

How to document a tower with forty different floor plates?

Maciej Wypych

Design Technology Coordinator at BVN

Adam Walmsley

Senior Technical Specialist Autodesk





About the speaker

Maciej Wypych

Maciej is a Design Technology Coordinator at BVN, previously Warren and Mahoney Architects and Design Information Management Sessional Tutor at UNSW. He is a committee member and frequent speaker at Dynamo User Group Sydney as well as BUILT ANZ, Wellington Digital Design User Group and other conferences. He has over 15 years' experience in the architecture and building industry in Australia and UK. Maciej brings extensive knowledge in architectural design technology, parametric 3d modelling and the rationalization and delivery of geometrical complex designs.



About the speaker

Adam Walmsley

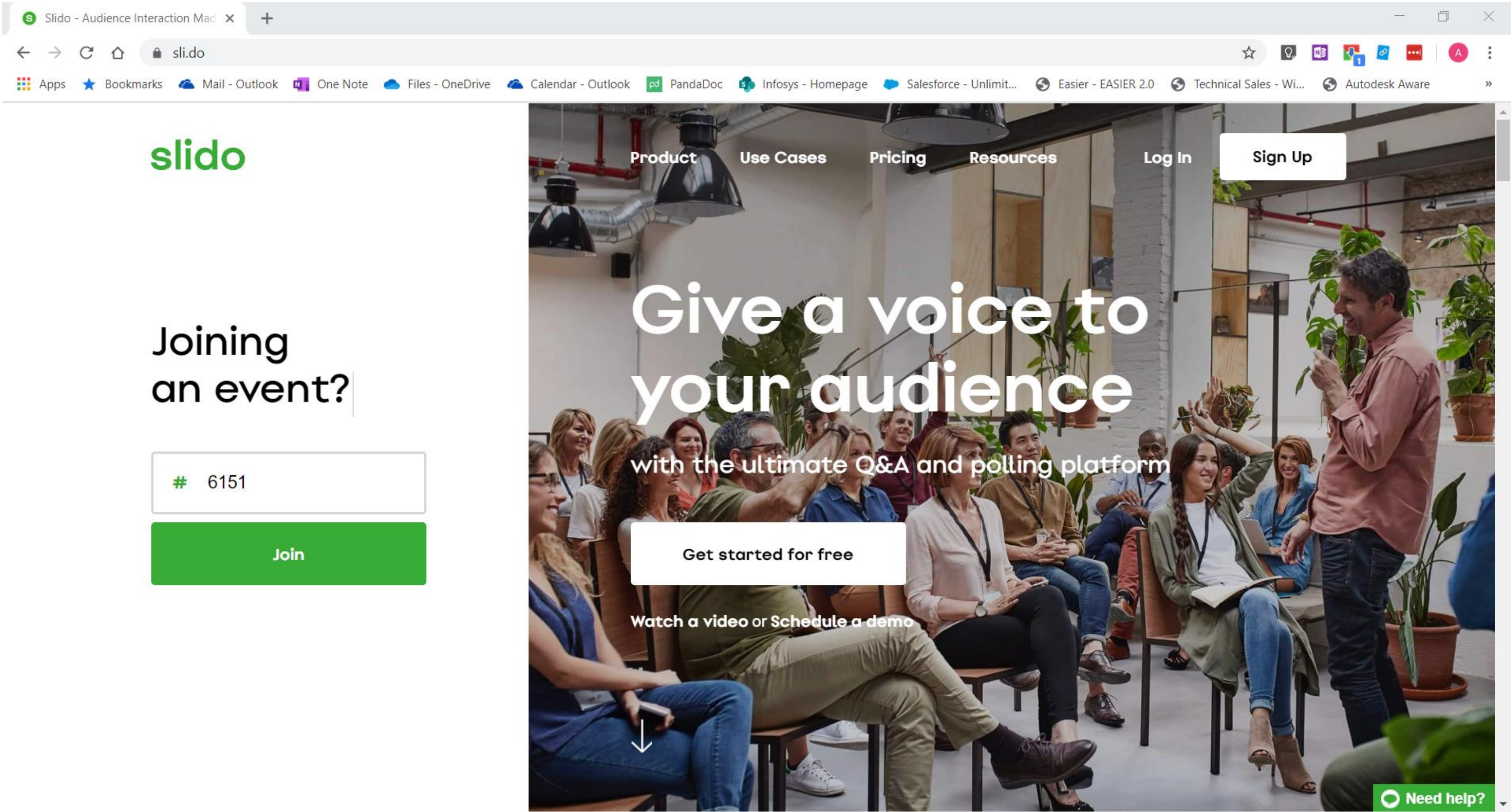
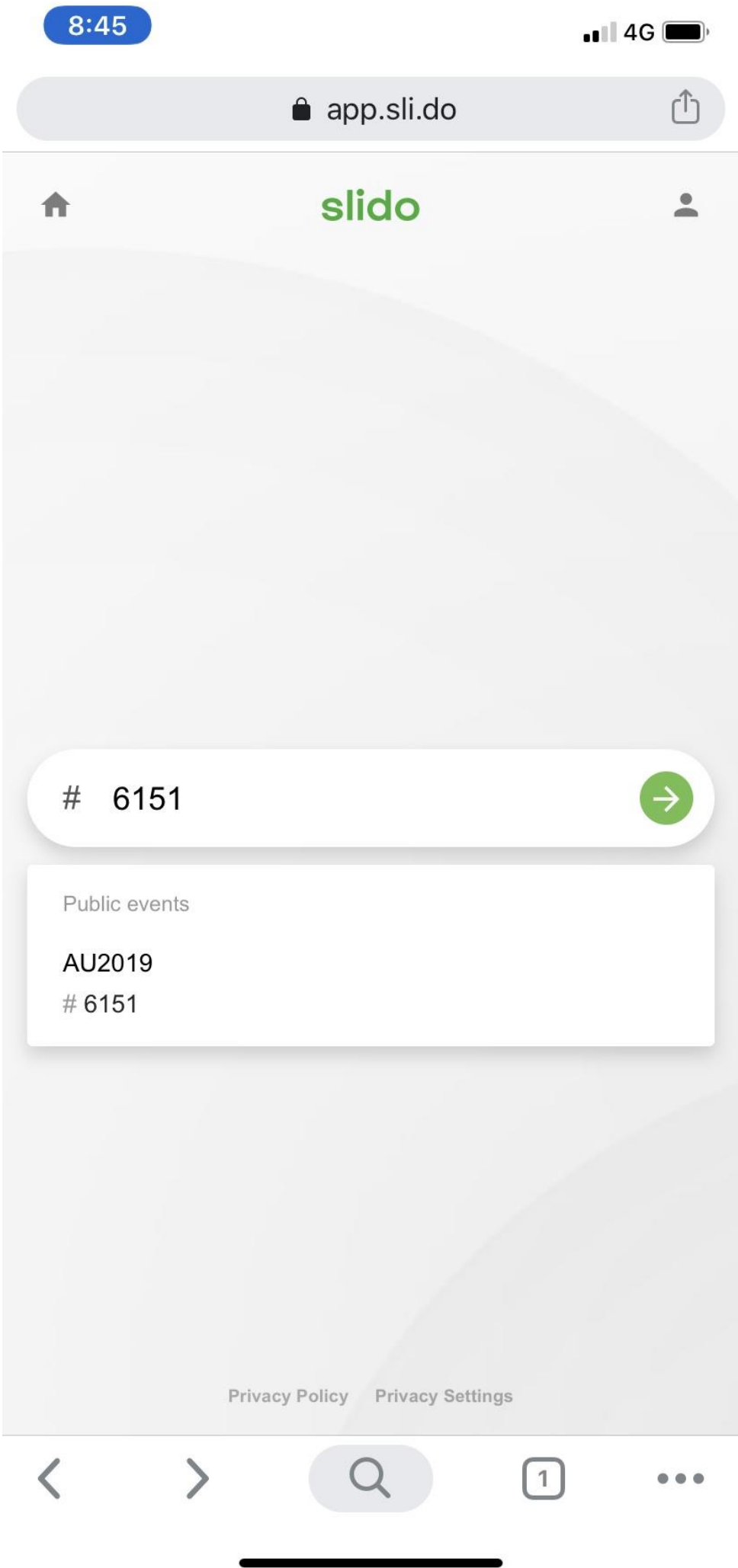
Adam Walmsley is a Civil Infrastructure Technical Specialist for Autodesk based in Sydney, Australia.

He focuses on enabling the industry to design, document and construct Civil Infrastructure projects using improved connected workflows. His passion lies in using computational design processes to help automate and improve design.

Prior to joining Autodesk in April 2019, Adam had worked for 12 years in the structural design and civil construction industry, holding lead Digital Engineering roles on challenging major projects in Australia.

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Event Number: 6151



LEARNING OBJECTIVES:

- PROJECT TIMELINE
- MODEL SPLIT
- LINKS VS GROUPS
- BUILDING FORM
- AUTOMATION
- FAÇADE ELEMENTS
- SUMMARY

SYDNEY
MELBOURNE
AUCKLAND
TAURANGA
WELLINGTON
CHRISTCHURCH
QUEENSTOWN



Warren and Mahoney is an architectural and design practice with seven locations functioning as a single studio.

The practice has nearly 300 people - working across architecture, interior design, masterplanning, urban design, customer experience, workplace strategy consultancy and sustainable design.

Our one studio approach allows us to draw from the wider group for skills and experience on every project, regardless of the location.

Our design philosophy is founded on the belief that human experience is improved through enduring design excellence, delivered through formal simplicity and material quality



TVNZ



COMMERCIAL BAY



LANDMARK



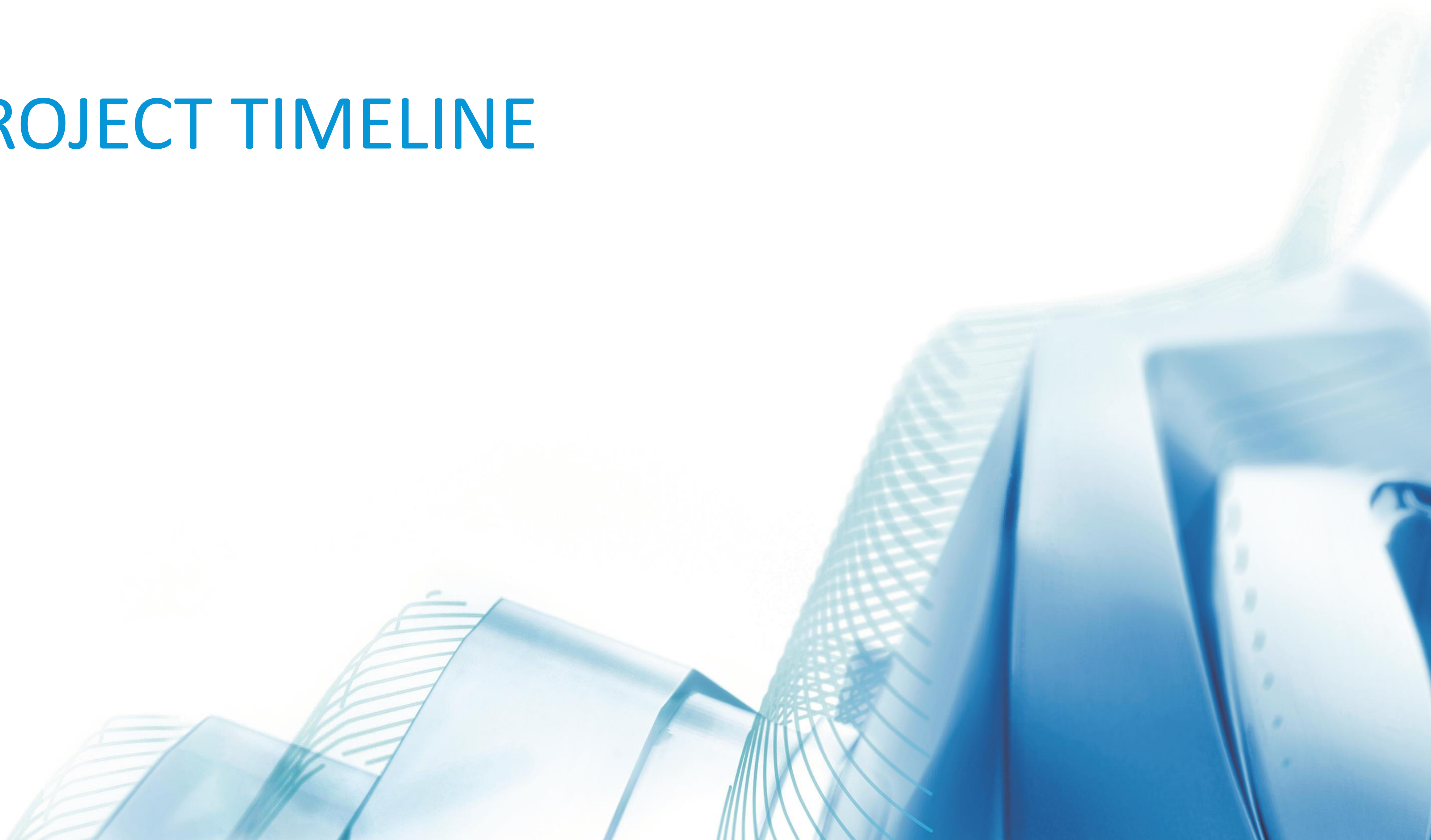
WARREN AND
MAHONEY OFFER
BOTH ARCHITECTURAL
AND INTERIOR DESIGN
SERVICES ACROSS
ALL MAJOR SECTORS

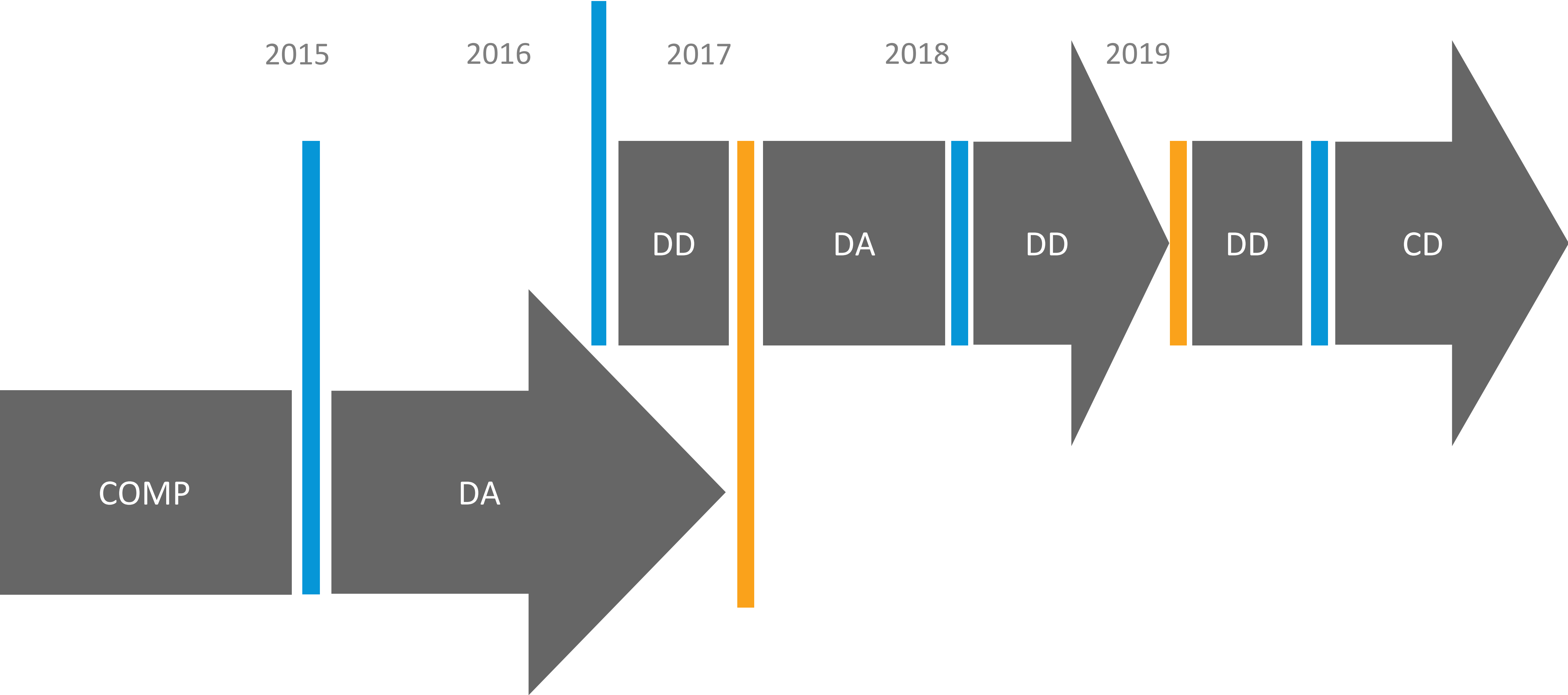
METRO SPORTS



LINCOLN UNIVERSITY HUB

PROJECT TIMELINE







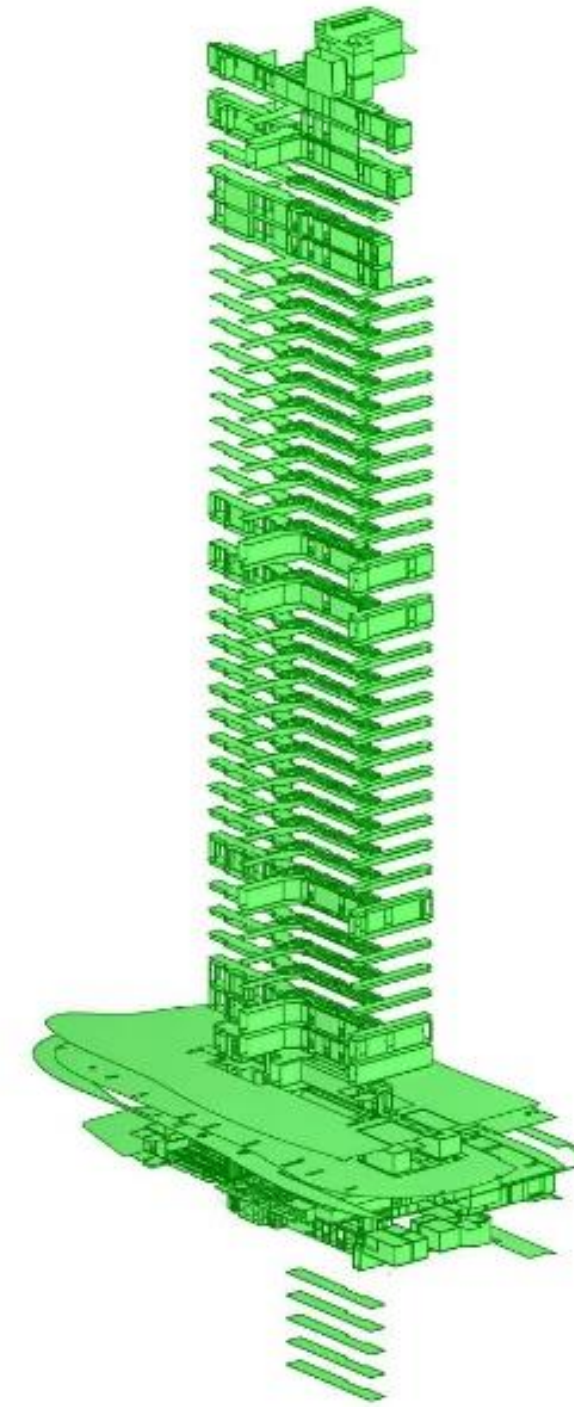
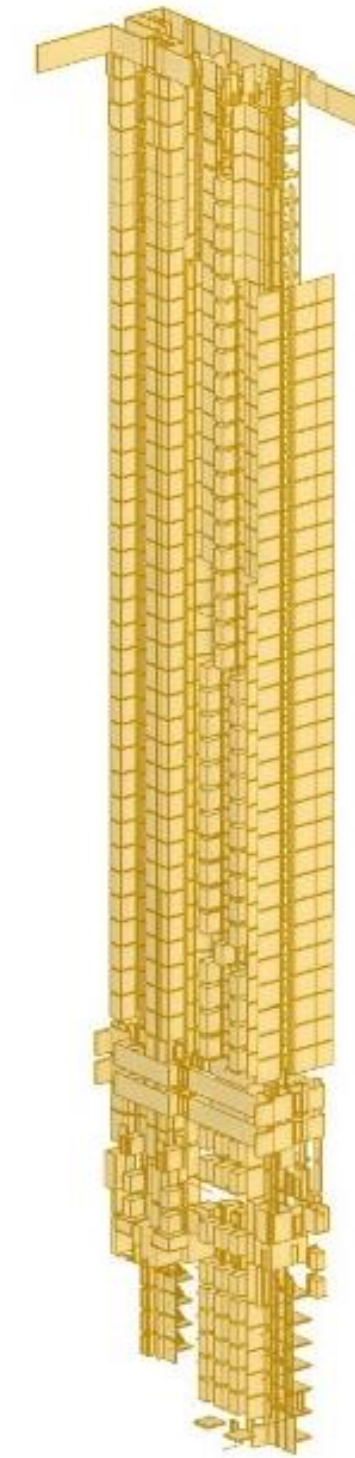
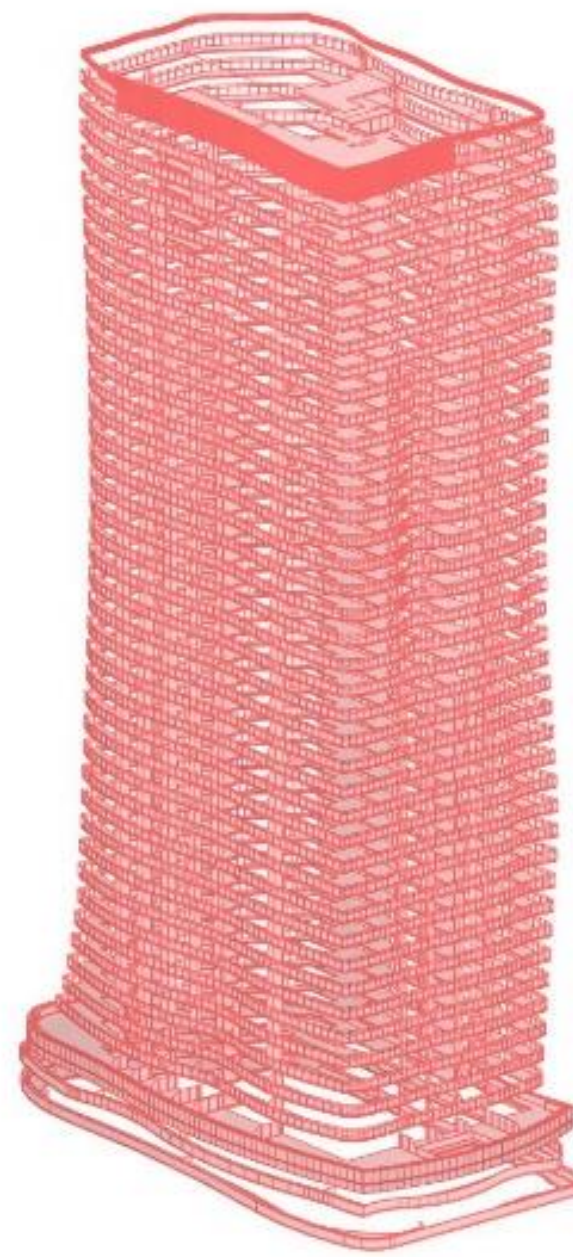
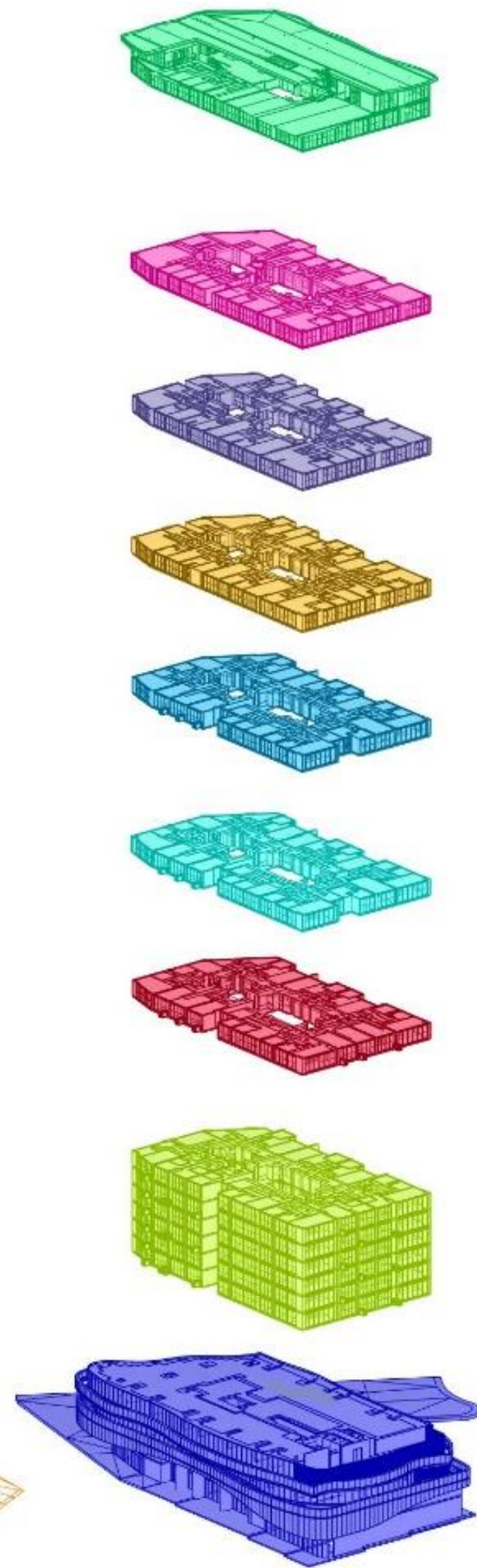
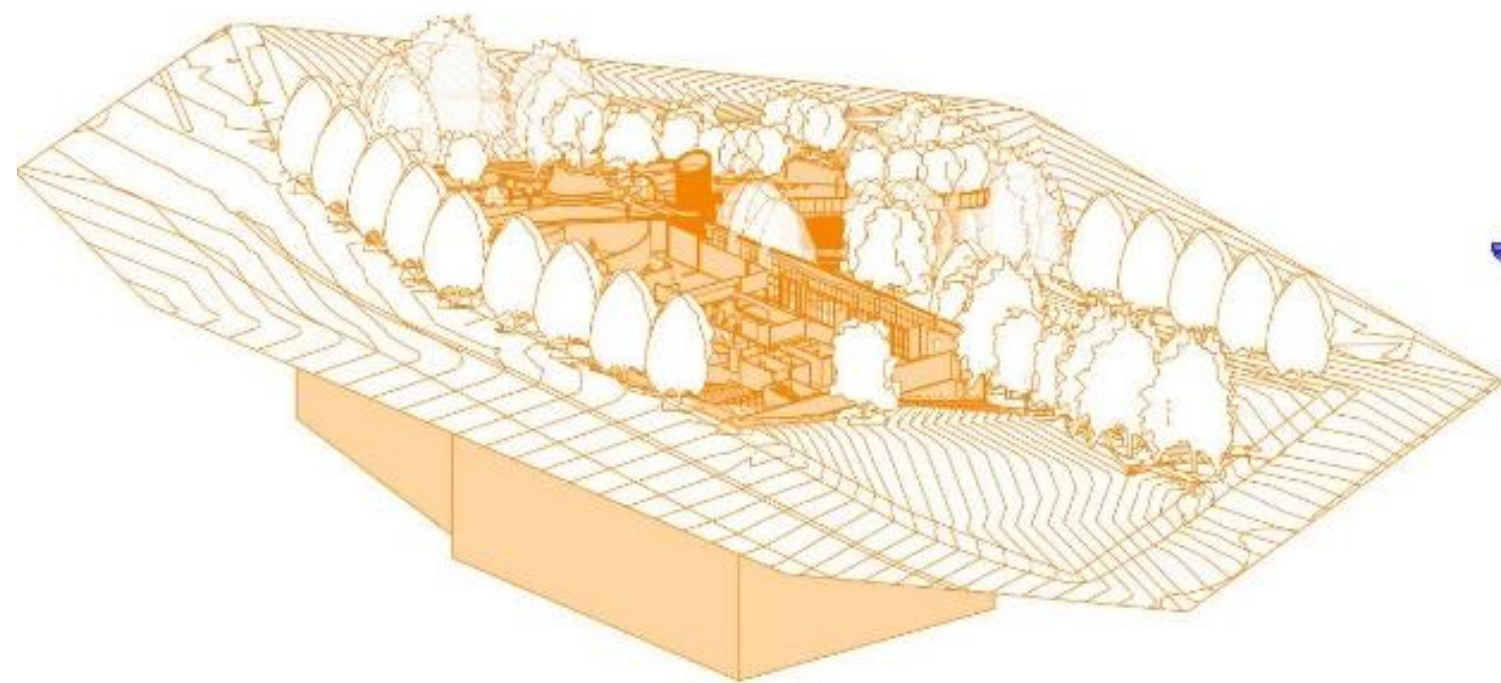
THE BUILDING

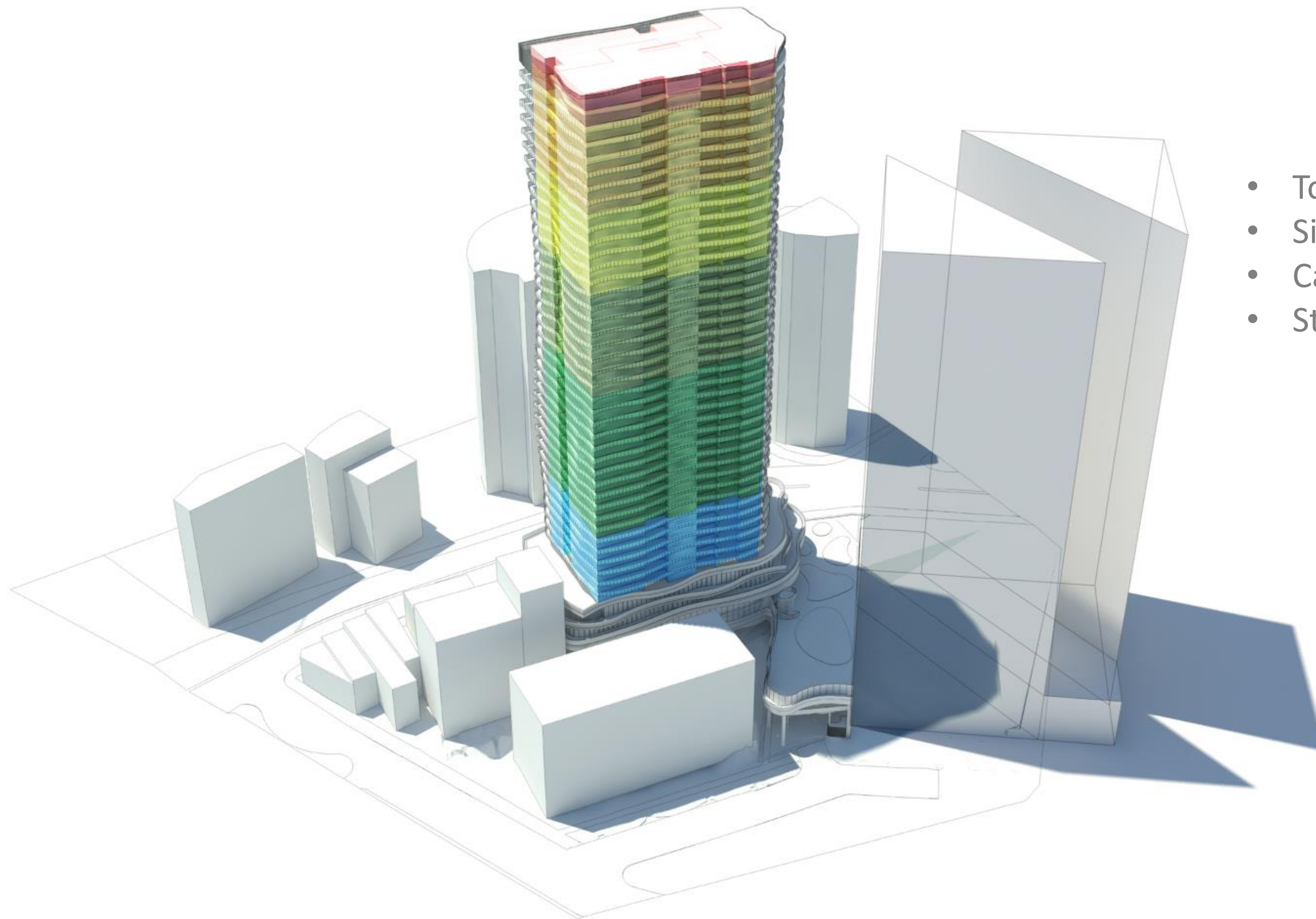


MODEL SPLIT

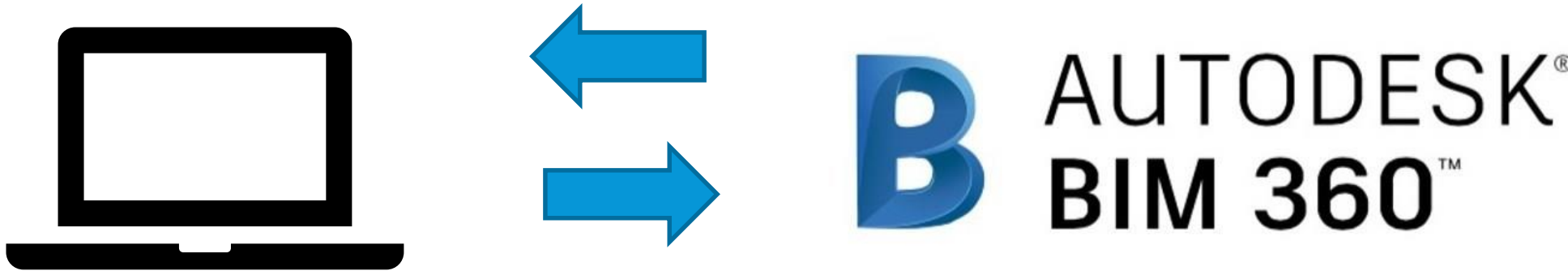
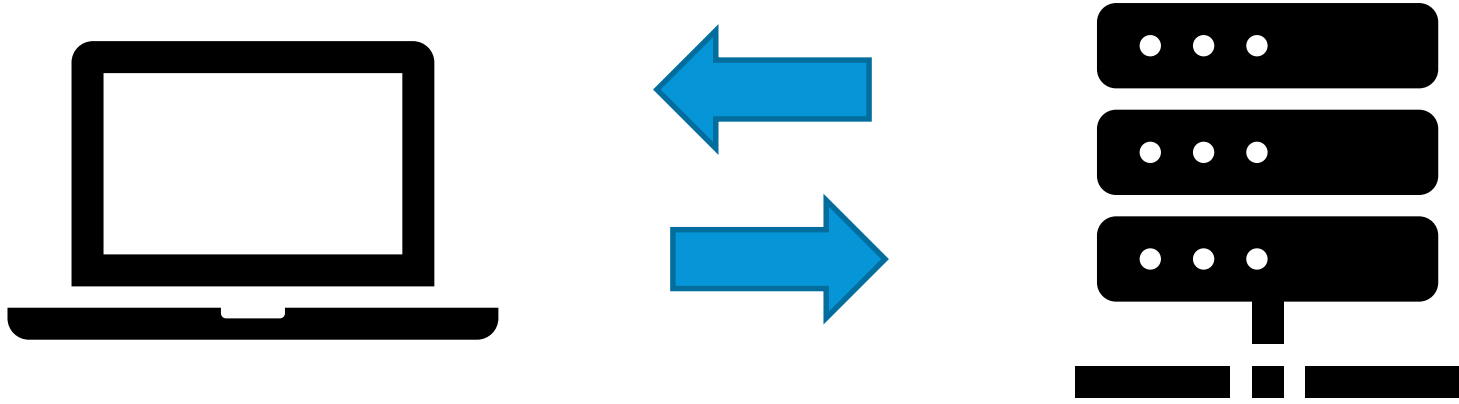
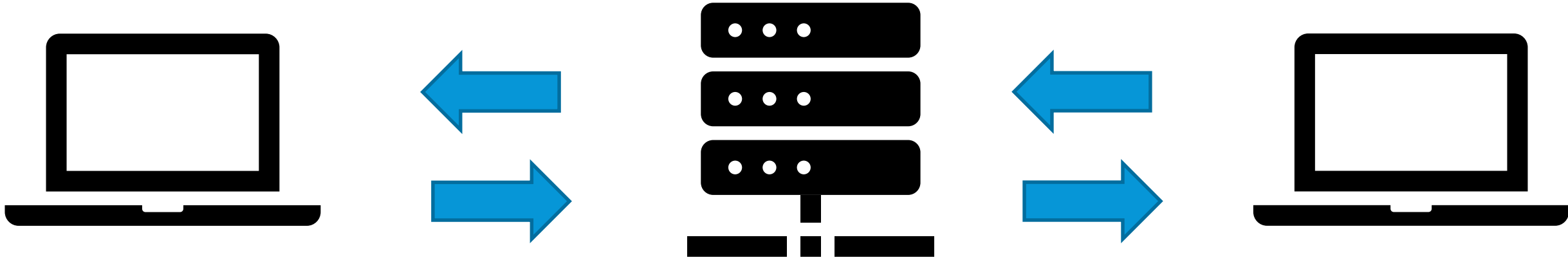


