

2D to 3D: How to Make it Work for You

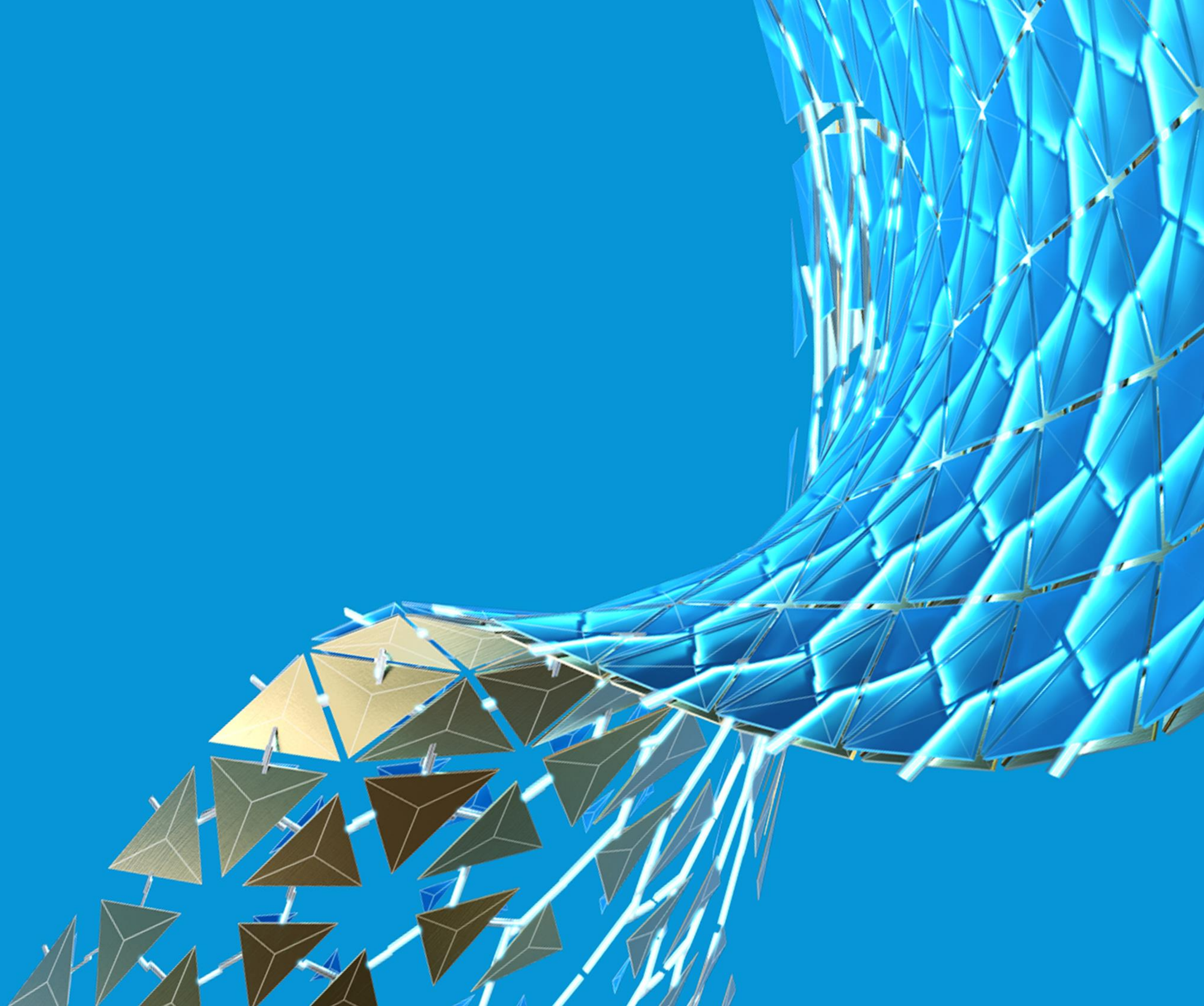
Kathryn Donald

Digital Design Leader | @KathrynDonald

Carlotta Mirri

Digital Design Engineer | @CarlottaMirri

Introduction





About the speaker

Kathryn Donald

Kathryn is a Partner at Max Fordham LLP, leading their transition to a fully digital design environment through Building Information Management (BIM) and digital engineering. Her digital design expertise has developed through her 10 years' experience as a building services engineer with the Practice.

As a project engineer on early BIM projects, Kathryn developed a real-world understanding of the opportunities and challenges of deploying digital design.

Kathryn and her Digital Design Team work closely with the engineering teams to develop bespoke digital tools, processes, content and training to improve the quality, efficiency and effectiveness of the Practice's engineering output.



About the speaker

Carlotta Mirri

Carlotta is passionate about applying technology in the AEC industry.

As a Digital Design Engineer at Max Fordham, Carlotta manages BIM model production for large scale projects and supports teams of engineers in optimizing and enforcing BIM strategies and effective collaboration.

She has been heavily involved in the development of BIM procedures, content and custom digital tools. Carlotta began exploring pyRevit as a way to interact with the Revit API using Python, for automating time consuming tasks in Revit and speeding up the production of information, and surfacing model data for engineering calculations.

Introduction

- INTRODUCTION TO MAX FORDHAM
- A DIFFICULT START TO 3D
- PLANNING FOR SUCCESS
- TRAINING
- DEVELOPMENT
 - Content
 - Workflow
 - Tools
- PROGRESS AND ACHIEVEMENTS
- FUTURE APPROACH & DEVELOPMENTS
- KEY MESSAGES





SPORTS & LEISURE



RESIDENTIAL



WORKSPACES



EDUCATION



ARTS & CULTURE



SCIENCE & TECHNOLOGY



INTERNATIONAL



THE UNEXPECTED

Key Max Fordham Figures

1966

YEAR FOUNDED

The year Max Fordham
founded the Practice

5

OFFICES

Number of offices, all of
which are located in the
UK

225

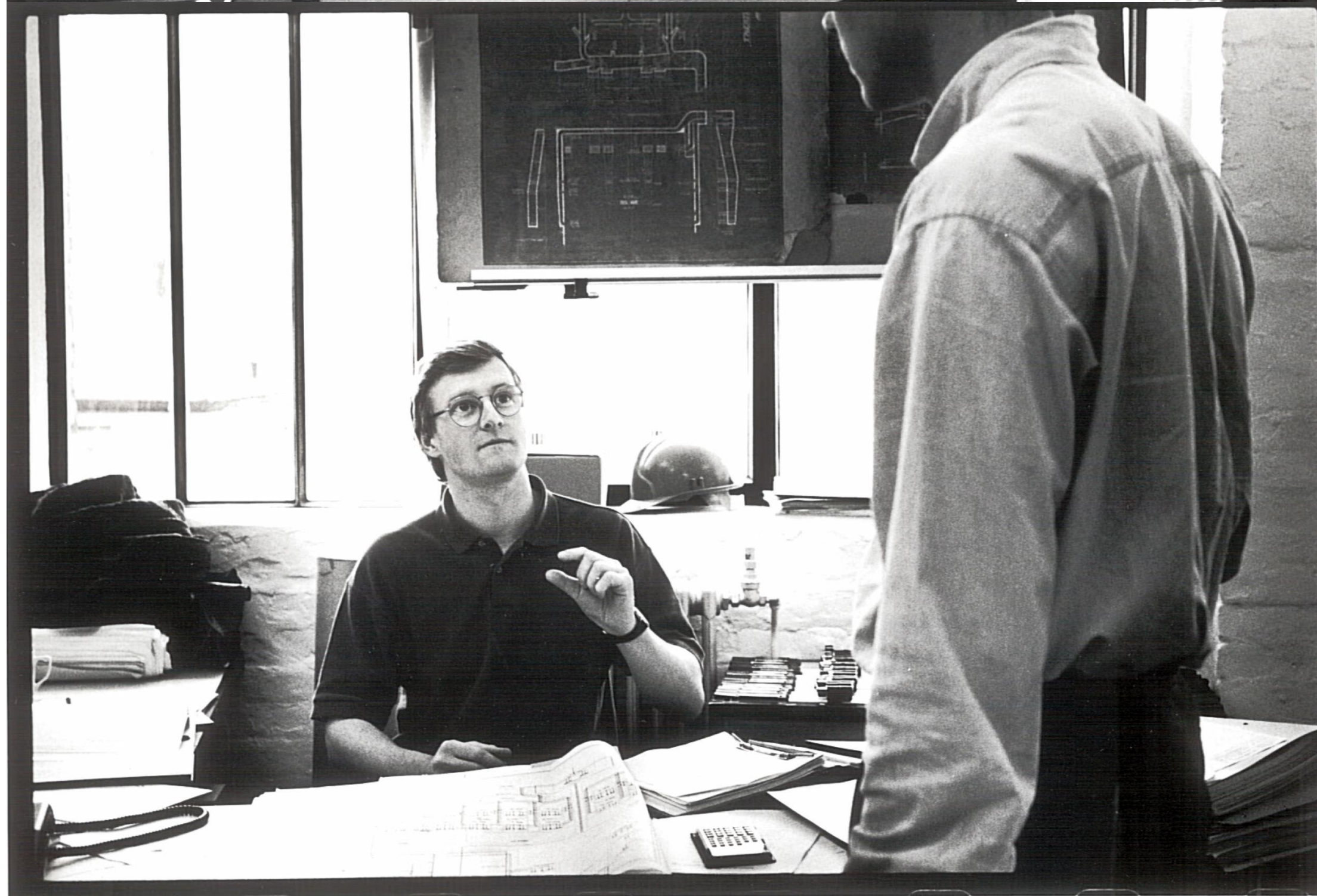
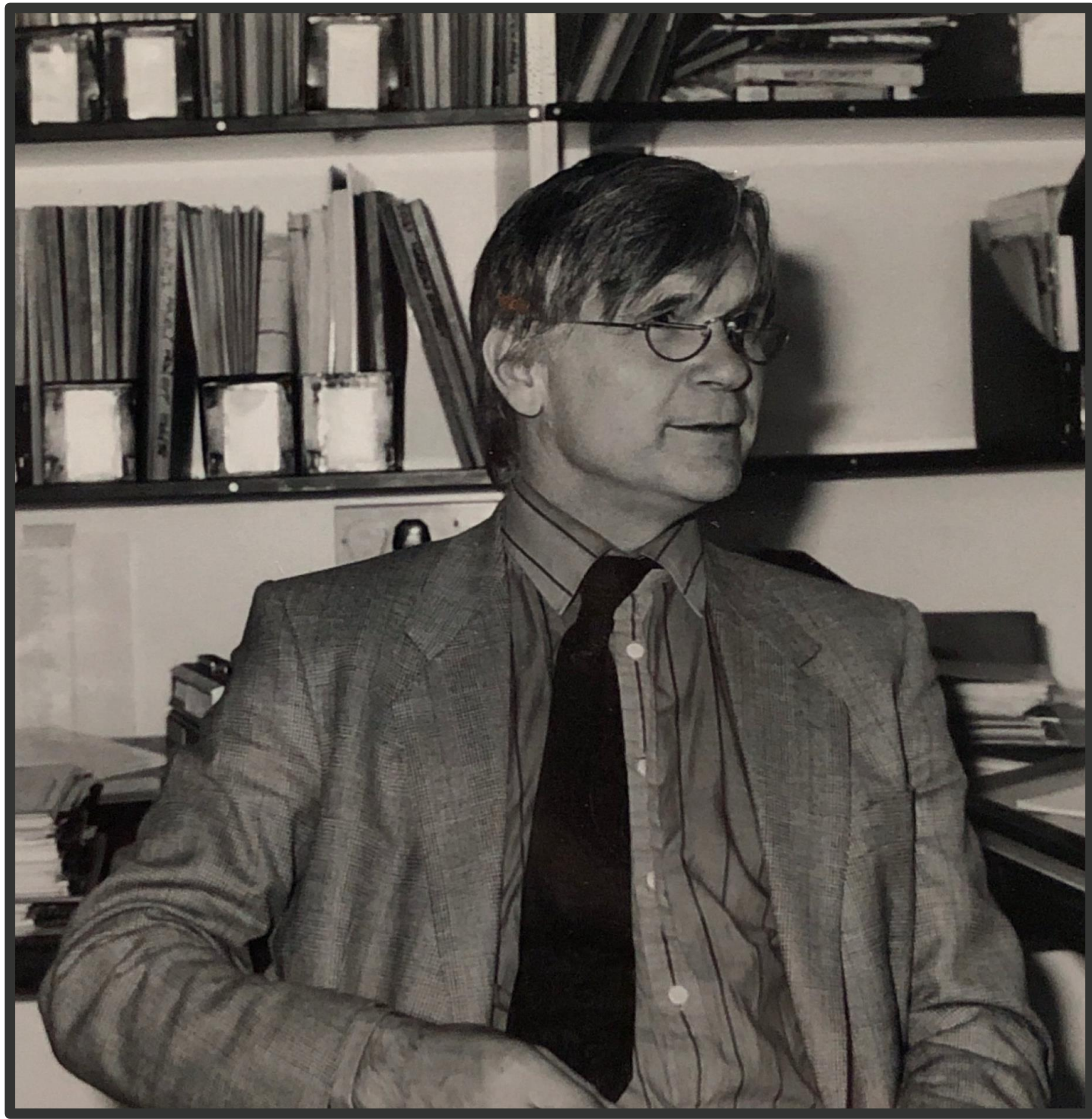
PEOPLE

Total number of partners
and employees at Max
Fordham

170

ENGINEERS

We currently have around
170 engineers



Key Max Fordham Revit Figures

2010

INTRO OF REVIT

Revit was first used by the
Practice in 2010

150

REVIT USERS

Around 150 engineers and
admin staff use Revit on a
regular basis to deliver our
projects

0

CAD TECHNICIANS

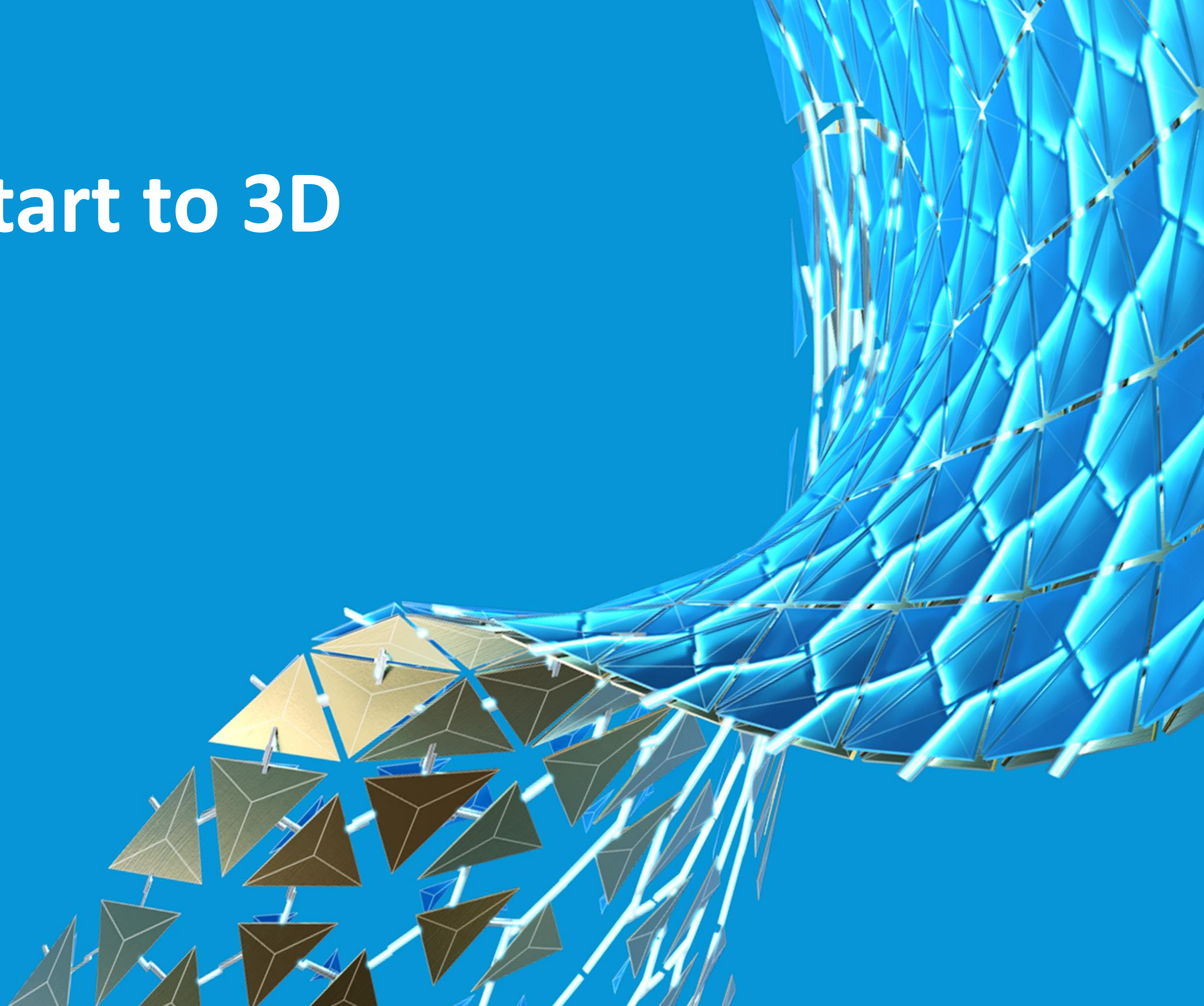
We don't typically employ
CAD technicians, our
engineers create our Revit
models

>200

**CURRENT REVIT
PROJECTS**

We have over 200 Revit
projects currently being
delivered

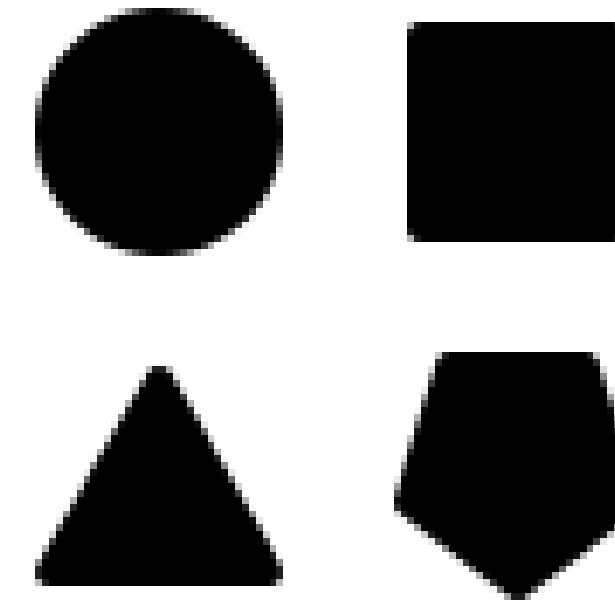
A Difficult Start to 3D



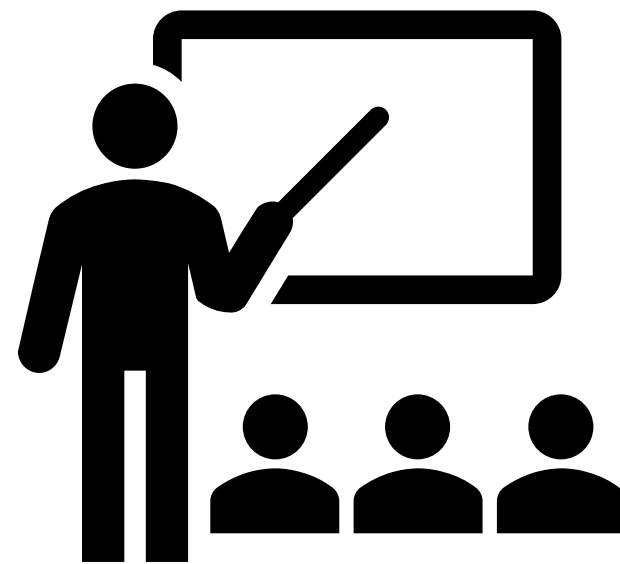
A Difficult Start to 3D



WHY REVIT?



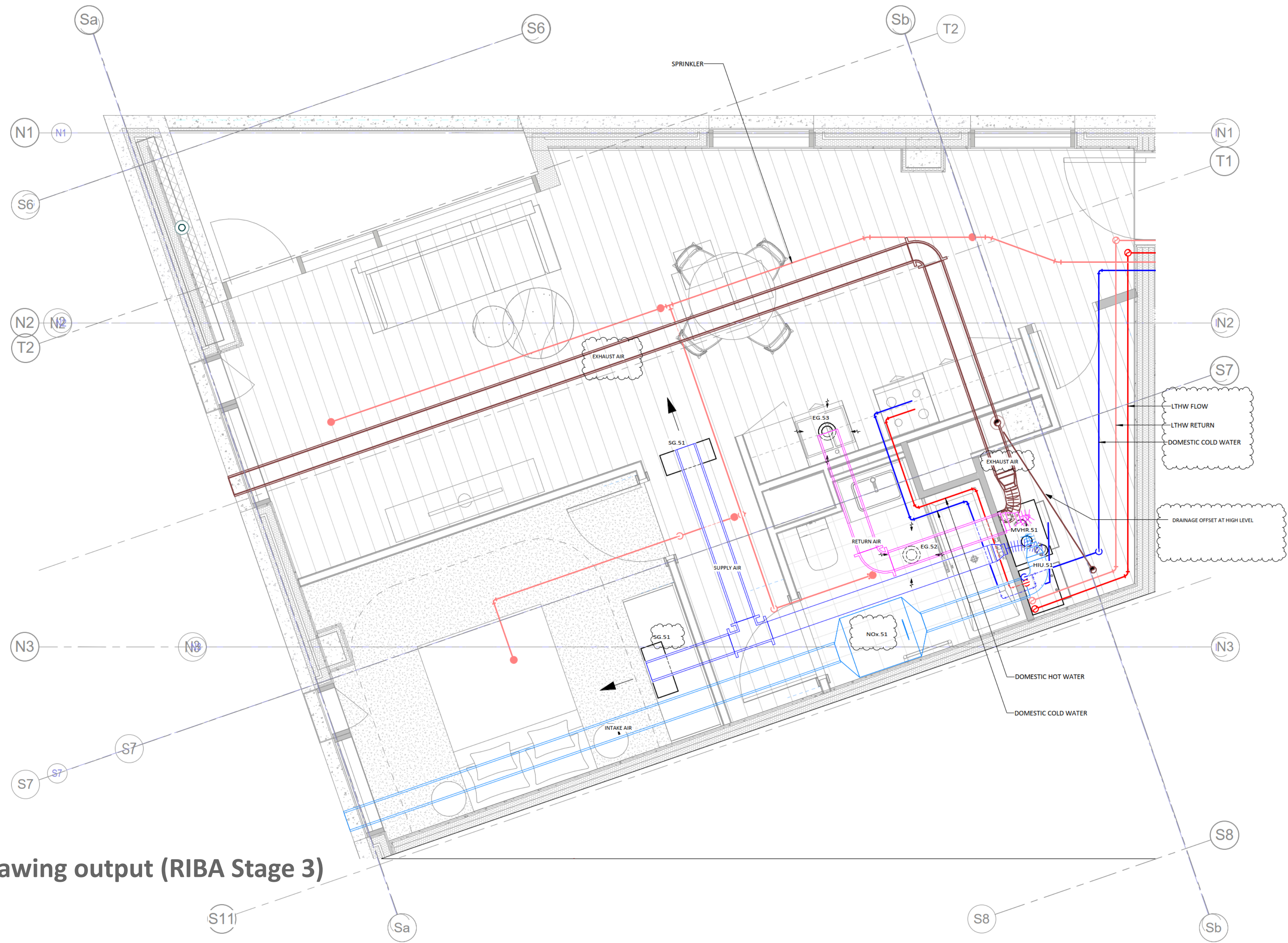
MINIMAL CENTRAL DEVELOPMENT



TRAINING

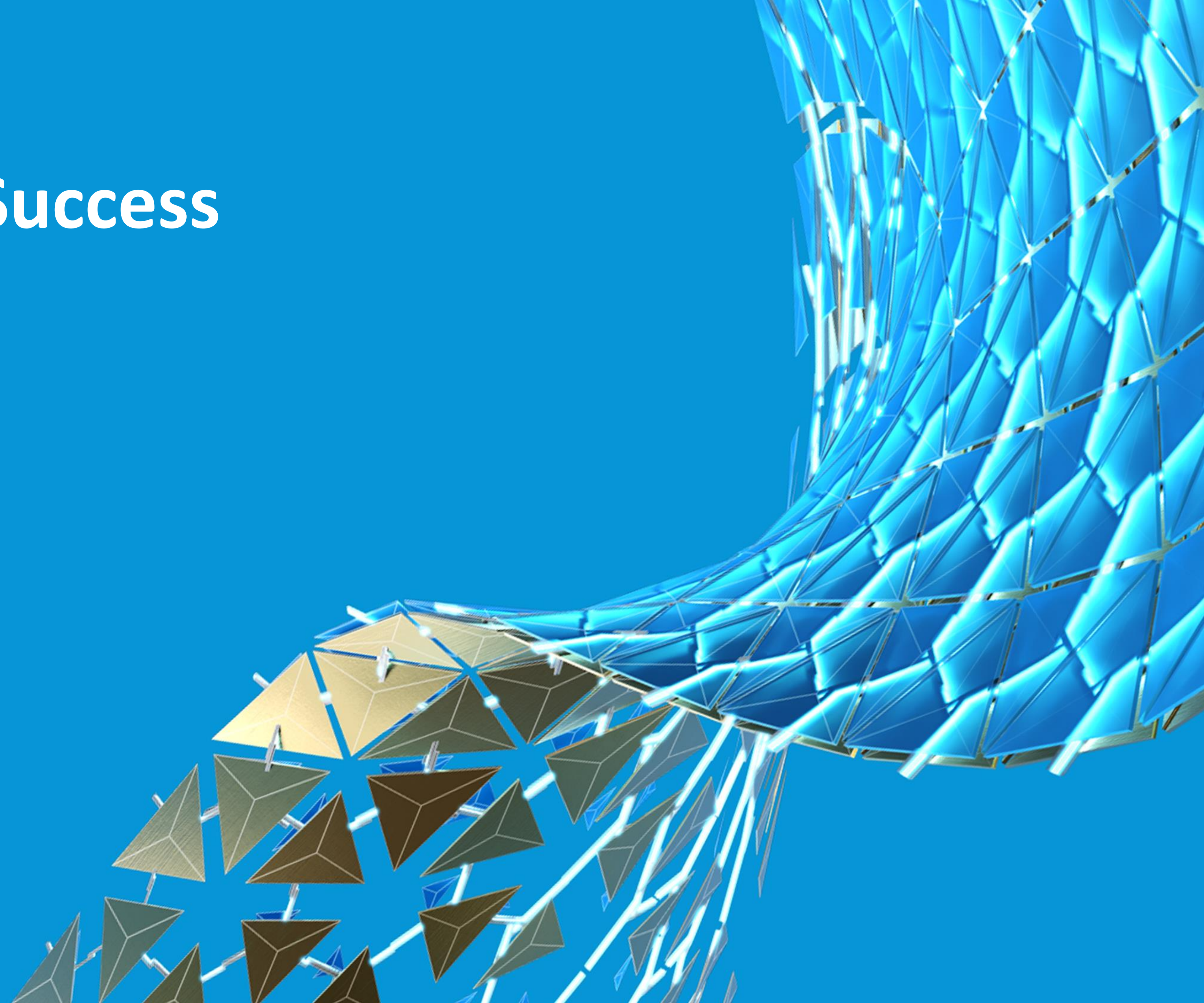


AUTOCAD REPLICATION



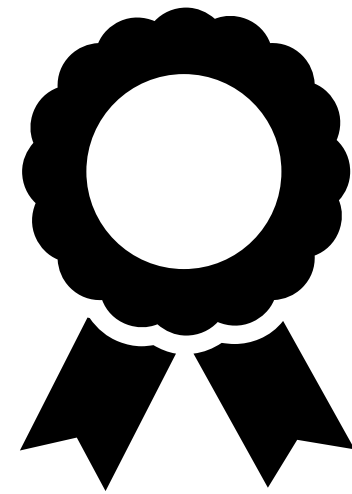
Example early drawing output (RIBA Stage 3)

Planning for Success



**What do you want to
achieve?**

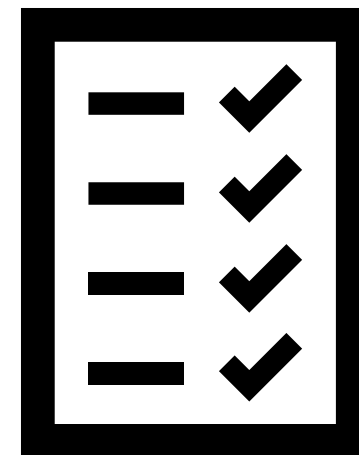
What do we want to achieve?



