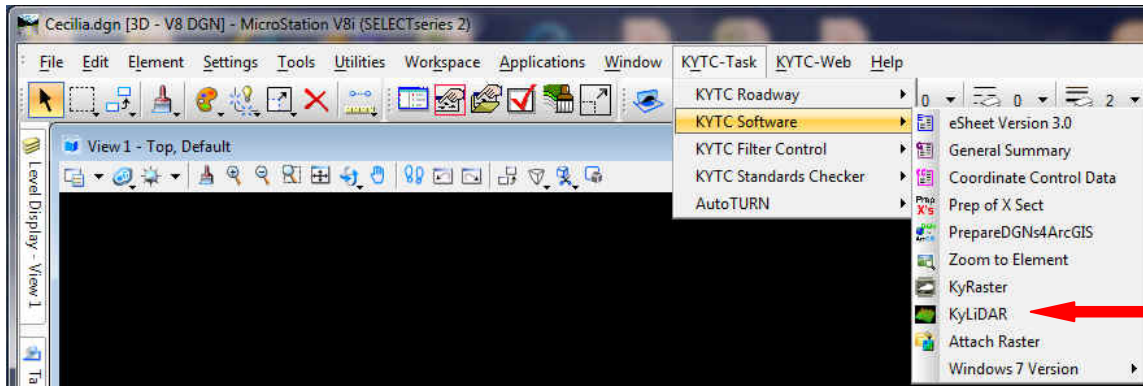 **Determining Which LiDAR Tiles you need**

KYTC and DGI have created a file that can be attached to your MicroStation drawing for determination of which LiDAR tiles are needed for your project. To attach the file, in MicroStation, select "KYTC-Task>KYTC Software>KyLiDAR".

