Georgia Department of Transportation

Introduction to Photogrammetry

Mapping Setup

Guidelines

Office of Locations

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Date	Revision Number	By	Section	Description

Table of Contents

This document was developed as part of the continuing effort to provide guidance within the Georgia Department of Transportation in fulfilling its mission to provide a safe, efficient, and sustainable transportation system through dedicated teamwork and responsible leadership supporting economic development, environmental sensitivity and improved quality of life. This document is not intended to establish policy within the Department, but to provide guidance in adhering to the policies of the Department.

Your comments, suggestions, and ideas for improvements are welcomed.

Please send comments to:

> State Location Office
>
> Georgia Department of
>
> Transportation 3993 Aviation
>
> Circle, NW
>
> Atlanta, GA. 30336

DISCLAIMER

The Georgia Department of Transportation maintains this printable document and is solely responsible for ensuring that it is equivalent to the approved Department guidelines.

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Introduction

Photogrammetry utilizes measurements obtained from aerial photography and digital stereo plotters to generate digital map data that contains man-made and natural terrain features which are referenced to the State Plane Coordinate System of Georgia. This data is then submitted to Survey Data Engineers as planimetric MicroStation (.DGN) files and topographic 3D mapping Digital Terrain Model (.DTM) files in InRoads. The digital mapping data is used as a database in the development of highway project plans.

These Photogrammetry Guidelines have been developed as part of the statewide GDOT implementation of MicroStation V8i and DAT/EM. The intent of this document is to provide guidelines and standards for processing photogrammetric data in Microstation V8i by way of DAT/EM. These guidelines must be followed in detail in order to conform to the current GDOT standards for producing the required photogrammetric deliverables. Updates to this document will be made periodically when minor revisions, additional information, and/or enhancements are added.

> If there is any approved deviation from the standard file and data naming/feature style conventions as prescribed by this document - a detailed description of the deviation(s) and approved reasons for the deviation(s) shall be documented and included with the project files in electronic format.

The objectives of this tutorial are to:
- Demonstrate the process required for setting up a photogrammetry job through Datem.
- Setting up your keypad.
- Setting up your Mouse pad.
- The general idea of what needs to be picked up in Photogrammetry and the principle of mapping.
- Demonstrate the process required for Z indexing.

Contact Information

To submit any comments or questions regarding the information contained in this document, please contact the **Office of Location:**

Please feel free to contact the parties involved in creating this document:

Mr. Benny Walden: Bewalden@dot.ga.gov

Mr. Dwayne Wilson: Dwilson@dot.ga.gov

Mr. William Retzloff: Wretzloff@dot.ga.gov

Mr. James Whitlock: Jwhitlock@dot.ga.gov

In the Email Subject Header, please reference the **Introduction to Photogrammetry Guidelines**

Start MicroStation V8i

In this section, you will be opening **MicroStation V8i Select Series 2** in the '**GDOT-Corporate Workspace**' and **Datem.** You will also select a "seed" file to use for the "Working" DGN file. This "Working" DGN file is used to display the temporary and/or permanent graphics in **InRoads**. **MicroStation** is opened first and then **Datem** is opened.

7.	From the desktop, double-click on the **GDOT MicroStation V8i SS2 (x86)** icon.
	Double click on the icon *labeled **DOT MicroStation V8i SS2 (x86)**.*
	This can also be done from the start menu.
	• When the **MicroStation Manager** dialog box opens – navigate to the **C:\InRoads Data\Standards** folder and select the "**GDOT 3D Working File.dgn**". Click **Open**.
	*After the **MicroStation** Splash Screen appears, the **MicroStation Manager** dialog (See Figure L1-1) will open so that you can select a "**Working**" DGN file. Once **MicroStation** is up and running, your desktop should look similar to that of Figure L1-2.*
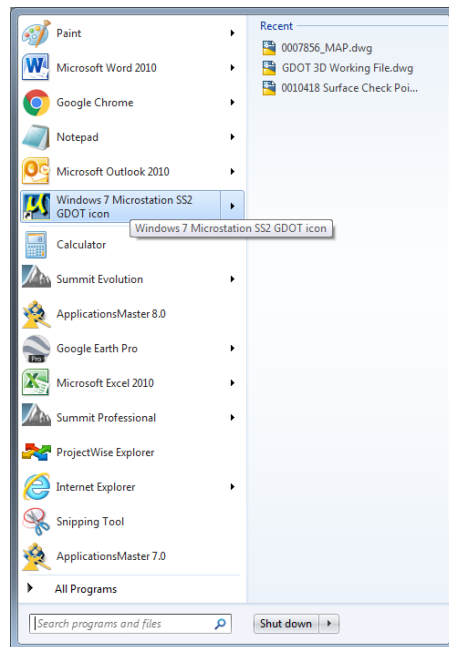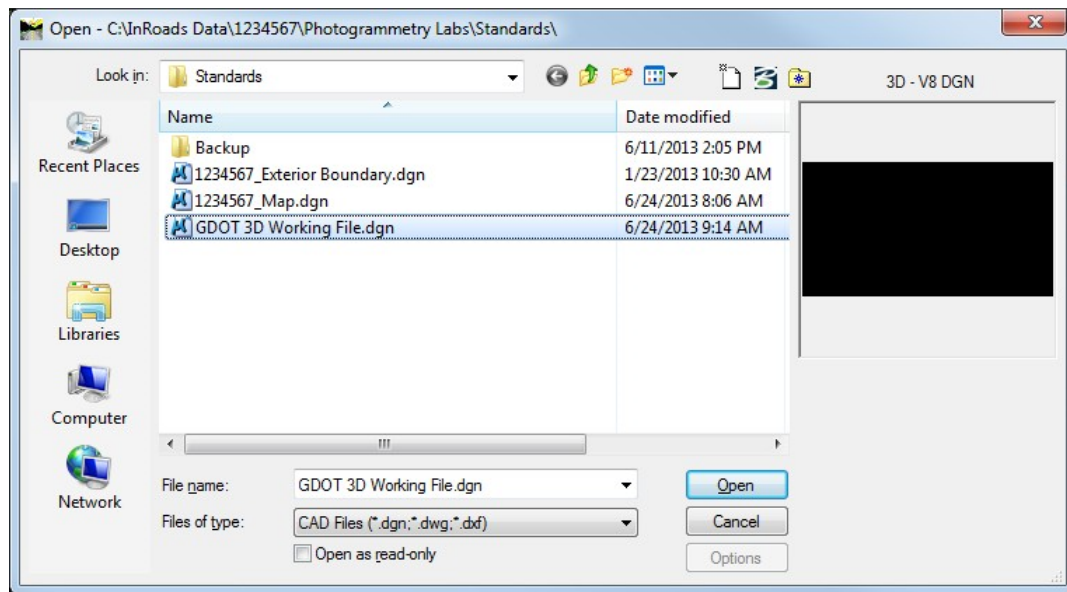
Figure L1-1 Starting **MicroStation V8i and InRoads Suite V8i**
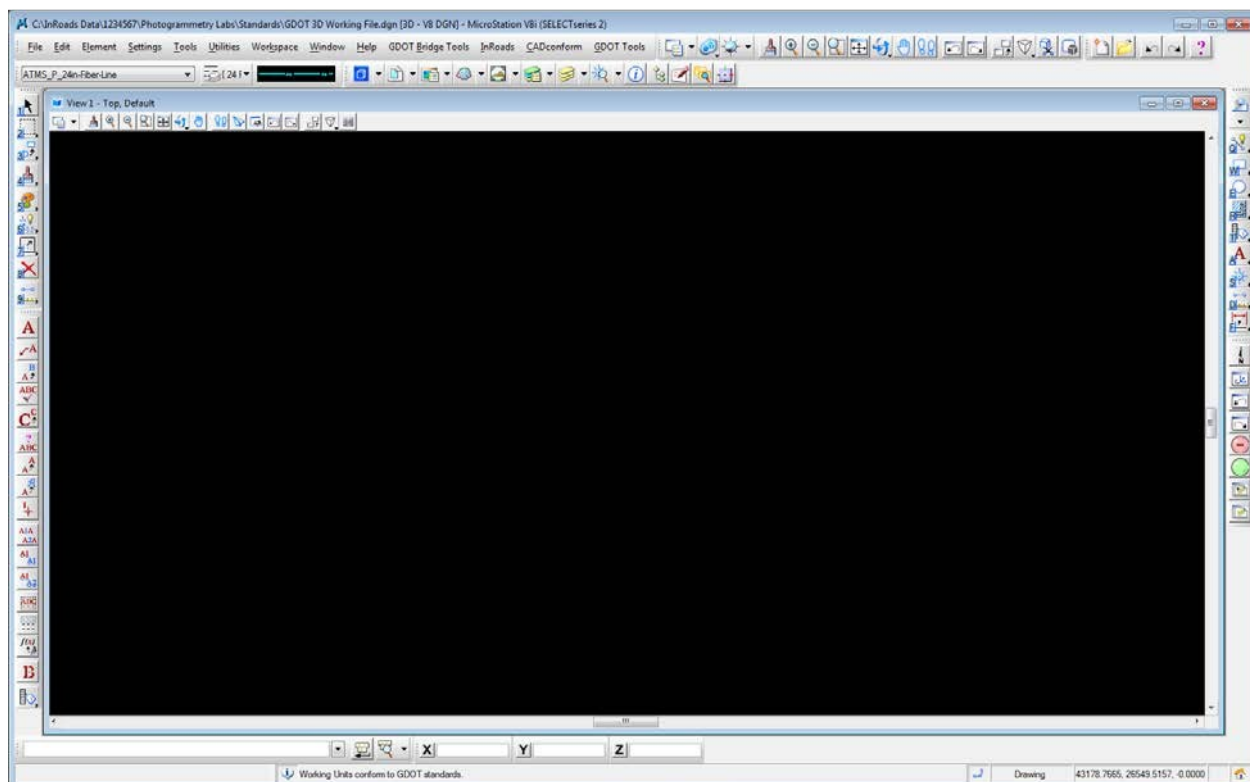
Figure L1-2 Main **MicroStation V8i** Window