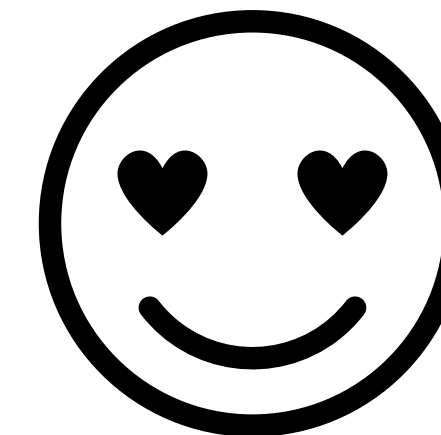
HIGHER QUALITY AND CONSISTENT OUTPUT



MORE EFFICIENT PROJECT DELIVERY



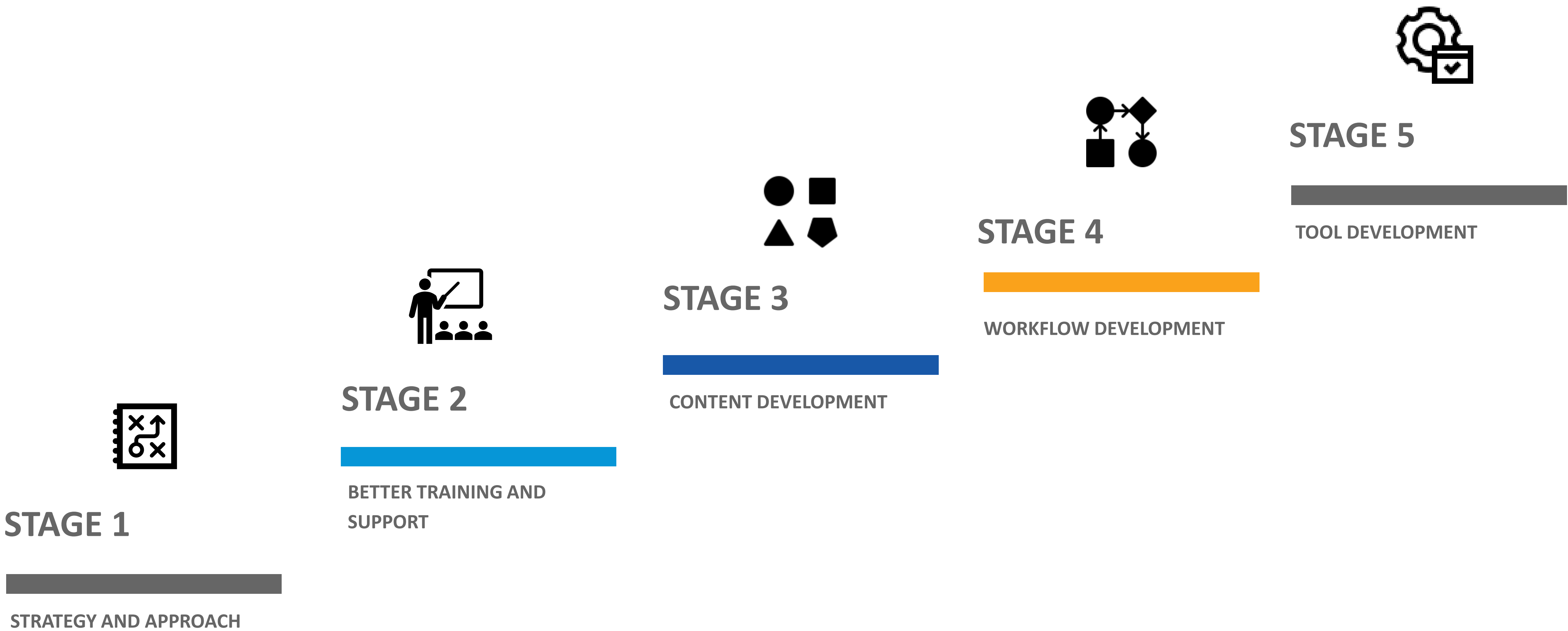
BIM COMPLIANCY



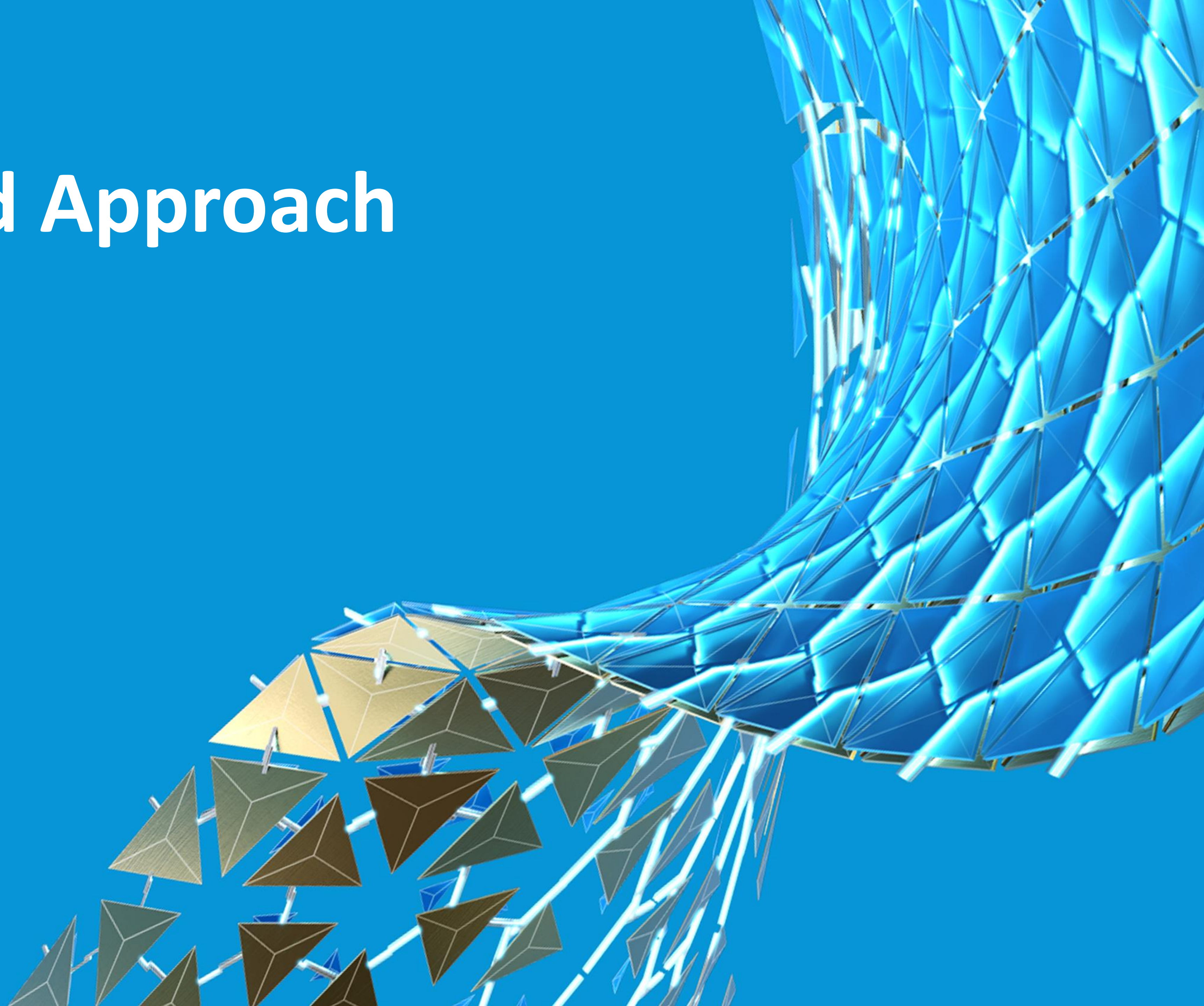
HAPPIER ENGINEERS

How to achieve this?

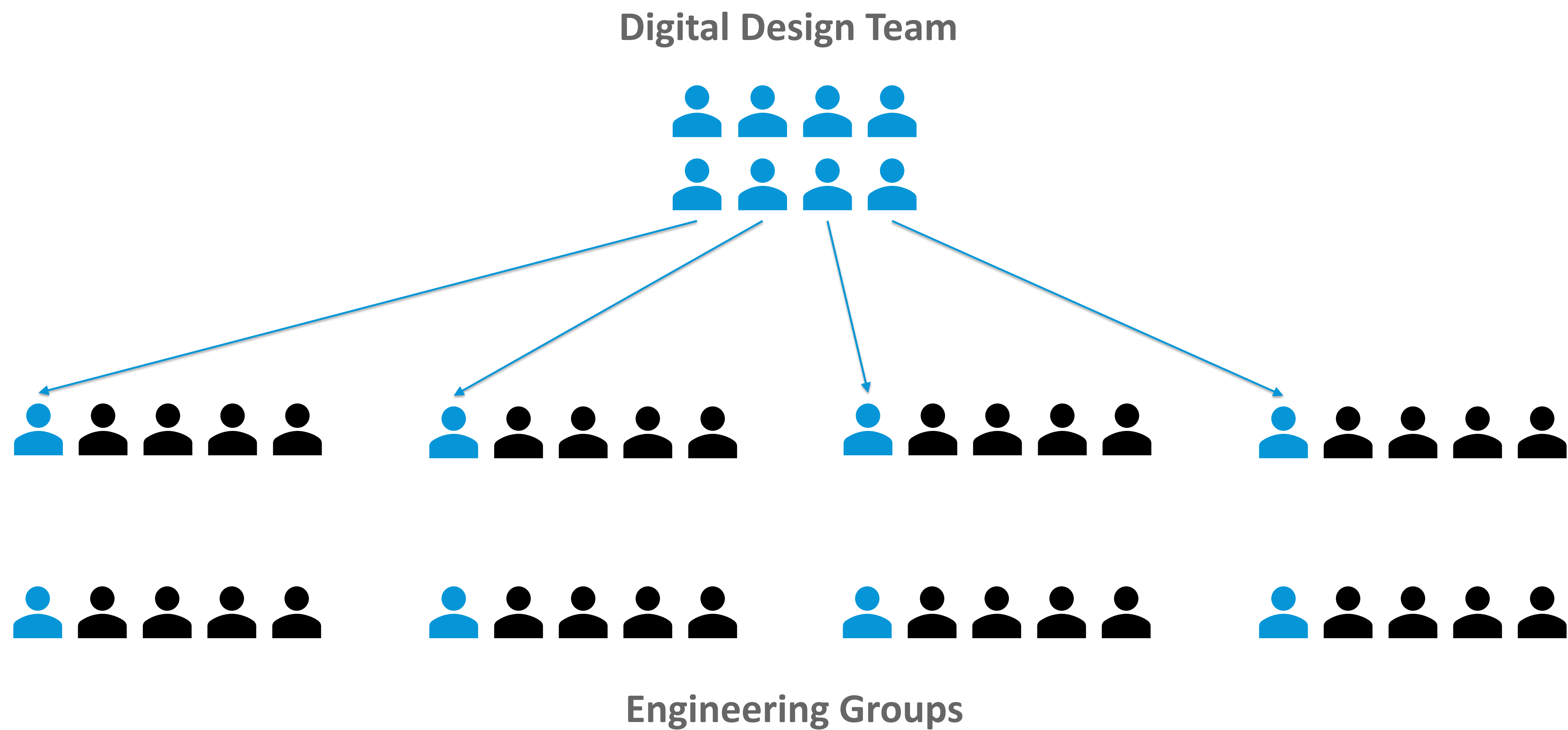
How to achieve this?



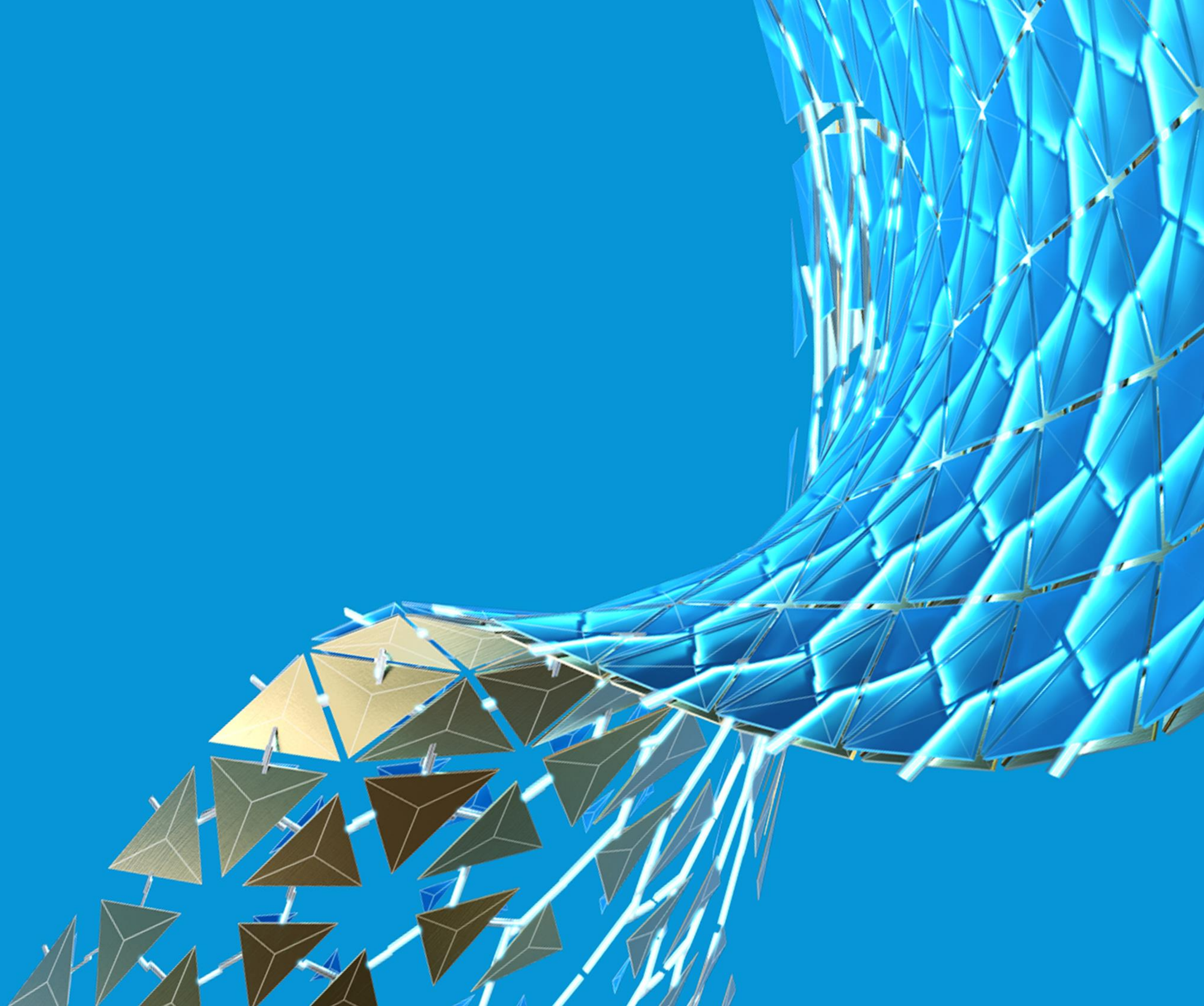
Strategy and Approach



Strategy and Approach

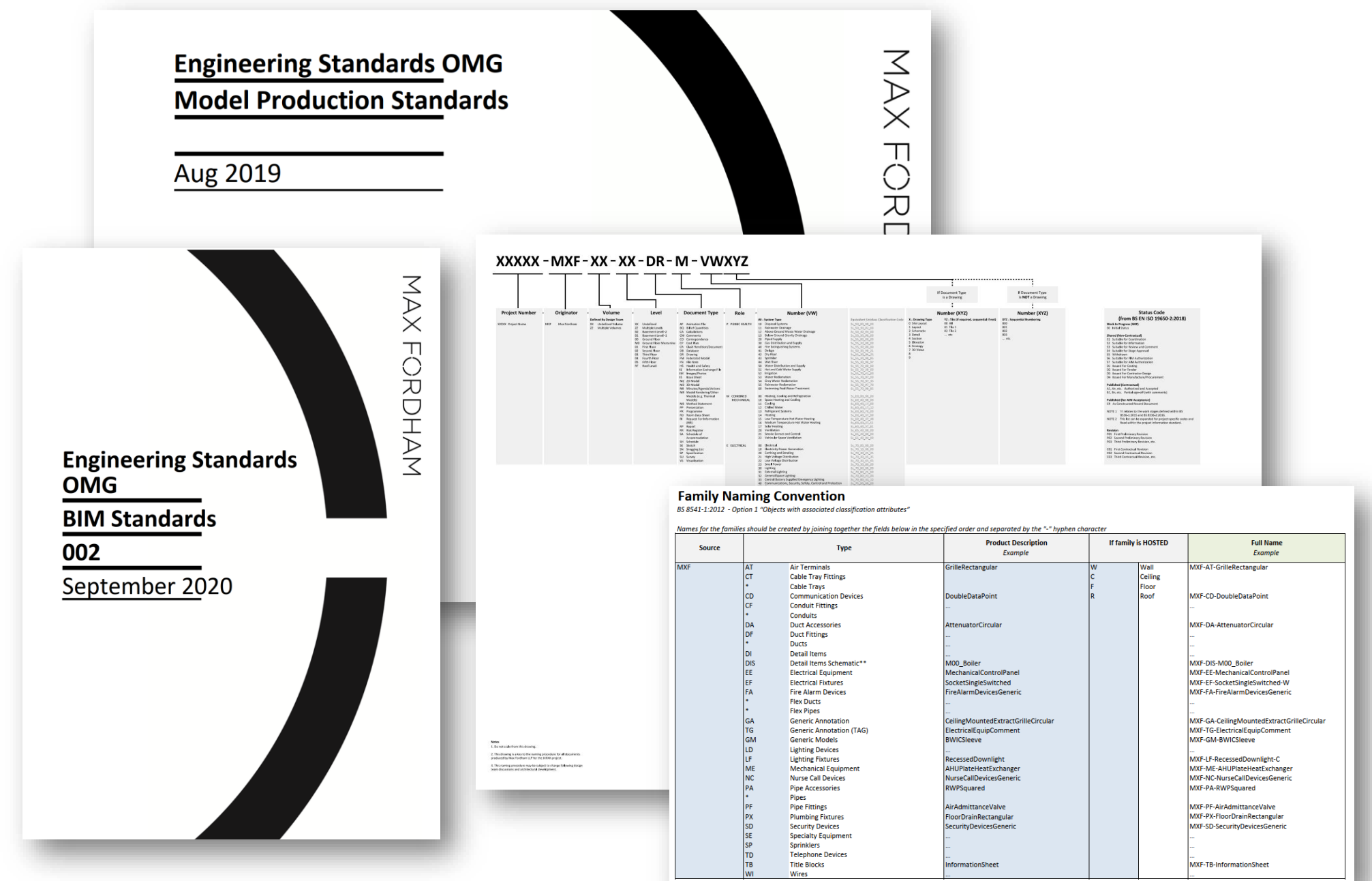
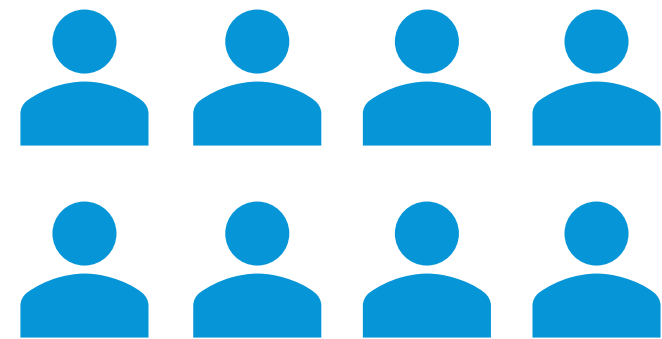


Training

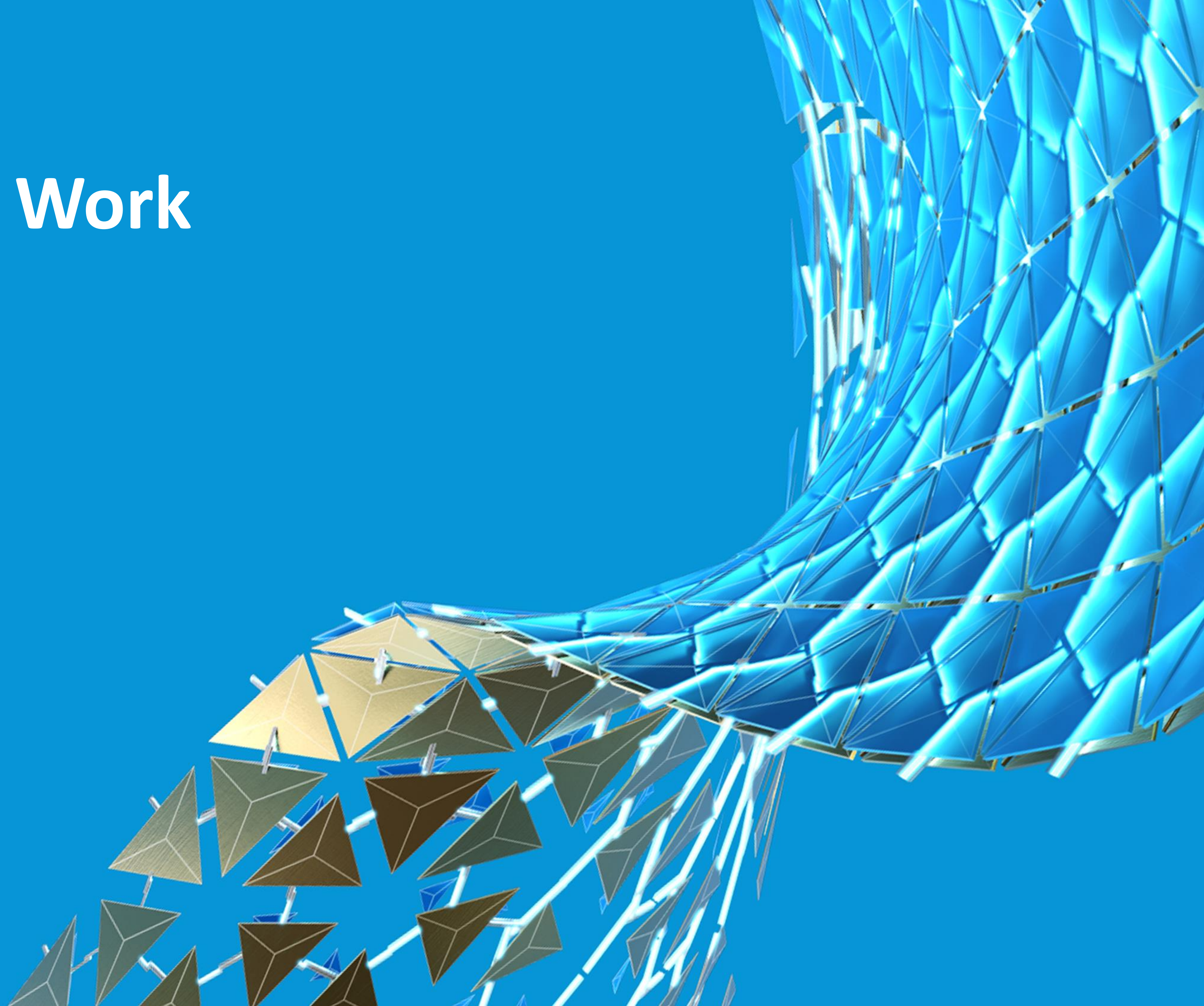


Training

Digital Design Team



Development Work

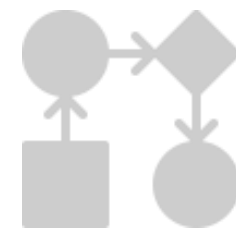


Content Development



CONTENT

- Project Template
- Families



WORKFLOWS

- Early stage drawings
- Schematics (or One Line Diagrams)
- Health and safety information
- Schedules
- Clash detection
- Model QA

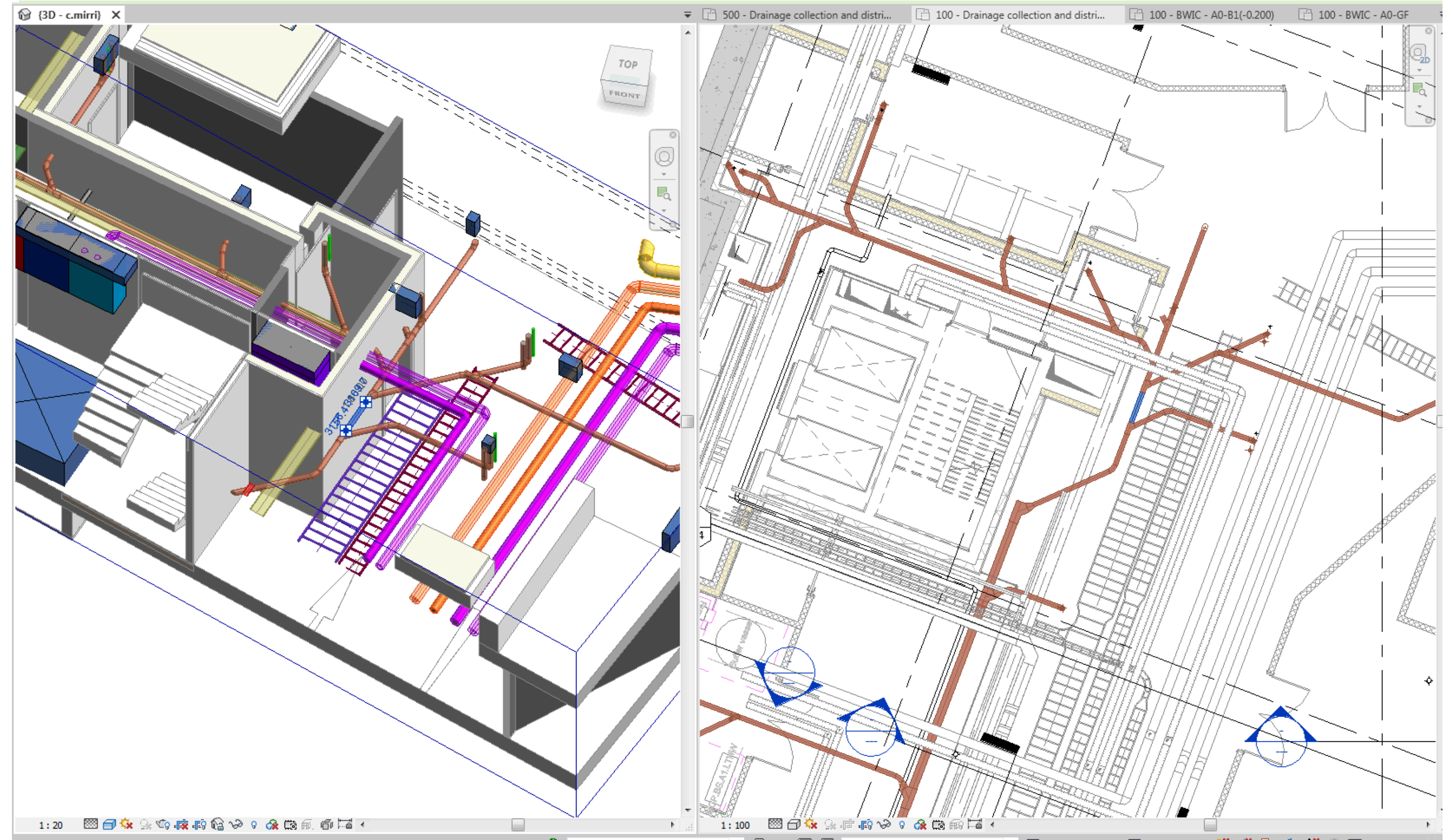
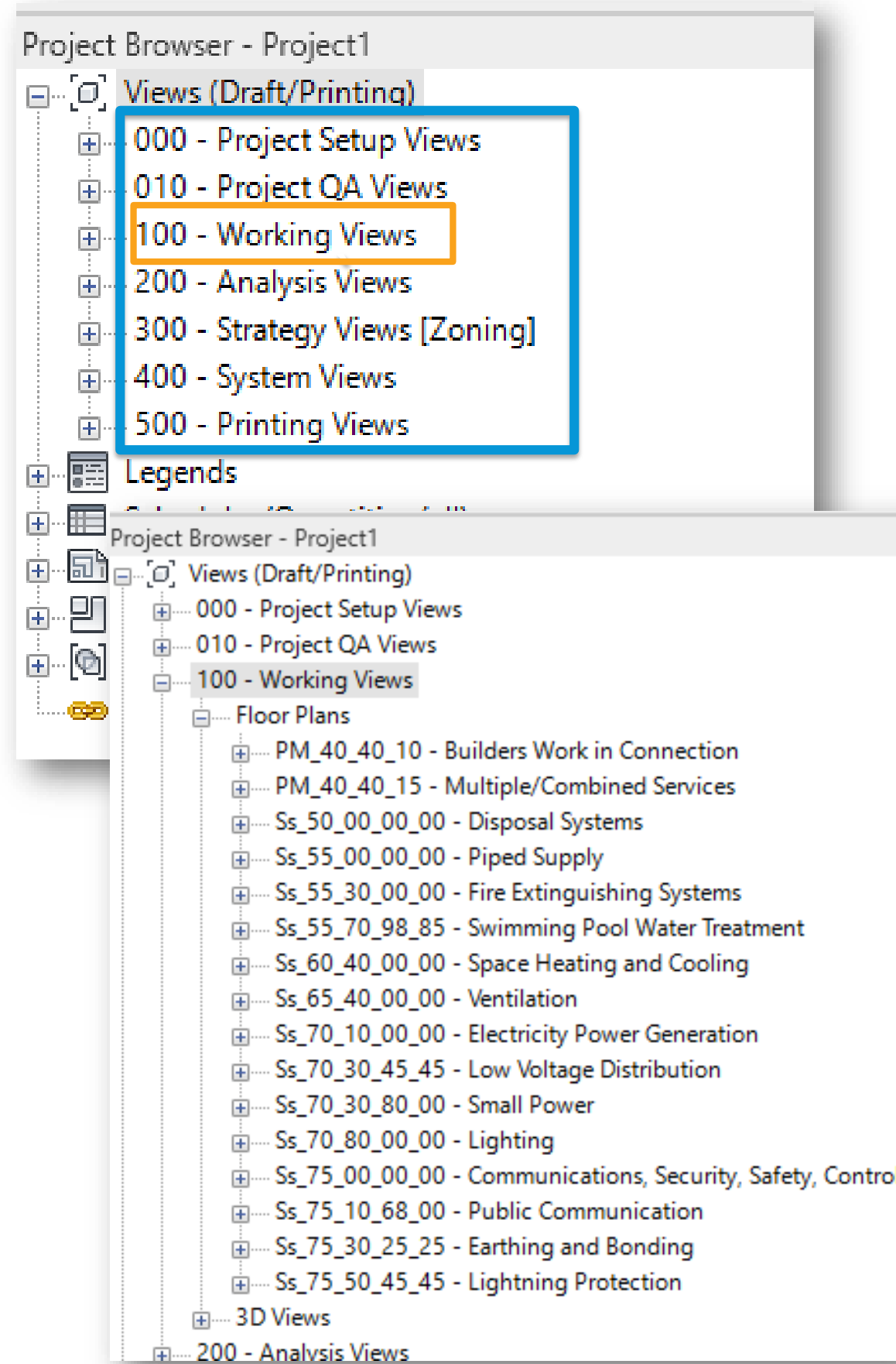


