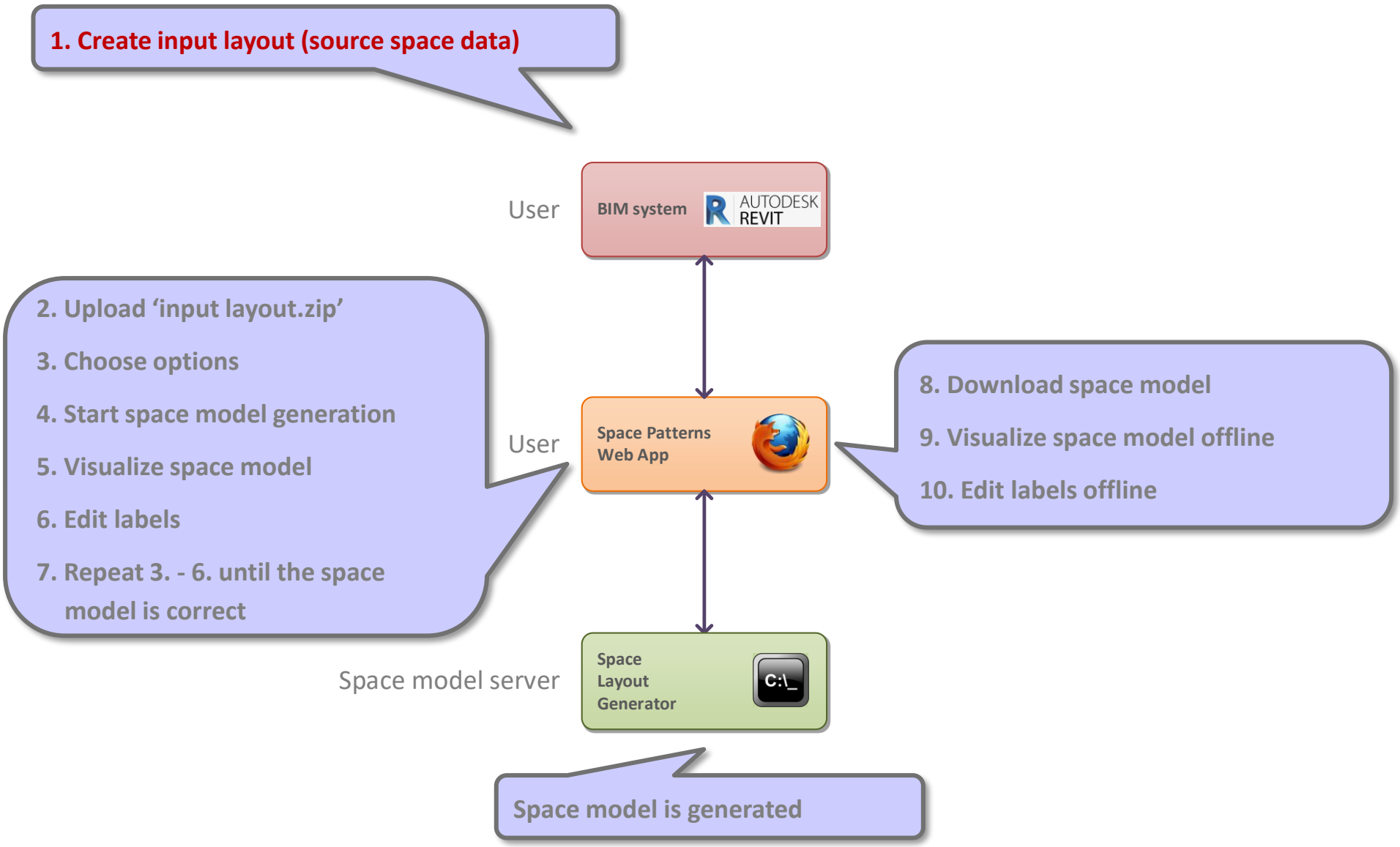
Space Modeler User Guide

Preparing an input layout in Revit

April 17, 2024

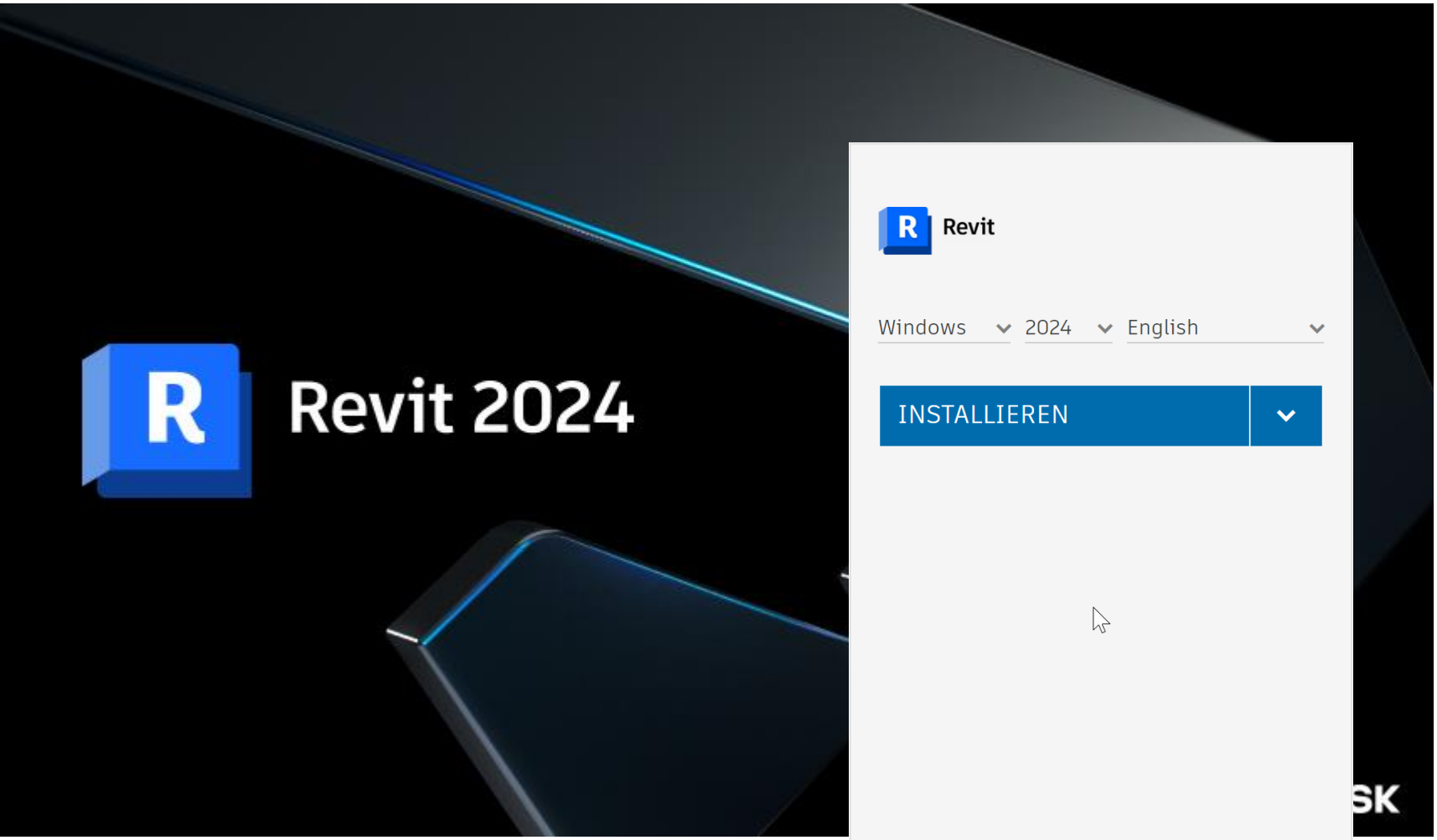
Workflow


1. Create input layout (source space data)
User
BIM system
AUTODESK REVIT
2. Upload 'input layout.zip'
3. Choose options
4. Start space model generation
5. Visualize space model
6. Edit labels
7. Repeat 3. - 6. until the space model is correct
User
Space Patterns Web App
8. Download space model
9. Visualize space model offline
10. Edit labels offline
Space model server
Space Layout Generator
C:_
Space model is generated

Software requirements

1. **Install Revit**
2. **Install WinZip**

Install Revit



Older versions of Revit are ok if already installed!

https://www.autodesk.de/education/home

Revit requirements

Revit 2024

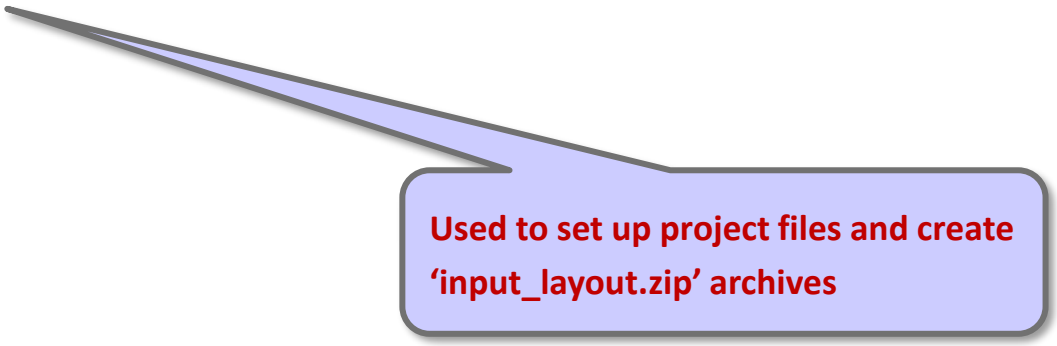
Minimum: Entry-Level Configuration

Operating System *	64-bit Microsoft® Windows® 10 or Windows 11. See Autodesk's Product Support Lifecycle for support information.
CPU Type	Intel® i-Series, Xeon®, AMD® Ryzen, Ryzen Threadripper PRO. 2.5 GHz or Higher. Highest CPU GHz recommended. Autodesk® Revit® software products will use multiple cores for many tasks.
Memory	16-GB RAM Usually sufficient for a typical editing session for a single model up to approximately 300 MB on disk. This estimate is based on internal testing and customer reports. Individual models will vary in their use of computer resources and performance characteristics. Models created in previous versions of Revit software products may require more available memory for the one-time upgrade process.
Video Display Resolutions	**Minimum:** 1280 x 1024 with true color **Maximum:** UltraHigh (4k) Definition Monitor
Video Adapter	**Basic Graphics:** Display adapter capable of 24-bit color **Advanced Graphics:** DirectX® 11 capable graphics card with Shader Model 5 and a minimum of 4 GB of video memory
Disk Space	30 GB free disk space
Pointing Device	MS-Mouse or 3Dconnexion® compliant device
.NET Framework	.NET Framework Version 4.8 or later.
Browser	Chrome, Edge, or Firefox
Connectivity	Internet connection for license registration and prerequisite component download

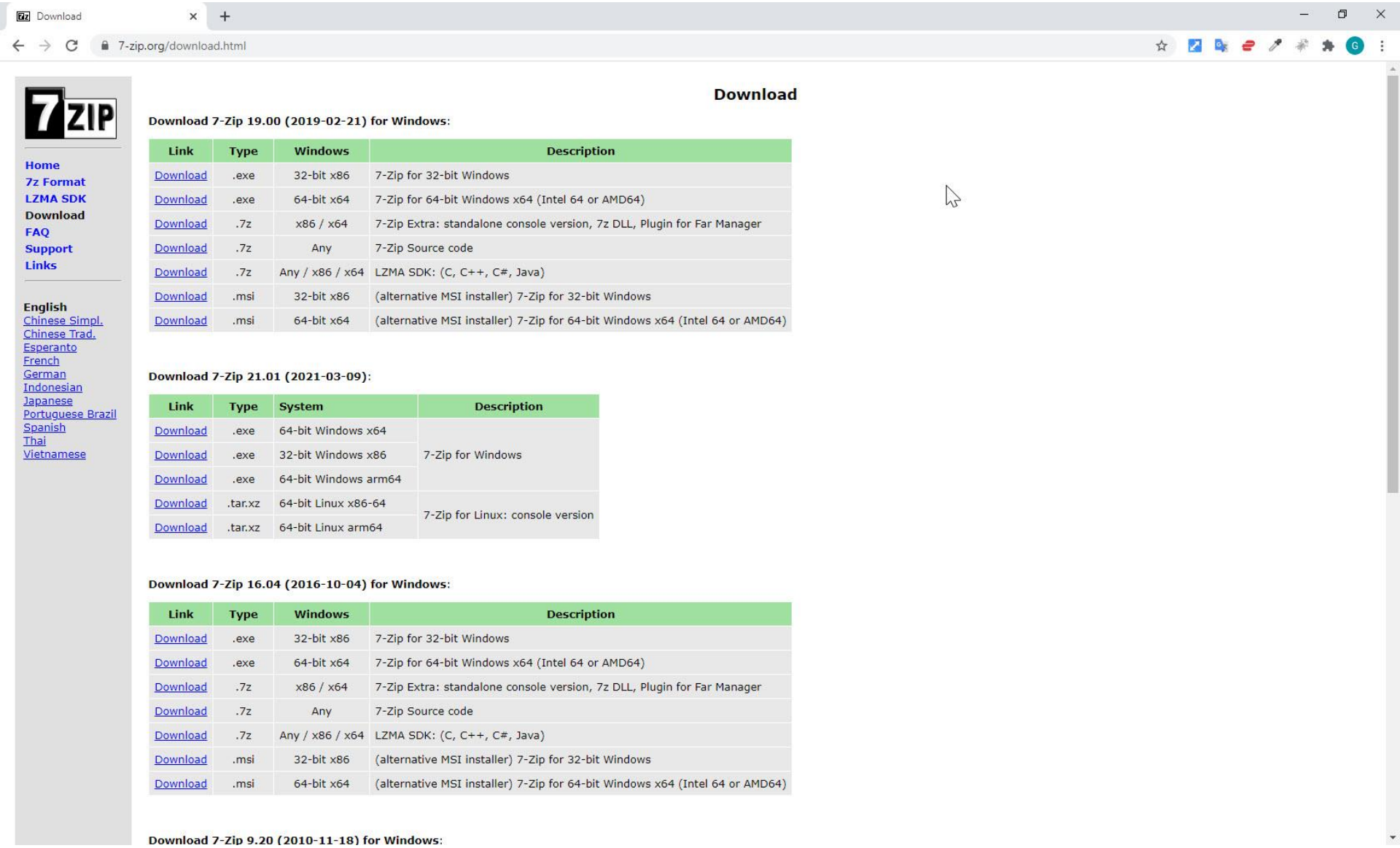
https://www.autodesk.com/support/technical/article/caas/sfdcarticles/sfdcarticles/System-requirements-for-Revit-2024-products.html

Software requirements

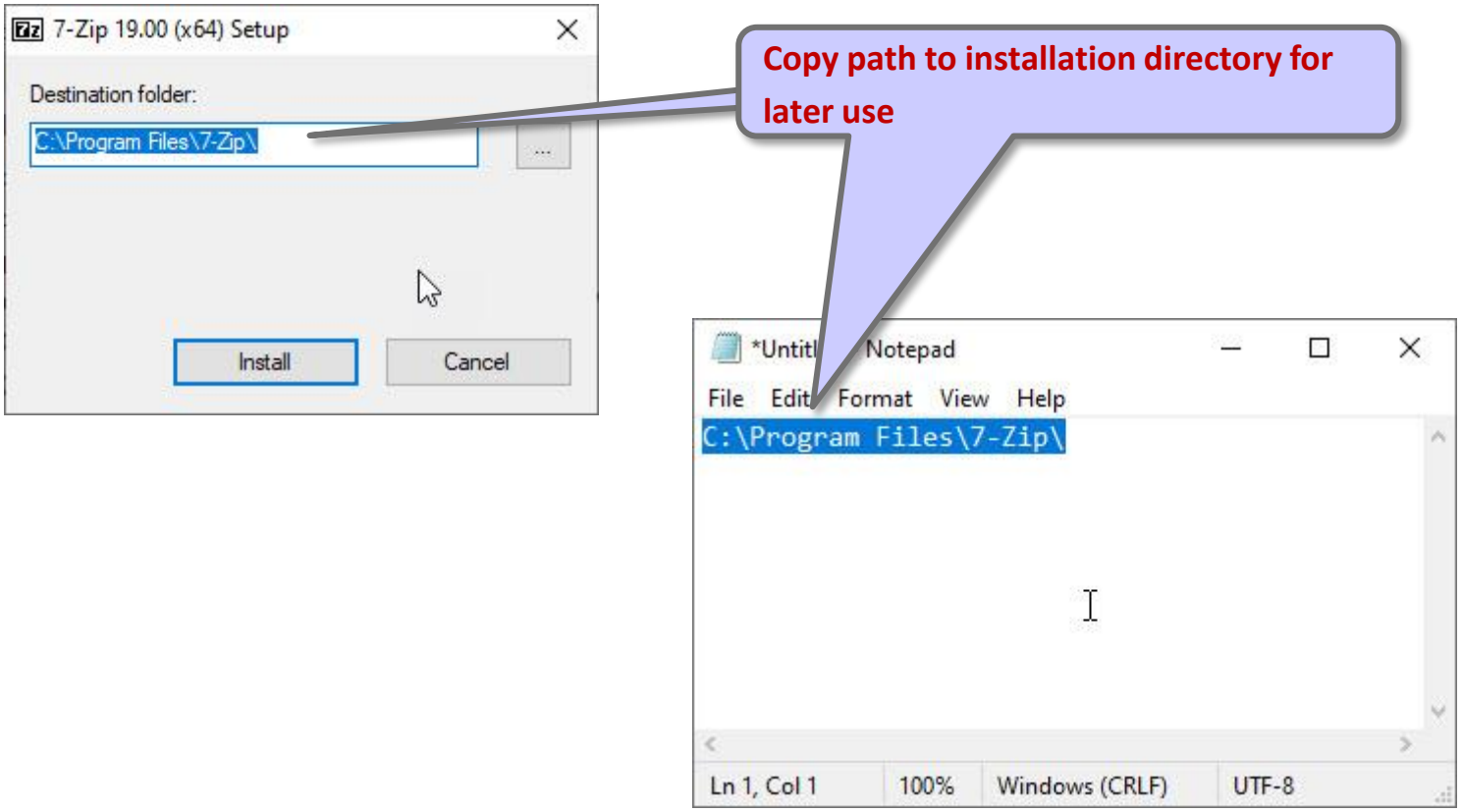
1. Install Revit
2. **Install 7-Zip**



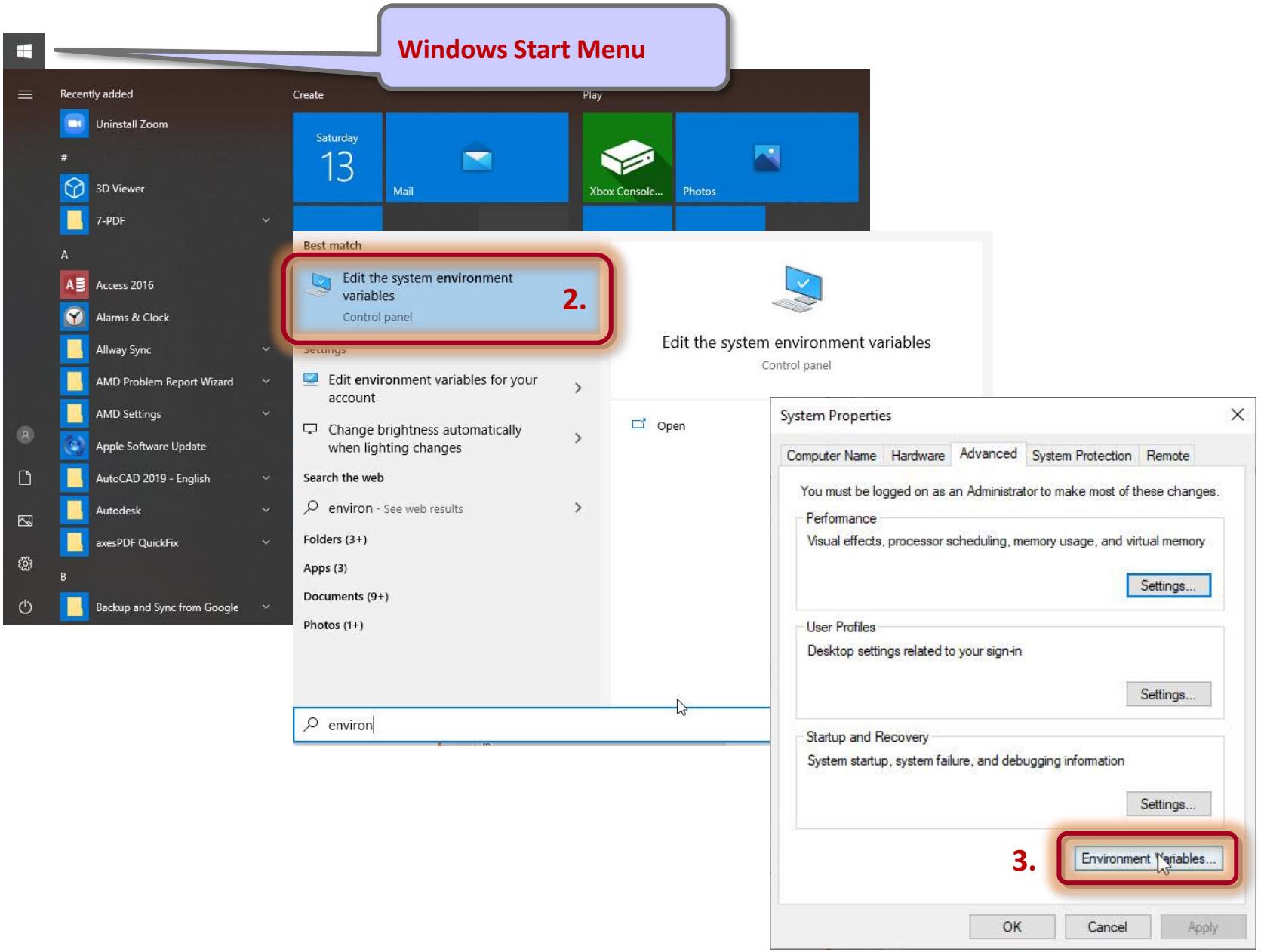
Download 7-Zip (https://www.7-zip.org/download.html)



Run 7-Zip installer



Windows: Add path to 7-Zip directory to Environment Variables



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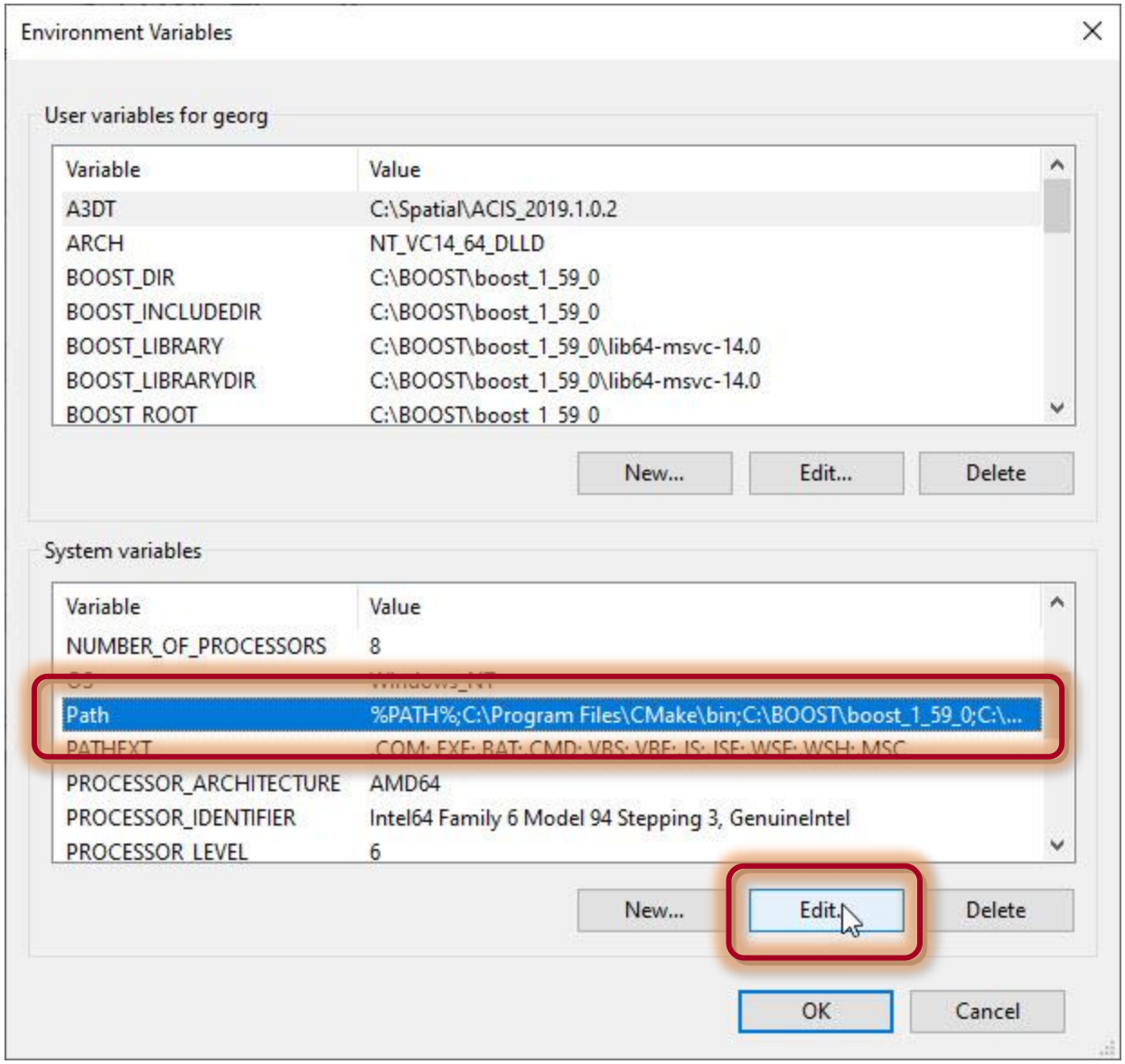

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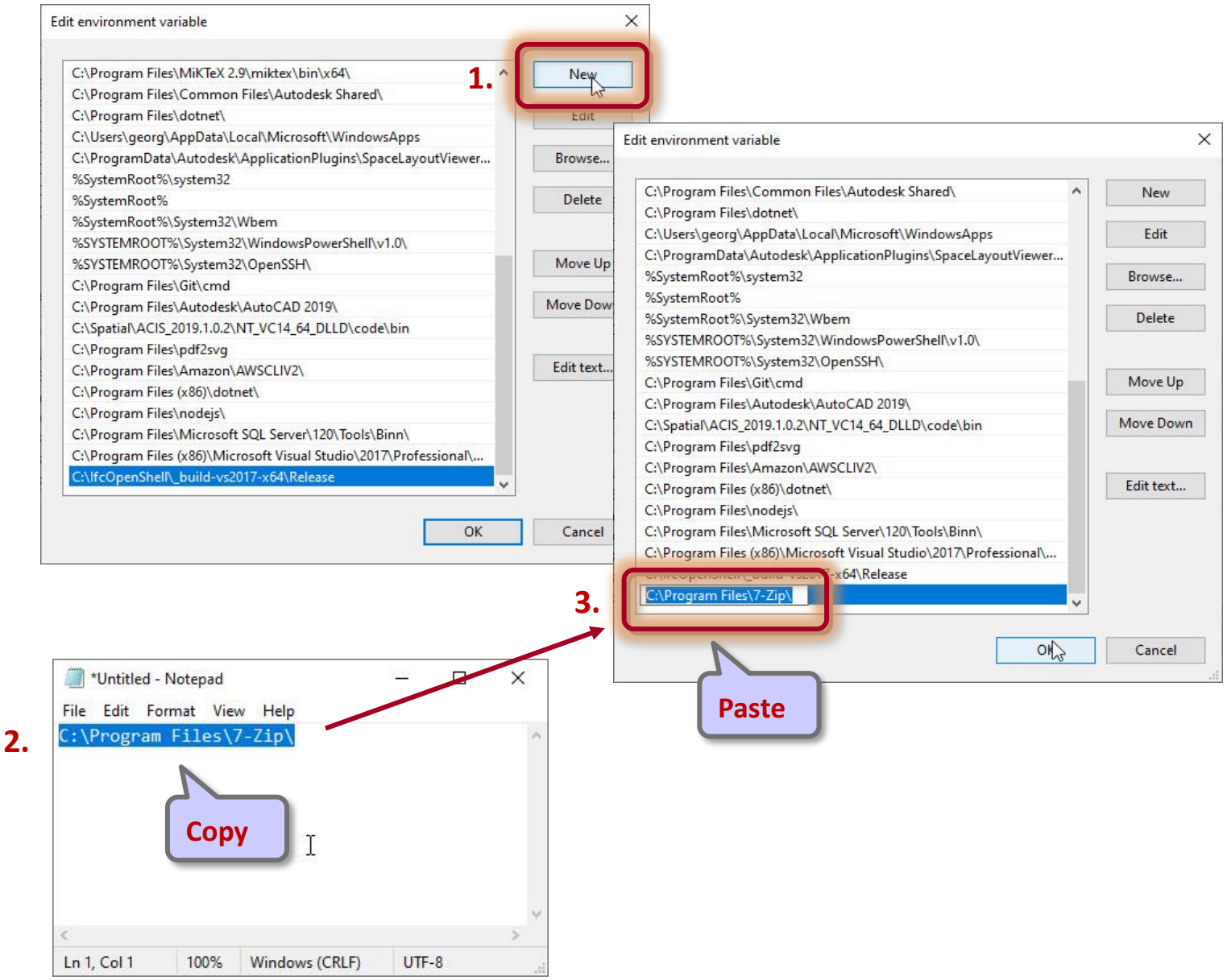
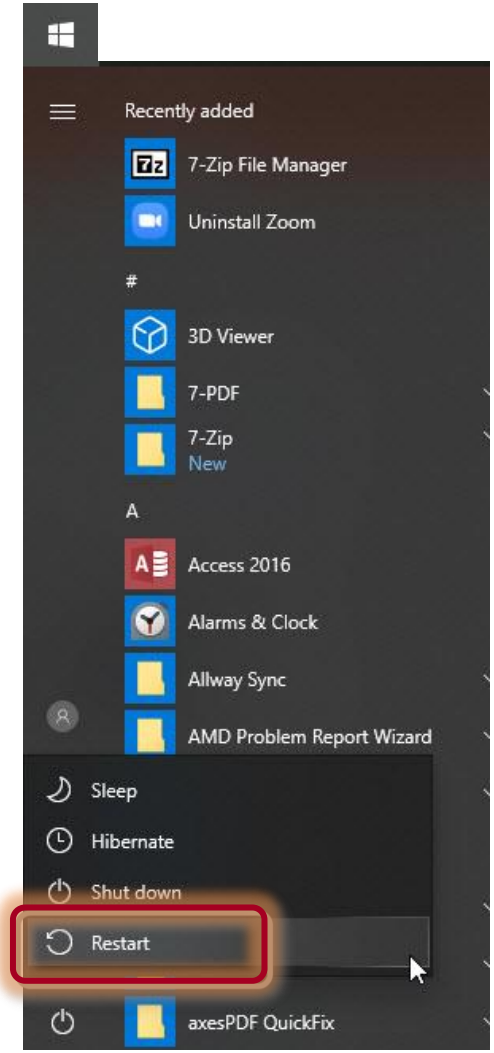


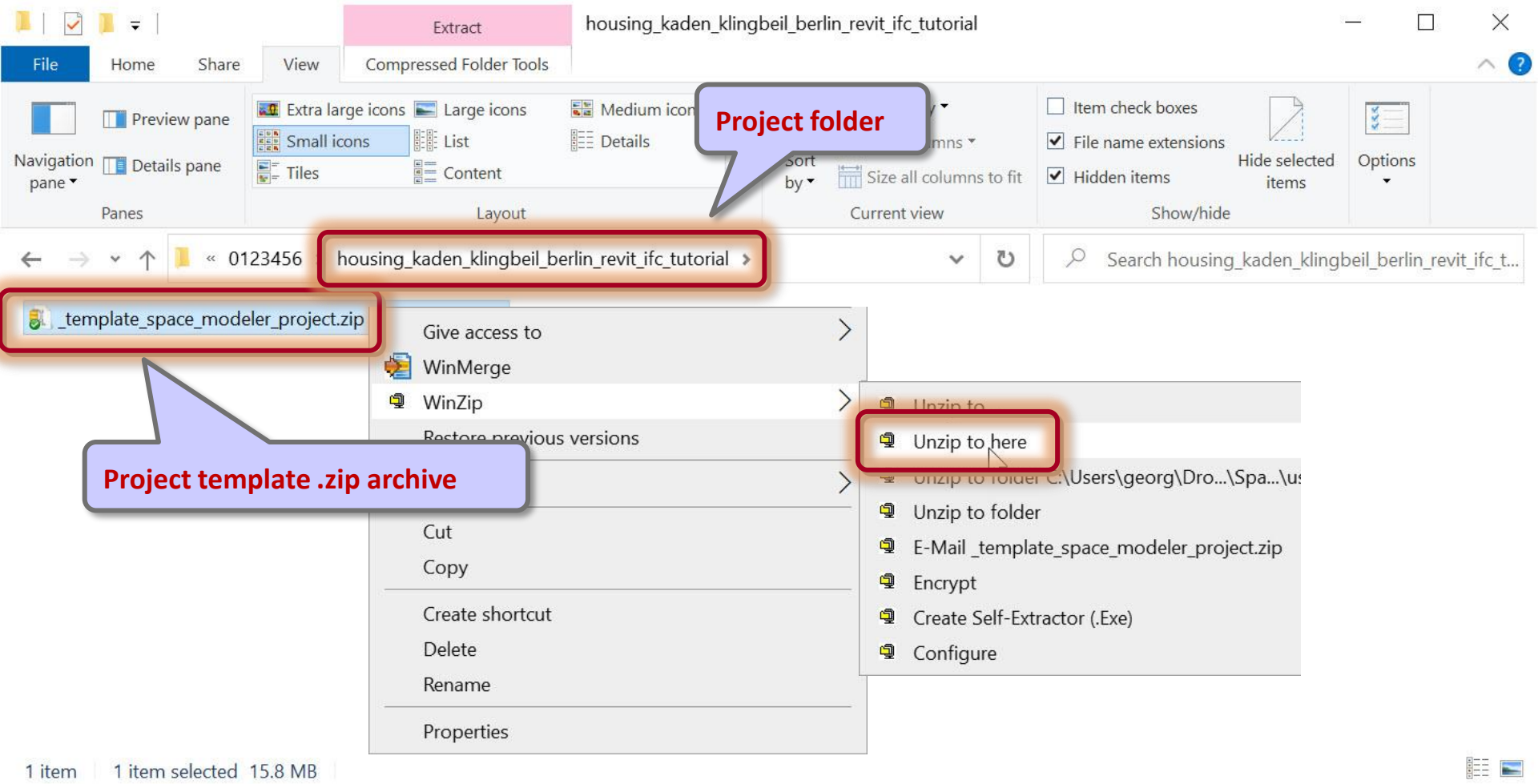
Restart your computer



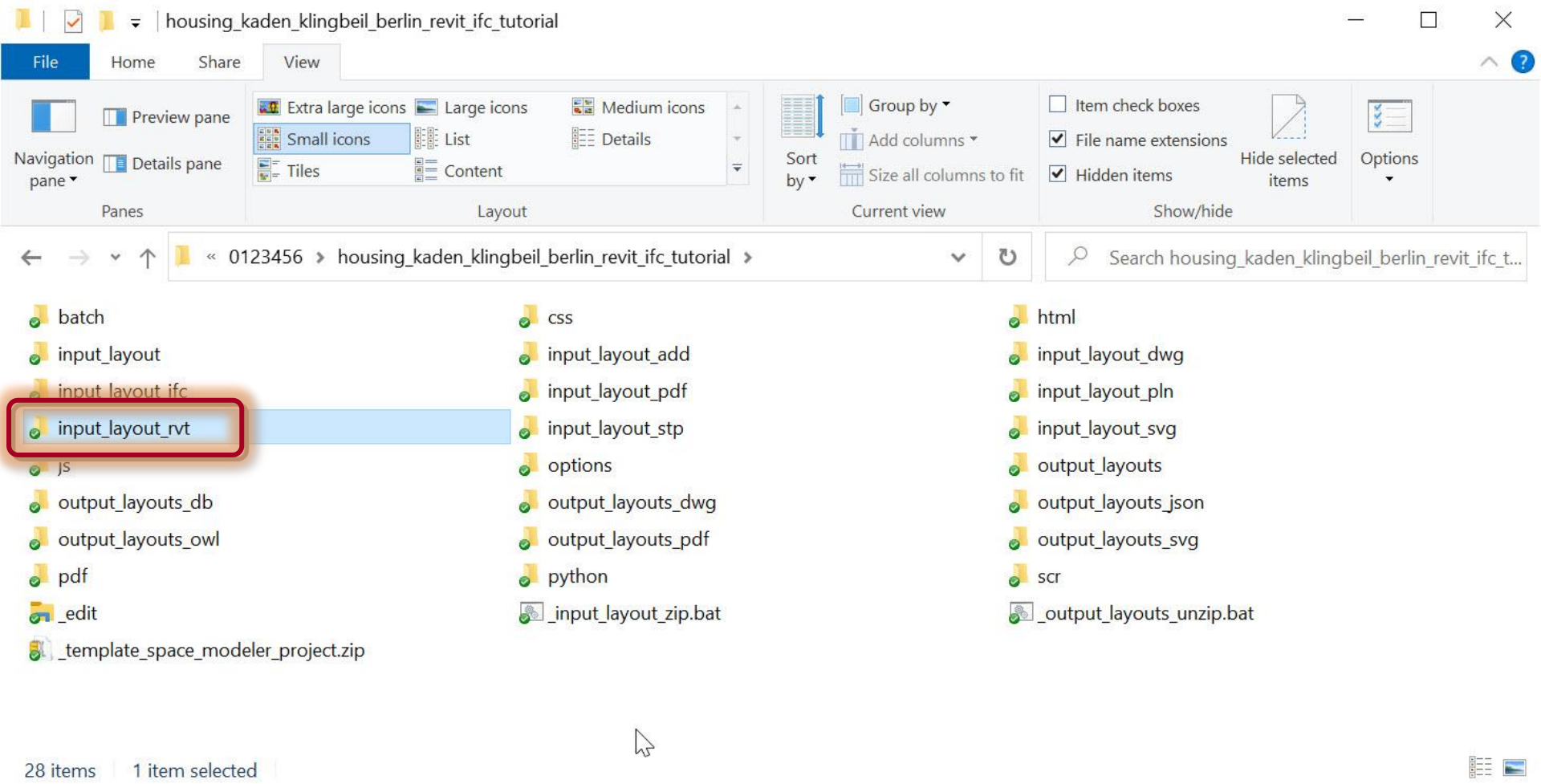
Steps

1. **Set up project**
2. Import pdf of original floor plan
3. Set floor-to-floor height
4. Determine internal and external spaces
5. Create building elements
6. Create windows
7. Create horizontal external elements
8. Create geocoordinates
9. Generate space model

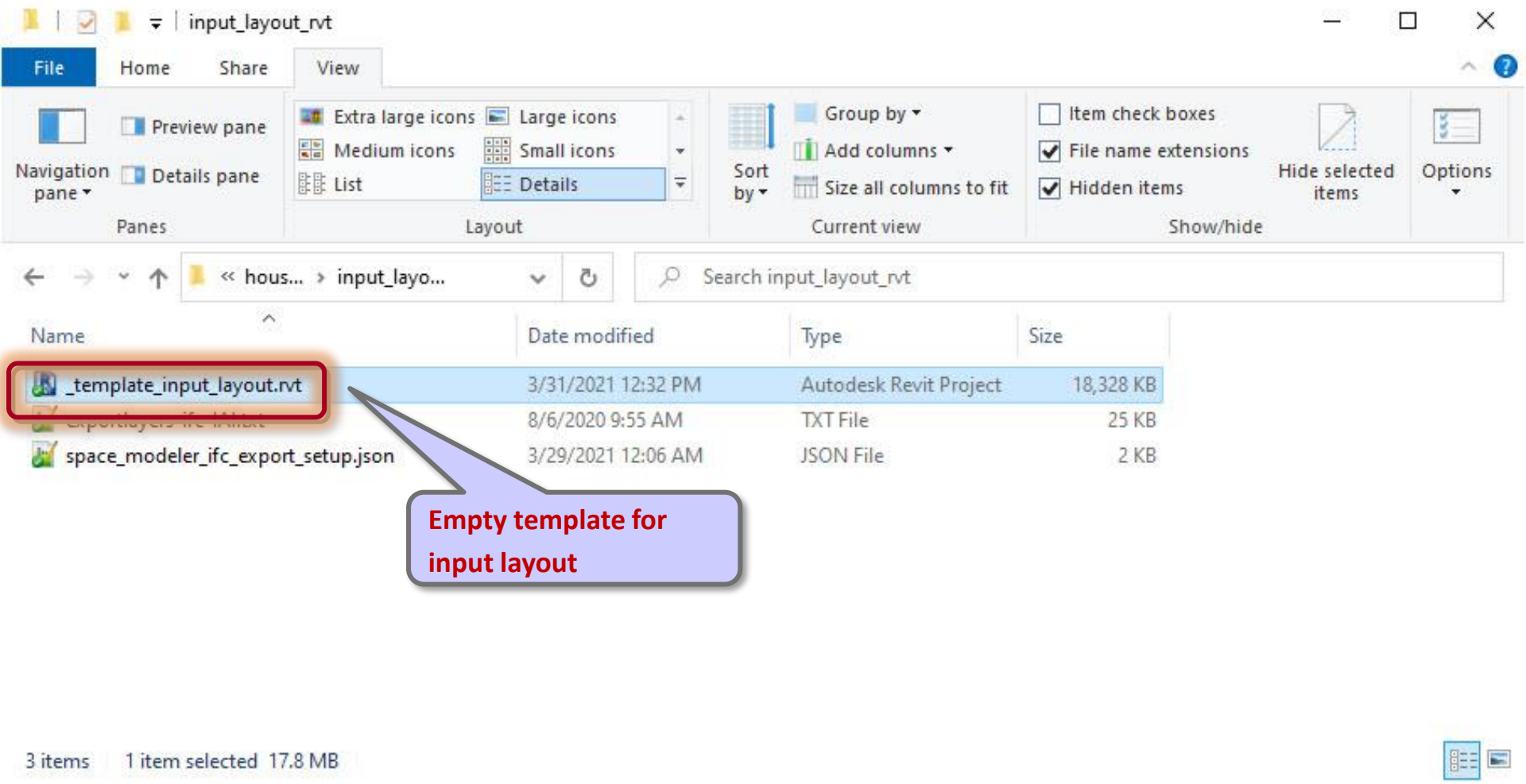
_template_space_modeler_project.zip > WinZip > Unzip to here



Open ‘input_layout_rvt’ folder



Make a copy of '_template_input_layout.rvt' (or rename it to 'input_layout.rvt')



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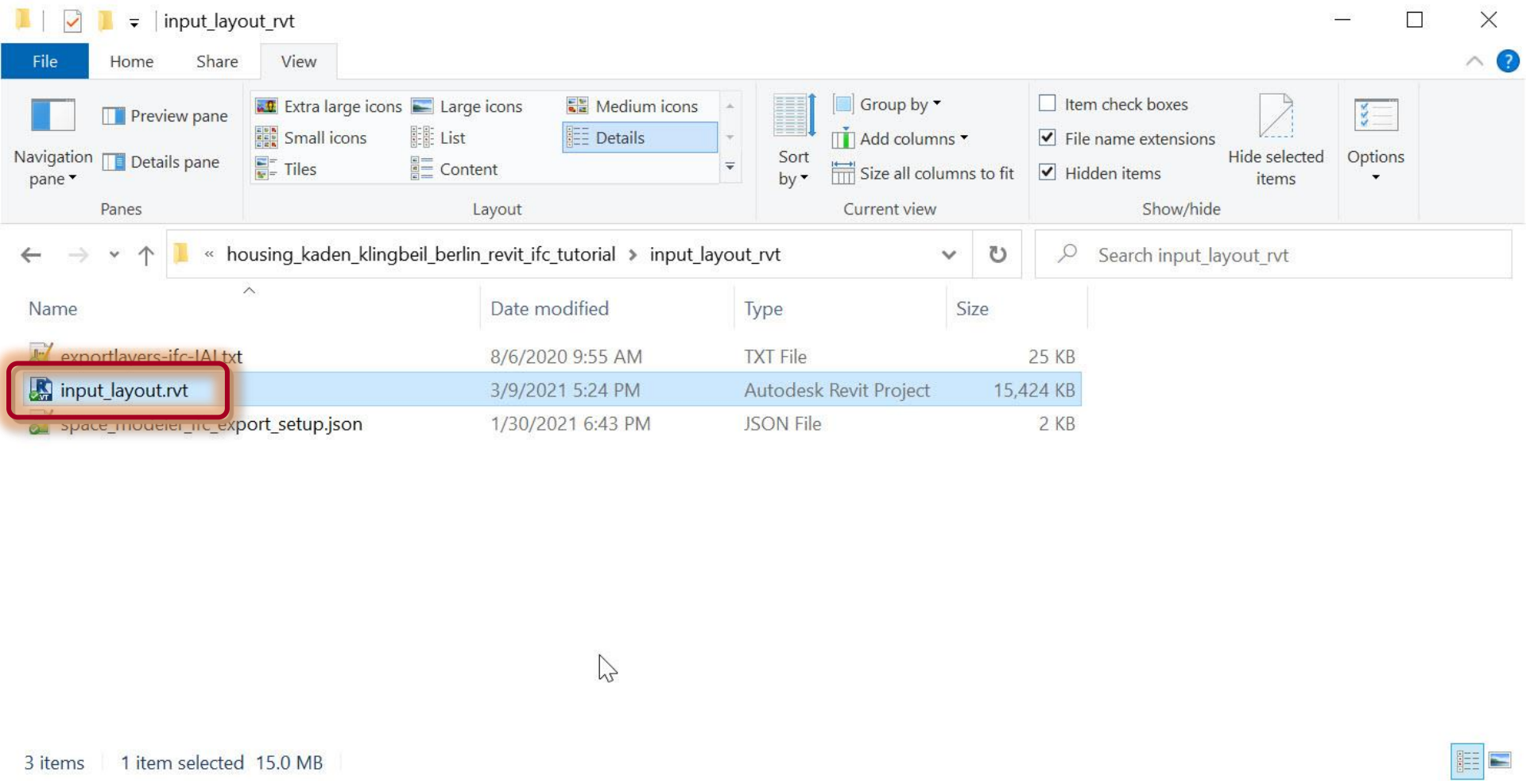
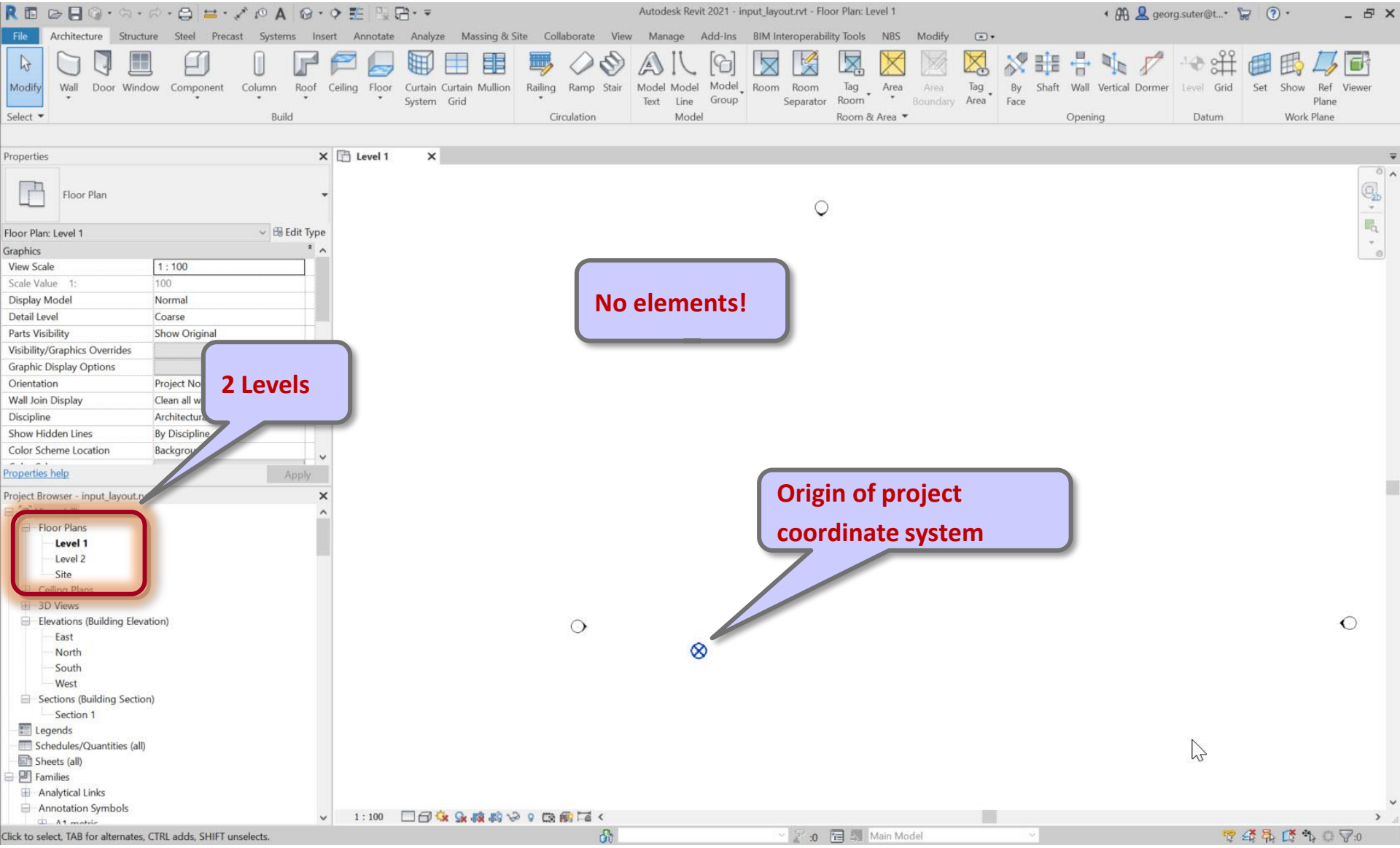


‘input_layout.rvt’



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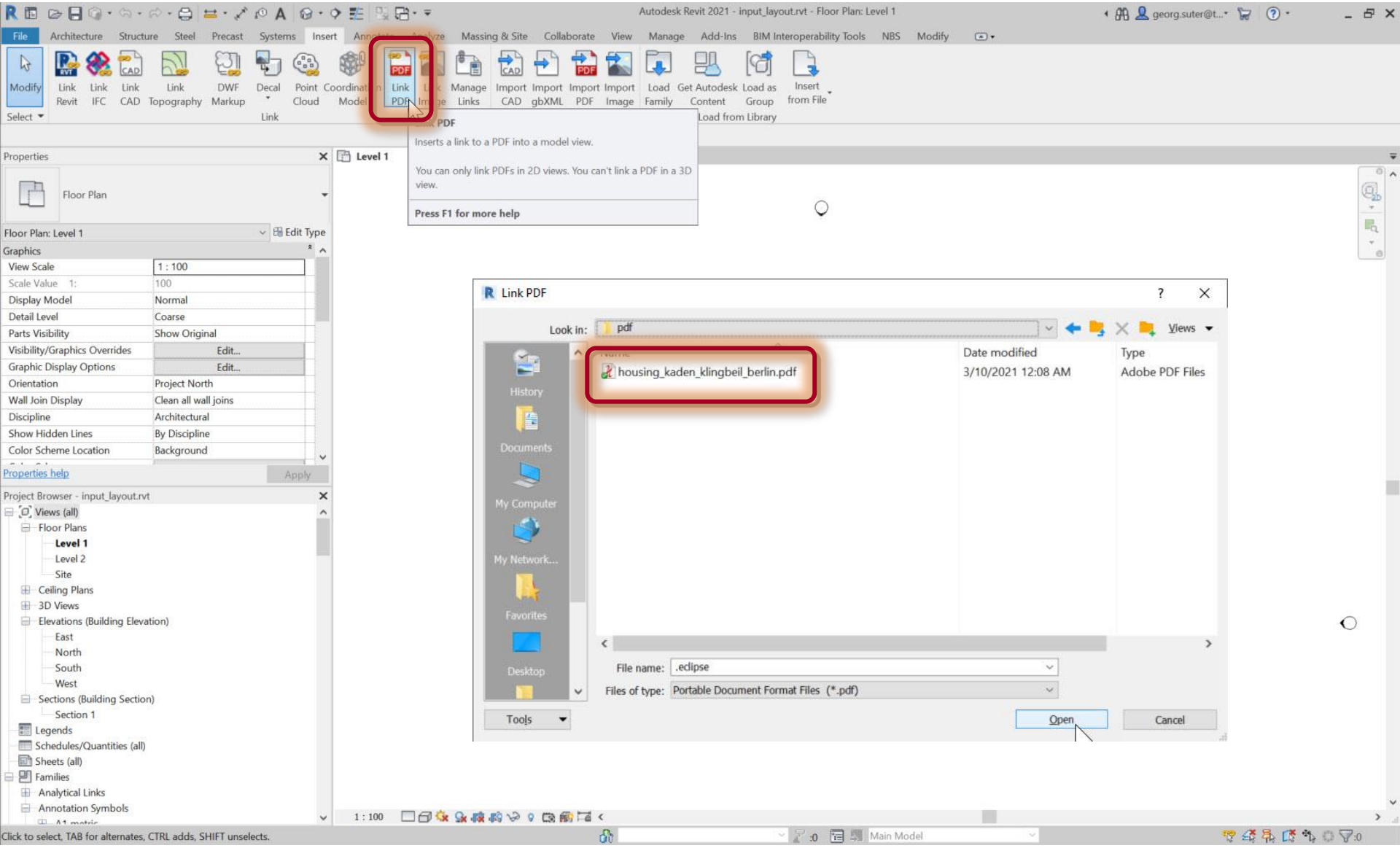
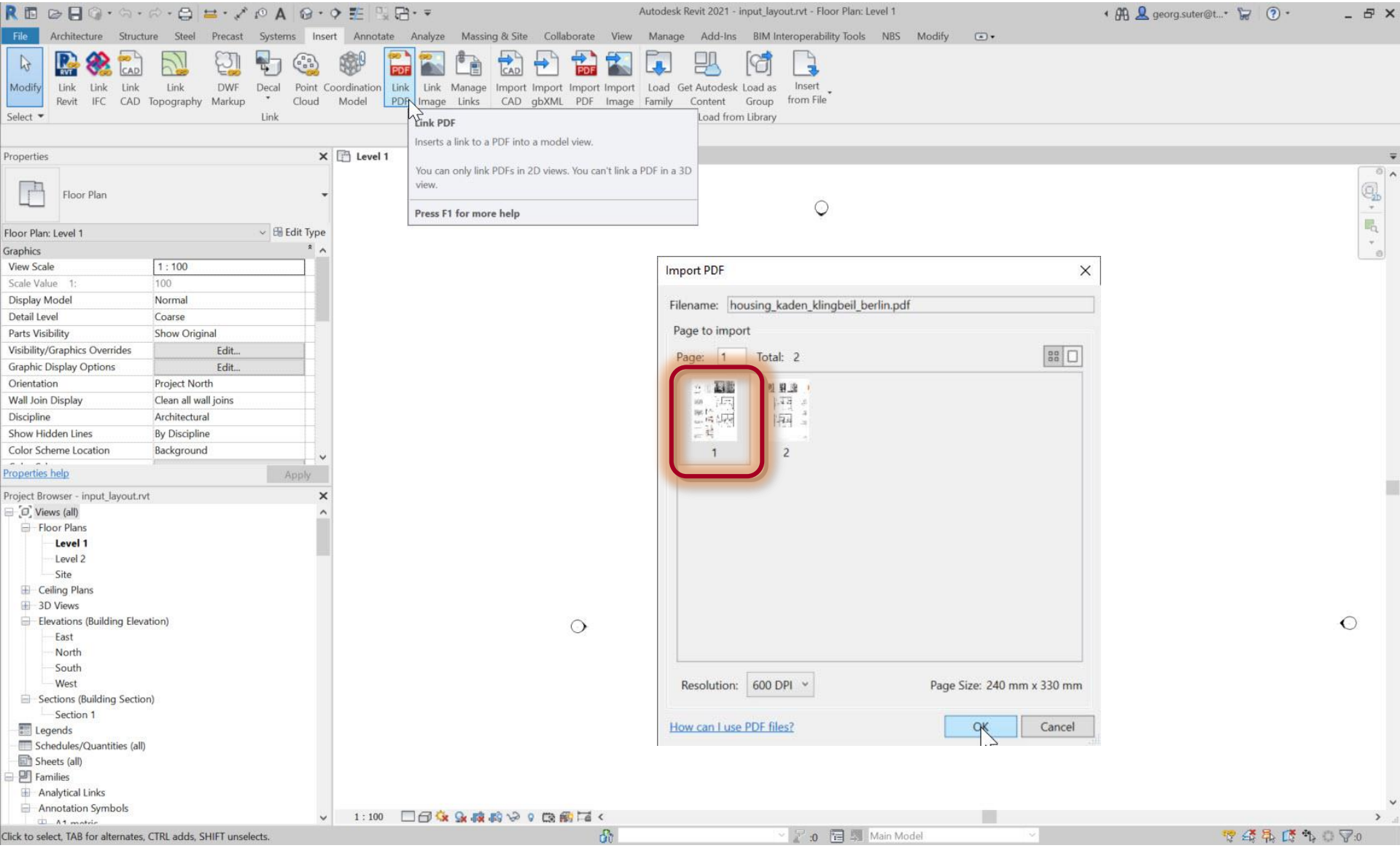
14. Create .zip archive
15. Generate space model

