Creation and Grading of New Toposolid Entities

Revit 2024

Guide by: Dennis Collin

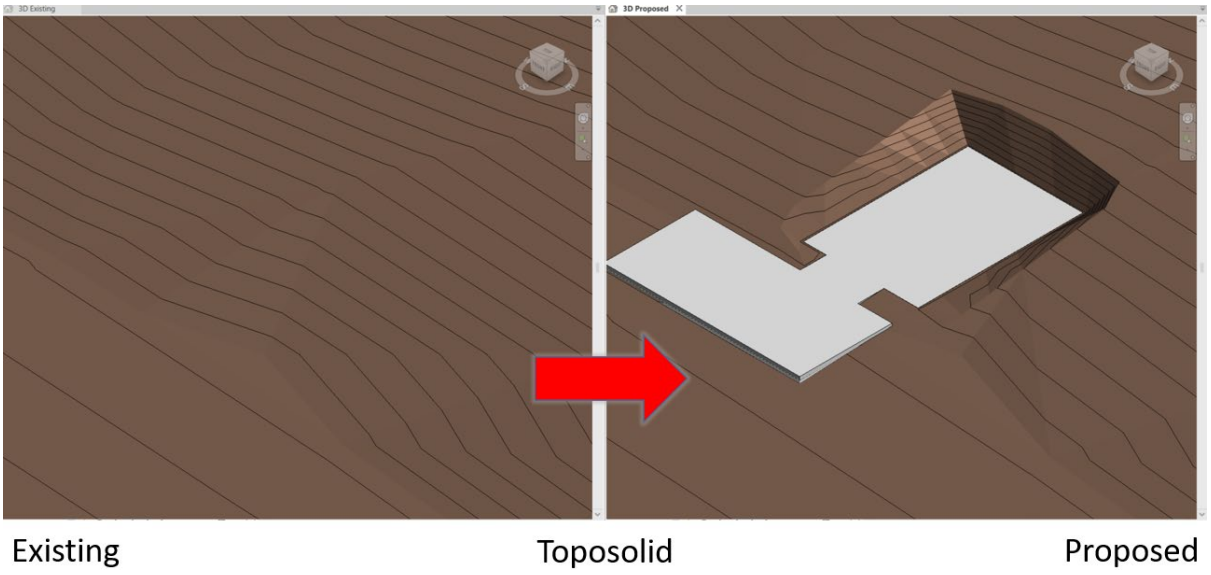


Fig 1. An existing surface (left) and a proposed design with surface grading applied around a slab component (right).

This Whitepaper discusses the process of grading Revit 2024's new Toposolid objects. If working with Revit version 2023 or earlier refer to a document here which refers to legacy Toposurfaces and Building pads. The concept is similar but has a few different steps.

The previous process using Toposurfaces can be found here:

https://www.cadlinecommunity.co.uk/hc/en-us/articles/4410436961553-Using-Revit-s-Graded-Region-Function

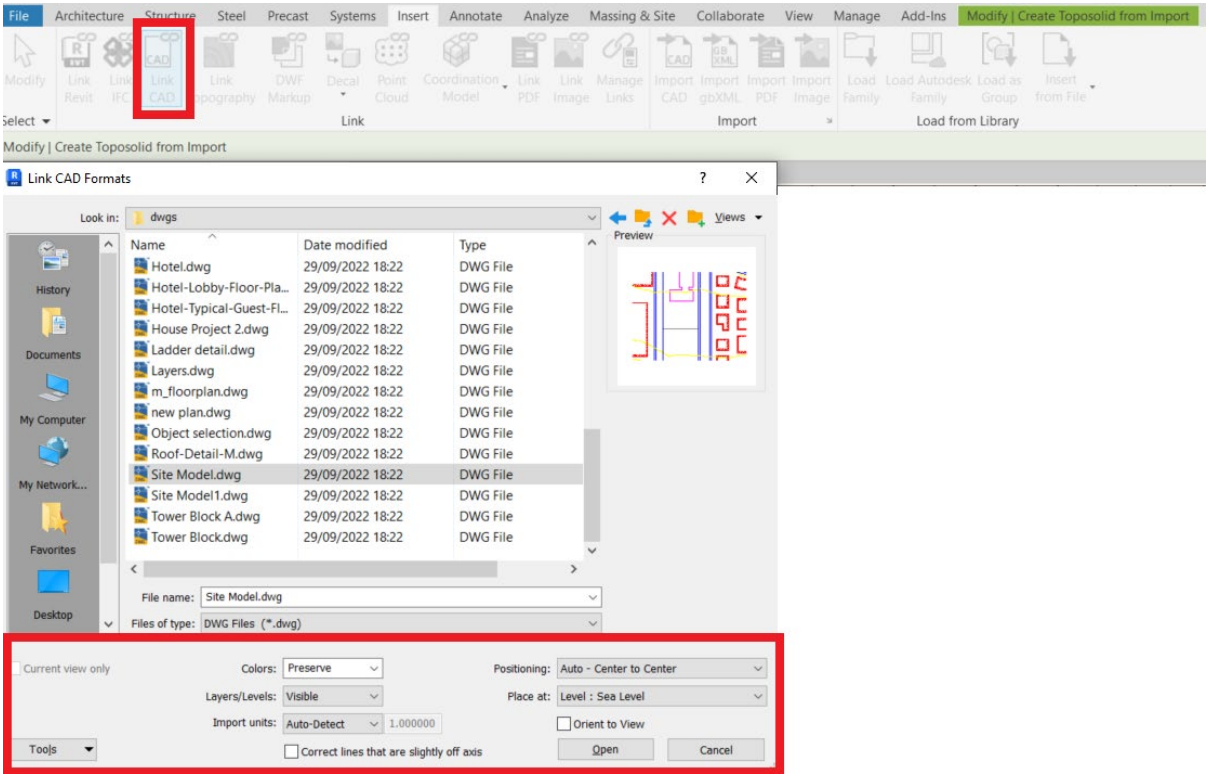
Revit's site tools enable users to create topographic solids via a variety of different means, from creating points individually using a CAD drawing reference or CSV based survey point data. This surface is frequently the existing solid that needs to be developed and forms the basis of the proposed or design solid. Rather than modelling these solids in different files, they can be modelled in the same project and