- Container file
- Master Federated
- Site
- Typical Levels x9
- Façade
- Core
- Interiors
- Furniture(Selected Levels)





- Tower
- Site
- Cad Links
- Structure(Architectural)*



LINKS VS GROUPS



Sync Times (Seconds)

Multiple Typical Models



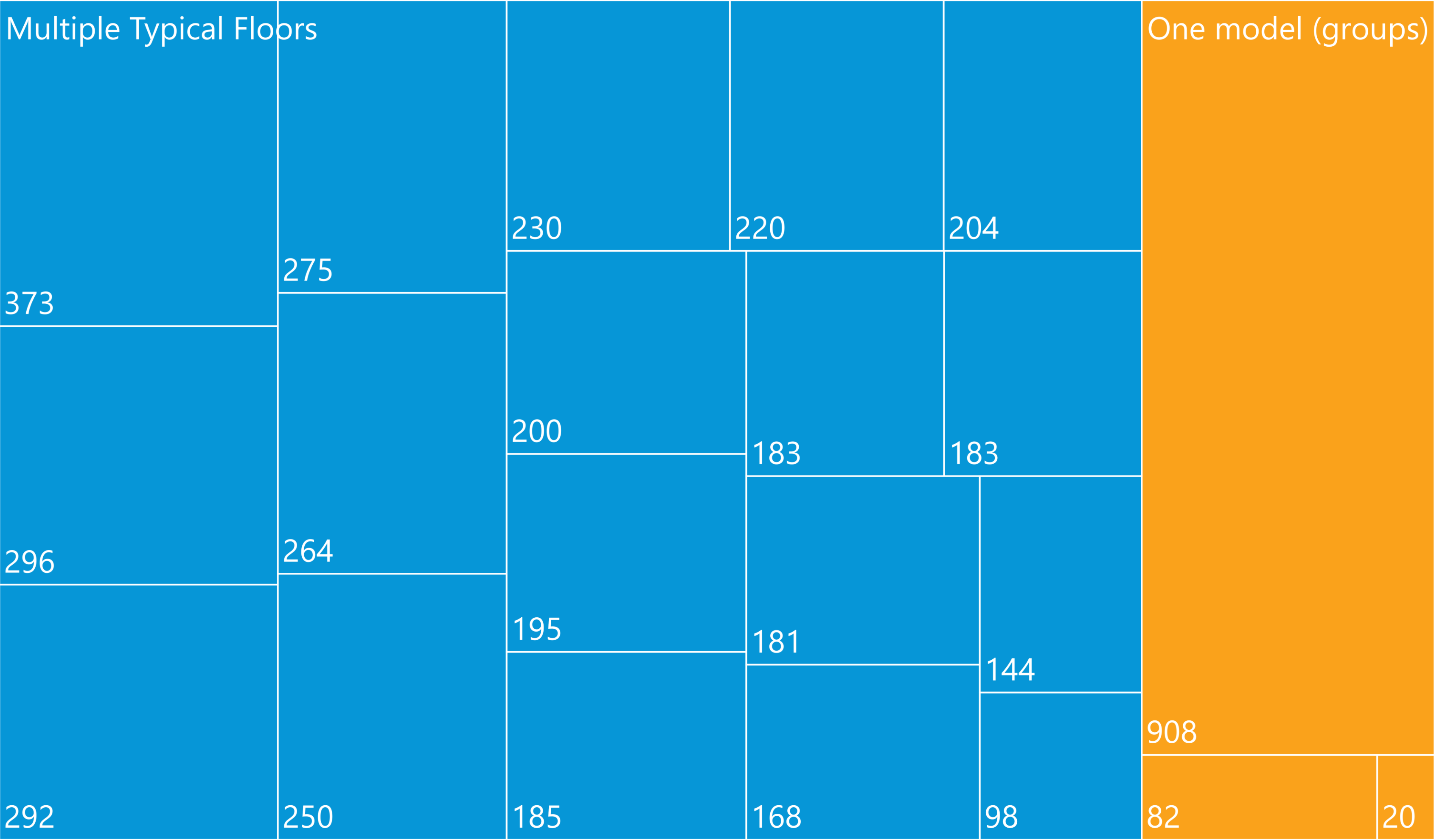
Single Tower Model



- Tower
- Site
- CAD Underlay
- Federated
- Podium
- Furniture
- Core
- Façade
- Typical Floors 10-21
- Typical Floors 22-23
- Basement
- Interiors
- Container
- Typical Floors 36
- Typical Floors 40-41
- Typical Floors 37-39
- Typical Floors 24-35
- Typical Floors 4-9
- Typical Floors 42-43
- Typical Floors 42-44

Model Size

Multiple Typical Floors One model (groups)



LINKS

- Annotation is dropping off
- Need to open multiple files
- Harder to maintain consistency
- Bigger and slower overall
- Not flexible if design changes
- Can't reference between files

GROUPS

- Break if you don't follow best practice
- All within one file
- Bigger file but smaller project overall
- Flexible if design changes
- Drawing references within single file



- Groups:
- Structure*
 - Core
 - Individual Apartments

Working with Revit groups:

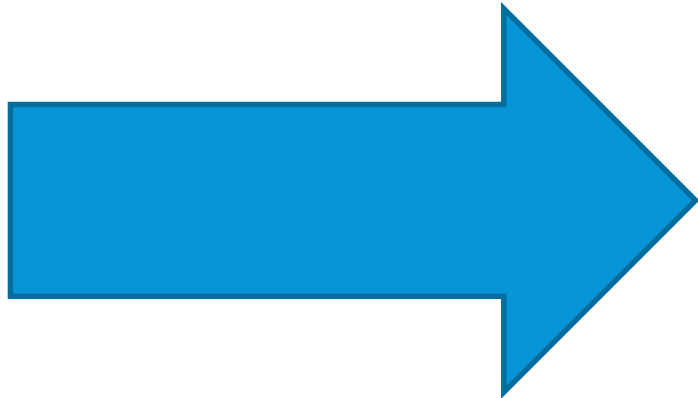
- Plan
- Don't ungroup
- Don't group if it's not repeated
- Don't exclude
- Don't nest
- Unjoin walls

BUILDING FORM



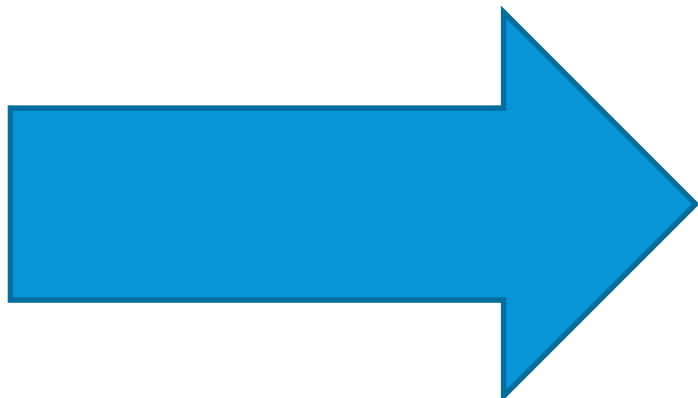


INITIAL WORKFLOW



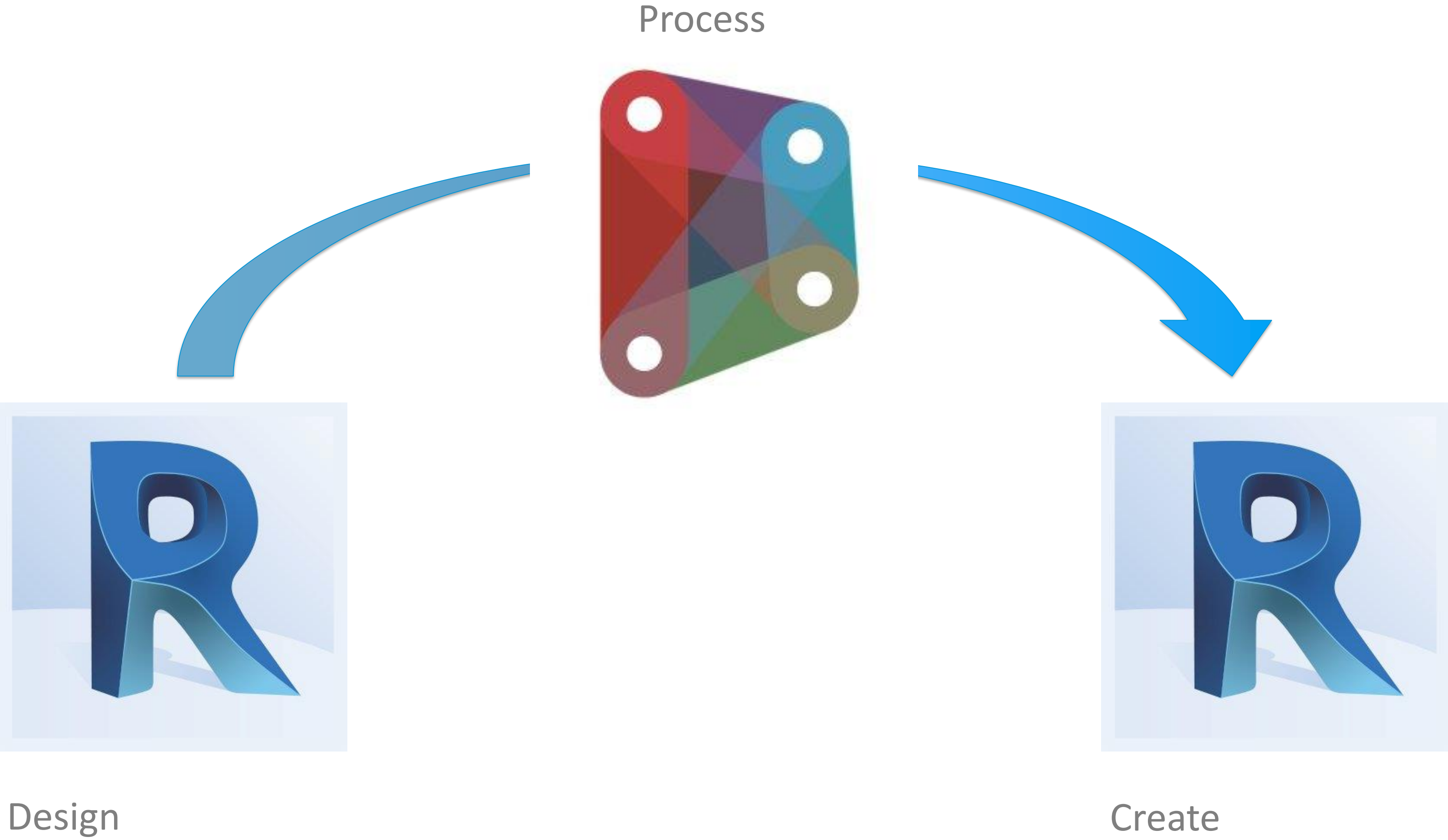
700+ Lines per floor outline

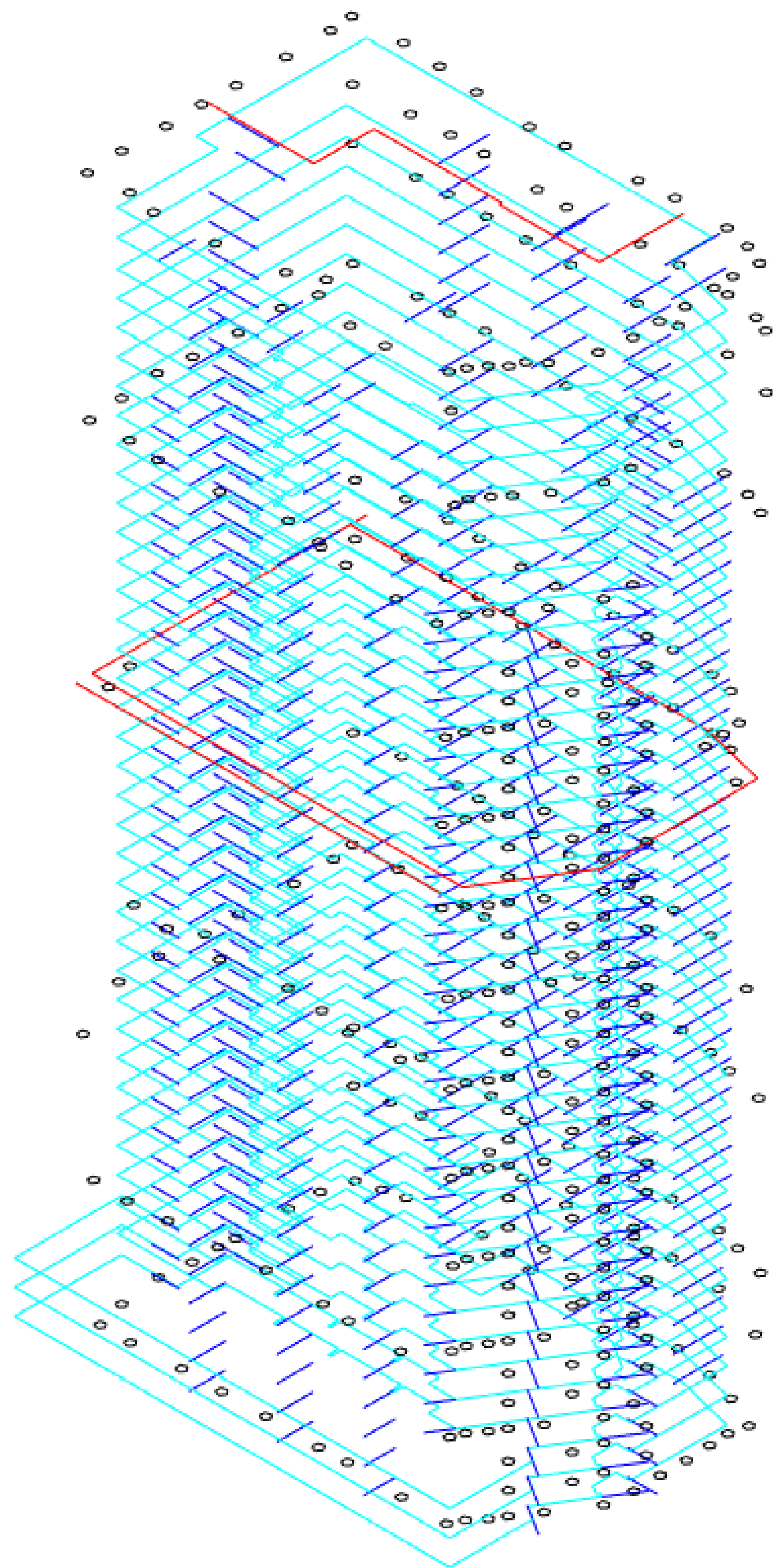
CURRENT WORKFLOW



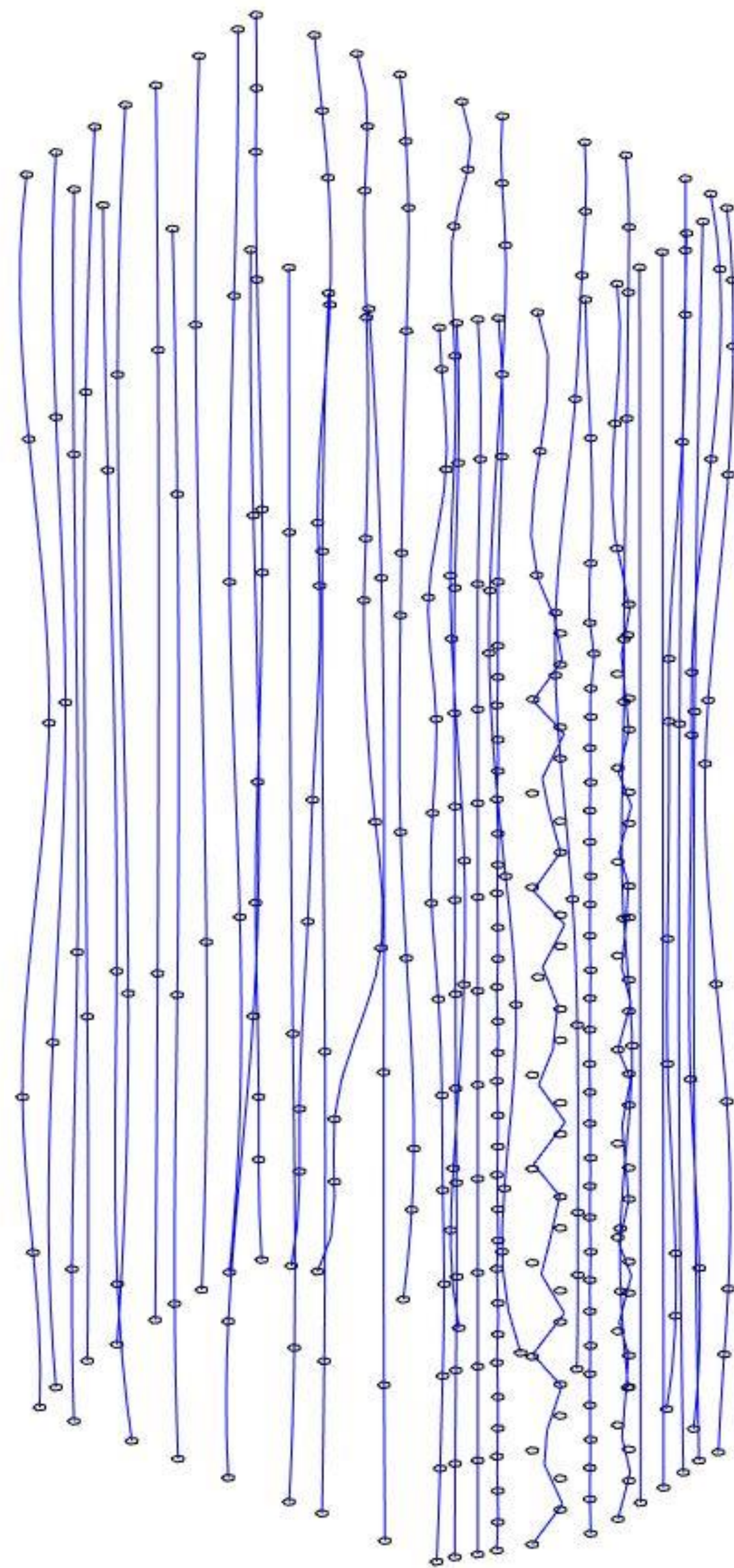
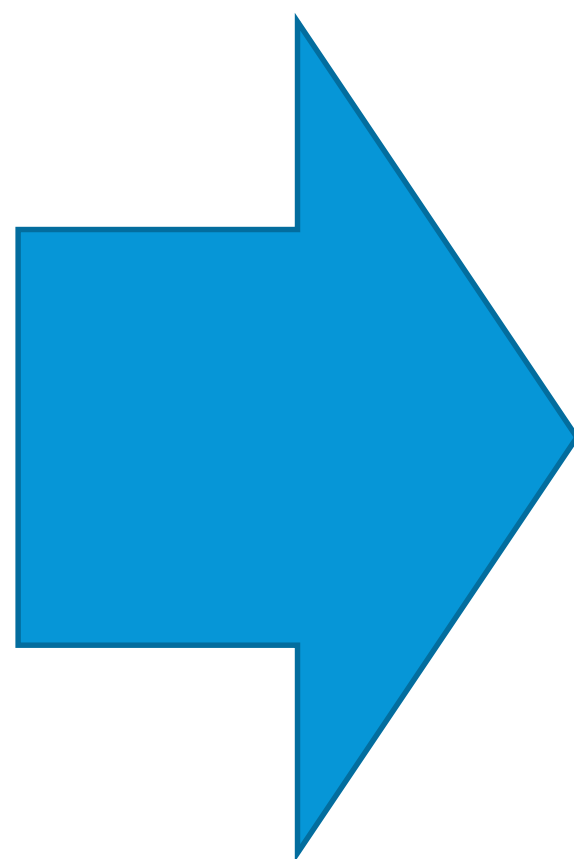
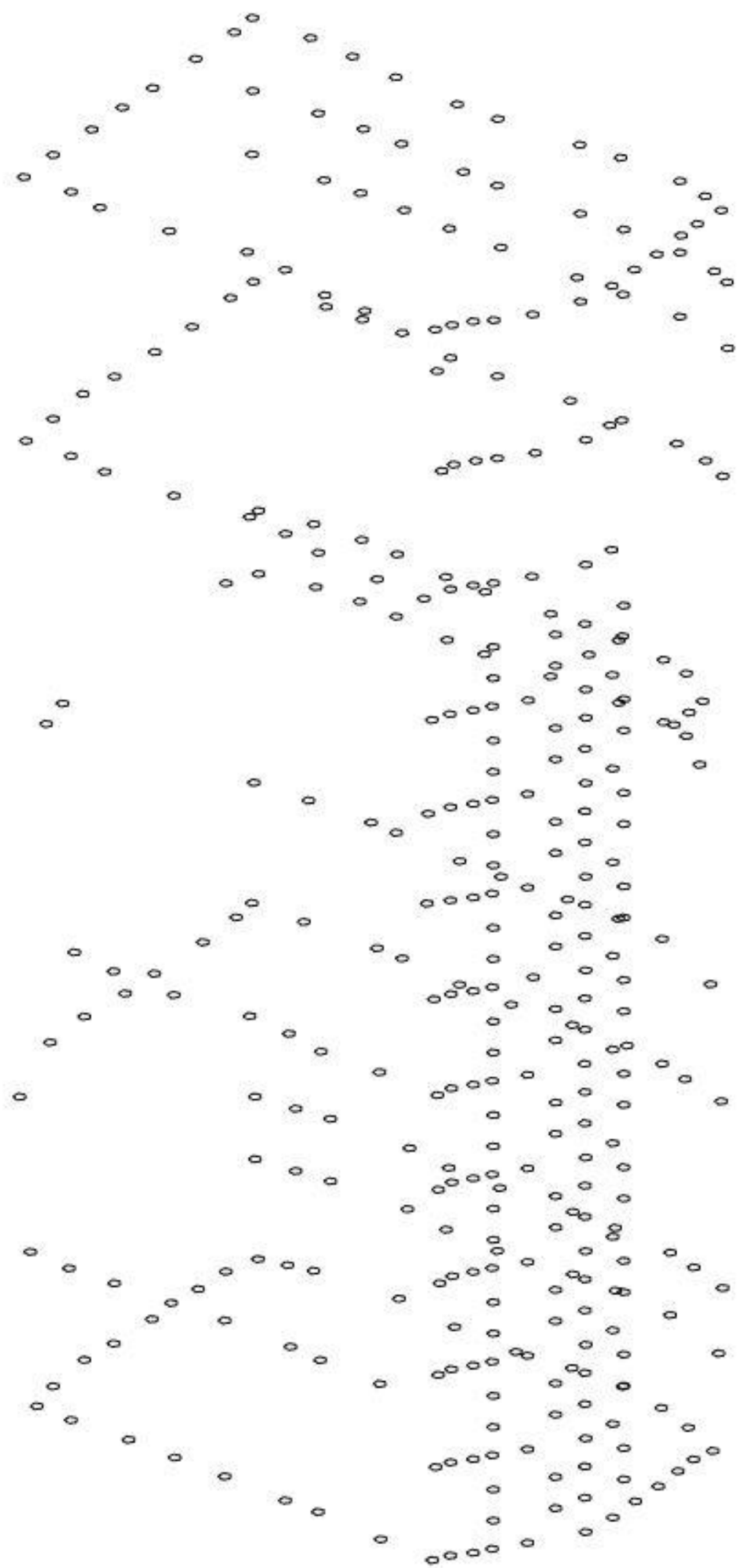
20-30 Arcs & Lines per floor outline

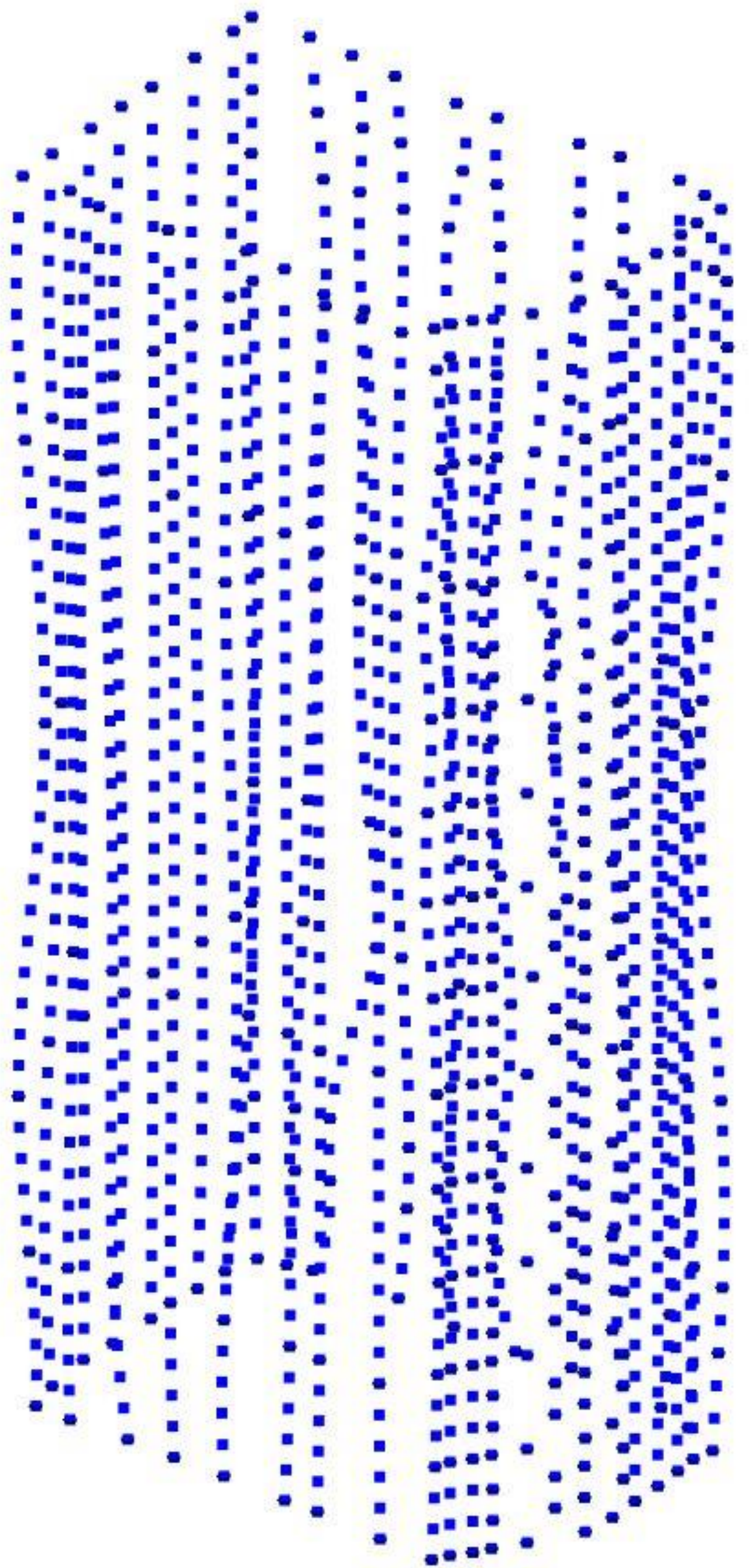
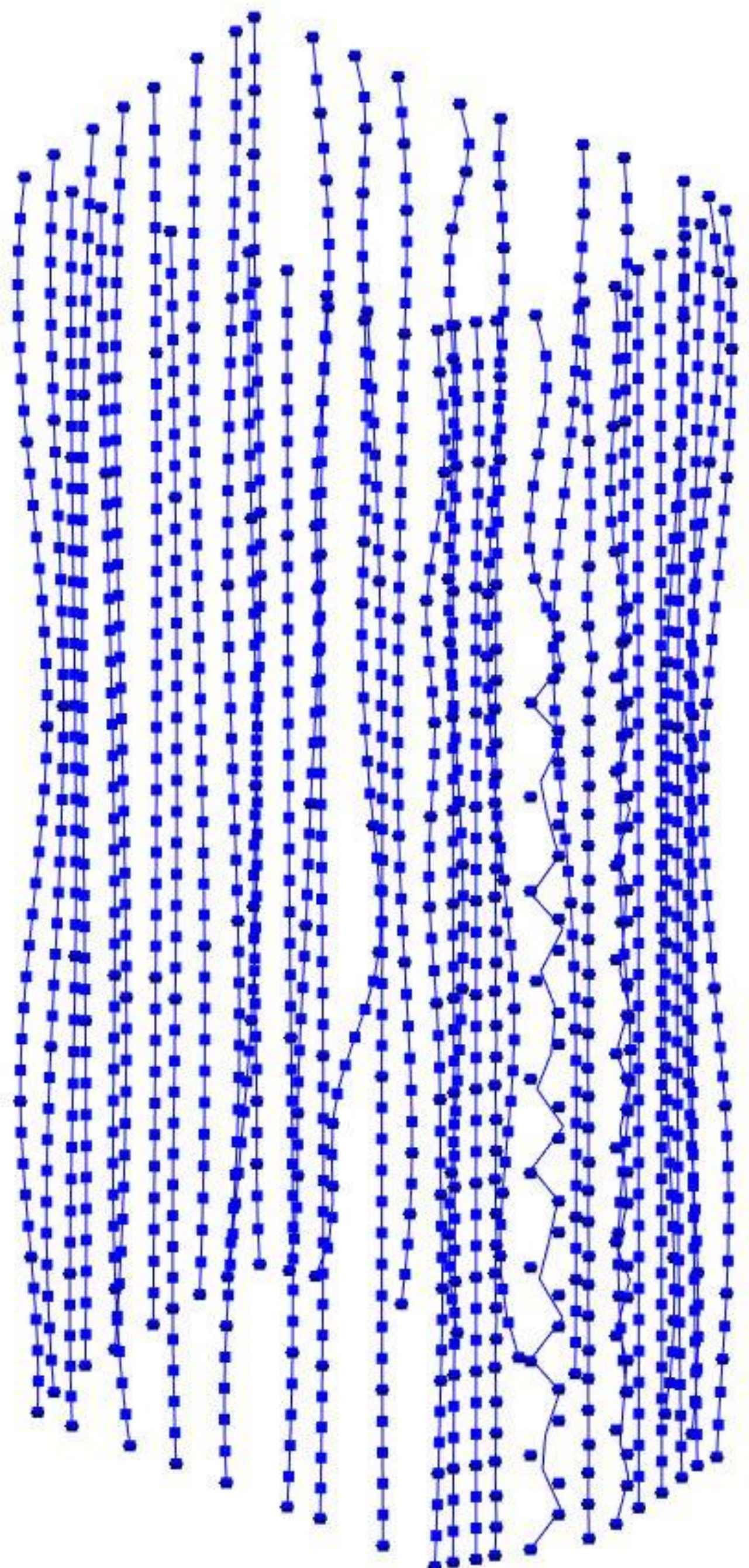
MODEL USING DYNAMO

