Topic #2: How to Import Lidar into ORD Using P3D to Filter the Point Cloud

Reason for Revision

Recent releases of some browsers (e.g. Chrome, Edge) are blocking FTP access to all KyGeoNet downloadable data resources. It is likely that all browsers will block FTP access in the future.

About this Write Up

We will be outlining a workflow to aid in developing your existing terrain model. This workflow is an alternate workflow using Carlson Precision 3D to trim and clip the point cloud for a more manageable tile.

Version

This workflow was written for OpenRoads Designer version 10.08.00.88 and Carlson Precision 3D 2019 [Build: 61707]. The workflows and directions may respond differently in other versions of the Programs.

Contact Information

This workflow was written by Patrick Stone; please send all questions, errors or overall complaints to KYTCCaddSupport@ky.gov or call 502-564-3280.

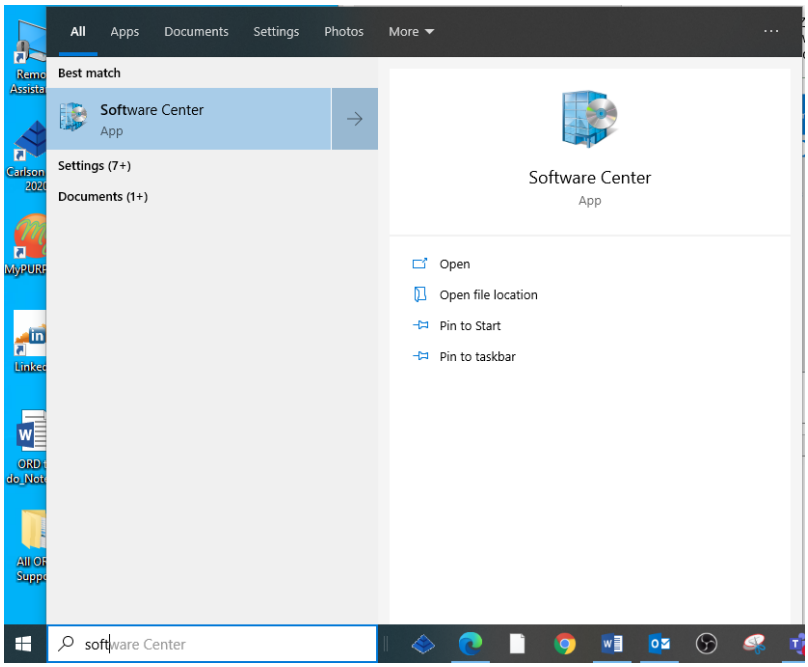
Getting Started: Where to Get Point Clouds

Here are workarounds that should allow access to the KYGeoNet downloadable data resources:

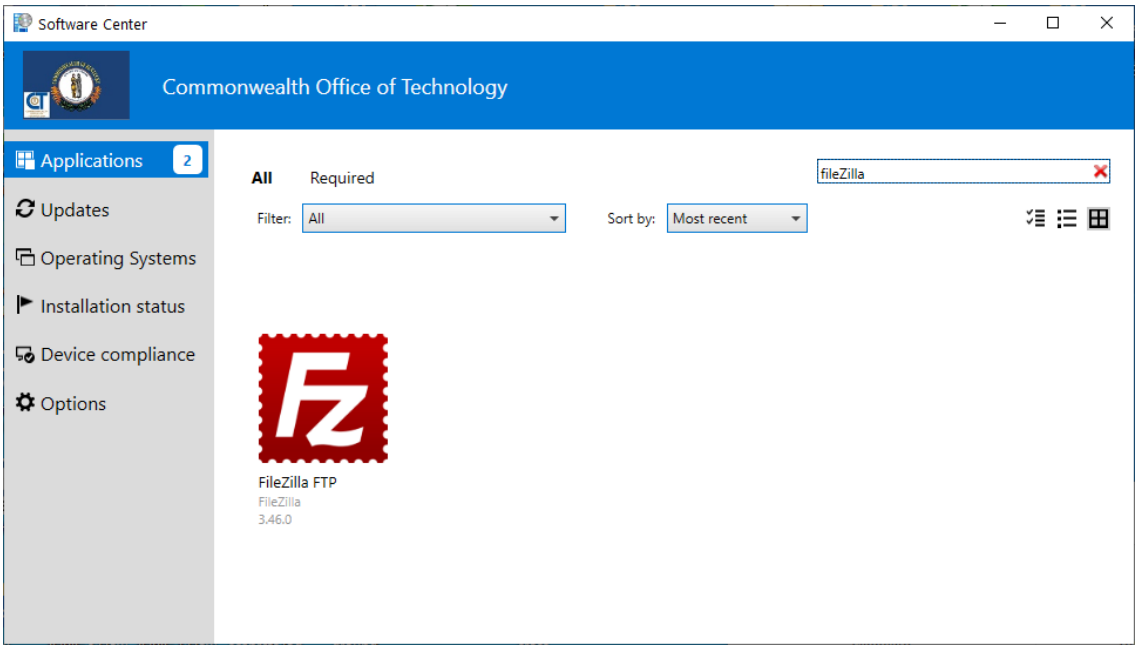
1. Use an ftp client to access the files. There are free ftp clients including FileZilla, Cyberduck, and Classic FTP. Links for the free ftp clients are listed below.

Links to Free FTP Clients

a. FileZilla - https://filezilla-project.org/download.php state employees should use the software center to avoid any installation issues to load FileZilla. The software center can be accessed by using the windows search command as shown below.



With the software Center up and running you may type in the Search field FileZilla.



Double click on the Icon and the program will load a reboot may be required.

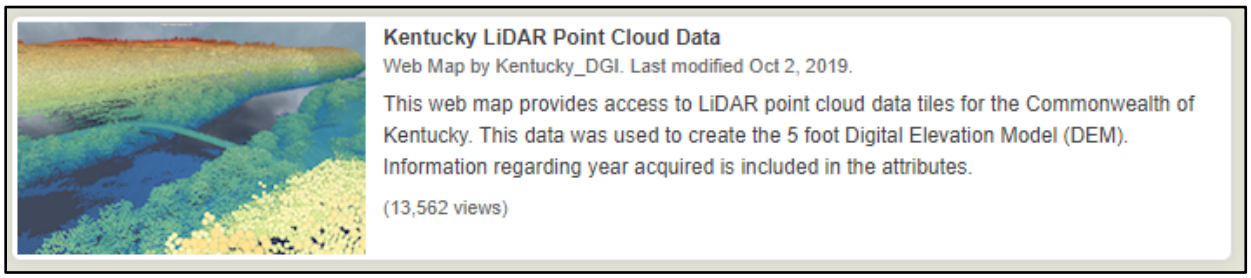
b. Cyberduck - https://cyberduck.io/download/

c. Classic FTP - https://www.nchsoftware.com/classic/download-now.html

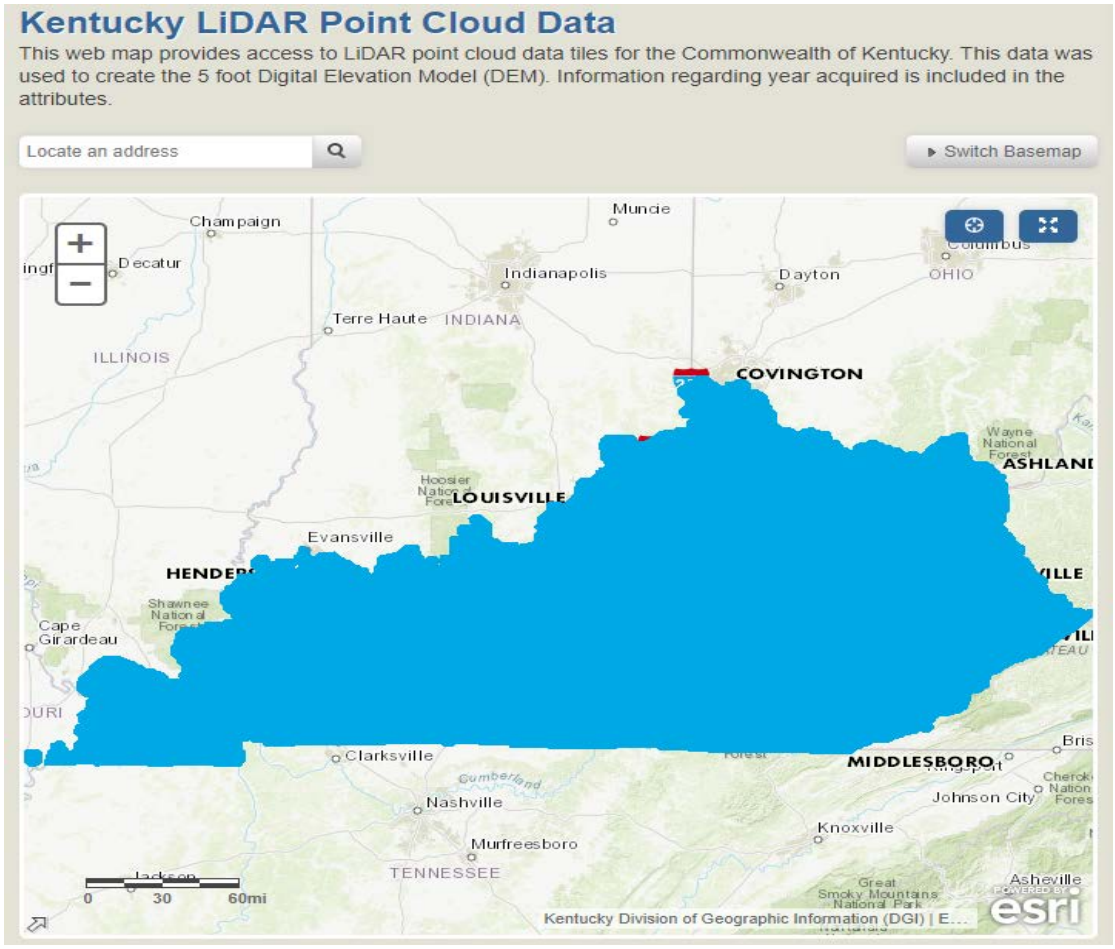
Consultants may use any FTP client they like.

