openBIM Project Solutions

3rd July 2024
Sydney

Jon Mirtschin
Geometry Gym
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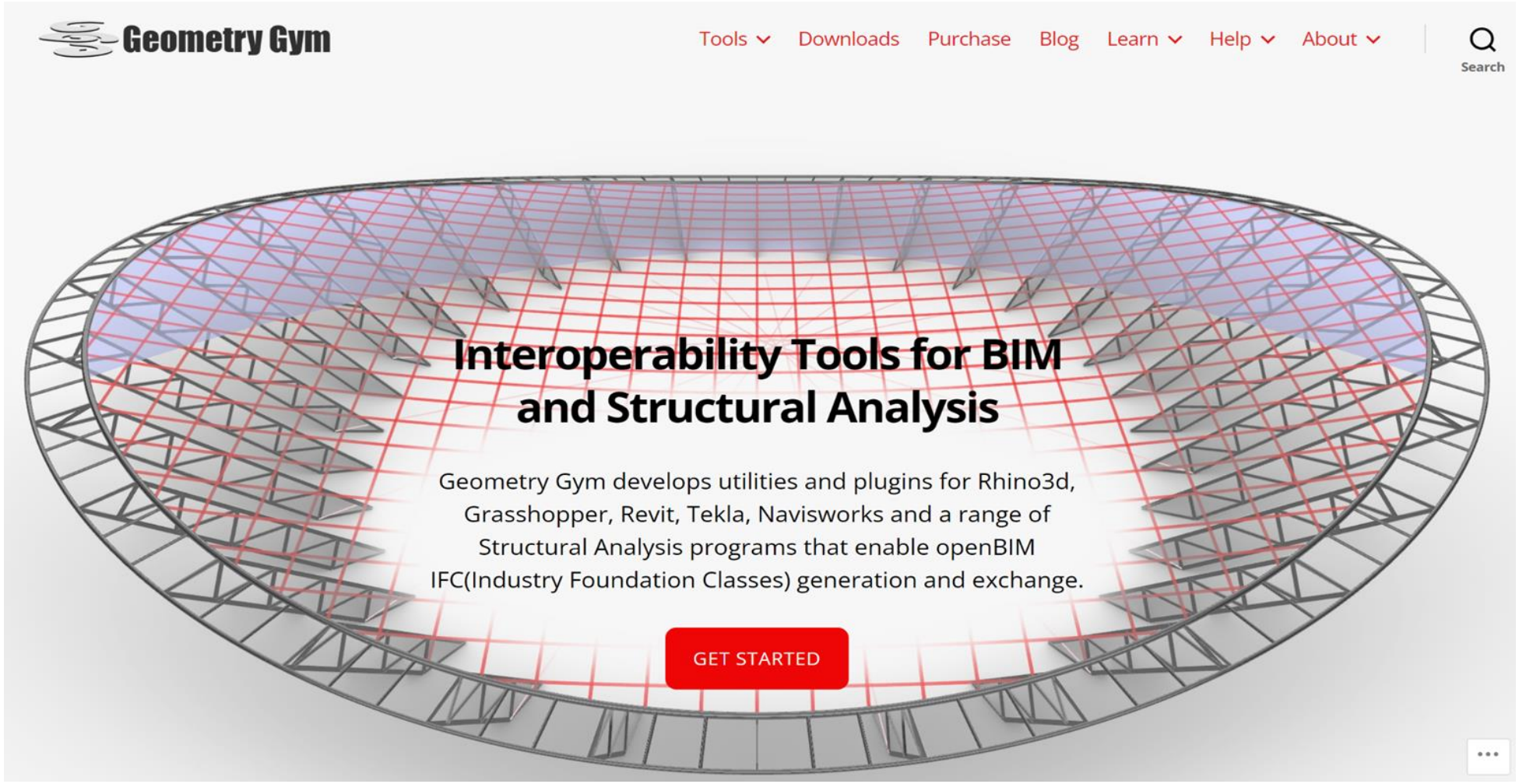
Geometry Gym

https://geometrygym.wordpress.com/



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Geometry Gym IFC Tools

Geometry Gym

Tools Downloads Purchase Blog Learn Help About Search

BIM and Industry Foundation Class (IFC)

Learn about BIM and Industry Foundation Class tools and Features

Free to Try

RhinoIFC

Rhino 6 and Newer

Available from Rhino Package Manager

Technical Examples Blog Updates

Learn about Rhino3d

Free to Try

RevitIFC

Revit 2018 to 2024. Earlier versions available on request.

ggRevit User v24.01.23 (24th Jan 2024)

Technical Blog Updates

Learn about Revit

Free to Try

NavisIFC

Navisworks Manage 2018 to 2024

ggNavisIFC v23.11.17 (17/11/2023)

Technical Blog

Learn about Navisworks

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Agenda

openBIM Project Solutions (Disclosed)

- Schema Compliance and Validation
- Inconsistent and Problematic Interpretations
- Efficiency vs Reliability (File Sizes)
- Model View Definitions

https://validate.buildingsmart.org/

Validation BETA
a service by buildingSMART International

JM

Let us know what we're getting right and what we can improve at validate@buildingsmart.org

- Home
- Validation

validate v0.6.4

Click or drop files here to upload for validation

UPLOAD & VALIDATE

1. Select the IFC file(s) you want to validate
2. Click on "Upload & Validate"
3. Check the detailed results by clicking on the icons

File Name	STEP Syntax	IFC Schema	Normative IFC Rules	Industry Practices	bSDD Compliance	Date	
IFC_Demo_Port_Fairy_Rail_Trail.ifc	✓	✓	!	✓	✓	4 days ago	Download file

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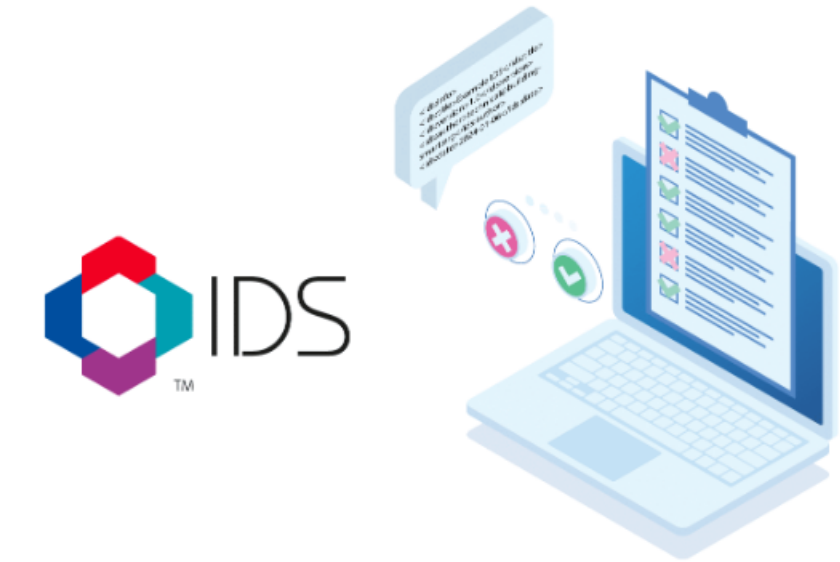
Information Delivery Specification (IDS)

https://www.buildingsmart.org/standards/bsi-standards/information-delivery-specification-ids/

Information Delivery Specification (IDS)

Define your exchange requirements with IDS to build confidence, clarity and enhance interoperability

Learn more **Documentation**



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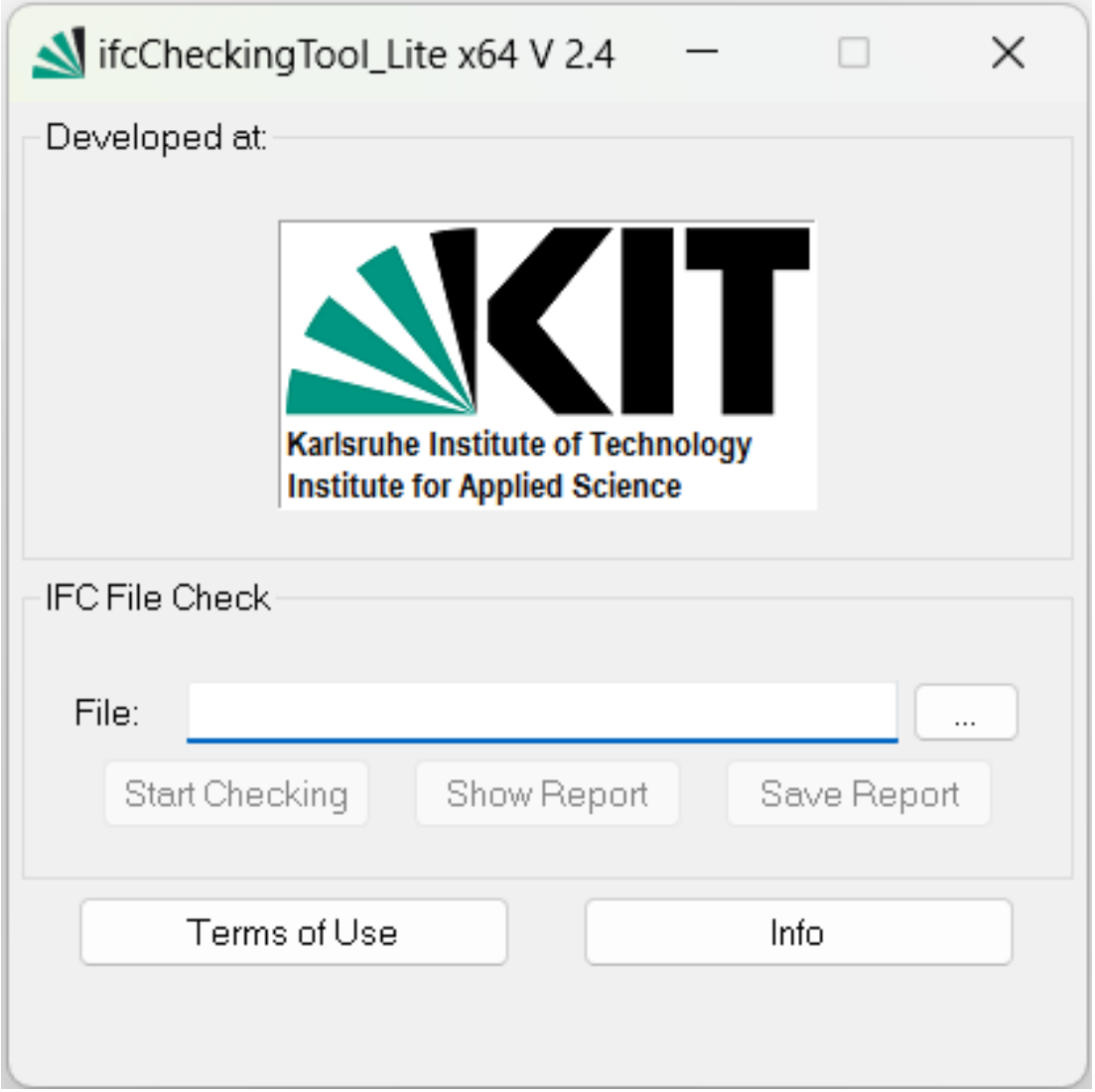
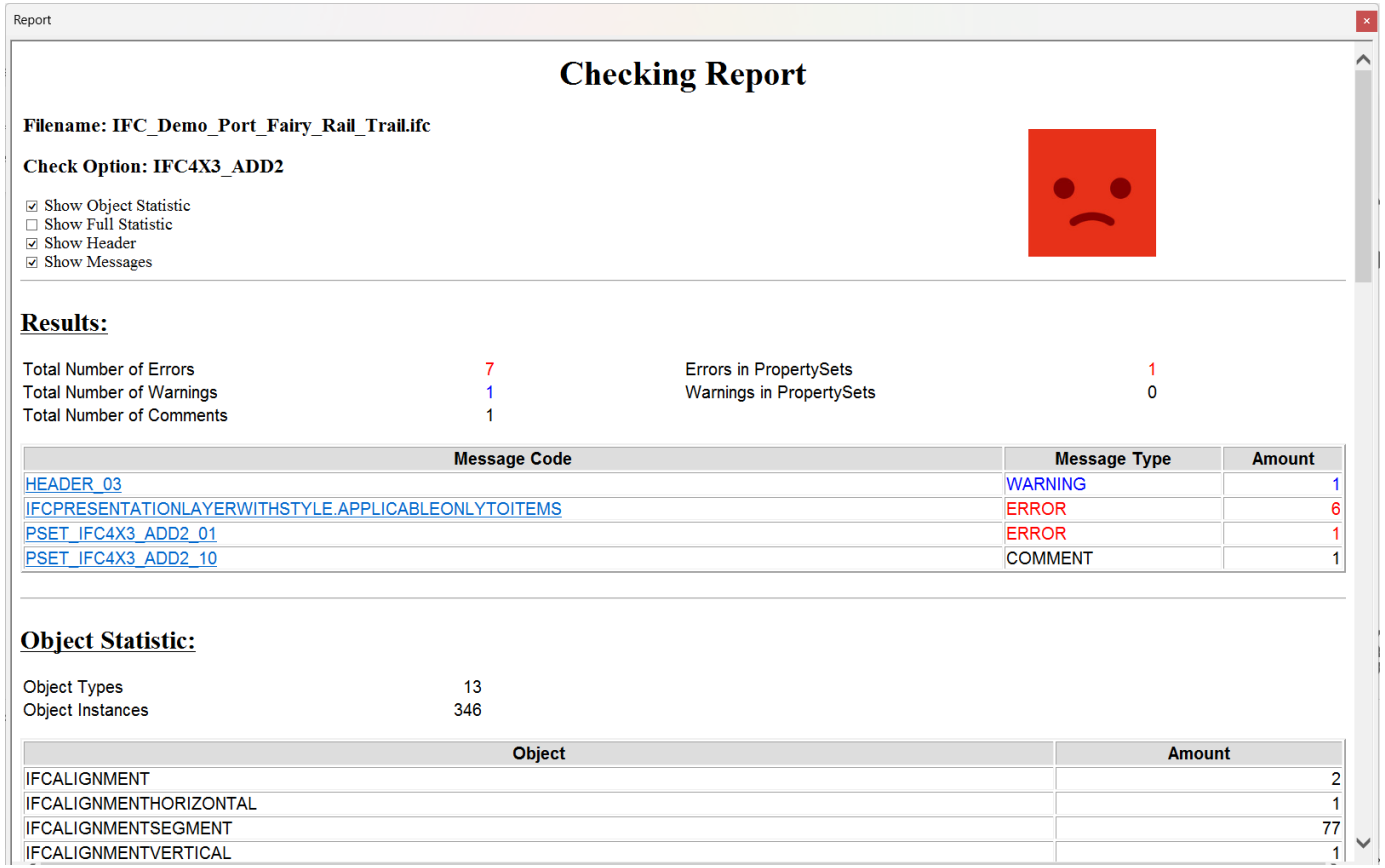
IfcCheckingTool