This launches the KyLiDAR app and will bring up the following dialog box from which you will copy LiDAR tiles.
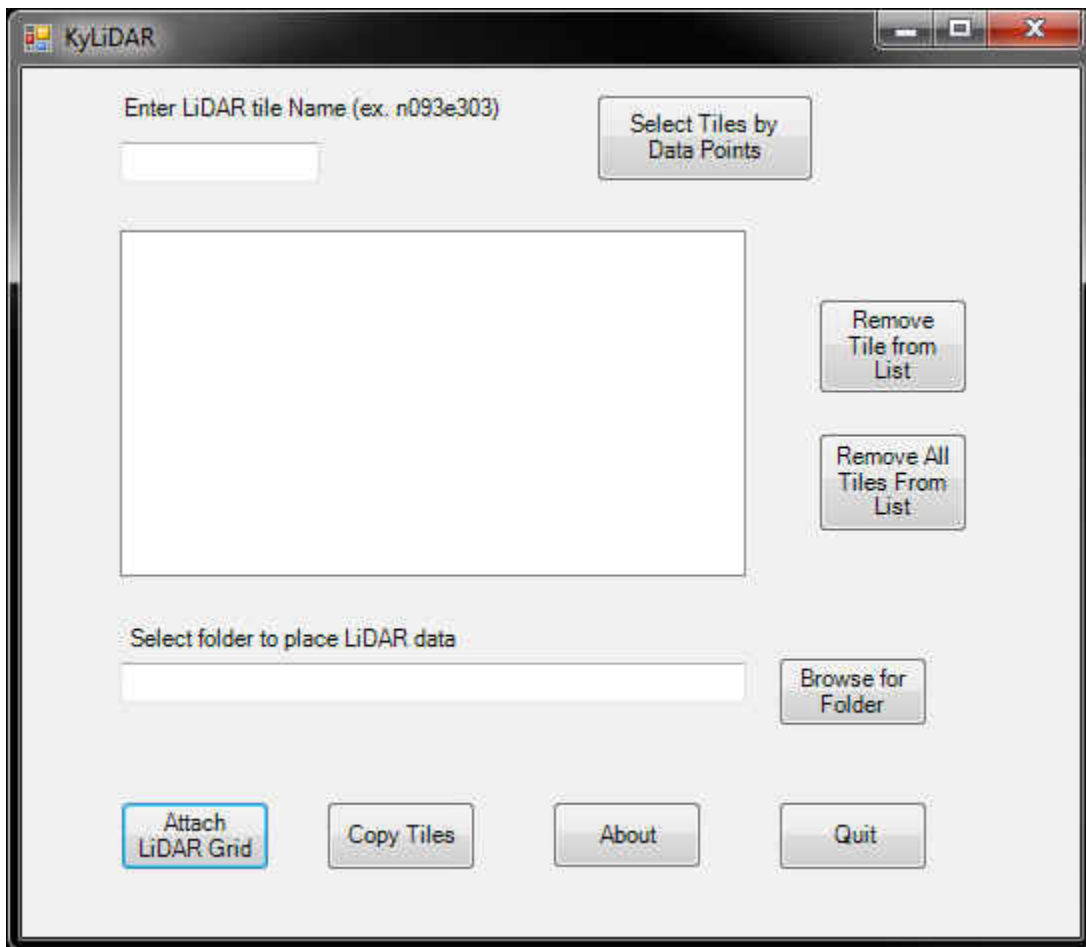
First you will need to select the "Attach LiDAR Grid" button. This will attach the file that contains the LiDAR grid for the entire state. If you have the project corridor boundary for which you want information already displayed in this same DGN file, then you can determine which tiles you need to retrieve.
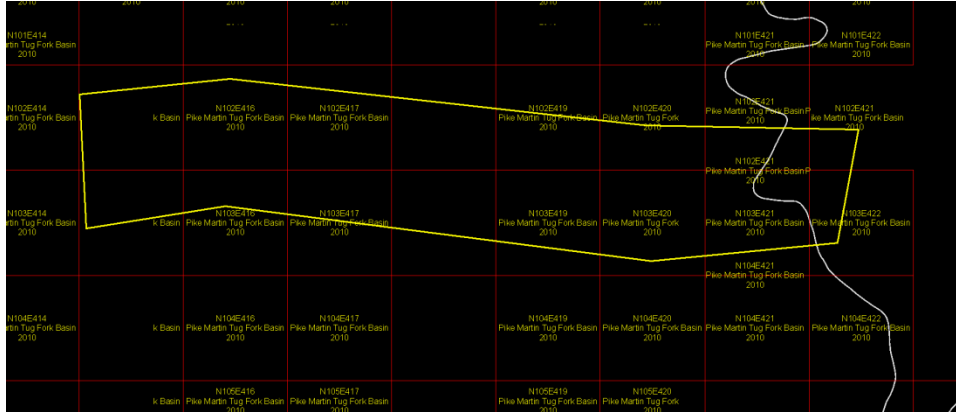

When you figure out which tiles you need, type the name in the "Enter LiDAR tile Name" field and hit enter. Alternatively, you can use the "Select Tiles by Data Points" button to select which tiles you need by clicking inside the tile boundary of each tile needed. This will add the tile to the list to search. You can remove individual tiles or the entire list of tiles from this dialog by using the appropriate button. Next, you need to tell the application where you would like the tiles to be placed on your local machine. Keep in mind that this application will search the LiDAR server for any file with that particular LiDAR tile name. These files can quite large so make sure wherever you are copying the tiles to has plenty of available memory. When your list is complete, select the "Copy Tiles" button. This will launch the search of the server for files related to your desired LiDAR tiles and copy them to the selected folder. After the copy is complete, select the "Quit" button to exit the app.

A side note about LiDAR files…LiDAR files are mass point files containing all returns on the laser. Some of the returns may have hit buildings, water surfaces, cars, trees, etc. The consultant who collected the data has gone through and classified the data into several categories (bare earth/ground, buildings, vegetation, water, "noise", and sometimes "Model Key"). We are interested in the "bare earth/ground" and "Model Key". The model key is created from the bare earth points. The model key is a "thinned out" bare earth surface. If the model key is available, select this file, as it will be much easier to work with in MicroStation. Some model keys cut the size of the LAS file from 150MB to 8MB! Also, the LAS files are in Kentucky Single Zone coordinates in US Survey Feet!