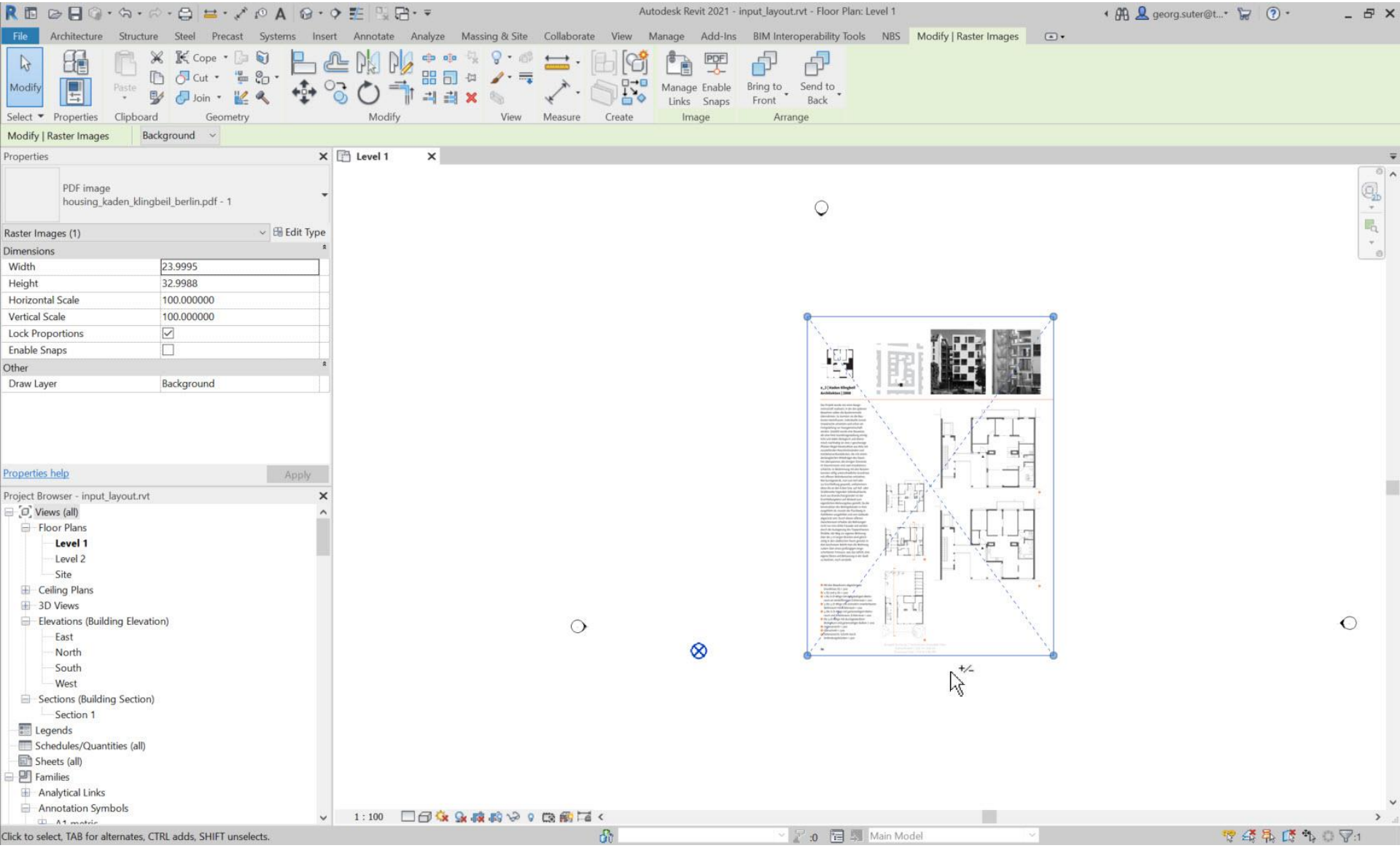
Insert > Link > Link PDF



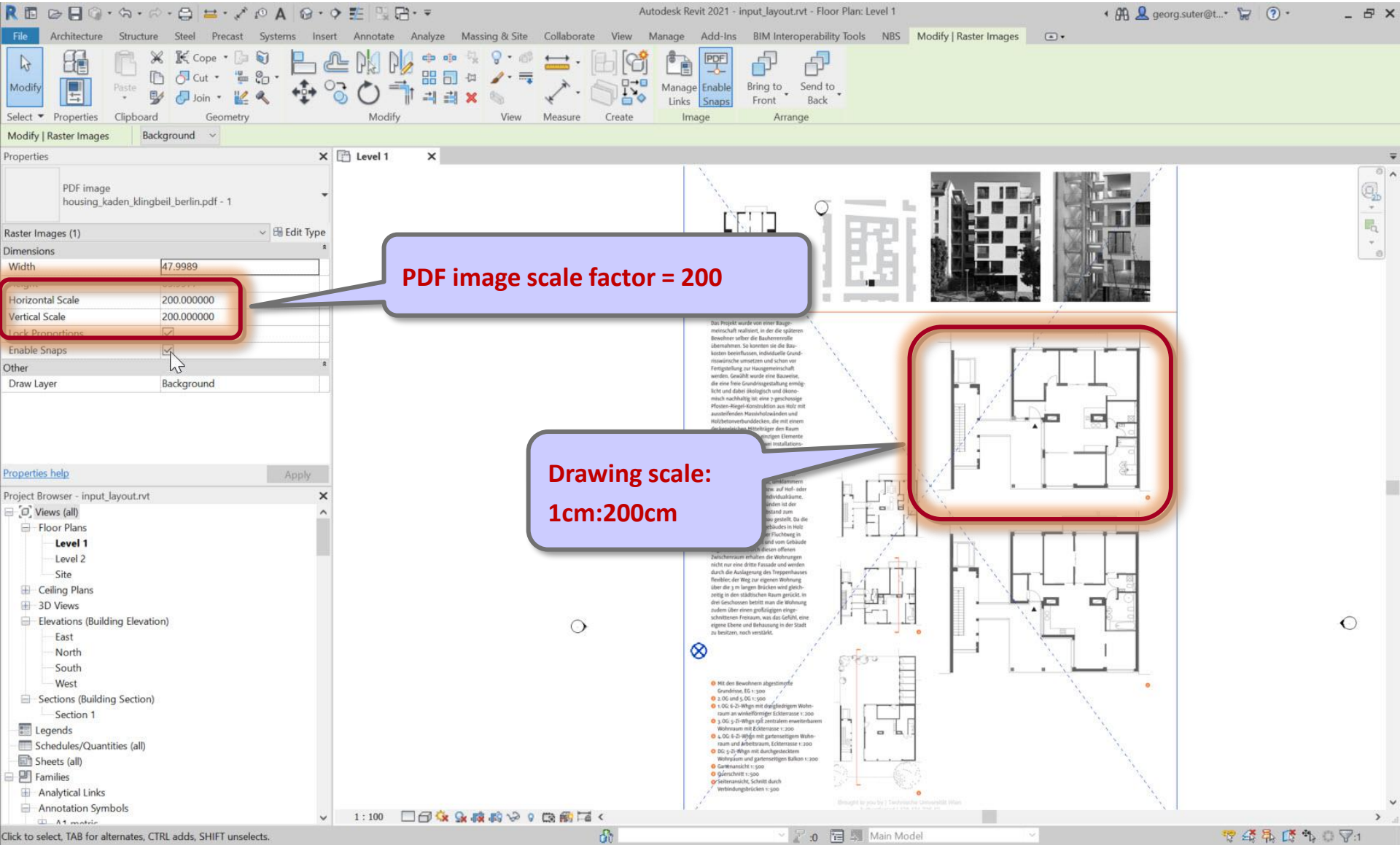
Insert > Link > Link PDF



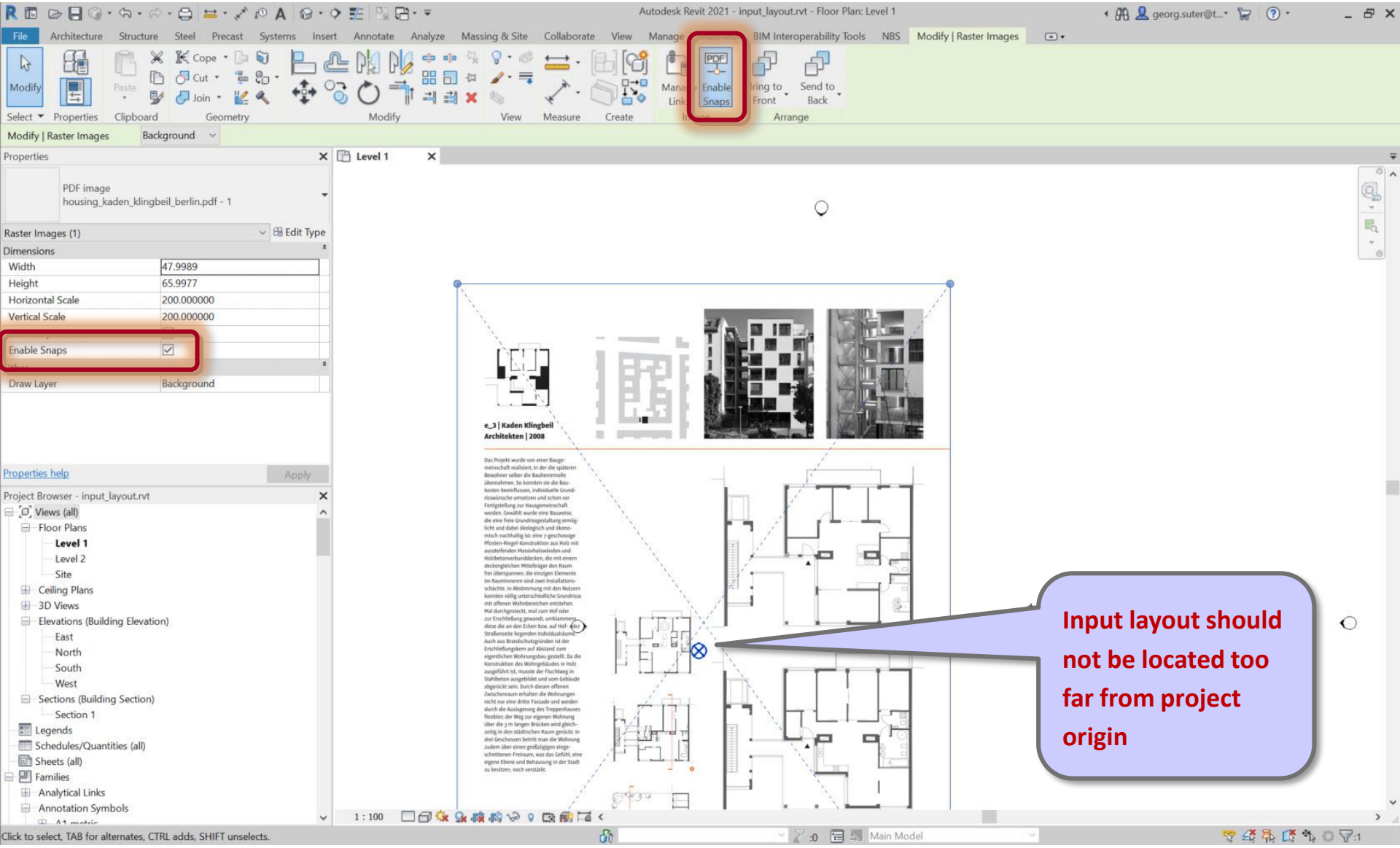
Insert > Link > Link PDF



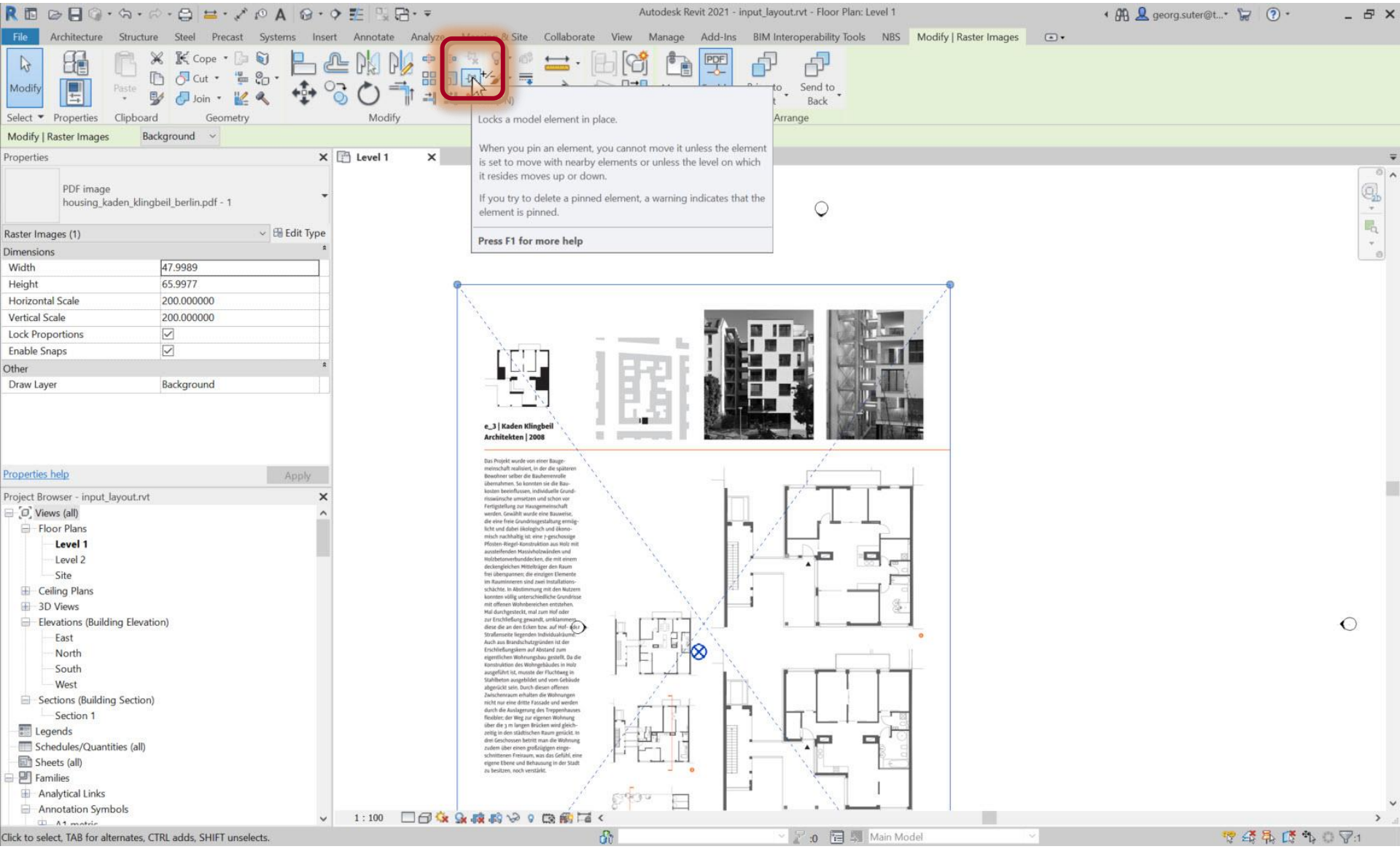
Scale pdf



Enable Snaps to lines in PDF



Pin to lock pdf



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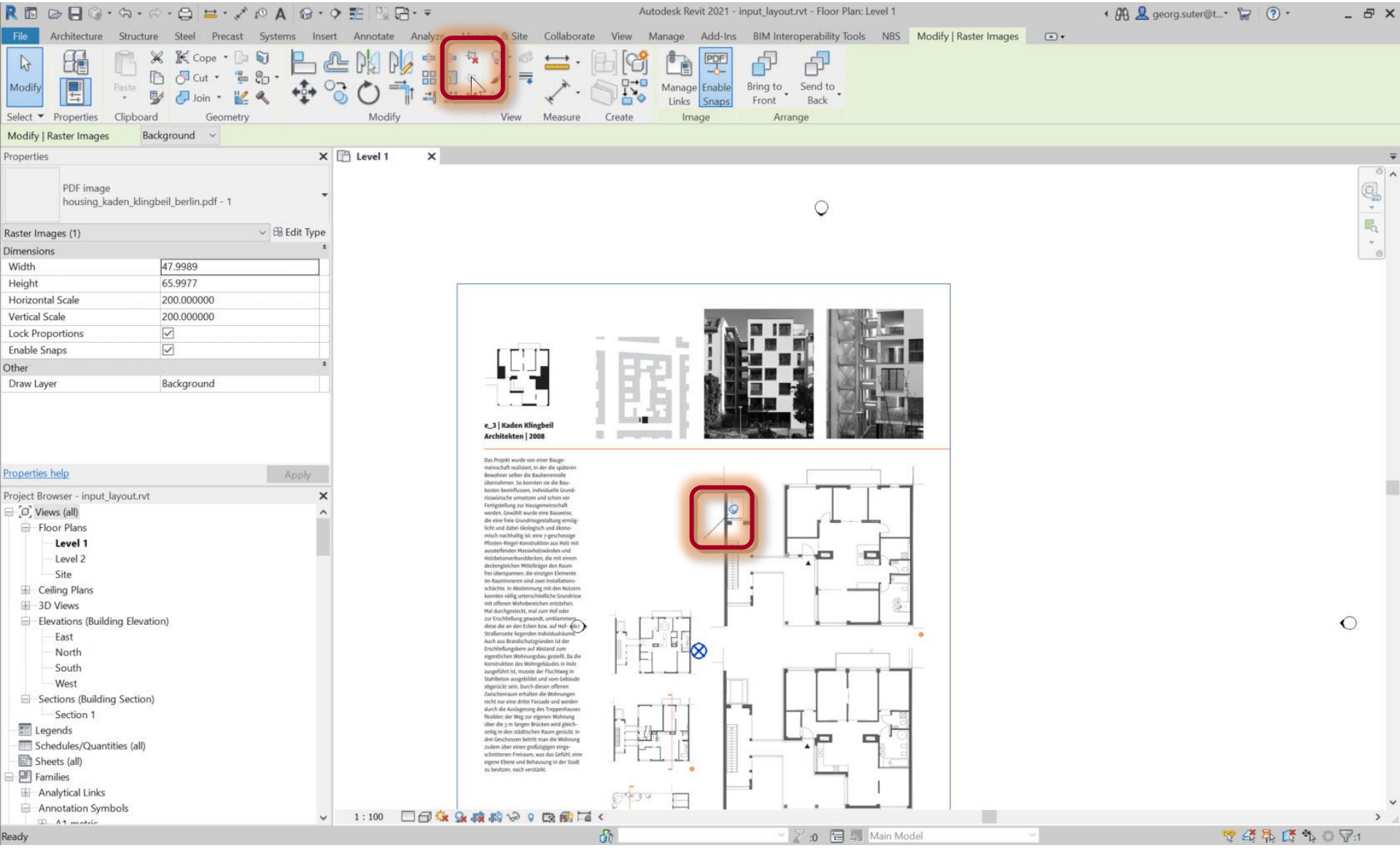
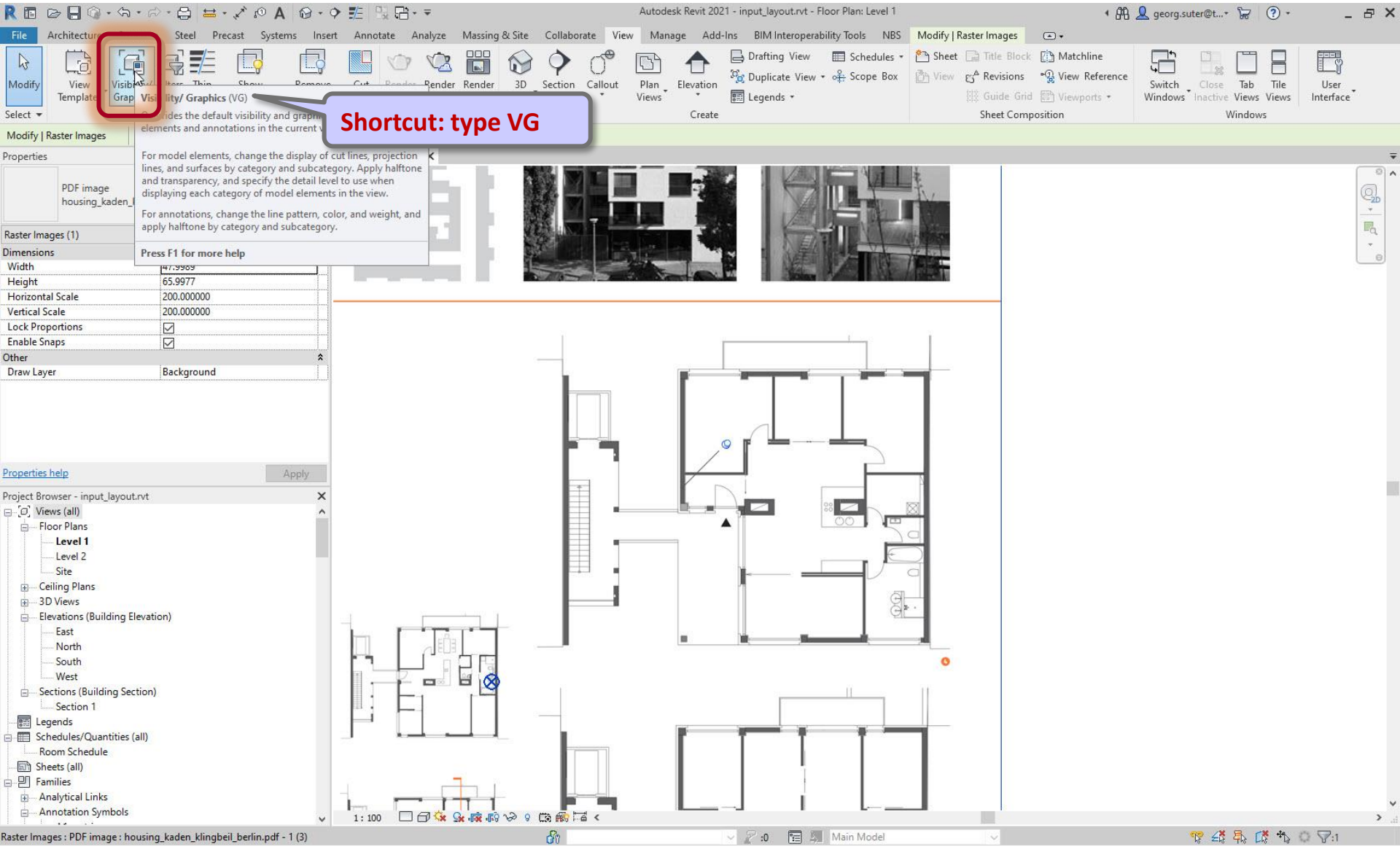
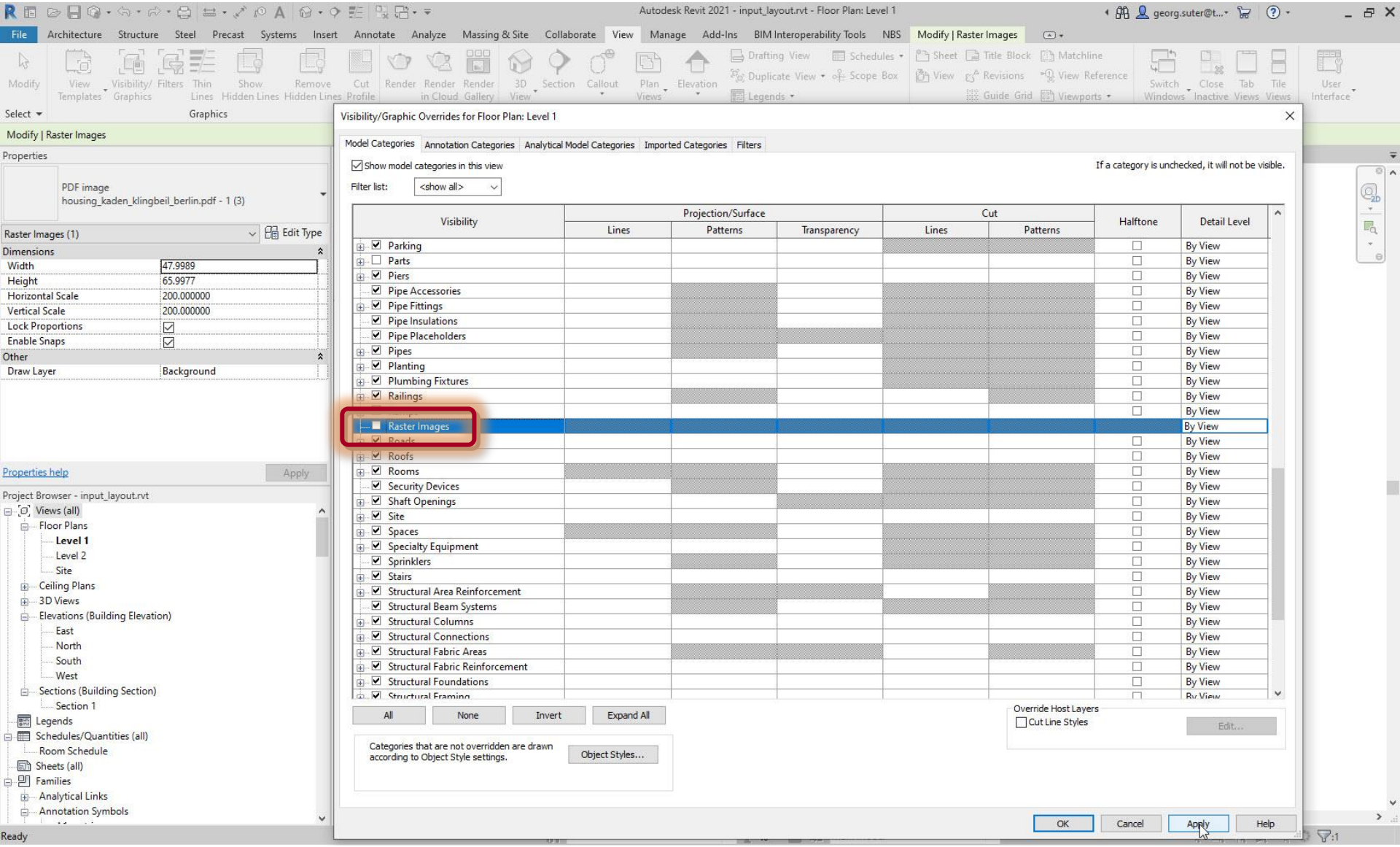


View > Visibility / Graphics



Uncheck ‘Raster Images’ to hide pdf



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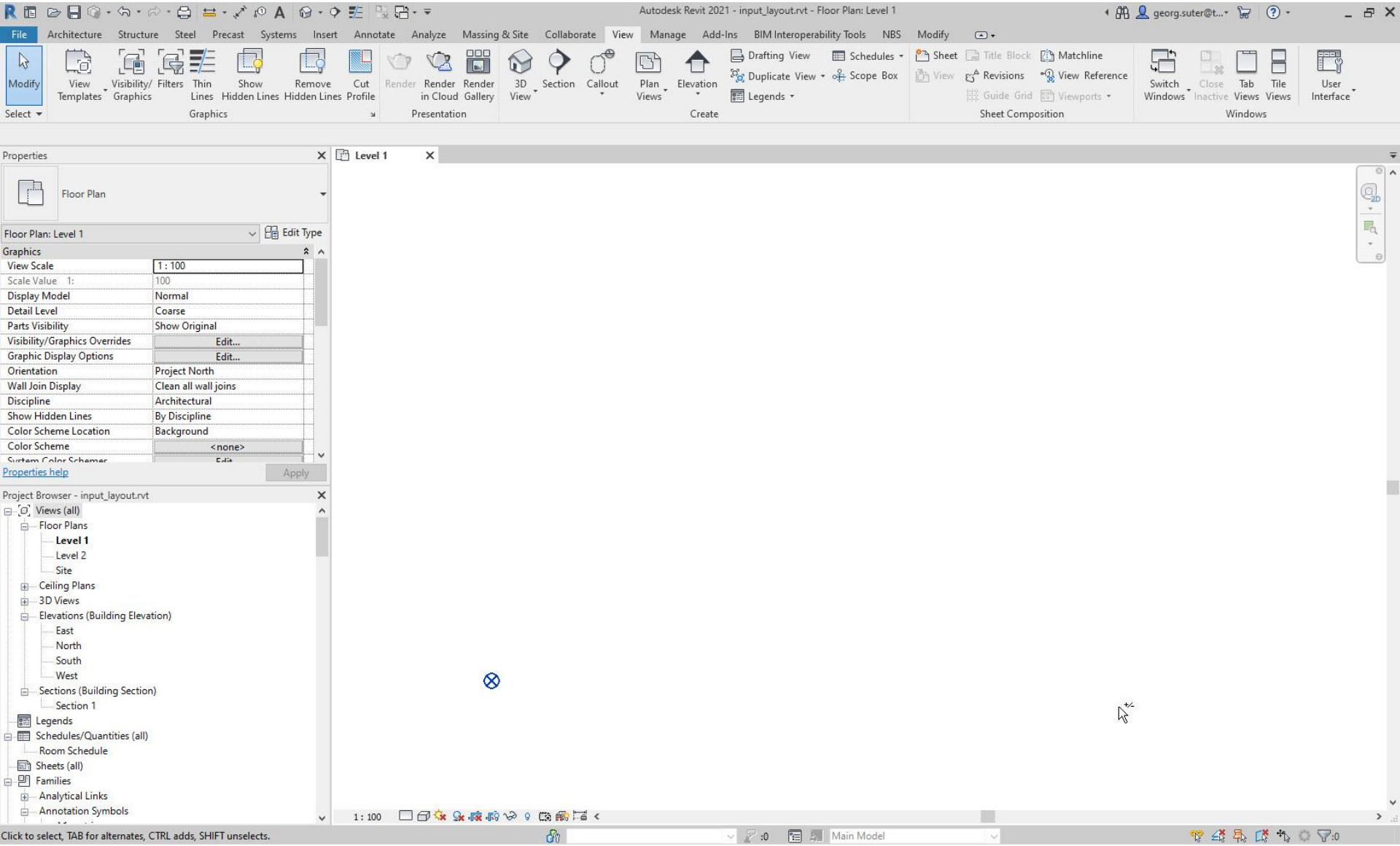
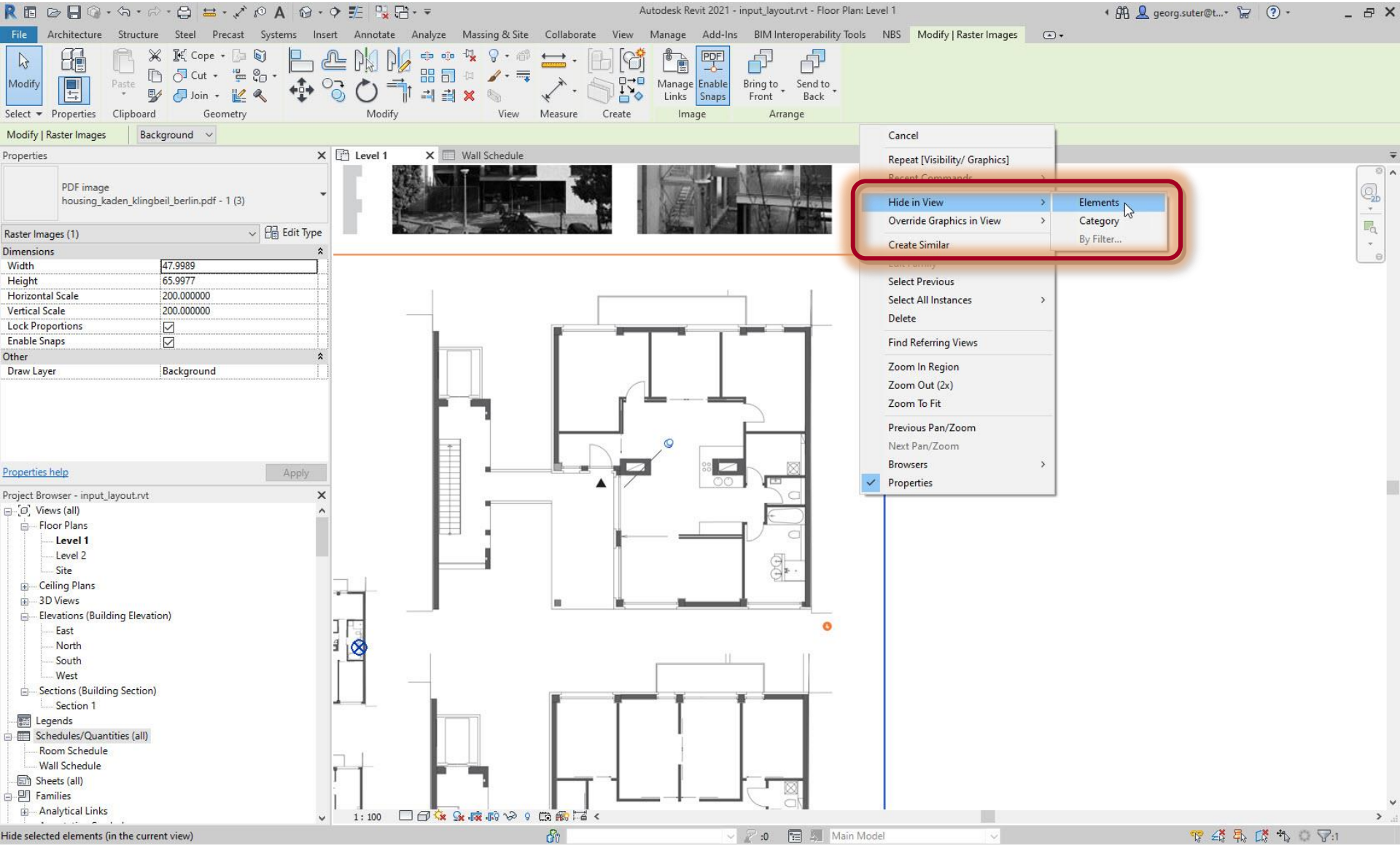
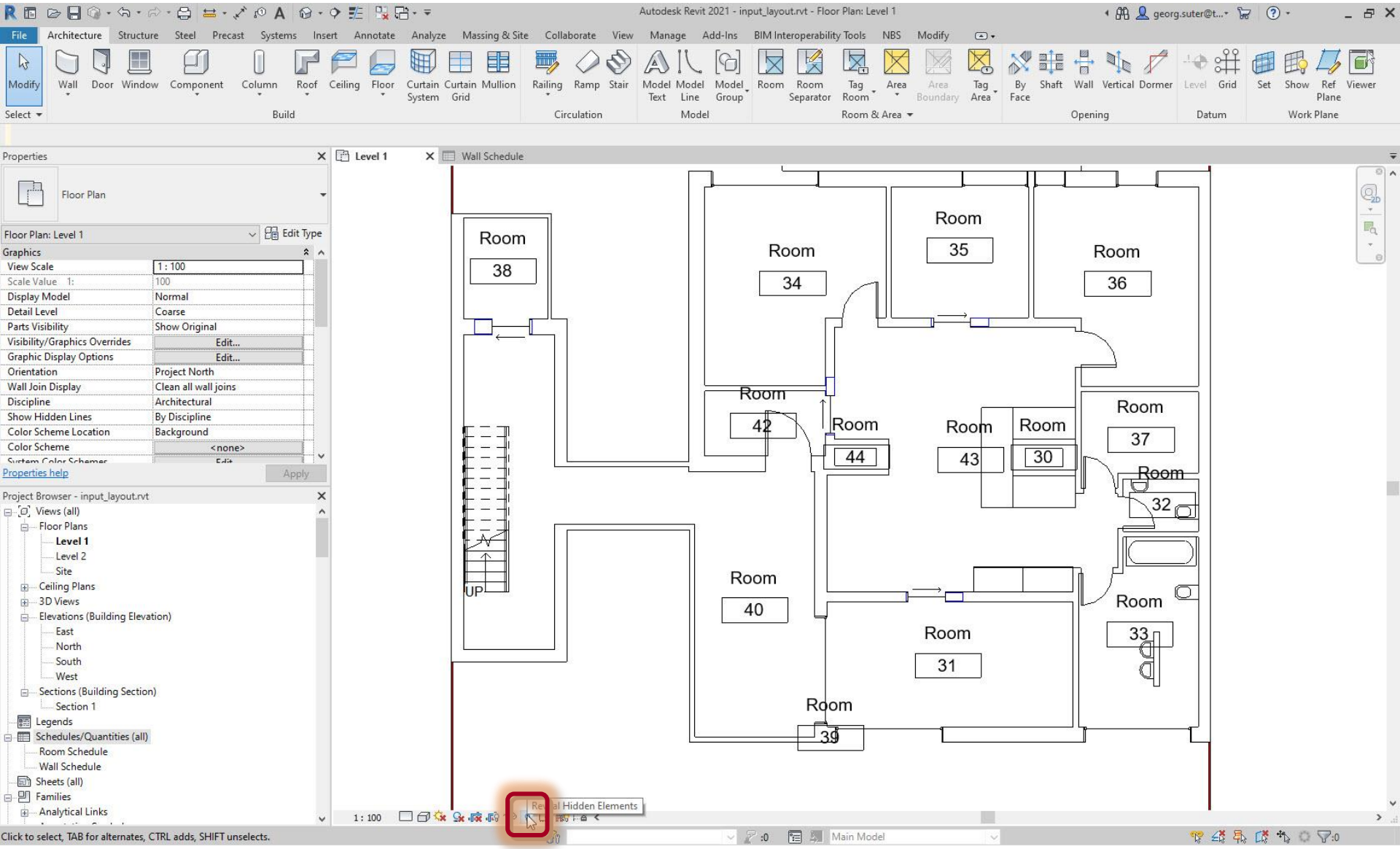


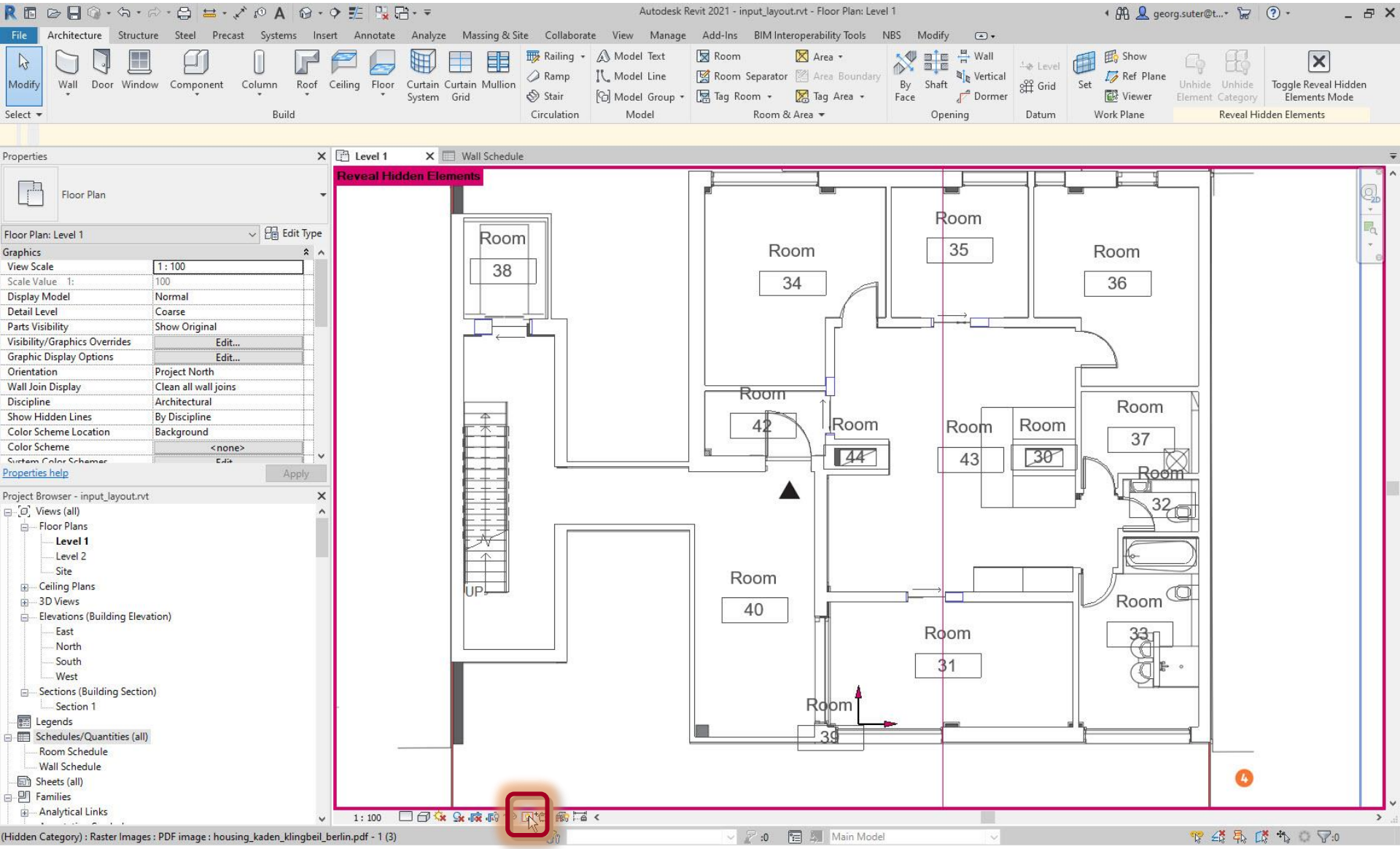
Alternative: Hide in View > Elements (or Category)



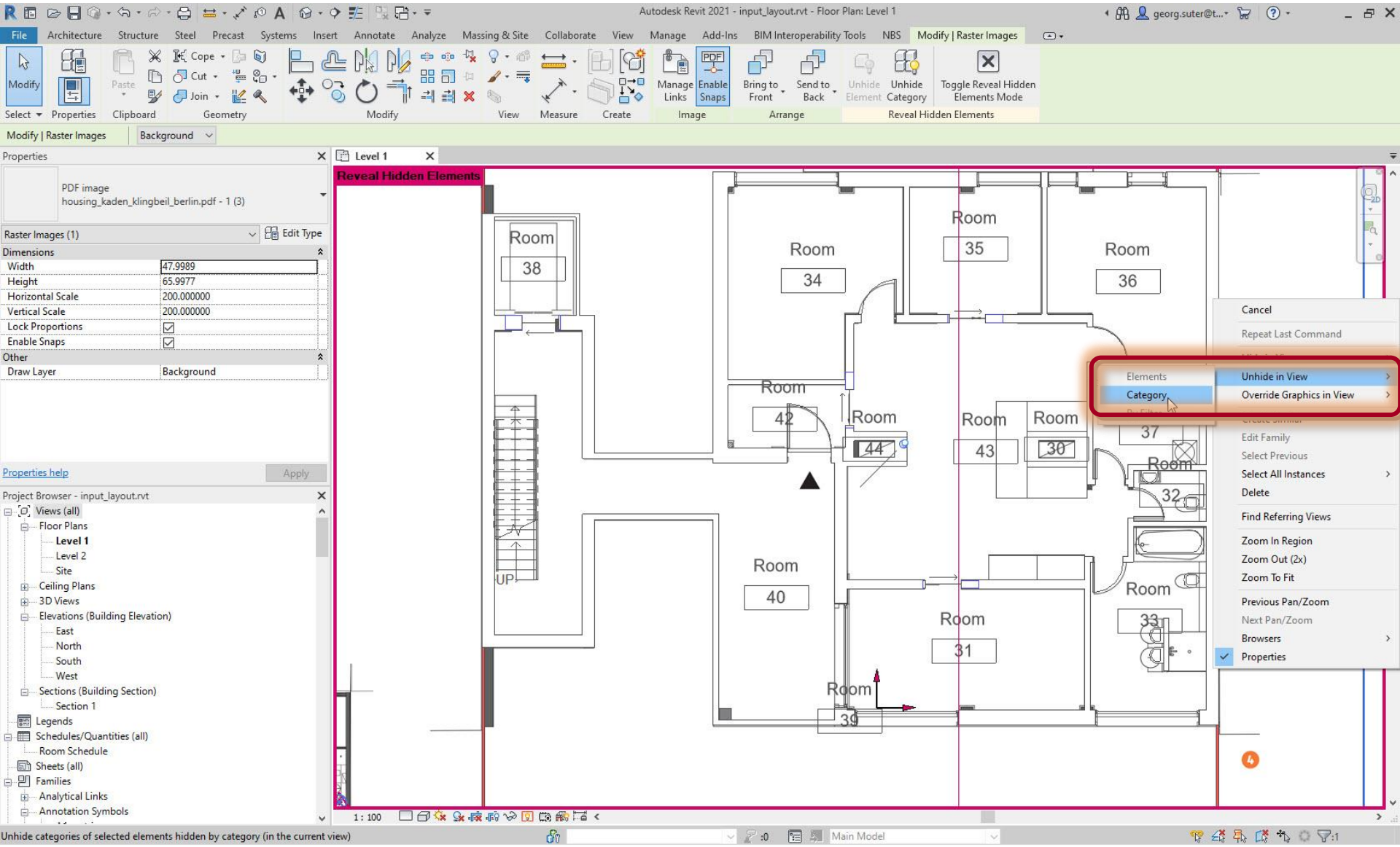
Alternative: Reveal Hidden Elements



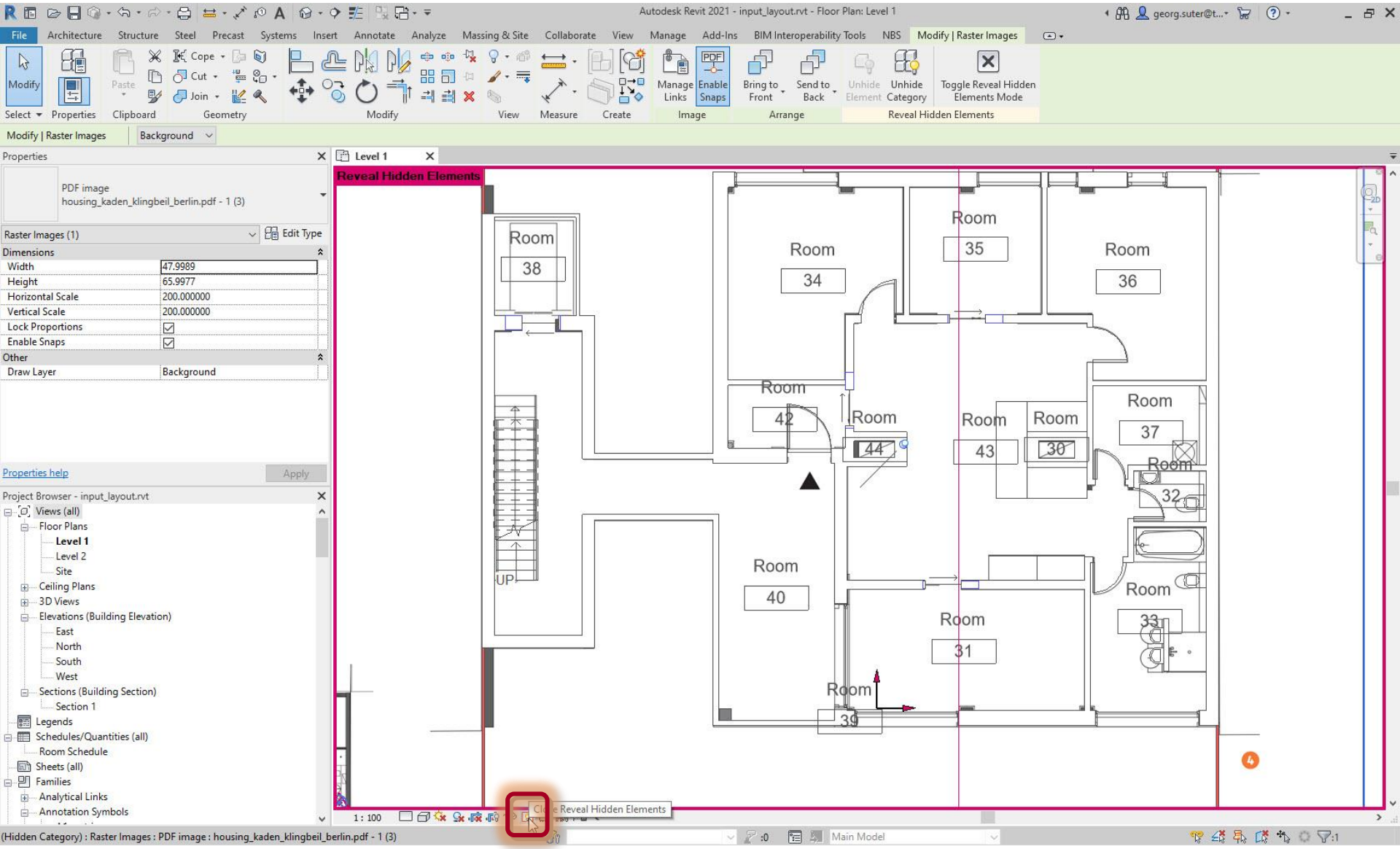
Alternative: Reveal Hidden Elements



Alternative: Unhide view > Category



Alternative: Close Reveal Hidden Elements



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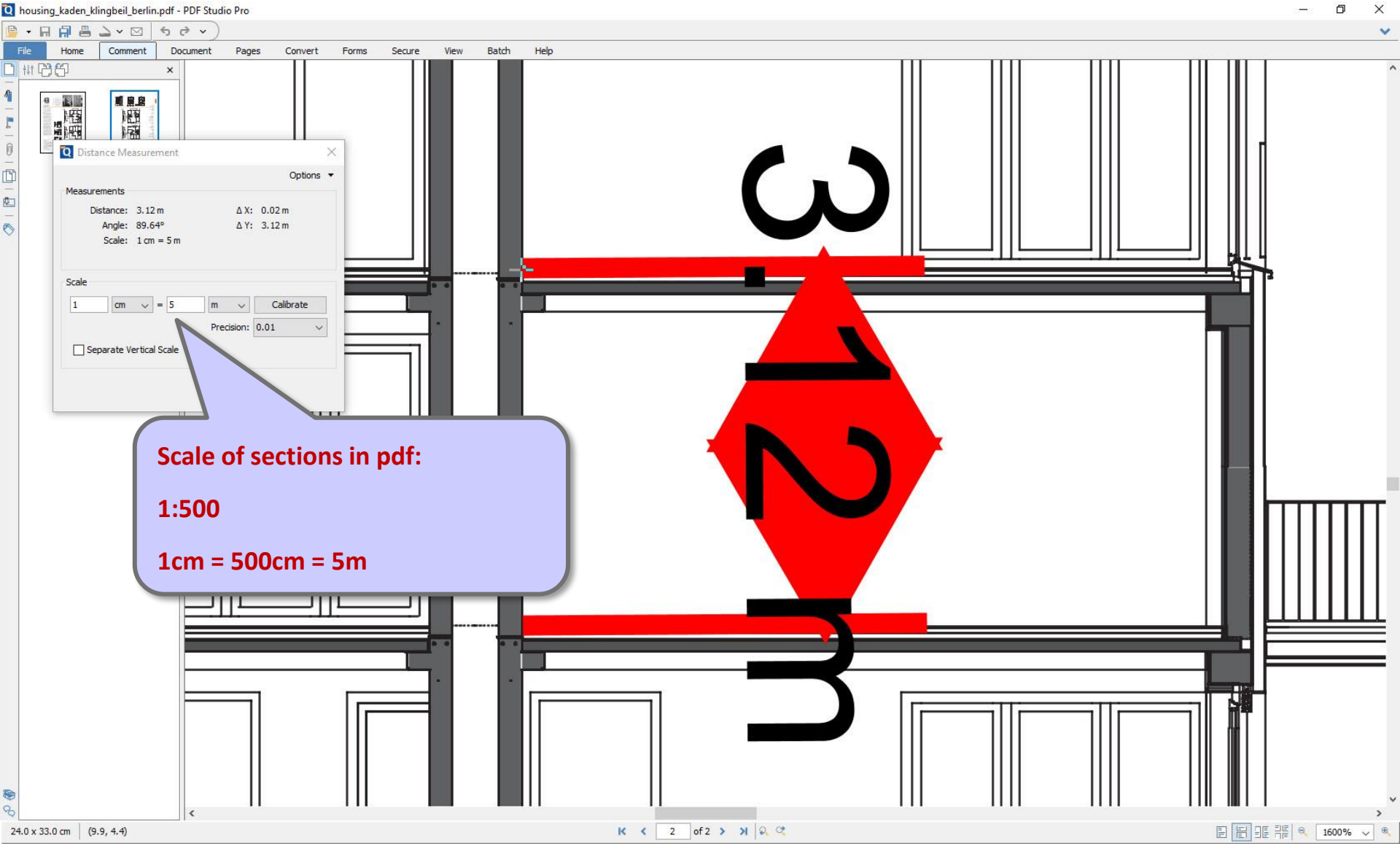
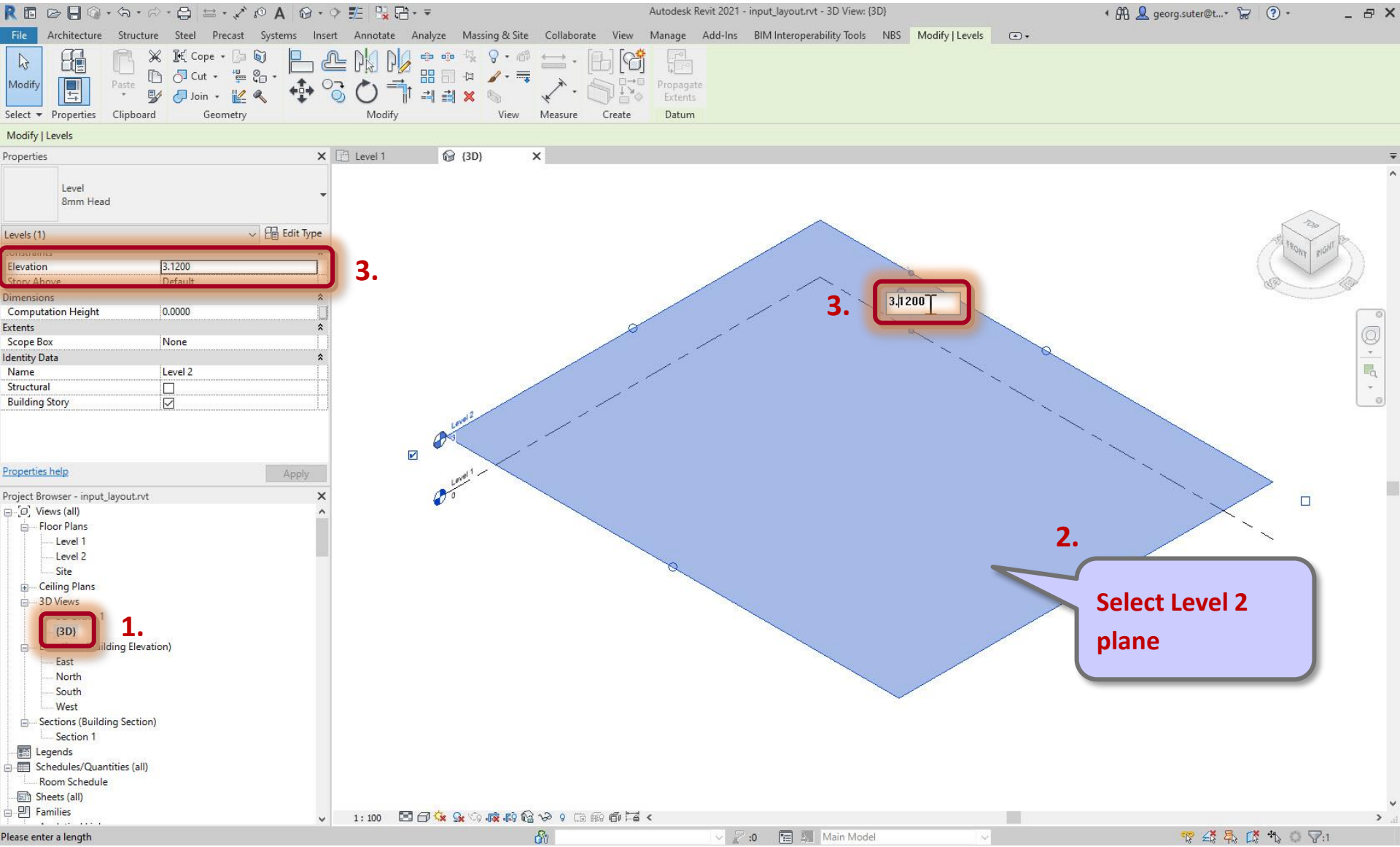
Original pdf document: determine floor-to-floor height



Set elevation of Level 2



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Determine internal and external spaces

Internal spaces

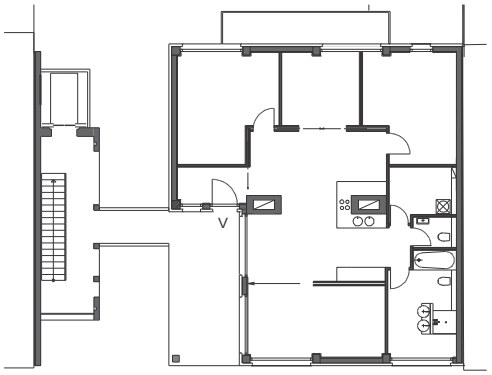
- Fully or partially separated by building enclosure from exterior

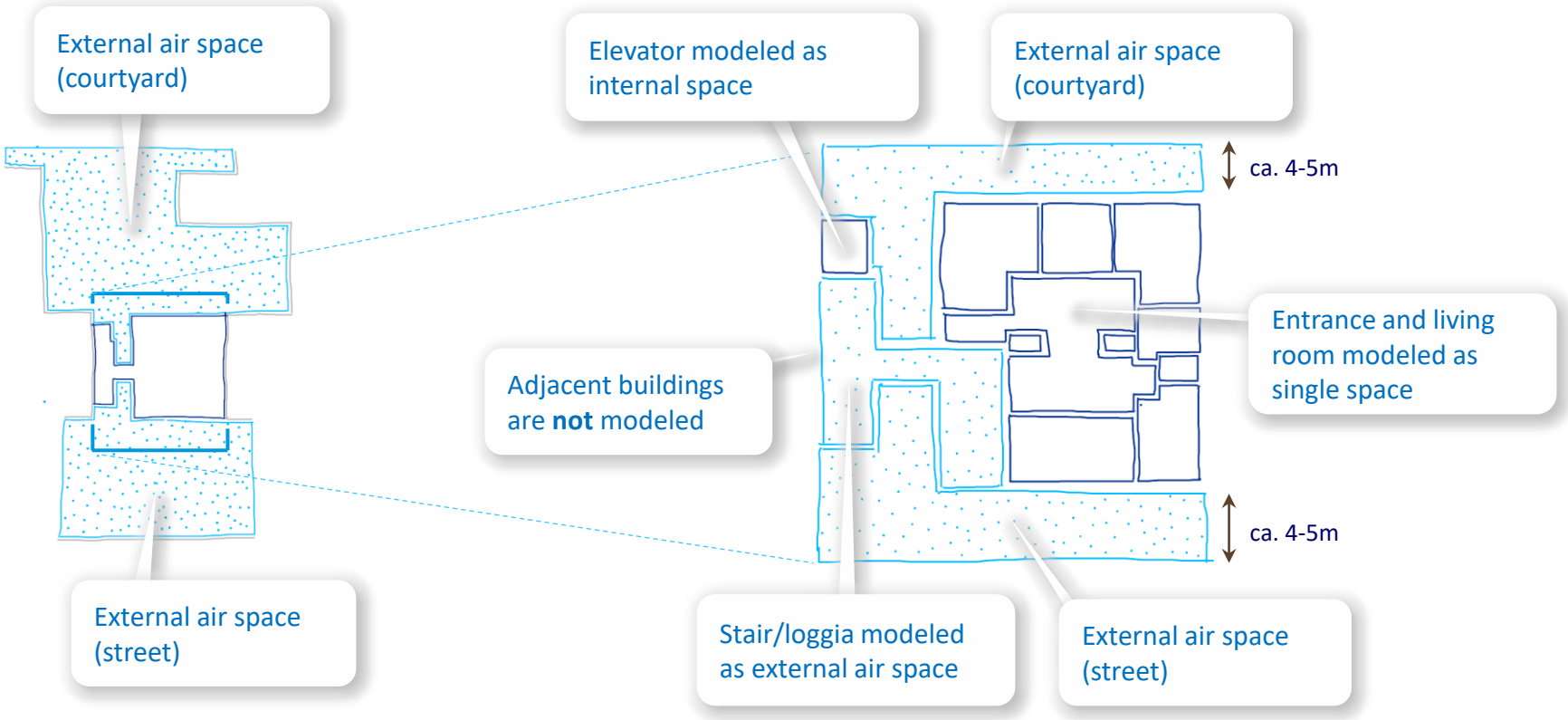
External spaces

- Model a building's immediate surroundings
- Required for spatial evaluation, e.g., of 'Natural lighting' or 'Orientation zones' views

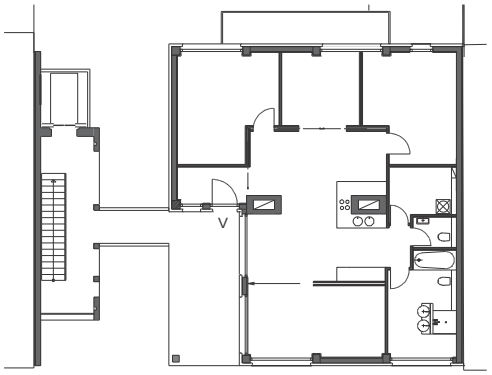
External space geometries must be created in the input layout in Revit!

Determine internal and external spaces





Determine internal and external spaces



External air space (courtyard)

See User Guide 'Space modeling workflow' for additional examples on how to determine internal and external spaces

space

ca. 4-5m

Entrance and living room modeled as single space

Adjacent buildings are **not** modeled

ca. 4-5m

External air space (street)

Stair/loggia modeled as external air space

External air space (street)

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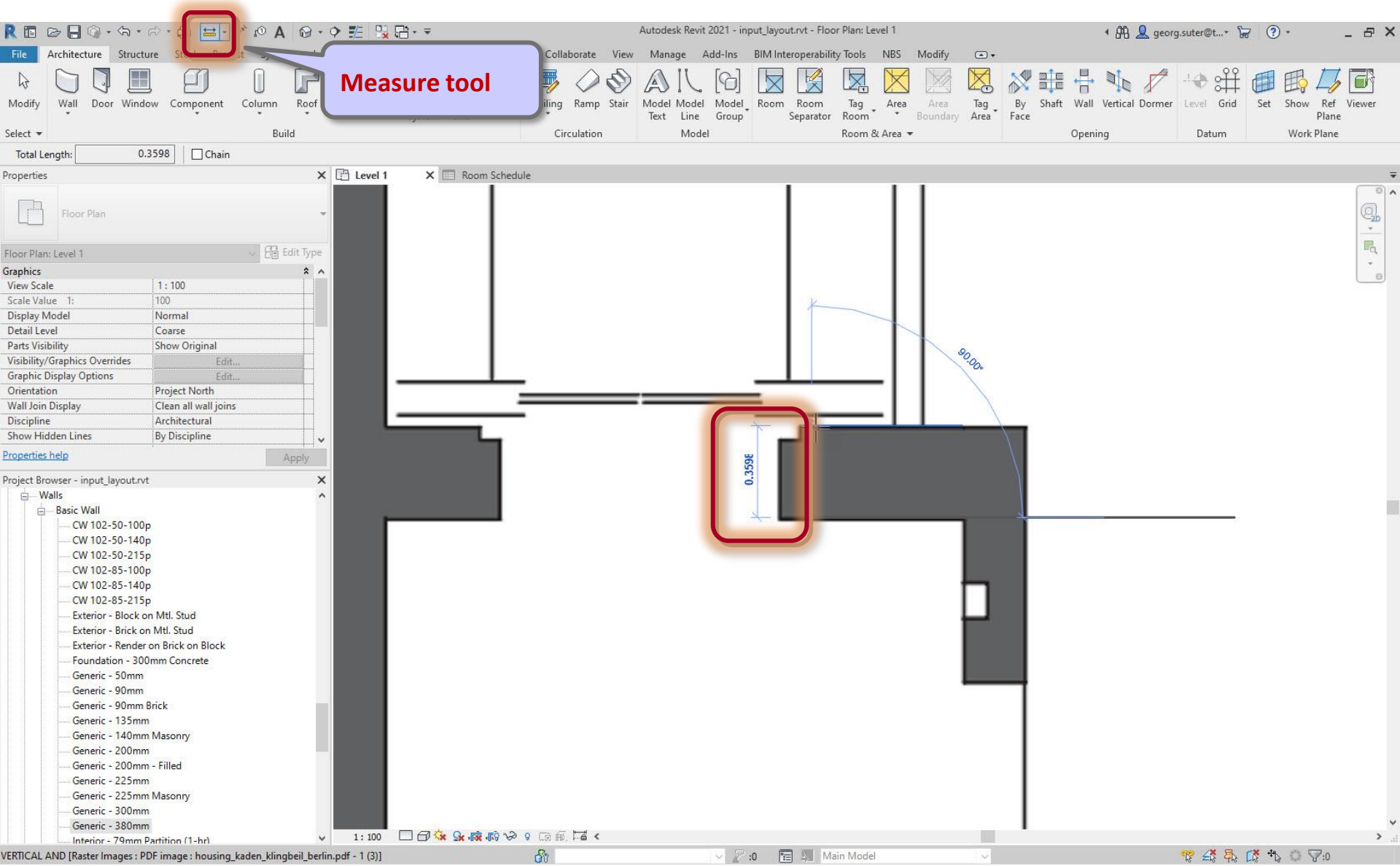
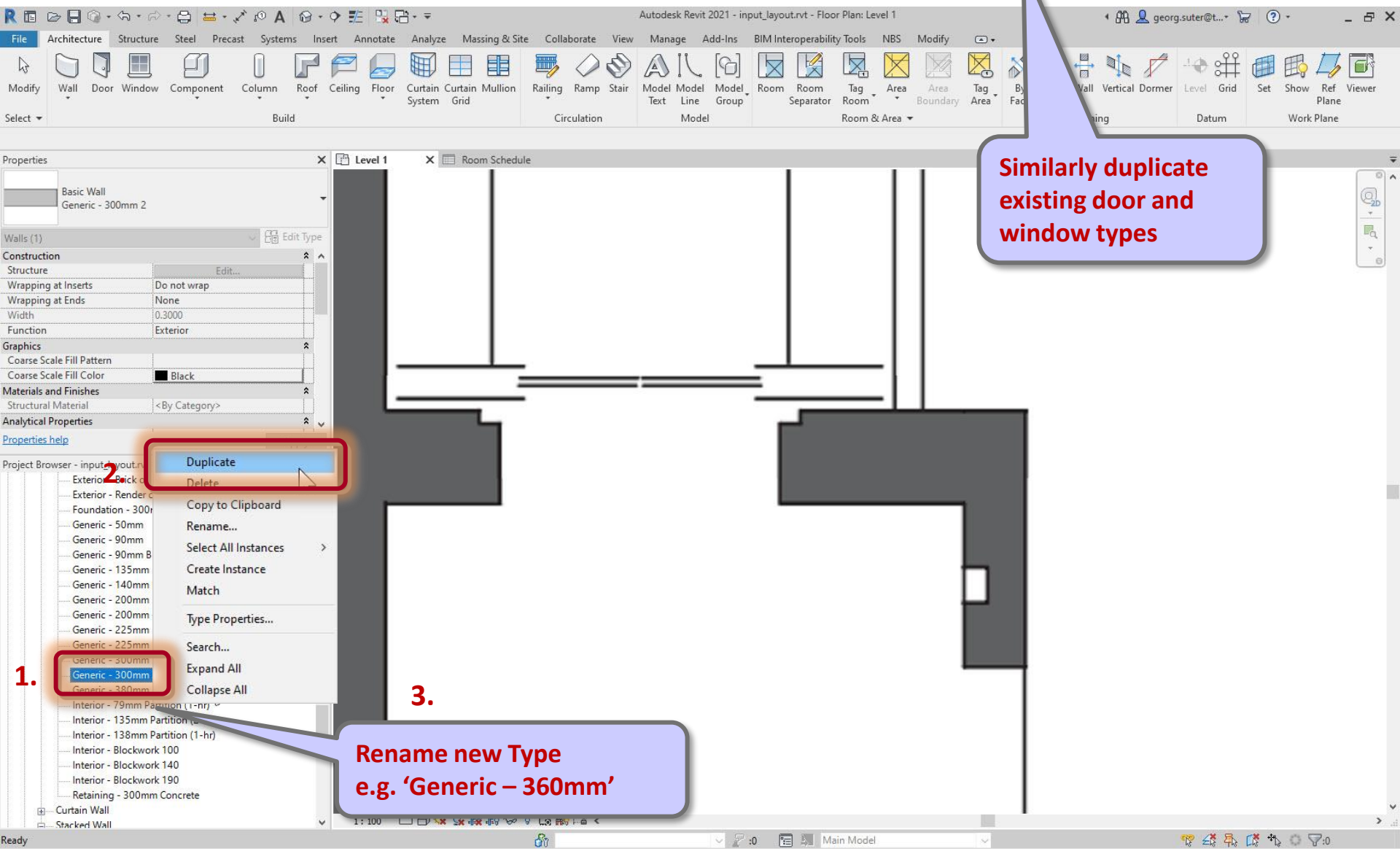
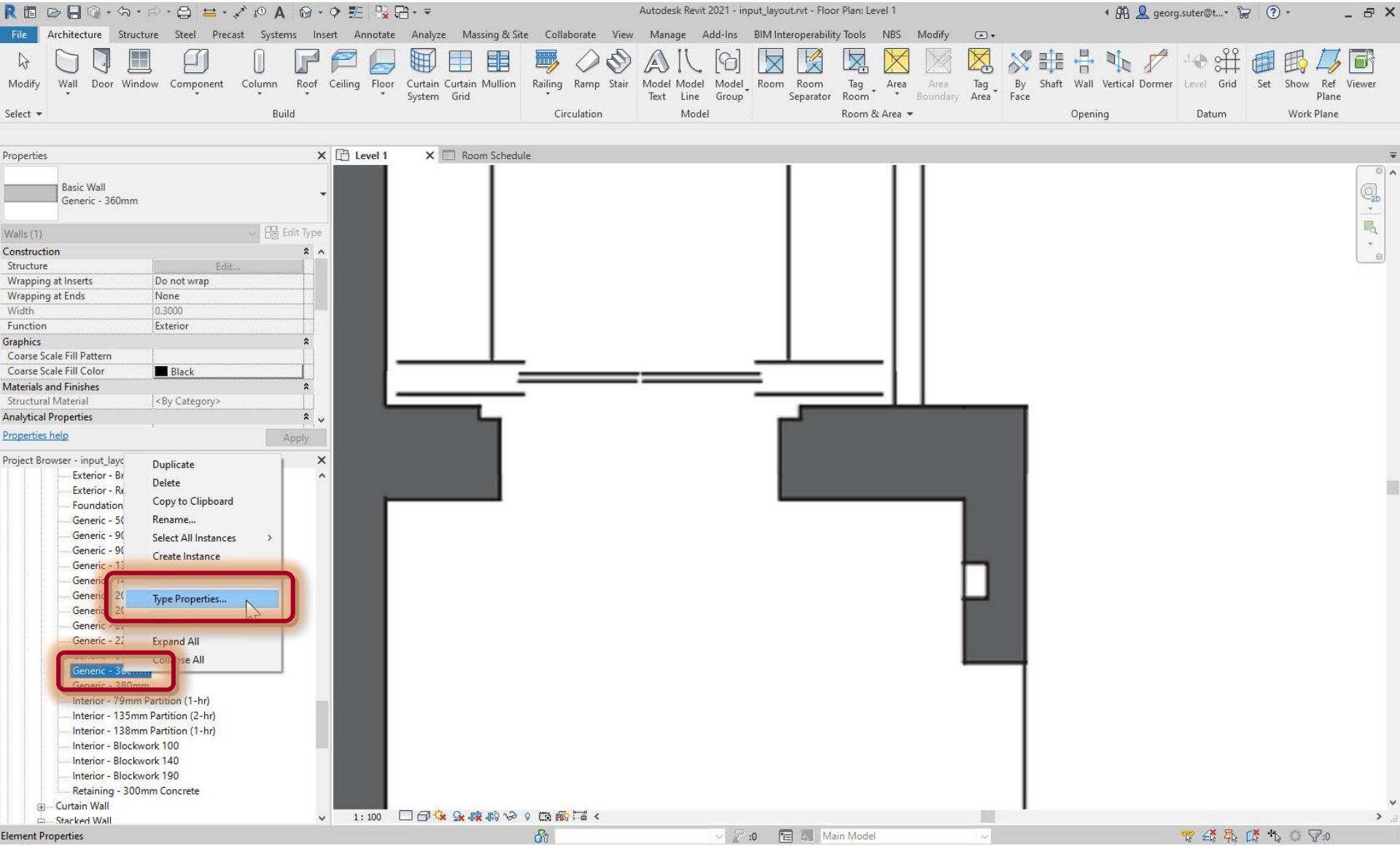
Measure wall thickness



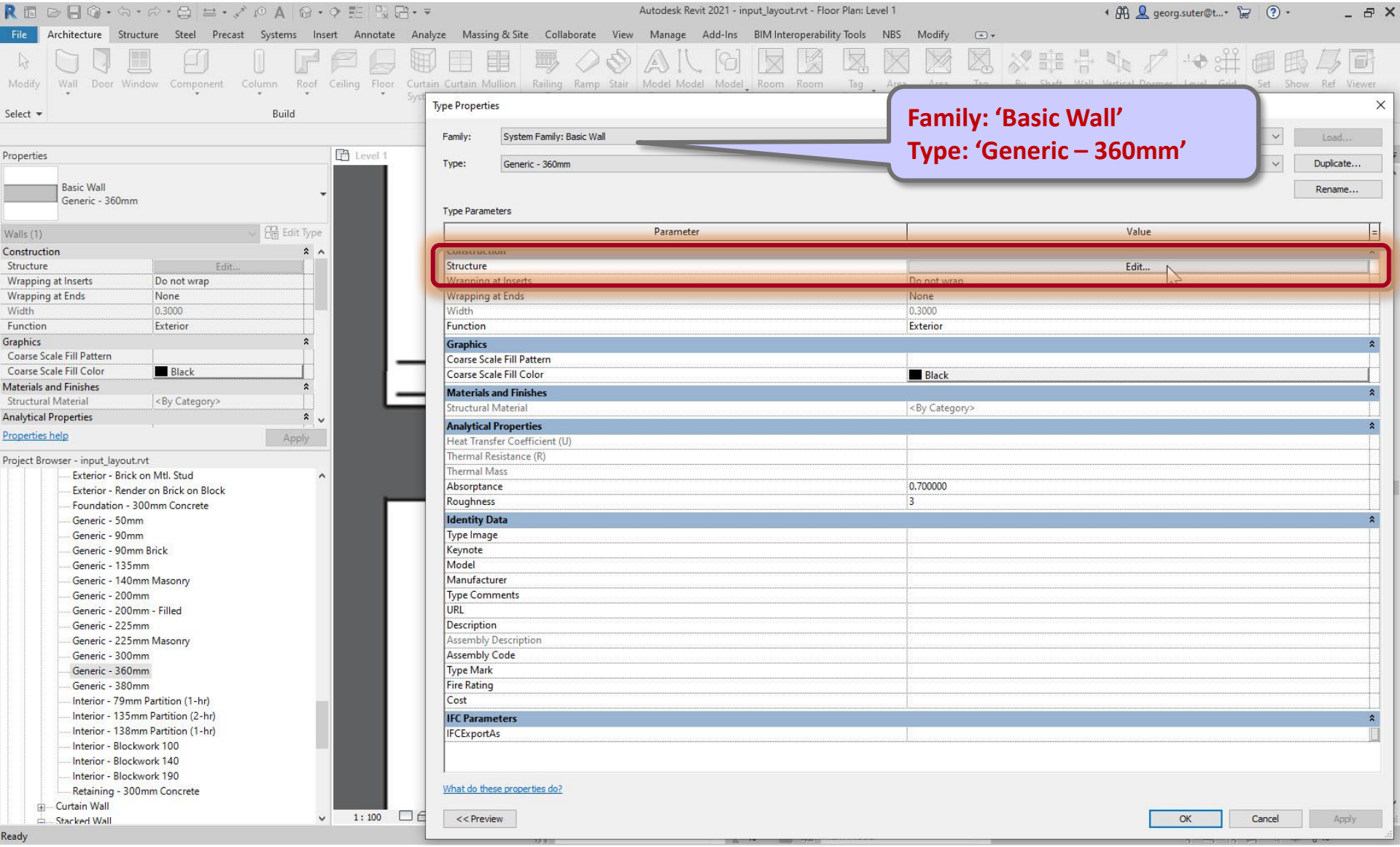
Project Browser > Walls > Basic Walls > Duplicate an existing wall type



