AUTODESK UNIVERSITY

BLD125063-L

CFD meets VR lab

Florian Neumayr, B(Hons) BA & Eng
A2K Technologies

Learning Objectives

- Digital Prototyping and Simulation is essential for a healthier environment and sustainable economy.
- VR is not only a marketing tools but allows the full confirmation of the right decision made through full immersion.
- We have seamless cross discipline interacting tools for no rework at hand.
- Full immersion is not science fiction and technology is accessible and ready to be used.

Description

Dynamic modelling and generative designs pathed the way for sophisticated digital prototyping. While software got better and better, it is often that stakeholder and clients are struggling to understand the design and plans not granting the use of the latest tools especially not accepting new solutions. New simulation methods will only path the way when the results are being communicated and well received. The presentation of 'CFD meets VR' addresses a well-designed workflow where critical facility data can be communicated to stakeholder to make the right decision about comfort supporting equipment and costs confirming the success of the architecture. The workflow describes the export of a Revit model to CFD Simulation making use of a CFD data translation within 3ds Max preparing it for its final destination Stingray. A second option is offered using Dynamo and Revit Live. The result offers a full immersion and experiencing of CFD data, which can be presented on VR rigs and mobiles. CFD data is 3D data, which is often difficult to communicate through 2D gates such as screens or paper.

Speaker

Florian Neumayr received postgraduate degrees in business and engineering with majors in product lifecycle management (PLM) and controlling in Germany. He offers 20 years of outstanding industry experience in Building Information Modelling for multistory buildings and warehouses. Living in New Zealand, he is counted to the top BIM, Sim and Viz experts of the Southern Hemisphere which leads him to speak and teach internationally. He has been working for the last 7 years as consultant for a top 5% Global Autodesk Reseller in the Asia Pacific, consulting multiple generations regarding a diversity of projects ranging from $100k to $1 billion. His focus as an application engineer is to optimize the computer as a communications tool. His expertise is to realize workflow studies that offer the flexibility to make room for options and changes while reducing costly repetition.

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Contents

Foreword to the tutorial

The tutorial covers all aspects of the workflow you want to follow when in need of presenting CFD data three dimensional with the help of a virtual reality solutions.

This tutorial shall not be a training tutorial of each software used. It describes how models and data can be conveyed from one software to another without rework. Hence, the training is about import, export and inspecting data and only little about software features.

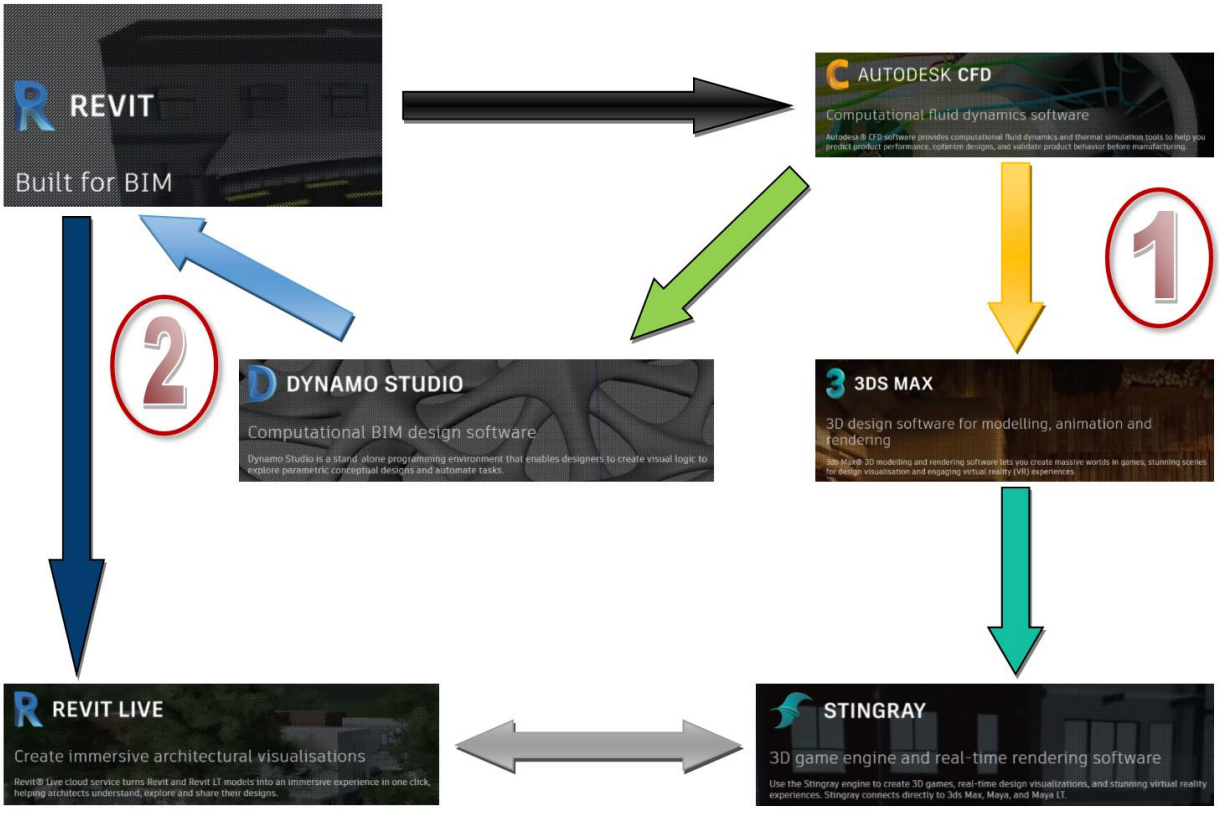
There are over 100+ screenshots documenting the workflow. It is about an advanced but also light weight tutorial to experience Autodesk Software offering to tackle extreme workflows.

Browse, export, import and enjoy! All files have already been prepared for you.

Cheers,
Florian

Contact me on: contact@bim2.tv
Visit me at: http://www.bim2.tv

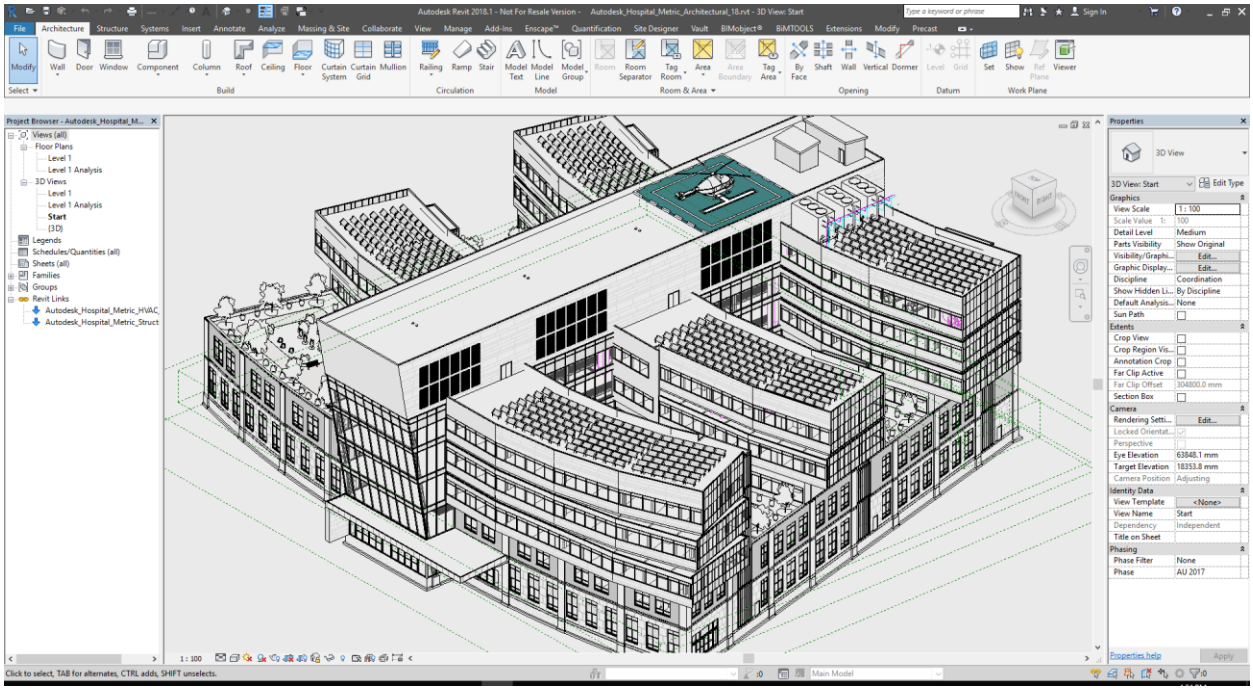
THE TREASURE MAP



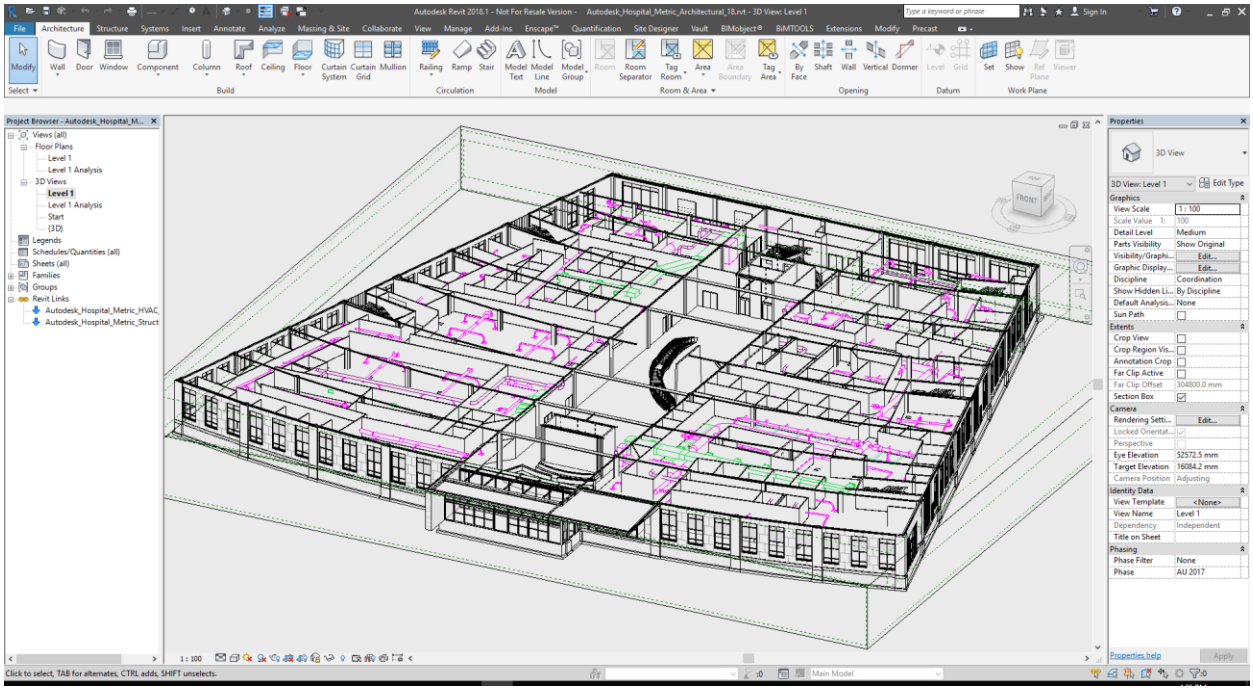

Today i will do what
others won't so tomorrow
i can do what others can't.
Jerry Rice
quotefancy

Preparing the model in Revit

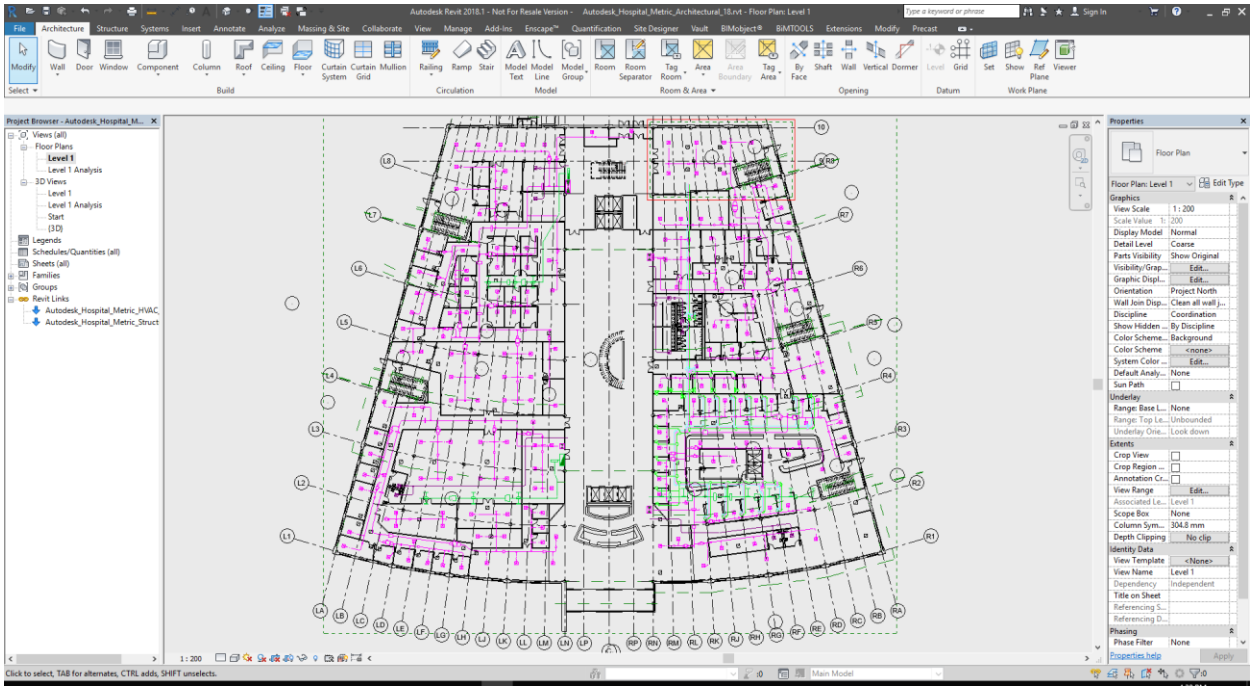
Find the example files in: 10 Revit Models
Find the screenshots in: 15 Screenshots



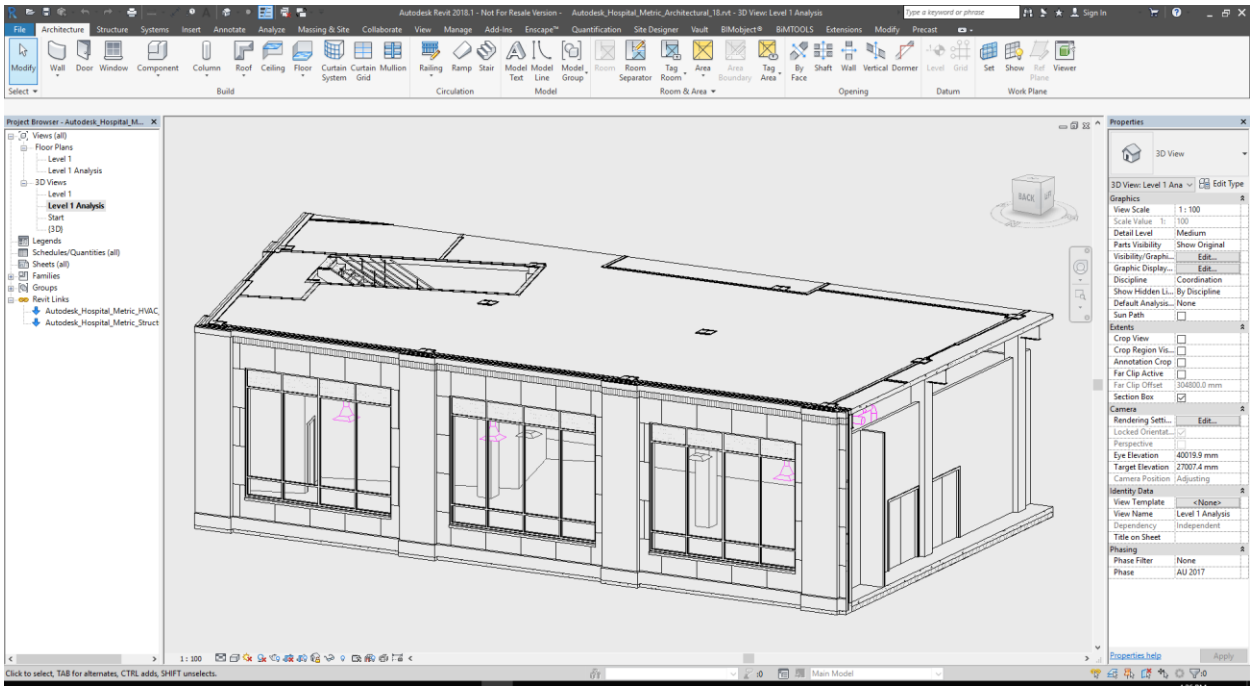
01 Start view opening the Revit project



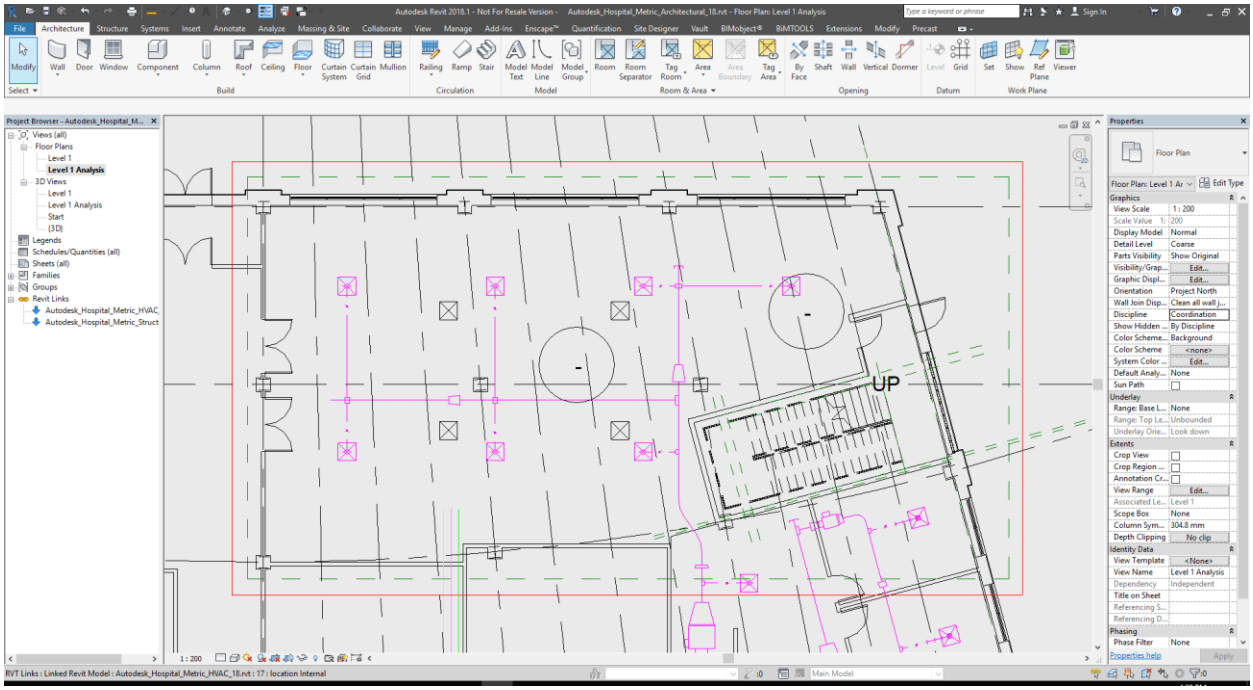
02 Level 1 in a 3D view



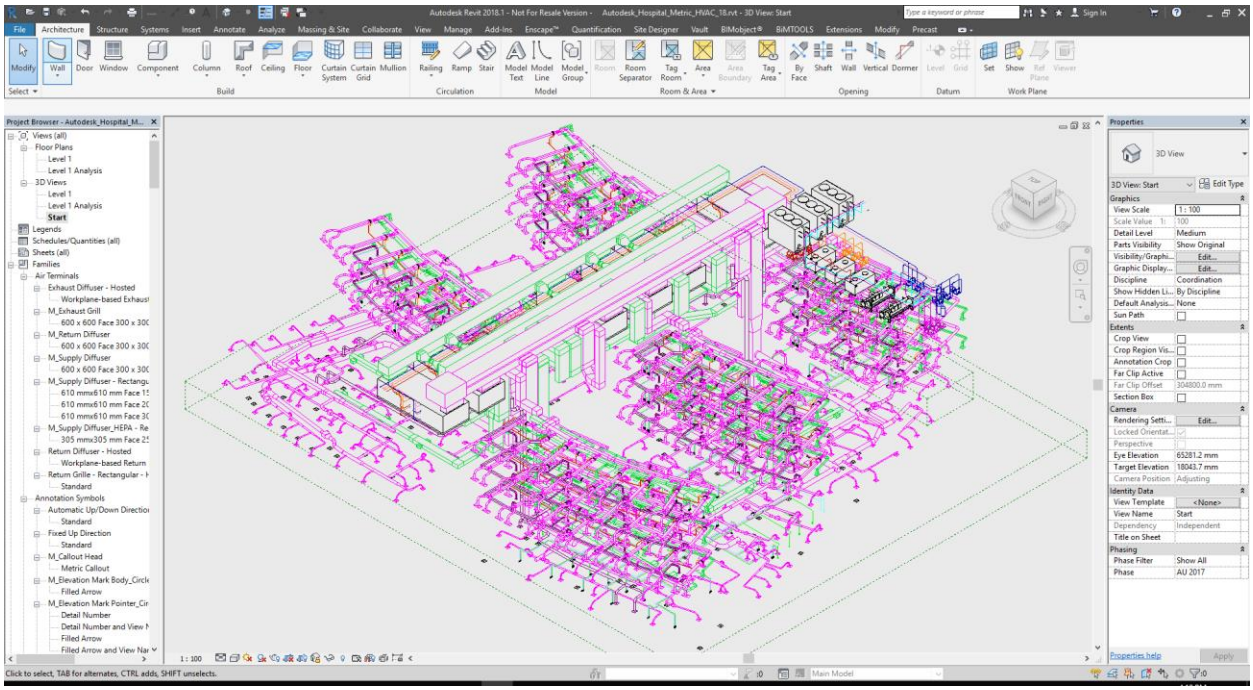
03 Level 1 in a 2D view



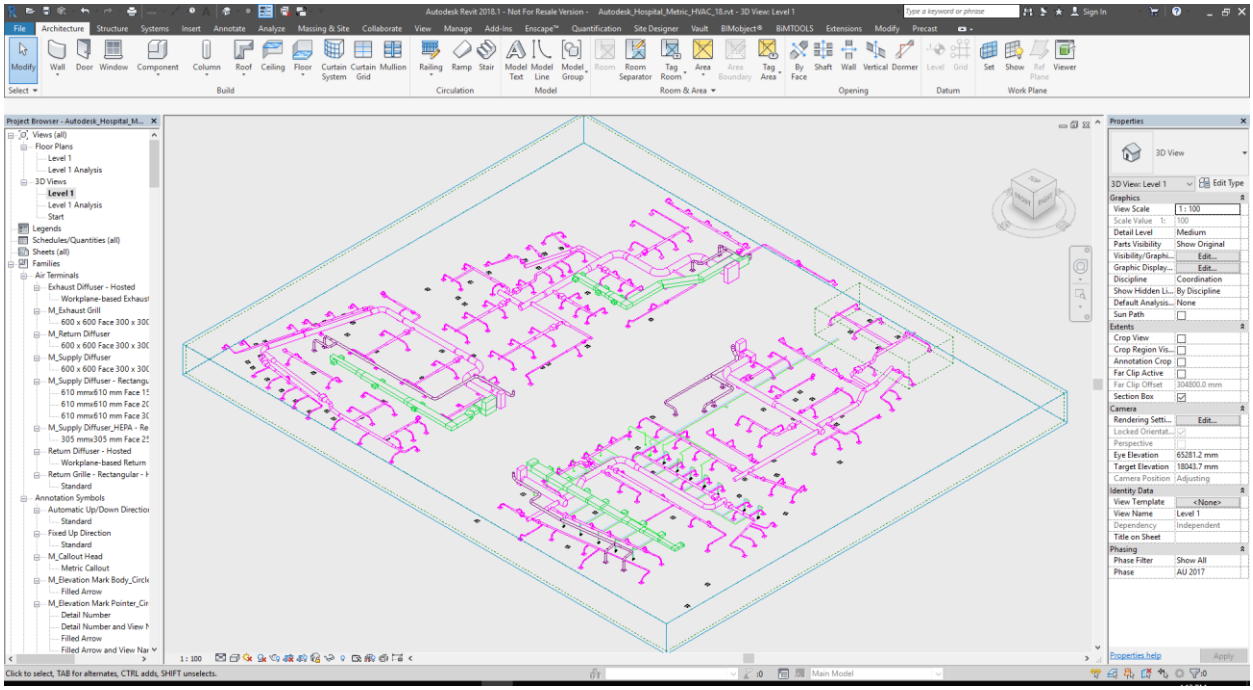
04 Level 1 3D view of the room to analyze



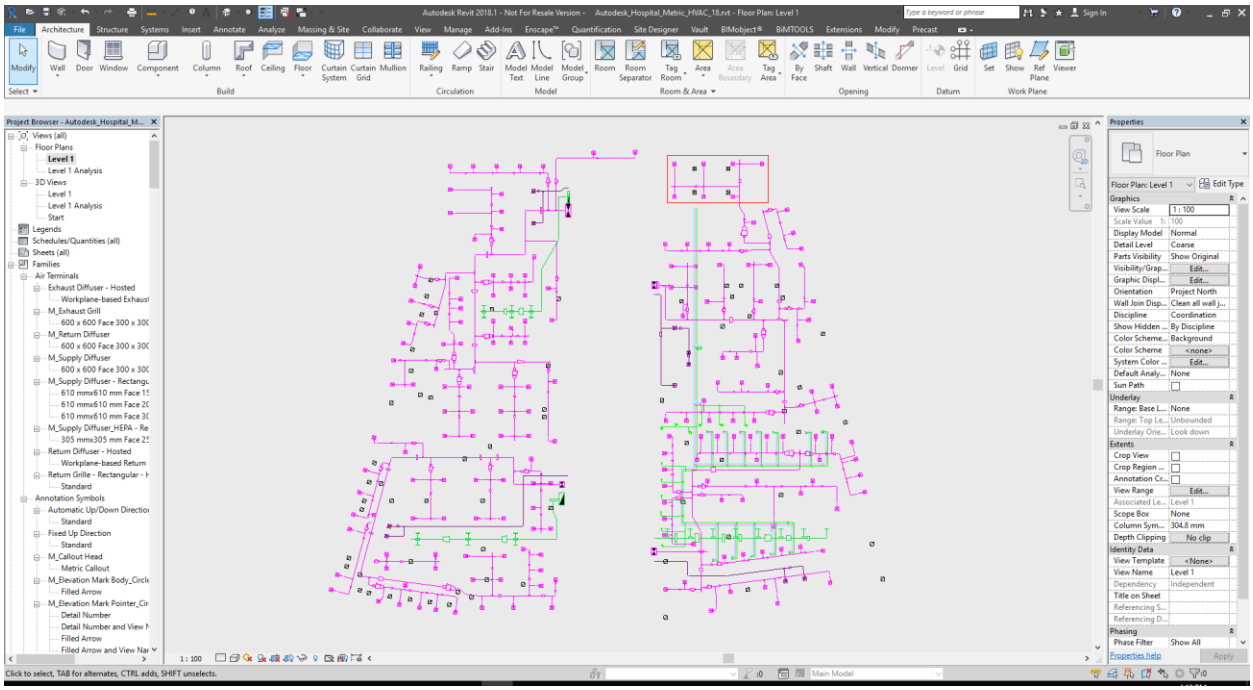
05 Level 1 2D view of the room to analyze



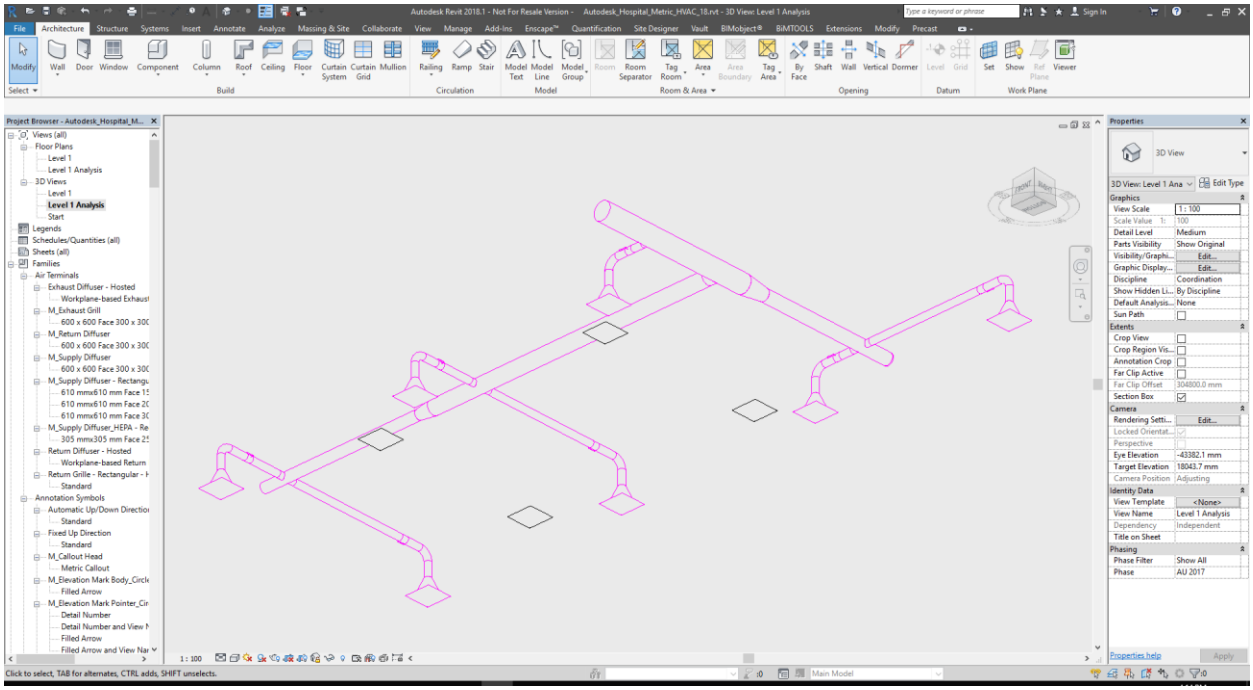
06 Start view of the HVAC model



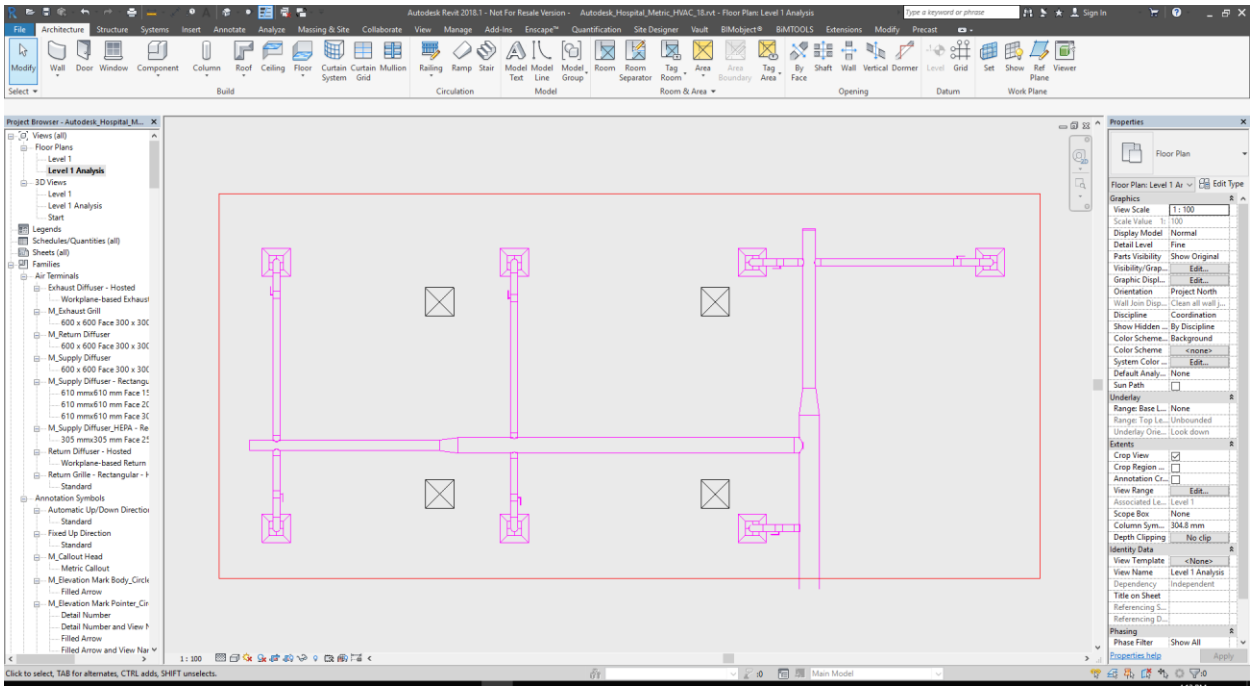
07 Level 1 3D view of the HVAC model



08 Level 1 2D view of the HVAC model



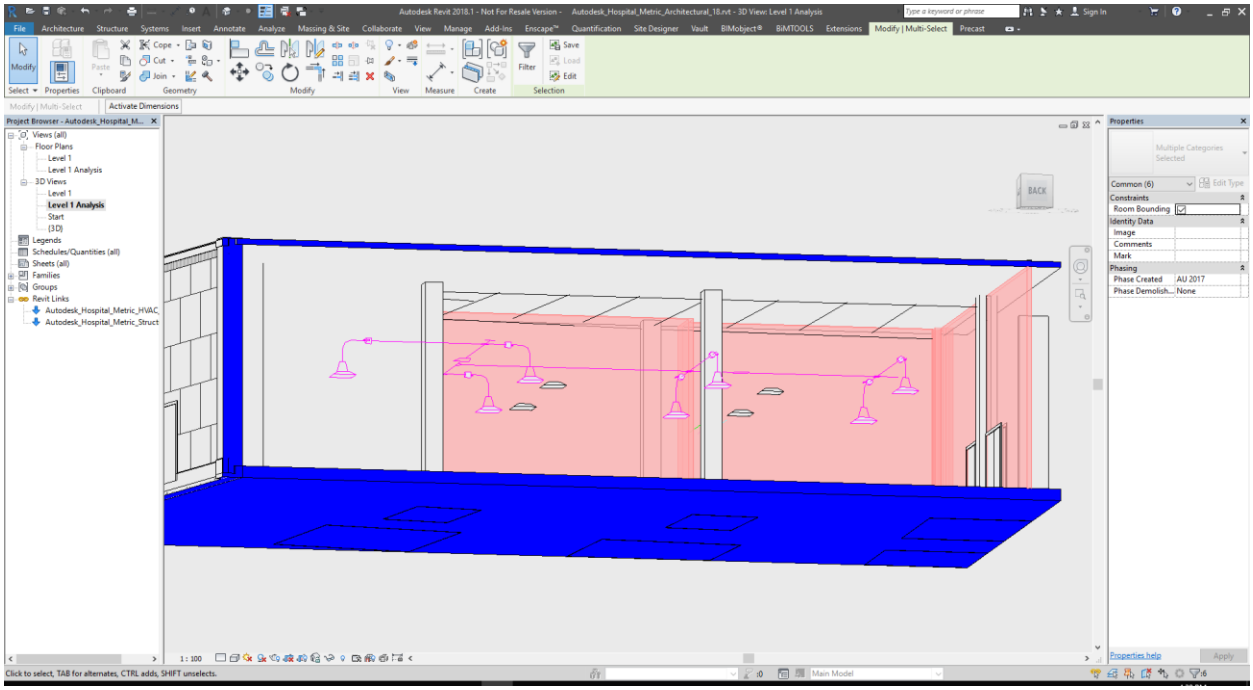
09 Level 1 3D view of the HVAC model and room to analyze