https://www.iai.kit.edu/english/1649.php





Report

Checking Report

Filename: IFC_Demo_Port_Fairy_Rail_Trail.ifc

Check Option: IFC4X3_ADD2

- ☑ Show Object Statistic
- ☐ Show Full Statistic
- ☑ Show Header
- ☑ Show Messages

Results:

Total Number of Errors	7	Errors in PropertySets	1
Total Number of Warnings	1	Warnings in PropertySets	0
Total Number of Comments	1		

Message Code	Message Type	Amount
HEADER_03	WARNING	1
IFCPRESENTATIONLAYERWITHSTYLE.APPLICABLEONLYTOITEMS	ERROR	6
PSET_IFC4X3_ADD2_01	ERROR	1
PSET_IFC4X3_ADD2_10	COMMENT	1

Object Statistic:

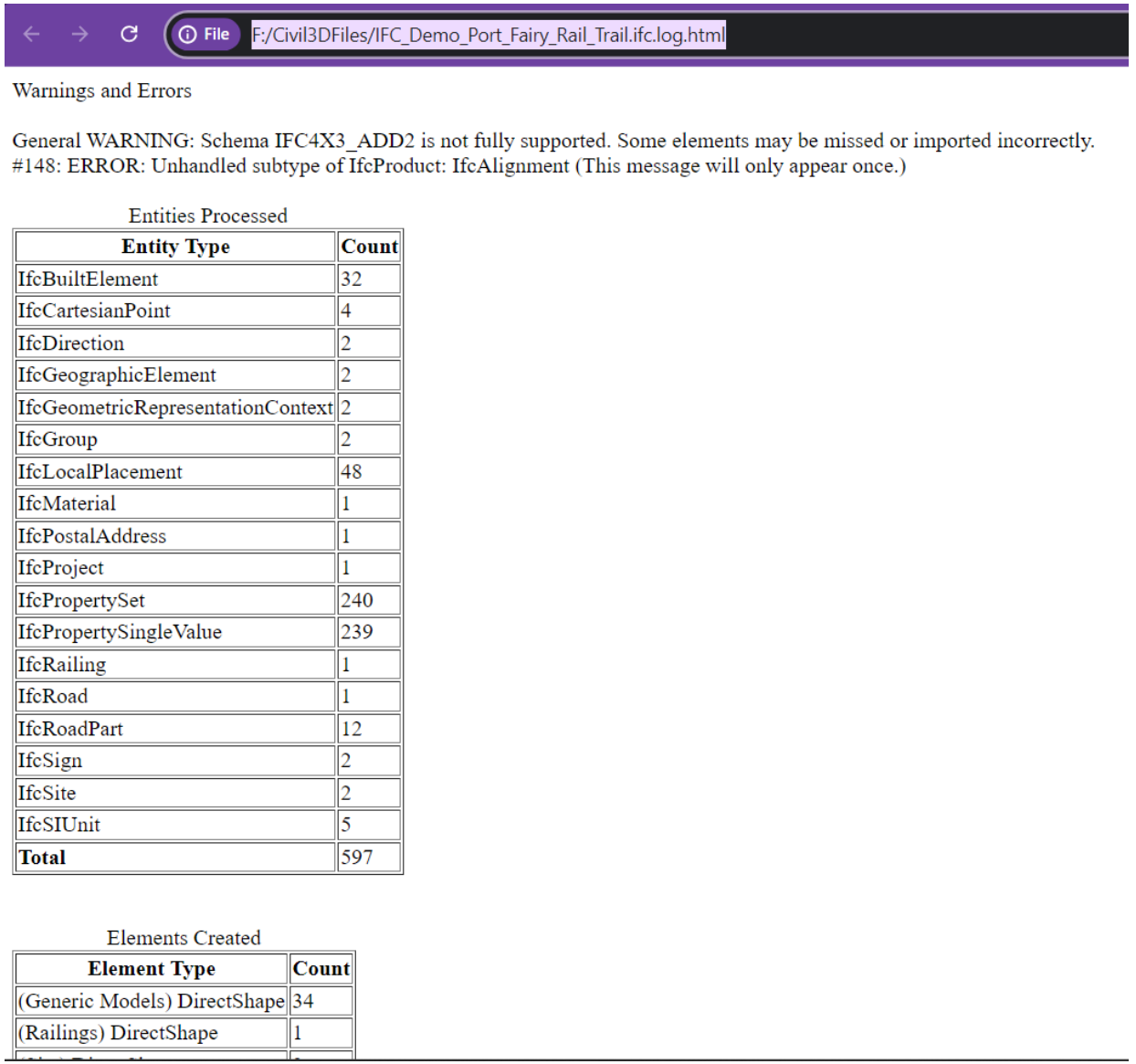
Object Types	13
Object Instances	346

Object	Amount
IFCALIGNMENT	2
IFCALIGNMENTHORIZONTAL	1
IFCALIGNMENTSEGMENT	77
IFCALIGNMENTVERTICAL	1

Errors and problems

Many viewers swallow / ignore issues and problems when importing/opening an IFC file.

Encourage vendors to provide a log file. Revit will generate a .log.html file when linking an IFC file that can be useful for troubleshooting on Autodesk software.



Warnings and Errors

General WARNING: Schema IFC4X3_ADD2 is not fully supported. Some elements may be missed or imported incorrectly.
#148: ERROR: Unhandled subtype of IfcProduct: IfcAlignment (This message will only appear once.)

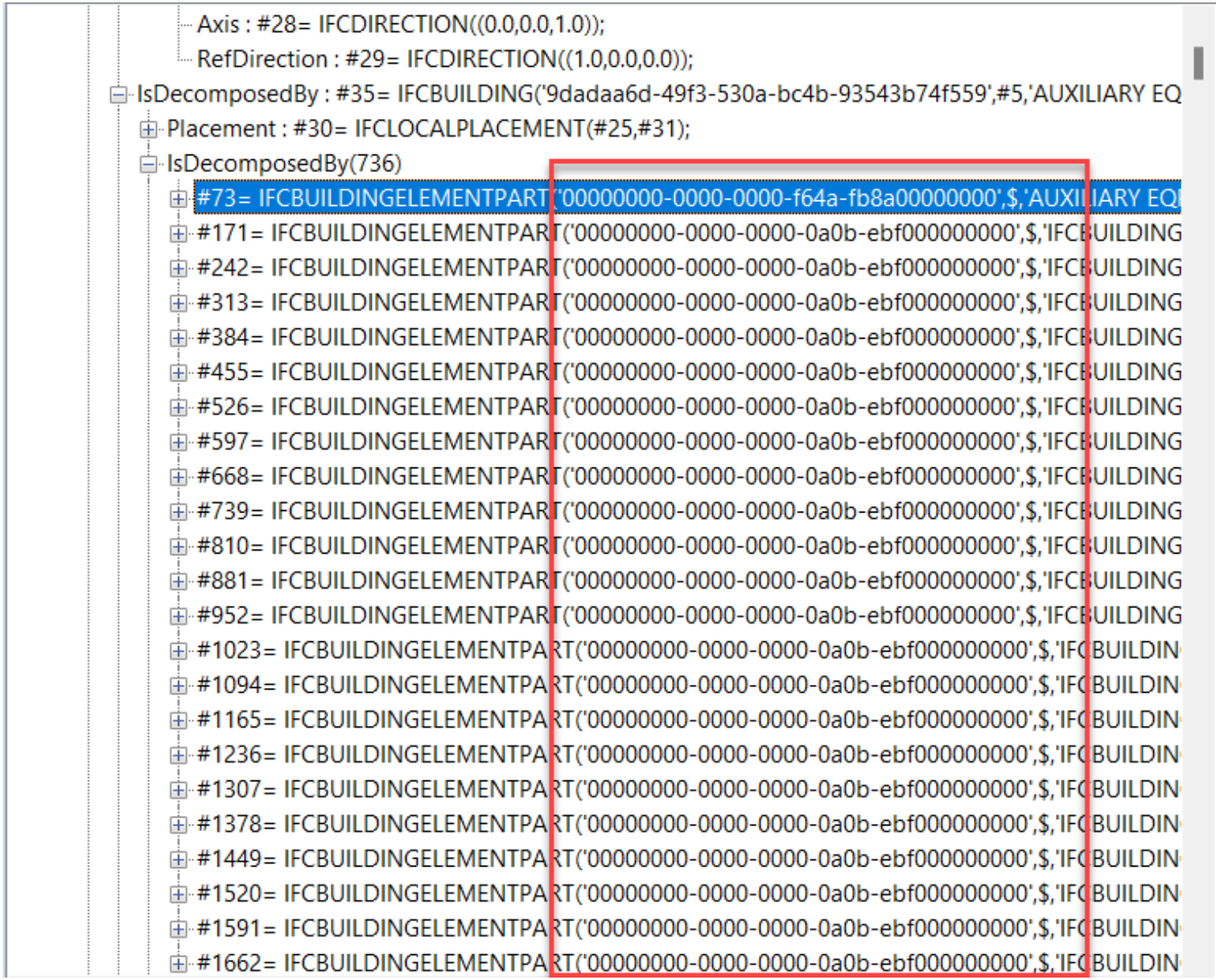
Entities Processed

Entity Type	Count
IfcBuiltElement	32
IfcCartesianPoint	4
IfcDirection	2
IfcGeographicElement	2
IfcGeometricRepresentationContext	2
IfcGroup	2
IfcLocalPlacement	48
IfcMaterial	1
IfcPostalAddress	1
IfcProject	1
IfcPropertySet	240
IfcPropertySingleValue	239
IfcRailing	1
IfcRoad	1
IfcRoadPart	12
IfcSign	2
IfcSite	2
IfcSIUnit	5
Total	597

