

Office of Engineering Division of Facilities & Transit



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Guide to the Earth Exploration Toolset with MicroStation V8i and OpenRoads

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Chapter 1 Introduction

The required versions are as follows:

ProjectWise Explorer V8i (SELECTseries 4) - Version 08.11.11.566 MicroStation V8i (SELECTseries 4) - Version 08.11.09.832 InRoads Suite V8i (SELECTseries 4, OpenRoads) - Version 08.11.09.872

The CTDOT MicroStation Earth Exploration toolset was created to improve the process of attaching aerial photography, reprojecting data and creating terrains from LiDAR Data. The CTDOT MicroStation Earth Exploration toolset can be found on the CTDOT Utilities menu bar under Earth Exploration. The menu includes the Aerial Tools Application, a tool that attaches aerial photography and LiDAR Data right into MicroStation. All of the tools except for Load Aerial Tools Application can be accessed from other areas of MicroStation; however they have been put in this menu to provide easy access to the tools required throughout the workflows in this document. To use this workflow you will need to be working in ProjectWise with geo-coordinated MicroStation files. By opening a MicroStation V8i/OpenRoads workspace; this workspace will connect you to the custom CTDOT Earth Exploration menu.

NOTE: If you are working on the X Drive (Network Project) please go to the Workflows on the <u>SELECTSeries Website</u> for separate sets of directions.





Section 1.1 Statewide Arial Photos

Statewide Arial Photos can be found in several locations. Keep in mind file formats found on websites might not be compatible with MicroStation V8i. Recently 4 band orthoimagery (MrSID4) for the Statewide 2016 Orthophotograhy flight was published on the NOAA Website and the UCONN/CT ECO Website, this format is not compatible with MicroStation V8i. The Statewide 2016 Orthophotograhy flight also released statewide 3 band orthoimagery (MrSID3) that is compatible with MicroStation V8i.

	Combatable with
	MicroStation V8i
ProjectWise	
Statewide 2016 Orthos	
MrSID3	YES 💙
Statewide 2012 Orthos	
MrSID3	YES 💙
CRCOG 2009	
MrSID3	YES 💙
USGS Topos	
	YES 💙
Statewide 2004 Orthos	
	YES 💙
NOAA Website	
Statewide 2016 Orthos	
MrSID4	
UCONN/CT ECO	
Statewide 2016 Orthos	
MrSID3	YES 💙
Statewide 2016 Orthos	
MrSID4	

Known Locations of Connecticut Orthophotograhy

Section 1.2 Statewide LiDAR

Statewide LiDAR can also be found in several locations. Keep in mind file formats found on websites might not be compatible with MicroStation V8i. Statewide LiDAR compatible with MicroStation V8i can be found in two places.

NOAA website - 2016 Flight, available at <u>https://coast.noaa.gov/dataviewer/#/lidar/search/</u> Data is retrieved and downloaded from the website and then imported into a MicroStation Point Cloud POD file.

ProjectWise – 2004 Flight, available through the Aerial Tools Application that runs inside of MicroStation and gets attached as a MicroStation Point Cloud POD file.

	Combatable with
	MicroStation V8i
ProjectWise	
Statewide 2004	
5 FT Point Clouds	YES 💙
NOAA Website	
2016 CRCOG LiDAR: Connecticut	
Statewide Points – ASCII X,Y,Z Pts	YES 💙
2016 CRCOG LiDAR: Connecticut	
Statewide Points - LAS	
2016 CRCOG LiDAR: Connecticut	
Statewide Points - LAZ	
UCONN/CT ECO	
Statewide 2016	
DEM	
Statewide 2016	
LAS	

Known Locations of Connecticut LiDAR Data

Section 1.3 Workflow Options

The flow chart below has reprojections as optional, these are only needed if the final output is something other than NAD 83/NAVD 88. The NOAA website has options to output and deliver reprojected liDAR data so reprojections on this data will most likely not need to be done using MicroStation. **Prerequisites for using this workflow include basic MicroStation knowledge including understanding the Raster Manager and Point Cloud tools.**



