AUTODESK. UNIVERSITY

S227255

BIM and Site Development

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Stantec

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Learning Objectives

- Discover the different workflows toward site development in 3D
- Understand the effective use of Revit in documenting Landscape Architecture
- Learn how to justify the early cost associated with modeling the site through the different workflows
- Understand the strengths and limitations of BIM software with landscape/site development

Description

Do you ever ask yourself these questions: I'm still working in 2D, how can I get myself to the third dimension? What are the best workflows for schedule and budget to model my site? Well, you're not the only one. Speed and accuracy in our files is crucial, and it can be difficult to coordinate across disciplines if we aren't working in 3D. This session will guide the audience through different workflows and the best ways to develop a site using BIM (Building Information Modeling). We will examine case studies where sites were modeled using Revit software and 3ds Max software. We will journey through best practices on modeling techniques that encompass the design process from documentation to visualization. By the end of this course, you will understand the process of implementing BIM software for site development.

Speaker(s)

Joseph Bertucci @BIMtucci

Joe Bertucci is a designer, leader, and educator at Stantec – a globally recognized design firm. As BIM Manager and a Revit Architecture Certified Professional, Joe offers specialized BIM outreach to the organization and a diverse skill-set collaborating with project teams for themed entertainment, hospitality, and commercial clients in the USA, Caribbean, and China. A Chicago native, Joe earned his bachelor's degree in Architecture at the Illinois Institute of Technology and a specialization in Digital Design with knowledge of 3-D printing, Digital Fabrication, and Virtual Reality. Joe established a 26-session training program that was designed to migrate the landscape architecture staff into Revit which was then offered to all production staff to develop their BIM/Revit knowledge. His portfolio includes work for Walt Disney Imagineering, SeaWorld Parks & Entertainment, Merlin Entertainment, NBC Universal, Core Development, True Blue Development, and Legend Cultural Development.

Robert Terry @3dRobT

Rob is a 3D artist and animator with 20 years of professional experience as both a production assistant and art director of many wide-ranging architecture projects in the corporate, hospitality, themed entertainment, and simulation industries. A graduate of the University of Massachusetts at Dartmouth and a 3ds Max Certified Professional, Rob uses the latest technologies to help develop customized workflows that facilitate the design process while providing high-quality renderings, animations, and real-time, interactive previsualization as a Design Visualization Specialist for international design firm, Stantec. His clients include Walt Disney Imagineering, SeaWorld Parks & Entertainment, NBC Universal, Florida Hospital, Merlin Entertainment, True Blue Development, Legend Cultural Development, and United States Army Corps of Engineers.

Which Path Should I Take?

At the beginning of our projects we have a choice on whether we should use BIM or not as part of our project delivery. Building Information Modeling is a digital representation of physical and functional characteristics of a structure. BIM is a process as much as it is a product. Common excuses though we hear are “We Want to Commit But….” There is always something that holds us back, the fear in change. We are used to a certain process in our innovation that we tend to lean against wanting to alter our methods of delivery. However, regarding BIM, the process in the same, just a different tool. The deliverables are not changing, just how we are producing them.

So then Why BIM? Well this can be broken down into 3 categories. The Inherent, the Attainable, and the Inevitable. The Inherent involves taking advantage of automation of manual tasks and better communication of design intent. The Attainable involves improved coordination and improved quality and efficiency on projects. Lastly, we have the Inevitable, which despite resistance to change, it is the direction the industry is going, and more clients are making it a requirement on projects. Because of this we need to adapt to the tools we have to achieve BIM on or projects.

As landscape architects, they are many approaches to developing our site. When we are trying to put ourselves on the path of BIM, we are first asking ourselves what is the right tool for the job? There are multiple solutions for a desired result. Programs such as AutoCAD, Civil 3D, Revit, 3DS Max, Rhino, and others are among the few that all contribute to the development of Site. For this course, we will be primarily focusing on Revit, 3DS Max, and the necessary plug-ins and workflows associated with these programs to develop our site.

REVIT-alize Your Site

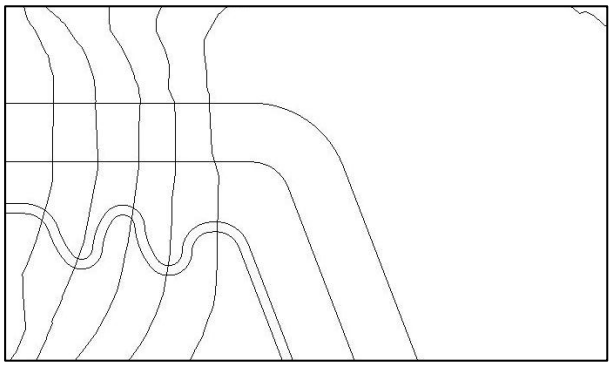
Once we agree as a team that we are committed to taking the BIM approach on projects. The next question we face is how do we migrate from CAD into Revit? A common mistake that is made is that we hand a tool over to a group of individuals that don’t know how to use it and expect them to become experts over a short period of time. BIM Managers become important in this migration process as we are educators and it is our job to educate those that are unfamiliar. However, when we take this approach, we should not overwhelm our audience at first since Revit can feel overwhelming at first glance. Start by knowing your audience and understanding what is familiar to them. Sell the tool initially on its capabilities that interest our audience. This includes schedules, areas, revisions, and various documentation tools. These are features they are familiar with in using CAD but educate them on the efficiencies of these tools in Revit.

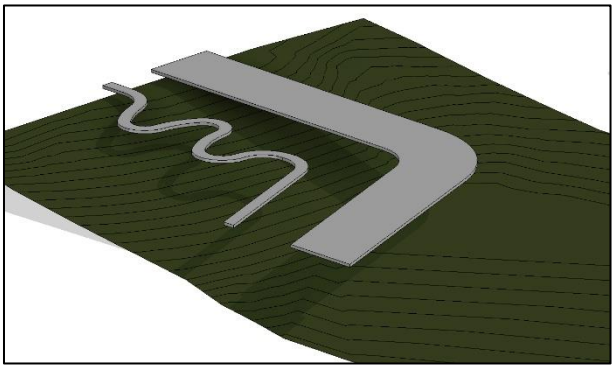
We have a common phrase, “One Team, One Dream”. However, it is difficult to achieve that dream if our team work in separate dimensions. Though we have dealt with this before on projects, we end up creating sub-workflows procedures to accommodate for this. Revit excels in being a Multi-Discipline collaboration tool, so instead of being the “Odd Man Out” we welcome the addition of our landscape team into Revit along with our other consultants/venders.

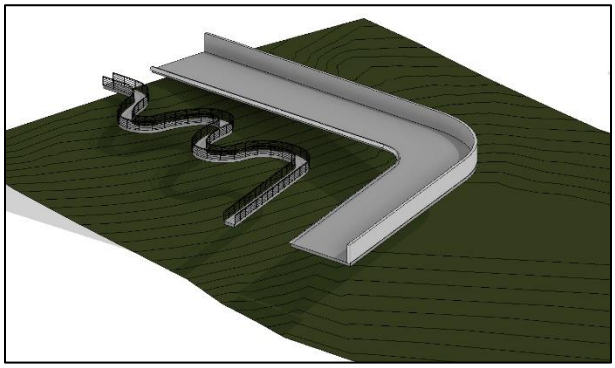
Migration Monday (a.k.a. Migraine Monday)

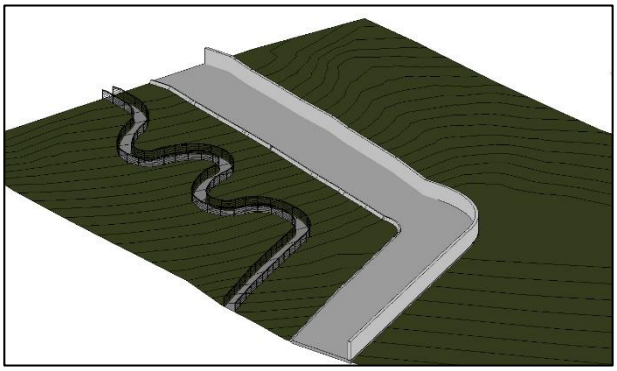
When do begin our migration, we lay out our work plan in 4 phases/stages. We illustrate this as a bottom-up approach.

- Container File – Start with 2D elements (Details, symbols, legends, notes, schedules, cartoon set, linework)
- Horizontal – Flat 3D (floors, planting, subregions)
- Vertical – Elevate 3D (Levels, Walls, Stairs, Ramps, Railings)
- Dynamo – Manipulation & Automation (Sloped floors, topo adjustments, hosting elements, plants calculations)