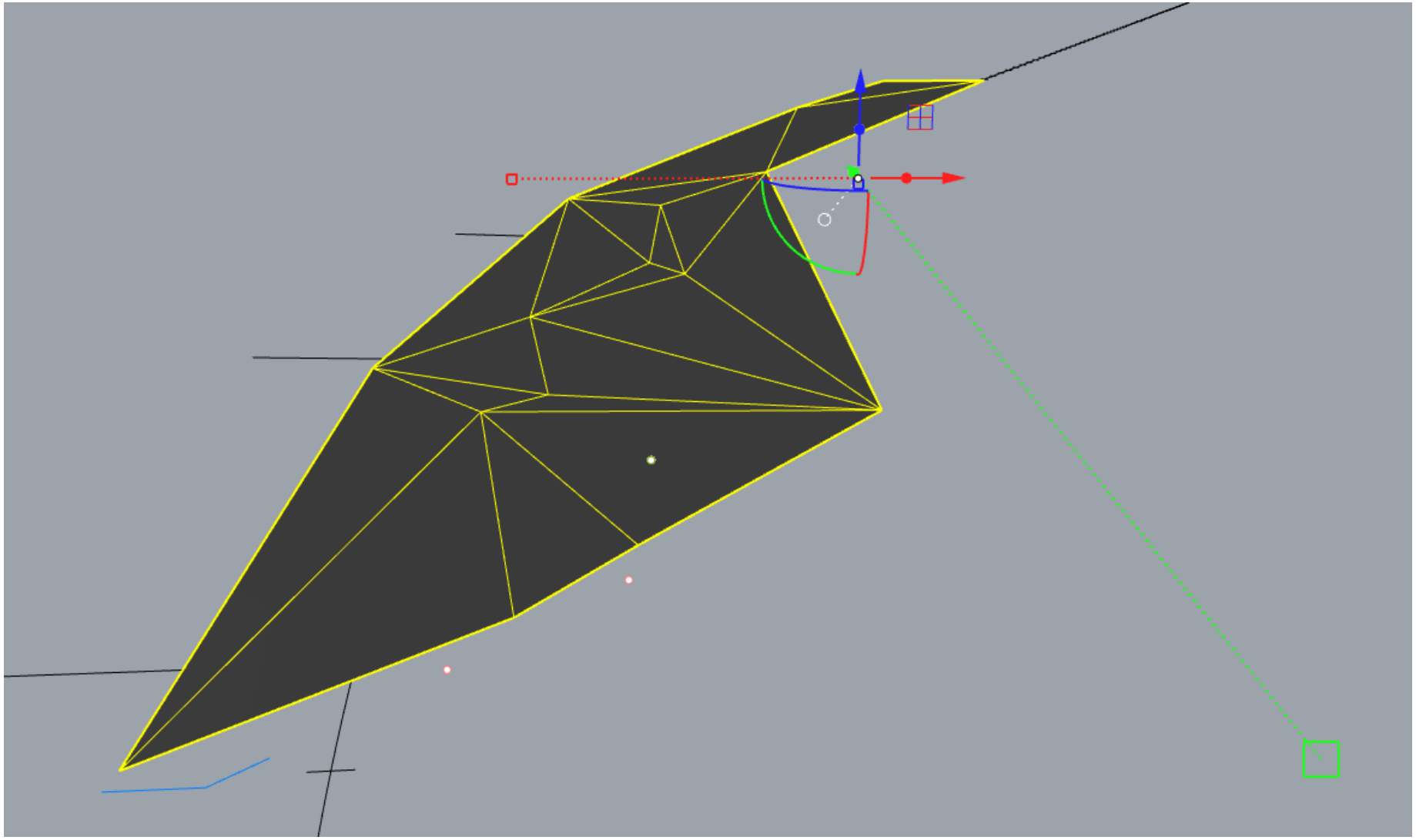
Elements Created

Element Type	Count
(Generic Models) DirectShape	34
(Railings) DirectShape	1

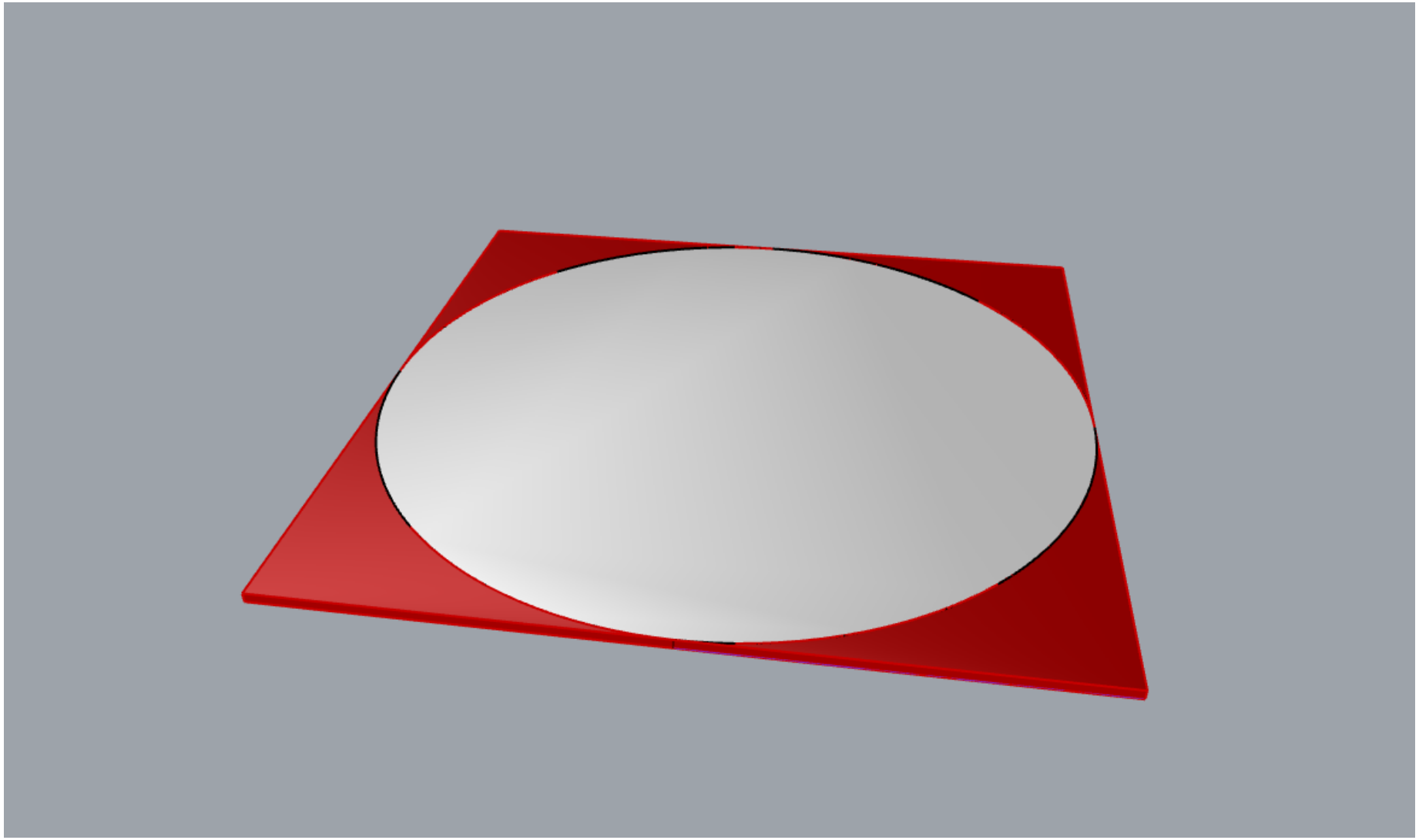
Errors and problems



Triangulated Geometry

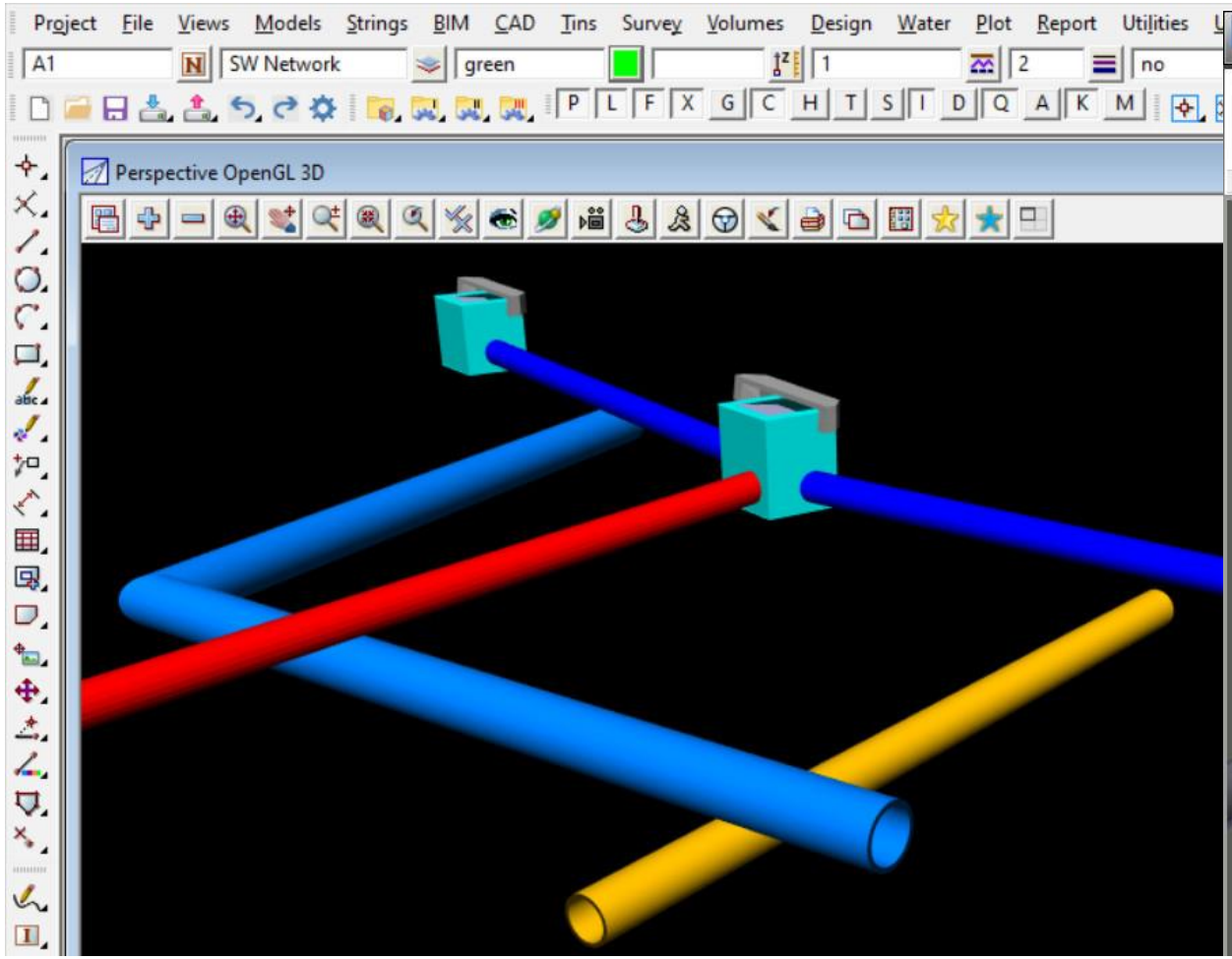


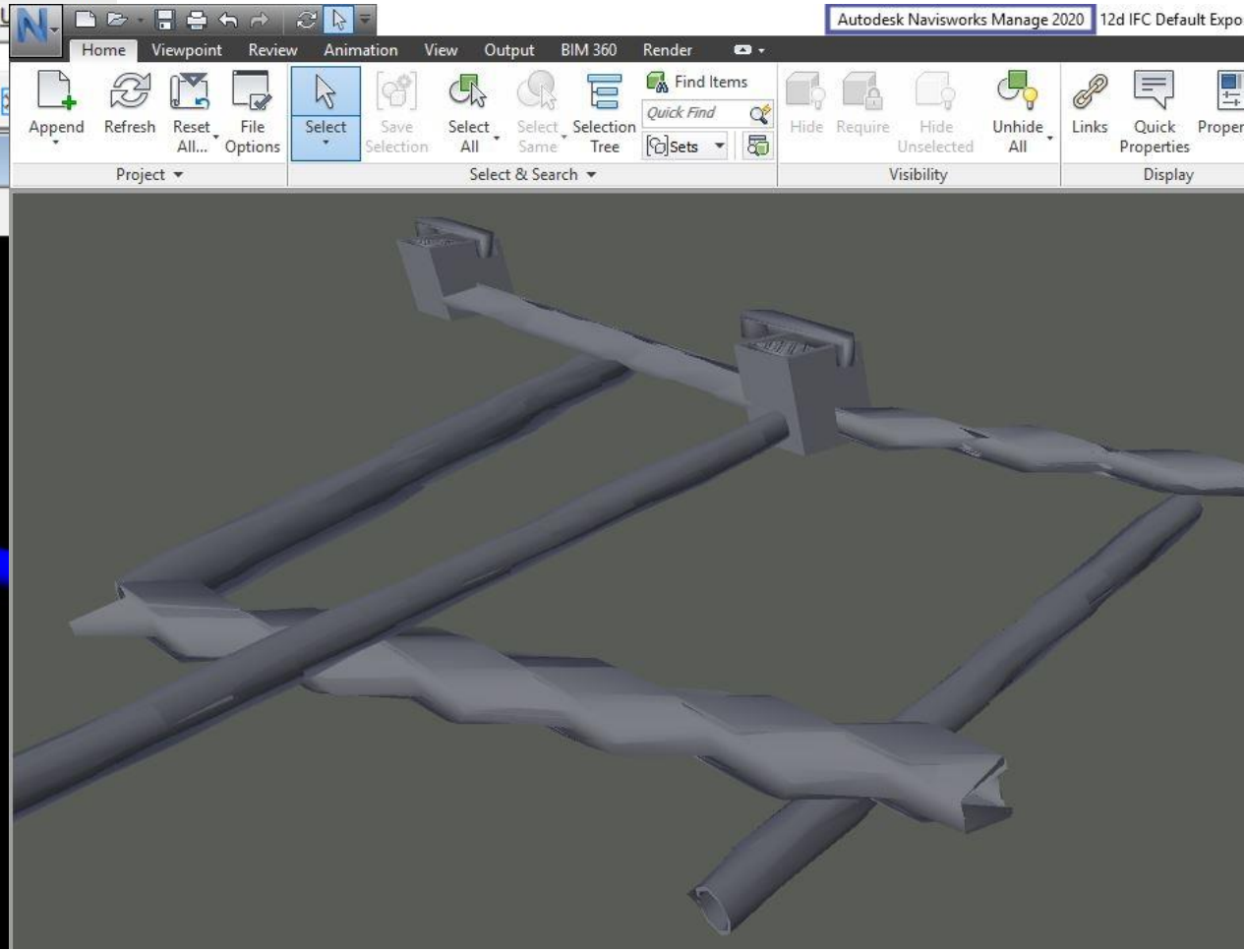
Constructive Solid Geometry



Implementations (Geometry)

Distorted Geometry





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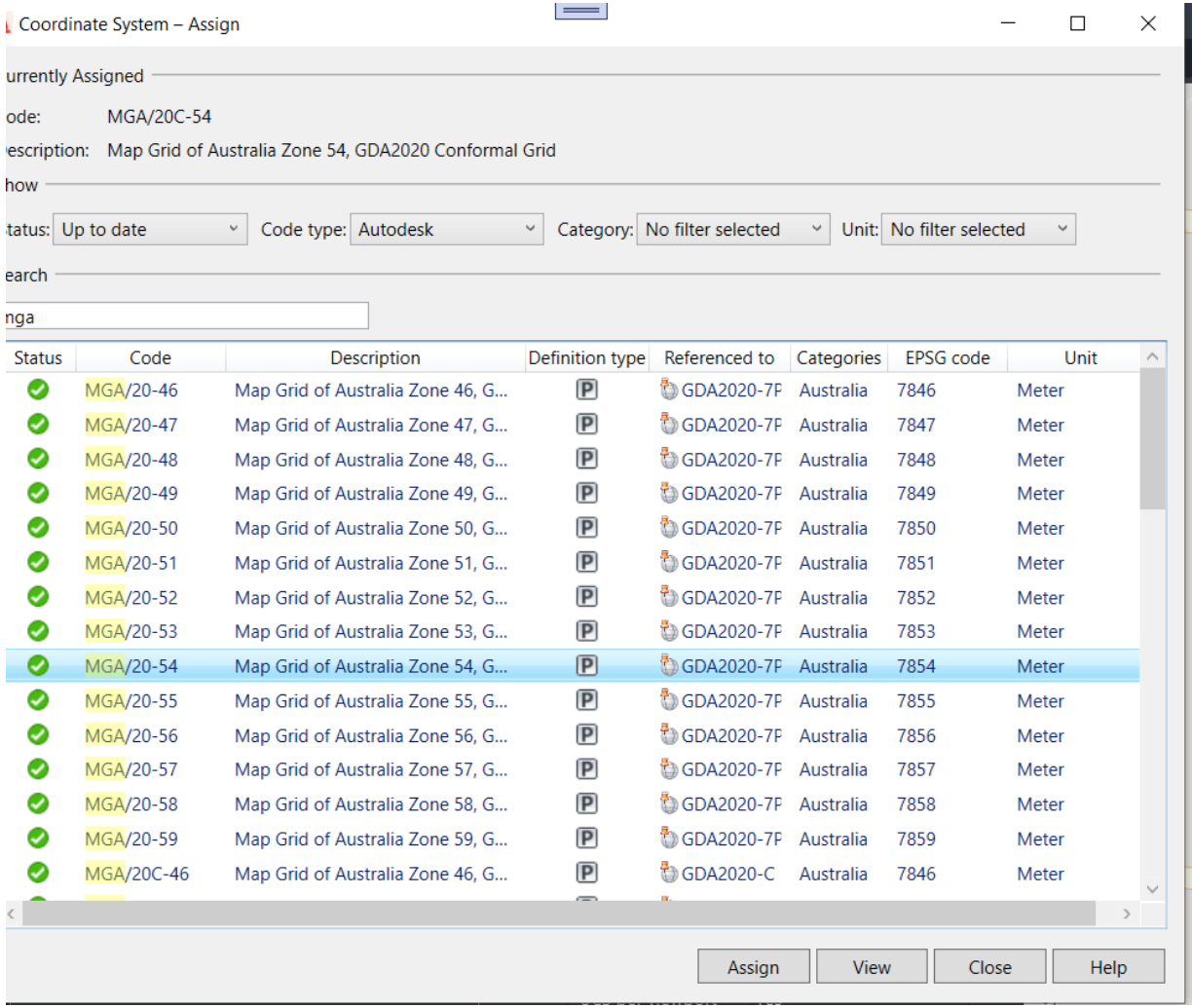
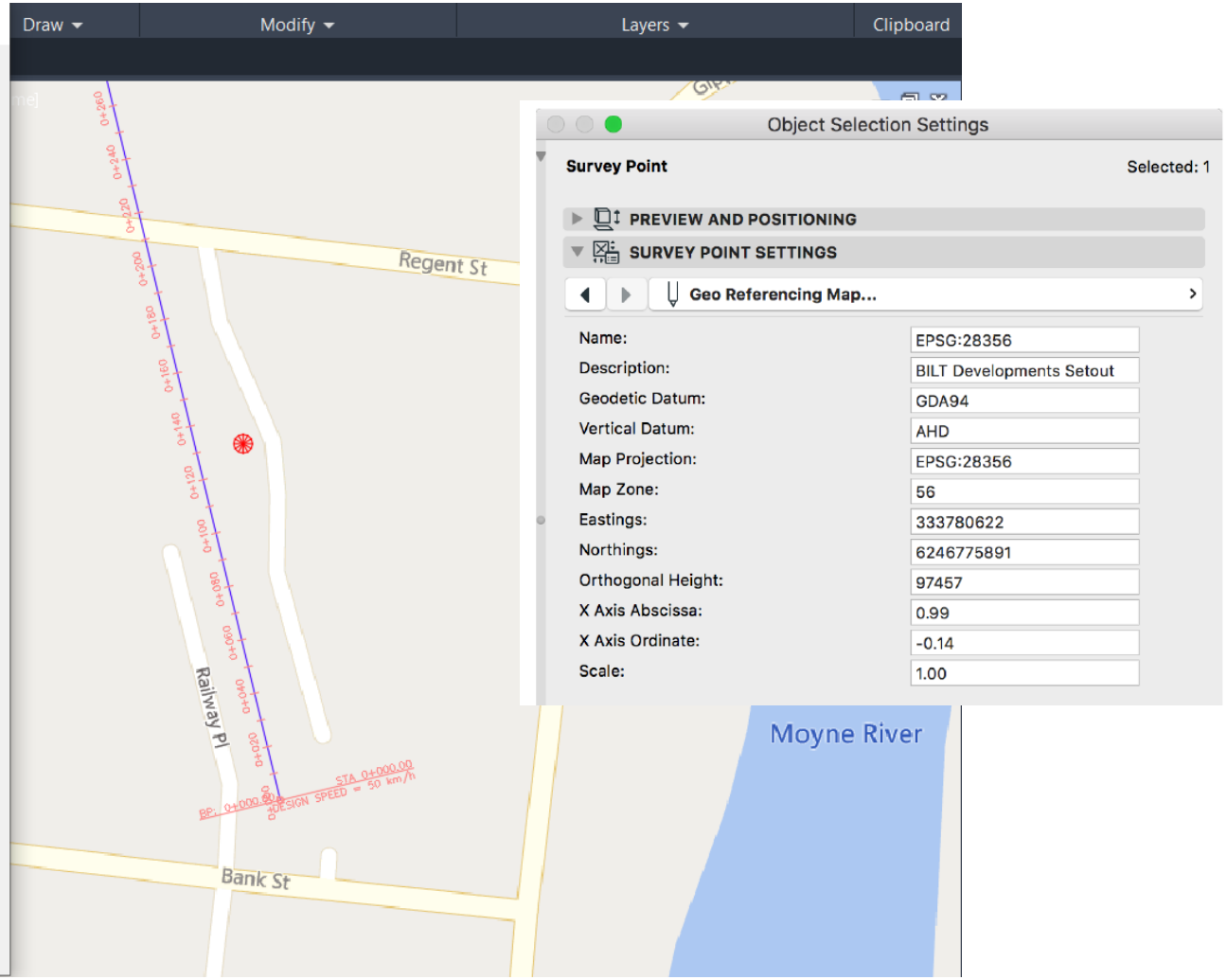
