



Parametric Classical Orders

A Journey with the Revit Family Editor

Paul F. Aubin – Paul F. Aubin Consulting Services

Class Description

Years ago, I began exploring the possibilities of creating the classical orders of architecture in today's CAD/BIM software. Initially I tried to faithfully reproduce the form and proportions of one of the orders using source materials drawn from many of the historical masters. It wasn't long before the project morphed into a more detailed exploration leveraging the possibilities that parametric modeling could lend to the exercise. What if a set of fully parametric classical orders could be devised? Parametric families are the cornerstone of Revit and this project presented an ideal way to push the family editor to its limits. The project was not without its challenges, but there were plenty of successes along the way as well. Enough so that I published a book detailing the process used to create each of the orders step-by-step in the Revit family editor. This session is part case-study (on the journey I took to go from original ideal all the way to publication), and part tutorial (to show the "nuts and bolts" of how the families were built) demonstrated directly in the Revit software. In this session I'll talk about scaling, reusing content, profiles, moldings, formulas, nested components, and complex forms in both the traditional and adaptive component family editors. I'll show both the final successful versions and a few not so successful earlier versions as well. So if you are interested historic architecture, classical form, or just like pushing the family editor to extremes, then this session is sure to please.

This document is not a tutorial. I will refer you to my book: Renaissance Revit for that. This document is instead meant to supplement the class and serve as notes to the session. As such it includes many of the images I will be presenting in the session. Thanks.

Learning Objectives

At the end of this class, you will be able to:

- See how Revit can be used to emulate historic architecture
- Understand the process of how to create traditional forms in the family editor
- Componentize your families: reuse the parts and pieces
- See the importance of formulas and other advanced techniques to build complex families


About the Speaker

Paul F. Aubin is the author of many CAD and BIM book titles including the widely acclaimed: The Aubin Academy Mastering Series: Revit Architecture, AutoCAD Architecture, AutoCAD MEP and Revit MEP titles. His latest book: Renaissance Revit is the subject of this talk today. Paul has also authored several video training courses for lynda.com (www.lynda.com/paulaubin). Paul is an independent architectural consultant who travels internationally providing Revit® Architecture and AutoCAD® Architecture implementation, training, and support services. Paul's involvement in the architectural profession spans over 20 years, with experience that includes design, production, CAD management, mentoring, coaching and training. He is an active member of the Autodesk user community, and has been a top-rated speaker at Autodesk University (Autodesk's annual user convention) for many years. Paul has also received high ratings at the Revit Technology Conference (RTC) in both the US and Australia and he spoke at the inaugural Central States Revit Workshop this year. His diverse experience in architectural firms, as a CAD manager, and as an educator gives his writing and his classroom instruction a fresh and credible focus. Paul is an associate member of the American Institute of Architects. He lives in Chicago with his wife and three children.


Contact Paul directly from the contact form at the website: www.paulaubin.com

Don't wait for the movie...

Books by Paul F. Aubin



- Renaissance Revit: *Creating Classical Architecture with Modern Software*
Paul F. Aubin
- Revit Architecture 2013 *and beyond* (PDF update to 2014 available)
Paul F. Aubin
- Aubin Academy: Revit MEP 2014
Paul F. Aubin, Darryl McClelland, LEED AP, Martin Schmid, PE & Gregg Stanley



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Today I want to talk about my newest book:

Renaissance Revit: Creating Classical Architecture with Modern Software.

<http://paulaubin.com/books/renaissance-revit/>

About the book:

This book tackles a subject never before approached in the world of Revit training manuals. In this exquisite hands-on guide, take a virtual tour through the history of architecture in a way like no other: hands-on! Paul's book is a tutorial of epic proportions that does not just talk about creating Doric, Ionic and Corinthian columns; it walks through the process step-by-step! This book brings together three of the author's favorite things: architecture, Revit and history. Following along with Paul as your guide, you'll learn the family editor in a completely unique way: building the classical orders!



I am a Long-time fan of Classical Architecture

I have always been fascinated by classical forms, Roman times, history and of course architecture. I ultimately called the book “Renaissance Revit” not only because it was a catchy title, but also because many of the Renaissance authorities looked to Roman classicism as their model to reinvent Europe’s cityscapes.

I did include a few Greek examples in the book as well, but most of my forms are Roman and/or Renaissance style forms

So in attempt to marry my many interests; Revit’s parametric qualities and the beauty and challenge of building these forms as fully parametric 3D forms was just too tempting for me to resist.

Sketches

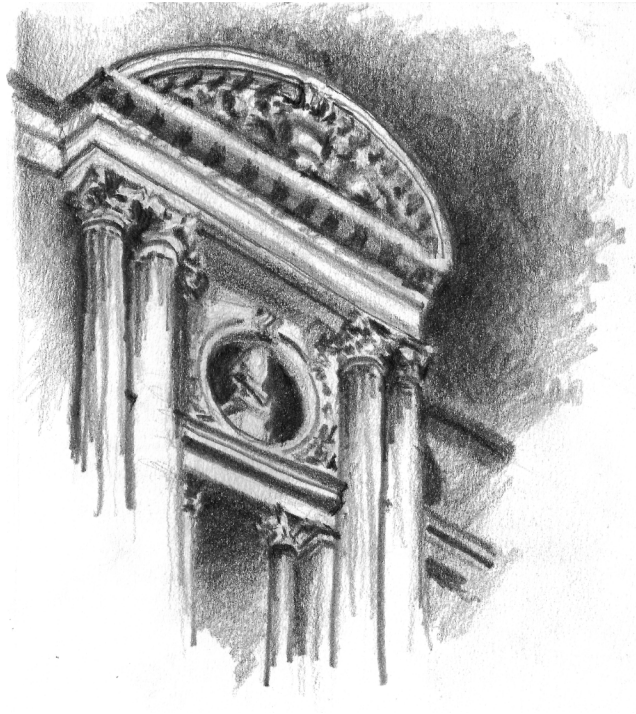
I suppose that the process began back in school with a semester study abroad.

We use sketches to help us understand our built environment, and in my semester in Europe, we did a lot of sketching!



These are some examples from my college sketchbook. My sketch of Palladio's Villa Rotunda and a Roman aqueduct.





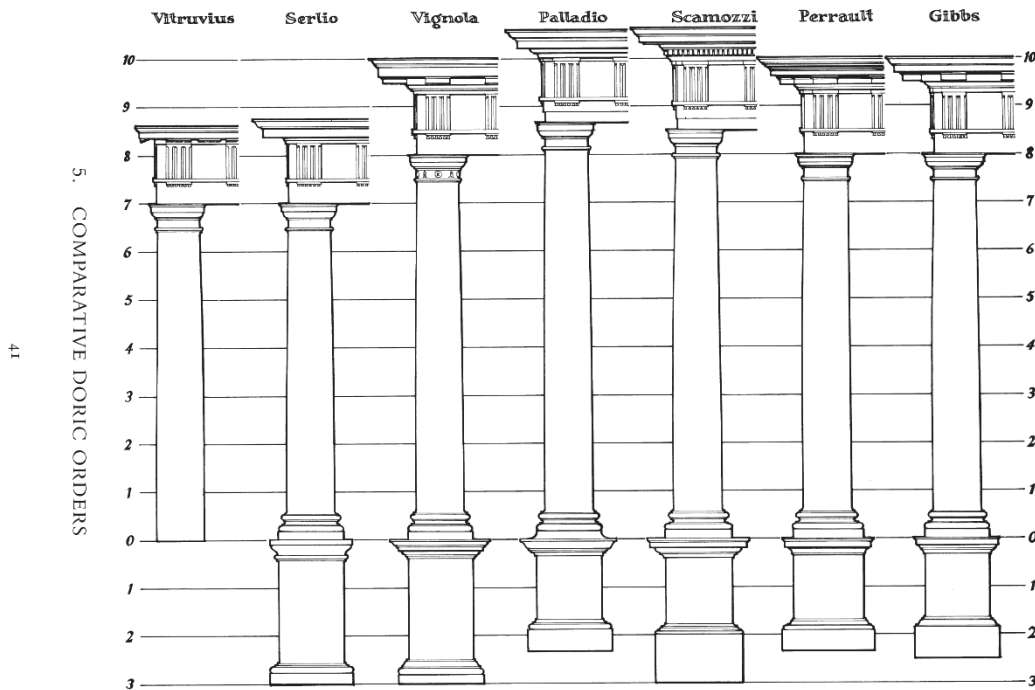
And one more: a sketch of the Paris Opera.

Sources:

My primary resource is a wonderful book by Robert Chitham. He has distilled the masters and their treatises into a very clever metric system of measurement.



I referred to several other books in my research as well. Another excellent one was: “The Architectural Orders of the Greeks and Romans: 100 Plates” Folio Edition by J.M. Mauch. This book contains some extraordinary drawings of many existing classical works. I used several other books as well (man pictured here). A complete bibliography is included in my book.

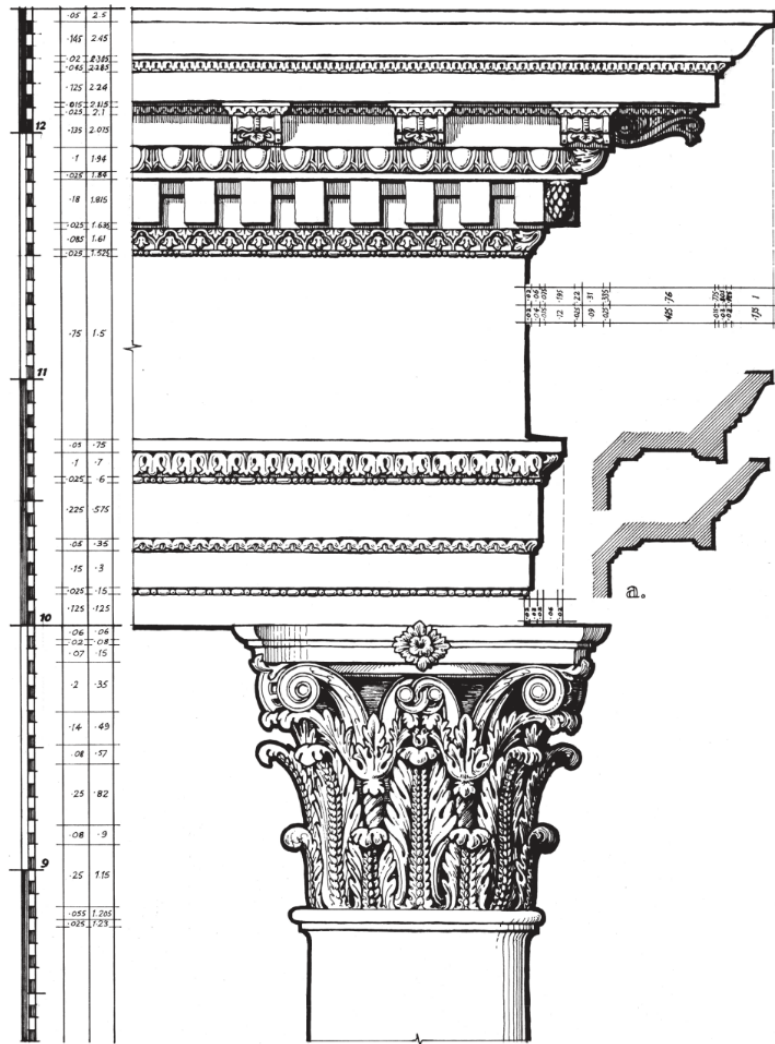


Sample plate from Chitham

The Classical Orders of Architecture, 2nd Edition

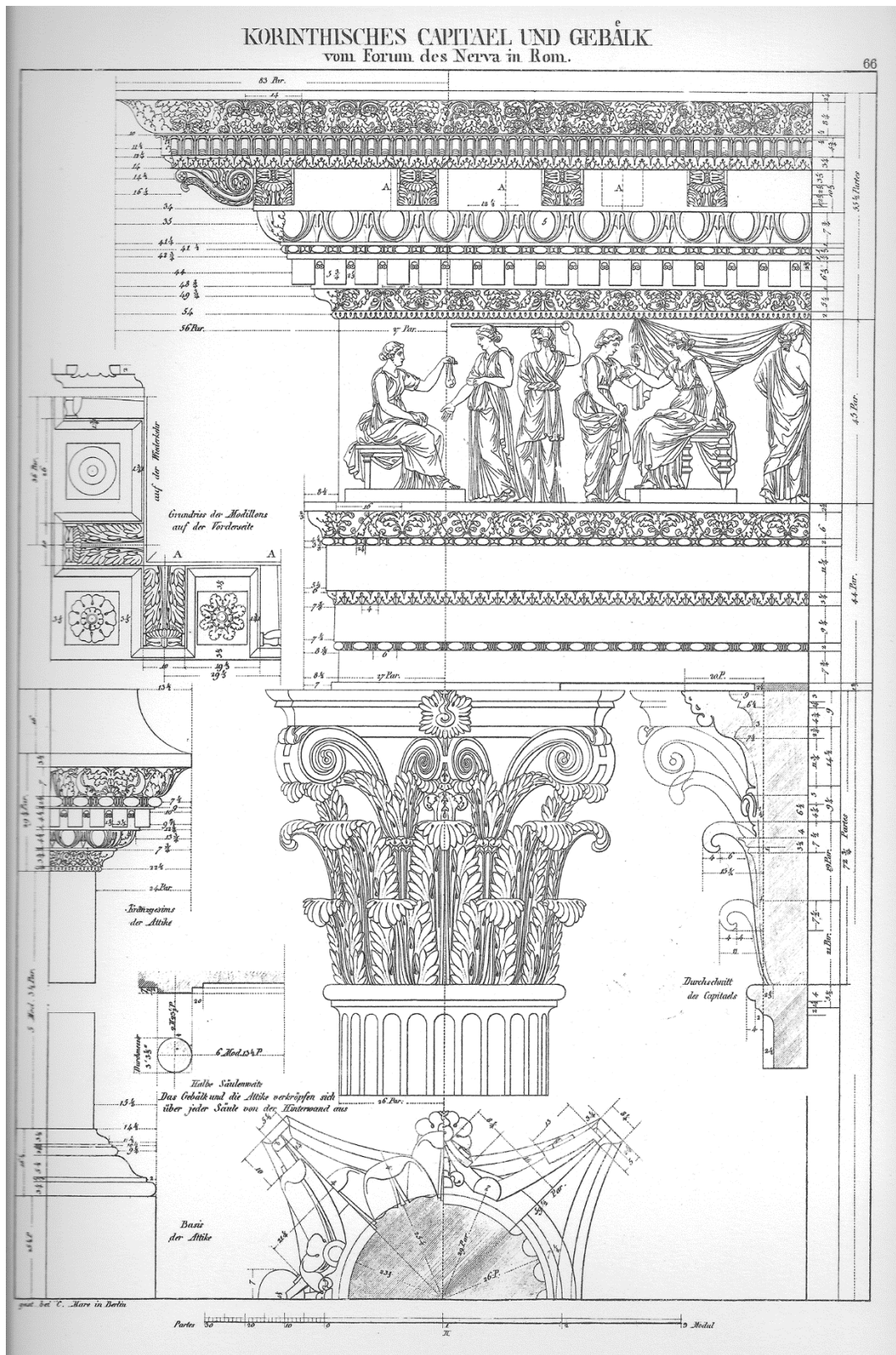
Chitham's comparison of the Doric order as presented by each of the masters.

Chitham used many sources to arrive at his own “idealized” form and proportion for each order. He then presents these idealized proportions in decimal measurements. This makes it very easy to transfer the measurements to formulas in the family editor.



24. THE CORINTHIAN CAPITAL AND ENTABLATURE

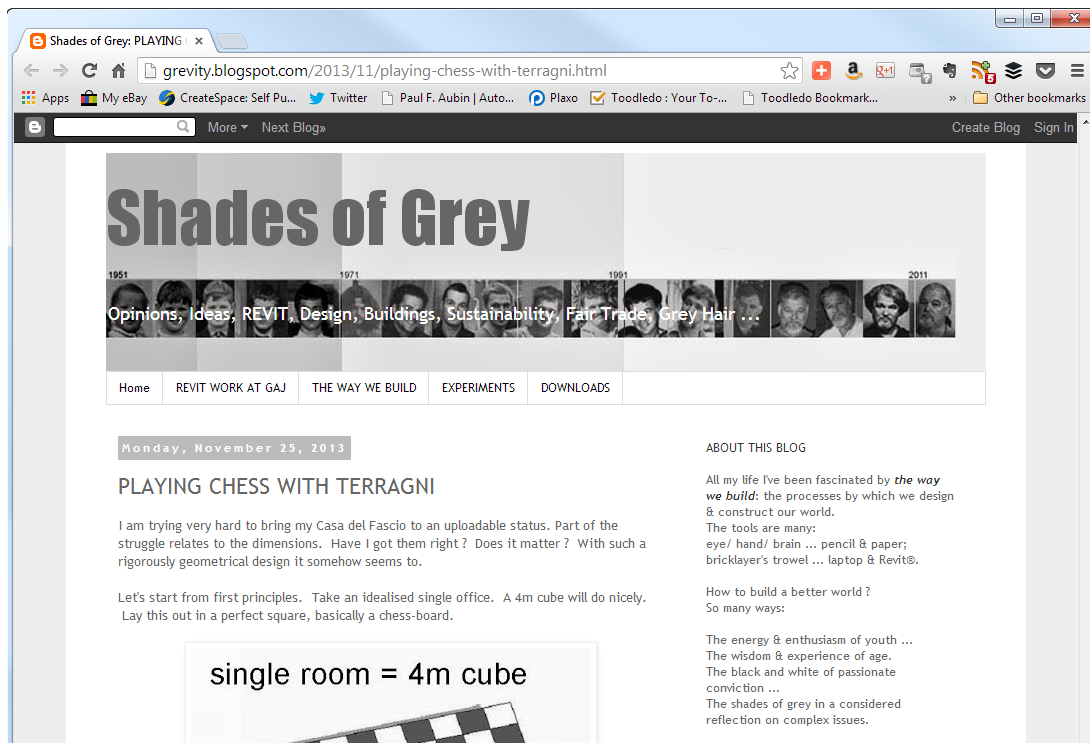
Chitham's Corinthian capital



One of Mauch's Corinthian capitals

I also use MANY online sources. These are just a few of my favorites:

- <http://buildz.blogspot.com/>
- <http://grevity.blogspot.com/>
- <http://revitswat.wordpress.com/>
- <http://boostyourbim.wordpress.com/>



There is a terrific blog called “**Shades of Grey**” and its author Andy Milburn has done some tremendous studies of architecture using Revit. So if classical is not your thing, I still think that process I have outlined here is well worth the effort. Andy’s blog is a treasure trove of information both highly practical and highly philosophical. I highly recommend it. Andy talks about Revit being his “pencil of choice” and I love that analogy.

Andy also wrote the foreword to my book! So I owe many thanks to Andy as well.

Zach Kron’s Buildz blog is also must reading. Zach has done tremendous work with the Revit massing environment, rationalization of 3D form, fabrication and even an awesome annual virtual pumpkin carving contest. Definitely worth checking out. Recently Zach has shifted his considerable talents to dynamo. Dynamo is a visual programming language that works as a plug in to Revit. Powerful stuff.

Goals of my Project

Several goals materialized as I began solidifying the project. Here is a list of what I hoped to achieve:

Fully scalable 3D models

- Scales to different sizes based on the size of the Base Diameter
- All pieces scale proportionately
- Optionally add other parametric behaviors like swapping nested components

Accurate Classical Proportions and Forms

- Based on various books and research noted above

Incorporate 3 Levels of Detail

- 3D models are heavy. I want to be able to use these components in projects.
- Add a medium (and low detail) model
- Add a coarse (sometimes 2D only) representation

Publish in Book and/or Video form

- As an educator, I am very interesting in sharing my findings
- This is why I published the book
- Video likely to follow the book, we'll see

Using AutoCAD

In reality, the project began long before Revit. Many years ago (ten or more) I started it with AutoCAD Architecture, (then Architectural Desktop). I have been using Revit for this project for at least five years.

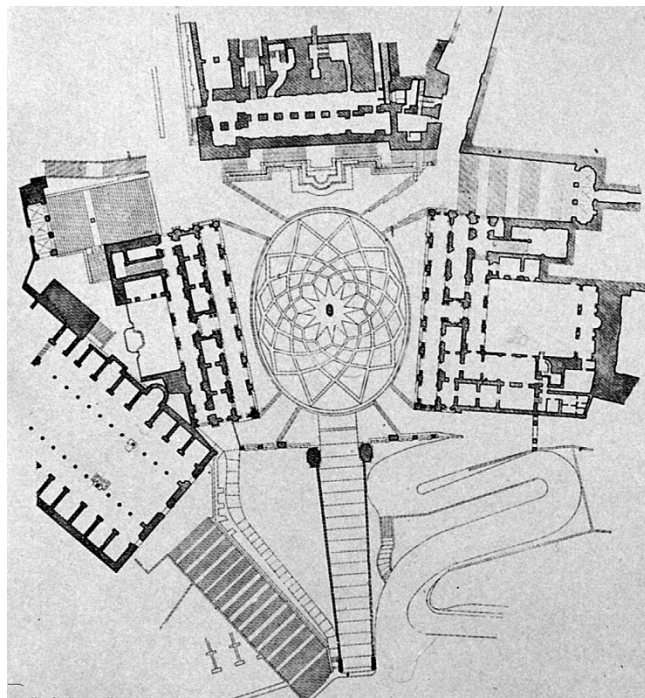
If I could just have the functions of both programs in one...

My own personal “rules” prevent me from using AutoCAD in Revit for this project.