Navigating to the FTP Site

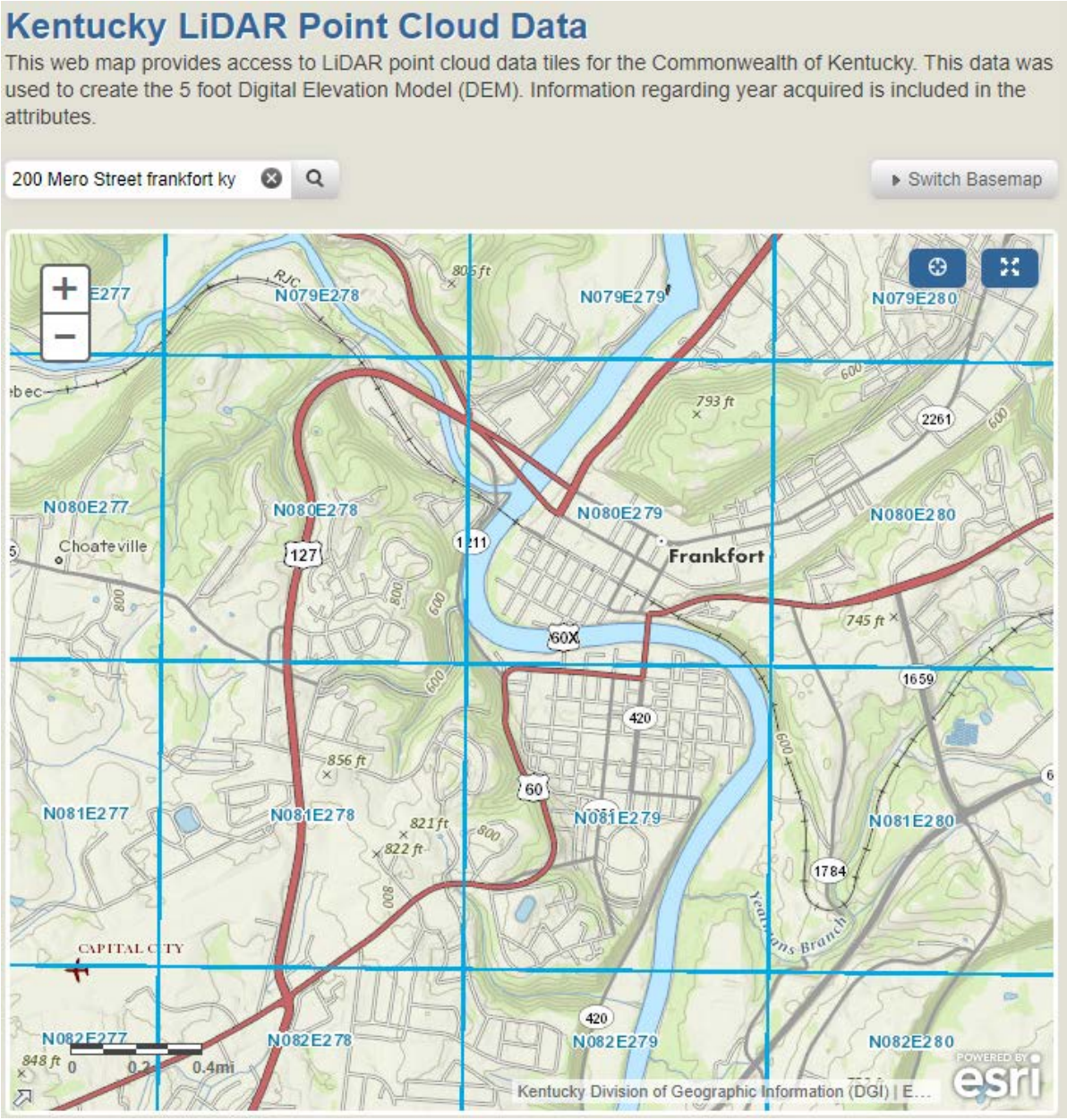
Go to: https://kygeonet.ky.gov/govmaps/KyFromAboveGallery/ and click on “Kentucky LiDAR Point Cloud Data”.



You should now see an image similar to the one below.



Navigate to your area and find the square(s) that you need for your project. You can do this by entering an address or you can simply zoom in and find your desired Tile.



Click on the Square and get your tile name or write it down, Copy to clipboard however you prefer. For this example we will be using tile `N080E279`.

Using the FTP Client FileZilla

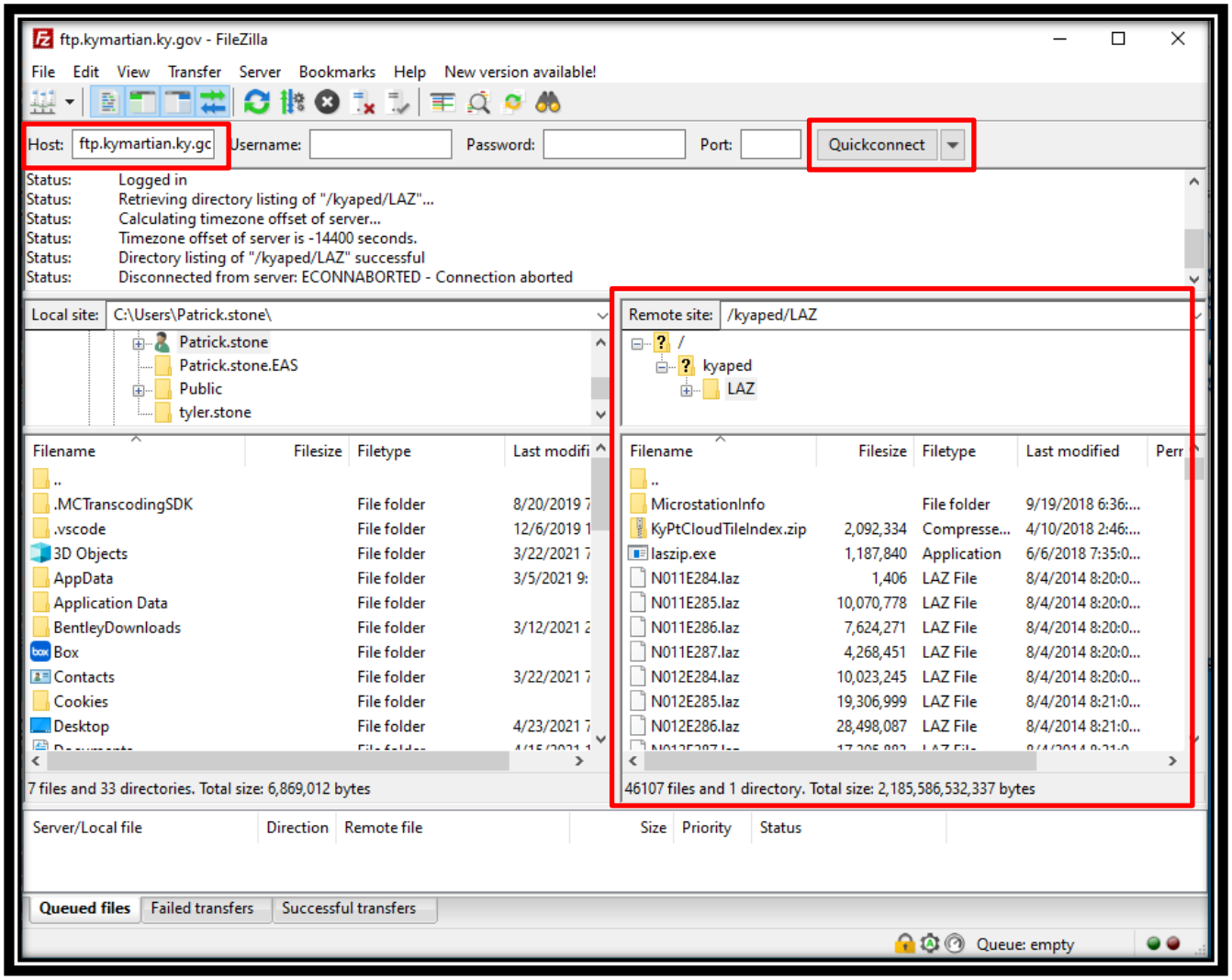
Open FileZilla or the FTP client you installed. For this example we will be using FileZilla.

Copy the link below and copy it into the Host this is the address of the server.

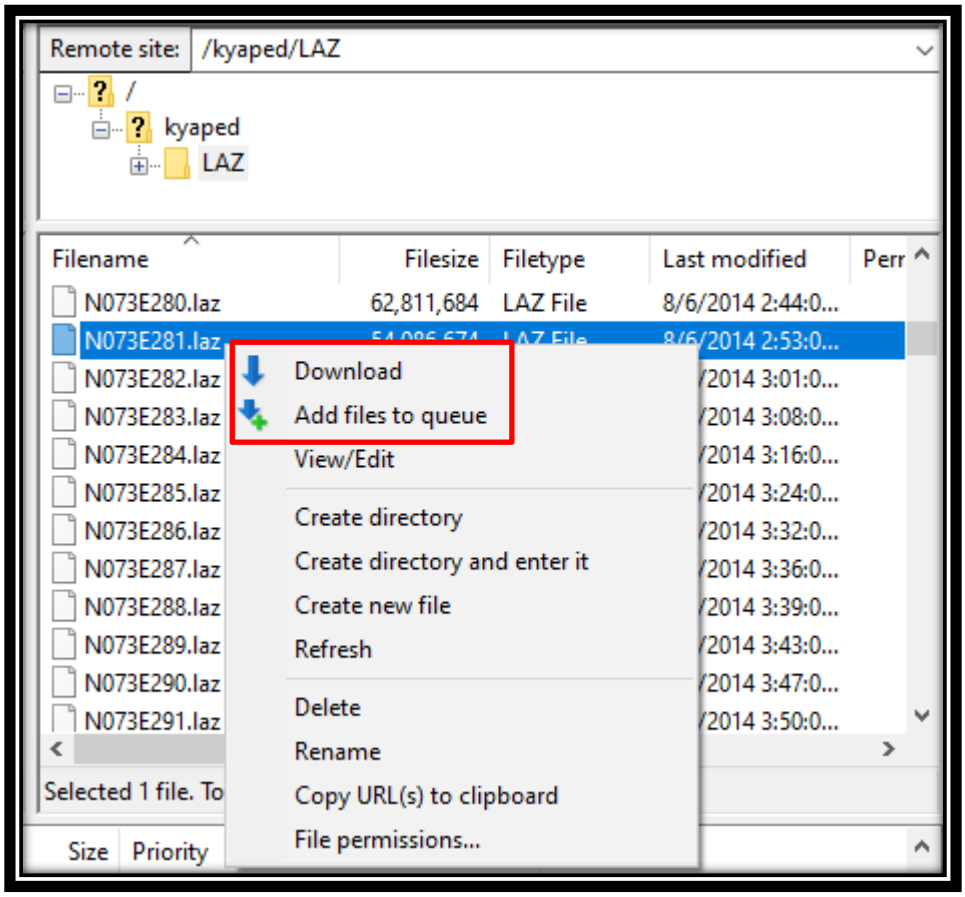
ftp://ftp.kymartian.ky.gov/kyaped/LAZ/

After the above link has been pasted or typed into the Host block select the Quick connect button.

You should now see the LAZ files.