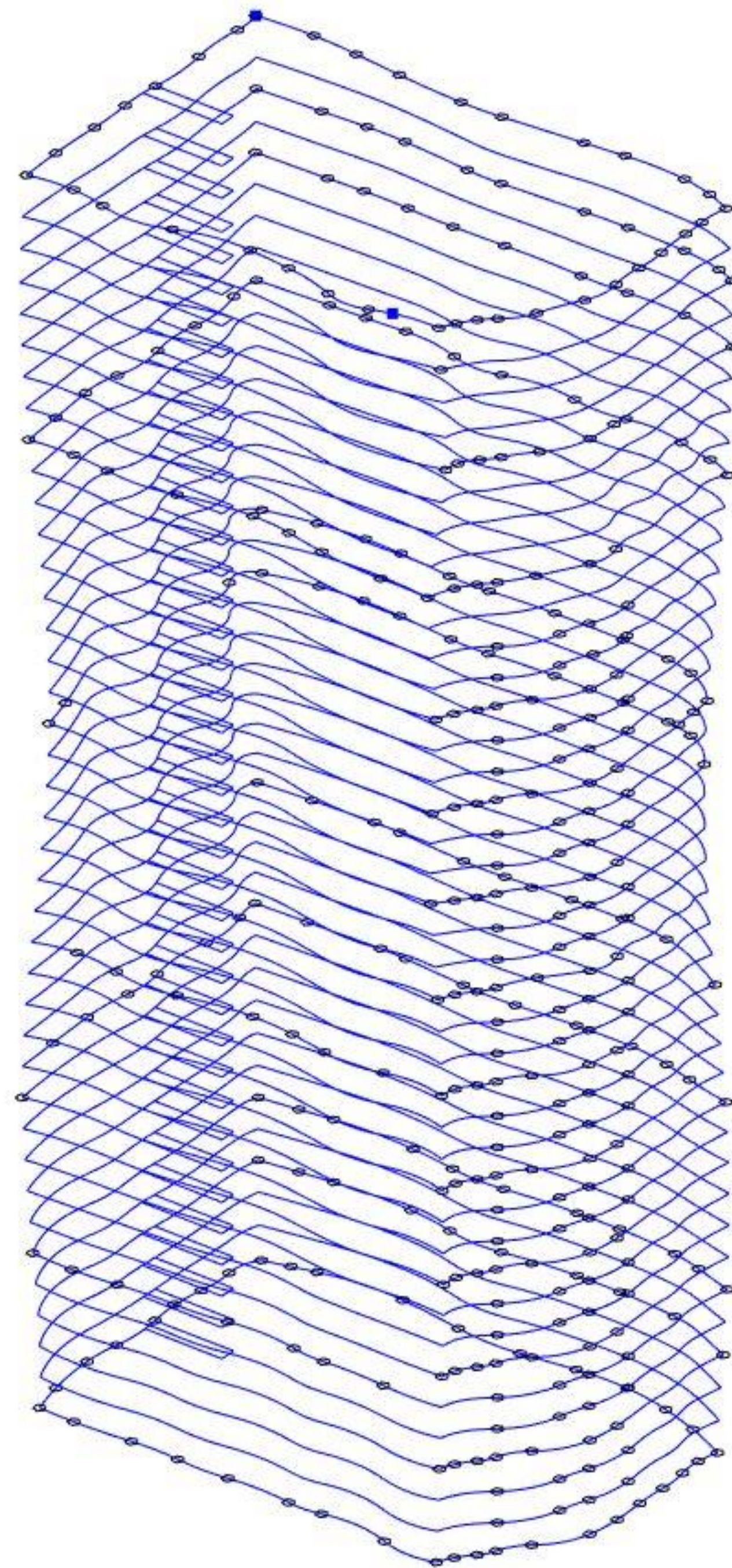
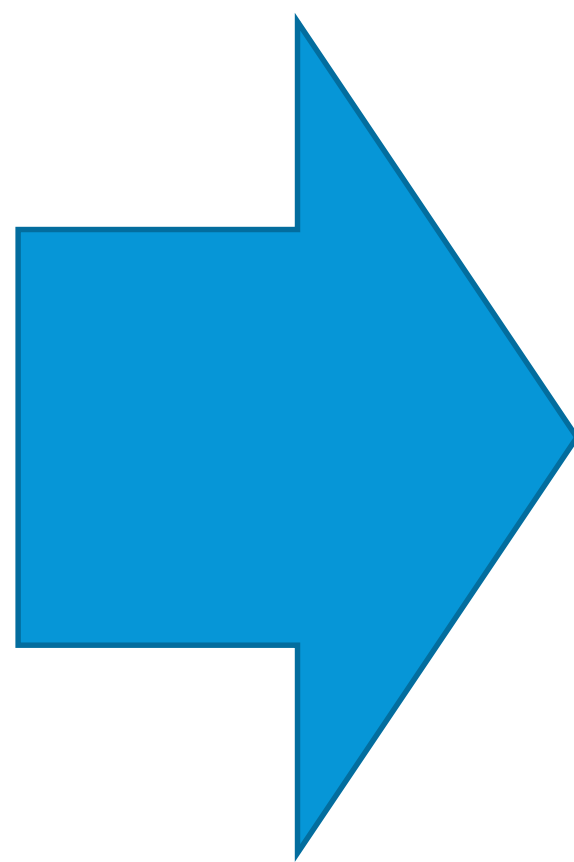
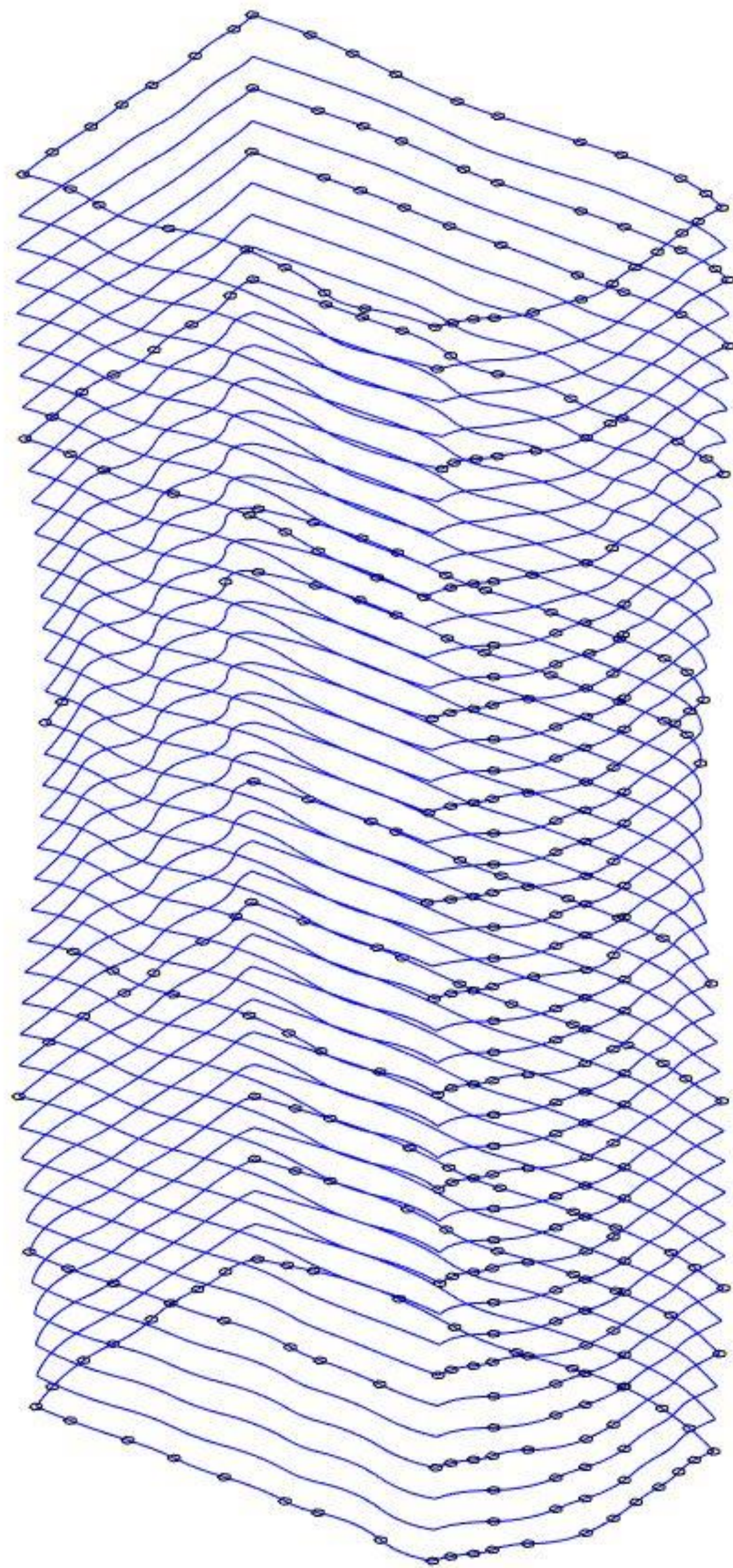


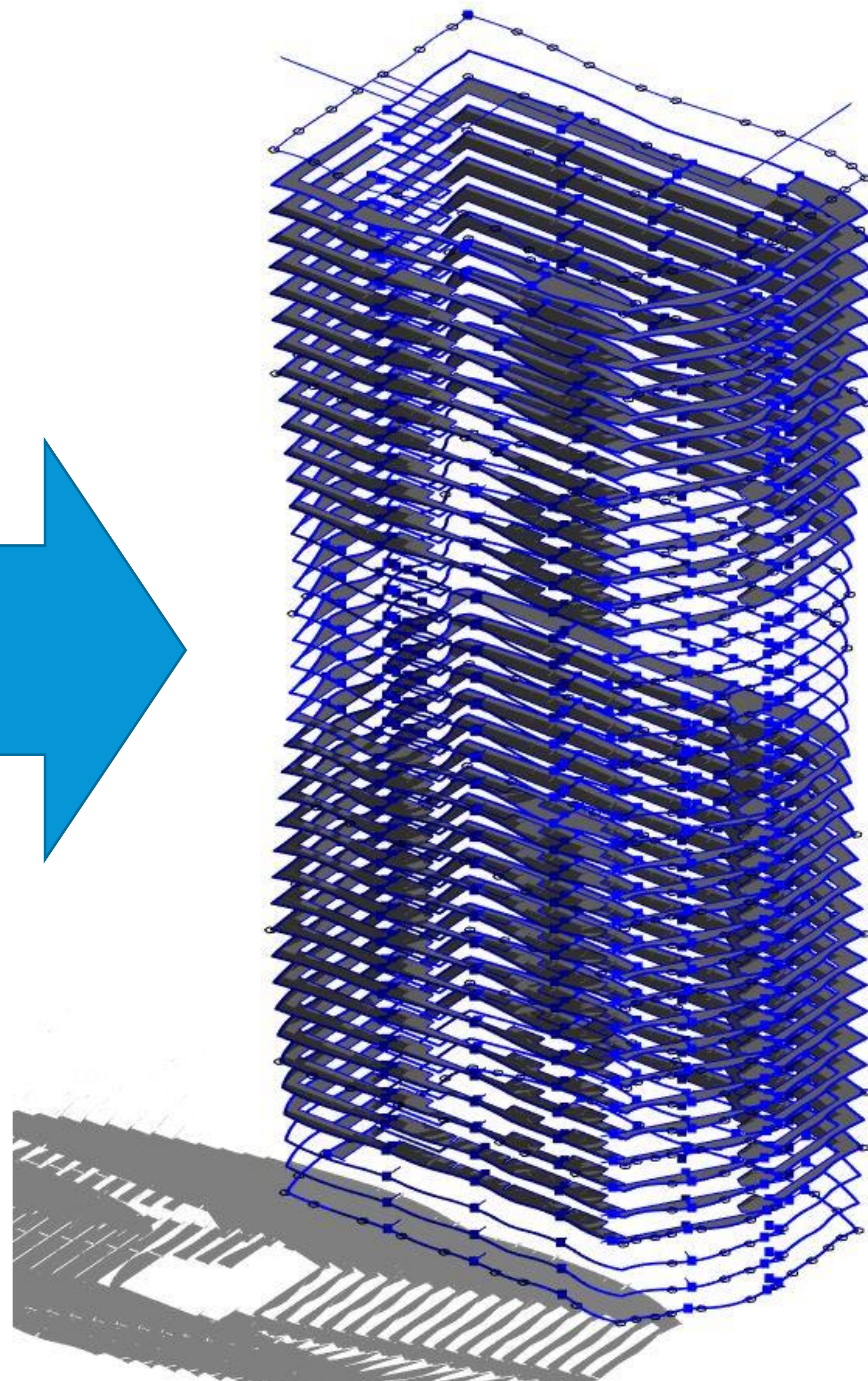
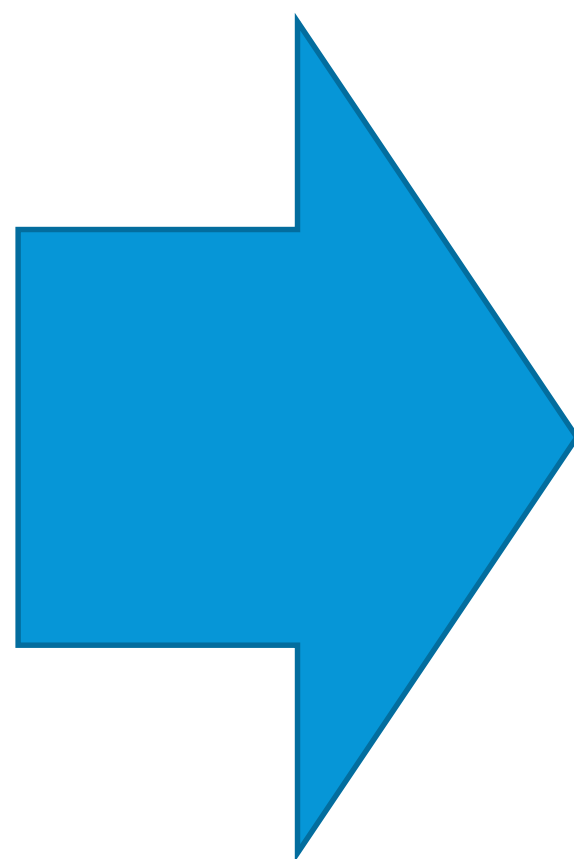
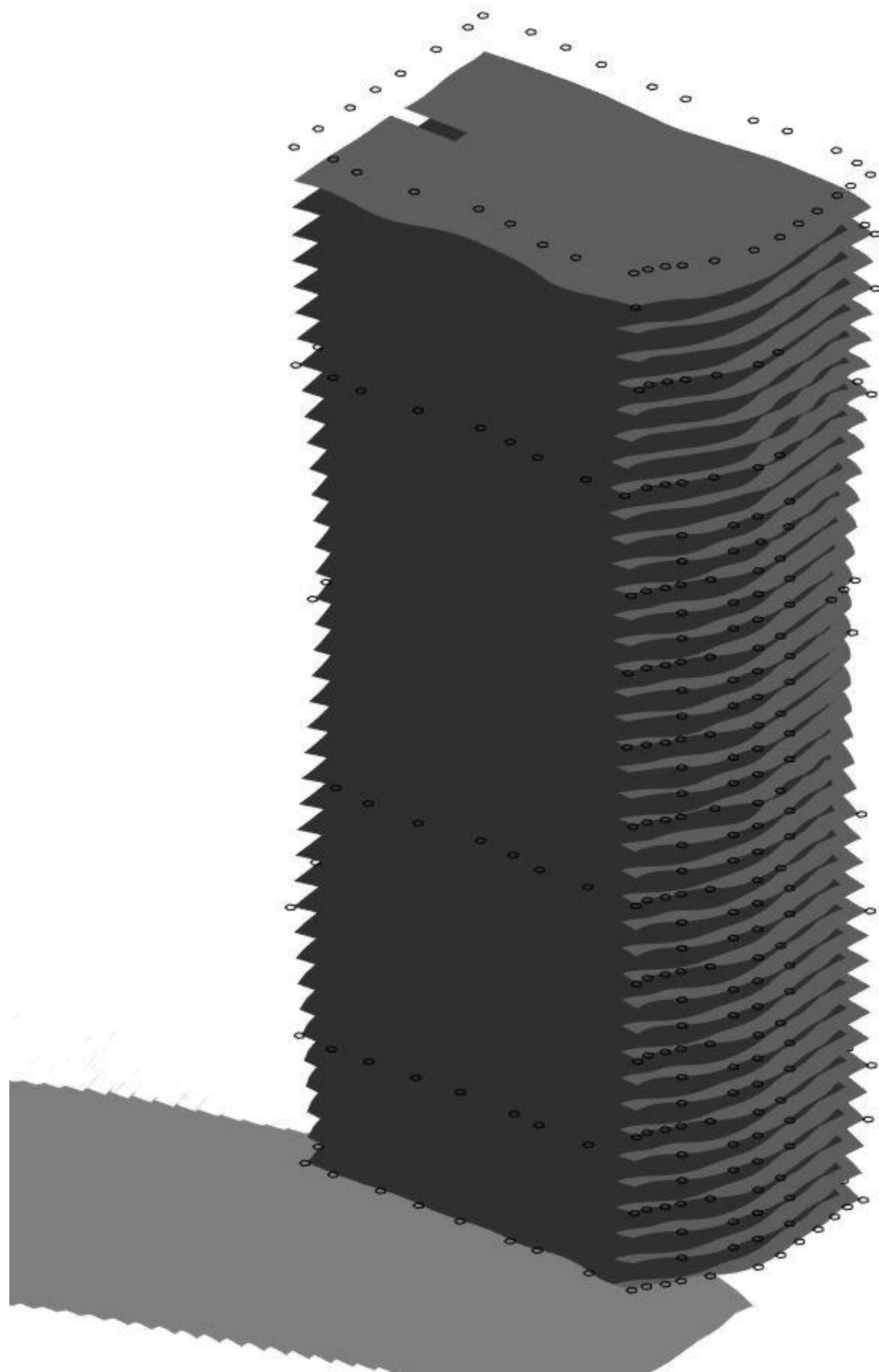


CONSTRAINTS CREATED USING MODEL
LINES AND GENERIC MODEL FAMILIES









0

1

2

3

4

5

6

7

8

Code Block

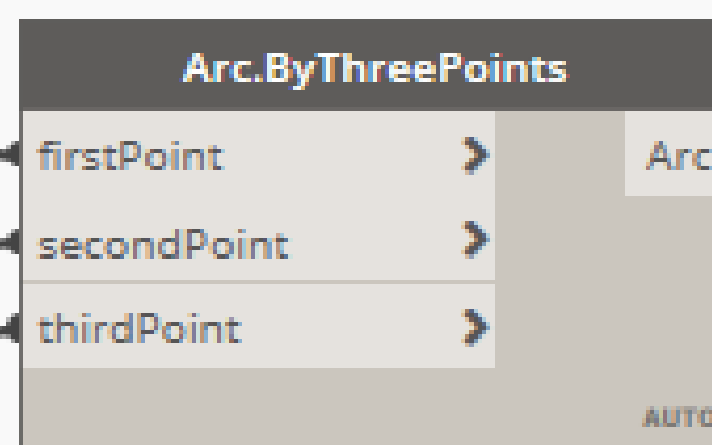
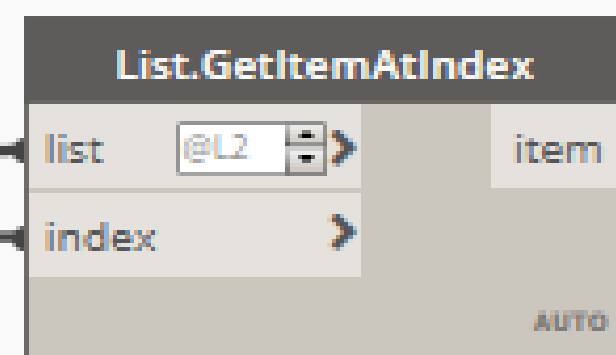
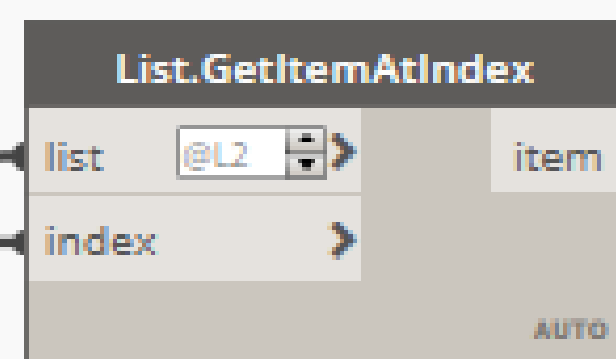
```
0;
```

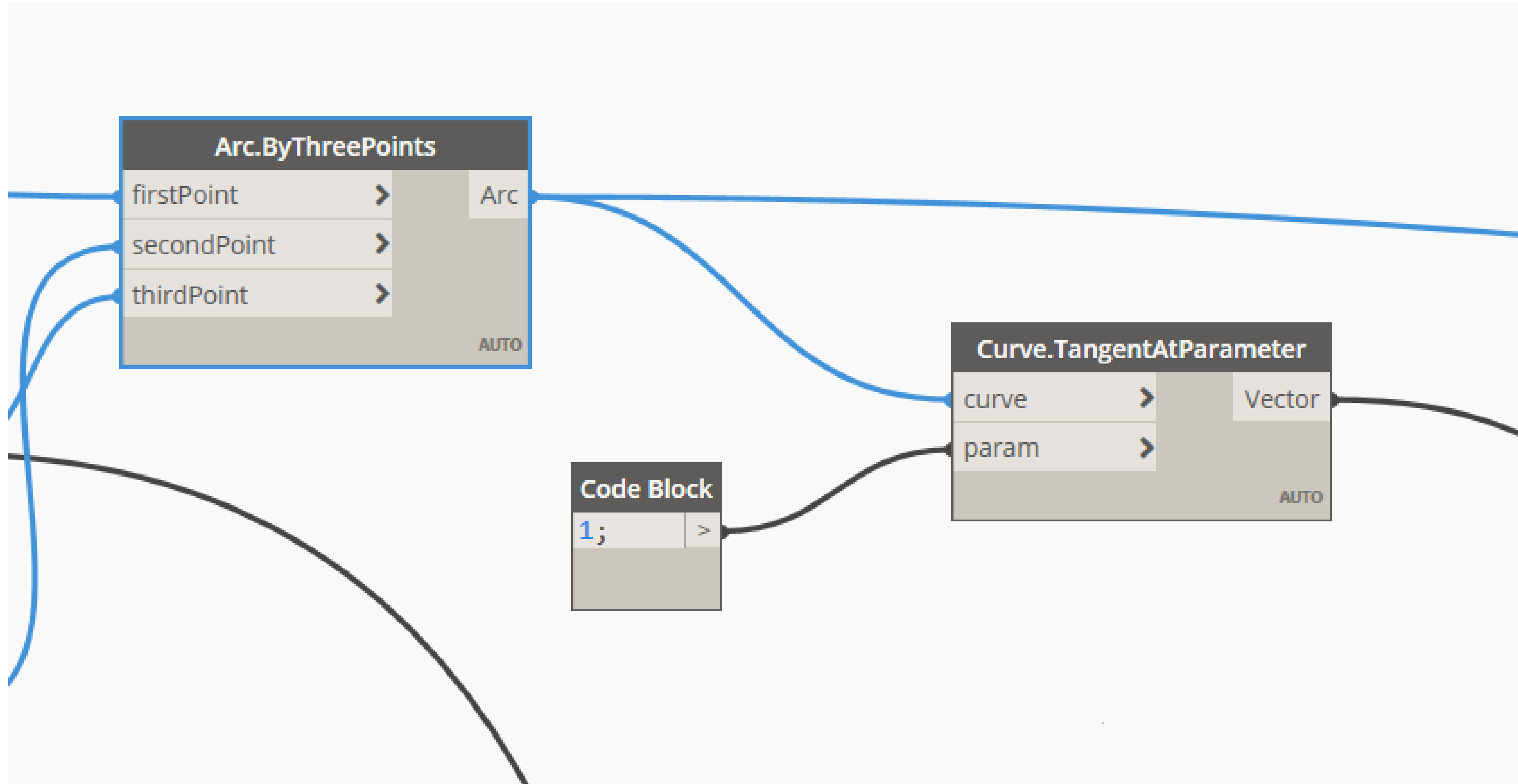
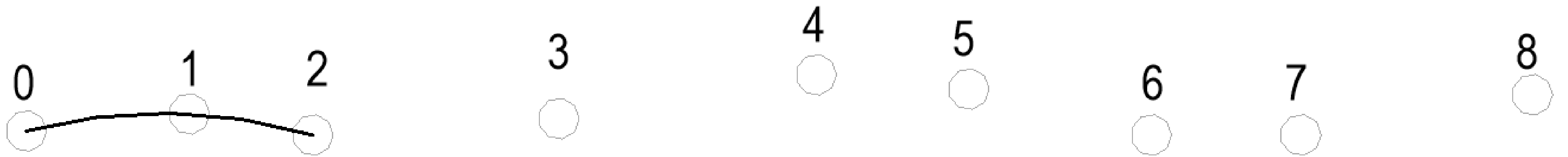
Code Block

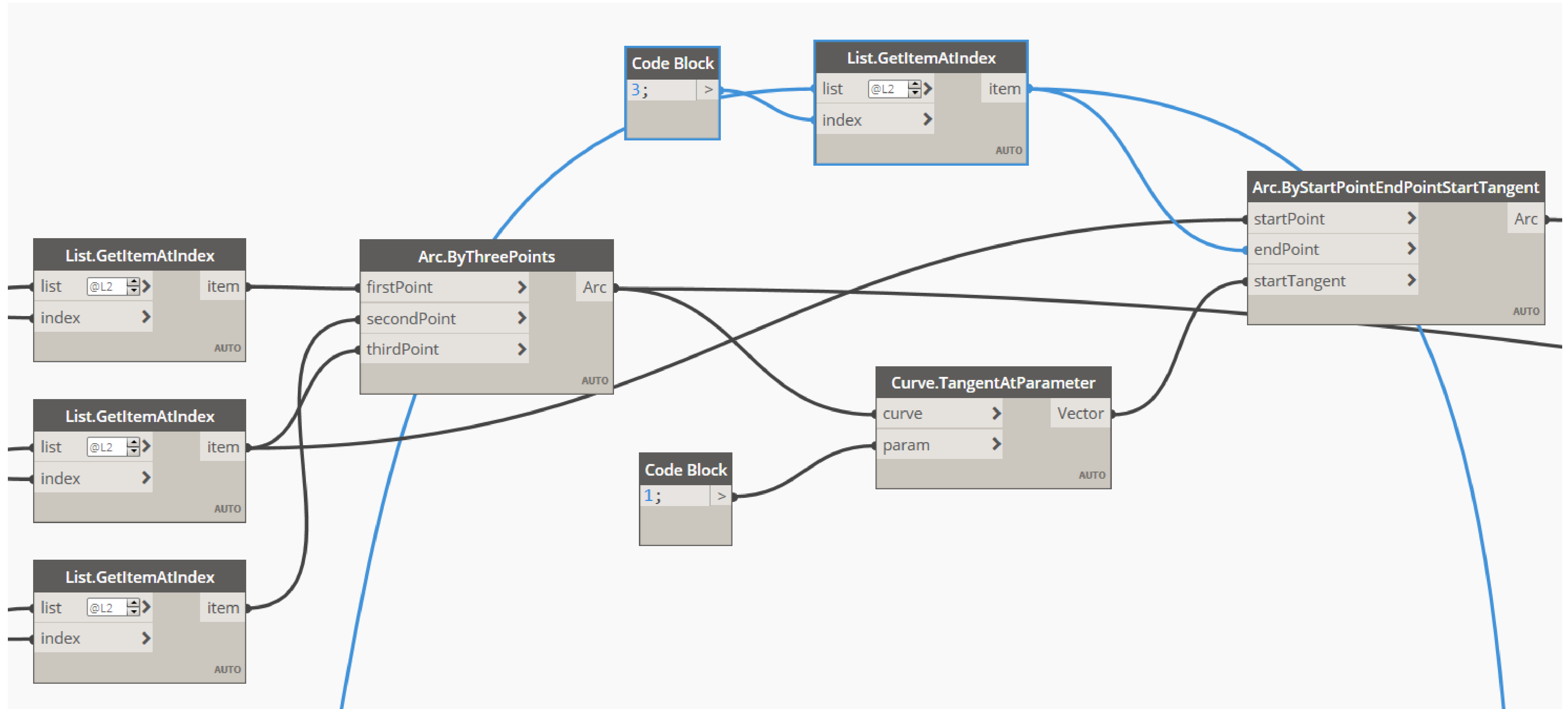
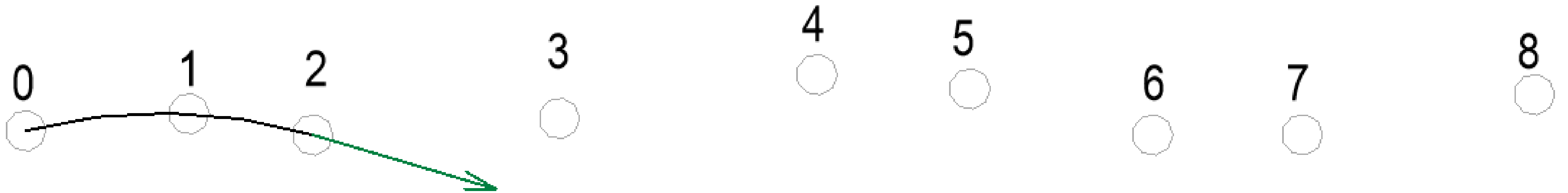
```
2;
```