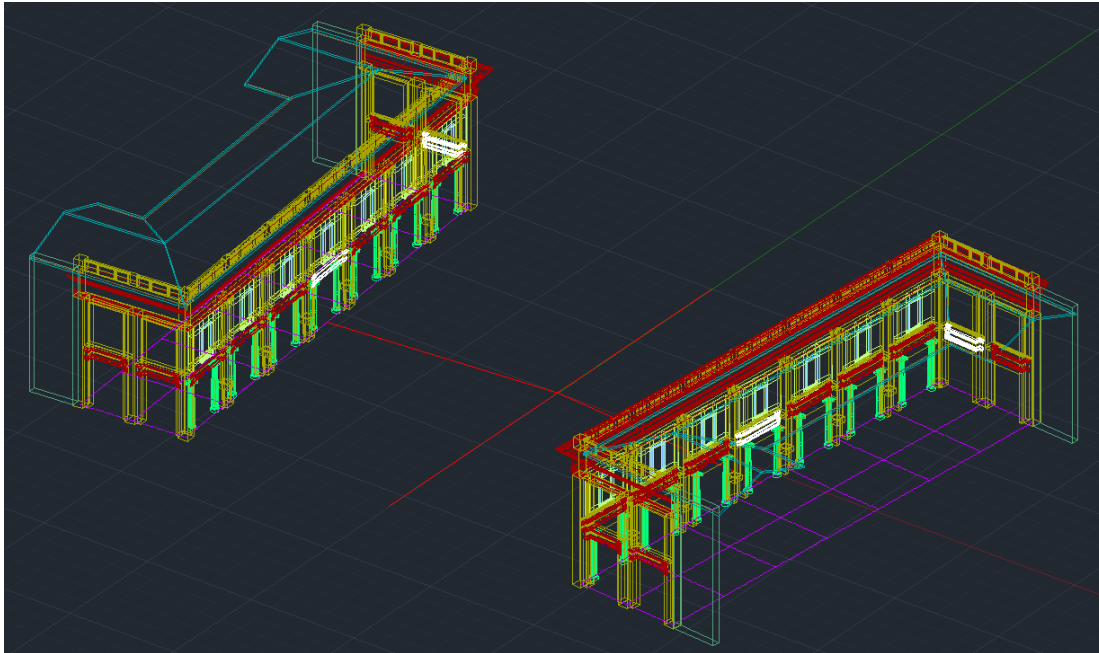


One of my favorite buildings is the Piazza del Campidoglio by Michelangelo. I love the way that Michelangelo used classical forms in an entirely "modern" way. We could do an entire semester on the subject, and I have no doubt that there are courses out there that do just that, but for the purposes of my project, the Capitoline Hill seemed the perfect challenge.

This is a photo I took when I was there in 1989 for semester in college.



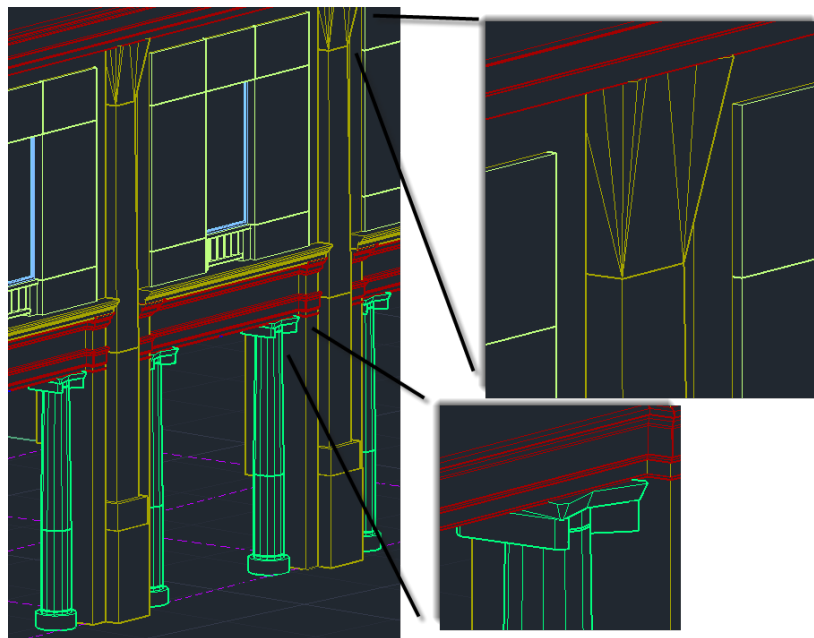
Regrettably I don't have the source for this image. I got it from Google.



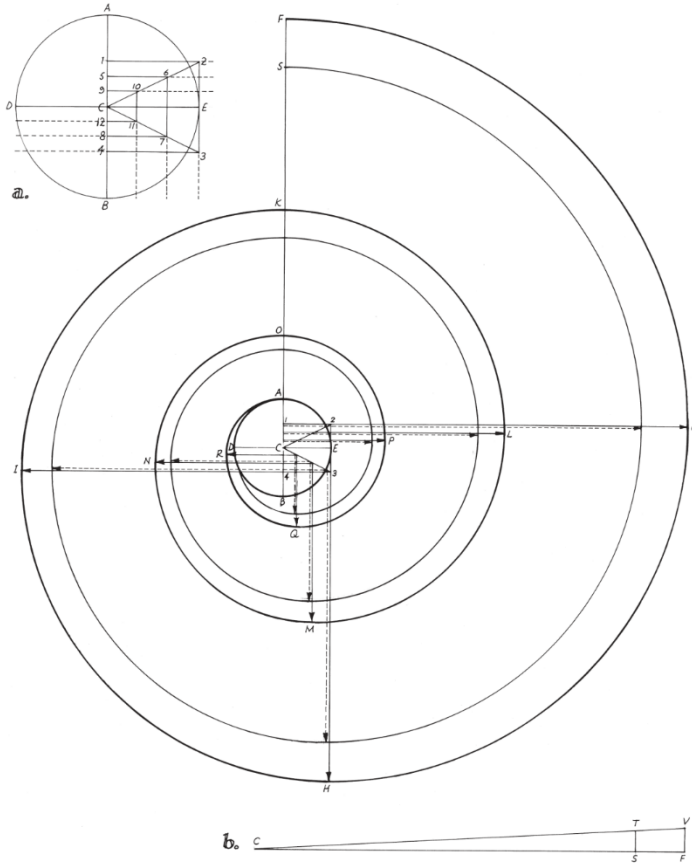
I did get around to roughing out the Campidoglio.

Life got busy after that...

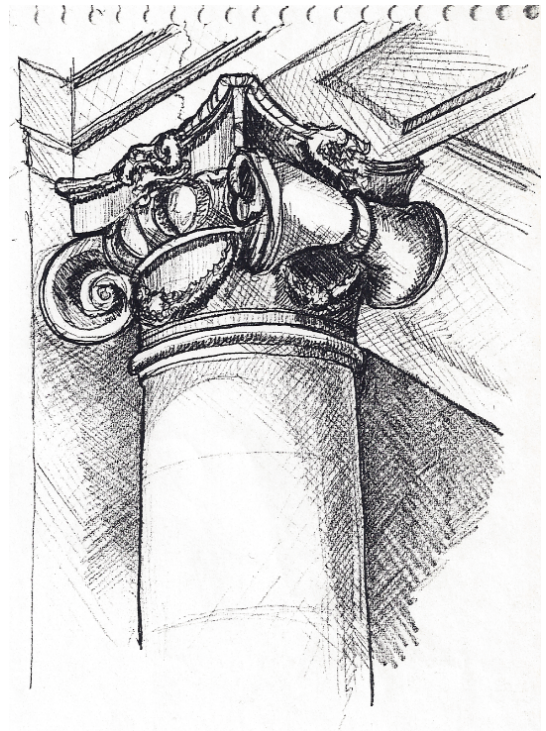
The Corinthian column however would have to wait some time... In fact (spoiler alert) it would have to wait many years later for me to revisit the project in Revit.



Here are some enlarged views of the low detail version. You can see that the Corinthian never got beyond the low detail stand-in in the AutoCAD model. But it will be fully completed below.

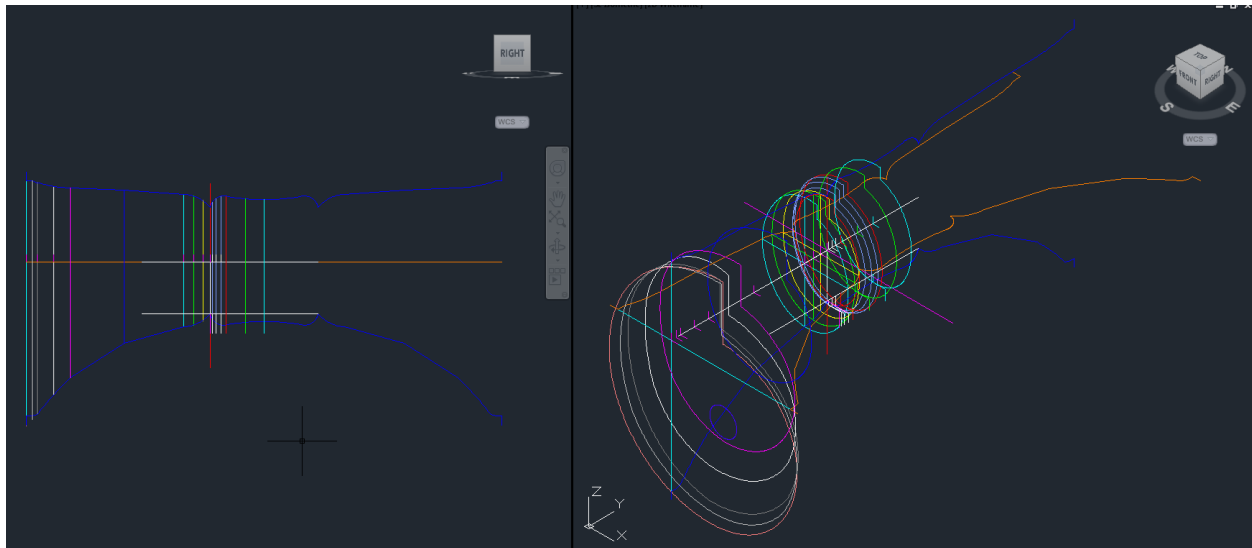


18. THE IONIC VOLUTE

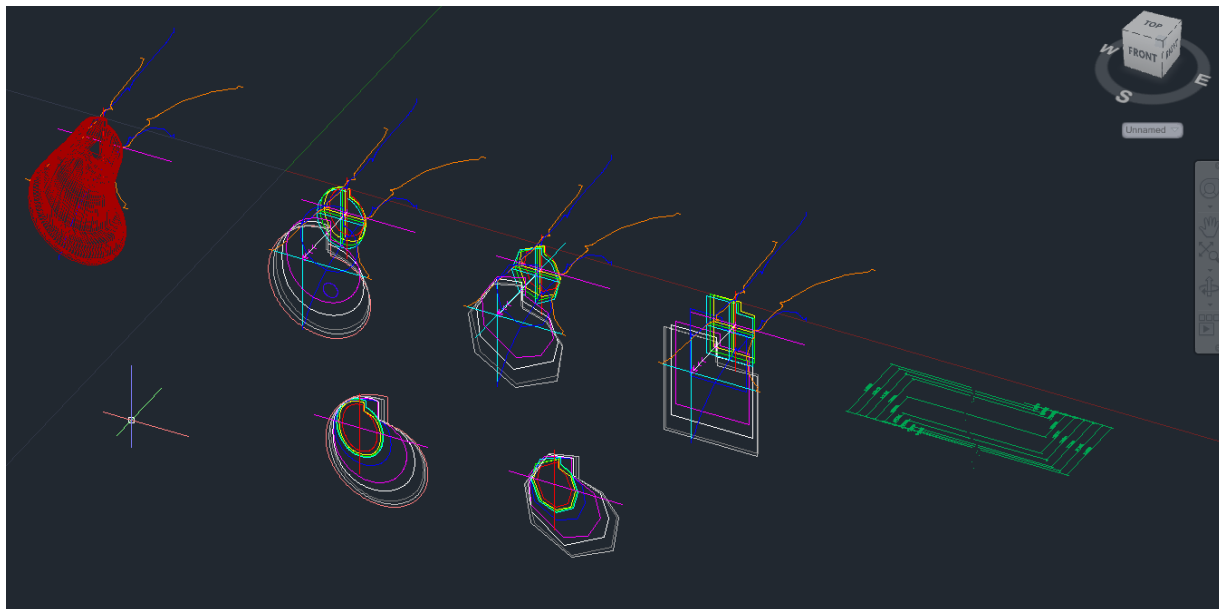


I was also itching to dig into Chitham's book, so what better place to start than an Ionic volute? He presents a nice way to construct it which was easy enough to replicate in AutoCAD. So off I went to build the volute and my first classical form in CAD.

I even had some of my own sketches from that college visit to Rome that I noted above (now nearly 25 years ago)... Where did the time go?

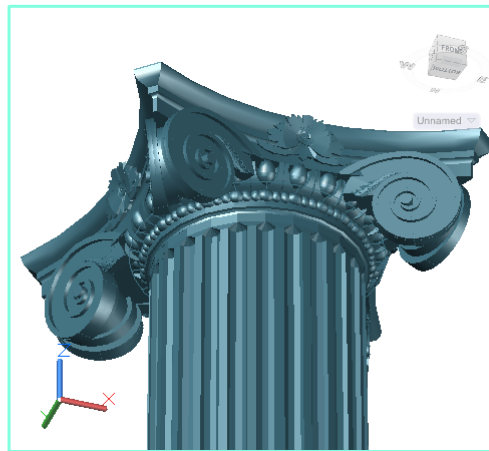
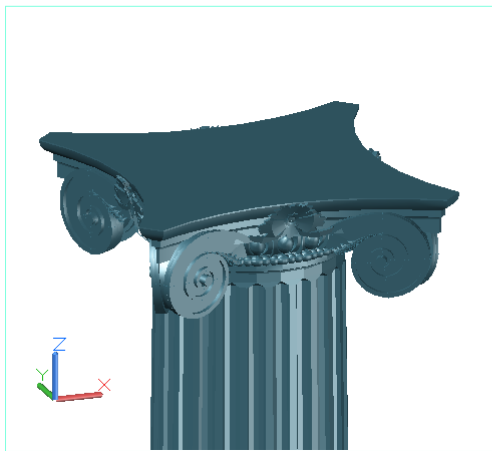
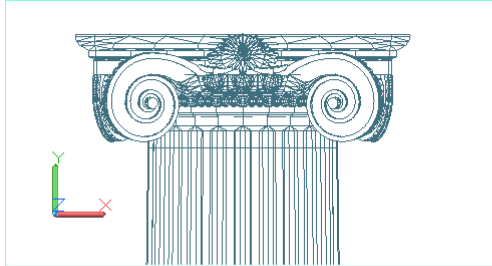


Working carefully from both Chitham and my own sketch, I constructed several profiles, which ultimately became "lofted" together to form the volute and horn.



Now I should note that even though I was using AutoCAD, it was actually AutoCAD Architecture, so even at that time (probably 10 or more years ago), I was trying to make the form parametric. In other words, classical form being all about proportion, it was important to make it scale correctly. Now, scaling in AutoCAD is no problem. You can easily scale a block or an object. But I also was looking to take advantage of ADT's levels of detail, which, much like Revit allows the same object to have low, medium and high detail representations—You can see a little of that here in the three sets of profiles I devised.

To create the “lofted” form, I used a structural member. Structural members can have many profiles.



This is another version of my AutoCAD Architecture Ionic column showing fine detail (This is actually a variation of the one I used in the Campidoglio). As you can see it is a four sided version instead of a two-sided one.

The final result was an ADT object (Structural Member) that incorporated AutoCAD display blocks and other settings native to the structural member object. The low detail version of this column can be seen in the image above that shows the low detail Corinthian column.

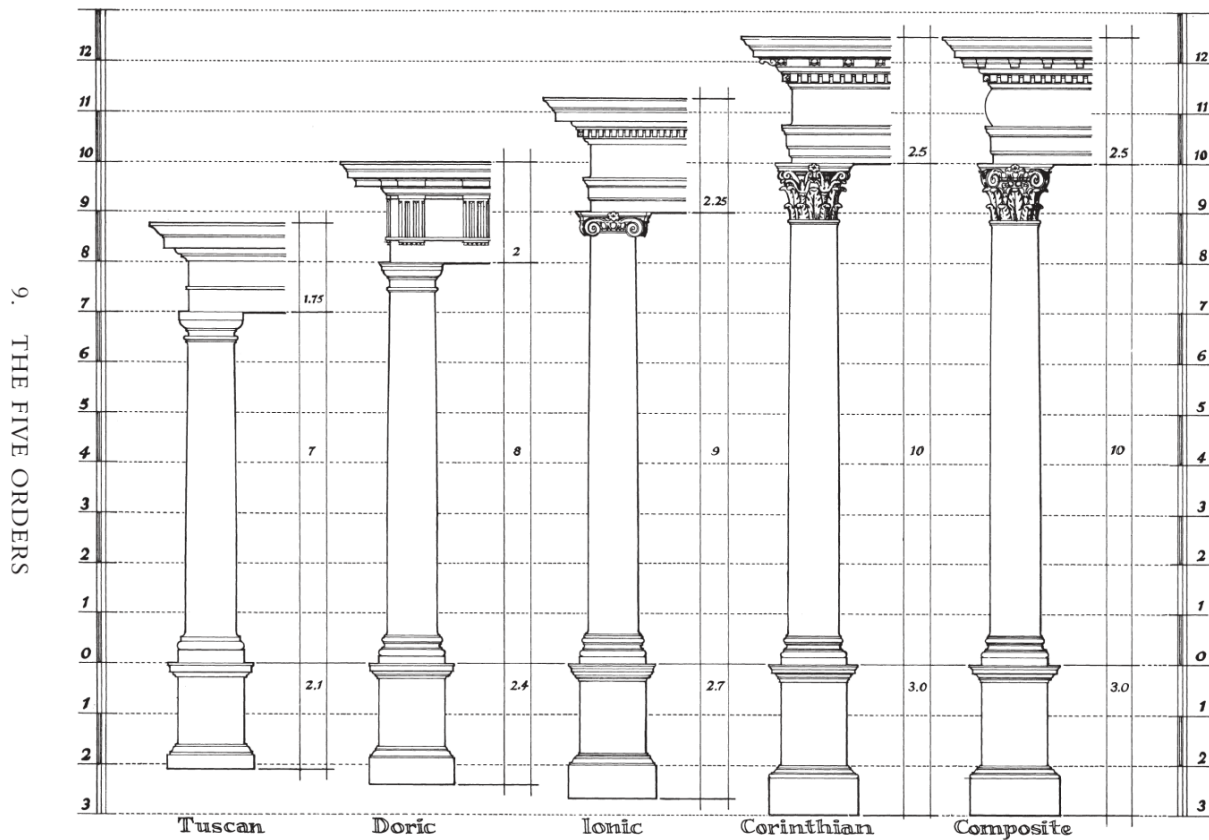


This is one of my earliest AutoCAD Architecture attempts brought to life on a 3D printer.

(Unfortunately, I have not had a chance to rebuild the Campidoglio in Revit yet. With the basic orders complete in Revit, I have many of the “raw” materials at this point. But Michelangelo stylized the orders quite a bit. So to build the model accurately will take more time and research. It’s certainly on my list!)

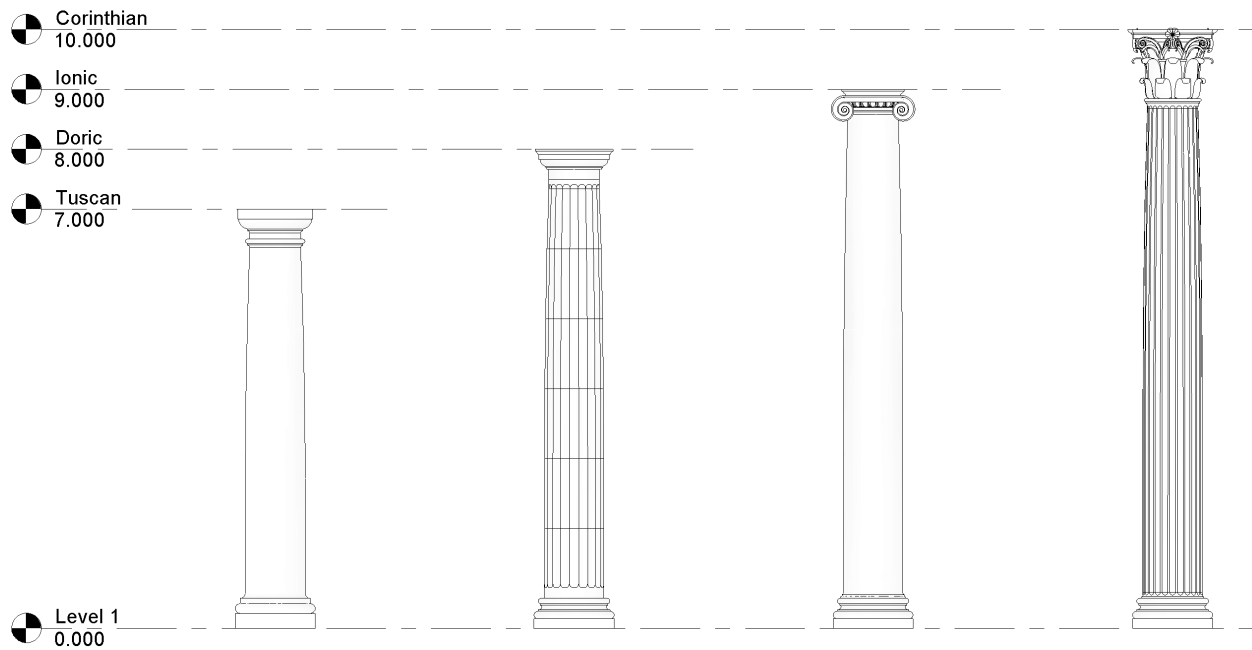
Renaissance Revit

Fast forward a few years and into the Revit era. I had not been using Revit for very long when the thought of returning to my classical project occurred to me. One of Revit's big strengths is parametric modeling. So, it seemed like a natural for this project... little did I know what I was getting into...