graded region tools are used to adjust the model and show the different stages via Phase and Phase Filter settings. However the solid is created, the grading and phasing process is the same. This paper will use the CAD import technique which has been within Revit for many years. If using newer versions of Revit, other methods of defining a surface will be possible including bringing in a Civil 3D surface from the Autodesk Construction Cloud. The process below covers the former.

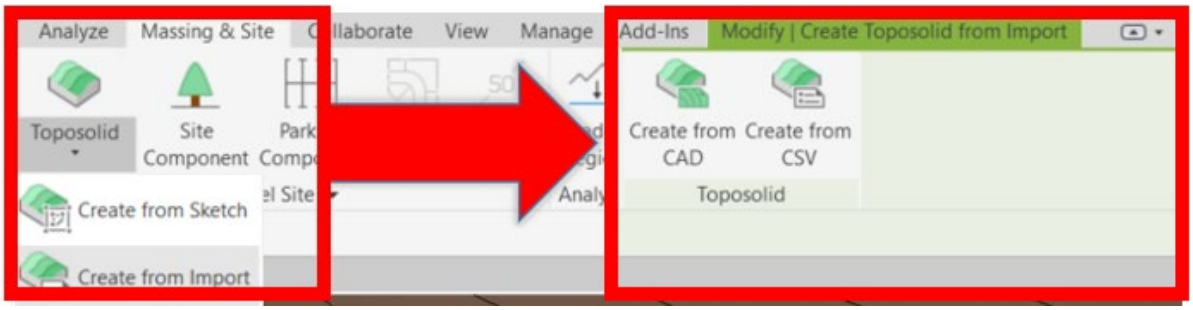
Within the project a CAD drawing is linked into the project.

Typical settings:

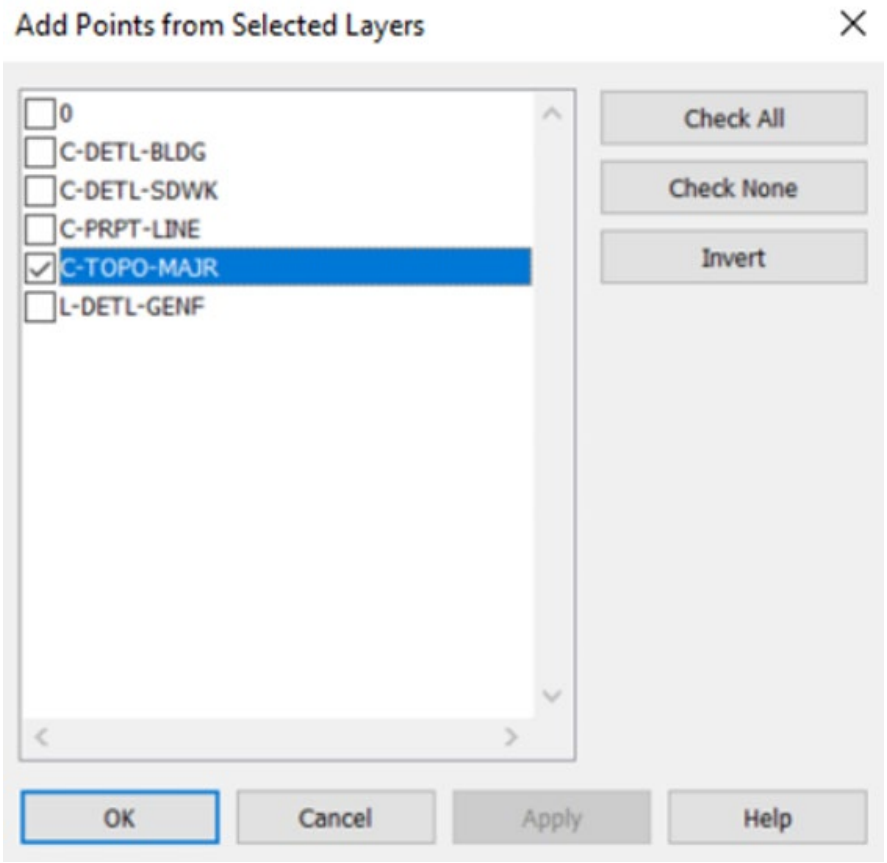
- Current View only (Unselected)
- Colours – Preserve
- Layers – Visible Only
- Units – Auto-select
- Correct off axis lines – (Unselected)
- Positioning – Auto – Centre to Centre



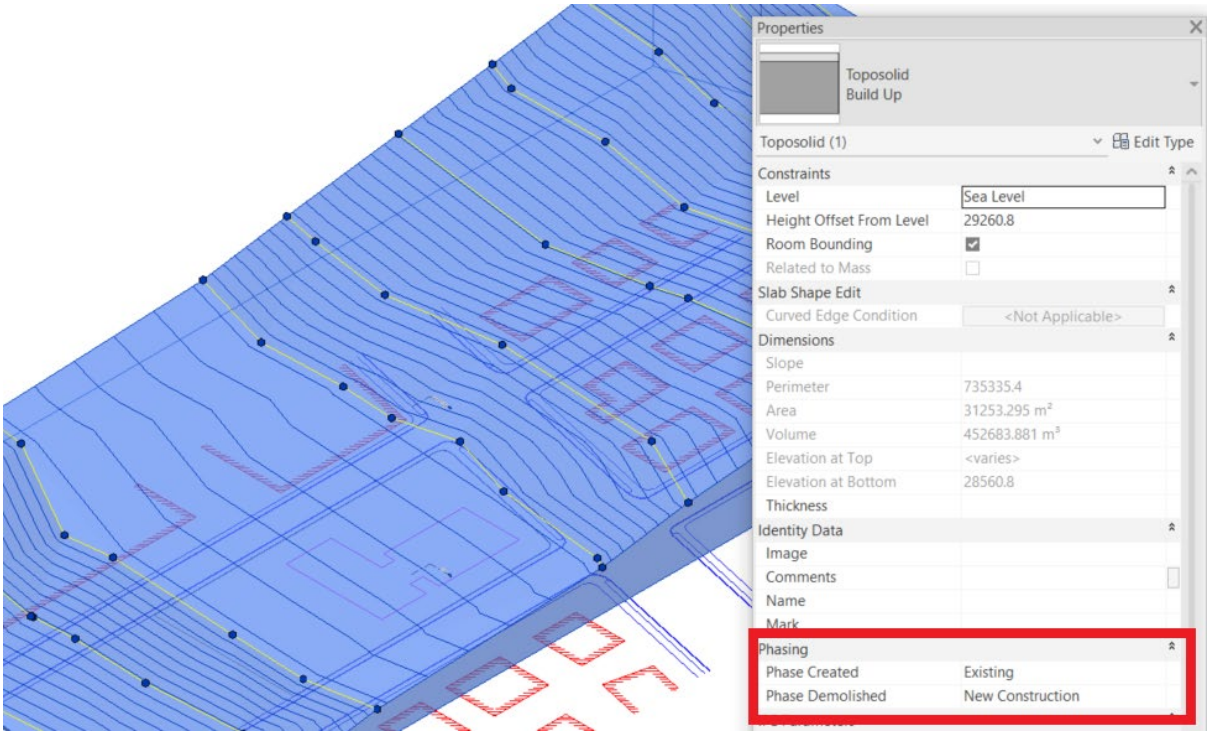
Once imported, go to the Massing and Site tab and choose Toposolid (formerly Toposurface), Create from Import. then choose Create from CAD (file) click on the linked CAD file.



