AU LONDON 2019

Discover how Manufacturers are collaborating in an AEC environment

Demir Ali

Snr. Technical Specialist | Design and Manufacturing

@deali12

AUTODESK. UNIVERSITY

About the speaker

Demir Ali

Senior Technical Specialist

Design and Manufacturing, Autodesk UK & Ireland

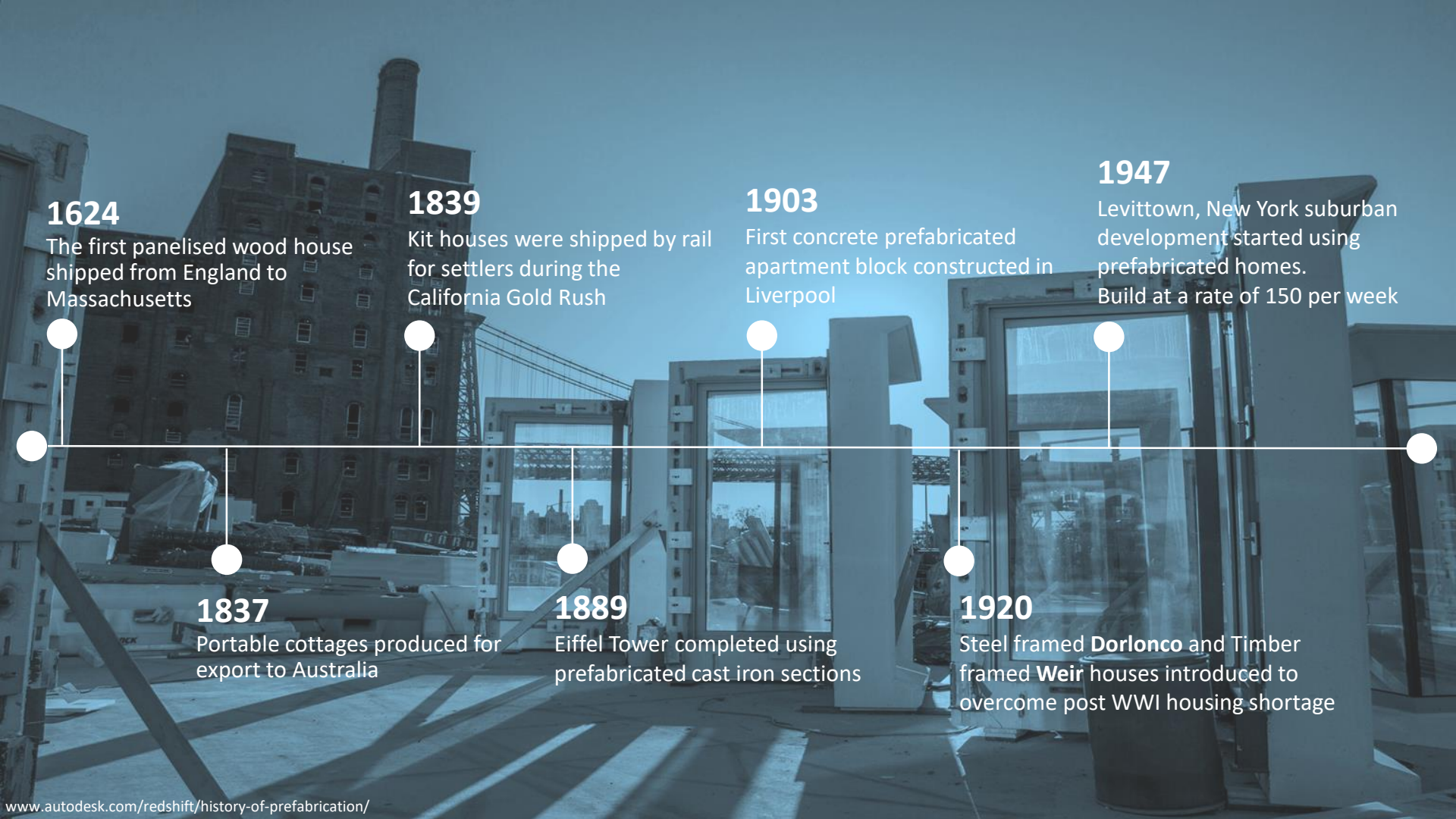
Been with Autodesk since 2012 with over 20 years experience working with the Autodesk manufacturing portfolio. Application focus is the Product Design and Manufacturing Collection, Vault & VRED.

When not working, enjoy sculling on the Thames, getting out on the MTB or motorbike.

Class Summary

This class will focus on how manufacturers are becoming an integral part of the architecture and construction digital pipeline.

It will cover not only how building product fabricators can deliver reusable information to architects, but also how custom fabricators and system integrators can deliver coordinated models into an ongoing project.



1624
The first panelised wood house shipped from England to Massachusetts

1837
Portable cottages produced for export to Australia

1839
Kit houses were shipped by rail for settlers during the California Gold Rush

1889
Eiffel Tower completed using prefabricated cast iron sections

1903
First concrete prefabricated apartment block constructed in Liverpool

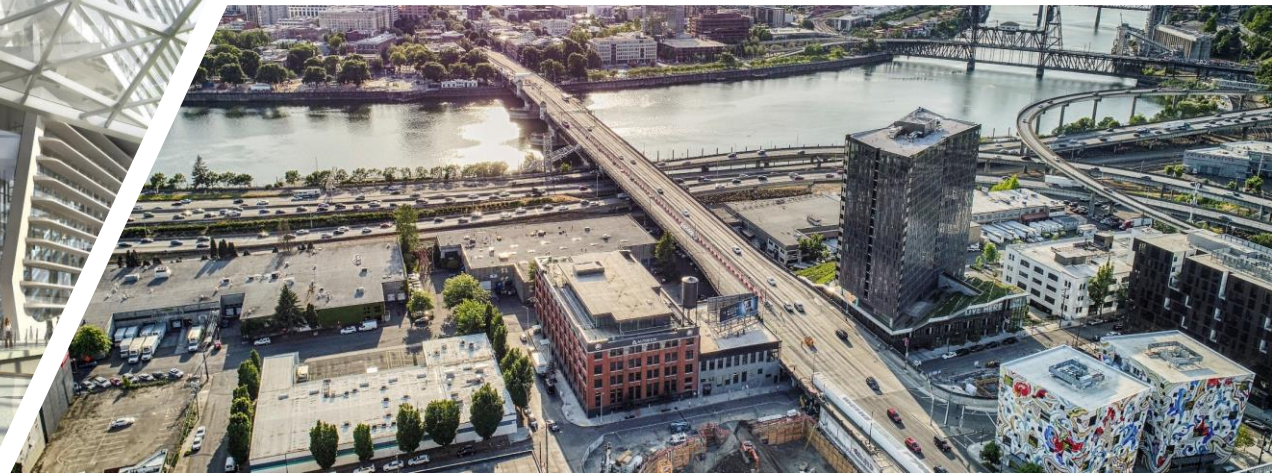
1920
Steel framed **Dorlonco** and Timber framed **Weir** houses introduced to overcome post WWI housing shortage

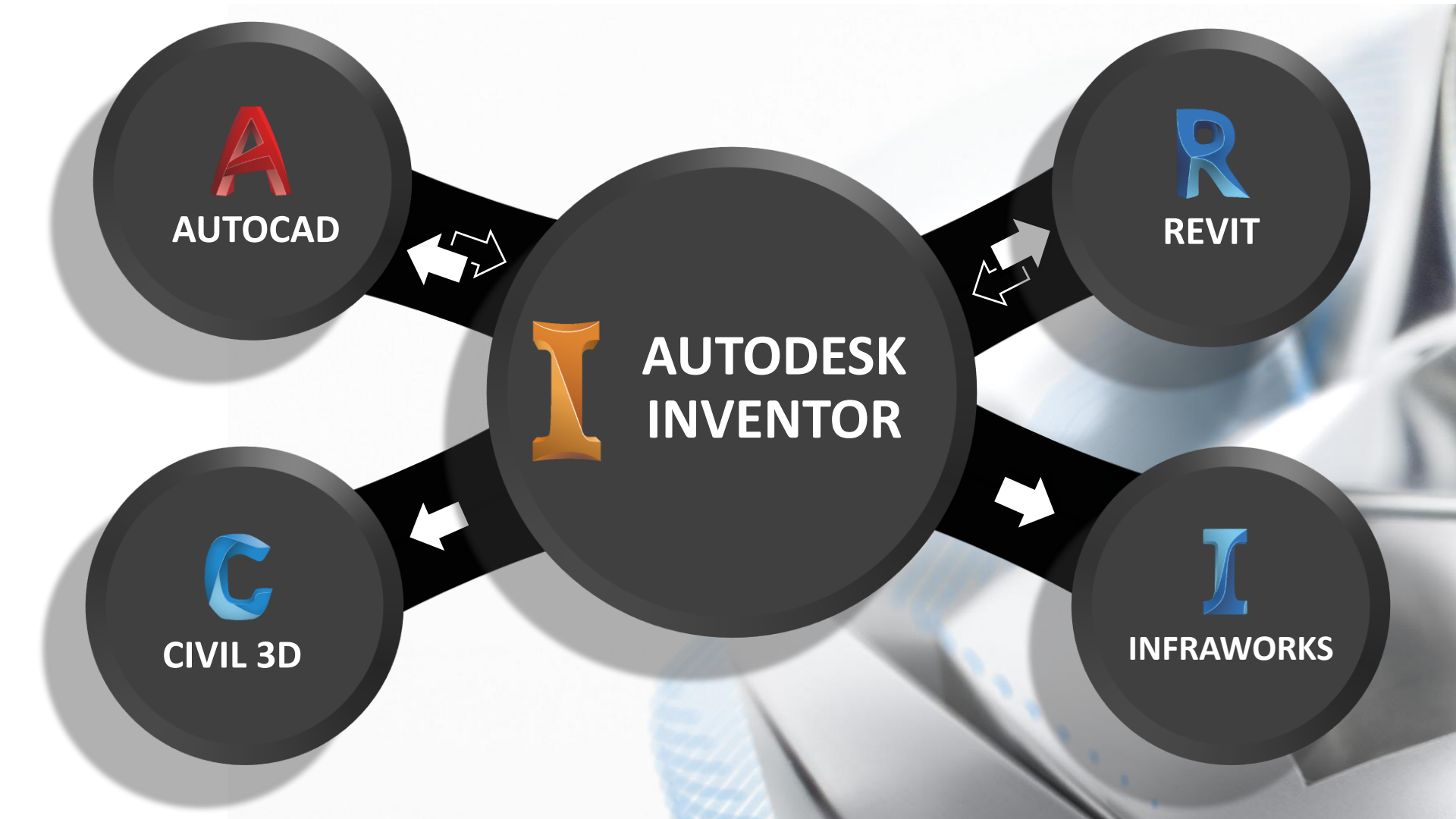
1947
Levittown, New York suburban development started using prefabricated homes.
Build at a rate of 150 per week

www.autodesk.com/redshift/history-of-prefabrication/

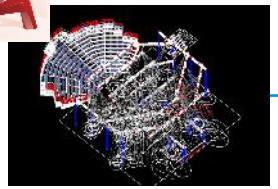

Flow

Rendering courtesy of Denver International Airport & Gensler



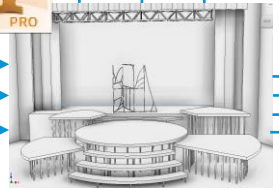

AUTOCAD
REVIT
AUTODESK
INVENTOR
CIVIL 3D
INFRAWORKS

Existing building - Laser Scan.
Image courtesy of Municipality of Milan.