Section 1.4 Getting Started

Before getting started with the Earth Exploration Tools set users will need to follow the Set up and Start up workflows in the CTDOT OpenRoads Manual

CTDOT OpenRoads Manual

ProjectWise Set Up - Chapter 2 Follow steps 1 to 6

Project Start Up - Chapter 3 Follow steps 1 and 2

Users will now switch over follow the links below located in this manual (Guide to the Earth Exploration Toolset with MicroStation V8i) for creating and opening MicroStation files, the seed file used will be based on the specific portion of this manual you are working on, the horizontal and the vertical datum.

Creating a DGN File Container for Aerial Photos

Creating a Terrain DGN File for 2016 LiDAR Data

Creating a Terrain DGN File for 2004 LiDAR Data

Chapter 2 Aerial Photos

Section 2.1 Creating a DGN File Container for Aerial Photos

- 1. In ProjectWise Explorer browse to your working location. On the ProjectWise Explorer Main Menu, select *Document > New Document*.
- In the Select a Wizard Dialog Box, select Advanced Wizard then OK. On the Advanced Document Creation Wizard Welcome dialog box select Next >. When prompted to Select Target Folder, verify that you are pointed to the correct folder and select Next >.
- 3. From the Select a Template options, toggle on Use ProjectWise as a template and click the Select button.
- 4. A Select Template Document dialog box will appear. Browse to the seed file location:
- 5. 0 5. 0 Workspace Resources \3_Workspace_V8i \Civil_Standards \seed \
- 6. Choose the 2D seed file 2D_OpenRoads_DesignSeed_83.dgn
- 7. Select the **Open** button.
- 8. The template is now populated for Advanced Document Creation. Select Next >.
- 9. Select the fields to Define Document Attributes. Tab to accept each field. The document file name will be built from these fields. Be sure to enter a *Label* and *Description*. These fields will be displayed and used for searching rather than the file name. Select Next >.
- On the Document Properties Dialog Box select Next >. On the Create a Document Dialog box select Next >.
- 11. Click Finish to close. The new file will now appear in ProjectWise. To update the ProjectWise Explorer Document View data point in the view and then select F5 on the keyboard. This will refresh Label and Description.
- 12. Right click on the DGN file and select **Open With**. In the Open document with dialog box locate the Description column and select *OpenRoads SS4* and click **OK**.

- 13. On the MicroStation main menu select *CTDOT Utilities > Earth Exploration > Set User Preferences*. Select the **Georeference** Tab. Verify the settings and select the **OK** button.
- 14. Use Sister File is toggled on
- 15. Default Unit Settings
- 16. Sister File: 1 Unit = 1 US Survey Feet
- 17. Raster file: 1 Unit = 1 Us Survey Feet
- 18. Use Unit Definition Geokey if Present (override PCS unit) *is toggle on*

Preferences [untitled]		
Category Database Descartes Input Look and Feel Mouse Wheel Operation Position Mapping Raster Manager Reference Spelling Tags Task Navigation Text View Options	Name for preferences Default Preferences Set Raster Manager preferences. General General Default Attributes Georeference Sister File Settings Image: Sister File, if Present, for Georeferenced Files Save Location Info in Sister File if Required Default Unit Settings Sister File: 1 Unit = 1.00000000 US Survey Feet Raster file: 1 Unit = 1.00000000 US Survey Feet Raster file: 1 Unit = Survey Feet Image: Signal Content of the second seco	OK Cancel Defaults

Section 2.2 Attaching Rasters Using the Aerial Tools Application

The Aerial Tools Application is specifically programmed for use with CTDOT data. It is used to locate and attach rasters (aerial photos) into MicroStation. A detailed map of the state of Connecticut will automatically get attached when Aerial Tools is accessed. This MicroStation file can be referenced into other MicroStation files and used as a background for laying out designs after attaching photos and applying any needed reprojection.

