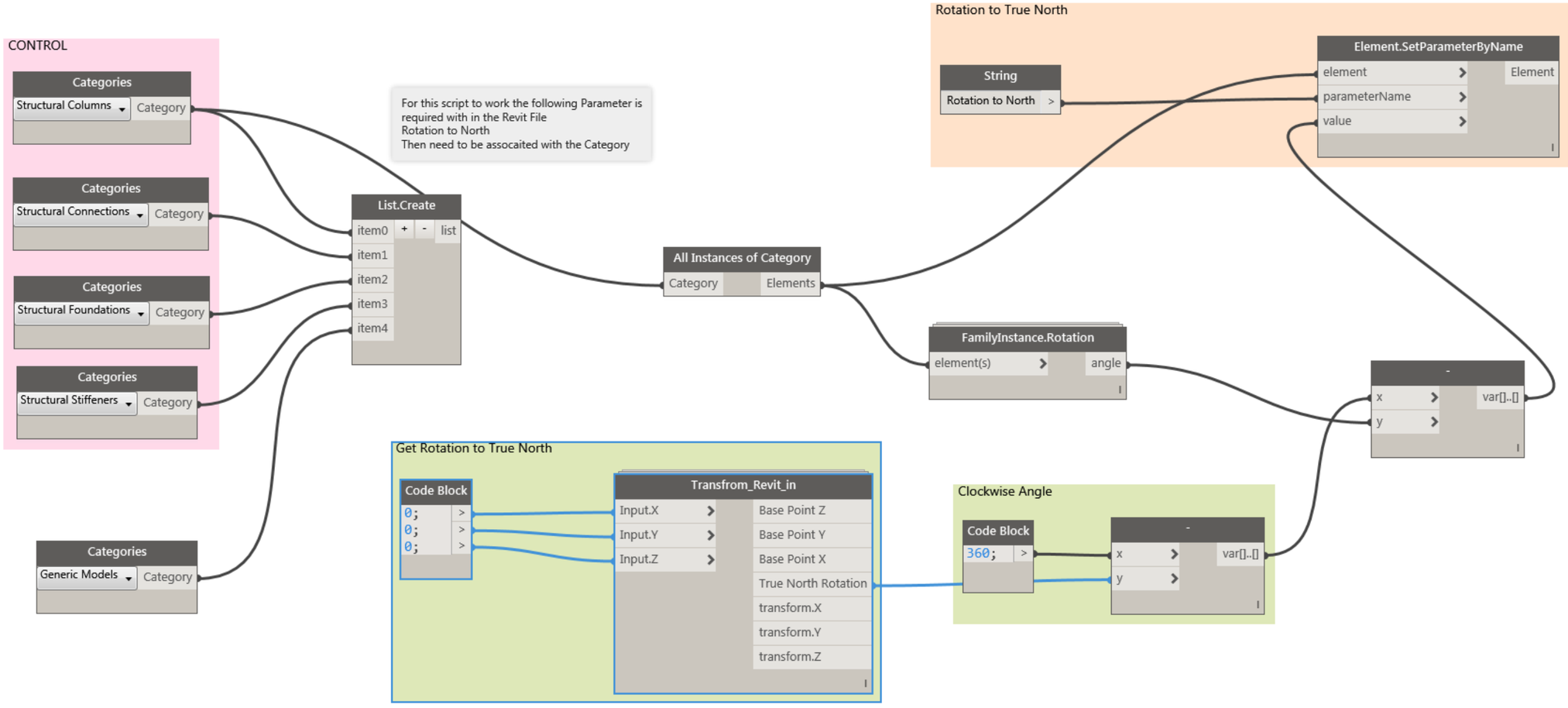
Dynamo



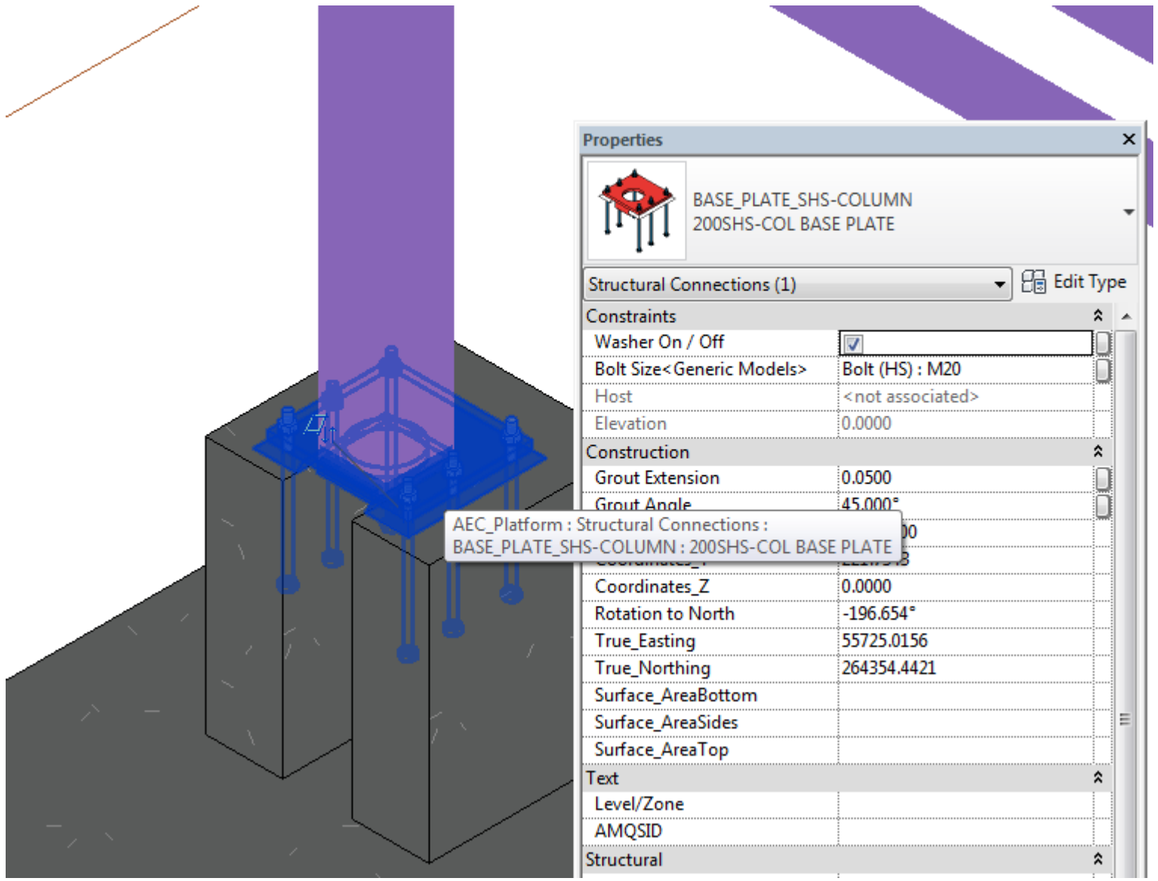
$$\begin{bmatrix} x' \\ y' \end{bmatrix} = \begin{bmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix}$$

