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Unity'ed We Stand with Revit and BIM 360

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Learning Objectives

Learning Objective 1

Learn how to plan and create optimum workflows to connect, organize, and optimize Revit projects using a Unity'ed platform

Learning Objective 2

Learn how to proactively build interactive AEC models with smooth BIM data imports

Learning Objective 3

Learn how to quickly assemble VR visualization experiences for coordination and presentation

Learning Objective 4

Learn how to assemble immersive and interactive VR visualization experiences at any stage of the project

Description

       Importing a Revit model and all of its BIM (Building Information Modeling) data into Unity can be a difficult and time-consuming process, possibly requiring multiple plug-ins. This session will explore optimum workflows to connect, organize, and optimize Revit projects using a Unity'ed platform. The result will empower project teams to work towards proactively building interactive architecture, engineering, and construction (AEC) models with smooth BIM data imports, and quickly assemble virtual reality (VR) visualization experiences.

       When imported, some Revit data (like BIM and materials) could be lost, creating additional work. We'll talk about streamlined workflows and other possible tools that let Revit data flow smoothly into VR tools via BIM 360 software, without the use of plug-ins, in an easy and efficient fashion. This collaboration will make it much easier for AEC professionals to quickly assemble VR visualization experiences, such as immersive and interactive walk-throughs and lifelike models, at any stage of a project. In addition, we will discuss some other 'helper' tools that can enhance and customize the process and products per project requirements.

Note - Please see the **Resources** document in the **Dataset** for more helpful information.

Speakers-

RIna Sahay

Rina is an Autodesk Expert Elite Community member, a Revit Certified Professional, and an Architectural Technician with Paradigm Design. Grand Rapids, Michigan. In addition to production of construction documents for a variety of entertainment, retail and commercial projects, she shares responsibility for creating and maintaining BIM standards; project support and troubleshooting; and training and onboarding of employees.

Other hats that she wears outside of her responsibilities at Paradigm - she mentors on the Autodesk Revit Forum and Directly.com; teaches Revit and Architecture at Kalamazoo Valley Community College; judges the Skills USA State Architectural Drafting competition; is a Revit Subject Matter Expert; and serves as the Chair of the Kent Career Technical Center Advisory Board.

Viveka Devadas

Viveka is a Premium Support Specialist for AEC products and Generative Design-BIM at Autodesk. She helps in troubleshooting customer issues with AEC applications, networks with the global Autodesk team, and the Revit community worldwide through Autodesk's social media accounts and interacts and the Autodesk Revit forums.

With a background in Digital Architectural Design and Construction Management, she has 9+ years of experience in the AEC industry as an EU exchange Scholar, Design Architect, BIM Manager, and Social Media Coordinator. She is passionate about the VR/AR technology and explores design challenges that are environment-friendly and cost-effective while analyzing how we connect with people, information, and experiences.

Case Study

Have you ever been riveted by a finished project at work and been inspired to think of how it could have been presented with the latest tools available at our disposal?

The inspiration for this presentation was a Paradigm Design project that was under construction when I started there, I remember looking over my team-mates' shoulders at the model on their monitors and thinking - "That's a really pretty building!". That is what set the wheels turning, inspired us to re-examine the Moviehouse project to see how it can be presented using Revit, BIM360, and Unity.

The Inspiration

The original project challenge was to develop a movie theater and retail tenant building to complement the character of downtown Holland's Eighth Street. The main tenant was a movie theater, with a first floor Restaurant Tenant and smaller Retail Tenant spaces.

The main tenant required the creation of a downtown "boutique" theater, with 7 or 8 screens and 500 luxury seats, uniquely different from large movie theater chains.

Our Objective - Unite 'em ALL!

The desired objective of this exercise was

- to explore an **updated toolbox** and rethink the presentation of this project through the creation of an immersive and informative VR experience that knits in 3D as well as 2D deliverables to present the design effectively.

- also explore current "Best Practices" applicable at each step of the way.

Our Workflow – briefly…..

The first thing that we needed to understand while creating VR with the united approach of Revit, BIM360, and Unity, was this series of objectives that that progress towards the desired outcome –

