



Extended workflows with Autodesk Advance Steel

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Class summary

In this class, we will explore extended workflows that lead to enhanced fabrication details with Autodesk Advance Steel. We will see the advantages of an integrated approach with Autodesk Revit, Autodesk Robot Structural Analysis Professional and ultimately Autodesk Navisworks. We will also be introducing how we can link to general connection design through an Autodesk Structural Partnering solution. Finally, in this class we will explore the use of Dynamo with Autodesk Advance Steel through discussion and worked examples. This session features Autodesk Advance Steel, Autodesk Revit and Autodesk Robot Structural Analysis Professional. AIA Approved

Key learning objectives

At the end of this class, you will be able to:

- Understand the Autodesk structural offerings
- Understand the integrated workflow with Autodesk Advance Steel
- Know some of the recent enhancements to the portfolio
- Learn where Dynamo can assist your design process

What is Structural Engineering?

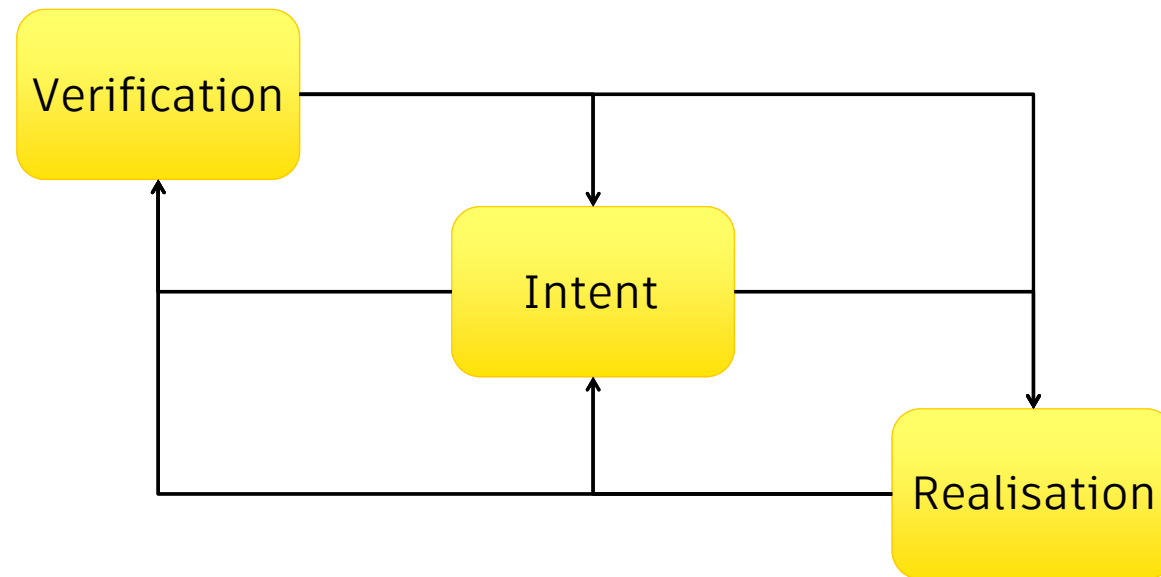
Structural Engineering

“Engineering is the art of modelling materials we do not wholly understand, into shapes we cannot precisely analyse so as to withstand forces we cannot properly assess, in such a way that the public has no reason to the suspect the extent of our ignorance.” Dr A R Dykes



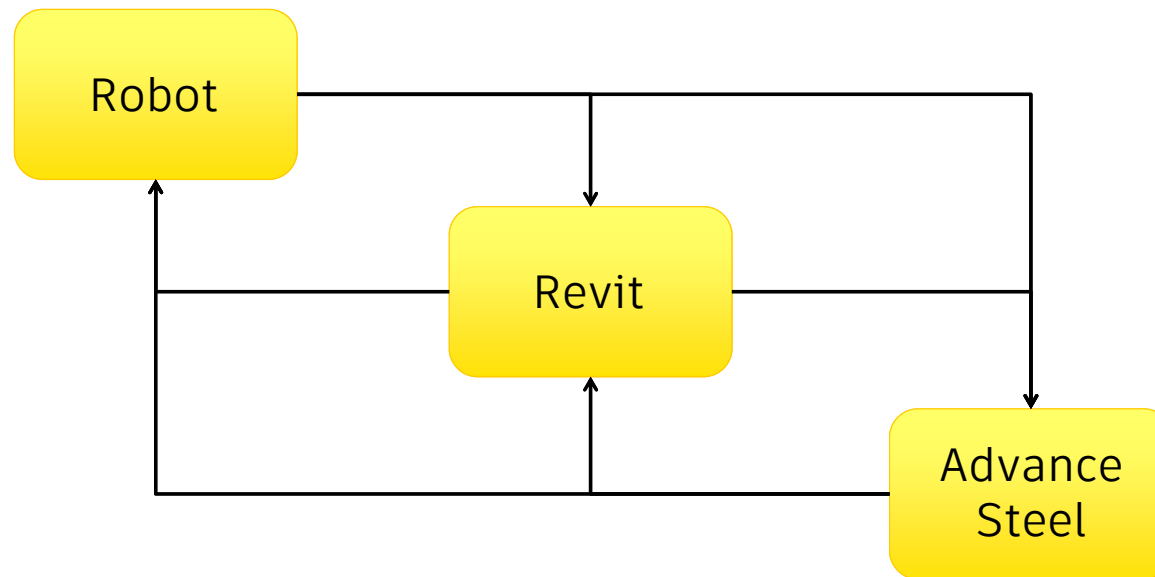
Why an integrated workflow?

Third party plug-ins/API Programming



Visual programming/laser scanning

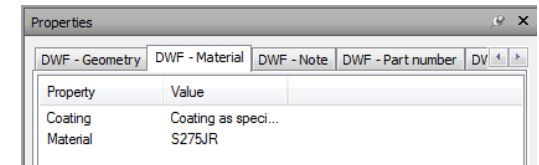
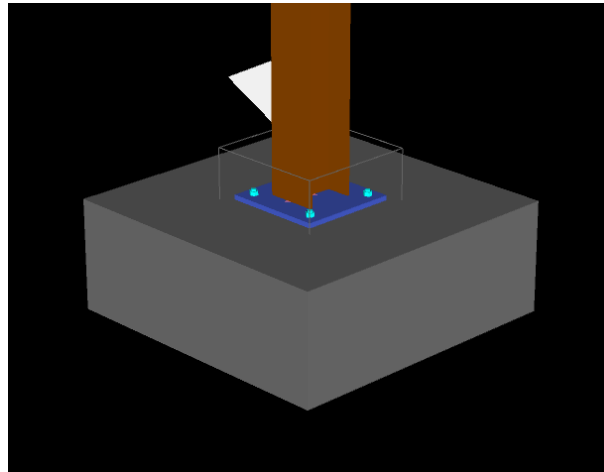
Partnerships



Dynamo/Recap

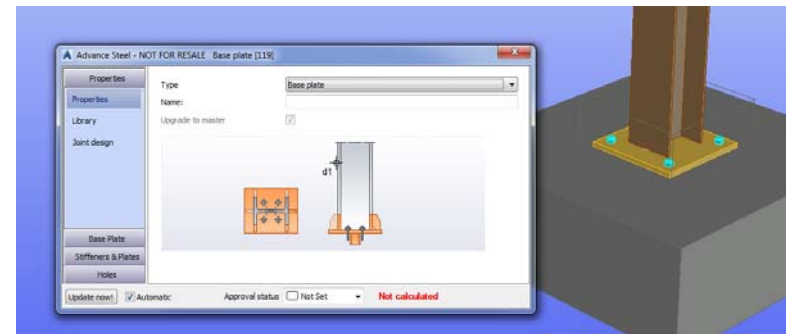
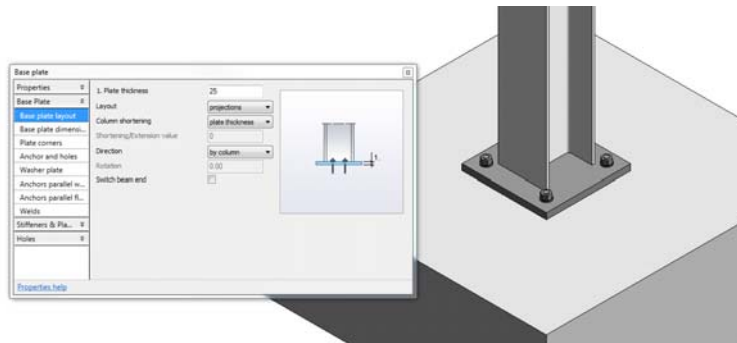
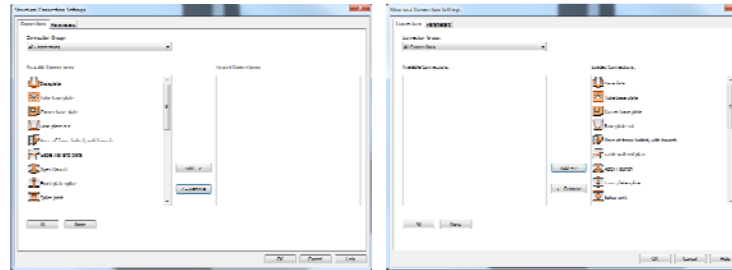
Integration with Autodesk Navisworks

- Leverages Autodesk Navisworks functionality
 - File formats
 - Coordination
 - Information
- Direct from Autodesk Advance Steel



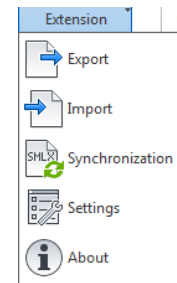
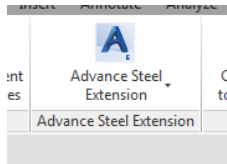
Connections in Autodesk Revit

- New for 2017

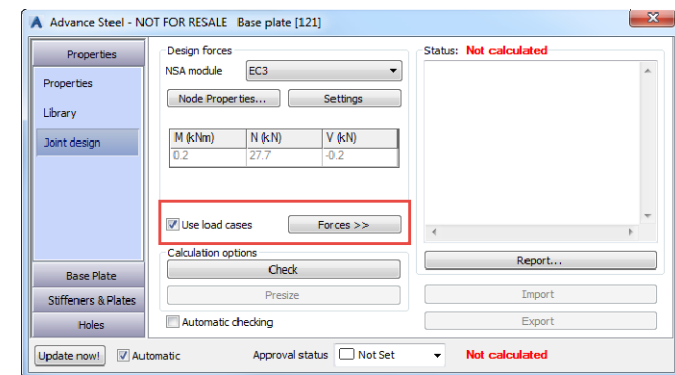
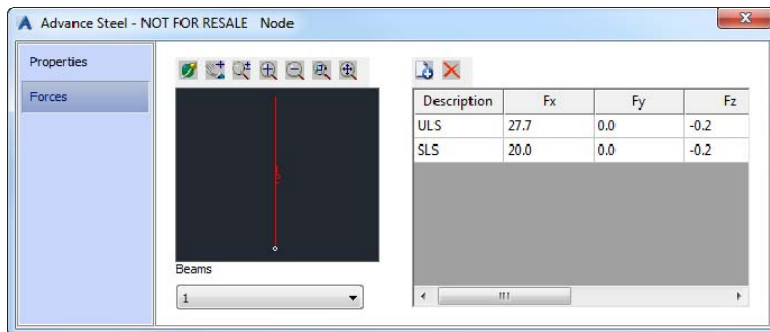


Autodesk Advance Steel add-in for Autodesk Revit

- Bi-directional integration via SMLX

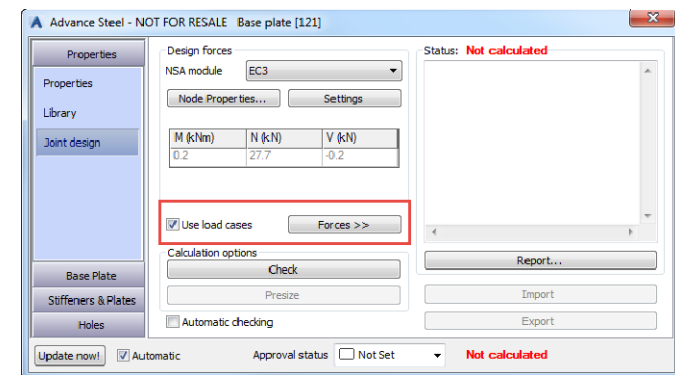
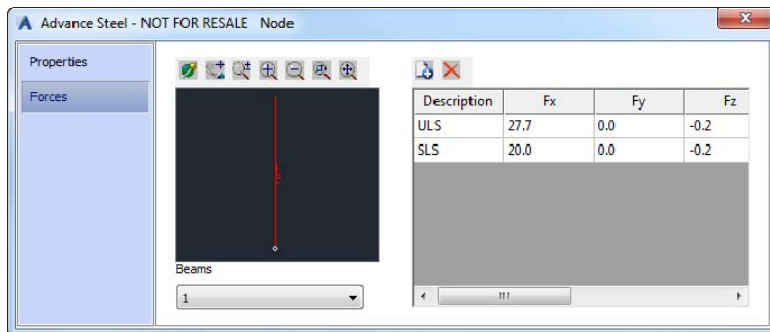
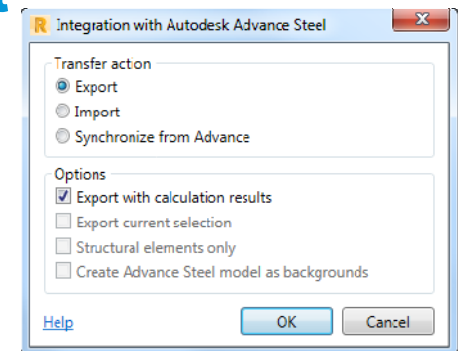


- Reactions re-used for connection design



Autodesk Advance Steel add-in for Autodesk Robot Structural Analysis Professional

