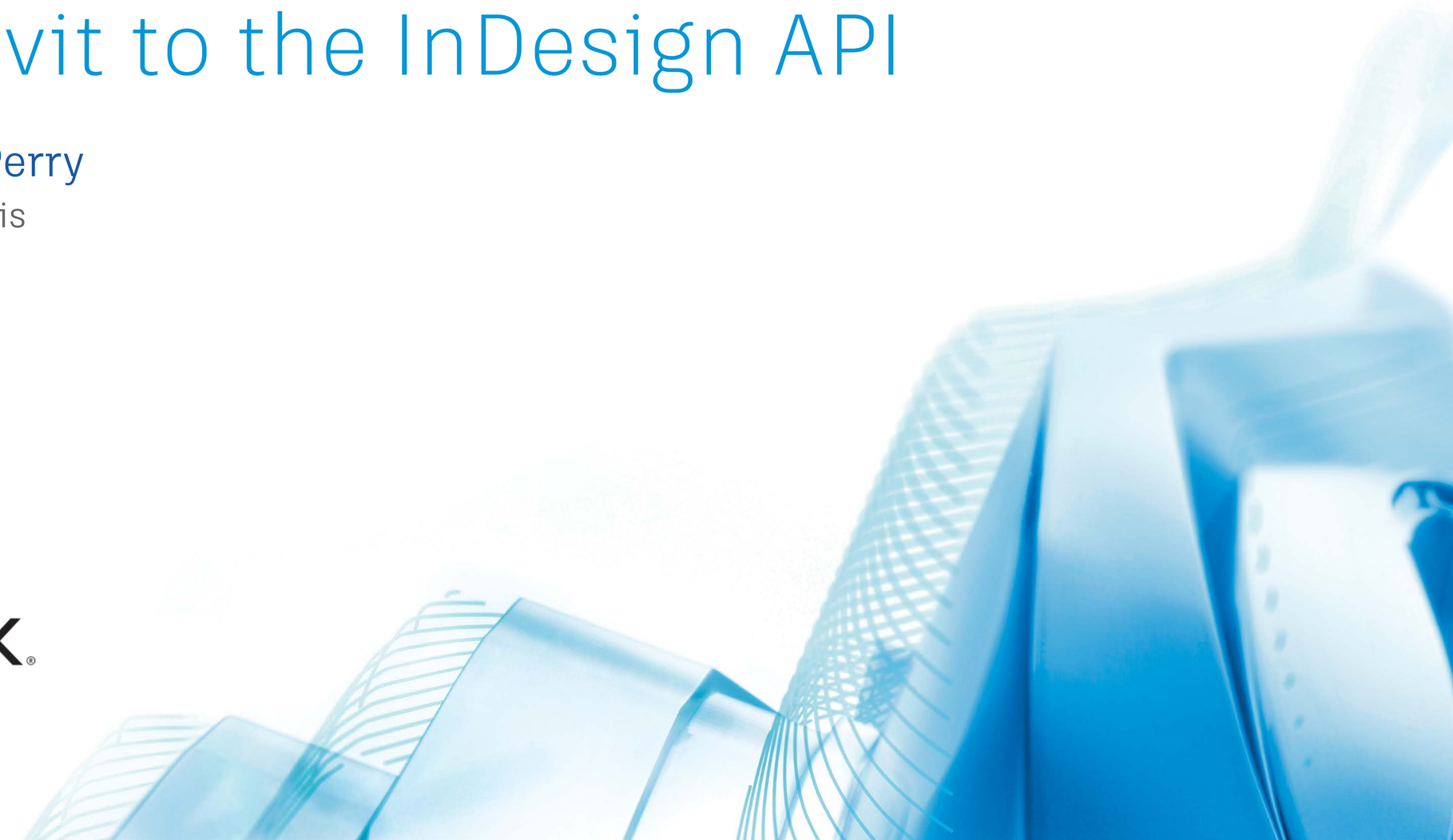
One-Click Model Reports: Connect Revit to the InDesign API

Oliver Green & Aaron Perry
Allford Hall Monaghan Morris



AUTODESK. UNIVERSITY

Thanks for Joining Us

Session Overview

Introduction
About AHMM, Digital Design Group, Speakers

Model Reviews
Overview of our Model Review Process, QA at AHMM

InDesign's API
Introduction to InDesign API, Interprocess Communications

Automated Model Reviews
Assembling Everything Into a Finished Product

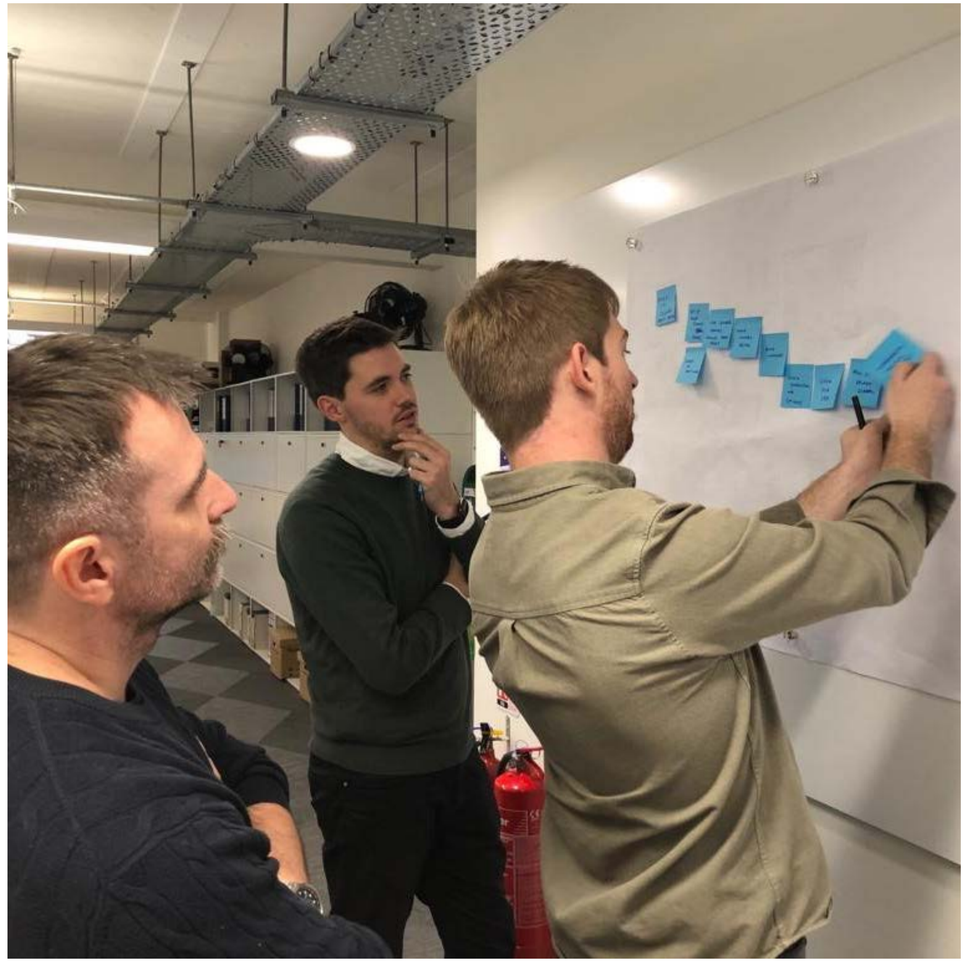
About AHMM

Allford Hall Monaghan Morris

AHMM is a large architecture firm (480+) with offices in London, Bristol and Oklahoma

Works across all sectors and sizes

Stirling Prize winners 2015
AJ100 Practice of the Year 2018
Building Magazine Practice of the Year 2018



Digital Design Group

Office-Wide Support

Within AHMM, the Digital Design Group offers full time project assistance in all areas of Digital Design strategy, application support, content and computation

The DDG develops and tests strategies for model maintenance, best-practice workflows, training, standards and QA

AHMM has extensive experience developing custom tools in-house to assist architectural teams

About the Speaker

Aaron Perry

Practice BIM manager and lead of AHMM's digital design group since 2015

Responsible for digital design across the entire practice, its multiple offices, stretching all live and future projects. This involves mitigating risk, engaging client / contractor, managing infrastructure and software, driving change and inspiring staff to embrace digital design authoring, review and visualisation technology

About the Speaker

Oliver Green

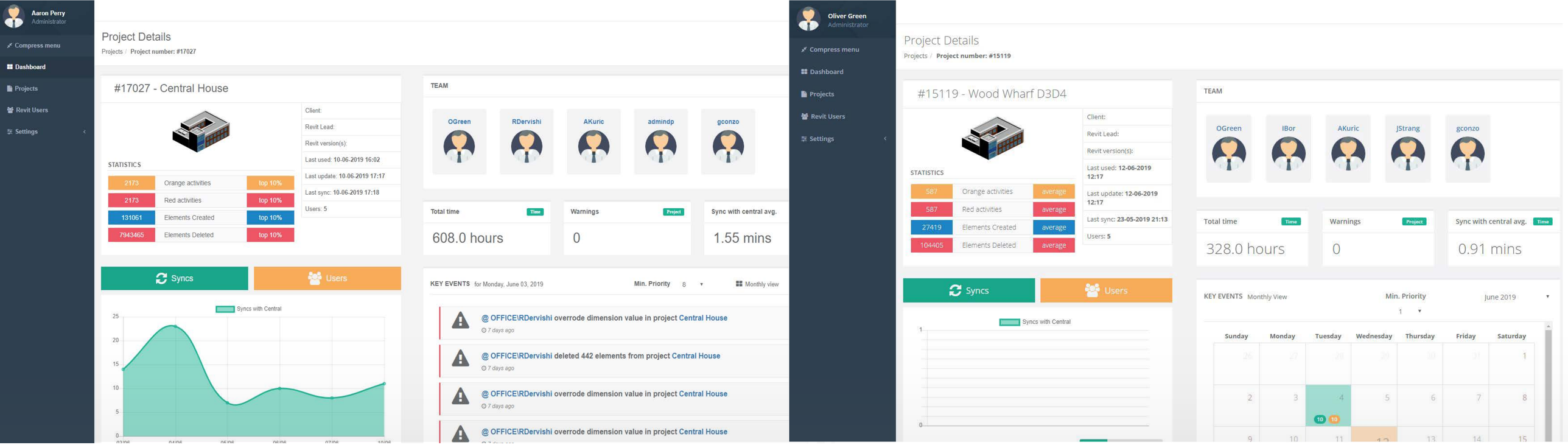
Designs and develops custom tools to assist AHMM's architects. This involves anything from building design tools, model analysis, data management to full process automation

Formerly worked as an architect

Before that, a video games designer

Self-taught developer, using Python, C# and Dynamo in daily work

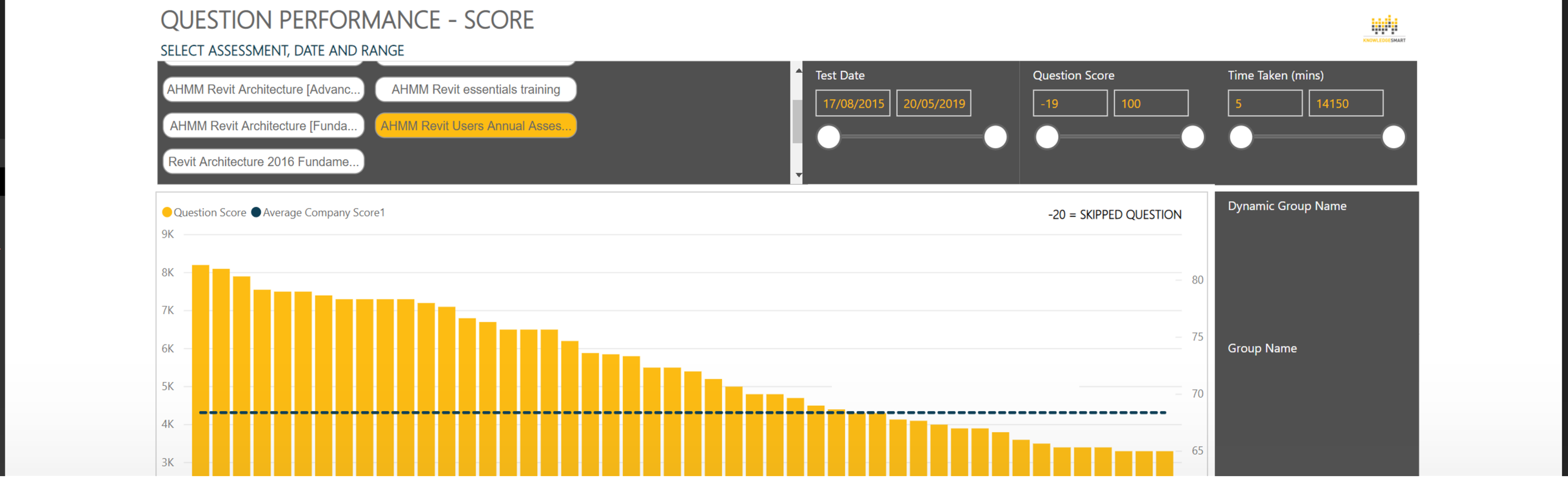
The Value of Model Metrics?



Digital Projects Dashboard

We could never open all models and manually review them on a weekly basis. It is very difficult to know when something is going wrong on a project, updates from some teams is very light.

AHMM run a monitoring tool that records all usage of Revit. When key activities occur on a project, we are notified. Healthy/unhealthy projects and comparison, Training/Support requirements and cross projects business insights.



KnowledgeSmart Assessments

I don't know what you don't know

Custom AHMM assessments to understand where knowledge gaps exist for us to then develop a training roadmap/plan

AHMM TRAINING OUTLINE

REVIT DEVELOPED DESIGN

Session Duration: One Day

Intended Audience

Those working on Revit projects between RIBA stages 2-3. Revit Developed Design is part of AHMM's core Revit training program. Users interacting with a Revit project between stages 2-3 will be expected to understand the basic principles and best practice when working with Revit at AHMM or have completed AHMM's Revit Basics training.

Session Goals

By the end you will understand how to develop and manage a project RIBA stage 2-3 at AHMM using Revit. Understand Revit's interface and terminology, how to create the model using architectural components, creating and modifying Revit system families, dynamic drawing schedules and understand Revit project collaboration.

Session Overview

System Family Editing
Edit type
Duplicate and create a new type
Naming standards
Edit system family structure
Shaft and vertical openings

Schedules Basics
Schedules building components
Schedule by Category
Add fields (Parameters)
Properties tabs
Filters and formatting

Families Walk through
Introduction to loadable families
Family placement
Duplicating family types

Design Options Basics

AHMM TRAINING OUTLINE

REVIT CONTENT CREATION ESSENTIALS

Session Duration: 4 Hours

Intended Audience

Those who have completed Revit eveloped Design training and are moving on to a project where they will be interacting with Revit families frequently. Revit Content Creation Essentials is part of AHMM's core Revit training program. The practices and techniques put forward in this training session will be required when taking part in more advanced training sessions and workshops.

Session Goals

By the end of ths session you will have an understanding of how Revit families are created and controlled. You will have an overview of the common practices and techniques used in AHMM's content. On completion of the training session an attendee will have the confidence to interact with families in a live project or from the AHMM library.

Session Overview

Introduction to Revit Families
Load families v system families
Revit categories + sub-categories
Family templates

Fully Parametric Table Exercise
Family creation best practice
Ref planes, dimensions and parameters
Associating geometry to reference planes
Hidden constraints
Work planes

Nesting
The concept of nesting
Levels of nesting
Best practice when nesting families

Visibility Controls For Families

AHMM TRAINING OUTLINE

REVIT WORKSHOP VISUALISATION

Session Duration: 1.5 Hours

Intended Audience

This workshop is designed for those looking to create renders directly from Revit using Enscape. Exploring how to get the best out of Revit materials and Appropriate application of ArchVision RPC content. Those wanting to gain a better understand Revit materials and how best to manage them in a project.

Session Goals

By the end of this session you will understand Revit materials, the elements that make up Revit materials and where to find AHMM's central Revit material resources. An introduction to Enscape, navigation, creating views, exports, VR experiences and best practice. An introduction to ArchVision RPC content for Revit . An introduction to AHMM content for visualisation, mannequin people and lighting families. Best practice when using all of this content in a Revit project.

Session Overview

Introduction to Revit Materials
Revit materials browser
Material identity, graphic and appearance
Material creation and duplication
z_Revit materials, hatches and textures
Materials container file

Enscape
Starting View
Navigation walking vs flying
Creating views Enscape to Revit
Exporting from Enscape
Enscape Settings

AHMM Mannequin People
When to use mannequin people
Where to find ENT families
Creation technique
How to control render appearance

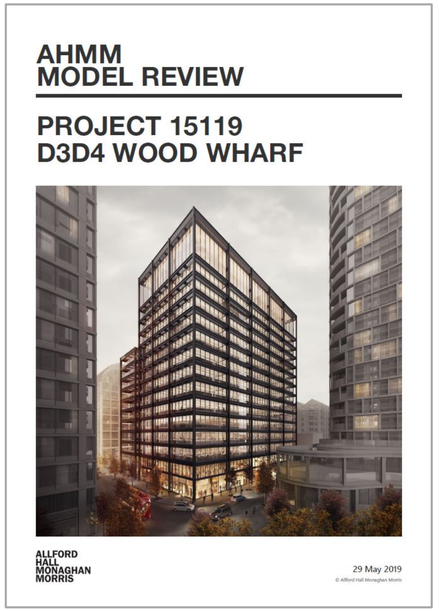
Training Courses

AHMM run regular training sessions almost every day

40+ Internally-developed training courses - from 1 hour workshops to full day Revit training sessions

Our experienced team delivers training in a standardised way, contextualised within the way we work at AHMM

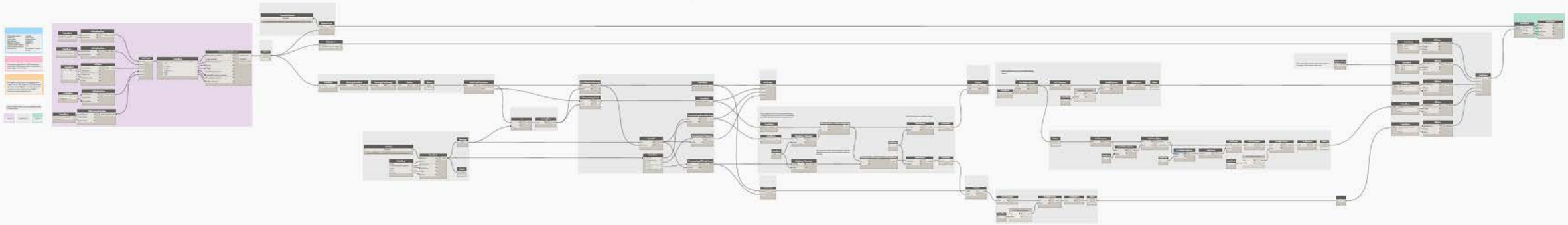
Model Reviews



A detailed 40-page InDesign document we prepare for each project per stage
Some parts automated export from Revit, other parts human-authored commentary

Not just a data export; a way of measuring Revit skills & imparting applied knowledge