Immerse

Unite

Collaborate
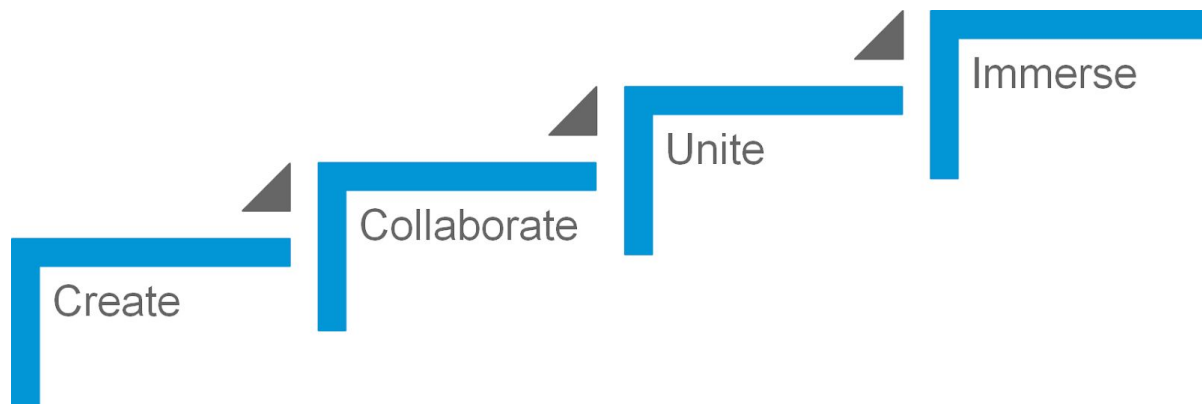
Create

Step 1 - Create

To start with -

1. We CREATED the Revit model

   a. We took the original project model (kind courtesy - Paradigm Design), **cleaned it** up to ensure that the model was fit for VR, healthy and nimble -

      - Optimized model for VR - addressed 'bloat' - irrelevant elements, views that are not being rendered

   Sections, 3D views are ruinous of software resources available to the model

We determined the path we wanted the VR tour to take, removed any elements not a part of the VR experience.

This operation reduced the information in the model, optimized the resources required.

- Screened for redundancy -
  Manage >> Purge Unused

- Converted any in-place models to Revit families

These add to the model's 'burden' and the resources required to render it successfully

b. Addressed **model health**

We screened the model for causes and signs of corruption -

- Screened for corrupt families
  - Red flags -
    Constraint errors
    Inability to edit or save the family
    Identify any 'third party' elements

To address signs of family corruption –

A clean version of the family will need to be audited, updated and saved to the Revit version that the project is in and reloaded to the project.`

Another approach is to open the family in a blank vanilla template to scan for errors in modeling and parameters

c. Removed any imported / exploded DWGs

- To see them –
  Object Styles >> Imported Objects
- To get rid of them –
  Manage >> Purge Unused

*This will allow you to remove the errant DWGs in their entirety. But sometimes, you may not be able to catch all the corruption from imports – **in which case, you would need to try the next step.***

d. Screened for other symptoms of corruption -

- IMPORT **line patterns** are a symptom of imported DWG files.

Sometimes even a directly linked DWG will bring them in.

- How do I find them?
  Manage>>Additional Settings>>Line Patterns

- **Solution –** Deleting each line pattern can be exhausting - they can run into the 100s! A Dynamo script will clean them out.

- **SecretInternal Arrowheads and Dimensions** are also a symptom of imported DWG files.
Sometimes even a directly linked DWG will bring them in.
  - How do I find them?
    Manage>>Additional Settings>>Arrowheads
  - **Solution –** Deleting each arrowhead style can be very time consuming - they can also run into the 100s! A Dynamo script will clean them out.

*Some **helpful tools** that were considered and used during our process –*
- *PyRevit – Family Quick Check tool*
- *Family Size Reporter*
- *Imaginit Utilities DWG Check tool*
- *Ideate Apps*
- *RushForth Tools*

We decided to explore the creation of a VR deliverable that would showcase the context within which the model is placed, and create context, to make the deliverable compelling

Infraworks was the tool of choice to help convey the 'big picture' of the appearance of the building on the site.

To generate the geographic location -

- Create a 3D view of the Revit model specifically for import to Infraworks
- Open Infraworks. Click on Model Builder. Enter the desired address.
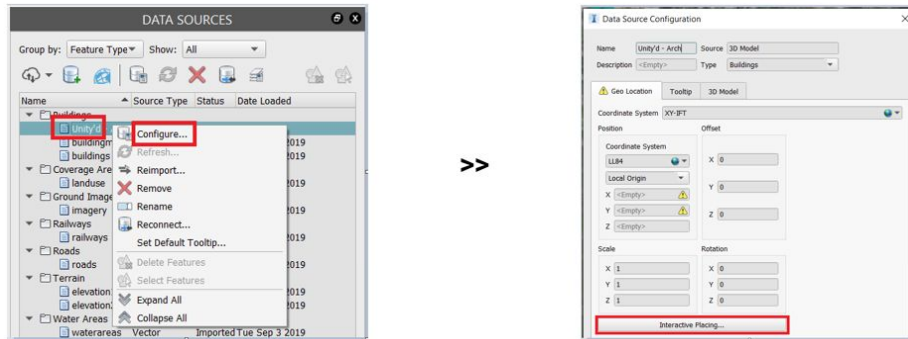- Import Revit model into the Infraworks model.

