

Christian Pallaria

BIM Manager – Digital Engineering Manager



AECOM



Introduction

I am Christian Pallaria, an architect passionate about **technology, BIM and BIM development**.

I am experienced in **managing big projects** from both an architectural and engineering point of view, covering the BIM Manager and DE Lead roles in Infrastructure sector since 2014.

In 2017 I got the **Project Management Professional (PMP)** certification by Project Management Institute (PMI).

I have been working in **Infrastructure field across the last 10 years in many countries**, such as: Chile, Peru', Mexico, Argentina, Turkey, Australia, Russia (among others). I moved to Australia joining AECOM in Dec-2020.

I am also **passionate about programming and visual programming**, aiming to create innovative workflows able to speed up processes in BIM field and BIM model production, breaking the barriers of the software for complex models.

Why am I here today?

I will tell you a story...



A story of BIM

~~Once upon a time...~~

One and a half year ago...

I was just landed a few days before...

I was asked to look after retaining walls of **the biggest projects in Australia...**

A story about Sydney Gateway Project



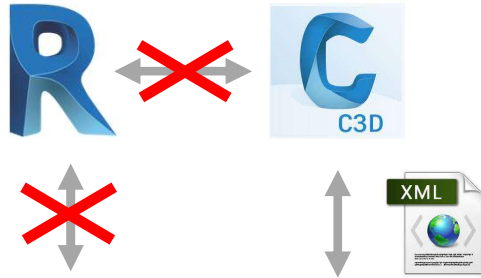
- Mega project
- More than 70 retaining walls...
- Full BIM approach
- Drawings must come from the BIM model...
- All in Autodesk Revit

Agenda

1. Data sharing and software **interoperability in Infrastructure projects** (Autodesk, Bentley, 12D) – working with more than 4 different software from different software-houses in the same project
2. **Retaining walls modelling and prefabrication for construction** using BIM solutions – more than 70 wall in the entire project
3. **Metadata** for construction – almost 500.000 metadata for walls only

Software interoperability

 **AUTODESK**



 **Bentley®**



12d® Model™ 



AECOM

Software interoperability



Software interoperability

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<?xml version="1.0" encoding="utf-8"?>
<LandXML xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation="http://www.landxml.org/schema/LandXML-1.2 http://www.landxml.org/schema/landxml-1.2/LandXML-1.2.xsd" version="1.2" date="2021-04-13" time="10:44:34" xmlns="http://www.landxml.org/schema/LandXML-1.2">
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  </Alignments>
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And “he” is actually right...

Software interoperability

Final workflow for retaining structure



Software interoperability

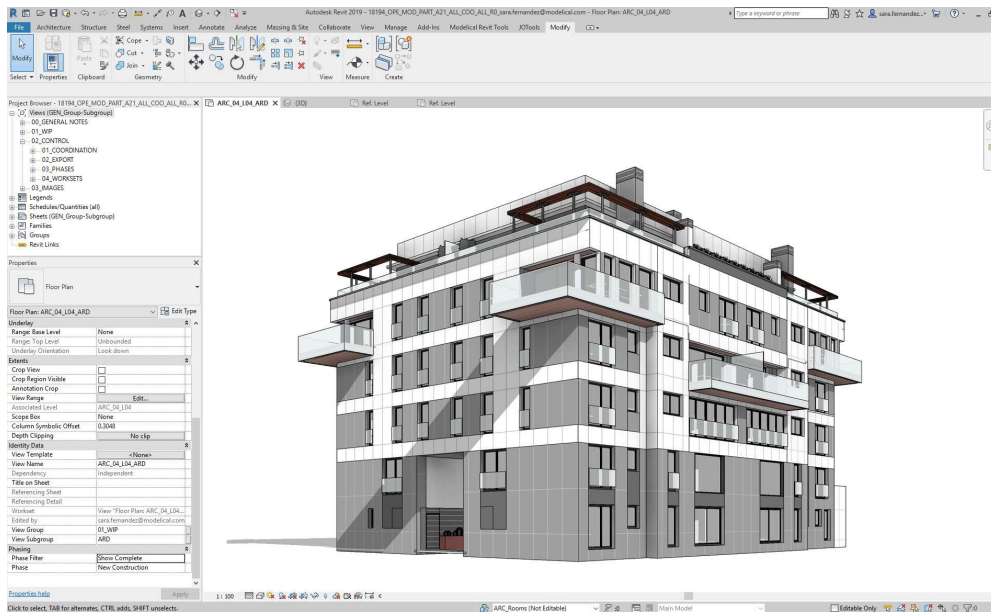


JSON file format
was the answer

Revit reaction when we showed “him” a JSON

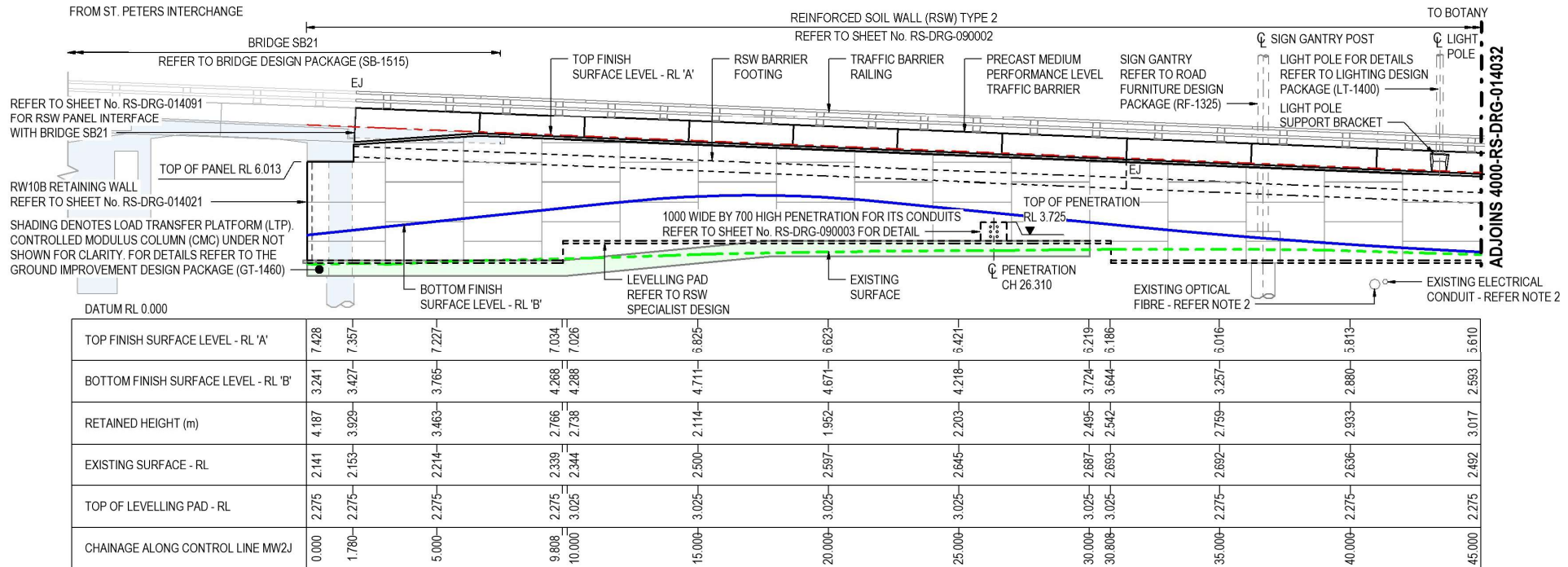
Modelling linear elements in Revit

Modelling a building....
easy peasy

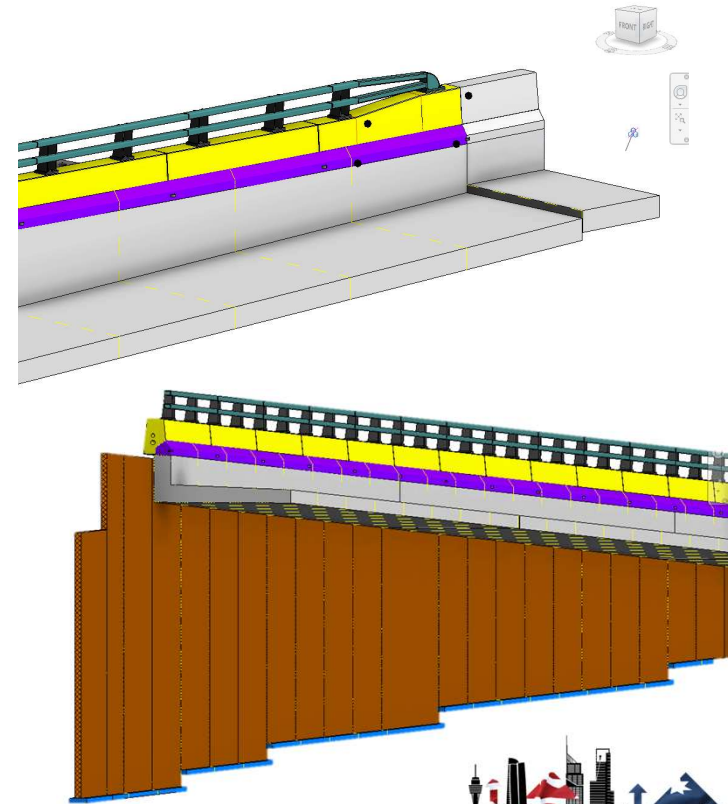
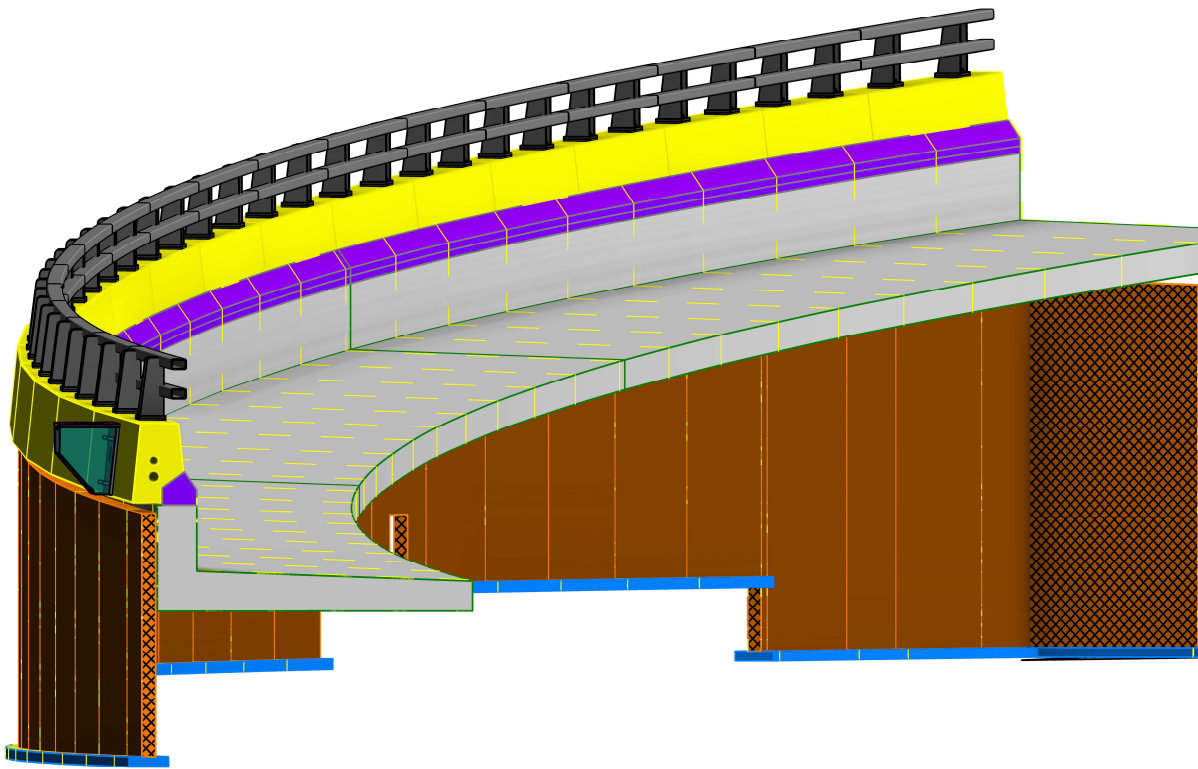