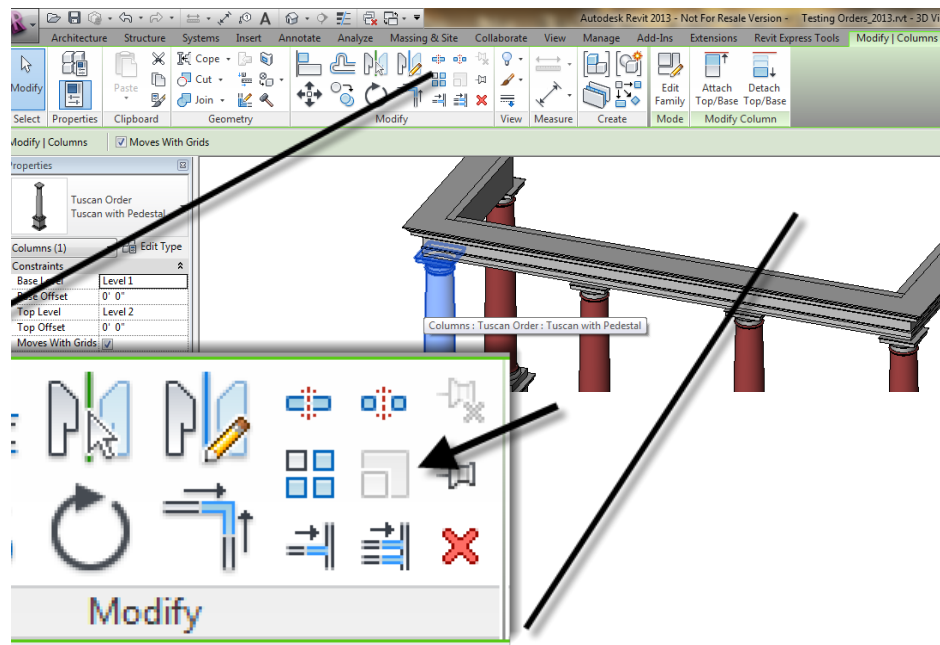
I certainly would like to revisit the Campidoglio and build that completely in native Revit geometry. It is still on my bucket list. But I thought I would start simpler this time.

Returning to Chitham, he has a very nice complete roundup of the entire classical vocabulary. Plate 9 in particular shows each of his "idealized" orders presented together. I decided to take a similar approach.



A look at the four orders that I create; step-by-step in the book Renaissance Revit. (I have omitted Composite in my book).

Revit is often regarded as "better" than AutoCAD, but better can be a relative term. It is certainly not superior in all ways. And the approach to things in Revit is quite different than in AutoCAD. Overall, Revit is certainly better tool to produce buildings in the modern World, but it is not better than AutoCAD in all ways.

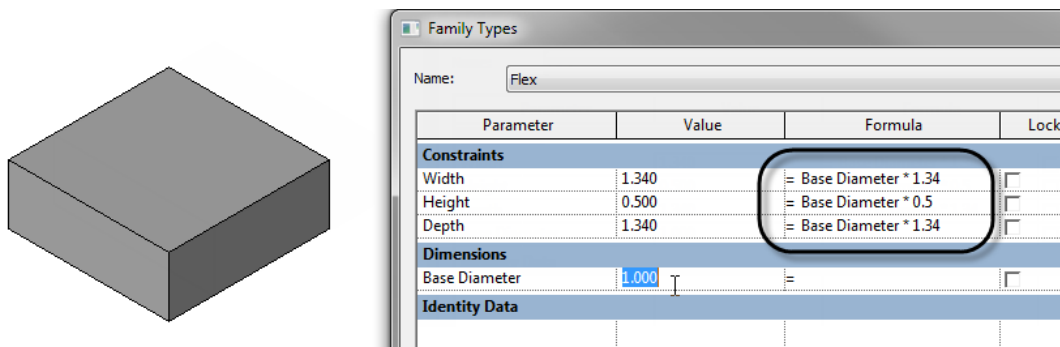


One very simple assumption permeates ALL procedures in Revit. In general, you are expected and encouraged to build things in your Revit model AS they will be built in real life. As a consequence, something as simple as being able to use the scale command to change the size of basic elements is NOT available in Revit!!!

This job just got a whole lot more complicated...

For most of the standard building components that we use in buildings today, the reasoning behind this Revit "limitation" or "prohibition" is quite sound. Rather than scale something, we change its dimensions to the "correct" or "desired" size. However, when the "correct" size is NOT fixed, and in fact is proportional to other key dimensions in the model, then the inability to easily scale items becomes a rather frustrating limitation.

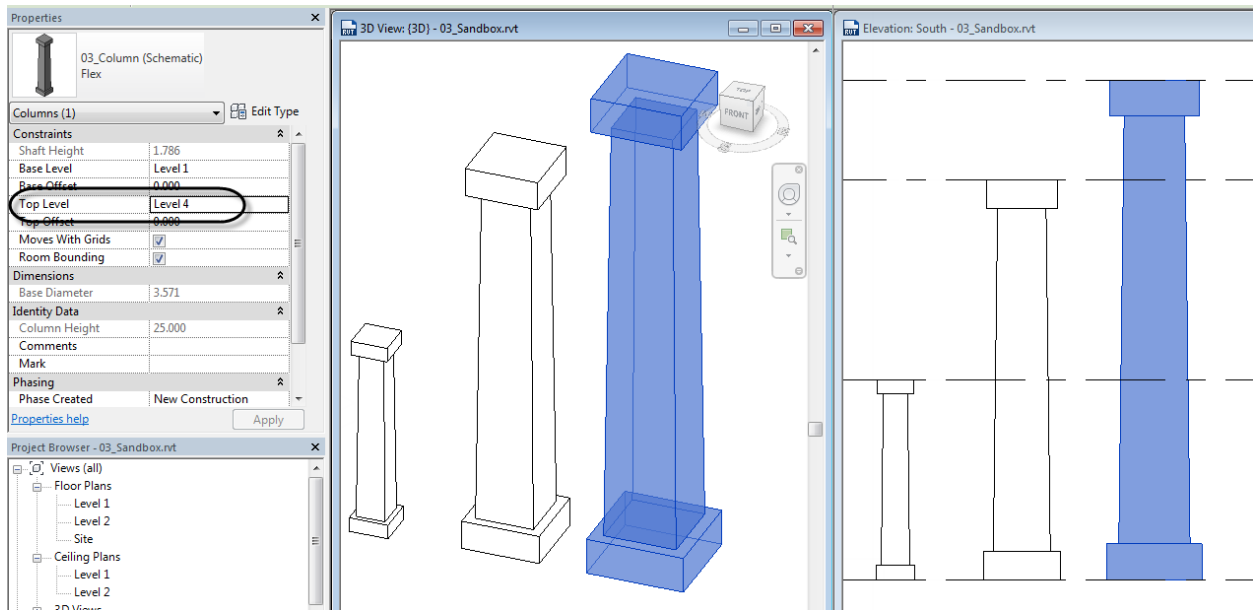
However, undeterred, I pressed on. *I do love a challenge...*



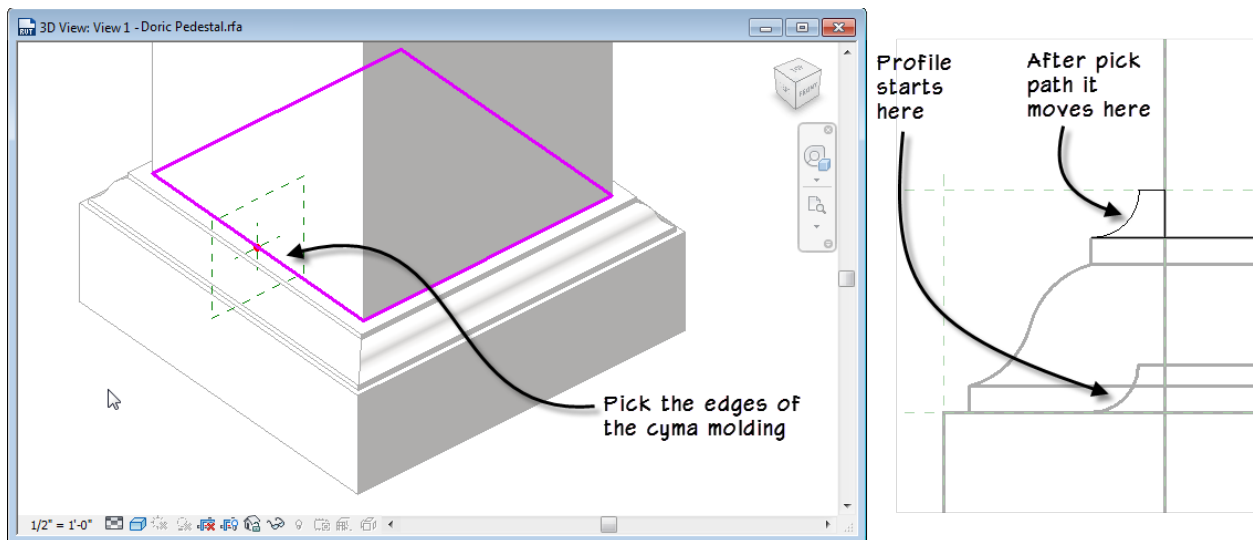
You can break down most elements into a series of simpler forms. These can even often be simple boxes. It is very easy to control the length, width and height of a box in Revit.

To control all three together, use a third parameter and a formula!

So the easiest solution to the inability to scale most component families is to simply tie all the dimensions together and drive them from a common proportion parameter.

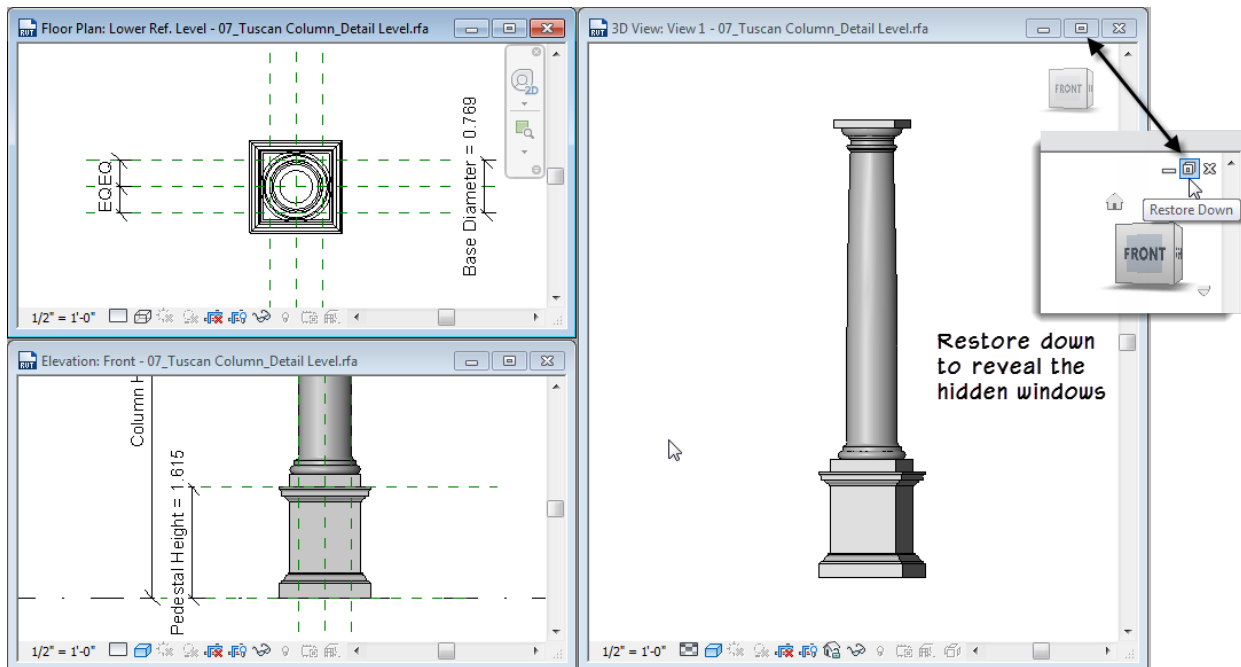


If you combine a few boxes you have a schematic of your column. Each of these boxes is in turn controlled by similar formulas driven by the same base diameter parameter.

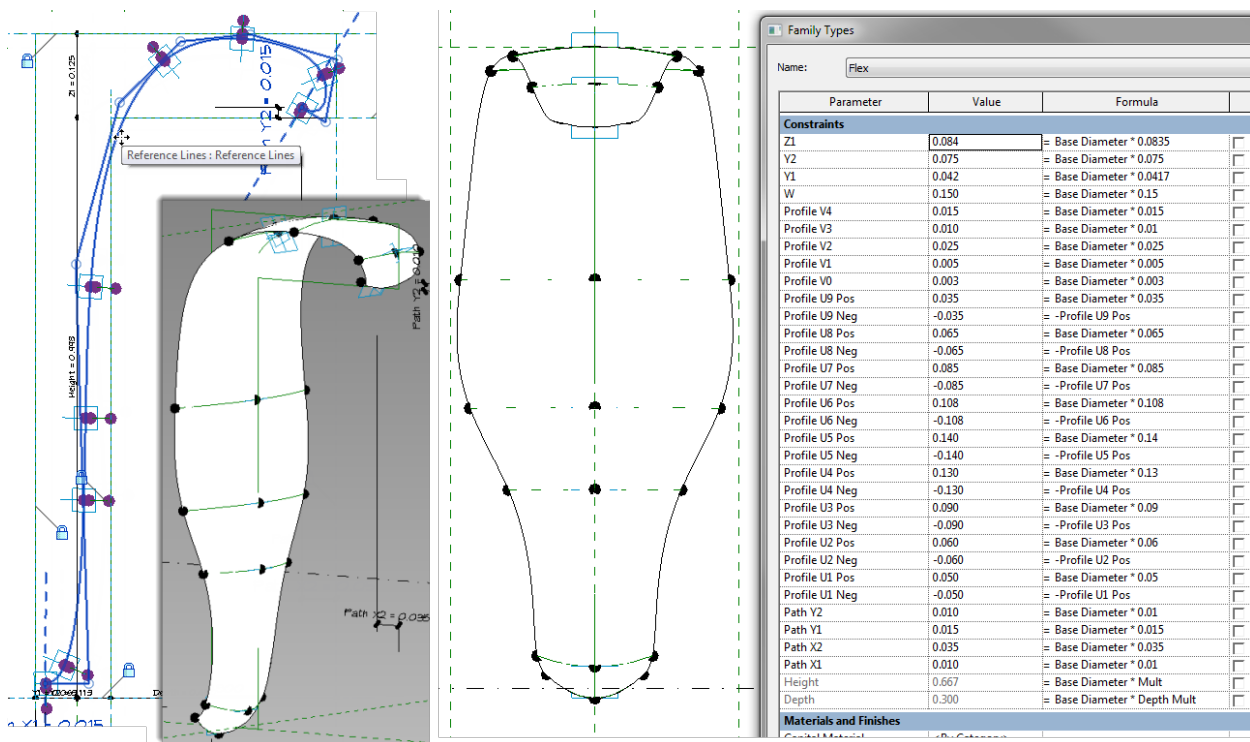


Supplement this with some parametric moldings and you are on your way!

Parametric Classical Orders—A Journey with the Revit Family Editor



The final result is simply a collection of the smaller parametric pieces: all of them tied back to a single Base Diameter parameter!



The basic orders are easily accomplished in the traditional family editor. However, some of the more ornate and complex forms (like the Corinthian) require adaptive components in the massing environment... and often many more parameters...

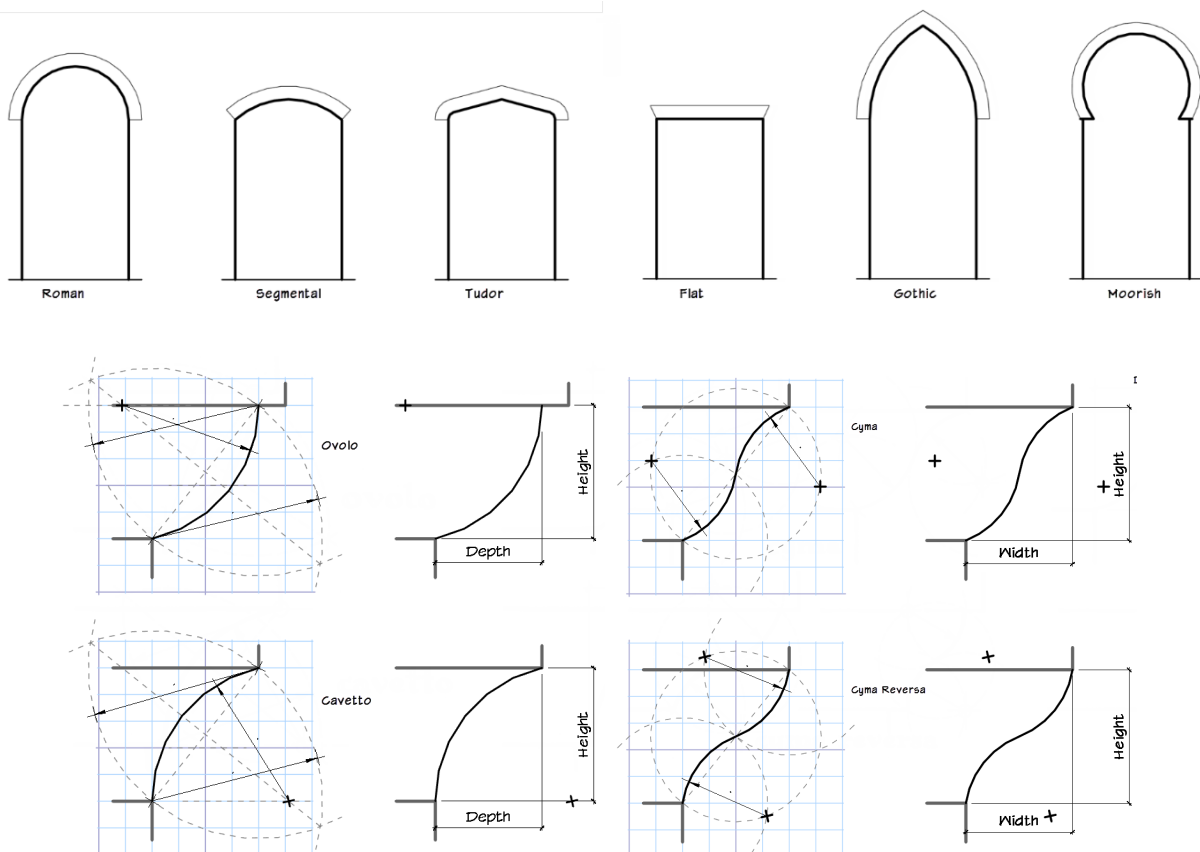
Summarizing the Challenges

- ⇒ Scaling Geometry is Tricky
- ⇒ Parameters can get complex
- ⇒ Have to be comfortable in both the traditional and massing family environments

Taming Curves

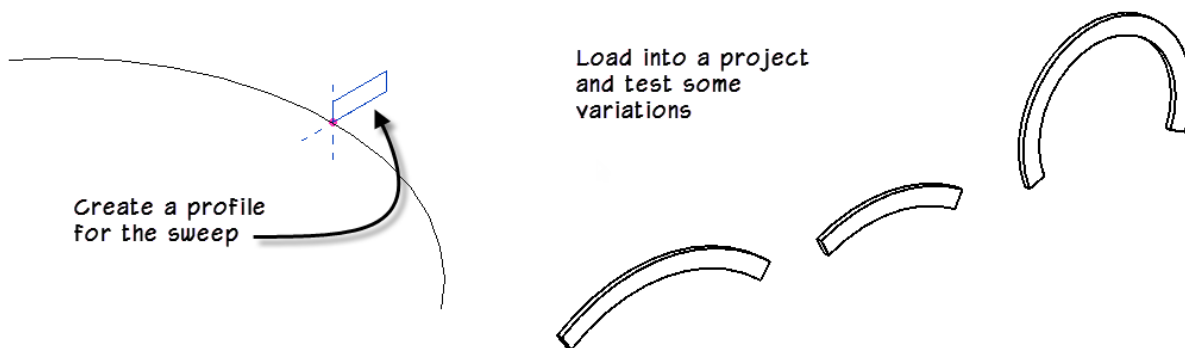
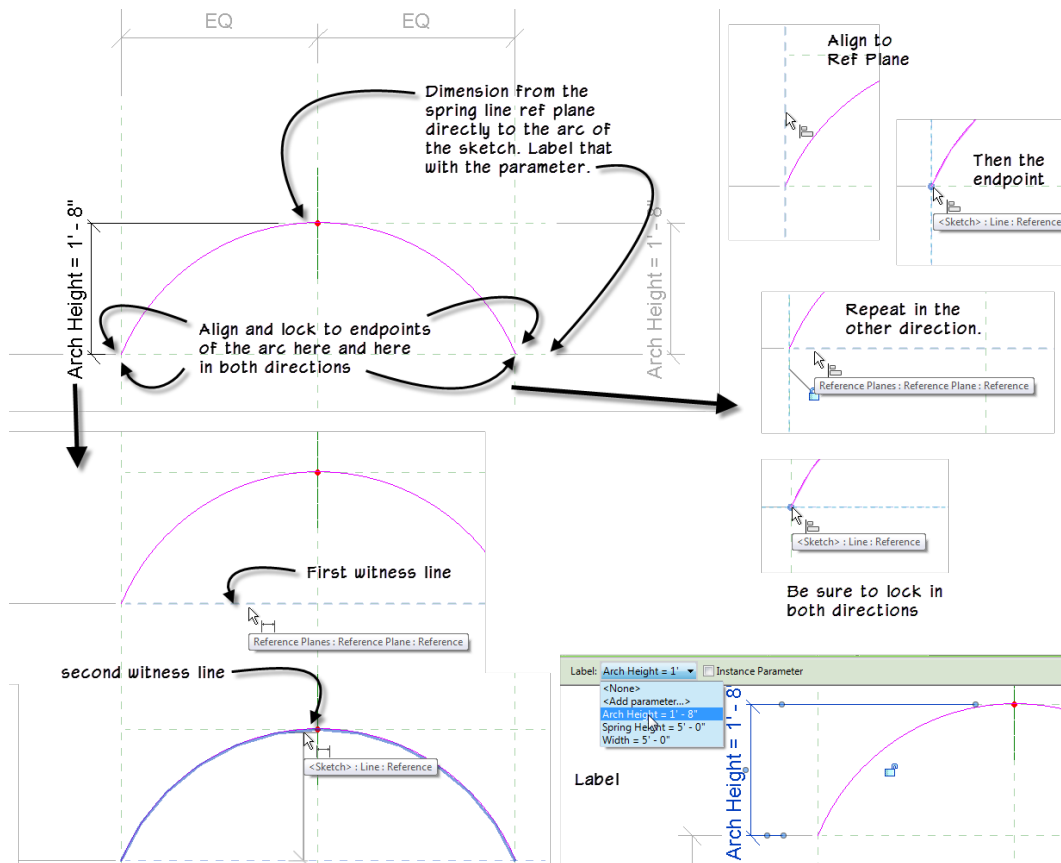
Backing up a bit, most classical forms use curves. They use common moldings described by curves both simple and complex. There are arches, curved colonnades, etc.