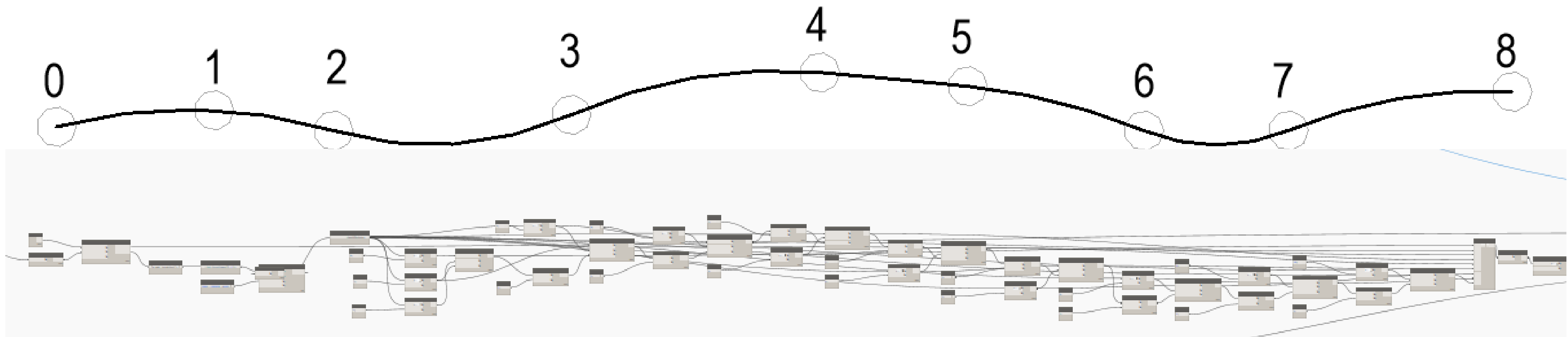
Code Block

```
1;
```





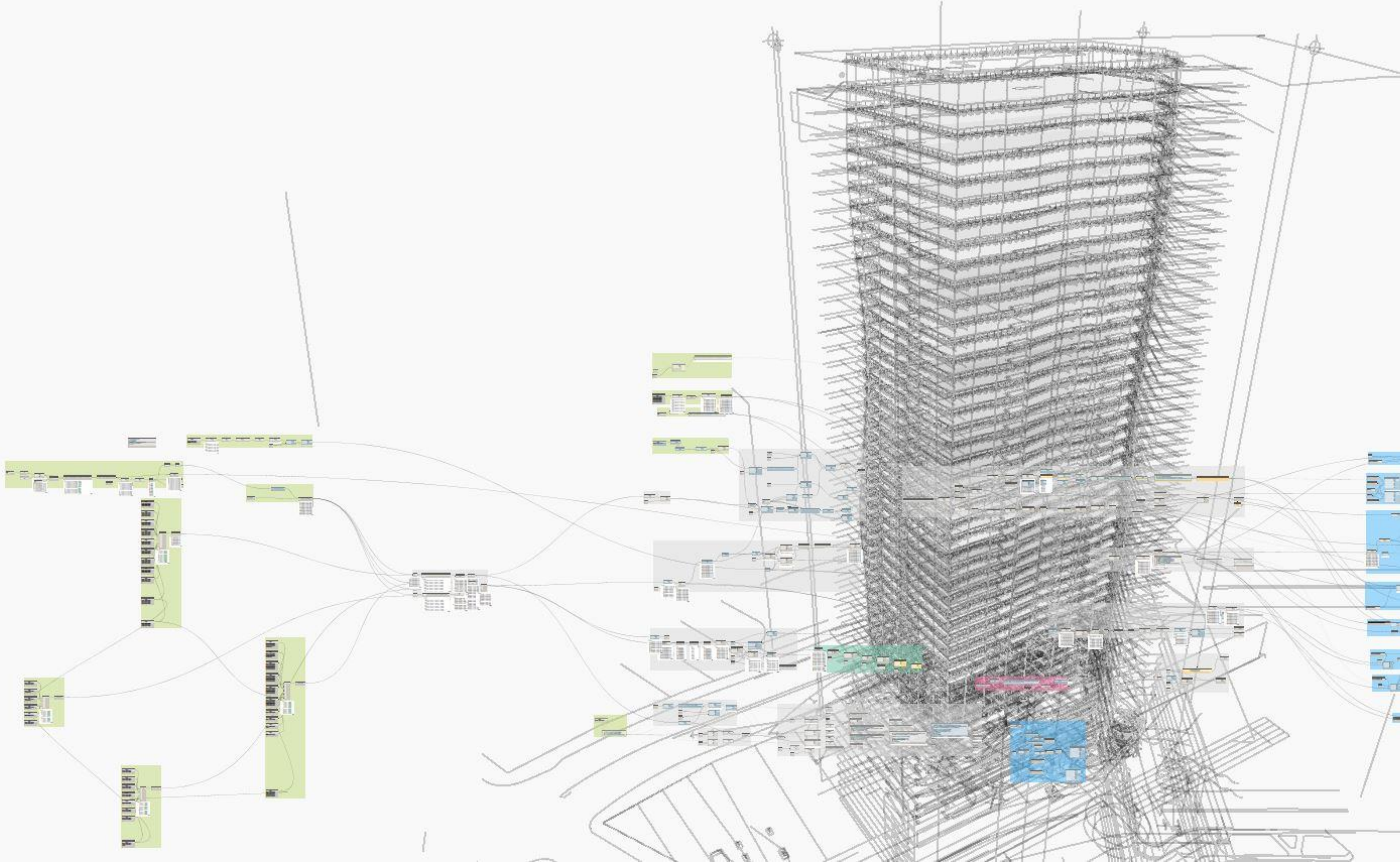


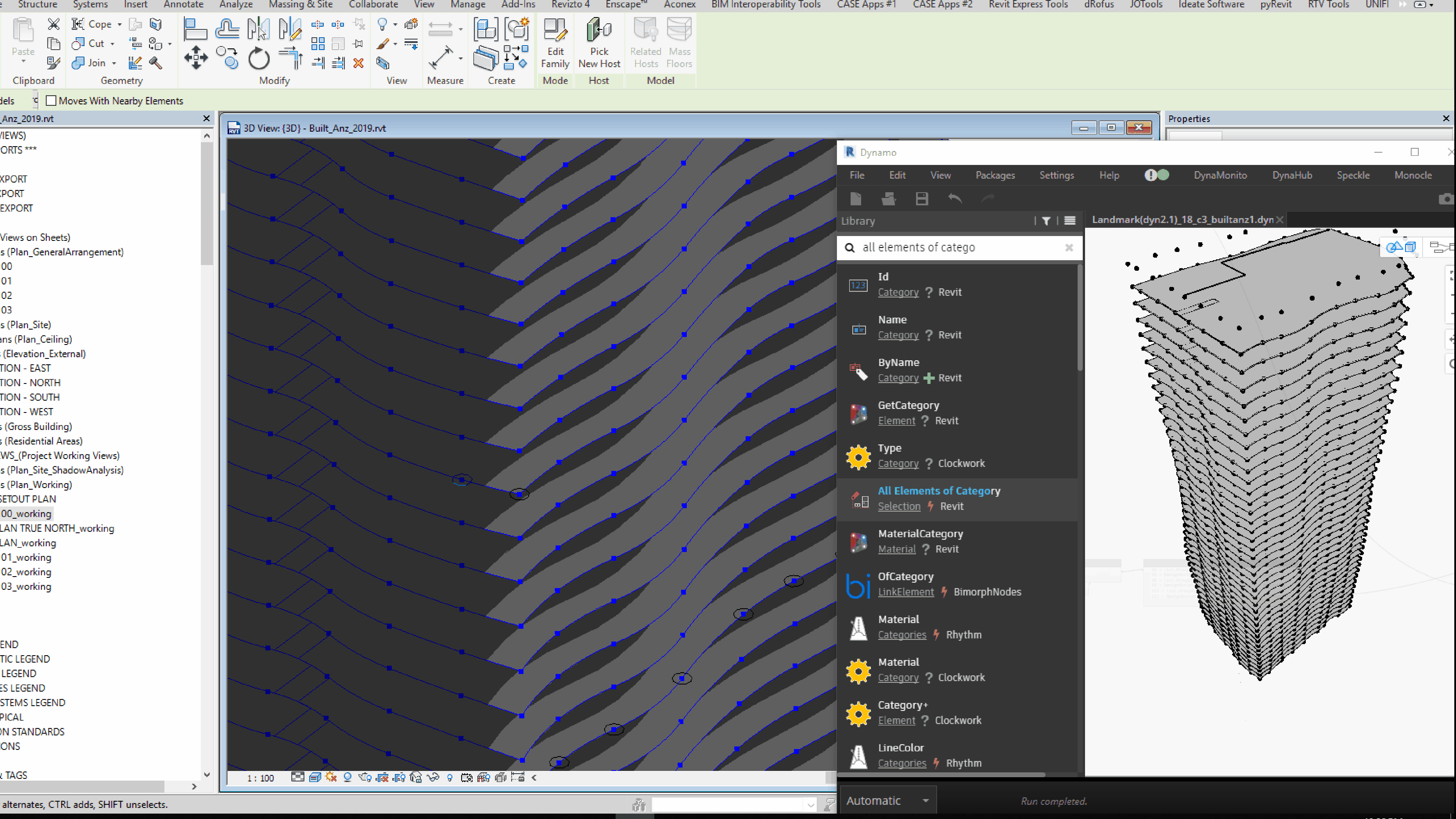


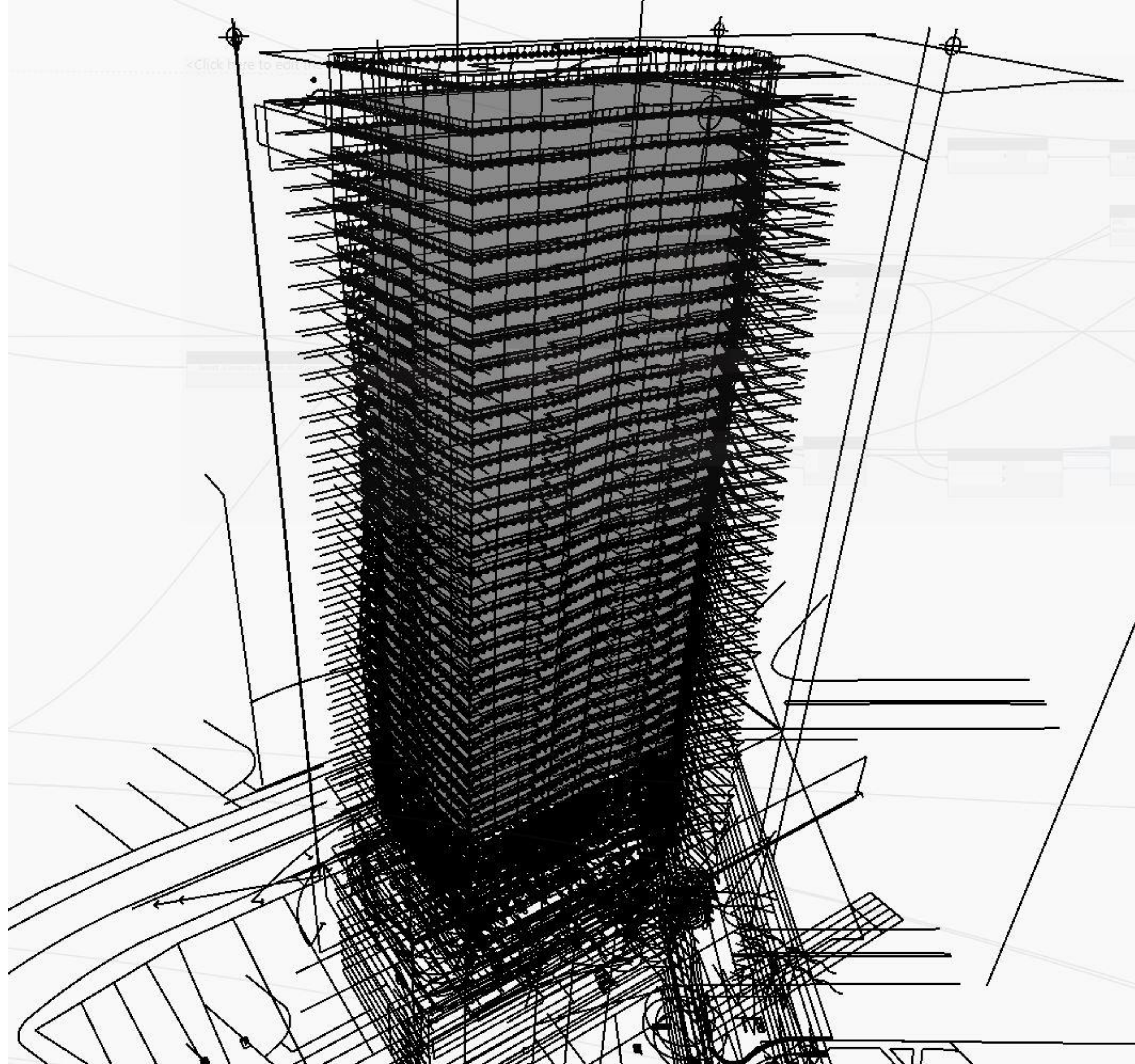
```

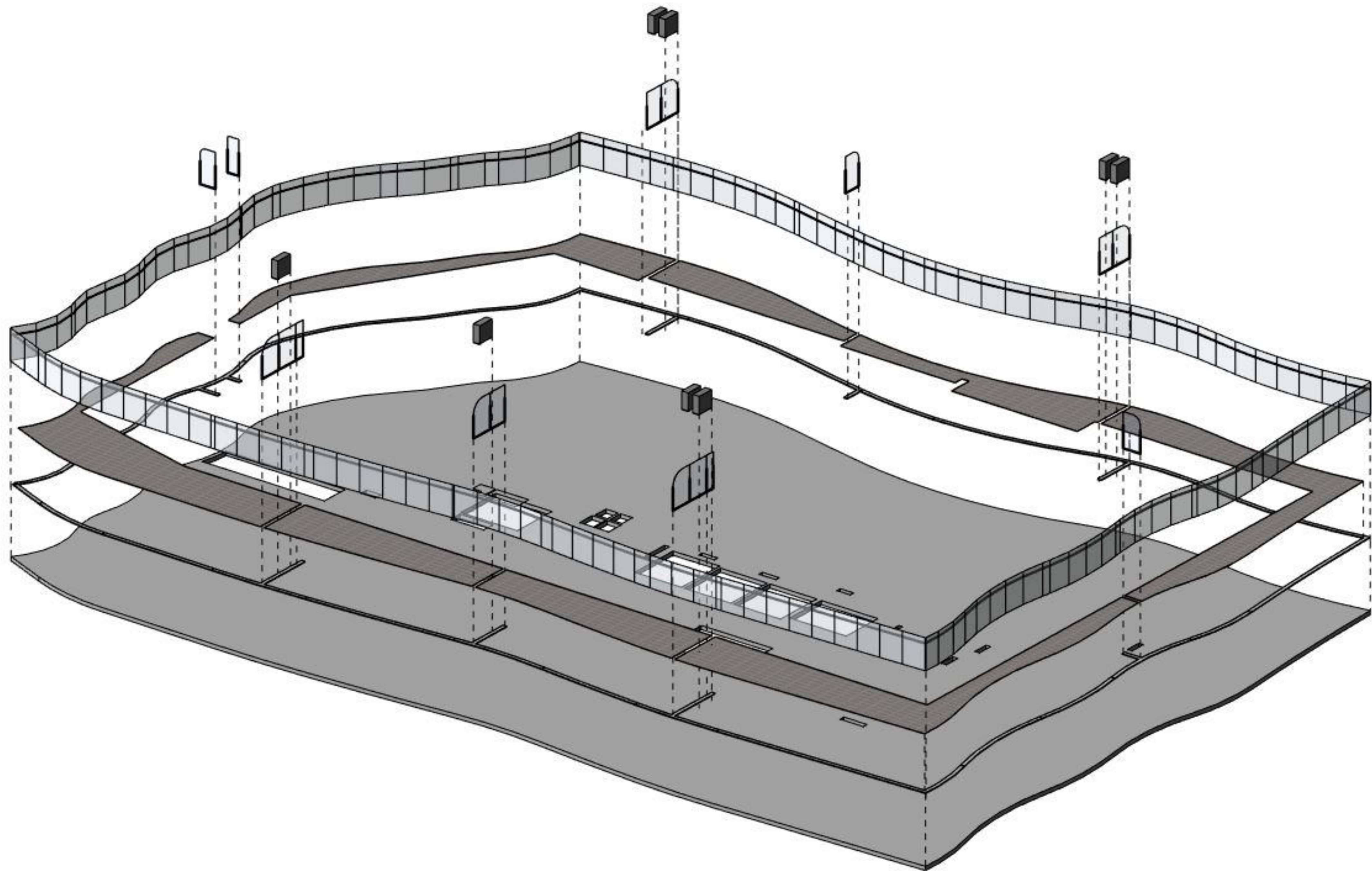
12 try:
13     errorReport = None
14     crvs = []
15     for e in pnts:
16
17         arcs = []
18         a1=Arc.ByThreePoints(e[0],e[1],e[2])
19         arcs.append(a1)
20
21
22         for ind, i in enumerate(e[3:]):
23             try:
24                 afnd = Arc.ByStartPointEndPointStartTangent(arcs[ind].EndPoint,i,arcs[ind].TangentAtParameter(1))
25                 arcs.append(afnd)
26             except:
27                 afnd = Line.ByStartPointEndPoint(arcs[ind].EndPoint,i)
28                 arcs.append(afnd)
29
30         crvs.append(PolyCurve.ByJoinedCurves(arcs))
31 except:
32     # if error occurs anywhere in the process catch it
33     import traceback
34     errorReport = traceback.format_exc()
35 #Assign your output to the OUT variable
36 if errorReport == None:
37     OUT = crvs
38 else:
39     OUT = errorReport

```

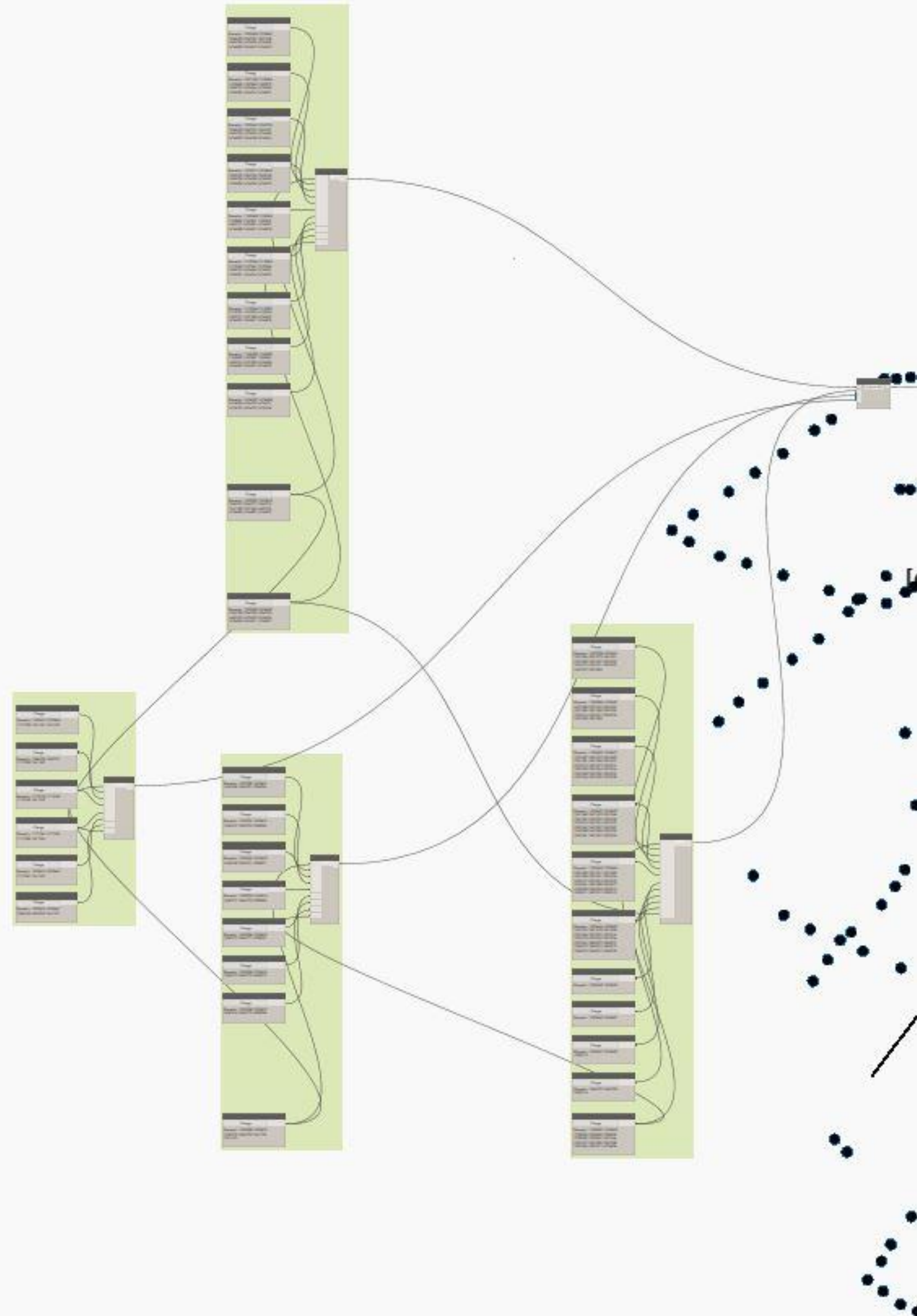
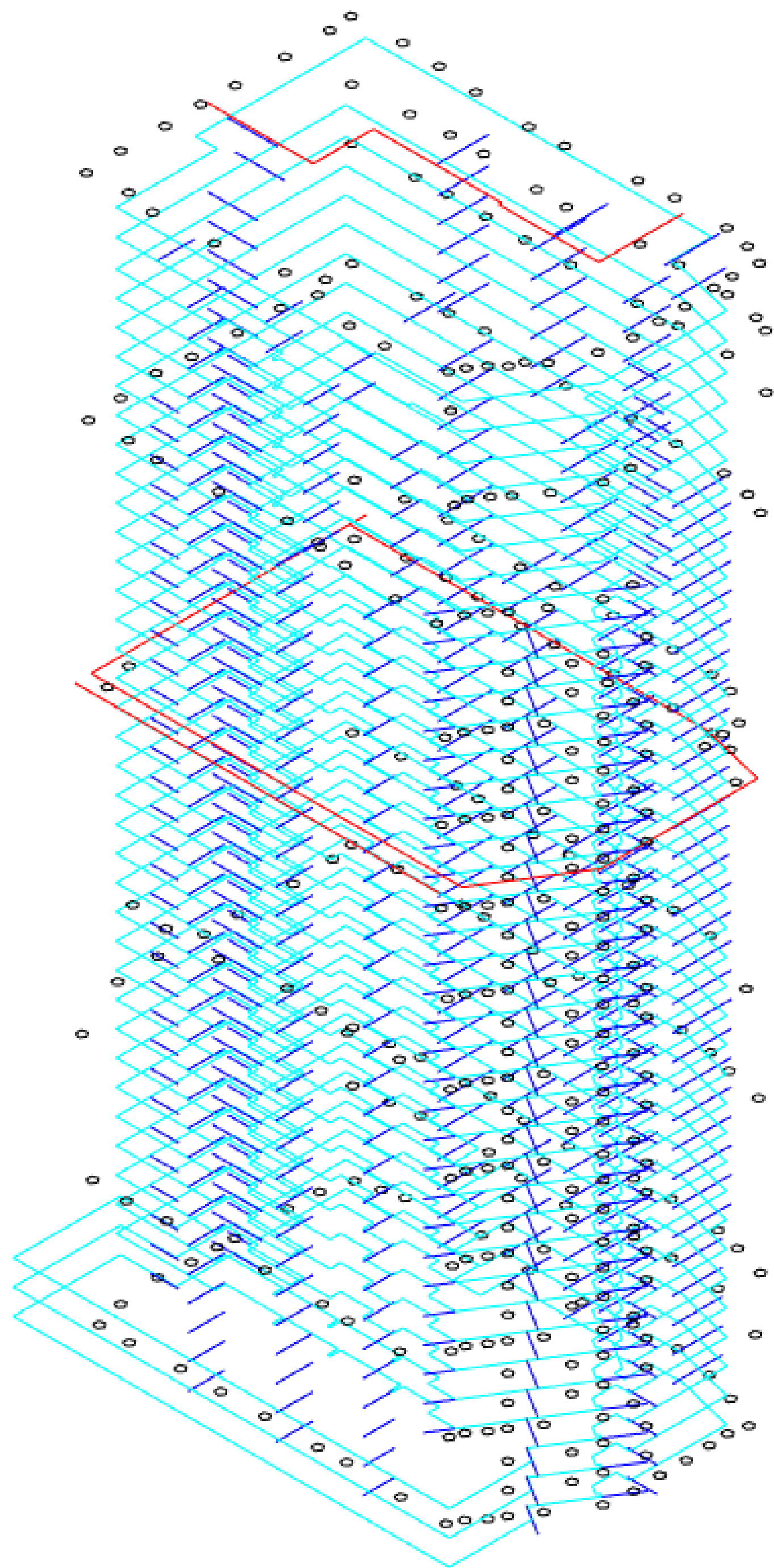









SELECTION



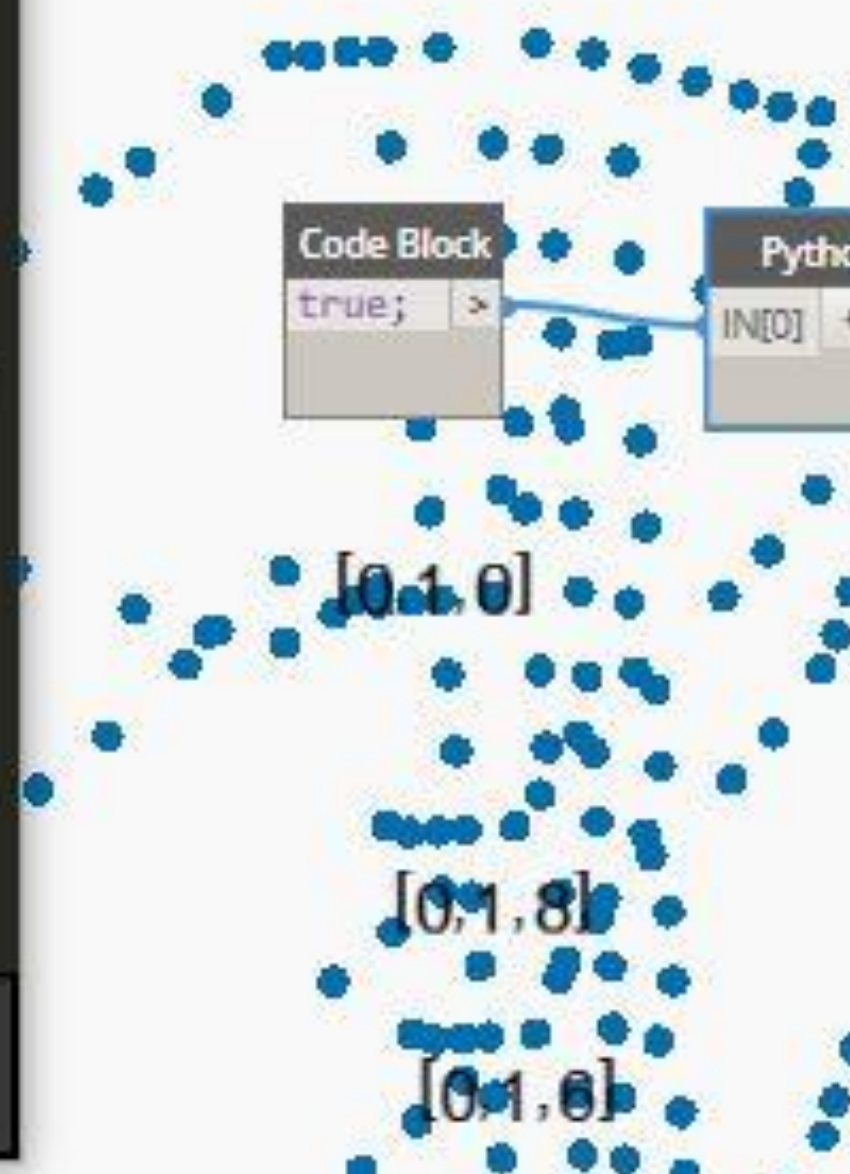
Select model
elements


```
Python Script
66 return e
67 if IN[0] == True:
68     collector = FilteredElementCollector(doc).OfCategory
        (BuiltInCategory.OST_GenericModel).WhereElementIsNotElementType
        ().ToElements()
69
70 gms =[]
71 pnts =[]
72 for i in collector:
73     if i.Name == "BalconyControls":
74         gms.append(i)
75         pnts.append(i.Location.Point.ToPoint())
76 comments=[]
77 for i in gms:
78     comments.append(i.LookupParameter("Comments").AsString())
79
80 FilterID=[]
81 for i in gms:
82     FilterID.append(i.LookupParameter("Filter_ID").AsString())
83
84
85 try:
86     #TransactionManager.Instance.EnsureInTransaction(doc)
87     errorReport = None
88     #result1 = ProcessList(DoStuff, inelements)
89     #TransactionManager.Instance.TransactionTaskDone()
90
```

Run Save Changes Revert



Filtered Element
Collector



```
Code Block
true; >
```

```
Python Script
IN[0] + - OUT
```

```
Code Block
t4 t5 = List.GroupByKey(t4[1], t4[2]);
t6 = DesignScript.Dictionary.ValueAtKey(t5, "groups");
t8 = List.GroupByKey(t4[0], t4[2]);
t9 = DesignScript.Dictionary.ValueAtKey(t8, "groups");
t11 = List.GroupByKey(t9@L2<1>, t6@L2<1>);
t12 = DesignScript.Dictionary.ValueAtKey(t11, "groups");
```


DIMENSIONS


```

try:
    errorReport = None
    TransactionManager.Instance.EnsureInTransaction(doc)
    dimensions=[]
    opt = Options()
    opt.ComputeReferences=True
    opt.IncludeNonVisibleObjects=True
    opt.View = doc.ActiveView
    for element in inelements:
        geometry = element.get_Geometry(opt)
        for solid in geometry:
            edges= solid.Edges
            #Count number of edges and get half
            n=(edges.Size-1)/2
            for i, edge in enumerate(edges):
                #Check if edges are flat and contained in second half of the enumeration
                if edge.Evaluate(1).Z == edge.Evaluate(0).Z and i>=n:
                    #Create start point
                    pnt =edge.Evaluate(0)
                    #create lists for distance measurement for vertical and horizontal
                    disth=[]
                    distv=[]
                    #create list of distances between curve start point and grid horizontal
                    for h in hgridcurves:
                        disth.append(h.Curve.Distance(pnt))
                    #get first item of the above list after sorting the values
                    minh = sorted(disth)[0]
                    #create list of distances between curve start point and grid vertical
                    for v in vgridcurves:
                        distv.append(v.Curve.Distance(pnt))
                    #get first item of the above list after sorting the values
                    minv = sorted(distv)[0]
                    #create horizontal lines from point for dim placement
                    lh=Line.CreateUnbound(pnt,XYZ(0,1,0))
                    for h in hgridcurves:
                        #check if the distance to grid is equal to minimum
                        if h.Curve.Distance(pnt) == minh:
                            refgh=h
                            break
                    lv=Line.CreateUnbound(pnt,XYZ(1,0,0))
                    for v in vgridcurves:
                        #check if the distance to grid is equal to minimum
                        if v.Curve.Distance(pnt) == minv:
                            refgv=v
                            break
                    #Create reference arrays
                    elementsRefh=ReferenceArray()
                    elementsRefv=ReferenceArray()
                    #get reference to curve start point
                    pntref = edge.GetEndPointReference(0)
                    #add references to arrays
                    elementsRefh.Append(pntref)
                    elementsRefh.Append(Reference(refgh))
                    elementsRefv.Append(pntref)
                    elementsRefv.Append(Reference(refgv))
                    #create dimensions
                    dimh= doc.Create.NewDimension(doc.ActiveView,lh,elementsRefh)
                    dimv= doc.Create.NewDimension(doc.ActiveView,lv,elementsRefv)
                    dimensions.append([dimh,dimv])

```

- Get solid of floor element
- Get edges of the solid
- Discard edges underside of slab
- Get Edge start points
- Calculate Distance between curve start point and each grid
- Create reference for grid at the minimal distance to point
- Add items to Reference Array
- Create dimension

*A reference **stable representation** string is a collection of Uniquelds combined with table indices, delimited by the colon : character. ... The structured data contained in the string can be used to reliably access geometry objects that are not completely exposed by the **API**.*

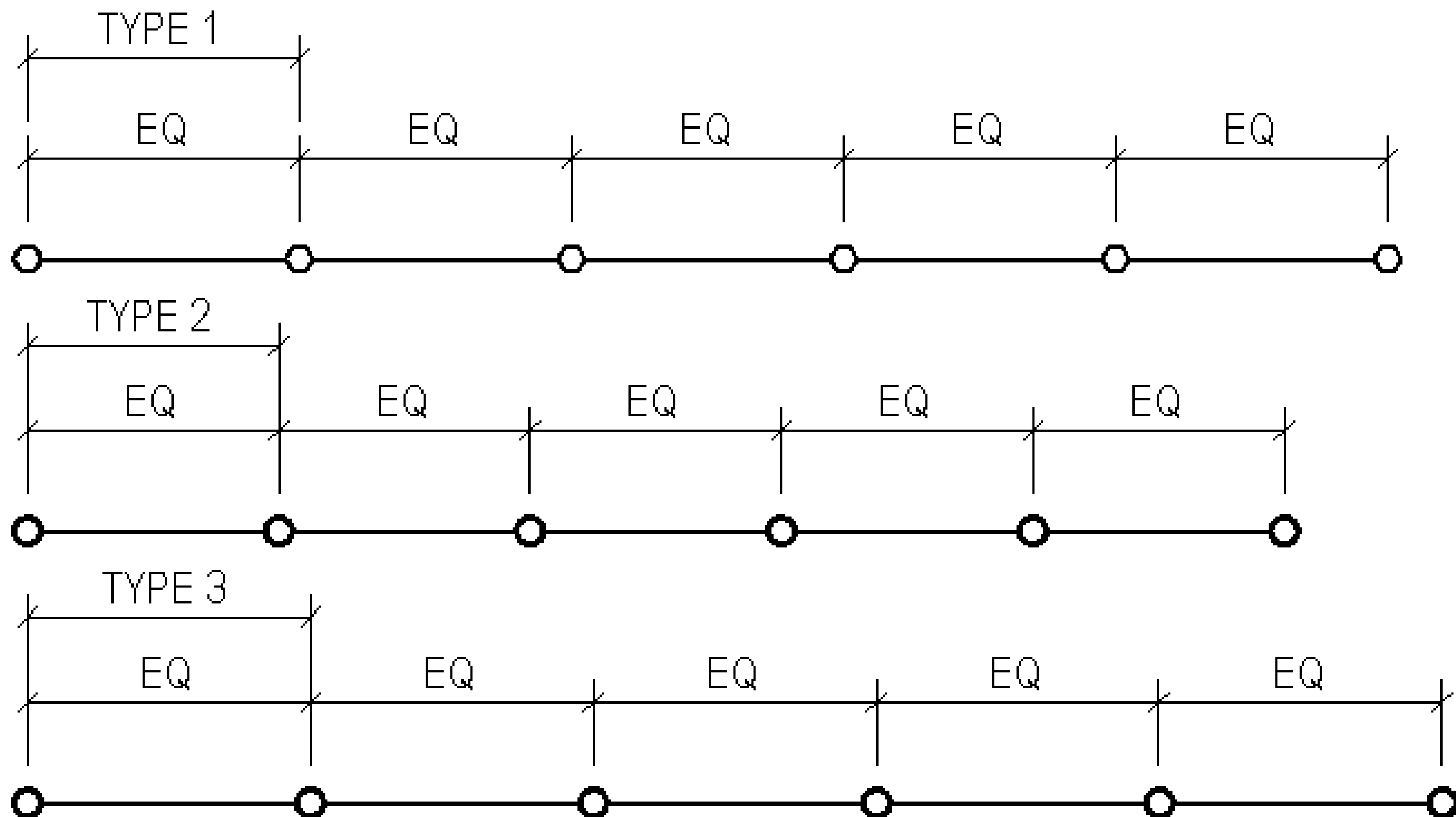
Jeremy Tammik

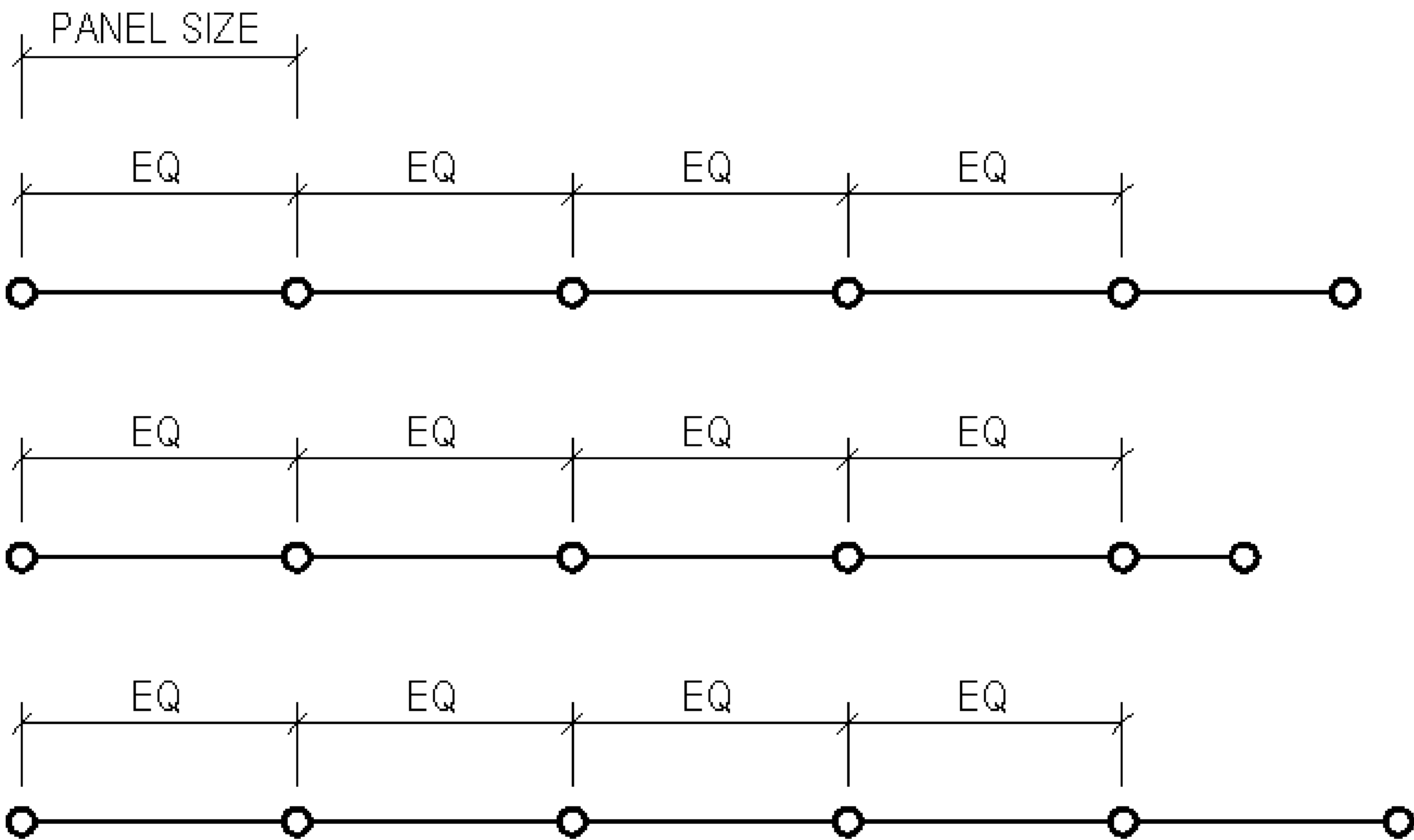
<https://thebuildingcoder.typepad.com/blog>

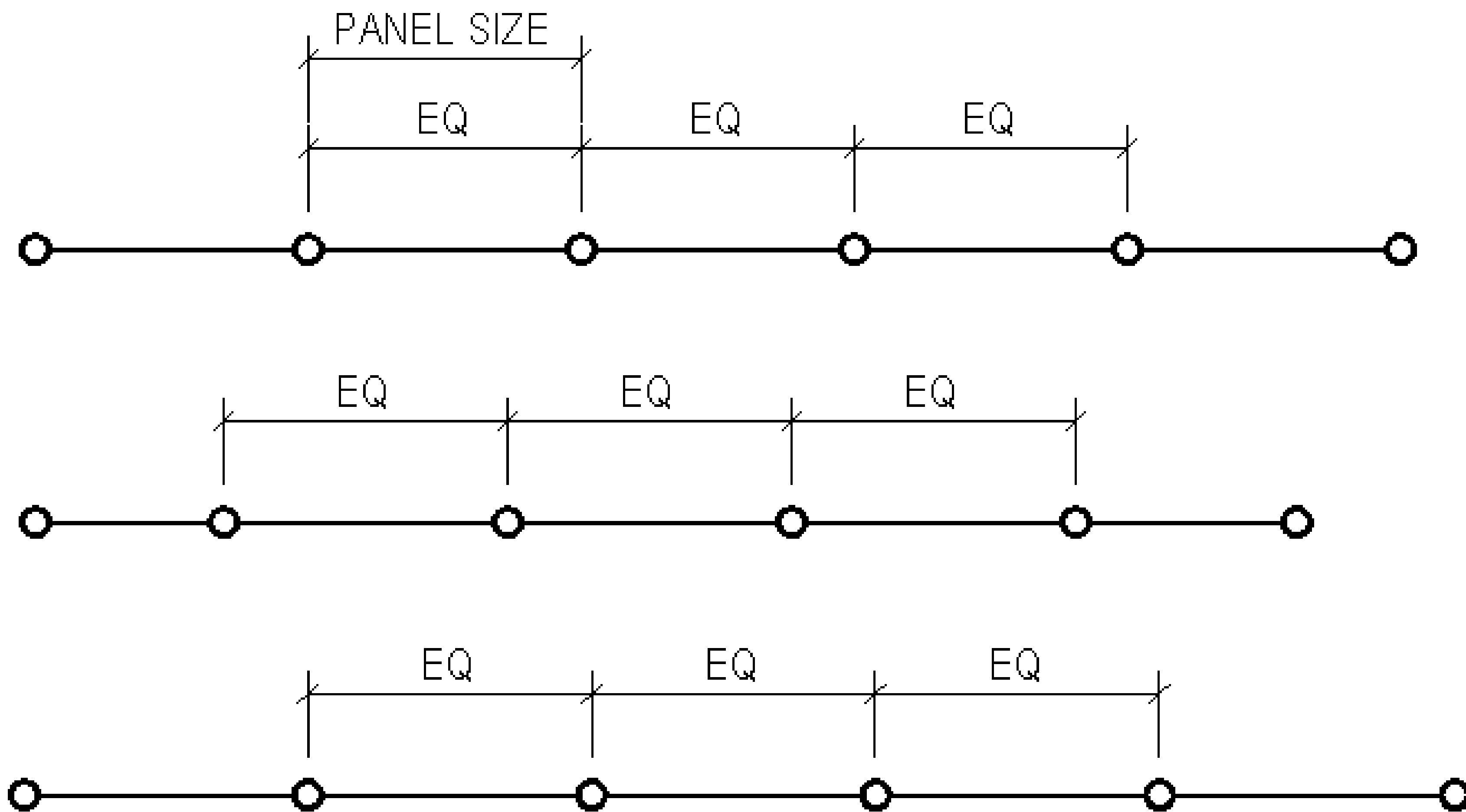
A reference string for a **PlanarFace** of a **FamilyInstance** element – accessed through its **GetSymbolGeometry** method – looks like this:

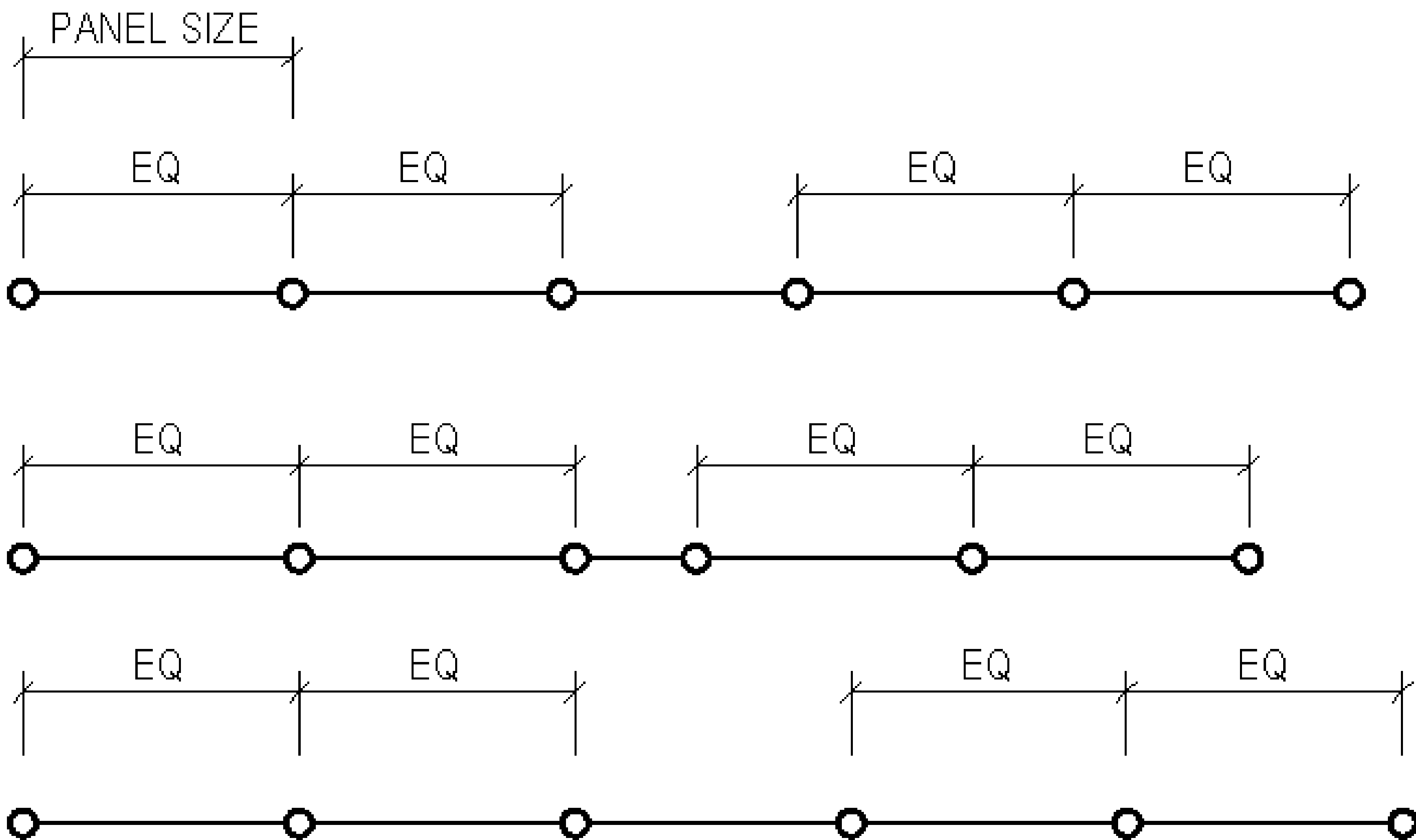
```
66a421da-90cb-4df2-8efe-c312e4f78aa0-  
0003d32b:0:INSTANCE:a2177cbb-03d8-4416-a4d8-8ada6fc0165a-  
0003ebf0:78:SURFACE
```


BALUSTRADE



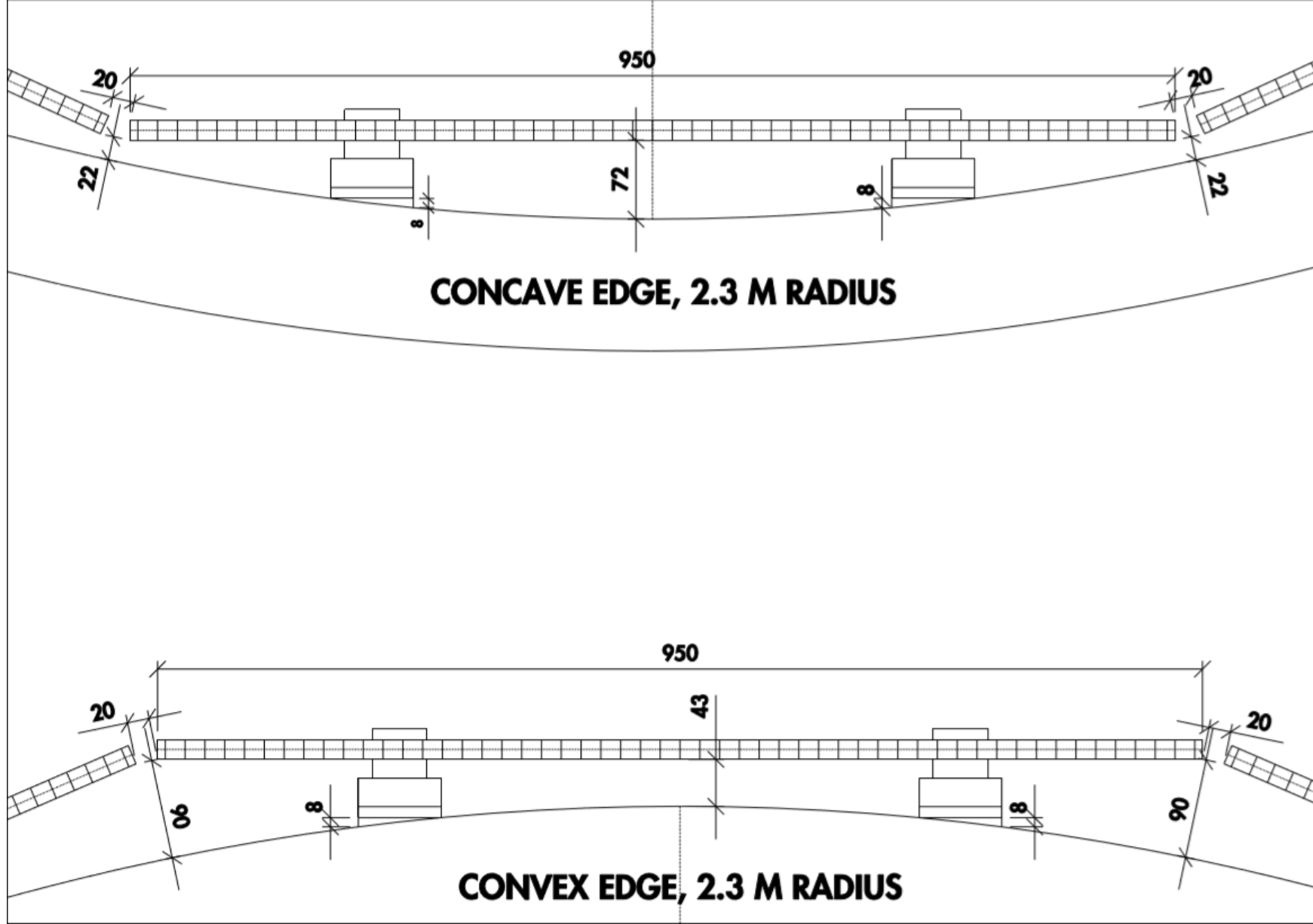






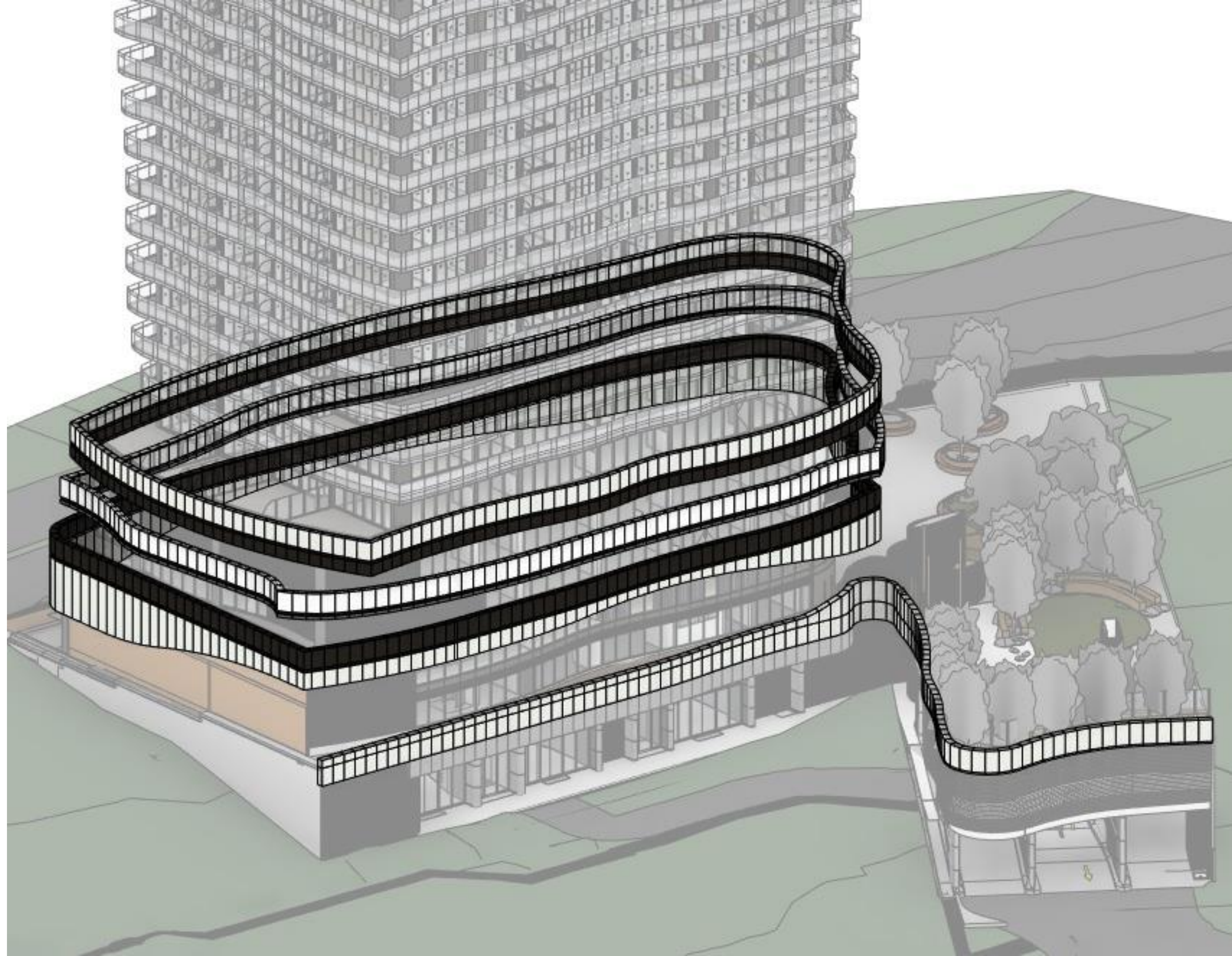
Code Block

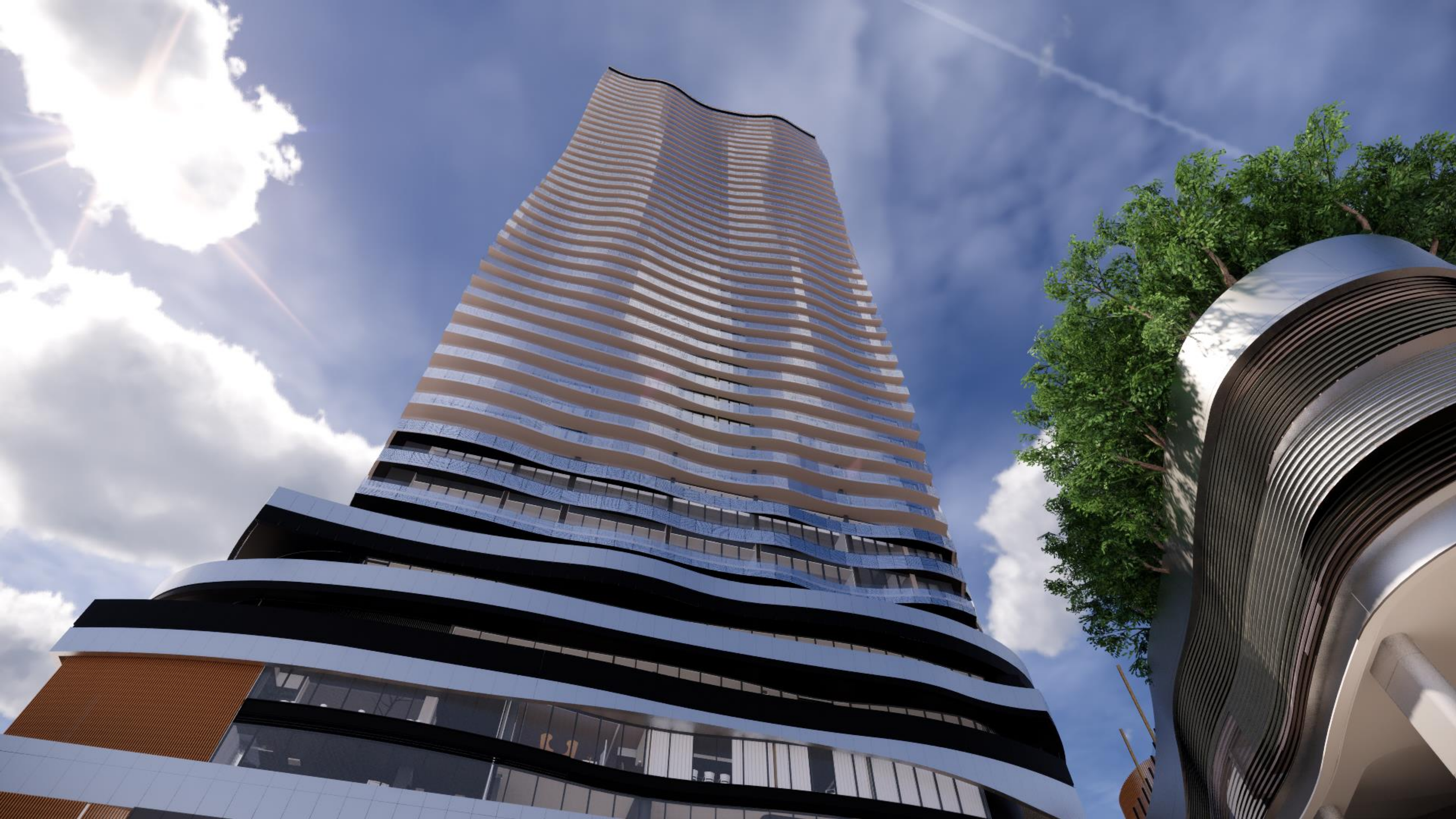
```
pclist pc = pclist;  
panellength =1000;  
divide =[Imperative]  
  
{  
    //create an empty list  
    ret=[];  
    for(i in 0..List.Count(pc)-1)  
    {  
        for(j in 0..List.Count(pc[i])-1)  
        {  
            //split polycurve in the middle  
            split = pc[i][j].SplitByPoints(pc[i][j].PointAtParameter(0.5));  
            //first curve add points at segment length from starting point  
            split1 = split[0].PointsAtSegmentLengthFromPoint(  
                split[0].StartPoint,panellength);  
            //second curve reverse add points at segment length from starting point  
            split2 = List.Reverse(  
                split[1].Reverse().PointsAtSegmentLengthFromPoint(  
                    split[1].EndPoint,panellength)  
            );  
            //create a list  
            ret[i][j]=pc[i][j].SplitByPoints(List.Flatten([split1,split2]));  
        };  
    };  
    return = ret;  
};
```

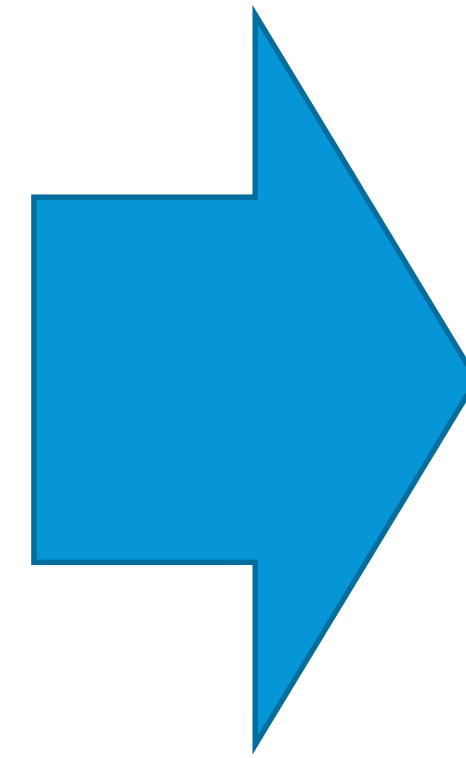
L05	386731	24513	83103	21564	925343	18677	85387	23117	67612	8432.7	3349.8	5035.5	7648.9	15305	39149	18426	9501.7	10031	15648	56440	21775	21426	22228	8071.5	11086	7925.8	28781	15904	13725	17652	11452	4322
L06	474030	41212	23313	12869	44503	43261	52310	69808	22137	7456.7	23849	8732.3	17036	10009	30306	13261	7751.8	8717.4	22211	29213	17786	17900	18869	7662.9	11822	8503	21439	34321	19090	25257	15011	5591.7
L07	1E+06	45306	20594	11914	41917	75827	37745	134411	20502	6766.3	23580	8721.8	16958	9991.3	29311	13039	7570.1	8868.2	19036	23468	17421	16947	17375	7748.6	13329	9645.1	19493	86968	24544	32191	17089	5671.2
L08	0	42019	24363	12785	47607	102480	34198	245095	21970	6209	3349.8	5035.5	7648.9	15305	37073	17705	9014.4	10985	12272	23015	19280	17685	16849	8313.9	16177	11750	19841	210505	26979	34564	17040	4449.3
L09	2E+06	38491	36554	15052	57776	114486	32129	2E+07	23638	5694.1	21498	8633.2	16320	9840.6	29964	12894	7347.2	9349.8	17639	26268	23954	20107	16916	9436.2	21853	15865	21920	196396	25058	31959	15607	3170.6
L10	0	38486	57367	17650	61707	210707	27935	93984	21554	5176.4	21354	8626.5	16273	9829.2	28863	12670	7193.6	9542	19683	35570	34798	24958	17400	11333	35923	25791	25995	102105	21021	27361	13786	2454.4
L11	577305	43921	59616	18484	51401	241601	22472	33691	16682	4651.8	3349.8	5035.5	7648.9	15304	35208	17038	8640.2	12286	16009	65413	70594	34530	18205	14472	109992	73106	33101	59087	17146	23019	12112	2300.6
L12	405835	51910	53927	18580	43183	88079	19039	21281	13417	4173.6	24493	8756.5	17218	10051	23011	11731	6715.7	9604.6	41885	856799	1E+06	56817	19255	19885	105620	92395	45777	39770	14168	19604	10740	2559
L13	522423	55568	56139	19321	41459	79327	17730	18233	11880	3855	24771	8766.5	17294	10068	21999	11490	6575.8	9746.9	99874	77237	63453	145659	20461	30160	37121	30104	70830	29801	12048	17075	9662.6	3198.2
L14	1E+06	48728	72038	21267	46798	129193	18115	19601	11471	3729.5	3349.8	5035.5	7648.9	15304	33522	16420	8366	13908	39826	38318	33632	373748	21696	53683	23489	18979	132039	24065	10576	15240	8832.3	4163
L15	5E+06	35099	133299	25052	65825	669741	20302	27762	11950	3780.6	19880	8553.3	15773	9705.7	25507	11799	6645.5	10657	167263	26563	23571	93364	22767	137653	17926	14488	379405	20537	9578.5	13926	8202.4	5182.1
L16	3E+07	23844	3E+06	31323	131287	87040	24597	74030	13235	3909.7	19309	8522.2	15567	9653.7	25405	11698	6588.6	10903	123714	21150	18666	58264	23451	1E+06	15106	12197	2E+06	18282	8925	13003	7733.5	5738.3
L17	3E+06	18996	251277	36834	299302	62079	28841	136376	14745	4008.9	3349.8	5035.5	7648.9	15304	31991	15846	8176.7	15603	45034	18143	15831	44967	23638	174822	13557	10969	535415	16726	8496.3	12335	7376.3	5491.5
L18	765969	18887	227185	35856	244498	72024	29739	46689	15722	4000.9	37332	9077.1	19925	10611	15131	9803	5748.5	9467.8	168086	16330	14052	38299	23258	125428	12744	10411	522267	15589	8222	11840	7100.9	4807.8
L19	341597	21553	360211	30817	135460	117067	28589	31725	16186	3957	205579	9630	26414	11625	11325	8674.1	5216.5	8368.3	143422	15243	12915	34634	22286	128911	12449	10320	1E+06	14737	8064.6	11475	6893.1	4080.4
L20	188211	25248	802931	26561	97164	233127	28408	23910	16479	3984.8	2831.7	4387.5	6746.7	27942	16016	10386	6028.1	10385	42825	14689	12229	32727	20790	188231	12593	10619	610696	14100	8002.5	11217	6747.3	3483.5
L21	116570	28685	2E+06	24133	86088	345259	30576	18693	16592	4208.5	55928	10283	39900	12908	8867.6	7665.2	4729	7317	57891	14602	11899	32092	18940	1E+06	13176	11332	198775	13636	8022	11051	6661.9	3051.9
L22	79292	31868	4E+06	22732	84146	297526	35119	15379	16361	4863.3	819375	9795.7	29032	11941	10136	8123.9	4980.1	7794.7	51544	14942	11852	32476	16972	196259	14233	12585	107460	13312	8111.6	10965	6636.3	2753
L23	58321	35071	1E+07	21783	85312	219762	42178	13329	15750	6687.6	3349.8	5035.5	7648.9	15304	29315	14810	7999.8	16458	34124	15723	12044	33802	15092	81203	15866	14729	70405	13091	8258.2	10946	6669.3	2552.7
L24	45888	38513	2E+06	20961	86069	175782	51630	12110	14865	13144	8778.5	7410.4	10097	7898.2	145955	15582	8359.3	17415	68224	17013	12452	36087	13439	49300	18256	18695	51723	12929	8442.9	10972	6755.3	2425.2
L25	38390	42350	592316	20083	83429	159853	61602	11485	13888	50211	5874.7	6637.6	7662.3	6789.8	17023	28587	12537	45308	31683	18900	13052	39320	12094	35225	21668	26396	41385	12765	8637.8	11010	6882.3	2350.9
L26	34060	46736	304240	19072	75875	169983	66875	11350	13008	202109	6286.9	8110.8	11664	7222.2	25585	120898	45716	32053	14353	21443	13798	43263	11092	27901	26425	38501	35670	12521	8805.7	11015	7030.5	2315.8
L27	32053	52022	179475	17918	64455	235474	62009	11717	12367	29915	6143.3	6726.3	7904.6	6912.7	20498	23814	11413	27912	138118	24520	14601	47133	10448	23978	32699	45130	33086	12124	8903.8	10937	7173.9	2311
L28	32042	58351	118653	16764	52837	746059	50225	12679	11994	12755	8011.2	7241.1	9494.1	7648.1	88989	15573	8662.1	14601	80985	27657	15334	49596	10160	22144	40062	49213	33126	11545	8904.9	10745	7292.6	2333.5
L29	34064	61980	93513	16129	45734	704864	40779	14159	11706	8544.1	4017.3	5818.3	8711.7	10902	97902	22712	11284	21383	38275	30338	15328	49940	10177	21698	47429	81354	35592	10866	8833.8	10477	7397.9	2386.3
L30	38691	58389	88865	16311	43752	377738	35696	15938	11350	7266.7	11679	7887.1	12069	8626.1	33494	11232	6957.7	8959.9	93589	32127	16353	48272	10459	22367	53081	196114	40974	10188	8734.1	10197	7515.6	2479.9
L31	46835	51082	95309	17119	45211	406407	33099	17937	10939	7027.4	11019	7803.2	9852.2	6707.3	13699	32716	14213	24717	12543	32808	16610	45242	10985	24177	55402	42956	50908	9587.7	8648.4	9964.6	7674.7	2628.1
L32	60421	44069	109812	18360	49405	797408	31807	20102	10503	7455.7	4227.5	6024.3	8522.6	11479	61251	19559	10599	13384	13718	32464	16717	41604	11747	27448	53960	30888	69733	9111.6	8613.7	9833.5	7904.2	2850.5
L33	83722	38828	131059	19883	56487	1E+06	31224	22383	10058	8168.1	7789.5	7153.1	7892.3	4997.6	4886.3	22339	51549	21779	4899.5	31375	16697	37920	12749	32992	49662	39727	111352	8788.2	8661.9	9850.6	8233.7	3175.8
L34	127142	35603	155524	21536	67294	326523	30974	24816	9618.3	8704.7	7118.1	6947.2	8546	7223.7	46135	16118	9583.1	9507.8	11816	29861	16572	34491	14006	42847	43919	160990	252153	8637.2	8824.7	10067	8698.4	3646.2
L35	221394	34381	173681	23128	83633	175442	30785	27561	9213.4	8762.7	24938	10289	21801	5450.5	8148.5	15692	26397	18297	4214.7	28172	16354	31428	15545	63279	37863	71451	3E+06	8681.7	9140.3	10550	9346.1	4327.7
L36	492931	35336	171279	24416	109114	120047	30444	30888	8903.5	8113.6	31834	22413	335595	3934.1	5064.1	5087.5	5494.6	4447.1	2633.3	26462	16046	28734	17416	126199	32130	45562	256480	8959.3	9665.2	11412	10252	5332.7
L37	2E+06	38672	146576	25152	151109	93643	29618	35094	8792.5	6730.3	11397	40221	20665	3832.2	5079.2	4311	4666.4	3800.2	2496.5	24808	15644	26361	19703	7E+06	26986	89878	156155	9539.4	10495	12857	11546	6873.6
L38	2E+06	42832	122437	25427	233297	78161	29064	39978	9040.3	5208.1	7243.2	12426	11497	4940.2	6418.9	5185.8	6011.1	5022.7	2978.5	23235	15143	24255	22553	121182	22492	161343	127620	10555	11811	15310	13480	9428.2
L39	757899	44697	113113	25638	523912	65769	28639	44045	9966.4	4045.6	5484	9855	8395.9	8866.4	11749	9439.7	13766	14181	4584.5	21744	14539	22361	26232	61227	18616	52257	122719	12282	14003	19819	16603	14232
L40	485386	41798	120846	25856	2E+06	55458	28671	46326	12169	3607.2	5326.4	12535	7283.9	24454	135519	76800	47528	15621	10296	20328	13836	20642	31243	4117								

FAÇADE ELEMENTS





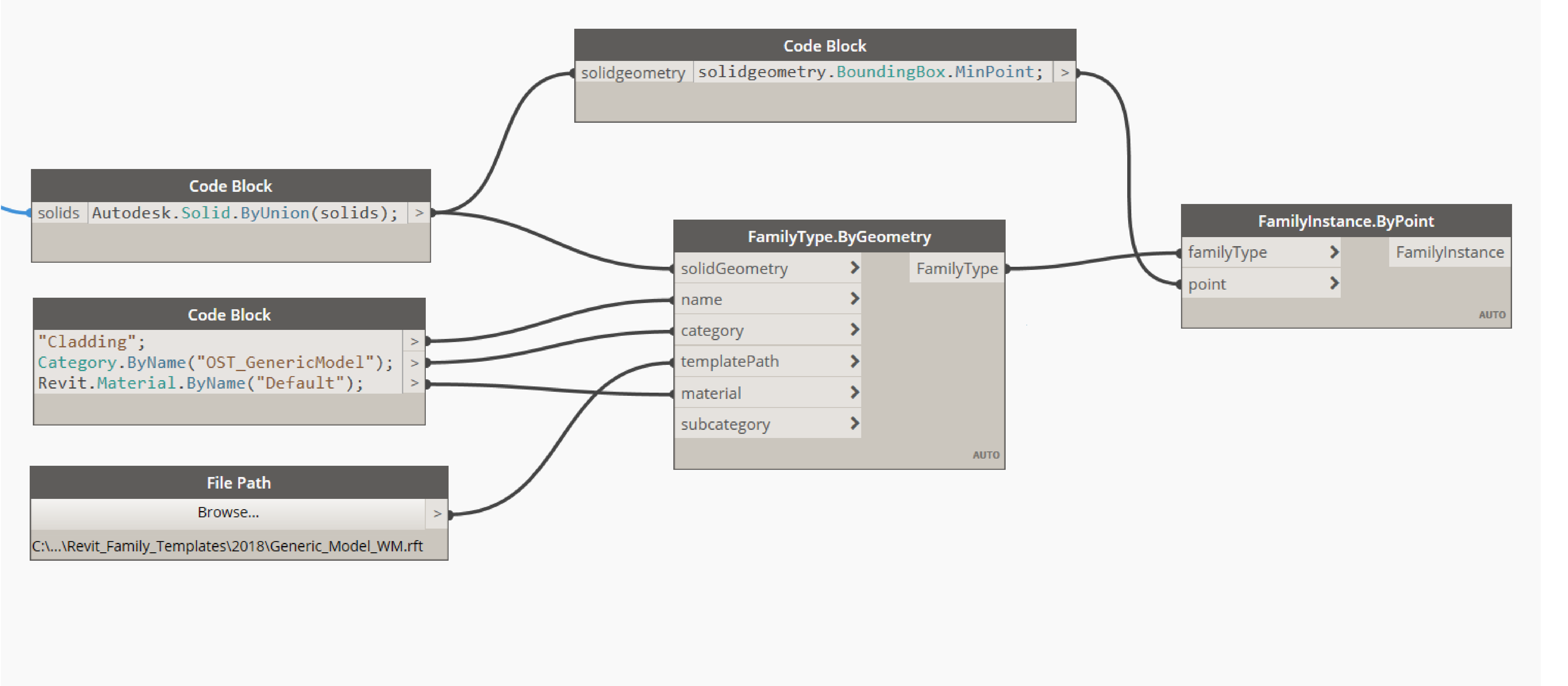


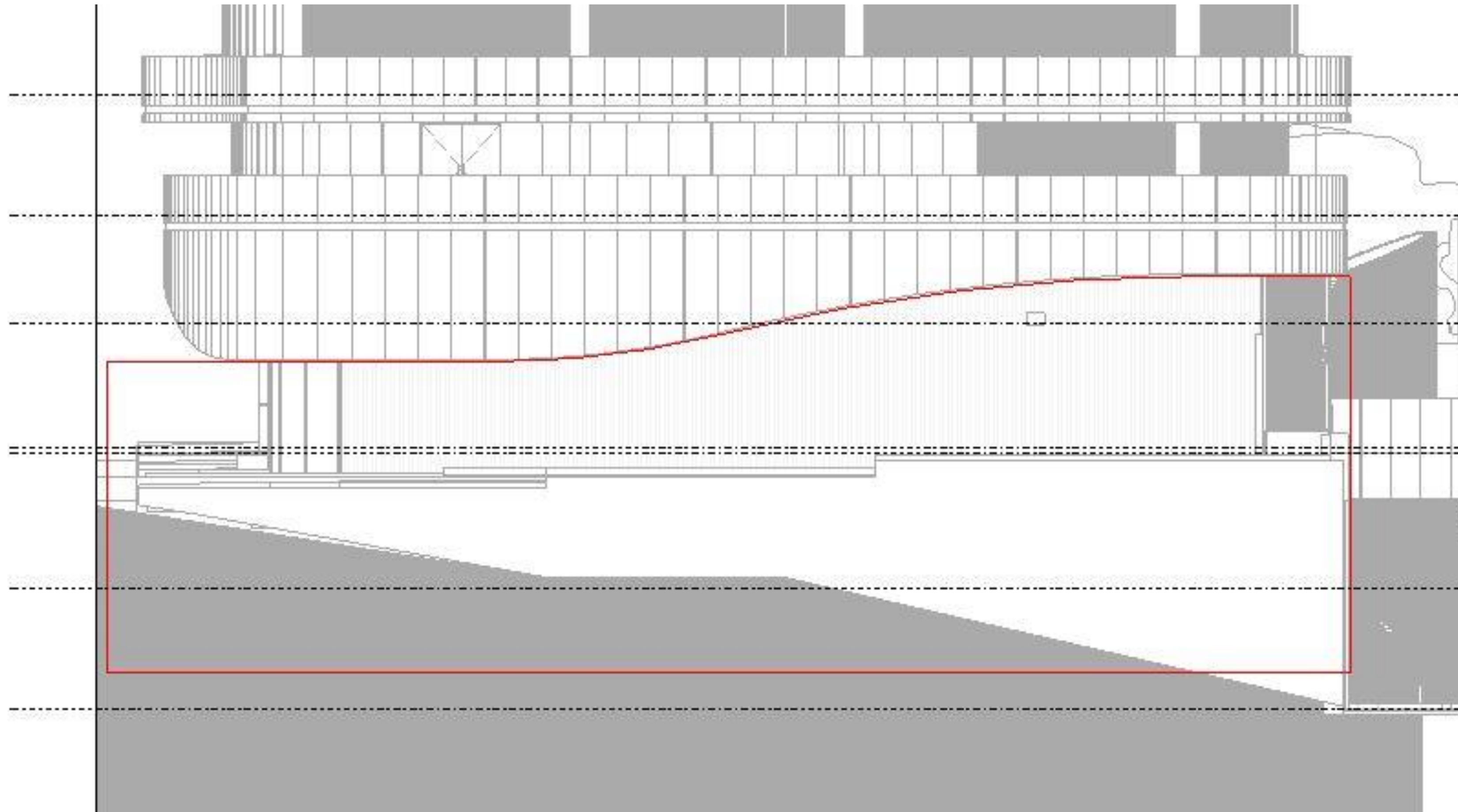


- GET FLOOR OUTLINES
- GET PROFILES

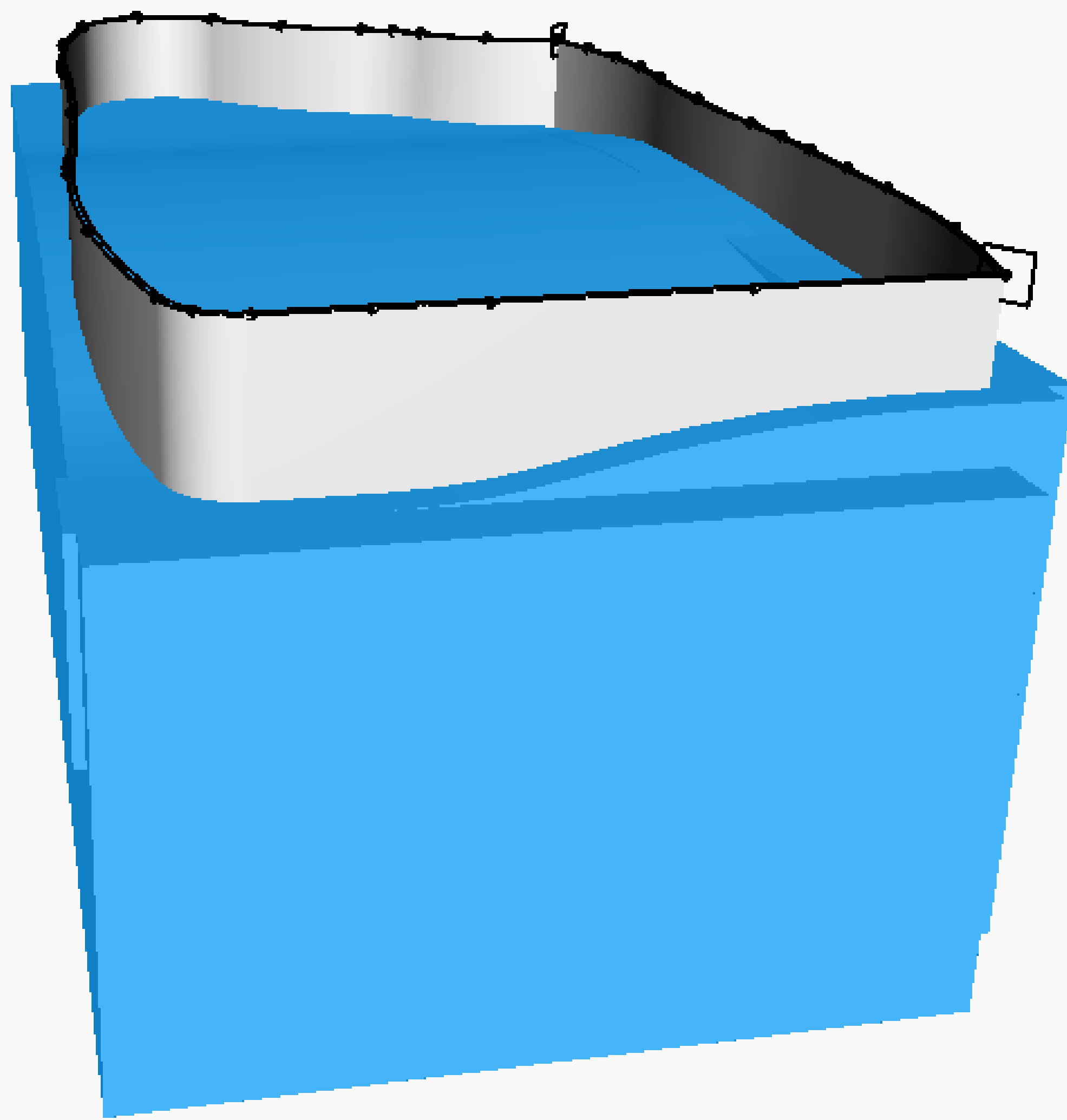
- CREATE FORM
- PLACE AND ADJUST PROFILES
- CREATE SOLIDS
- FILTER UNIQUE ELEMENTS