lemon squeezy

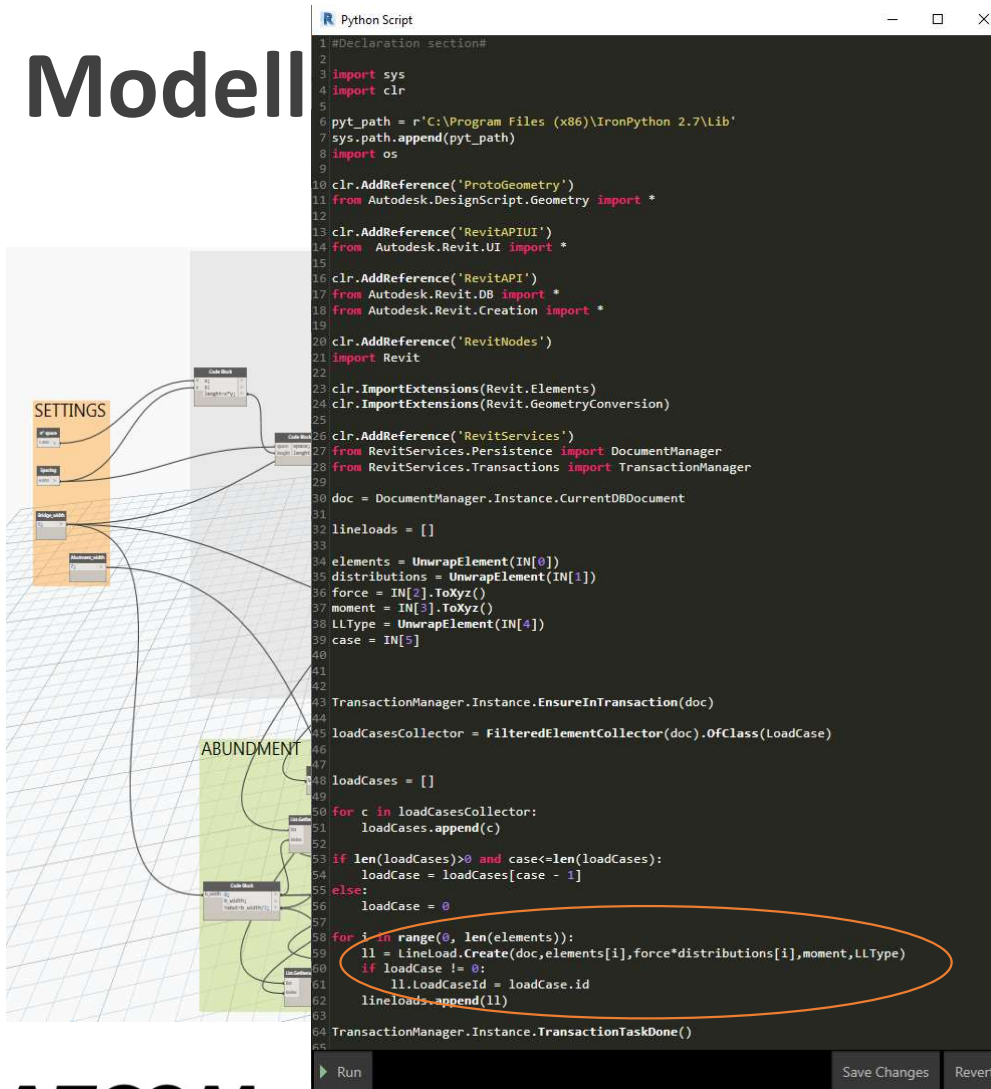
Modelling linear elements in Revit



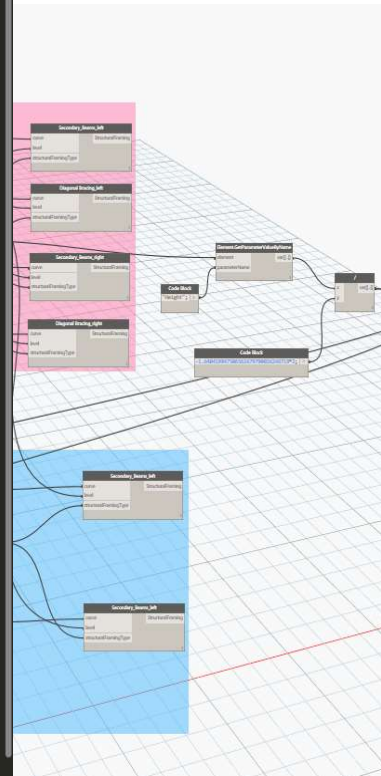
Modelling linear elements in Revit



Modell



ts in Revit



Logical connection
between nodes

Custom nodes
creation writing
codes

Modelling linear elements in Revit

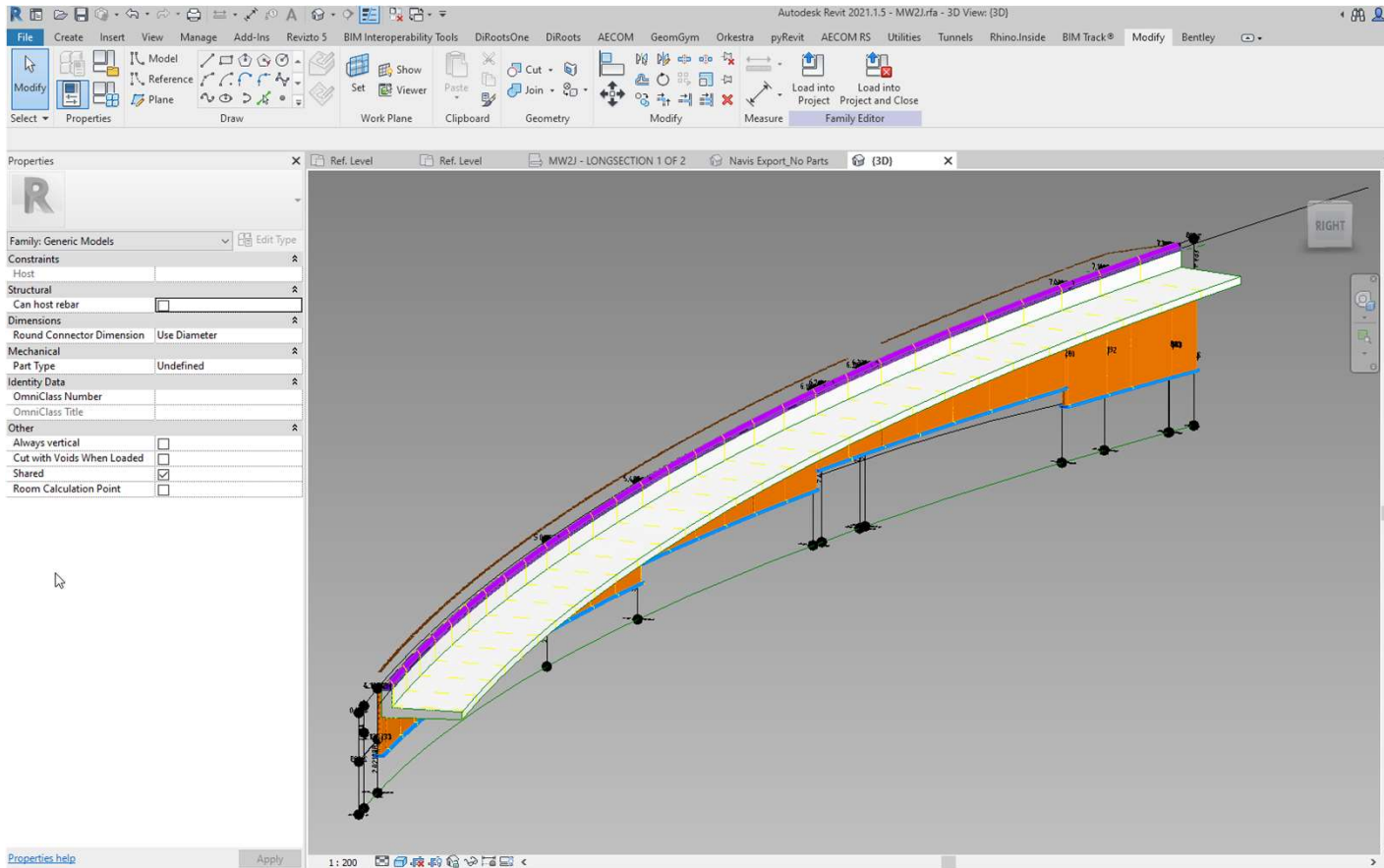


**Dynamo...Our best
friend**

We “renamed” it "Doc"