**Creating a DTM from LiDAR Data Through MicroStation**

Now you can begin to bring the LAS files into MicroStation for use as an existing surface. As of May 2013, the best way to work with the LAS files is to bring them into MicroStation through the Data Acquisition tool (it should be under your Task menu or go to Tools>Data Acquisition).
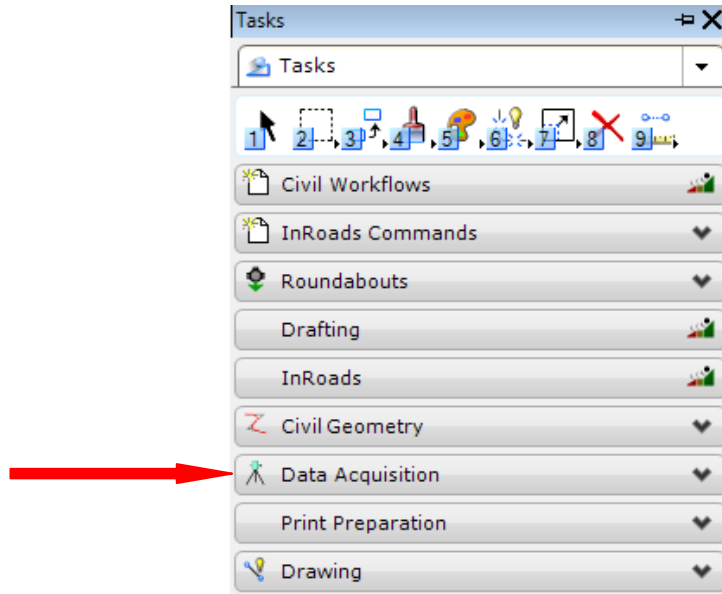
This will bring up two boxes, one called "Data Acquisition" and the other "Data Acquisition Details". We will be working in the "Data Acquisition" box.
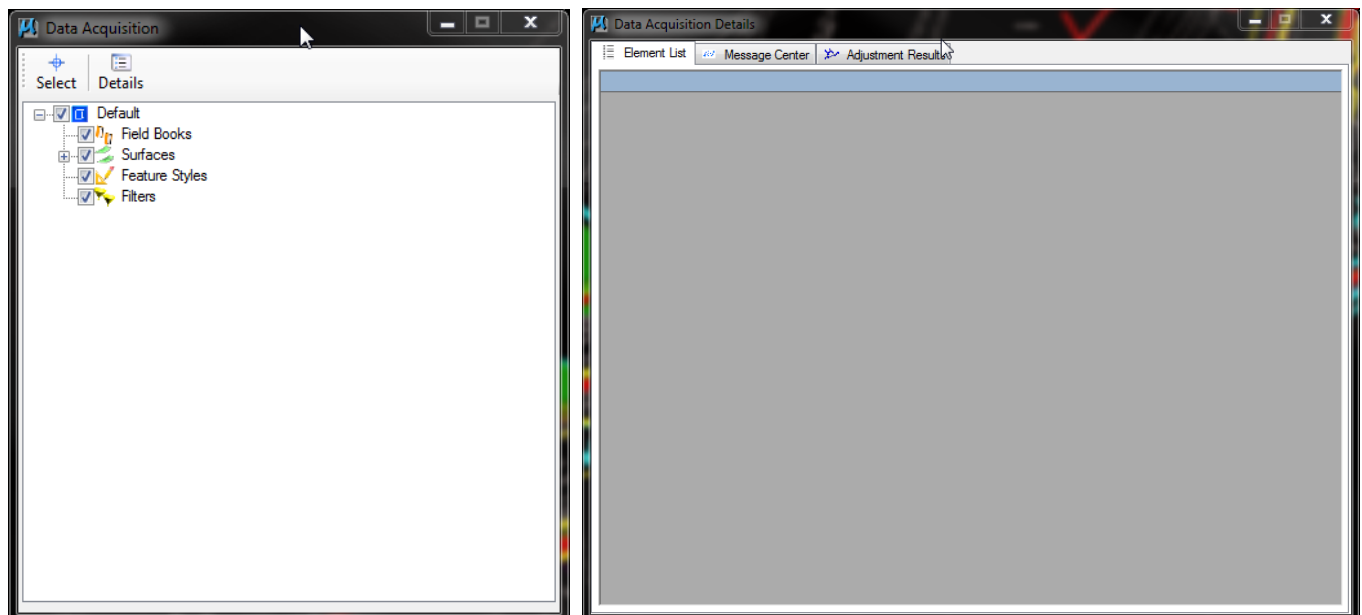
Right-click on "Surfaces" and select "Create Surface>Import External Surface>Import Lidar LAS". Now you can tell the program which LAS tiles to import.
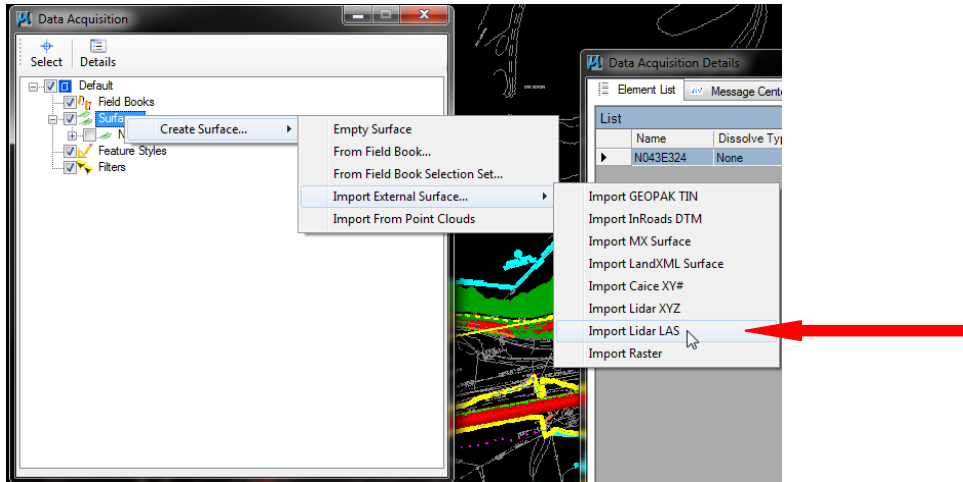
It is important to note that as you are bringing in these tiles, they are being "written" to your DGN and thus, your DGN will grow significantly in size with each tile added.