IFC 4.3 – Georeferencing (Model Setout)





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IFC Geometry Implementations

Geometry challenges

- Coincident vertex or points
- Short Edge lengths
- Constructive Solid Geometry
- Sweeps

IFC Implementations

IFC is a comprehensive data model that has evolved over 20+ years.

Vendors do find it challenging to implement and support.

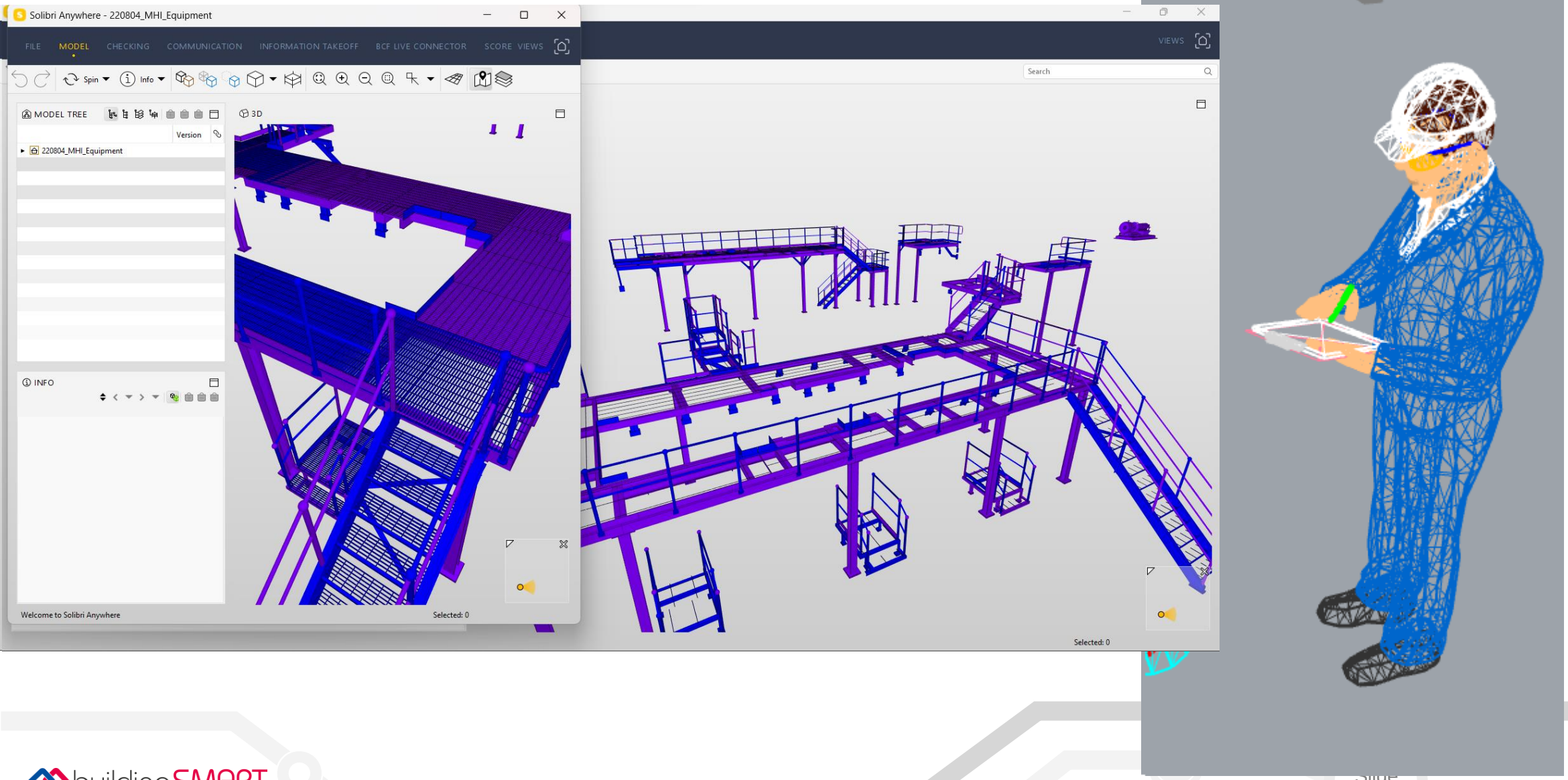
Data model does have some duplication (ie number of ways to color an object).