TOOLS

- Third party tools
- Dynamo
- pyRevit

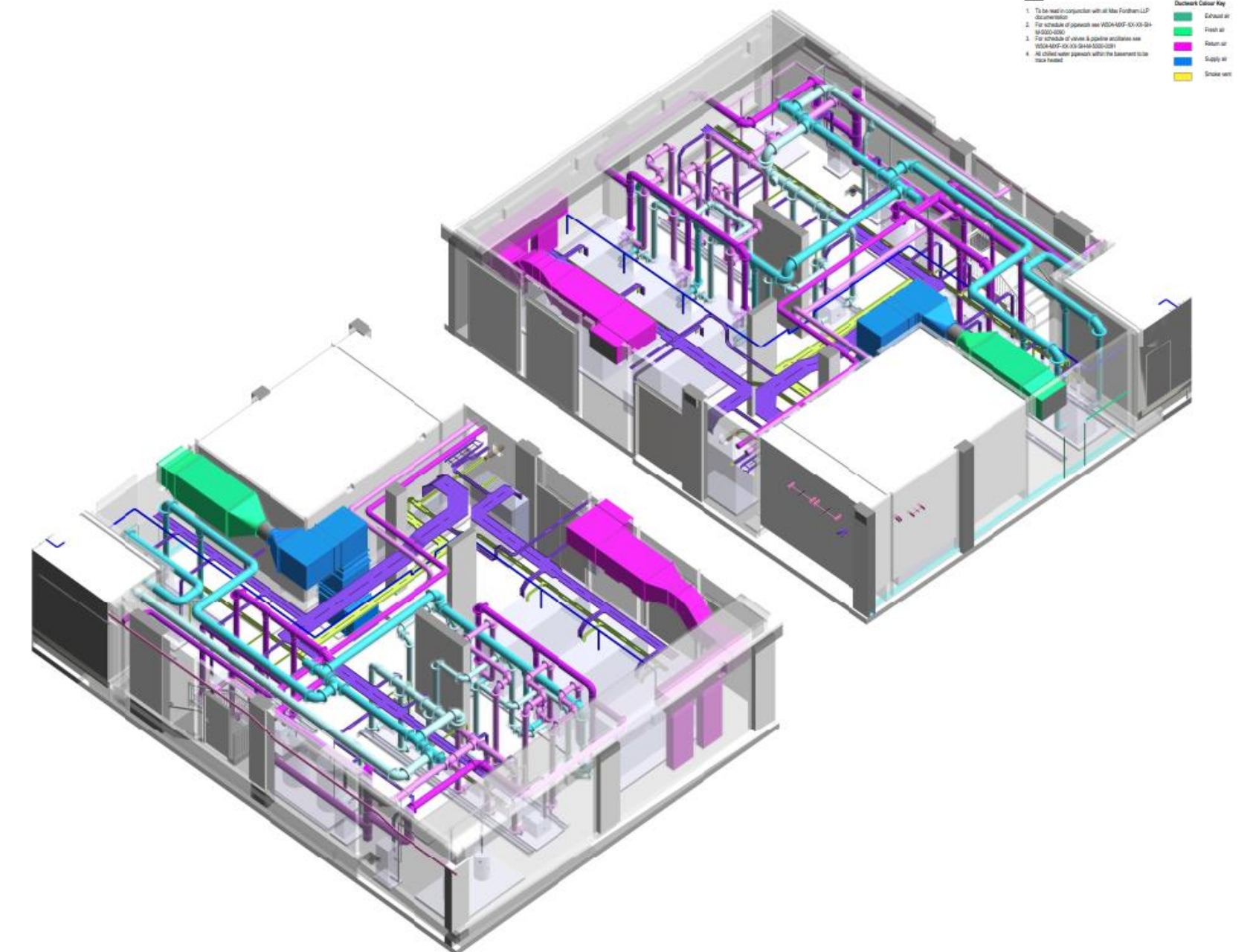
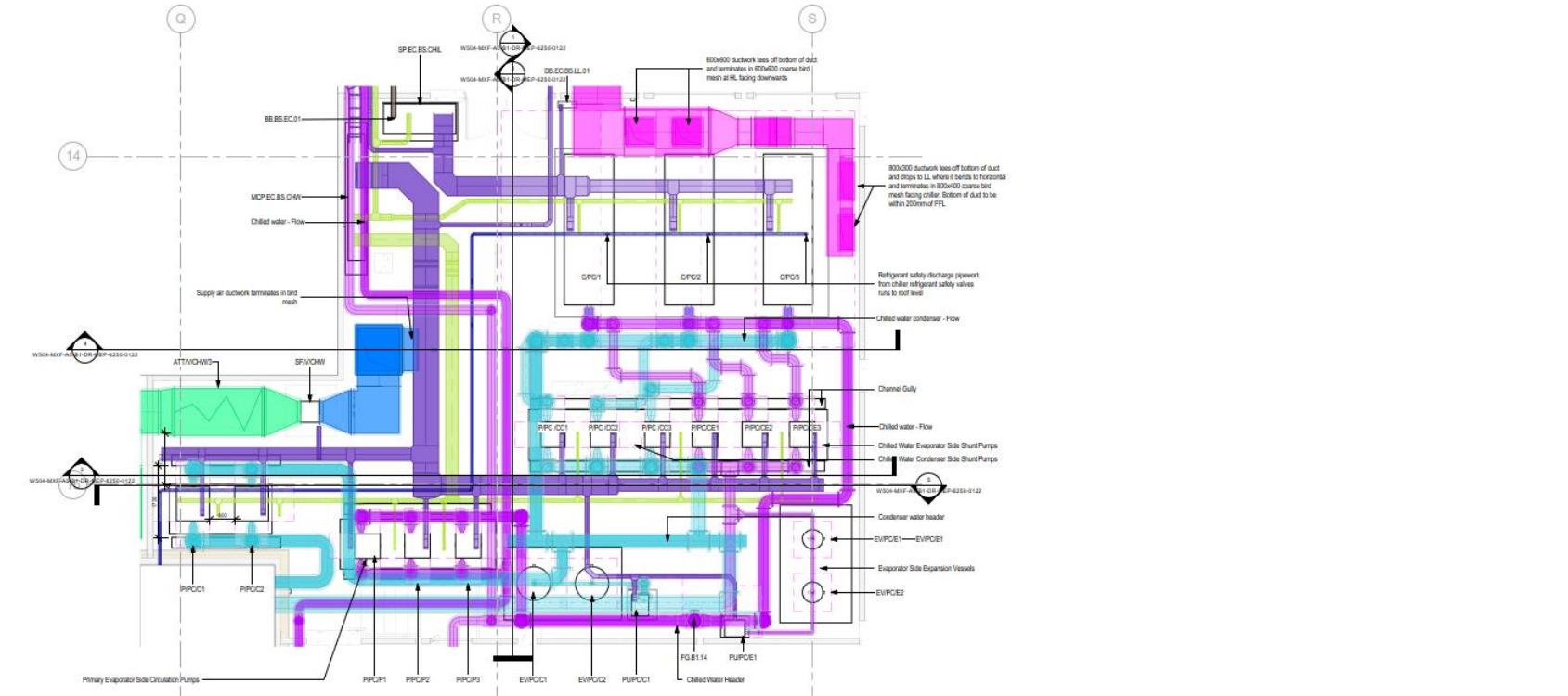
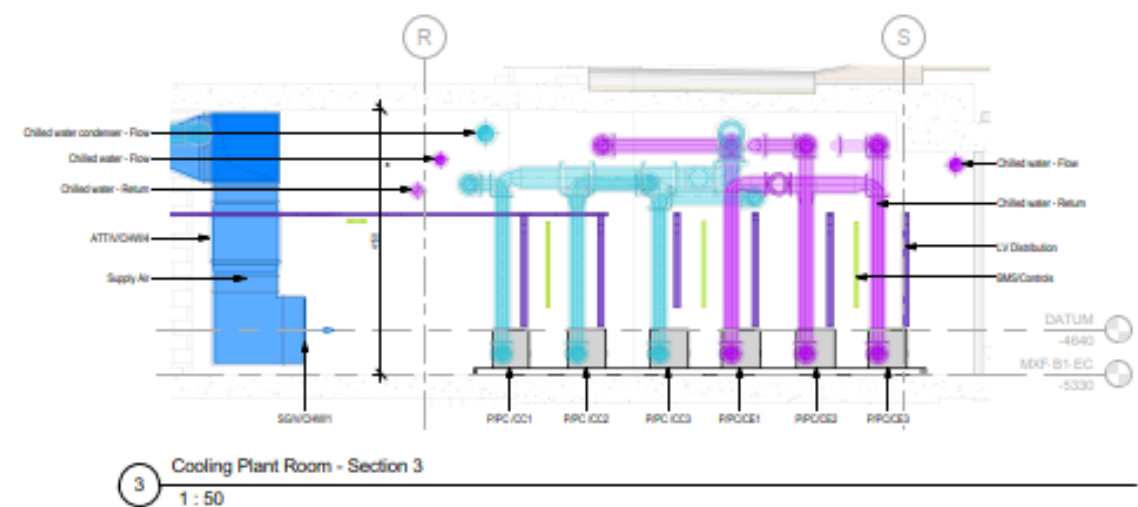
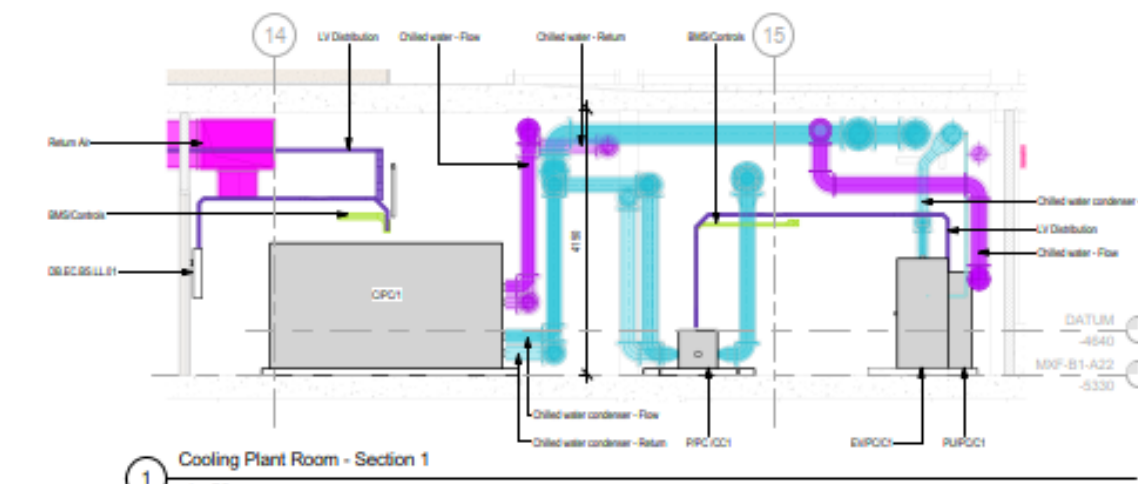
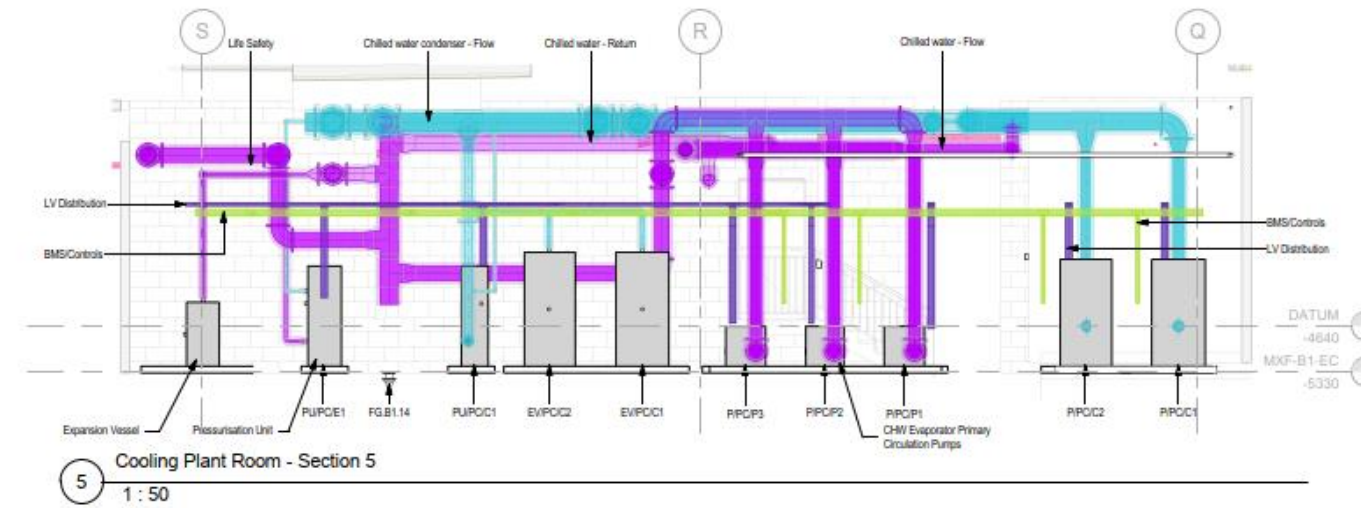
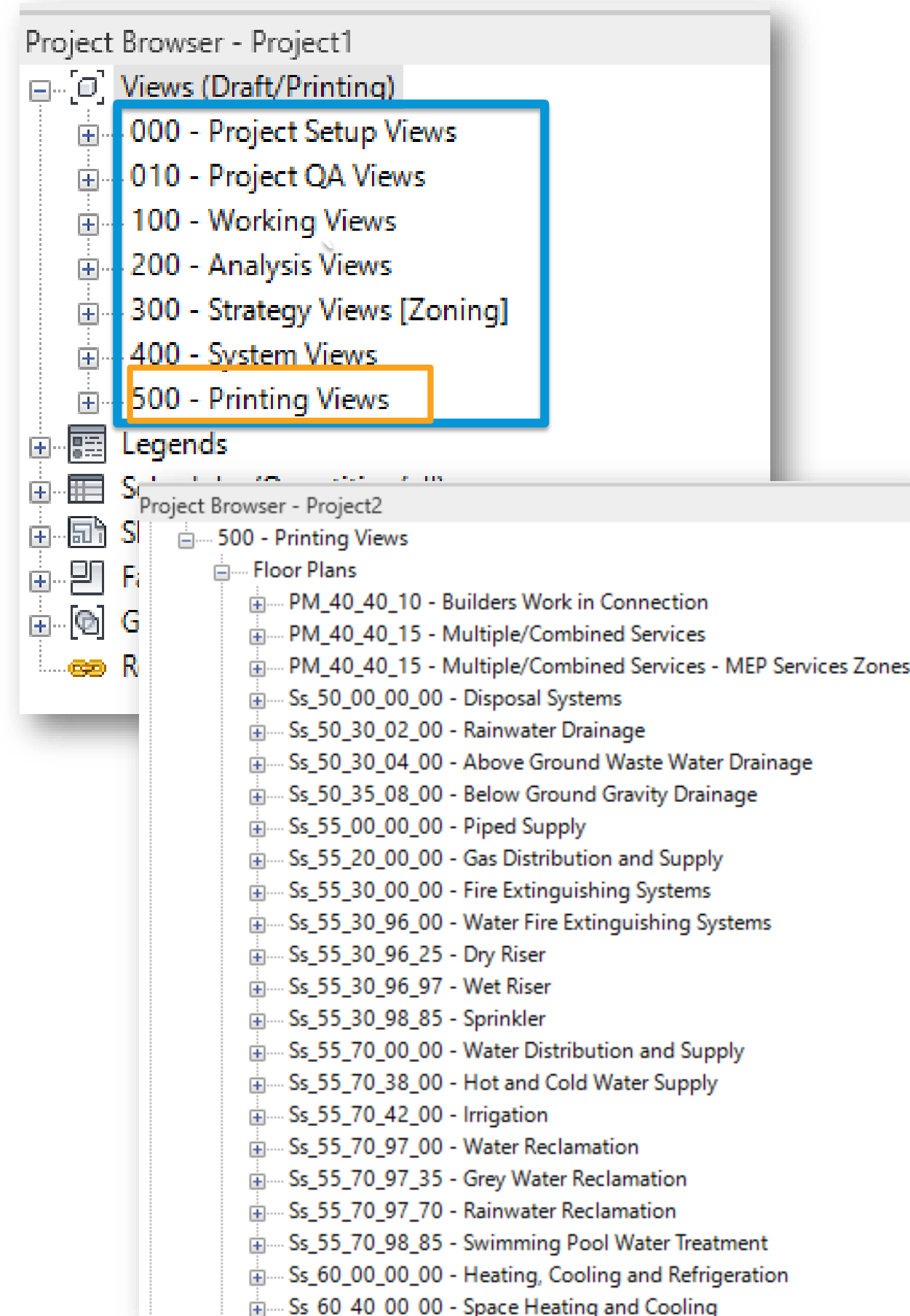
- ✓ Consistent and high quality output
- ✓ BIM compliant
- ✓ Easy to use
- ✓ More efficient

Content Development – Project Template



Project Browser organization

Content Development – Project Template



Project Browser organization

Content Development – Project Template

View group number	-	View type	-	Output	-	Role and discipline code	-	Classification Number	-	Classification Description
000		Ex <i>Export/Setup</i>		2DP <i>2D plan</i>		PXX Public Health		Uniclass 2015		Uniclass 2015
000		Fx <i>Fix</i>		2DS <i>2D Section</i>		MXX Mechanical				
010		QA <i>Quality Check</i>		3DV <i>3D View</i>		EXX Electrical				
100		Wo <i>Working</i>		SCH <i>Schematics</i>		JXX Combined Services				
200		An <i>Analysis</i>								
300		St <i>Strategy</i>								
400		Sy <i>System</i>								
500		Pr <i>Printing</i>								

View Templates

View templates

Discipline filter:

<all>

View type filter:

<all>

Names:

500 - Pr - 2DP - E10 - Ss_70_10_00_00 - Electricity Power Generation
500 - Pr - 2DP - E20 - Ss_75_30_25_25 - Earthing and Bonding
500 - Pr - 2DP - E21 - Ss_70_30_35_35 - High Voltage Distribution
500 - Pr - 2DP - E22 - Ss_70_30_45_45 - Low Voltage Distribution
500 - Pr - 2DP - E23 - Ss_70_30_80_00 - Small Power
500 - Pr - 2DP - E30 - Ss_70_80_00_00 - Lighting
500 - Pr - 2DP - E31 - Ss_70_80_25_00 - External Lighting
500 - Pr - 2DP - E32 - Ss_70_80_33_00 - General Space Lighting
500 - Pr - 2DP - E33 - Ss_70_80_33_12 - Central Battery Supplied Emergency Lighting
500 - Pr - 2DP - E40 - Ss_75_00_00_00 - Communications, Security, Safety, Control and Protection
500 - Pr - 2DP - E50 - Ss_75_10_00_00 - Communication
500 - Pr - 2DP - E51 - Ss_75_10_21_00 - Data Distribution and Telecommunications
500 - Pr - 2DP - E52 - Ss_75_10_68_00 - Public Communication
500 - Pr - 2DP - E53 - Ss_75_10_70_00 - Radio and Television Distribution
500 - Pr - 2DP - E60 - Ss_75_40_00_00 - Security
500 - Pr - 2DP - E61 - Ss_75_40_02_00 - Access Control
500 - Pr - 2DP - E62 - Ss_75_40_53_86 - Surveillance Systems
500 - Pr - 2DP - E63 - Ss_75_40_75_40 - Intruder Detection & Alarm
500 - Pr - 2DP - E70 - Ss_75_50_11_00 - Call and Alarm
500 - Pr - 2DP - E71 - Ss_75_50_28_29 - Fire Detection and Alarm
500 - Pr - 2DP - E72 - Ss_75_50_45_45 - Lightning Protection
500 - Pr - 2DP - E80 - Ss_75_70_54_00 - Metering, Monitoring and Management

500 - Pr - 2DP - M20 - Ss_65_40_00_00 - Ventilation

View
Group
Number

View
Type

Output

Discipline

Uniclass 2015
Classification
Number

Uniclass 2015
Classification
Description

Content Development – Project Template

NOTES

1. This drawing is to be read in conjunction with all other Max Fordham LLP drawings, specifications and schedules.
2. This drawing should be printed in colour.
3. Refer to the architects and structural engineers information for additional details.
4. This drawing should be printed in colour.
5. All components installed within the domestic water service installation are to be WRAS approved suitable for use on a potable water system and be in accordance with the requirements of the local water company.
6. Sanitaryware specified by others.
7. Not all valves are shown on the layouts. Valves only shown where they need to be coordinated with the locations of accessible ceilings.
8. All external pipework to be trace heated to protect it from freezing.

KEY

- CAT 5 Irrigation
- Domestic Boosted Cold Water
- Domestic Hot Water Flow
- Domestic Hot Water Return
- Mains Cold Water
- Pool Filtration - Flow
- Pool Filtration - Return
- Fire Protection - Deluge
- Fire Protection - Deluge
- Fire Protection - Sprinklers
- Fire Protection - Wet Riser
- Fuel
- Gas
- Harvesting - Grey Water
- Harvesting - Rainwater
- FA From Above
- TB To Below
- Pipework at Low Level
- Pipework at High Level

NOTES

1. This drawing shows the design intent and is to be completed by the Fire alarm specialist to the satisfaction of the Fire Officer.
2. Fire alarm system to be compliant with BS EN 54, BS 5839-1 & BS 9999. Refer to Fire Engineers information for system grading and additional information.
3. All electrical works are to be designed installed and tested to BS 7671 : 2018 (18th Edition of the Wiring Regulations).
4. Combined detectors / sounders / beacons are to be used wherever possible.
5. All fire alarm cabling is to be FP200 gold in dedicated closed trunking.
6. General setting out of all fire alarm components and ancillary items to be by the Architect.

KEY

- Aspirator
- Beam Detector - Receiver
- Beam Detector - Transmitter
- Carbon Dioxide Detector
- Concealed Area Smoke Detector
- Door Lock or Hold Open Device
- Fire Alarm Interface
- Fire Alarm Panel
- Fire Alarm Repeater Panel
- Fireman's Switch
- Flashing Beacon
- Flashing Beacon & Sounder
- Heat & Beacon Alarm
- Heat Detector
- Heat Sounder & Beacon Alarm
- Heat Sounder and Detector
- Manual Call Point
- Smoke & Beacon Alarm
- Smoke Detector
- Smoke Sounder & Beacon Alarm
- Smoke Sounder & Detector
- Sounder Alarm

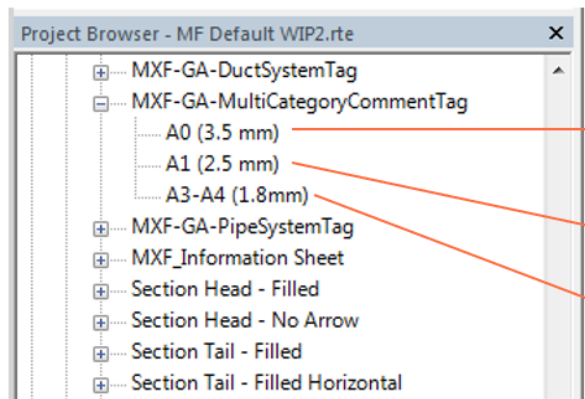
KEY

- Chilled Water Flow (CHW F)
- Chilled Water Return (CHW R)
- Low Temperature Hot Water Flow (LTHW F)
- Low Temperature Hot Water Return (LTHW R)
- Pipework at Low Level
- Pipework at High Level
- Under Floor Heating zone
- F/A From Above
- T/B To Below
- F+R Flow and Return
- RAD.xx Radiator
- AHU.xx Air handling unit
- ASHP.xx Air source heat pump
- BV.xx Buffer vessel
- CH.xx Chiller

Line Styles

Line Styles

Category	Line Weight	Line Color	Line Pattern
	Projection		
SCH_E00_Panel/DB De...	1	RGB 128-128-128	Solid
SCH_E00_Standard Su...	3	Black	Solid
SCH_E00_Telecom	3	RGB 189-189-126	Solid
SCH_E00_Vertical Busbar	6	Black	Dash dot
SCH_J30_Arch/Struct	1	RGB 128-128-128	Dash
SCH_J30_BMS/Control	1	RGB 192-192-192	Dash 1
SCH_M00_Chilled Wat...	3	RGB 191-000-255	Solid
SCH_M00_Chilled Wat...	3	RGB 191-000-255	Dash
SCH_M00_Ground Ioo...	3	RGB 128-064-064	Solid
SCH_M00_Ground Ioo...	3	RGB 128-064-064	Dash
SCH_M00_LTHW Flow	3	RGB 255-117-056	Solid
SCH_M00_LTHW Return	3	RGB 255-117-056	Dash
SCH_M00_VRF	3	Cyan	Solid
SCH_M20_Exhaust Air	3	RGB 040-186-143	Solid
SCH_M20_Fresh Air	3	RGB 000-255-127	Solid
SCH_M20_Kitchen Extr...	3	Magenta	Solid
SCH_M20_Kitchen Sup...	3	RGB 000-127-255	Solid
SCH_M20_Return Air	3	Magenta	Solid
SCH_M20_Smoke Extr...	3	RGB 242-040-071	Solid
SCH_M20_Smoke Air	3	RGB 000-127-255	Solid



WC Intake

WC Intake

WC Intake

Project Browser - Project4

Views (Draft/Printing)

Legends

MXF Conventions - Text

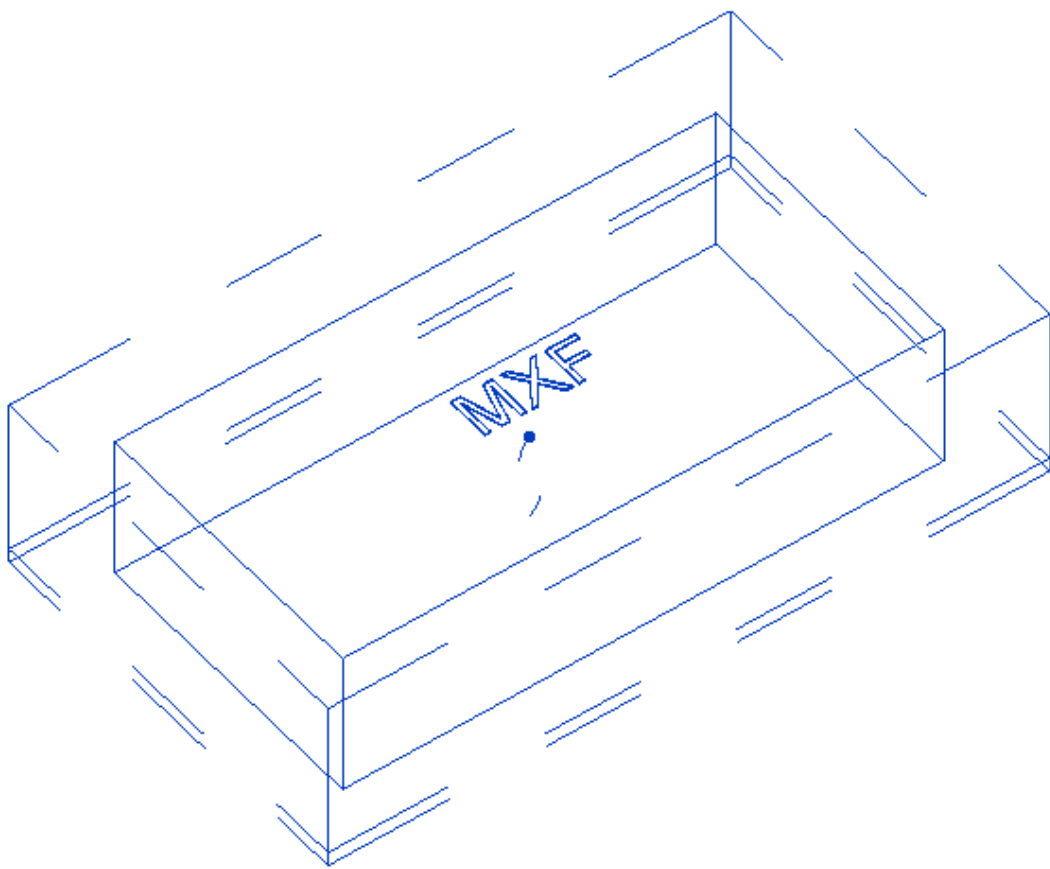
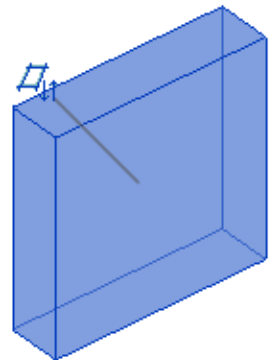
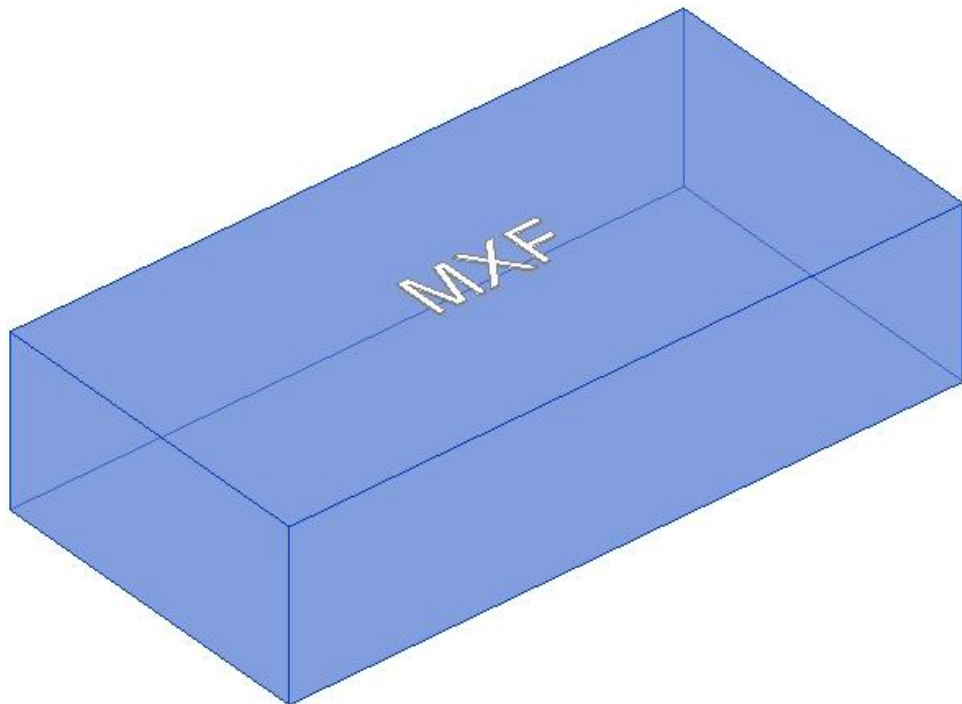
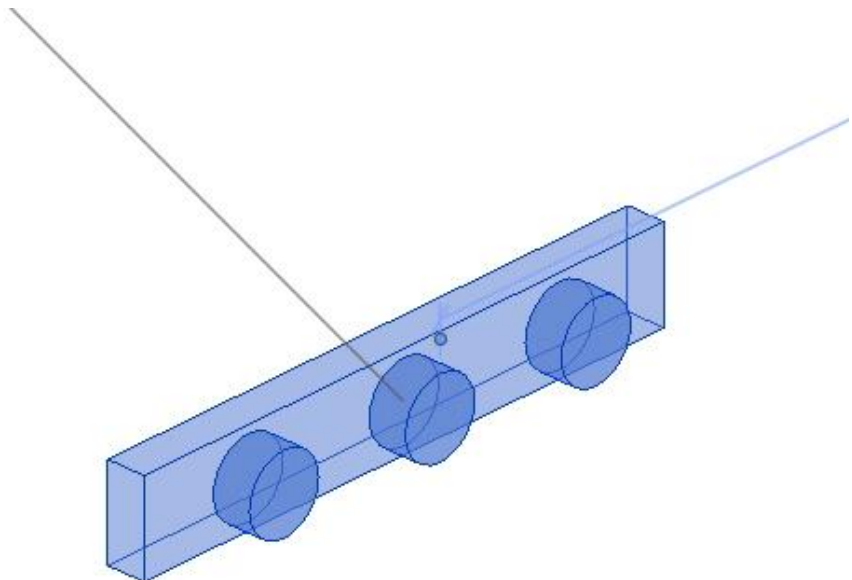
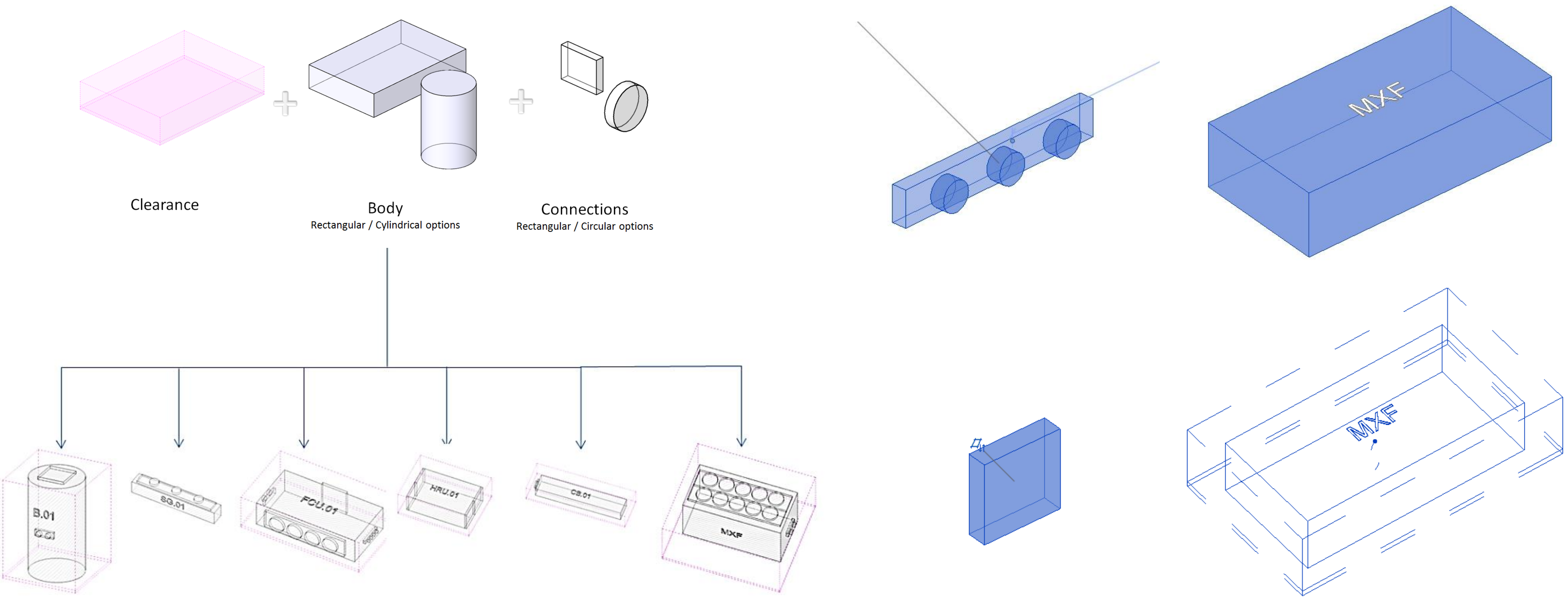
- Above Ground Drainage @1/100
- BWIC @1/100
- Call and Alarm @1/100
- CCTV, Security @1/100
- Combined Services @1/100
- Comms Security Access Control CCTV @1/100
- Earthing and Bonding @1/100
- Electrical LV Distribution @1/100
- External Lighting @1/100
- Fire Detection and Alarm @1/100
- General LV Power @1/100
- Lighting @1/100
- Lightning Protection @1/100
- PA Sound and Amplification @1/100
- Piped Supply @1/100
- PV @1/100
- Space Heating and Cooling @1/100
- Ventilation @1/100
- Water/Gas - Pipework @1/100
- Water/Gas @1/100