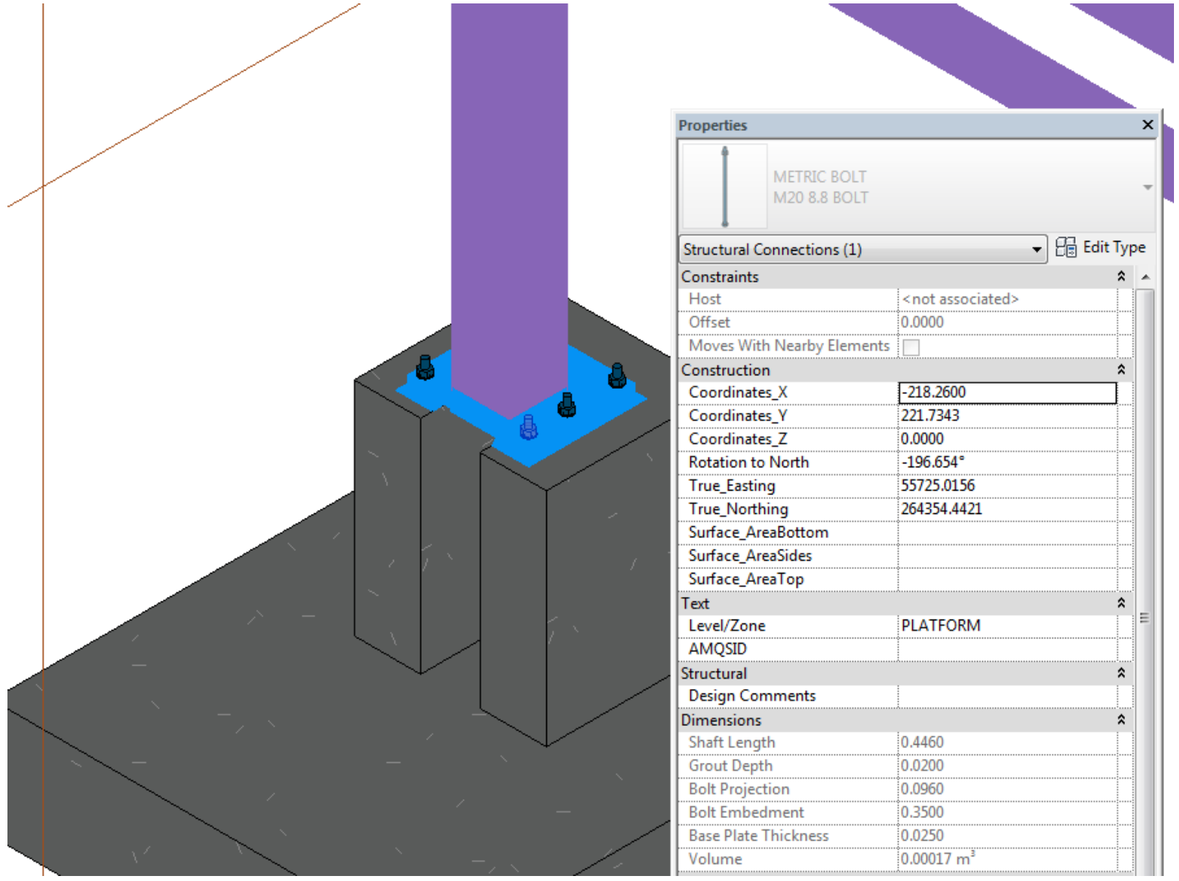
Element Rotation to True North

Dynamo

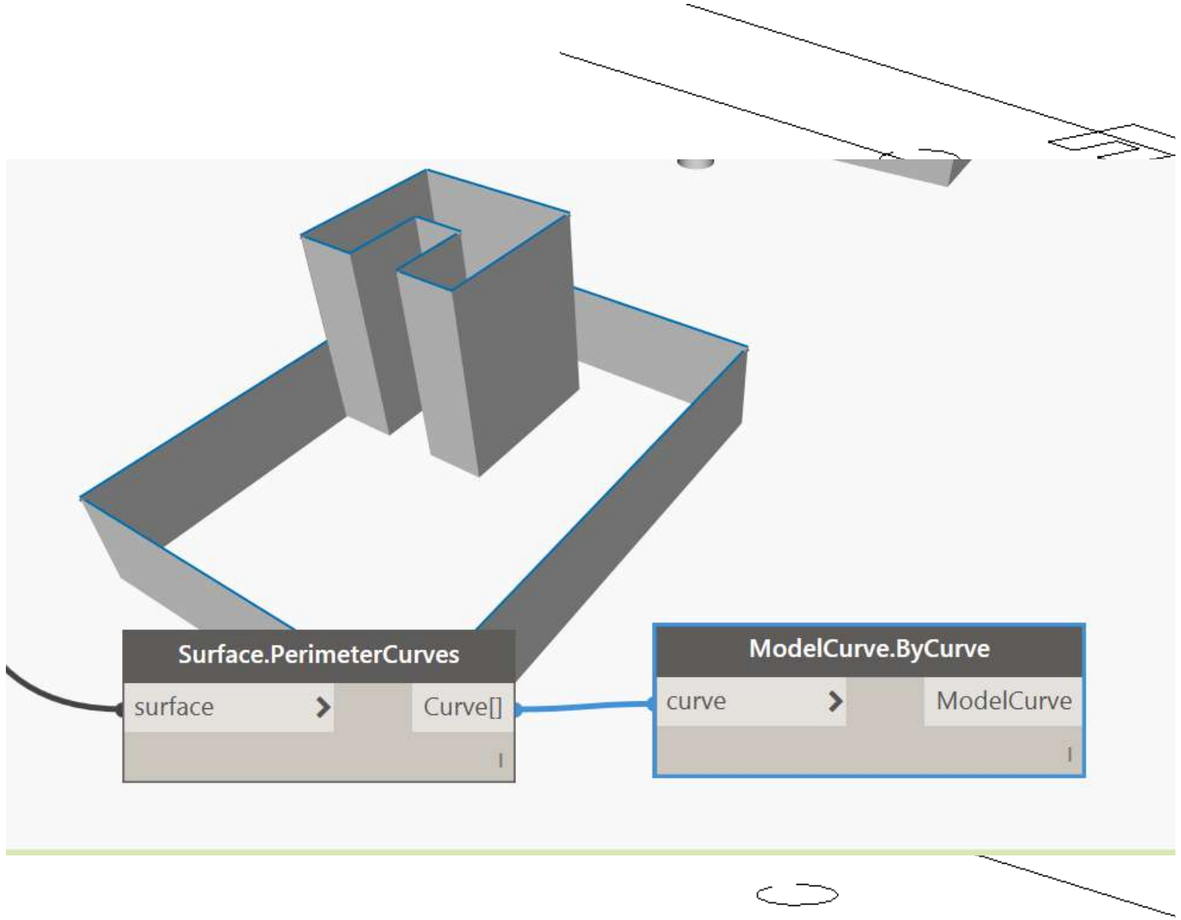


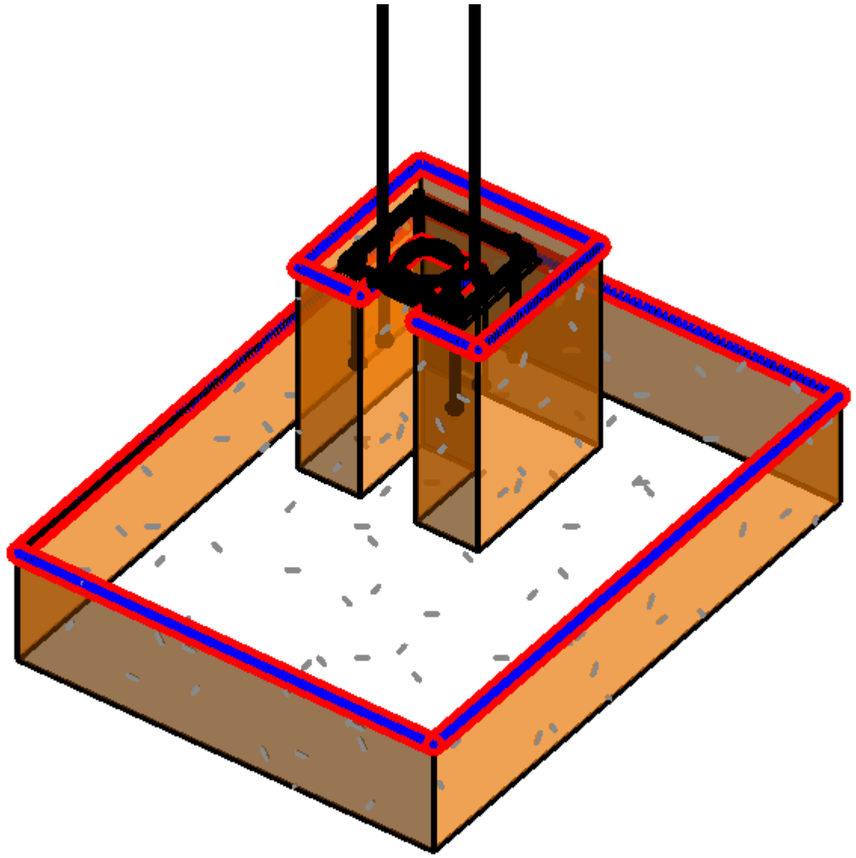
Set out Coordinates



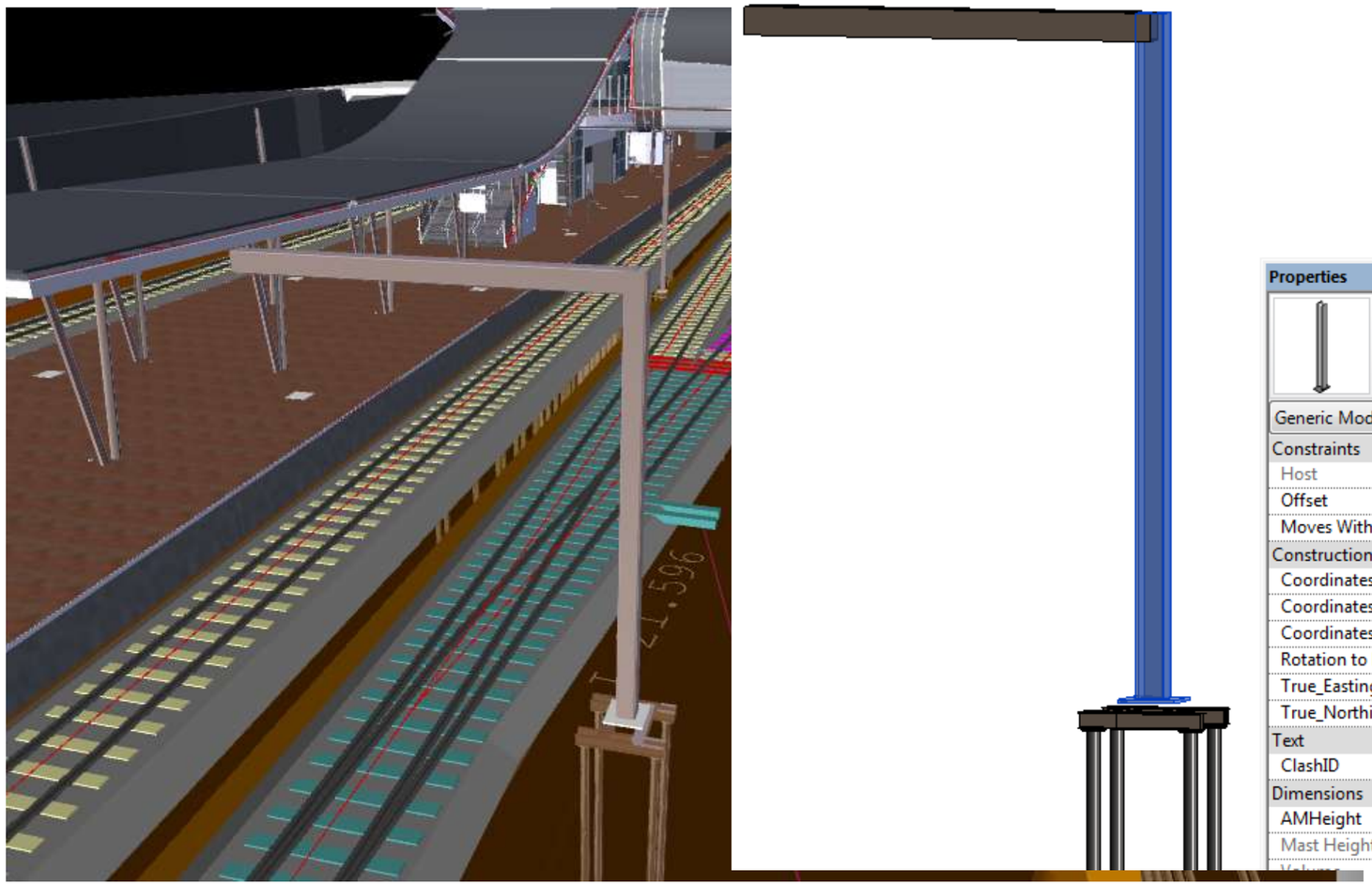


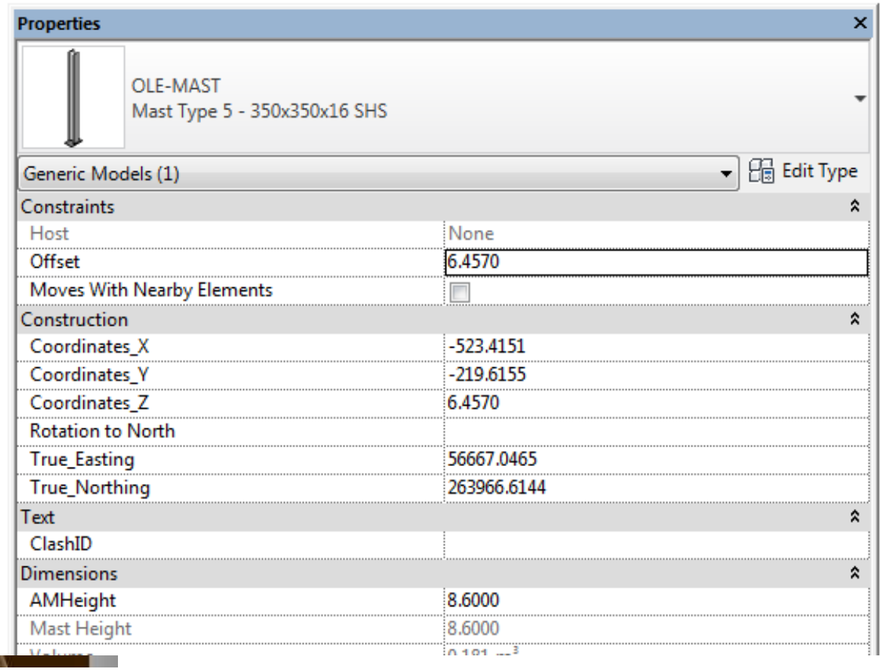
Set out Coordinates – 3d Line work





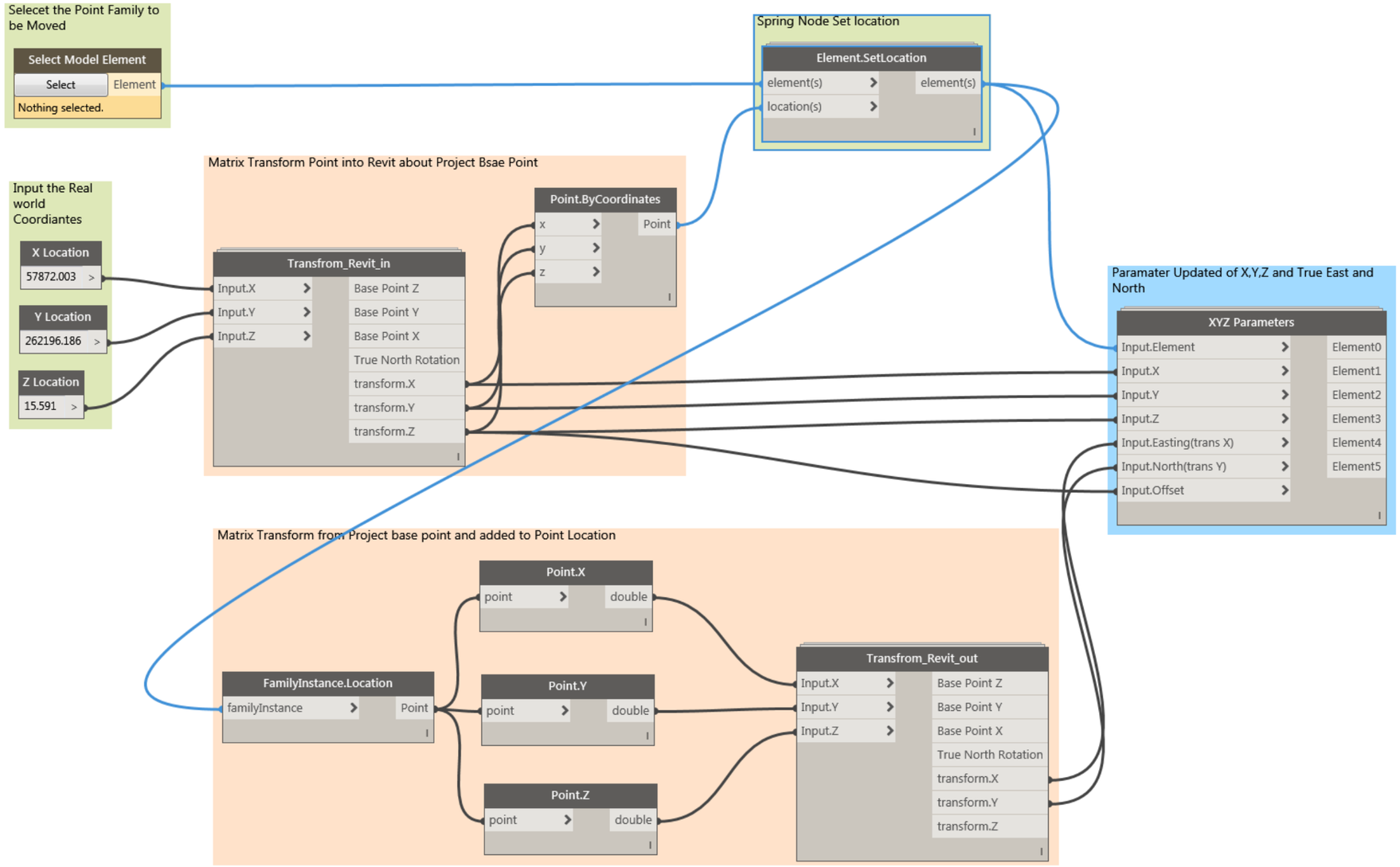
Move by Coordinates





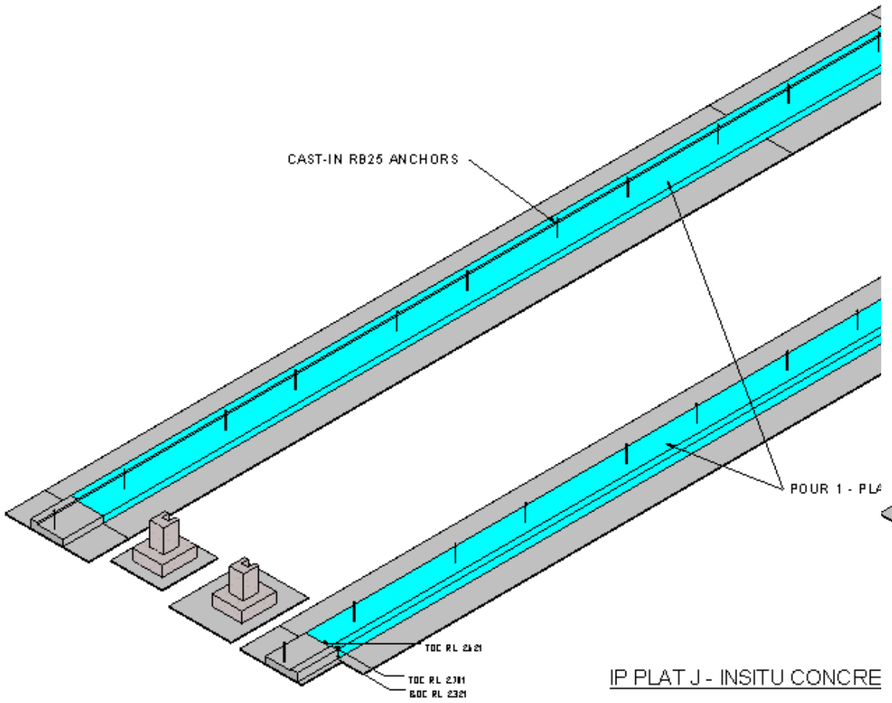