**Be patient!   Because of the size of the files, this process can be very tedious and frustrating! Be patient and everything should come in fine.

As you attach each LiDAR tile, you will be asked to filter the data. It is important to note that if you are using the "Model Key" you do not need to filter the data as it has already been done for you. Select "No Filter" and accept. If, however, you have a fully classified LAS file, you will need to filter select the "Ground" classification only and set the other settings as desired.
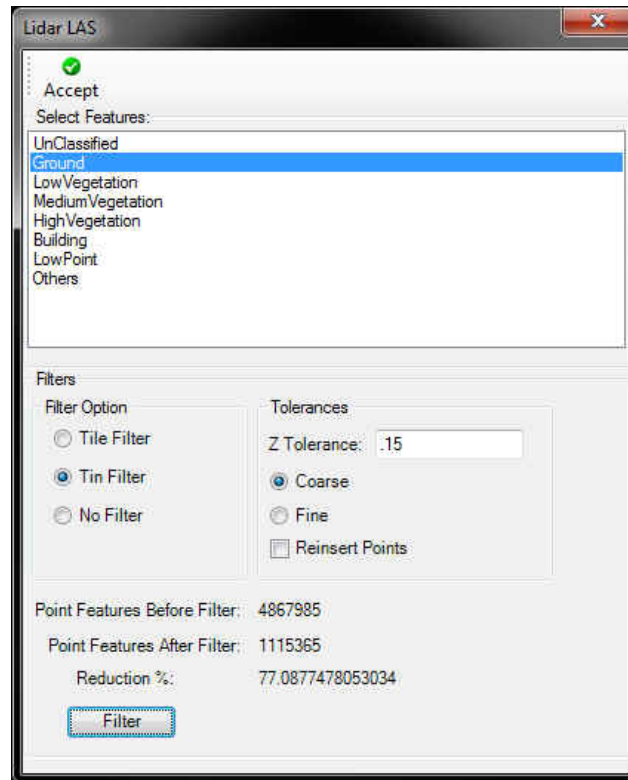
You can test the filter by selecting the "Filter" button at the bottom of the dialog box. It will run through the filter process with your setting and present you filtering statistics most importantly the "Reduction %". As this number increases, more points are being filtered out. Play around with the settings until you are comfortable with this number. Think about what you are wanting to see from your data; if you want to see curb and gutter, it would not be advantageous to set the "Z Tolerance" to more than 0.5 ft (the height of standard curb). If you are needing this information for planning purposes, you can bump up the "Z Tolerance." For final design, you would likely want to have a tighter array and lower tolerance.