- Bi-directional integration via SMLX
- Reactions re-used for connection design

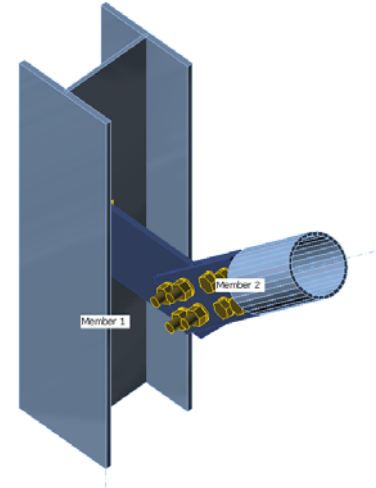
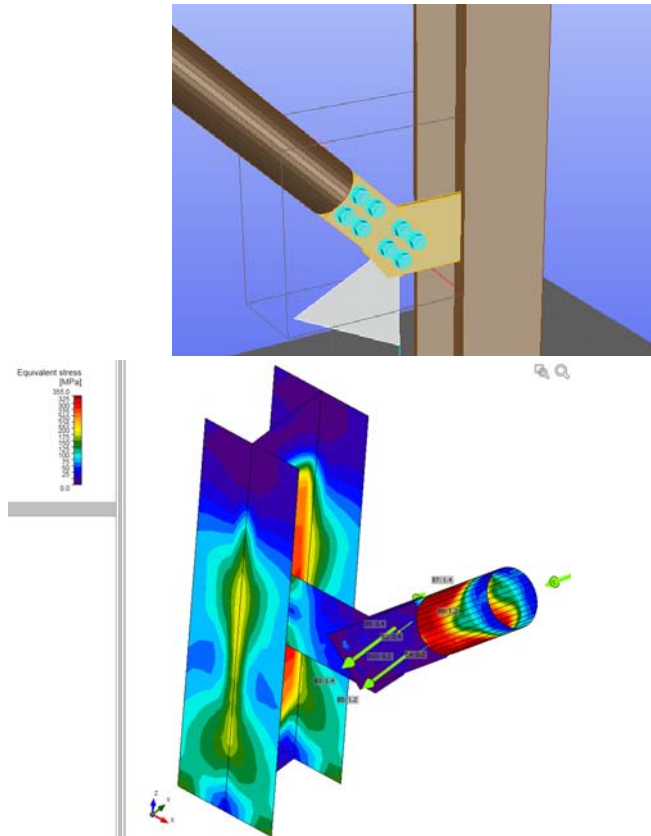


Complex Connections

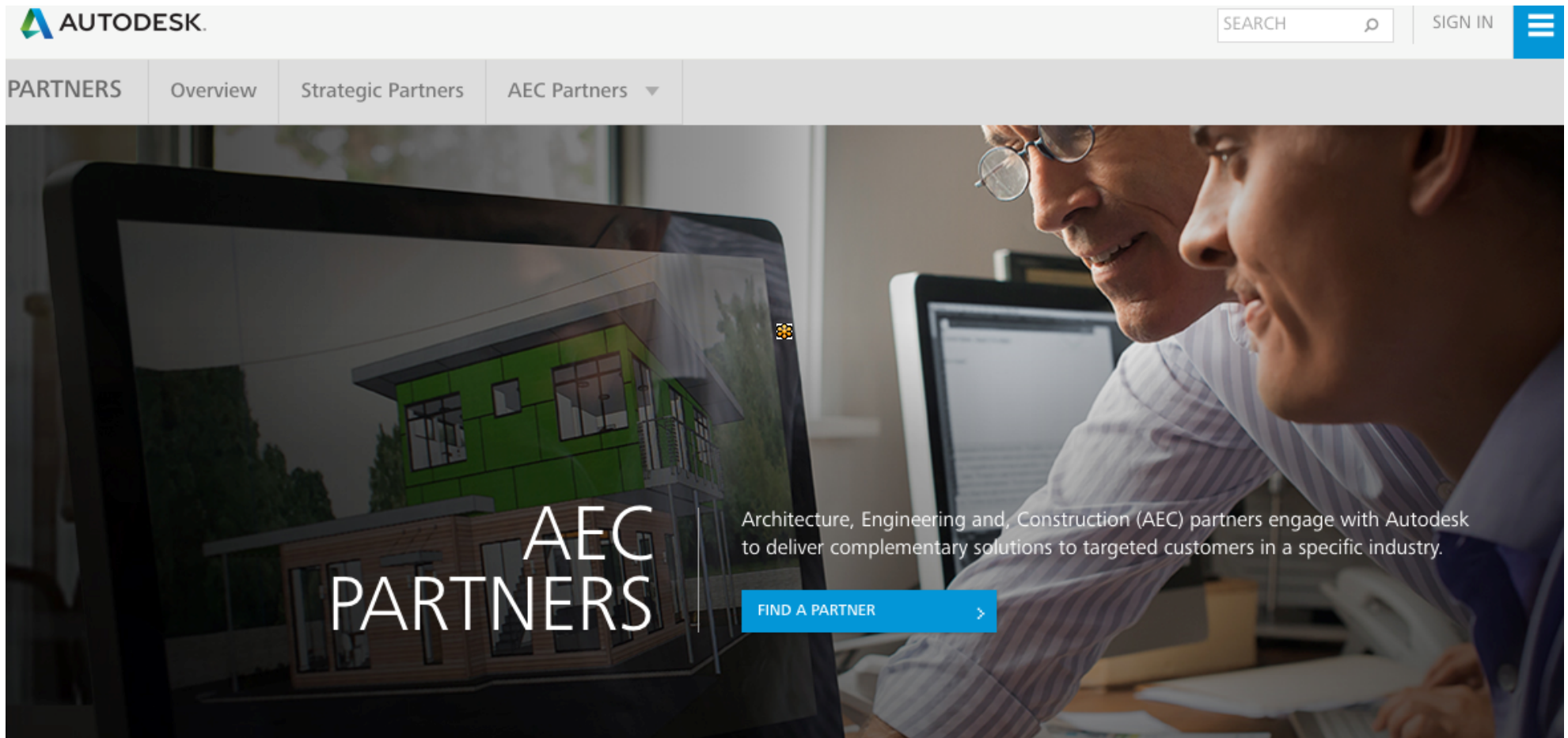
- Idea Statica
 - CBFEM

Overview of all checks for extreme load effect


Check item	Value	Status
Analysis	Applied loads : 100.0%	✓
> Plates	142.7 > 5%	✗
Bolts	8.8 < 100%	✓
Welds	120.9 > 100%	✗




IDEA StatiCa is a solution associate of Autodesk

A screenshot of the Autodesk website's 'AEC PARTNERS' section. The header features the Autodesk logo on the left, a search bar with the text 'SEARCH' and a magnifying glass icon, and a 'SIGN IN' link next to a hamburger menu icon. Below the header is a navigation bar with the following links: 'PARTNERS', 'Overview', 'Strategic Partners', and 'AEC Partners' with a dropdown arrow. The main content area has a background image of two men in business attire looking at a computer monitor. The monitor displays a 3D architectural rendering of a modern building with green and brown facades. Overlaid on the image is the text 'AEC PARTNERS' in large white letters. To the right of this text is a paragraph: 'Architecture, Engineering and, Construction (AEC) partners engage with Autodesk to deliver complementary solutions to targeted customers in a specific industry.' Below the paragraph is a blue button with the text 'FIND A PARTNER' and a right-pointing arrow.

AUTODESK.

SEARCH 

SIGN IN 

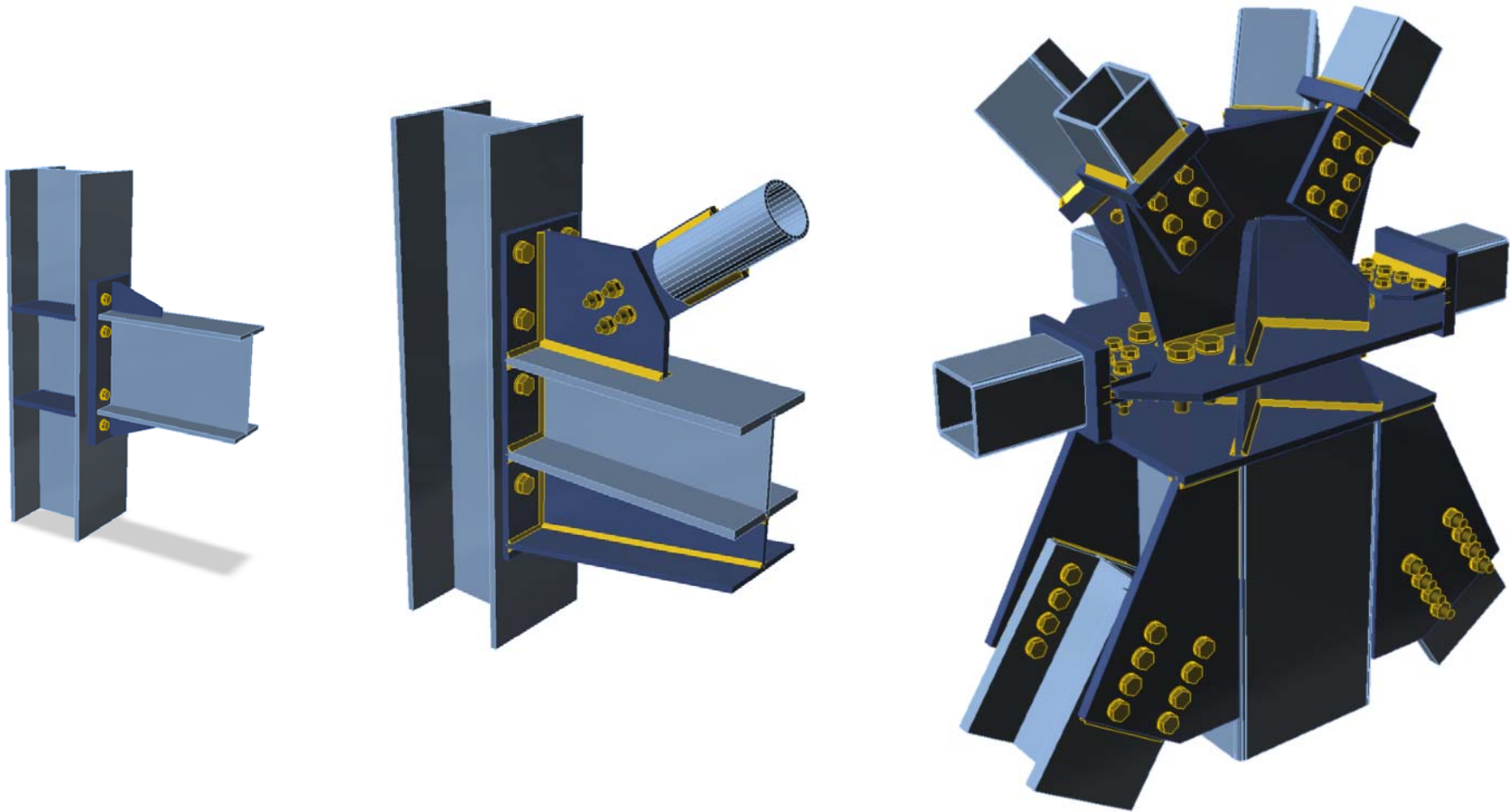
PARTNERS Overview Strategic Partners AEC Partners ▼

AEC PARTNERS

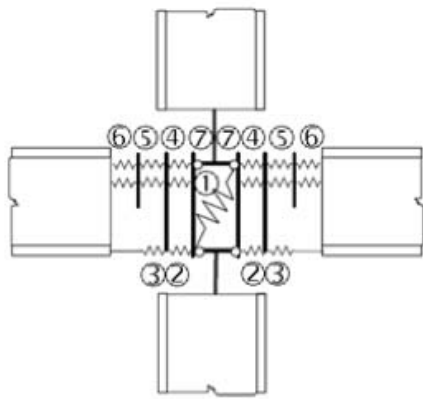
Architecture, Engineering and, Construction (AEC) partners engage with Autodesk to deliver complementary solutions to targeted customers in a specific industry.

[FIND A PARTNER >](#)

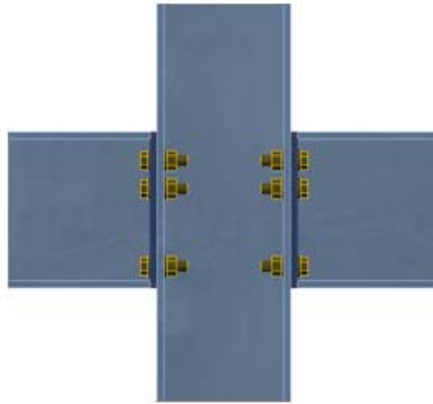
What does any topology mean



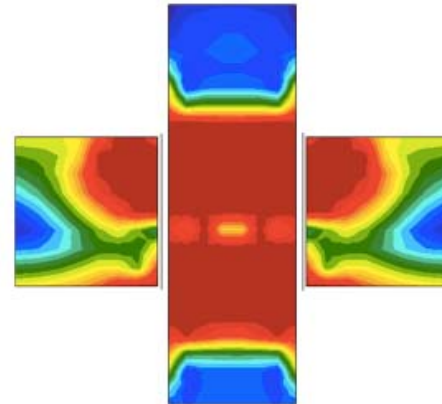
Component based finite element model (CBFEM)