Modelling linear elements in Revit

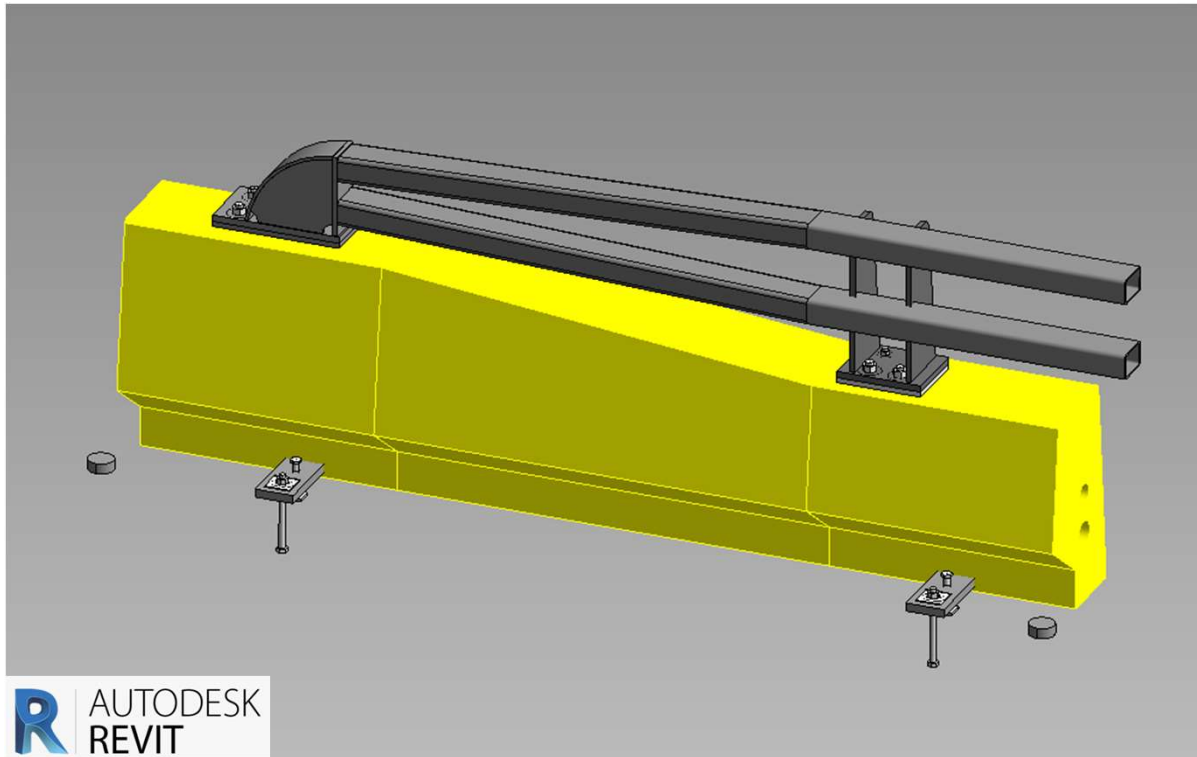


Computational design has been used to import the geometric information, place the cross sections along the alignment and model the elements by loft

Precast elements: barriers

1. 9 types of barriers
2. Maximum length: 4,8 m
3. 2 posts barriers
4. Single post barriers
5. Curved railing for curved walls
6. Mid-offset calculation for curved walls
7. Vertical posts for walls with slope $> 4\%$
8. Etc....

Precast elements: barriers



 **AUTODESK
REVIT**

LOD 350

max tolerance
5mm

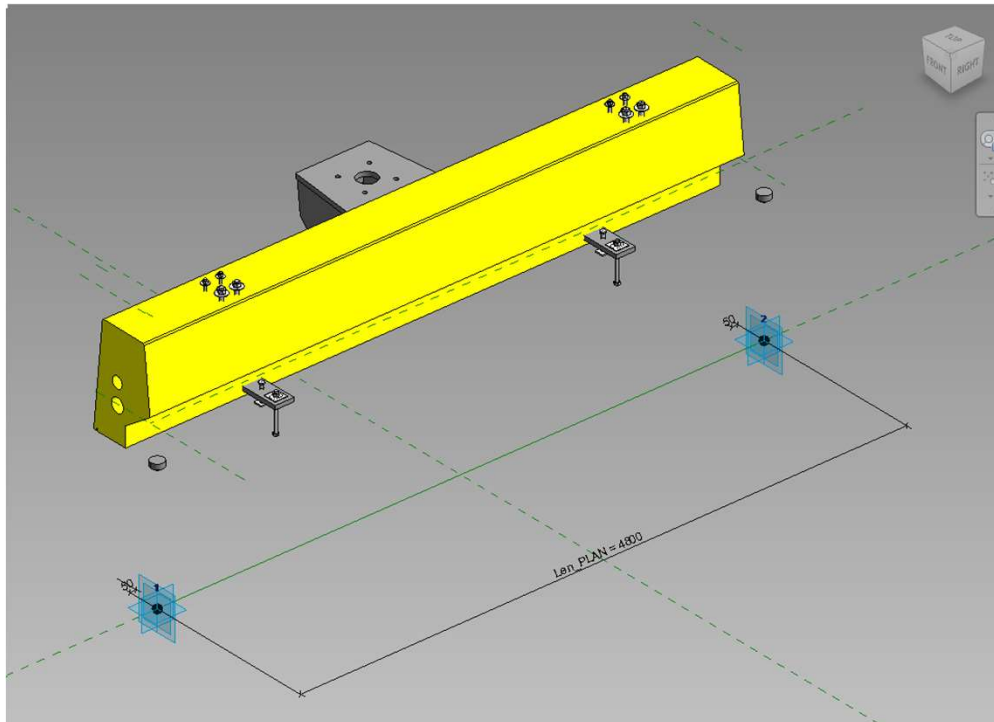
Revit Families have been
created for each precast
element

Precast elements: barriers



- Mike (dad): Standard Barrier
- Linda (mom): Regular Transition
- Zack (son): Special transition
- Summer (daughter): Regular Performance Barrier
- Queenie (cat 1): Straight railing
- Lovie (cat 2): Curved convex railing
- (Uncle?): Curved concave railing
- Etc...

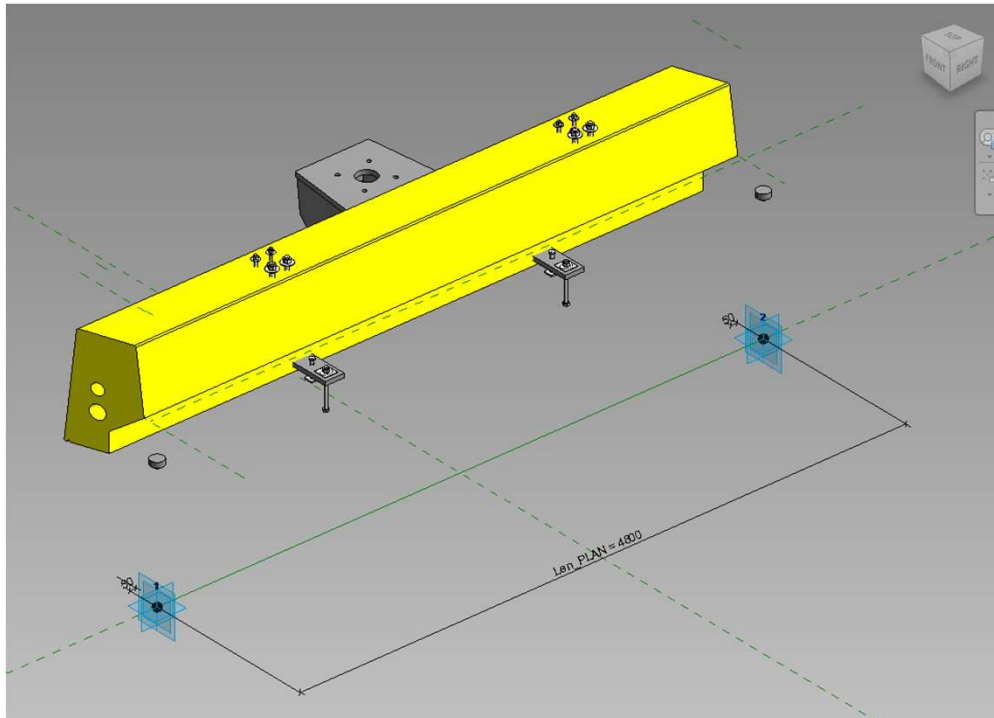
Precast elements: barriers



Dimensions	
Ang_Barrier_HorizSkewEnd	10.00°
Ang_Barrier_HorizSkewStart	10.00°
Ang_Barrier_VertSkewEnd	0.00°
Ang_Barrier_VertSkewStart	0.00°
Hts_SOP-01	1.0000
Hts_SOP-02	1.0000
Off_Ctr-LongitudinalSopAncor01	0.9500
Off_Ctr-LongitudinalSopAncor02	0.9500
Off_Ctr-SopAncor01	0.1300
Off_Ctr-SopAncor02	0.1300
Off_Ctr_LongitudinalSopPost01	1.2000
Off_Ctr_LongitudinalSopPost02	1.2000
Off_Ctr_SopPost01	0.3430
Off_Ctr_SopPost02	0.3430
Off_MidOrdinateOffset	0.0000
Off_SOP-01_Offset	0.0000
Off_SOP-02_Offset	0.0000