If you have ever tried to control the way a curve flexes in a parametric family, you know that it can present some challenges (to say the least).

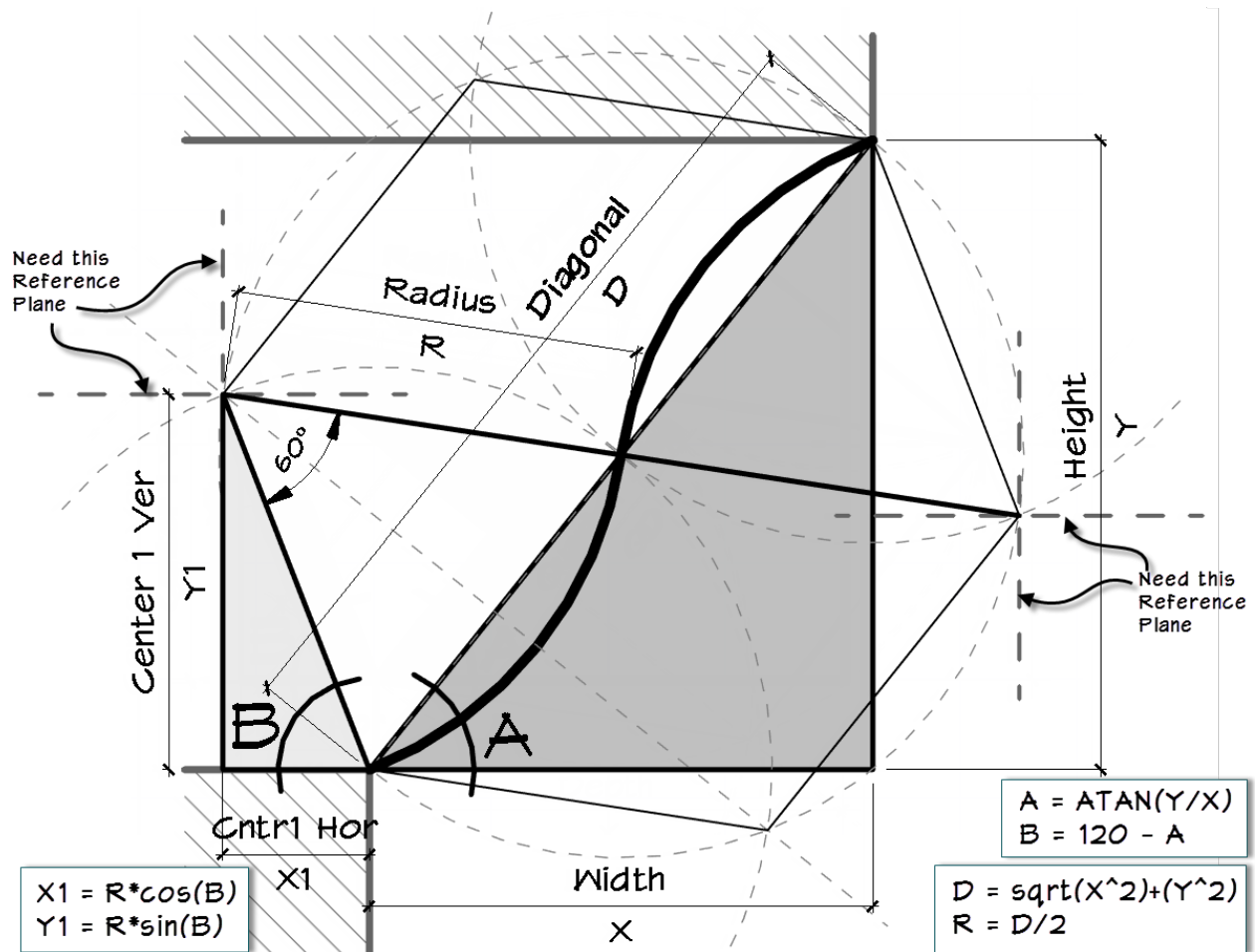


Two very common needs for parametric curves are arches and moldings.

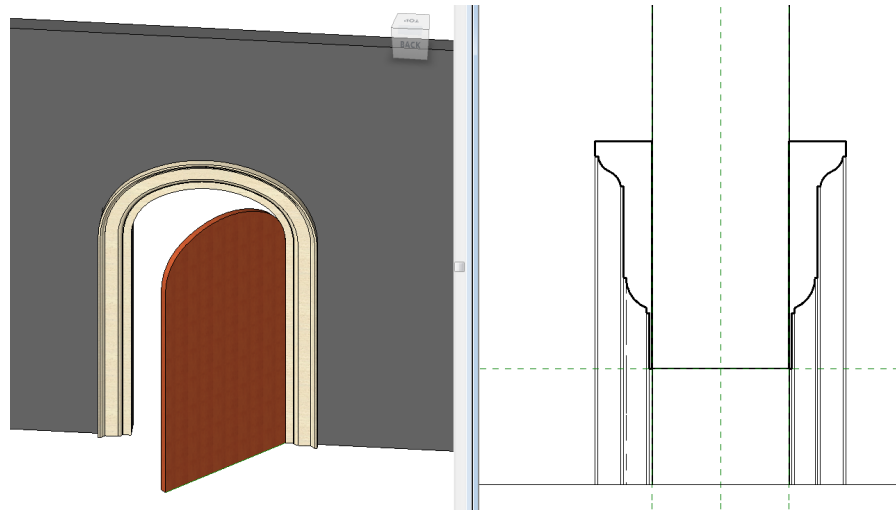
Chitham gives very simple guidelines on how to lay out most common moldings. I have devised ways to replicate each of these parametrically. The trick is to ensure that they flex proportionately and that the curves do not become malformed in the process.



The trick to controlling an arch form or other similar curve is to lock both endpoints to both a horizontal and vertical reference plane and then dimension from the spring line *directly* to the arc itself.



Moldings are best approached by creating a Profile family. This profile can then be reused in other families to create 3D form. To control the curve parametrically, there are a few approaches to locking everything down reliably; but I like trigonometry the best. It is very stable.



Combining curves, arches, moldings and parametric rotation in a single family.

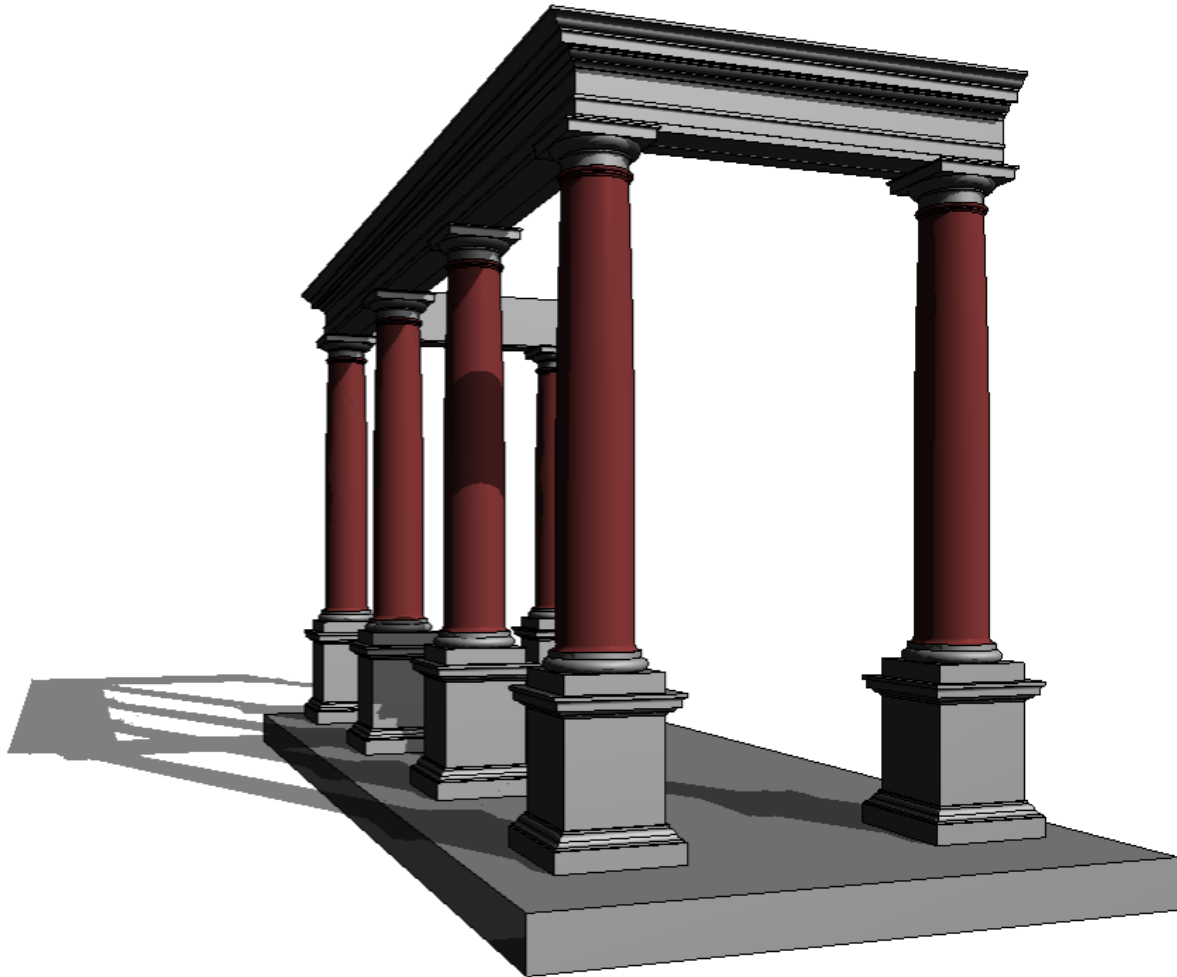
A profile defines the arch shape. These curves flex parametrically. The same profile is used for both the door opening and the door panel. A complex profile shape is defined using trigonometry or rigs and then loaded into a sweep around the opening shape for the molding.

Taming Curves Summary

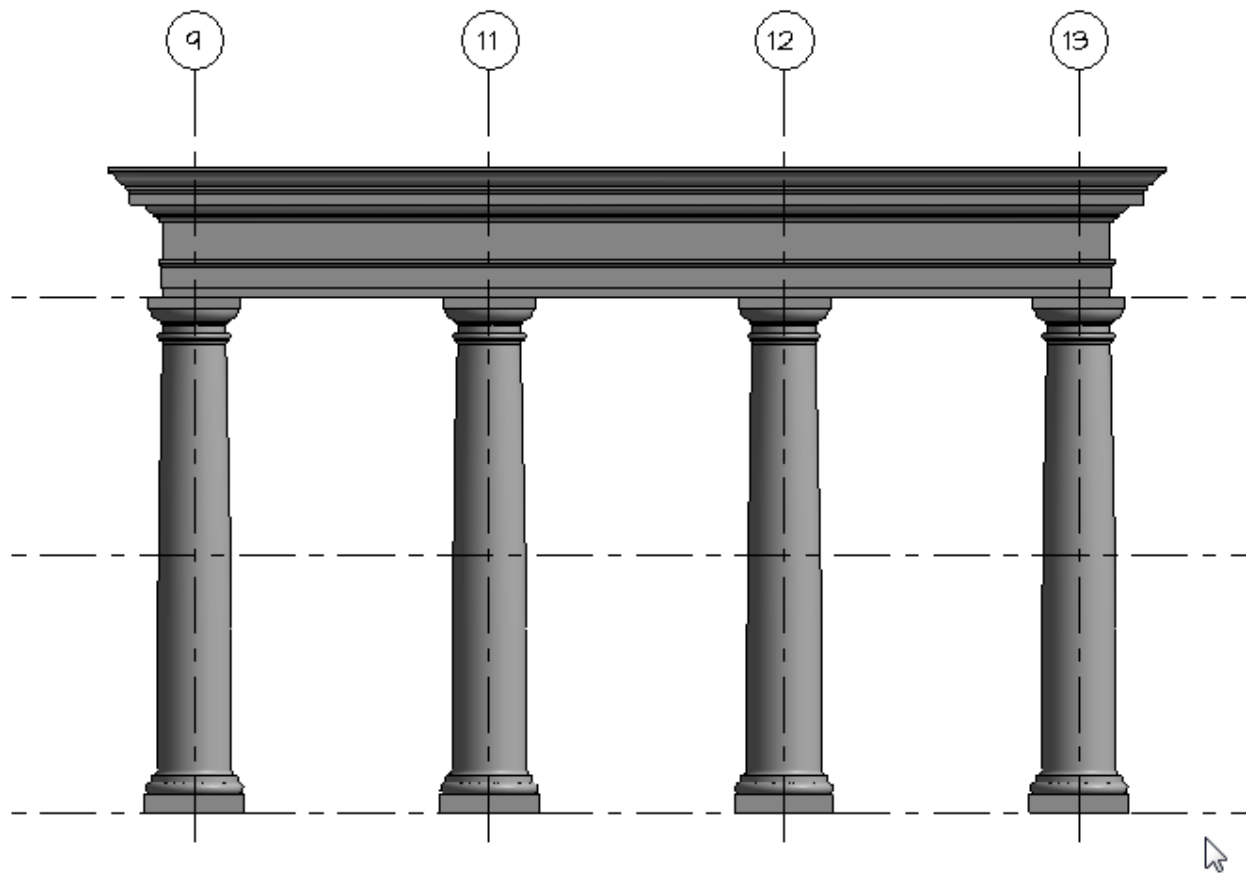
- ⇒ Dimension Directly to the curve
- ⇒ Build Profile Families
- ⇒ Nest Detail Component Rigs into Profiles
- ⇒ Use Trigonometry

The Tuscan Order

Let's take a quick look at each order, starting with Tuscan

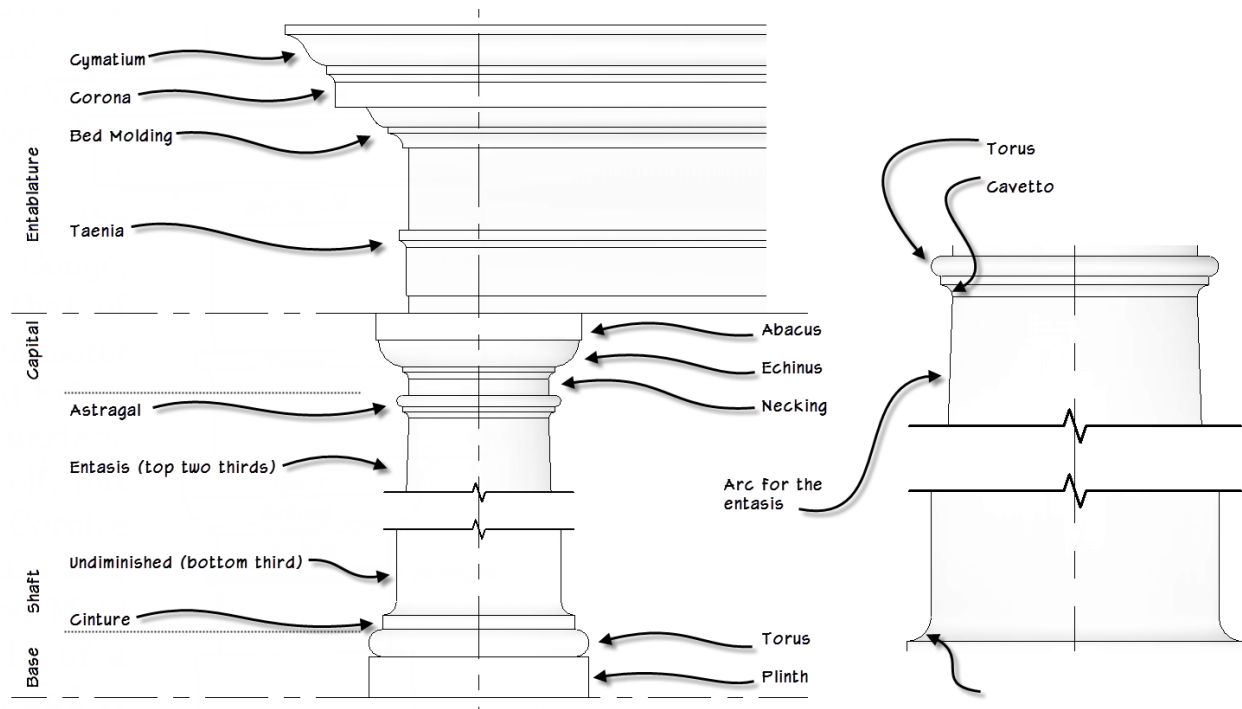


My earliest Revit classical family was the Tuscan order complete with pedestal.



I ended up rebuilding all of the orders from scratch for the book. This is the latest version of the Tuscan. It contains separate nested families for each of the following:

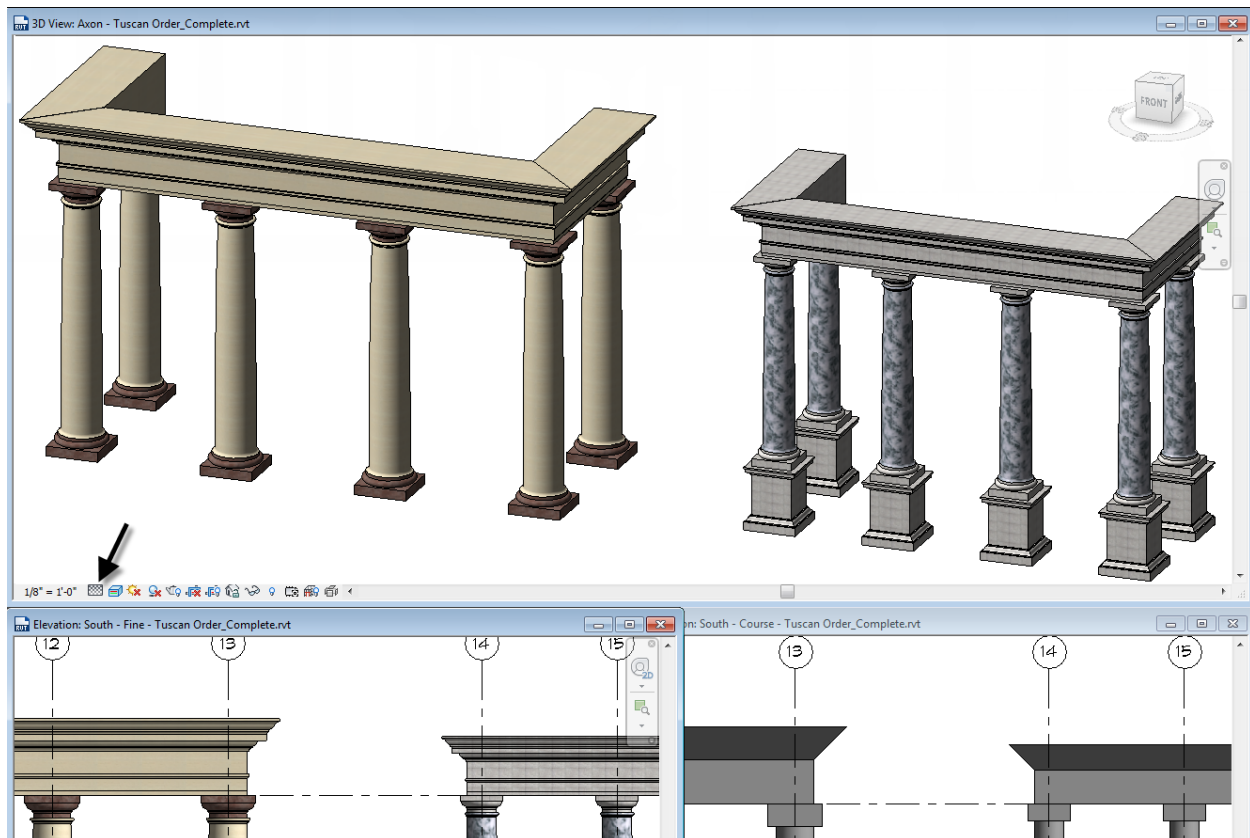
- ⇒ The Capital
- ⇒ The Shaft
- ⇒ The Base
- ⇒ The Pedestal
- ⇒ The Entablature



Here's a detailed look at each piece.

Tuscan Example in Revit

Here is a simple colonnade made from the Tuscan order. Note both coarse and fine versions.



