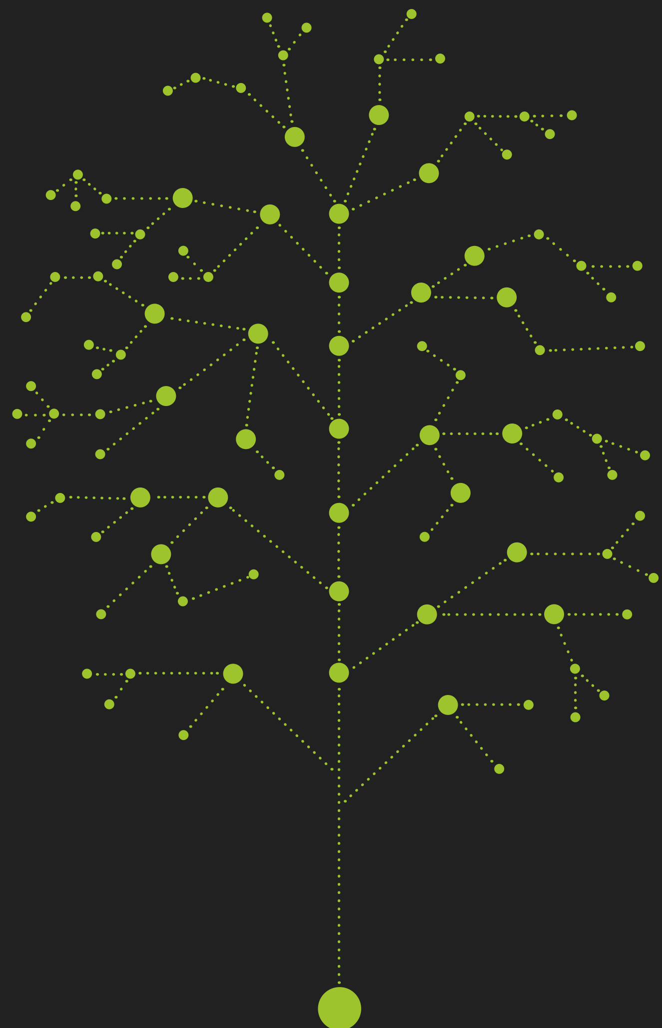

Cracow University of Technology

environmental engineering

Introduction to BIM concept

Jarosław Müller
Nina Szczepanik-Ścisło

Kraków 2020

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European Funds Knowledge Education Development
Republic of Poland
European Union European Social Fund

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Part 1

Introduction

BIM

BIM (**Building Information Modeling**) is a process based on an intelligent 3D model. The model enables access to accurate and always up-to-date project data, and, consequently, facilitates making decisions based on information throughout the project life cycle.

BIM

BIM – Building Information Modeling

Building Information Management

Building Information Model

Big BIM – integrated design process

Little bim – tools, software (technology)

Source: Finith E. Jernigan AIA – BIG BIM little bim, 2nd Edition, 4Site Press, 2008

BIM

BIM digital model

It is a database that should contain all the information describing a given building: geometric data, physical features, functional features, cost data, technical parameters, data necessary to ensure the maintenance of equipment, data on the demand for utilities.

BIM as process

It is a process by which a virtual model of a planned or existing building object is created in the computer. This model is used already at the design stage for various analyzes, construction simulations (for new objects) or repair assessments (for existing facilities).

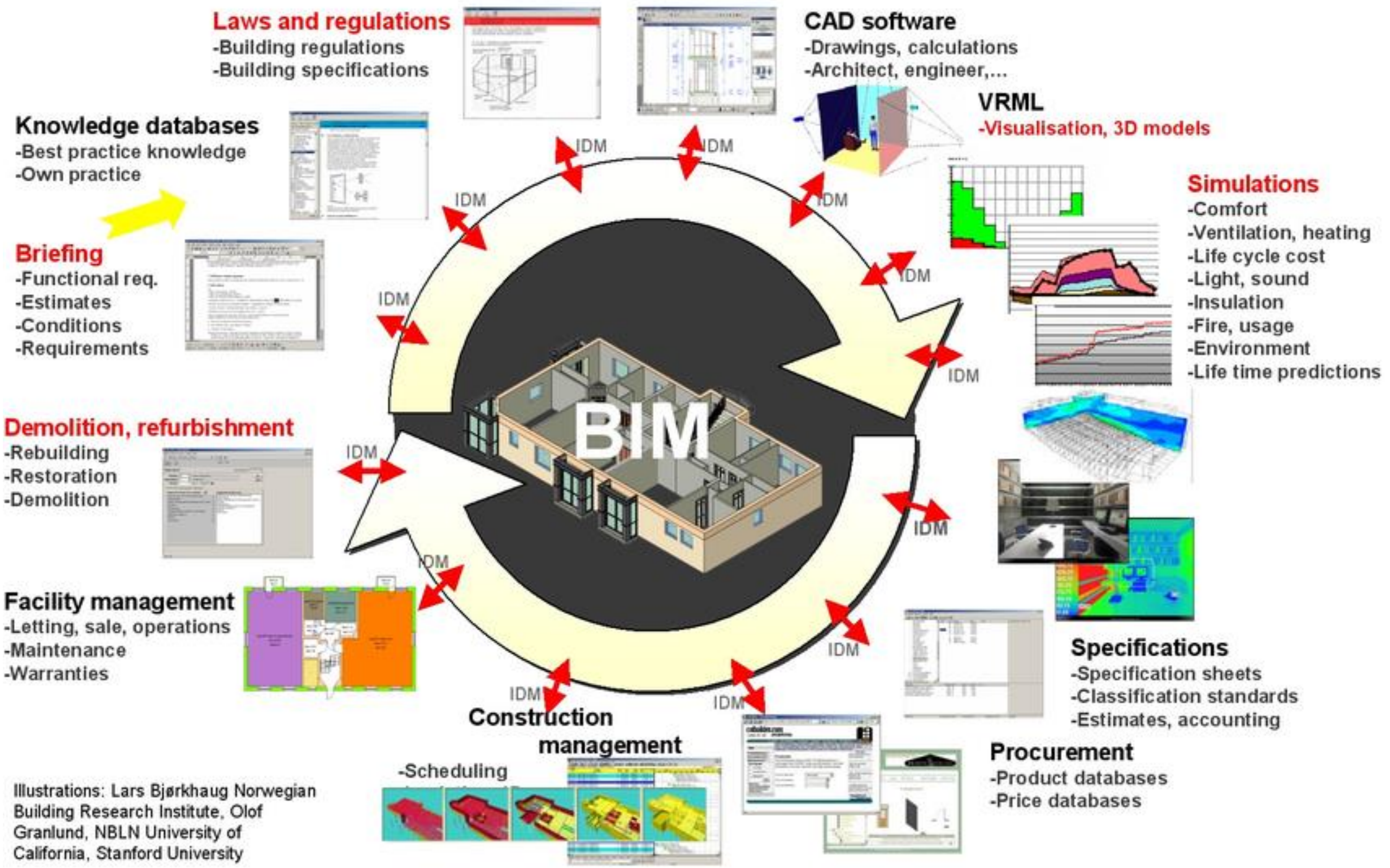
ISO 19650

Replaced national standards since 2018

Building

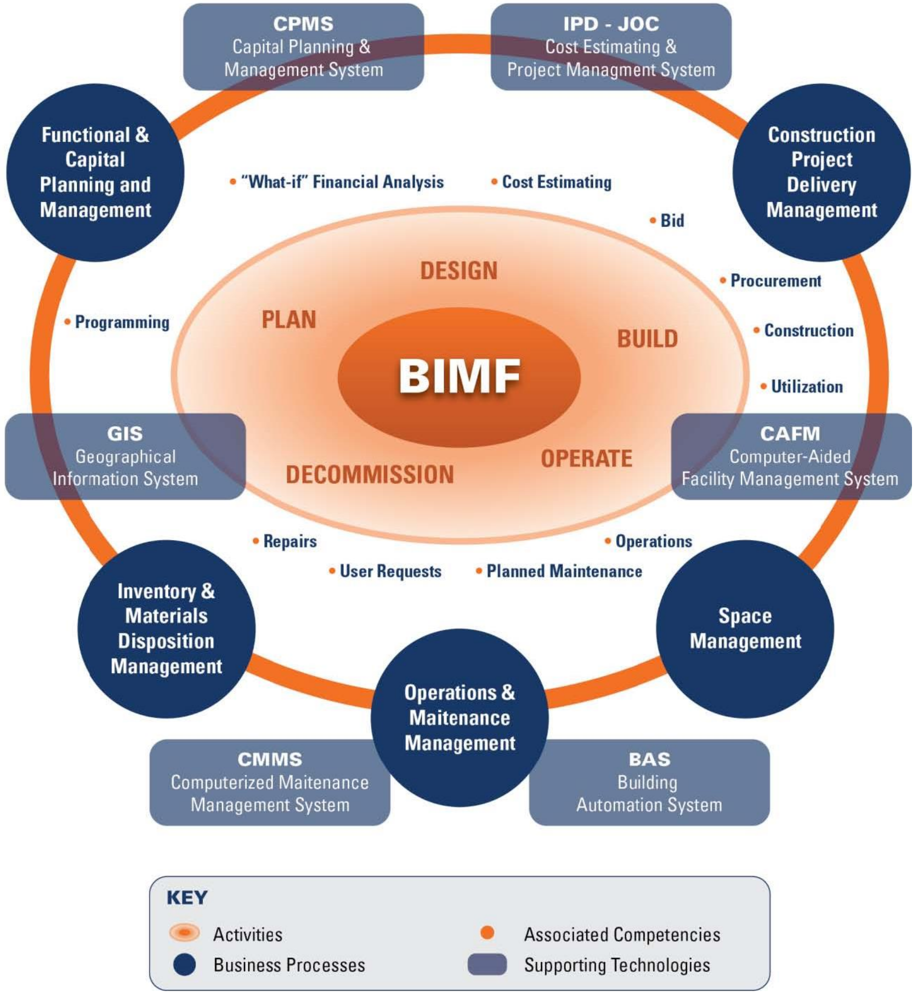
Building:

- A building structure (residential buildings, office buildings, hospitals)
- Linear object (roads, motorways, railway lines, underground and ground transmission networks)
- Industrial facility (installations and technological lines with infrastructure)
- Bridges, viaducts, airports



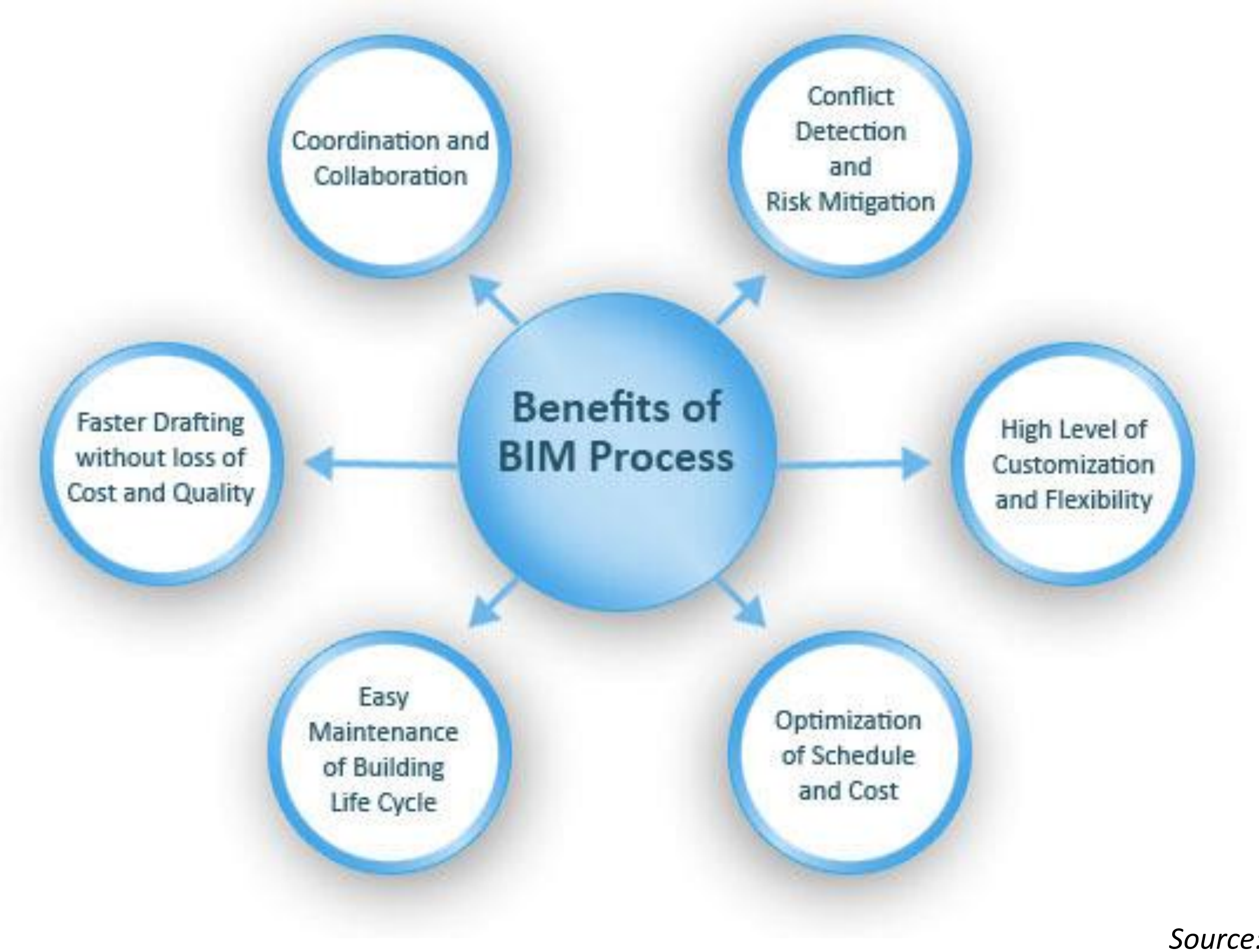
Source: www.buildinginformationmanagement.worldpress.com

Building information management framework – BIMF

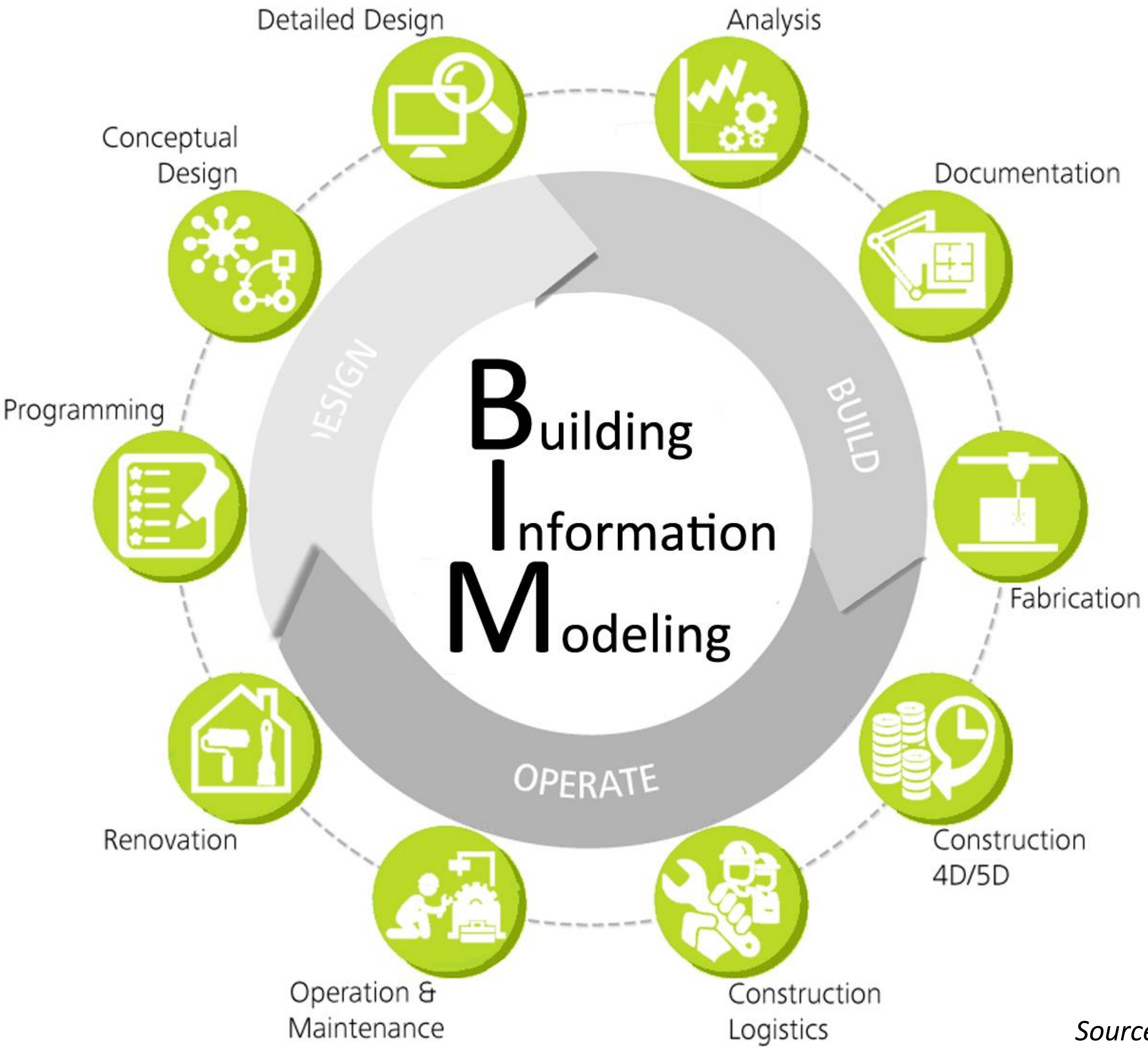


Source: www.buildinginformationmanagement.worldpress.com

Benefits of BIM process



Source: lideshare.net

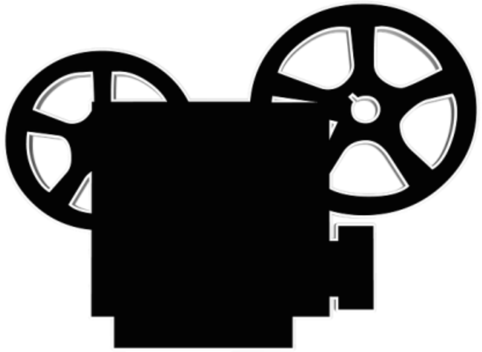


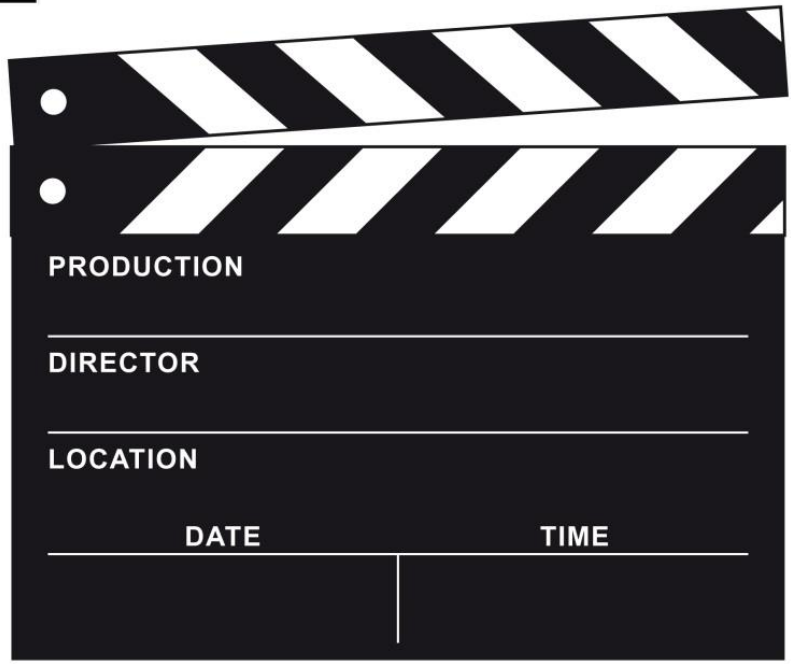
Source: Slideshare.net

BIM

Information:

- Complete
- Current
- Legible
- Available
- Easy to modify
- Protected





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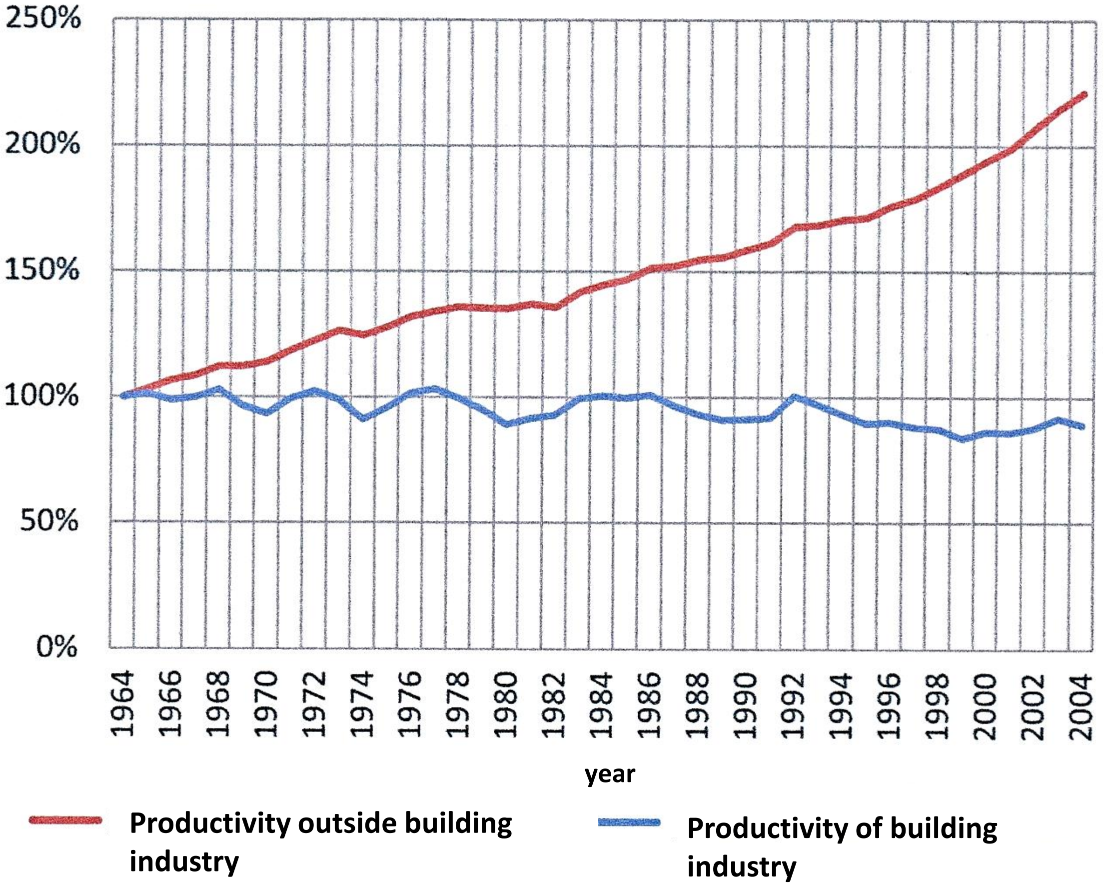
Productivity

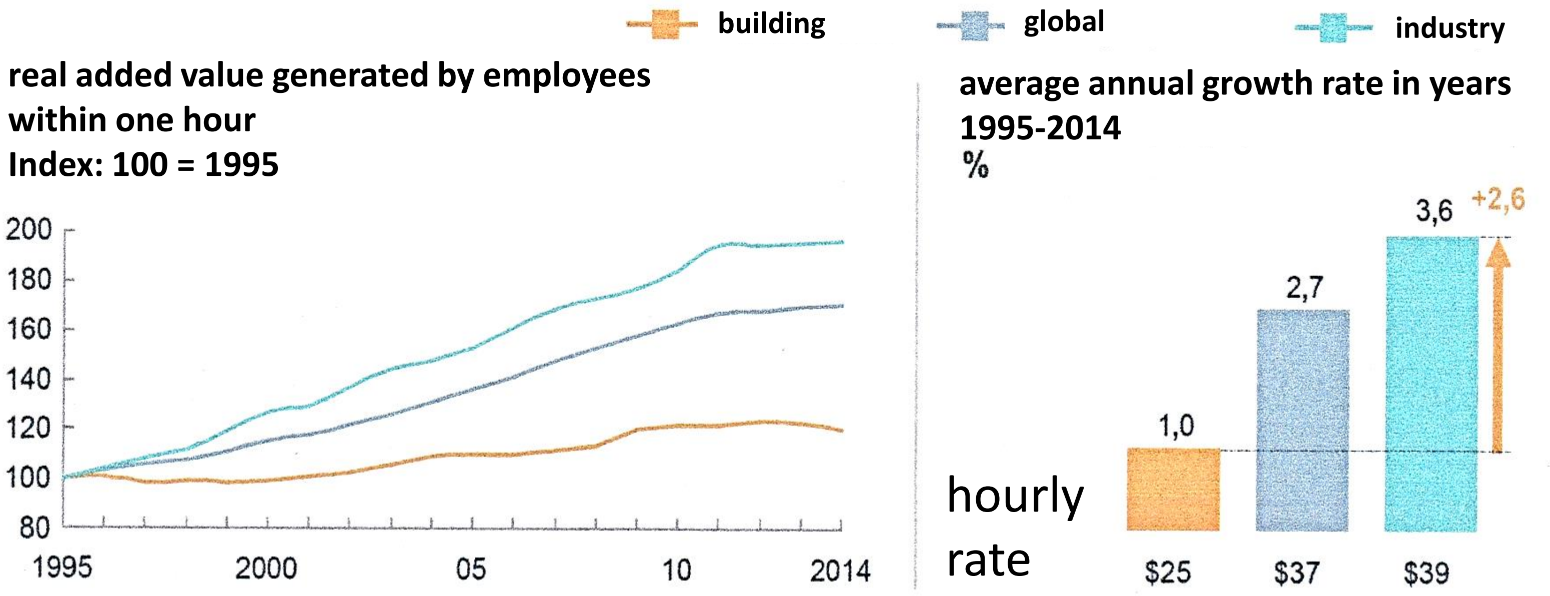


USA

Source: Kasznia D., Magiera J., Wierzowiecki P., BIM w praktyce. Standardy. Wdrożenie. Case Study, PWN, Warszawa 2018

Global increase in work efficiency

Global productivity growth in building industry is lower than in the global economy



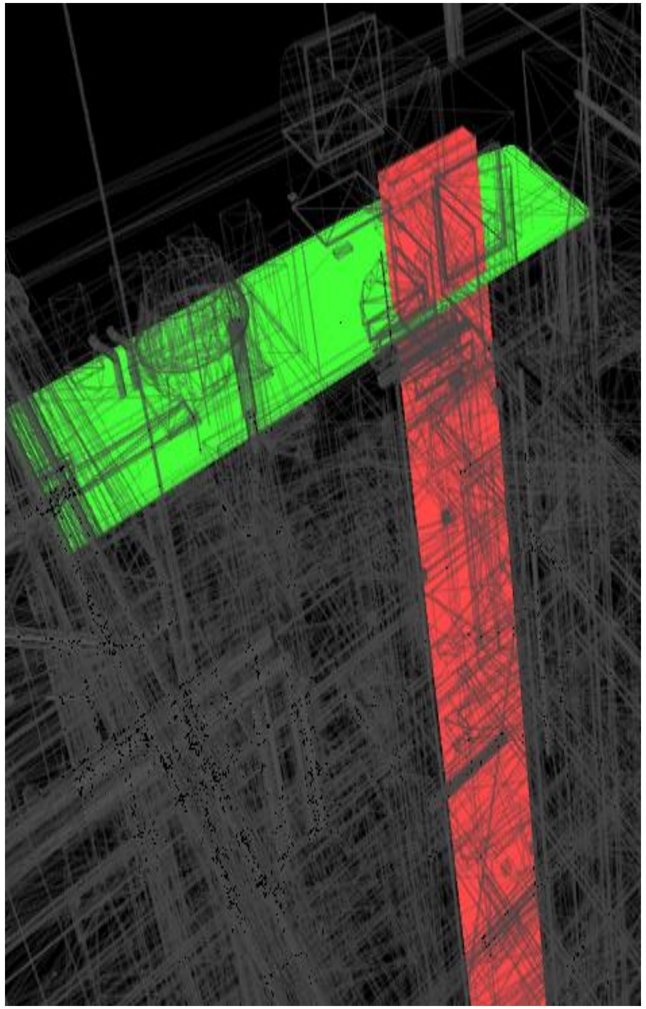
USA

Source: Kasznia D., Magiera J., Wierzowiecki P., BIM w praktyce. Standardy. Wdrożenie. Case Study, PWN, Warszawa 2018

Benefits

Using the BIM-compliant model, optimal construction, technological and logistics solutions can be chosen. Costs and implementation schedules can be analyzed, and project collisions and assembly collisions can be captured.

It is estimated that the costs resulting from collisions range between 4–10% of the investment value.



Analysis of investment costs

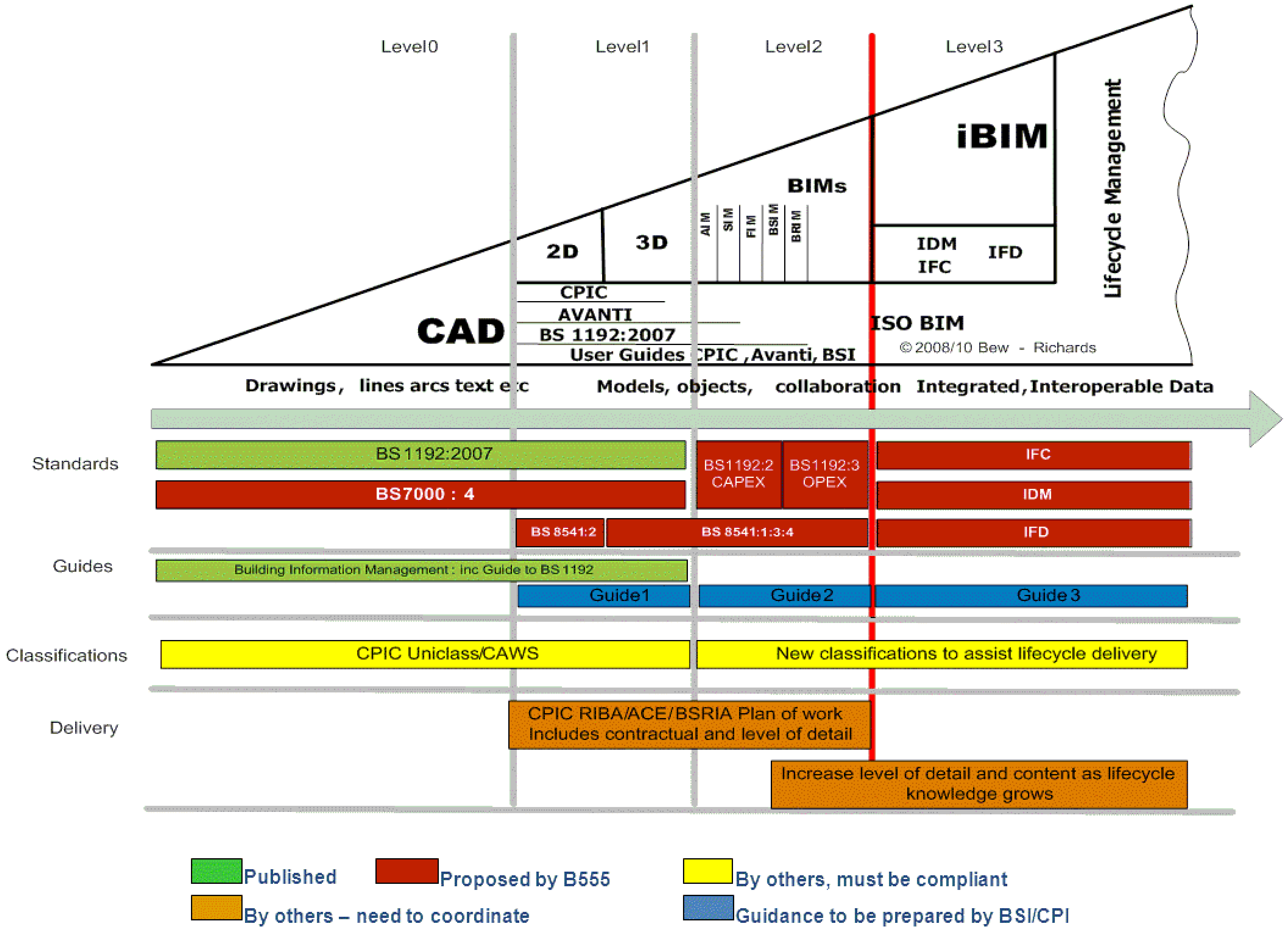
CAPEX (Capital Expenditure) is capital expenditure needed to complete a specific investment (purchase, construction). This term is used not only in construction, but in the entire economy as well as in everyday life (buying a new car, flat or washing machine is CAPEX for the household budget). This is the basic, and often unfortunately the only indicator of the assessment of the effectiveness of a construction investment

OPEX (Operating Expenditure) is operational expenses related to the current maintenance of the object. This term also applies not only to construction but to the entire economy and everyday life (e.g. OPEX for the home budget is the purchase of gasoline for a private car). OPEX costs are often **neglected** or **are not analyzed** at the investment planning stage, although in the life cycle of the facility, these expenses often exceed the cost of the investment itself. In the BIM methodology, the OPEX analysis is one of the most important elements in assessing the effectiveness of a construction investment.

Analysis of investment costs

TOTEX (Total Expenditure) is the total investment cost in the entire life cycle. All expenses related to the implementation of the project and maintenance of the facility until its technical death. TOTEX is the sum of CAPEX and OPEX costs. Due to the mutual dependence of CAPEX and OPEX (reduction of CAPEX construction costs often results in increased OPEX operating costs and vice versa), TOTEX gives the simplest picture of the total construction investment costs in the whole life cycle of the facility.

BIM maturity levels



Description of abbreviations:

CAD – Computer Aided Design

2D – two-dimensional modeling, documentation in the form of flat drawings

3D – three-dimensional modeling, spatial digital models of the designed / existing object

SIM – Structure Information Model

AIM – Architecture Information Model

FIM – Facilities Information Model

BSIM – Building Services Information Model

BrIM – Bridge Information Model

iBIM – Interoperable Building Information Model

Source: https://www.designingbuildings.co.uk

BIM maturity levels

BIM Level 0

This is the level on which construction has been in place for many years. The basic communication medium are paper documents containing flat drawings, tables and descriptions. Partial source information is often stored by process participants in CAD files, while the main database is paper documentation. There are no common standards for the representation, storage and management of information. The standards previously developed for paper documentation are used.

BIM maturity levels

BIM level 1

It is primarily a change in the way of creating a project in which 3D design appears.

The 3D model begins to be introduced at the concept stage and is used primarily by architects to create visualizations, and thus to improve communication with the investor. At this level of BIM, only a small percentage of the possibilities offered by 3D modelling are used. There is no information exchange between participants in the design process. The 3D model is treated as being under the "ownership" of the creator of the model and is not shared with other entities. Designers of other specialties (especially construction engineers) create their own 3D models. BIM on level 1 is often called Lonely BIM.

BIM maturity levels

BIM level 1

3D models are sometimes used to generate 2D documentation, but the basis of the process is paper 2D documentation. The design uses the elements of parameterization, which speeds up the design work and facilitates the introduction of changes, information exchange can be made in electronic form, but the data is not integrated in the model.

In large British infrastructure investments, the 3D model at level 1 was used to support design processes and solve problems at the design stage, which often appeared on previous construction sites and generated losses (mainly due to excessive material consumption).

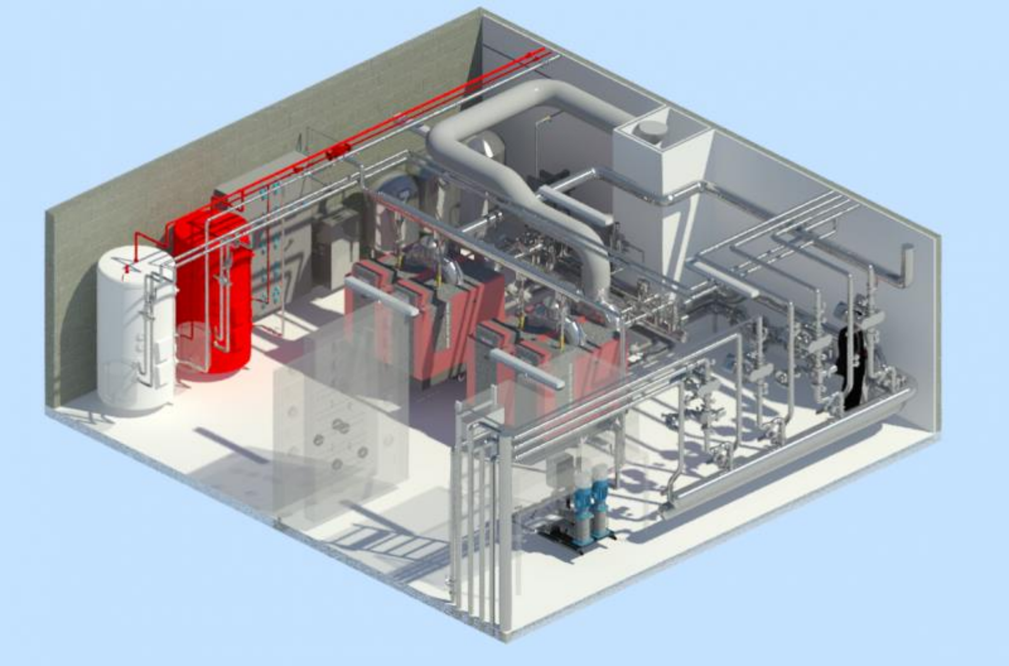
BIM maturity levels

BIM level 1

An important feature of level 1 is the introduction of project documentation management systems, i.e. CAD files, which are still the basic source of creating paper documentation that is the basis for information exchange.

At level 1, the first elements of standardization of information management and cooperation of participants in the construction process are introduced.

BIM level 2



BIM maturity levels

BIM level 2

This is the next step in information modelling. The integrated 3D model becomes the basic information bank about the object. "Integrated" means containing information covering various issues (architecture, design, installations). Importantly, this model does not have to be placed in one file. Many files are used that are related to each other and contain data created according to specific rules and standards (e.g. at the beginning of the project, the exact location of all reference points for individual project industries, colours assigned to different types and classes of objects, etc.) is defined. The 3D model contains geometric and non-geometric data describing the complete object at the implementation and use stage. The "logic" of the creation of the project, the required levels of information detail for individual investment stages and for the indicated process participants are defined.

BIM maturity levels

BIM level 2

The integrated 3D model is a source of information, and appropriate programs allow to automatically generate 2D documentation based on the data contained in the model.

The 3D model is the basis of the implementation and coordination process. In using it, the process of building the object can be simulated, and, hence, at the design stage many dangerous or undesirable situations that could occur at the construction stage can be eliminated.

BIM maturity levels

BIM level 2 – Dimensions

At level 2, the 3D model begins to be extended with new information that allows the drafting of a delivery and implementation **schedule (4D)** as well as a cost estimate and budget, also in the **time aspect (5D)**.

Using the BIM model, it is possible to carry out analyzes of the object's **impact on the environment (6D).**

The model can contain data that can then be manually or automatically added to the systems supporting the **management** of the finished object **(7D)**. Because the history of BIM – at all times "is being written", so most likely in the coming years, a "xD" describing the subsequent applications of BIM, or the next "dimensions of BIM" will appear.

BIM maturity levels

BIM level 2

The integrated information model includes data that cover many areas, including:

- Structure **SIM** (Structure Information Model)
- Architecture **AIM** (Architecture Information Model)
- Equipment and management **FIM** (Facility Information Model)
- **BSIM** (Building Services Information Model) services
- And information specific to bridge objects – **BrIM** (Bridge Information Model).

National standards and other documents should bring into line most elements of the process, and the use of standardized bases of components facilitates design and assembly.

In the design and implementation process, CDE information management systems with full standardization of electronic information exchange are used. Paper documentation is no longer necessary because it is perfectly replaced by mobile devices with access to project data.

BIM maturity levels

BIM level 2

At this level, the organization of work changes and BIM ceases to be "lonely". Teams work closely together, and an effective exchange of information becomes an important element.

Participants of the process realize their tasks while taking into account a wider perspective: **"how does what I do affect the work of others and the end result?"**

In design and construction companies, there are completely new positions, or even professions, very important for the whole process, e.g. BIM manager, information manager or model manager that now exist due to BIM level 2.

BIM maturity levels

BIM level 3

This is the biggest challenge. In British literature, level 3 BIM is considered the "**Holy Grail of construction**".

The core of this BIM level is a model containing complete data about the object (3D, 4D, 5D, 6D, ...), based on one centralised data base with possible active links to external data that allows for bi-directional information exchange. This model is referred to as an iBIM (interoperable Building Information Model), i.e. an interoperable digital object model. The term "interoperable" here means that it enables full cooperation of all participants in the process, using the data contained in the model and introducing new data to it.

In this way, the model is updated in a continuous mode and the derived result is shared by all process participants.

BIM maturity levels

BIM level 3

The implementation of level 3 allows for a precise reflection of a real – existing or planned – building object, in the form of a digital model.

Thanks to this, at the concept and design stage, the design team can:

- Carry out **multiple iterations** of the model in order to obtain the expected indicators related to ecology and environmental protection, construction time, operating costs or other elements relevant to a given project.
- **Simulate the construction process –** taking into account the aspects of safety, costs, time.
- Carry out **simulations of the facility's use** and examine related aspects of health, ecology, environmental protection and safety.

The model containing all data corresponding to the actual object will be used to manage the object **throughout its life cycle**.

BIM maturity levels

BIM level 3

The core of level 3 activation is basing the design, implementation and management processes on Internet services integrated with BIM, as well as placing data in the cloud with the possibility of having access to them from any authorized device.

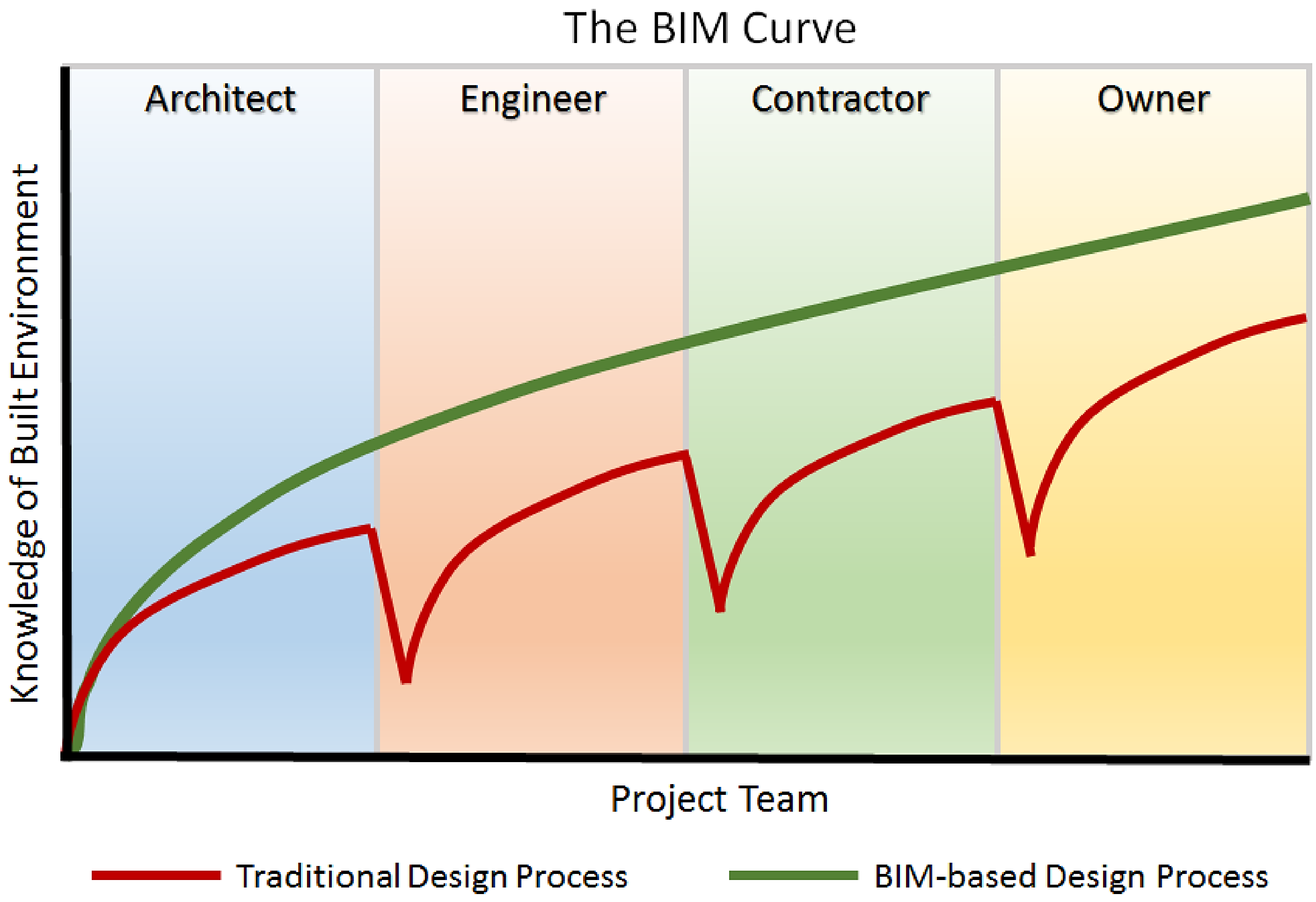
The definition of BIM level 3 is constantly changing. In the United Kingdom, for some time, there has been talk about the need to establish sublevels within it. This would allow a better definition of the subsequent steps that will allow users to reach the full level 3 maturity. It should be noted that at such a high level of data and process integration, it is necessary to introduce a number of new provisions regarding, for example, copyright or professional liability.

The implementation of BIM at level 3 requires advanced IT infrastructure, fast networks, access to high-speed wireless data transmission, as well as secure and effective data storage systems equipped with advanced information management tools based on cloud solutions.

Level 3 BIM will completely change the degree of the digitization of the construction industry, which is why it is one of the elements of the long-term development strategy of the United Kingdom – deemed "Digital Built Britain".

It is worth to be aware that level 3 has not been defined as the final level of BIM development.

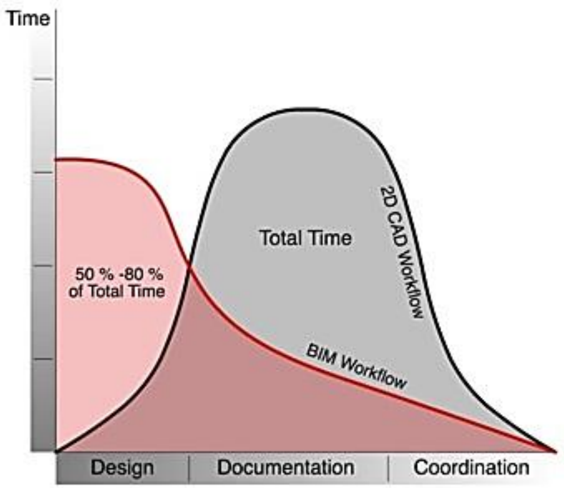
The BIM Curve



Source: Keysoftsolutions.co.uk

The BIM savings

50% design saving



30% construction saving

20% operations saving

Source: lodplanner.com

BIM beneficiaries

The most important users of information contained in BIM

- Investors
- Designers and specialists in various industries
- Companies that build or modernize an object or its surroundings
- Owners
- Managers
- Tenants
- Users and customers
- Companies involved in the maintenance of equipment of the facility
- Emergency services
- Public administration and local governments
- Companies providing media
- Demolition companies

BIM beneficiaries – designers

At various stages of investment implementation, the investor obtains diverse added values resulting from the use of BIM.

At the design stage:

- The possibility of active participation in the design process.
- Easy variant analysis for various design and technical solutions, particularly useful in the aspect of ecology and environmental protection.
- Facilitated social consultations, especially for large or controversial investments.
- Taking into account many criteria and their impact on the investment cost (good example: scaffolding).
- A much more accurate estimation of the budget and schedule.
- Obtaining an object of greater value (better use of the plot area, more effective design of the layout of rooms or passageways, better technical parameters of the facility).

BIM beneficiaries – designers

At various stages of investment implementation, the investor obtains various added values resulting from the use of BIM

At the design stage (cont.):

- It is easier to pre-determine the impact of construction time on the environment, e.g. excluding road sections, railway lines, viaducts, traffic congestion around the site, increased demand for utilities, etc.).
- Lower cost of making changes to the project.
- Easy communication with designers based on 3D model visualization.
- Better mutual understanding of the process participants.
- Clear definition of the scope of responsibility.
- Accurate estimation of maintenance costs of the finished object.

BIM beneficiaries – contractors

Contractor selection stage:

- Easy verification of offers due to the price.
- Easy verification of offers due to the schedule.
- Easier comparison of the quality of offers.
- A clearer definition of the investor's requirements towards the contractor.

Construction stage:

- Lower construction price.
- Ongoing cost control.
- Ongoing inspection of work progress.
- Easy communication with the contractor using a 3D model.
- Using the 3D model to start selling space in a non-existent object, especially when applying virtual and augmented reality technology.
- Addressing ecological concerns (less waste, green technologies, easier estimation of the impact of building construction on the natural environment).
- New possibilities of control and evaluation of the quality of performed works.

BIM beneficiaries - investors

Sales stage:

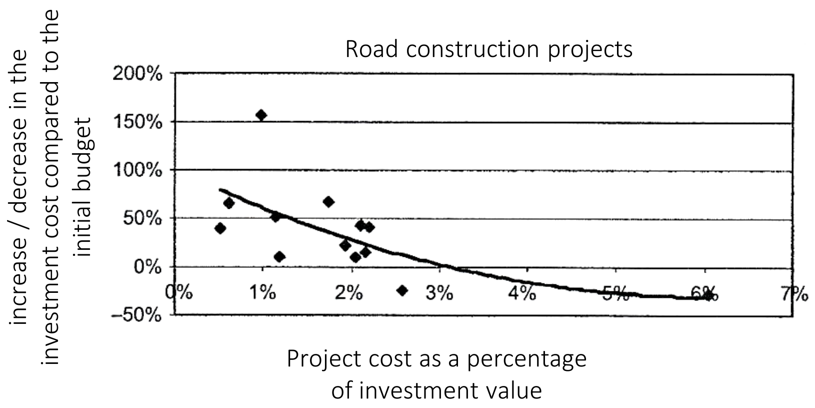
- High quality of the object.
- Compliance of as-built documentation with reality.
- Easy preparation of attractive offers based on the 3D model.
- Easy customization of the offer and arrangement.
- Easiness of estimating the costs and time of possible changes and arrangements.
- Opportunity to sell added value (ecology, low maintenance costs, access to data reducing management and maintenance costs).
- Enabling an increase of the object’s worth by offering added value – digital data that can be used directly in FM systems.

Ways of implementing a construction project

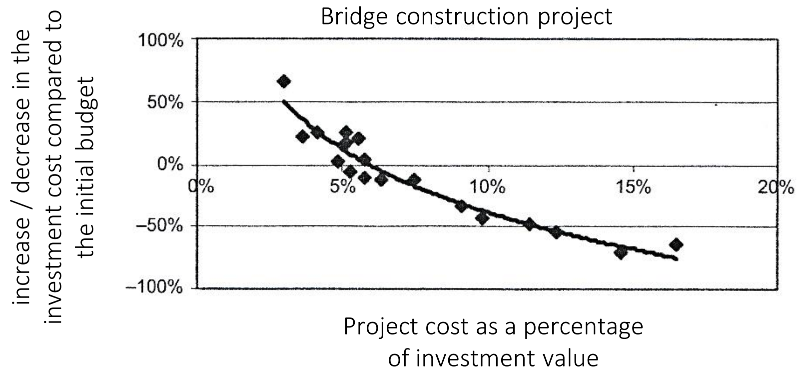
Three basic ways to implement a construction project:

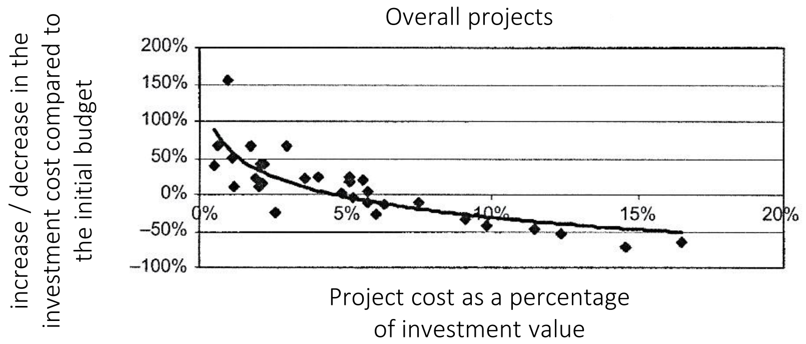
- Traditional **DBB (Design-Bid-Build**), the most commonly used in our country, e.g. Design, select a contractor and build, consisting of independent carrying out three processes: order preparation, project execution and construction completion. These processes are enacted by various entities that are linked by independent contracts.
- Popular in developed countries – **DB (Design and Build)**, in which design and construction are treated as one process implemented by one main entity that is also a party to the contract with the investor (most often it is a general contractor, less often, an architectural company).
- Increasingly better known in the context of the use of BIM, **IPD (Integrated Project Delivery)**, i.e. an integrated investment process in which ordering, design and construction are one process implemented jointly by all participants.

Ways of implementing a construction project



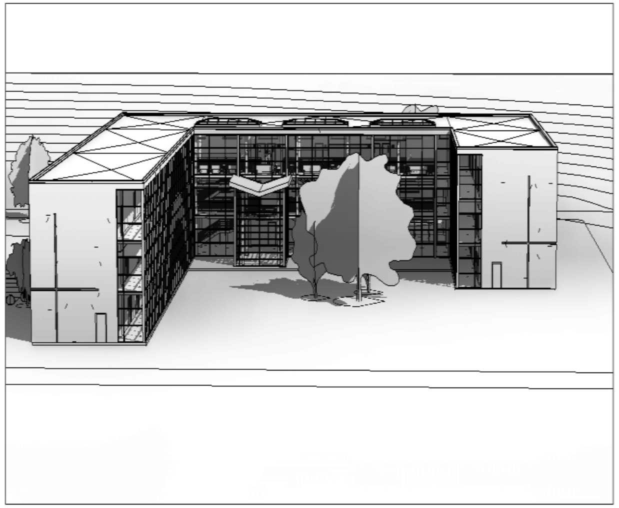
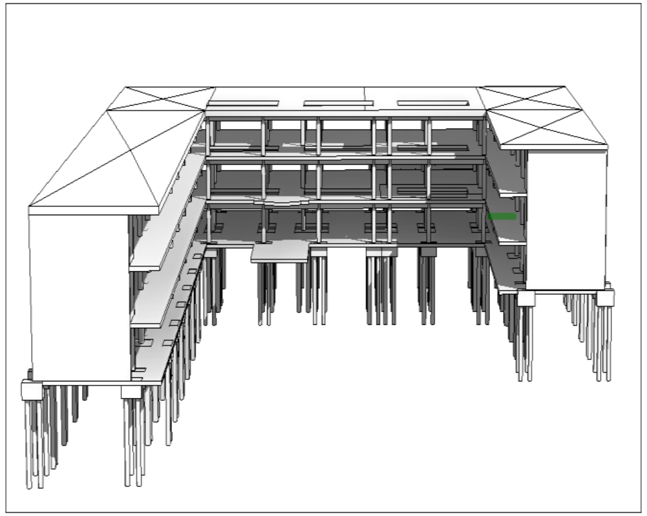
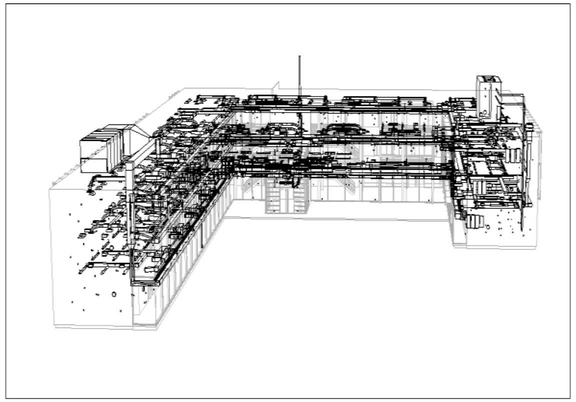
It is worth extending investment in the design stage. Money spent on the project here, can reduce total investment costs (to some extent)





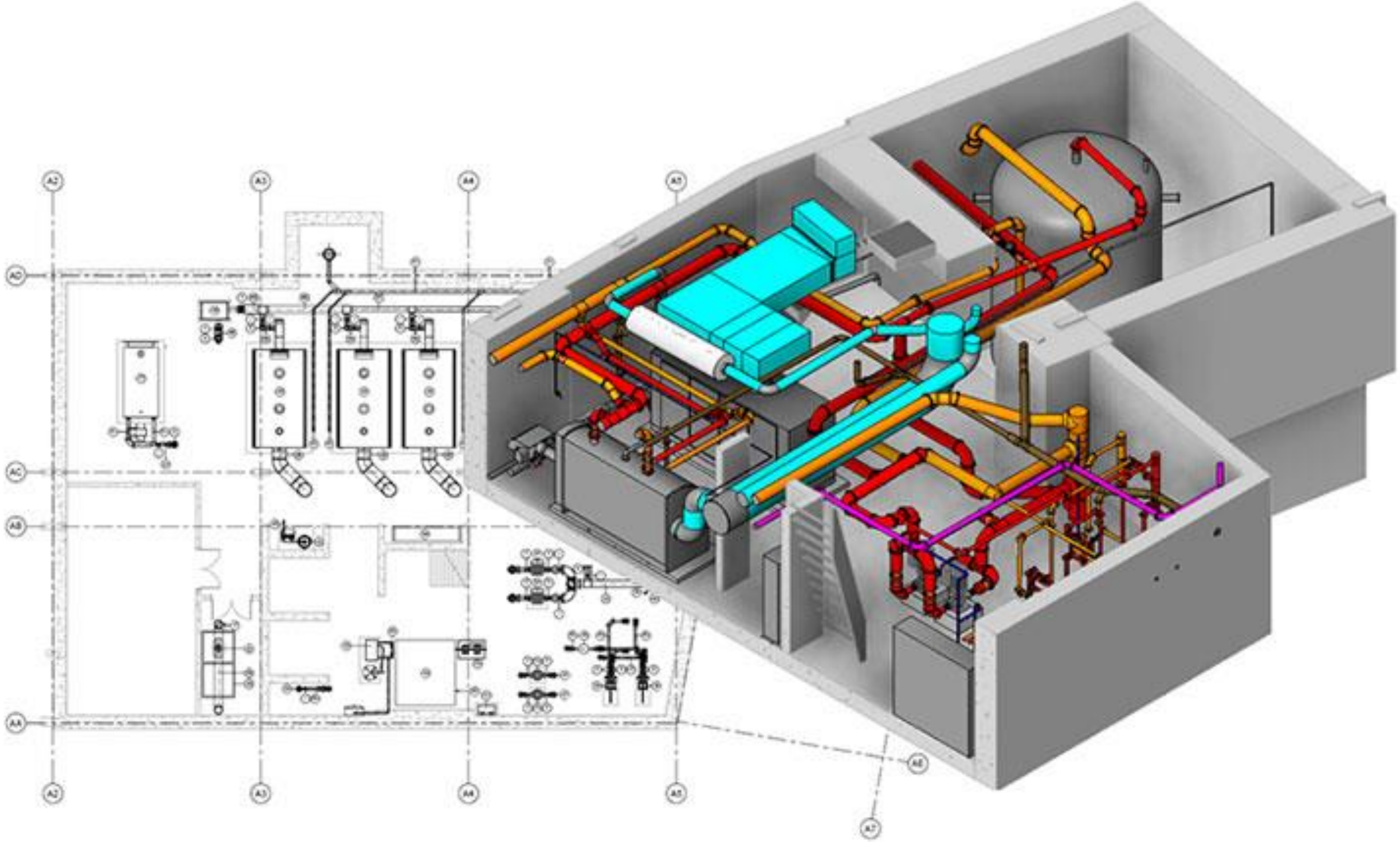
Source: Kasznia D., Magiera J., Wierzowiecki P., BIM w praktyce. Standardy. Wdrożenie. Case Study, PWN, Warszawa 2018

3D models of the building

Architecture	Construction	Installations
		

Thanks to the use of BIM, designers are now able to develop designs for the most complex buildings. BIM is used in the field of planning, design, management and construction. By working in this standard, designers easily collect and exchange data, by collaborating and sharing the necessary information. BIM technology is already used at the stage of creation (creation) of most projects. As a result, both architects and other participants of the investment process working on a 3D model are able to check virtually all technical aspects of the planned implementation before heavy equipment begins to work. Because the cooperation is based on 3D models, changes made by one of the parties can be immediately captured automatically by the others, so the time is saved that was previously spent on painstaking coordination of compliance and adaptation of all documentation to the introduced changes in 2D. The collaboration of specialists is thus smoother, and project data and information are used in a completely new way.

BIM



Part 2

Building Information Model

BIM

Building Information Modelling is a process based on an intelligent 3D model. The model enables access to accurate and always up-to-date project data, and, consequently, making decisions based on information throughout the project life cycle.

It is a database that should contain all the information describing a given building: geometric data, physical features, functional features, cost data, technical parameters, data necessary to ensure the maintenance of equipment, data on the demand for utilities.

It is a process by which a virtual model of a planned or existing building object is created in the computer. Even at the design stage, this model is used for various analyzes, construction simulations (for new objects) or repairs (for existing facilities).

Revit

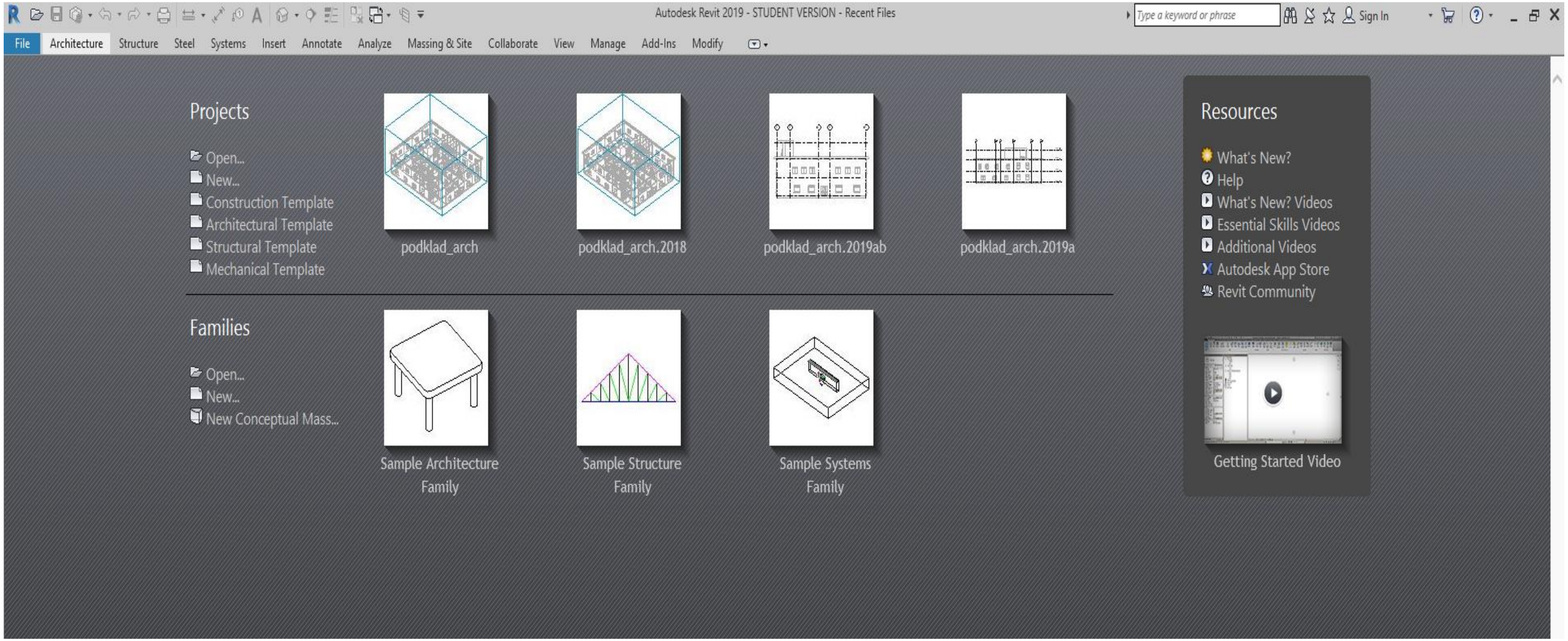
Revit is not a CAD program

- Autodesk Revit is a BIM application that uses parametric 3D modelling to generate projections, sections, elevations, visualizations, details and combinations of all the necessary instruments needed to document a construction project.
- Drawings created using Revit are not a sum of 2D lines and shapes that are interpreted as a building; these are real views from the virtual model.
- The created elements retain a bidirectional relation – if the elements are changed in one view, e.g. a projection, these changes are automatically updated in the remaining views.
- In addition, all properties and information about each element are collected in the element itself, thanks to which the description of the element does not play such a significant role as it is in CAD applications.

Revit tutorials

- Revit Tutorial for Beginners https://www.youtube.com/watch?v=F322Jvs24Do
- Revit MEP Lesson 1: User Interface: https://www.youtube.com/watch?v=ZSXN-7mRSvM
- Plumbing in Revit MEP Beginner Tutorial: https://www.youtube.com/watch?v=Mvb-lu6ivq0
- Simple Mechanical System in Revit Tutorial https://www.youtube.com/watch?v=PJLHu_Yke0A

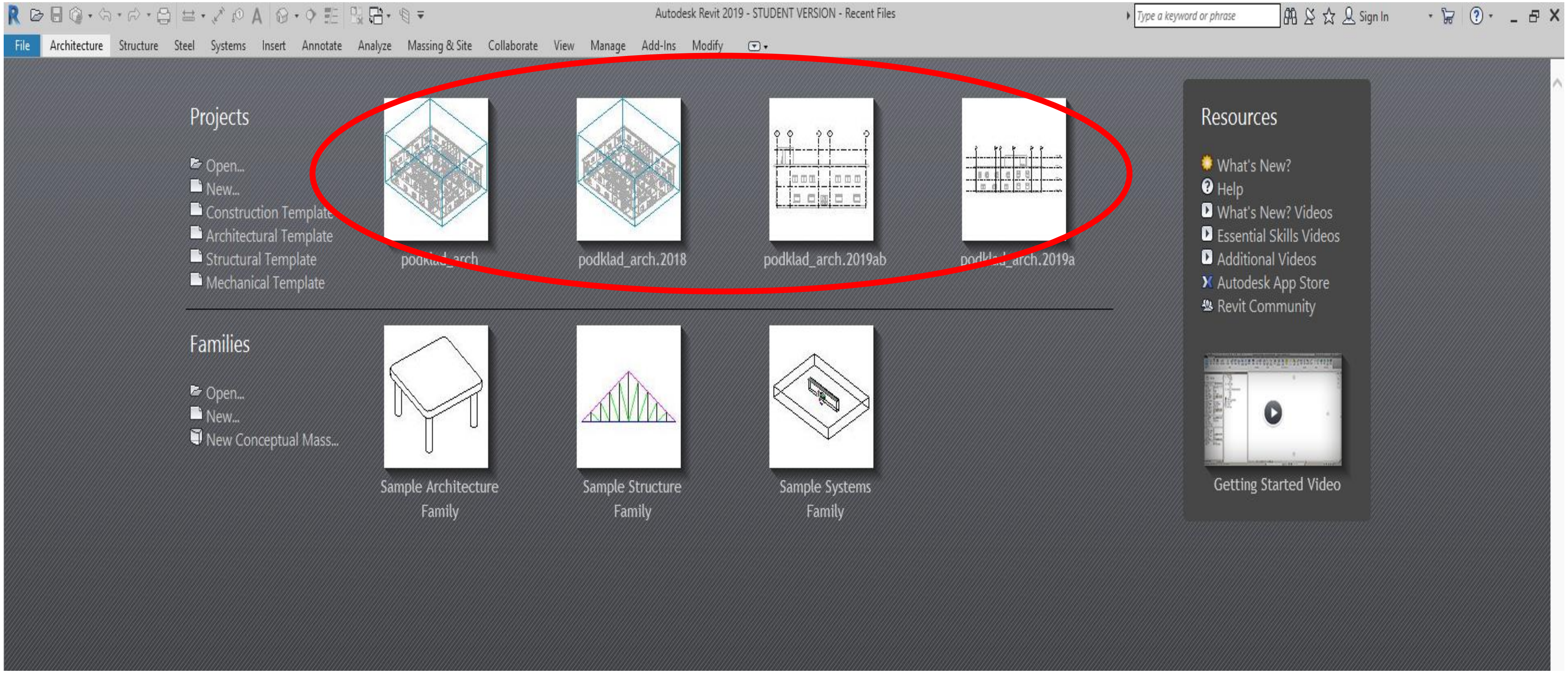
Revit Interface



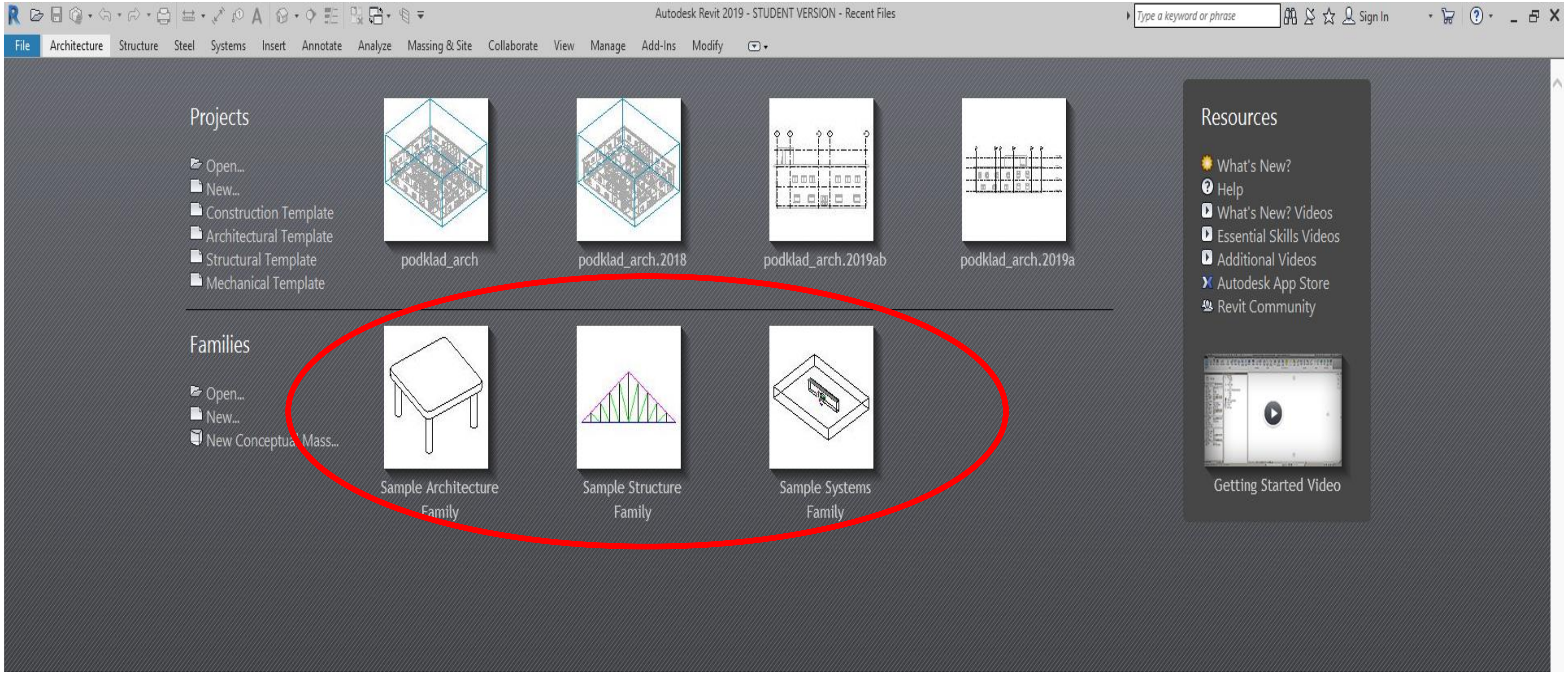
Important!