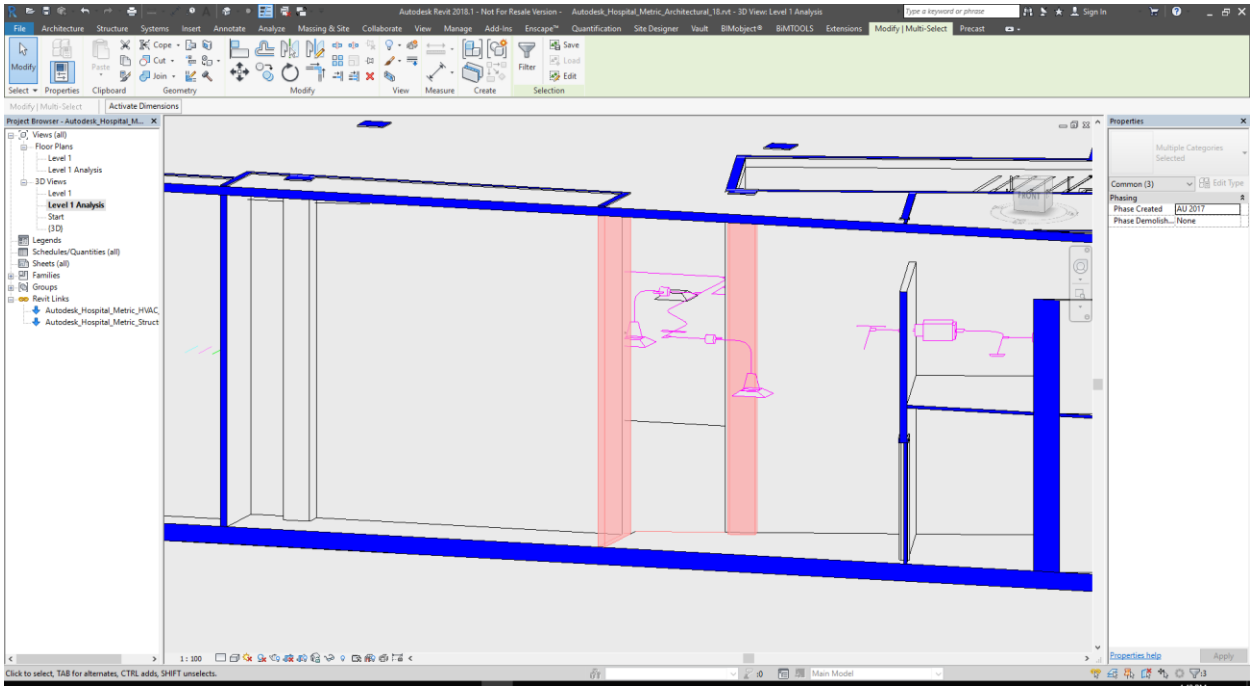
10 Level 1 floor plan of the HVAC model and room to analyze

Export to the CFD Study Environment

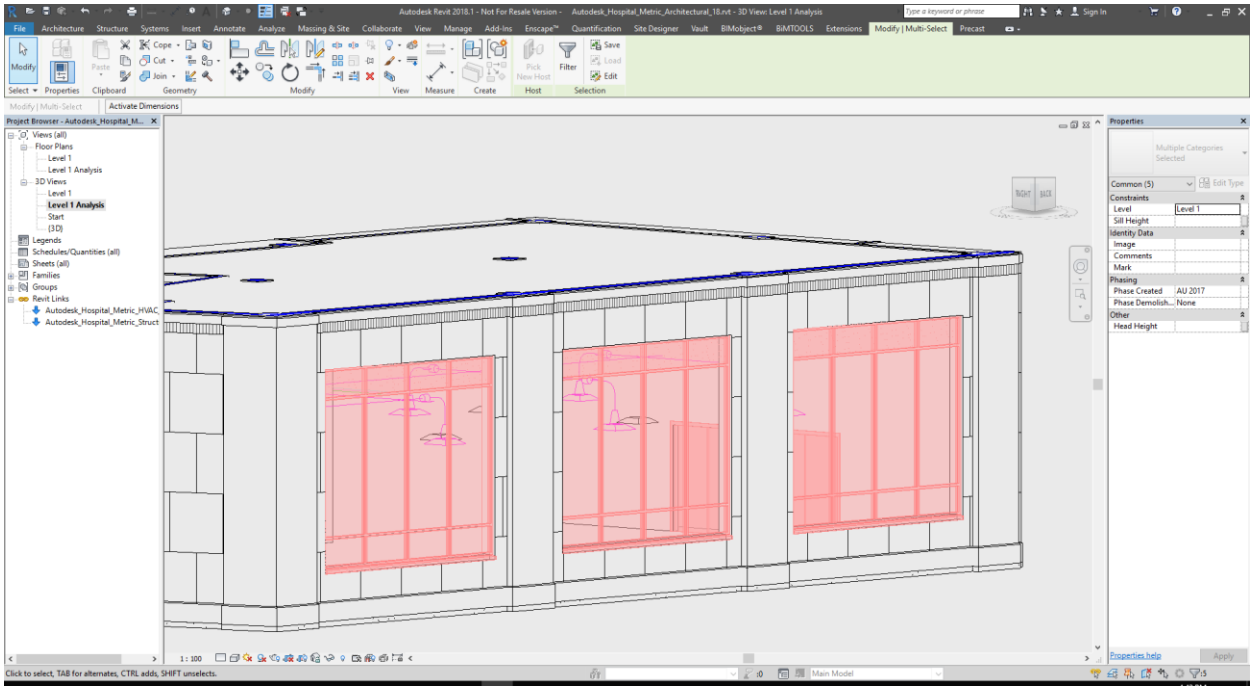
Find the example files in: 20 Exports to CFD
Find the screenshots in: 25 Screenshots



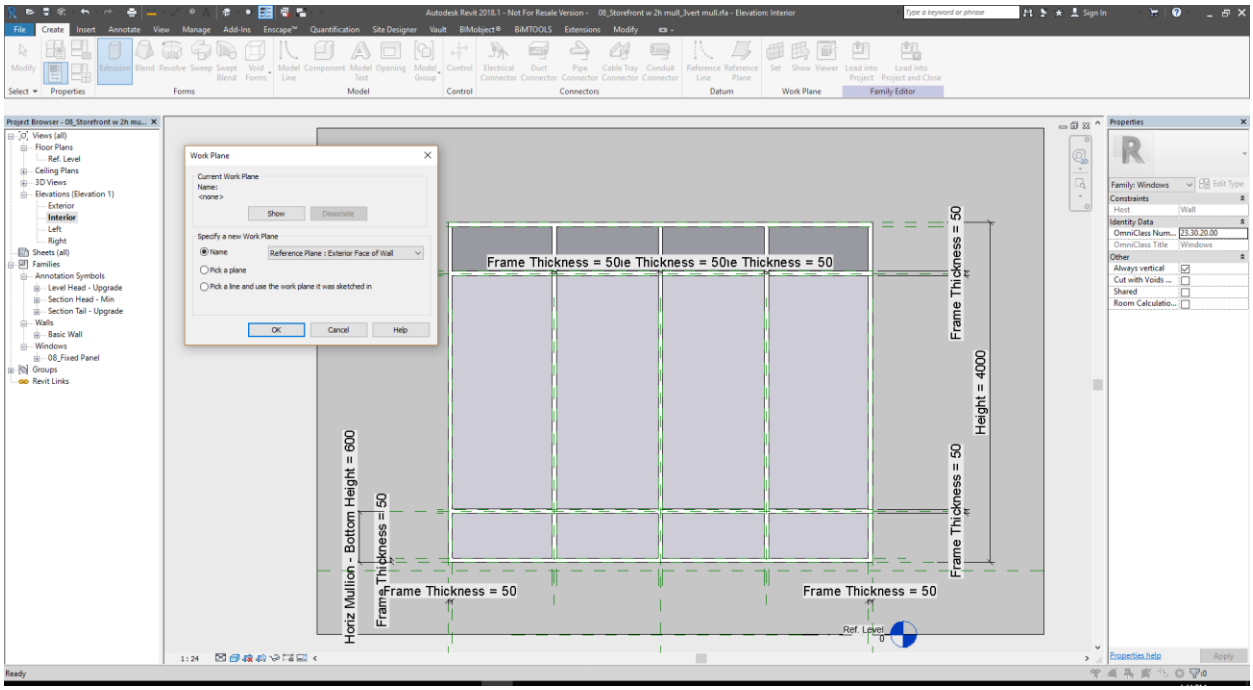
11 Simple geometry with attached walls



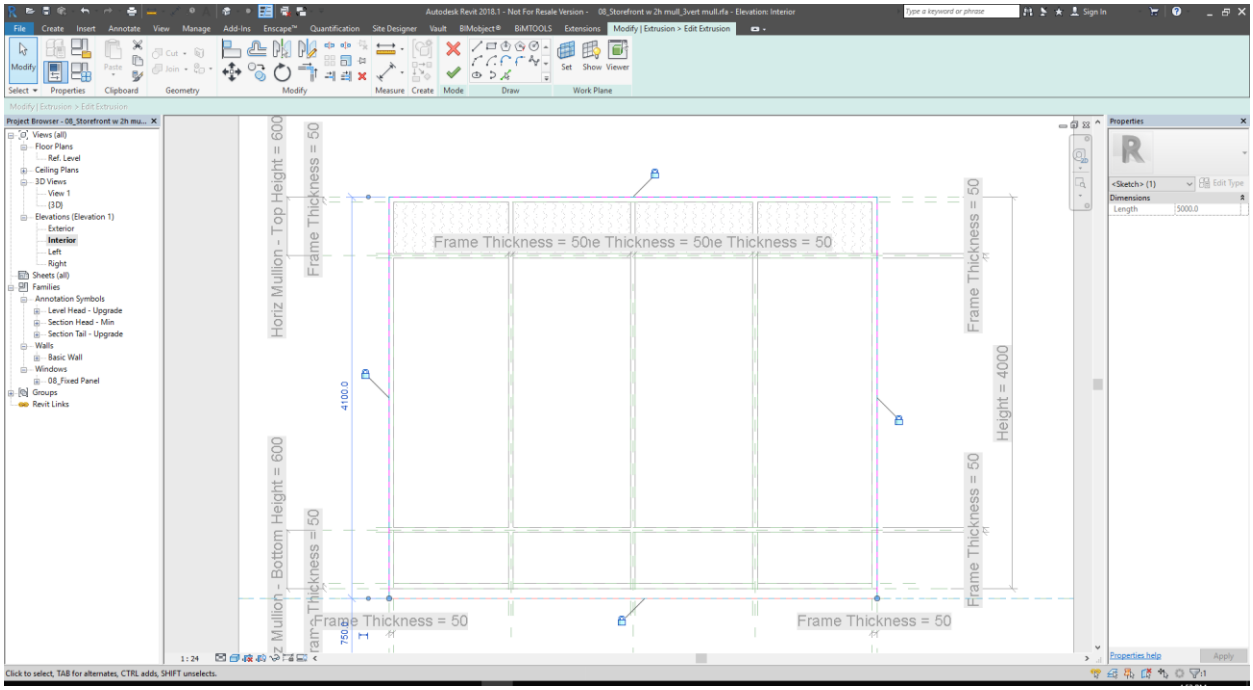
12 Any access can be closed within the CFD Design Study Environment



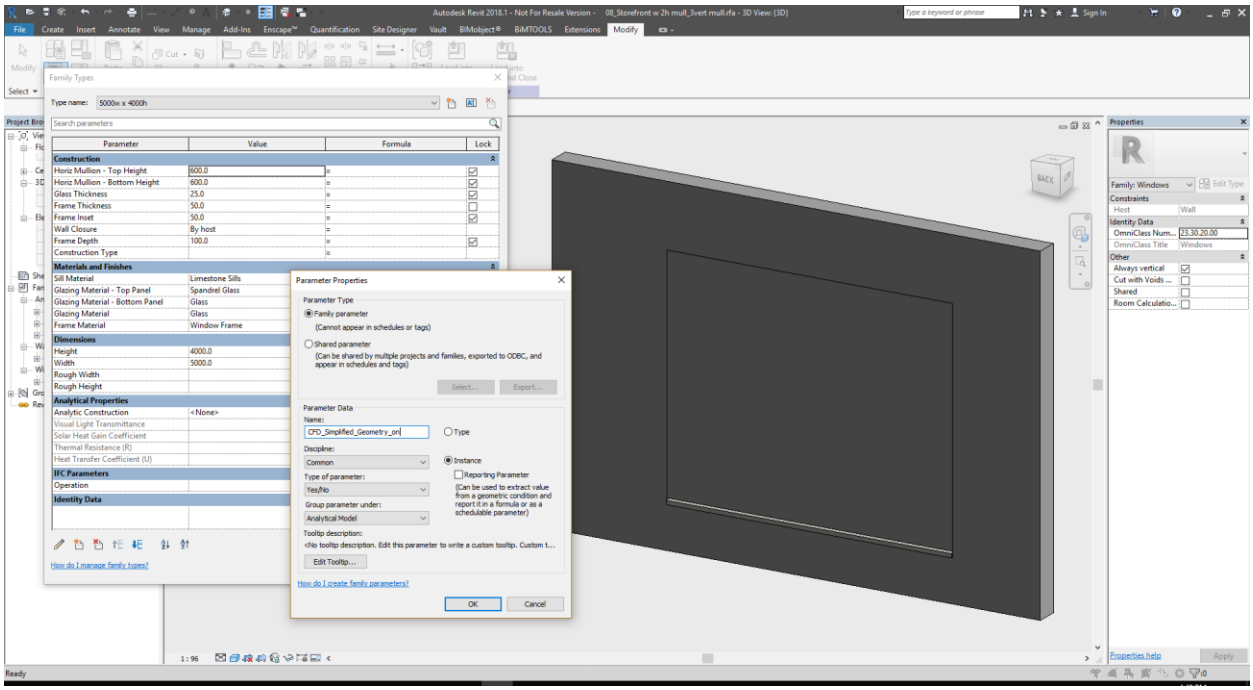
13 Try to simplify windows and doors



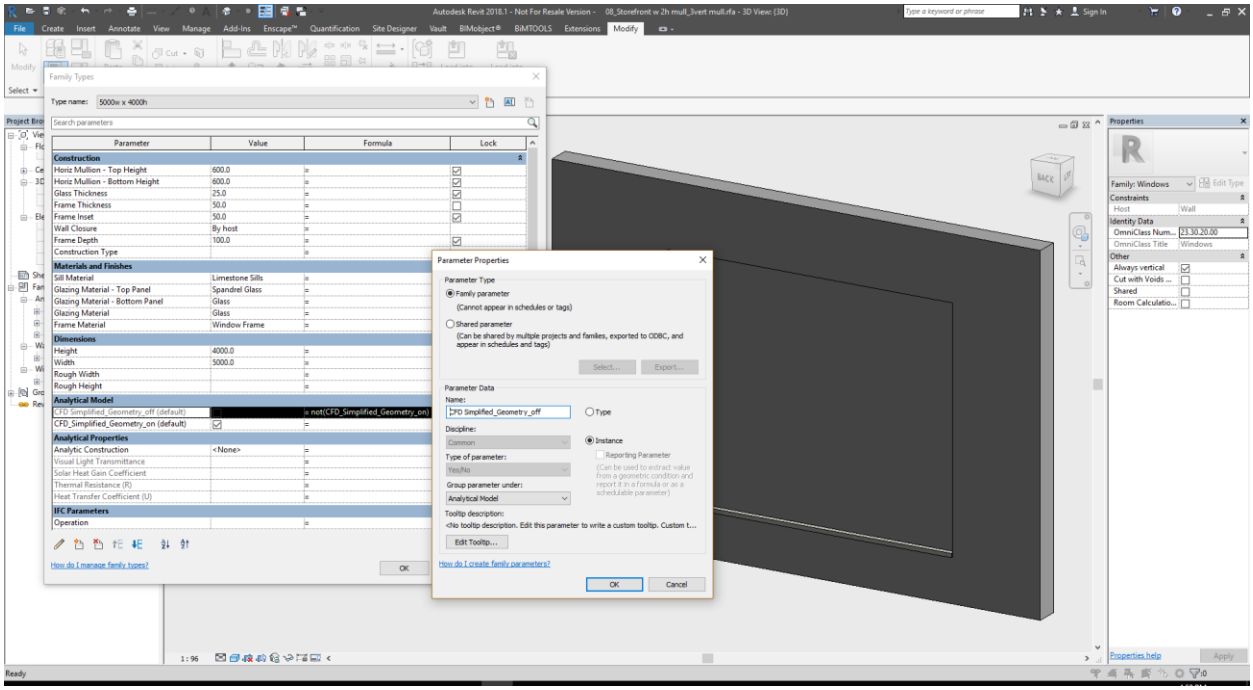
14 We can edit the family and add simple geometry



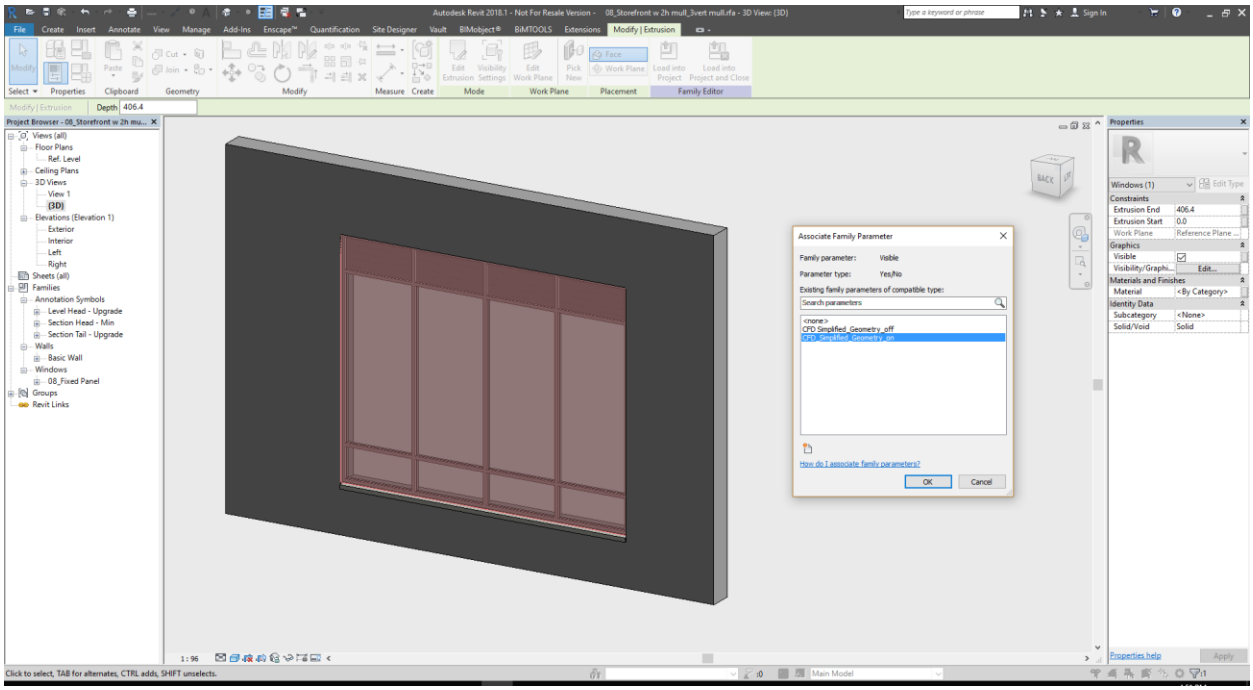
15 For example, create extrusions to cover windows



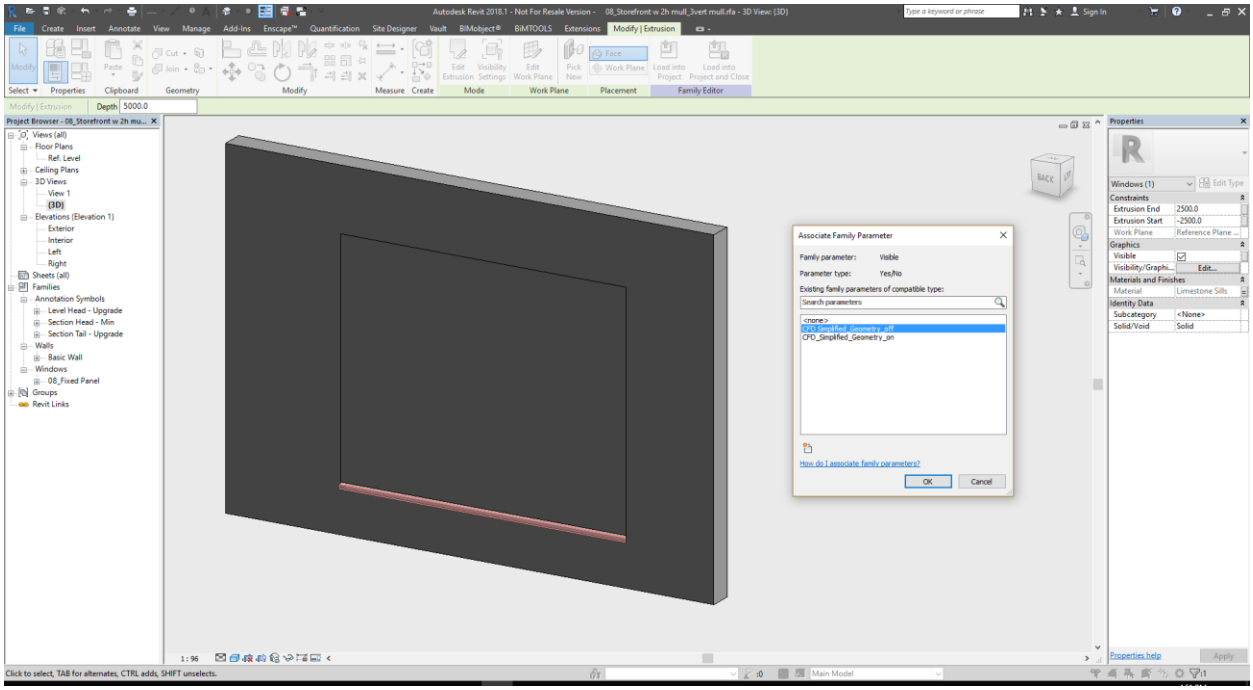
16 Create simplified geometry for the CFD analysis using visibility parameter



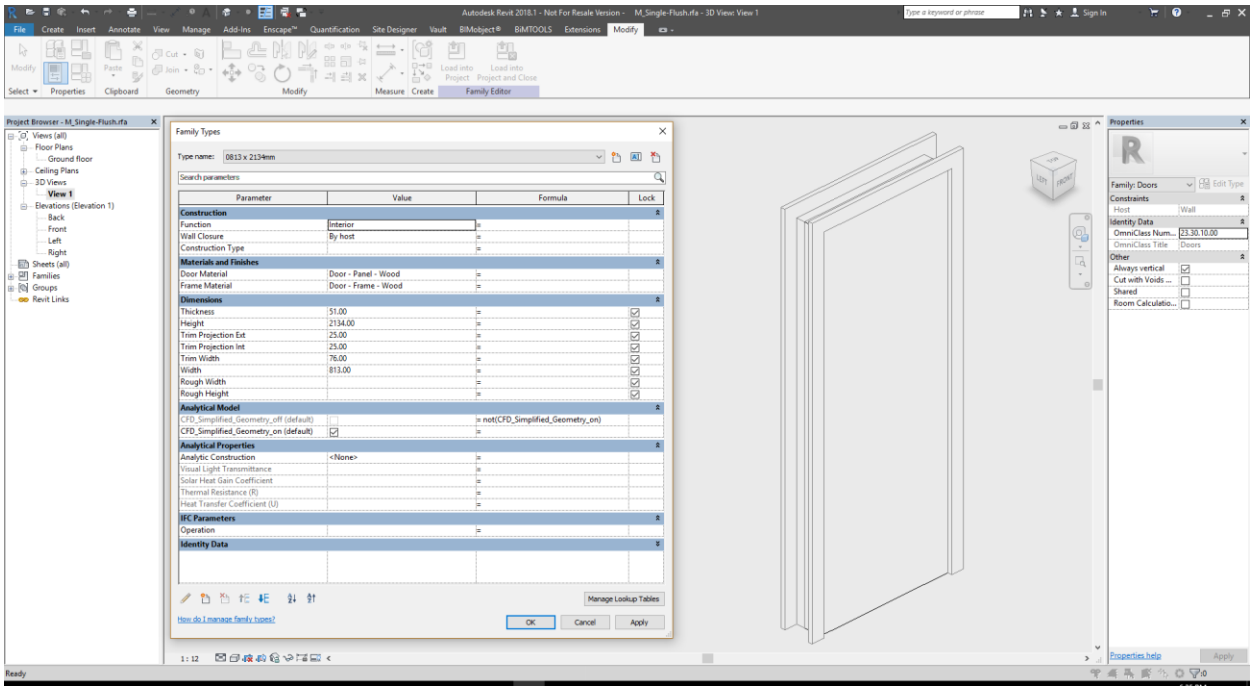
17 Create the parameter to turn on and off the geometry required



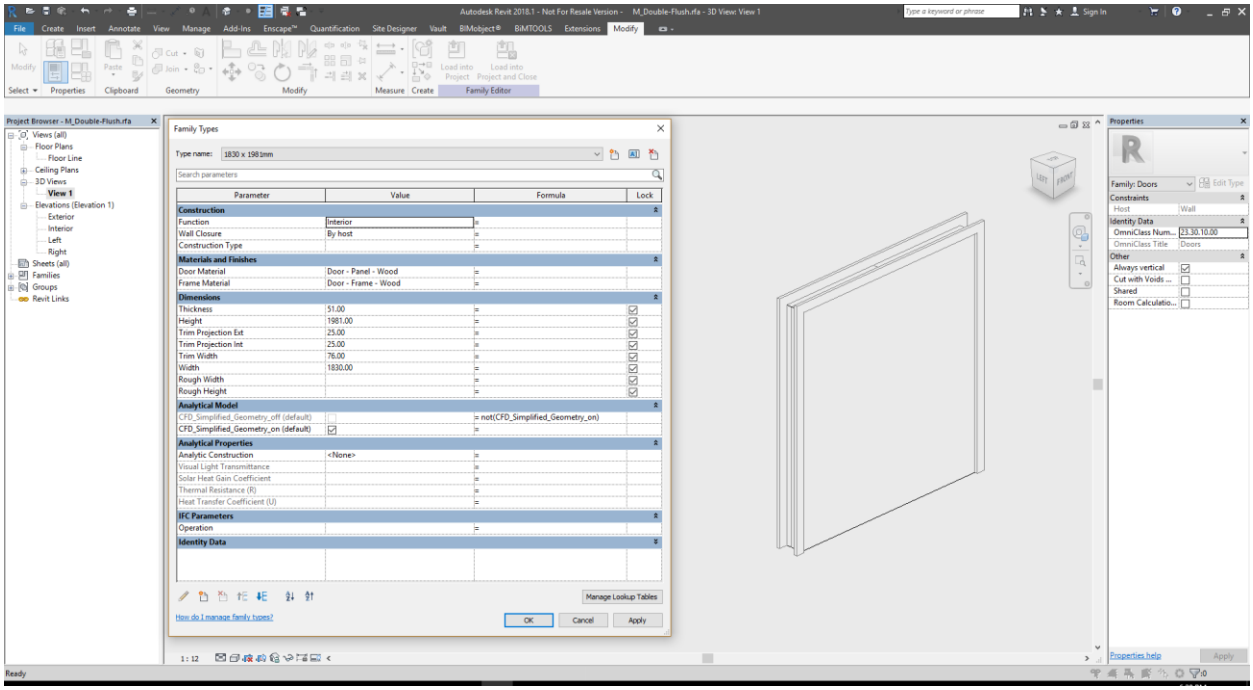
18 Connect the parameter ON



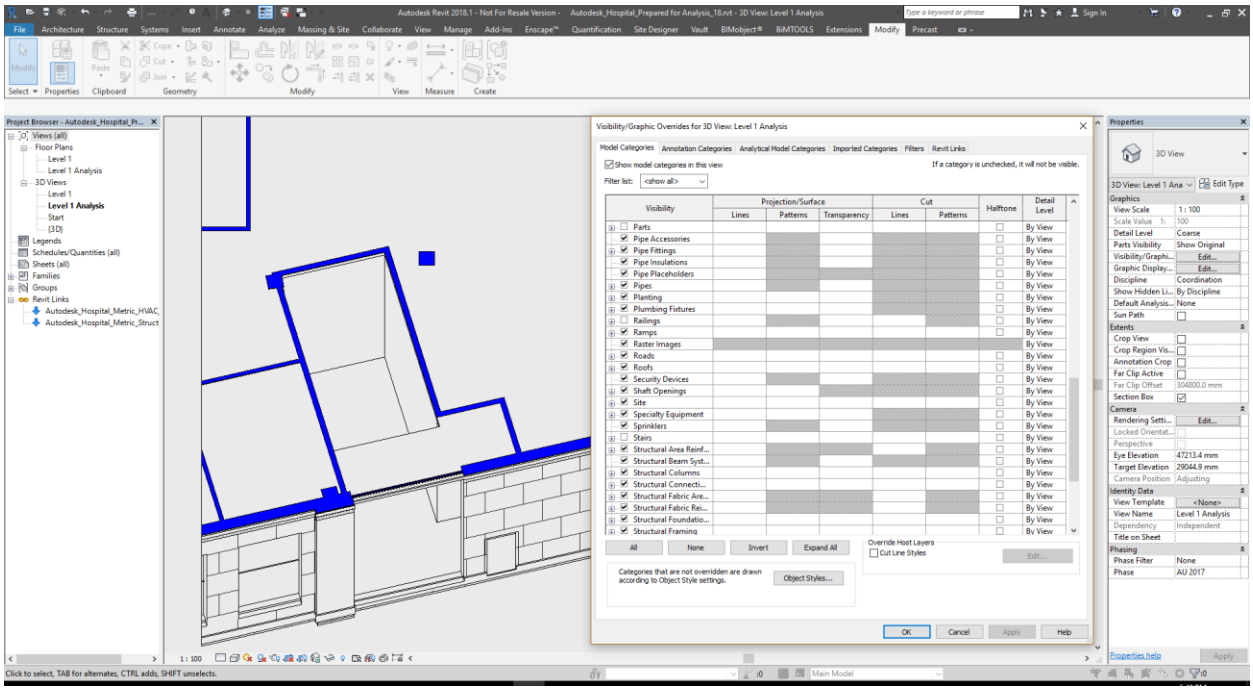
19 Connect the parameter OFF



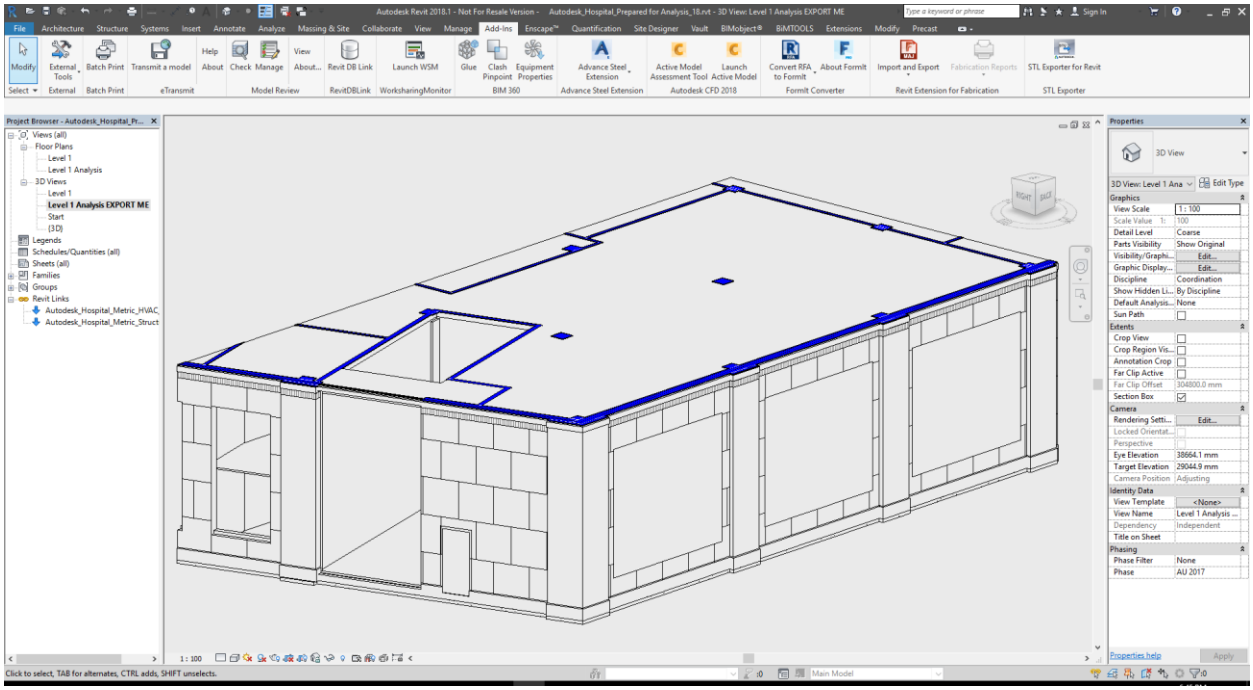
20 Another door example



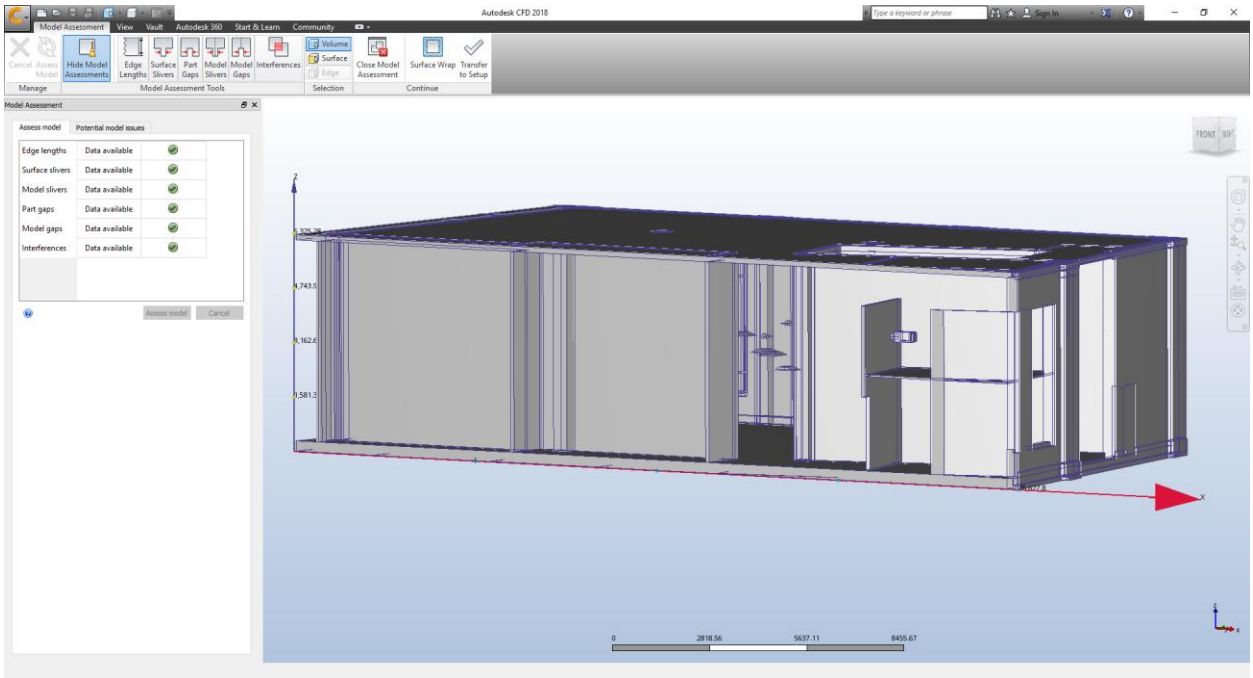
20a More examples



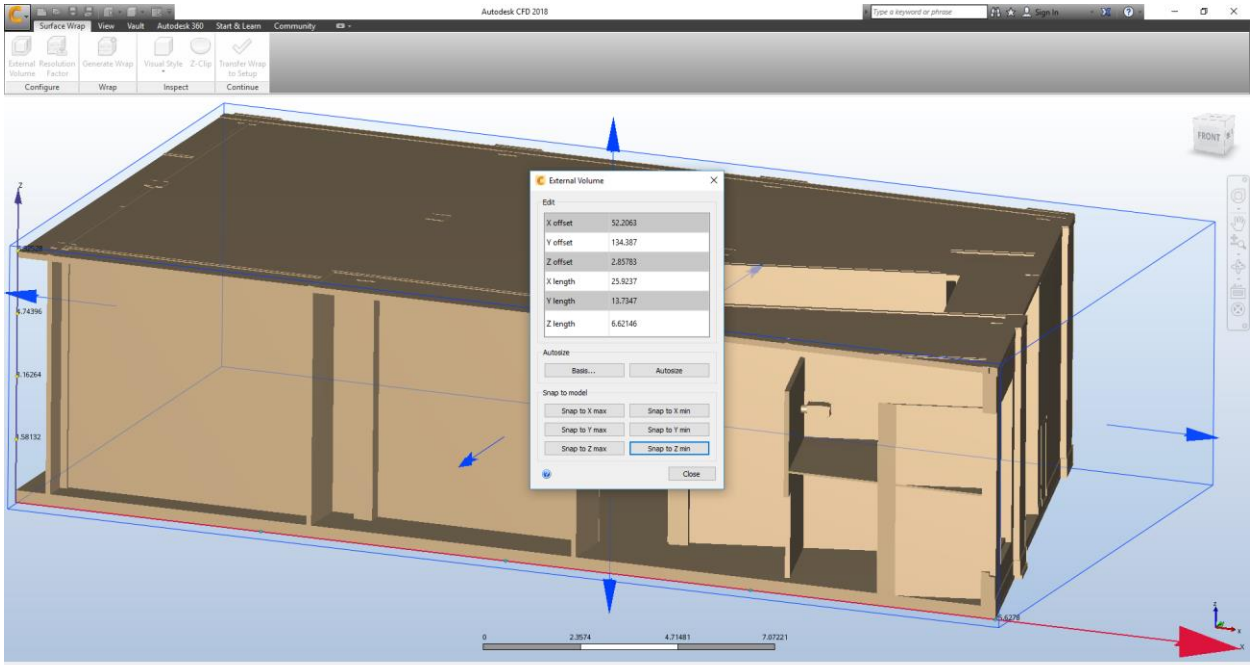
21 Prepare the view, hiding elements by category and consider view filter for the future