Workflow Options to import the model –

- **Option A -** Directly import a Revit model into Infraworks

I

 >> Data Sources >>
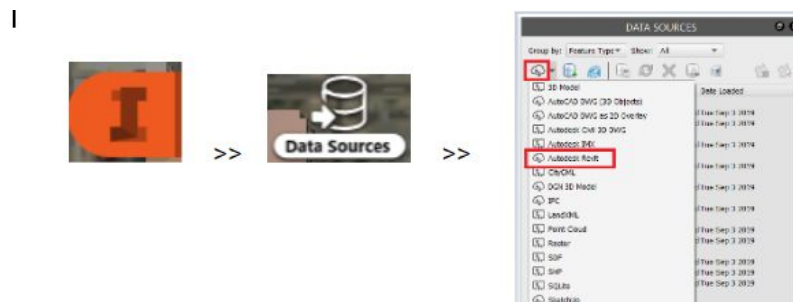
Since this is an older project, the Revit model is not geolocated. The Interactive Placing tool allows us to place the model where we need it to be.

However, Option A will bring in the entire model, which is definitely not what we wanted.

● For our deliverable, we opted for **Option B** –

  i.   Create a 3D view in the Revit Model
  ii. Isolate the Exterior worksets
  iii. Export to the FBX format.
  iv. Bring it into the Infraworks model
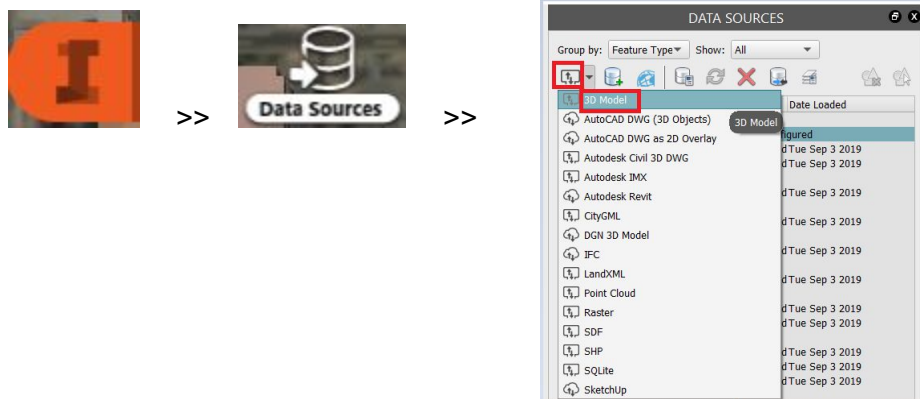
Don't forget to Configure the import! The FBX can then be placed in the desired location using Interactive Placing, as was in Option A

The end result of this process was the model being placed and viewed in the actual context in Holland, Michigan.
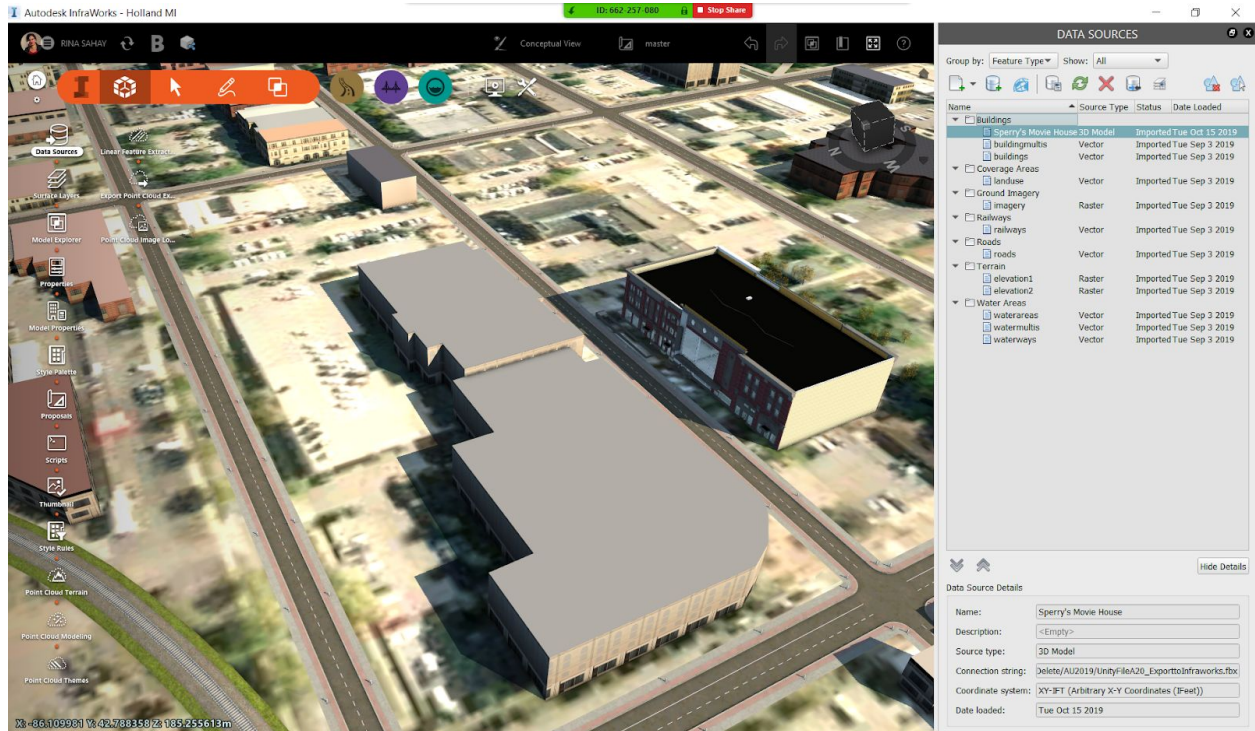
Step 2 - Collaborate -