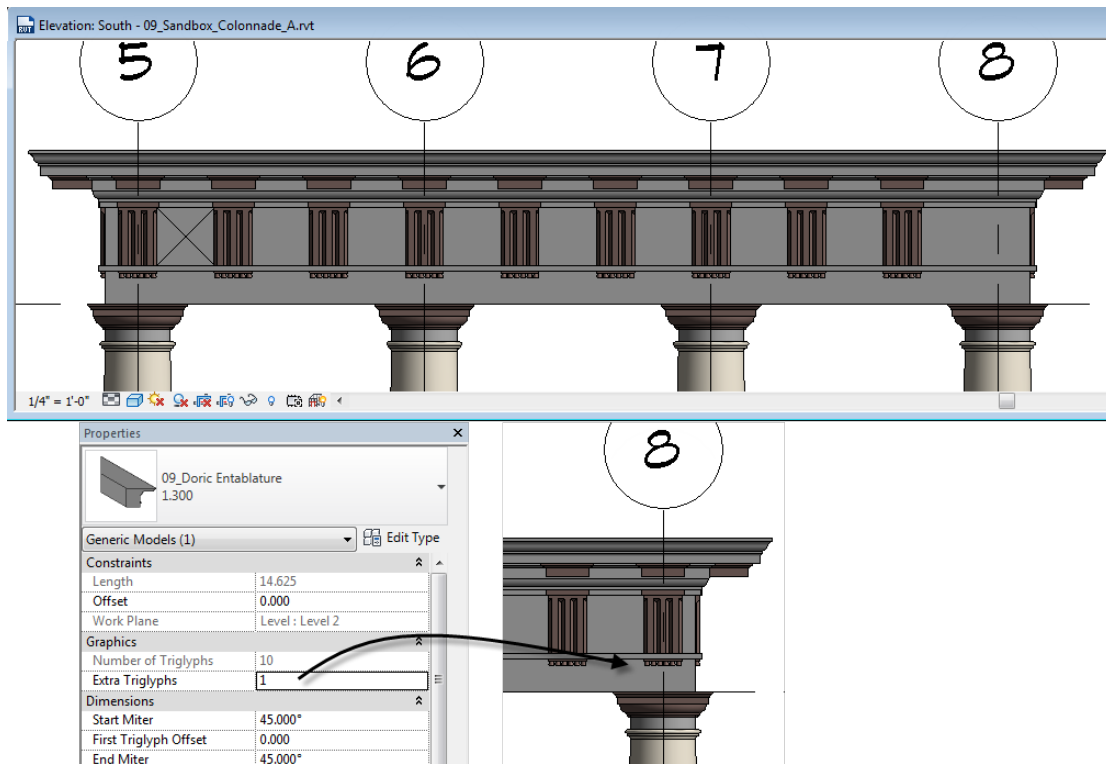
The Tuscan columns are stand-alone Column families. The family contains four nested families: Capital, Shaft, Base and Pedestal. Each one relies primarily on Extrusions for any elements that are square in plan. Elements that are round in plan use sweeps. (It is possible to use revolves, but revolves cannot use profiles. So I typically use sweeps).

- Material parameters are linked through each nested family to allow for control from the parent family.
- The pedestal can be turned on or off using a visibility parameter and this in-turn adjusts the overall height of the family.
- The entablature in the Tuscan order is a beam family. You have to right-click to miter the corners.

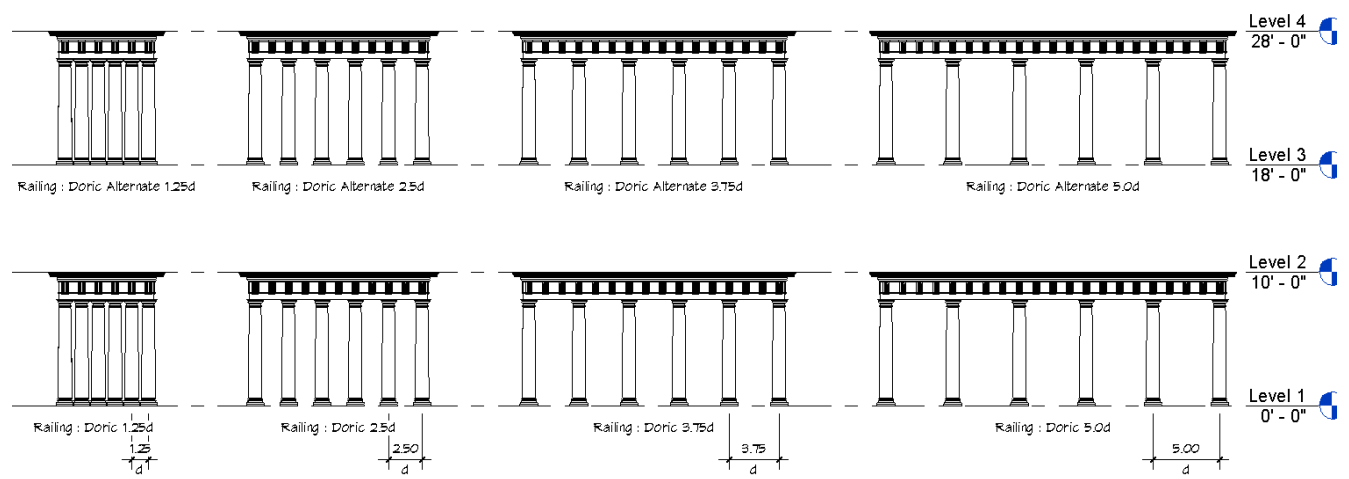
The Doric Order

Doric uses similar strategies. Again, the main family contains the same four nested families, uses materials and has the visibility control for optionally showing the pedestal.

More reference planes are used this time to constrain the dimensions and parameters.



The family also has the beginnings of a low detail version for use in coarse display.



A big issue with Doric is intercolumniation. Only certain spacings are allowed for proper layout of the triglyphs and metopes. For this reason, I experimented with using a Railing Type to lay these out. This is not an ideal solution since there is no way to change the category of the railing, but there are some nice benefits to doing it this way such as being able to define types for each intercolumniation and then simply sketching the “railing” at a properly calculated length.

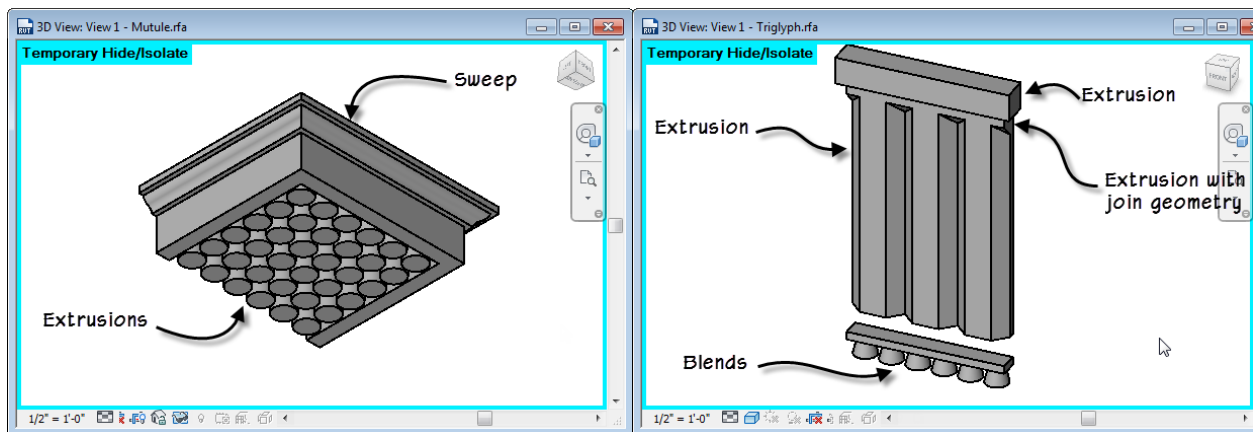
Doric using a Railing Family

This is mapping of the family nesting. The railing type uses both profiles for the rails and baluster families for the columns and triglyphs. The baluster family then has the nested column family, which in-turn has the other four nested families within it.

- ⇒ Railing Type
 - ⇒ Rails – (Profile Families) for Entablature
 - ⇒ Balusters – (contain Column Families) for Columns
 - ⇒ Doric Baluster & Doric Baluster with Triglyph
 - ⇒ Doric Order
 - ↑ Capital
 - ↑ Shaft
 - ↑ Profile
 - ↑ Base
 - ↑ Pedestal
 - ⇒ Balusters – for Triglyphs
 - ⇒ Baluster Posts – for corner Columns



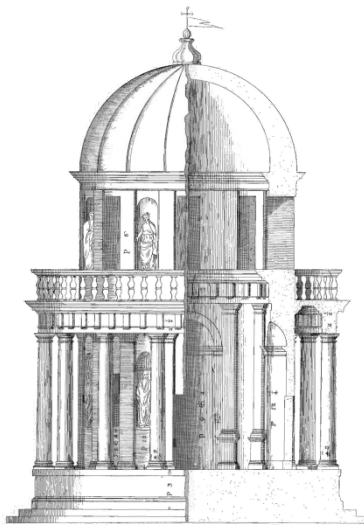
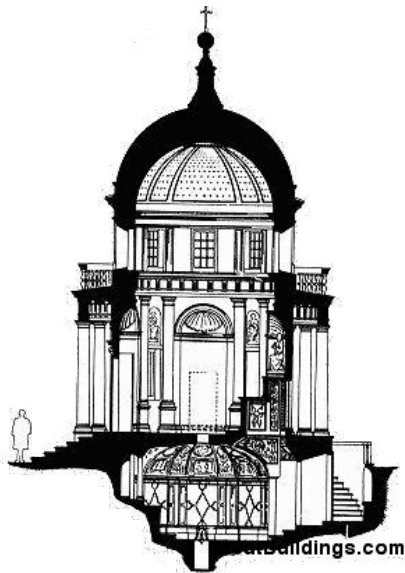
Ultimately, I like the solution of a custom beam family with repeating array families for these items better.

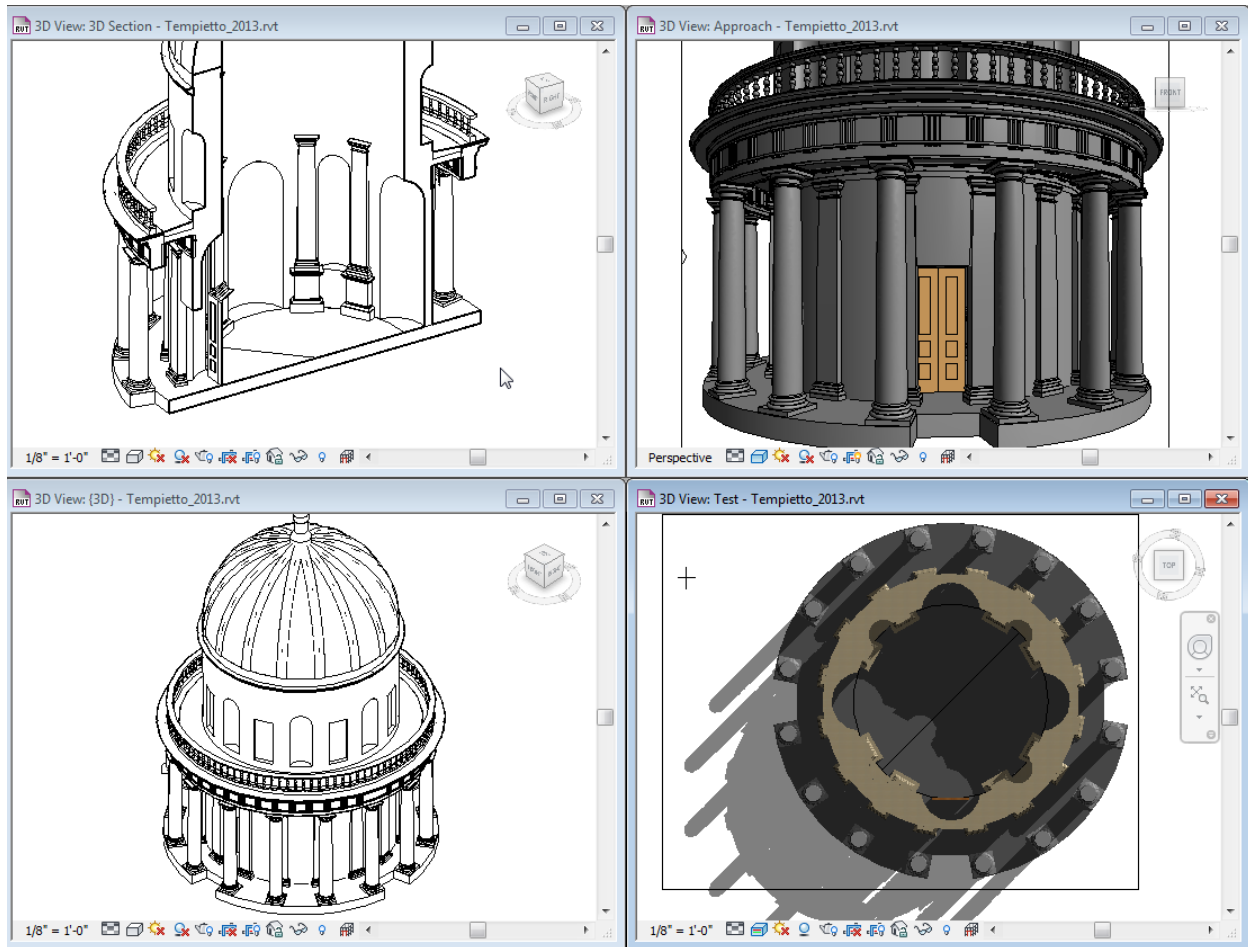


The Mutule on the left and the Triglyph on the right

Il Tempietto

So after having built many Doric pieces, I wanted to put them to the test. What better building than the Tempietto.





Here we see some photographs and sketches of the Tempietto and some images of the model I built of it in Revit.

This model is not complete, but I have built the overall form in Revit and used many of the Doric elements as well as creating additional elements that were required like niches and coffers.

(I have not rebuilt this with my latest version of the Doric. So the model you see here is older version).

I had to calculate the correct circumference from photographs and make sure that it worked with the intercolumniation. I suspect that Bramante himself performed similar calculations.

I made a pilaster version of the Doric for the interior edges of the colonnade and the inside of the building.

For niches and coffers, simple face based generic model families with voids did the trick.

The balustrade required the creation of another family for its balusters. Chitham covers balustrades for each order, so I was able to create a family that matches what is required.

The roof is an in-place family for the dome. I made component families for the ribs.



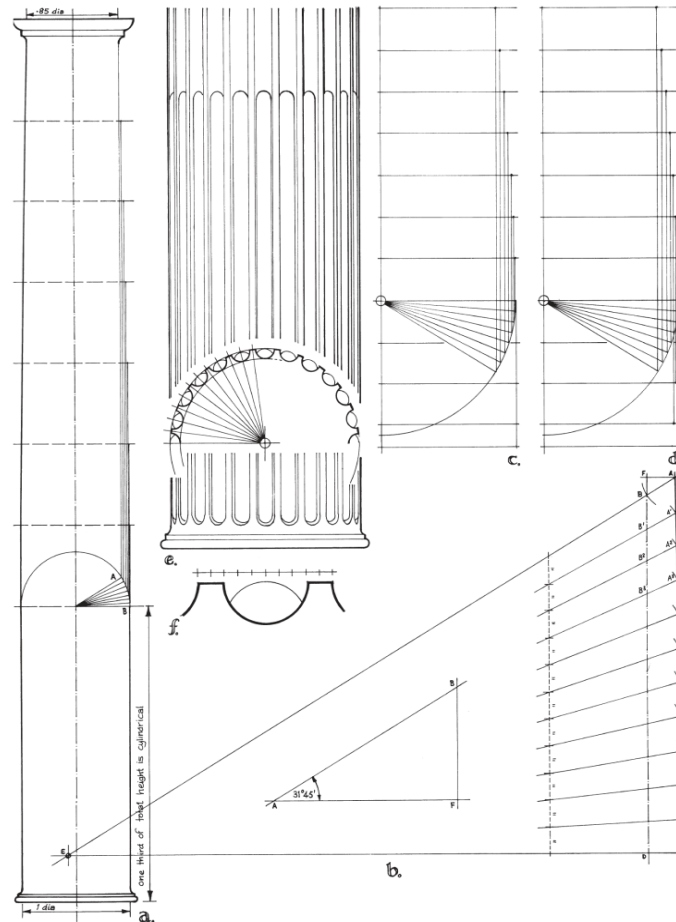
Doric Summary

To summarize the approach on the Doric order, it builds on the strategies employed for the Tuscan and begins looking at other important issues like intercolumniation and some non-traditional approaches to repeating columns and adding the entablature.

- ⇒ The Pieces
 - ⇒ Triglyphs
 - ⇒ Mutules
- ⇒ Intercolumniation
- ⇒ Doric Colonnade
 - ⇒ Beams
 - ⇒ Railings
 - ⇒ Other

Column Shafts

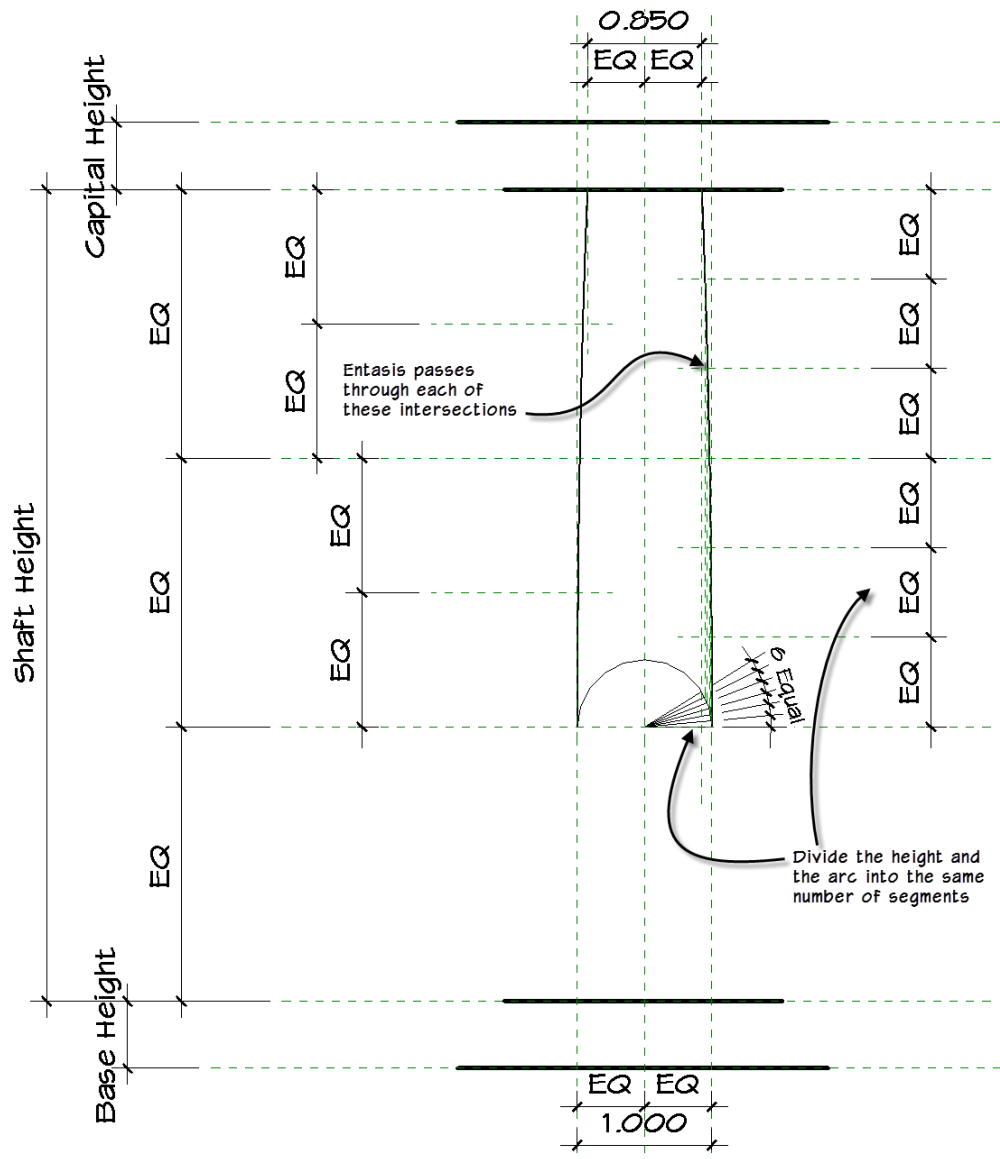
All of the orders have similar shafts. Only the height varies for most (the Tuscan is slightly different at the bottom). A single shaft family can therefore be made parametric and accommodate all of the orders.



61. THE COLUMN: DIMINUTION AND FLUTING

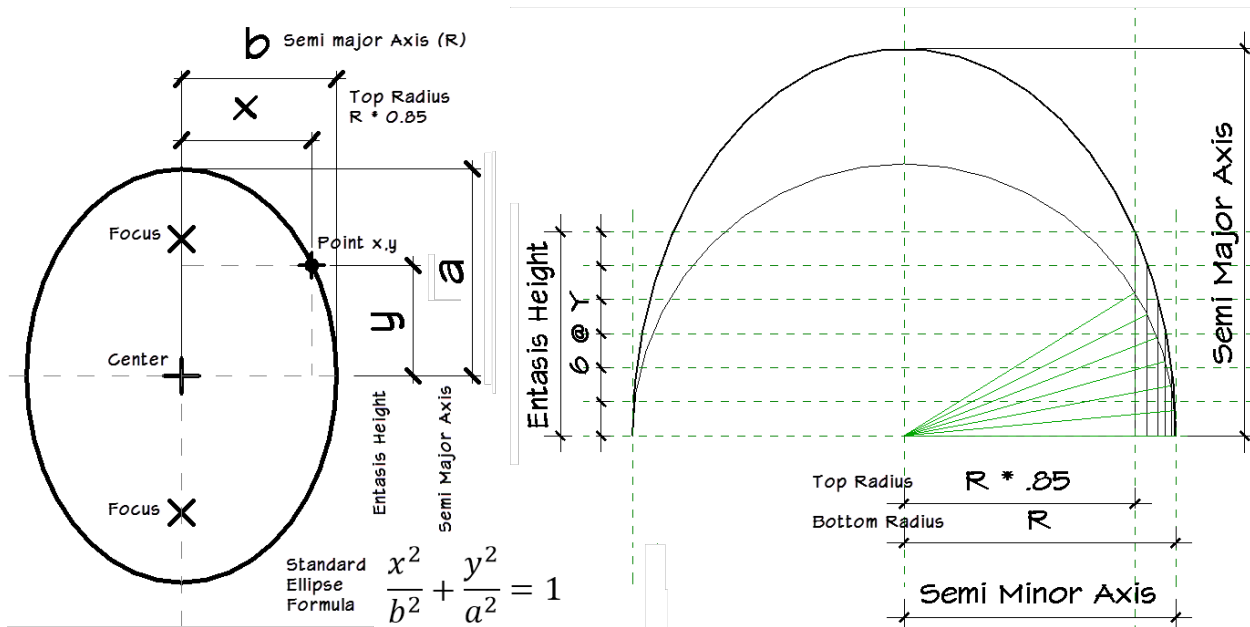
Plate 61 from Chitham

Turning again to Chitham, the Diminution can be established to create the tapered effect on the column. Chitham discusses the difference between diminution and entasis and why he chose to refer to his as diminution.