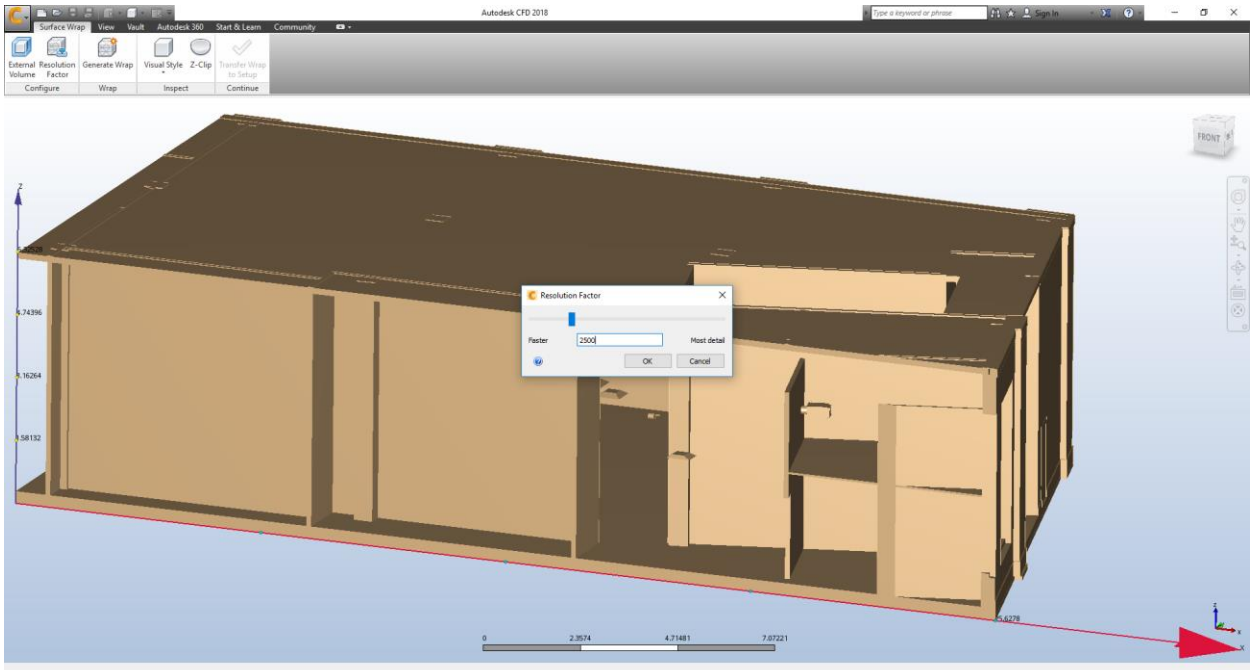
22 Launch the assessment tool



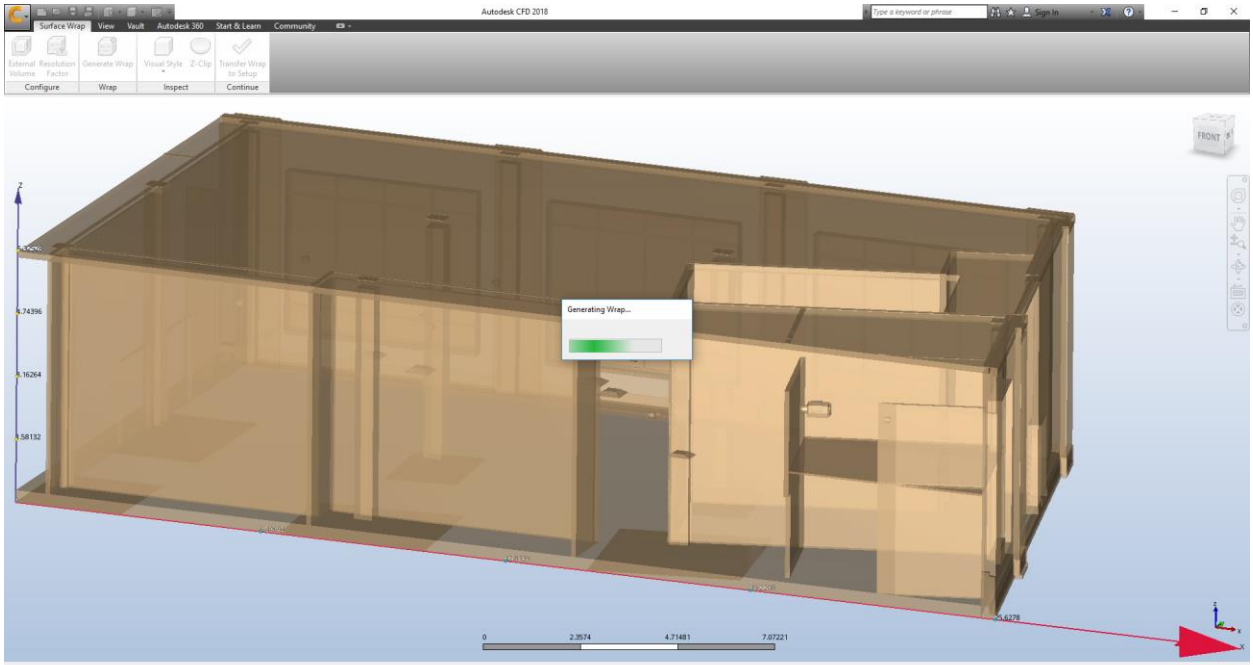
23 Review the model using the assessment tool



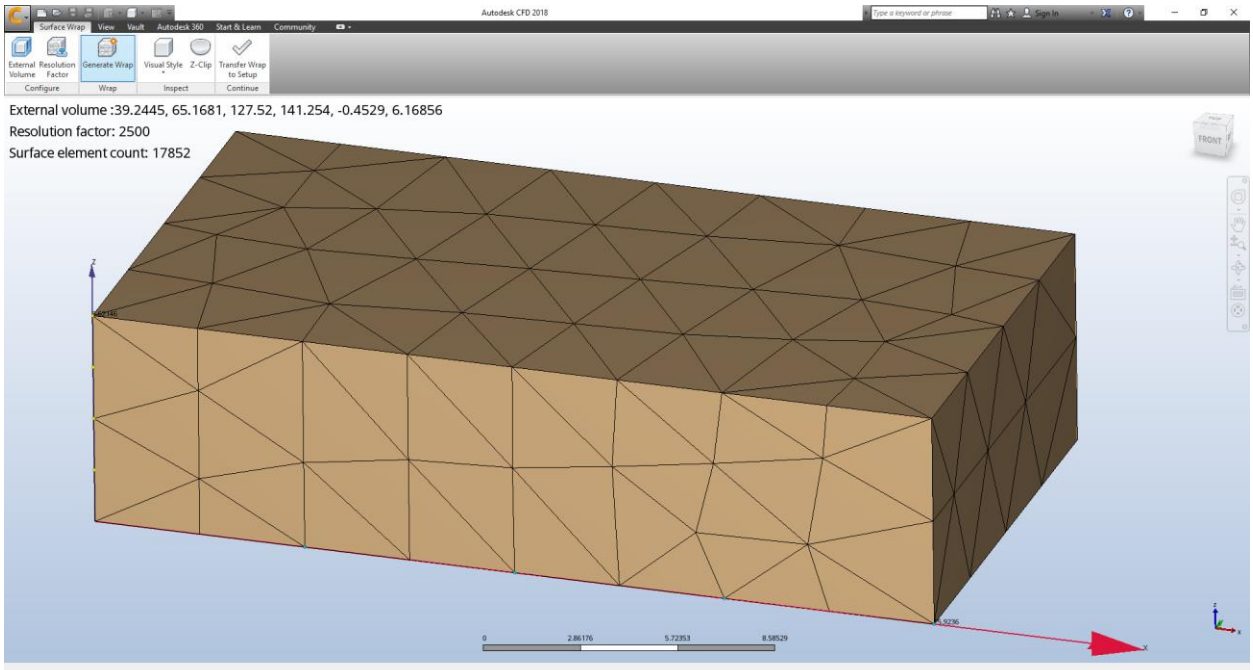
24 We can set already external volumes



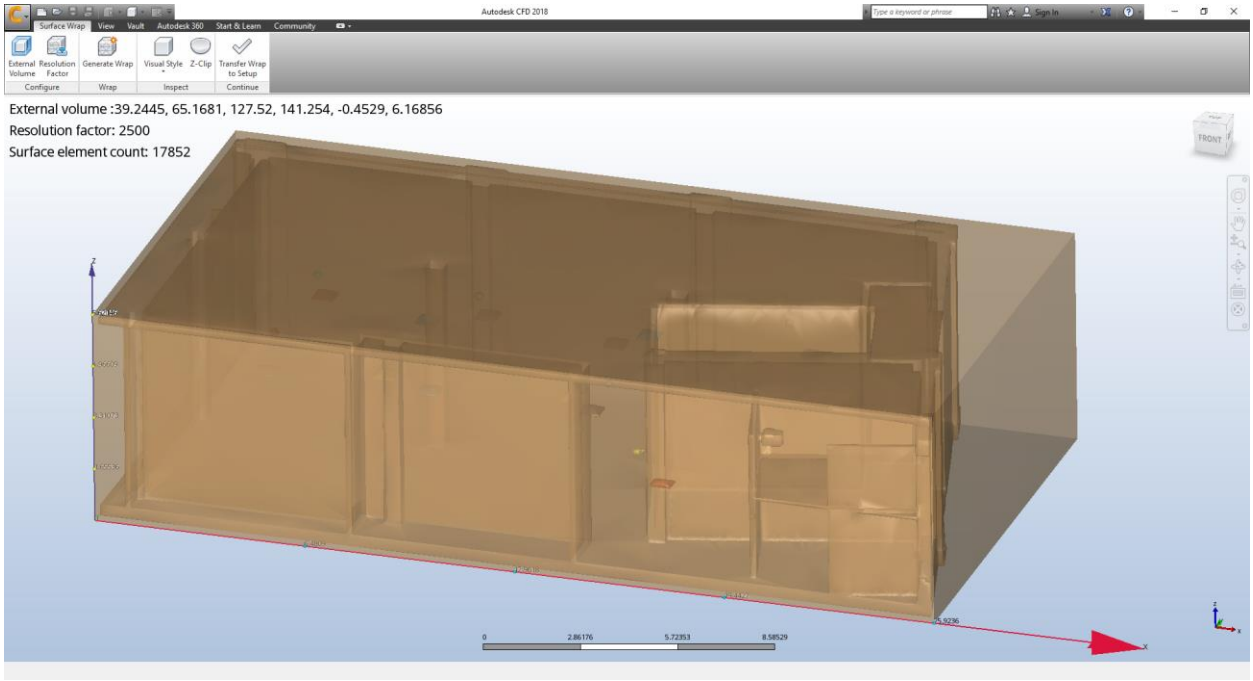
25 We can set the resolution for the meshing of our geometry



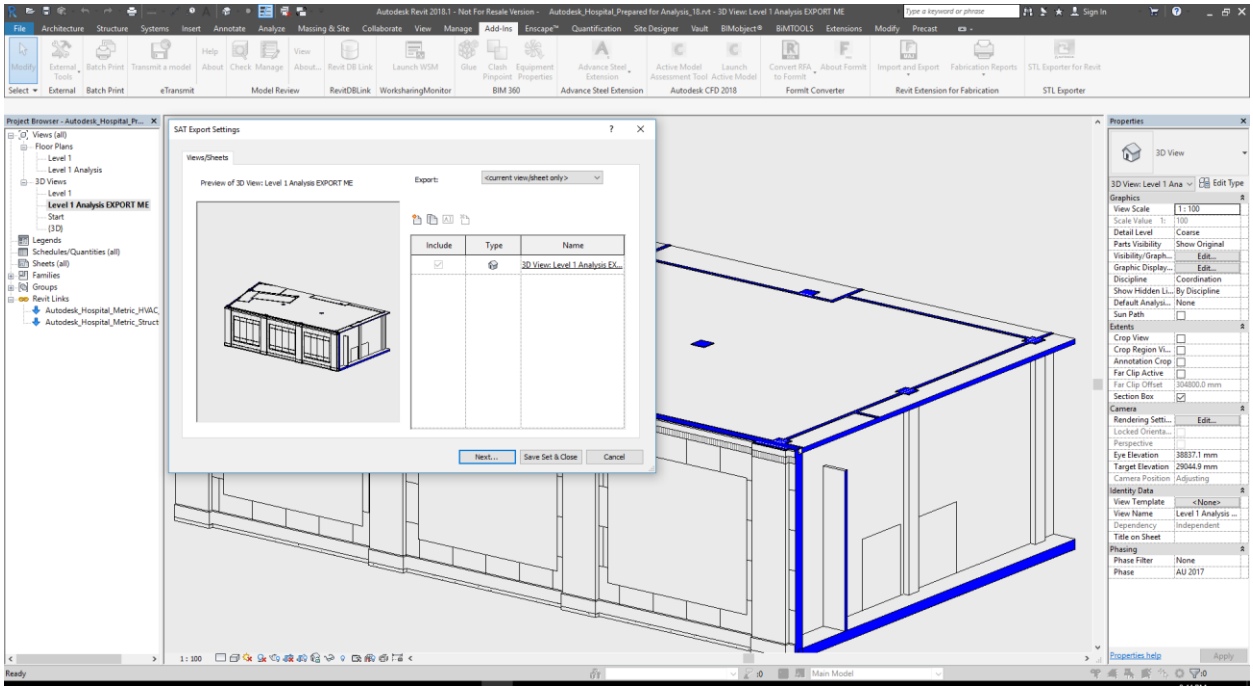
26 We can generate a wrap around our geometry. This simplifies the geometry heavily.



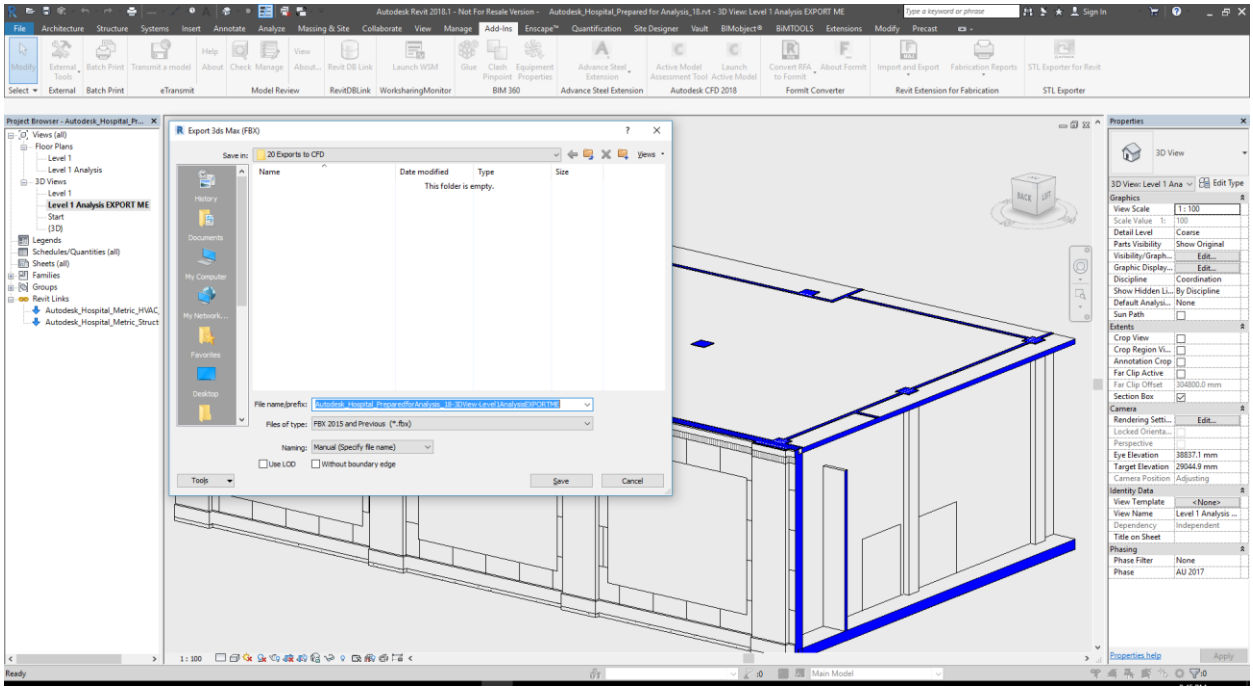
27 This shows a possible view with meshed geometry



28 This shows the meshed geometry semi-transparent



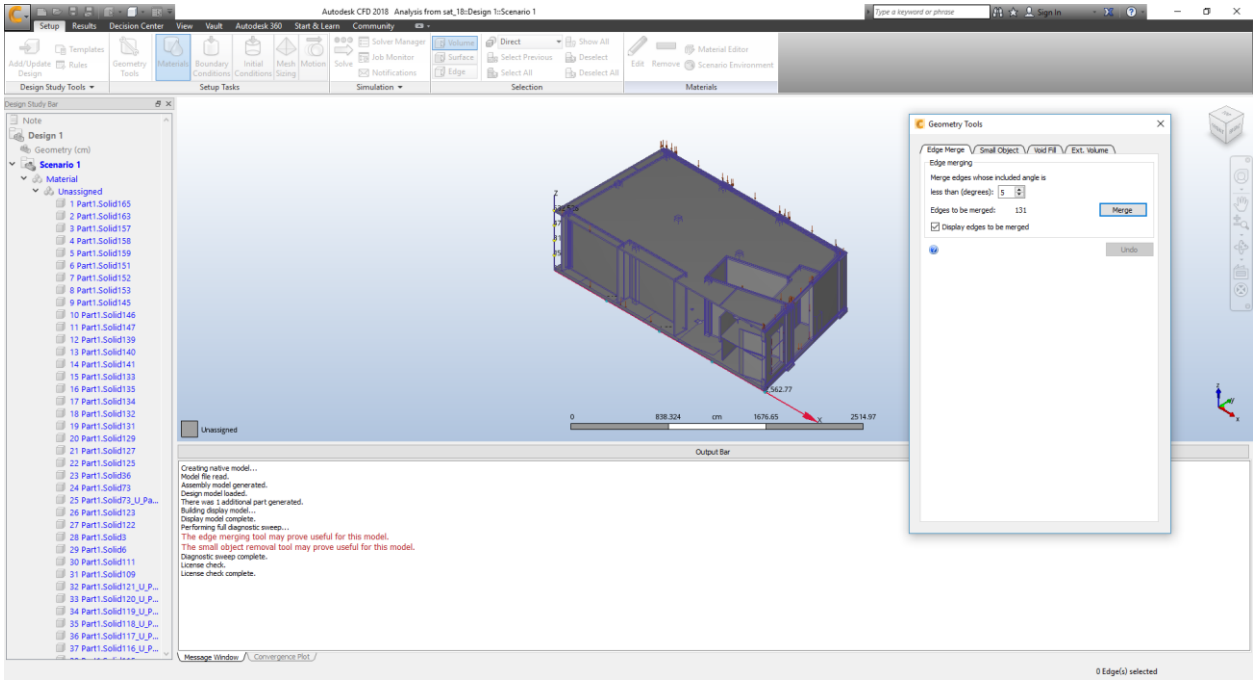
29 Another option is a SAT export



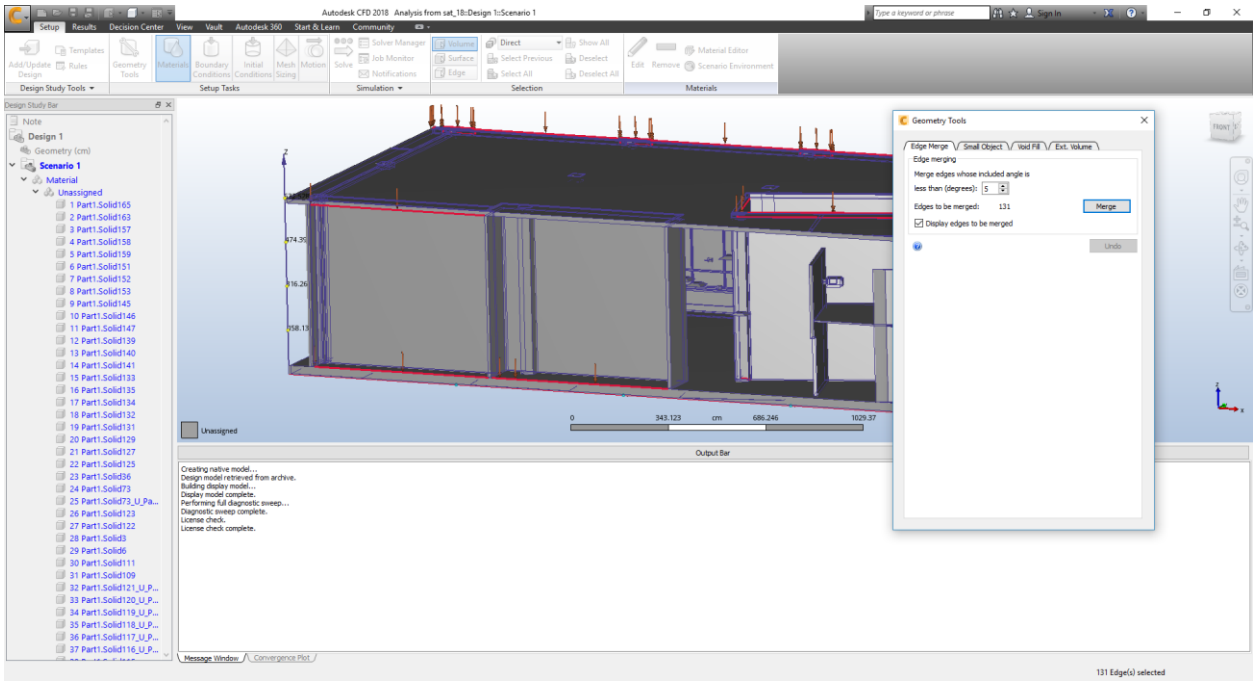
30 Another option is also a FBX export from Revit

Using the CFD Study Environment

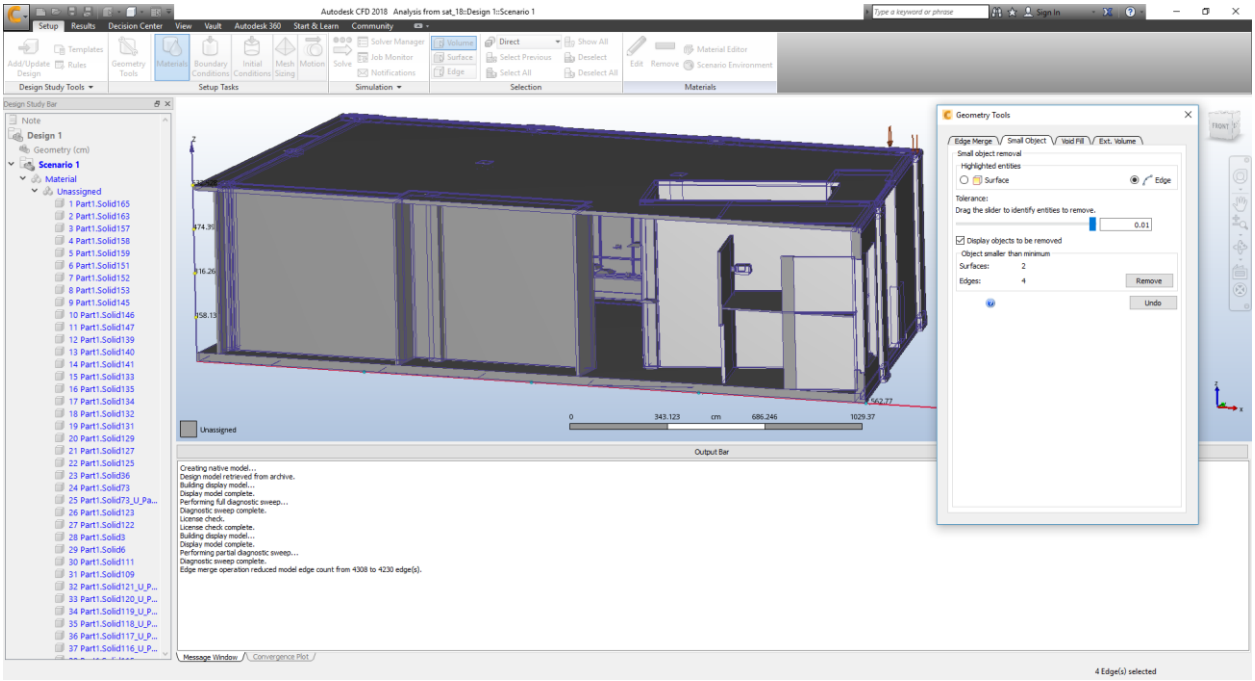
Find the example files in: 30 CFD Projects
Find the screenshots in: 35 Screenshots



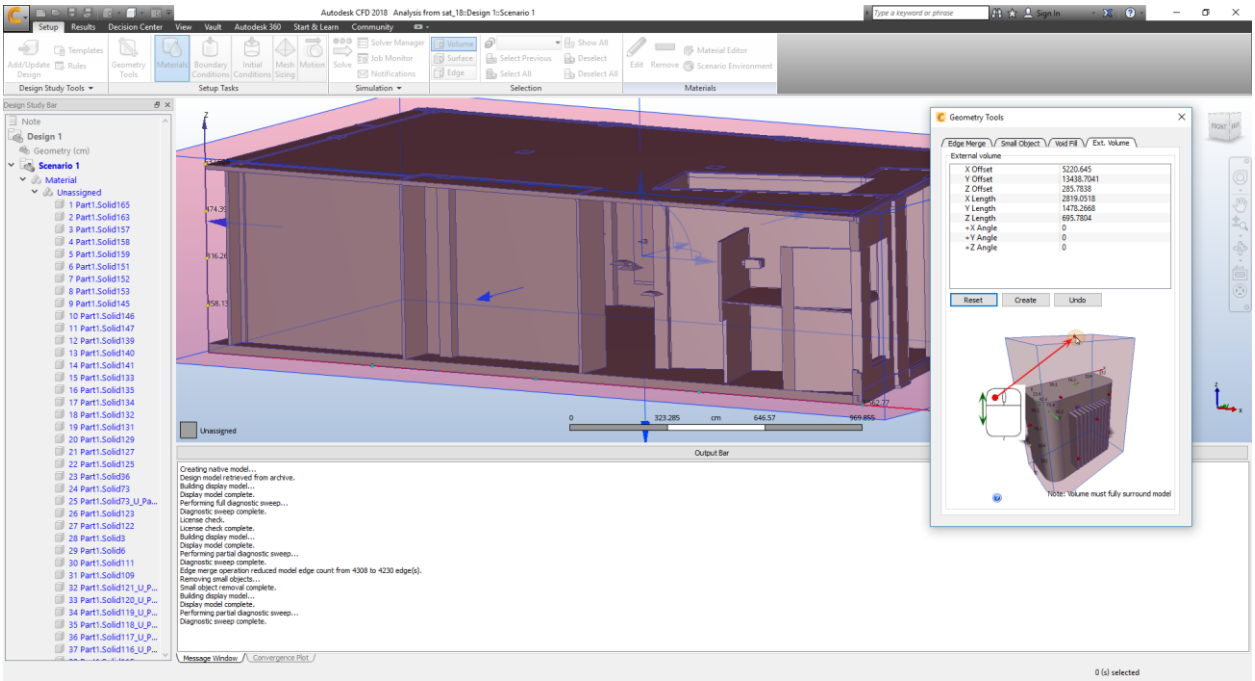
31 Working with the SAT file importing the geometry