Component Model



Bolted Joint

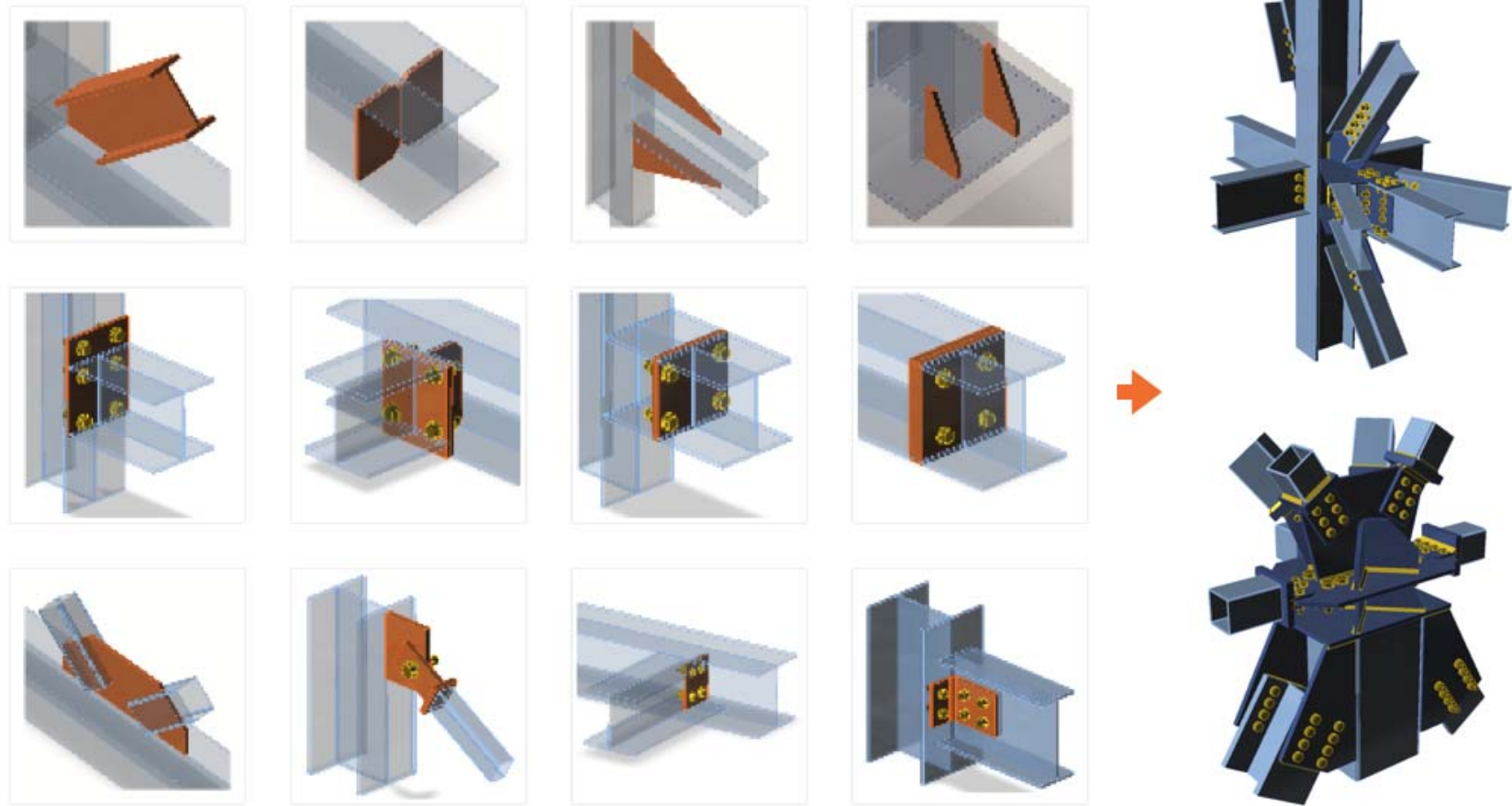


CBFEM model

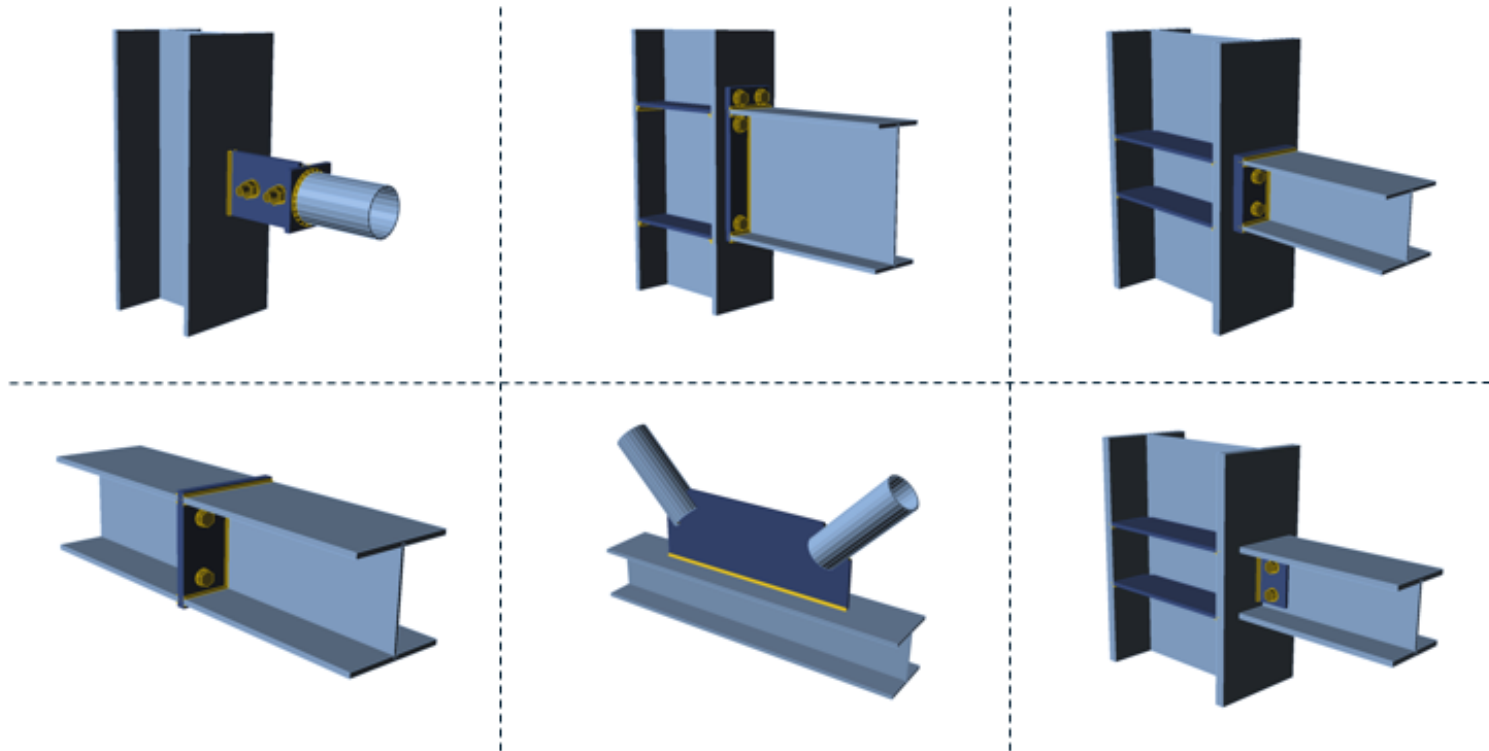


The weak point of standard Component method Design guides is that the topology is limited.

Real-life manufacturing operations

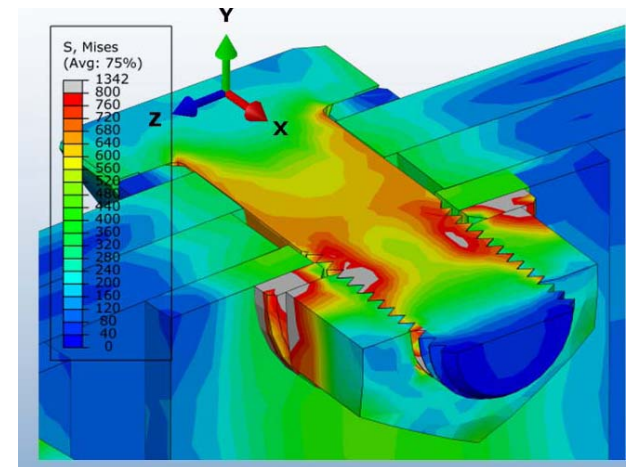
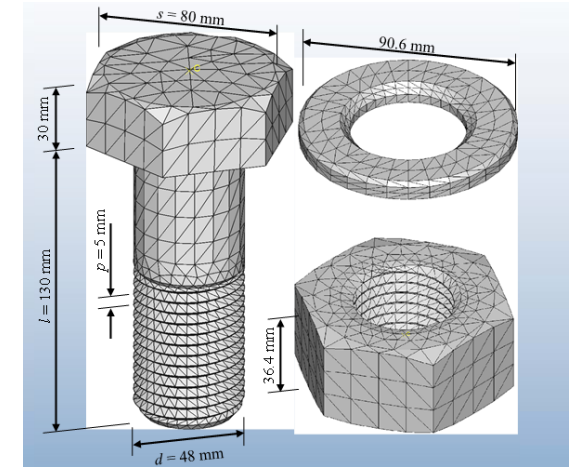
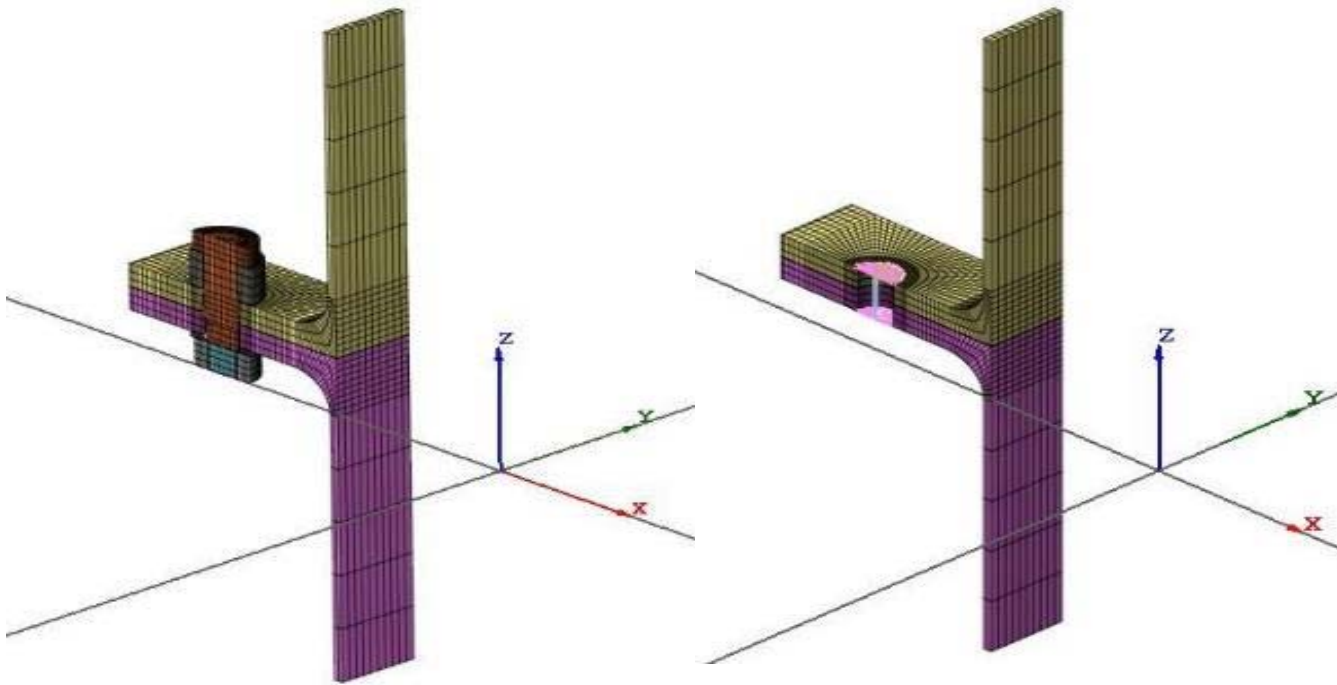


Verification and validation – level 1



All standard connections from Eurocode / AISC design guides, calculated with the same results.

Level 2 – analytical models



Level 3 – live tests

VERIFICATION – COMPLEX TOPOLOGIES

Tailor-made design
models created in various
software.

Live testing.

All studies published.

Two university teams
spent over 3 years on
this.



Everything is published

COOPERATION WITH UNIVERSITIES = VERIFIED SOLUTION



Workflow with Advance Steel

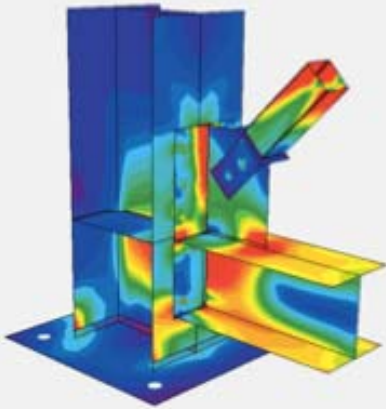
Workflow demonstration



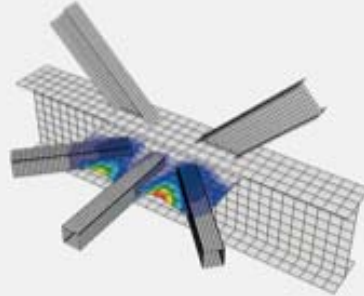
Real-life projects

What had to be taken into account

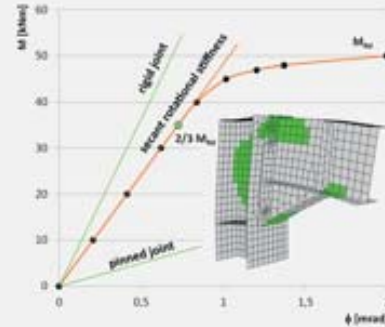
Stress-strain



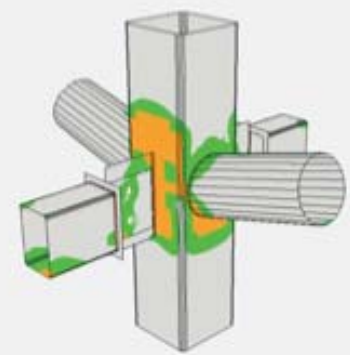
Buckling Analysis



Stiffness Analysis



Overall Check



Stress-strain

Buckling analysis

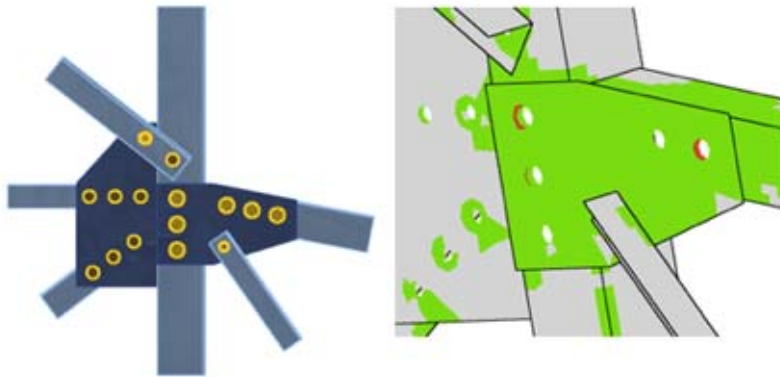
Stiffness analysis

Overall check

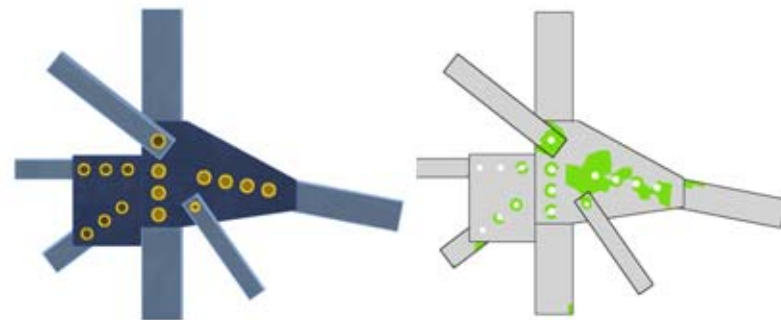
ELECTRICITY TOWER MAST – POLAND



Huge normal force loads the group of bolts eccentrically. Bolts cannot take this.