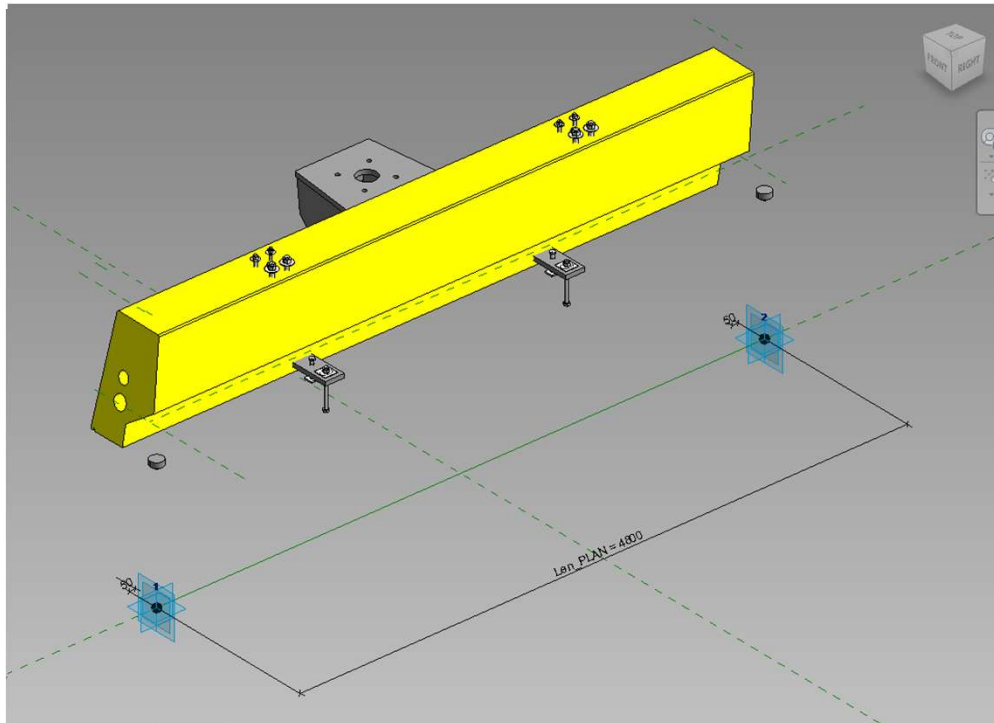
Precast elements: barriers



Dimensions	
Ang_Barrier_HorizSkewEnd	10.00°
Ang_Barrier_HorizSkewStart	10.00°
Ang_Barrier_VertSkewEnd	0.00°
Ang_Barrier_VertSkewStart	0.00°
Hts_SOP-01	1.0000
Hts_SOP-02	1.0000
Off_Ctr-LongitudinalSopAncor01	0.9500
Off_Ctr-LongitudinalSopAncor02	0.9500
Off_Ctr-SopAncor01	0.1300
Off_Ctr-SopAncor02	0.1300
Off_Ctr_LongitudinalSopPost01	1.2000
Off_Ctr_LongitudinalSopPost02	1.2000
Off_Ctr_SopPost01	0.3430
Off_Ctr_SopPost02	0.3430
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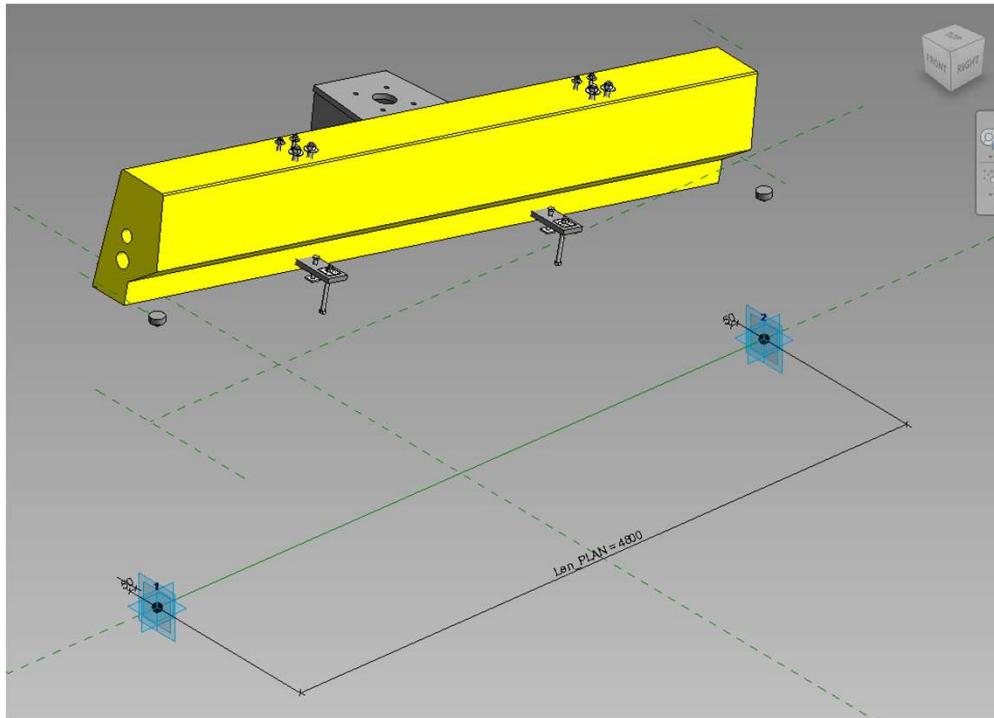
Precast elements: barriers



Dimensions	
Ang_Barrier_HorizSkewEnd	10.00°
Ang_Barrier_HorizSkewStart	10.00°
Ang_Barrier_VertSkewEnd	0.00°
Ang_Barrier_VertSkewStart	0.00°
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Hts_SOP-02	1.0000
Off_Ctr-LongitudinalSopAncor01	0.9500
Off_Ctr-LongitudinalSopAncor02	0.9500
Off_Ctr-SopAncor01	0.1300
Off_Ctr-SopAncor02	0.1300
Off_Ctr_LongitudinalSopPost01	1.2000
Off_Ctr_LongitudinalSopPost02	1.2000
Off_Ctr_SopPost01	0.3430
Off_Ctr_SopPost02	0.3430
Off_MidOrdinateOffset	0.0000
Off_SOP-01_Offset	0.0000
Off_SOP-02_Offset	0.0000



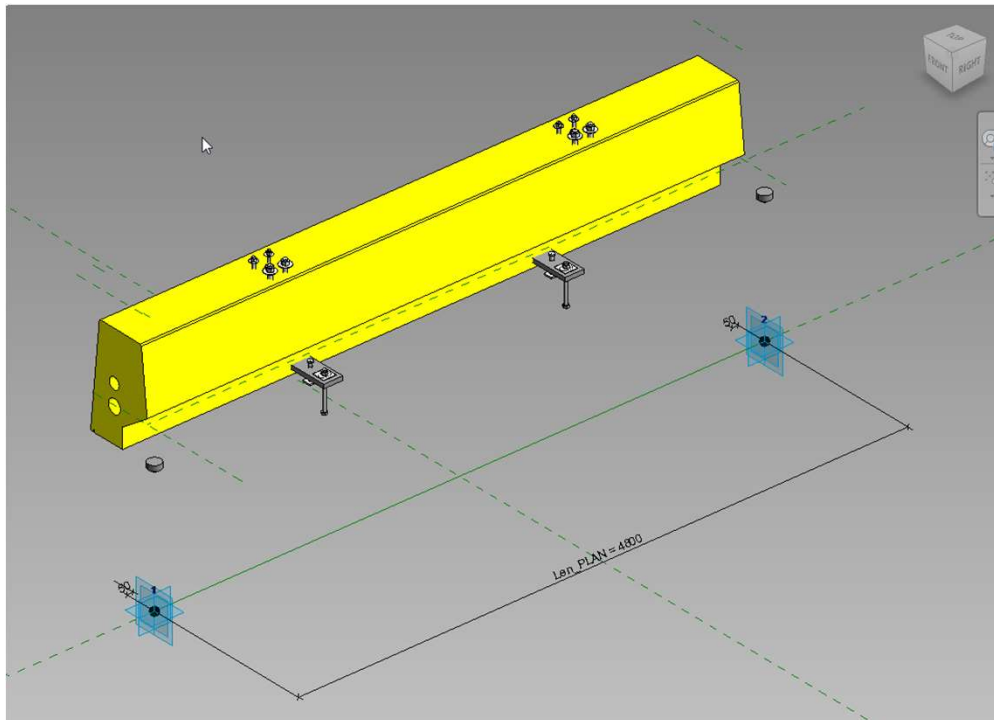
Precast elements: barriers



Dimensions	
Ang_Barrier_HorizSkewEnd	10.00°
Ang_Barrier_HorizSkewStart	10.00°
Ang_Barrier_VertSkewEnd	0.00°
Ang_Barrier_VertSkewStart	0.00°
Hts_SOP-01	1.0000
Hts_SOP-02	1.0000
Off_Ctr-LongitudinalSopAncor01	0.9500
Off_Ctr-LongitudinalSopAncor02	0.9500
Off_Ctr-SopAncor01	0.1300
Off_Ctr-SopAncor02	0.1300
Off_Ctr_LongitudinalSopPost01	1.2000
Off_Ctr_LongitudinalSopPost02	1.2000
Off_Ctr_SopPost01	0.3430
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Off_MidOrdinateOffset	0.0000
Off_SOP-01_Offset	0.0000
Off_SOP-02_Offset	0.0000



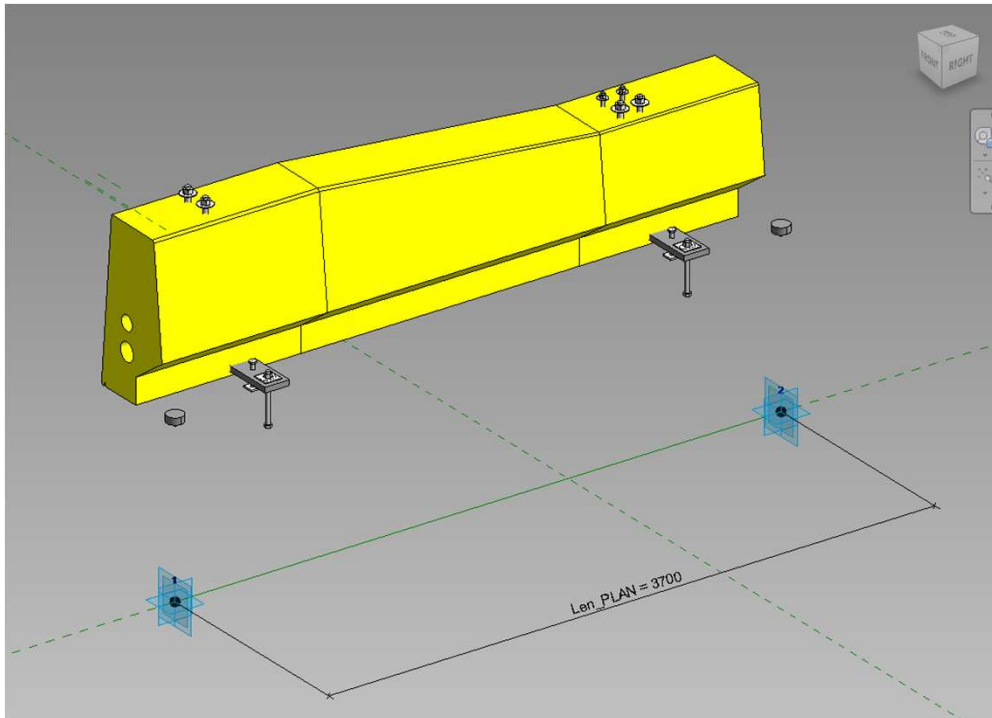
Precast elements: barriers



Dimensions	
Ang_Barrier_HorizSkewEnd	10.00°
Ang_Barrier_HorizSkewStart	10.00°
Ang_Barrier_VertSkewEnd	0.00°
Ang_Barrier_VertSkewStart	0.00°
Hts_SOP-01	1.0000
Hts_SOP-02	1.0000
Off_Ctr-LongitudinalSopAncor01	0.9500
Off_Ctr-LongitudinalSopAncor02	0.9500
Off_Ctr-SopAncor01	0.1300
Off_Ctr-SopAncor02	0.1300
Off_Ctr_LongitudinalSopPost01	1.2000
Off_Ctr_LongitudinalSopPost02	1.2000
Off_Ctr_SopPost01	0.3430
Off_Ctr_SopPost02	0.3430
Off_MidOrdinateOffset	0.0000
Off_SOP-01_Offset	0.0000
Off_SOP-02_Offset	0.0000



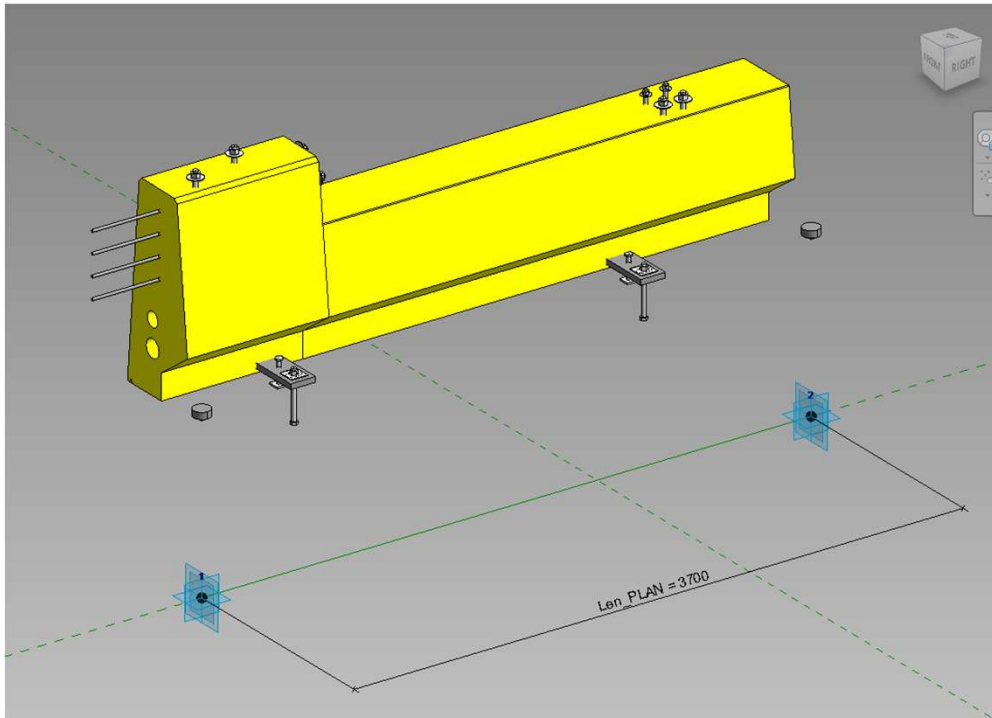
Precast elements: transition barriers



Dimensions	
Ang_Barrier_HorizSkewEnd	10.00°
Ang_Barrier_HorizSkewStart	10.00°
Ang_Barrier_VertSkewEnd	0.00°
Ang_Barrier_VertSkewStart	0.00°
Hts_SOP-01	1.0000
Hts_SOP-02	1.0000
Off_Ctr-LongitudinalSopAncor01	0.9500
Off_Ctr-LongitudinalSopAncor02	0.9500
Off_Ctr-SopAncor01	0.1300
Off_Ctr-SopAncor02	0.1300
Off_Ctr_LongitudinalSopPost01	1.2000
Off_Ctr_LongitudinalSopPost02	1.2000
Off_Ctr_SopPost01	0.3430
Off_Ctr_SopPost02	0.3430
Off_MidOrdinateOffset	0.0000
Off_SOP-01_Offset	0.0000
Off_SOP-02_Offset	0.0000