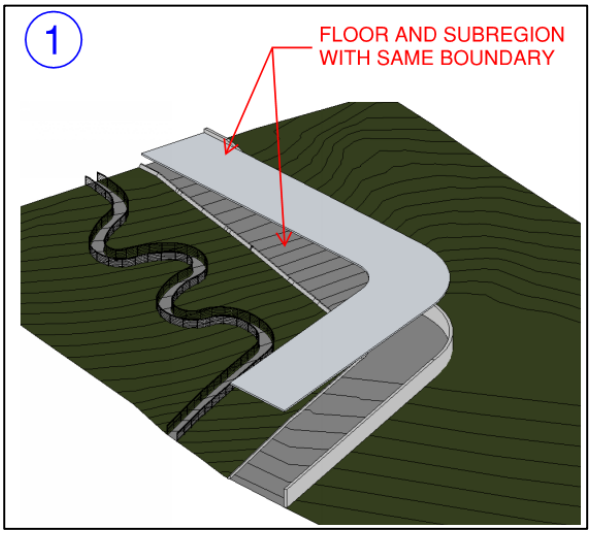


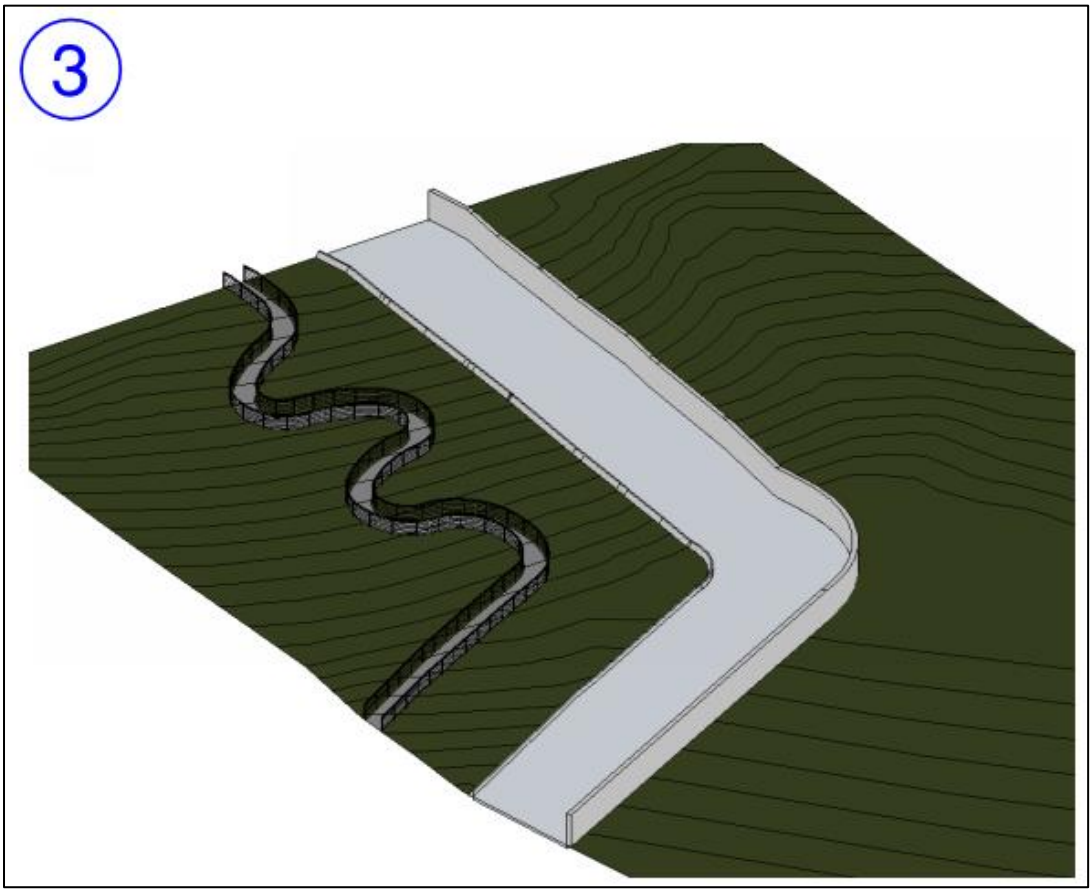




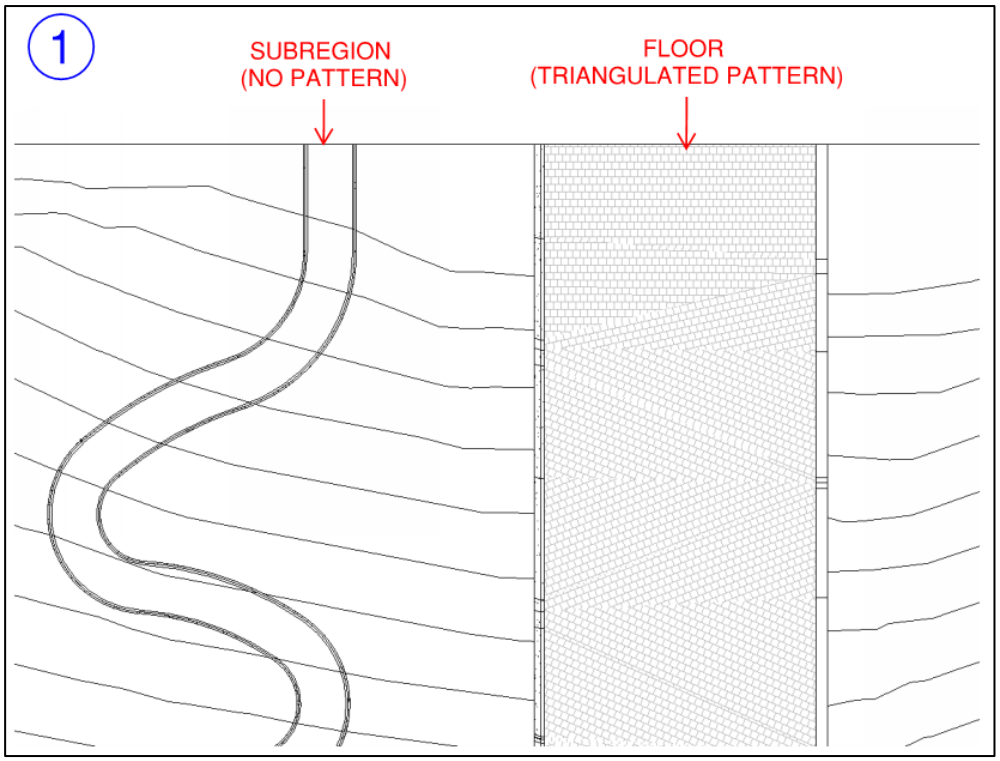
Modeling Techniques

- Floors & Subregions – Our hardscape and landscape are modeled as different floor types. This is easy for our Landscape Architects to alternate between different types and to schedule accordingly. These floor types will allow for opportunities for us to add certain parameters to do calculations, counts, and cost estimates. If we edit the floor boundary and copy the boundary lines, we can use these to create a subregion of the topography. By doing this, we can run a dynamo script that will then map the floor to the surface of the topo.