Rearranging of bolts solved the problem.



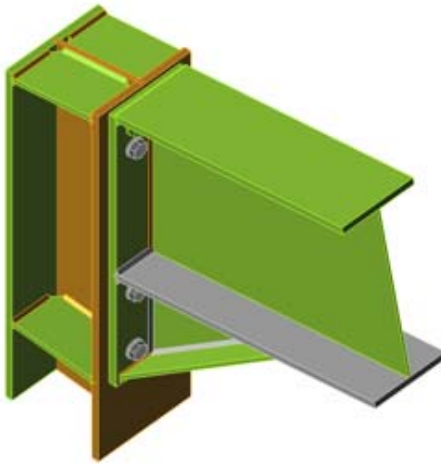
Stress-strain

Buckling analysis

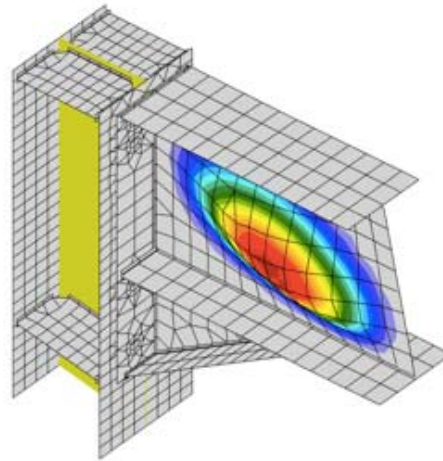
Stiffness analysis

Overall check

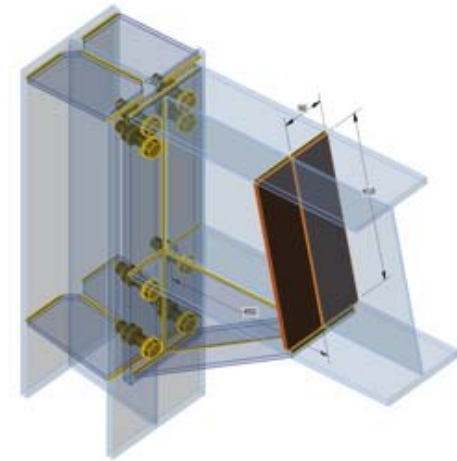
STEEL WAREHOUSE – GERMANY



Connection fully satisfies all stress/strain checks



But the web of the beam can collapse because of local buckling



Additional stiffener resolved this problem



Stress-strain

Buckling analysis

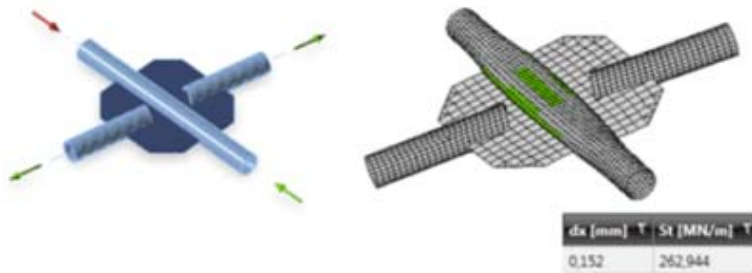
Stiffness analysis

Overall check

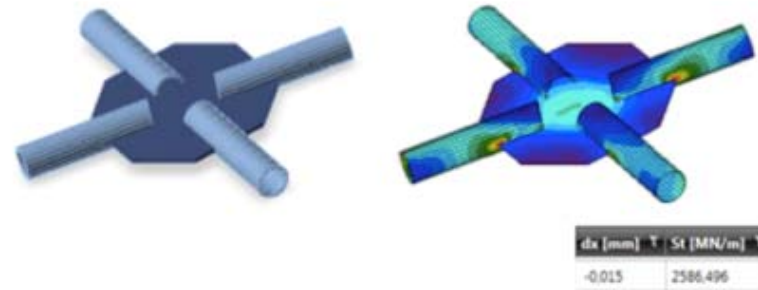
POWER PLANT – CZECH REPUBLIC



Ovalization of CHS. Stiffness perpendicular to CHS is weaker.



All CHS are welded to one plate. Stiffness is 10x higher.



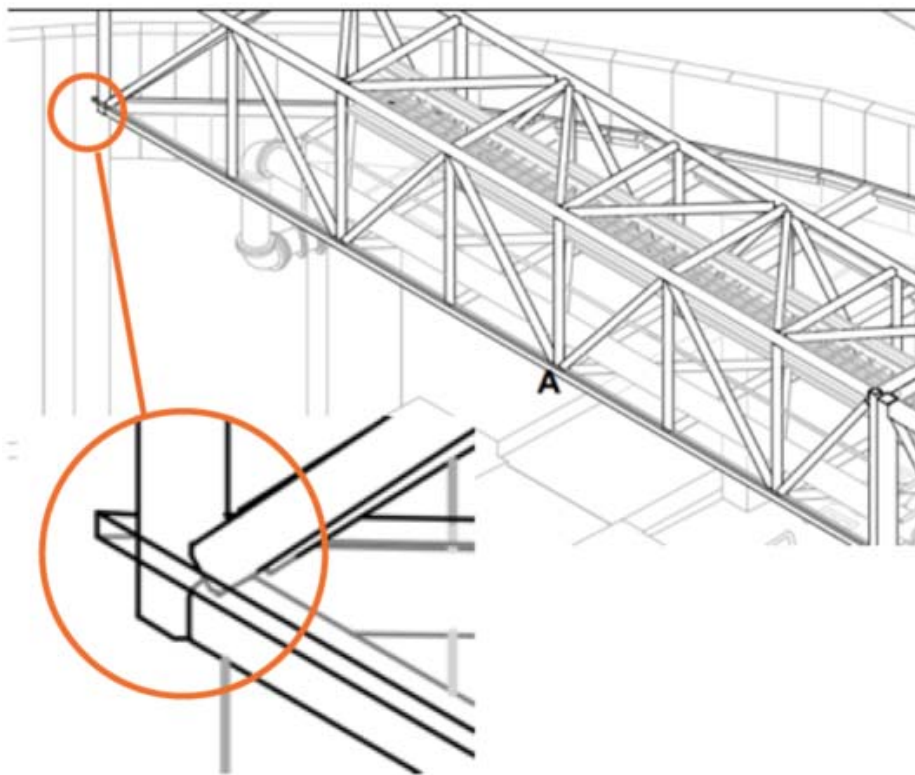
Stress-strain

Buckling analysis

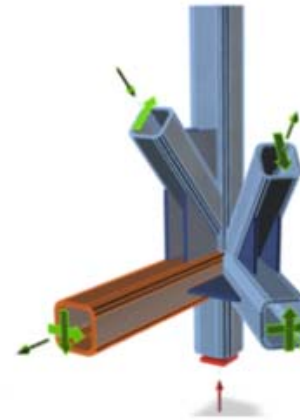
Stiffness analysis

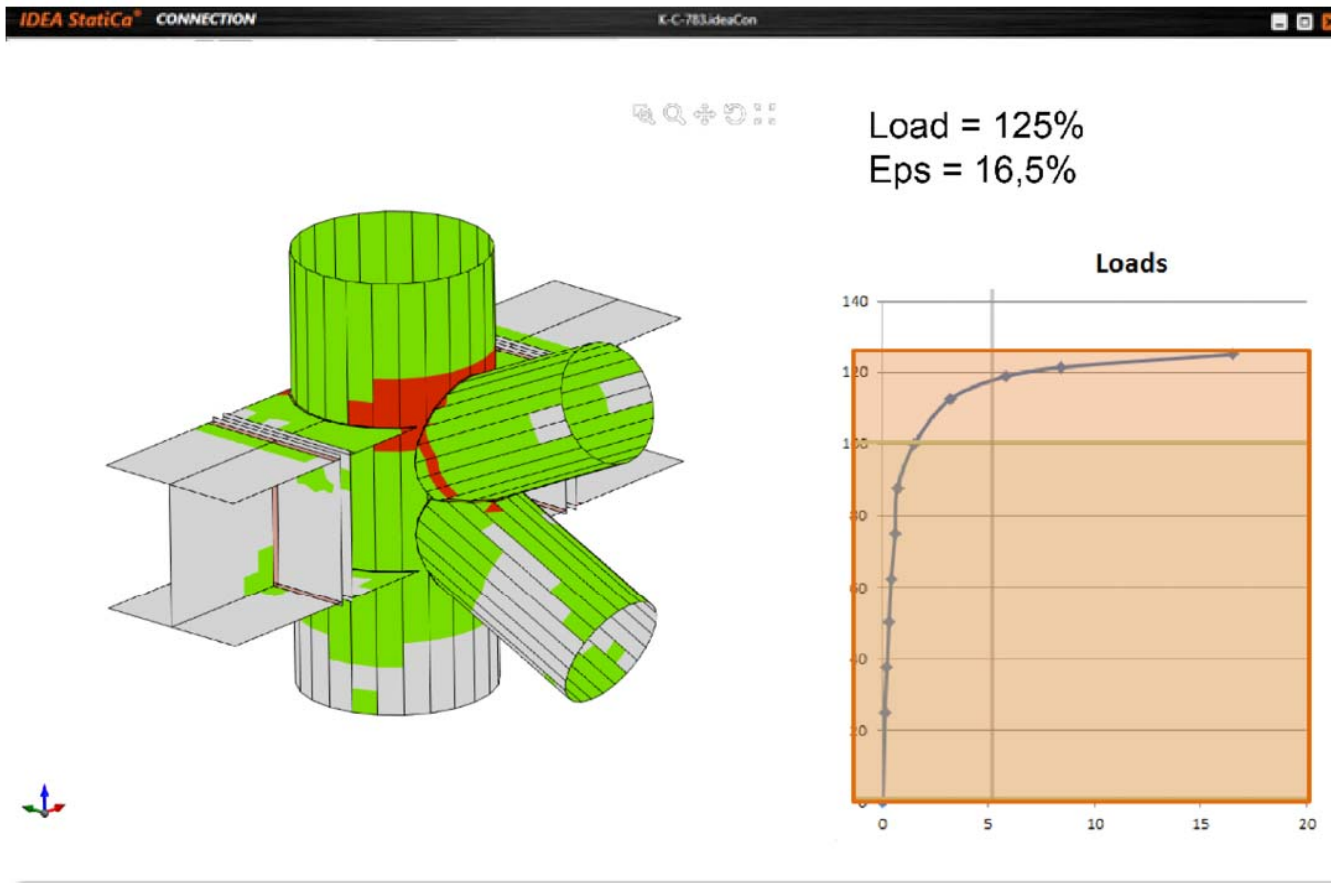
Overall check

HEATHROW AIRPORT – UK



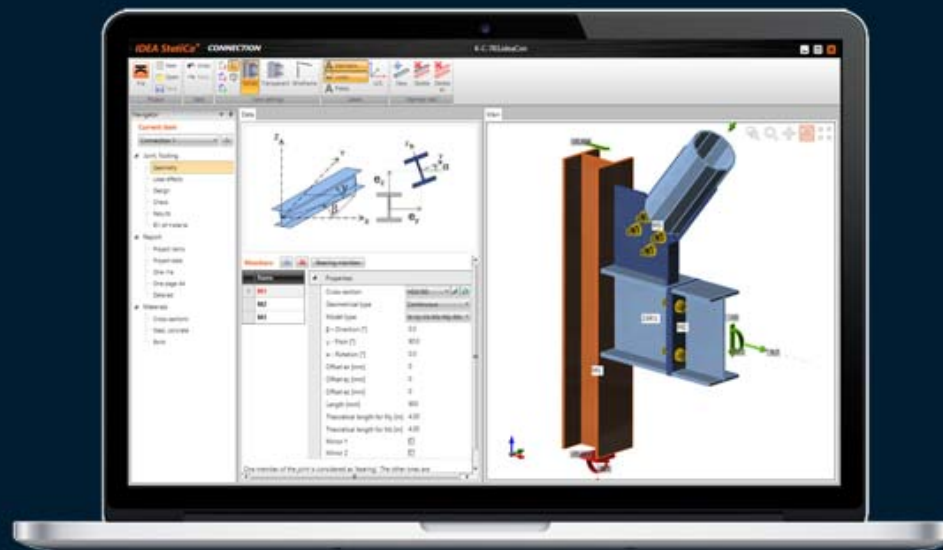
Connection was not designable with the suggested prescribed EC3 requirements and a more generic analysis approach had to be adopted.





We can design and check steel joints of any topology, any loading, in minutes.