Mapping Setup

- The equipment you will need is a 3d mouse device. See Figure L1-3.
- A 3D monitor
- A 3D glasses
- A 3D emulator
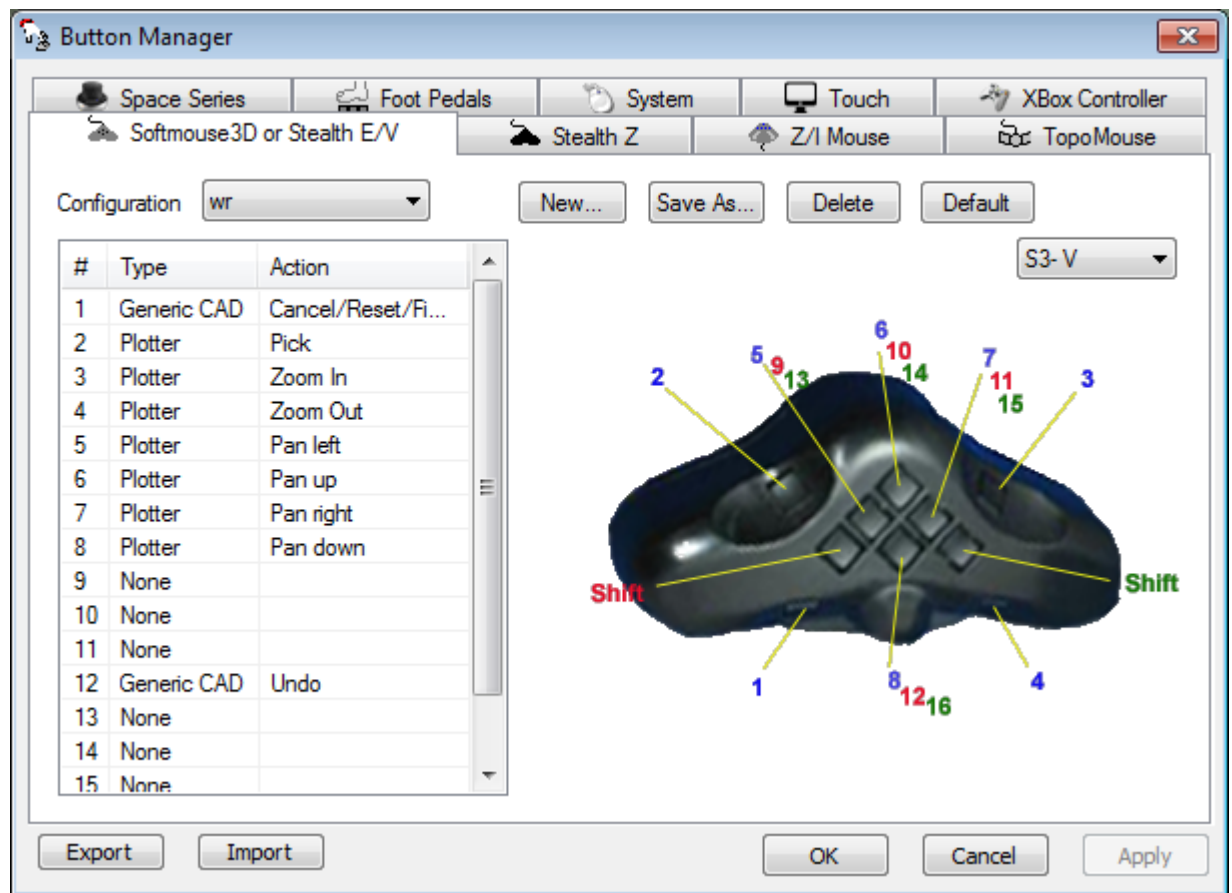- A Dat/em keypad that has all of your 3d and 2d feature codes for mapping. See Figure L1-4.

Figure L1-3   3D Mouse device at Button Manager

Figure L1-4   Keypad

Mapping Setup:

In V8i, go to File > open a [GDOT 3d blank working file].

- In V8i Go to Tools > and select all the tools shown below that have a check mark beside them. Feel free to familiarize yourself with the options to choose other tools that can benefit you.
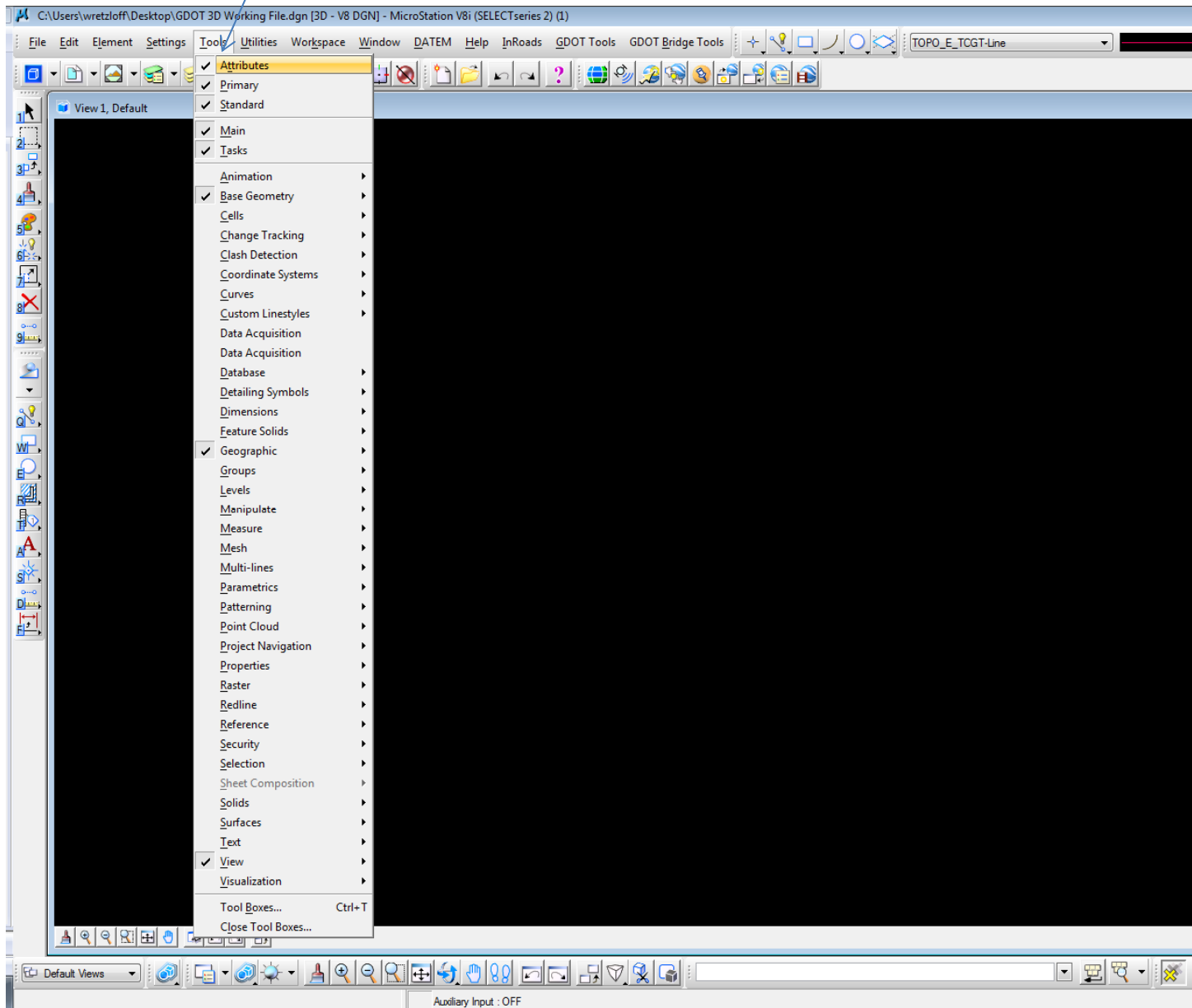
Start DAT/EM Summit

In this section, you will be opening **DAT/EM SUMMIT**

- If you have a project that is ready to be mapped go to the correct file location and double click the summit file. It ends in .smtxml shown below.
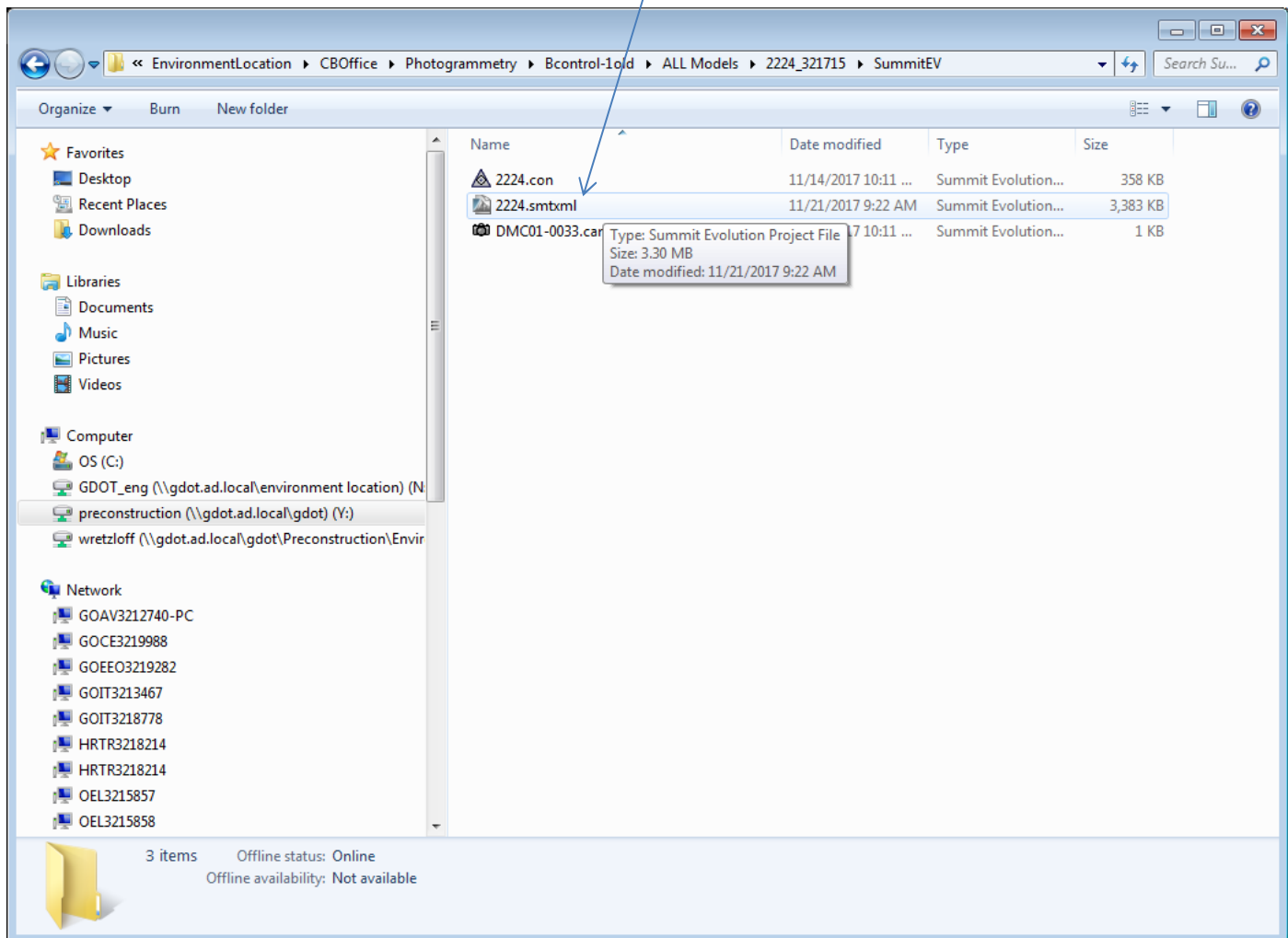
- If you don't have a project ready you can still just open the summit professional icon from your desktop.
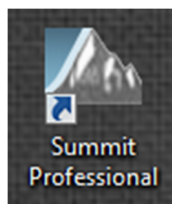
Once you have summit opened you need to make sure you know where your correct file location(s) are for your images.