- 1. To start using the Aerial Tools Application go to the MicroStation Main menu and select CTDOT Utilities
 - > Earth Exploration > Load Aerial Tools Application. A help video can be accessed by clicking on Aerial Tools Help Video above the load application.





- 2. On the Aerial Tools dialog box select the *desired data set* from the picklist.
- 3. In the MicroStation view zoom to the *area of interest*.
- 4. On the Aerial Tools Dialog box click the **Place** button and the MicroStation Place Shape command will load. Place a shape around the area you would like data to appear. Using MicroStation Element Section add the shape to your selection set.
- 5. On the Aerial Tools Dialog box click the Set button. If prompted with the Boundary Element Box select Yes.
- 6. On the Aerial Tools Dialog box click the **Refresh** button in Raster area. It may take a few minutes to update if you are loading several files at once.
- 7. Click **Done** on the Aerial Tools Dialog Box and the application will close. The photos will be displayed in the view and be listed in the Raster Manager dialog box.



Aerial Tools
Google Earth
Synchronize
Boundary Element Base Map
Place Set Show Display
Datasets
CT 2004 Orthos; 5 FT Point Clouds
CT 2004 Orthos; 5 FT Point Clouds
CT 2012 Orthos
CRCOG 2009 Orthos
USGS Topos
Intended to support mapping at 1:2400 scale (1 in
Refresh Clip Display
- Point Clouds
5 FT Point Clouds. For CTDOT Internal use only! Contact CTDOT Manager of Central Surveys with questions @ 860-594-2510
Refresh
Indices
Display Help Done

Section 2.3 Reprojecting Photos

At this point you must have the needed aerial photos attached. You are currently working in the NAD 83 coordinate system and will follow this workflow if you need to reproject these files to a different system. Most needed reprojections will be English NAD 83 to English NAD 27 and in some cases metric reprojections are needed.

2.3.1 Convert to Metric

If you need to work in metric you will need to change your working units, select *Settings > Design File*. Click on Working Units and change as follows. Click OK to close the dialog box.

Format: *MU* Master Unit: *Meters* Sub Unit: *Centimeters* Accuracy: *.123*

Design File Settings Category Active Angle Active Scale Angle Readout Axis Color	Modify Working Unit Settings Linear Units <u>Format:</u> <u>MU</u> <u>Master Unit:</u> Meters <u>Sub Unit:</u> Centimeters
Element Attributes Fence Grid Isometric Locks Snaps Stream Views Working Units	Advanced Settings Resolution: 10000 per Distance Meter Working Area: 9.0072E+008 Kilometers Solids Area: 1 Kilometers Solids Accuracy: 1E-008 Meters <u>Edit</u>
	Focus Item Description Specifies the largest measuring unit, for example, Meters or Feet used in the design.

2.3.2 Horizontal Re-projection

- 1. To change the Coordinate System, select CTDOT Utilities > Earth Exploration > Geographic Tools.
- 2. On the Geographic Tool Box choose Select Geographic Coordinate System.

3. On the Geographic Coordinate System Tool Box select From File.



4. In ProjectWise browse to 05.0 - Workspace Resources 3_Workspace_V8i Standards seed and select the needed Geospatial File.



5. On the Geographic Coordinate System Changed dialog box select Reproject the Data to the new Geographic Coordinate System and select OK.



- 6. Update the name of your model in the Models Dialog box to match the reprojection.
- If you need to use Aerial tools again you will need to repeat steps 1 to 4 and set the coordinate system back to English NAD 83.

: 🖸		} - ☆ - ≰	\$ • (i) 🔁 31 -	N
et	▼ US Survey Inches ▼ 🧟 1"	=40' 🔹	EPSG:102656	☞ 1"=40'
6				
	Models			
	😤 Active File 🔻 🎦 🕒 🚰 🗙	🤔 🔲 ≽		
	Type 2D/3D Name		Description	
	D I USFeet CT NAD83		Master Mo	del
		Modify to USFeet	match datum CT NAD27	

Chapter 3 LiDAR

Statewide LiDAR compatible with MicroStation V8i can be found in two places.