IFC Efficiency – Duplicated Data

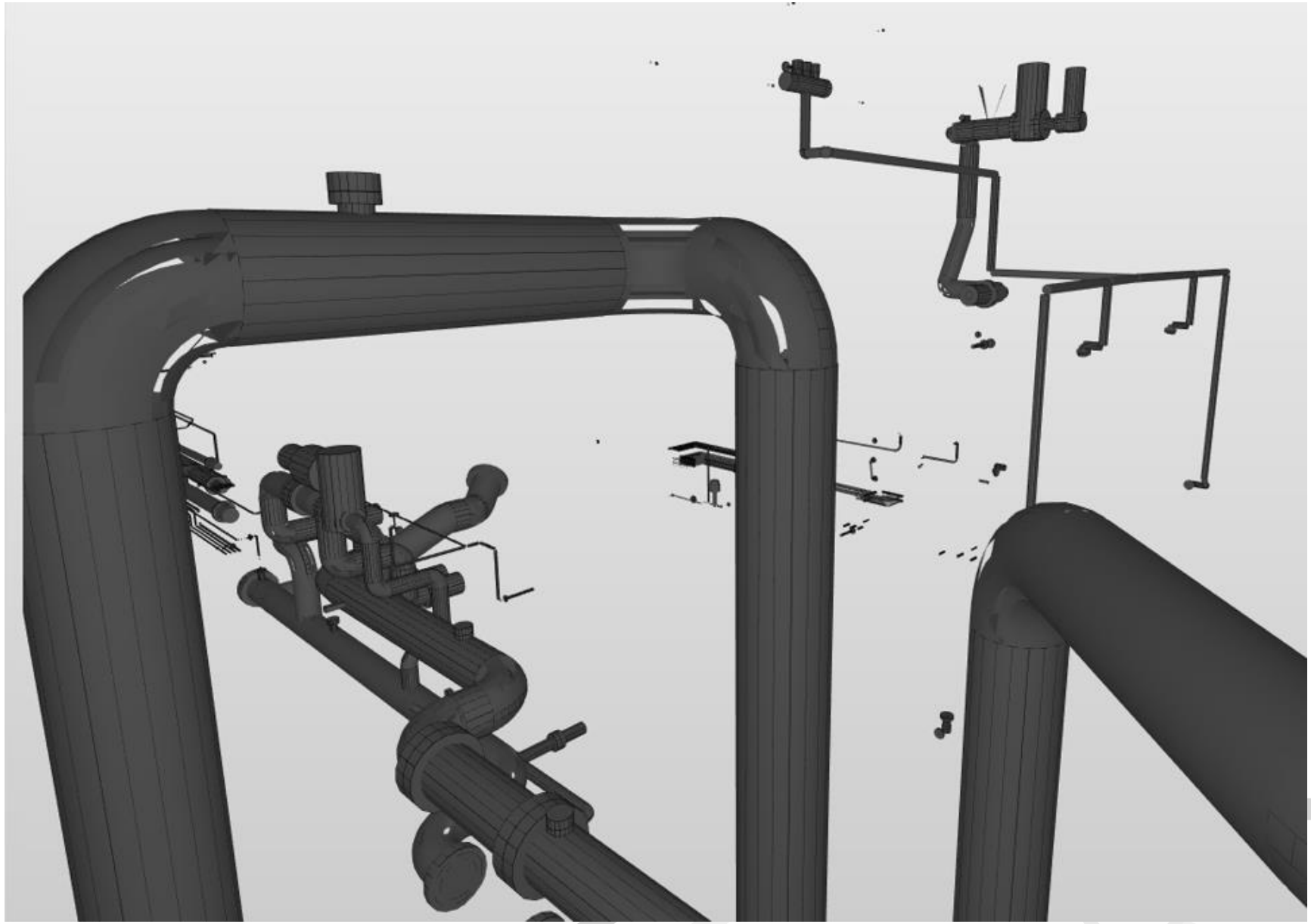
```
#2110=IFCMATERIAL('S235JR');
#2120=IFCPROPERTYSINGLEVALUE('Reference',$,IFCIDENTIF
#2130=IFCPROPERTYSINGLEVALUE('Span',$,IFCPOSITIVELENG
#2140=IFCPROPERTYSINGLEVALUE('Slope',$,IFCPLANEANGLEM
#2150=IFCPROPERTYSINGLEVALUE('IsExternal',$,IFCBOOLEA
#2160=IFCPROPERTYSINGLEVALUE('LoadBearing',$,IFCBOOLE
#2170=IFCPROPERTYSINGLEVALUE('FireRating',$,IFCLABEL(
#2180=IFCPROPERTYSET('177rmsZJ5FXw1MT8DXet0k',#150,'P
#2190=IFCRELDEFINESBYPROPERTIES('38l4gjCRj1zwzUcZjjoC
#2200=IFCPROPERTYSINGLEVALUE('SectionFamily',$,IFCIDE
#2210=IFCPROPERTYSINGLEVALUE('Section',$,IFCIDENTIFIE
#2220=IFCPROPERTYSET('3GgsCQTin5wPCPOeM6PHHO',#150,'P
#2230=IFCRELDEFINESBYPROPERTIES('3hw6AhyYX3wultAK2zmu
#2240=IFCBOOLEANCLIPPINGRESULT(.DIFFERENCE.,#2250,#23
#2250=IFCEXTRUDEDAREASOLID(#2270,#2300,#2260,1129.981
#2260=IFCDIRECTION((0.,0.,-1.));
#2270=IFCCIRCLEHOLLOWPROFILEDEF(.AREA.,'RO42.4X4',#22
#2280=IFCAXIS2PLACEMENT2D(#2290,$);
#2290=IFCCARTESIANPOINT((0.,0.));
#2300=IFCAXIS2PLACEMENT3D(#2310,$,$);
#2310=IFCCARTESIANPOINT((0.,0.,0.));
#2320=IFCHALFSPACESOLID(#2330,.T.);
#2330=IFCPLANE(#2340);
#2340=IFCAXIS2PLACEMENT3D(#2370,#2350,#2360);
#2350=IFCDIRECTION((0.,0.,-1.));
#2360=IFCDIRECTION((1.,0.,0.));
#2370=IFCCARTESIANPOINT((31299.965789789,1.,-46.18232
```

```
#2590=IFCDIRECTION((0.,0.,1.));
#2600=IFCDIRECTION((-1.,0.,0.));
#2610=IFCCARTESIANPOINT((31299.965789789,1.,7229.981327522));
#2620=IFCPRODUCTDEFINITIONSHAPE($,$,(#2630));
#2630=IFCSHAPEREPRESENTATION(#20,'Body','Clipping',(#2240));
#2640=IFCMATERIAL('S235JRG2');
#2650=IFCPROPERTYSINGLEVALUE('Reference',$,IFCIDENTIFIER('Not
#2660=IFCPROPERTYSINGLEVALUE('Slope',$,IFCPLANEANGLEMEASURE(0.
#2670=IFCPROPERTYSINGLEVALUE('IsExternal',$,IFCBOOLEAN(.F.),$)
#2680=IFCPROPERTYSINGLEVALUE('LoadBearing',$,IFCBOOLEAN(.F.),$
#2690=IFCPROPERTYSINGLEVALUE('FireRating',$,IFCLABEL(''),$);
#2700=IFCPROPERTYSET('1kXiBfRO5BHuqquYPbtaVq',#150,'Pset_Colum
#2710=IFCRELDEFINESBYPROPERTIES('1TX9lmoOj7m9NACWZEnJcr',#150,
#2720=IFCPROPERTYSINGLEVALUE('SectionFamily',$,IFCIDENTIFIER('
#2730=IFCPROPERTYSINGLEVALUE('Section',$,IFCIDENTIFIER('RO42.4
#2740=IFCPROPERTYSET('36xbcUqJ1AAA1$9Gq5g6_b',#150,'ProfileProp
#2750=IFCRELDEFINESBYPROPERTIES('0eTx2IT2195vSj1Zwvv1U4',#150,
#2760=IFCBOOLEANCLIPPINGRESULT(.DIFFERENCE.,#2770,#2810);
#2770=IFCEXTRUDEDAREASOLID(#2270,#2790,#2780,1129.981327522);
#2780=IFCDIRECTION((0.,0.,-1.));
#2790=IFCAXIS2PLACEMENT3D(#2800,$,$);
#2800=IFCCARTESIANPOINT((0.,0.,0.));
#2810=IFCHALFSPACESOLID(#2820,.T.);
#2820=IFCPLANE(#2830);
#2830=IFCAXIS2PLACEMENT3D(#2860,#2840,#2850);
#2840=IFCDIRECTION((0.,0.,-1.));
#2850=IFCDIRECTION((1.,0.,0.));
#2860=IFCCARTESIANPOINT((30364.253947661,1.,-46.182327522));
#2870=IFCOPENINGELEMENT('0eb0s9Nfn6cfC9FN_Sb0FH',#150,$,$,'Oper
```

Level of Detail (and asset breakdown)



Should not be a 2GB IFC File



Efficiency

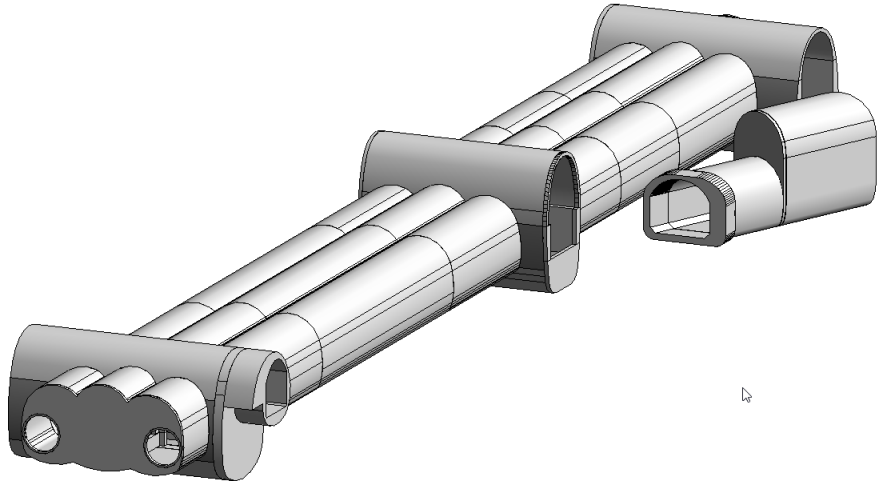
Solibri Model Optimizer seems to have been withdrawn