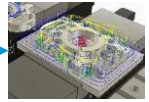


AutoCAD Layout

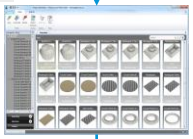
Revit model
Image courtesy of Municipality of Milan.



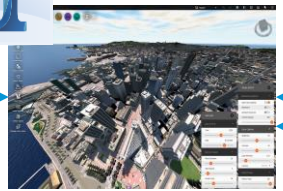
Inventor model



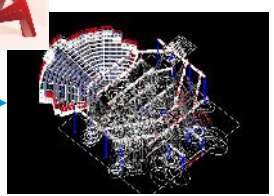
Computer Aided Machining



Civil library



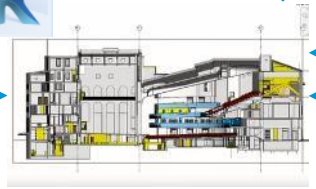
Civil / Infrastructure Model



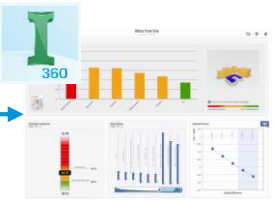
AutoCAD Layout

Visualisation model

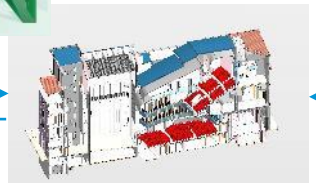
Design Review
& Virtual Reality
Experience



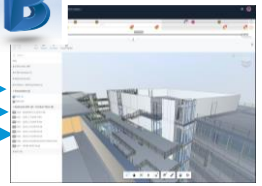
Revit model
Image courtesy of Municipality of Milan.



Building Performance Analysis



Co-Ordination Review model
Image courtesy of Municipality of Milan.



Contractor
Co-Ordination /
Field Feedback

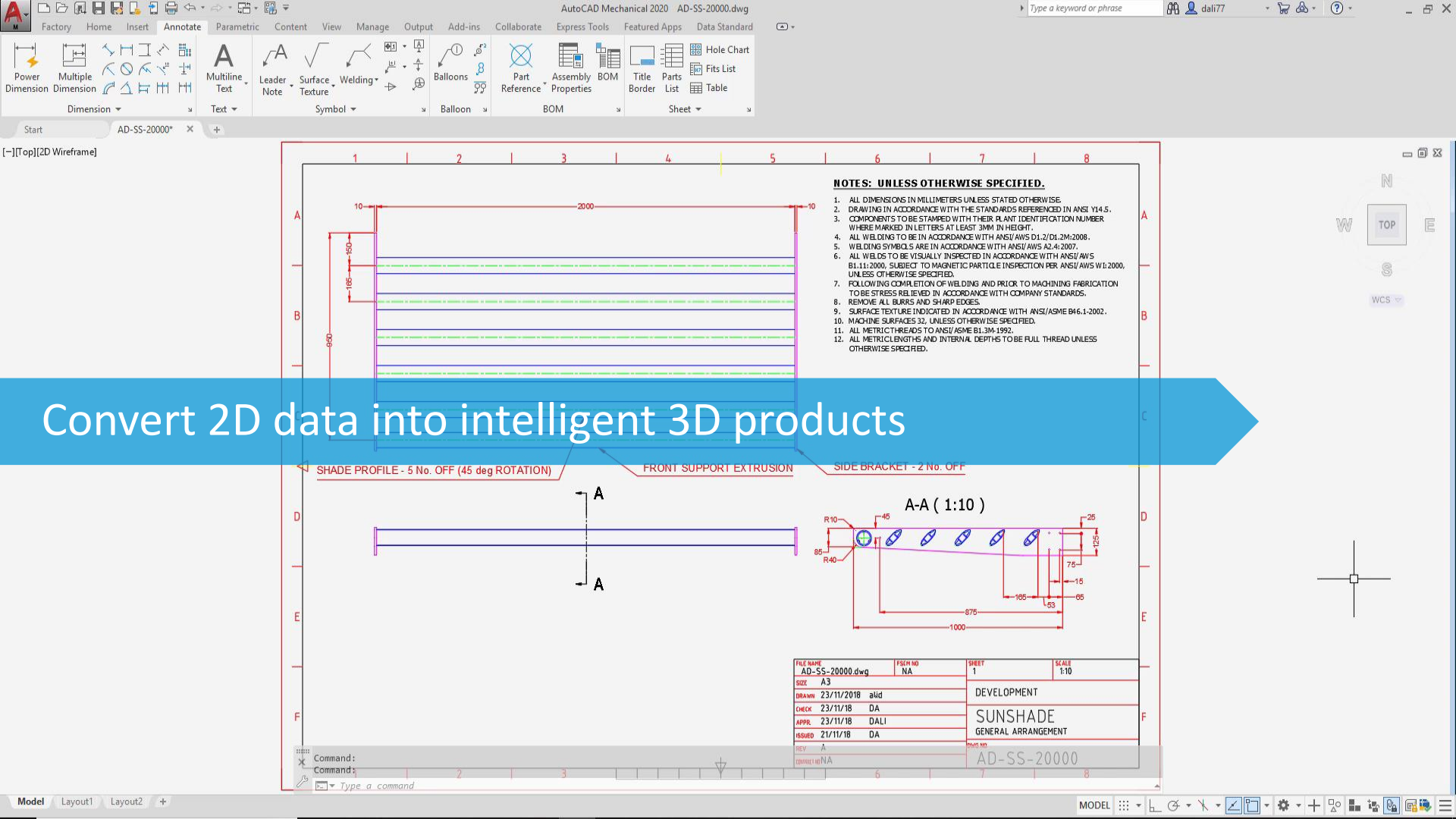
Vault - Data Management

Cloud Services

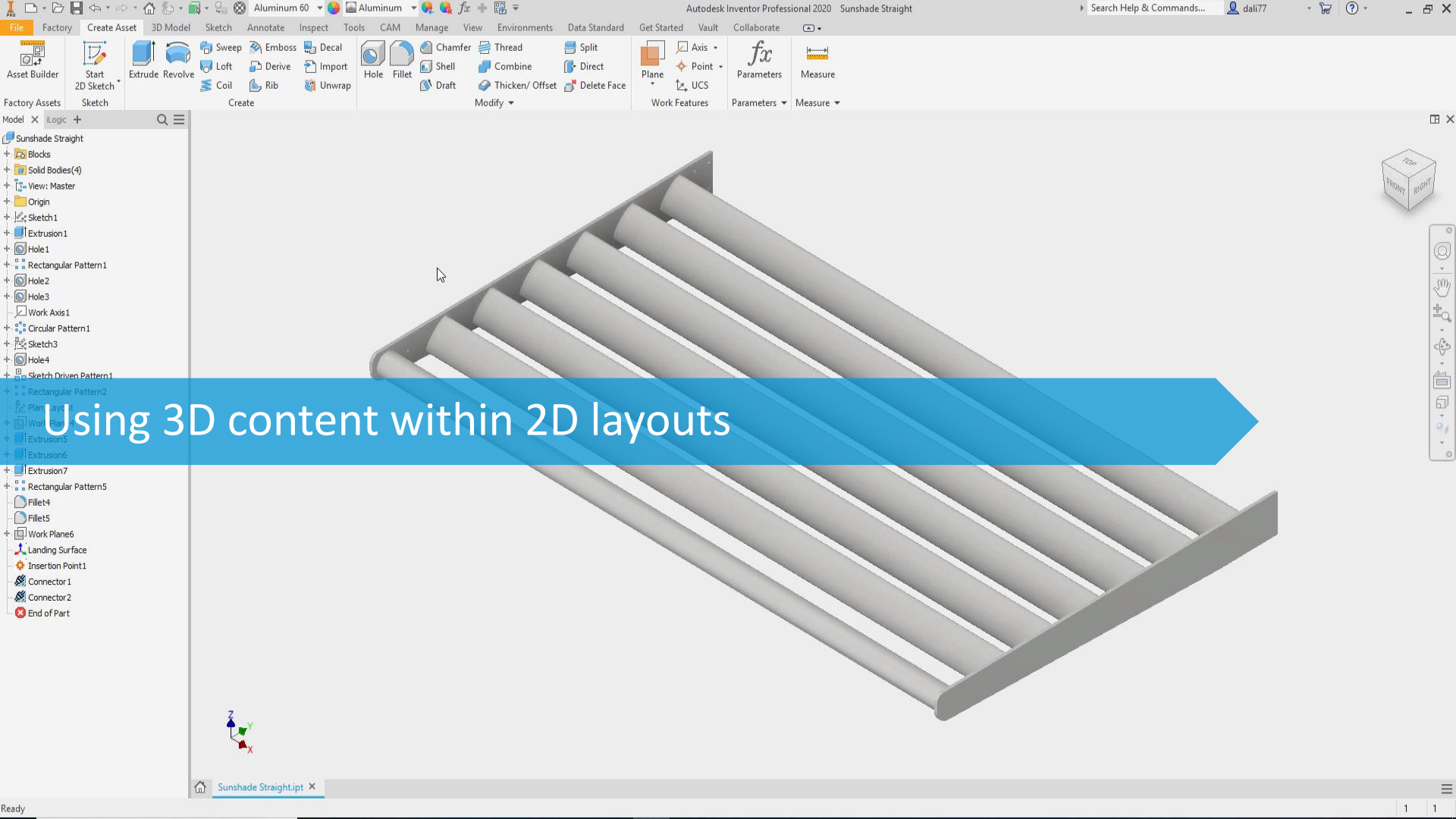
Fusion Lifecycle – Product Lifecycle Management