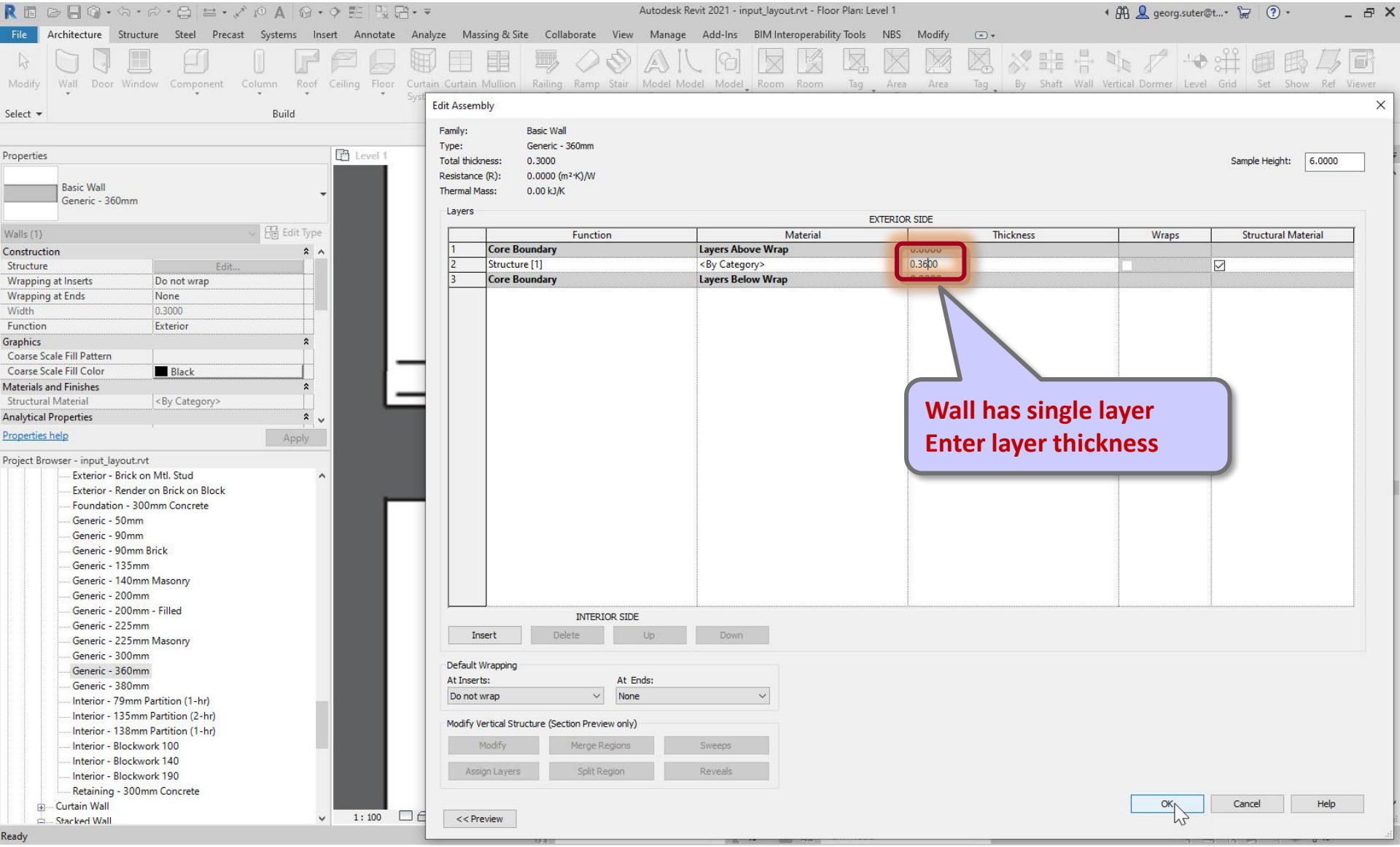
Type properties…



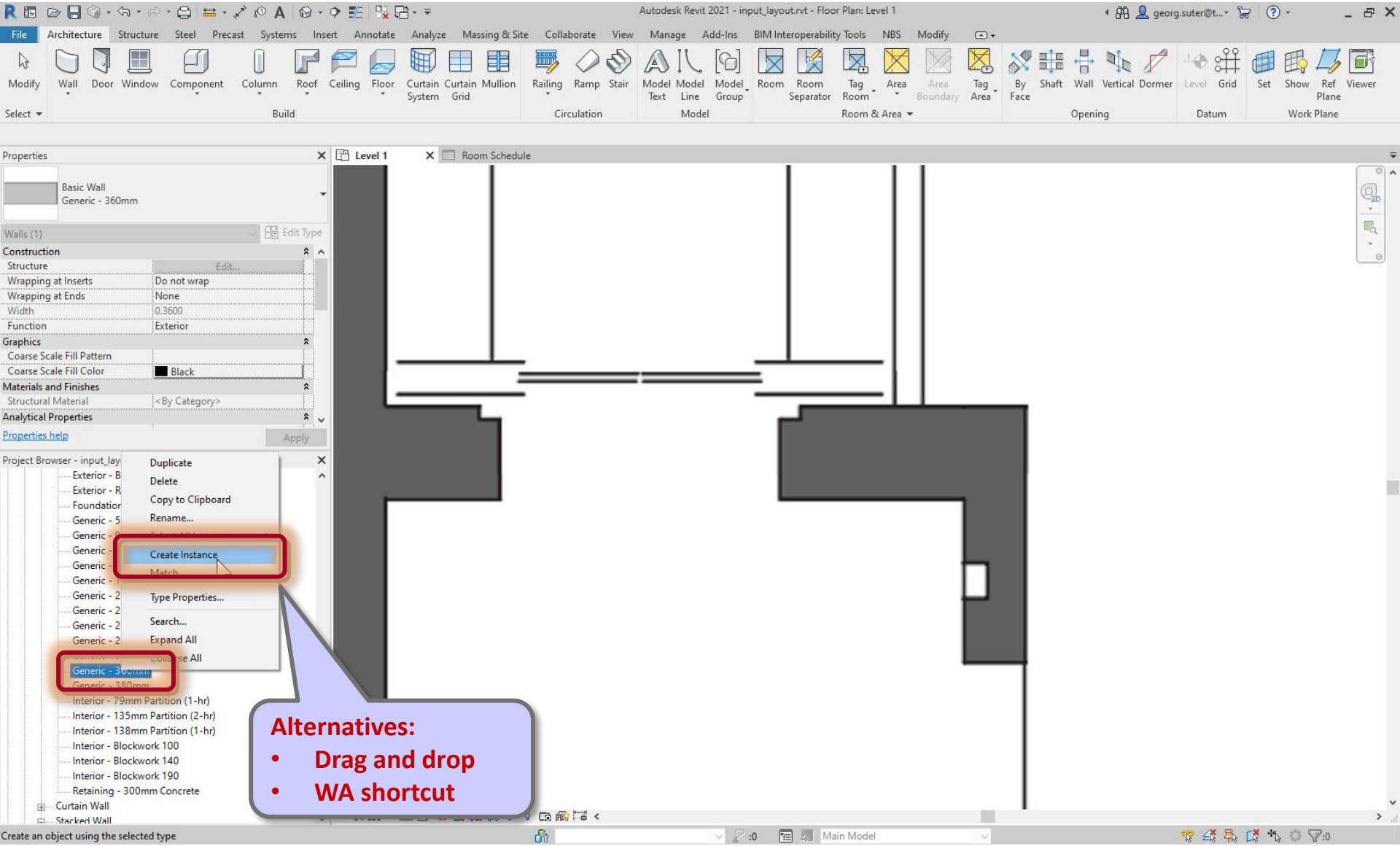
Type properties > Structure > Edit…



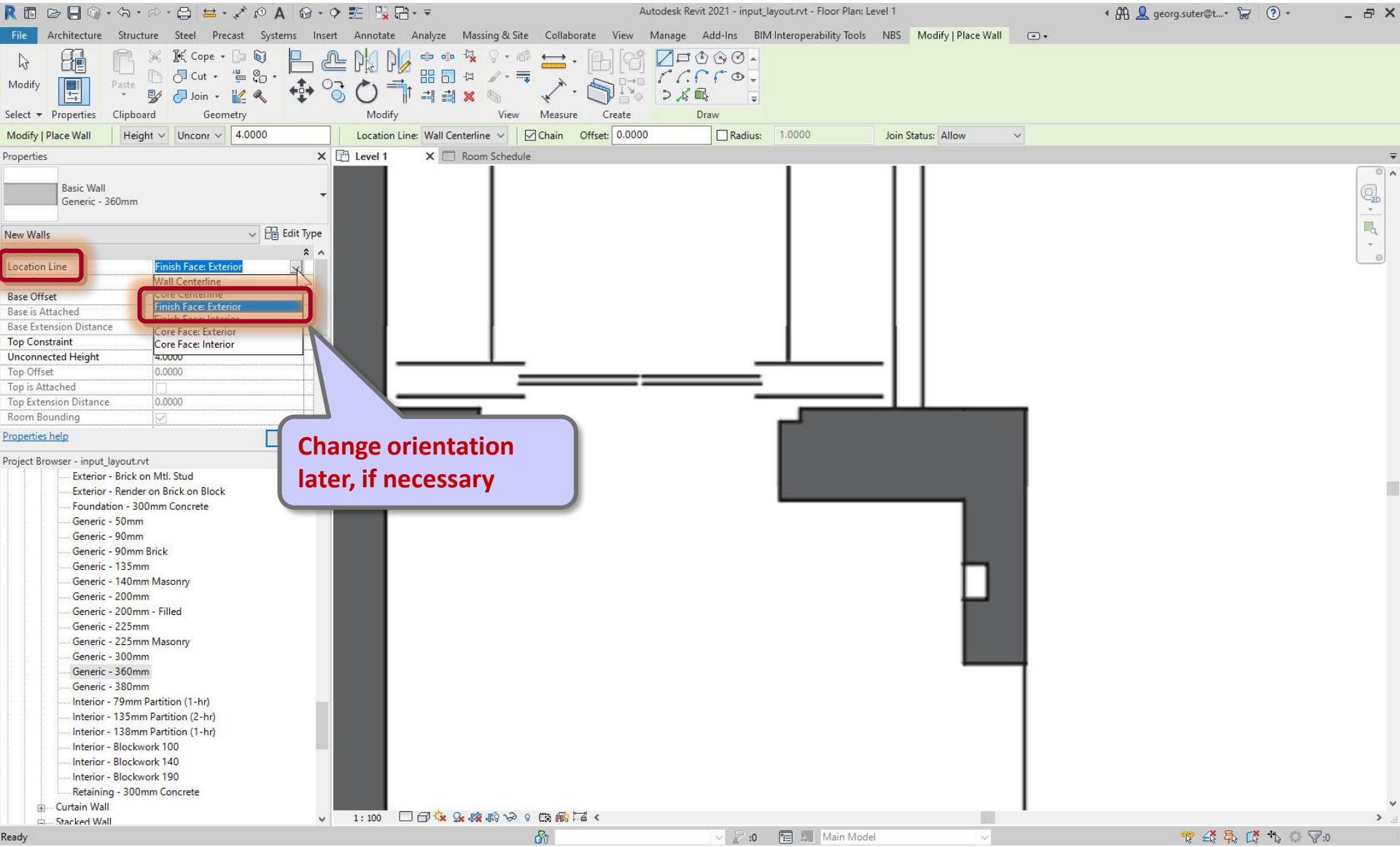
Set layer thickness



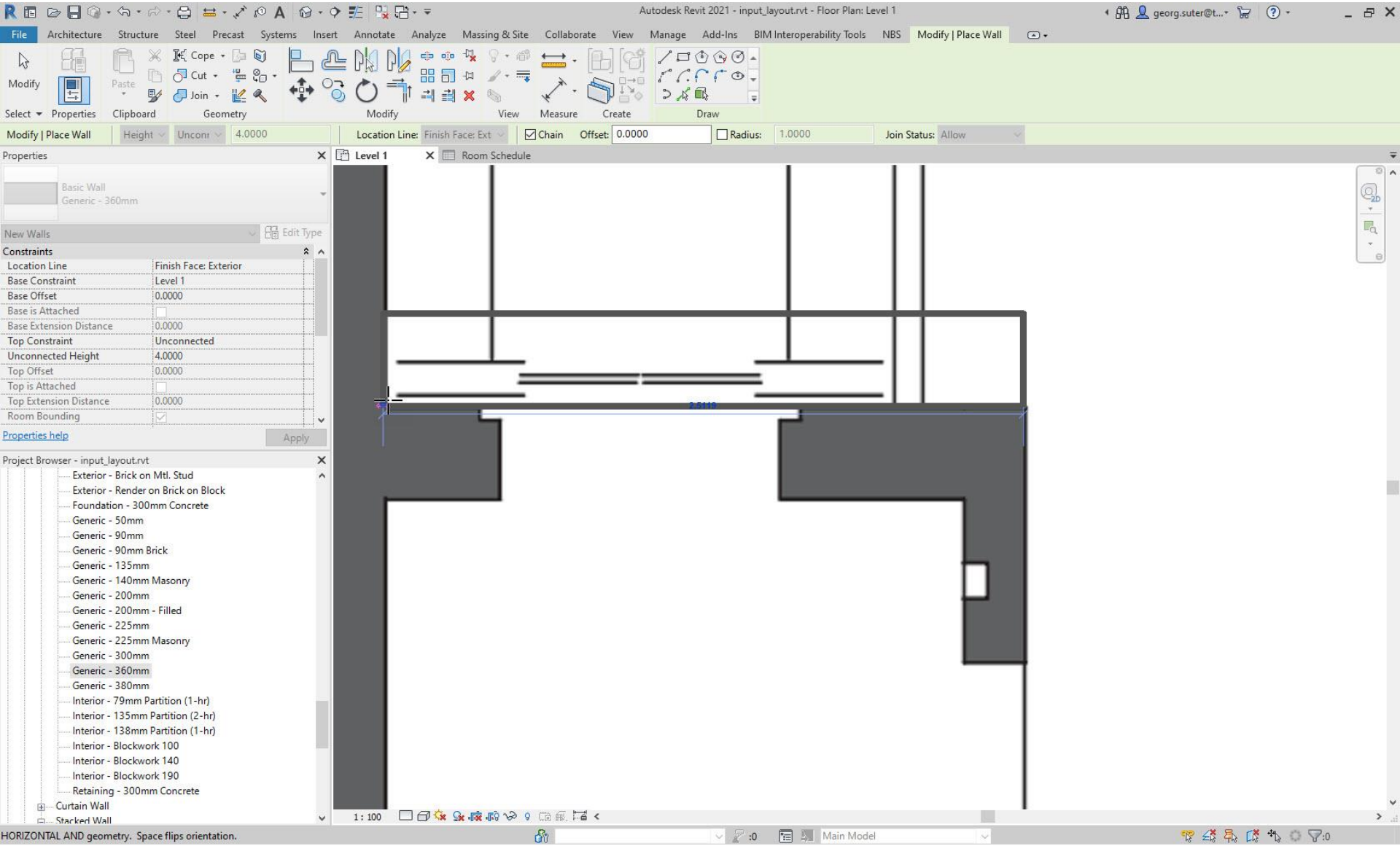
Create Instance



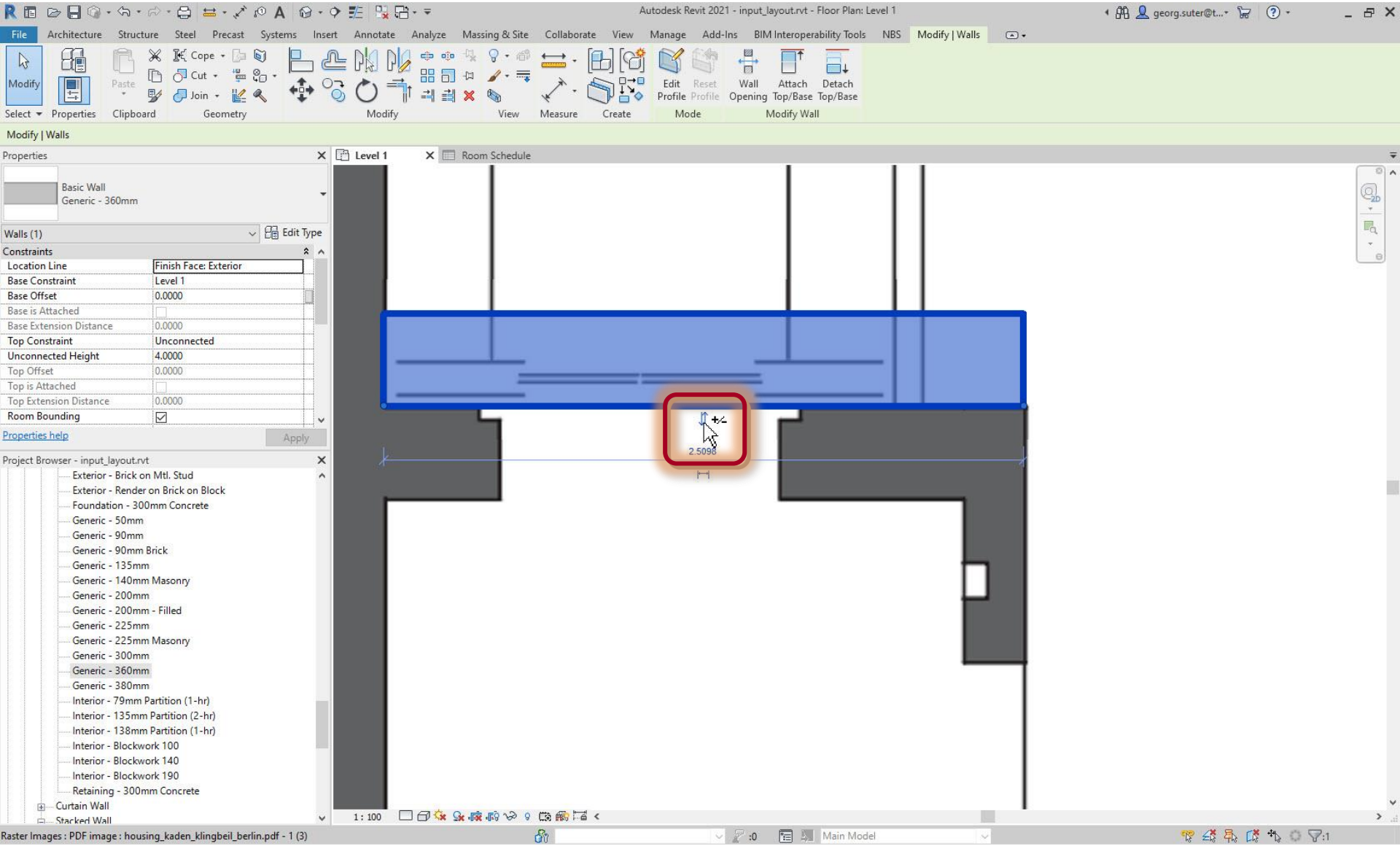
Constraints > Location Line > Finish Face Exterior



Draw wall segment



Set wall orientation, if necessary



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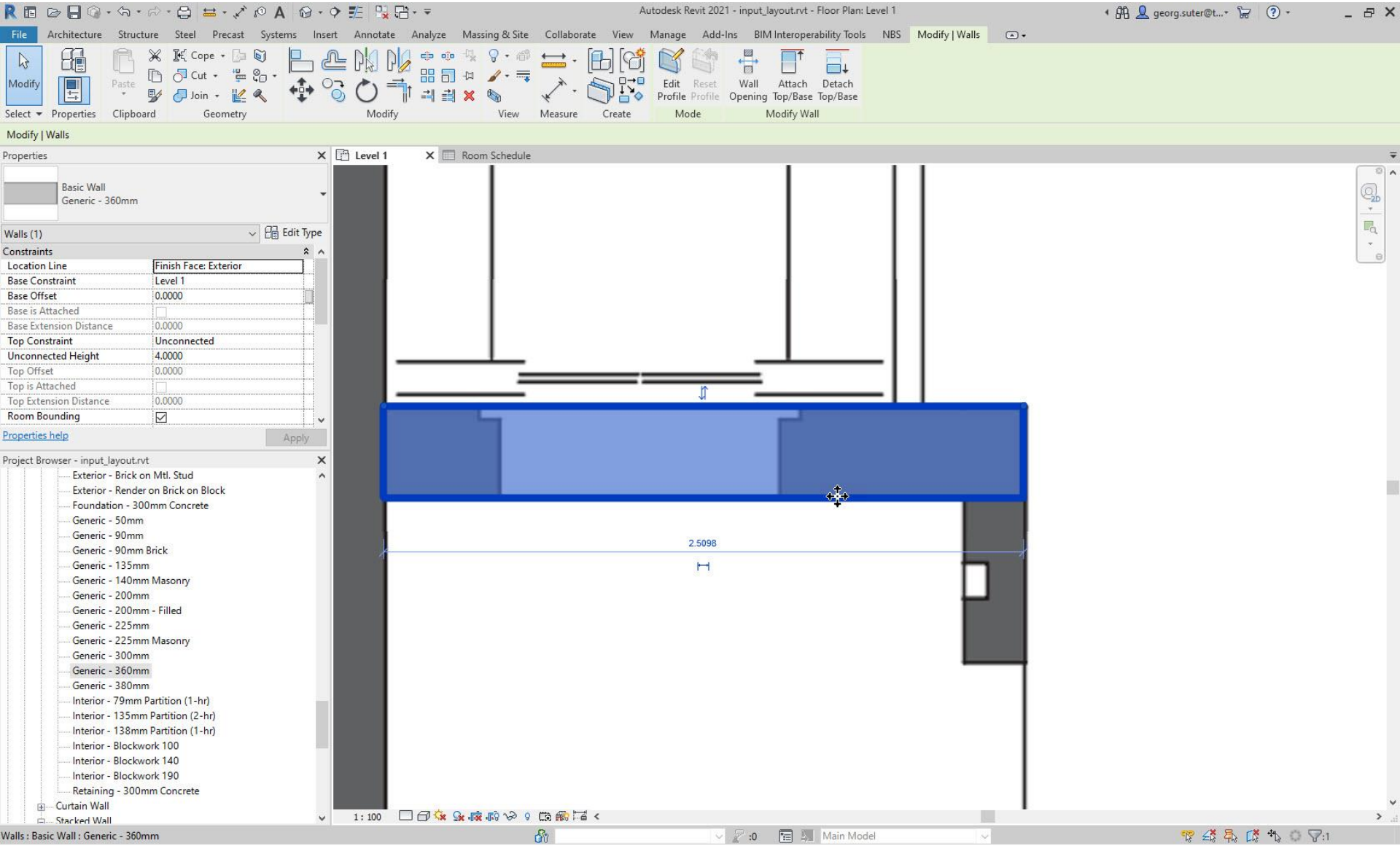
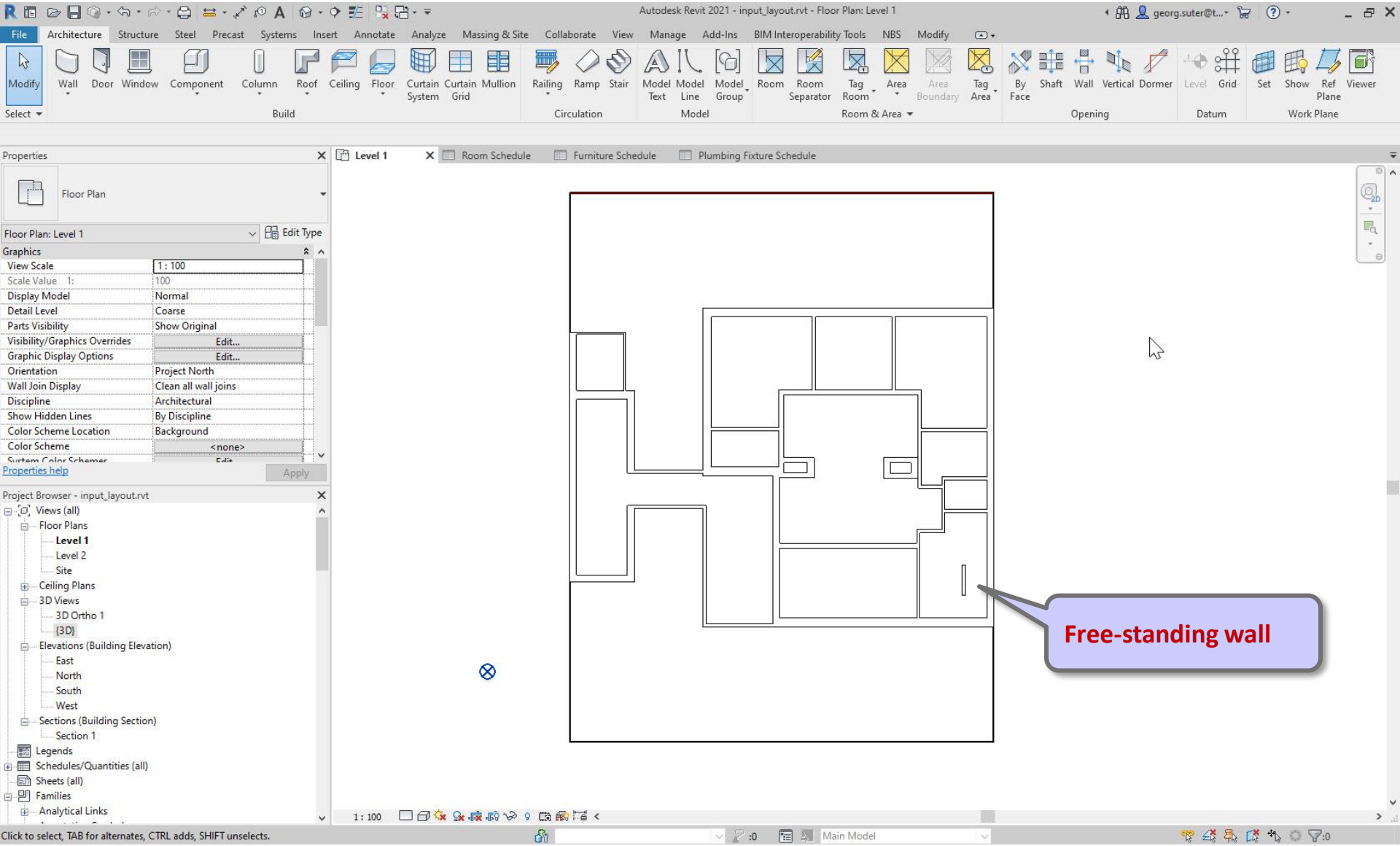
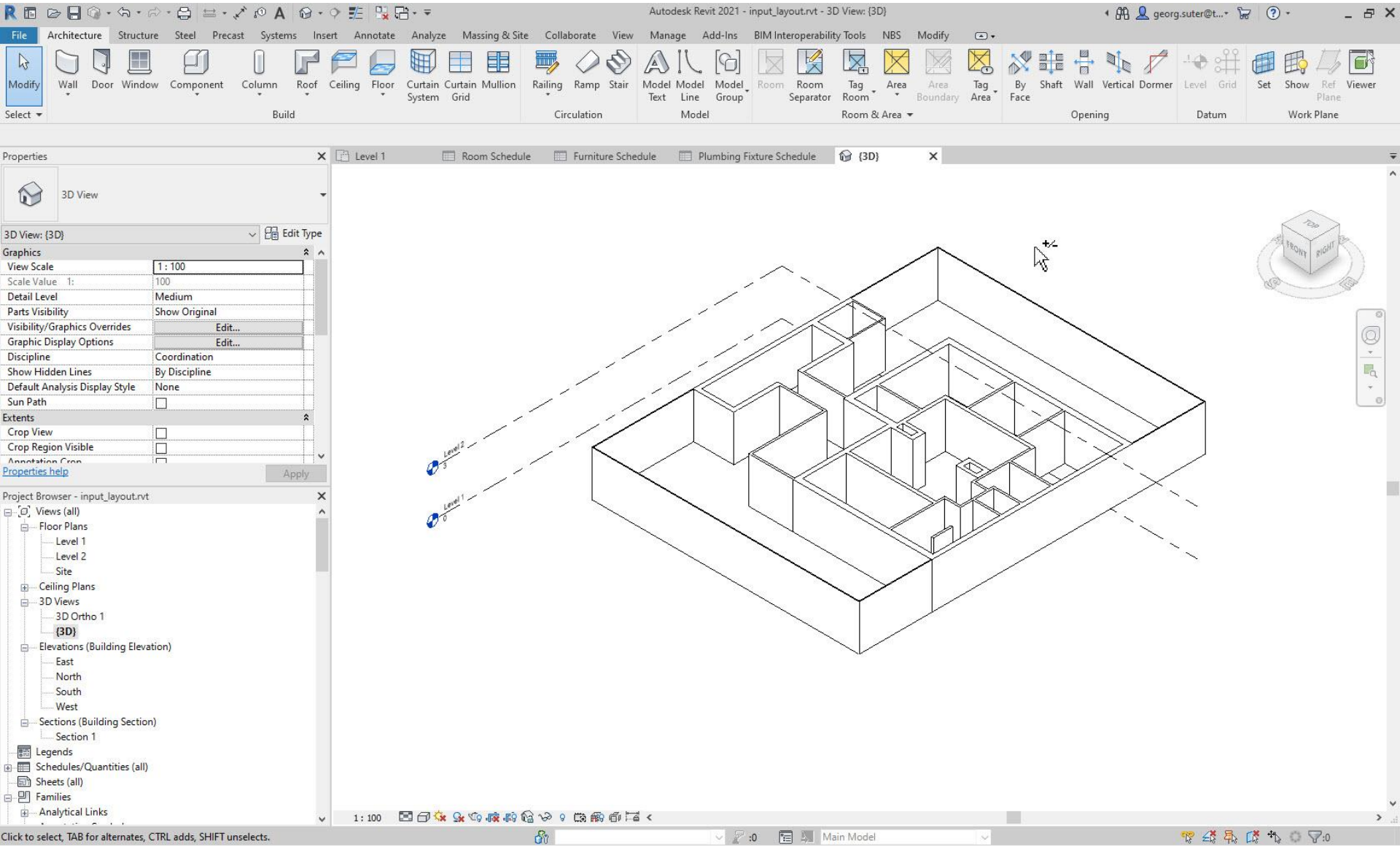


Check if all walls are modeled



Check correct wall elevations and heights



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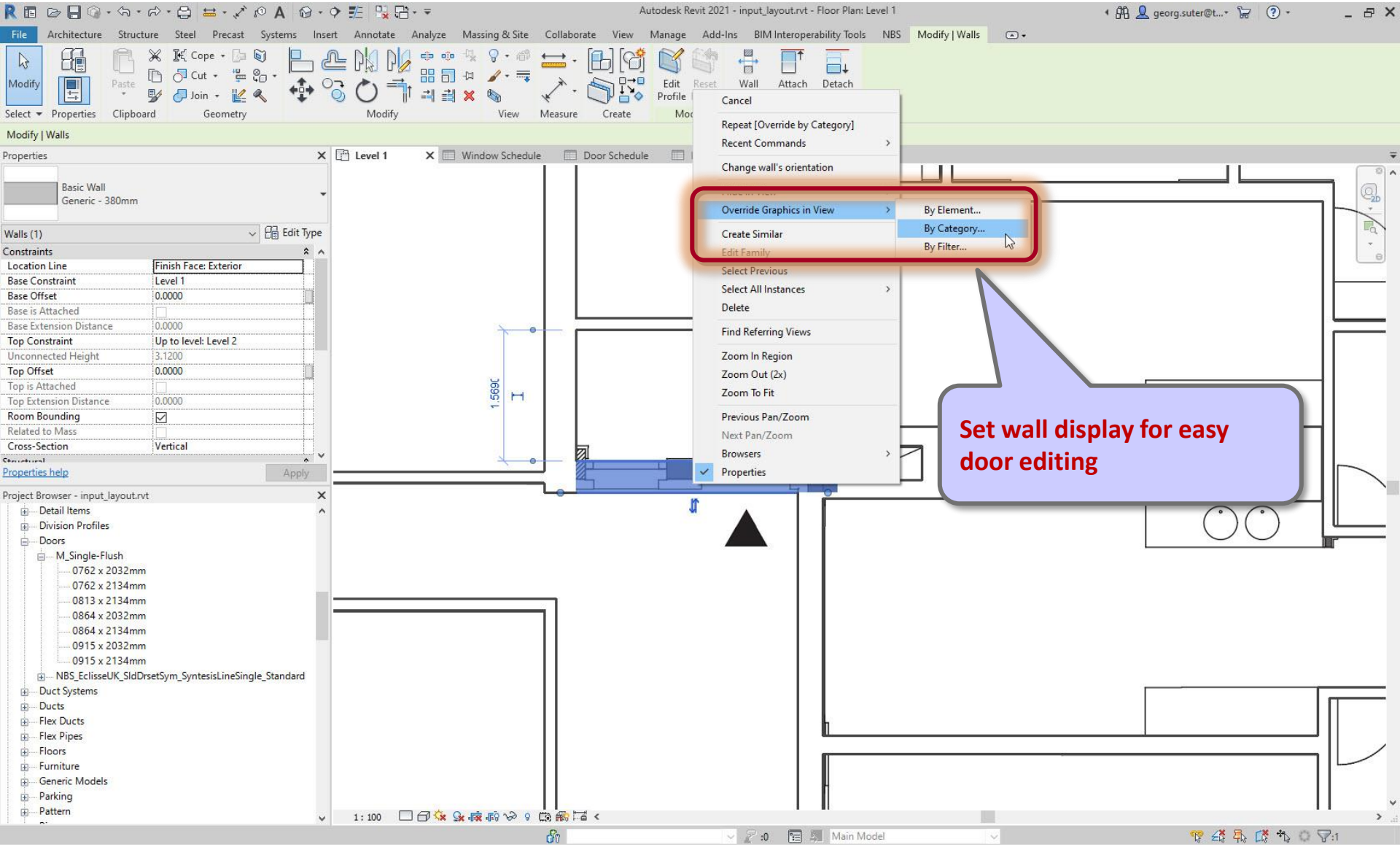
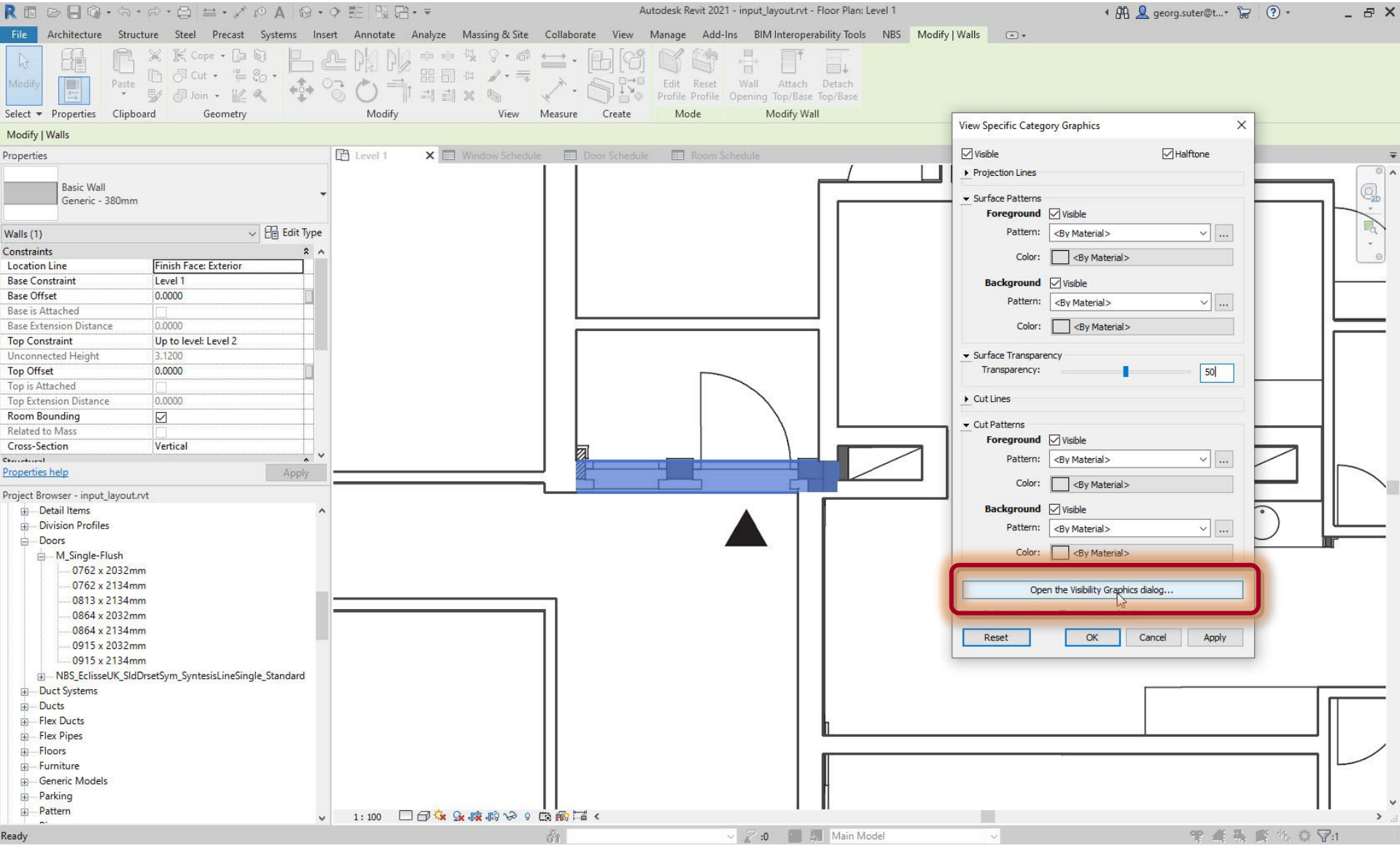
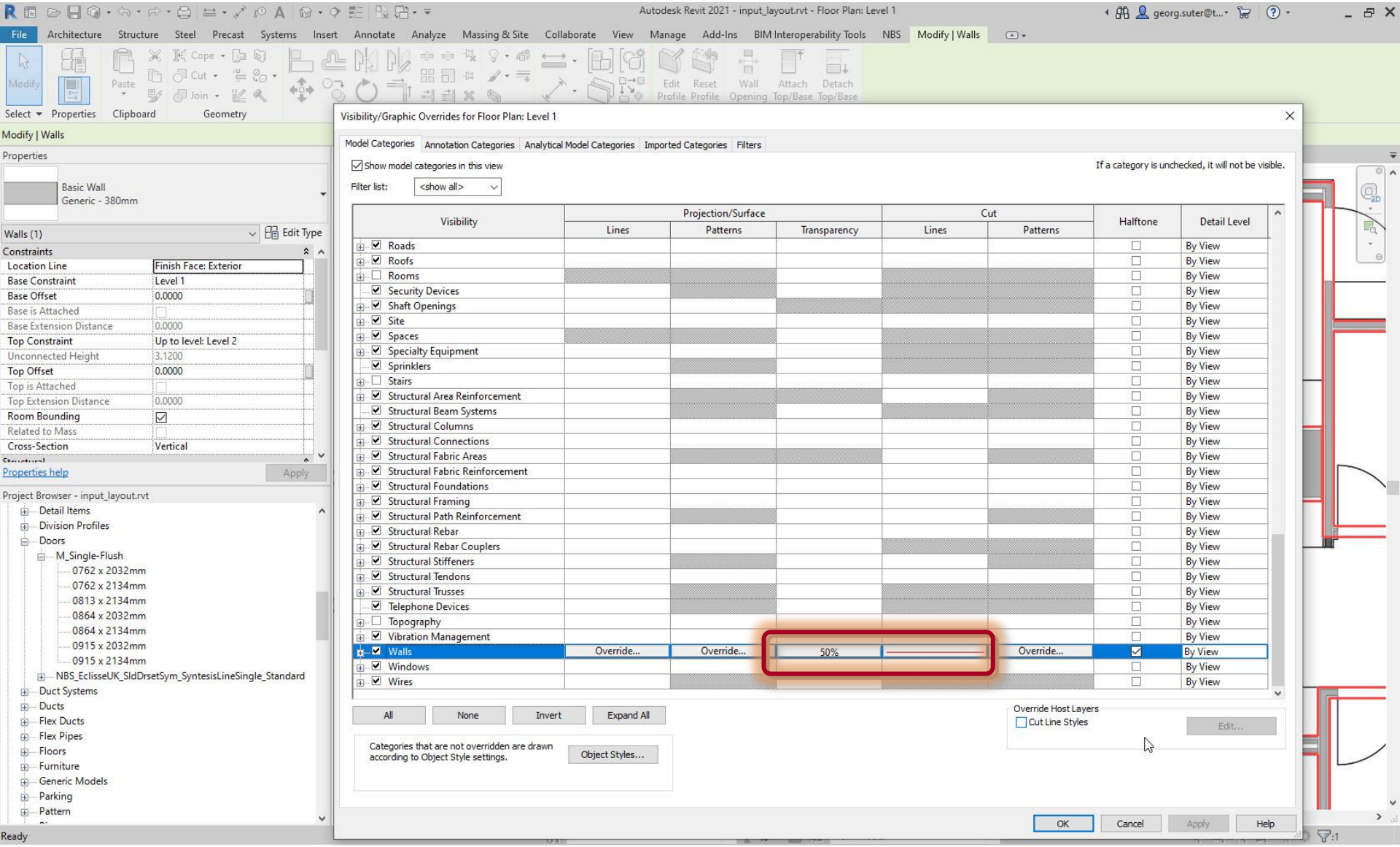
Select a wall > Override Graphics in View > By Category…



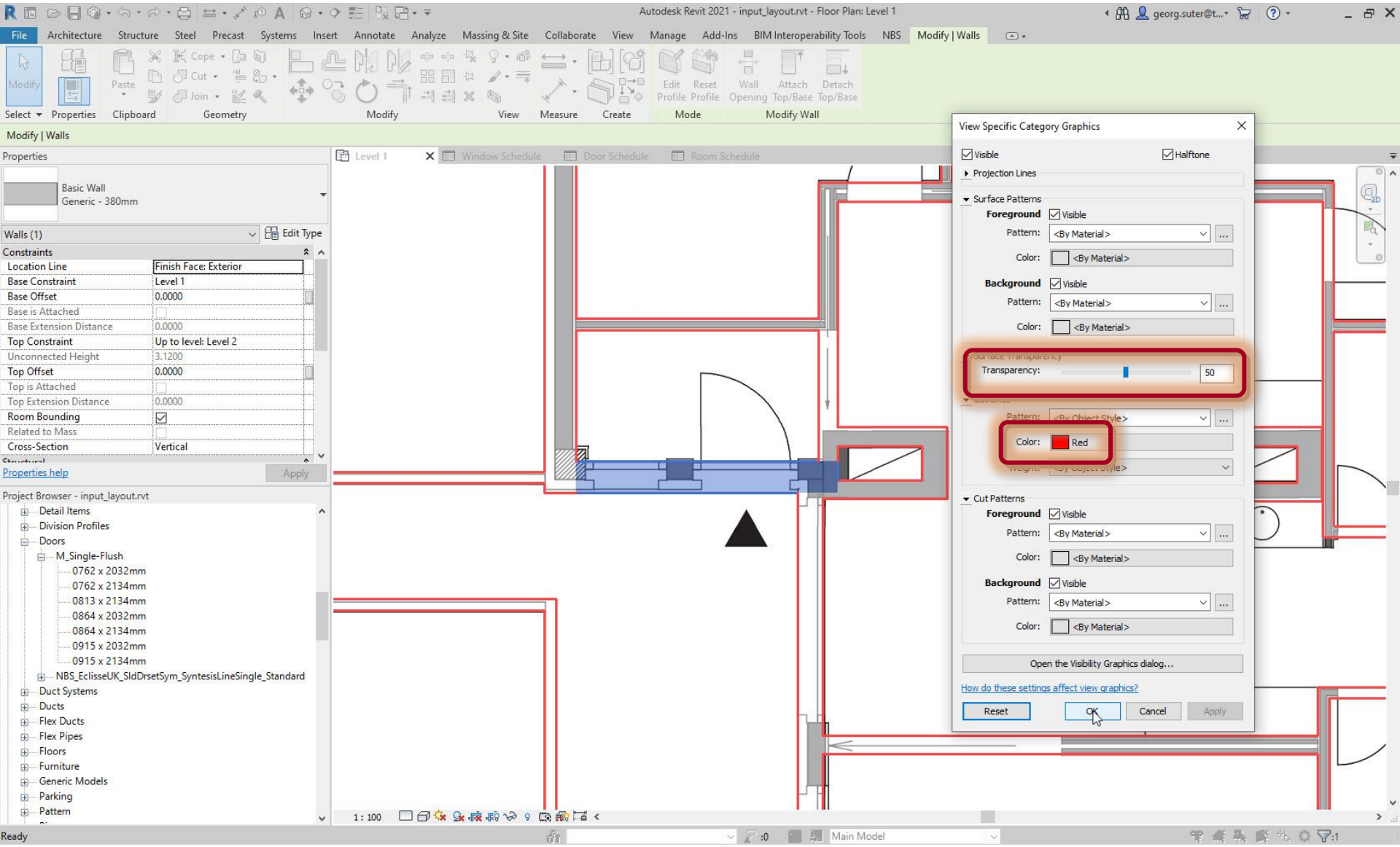
Open the Visibility Graphics dialog…



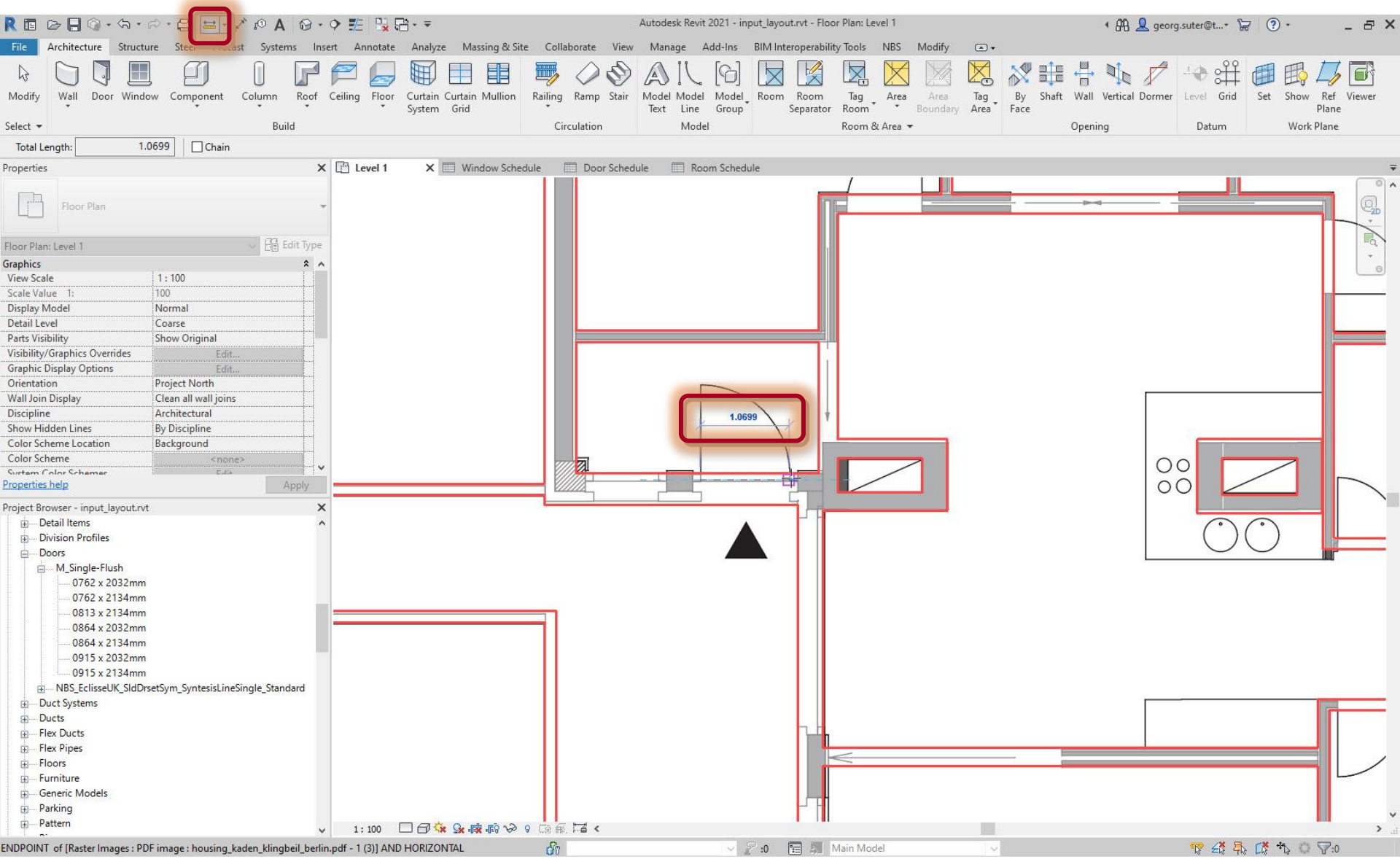
Set ‘Transparency’ value and ‘Lines’ color



Set ‘Transparency’ value and ‘Lines’ color

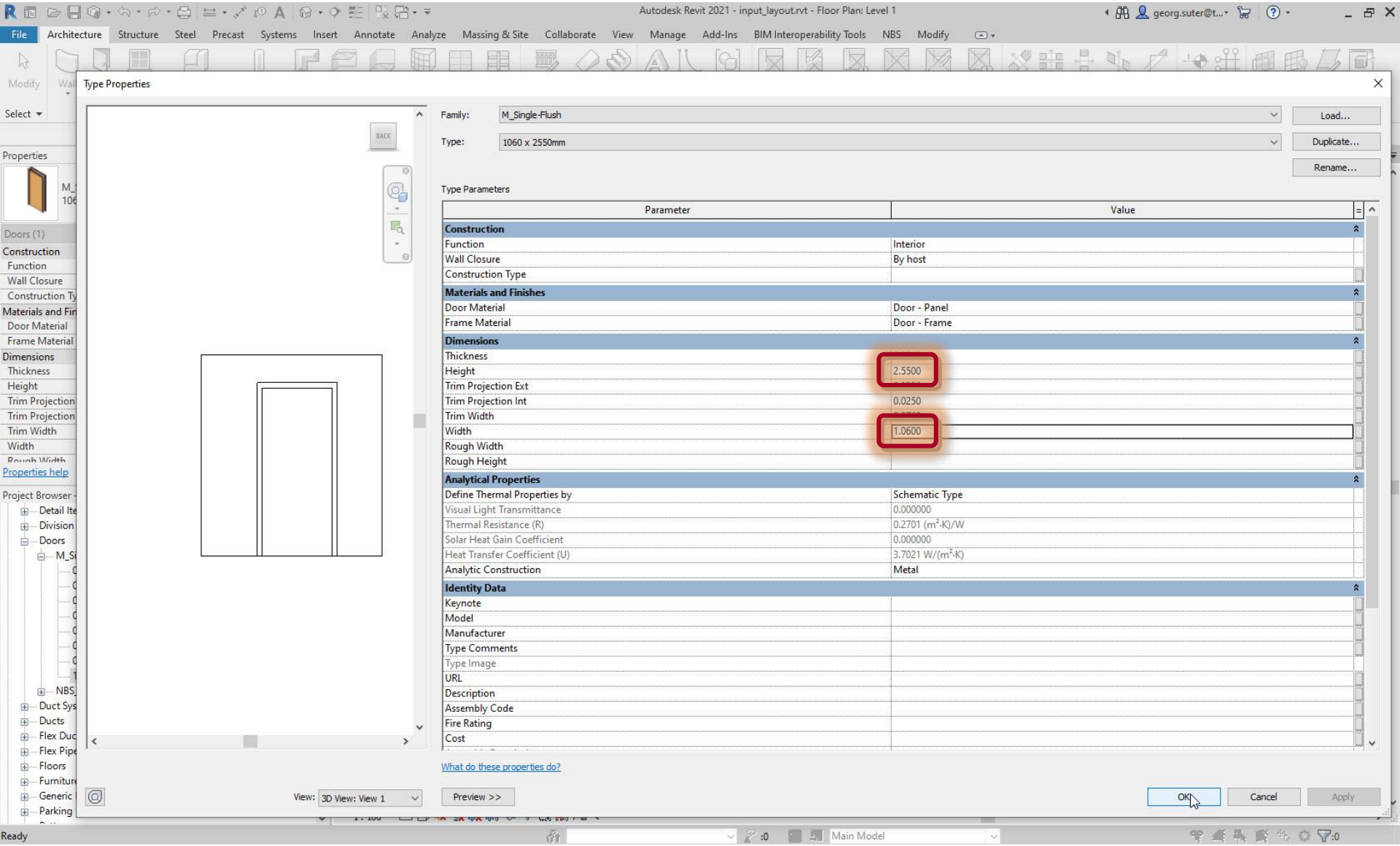


Measure door width

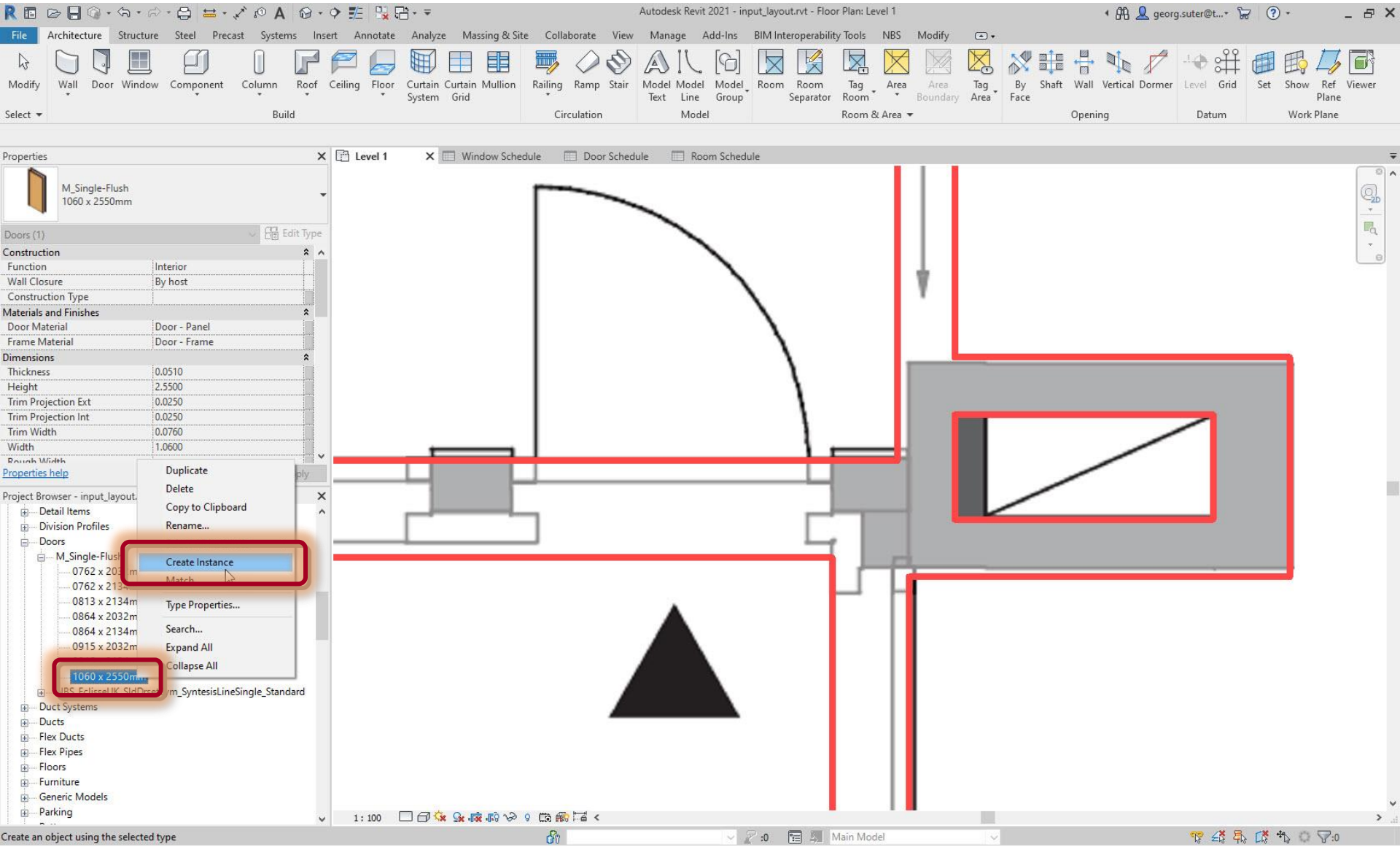


Original pdf document: measure door height

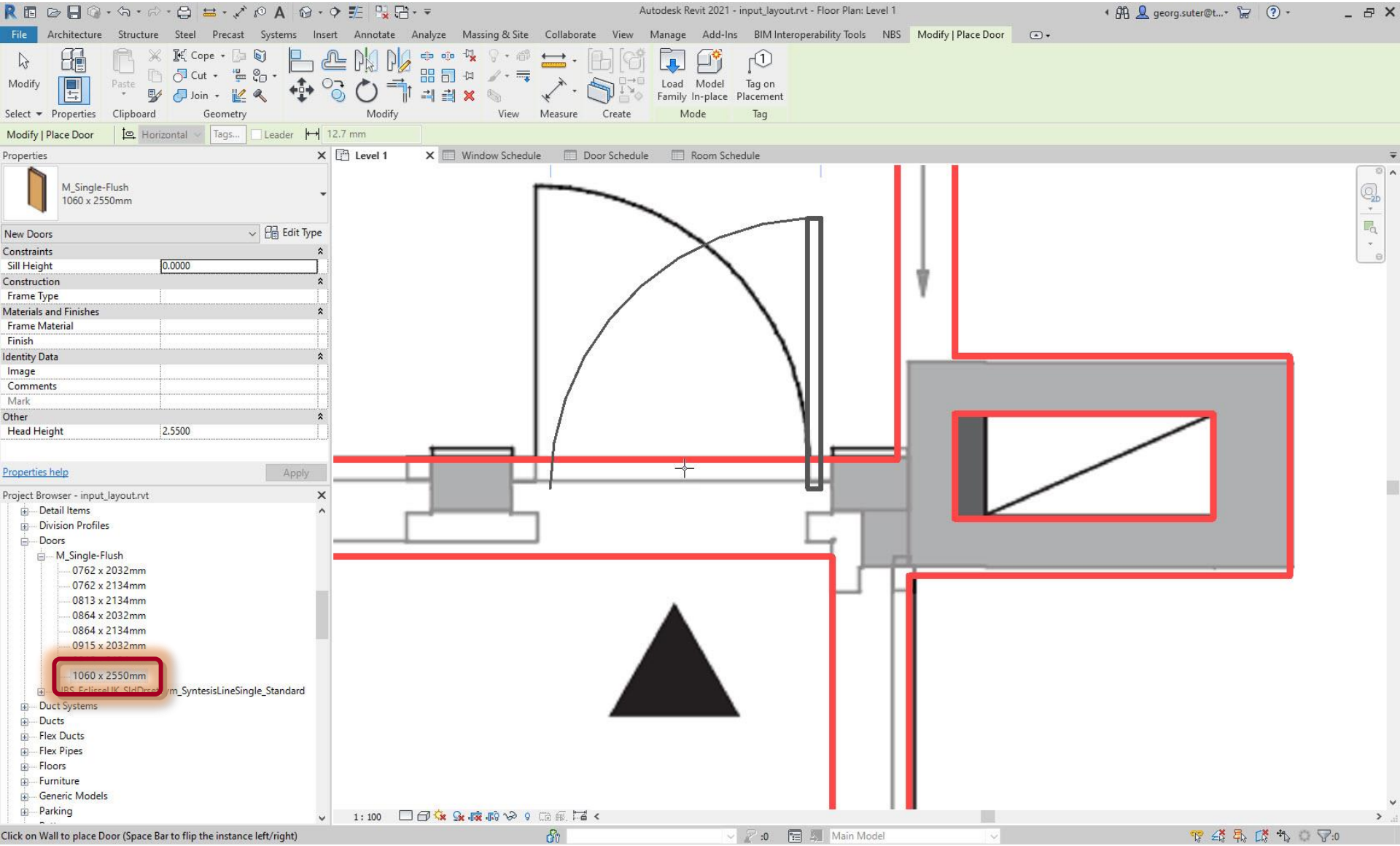
Type Properties > Set ‘Height’ and ‘Width’



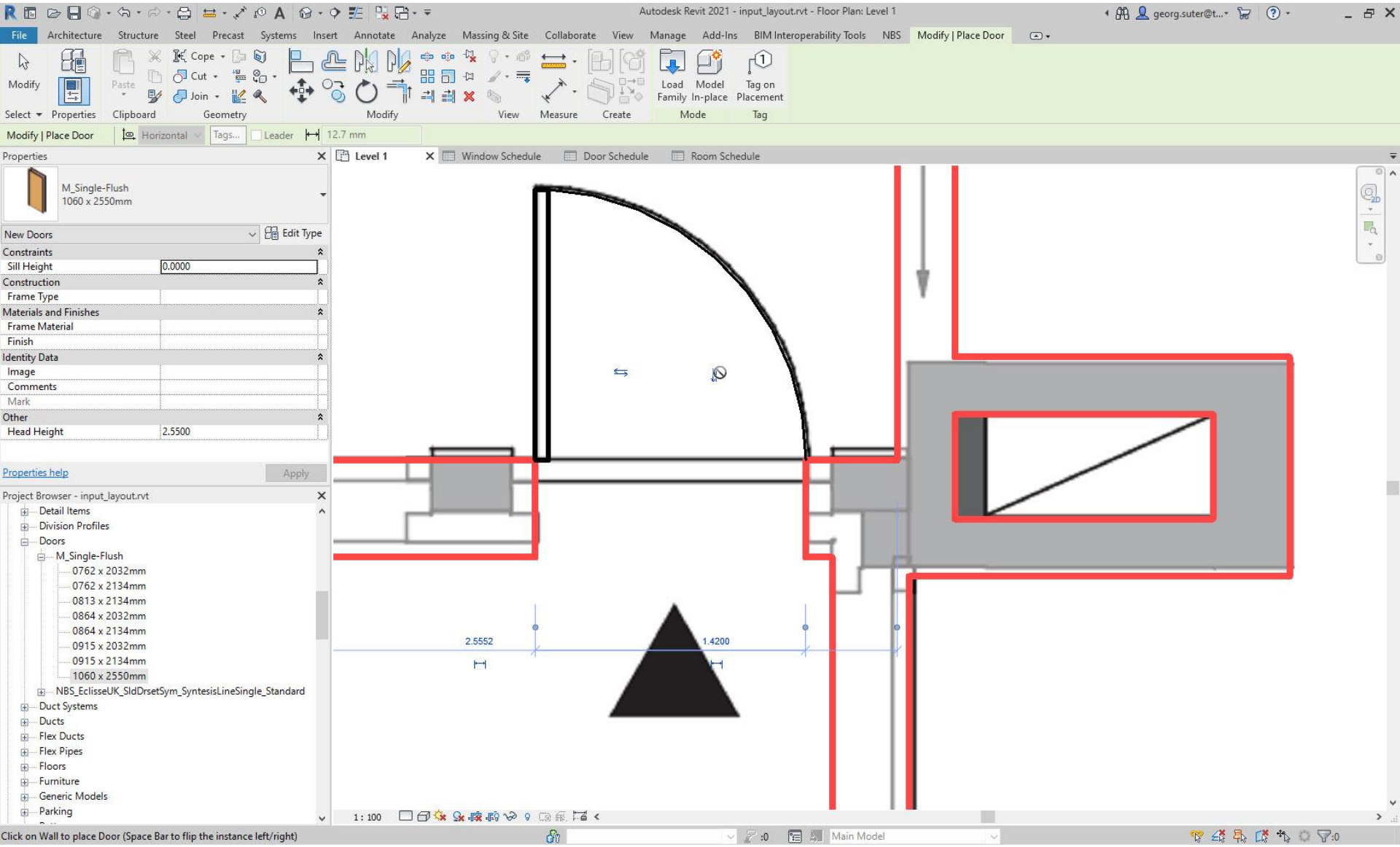
Create Instance



Change orientation, if necessary



Change orientation, if necessary

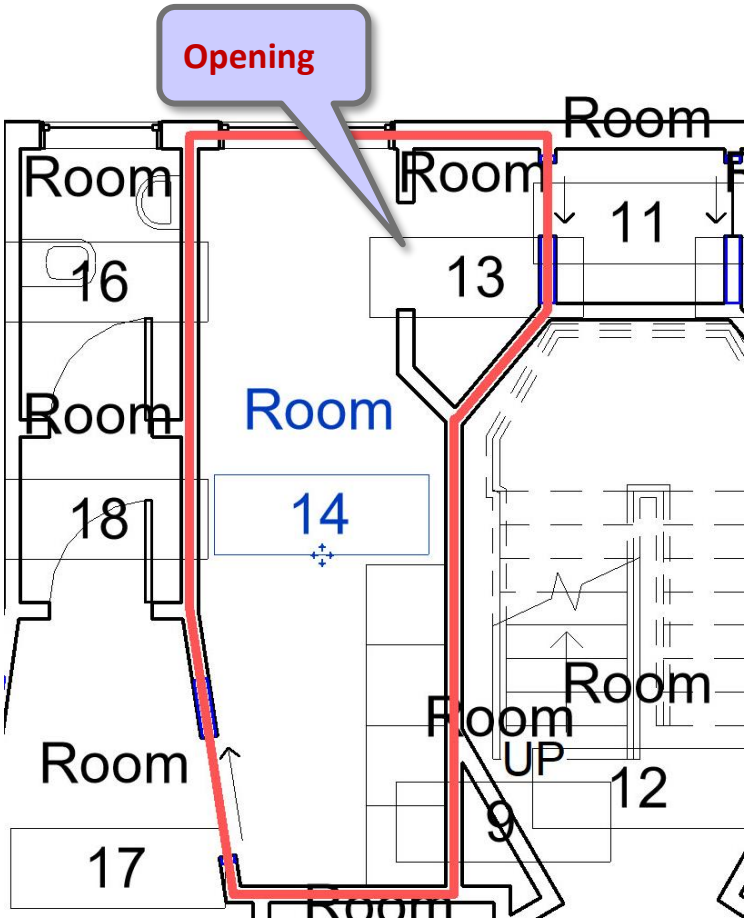


Issue

- Accessible openings are not interpreted as separating 2 rooms by Revit's space generation method

Solution

- Model openings as doors
- Label doors as openings (see User Guide 'Labeling a space model')



Steps

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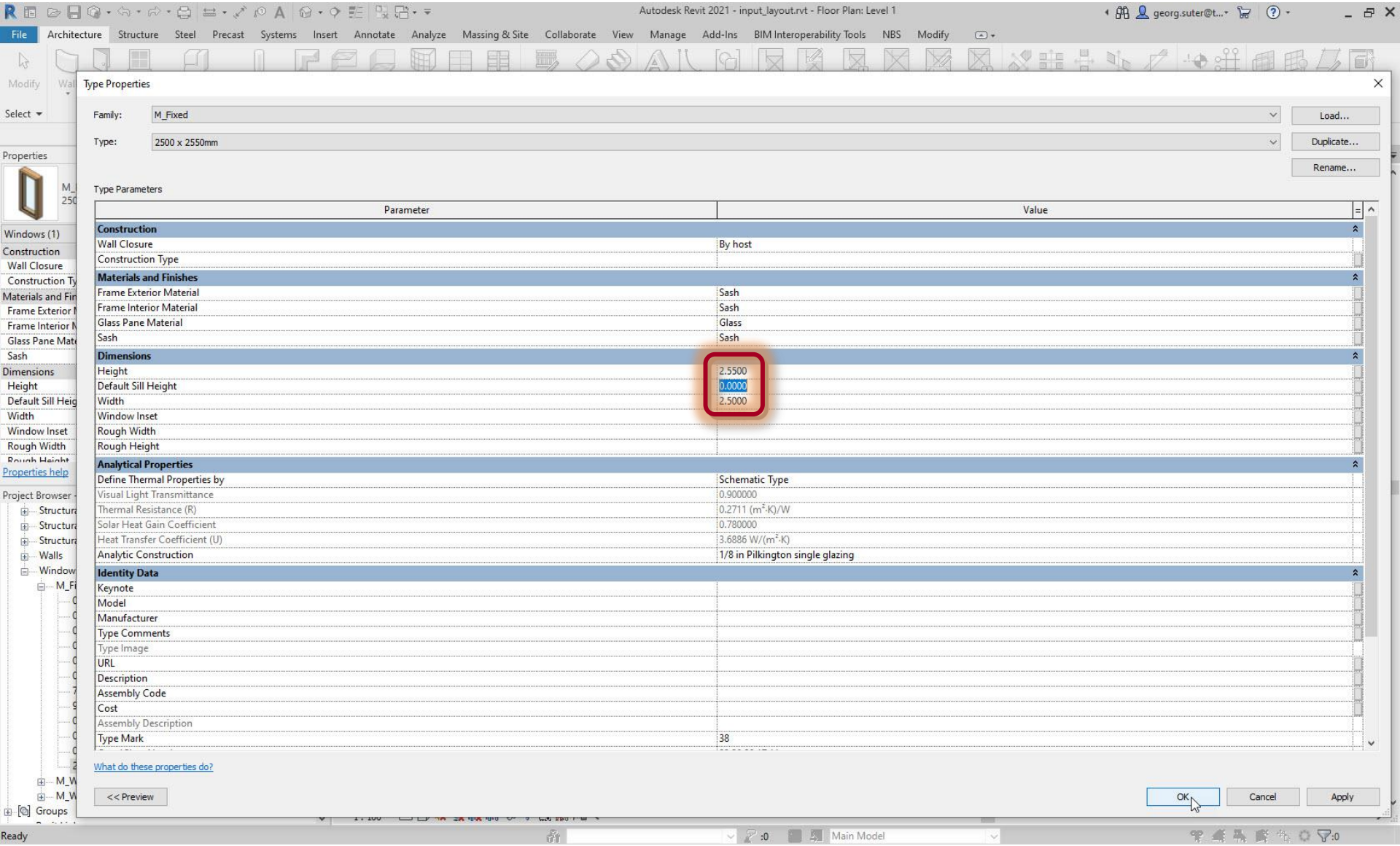
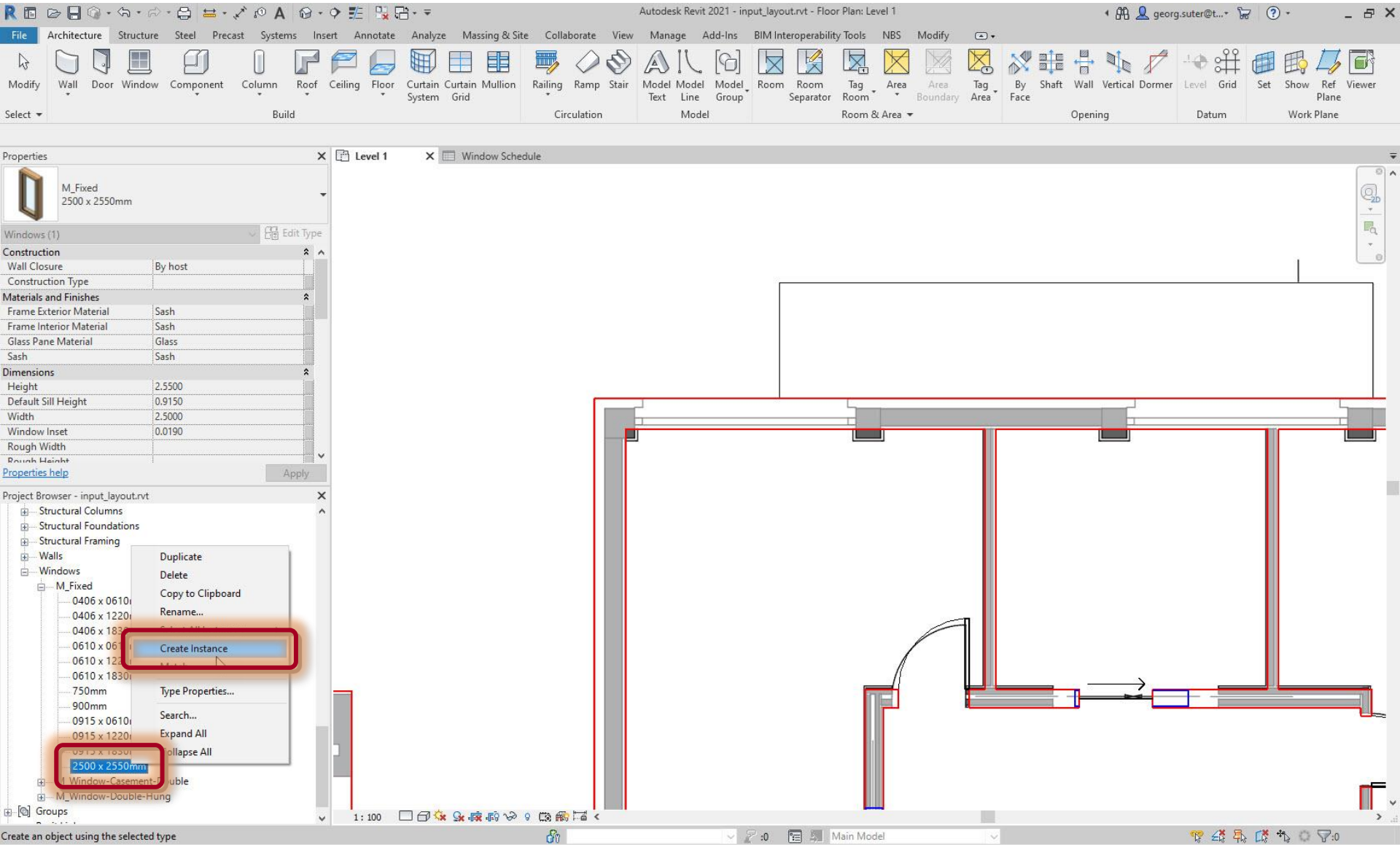
4. Determine internal and external spaces
5. Create walls
6. Create doors and openings
7. **Create windows**
8. Create rooms
9. Create circulation elements
10. Create horizontal external elements
11. Create furnishing elements
12. Create geocoordinates
13. Export input layout
14. Create .zip archive
15. Generate space model

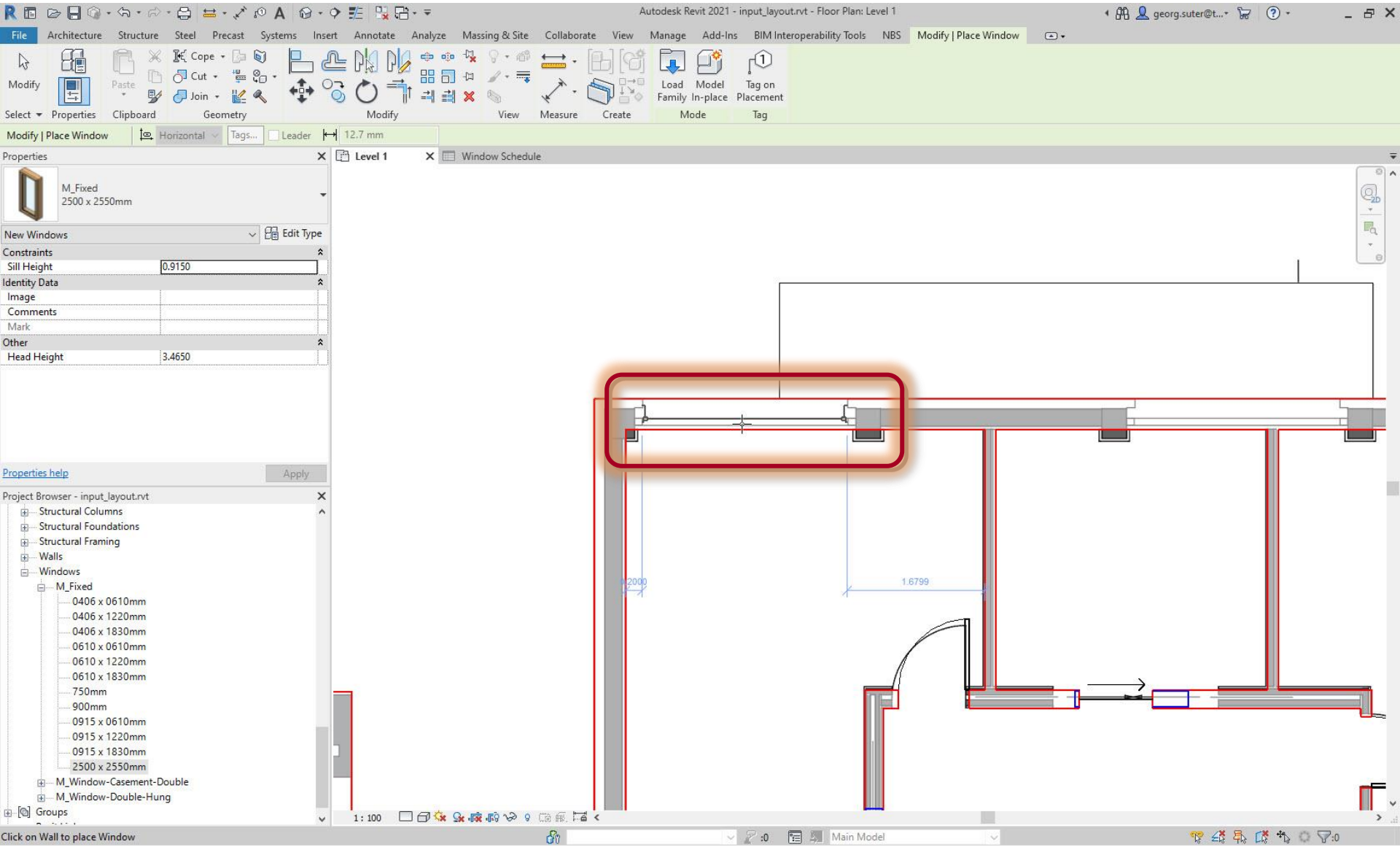
Type Properties > Set ‘Height’, ‘Default Sill Height’, and ‘Width’ values