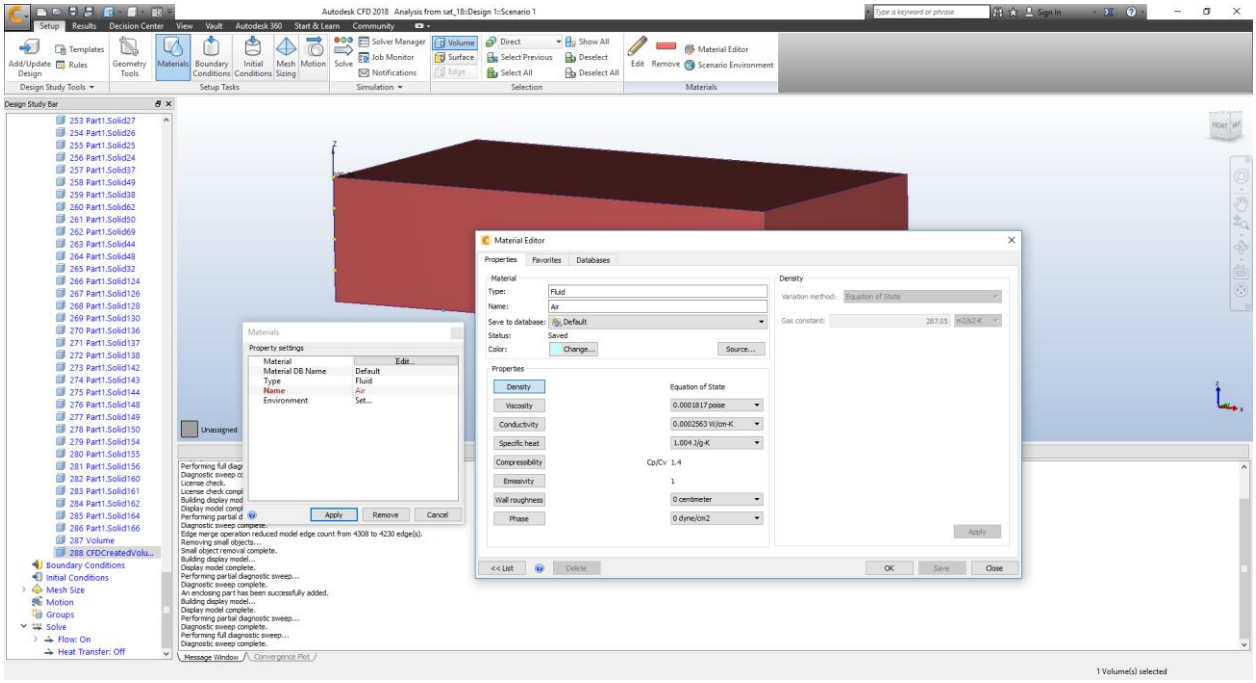
32 Merging complex edges



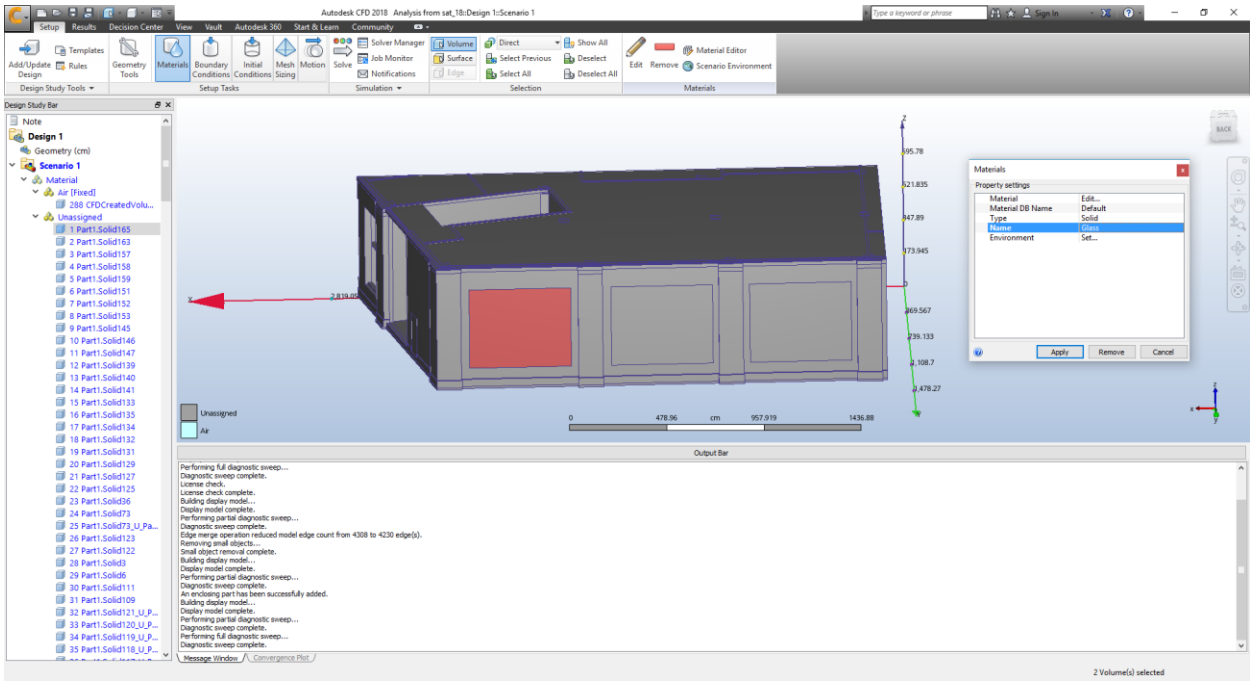
33 Removing of small objects



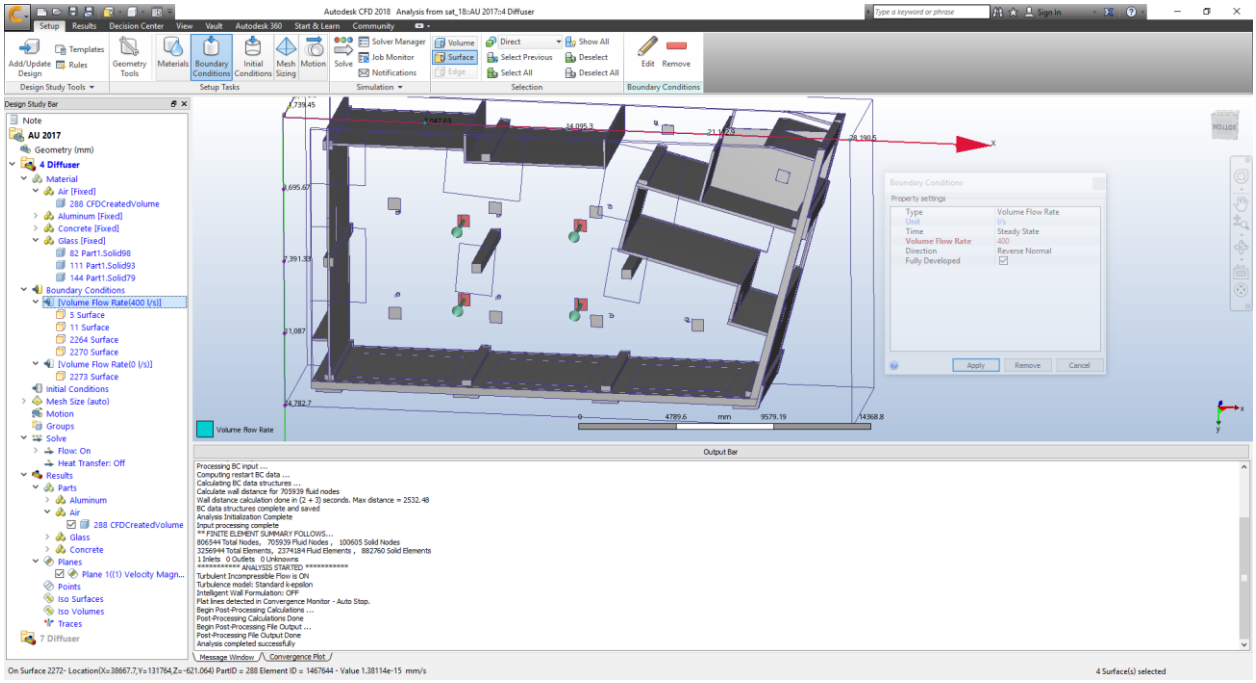
34 Creating an external volume



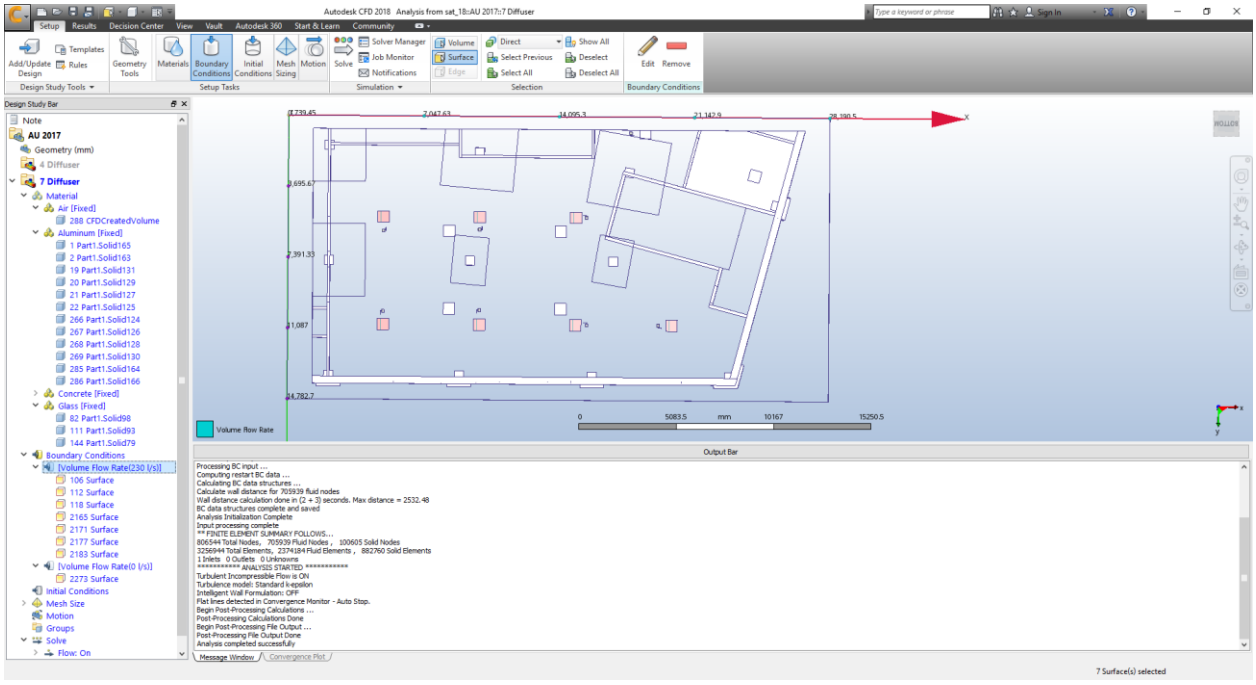
35 Apply the material AIR



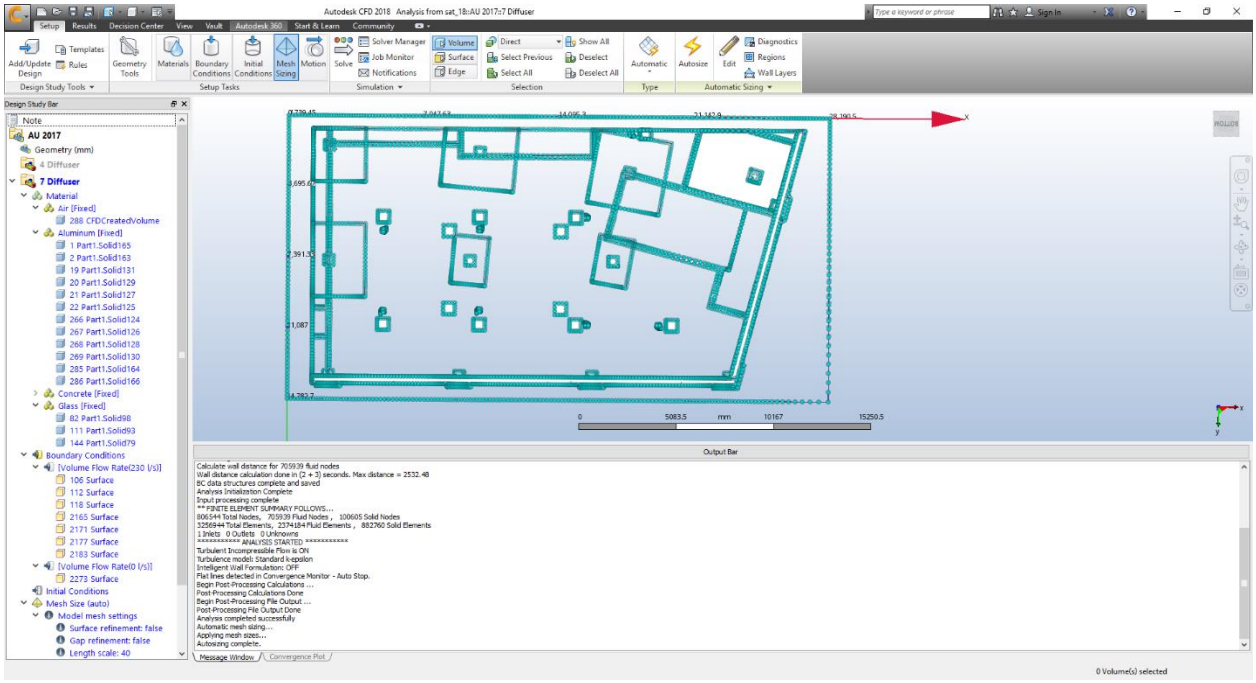
36 Apply other materials and hide not required geometry



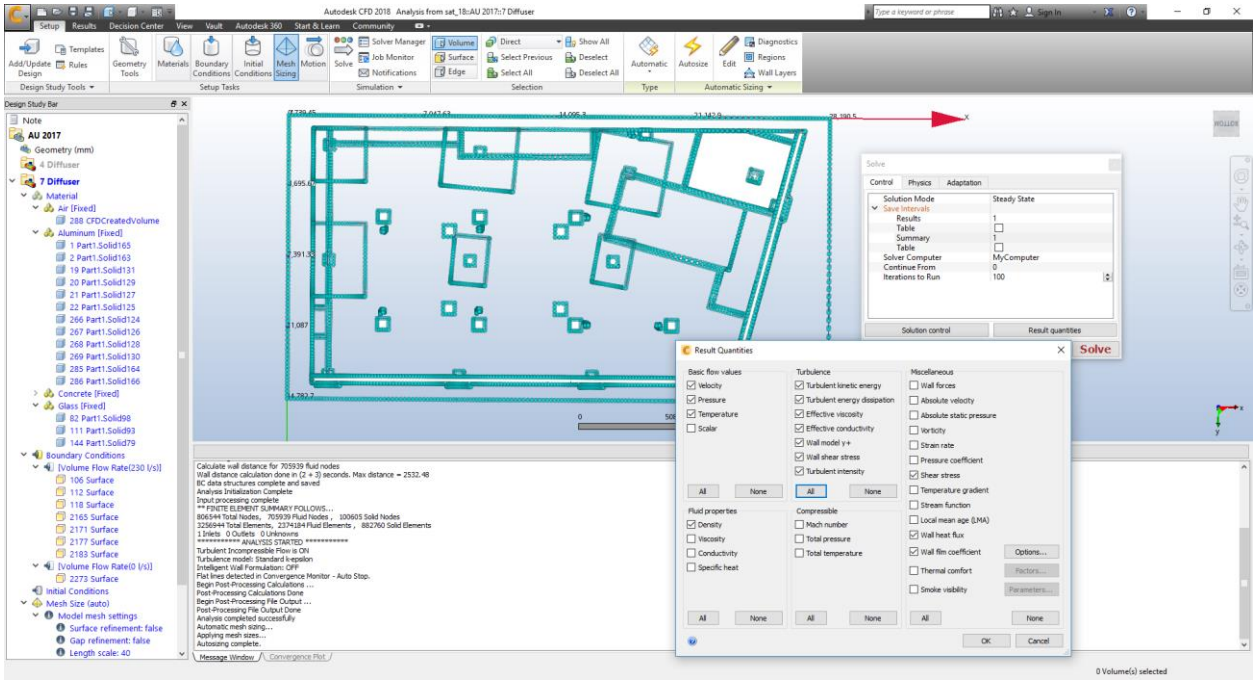
37 Set up the boundary conditions



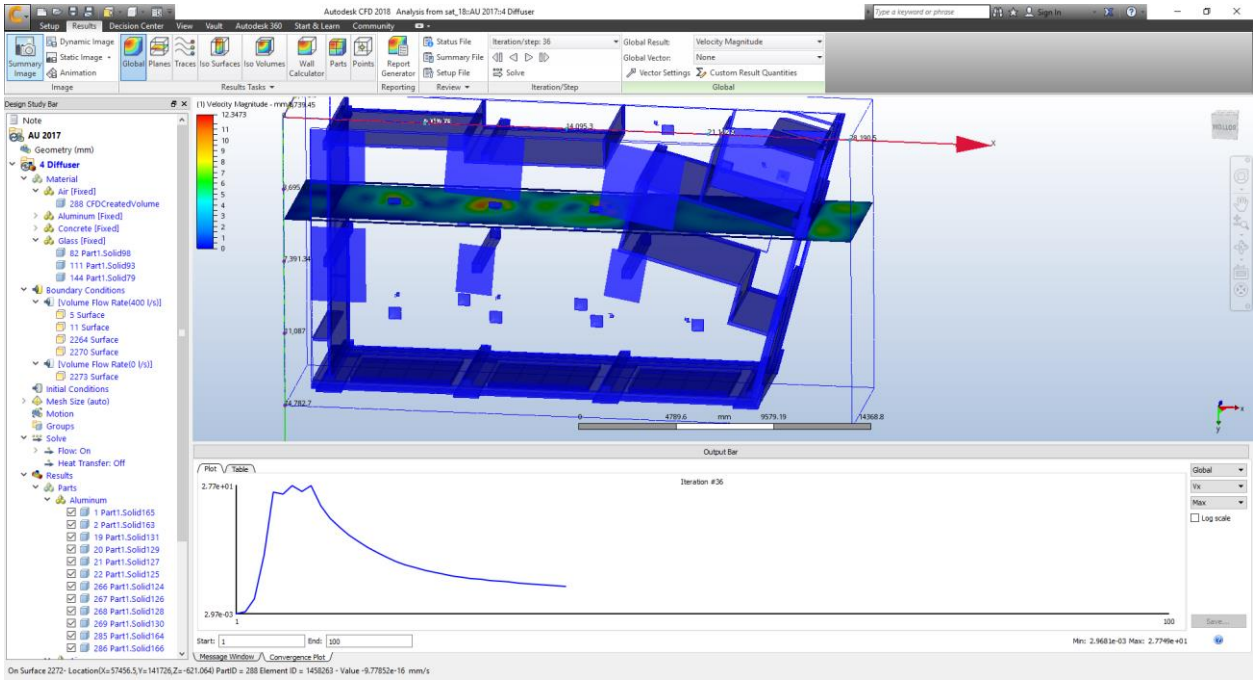
38 We can clone the case to compare studies



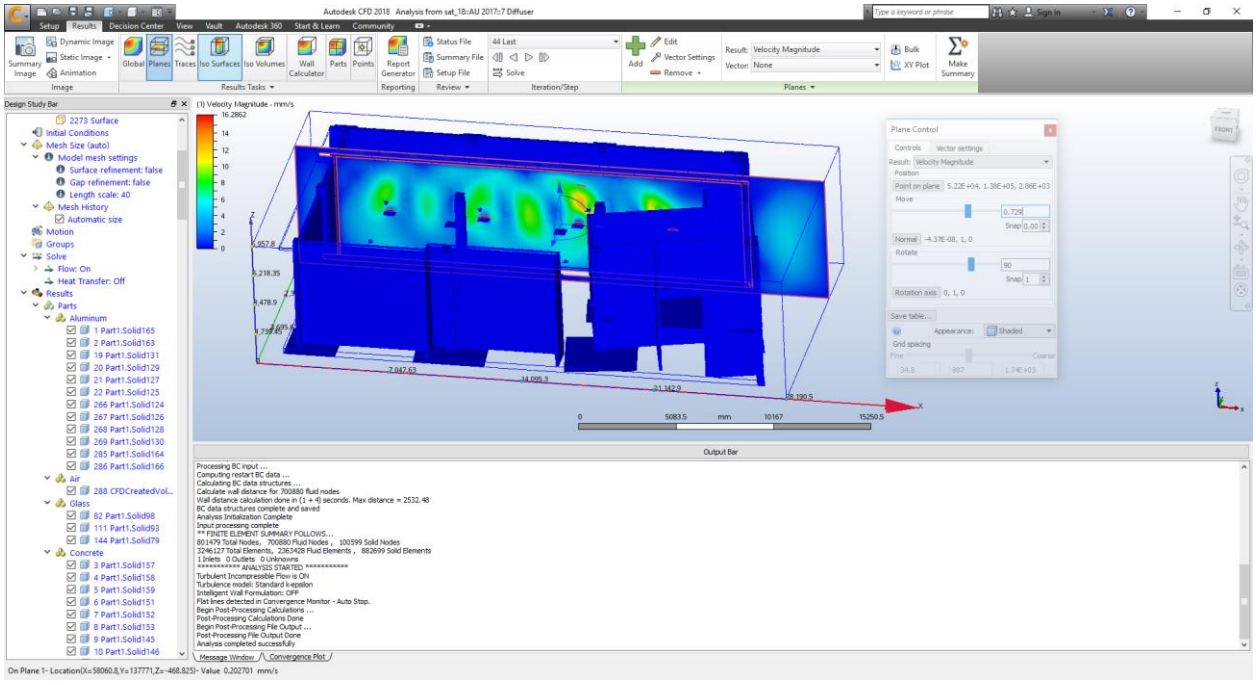
39 Setup the mesh for the analysis to run



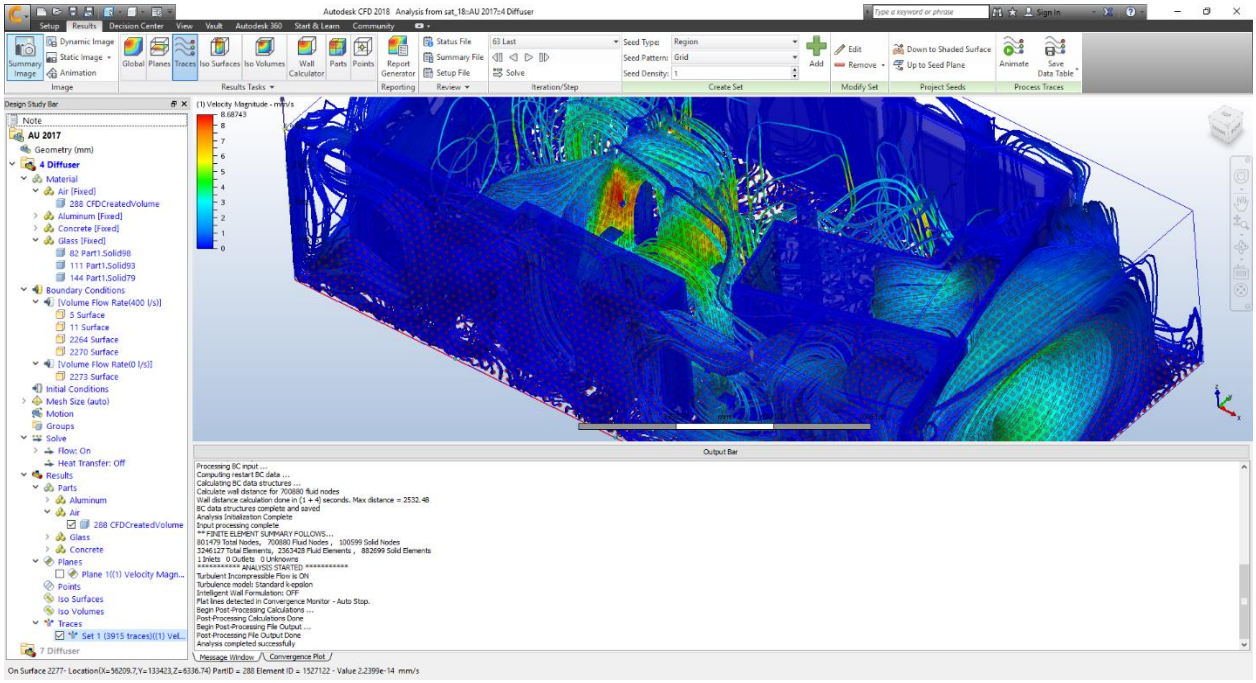
40 Check SOLVE and the required quantities



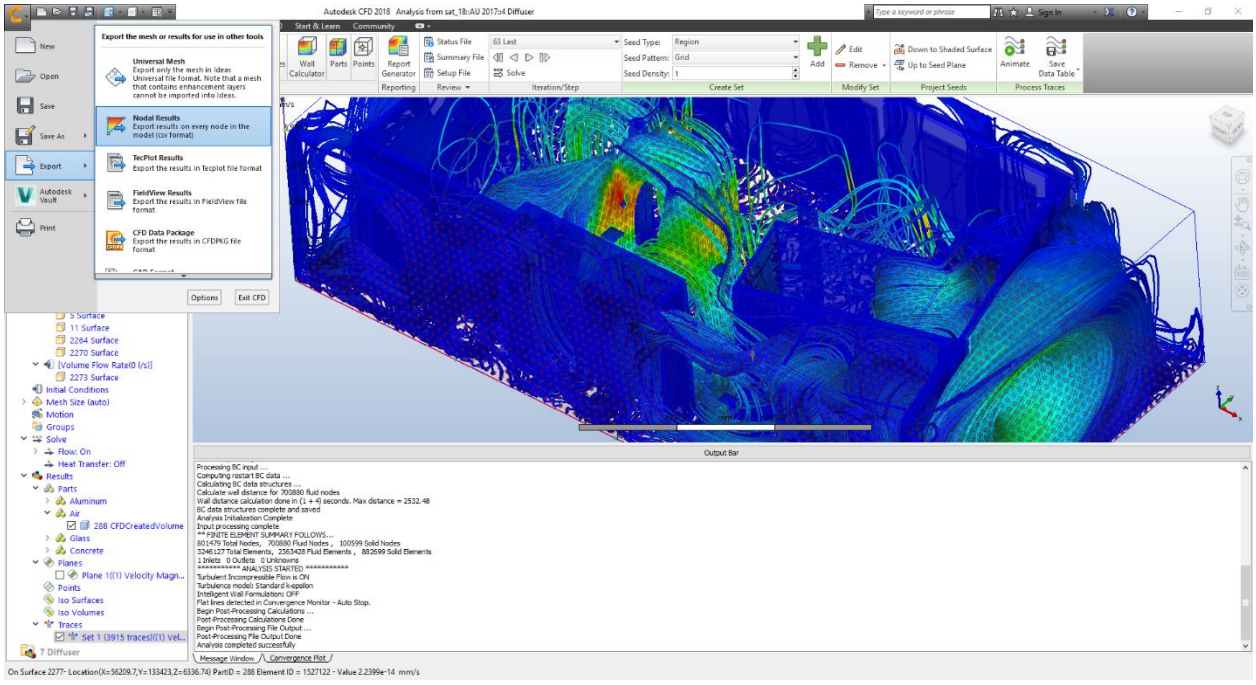
41 Review the convergence plot



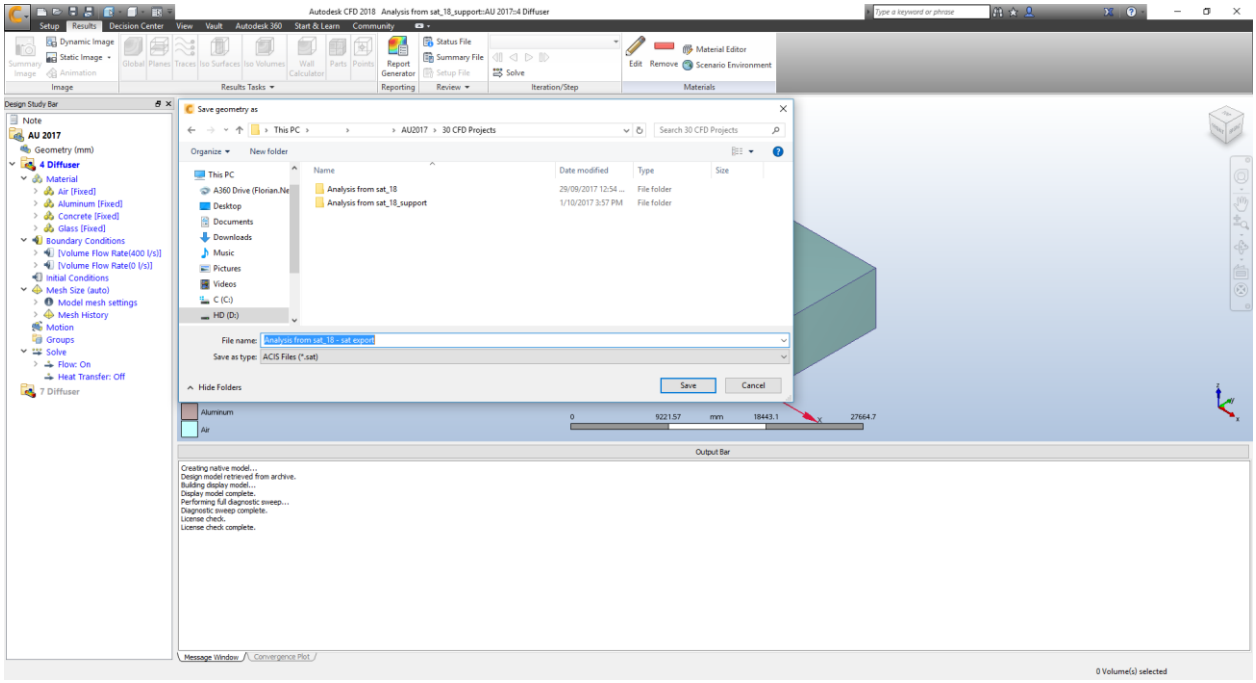
42 Review the complete analysis



43 We can trace the flows



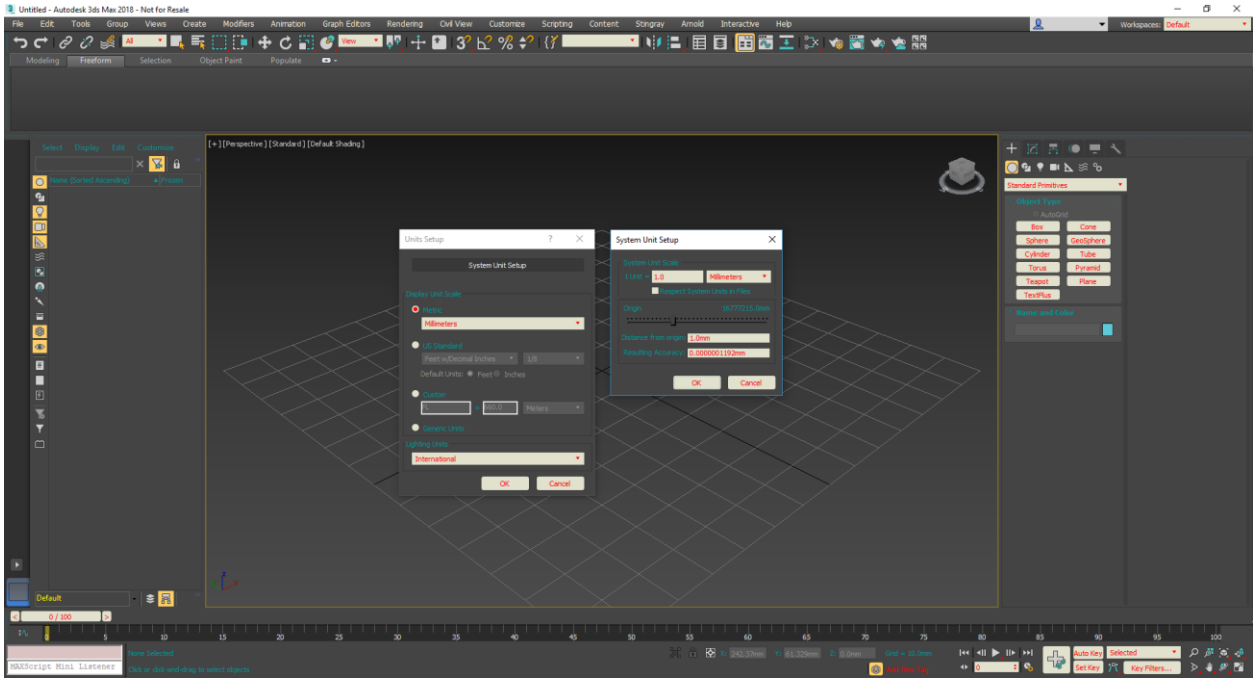
44 Export the nodal results



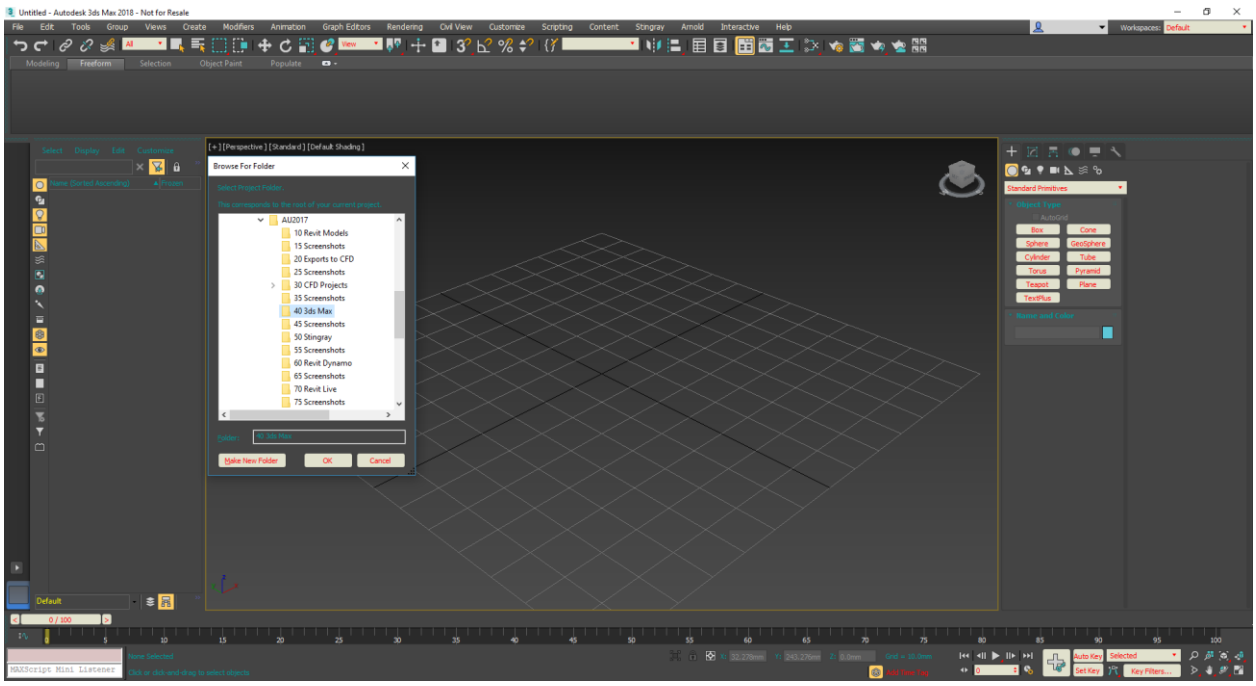
45 Also export the touched-up geometry from the CFD Study Environment

Preparing the results with 3ds Max

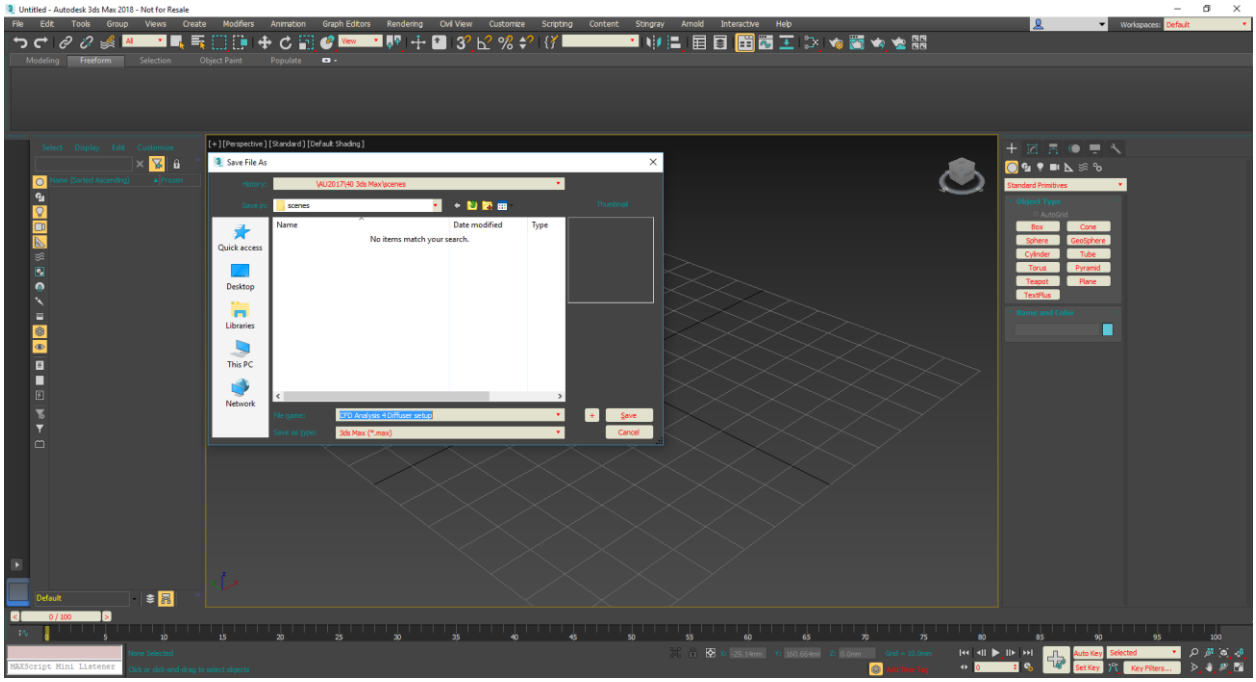
Find the example files in: 40 3ds Max
Find the screenshots in: 45 Screenshots



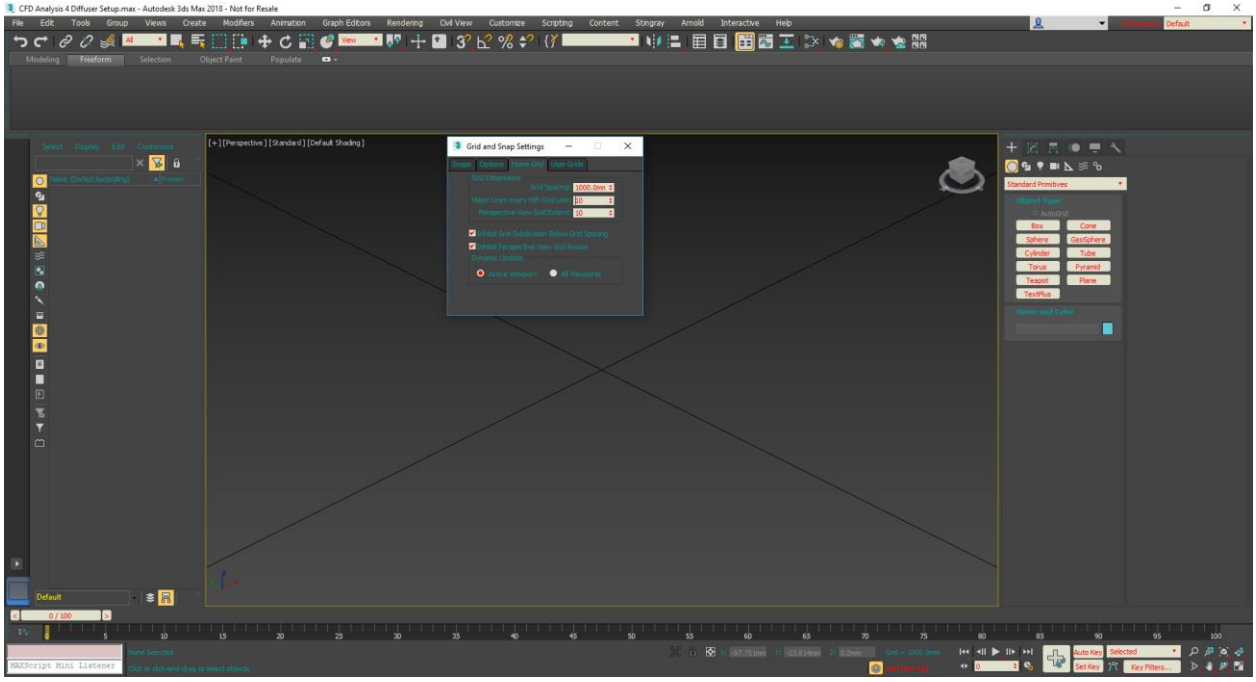
46 Always check the units first when opening 3ds Max



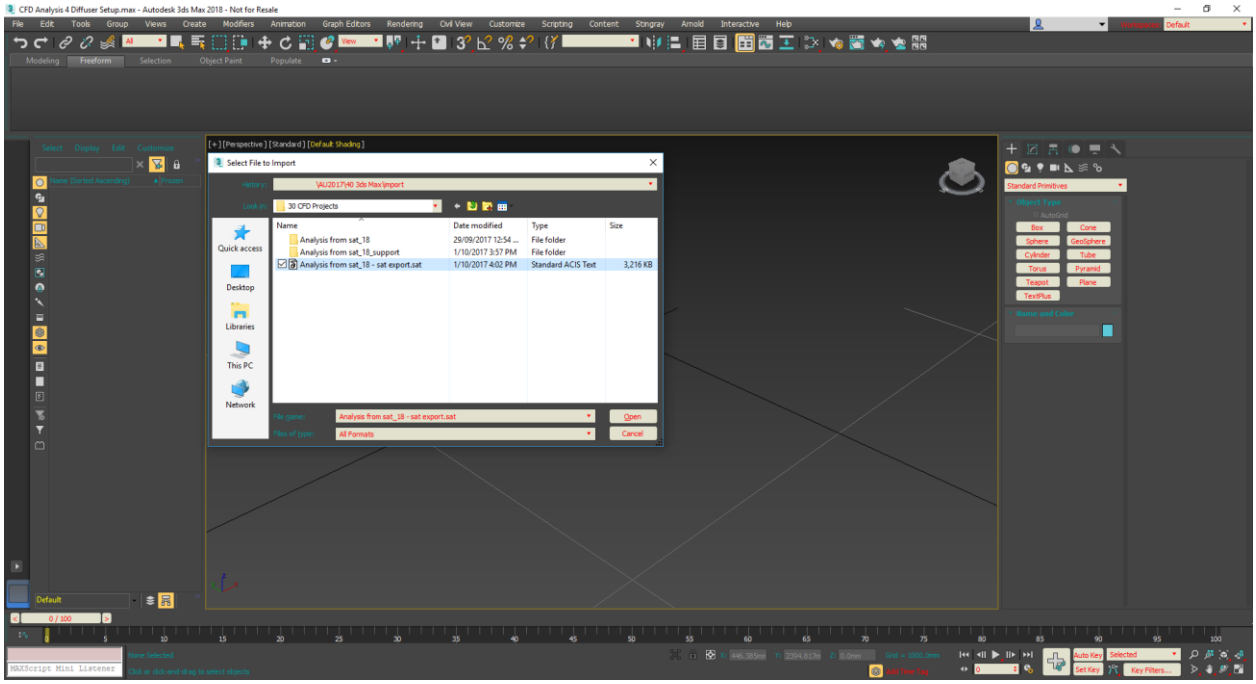
47 Always check the project folder when starting to work with 3ds Max