- If you open summit through a project that is ready to be mapped usually the images and everything you need are already loaded correctly.
- If you open Summit by just clicking the icon summit will open a blank template.
- Below is Summit opened from a project ready to be mapped and on the right side you can see the models loaded in.
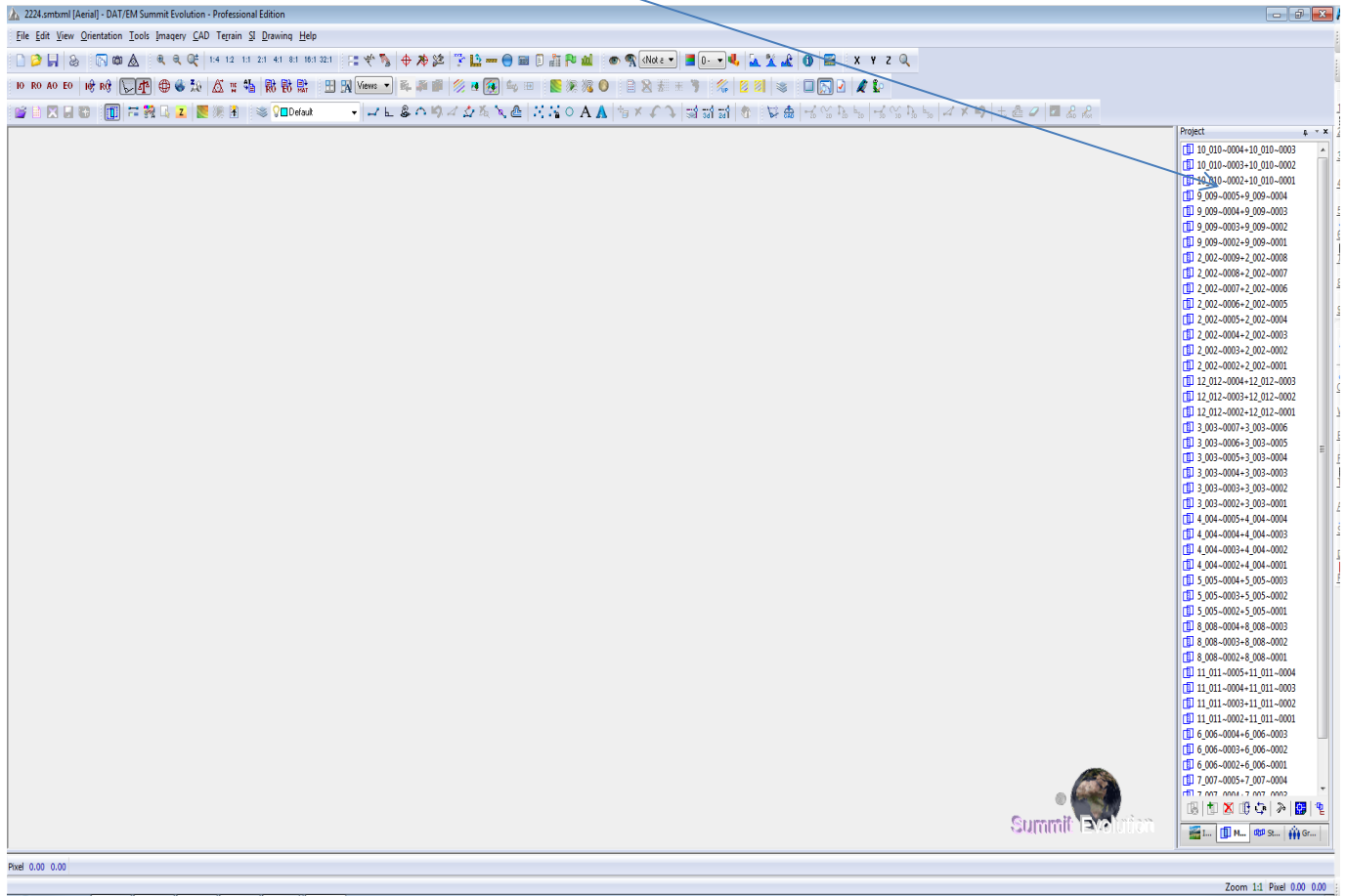
- If summit opens with nothing but a blank template you need to locate the project you wish to map and the images.
- Once you open the project you are mapping in the bottom right corner of summit click the images tab. Shown below.
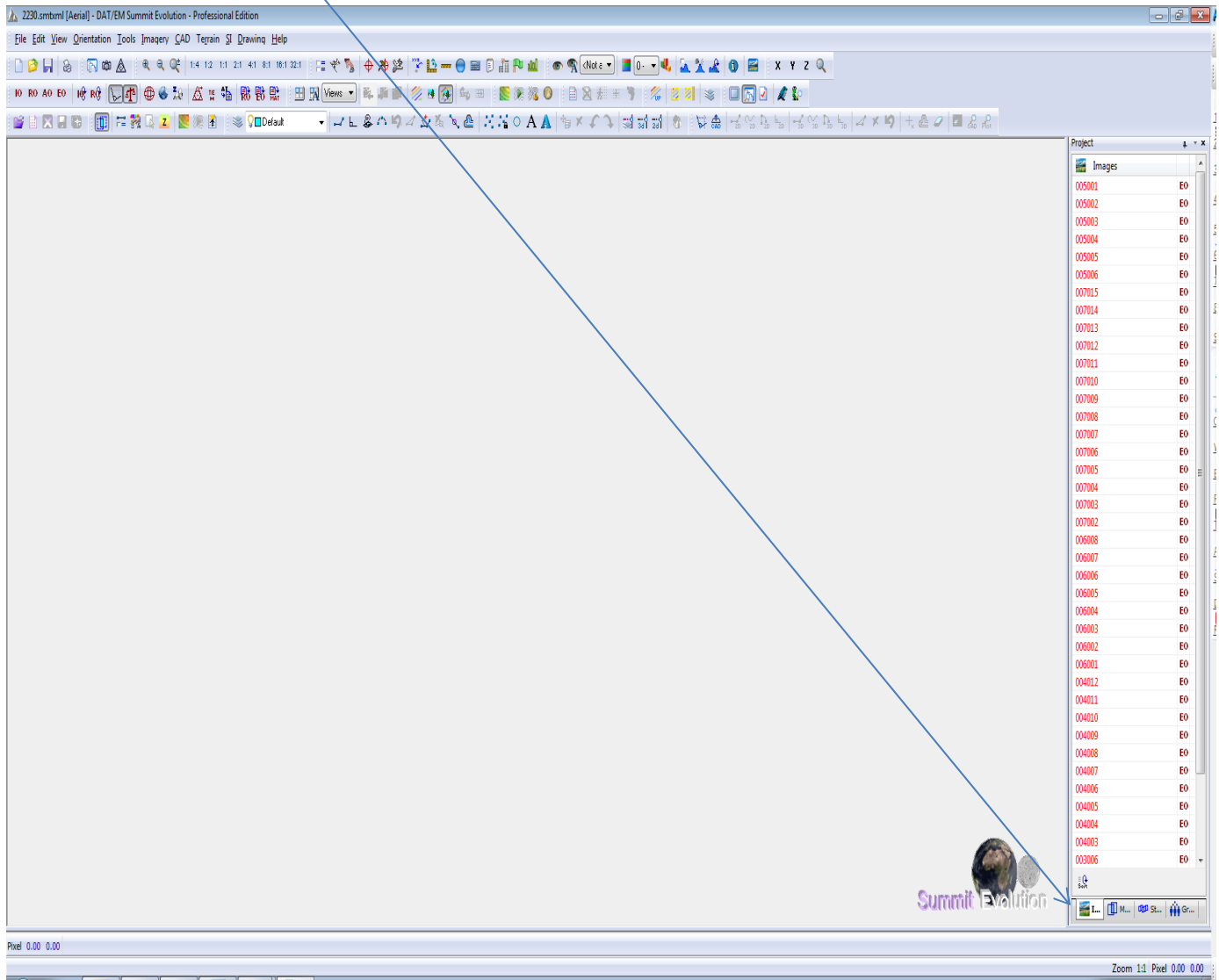
- If the images have red text you need to locate the correct file location.

- If the images have black text you just need to go back to the models tab and select the correct model you want to work on.
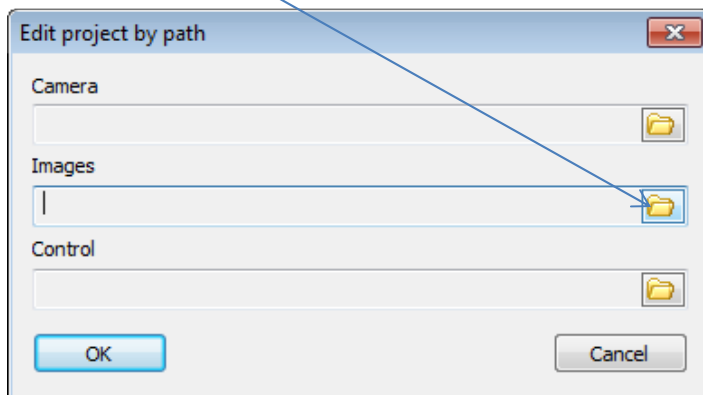
- Locating red text images.
  - o In summit go to EDIT > PROJECT.
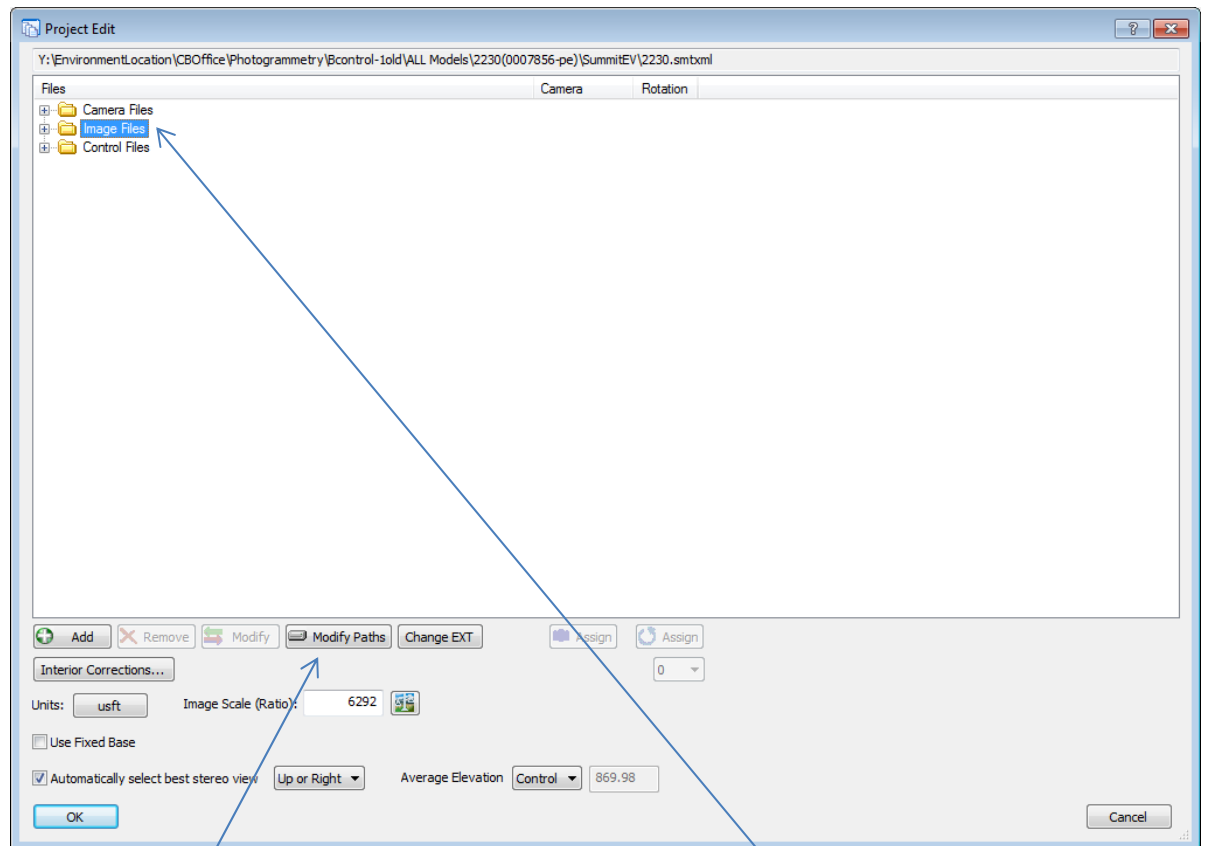
Select the Image Files folder.