Move by Coordinates

Dynamo

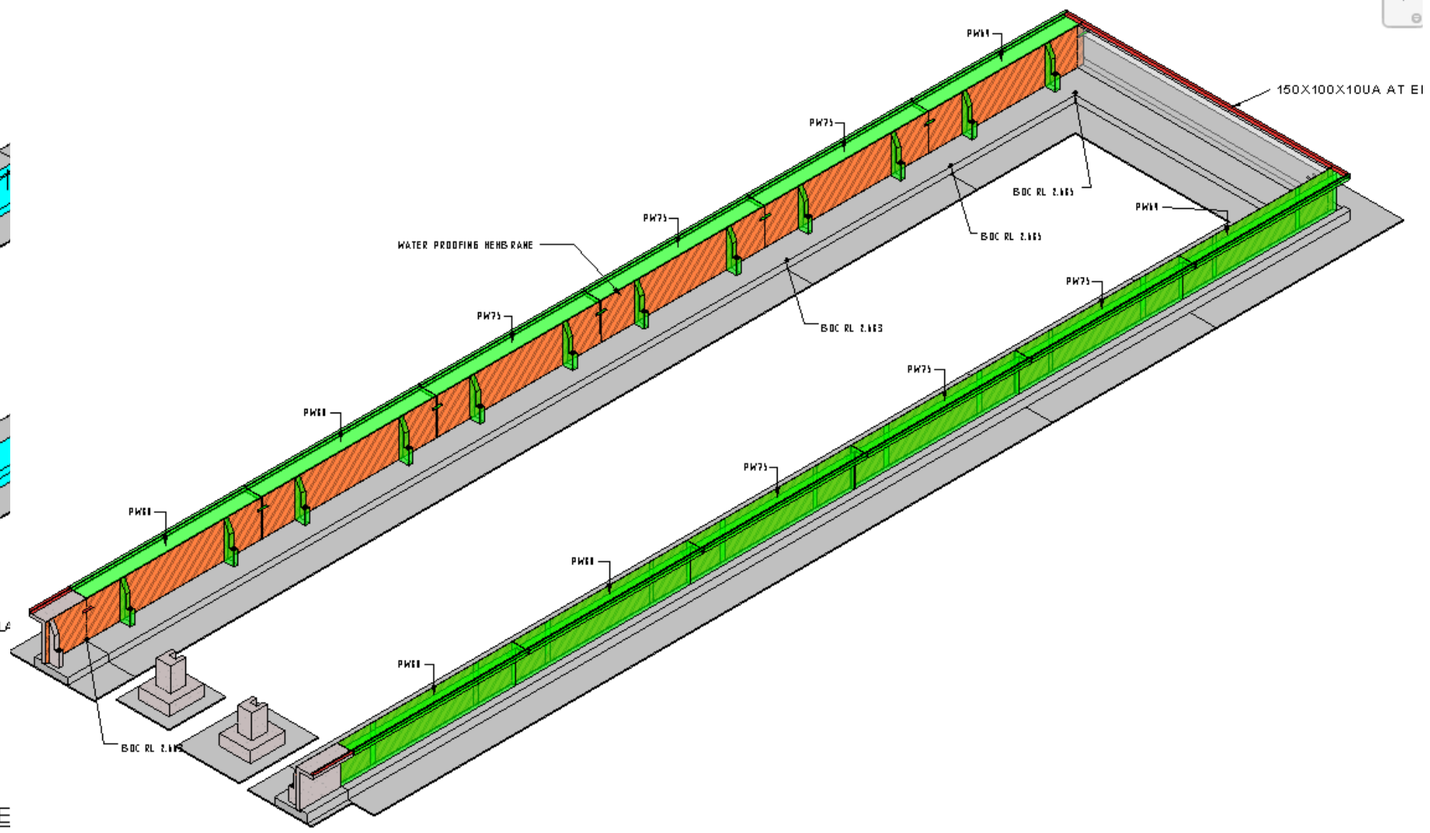


1.2km of Precast Platform wall

1.2km of Precast Platform wall



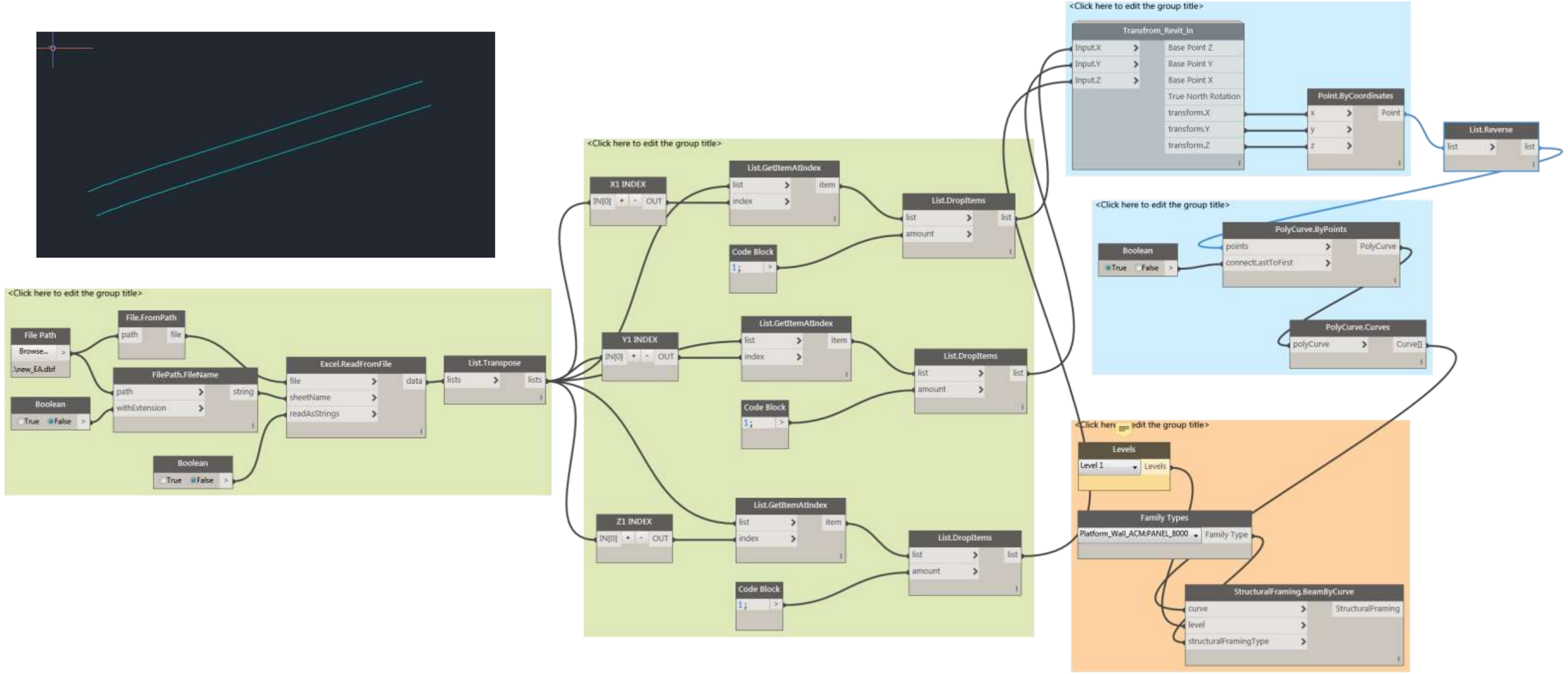
IP PLAT J - INSITU CONCRE



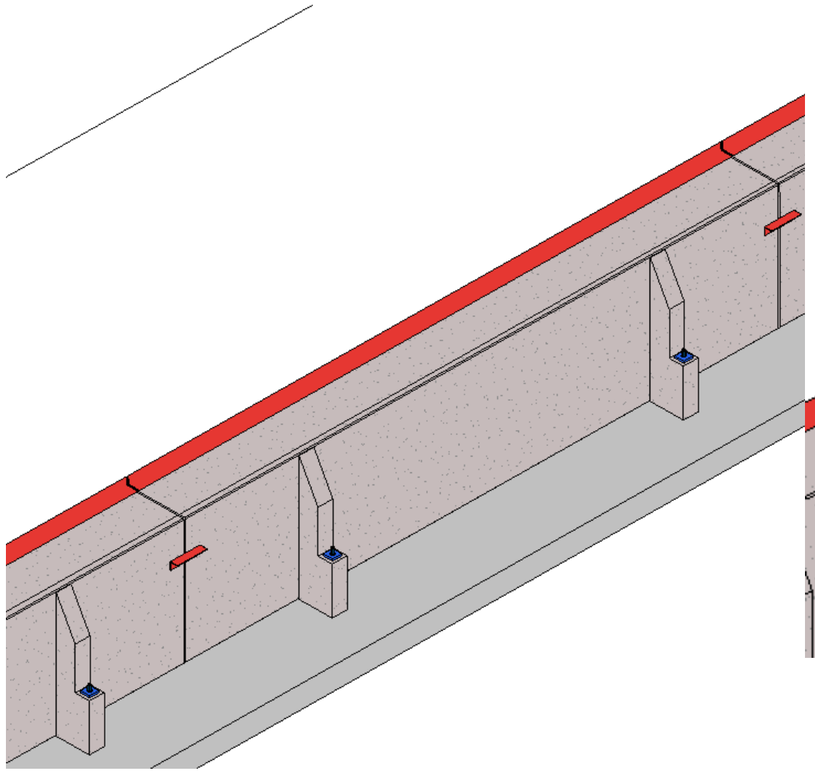
IP PLAT J - PRECAST CONCRETE LAYOUT

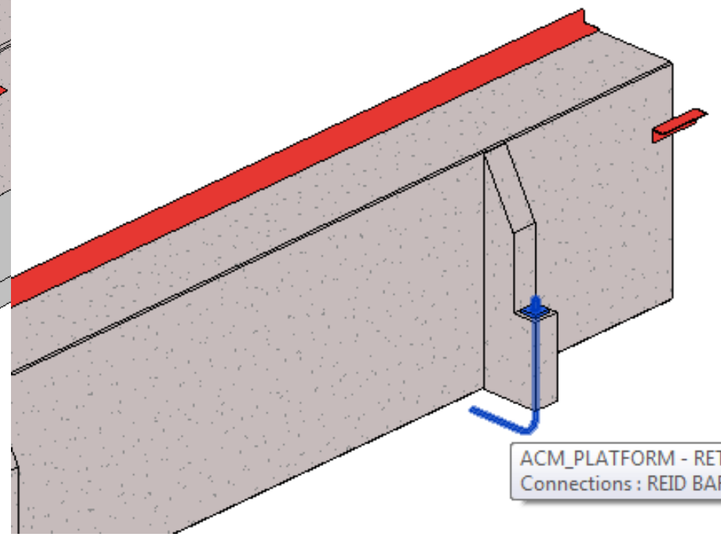
Lay outing out 1.2km of wall

Dynamo



1.2km of Precast Platform wall

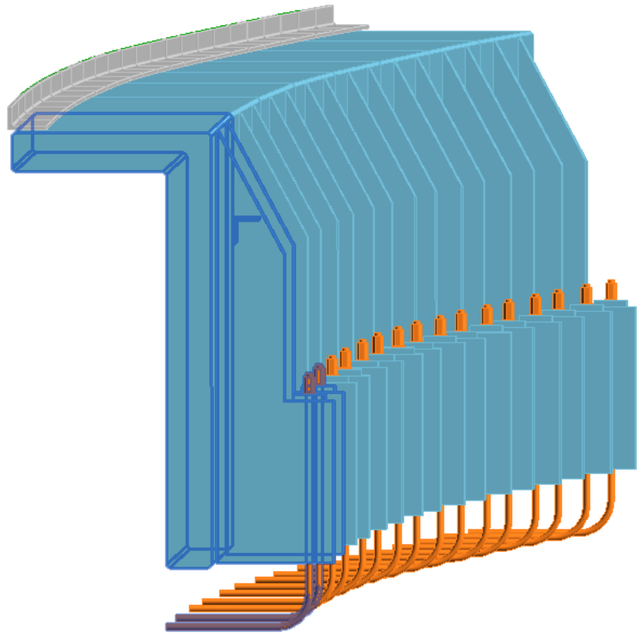




Offset	720.184
Moves With Nearby Elements	
Construction	
AMLevel/Zone	
Procurement Pack No	
Status	
Workpack Id	IP PLAT M
Pour Sequence	
Part-Filter	☑
Progress Account ID	54C2-FRP-05
Dimensions	
Shaft Length	991.500
Grout Depth	0.000
Bolt Embedment	885.000
Volume	0.001 m³
Coordinates_X	193000.480
Coordinates_Y	-5310.783
Coordinates_Z	3461.136
True_Easting	57309733.079
True_Northing	263584342.469
Comments	