TRY THIS NEW WORKFLOW



14-day trial

Drop us an email
juraj.sabatka@idea-rs.com

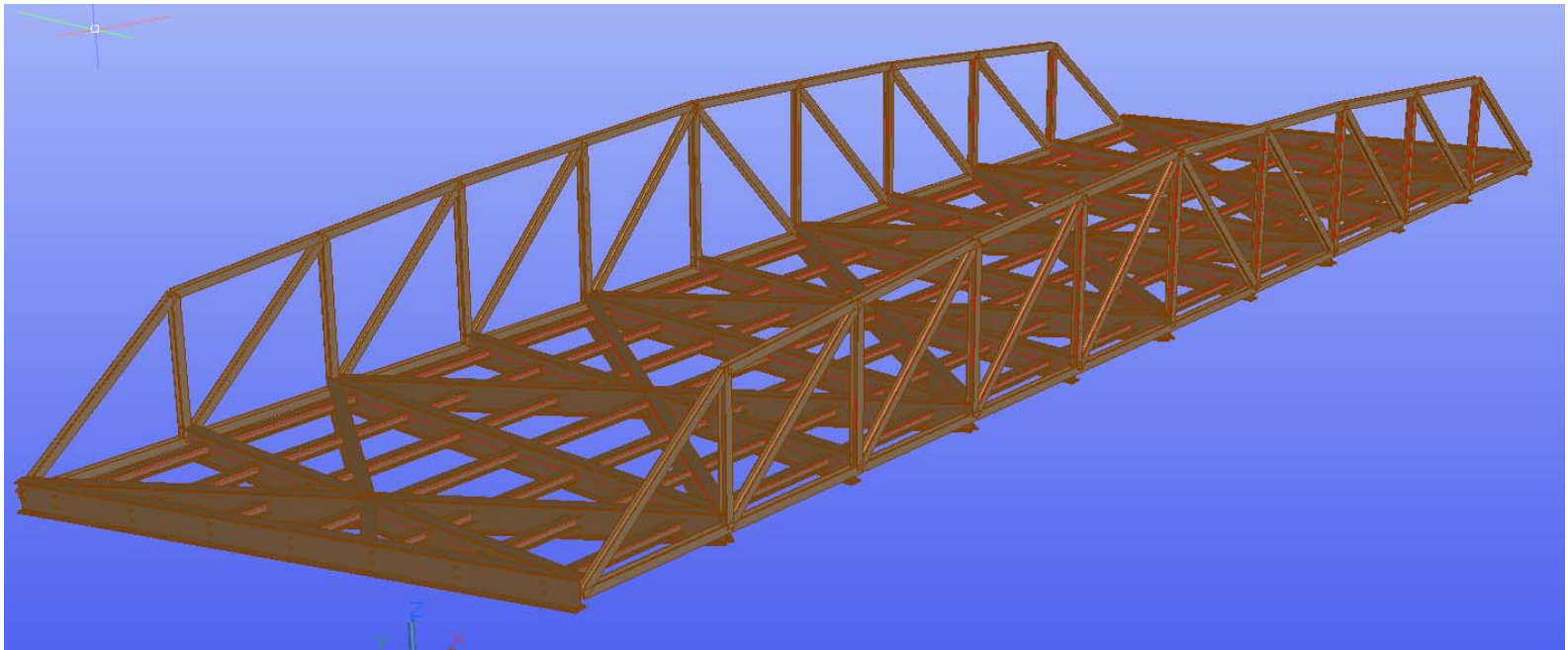
Visit our website
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AUTODESK UNIVERSITY 2016

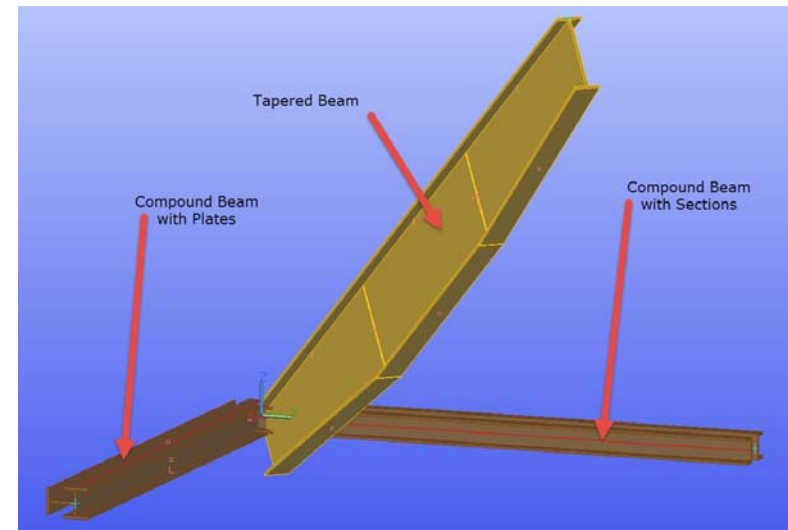
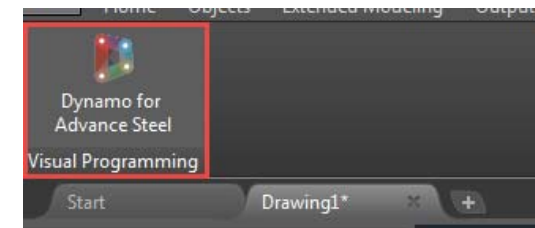
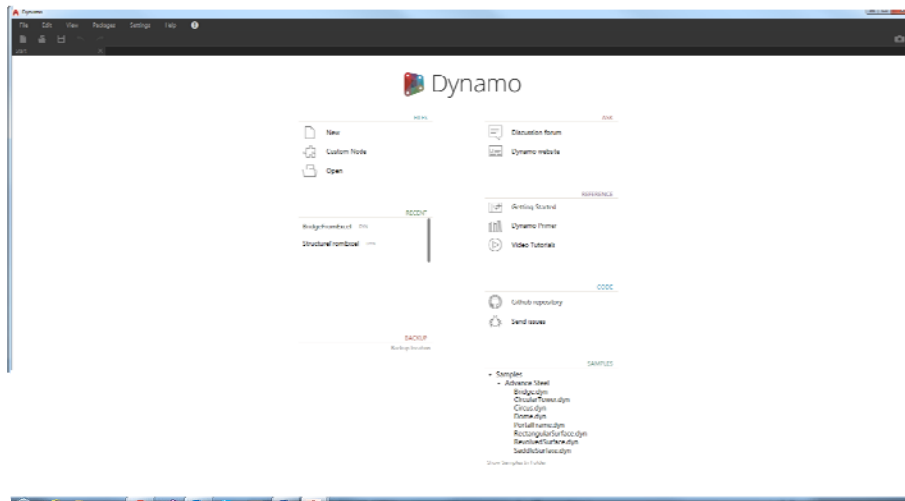


Computational BIM and Autodesk Advance Steel

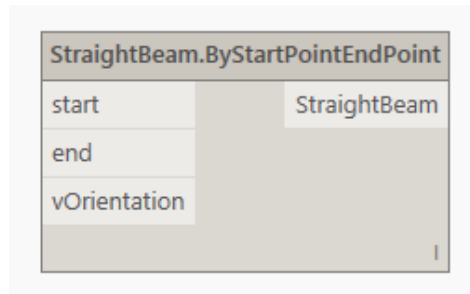


Dynamo for Autodesk Advance Steel

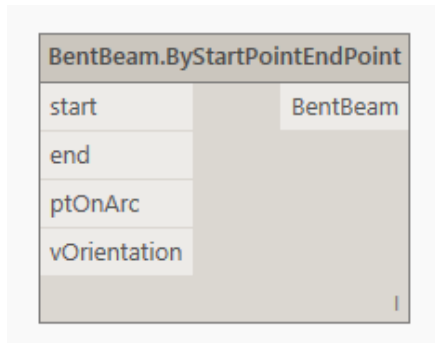
- New for 2017.1
 - New nodes...
- WARNING!!!



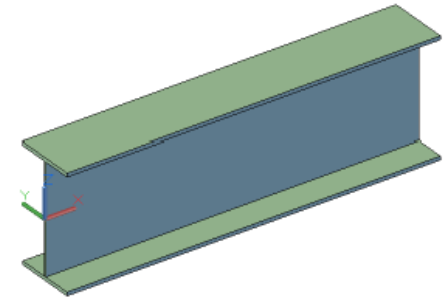
Dynamo nodes



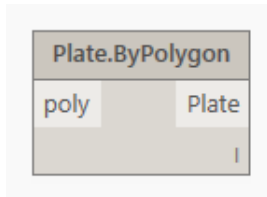
- Straight beam



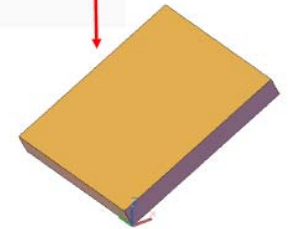
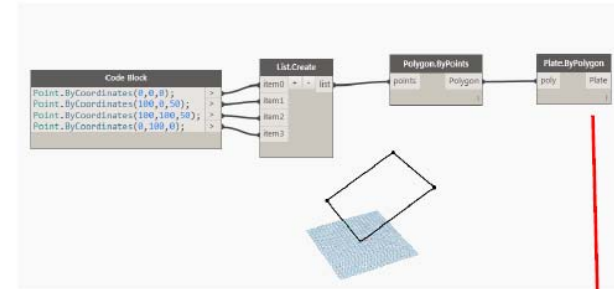
- Bent beam



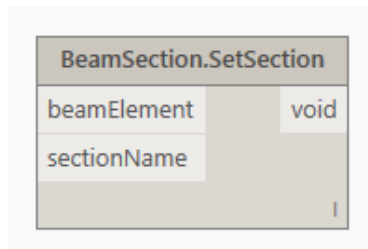
Dynamo nodes



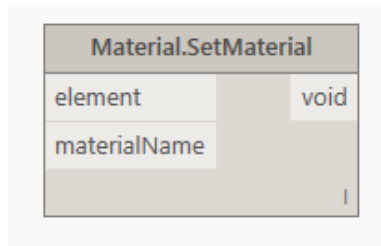
- Plate



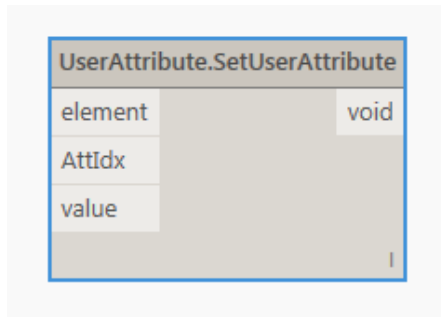
- Beam section



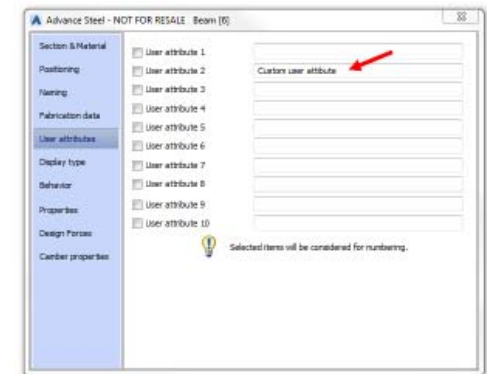
Dynamo nodes



- Material



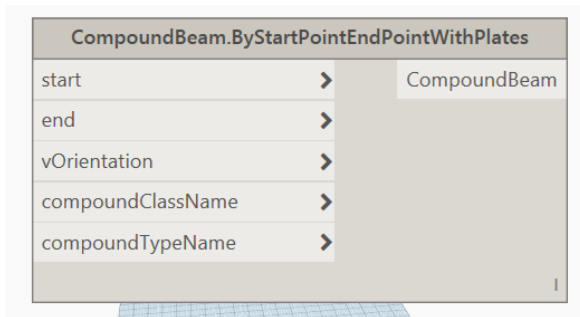
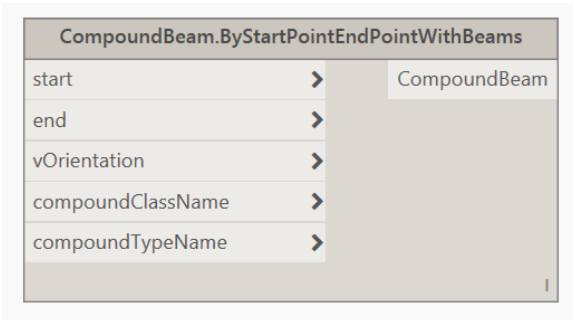
- User attribute
 - Model role
 - Description



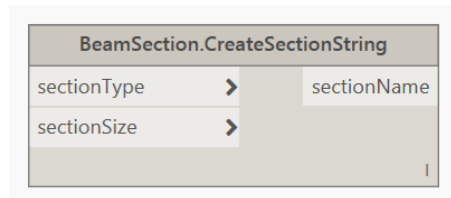
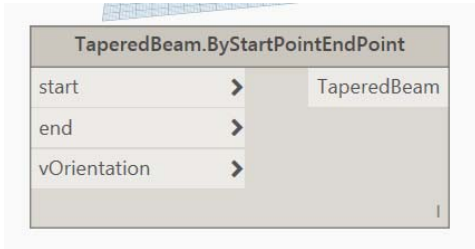
Dynamo nodes (new)

- Compound beam (beams)

- Compound beam (plates)

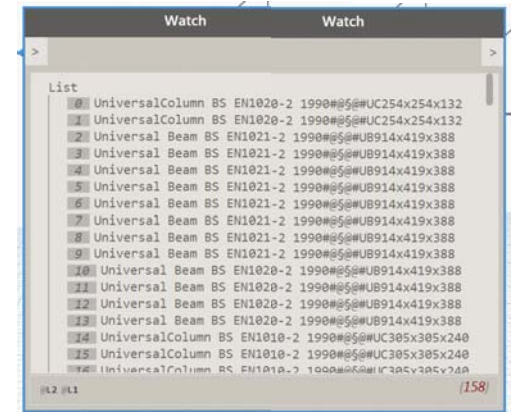


Dynamo nodes (new)