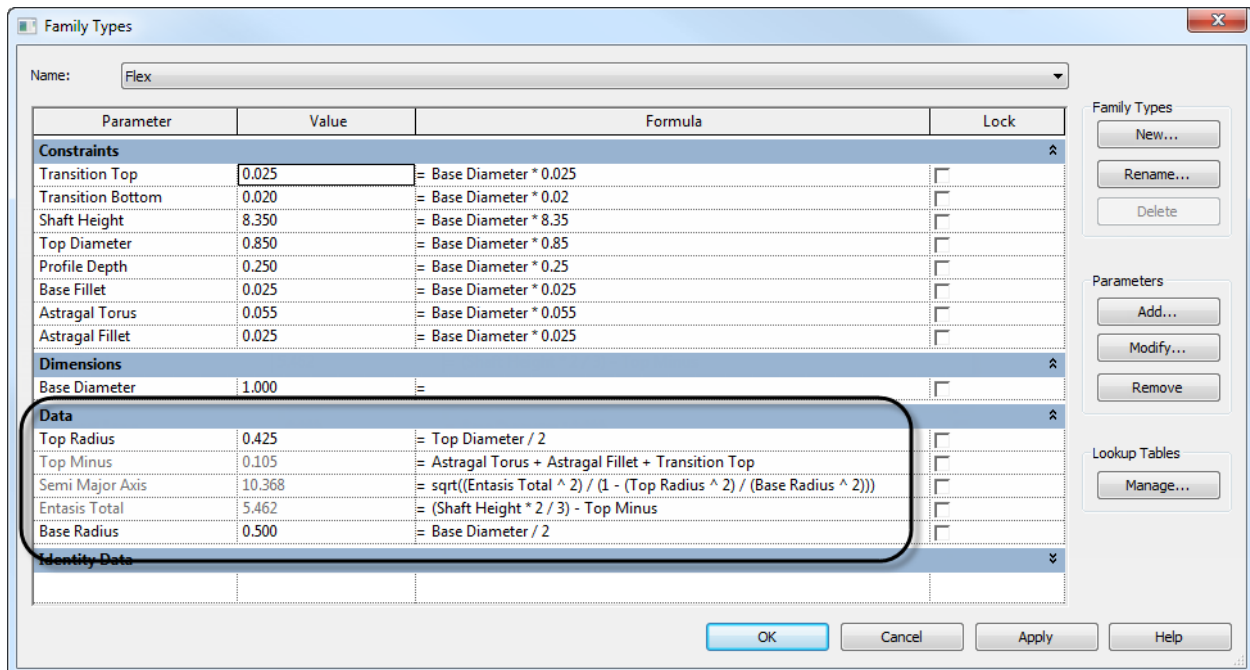
Fluting is also set out in the plate.

When creating a shaft family that uses entasis, fluting has proven quite challenging. My preference would be to create the fluting with voids. But getting the voids to follow the diminution and repeat the 24 times required, has proven quite difficult. Instead I have stacked a series of profiles and built a lofted form in the massing environment for the fluted shaft. It is a bit heavier than I would like, but perhaps not a whole lot more so than would be the case with 24 voids.

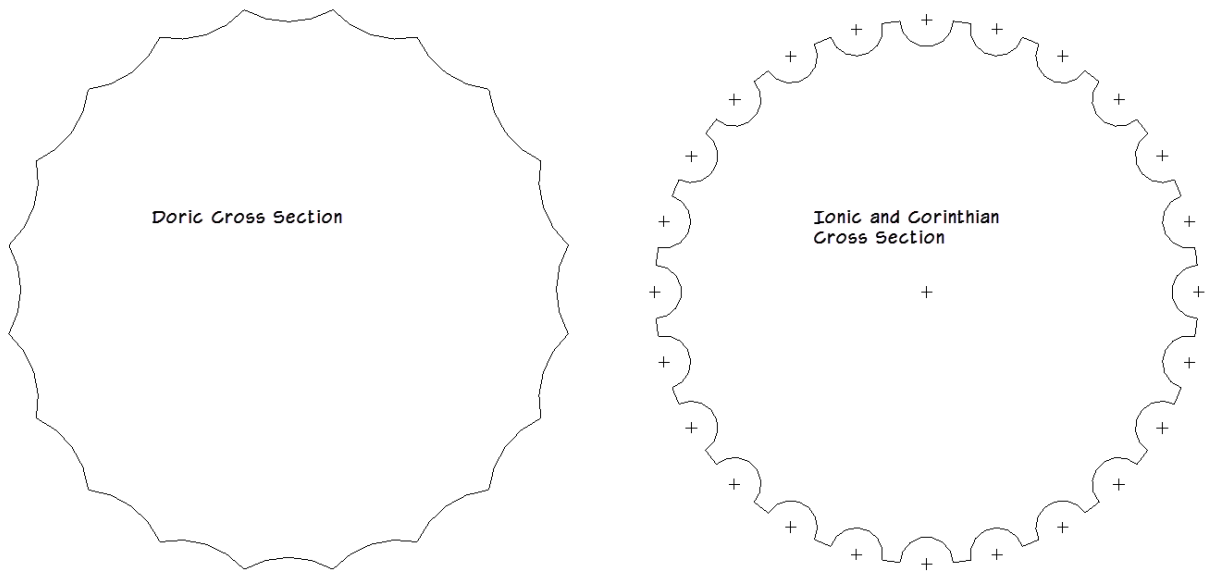


In building the shaft, I discovered that the entasis as recommended by Chitham and others is actually elliptical.

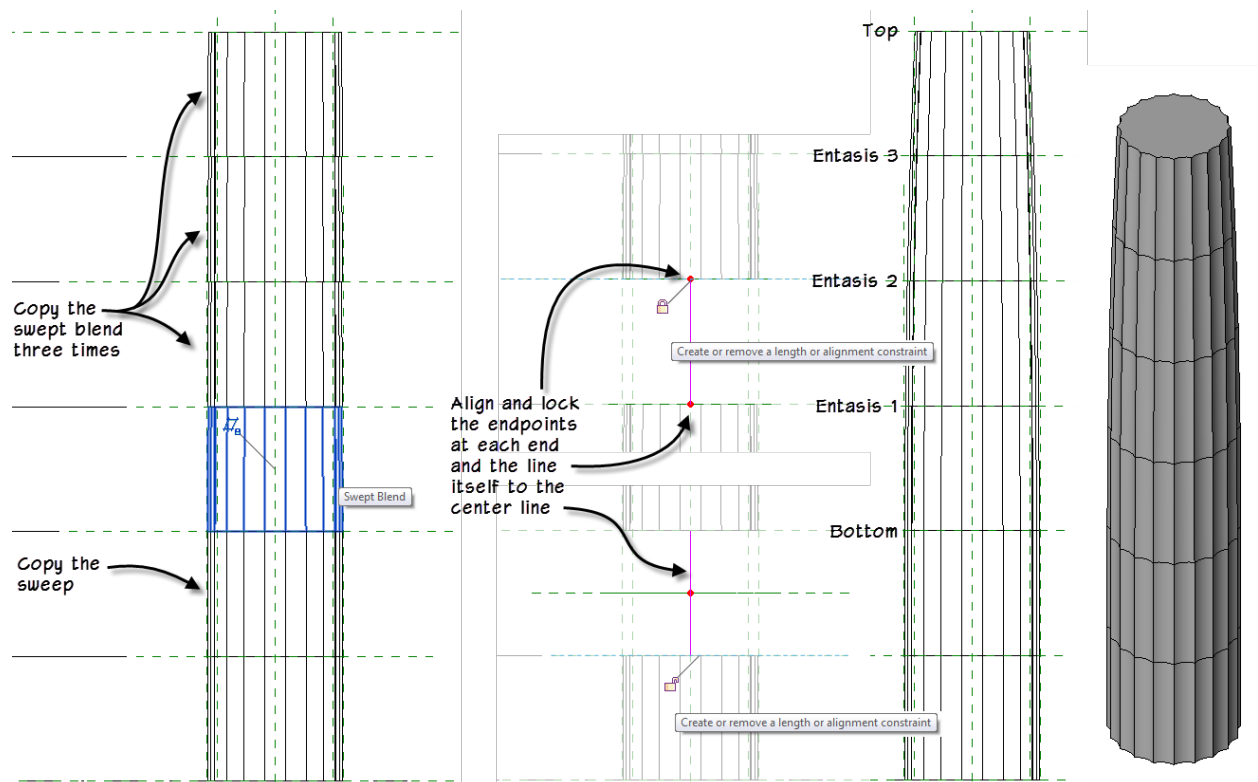
With the help of a colleague to figure out formula for an ellipse, I was able to plot the ellipse and prove this assumption!



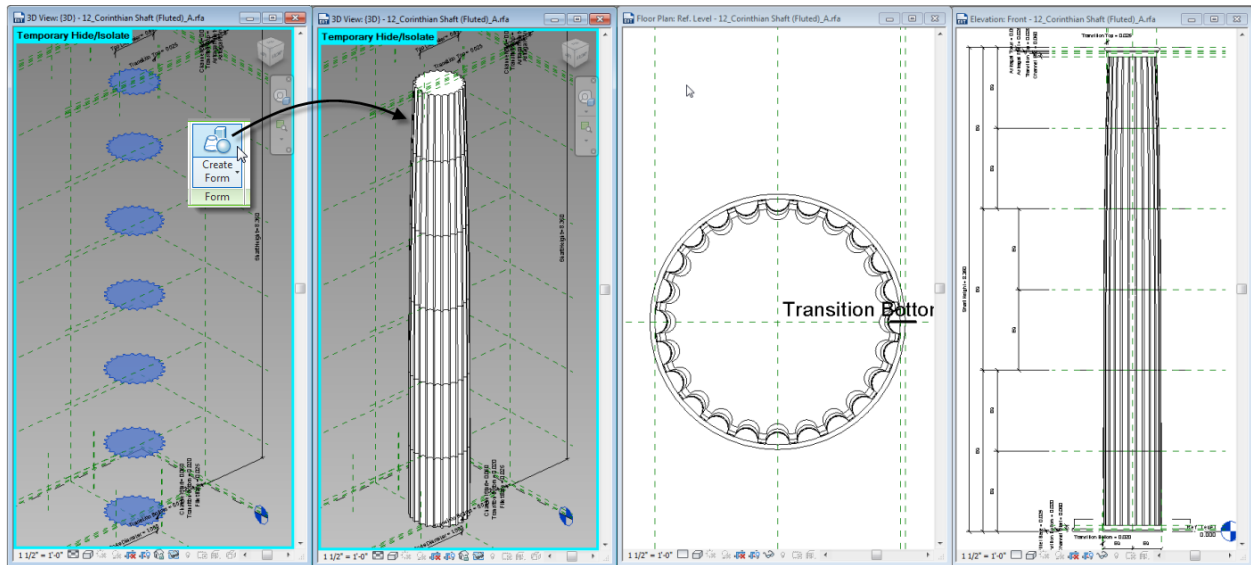
Here is the formula in Revit format



Doric uses differently shaped channels than the other orders

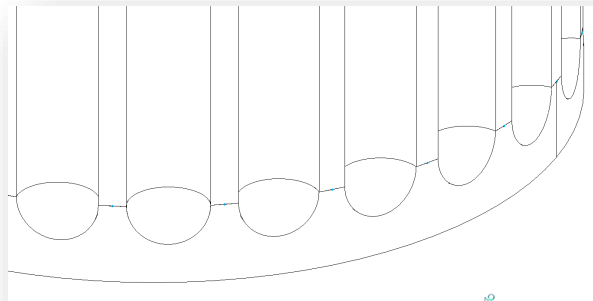
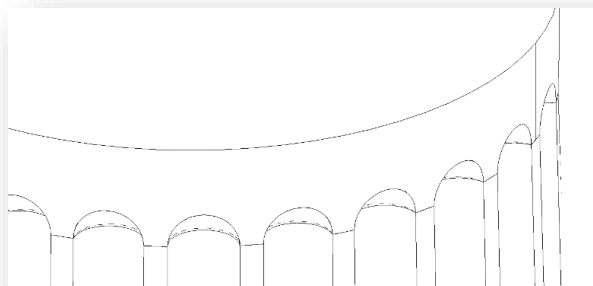


One approach was to stack up several blends that slowly taper. I built a Greek-style Doric using this approach.



The other approach is to do an adaptive family that lofts the profiles as they diminish up the shaft height. This approach was employed to build the Corinthian.

At the top and bottom a separate form using voids for the routed ends was required. I went through several iterations of this form before finding one that worked well.



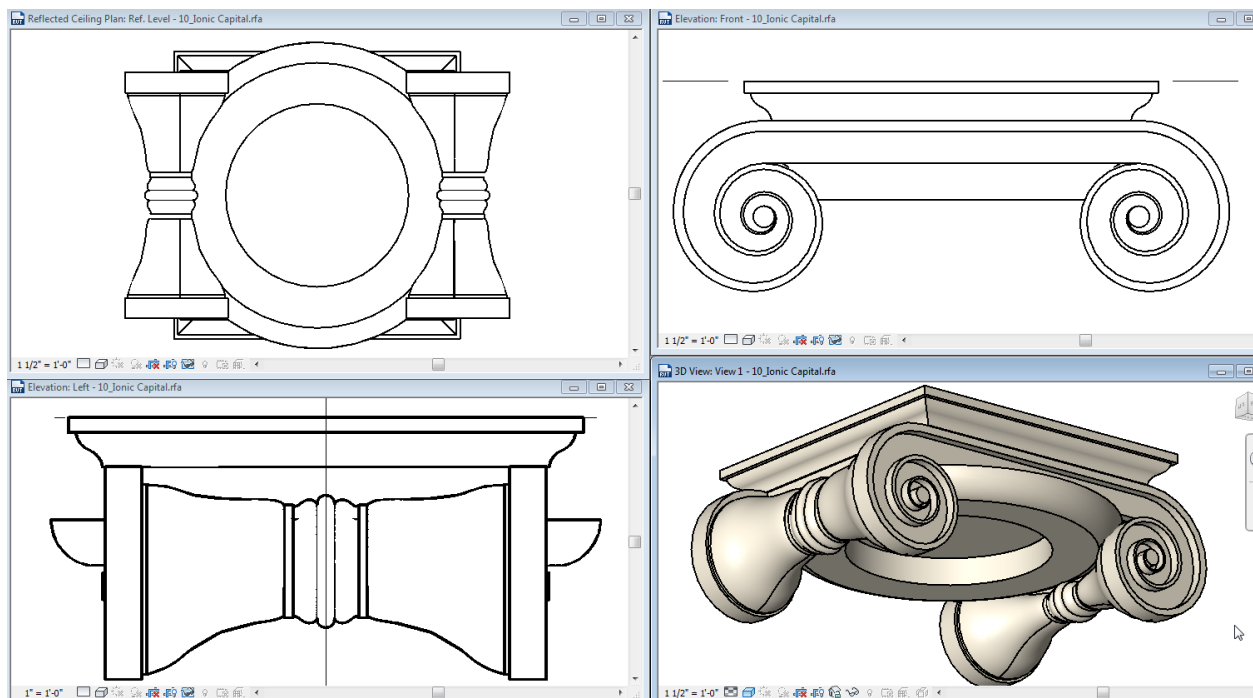
A few seams do show, but overall it is not bad.

Column Shaft Summary

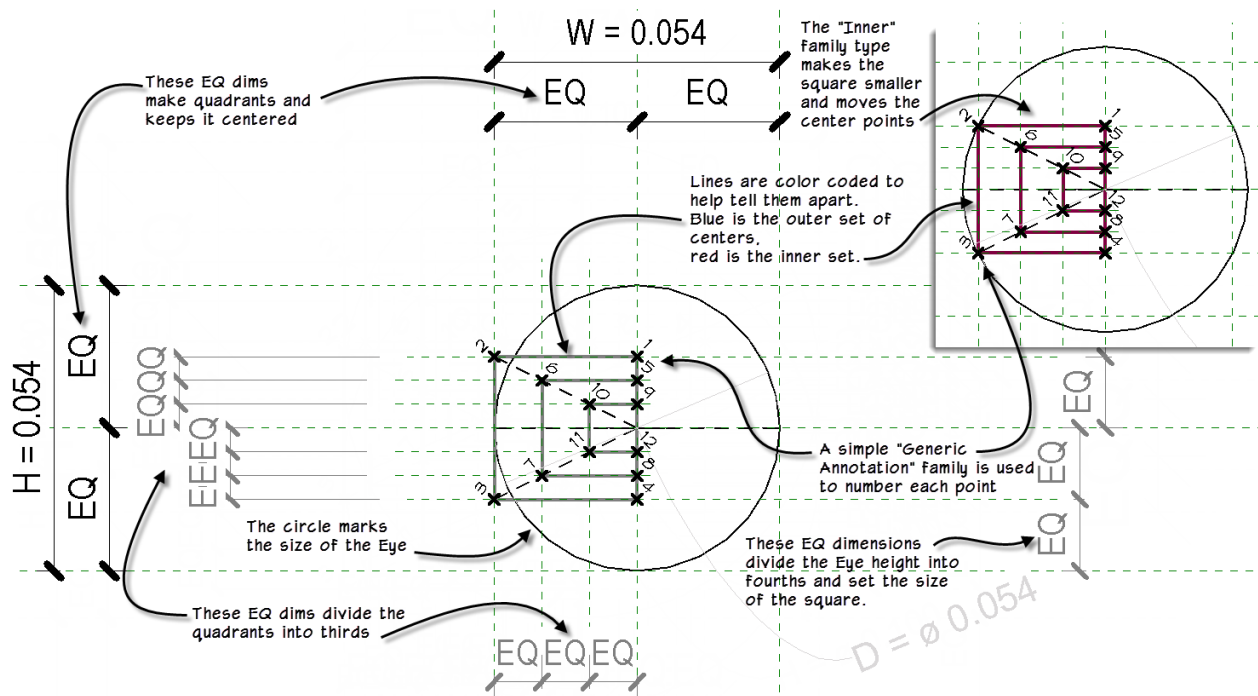
- ⇒ Revolve vs. Sweep
- ⇒ Diminution/Entasis
 - ⇒ Arc vs. Spline vs. Ellipse
- ⇒ Fluting
 - ⇒ Stacking Blends
 - ⇒ Adaptive Component
- ⇒ Parametric Control

The Ionic Order

I wanted to push the traditional family editor as far as possible. This Ionic capital is modeling in the traditional family editor! It is not an adaptive component.



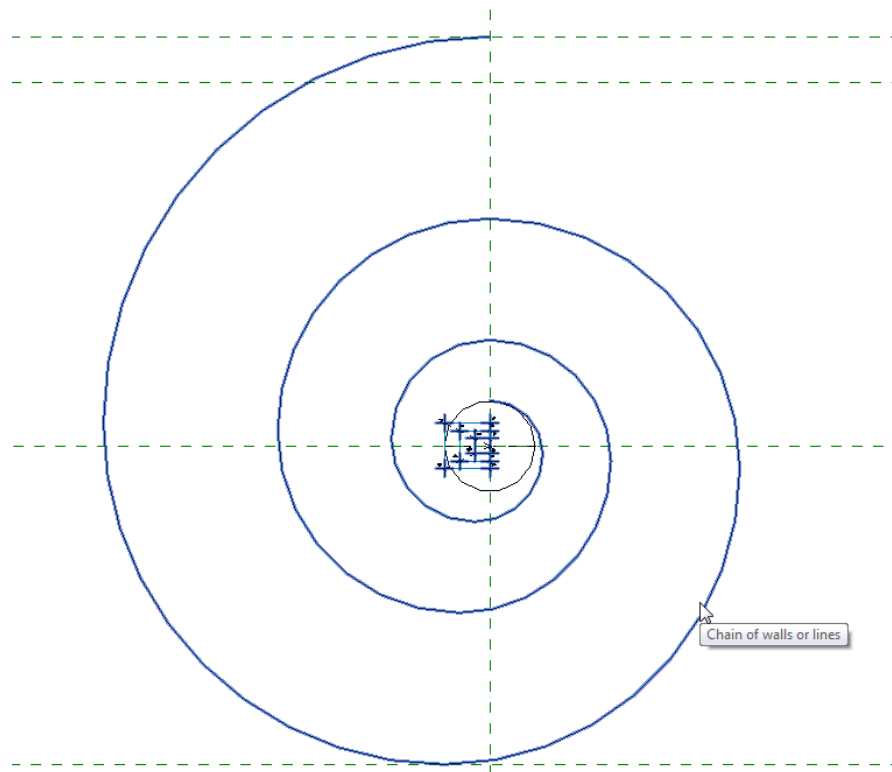
Ionic Capital in the family editor



If you look closely at the spiral on the volute, you see that the inner and out spirals taper in towards the eye. So you cannot do a sweep along the path in the traditional family editor. It might be possible to use a swept blend but the path would have to be a spline. But getting a spline path to follow the spiral exactly is tricky. The volute is a series of diminishing arcs; each one a quarter of a circle. The spline can come close to approximating this, but not exactly.

I opted instead to sweep it the other way. Instead of sweeping along the spiral, I swept instead along a short line perpendicular to the spiral plane. This allows for the two spirals to become an enclosed shape that form the profile of the sweep.