You can play around with the settings to find the tolerance that is "optimal", meaning that you have reached the point of diminishing return. As you decrease the "Z Tolerance" the "Reduction %" will decrease. Eventually, you will find a tolerance where the "Reduction %" begins to drop dramatically; this is your point of diminishing return. You can have a tighter "Z Tolerance" if you desire, but having any larger tolerance doesn't provide much value.

Once you have your filter set to your liking, select the "Accept" button at the top of the dialog to import the data

Following are explanations from Bentley about what each setting in this dialog does/means:

The **Tile Filter** uses an algorithm that divides the LIDAR data set into tiles. A best fit plane is calculated for each tile, and LIDAR points are removed if they fall within the user set Z Tolerance to the plane.

The **TIN Filter** first separates the LIDAR points into tiles with a maximum of 2 million points and then repetitively triangulates each tile, filtering out points. The TIN Filter algorithm filters out the points if they fall within the user set Z Tolerance of the triangle planes.

Z Tolerance - common to both algorithms and is basically the variation in the Z coordinate that the surface is allowed to move during the filtering process. Typically for the first invocation of the filtering function, the Z Tolerance should be set from 0.5 to 1.0 for imperial data sets and from 0.25 to 0.5 for metric data sets. Depending on the outcome and the desired result, the Z Tolerance can be varied up or down.

Max. Tile Points - specifies that a tile will not be subdivided if it has less than this number of points. Typically this is set to five.

Max. Tile Divisions - the allowable level of recursion allowed and is the number of time the initial tiling set can be subdivided. Typically this is set to five.

Start Tile Length – The LIDAR data set is initially divided into tiles of this size, prior to recursion to the minimum tile points. The setting of this parameter requires some knowledge of the distance between the LIDAR points, which requires an inspection of the LIDAR points in MicroStation to determine. Typically set this to 10 times the distance between the LIDAR points.

Course Filter (TIN option only) – Filter more points with some blurring of ridges and valleys

Fine Filter (TIN option only) – Filters fewer points with less blurring of ridges and valleys

Points Before Filter/Points After Filter/Reduction % - Display of the number of points before and after filtering, plus the percentage reduction of points from before and after