Viveka lives in Boston, Rina lives in Michigan. A vehicle that would allow real time collaboration over this distance was BIM360.

A. Cloud based collaboration of workshared model

    a. BIM360 issue – for a model larger than 1GB - worksets need to be closed / purged

This is a general best practice to improve model performance.

    b. Create BIM360 project

    c. Invite collaborators

B. **Set up folders** to organize documents for worksharing
Information saved in BIM360 is not just confined to Revit.

B AUTODESK®
BIM 360° DESIGN

+ **Revit Cloud Worksharing**
  + With Next-gen BIM 360 platform
  + With BIM 360 Team as you have been doing with Collaboration for Revit in Revit 2018.3 and earlier
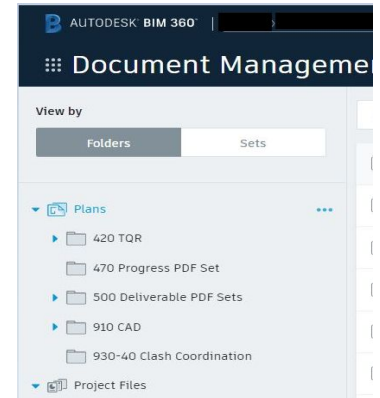
+ **Design Collaboration**
  Next-gen BIM 360 module

+ **Document Management**
  Next-gen BIM 360 module

+ **Desktop Connector**
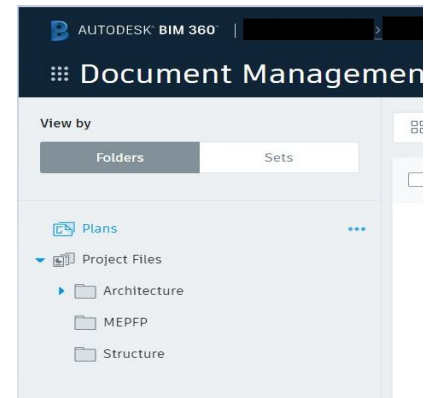 Service connecting cloud to desktop

In addition to our workshared Revit model we have stored our
   Infraworks site model
   Powerpoint,
   Word documentation