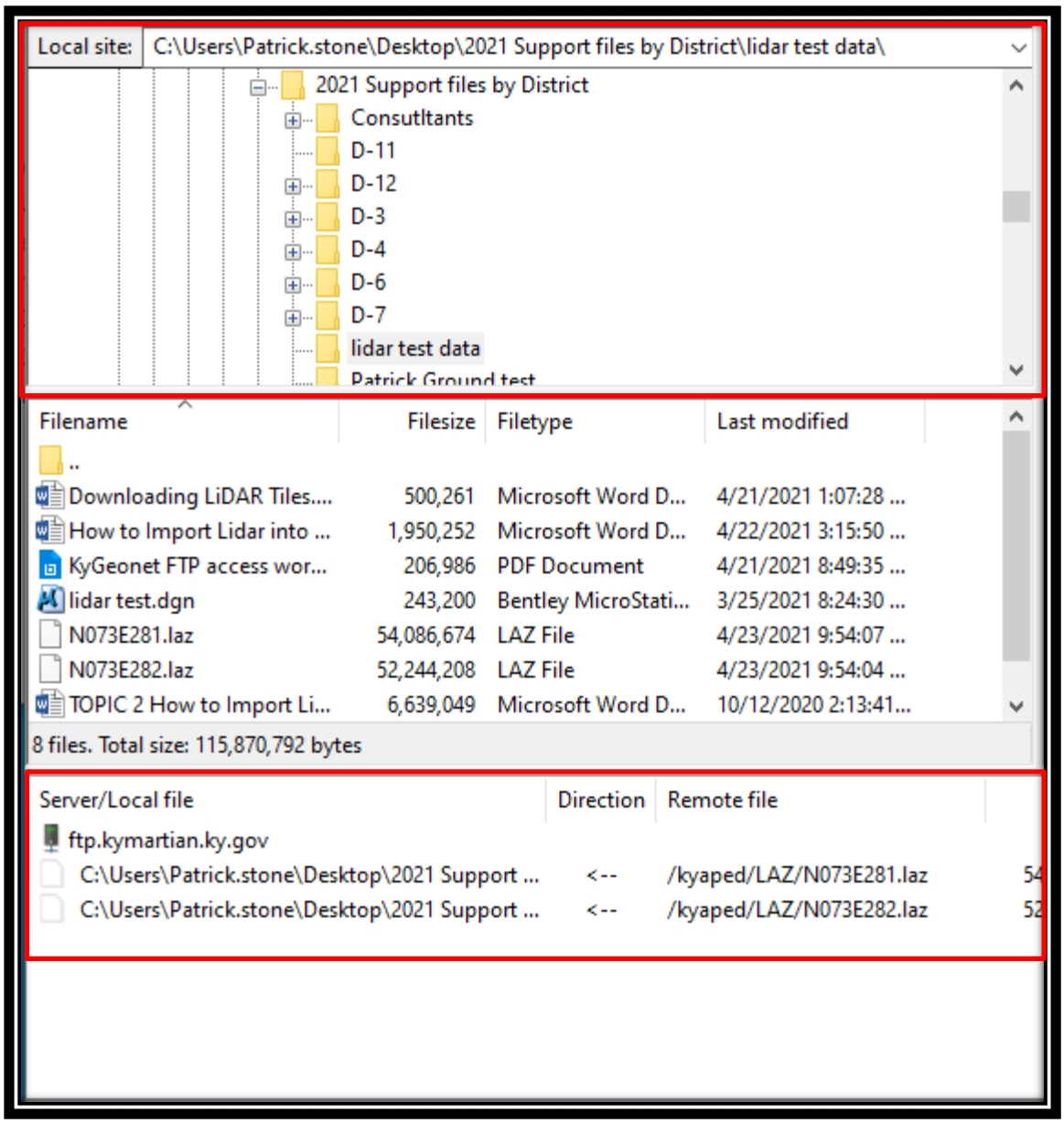


Select the tile or tiles you need. Right Click and you will get the Download and Add files to queue options. If you are downloading one file use the Download if you have multiple files to download us the Add files to queue.



With the files added to the queue.

Define the location for your download to somewhere you know you can browse to. Right Click on your laz files and right click and process queue. Your files will now be downloaded to the path you have defined for your Local site as shown below.


Local site: C:\Users\Patrick.stone\Desktop\2021 Support files by District\lidar test data\
2021 Support files by District
ConsutItants
D-11
D-12
D-3
D-4
D-6
D-7
lidar test data
Patrick Ground test
Filename
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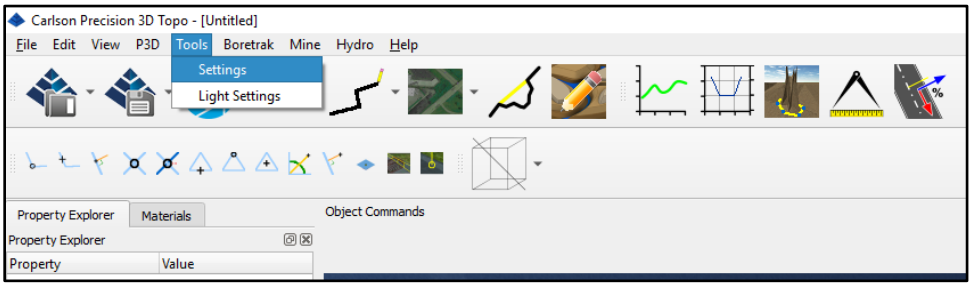
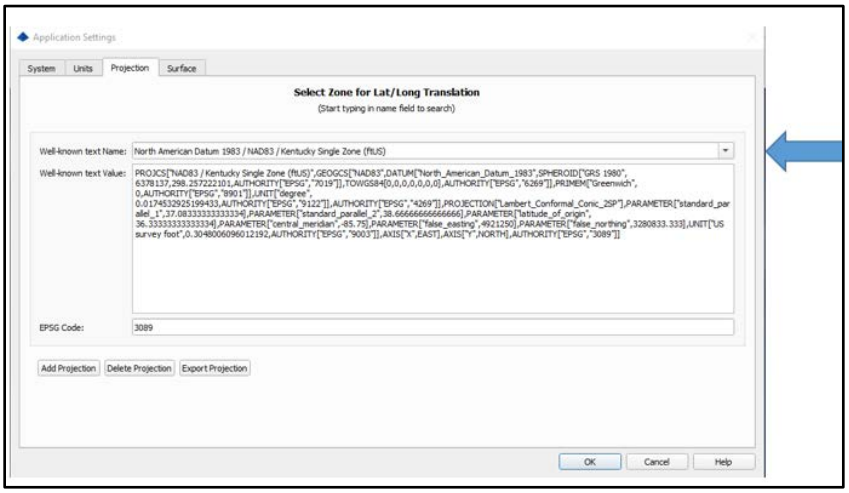
Filetype
Last modified
..
Downloading LiDAR Tiles.... 500,261 Microsoft Word D... 4/21/2021 1:07:28 ...
How to Import Lidar into ... 1,950,252 Microsoft Word D... 4/22/2021 3:15:50 ...
KyGeonet FTP access wor... 206,986 PDF Document 4/21/2021 8:49:35 ...
lidar test.dgn 243,200 Bentley MicroStati... 3/25/2021 8:24:30 ...
N073E281.laz 54,086,674 LAZ File 4/23/2021 9:54:07 ...
N073E282.laz 52,244,208 LAZ File 4/23/2021 9:54:04 ...
TOPIC 2 How to Import Li... 6,639,049 Microsoft Word D... 10/12/2020 2:13:41...
8 files. Total size: 115,870,792 bytes
Server/Local file
Direction
Remote file
ftp.kymartian.ky.gov
C:\Users\Patrick.stone\Desktop\2021 Support ... <-- /kyaped/LAZ/N073E281.laz
C:\Users\Patrick.stone\Desktop\2021 Support ... <-- /kyaped/LAZ/N073E282.laz

How to Import LIDAR Tiles into Carlson

Now that you have saved you Las or Laz files in a location on your local machine, open Carlson Precision 3d (the desktop logo is below).

Go to tools settings, after opening. Then, make sure your Projection is set to the appropriate zone. For this example, we will be using Kentucky Single Zone (ftUS). Illustrated below is how it should look on your machine.

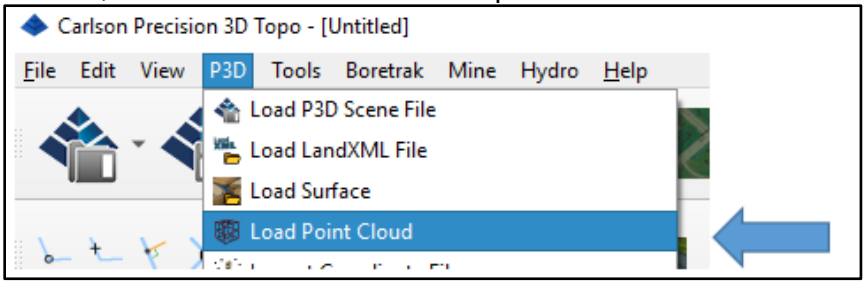




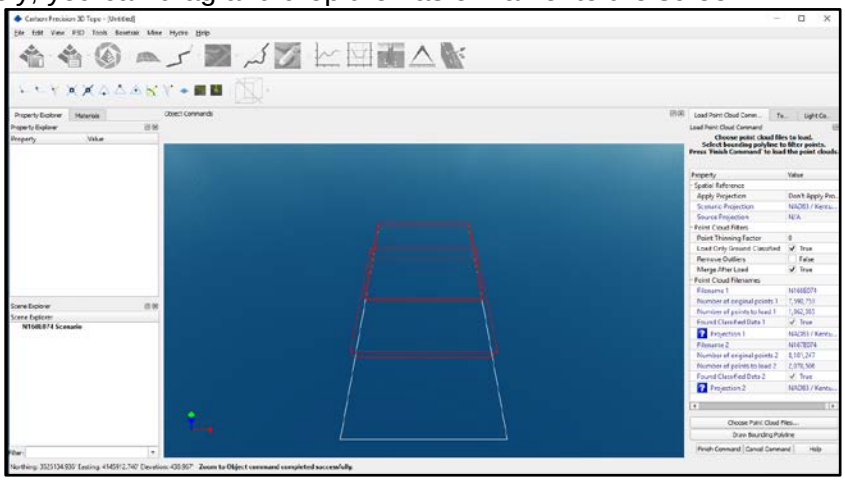
With the appropriate zone selected, you are ready to import your tiles. Carlson can handle multiple tiles; for this example, we will be importing and smoothing two tiles.

There are two ways to import LIDAR tiles into Carlson, detailed below.

1. Select the P3D tab and then select the Load Point Cloud button. Carlson will import both Las and Laz files, so there is no need to decompress the Laz files.

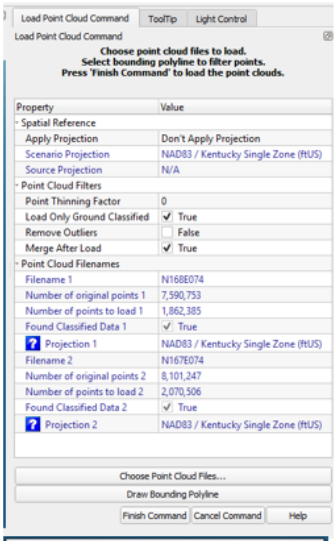


2. Alternatively, you can drag and drop the Las or Laz onto the screen.



No matter which method you choose to import the Las or Laz files, you will still have to make a few decisions on the import.

Point Cloud Options for Import



The information in blue, in the graphic to the left, is not editable at this point of the processing. Only the information in black, as shown, is editable.

The projection comes from the projection we set when we first opened the file.

The Point Cloud Filters should be set to the following:

a. Point Thinning Factor should remain as zero.
b. Load Only Ground Classified should be set to true.
c. Remove Outliers should be set to false.
d. Merge After Load: this will combine the point cloud into one cloud for easier import into Bentley.