- NOAA website 2016 Flight, available at https://coast.noaa.gov/dataviewer/#/lidar/search/ Data is retrieved and downloaded from the website and then imported into a MicroStation Point Cloud.
- **ProjectWise 2004 Flight**, available through the Aerial Tools Application that runs inside of MicroStation and gets attached as a Point Cloud POD file.

Section 3.1 2016 LiDAR Data

3.1.1 Retrieving LiDAR Data from NOAA

- 1. Go to the NOAA Data Access Viewer and search for your location.
- 2. https://coast.noaa.gov/dataviewer/#/lidar/search/
- 3. After entering a location or address the viewer may make the map zoomed in too far, you may need to zoom out a bit to see the map information.







4. Click the **Draw Search Area** icon. Click and Drag from left to right to create a selection area. The area should be shaded.



5. To select a data set, click the **Cart** icon next to the *2016 CRCOG Lidar: Connecticut Statewide* data set title the cart icon in the upper right should update and show the number of items added.



6. Click on the shopping cart icon.



7. The MY CART page should appear, the data source you selected should be shown. Click Next.

T (⇒) S https://coast.noaa.gov/dataviewer/#/lidar/search/-80953 Ie Edit View Favorites Tools Help	31.984 🔎 〒 🗎 🖒 🚫 NOAA: Data Access Viewer#/ × 👘 🏠 י
🖇 🚰 Bentley Cloud Services 📓 Level Naming And Numb	🎽 🕶 🔂 👻 🖃 🖶 🕶 Page 🕶 Safety 🕶 Tools 🕶 🔞
MY	CART ×
Items in Your Cart - 1	
Lidar ×	
2016 CRCOG Lidar: Connecticut Statewide - 1	
Clear Cart	
Foodback Poture to Viewer	Next
reedback Return to viewer	NCAL

8. The next page shows projection options. Set the *Projection, Datum and Unit fields* to those matching your survey ground file, if you do not have a survey file select NAD83 and NAVD88. Set the *Output Product* to **Point**, and the *Output Format* to **Points – ASCII X,Y,Z Pts**. then Click Next.

NOTE: See AEC for further instruction if your survey is Horizontal Datum NAD27 and Vertical Datum NAVD88. Extra steps will need to be completed as this is not an option on the NOAA website the reprojection will need to be completed in MicroStation.

	MY CAF	RT.		
Provision Your Data				Help
2016 CRCOG Lidar: Connecticut Statewide - 1	Lidar Projection & Datum Options:			
	Projection:		Zone:	
	State Plane 1983	\checkmark	Zone 0600 Connecticut	~
	Horizontal Datum:		Horizontal Units:	
	NAD83	\checkmark	U.S. Feet	~
	Vertical Datum:	What's this?	Vertical Units:	
	NAVD88	\checkmark	Feet	\checkmark
	Output Options:			
	Output Product:		Output Format:	
	Point	\checkmark	Points - ASCII X,Y,Z Pts	~
	Data Options:			
	Use Advanced Options	What's this?		
	Data Classes:	What's this?		
	Ground All			
	 Add Intensity Images Reset 			
Feedback Return to Viewer			Previou	s Next

- 9. On the next page enter your state email address. Click Next.
- 10. Review your selections and if correct, click Submit.
- 11. Take note of the *order number* provided on the confirmation page and make a note for the location, this will make it easier to sort out emails received later with the data links.

	Success
Your request has been	a sucessfully submitted for processing.