Some organizational strategies -
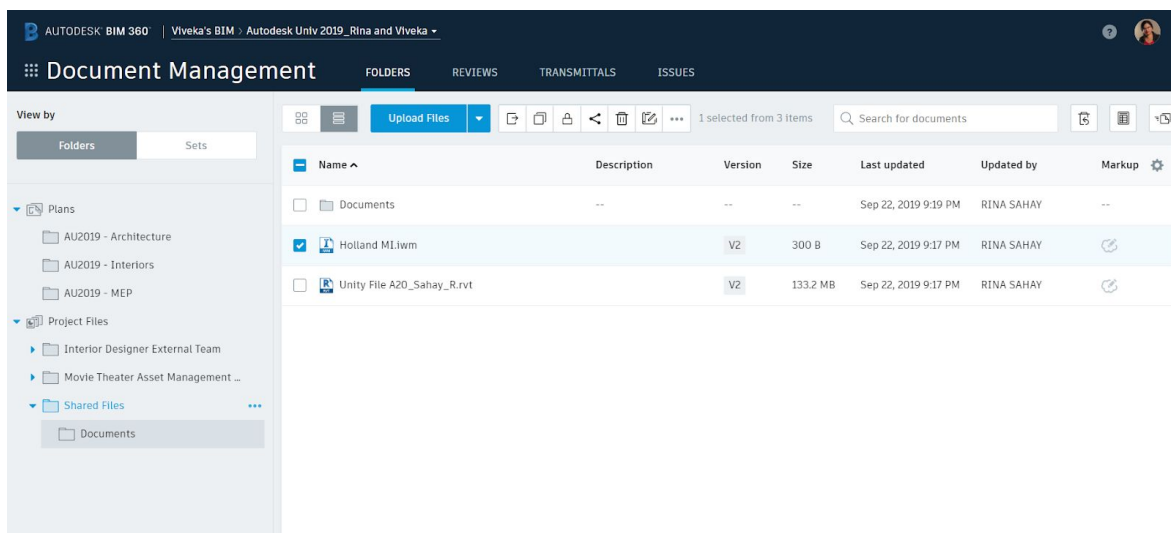
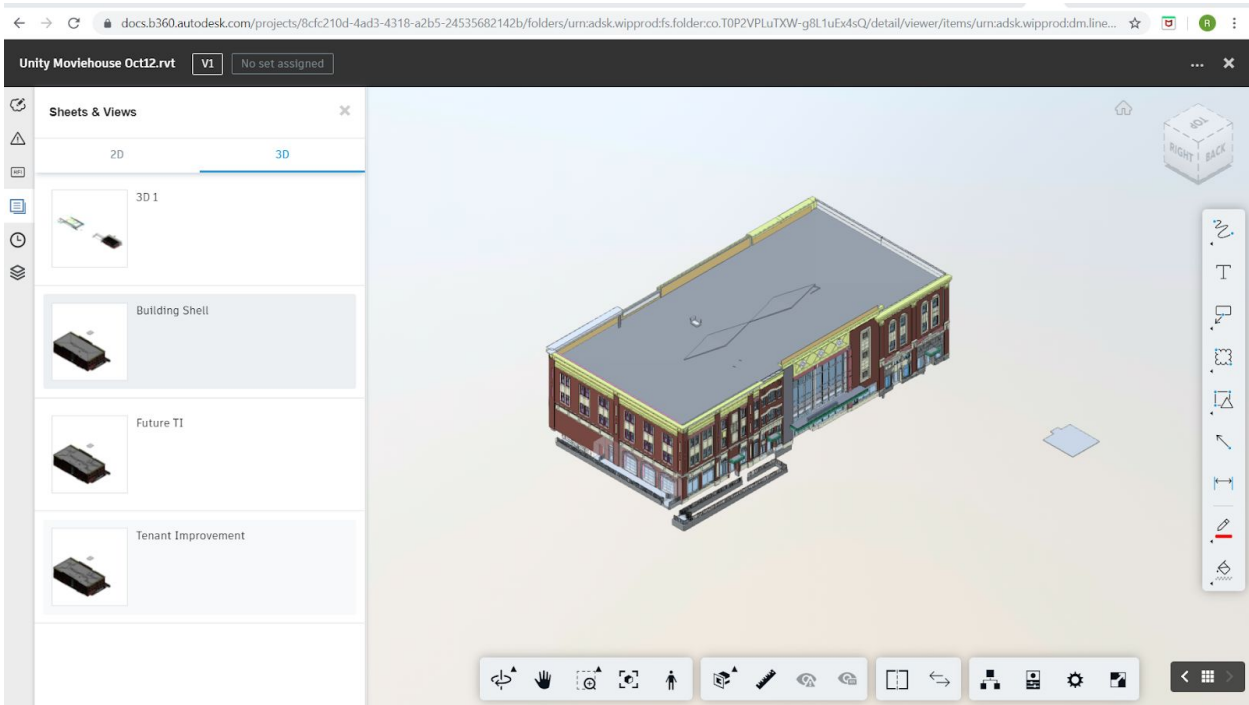   i.   Workshared folders saved under Project Files

   ii. Workshared folders saved under the Plans
        folder

The option preferred by us was to keep our Shared Files in the Shared Files folder

    b. Invite collaborators
        i. All collaborators must have a BIM360 license
        ii. The designated Project Manager can choose and assign the level of sharing and editing permissions to multiple stakeholders

Step 3 - Unite –

Now that we had our model optimized, in the cloud, and ready for VR, the next step was to bring it into Unity to process our VR deliverables.

The next question was - what purpose is the VR vehicle being created for? Are we thinking for of Design Coordination and Review, or for client presentation? The answer to this question led us to explore the use of a different tool

**<u>Workflow – VR for Design Coordination -</u>**

One of the tools that we explored was Insite VR.