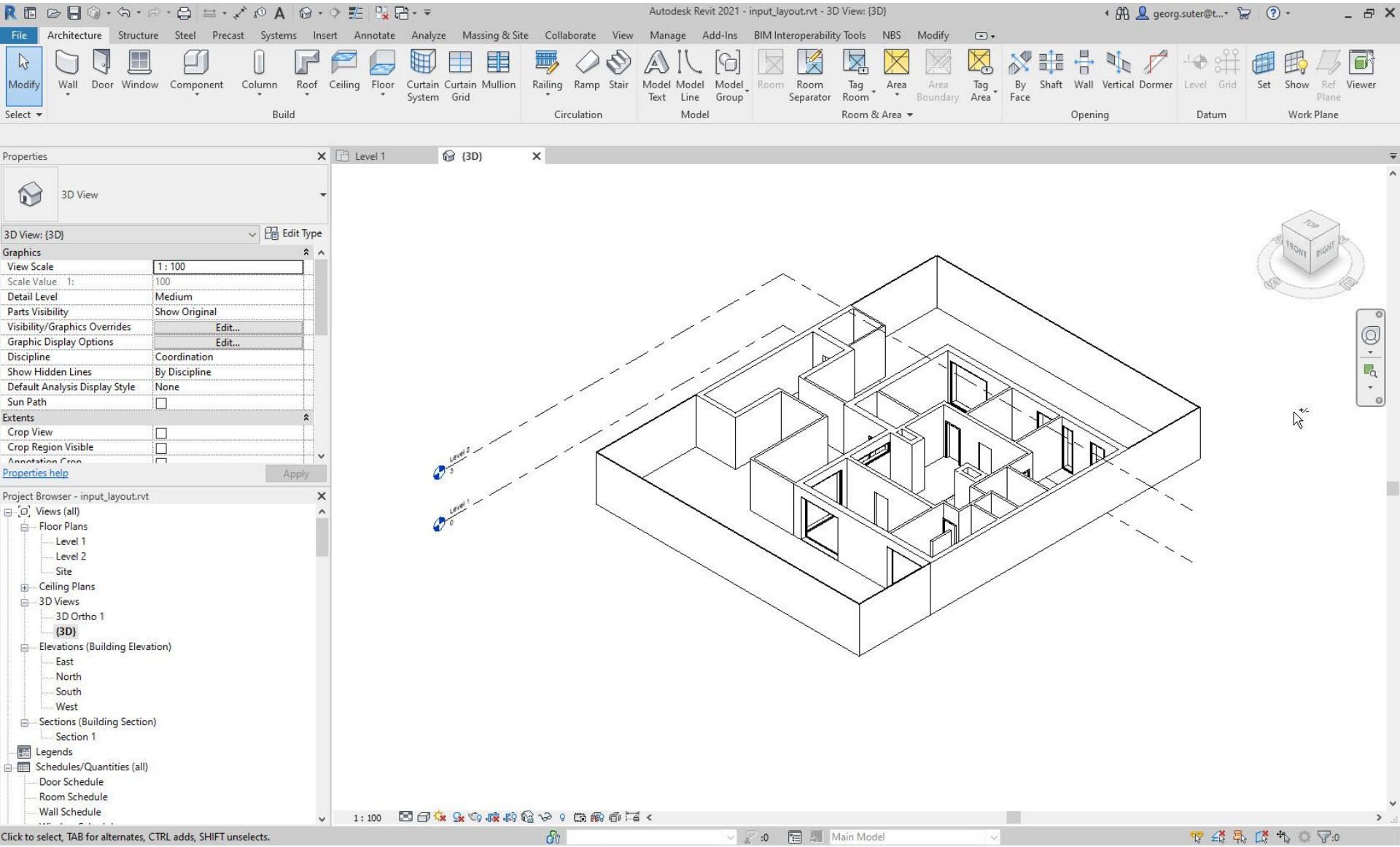
Create Instance



Create Instance



Check correct window elevations and heights



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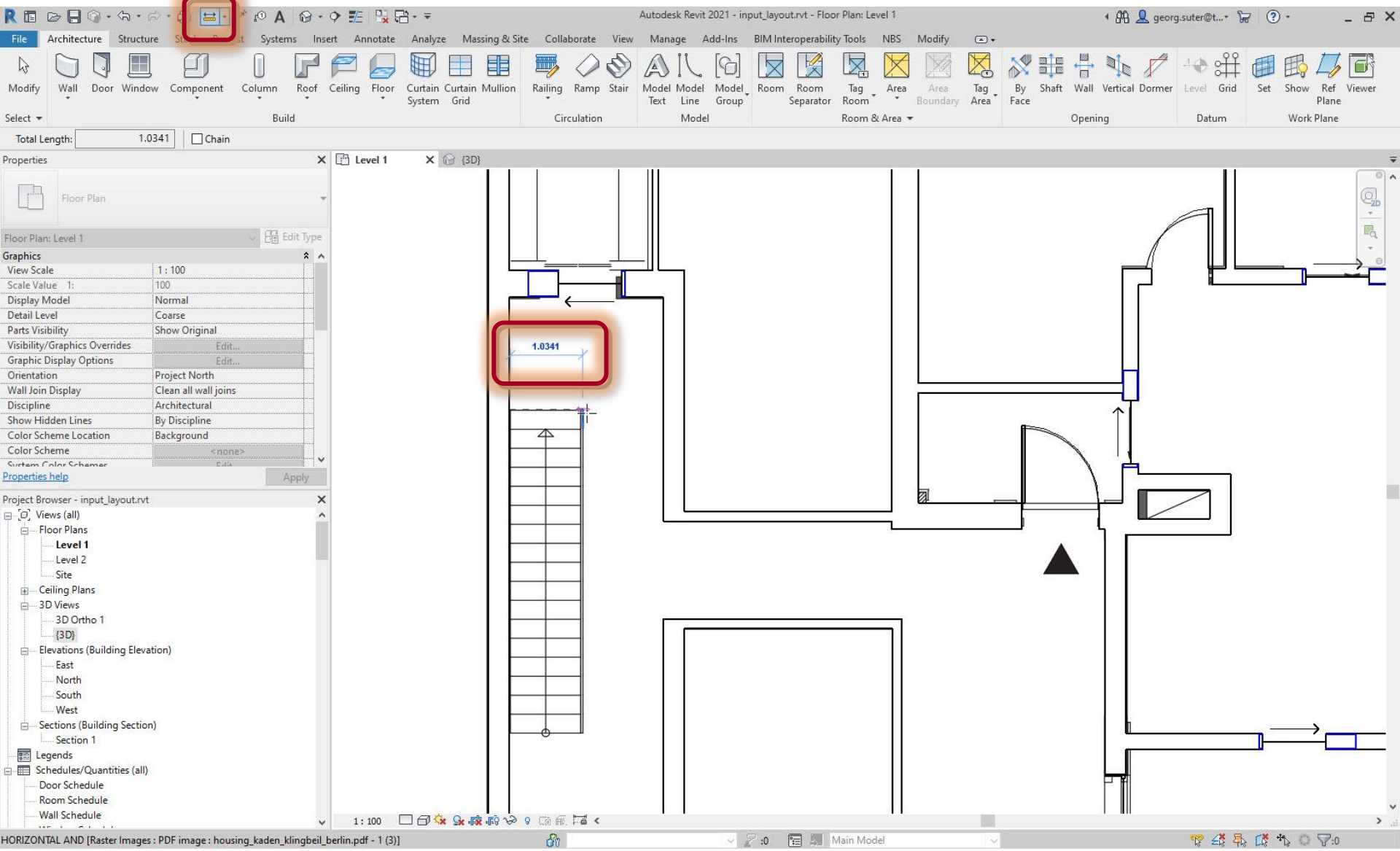
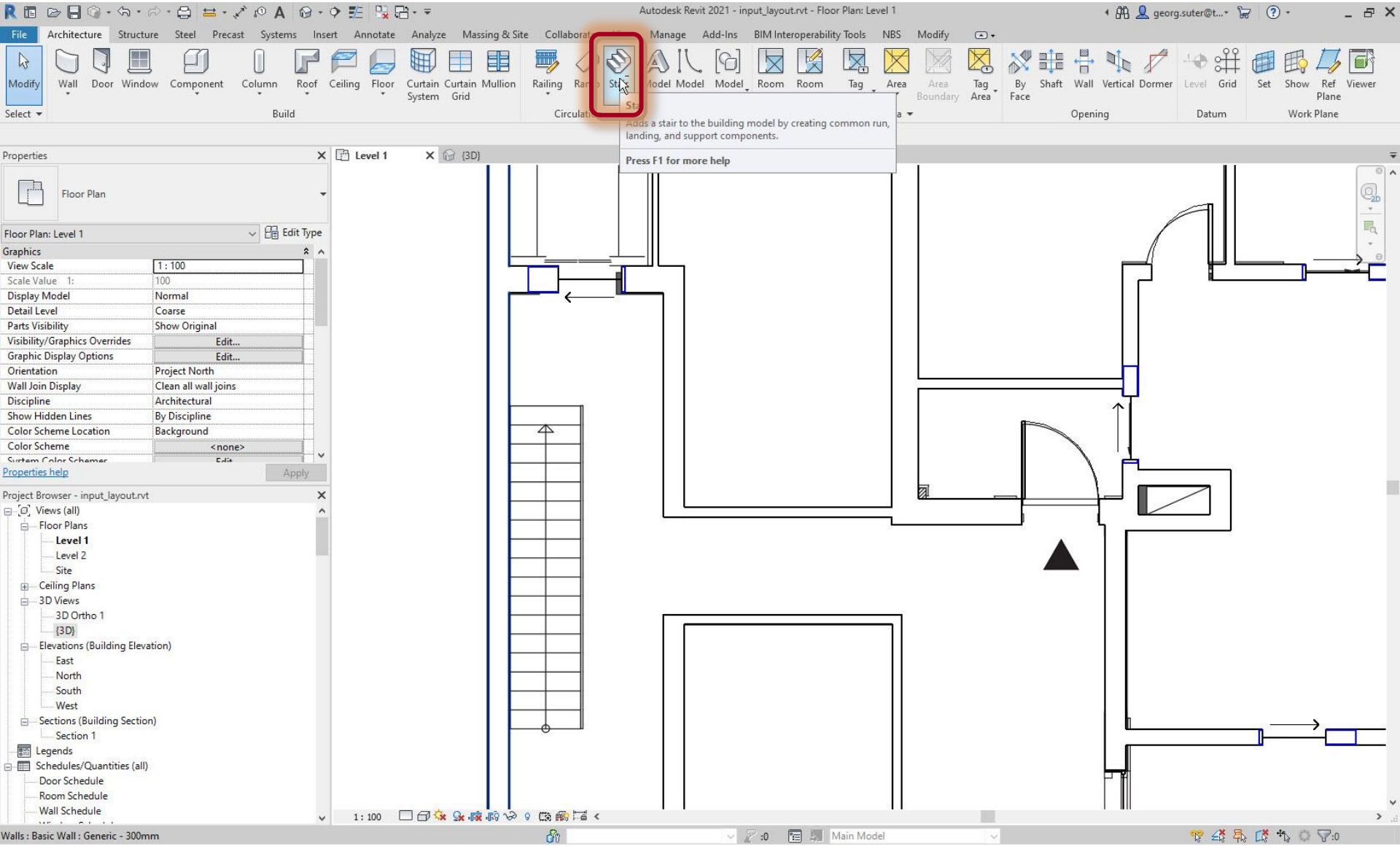
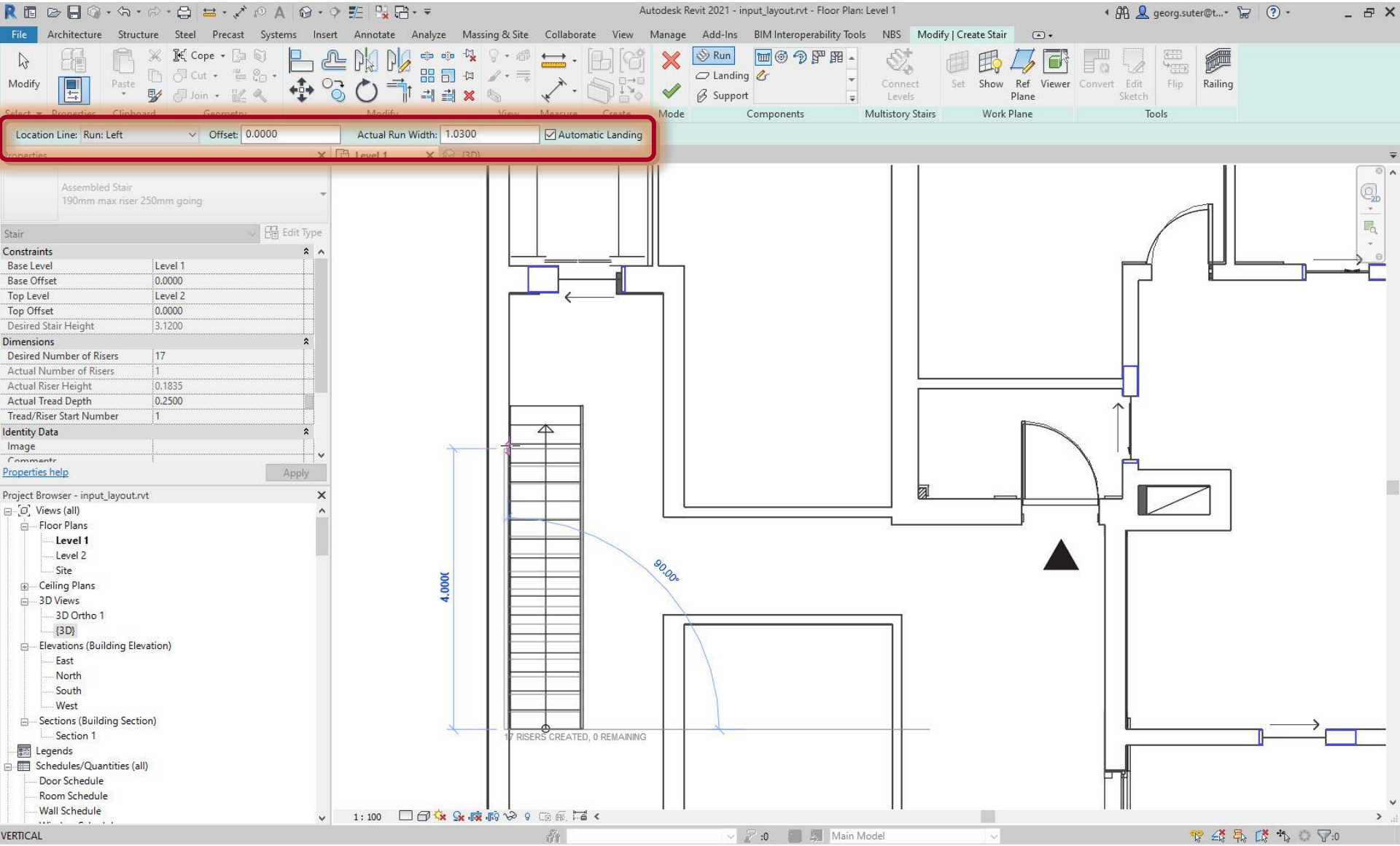
Measure stair width



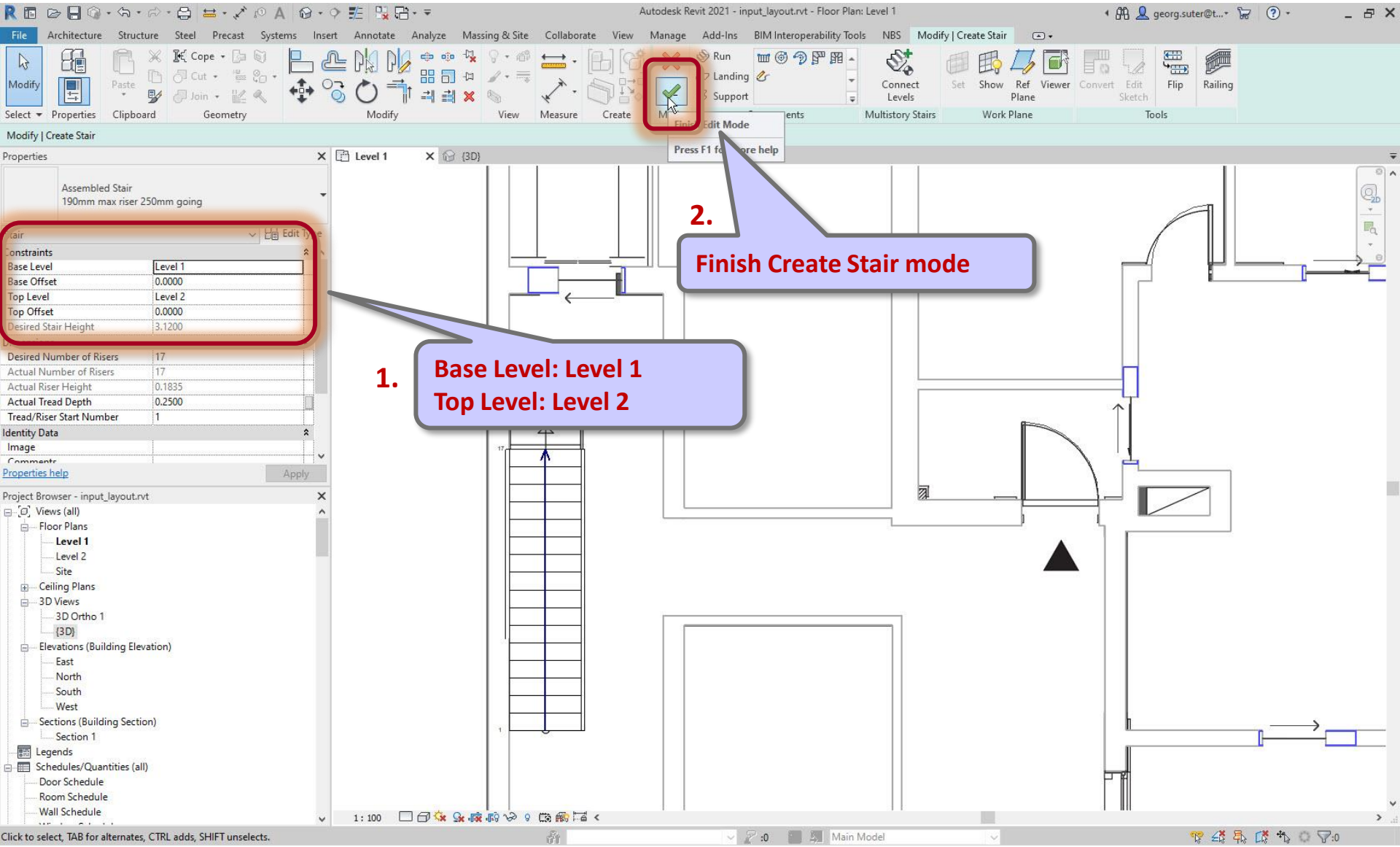
Architecture > Stair



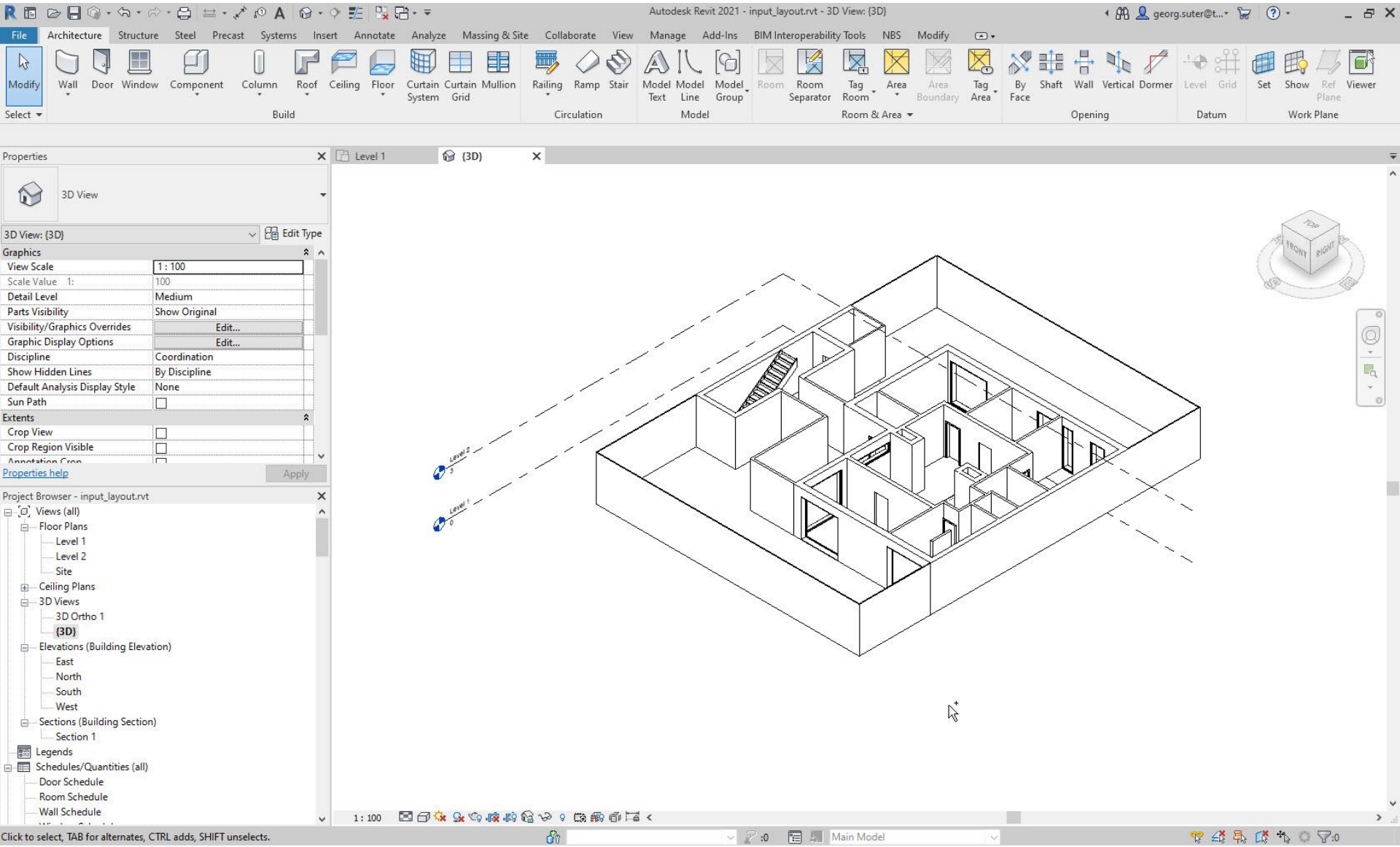
Set ‘Location Line’, ‘Offset’, ‘Actual Run Width’ values



Set ‘Base Level’ and ‘Top Level’ values



Check if stair starts at Level 1 and ends at Level 2



Steps

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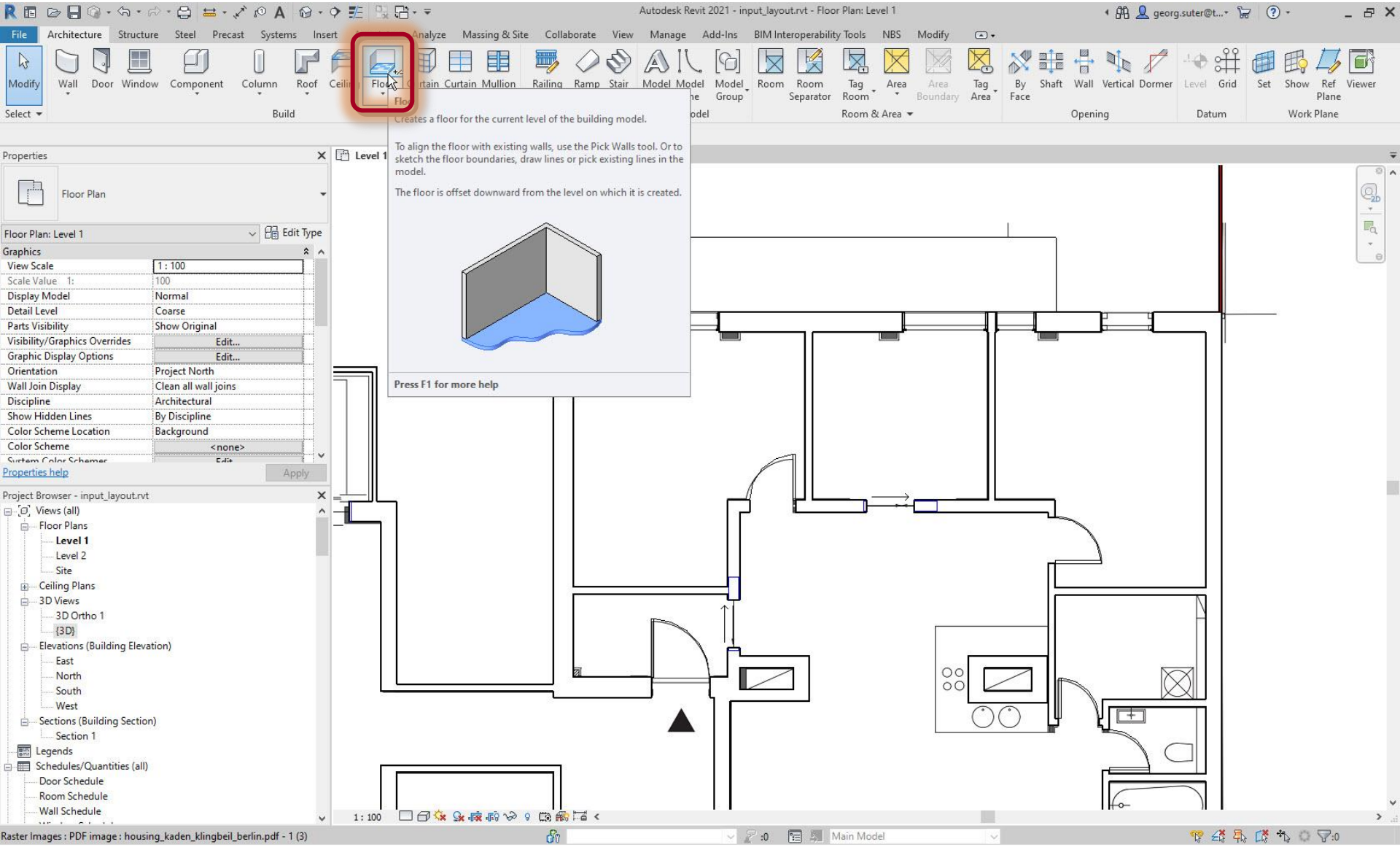
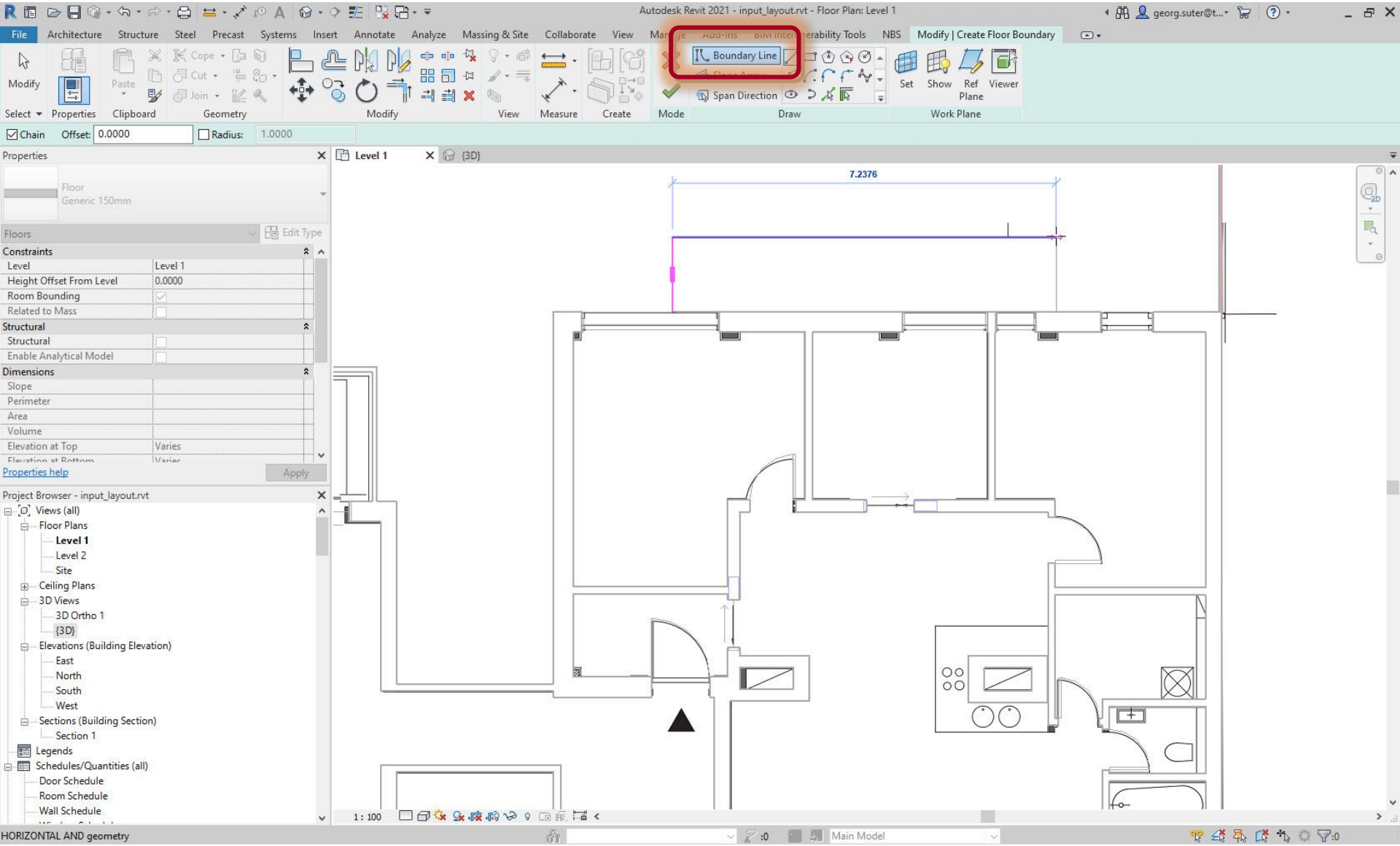
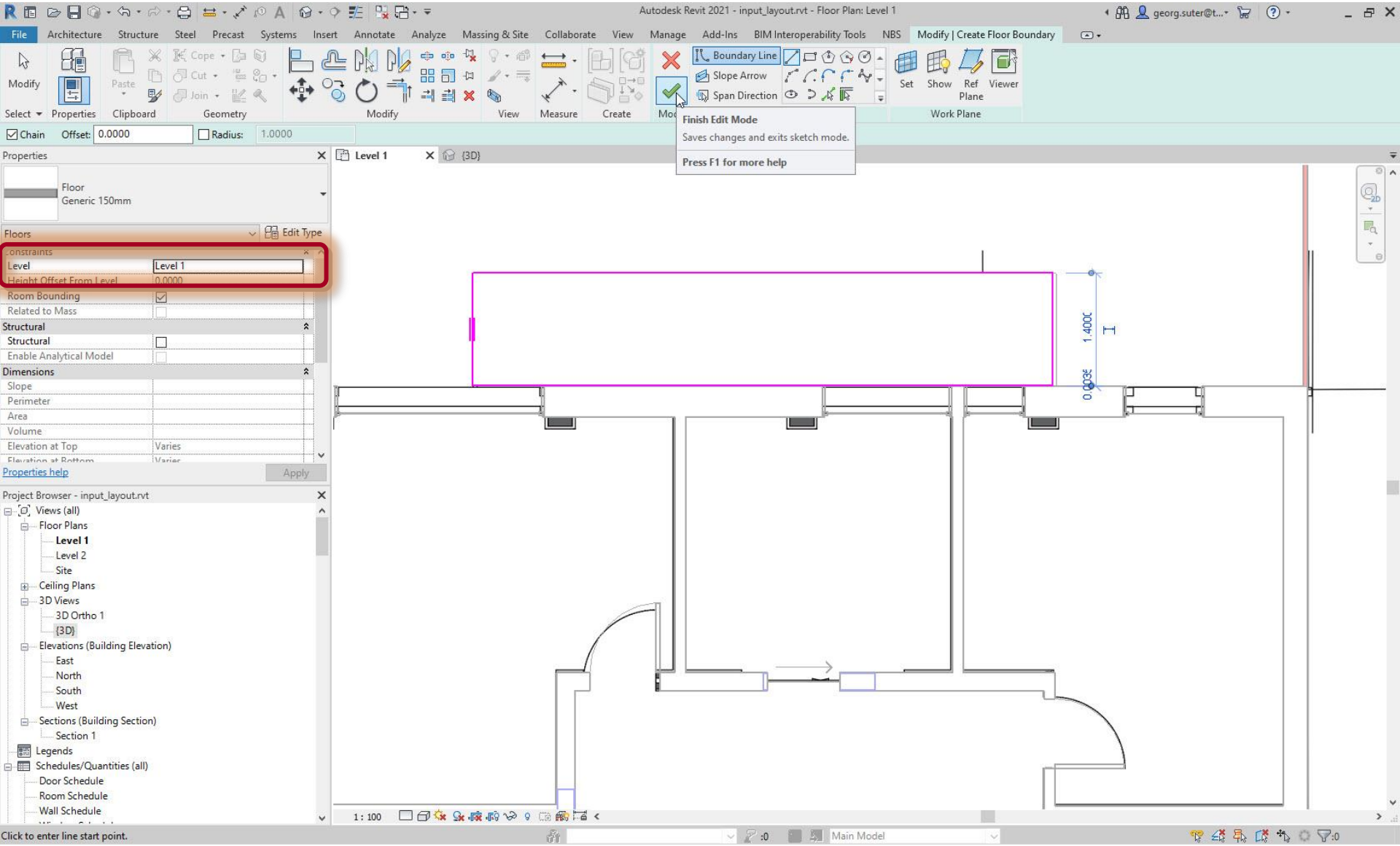
Architecture > Floor



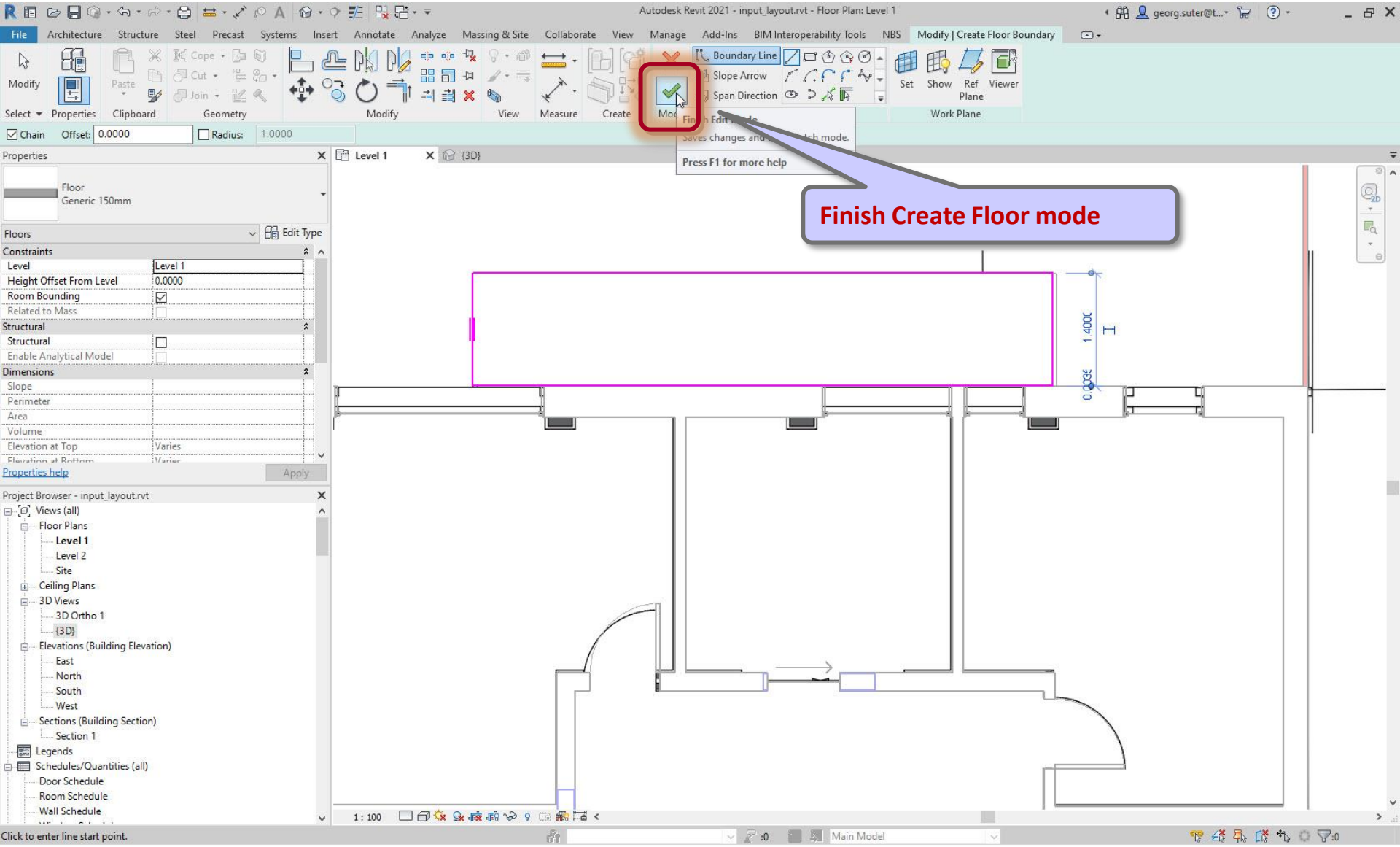
Draw boundary lines



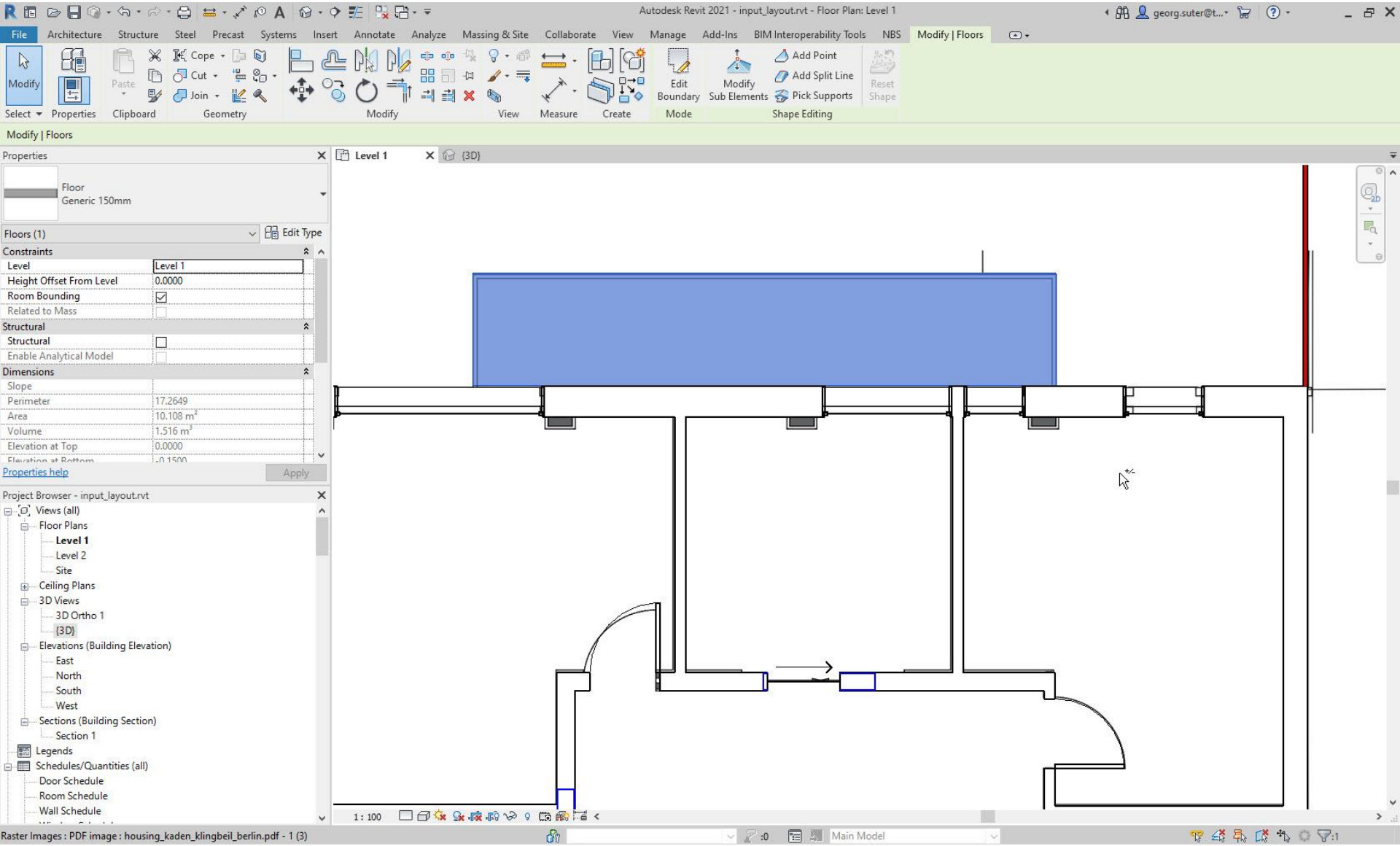
Check level


Autodesk Revit 2021 - input_layout.rvt - Floor Plan: Level 1
File
Architecture
Structure
Steel
Precast
Systems
Insert
Annotate
Analyze
Massing & Site
Collaborate
View
Manage
Add-Ins
BIM Interoperability Tools
NBS
Modify | Create Floor Boundary
Boundary Line
Slope Arrow
Span Direction
Finish Edit Mode
Saves changes and exits sketch mode.
Press F1 for more help
Properties
Floor
Generic 150mm
Floors
Edit Type
Level
Level 1
Height Offset From Level
Room Bounding
Related to Mass
Structural
Enable Analytical Model
Dimensions
Slope
Perimeter
Area
Volume
Elevation at Top
Varies
Properties help
Apply
Project Browser - input_layout.rvt
Views (all)
Floor Plans
Level 1
Level 2
Site
Ceiling Plans
3D Views
3D Ortho 1
{3D}
Elevations (Building Elevation)
East
North
South
West
Sections (Building Section)
Section 1
Legends
Schedules/Quantities (all)
Door Schedule
Room Schedule
Wall Schedule
Level 1
{3D}
1 : 100
Click to enter line start point.
Main Model

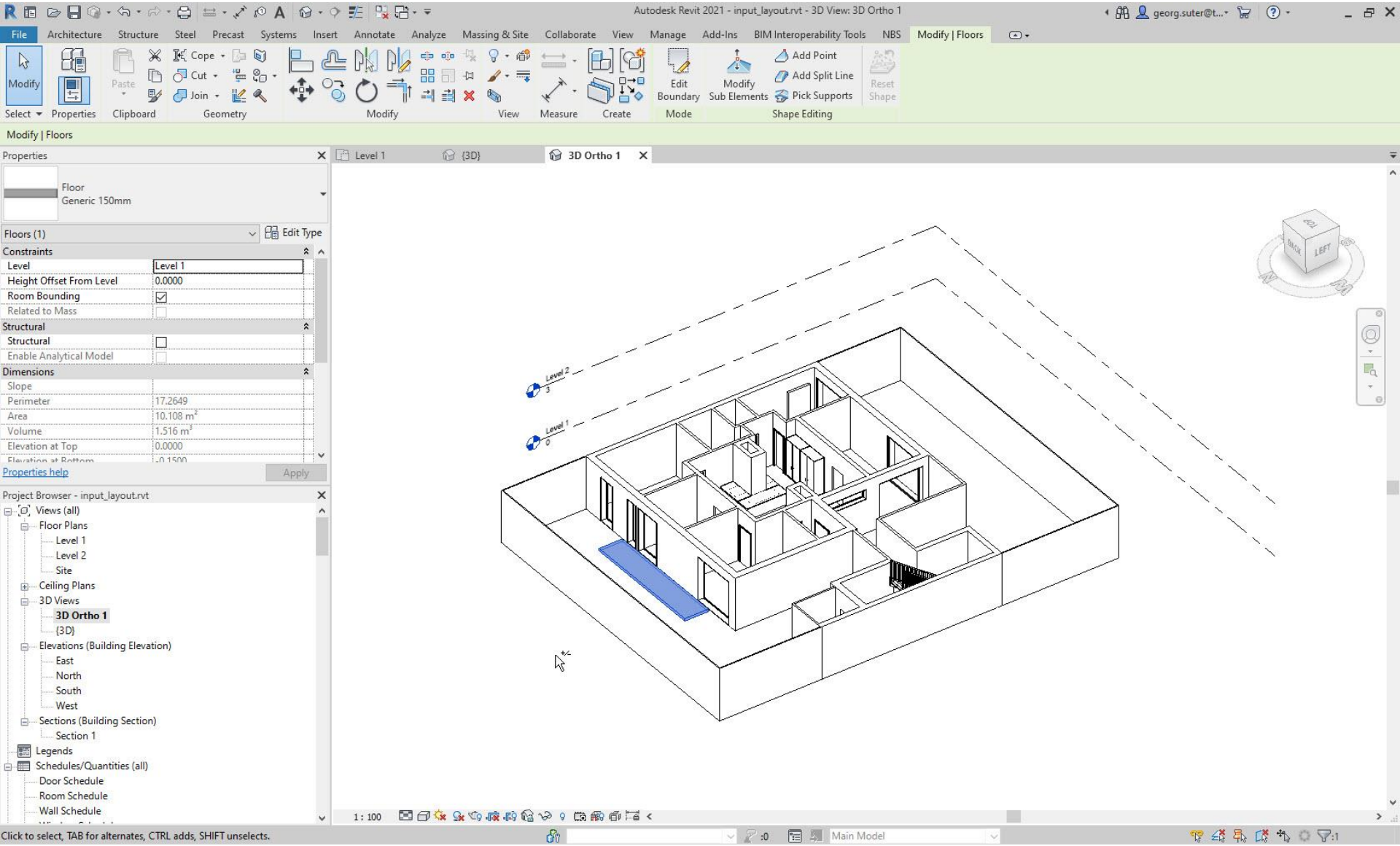
Finish edit mode



Floor element should be colored if its creation is successful



Check correct elevations of horizontal external elements



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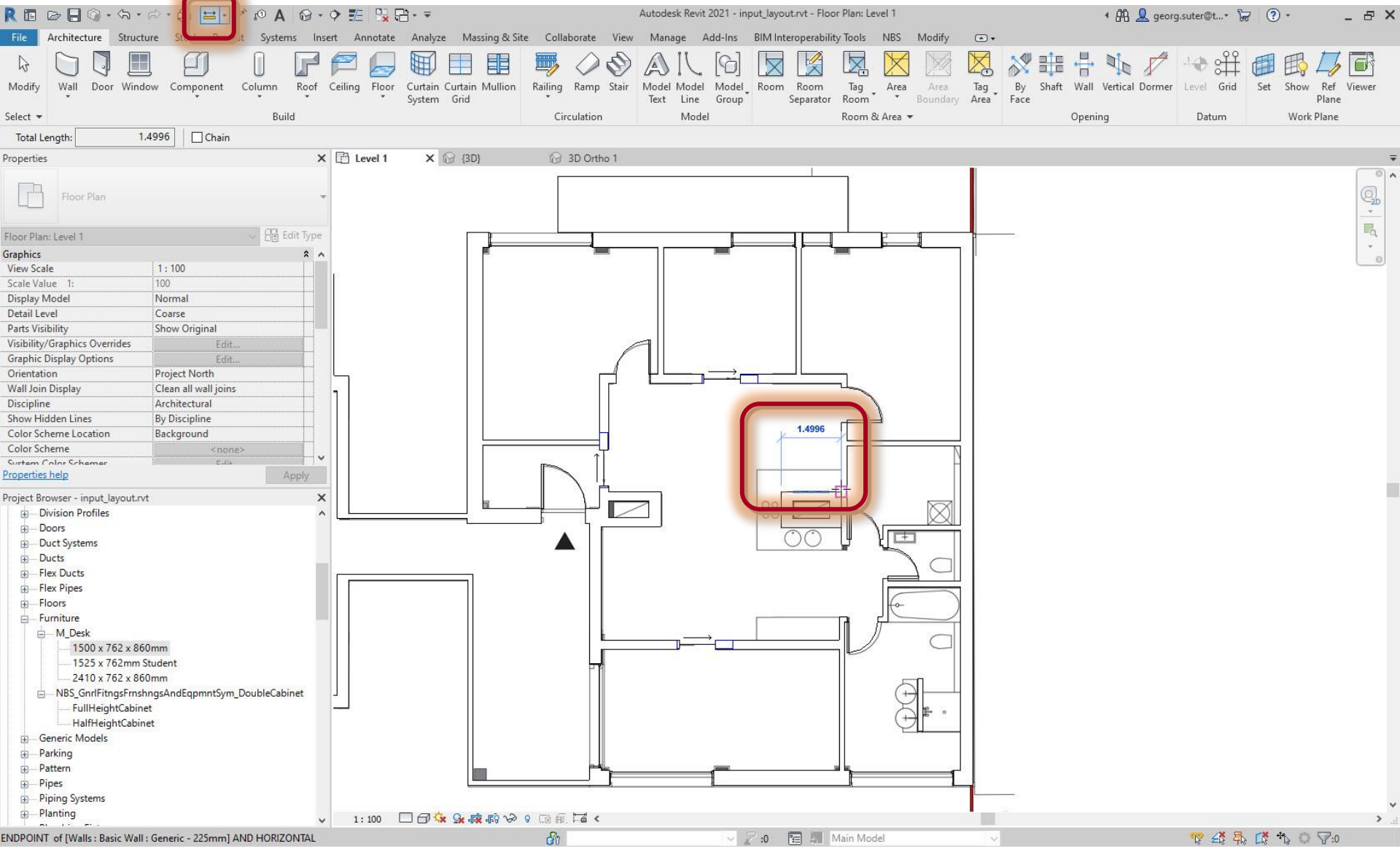
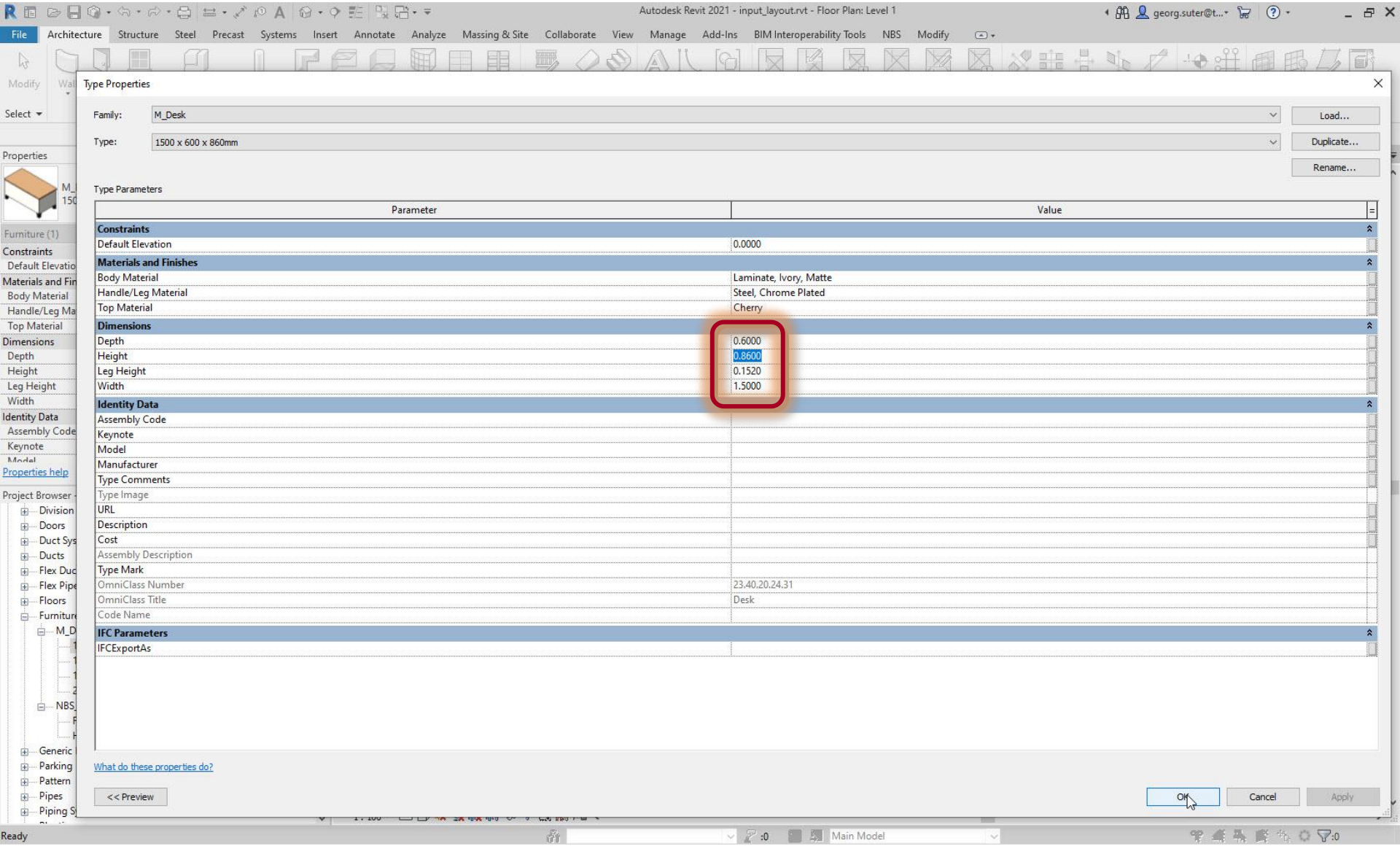
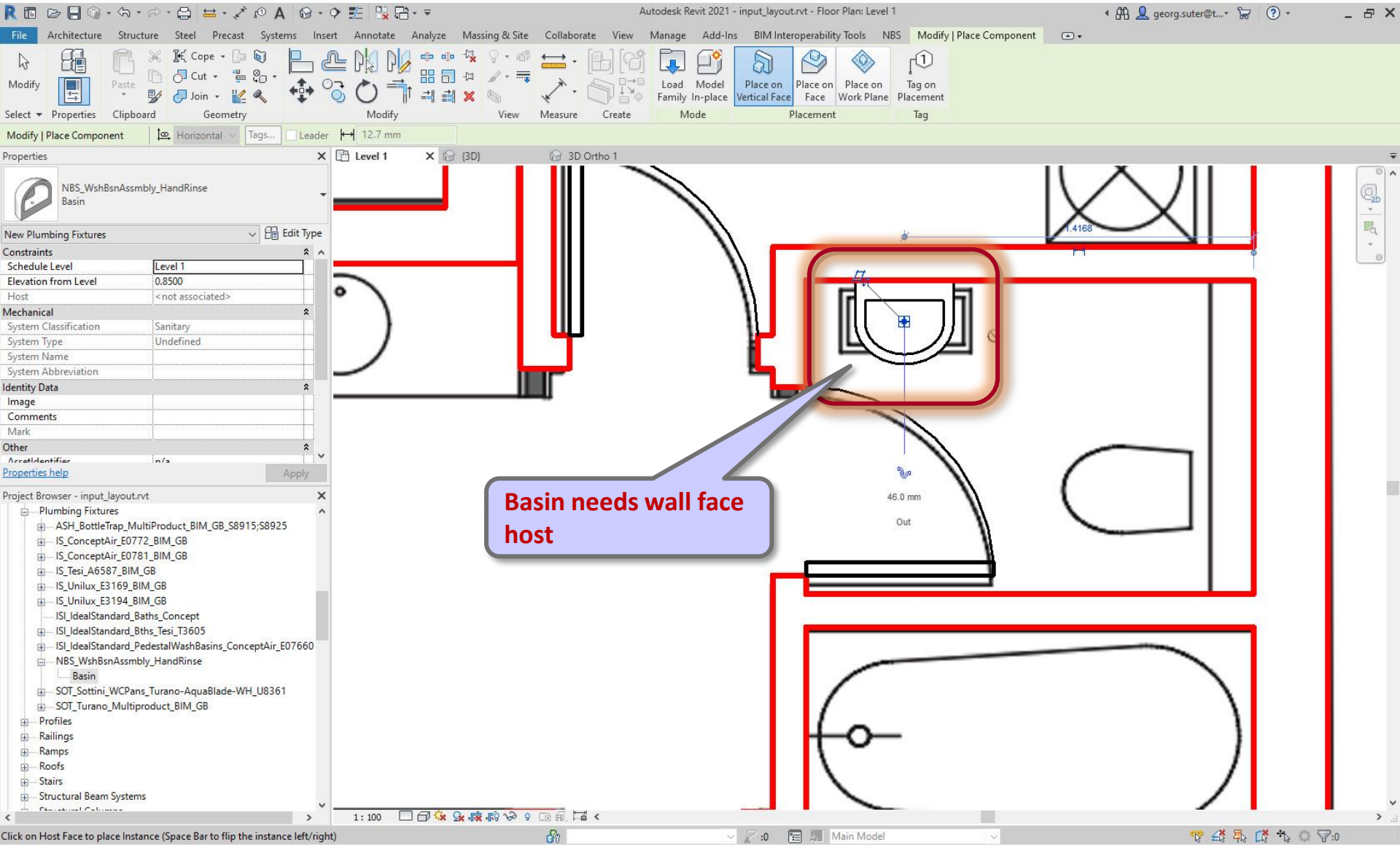
Measure cabinet dimensions



Set desk type property values



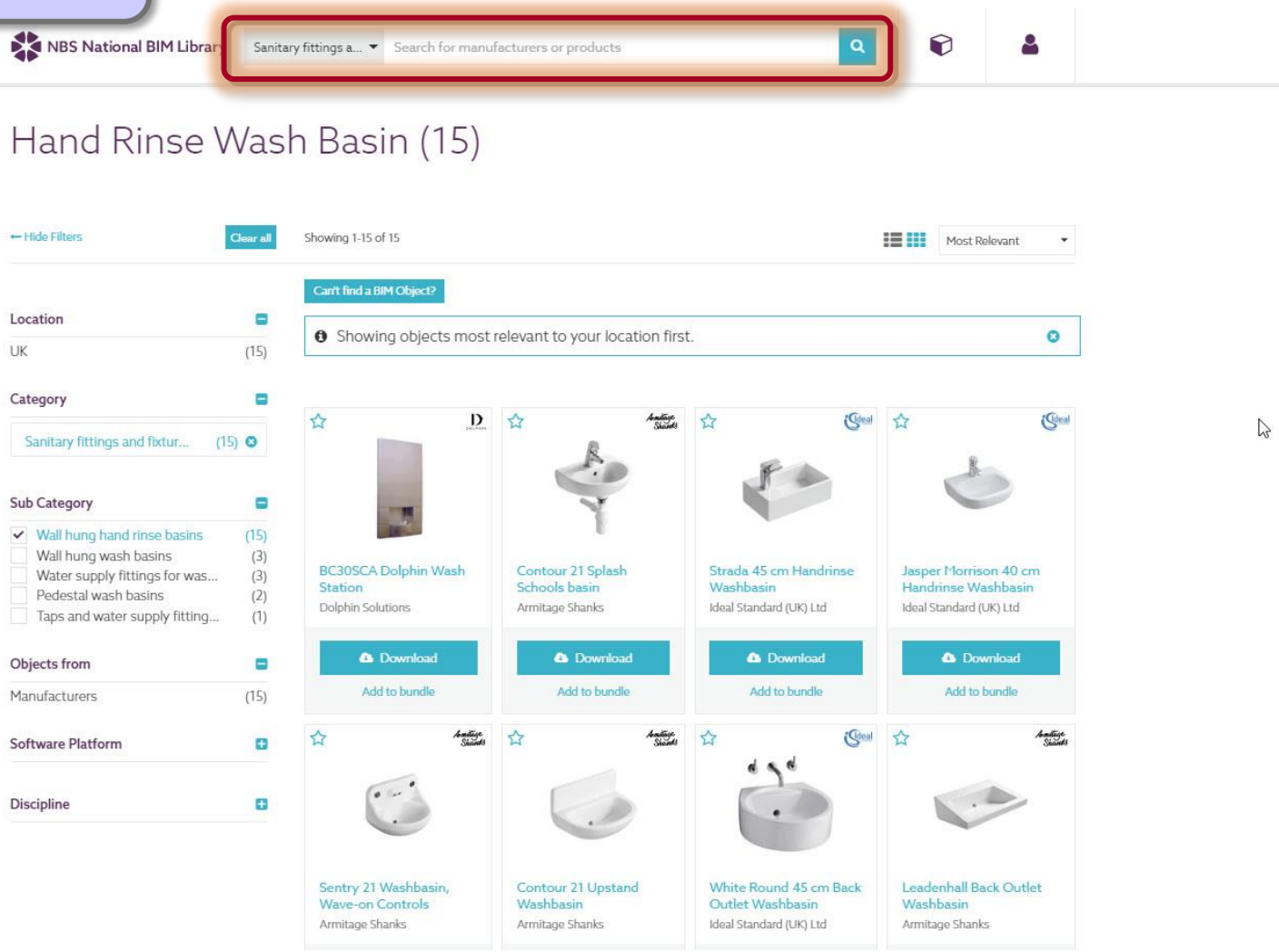
Create Instance



Online resources for generic and manufacturer BIM objects:

e.g. National BIM library (UK, https://www.nationalbimlibrary.com/)

Use Revit families from online resources, if necessary



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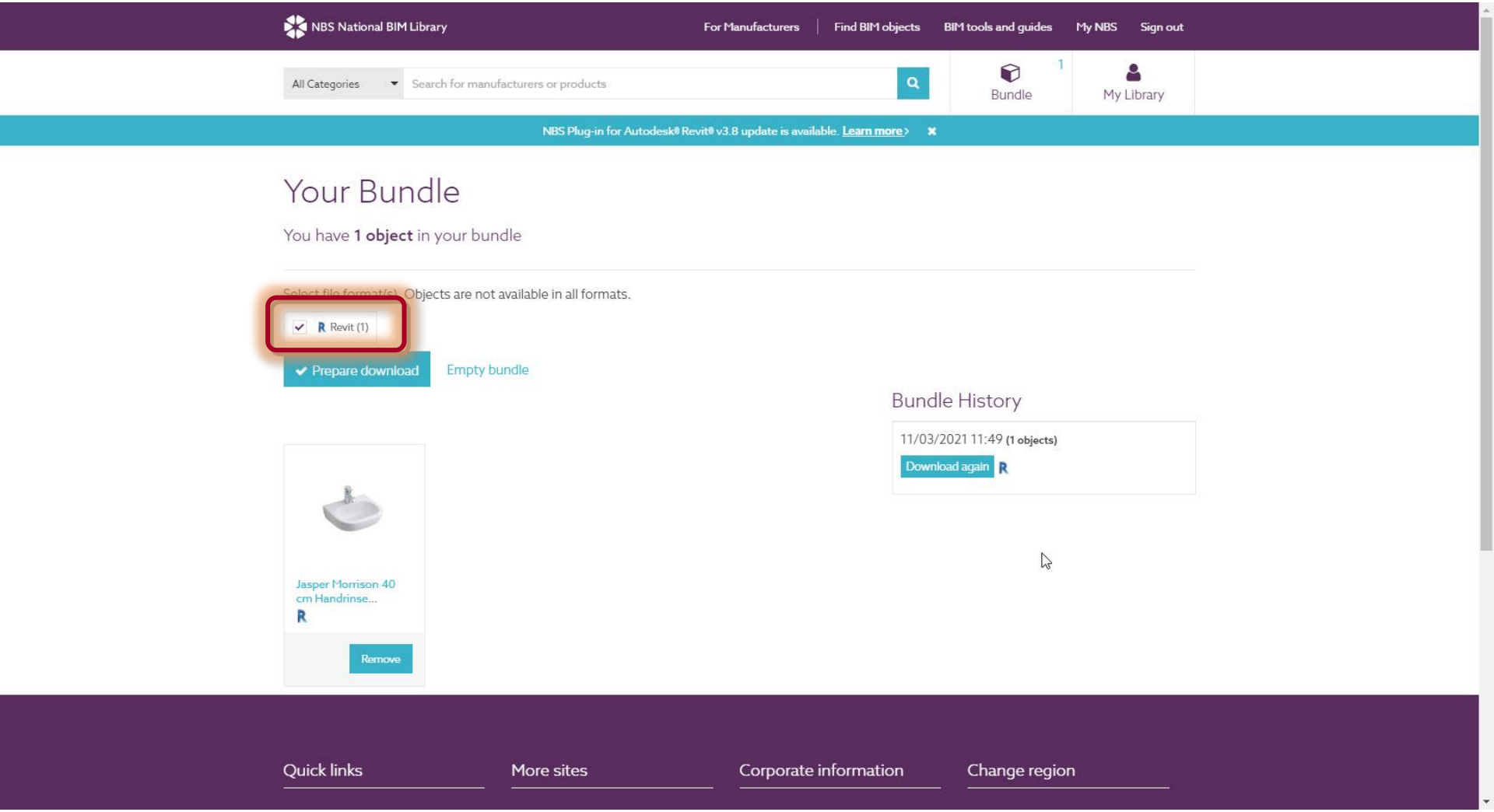
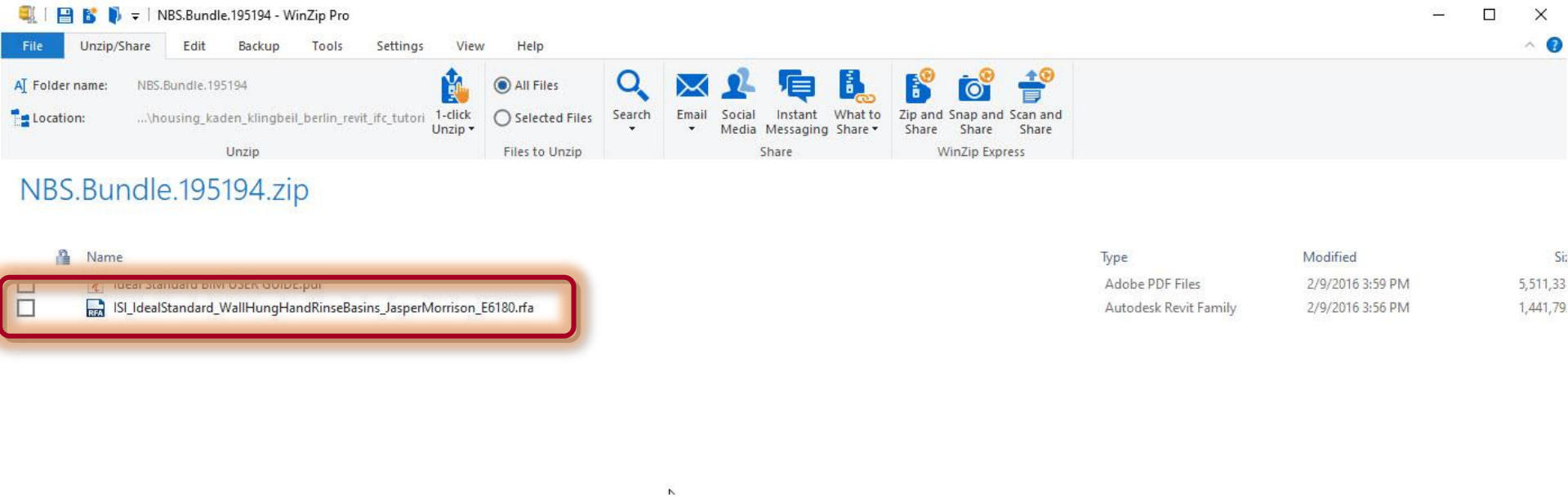
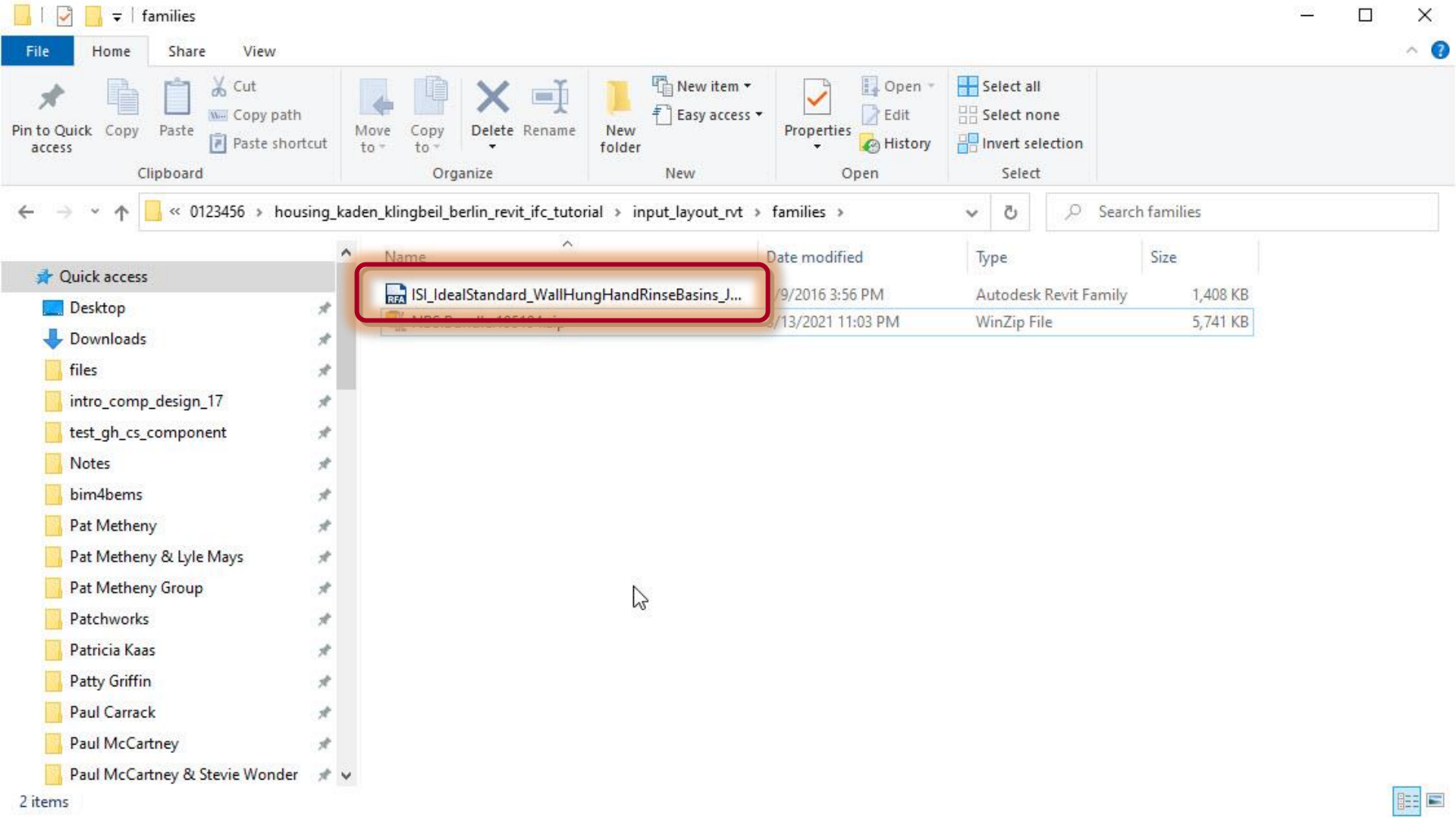
e.g. National BIM library (UK, https://www.nationalbimlibrary.com/)