3.1.2 Downloading and Saving the LiDAR Data Set

1. The first email you receive from Digital Coast is a confirmation of the data request. No action needs to be taken with this email. The second email contains the *download link* for the data. Click the link in the email and save the zip file to your project. The third email you receive also contains links to the same data in the second email. This email can be ignored. Emails may take a few minutes to receive; your wait time will be longer for larger data sets.

om: Digital Coast Data Processor < com.dds@noaa.gov> Sent: Tue 2/13/2018 1:
: : bied: Dialtal Coast Data Request: 255156 (Job399376 dt2016 lidar)
The data you have requested through Digital Coast is now ready. This is Digital Coast job ID 255156, lidar job ID 399376. Download at: <u>https://coast.noaa.gov/pickup/dav//255156/Job399376_ct2016_lidar_raw.zip</u> File Size: 15.09 MB
Request: Projection: NAD83NSRS2007 Connecticut ftUS ; Format: ASCII xyz; Lat,lon bounding box: 41.66709681,-72.72205367 41.67479042,-72.71137011; Vertical Datum: NAVD88; Vertical Units: feet; Horizontal Datum: NAD83; Horizontal Units: US survey feet; Classes used: Ground; Processing Notes: Bin type was reset to NONE for point data.
The Zip file contains the following files:
Lidar data file: Job399376_ct2016_lidar_raw.txt Metadata file: Job399376_ct2016_lidar_raw_metadata.xml
Your LIDAR data is in a text file, with three columns of numbers separated by commas. The three columns are: Longitude/X/Easting, Latitude/Y/Northing, and Elevation. The first line of the file will consist of column headers. You extracted 1877379 points from the on-line data set.
Please refer the Data_Set_Credit section in the metadata file for the appropriate data set acknowledgement information.

2. After clicking the link, Select Save as. Browse to *my documents* on your D drive. Create a folder called NOAA and click Save.

Internet Explorer	Save As
What do you want to do with Job399376_ct2016_lidar_raw.zip?	Image: Constraint of the second se
Size: 15.0 MB From: coast.noaa.gov	★ Favorites ▲ Documents libr Arrange by: Folder ▼ ■ Desktop NOAA
Open The file won't be saved automatically.	Downloads Name PAC Pacent Places No items match your search.
→ Save	Libraries Documents
Save as	v < m
Cancel	File name: Job399376_ct2016_lidar_raw.zip Save as type: Compressed (zipped) Folder (*.zip)
	Hide Folders Save Cancel

3. In window explorer select the zip file, right click and *choose* Extract All. The files will extract into a folder and contain a .txt file(s) and an .xml file.

3.1.3 Creating a Terrain DGN File for 2016 LiDAR Data

- 1. In ProjectWise Explorer browse to your working location. On the ProjectWise Explorer Main Menu, select *Document > New Document*.
- 2. In the Select a Wizard Dialog Box, select Advanced Wizard then OK. On the Advanced Document Creation Wizard Welcome dialog box select Next >. When prompted to Select Target Folder, verify that you are pointed to the correct folder and select Next >.
- 3. From the Select a Template options, toggle on Use ProjectWise as a template and click the Select button.
- 4. A Select Template Document dialog box will appear. Browse to the seed file location:
- 5. 0 5. 0 Workspace Resources 3_Workspace_V8i \Civil_Standards seed
- 6. Choose the correct 3D seed file 3D_OpenRoads_DesignSeed_83.dgn or 3D_OpenRoads_DesignSeed_27.dgn
- 7. Select the Open button. The template is now populated for Advanced Document Creation. Select Next >.
- 8. Select the fields to Define Document Attributes. Tab to accept each field. The document file name will be built from these fields. Be sure to enter a *Label* and *Description*. These fields will be displayed and used for searching rather than the file name. Select Next >.
- On the Document Properties Dialog Box select Next >. On the Create a Document Dialog box select Next >.
- 10. Click Finish to close. The new file will now appear in ProjectWise. To update the ProjectWise Explorer Document View data point in the view and then select F5 on the keyboard. This will refresh Label and Description.
- 11. Right click on the DGN file and select **Open With**. In the Open document with dialog box locate the Description column and select *OpenRoads SS4* and click **OK**.