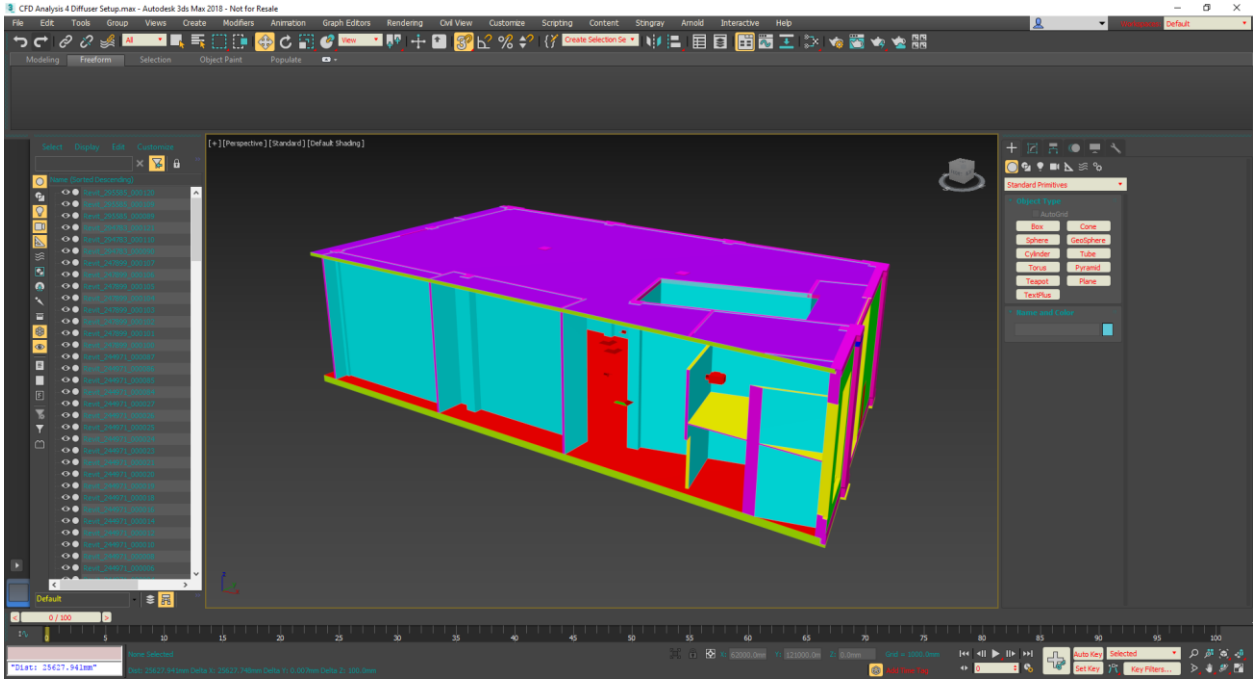
48 Save the project as the 4 diffuser configuration



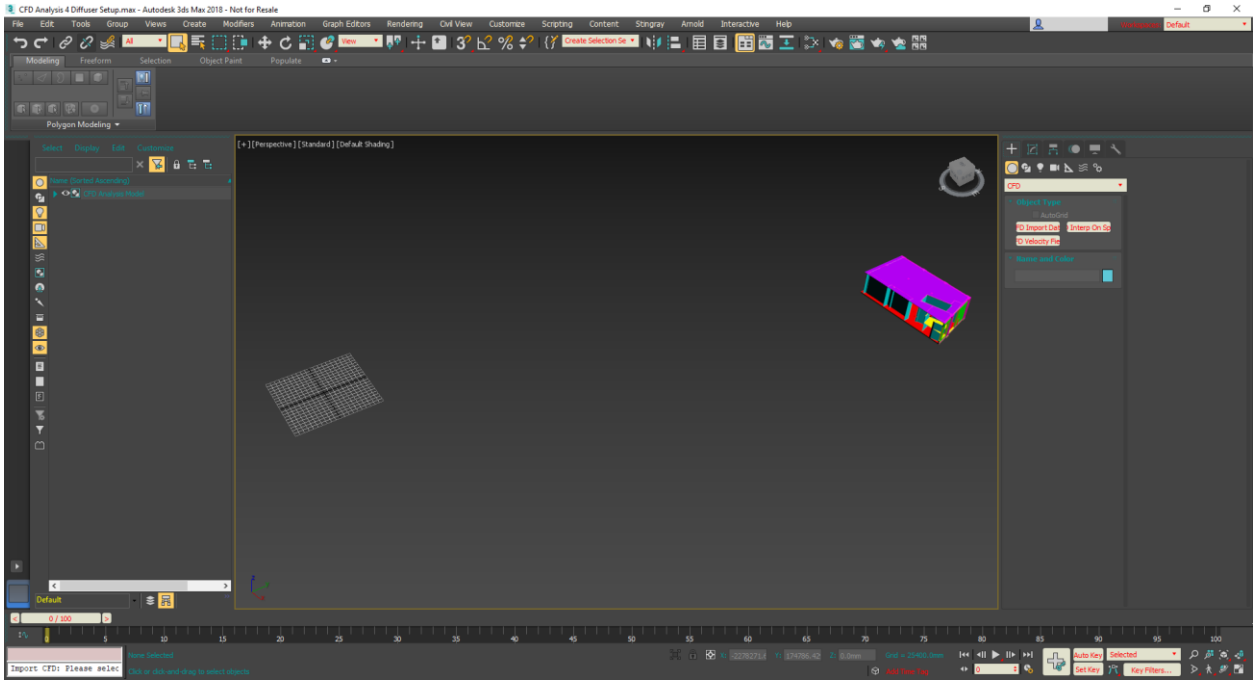
49 Setup the grid to suit the project



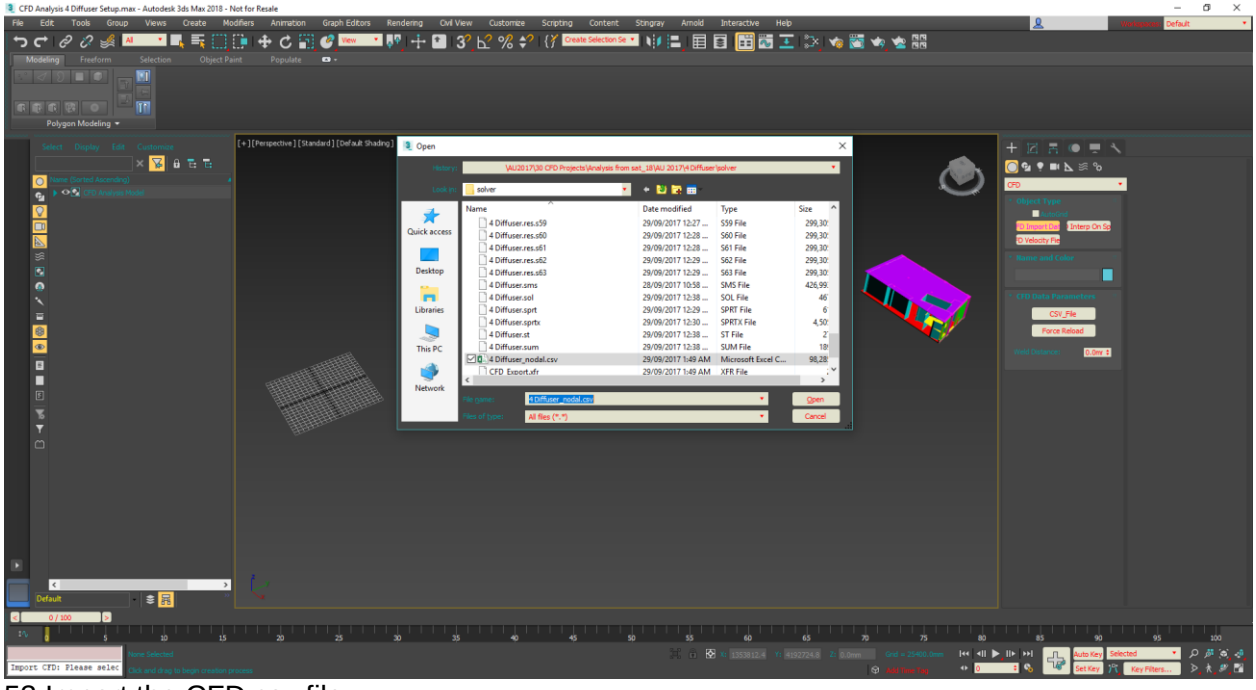
50 Import the SAT file



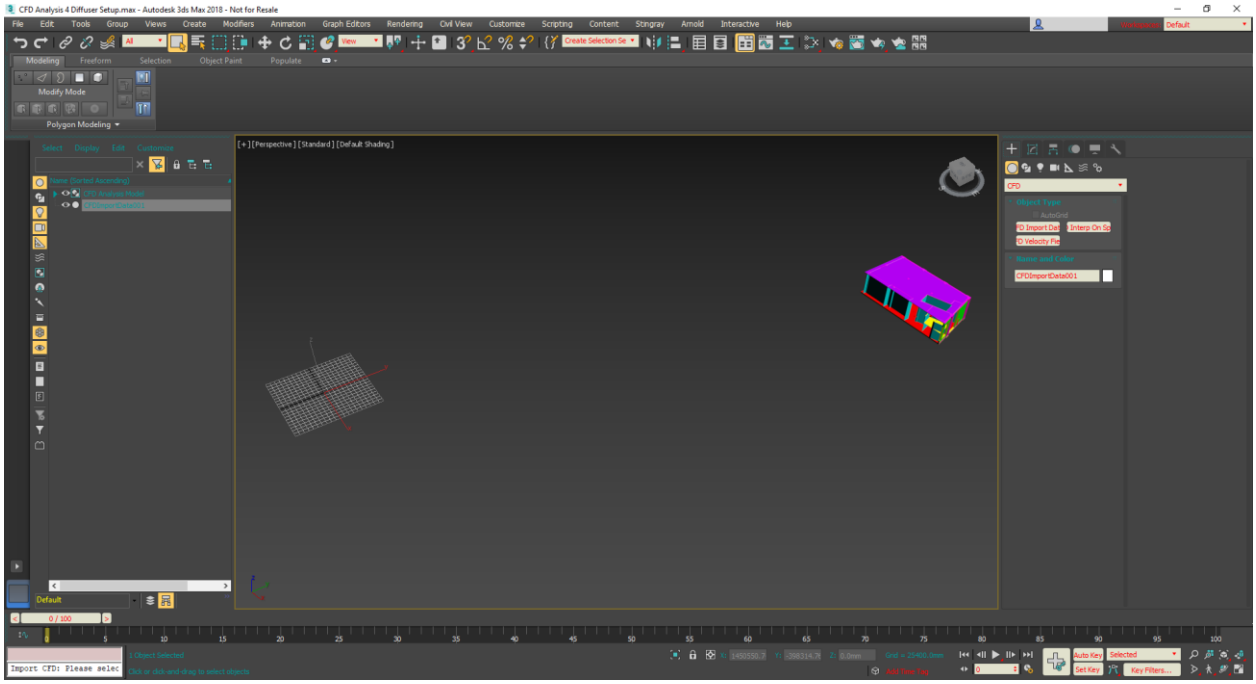
51 Check the dimensions measuring the geometry



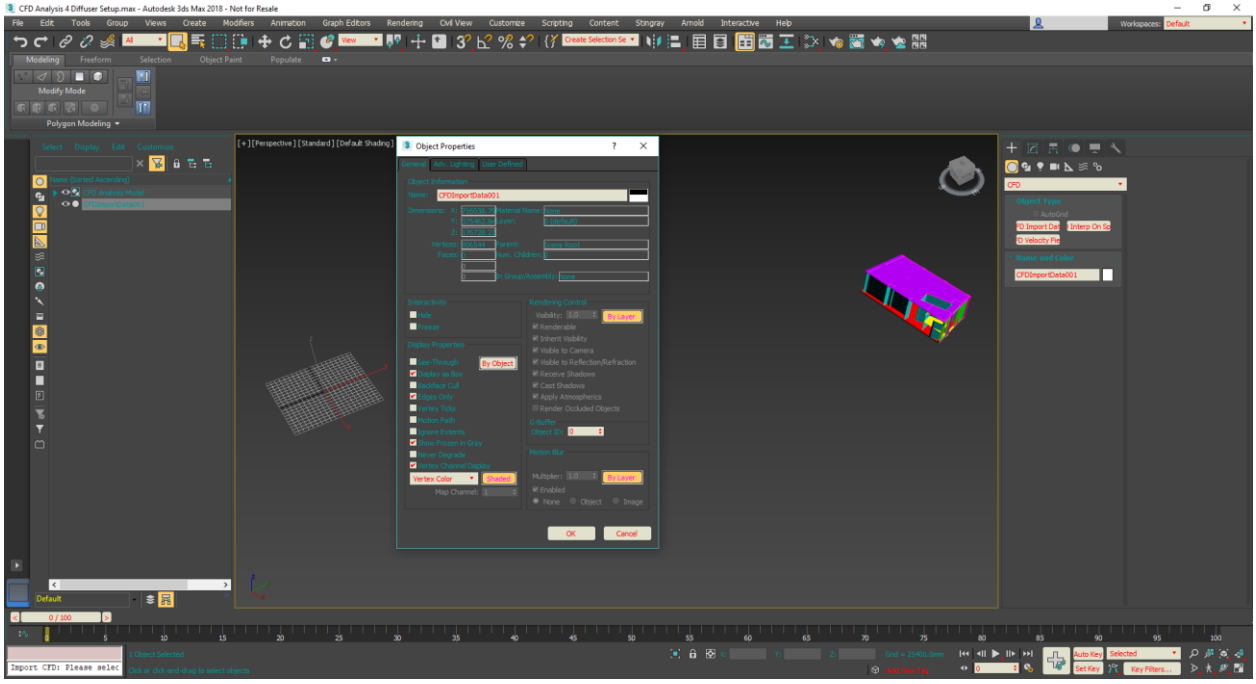
52 Prepare your working view



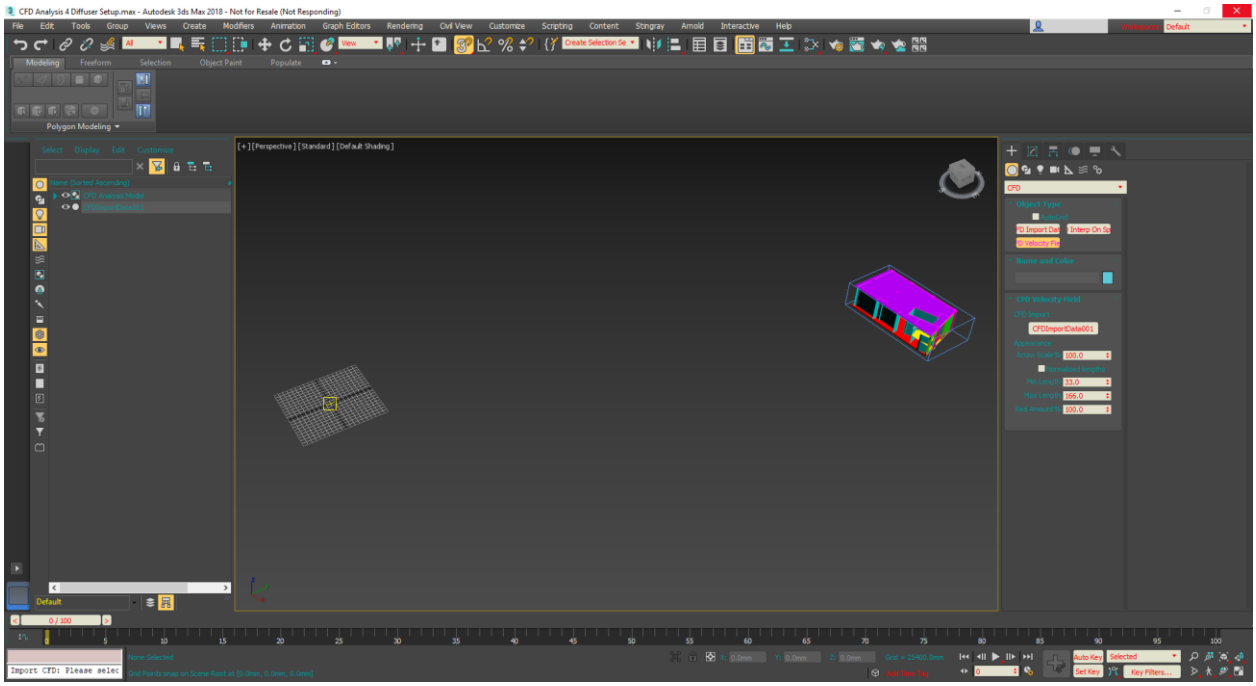
53 Import the CFD csv file



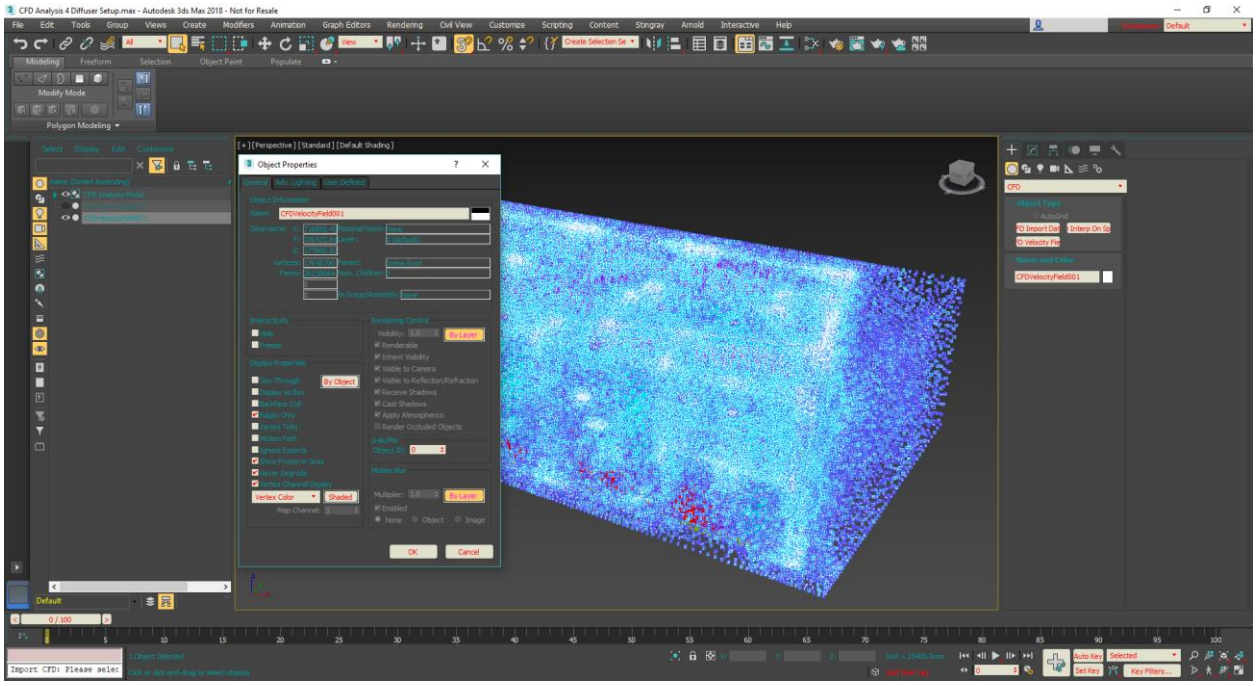
54 Place the object on the origin, even if you don’t see it immediately



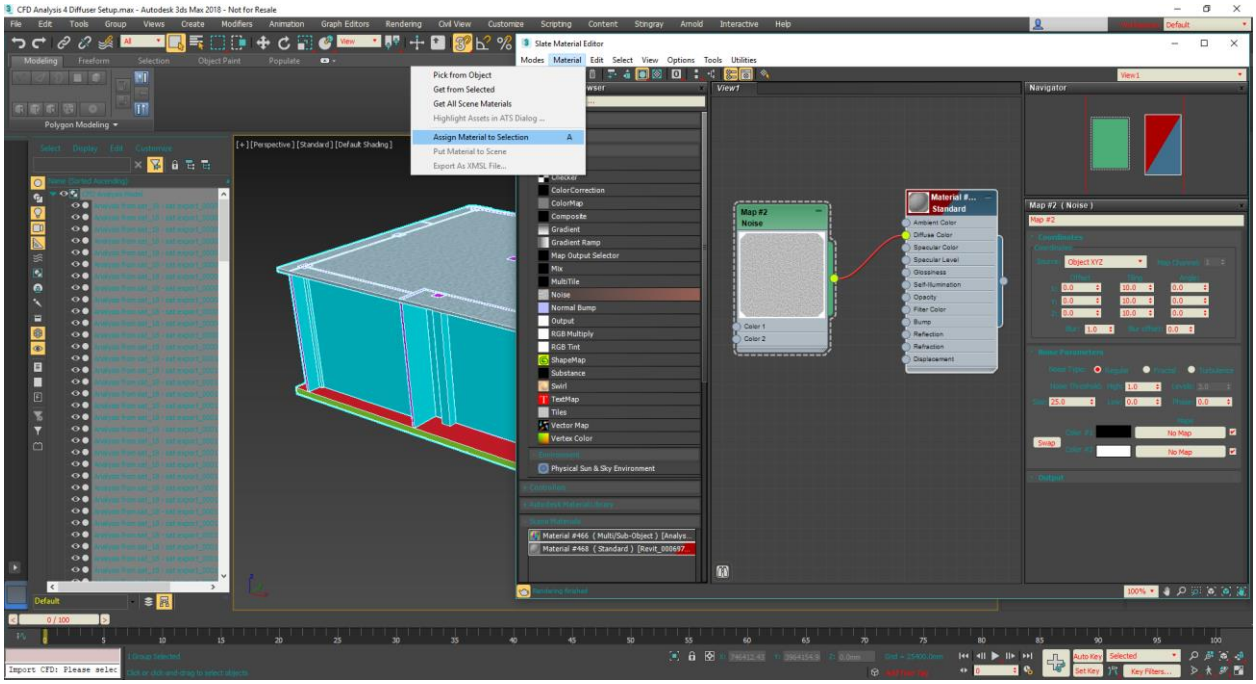
55 Update the properties



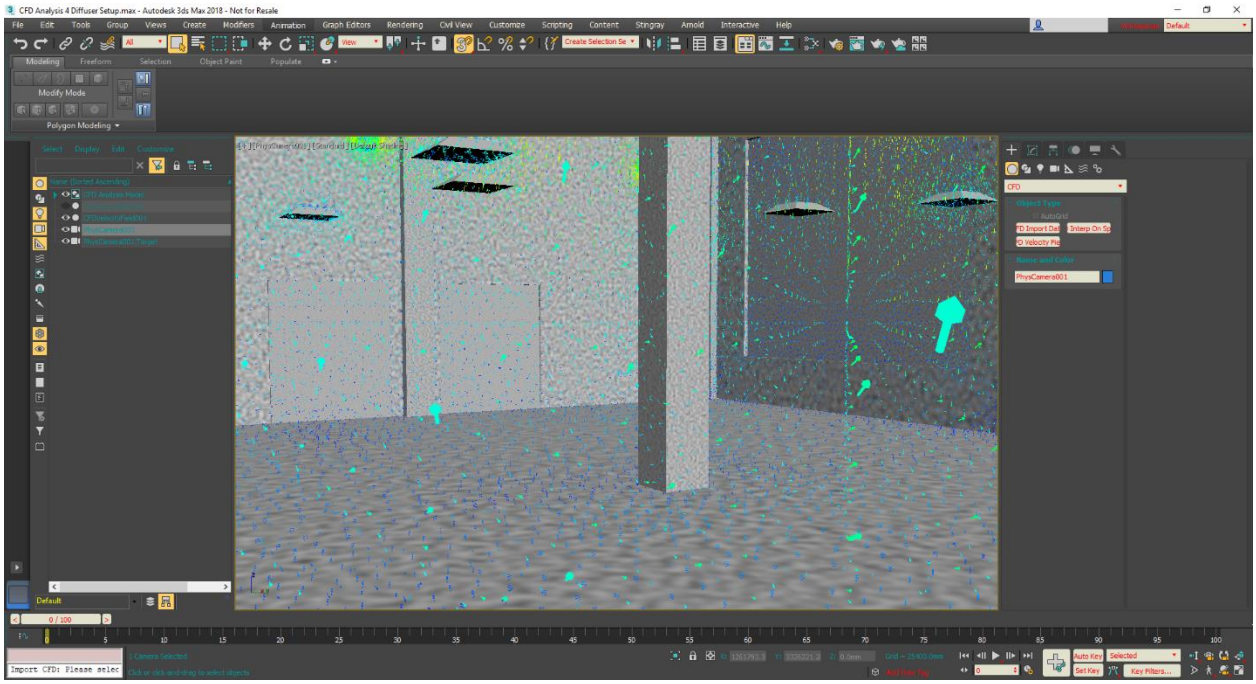
56 Create the velocity field on the origin



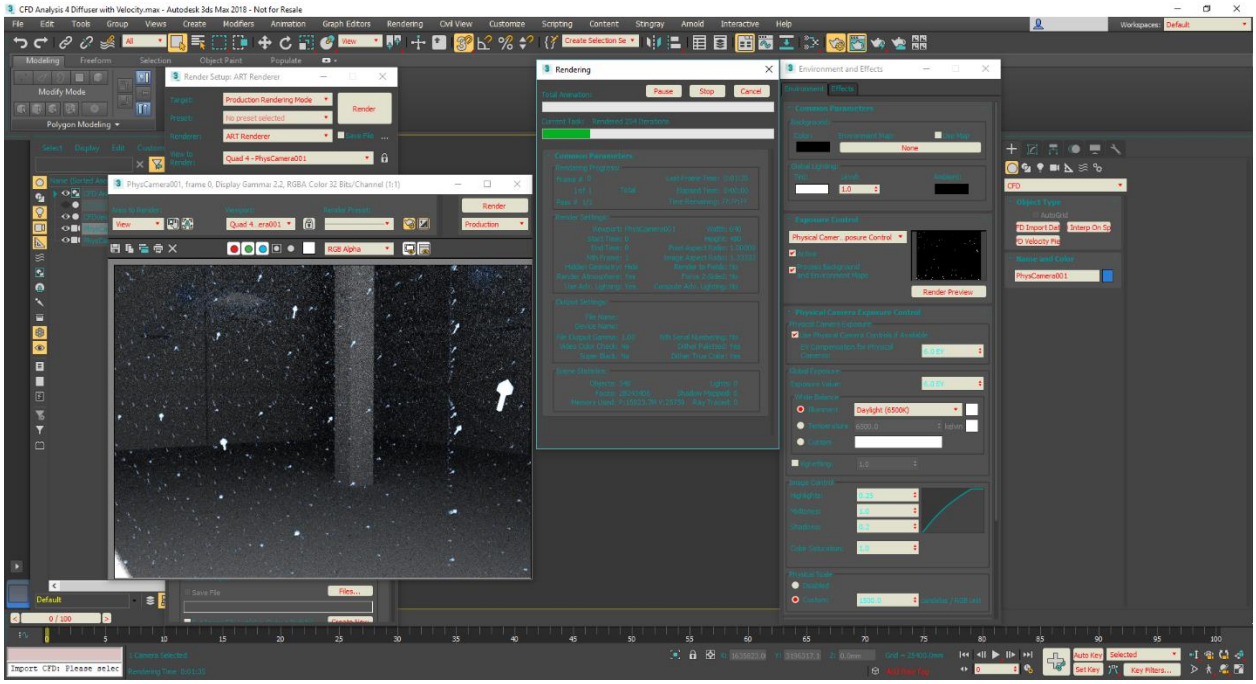
57 Update the properties of the field



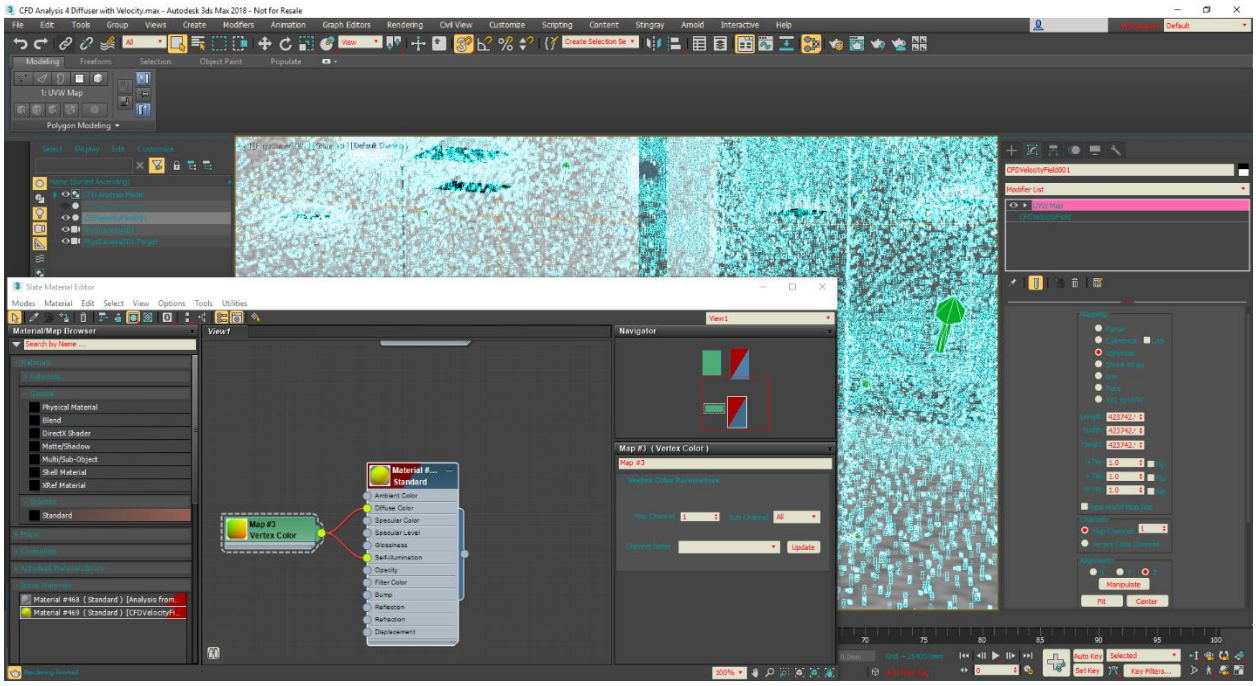
58 We can work with materials



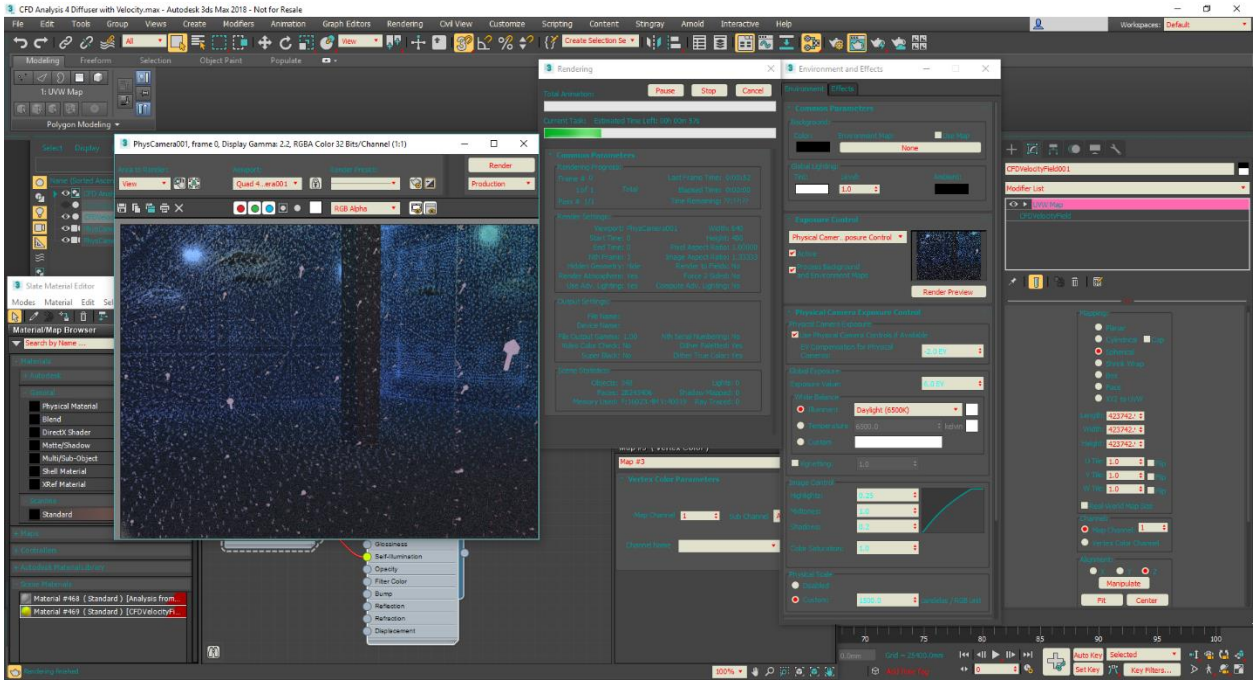
59 Setup a camera for your reference (ideally use a physical camera)



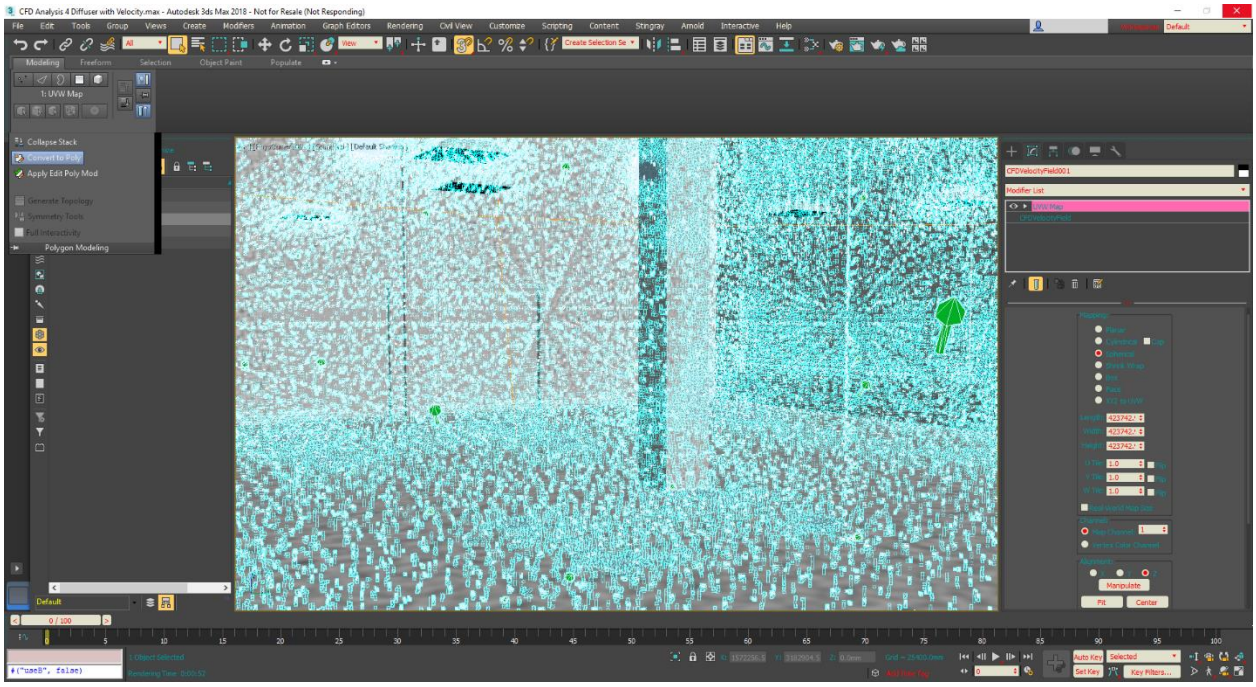
60 Why not trying for a motivational test render