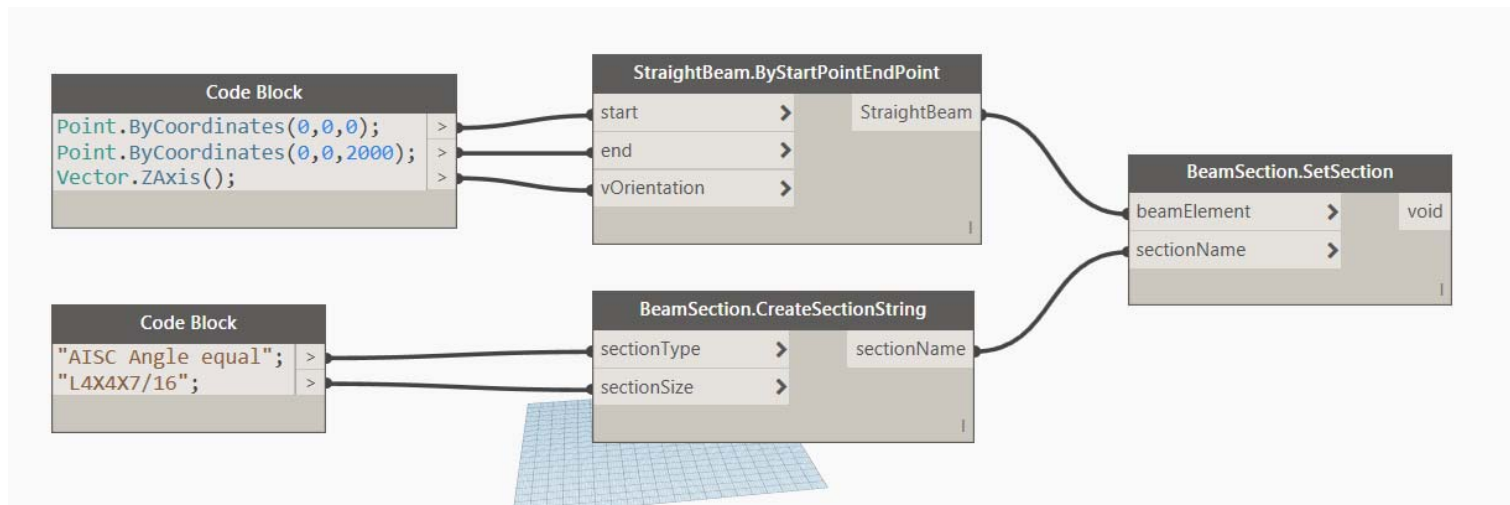


- Tapered beam

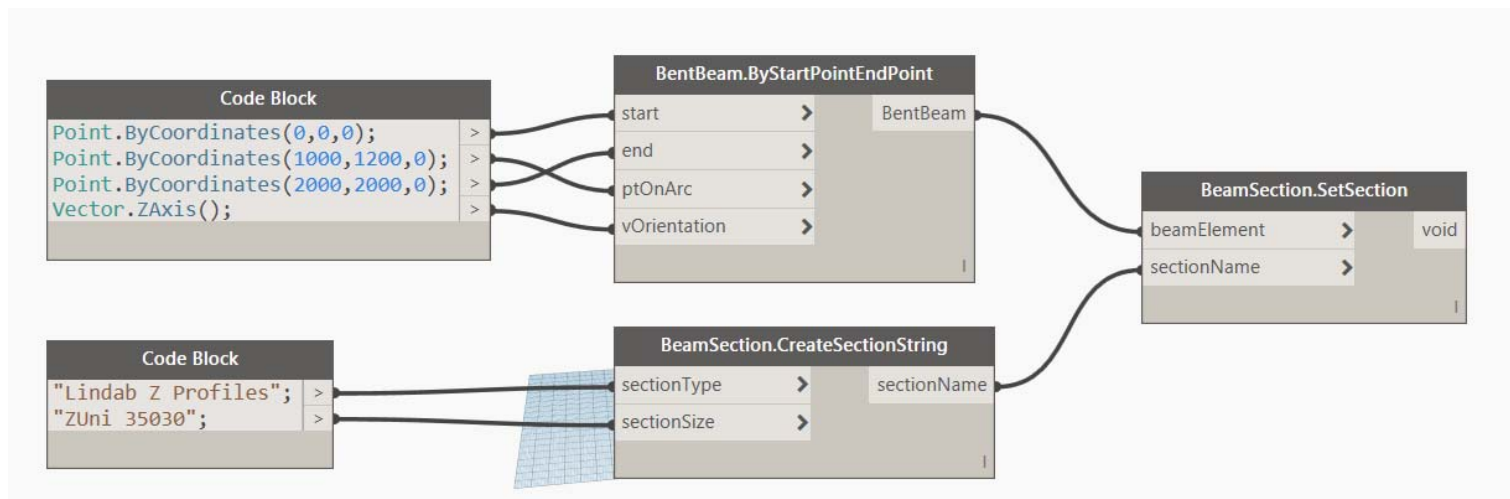
- Beam section string



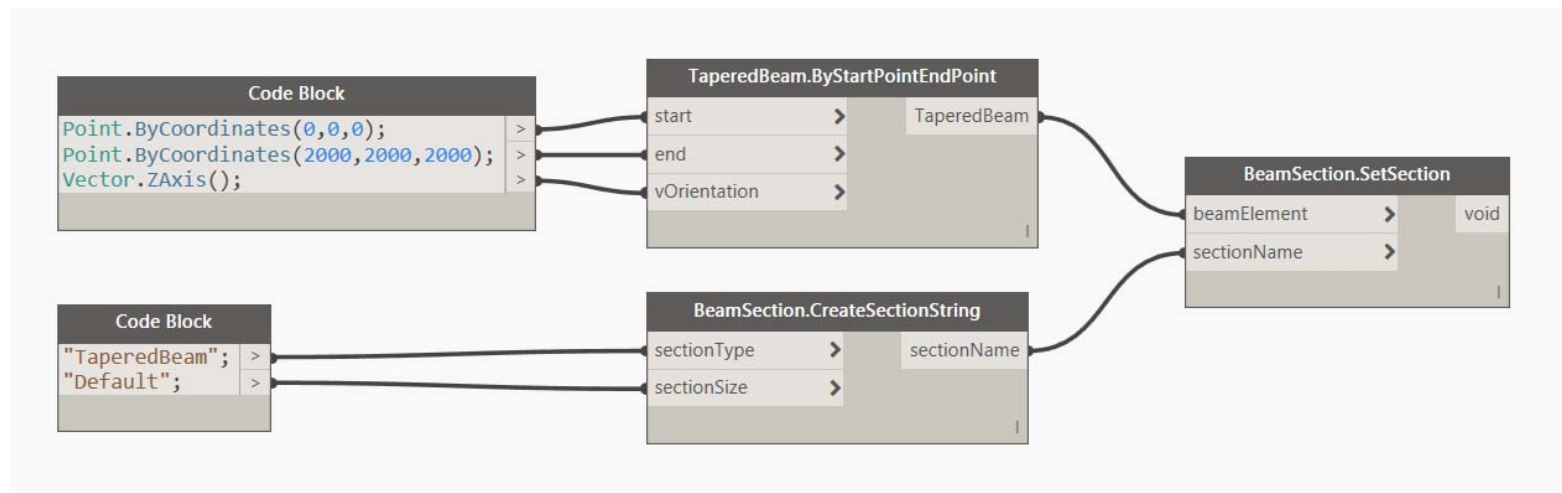
Examples



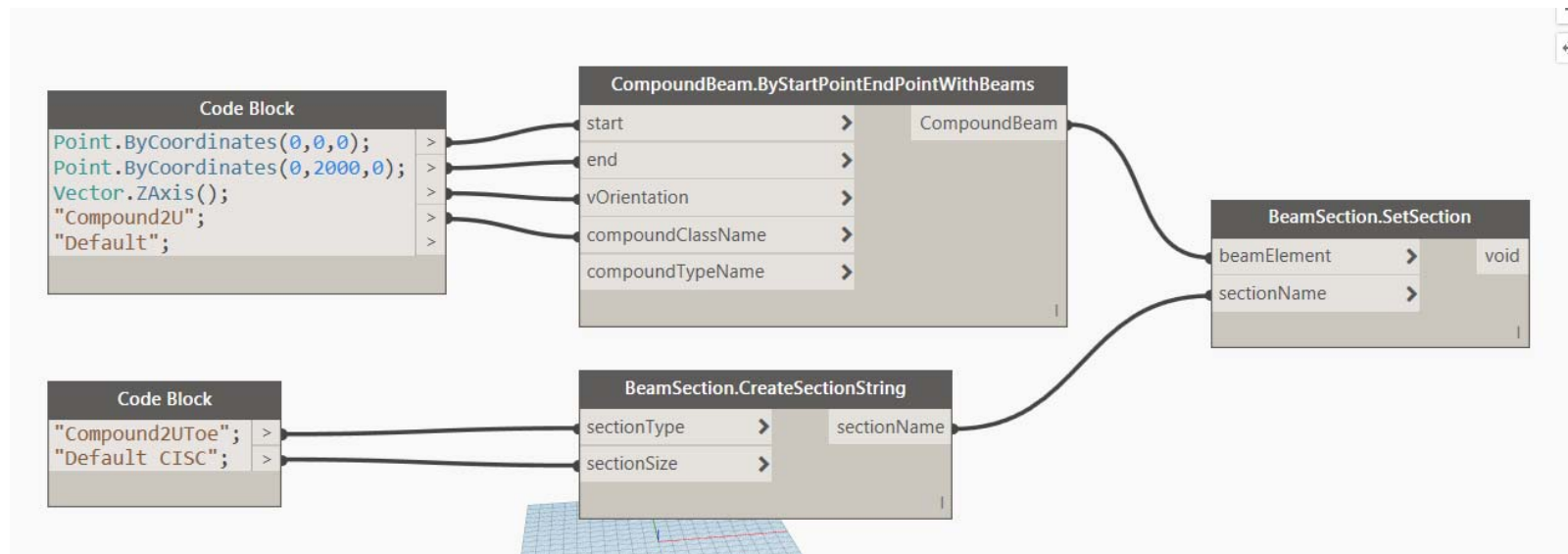
Examples



Examples



Examples



Putting it all together...

■ Using Microsoft Excel

DynamoGeometry.xls [Compatibility Mode] - Excel

	C	D	E	F	G	H	I	J	K	L	M	N
	X1	y1	z1	Node2	x2	y2	z2	Gamma	Material	Catalog	Section	Description
2	0	16.5	0	2	55	16.5	0	90	S275	UniversalColumn BS EN10210-2 1990	UC254x254x132	
3	5.5	0	0	4	60.5	0	0	90	S275	UniversalColumn BS EN10210-2 1990	UC254x254x132	
4	0	16.5	0	3	5.5	0	0	0	S275	Universal Beam BS EN10210-2 1990	UB914x419x388	
5	5.5	0	0	5	5.5	16.5	0	0	S275	Universal Beam BS EN10210-2 1990	UB914x419x388	
6	11	0	0	7	11	16.5	0	0	S275	Universal Beam BS EN10210-2 1990	UB914x419x388	
7	16.5	0	0	9	16.5	16.5	0	0	S275	Universal Beam BS EN10210-2 1990	UB914x419x388	
8	22	0	0	11	22	16.5	0	0	S275	Universal Beam BS EN10210-2 1990	UB914x419x388	
9	27.5	0	0	13	27.5	16.5	0	0	S275	Universal Beam BS EN10210-2 1990	UB914x419x388	
10	33	0	0	15	33	16.5	0	0	S275	Universal Beam BS EN10210-2 1990	UB914x419x388	
11	38.5	0	0	17	38.5	16.5	0	0	S275	Universal Beam BS EN10210-2 1990	UB914x419x388	
12	44	0	0	19	44	16.5	0	0	S275	Universal Beam BS EN10210-2 1990	UB914x419x388	
13	49.5	0	0	21	49.5	16.5	0	0	S275	Universal Beam BS EN10210-2 1990	UB914x419x388	
14	55	0	0	2	55	16.5	0	0	S275	Universal Beam BS EN10210-2 1990	UB914x419x388	
15	55	16.5	0	4	60.5	0	0	0	S275	Universal Beam BS EN10210-2 1990	UB914x419x388	
16	0.35	15.45	0	24	5.5	15.45	0	0	S275	UniversalColumn BS EN10210-2 1990	UC305x305x240	
17	5.15	1.05	0	26	5.5	1.05	0	0	S275	UniversalColumn BS EN10210-2 1990	UC305x305x240	
18	1.15	13.05	0	28	5.5	13.05	0	0	S275	UniversalColumn BS EN10210-2 1990	UC305x305x240	
19	1.95	10.65	0	30	5.5	10.65	0	0	S275	UniversalColumn BS EN10210-2 1990	UC305x305x240	
20	2.75	8.25	0	32	5.5	8.25	0	0	S275	UniversalColumn BS EN10210-2 1990	UC305x305x240	
21	3.55	5.85	0	34	5.5	5.85	0	0	S275	UniversalColumn BS EN10210-2 1990	UC305x305x240	