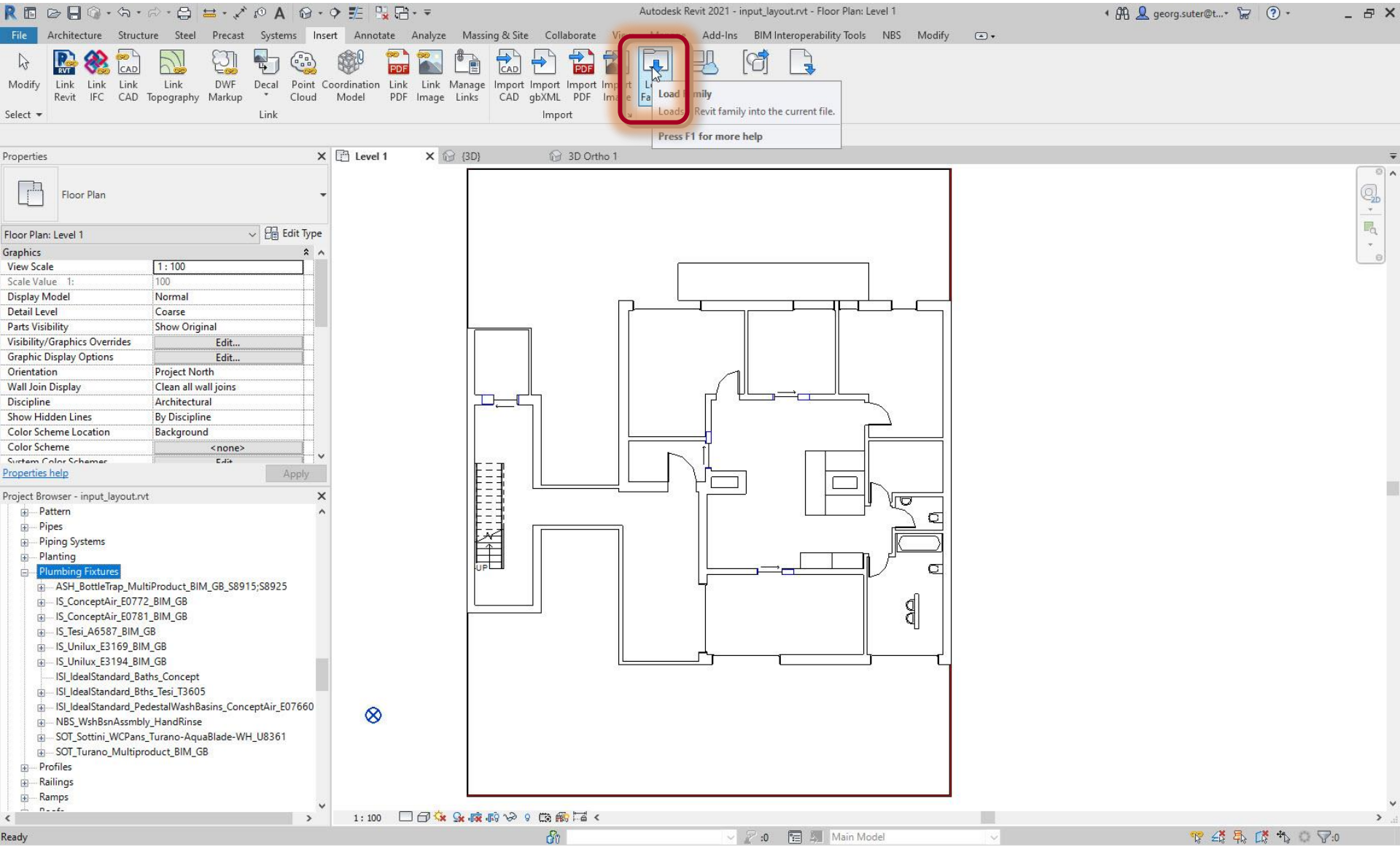
.rfa: format for Revit family definitions



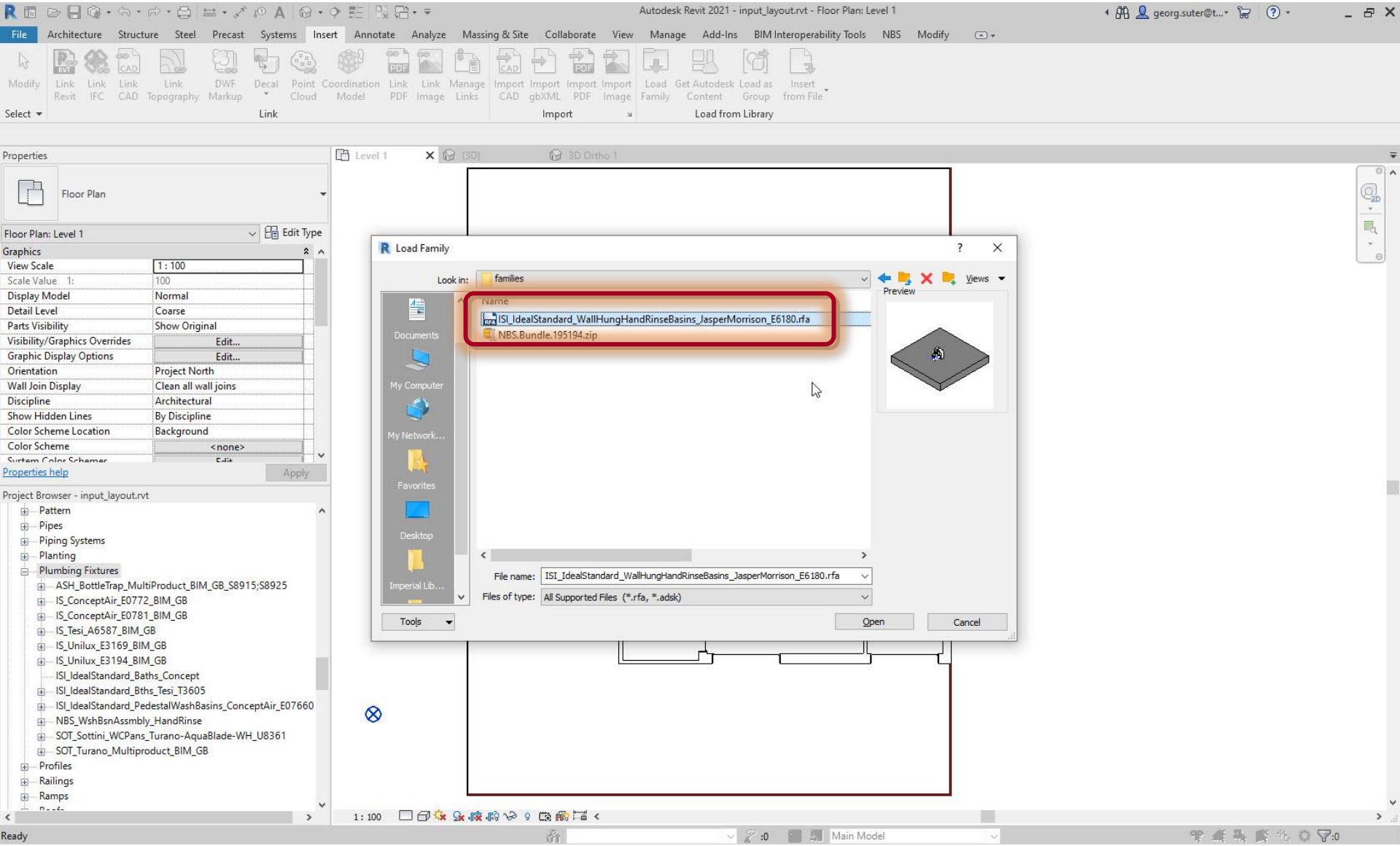
.rfa: format for Revit family definitions



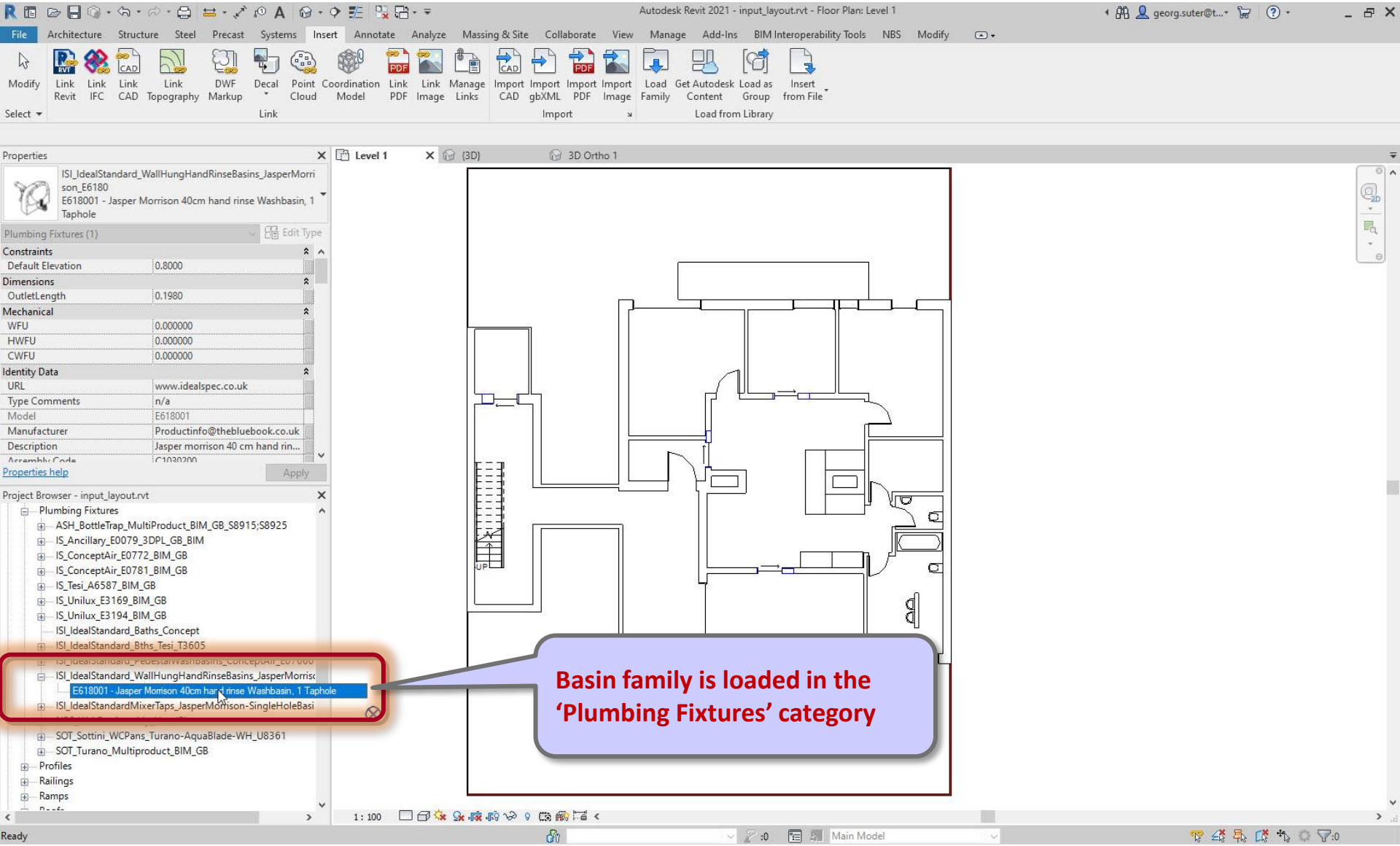
Insert > Load Family



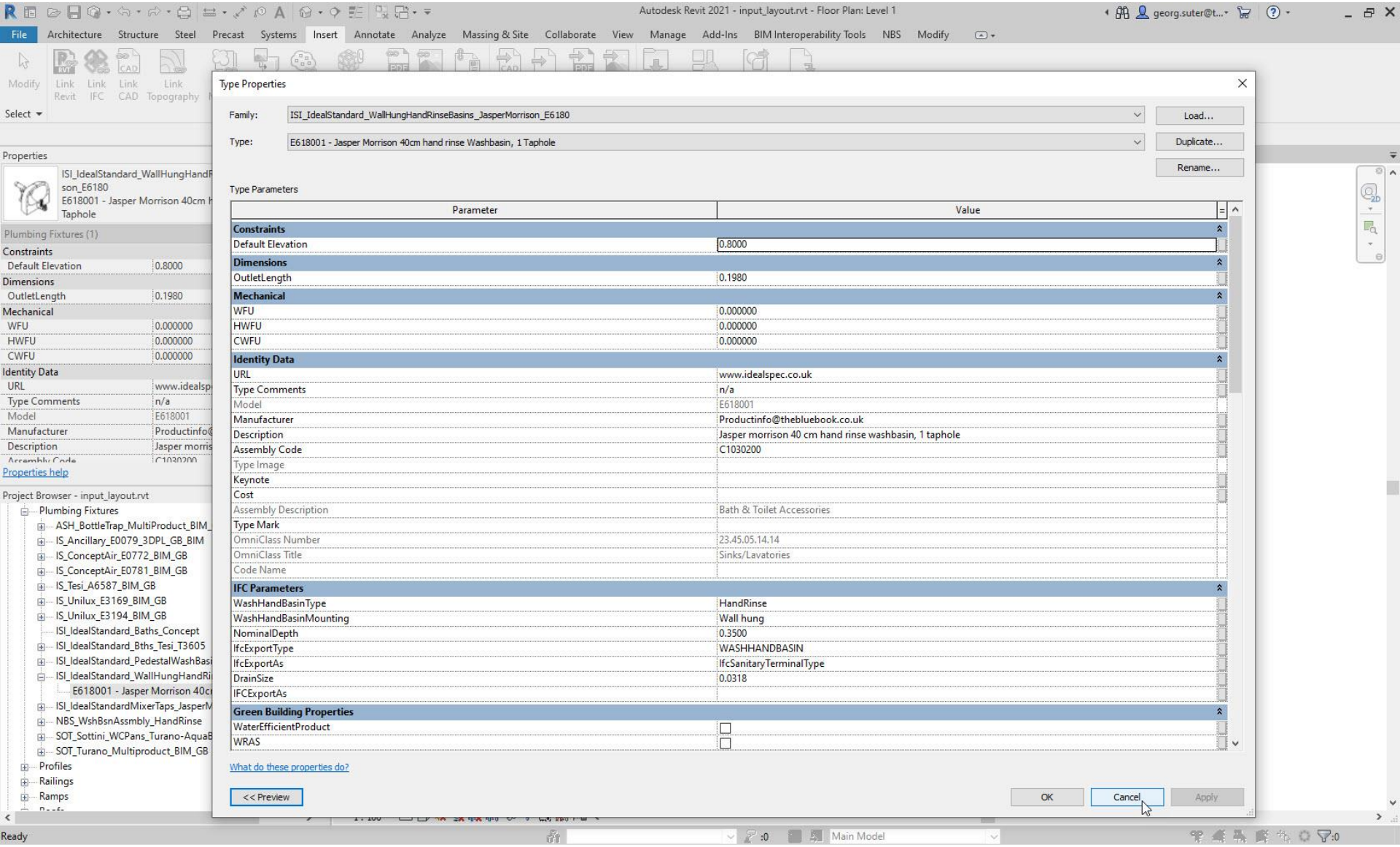
Insert > Load Family



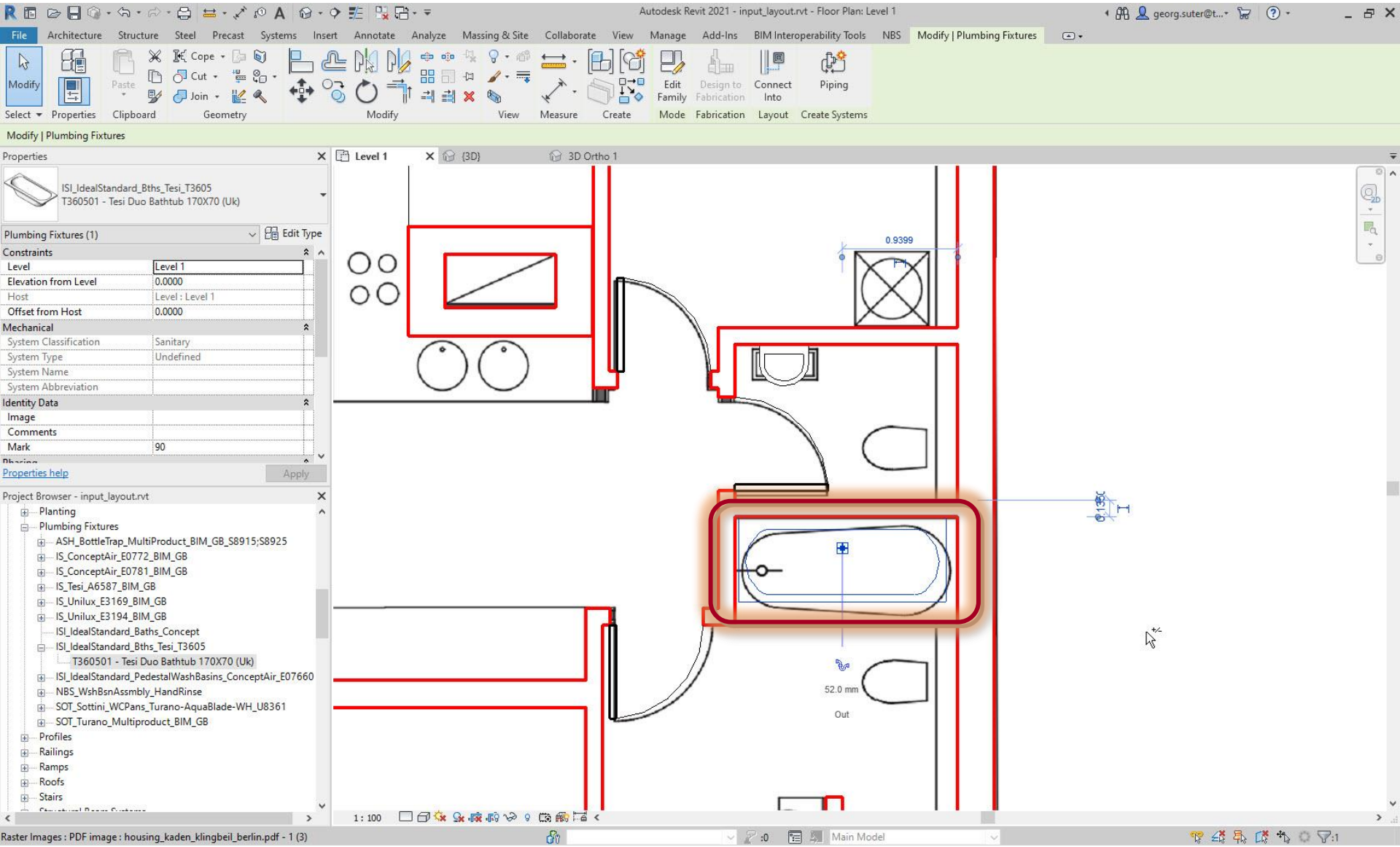
Insert > Load Family



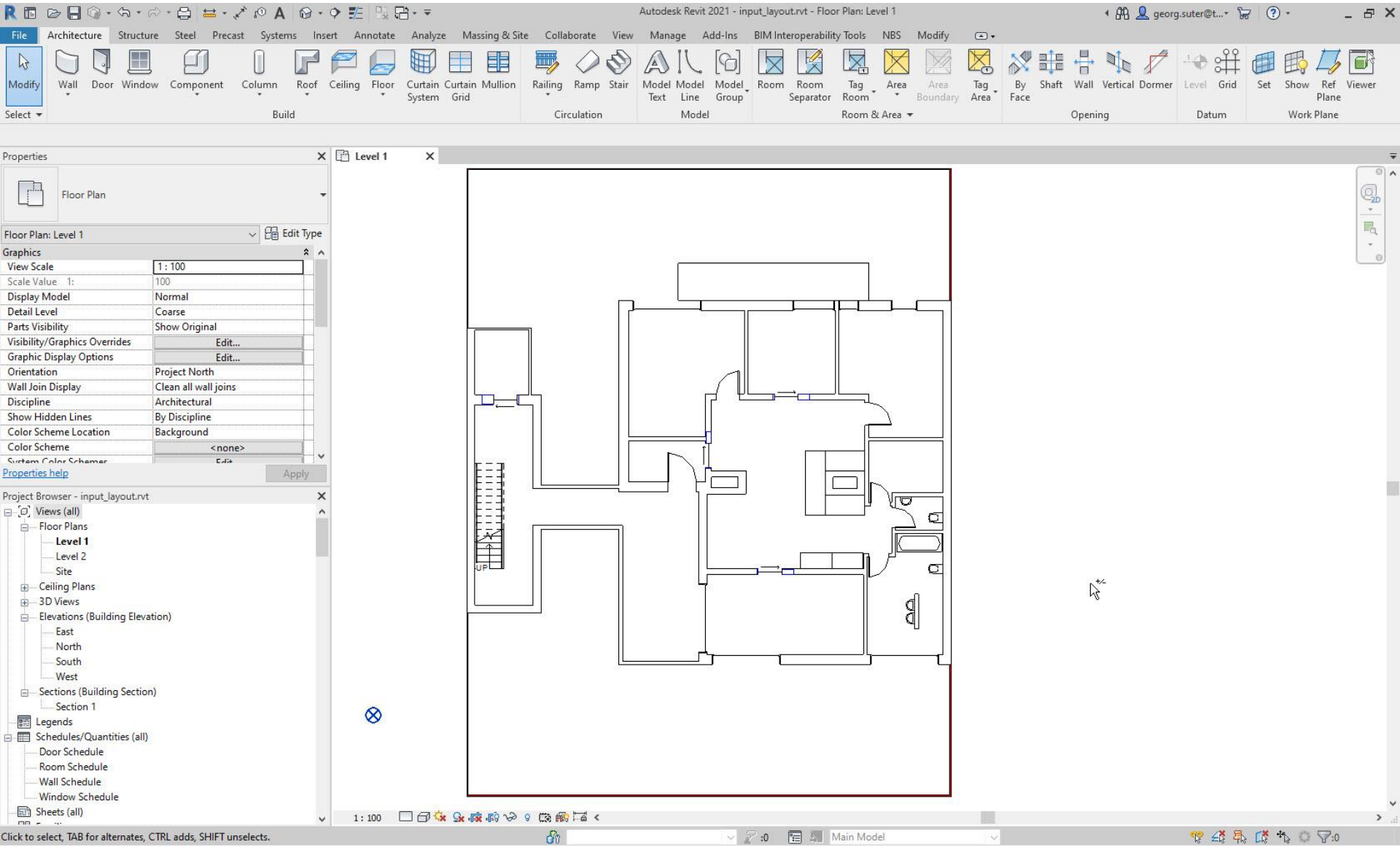
Type data


Autodesk Revit 2021 - input_layout.rvt - Floor Plan: Level 1
Type Properties
Family: ISI_IdealStandard_WallHungHandRinseBasins_JasperMorrison_E6180
Type: E618001 - Jasper Morrison 40cm hand rinse Washbasin, 1 Taphole
Load...
Duplicate...
Rename...
Type Parameters
Parameter
Value
Constraints
Default Elevation 0.8000
Dimensions
OutletLength 0.1980
Mechanical
WFU 0.000000
HWFU 0.000000
CWFU 0.000000
Identity Data
URL www.idealspec.co.uk
Type Comments n/a
Model E618001
Manufacturer Productinfo@thebluebook.co.uk
Description Jasper morrison 40 cm hand rinse washbasin, 1 taphole
Assembly Code C1030200
Type Image
Keynote
Cost
Assembly Description Bath & Toilet Accessories
Type Mark
OmniClass Number 23.45.05.14.14
OmniClass Title Sinks/Lavatories
Code Name
IFC Parameters
WashHandBasinType HandRinse
WashHandBasinMounting Wall hung
NominalDepth 0.3500
IfcExportType WASHHANDBASIN
IfcExportAs IfcSanitaryTerminalType
DrainSize 0.0318
IFCExportAs
Green Building Properties
WaterEfficientProduct
WRAS
What do these properties do?
<< Preview
OK
Cancel
Apply

Create Instance



Check if all furnishing elements have been placed correctly



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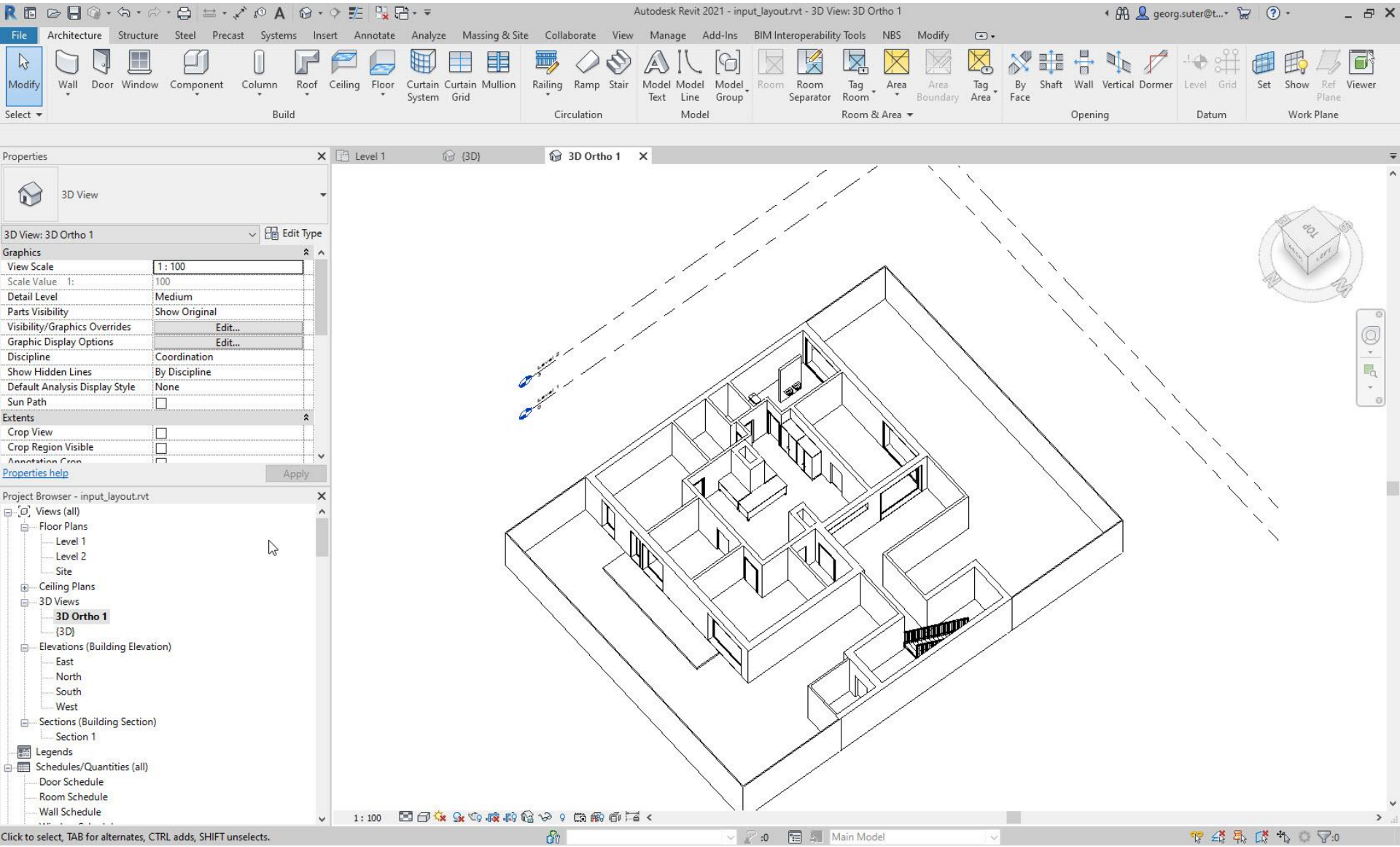

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12. Create geocoordinates
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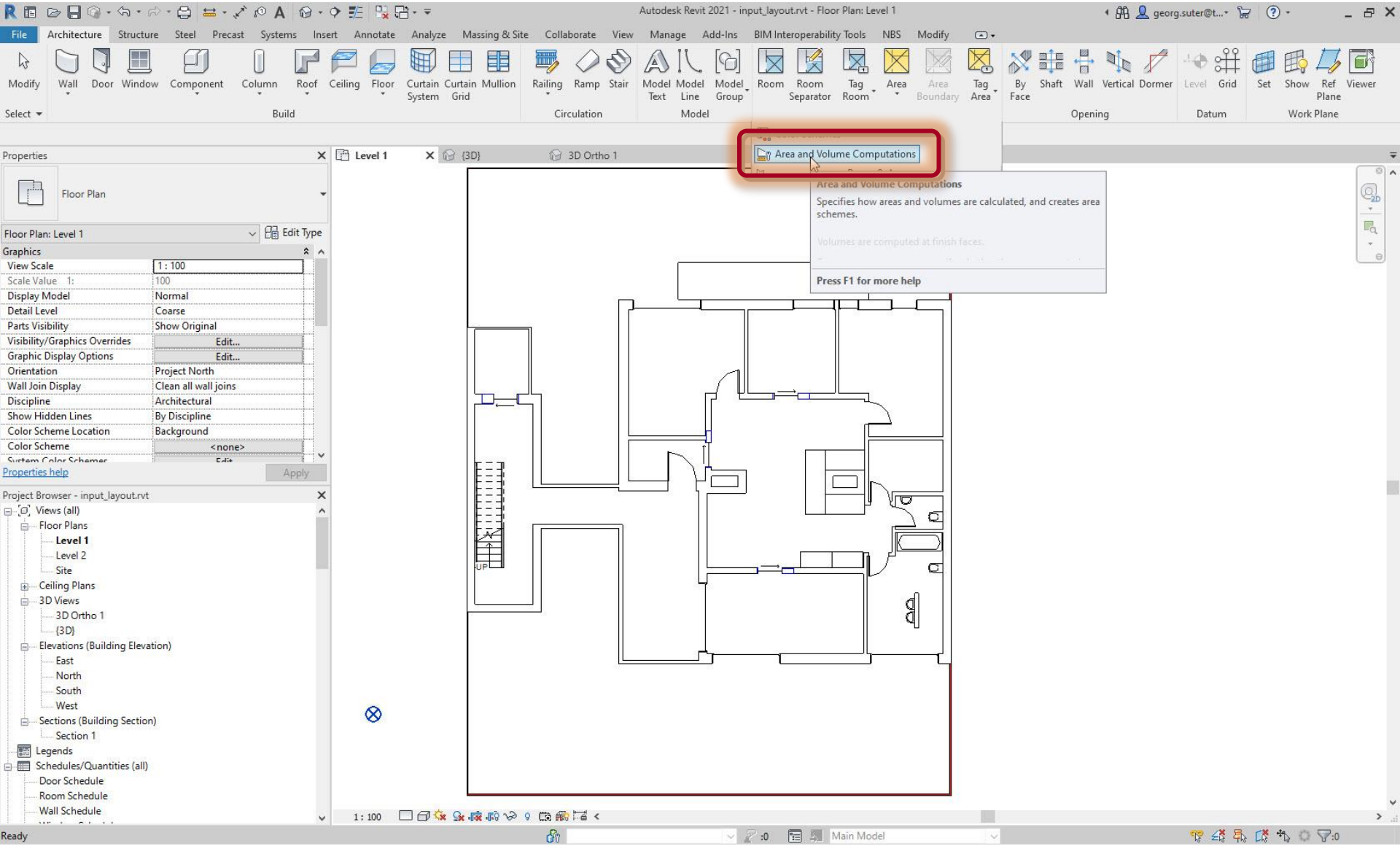
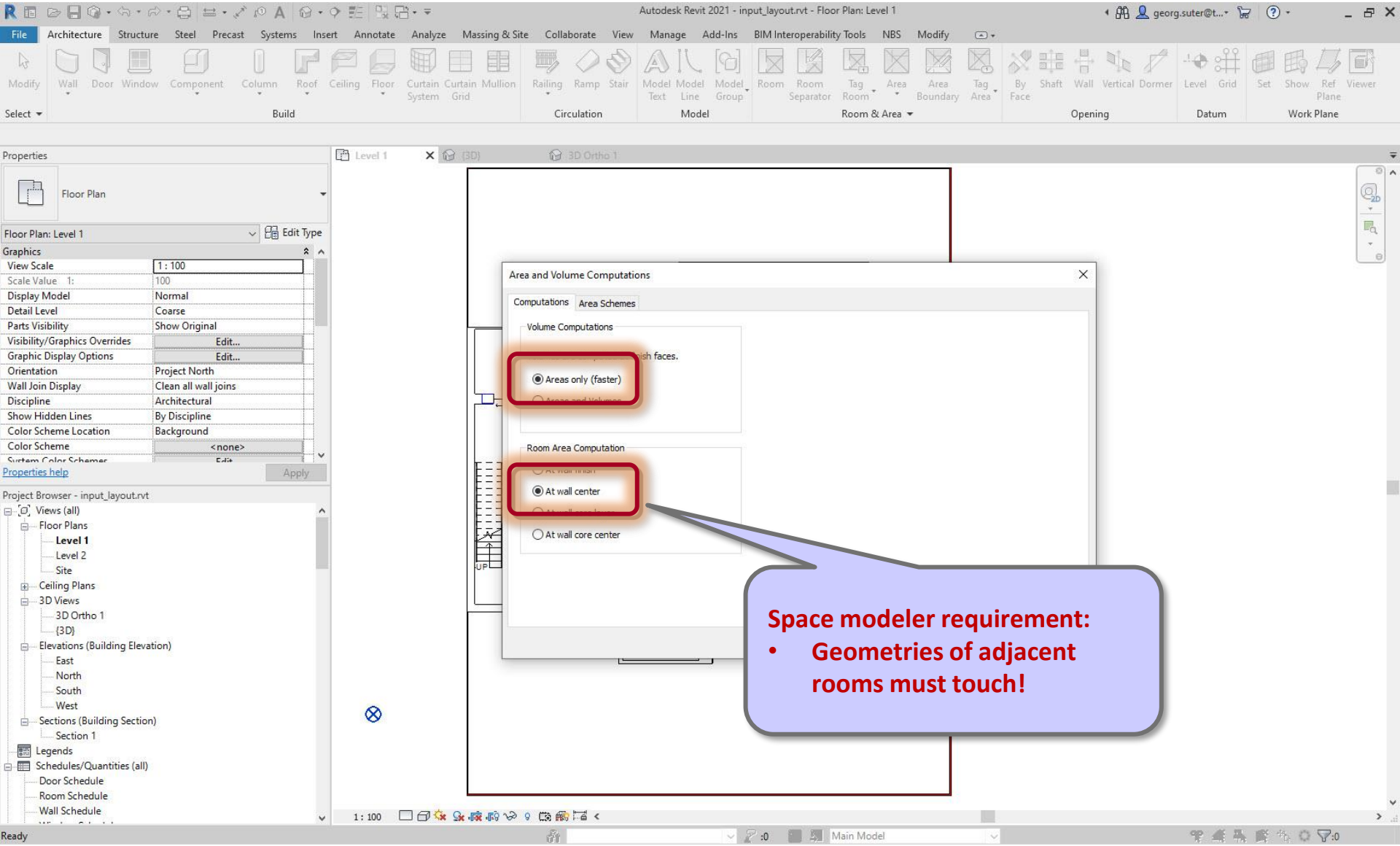
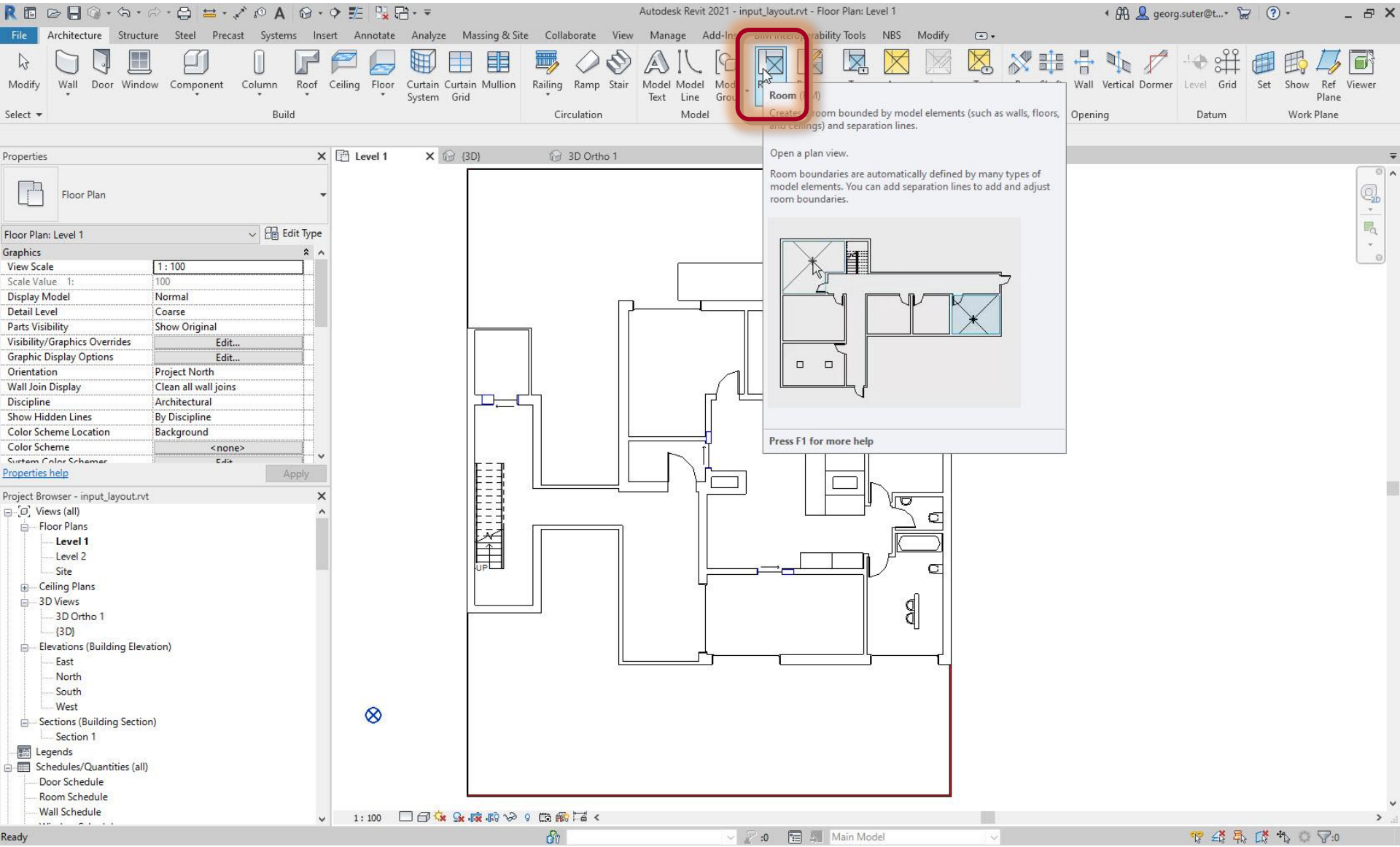
Architecture > Room & Area > Area and Volume Computations



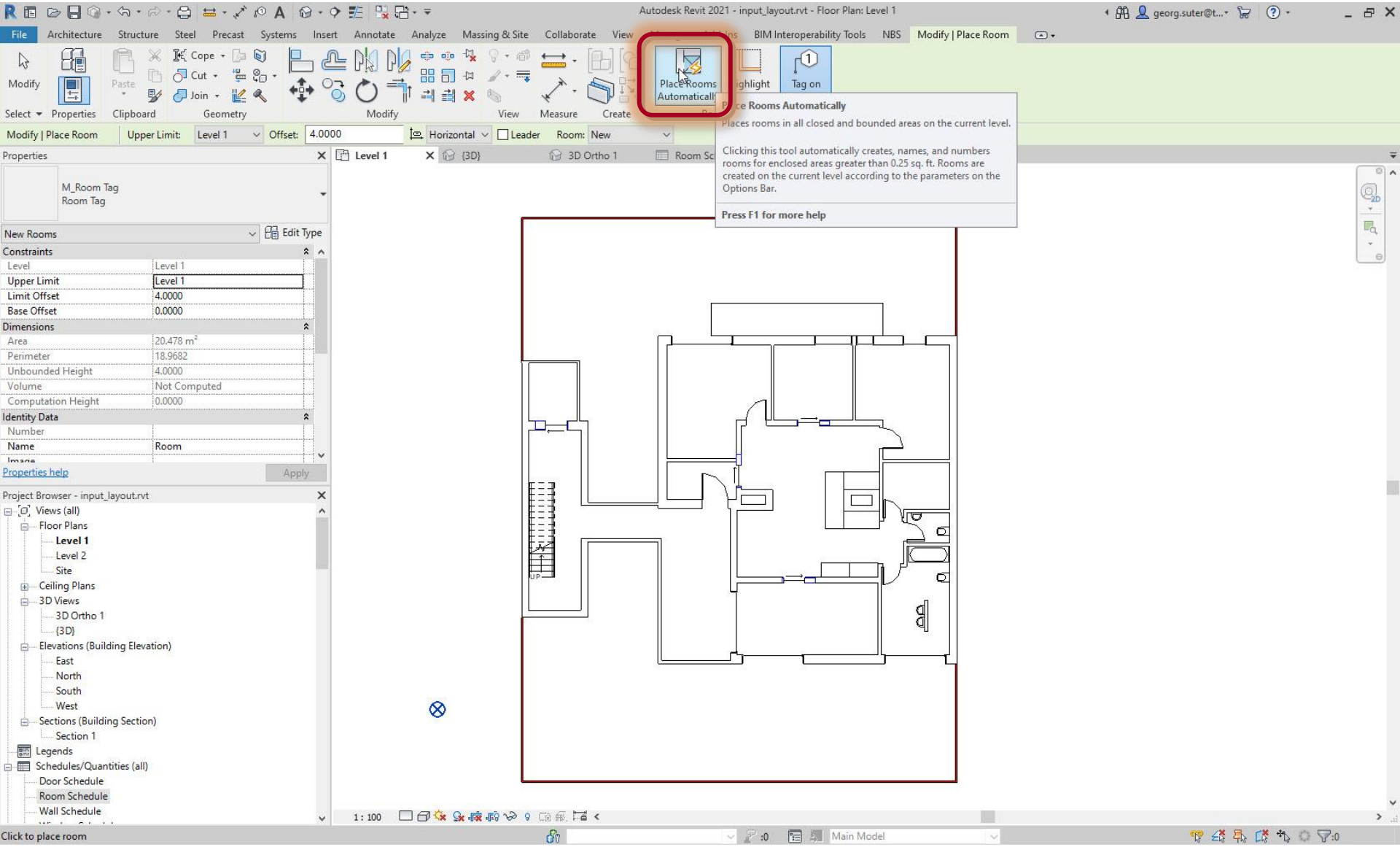
Select ‘Areas only (faster)’ and ‘At wall center’ options



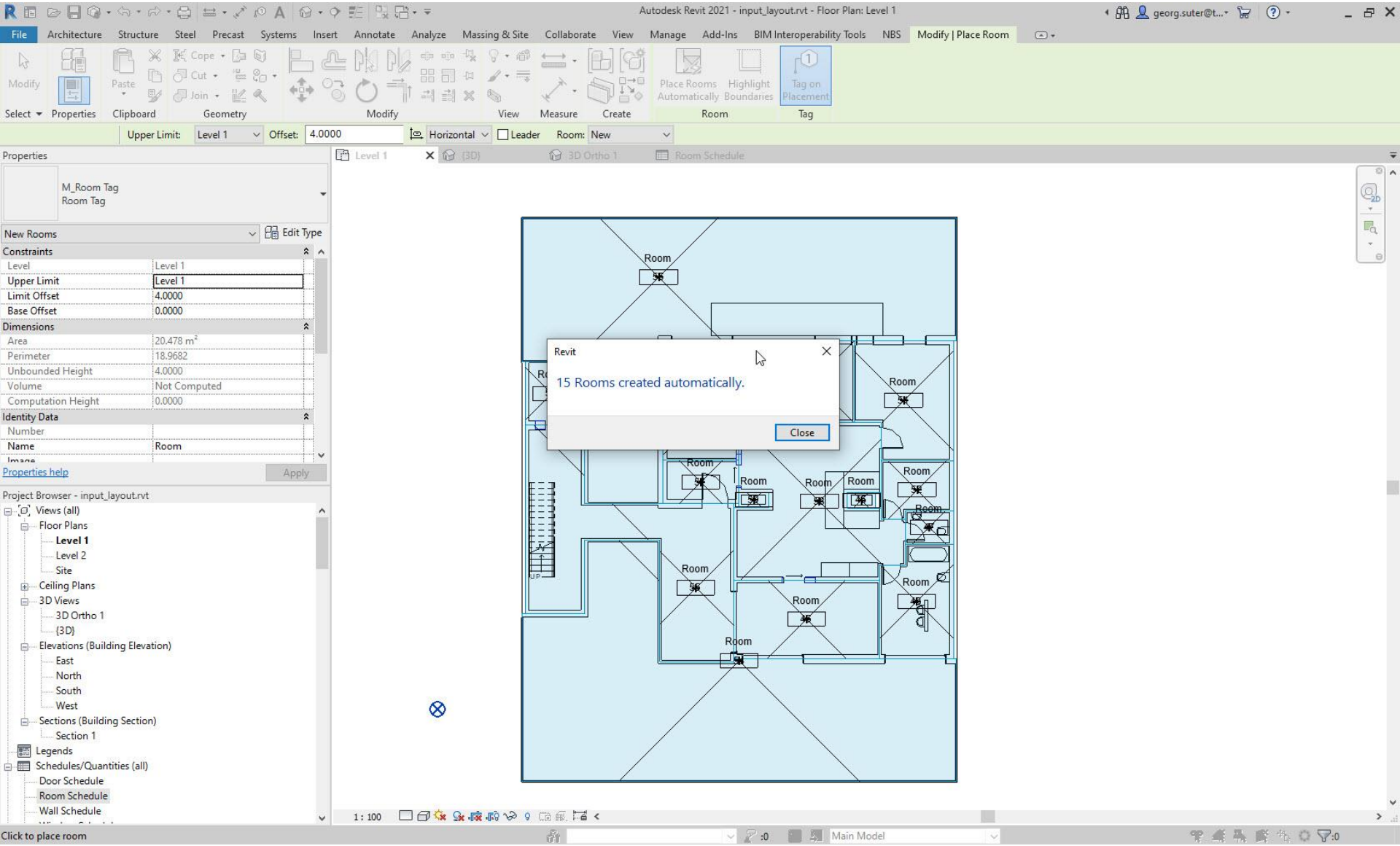
Architecture > Room & Area > Room



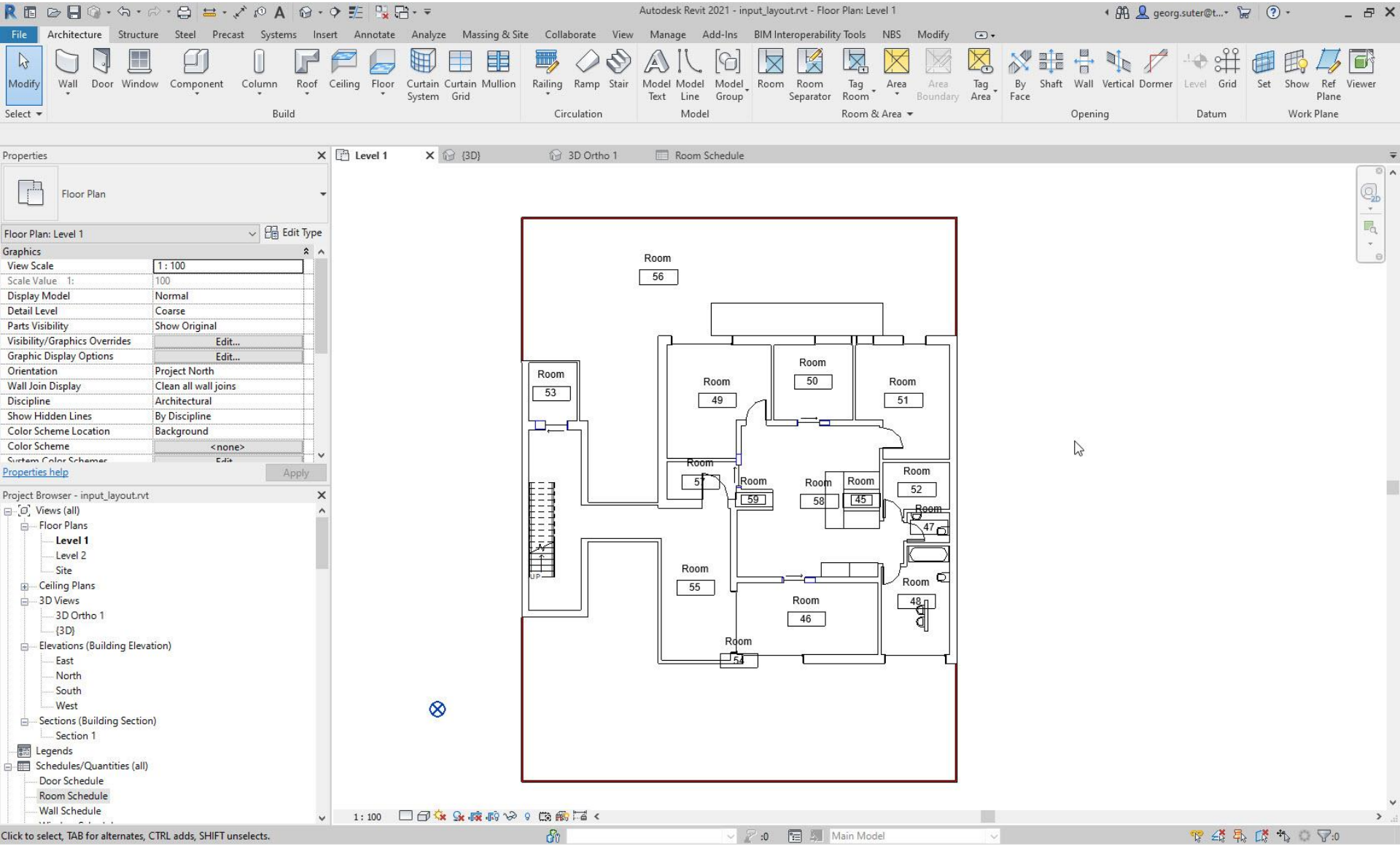
Place Rooms Automatically



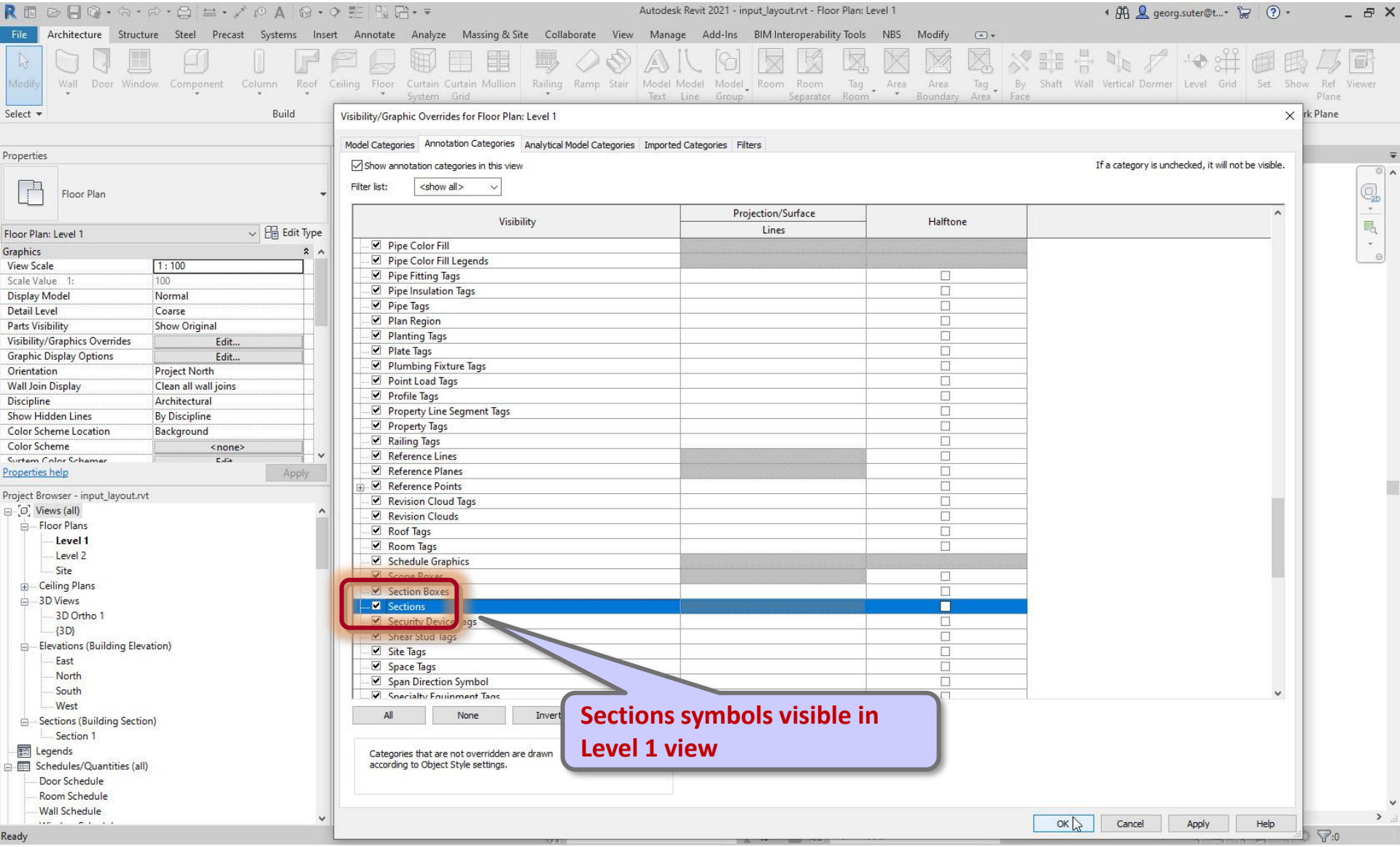
Place Rooms Automatically



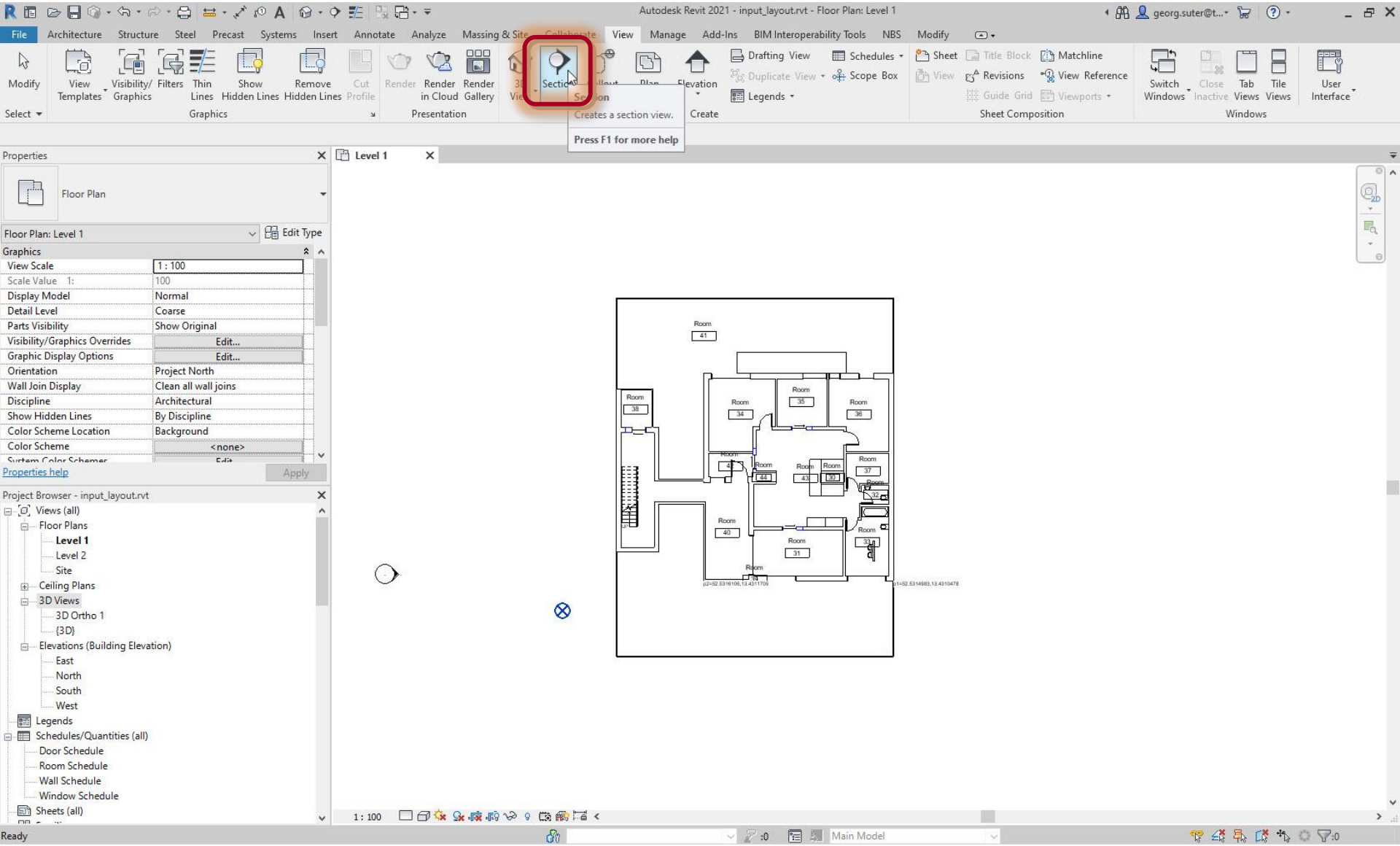
Rooms are tagged



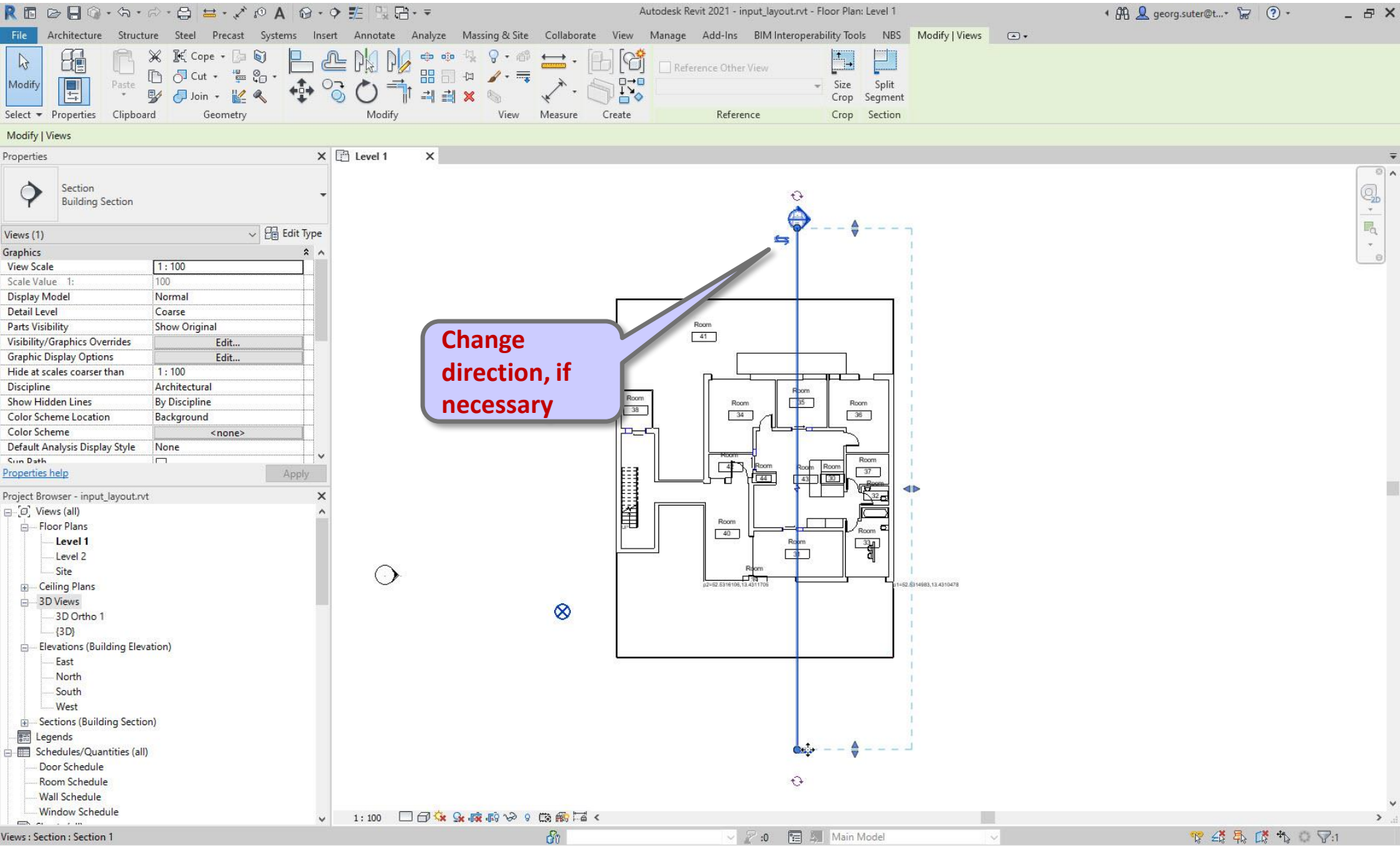
Define section to check correct room elevations and heights



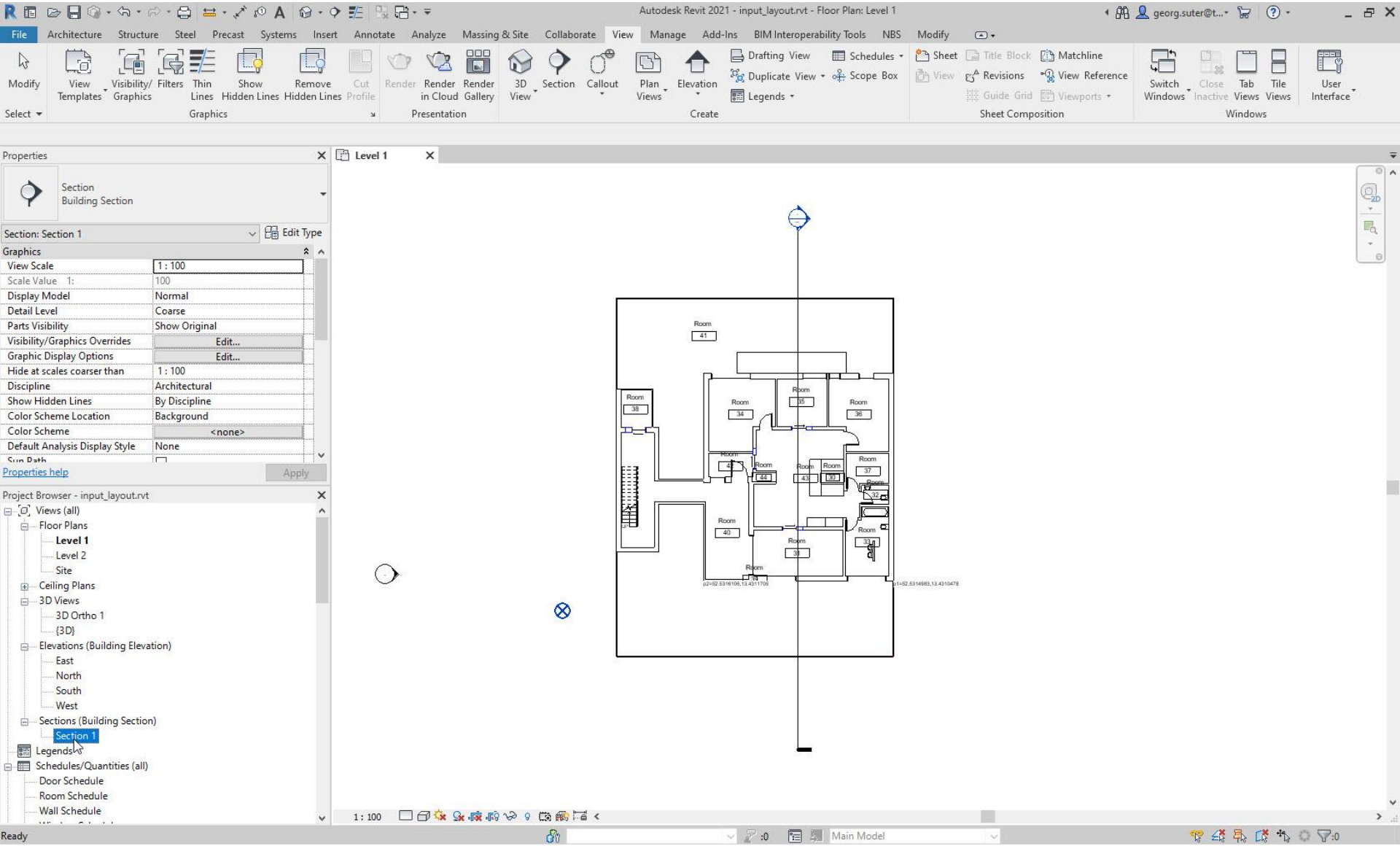
View > Section



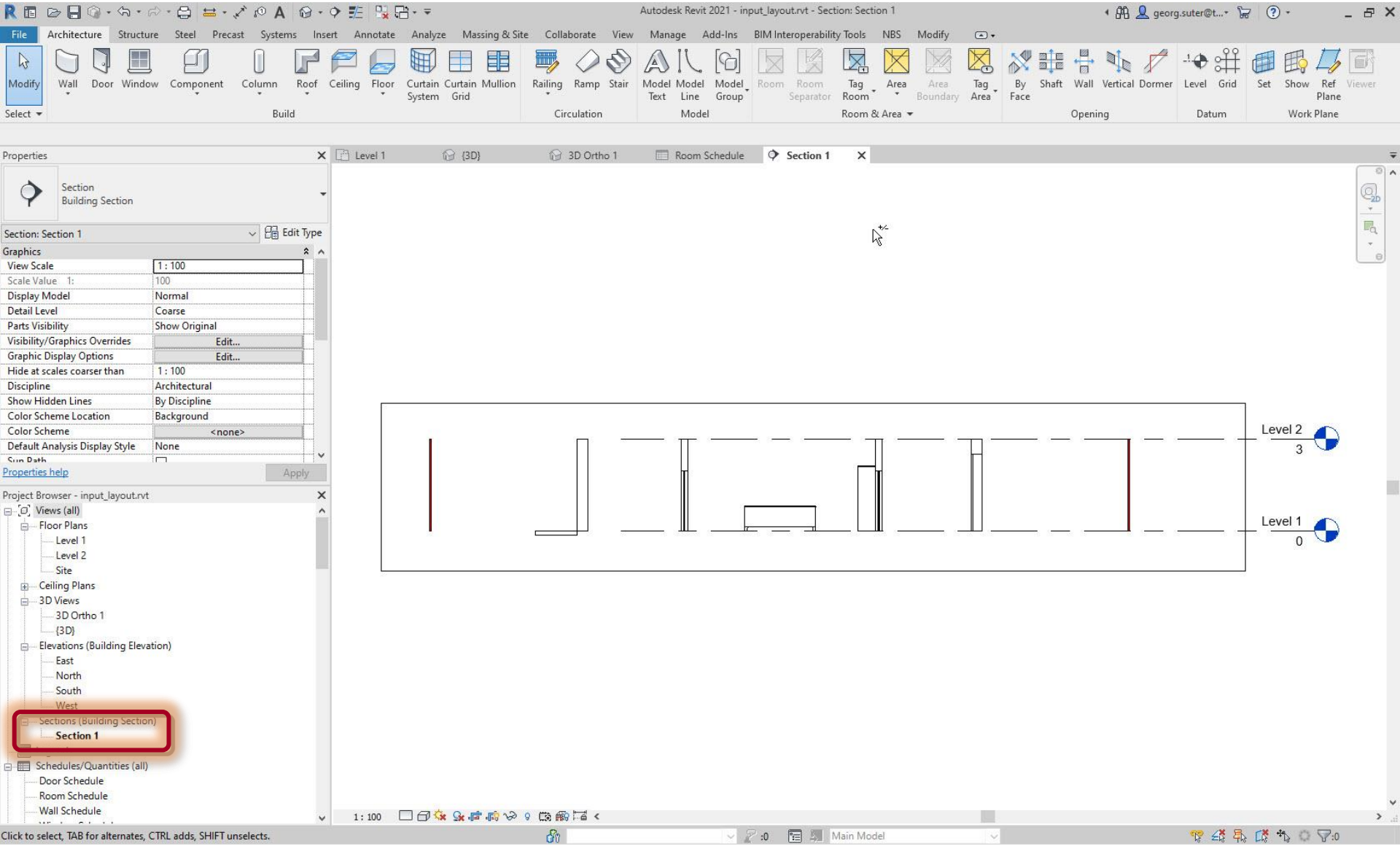
Set section parameter values



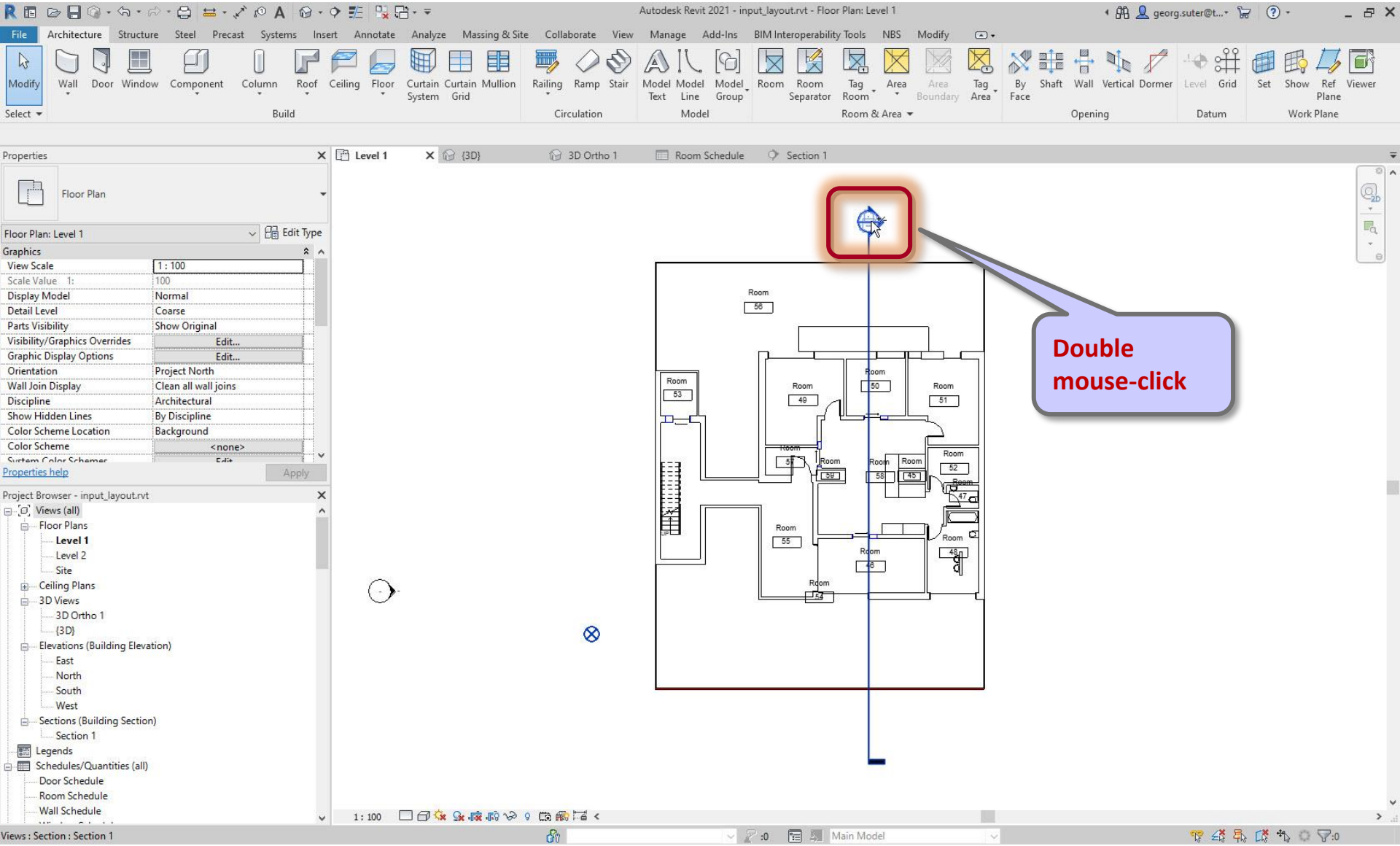
New section is added in Project Browser > Sections