- Click modify paths button.

Select the images folder button and browse to where the images are located for that Project.
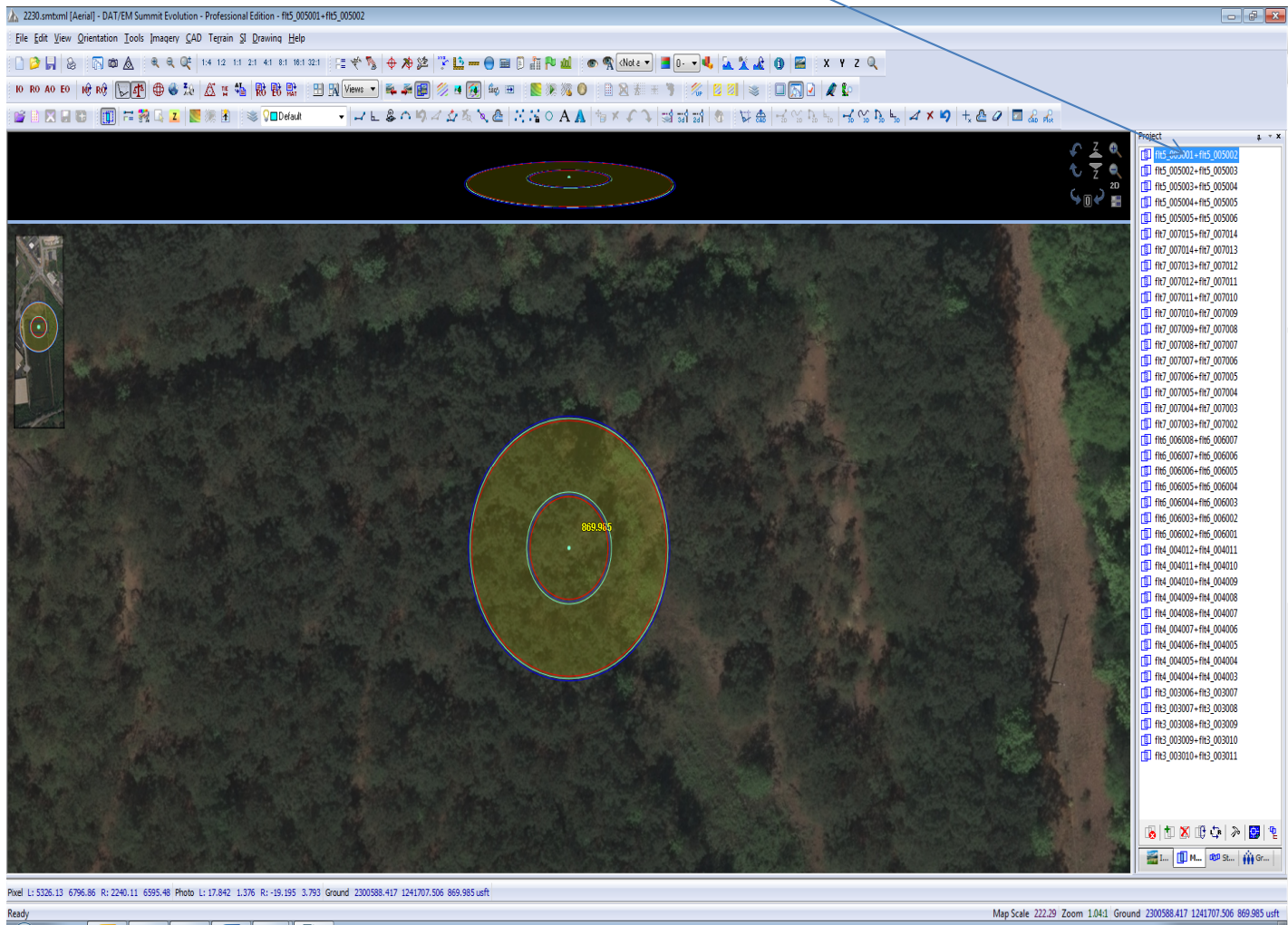

Once you find the images, click OK > OK.

You should now have black text in your images tab in summit. Shown below.
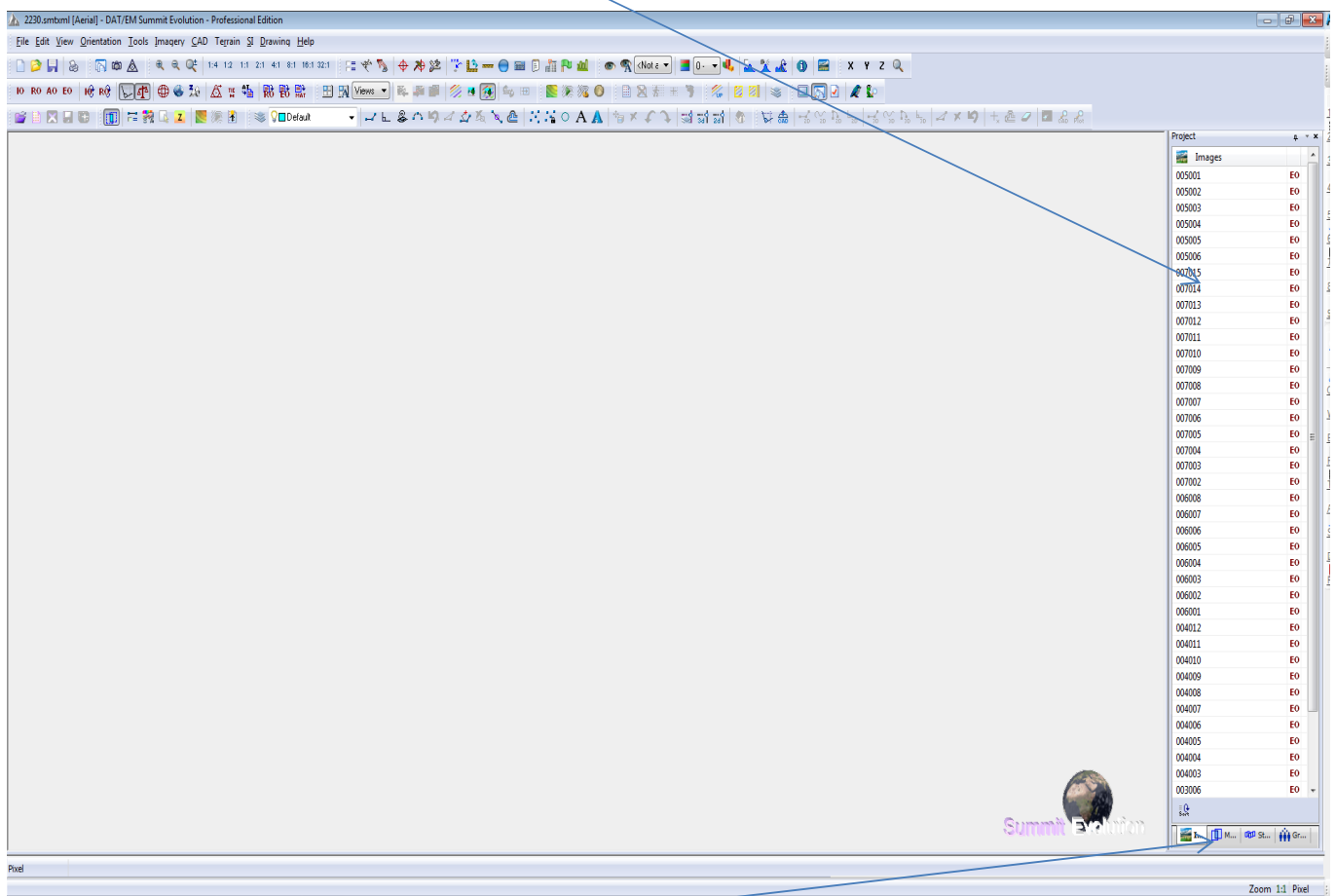
Now you can select [models tab].

Next, you can select a model to map and your images should come in.

3D Mouse Setup

Now that your project is loaded and your images are viewable, you now need to make sure your 3D mouse is working.