12. On the main MicroStation menu bar select *CTDOT Utilities > Earth Exploration > Geographic Coordinate System Settings*. Change Reproject Elevations to **Yes** on both the Reference and Active Model tabs.

Keprojection Settings			🛛 🖉 Reprojecti
Reference Active Model			Reference A
Reprojection Settings		~	Reproj
Stroke Tolerance	0.1		Stroke To
Reproject Cell components in	If Spatially Large		Reproject
Reproject Multiline Text com	If Spatially Large		Reproject
Rotate Cells	Yes		Rotate Ce
Scale Cells	Yes		Scale Cel
Rotate Text Elements	Yes		Rotate Te
Scale Text Elements	Yes		Scale Tex
Stroke Arcs to Line Strings	If Spatially Large		Stroke Are
Stroke Ellipses to Line String	If Spatially Large		Stroke Ell
Stroke Curves to Line Strings	If Spatially Large		Stroke Cu
Reproject Elevations	Yes 🚽		Reproject
Add Points If Needed	No		Add Point
	Ok Ca	ncel	

🌠 Reprojection Settings	
Reference Active Model	
Reprojection Settings	*
Stroke Tolerance	0.1
Reproject Cell components in	If Spatially Large
Reproject Multiline Text com	If Spatially Large
Rotate Cells	Yes
Scale Cells	Yes
Rotate Text Elements	Yes
Scale Text Elements	Yes
Stroke Arcs to Line Strings	If Spatially Large
Stroke Ellipses to Line String	If Spatially Large
Stroke Curves to Line Strings	If Spatially Large
Reproject Elevations	Yes 🚽
Add Points If Needed	No
	Ok Cancel

- 13. If you downloaded a 1983 State Plane data set with NAD83 horizontal information and chose a vertical datum of NGVD29 (rather than the typical NAVD88) you will need to adjust the Vertical Datum setting in MicroStation before importing the points. Select *CTDOT Utilities > Earth Exploration > Geographic Coordinate System Details*. Change the Vertical Datum to *National Geodetic Vertical Datum of 1929* and select OK.
- 14. On the Geographic Coordinate System Changed dialog box select Reproject the Data to the new Geographic Coordinate System and select OK.
- 15. On the MicroStation main menu select *File > Save Settings*.

🧖 Geographic Coordinate System Propert	ies 🗖 🗖 🗙 🗖
Coordinate System	*
Datum	*
Ellipsoid	*
Coordinate System Modifiers	*
Vertical Datum	North American Vertical Datum of 1988
Local Transform Type	North American Vertical Datum of 1988
	National Geodetic Vertical Datum of 1929
Ok Cancel	

1. In the MicroStation window click the Point Clouds Icon.

2. The Point Clouds dialog will appear, Click the Attach button.

3. A ProjectWise dialog box will appear, click Cancel and a Windows Explorer dialog box will appear, browse to and *select the text file* that was downloaded from the NOAA site. Change the Files of Type: to ASCII Files (*.txt) and click Open.





🥂 Open - \\DOT	-SDCENG07V\CTDOT_Proje	cts\$\999_IRSS2_TEST\Su	rvey\Oxford\Job397829	_ct2 💌
Look in:	\mu Job397829_ct2016_lidar	•	G 🤌 📂 🖽 -	3 🖲
Ca	Name		Date modified	Туре
~	job397829_41073_41_1	2_raw.txt	2/5/2018 3:15 PM	Text Docu
Recent Places	job397829_41073_41_14	4_raw.txt	2/5/2018 3:15 PM	Text Docu
	job397829_41073_41_1	5_raw.txt	2/5/2018 3:15 PM	Text Docu
	job397829_41073_41_1	3_raw.txt	2/5/2018 3:15 PM	Text Docu
Desktop	job397829_41073_43_1	2_raw.txt	2/5/2018 3:15 PM	Text Docu
	job397829_41073_43_14	1_raw.txt	2/5/2018 3:15 PM	Text Docu
	job397829_41073_43_1	5_raw.txt	2/5/2018 3:15 PM	Text Docu
Libraries	job397829_41073_43_18	3_raw.txt	2/5/2018 3:16 PM	Text Docu
	job397829_41073_45_1	2_raw.txt	2/5/2018 3:16 PM	Text Docu
	job397829_41073_45_14	1_raw.txt	2/5/2018 3:16 PM	Text Docu
Computer	job397829_41073_45_1	5_raw.txt	2/5/2018 3:16 PM	Text Docu
	job397829_41073_45_1	3_raw.txt	2/5/2018 3:16 PM	Text Docu
		III		F
Network	File name:	0 41072 45 10 mutht		Onen
	rile fiame.	5_41075_45_16_1dW.btt		Open
	Files of type: ASCII File	es (*.bd)) [Cancel