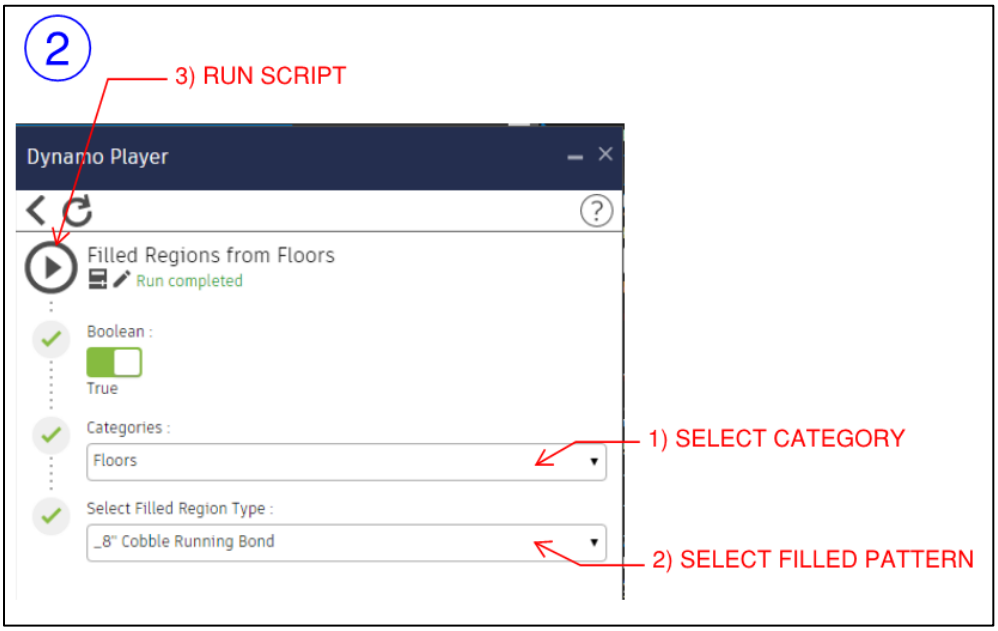


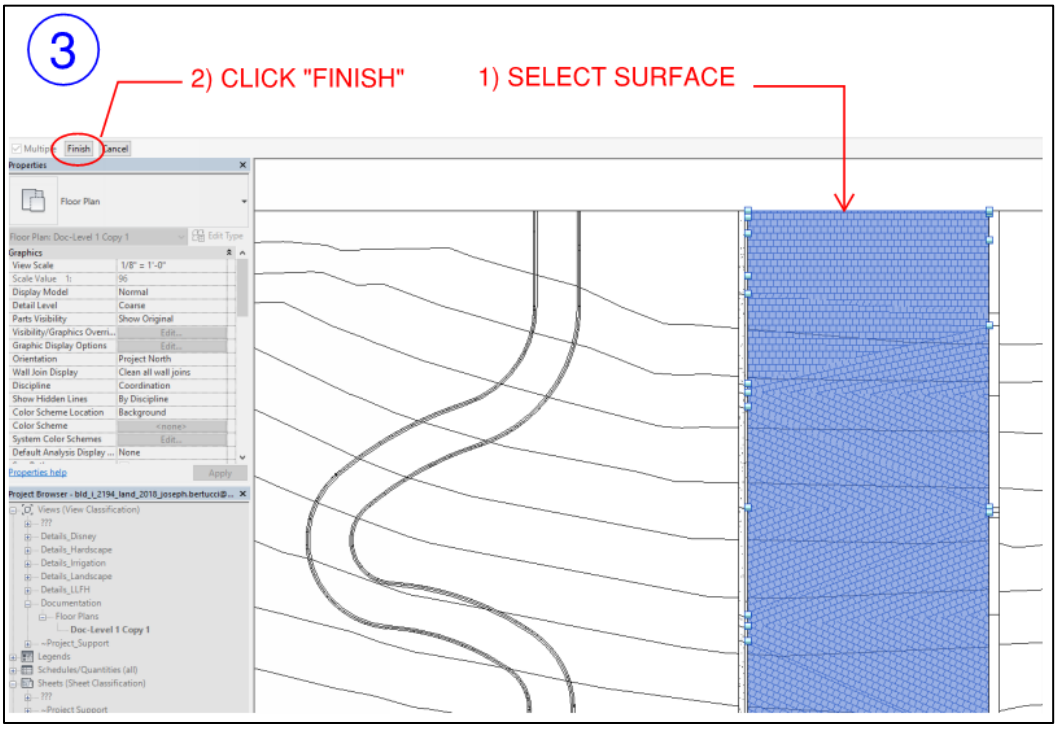


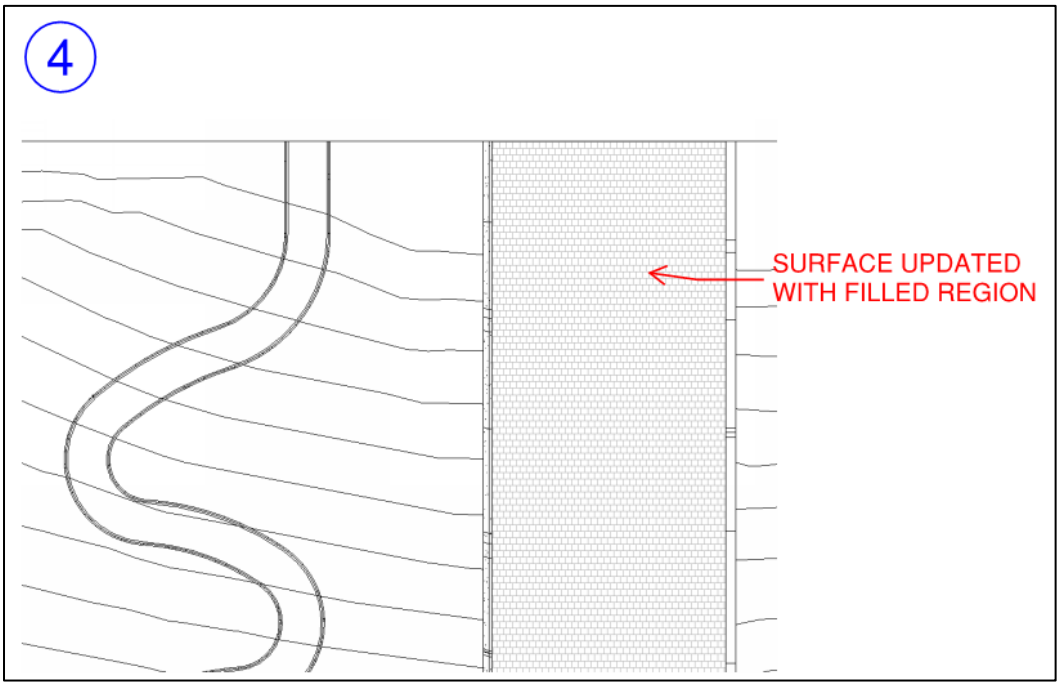
One thing to note that becomes cumbersome in Revit is the translation of patterns on a sloped surface. When we manipulated our floors to align with the topography, the hatch patterns associated with these floors are triangulated which is not ideal for a clean look for our drawings. In addition, if the team uses a mix of subregions as well to emulate surfaces, it is known that subregions don't retain patterns. To resolve both these issues during documentation, we also can run a script in dynamo that allows us to select the category type we want. In this case it would be floor or topography. Then by running the script, we can extract the boundary lines and place them into a filled region of our choosing which will give us a more desired result.


1
SUBREGION
(NO PATTERN)
FLOOR
(TRIANGULATED PATTERN)

\

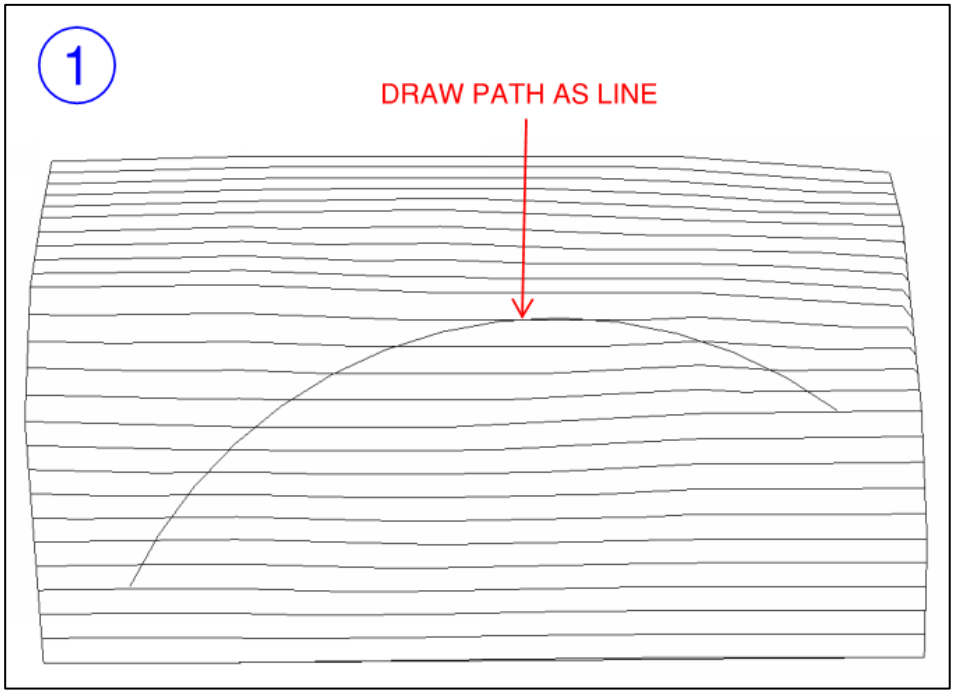

2
3) RUN SCRIPT
Dynamo Player
Filled Regions from Floors
Run completed
Boolean :
True
Categories :
Floors
1) SELECT CATEGORY
Select Filled Region Type :
_8" Cobble Running Bond
2) SELECT FILLED PATTERN

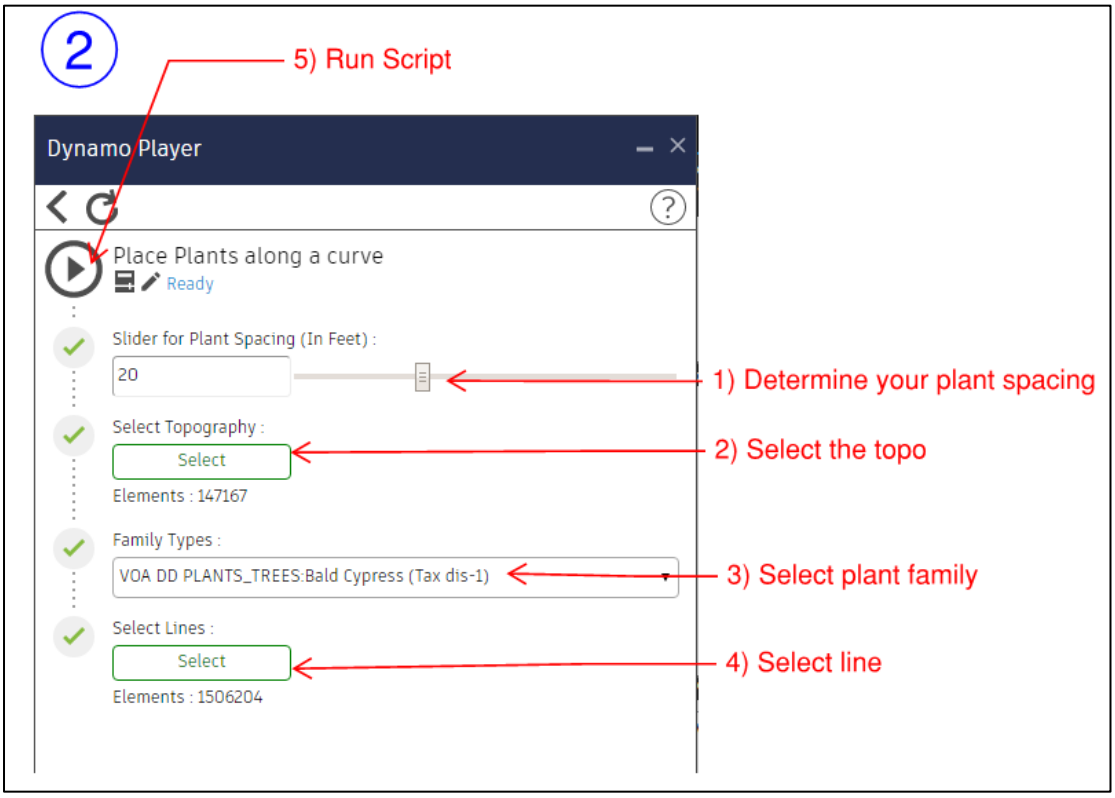

3
2) CLICK "FINISH"
1) SELECT SURFACE
Finish
Cancel
Properties
Floor Plan
Graphics
Project Browser