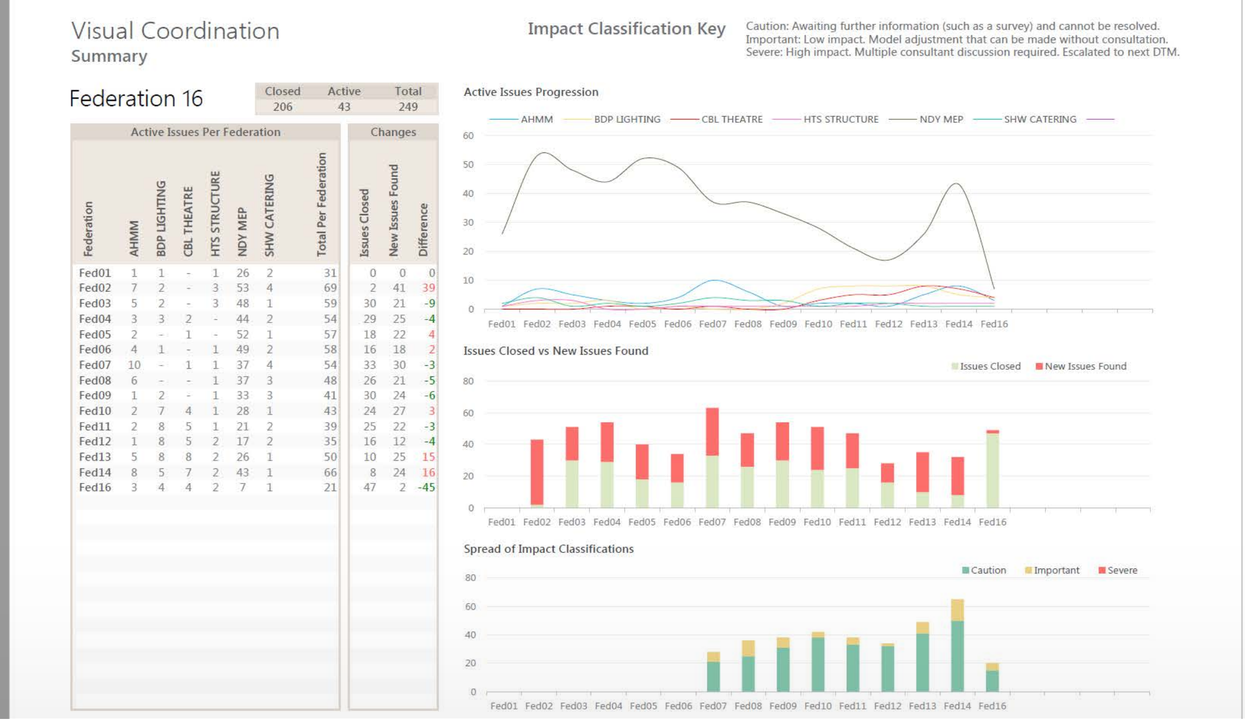
Not Just a Technology Talk

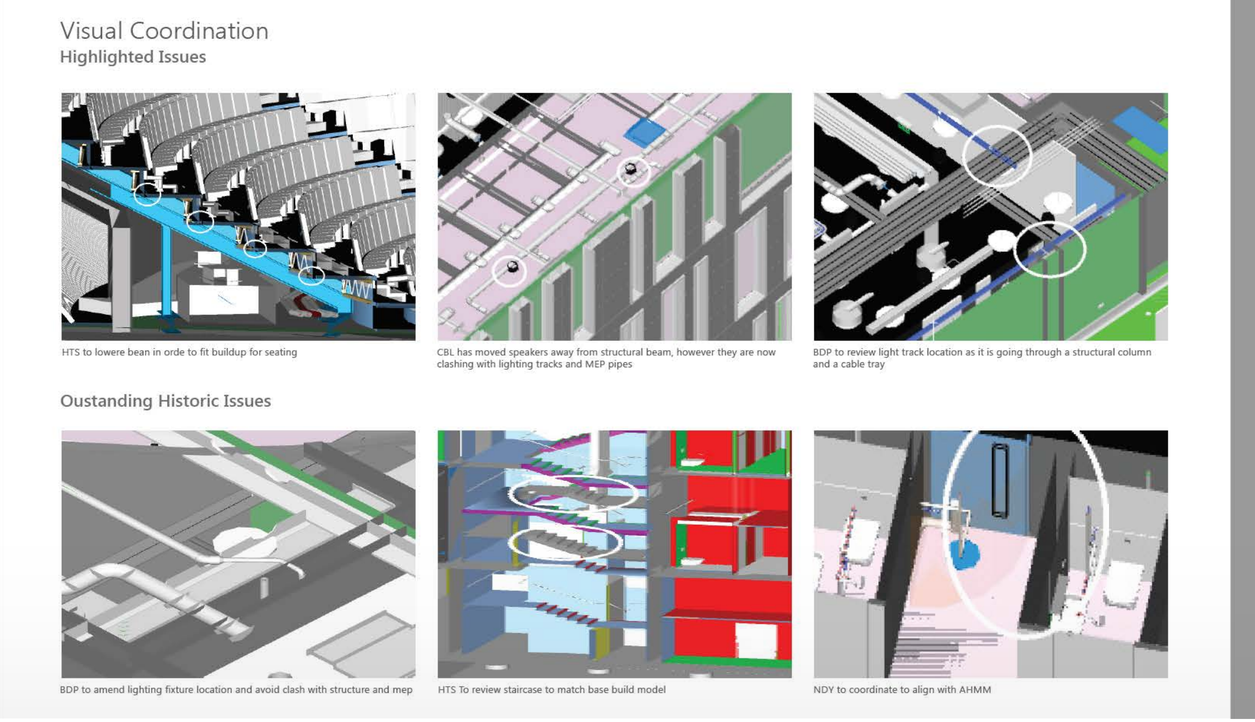


Development at AHMM

We develop our own tools in-house to allow for custom UI, high-performance functionality that meets our needs.
A library of pre-built and audited content, Dynamo & Python scripts, our C# Revit Ribbon (+ WPF front-end)

Whatever we can do to "let architects be architects"

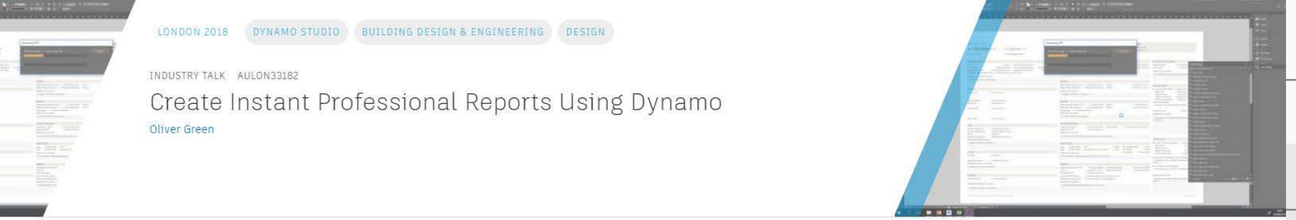


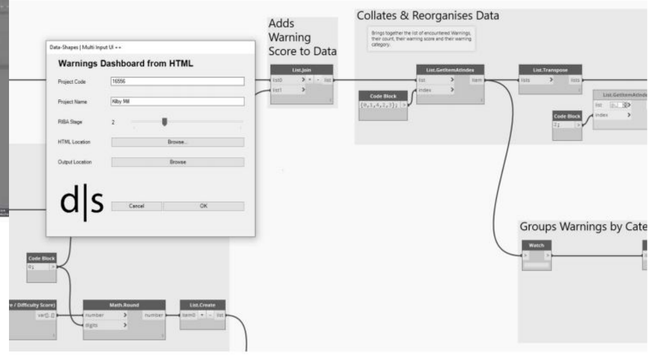


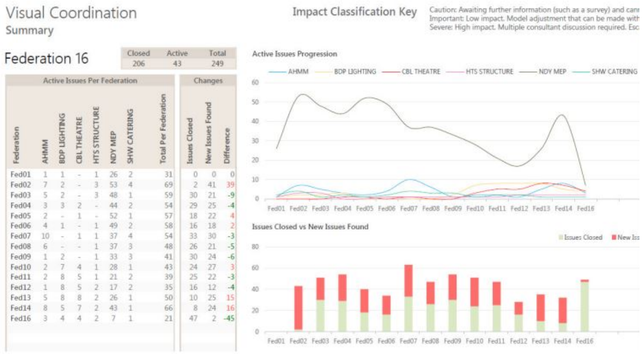
Digital Coordination Report

We use InDesign at lot at AHMM - it's powerful, flexible and creates beautiful reports that are easy to edit
Automating InDesign has been on our wish list for a long time

Not just for architects – potentially helpful for all parts of AEC







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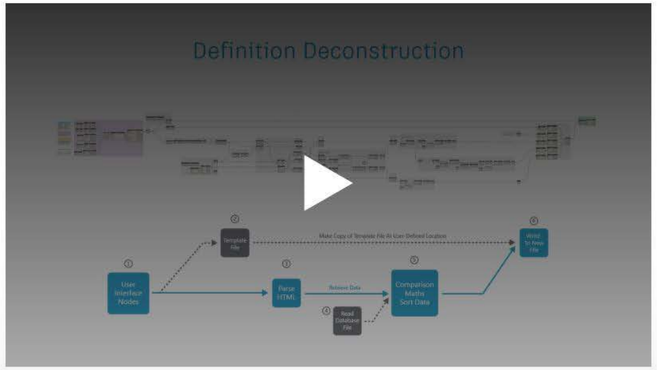
44 min 30 sec

Presentation
51 slides

Downloads
2 files



Process Automation

Use Dynamo to automate your data collection

Automate summaries & formatting

Use Python to generate reports from a template

Quality Presentation

Visualise data consistently

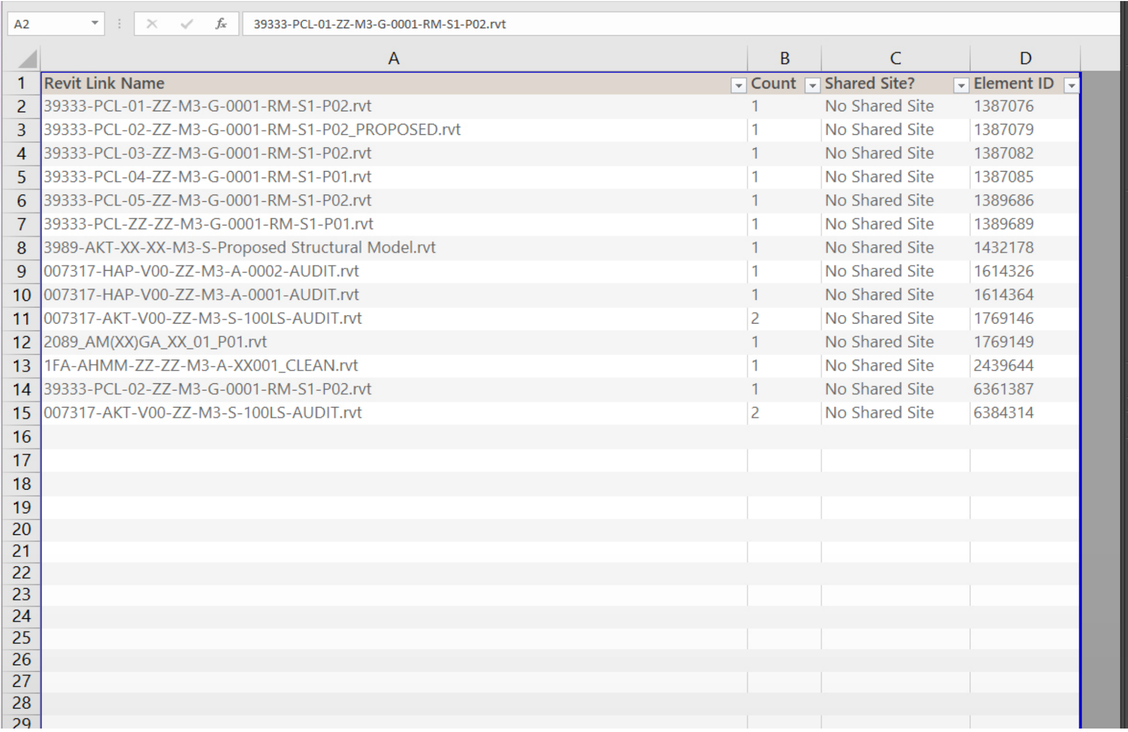
Choosing the right visuals

How to summarise data for maximum impact

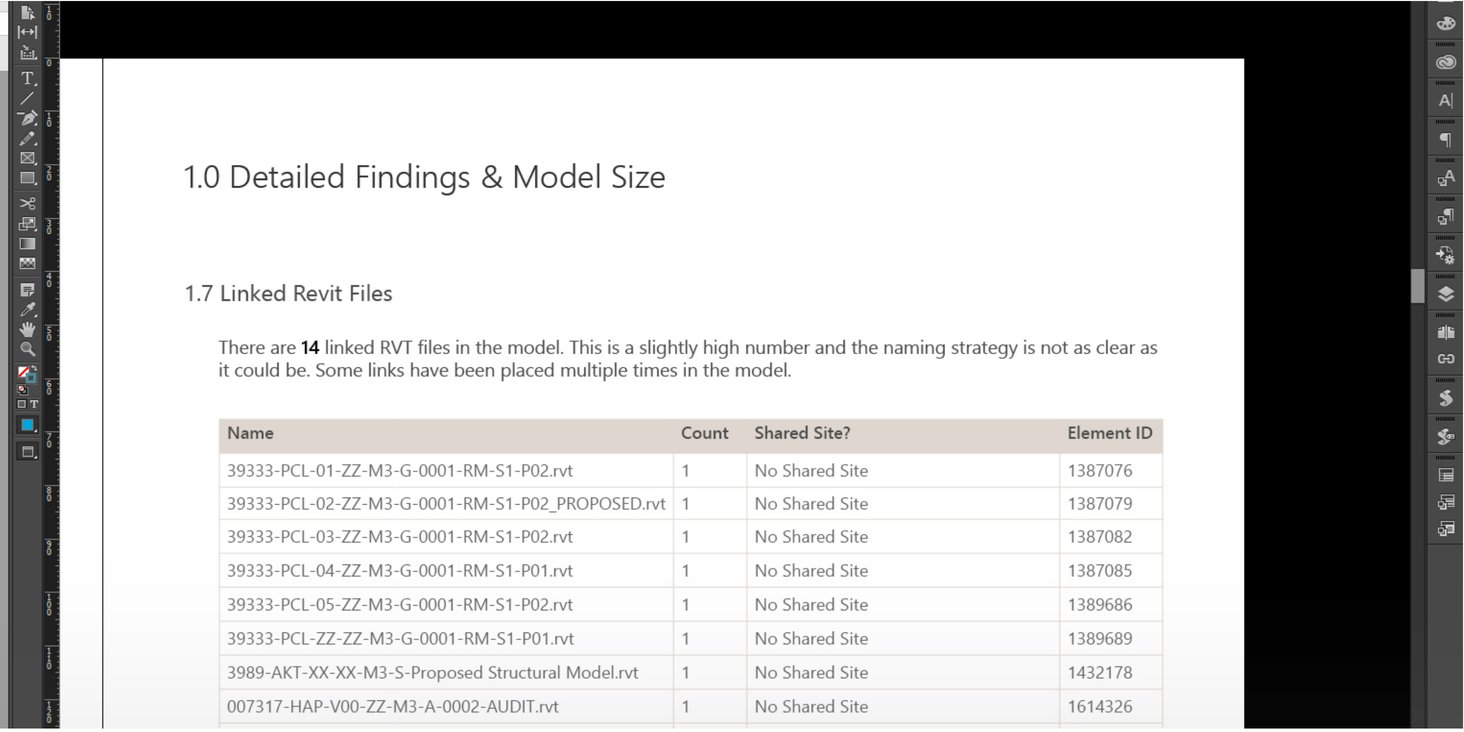
AU 2018 Presentation

Last Year's AU London Presentation was also about creating reports
A different take - using Dynamo. This is more manual, but more accessible technologically

Also a talk about data visualisation and displaying accurate information in a succinct way



Revit Link Name	Count	Shared Site?	Element ID
39333-PCL-01-ZZ-M3-G-0001-RM-S1-P02.rvt	1	No Shared Site	1387076
39333-PCL-02-ZZ-M3-G-0001-RM-S1-P02_PROPOSED.rvt	1	No Shared Site	1387079
39333-PCL-03-ZZ-M3-G-0001-RM-S1-P02.rvt	1	No Shared Site	1387082
39333-PCL-04-ZZ-M3-G-0001-RM-S1-P01.rvt	1	No Shared Site	1387085
39333-PCL-05-ZZ-M3-G-0001-RM-S1-P02.rvt	1	No Shared Site	1389686
39333-PCL-ZZ-ZZ-M3-G-0001-RM-S1-P01.rvt	1	No Shared Site	1389689
3989-AKT-XX-XX-M3-S-Proposed Structural Model.rvt	1	No Shared Site	1432178
007317-HAP-V00-ZZ-M3-A-0002-AUDIT.rvt	1	No Shared Site	1614326
007317-HAP-V00-ZZ-M3-A-0001-AUDIT.rvt	1	No Shared Site	1614364
007317-AKT-V00-ZZ-M3-S-100LS-AUDIT.rvt	2	No Shared Site	1769146
2089_AM(XX)GA_XX_01_P01.rvt	1	No Shared Site	1769149
1FA-AHMM-ZZ-ZZ-M3-A-XX001_CLEAN.rvt	1	No Shared Site	2439644
39333-PCL-02-ZZ-M3-G-0001-RM-S1-P02.rvt	1	No Shared Site	6361387
007317-AKT-V00-ZZ-M3-S-100LS-AUDIT.rvt	2	No Shared Site	6384314



1.0 Detailed Findings & Model Size

1.7 Linked Revit Files

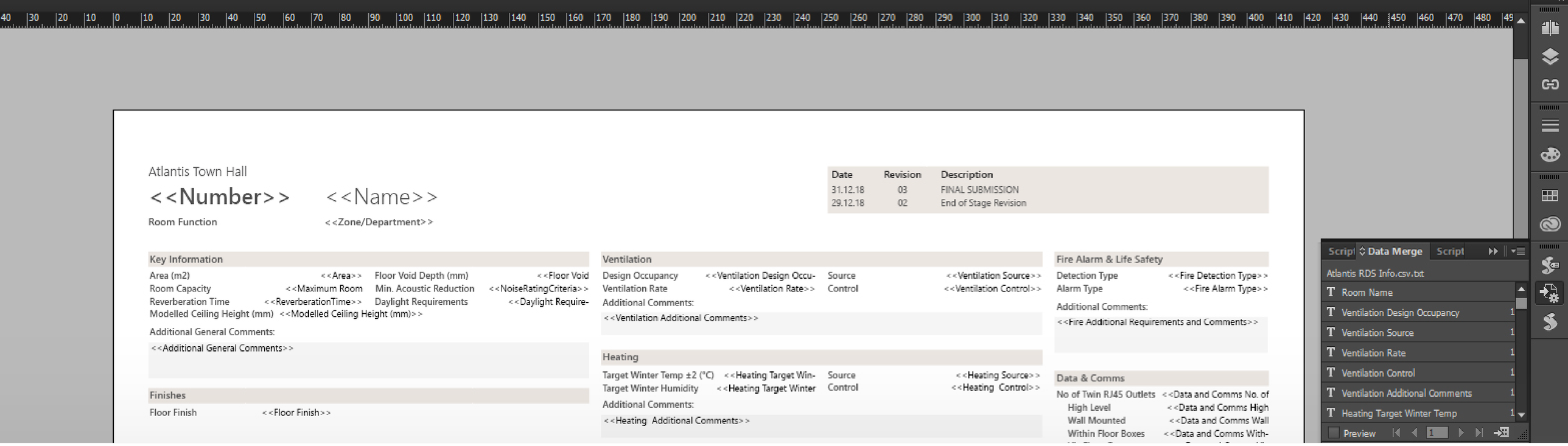
There are **14** linked RVT files in the model. This is a slightly high number and the naming strategy is not as clear as it could be. Some links have been placed multiple times in the model.