Your 3D mouse and 3D emulator should already be connected to your computer and you should have a green light on your 3D emulator. If not, contact or find a supervisor for help.
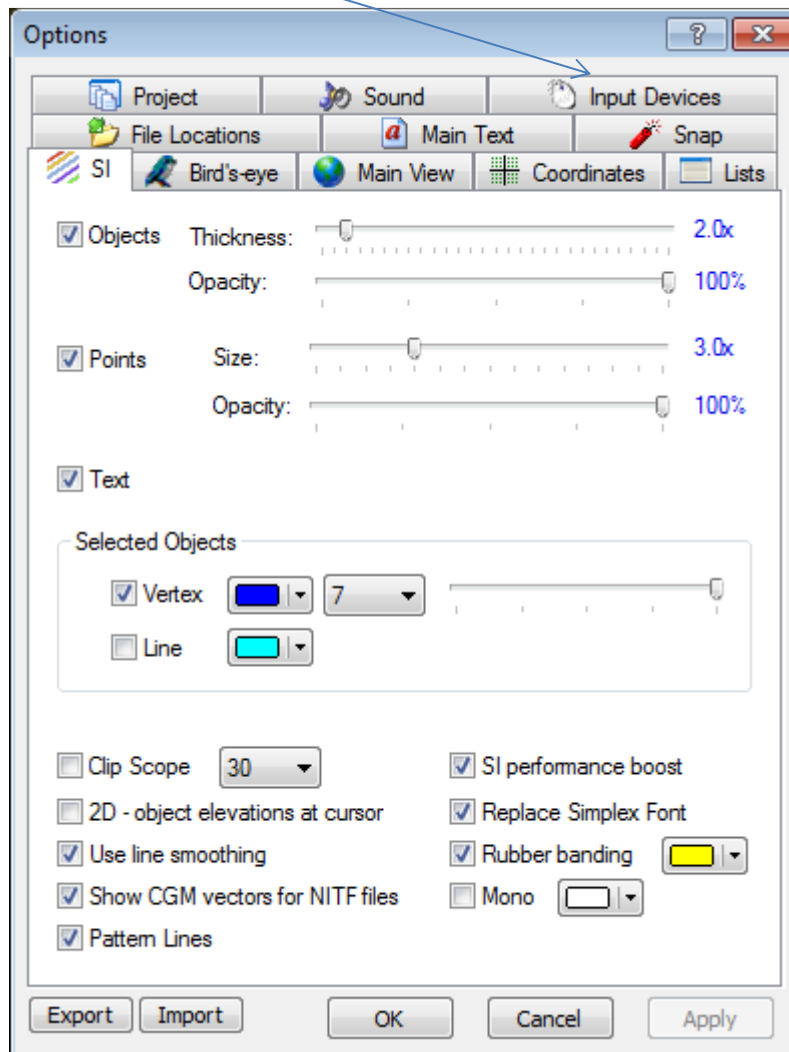
Move your 3D mouse in summit. If your images or cross hair are moving, then you are connected properly.

If nothing is moving, you need to find your 3D mouse in Summit's Tools options.

- Locate 3D mouse:
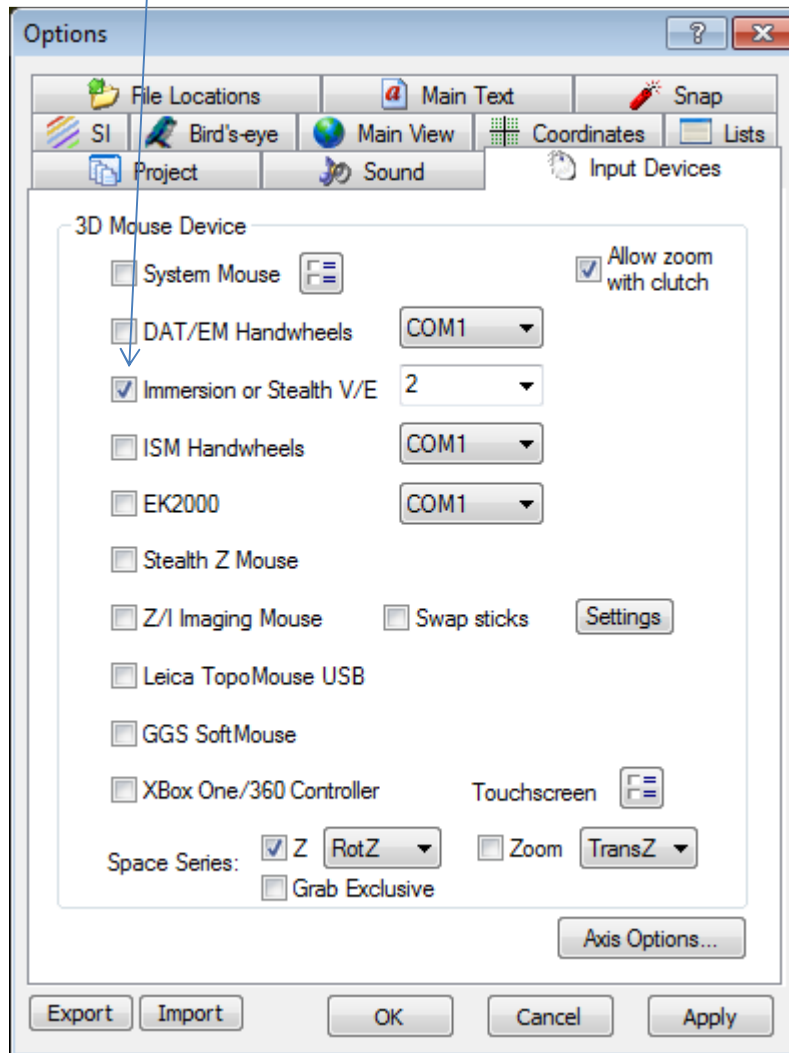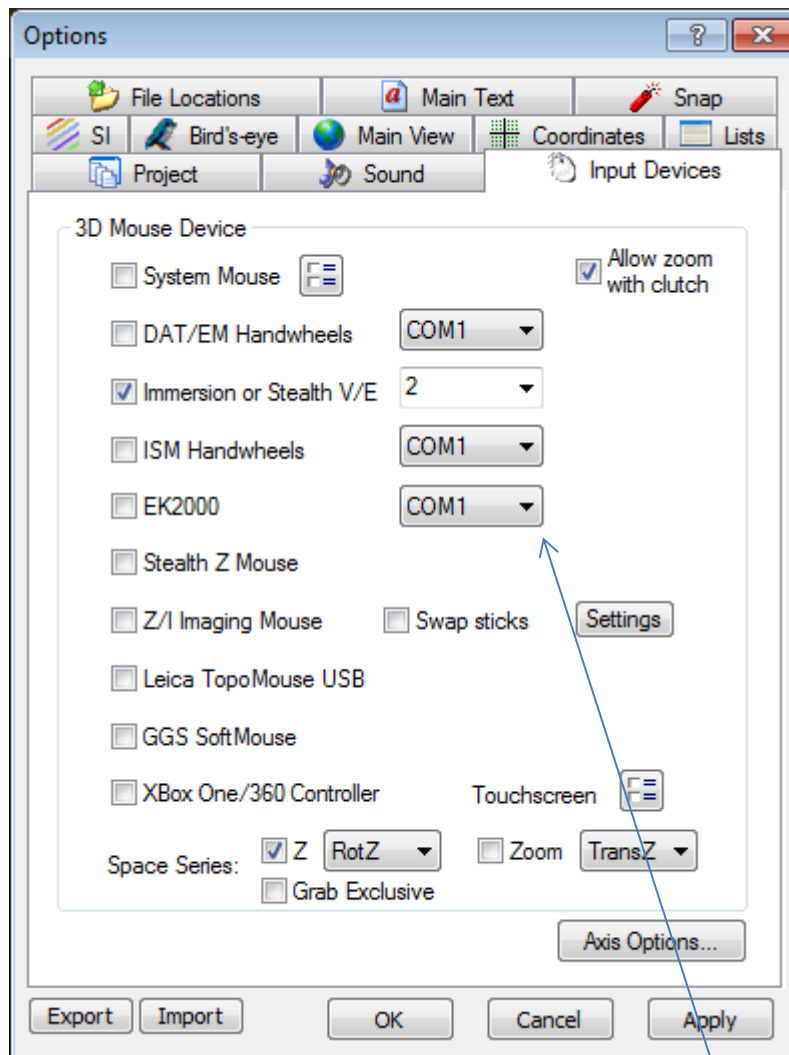 - o In summit, go to Tools > options
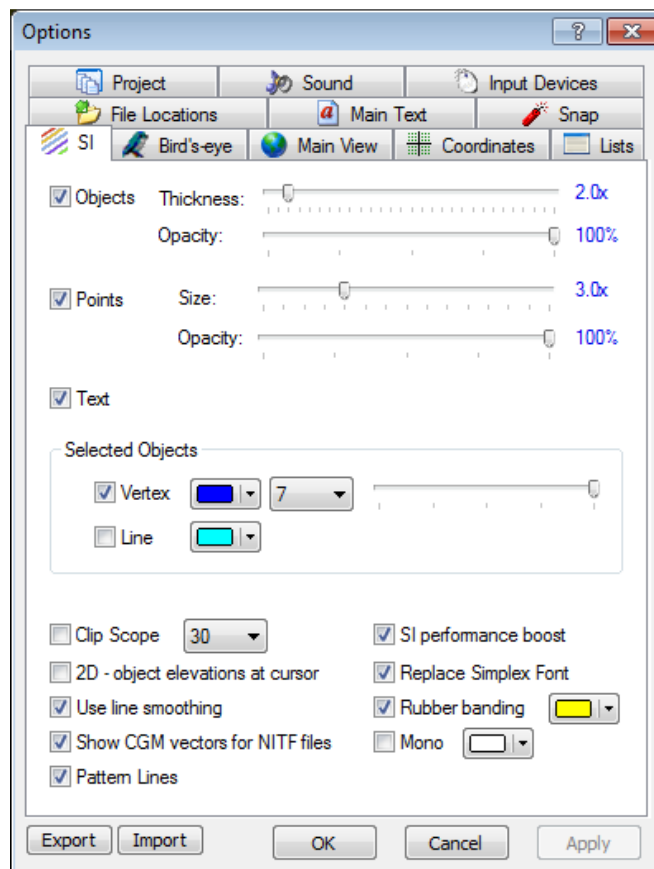
- Select the input device tab.

Once you selected input devices, you need to make sure you know what 3D mouse you are working with.

GDOT currently uses the Immersion Stealth 3D mouse (verify your mouse upon setup). Place a check mark on immersion or Stealth V/E.

NOTE: Move the mouse and see if you are getting movement in summit.