- CREATE FAMILY TYPES
- PLACE INSTANCES

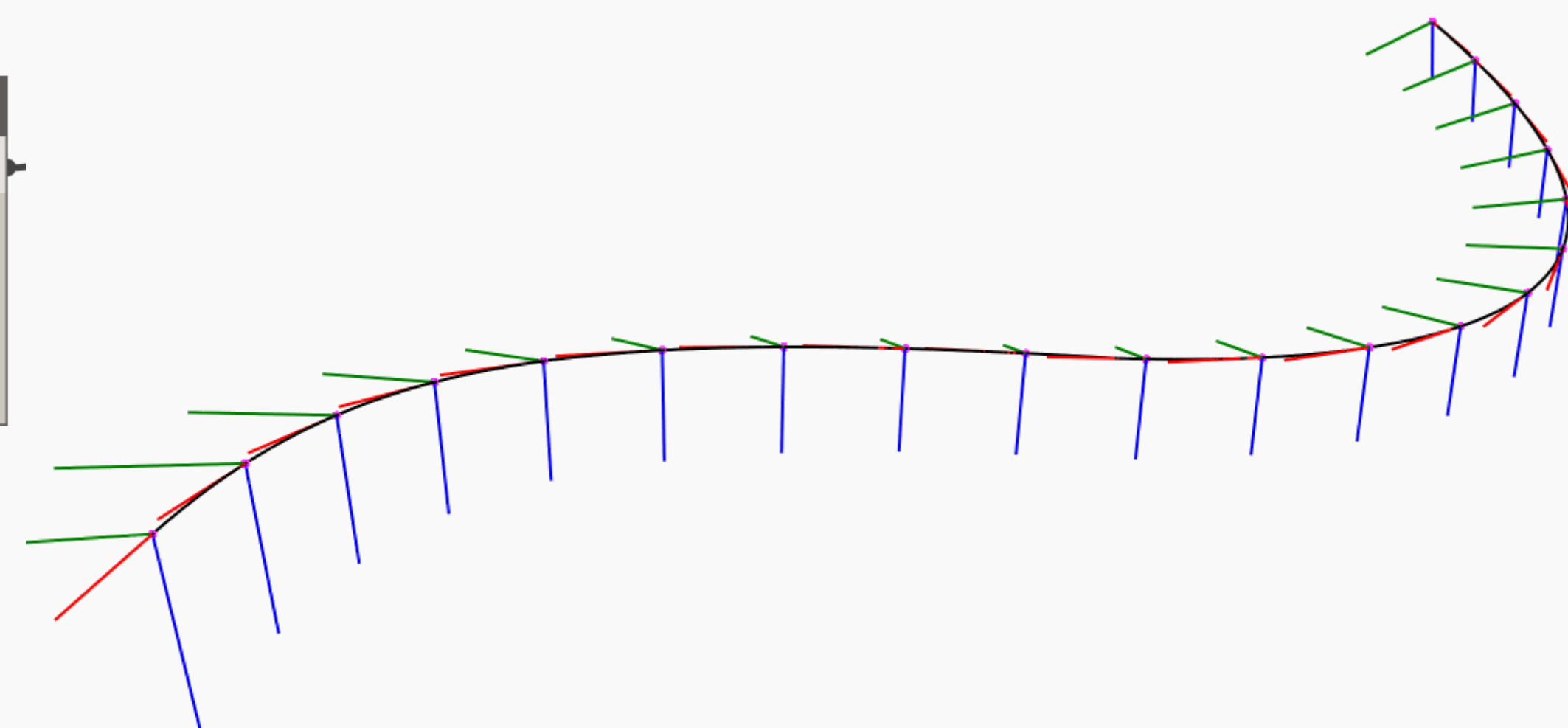
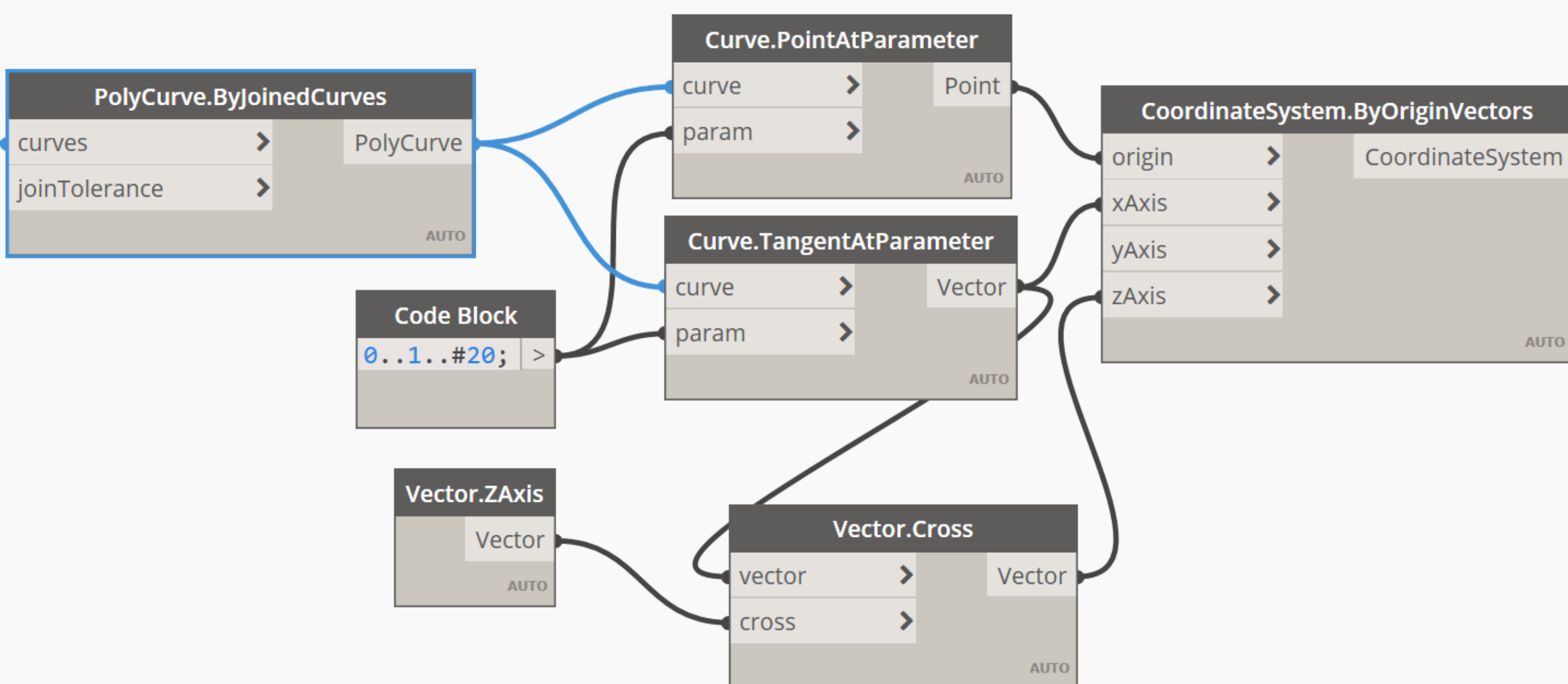
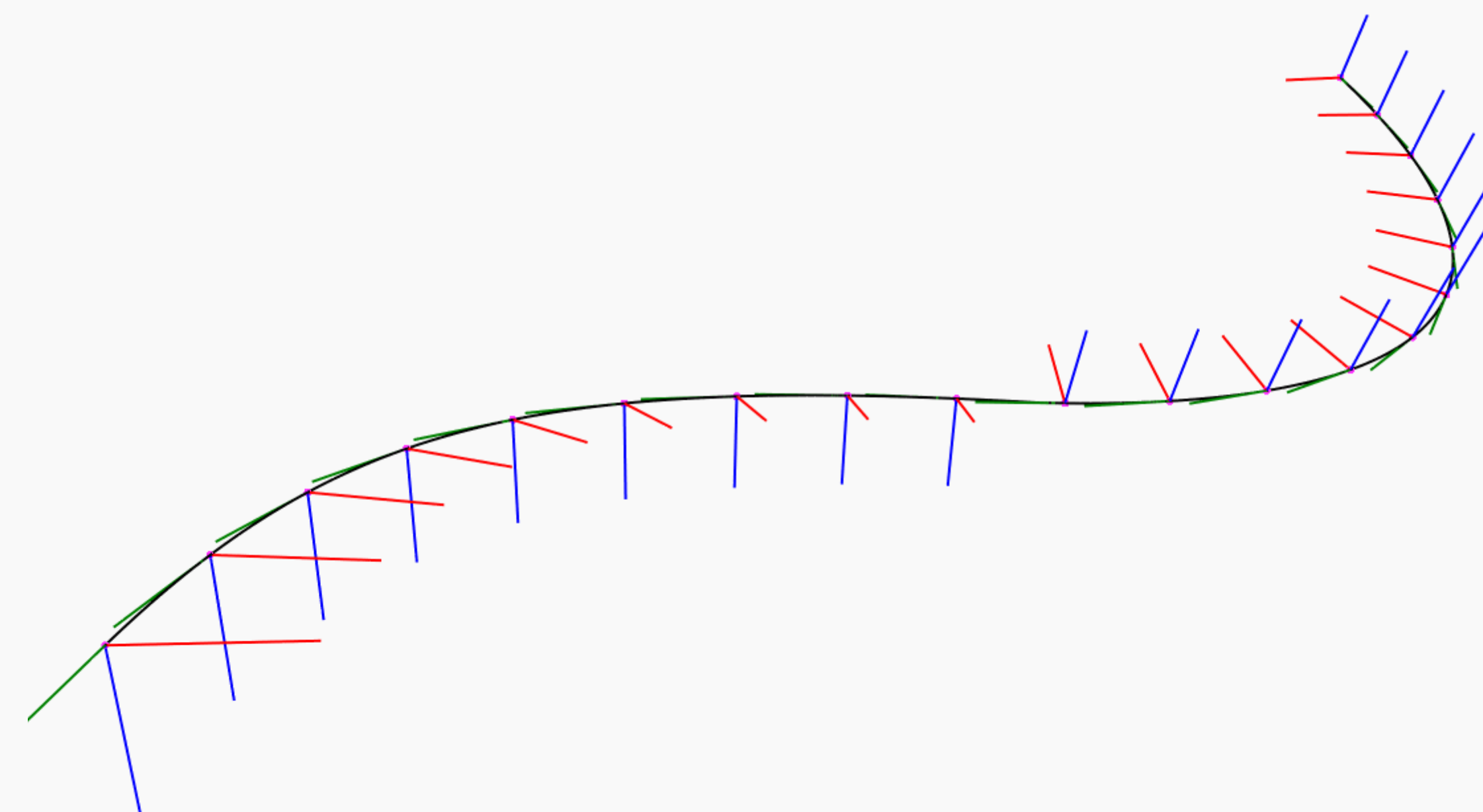
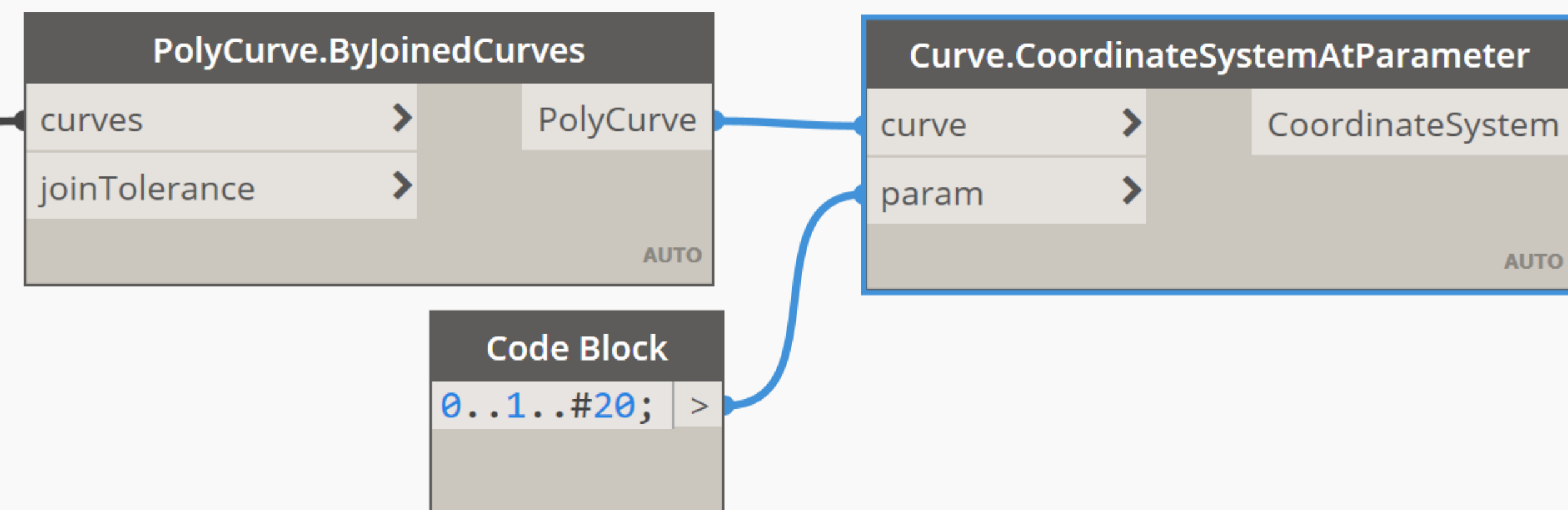


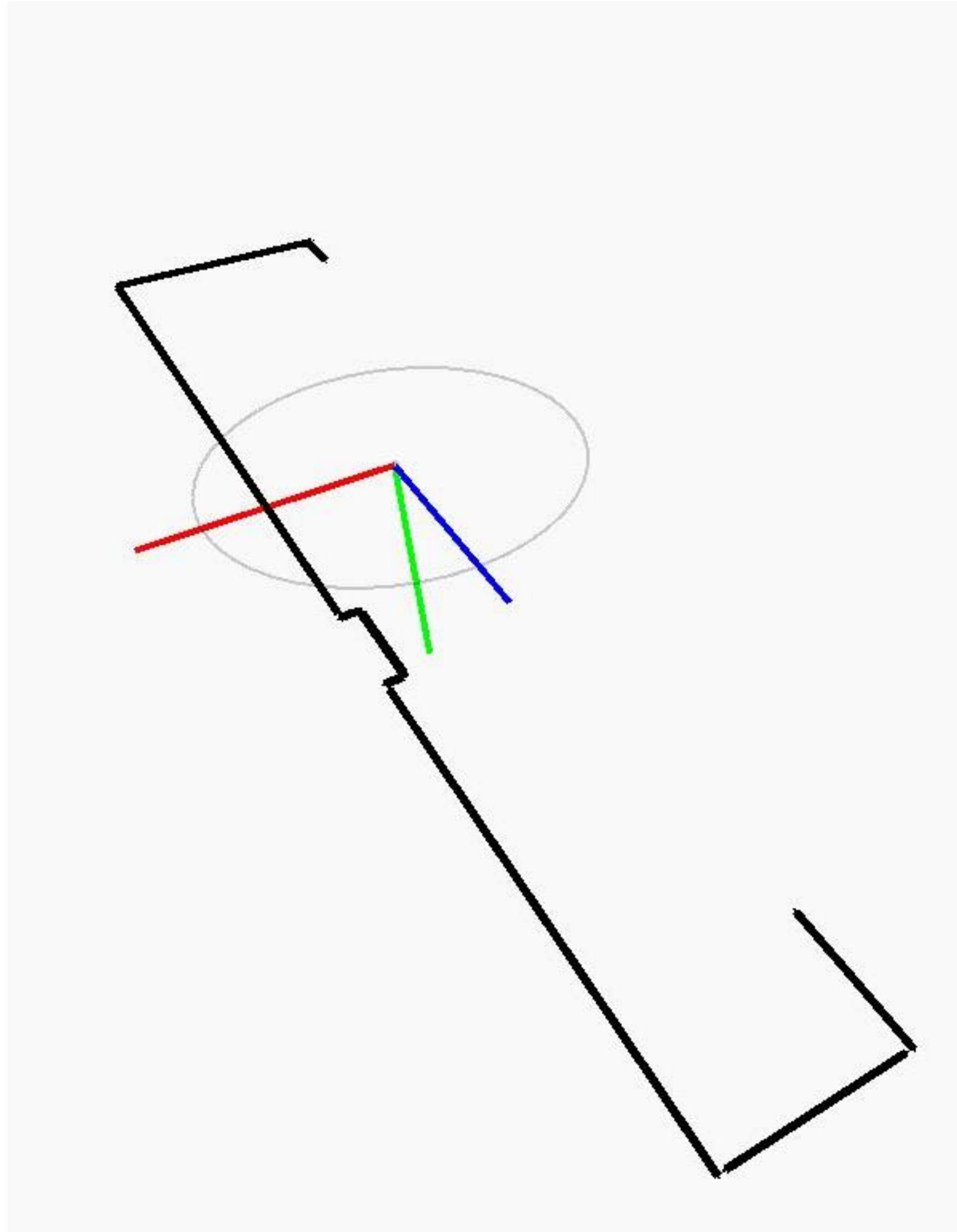


Constraints defined with
Detail Lines in sections

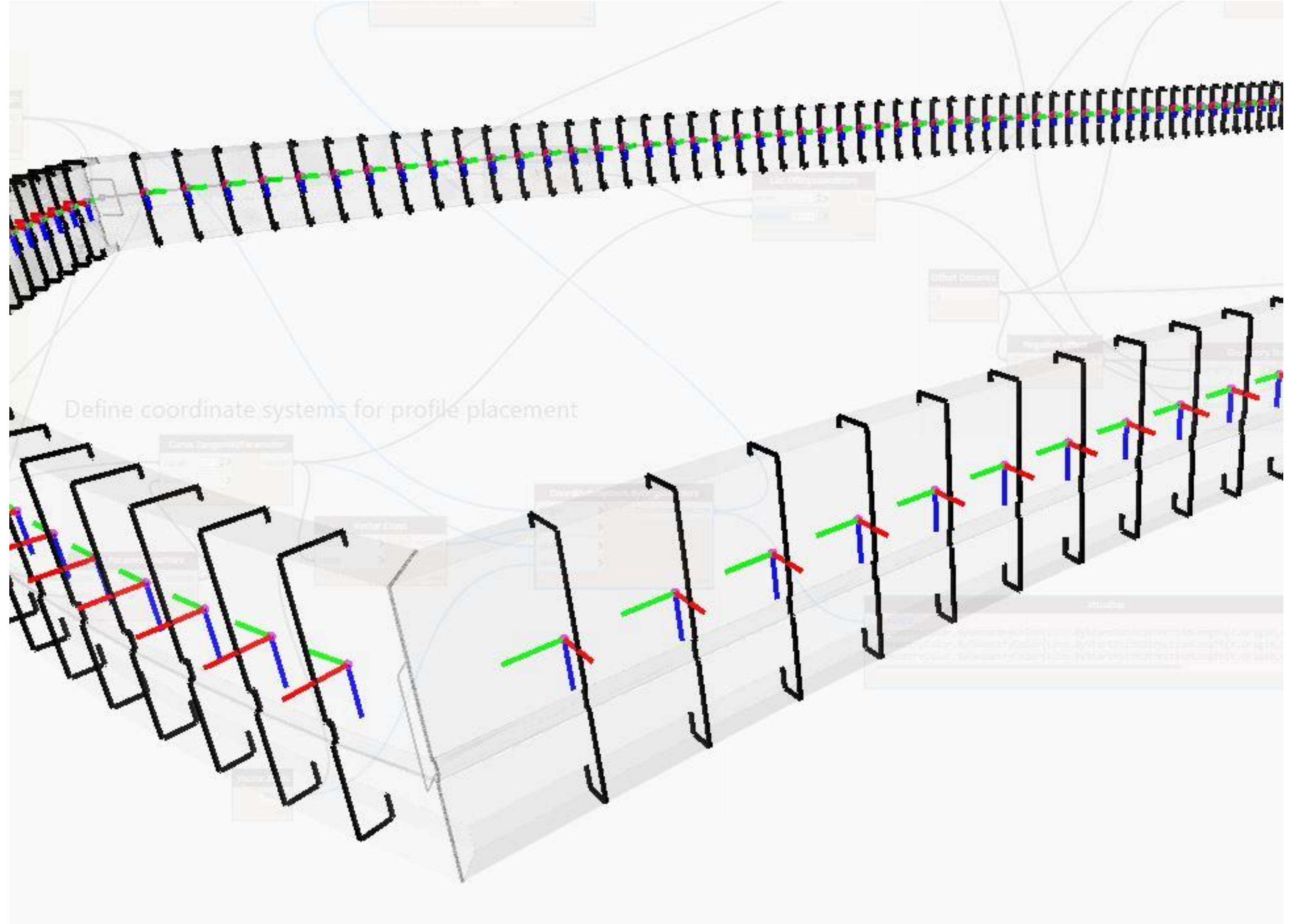


Constraints used to cut
geometry

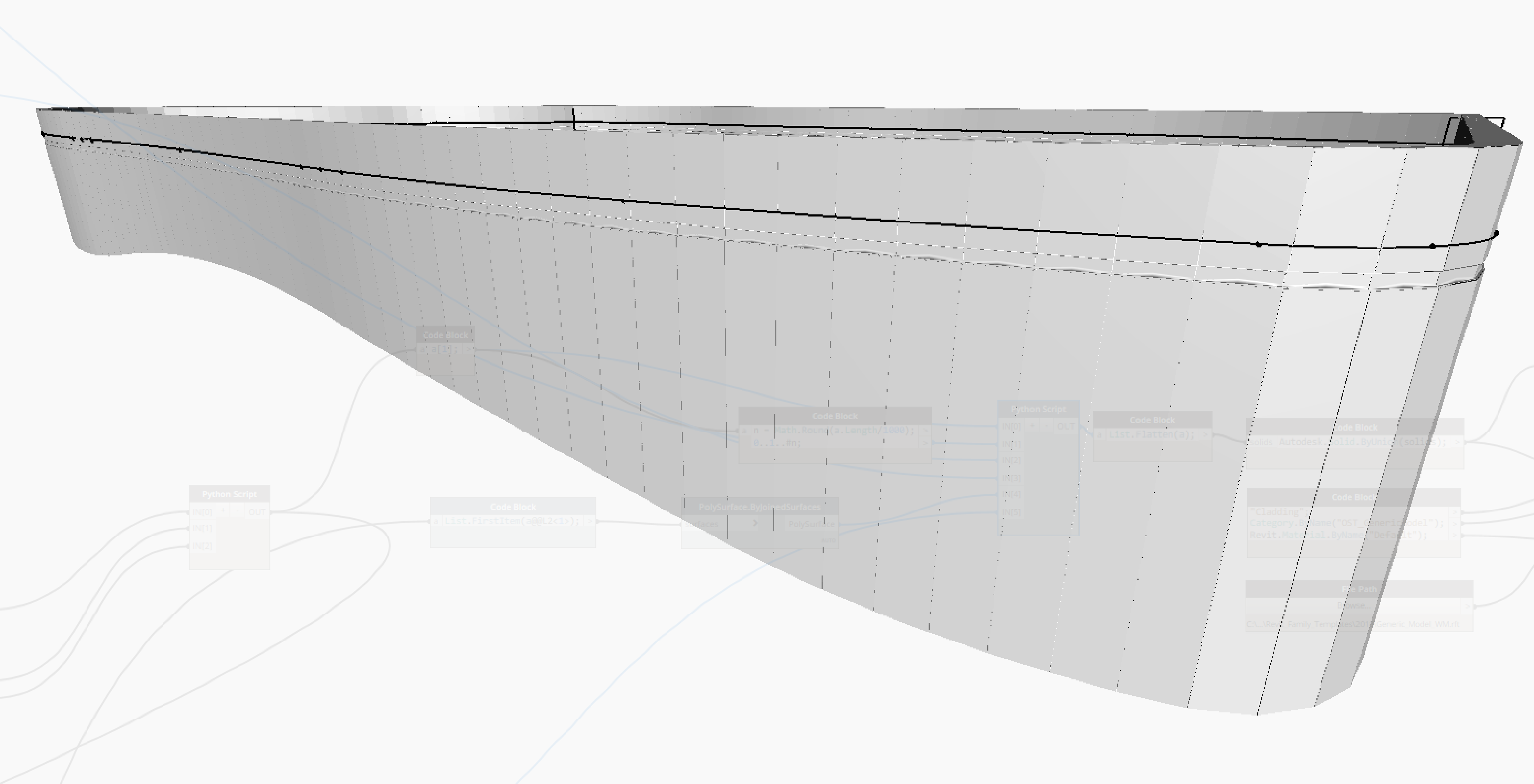


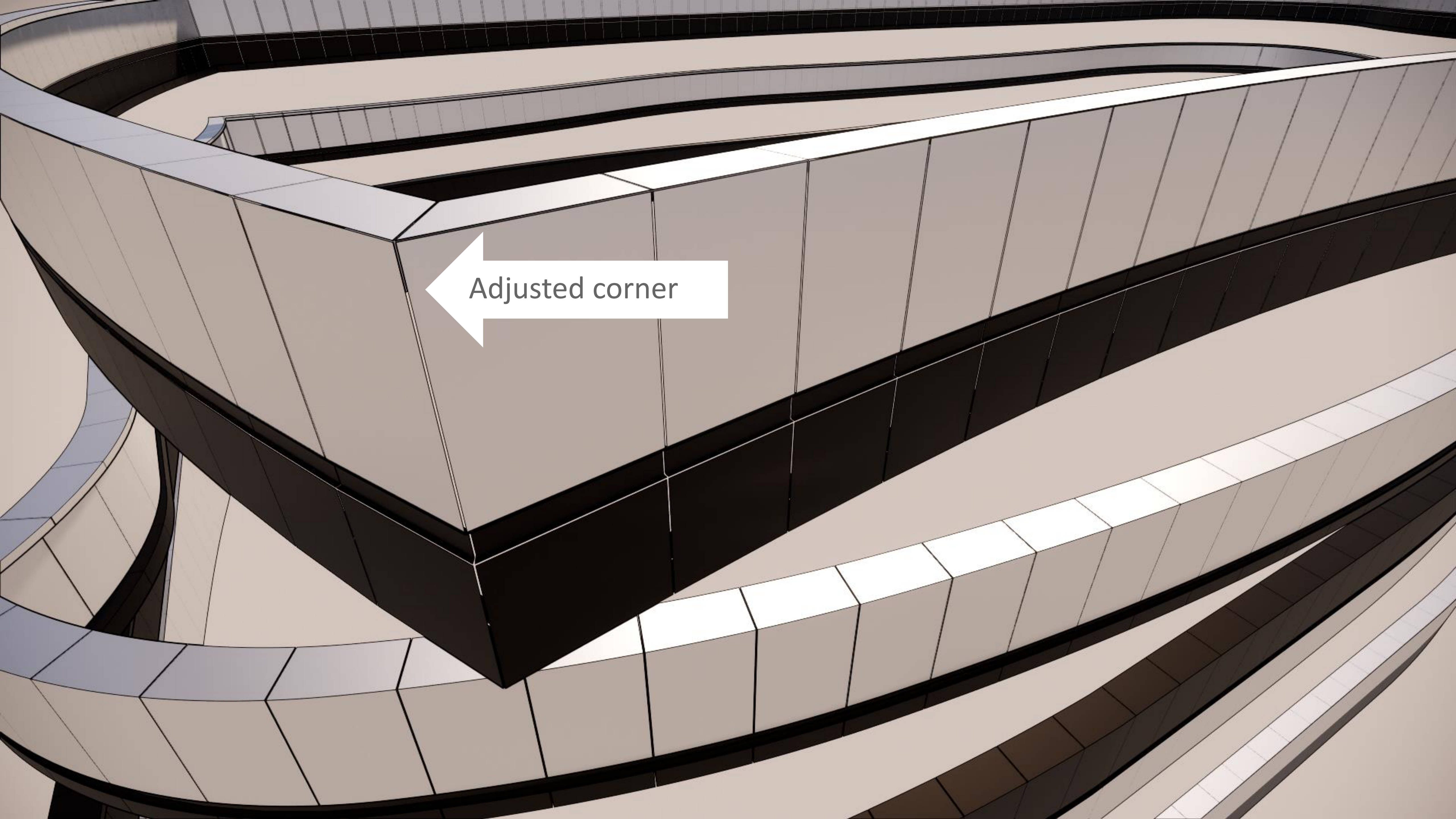


Profile from Revit



Transformed profiles





Adjusted corner

List.Flatten

list	>	var[]..[]
amt	>	

AUTO

Code Block

```
c1 //get next curve
c=List.AddItemToEnd(List.FirstItem(c1),List.DropItems(
List.ShiftIndices(c1,-1),-1));
//get startpoint of next curve
i = c.PointAtParameter(0);
//get end point of curve
i1 = c1.PointAtParameter(1);
//get tangent of next curve at start
f = c.TangentAtParameter(0);
//get tangent of curve at end
f1 = c1.TangentAtParameter(1);

//get points where curve is not continous
pnts = List.Clean(Vector.IsParallel(f,f1)?null:i,false);
//subtract the vector between curve and next curve if it's not continous
//and cross to get perpendicular
vc =List.Clean(Vector.IsParallel(f,f1)?null:f.Subtract(f1),false).Cross(
Vector.ZAxis());
//create planes at points with normal from vector cross
planes = Plane.ByOriginNormal(pnts,vc);
```

List

0	Curve(StartPoint = Point(X = 57542
1	Curve(StartPoint = Point(X = 59773
2	Curve(StartPoint = Point(X = 65987
3	Curve(StartPoint = Point(X = 64815
4	Curve(StartPoint = Point(X = 49473
5	Curve(StartPoint = Point(X = 46765
6	Curve(StartPoint = Point(X = 24458
7	Curve(StartPoint = Point(X = 21863
8	Curve(StartPoint = Point(X = 2412.
9	Curve(StartPoint = Point(X = 54.73
10	Curve(StartPoint = Point(X = 54.7
11	Curve(StartPoint = Point(X = 54.7
12	Curve(StartPoint = Point(X = 1318
13	Curve(StartPoint = Point(X = 2889
14	Curve(StartPoint = Point(X = 2786
15	Curve(StartPoint = Point(X = 3998