Once selected a dialogue box will appear asking what CAD Layers/Levels will participate in the creation of the surface. This will typically be layers containing 3D information such as contour lines. Click OK when complete.

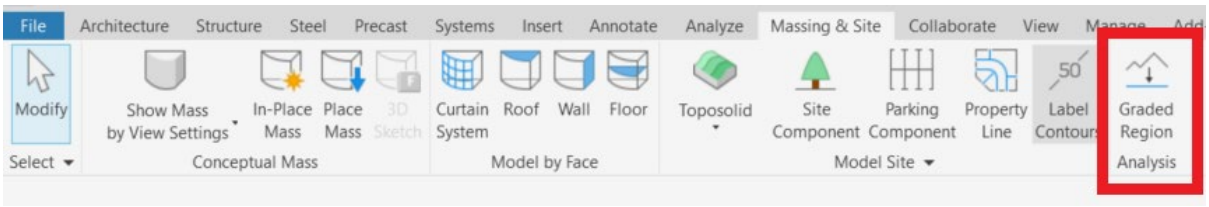


A solid landform should now be created. As this is the original surveyed form, modify its phase created property to ‘existing’. This is a setting in the element properties dialogue.

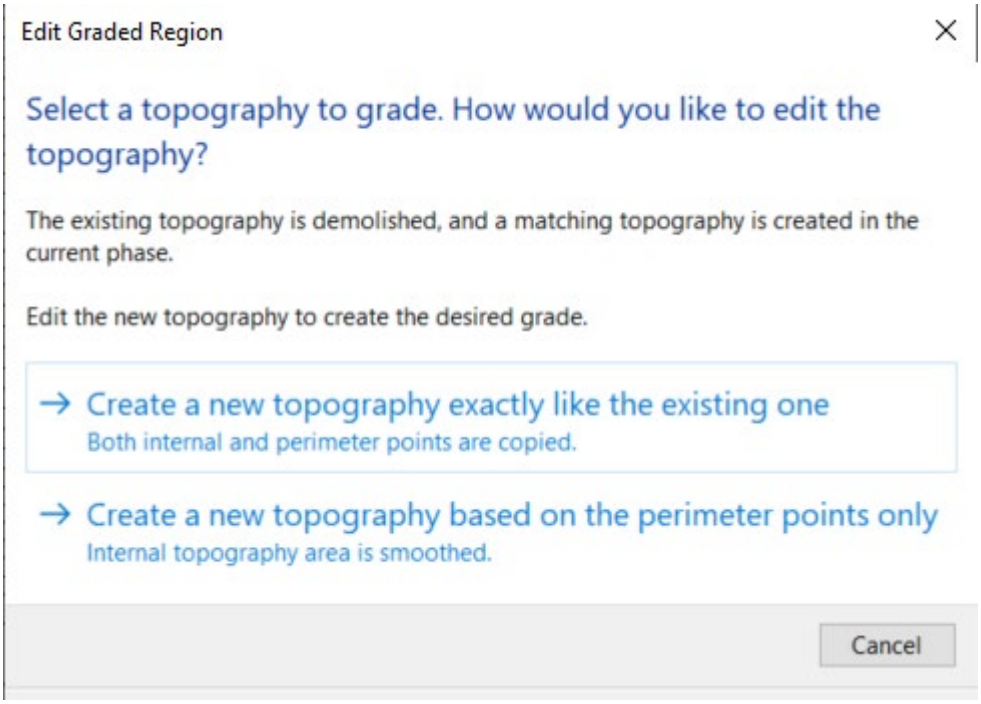


Once complete, switch to a ‘new construction’ site view. The existing surface should appear grey due to the phase filter applied to that view. Locate the Graded Surface tool to modify the existing site and create a flattened area to add a suitable slab entity.

The marked area needs to be flattened. Note the contours crossing over the area to be a foundation or floor slab. The solid can be graded to create a flat area to build upon and can be scheduled to see how much material needs to be removed or added to site. This information will be calculated and accessed via Cut and Fill parameters.



Revit’s site tools lack such features like break lines so to control the shape of the toposolid, additional spot heights need to be added to define the bottom and top edges of banking. This will be achieved with the grading tool. Clicking the existing solid to grade will display the following message:



Choose the first option ‘exactly like the existing one’. This will ensure better surface modelling accuracy. Use the perimeter points option only on simple flat solids. This will create a new surface which can be adjusted to suit design intent. Most situations will usually require the former option.