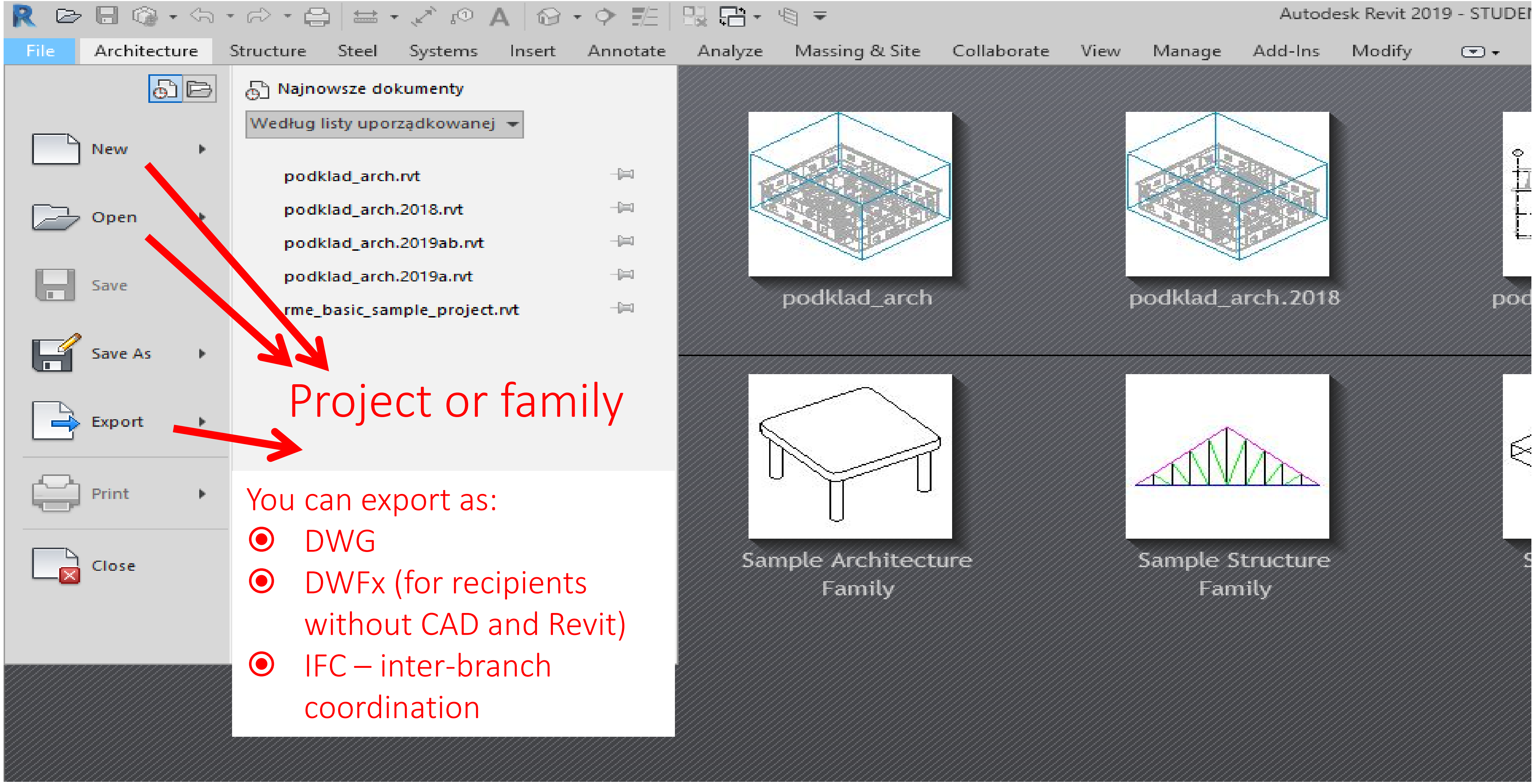
- Always open the file from within Revit, not by double clicking on the file in the browser. In this way, while working as a group, we open the current file;
- Revit files are not backward compatible, e.g. a file of Revit 2019 will not open in 2016;
- Opening the 2016 file in Revit 2019 will automatically convert to version 2019. (it will stay like this forever)

Previously open projects



Previously open or created families

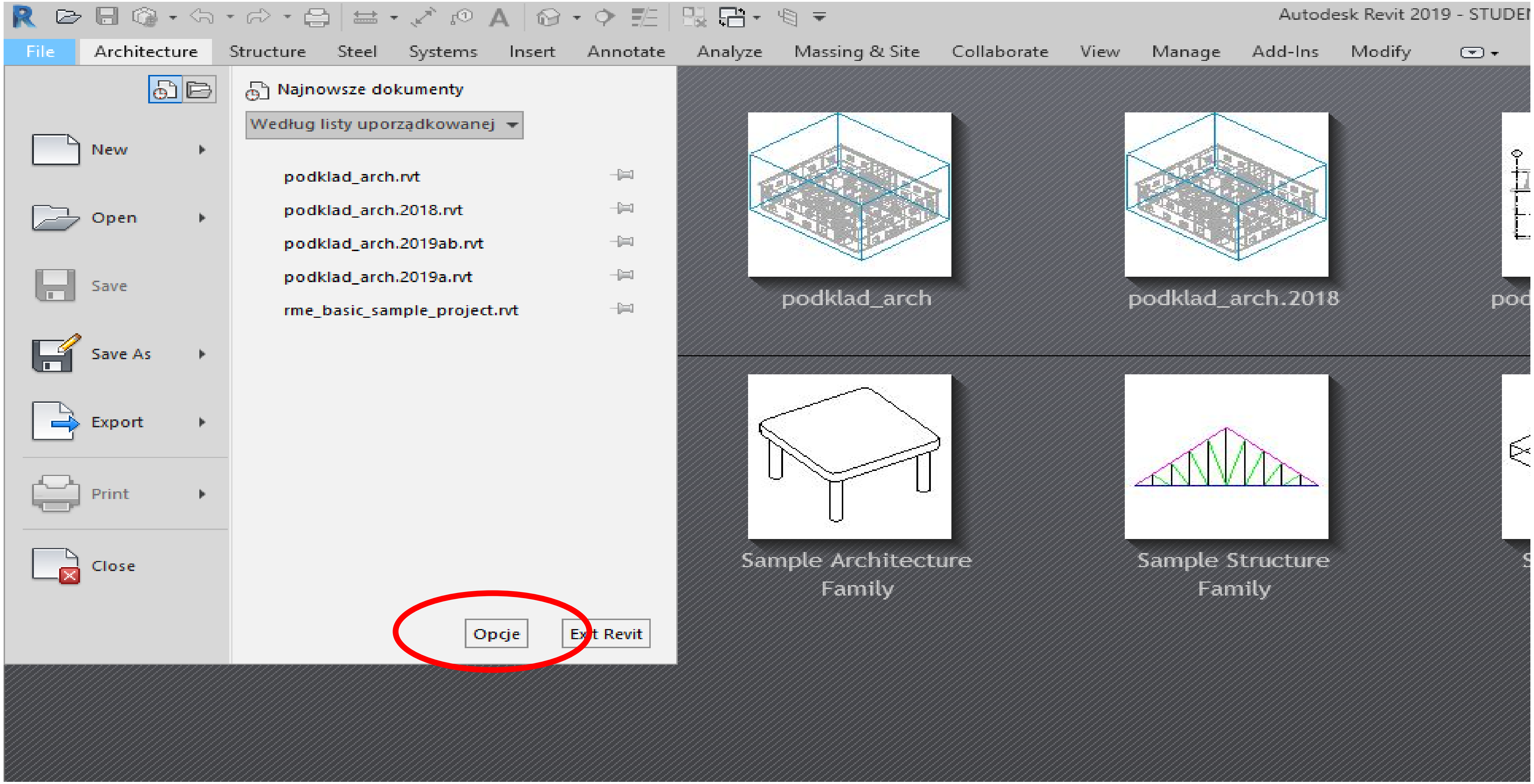




Project or family

You can export as:

- DWG
- DWFx (for recipients without CAD and Revit)
- IFC – inter-branch coordination



Autodesk Revit 2019 - STUDEN
File
Architecture
Structure
Steel
Systems
Insert
Annotate
Analyze
Massing & Site
Collaborate
View
Manage
Add-Ins
Modify
New
Open
Save
Save As
Export
Print
Close
Najnowsze dokumenty
Według listy uporządkowanej
podklad_arch.rvt
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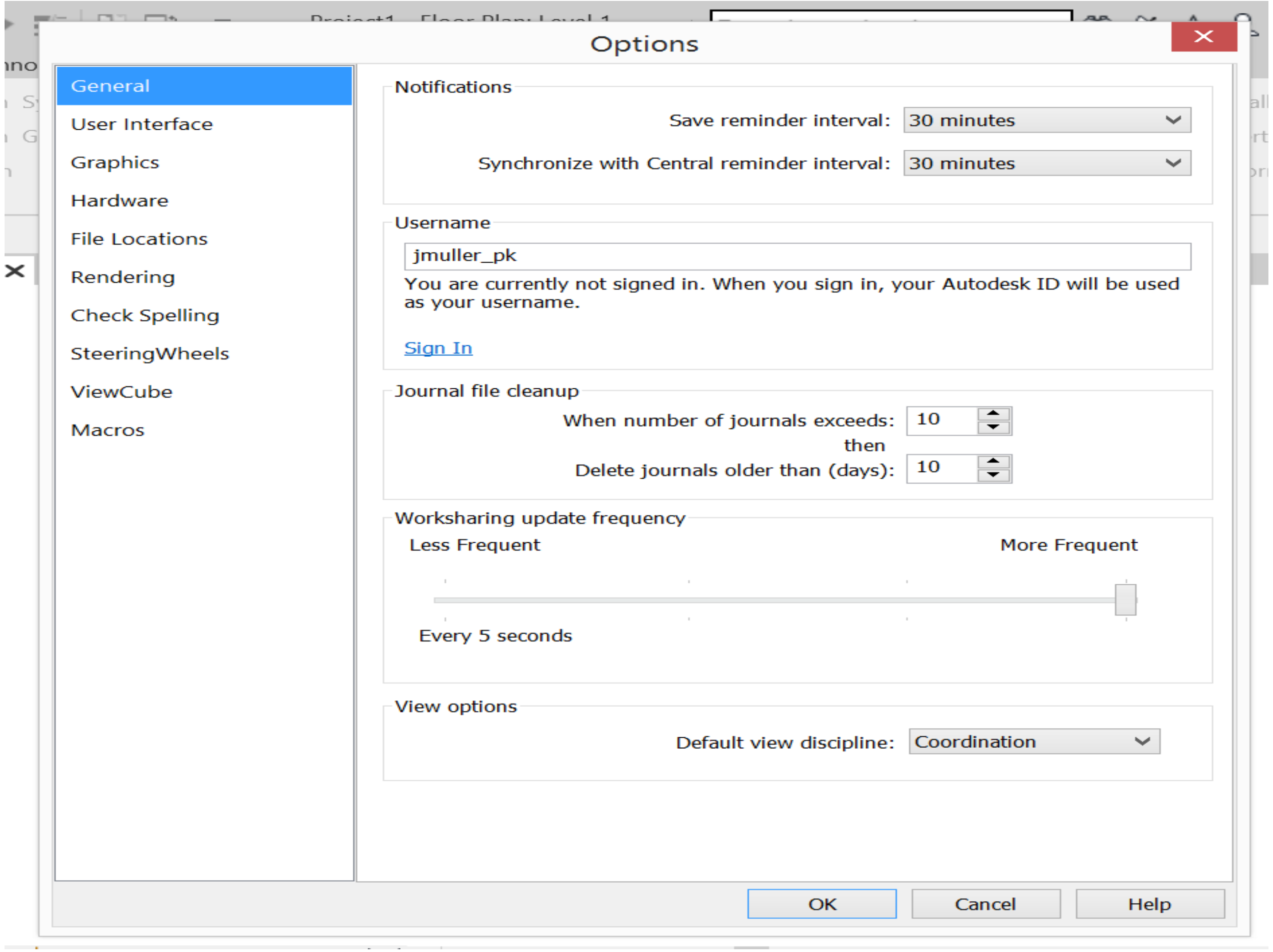
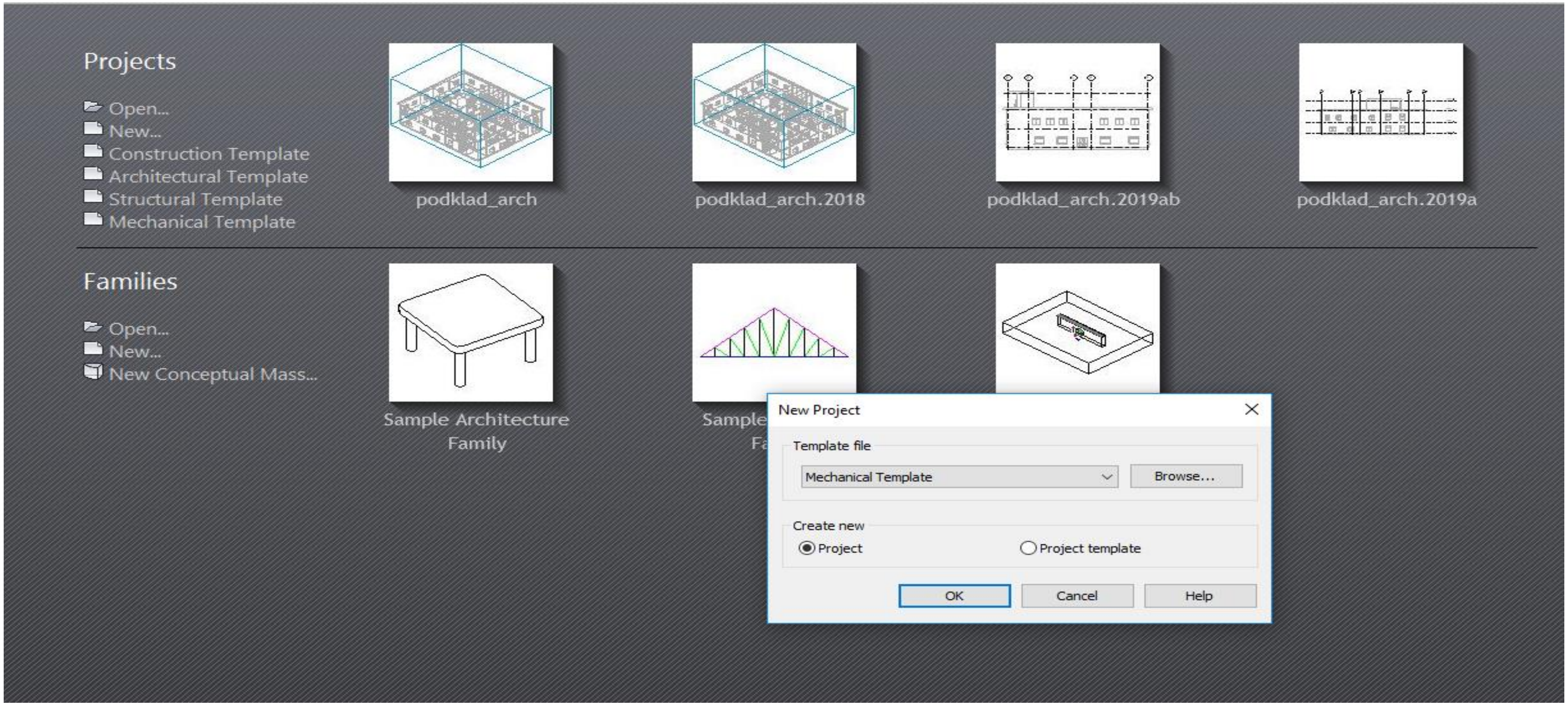
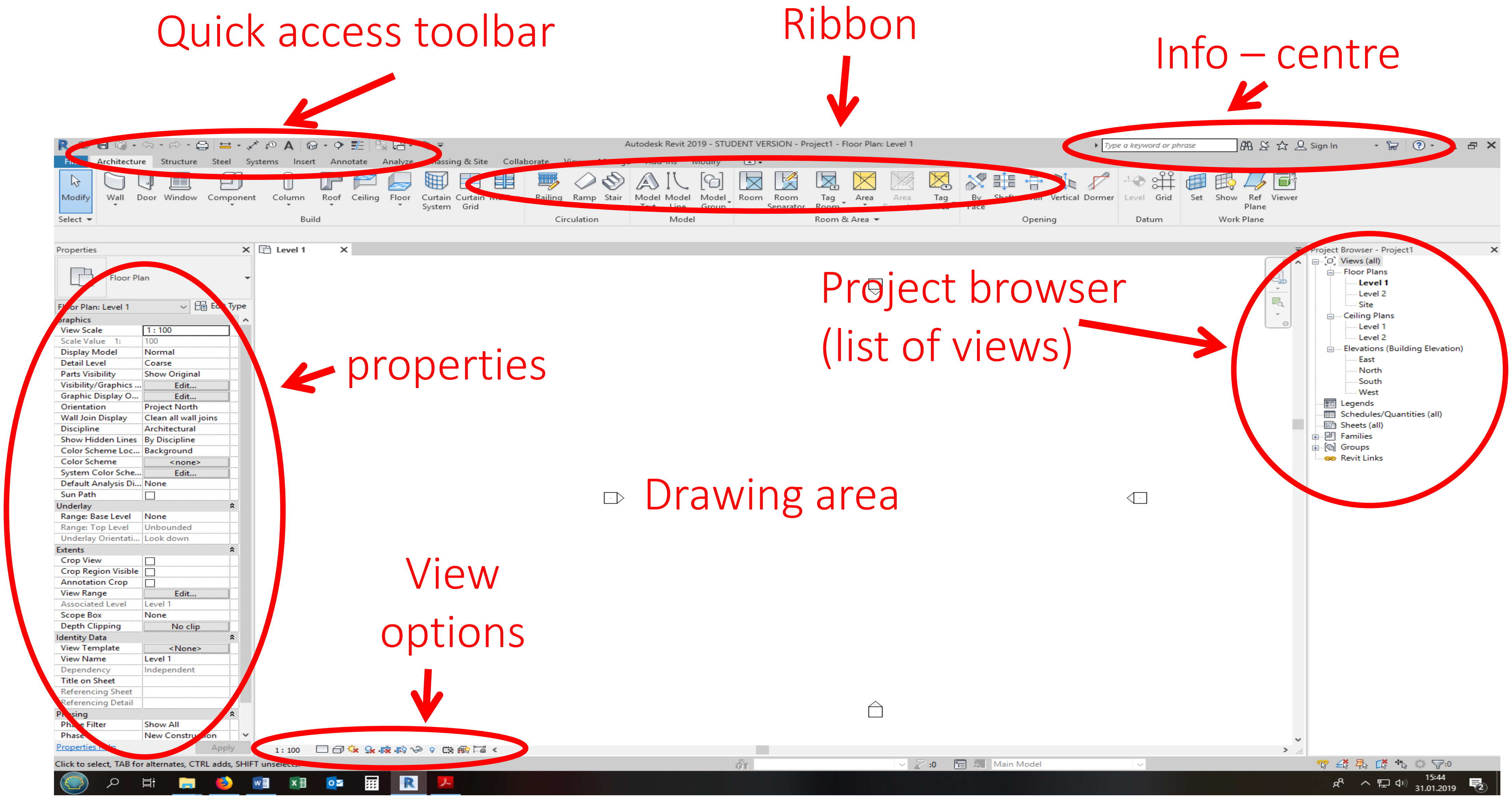
podklad_arch.2019ab.rvt
podklad_arch.2019a.rvt
rme_basic_sample_project.rvt
Opcje
Exit Revit
podklad_arch
podklad_arch.2018
Sample Architecture Family
Sample Structure Family

Important options

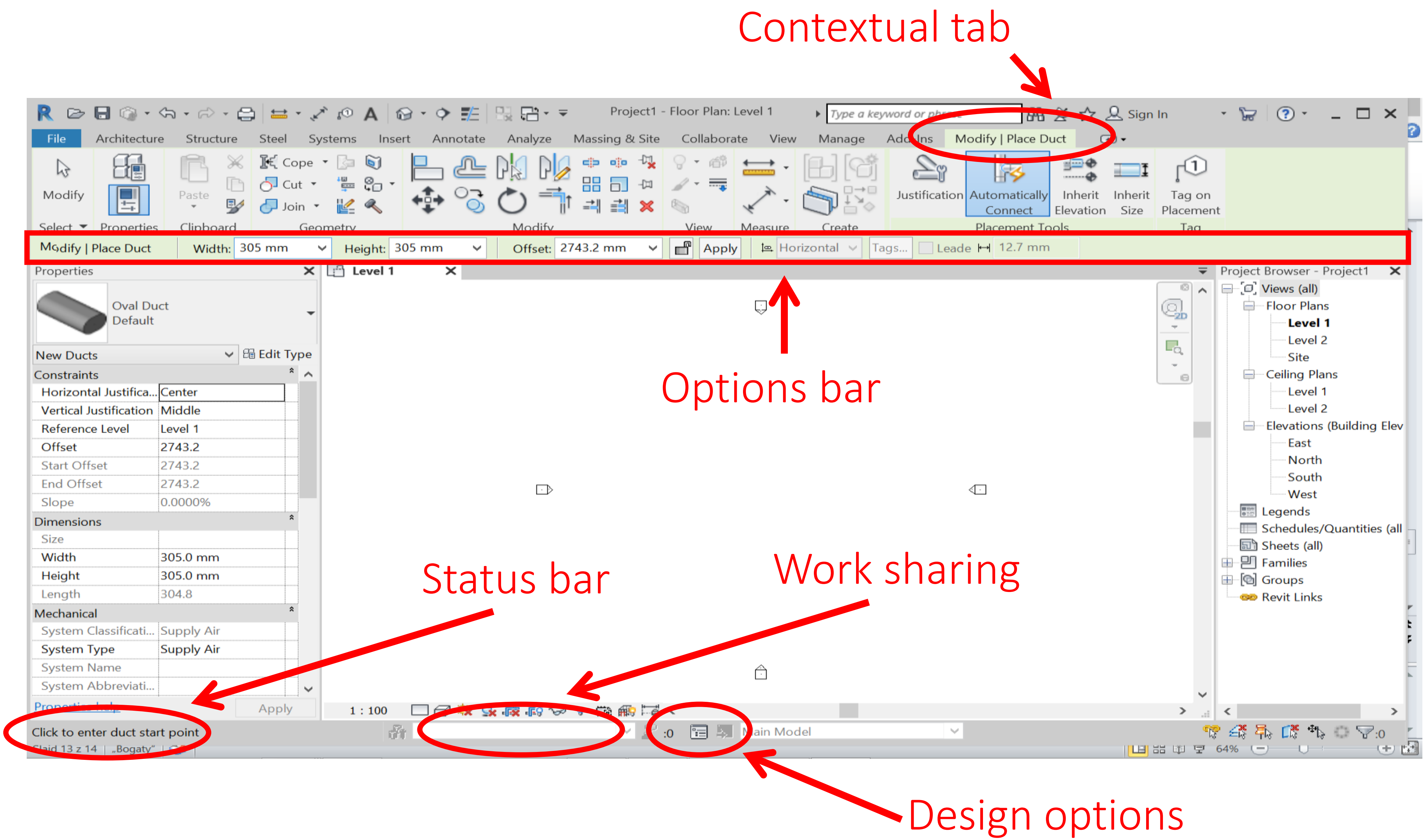


Choice of Template „Mechanical Template”





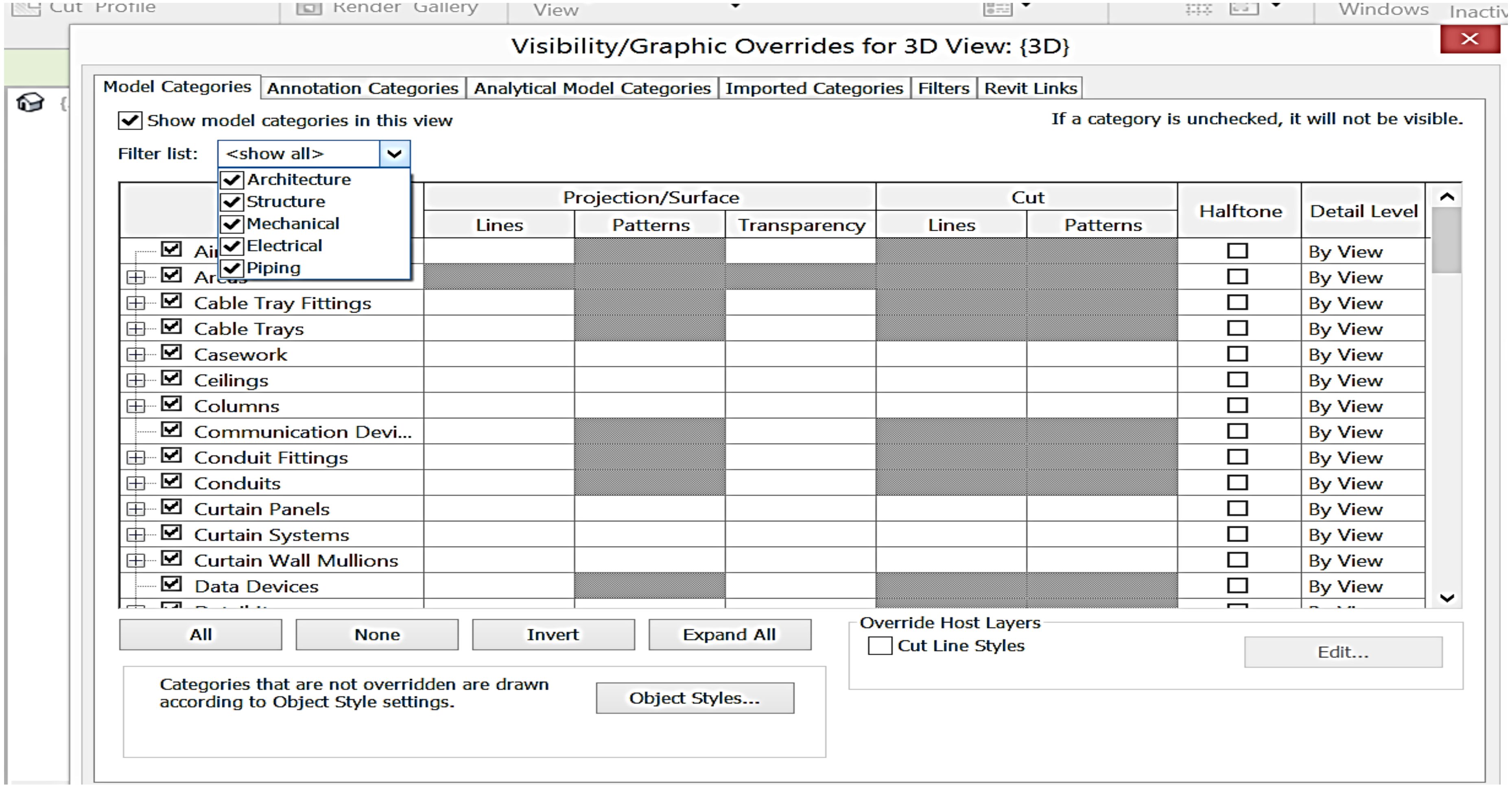
Quick access toolbar
Ribbon
Info – centre
Project browser
(list of views)
properties
Drawing area
View
options
Autodesk Revit 2019 - STUDENT VERSION - Project1 - Floor Plan: Level 1
Properties
Project Browser - Project1


Contextual tab
Options bar
Status bar
Work sharing
Design options
Project1 - Floor Plan: Level 1
File
Architecture
Structure
Steel
Systems
Insert
Annotate
Analyze
Massing & Site
Collaborate
View
Manage
Add-Ins
Modify | Place Duct
Modify | Place Duct
Width: 305 mm
Height: 305 mm
Offset: 2743.2 mm
Apply
Properties
Oval Duct
Default
Project Browser - Project1
Click to enter duct start point

Customize

- You can match several elements to your own needs and habits;
- "Quick access bar" can be extended to frequently used commands (right click) or reduced (arrow);
- Bookmarks can be arranged in any order (ctrl);
- Panels can be moved, even to the work area or the second screen;
- Properties and browser are individual for each user;
- You can use keyboard shortcuts (mouse over or alt);
- Abbreviations run without "enter".

Graphics visibility



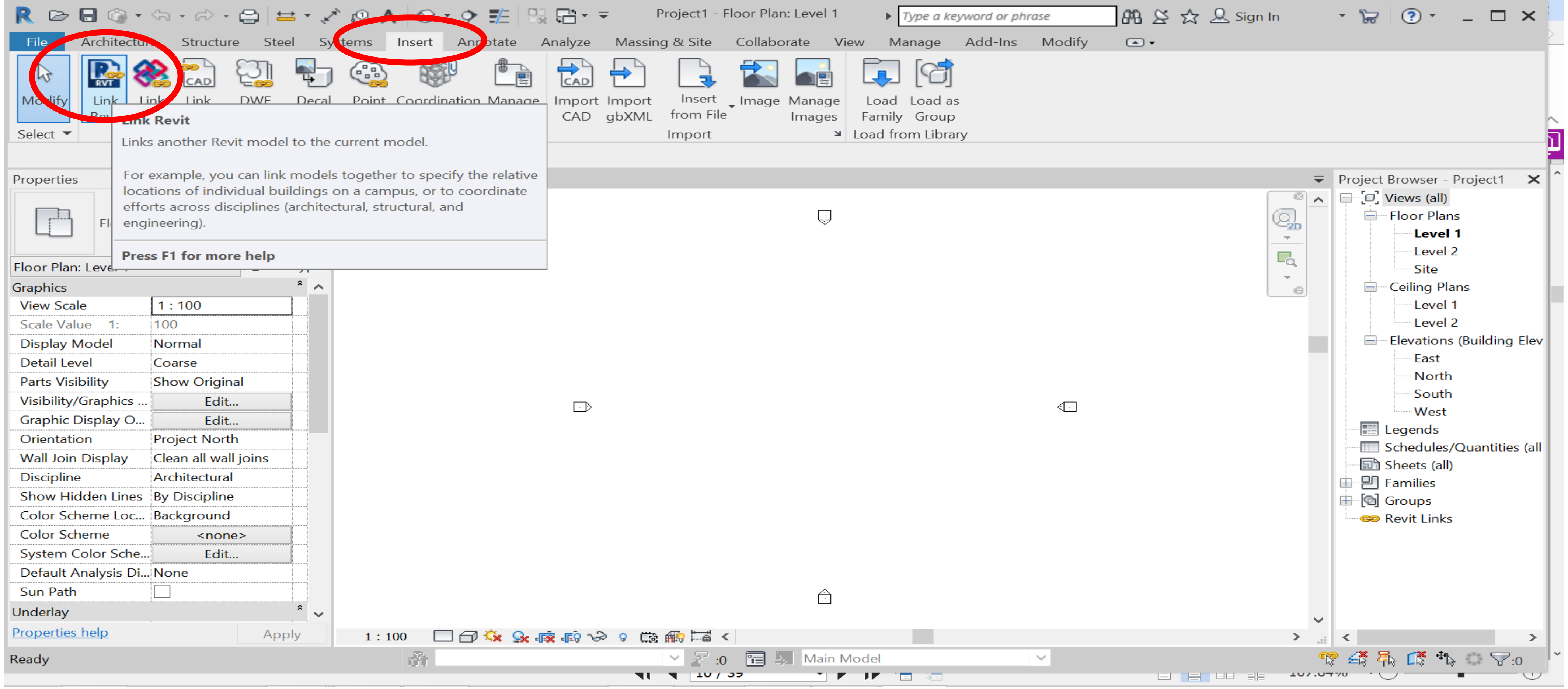
Projects, templates families

- Template extension .rte;
- While working in Revit, we create (or use a predefined) template;
- Families are components we use to build our model, such as equipment, ducts, diffusers, walls, windows, etc. Each family can have multiple types, such as different size, parameter variables materials, etc.;
- The .rft family template file extension;
- The family is closely related to the template;
- .rfa family file extension;
- The family can be loaded into the project file.

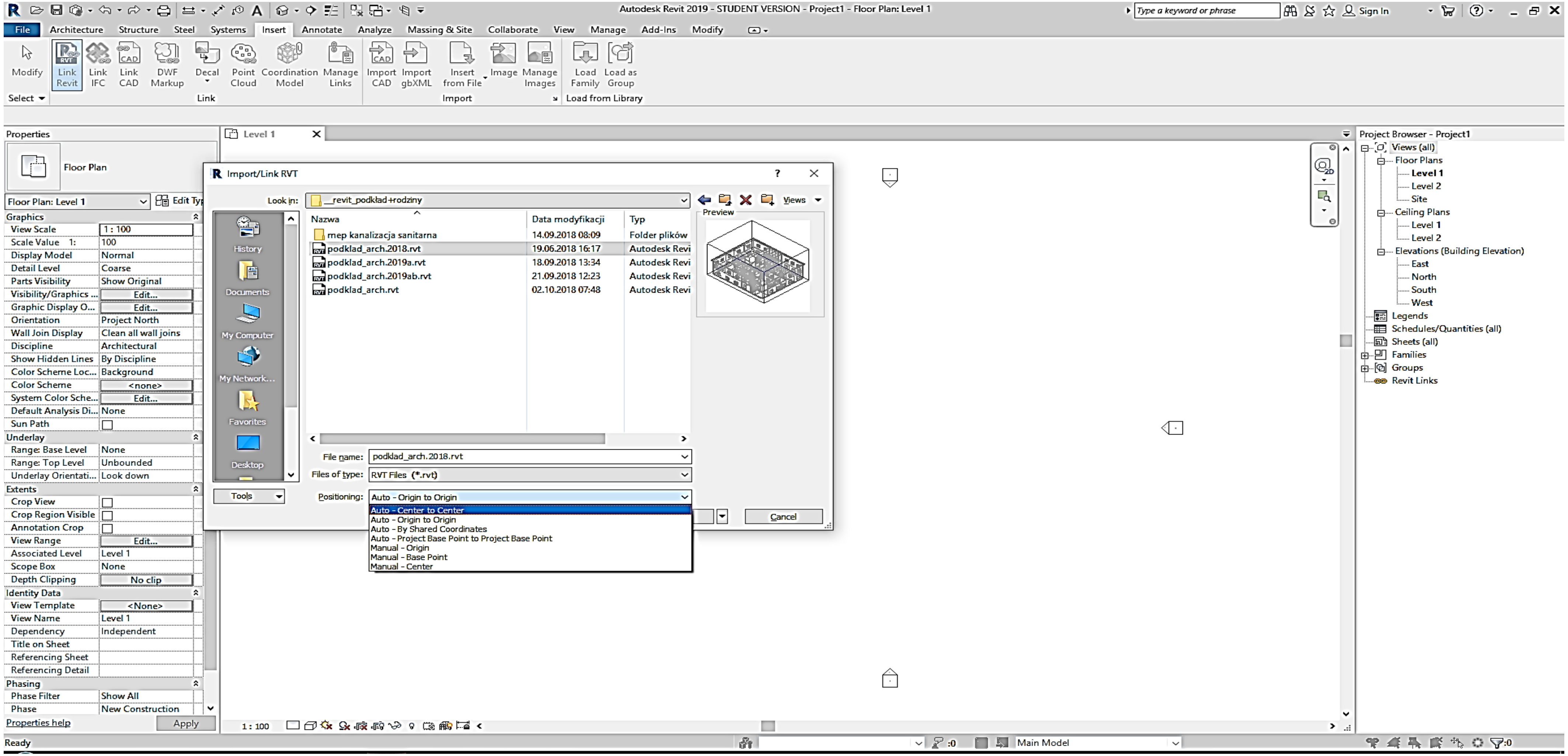
Views

- Views are selected from "project browser";
- Each selected view is opened all the time;
- The view currently in use is highlighted (bold) in "project browser";
- Each command is performed in each view;
- Optimization – disabling unused views (close inactive) – "quick access" or "view ribbon".

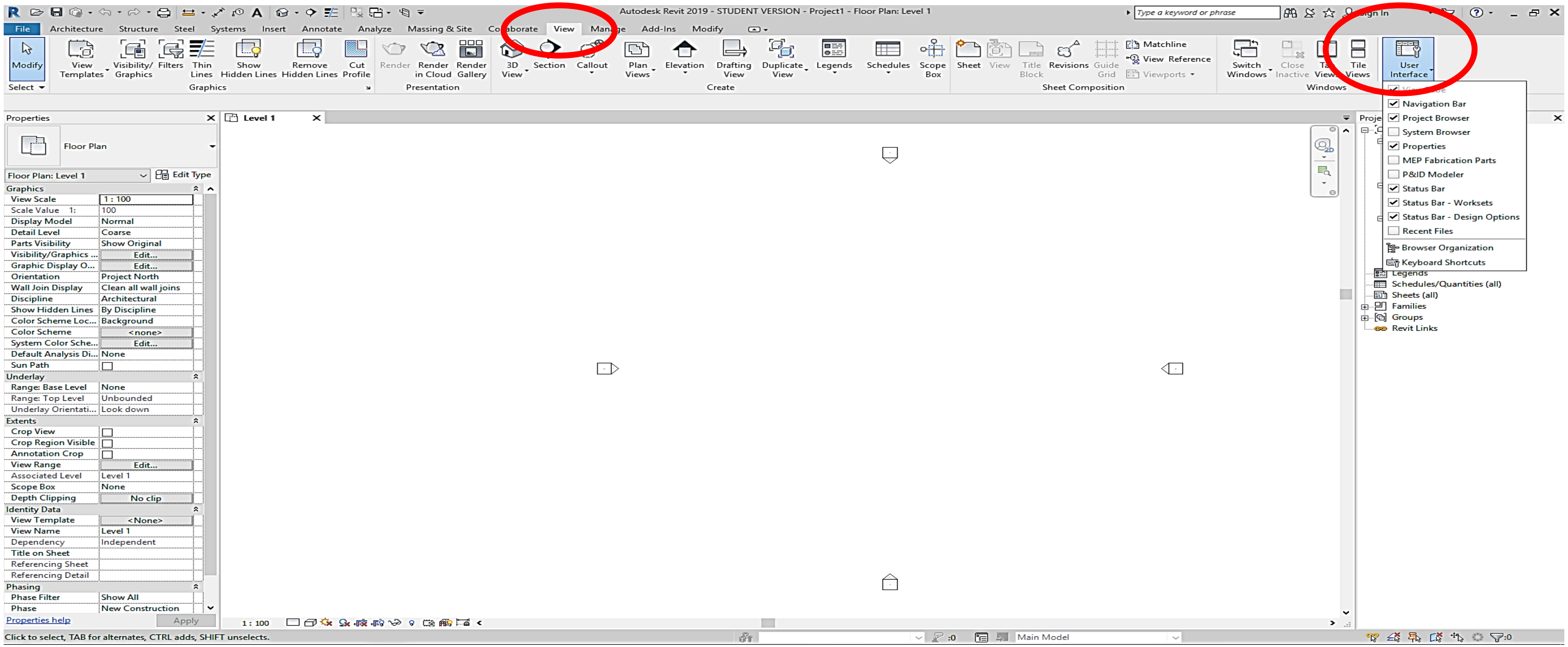
Link


Project1 - Floor Plan: Level 1
Type a keyword or phrase
Sign In
File
Architecture
Structure
Steel
Systems
Insert
Annotate
Analyze
Massing & Site
Collaborate
View
Manage
Add-Ins
Modify
Select
Import CAD
Import gbXML
Insert from File
Image
Manage Images
Import
Load Family
Load as Group
Load from Library
Link Revit
Links another Revit model to the current model.
For example, you can link models together to specify the relative locations of individual buildings on a campus, or to coordinate efforts across disciplines (architectural, structural, and engineering).
Press F1 for more help
Properties
Graphics
View Scale
1 : 100
Scale Value 1:
100
Display Model
Normal
Detail Level
Coarse
Parts Visibility
Show Original
Visibility/Graphics ...
Edit...
Graphic Display O...
Edit...
Orientation
Project North
Wall Join Display
Clean all wall joins
Discipline
Architectural
Show Hidden Lines
By Discipline
Color Scheme Loc...
Background
Color Scheme
<none>
System Color Sche...
Edit...
Default Analysis Di...
None
Sun Path
Underlay
Properties help
Apply
Project Browser - Project1
Views (all)
Floor Plans
Level 1
Level 2
Site
Ceiling Plans
Level 1
Level 2
Elevations (Building Elev
East
North
South
West
Legends
Schedules/Quantities (all
Sheets (all)
Families
Groups
Revit Links
Ready
Main Model

Positioning

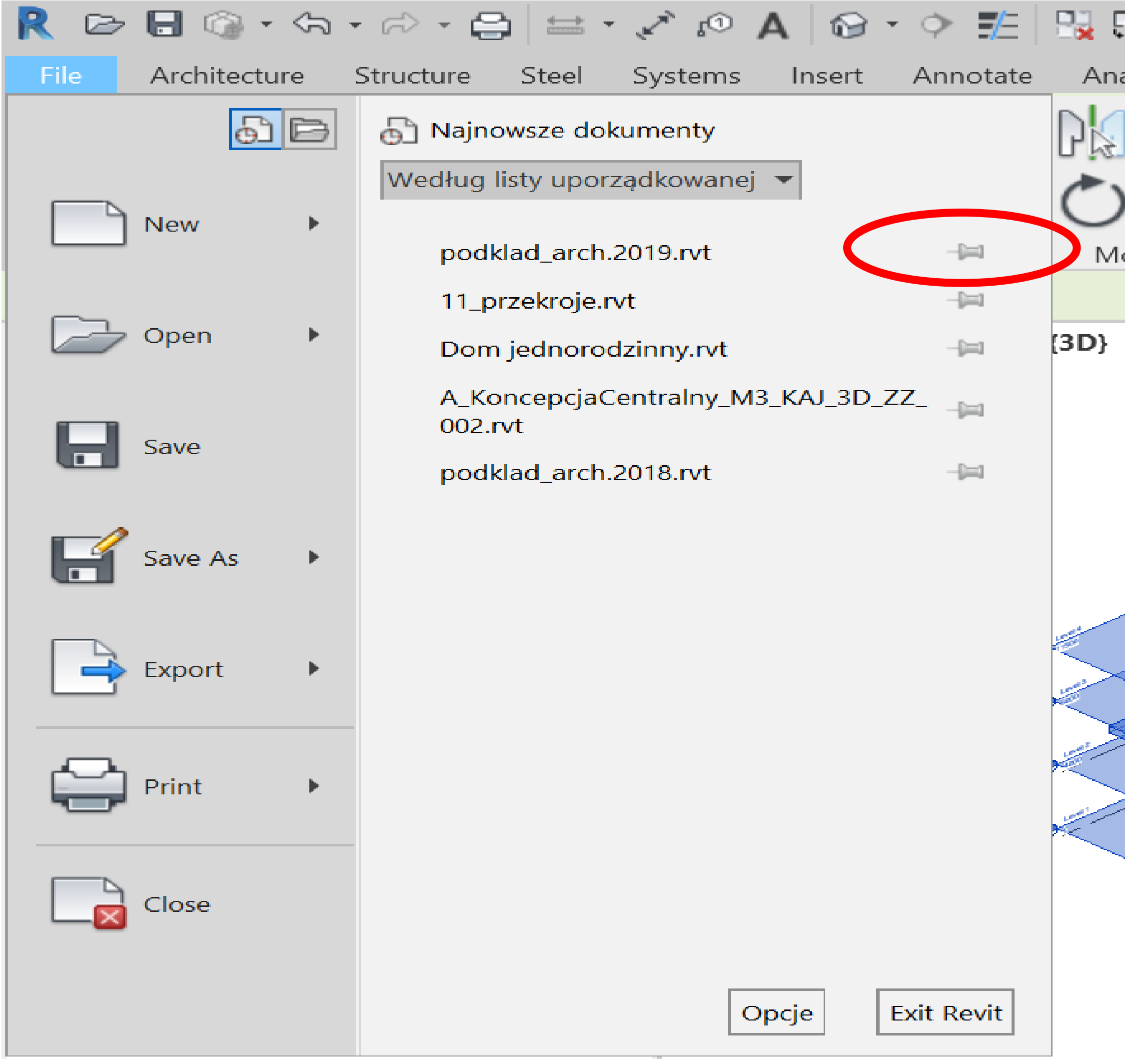


Interface



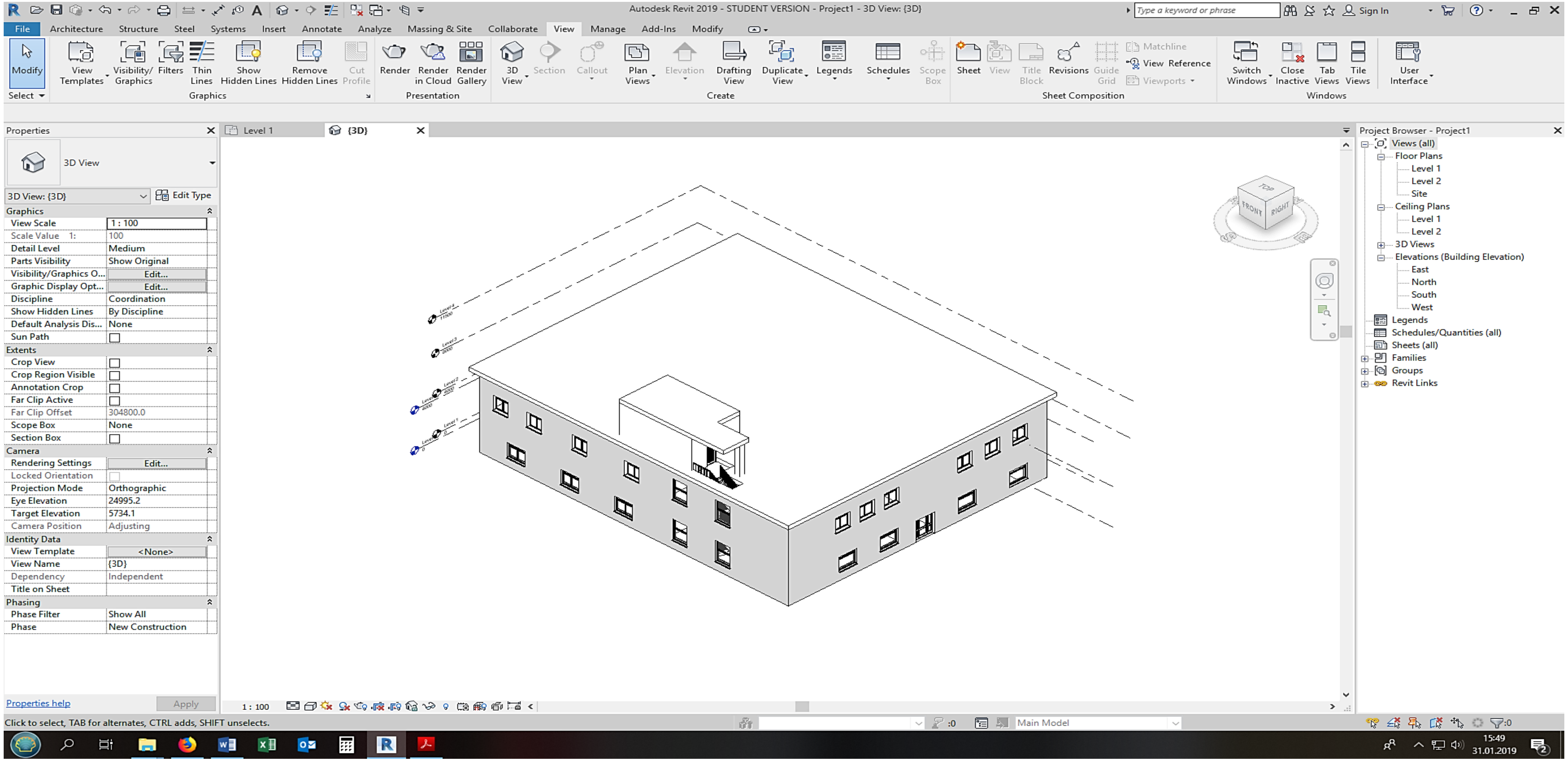
Autodesk Revit 2019 - STUDENT VERSION - Project1 - Floor Plan: Level 1
File Architecture Structure Steel Systems Insert Annotate Analyze Massing & Site Collaborate View Manage Add-Ins Modify
User Interface
Navigation Bar
Project Browser
System Browser
Properties
MEP Fabrication Parts
P&ID Modeler
Status Bar
Status Bar - Worksets
Status Bar - Design Options
Recent Files
Browser Organization
Keyboard Shortcuts
Properties
Floor Plan
Floor Plan: Level 1
Edit Type
Level 1
Click to select, TAB for alternates, CTRL adds, SHIFT unselects.

Opening



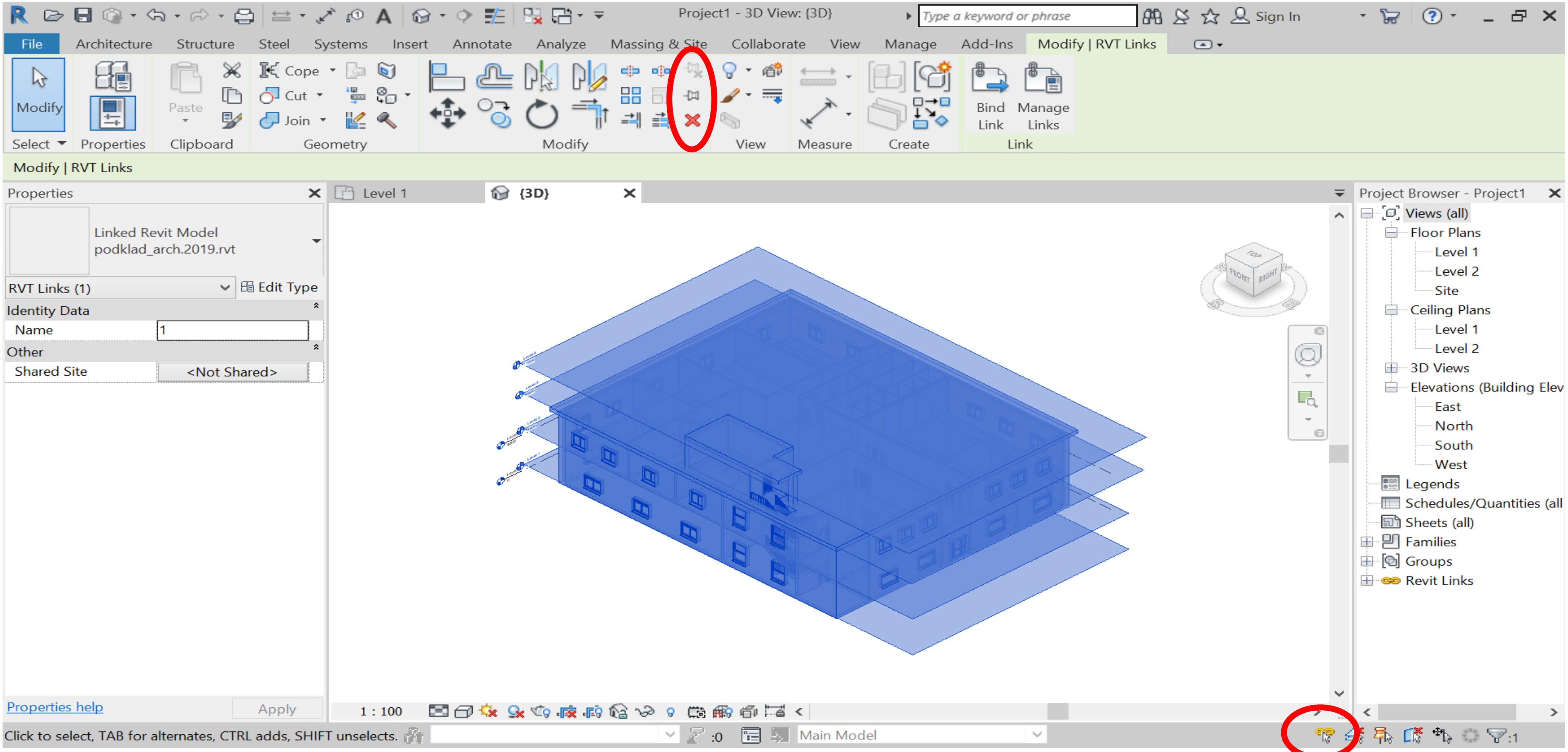
File
Architecture
Structure
Steel
Systems
Insert
Annotate
New
Open
Save
Save As
Export
Print
Close
Najnowsze dokumenty
Według listy uporządkowanej
podklad_arch.2019.rvt
11_przekroje.rvt
Dom jednorodzinny.rvt
A_KoncepcjaCentralny_M3_KAJ_3D_ZZ_002.rvt
podklad_arch.2018.rvt
Opcje
Exit Revit
{3D}

Zoom to fit (right click)



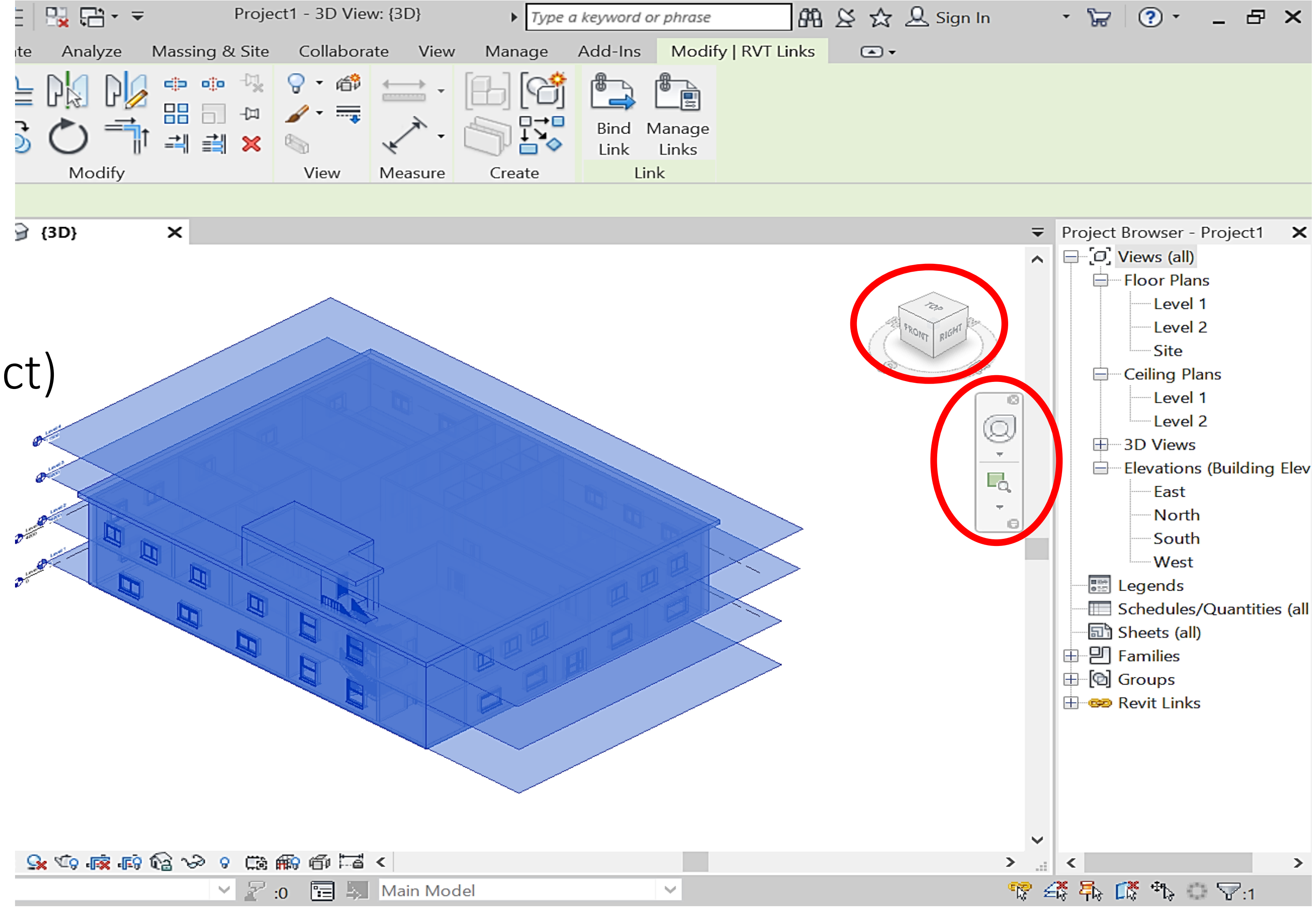
Click and pin

Block link



3D views:

- Cube
- Panel
- Orbit (around object)

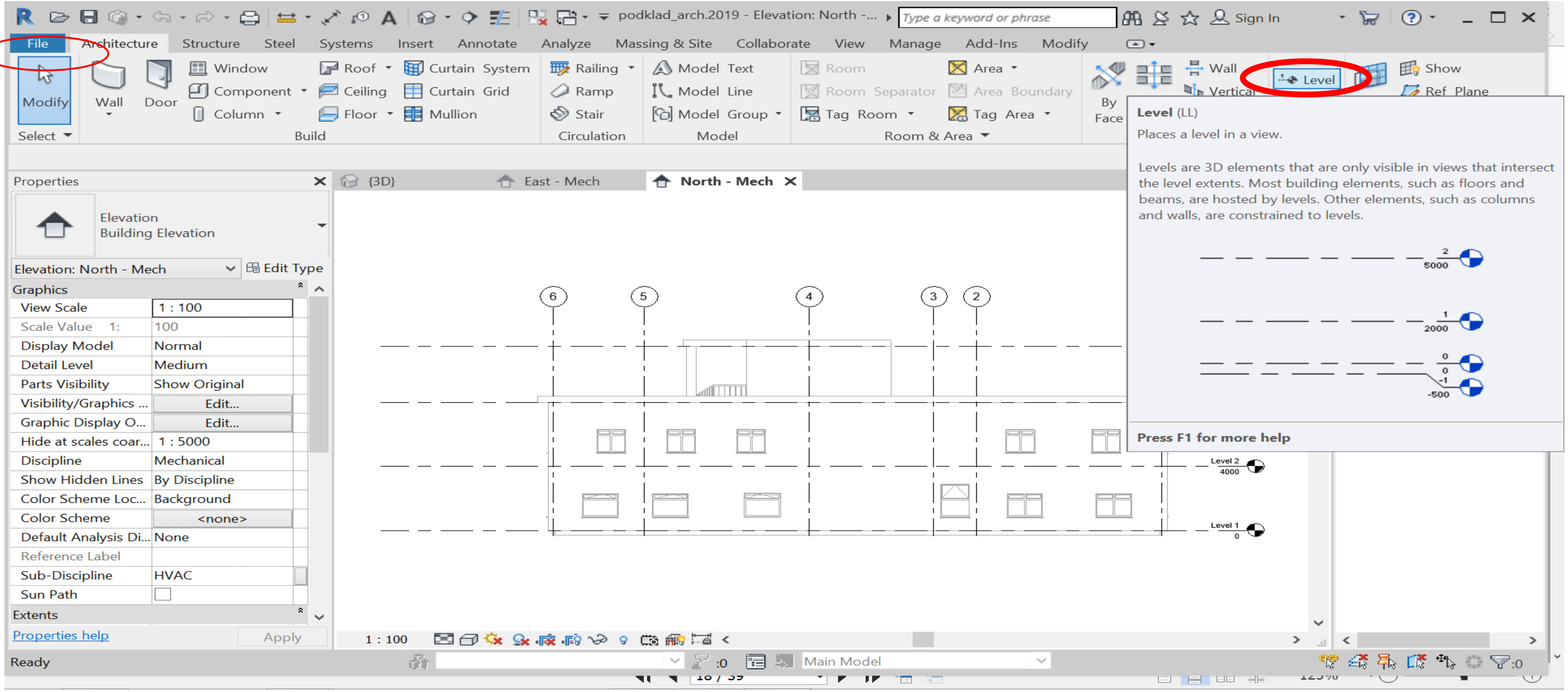


Levels

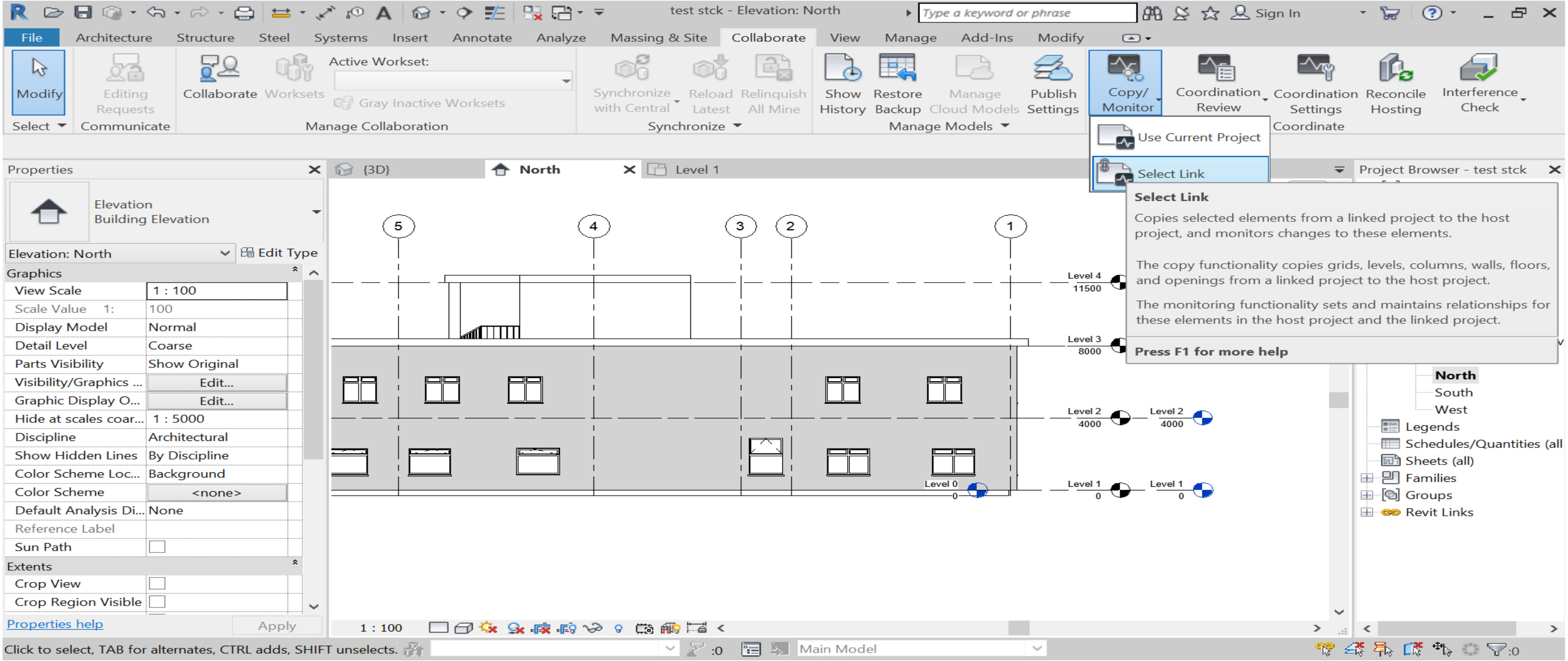
Levels can be created:

- From architectural layout (from the elevation view);
- Import from other model’s links;
- Manually;
- Through line selection.