Name	Count	Shared Site?	Element ID
39333-PCL-01-ZZ-M3-G-0001-RM-S1-P02.rvt	1	No Shared Site	1387076
39333-PCL-02-ZZ-M3-G-0001-RM-S1-P02_PROPOSED.rvt	1	No Shared Site	1387079
39333-PCL-03-ZZ-M3-G-0001-RM-S1-P02.rvt	1	No Shared Site	1387082
39333-PCL-04-ZZ-M3-G-0001-RM-S1-P01.rvt	1	No Shared Site	1387085
39333-PCL-05-ZZ-M3-G-0001-RM-S1-P02.rvt	1	No Shared Site	1389686
39333-PCL-ZZ-ZZ-M3-G-0001-RM-S1-P01.rvt	1	No Shared Site	1389689
3989-AKT-XX-XX-M3-S-Proposed Structural Model.rvt	1	No Shared Site	1432178
007317-HAP-V00-ZZ-M3-A-0002-AUDIT.rvt	1	No Shared Site	1614326

Semi-Automated Model Review

Initial forays streamlining InDesign workflows – best practice templates, styles and using Text Variables
We created Dynamo definitions to generate images highlighting aspects of the model

This saved lots of time… **but still involved lots of manual copy-pasting data from an Excel export!**

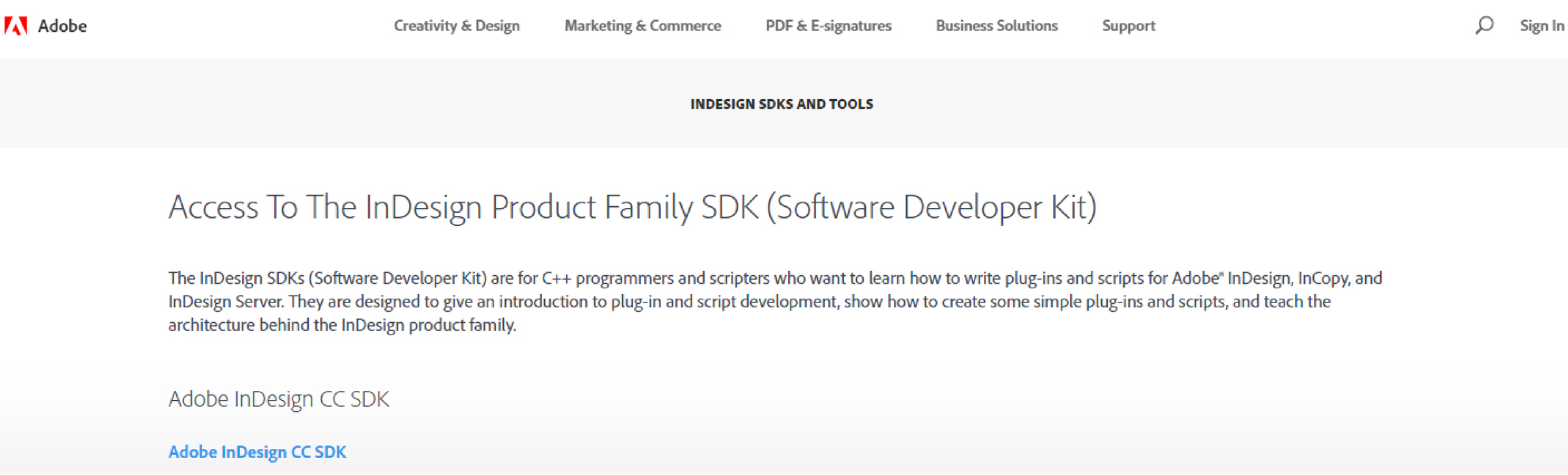


AU 2018 Datamerge

A year ago we demonstrated generating 536 Room Data Sheets in 1 minute
InDesign's database publishing tool – combines structured data with a page template

We wanted the ability to generate the kinds of InDesign documents a user would normally create – from scratch

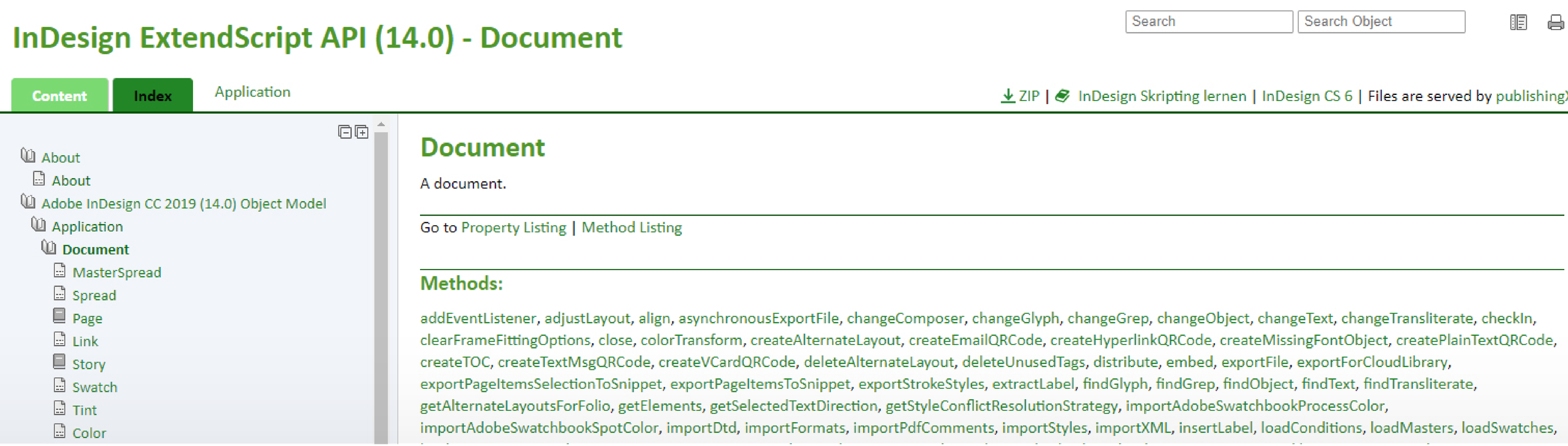
Initial Explorations



InDesign SDK

Initial research showed yes - there's an InDesign API, and an SDK with documentation
Downloaded SDK & read through docs. InDesign Server or short, simple scripts

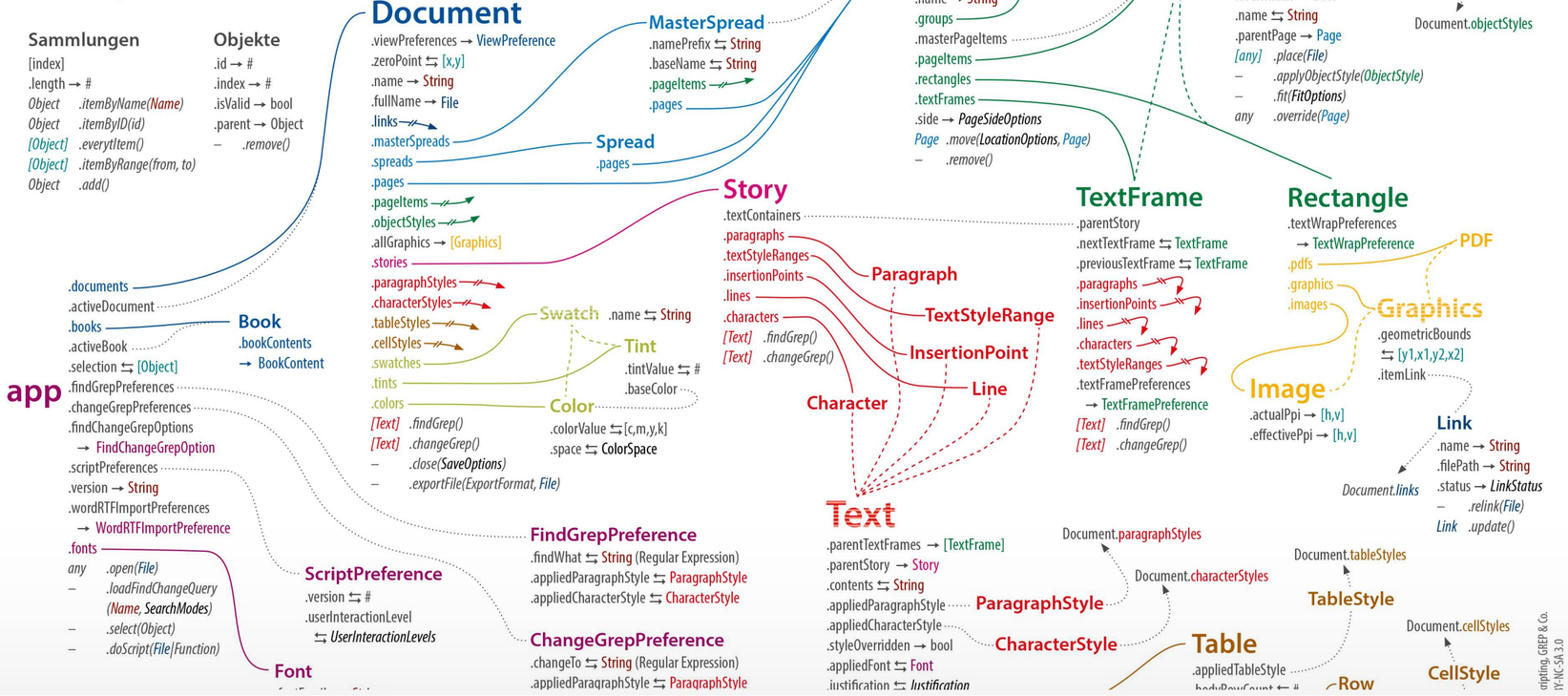
Lots and lots of JavaScript mentions, some TypeScript and AppleScript



InDesign API Documentation

Documentation online and in downloadable SDK
Some helpful, but incomplete 'mind maps' online. Not always intuitive

Wanted a fully .NET-based solution if possible; easier to integrate with existing Revit / WPF tech we use



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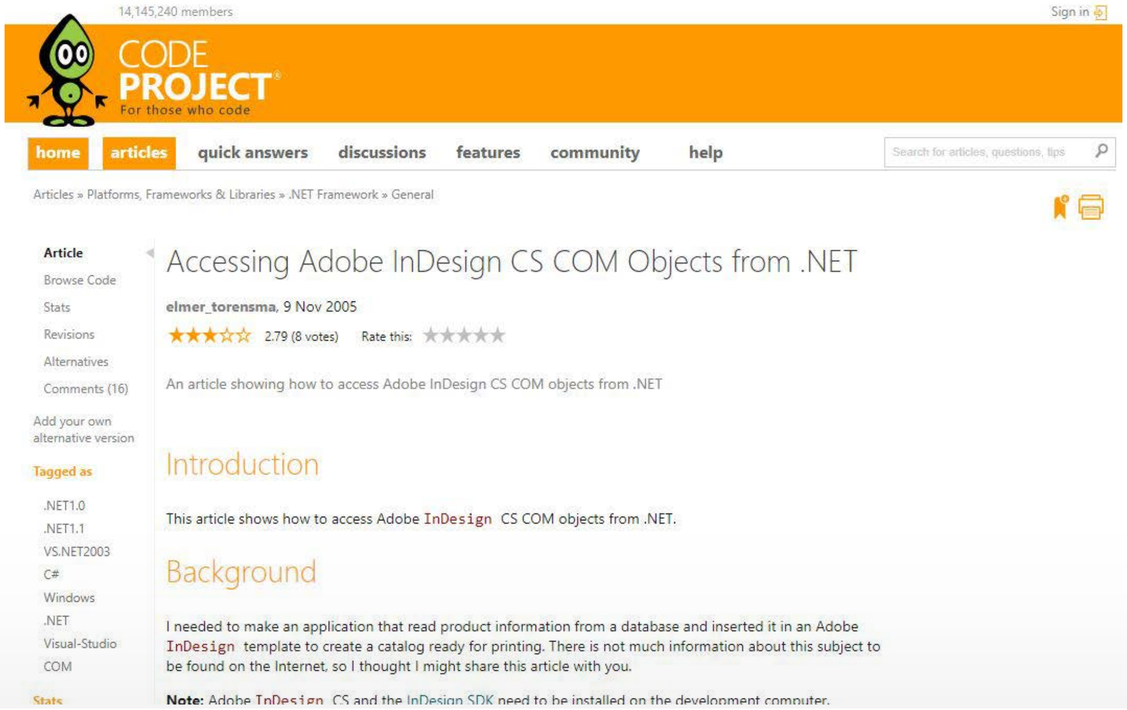
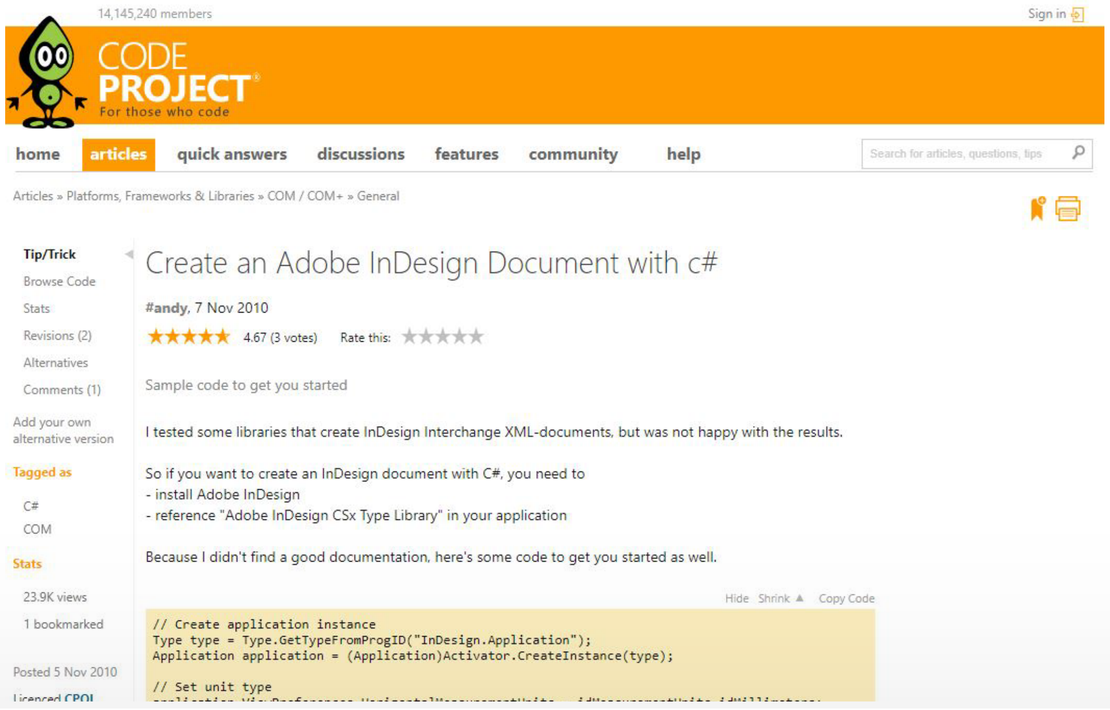




C# Examples

Early 2019 I started reading about InDesign's API in depth - I found just a few examples using C#
Example script would open a new InDesign document and create five blank pages

Being able to see a test script implied it should be possible to create something in C# that talks to InDesign

I found the C# application to hang when I ran it next, so had to close InDesign down, and let C# open it up by itself! Example:

```
Type type = Type.GetTypeFromProgID("InDesign.Application");
Application app = (Application)Activator.CreateInstance(type);

var doc = app.Documents.Add();

for (var i = 0; i < 5; i++)
    doc.Pages.Add(idLocationOptions.idAtBeginning);
```

share edit

answered May 14 '16 at 16:29

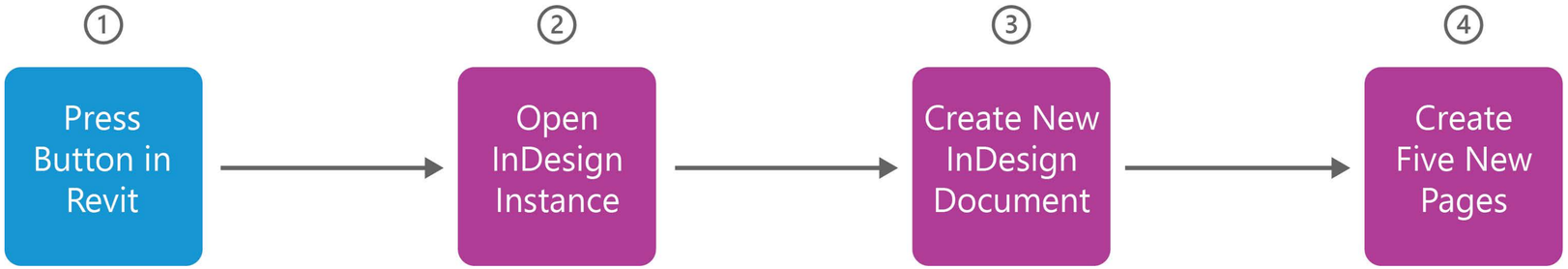
user3791372

2,574 ●2 ●25 ●57

Thank You user3791372!

This was the initial script I read (on Stackoverflow) that I based our proof of concept on.

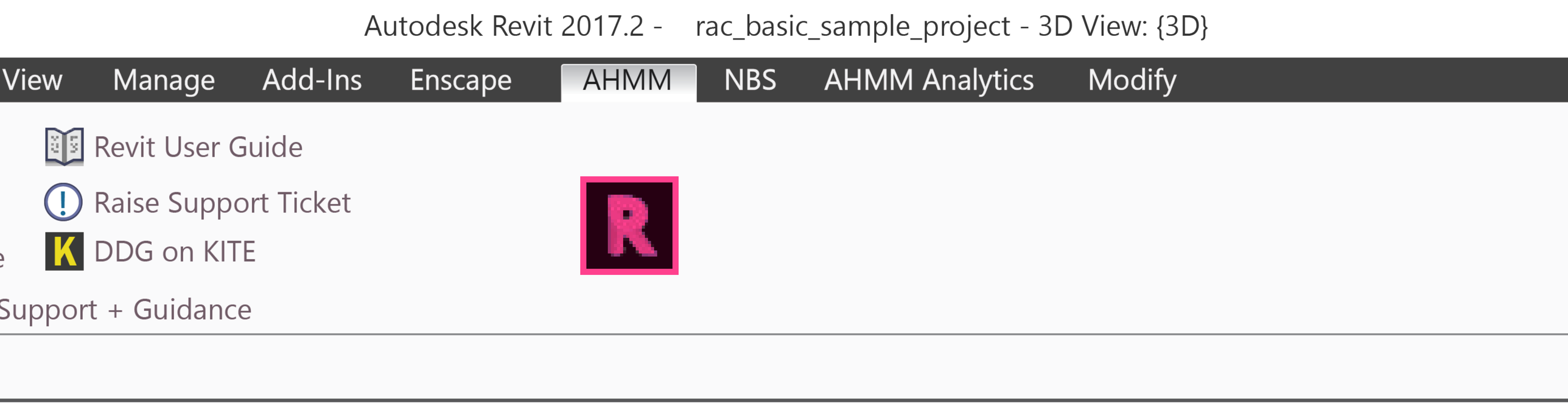
Sometimes, this is all you need to set off developing something.