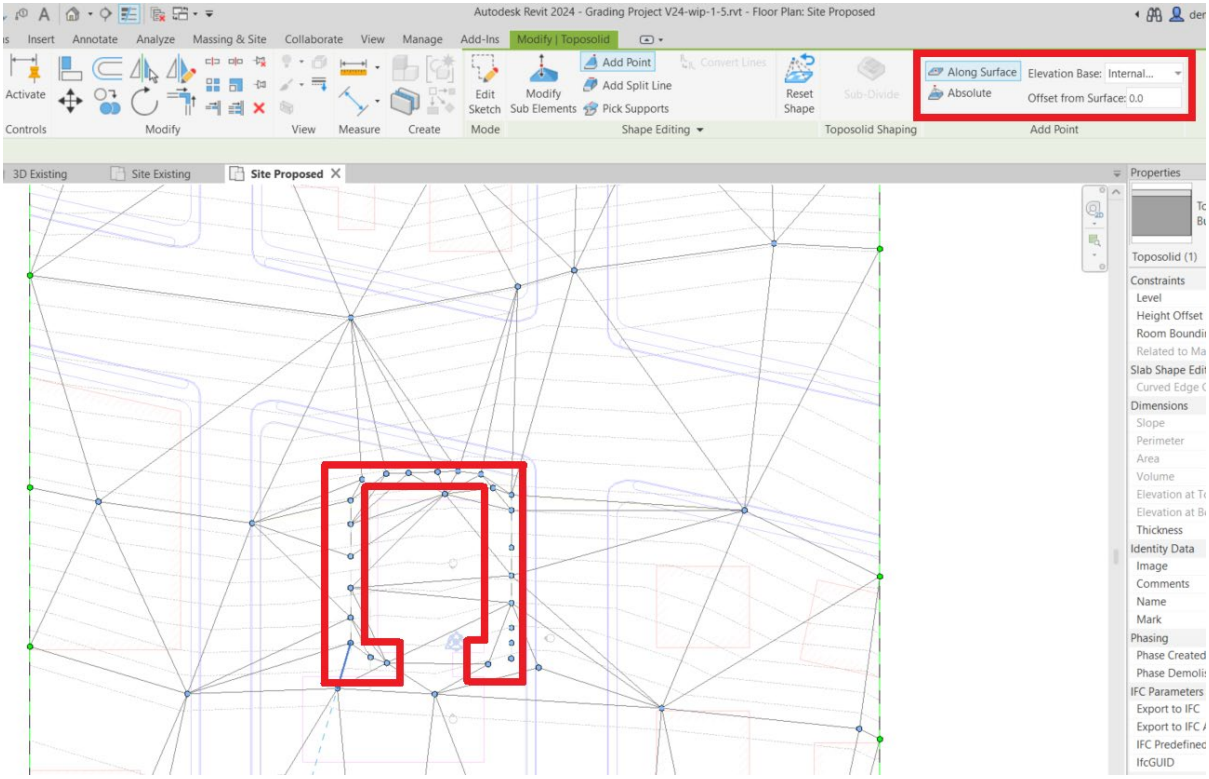


Fig 2. Creating ‘top of bank’ spot heights relative to surface.

Click on the solid to grade and place points that will be the top of a new bank feature. Point elevations to be set at zero offset, relative to existing face of the toposolid.

Once the top of the bank has been established, create some additional points at a suitable explicit elevation to represent the level of the proposed groundwork/building pad. To determine what height these points should be, place a section view through the site and create or adjust a level line element to establish a suitable height to build from. The Level line should display a height value that will be used to determine a ‘Z’ value for the bottom of bank points.

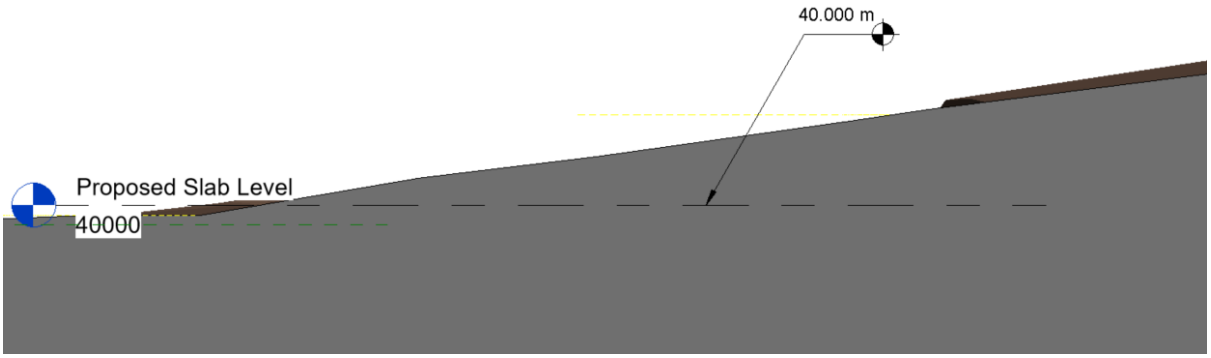


Fig 3. Determining the level for the building slab.