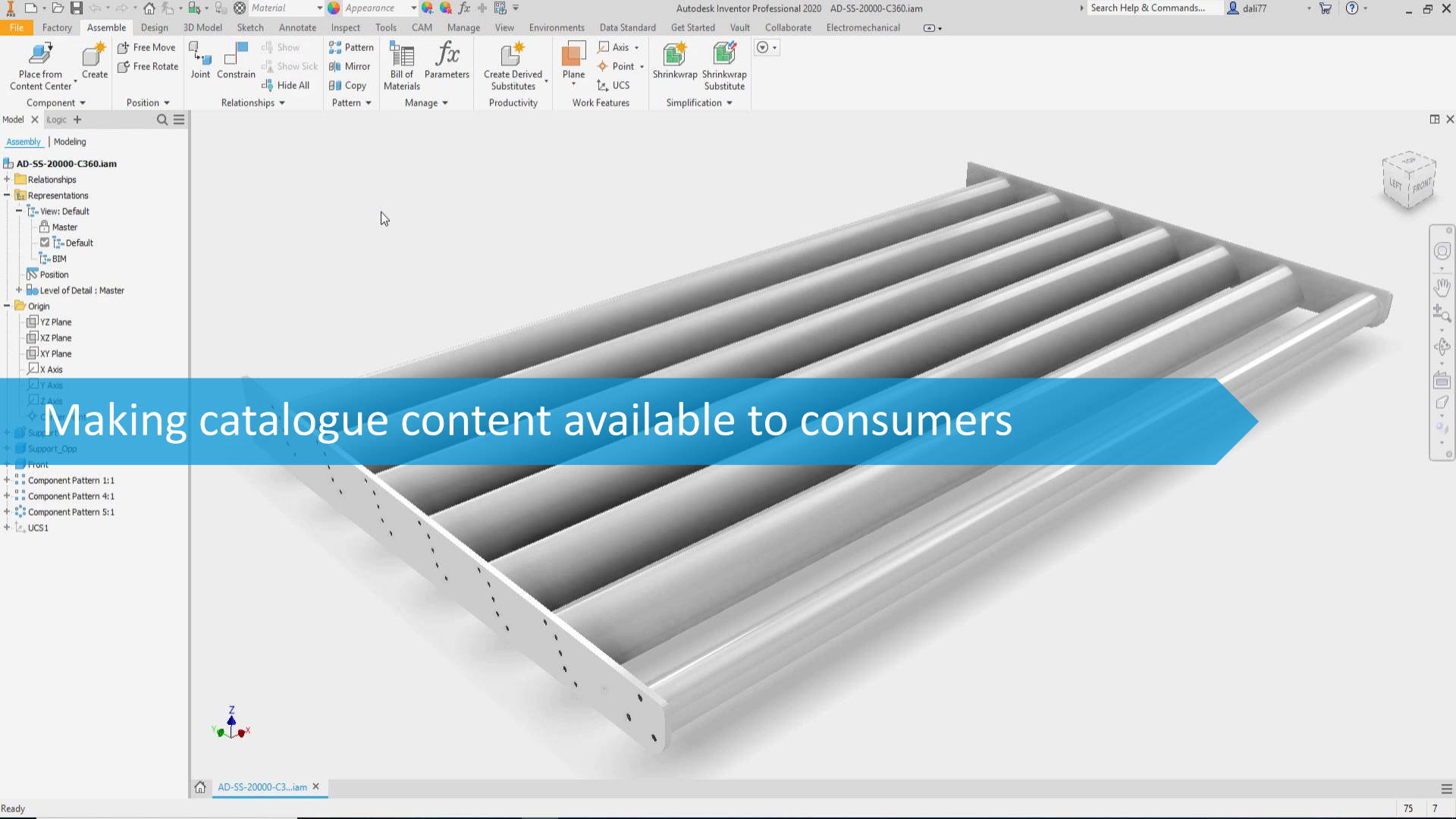
Building Products

- Discrete manufactured elements
- Standard / configurable building items
- Content access makes being ‘specified’ easier
- Ideal fit for online catalogue



Convert 2D data into intelligent 3D products


Autodesk Inventor Professional 2020 Sunshade Straight
Search Help & Commands...
dali77
File Factory Create Asset 3D Model Sketch Annotate Inspect Tools CAM Manage View Environments Data Standard Get Started Vault Collaborate
Asset Builder
Start 2D Sketch
Extrude Revolve
Sweep Loft Coil
Emboss Derive Rib
Decal Import Unwrap
Hole Fillet
Chamfer Shell Draft
Thread Combine Thicken/ Offset
Split Direct Delete Face
Plane
Axis Point UCS
Parameters
Measure
Factory Assets Sketch Create Modify Work Features Parameters Measure
Model iLogic
Sunshade Straight
Blocks
Solid Bodies(4)
View: Master
Origin
Sketch1
Extrusion1
Hole1
Rectangular Pattern1
Hole2
Hole3
Work Axis1
Circular Pattern1
Sketch3
Hole4
Sketch Driven Pattern1
Rectangular Pattern2
Extrusion5
Extrusion6
Extrusion7
Rectangular Pattern5
Fillet4
Fillet5
Work Plane6
Landing Surface
Insertion Point1
Connector1
Connector2
End of Part
Using 3D content within 2D layouts
Sunshade Straight.ipt
Ready


Autodesk Inventor Professional 2020 AD-SS-20000-C360.iam
Search Help & Commands...
dali77
File Factory Assemble Design 3D Model Sketch Annotate Inspect Tools CAM Manage View Environments Data Standard Get Started Vault Collaborate Electromechanical
Place from Content Center
Create
Free Move
Free Rotate
Joint
Constrain
Show
Show Sick
Hide All
Pattern
Mirror
Copy
Bill of Materials
Parameters
Create Derived Substitutes
Plane
Axis
Point
UCS
Shrinkwrap
Shrinkwrap Substitute
Component
Position
Relationships
Pattern
Manage
Productivity
Work Features
Simplification
Model
iLogic
Assembly
Modeling
AD-SS-20000-C360.iam
Relationships
Representations
View: Default
Master
Default
BIM
Position
Level of Detail : Master
Origin
YZ Plane
XZ Plane
XY Plane
X Axis
Y Axis
Z Axis
Support_Opp
Front
Component Pattern 1:1
Component Pattern 4:1
Component Pattern 5:1
UCS1
Making catalogue content available to consumers
AD-SS-20000-C3...iam
Ready
75
7

Building Equipment

- Configured or Engineered to Order
- Complex, often integrated into building systems
- MEP service connections required
- Examples incl. lifts, escalators, HVAC units…

Level of Complexity

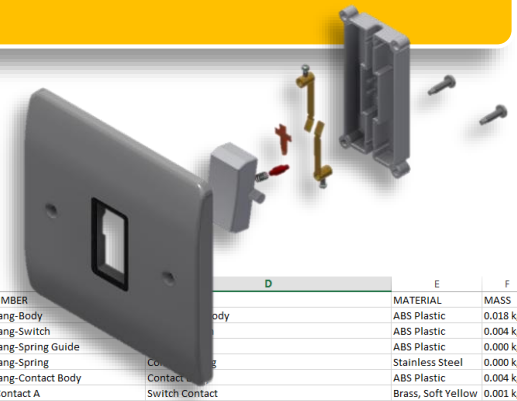
Manufacturing Model

Assembly level detail.

Component level detail.

Assembly Bill of Materials.

BIM specific content to be added to simplified 3D model.



A	B	C	D	E	F
ITEM	QTY	PART NUMBER		MATERIAL	MASS
1	1	Single Gang-Body	ody	ABS Plastic	0.018 kg
2	1	Single Gang-Switch		ABS Plastic	0.004 kg
3	1	Single Gang-Spring Guide		ABS Plastic	0.000 kg
4	1	Single Gang-Spring	Co g	Stainless Steel	0.000 kg
5	1	Single Gang-Contact Body	Contact	ABS Plastic	0.004 kg
6	2	Switch-Contact A	Switch Contact	Brass, Soft Yellow	0.001 kg
7	2	ISO 1580 - M2 x 6	Slotted pan head screws - Product grade A	Steel, Mild	0.000 kg
8	1	Single Gang-Contact	Single Contact	Copper	0.000 kg
9	4	ANSI/ASME B18.6.5M - M2.5x0.45 x 10	Slotted Pan Head Tapping Screw - Type D - Metric	Steel, Mild	0.001 kg
10	1	Single Gange Insert		ABS Plastic	0.000 kg

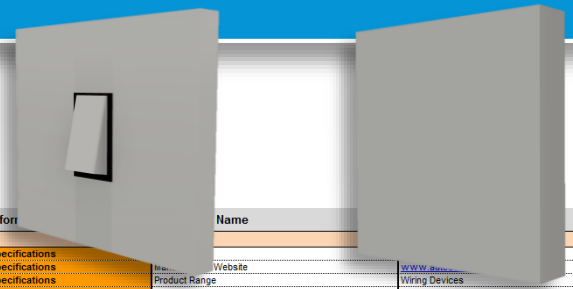
Architectural Model

Top level component metadata required. Such as Mass, Size limits. Content specific information such as Voltage, Warranty, also needs to be included.

‘Visual 3D model’ suitable for Medium or Fine representation.

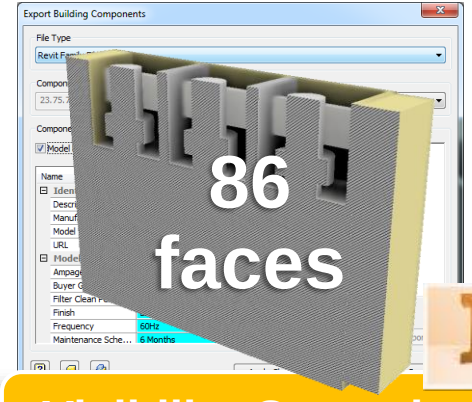
‘Bounding Box model’ Suitable for Course representation.

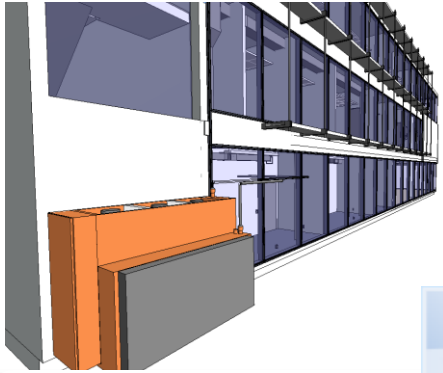
‘Annotation sketch’ replaces 3D model in Plan views.



Infor	Name		Units	Notes
Specifications			Text	
Specifications	Website	www.au...	URL	
Specifications	Product Range	Wiring Devices	Text	
Specifications	Product Model Number (Code)	A123456	Text	
Specifications	CE Approval	Yes	Text	
Specifications	Product Literature Webpage	www.autodesk.co.uk/Documents/English	URL	
Specifications	Product Features	10-Year Guarantee	Text	
Construction Data				
Specifications	Type	Socket	Text	
Specifications	Shape	Rectangle	Text	
Specifications	Material	ABS	Text	
Specifications	Colour	White	Text	
Specifications	Finish	Moulded	Text	
Application				
Specifications	Reference Standard	BS 1363: Pt 2: 1995	Text	
Specifications	Power Source (if required)	Mains Connection	Text	
Dimensional Data				
Specifications	Overall Length	27	mm	

Removing the complexity





Design

Create, detail and document manufacturing level of detail within Inventor or import existing design from 3rd party via AnyCAD capability.