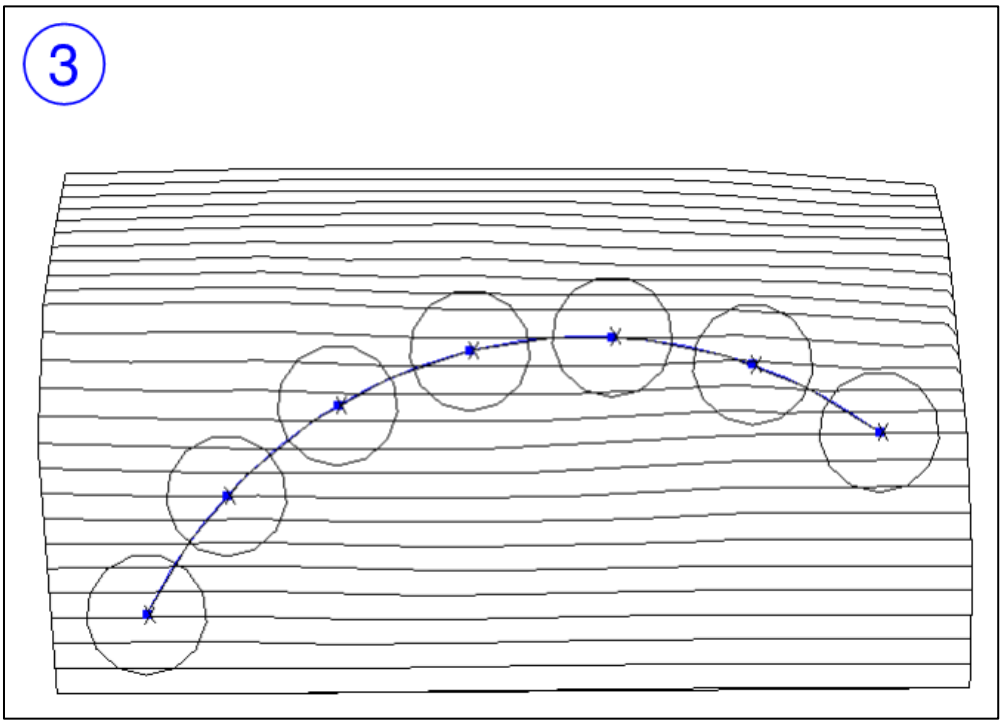

4
SURFACE UPDATED
WITH FILLED REGION

- Railings & Curbs – Railings have new hosting parameters. Since 2018 they are now allowed to host to topography. If we deconstruct the procedure to model a railing in Revit, it essentially is a series of sweeps and arrayed elements. If we use this knowledge and apply it to making Curbs, it's the same workflow. We would use our curb profile and use the railing tool to model it.

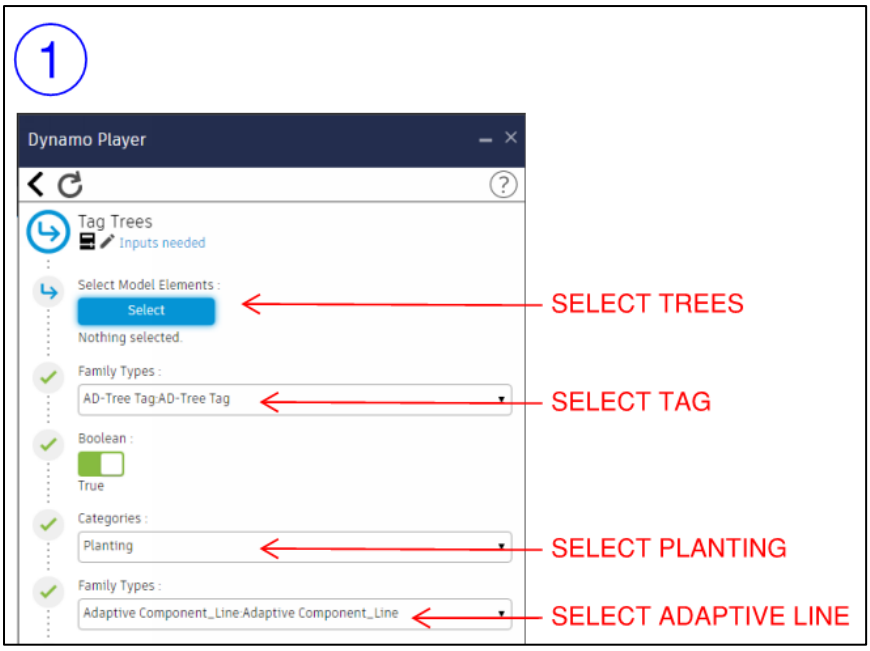
- Tree Placement - Trees can be manually placed in Revit. Another approach is using Dynamo which can place trees along a curve and array them with a set distance. This approach will give us another layer of control if we want the trees to follow a certain path or spacing.

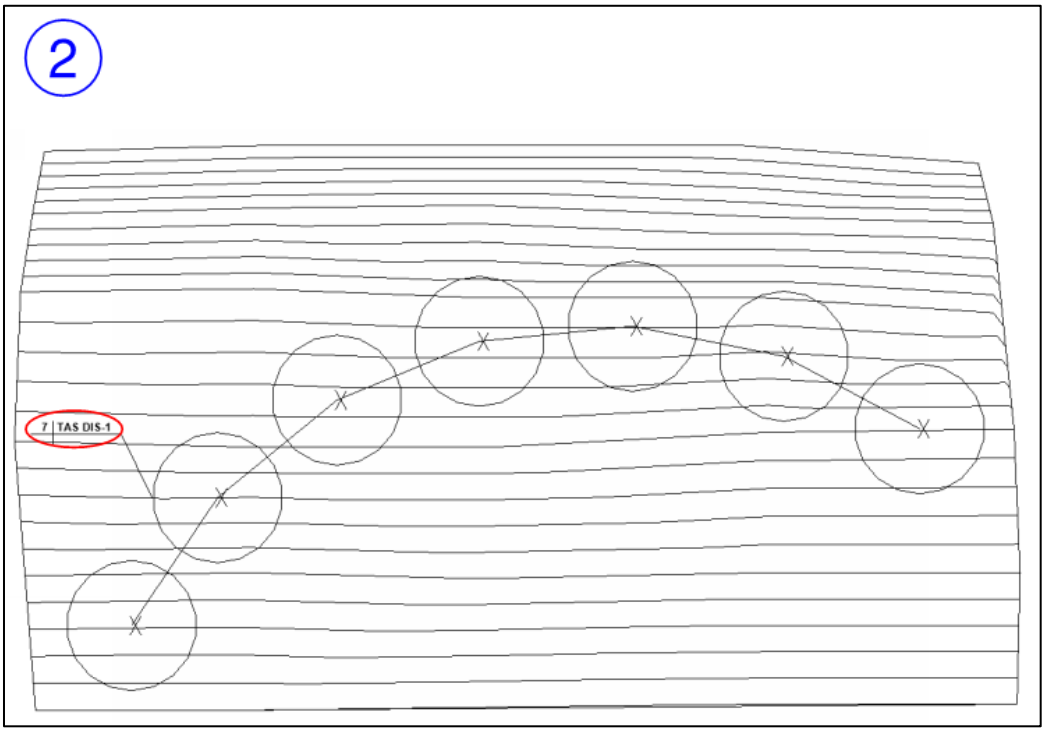



2
5) Run Script
Dynamo Player
Place Plants along a curve
Ready
Slider for Plant Spacing (In Feet) :
20
1) Determine your plant spacing
Select Topography :
Select
2) Select the topo
Elements : 147167
Family Types :
VOA DD PLANTS_TREES:Bald Cypress (Tax dis-1)
3) Select plant family
Select Lines :
Select
4) Select line
Elements : 1506204


3

In addition, when you look at documentation, we want to tag our trees accordingly. Usually this is done on a string of the same species and the tag indicates the total count in that string. Dynamo helps automate this process pretty efficiently by giving us control of selecting the trees and then having an adaptive family string the trees together and the tag placed accordingly with the selected amount of trees.

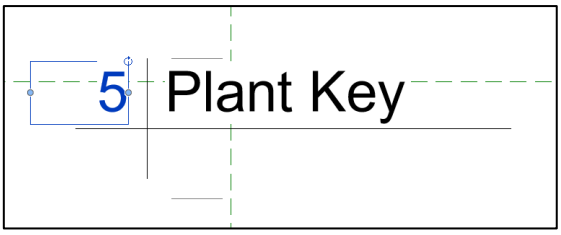


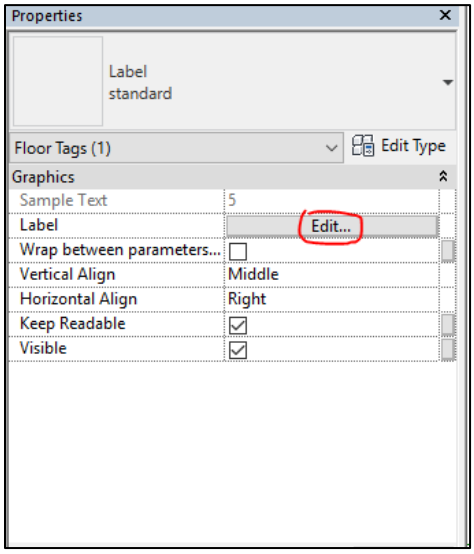


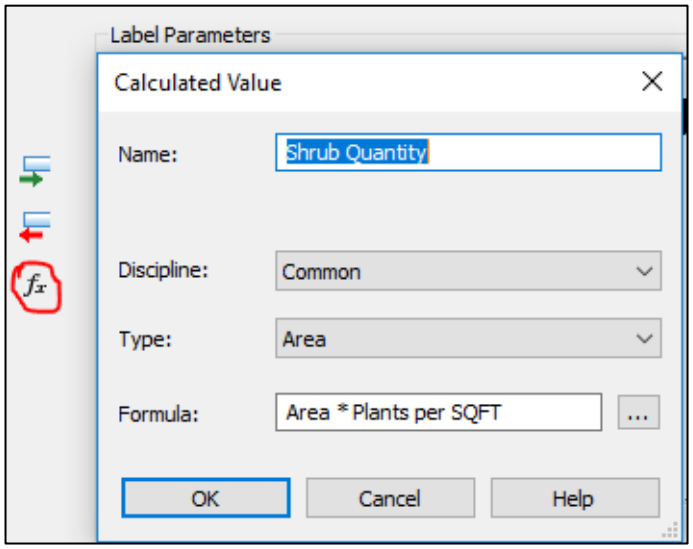
- Plant Calculations – We have developed annotation tags that are used to enhance our documentation. These tags are made to recognize our floors types that are for planting beds. Our planting beds are given a type parameter associated with the plant spacing per sq/ft. The tag has a formula assigned to take the area of the planting bed and multiple by the plant spacing. The result is the number of plants/shrubs that can fit into that planting bed and the number will automatically be updated in the tag.