Levels manually Line copying as level, offset, ordinates

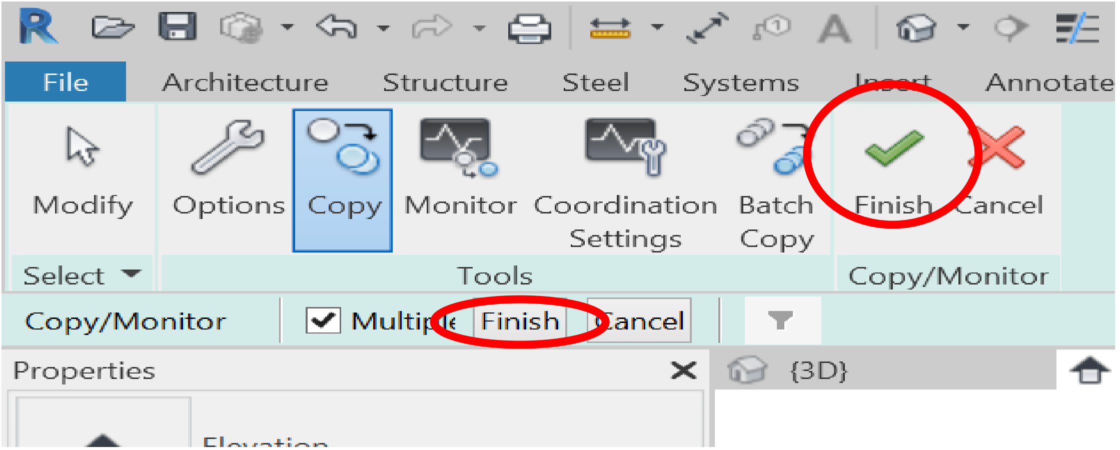


Levels – copying



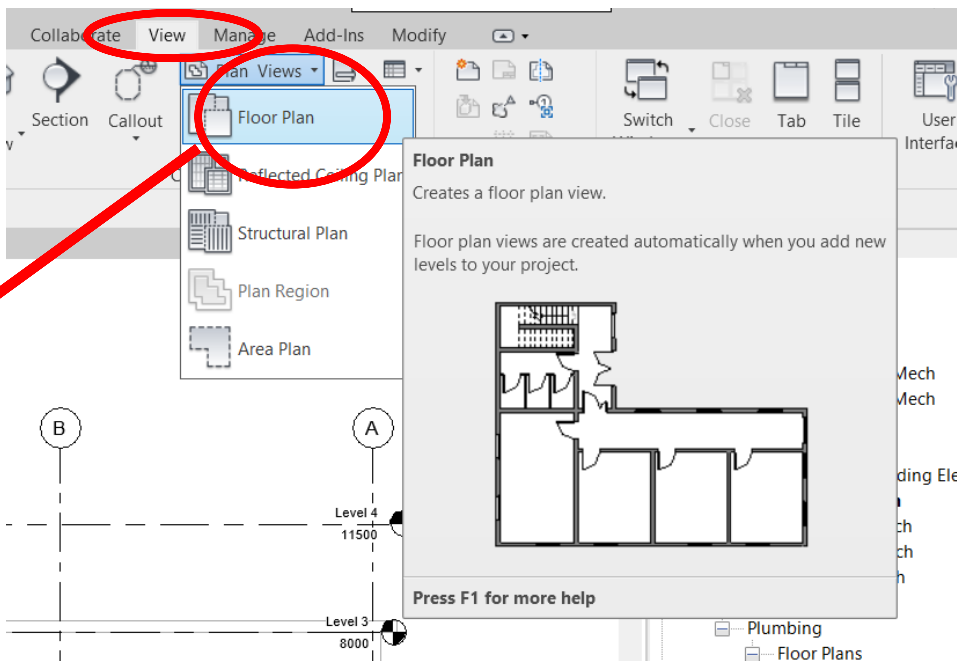
Click on layout

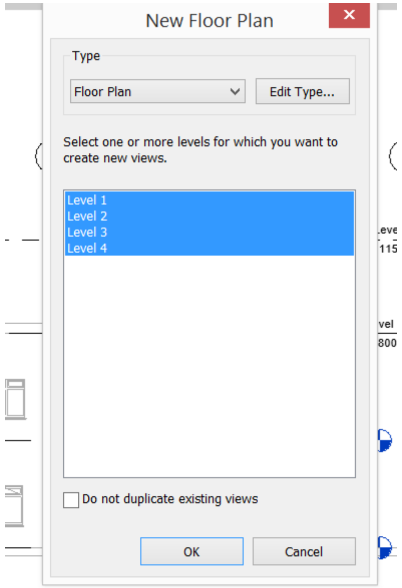
Levels – copying



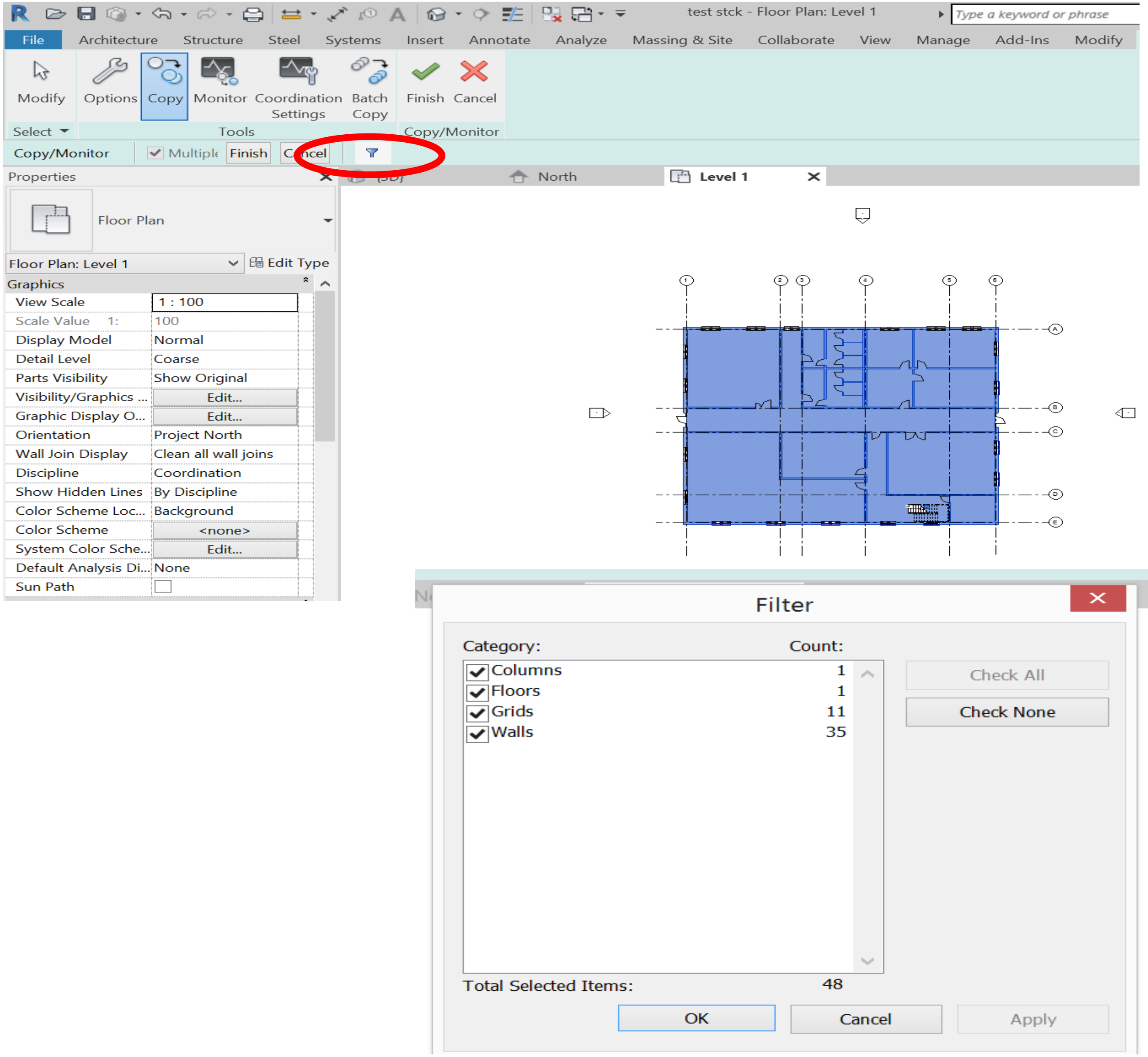
Select levels
Click on finish
Find copy/monitor – bookmark
Click again on finish (if it was "multiple")

Levels – copying



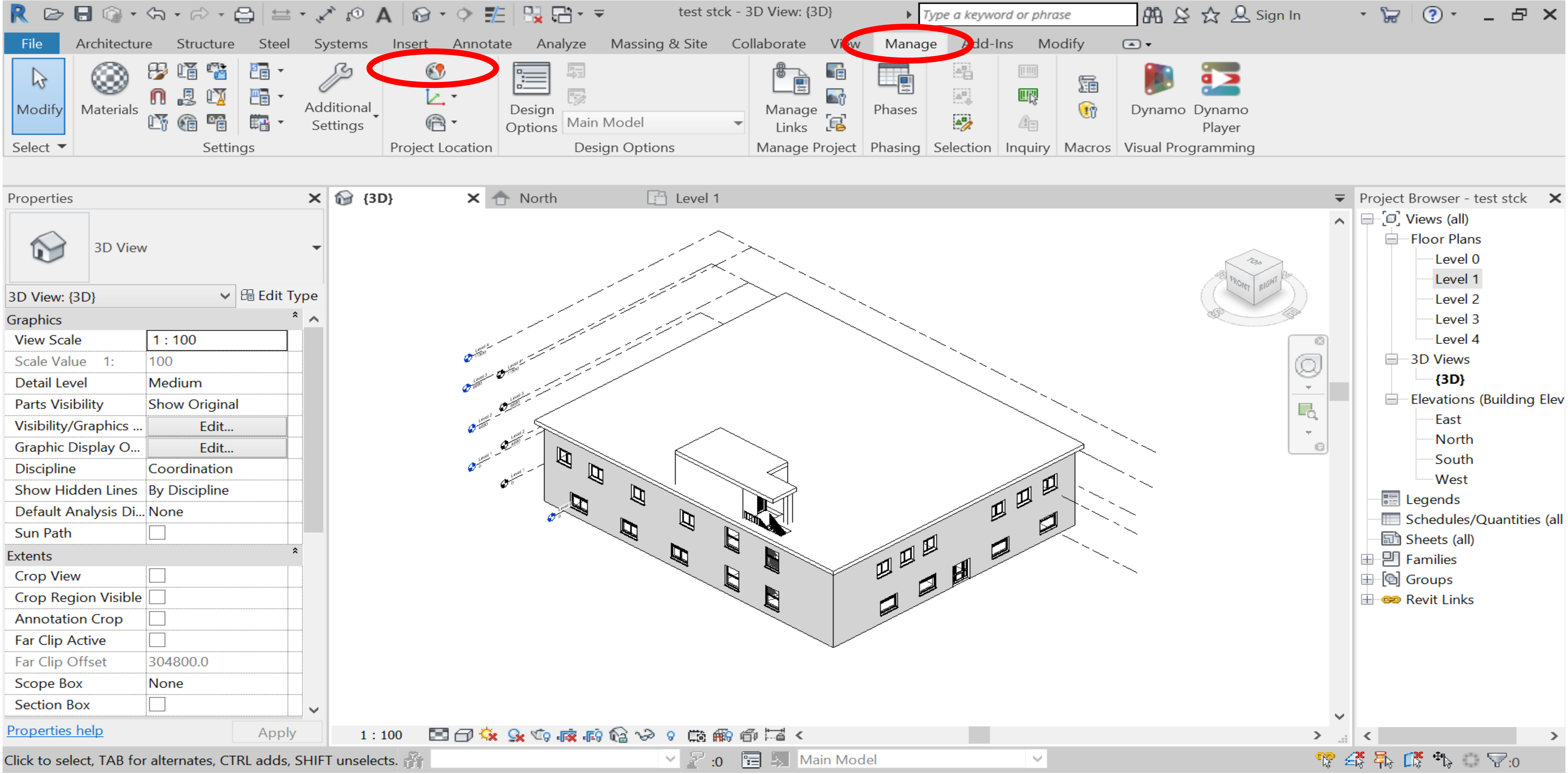


Grids – copying

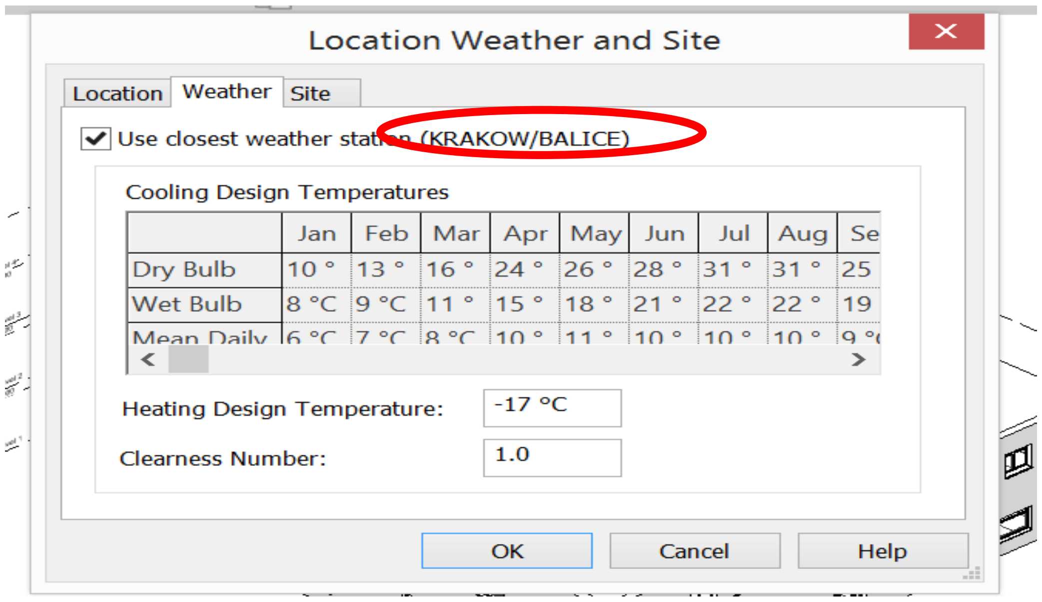


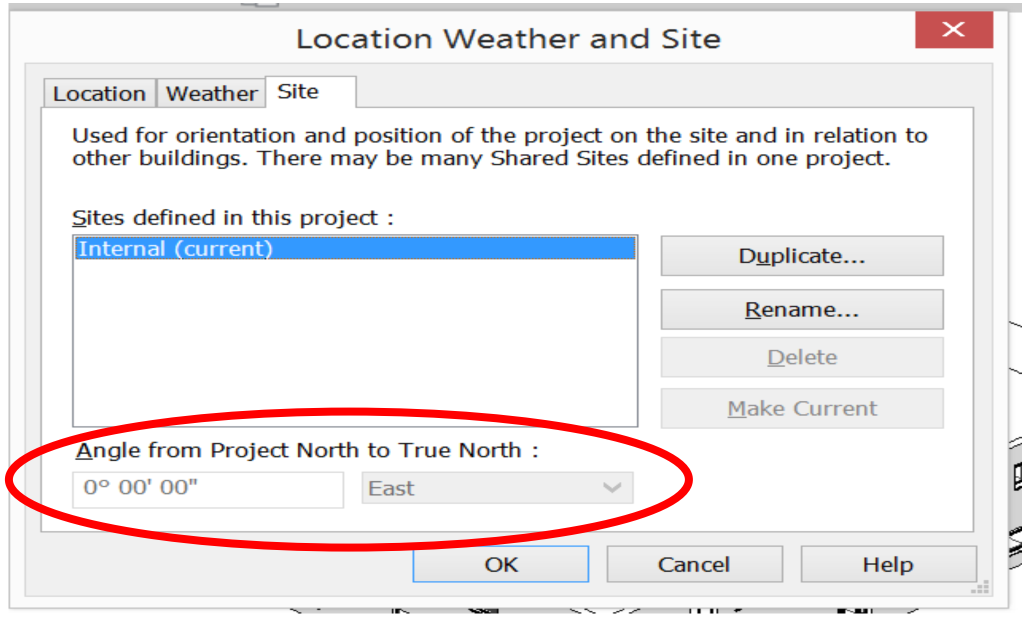
Plan view
Copy/monitor, click on plan
Select all
Filter
Select „grids”
Finish, finish

Project data



Project data



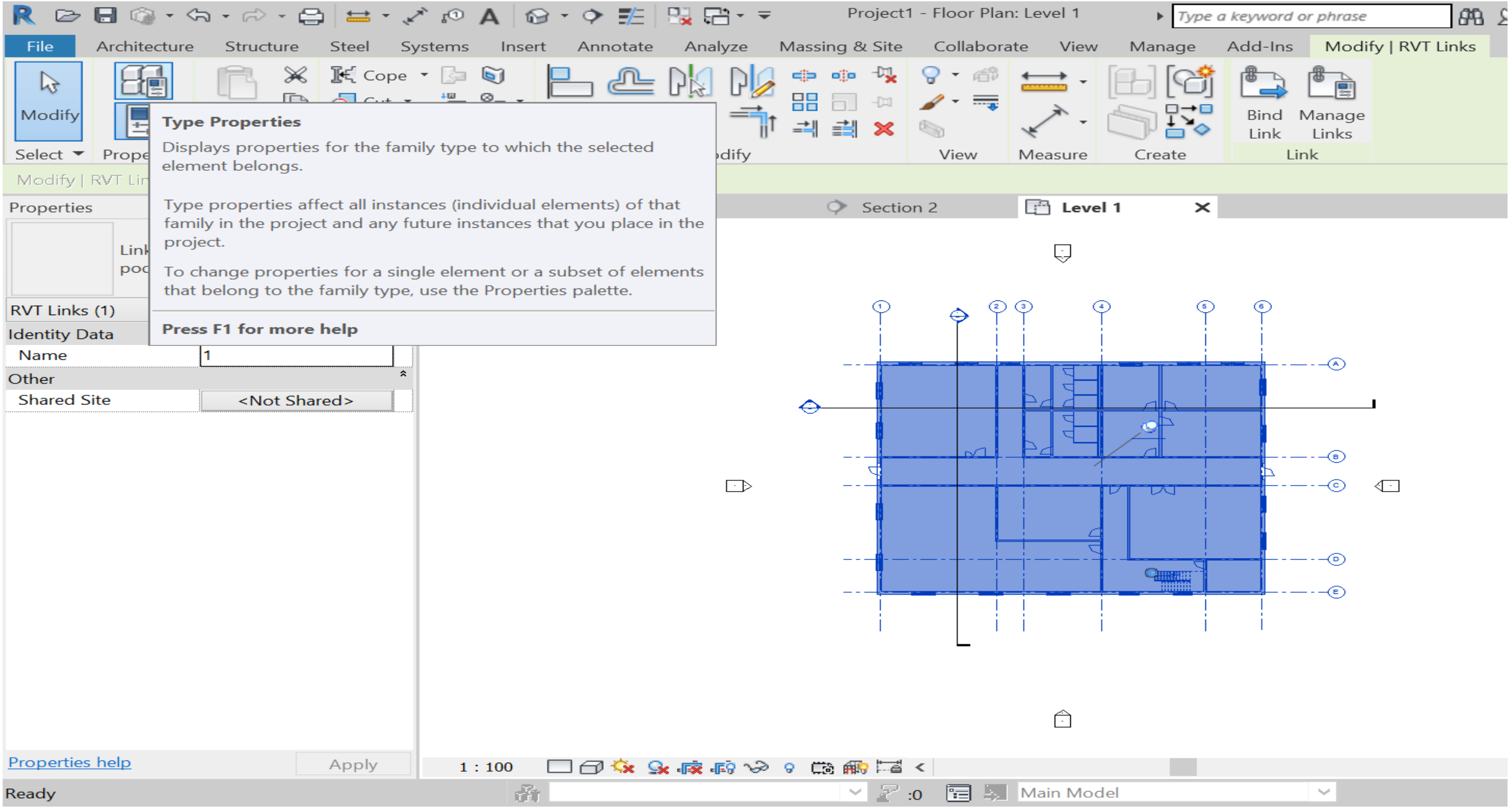


Part 3

Energy analysis

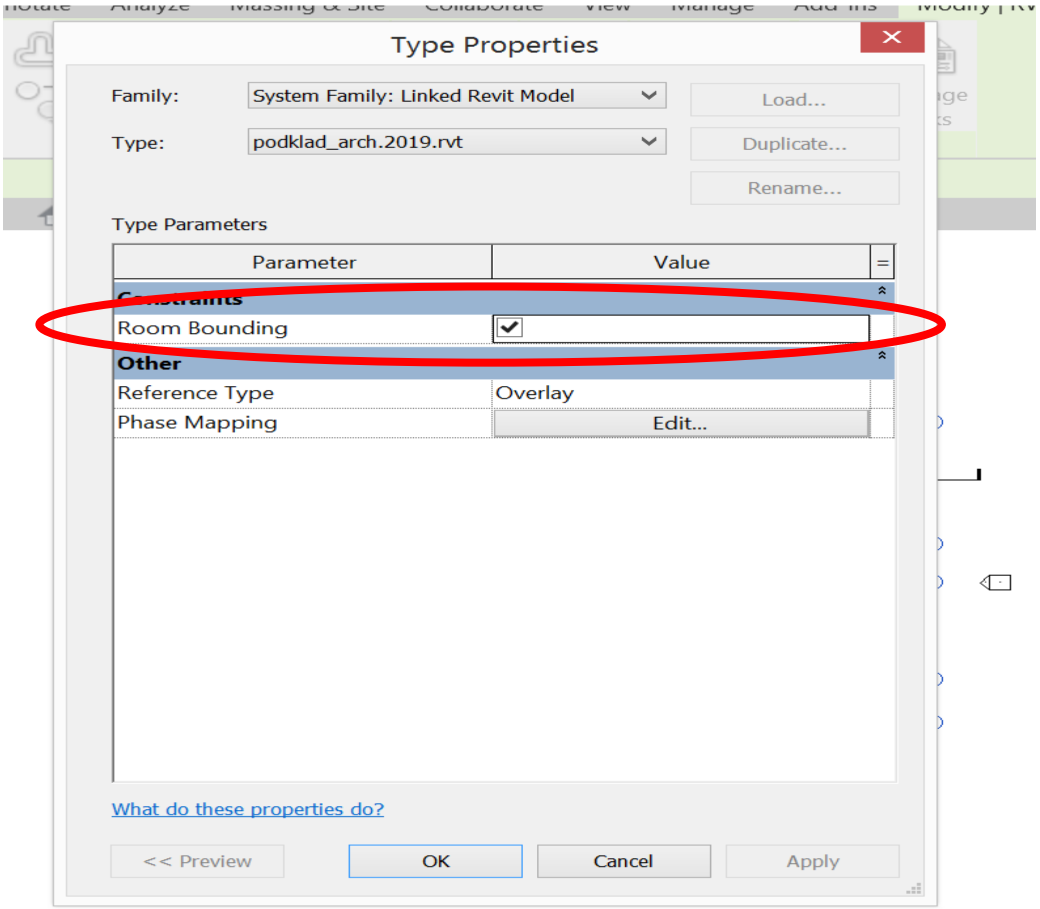
Creating volumes

Select the level and click on "Type properties"

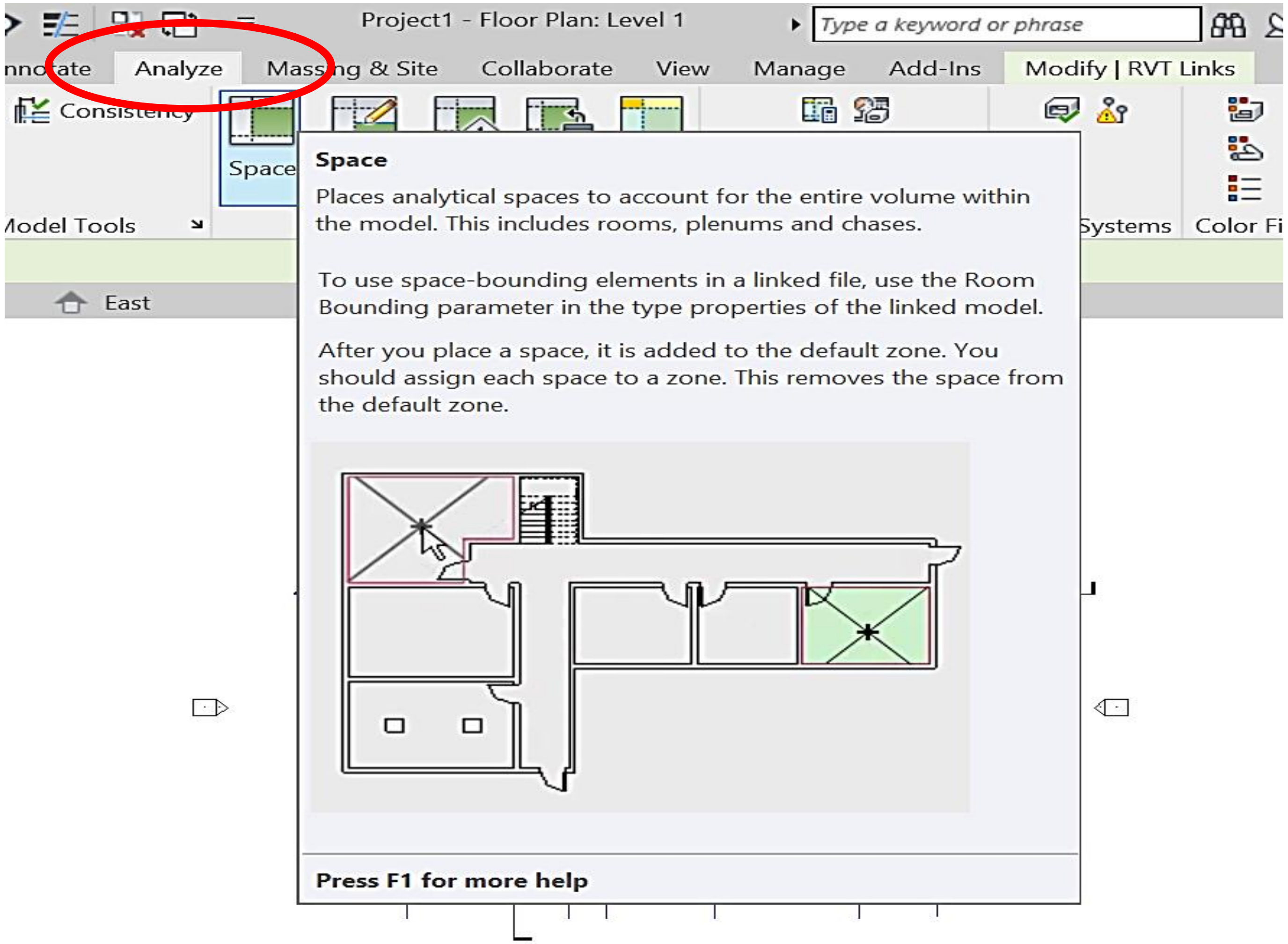


Creating volumes

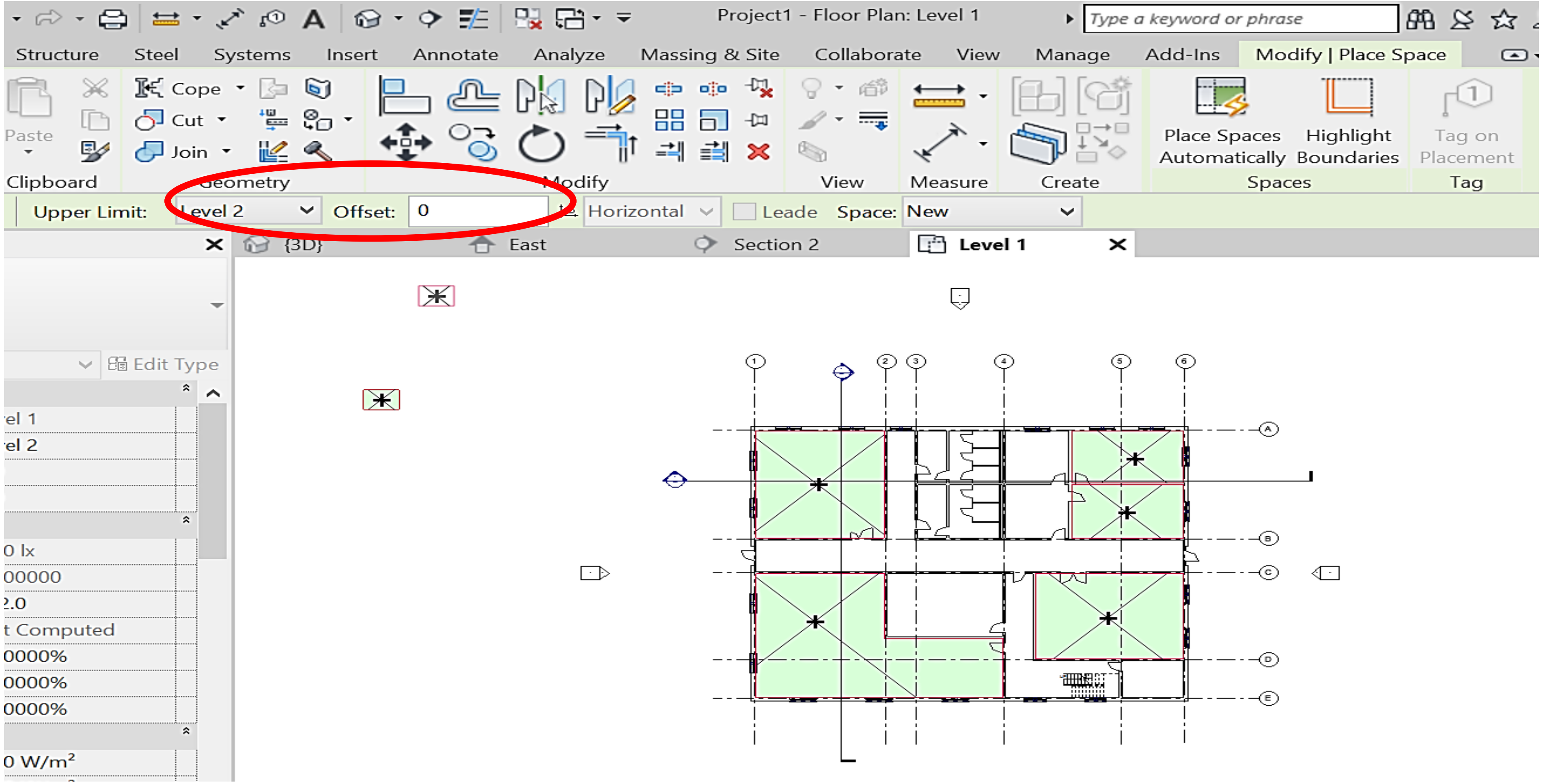
Mark „Room Bounding”



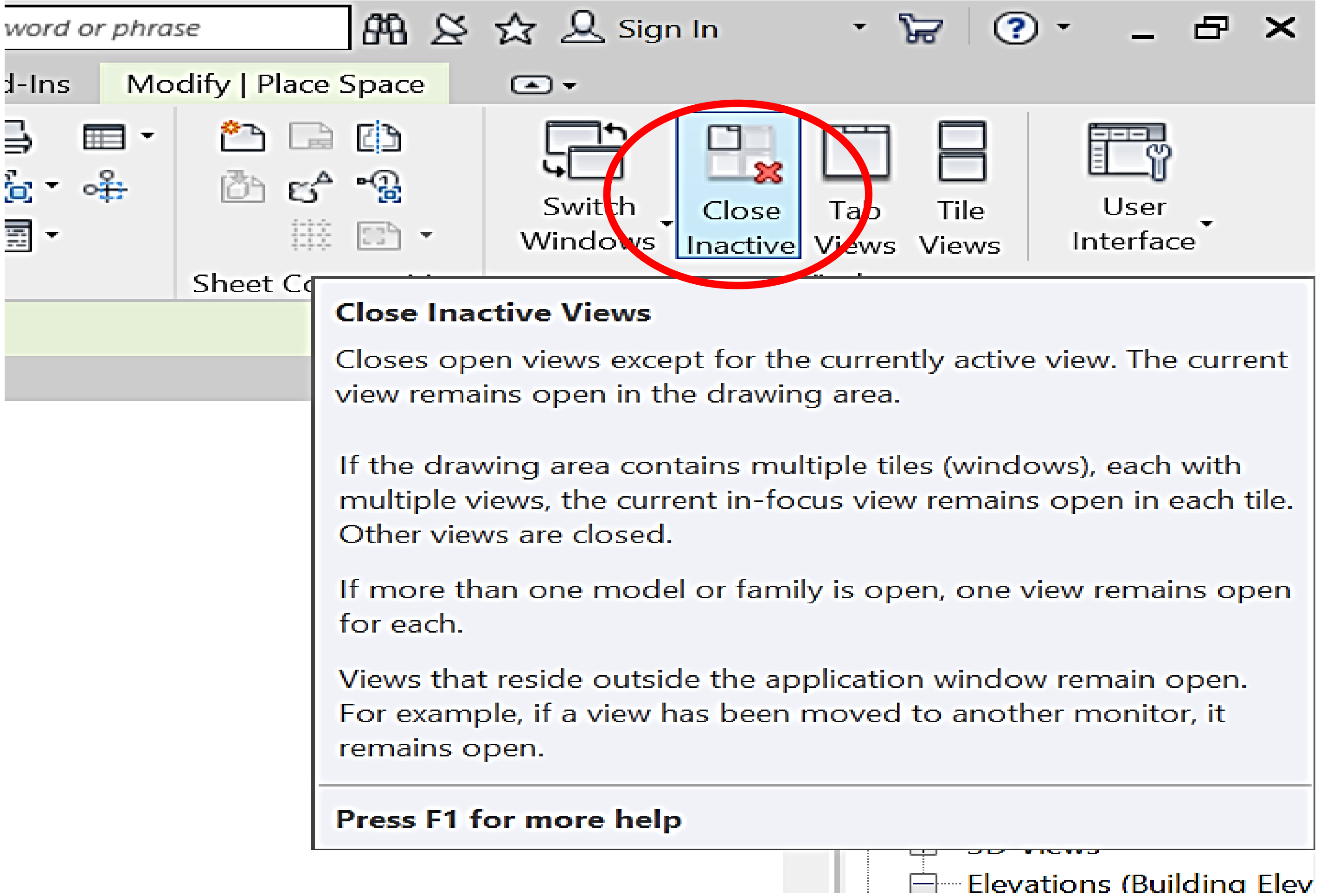
Creating spaces



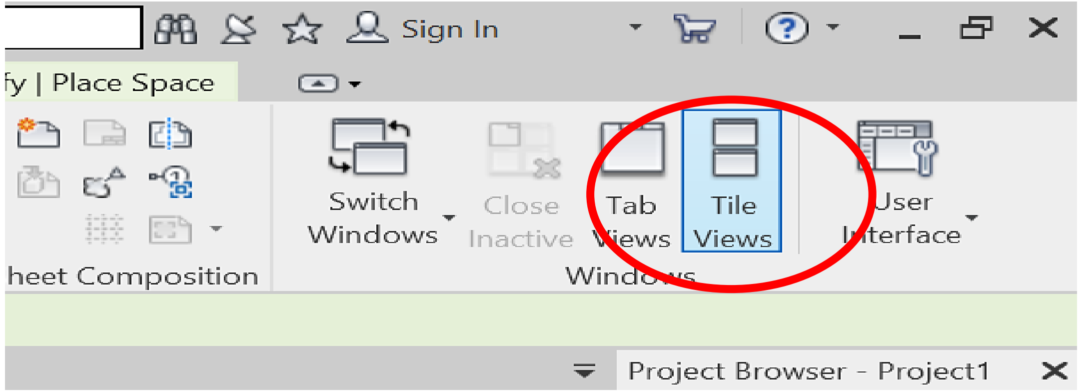
Creating spaces



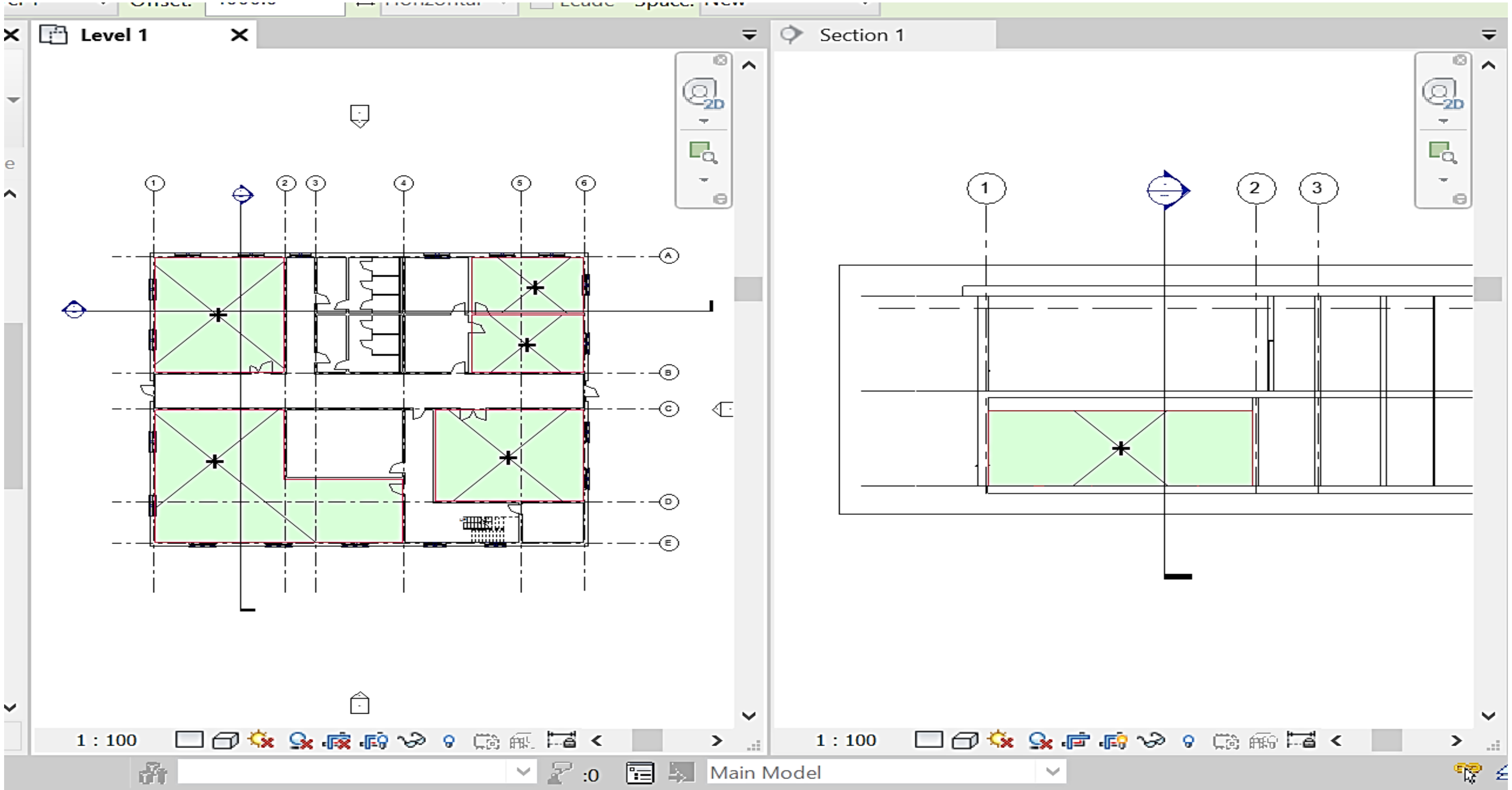
Closing inactive views



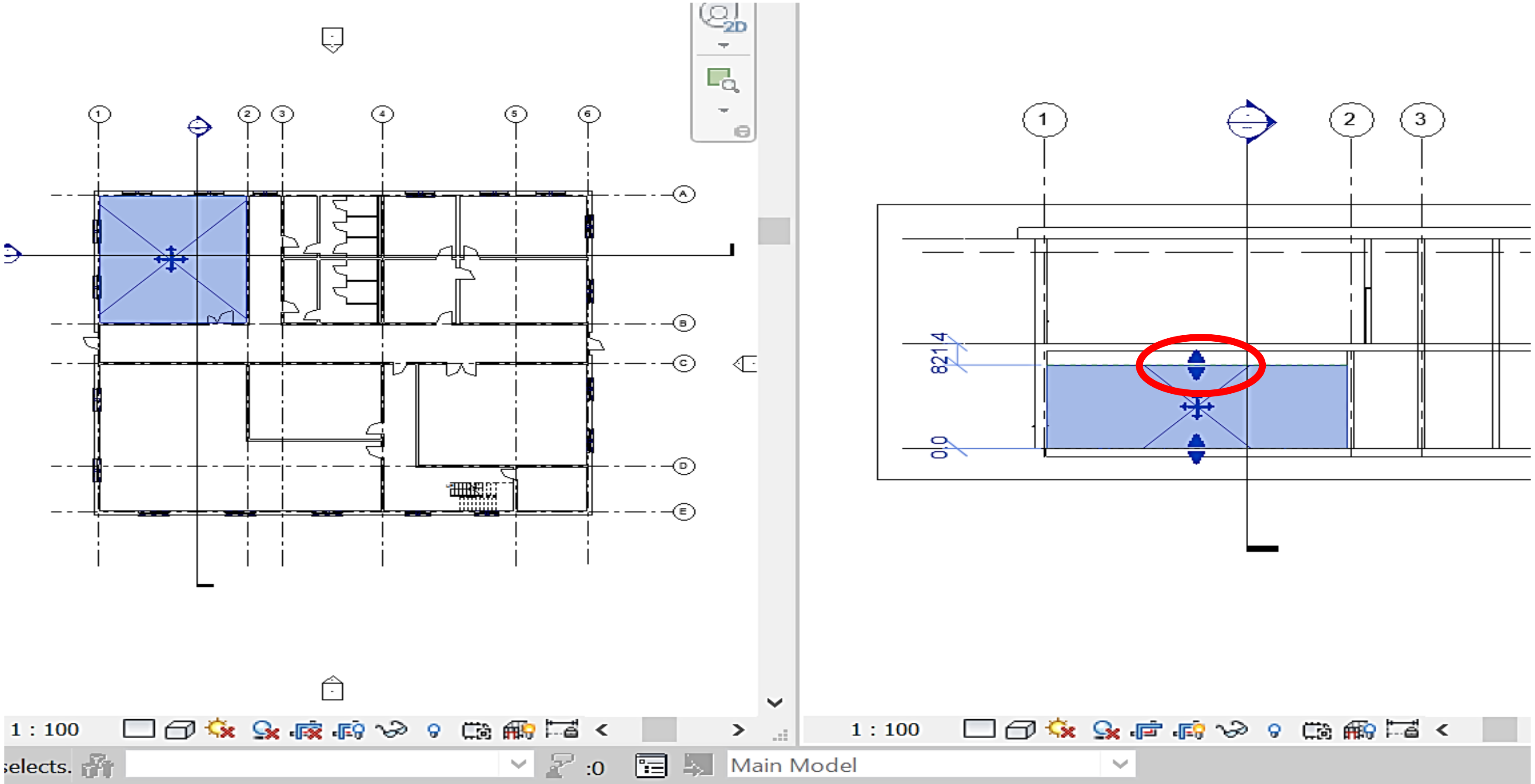
Tiling views



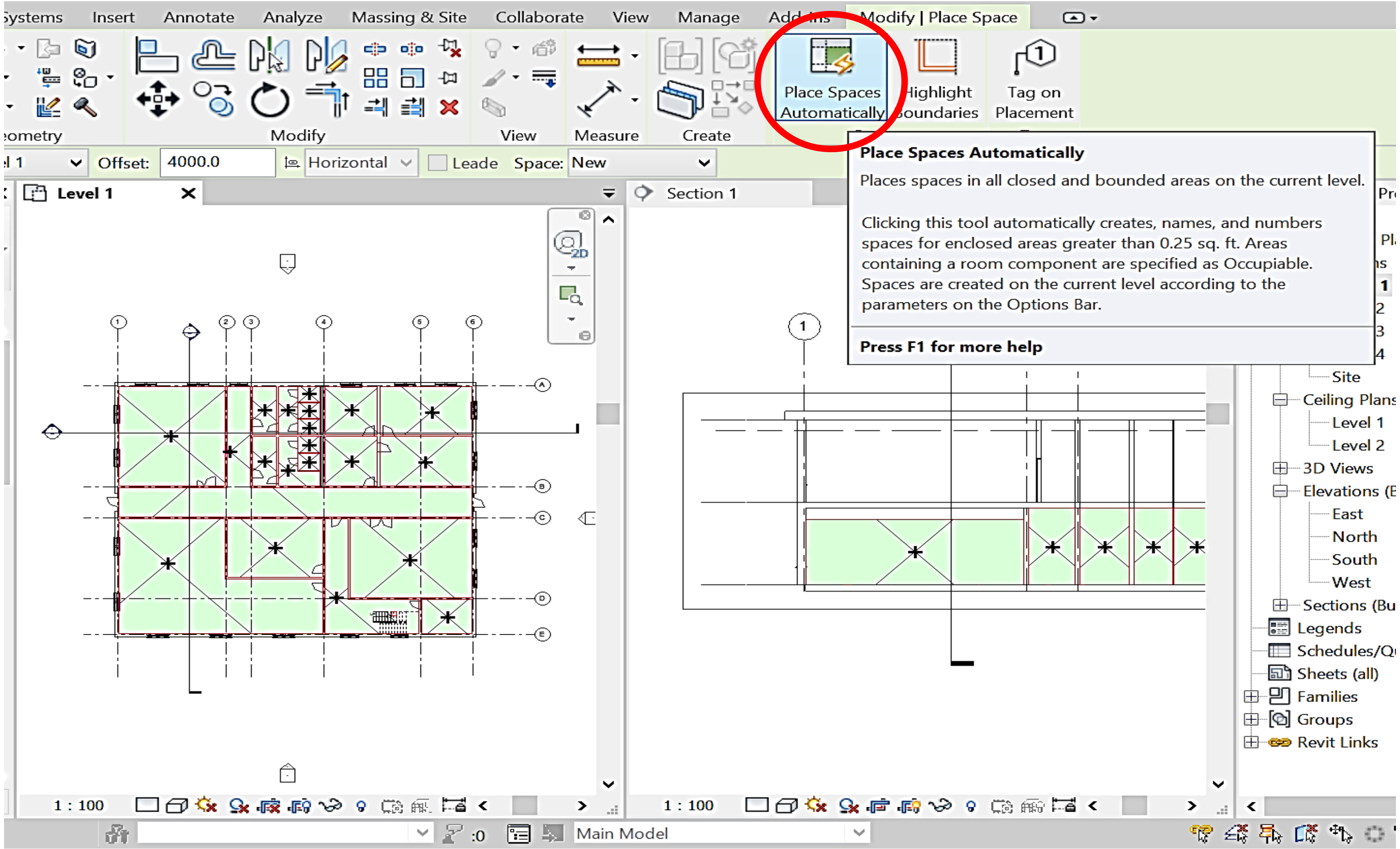
Tiling views



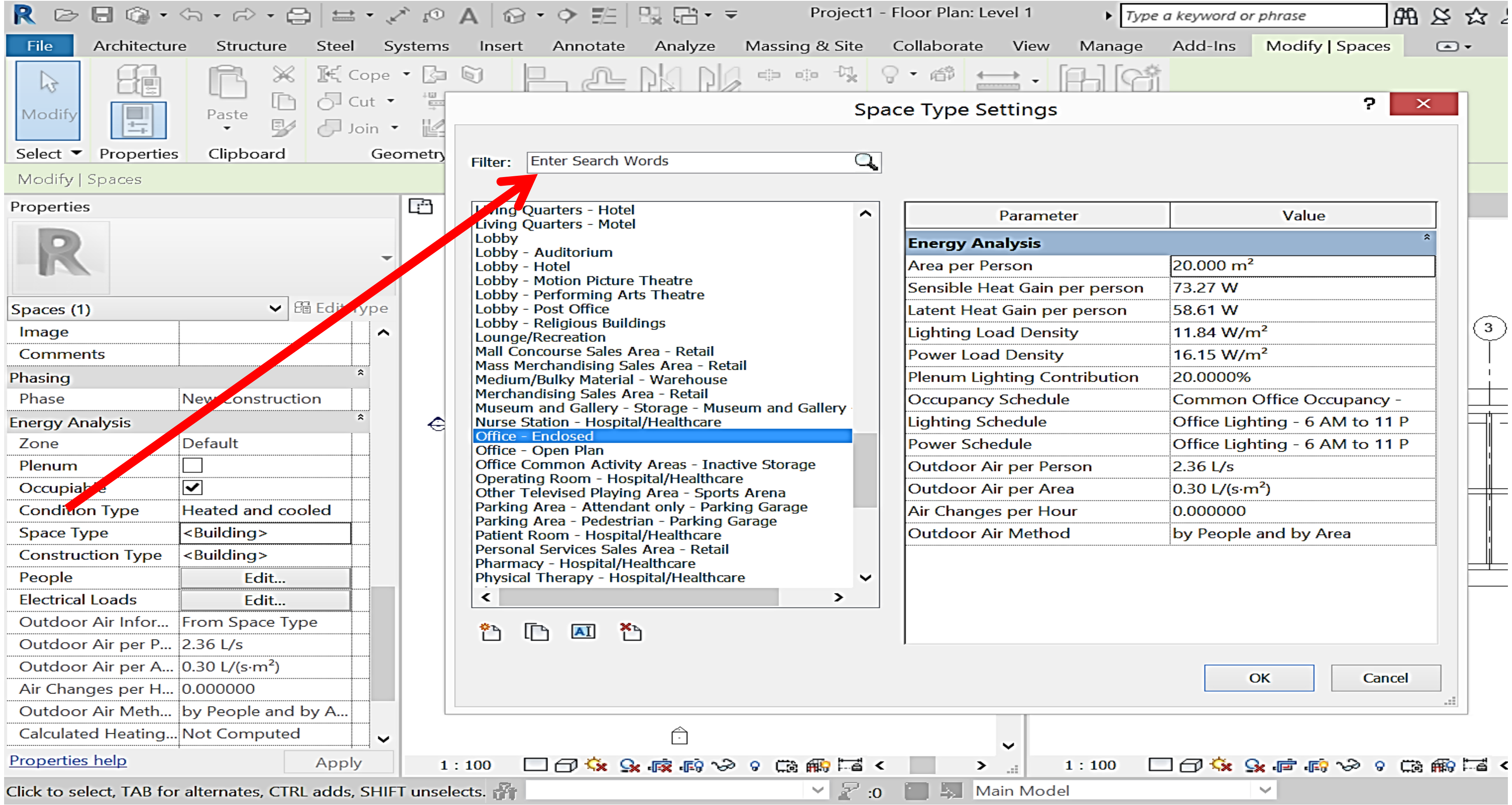
Volume edition



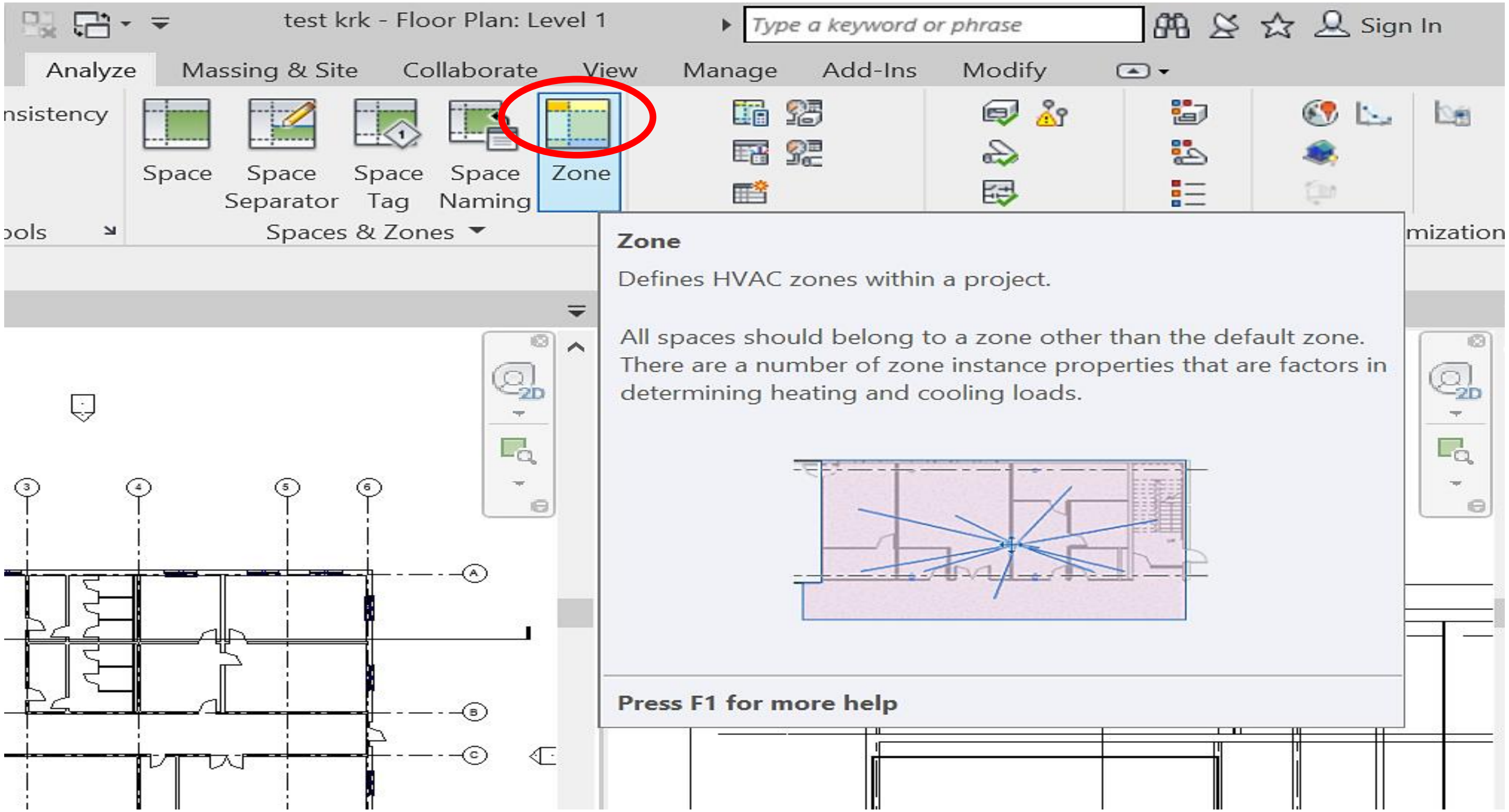
Automatically placing spaces



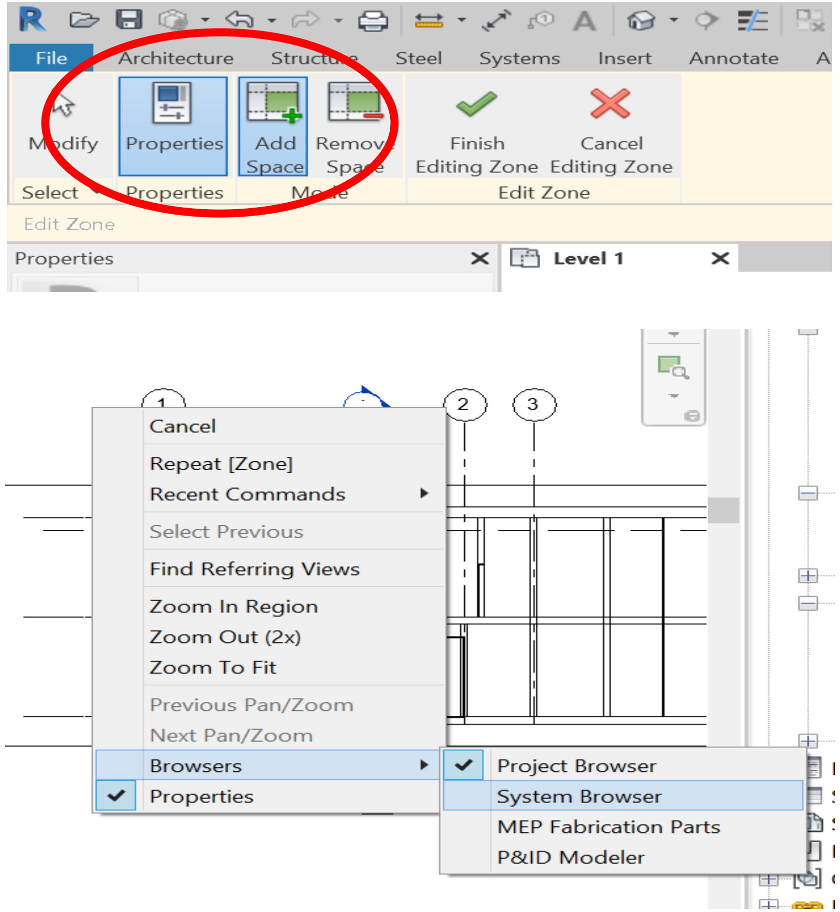
Room parameters definition



Creating zones – volumes of the same properties

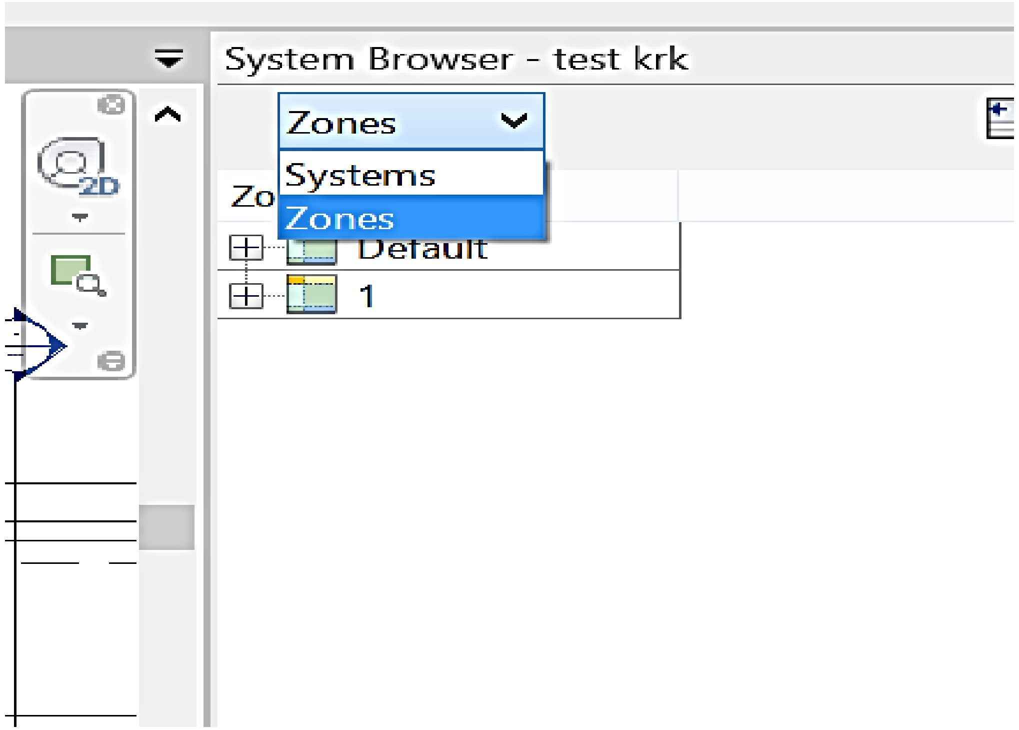


Creating zones – volumes of the same properties



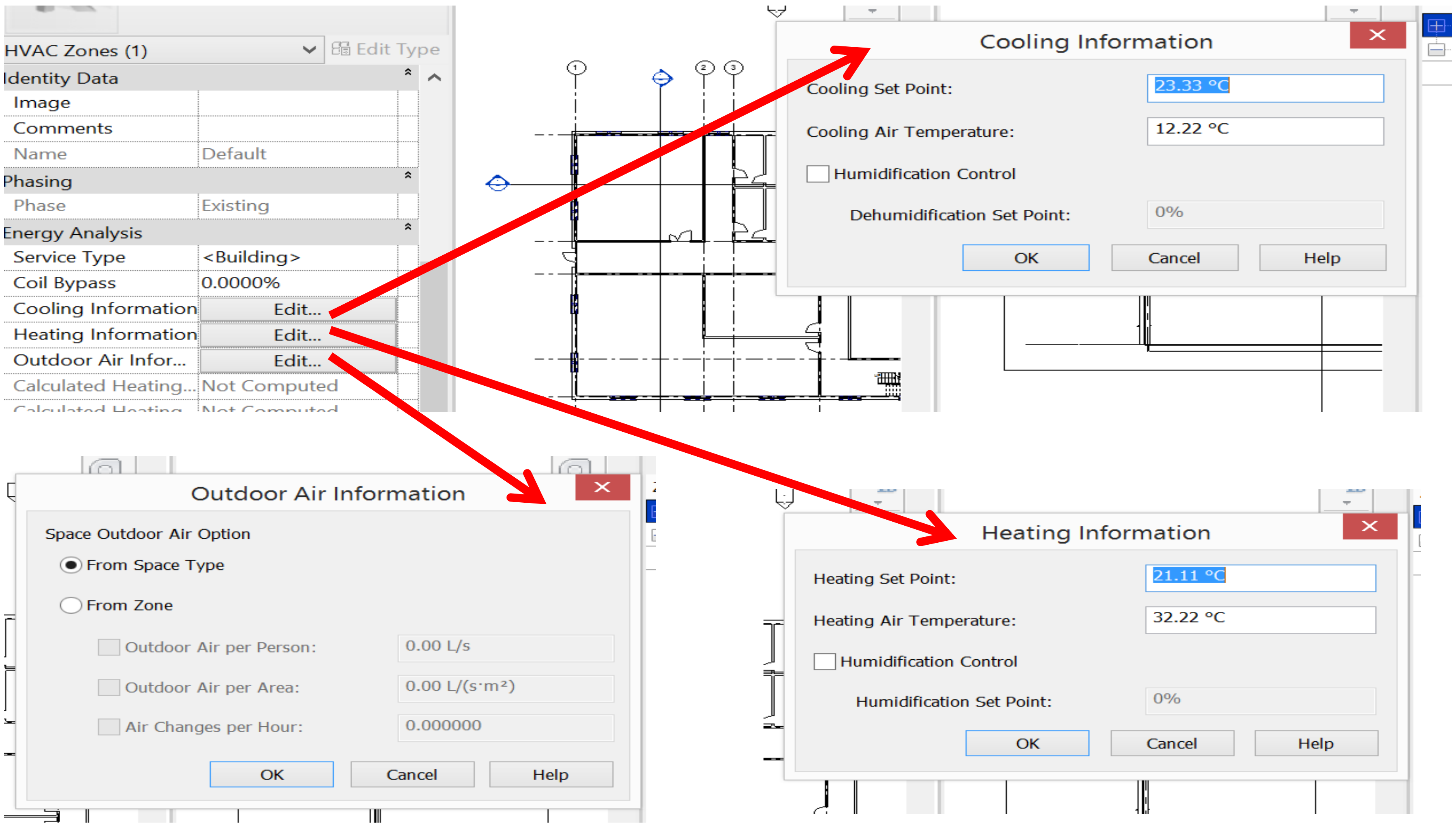
Right click
(or F9)

Creating zones – volumes of the same properties

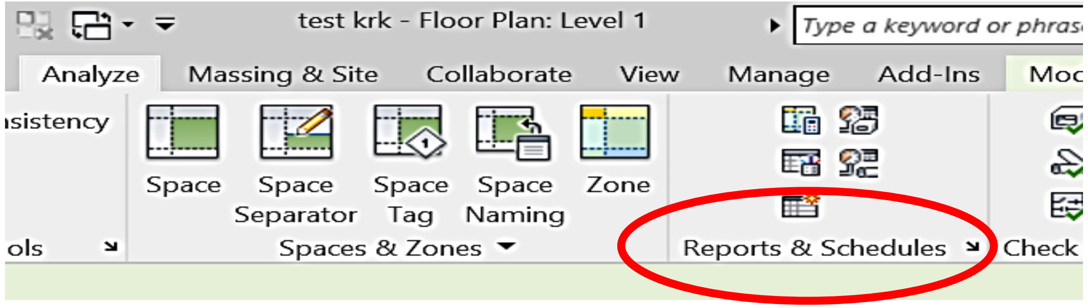


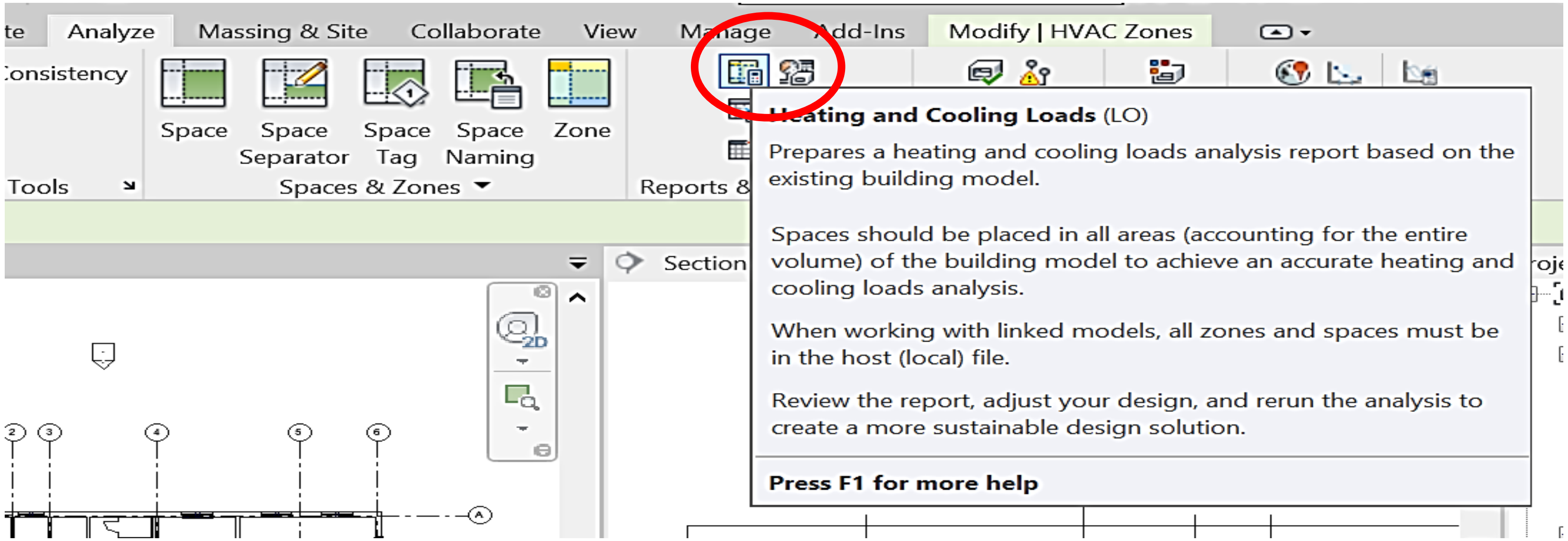
System browser

Entire zone parameters

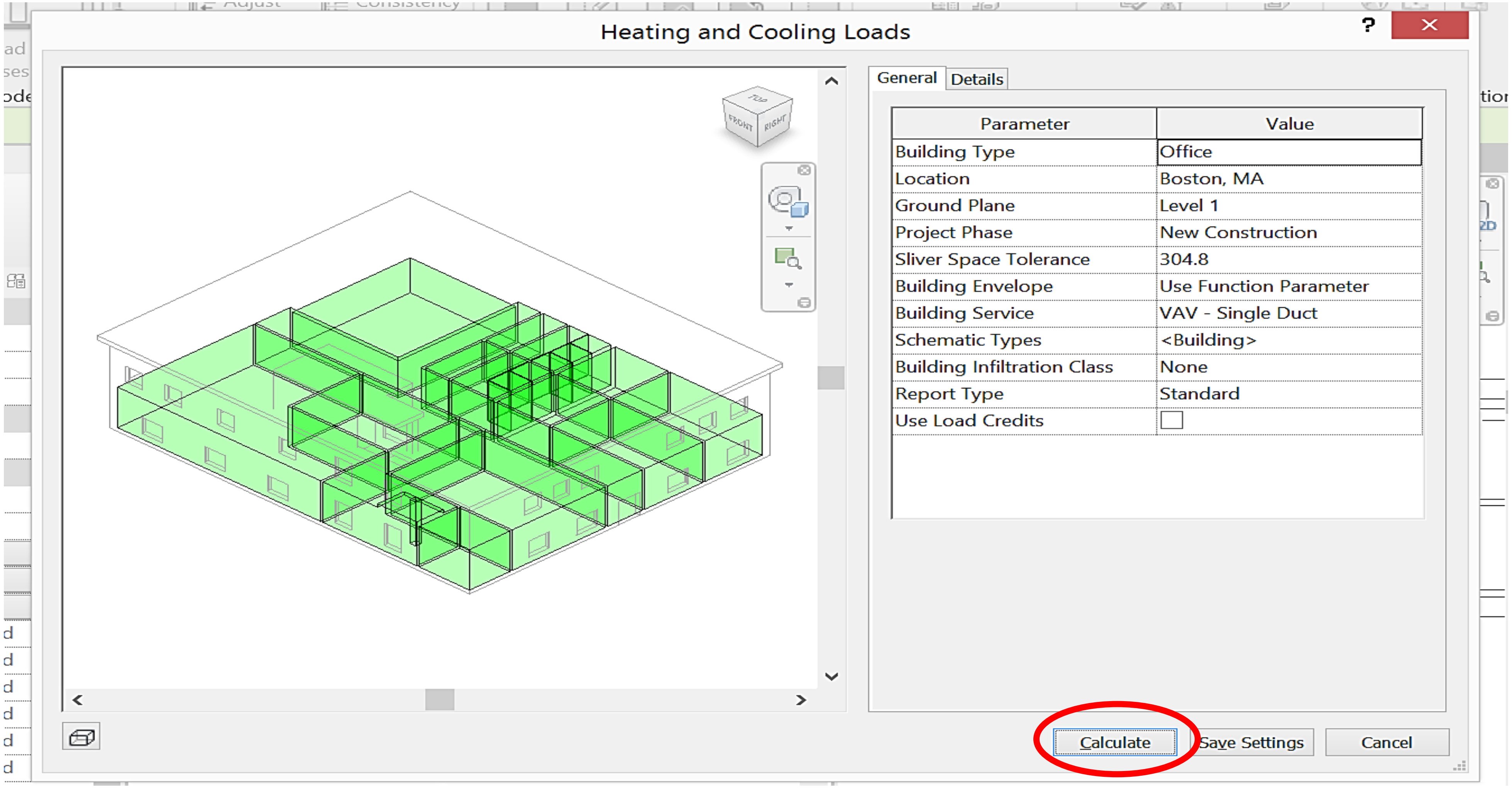


Generating a report





Generating a report



Generating a report

test krk - Report: Loads Report (1)

Project Summary

Location and Weather	
Project	Project Name
Address	## Street City, State Zip
Calculation Time	3 marca 2019 01:05
Report Type	Standard
Latitude	42.36°
Longitude	-71.06°
Summer Dry Bulb	34 °C
Summer Wet Bulb	25 °C
Winter Dry Bulb	-14 °C
Mean Daily Range	9 °C

Building Summary

Inputs	
Building Type	Office
Area (m^2)	693
Volume (m^3)	2,522.13
Calculated Results	
Peak Cooling Total Load (W)	**34,584**
Peak Cooling Month and Hour	July 16:00
Peak Cooling Sensible Load (W)	27,633
Peak Cooling Latent Load (W)	6,951
Maximum Cooling Capacity (W)	34,584
Peak Cooling Airflow (L/s)	1,822.9
Peak Heating Load (W)	**29,031**
Peak Heating Airflow (L/s)	957.9
Checksums	
Cooling Load Density (W/m^2)	49.87
Cooling Flow Density ($L/(s \cdot m^2)$)	2.63
Cooling Flow / Load ($L/(s \cdot kW)$)	52.71
Cooling Area / Load (m^2/kW)	20.05
Heating Load Density (W/m^2)	41.86
Heating Flow Density ($L/(s \cdot m^2)$)	1.38