Simple Proof of Concept Workflow

I put together a proposal for a 'minimum test case' to see if we could create a working proof of concept
Our end goal was to read a Revit model's information into a ready-made InDesign template

POC was to see if I could click a button in Revit that would open InDesign and a new document and edit it



Ribbon Buttons in Revit

We already had some experience with building our own ribbon, so I can give you an outline of what we did

There are two straightforward ways to launch your own code from the Revit ribbon: these are referred to as **ExternalCommands and ExternalApplications**

Intro to External Commands

ExternalCommands & ExternalApplications

Both are a way of bringing external code into Revit
We used Microsoft Visual Studio as our "Integrated Development Environment" (i.e. where we write our code)

Written in C# using the Revit API's Classes
Code gets compiled into a .dll file and placed somewhere Revit can see it (e.g. AppData)

On Revit application startup, it loads in these resources

With both approaches the .dll file will also contain the code that fires when you launch your command or click on each custom-made button

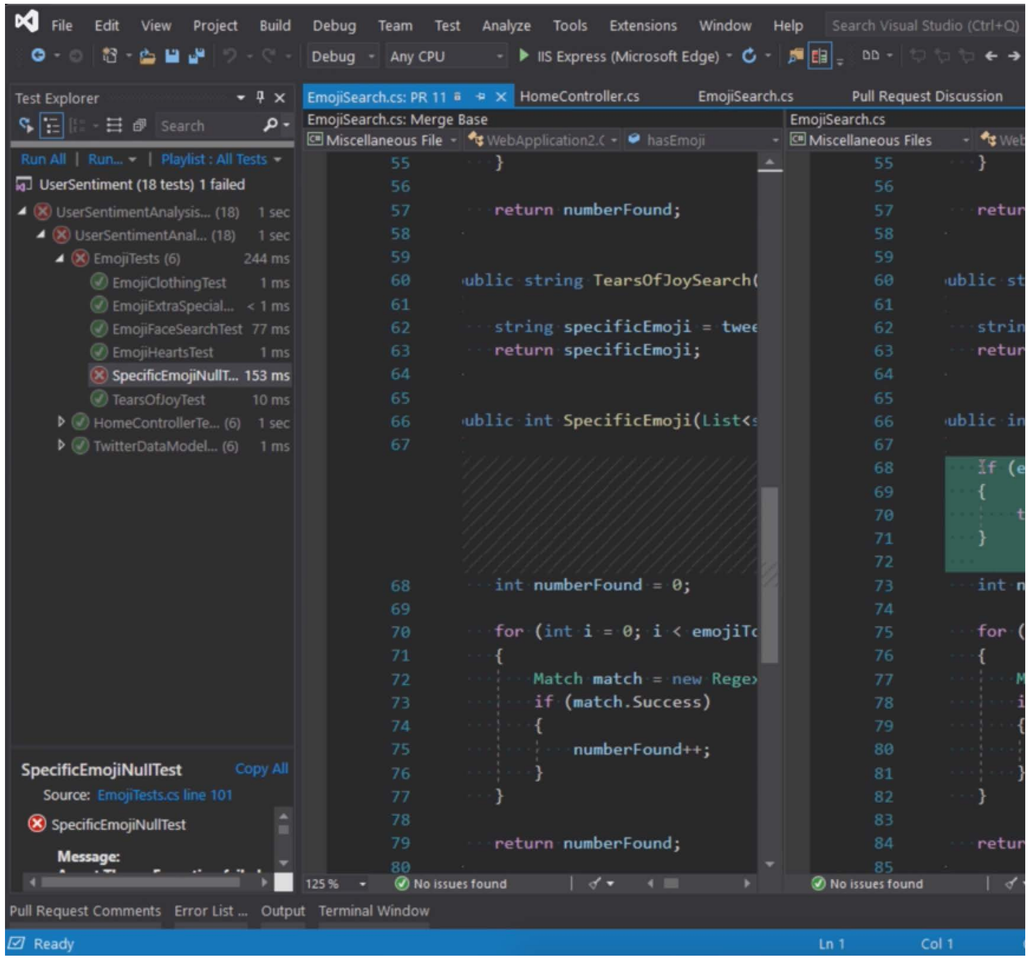
Within this code, you can access Revit's API to make adjustments to the model just like in a Macro

Visual Studio Overview

Visual Studio is the program everyone uses to compile their Revit addins

It's a code-editor, a UI designer, database administration tool, debugger, and more all in a single program

It's where we compile all our scripts together into a single DLL, which Revit can then run

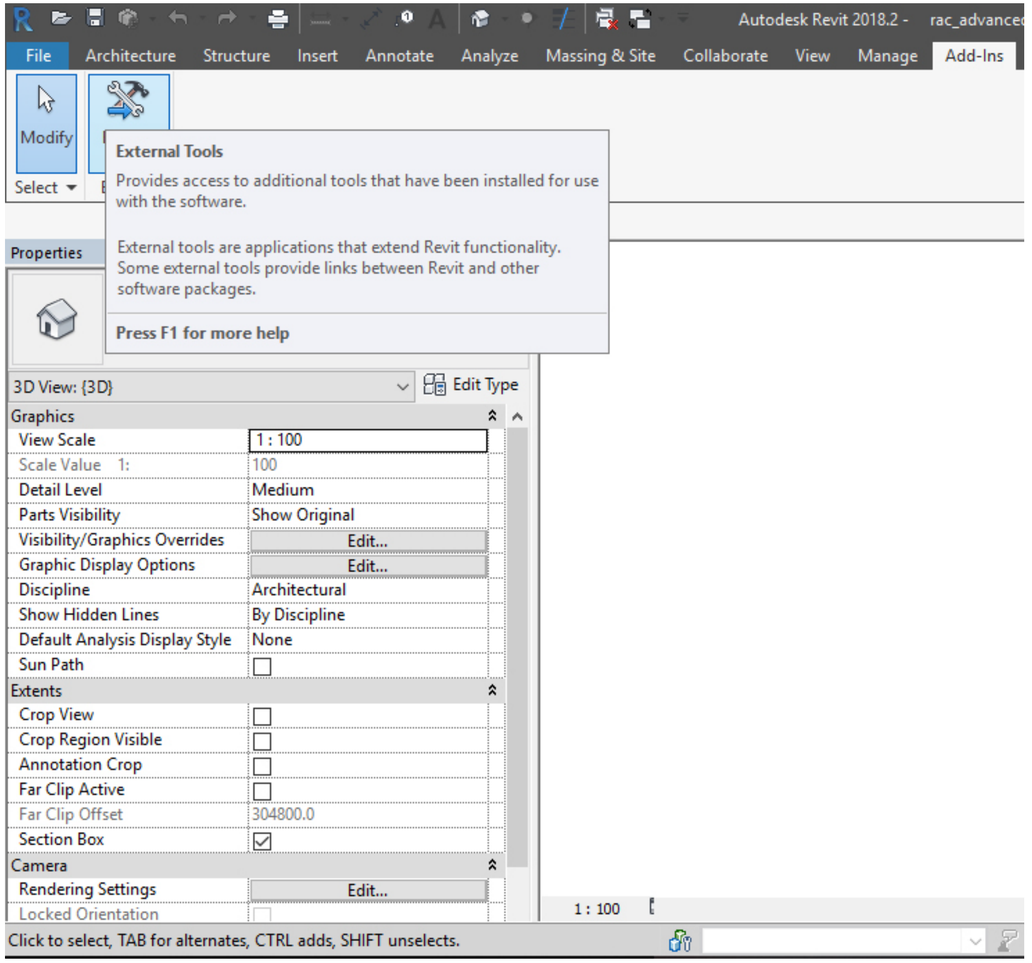


ExternalCommands

If your tool is an ExternalCommand, Revit will read the .dll file and load it in as a button

This button will appear in Revit under the Add-ins tab in the External Tools drop-down menu

The ExternalCommand approach is a bit like firing a macro - it's a one-off command you're launching



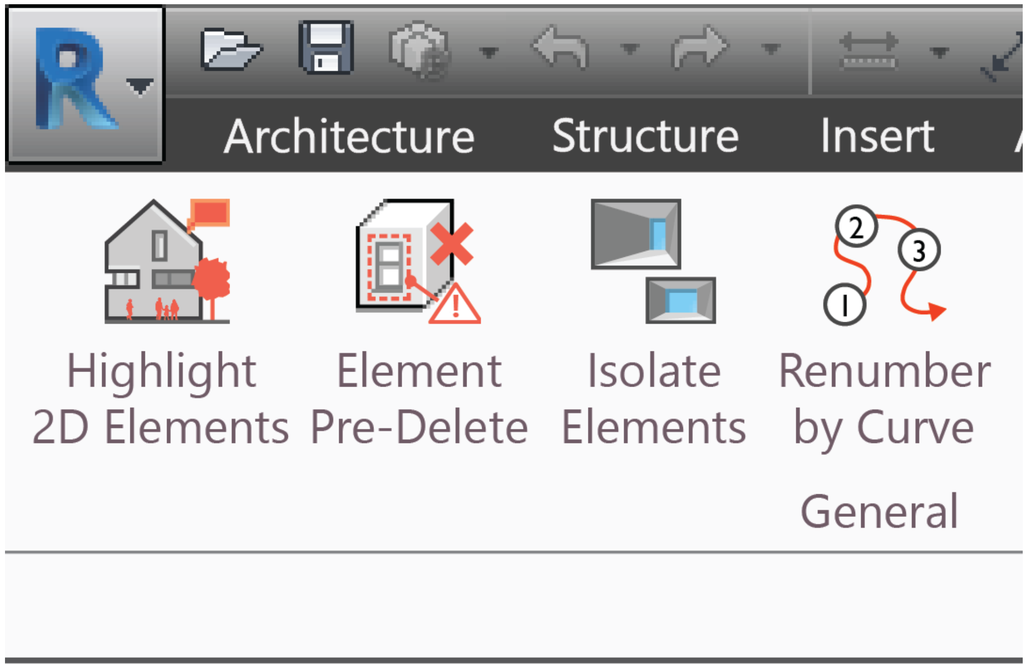
ExternalApplications

If your tool is an ExternalApplication it probably lives in its own custom Revit ribbon tab

Revit reads your .dll upon opening and creates your ribbon tabs, ribbon panels and buttons

The Revit ribbon buttons essentially fire off their own ExternalCommands, but there are some differences

The ribbon is always accessible from within Revit, meaning you can retain data between tool runs



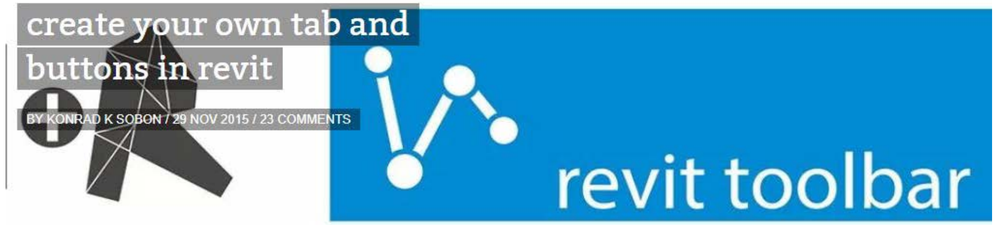
Further Reading

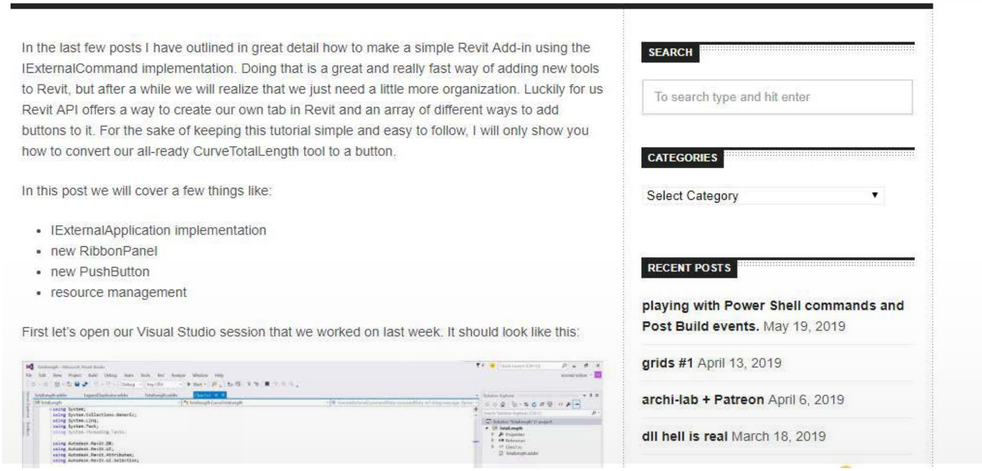
If you'd like to learn how to build your own custom Revit ribbon, or ExternalCommand button I would recommend archi-lab's blog

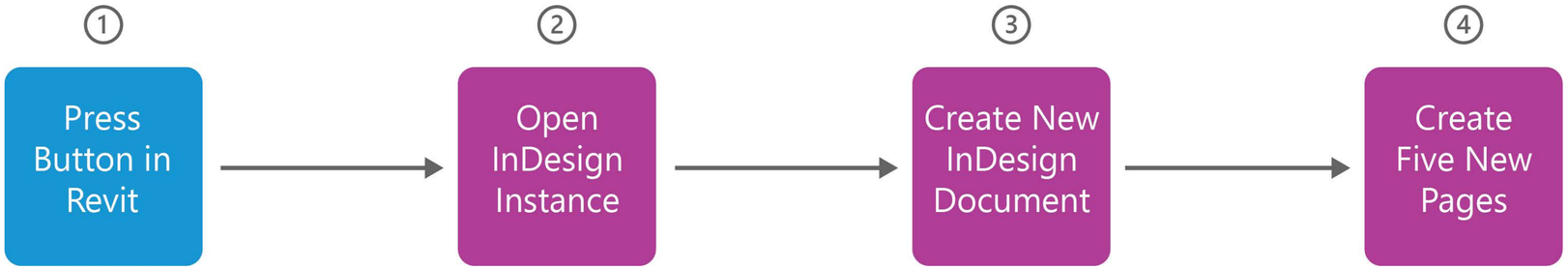
http://archi-lab.net

Clear step-by-step instructions on how to build ExternalCommands and ExternalApplications from scratch

If this helps you, consider supporting Konrad!







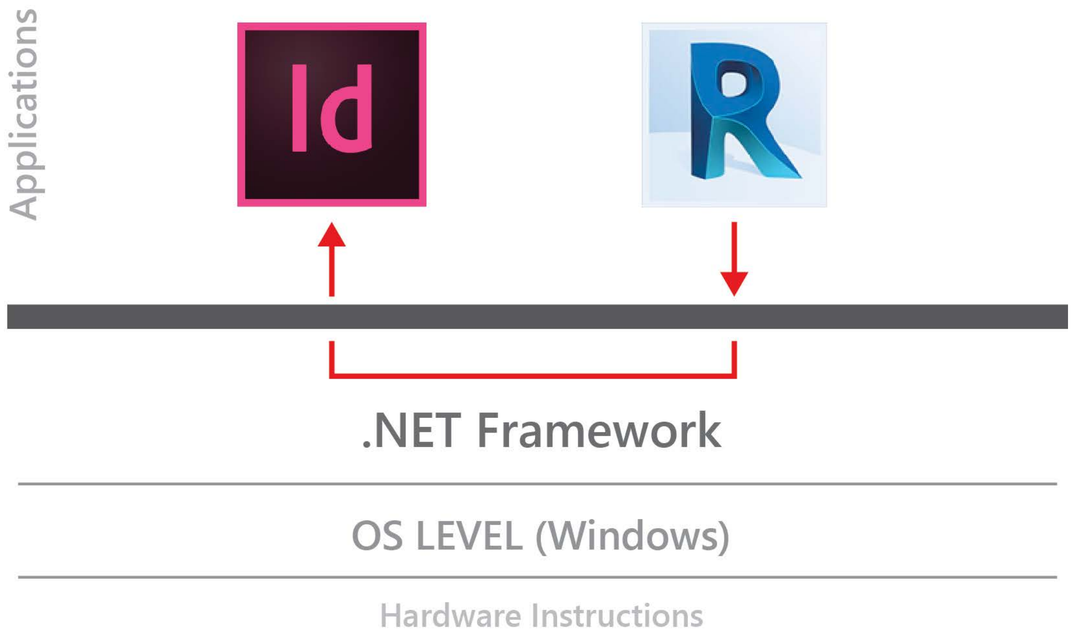
ExternalCommand or
ExternalApplication
using Visual Studio

Back to Proof of Concept

We want our code to fire when we press a button in Revit, so we're using an ExternalApplication to create our custom AHMM ribbon and place buttons in there. These buttons will fire off our custom code.

Next, we want to learn how to open an instance of the InDesign application from within our custom code.

Interprocess Communications



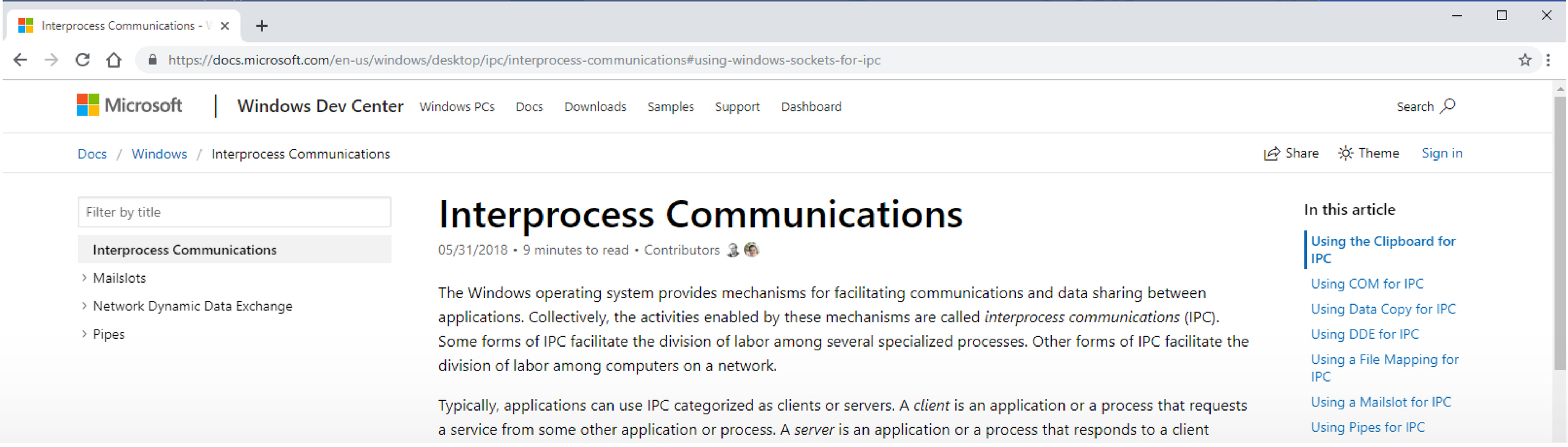
Revit and the .NET Framework

Revit is a Windows application and **it runs on top of the .NET Framework**

Microsoft's .NET Framework is the lower-level architecture that unifies software running on a Windows machine, provides important class libraries and resources.