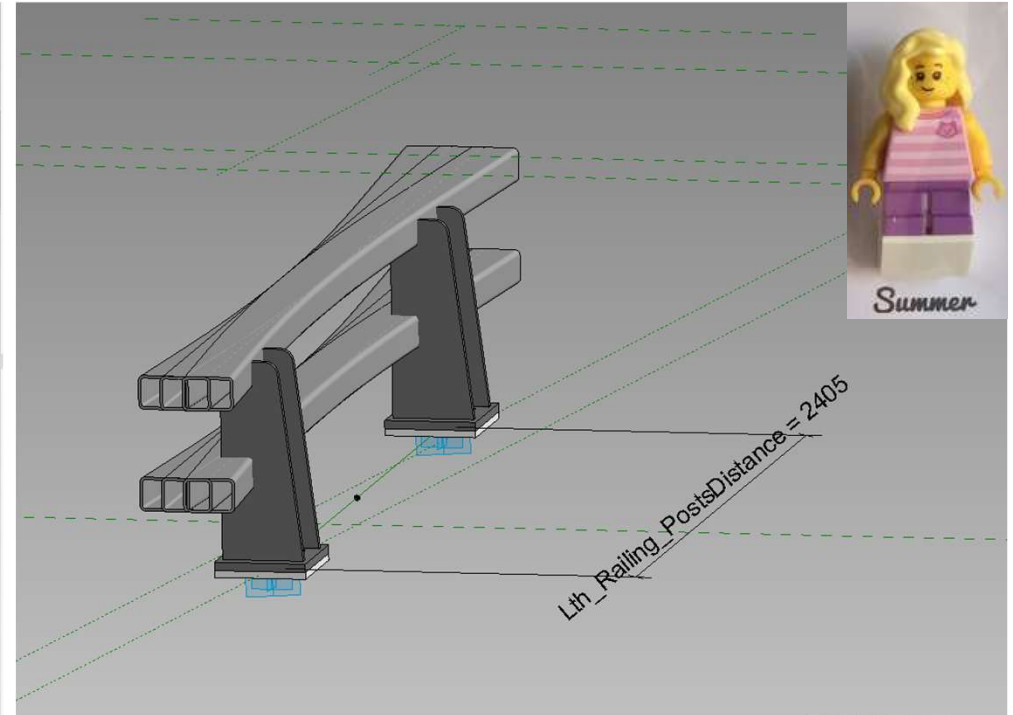
Precast elements: special transition barriers



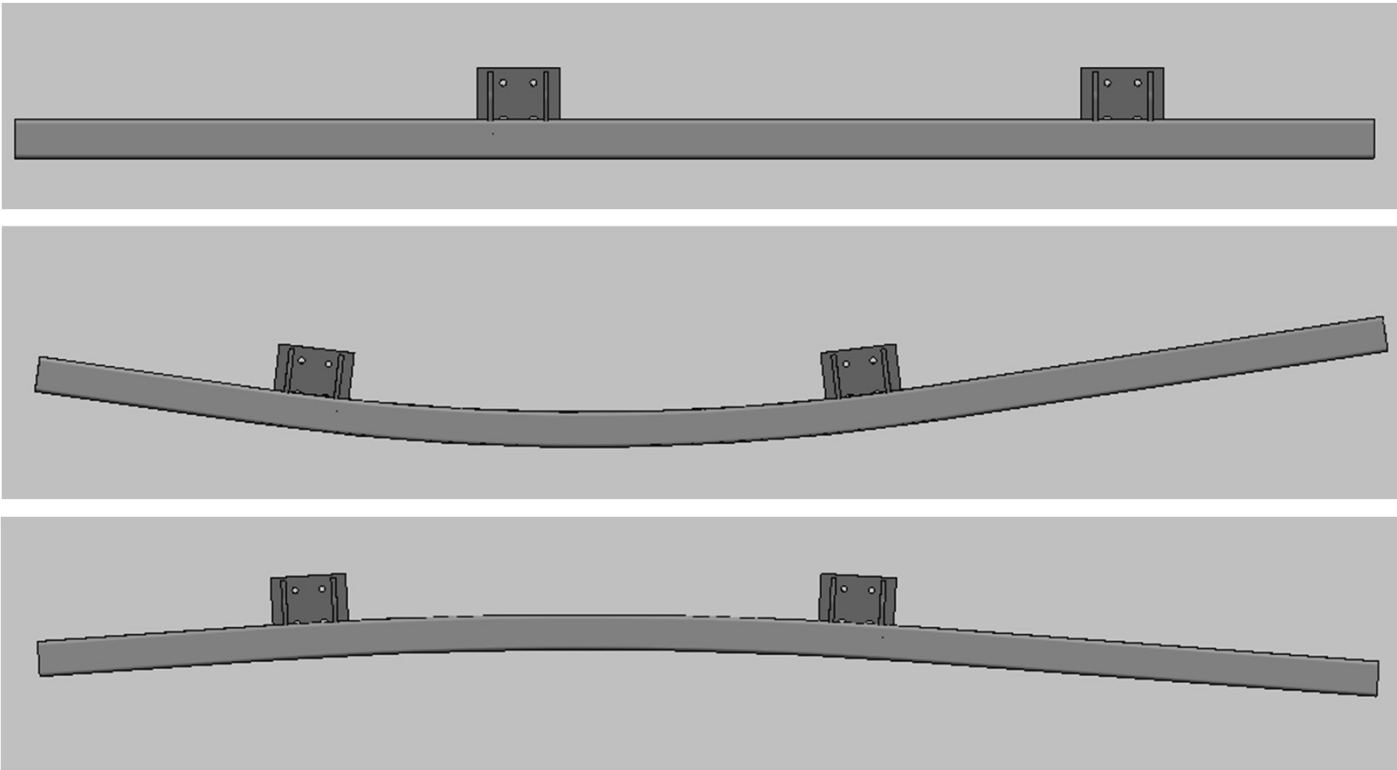
Dimensions	
Ang_Barrier_HorizSkewEnd	10.00°
Ang_Barrier_HorizSkewStart	10.00°
Ang_Barrier_VertSkewEnd	0.00°
Ang_Barrier_VertSkewStart	0.00°
Hts_SOP-01	1.0000
Hts_SOP-02	1.0000
Off_Ctr-LongitudinalSopAncor01	0.9500
Off_Ctr-LongitudinalSopAncor02	0.9500
Off_Ctr-SopAncor01	0.1300
Off_Ctr-SopAncor02	0.1300
Off_Ctr_LongitudinalSopPost01	1.2000
Off_Ctr_LongitudinalSopPost02	1.2000
Off_Ctr_SopPost01	0.3430
Off_Ctr_SopPost02	0.3430
Off_MidOrdinateOffset	0.0000
Off_SOP-01_Offset	0.0000
Off_SOP-02_Offset	0.0000



Precast elements: railings



Precast elements: railings



Dimensions	
Ang_Railing_RotationPost1	6.89°
Ang_Railing_RotationPost2	-6.89°
Ang_VerticalAnglePost	0.00°
Lth_CurvedExtentionEnd	0.0000
Lth_CurvedExtentionStart	0.0000
Lth_Railing_PostsDistance	2.4000
Lth_StraightExtentionEnd	1.0000
Lth_StraightExtentionStart	2.0000
Off_Railing_Sagitta	0.0701
Rad_Railing_Radius	10.0000