Apply and manage suitable metadata such as product data information

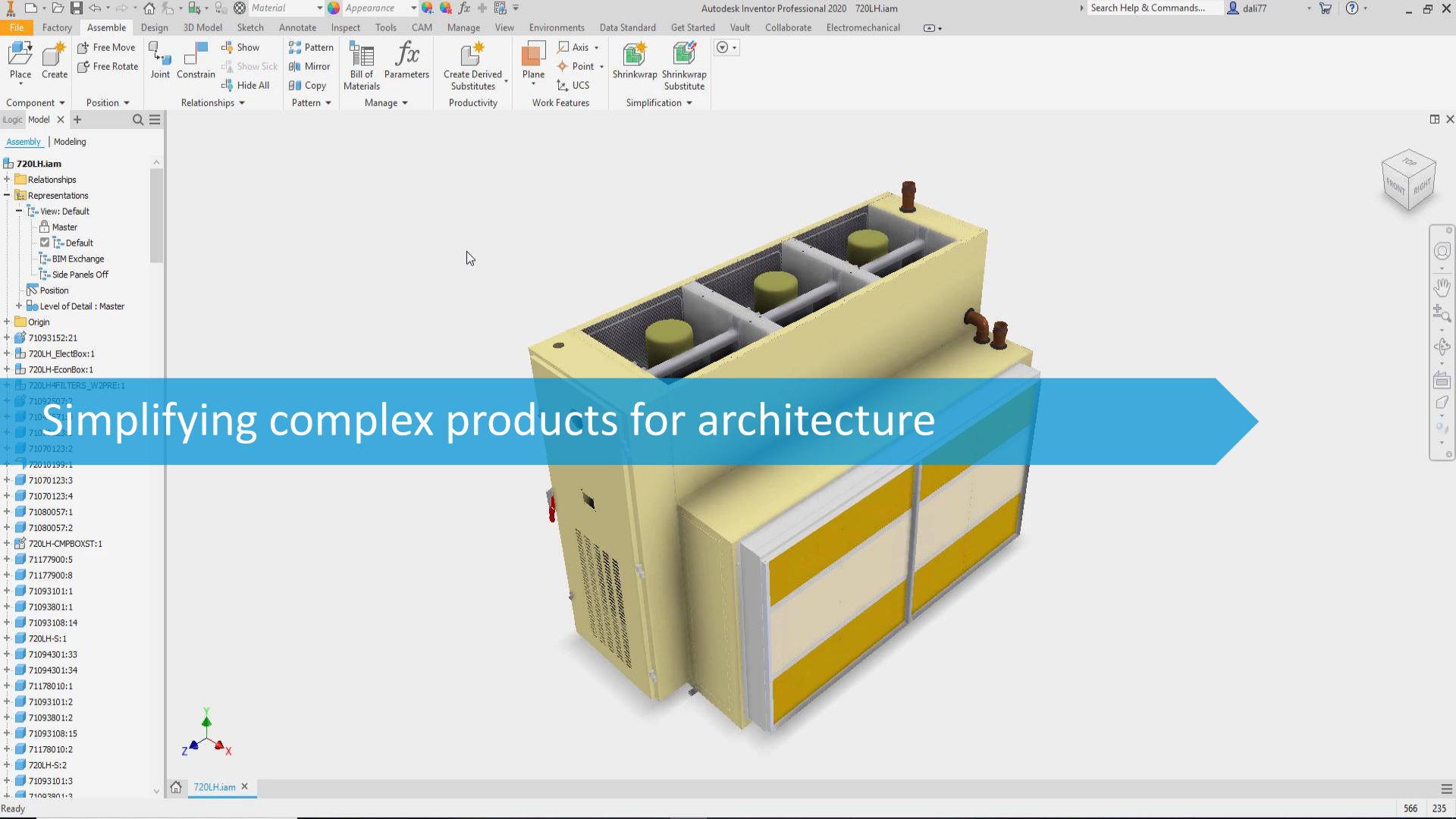
Visibility Control & Simplification

Remove unnecessary detail, add relevant metadata such as classifications, flowrates etc. If connected to services add connections, size and flow direction.

Share & Utilise

Supply and use item without recreation or cross referencing technical specifications for connections and properties.

Create visualisations and layouts faster.


Simplifying complex products for architecture

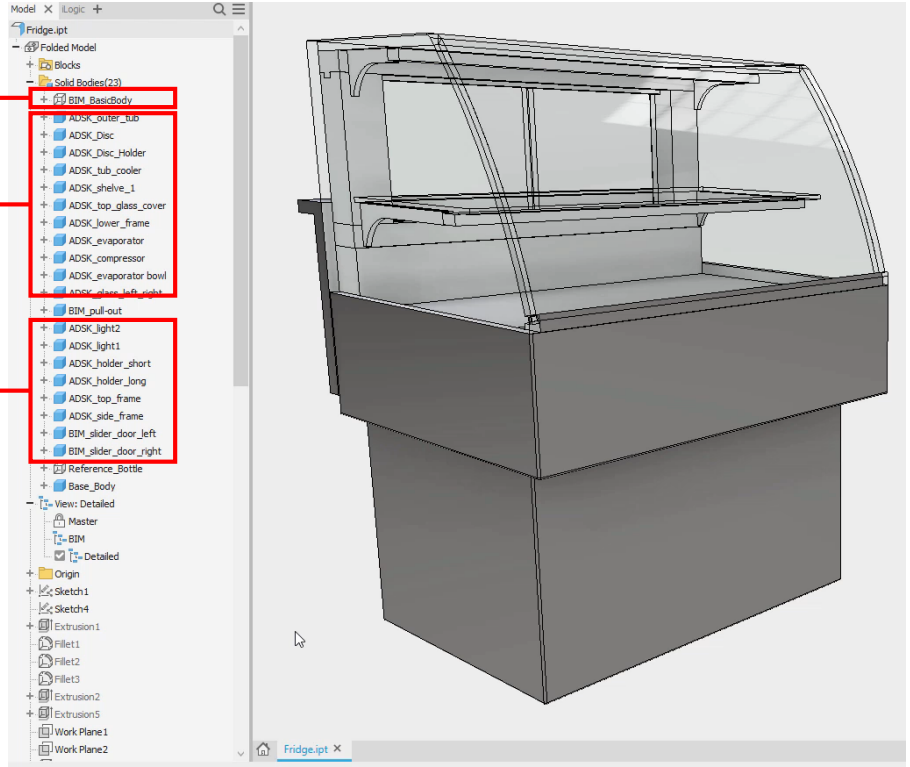
Removing the complexity before exporting

- With PART files, utilise design views to switch off & toggle body visibility

Simple Solid Body Representation

When required set unnecessary solid bodies visibility to **Off**.

Easy to control from Design View Representations



Using part level feature suppression and simplification

- In addition to using Inventors simplification tools, a hybrid approach using Part visibility, Direct Edit, Sculpt & Feature Suppression can be applied to selectively simplify components within a model.
- iLogic can the be used to automate the suppression of these features to control simplification.

LEVEL OF COMPLEXITY

MFG

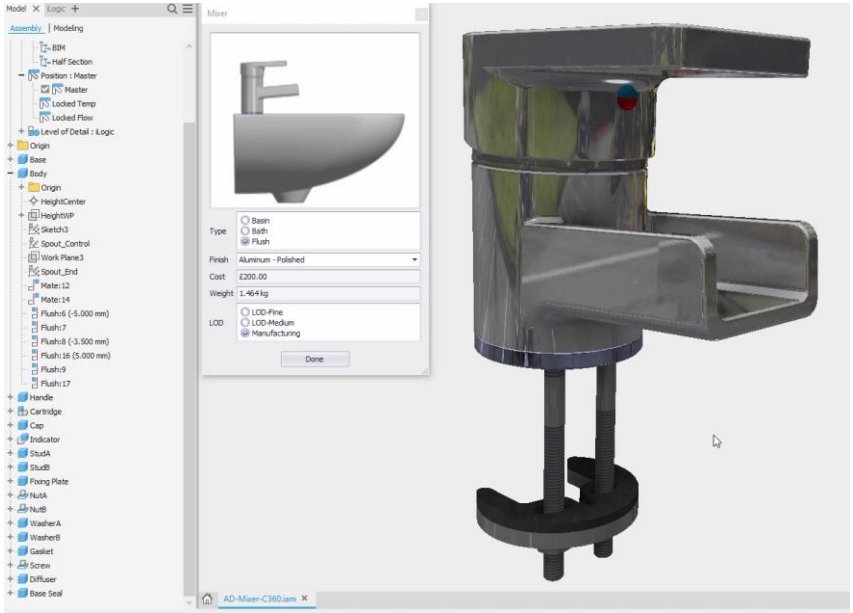
- All parts and features - **Active**
- Boundary Patch Faces - **Suppressed**
- Sculpt / Void Fill - **Suppressed**
- Delete Fillet Faces - **Suppressed**

FINE

- Unnecessary parts - **Suppressed**
- Boundary Patch Faces - **Active**
- Sculpt / Void Fill - **Active**
- Delete Fillet Faces - **Suppressed**

MEDIUM

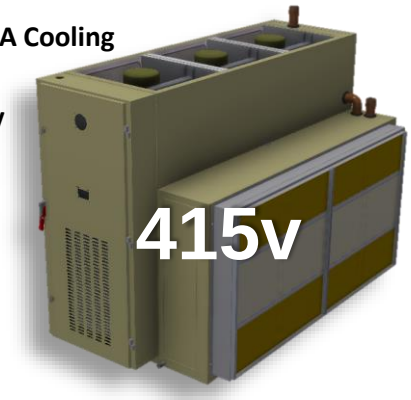
- Unnecessary parts - **Suppressed**
- Boundary Patch Faces - **Active**
- Sculpt / Void Fill - **Active**
- Delete Fillet Faces - **Active**



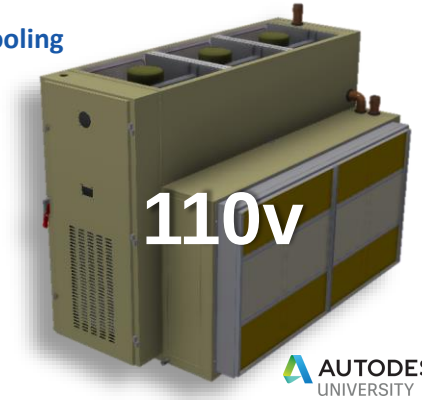
What additional intelligence can be included?