This let us have conversations with other applications, access external servers, databases, run tests, etc

We have access to all different parts of Windows to play with if we want - can access speakers, webcams, files

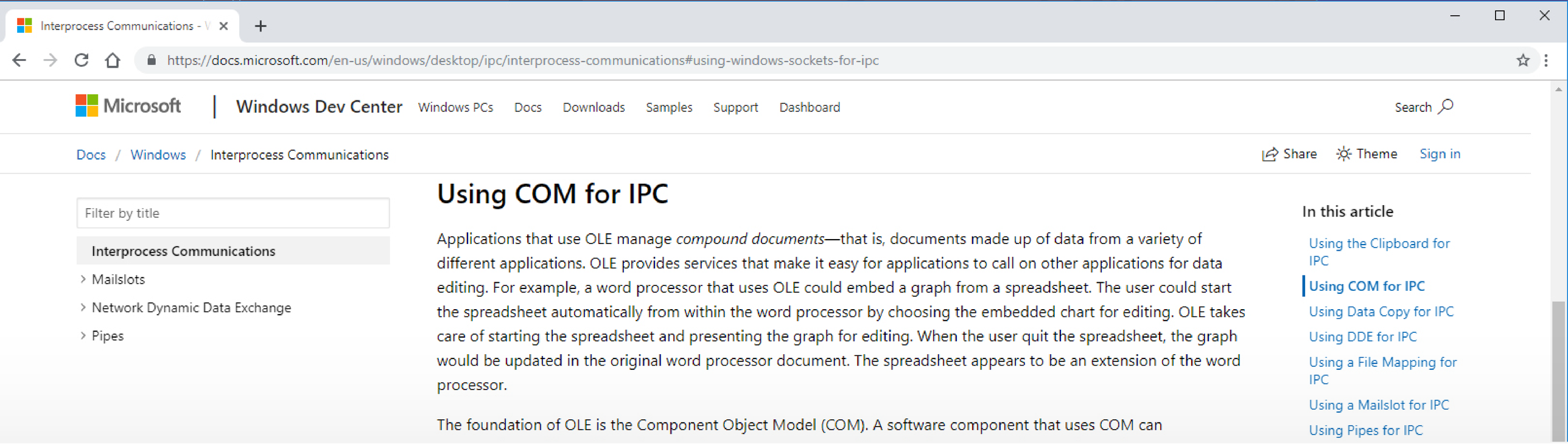


Interprocess Communications

Windows provides many approaches for sending data between applications - 'inteprocess communication' (or IPC) is one fo them. Refer to MSDN Website for developers who want to develop on top of Microsoft systems

"Interprocess Communications" just means getting pieces of software to talk with one another

I found this page, which outlines multiple IPC technologies: IPC, Sockets, Data Copy, Pipes...



COM (Component Object Model)

COM is old (1993) technology but is still supported by .NET using the System.Runtime.InteropServices namespace. For instance, Dynamo's Bumblebee package uses COM to open & edit Excel documents

Spoiler Alert: As we will see later, this is the approach I would have to use

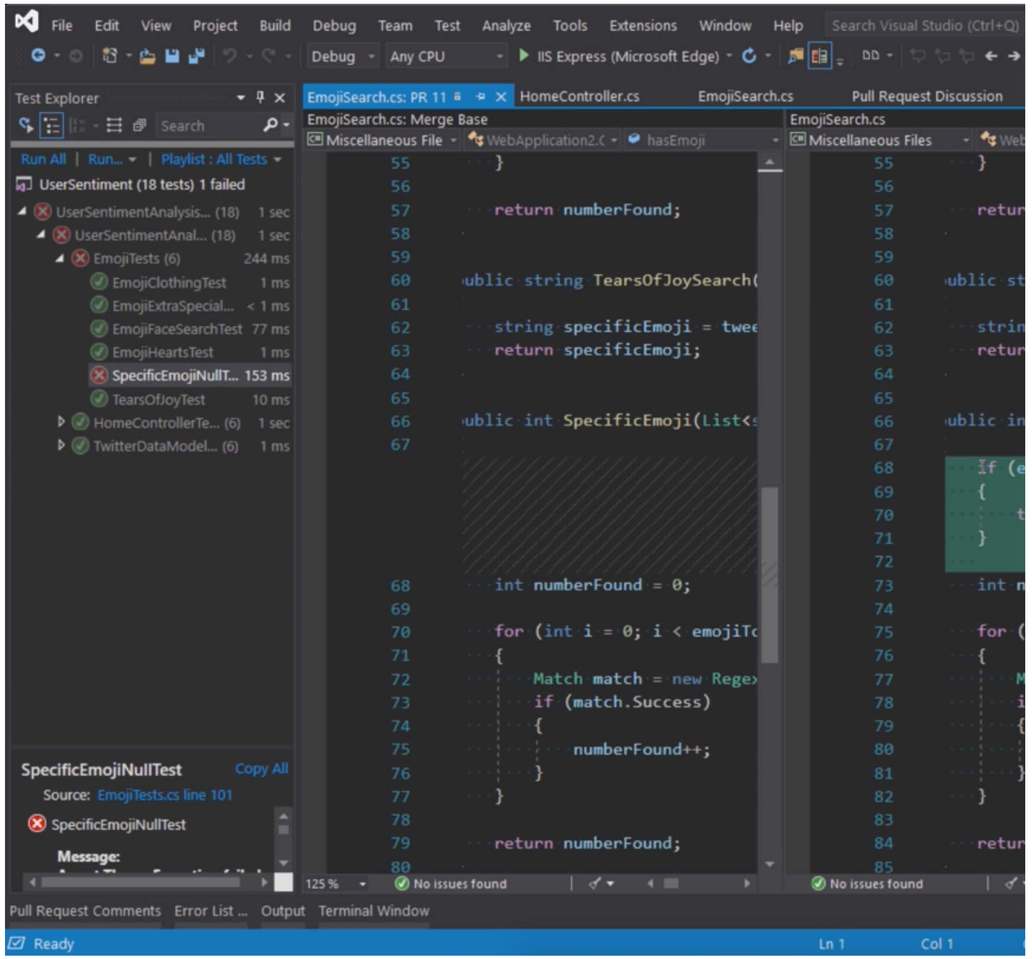
Visual Studio Setup

Back to Visual Studio

Our code in Visual Studio would need to bring everything together.

It's where we have the code for creating our Revit ribbon, buttons and model review functionality (e.g. counting the number of warnings).

It's also where we need to have the code which launches and manipulates InDesign.



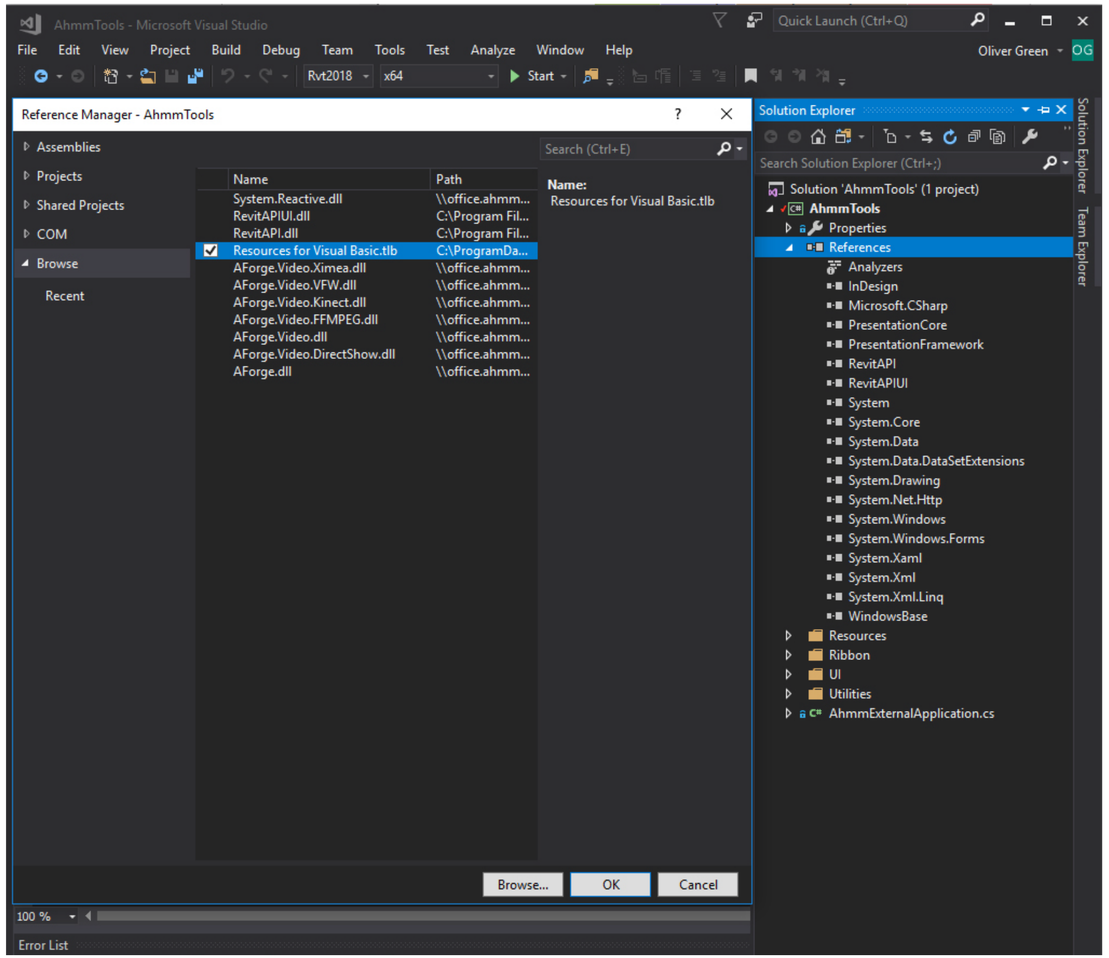
Add Reference to InDesign API

The online script had lots of reference to InDesign's native classes (such as Page)

In order to resolve these references, I needed to add a reference to InDesign's API

I was entirely sure how to do this so, some Googling later, I found it's called ResourcesForVisualStudio.tbl, which is a COM type library file

That's how I knew I was going to use the COM approach to Interprocess Communications



Add Reference to InDesign API

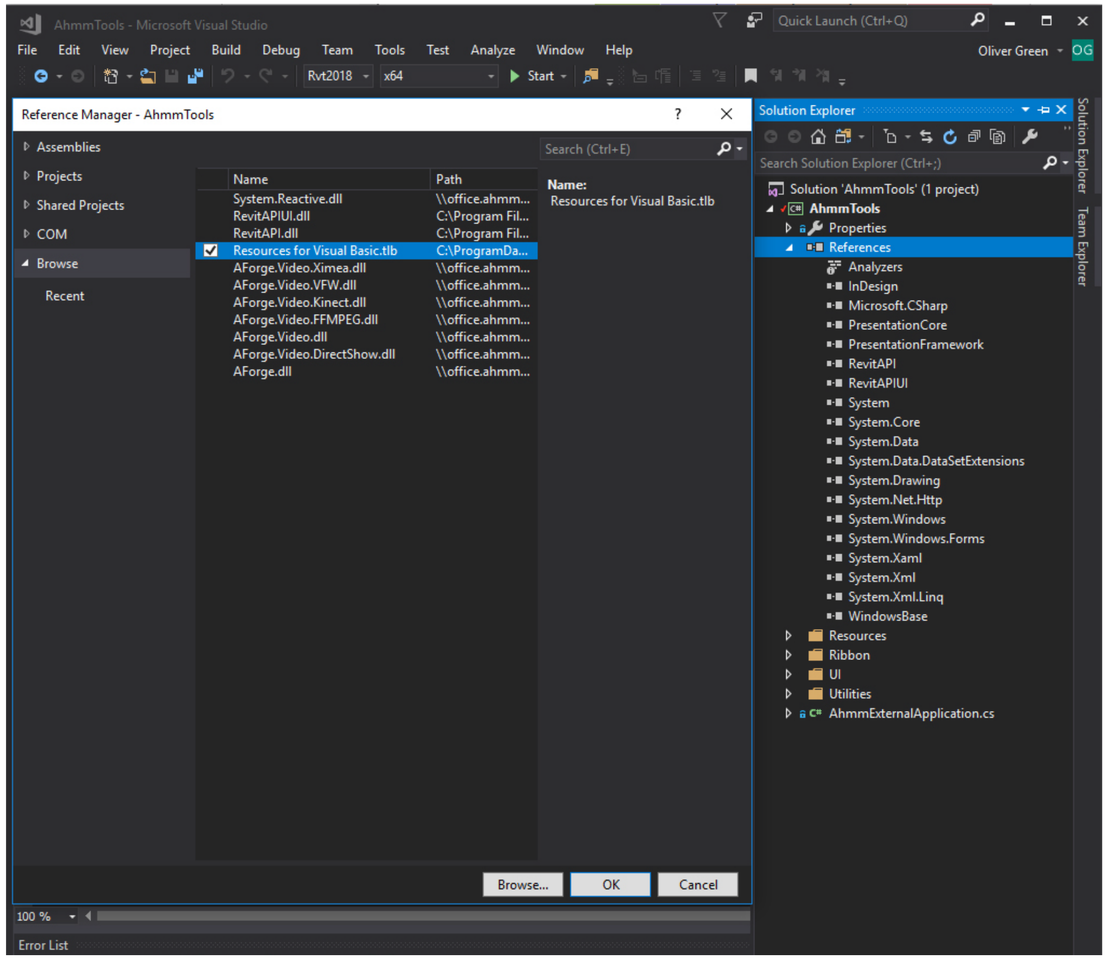
If you have InDesign installed, you can find it at:

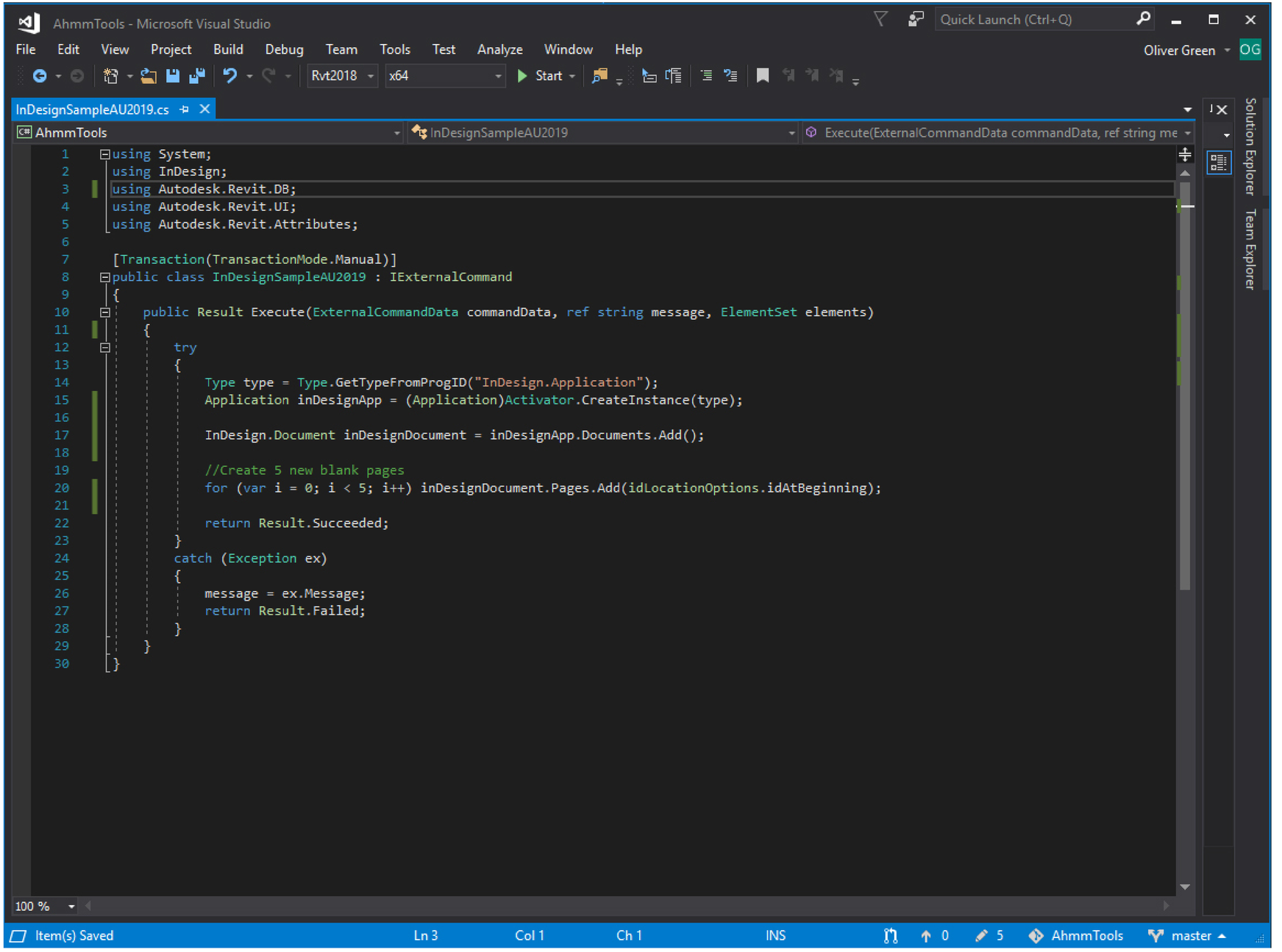
C:\ProgramData\Adobe\InDesign\Version 11.0\en_GB\Scripting Support\11.0\Resources for Visual Basic.tlb

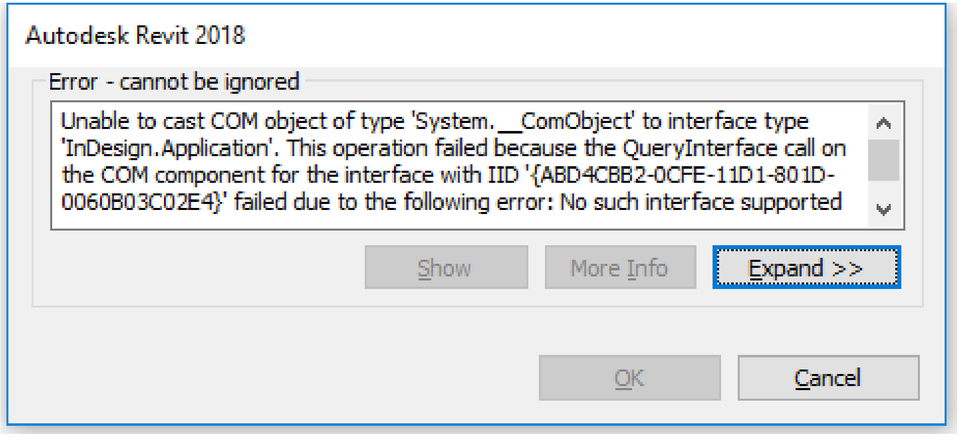
(Exact path address depends on Version but will be almost exactly the same)