Precast elements: railings and barriers

 **Dynamo**
Computational Design for BIM

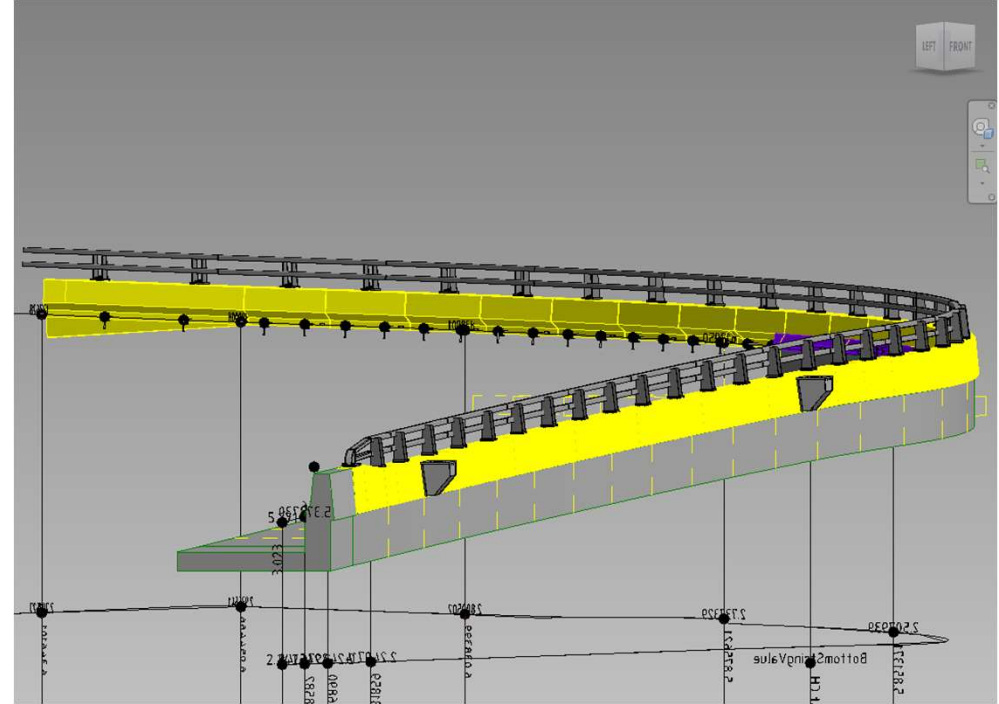
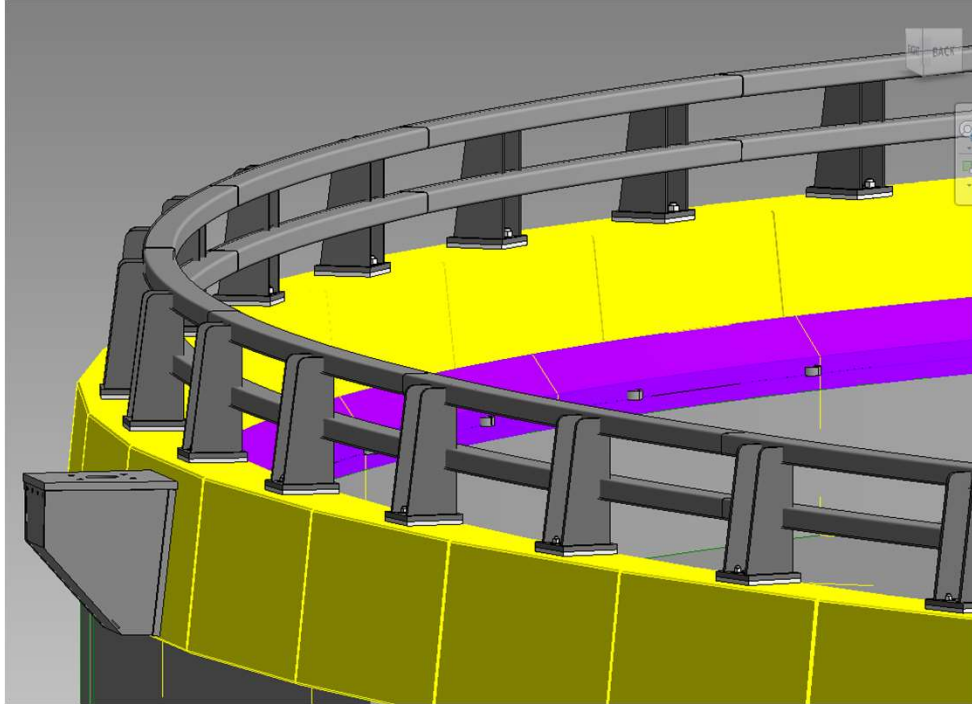
Dial “000” and call Doc



Once you
have your
families, you
need to place
them....

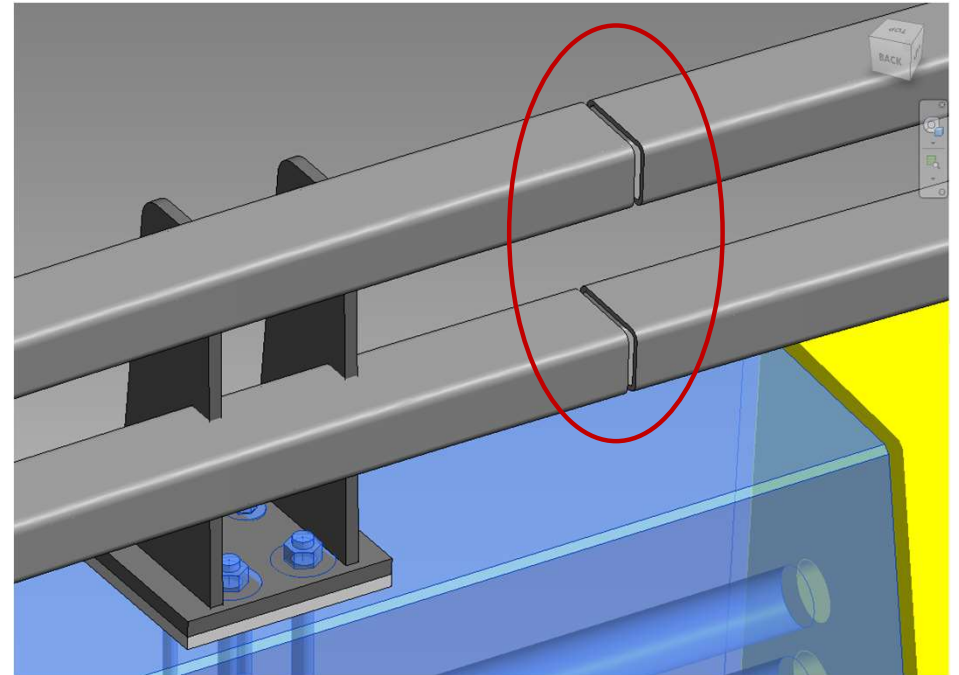
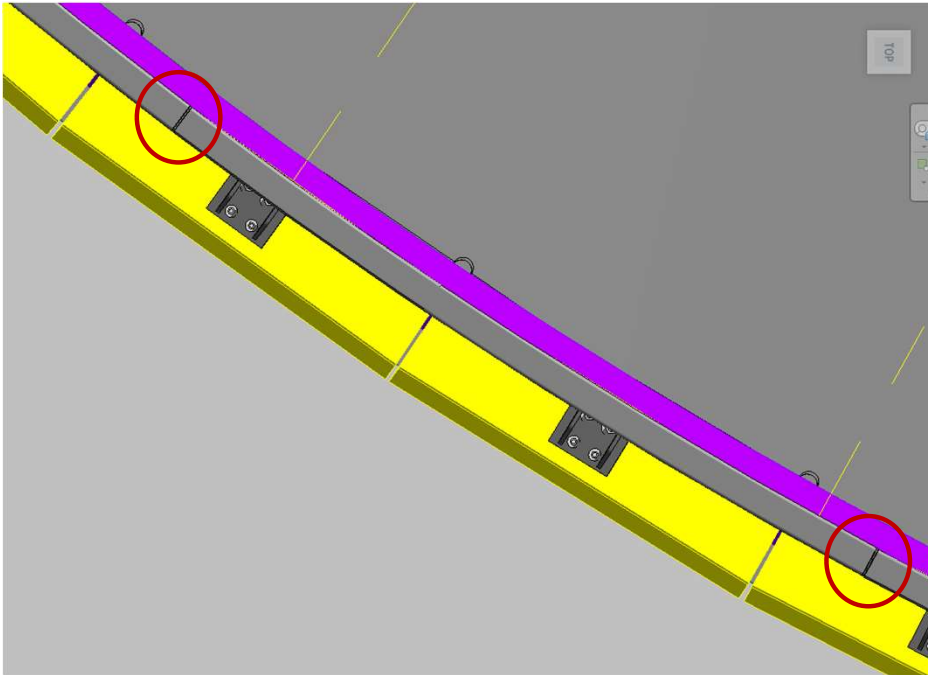
HOW?

Precast elements: railings and barriers



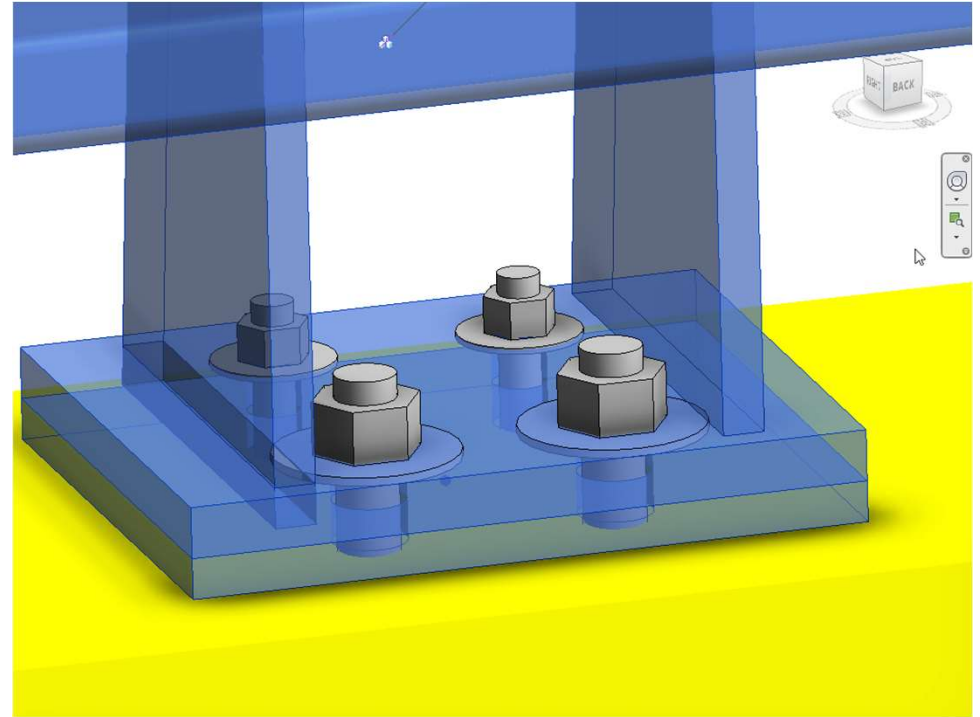
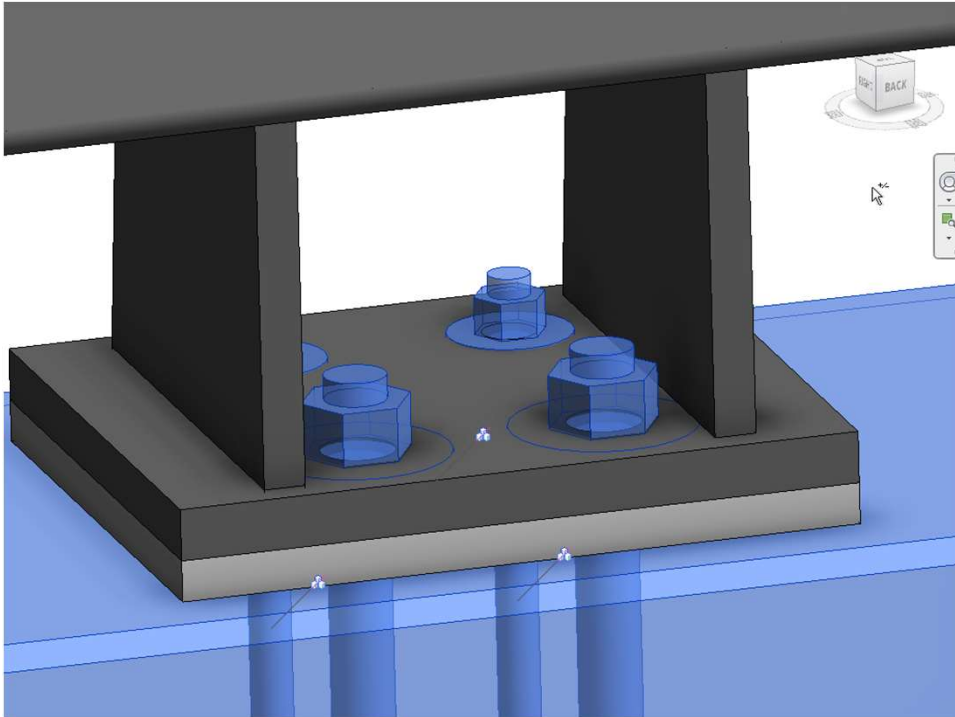
max tolerance 5mm