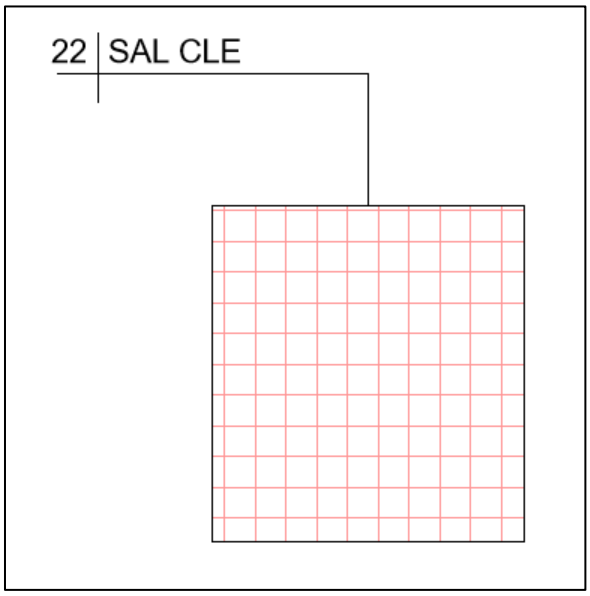
PLANT SPACING CHART:

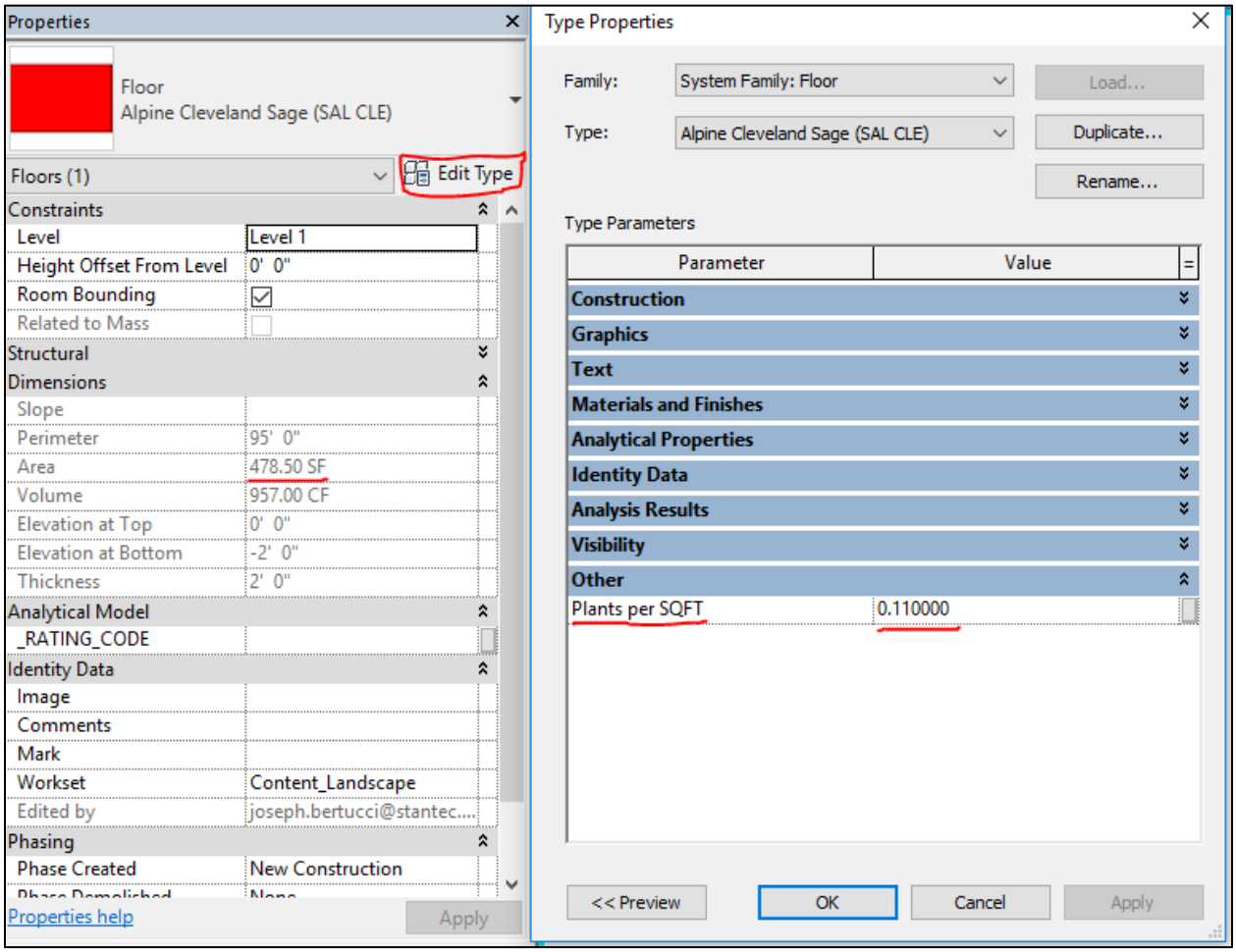
Plant Spacing inches O.C. 'X'	Plant Spacing inches O.C. 'A'	Number of Plants Per Square Feet. 'Q'
6"	5.2"	4.61"
8"	6.93"	2.25"
10"	8.66"	1.66"
12"	10.40'	1.15"
14"	11.74'	.73'
15"	13.00'	.64'
16"	14.95'	.54'
18"	15.60'	.44'
24"	20.80'	.25'
30"	26.00'	.16'
36"	30.00'	.11'
48"	3.46"	.06'

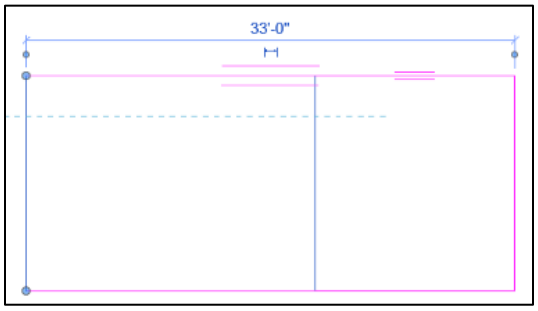


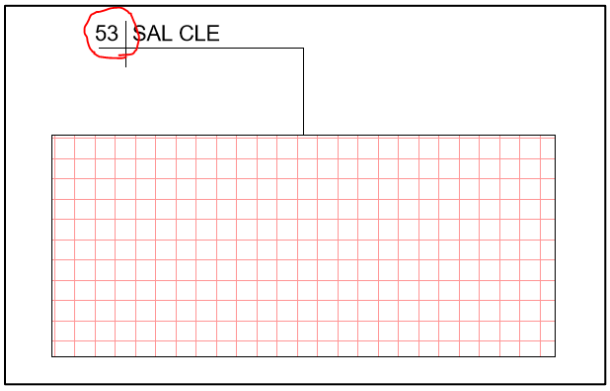

Properties
Label
standard
Floor Tags (1)
Edit Type
Graphics
Sample Text
5
Label
Edit...
Wrap between parameters...
Vertical Align
Middle
Horizontal Align
Right
Keep Readable
Visible


Label Parameters
Calculated Value
Name:
Shrub Quantity
Discipline:
Common
Type:
Area
Formula:
Area * Plants per SQFT
...
OK
Cancel
Help


22
SAL CLE

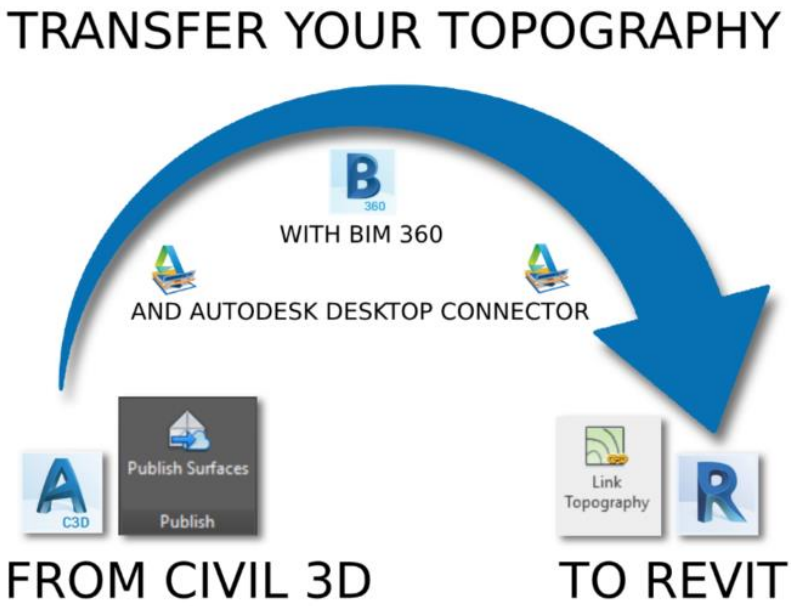

Properties
Floor
Alpine Cleveland Sage (SAL CLE)
Floors (1)
Edit Type
Constraints
Level
Level 1
Height Offset From Level
0' 0"
Room Bounding
Related to Mass
Structural
Dimensions
Slope
Perimeter
95' 0"
Area
478.50 SF
Volume
957.00 CF
Elevation at Top
0' 0"
Elevation at Bottom
-2' 0"
Thickness
2' 0"
Analytical Model
_RATING_CODE
Identity Data
Image
Comments
Mark
Workset
Content_Landscape
Edited by
joseph.bertucci@stantec....
Phasing
Phase Created
New Construction
Properties help
Apply
Type Properties
Family:
System Family: Floor
Load...
Type:
Alpine Cleveland Sage (SAL CLE)
Duplicate...
Rename...
Type Parameters
Parameter
Value
Construction
Graphics
Text
Materials and Finishes
Analytical Properties
Identity Data
Analysis Results
Visibility
Other
Plants per SQFT
0.110000
<< Preview
OK
Cancel
Apply