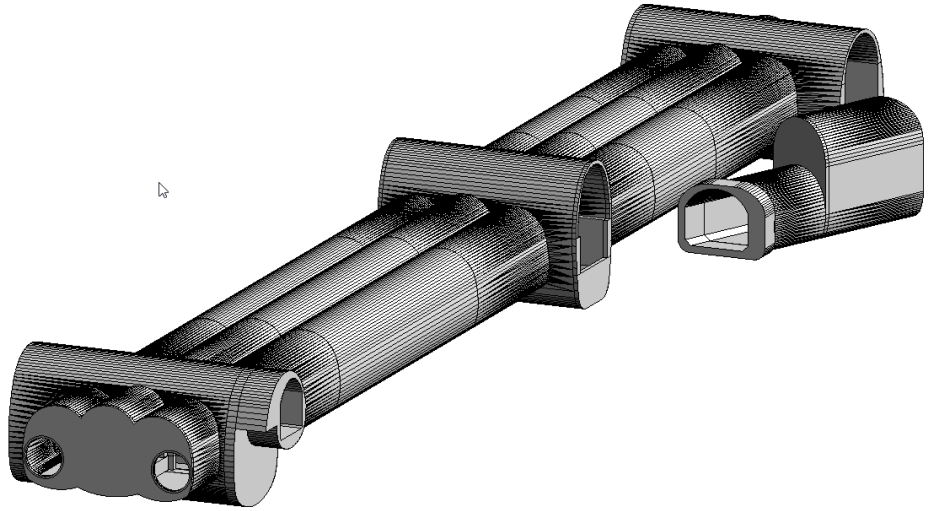
BlenderBIM has developed open source functionality

Geometry Gym also develops functions to optimize and decimate IFC

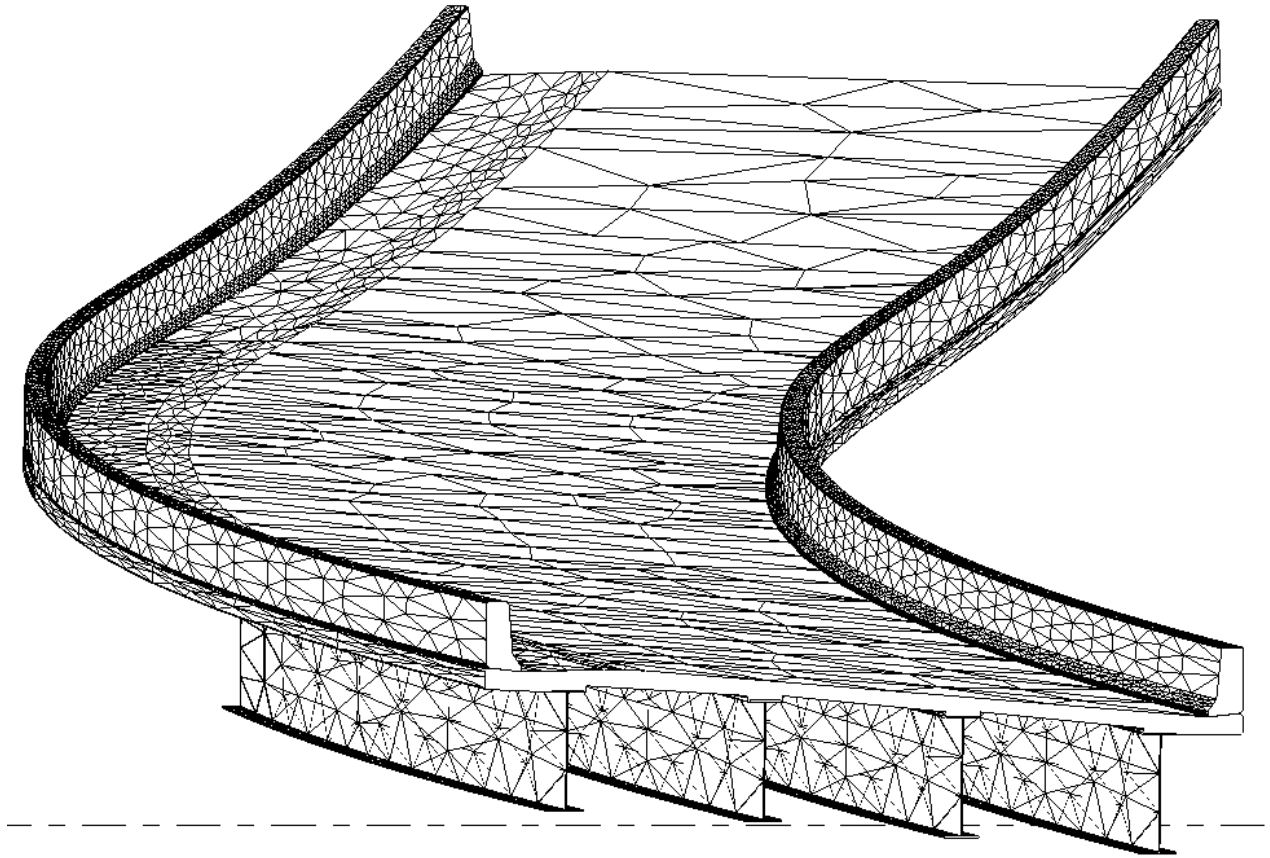
Efficiency

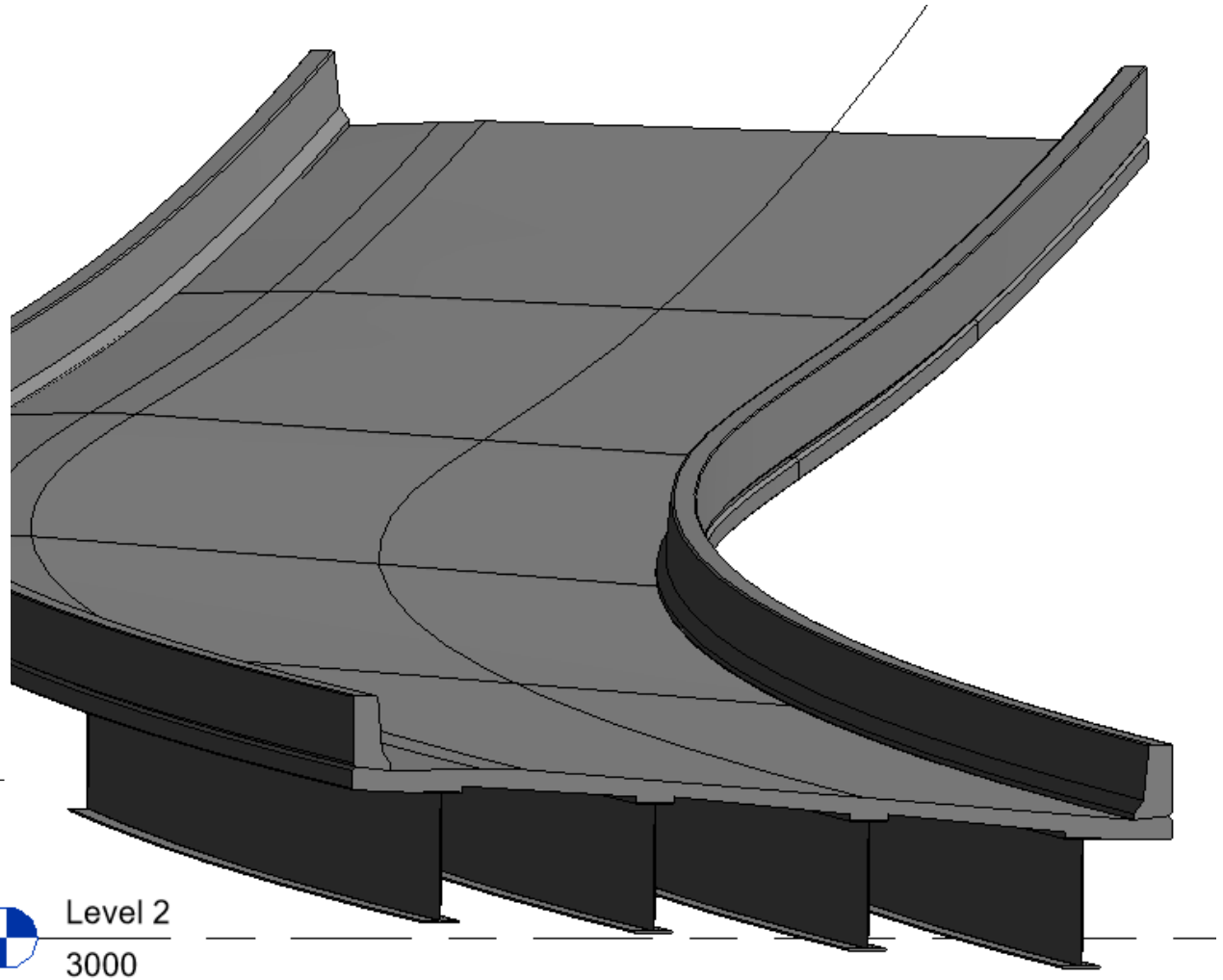
- Typically a trade off between efficiency and reliability
- Short Edge lengths
- Constructive Solid Geometry
- Extrusions / Sweeps
- IFC4 (and newer) vs IFC2x3





Efficiency





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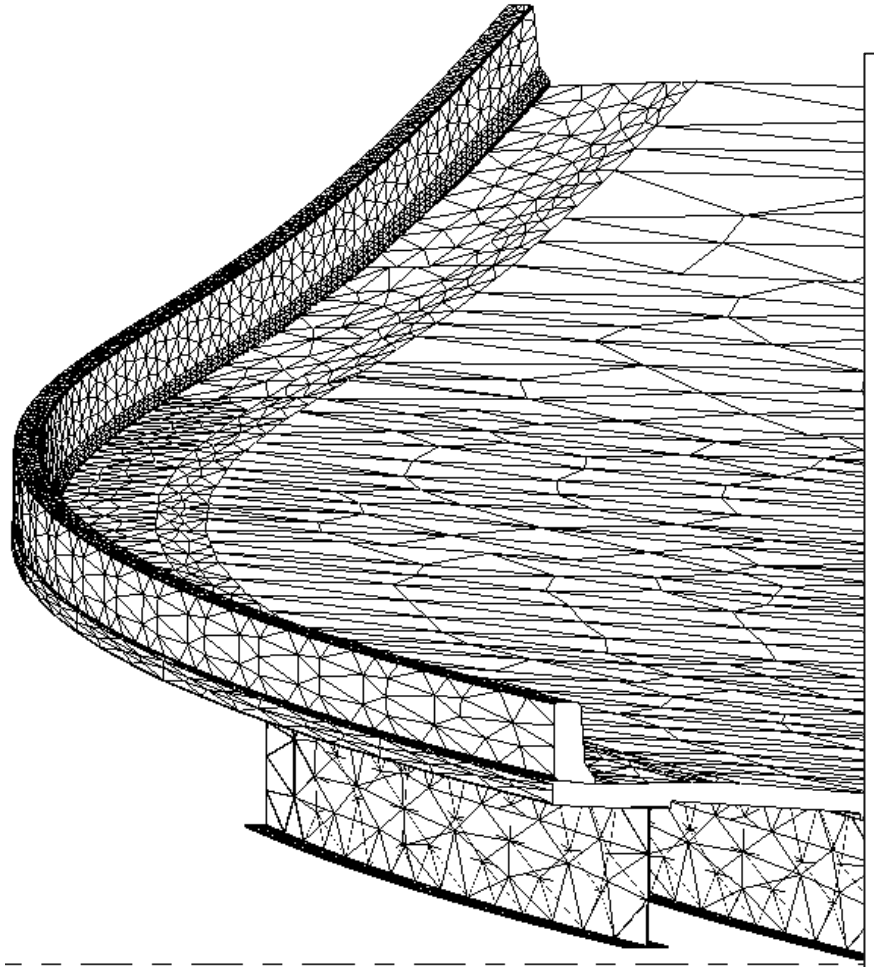