If not, you may need to troubleshoot the COMS. The COMS need to be the same number but can be moved from com1 through com4. The reason behind this is because some devices that are connected via USB are already interacting with your computer on a specific COM and your 3d mouse can't connect on that COM and needs a new COM. (after initial setup, this should not need to be done again, first reboot your CPU if you are having problem before attempting to change COM)
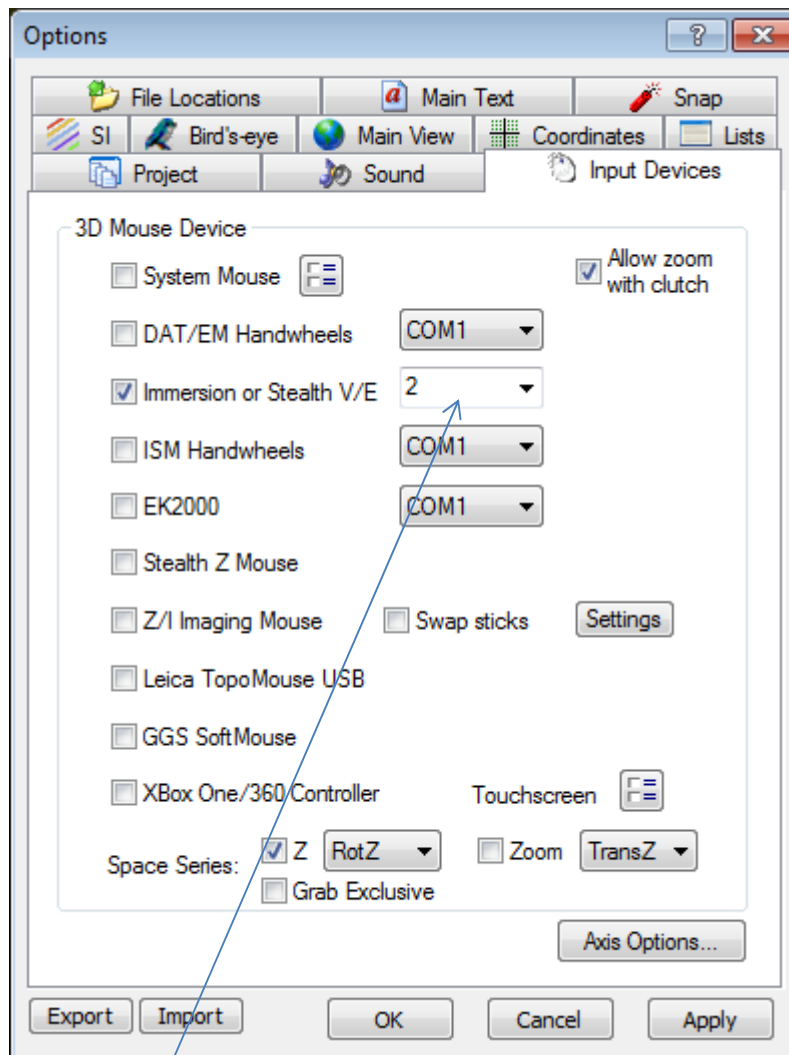
This number can be changed 1 through 4 and does not have to match the COMS numbers.

- Every time you change to a new COM, click the [apply button] and test your 3D mouse for movement. If you still have no movement in your 3D mouse, contact your supervisor or your I.T. department for assistance. (after initial setup, this should not need to be done again, first reboot your CPU if you are having problem before attempting to change COM)

3d Mouse Button Configuration:

- If you have already mapped your buttons to your 3D mouse, you can bypass this section.
- To map your buttons to your 3D mouse in summit, go to TOOLS > BUTTON MANAGER.
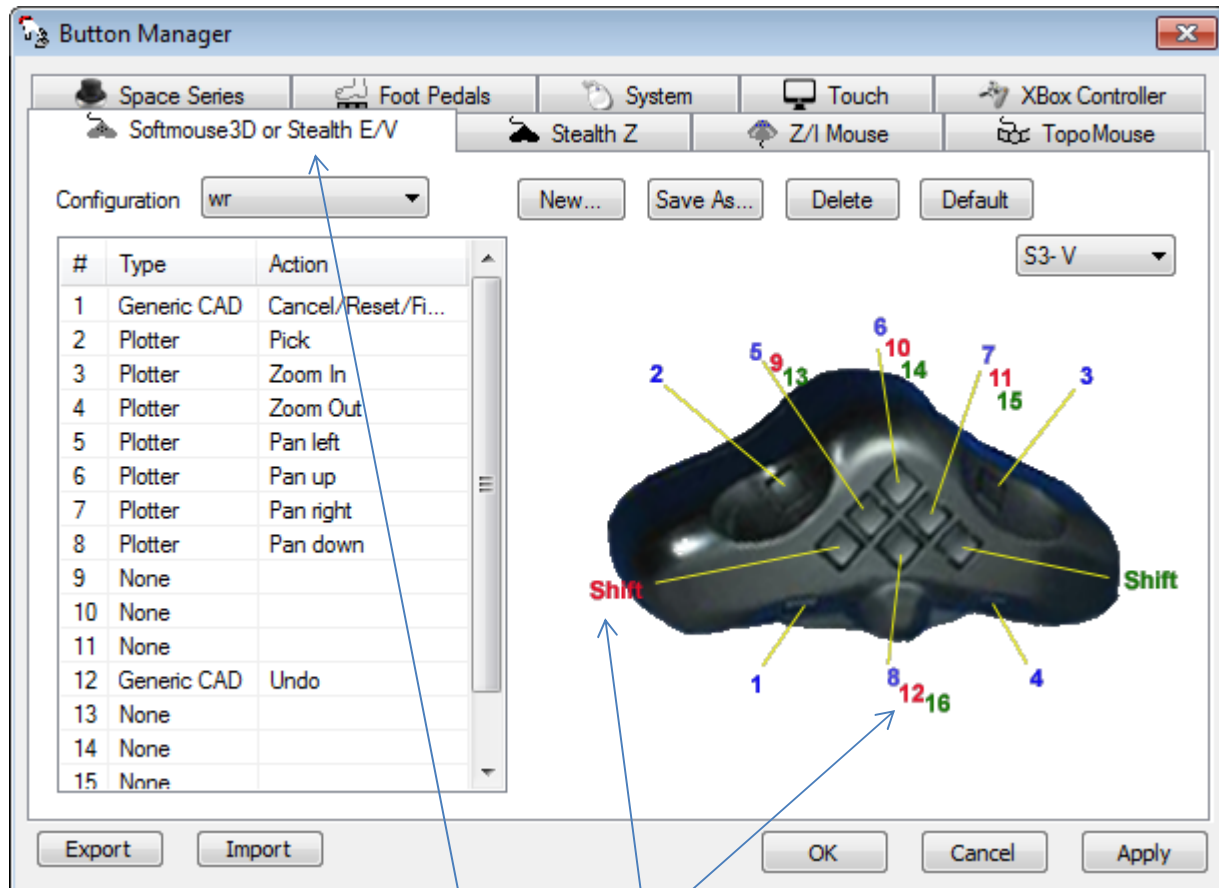
- Select the correct 3D mouse you are using and follow the number layout map to what you want a specific button to be.
- Example: the blue numbers are 1 hit buttons. Meaning you just click a button once on your 3d mouse and it will do what action you programmed it to do.
- The red numbers require you to hold red shift then click a red number button to complete an action command. Same for green numbers require you to hold green shift then click a green number.

To change a numbers [commands], first highlight the number on the left then click the plotter cell.
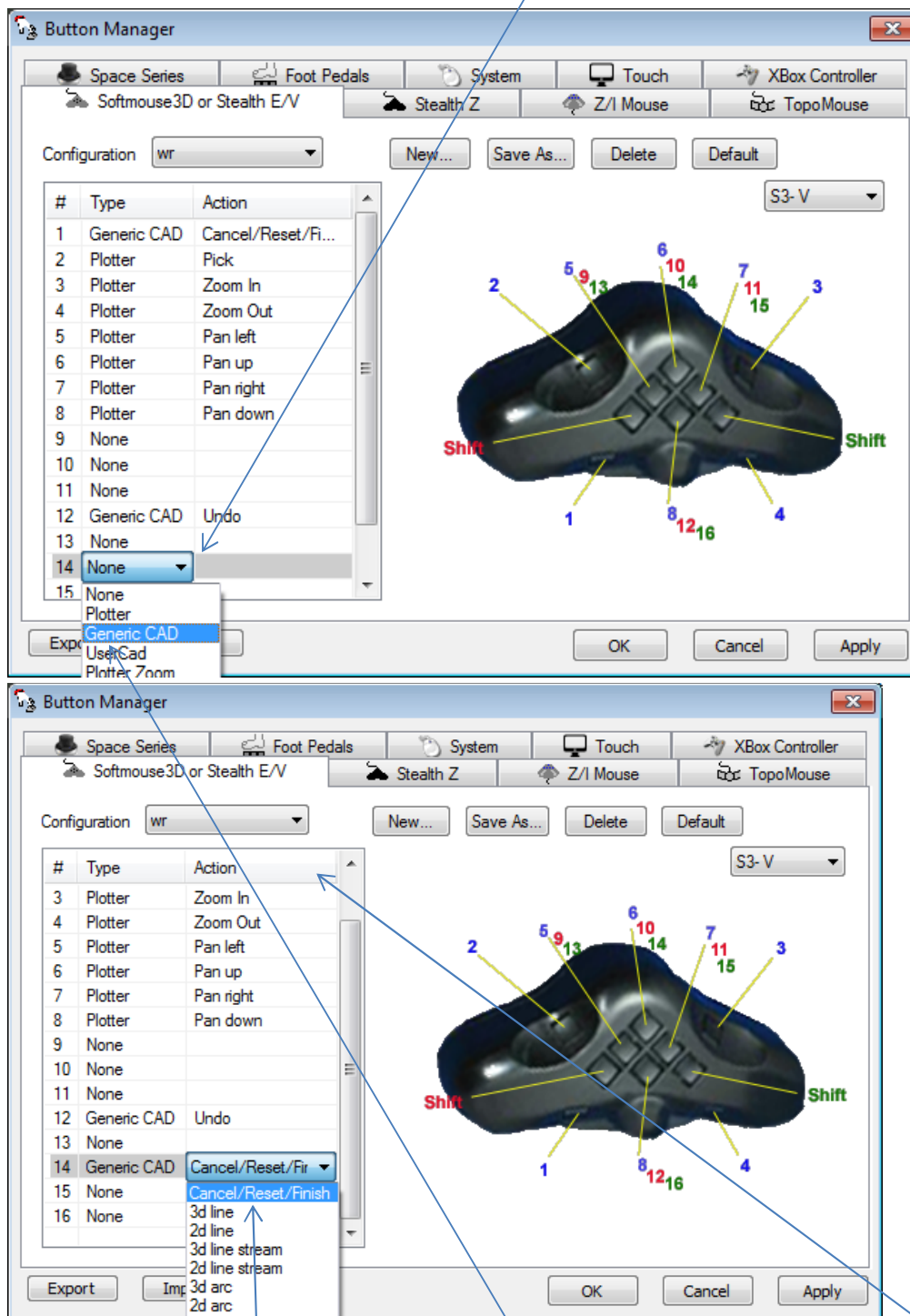

- For GDOT mapping, we're using [Generic CAD] type, and then choose what action you want in the drop down list for that number. When you're finished, select APPLY > OK.

Keypad Setup

Now you need to calibrate your keypad to work with summit and V8i.