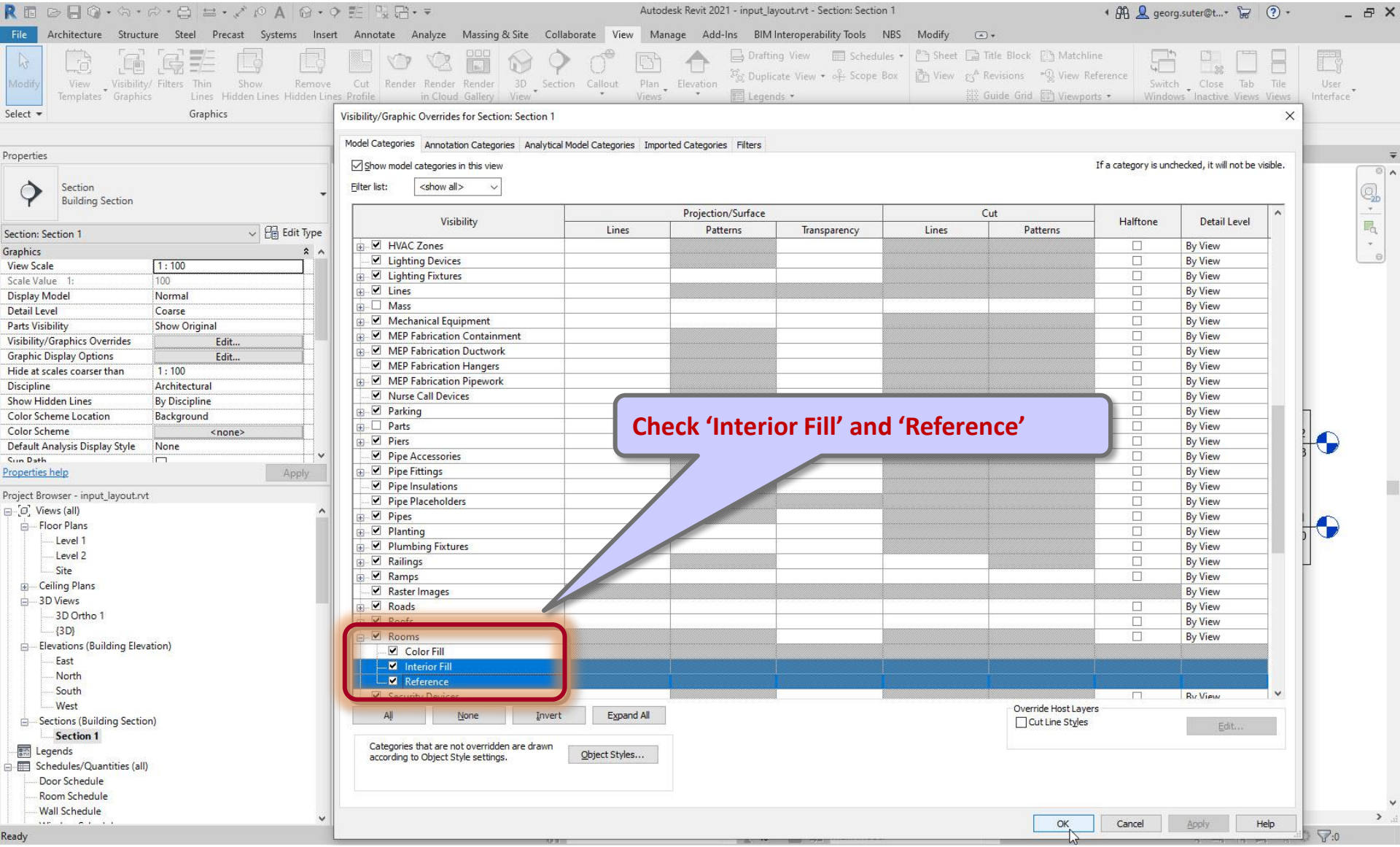
Project Browser > Sections > Section 1

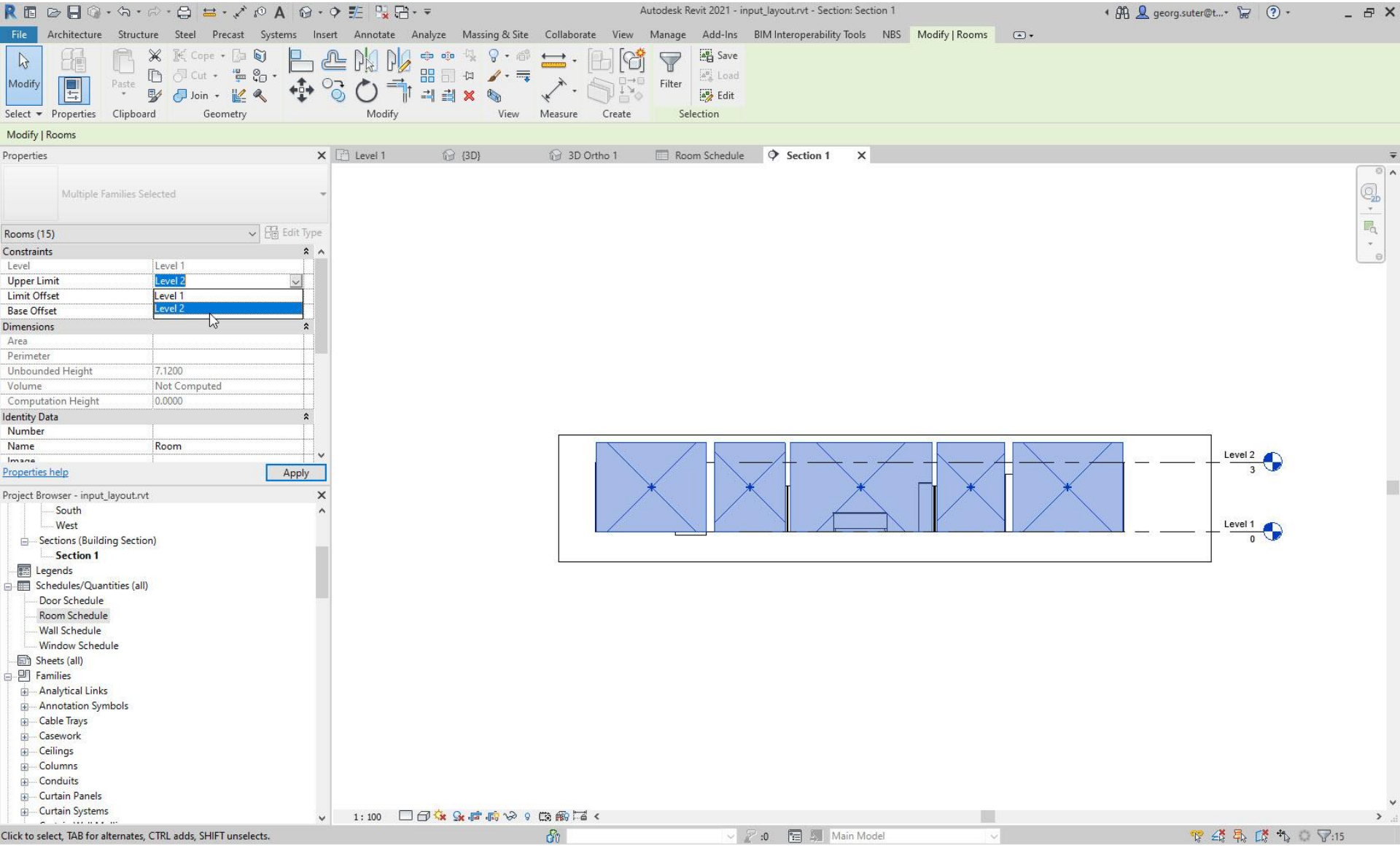


Alternative: select Section symbol to open section view

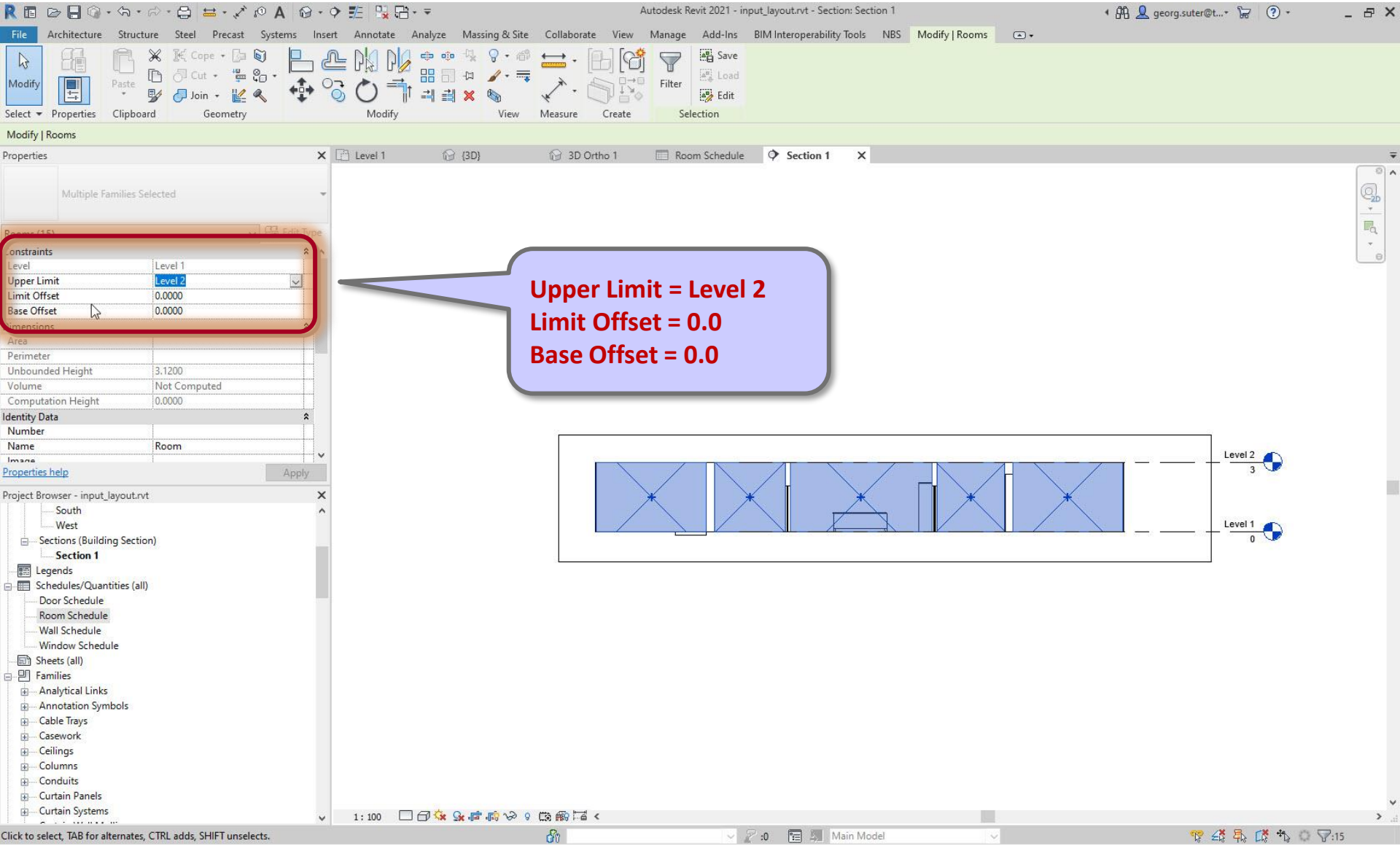


View > Visibility / Graphics > Rooms

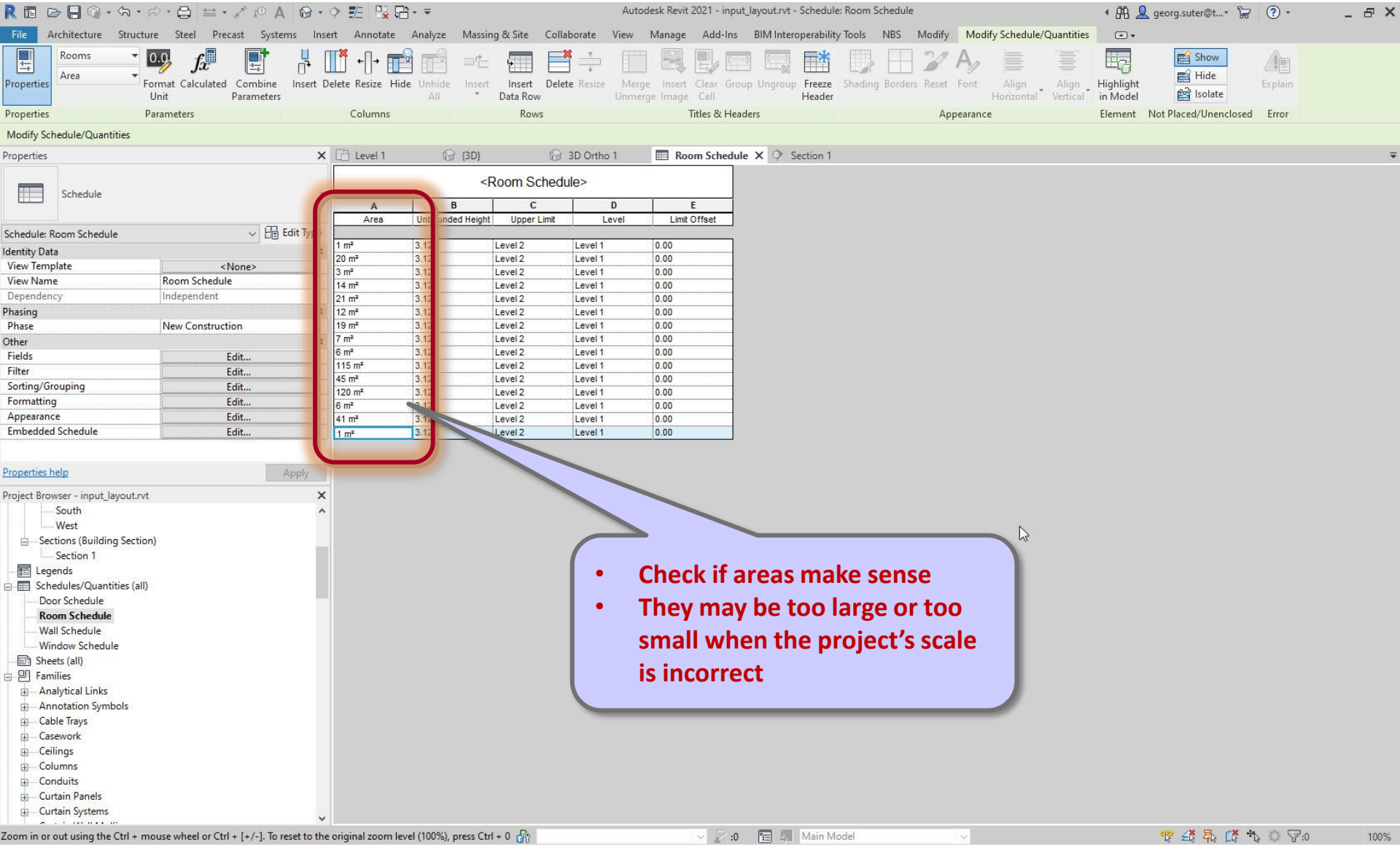



Autodesk Revit 2021 - input_layout.rvt - Section: Section 1
File
Architecture
Structure
Steel
Precast
Systems
Insert
Annotate
Analyze
Massing & Site
Collaborate
View
Manage
Add-Ins
BIM Interoperability Tools
NBS
Modify | Rooms
Modify
Select
Properties
Clipboard
Geometry
Modify
View
Measure
Create
Selection
Save
Load
Edit
Filter
Modify | Rooms
Properties
Multiple Families Selected
Rooms (15)
Edit Type
Constraints
Level
Level 1
Upper Limit
Level 2
Limit Offset
Level 1
Level 2
Base Offset
Dimensions
Area
Perimeter
Unbounded Height
7.1200
Volume
Not Computed
Computation Height
0.0000
Identity Data
Number
Name
Room
Properties help
Apply
Project Browser - input_layout.rvt
South
West
Sections (Building Section)
Section 1
Legends
Schedules/Quantities (all)
Door Schedule
Room Schedule
Wall Schedule
Window Schedule
Sheets (all)
Families
Analytical Links
Annotation Symbols
Cable Trays
Casework
Ceilings
Columns
Conduits
Curtain Panels
Curtain Systems
Level 1
{3D}
3D Ortho 1
Room Schedule
Section 1
Level 2
3
Level 1
0
1 : 100
Click to select, TAB for alternates, CTRL adds, SHIFT unselects.
Main Model

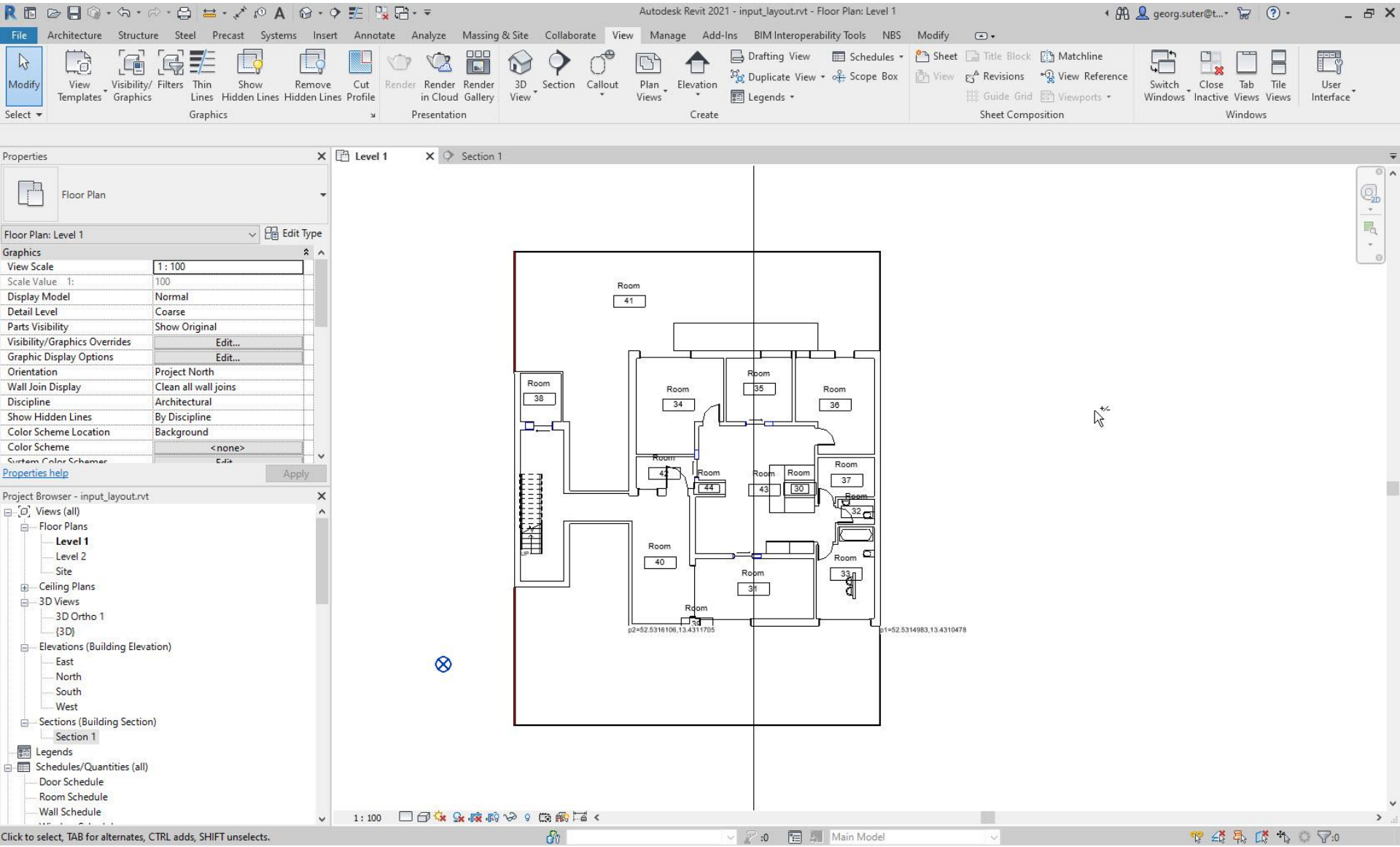
Set room constraints



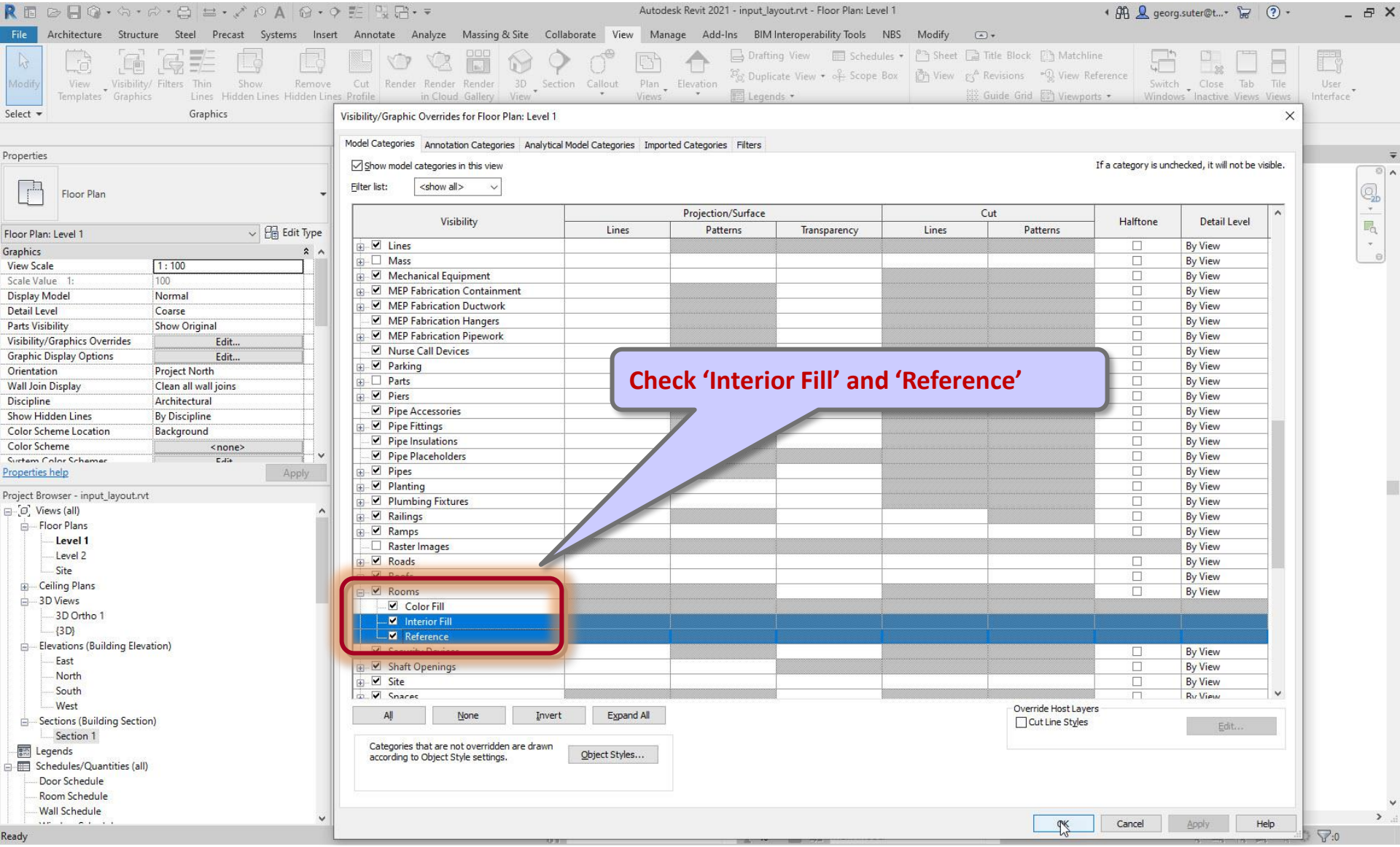
Project Browser > Schedules/Quantities > Room Schedule



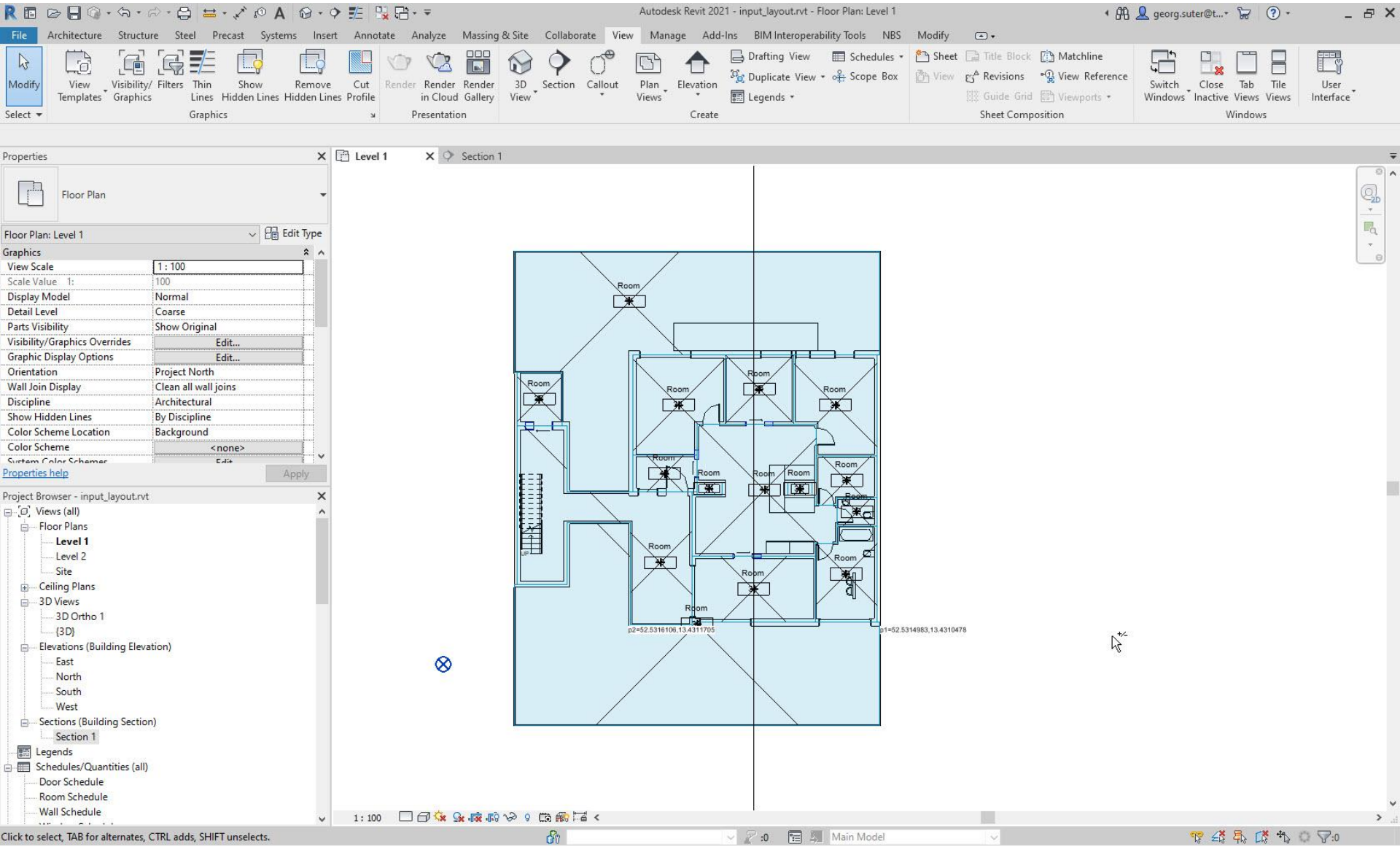
Check if all rooms are tagged



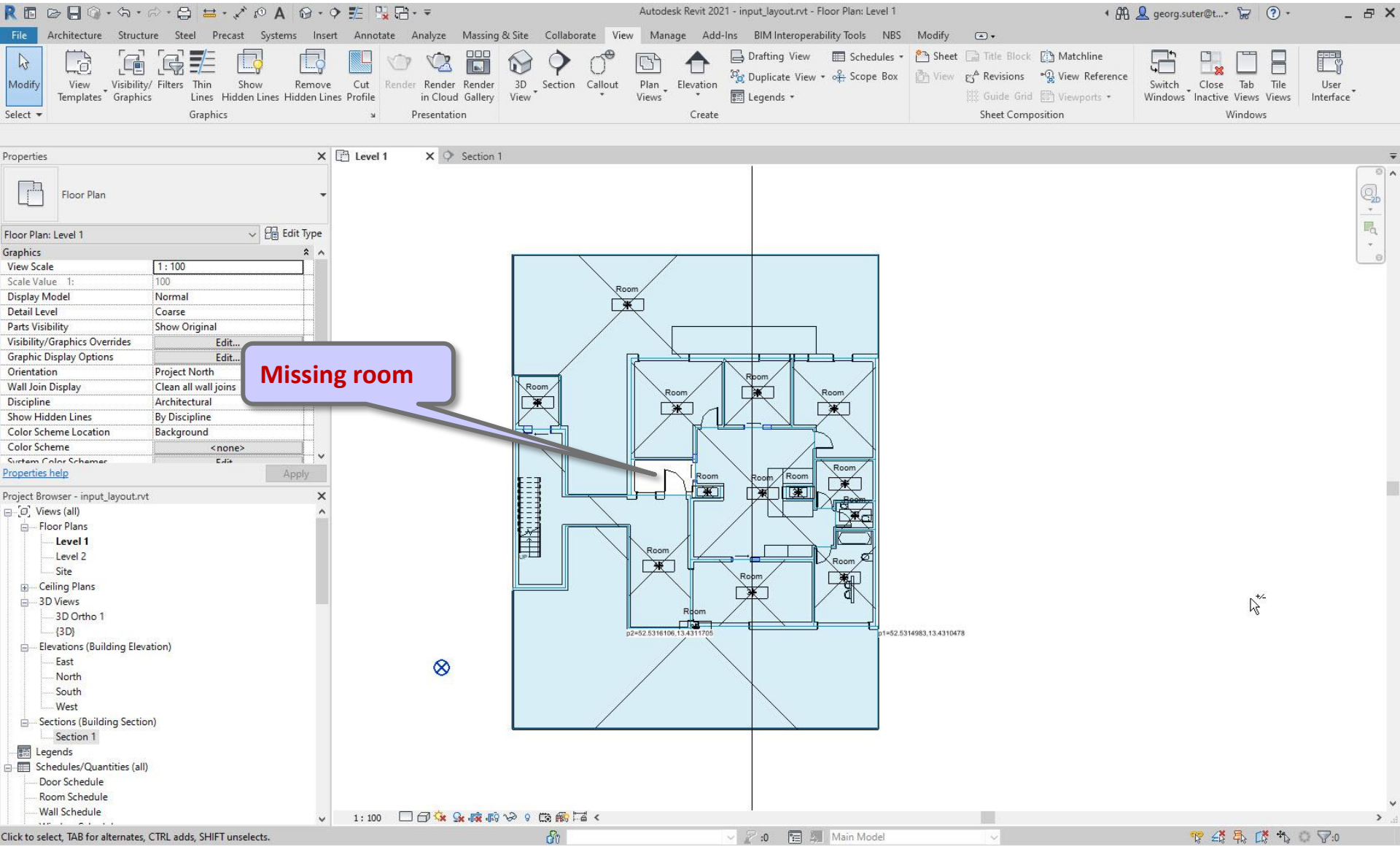
View > Visibility / Graphics > Rooms



Check if room geometries are generated



Check if room geometries are generated



Steps

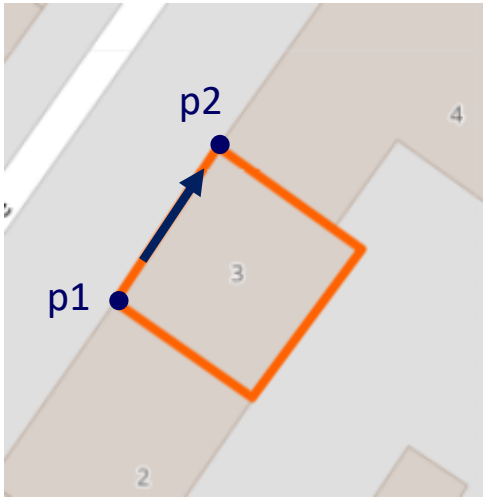
1. Set up project
2. Import pdf of original floor plan
3. Set floor-to-floor height
4. Determine internal and external spaces
5. Create walls
6. Create doors and openings
7. Create windows
8. Create circulation elements
9. Create horizontal external elements
10. Create furnishing elements
11. Create rooms
12. **Create geocoordinates**
13. Export input layout
14. Create .zip archive
15. Generate space model

Create geocoordinates

- **Determine geocoordinates in Open Street Map**
- **Edit geocoordinates in Revit**

Determine geocoordinates in Open Street Map

- **Open Street Map (OSM):**
  - Determine geocoordinates based on building outlines (‘features’)
- **Google Maps (GM):**
  - Determine geocoordinates based on satellite images
- **Discrepancies between OSM and GM coordinates**
  - Model visualizations on GM typically do not match with maps or satellite images
  - OSM coordinates are used because they are easier to validate
- **2 geocoordinates are required**
  - p1: locate the input layout in geo coordinate system
  - p2: orientation (direction) of the input layout in geocoordinate system
- Edit geocoordinates in Revit



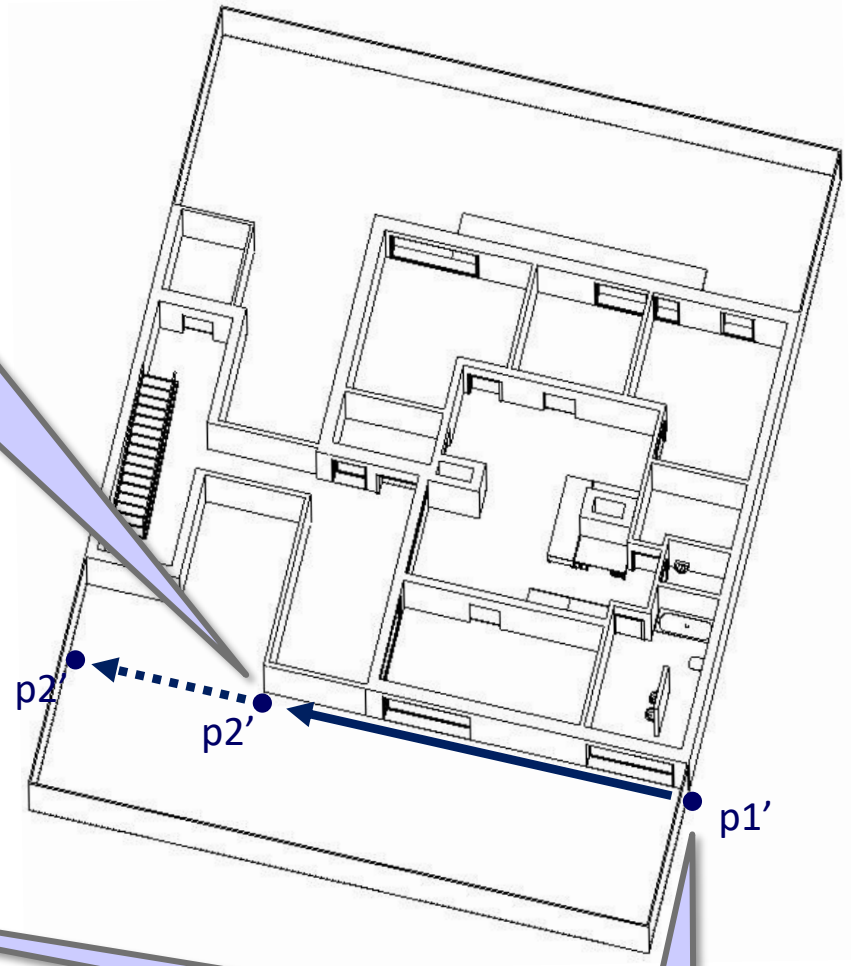
Determine geocoordinates p1 and p2

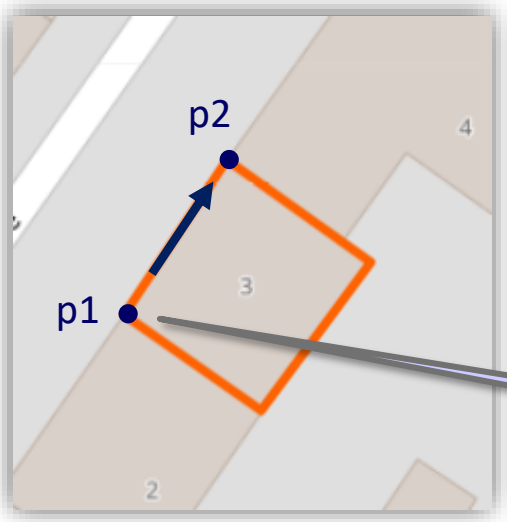
p2 → p2’:

p2’ must lie on line that starts at p1’ and whose direction corresponds to that of line (p1, p2)

No exact match required

Local (input layout) coordinate system (Revit)





Geo coordinate system (Open Street Map)

p1 → p1’:

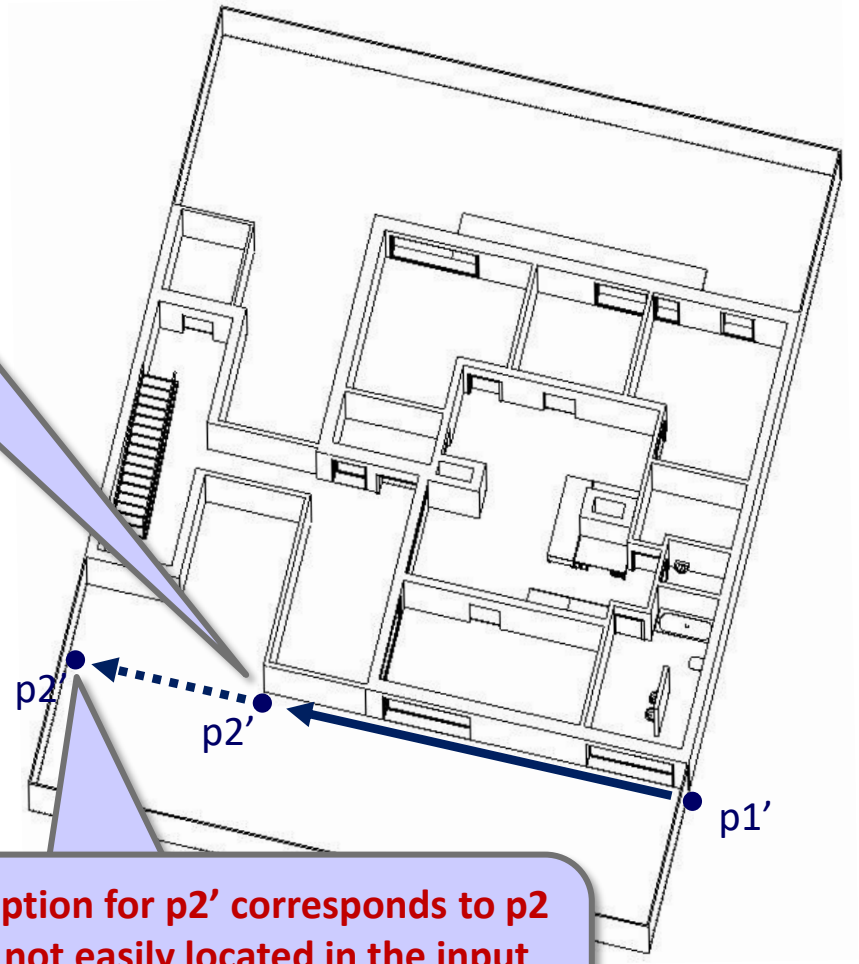
Exact match between geocoordinates and local (input layout) coordinates required

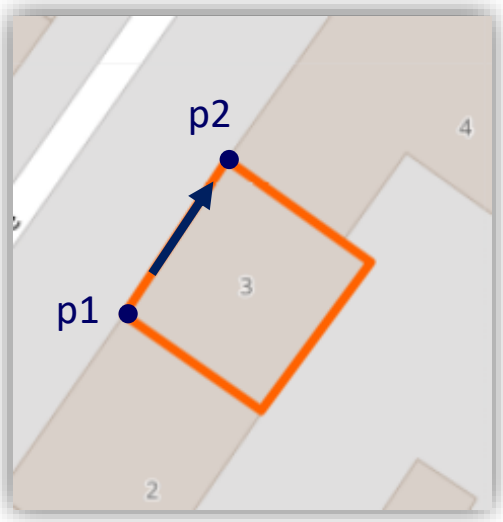
Determine geocoordinates p1 and p2

This option for p2’ is easily located in the input layout

Preferred option for p2’

Local (input layout) coordinate system (Revit)





Geo coordinate system (OSM)

This option for p2’ corresponds to p2 but is <u>not</u> easily located in the input layout

Less preferred option for p2’

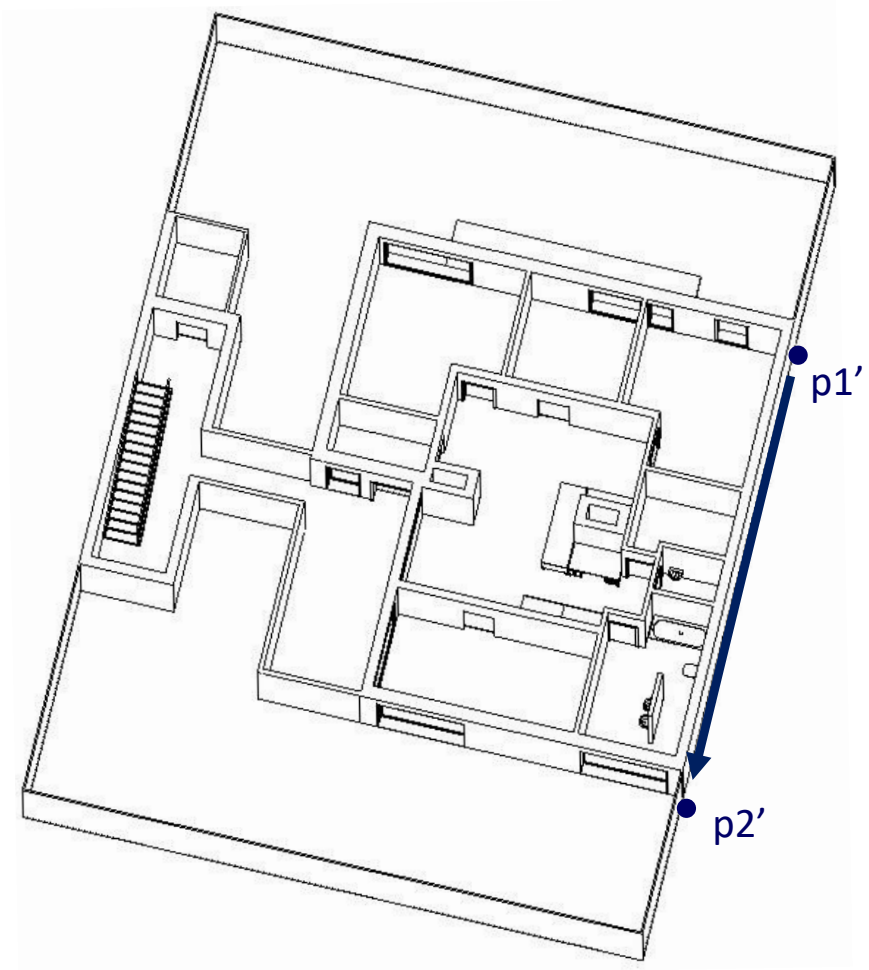
Determine geocoordinates p1 and p2

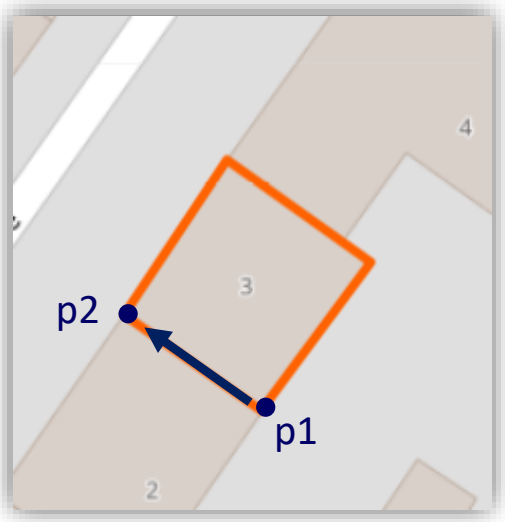
Alternative selection of p1 and p2

p1’ and p2’ are easily located in the input layout

p1’ does not need to be at the origin of the local coordinate system!

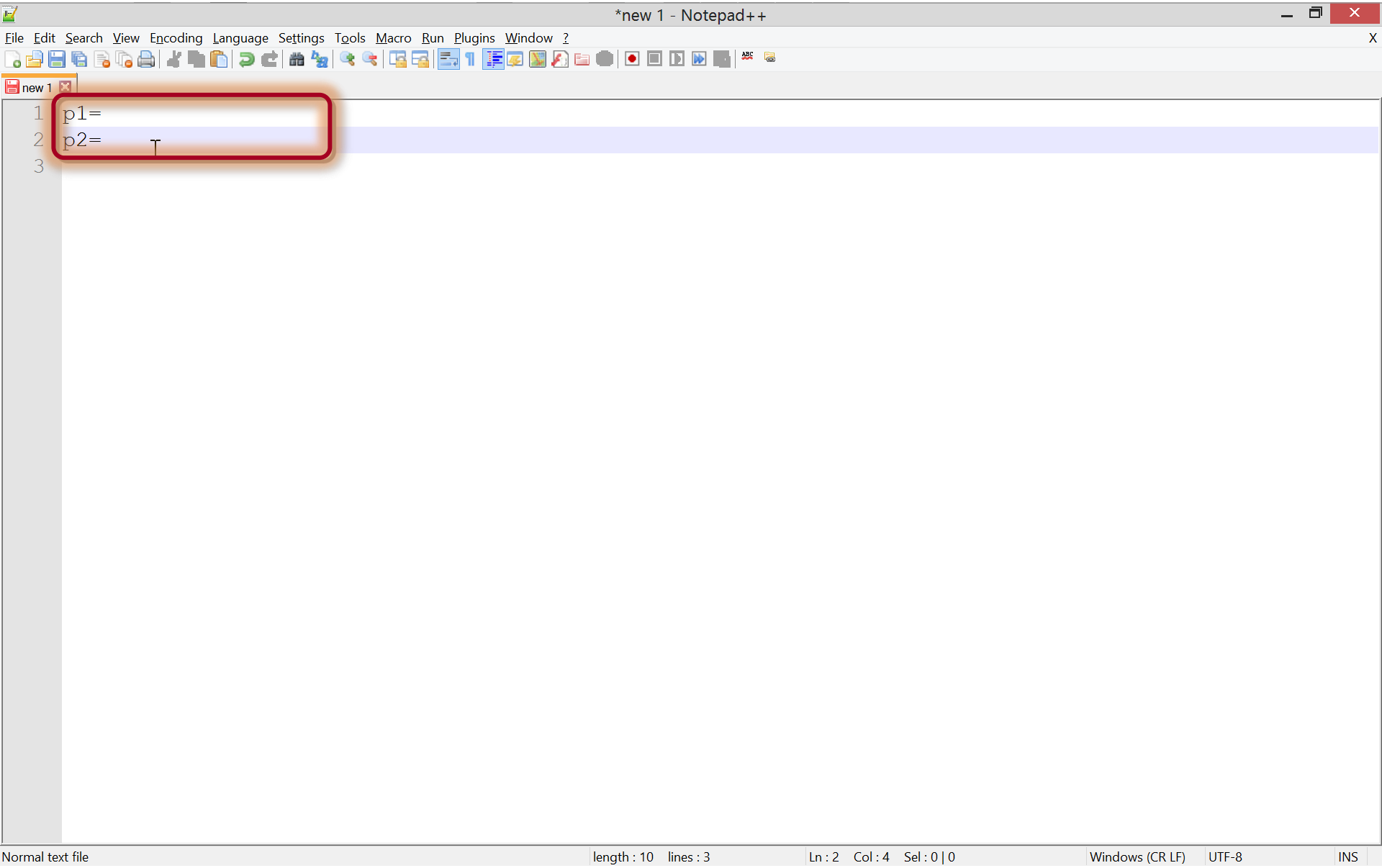
Local (input layout) coordinate system (Revit)



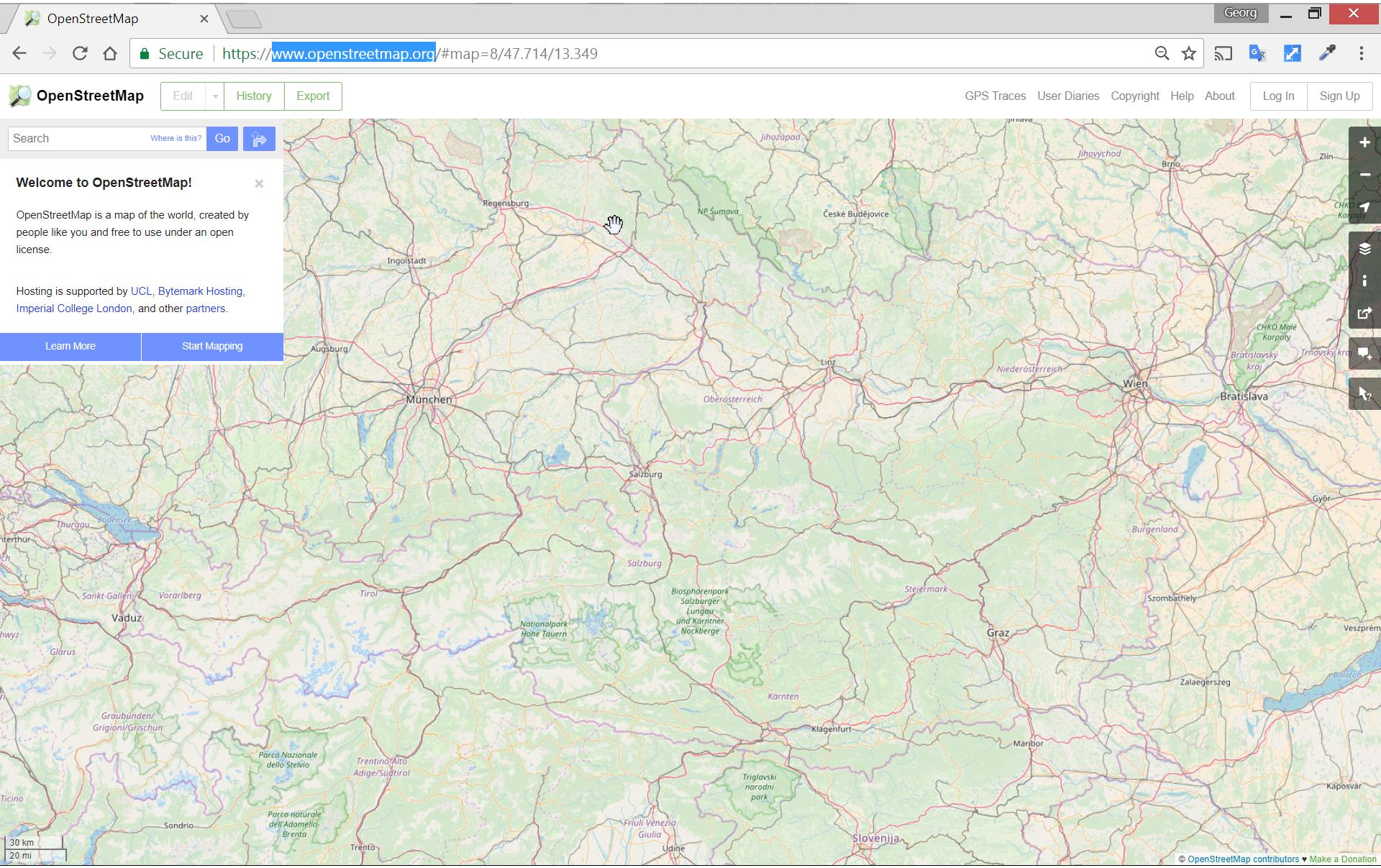


Geo coordinate system (OSM)

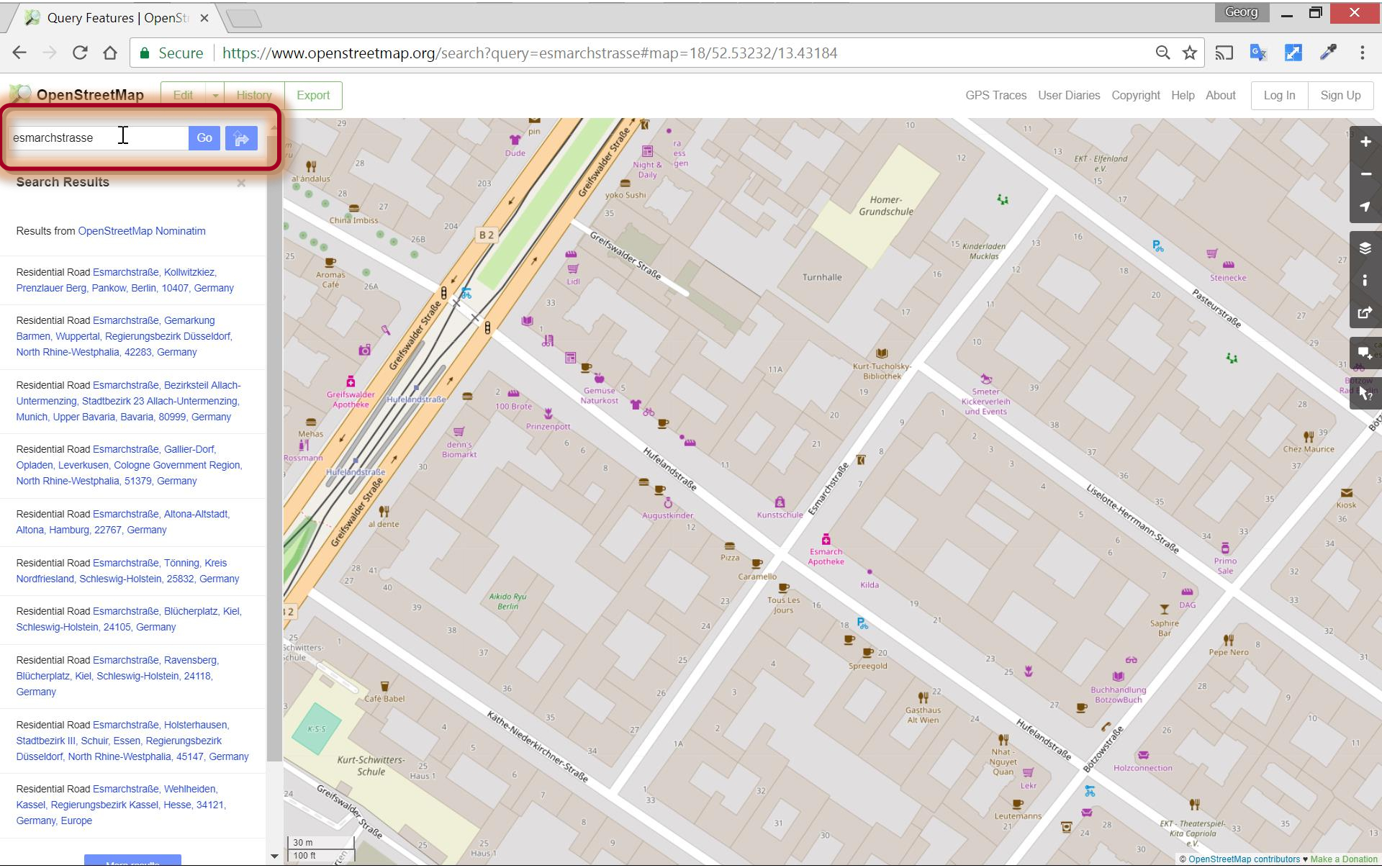
Text editor: set up file to paste geocoordinates



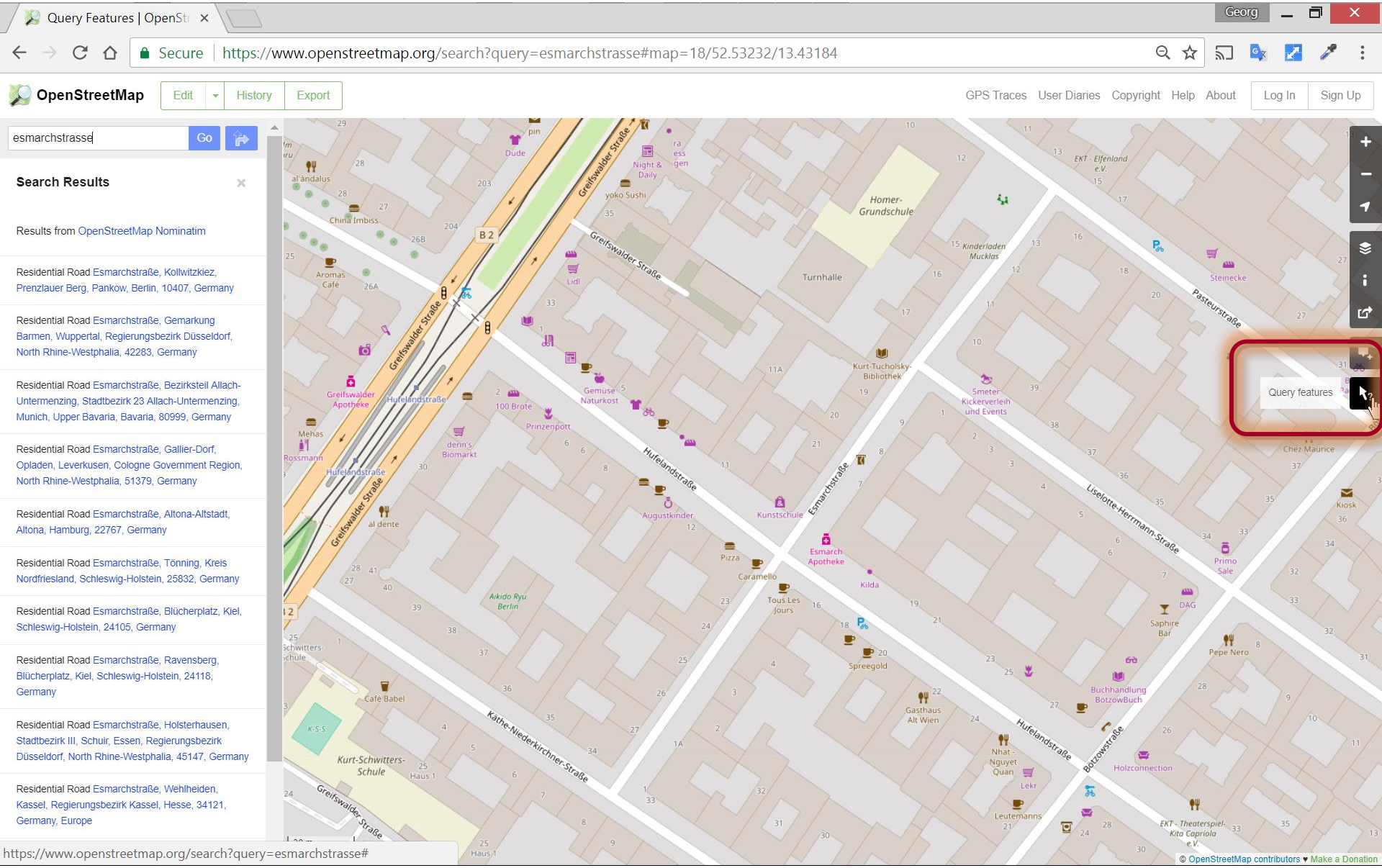
Open Street Map (www.openstreetmap.org)