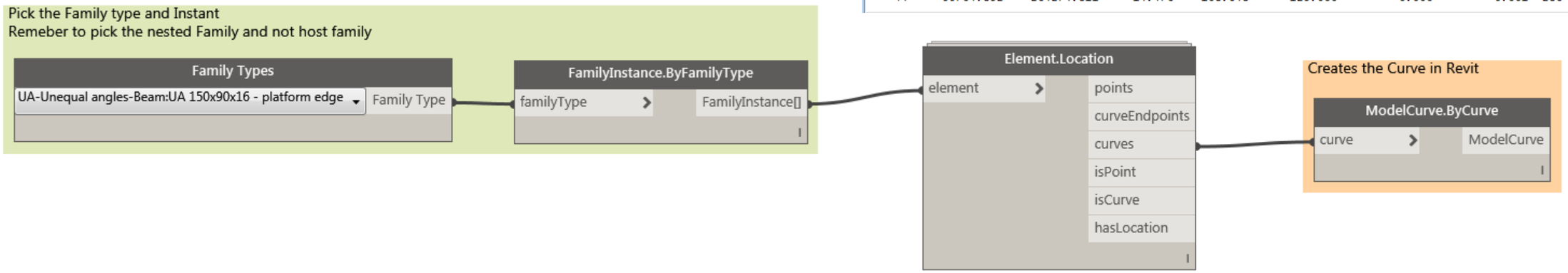
1.2km of Precast Platform wall

Model vs Design Rail

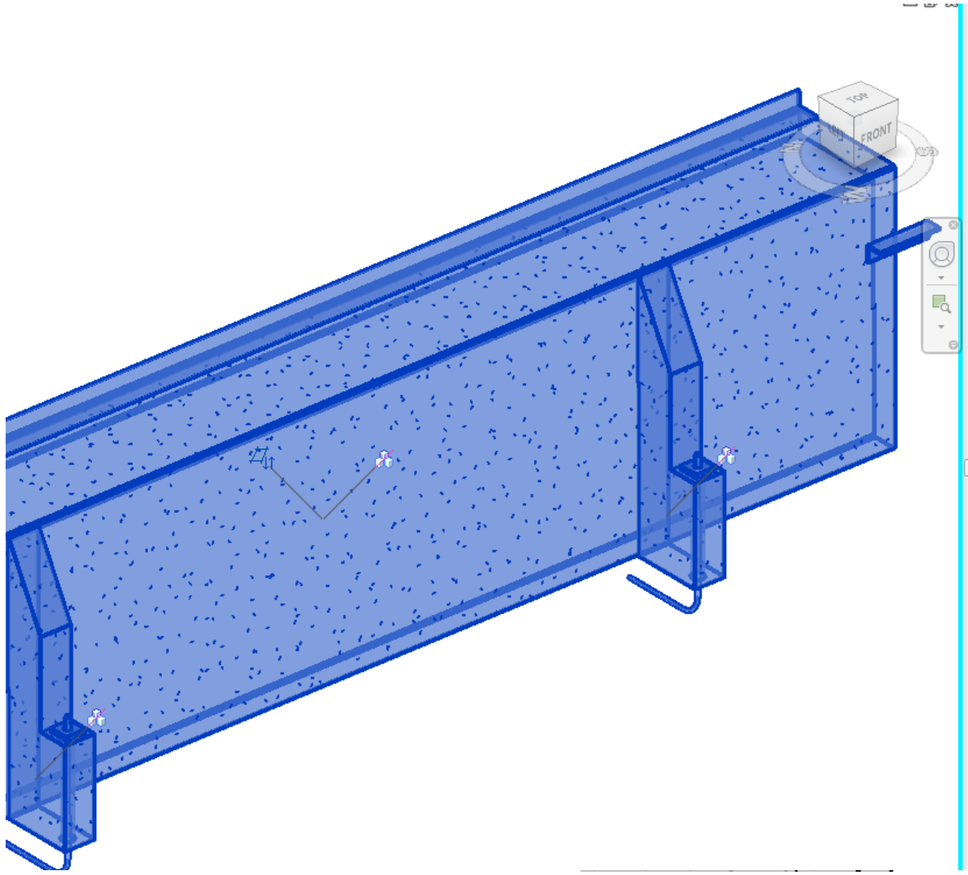


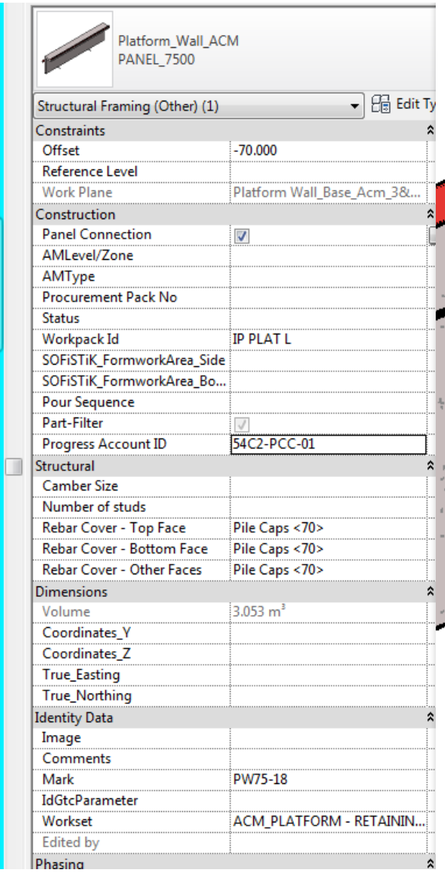
```
Reference string: UP
1st       string: UP
2nd       string: control mcplup00600 up main platform edge
Please Note: Crossfall is negative if 2nd string is below 1st string.
             Vertical offset is negative if 2nd string is below 1st string.
             Horizontal offset is negative if 2nd string is to the left of 1st string.
```

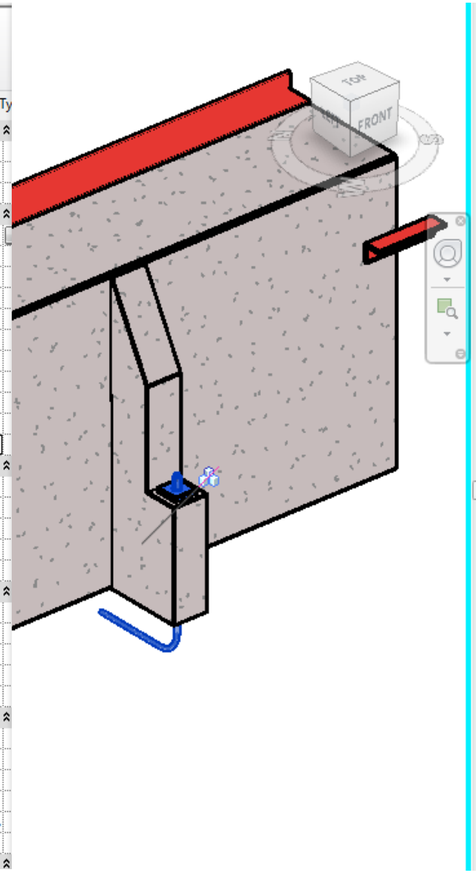
Point	Secondary Easting	Secondary Northing	String Elevation	String Chainage	Reference Chainage	Horizontal Offset	Vertical Offset	Bearing	CrossFall
1	55741.911	264398.385	14.911	20.352	0.000	0.000	0.000	286°40'36"	0.000
2	55741.050	264395.511	14.901	17.352	3.000	0.000	-0.000	286°40'36"	0.000
3	55740.189	264392.637	14.891	14.352	6.000	0.000	-0.000	286°40'36"	0.000
4	55739.328	264389.764	14.881	11.352	9.000	0.000	-0.000	286°40'36"	0.000
5	55738.467	264386.890	14.871	8.352	12.000	0.000	-0.000	286°40'36"	0.000
6	55737.606	264384.016	14.861	5.352	15.000	0.000	-0.000	286°40'36"	0.000
7	55736.746	264381.142	14.851	2.352	18.000	0.000	-0.000	286°40'36"	0.000
8	55735.885	264378.268	14.841	-0.648	21.000	-0.000	-0.000	286°40'36"	0.000
9	55735.024	264375.395	14.831	-3.648	24.000	0.000	-0.000	286°40'36"	0.000
10	55734.163	264372.521	14.821	-6.648	27.000	0.000	-0.000	286°40'36"	0.000
11	55733.302	264369.647	14.810	-9.648	30.000	0.000	-0.000	286°40'36"	0.000
12	55732.441	264366.773	14.800	-12.648	33.000	0.000	-0.000	286°40'36"	0.000
13	55731.580	264363.899	14.790	-15.648	36.000	0.000	-0.000	286°40'36"	0.000
14	55730.719	264361.025	14.780	-18.648	39.000	0.000	-0.000	286°40'36"	0.000
15	55729.858	264358.152	14.770	-21.648	42.000	0.000	-0.000	286°40'36"	0.000
16	55728.997	264355.278	14.760	-24.648	45.000	0.000	-0.000	286°40'36"	0.000
17	55728.136	264352.404	14.750	-27.648	48.000	0.000	-0.000	286°40'36"	0.000
18	55727.276	264349.530	14.740	-30.648	51.000	0.000	-0.000	286°40'36"	0.000
19	55726.415	264346.656	14.730	-33.648	54.000	0.000	-0.000	286°40'36"	0.000
20	55725.554	264343.783	14.720	-36.648	57.000	-0.000	-0.000	286°40'36"	0.000
21	55724.693	264340.909	14.710	-39.648	60.000	-0.000	-0.000	286°40'36"	0.000
22	55723.832	264338.035	14.700	-42.648	63.000	0.000	-0.000	286°40'36"	0.000
23	55722.971	264335.161	14.690	-45.648	66.000	0.000	-0.000	286°40'36"	0.000
24	55722.110	264332.287	14.680	-48.648	69.000	0.000	-0.000	286°40'36"	0.000
25	55721.249	264329.413	14.669	-51.648	72.000	0.000	-0.000	286°40'36"	0.000
26	55720.388	264326.540	14.659	-54.648	75.000	0.000	-0.000	286°40'36"	0.000
27	55719.527	264323.666	14.649	-57.648	78.000	0.000	-0.000	286°40'36"	0.000
28	55718.666	264320.792	14.639	-60.648	81.000	0.000	-0.000	286°40'36"	0.000
29	55717.805	264317.918	14.629	-63.648	84.000	0.000	-0.000	286°40'36"	0.000
30	55716.945	264315.044	14.619	-66.648	87.000	0.000	-0.000	286°40'36"	0.000
31	55716.084	264312.171	14.609	-69.648	90.000	-0.000	-0.000	286°40'36"	0.000
32	55715.223	264309.297	14.599	-72.648	93.000	-0.000	-0.000	286°40'36"	0.000
33	55714.362	264306.423	14.589	-75.648	96.000	0.000	-0.000	286°40'36"	0.000
34	55713.501	264303.549	14.579	-78.648	99.000	-0.000	-0.000	286°40'36"	0.000
35	55712.640	264300.675	14.569	-81.648	102.000	0.000	-0.000	286°40'36"	0.000
36	55711.779	264297.801	14.559	-84.648	105.000	0.000	-0.000	286°40'36"	0.000
37	55710.918	264294.928	14.549	-87.648	108.000	0.000	-0.000	286°40'36"	0.000
38	55710.057	264292.054	14.538	-90.648	111.000	0.000	-0.000	286°40'36"	0.000
39	55709.196	264289.180	14.528	-93.648	114.000	0.000	-0.000	286°40'36"	0.000
40	55708.335	264286.306	14.518	-96.648	117.000	0.000	-0.000	286°40'36"	0.000
41	55707.474	264283.432	14.508	-99.648	120.000	0.000	-0.000	286°40'36"	0.000
42	55706.614	264280.559	14.498	-102.648	123.000	0.000	0.000	286°40'36"	0.000
43	55705.753	264277.685	14.488	-105.648	126.000	0.000	0.001	286°40'36"	0.000
44	55704.892	264274.811	14.476	-108.648	129.000	0.000	0.001	286°40'36"	0.000