33'-0"


53 SAL CLE

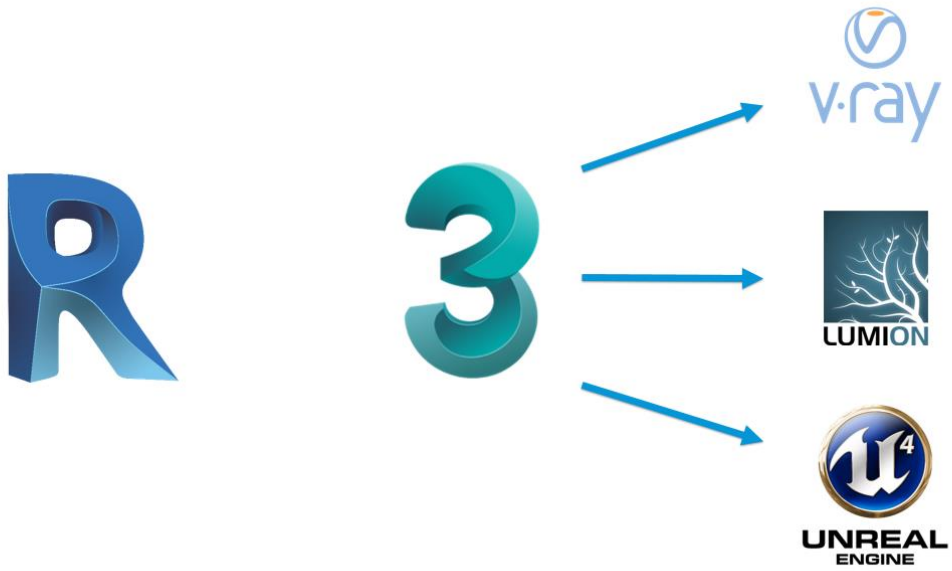
Civil with Revit

Since Civil 3D 2019 and Revit 2019, you are now able to link directly to topography. With the use of desktop connector and BIM360 Document Management, Civil engineers can now publish their surfaces for then the Landscape Architects / Architects to then link directly to and update their topography.



Design, Enhance, Present

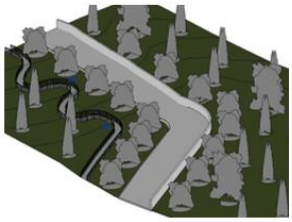
The final product is always something we think about. But usually what happens is that our process becomes linear in design and we essentially follow a “hand-off” procedure which becomes a bottleneck is at the end when we are trying to produce illustrative renderings or animations. Instead we need to have a more integrated approach that doesn’t break the link between multiple platforms. We developed what we call “Design, Enhance, Present”. We refer to this as the parallel path in design. What that means is that, our design model and illustrative product are developing side by side over the course of the product. We do this by determining the initial authoring tool which we are designing in. We then export this to where we are enhancing the model in materials and geometry. Lastly, we bring this into the tool that we will be presenting in which puts the final touches on design. Our workflow for example is Revit -> 3DS Max -> Lumion. But this is not limited to these programs as for example, your output may be different regarding your final product.



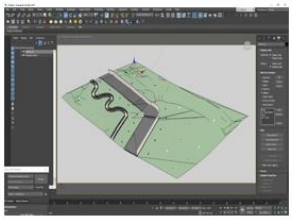
As an example of this workflow would be how we handle our trees. When we develop our tree families in Revit, we “nest” another family within in that represents the tree base or root ball. We make sure though that this nested family is not categorized as “planting”. We typically categorize this as “site”. The base/root ball has a material type parameter associated with it. The material we give is an indicator of the tree type. We then load this family into Revit and place our trees around the site. Since our site will contain multiple tree types, we set up a viewing dedicated to each tree type and filter out the other information. We export each view as its own FBX file. We then import this FBX files into 3DS Max and group by material. Since planting families are not recognized in 3DS Max, they come in as “dummy objects”. However, because we nested the base/root ball and categorized it separately than planting, 3DS Max can recognize that object and the material associated with it. We then export this information out as an FBX from 3DS Max and import into Lumion. Lumion has a feature called “place item on nodes” In this case, our nodes are the bases/root balls, and because we have indicated the tree type by its material, it is easy for us to select a tree similar from Lumion’s library that aligns with that type. The result is that each “node” then has that tree type placed on top of it. This is beneficial because normally when we get to this step-in design, we have to manually replace every tree we would’ve already placed in Revit. By taking this approach, we can reduce duplicate work and know that our visualizations are developed the way the Landscape Architects intended for them to look.

Workflow Example

Plant families – Nested root ball family (categorized as site) with a material associated to the plant type



Place trees in Revit – Export each tree type as separate FBX



Link FBX (do Not Combine Entities) – Trees are "dummy" objects but root ball is recognized as geometry. Export as FBX for Lumion.