- There may be variations of the design that do not effect the visual representation of the content.
- Different models for example may look the same BUT have different properties that need to be accommodated such as description, voltage, warranty, etc.

Model	**720-415v**
Part Number	**720-LH-A**
Voltage	**415v**
Ampage	**60A**
Maintenance Schedule	**6 Months**
SubType	**Fluid Type A Cooling**
Frequency	**60Hz**
Filter Clean Period	**Bi-Monthly**



Model	**720-110v**
Part Number	**720-LH-V**
Voltage	**110v**
Ampage	**75A**
Maintenance Schedule	**5 Months**
SubType	**Fluid Type B Cooling**
Frequency	**50Hz**
Filter Clean Period	**Monthly**

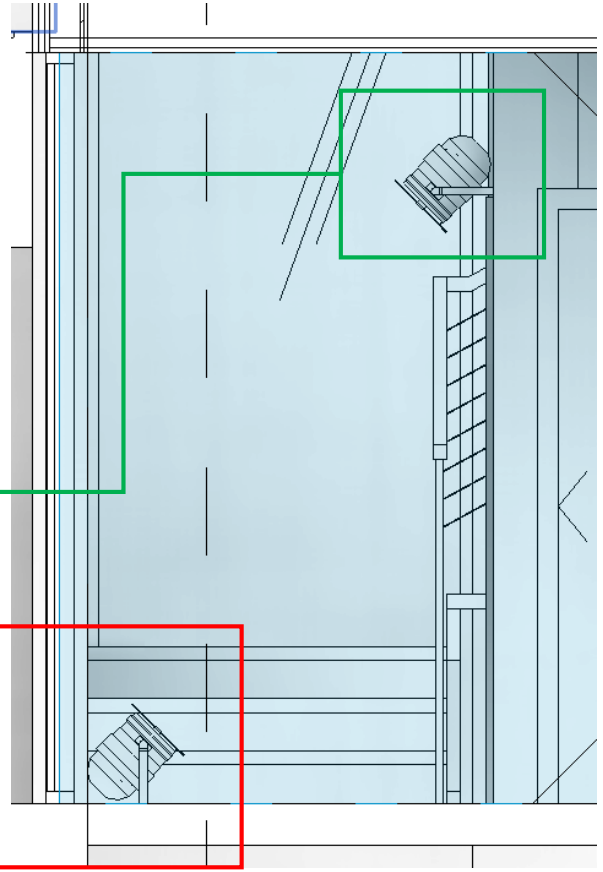


What if a specific template type is required?

- What if you need the content to be a face / wall orientated object instead of the floor?
- Without setting any controls the default template is always generic and level based.

Modified = ‘Face Based’ Template Position

Default = ‘Generic’ Level based position



What about backwards compatibility?

When sharing model data, what if the architect is using an older version of Revit compared to Inventor?

Although not via a UI option**, there is the ability to create a Revit '**legacy**' compatible *.rfa files from a newer version of Inventor.

Up to **3** versions back is supported for export.

**Instructions & sample iLogic snippet available in the appendix of this presentation

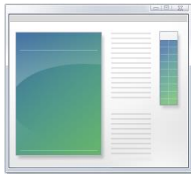
What's needed to export a previous version?

There are **3** prerequisites to export a **legacy *.rfa**.

The exporting system must have the following full software installed:

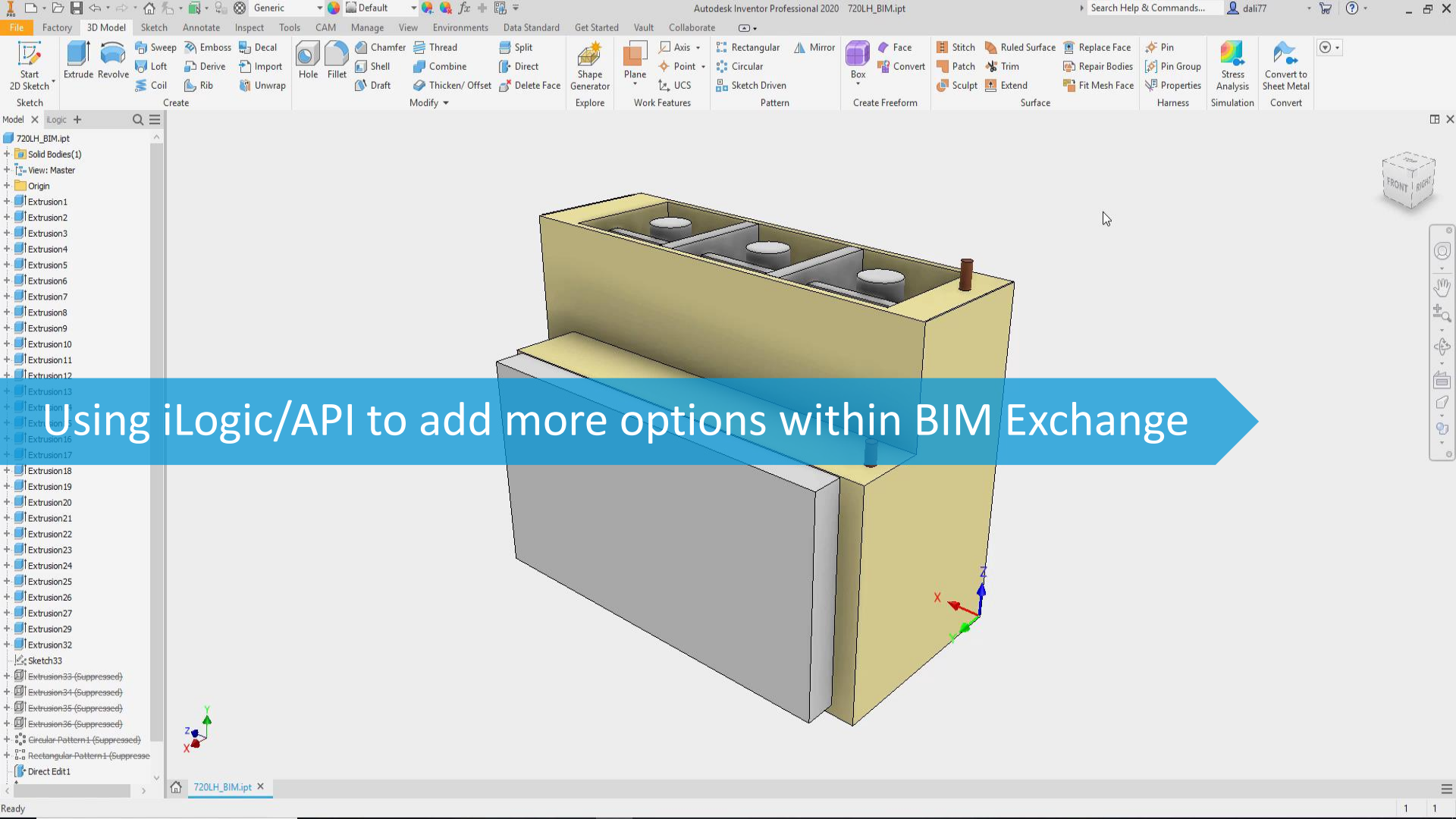
plus

&



RFATranslator.Translate.RevitServerLegacy.exe

From the Inventor Server installation included with product installations such as **Navisworks** and **Factory Utilities**

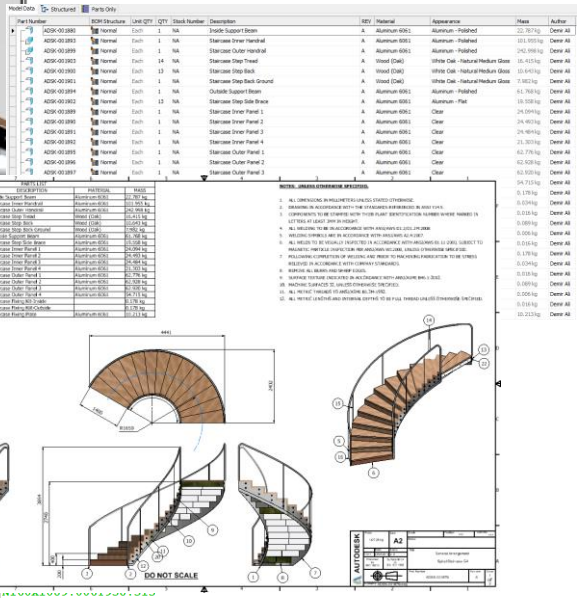

Using iLogic/API to add more options within BIM Exchange

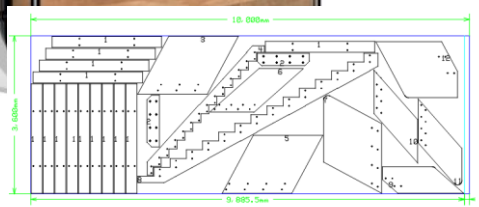
Custom Fabrication

- Project specific building elements
- Reliant on the building interface for fitment
- Data delivery needs to be flexible
- Examples incl. facades, stairwells, railings, chimneys…

Custom Fabrication considerations

- Due to there bespoke nature this type of model data would not be created within the architectural application such as Revit.
- Project specific details such as fabrication drawings, bills of materials, NC programs are required.
- But the data needs to both reference the building model and be able to be consumed within the architectural space.
- This is done within Autodesk Inventor.