Dynamo Nodes Members Material Mapping Section Mapping Results

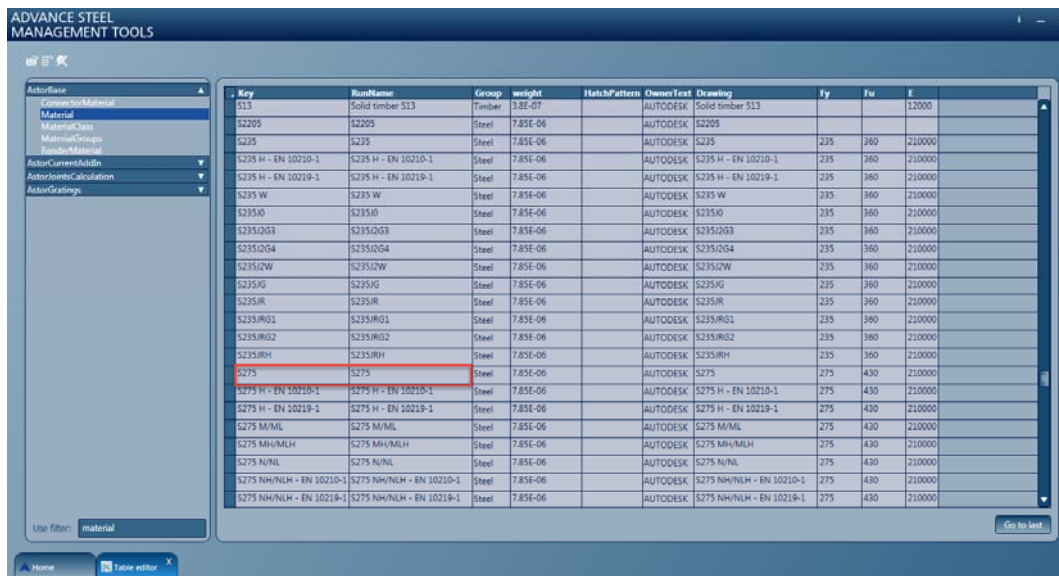
Contents	Formula
Member	=Members!A[ROW]
Node1	=Members!B[ROW]
X1	=VLOOKUP(B[ROW],Nodes,2)
Y1	=VLOOKUP(B[ROW],Nodes,3)
Z1	=VLOOKUP(B[ROW],Nodes,4)
Node2	=Members!C[ROW]
X2	=VLOOKUP(F[ROW],Nodes,2)
Y2	=VLOOKUP(F[ROW],Nodes,3)
Z2	=VLOOKUP(F[ROW],Nodes,4)
Gamma	=Members!F[ROW]
Material	=VLOOKUP(Members!E[ROW],Materials,2)
Catalog	=VLOOKUP(Members!D[ROW],Sections,2)
Section	=VLOOKUP(Members!D[ROW],Sections,3)
Description	

Step 1 – Format Microsoft Excel

- Dynamo
 - Where it all comes together
- Nodes
 - X, Y, Z
- Members
 - Node, Node
- Material mapping
- Section mapping

Autodesk Advance Steel knowledge required

- Material mapping
 - AstorBase database (or Management Tools)



ADVANCE STEEL
MANAGEMENT TOOLS

AstorBase

Material

MaterialClass

MaterialGroup

AstorCurrentAddIn

AstorJointCalculation

AstorGratings

Use filter: material

Key	RunName	Group	weight	Hatch/Pattern	OwnerText	Drawing	Fy	Fu	E
S13	Solid timber S13	Timber	3.8E-07		AUTODESK	Solid timber S13			12000
S220S	S220S	Steel	7.85E-06		AUTODESK	S220S			
S235	S235	Steel	7.85E-06		AUTODESK	S235	235	360	210000
S235 H - EN 10210-1	S235 H - EN 10210-1	Steel	7.85E-06		AUTODESK	S235 H - EN 10210-1	235	360	210000
S235 H - EN 10219-1	S235 H - EN 10219-1	Steel	7.85E-06		AUTODESK	S235 H - EN 10219-1	235	360	210000
S235 W	S235 W	Steel	7.85E-06		AUTODESK	S235 W	235	360	210000
S235JO	S235JO	Steel	7.85E-06		AUTODESK	S235JO	235	360	210000
S235JG3	S235JG3	Steel	7.85E-06		AUTODESK	S235JG3	235	360	210000
S235JG4	S235JG4	Steel	7.85E-06		AUTODESK	S235JG4	235	360	210000
S235J2W	S235J2W	Steel	7.85E-06		AUTODESK	S235J2W	235	360	210000
S235JG	S235JG	Steel	7.85E-06		AUTODESK	S235JG	235	360	210000
S235JR	S235JR	Steel	7.85E-06		AUTODESK	S235JR	235	360	210000
S235JRG1	S235JRG1	Steel	7.85E-06		AUTODESK	S235JRG1	235	360	210000
S235JRG2	S235JRG2	Steel	7.85E-06		AUTODESK	S235JRG2	235	360	210000
S235JRH	S235JRH	Steel	7.85E-06		AUTODESK	S235JRH	235	360	210000
S275	S275	Steel	7.85E-06		AUTODESK	S275	275	430	210000
S275 H - EN 10210-1	S275 H - EN 10210-1	Steel	7.85E-06		AUTODESK	S275 H - EN 10210-1	275	430	210000
S275 H - EN 10219-1	S275 H - EN 10219-1	Steel	7.85E-06		AUTODESK	S275 H - EN 10219-1	275	430	210000
S275 M/ML	S275 M/ML	Steel	7.85E-06		AUTODESK	S275 M/ML	275	430	210000
S275 MH/MLH	S275 MH/MLH	Steel	7.85E-06		AUTODESK	S275 MH/MLH	275	430	210000
S275 N/NL	S275 N/NL	Steel	7.85E-06		AUTODESK	S275 N/NL	275	430	210000
S275 NH/NLH - EN 10210-1	S275 NH/NLH - EN 10210-1	Steel	7.85E-06		AUTODESK	S275 NH/NLH - EN 10210-1	275	430	210000
S275 NH/NLH - EN 10219-1	S275 NH/NLH - EN 10219-1	Steel	7.85E-06		AUTODESK	S275 NH/NLH - EN 10219-1	275	430	210000

Go to level

Autodesk Advance Steel knowledge required

- Section mapping
 - AstorProfiles database (or Management Tools)

The screenshot displays the Autodesk Advance Steel Management Tools interface, which is used for managing steel profiles. It consists of two main windows side-by-side.

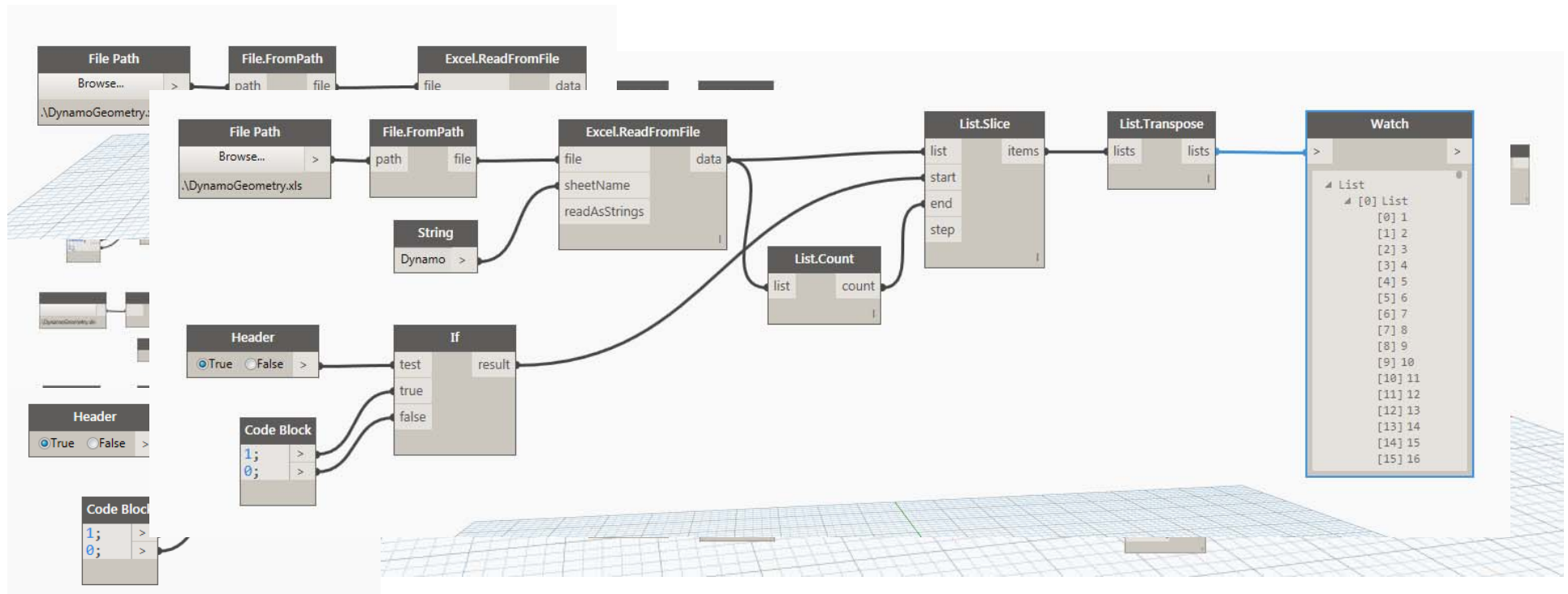
Left Window: ProfileMasterTable

TypeName	TypeNameText	TableName	TableColumns
ULT_ACC_ROD	Ultra Rod Accessories	EXT_UltraBeam_ACC_ROD	2
ULT_TCS	Ultra Trimmer Cleats	EXT_Ultra_Trimmer_Cleats	10
ULT_ACC_U	Ultra U Accessories	EXT_UltraBeam_ACC_U	10
Utr_Profiles	UltraBeam Accessories	INT_UltraBeam_ACC_BM	4
Utr_Profiles	UltraBeam Taves Beam Section	INT_UltraBeam_TB	4
ULT_EB_Cleat	UltraBeam EB Cleat	EXT_UltraBeam_EB_Cleat	10
Utr_Profiles	UltraBeam Section	INT_UltraBeam_BM	4
ULT_CS	UltraBeam Section Sleeve	EXT_UltraBeam_BM_Sleeve	8
Utr_Profiles	UltraZed Section	INT_UltraBeam_Z	4
Utr_Profiles	UltraZed Sleeve Section	INT_UltraBeam_Z_Sleeve	4
UK_UB	Universal Beam BS EN10210-2 1990	EXT_UK_UniversalBeams	10
UK_UBP	UniversalBearingPiles BS EN10210-2 1990	EXT_UK_UniversalBearingPiles	10
UK_UC	UniversalColumn BS EN10210-2 1990	EXT_UK_UniversalColumns	10
UPAF_Section	UPAF_Section	EXT_UPAF	6
UPIE_Section	UPIE_Section nach CSN	EXT_CZ_UPIE	10
UPIE_Section	UPIE_Section nach DIN	EXT_UPIE_Section	10
UPN_Section	UPN_Section	EXT_UPN_Section	10
Utr_Profiles	Utr_ALU_SECTION	Utr_ALU_SECTION	4
Utr_Profiles	Utr_ALUSystems	Utr_ALUSystems	4
Utr_Profiles	Utr_ANCON	Utr_ANCON	4
Utr_Profiles	Utr_BACACIER Decks cladding	Utr_BACACIERDeckscladding	4
Utr_Profiles	Utr_BACACIER Roof cladding	Utr_BACACIERRoofcladding	4

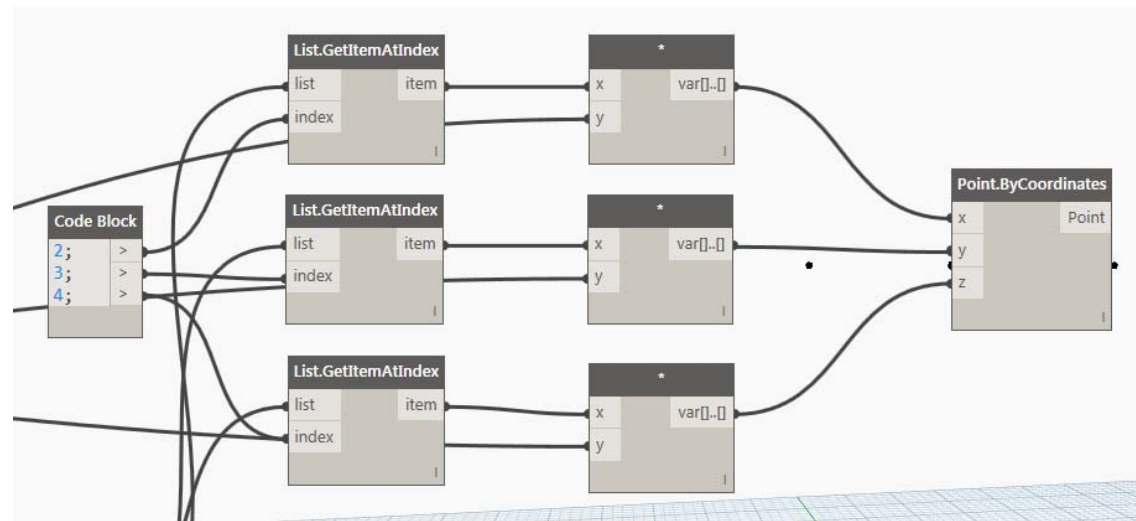
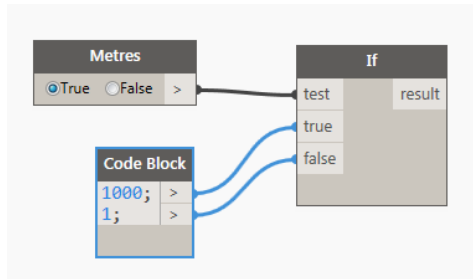
Right Window: EXT_UK_UniversalColumns