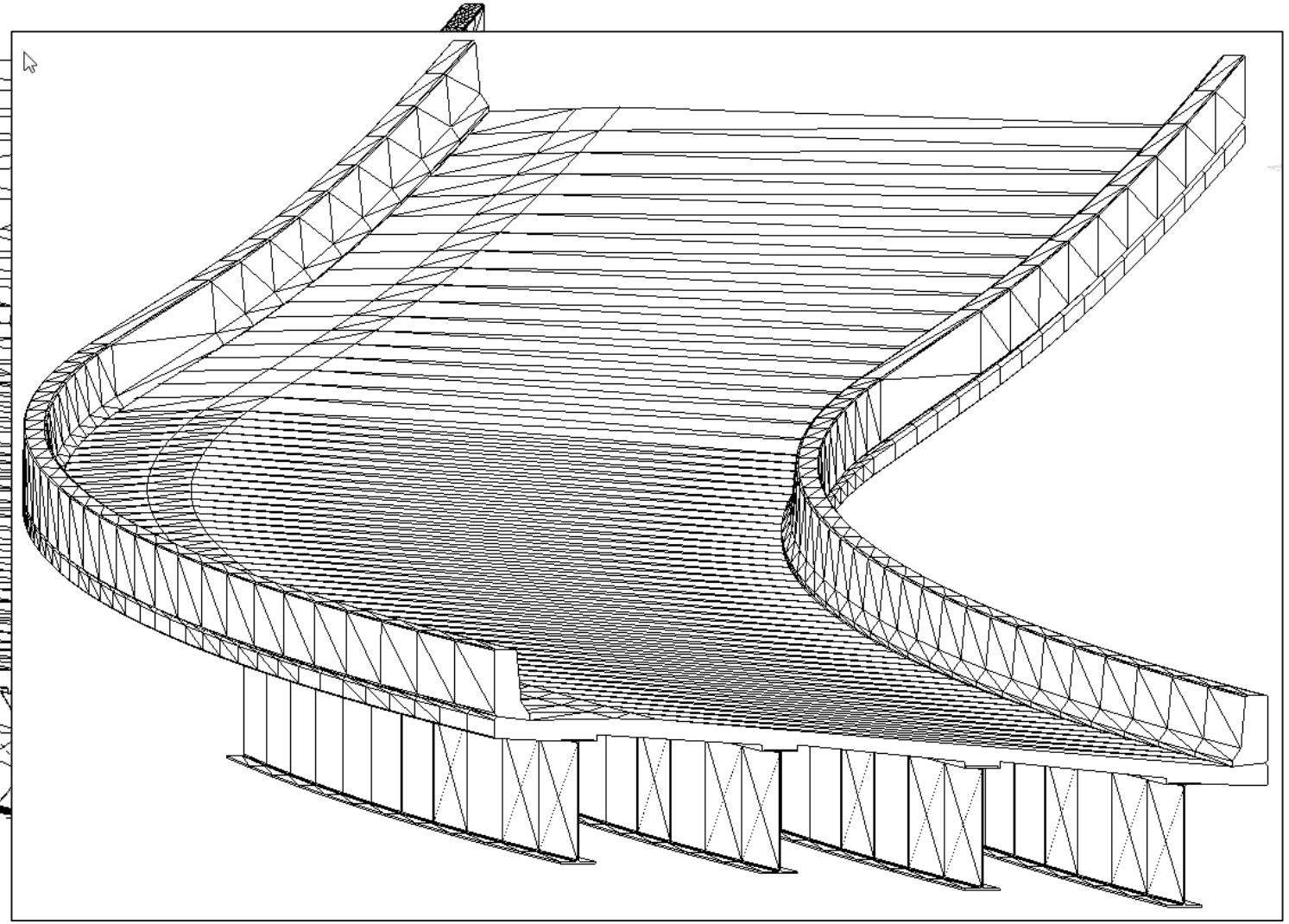

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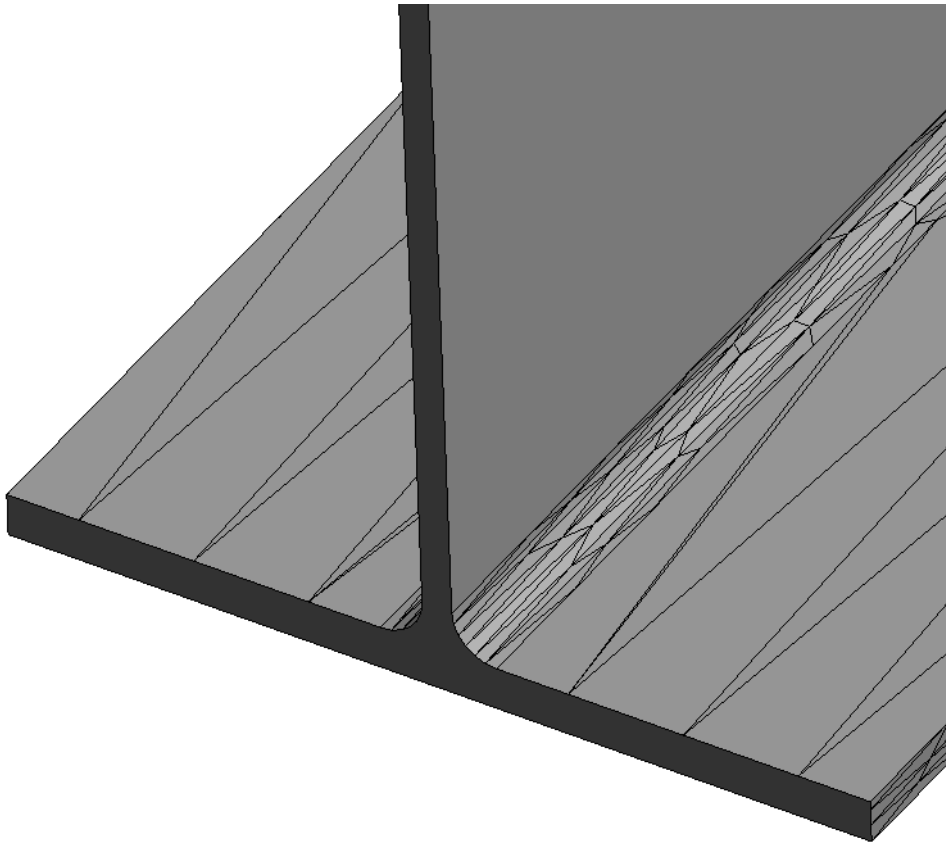
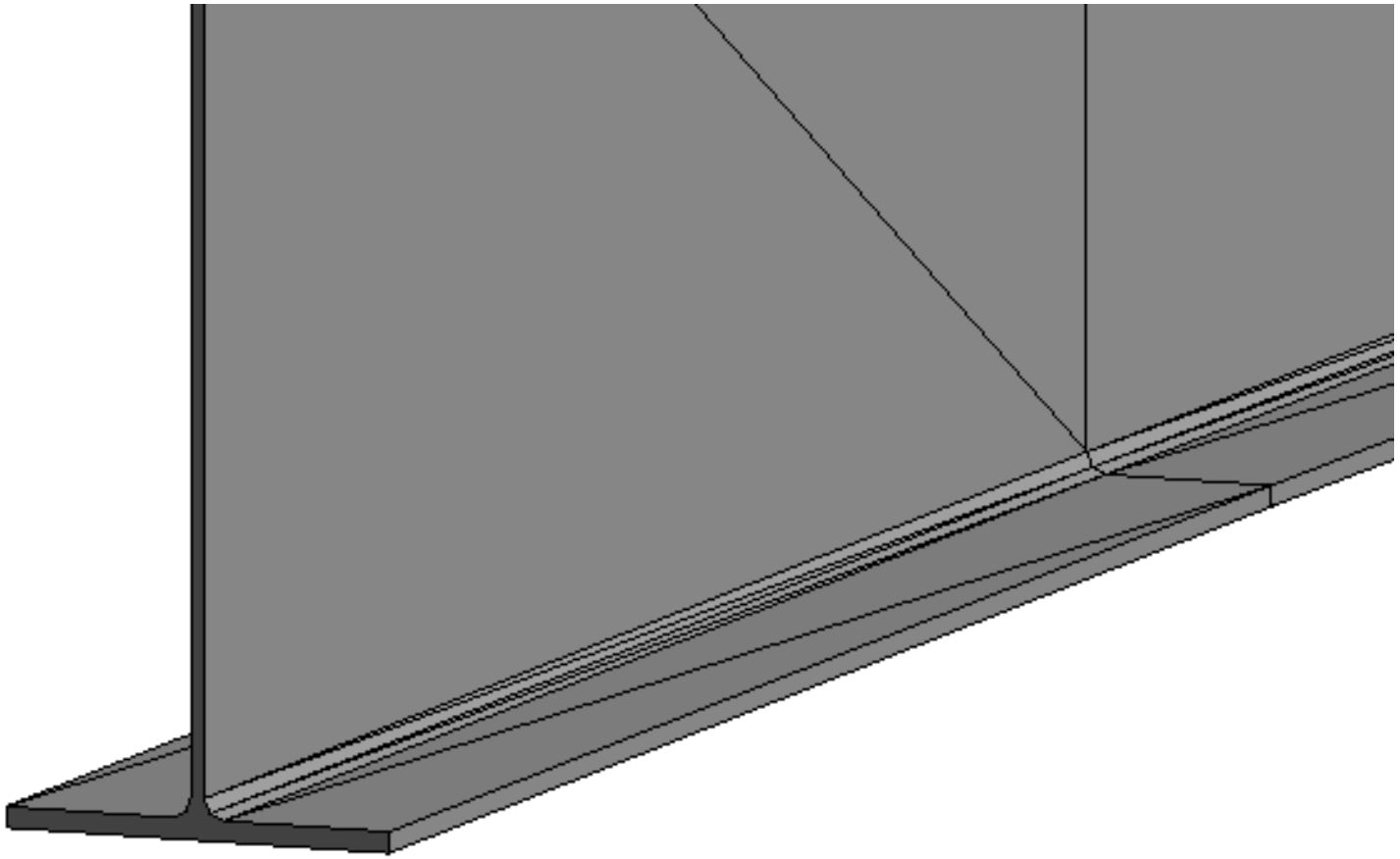
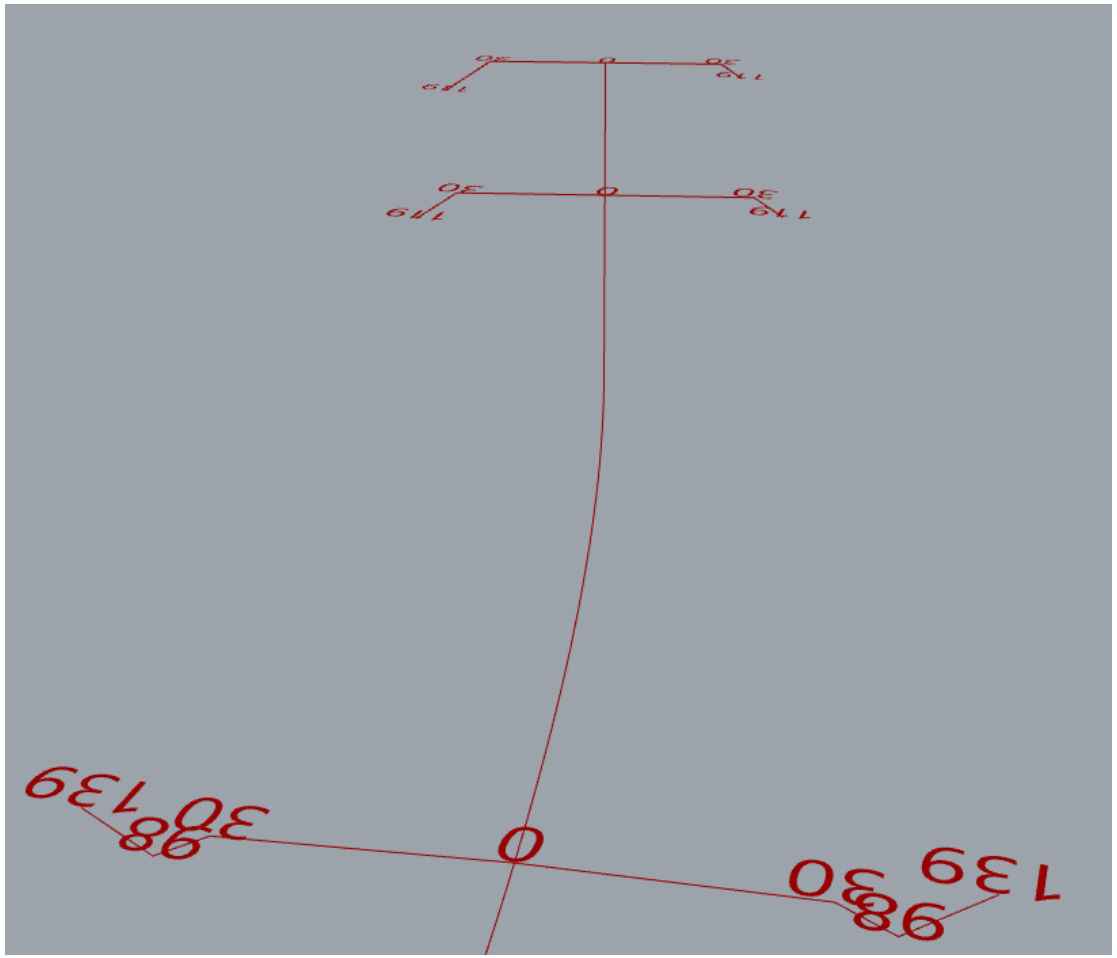
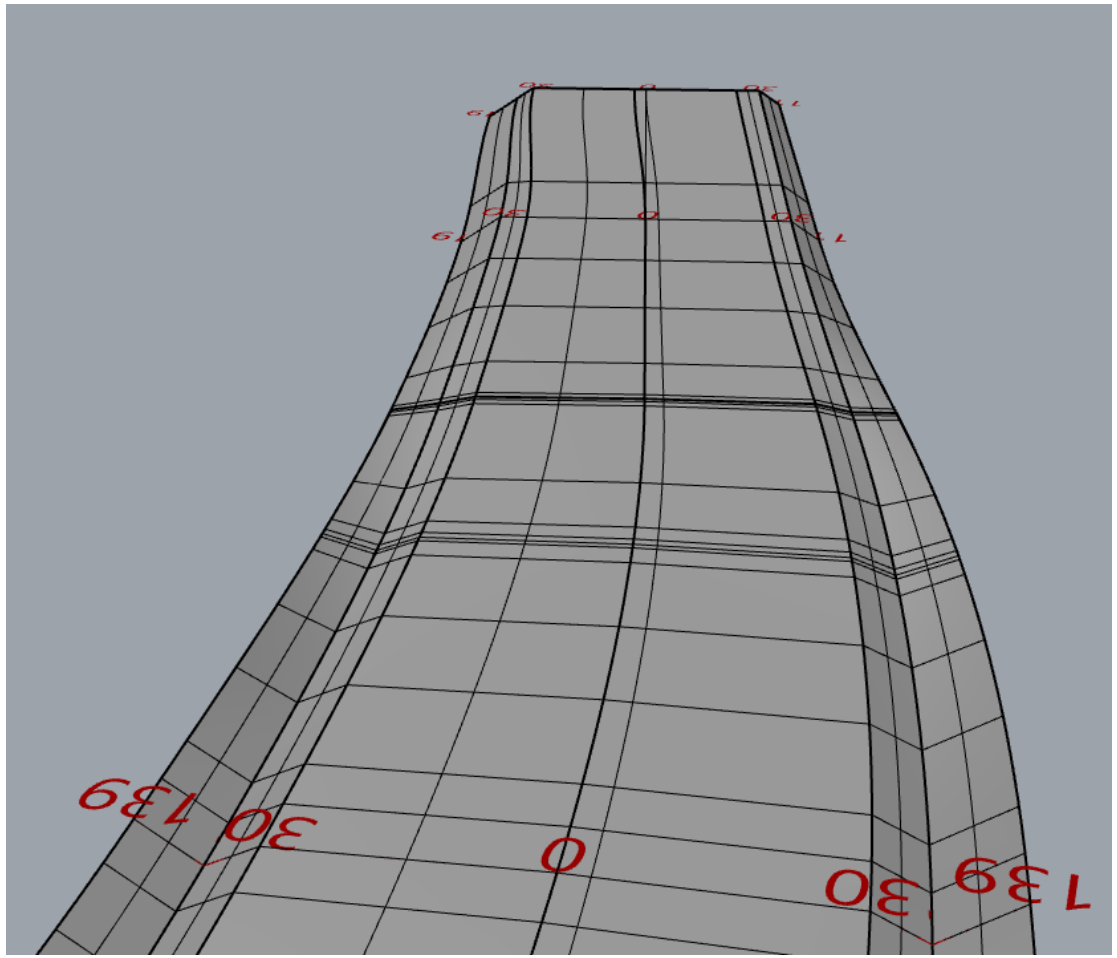