- 4. A dialog for converting ASCII will open, make sure the columns are set to x, y, z and the Geometry Units are set to *Feet* if the job is in English and Meters if the job is in Metric. Click OK.
- 5. The Select a Wizard dialog box will appear, select No Wizard and click OK.

- 6. The Specify new pod file dialog box will appear, Save the file as a .pod file ensuring it will go into the correct folder in ProjectWise. It may take some time, wait until cursor comes back.
- 7. Click Fit View to see the points.
- 8. To make the points easier to see, go to the View Attributes dropdown and set the *Point Cloud Presentation Style* to Elevation. To change the display click on the Magnifying Icon under Point Cloud Presentation. Select the desired look under Depth and Colorization and click Save Settings. For more information about Point Clouds go to <u>Section 4 - Working with</u> <u>Point Clouds</u>. You can also set this from the Point Clouds dialog, choose <u>Settings>Presentation</u> and select Elevation. Right click to apply to open views.

	Point Y	-	Point Z	
1010000.31	805005.55		167.45	
1010000.64	805003.69		167.91	
1010000.99	805001.68		168.40	
1010000.25	805020.12		163.90	
1010000.63	805018.19 163.84			
1010001.02	805016.22	805016.22 163.87		
1010001.59	805012.54		165.87	
Action				~
Attach	Yes			
Options				~
Geometry Unit	Feet			-
RGB Unit	0102	JJ (Dyte		
Intensity Unit	0 to 2	55 (byte)		
Compression	Aerial		lata () (150 (50mm)	
Spatial Eiltering	Disab	ed		
	0.001	00		
Spatial Spacing				
Spatial Spacing Geographic Inform	nation			
Spatial Spacing Geographic Inform Reproject	nation No			
Spatial Spacing Geographic Inform Reproject	nation No			
Spatial Spacing Geographic Inform Reproject El Source GeoCS	nation No			
Spatial Spacing Geographic Inform Reproject Disource GeoCS	No			
Spatial Spacing Geographic Inform Reproject D Source GeoCS	No			



3.1.5 Creating a Terrain from Point Clouds

 On the MicroStation Task menu select Civil Tools > Terrain Model and select the Create from Point Cloud Icon.

- 2. On the Create Terrain From Point Cloud dialog box select the following:
- 3. Filter: None
- 4. Feature Definition: *EX_TERR_Triangles*
- 5. Edge Method: No Removal
- 6. Click on the **Import** Button and triangles will appear on your screen.

NOTE: If the file spins out and you experience a crash the file you are trying to create maybe too big. Go to <u>Section 5.1</u> for directions on how to reduce the size of the import.

- 7. You should now detach the POD file so only the Terrain is in the files.
- Hoover over the triangles and set the Terrain active. The Terrain is now part of the MicroStation DGN. This file can be referenced in and used as the existing terrain for an OpenRoads preliminary design work.