- First, make sure you have an updated keypad layout printout inside your keypad.
- Then in the bottom right corner of your windows task bar, select the show hidden icons button.
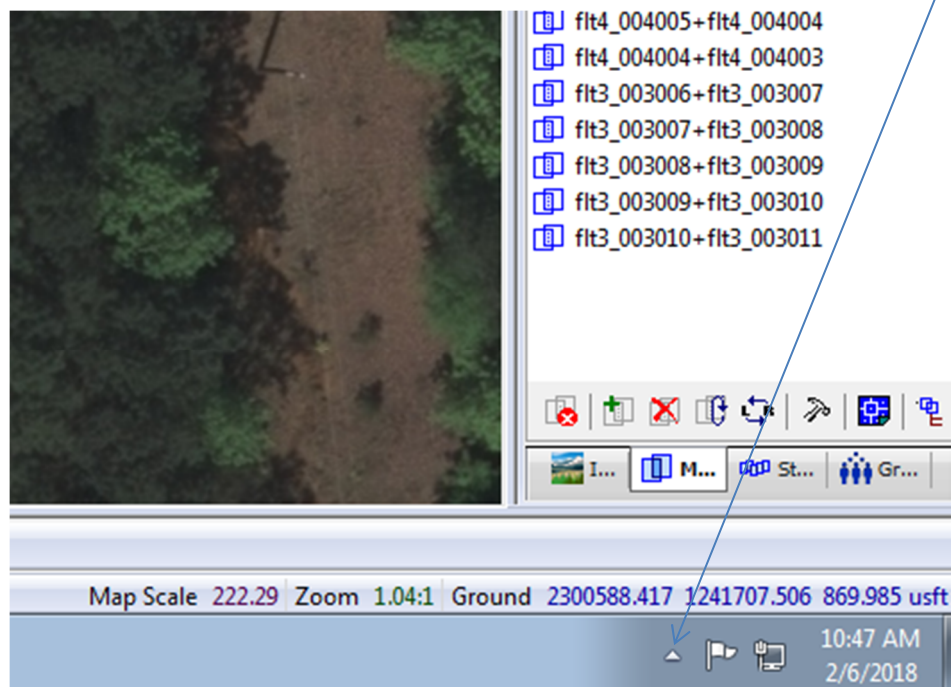
- Then right click the SLB keypad blue icon and choose OPEN.
- It should open to the location of the blue icon keypad. If it does not, hover over the icon and it should show you the file path to locate the file.
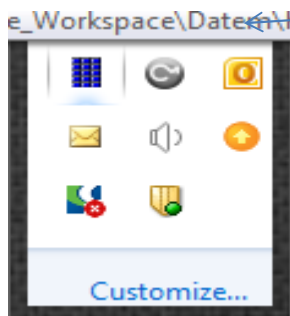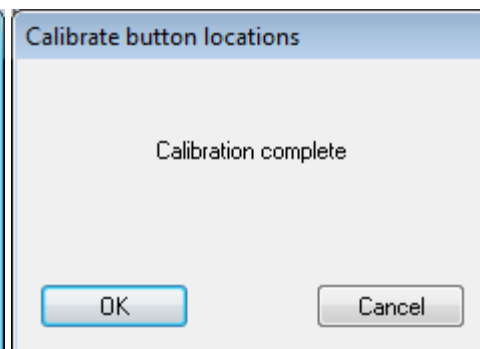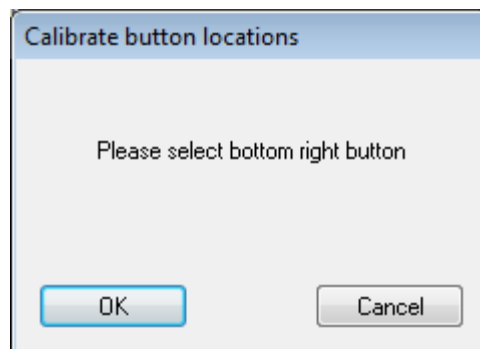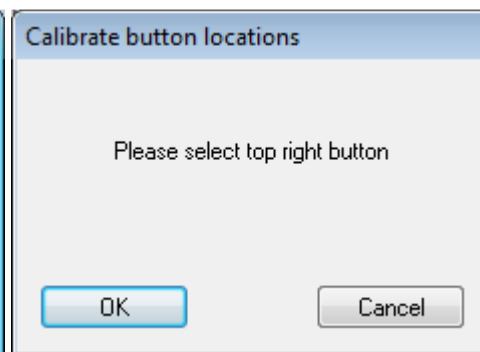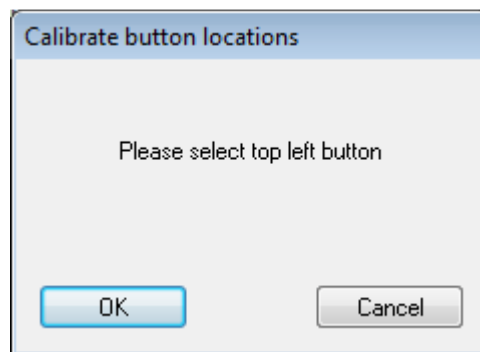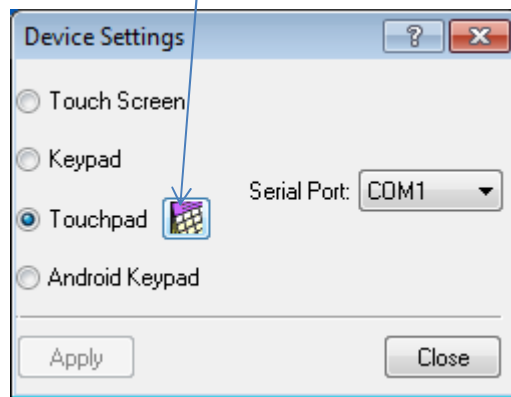
- Open SLB Keypad.

- Then go to TOOLS > DEVICE SETTINGS.

Click the Touchpad button.

- On your actual key pad, the sheet of paper should have three red crosshairs on the corners of the paper. Top left / top right / bottom right. When you press one of the red crosshairs with your finger, the calibration button will change to the next button location until completed.   Click OK.   Close.
- **Important:** Don't close the keypad just minimize.

Mapping

This section cannot actually teach you how to map as mapping entails being able to see the elevations from the aerial images using the 3D glasses and accurately mapping on the ground surface. This section however goes over items that should be picked up and mapping principles to keep in mind.

Features that should be captured:

- Dam, Toe
- Dam, Top
- Headwall/wingwall top
- Paved ditch
- Ditch flow line
- Obscured areas (text also)
- Swimming pool
- Ruins (old infrastructures or what's left of it)
- Construction boundary (active construction and the text)
- Curb & Gutter
- Top of Curb
- Bottom of curb, flowline
- Crown of Road (when roadway features are actively being picked up)
- Edge of Asphalt Drive
- Edge of Asphalt Pavement (when roadway features are actively being picked up)
- Edge of Ashpalt Shoulder (when roadway features are actively being picked up)
- Edge of Concrete Drive
- Edge of Dirt Road
- Emergency lane (when roadway features are actively being picked up)
- Edge of Travel Lane (when roadway features are actively being picked up)
- Edge of Lake (text also)
- Terrain point on breakline
- Edge of River (text also)
- Random Terrain point (sparse areas where you know the elevation should be constant but you can't see well enough to place breaklines)
- Sidewalk, edge
- Wall bottom
- Wall top
- Catch basin (text also)
- Drop inlet (text also)
- Ditch Taper

- Golf Course (text also)
- Planted trees (text also)
- Swimming pool (text also)
- Quarry symbol
- Tank/silo
- Buildings
- Houses
- Mobile Homes
- Playground text
- Underground Storage Tank text (UST)
- Bridge Perimeter
- Cemetery (Text also)
- Parking text
- Trail text
- Barbed wire fence
- Wooden/Privacy fence
- Chain link fence
- Gate
- Guardrails
- Trailer Park (text also)
- Tree line
- Billboard sign (text also)
- Overhead sign (text also)
- Signs
- Two-legged sign
- Commercial signs
- Paint striping
- One Tree
- Deck/Patio
- Wall Top
- Wall fence
- Railroad Signal
- Pole
- LP Tank (text also)
- Railroad centerline
- Satellite Dish (text also)
- Utility box (text also)
- Fire Hydrant

- Man hole with text
- Gas valve
- Transmission line
- Light pole
- Multi- light pole
- Power pole
- Transmission tower
- Yard light

Things to keep in mind when mapping:

- Verify what zone you are mapping in, Georgia West or Georgia East
- Reference in your limit lines
- Reference in all tie models before you start on your model
- Check sign out sheet before you start your model
- Review what was done on they tie models before you start your model
- When drawing in your feature, do not have points exceed 50 ft apart
- Slopes should be drawn with breakline at top and breakline at bottom
- Find a method to approach each model and stick to it as to avoid skipping items, i.e.
    - Where you will start the model (Top right, Top left, Bottom right or bottom left)
    - When you will do your obscure areas, your 3D areas or your 2 D areas
- No Random or terrain breaks in parking lots unless there is a drop inlet, then you put a terrain break around the elevation at the drop inlet.
- If parking lot has a slope, then put terrain breaks to capture the slope
- Do not label landscape material around playground, i.e. flower beds, etc
- Be careful when snapping
- Driveways and sidewalks should be closed (terrain breaks can snap to either feature to close off when close to a building
- Label catch basins (TECP) and man holes (M.H.) when doing sidewalks
- Concrete Island that does not have curb and gutter, be sure to capture the bottom of the island and the top if raised.
- Do not map crown of road in curve areas, only show crown of road in tangent (areas without curve).
- Use built-in Micro-station function with Google maps to verify areas you are unsure about from your aerial photo model image.

Z-Indexing

This section goes over the instructions on how to Z index your model. Z index is a method used to make tiny elevation corrections for users who tend to read the ground a little low or a little high compared to their coworkers. Z index is not used to correct orientation or errors from bridging, it only brings your reading back in perspective to the controls measured against.

- To start Z indexing, first you need to know what model you're working on.
- Once you selected your model in summit's model tab and you see your images, you are now ready to begin Z indexing.
- In summit, go to ORIENTATION > Z INDEX.
- A [Z] index point box will open shown below.

There are 2 ways you can Z index, either by selecting multiple points (if available) or single points. Some models might only have 1 point to measure. When selecting the Z index point/(s), only select the 5 digit points in the point box (These points are the ground control points and will be named accordingly to match points picked from aerial photo). They are usually always the first set of numbers.