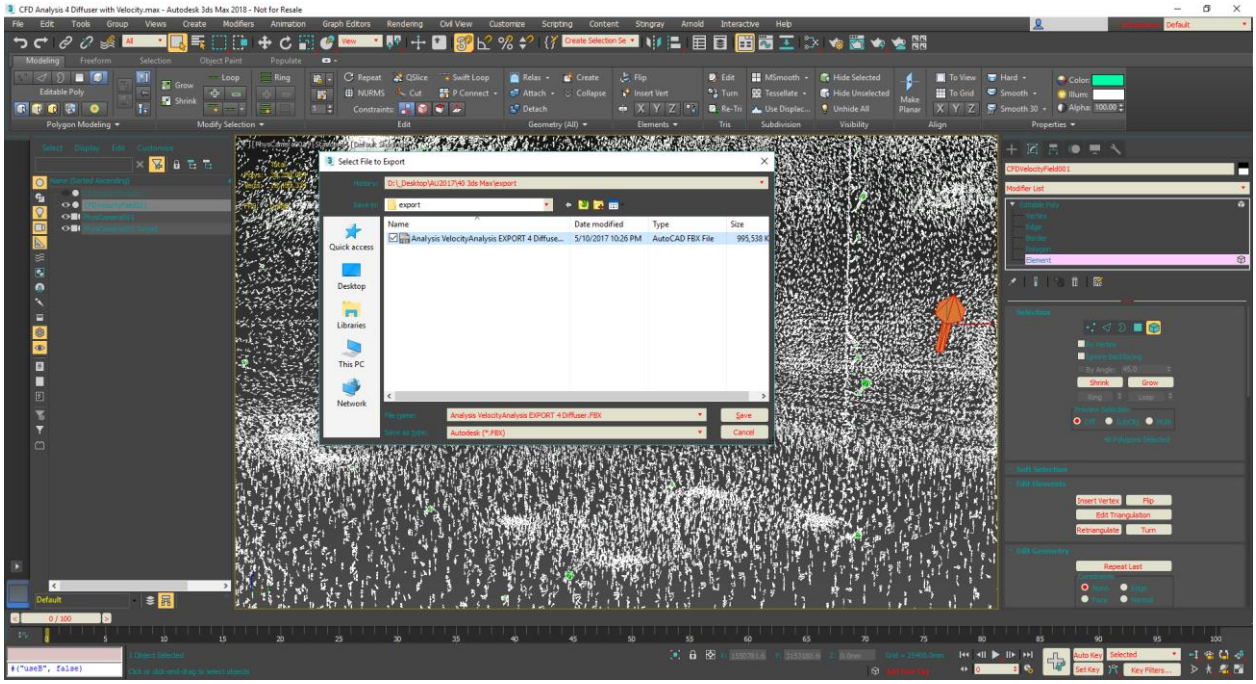
61 Work with materials and a uvw map



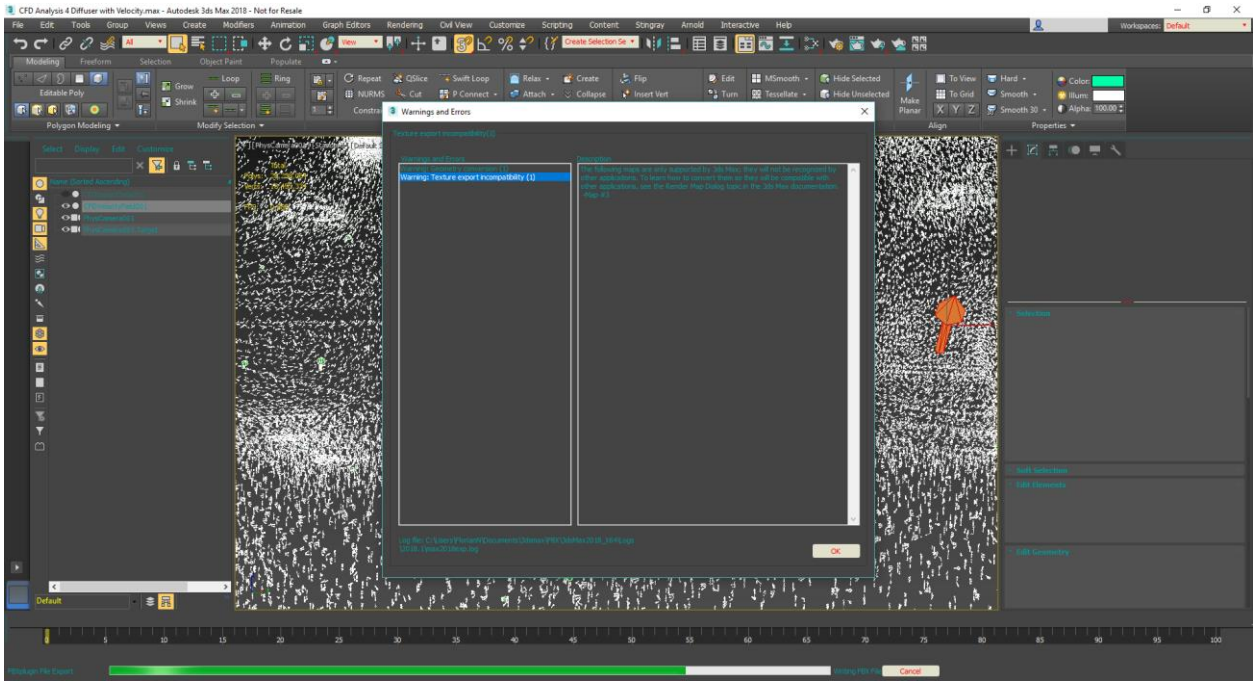
62 Render with the map applied



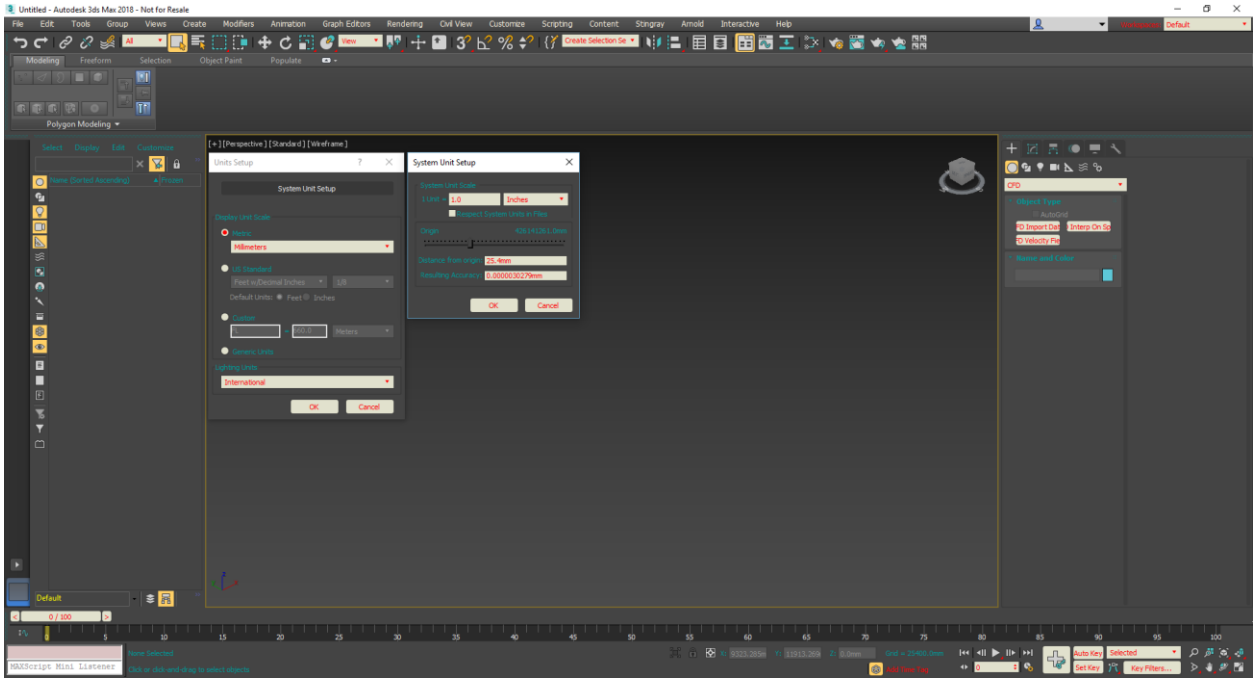
63 Convert the geometry to polygons, which can be exported



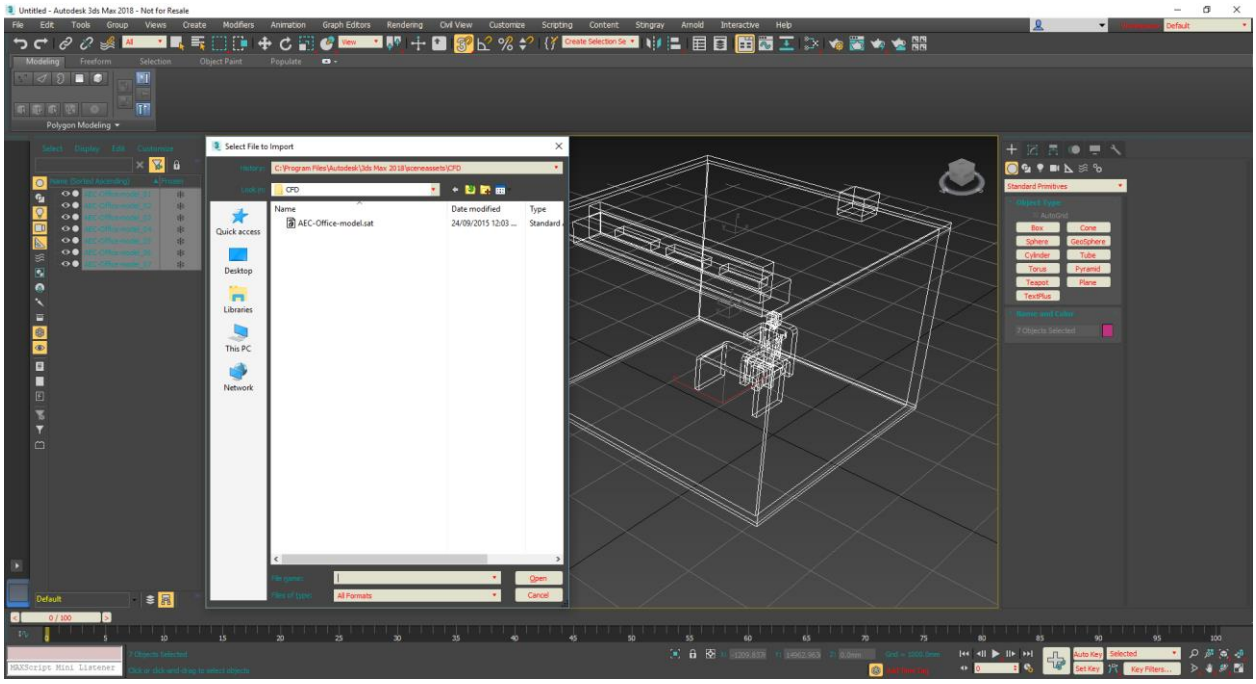
64 Export the vectors



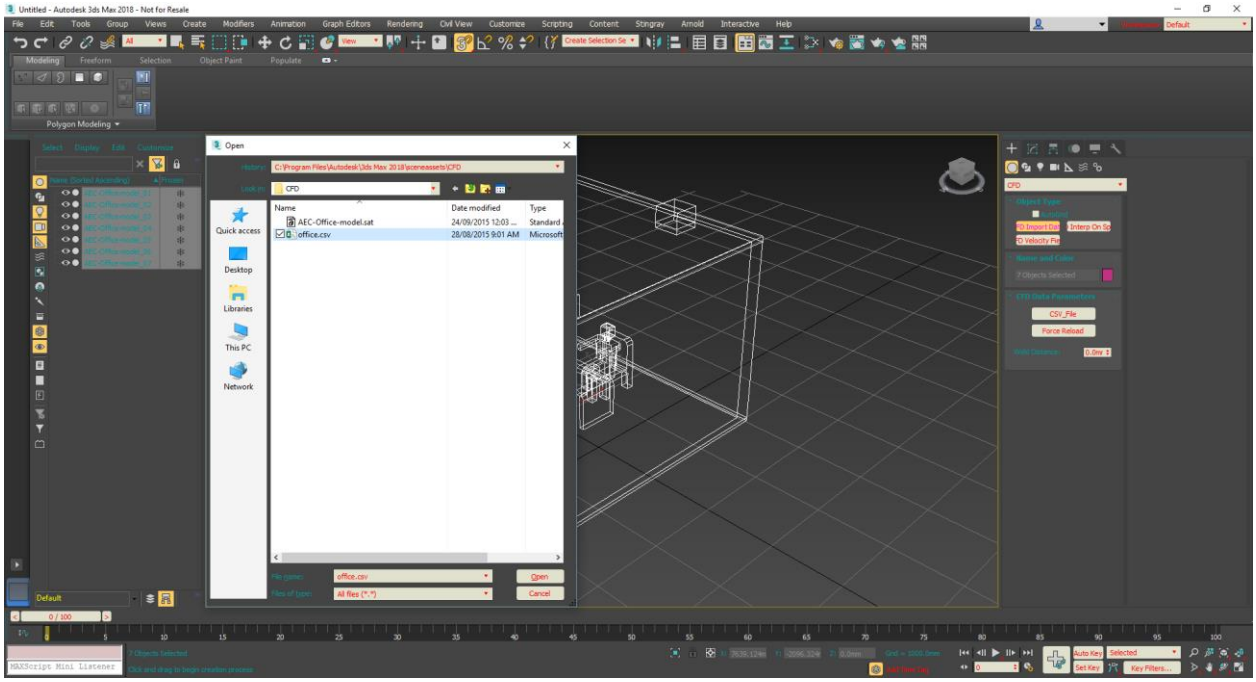
65 Master the export challenges



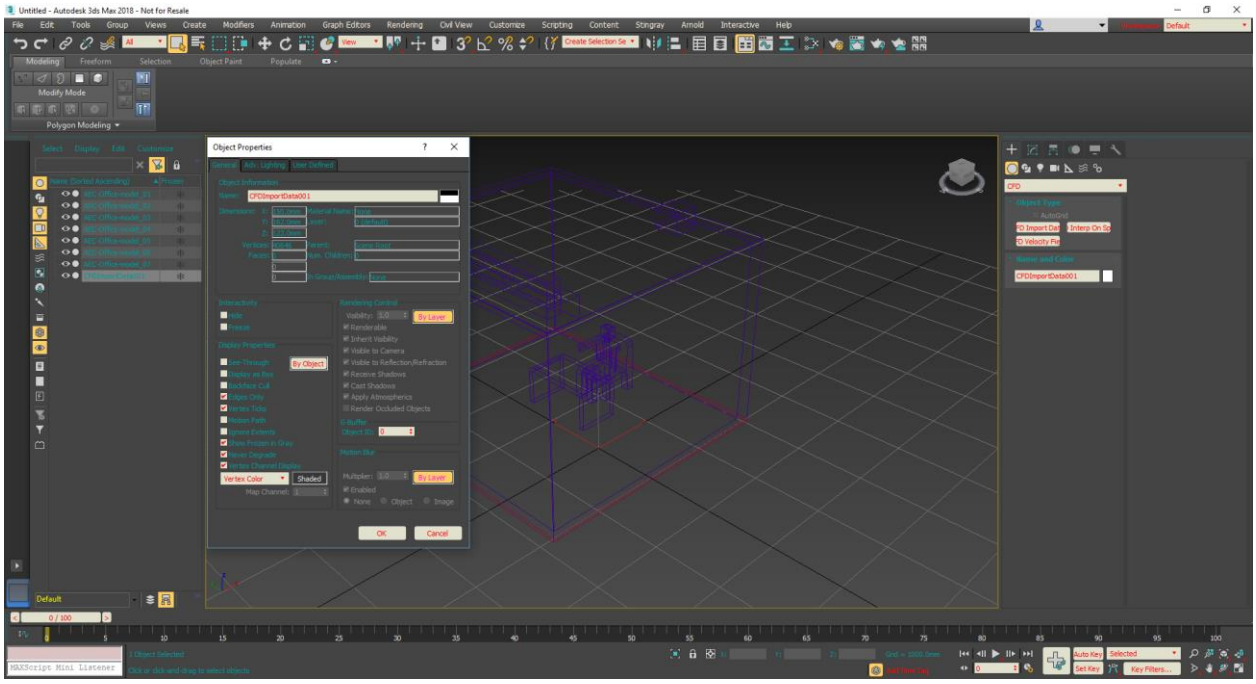
66 Round 2, let's change the system units to inch



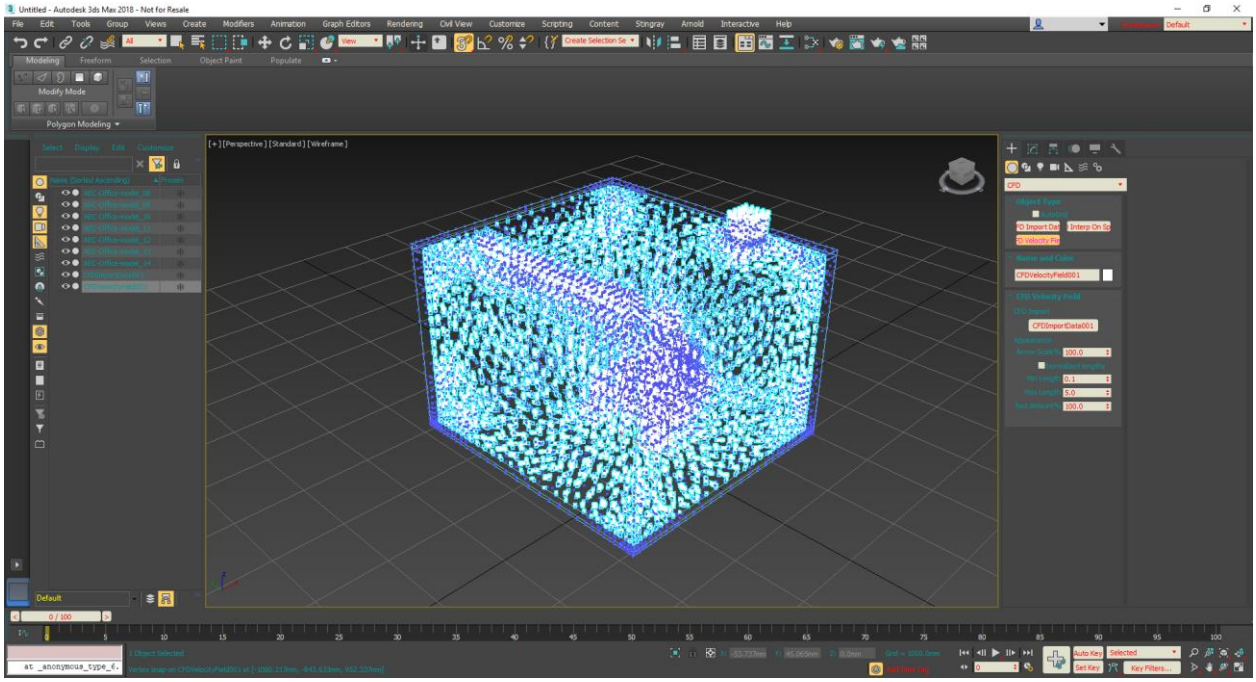
67 Import the SIMPLE example to practice



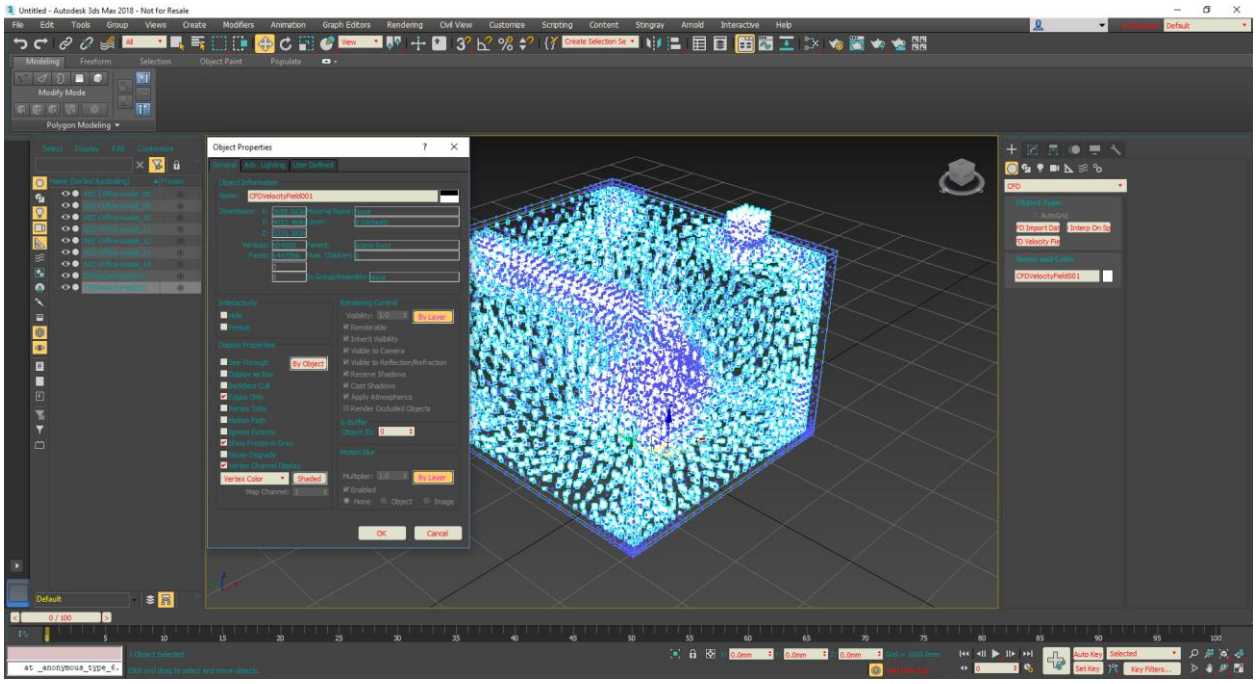
68 Import the SIMPLE csv dataset



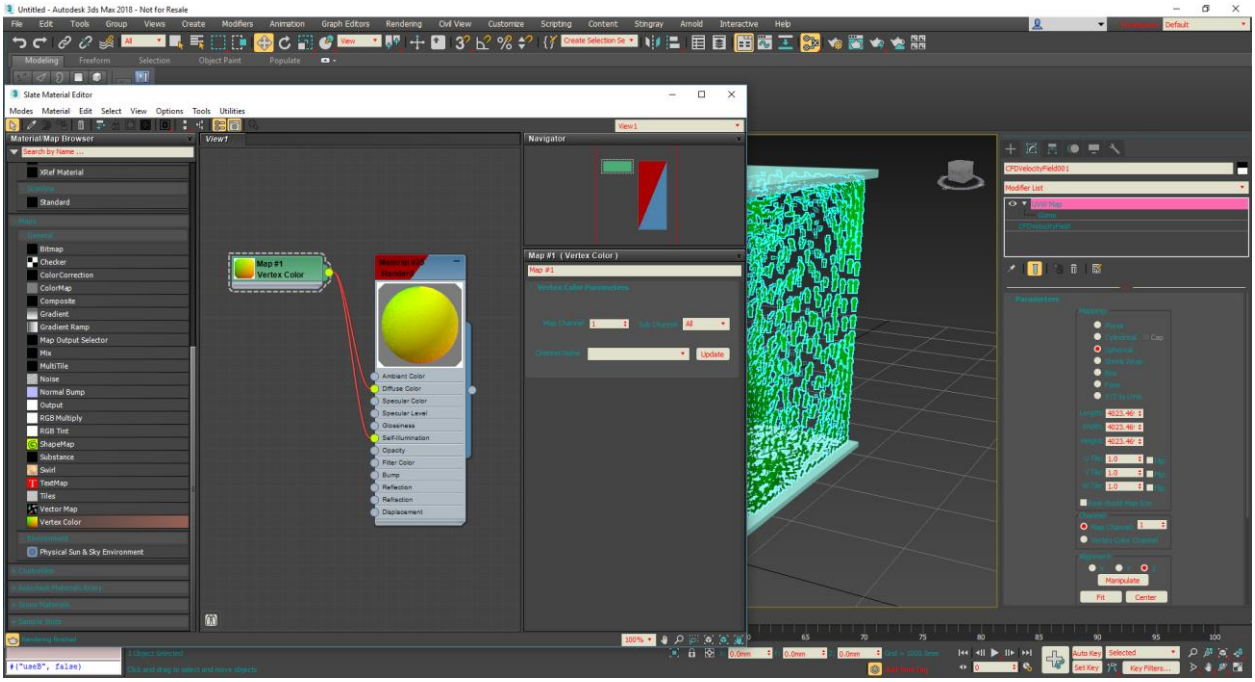
69 Update the object properties



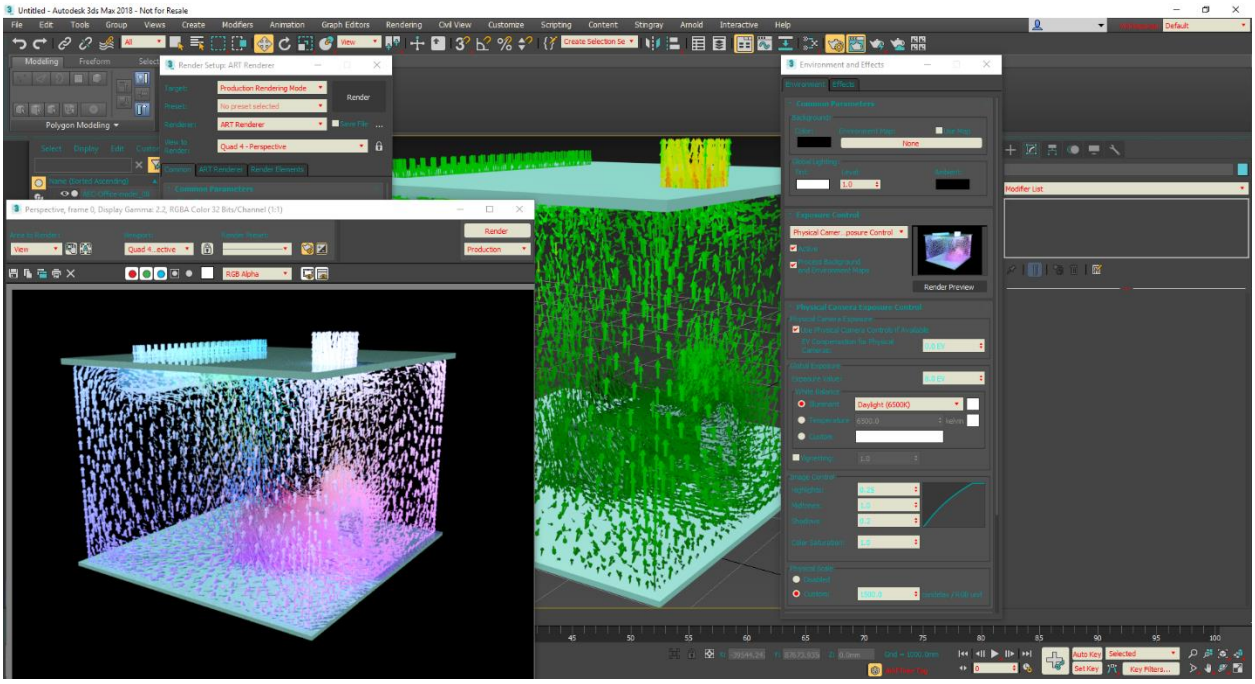
70 Create the velocity field



71 Update the vertex field properties



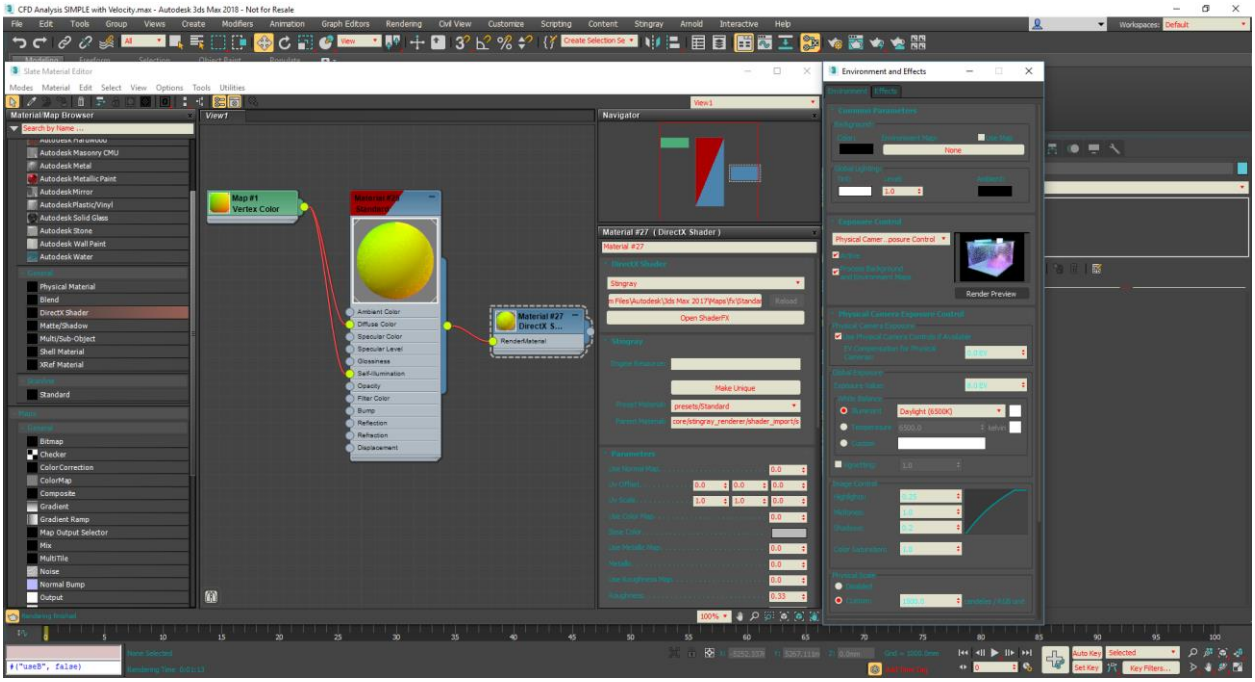
72 Apply the material and UVW Map modifier



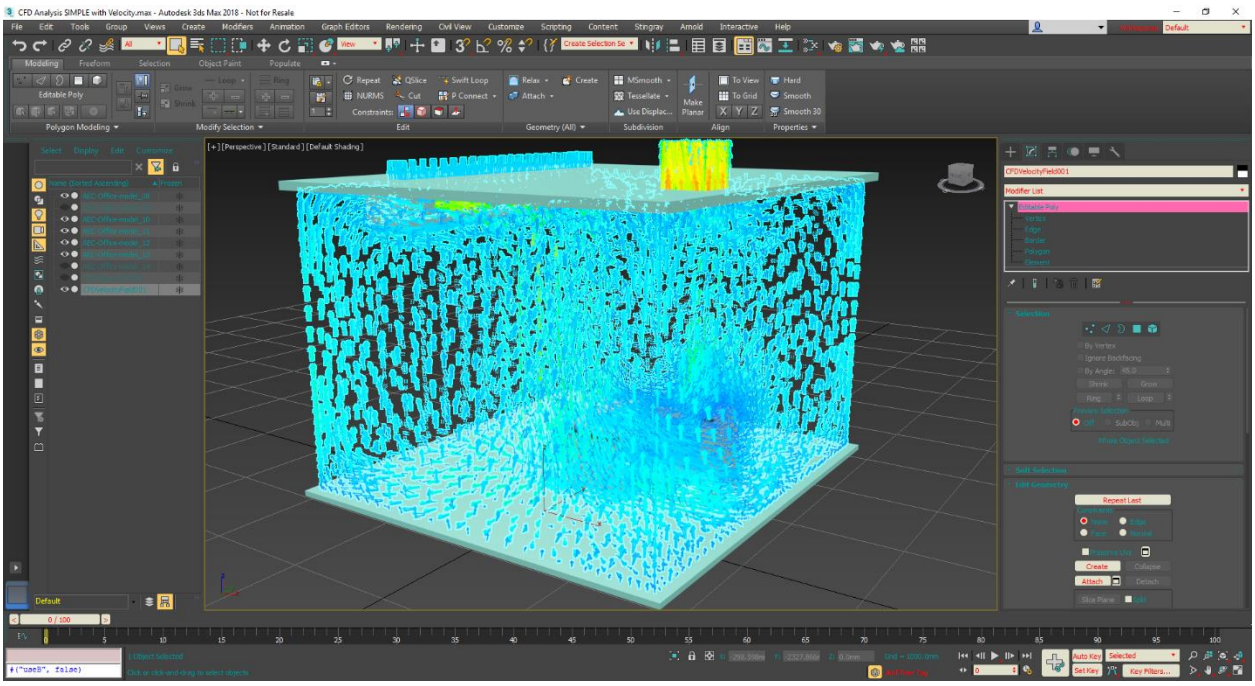
73 What about a motivational test render

Presenting the results with Stingray

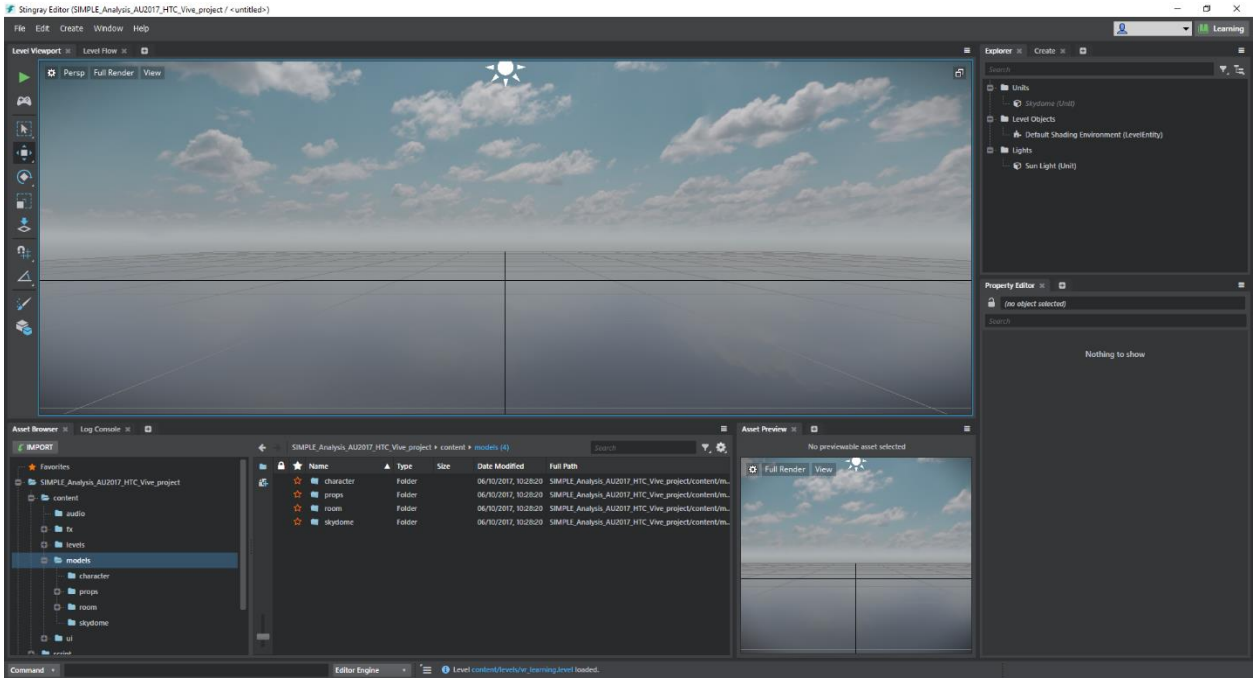
Find the example files in: 50 Stingray
Find the screenshots in: 55 Screenshots