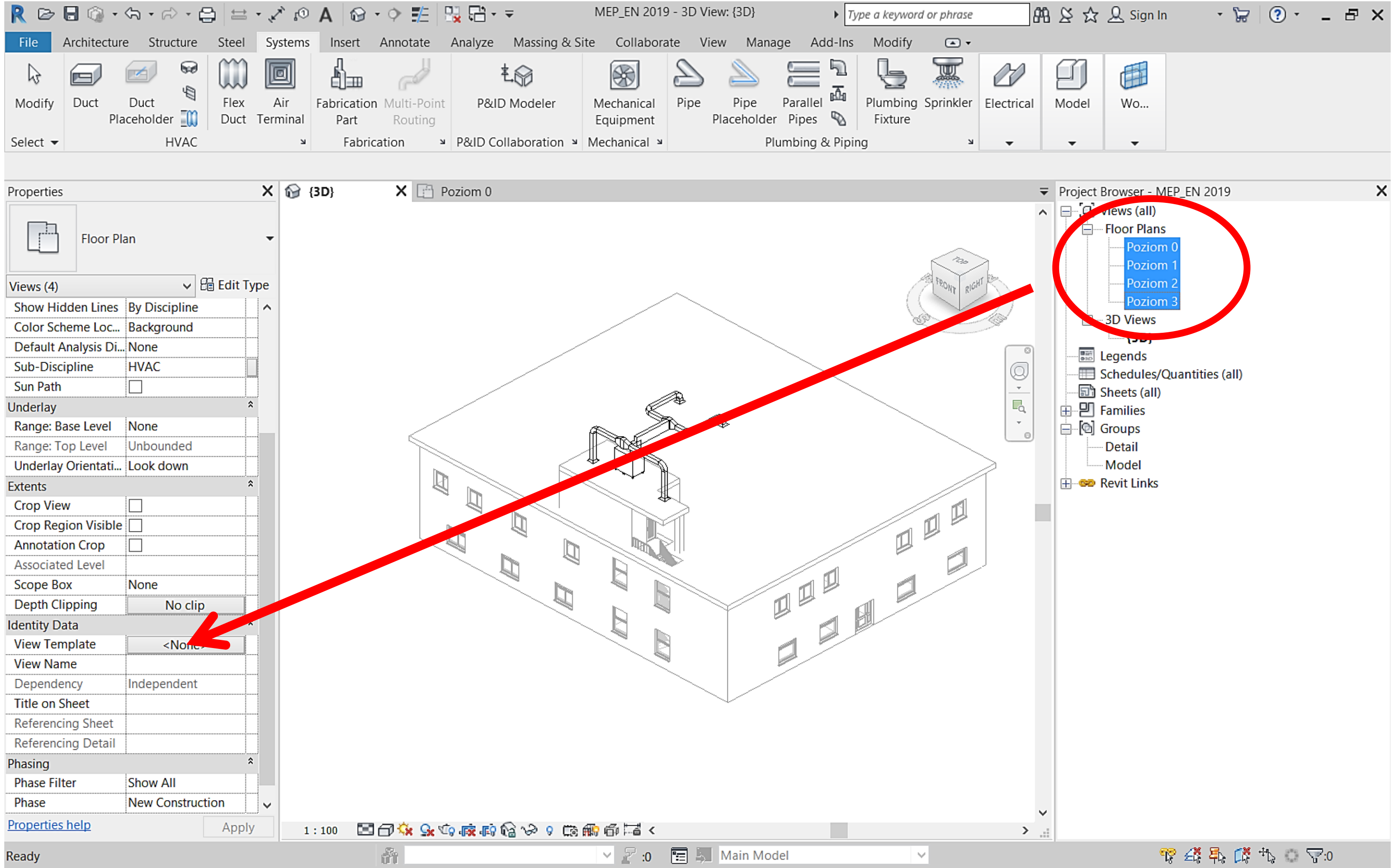
Zone Summary - Default

Inputs	
Area (m^2)	605
Volume (m^3)	2,242.07

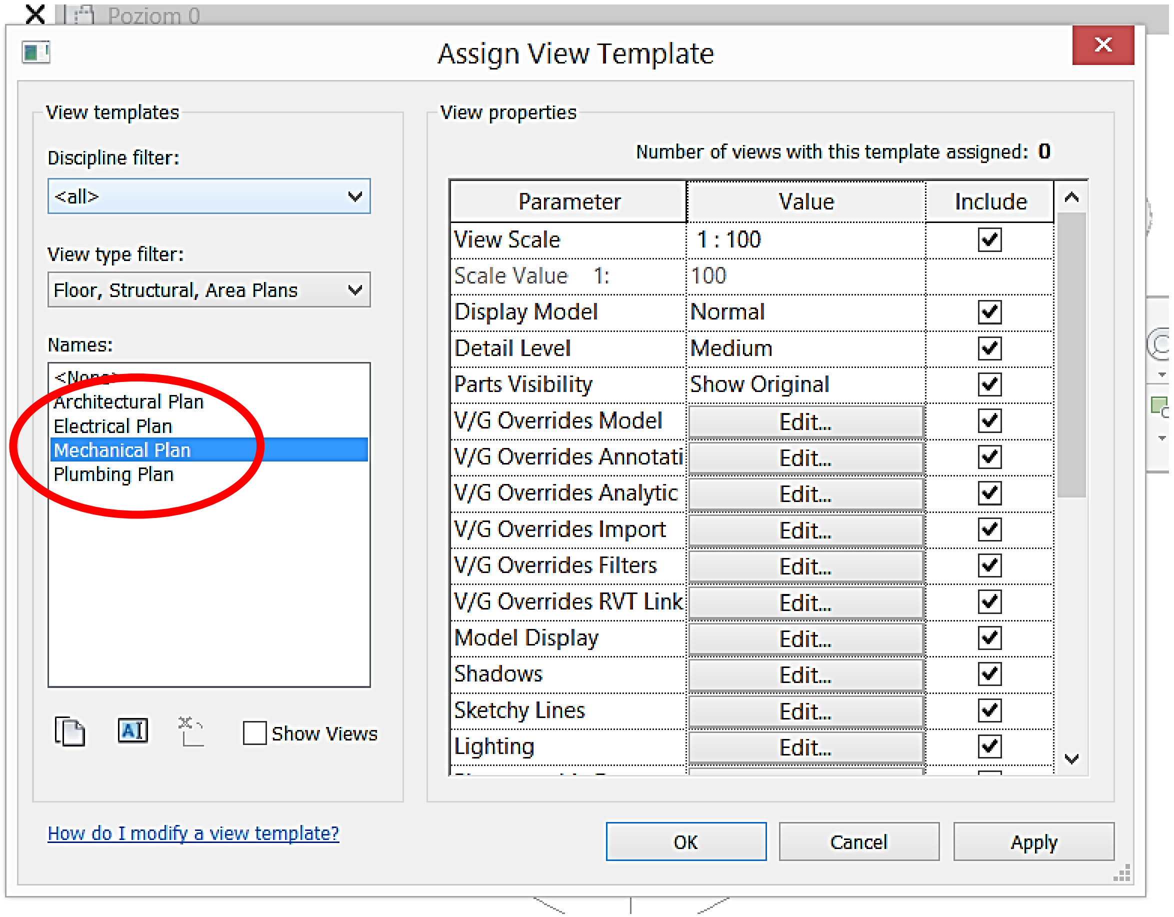
Part 4

MODELING the HVAC installation

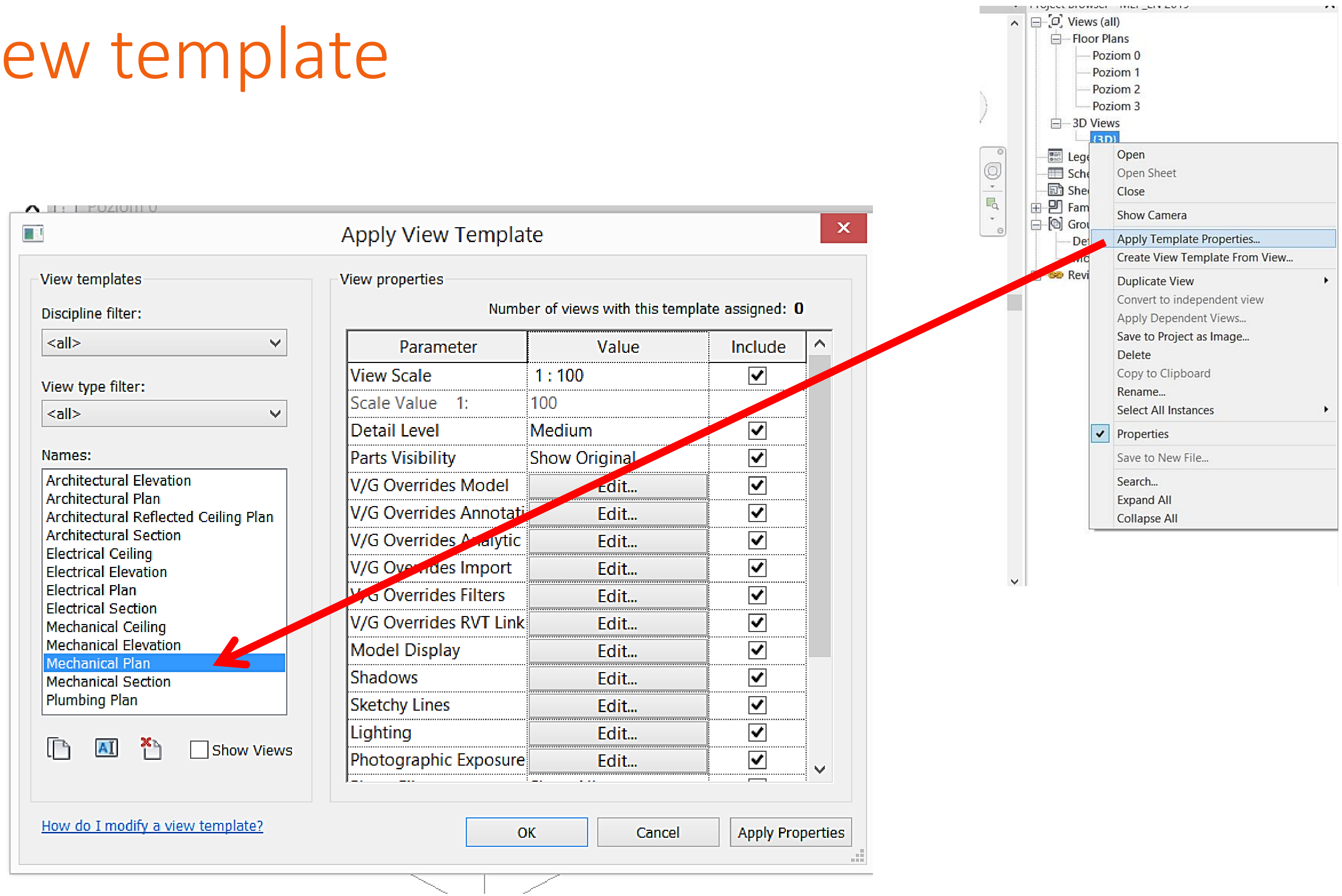
Assigning a view template



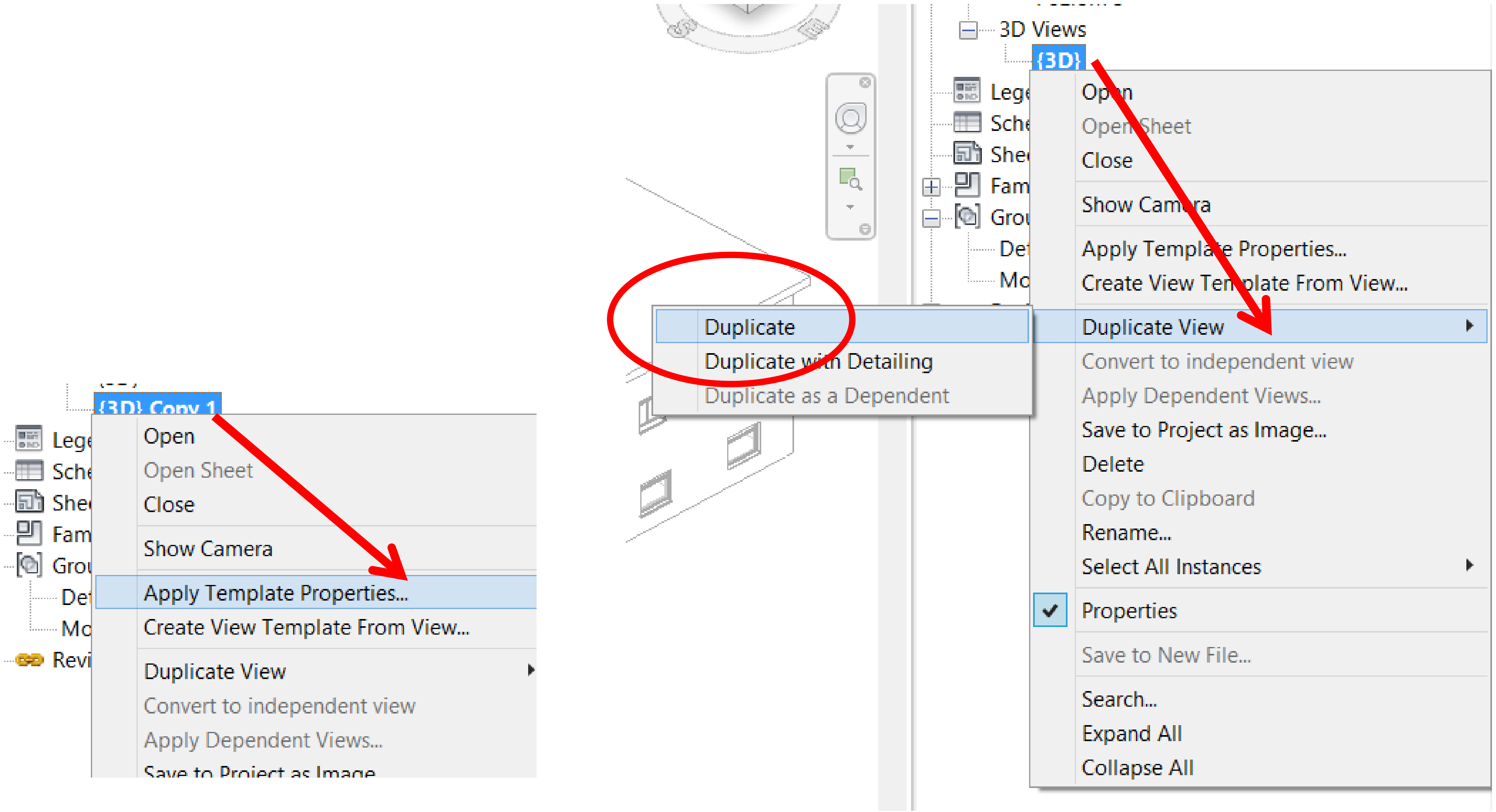
Assigning a view template



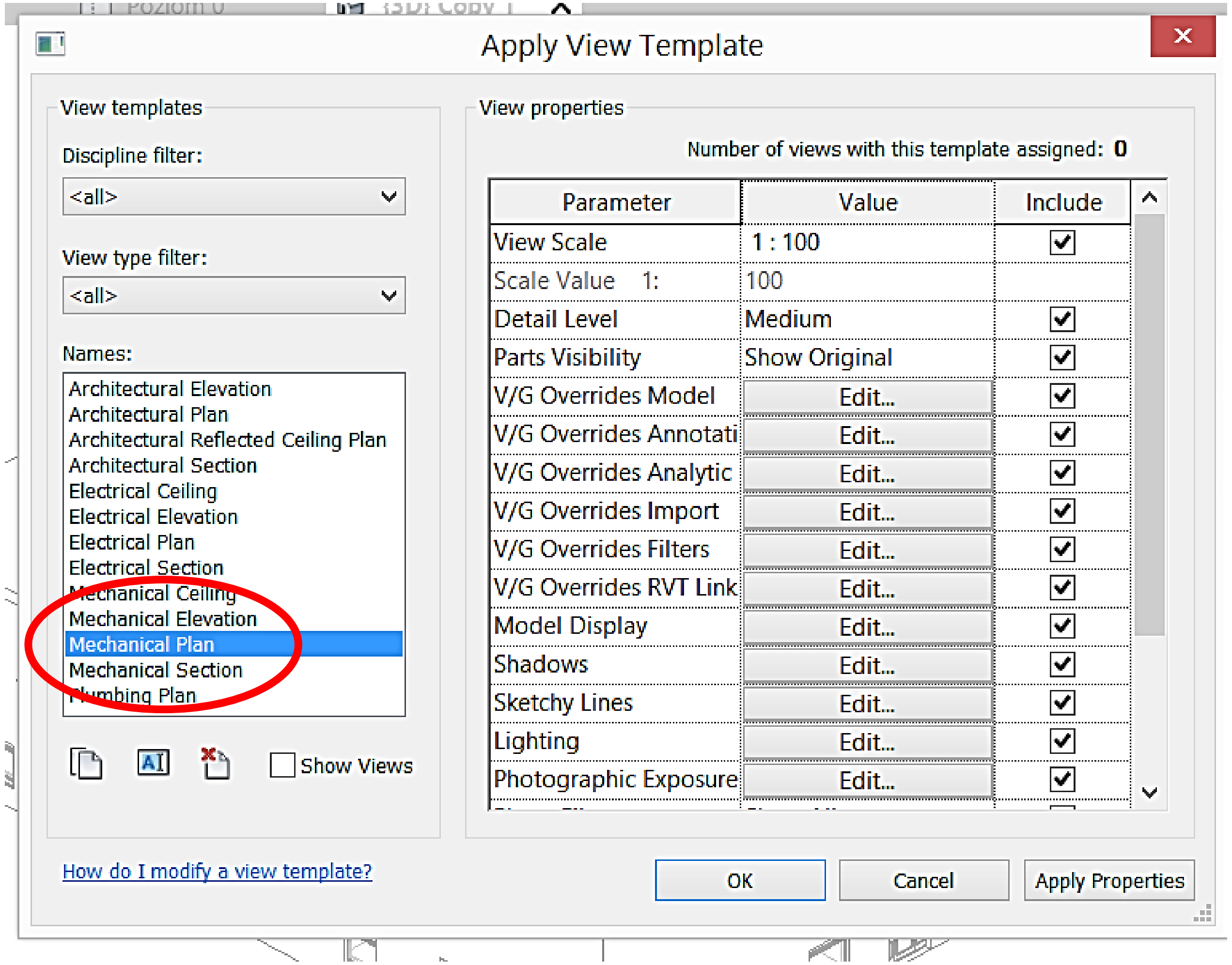
Assigning a view template



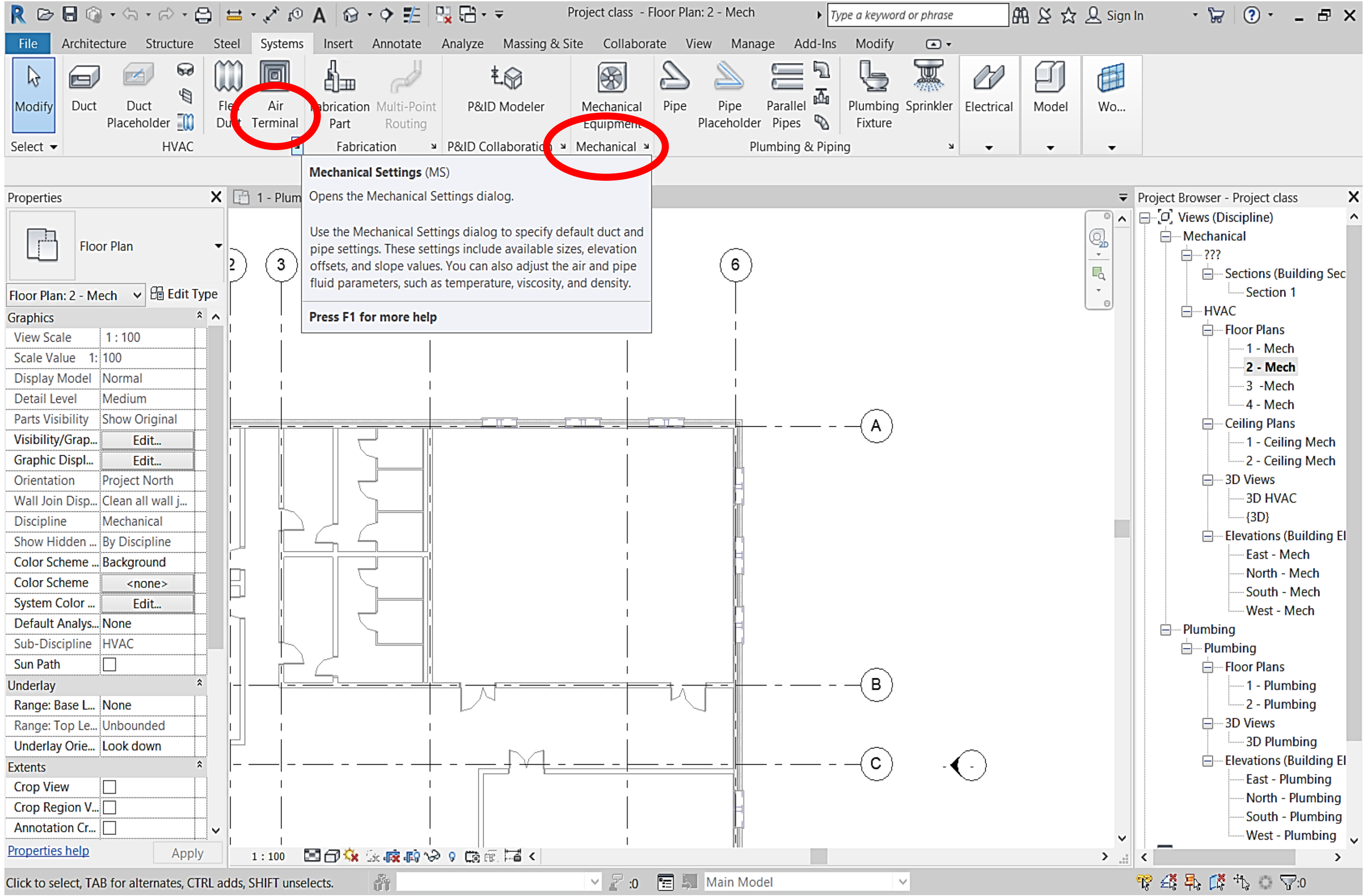
Assigning a view template



Assigning a view template

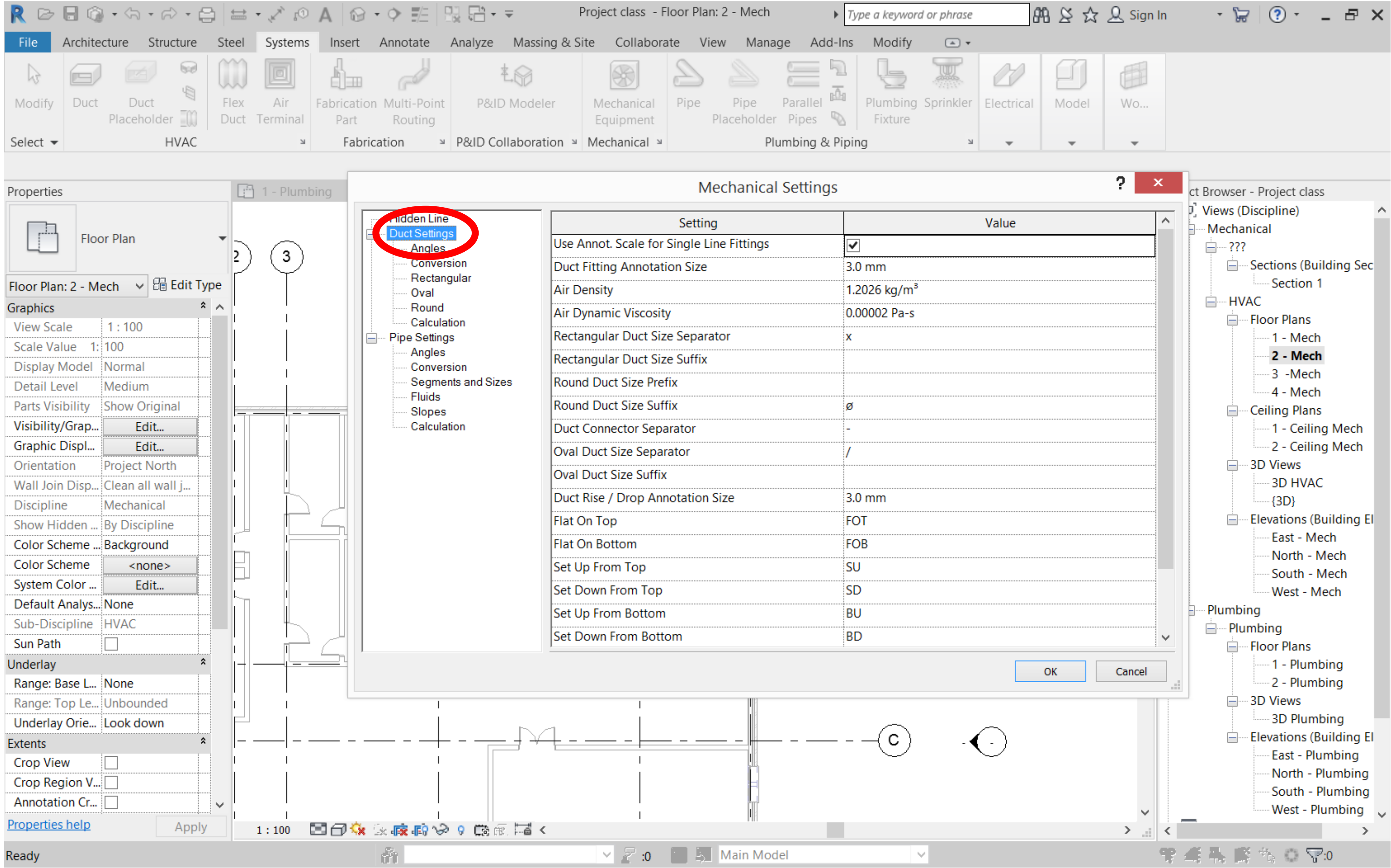


Mechanical settings

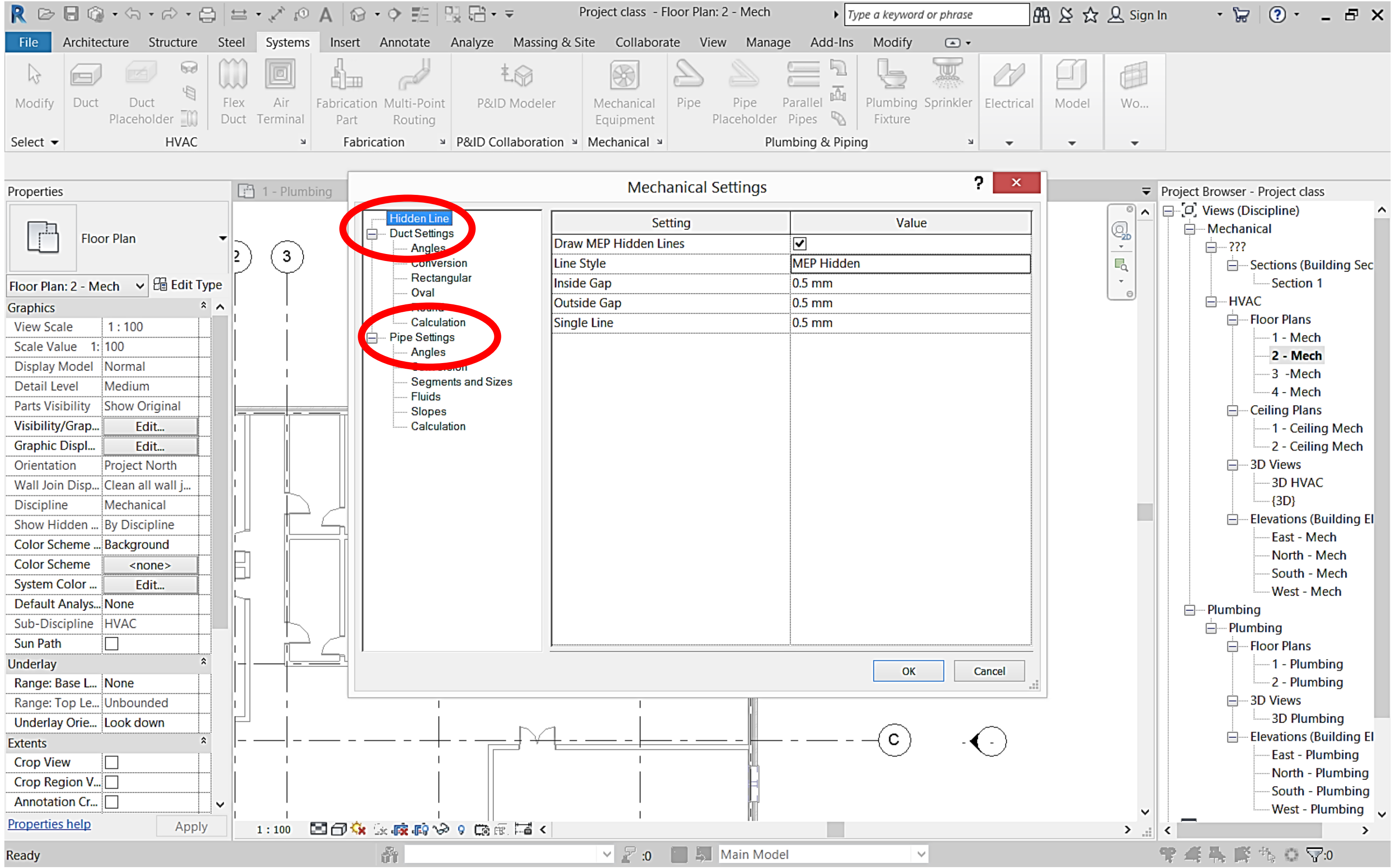


Mechanical settings

Duct settings

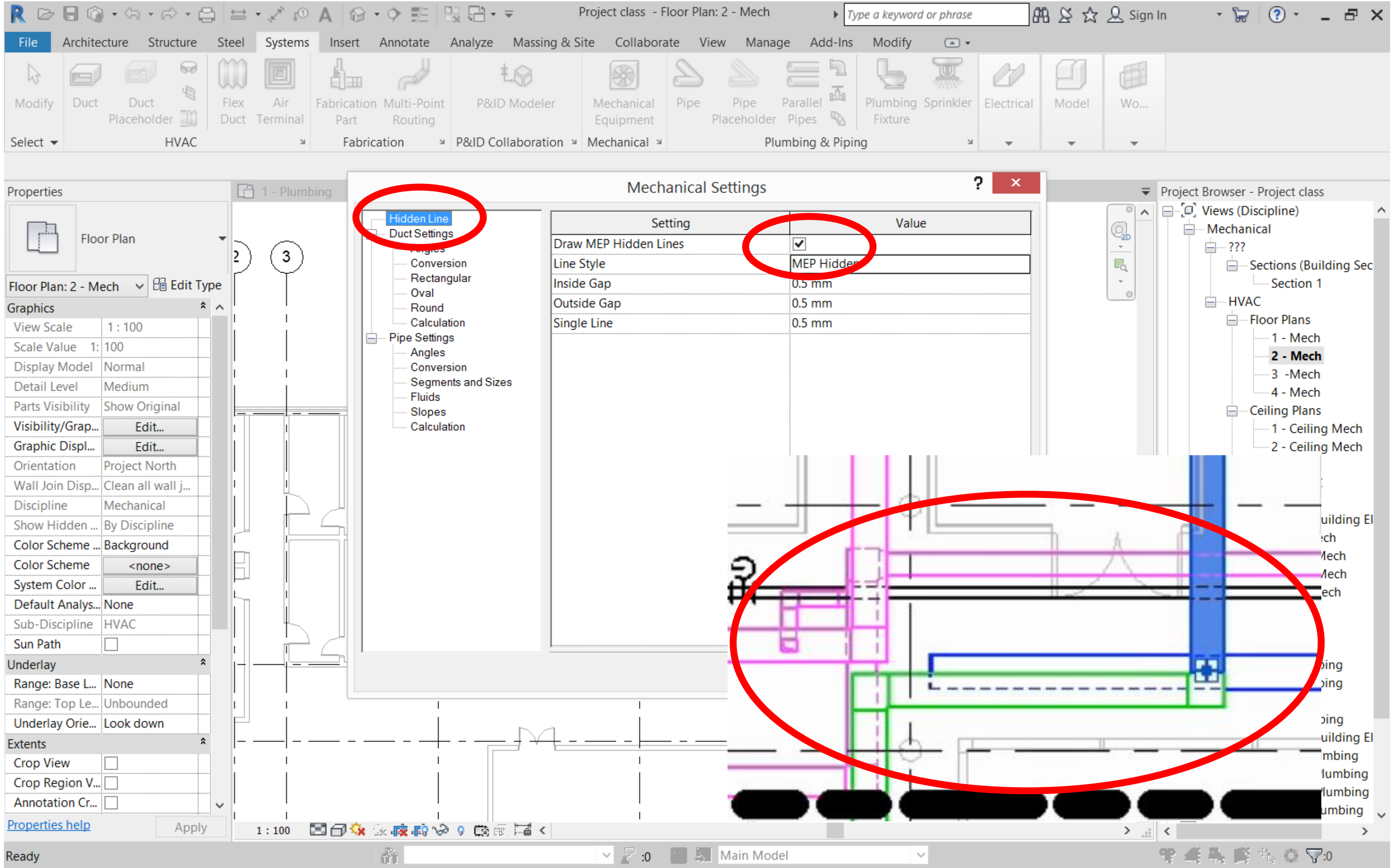


Mechanical settings



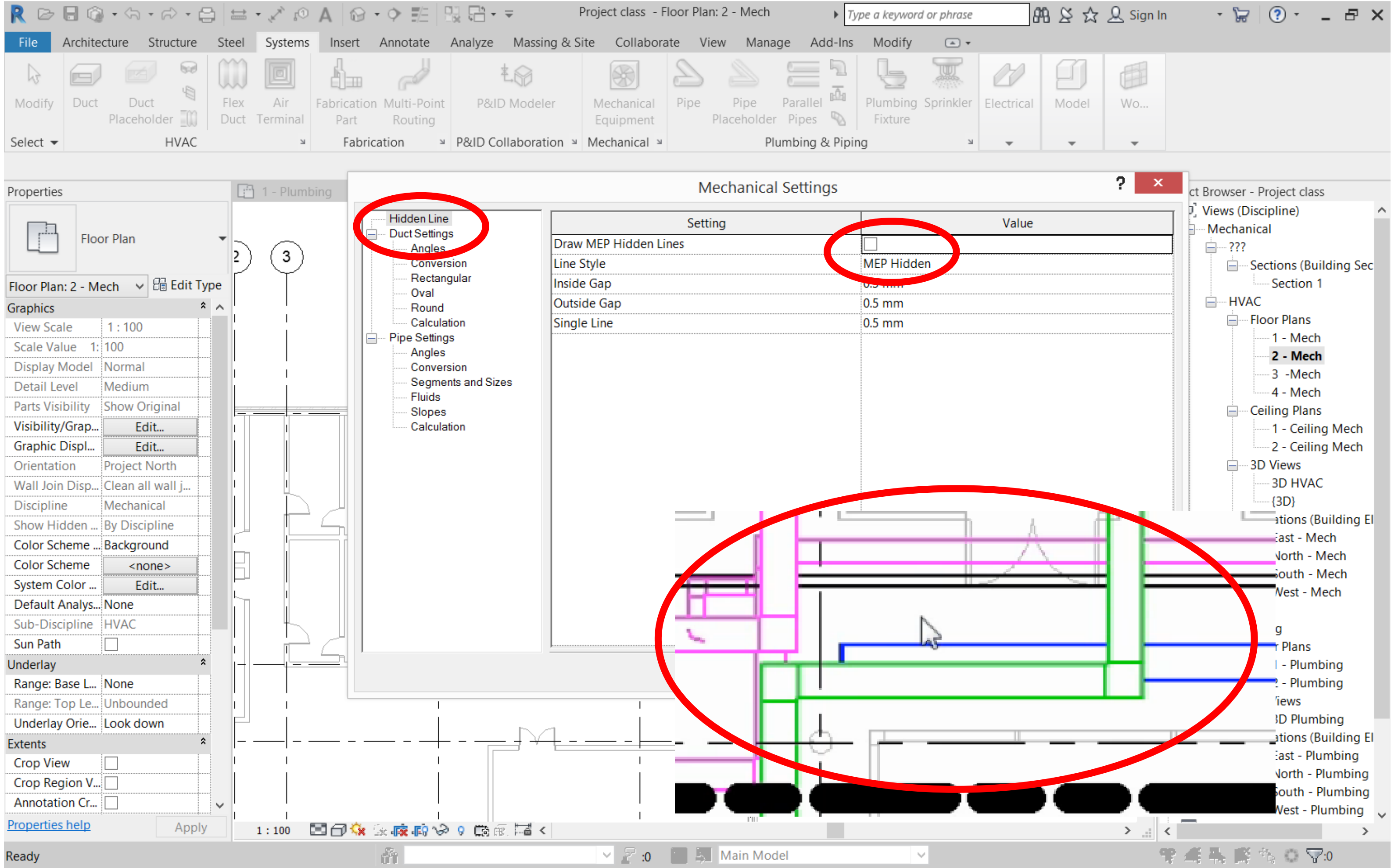
Mechanical settings

Hidden lines

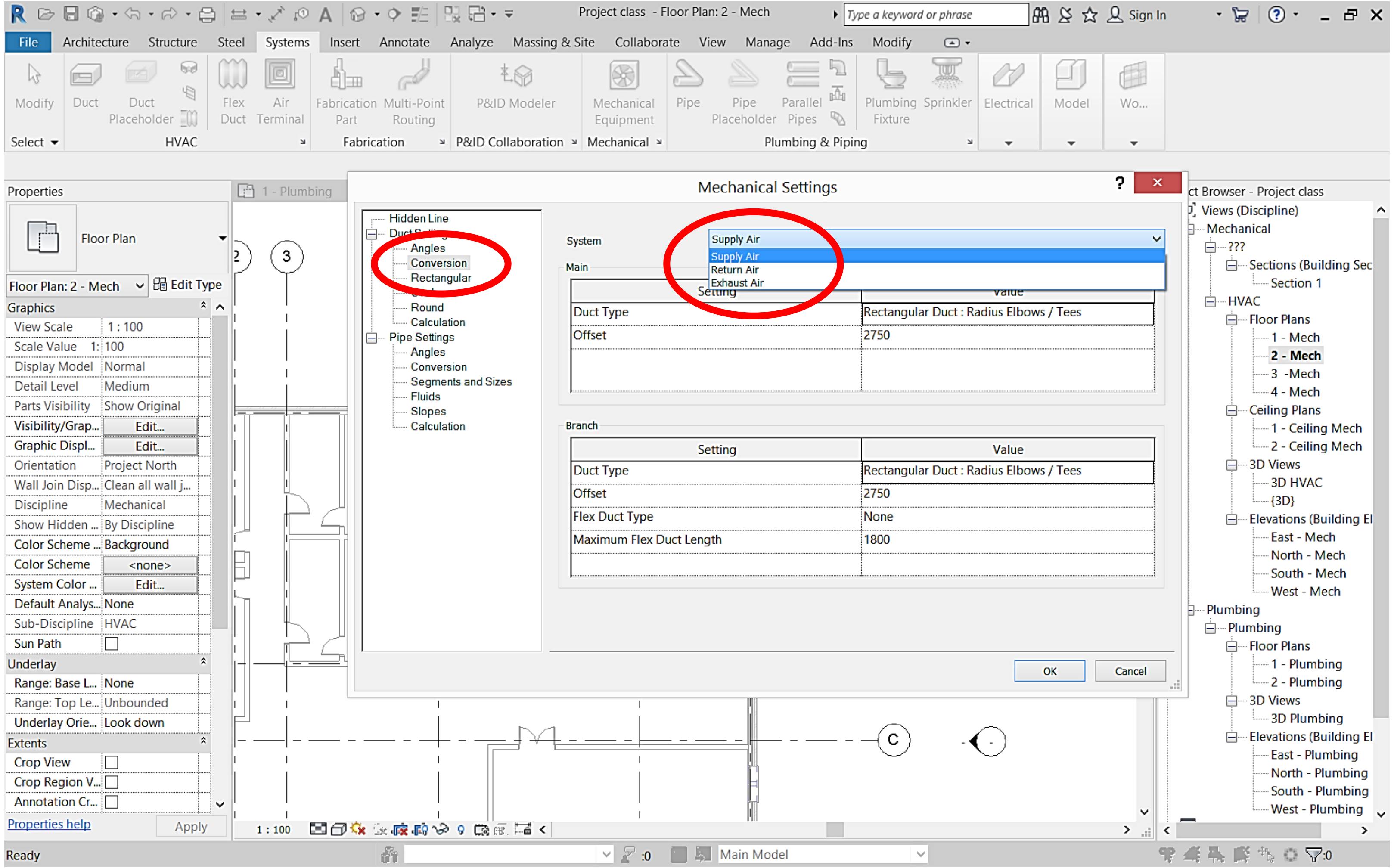


Mechanical settings

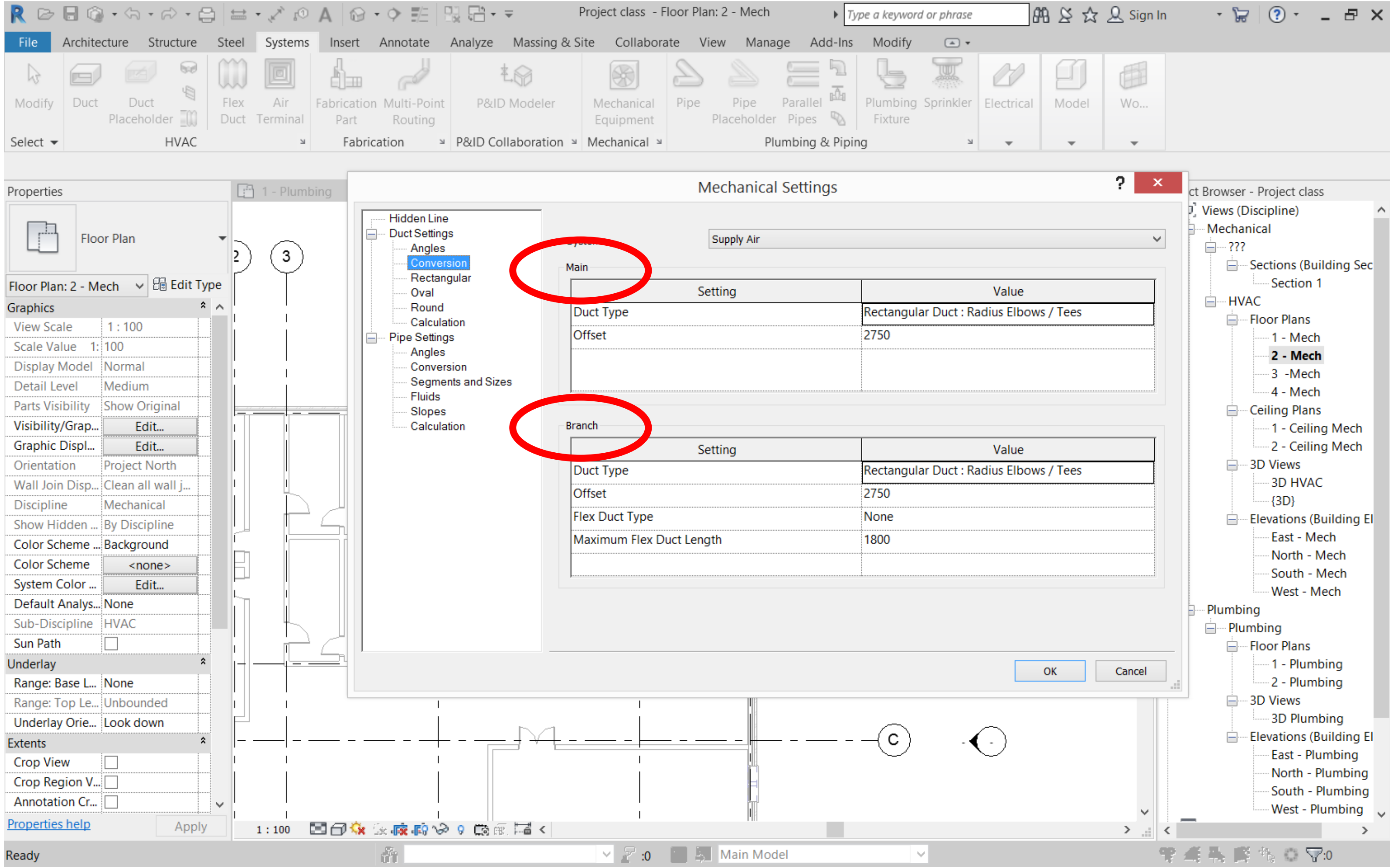
Hidden lines



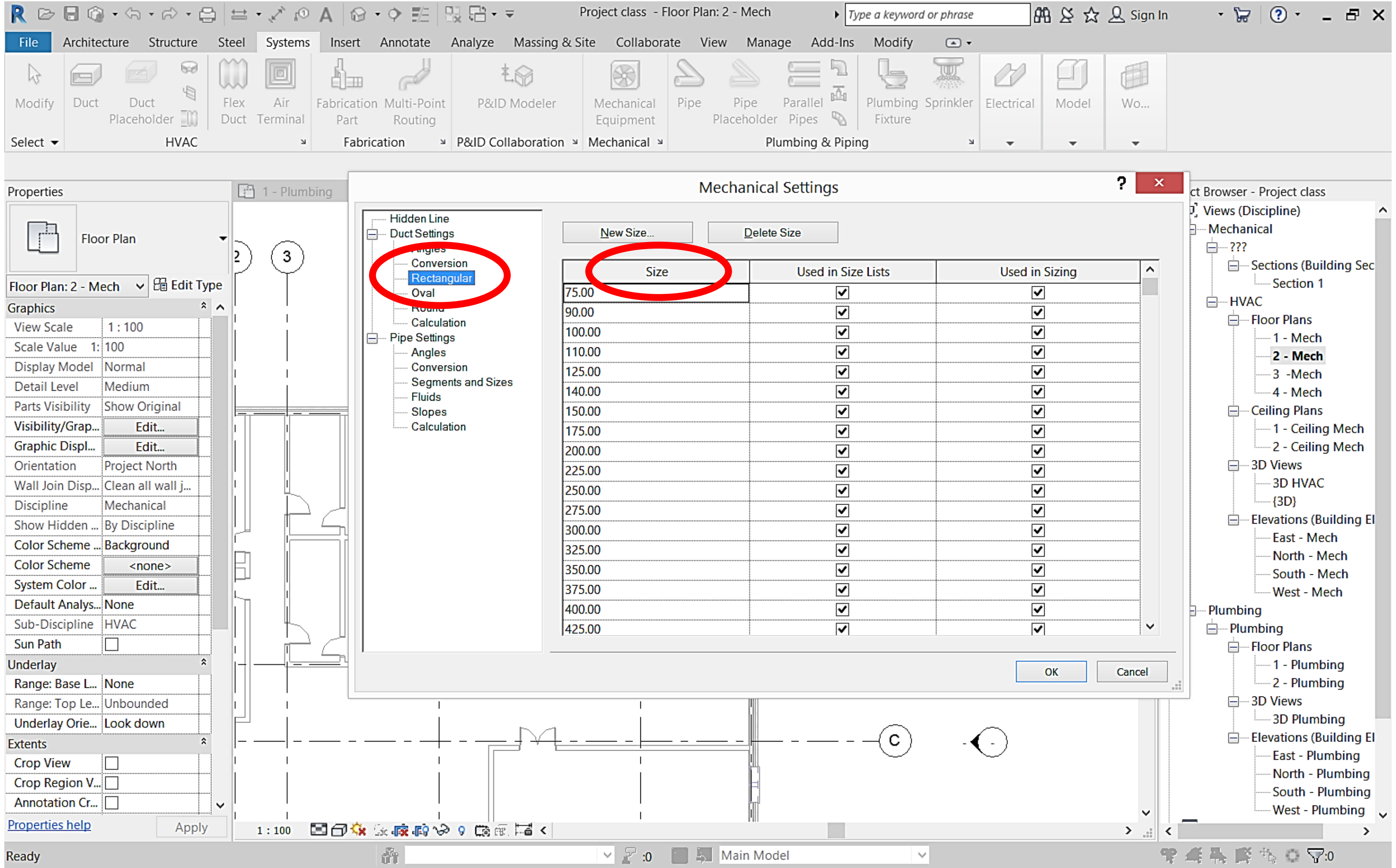
Mechanical settings



Mechanical settings

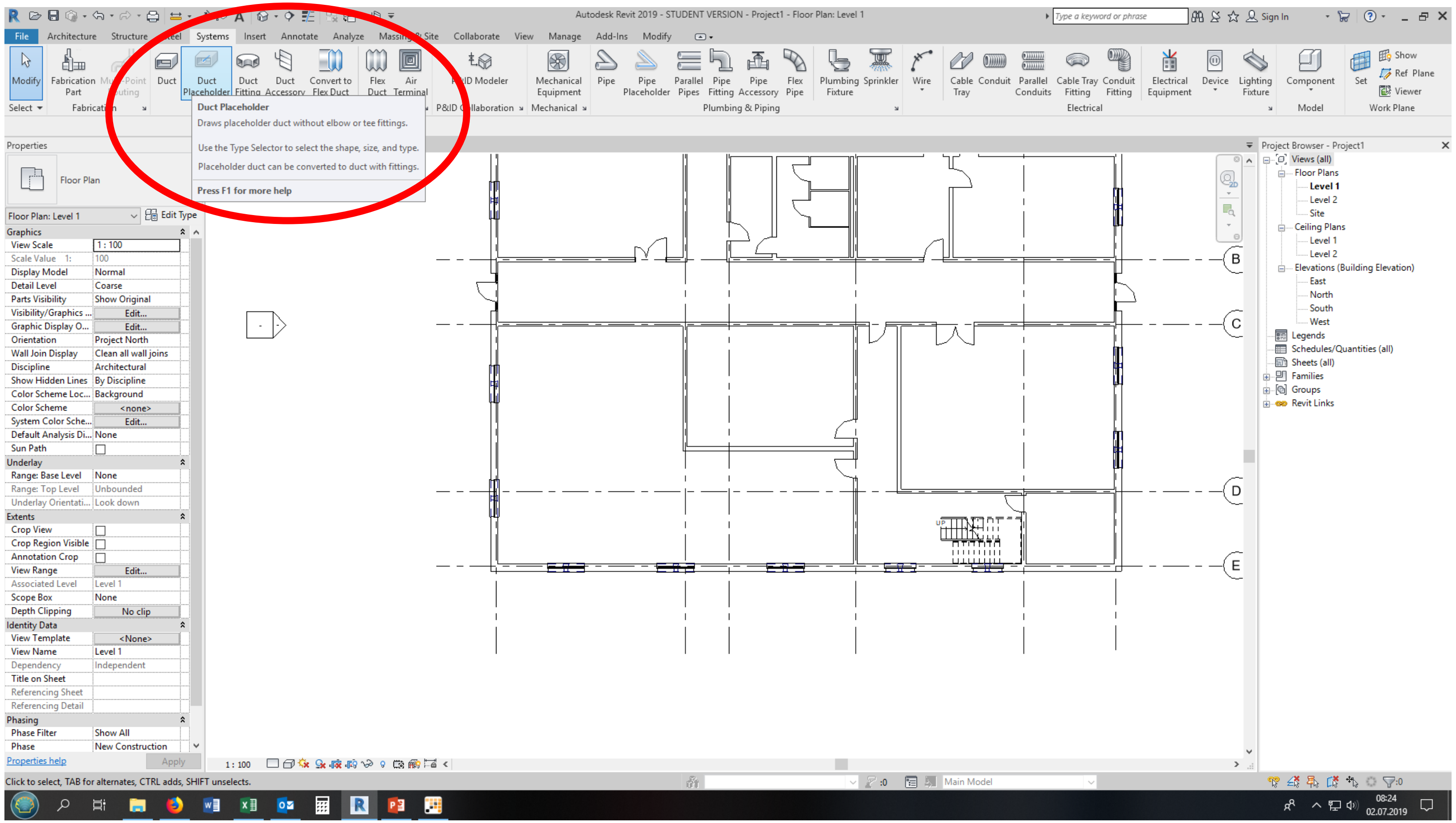


Mechanical settings



Drawing ducts

Duct placeholder



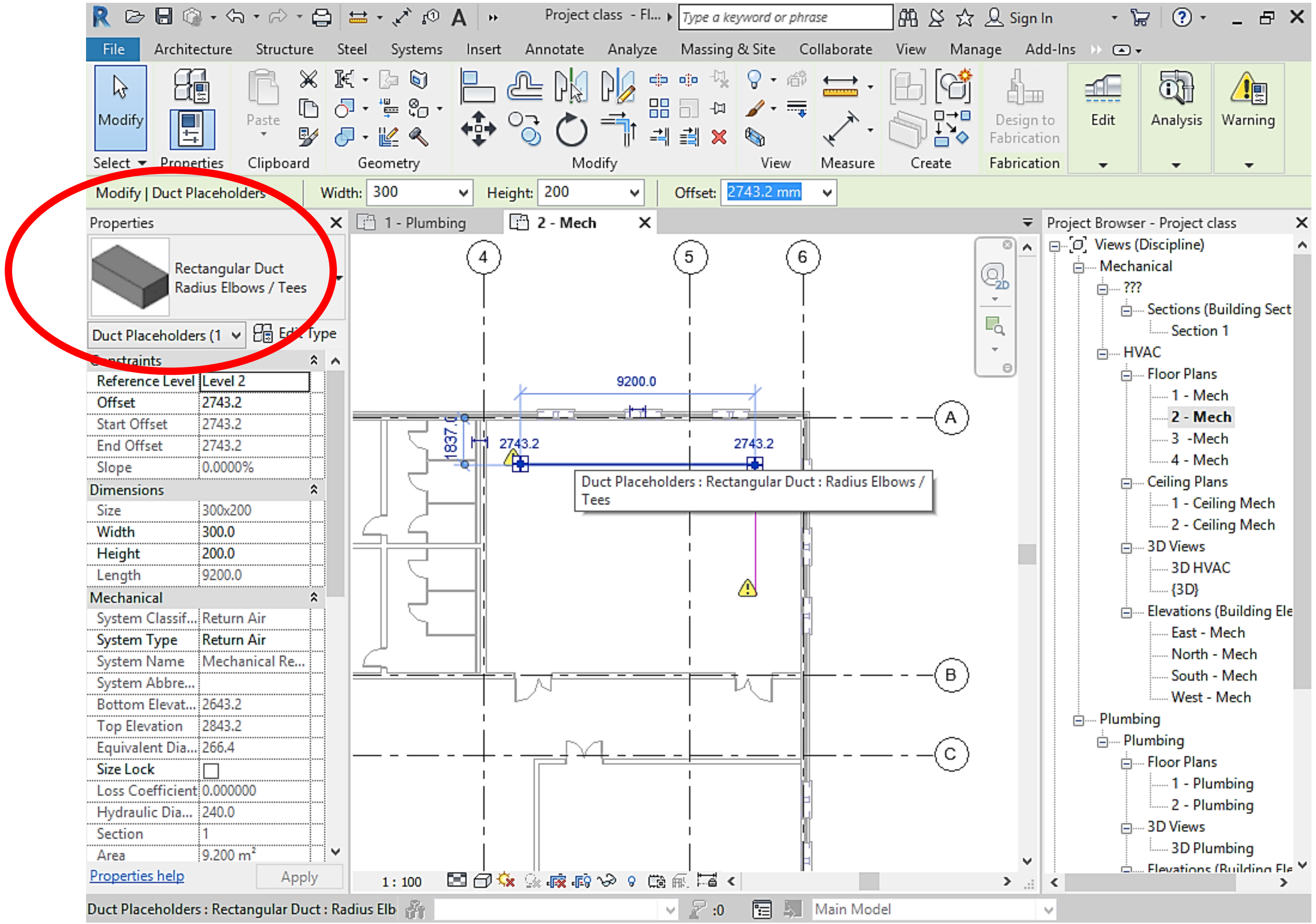
Drawing ducts

Duct placeholder

Properties

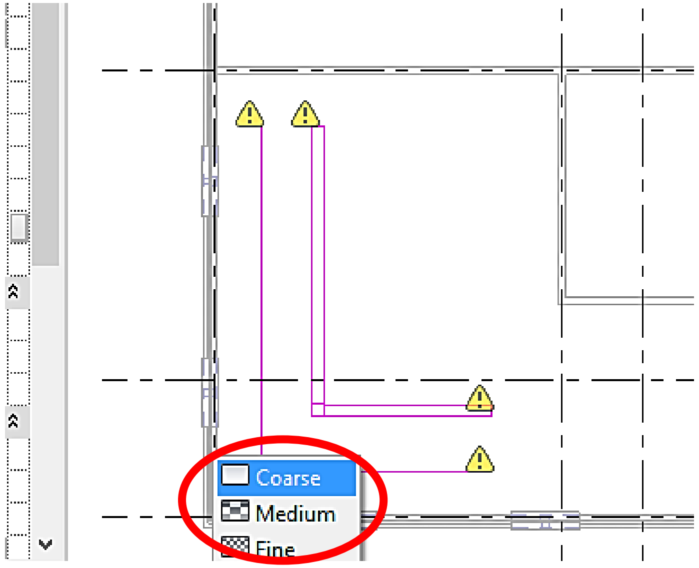
Dimensions

Offset

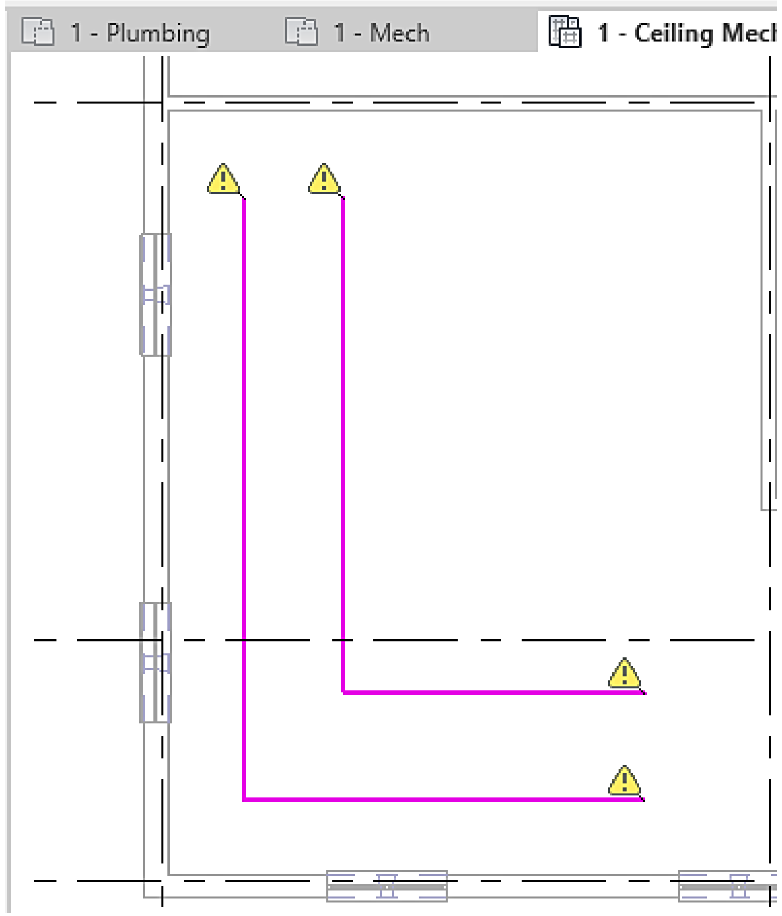


Drawing ducts

Duct placeholder



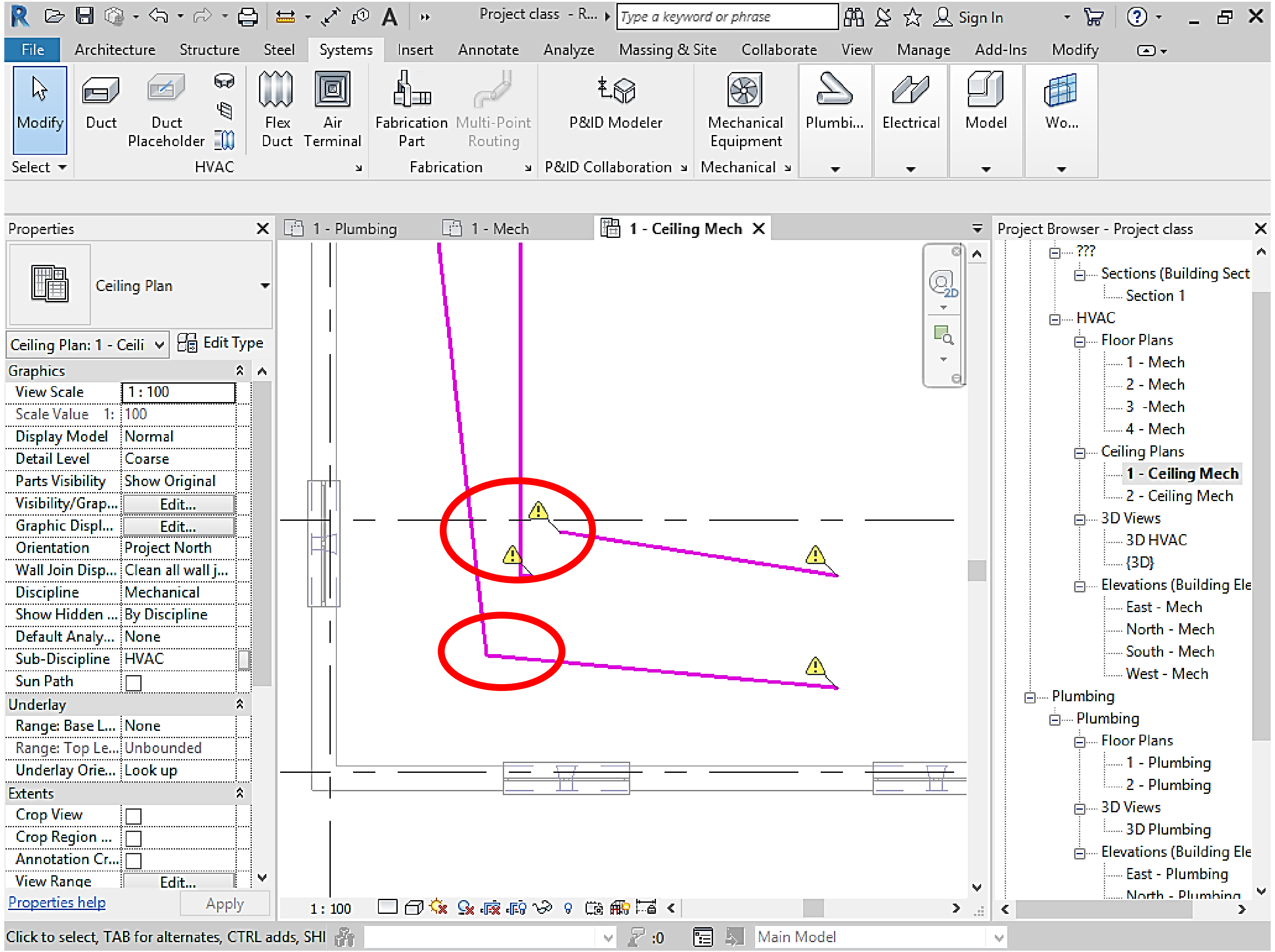
With the coarse level of detail looking the same – not the same



Drawing ducts

Duct placeholder

Modification – effect of stretching

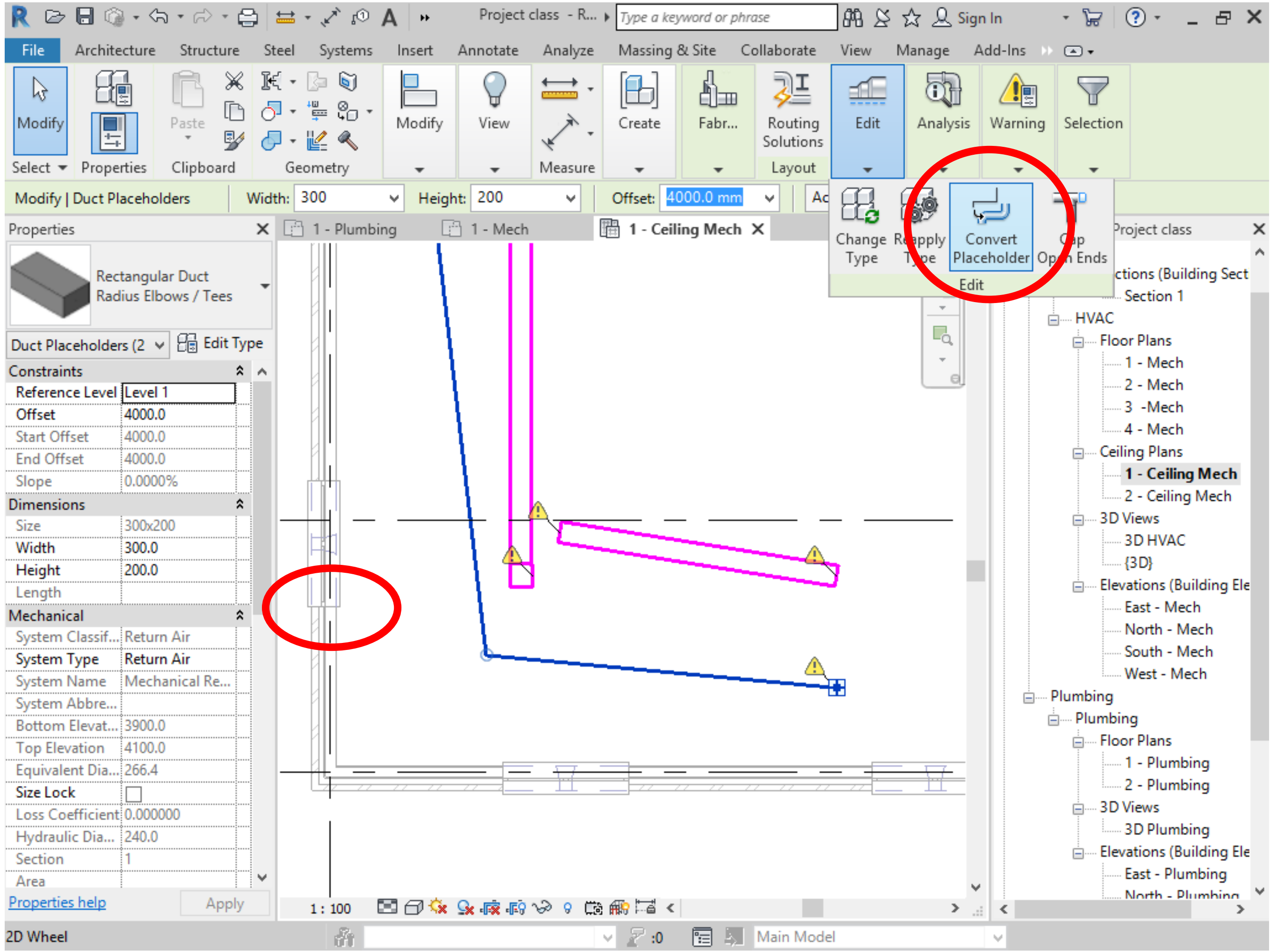


Drawing ducts

Duct placeholder

Select the entire run of ducts

Change into the full size ducts



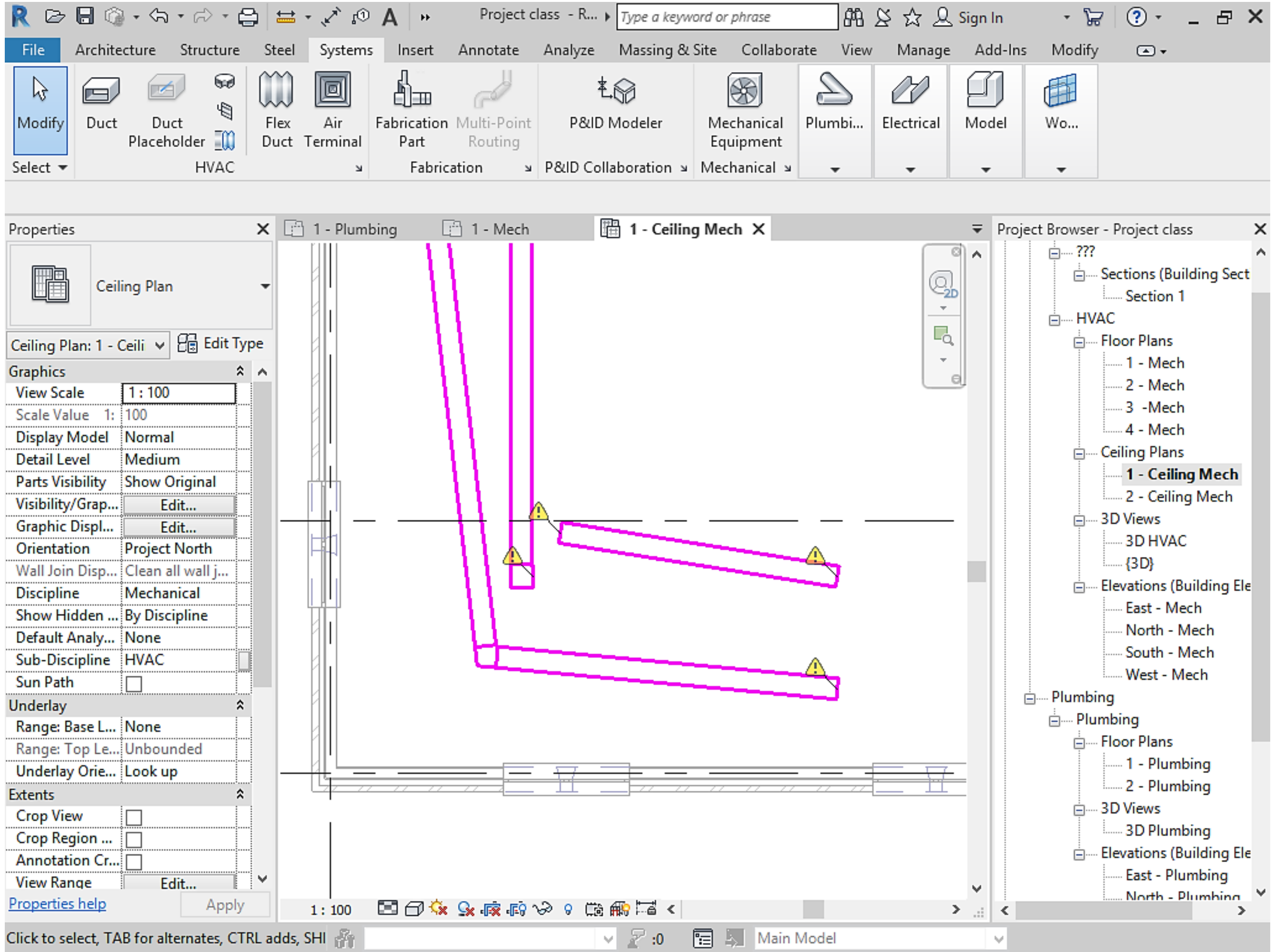
Drawing ducts

Duct placeholder

Change into the full size ducts

Results

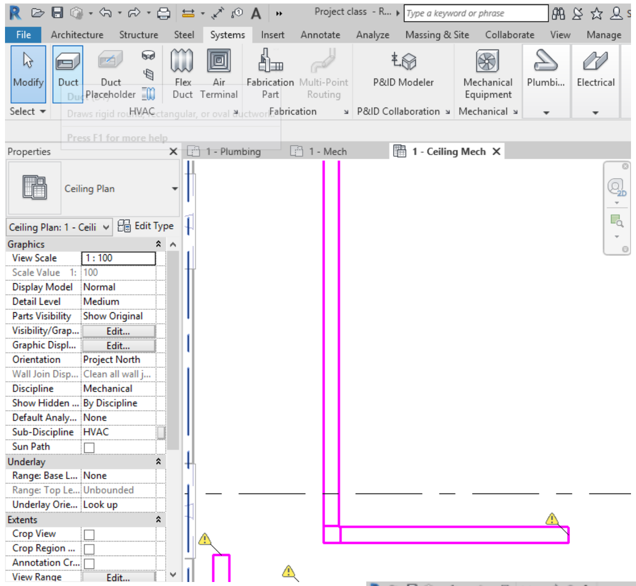
Caution! – Irreversible process

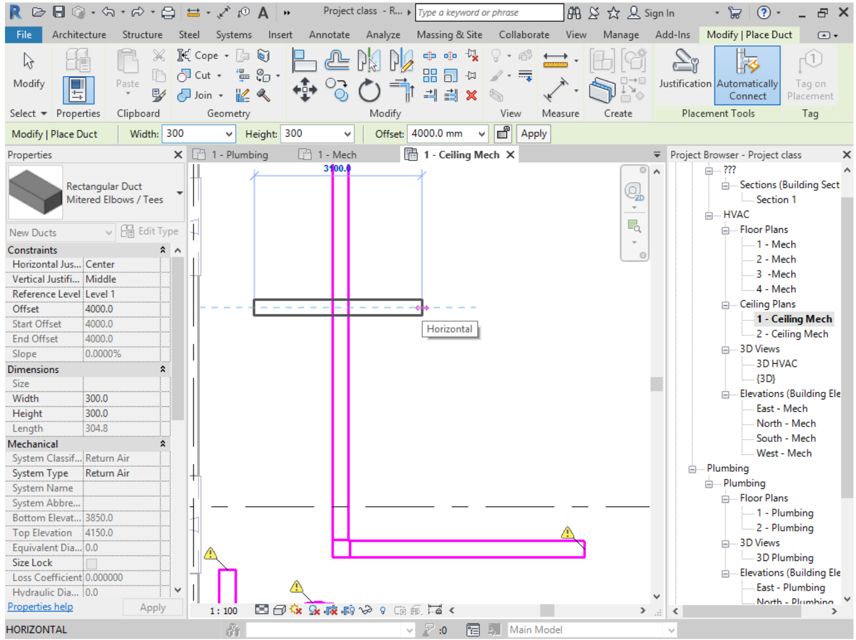


Drawing ducts

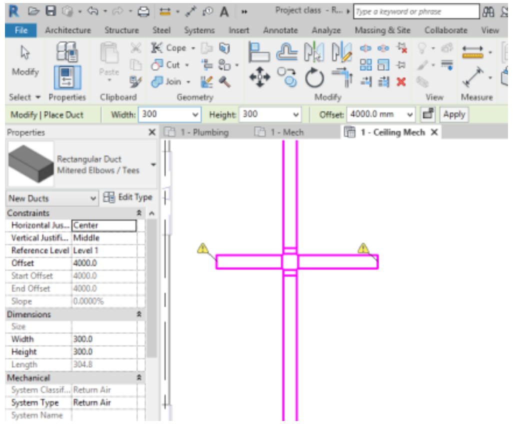
The same system

Drawing and connecting





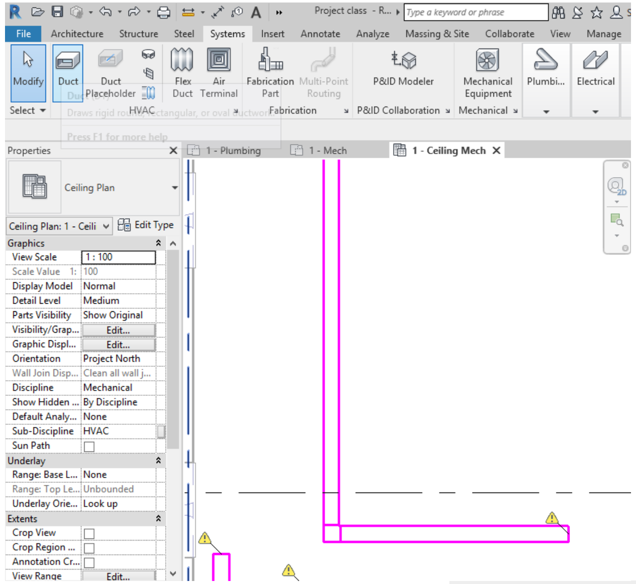
The connection is created

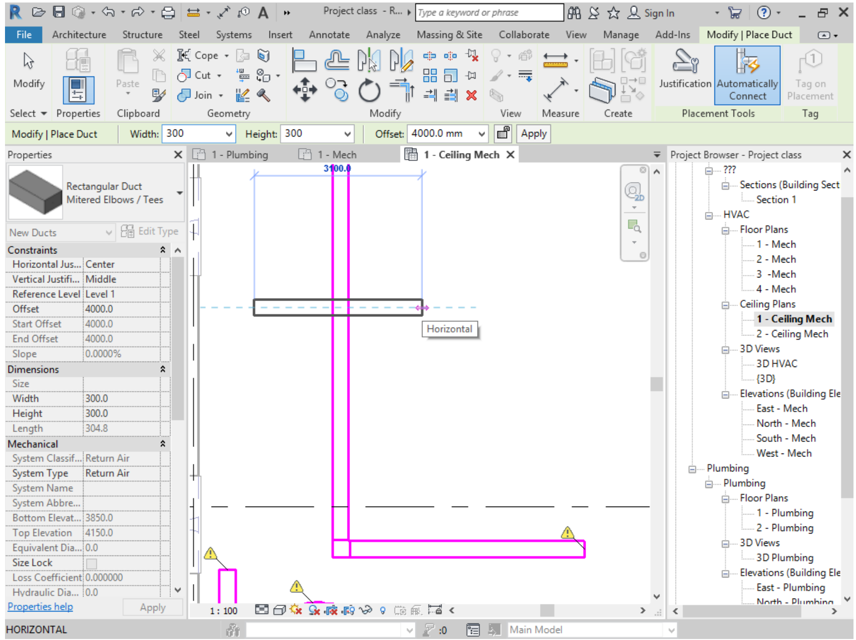


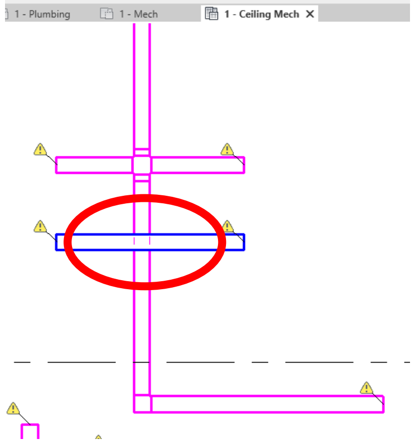
Drawing ducts

Different system e.g. „return air”