All the text in the project shall be restricted to the following sizes:

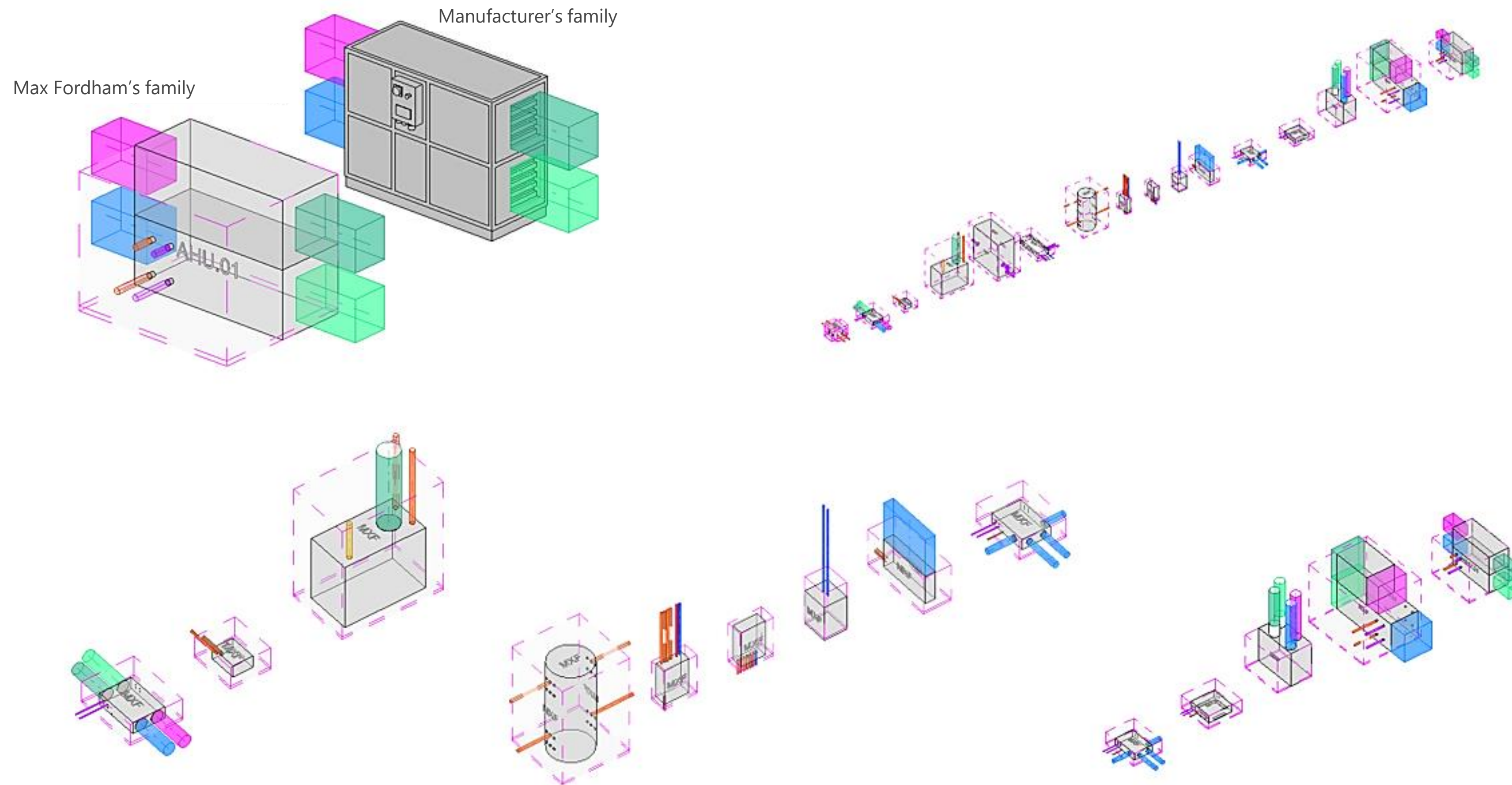
- THIS IS AN EXAMPLE TEXT
1.8 mm
- THIS IS AN EXAMPLE TEXT
2.5 mm
- THIS IS AN EXAMPLE TEXT
3.5 mm
- THIS IS AN EXAMPLE TEXT
5.0 mm
- THIS IS AN EXAMPLE TEXT
7.0 mm

Legends and Annotations

Content Development – Families

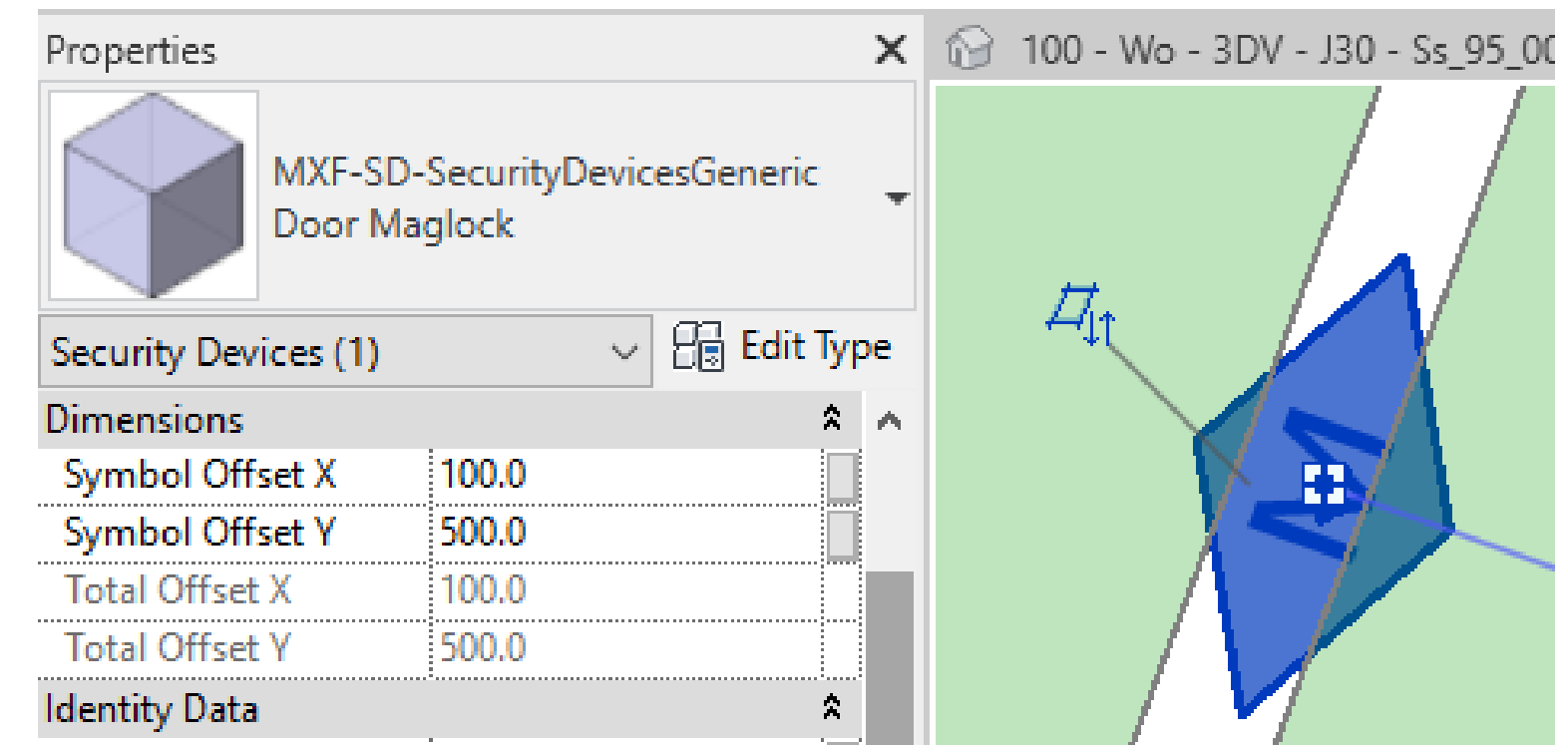
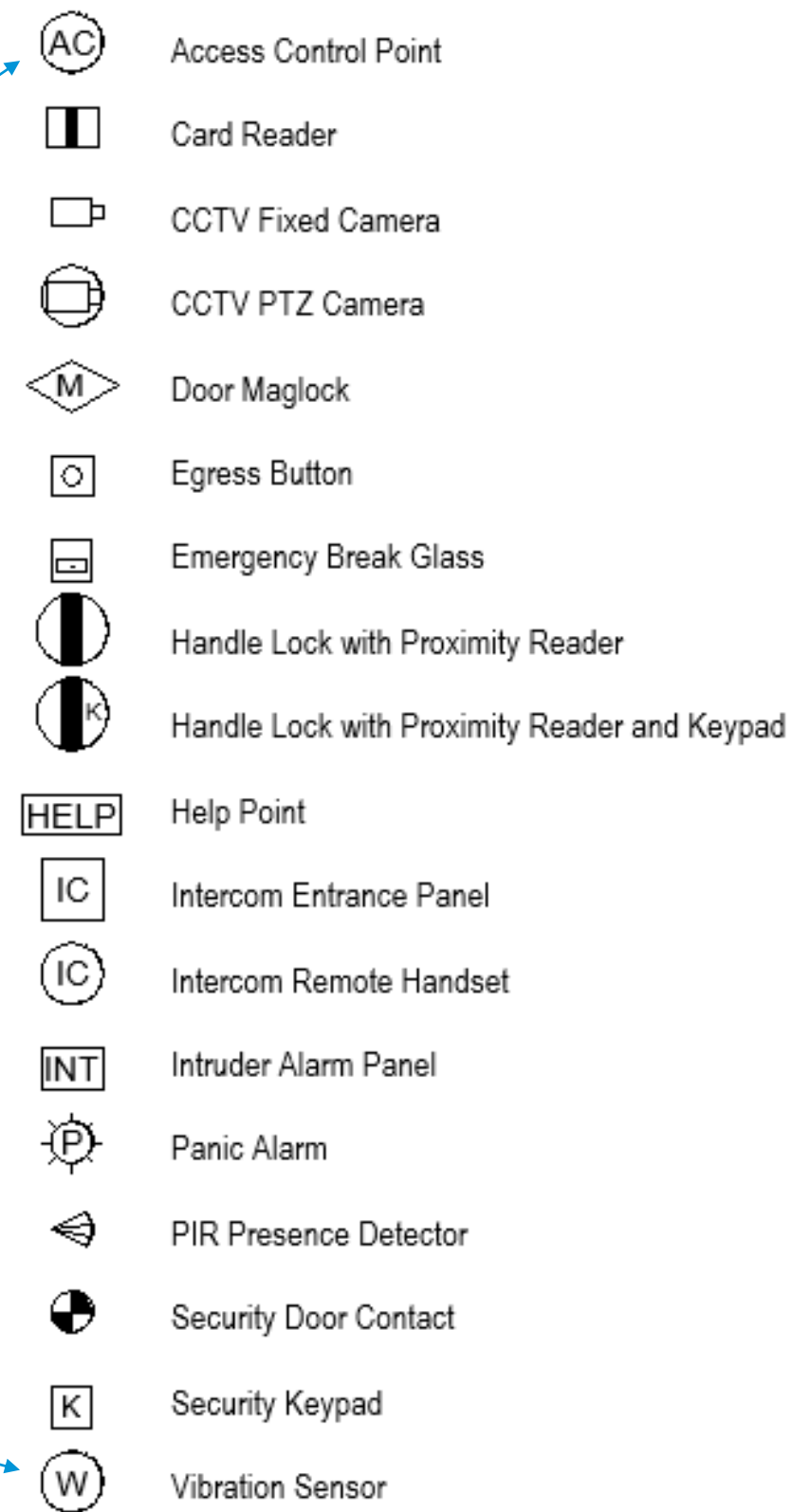
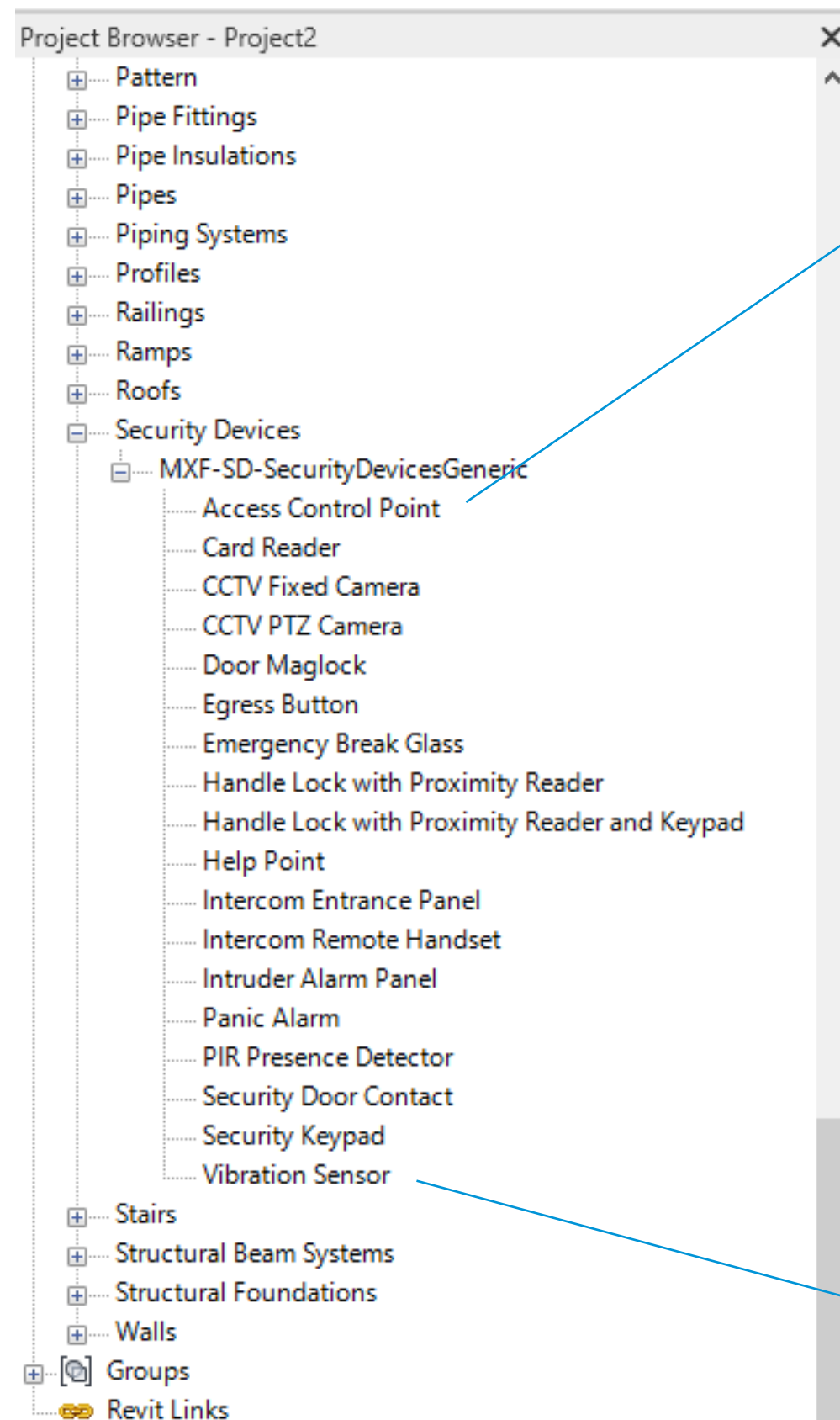


Content Development – Families



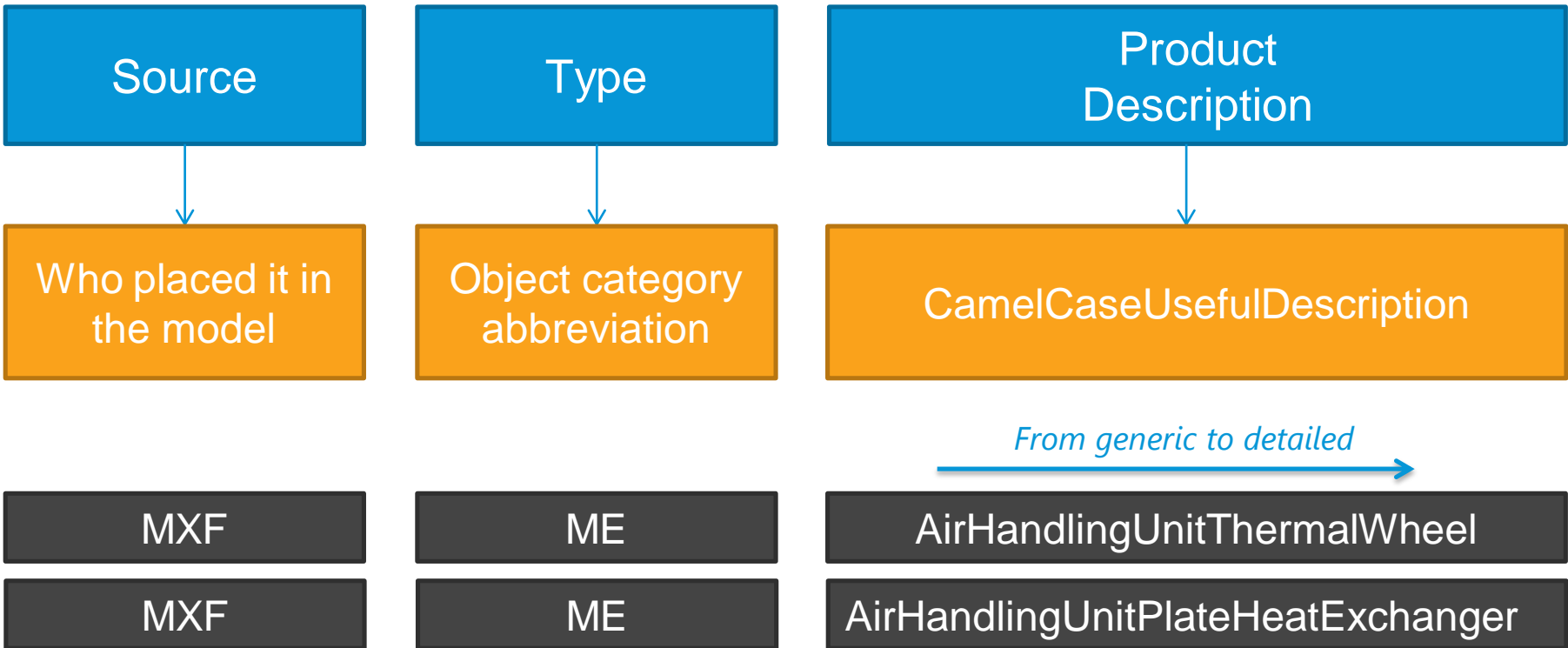
Family Library

Content Development – Families



Family Template

Content Development – Families



- Name
- MXF-ME-ActiveChilledBeam.rfa
 - MXF-ME-AHUPlateHeatExchanger.rfa
 - MXF-ME-AHUSupplySingleCompartment.rfa
 - MXF-ME-AHUThermalWheel.rfa
 - MXF-ME-AHUTopConnections.rfa
 - MXF-ME-AirCooledCondenserUnit.rfa
 - MXF-ME-AirFilterCircularConnections.rfa
 - MXF-ME-AirFilterRectangularConnections.rfa
 - MXF-ME-AirSeparator.rfa
 - MXF-ME-BallcockValveSet.rfa
 - MXF-ME-Boiler.rfa
 - MXF-ME-BoosterSet.rfa
 - MXF-ME-BufferVessel.rfa
 - MXF-ME-ChillerAirCooled.rfa
 - MXF-ME-ChillerWaterCooledLongSideConnec
 - MXF-ME-ChillerWaterCooledShortSideConnec
 - MXF-ME-CombinedHeat&PowerModule.rfa
 - MXF-ME-CoolingCoilDuctMounted.rfa