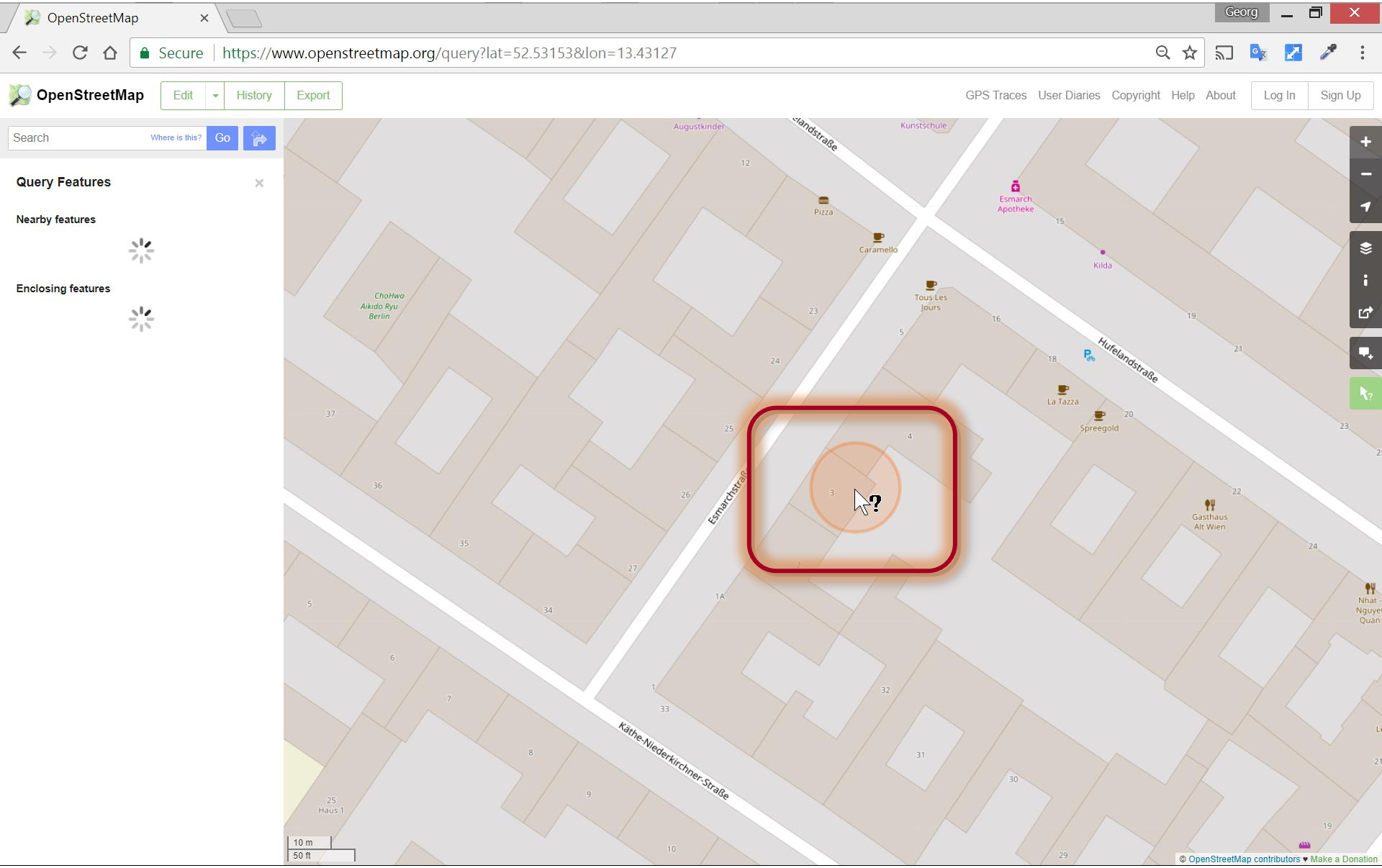
Enter street name



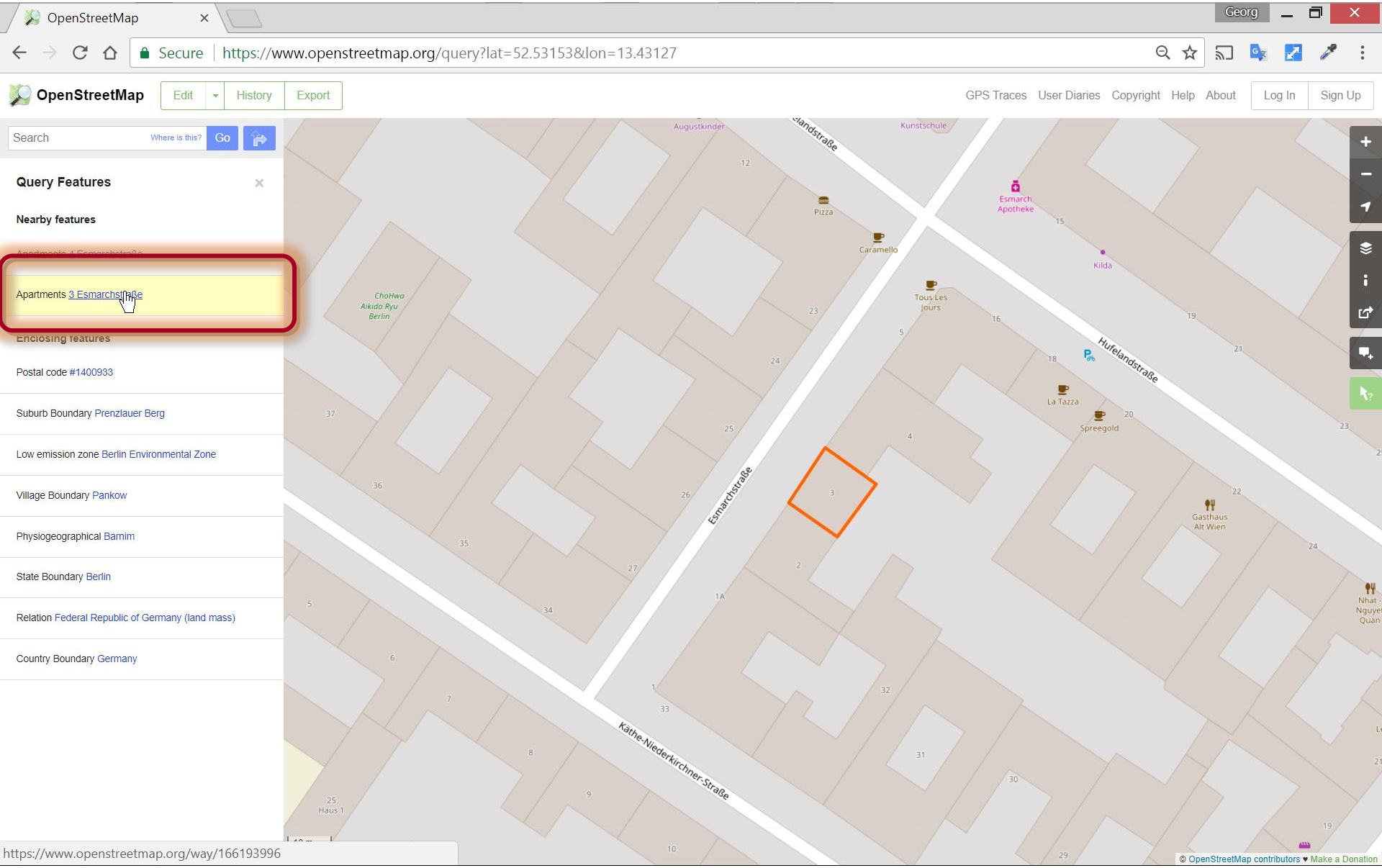
Query features



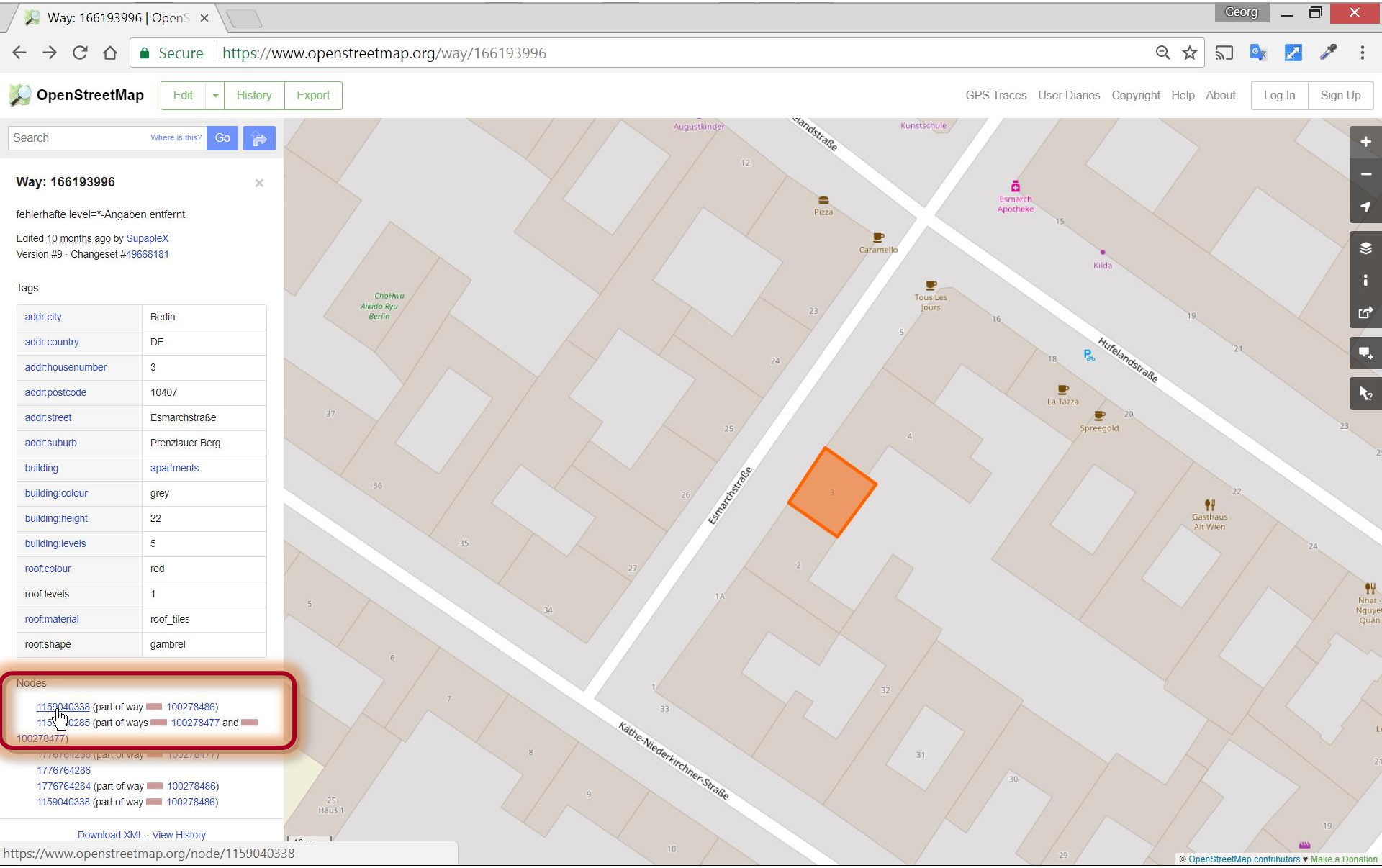
Query features



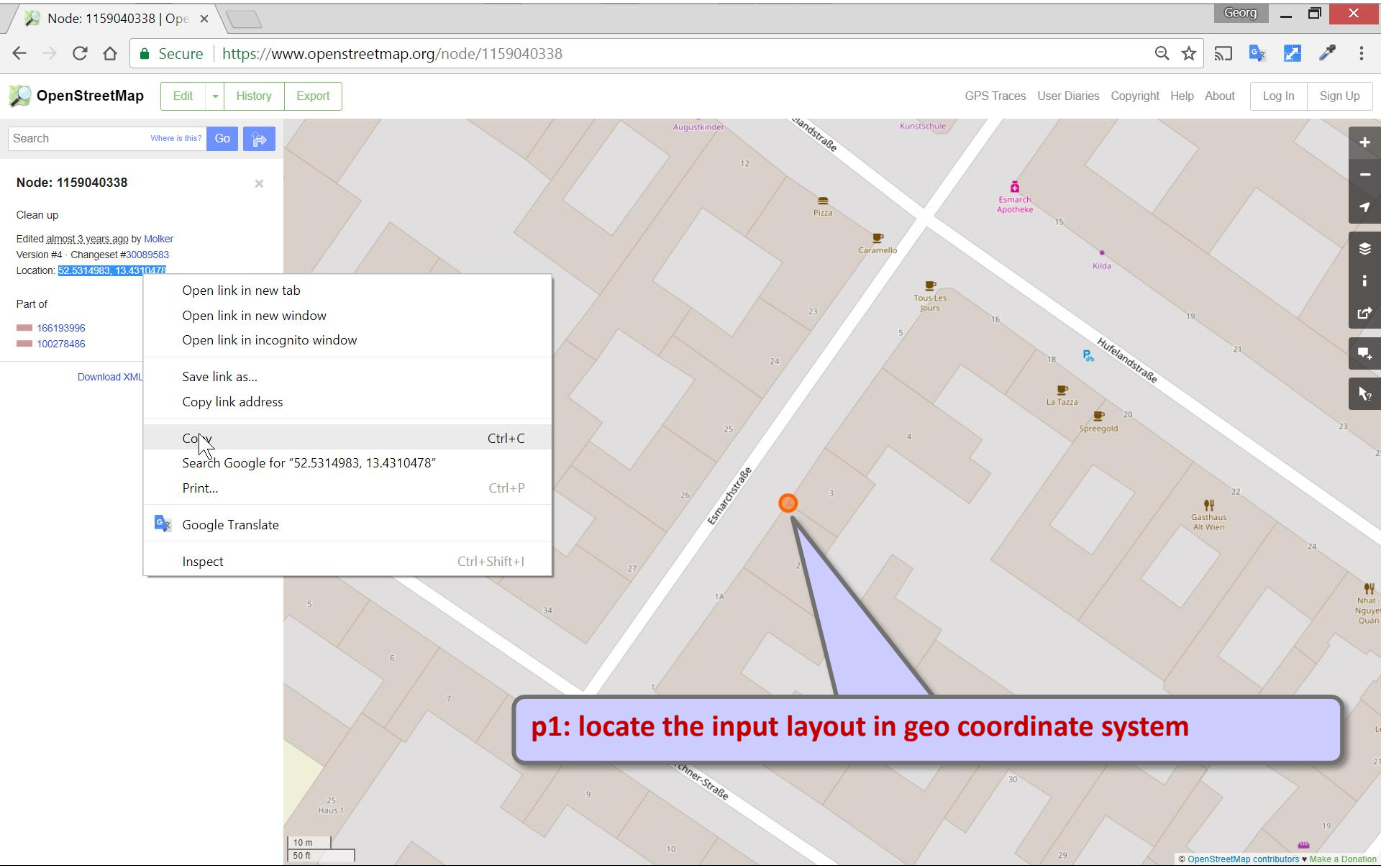
Select feature



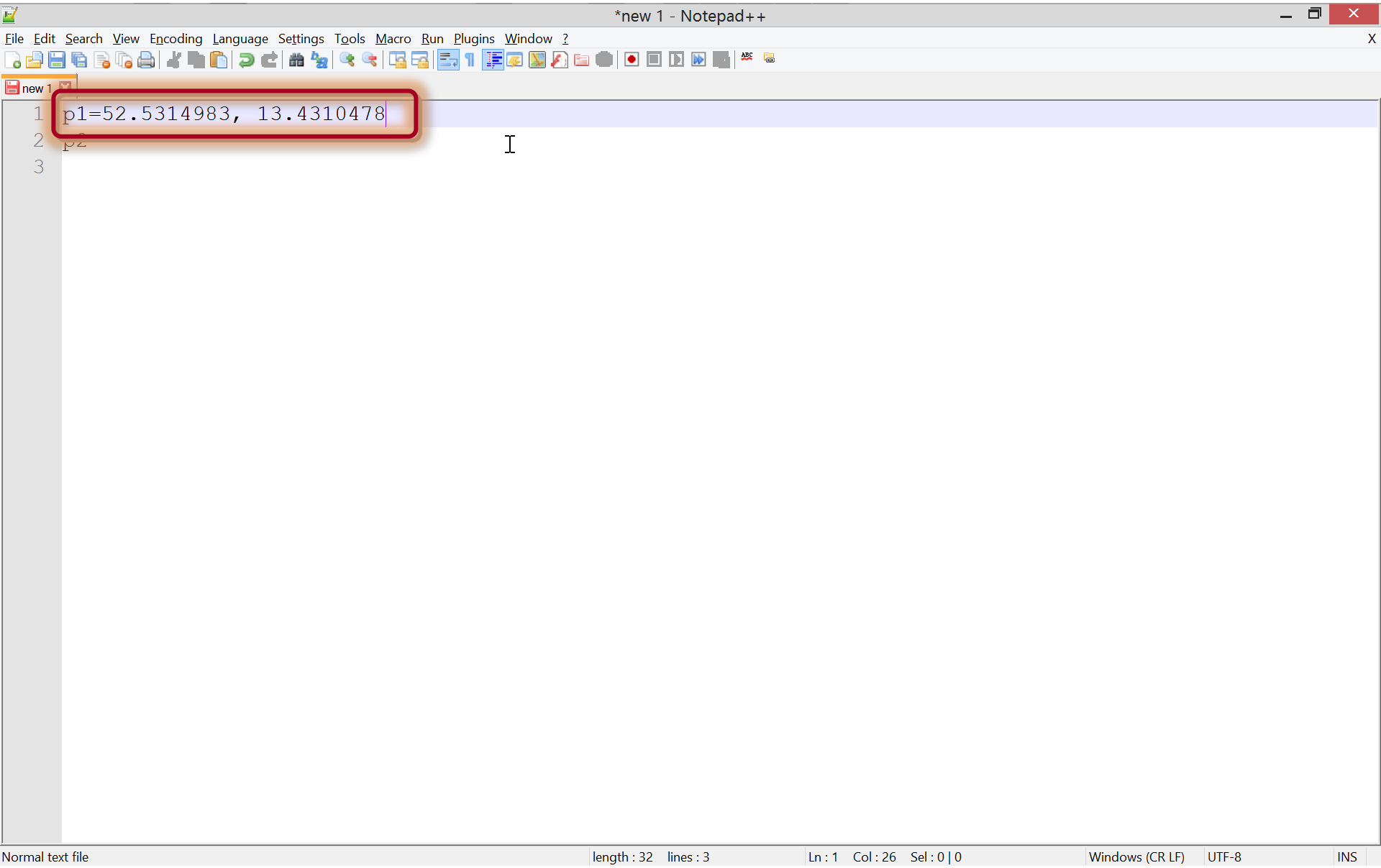
p1: select feature node (trial and error)



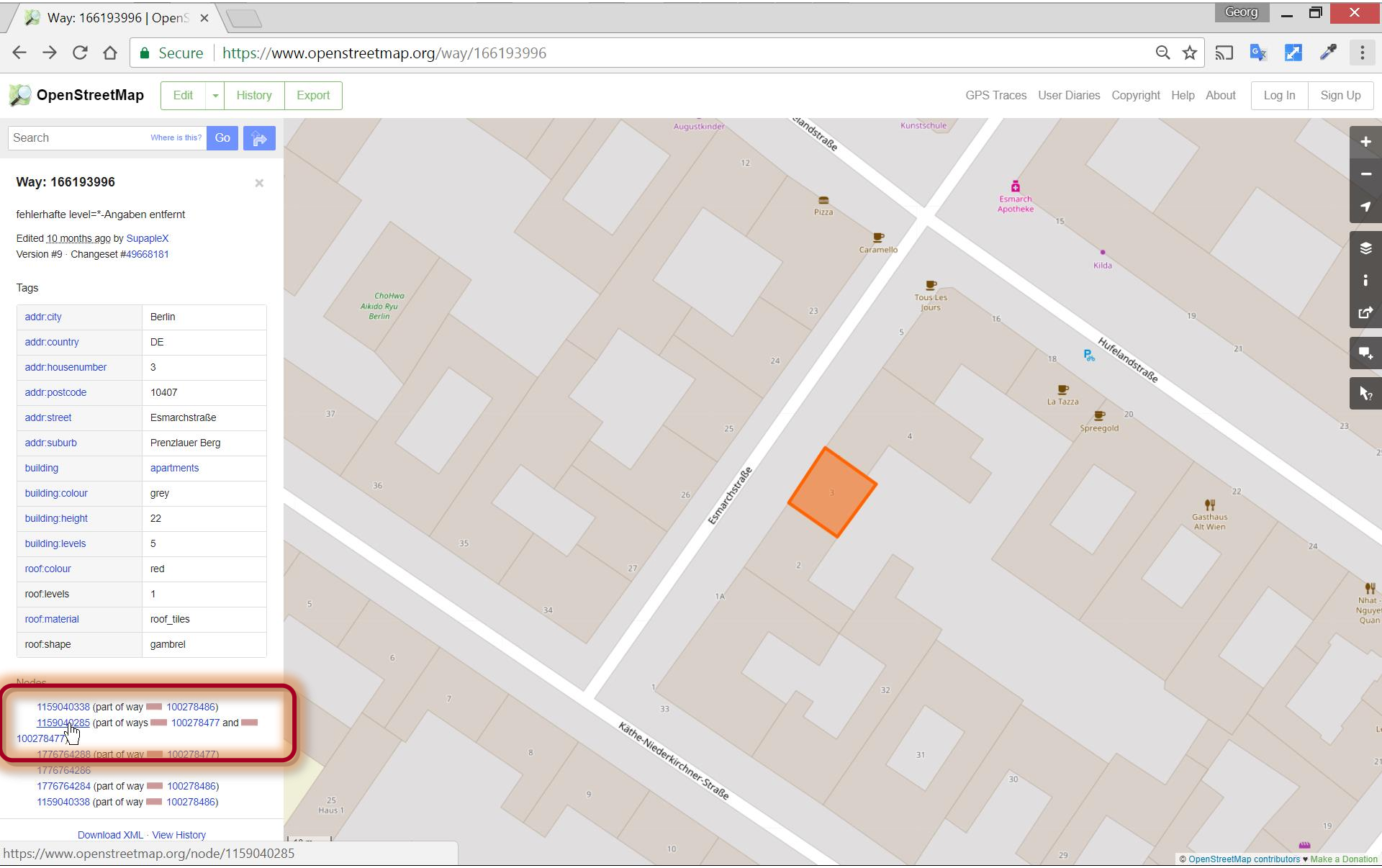
p1: copy geocoordinate of node



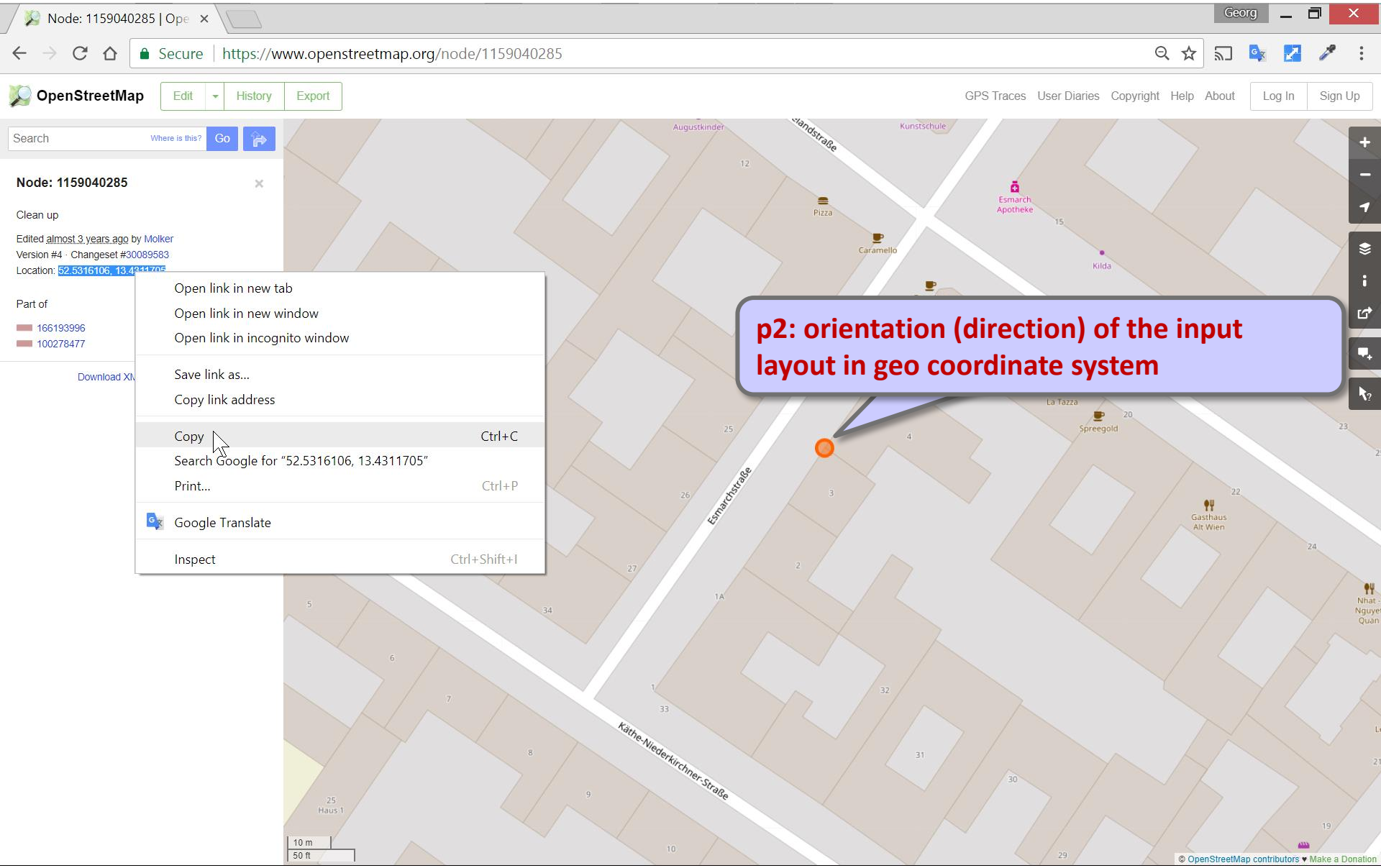
p1: paste to text editor



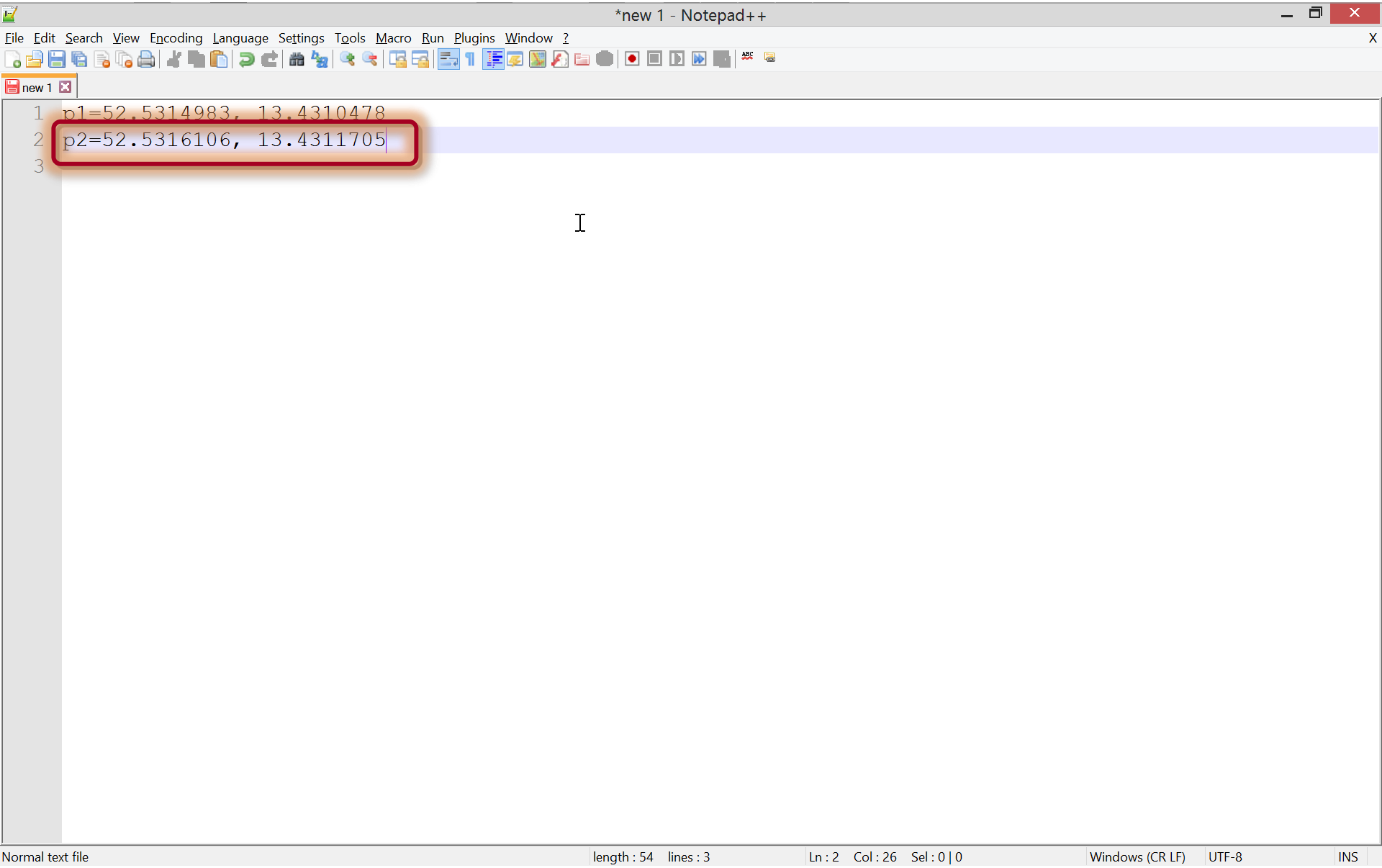
p2: select feature node (trial and error)



p2: copy geocoordinate of node



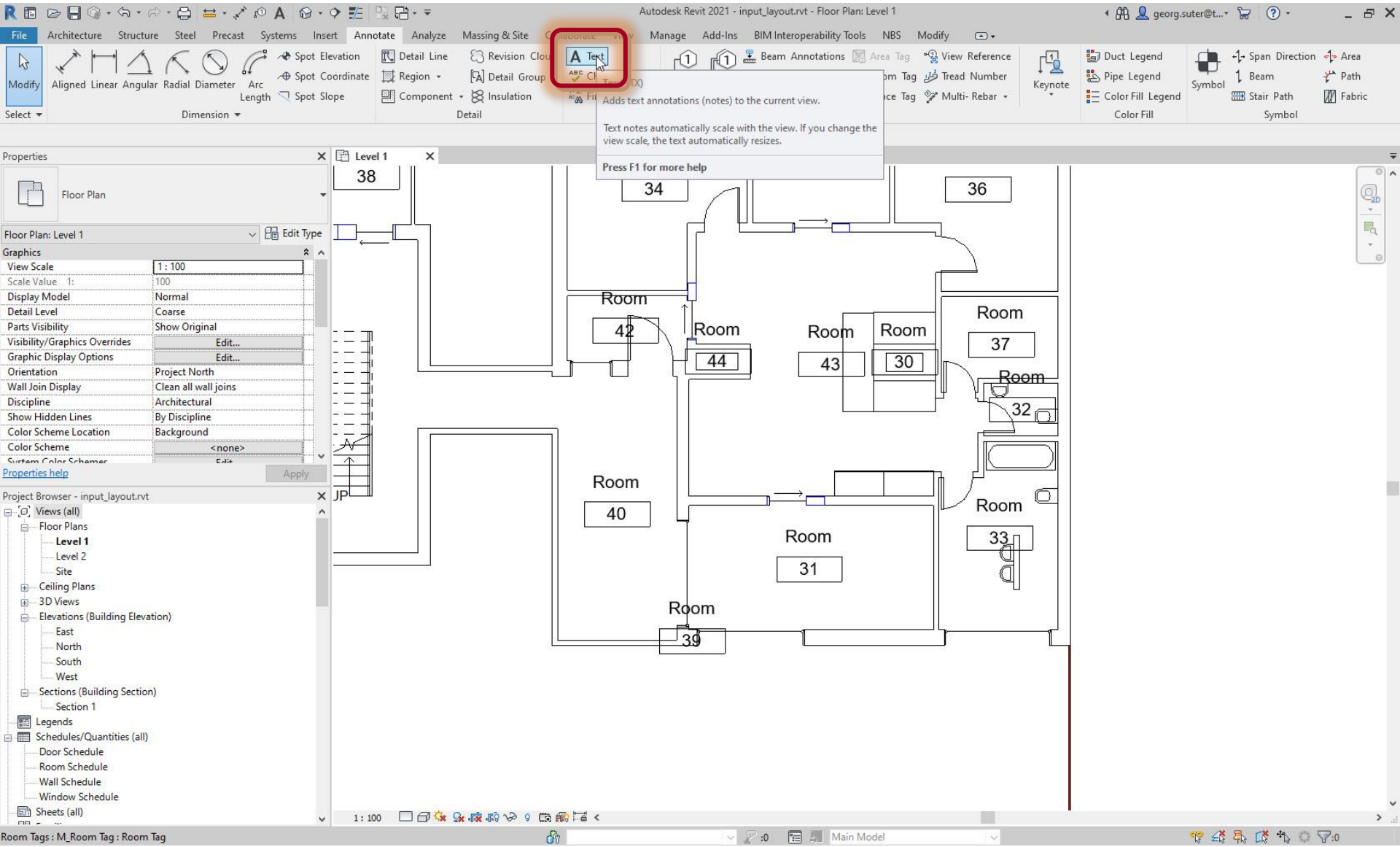
p2: Paste to text editor



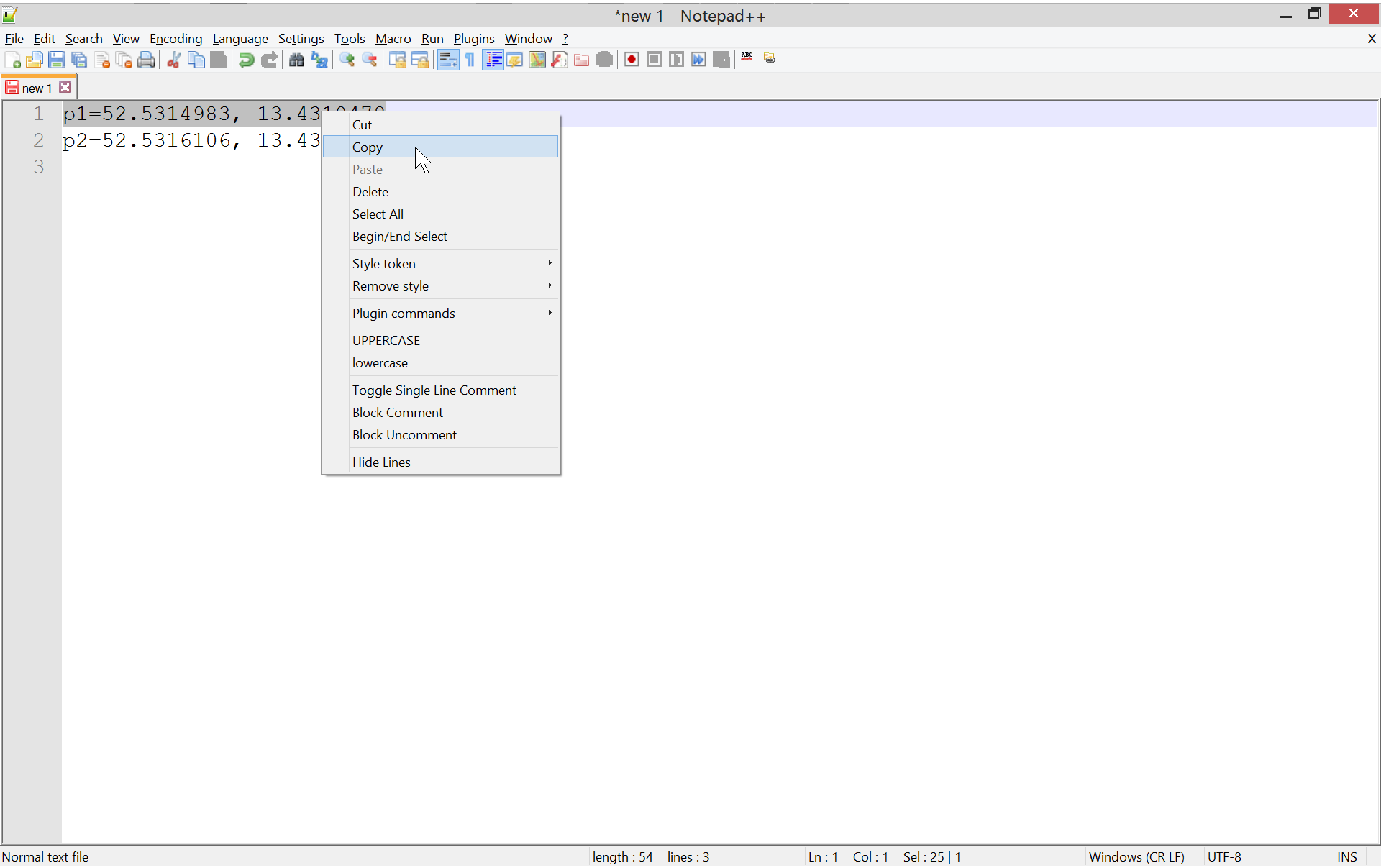
Create geocoordinates

- Determine geocoordinates in Open Street Map
- **Edit geocoordinates in Revit**

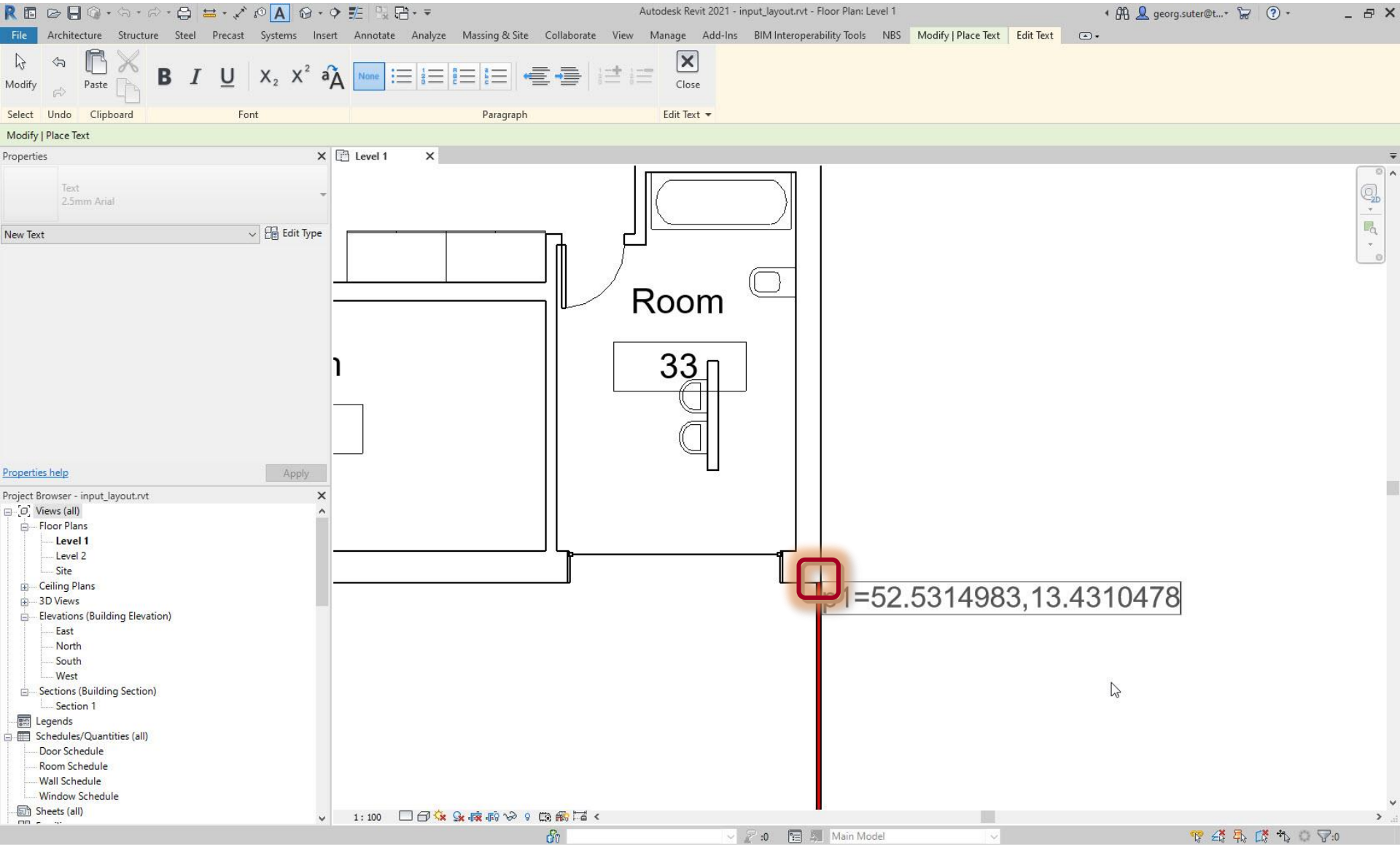
Annotate > Text



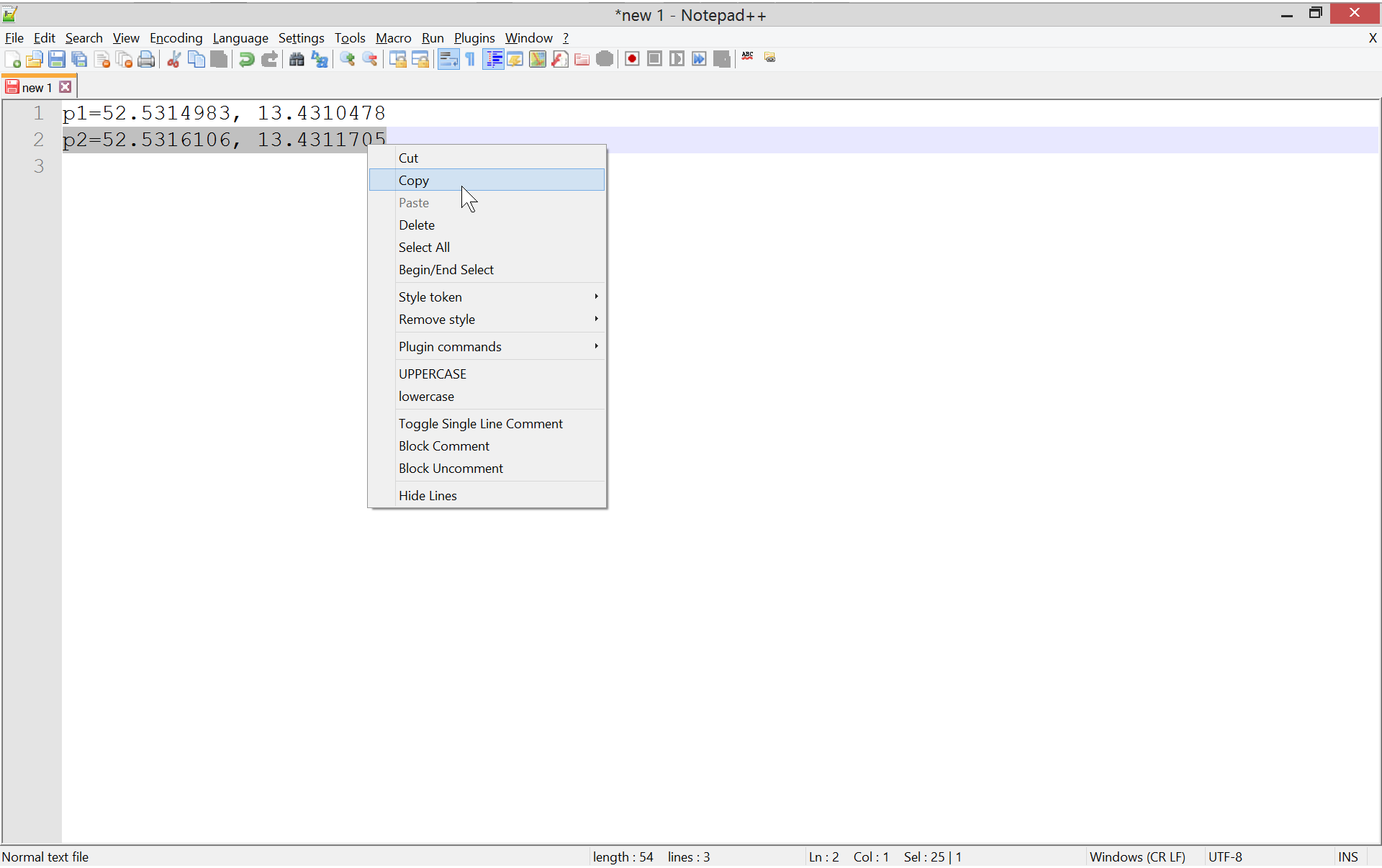
Text editor: copy p1



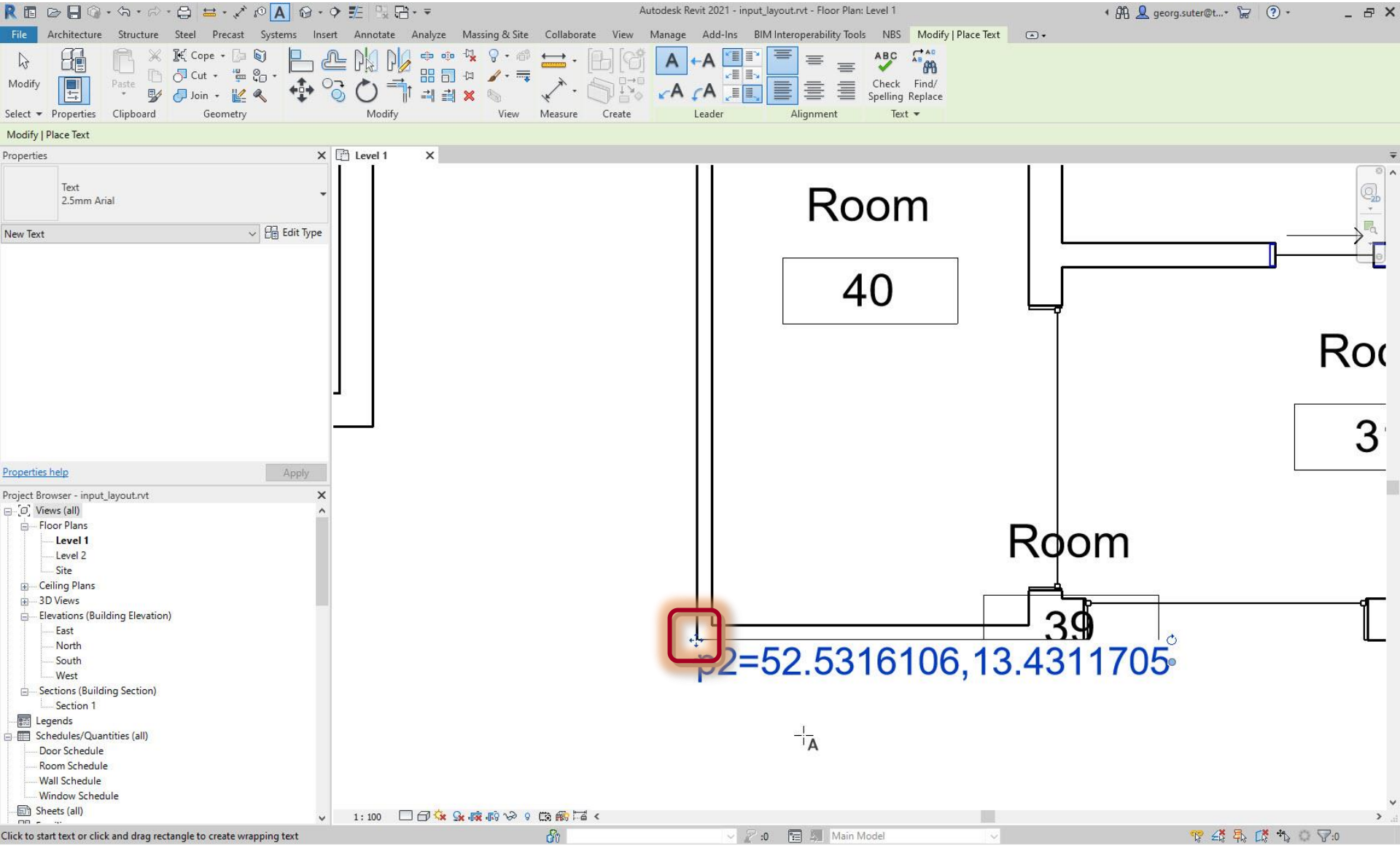
Upper left corner of text element should coincide with chosen location



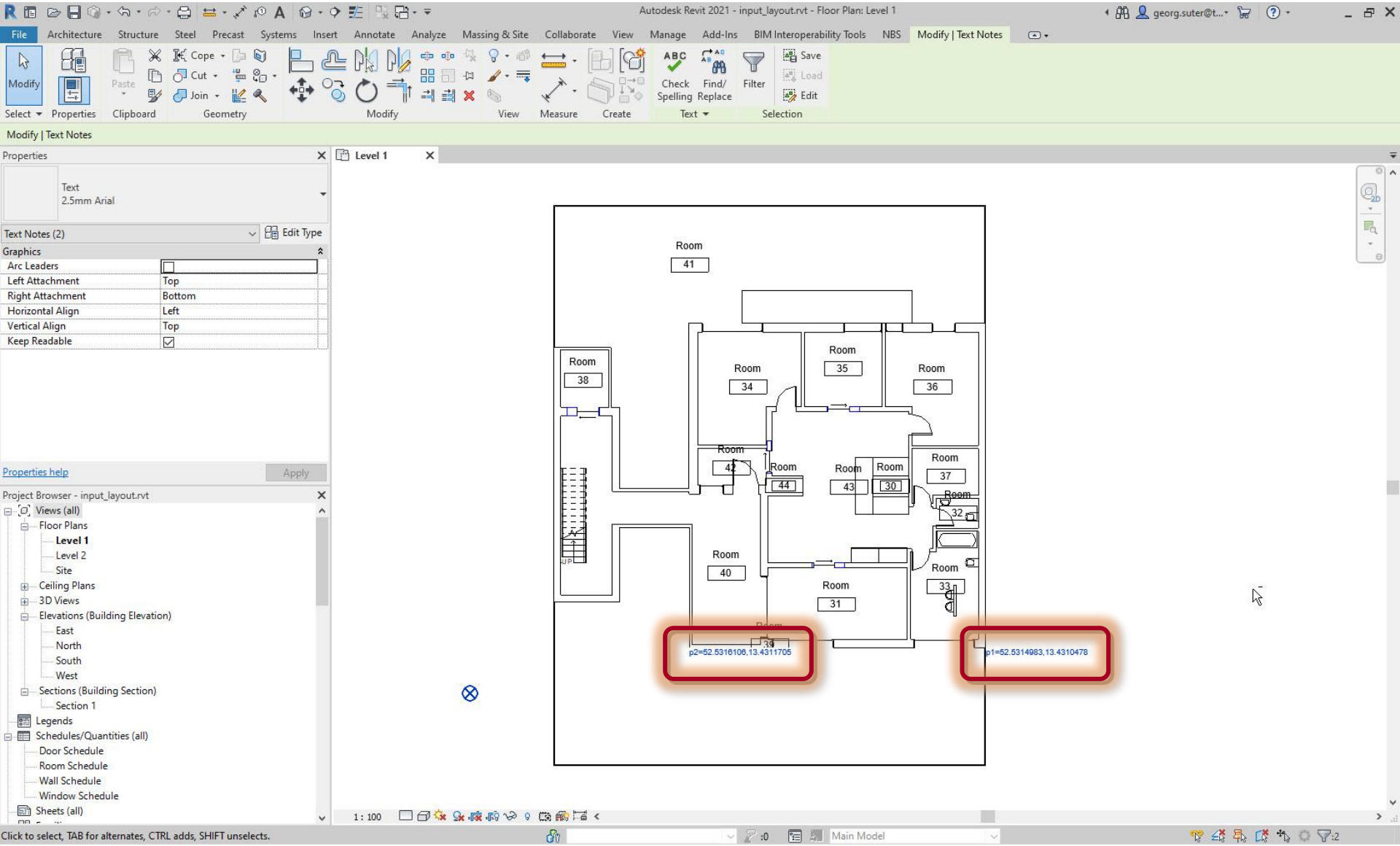
Text editor: copy p2



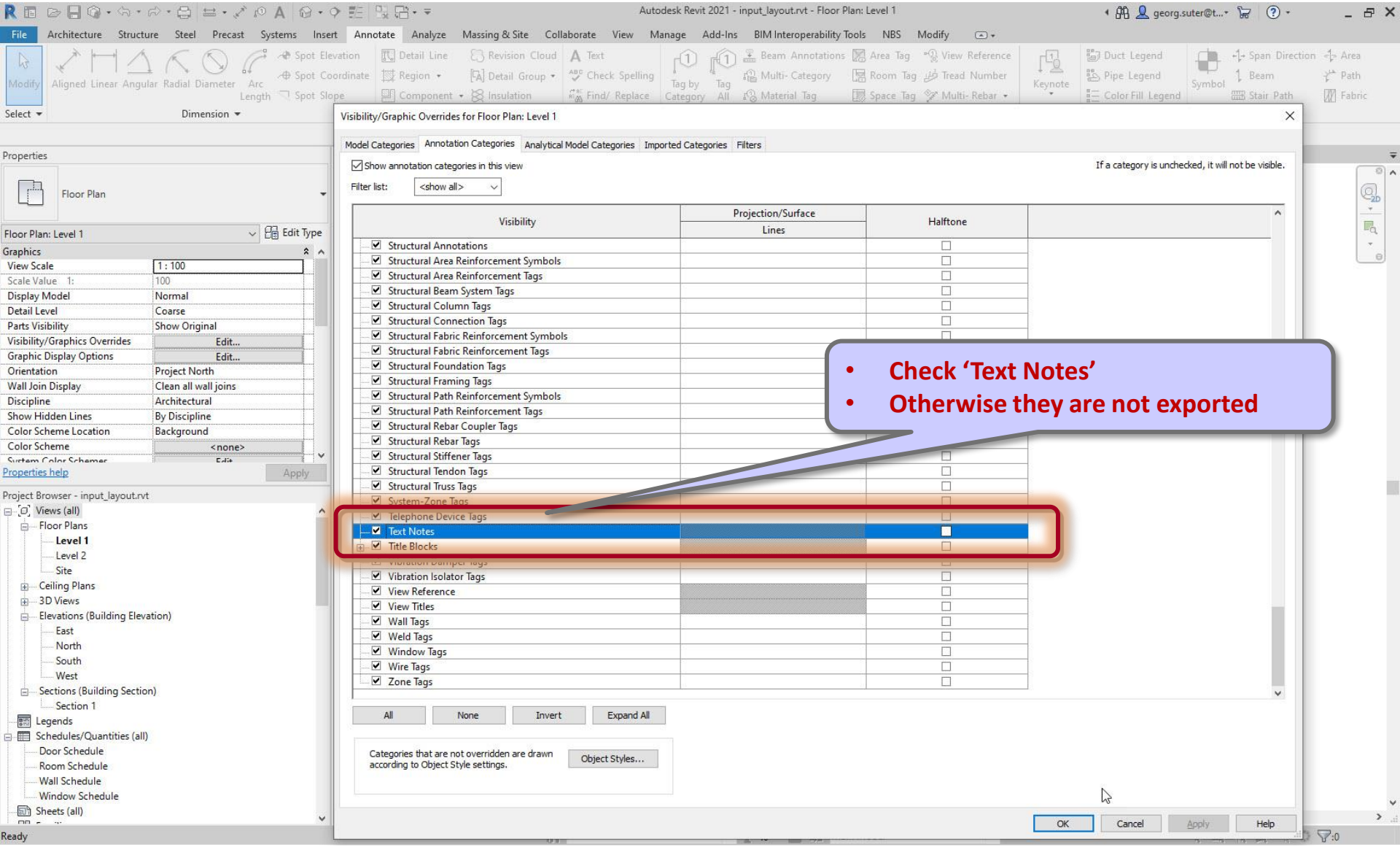
Upper left corner of text element should coincide with chosen location



Check if p1 and p2 are correctly positioned



View > Visibility / Graphics > Text Notes



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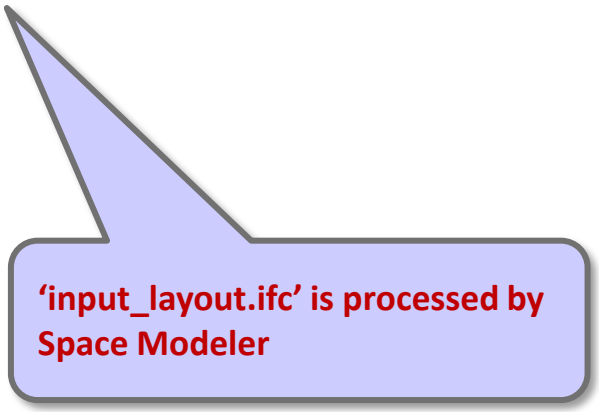
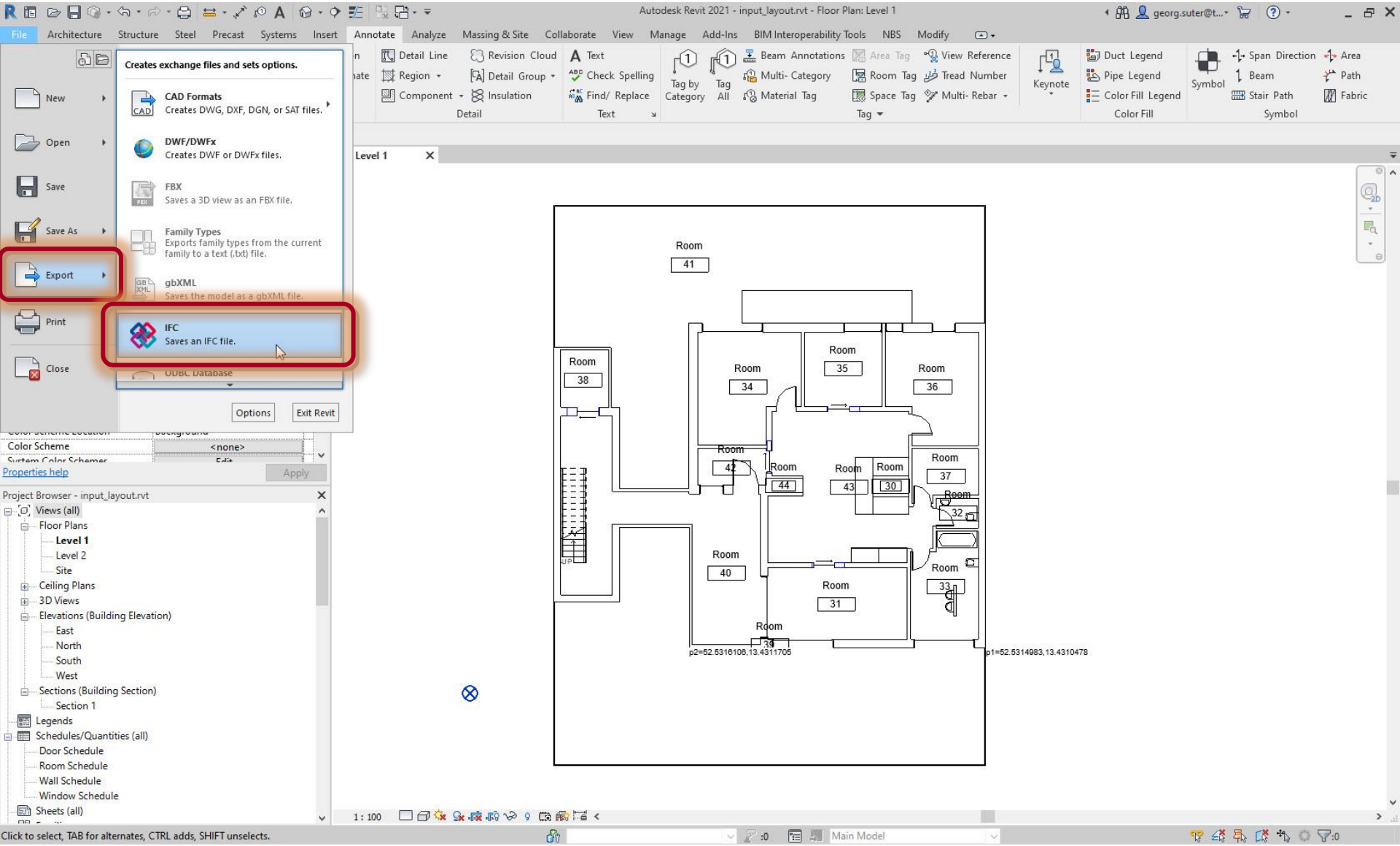
Export input layout

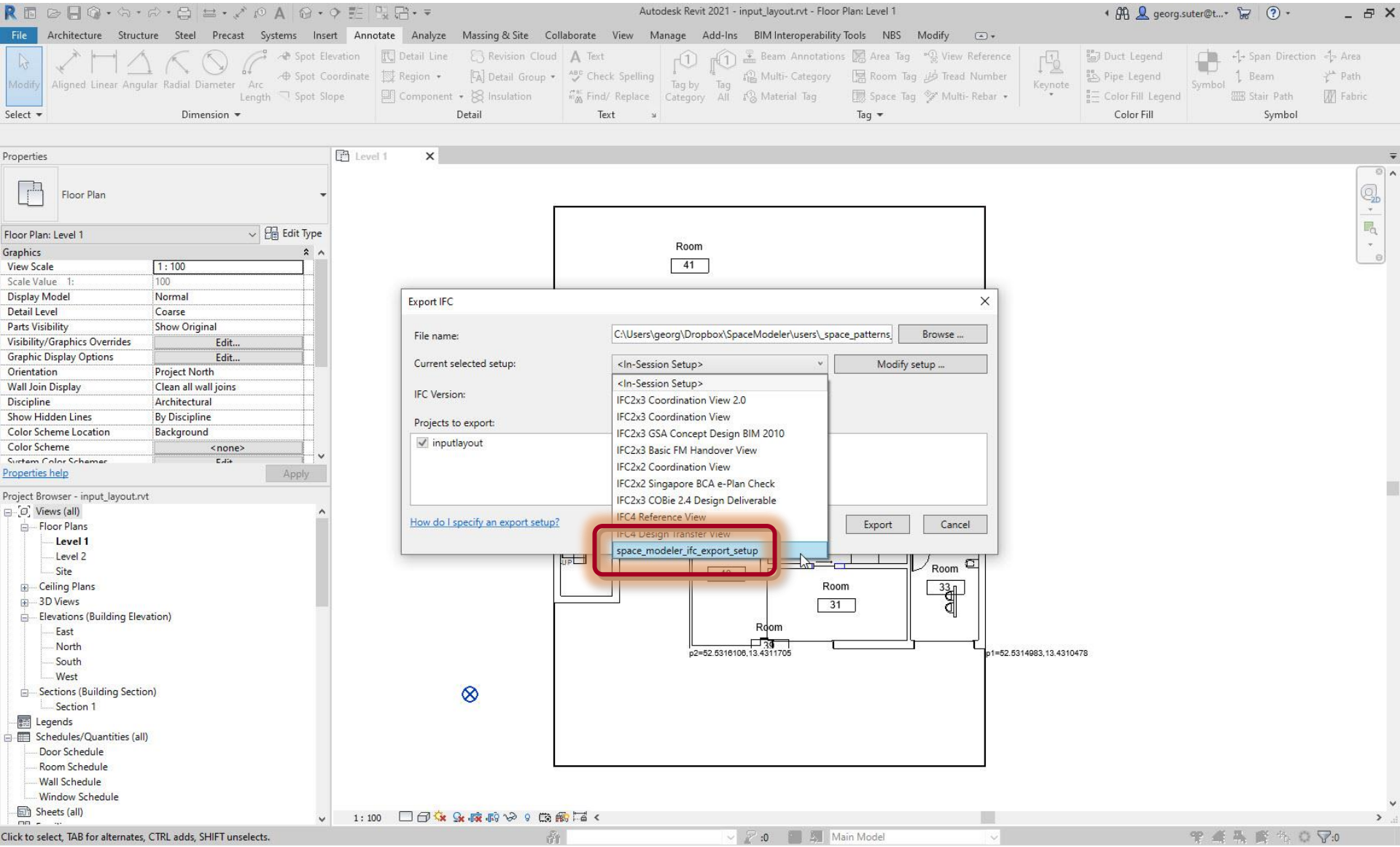
- **Export to Industry Foundation Classes (IFC) format (.ifc)**
- Export to Autocad drawing format (.dwg)



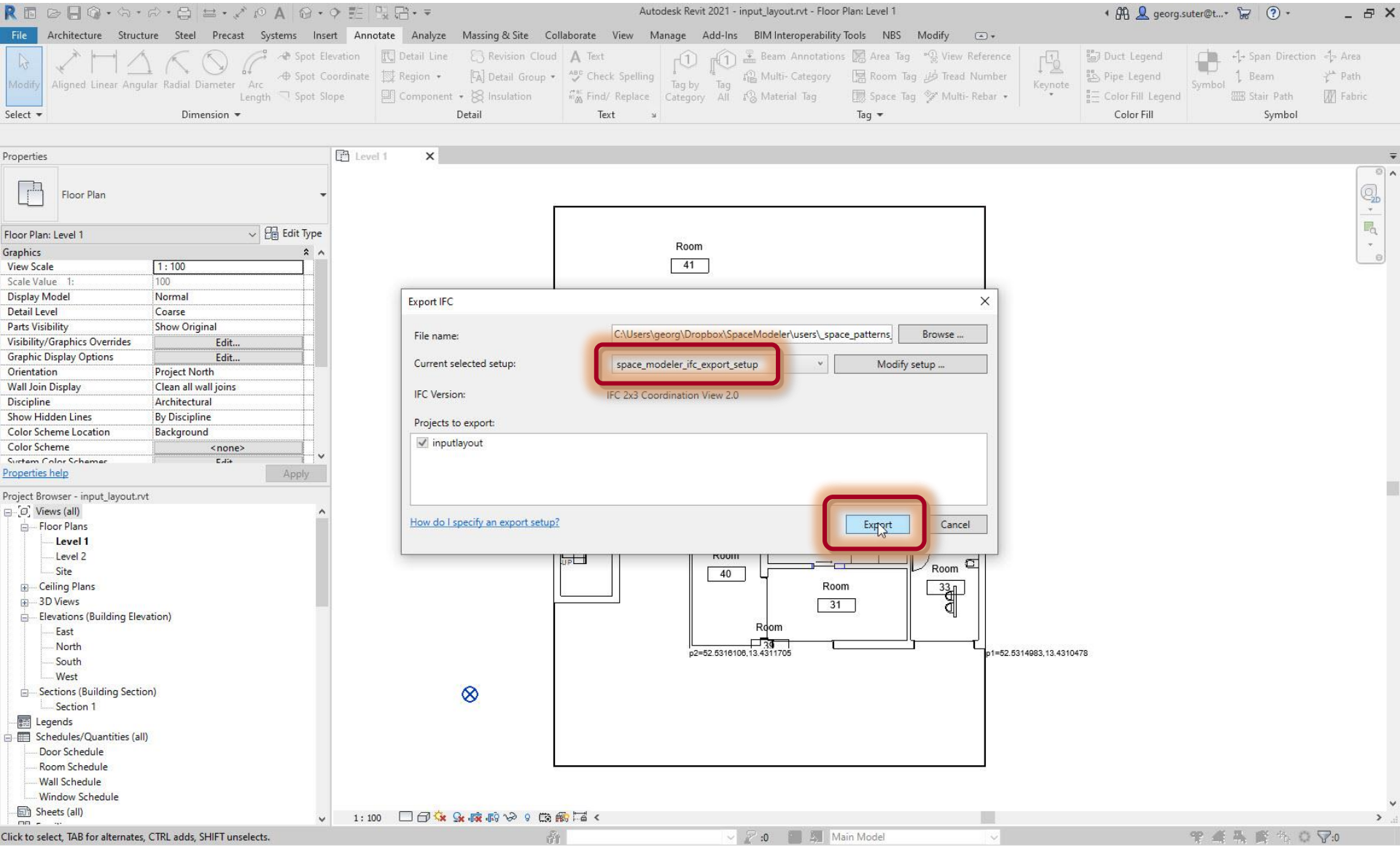
File > Export > IFC



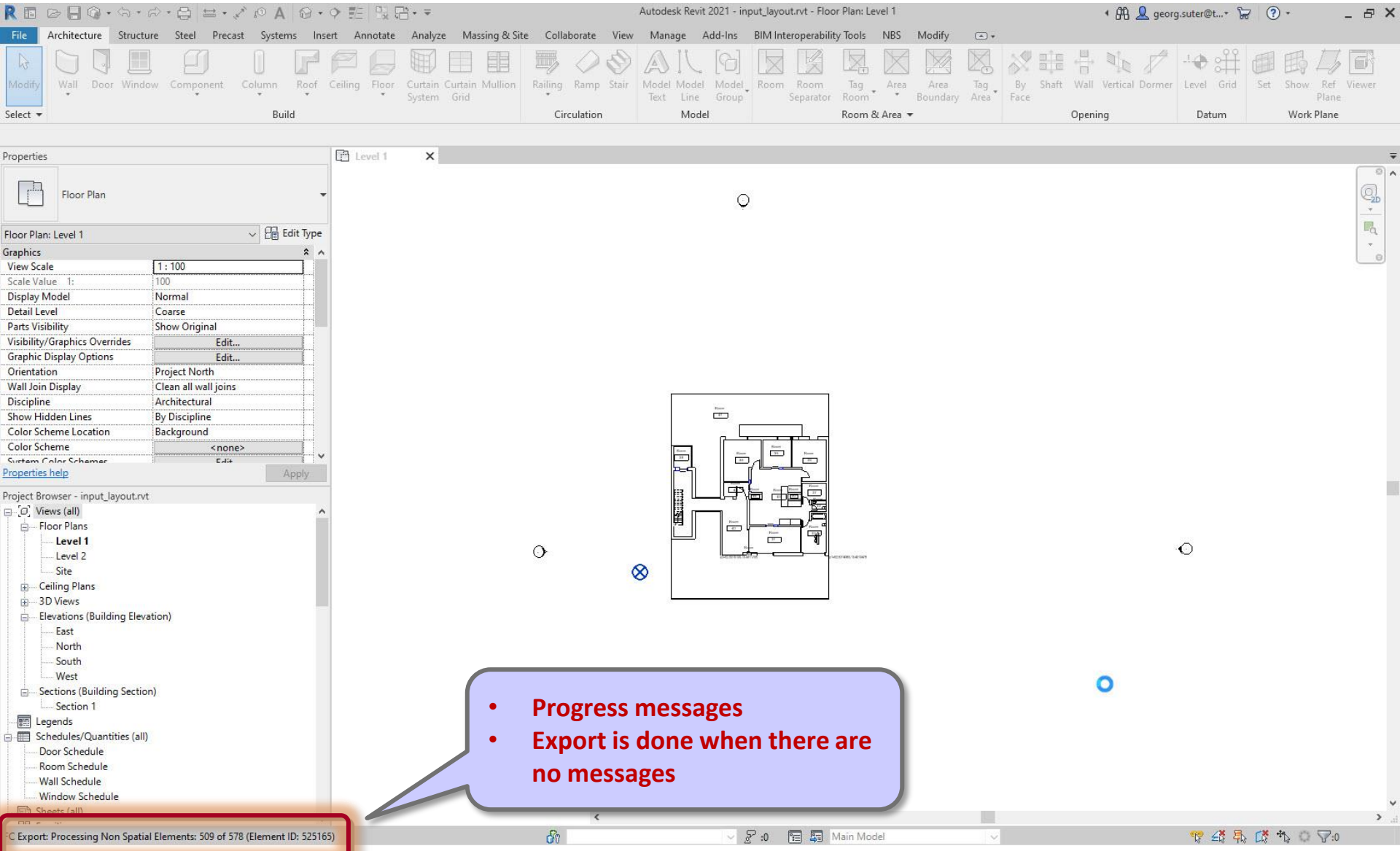
Select ‘space_modeler_ifc_export_setup’ from ‘Current selected setup’



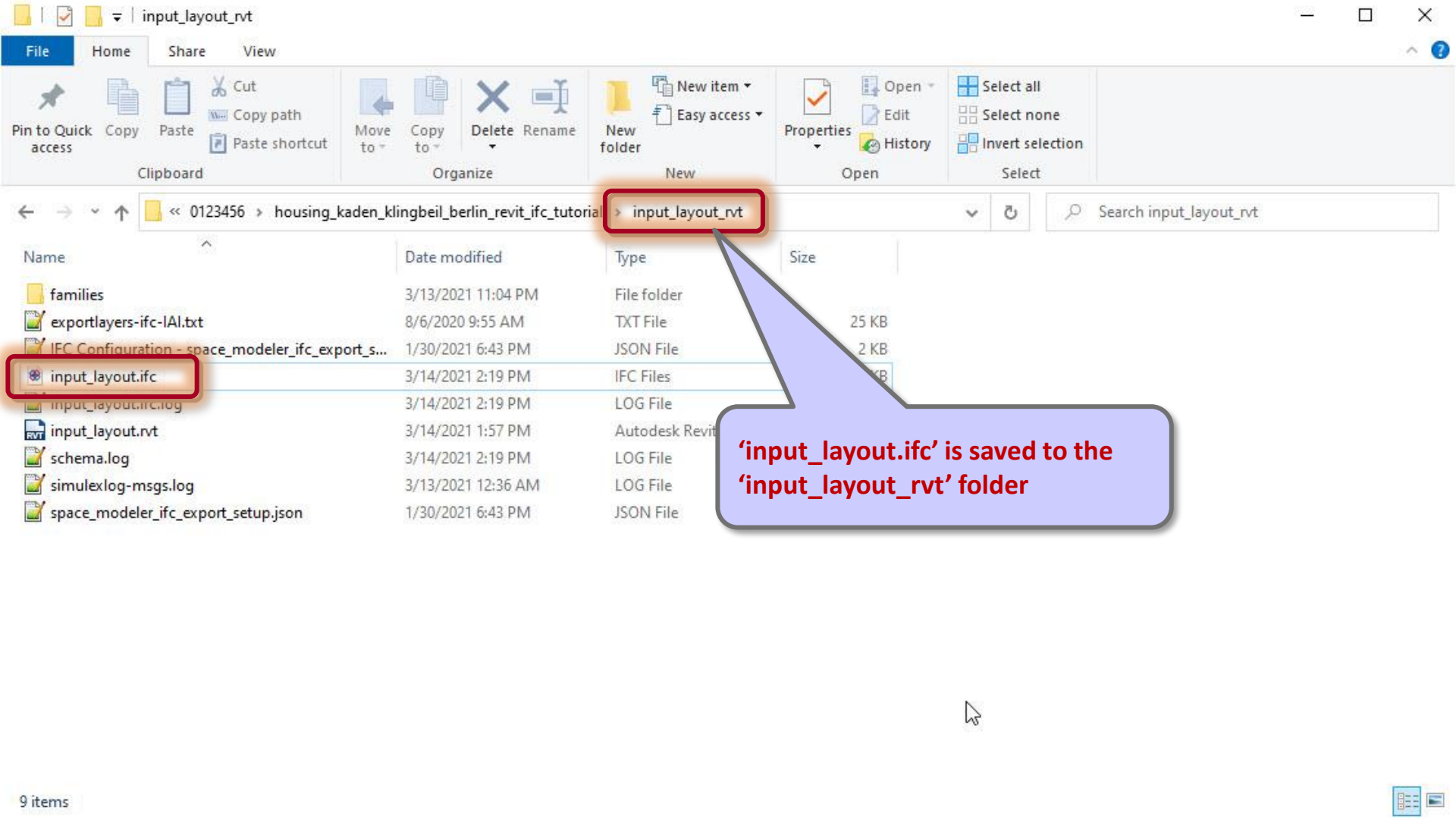
Export


Autodesk Revit 2021 - input_layout.rvt - Floor Plan: Level 1
Export IFC
File name:
C:\Users\georg\Dropbox\SpaceModeler\users_space_patterns_
Browse ...
Current selected setup:
space_modeler_ifc_export_setup
Modify setup ...
IFC Version:
IFC 2x3 Coordination View 2.0
Projects to export:
inputlayout
How do I specify an export setup?
Export
Cancel
Room
41
40
31
33
p2=52.5316106,13.4311705
p1=52.5314983,13.4310478