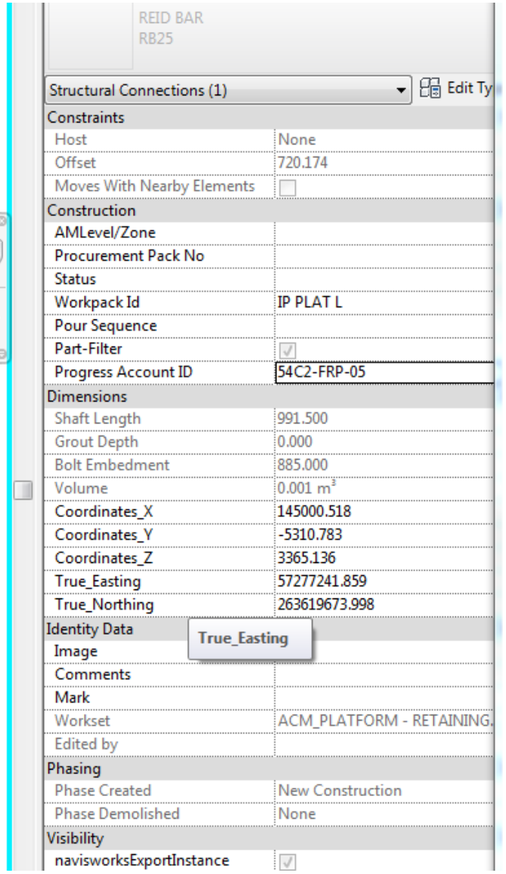


Construction Data Input – Nest families



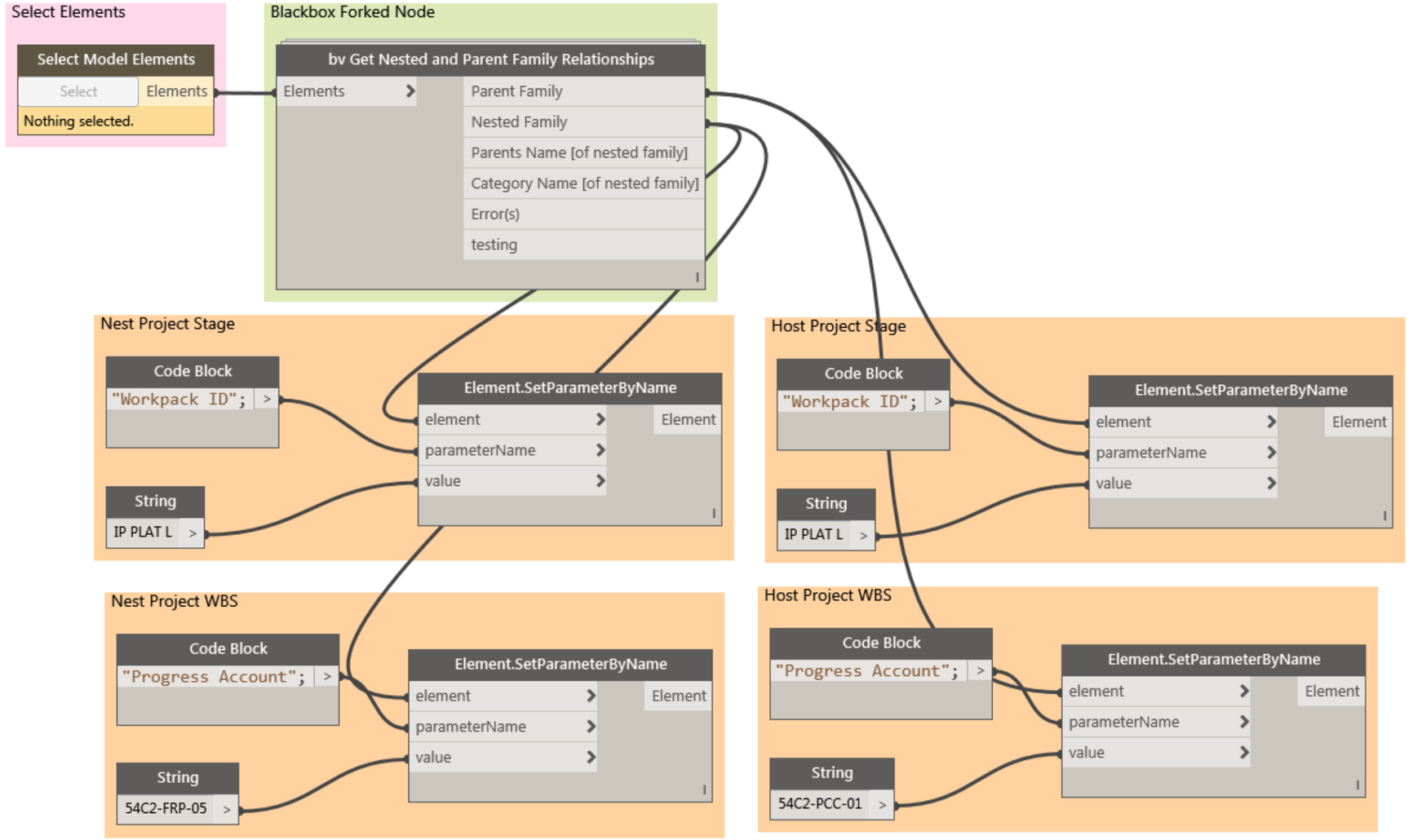






Data input – Host & Nested

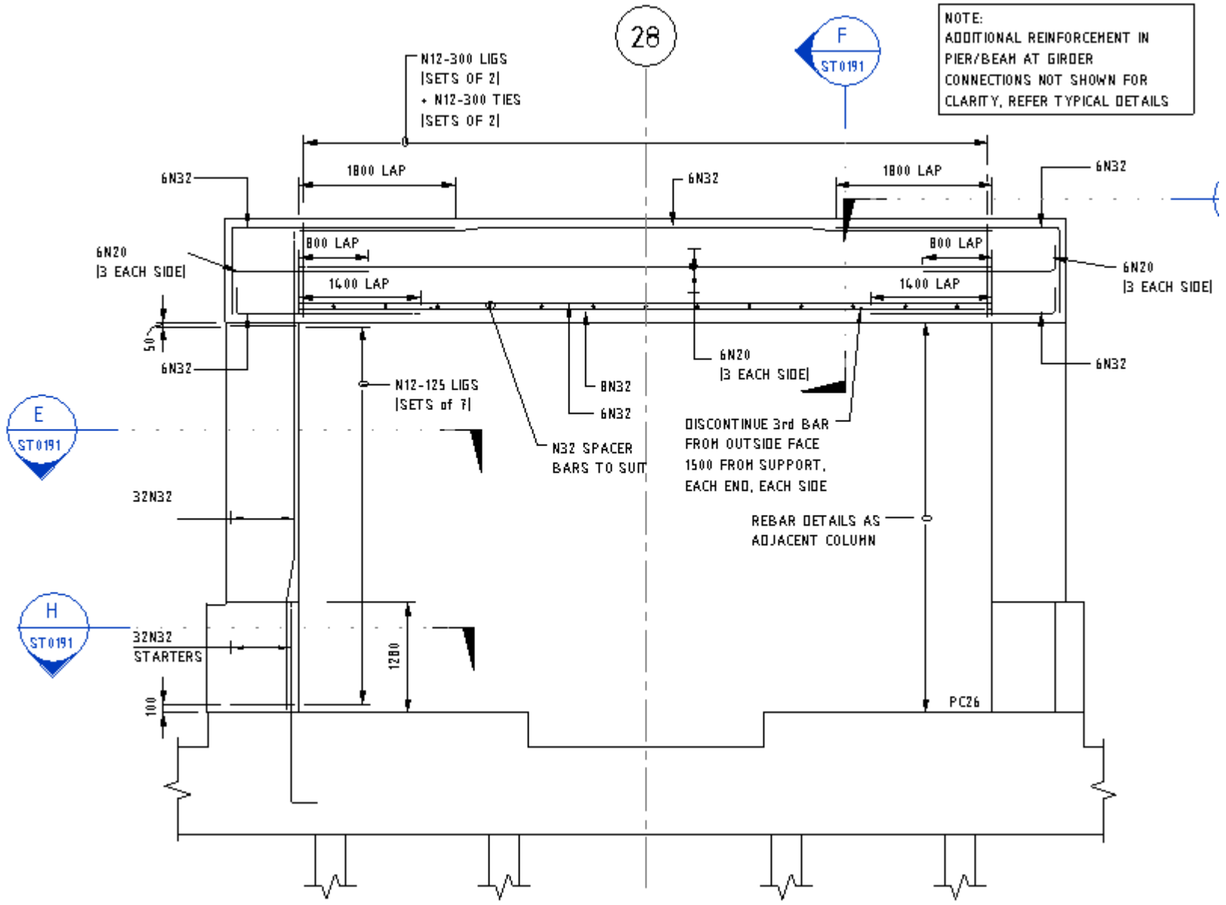
Dynamo

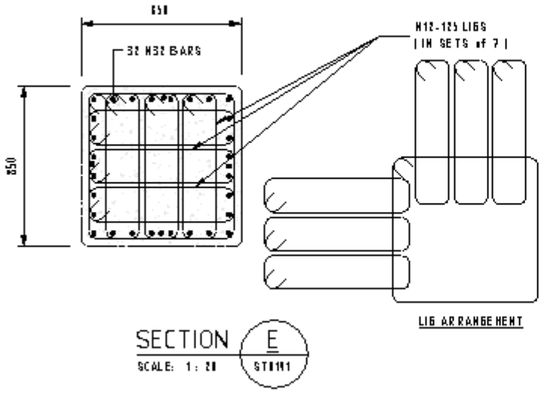


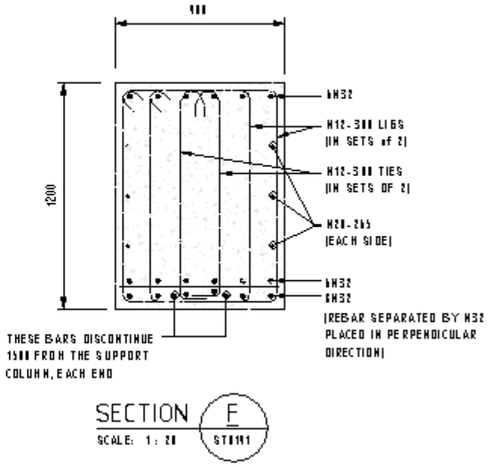
Complex Reinforcement Arrangement

Complex Reinforcement

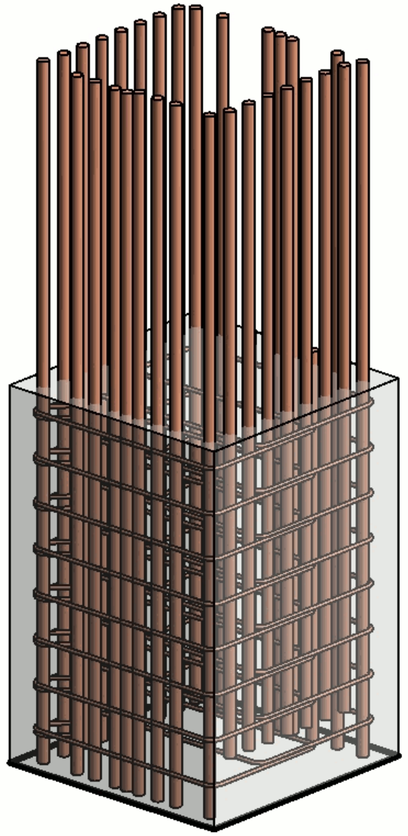
Complex Reinforcement







Complex Reinforcement

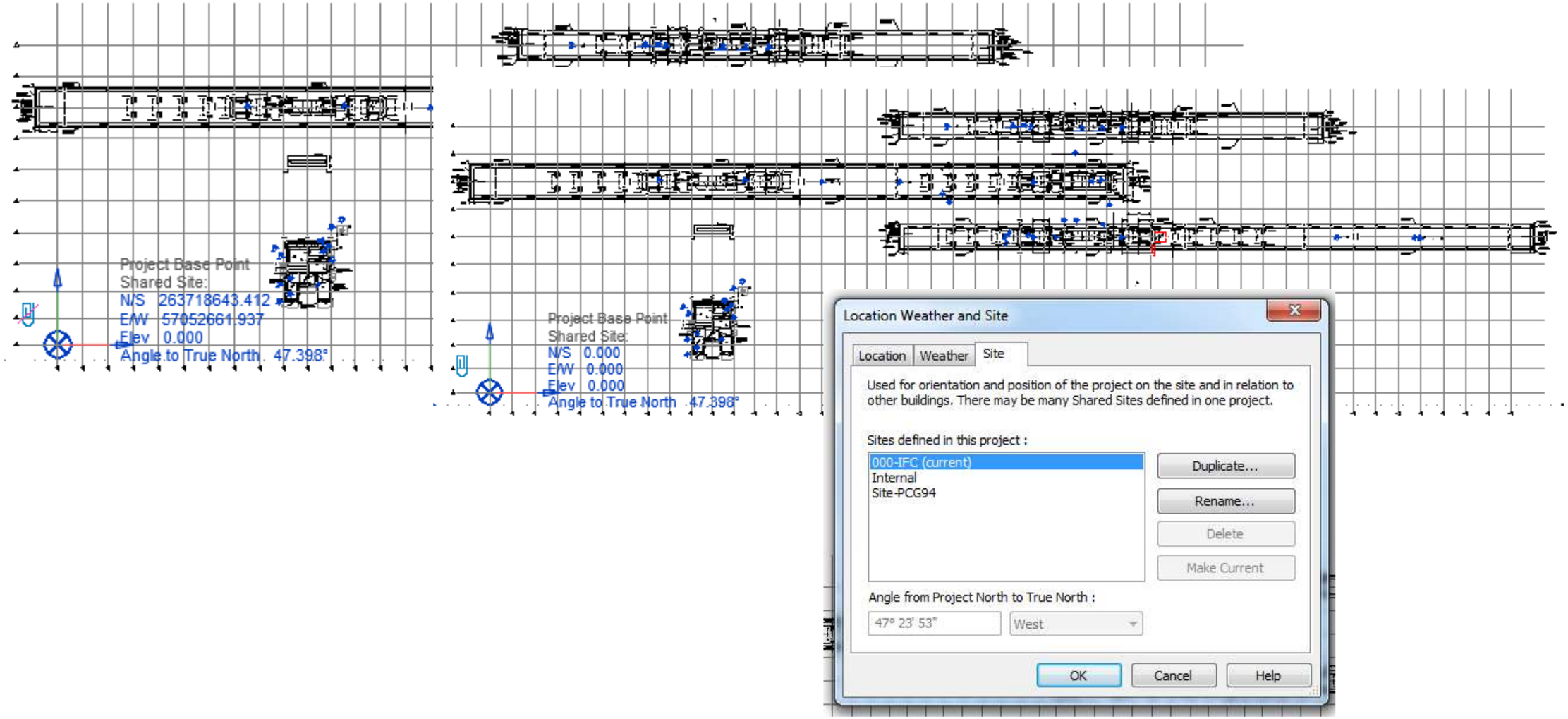


Complex Reinforcement

Complex Reinforcement

Open BIM Collaboration

Open BIM Collaboration



IFC and Revit

Why IFC with world coordinates can’t be used with Revit! (not true as changes in other OpenBim this year)

- The current 2x3 IFC data schema makes IFClocalplacement PlacementRelTo optional.
- IfcLocalPlacement is like a Personal Survey Marker (PSM),
- Revit uses the project base point as a PSM and transforms elements about its location

IfcLocalPlacement

- *Definition from IFC: The IfcLocalPlacement defines the relative placement of a product in relation to the placement of another product or the absolute placement of a product within the geometric representation context of the project.*

- *PlacementRelTo : Reference to Object that provides the relative placement by its local coordinate system. If it is omitted, then the local placement is given to the WCS, established by the geometric representation context.*