Search in the Family Library

water

☐ MXF-GA-MixedWater.rfa

☐ MXF-DIS-P20_MixedWaterOutlet.rfa

☐ MXF-ME-ChillerWaterCooledLongSideConnections.rfa

☐ MXF-DIS-P20_SinkHot&ColdWaterTapManual.rfa

☐ MXF-GA-ColdWater.rfa

☐ MXF-ME-ManifoldHotWater6ways.rfa

☐ MXF-DIS-P20_HotWaterOutlet.rfa

☐ MXF-ME-DoubleFeedIndirectHotWaterStorageCylinder.rfa

☐ MXF-DIS-P20_DomesticHotWaterCalorifier.rfa

☐ MXF-ME-ElectricInstantaneousWaterHeater.rfa

☐ MXF-DIS-P20_WaterFilter.rfa

☐ MXF-DIS-M00_WaterSoftener.rfa

Check

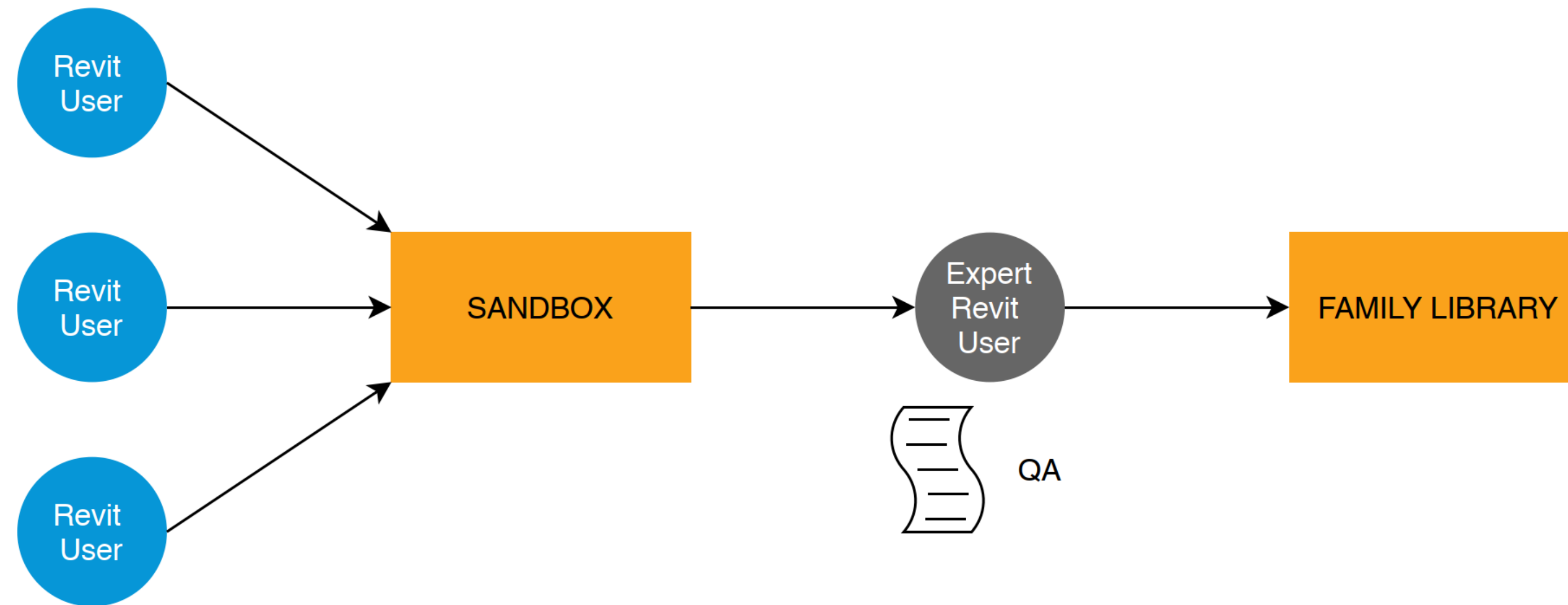
Uncheck

Toggle

Copy family in Project Families folder

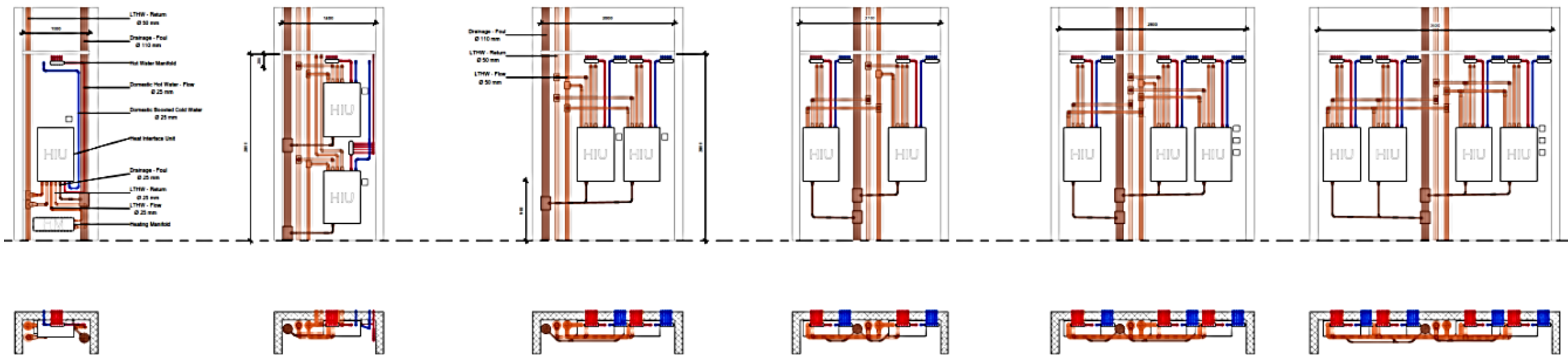
Naming Conventions

Content Development – Families

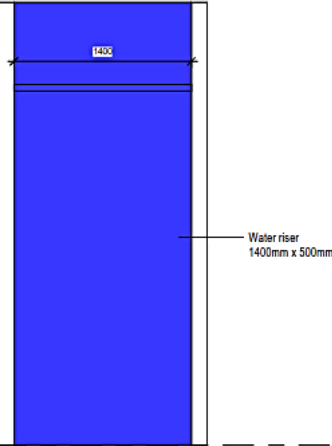


QA process

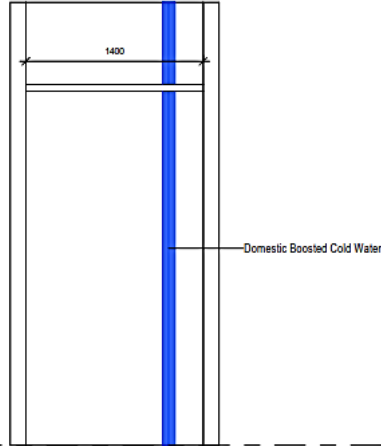
Content Development – Families



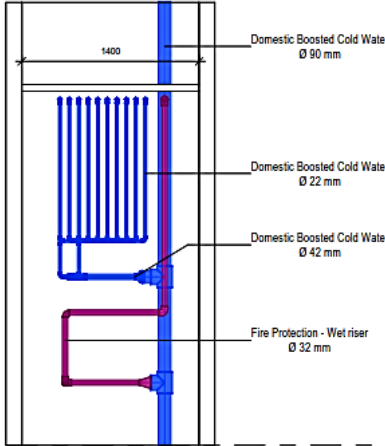
Stage 2
Concept Design



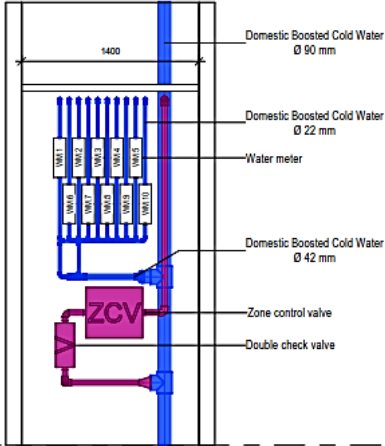
Stage 3
Spatial Coordination



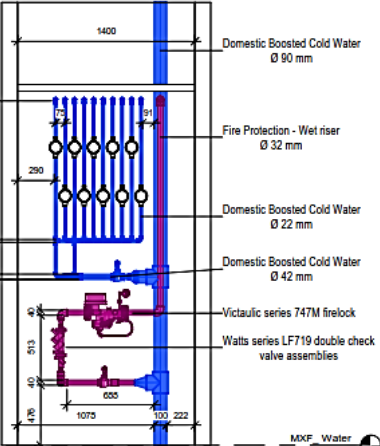
Stage 4a
Technical Design



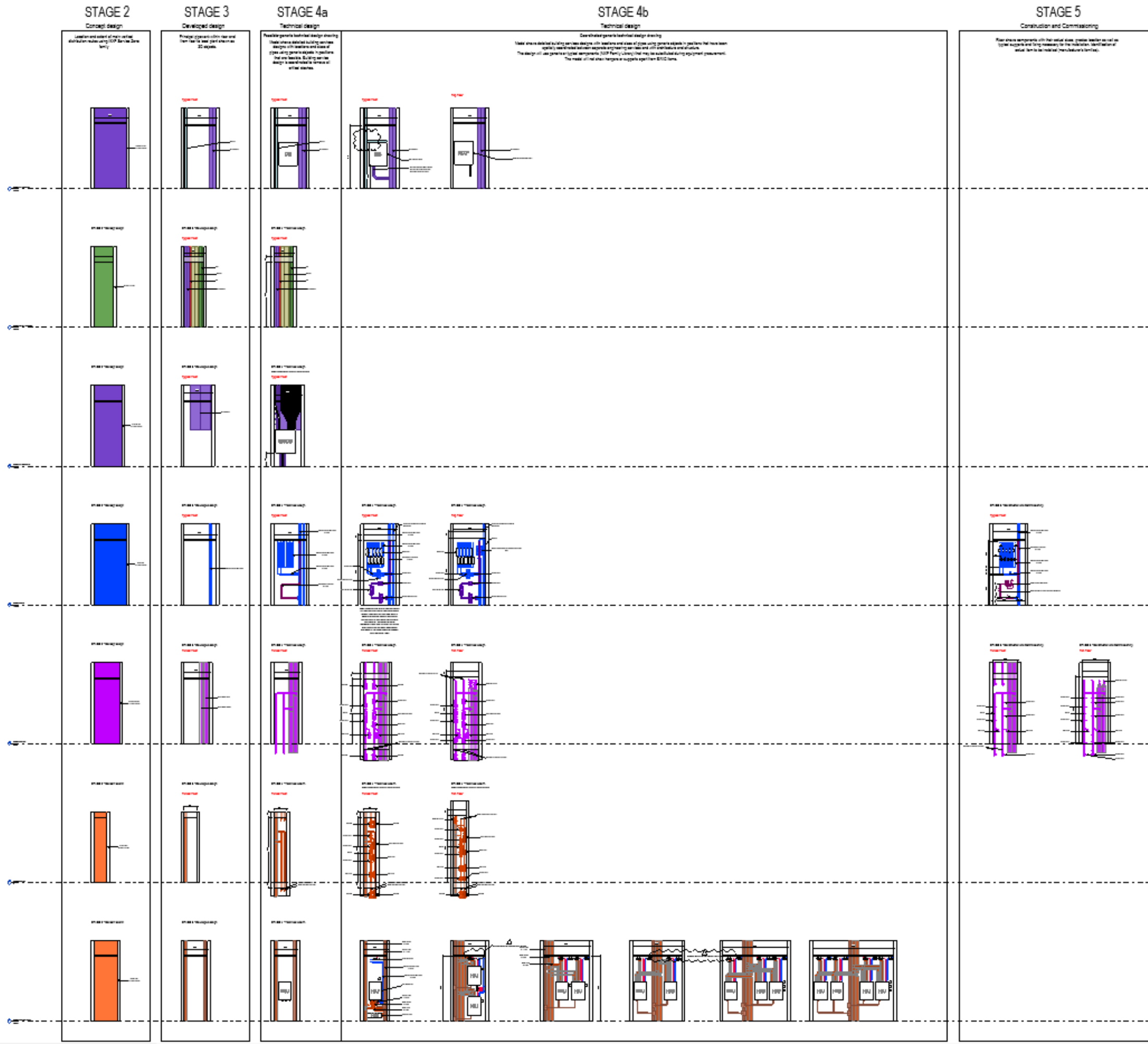
Stage 4b/c
Technical Design



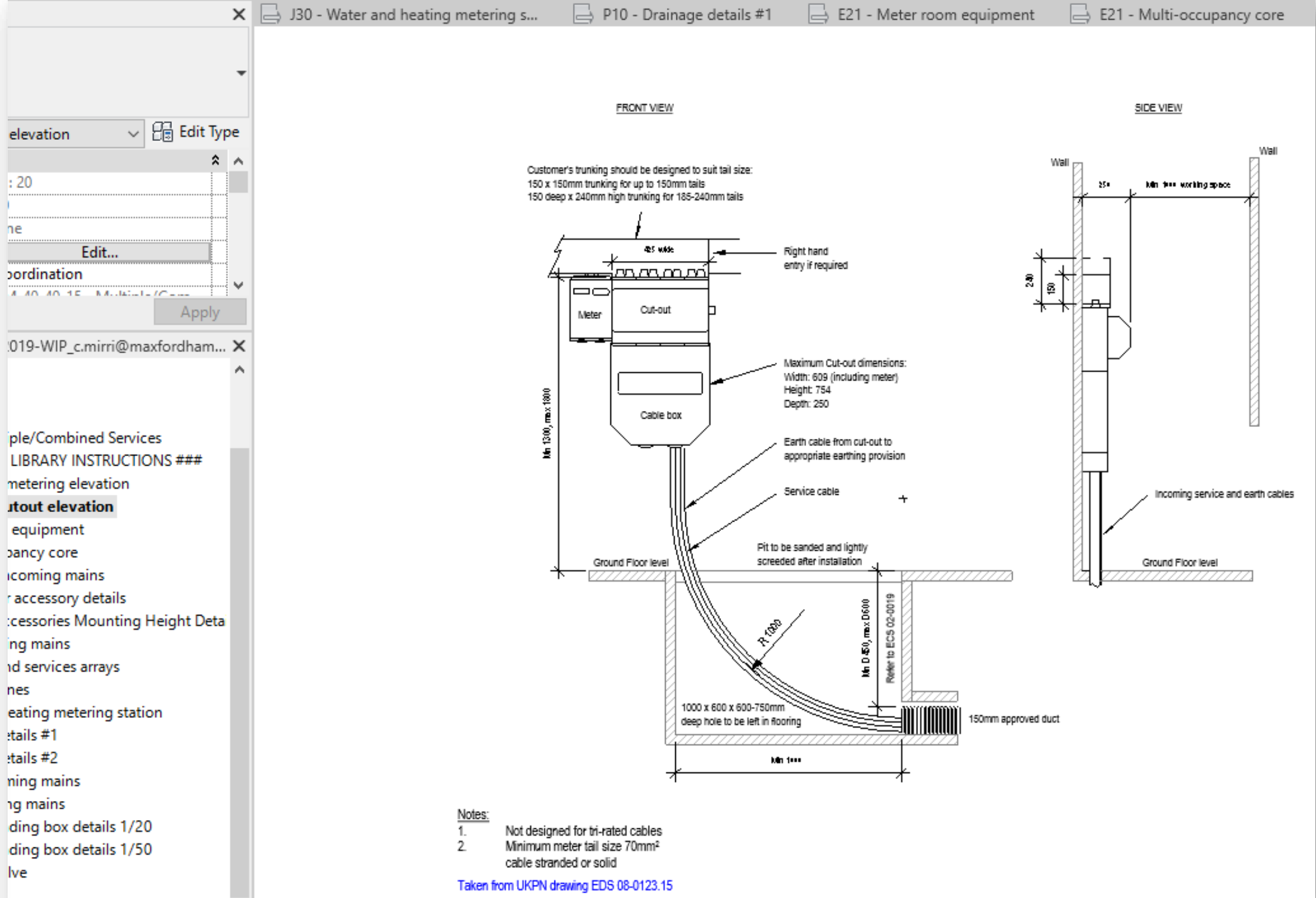
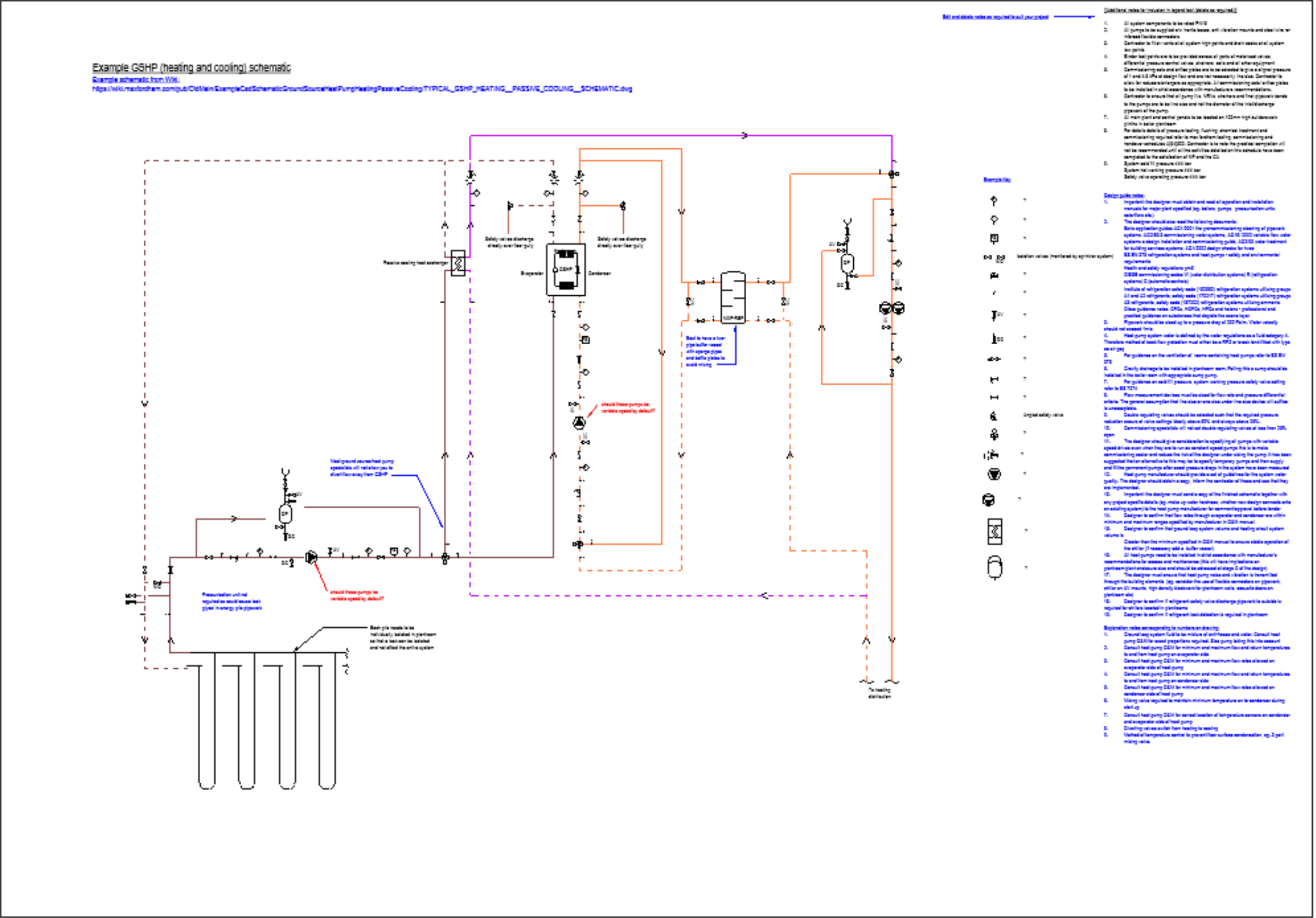
Stage 5
Manufacturing and Construction



3D Typical Arrangements



Content Development – Families



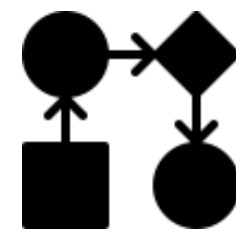
2D Typical Arrangements

Workflow Development



CONTENT

- Project Template
- Families



WORKFLOWS

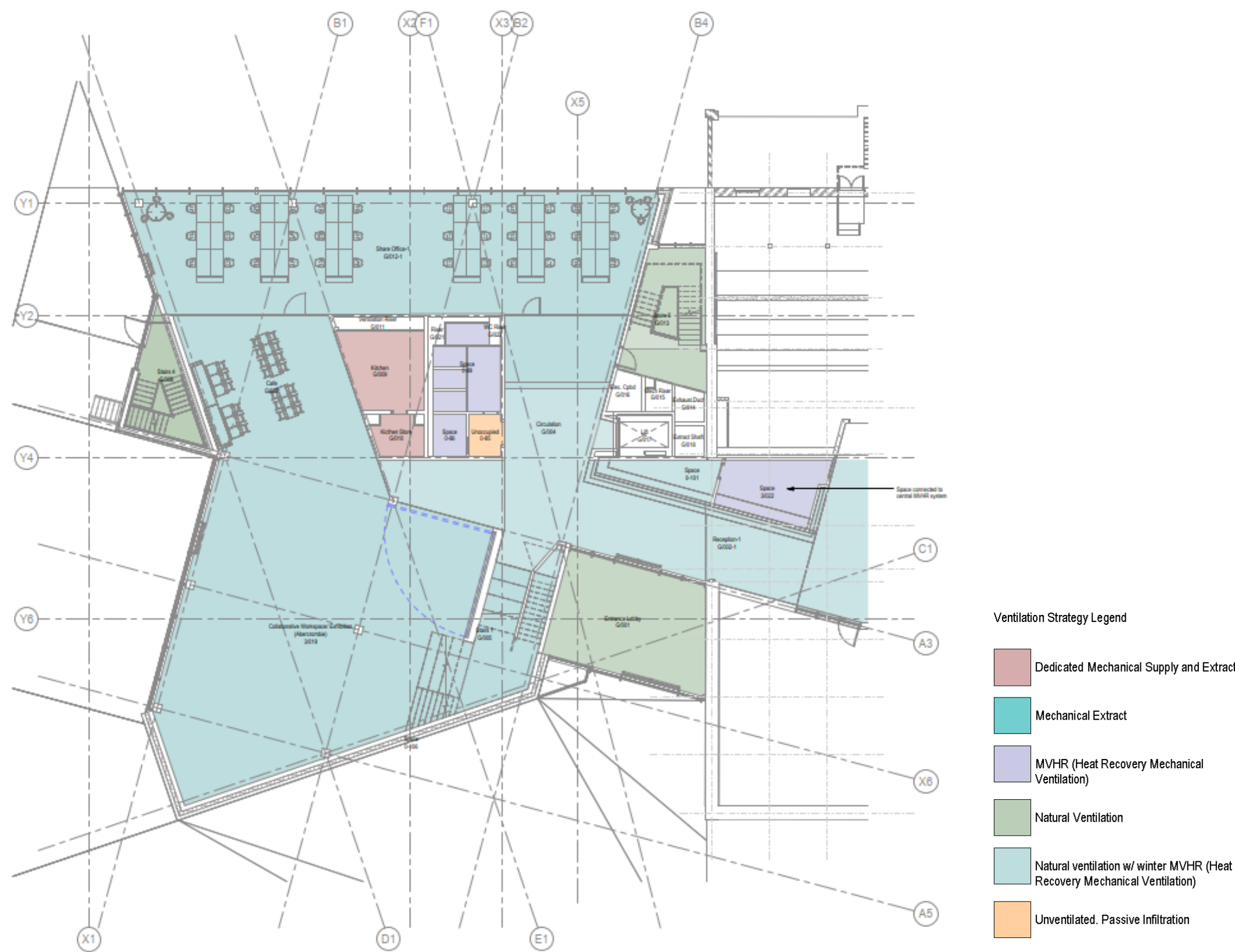
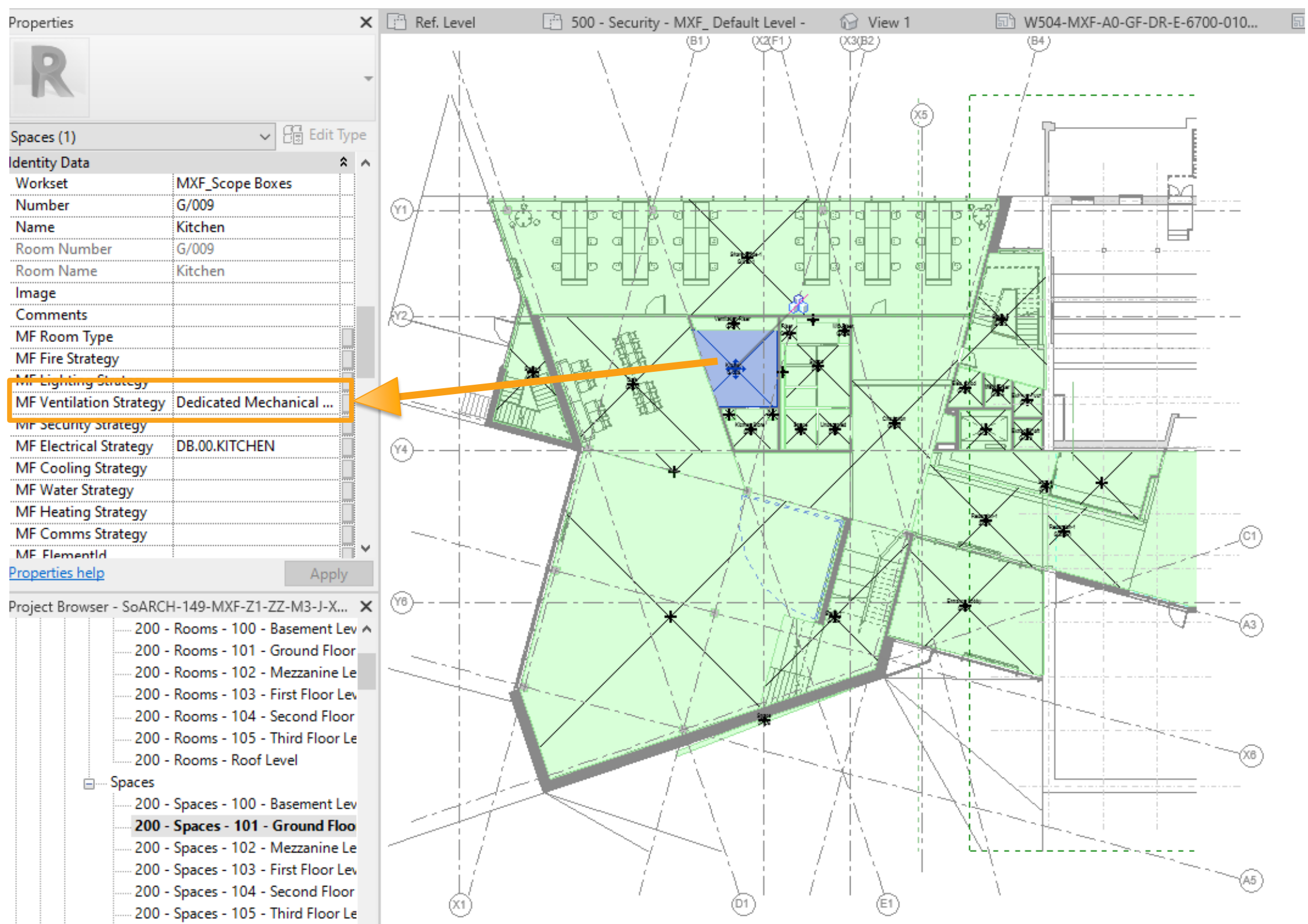
- Early stage drawings
 - Schematics (or One Line Diagrams)
 - Health and safety information
 - Schedules
 - Clash detection
 - Model QA
-
- ✓ Consistent and quality output
 - ✓ Simpler for less experienced Revit users
 - ✓ More efficient
 - ✓ BIM compliant



TOOLS

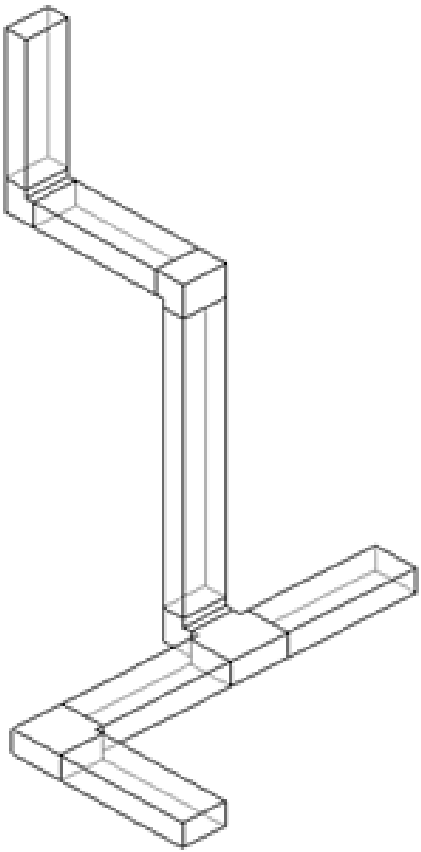
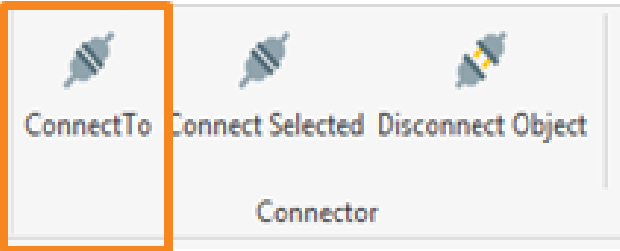
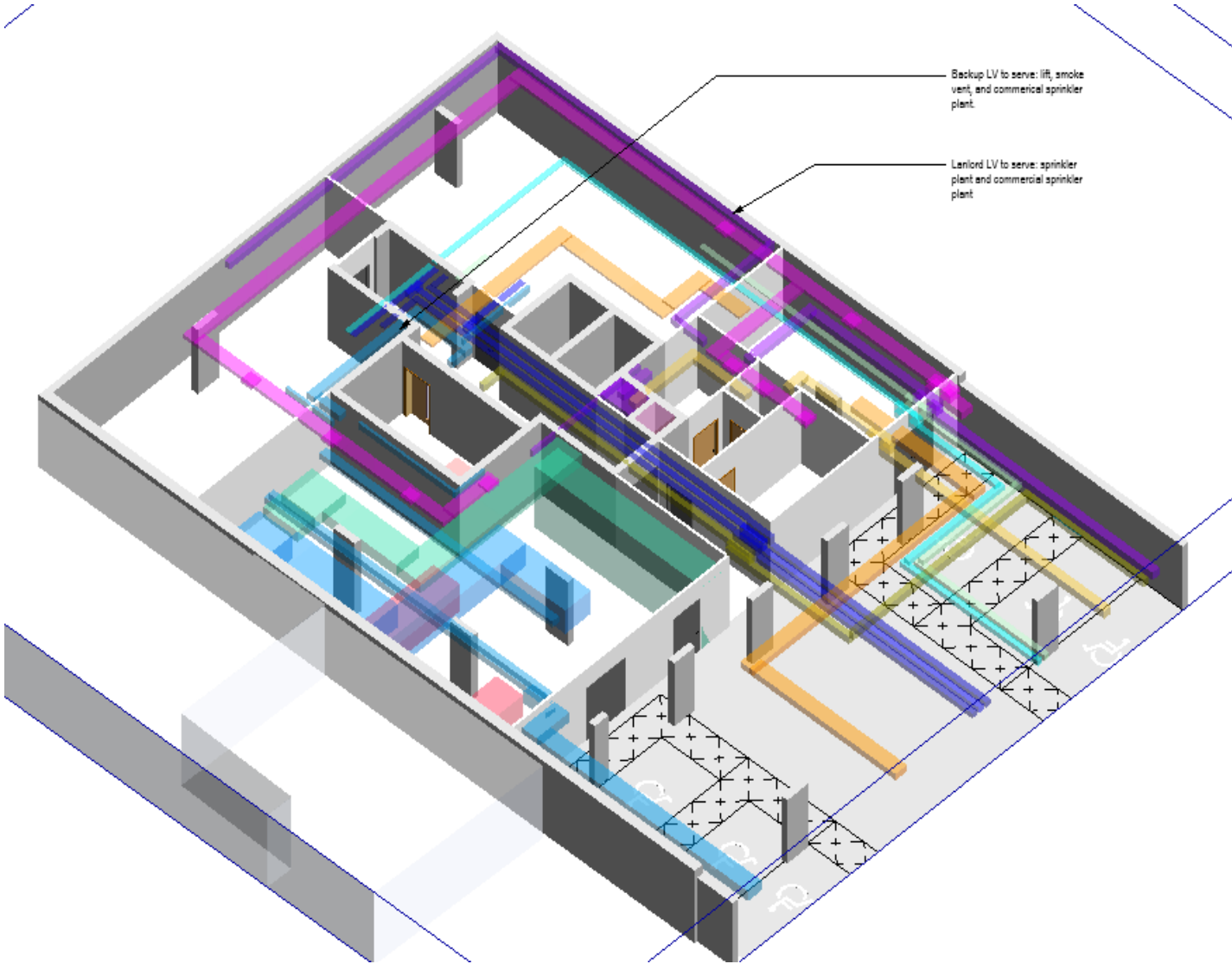
- Third party tools
- Dynamo
- pyRevit