Precast elements: railings and barriers



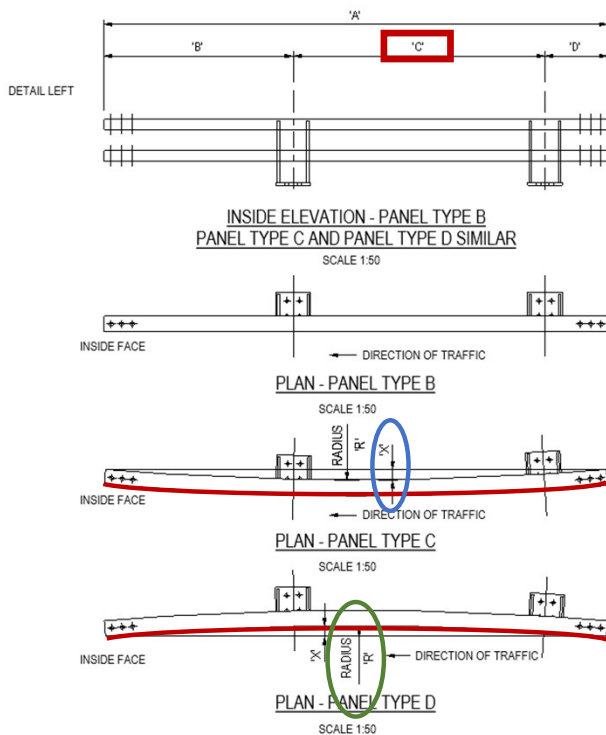
max tolerance 5mm

Precast elements: railings and barriers



max tolerance 2mm

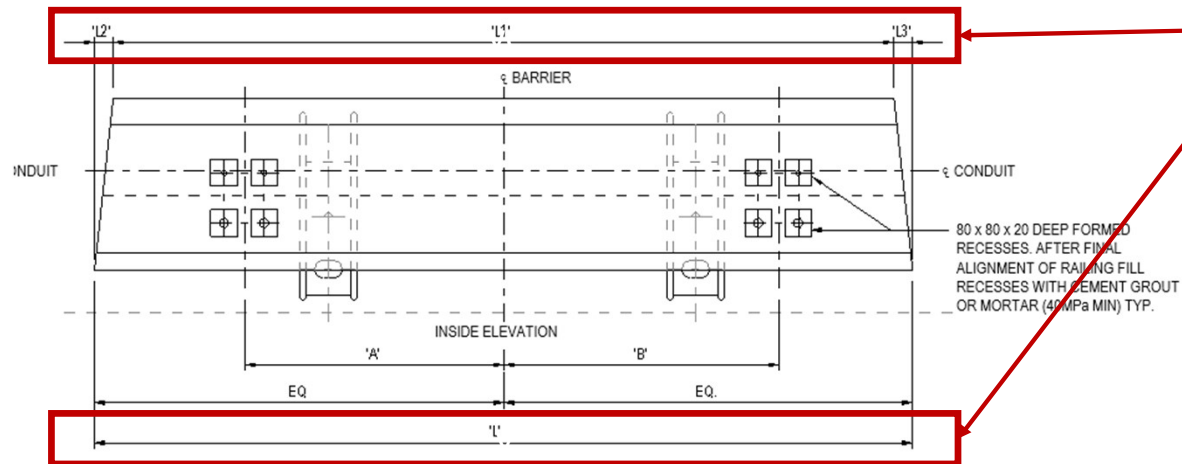
Railings documentation



Dimensions

Ang_Railing_RotationPost1	6.89°	nts	
Ang_Railing_RotationPost2	-6.89°	ngleEnd	0.00°
Ang_VeriticalAnglePost	0.00°	ngleMid	13.99°
Lth_CurvedExtentionEnd	0.0000	ngleStart	0.00°
Lth_CurvedExtentionStart	0.0000	hord	13.99°
Lth_Railing_PostsDistance	2.4000	rvedExtentionEnd_CONS	0.0000
Lth_StraightExtentionEnd	1.0000	rvedExtentionEnd_InsideFace	0.0000
Lth_StraightExtentionStart	2.0000	rvedExtentionStart_CONS	0.0000
Off_Railing_Sagitta	0.0701	Lth_CurvedExtentionStart_InsideF...	0.0000
Rad_Railing_Radius	10.0000	Lth_PostsChordDistance	2.4357
		Lth_PostsChordDistance_InsideFace	2.4601
		Lth_Railing_PostArcDistance	2.4418
		Off_RadiusOffset	10.0000
		Rad_Negative	-9.9275
		Rad_Positive	10.0725
		Wth_RailingSectionWidth	0.1430

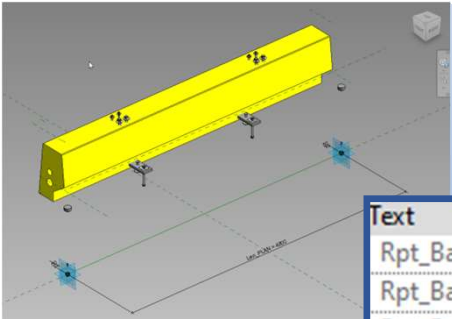
Barriers documentation



PLAN - PRECAST BARRIER TYPE B - CONCRETE
 SCALE 1:20
 (CONDUIT OUTLINES NOT SHOWN FOR CLARITY)

Data	
Len_1	4.7803
Len_2	4.7803
Len_3	0.0000
Len_4	0.0000
Len_PLAN	4.7988
Mrk_BARRIER	PB-19
Mrk_Bolt-1	PB-19-1
Mrk_Bolt-2	PB-19-2
Mrk_WALL	MW2J
Off_Join-1	0.0100
Off_Join-2	0.0100
Pos_Bolt-1_X	331310.264995
Pos_Bolt-1_Y	6244506.79015
Pos_Bolt-2_X	331312.122234
Pos_Bolt-2_Y	6244506.39191

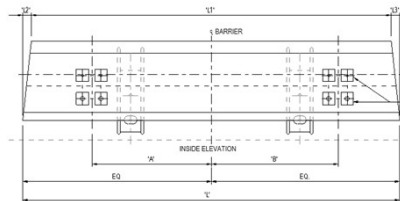
Precast elements: documentation



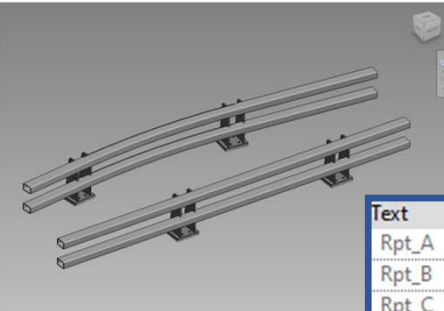
Text	
Rpt_BarrierLength_L1	4780
Rpt_BarrierLength_L2	NA
Rpt_BarrierLength_L3	NA
Rpt_BarrierLength_L4	NA
Rpt_BarrierType	A
Rpt_Post1_DistanceFromC...	1200
Rpt_Post2_DistanceFromC...	1200
Rpt_Slope	NA
Rpt_Y1	9
Rpt_Y2	11
Rpt_Y3	9

<TABLE 1 - RW10 PRECAST BARRIER CONCRETE>

A	B	C	D	E	F	G	H	I	J	K
BARRIER ID	BARRIER TYPE	'L' (mm)	'L1' (mm)	'L2' (mm)	'L3' (mm)	'A' (mm)	'B' (mm)	Y1	Y2	Y3
PB-1	E	4727	4776	49	NA	1186	1186	9	11	9
PB-2	A	3991	NA	NA	NA	1002	1002	8	8	8
PB-3	A	3991	NA	NA	NA	1002	1002	8	8	8
PB-4	A	3991	NA	NA	NA	1002	1002	8	8	8
PB-5	A	3991	NA	NA	NA	1002	1002	8	8	8
PB-6	A	3991	NA	NA	NA	1002	1002	8	8	8
PB-7	A	4780	NA	NA	NA	1199	1199	9	11	9
PB-8	A	4780	NA	NA	NA	1199	1199	9	11	9
PB-9	A	4780	NA	NA	NA	1199	1199	9	11	9
PB-10	A-(LIGHT)	4780	NA	NA	NA	1199	1199	9	11	9
PB-11	A	4780	NA	NA	NA	1199	1199	9	11	9
PB-12	A	4771	NA	NA	NA	1197	1197	9	11	9
PB-13	A	4780	NA	NA	NA	1199	1199	9	11	9
PB-14	A	4780	NA	NA	NA	1199	1199	9	11	9
PB-15	A	4780	NA	NA	NA	1199	1199	9	11	9
PB-16	A	4780	NA	NA	NA	1199	1199	9	11	9
PB-17	A	4780	NA	NA	NA	1199	1199	9	11	9
PB-18	A	4780	NA	NA	NA	1200	1200	9	11	9
PB-19	A-(LIGHT)	4780	NA	NA	NA	1200	1200	9	11	9



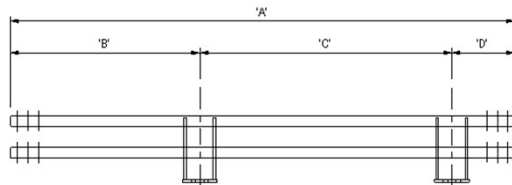
Precast elements: documentation



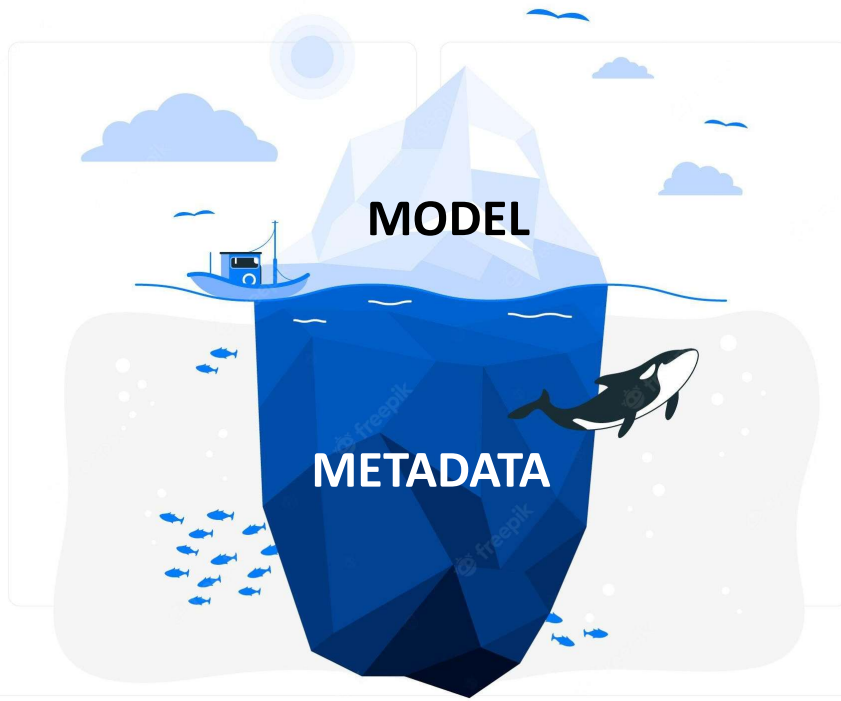
Text	
Rpt_A	4777
Rpt_B	1790
Rpt_C	2397
Rpt_D	590
Rpt_E	NA
Rpt_F	NA
Rpt_G	NA
Rpt_H	NA
Rpt_L	NA
Rpt_M	NA
Rpt_Radius	215
Rpt_RailingType	D
Rpt_Sagitta	13
Rpt_Slope	NA