IFC Compare

PRISM-ACM-SS-00-ST-MOD-SUB-R-2015.ifc | PRISM-ACM-SS-00-ST-MOD-SUB-R-2015 -IFC000.ifc

```
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311359 #542313= IFCPROPERTYSET('0k8VE16vnBLvYmRZenL5JZ',#41,'Other',$,(#541962,#541963,#
311360 #542315= IFCRELDEFINESBYPROPERTIES('2hcH89vnX1cP69nilSSgk_',#41,$,$,(#542280),#54
311361 #542318= IFCPROPERTYSET('3b9OZkdh1DPO48cVVBFYeE',#41,'Phasing',$,(#2200));
311362 #542320= IFCRELDEFINESBYPROPERTIES('3b9OZkdh1DPO48cFVBFYeE',#41,$,$,(#542280),#54
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311367 #542346= IFCAXIS2PLACEMENT3D(#542342,#19,#542344);
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311369 #542348= IFCSITE('3tXVJhjon9evRvCX1j82VI',#41,'Default',$,'',#542347,$,$,.ELEMENT
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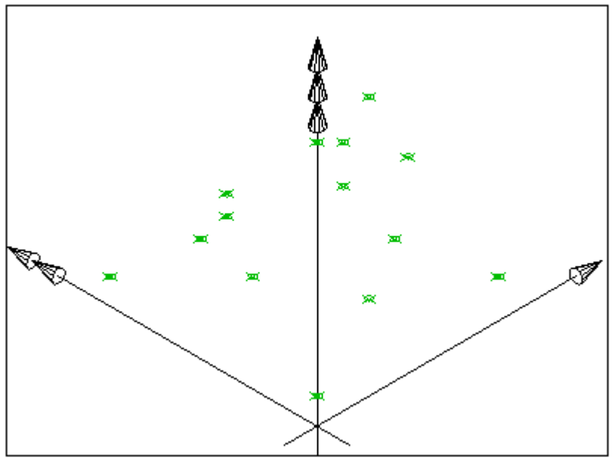

PRISM-ACM-SS-00-ST-MOD-SUB-R-2015 -IFC000.ifc

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4378 #24371=IFCEXTRUDEDAREASOLID(#5858,#113437,#4,5825.0);
4379 #24372=IFCEXTRUDEDAREASOLID(#6094,#113535,#4,19329.9);
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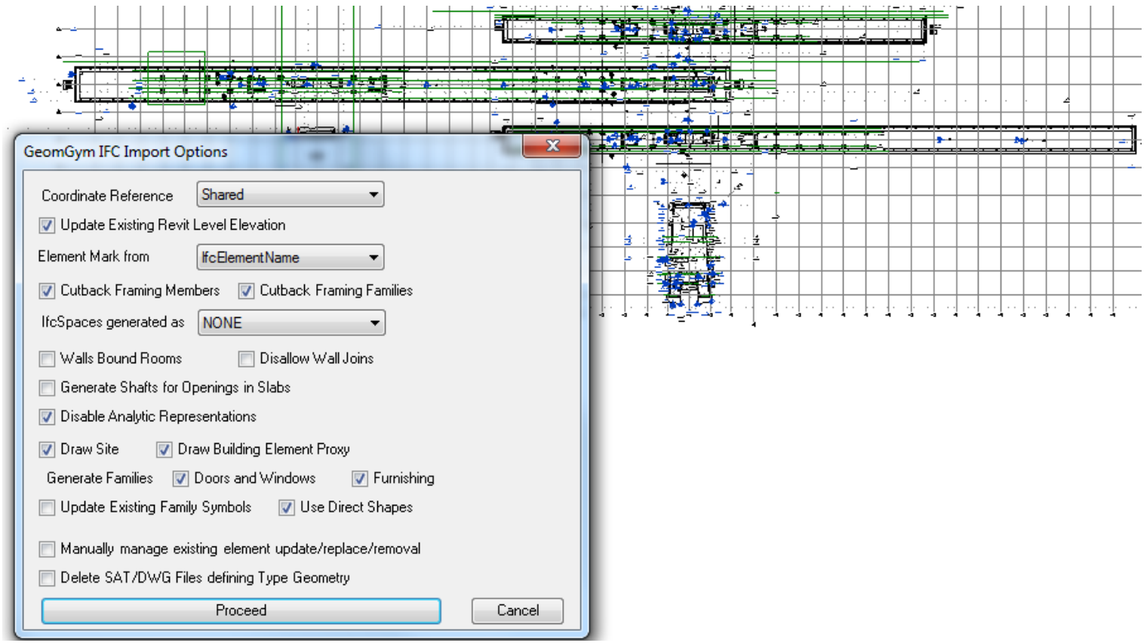
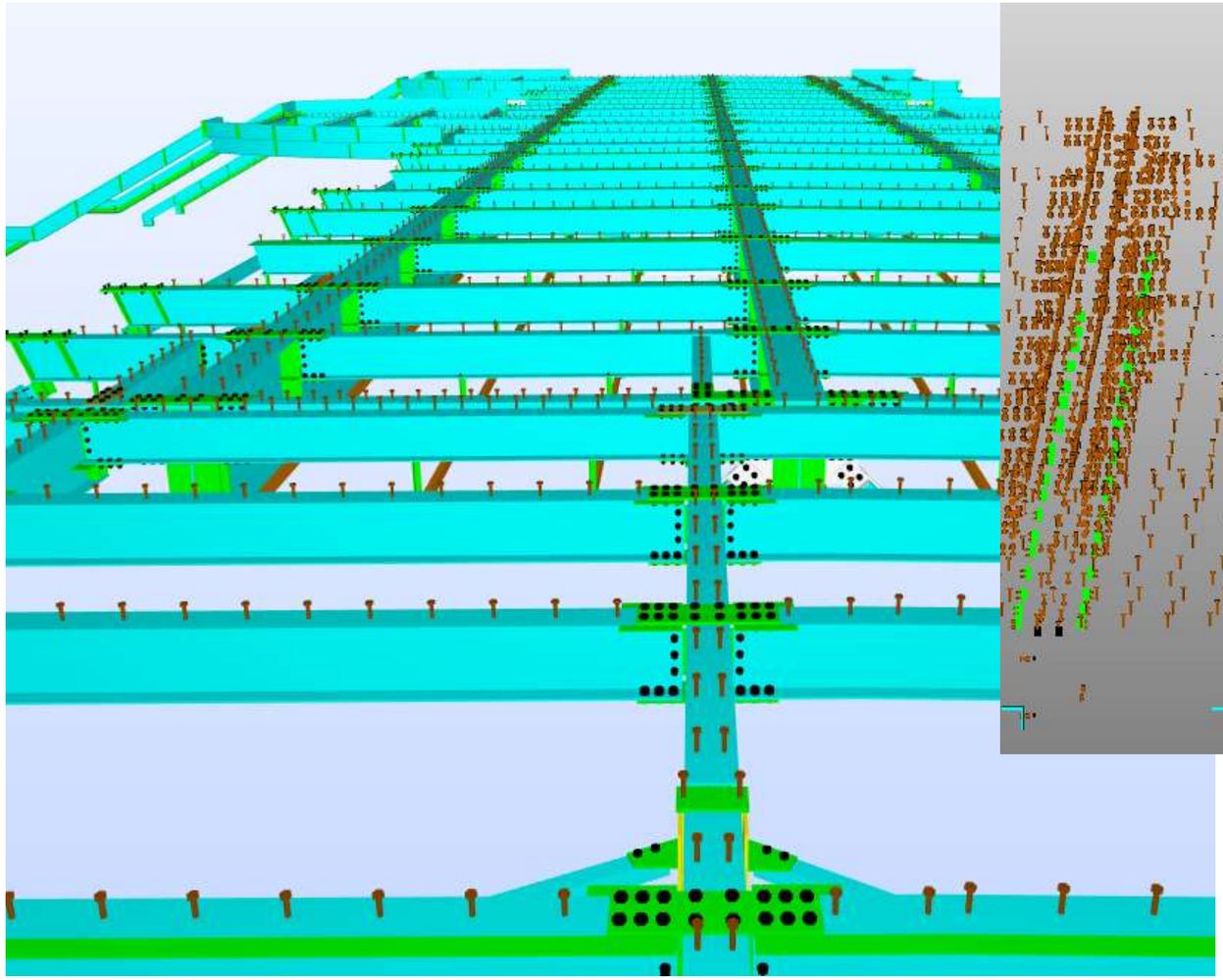
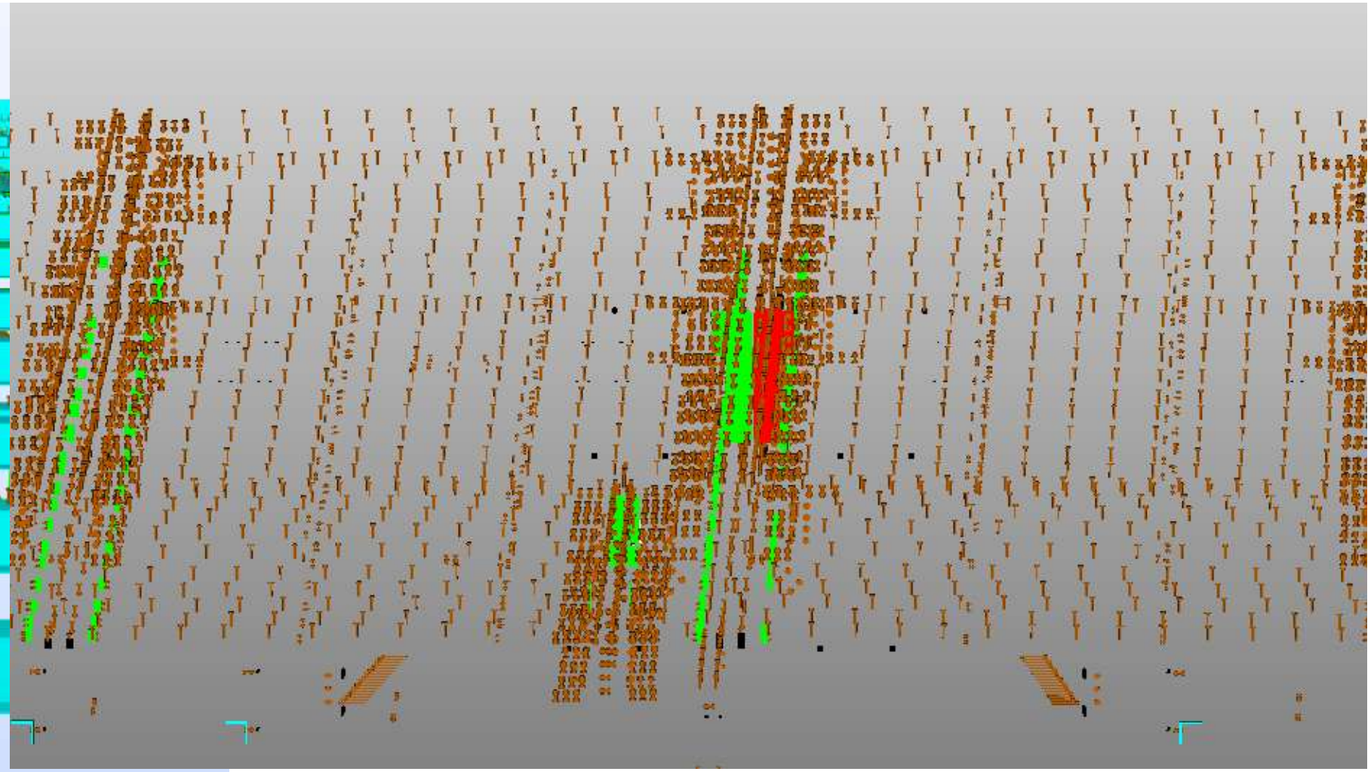
Geometry gym



- Import IFC into current file
- Coordinate references Point.
- Removes assembly, bolts

Stepping down LOD

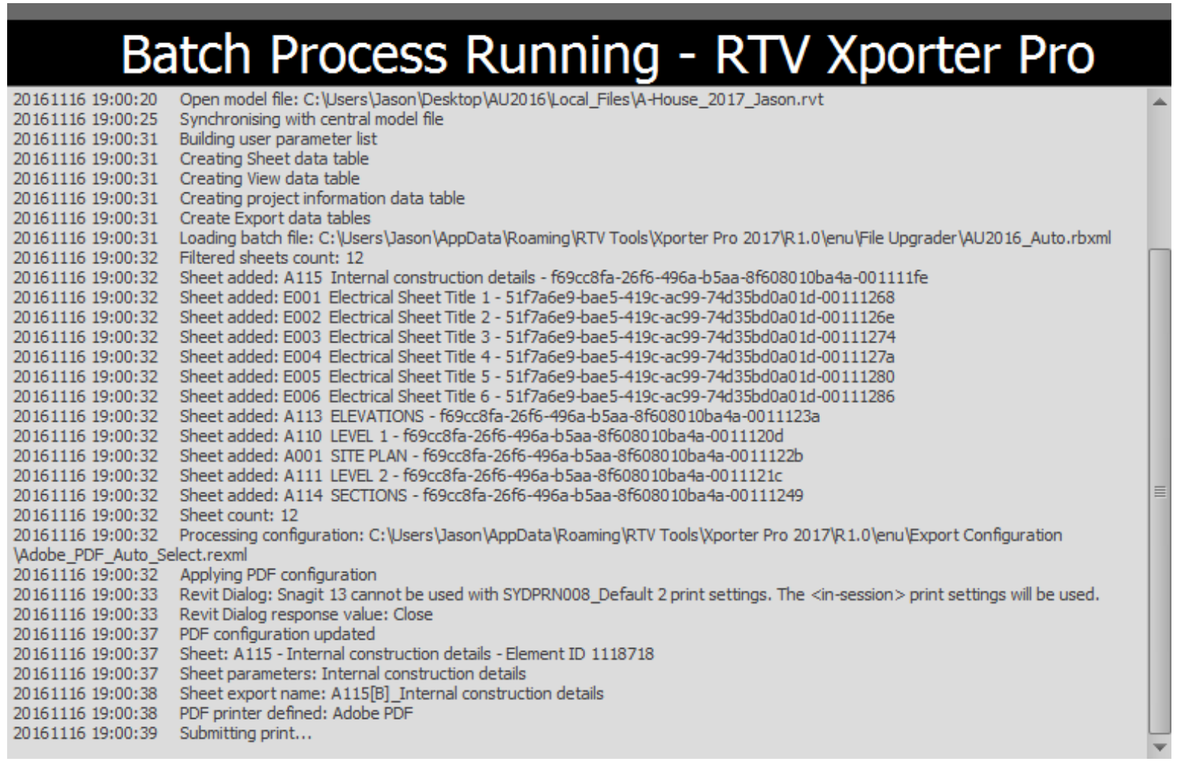




Revit Automation

RTVTOOLS
Simple . Effective . Solutions to automate BIM

- Run file exports and printing overnight.
- IFC, NWC & PDF's
- Drawing sheet and revision management.
- Remote task batch processing.



Aerial Image - October

Lesson Learnt

- Model for Construction not documentation!
- Be honest on modelling skill for use
- What doesn't work!
  - Worksharing monitor for Revit
  - Element Requesting – (WAN Latency)
  - Workaround for communication – Lync / Skype to communicated between team members

Class summary

- Revit can be used for Infrastructure documentation using Dynamo.
- Revit modelling techniques can support downstream construction management workflows.
- openBIM file formats can be used effectively into Revit for coordination.

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