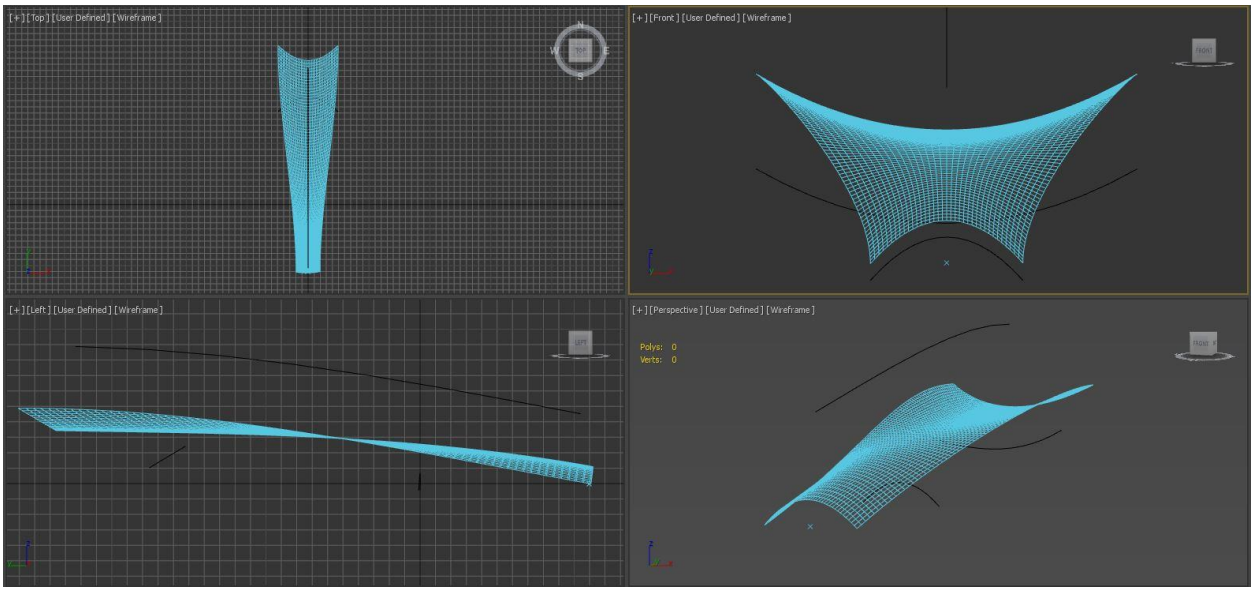
Place item on nodes in Lumion

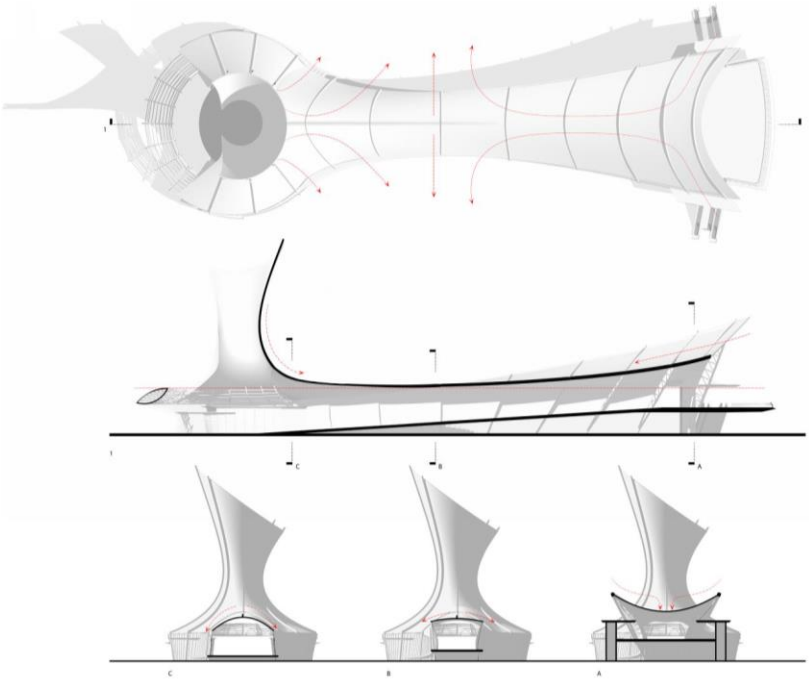
MAX-imum Effort

Form Follows Function

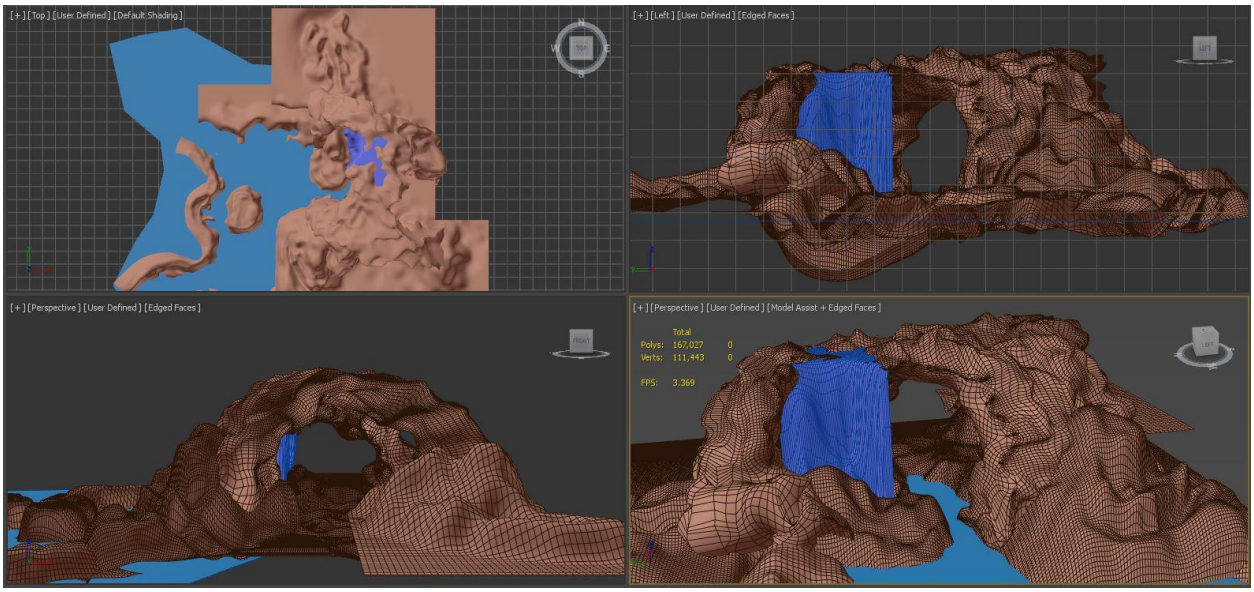
Upon first glance, 3DS max can be an intimidating interface. By getting yourself familiar though, you can discover that it is just another tool in the toolbox. 3DS Max offers us the ability to take advantage of different elements that might be too cumbersome in other programs. A few of these advantages involve parametric design options, material mapping control, and animation capabilities.

When we look at structures that are sculptural or even based on a tensile/fabric, we can utilize spline parametric modeling techniques to generate our desired result. By developing this type of content in 3DS Max during the design process, we can adjust, flex, or expand our concept until we are able to achieve the look we are going for.





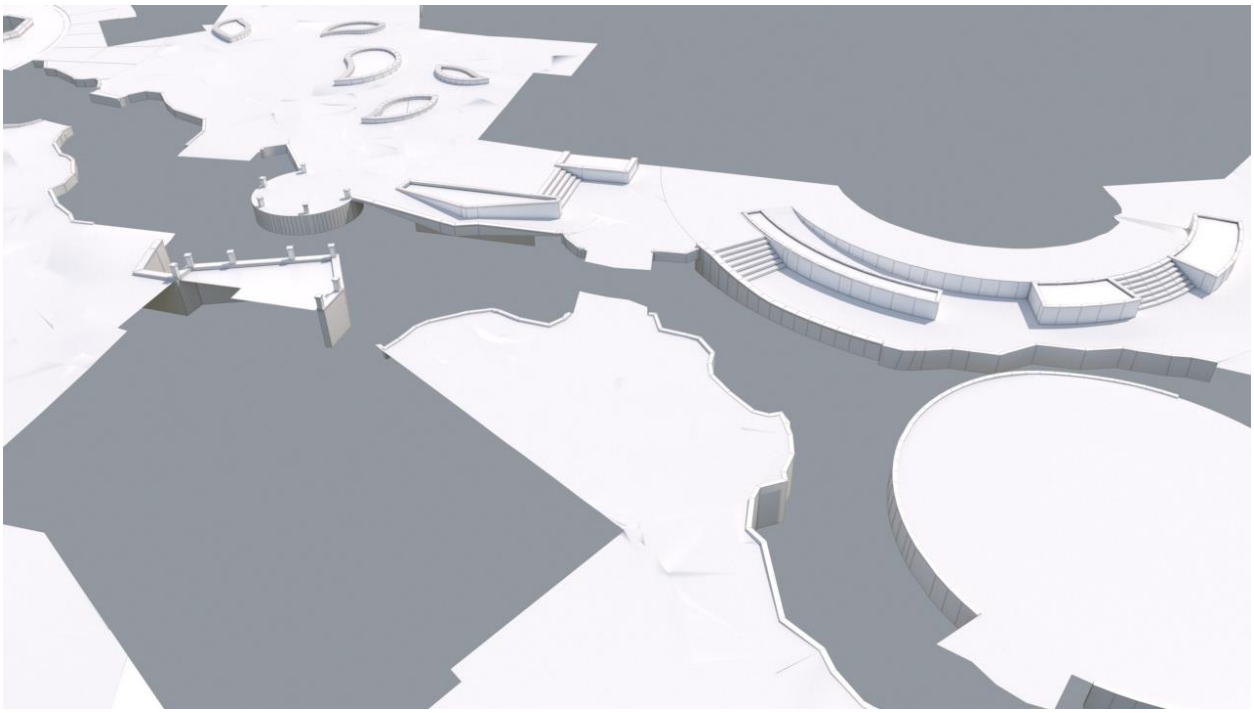
Another type of element that fits well with 3DS Max is the creation of Mountains or Rockwork. This type of modeling is amorphous and organic. With 3DS Max being a NURBS based software, we can take advantage of surface manipulation and procedural modeling to sculpt the mountainous landscape to our desired intent. By take this approach we can easily adjust the surface as needed as we develop our design and site.

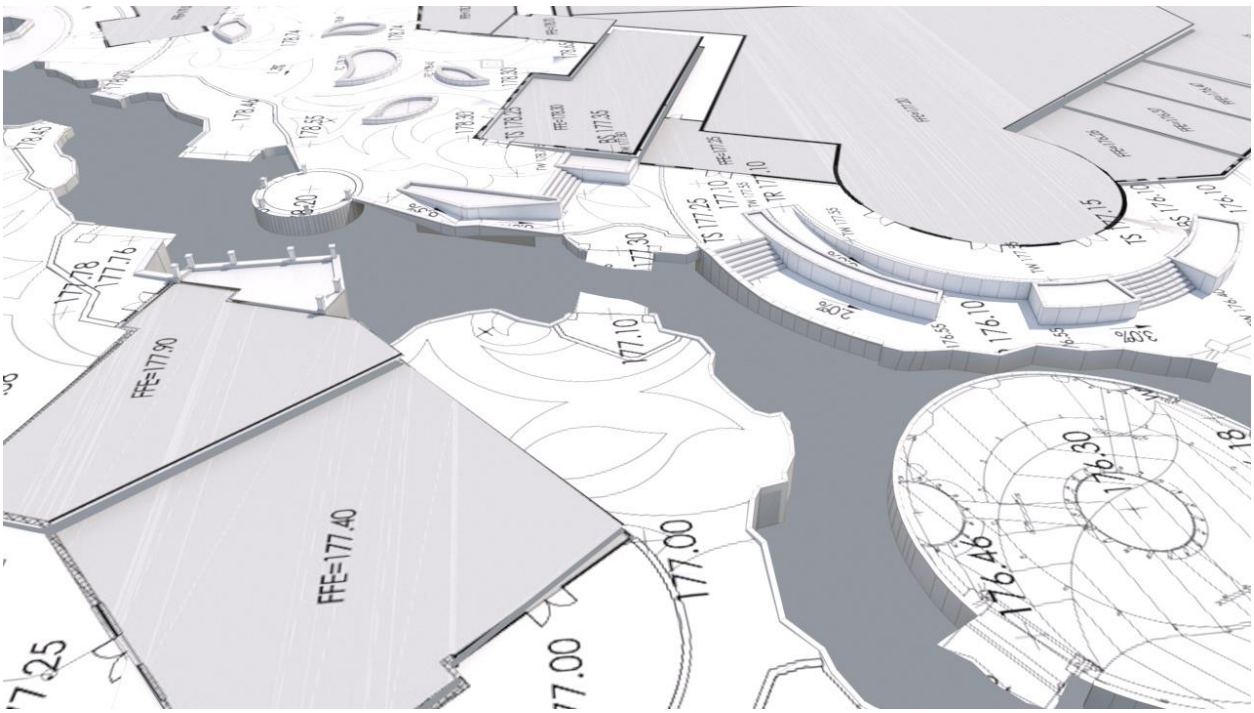


Since we work heavily in the Themed Entertainment industry, you know at some point you will come across ride/coaster design and having to develop this content in our models. Since these rides impact the site, it is important for us to have these models to design around and understand how the site interacts with these experiences. By using the No Limits software, we can extract 3D spline data which we then import into 3DS Max and run a script that places the structure and tracks accordingly along this path. We can utilize this information for not just site related purposes but also for interactive animations and illustrative renderings.

Function adds to the Form

In landscape design, it is common to place joints on our hardscape. This is a result we can achieve in Revit but once we manipulate our surface to align with the topography, this effort becomes a bit cumbersome. For documentation purposes we determined it was enough to annotate these as linework that we can group together. When we need to produce renderings or animations however, these joints within the hardscape are ideal to illustrate our site. With the use of 3DS Max, we are able to export our models in a FBX format along with a DWG export of the linework. When we import both, we can overlay the line work on top of the hardscape. By utilizing the modifier stack in 3DS Max, we can divide the surface at these lines and create joints. In addition, we can add bevel these edges to create a more realistic look. This overlay process is the same when we have patterns within the hardscape that are to be illustrate as well.