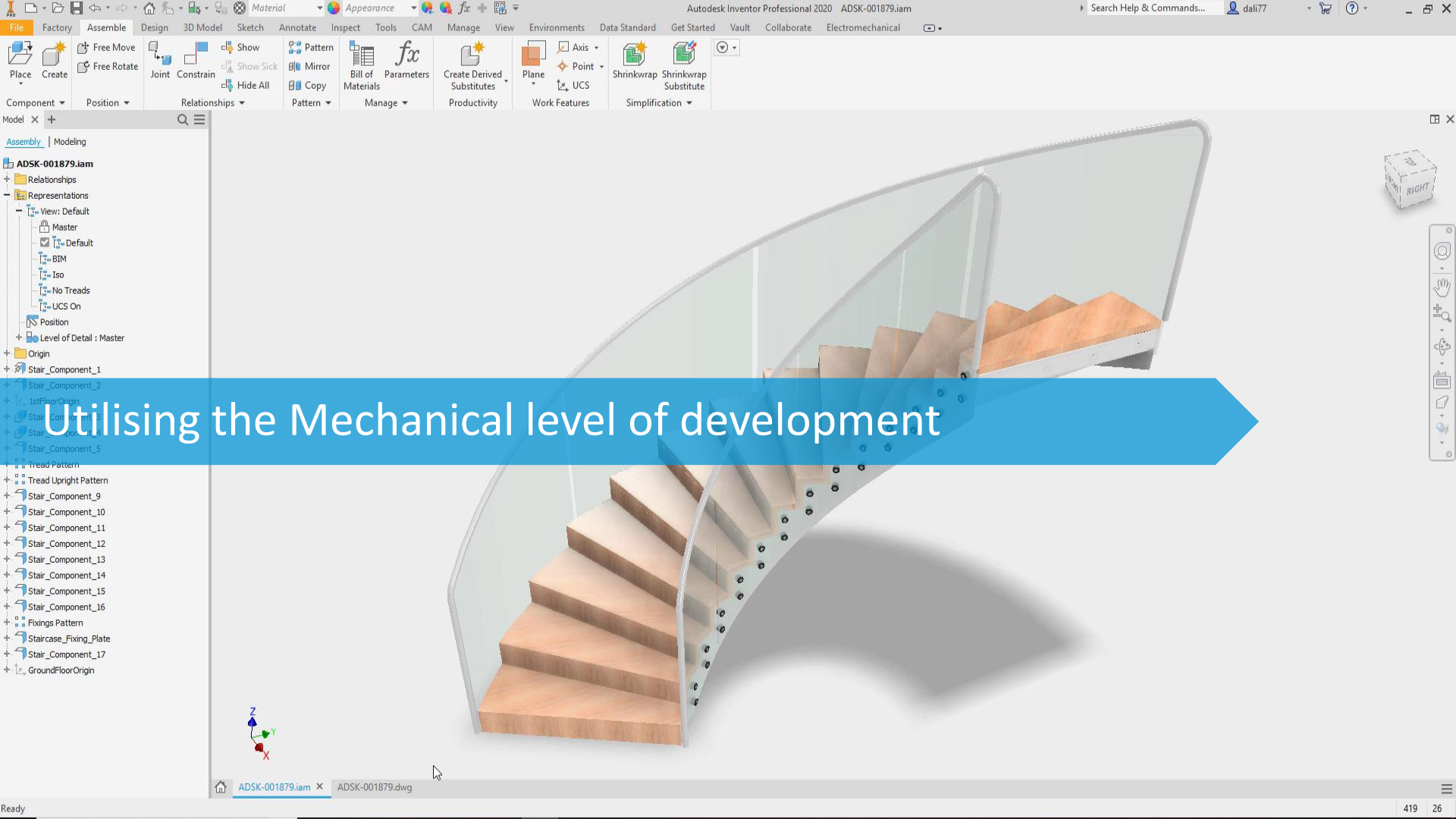


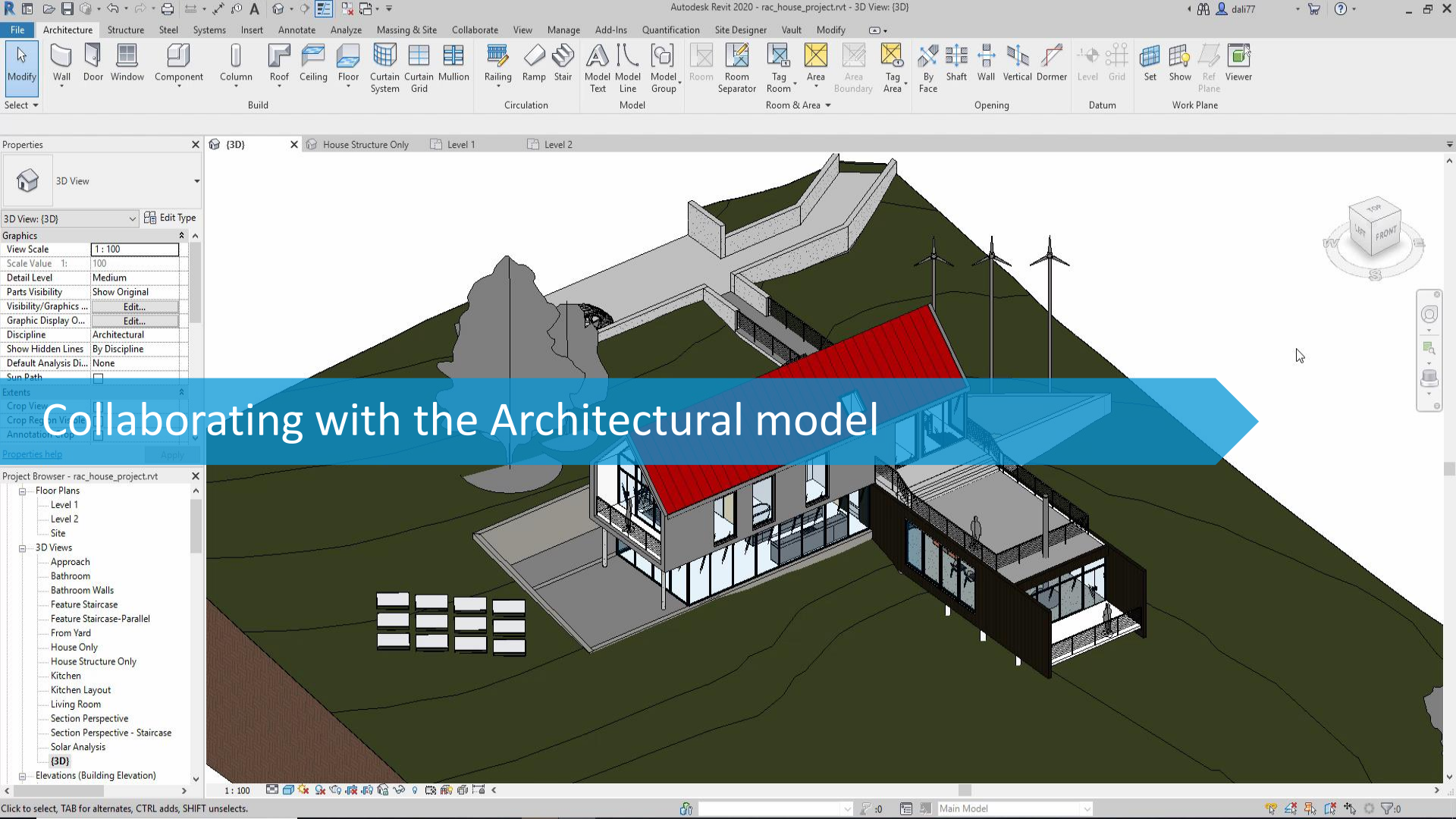


1) ADSK-001902 (14)
2) ADSK-001888 (2)
3) ADSK-001897
4) ADSK-001880
5) ADSK-001896
6) ADSK-001890
7) ADSK-001895
8) ADSK-001894
9) ADSK-001892
10) ADSK-001891
11) ADSK-001889
12) ADSK-001898

```
101 N170X1088.89Y938.38
2   N180X1088.39
3   N190G03Y916.38I0J-11
4   N200Y938.38I0J11
5   N210G01X1087.89
6   N220X1087.774Y938.313
7   N230X1087.524Y937.88
8   N240X1082.524Y929.22
9   N250X1083.39Y928.72
0   N260TC_LASER_OFF(2)
1   N270G00X1085.868Y1065.48
2   N280TC_LASER_ON(11,"AL012IA0-N2S0-30-2
3   N290TC_LASERCORR_ON(T_LEFT)
4   N300G01X1085.623Y1064.51
5   N310X1095.319Y1062.063
6   N320X1095.804Y1061.941
7   N330X1095.933Y1061.978
8   N340X1096.281Y1062.336
9   N350G03X1080.499Y1077.664I-7.891J7.664
0   N360X1096.281Y1062.336I7.891J-7.664
1   N370G01X1096.629Y1062.695
```

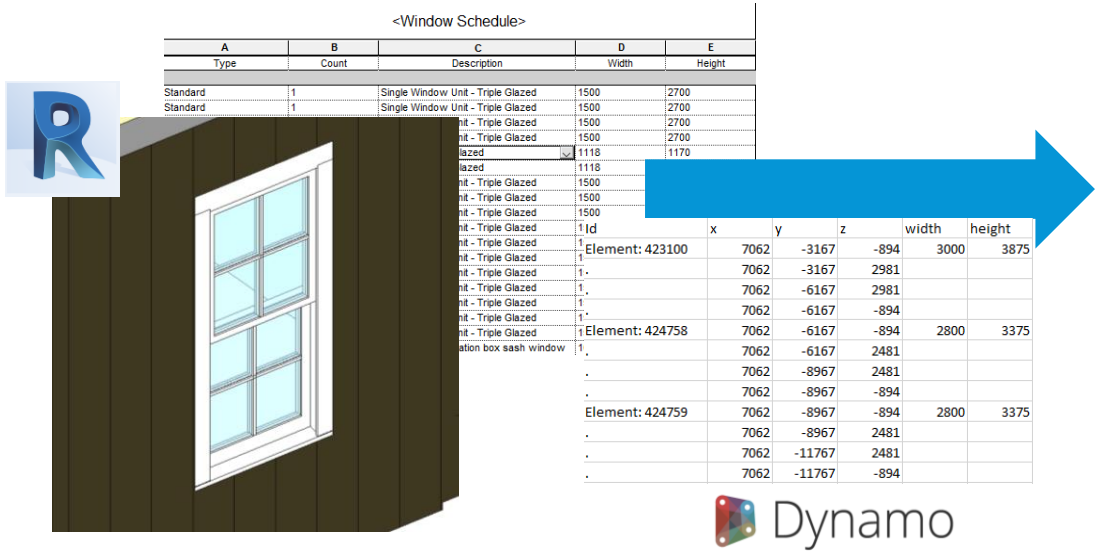
AUTODESK UNIVERSITY

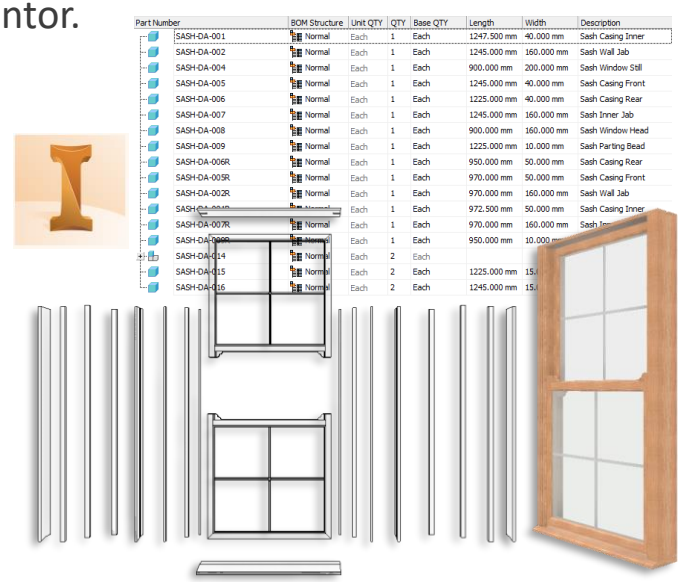

Autodesk Inventor Professional 2020 ADSK-001879.iam
Utilising the Mechanical level of development
ADSK-001879.iam
ADSK-001879.dwg
Ready