As these points are created the geometry of the toposolid will adjust to the updated topography arrangement.

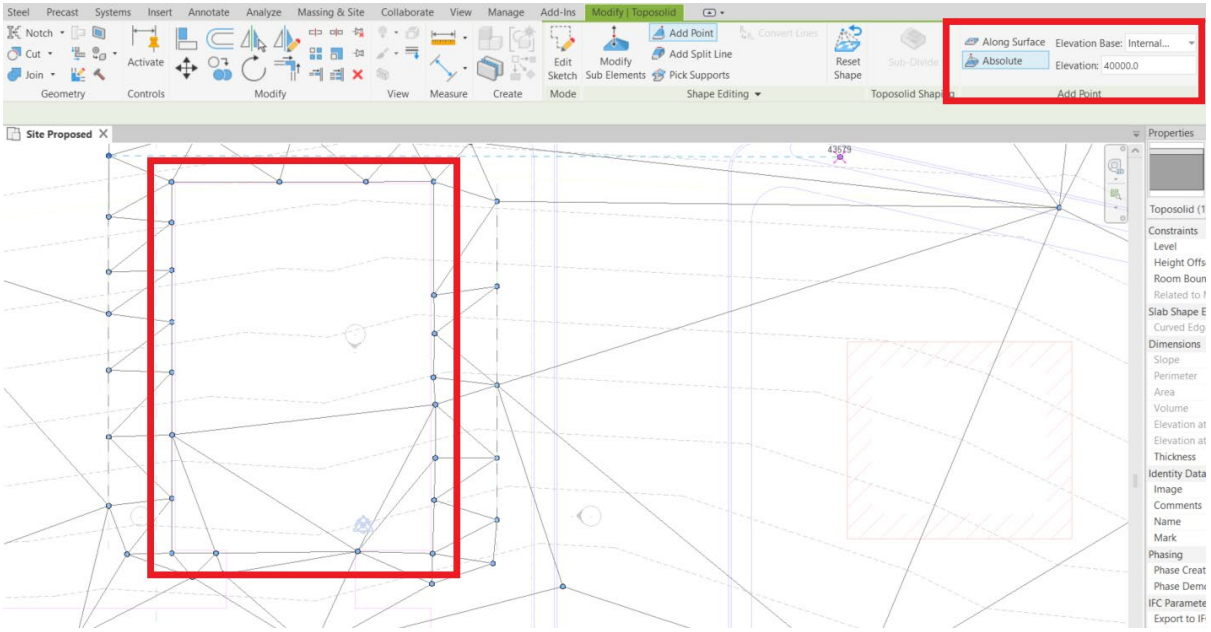
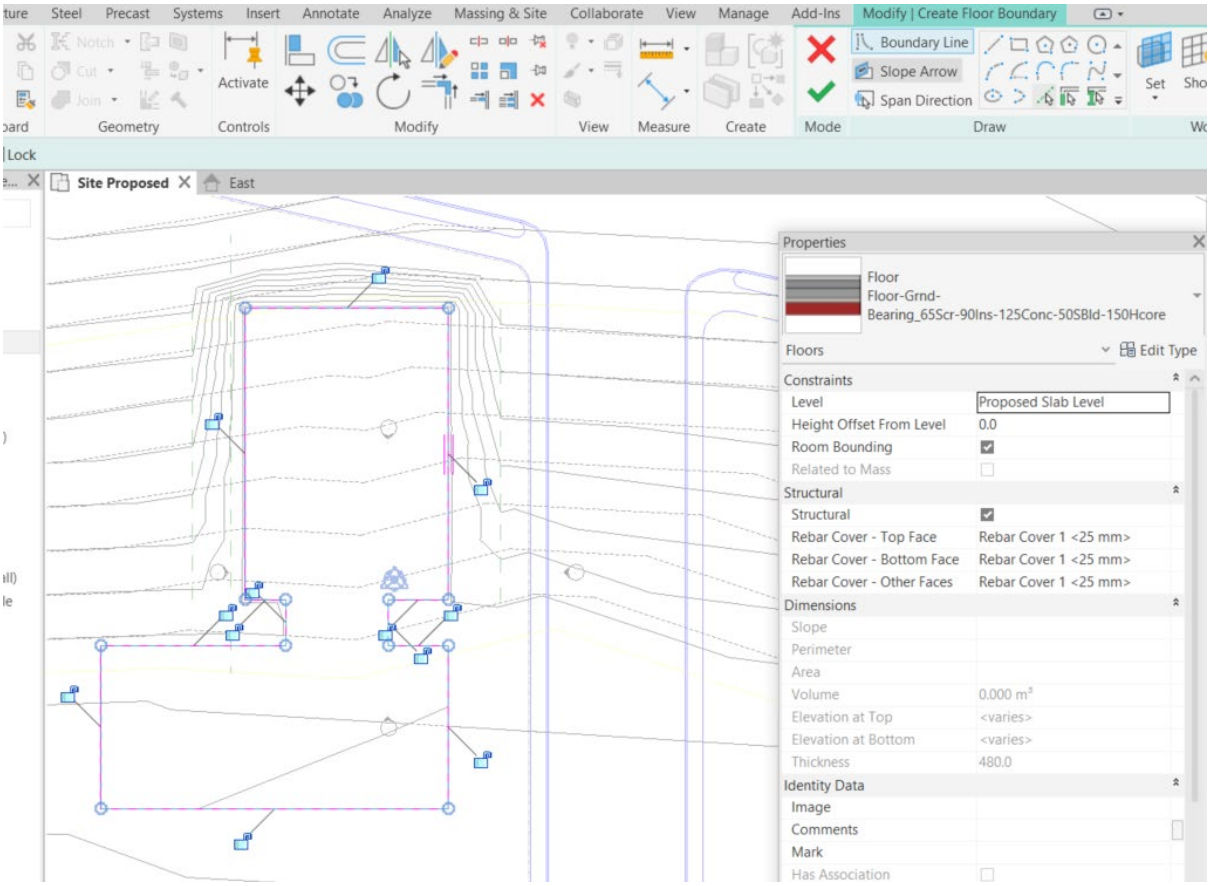