Workflow Development

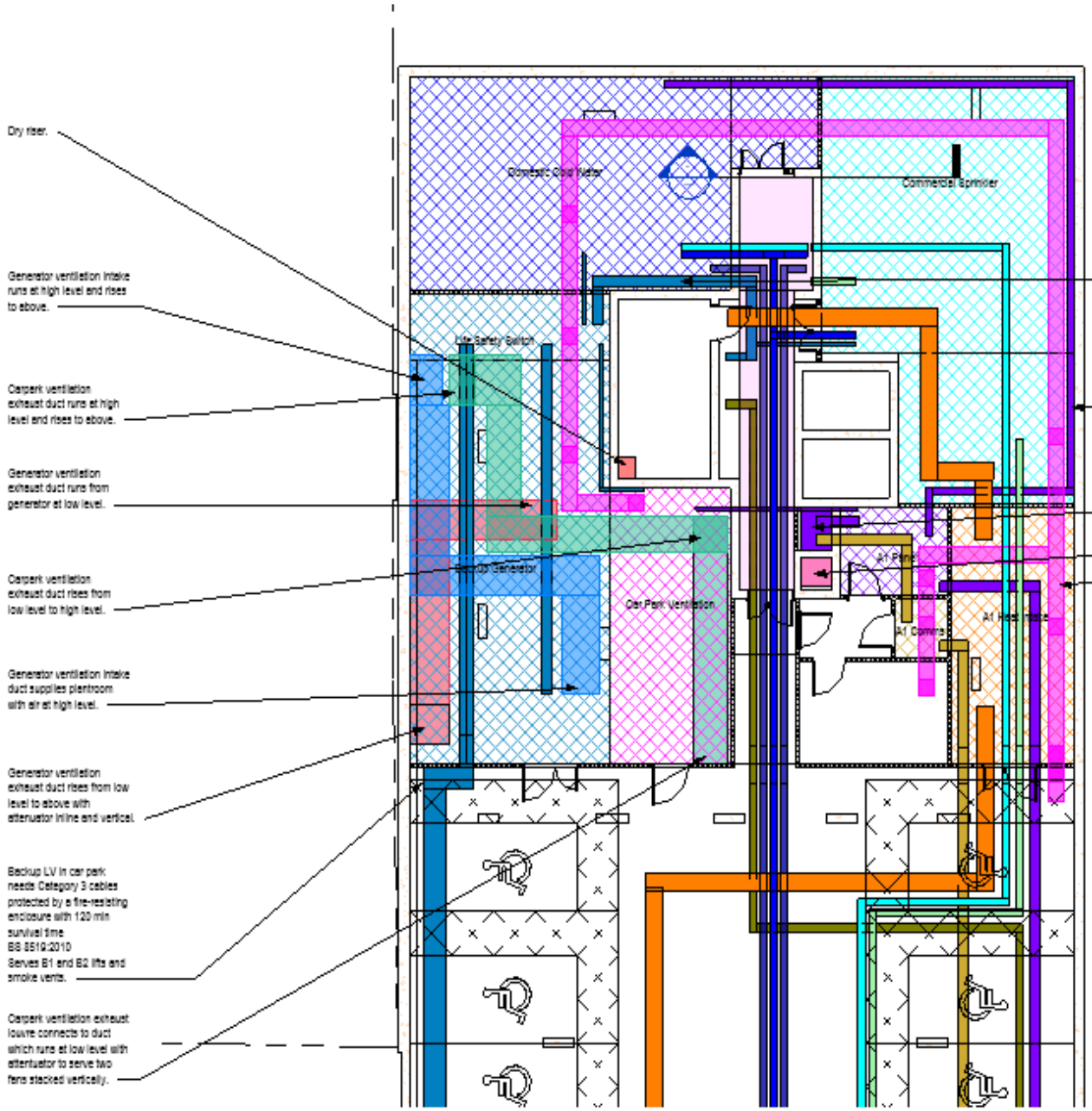


Strategy Drawings

Workflow Development

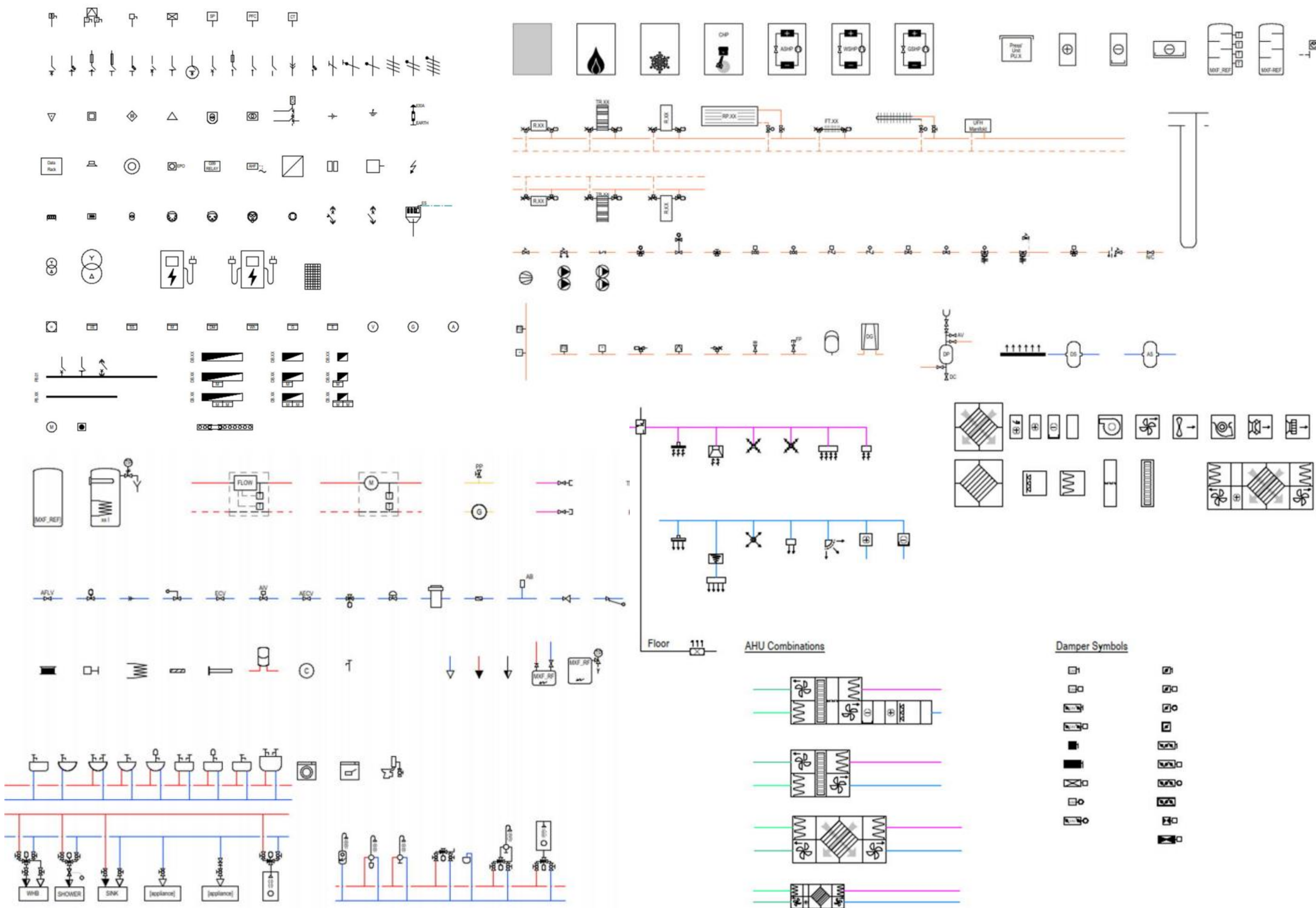
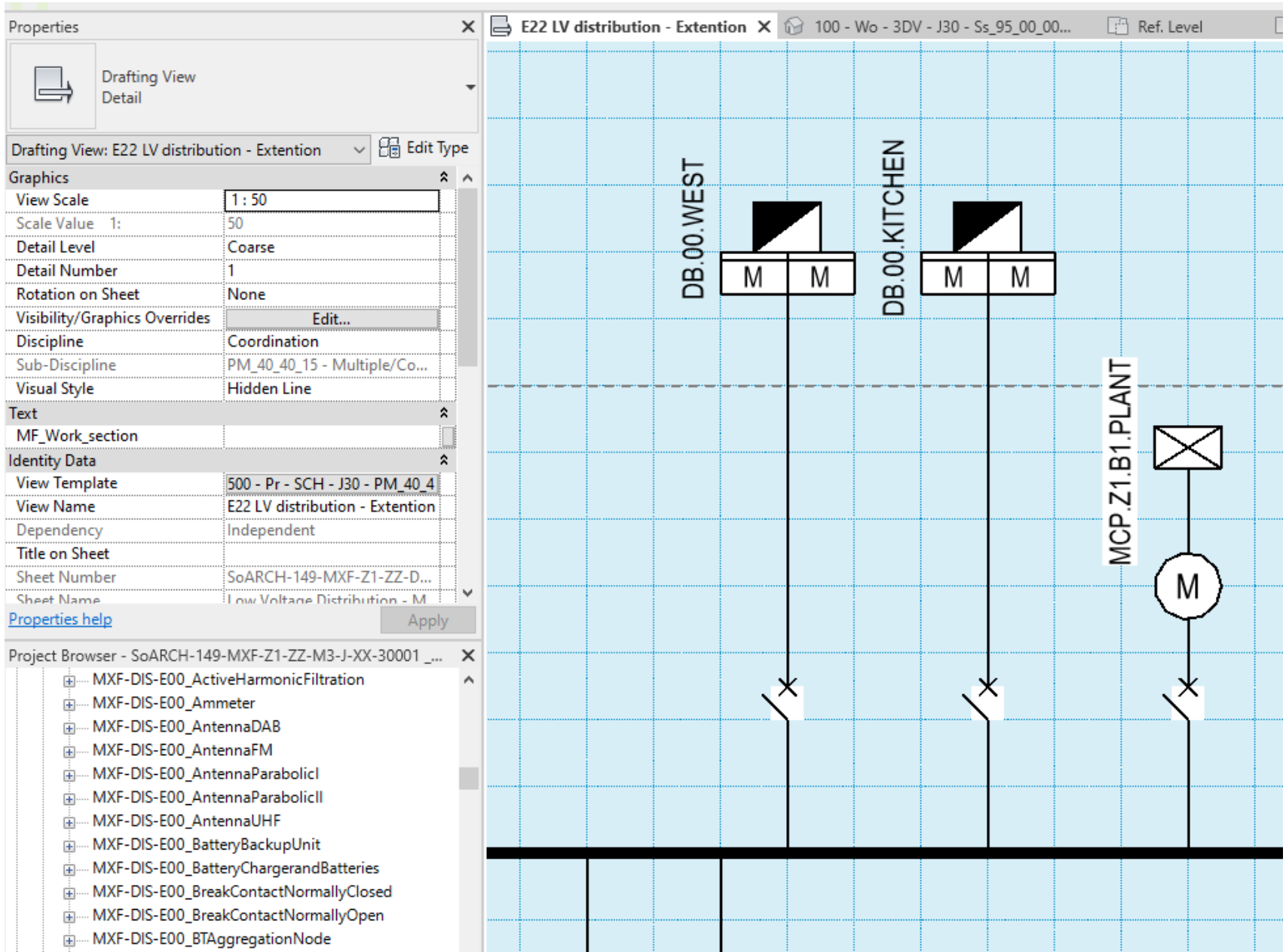


- MXF-GM-ServiceZoneCornerHorizontal
- MXF-GM-ServiceZoneCornerVerticalBottom
- MXF-GM-ServiceZoneCornerVerticalTop
- MXF-GM-ServiceZoneStraightHorizontal
- MXF-GM-ServiceZoneStraightVertical
- MXF-GM-ServiceZoneTeeHorizontal
- MXF-GM-ServiceZoneTeeVertical



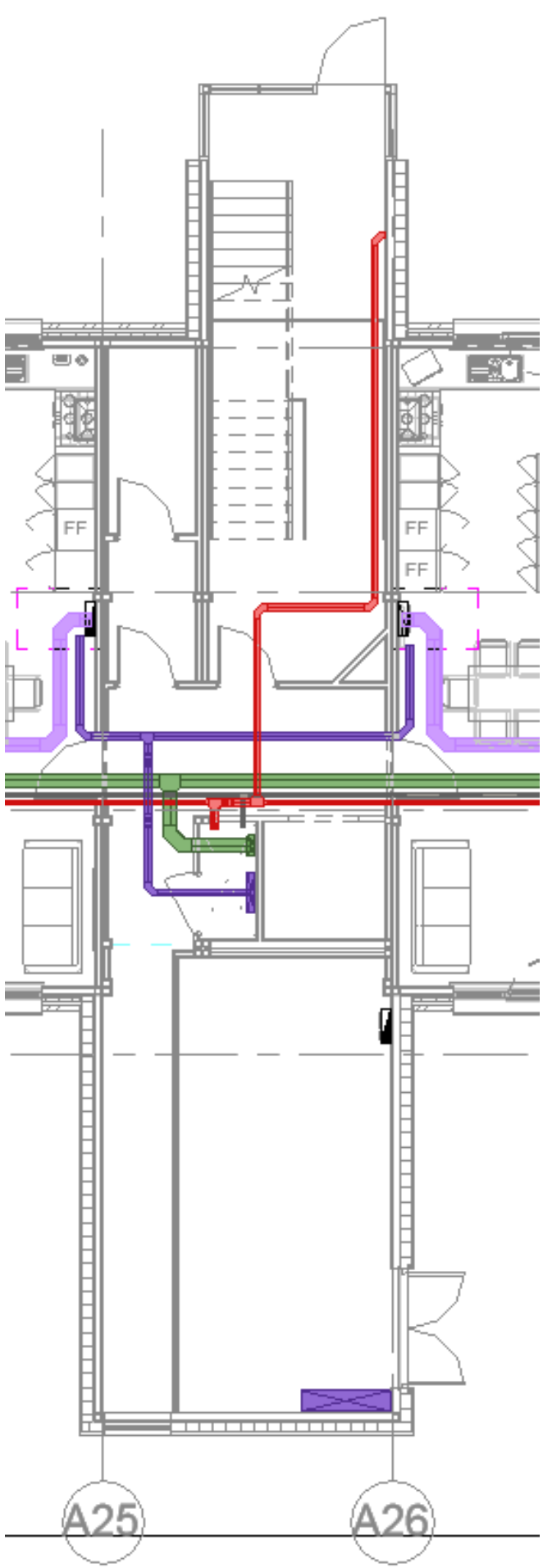
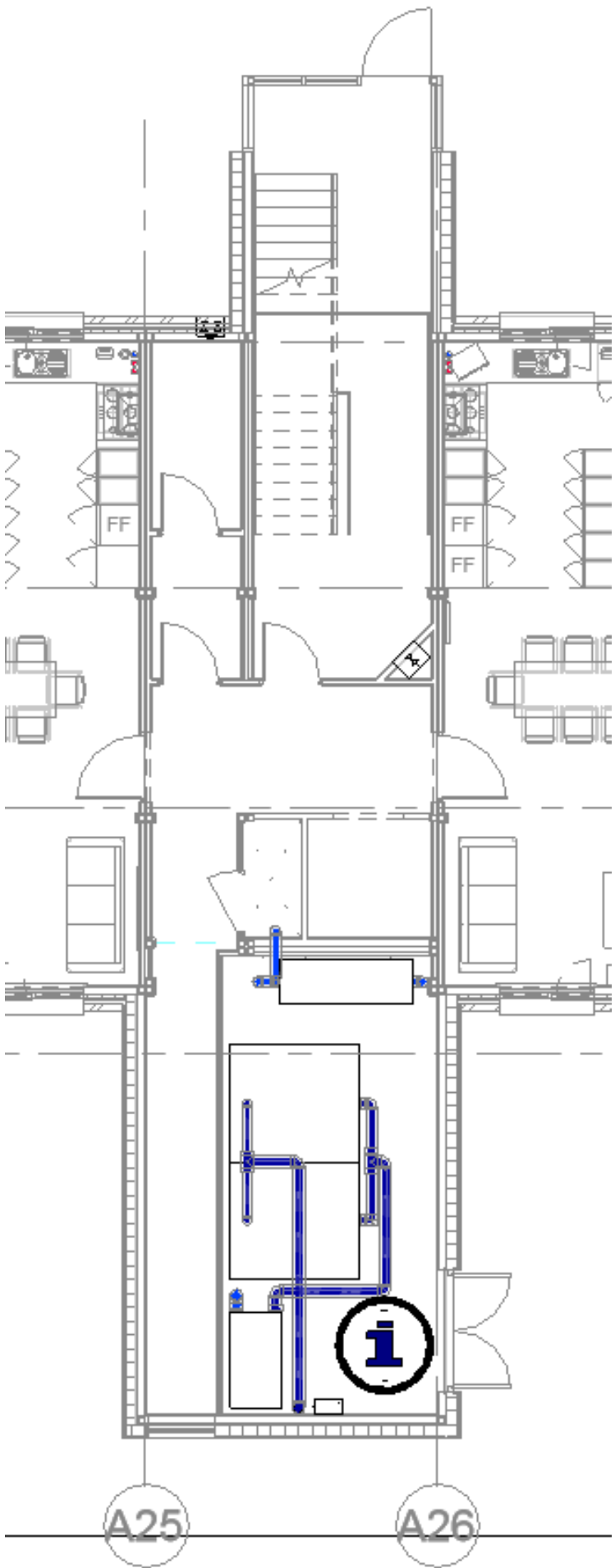
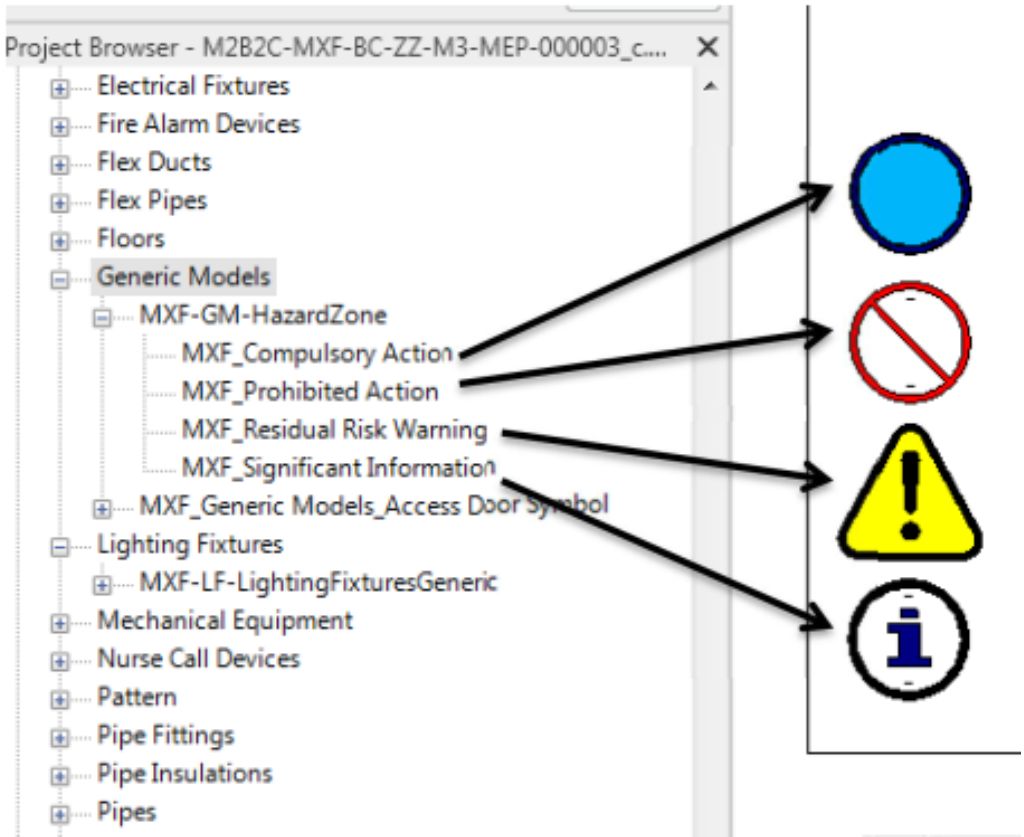
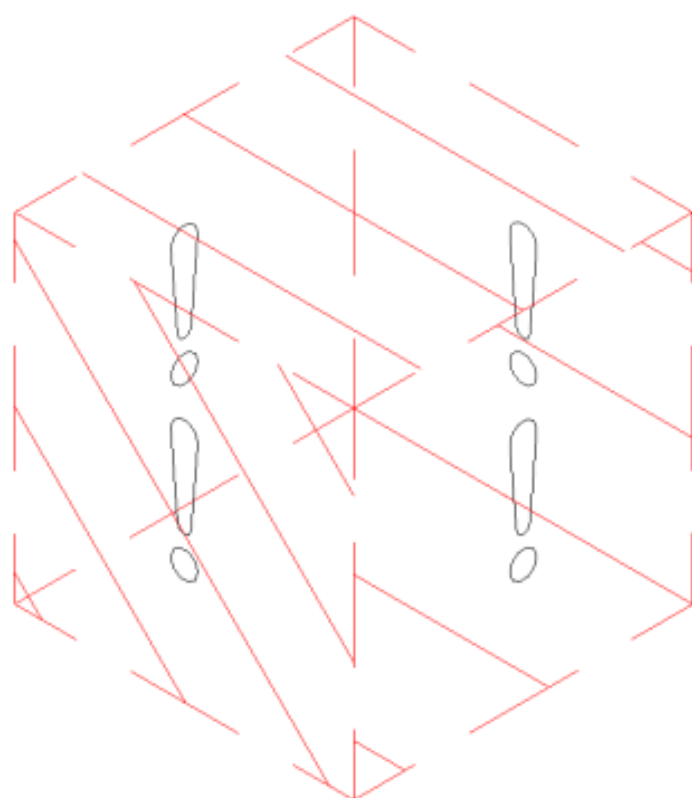
MEP service zones

Workflow Development



Schematics

Workflow Development



<000 - PM_80_60_70 - Residual Risk Schedule>								
Notes: 1.This schedule includes information about aspects of the services work covered under this contract that may affect the health and safety of persons involved in the construction, operation, maintenance or demolition of the work, or affected by it. It is provided in accordance with the Construction (Design and Management) Regulations 2015. 2.The possible actions are broadly indicative and are for general guidance. The relevant contractor shall inform the Principal Contractor of the general approach and specific action he/she intends to take to deal with each health and safety matter identified. Where the specific action proposed involves further design work, the relevant contractor shall also inform the Principal Designer. 3.This schedule should be read in conjunction with the Hazard/Access/Maintenance notes on drawings, and all other contract documents. 4.This schedule is only intended to highlight significant risks associated with the design that are i) not likely to be obvious to a competent contractor, ii) unusual, or iii) likely to be difficult to manage effectively. Contractors, or persons carrying out the works, are expected to identify and assess all other risks associated with the work.								
A	B	C	D	E	F	G	H	I
Type	Mar	Mark	Level	Space Name	Hazard Description	Hazard Category	Target Group	Responsible Party
Compulsory Action								
CA	CA01	ZA_LGF_Lower	Car Park Plantroom	Flooding to car park.	Electricity	Car park operator, public	Isolate power prior to flooding event.	Car park operator
CA	CA02	ZA_LGF_Lower	LOWER GROUND PARKING - CO	Exposed gas pipework at high level	Harmful substances	Contractor, car park operator, public	Install to IGEN UP2 including natural ventilation and welded joints. Isolate and inert gas fill, for tenant to	Contractor
CA	CA03	ZG_GF_Ground		Remote connection to Fire Alarm	Fire	Student accommodation operators	Fire alarm in Energy Centre and Student Refuse to be linked to B6 main building fire alarm system, as t	Contractor
CA	CA04	ZG_GF_Ground		Remote connection to Fire Alarm	Fire	Commercial operator	Fire alarm in Commercial Refuse and Covered Service Yard to be linked to B6 Management Suite whic	Contractor
Residual Risk Warning								
RRW	RRW06	ZA_RD_Road_D		Unconfirmed flow and pressure to new hydrant co	Fire	Fire fighters, operators, occupants	Schedule flow and pressure test with Water authority and for approval of fire officer.	
Significant Information								
SI	SI01	ZH_03_Thir	Flo	Corridor	Soil vents to atmosphere would be too close to ope	Disease and Health	Occupants	Use of air admittance valves at top of risers at grids B12 and C12
SI	SI02	ZH_03_Thir	Flo	Corridor	Soil vents to atmosphere would be too close to ope	Disease and Health	Occupants	Use of air admittance valves at top of risers at grids T12 and U12
SI	SI03	ZA_LGF_Lower	LOWER GROUND PARKING - CO	Electric Vehicle Charging Point. Potential to flood.	Electricity	Car park operator, public	Charging point to rear wall, where they are mounted high. Isolator at high level to allow isolation prior t	Contractor
SI	SI04	B6_GF_Ground	RETAIL C10	No fire strategy yet in place for phased occupation	Fire	Commercial Tenant, Student Accomodatio	Fire Engineer advises: The commercial units and the resi have independent escape. Their alarms do n	Client
SI	SI05	B6_GF_Ground	RETAIL C11	No fire strategy yet in place for phased occupation	Fire	Commercial Tenant, Student Accomodatio	Fire Engineer advises: The commercial units and the resi have independent escape. Their alarms do n	Client
SI	SI06	B6_GF_Ground	RETAIL C12	No fire strategy yet in place for phased occupation	Fire	Commercial Tenant, Student Accomodatio	Fire Engineer advises: The commercial units and the resi have independent escape. Their alarms do n	Client

Health and Safety Information

Workflow Development

Template Category	Pumps			
Template Version	v1			
Category Description	Devices for moving fluid to serve (or serving) a building services system			
Classification System				
Classification	Value			
Suitability for Use	Approved			
Template Custodian	CIBSE			
Information Category	Parameter Name	Value	Units	Notes
Manufacturer Data				
Specifications	Manufacturer		Text	
Specifications	Manufacturer Website		URL	
Specifications	Product Range		Text	
Specifications	Product Model Number		Text	or code
Specifications	CE Approval		Text	number, yes, no
Specifications	Approvals		Text	e.g. WRAS number
Specifications	Product Literature		URL	
Specifications	Features		Text	Free text to describe product
Construction Data				
Specifications	Application		Text	e.g. LTHw, CHV, etc.
Specifications	Pump Type		Text	e.g. End Suction, Inline, Glandless, Vertical multistage etc.
Specifications	Configuration		Text	e.g. close coupled, long coupled, split coupled etc.
Specifications	Drive Type		Text	e.g. Direct, Belt, Integrated drive
Specifications	Casing Material		Text	e.g. cast iron, ductile iron, bronze etc.
Specifications	Impeller Material		Text	e.g. bronze, plastic etc.
Specifications	Shaft Material		Text	e.g. Stainless steel, brass etc.
Specifications	Shaft Seal Type		Text	e.g. carbon, silicon carbide etc.
Specifications	PN Rating		Text	e.g. as per ISO 7005
Specifications	Colour		Text	e.g. RAL Colour
Specifications	Finish		Text	e.g. polished, matt, gloss etc.
Specifications	Connection Type		Text	e.g. flanged, screwed etc.
Dimensional Data				
Specifications	Impeller diameter		mm	to be a range, user input
Specifications	Number of Impellers		Number	
Specifications	Suction Connection diameter		mm	

Schedules

MAX FORDHAM PDT Import Tool

Select PDT files and Families:

Select PDT Files to ImportImport Parameters and Types into FamiliesExport to Pdt Spreadsheets

Select	Preview	PDT File	Family Files
Select Families	Preview Parameters	J:\V6246\Cad\Revit\MF Model\UserInput\Pdts\FanCoilUnits\Pr_70_65_03_29-FanCoilUnits.xlsx	
Select Families	Preview Parameters	J:\V6246\Cad\Revit\MF Model\UserInput\Pdts\CoolingPumps\Pr_65_53_86_15-Close-coupledInLinePumps.xlsx	
Select Families	Preview Parameters		

NBS BOS Shared Parameter File Path:Y:\Revit\Family Data\SP\NBS_BIMObjectStandardParameters_BOS2.0.0.txt

MF Shared Parameter File Path:Y:\Revit\Family Data\SP\MXF-NBS-PDT-SP.txt

PP	TECHNICALDATA	TECHNICALDATA	TECHNICALDATA
IDENTITYDATA	Hydraulic Performance Required Flow At The Guarantee Point	Expected Noise Levels At The Guarantee PointTBC DB A1M	Operating Speed At Maximum Flow offset and ida
TypeId 0903903	Hydraulic Performance Net Positive Inlet Pressure Available At The Guarantee Point	Hydraulic Performance Net Positive Inlet Pressure Available	Valves TBC
MF_ElementId 7004020	Mode Of Operation	Hydraulic Performance Overall Efficiency At The Minimum Flow	Valves Adjustable Response To Hydraulic Fluctuations
Spaces ["109-Lounge","1","(unresolved space)","1"]	Ancillary Connections Drain	Hydraulic Performance Inlet Pressure At The Guarantee Point	Unitisation TBC
Type Mark PP	Hydraulic Performance Differential Pressure At The Guarantee Point	Drive System Rating Of Hydraulic Power Unit	Operating Speed At Minimum Flow 1000 rpm
DESCRIPTION	Standard	Pump Unit Application LTHW System	Hydraulic Performance Required Flow Minimum
Manufacturer Grundfos	Valves Material Copper	Ancillary Connections Inlet And Outlet	Pump Body And Casing Material Aluminium
Reference PP01	Diaphragm Material TBC	Pressure Gauges	Valves Double Inlet And Outlet Valves TBC
Family MXF-AIE-Pump	Process Connection Details Inlet Connection	Drive System Type Of Mechanical Drive System	Operating Speed 1800 rpm
Model HYDRO E Multi	Valves Type Of Valve TBC	Drive System Type Of Drive System TBC	Process Connection Details Outlet Connection Nominal Bore TBC
Type Generic Pump	Process Connection Details Outlet Connection Flange Rating	Hydraulic Performance Outlet Pressure Minimum	Hydraulic Performance Overall Efficiency At The Maximum Flow
Description LTHW Pump	Ancillary Connections Vent	Hydraulic Performance Inlet Pressure Minimum	Process Connection Details Inlet Connection Nominal Bore TBC
Image	Process Connection Details	Drive System Adjustable Crank Stroke Facility	Durability TBC
Model Image	Hydraulic Performance Required Flow Maximum	Ancillary Connections Overall Efficiency	Hydraulic Performance Net Positive Inlet Pressure Available At The Maximum Flow TBC
	Hydraulic Performance Overall Efficiency At The Guarantee Point	Hydraulic Performance Outlet Pressure At The Guarantee Point	Valves Quick Release Covers TBC
	Operating Speed At The Guarantee Point	Diaphragm Failure Protection Facilities	Hydraulic Performance Outlet Pressure Maximum
	Hydraulic Performance Outlet Pressure At The Guarantee Point	System Name LTHW F 12.LTHW R 24	NOTES
	Process Connection Details Outlet Connection	Process Connection Details Inlet Connection Flange Rating	MF_Instance_Notes Positioned close to the wall-br />br />Care to be taken to allow access / maintenance
	Vibration Requirements	Isolation Mounting	MF_Type_Notes Multi Stage LTHW Pump
	Hydraulic Performance TBC		
	Drive System Method Of Oil Cooling		
	Hydraulic Performance Inlet Pressure Maximum		

Schedule Title: Pumps
Project Name: EDIT IN PROJECT INFORMATION*
Uniclass Product: Pr_65_53 Pump products

Uniclass System: Sr_60_40 Space heating and cooling systems

MAX FORDHAM

Workflow Development

The screenshot displays the Autodesk Navisworks Manage 2019 interface. The top ribbon includes tabs for Home, Viewpoint, Review, Animation, View, Output, Item Tools, BIM 360, and Render. The left sidebar contains the Selection Tree and Sets. The central 3D view shows a complex network of pipes and ducts. The right sidebar features a Clash Group table and an Interference Report. The bottom panel shows the Find Items search results.