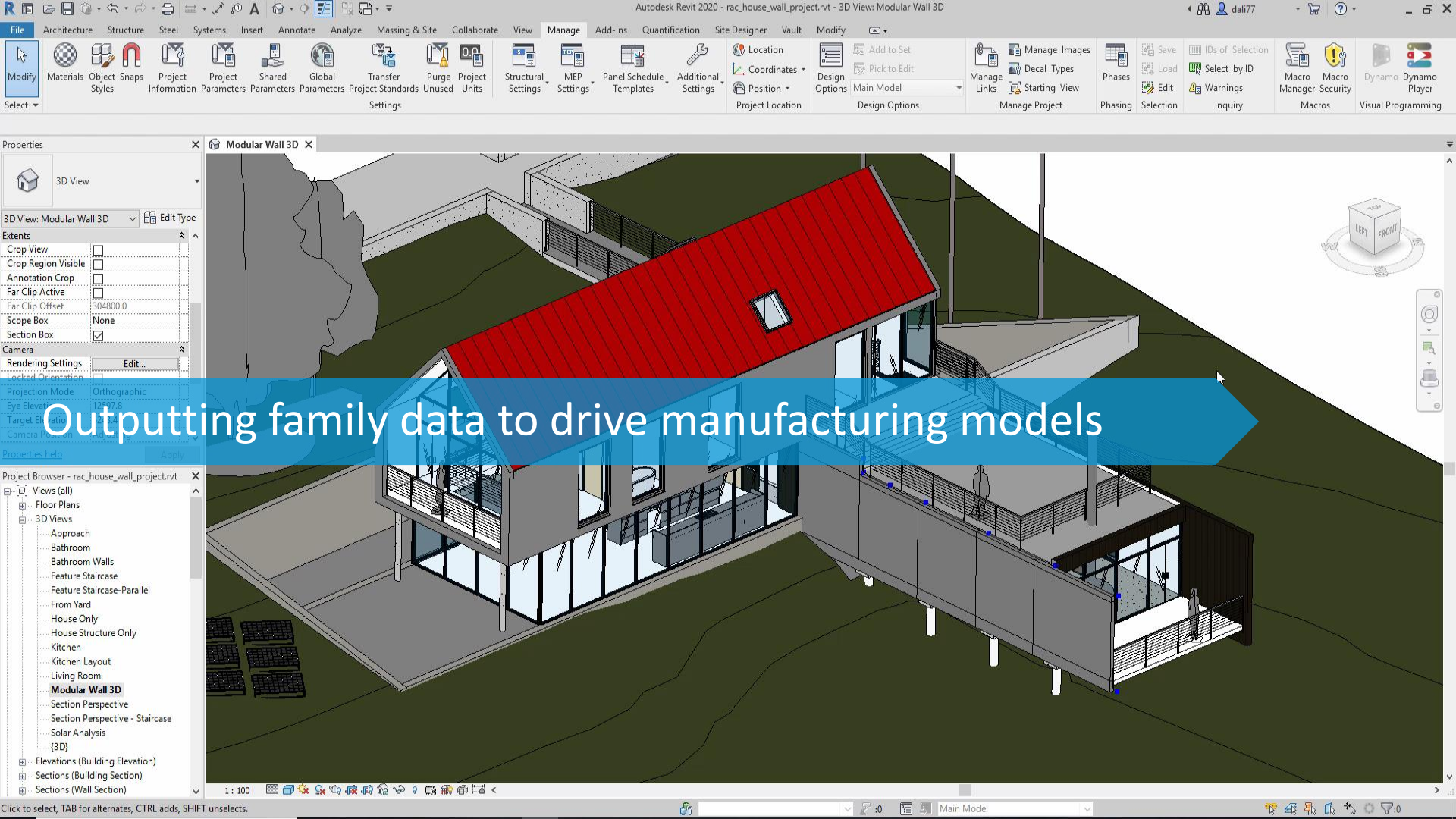

Autodesk Revit 2020 - rac_house_project.rvt - 3D View: {3D}
Collaborating with the Architectural model

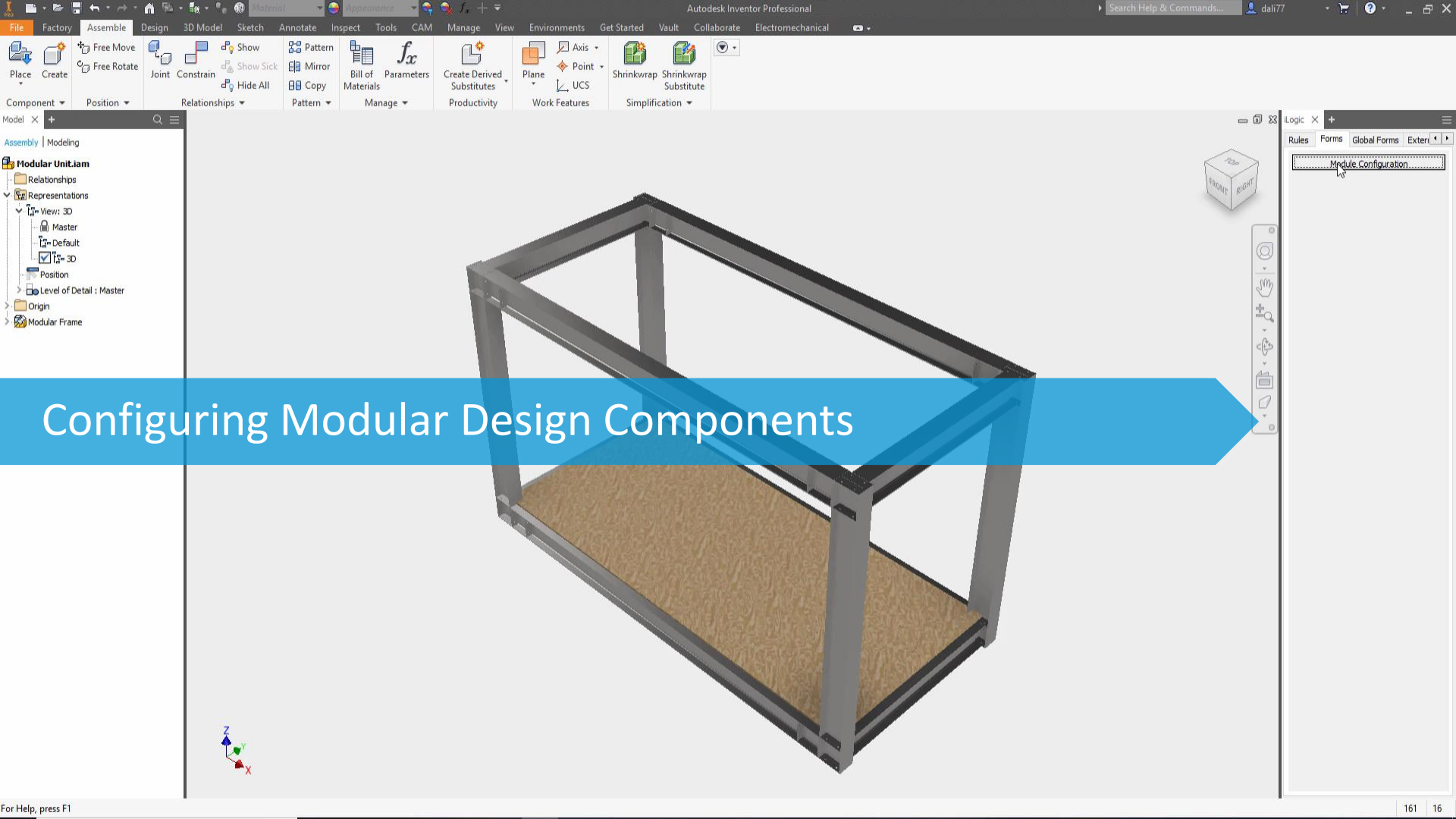
Referencing Architectural data to drive Manufacturing

- Detail required within the Architectural plans is often high level and not suitable for manufacturing.
- Data such as type, size, quantity and position can be utilised within the manufacturing detail.
- Schedule within Revit and extract the Bill of Materials using Inventor.






Autodesk Revit 2020 - rac_house_wall_project.rvt - 3D View: Modular Wall 3D
Outputting family data to drive manufacturing models
Modular Wall 3D
Properties
Project Browser - rac_house_wall_project.rvt



Configuring Modular Design Components

Infrastructure

- Custom intelligent infrastructure components
- Require more complex modelling capability
- Need for library content directly inside InfraWorks & Civil 3D
- Examples incl. drainage, road furniture, bridges elements..