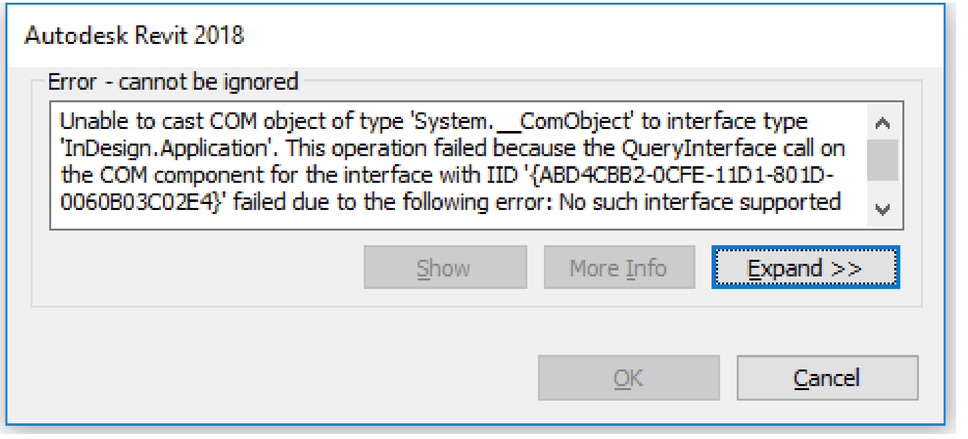
Right-Click on your Solution > Add Reference > Browse and select .tlb file

Add 'using InDesign; to your using directives at the top of your C# file, references should resolve




AhmmTools - Microsoft Visual Studio
Quick Launch (Ctrl+Q)
File Edit View Project Build Debug Team Tools Test Analyze Window Help
Oliver Green
Rvt2018
x64
Start
InDesignSampleAU2019.cs
AhmmTools
InDesignSampleAU2019
Execute(ExternalCommandData commandData, ref string me
using System;
using InDesign;
using Autodesk.Revit.DB;
using Autodesk.Revit.UI;
using Autodesk.Revit.Attributes;
[Transaction(TransactionMode.Manual)]
public class InDesignSampleAU2019 : IExternalCommand
{
public Result Execute(ExternalCommandData commandData, ref string message, ElementSet elements)
{
try
{
Type type = Type.GetTypeFromProgID("InDesign.Application");
Application inDesignApp = (Application)Activator.CreateInstance(type);
InDesign.Document inDesignDocument = inDesignApp.Documents.Add();
//Create 5 new blank pages
for (var i = 0; i < 5; i++) inDesignDocument.Pages.Add(idLocationOptions.idAtBeginning);
return Result.Succeeded;
}
catch (Exception ex)
{
message = ex.Message;
return Result.Failed;
}
}
}
100 %
Item(s) Saved
Ln 3
Col 1
Ch 1
INS
0
5
AhmmTools
master
Solution Explorer
Team Explorer


Autodesk Revit 2018
Error - cannot be ignored
Unable to cast COM object of type 'System.__ComObject' to interface type 'InDesign.Application'. This operation failed because the QueryInterface call on the COM component for the interface with IID '{ABD4CBB2-0CFE-11D1-801D-0060B03C02E4}' failed due to the following error: No such interface supported
Show
More Info
Expand >>
OK
Cancel



Note: COM error messages are almost worthless!

Fixing COM Error

Find your InDesign .tlb file and delete it

Then run InDesign as Administrator

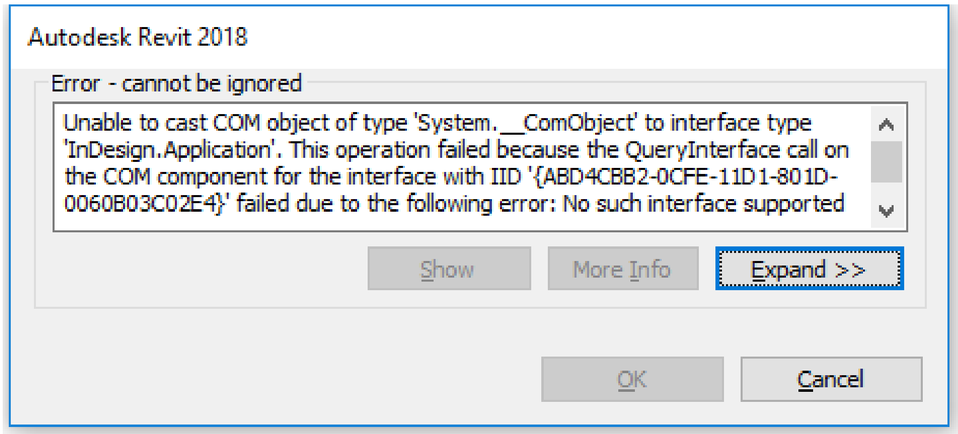
This will recreate the .tlb file, which should no longer throw an error

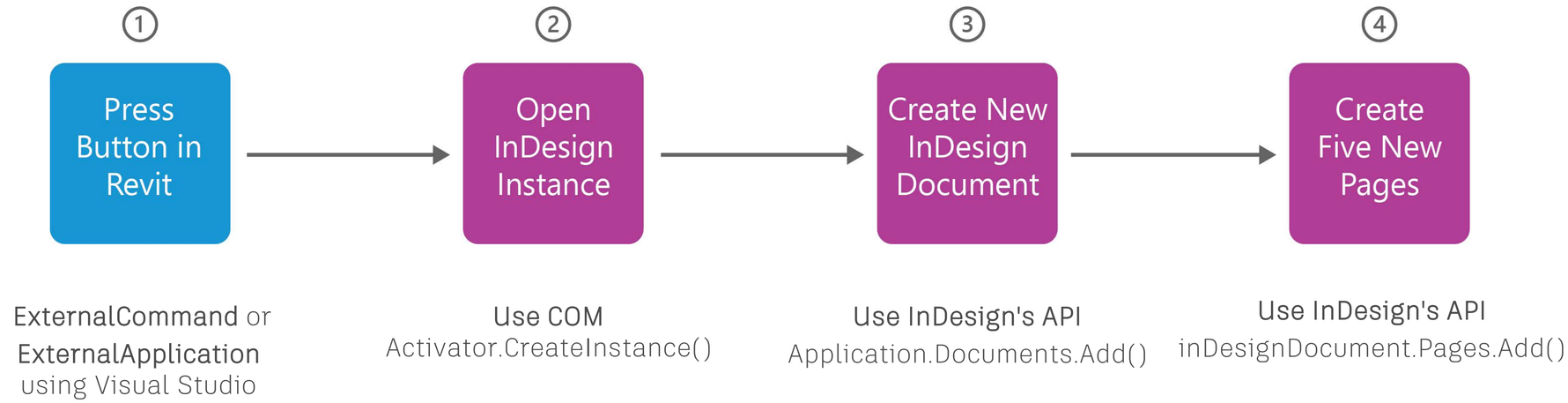
The test script worked, opening InDesign and creating 5 new blank pages!

Tested on Revit 2017/2018/2019.

Windows 10 with InDesign CC

ExternalApplication is compiled to x64 architecture / solution platform.





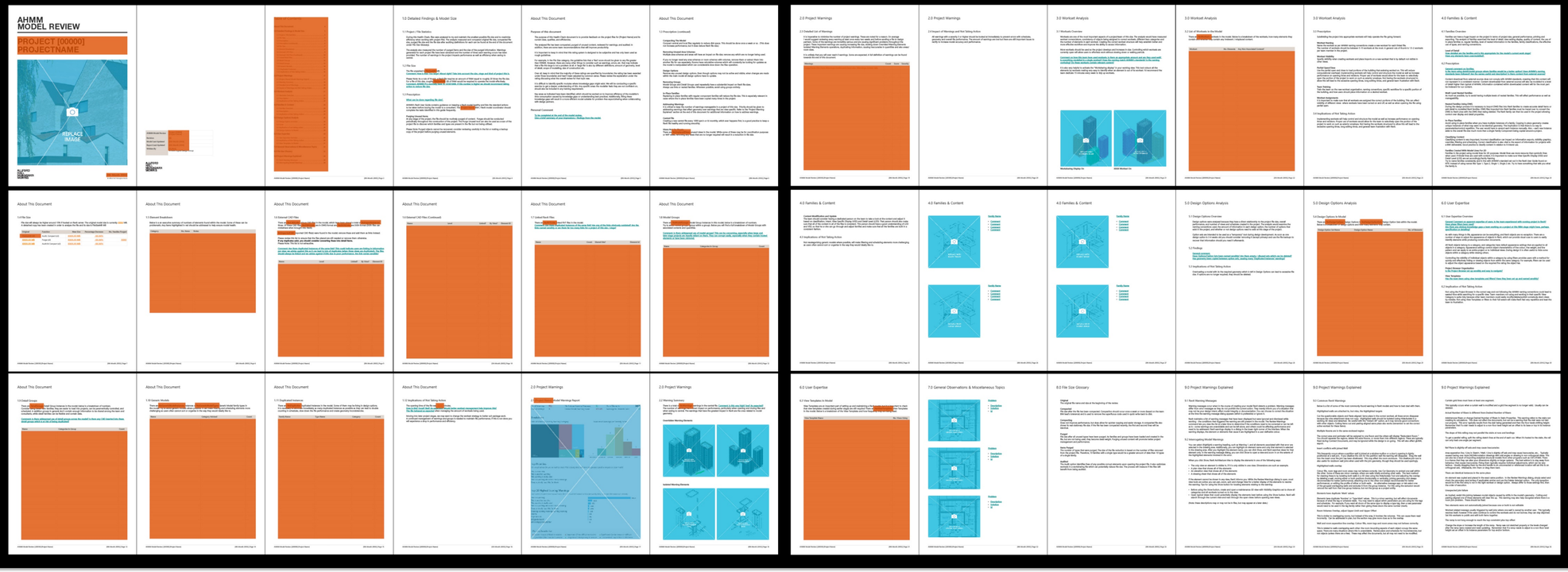
Back to Proof of Concept

We create an instance of the InDesign application using COM's Activator.CreateInstance() method. This gives us a handle on an opened session of InDesign.

From here, we need to create a Document to edit. I create a blank document as a proof of concept.

Once we have a Document we can do nearly anything we want to. In our example code we created five pages.

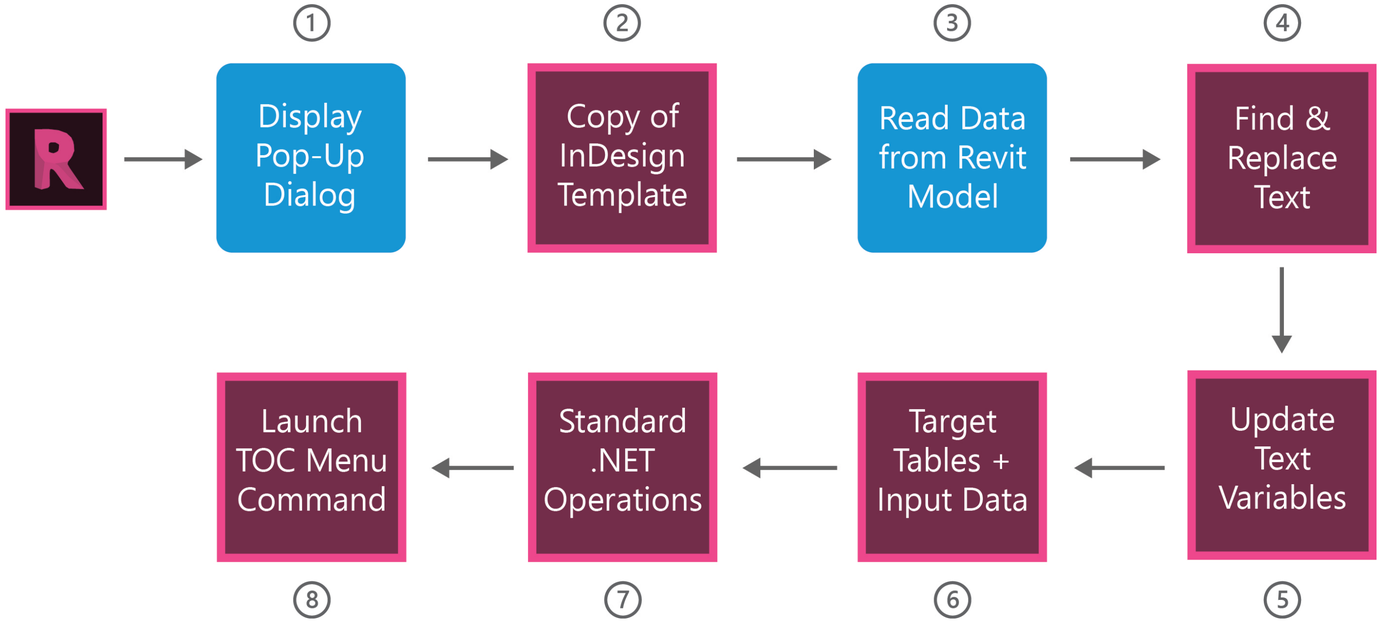
Preparing The Model Report Process



What Can We Automate?

Proof of Concept worked so I printed out our Model Report and marked up in red what I thought we could automate
It was a lot, maybe 80% of the information in the report

Around 40 pages - a structured & formatted report, made up of a mix of tables, images, critical commentary



Full Proposed Process Diagram

Having marked up our report I could differentiate different key tasks our tool would need to complete
We already demonstrated we had working access to the InDesign API from within Revit

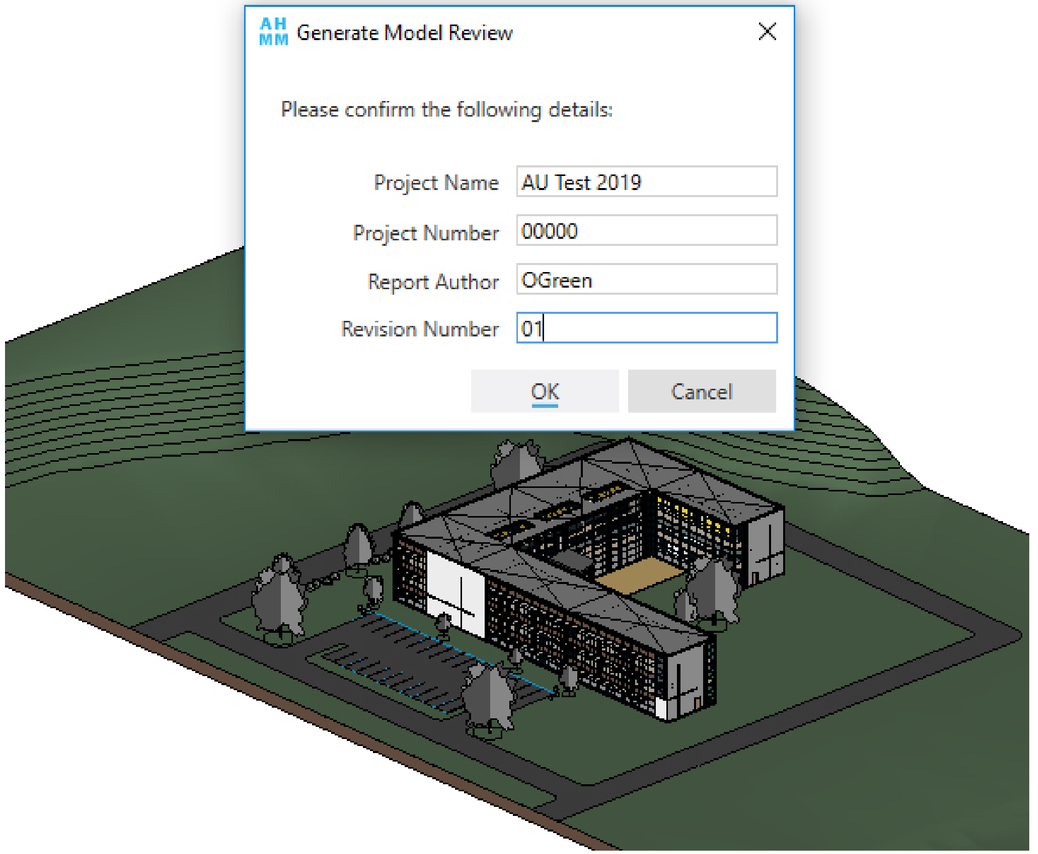
Next, I had to work our if, and how, these could be automated in code

1. Pop-Up Dialog for Input Info

The process would seek to confirm a few key values from the user at the start of each run

This is a WPF pop-up dialog window to let users enter the project name and number

Where possible, they are pre-populated from the Project Information parameters, but ultimately having a user confirm they're useful and valid values



2. Create New File from Template

I would need to begin the process by opening an instance of the InDesign application using COM.