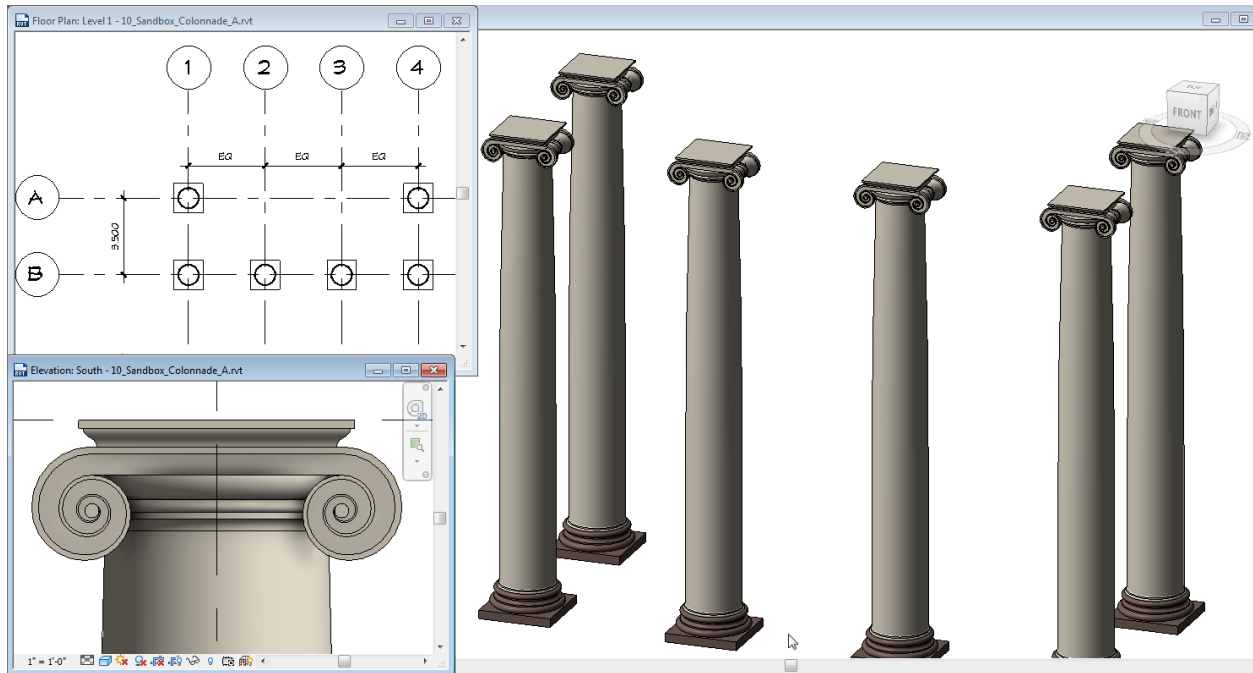
Constructing the spirals uses a fairly complex rig and several arcs. Each one has to be constrained carefully.



You end up with a chain of lines for the inside and another for the outside.



This image shows the final capital. It also shows the egg and dart, which I did not include in the book. I was having a difficult time getting the egg and dart to flex. So the book version is left smooth.



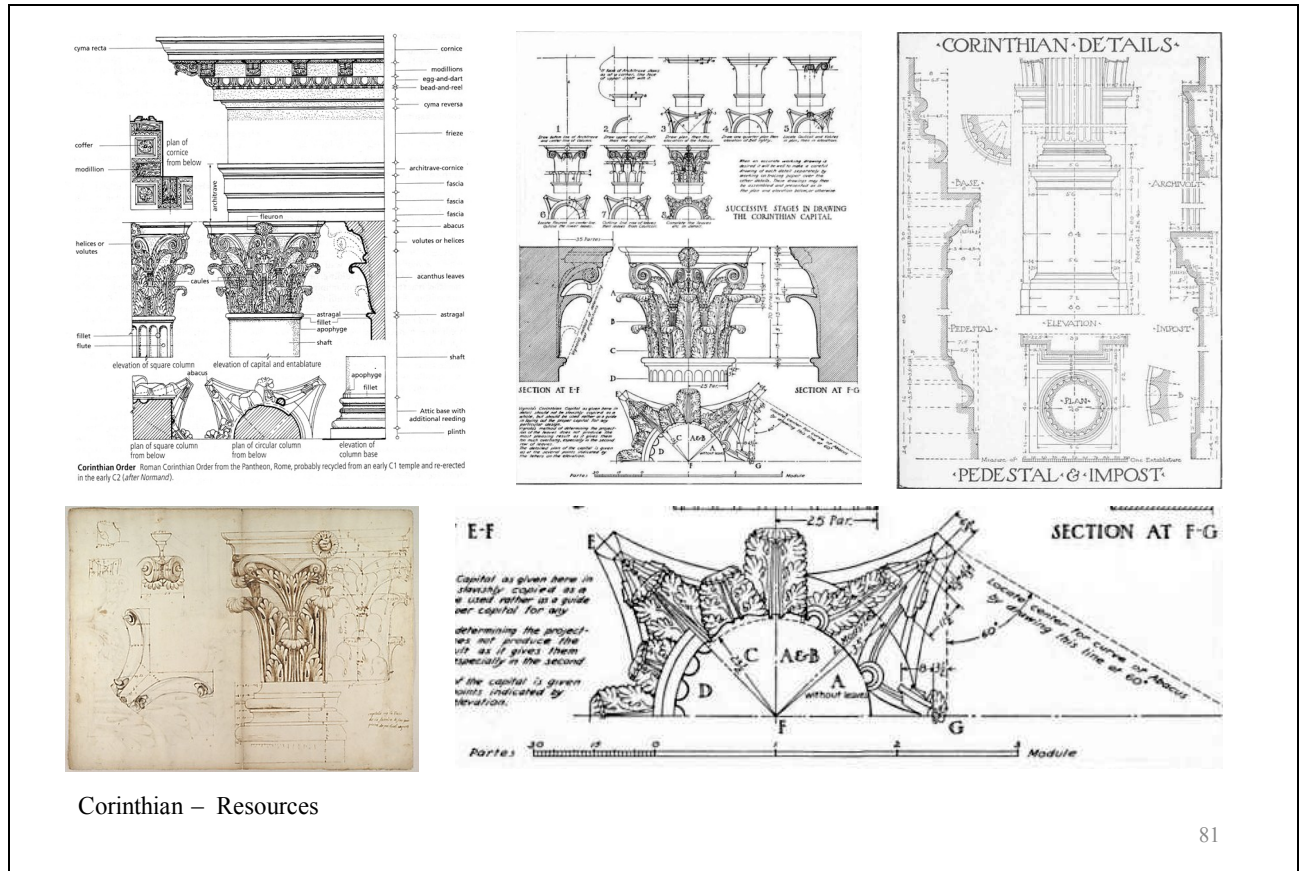
Completed Ionic with a smooth shaft

Ionic Order Summary

- ⇒ Laying out the Volute in a Profile Family
- ⇒ Using Sweeps for volutes
- ⇒ Using Swept Blends for the horns
- ⇒ Using a Spline to help shape the collars

The Corinthian Order

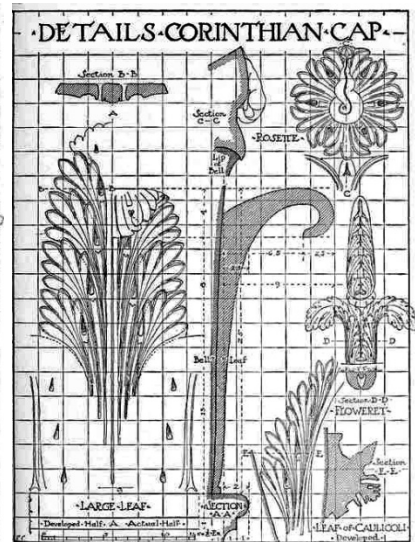
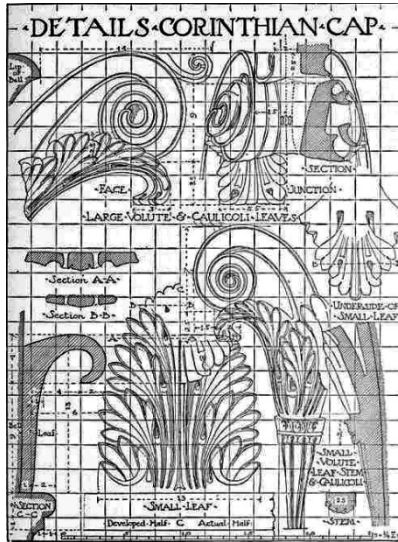
The Corinthian capital is built in the massing environment as an adaptive component



Given the complexity of the Corinthian, I opted for the Massing Environment. There is a couple key trade-offs when going to the Massing Environment, you can only change categories and build "components" if they are Adaptive Components. I have not addressed file size at all so far, but believe me, these files are breaking ALL the rules! So at some point I will have to try to optimize them. As much as I would like the Corinthian to be a standard Family, I just don't feel that the forms would be successful using the traditional family editor.

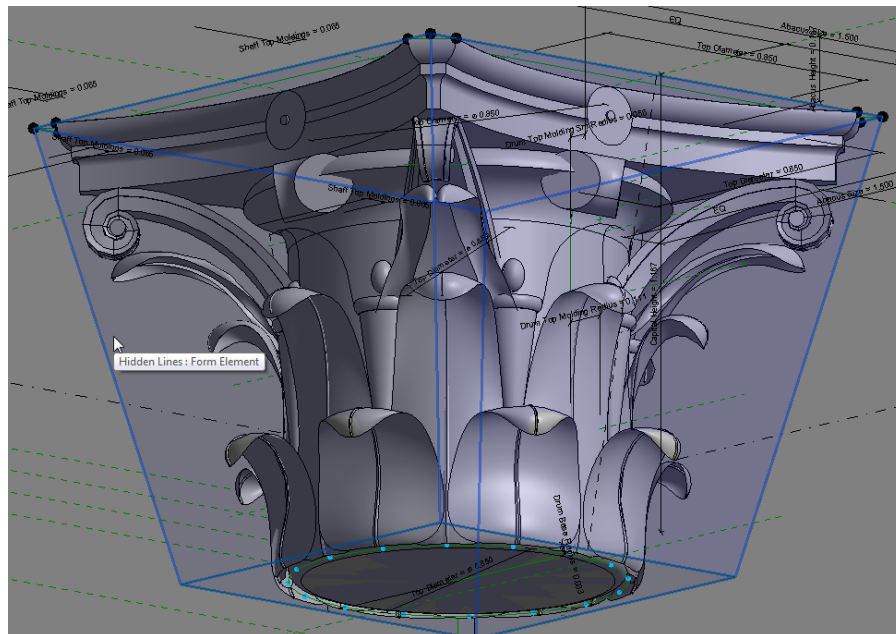
My first Corinthian version was 150MB!

My current version is about 30MB. Still very large, but much better.

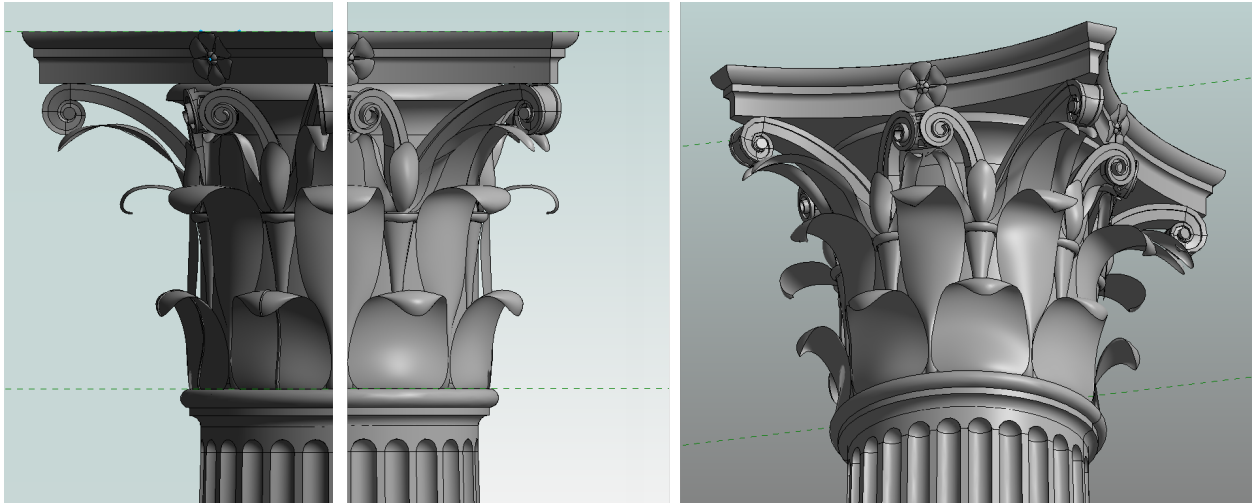


In addition to Chitham, I have been scouring the web for resources and taking photographs of local buildings here in Chicago.

Early Attempts

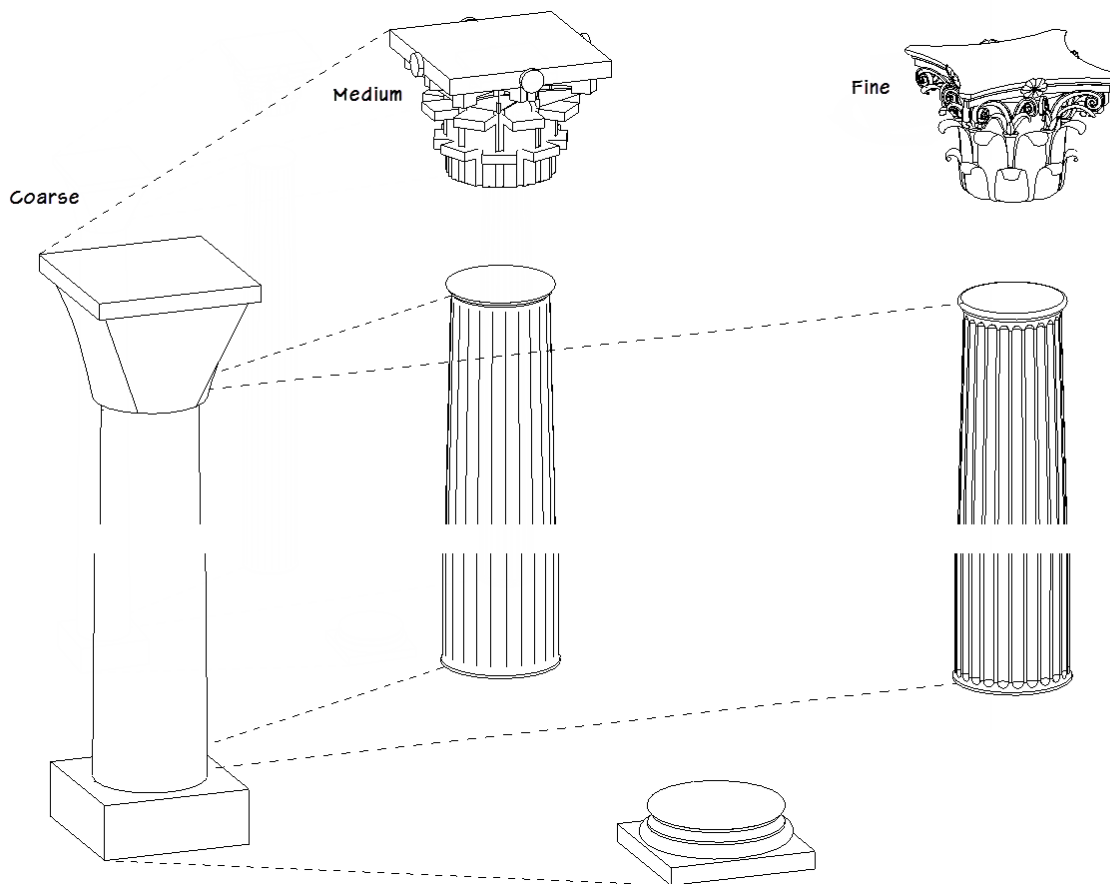


This is the first version I built



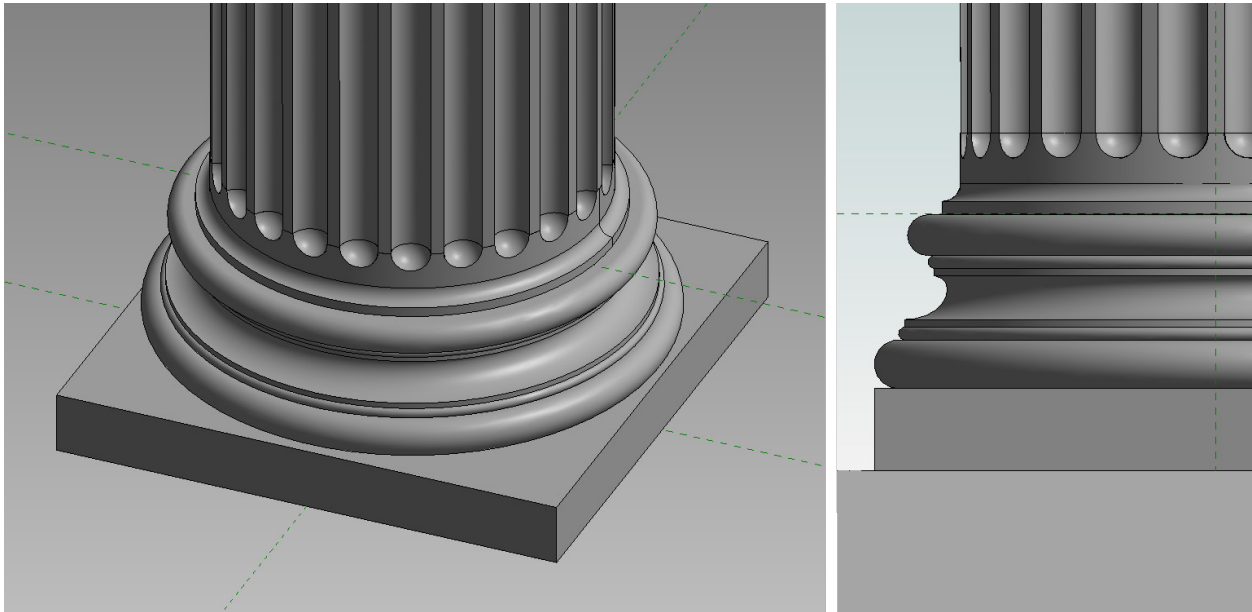
Current Version

I figured out much of what I wanted to do in the early version, but completely rebuilt it from scratch for the book.

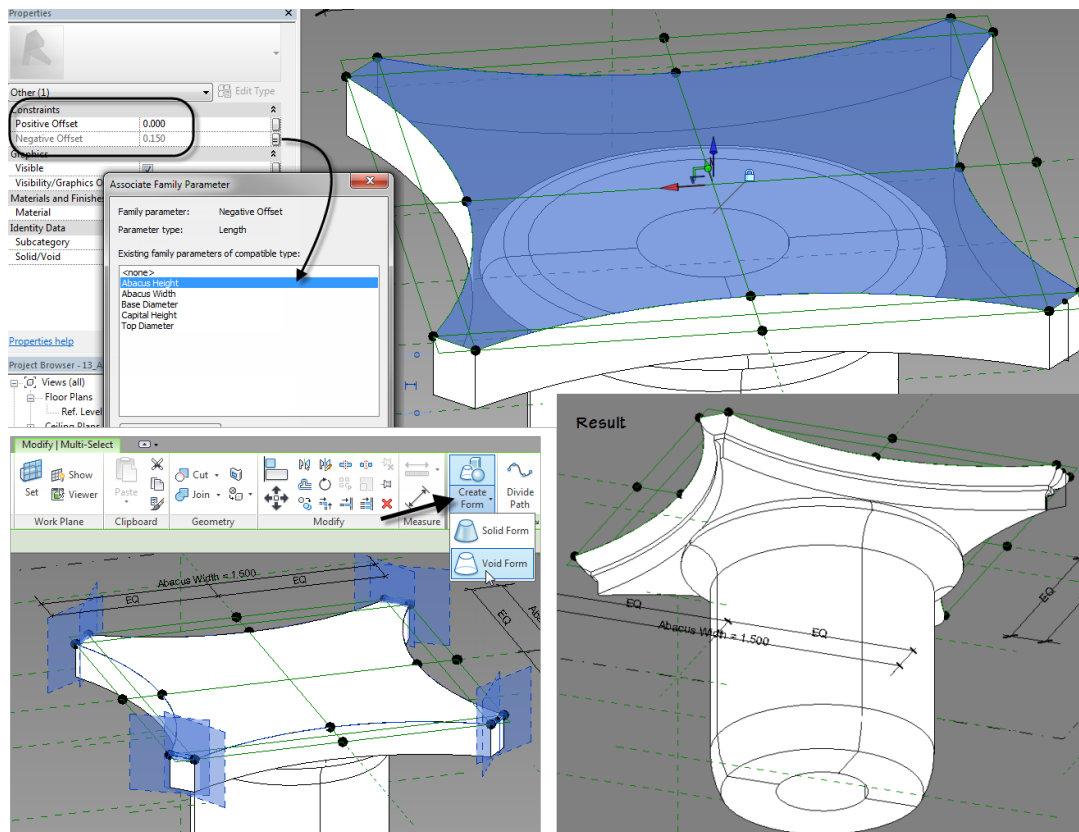


The full column is an adaptive component. The schematic version is the simple block family like the other orders. The base is shared by both medium and fine. It is a traditional family. The shaft for medium is smooth with lines on the surface to represent the flutes. The fluted version is displayed in fine.

There is a medium detail capital and a fine detail one. Both are adaptive components.