At some point, either after you import each tile or after you have imported all tiles, you should "clip" the tiles by your boundary. This will trim down the amount of data that MicroStation is attempting to process making this process quicker. Select the boundary polygon (it needs to be a closed shape) using the MicroStation Element Selection Tool (the mouse cursor). With the boundary selected, right click on each "Surface" and select "Clip by Polygon>External" because you have defined the external boundary of your area of interest. Again, be patient as this process takes time as well.
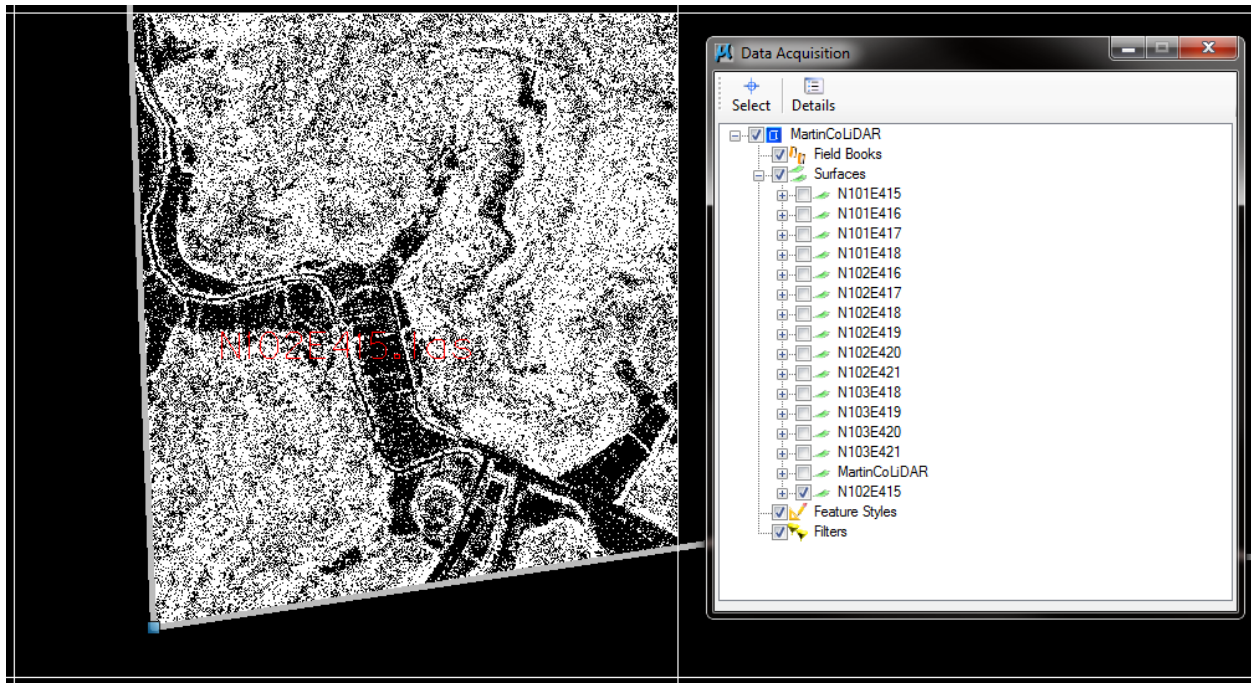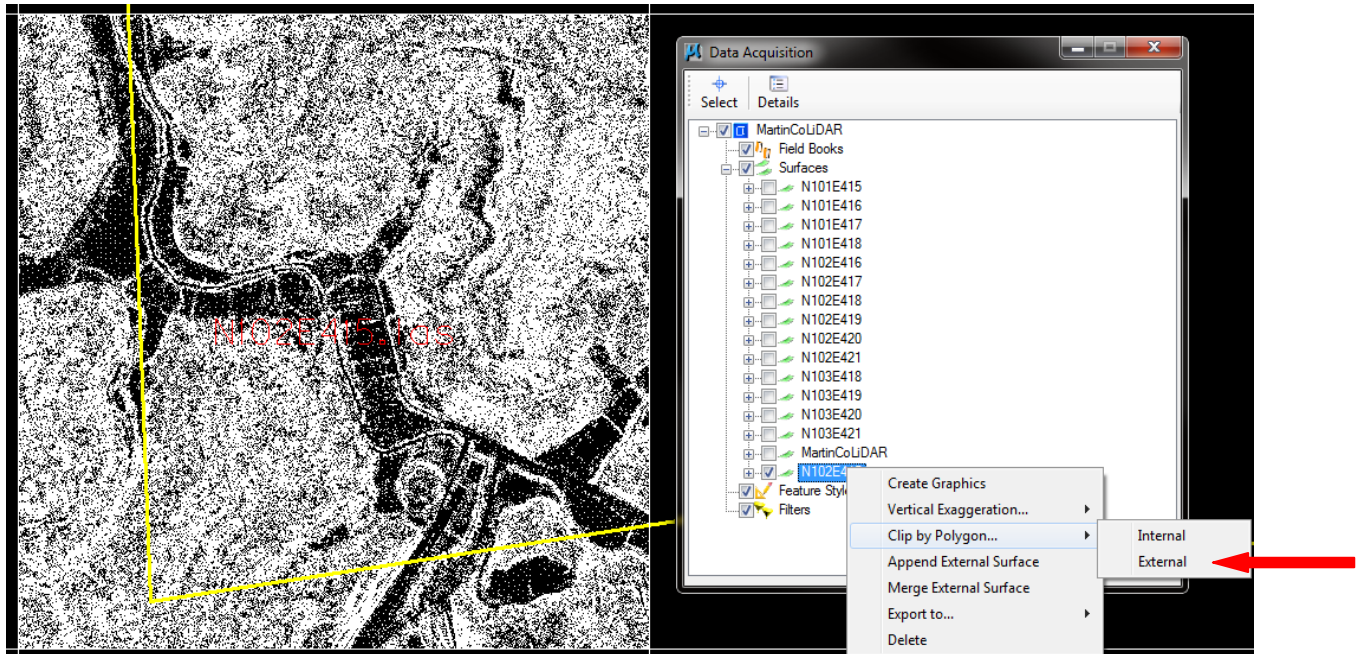