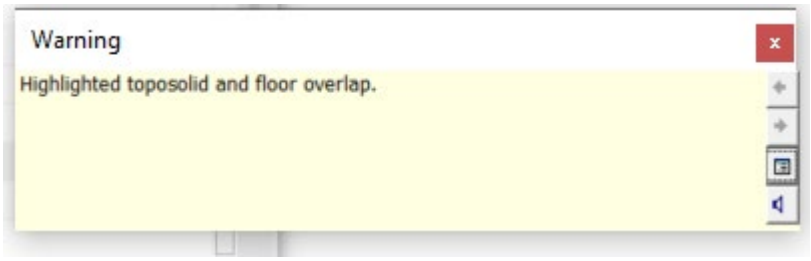
Fig 4. Creating ‘bottom of bank’ spot heights at an explicit elevation.

Once complete click Finish.

If required, a foundation or floor slab can be added which will serve as a basis for any building. Use Mass voids and the cut tool if an underground structure is required e.g. car park or basement or tunnel. The slab entity can be set to suit the proposed slab level, but the properties can always be altered later as required.



NB. Revit will report that the slab and toposolid overlap. To ensure clean section display and accurate reporting, the slab will need to be cut from or joined with the toposolid. If using the Join tool, select the toposolid FIRST, then the slab to ensure accurate reporting of cut and fill volumes.



Should there be a need to fill ground to accommodate a slab and other features model a Massing Solid Form. Adjust to suit. This can also be joined to the toposolid which will adjust the cut and fill amounts accordingly.