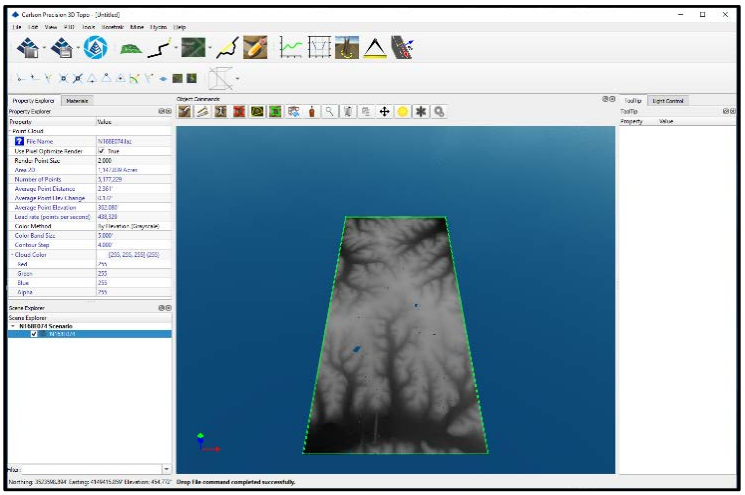
You could draw a bounding polyline at this point if desired. I generally import one from Bentley; I find this method easier.

Now hit the Finish Command button.

You will then get the pallet to the left. If not already selected, choose the appropriate units for import.

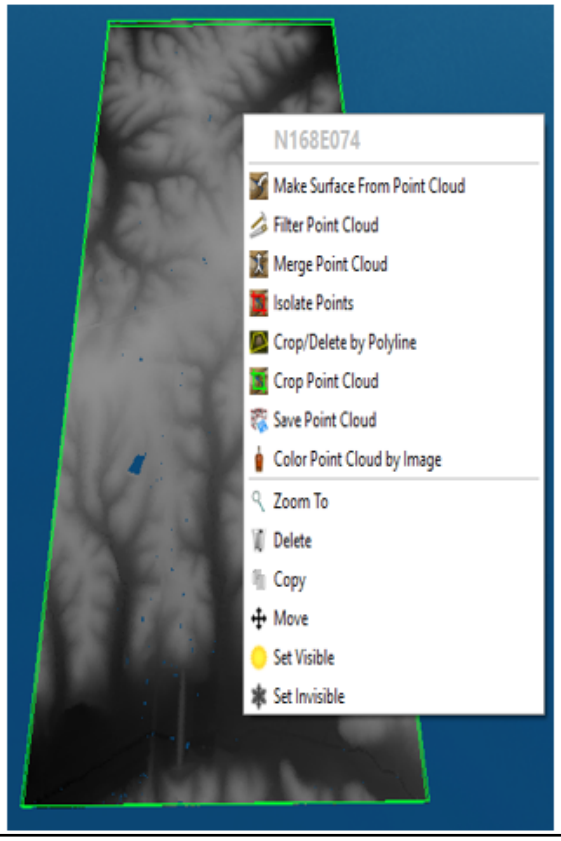
Then select OK.

Now you can see that the two tiles are merged into one, shown below.



Right click on the combined point cloud to get a list of commands, illustrated in the graphic below.

“Make Surface From Point Cloud” creates a TIN file that is only used in Carlson. Bentley does import some TIN files, but as of this writing, it does not import Carlson TIN files.



Filter Point Cloud will reduce the Point Cloud size. This is the main tool for reducing the Point Cloud size that we will be using further in the write-up.

Merge Point Cloud merges the point clouds into one point cloud. (This is the same command we used when we imported the two point clouds earlier.)

Isolate Points allows you to select points in a point cloud for cropping, deleting or moving to a new point cloud.

Crop/Delete by Polyline allows you to crop or delete points from a point cloud by a bounding polyline.

Crop Point Cloud: this command crops sections of a point cloud with a rectangular selection.

Save Point Cloud saves a point cloud as a .las or .laz file. It is important to note that point clouds are not automatically saved. You must manually save the file to keep your edits.

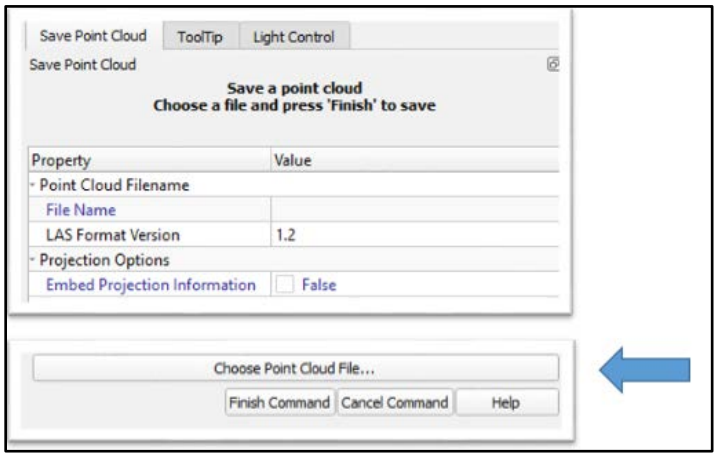
Color Point Cloud by Image drapes an image on the point cloud and each pixel is colored with the corresponding pixel of the image attached.

Saving the Point Cloud

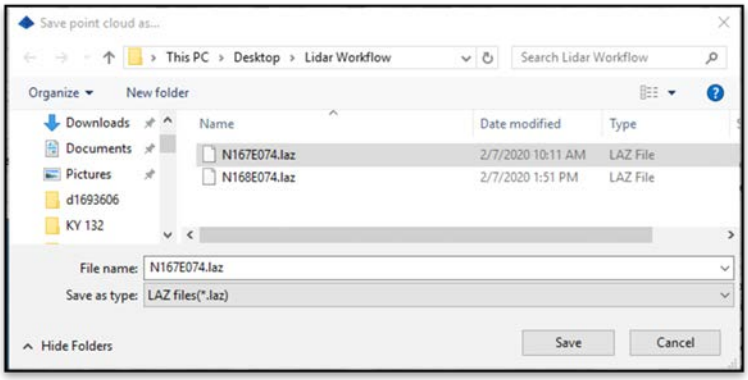
We will be saving the point cloud in version 1.2 (you have the option to save the point cloud in version 1.2, 1.3 and 1.4; as of this writing, Bentley will only import version 1.2).

Pick the Save Point Cloud Command. I suggest you rename the point cloud before saving with a name that indicates you have merged the tiles; for this example, we will name it Merged Point Cloud.

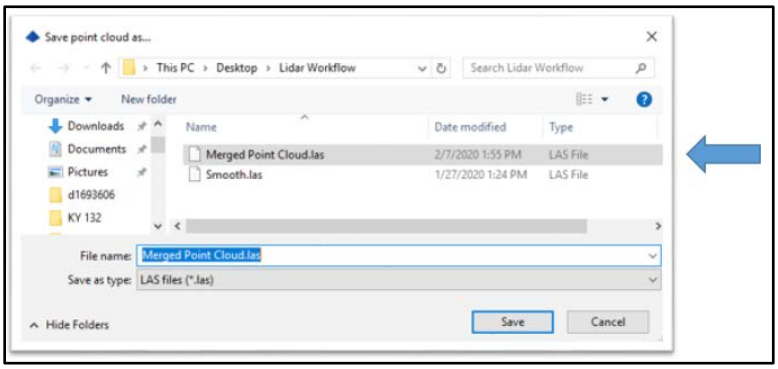
Below are graphic representing the saving process.



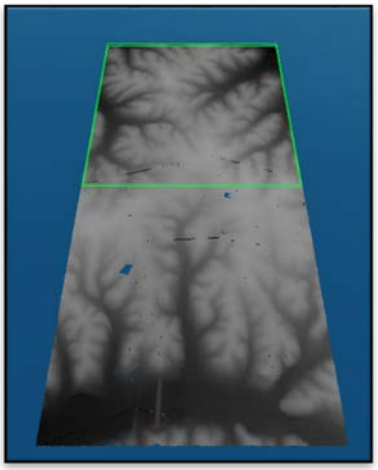
To rename the file from the “Save a Point Cloud” command, first select the “Choose a Point Cloud File” button, shown above. Notice this file is a LAZ file; we will need to change the filename and the file extension. Select the file you have been working in. In this example, we have been using N167E074.LAZ as the name, shown below.



Now that the file is selected, change the file name to the desired name; in this example, we will name the file “Merged Point Cloud.las”. See below for steps and lastly save the file.

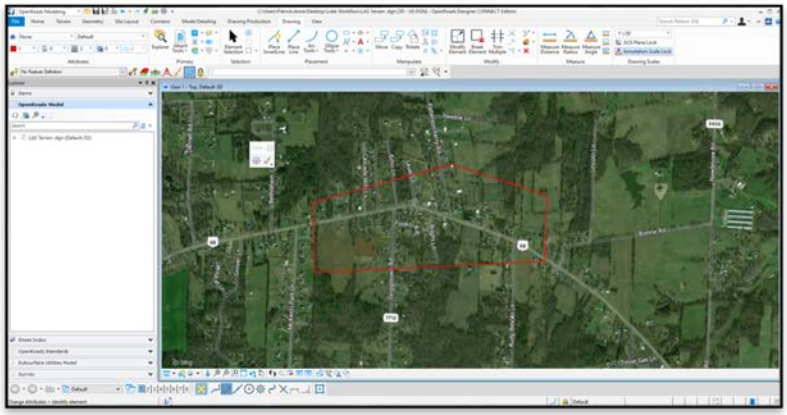


Note: this file has not been clipped or reduced in size. This file includes two point cloud tiles, so it is highly recommended that you clip these tiles to include only the area of interest. I find it easiest to clip these files in Carlson. Some users with more powerful computers do not need to clip the files for performance reasons, however, most of users will need to clip and possible thin the tile. We will now discuss the process of clipping the tile. As with most projects, chances are high that your project will span multiple tiles. This project clips two tiles, as shown below.



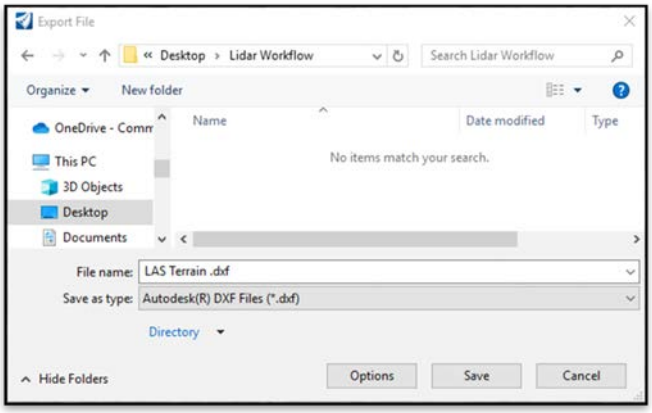
Our project is split over two tiles, so we will need to clip this tile to cut the file size down. I recommend that you make your cut shape in Bentley and import it to Carlson as a DXF file. Similar to the one that is illustrated in the following procedures.