Drawing
and connecting



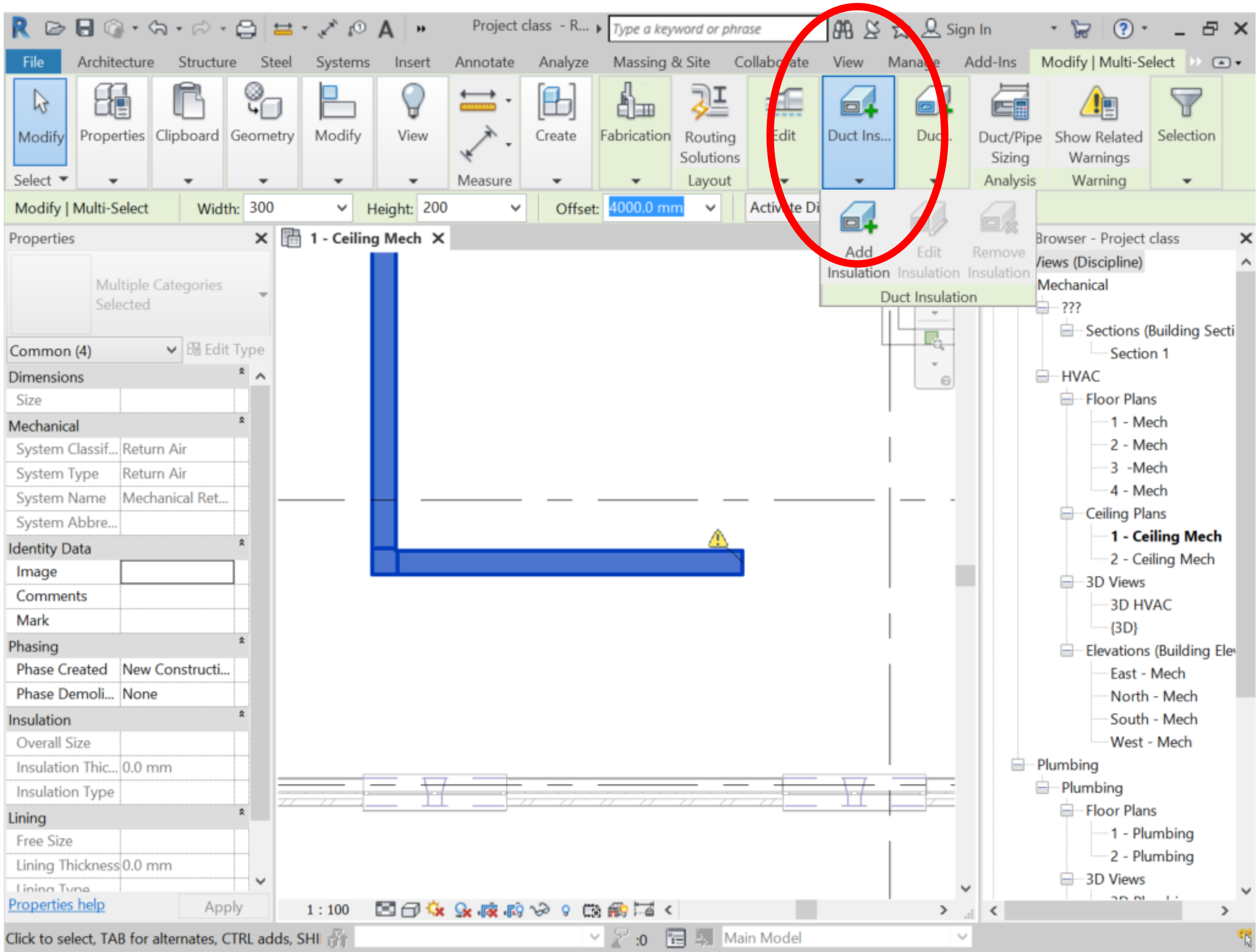




The connection is not created

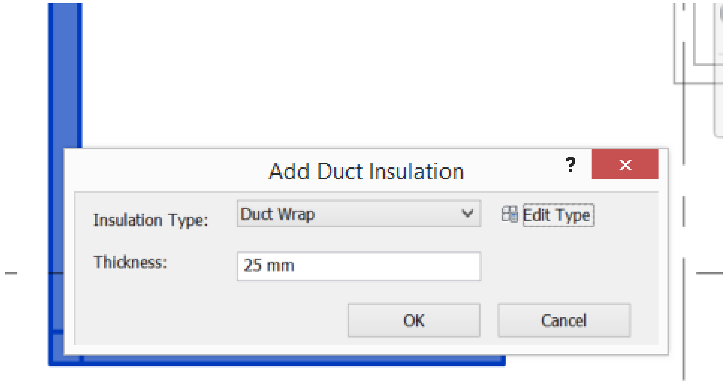
Drawing ducts

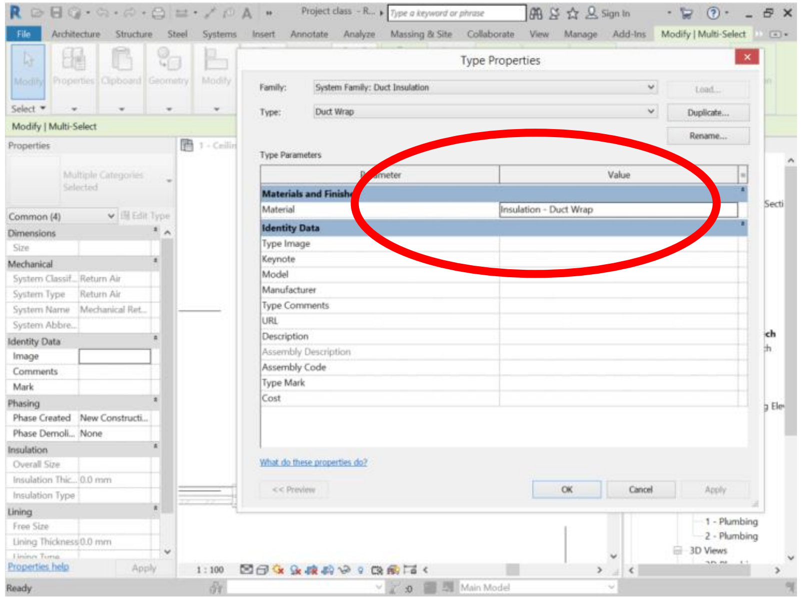
Adding insulation

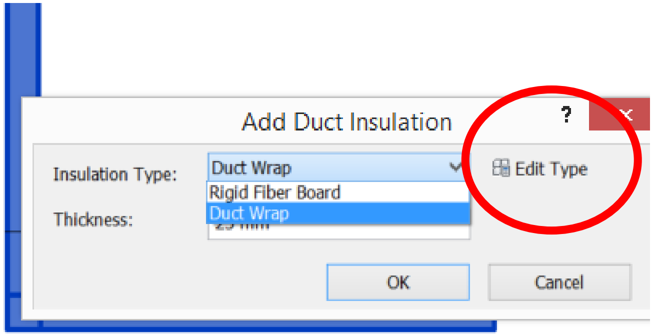


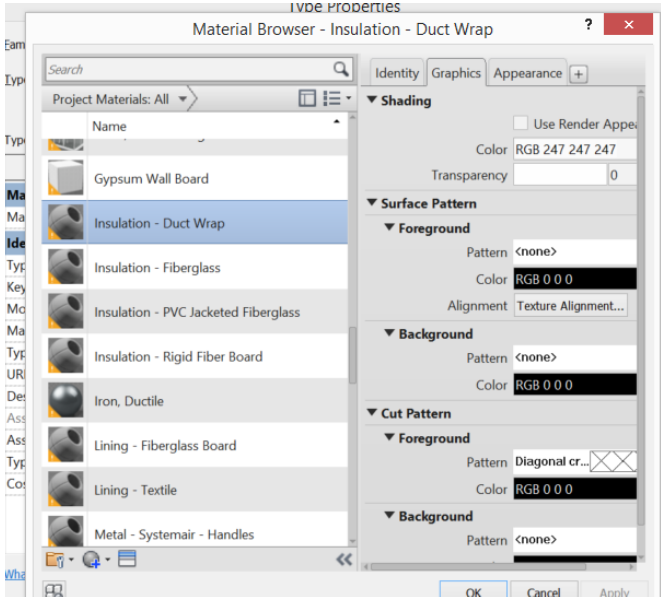
Drawing ducts

Editing insulation



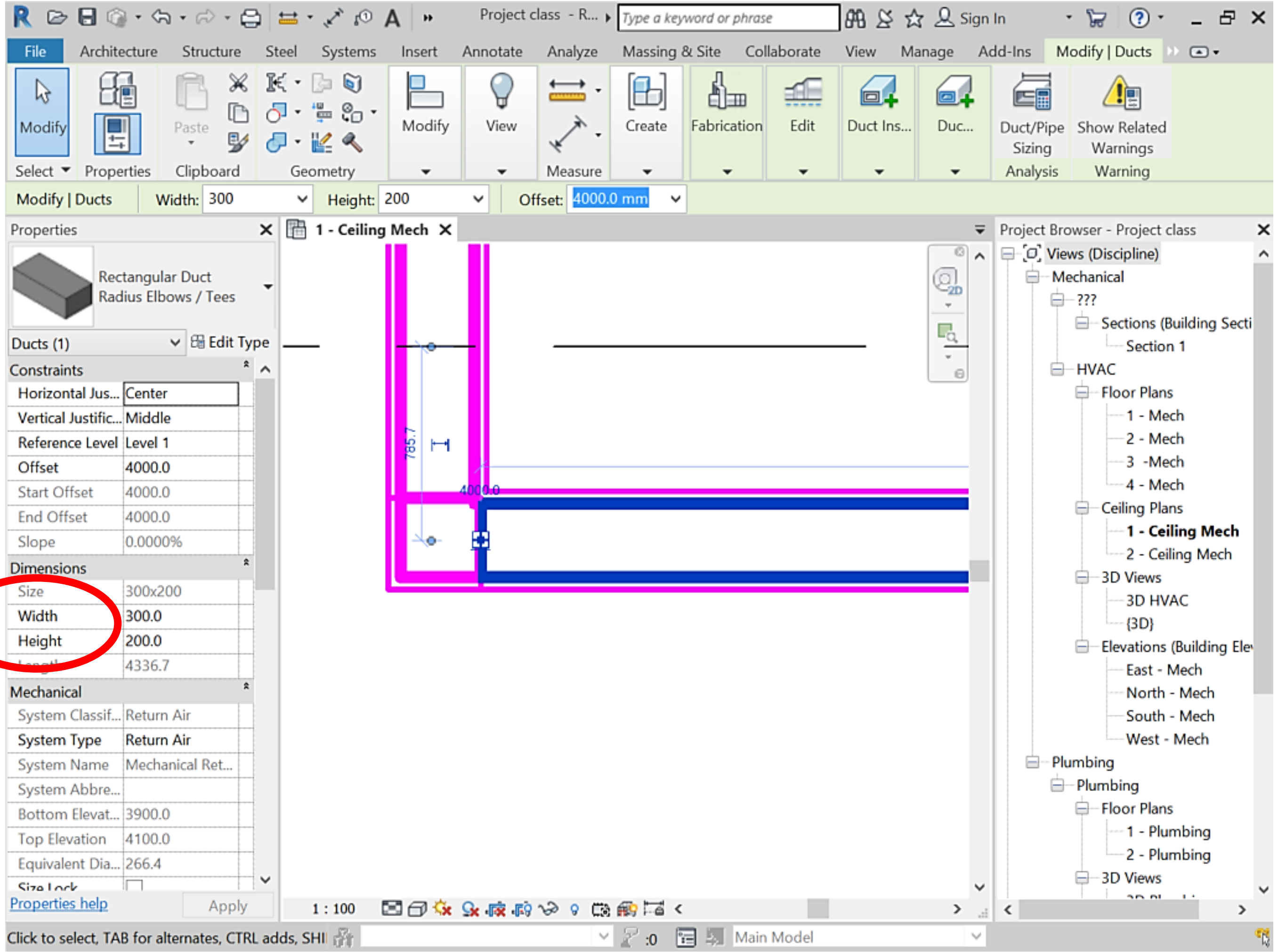






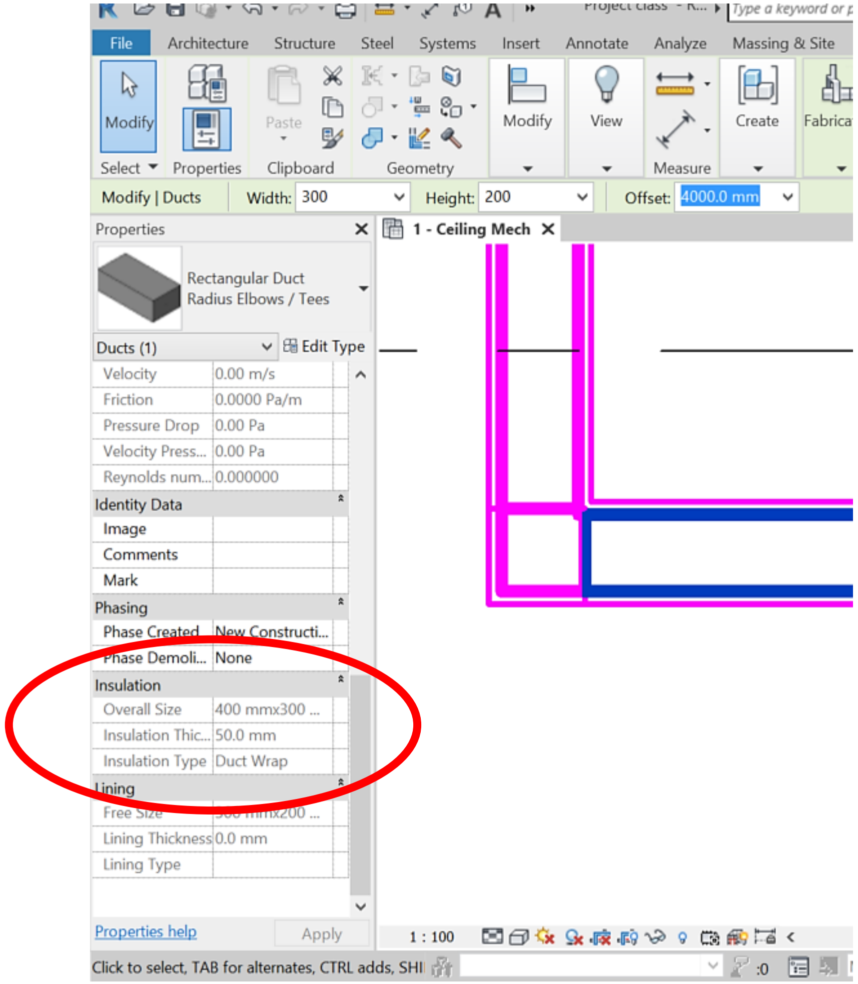
Drawing ducts

Insulated duct dimensions



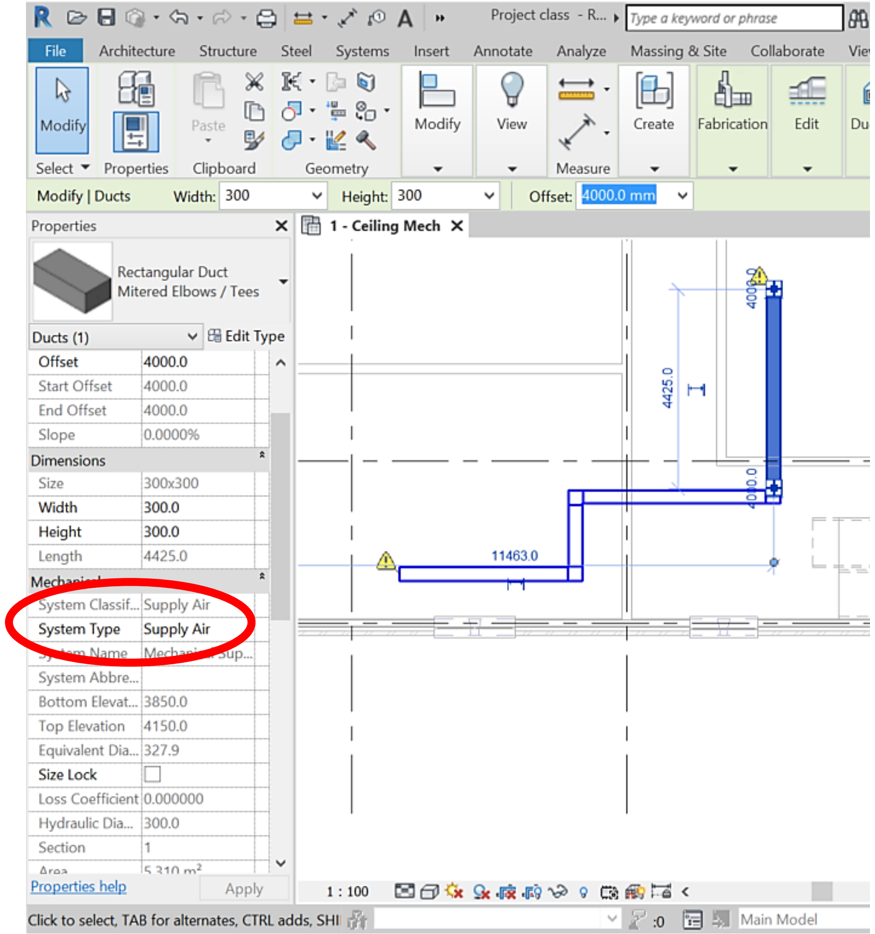
Drawing ducts

Insulated duct dimensions



Modifying ducts

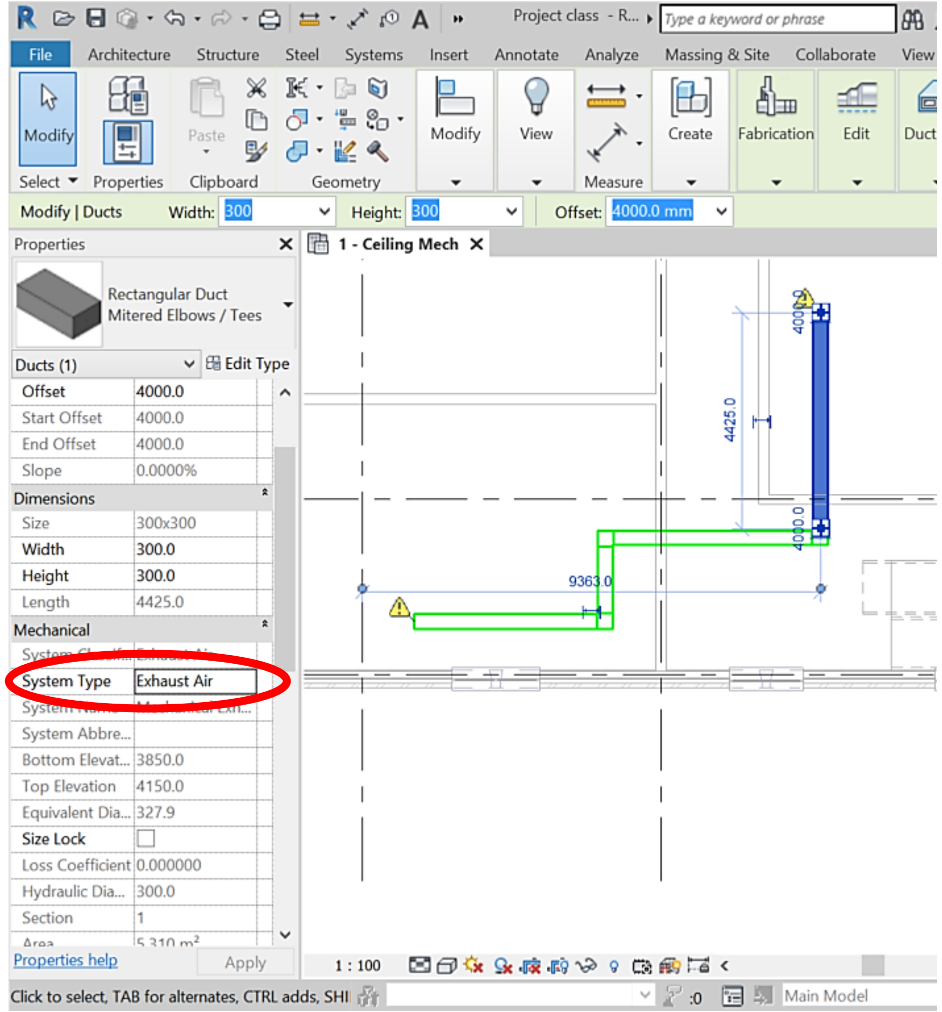
Changing type



Modifying ducts

Changing type

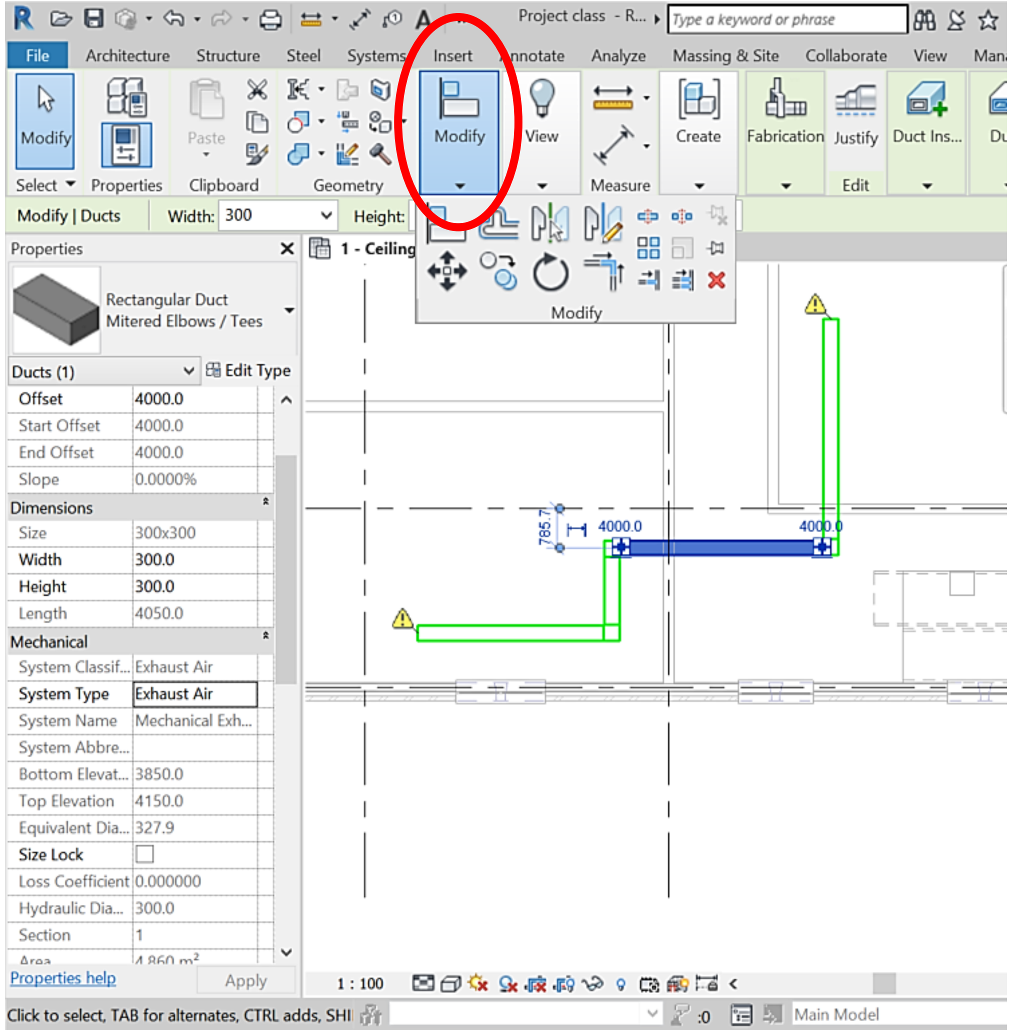
Selecting only one duct and changing its type – Revit will change the type of the entire run



Modifying ducts

Moving ducts

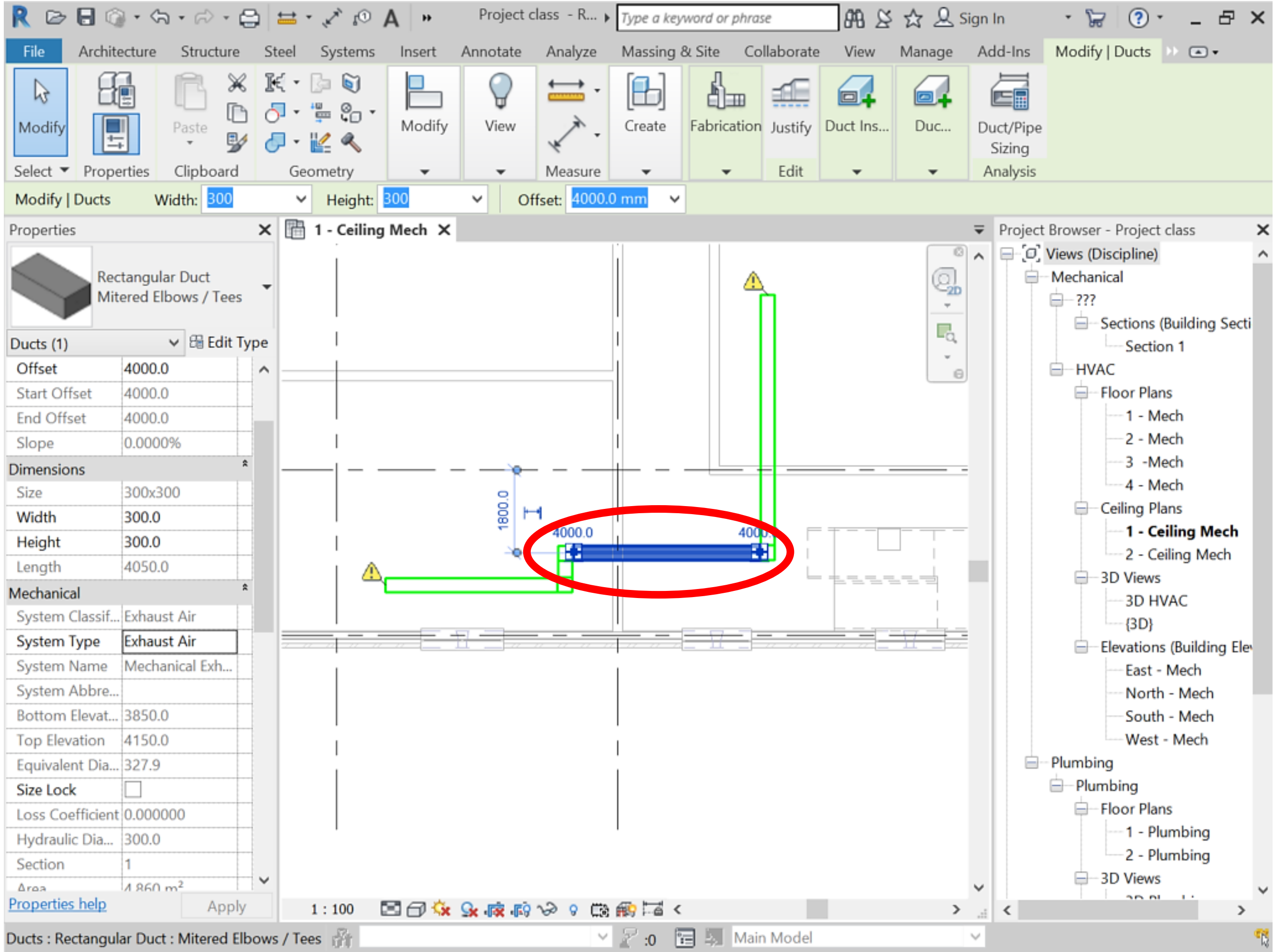
Moving one duct in the run – Revit will stretch the connected ones



Modifying ducts

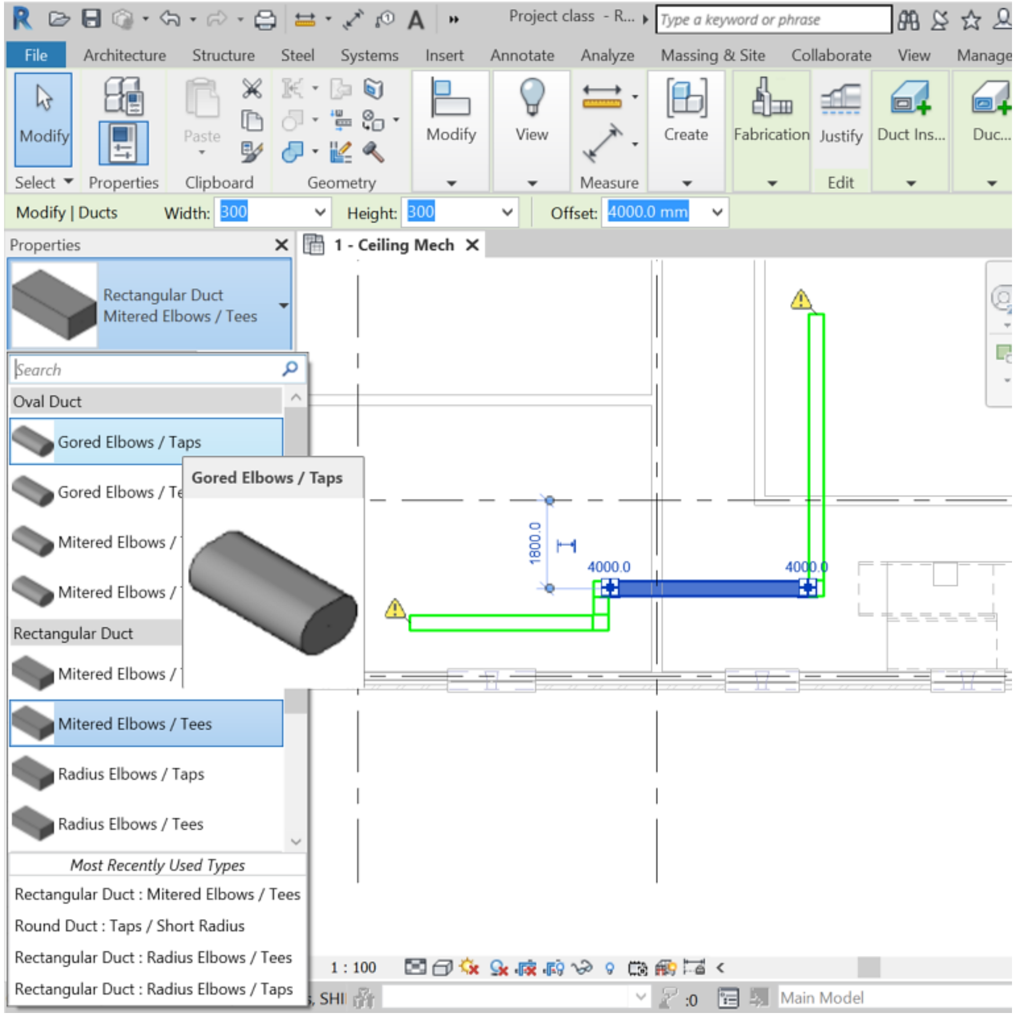
Moving ducts

Moving one duct in the run – Revit will stretch the connected ones



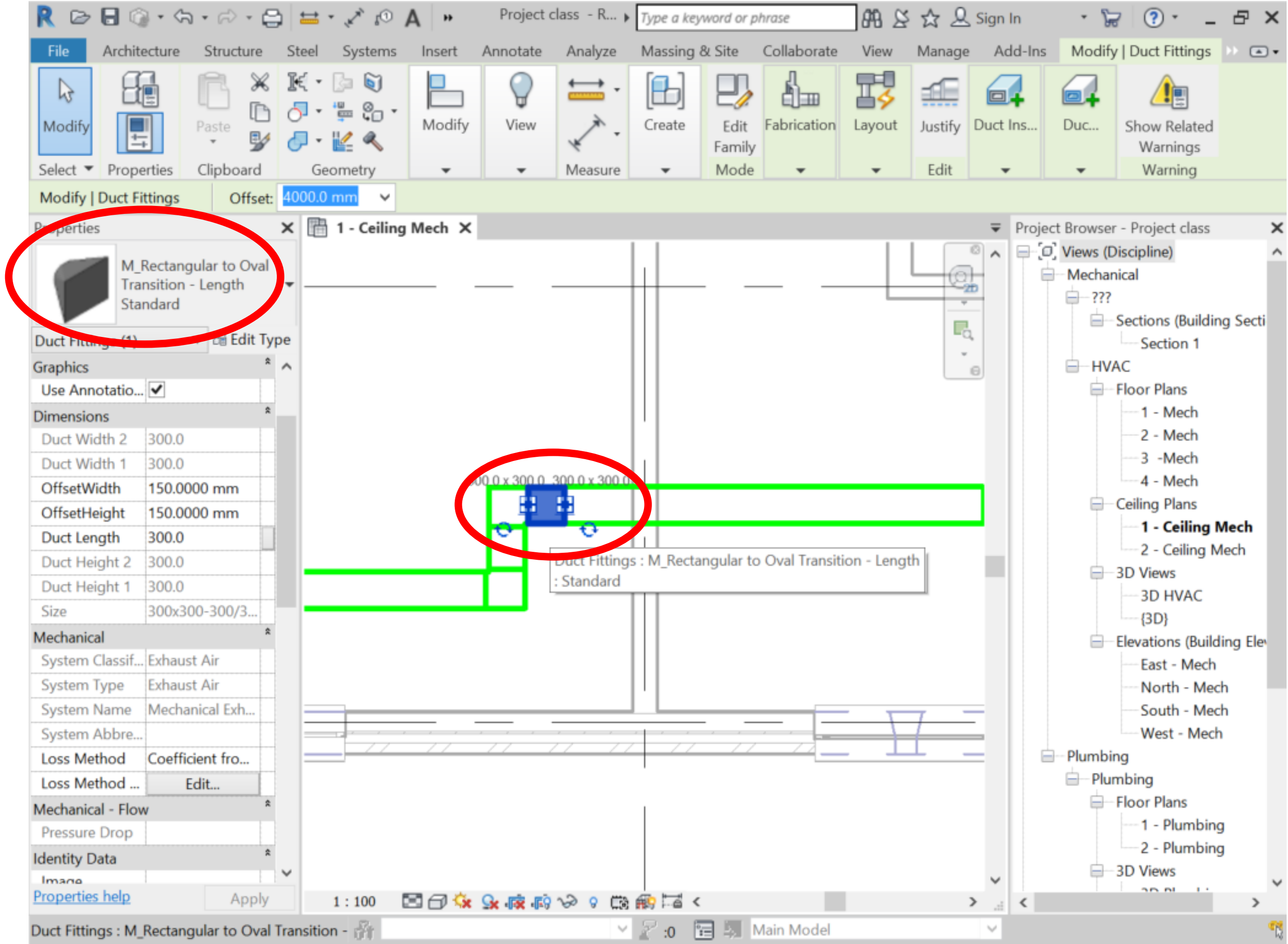
Modifying ducts

Changing duct type of one part



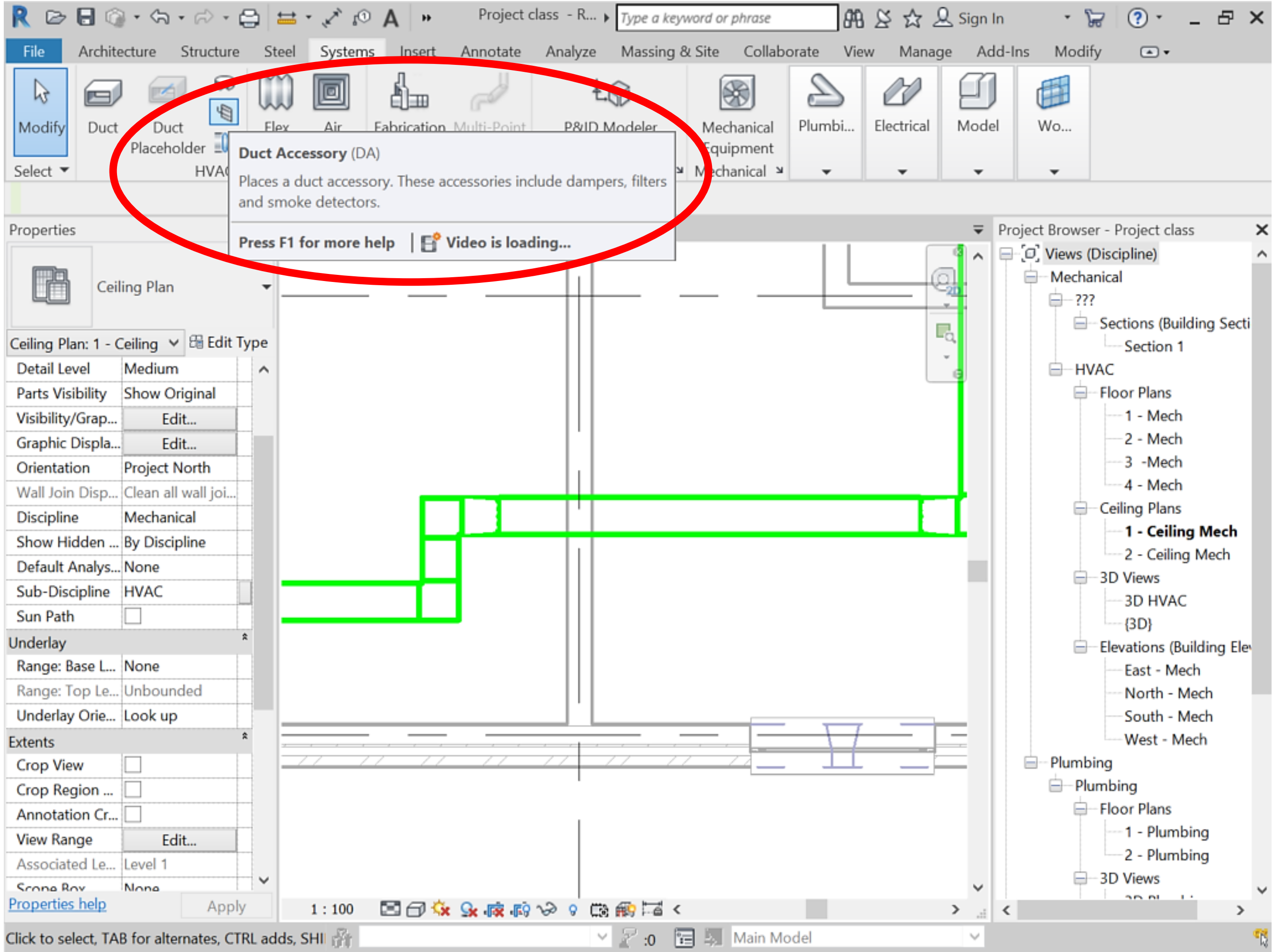
Modifying ducts

Changing duct type of one part – Revit will add the transition



Modifying ducts

Accessories

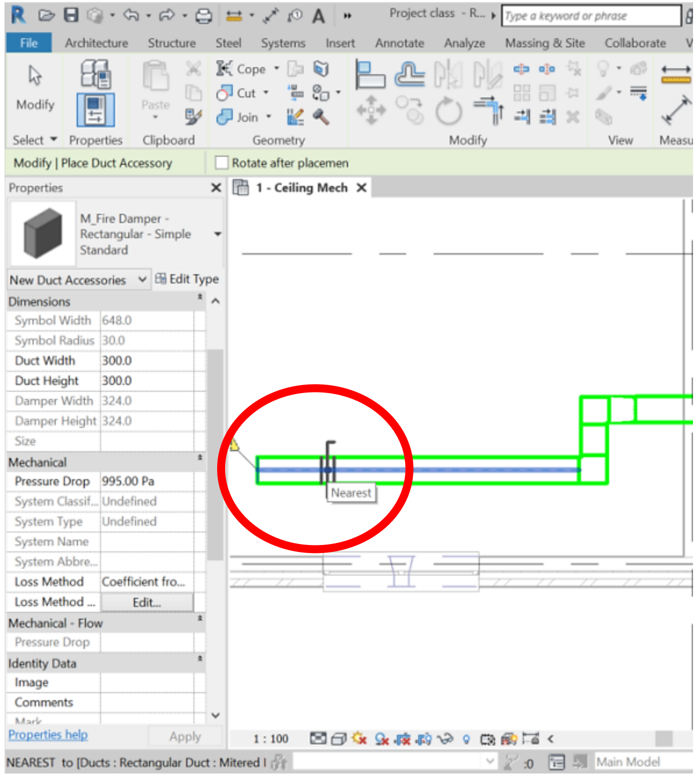


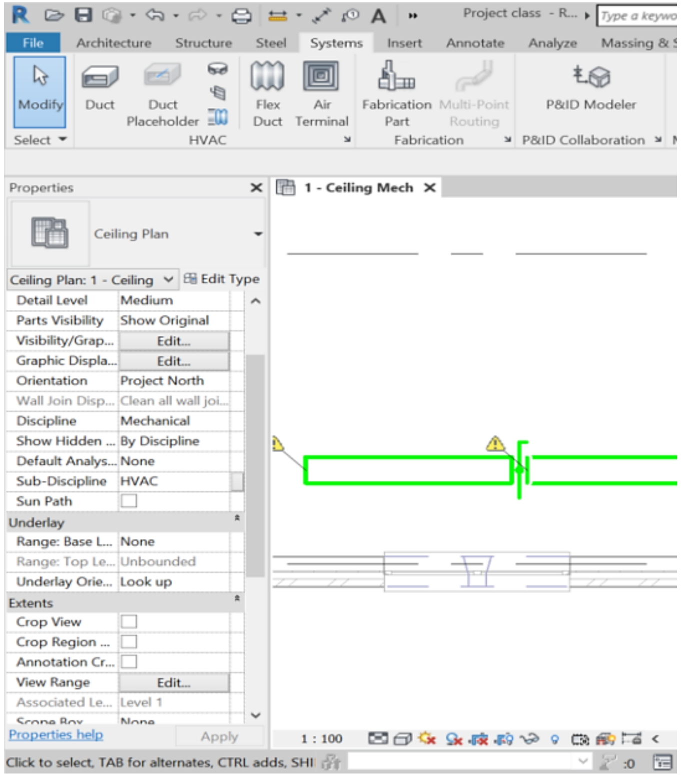
Modifying ducts

Accessories –

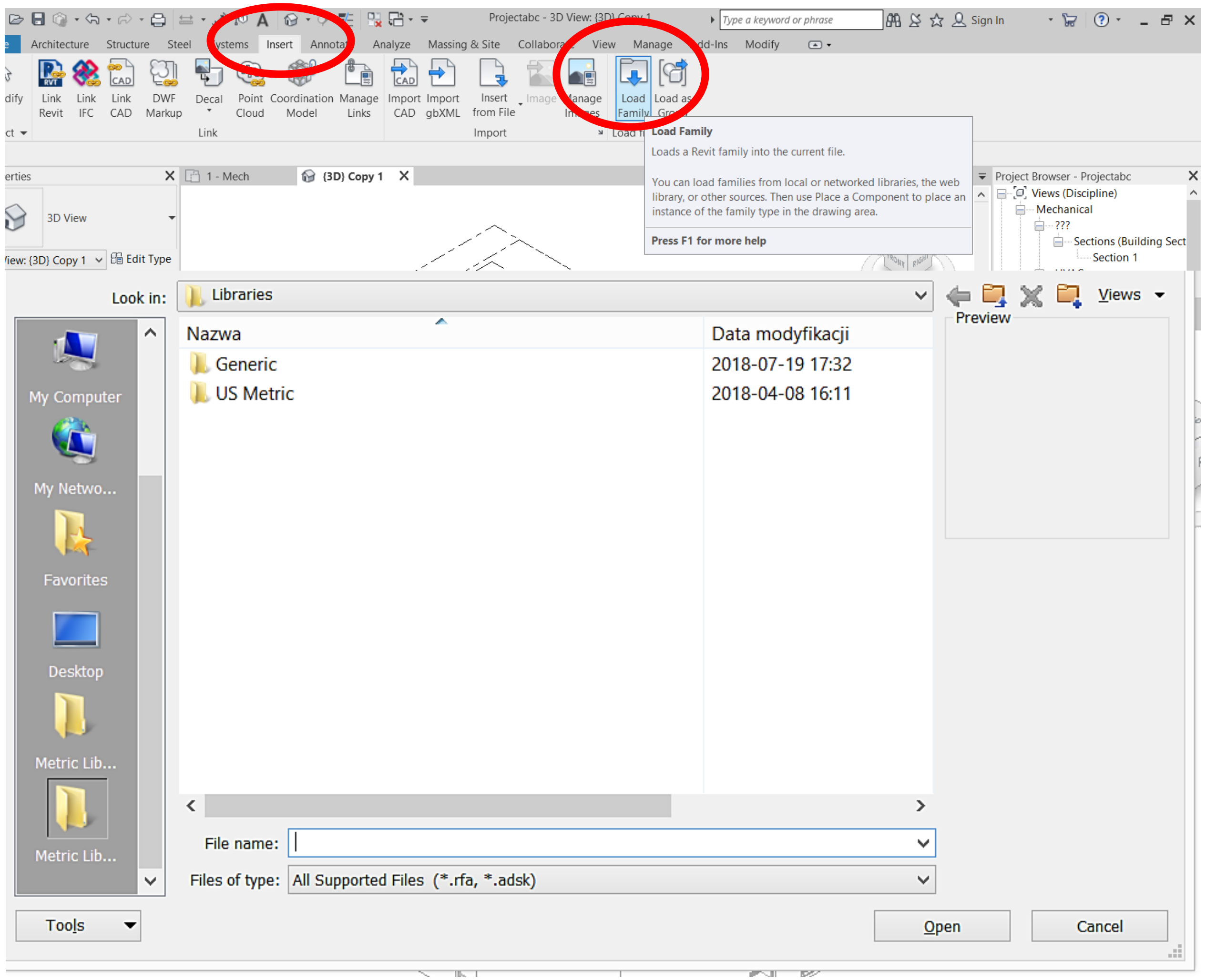
Fire damper put into the duct run

When moved – the cut in the duct will move as well

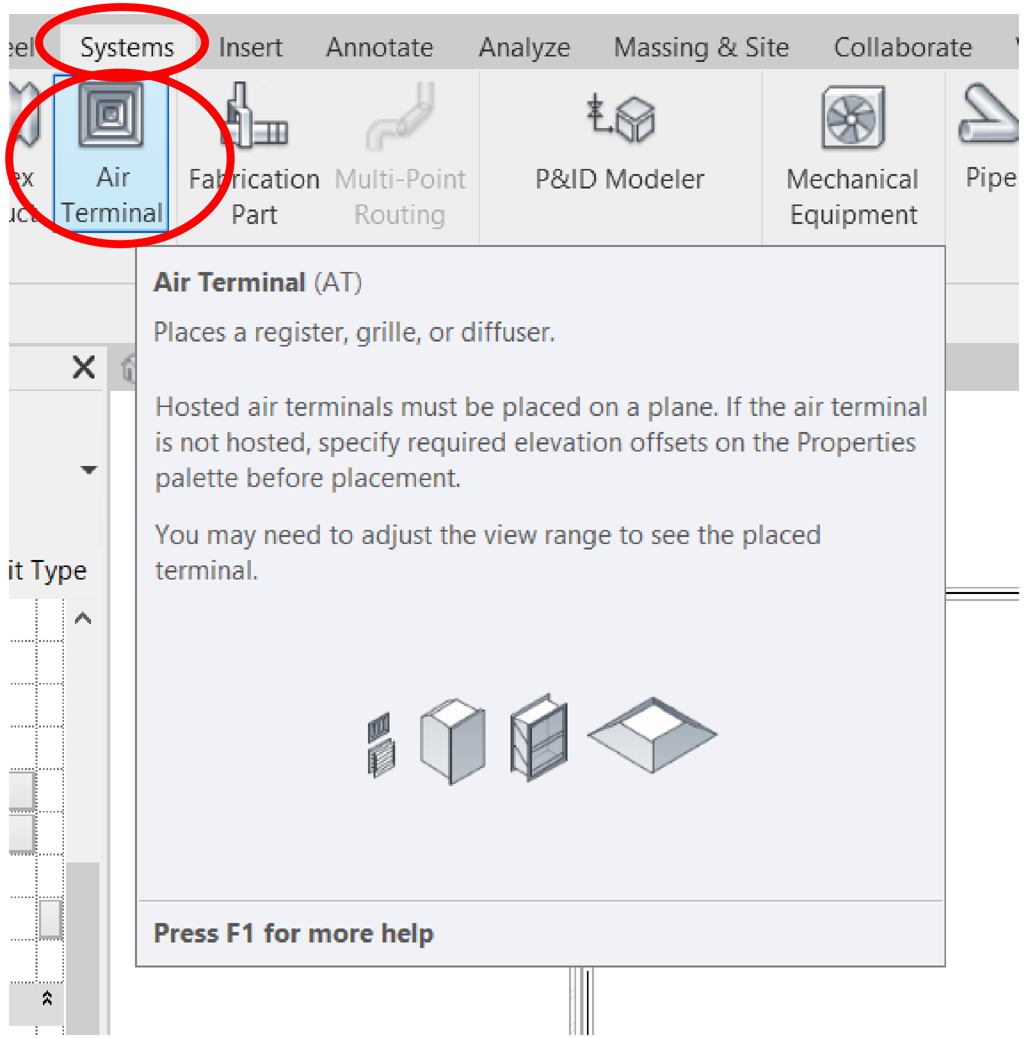




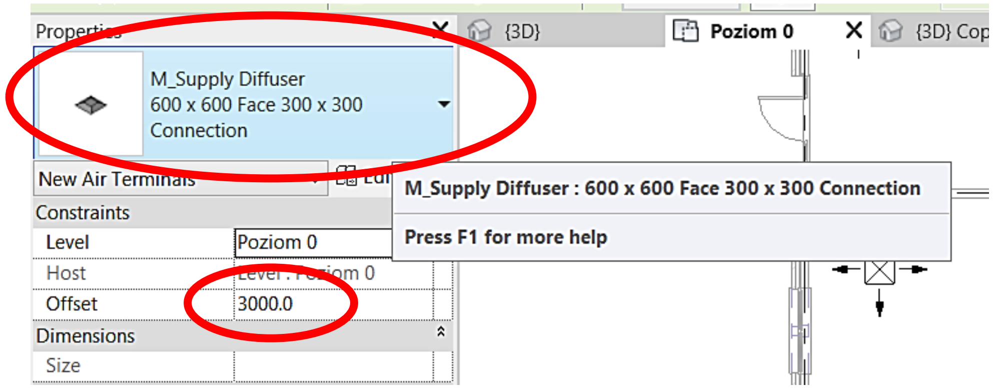
Families – location

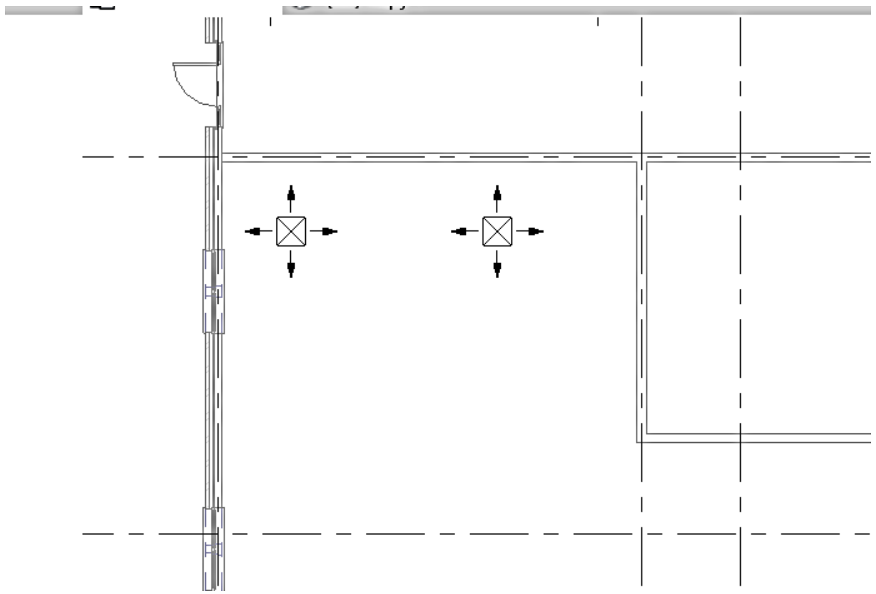


Placing air terminals

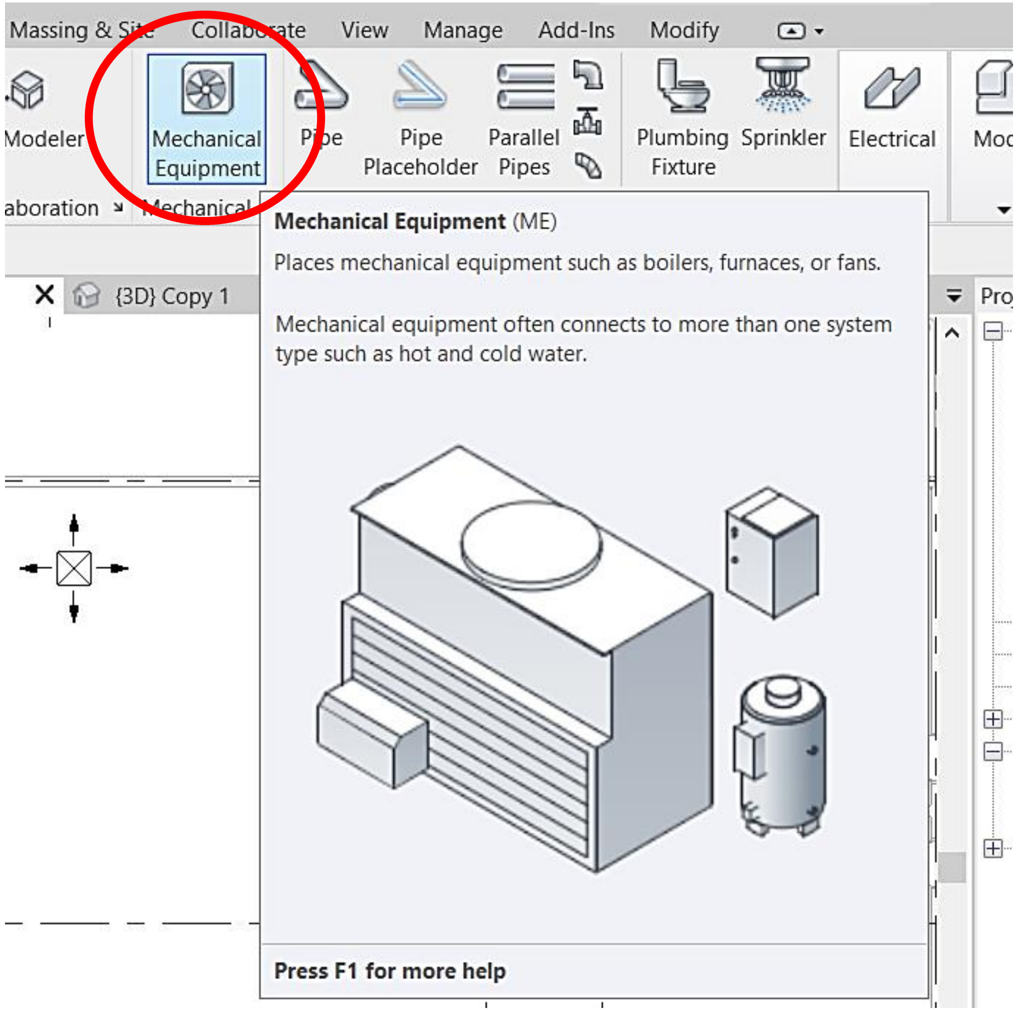


Placing air terminals

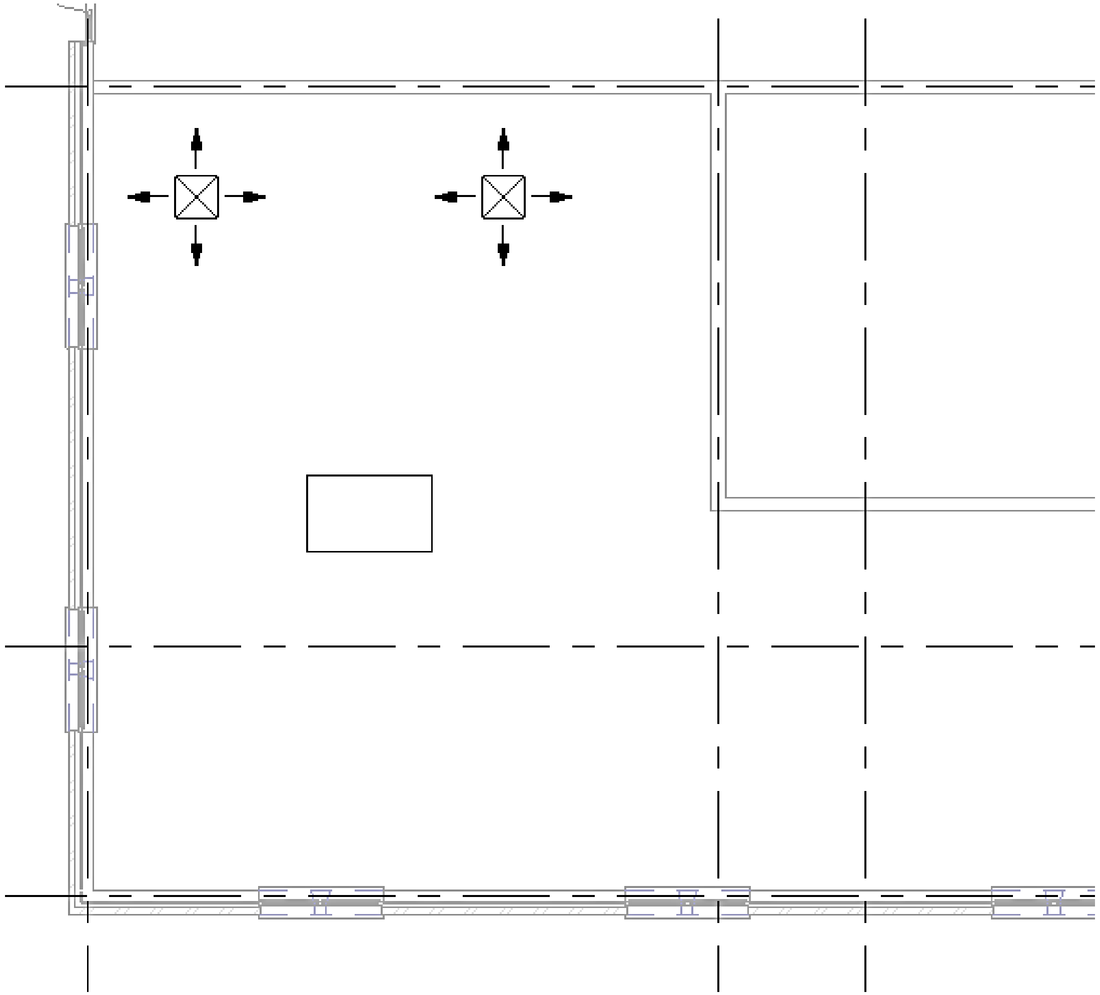




Placing Air Handling Unit

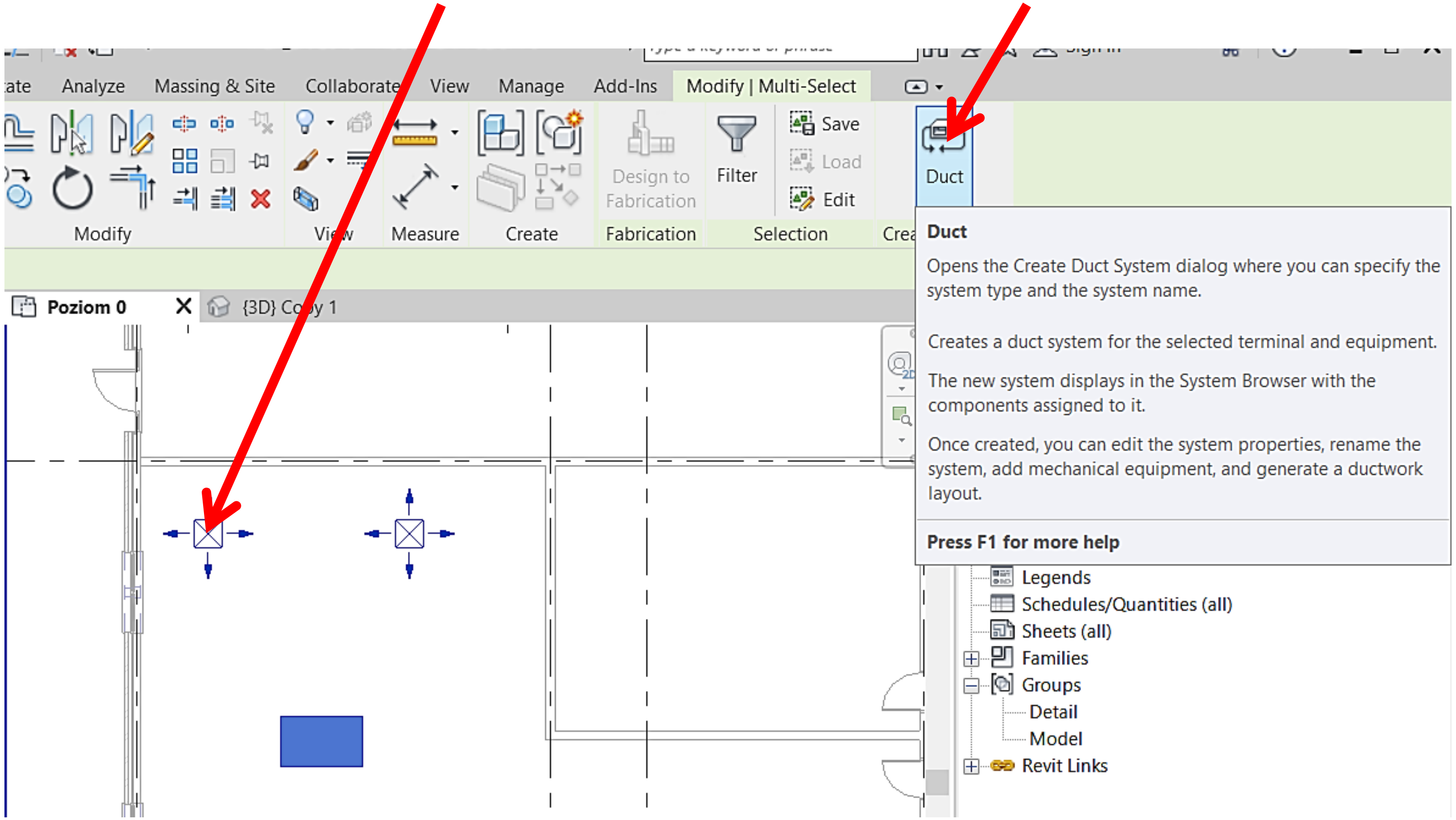


Placing Air Handling Unit

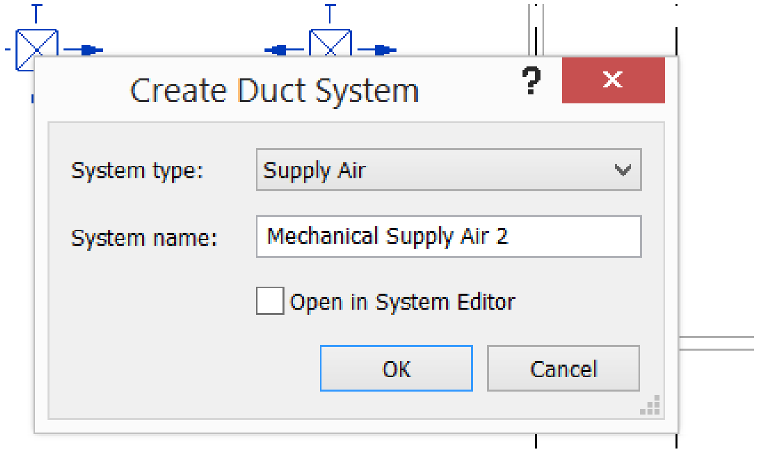


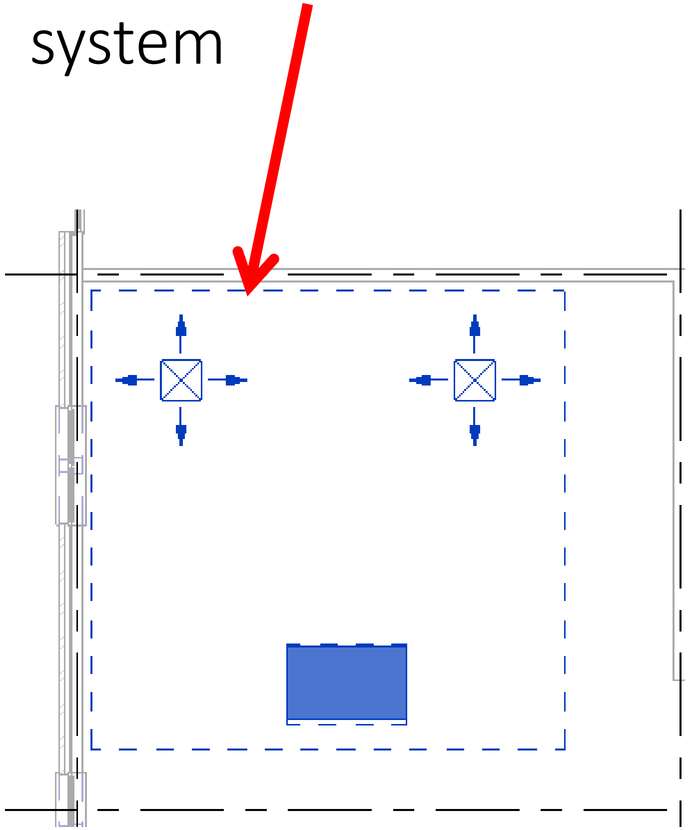
Creating a system

Select AHU and air terminals, next

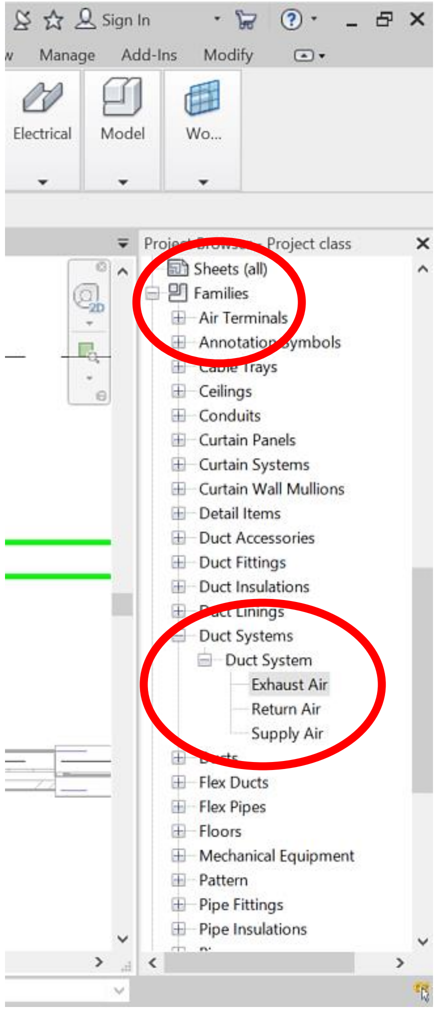


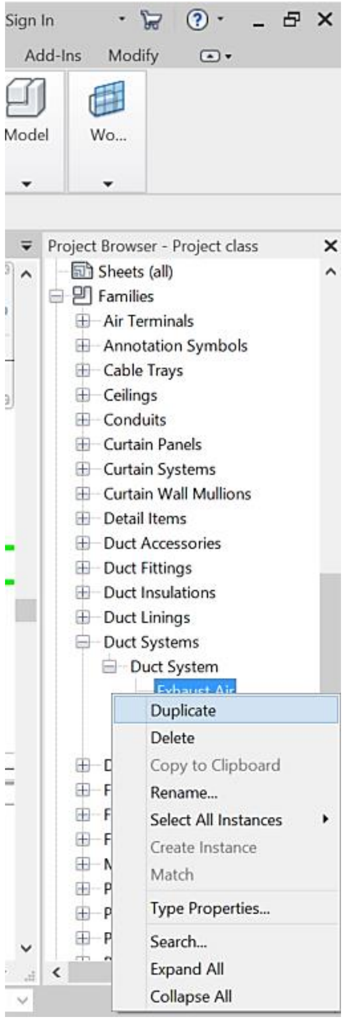
Creating a system





Editting a system



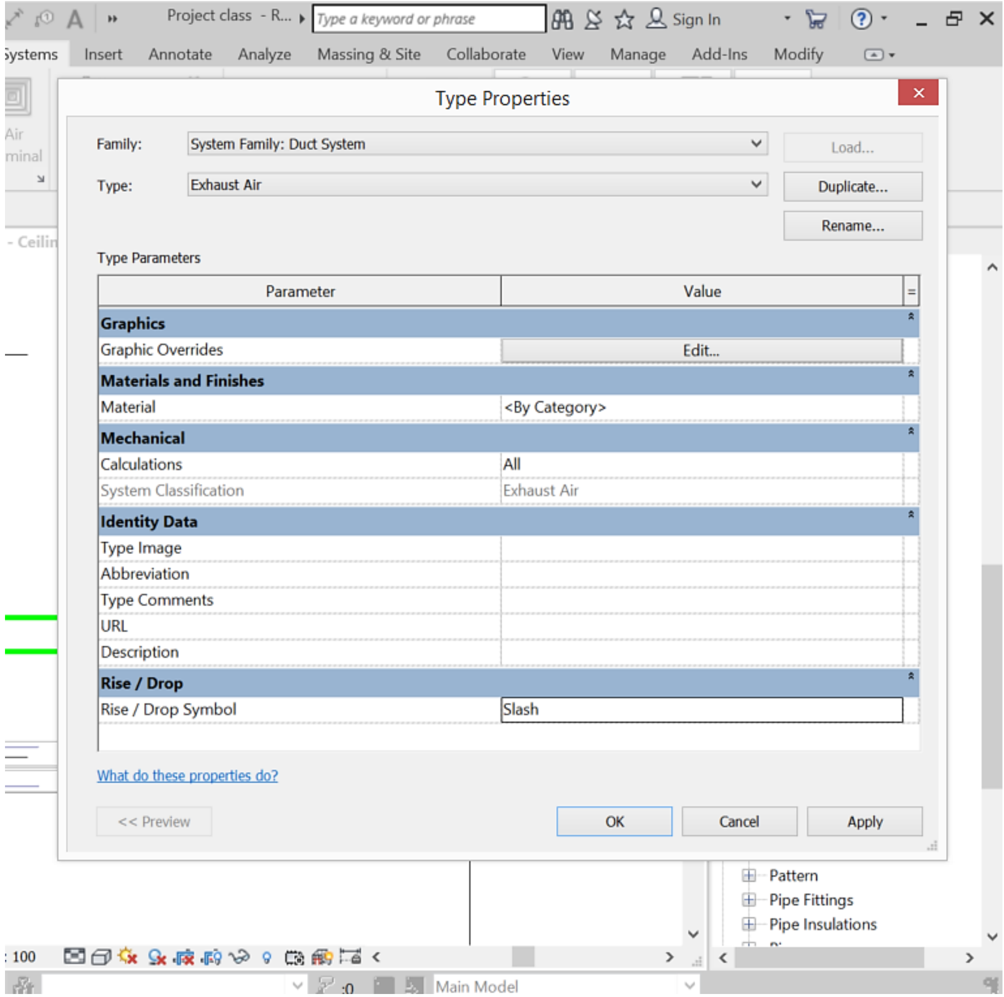


Right click

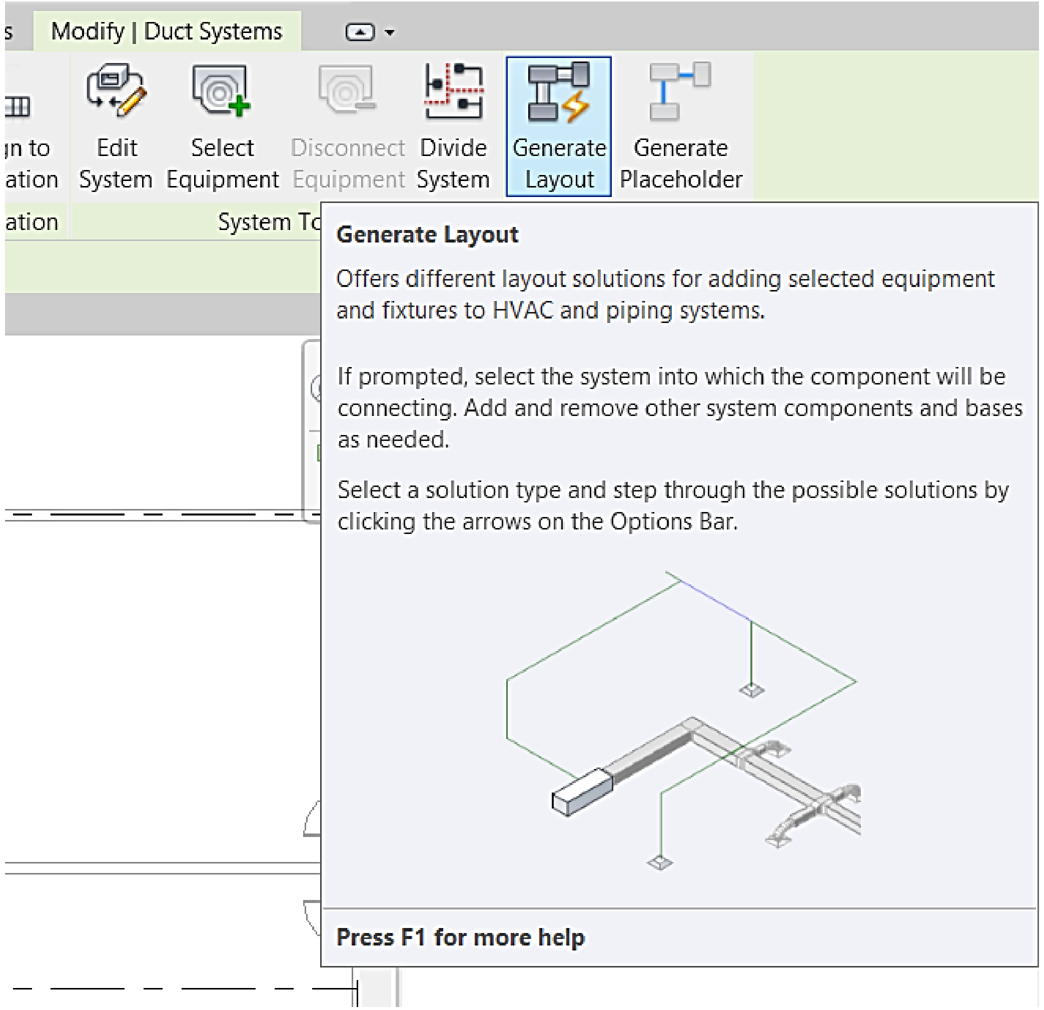
and select

„type properties"