Helpful features of the plug-in-
　　　One click integration with the Revit model directly in BIM360
Interactive stakeholder participation using Oculus Quest
　　　Ability to measure, markup the model by participants
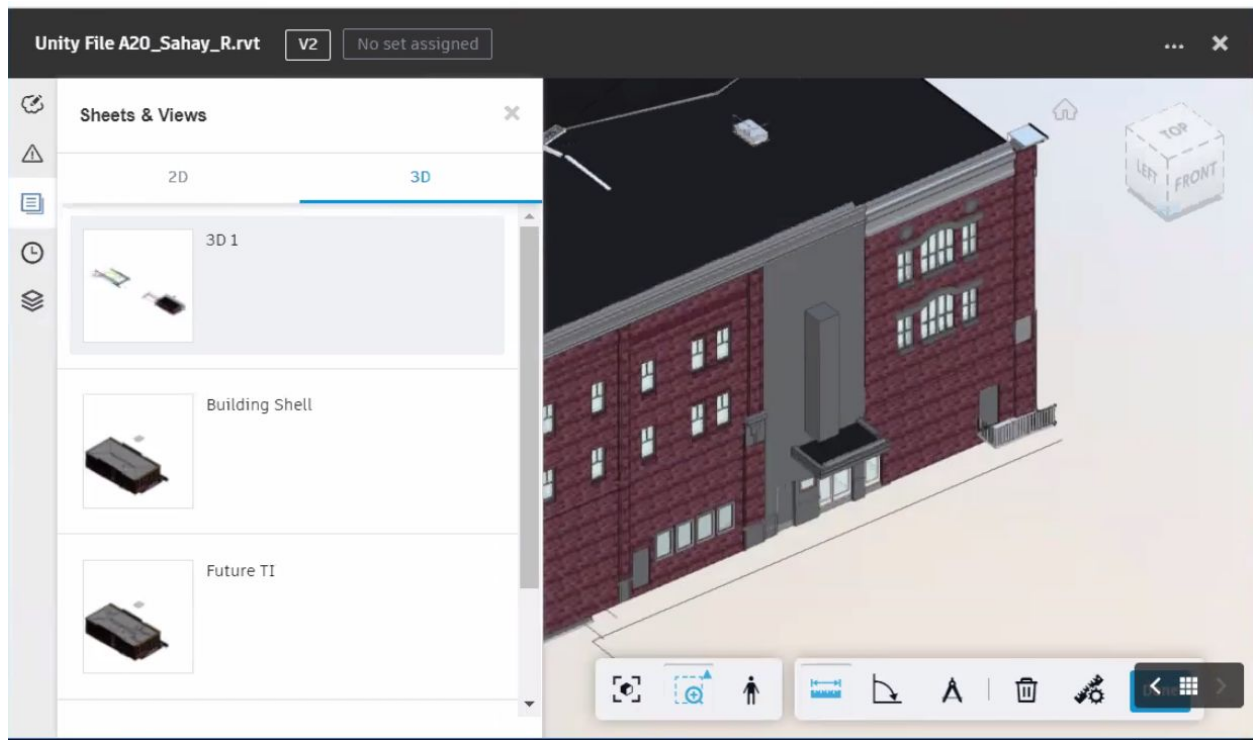　　　Ability for clash detection

Once a project has been created, stakeholders equipped with a head mounted device can be invited to participate. This includes real life measurement, markups of the drawings.
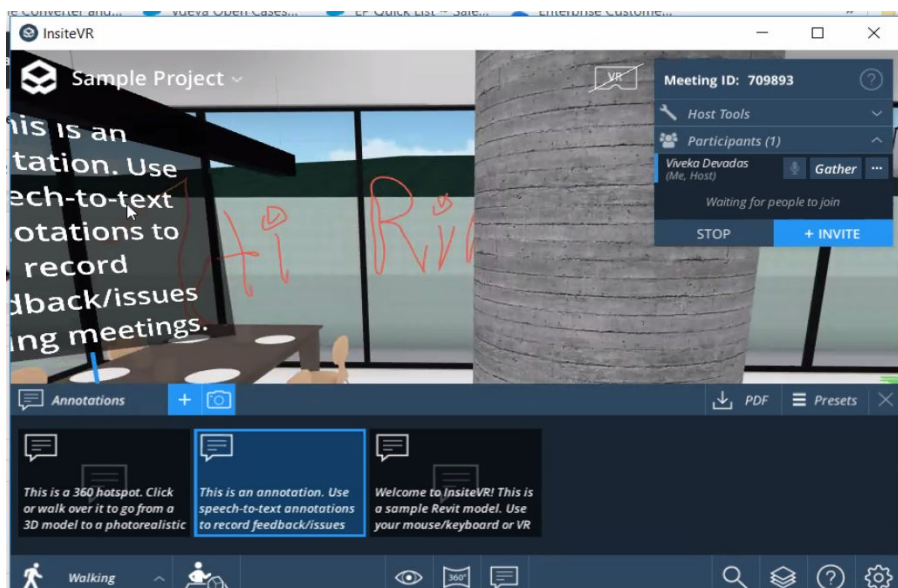
The Insite VR interface as viewed in our project in BIM360

Workflow for client presentation - the preferred workflow that we arrived at was to take the model from Revit to 3D Max to Unity

Step 1 - Revit to 3DS Max -

Import the Revit model to 3ds Max 2019 by .fbx-file export or import the Revit file into 3ds Max 2019.