Drawing a Clipping Limit in ORD



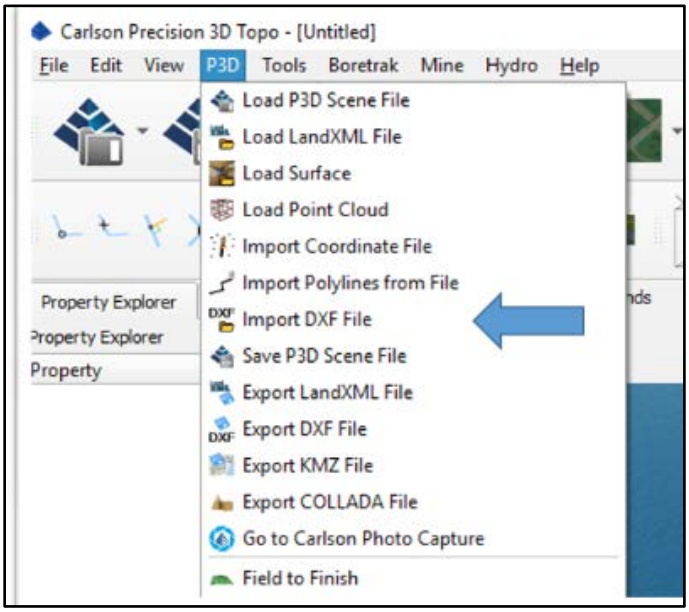
From Bentley, draw a shape or line strings to delineate the extents of your desired surface (see above).

Under “File”, export and navigate to the folder you wish to save the file. This file will need to be in DXF format, as shown below.

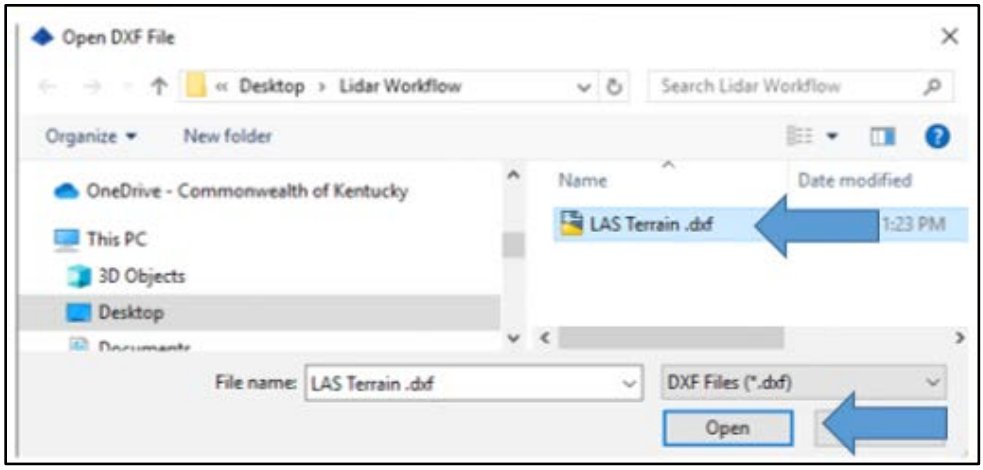


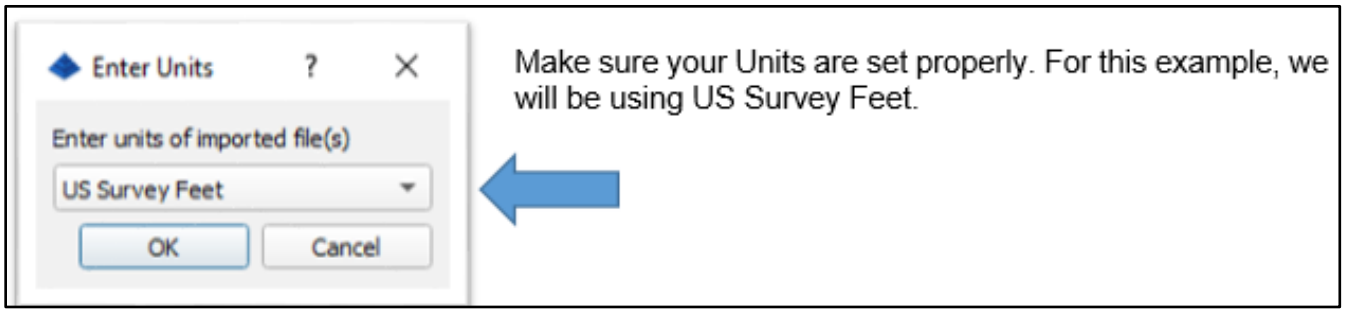
Importing a Clip Boundary into Carlson

Now that the file is saved, open Carlson. Then, go to the P3D tab and select the Import DXF file button, as seen below.

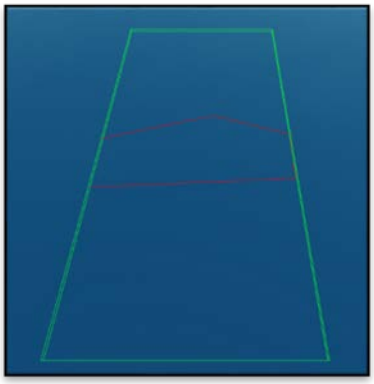


Next, navigate to the desired path, select the file “LAS Terrain.dxf” and select open. See below for details.

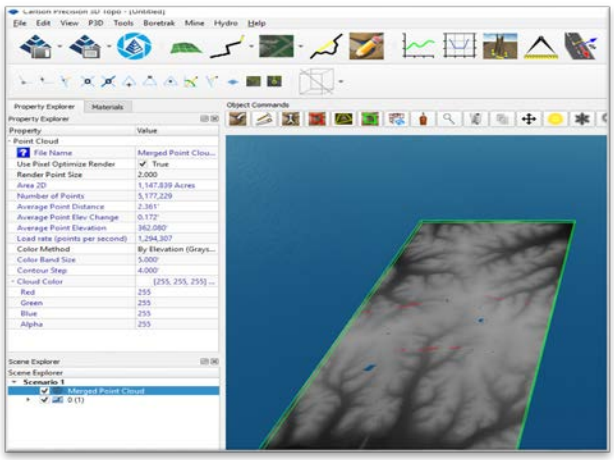




Now you will be able to see the shape you just imported. As you can tell, we have quite a few points we do not need (see graphic). Leaving these points in will make your design files potentially run slow. Therefore, we will clip them with the shape we just imported.

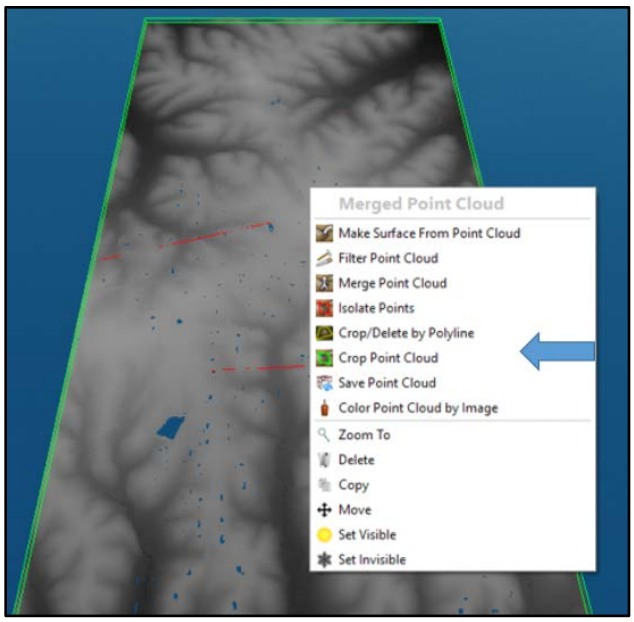


Next, make sure the point cloud is set to active. You can do this by checking the box next to the point cloud.



Cropping the Point Cloud

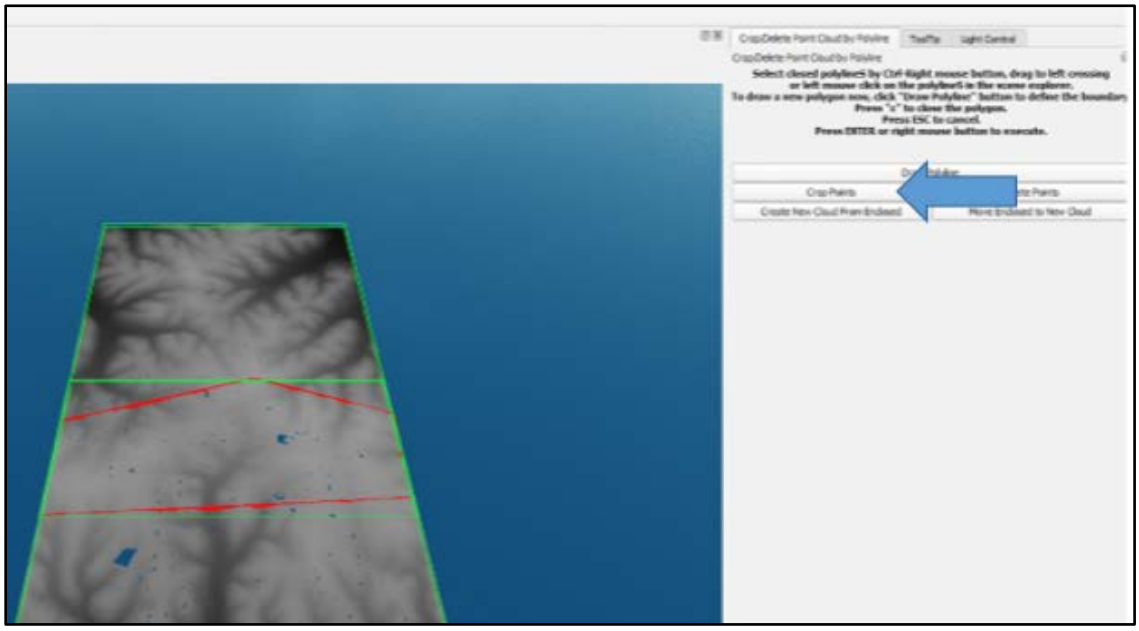
After you have the point cloud set to active, right click on the Lidar tile and you will get the following menu:

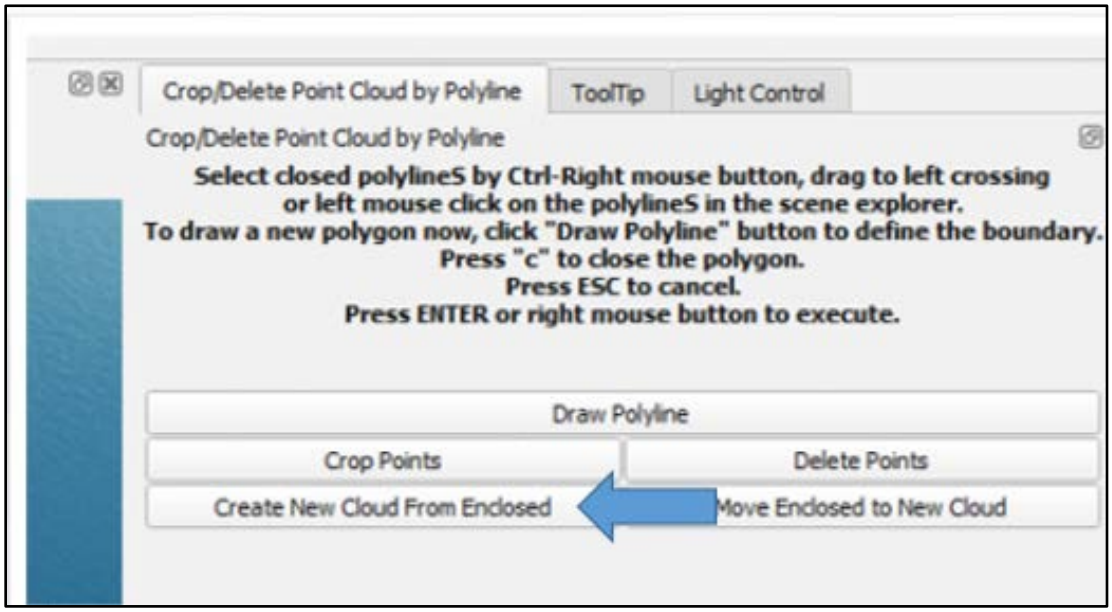


After picking the “Crop Point Cloud” command, you will have several options:

1. You can select the draw Polyline command: this will be used only if you choose not to import your DXF file from Bentley.
2. You can Ctrl-Right mouse button and then drag to left crossing or left mouse click on the polylines in the scene explorer. We will be using this method.