@L2 @L1 {18}

Curve.ParameterAtPoint

curve	>	double
point	>	

AUTO

List.SortByKey

list	>	sorted list
keys	>	sorted keys

AUTO

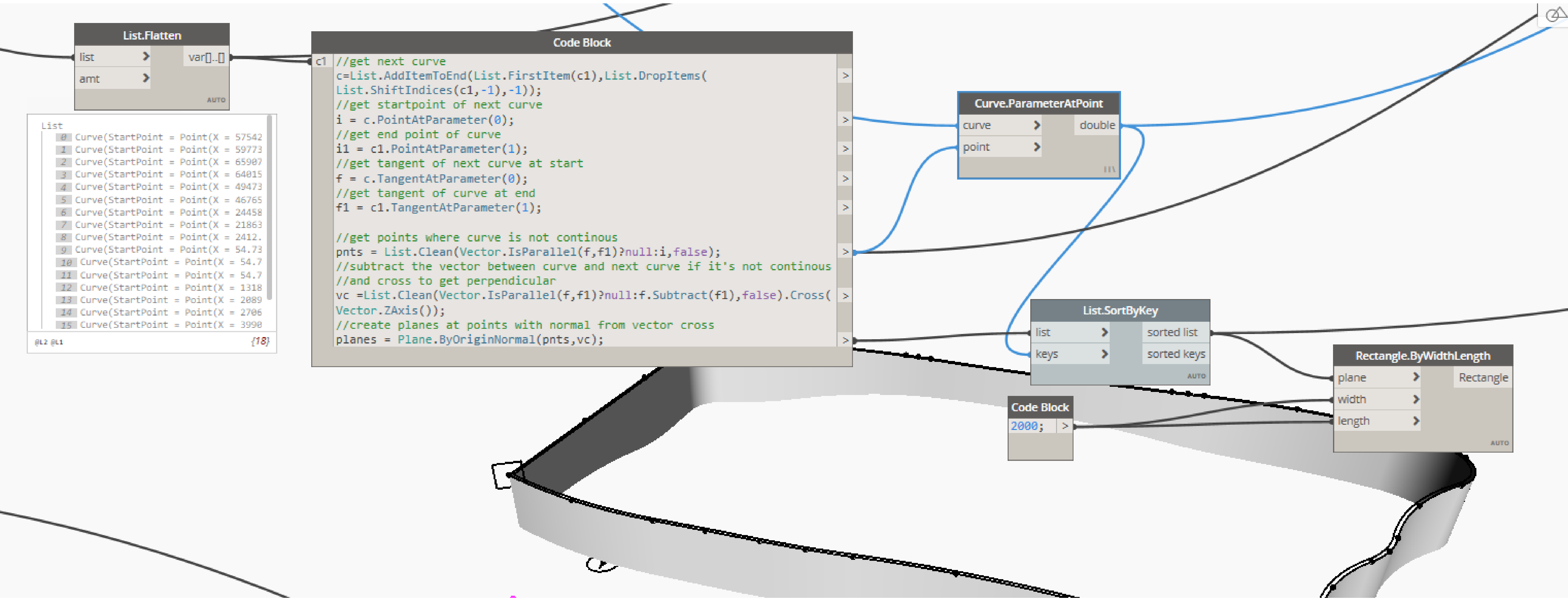
Rectangle.ByWidthLength

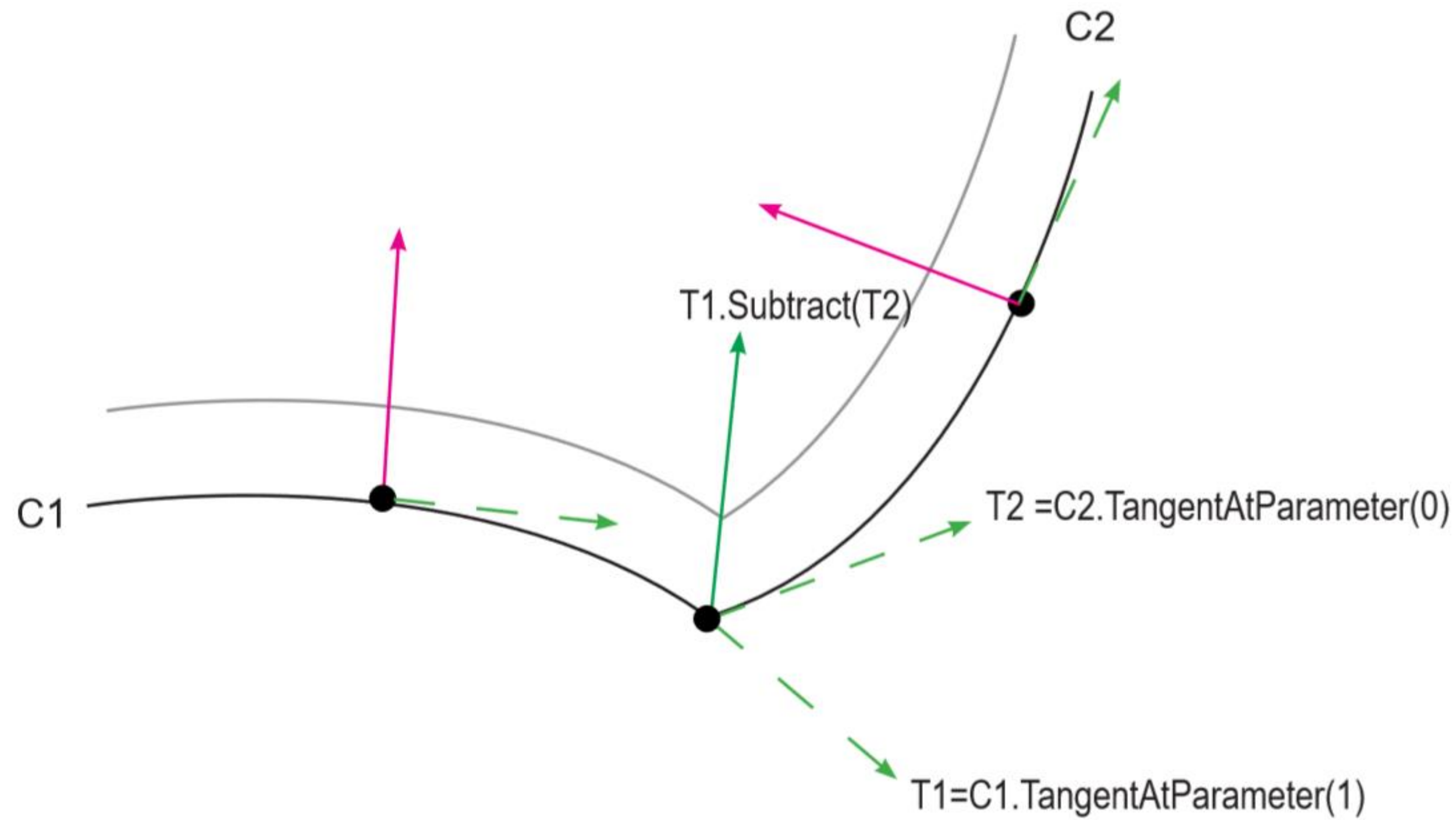
plane	>	Rectangle
width	>	
length	>	

AUTO

Code Block

```
2000; >
```





```
vc =List.Clean(Vector.IsParallel(f,f1)?null:f.Subtract(f1),false).Cross(
Vector.ZAxis());
```


Properties

Section Temporary Section

Section: Section 28 Edit Type

Constraints

Folders	wypychm
Filter_ID	
User_ID	
FilterID_new	<input checked="" type="checkbox"/>
FilterID_deleted	<input checked="" type="checkbox"/>
FilterID_moved	<input checked="" type="checkbox"/>
Building_ID	

Graphics

View Scale	1 : 100
Scale Value 1:	100
Display Model	Halftone
Detail Level	Coarse
Parts Visibility	Show Original
Visibility/Graphics Over...	Edit...
Graphic Display Options	Edit...
Hide at scales coarser t...	1 : 100
Discipline	Coordination
Show Hidden Lines	By Discipline
Color Scheme Location	Background
Color Scheme	<none>
Default Analysis Displa...	None
Sun Path	<input type="checkbox"/>

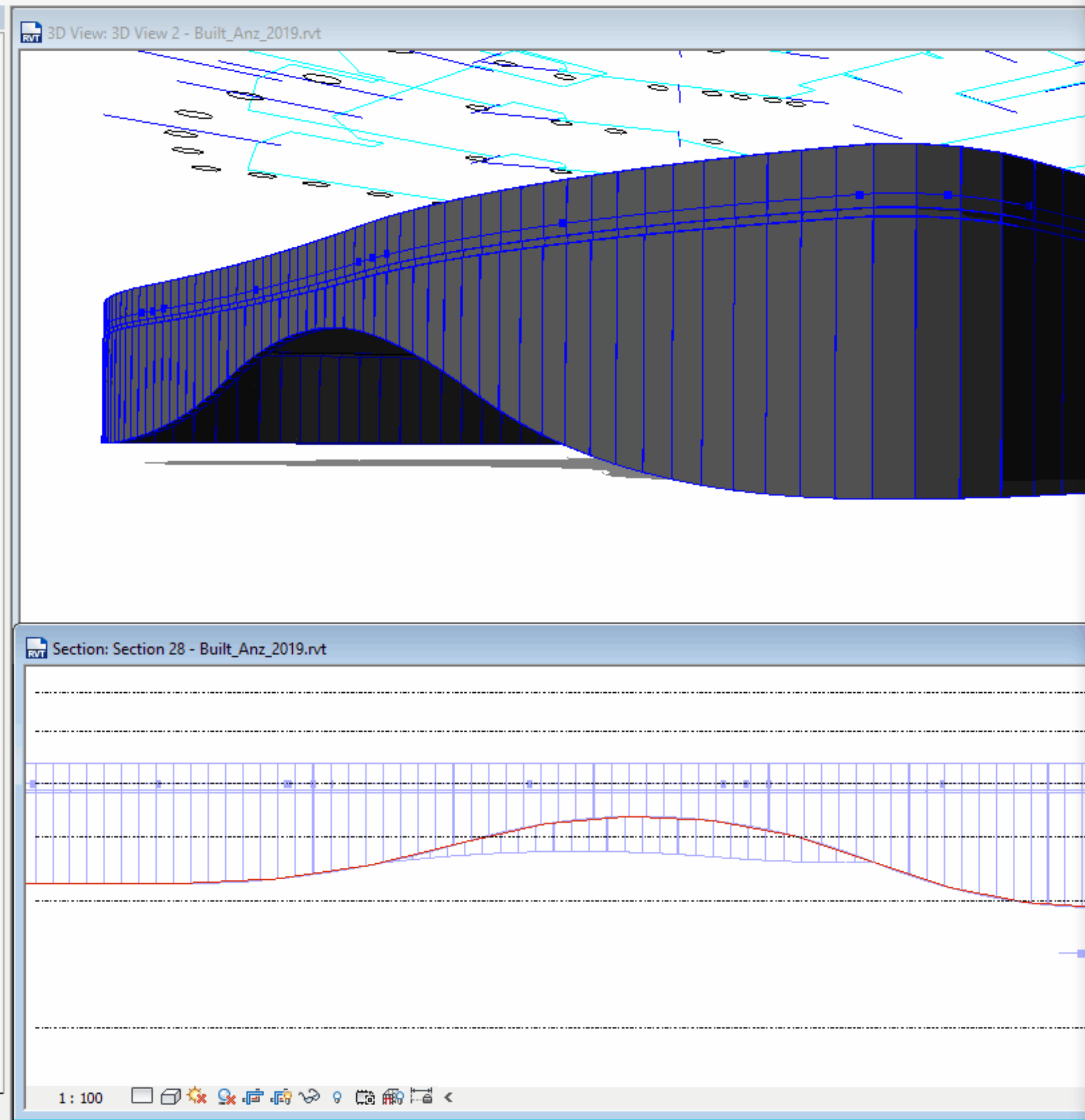
Extents

Crop View	<input checked="" type="checkbox"/>
Crop Region Visible	<input checked="" type="checkbox"/>
Annotation Crop	<input type="checkbox"/>
Far Clipping	Clip without line
Far Clip Offset	74486.715
Scope Box	None

Identity Data

View Template	<None>
View Name	Section 28
Dependency	Independent
Title on Sheet	
Referencing Sheet	
Referencing Detail	

Properties help Apply



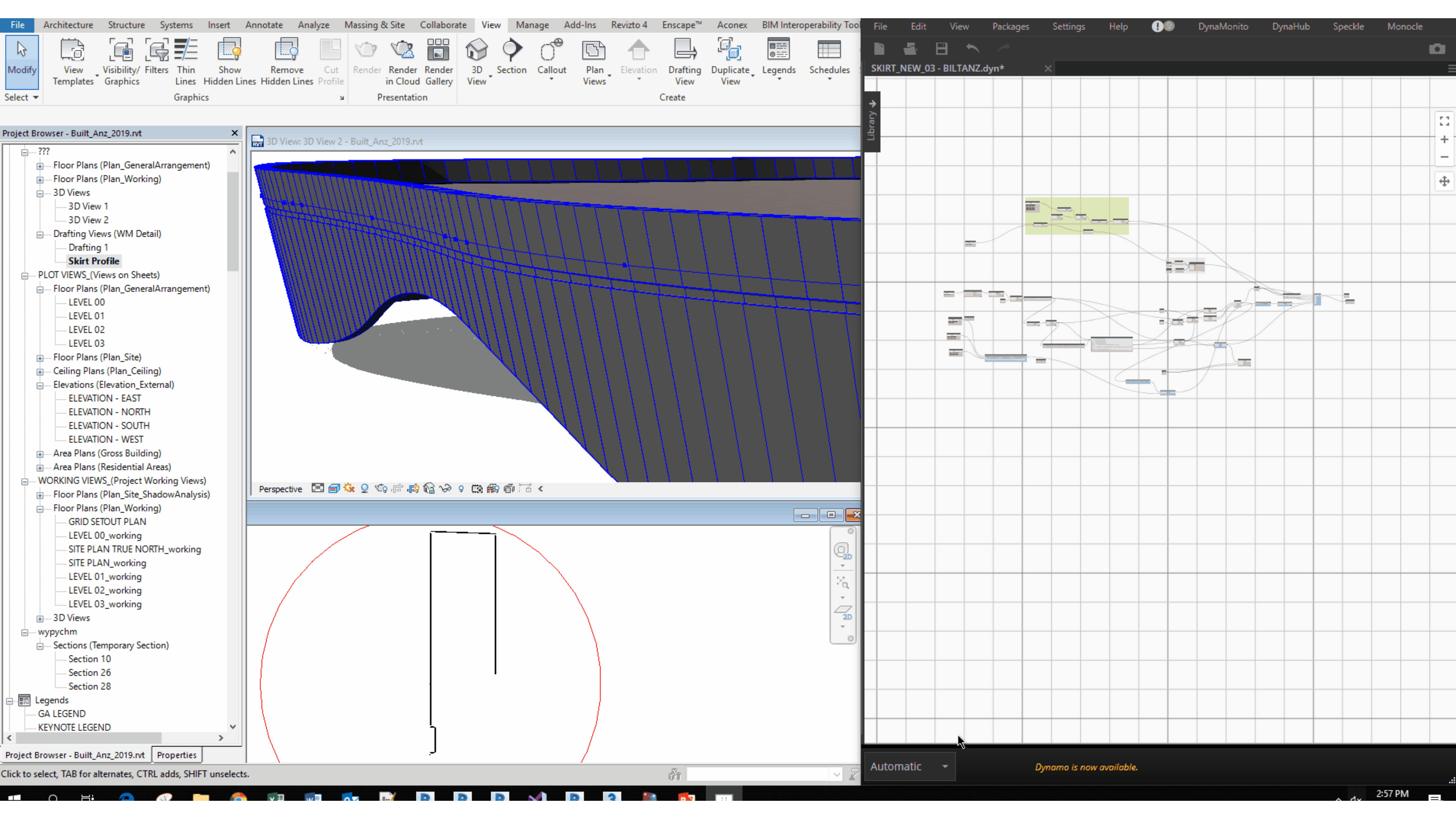
SKIRT_NEW_03 - BILTANZ.dyn*

Library

Automatic

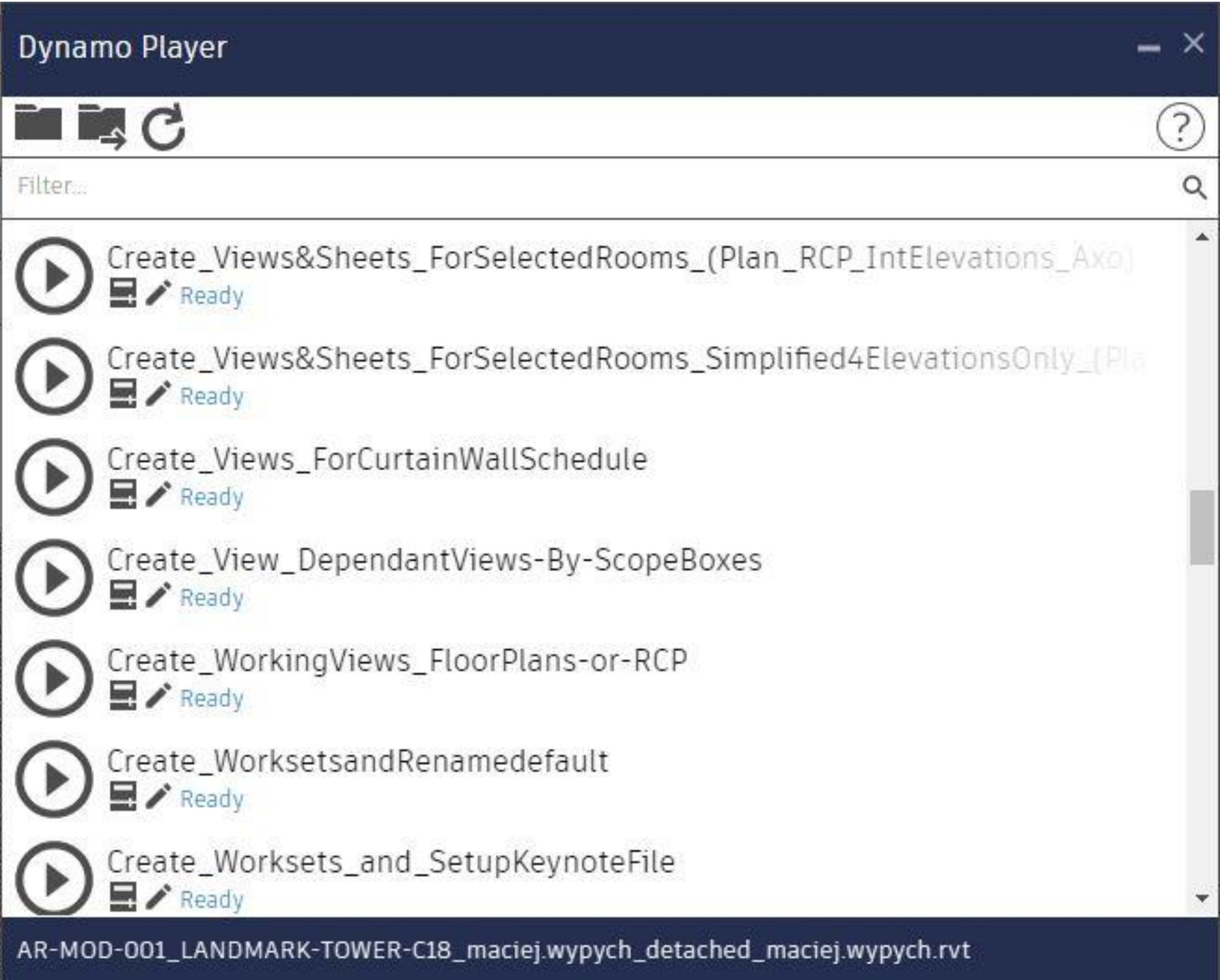
Dynamo is now available.

2:48 PM

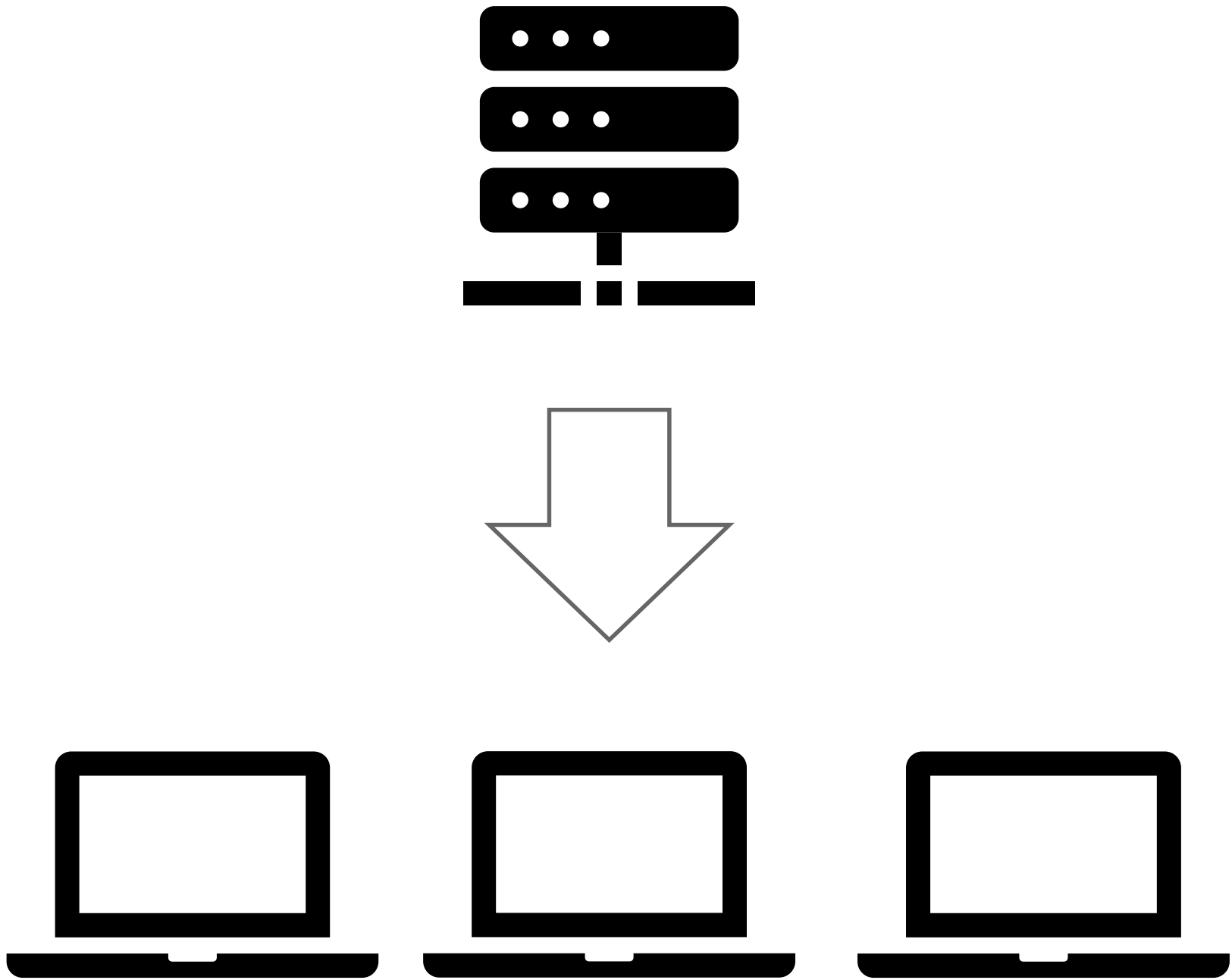


AUTOMATION

Definitions and packages accessed from C:
Drive



Centralized location for packages and
definitions



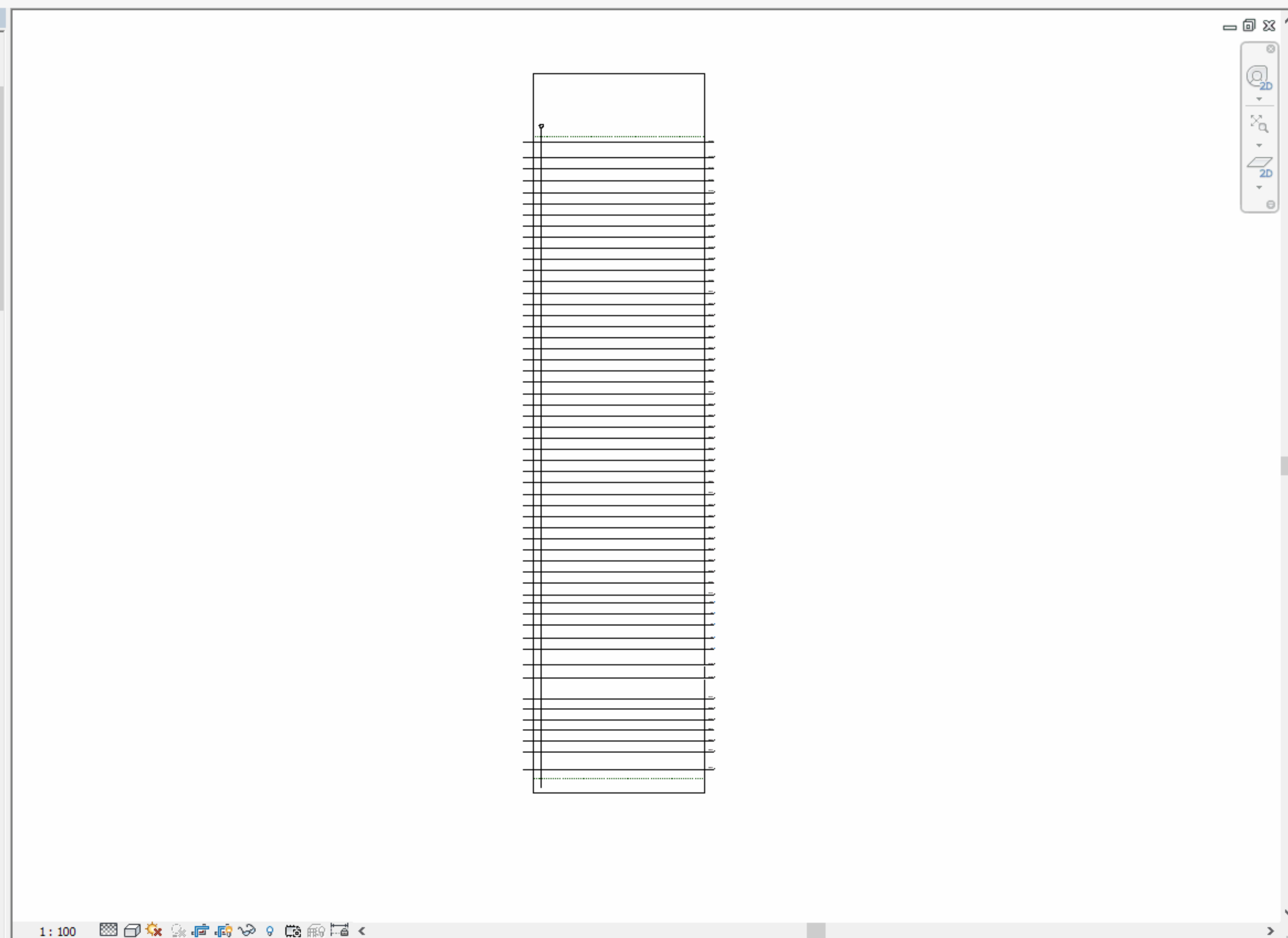
Push to users laptops at login

File Architecture Structure Systems Insert Annotate Analyze Massing & Site Collaborate View Manage Add-Ins Revizto 4 Enscape™ Aconex BIM Interoperability Tools CASE Apps #1 CASE Apps #2 Revit Express Tools dRofus JOTools Ideate Software pyRevit RTV Tools UNIFI

Modify Materials Object Snaps Project Information Project Parameters Shared Parameters Global Parameters Transfer Project Standards Unused Project Units Settings Structural Settings MEP Settings Panel Schedule Templates Additional Settings Location Coordinates Position Project Location Design Options Main Model Manage Links Manage Images Decal Types Starting View Phases Phasing Selection IDs of Selection Select by ID Warnings Inquiry Macro Manager Macro Security Macros Visual Programming

Project Browser - Built_Anz_2019.rvt

- Floor Plans (Plan_GeneralArrangement)
 - LEVEL 00
 - LEVEL 01
 - LEVEL 02
 - LEVEL 03
- Floor Plans (Plan_Site)
- Ceiling Plans (Plan_Ceiling)
- Elevations (Elevation_External)
 - ELEVATION - EAST**
 - ELEVATION - NORTH
 - ELEVATION - SOUTH
 - ELEVATION - WEST
- Area Plans (Gross Building)
- Area Plans (Residential Areas)
- WORKING VIEWS_(Project Working Views)
- Floor Plans (Plan_Site_ShadowAnalysis)
- Floor Plans (Plan_Working)
 - GRID SETOUT PLAN
 - LEVEL 00_working
 - SITE PLAN TRUE NORTH_working
 - SITE PLAN_working
 - LEVEL 01_working
 - LEVEL 02_working
 - LEVEL 03_working
- 3D Views
- Legends
 - GA LEGEND
 - KEYNOTE LEGEND
 - WALL ACOUSTIC LEGEND
 - WALL FABRIC LEGEND
 - WALL FINISHES LEGEND
 - WALL FIRE SYSTEMS LEGEND
 - WALL TAG TYPICAL
 - x_ANNOTATION STANDARDS
 - x_FILLED REGIONS
 - x_LINE TYPES
 - x_SYMBOLS & TAGS
- Schedules/Quantities (Category)
- Sheets (W&M_SERIES)
 - ???
 - A00-001 - COVER SHEET
 - SK0001 - OPTION 1
 - ZZ - Starting_View
- Families
- Annotation Symbols



Properties

Elevation
Elevation_External

Elevation: ELEVATION - EAST Edit Type

Constraints

Folders	PLOT VIEWS_(Views on Shee...
Filter_ID	
User_ID	
FilterID_new	<input checked="" type="checkbox"/>
FilterID_deleted	<input checked="" type="checkbox"/>
FilterID_moved	<input checked="" type="checkbox"/>
Building_ID	

Graphics

View Scale	1 : 100
Scale Value 1:	100
Display Model	Normal
Detail Level	Fine
Parts Visibility	Show Original
Visibility/Graphics Overrides	Edit...
Graphic Display Options	Edit...
Hide at scales coarser than	1 : 5000
Discipline	Architectural
Show Hidden Lines	By Discipline
Color Scheme Location	Background
Color Scheme	<none>
Default Analysis Display Style	None
Reference Label	
Sun Path	<input type="checkbox"/>

Extents

Crop View	<input checked="" type="checkbox"/>
Crop Region Visible	<input checked="" type="checkbox"/>
Annotation Crop	<input type="checkbox"/>
Far Clipping	Clip without line
Far Clip Offset	66391.637
Scope Box	None
Associated Datum	None

Identity Data

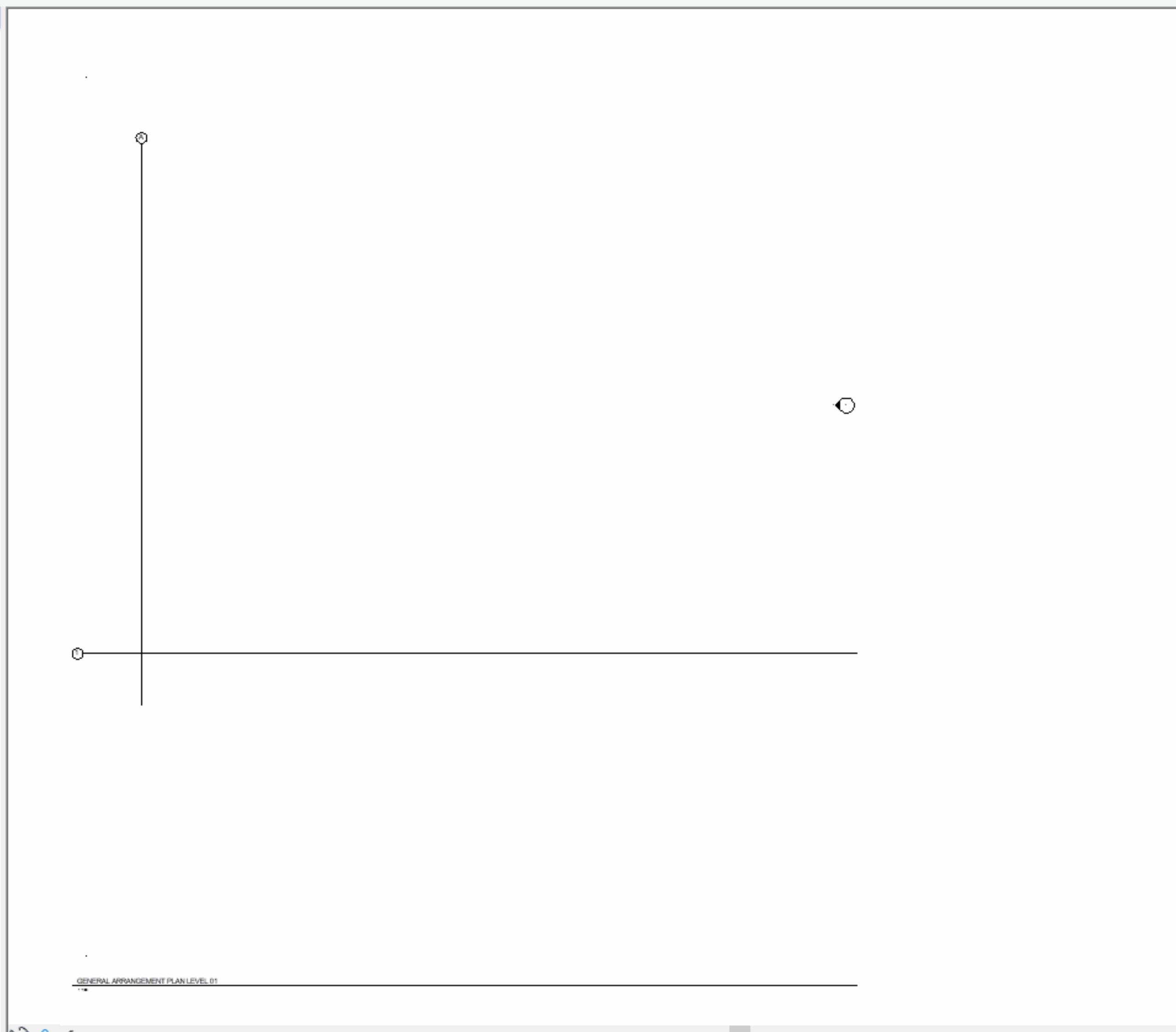
View Template	WM_A2 Elevations_External
View Name	ELEVATION - EAST
Dependency	Independent
Title on Sheet	
Referencing Sheet	
Referencing Detail	

Properties help Apply

File Architecture Structure Systems Insert Annotate Analyze Massing & Site Collaborate View Manage Add-Ins Revit 4 Enscape™ Aconex BIM Interoperability Tools CASE Apps #1 CASE Apps #2 Revit Express Tools dRofus JOTools Ideate Software pyRevit RTV Tools UNIFI

Modify Select Materials Object Snaps Styles Project Information Parameters Shared Parameters Global Parameters Project Standards Transfer Unused Project Units Settings Structural Settings MEP Settings Panel Schedule Templates Additional Settings Location Coordinates Position Project Location Design Options Add to Set Pick to Edit Main Model Design Options Manage Images Decal Types Starting View Manage Project Phases Phasing Phases Save Load Edit Selection IDs of Selection Select by ID Warnings Inquiry Macro Manager Macro Security Macros Visual Programming Dynamo Player