I found examples of how to do this online. I needed to specify InDesign.Application as the type, as Revit has its own native Application Type

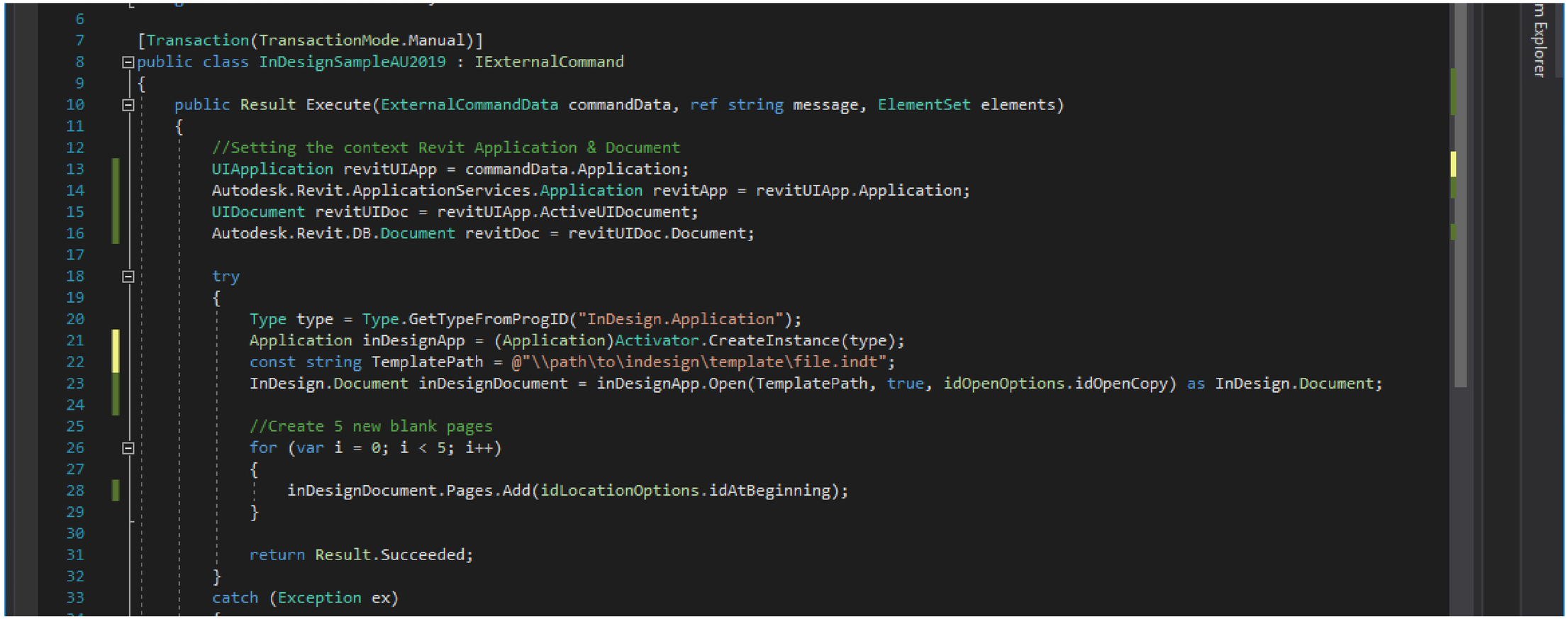
```
Type type = Type.GetTypeFromProgID("InDesign.Application");
InDesign.Application indesignApplication = (InDesign.Application)Activator.CreateInstance(type);
```

Activator.CreateInstance is used to open the application, which I cast back to the InDesign.Application type, allowing me access to the application's members (methods, events, properties, etc)

Finally, I was able to open an copy of an existing template file and create a handle for it:

```
InDesign.Document inDesignDocument = inDesignApp.Open(TemplatePath, true, idOpenOptions.idOpenCopy) as InDesign.Document;
```

2. Create New File from Template



```
6
7     [Transaction(TransactionMode.Manual)]
8     public class InDesignSampleAU2019 : IExternalCommand
9     {
10        public Result Execute(ExternalCommandData commandData, ref string message, ElementSet elements)
11        {
12            //Setting the context Revit Application & Document
13            UIApplication revitUIApp = commandData.Application;
14            Autodesk.Revit.ApplicationServices.Application revitApp = revitUIApp.Application;
15            UIDocument revitUIDoc = revitUIApp.ActiveUIDocument;
16            Autodesk.Revit.DB.Document revitDoc = revitUIDoc.Document;
17
18            try
19            {
20                Type type = Type.GetTypeFromProgID("InDesign.Application");
21                Application inDesignApp = (Application)Activator.CreateInstance(type);
22                const string TemplatePath = @"\\path\to\indesign\template\file.indt";
23                InDesign.Document inDesignDocument = inDesignApp.Open(TemplatePath, true, idOpenOptions.idOpenCopy) as InDesign.Document;
24
25                //Create 5 new blank pages
26                for (var i = 0; i < 5; i++)
27                {
28                    inDesignDocument.Pages.Add(idLocationOptions.idAtBeginning);
29                }
30
31                return Result.Succeeded;
32            }
33            catch (Exception ex)
```

3. Find & Replace Text

With the template copy open, we can get to work!

The first edit I'd want to make would be to target specific placeholder words in our Model Review template and replace them with meaningful values

The template we designed for automation purposes was created full of placeholder words for certain values, such as "There are NoWarnings in the model". I wanted to build a method to switch out these placeholder values

3. Find & Replace Text

The InDesign API has find & replace functionality using GREP - Global Regular Expressions Print.
GREP operations are very quick & efficient, using regular expressions
I created a method called FindAndReplaceGREP():

```
void FindAndReplaceGREP(string stringToFind, string stringToReplace) {
inDesignApplication.ChangeGrepPreferences    //to initially set up parsing rules. These will not change
inDesignApplication.FindGrepPreferences.findWhat  = stringToFind;
var findGrep = inDesignDocument.FindGrep();
inDesignApplication.ChangeGrepPrerences.changeTo = stringToReplace;
inDesignDocument.ChangeGrep(); }
```

With that method set up, this is all that's required to find and replace text within the target document

3. Find & Replace Text

I created a 'GREP Dictionary', which is just a dictionary to associate certain specific words to their replacement values

Then I could iterate through all entries in this dictionary to set the values I wanted, while keeping all data together

```
Dictionary<string, string> grepDictionary = new Dictionary<string, string>()
{
    {"ProjectName", modelReviewInfo.TextBoxProjectName.Text},
    {"NoImportInstances", allImportInstances.Count.ToString()},
    {"NoCADLinks", allCadLinkTypes.Count.ToString()},
    {"NoRVTLinks", allRevitLinkIds.Count.ToString()},
    {"NoDWGLinks", numberDwgLinks.ToString()},
    {"NoDGNLinks", numberDgnLinks.ToString()},
    {"NoImportedCAD", numberImportedCad.ToString()},
    {"NoUnplacedViews", numberUnplacedViews.ToString()},
    {"NoViewTemplates", allViewTemplates.Count.ToString()},
    {"NoModelGroups", allModelGroups.Count.ToString()},
    {"NoDetailGroups", allDetailGroups.Count.ToString()},
    {"NoGenericModelTypes", allGenericModelTypes.Count.ToString()},
    {"NoGenericModelInstances", allGenericModelElements.Count.ToString()},
    {"NoWorksets", allWorksets.Count.ToString()},
    {"FileSizeMB", fileSizeMB.ToString()},
    {"FileSizeRAM", Math.Round(fileSizeMB*(20.0/1000), 0).ToString()},
    {"NoDesignOptions", allDesignOptions.Count.ToString()},
    {"NoDesignOptionSets", allDesignOptionSetIds.Count.ToString()},
};

//Iterate through the grepDictionary to replace keywords
foreach (KeyValuePair<string, string> item in grepDictionary)
{ FindAndReplaceGREP(item.Key, item.Value); }
```

4. Update Text Variables

I wanted to target the document's Text Variables, which are defined once and implemented in many places across the document

Accessed via Document.TextVariables which returns a list of TextVariables we can loop through

In a similar manner to my 'GREP dictionary', I created a 'Text Variables Dictionary' to associate text variable names to their values

The values can be set using TextVariable.VariableOptions.Contents

```
Dictionary<string, string> textVariableDictionary = new Dictionary<string, string>
{
    { "Project Name", modelReviewInfo.TextBoxProjectName.Text},
    { "Project Number", modelReviewInfo.TextBoxProjectNumber.Text},
    { "Report Author Name", modelReviewInfo.TextBoxWrittenBy.Text},
    { "Model Last Updated Date", DateTime.Now.ToString("d MMMM yyyy")},
    { "Document Revision", modelReviewInfo.TextBoxRevision.Text},
    { "Document Issue Date", DateTime.Now.ToString("d MMMM yyyy")},
};

//Iterate through the textVariableDictionary to set text variable values
foreach (KeyValuePair<string, string> item in textVariableDictionary)
{ TrySetTextVariable(item.Key, item.Value); }
```

```
//Function to set a value to a text variable
void TrySetTextVariable(string textVariableName, string textValue)
{
    foreach (TextVariable textVariable in inDesignDocument.TextVariables)
    {
        if (textVariable.Name == textVariableName)
        {
            textVariable.VariableOptions.Contents = textValue;
        }
    }
}
```

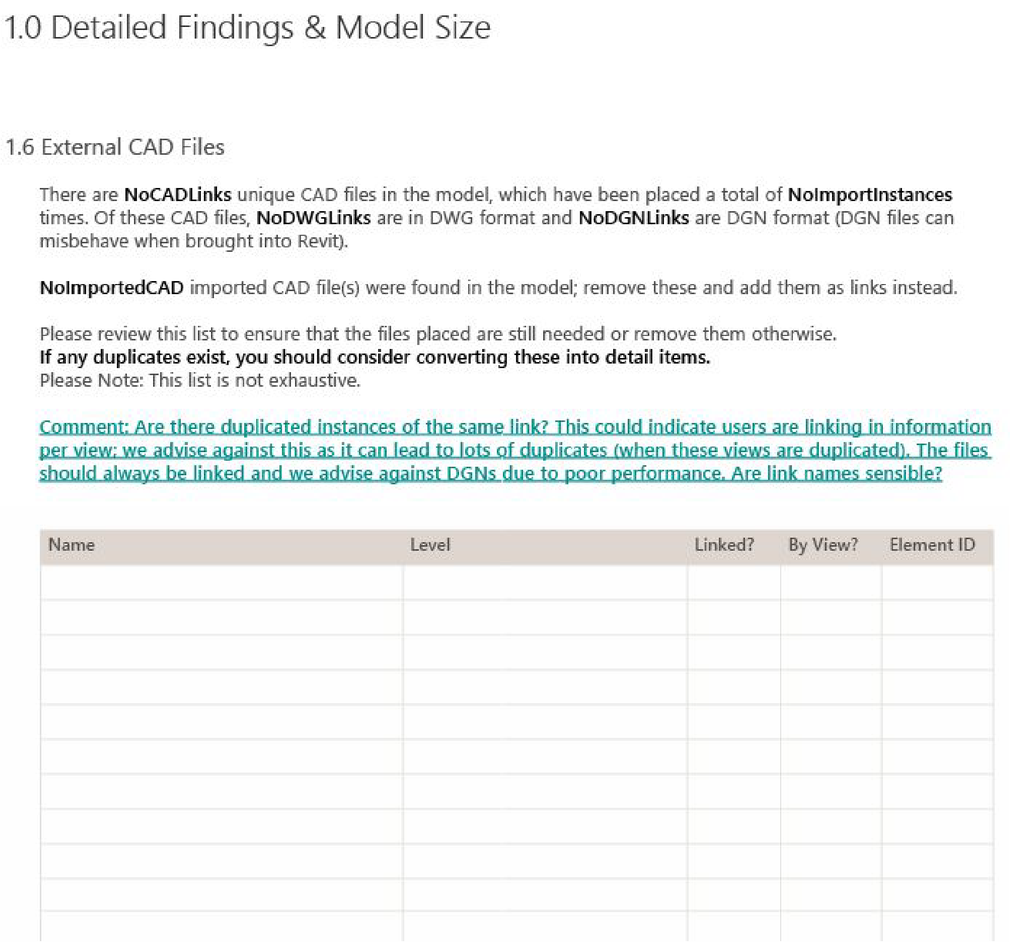
5. Target Tables & Input Data

Tables were difficult to access because the API is a bit odd in places

Tables cannot be accessed conveniently using Document.Tables, or even Page.Tables

They are accessed as Document > Pages > TextFrames. Tables are a kind of TextFrame, but so are normal text boxes in InDesign

There are tests to determine which is which, but this all seemed a bit backwards as I wanted the ability to target specific tables



1.0 Detailed Findings & Model Size

1.6 External CAD Files

There are **NoCADLinks** unique CAD files in the model, which have been placed a total of **NoImportInstances** times. Of these CAD files, **NoDWGLinks** are in DWG format and **NoDGNLinks** are DGN format (DGN files can misbehave when brought into Revit).

NoImportedCAD imported CAD file(s) were found in the model; remove these and add them as links instead.

Please review this list to ensure that the files placed are still needed or remove them otherwise.
If any duplicates exist, you should consider converting these into detail items.
Please Note: This list is not exhaustive.

Comment: Are there duplicated instances of the same link? This could indicate users are linking in information per view; we advise against this as it can lead to lots of duplicates (when these views are duplicated). The files should always be linked and we advise against DGNs due to poor performance. Are link names sensible?

Name	Level	Linked?	By View?	Element ID

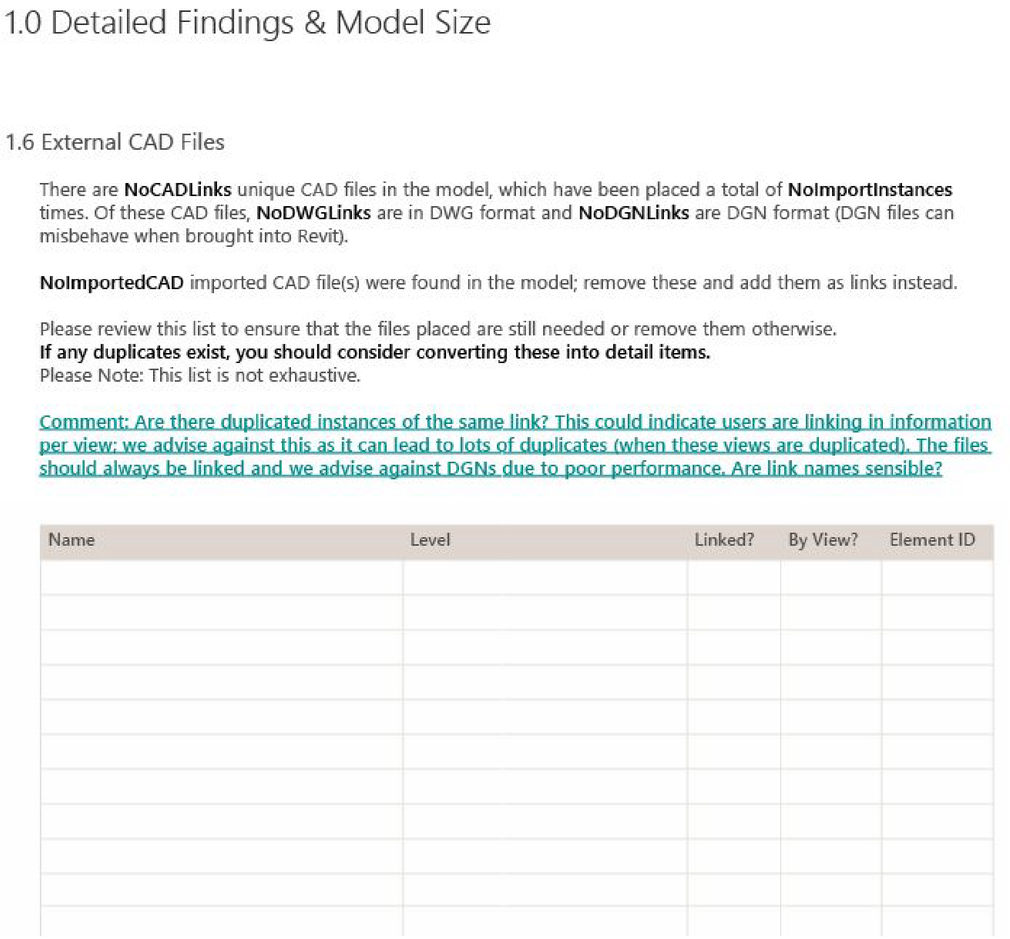
5. Target Tables & Input Data

In InDesign all elements have an arbitrary ID number, like 6 or 52

The InDesign API lets us select items by their ID

But it would be a bad idea to hard-code the IDs of each table in the template; this could easily change as I make new copies of or update the model review template

I wanted an approach to guarantee I was selecting the right table every time, regardless of its ID



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Name	Level	Linked?	By View?	Element ID

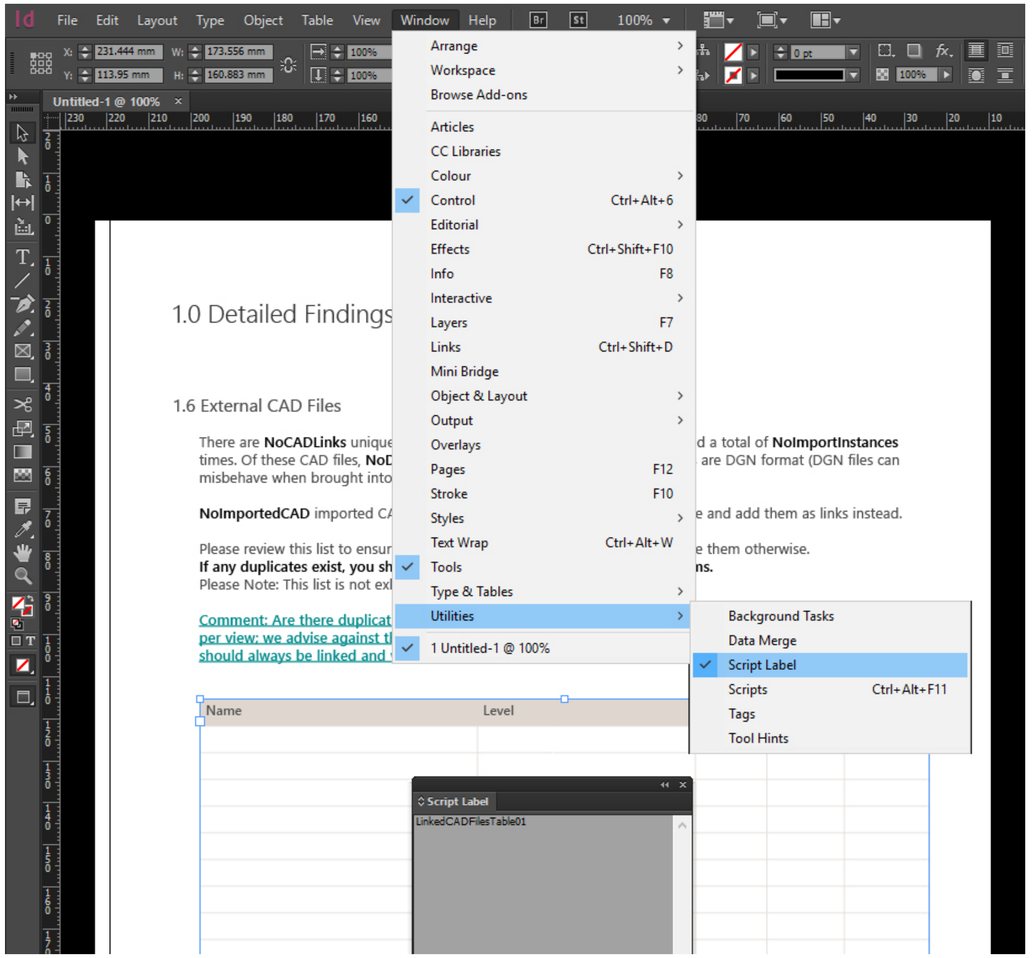
5. Target Tables & Input Data

However, InDesign lets you apply something called 'Script Labels' (readable strings) to elements

We can't search for elements by their Script Label.