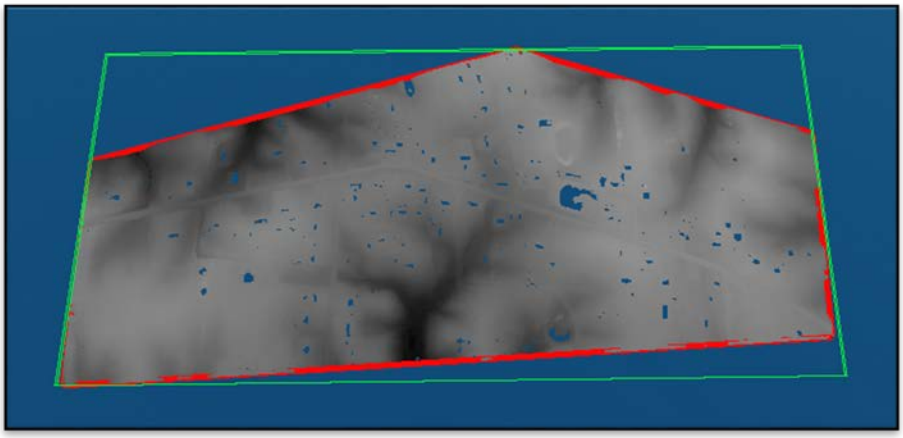
After you have your polyline or polylines selected, your shape or lines should be on top of the Point Cloud as shown below.



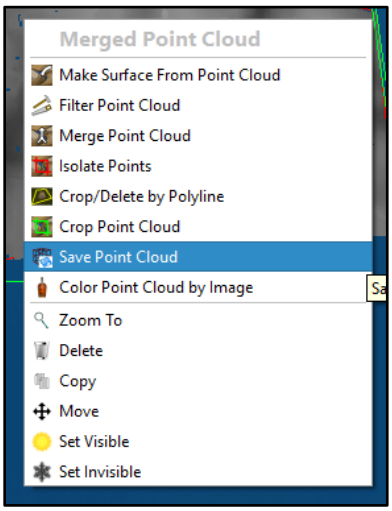


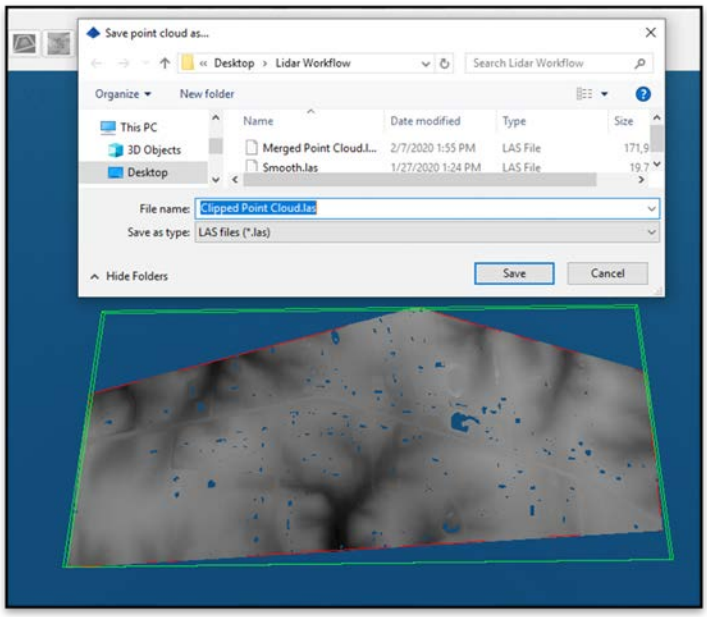
With the Polyline selected, press either the “Crop Points” or “Create New Cloud From Enclosed” buttons. If you use the Crop Points command, it will Crop down your original file.

Now that you have cropped the tile down to a more useable point cloud, it should look like the one below:

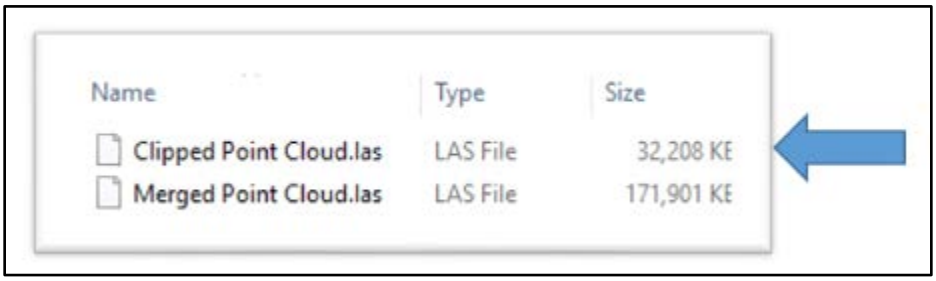


Next, right click while over the point cloud and select “Save Point Cloud” (shown below). We will name the file “Clipped Point Cloud.las”.





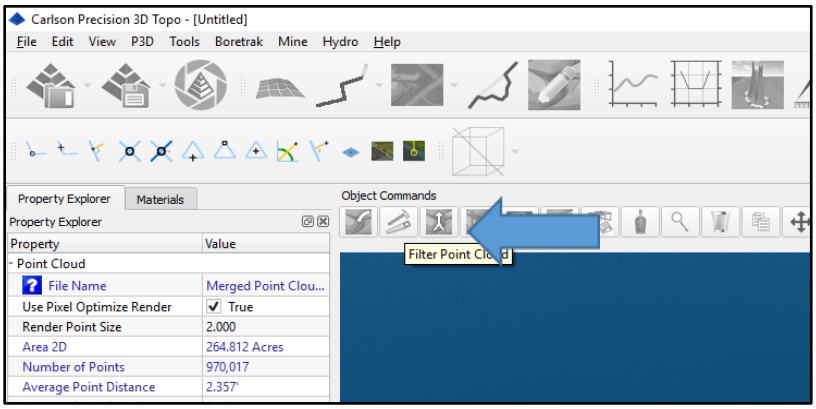
Note: notice the reduction in file size just by clipping the unneeded area out of the Cloud.



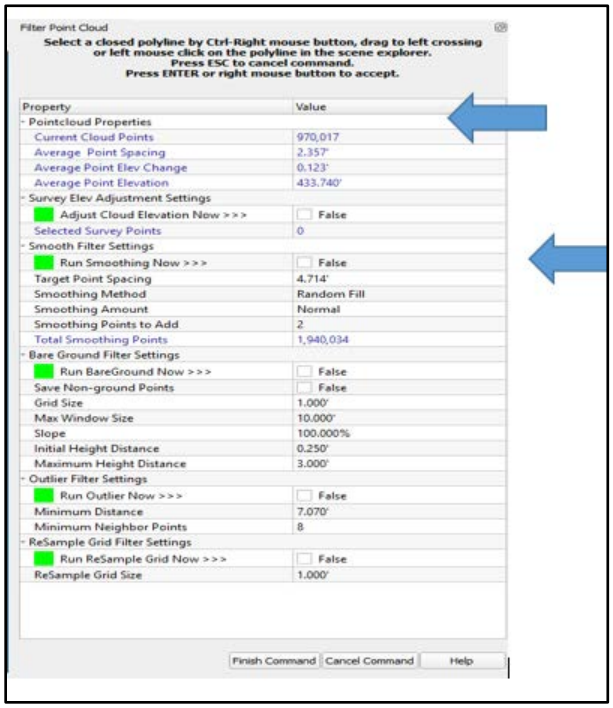
Now, you can either import into Bentley or smooth the point cloud. We will smooth the cloud first to reduce the file size even more, continuing this example.

Smoothing the Point Cloud

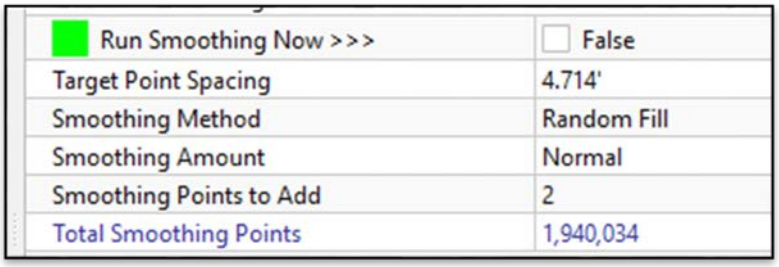
Pick the Filter Point Cloud command.



After launching, you will get the following menu, seen below. From the Filter Point Cloud command, we will primarily be using the Run Smoothing Now Command.

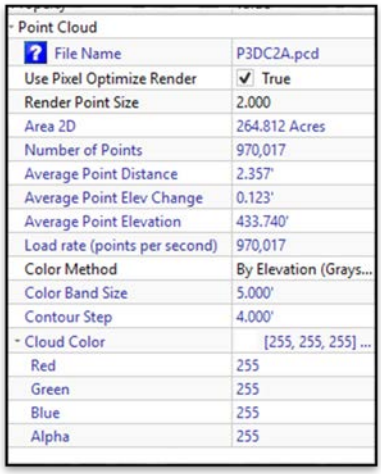


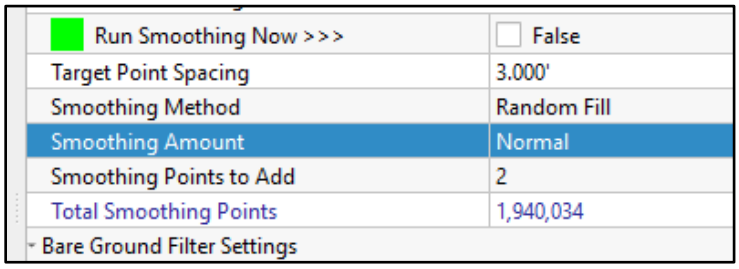
The Run Smoothing Now command consists of four commands.