- Project Browser - Built_Anz_2019.rvt
- A01
 - A01.001 - GENERAL ARRANGEMENT PLAN LEVEL 01**
 - A01.002 - GENERAL ARRANGEMENT PLAN LEVEL 02
 - A01.003 - GENERAL ARRANGEMENT PLAN LEVEL 03
 - A01.004 - GENERAL ARRANGEMENT PLAN LEVEL 04
 - A01.005 - GENERAL ARRANGEMENT PLAN LEVEL 05
 - A01.006 - GENERAL ARRANGEMENT PLAN LEVEL 06
 - A01.007 - GENERAL ARRANGEMENT PLAN LEVEL 07
 - A01.008 - GENERAL ARRANGEMENT PLAN LEVEL 08
 - A01.009 - GENERAL ARRANGEMENT PLAN LEVEL 09
 - A01.010 - GENERAL ARRANGEMENT PLAN LEVEL 10
 - A01.011 - GENERAL ARRANGEMENT PLAN LEVEL 11
 - A01.012 - GENERAL ARRANGEMENT PLAN LEVEL 12
 - A01.013 - GENERAL ARRANGEMENT PLAN LEVEL 13
 - A01.014 - GENERAL ARRANGEMENT PLAN LEVEL 14
 - A01.015 - GENERAL ARRANGEMENT PLAN LEVEL 15
 - A01.016 - GENERAL ARRANGEMENT PLAN LEVEL 16
 - A01.017 - GENERAL ARRANGEMENT PLAN LEVEL 17
 - A01.018 - GENERAL ARRANGEMENT PLAN LEVEL 18
 - A01.019 - GENERAL ARRANGEMENT PLAN LEVEL 19
 - A01.020 - GENERAL ARRANGEMENT PLAN LEVEL 20
 - A01.021 - GENERAL ARRANGEMENT PLAN LEVEL 21
 - A01.022 - GENERAL ARRANGEMENT PLAN LEVEL 22
 - A01.023 - GENERAL ARRANGEMENT PLAN LEVEL 23
 - A01.024 - GENERAL ARRANGEMENT PLAN LEVEL 24
 - A01.025 - GENERAL ARRANGEMENT PLAN LEVEL 25
 - A01.026 - GENERAL ARRANGEMENT PLAN LEVEL 26
 - A01.027 - GENERAL ARRANGEMENT PLAN LEVEL 27
 - A01.028 - GENERAL ARRANGEMENT PLAN LEVEL 28
 - A01.029 - GENERAL ARRANGEMENT PLAN LEVEL 29
 - A01.030 - GENERAL ARRANGEMENT PLAN LEVEL 30
 - A01.031 - GENERAL ARRANGEMENT PLAN LEVEL 31
 - A01.032 - GENERAL ARRANGEMENT PLAN LEVEL 32
 - A01.033 - GENERAL ARRANGEMENT PLAN LEVEL 33
 - A01.034 - GENERAL ARRANGEMENT PLAN LEVEL 34
 - A01.035 - GENERAL ARRANGEMENT PLAN LEVEL 35
 - A01.036 - GENERAL ARRANGEMENT PLAN LEVEL 36
 - A01.037 - GENERAL ARRANGEMENT PLAN LEVEL 37
 - A01.038 - GENERAL ARRANGEMENT PLAN LEVEL 38
 - A01.039 - GENERAL ARRANGEMENT PLAN LEVEL 39
 - A01.040 - GENERAL ARRANGEMENT PLAN LEVEL 40
 - A01.041 - GENERAL ARRANGEMENT PLAN LEVEL 41
 - A01.042 - GENERAL ARRANGEMENT PLAN LEVEL 42
 - A01.043 - GENERAL ARRANGEMENT PLAN LEVEL 43
 - A01.044 - GENERAL ARRANGEMENT PLAN LEVEL 44



Dynamo Player

shee

- Create_Plans & Sheets_MultipleSequence Run completed with errors
- Create_Sheets_Duplicate-Sheets&Views Ready
- Create_Sheet_MultipleSheetSequence Ready
- Create_Views&Sheets_ForSelectedRooms_(Plan_RCP_IntElevations) Ready
- Create_Views&Sheets_ForSelectedRooms_Simplified4ElevationsOn Ready
- Modify_Sheets_Renumber Ready
- Modify_Viewport_AlignLegendsOnSheets Ready
- Modify_Viewport_AlignViewportsOnSheets Ready
- Modify_Viewport_Change_TypesOnSheets Ready
- Place_Legend_OnMultipleSheets Ready

Built_Anz_2019.rvt

Properties Help Apply

FileArchitectureStructureSystemsInsertAnnotateAnalyzeMassing & SiteCollaborateViewManageAdd-InsRevizto 4Enscape™AconexBIM Interoperability ToolsCASE Apps #1CASE Apps #2Revit Express ToolsdRofusJOToolsIdeate SoftwarepyRevitRTV ToolsUNIFI

ModifySelect

MaterialsObject Snaps StylesProject InformationParametersShared ParametersGlobal ParametersTransfer Project StandardsPurge UnusedProject UnitsSettings

Structural SettingsMEP SettingsPanel Schedule TemplatesAdditional Settings

LocationCoordinatesPositionProject Location

Design OptionsAdd to SetPick to EditMain ModelDesign Options

Manage ImagesManage LinksDecal TypesStarting ViewManage Project

PhasesPhasingSaveLoadEditSelection

IDs of SelectionSelect by IDWarningsInquiry

Macro ManagerMacro SecurityMacros

DynamoDynamo PlayerVisual Programming

Project Browser - Built_Anz_2019.rvt

A01

A01.001 - GENERAL ARRANGEMENT PLAN LEVEL 01

A01.002 - GENERAL ARRANGEMENT PLAN LEVEL 02

A01.003 - GENERAL ARRANGEMENT PLAN LEVEL 03

A01.004 - GENERAL ARRANGEMENT PLAN LEVEL 04

A01.005 - GENERAL ARRANGEMENT PLAN LEVEL 05

A01.006 - GENERAL ARRANGEMENT PLAN LEVEL 06

A01.007 - GENERAL ARRANGEMENT PLAN LEVEL 07

A01.008 - GENERAL ARRANGEMENT PLAN LEVEL 08

A01.009 - GENERAL ARRANGEMENT PLAN LEVEL 09

A01.010 - GENERAL ARRANGEMENT PLAN LEVEL 10

A01.011 - GENERAL ARRANGEMENT PLAN LEVEL 11

A01.012 - GENERAL ARRANGEMENT PLAN LEVEL 12

A01.013 - GENERAL ARRANGEMENT PLAN LEVEL 13

A01.014 - GENERAL ARRANGEMENT PLAN LEVEL 14

A01.015 - GENERAL ARRANGEMENT PLAN LEVEL 15

A01.016 - GENERAL ARRANGEMENT PLAN LEVEL 16

A01.017 - GENERAL ARRANGEMENT PLAN LEVEL 17

A01.018 - GENERAL ARRANGEMENT PLAN LEVEL 18

A01.019 - GENERAL ARRANGEMENT PLAN LEVEL 19

A01.020 - GENERAL ARRANGEMENT PLAN LEVEL 20

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A01.023 - GENERAL ARRANGEMENT PLAN LEVEL 23

A01.024 - GENERAL ARRANGEMENT PLAN LEVEL 24

A01.025 - GENERAL ARRANGEMENT PLAN LEVEL 25

A01.026 - GENERAL ARRANGEMENT PLAN LEVEL 26

A01.027 - GENERAL ARRANGEMENT PLAN LEVEL 27

A01.028 - GENERAL ARRANGEMENT PLAN LEVEL 28

A01.029 - GENERAL ARRANGEMENT PLAN LEVEL 29

A01.030 - GENERAL ARRANGEMENT PLAN LEVEL 30

A01.031 - GENERAL ARRANGEMENT PLAN LEVEL 31

A01.032 - GENERAL ARRANGEMENT PLAN LEVEL 32

A01.033 - GENERAL ARRANGEMENT PLAN LEVEL 33

A01.034 - GENERAL ARRANGEMENT PLAN LEVEL 34

A01.035 - GENERAL ARRANGEMENT PLAN LEVEL 35

A01.036 - GENERAL ARRANGEMENT PLAN LEVEL 36

A01.037 - GENERAL ARRANGEMENT PLAN LEVEL 37

A01.038 - GENERAL ARRANGEMENT PLAN LEVEL 38

A01.039 - GENERAL ARRANGEMENT PLAN LEVEL 39

A01.040 - GENERAL ARRANGEMENT PLAN LEVEL 40

A01.041 - GENERAL ARRANGEMENT PLAN LEVEL 41

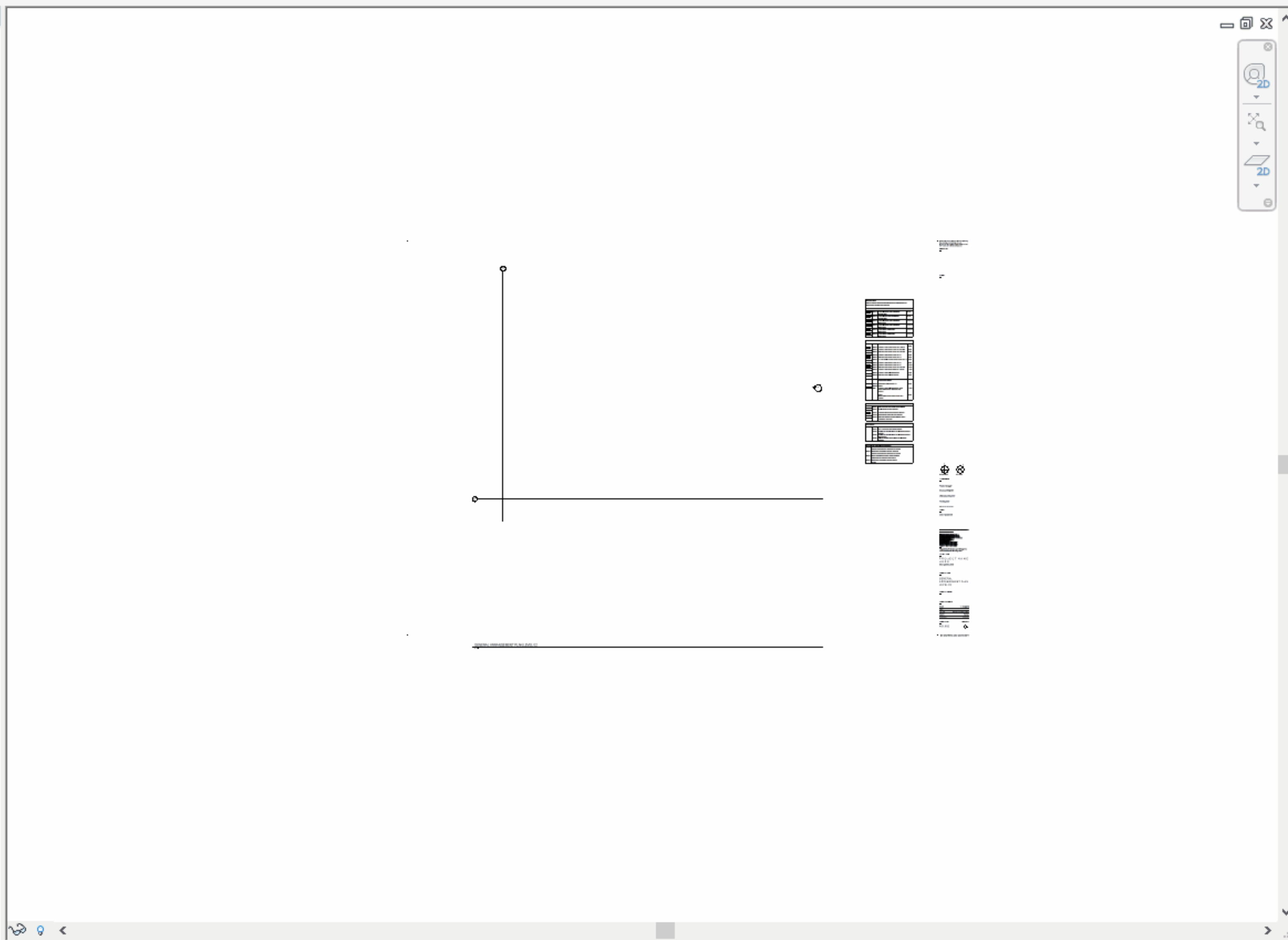
A01.042 - GENERAL ARRANGEMENT PLAN LEVEL 42

A01.043 - GENERAL ARRANGEMENT PLAN LEVEL 43

A01.044 - GENERAL ARRANGEMENT PLAN LEVEL 44

2D

2D



Properties

Sheet

Sheet: GENERAL ARRANGEMENT PLAN LEVEL C Edit Type

Constraints

Filter_ID	
User_ID	
FilterID_new	<input checked="" type="checkbox"/>
FilterID_deleted	<input checked="" type="checkbox"/>
FilterID_moved	<input checked="" type="checkbox"/>
Building_ID	

Graphics

Visibility/Graphics Overrides	Edit...
Scale	1 : 100

Text

Drawing Series	A01
Model File Name	
Revit Build Number	

Identity Data

Dependency	Independent
Referencing Sheet	
Referencing Detail	
Current Revision Issued	<input type="checkbox"/>
Current Revision Issued By	
Current Revision Issued To	
Current Revision Date	
Current Revision Description	
Current Revision	
Approved By	Approver
Designed By	Designer
Checked By	Checker
Drawn By	Author
Sheet Number	A01.002
Sheet Name	GENERAL ARRANGEMENT PL...
Sheet Issue Date	05/05/19
Appears In Sheet List	<input checked="" type="checkbox"/>
Revisions on Sheet	Edit...

Other

File Path	D:\wypychm\Documents\BUI...
Guide Grid	<None>

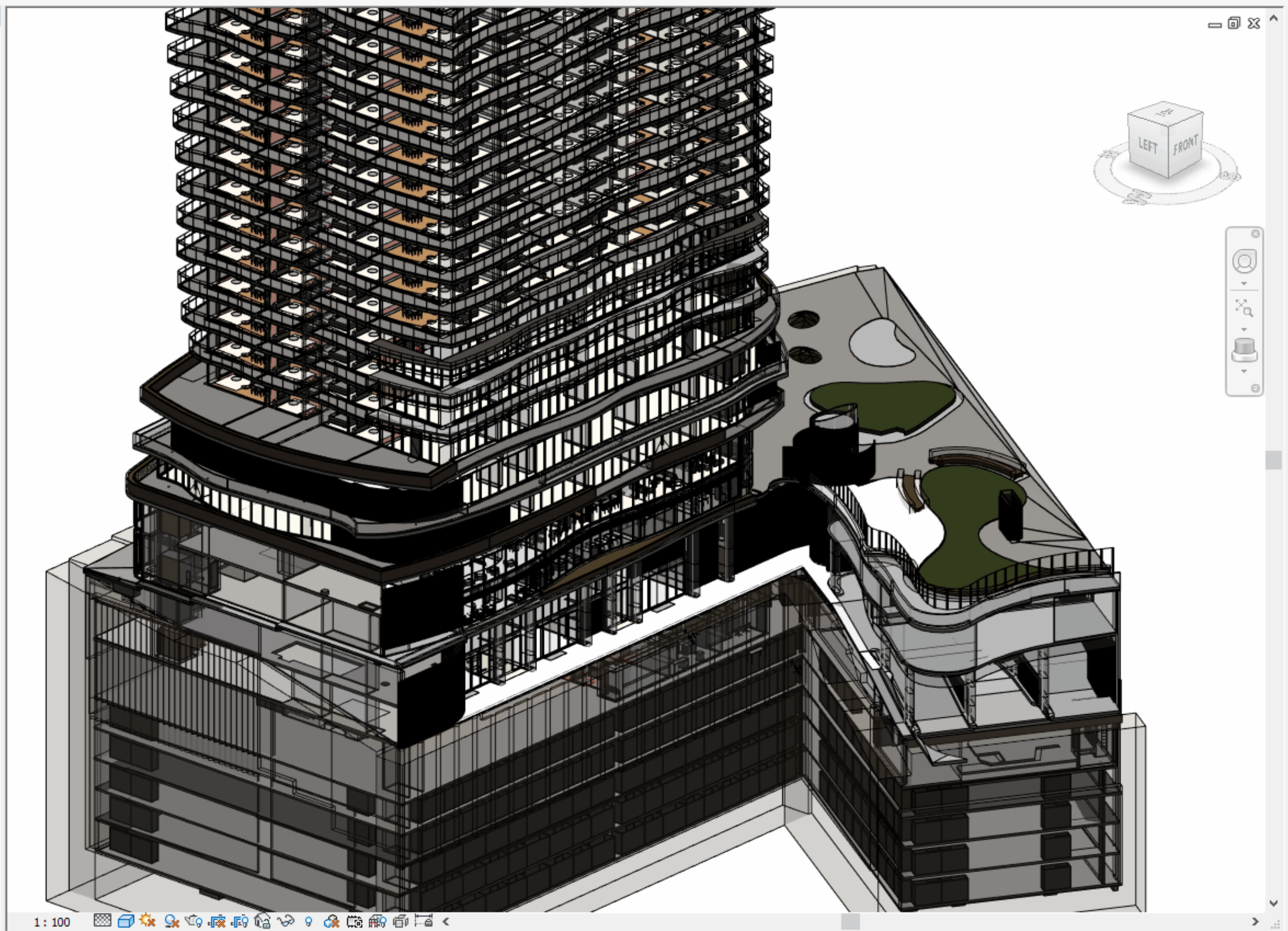
Properties help

Apply

File Architecture Structure Systems Insert Annotate Analyze Massing & Site Collaborate View Manage Add-Ins Revit 4 Enscape™ Aconex BIM Interoperability Tools CASE Apps #1 CASE Apps #2 Revit Express Tools dRofus JOTools Ideate Software pyRevit RTV Tools UNIFI

Modify Select Materials Object Snaps Styles Project Information Parameters Shared Parameters Global Parameters Transfer Project Standards Purge Unused Units Settings Structural Settings MEP Settings Panel Schedule Templates Additional Settings Location Coordinates Position Project Location Design Options Add to Set Pick to Edit Main Model Design Options Manage Images Manage Links Decal Types Starting View Manage Project Phasing Phases Save Load Edit Selection IDs of Selection Select by ID Warnings Inquiry Macro Manager Macro Security Macros Visual Programming Dynamo Player

- Project Browser - AR-MOD-001_LANDMARK-TOWER-C18_maciej.wypych...
- Floor Plans (DD_Wall Setout Plan)
 - Floor Plans
 - Floor Plans (WK_Floor Plan)
 - Floor Plans (WM Detail Floor Plan)
 - Floor Plans (WM ENLARGED ROOM TYPE PLAN)
 - Ceiling Plans (Plan_Ceiling_GA)
 - Ceiling Plans (Plan_Ceiling_Unit_A60)
 - Ceiling Plans (Plan_Ceiling_Unit_Marketing)
 - Ceiling Plans (Plan_Ceiling_WK)
 - 3D Views
 - Elevations (DA_Elevation_20_External)
 - Elevations (DD_Elevation_45_External Entity)
 - Elevations (DD_Elevation_70_Window Elevation)
 - Elevations (DD_Elevation_A44 Miscellaneous Details)
 - Elevations (DD_Elevation_Casework_A61)
 - Elevations (DD_Elevation_External)
 - DD_ELEVATION NORTH - STAIR 05
 - DD_GA_ELEVATION_EAST
 - DD_GA_ELEVATION_EAST CROWN
 - DD_GA_ELEVATION_EAST L05-L33
 - DD_GA_ELEVATION_EAST CARPARK
 - DD_GA_Elevation_North
 - DD_GA_Elevation_North CROWN
 - DD_GA_ELEVATION_SOUTH CARPARK
 - DD_GA_ELEVATION_SOUTH CROWN
 - DD_GA_ELEVATION_SOUTH L05-L33
 - DD_GA_ELEVATION_WEST
 - DD_GA_ELEVATION_WEST CARPARK
 - DD_GA_ELEVATION_WEST L05-L33
 - PART ELEVATION - EAST (ZONE B) RETAIL / PUBLIC
 - PART ELEVATION - FIRE BOOSTER ASSEMBLY
 - PART ELEVATION - GOODS ACCESS
 - PART ELEVATION - SOUTH (ZONE B) RETAIL / PUBLIC
 - PART ELEVATION - SOUTH (ZONE C & D) COMMERCIAL
 - PART ELEVATION - SOUTH WEST (ZONE C, D & E) COMMERCIAL
 - PART ELEVATION - WEST (ZONE E & F) RESIDENTIAL 8
 - PART ENLARGED ELEVATION - GOODS ACCESS
 - SECTION DIAGRAM - FRIEDLANDER PLACE TO NICHOLSON
 - Elevations (DD_Elevation_Internal_A60)
 - Elevations (DD_Elevation_Internal_A60 with sheet)
 - Sections (A51_SECTIONS)
 - Sections (Concrete Setout Section)
 - Sections (Core Sections)
 - Sections (Facade Sections)
 - Sections (GA Section)



Properties

3D View

3D View: {3D - maciej.wypych}

Constraints

Drawing Series	
Folders	WORKING VIEWS_(Project ...)
Filter_ID	
User_ID	
FilterID_new	<input checked="" type="checkbox"/>
FilterID_deleted	<input checked="" type="checkbox"/>
FilterID_moved	<input checked="" type="checkbox"/>

Graphics

View Scale	1 : 100
Scale Value 1:	100
Detail Level	Fine
Parts Visibility	Show Original
Visibility/Graphics Overrides	Edit...
Graphic Display Options	Edit...
Discipline	Coordination
Show Hidden Lines	By Discipline
Default Analysis Display Style	None
Visible In Option	all
Sun Path	<input type="checkbox"/>

Extents

Crop View	<input type="checkbox"/>
Crop Region Visible	<input type="checkbox"/>
Annotation Crop	<input type="checkbox"/>
Far Clip Active	<input type="checkbox"/>
Far Clip Offset	304800.0
Section Box	<input type="checkbox"/>

Camera

Rendering Settings	Edit...
Locked Orientation	<input type="checkbox"/>
Perspective	<input type="checkbox"/>
Eye Elevation	14074.6
Target Elevation	-151822.2
Camera Position	Adjusting

Identity Data

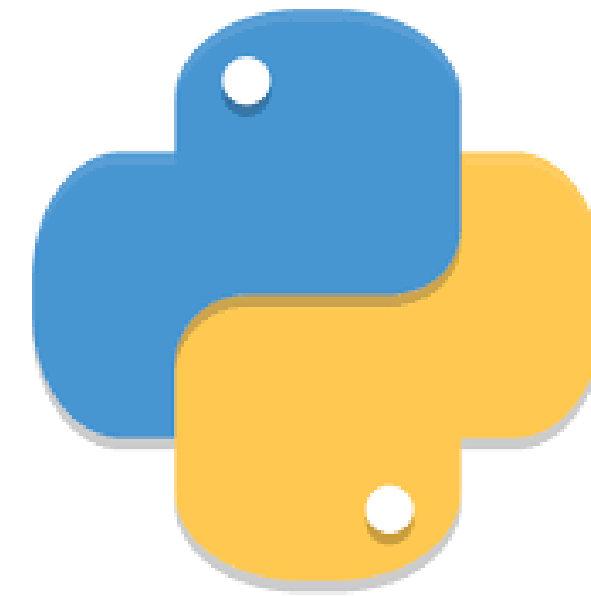
View Template	<None>
View Name	{3D - maciej.wypych}
Dependency	Independent
Title on Sheet	

Properties help

Apply

WHICH IS FASTER?

DESIGN
SCRIPT
IMPERATIVE
FUNCTION



Clockwork

Display

Environment

Geometry

ImportExport

Input

DateTime

Object

TimeSpan

+

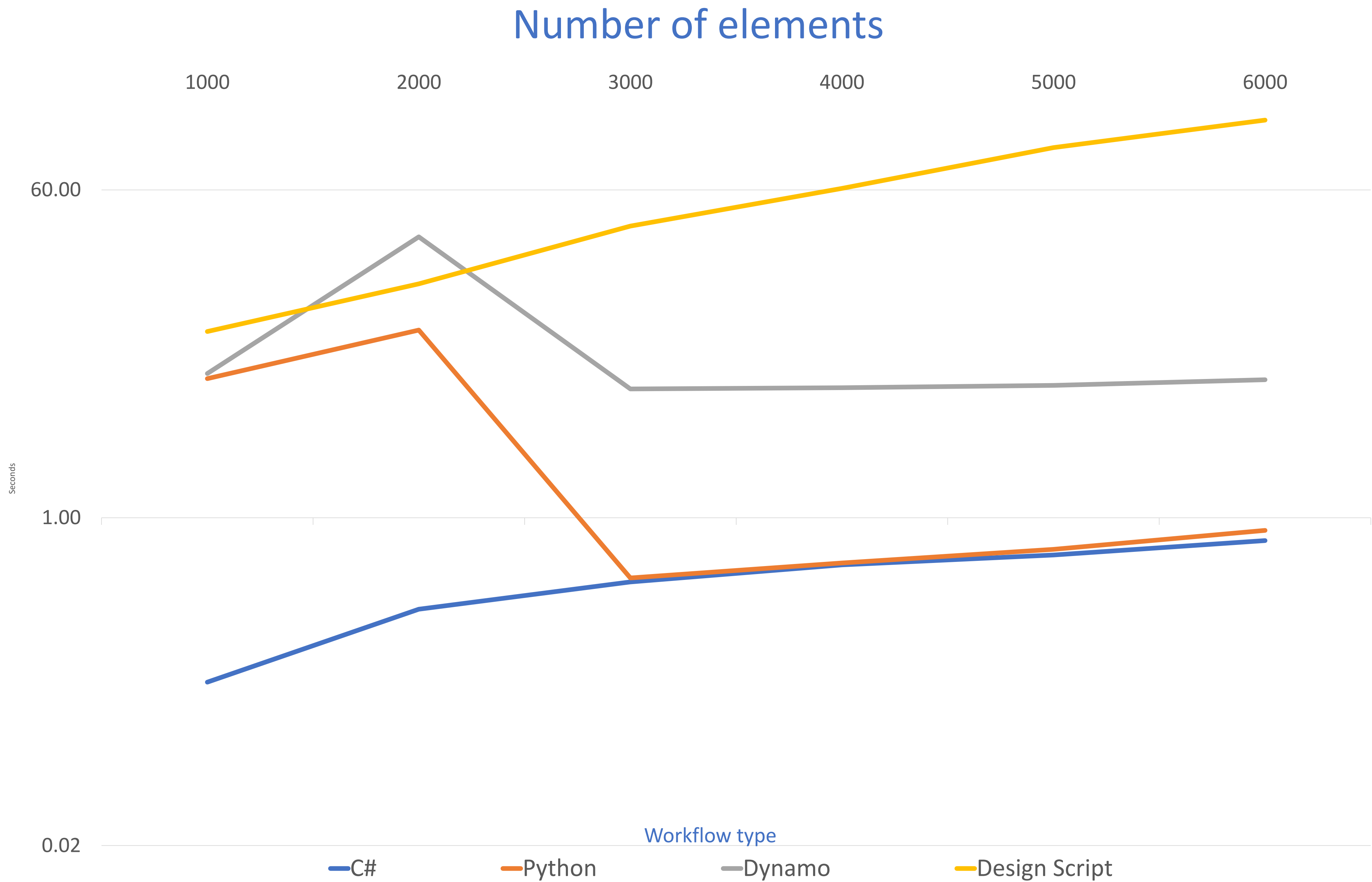
LapTime

?

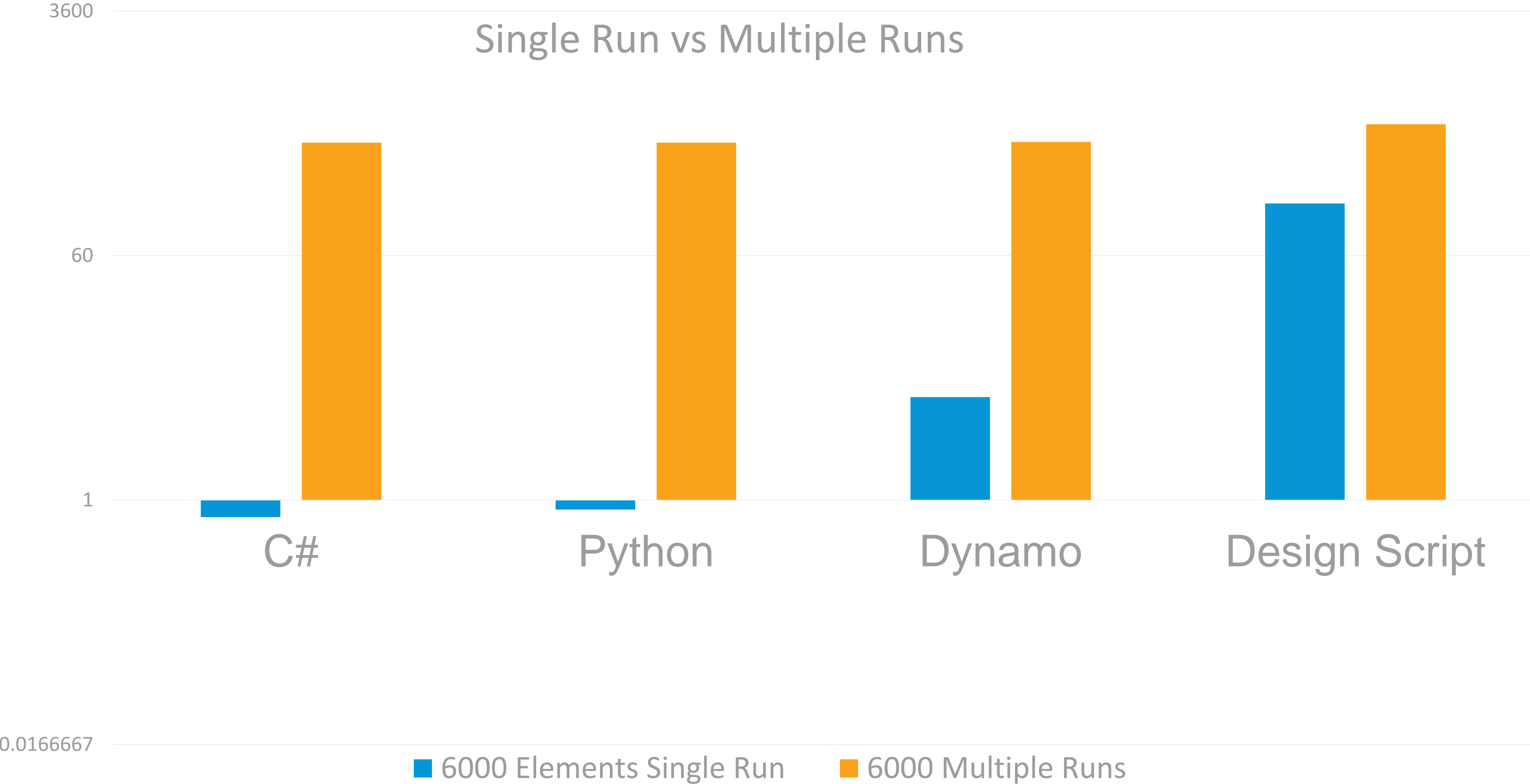
EvaluateLapTimes

The diagram illustrates a data flow between two components in a visual programming environment:

- TimeSpan.LapTime** (Left Component):
 - Inputs: `lapTimes` and `Passthrough` (both connected by black lines).
 - Output: `rerunToggle` (connected by a black line).
 - Bottom right corner: `AUTO`.
- TimeSpan.EvaluateLapTimes** (Right Component):
 - Input: `LapTimes` (connected by a blue line from the `lapTimes` output of the first component).
 - Output: `NetLapTimes` (connected by a blue line).
 - Bottom right corner: `OverallTime` (with `AUTO` below it).

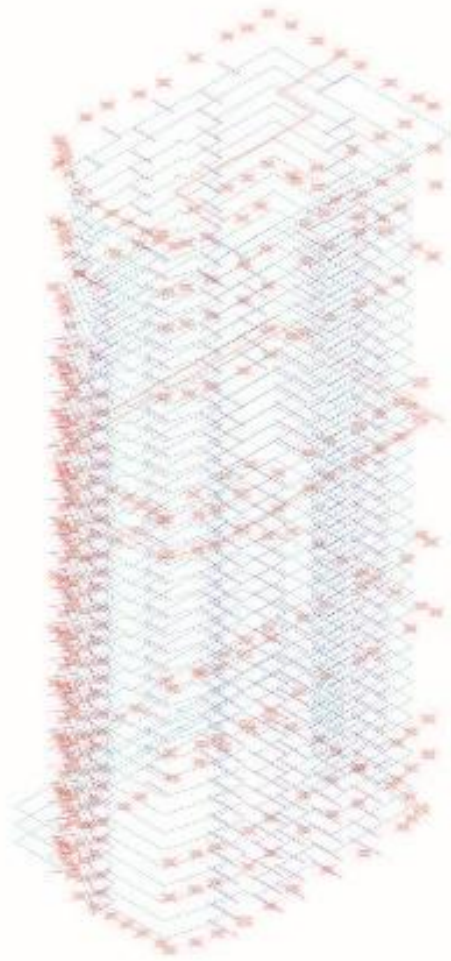


Single Run vs Multiple Runs

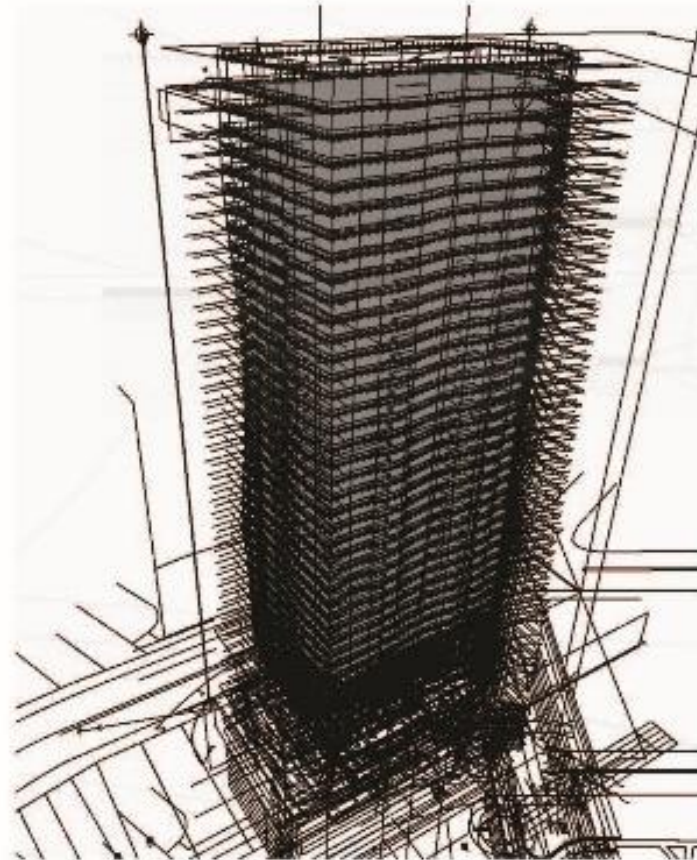


SUMMARY

THE LANDMARK - WORKFLOW



REVIT MODEL LINES
AND EXCEL DATA USED
TO CREATE TOWER
CONSTRAINTS



MULTIPLE DYNAMO
DEFINITIONS USED FOR
DESIGN EXPLORATION



19,942 MODEL ELEMENTS
CREATED OR PLACED
USING DYNAMO FOR REVIT
INCLUDING:

- STRUCTURAL SLABS
- FLOOR FINISHES
- ROOF
- CLADDING PANELS
- BALCONY DIVIDERS
- FLOOR UPSTANDS
- BALUSTRADES



23,508 MODEL ELEMENTS
PLACED MANUALLY AND
DISTRIBUTED ACCROSS
50 LEVELS INCLUDING 7
LEVELS OF BASEMENT
USING MODEL GROUPS

DYNAMO PLAYER USED TO
CREATE, POPULATE AND
ALIGN 200+ SHEETS.



EXCEL DATA FROM
CONSULTANTS IMPORTED
THROUGH DYNAMO TO
POPULATE ELEMENT
PARAMETERS

WE'VE ALWAYS DONE
IT THIS WAY...

PLAN AHEAD

AUTOMATE

USE REVIT TO DRIVE
DYNAMO GEOMETRY



AUTODESK[®]

Make anything[™]

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