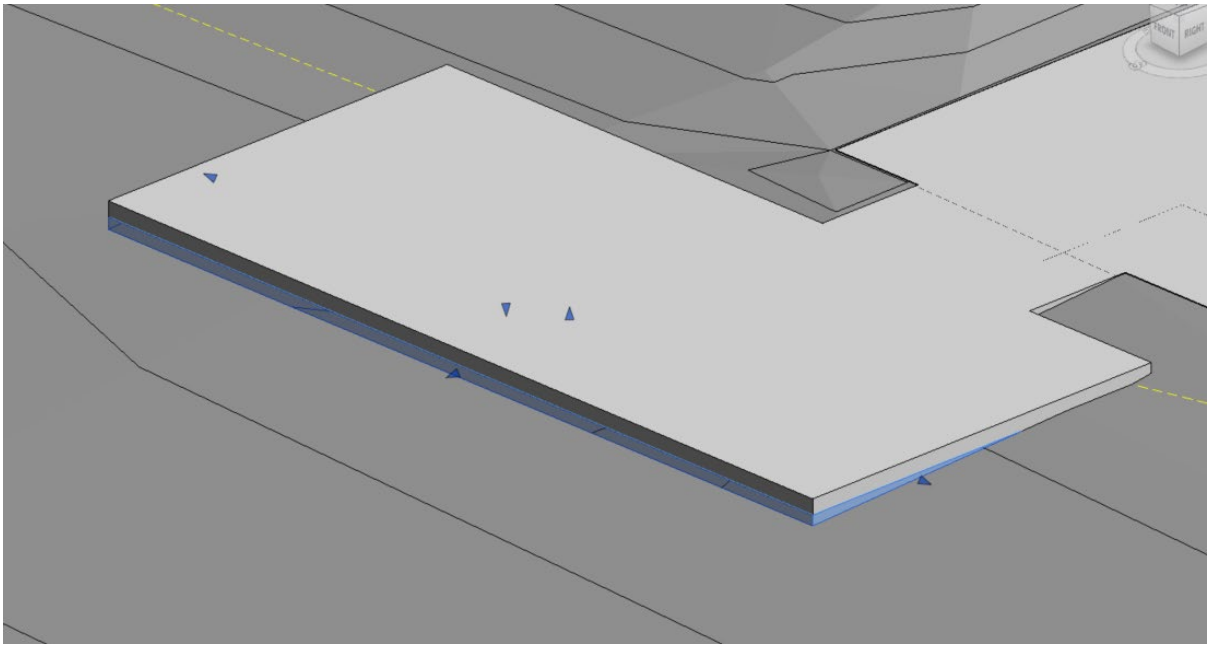


Fig 5. Use Mass elements or modify the proposed toposolid to show the amount to fill.

To see the existing and proposed toposolids, duplicate the view and name them to Existing and Proposed Site, or similar. Ensure that the Views properties are set as follows:

For Existing Site

- Phase: Existing
- Phase Filter: Show New

For Proposed Site

- Phase: New Construction (or similar)
- Phase: Show Complete

Lining the two plans alongside should show how the grading will affect the proposed site plan.

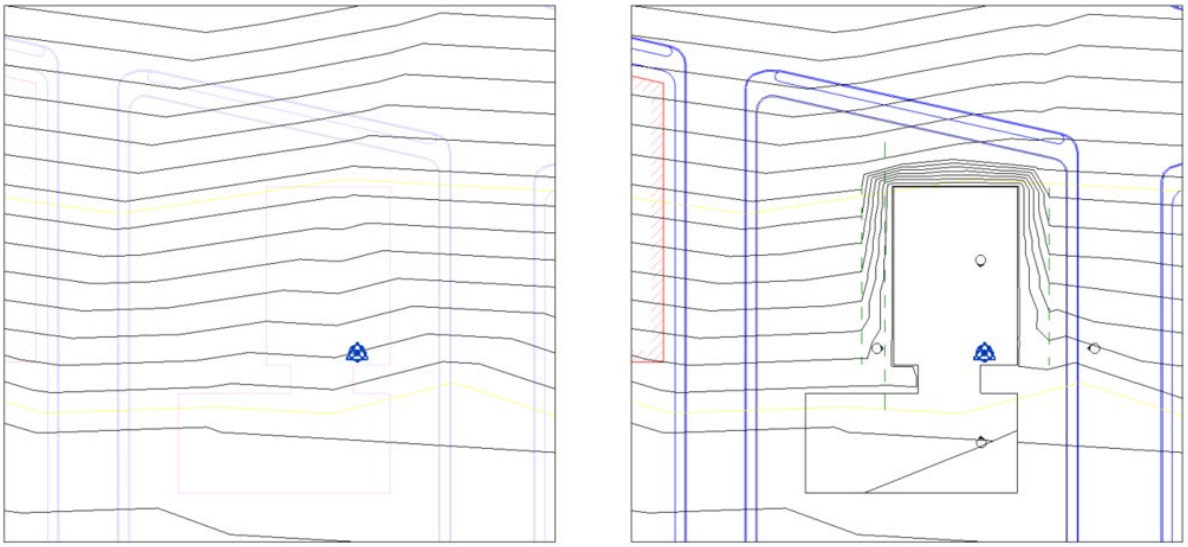


Fig 6. The Original Site plan, along with the original CAD survey and the proposed graded site with modified contours.

The change in volume can be seen in the Toposolid schedule with a negative total of cut/fill indicating the amount of material to be removed or distributed elsewhere on site. Using filters can change values that are displayed and totalled.

<Toposolid Schedule>

A	B	C	D
Name	Phase Created	Net cut/fill	Volume
Existing Survey	Existing	0.00 m³	449591.91 m³
Proposed Site	New Construction	-797.04 m³	448794.85 m³
Grand total: 2		-797.04 m³	