    A. In Revit, open a 3D view, and prepare it for export to the FBX by **limiting model geometry** using any or all of the measures listed below

        a. Isolate worksets that need to be rendered.
        b. Isolate objects, categories that will be a part of the rendering
        c. Use a Section Box or a Crop region
        d. Specify the required Detail Level of the view
        e. Rename, save the view

    B. Export the Revit view that was just created to the .FBX format
    C. Import the FBX file into 3ds Max, using the 3ds Max FBX add-in.
    D. Make sure that no textures are missing.
    E. If necessary copy the textures to a single folder and relink the path to it by using the Asset Tracking Window in 3ds Max.

Step 2 – In 3DS Max –

A. Ensure that the textures are right

Textures can be relinked by right-mouse click on the texture and click Set Path or Browse

B. Make sure that all materials in the scene are **Standard Materials**

C. Export the scene as an **FBX file** with the **Triangulate** and **Embed Media** settings activated

Step 3 – 3DS Max to Unity –

A. Create Assets.
The first thing for us to do was to convert our model into an Asset for Unity.

An Asset is any item used in your Project.

An Asset may come from a file created outside of Unity, such as a 3D Model, an audio file, an image, or any of the other file types that Unity supports.

Some Asset types can be created in Unity, such as a Mesh, an Animator Controller, an   Audio Mixer, or a Render Texture.

B. Types of Assets -
- Image files (BMP, TIF, TGA, JPG, and PSD)
- Model files (FBX) - from any application that supports the FBX format
- Materials and Textures – can be extracted, or left embedded in the model.
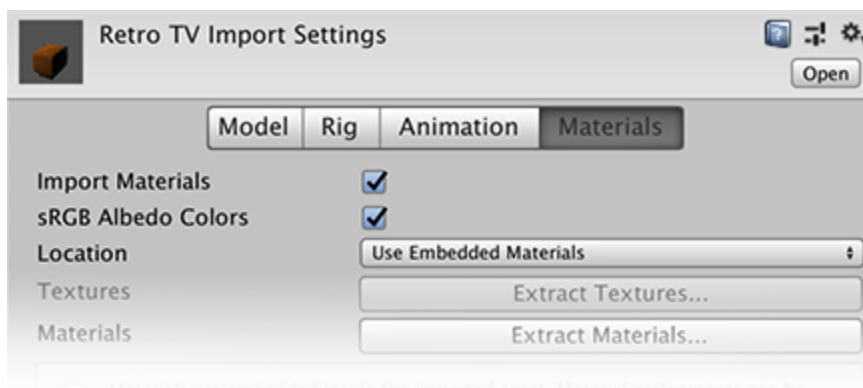
■ Animations – *Revit's Walkthrough tools are primitive, at best.* Bringing the model into Unity seemed to be a better opportunity to create a good quality walkthrough. So we chose not to create a Walkthrough in Revit.

A 3D Model can represent a building, or a piece of furniture. In these cases, Unity will create multiple Assets from a single model file. In the Project window, the main imported object is always a model.

○ Creating assets - There are two ways to import Models into Unity:

■ Drag the Model file from your file browser straight into the Unity Project window.
■ Copy the Model file into the Project's Assets folder.
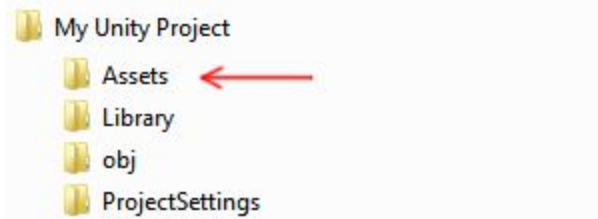
● You must store Textures in a folder called Textures, placed inside the Assets folder within your Unity Project. This enables the Unity Editor to find the Textures and connect them to the generated Materials
● In the Project, view and navigate to the Model tab in the Inspector window to configure import options
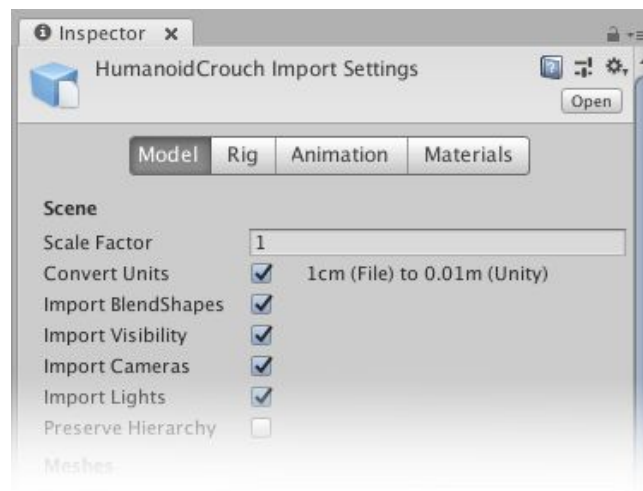
■ Unity Workflows

- **Revit** → **FBX** → **3DS Max**

- **Revit** → **3DS Max** → **Unity**

- **Infraworks** → **FBX** → **Unity**

Our workflow was to

- ○ Create a new Unity project
- ○ Copy all textures from the 3ds Max scene into the Asset folder of the new Unity project.
- ○ Copy the exported 3ds Max FBX file at the same place

Step 4 – On to VR!