Clash Group Table:

Clash Group	Categories	Element Links
1	Pipes, Pipes	6995376, 14299690
2	Pipes, Pipes, Pipes	8676703, 12105869, 13189174
3	Pipes, Pipes, Pipes	12105869, 14299690, 14299898
4	Pipes, Pipes, Pipes	13189174, 14299690, 14299898
5	Cable Trays, Cable Tray Fittings	13871180, 15852469
6	Pipes, Cable Trays	14299690, 15851308
7	Cable Trays, Cable Trays, Cable Tray Fittings	15852177, 15852560, 15852561
8	Cable Tray Fittings, Cable Tray Fittings	15852469, 16481425

Interference Report:

Group by: Category 1, Category :
Message

- Cable Tray Fittings
 - Cable Tray Fittings
 - MEP-Linked File Sprinkler system : Cable Tray Fittings : Ladder Horizontal Bend : Standard : id 15852469
 - MEP-Mechanical : Cable Tray Fittings : Ladder Horizontal Bend : Standard : id 16481425
- Cable Trays
 - Cable Tray Fittings
 - MEP-Electrical : Cable Trays : Cable Tray with Fittings : Ladder Cable Tray : id 15852177
 - MEP-Linked File Sprinkler system : Cable Tray Fittings : Ladder Vertical Inside Bend : Standard : id 15852561
 - Cable Tray Fittings
 - Cable Trays
- Pipes
 - Cable Trays
 - Pipes
 - Pipes
 - Pipes
 - Pipes
 - Pipes
 - Pipes

Find Items Search Results:

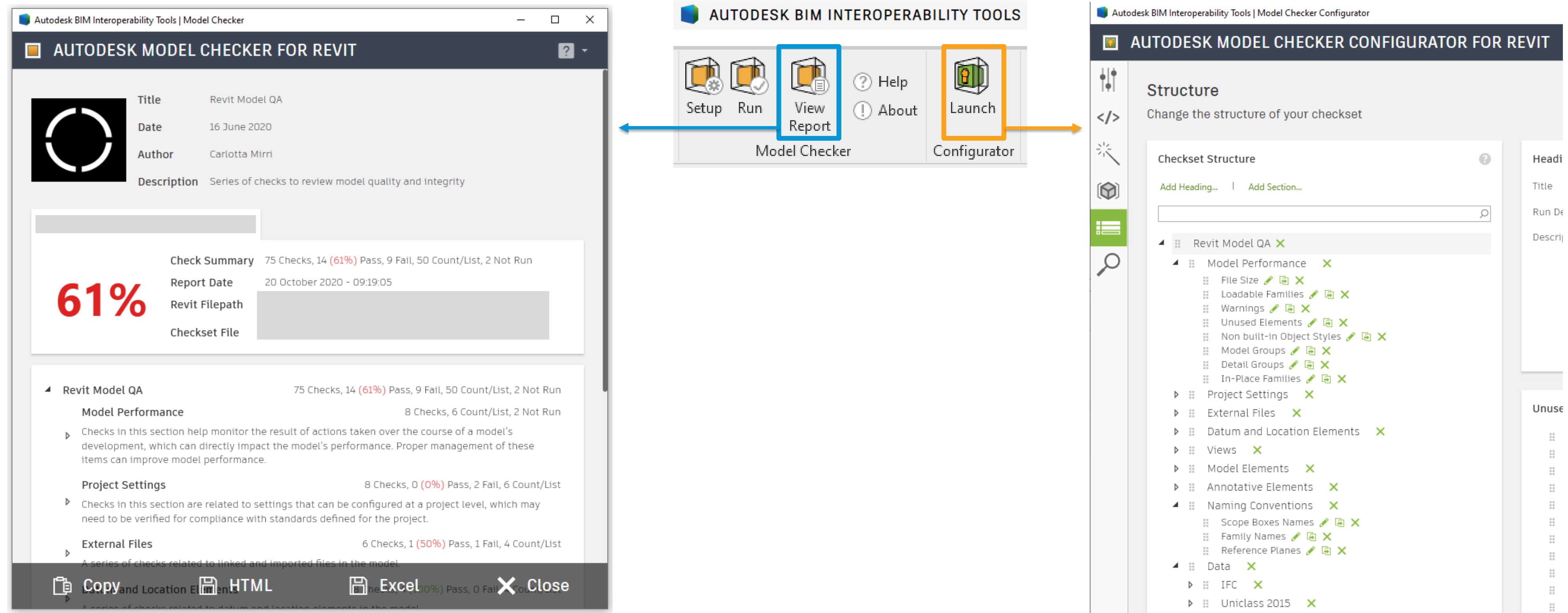
Category	Property	Condition	Value
Element	Category	=	Duct Accessories
+ Element	Category	=	Duct Fittings
+ Element	Category	=	Duct Insulations
+ Element	Category	=	Ducts
+ Element	Category	=	Flex Ducts

Search: Default

Find First Find Next Find All

Clash Detection

Workflow Development



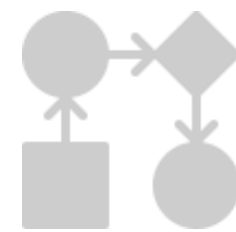
QA check

Tool Development



CONTENT

- Project Template
- Families



WORKFLOWS

- Early stage drawings
- Schematics (or One Line Diagrams)
- Health and safety information
- Schedules
- Clash detection
- Model QA

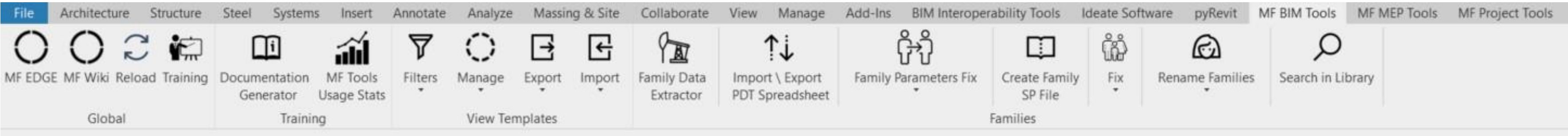


TOOLS

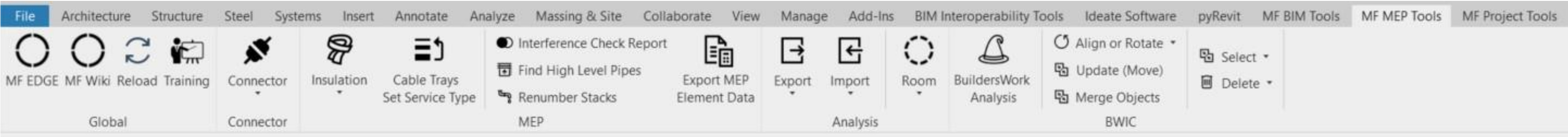
- Third party tools
 - Dynamo
 - pyRevit
-
- ✓ Consistent and quality output
 - ✓ Simpler for less experienced Revit users
 - ✓ More efficient
 - ✓ BIM compliant

Tool Development

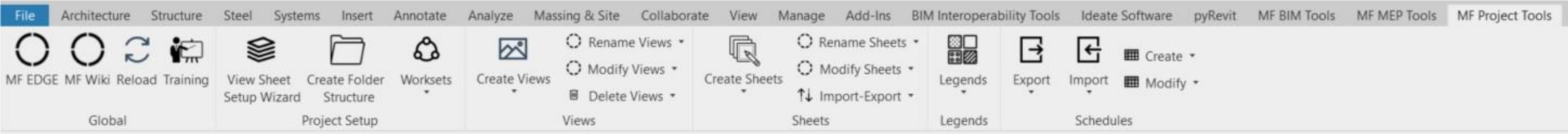
Model
Management
Tools



Automated
Modelling
Tools

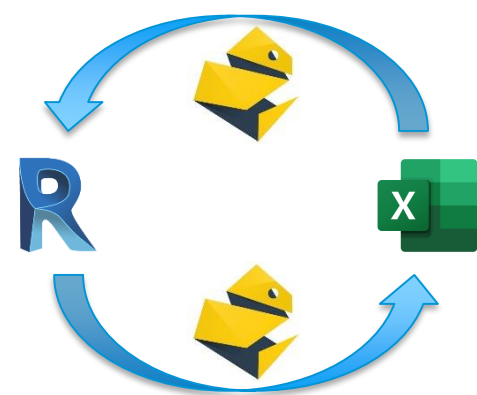
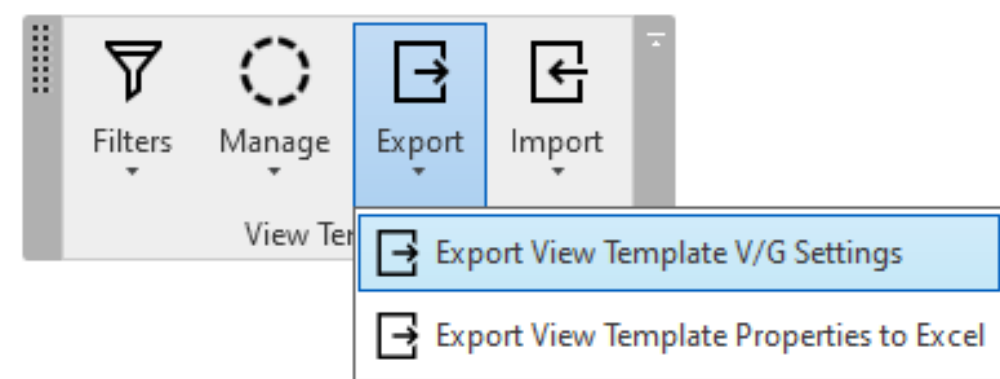


Document
Management
Tools

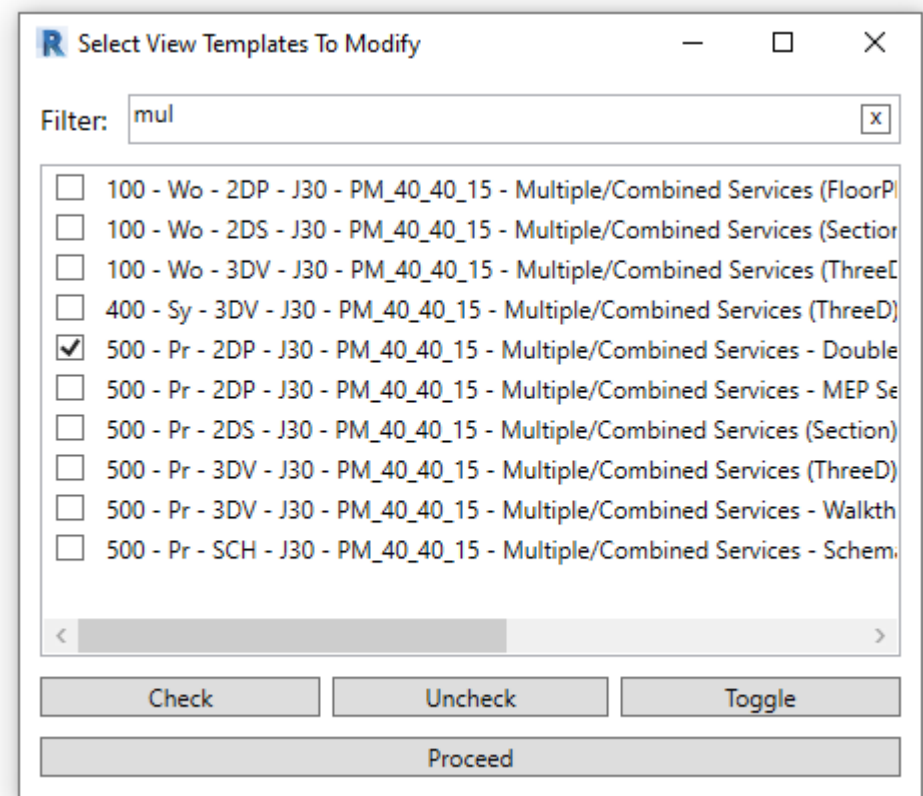
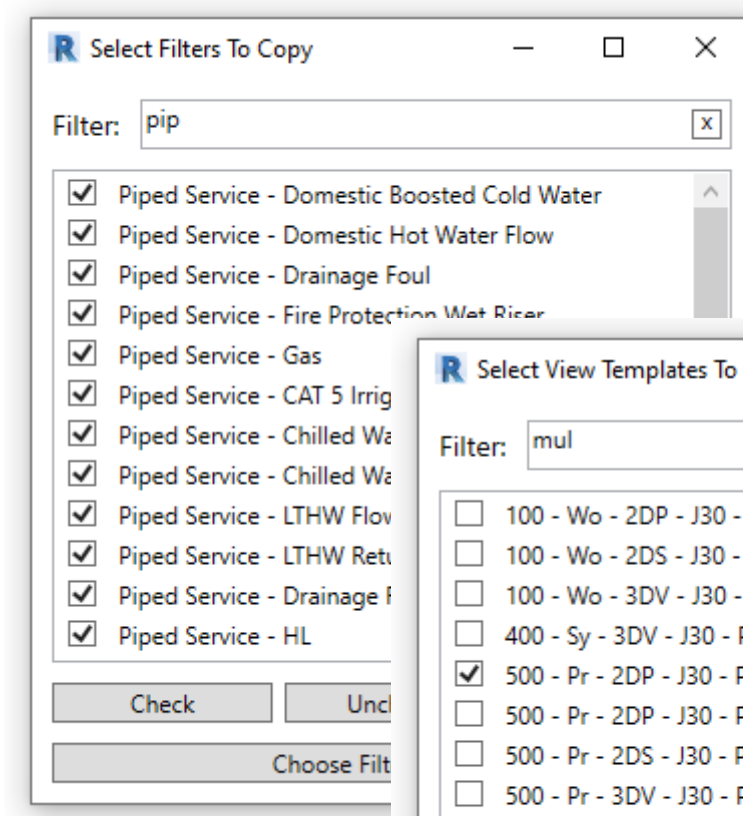
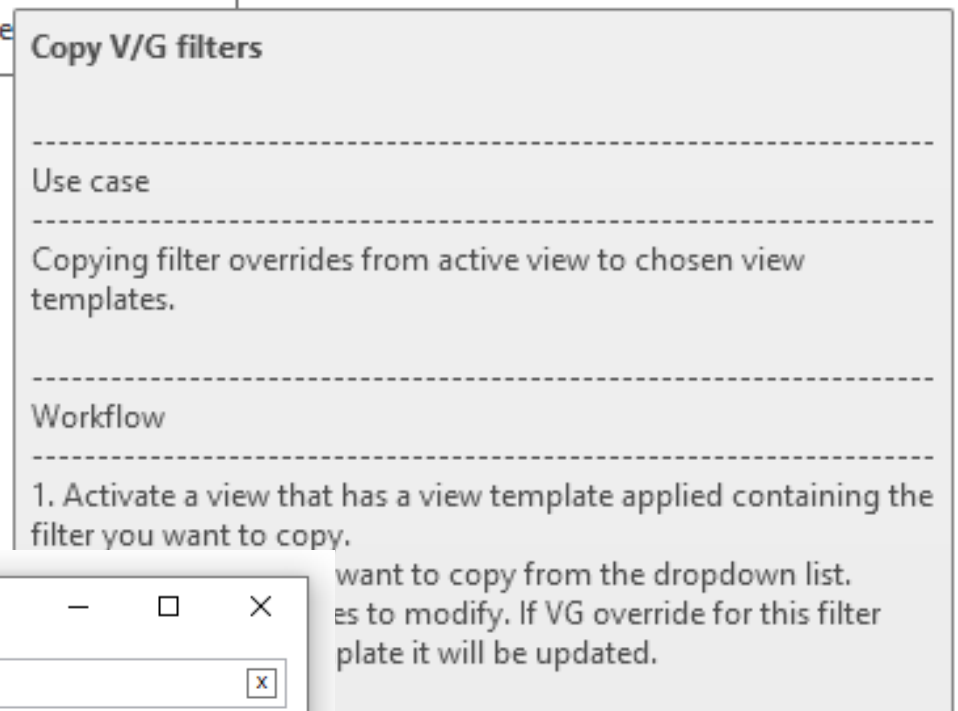
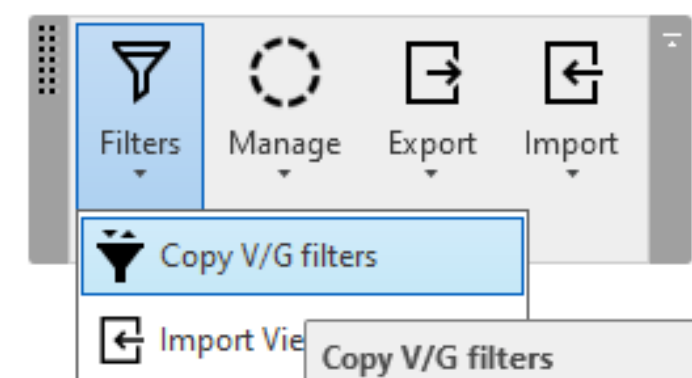


Max Fordham in-house toolbars (MF Tools)

Tool Development

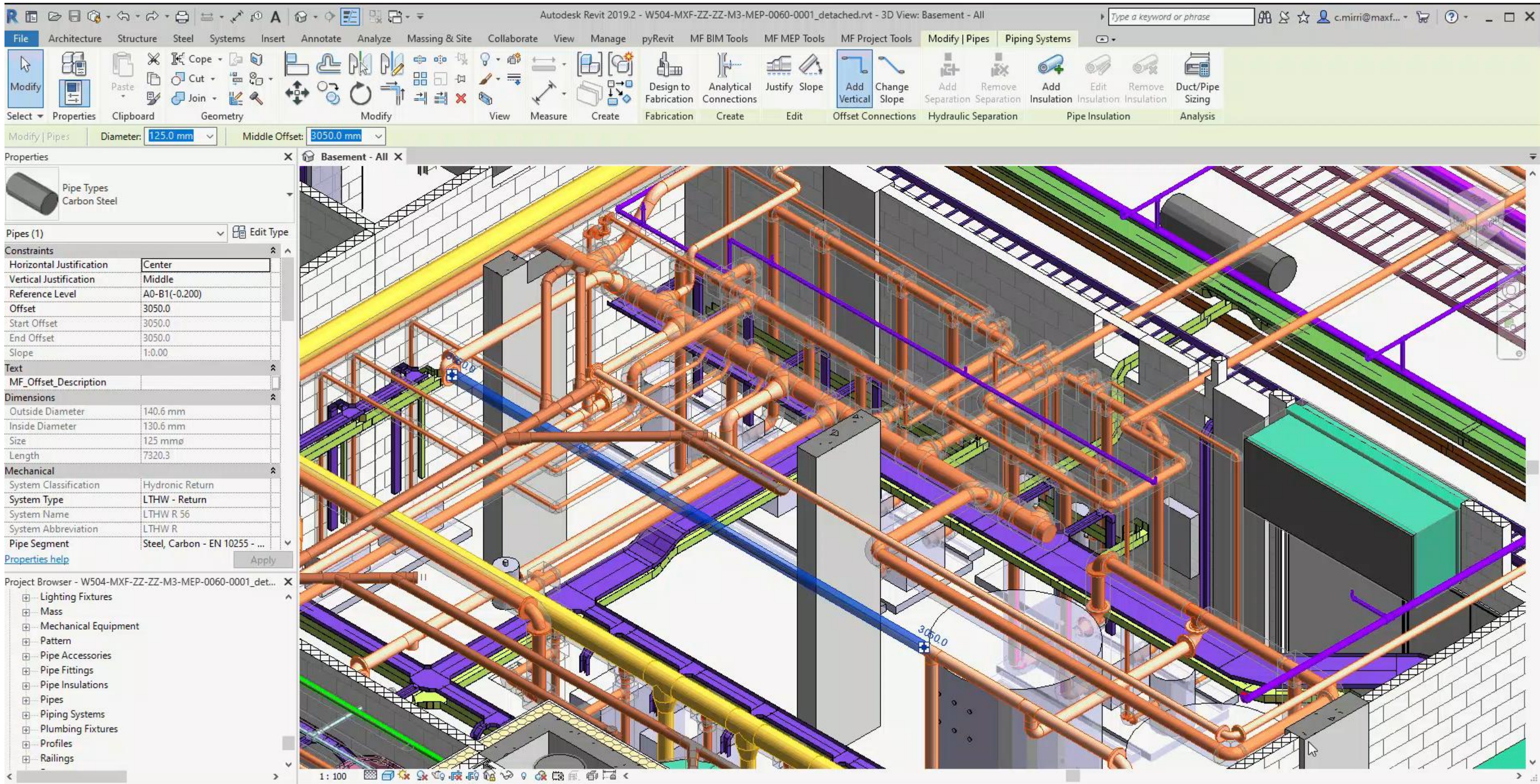


	A	B	C	D	E	F	G	H	I	J	K	L	
	View Template ID	View Template Name	Filter ID	Filter Name	Categories	Visibility	Halftone	Line Weight	Line Colour	Fill Colour	Fill Pattern	Transparency	Filter Rules
1													
2	975664	500 - Pr - 2DP - J30 - Ss_95_00_00_00 - Combined Services	513355	Ventilation - General Supply	Duct Placeholders ,	TRUE	FALSE	-1	0,128,255	0,128,255	3		40 ['Duct Placeholder
3	975664	500 - Pr - 2DP - J30 - Ss_95_00_00_00 - Combined Services	513356	Ventilation - General Extract	Duct Placeholders ,	TRUE	FALSE	-1	115,0,115	255,0,255	3		40 ['Duct Placeholder
4	975664	500 - Pr - 2DP - J30 - Ss_95_00_00_00 - Combined Services	513357	Ventilation - General Exhaust	Duct Placeholders ,	TRUE	FALSE	-1	41,146,112	40,189,143	3		40 ['Duct Placeholder
5	975664	500 - Pr - 2DP - J30 - Ss_95_00_00_00 - Combined Services	513361	Piped Service - Domestic Boosted Cold Water	Pipe Placeholders ,	TRUE	FALSE	-1	0,63,255	0,63,255	3		20 ['Pipe Placeholder
6	975664	500 - Pr - 2DP - J30 - Ss_95_00_00_00 - Combined Services	513362	Piped Service - Domestic Hot Water Flow	Pipe Placeholders ,	TRUE	FALSE	-1	255,0,63	255,0,0	3		20 ['Pipe Placeholder
7	975664	500 - Pr - 2DP - J30 - Ss_95_00_00_00 - Combined Services	738753	Ventilation - Kitchen Extract	Duct Placeholders ,	TRUE	FALSE	-1	115,0,115	255,0,255	3		40 ['Duct Placeholder
8	975664	500 - Pr - 2DP - J30 - Ss_95_00_00_00 - Combined Services	738764	Electrical - Fire	Center line , Center	TRUE	FALSE	-1	207,16,16	142,88,88	3		20 ['Center line , Ce
9	975664	500 - Pr - 2DP - J30 - Ss_95_00_00_00 - Combined Services	738765	Electrical - Telecom	Center line , Center	TRUE	FALSE	-1	109,109,56	189,189,126	3		20 ['Center line , Ce
10	975664	500 - Pr - 2DP - J30 - Ss_95_00_00_00 - Combined Services	739111	Piped Service - Drainage Foul	Pipe Placeholders ,	TRUE	FALSE	-1	129,73,54	180,101,77	3		20 ['Pipe Placeholder
11	975664	500 - Pr - 2DP - J30 - Ss_95_00_00_00 - Combined Services	739114	Piped Service - Fire Protection Wet Riser	Pipe Placeholders ,	TRUE	FALSE	-1	121,0,91	189,0,141	3		20 ['Pipe Placeholder
12	975664	500 - Pr - 2DP - J30 - Ss_95_00_00_00 - Combined Services	739118	Piped Service - Gas	Pipe Placeholders ,	TRUE	FALSE	-1	179,134,0	255,207,72	3		20 ['Pipe Placeholder
13	975664	500 - Pr - 2DP - J30 - Ss_95_00_00_00 - Combined Services	739120	Piped Service - CAT 5 Irrigation	Pipe Placeholders ,	TRUE	FALSE	-1	18,51,84	26,72,118	3		20 ['Pipe Placeholder
14	975664	500 - Pr - 2DP - J30 - Ss_95_00_00_00 - Combined Services	739135	Piped Service - Chilled Water Flow	Pipe Placeholders ,	TRUE	FALSE	-1	41,0,255	191,0,191	3		20 ['Pipe Placeholder
15	975664	500 - Pr - 2DP - J30 - Ss_95_00_00_00 - Combined Services	739136	Piped Service - Chilled Water Return	Pipe Placeholders ,	TRUE	FALSE	-1	131,0,255	191,0,191	3		80 ['Pipe Placeholder
16	975664	500 - Pr - 2DP - J30 - Ss_95_00_00_00 - Combined Services	739137	Piped Service - LTHW Flow	Pipe Placeholders ,	TRUE	FALSE	-1	116,63,0	255,157,15	3		10 ['Pipe Placeholder



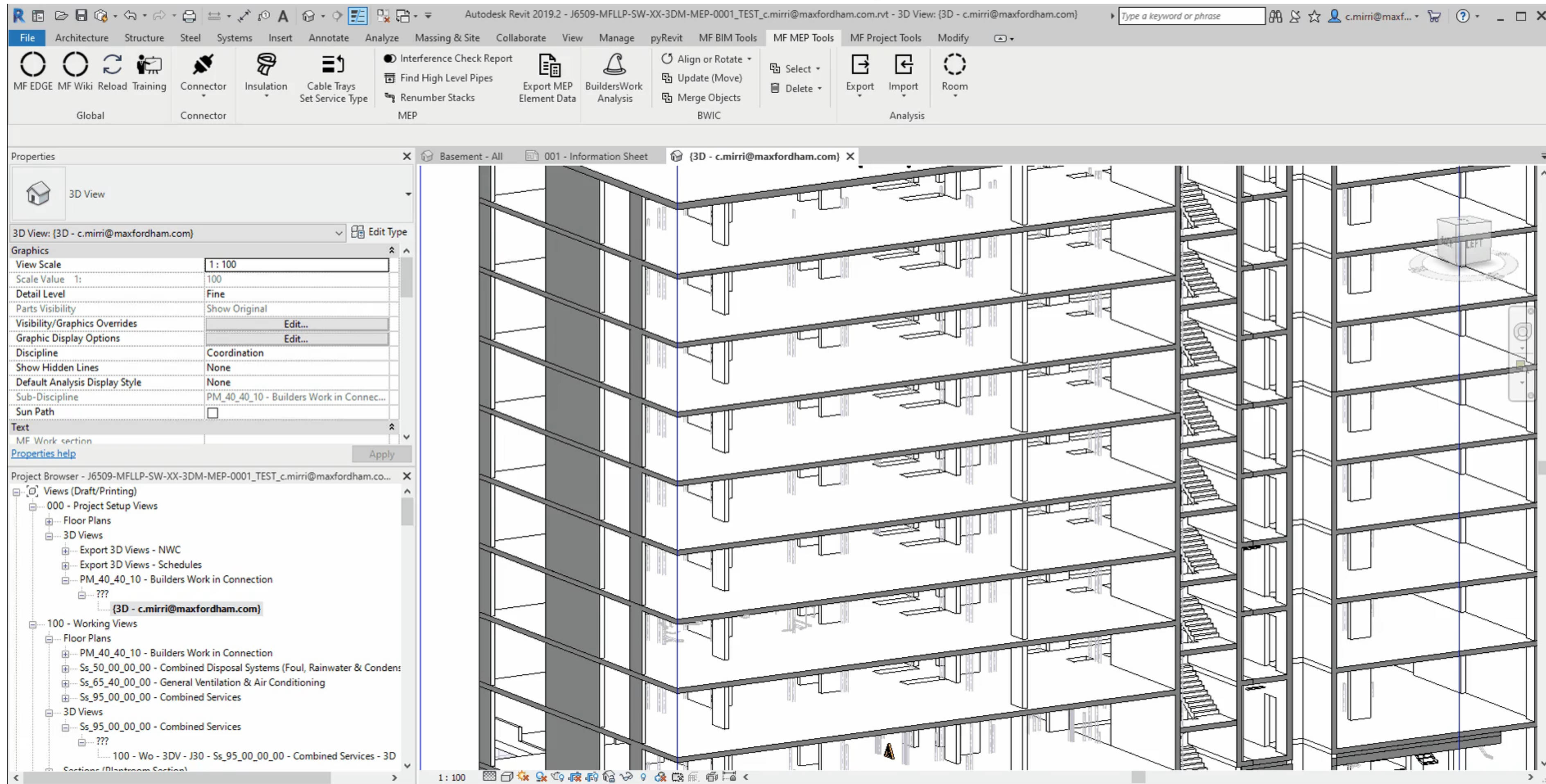
Model Management Tools

Tool Development



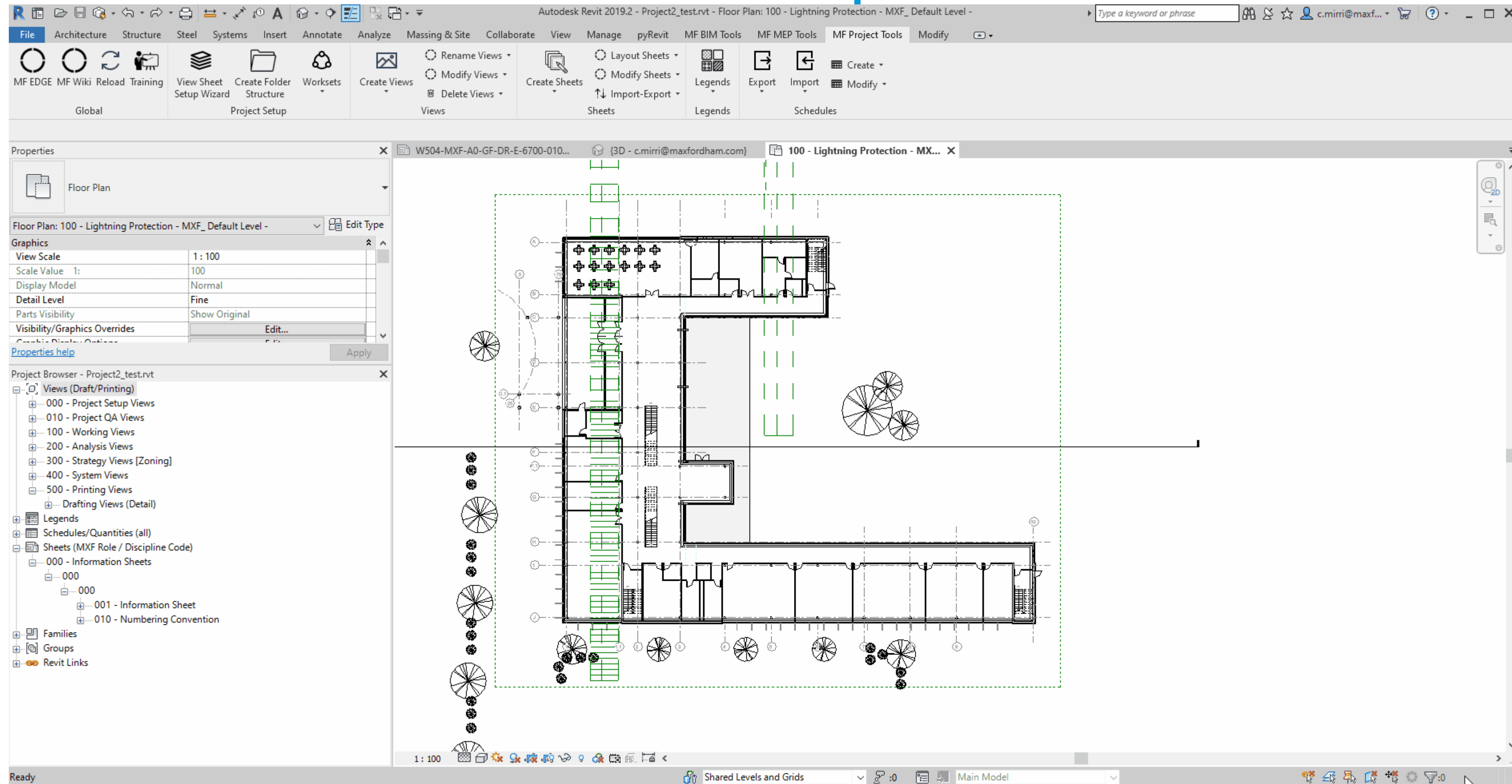
Automated Modelling Tools – Insulation Tool