1. Target Point Spacing this value is set to double the Average point cloud distance. So for this example our Tile has an average of 2.357' point distance therefor the Target point spacing is set to 4.714 by default.
2. Smoothing Method has three options 1. Random Fill. 2. Planar Fill. 3. Reduce Noise.
   Random fill will be used for the first few runs.
   Planar fill will fill in the areas that are open such as buildings and ponds.
   Reduce Noise should not be used on LIDAR tiles it would be used on Photogrammetry files.
3. Smoothing Amount I would keep this at normal. The Smoother and Smoothest are more aggressive reductions it is very easy to loose peeks and fill in valleys.
4. Smoothing Points to Add this works with the Random Fill has to do with statistical Sampling and how may point you use to sample each point in the point cloud. Recommended values are from 2-6 the higher the number the more precisely the point will be placed but the longer it will take to place that point. I suggest you keep this value at 2.

Next, we will smooth the point cloud. We will set the Target Point Spacing to 3.00 because the average point distance is 2.357 feet; this will give us about a 20% reduction.



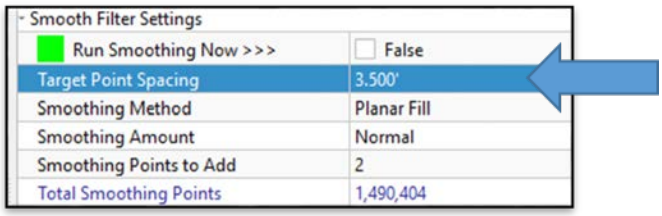


Set the Run Smoothing Now to “true”; this will run the command. As you can see below, we were able to get around a 20% reduction and our average point spacing went to 2.569’ from 2.357’.

You need to be very careful not to smooth your Point Cloud to the point you lose curbs and super.

Property	Value
Point Cloud	
File Name	P3DC2A.pcd
Use Pixel Optimize Render	True
Render Point Size	2.000
Area 2D	264.796 Acres
Number of Points	745,202
Average Point Distance	2.569'
Average Point Elev Change	0.073'
Average Point Elevation	433.639'
Load rate (points per second)	970,017
Color Method	By Elevation (Grays...
Color Band Size	5.000'
Contour Step	4.000'
Cloud Color	[255, 255, 255] ...
Red	255
Green	255
Blue	255
Alpha	255

We are going to run the Smoothing filter again. This time we will switch the Smoothing Method to Planar fill and change our Target point pacing to 3.5 feet; this will fill in the majority of the smaller holes from buildings and ponds.

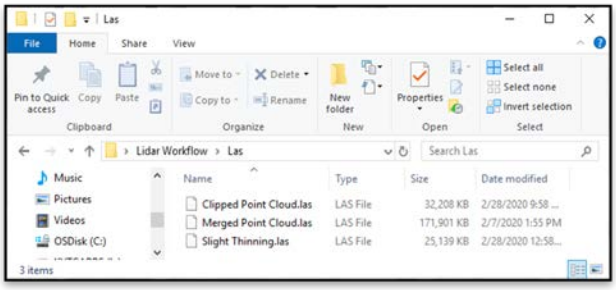


Set the Run Smoothing Now to “true”; this will run the command. This will add some additional triangles to the file and will fill in the majority of the holes. You can refine your smoothing to get the desired level of detail.

Property	Value
Point Cloud	
File Name	P3DC2A.pcd
Use Pixel Optimize Render	True
Render Point Size	2.000
Area 2D	266.148 Acres
Number of Points	757,116
Average Point Distance	3.114'
Average Point Elev Change	0.097'
Average Point Elevation	433.279'
Load rate (points per second)	970,017
Color Method	By Elevation (Grays...
Color Band Size	5.000'
Contour Step	4.000'
Cloud Color	[255, 255, 255] ...
Red	255
Green	255
Blue	255
Alpha	255

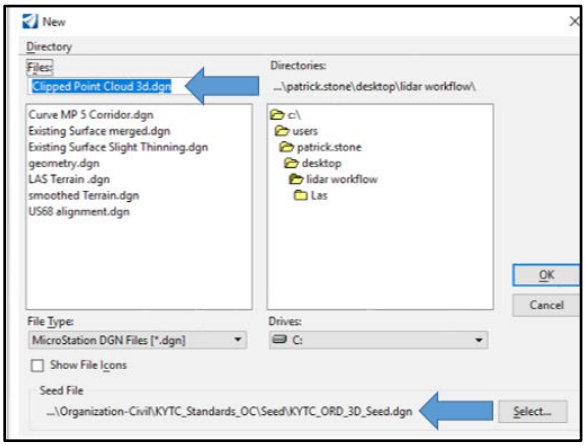
Import surface into ORD

Now we will Open ORD and import our surfaces. Firstly, notice the size of the point clouds.



Open ORD and create a new file from a seed file. We will be using the seed file: KYTC_ORD_3D_Seed.dgn and we will create two files. One is the merged and clipped and the other file will have the thinned file. For this example, we will name this Clipped Point Cloud 3d.dgn.

Select OK.



With the file open, navigate to the OpenRoads Modeling Workflow - Terrain Tab - Create Ribbon Group – From File Ribbon Button.

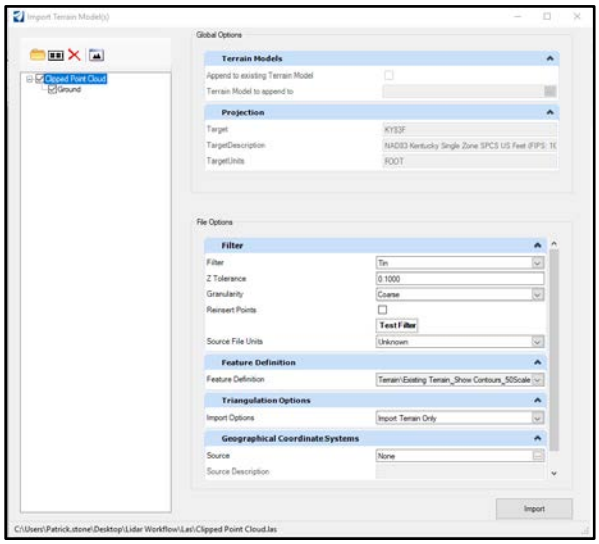
Select the file and hit the “done” button.

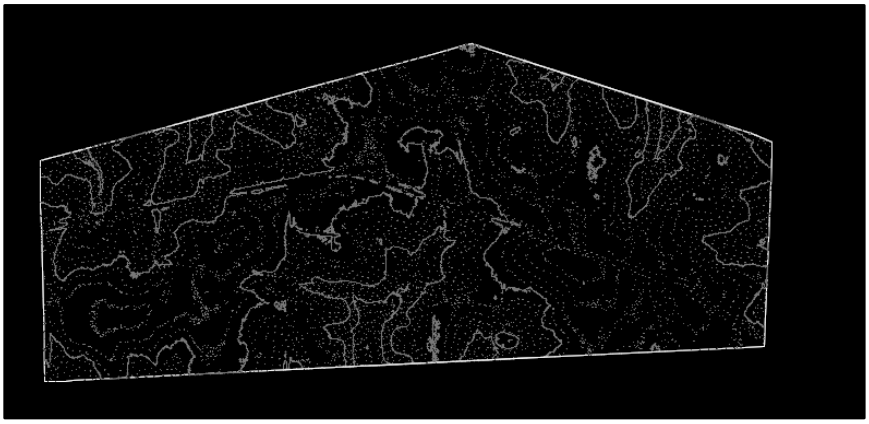
You will now see the following menu (on the subsequent page). Set your settings as desired. We will be using the feature definition “Existing Terrain_Show Contours_50Scale” for this example.

Select import.

Fit to view and you should get a similar result as below (again, on the subsequent page).

Now we have created our Clipped surface; we will create a new file and create our thinned surface in the following steps.

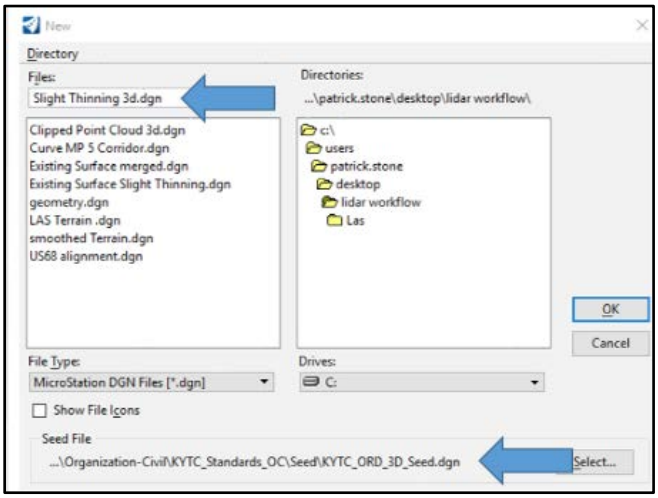




Create a New File from Seed

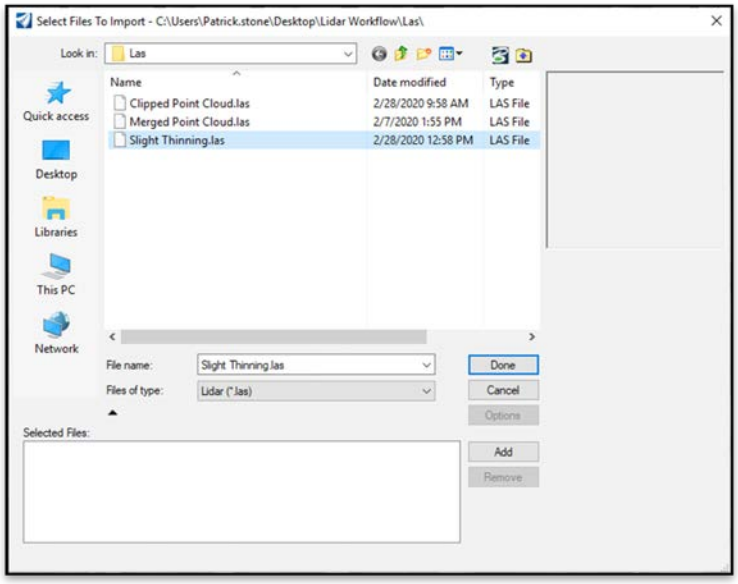
Create a new file from a seed. Navigate to the KYTC seed files and select the KYTC_ORD_3D_Seed.dgn; for this example, we will name this “Slight Thinning 3d.dgn”.

Select OK.