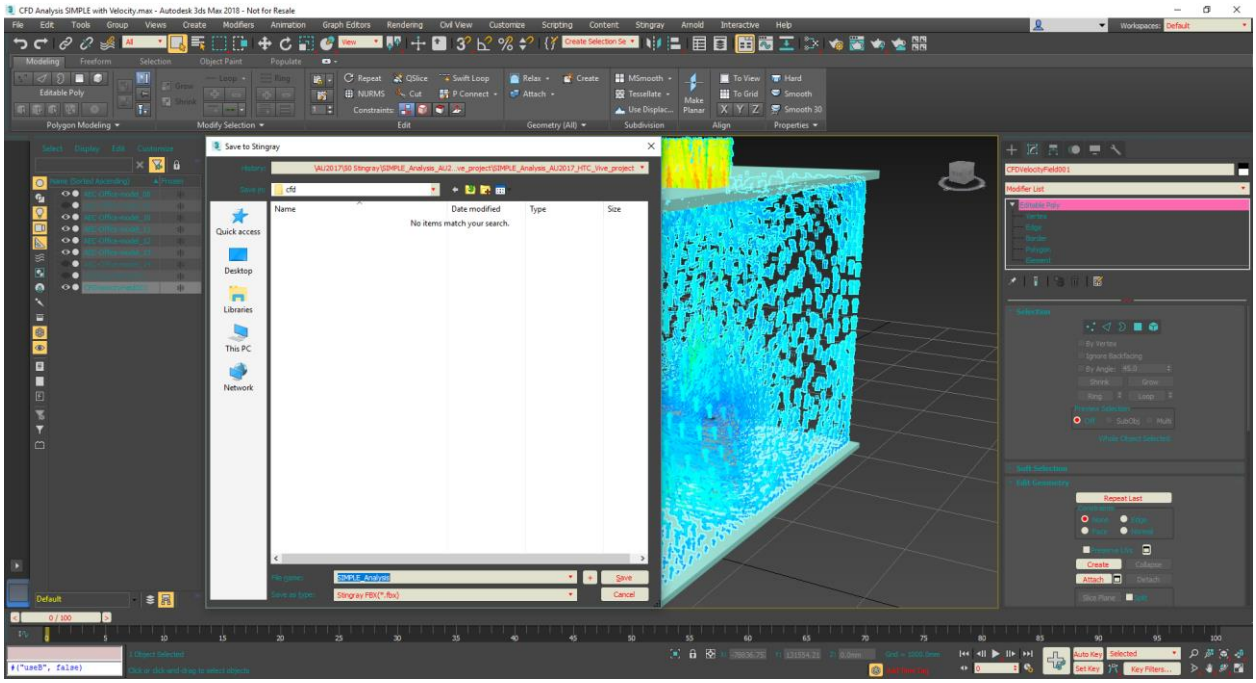
74 In 3ds Max, we need to apply a shader material for Stingray



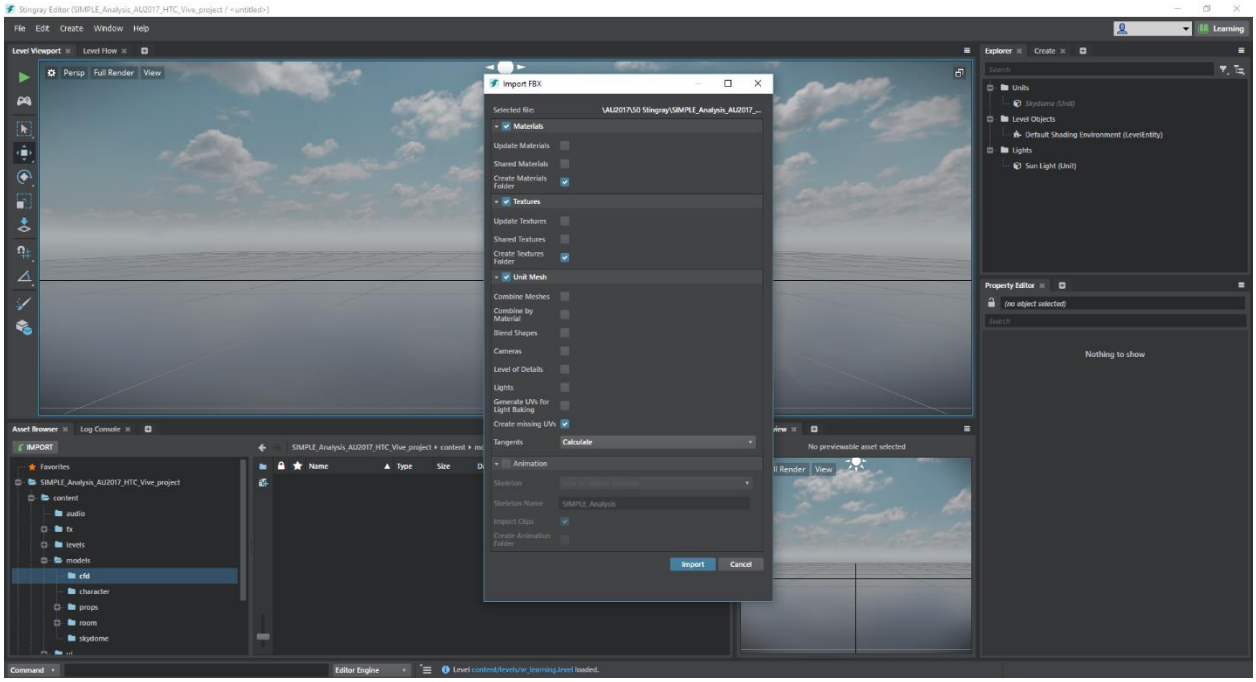
75 We would need to convert all objects to polygons



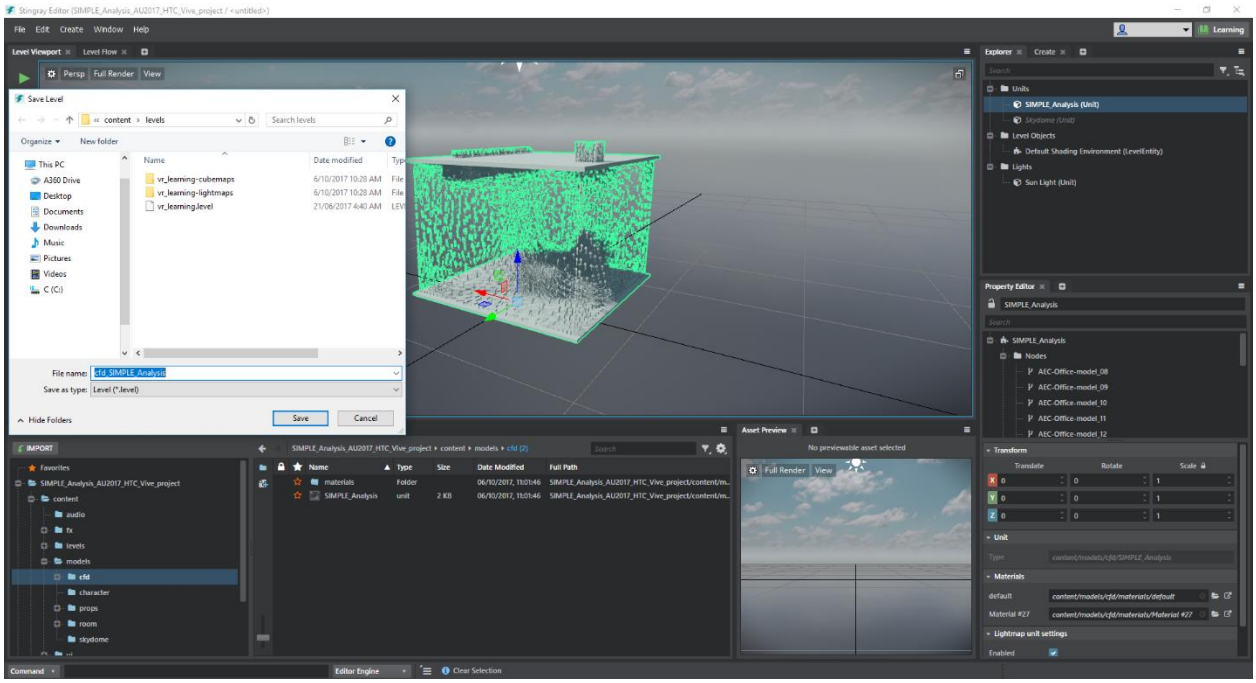
76 Start Stingray (3ds Max Interactive) using your VR template and create a new level



77 Connect with 3ds Max and send all elements to a new created CFD folder



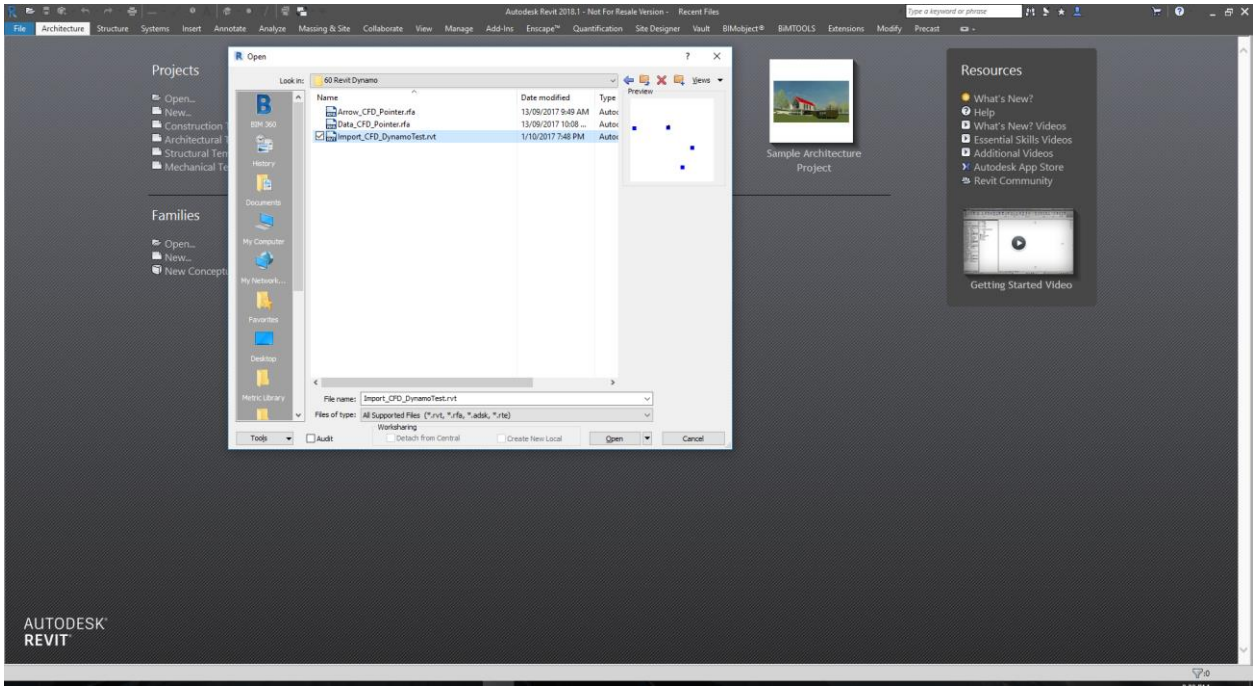
78 Accept the import settings



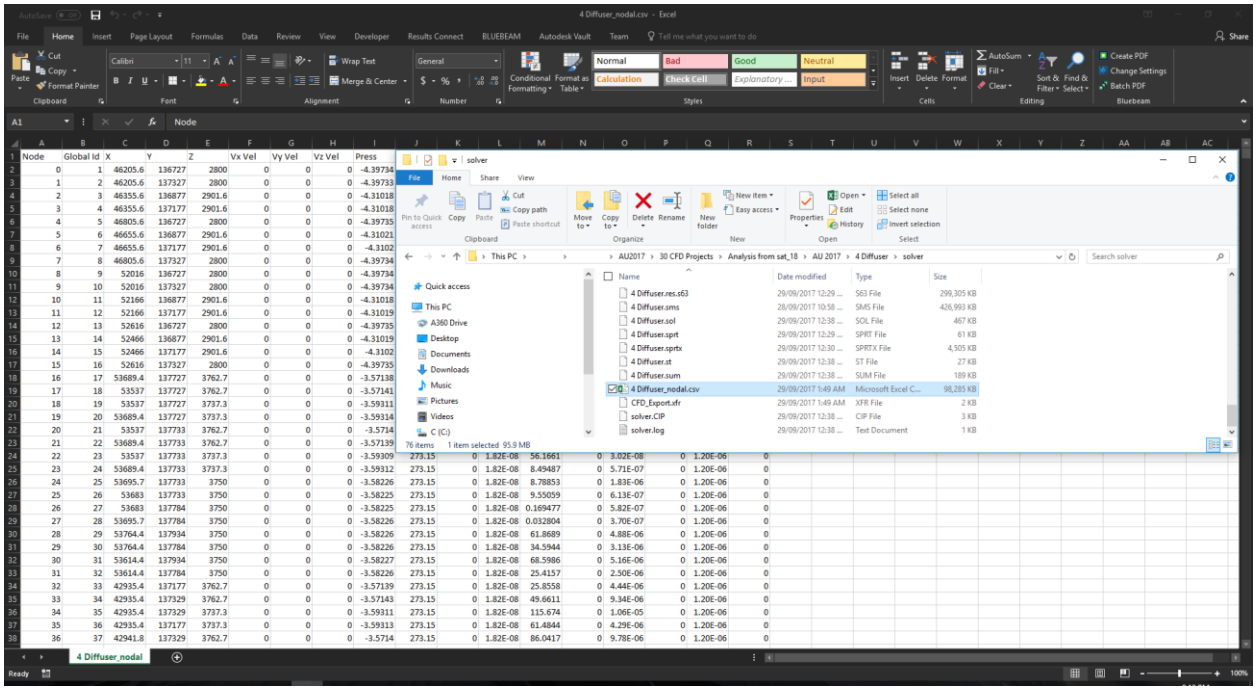
79 Drag and drop your model on to the origin and save the level

Preparing the results with Revit and Dynamo

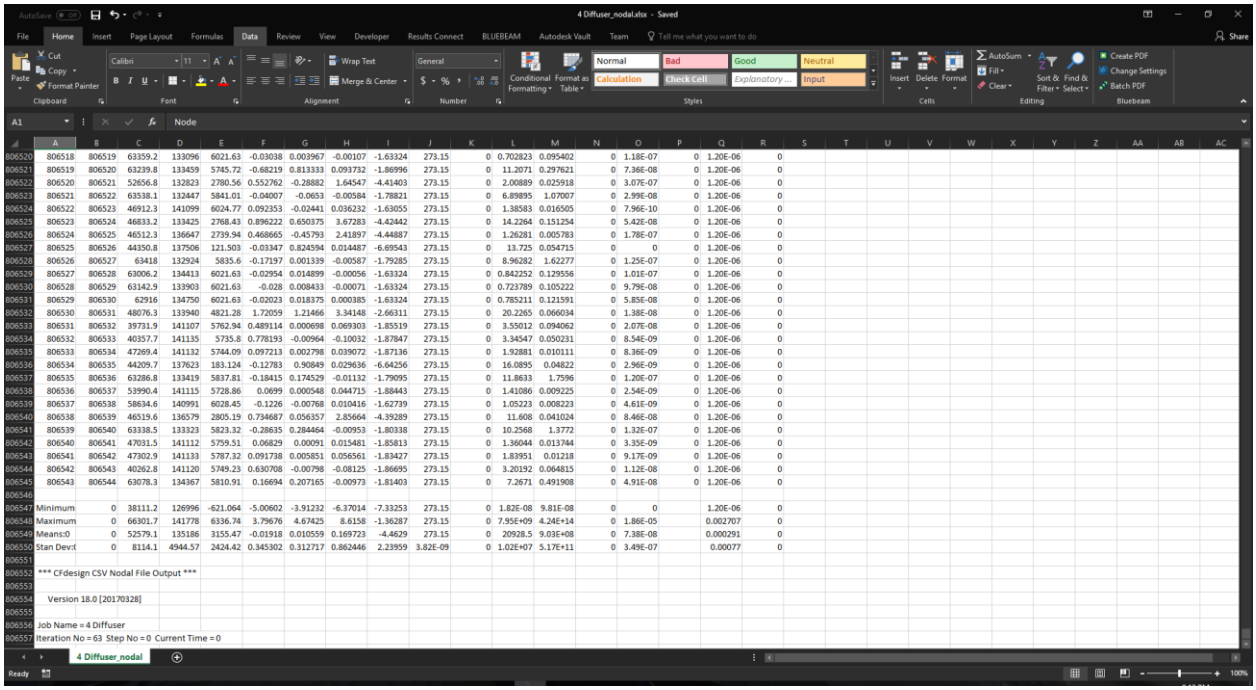
Find the example files in: 60 Revit Dynamo
Find the screenshots in: 65 Screenshots



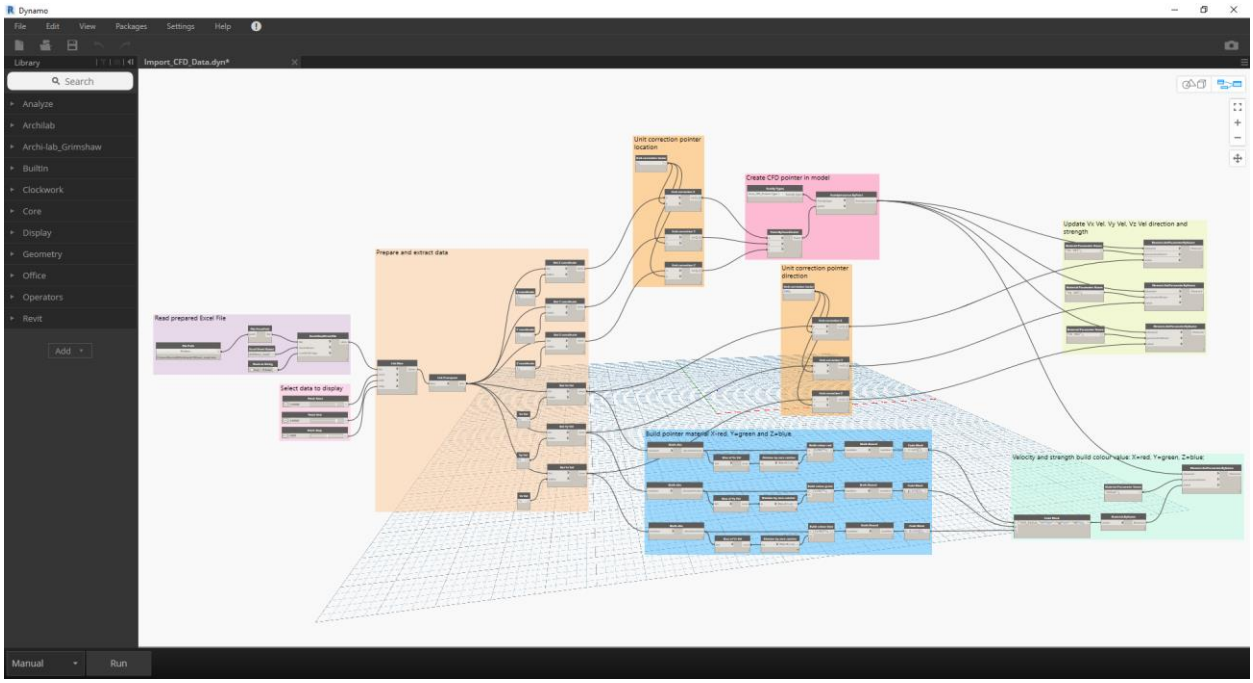
85 Open Import_CFD_DynamoTest for a practice round



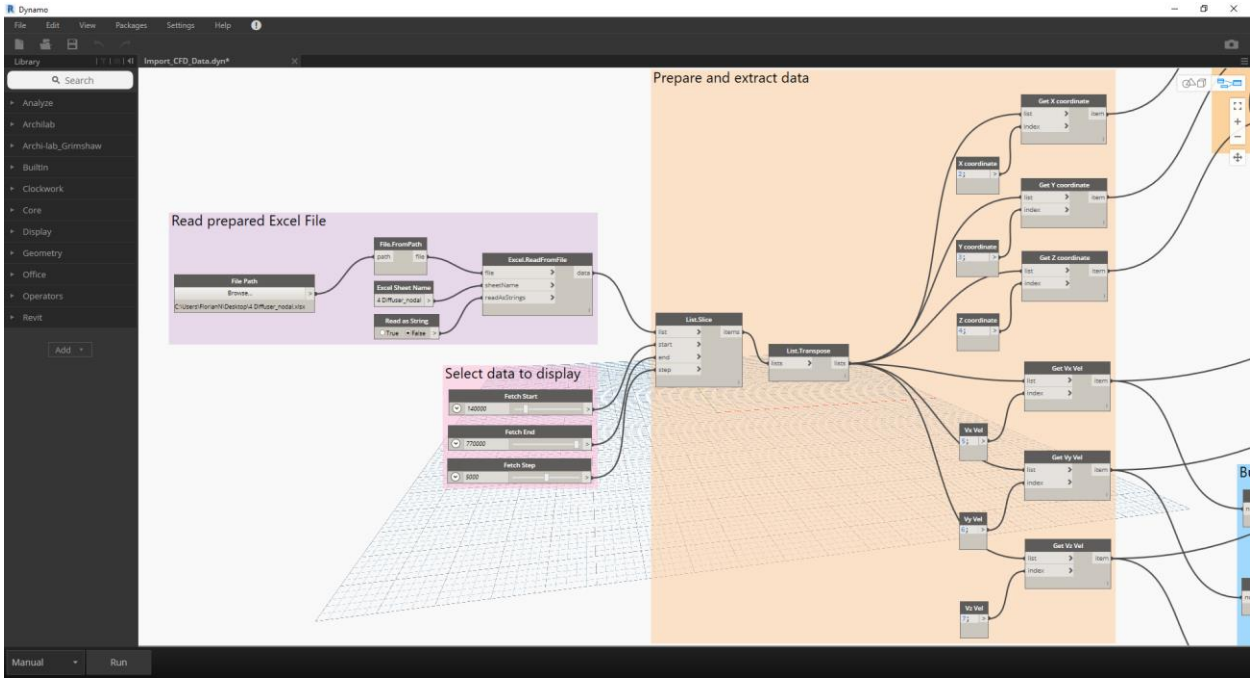
86 Convert the csv to xlsx



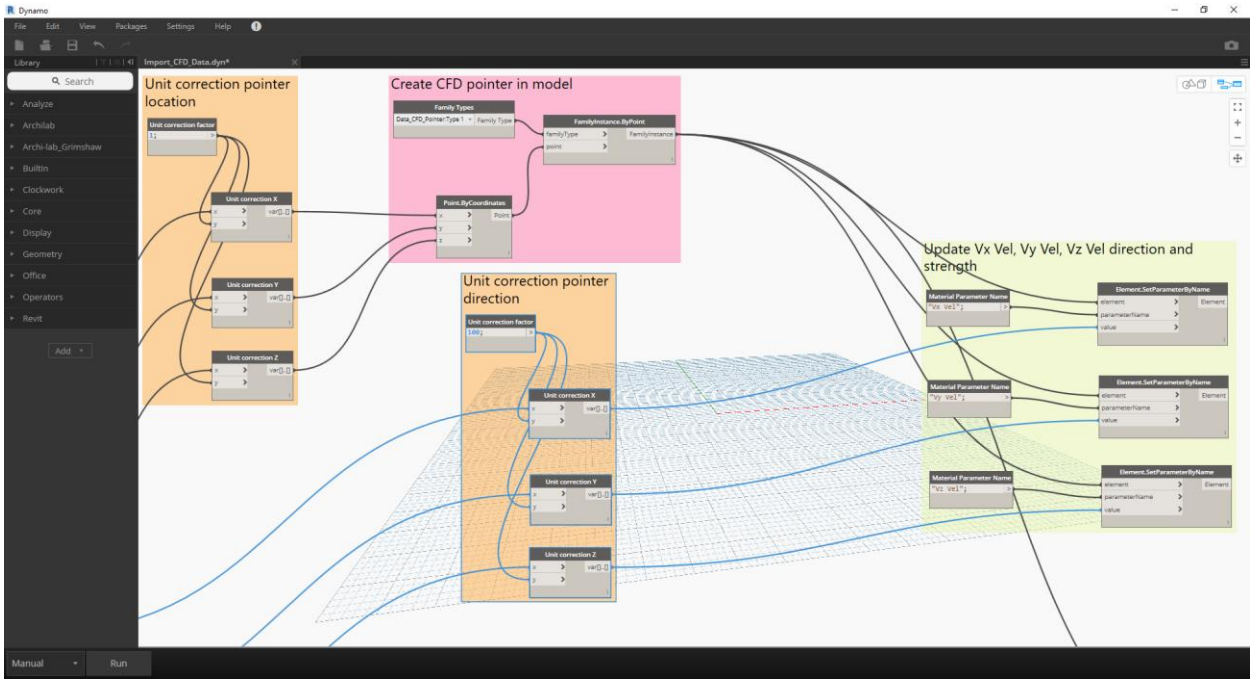
87 Review the end of the file



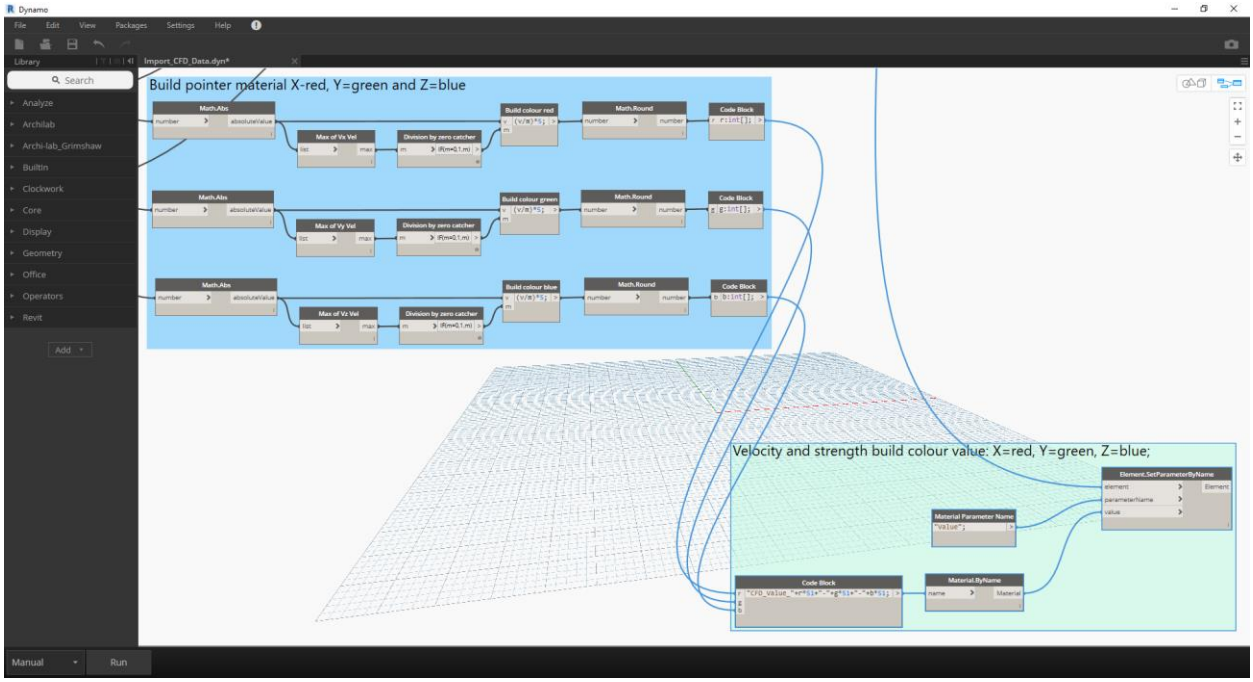
88 This is the Dynamo script, which will create pointers with values as colour in Revit



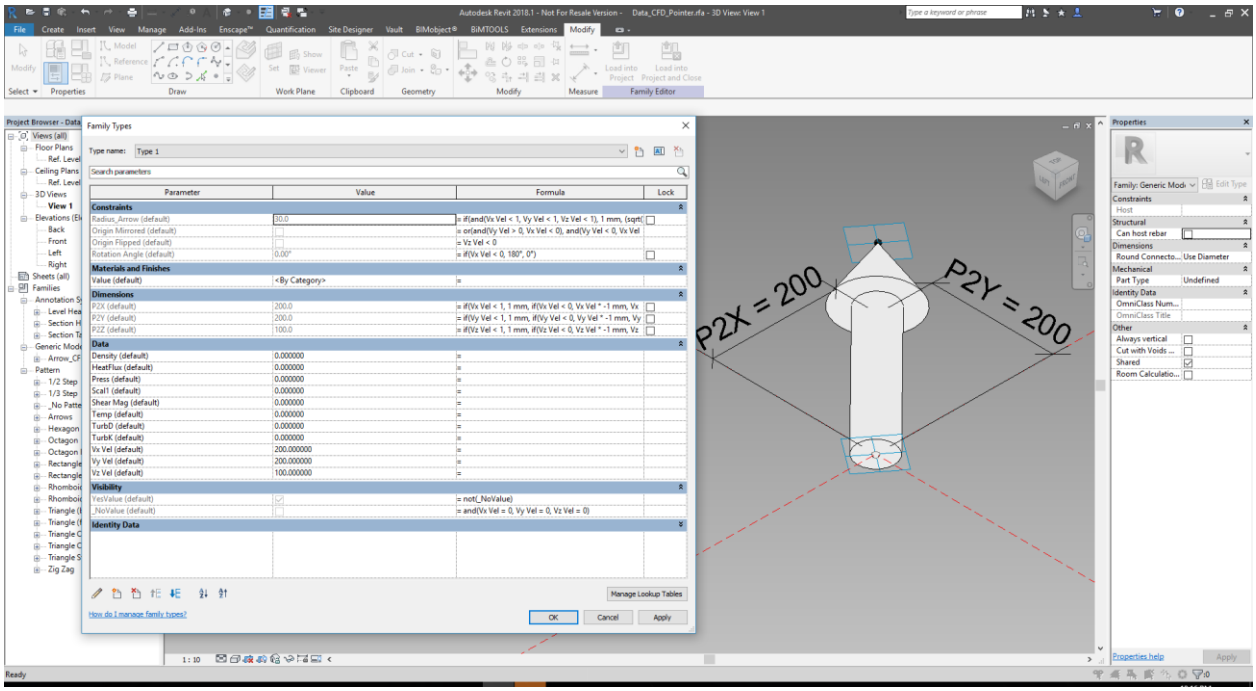
89 The first part will read the Excel data and slice the list



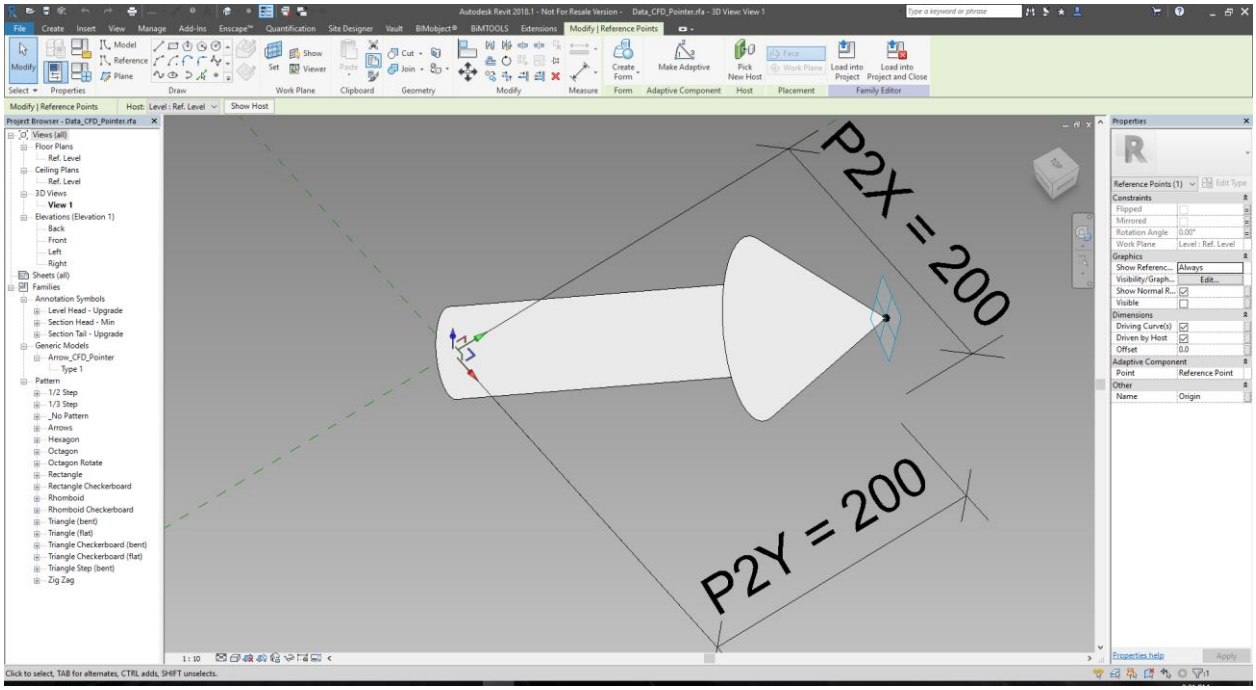
90 Create the pointer and orient it



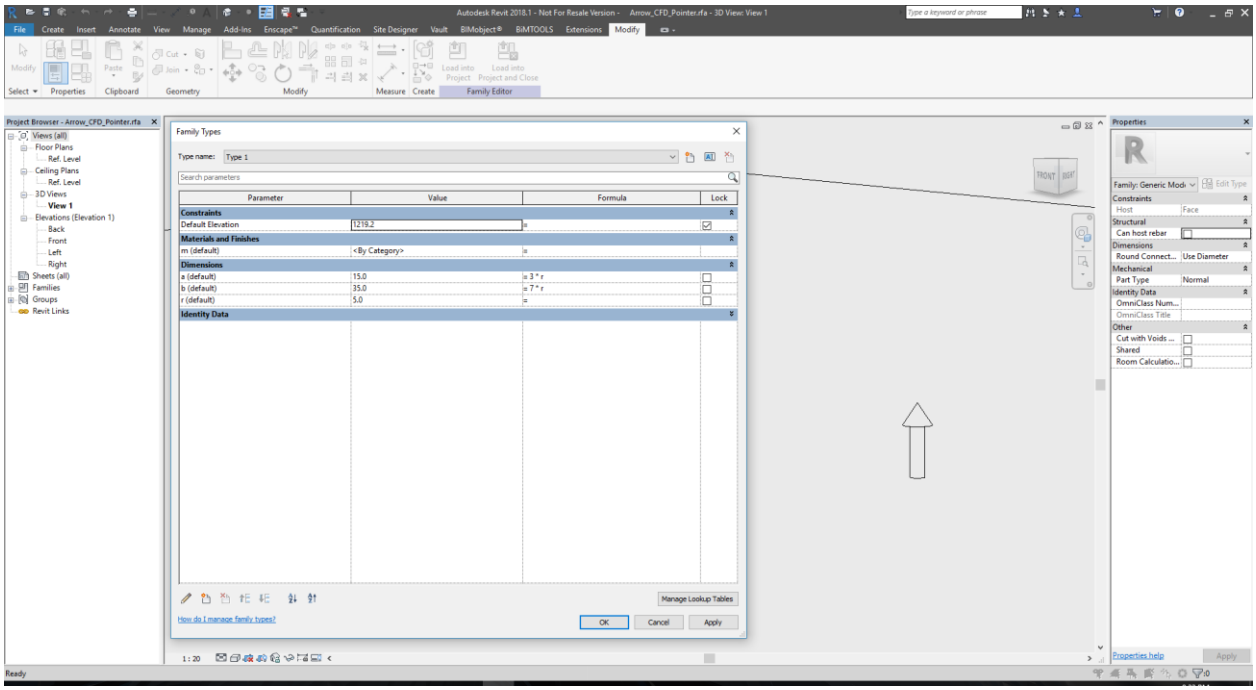
91 Grab the velocity value and build a material code to assign it to the arrow