Therefore, I created a dictionary to map each table (with its script label) to its internal ID when the ExternalCommand first runs

This would let us create a method to search for a table by its label and have it returned to us (courtesy of its ID)



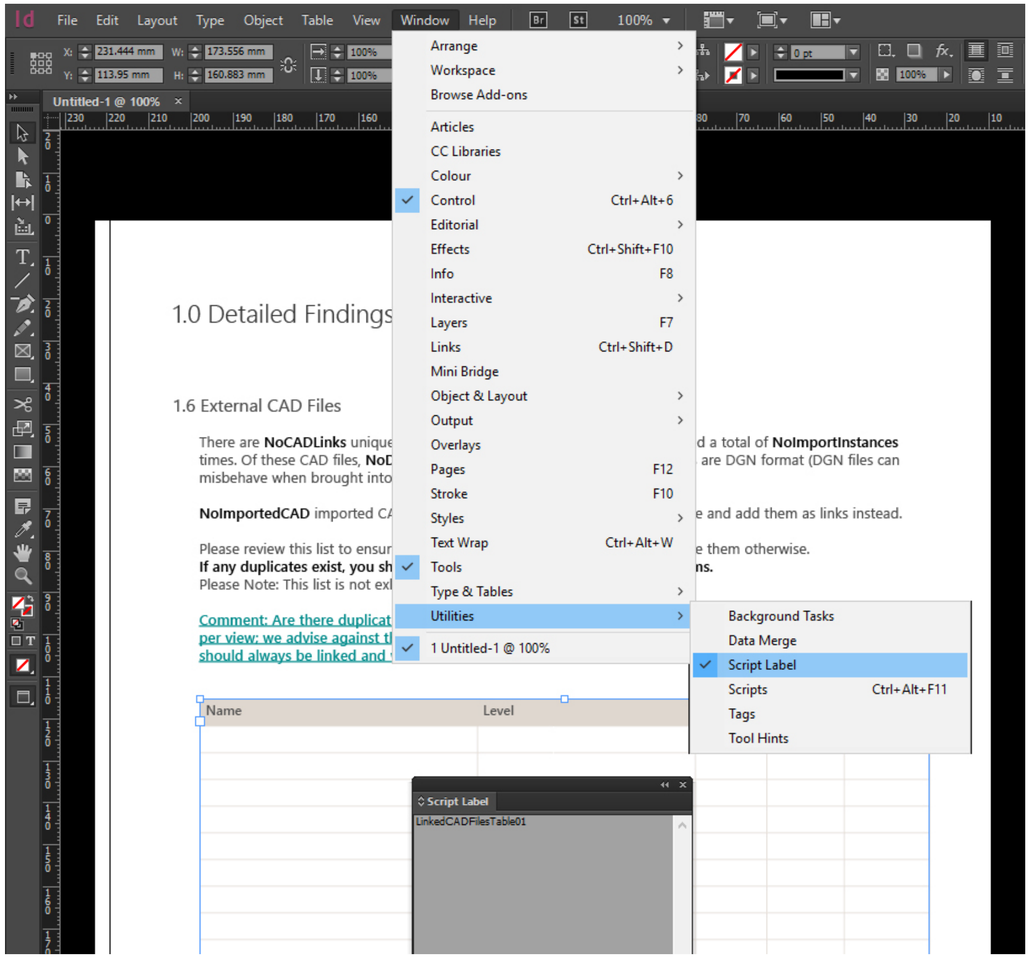
5. Target Tables & Input Data

We can't access a document's Tables directly

Since tables are a subclass of TextFrame, we have to iterate through all of these, querying whether each TextFrame has a Script Label applied to it. In order to access TextFrames, we need to iterate through the pages in the document

We can do this and populate our Script Label / ID reference dictionary. We need to create this dictionary only once at the start of our script run

We can then use it for reference to look up Tables



5. Target Tables & Input Data

I created a method called FindTable, which simply takes the ScriptLabel name as its key, and which returns the Table I'm after

We now have the ability to target specific tables by their name

Table linkedRevitFilesTable = FindTable("LinkedRevitFilesTable");

The table's contents are accessed via its Contents property, which needs to be passed an array of strings

```
//Logging the ID of every table for faster access
foreach (Page page in inDesignDocument.Pages)
{
    TextFrames textFrames = page.TextFrames;
    if (textFrames != null && textFrames.Count > 0)
    {
        foreach (TextFrame textFrame in textFrames)
        {
            if (!tableIdDictionary.ContainsKey(textFrame.Label))
            {
                tableIdDictionary.Add(textFrame.Label, textFrame.Id);
            }
        }
    }
}

//Function to return Table according to its Script Label name in InDesign
Table FindTable(string labelName)
{
    int textFrameId = tableIdDictionary[labelName];
    TextFrame textFrame = inDesignDocument.TextFrames.ItemByID(textFrameId);
    return textFrame.Tables.FirstItem();
}
```

6. Normal .NET Operations

There were some key values I wanted the report to be able to display which I knew could be accessed using the .NET class libraries

I read the current date and time and formatted them using DateTime.Now.ToString("yyyyMMdd");

I set the Text Variable for the Report Author's name to read their login name, e.g. OGreen, using System.Environment.UserName

These were used to set Text Variables or for Find & Replace operations

6. Normal .NET Operations

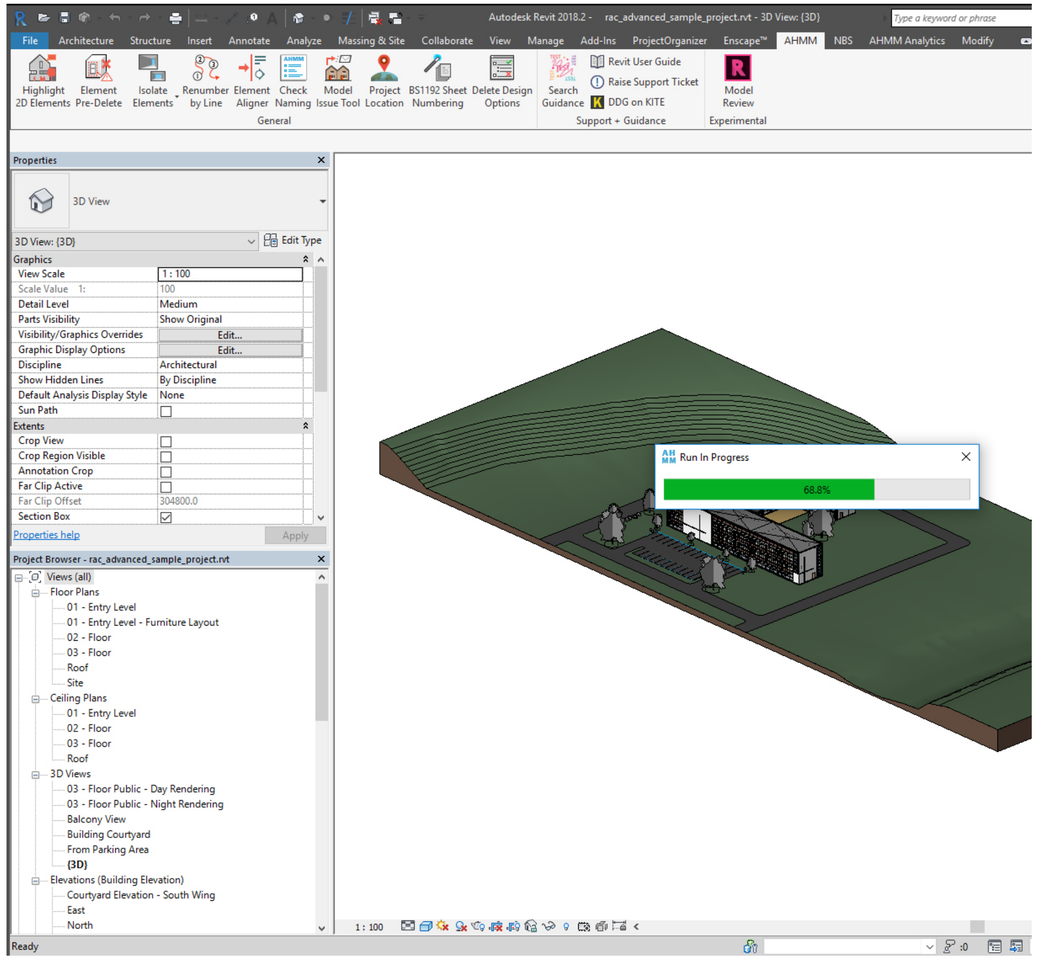
I used .NET's threading libraries and WPF to display a live-updating progress bar

This updates in its own thread to get around Revit's single-threadedness

Progress percentage was somewhat arbitrary; I decided how many steps there were and wrote code to update the progress bar after each step

How does one accurately reflect progress?

Seems to be a classic programming debate...



6. Normal .NET Operations

Finally, I used some Precompiler Directives in my code to adjust certain operations for different versions of Revit's API

For instance, I couldn't access the number of model warnings via the Revit 2017 API to write this value into our document

```
354
355     #if REVIT2018 || REVIT2019
356
357             List<FailureMessage> allWarnings = revitDocument.GetWarnings().ToList();
358             FindAndReplaceGREP("NoWarnings", allWarnings.Count.ToString());
359
360     #endif
361
```

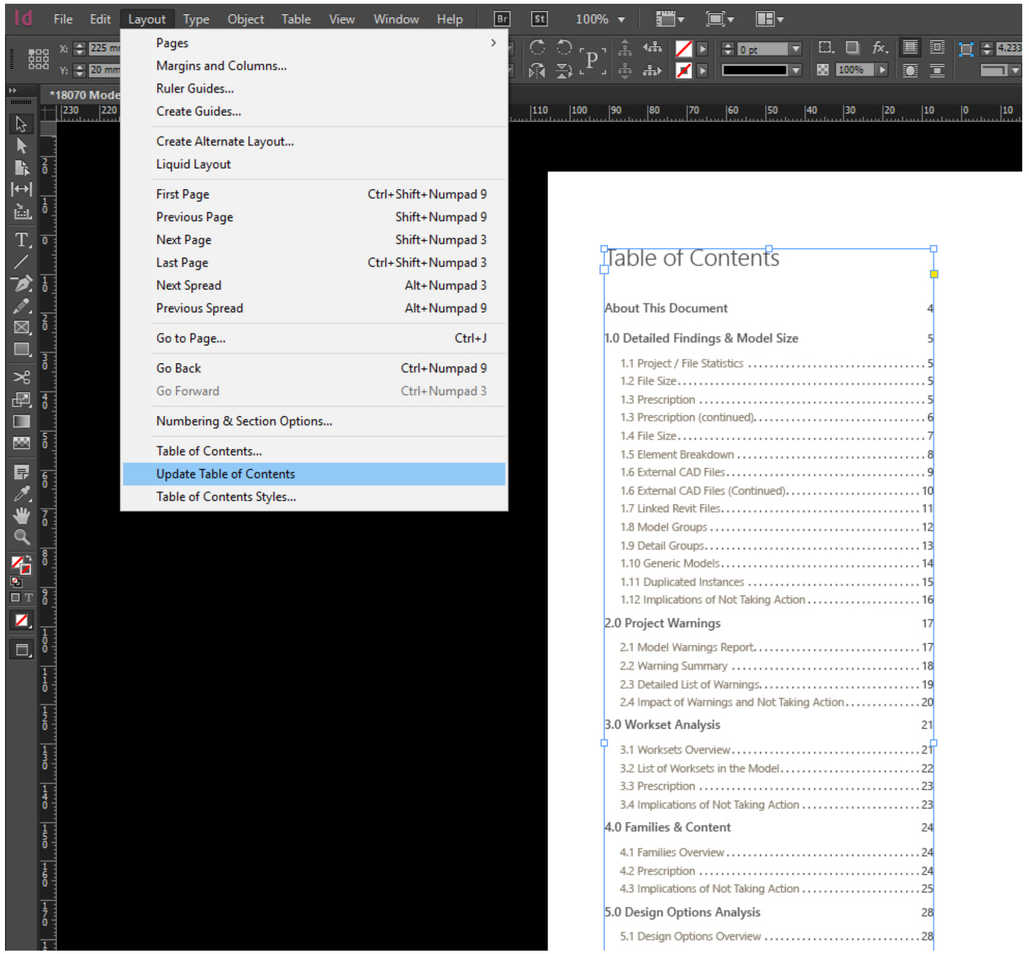
7. Launch UI Menu Commands

As the last step in our report generation, I needed the ability to update the Table of Contents

This is normally accessed in the UI via the Layout Menu > Update Table of Contents

Menu Commands in InDesign each have a specific 'Command ID'

I found a free Javascript script online, written by a Lancaster-based typesetter called Peter Kahrel

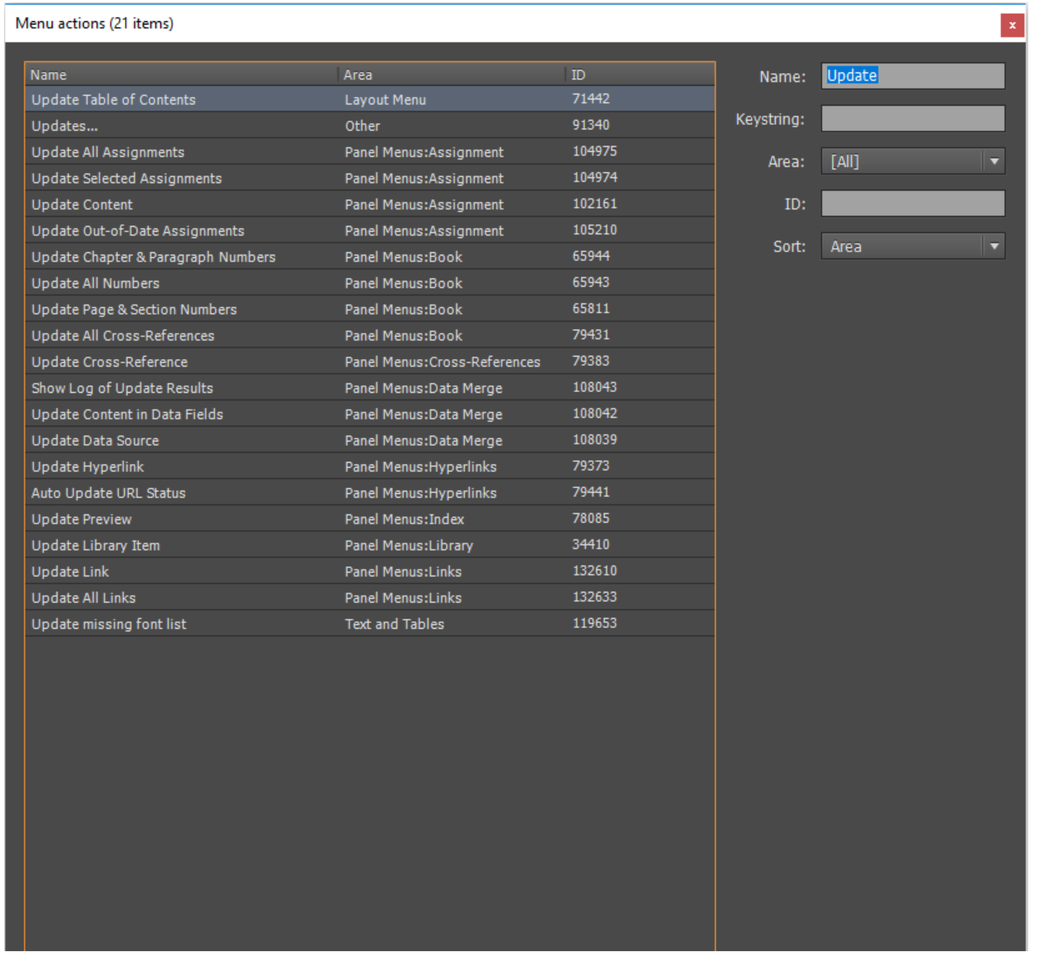


7. Launch UI Menu Commands

The script creates a mini menu of all CommandIds in InDesign

I could then sort these menu commands or search using keywords to find the ID of the menu action I needed (it was 71442)

I needed to find the TextFrame containing the Table of Contents using its Script Label, and select it in code using Application.Selection

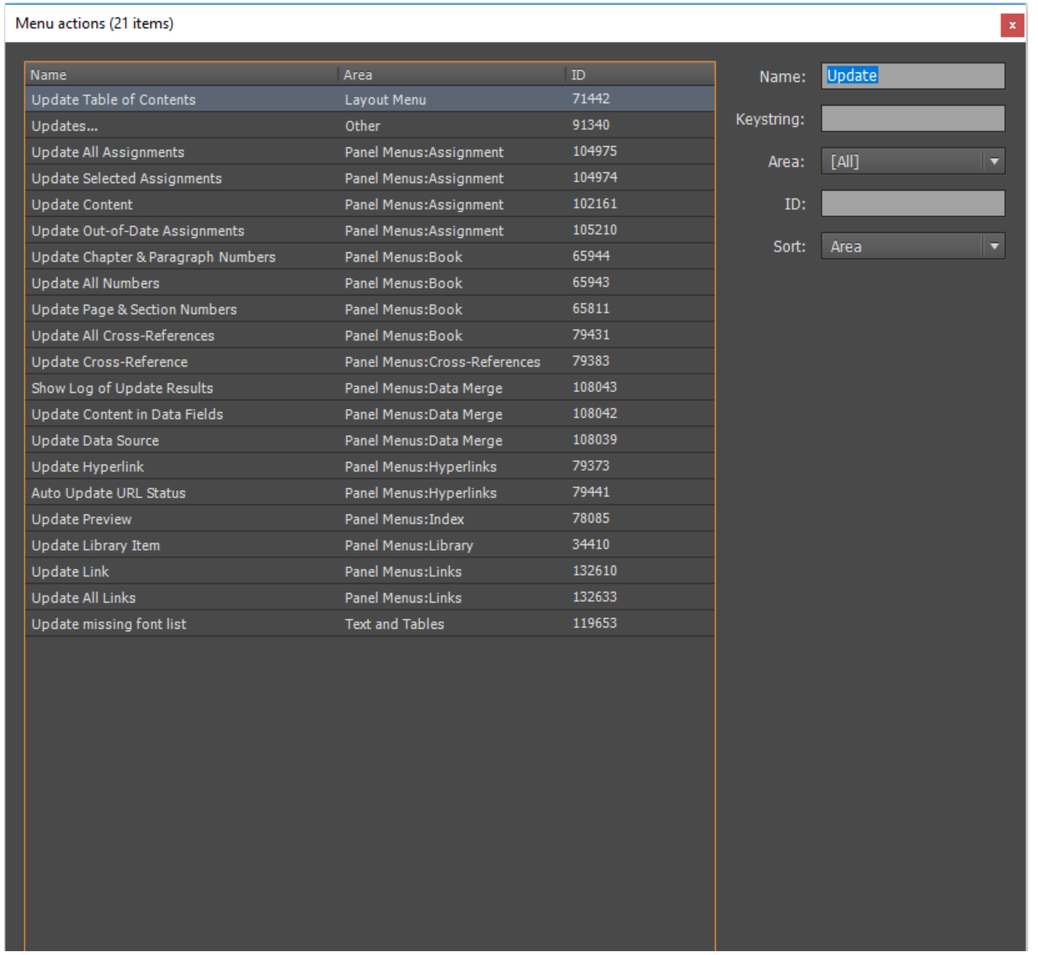


7. Launch UI Menu Commands

Then I could use the MenuAction and indesignApplication.MenuActions.ItemByID(71442);

To select the Action, followed by menuAction.Invoke() to invoke the command

This Updated the Table of Contents



Live Demonstration

Conclusion

Our Model Review tool did everything we wanted it to: copying a template, filling tables & key values

About 80% of the report's content was auto-generated, saving many hours per model review

It was naturally limited in its scope:
"Let's not spent months on this, but what could we reasonably achieve?"

It is certainly possible to take this further

Further Possibilities

Use Revit API to create isolated images of warning elements / worksets, save an image and dynamically update template's image placeholders

Intelligent commenting based on pre-existing knowledge of filesize, RIBA stage and number of elements in the model

Automatic formatting of paragraphs according to a condition

Using WPF data visualisation libraries to create charts & graphs (e.g. LiveCharts)

Now It's Your Turn

Have any reports you want to automate?

We have uploaded skeleton code samples to AHMM's Github repository

We have just scratched the surface of what Revit and InDesign's API can do together

Resources

archi-lab blog for very detailed posts on creating ExternalCommands and ExternalApplications

The Building Coder blog for Revit API reference

InDesign's SDK for API docs and examples

YouTube: Jamie King's channel for helpful explanations of C# concepts

Our Github - to get started

Thank You for Listening

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Make anything™