Editing a system

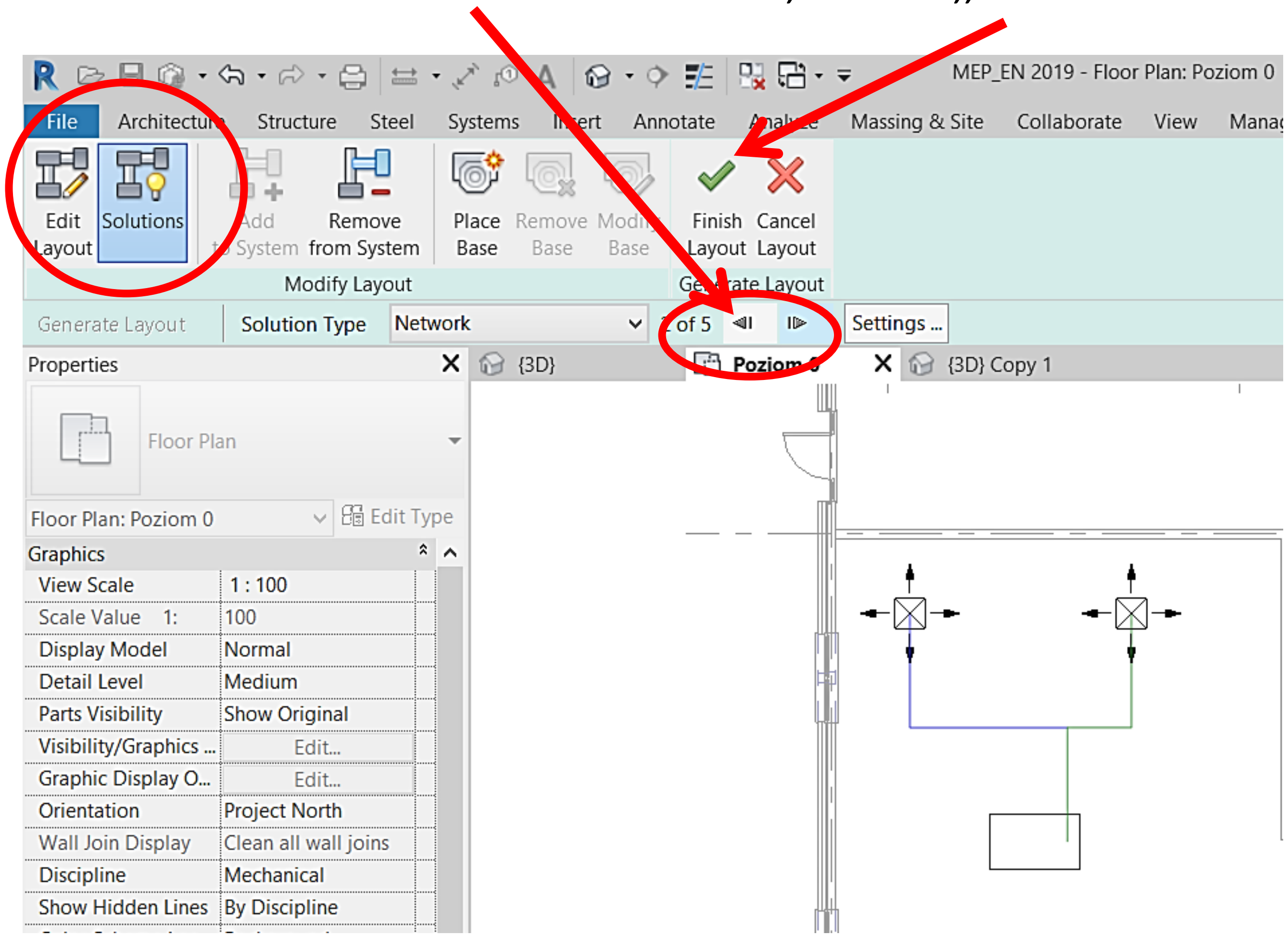


Creating a system

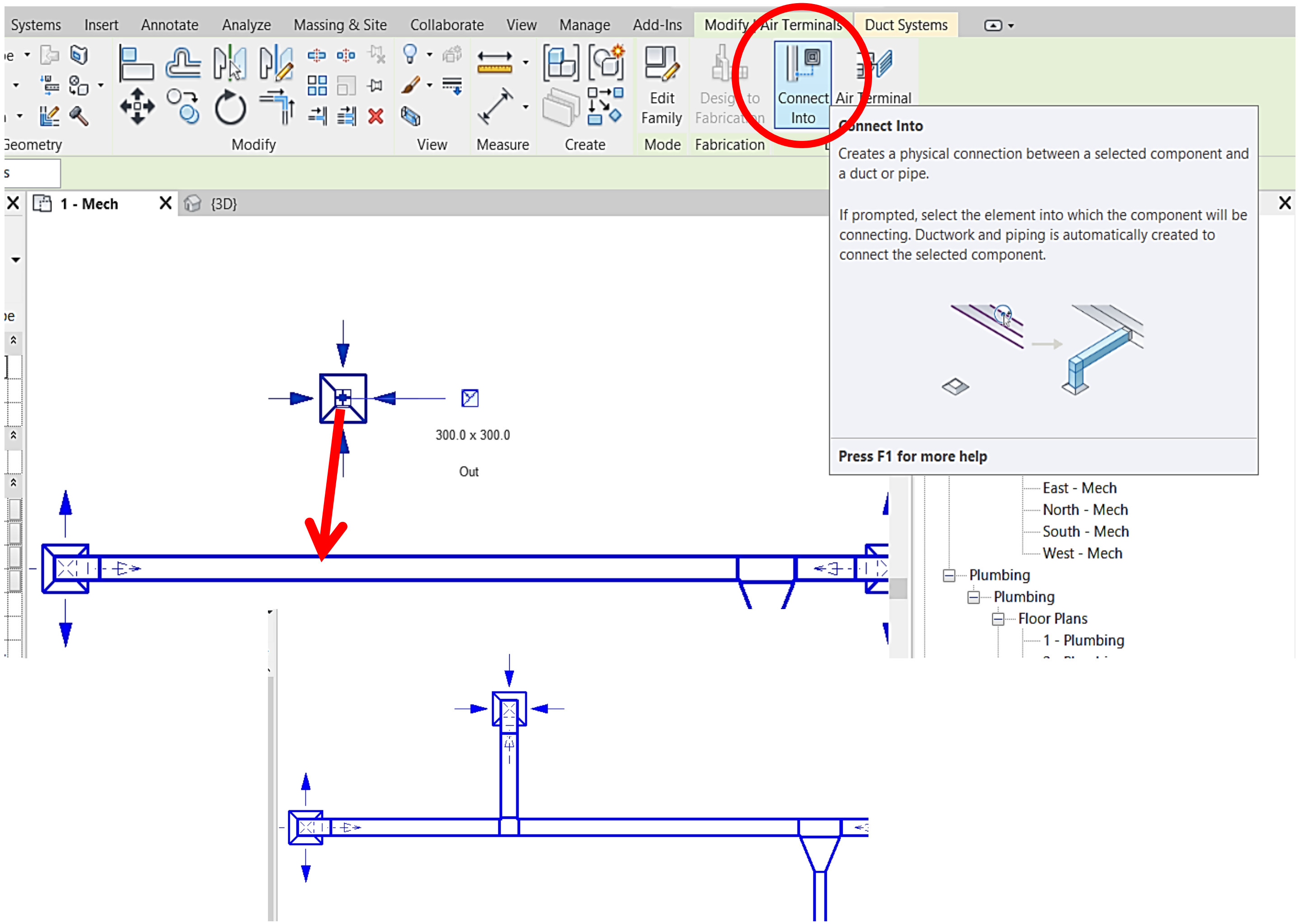


Creating a system

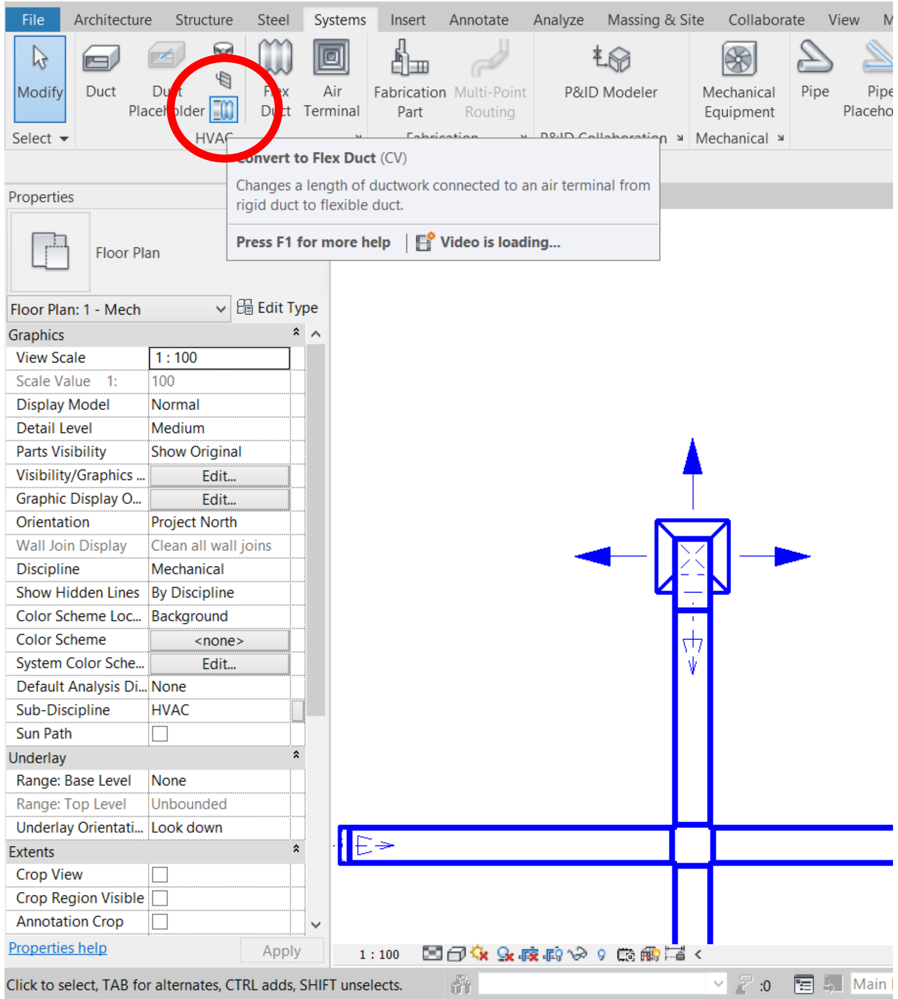
Arrows show solutions, next „finish”



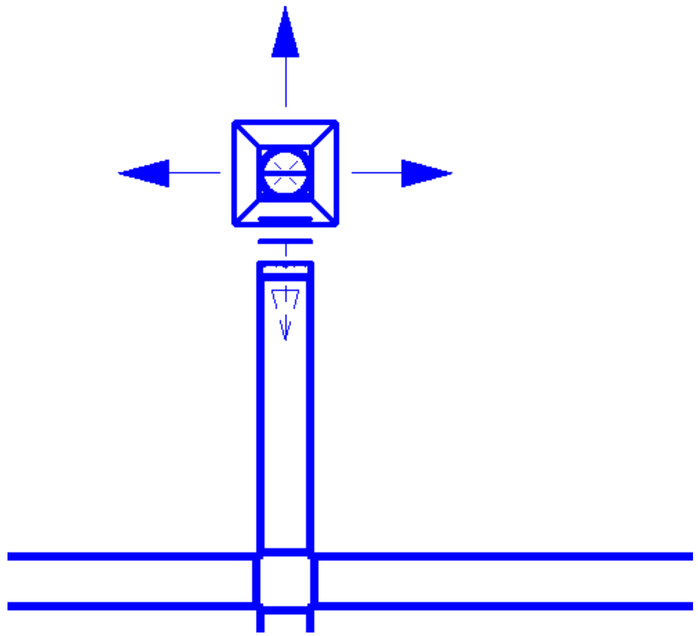
Adding to system

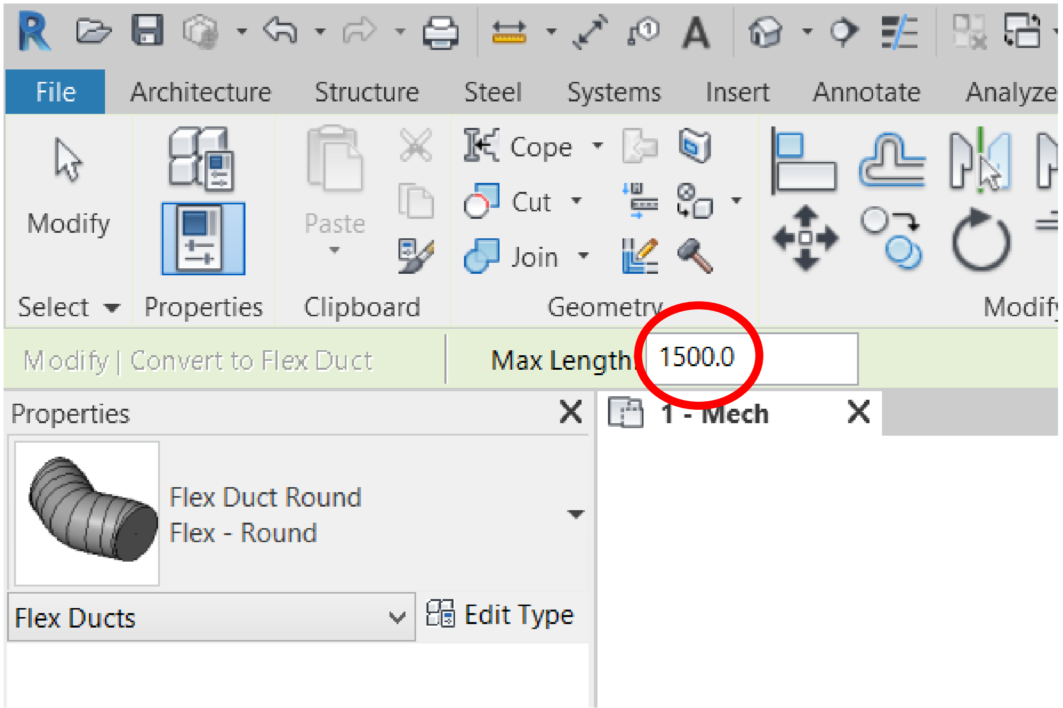


Flex


File
Architecture
Structure
Steel
Systems
Insert
Annotate
Analyze
Massing & Site
Collaborate
View
Modify
Duct
Air Terminal
Fabrication Part
Multi-Point Routing
P&ID Modeler
Mechanical Equipment
Pipe
Select
HVAC
Mechanical
Convert to Flex Duct (CV)
Changes a length of ductwork connected to an air terminal from rigid duct to flexible duct.
Press F1 for more help
Video is loading...
Properties
Floor Plan
Floor Plan: 1 - Mech
Edit Type
Graphics
View Scale 1 : 100
Scale Value 1: 100
Display Model Normal
Detail Level Medium
Parts Visibility Show Original
Visibility/Graphics ... Edit...
Graphic Display O... Edit...
Orientation Project North
Wall Join Display Clean all wall joins
Discipline Mechanical
Show Hidden Lines By Discipline
Color Scheme Loc... Background
Color Scheme <none>
System Color Sche... Edit...
Default Analysis Di... None
Sub-Discipline HVAC
Sun Path
Underlay
Range: Base Level None
Range: Top Level Unbounded
Underlay Orientati... Look down
Extents
Crop View
Crop Region Visible
Annotation Crop
Properties help
Apply
1 : 100
Click to select, TAB for alternates, CTRL adds, SHIFT unselects.

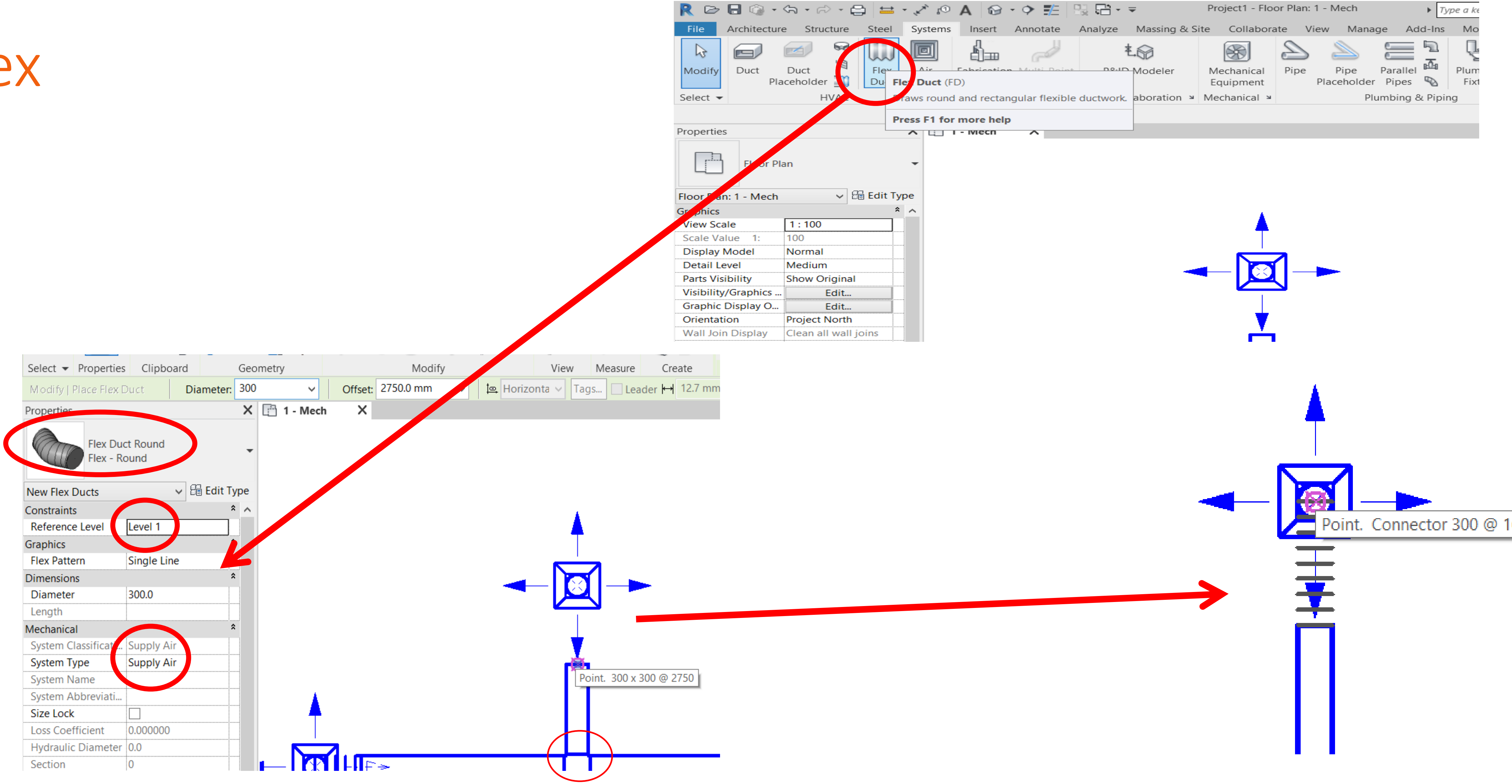
Flex





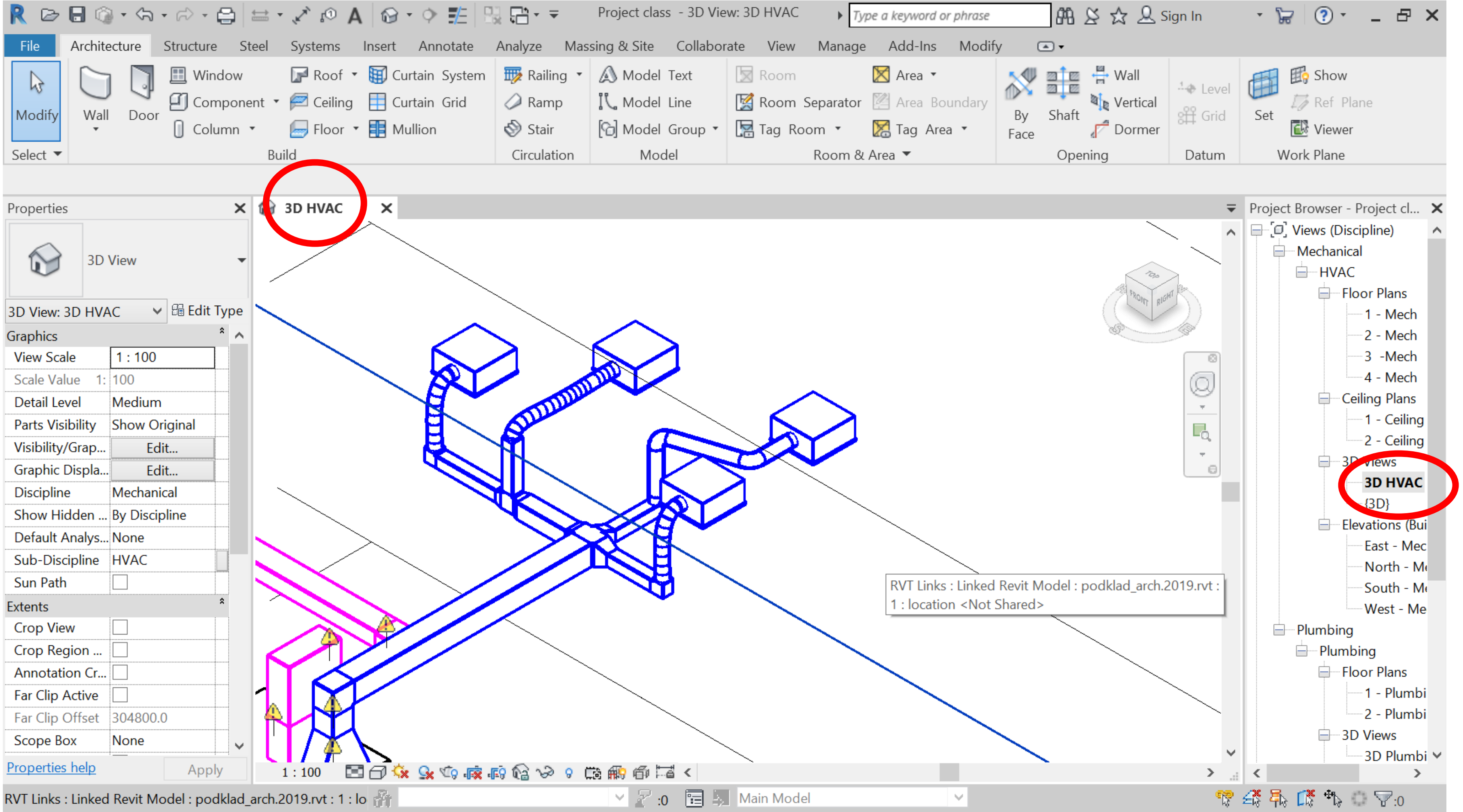
File
Architecture
Structure
Steel
Systems
Insert
Annotate
Analyze
Modify
Paste
Cope
Cut
Join
Select
Properties
Clipboard
Geometry
Modify | Convert to Flex Duct
Max Length
1500.0
Properties
1 - Mech
Flex Duct Round
Flex - Round
Flex Ducts
Edit Type

Flex



Project1 - Floor Plan: 1 - Mech
File
Architecture
Structure
Steel
Systems
Insert
Annotate
Analyze
Massing & Site
Collaborate
View
Manage
Add-Ins
Modify
Duct
Duct Placeholder
Mechanical Equipment
Pipe
Pipe Placeholder
Parallel Pipes
Select
Mechanical
Plumbing & Piping
Duct (FD)
Press F1 for more help
Properties
Floor Plan
Edit Type
View Scale
1 : 100
Scale Value 1:
100
Display Model
Normal
Detail Level
Medium
Parts Visibility
Show Original
Visibility/Graphics ...
Edit...
Graphic Display O...
Edit...
Orientation
Project North
Wall Join Display
Clean all wall joins
Select
Properties
Clipboard
Geometry
Modify
View
Measure
Create
Modify | Place Flex Duct
Diameter:
300
Offset:
2750.0 mm
Tags...
Leader
12.7 mm
Properties
1 - Mech
Flex Duct Round
Flex - Round
New Flex Ducts
Edit Type
Constraints
Reference Level
Level 1
Graphics
Flex Pattern
Single Line
Dimensions
Diameter
300.0
Length
Mechanical
Supply Air
System Type
Supply Air
System Name
System Abbreviati...
Size Lock
Loss Coefficient
0.000000
Hydraulic Diameter
0.0
Section
0
Point. 300 x 300 @ 2750
Point. Connector 300 @ 1

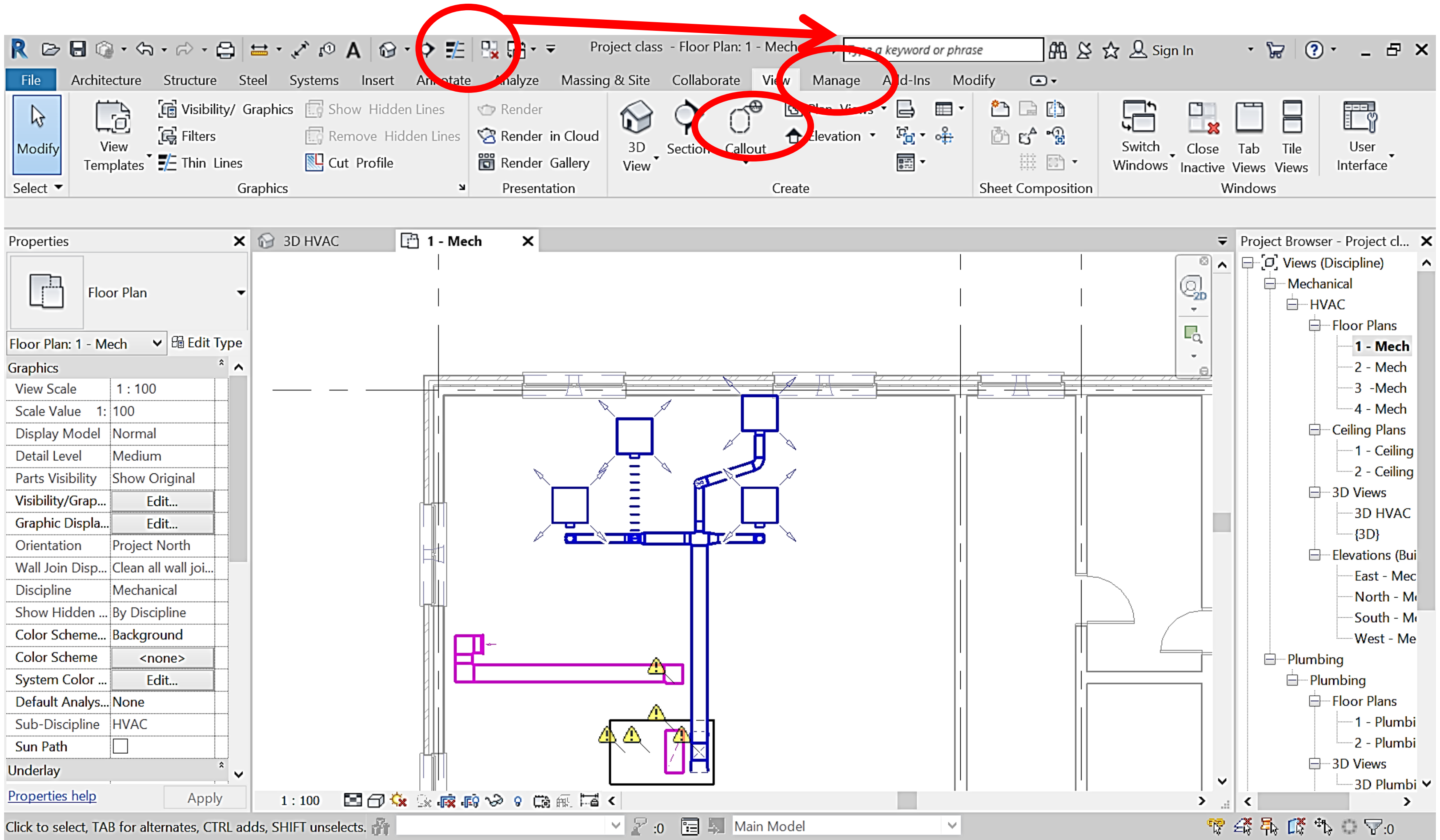
3D View



Project class - 3D View: 3D HVAC
Type a keyword or phrase
Sign In
File
Architecture
Structure
Steel
Systems
Insert
Annotate
Analyze
Massing & Site
Collaborate
View
Manage
Add-Ins
Modify
Modify
Wall
Door
Window
Component
Column
Roof
Ceiling
Floor
Curtain System
Curtain Grid
Mullion
Railing
Ramp
Stair
Model Text
Model Line
Model Group
Room
Room Separator
Tag Room
Area
Area Boundary
Tag Area
By Face
Shaft
Wall
Vertical
Dormer
Level
Grid
Set
Show
Ref Plane
Viewer
Select
Build
Circulation
Model
Room & Area
Opening
Datum
Work Plane
Properties
3D View
3D View: 3D HVAC
Edit Type
Graphics
View Scale
1 : 100
Scale Value 1:
100
Detail Level
Medium
Parts Visibility
Show Original
Visibility/Grap...
Edit...
Graphic Displa...
Edit...
Discipline
Mechanical
Show Hidden ...
By Discipline
Default Analys...
None
Sub-Discipline
HVAC
Sun Path
Extents
Crop View
Crop Region ...
Annotation Cr...
Far Clip Active
Far Clip Offset
304800.0
Scope Box
None
Properties help
Apply
3D HVAC
RVT Links : Linked Revit Model : podklad_arch.2019.rvt :
1 : location <Not Shared>
1 : 100
Project Browser - Project cl...
Views (Discipline)
Mechanical
HVAC
Floor Plans
1 - Mech
2 - Mech
3 -Mech
4 - Mech
Ceiling Plans
1 - Ceiling
2 - Ceiling
3D Views
3D HVAC
{3D}
Elevations (Bui
East - Mec
North - M
South - M
West - Me
Plumbing
Plumbing
Floor Plans
1 - Plumbi
2 - Plumbi
3D Views
3D Plumbi
RVT Links : Linked Revit Model : podklad_arch.2019.rvt : 1 : lo
:0
Main Model
:0

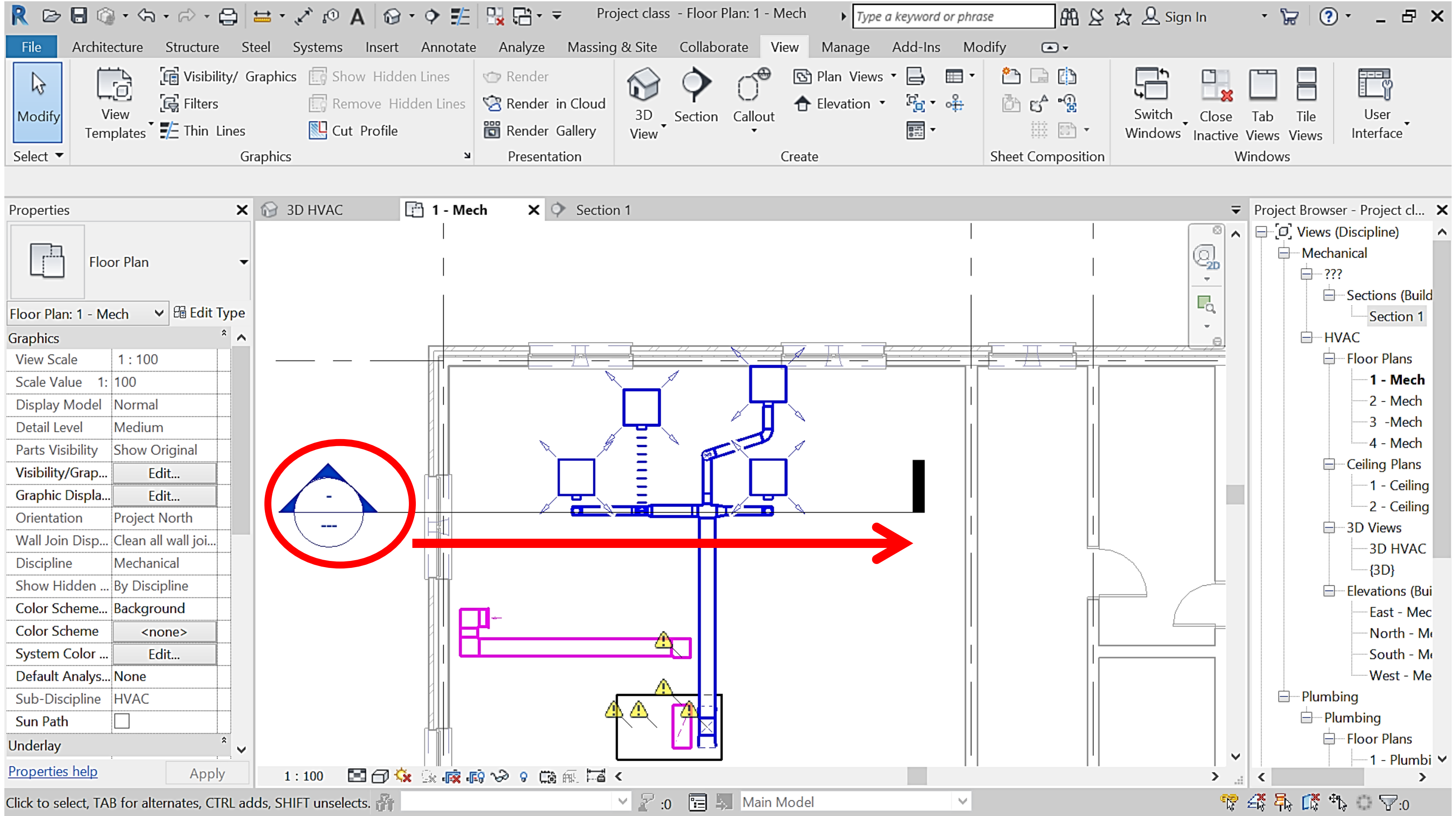
Section

or



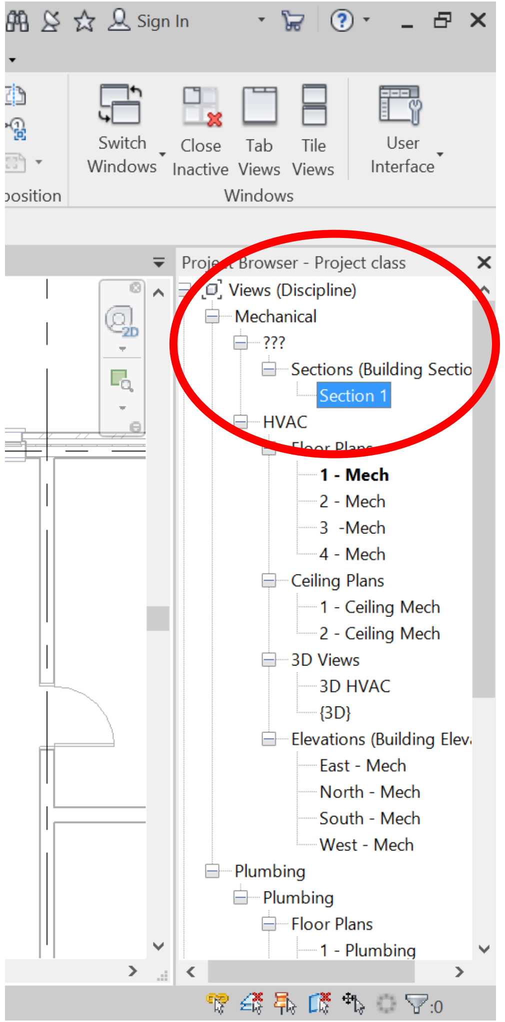
Project class - Floor Plan: 1 - Mech
Sign In
File
Architecture
Structure
Steel
Systems
Insert
Collaborate
Manage
Modify
Massing & Site
Modify
Select
View Templates
Visibility/ Graphics
Filters
Thin Lines
Show Hidden Lines
Remove Hidden Lines
Cut Profile
Graphics
Render
Render in Cloud
Render Gallery
Presentation
3D View
Section
Callout
Elevation
Create
Sheet Composition
Switch Windows
Close Inactive
Tab Views
Tile Views
Windows
User Interface
Properties
Floor Plan
Floor Plan: 1 - Mech
Edit Type
Graphics
View Scale
1 : 100
Scale Value 1:
100
Display Model
Normal
Detail Level
Medium
Parts Visibility
Show Original
Edit...
Orientation
Project North
Discipline
Mechanical
Show Hidden ...
By Discipline
Color Scheme...
Background
Color Scheme
<none>
System Color ...
Default Analys...
None
Sub-Discipline
HVAC
Sun Path
Underlay
Properties help
Apply
3D HVAC
1 - Mech
Project Browser - Project cl...
Views (Discipline)
Mechanical
HVAC
Floor Plans
1 - Mech
2 - Mech
3 -Mech
4 - Mech
Ceiling Plans
1 - Ceiling
2 - Ceiling
3D Views
3D HVAC
{3D}
Plumbing
Floor Plans
3D Views
Click to select, TAB for alternates, CTRL adds, SHIFT unselects.
Main Model

Section



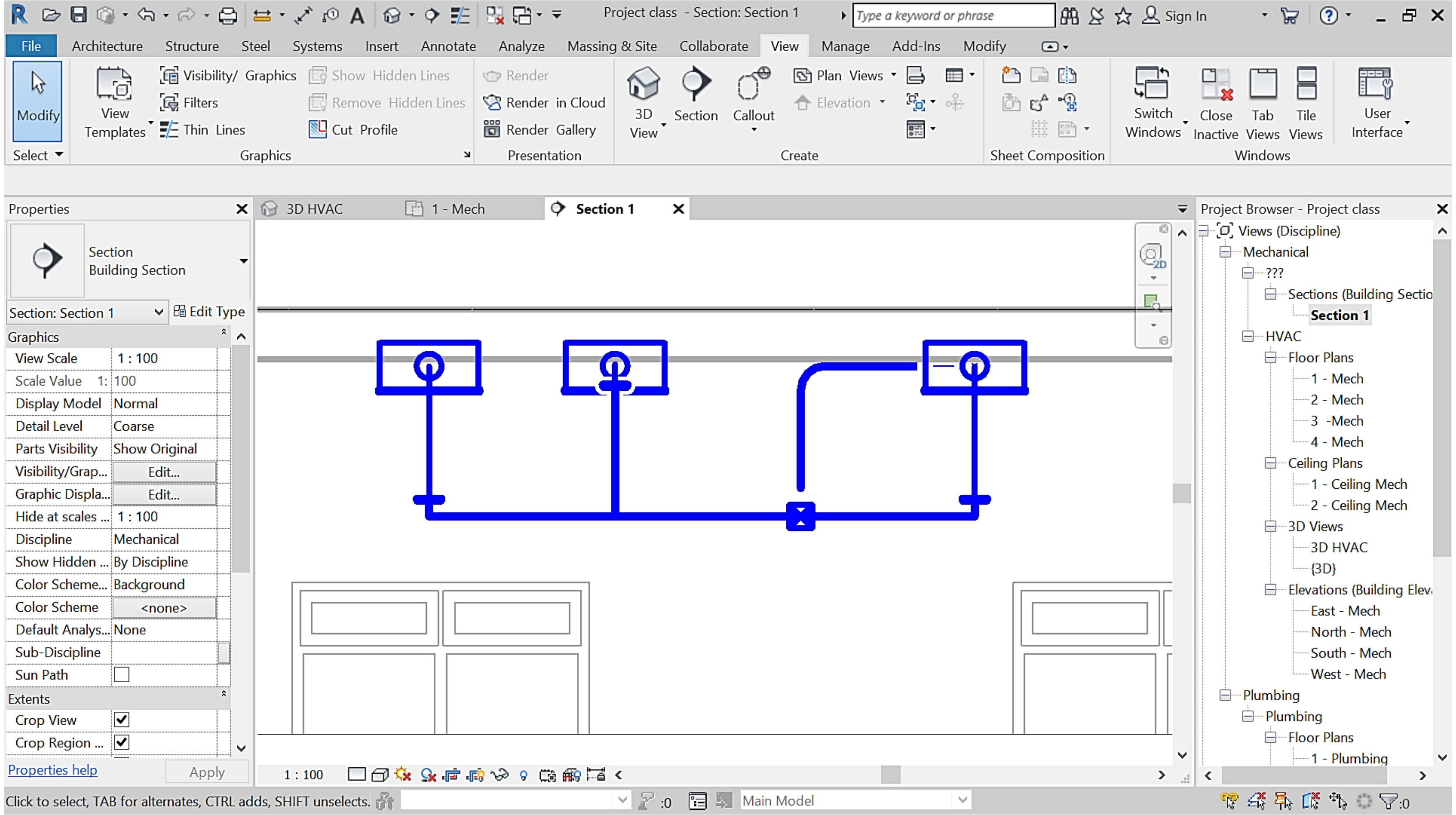
Project class - Floor Plan: 1 - Mech
File
Architecture
Structure
Steel
Systems
Insert
Annotate
Analyze
Massing & Site
Collaborate
View
Manage
Add-Ins
Modify
Visibility/ Graphics
Filters
Thin Lines
Show Hidden Lines
Remove Hidden Lines
Cut Profile
Render
Render in Cloud
Render Gallery
3D View
Section
Callout
Plan Views
Elevation
Switch Windows
Close Inactive
Tab Views
Tile Views
User Interface
Graphics
Presentation
Create
Sheet Composition
Windows
Properties
Floor Plan
Floor Plan: 1 - Mech
Edit Type
View Scale 1 : 100
Scale Value 1: 100
Display Model Normal
Detail Level Medium
Parts Visibility Show Original
Discipline Mechanical
Sub-Discipline HVAC
3D HVAC
1 - Mech
Section 1
Project Browser - Project cl...
Views (Discipline)
Mechanical
Sections (Build
Section 1
HVAC
Floor Plans
Ceiling Plans
3D Views
Plumbing
Click to select, TAB for alternates, CTRL adds, SHIFT unselects.
Main Model

Section

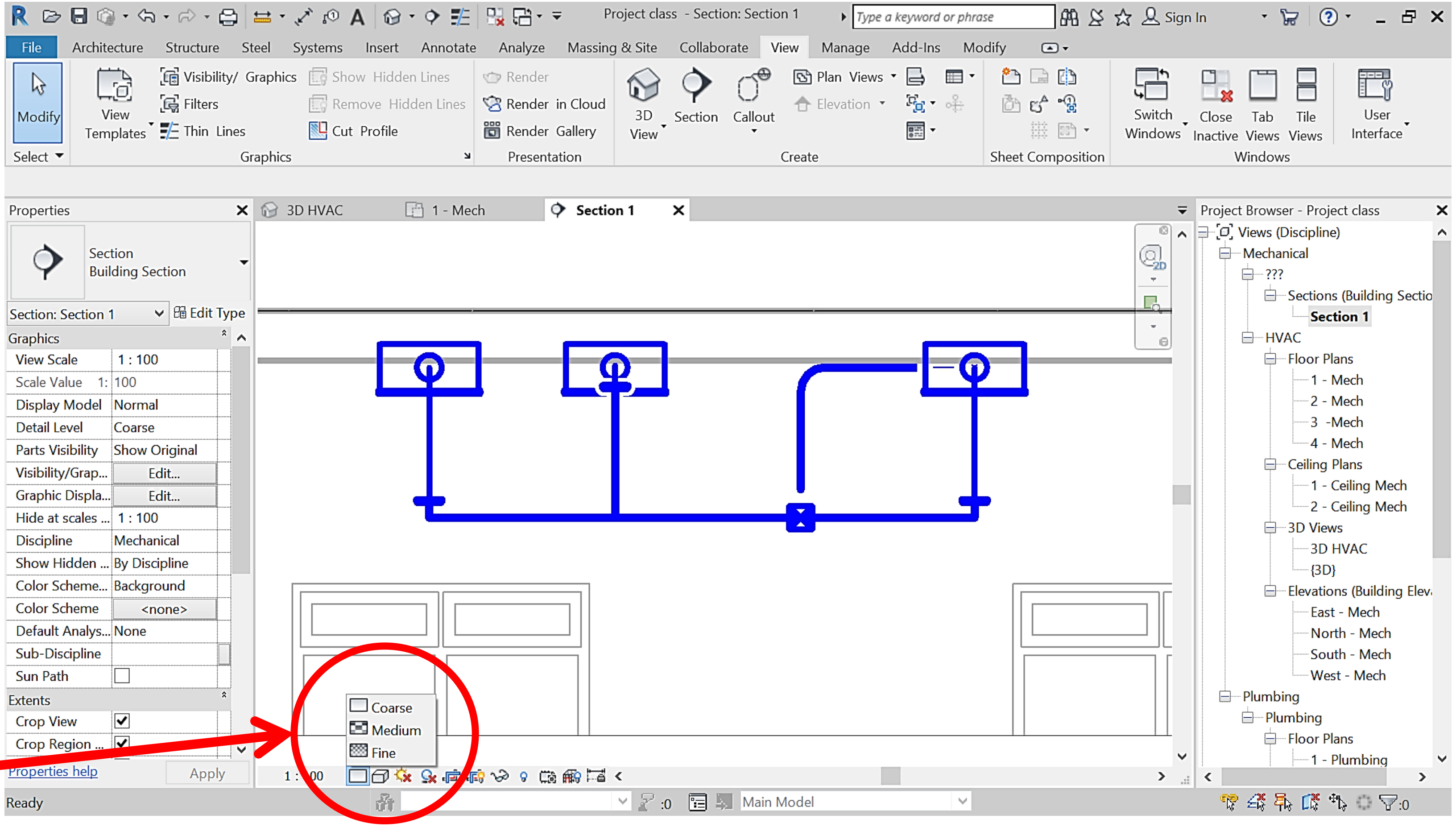


Sign In
Switch Windows
Close Inactive
Tab Views
Tile Views
User Interface
Windows
Project Browser - Project class
Views (Discipline)
Mechanical
???
Sections (Building Sectio
Section 1
HVAC
Floor Plans
1 - Mech
2 - Mech
3 -Mech
4 - Mech
Ceiling Plans
1 - Ceiling Mech
2 - Ceiling Mech
3D Views
3D HVAC
{3D}
Elevations (Building Elev
East - Mech
North - Mech
South - Mech
West - Mech
Plumbing
Plumbing
Floor Plans
1 - Plumbing

Section

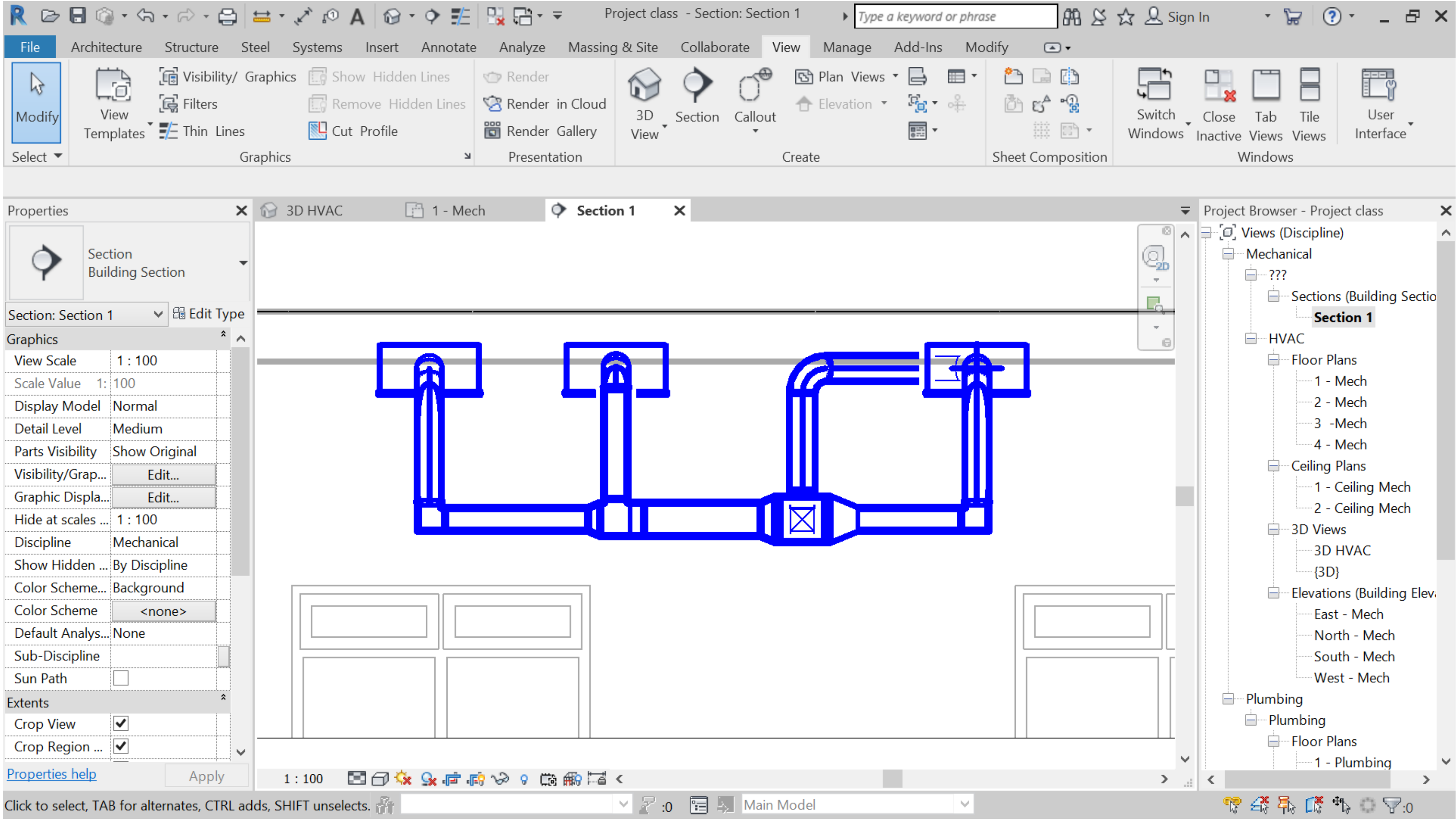


Section



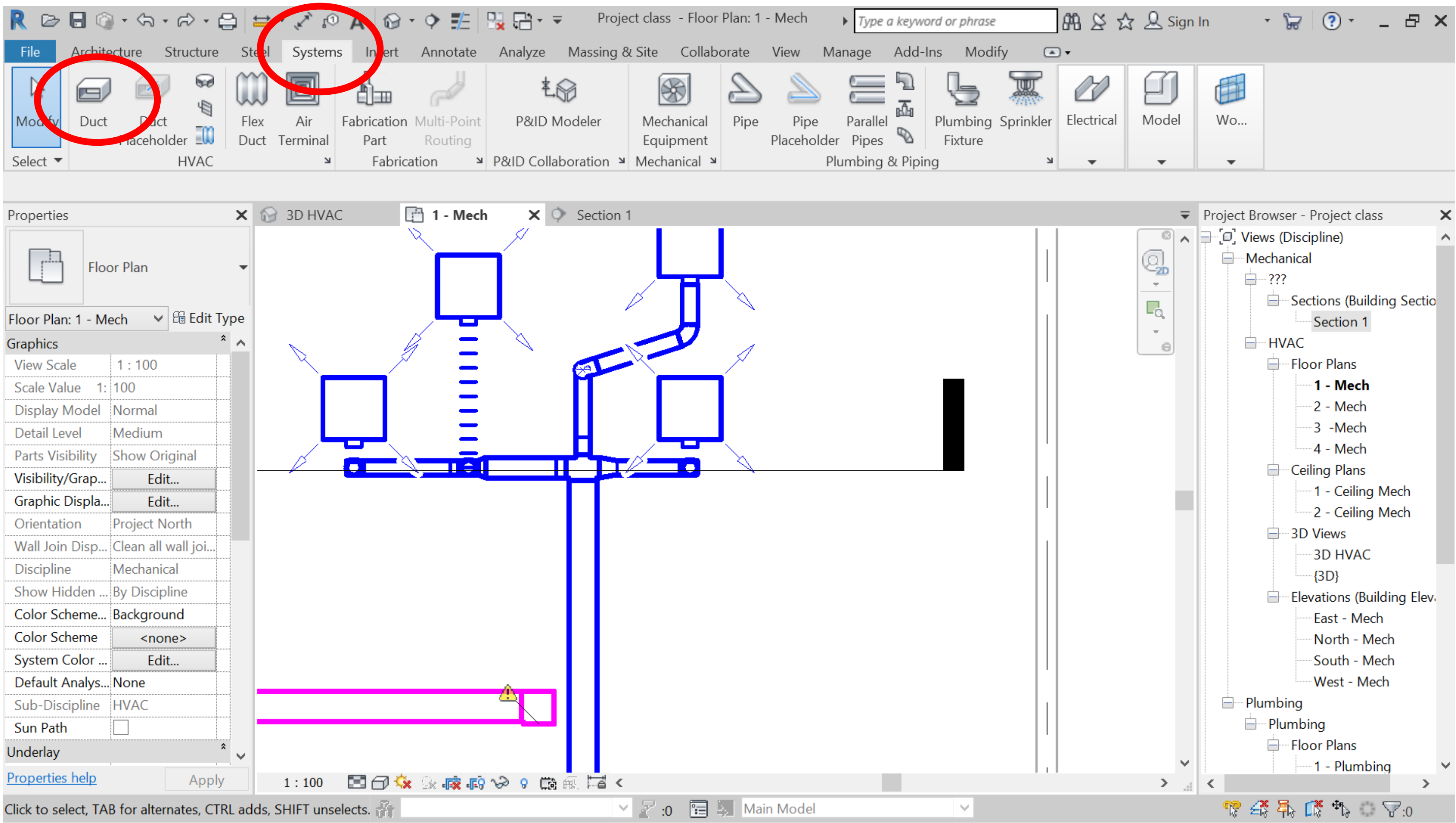
Detail level

Section



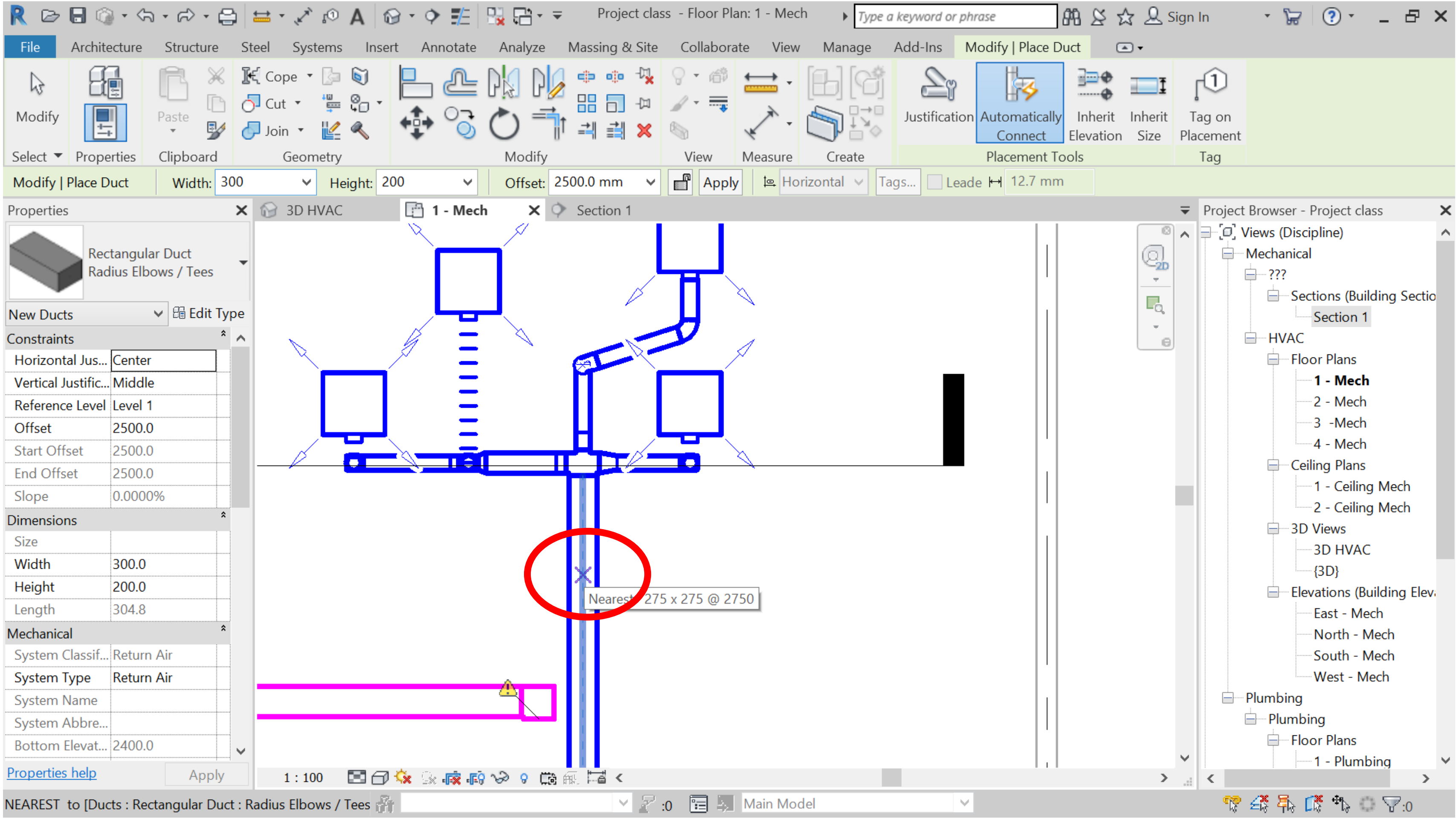
Detail level – medium

Drawing ducts



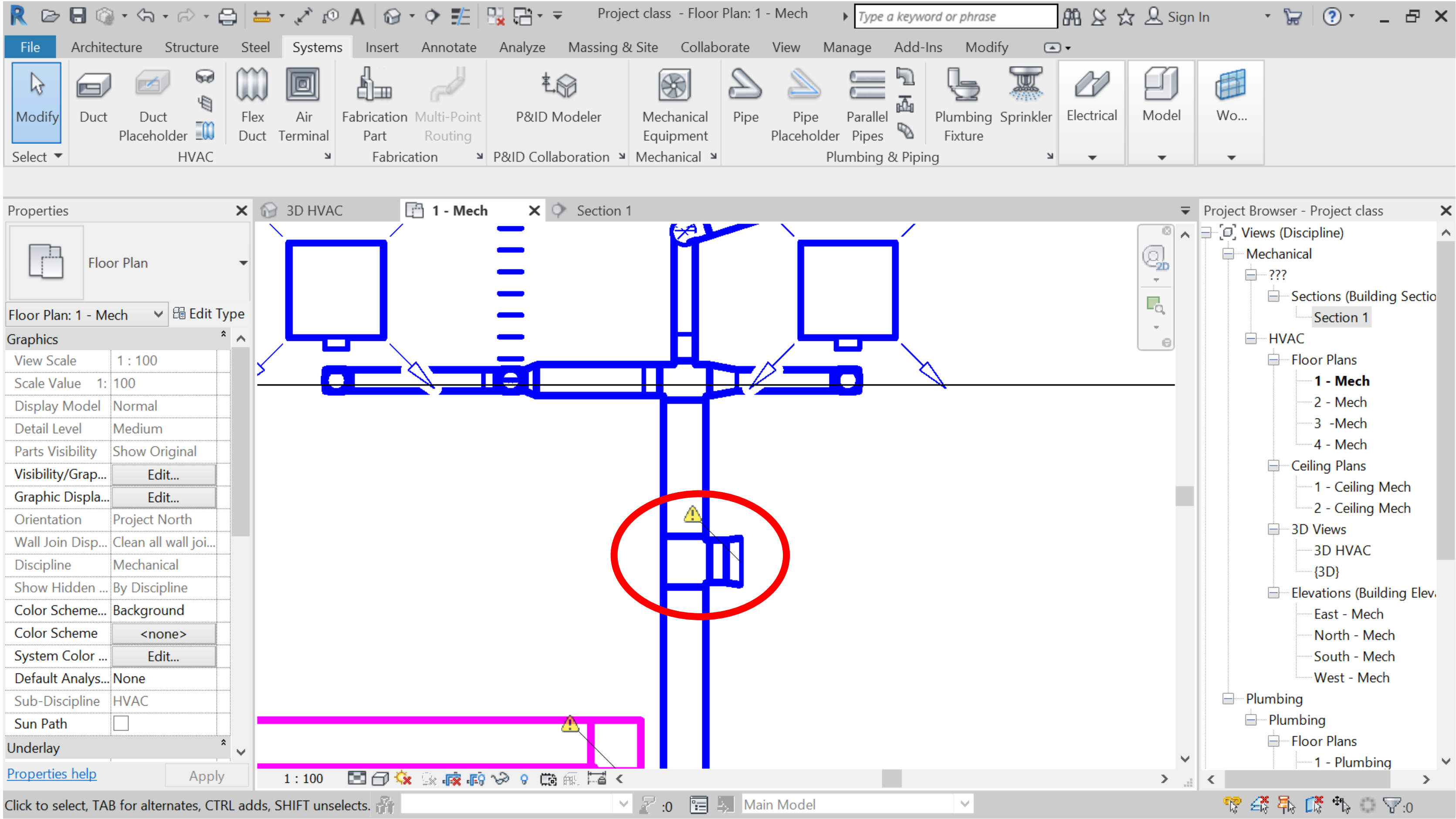
Drawing ducts

Start a new duct at some point of the run



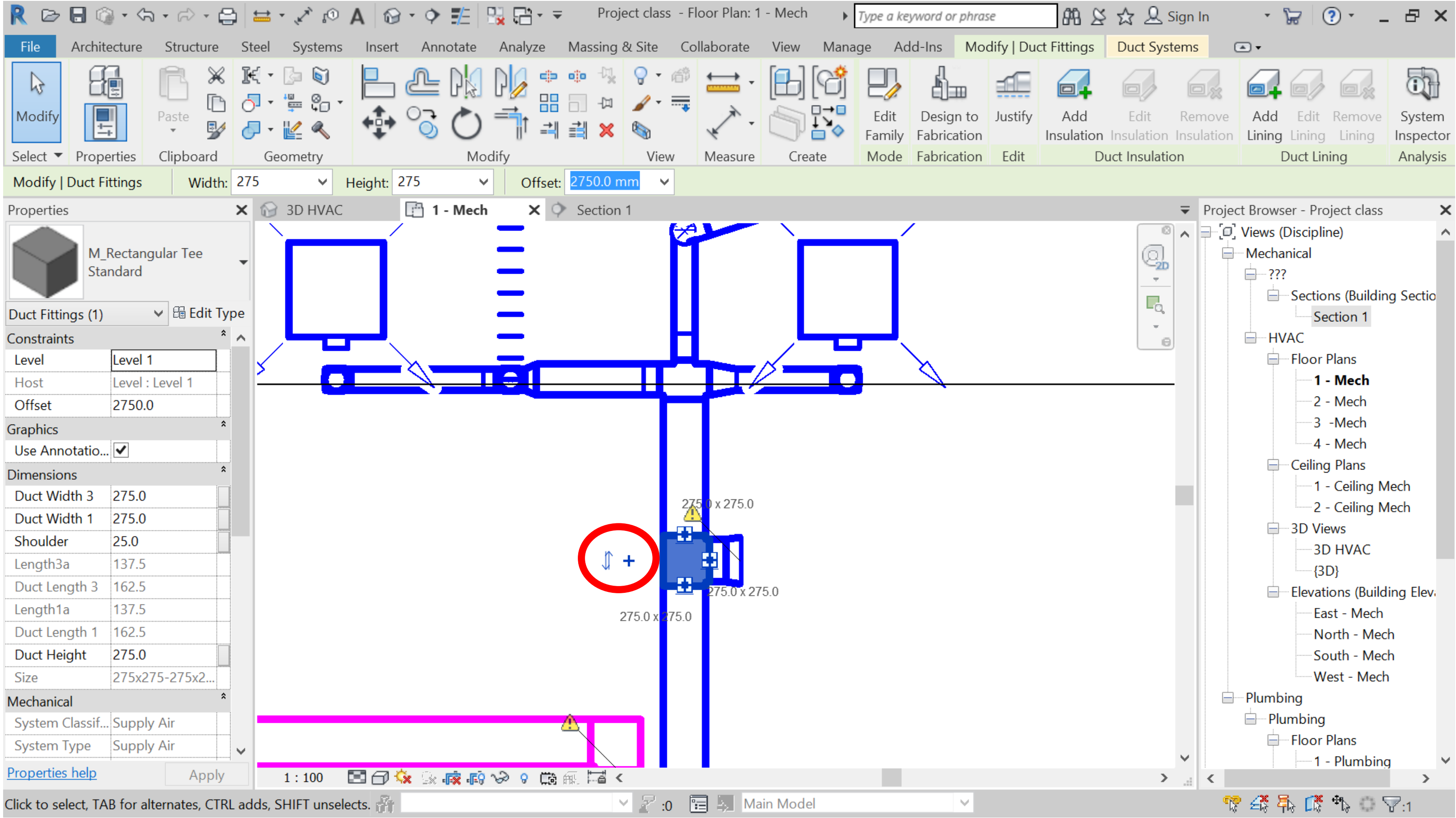
Drawing ducts

Revit will create an accessory

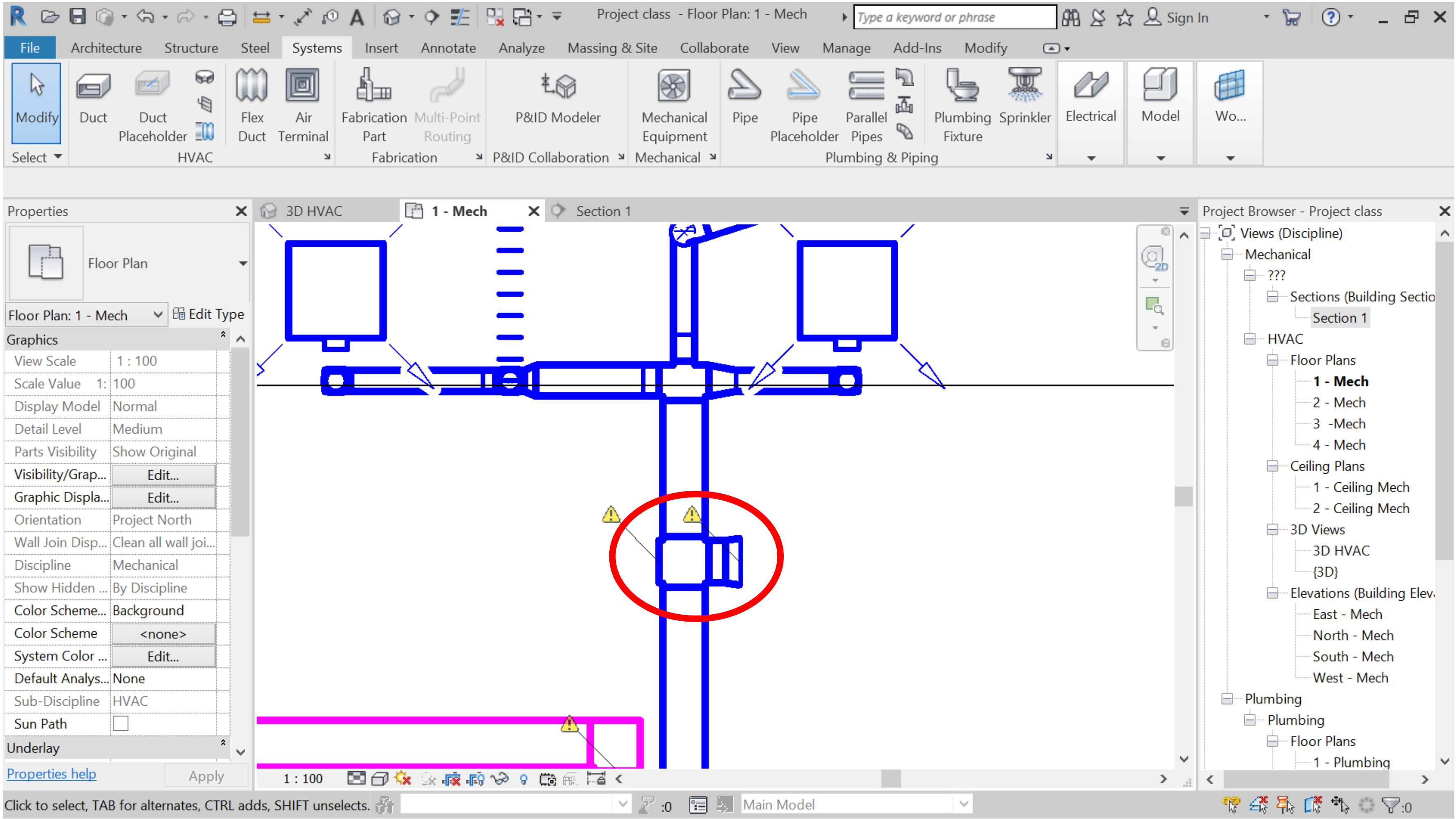


Drawing ducts

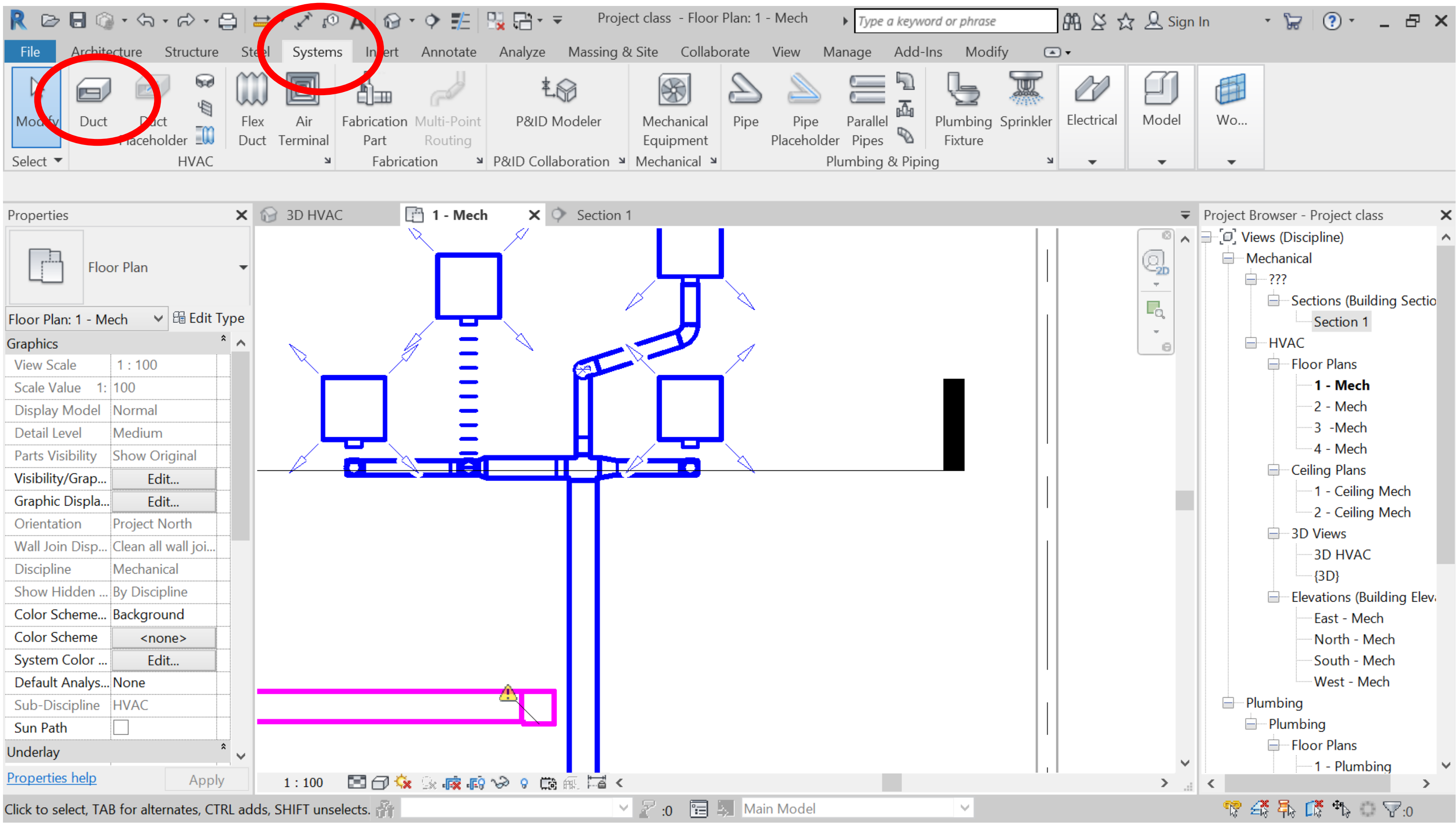
Changing orientation of accessories by using „+” or „-”