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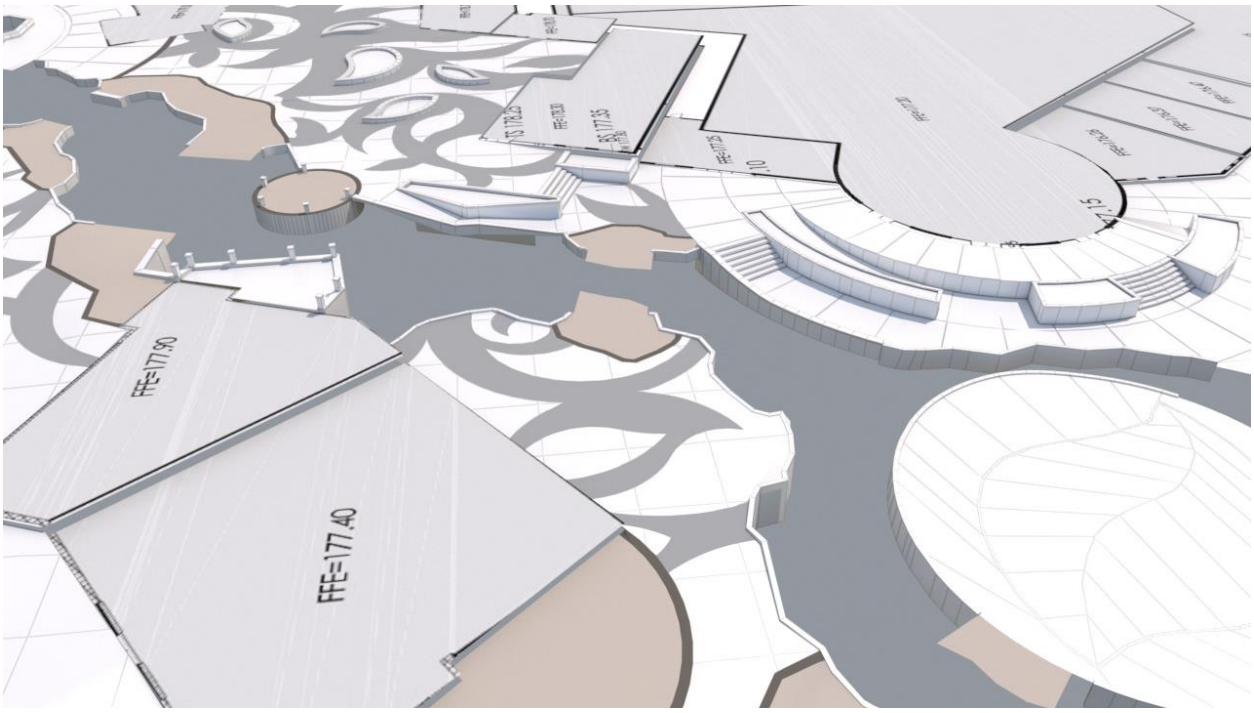
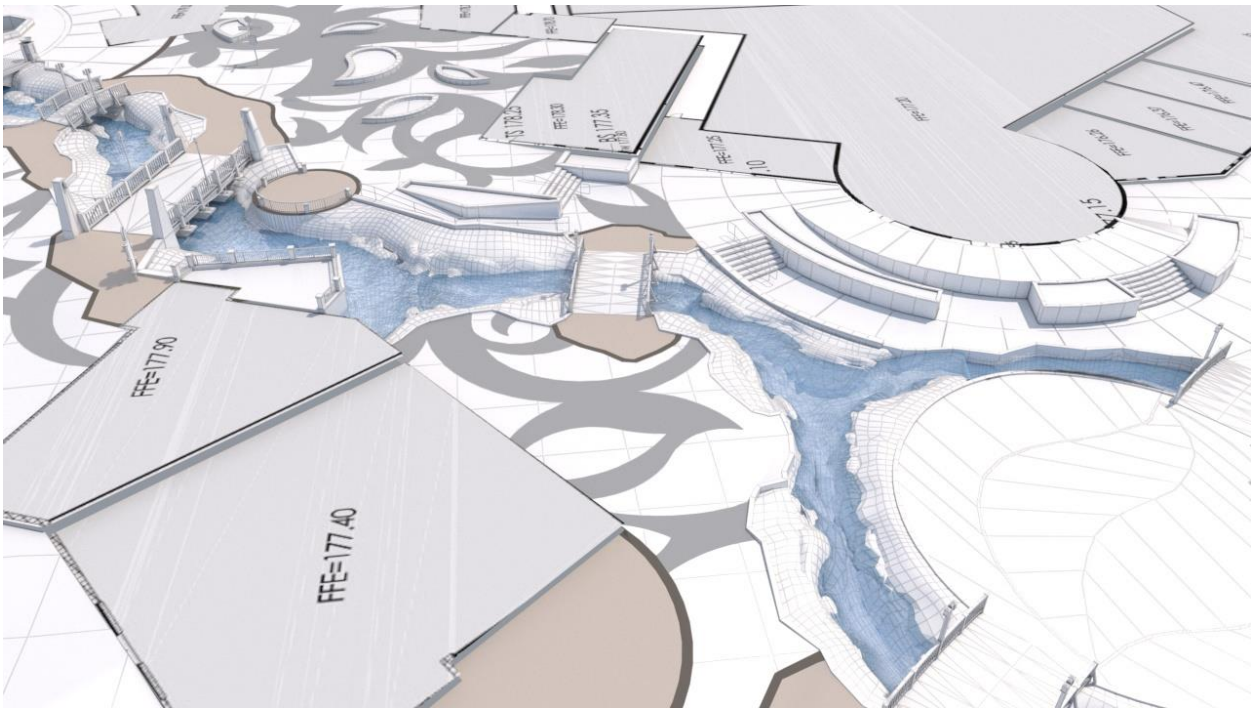
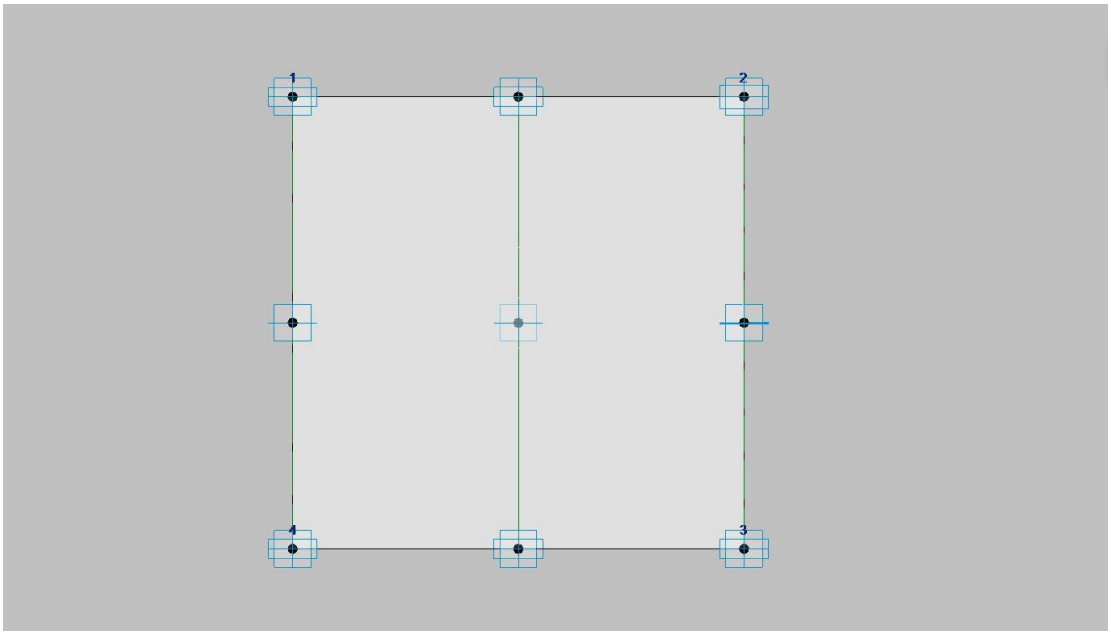


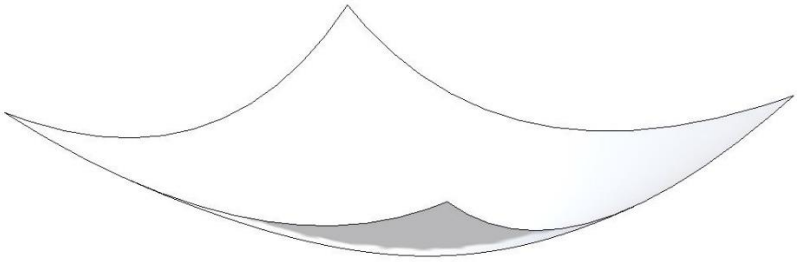
And similar to our rockwork workflow, we can manipulate the softscape to conform to the water's edge and illustrate our design intent. After these efforts are completed in 3DS Max, we can generate renderings or animations through your choice of output.



Revit Integration

As we push the limits of the tools we use, we discover adaptive and creative solutions to problems. While relying on 3DS max for tensile type structures, we learned how to create this type of model using Revit. With the use of adaptive families, we can create multiple points of insertion for a surface and create unique shapes. With additional points places on edges and along the surface, we can control the amount of “sag” we intend for our fabric the drape.





References

http://au.autodesk.com/au-online/classes-on-demand/class-catalog/2016/revit/ar20475#chapter=0

http://au.autodesk.com/au-online/classes-on-demand/class-catalog/classes/year-2017/autocad-civil-3d/lo-aec30#chapter=0

http://www.infrastructure-reimagined.com/four-ways-latest-civil-3d-2019-features-will-improve-efficiency/

http://au.autodesk.com/au-online/classes-on-demand/class-catalog/2016/3ds-max/dv21762#chapter=0

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