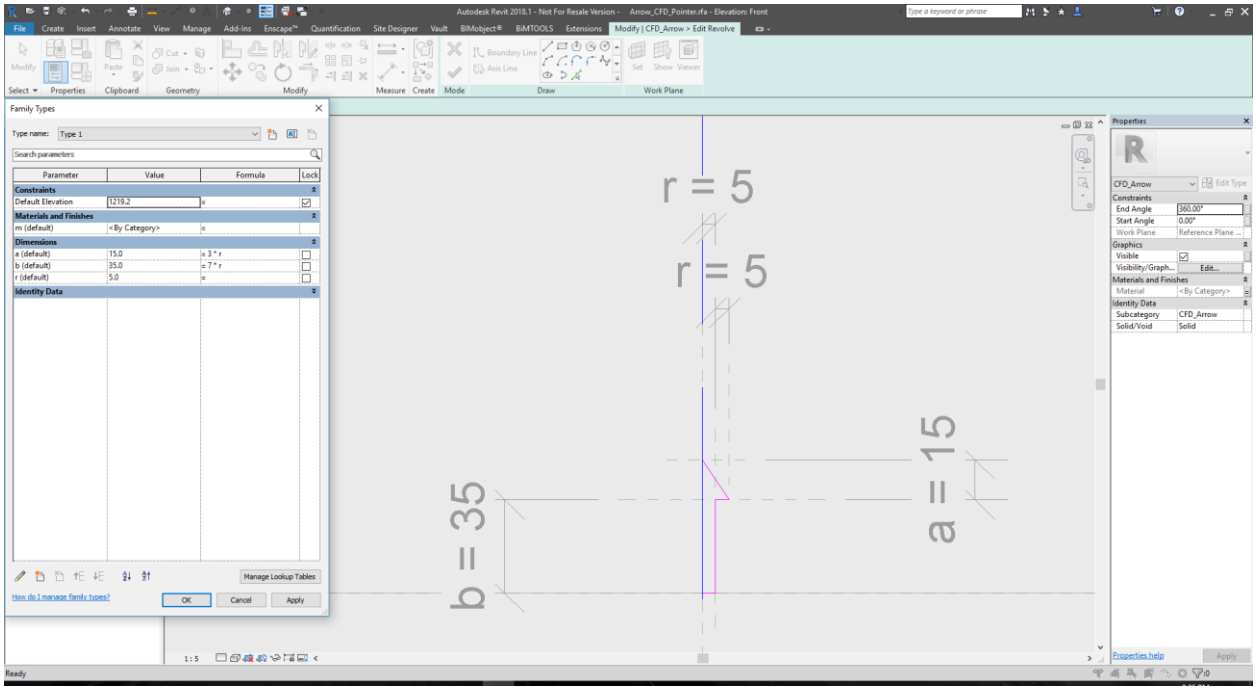
92 This is the data family and its parameter



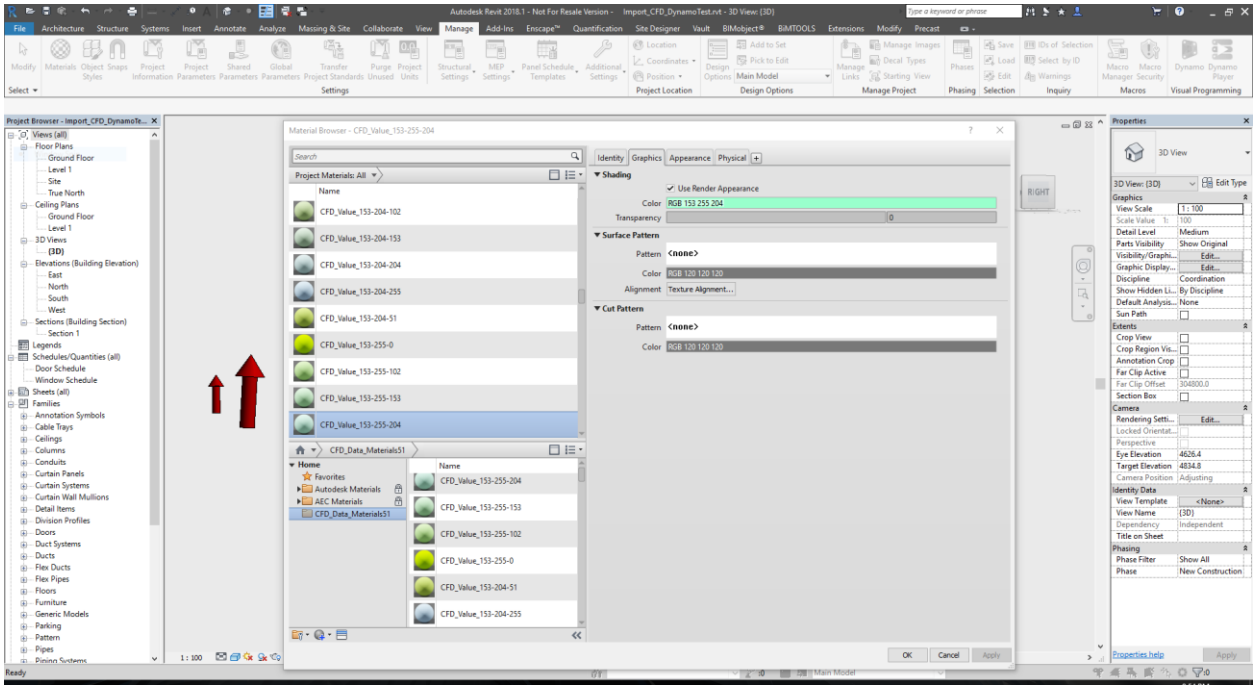
93 the parameters are set from the origin and linked to the nested family



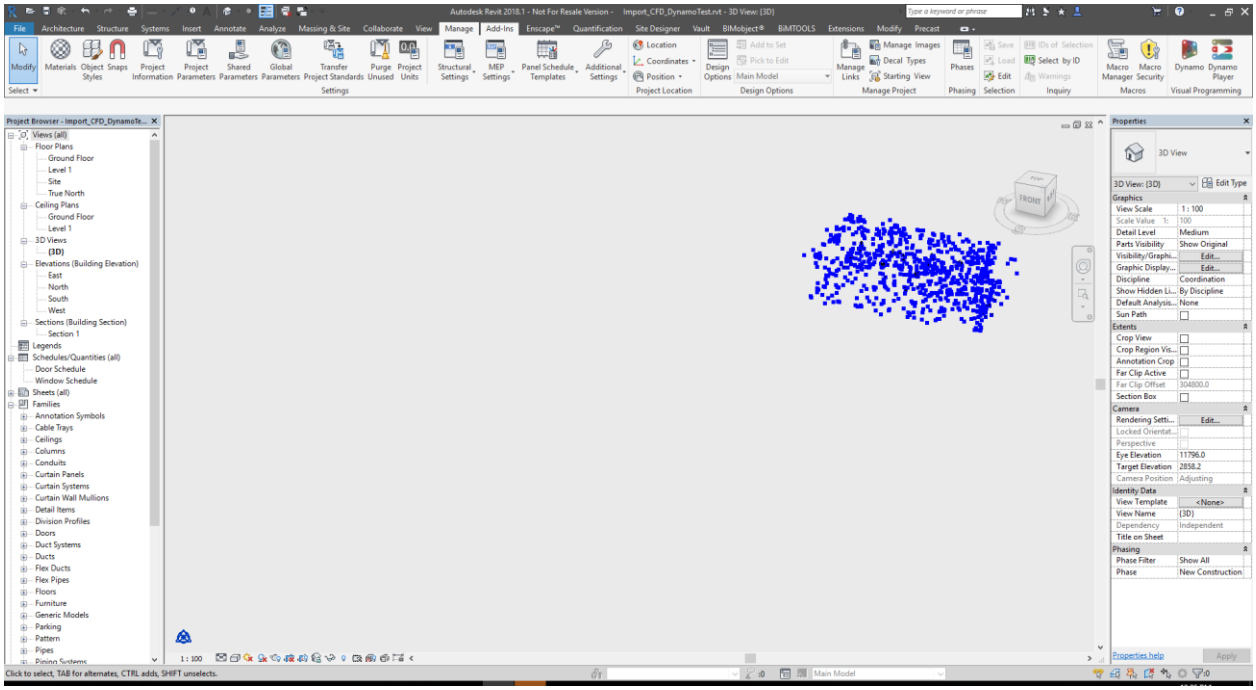
94 Setup the arrow family



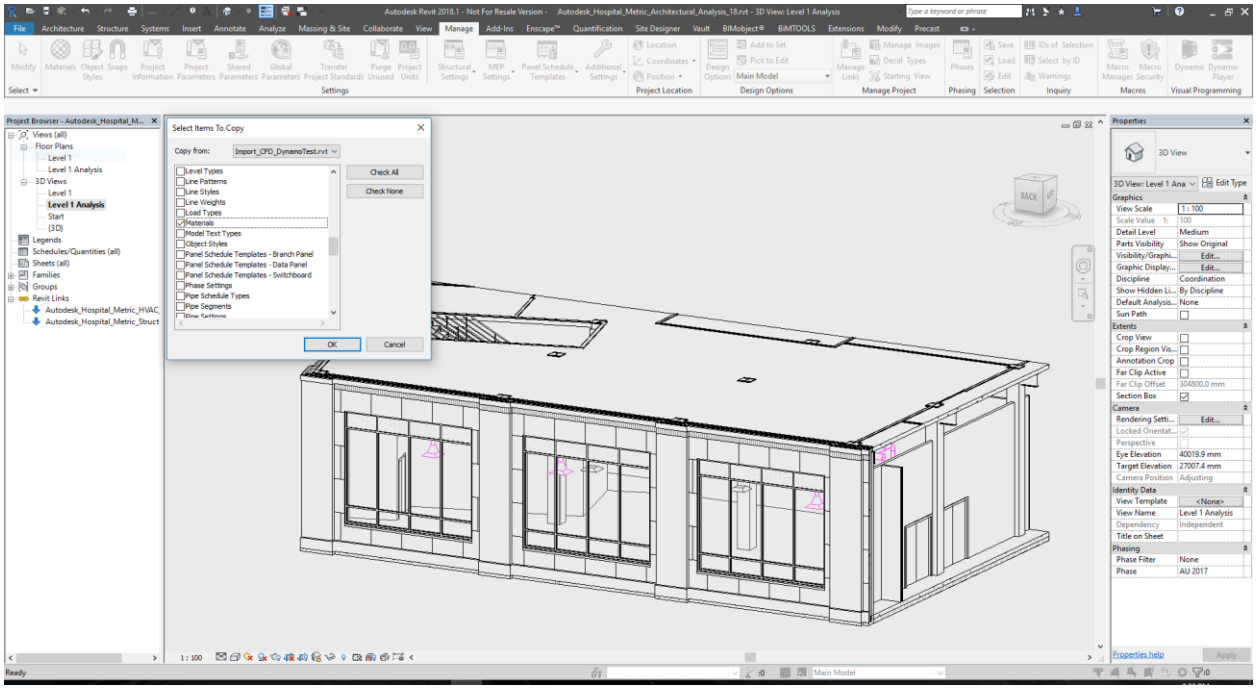
95 Edit and revolve the sketch



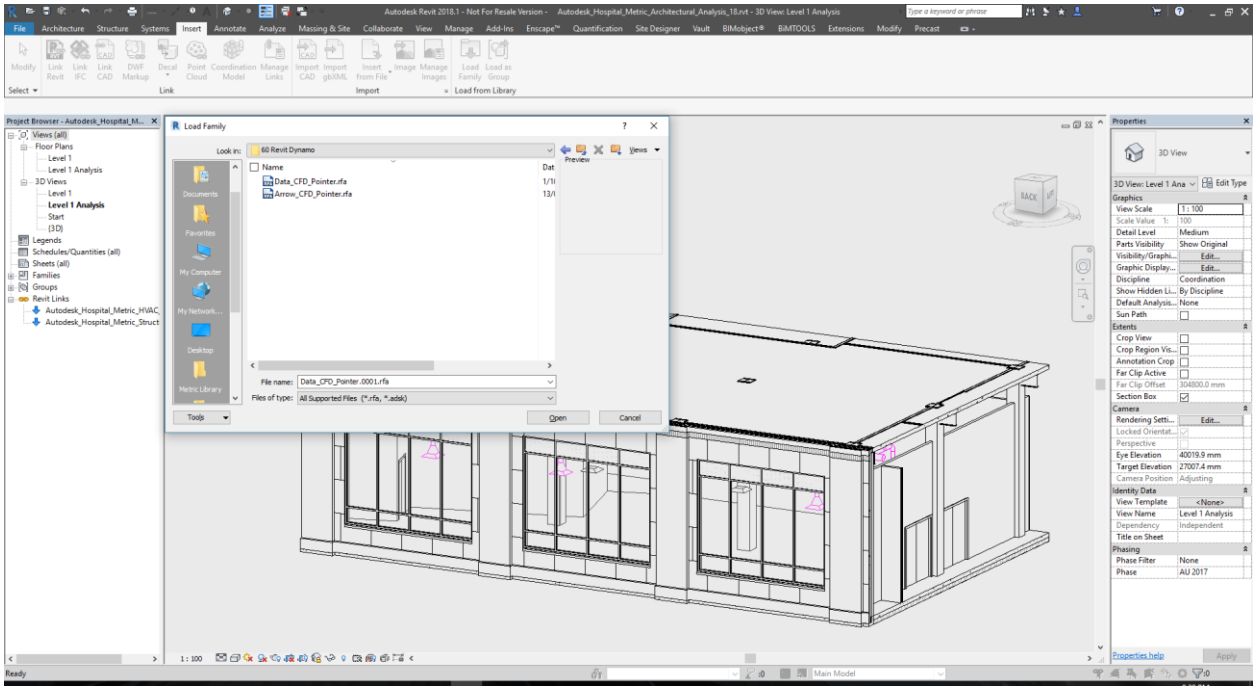
96 The material library has already been created



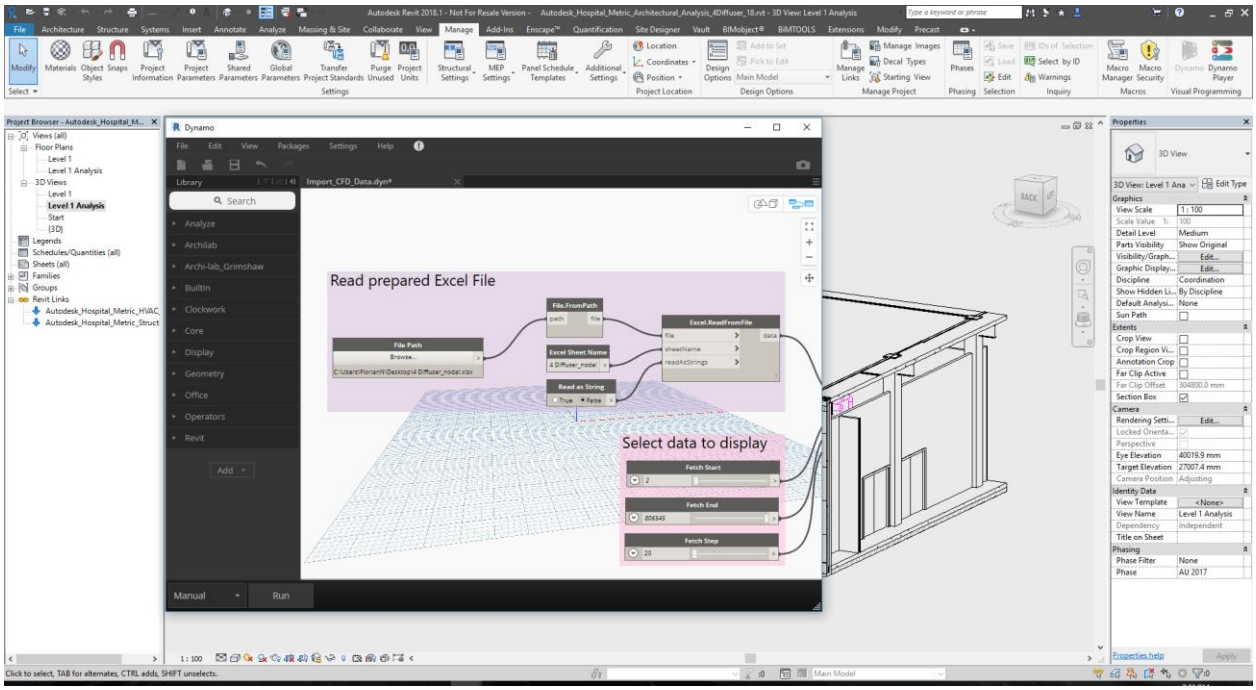
97 Test the creation of the arrow for only a few samples



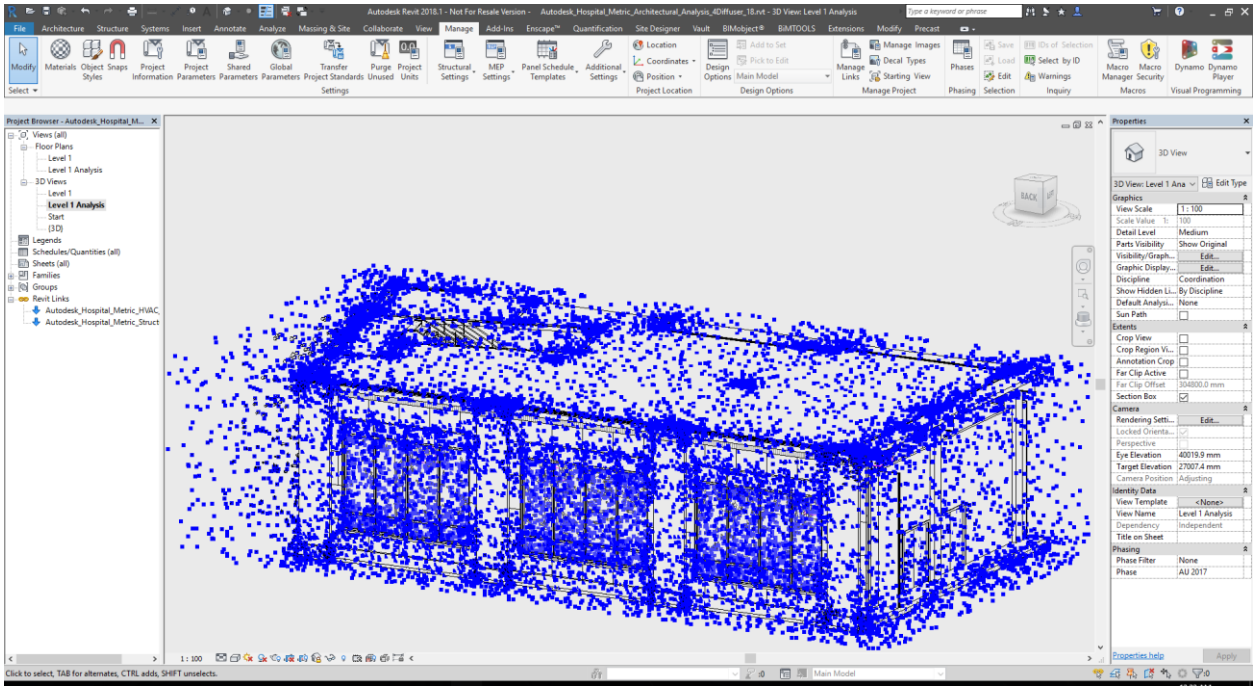
98 We can transfer the materials into our real project



99 Load the arrow family



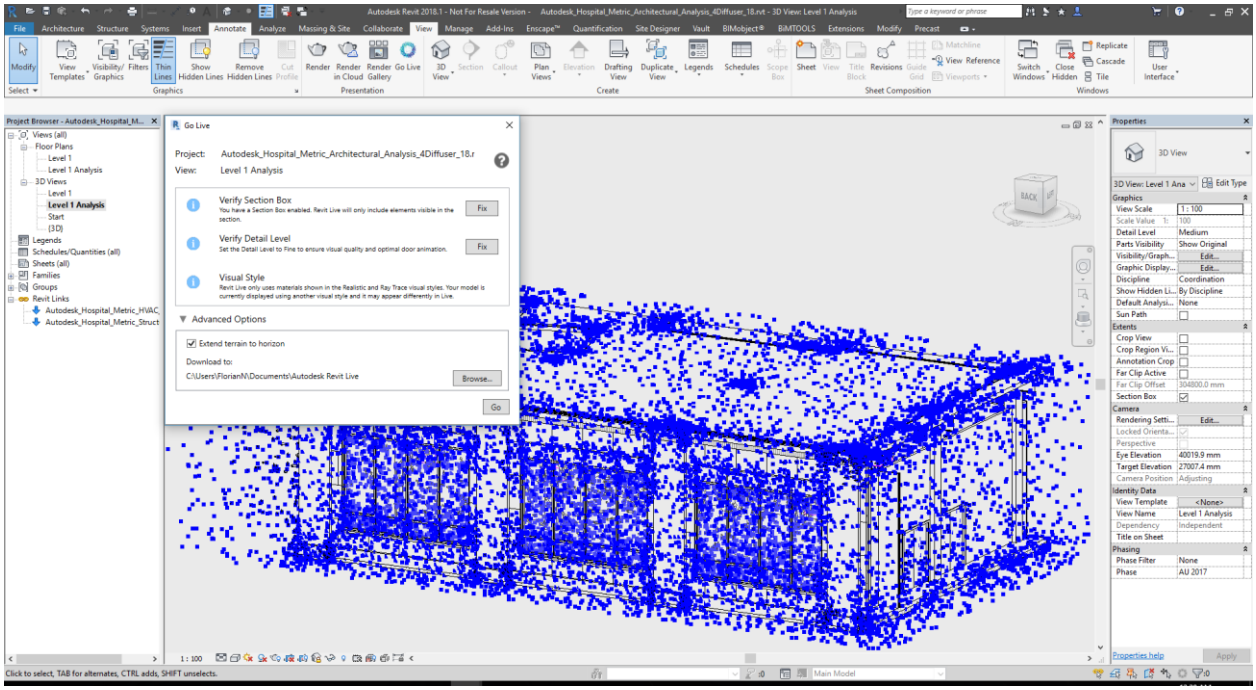
100 Run the Dynamo script with the full data extend, this might take a very long while (10h?)



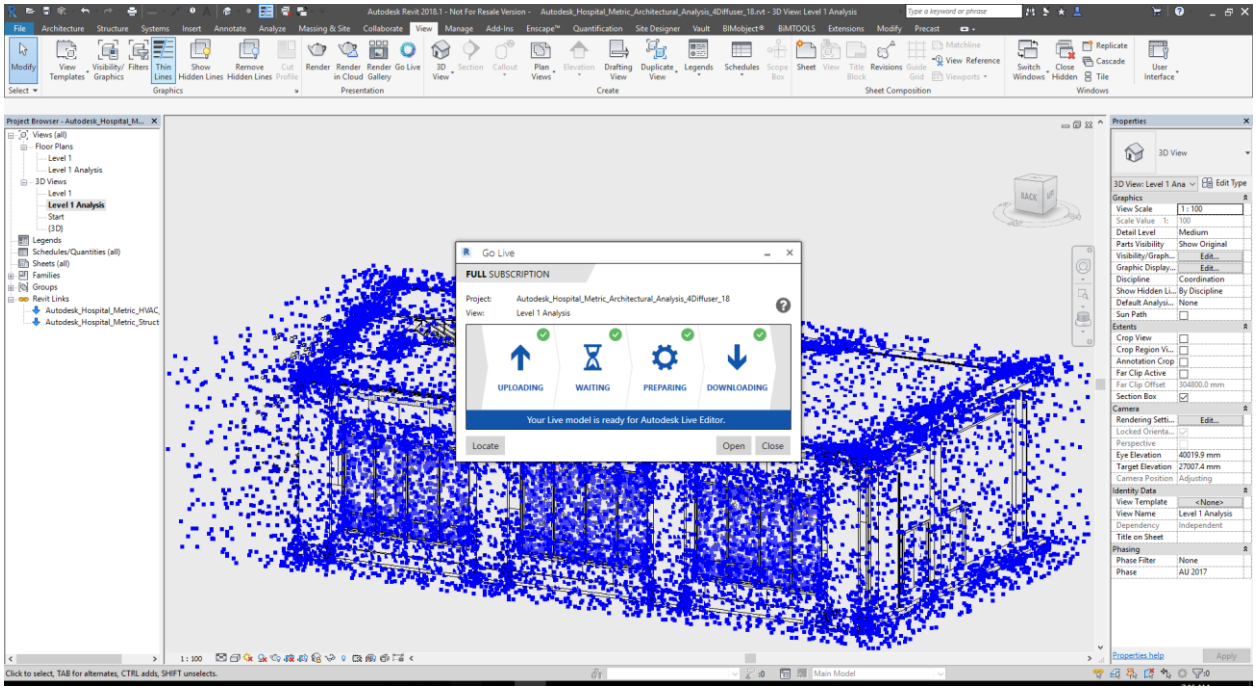
101 Inspect the results

Presenting the results with Revit Live

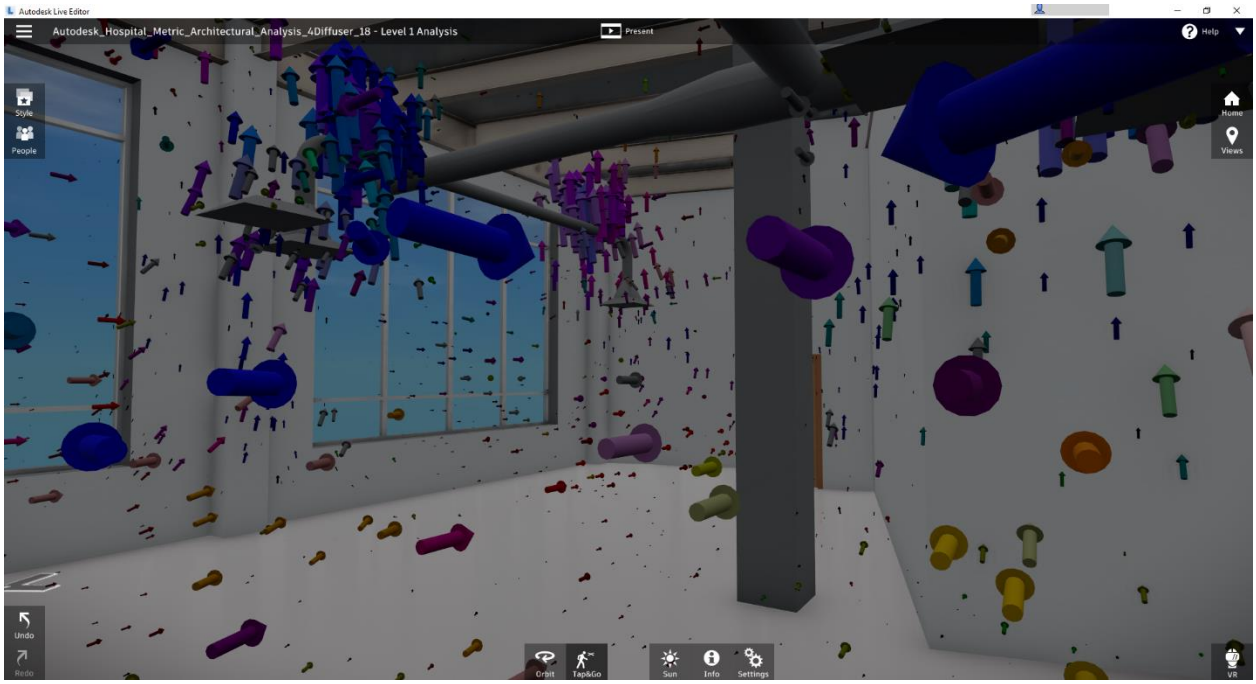
Find the example files in: 70 Revit Live
Find the screenshots in: 75 Screenshots



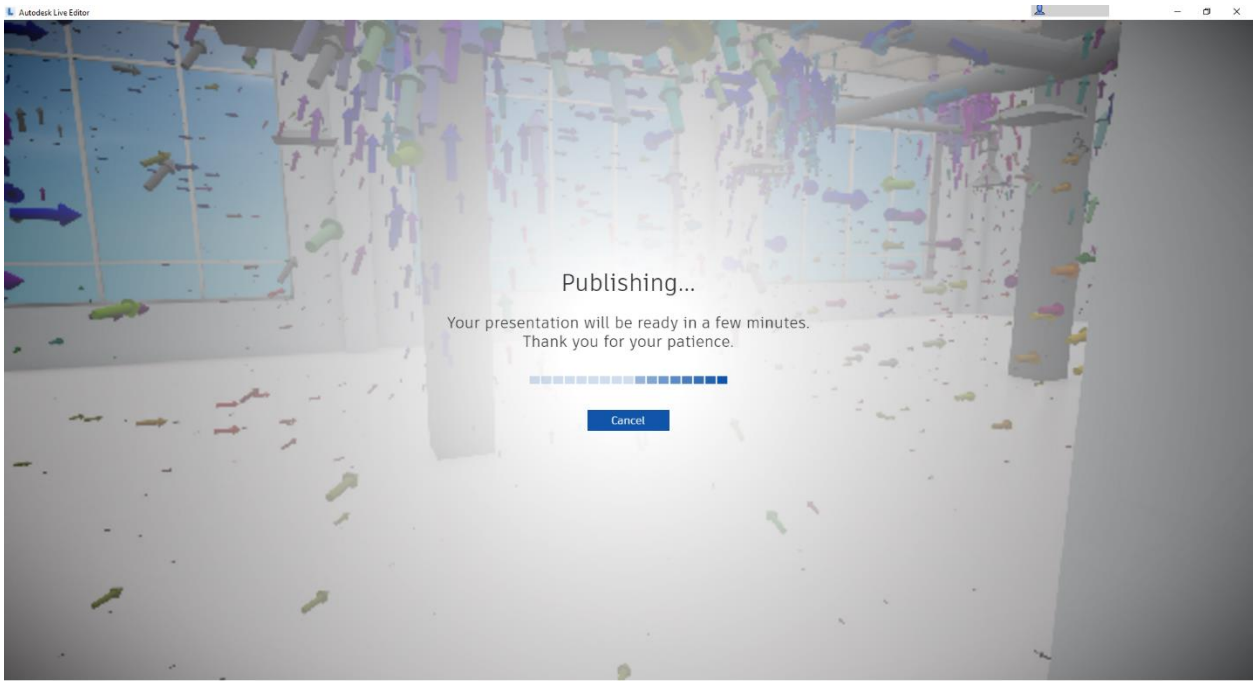
102 Upload the file to Revit Live



103 Wait till the model has been converted



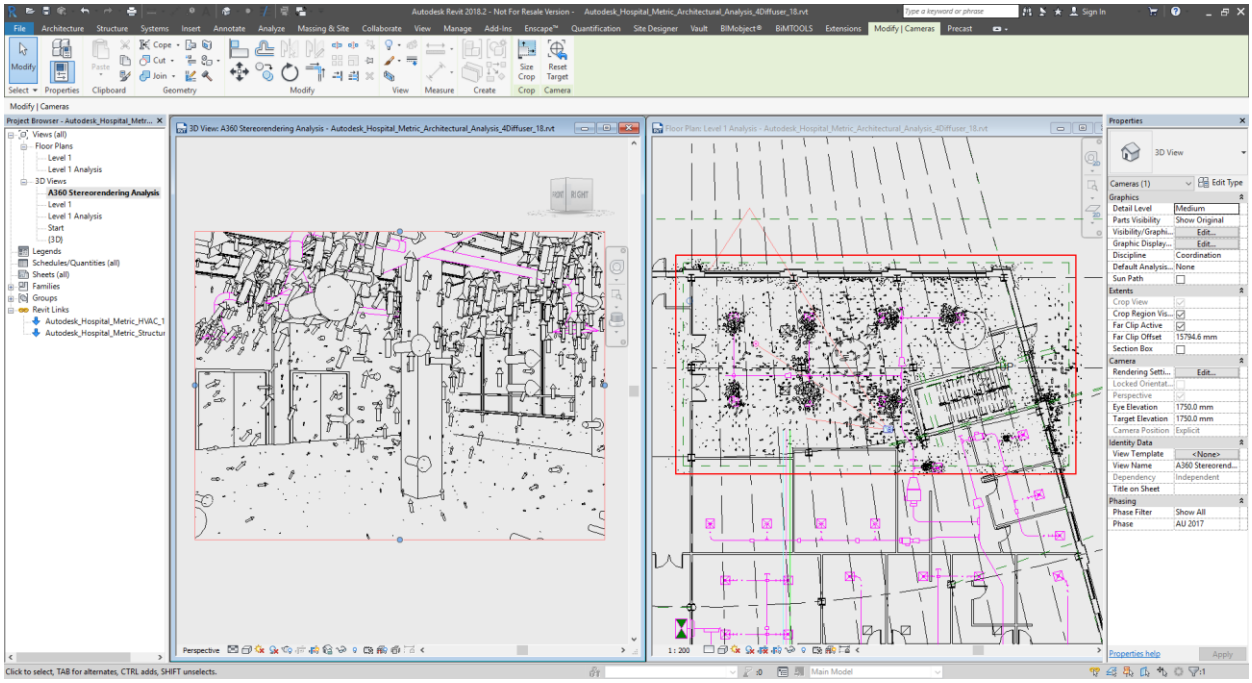
104 Open the model in Revit Live



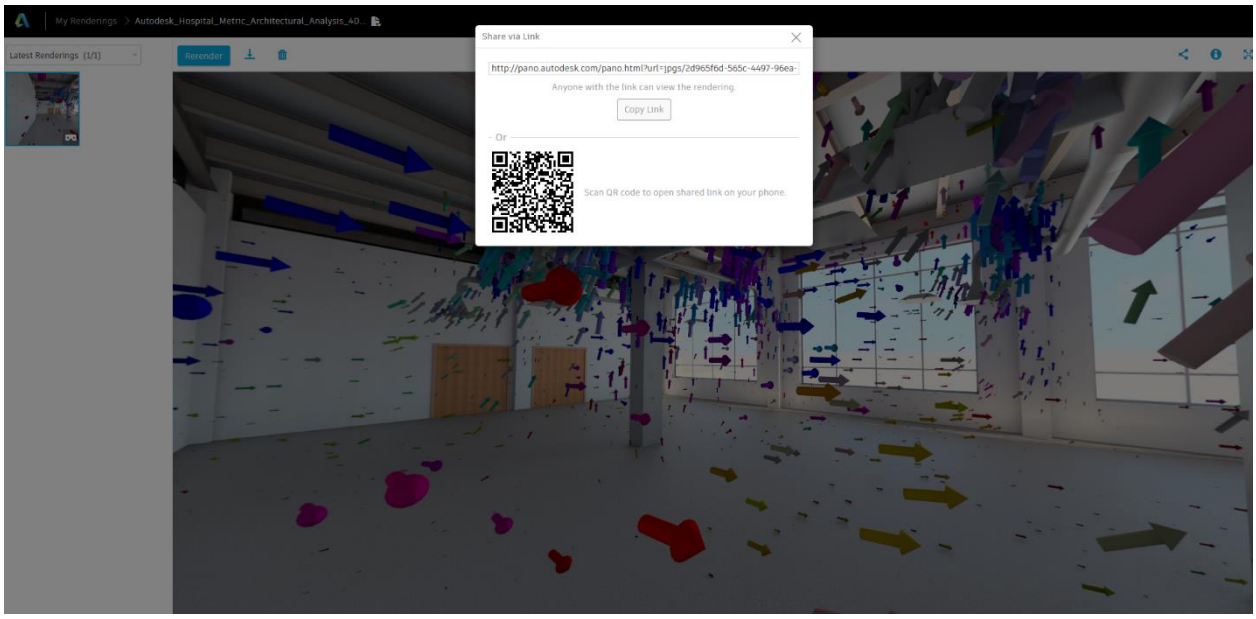
105 Publish it to Windows or other platforms

Using A360 as mobile VR solution

Find the example files in: 80 A360 Stereo Panorama
Find the screenshots in: 85 Screenshots



106 Setup a camera



107 Render the camera as a Stereo Panorama Rendering with A360