Drawing ducts

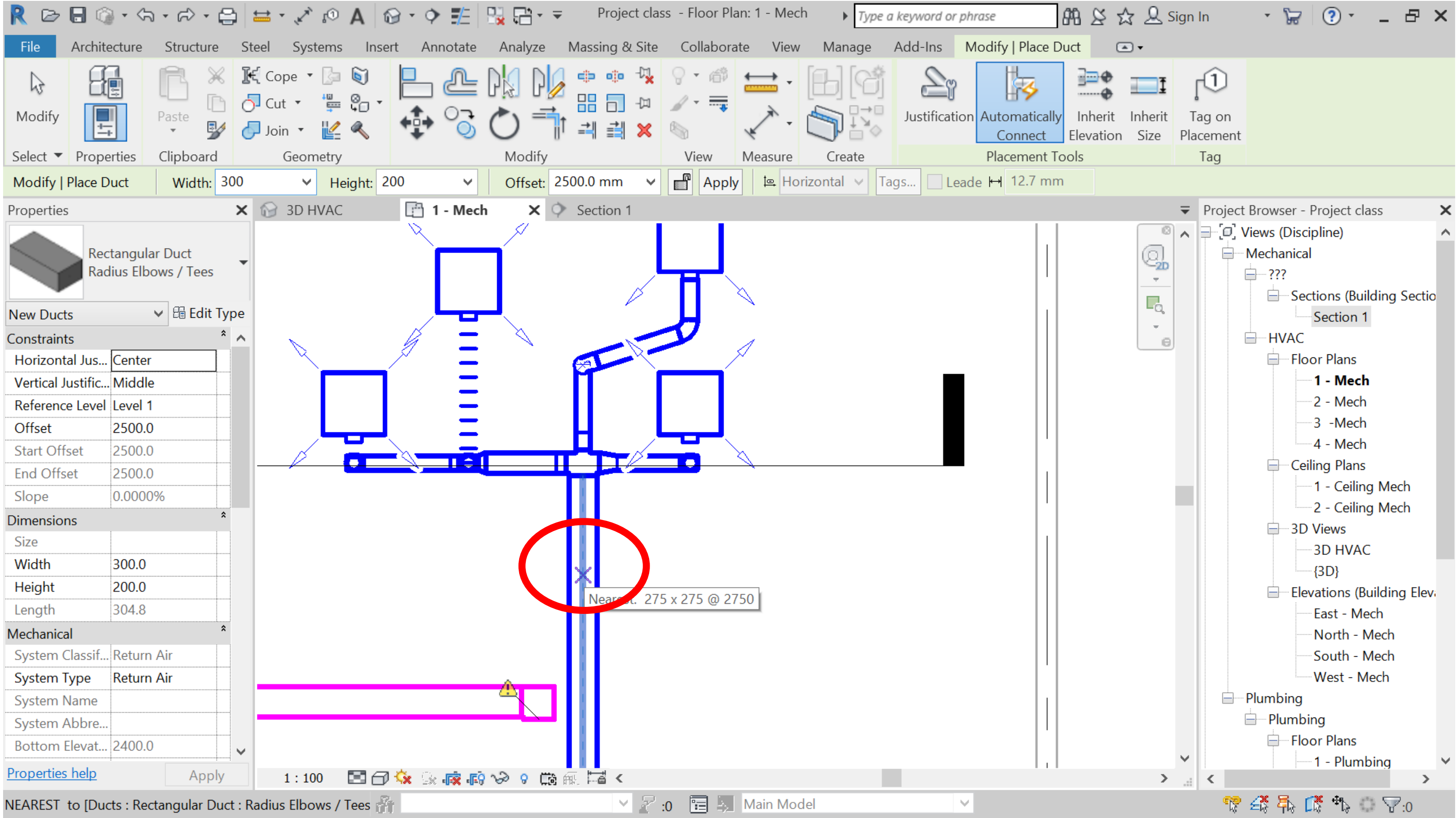


Drawing vertical ducts



Drawing vertical ducts

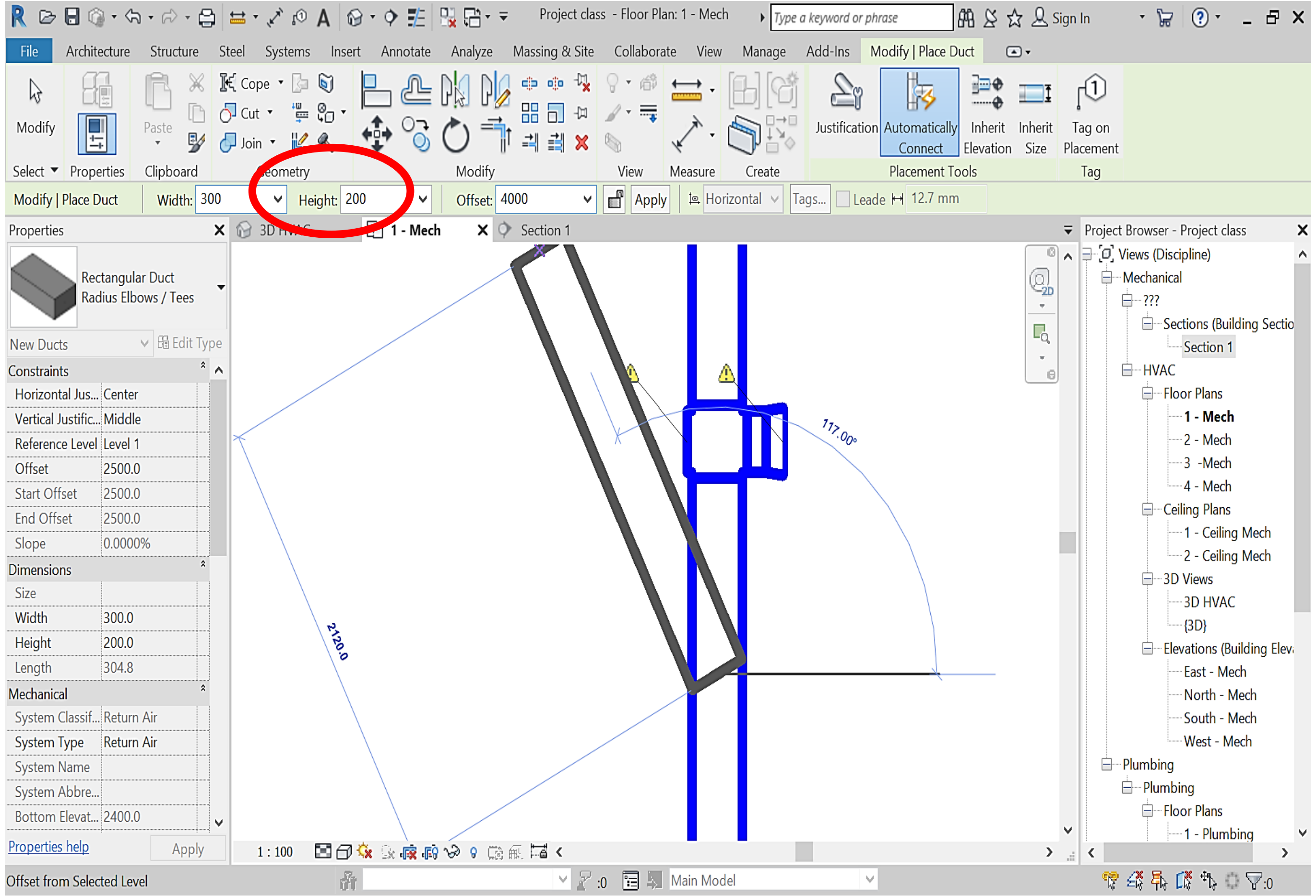
Click on a duct



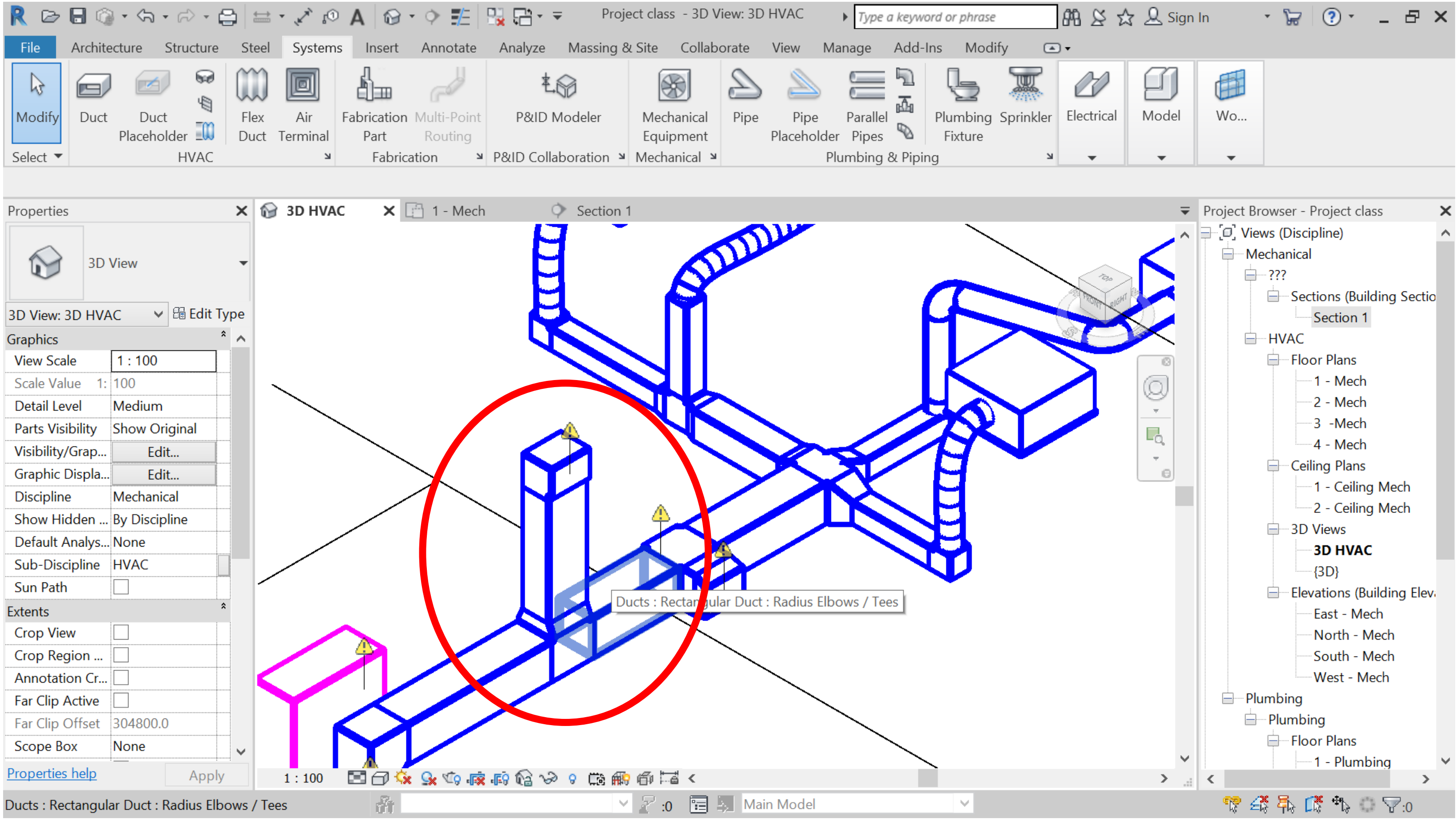
Drawing vertical ducts

Changing the offset

Move to „offset”, enter the height

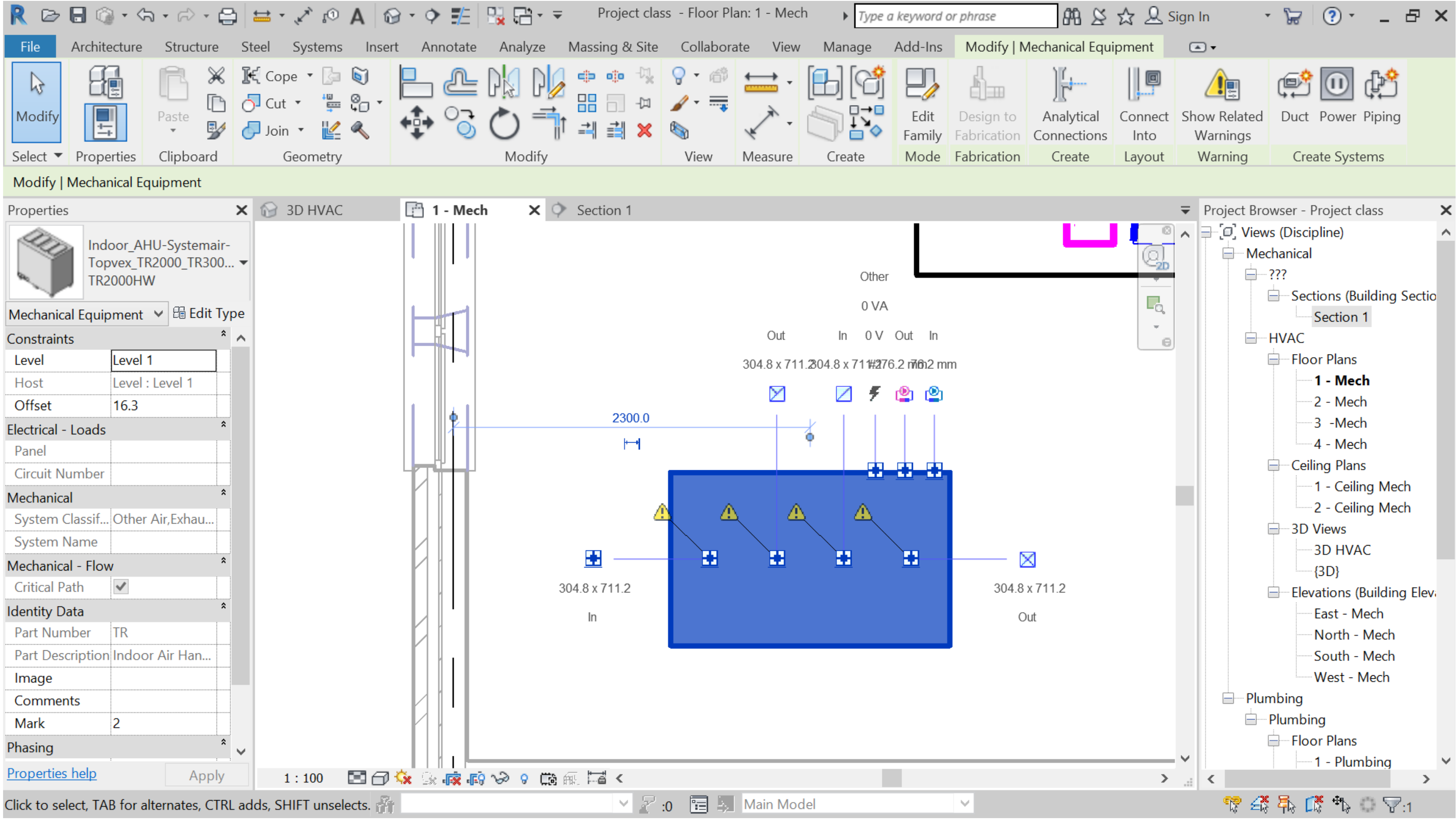


Drawing vertical ducts

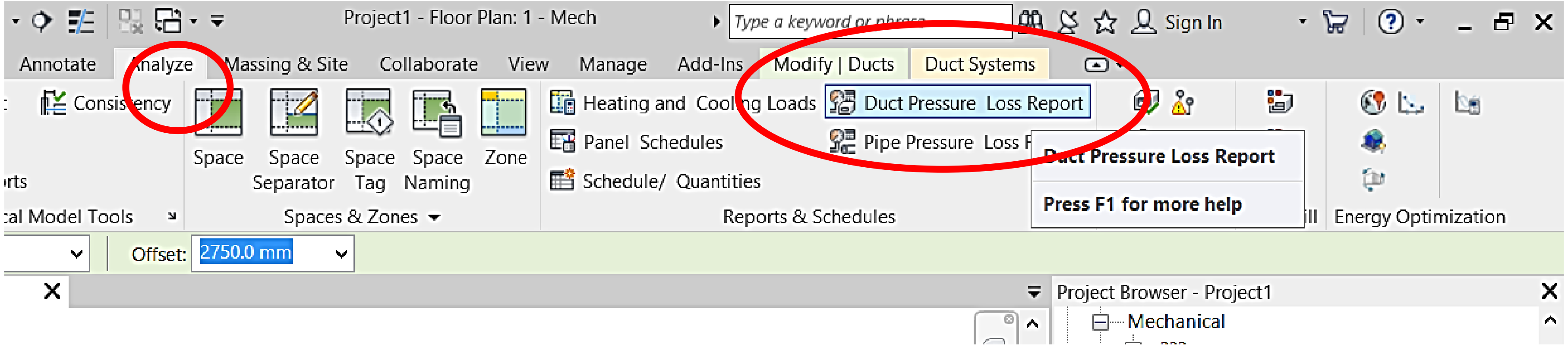


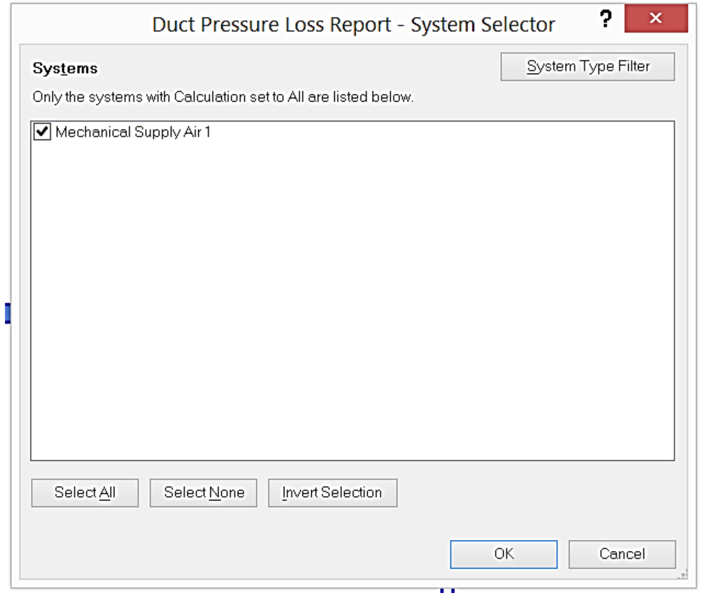
AHU

AHU – all the connectors are marked

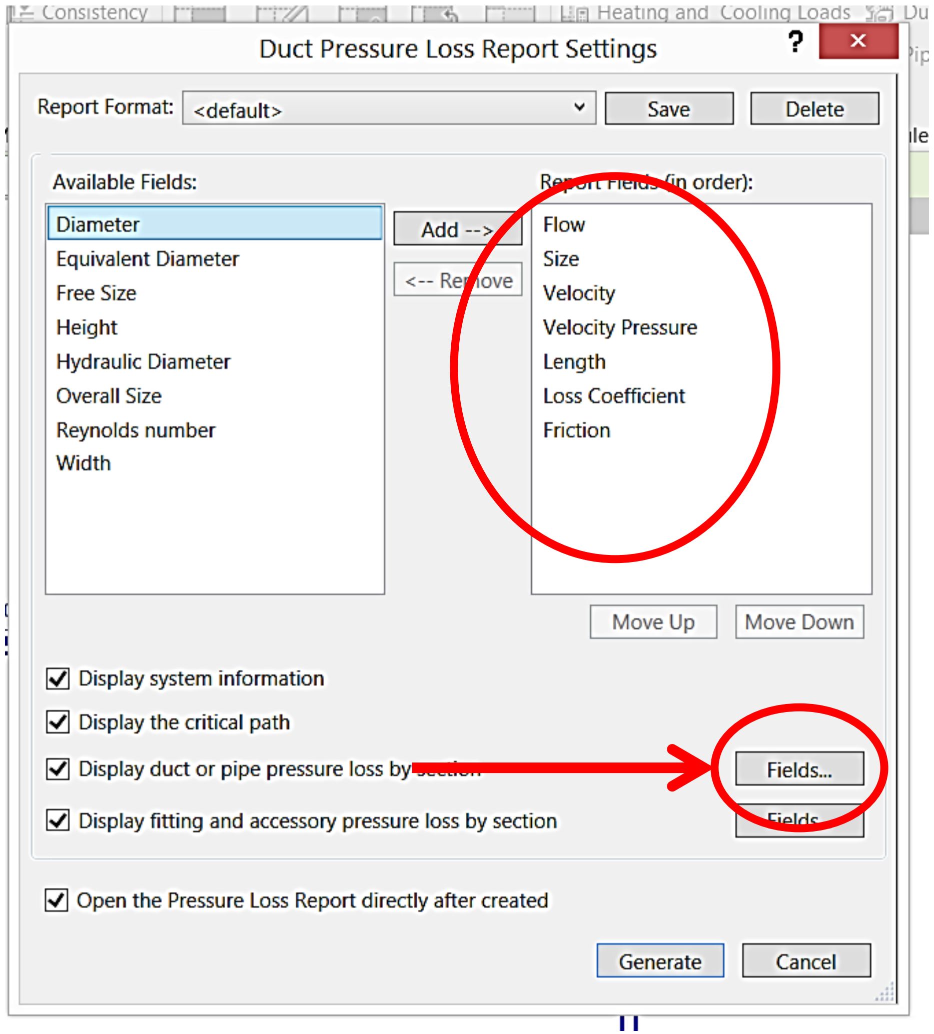


Pressure drop

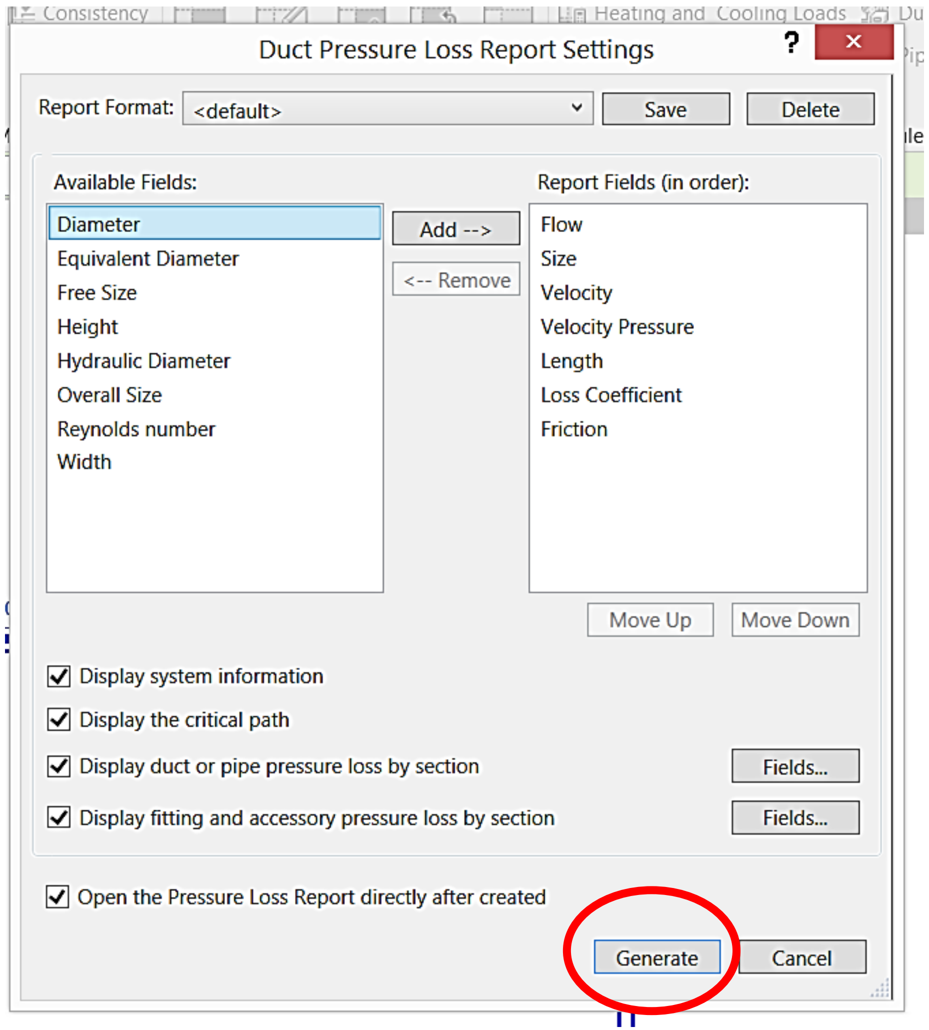




Pressure drop



Pressure drop



Pressure drop

Pressure Loss Report

file:///C:/Users/PK_jarek/Desktop/erer.html

1	Air Terminal	100.0 L/s	-	-	-	-	-	-	14.0 Pa	14.0 Pa
2	Duct	100.0 L/s	-	1.4 m/s	-	1309	-	0.10 Pa/m	0.1 Pa	0.1 Pa
	Fittings	100.0 L/s	-	1.4 m/s	1.2 Pa	-	0	-	0.0 Pa	
3	Duct	100.0 L/s	300x300	1.1 m/s	-	2707	-	0.07 Pa/m	0.2 Pa	-74233.6 Pa
	Fittings	100.0 L/s	-	1.1 m/s	0.7 Pa	-	-99999	-	-74233.8 Pa	
4	Duct	435.0 L/s	300x300	4.8 m/s	-	5226	-	0.92 Pa/m	4.8 Pa	4.8 Pa
	Fittings	435.0 L/s	-	4.8 m/s	14.0 Pa	-	0	-	0.0 Pa	
5	Fittings	435.0 L/s	-	0.0 m/s	13.6 Pa	-	0	-	0.0 Pa	0.0 Pa
6	Fittings	535.0 L/s	-	0.0 m/s	3.7 Pa	-	75	-	274.7 Pa	274.7 Pa
7	Duct	535.0 L/s	200x200	13.4 m/s	-	8739	-	10.07 Pa/m	88.0 Pa	477.4 Pa
	Fittings	535.0 L/s	-	13.4 m/s	107.6 Pa	-	3.62	-	389.4 Pa	
8	Duct	535.0 L/s	305x711	2.5 m/s	-	60	-	0.18 Pa/m	0.0 Pa	0.0 Pa
	Fittings	535.0 L/s	-	2.5 m/s	3.7 Pa	-	0	-	0.0 Pa	
	Equipment	535.0 L/s	-	-	-	-	-	-	0.0 Pa	
9	Duct	100.0 L/s	300x300	1.1 m/s	-	1480	-	0.07 Pa/m	0.1 Pa	15.0 Pa
	Fittings	100.0 L/s	-	1.1 m/s	0.7 Pa	-	1.15	-	0.9 Pa	
	Air Terminal	100.0 L/s	-	-	-	-	-	-	14.0 Pa	
10	Fittings	100.0 L/s	-	0.0 m/s	0.7 Pa	-	0	-	0.0 Pa	0.0 Pa
11	Fittings	235.0 L/s	-	0.0 m/s	4.1 Pa	-	0	-	0.0 Pa	14.0 Pa
	Air Terminal	235.0 L/s	-	-	-	-	-	-	14.0 Pa	
12	Duct	235.0 L/s	-	3.3 m/s	-	1574	-	0.47 Pa/m	0.7 Pa	0.7 Pa
	Fittings	235.0 L/s	-	3.3 m/s	6.6 Pa	-	0	-	0.0 Pa	
13	Duct	235.0 L/s	300x300	2.6 m/s	-	1200	-	0.30 Pa/m	0.4 Pa	-409955.9 Pa
	Fittings	235.0 L/s	-	2.6 m/s	4.1 Pa	-	-99999	-	-409956.3 Pa	
14	Fittings	100.0 L/s	-	0.0 m/s	0.7 Pa	-	0	-	0.0 Pa	14.0 Pa
	Air Terminal	100.0 L/s	-	-	-	-	-	-	14.0 Pa	
[illegible]	Duct	100.0 L/s	-	1.4 m/s	-	1797	-	0.10 Pa/m	0.2 Pa	0.2 Pa
	Fittings	100.0 L/s	-	1.4 m/s	1.2 Pa	-	0	-	0.0 Pa	
16	Duct	100.0 L/s	300x300	1.1 m/s	-	900	-	0.07 Pa/m	0.1 Pa	-74233.8 Pa
	Fittings	100.0 L/s	-	1.1 m/s	0.7 Pa	-	-99999	-	-74233.8 Pa	

Critical Path : 8-7-6-10-9 ; Total Pressure Loss : 767.0 Pa

Detail Information of Straight Segment by Sections

Section	Element ID	Flow	Size	Velocity	Velocity Pressure	Length	Pressure Loss	Total Pressure Loss
2	922335	100.0 L/s	300	1.4 m/s	1.2 Pa	1309	0.1 Pa	0.1 Pa
3	920244	100.0 L/s	300x300	1.1 m/s	0.7 Pa	2707	0.2 Pa	0.2 Pa
4	920228	435.0 L/s	300x300	4.8 m/s	14.0 Pa	5226	4.8 Pa	4.8 Pa
7	919595	535.0 L/s	200x200	13.4 m/s	107.6 Pa	5555	55.9 Pa	88.0 Pa
	919636	535.0 L/s	200x200	13.4 m/s	107.6 Pa	3184	32.1 Pa	
8	919653	535.0 L/s	305x711	2.5 m/s	3.7 Pa	60	0.0 Pa	0.0 Pa
9	919583	100.0 L/s	300x300	1.1 m/s	0.7 Pa	781	0.1 Pa	0.1 Pa
	919588	100.0 L/s	300x300	1.1 m/s	0.7 Pa	698	0.0 Pa	
12	922416	235.0 L/s	300	3.3 m/s	6.6 Pa	1574	0.7 Pa	0.7 Pa
13	922361	235.0 L/s	300x300	2.6 m/s	4.1 Pa	1200	0.4 Pa	0.4 Pa
15	922328	100.0 L/s	300	1.4 m/s	1.2 Pa	1797	0.2 Pa	0.2 Pa
16	922286	100.0 L/s	300x300	1.1 m/s	0.7 Pa	900	0.1 Pa	0.1 Pa

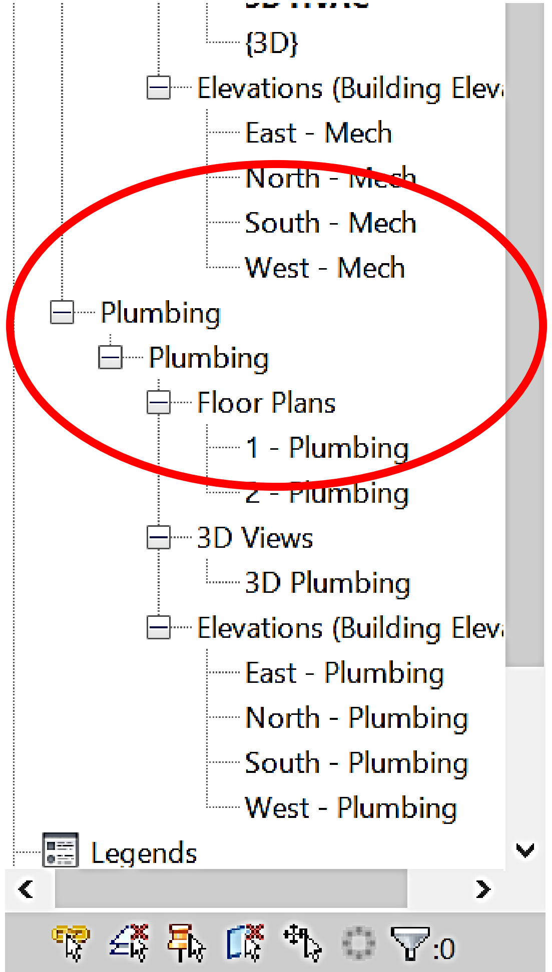
Fitting and Accessory Loss Coefficient Summary by Sections

Section	Element ID	Loss Method	ASHRAE Table	Loss Coefficient	Pressure Loss	Total Pressure Loss
1	922337	Coefficient from ASHRAE Table	-	0	0.0 Pa	0.0 Pa
	922337	Coefficient from ASHRAE Table	-	0	0.0 Pa	

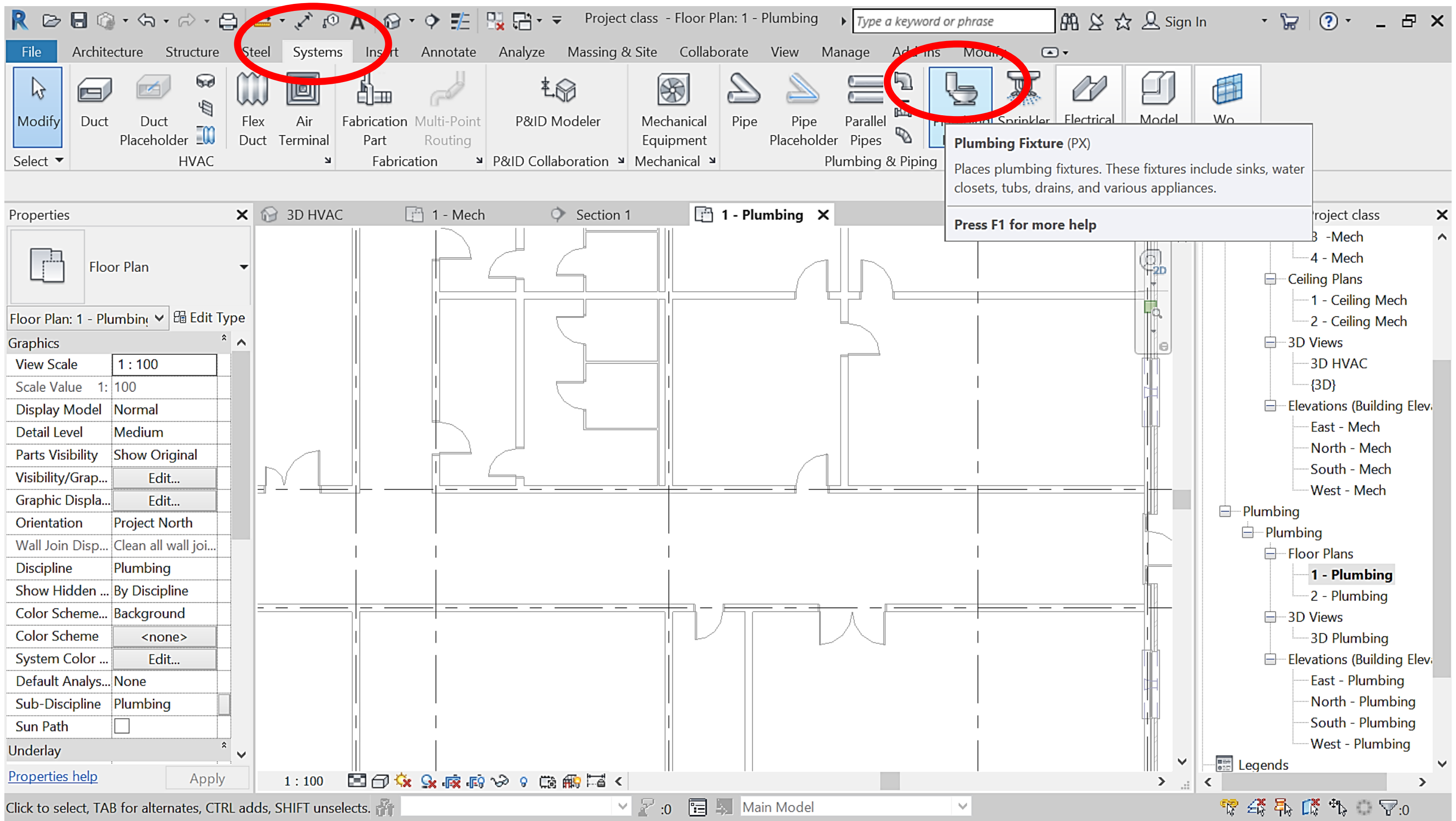
Part 5

MODELING installation

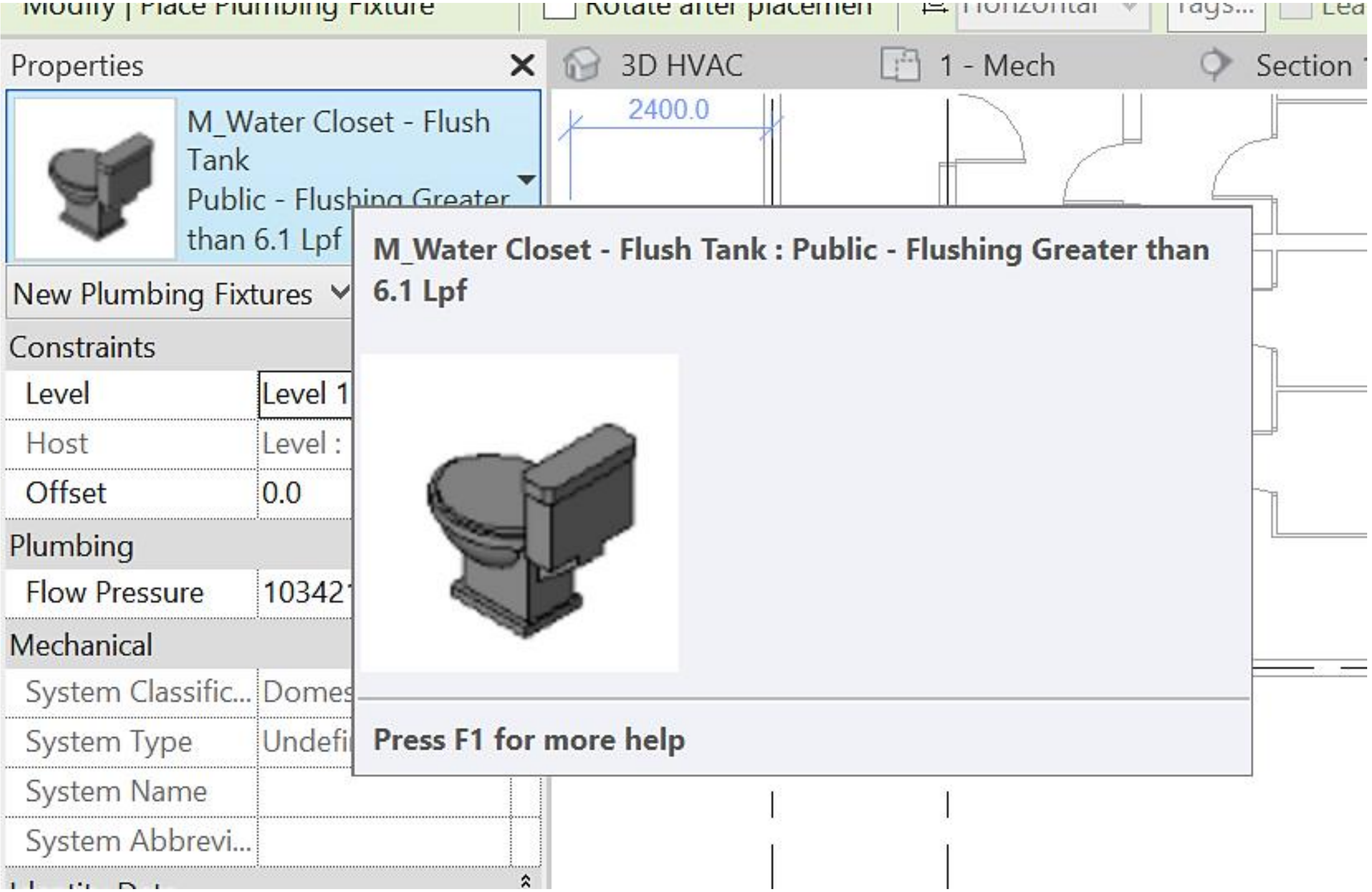
Select correct level in plumbing section



Select „Systems”and „Plumbing fixture”

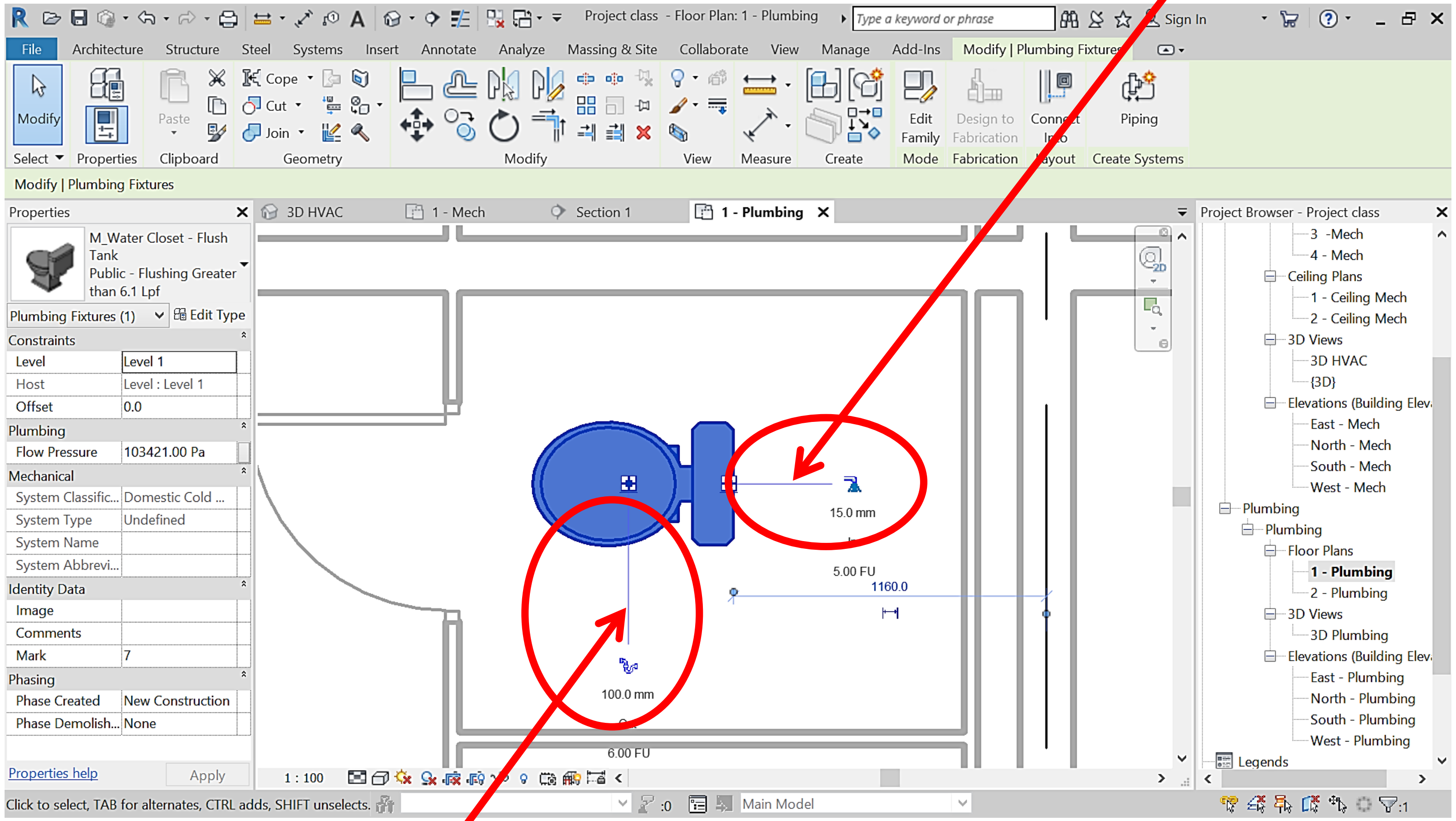


Select the fixture



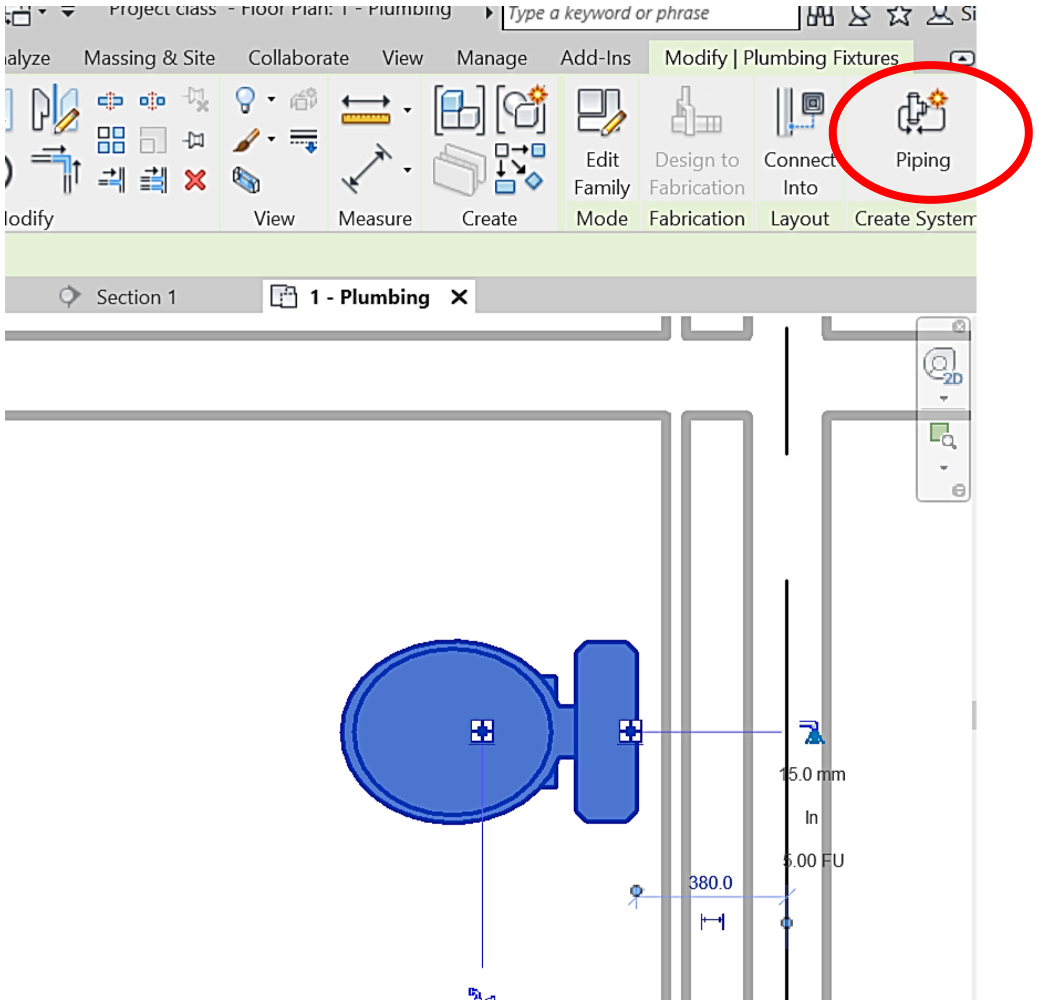
Connectors on the fixture

cold water



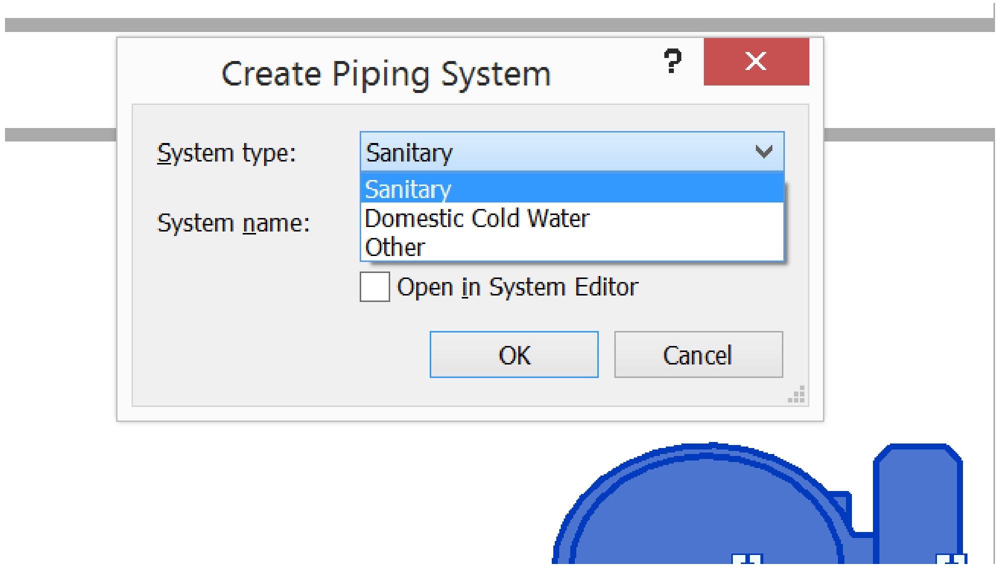
sewage

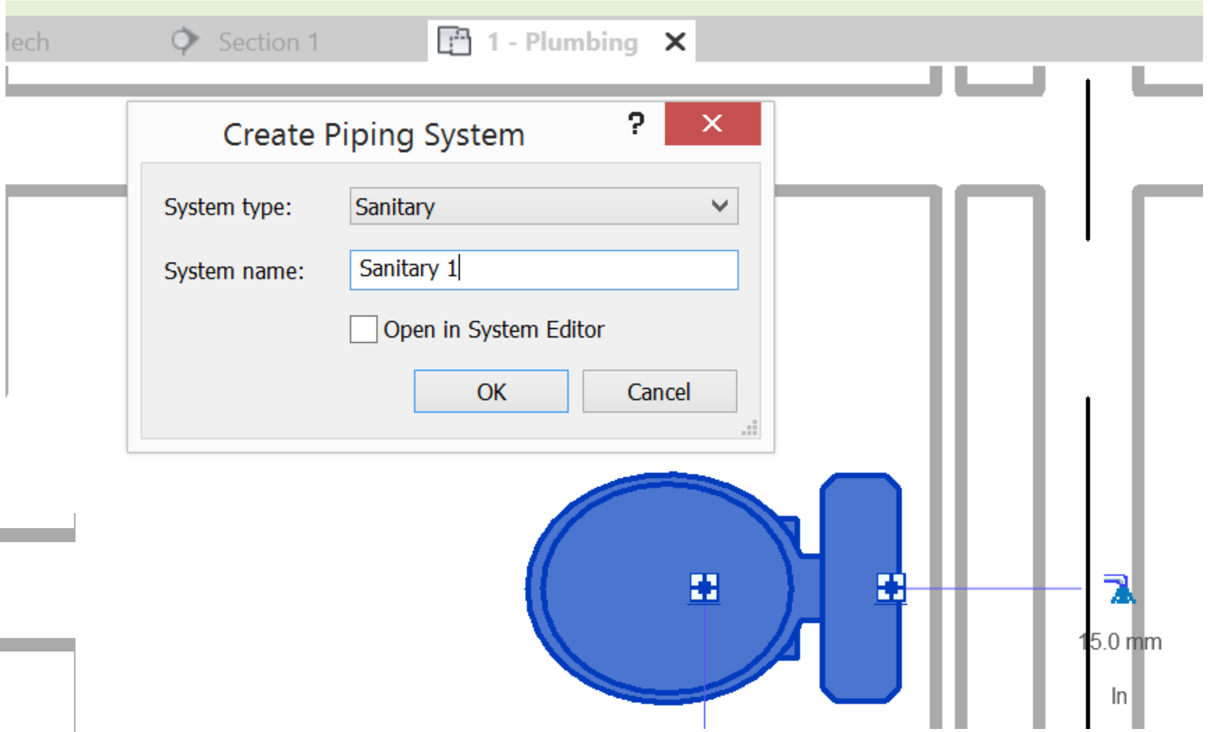
Create the system



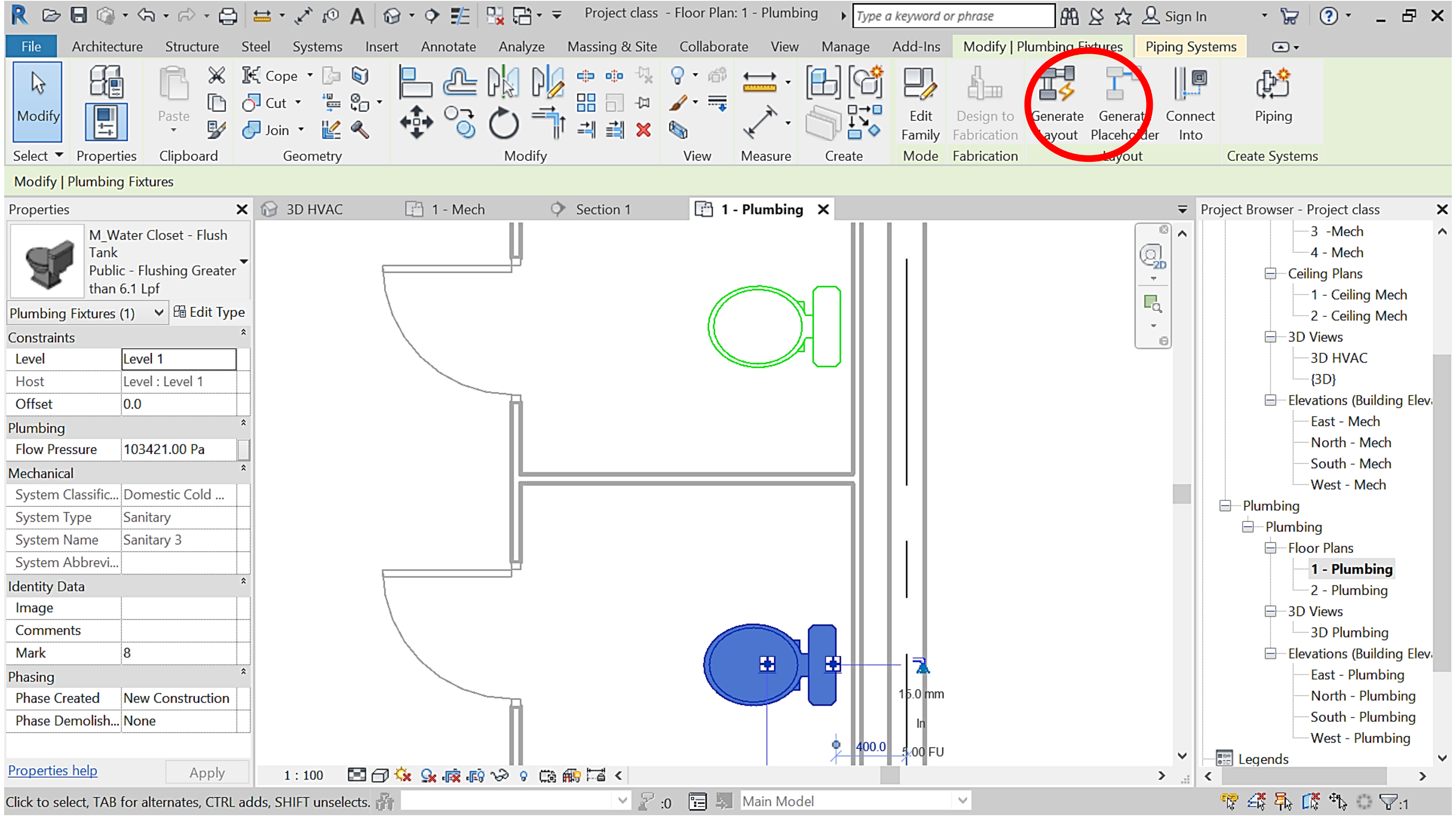
Create the system

The choice

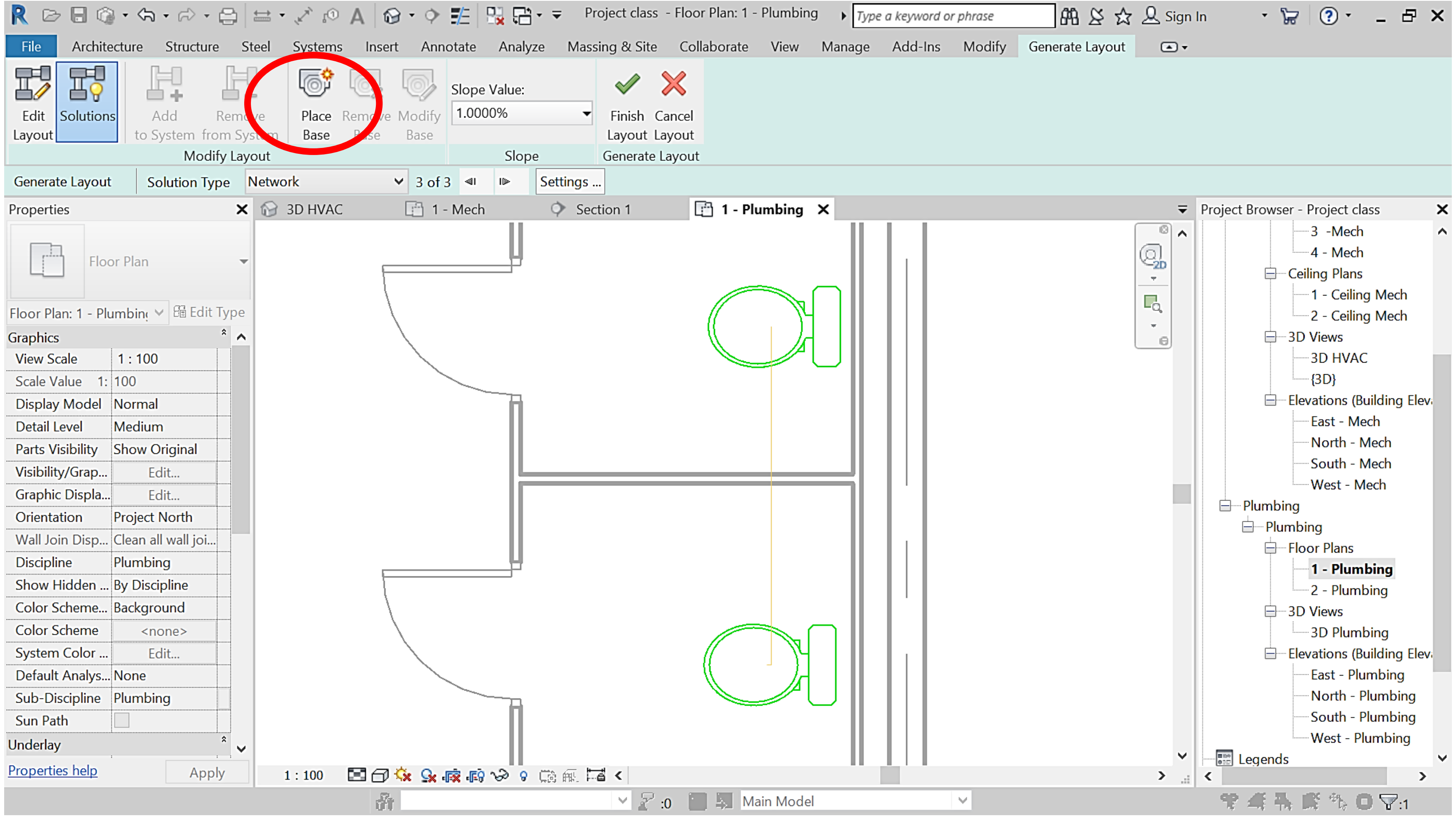




Generate layout



Place base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Generate Layout
Edit Layout
Solutions
Add to System
Remove from System
Place Base
Remove Base
Modify Base
Slope Value:
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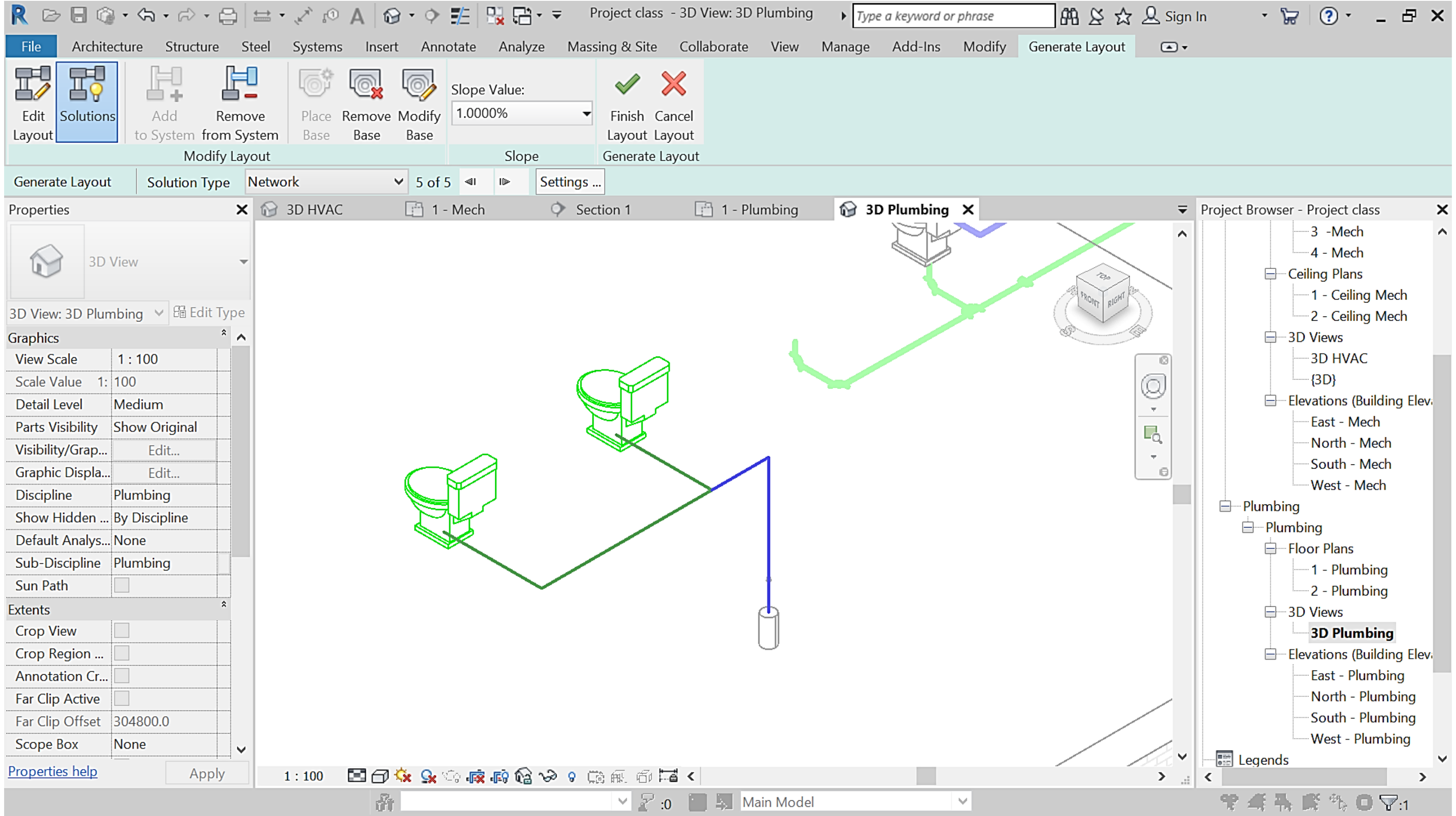
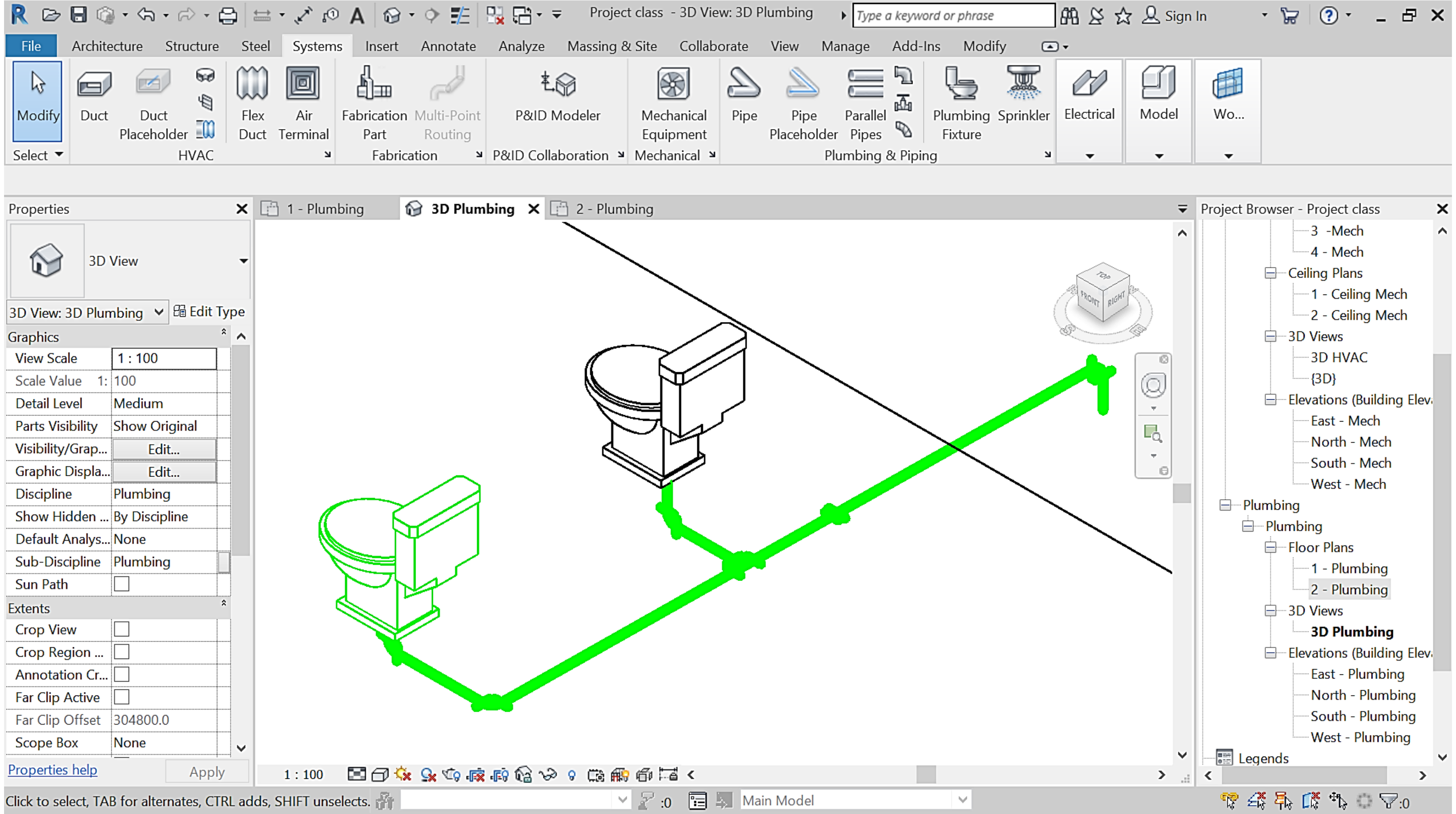
Finish Layout
Cancel Layout
Modify Layout
Slope
Solution Type
Network
3 of 3
Settings ...
Properties
Floor Plan
Project Browser - Project class
1 - Plumbing

Solutions



Project class - 3D View: 3D Plumbing
File
Architecture
Structure
Steel
Systems
Insert
Annotate
Analyze
Massing & Site
Collaborate
View
Manage
Add-Ins
Modify
Generate Layout
Edit Layout
Solutions
Add to System
Remove from System
Place Base
Remove Base
Modify Base
Slope Value:
1.0000%
Finish Layout
Cancel Layout
Modify Layout
Slope
Generate Layout
Generate Layout
Solution Type
Network
5 of 5
Settings ...
Properties
3D View
3D View: 3D Plumbing
Edit Type
Graphics
View Scale
1 : 100
Scale Value 1:
100
Detail Level
Medium
Parts Visibility
Show Original
Discipline
Plumbing
Sub-Discipline
Plumbing
Sun Path
Extents
Crop View
Far Clip Offset
304800.0
Scope Box
None
Properties help
Apply
3D HVAC
1 - Mech
Section 1
1 - Plumbing
3D Plumbing
Project Browser - Project class
Ceiling Plans
1 - Ceiling Mech
2 - Ceiling Mech
3D Views
Plumbing
Floor Plans
1 - Plumbing
2 - Plumbing
East - Plumbing
North - Plumbing
South - Plumbing
West - Plumbing
Legends
Main Model