StandardName	SectionName	Standards	Reserved	Owner Text	h (Profile height)	b (Profile width)	ts (s) Web thickness	tf (t) Flange thickness	r1 (r) r2 (R) Flange slope	w1 (l) Flange hole
UC254x254x73	UC254x254x73	1	1	DSC	254.1	254.6	8.6	14.2	12.7 0 0	140
UC254x254x89	UC254x254x89	1	1	DSC	260.3	256.3	10.3	17.3	12.7 0 0	140
UC305x305x118	UC305x305x118	1	1	DSC	314.5	307.4	12	18.7	15.2 0 0	140
UC305x305x137	UC305x305x137	1	1	DSC	320.5	309.2	13.8	21.7	15.2 0 0	140
UC305x305x158	UC305x305x158	1	1	DSC	327.1	311.2	15.8	25	15.2 0 0	140
UC305x305x198	UC305x305x198	1	1	DSC	339.9	314.5	19.1	31.4	15.2 0 0	140
UC305x305x240	UC305x305x240	1	1	DSC	352.5	318.4	23	37.7	15.2 0 0	140
UC305x305x283	UC305x305x283	1	1	DSC	365.3	322.2	26.8	44.1	15.2 0 0	140
UC305x305x297	UC305x305x297	1	1	DSC	307.9	305.3	9.9	15.4	15.2 0 0	140
UC356x368x129	UC356x368x129	1	1	DSC	355.6	368.6	10.4	17.5	15.2 0 0	140
UC356x368x153	UC356x368x153	1	1	DSC	362	370.5	12.3	20.7	15.2 0 0	140
UC356x368x177	UC356x368x177	1	1	DSC	368.2	372.6	14.4	23.8	15.2 0 0	140
UC356x368x202	UC356x368x202	1	1	DSC	374.6	374.7	16.5	27	15.2 0 0	140
UC356x406x235	UC356x406x235	1	1	DSC	381	394.8	18.4	30.2	15.2 0 0	140
UC356x406x287	UC356x406x287	1	1	DSC	393.6	399	22.6	36.5	15.2 0 0	140
UC356x406x340	UC356x406x340	1	1	DSC	408.4	403	26.6	42.9	15.2 0 0	140
UC356x406x393	UC356x406x393	1	1	DSC	419	407	30.6	49.2	15.2 0 0	140
UC356x406x467	UC356x406x467	1	1	DSC	436.6	412.2	35.8	58	15.2 0 0	140
UC356x406x551	UC356x406x551	1	1	DSC	455.6	418.5	42.1	67.5	15.2 0 0	140
UC356x406x634	UC356x406x634	1	1	DSC	474.6	424	47.6	77	15.2 0 0	140
?????????Extern	?????????Extern	1	1	DSC	800	220	14	18	26.5 18 9	0

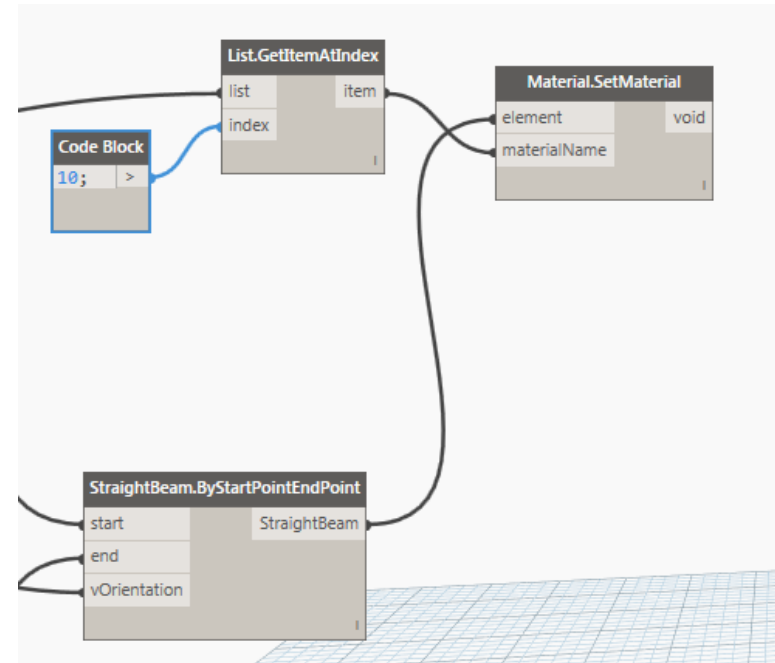
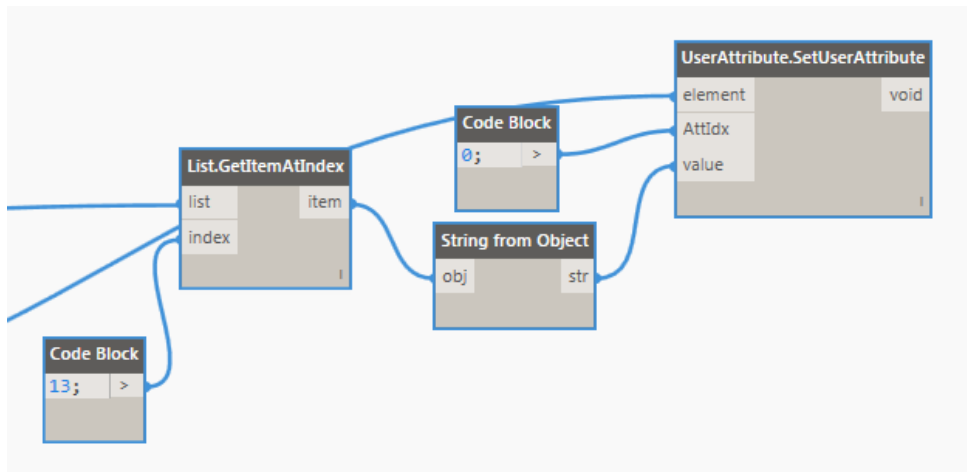
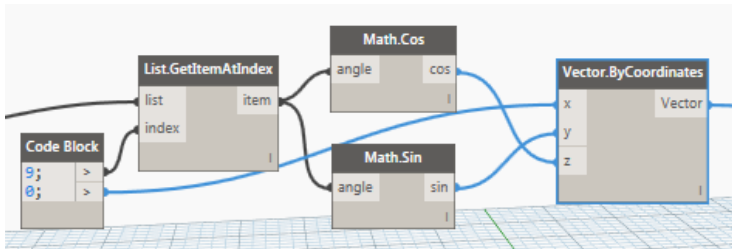
Step 2 – The Dynamo Graph



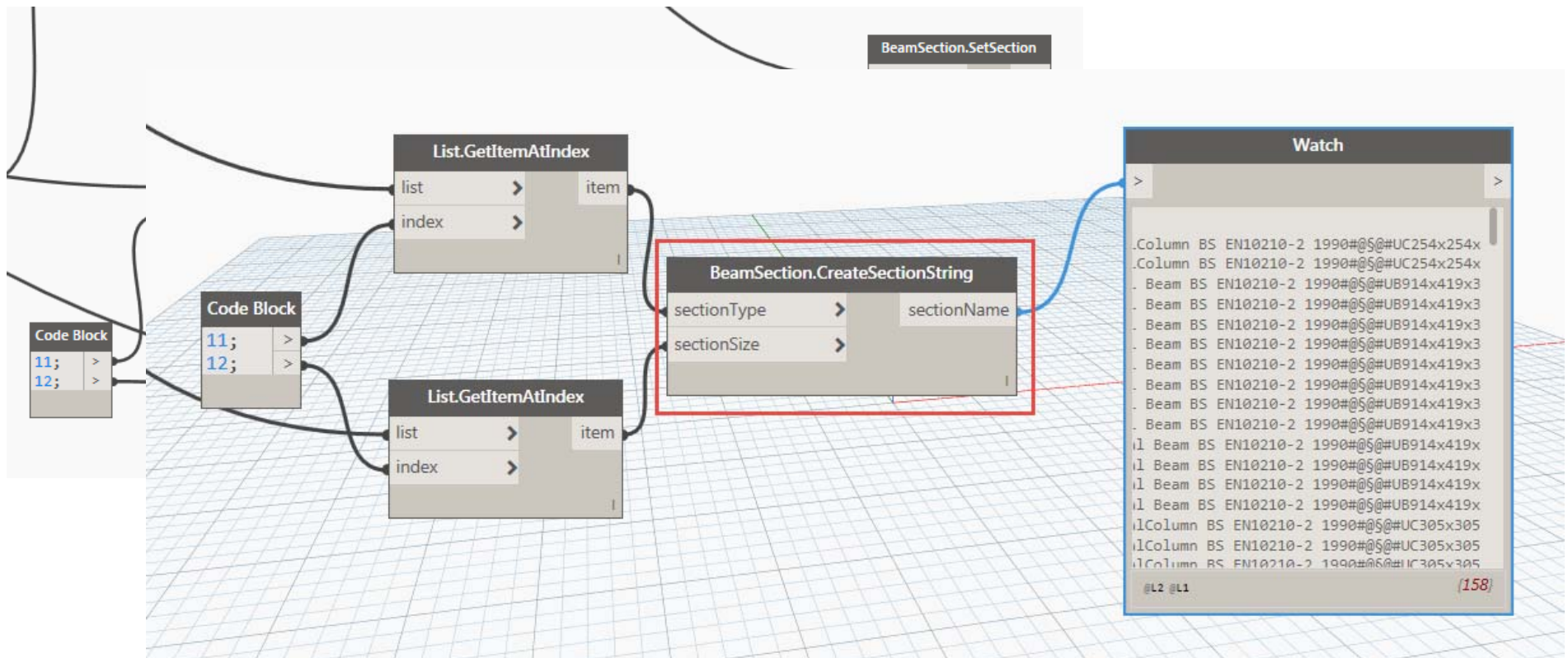
Step 2 – The Dynamo Graph



Step 2 – The Dynamo Graph



Step 2 – The Dynamo Graph



Additional thoughts

- Beam nodes

- Straight
- Bent
- Compound*
- Tapered*

} Need to distinguish between different types of member for modelling purposes – how?

- * - more application knowledge required...

Autodesk Advance Steel knowledge required

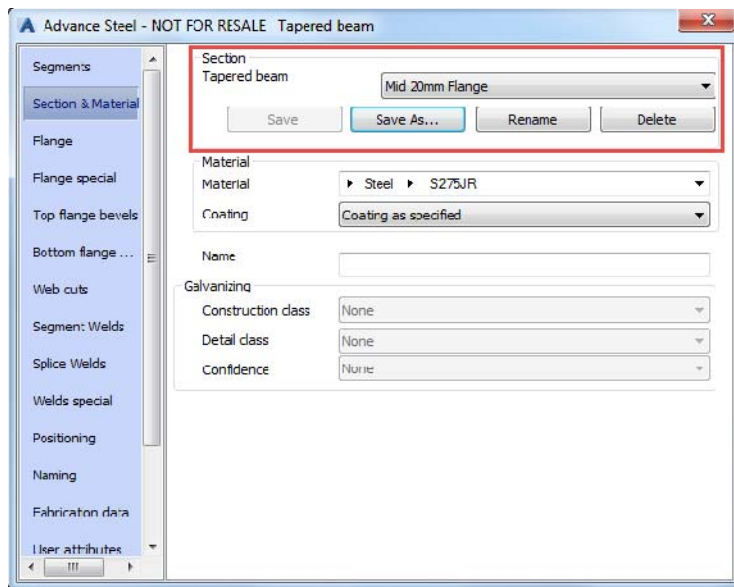
- AstorProfiles database (or Management Tools)

The screenshot displays the Autodesk Advance Steel Management Tools interface, which is used for managing the AstorProfiles database. The interface is divided into several panes:

- Left Pane:** A tree view showing the hierarchy of the database, including sections like "CompoundMasterTable", "CompoundProfiles", "CompoundRelations", and "CompoundChannels".
- Center Pane:** A table listing various compound profiles. The table has columns for "Key", "CompoundProfileName", "CompoundClassName", "Table Name", "JoinTable", and "Description". The table lists 25 different compound profiles, including "Welded beams - T Symmetric", "Welded beams - T Asymmetric", "Welded beams - Column", "Welded beams - Hollow", "Double channel - back to back", "Double channel - toe to toe", "Double angle - diagonal", "Double angle - back to back", "Star angles - back to back", "Star angles - toe to toe", "Double I section - toe to toe", "Generic Aluminium Systems compound", "Welded beams - Half Column", "Welded beams - Half Column I+T", "Welded beams - Column I+2T", "Welded tapered beam", and "Welded beams - Hollow Asymmetric".
- Right Pane:** A detailed view of a selected compound profile, showing its "AutoProfile" and "Table Name". The table lists various compound profiles, including "COMPOUND_U_BACK_TABLE", "COMPOUND_U_BACK_TABLE_Grsky", "COMPOUND_U_BACK_TABLE_Deutsch", "COMPOUND_U_BACK_TABLE_English", "COMPOUND_U_BACK_TABLE_Francais", "COMPOUND_U_BACK_TABLE_Italian", "COMPOUND_U_BACK_TABLE_Nederlands", "COMPOUND_U_BACK_TABLE_Polish", "COMPOUND_U_BACK_TABLE_Russian", "COMPOUND_U_BACK_TABLE_Spanish", "COMPOUND_U_BACK_TABLE_USEnglish", "COMPOUND_U_BACK_TABLE_USFrench", "COMPOUND_U_TOE_TABLE", "COMPOUND_U_TOE_TABLE_Grsky", "COMPOUND_U_TOE_TABLE_Deutsch", "COMPOUND_U_TOE_TABLE_English", "COMPOUND_U_TOE_TABLE_Francais", "COMPOUND_U_TOE_TABLE_Italian", "COMPOUND_U_TOE_TABLE_Nederlands", "COMPOUND_U_TOE_TABLE_Polish", "COMPOUND_U_TOE_TABLE_Russian", "COMPOUND_U_TOE_TABLE_Spanish", "COMPOUND_U_TOE_TABLE_USEnglish", and "COMPOUND_U_TOE_TABLE_USFrench".

Autodesk Advance Steel knowledge required

- Autodesk Advance Steel
- AstorProfiles database (or Management Tools)



The screenshot shows the 'ADVANCE STEEL MANAGEMENT TOOLS' interface. The 'AstorProfiles' tab is active. The 'COMPOUND, TAPERED, CONNECTIONS' section is selected. The table below shows the data for the selected section.

Key	SegmentKey	CompoundKey	Upper flange fullSectionName	Upper flange WidthAtStart	Upper flange Parallel	Upper flange WidthAtEnd	Upper flange Thickness	Upper flange LevelType	Upper flange Level
1	1	1	Flat nach DIN EN 10100-1	100	0	100	10	0	0
2	2	1	Flat nach DIN EN 10100-1	100	0	100	10	0	0
3	3	1	Flat nach DIN EN 10100-1	100	0	100	10	0	0
22001	1	22001	Flat nach DIN EN 10100-1	100	0	100	10	0	0
22002	2	22001	Flat nach DIN EN 10100-1	100	0	100	20	0	0
22003	3	22001	Flat nach DIN EN 10100-1	100	0	100	10	0	0
22004	1	22002	Flat nach DIN EN 10100-1	100	0	100	10	0	0

Where next?

- [illegible]

Questions?

Thankyou!

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