Tool Development



Automated Modelling Tools – Builder's work holes Tool

Tool Development

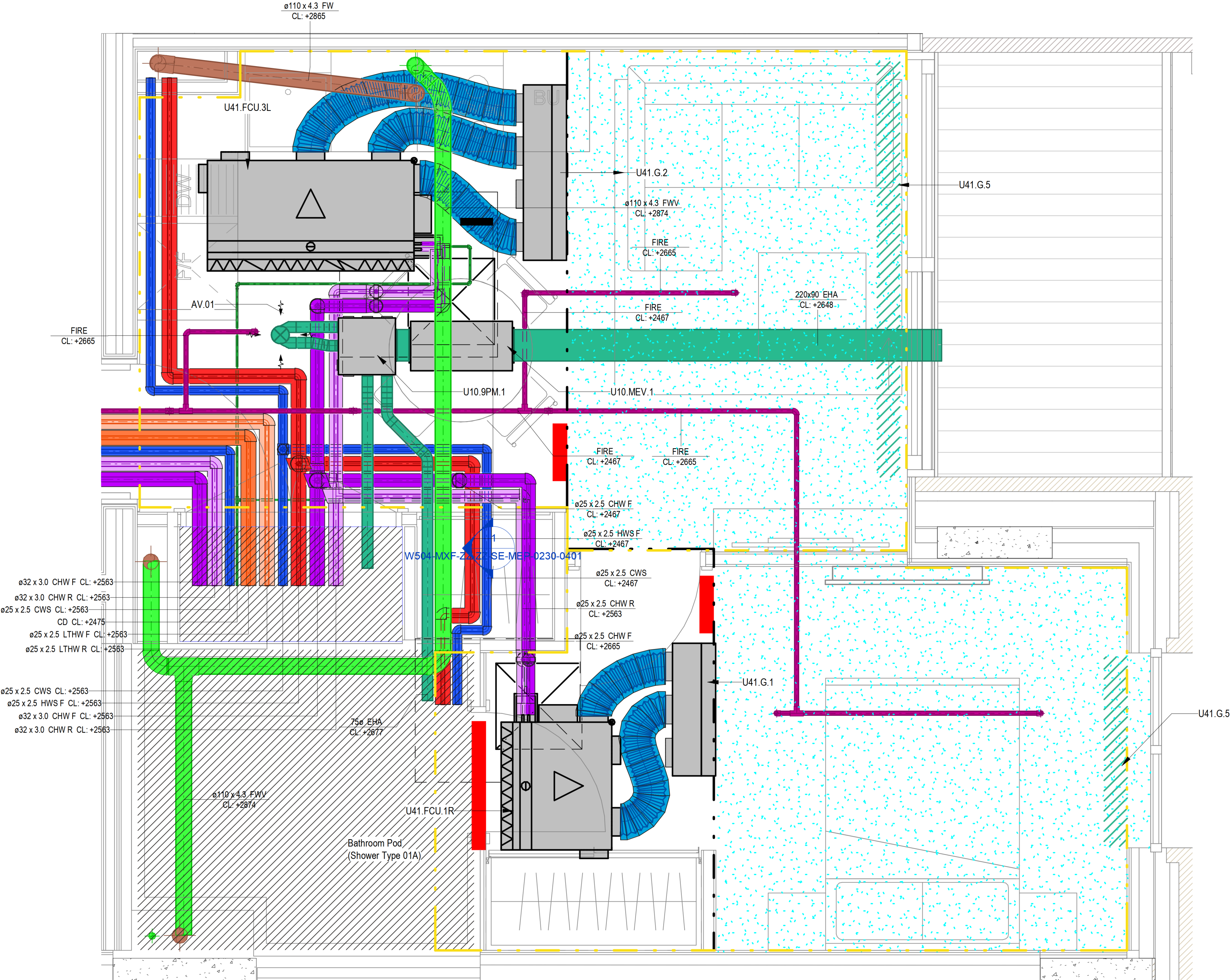


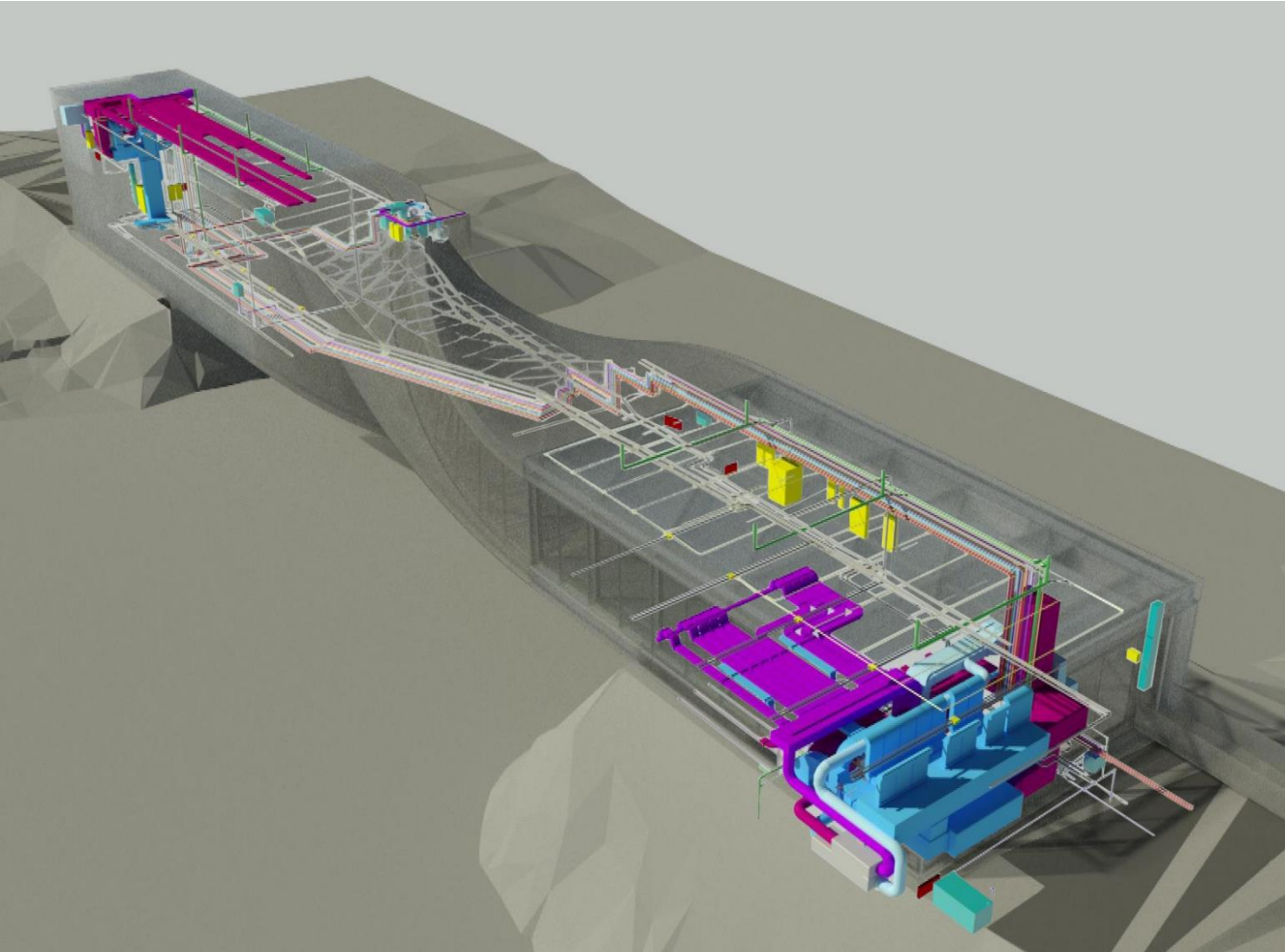
Document Management Tools

Progress and Achievements

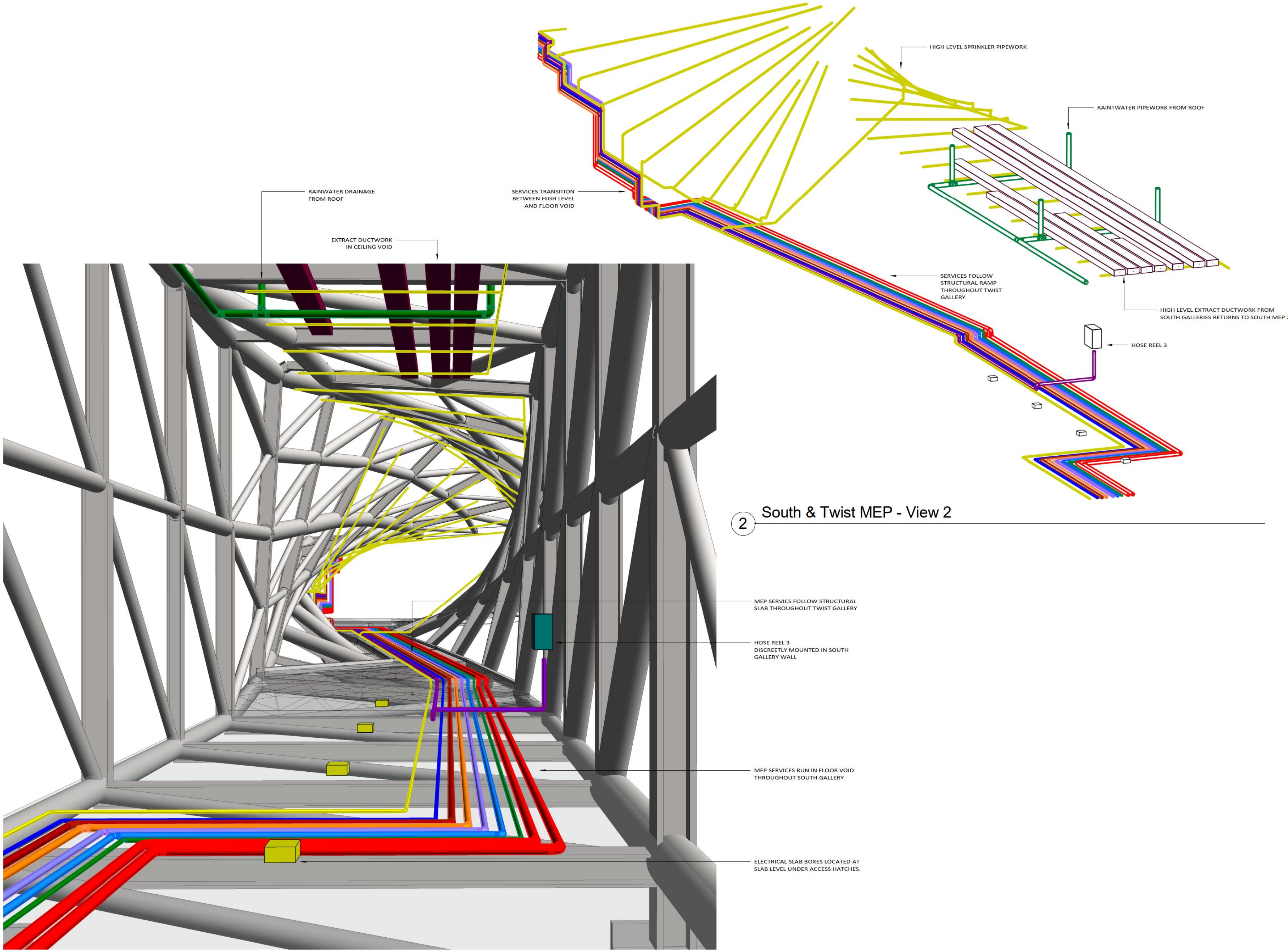


Example drawing output





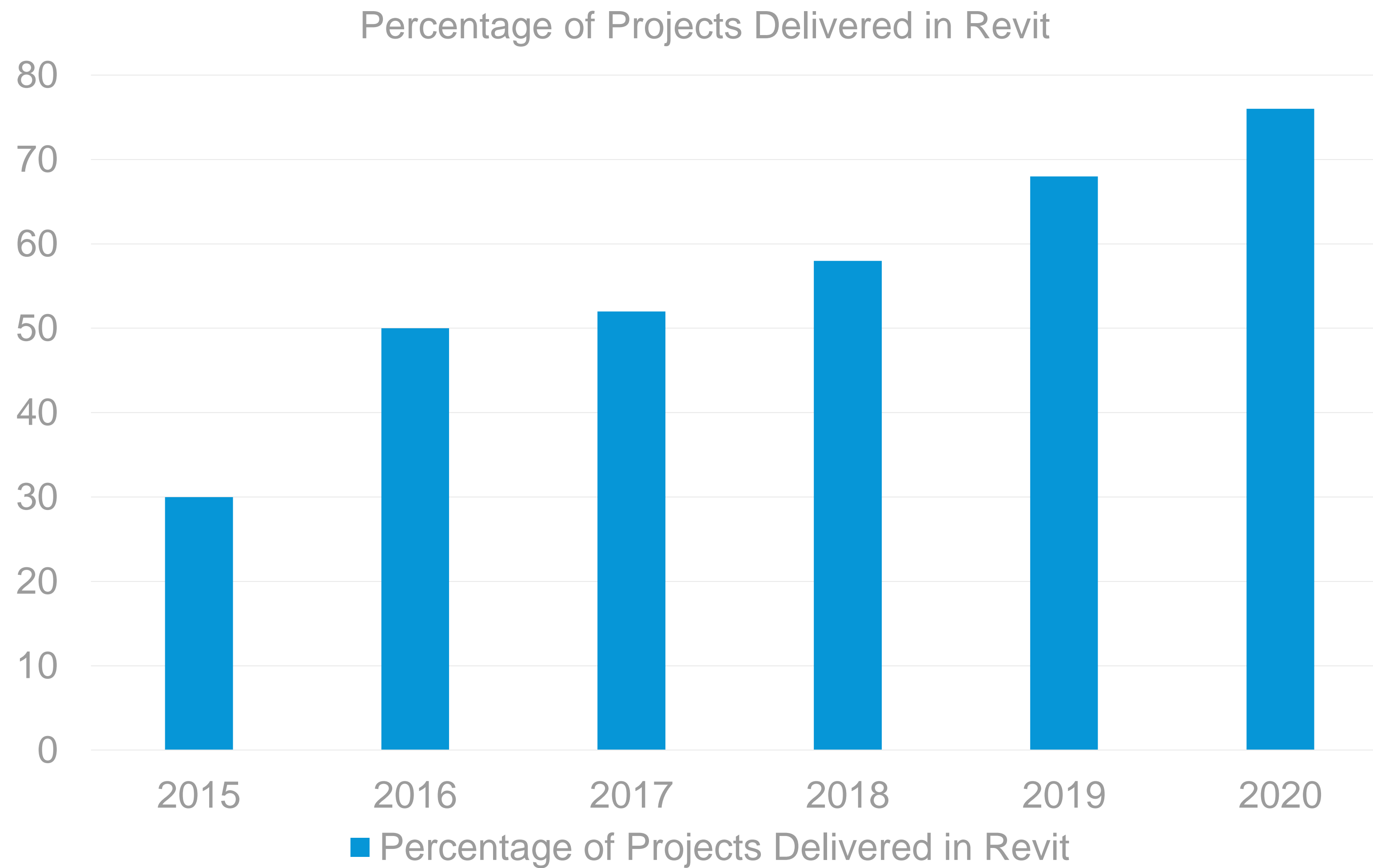
Example drawing output



1 South & Twist MEP - View 1

2 South & Twist MEP - View 2

% Revit Projects by Year Started



Revit Tools

£35k

TOOL CREATION

Estimated cost of creating
the bespoke tools

£10k

ANNUAL MAINTENANCE

Estimated yearly
maintenance cost of
bespoke tools

~9000

NUMBER OF USES

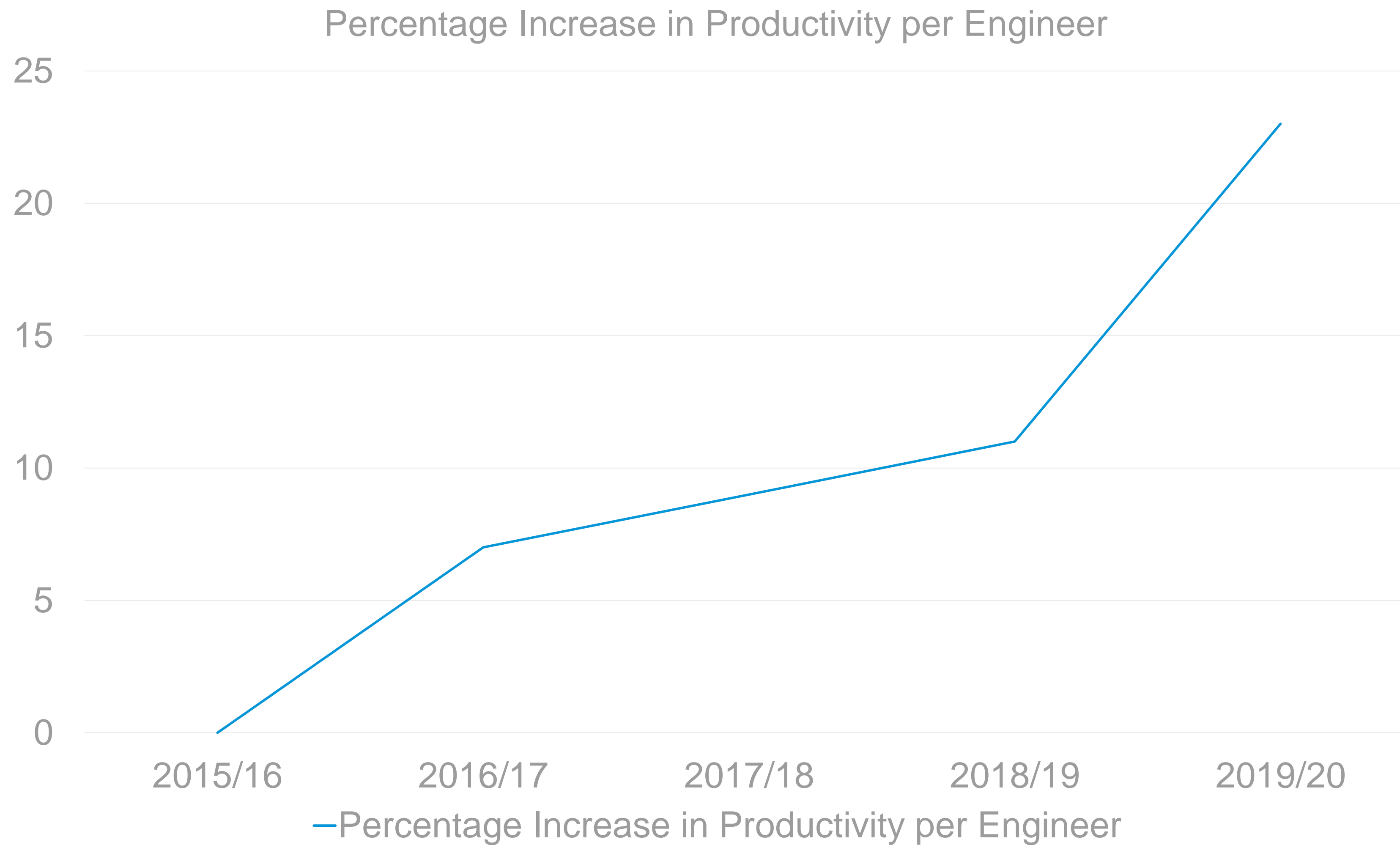
The average number of
times the tools are used
per year

~14k

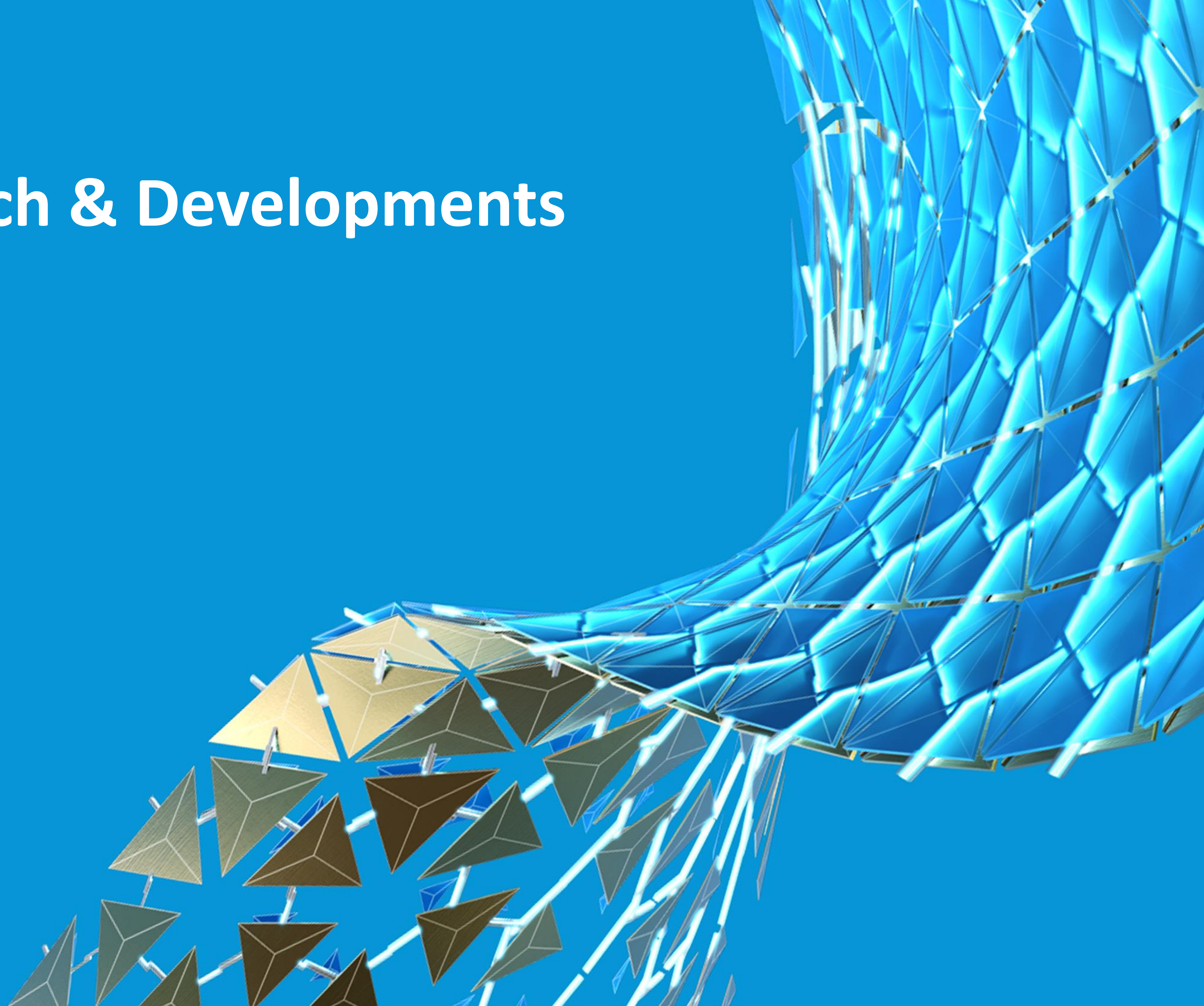
HOURS SAVED

Estimated number of
engineering hours saved
through using the tools

Productivity per Engineer



Future Approach & Developments



Future Approach

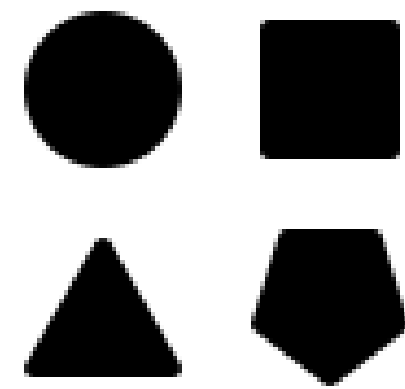


FUTURE LICENSING ARRANGEMENTS

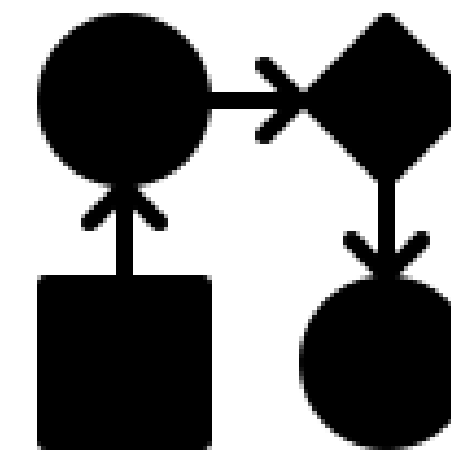


ADAPTING WORKFLOWS

Future Developments



FURTHER CENTRAL CONTENT



IMPROVED WORKFLOWS

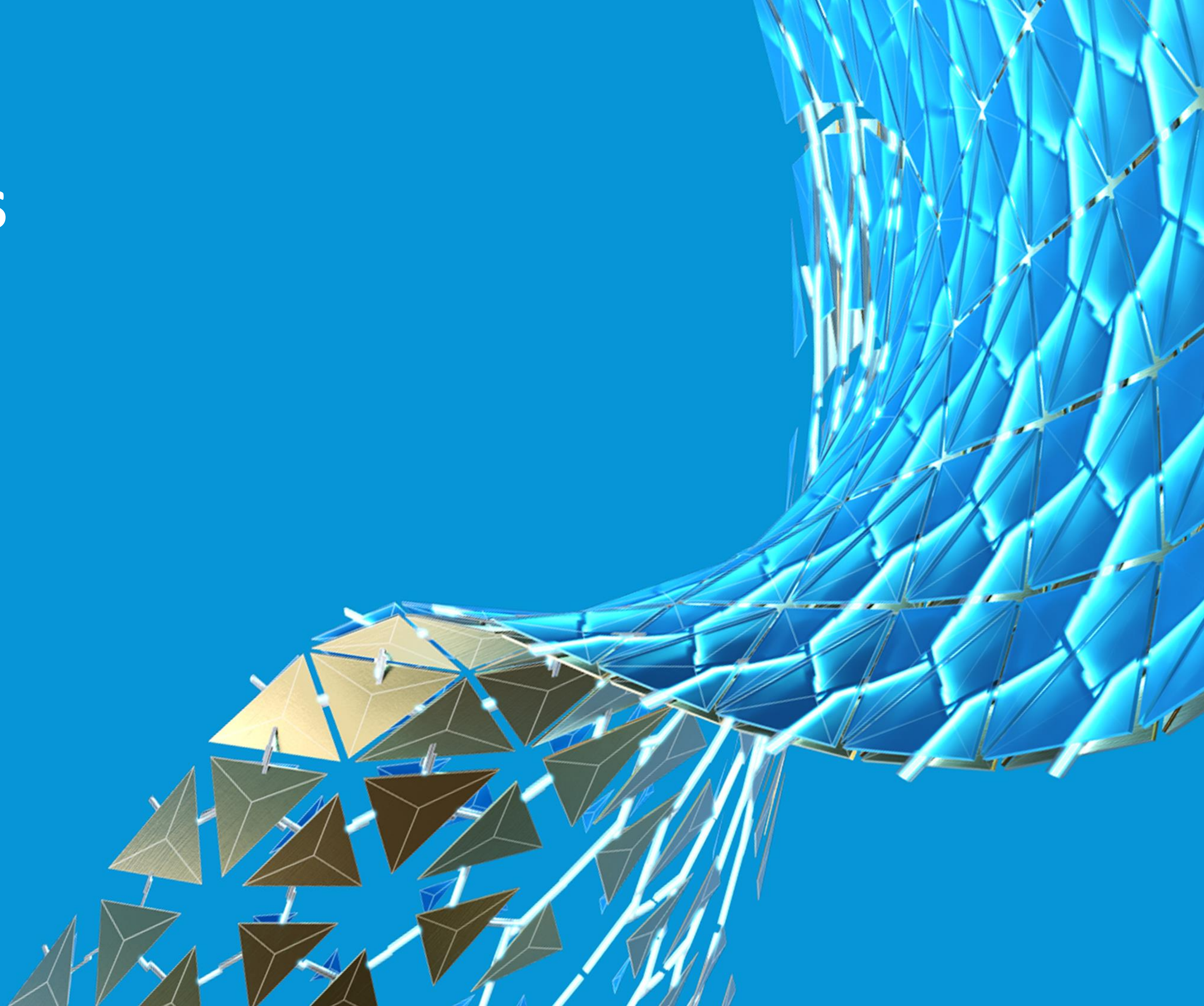


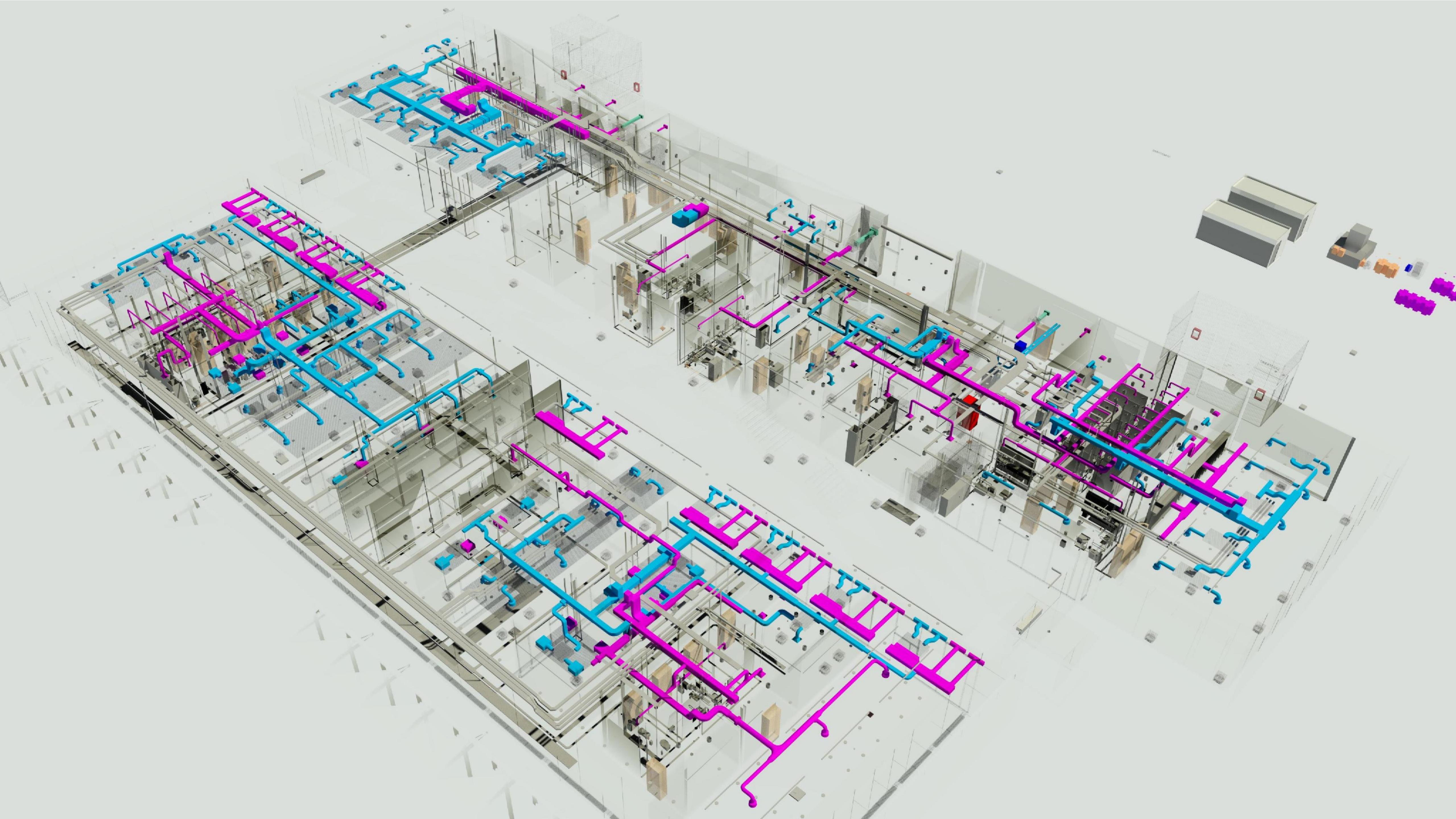
DATA FOR ANALYTICS



FURTHER AUTOMATION

Key Messages





Key Messages

- Complex with lots of functionality
- Gradually build up your content and templates
- Learning from others mistakes and successes
- Don't worry too much about making mistakes
- Plan out your strategy and standards
- Targeted training



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