Solutions


Project class - 3D View: 3D Plumbing
Type a keyword or phrase
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Manage
Add-Ins
Modify
Modify
Duct
Duct Placeholder
Flex Duct
Air Terminal
Fabrication Part
Multi-Point Routing
P&ID Modeler
Mechanical Equipment
Pipe
Pipe Placeholder
Parallel Pipes
Plumbing Fixture
Sprinkler
Electrical
Model
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Select
HVAC
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P&ID Collaboration
Mechanical
Plumbing & Piping
Properties
3D View
3D View: 3D Plumbing
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Graphics
View Scale
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Scale Value 1:
100
Detail Level
Medium
Parts Visibility
Show Original
Visibility/Grap...
Edit...
Graphic Displa...
Edit...
Discipline
Plumbing
Show Hidden ...
By Discipline
Default Analys...
None
Sub-Discipline
Plumbing
Sun Path
Extents
Crop View
Crop Region ...
Annotation Cr...
Far Clip Active
Far Clip Offset
304800.0
Scope Box
None
Properties help
Apply
1 - Plumbing
3D Plumbing
2 - Plumbing
1 : 100
Project Browser - Project class
3 -Mech
4 - Mech
Ceiling Plans
1 - Ceiling Mech
2 - Ceiling Mech
3D Views
3D HVAC
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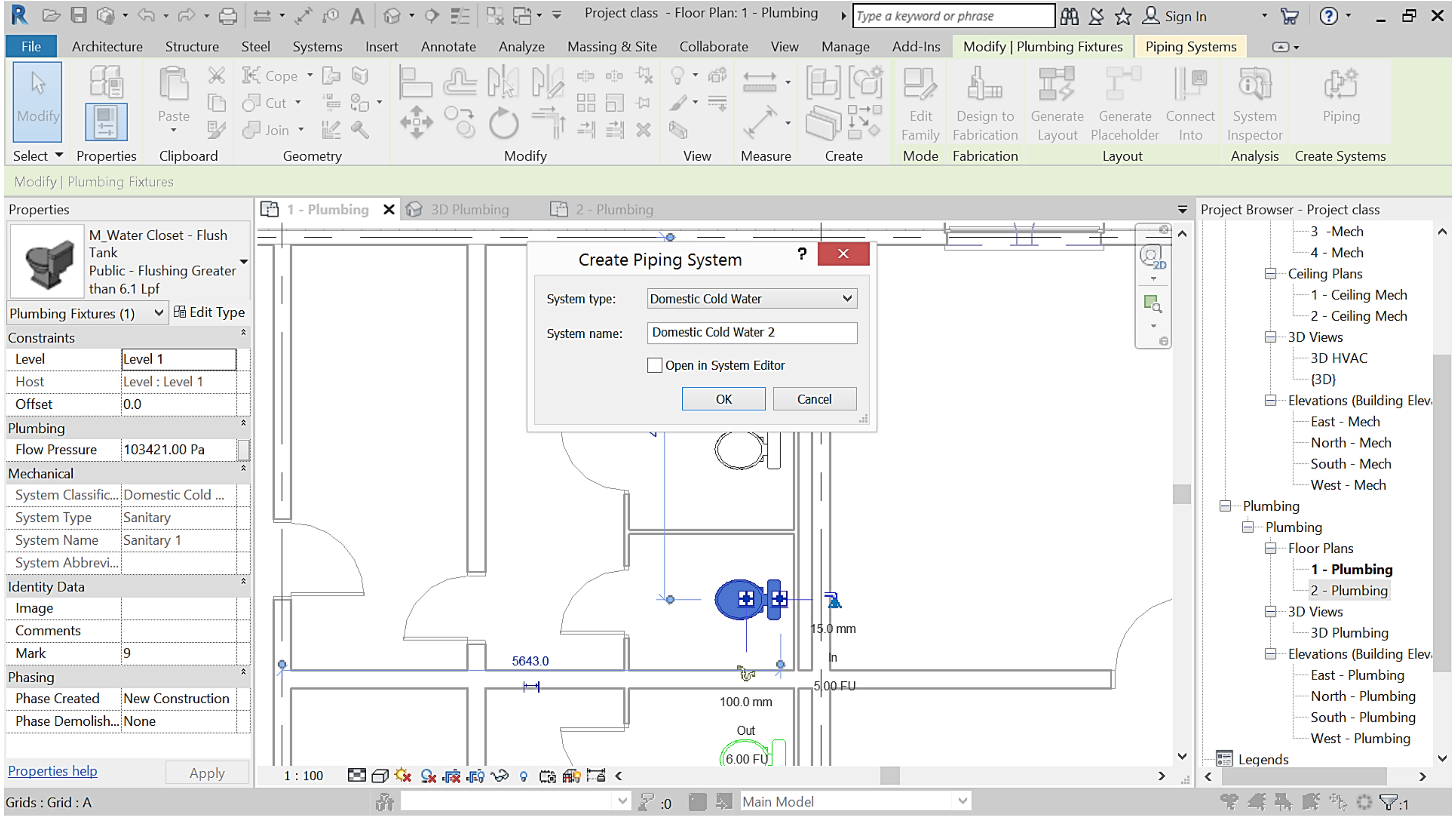
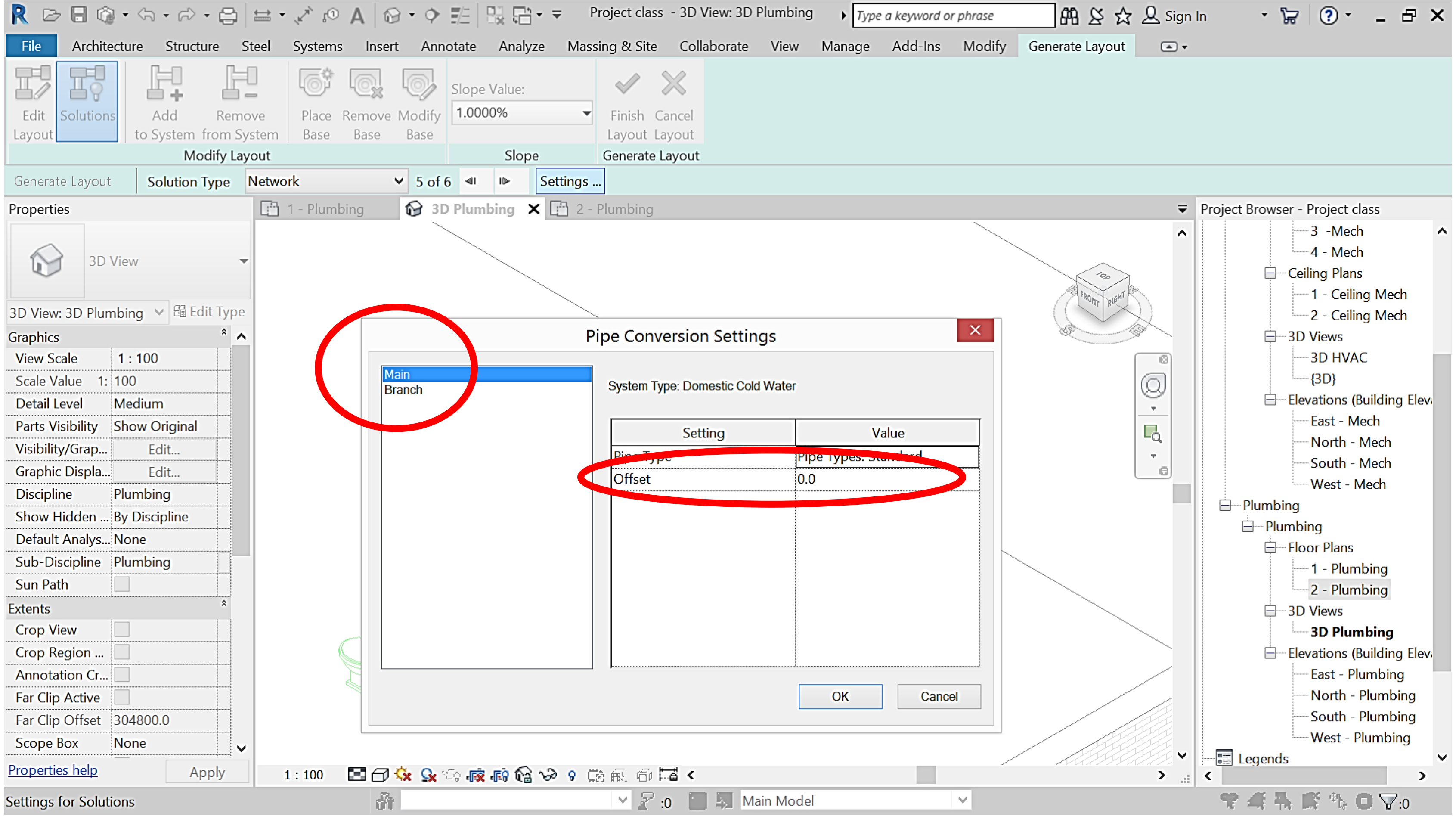
Elevations (Building Elev...
East - Mech
North - Mech
South - Mech
West - Mech
Plumbing
Plumbing
Floor Plans
1 - Plumbing
2 - Plumbing
3D Views
3D Plumbing
Elevations (Building Elev...
East - Plumbing
North - Plumbing
South - Plumbing
West - Plumbing
Legends
Click to select, TAB for alternates, CTRL adds, SHIFT unselects.
Main Model

Creating cold water piping

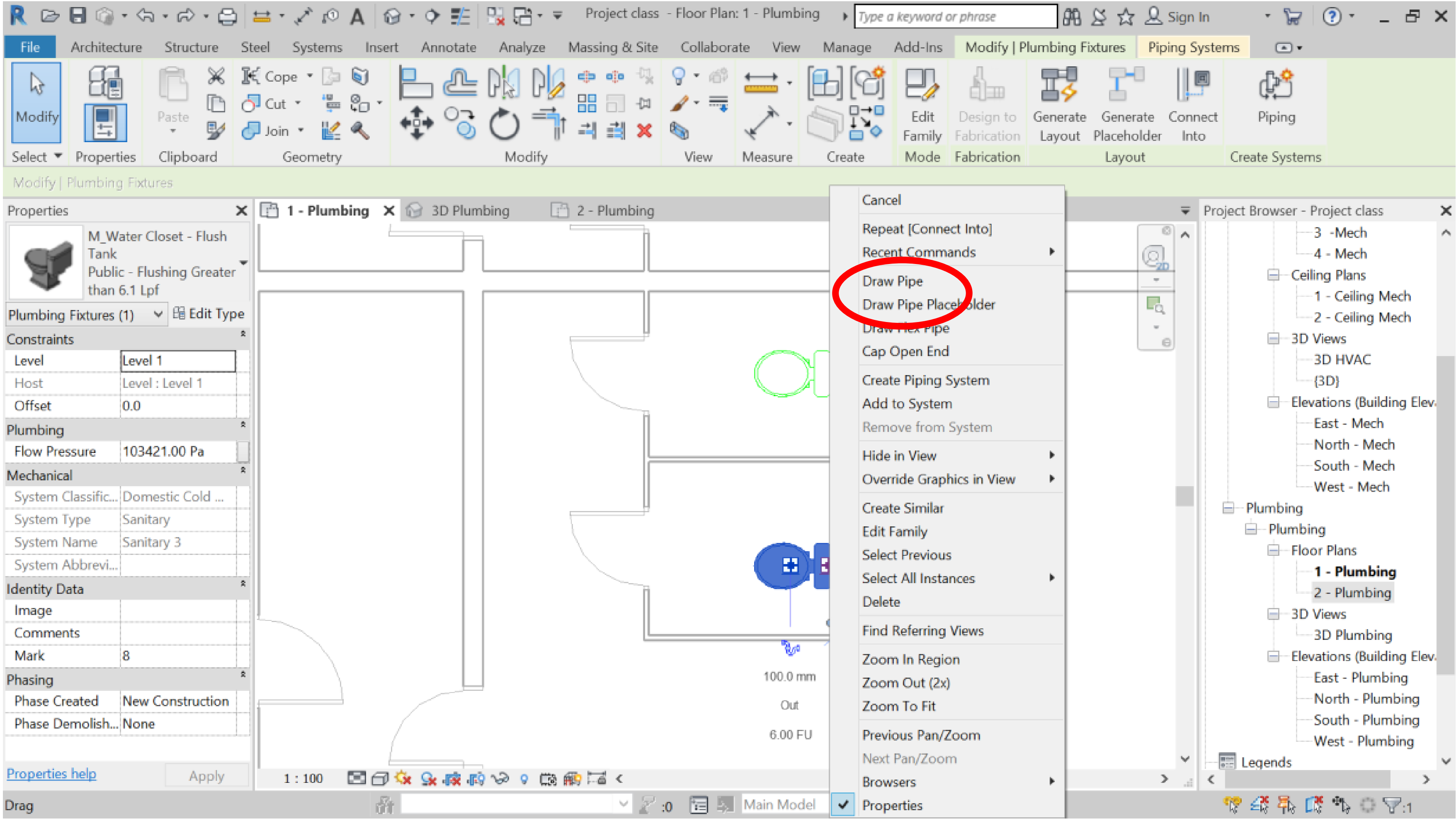


Creating cold water piping – settings

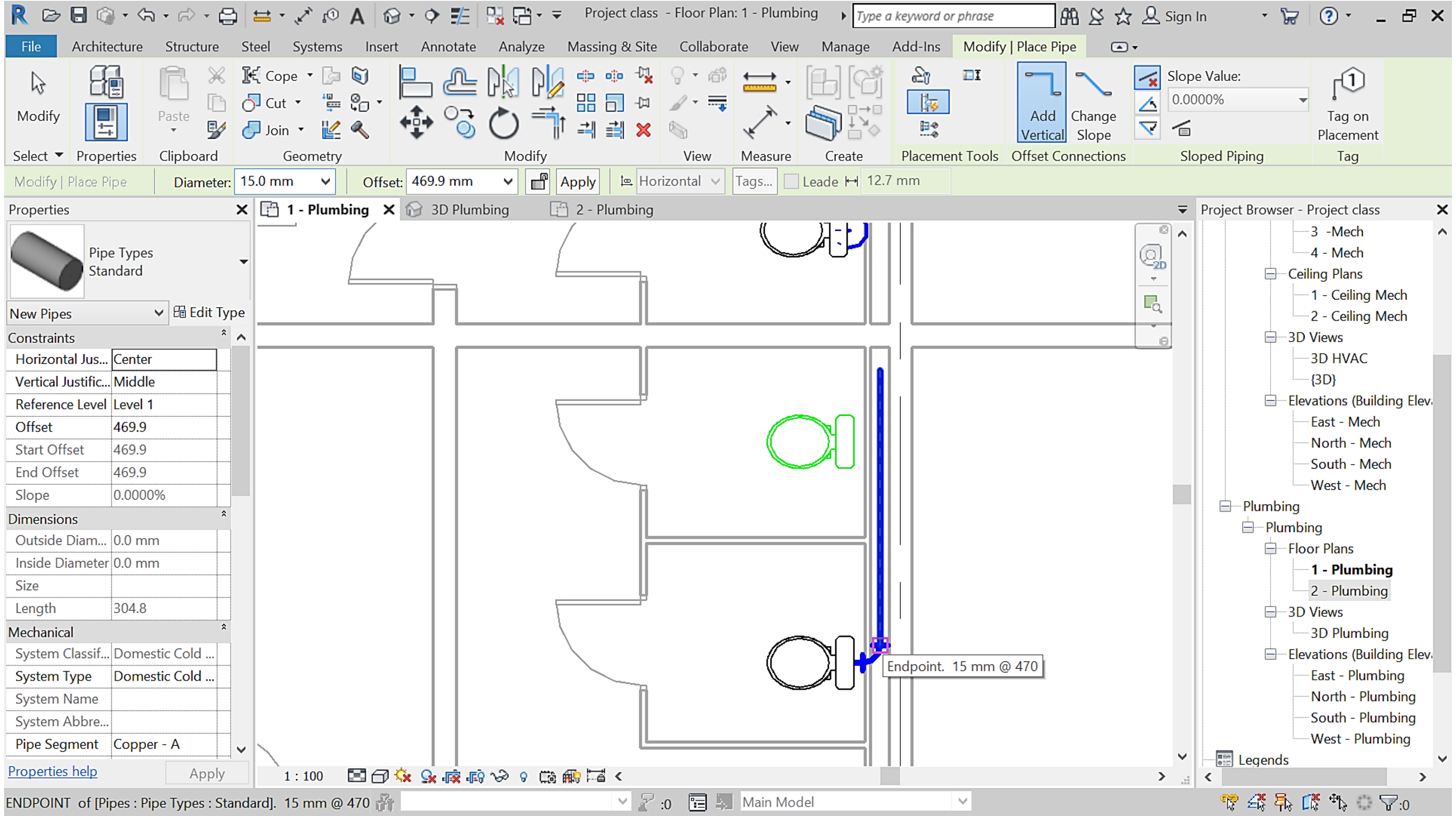
Main or branch offset



Creating cold water piping – manually

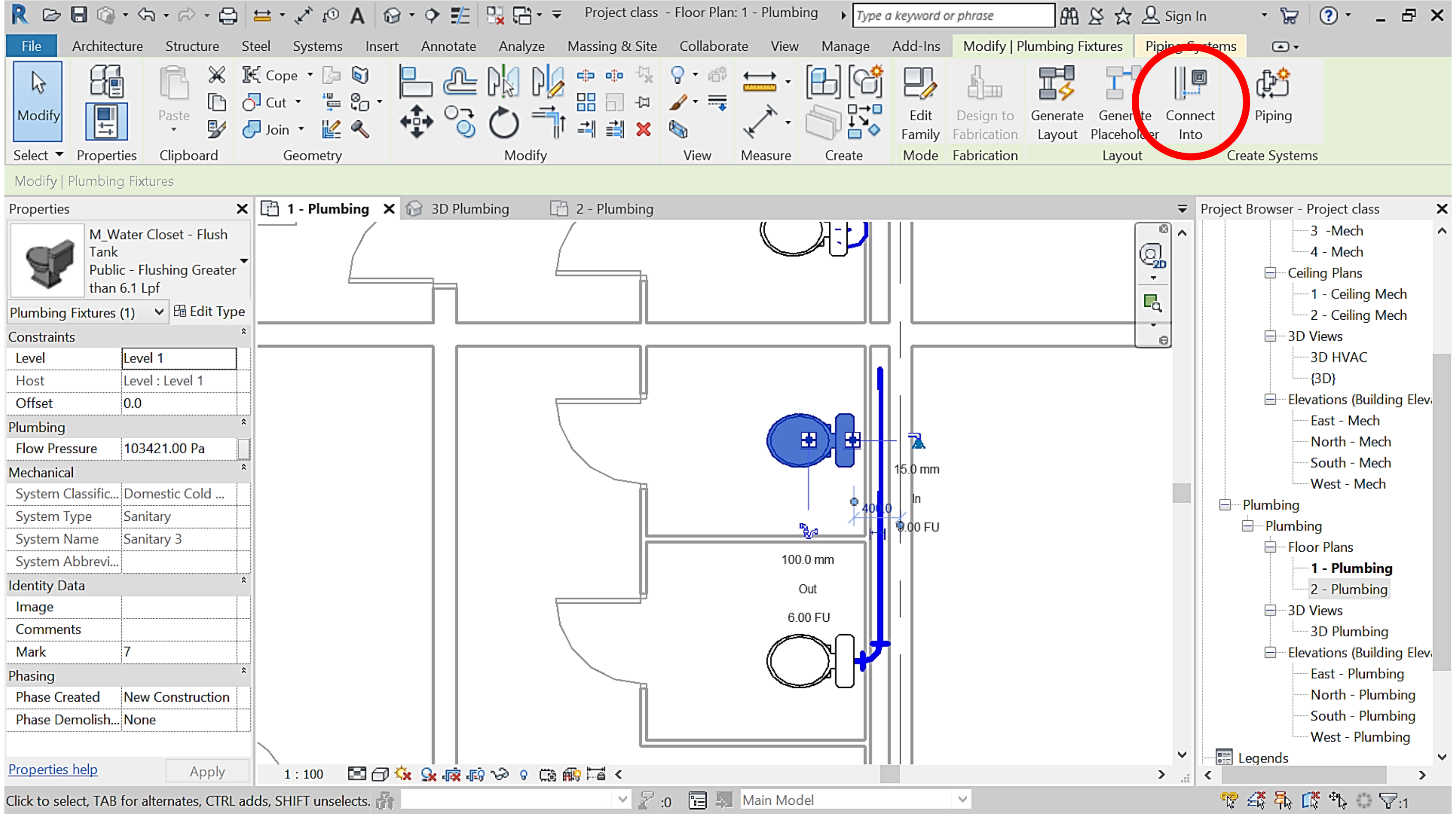


Creating cold water piping – manually



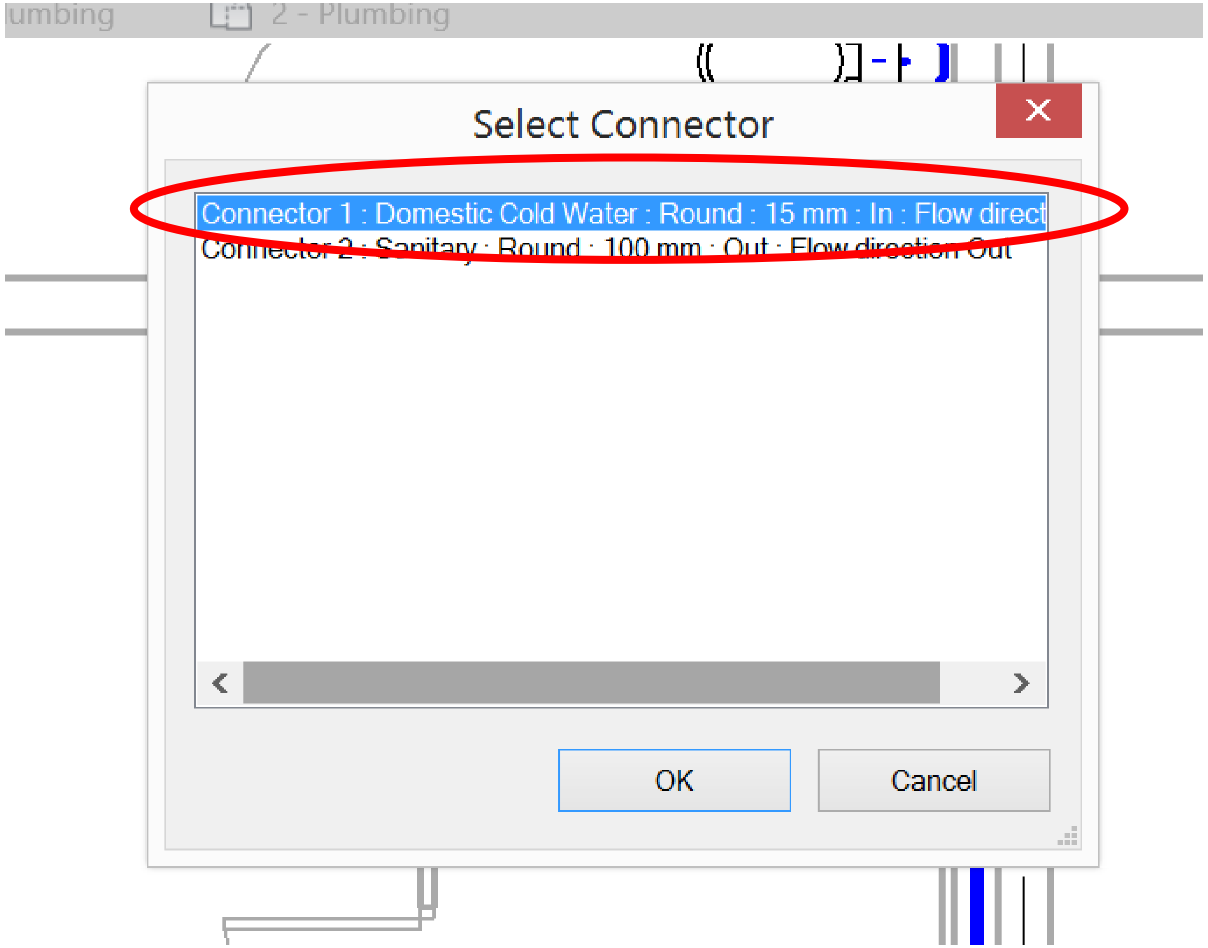
Creating cold water piping – manually

Connect into



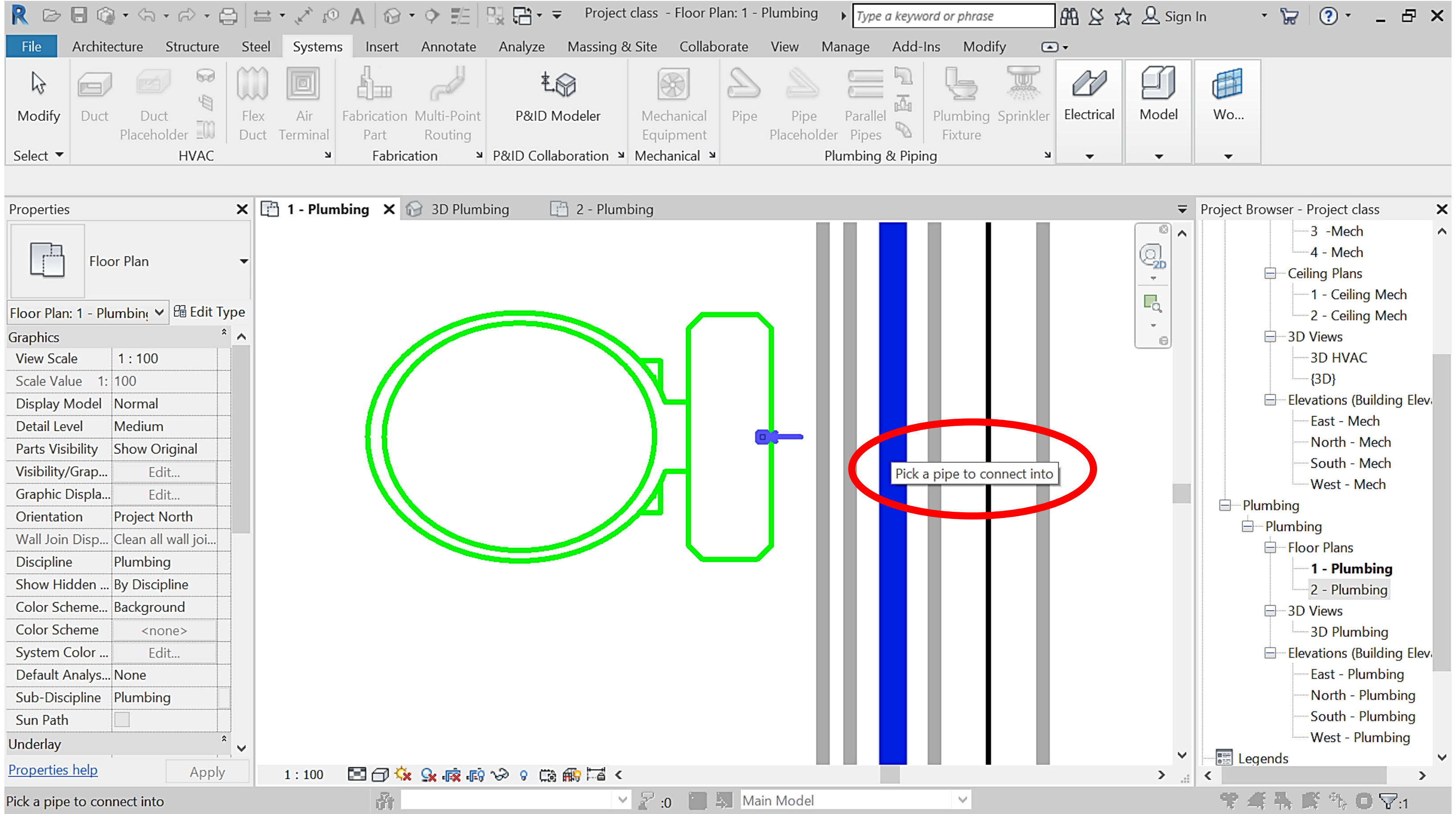
Creating cold water piping – manually

Select system

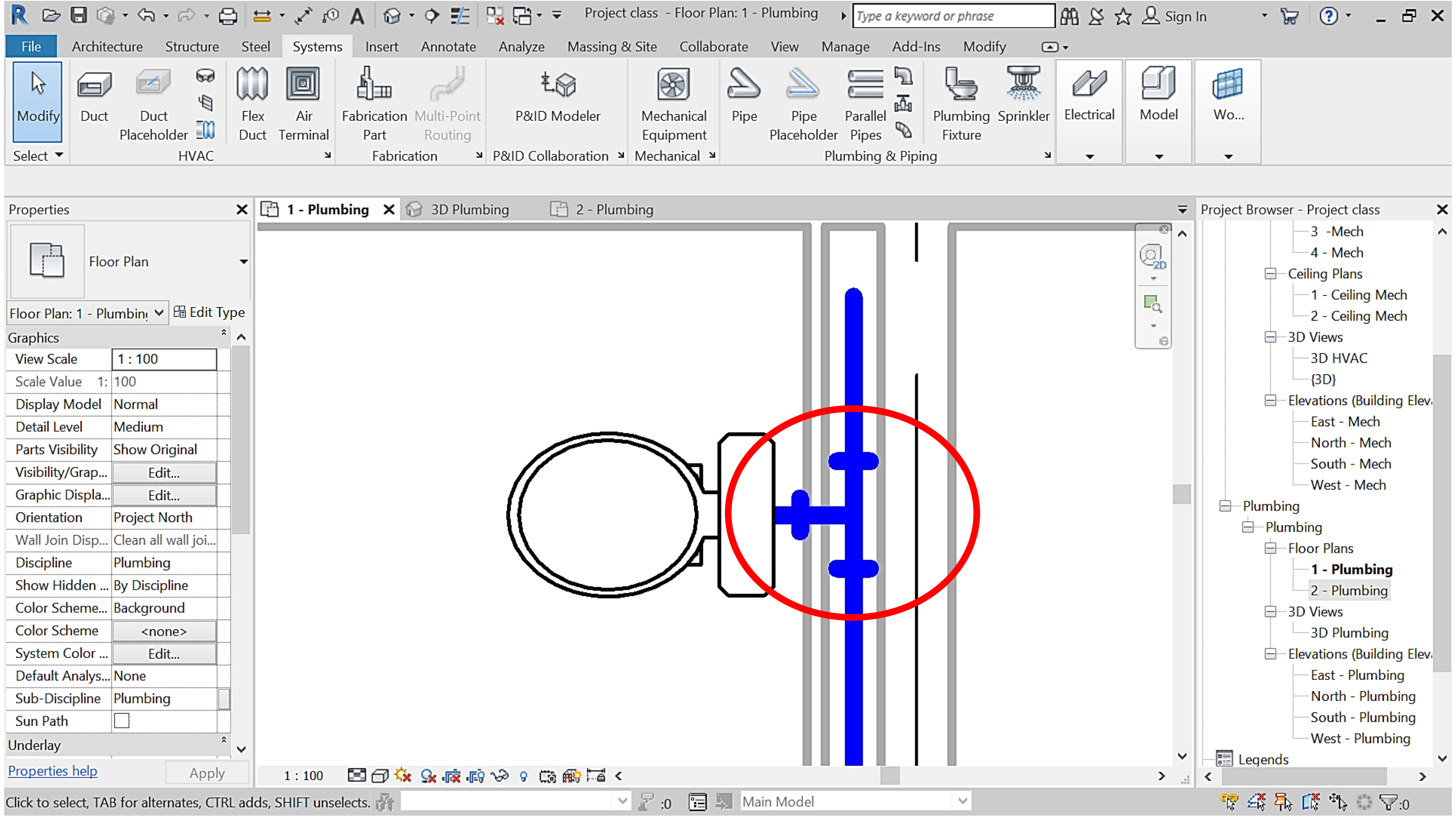


Creating cold water piping – manually

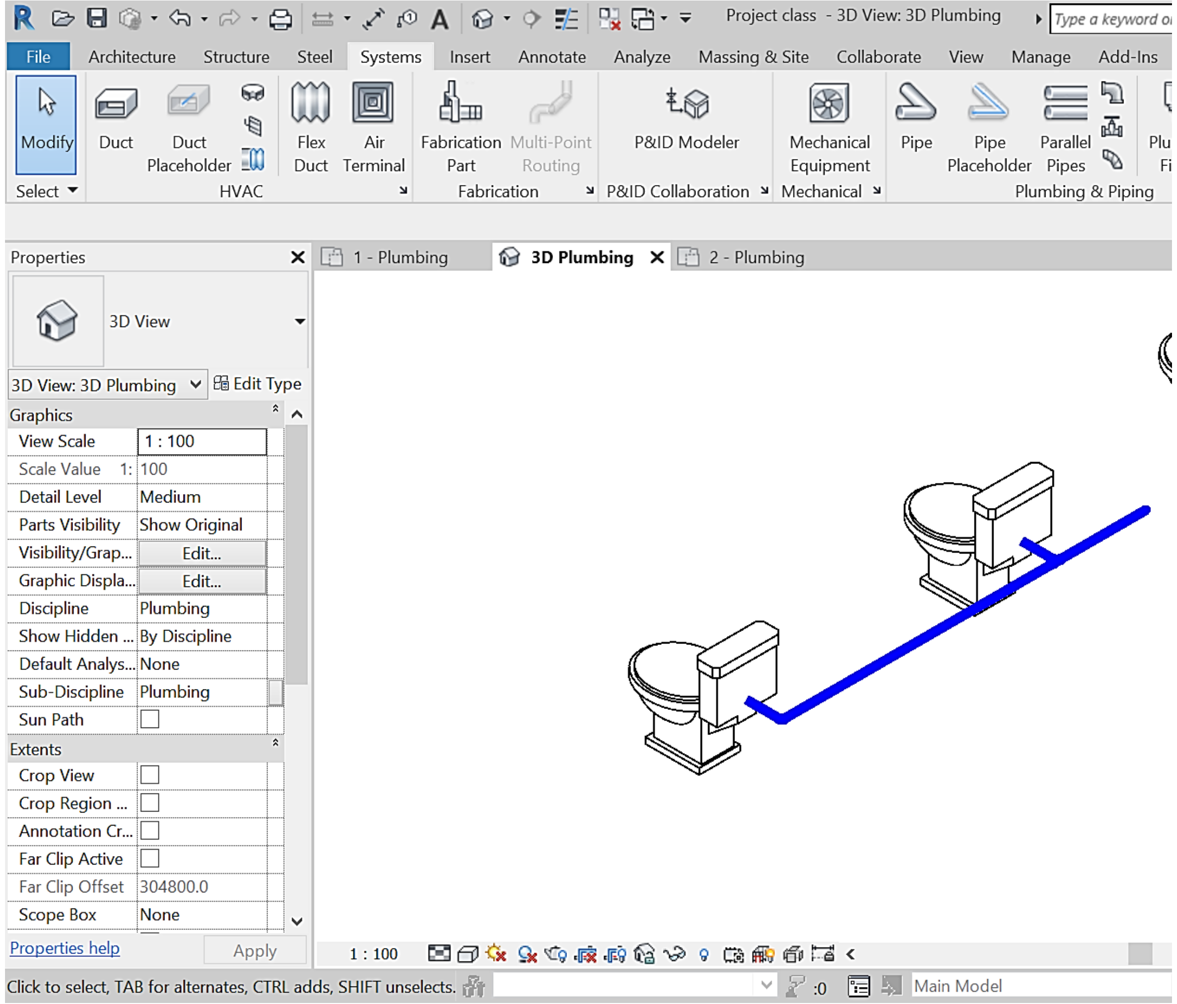
Select pipe



Creating cold water piping – manually

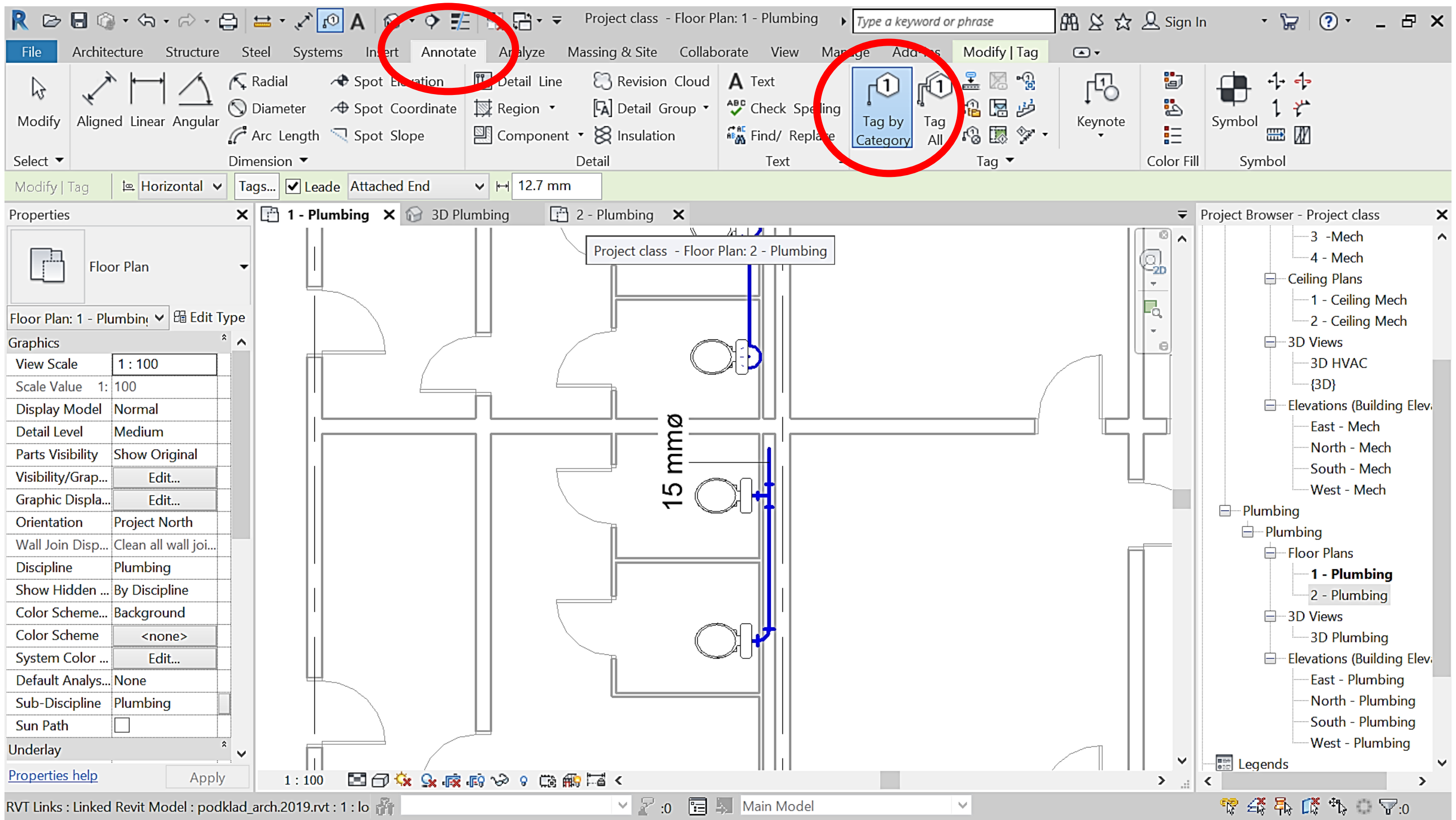


Creating cold water piping – manually

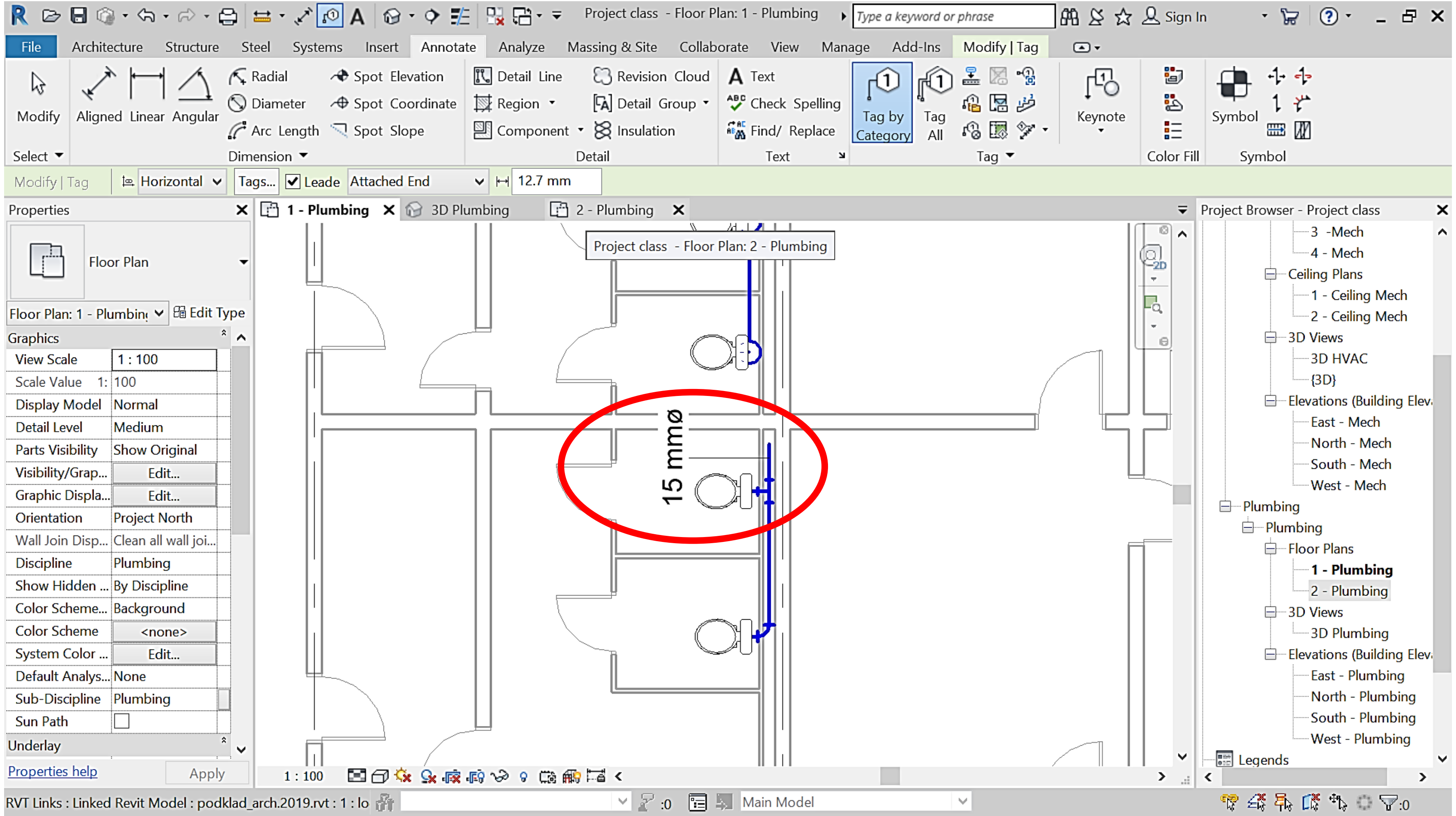


Annotate

By category



Annotate



Project class - Floor Plan: 1 - Plumbing
Type a keyword or phrase
Sign In
File
Architecture
Structure
Steel
Systems
Insert
Annotate
Analyze
Massing & Site
Collaborate
View
Manage
Add-Ins
Modify | Tag
Modify
Aligned
Linear
Angular
Radial
Diameter
Arc Length
Spot Elevation
Spot Coordinate
Spot Slope
Detail Line
Region
Component
Revision Cloud
Detail Group
Insulation
Text
Check Spelling
Find/ Replace
Tag by Category
Tag All
Keynote
Color Fill
Symbol
Select
Dimension
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Attached End
12.7 mm
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Floor Plan: 1 - Plumbin
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View Scale
1 : 100
Scale Value 1:
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Display Model
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Detail Level
Medium
Parts Visibility
Show Original
Visibility/Grap...
Edit...
Graphic Displa...
Edit...
Orientation
Project North
Wall Join Disp...
Clean all wall joi...
Discipline
Plumbing
Show Hidden ...
By Discipline
Color Scheme...
Background
Color Scheme
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System Color ...
Edit...
Default Analys...
None
Sub-Discipline
Plumbing
Sun Path
Underlay
Properties help
Apply
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3D Plumbing
2 - Plumbing
Project class - Floor Plan: 2 - Plumbing
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Project Browser - Project class
3 -Mech
4 - Mech
Ceiling Plans
1 - Ceiling Mech
2 - Ceiling Mech
3D Views
3D HVAC
{3D}
Elevations (Building Elev
East - Mech
North - Mech
South - Mech
West - Mech
Plumbing
Plumbing
Floor Plans
1 - Plumbing
2 - Plumbing
3D Views
3D Plumbing
Elevations (Building Elev
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North - Plumbing
South - Plumbing
West - Plumbing
Legends
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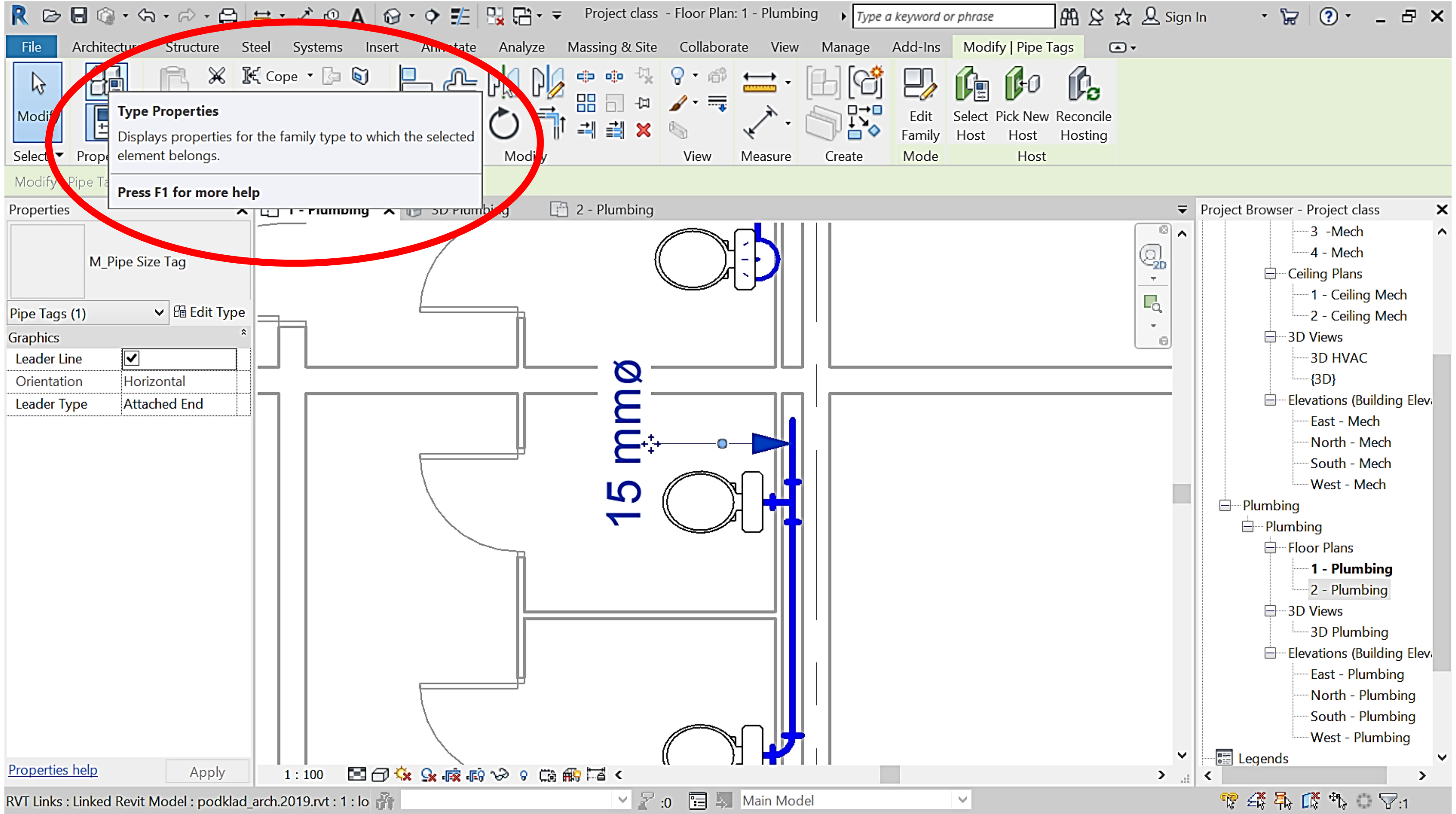
Main Model

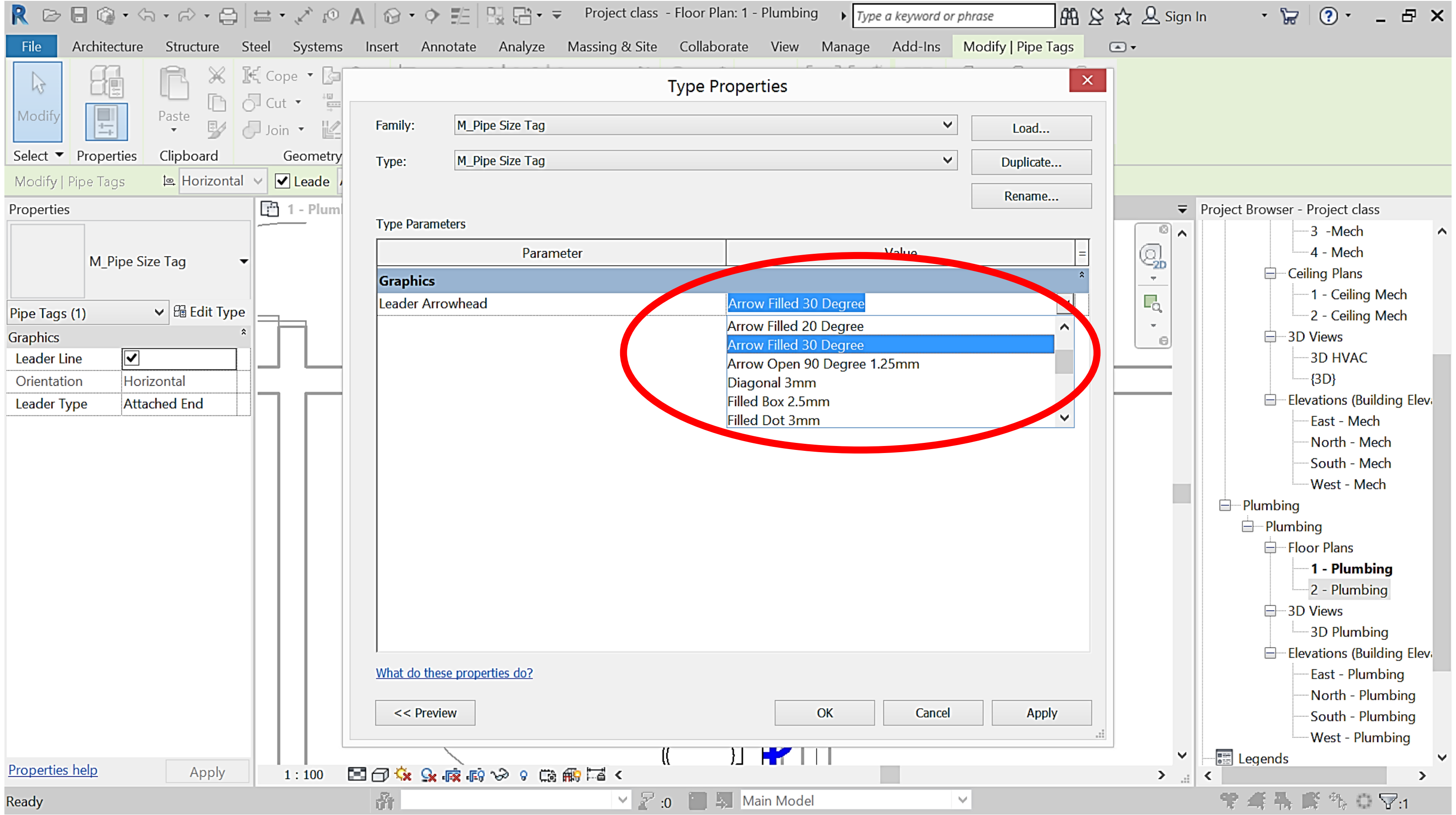
Annotate

Change of annotation type



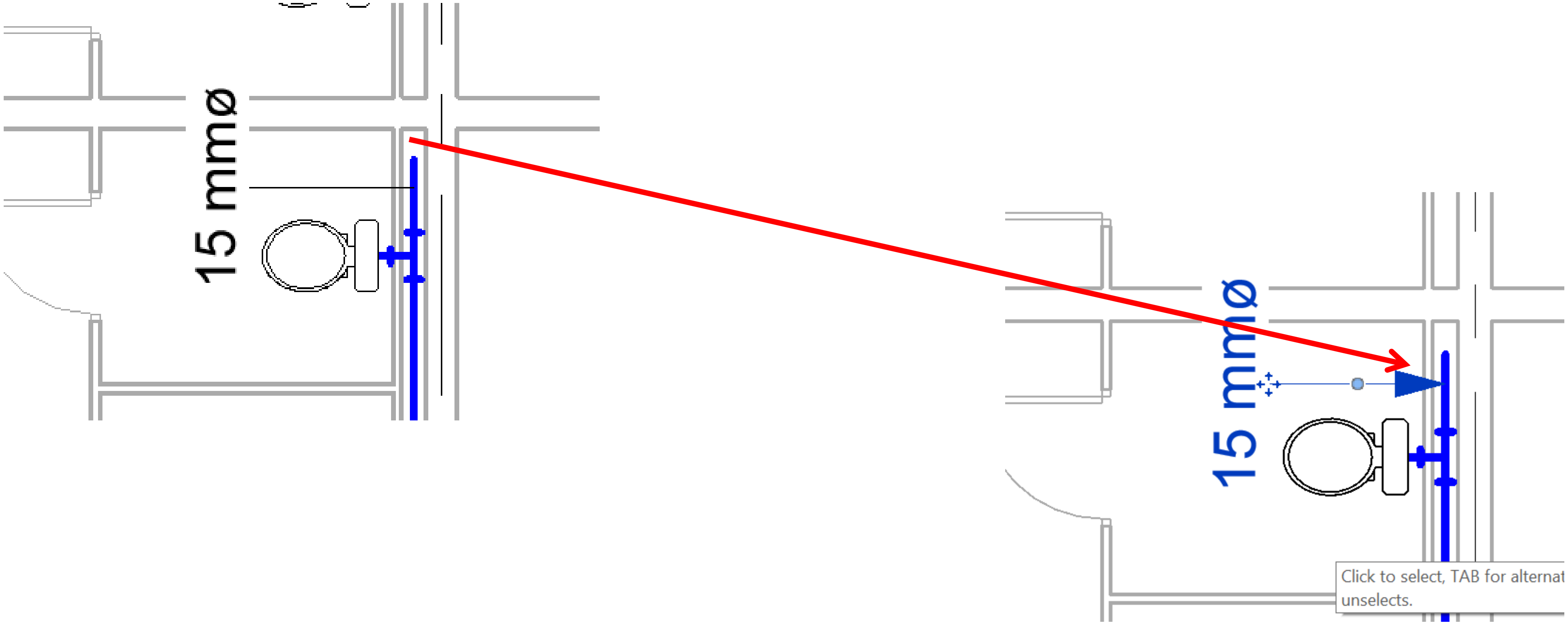
Annotate

Change of annotation type

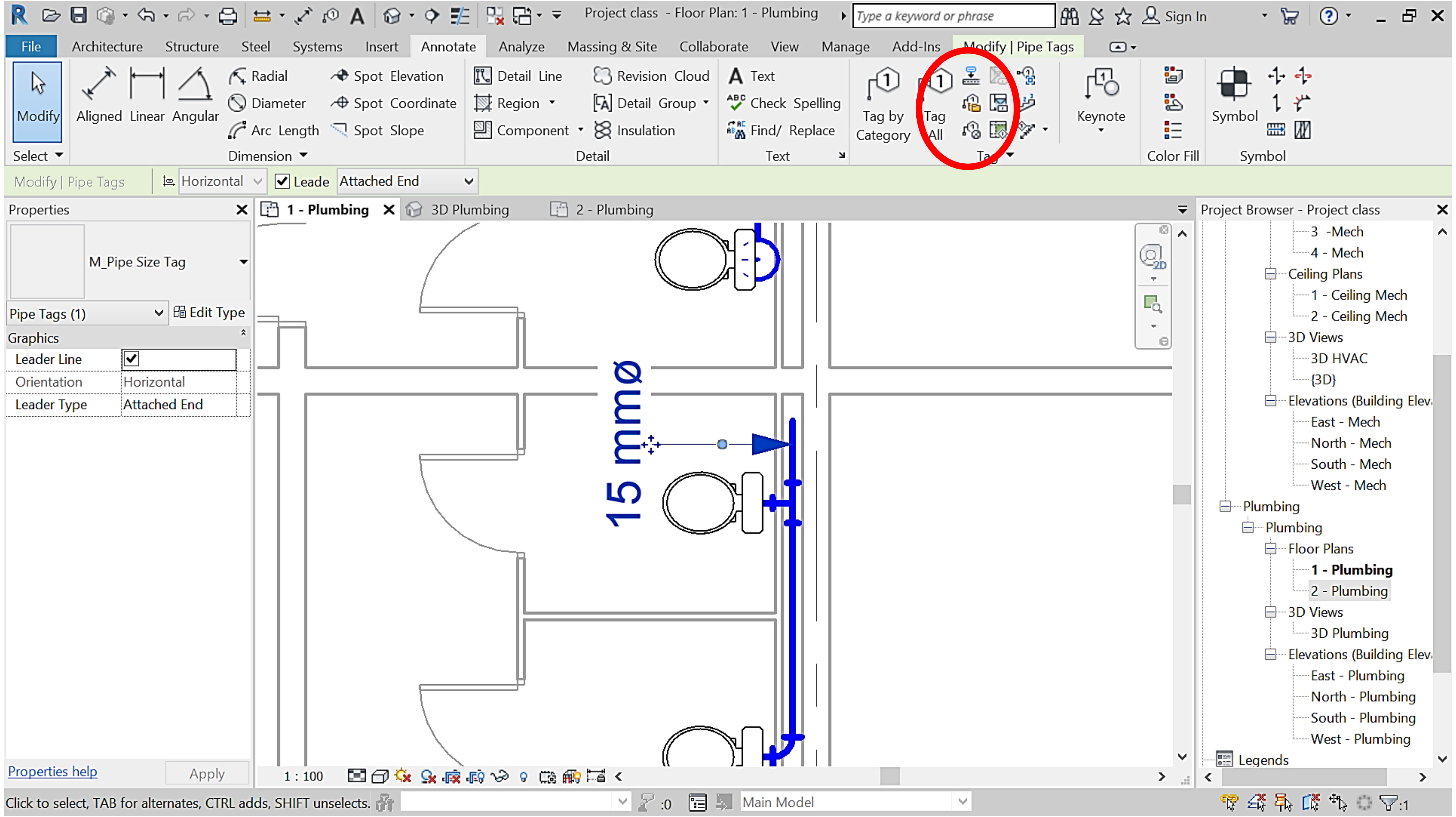


Annotate

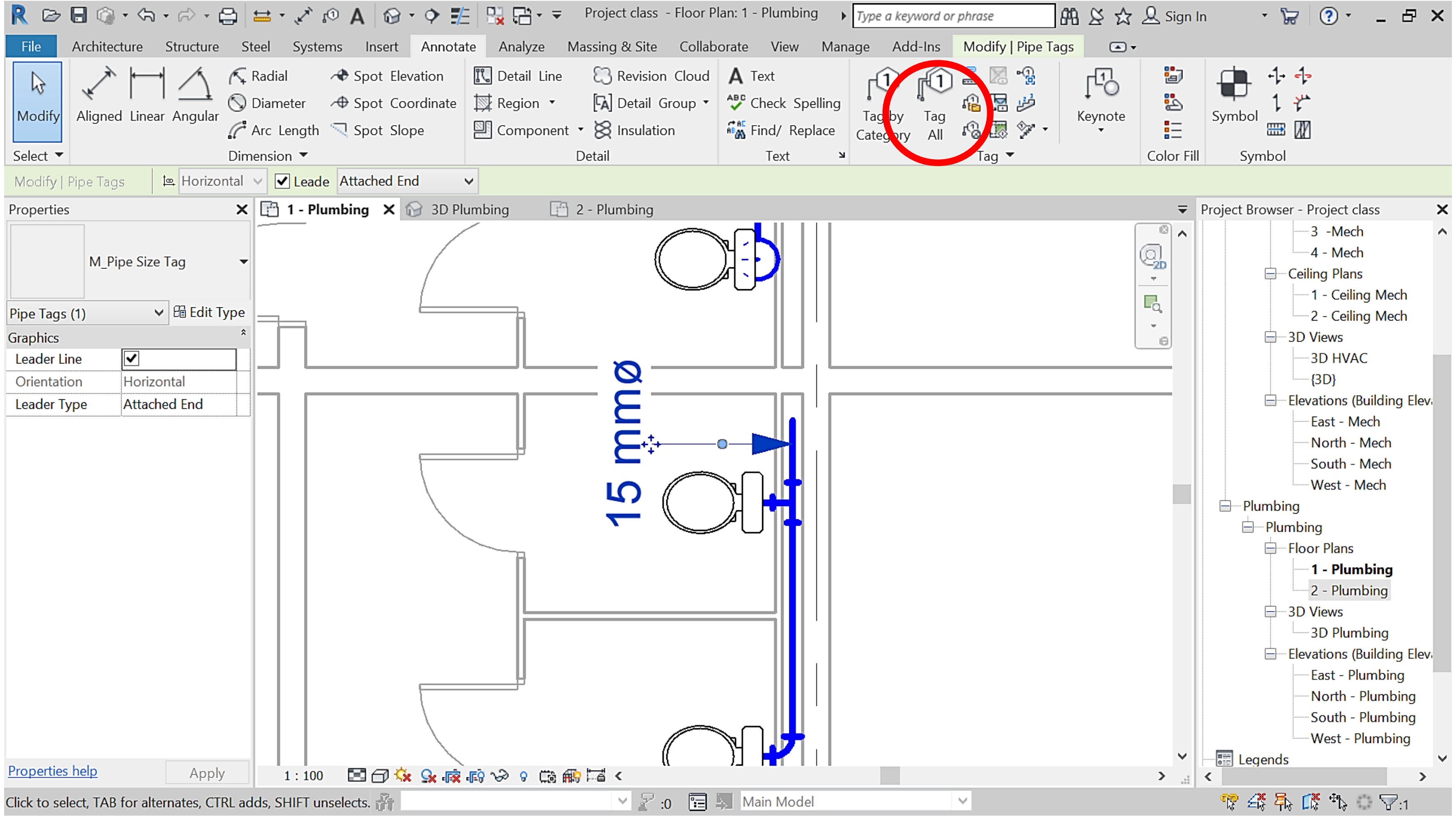
Change of annotation type



Annotate All



Tag All


Project class - Floor Plan: 1 - Plumbing
Type a keyword or phrase
Sign In
File
Architecture
Structure
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Systems
Insert
Annotate
Analyze
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Collaborate
View
Manage
Add-Ins
Modify | Pipe Tags
Modify
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Linear
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Radial
Diameter
Arc Length
Spot Elevation
Spot Coordinate
Spot Slope
Detail Line
Region
Component
Revision Cloud
Detail Group
Insulation
Text
Check Spelling
Find/ Replace
Tag by Category
Tag All
Keynote
Symbol
Select
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Properties help
Apply
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Project Browser - Project class
3 -Mech
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Ceiling Plans
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3D HVAC
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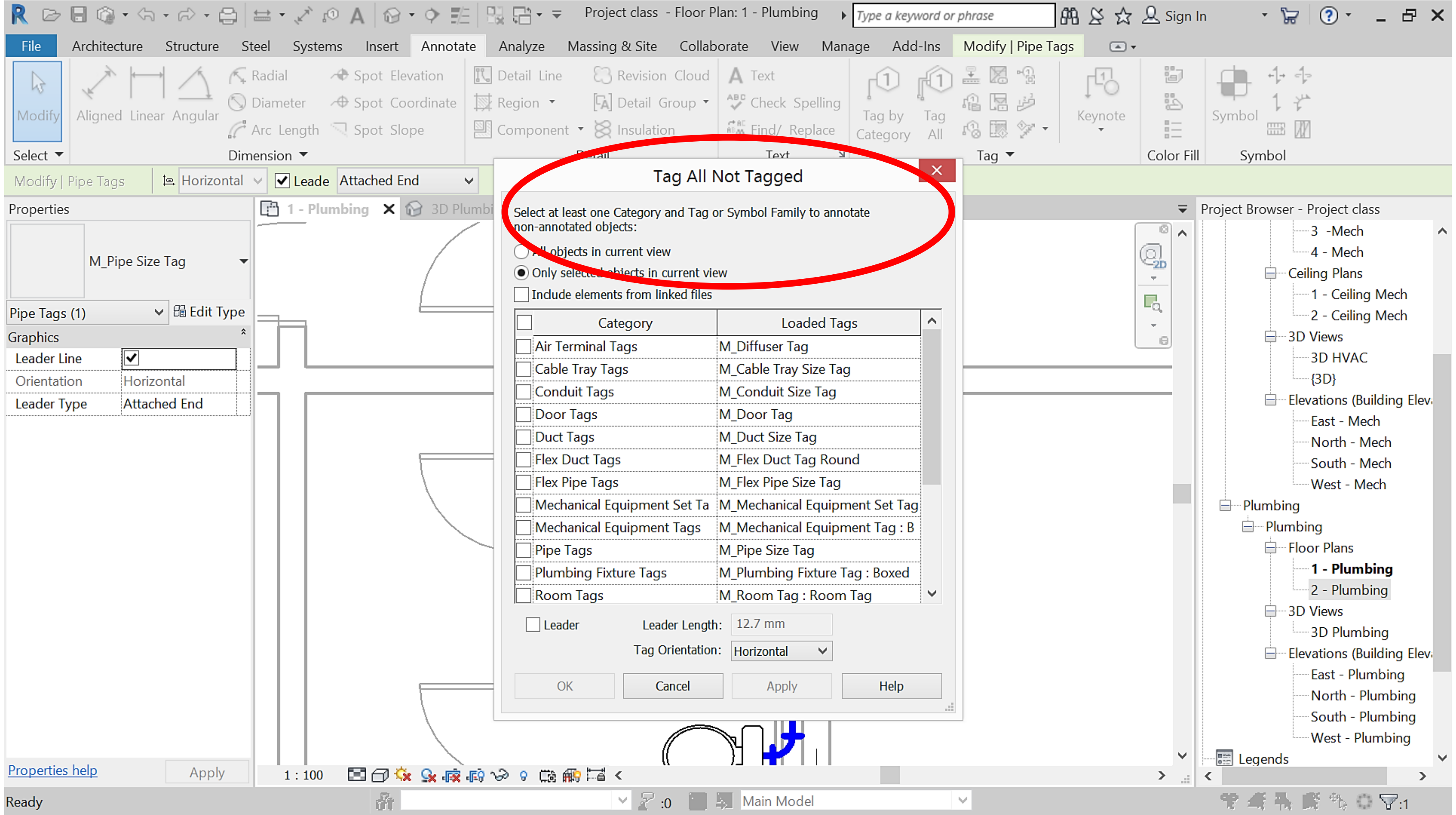
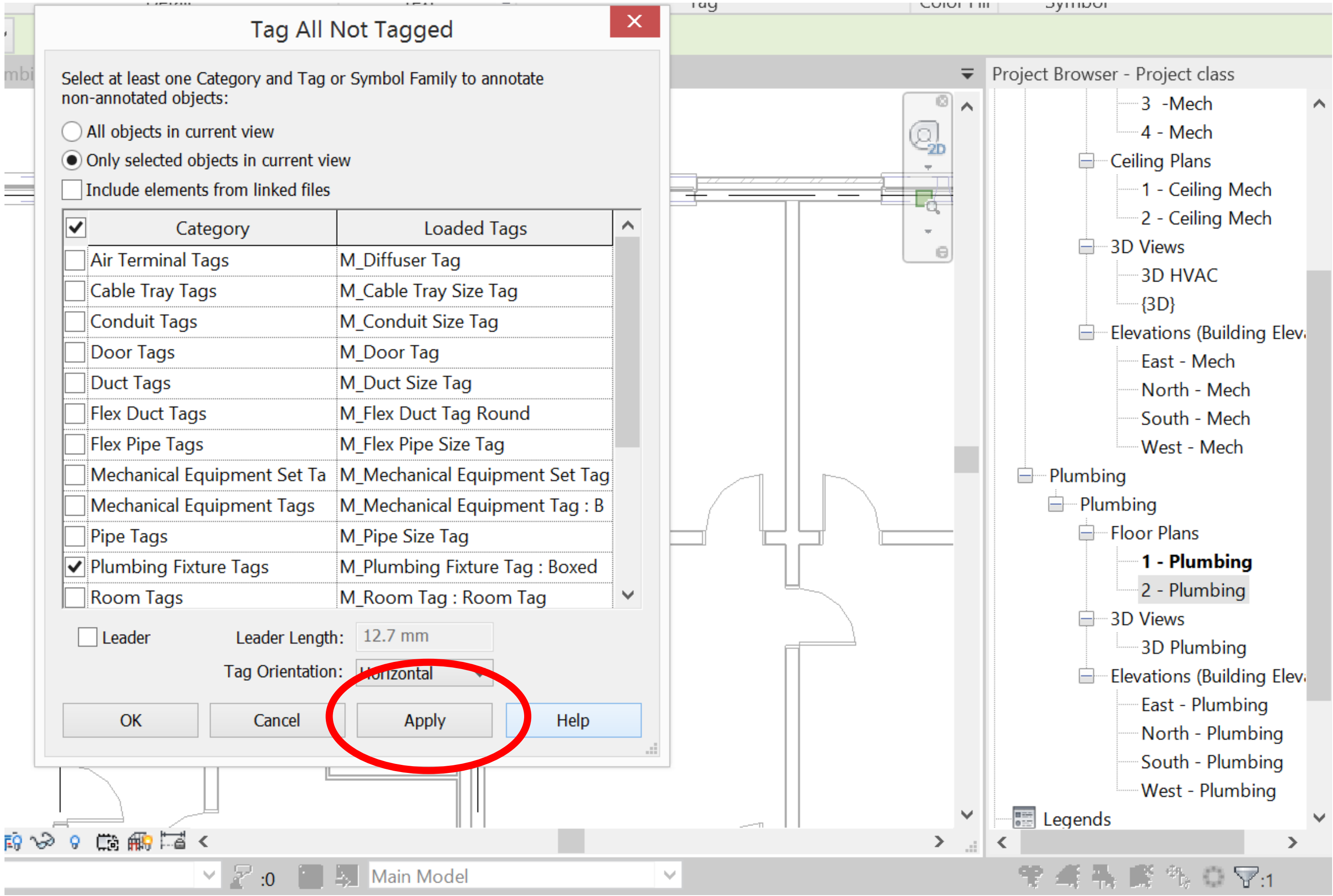
Plumbing
Plumbing
Floor Plans
1 - Plumbing
2 - Plumbing
3D Views
3D Plumbing
East - Plumbing
North - Plumbing
South - Plumbing
West - Plumbing
Legends
Click to select, TAB for alternates, CTRL adds, SHIFT unselects.
Main Model

Select system



Select system



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