Developing intelligent Infrastructure content

Factory / Facility Digitisation

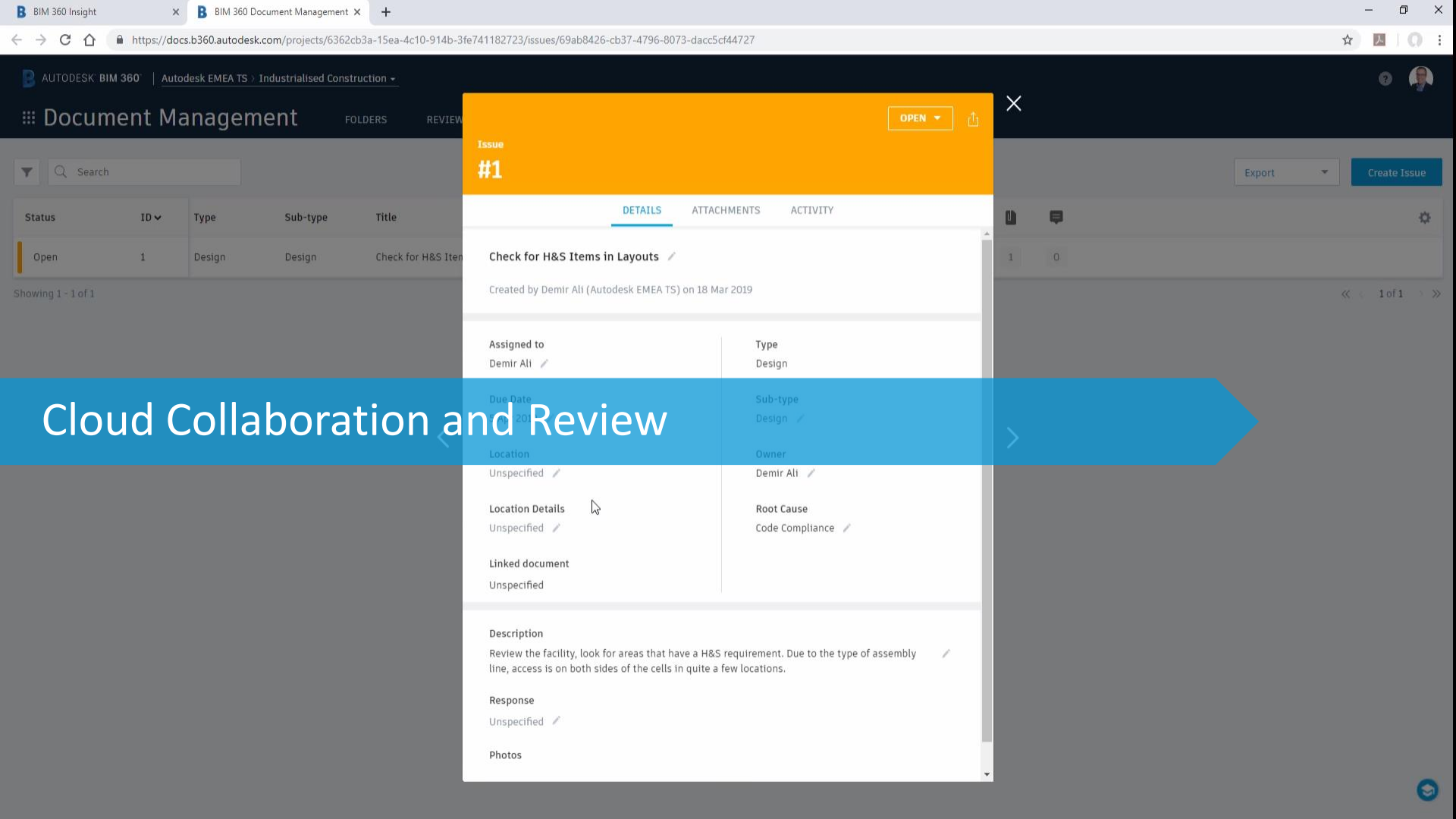
- Organisations are working towards Industry 4.0
- A complete digital representation is fundamental
- Collaborating across all stakeholders is a necessity
- Downstream data reuse is an expectation

Connecting the digital facility pipeline

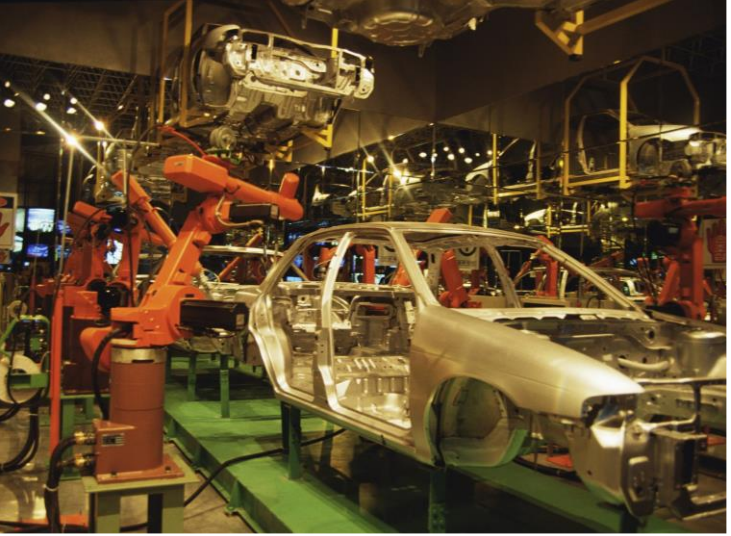

AUTOCAD
BIM 360
VAULT
PROFESSIONAL
INVENTOR
NAVISWORKS

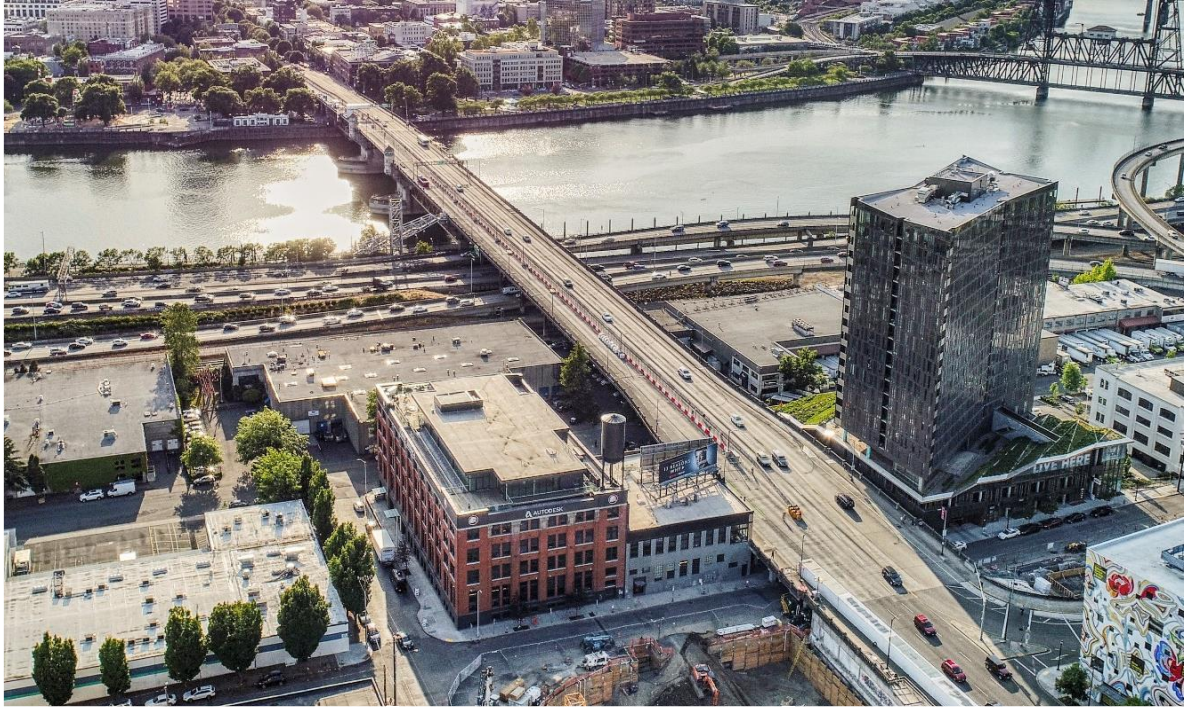
Cloud Collaboration

- Control and share data more consistently
- Centralise data so people have access 24/7
- Better co-ordination of all model based information



Cloud Collaboration and Review




AUTODESK
LIVE HERE

Class Summary

This class has focused on how manufacturers are becoming an integral part of the architecture and construction digital pipeline.

It concentrated on how building product fabricators can deliver reusable information to architects in addition to how custom fabricators and system integrators can deliver coordinated models into an ongoing project.

Other related AU classes

AULON694 - **Inventor and Revit Interop Workflows**

19th June | Start Time: **10:45** | End Time: **11:45** | Room : **Research**

AULON492 - Design Automation: Revit and Inventor Better Together

19th June | Start Time: **14:15** | End Time: **15:15** | Room : **Session Room 7**

AUTODESK®

Make anything™

Appendix

To export an older version of Revit RFA

Install **Inventor2020** with Autodesk Revit Interoperability for Autodesk Inventor 2020

Install **Inventor2017** with Autodesk Revit Interoperability for Autodesk Inventor 2017

Get **RFATranslator.Translate.RevitServerLegacy.exe**

The file is included as part of software installs that contain the Inventor 2020 Server package

Please copy it to **“..\Common files\Autodesk Shared\Revit Interoperability for Inventor 2017\Rx\”** from

Example of Inventor Server install file location from Factory Utilities extracted install package:

“C:\Autodesk\WI\Autodesk Factory Design Utilities 2020\x64\en-US\FIS\A\FD\Util\IS\IVS\Bin\RFATranslator.Translate.RevitServerLegacy.exe”

Run Inventor 2020 and use the following code snippet to export *.rfa 2017 file format when using the “**Legacy**” option.

Sample snippet to export Revit from API/iLogic

```
'----- Revit Family Ouput Start------

Dim ThisDoc As Inventor.Document
ThisDoc = ThisApplication.ActiveDocument

'Dim oDoc As AssemblyDocument 'For exporting an assembly file
Dim oDoc As PartDocument  'For exporting an part file
oDoc = ThisApplication.ActiveDocument

'Get File Name of Assembly
Dim BaseFileName As String
BaseFileName = Left(ThisDoc.FullFileName, Len(ThisDoc.FullFileName) -4)

Dim pRFT As String
pRFT = "C:\ProgramData\Autodesk\RVT 2020\Family Templates\English\Metric Generic Model wall based.rft"

Dim Description As String
Dim PartNumber As String
Dim ComponentType As String
Dim Manufacturer As String
Dim Model As String
Dim URL As String
Dim customPropSet As PropertySet
Dim designPropSet As PropertySet
Dim propertyName As String

customPropSet = oDoc.PropertySets.Item("Inventor User Defined Properties")
designPropSet = oDoc.PropertySets.Item("Design Tracking Properties")
pDesc = designPropSet.Item("Description")
pPart = designPropSet.Item("Part Number")
pVend = designPropSet.Item("Vendor")

'Set Properties
Description = pDesc.Value
PartNumber = pPart.Value
Manufacturer = pVend.Value
Model = Left(oDoc.FullFileName, Len(oDoc.FullFileName) - 4)
URL = "www.autodesk.co.uk"
ComponentType = "23.75.70.00" 'HVAC Classification


'----- RFA Ouput Start------
Dim oBIMComp As BIMComponent
oBIMComp = oDoc.ComponentDefinition.BIMComponent

'Write Component Type Definition
oBIMComp.ComponentDescription.ComponentType = ComponentType 'Blank out if deliberately want Generic Model Classification

oBIMComp.ComponentDescription.OrientationType = 103683 '103681 = ViewCube, 103683 = UCS, 103682 = Model Origin

'Set Family Type
oBIMComp.ComponentDescription.FamilyType = pPart.Value

Dim oNameValueMap As NameValueMap
oNameValueMap = ThisApplication.TransientObjects.CreateNameValueMap

oNameValueMap.Add("RevitFileVersion", "Current")'Supported Revit File Version ("Current" = RFA2020, "Legacy" = RFA2017)
oNameValueMap.Add("CustomRevitFamilyTemplate", pRFT)'Supported Revit Template (Generic *.rft options included with Inventor install)

'Export the file
oBIMComp.ExportBuildingComponentWithOptions(BaseFileName & ".rfa", oNameValueMap) 'Can also use ".adsk" if required.

'----- Revit Family Ouput End------
```

Note:-

Just copy and paste the text from this slide into an iLogic rule.

This snippet assumes you are exporting a current release Revit *.rfa family file.