TABLE 1 - ROAD TRAFFIC BARRIER RAILING SCHEDULE

A	B	C	D	E	F	G	H
RAILING ID	PANEL TYPE	'A' (mm)	'B' (mm)	'L' (mm)	'D' (mm)	'R' (mm)	'X' (mm)
TR-1	D	4735	1640	2370	725	215	13
TR-2	D	4033	1490	2003	540	215	9
TR-3	D	3983	1490	2003	490	215	9
TR-4	D	3983	1490	2003	490	215	9
TR-5	D	3983	1490	2003	490	215	9
TR-6	D	4138	1645	2003	490	215	10
TR-7	D	4726	1790	2396	540	215	13
TR-8	D	4776	1790	2396	590	215	13
TR-9	D	4776	1790	2396	590	215	13
TR-10	D	4776	1790	2396	590	215	13
TR-11	D	4776	1790	2396	590	215	13
TR-12	D	4772	1790	2392	590	215	13
TR-13	D	4777	1790	2397	590	215	13
TR-14	D	4777	1790	2397	590	215	13
TR-15	D	4777	1790	2397	590	215	13
TR-16	D	4777	1790	2397	590	215	13
TR-17	D	4777	1790	2397	590	215	13
TR-18	D	4777	1790	2397	590	215	13
TR-19	D	4323	1335	2398	590	215	11

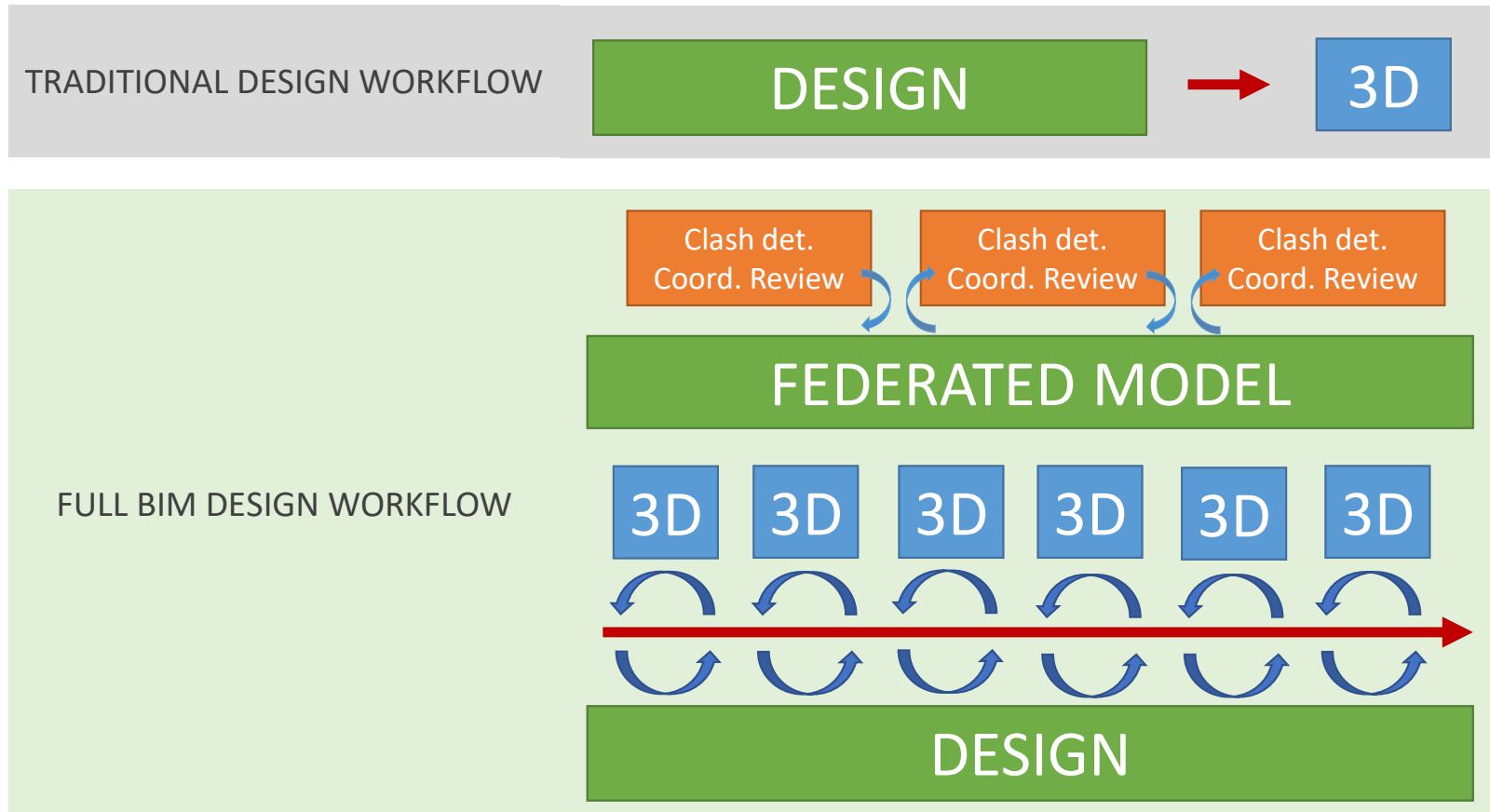


Metadata



- 73 walls
- 50.000 elements
- 20 metadata per element
- 500.000 metadata in total for Retaining Structure only

Metadata



Metadata

[illegible]

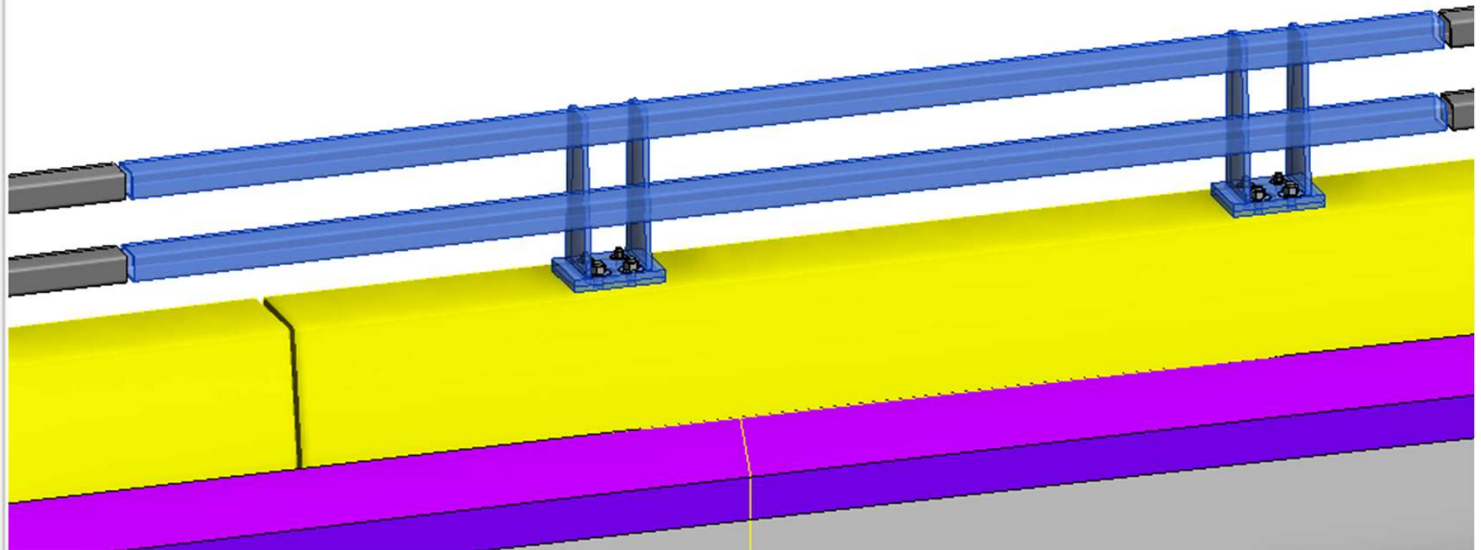
Dynamo
Computational Design for BIM

Dial "000" and call Doc

Category1	RAMS.AssetTag
L	RETW-1001-C-381-CA-L
L	RETW-168-Z-327-RE-L
R	RETW-168-C-230-RE-R
L	RETW-658-Z-428-RE-L
L	RETW-658-Z-137-RE-L
R	RETW-168-C-277-CA-R
L	RETW-1001-V-345-RE-L
R	RETW-1001-V-225-RE-R
C	RETW-1001-V-345-RE-C
L	RETW-1001-V-504-CA-L
L	RETW-6008-R-364-RE-L
L	RETW-6008-C-663-RE-L
C	RETW-6008-B-198-RE-C
L	RETW-1001-B-805-CA-L
L	RETW-6008-B-166-RE-L
L	RETW-1001-B-695-CA-L
L	RETW-6008-C-703-RE-L
C	RETW-6008-C-632-RE-C
R	RETW-2001-A-458-RE-R
L	RETW-2001-A-473-RE-L
C	RETW-2001-A-453-RE-C
C	RETW-2001-A-457-RE-C
L	RETW-2001-A-367-RE-L
L	RETW-2001-A-367-RE-L
R	RETW-2001-A-375-RE-R
R	RETW-2001-A-308-RE-R
R	RETW-2001-A-308-RE-R
C	RETW-2001-A-384-RE-C
R	RETW-2001-A-298-RE-R
R	RETW-2001-A-384-CA-R
R	RETW-2001-A-311-CA-R
L	RETW-168-C-1445-OT-L
L	RETW-168-B-1592-OT-L
L	RETW-1001-C-660-CA-L
L	RETW-6008-C-635-OT-L
L	RETW-2001-A-367-OT-L
L	RETW-6008-C-695-OT-L

Metadata

Data	
Mrk_WALL	MW2J
Txt_RailingMark	TR-18
RAMS.InventoryType	RETW
RAMS.Description	Retaining Wall
RAMS.RoadNumber	658
RAMS.CarriagewayCode	C
RAMS.Chainage	1750
RAMS.Attributeld	RE
RAMS.AttributeDescription	REINFORCED EARTH
RAMS.Category1	R
RAMS.AttributeCode	RETW-658-C-1750-RE-R
WallName	RW10
Volume	2.006395
Area	1.687056
Length	4777
Width	-
Diameter	-
Sub Zone	MC20
Design Lot Number	RW-1610
Zone	4000



Conclusions



- **Software interoperability and common language** (remember your kids' face when they don't understand)
- **Computational Design and Dynamo** (remember Doc from Back to the Future)
- **Precast Revit Families** (remember the Shilton Lego Family)

Christian Pallaria
BIM Manager – Digital Engineering Manager

THANK YOU

AECOM