After you have all your tiles clipped, you can begin to merge them into one surface. In the Data Acquisition box, right click on "Surfaces" and select "Create Surface>Empty Surface".
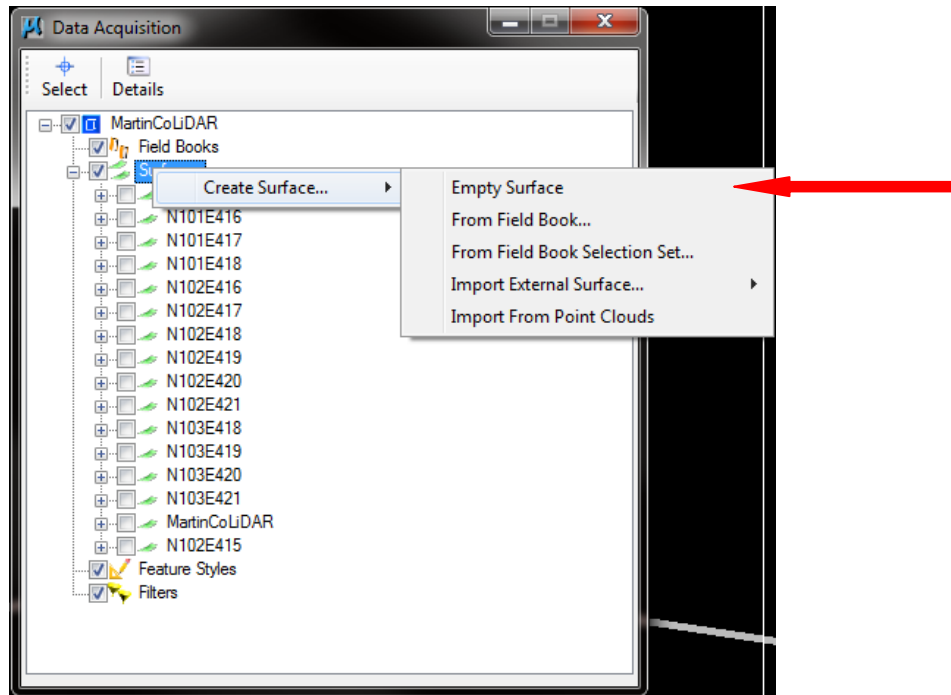
A new surface will appear at the bottom of your list. Right click on the new surface and select "Append From" and systematically go through each LiDAR tile and append them to the new surface. As with the rest of this process, be patient because it takes a while to combine each surface and you have to append each one individually.
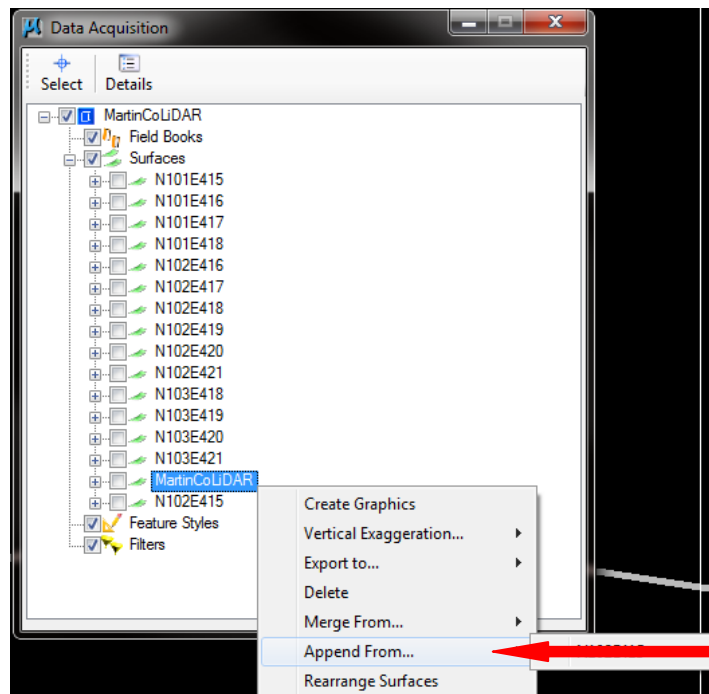
Once you have finally gotten all your tiles together, you can export them to an InRoads DTM. Select the surface where you combined all the tiles, right click and select "Export To>InRoads DTM". It is important to