To create the VR deliverables -

*Other routes from **Revit to VR***

- o ***Revit Live*** *- cloud service which turns Revit models into an immersive experience, helping architects to understand, explore, and share their designs. Only available in the Architecture, Engineering & Construction Collection upto Revit 2019*

- o ***Autodesk Cloud Rendering*** *- With cloud rendering, you can take advantage of virtually infinite computing power to quickly create photorealistic and high-resolution images. Stunning 3D Panoramas can be viewed through our Virtual Reality Panorama*

- o ***Lumion*** *- Preparatory to VR, instantly breathes life into your designs with realistic landscapes and urban context, stylish effects, and thousands of objects and materials from the content library.*

- o ***V-Ray*** *- Now with support for live geometry changes, you can render your full scene while you design and prep your model for VR.*

- o *Enscape - is a key and very popular add-in for Revit and a workflow through to VR. Real-time rendering technology your project will impress from every angle, even at different times of day.*

- o *InsiteVR - In the click of a button your model will be VR ready and synced to the InsiteVR cloud for interactive participation in design review and coordination meetings.*

- o *TwinMotion*
  Twinmotion features real-time radiosity, and includes over 600 PBR materials that react to your environment, making it easy to get the realistic look you need.

Step 5 – Immerse

Applications of immersive experiences:

- Conceptual Design
- Design Review
- Training and Simulation
- Immersive storytelling
- Remote systems control and analysis

It was important for us to understand the distinction between the different types of immersive experiences that are available

AUGMENTED REALITY
AR adds digital elements to the real world and projects them onto your line of sight. Using AR, workers can view an overlay of 3D models and project information at a job site.

VIRTUAL REALITY
VR replaces the real world with a simulated one in 3D. With VR, you can experience a simulation of a factory you've designed wearing a head mounted device (HMD) —with machines running—all before it's built.

MIXED REALITY

MR is a hybrid of virtual reality and augmented reality. Using MR, you can touch a real table and use it as an interface to manipulate a digital model.

VR App - Unity Reflect - Let us Reflect
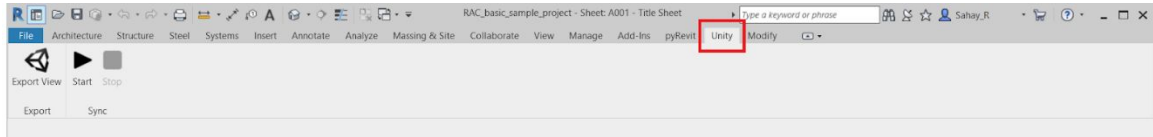
Data preparation for VR, including the creation of rendered and animated deliverables via Revit, can be painful and time consuming. Unity Reflect is a native plug in for Revit that has been created to be a simple one-click yet collaborative solution to bring information from Revit to Unity to create immersive VR and AR experiences. Offering a fluid approach to design and enhanced QA / QC capabilities, Reflect is built on top of Unity and shares its asset libraries. It creates a live link with Revit, where it sees and responds intuitively to modifications in the Revit model.

What Unity Reflect can do –
Skips the Export to FBX step from Revit
Skips any involvement with 3DS Max
Can see clashes, errors in context
AR can be aligned with the real world
Display the effects of editing the Revit model in real time
Real time review and changes by technical and non-technical audiences

Future developments -
AR viewer for Android phones and tablets is in the works
A Reflect viewer app that works standalone or on mobile device (with AR)
Mac viewer, connection to NavisWorks next year

VR Devices -

Conclusion -

At the end of the exploratory journey described above, we were able to generate VR deliverables to highlight the interior and exterior of the project. We optimized our Revit model for VR, used 3DS Max and Infraworks as intermediary steps to lose as little model data as possible, and examined available options to bring the model into VR to create compelling VR deliverables

More than just cool technologies, Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR) are changing how we design, create and experience everything from factories, buildings, automobiles, to training, learning, and entertainment.

The technology compromises of a powerful toolkit for early stage design, and an easy synthesis of building information modeling combined with visualization to create compelling architectural designs and client presentations.

AR, VR, and MR represent both a disruption and an opportunity for people who 'make' things. Using these technologies, 2D designs can be transformed into interactive, immersive digital experiences, giving immersive context to digital information - a great step up from the way that things used to be done.

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