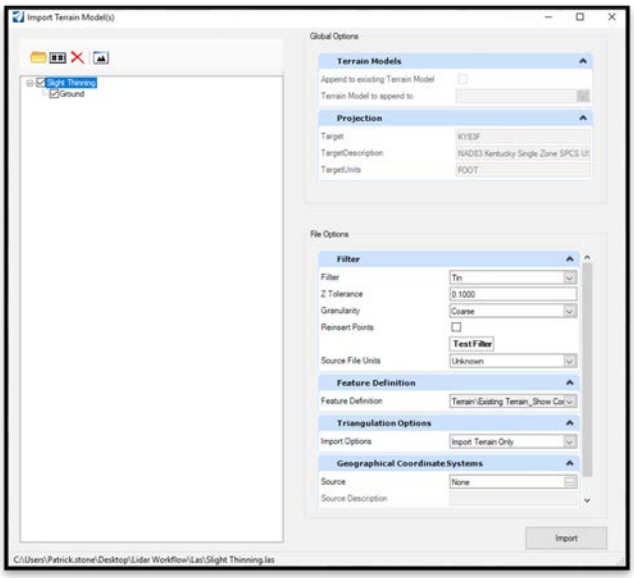


With the file open, navigate to the OpenRoads Modeling Workflow - Terrain Tab - Create Ribbon Group – From File Ribbon Button.

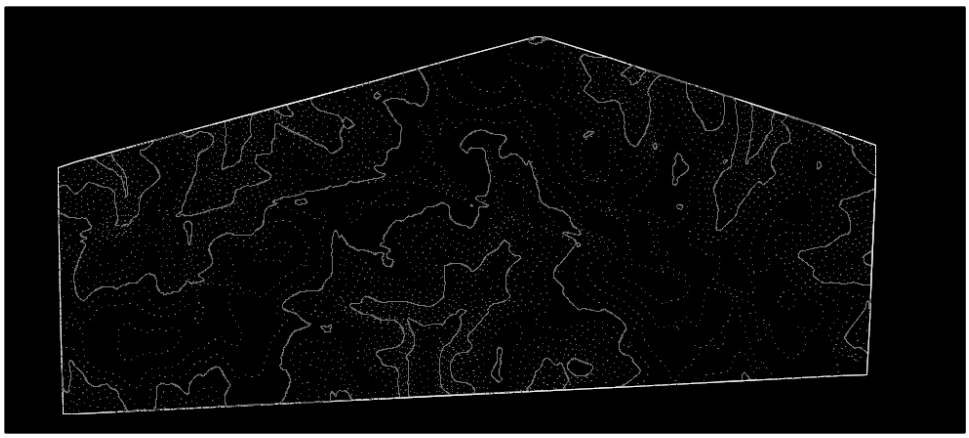
Select the file and hit the “done” button, outlined below.



You will now see the following menu, pictured below. Set your settingd as desired. We will be using the feature definition “Existing Terrain_Show Contours_50Scale” for this example. Select import.



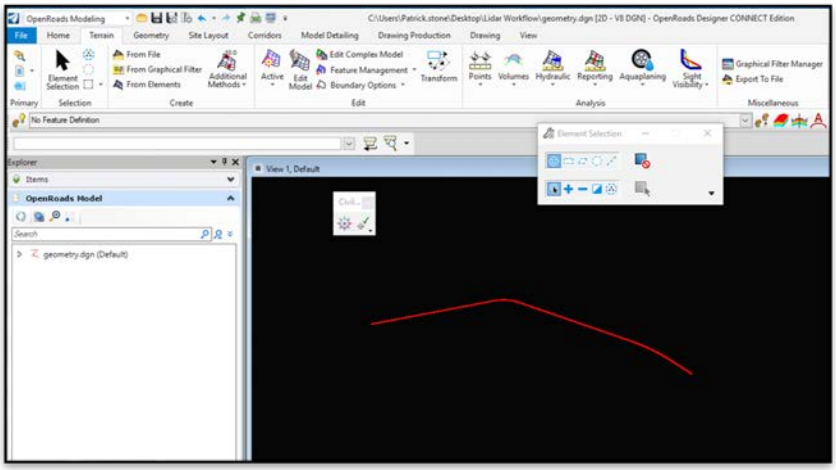
Fit to view and you should get a similar result, as below, on the following page. You can see that the contours are smoother with this process.



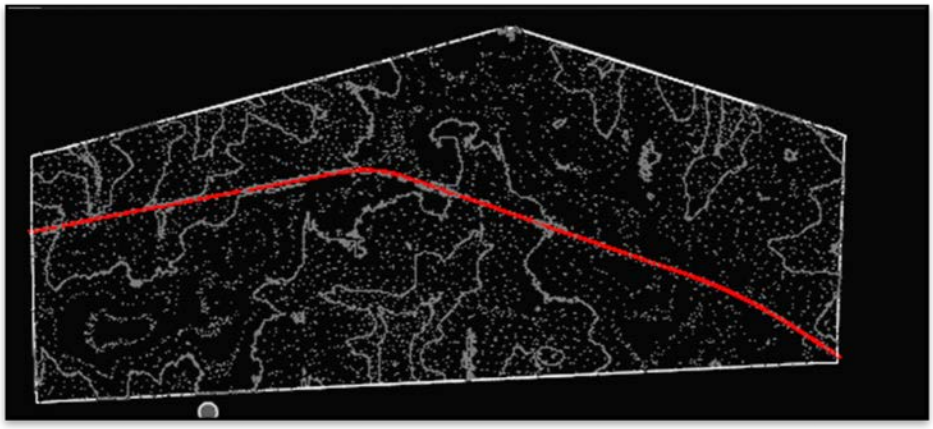
Reviewing the Difference in the Surfaces

Next, we will cut a profile and attach one surface at a time so you can see how the smoothing affected the surface.

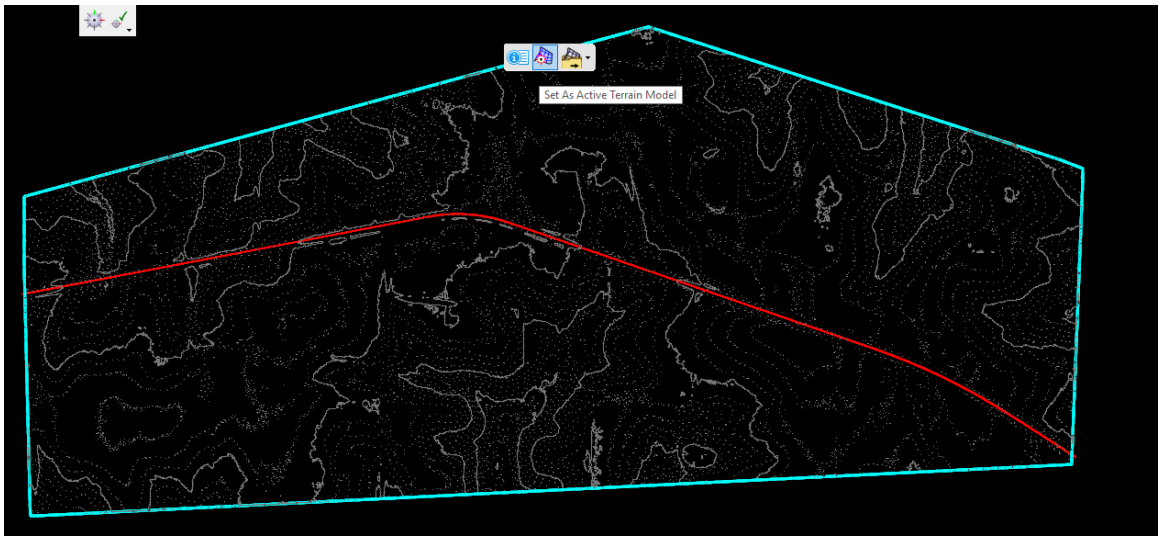
Open or create your geometry file.



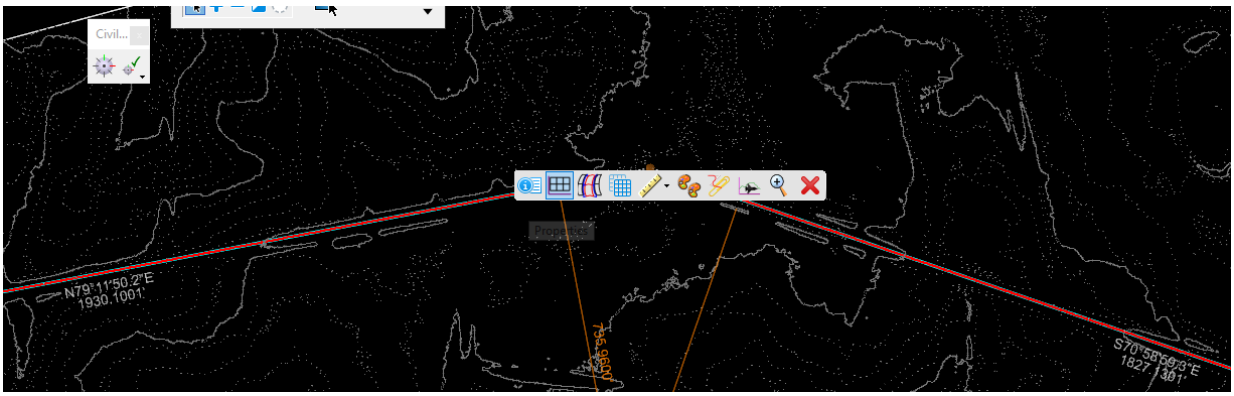
Attach the surface to your geometry file. We will be attaching the “Clipped Point Cloud 3d.dgn” that we just created.



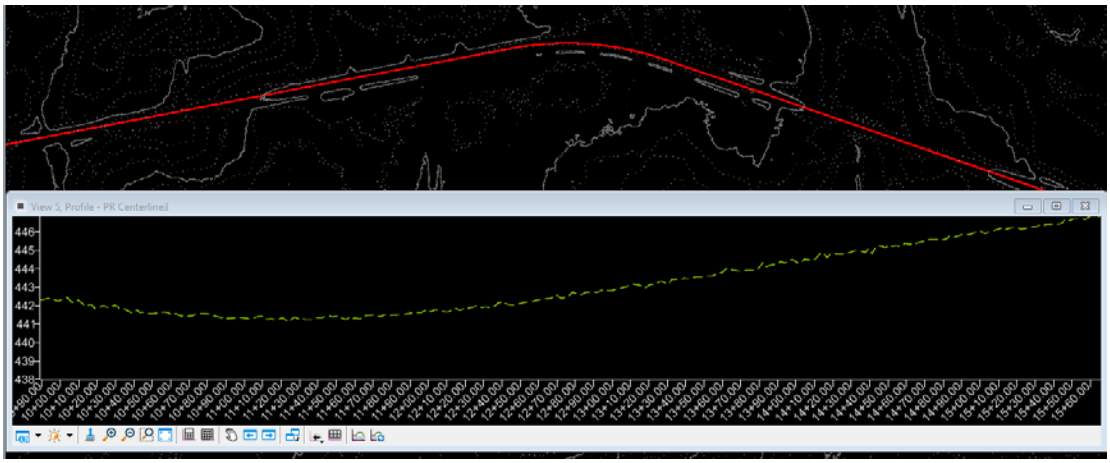
Now we need to set the Active terrain Model. You do this by hovering over the exterior of the model and selecting the “Set as Active Terrain Model” button.



Now we will cut a profile and look at the ground line. Hover over the Horizontal alignment and select the profile icon.



When prompted, select the view you want to place the profile in; for this example, we will use View 5, as shown below. Notice the spikes in the surface, seen below.



Now, we will attach the “Slight Thinning 3d.dgn”. Next, we will recut the profile. The process is complete.