- To measure multiple points, in the **Measure** section, select selected.
- Click the first point and hold shift and click the last point.
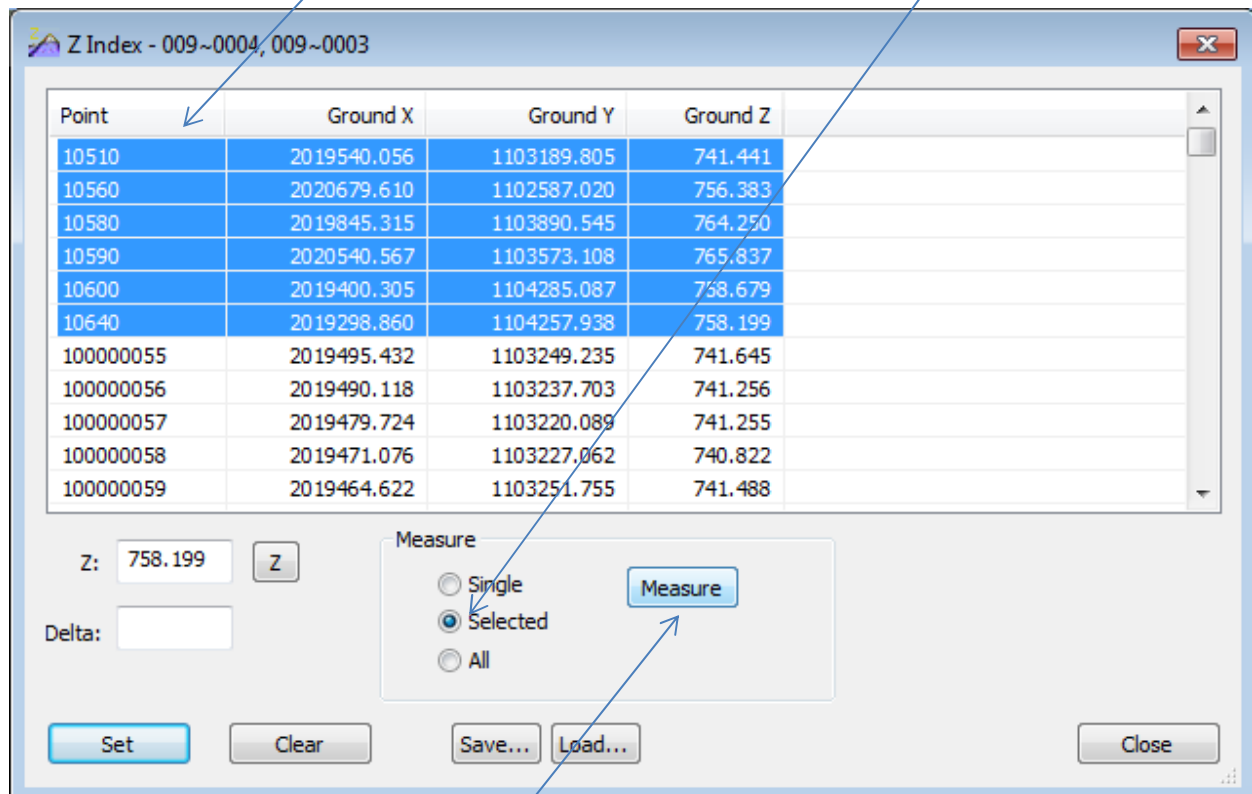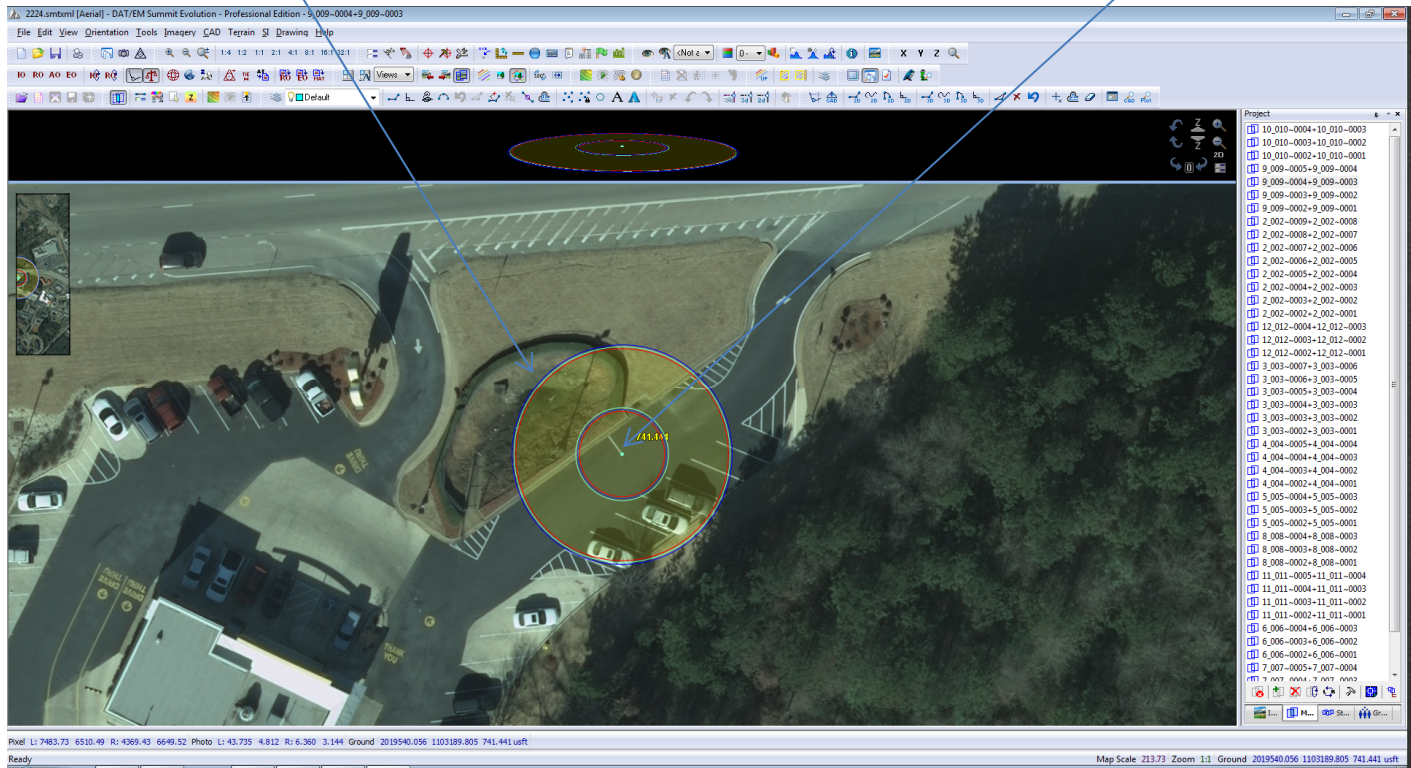

- Now click the measure button.

Note:

If you only have 1 point to measure, you can select [single] measure. Sometimes the Z index dialog box does not measure all points in [selected] mode and single mode is used in its place to measure all Z index points for a model.

Once you have clicked the measure button, Summit is going to drive you to the area of that Z index point. For accurate feedback, you now need to look on the back of the original photos for that model and find exactly where that point is located before measuring to get the best possible reading for that point.

Image below is the back of photograph for a particular model to help guide a mapper to the correct location on a control Z index point.
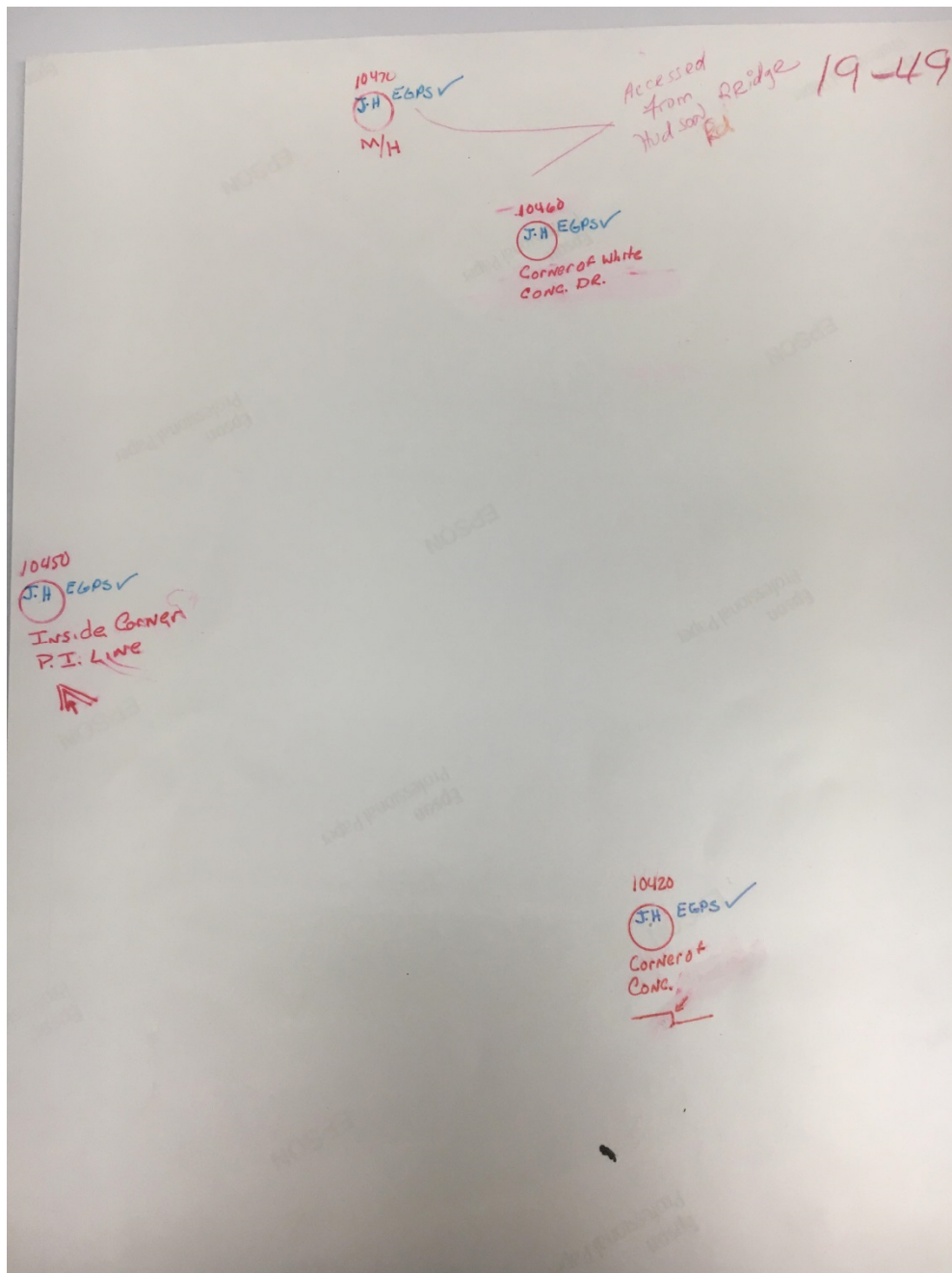
When you find the correct location of the Z index point you are measuring, use your 3D mouse and place z cross hair cursor on the location and use 3D mouse Z wheel to measure the point on ground level of how you see it in your eyes.

Once you think the index point is ground level and measured correctly, click the [pick command button] on your 3D mouse to accept the elevation measured. To find what your pick button is on your 3D mouse, go back to 3D mouse button configuration to locate it if necessary.

Once you picked that first Z index point, summit will drive you to the next area for the next Z index point to be measured. Repeat these steps until all Z index points are measured for your model.

- When you measure your last Z index point, you will have your delta reading in the Z index dialog box appear as shown below.

- Click the [SET button] to accept your new Z index
- Click close to close out of Z index dialog box.

In the above example, the delta reading is -0.324 which means this mapper see's around 3 tenths below the original aerial triangulation setup. If your delta reading is around +/- 5 or +/- 6 tenths difference, contact a supervisor to investigate the model and readings.

Note:

Always remember to go back and Z index periodically throughout the day, at the start of the day, after breaks, lunch, and etc to make sure you are still mapping with your correct measured eye sight readings relatively consistent at all times to the ground control.

Notes