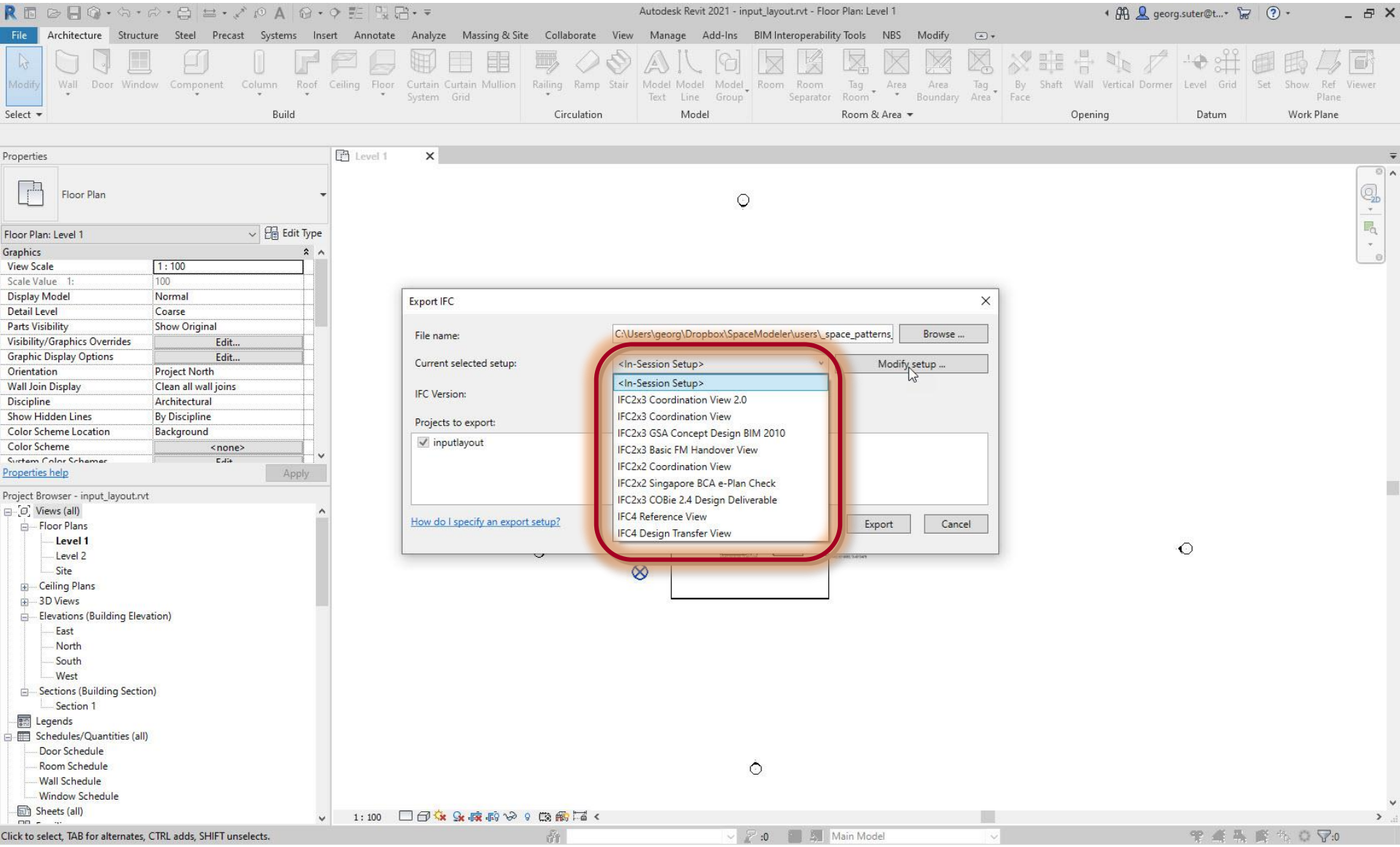
Export runs in the background



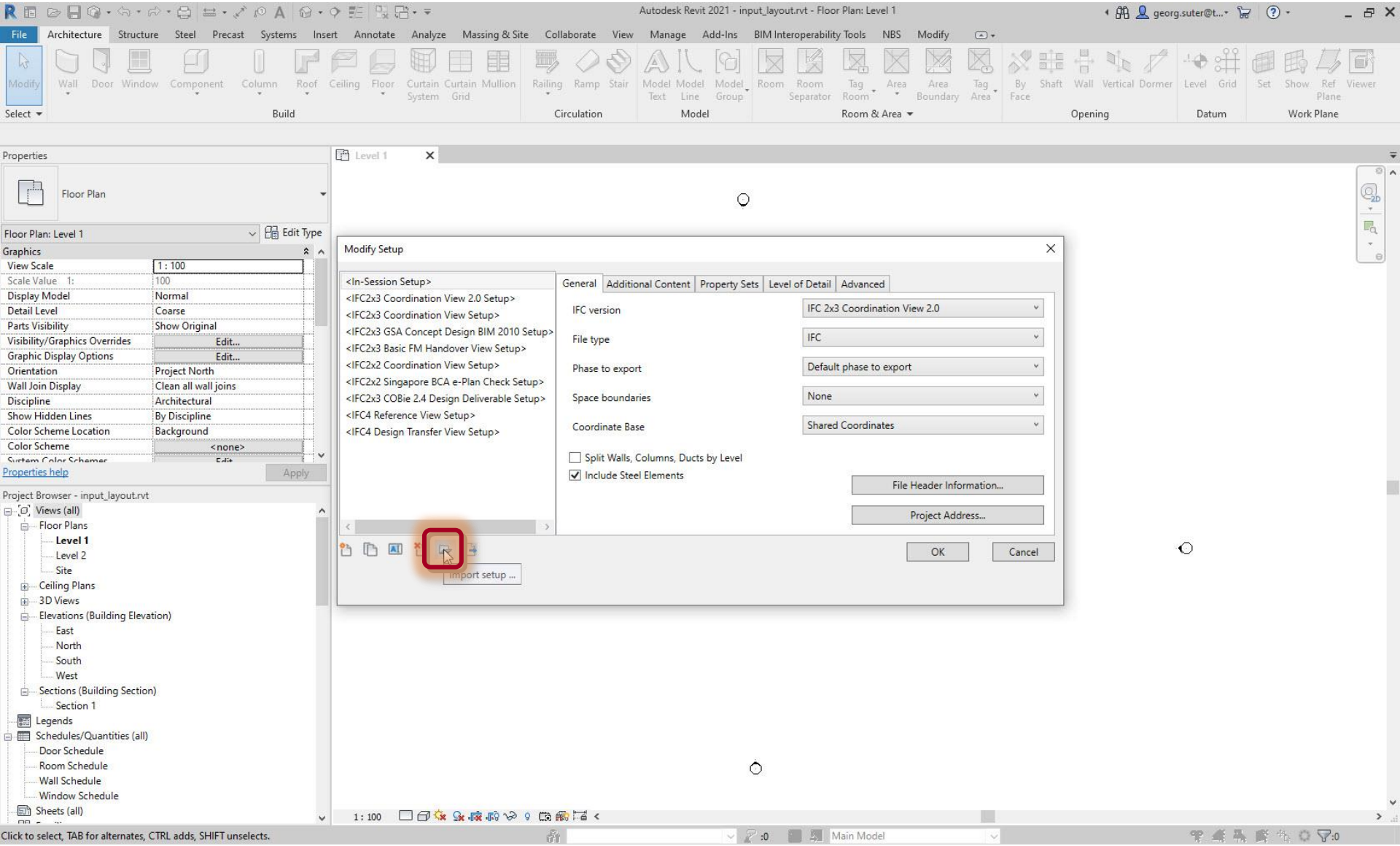
Check ‘input_layout.ifc’ in ‘input_layout_rvt’ folder



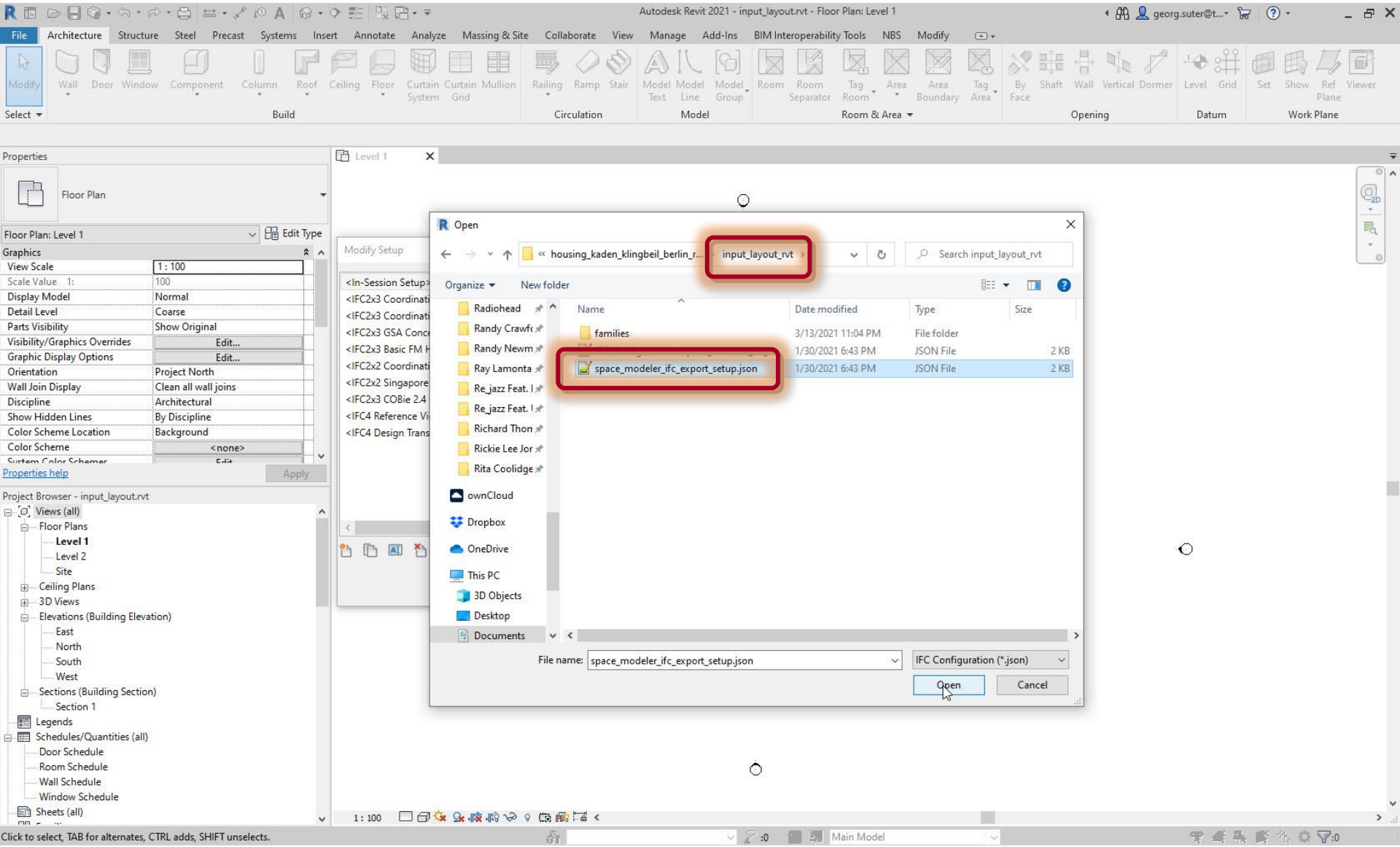
Troubleshooting: ‘space_modeler_ifc_export_setup’ is missing



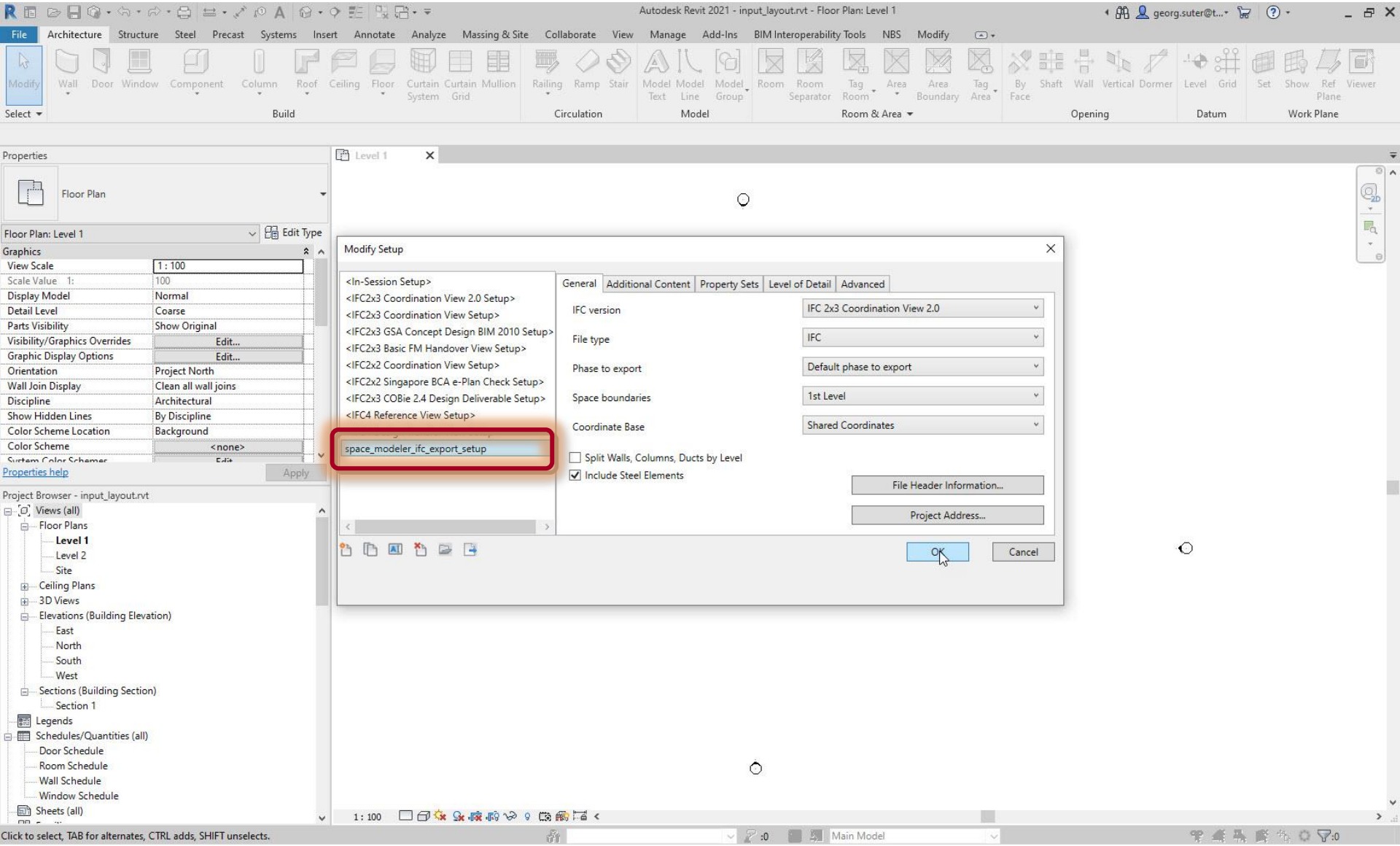
Troubleshooting: Modify setup > Import setup…



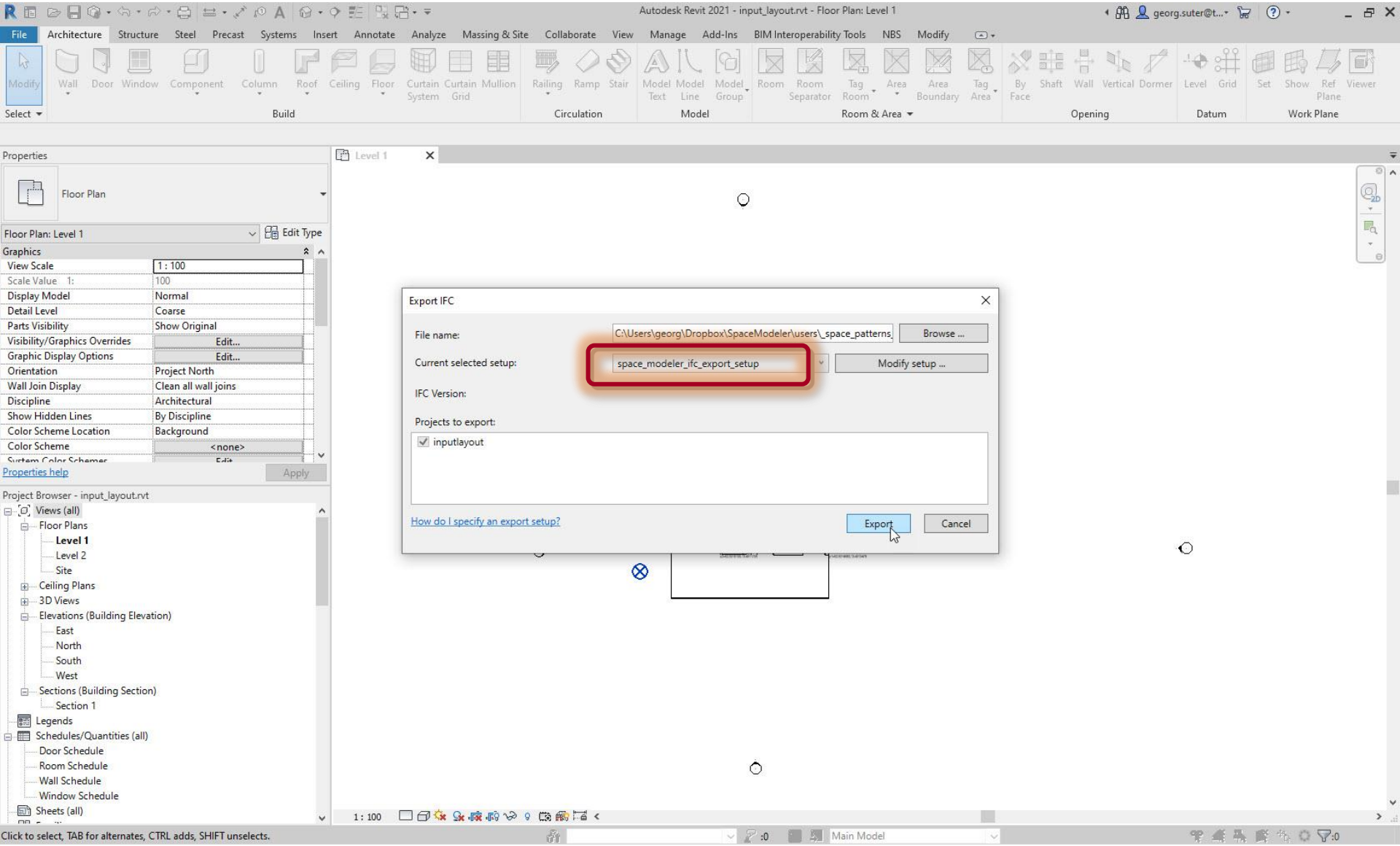
Open ‘space_modeler_ifc_export_setup.json’ file in ‘input_layout_rvt’ folder



Select ‘space_modeler_ifc_export_setup’ option

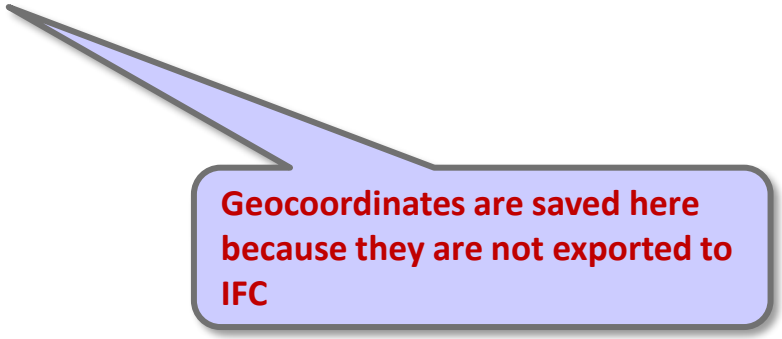


Export

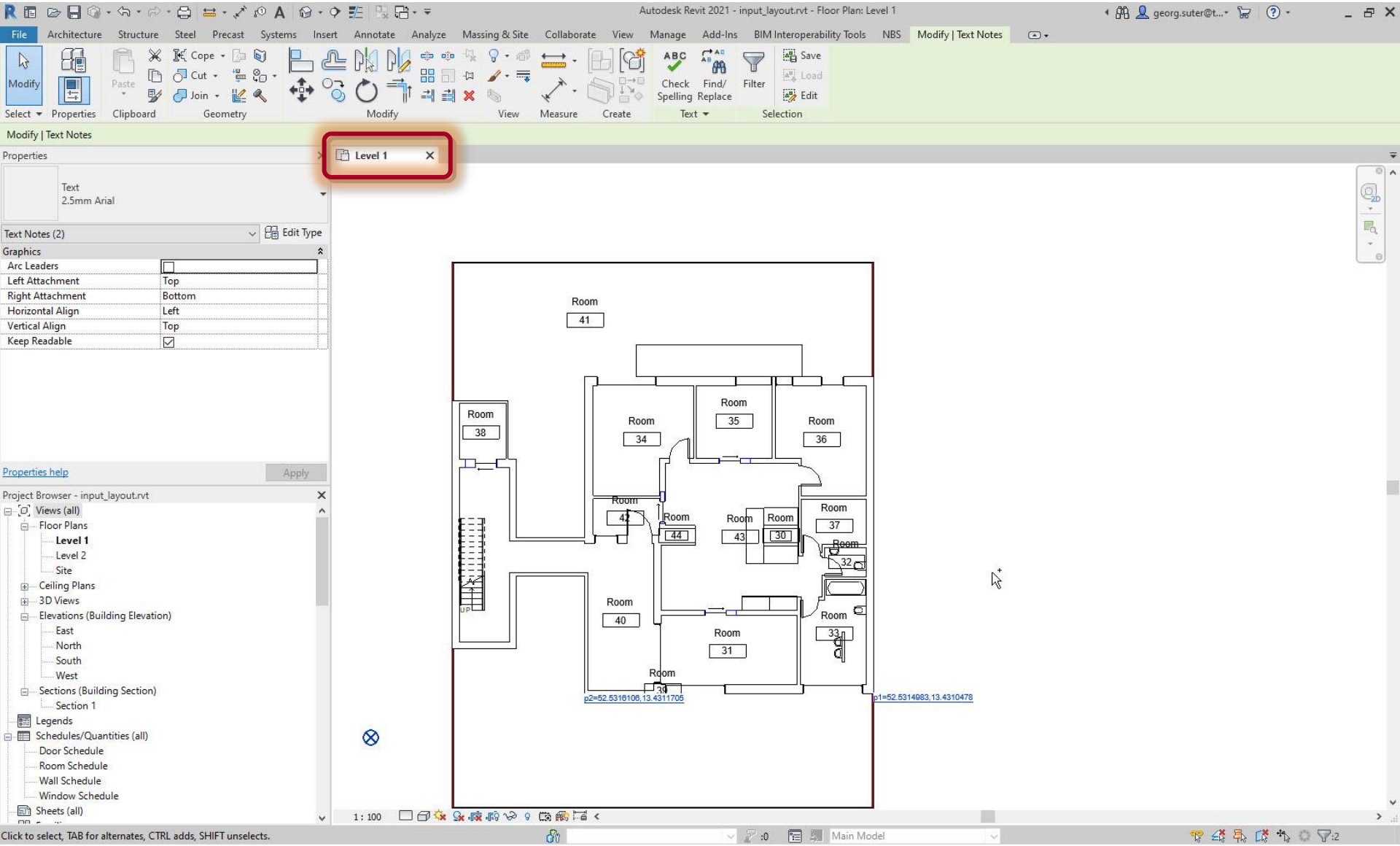

Autodesk Revit 2021 - input_layout.rvt - Floor Plan: Level 1
Export IFC
File name:
C:\Users\georg\Dropbox\SpaceModeler\users_space_patterns
Browse ...
Current selected setup:
space_modeler_ifc_export_setup
Modify setup ...
IFC Version:
Projects to export:
inputlayout
How do I specify an export setup?
Export
Cancel

Export input layout

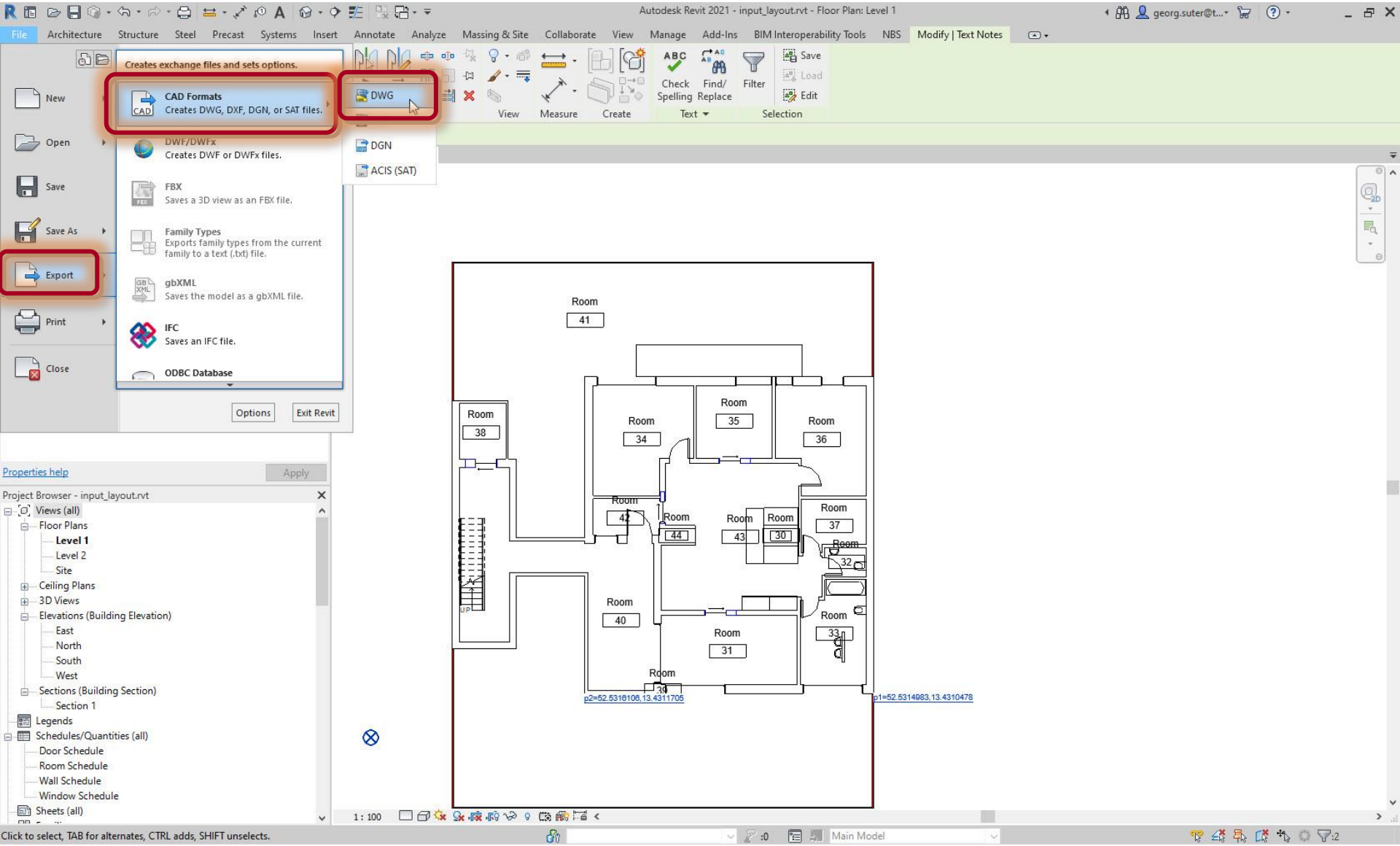
- Export to Industry Foundation Classes (IFC) format (.ifc)
- **Export to Autocad drawing format (.dwg)**



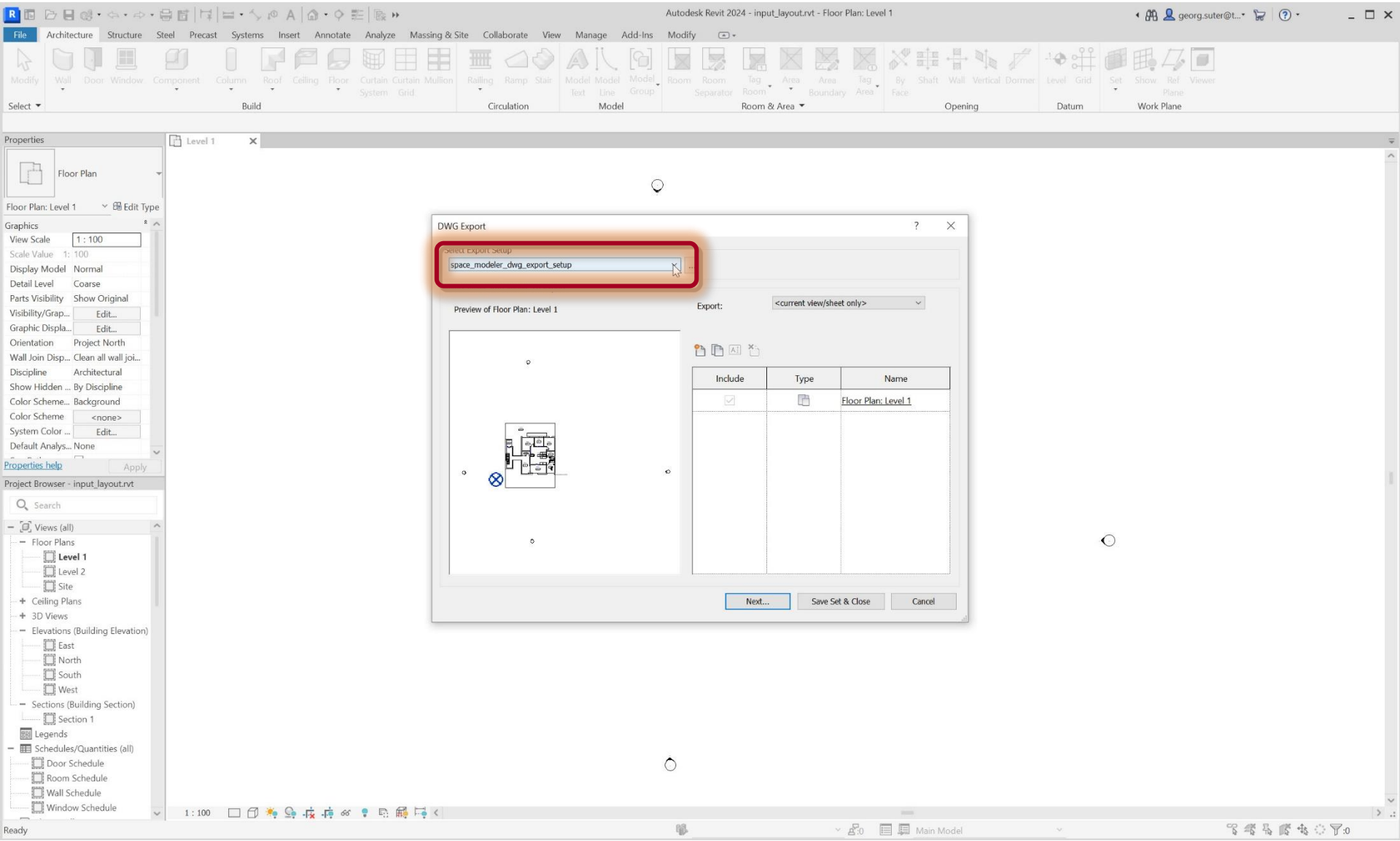
Project Browser > Floor Plans > Level 1



File > Export > CAD Formats > DWG

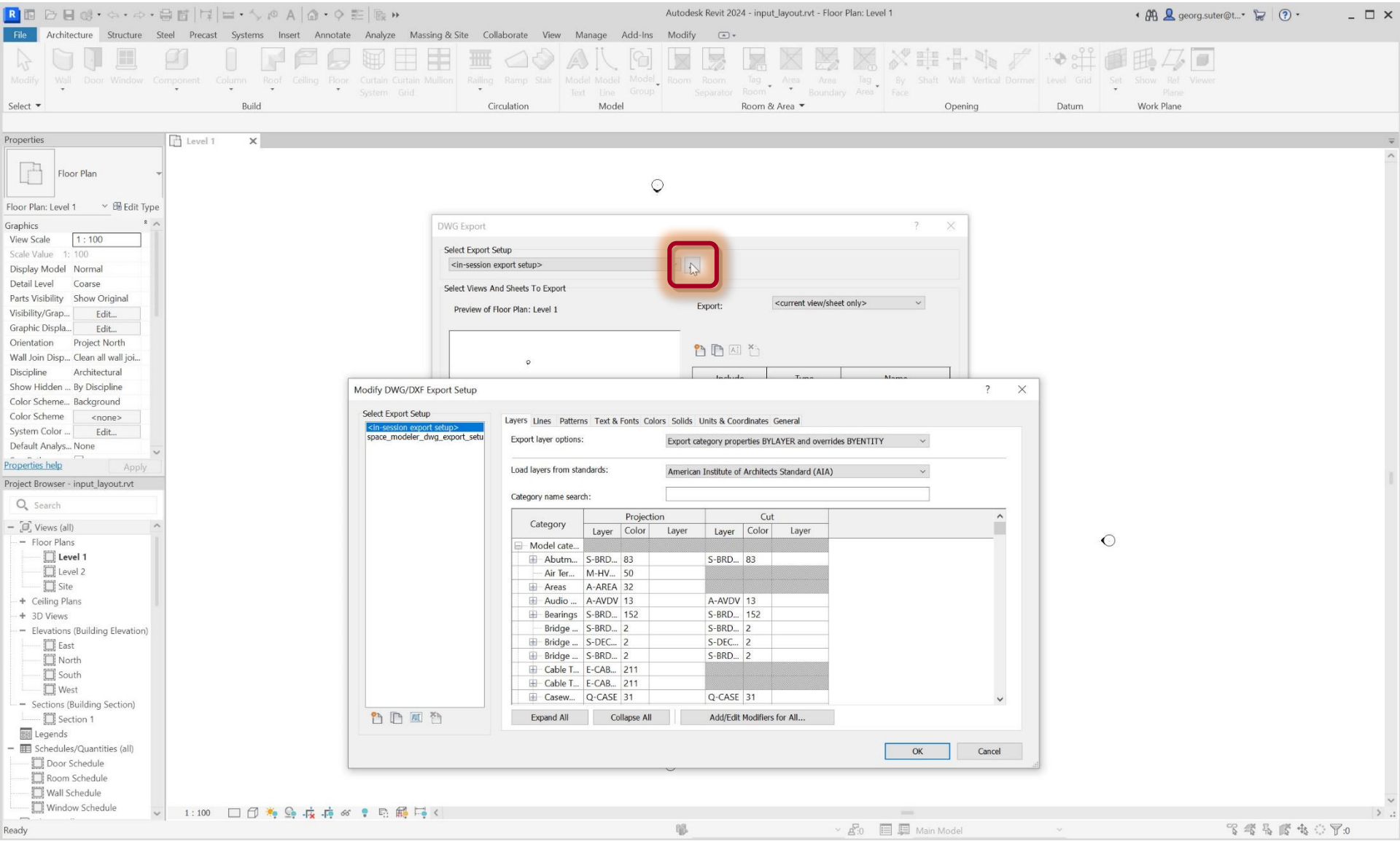


Select ‘space_modeler_dwg_export_setup’ (if available)



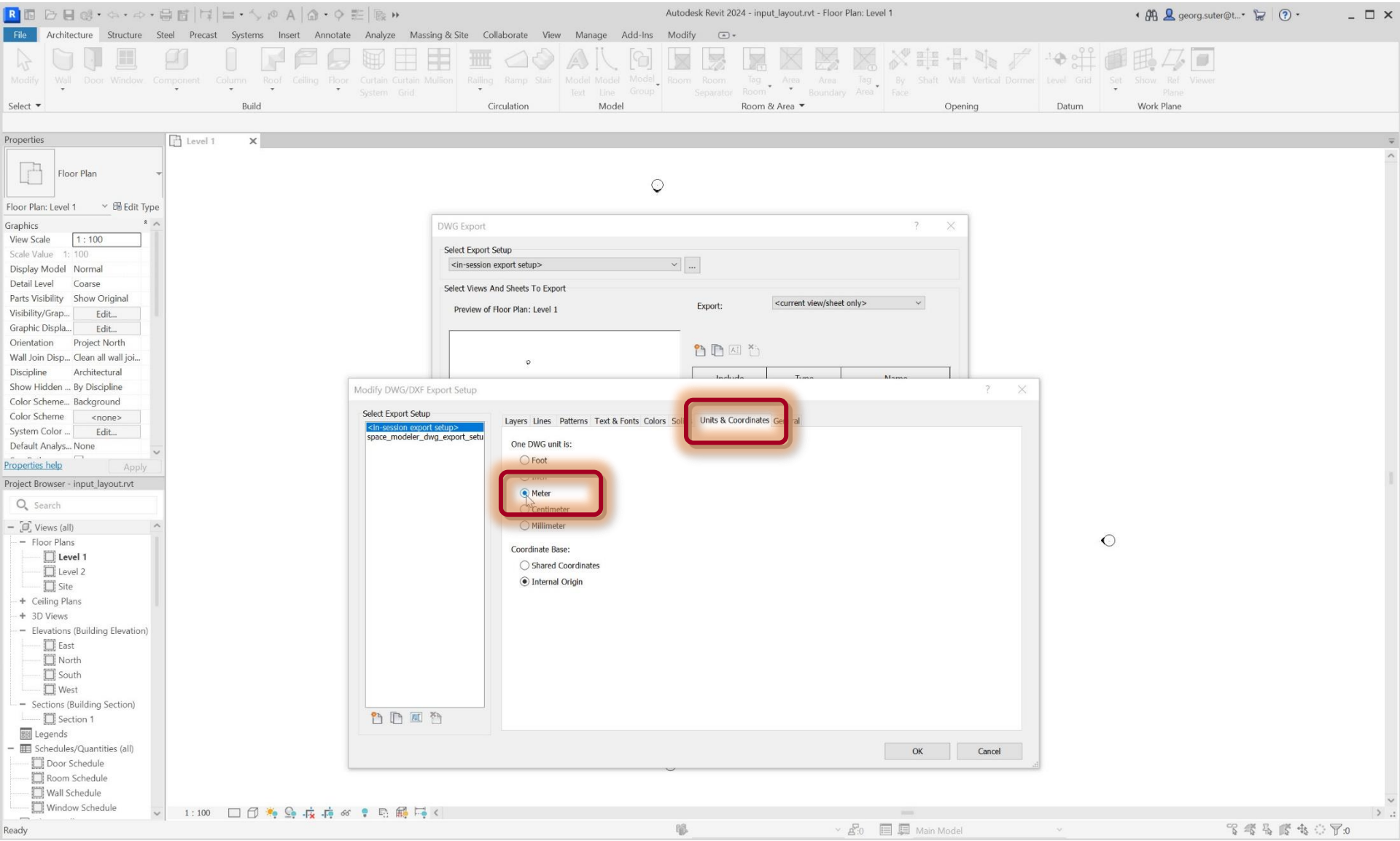
Alternative (if ‘space_modeler_dwg_export_setup’ unavailable):

<in-session export setup> …

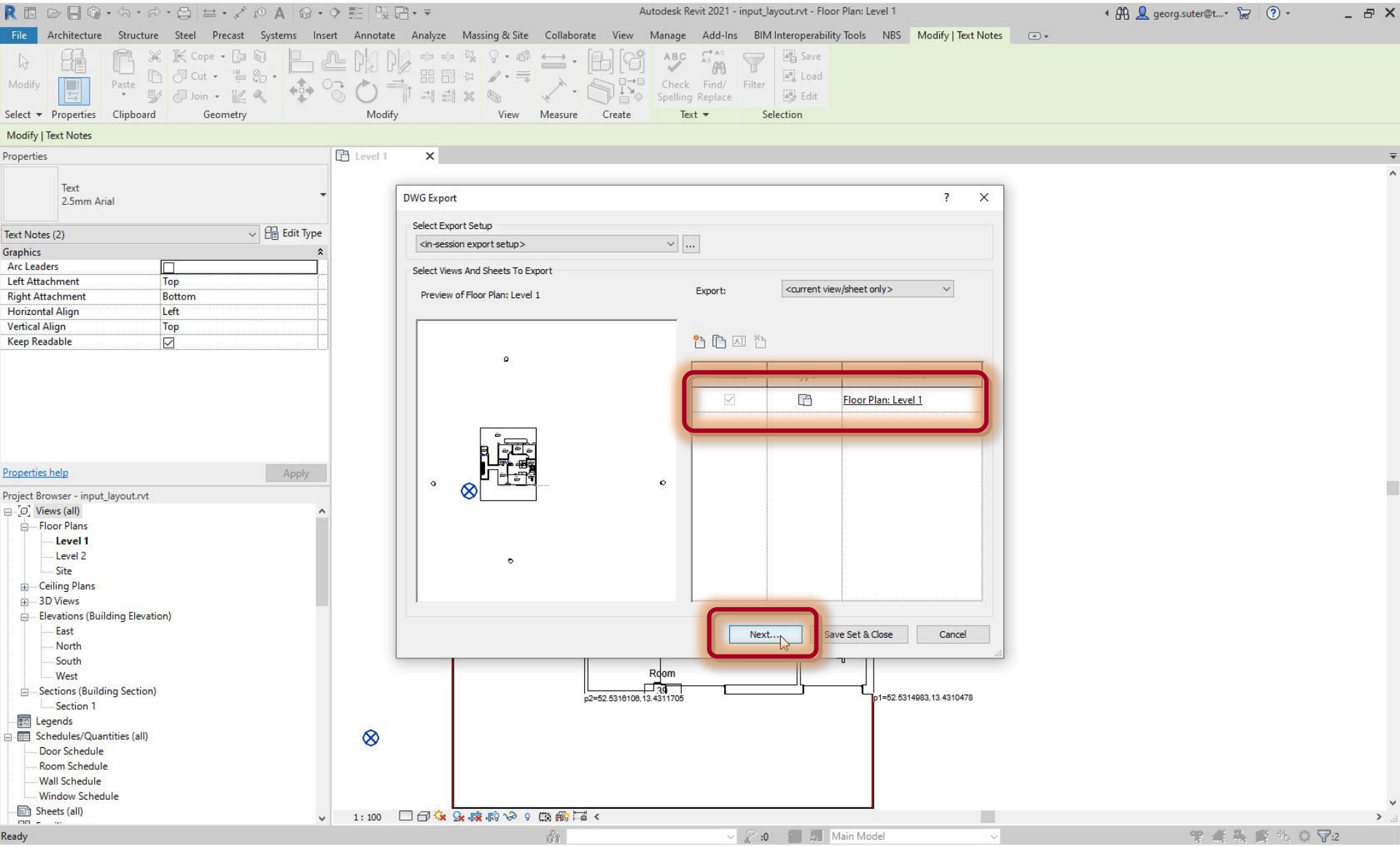


Alternative (if ‘space_modeler_dwg_export_setup’ unavailable):

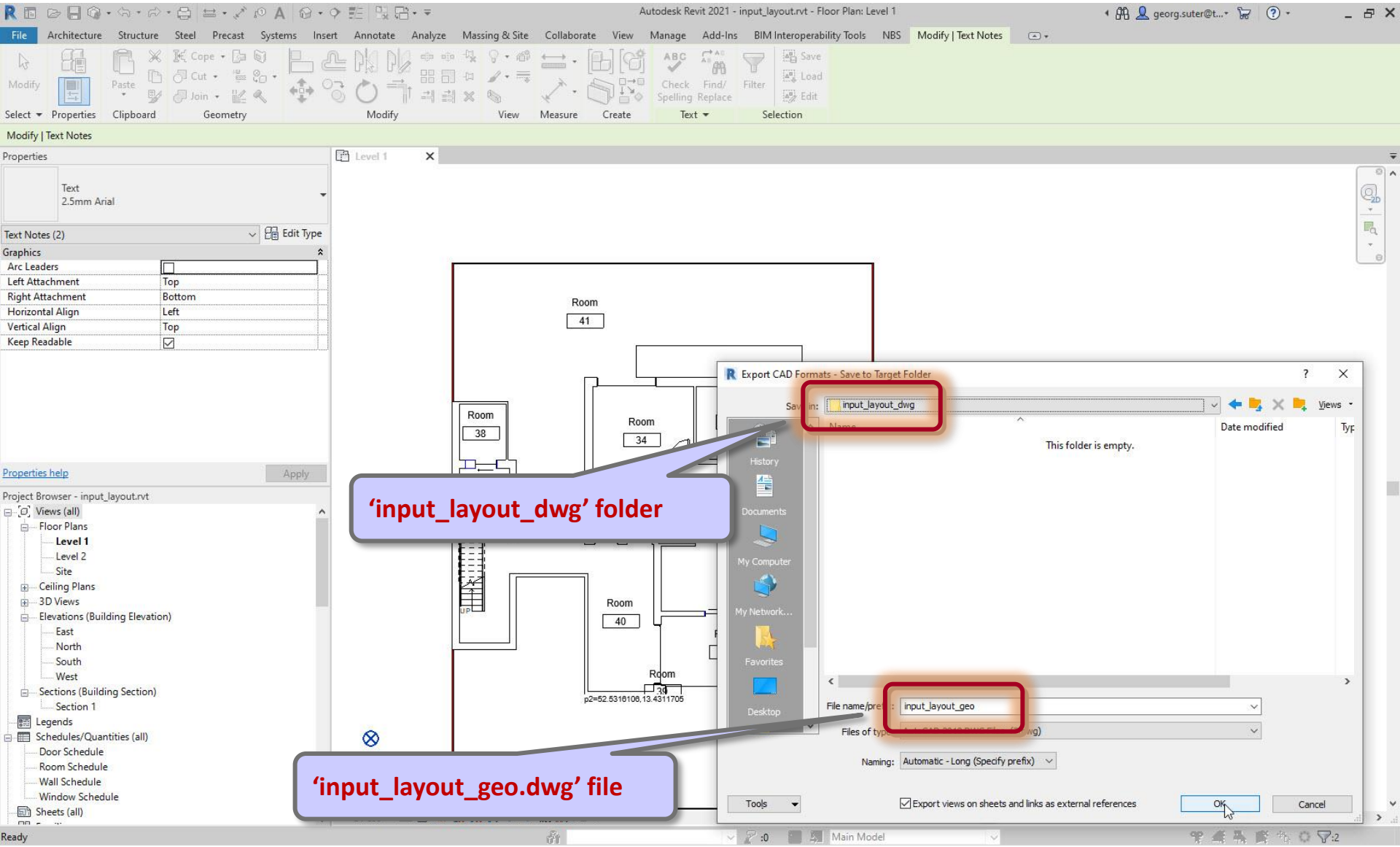
Units & Coordinates > One DWG unit is: > Meter



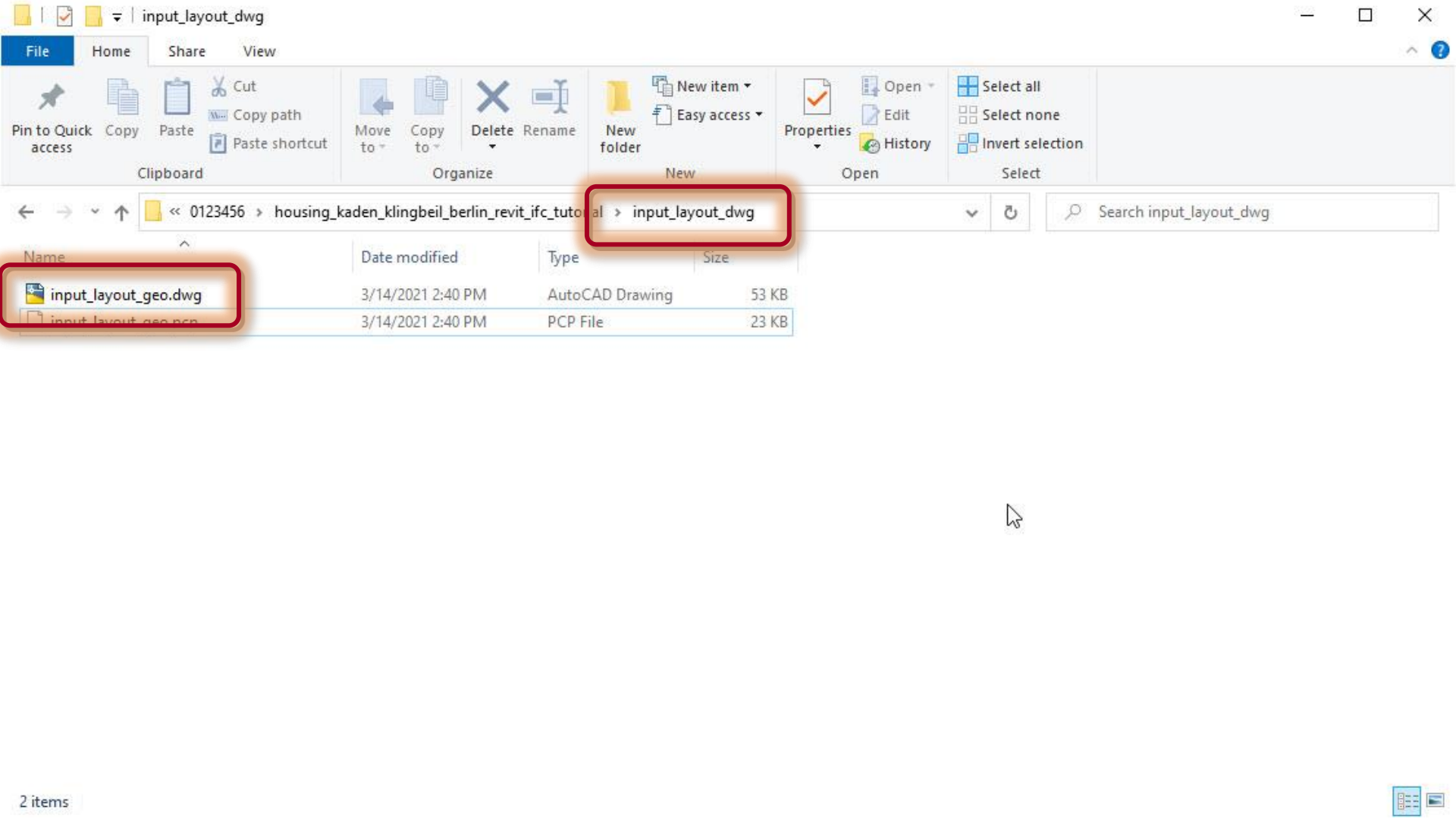
Next...


Autodesk Revit 2021 - input_layout.rvt - Floor Plan: Level 1
Modify | Text Notes
Properties
Text
2.5mm Arial
Text Notes (2)
Edit Type
Graphics
Arc Leaders
Left Attachment Top
Right Attachment Bottom
Horizontal Align Left
Vertical Align Top
Keep Readable
Properties help
Apply
Project Browser - input_layout.rvt
Views (all)
Floor Plans
Level 1
Level 2
Site
Ceiling Plans
3D Views
Elevations (Building Elevation)
East
North
South
West
Sections (Building Section)
Section 1
Legends
Schedules/Quantities (all)
Door Schedule
Room Schedule
Wall Schedule
Window Schedule
Sheets (all)
DWG Export
Select Export Setup
<in-session export setup>
Select Views And Sheets To Export
Preview of Floor Plan: Level 1
Export:
<current view/sheet only>
Floor Plan: Level 1
Next...
Save Set & Cancel
Cancel
Room
p2=52.5316106,13.4311705
p1=52.5314983,13.4310478
1 : 100
Ready
Main Model

Save as ‘input_layout_geo.dwg’ file to ‘input_layout_dwg’ folder



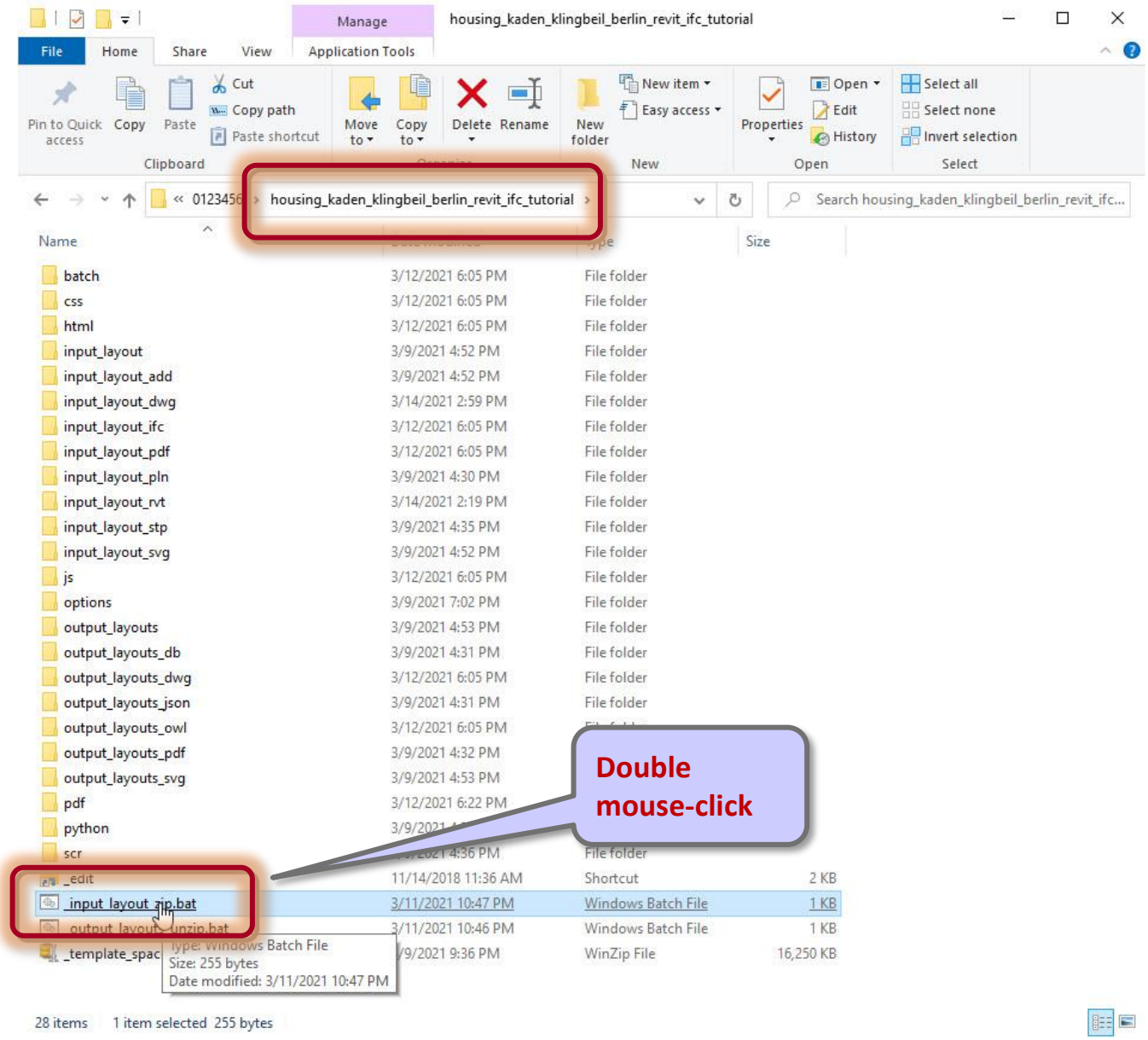
Check ‘input_layout_geo.dwg’ in ‘input_layout_dwg’ folder



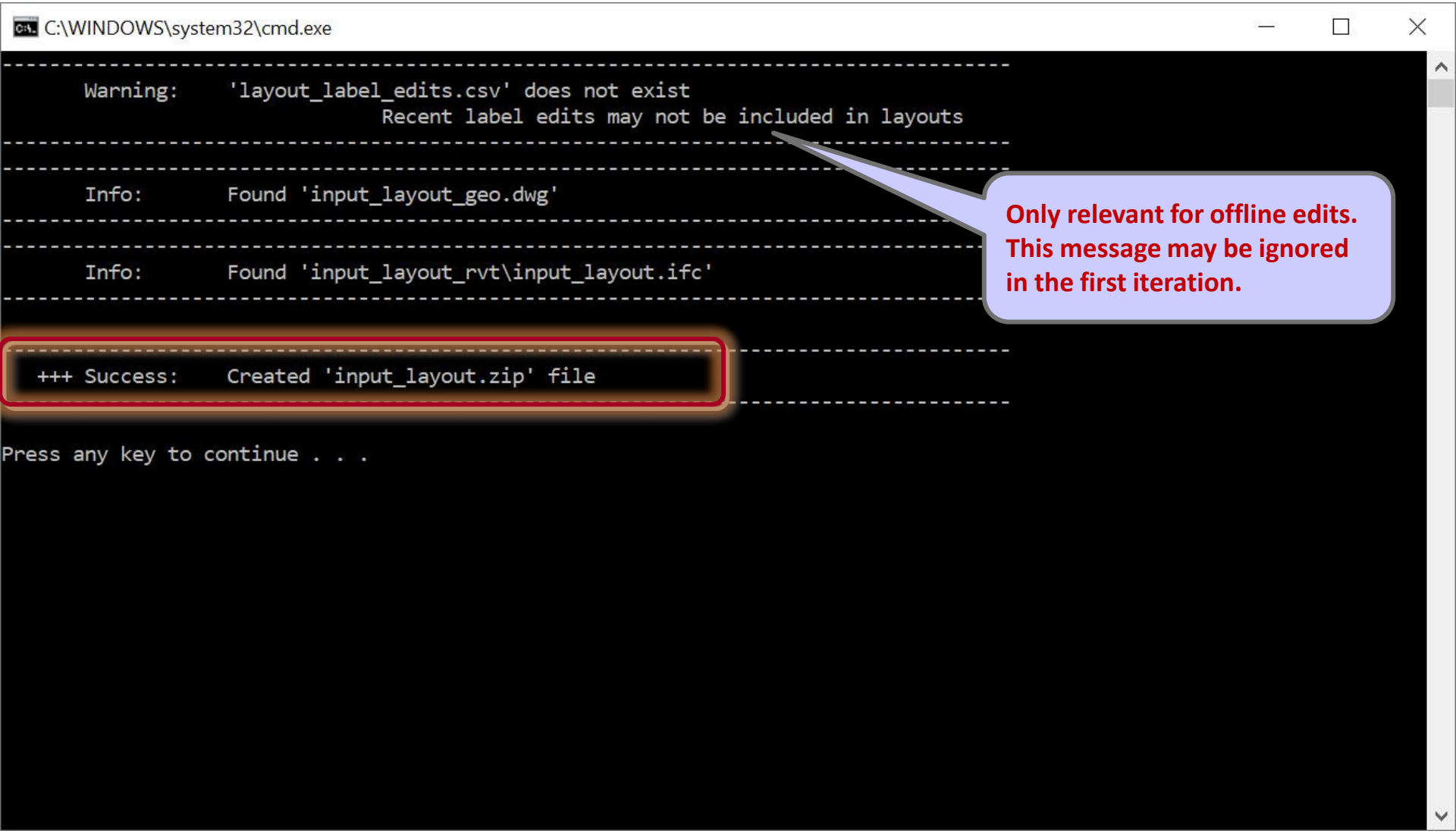
Steps

1. Set up project
2. Import pdf of original floor plan
3. Set floor-to-floor height
4. Determine internal and external spaces
5. Create walls
6. Create doors and openings
7. Create windows
8. Create circulation elements
9. Create horizontal external elements
10. Create furnishing elements
11. Create rooms
12. Create geocoordinates
13. Export input layout
14. **Create .zip archive**
15. Generate space model

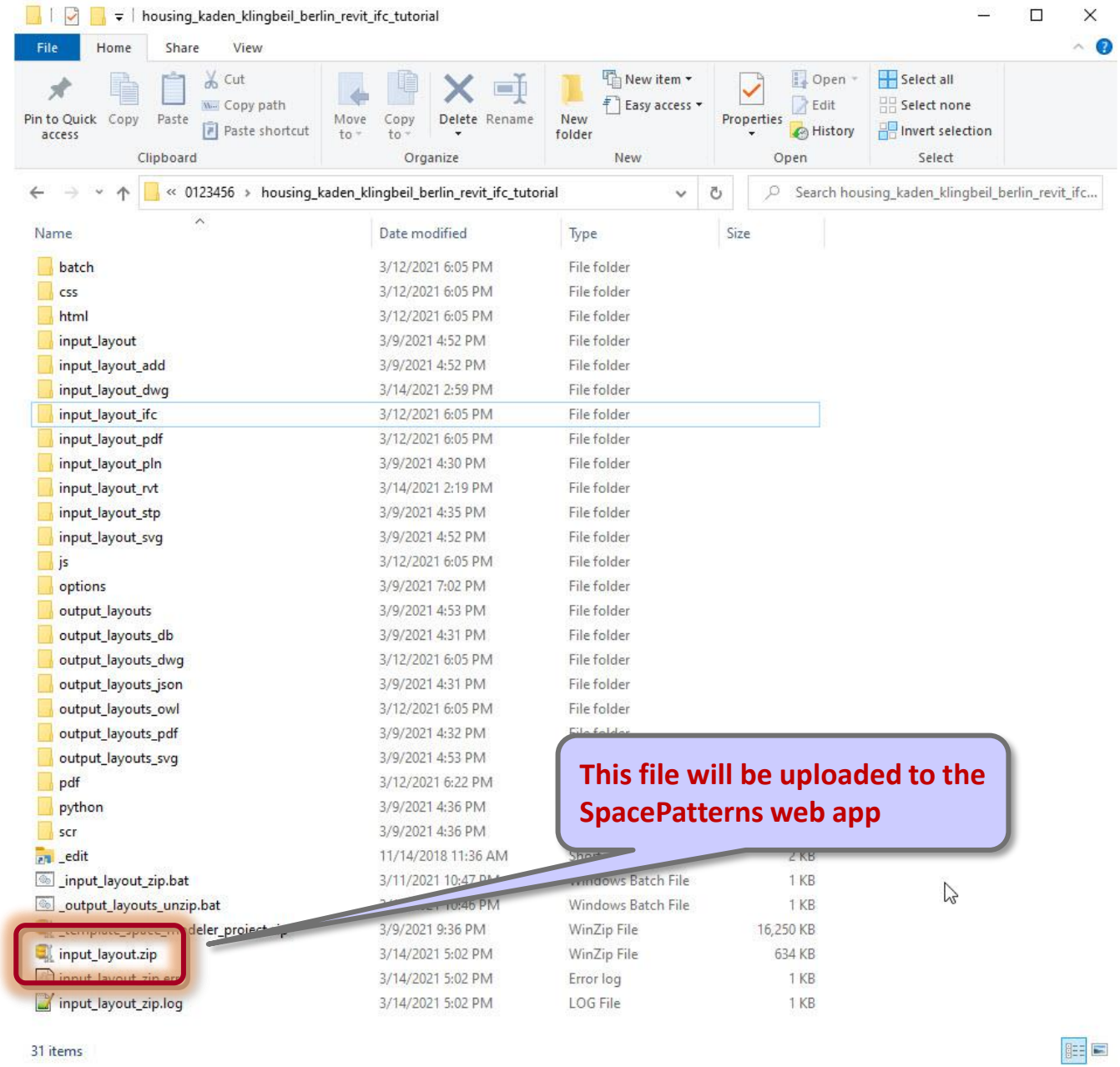
Run '_input_layout_zip.bat' script in project folder



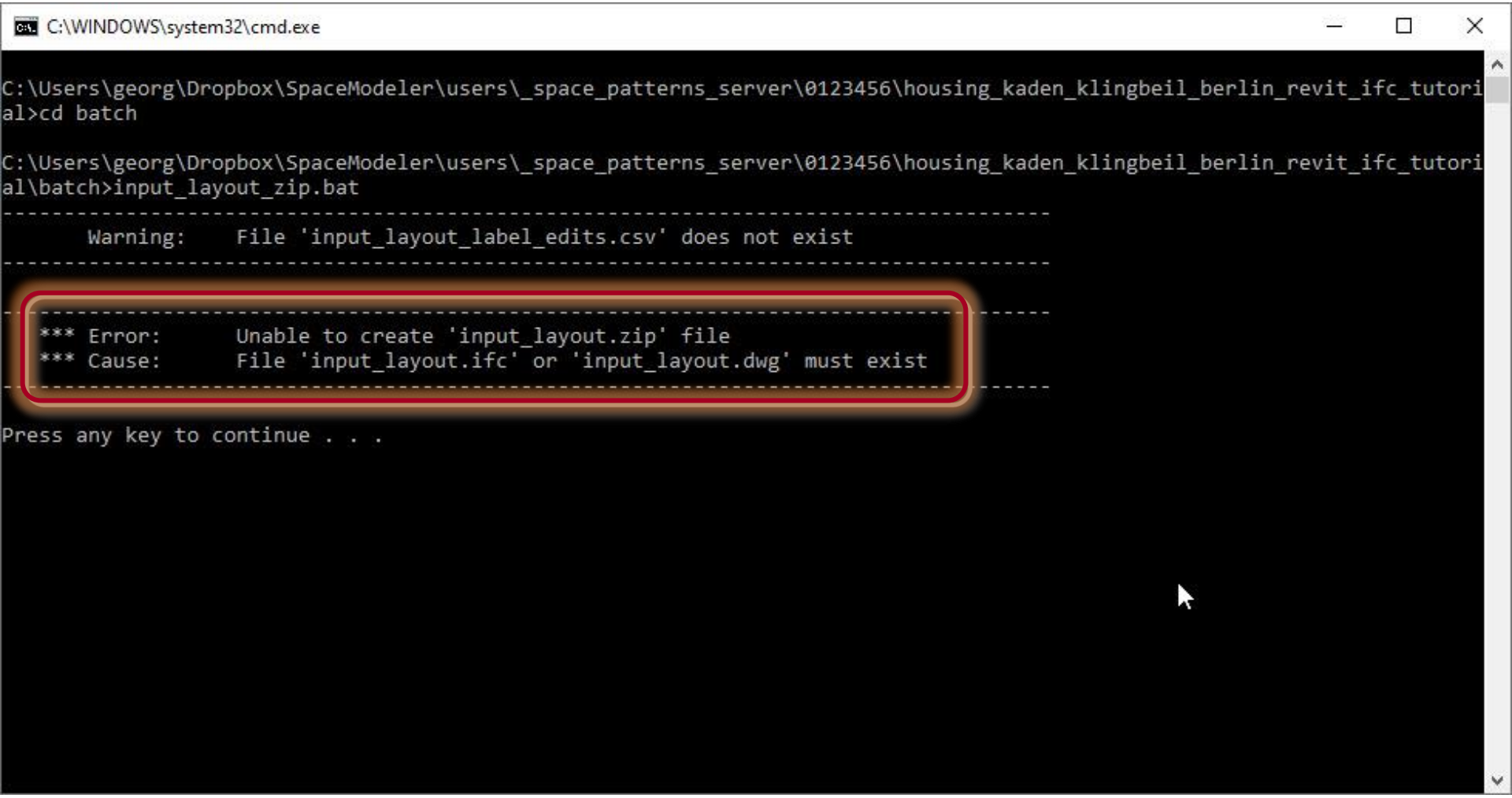
Check if ‘input_layout.zip’ archive has been created



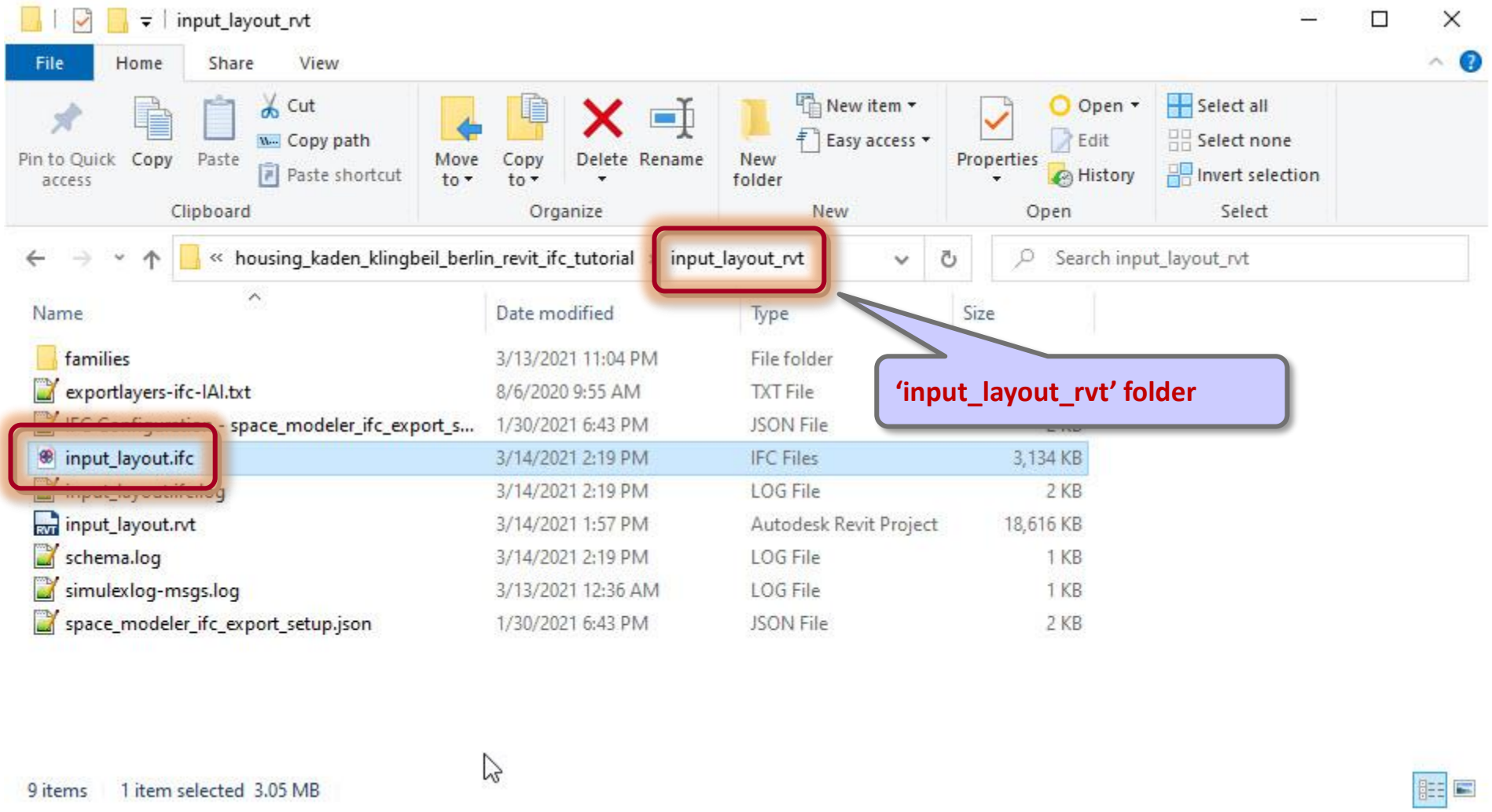
Check if ‘input_layout.zip’ archive has been created



Troubleshooting: Missing ‘input_layout.ifc’ (or ‘input_layout.dwg’)



Troubleshooting: Check ‘input_layout.ifc’ file in ‘input_layout_rvt’ folder



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See User Guide 'Generating a space model'