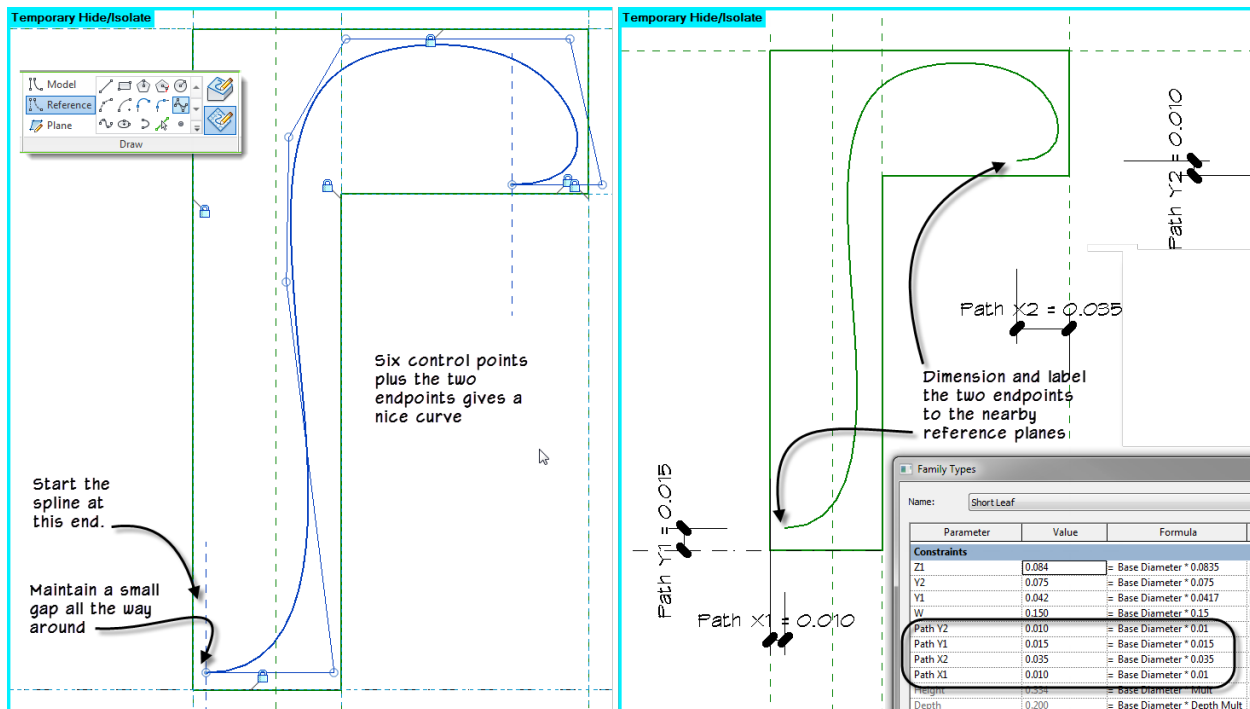
The base is very similar to the bases of the other orders.



The bell and abacus provide the backup for the other elements.

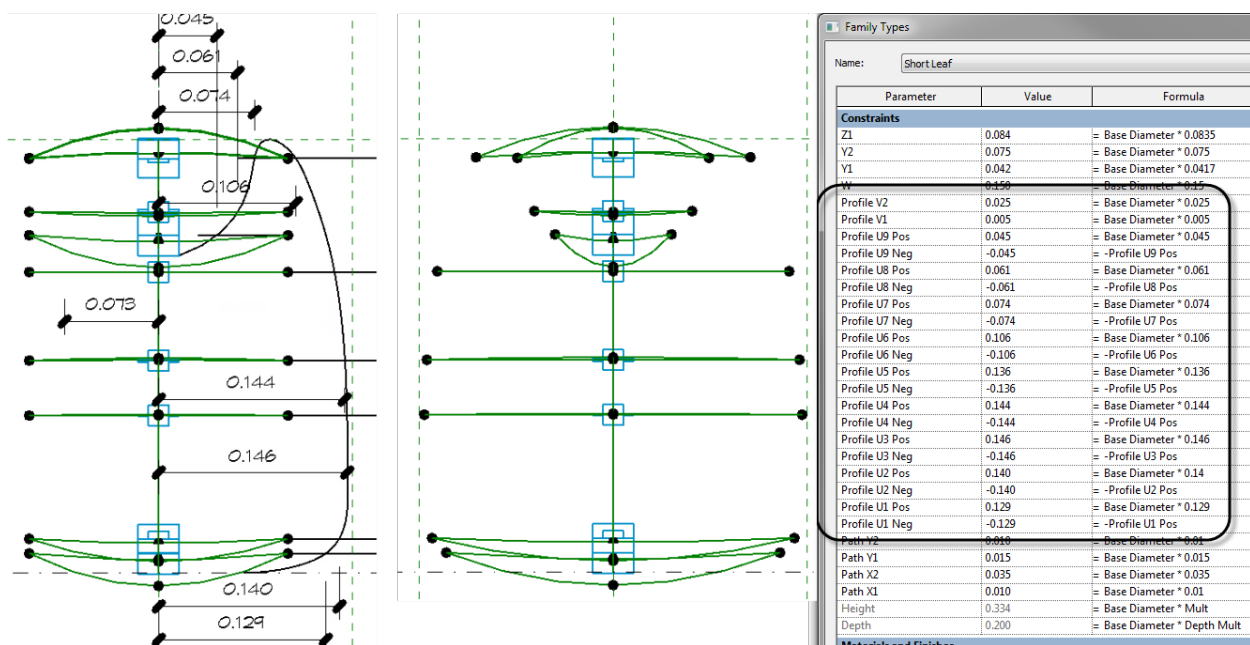
The abacus is an extruded form with a swept void to carve the molding.

To do a sweep with a profile in the family editor, you use a nested **generic model** family. The generic model family contains a closed model line shape. You cannot use a standard profile family in massing.



The Leaves are lofted forms in an adaptive family. There is a spline path.

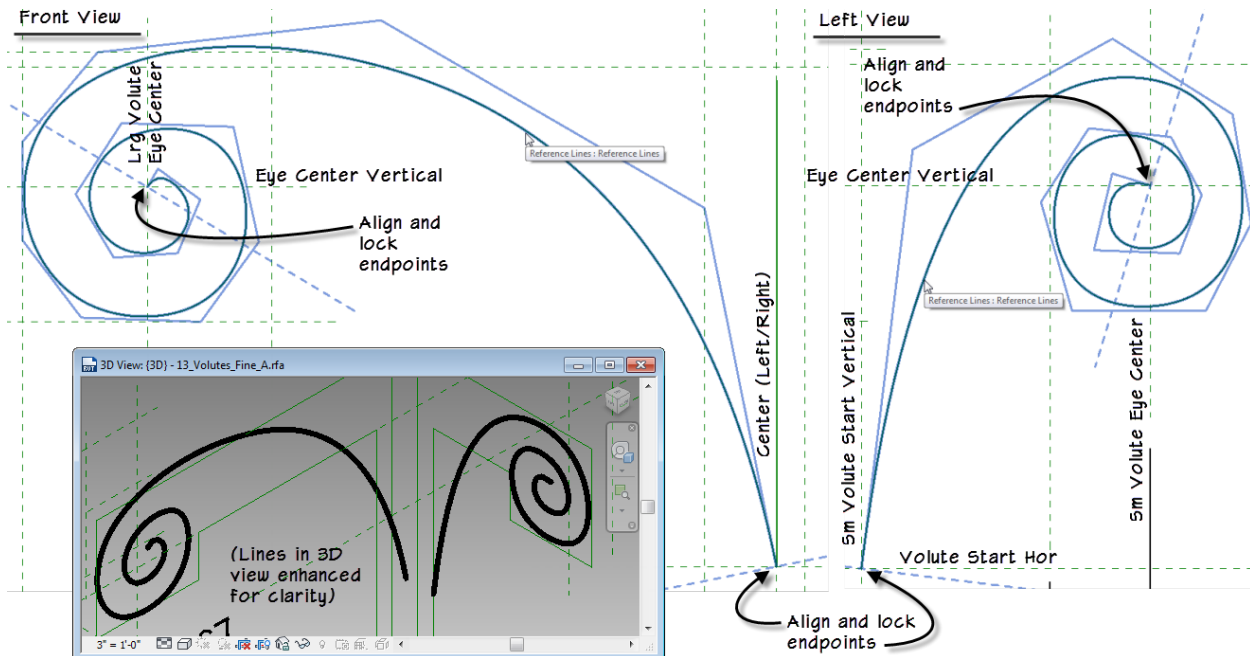
Splines have a unique super power. You only need to lock down the two endpoints. When these endpoints flex, the shape of the spline is maintained as it resizes.



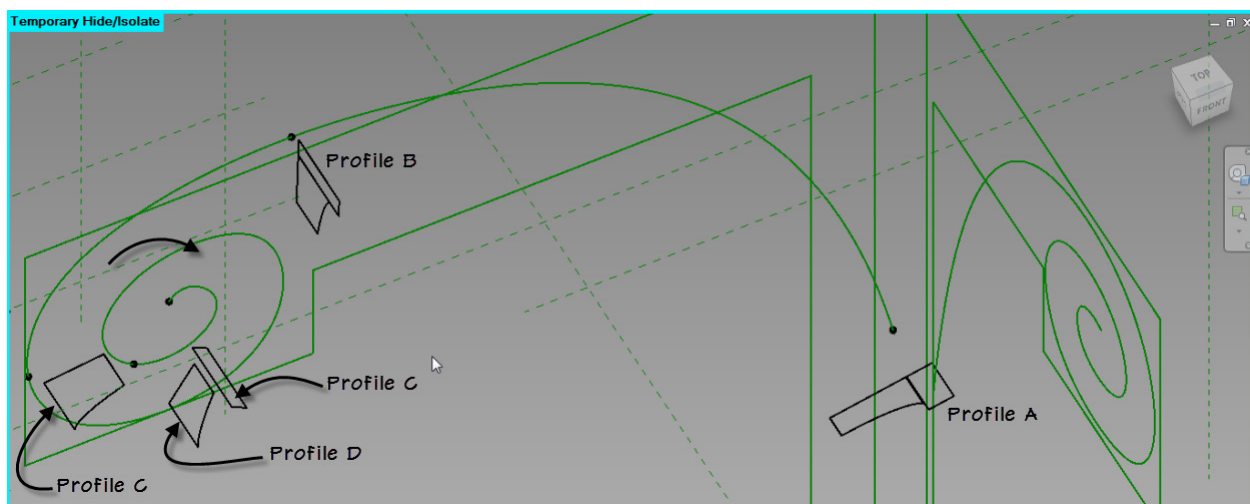
The next feature to leverage is hosted points.

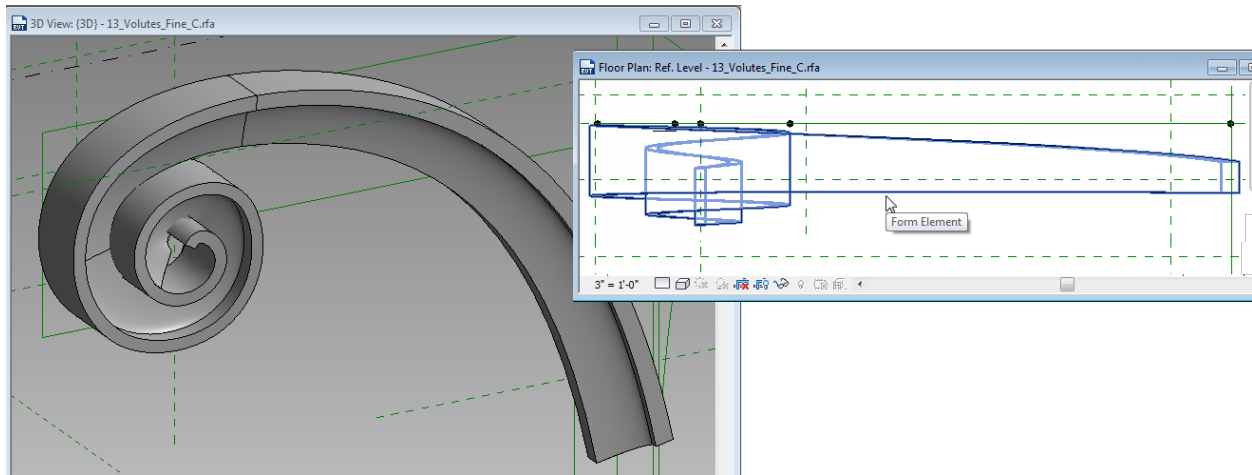
Place a point hosted on the spline, then add points and splines hosted to it.

Use parameters to control the offsets of the points with respect to their hosts. This in turn makes the whole rig parametric and controllable from the single Base Diameter parameter.



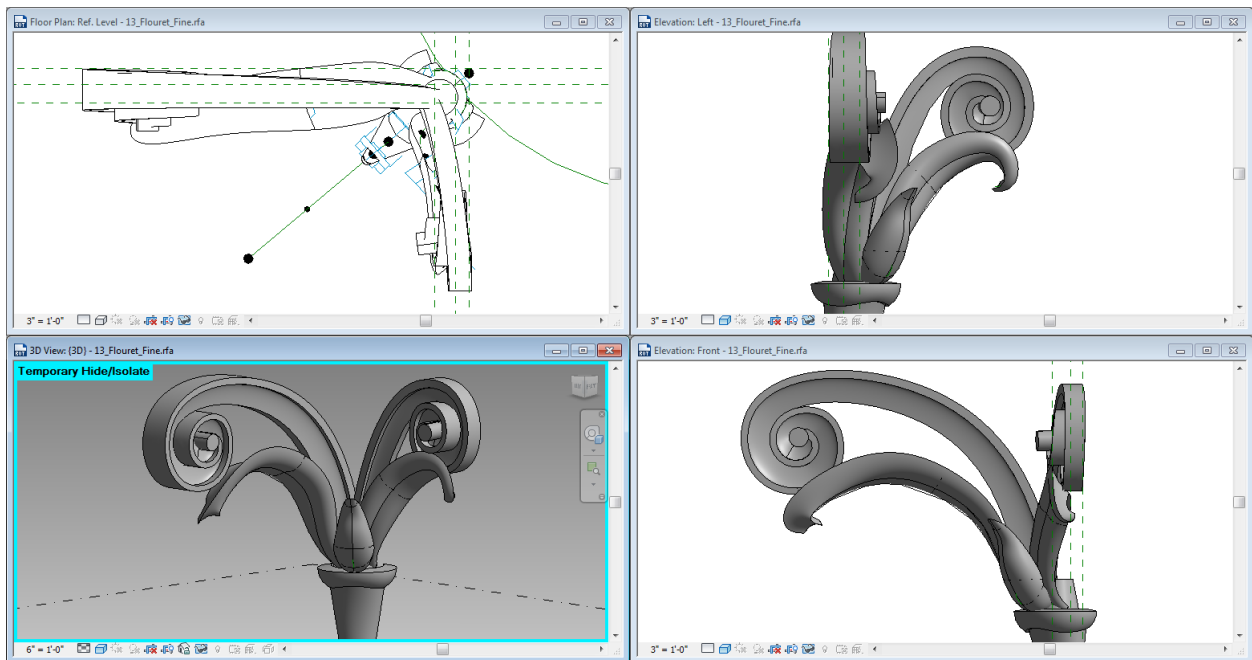
Here I used a single spline to make the path of the volutes. These are constrained and locked.



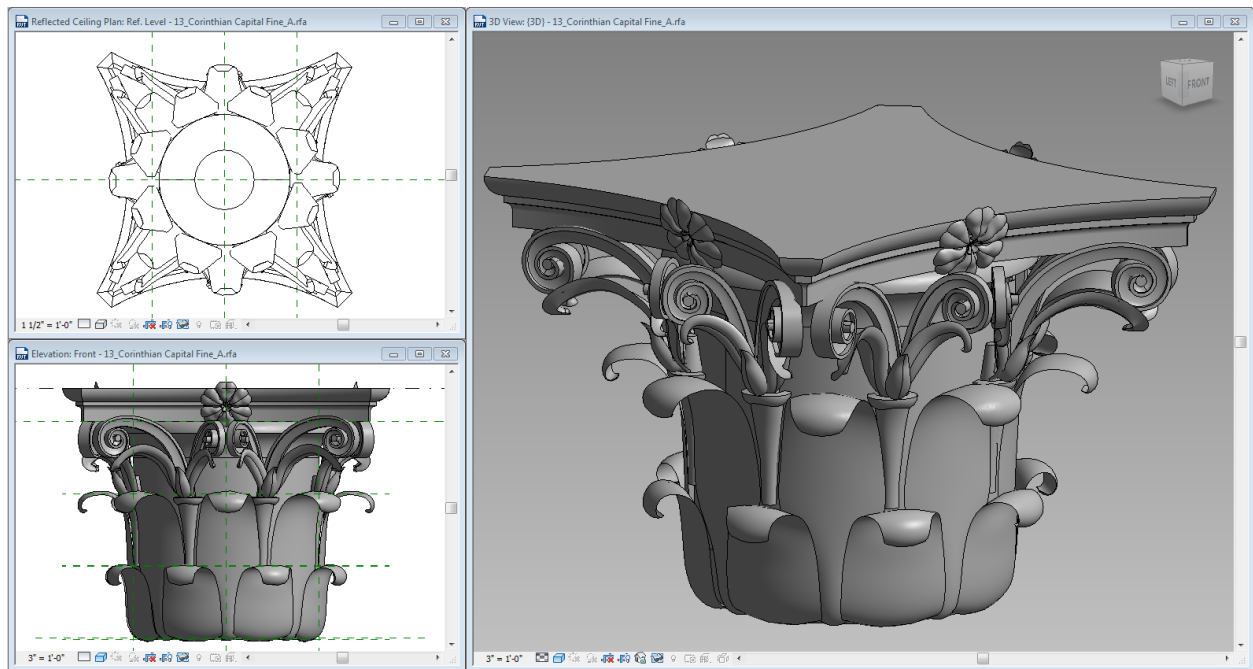


Again hosted points along the spline. But this time, generic model profiles are hosted on these points.

You can loft a form between the hosted profiles.

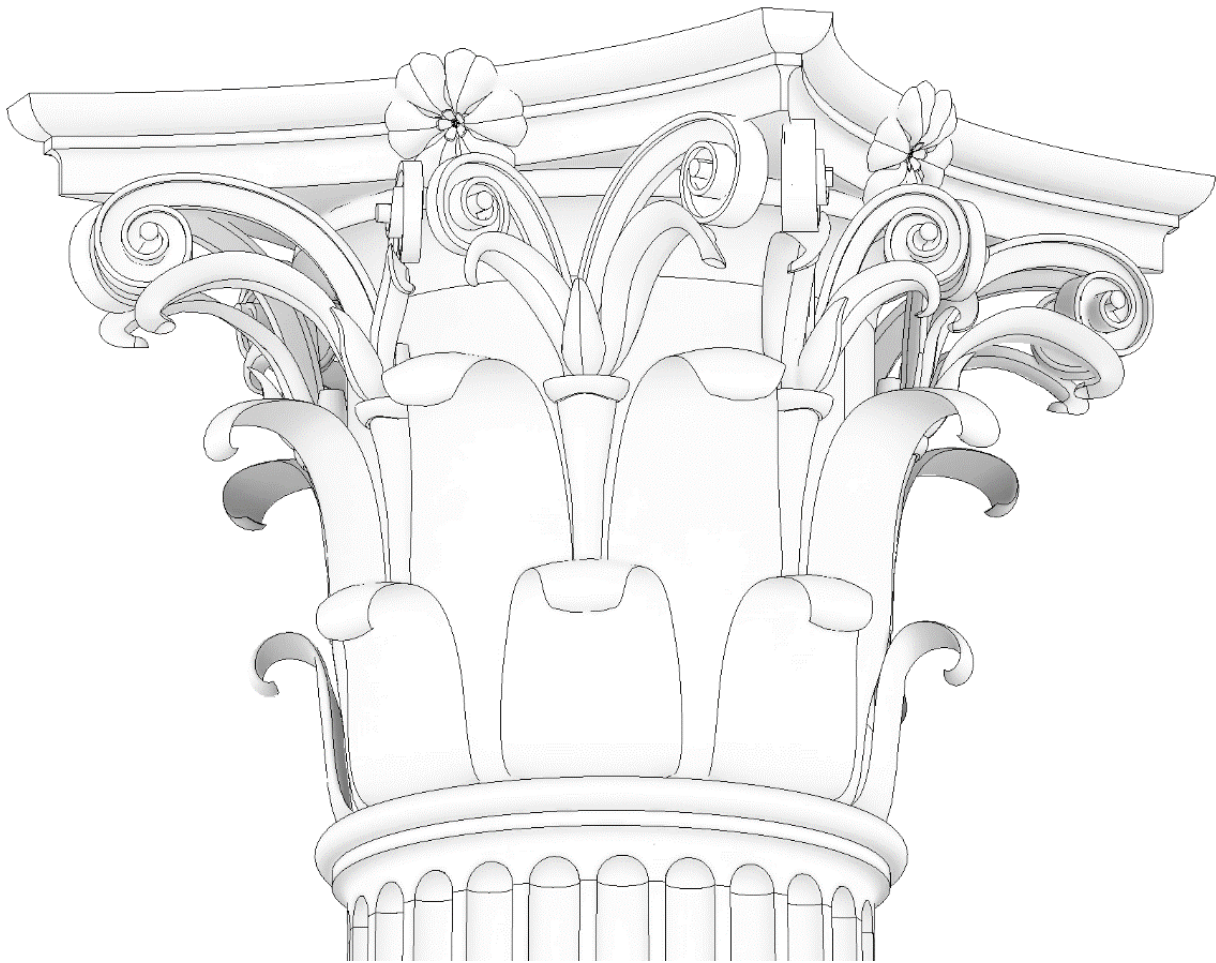


Combine several of the previous techniques to create the remaining pieces



Pull in all of the nested pieces and copy them around the bell.

I decided against divide and repeat in this version. Repeaters can be a little difficult to control after they are placed. So I liked the flexibility of simply having free-standing copies.



The final version with ambient shadows

Corinthian Summary

- ⇒ Using the Massing Environment
- ⇒ Adaptive Component
- ⇒ Divide and Repeat (Opted not to use)
- ⇒ Using Generic Models as Profiles
- ⇒ Building a Reference Line Rig
 - ⇒ Awesome way to scale...
- ⇒ Creating Solid Leaves

Wrap up



A few more of my sketches from my Italian semester. (Regrettably I have not had much time to sketch since then).

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⇒ paubin@paulaubin.com

⇒ [@paulfaubin](#)

⇒ **Thank you!**



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Thank you very much for attending! I sincerely hope you enjoyed it. Please feel free to contact me at the above addresses.

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Thank you!