note that if you delete any of the original tiles from data acquisition that this will also delete it from your "merged" surface.
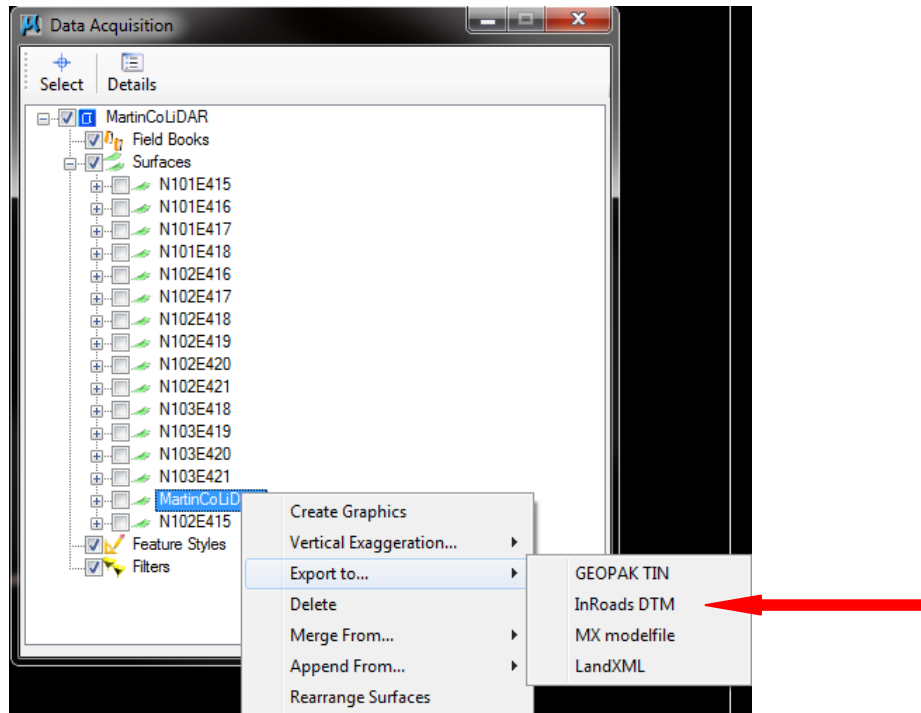
 A dialog box will pop up asking for the name of the file you are creating. Once you give it a name, the process will begin. This may take a few minutes but once the surface is created, you are done!

It is important to note that because of the detail of LiDAR, your contours WILL NOT be smooth. They will not look like they used to look. Also, there are no breaklines in the LAS file, just mass points. InRoads will treat these points as a random feature and triangulate accordingly.

If you have any questions please contact the CO Developmental Branch, 502-564-3280.