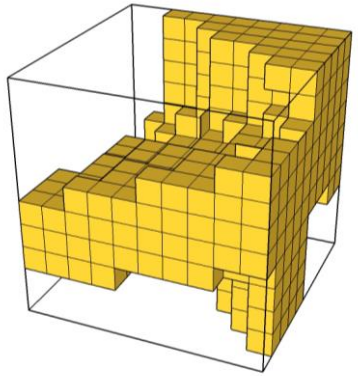


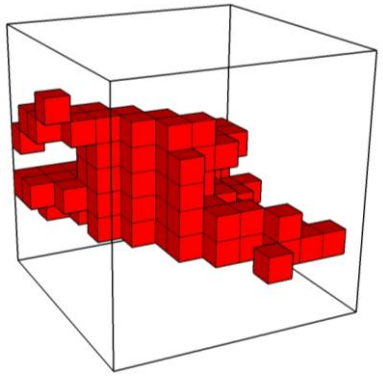
IFC 4.3 – Sectioned Shapes (Solids and surfaces)

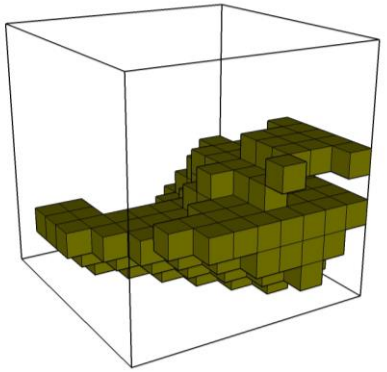


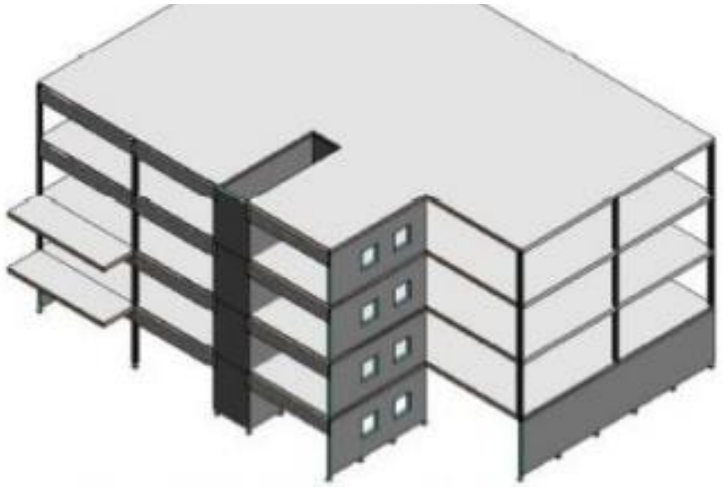


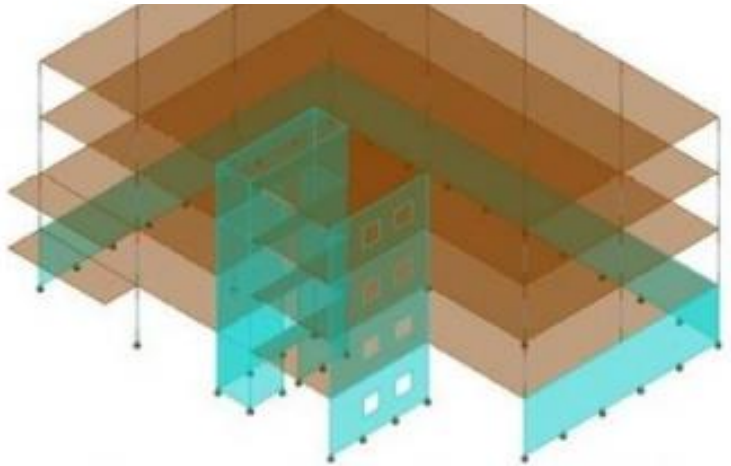
Model View Definitions

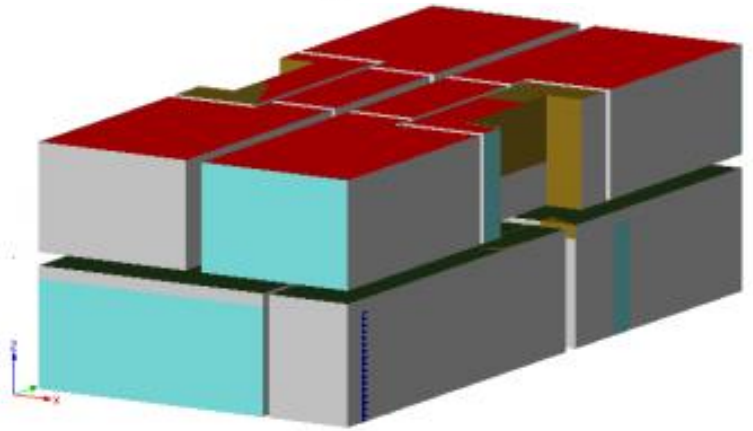












IFC Coordination View

IFC Structural Analysis View

IFC Thermal Analysis View

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Model View Definitions

IFC2x3 Coordination Model View

IFC4 Reference View

IFC4x3 Alignment Based Reference View

Other Model View Definitions
Not Official
IFC4x3 Design Transfer

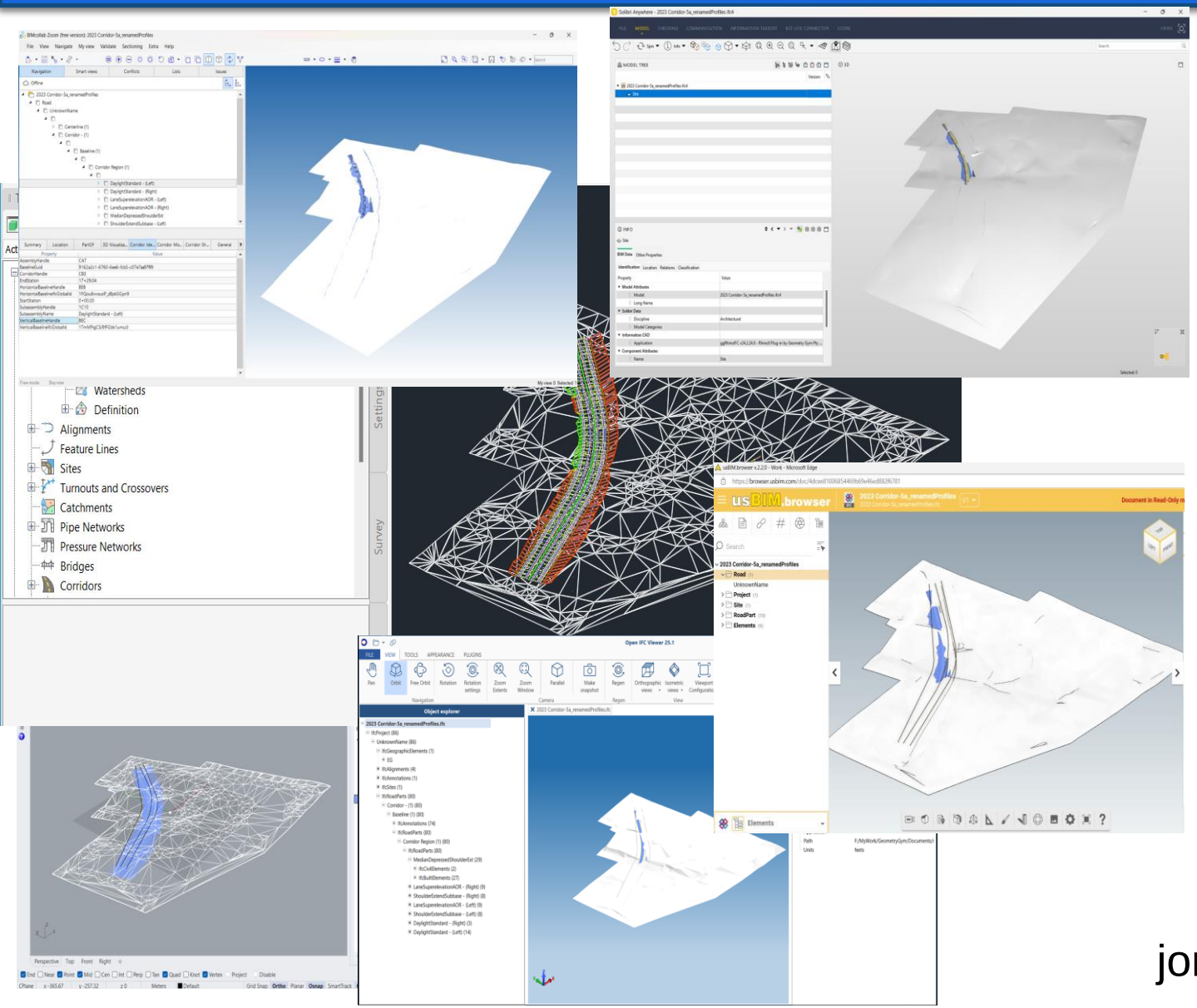
Recipient Requirements

BIM should no longer be a trust request.

Party requesting IFC deliverable should specify Model View Definition and the contents of the IFC using IDS.

If frustrated with problems generating or receiving IFC, discuss with your software vendor.

buildingSMART Xchange Conference July 2024



UTS Sydney

3rd July 2024

Thankyou

Any questions

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