# 🗙 🕂	Options	
	Terrain Models	*
	Append to existing Terrain Model	
	Terrain Model to append to	
	Filter	*
	Filter	None
		Test Filter
	Feature Definition	*
	Feature Definition	EX_TERR_Triangles
	Include Spot Features	No Feature Definition
	Triangulation Options	Existing Terrain Display
	Edge Method	EX_TERR_AII
		EX_TERR_Contours EX_TERR Contours w Arroy
		EX_TERR_Triangles
		±
		< III

Section 3.2 2004 LiDAR Data

3.2.1 Creating a Terrain DGN File for 2004 LiDAR Data

- 1. In ProjectWise Explorer browse to your working location. On the ProjectWise Explorer Main Menu, select *Document > New Document*.
- In the Select a Wizard Dialog Box, select Advanced Wizard then OK. On the Advanced Document Creation Wizard Welcome dialog box select Next >. When prompted to Select Target Folder, verify that you are pointed to the correct folder and select Next >.
- 3. From the Select a Template options, toggle on Use ProjectWise as a template and click the Select button.
- 4. A Select Template Document dialog box will appear. Browse to the seed file location: 0 5. 0 - Workspace Resources 3_Workspace_V8i \Civil_Standards\seed
- 5. Choose the correct 3D seed file 3D_OpenRoads_DesignSeed_83.dgn
- 6. Select the Open button. The template is now populated for Advanced Document Creation. Select Next
 >.
- 7. Select the fields to Define Document Attributes. Tab to accept each field. The document file name will be built from these fields. Be sure to enter a *Label* and *Description*. These fields will be displayed and used for searching rather than the file name. Select Next >.
- On the Document Properties Dialog Box select Next >. On the Create a Document Dialog box select Next >.
- 9. Click Finish to close. The new file will now appear in ProjectWise. To update the ProjectWise Explorer Document View data point in the view and then select F5 on the keyboard. This will refresh Label and Description.

- 10. Right click on the DGN file and select **Open With**. In the Open document with dialog box locate the Description column and select *OpenRoads SS4* and click **OK**.
- 11. On the main MicroStation menu bar select *CTDOT Utilities > Earth Exploration > Geographic Coordinate System Settings.* Change Reproject Elevations to **Yes** on both tabs.

Perence Active Model		Reference	Active Model		
Chalka Talanana	0.1	 Chal	Telesson	0.1	
Stroke Tolerance		Strok	e rolerance		
Reproject Cell components i	r If Spatially Large	Repr	oject Cell components ir	If Spatially Large	
Reproject Multiline Text con	n If Spatially Large	Repr	oject Multiline Text com	If Spatially Large	
Rotate Cells	Yes	Rotat	te Cells	Yes	
Scale Cells	Yes	Scale	e Cells	Yes	
Rotate Text Elements	Yes	Rotat	te Text Elements	Yes	
Scale Text Elements	Yes	Scale	e Text Elements	Yes	
Stroke Arcs to Line Strings	If Spatially Large	Strok	e Arcs to Line Strings	If Spatially Large	
Stroke Ellipses to Line String	g If Spatially Large	Strok	e Ellipses to Line String	If Spatially Large	
Stroke Curves to Line String	s If Spatially Large	Strok	e Curves to Line Strings	If Spatially Large	
Reproject Elevations	Yes	Repr	oject Elevations	Yes	
Add Points If Needed	No	Add F	Points If Needed	No	

3.2.2 Attaching POD Files using The Aerial Tools Application

To start using the Aerial Tools Application go to the MicroStation Main menu and select CTDOT Utilities
 > Earth Exploration > Load Aerial Tools Application. A help video can be accessed by clicking on Aerial
 Tools Help Video above the load application.



- 2. On the Aerial Tools Dialog box select CT 2004 Orthos, 5FT Point Clouds from the Picklist.
- 3. In the MicroStation view zoom to the area of interest.
- 4. On the Aerial Tools Dialog box click the Place button and the MicroStation Place Shape command will load. Place a shape around the area you would like data to appear. Using MicroStation Element Section add the shape to your selection set.
- 5. On the Aerial Tools Dialog box click the Set button. If prompted with the Boundary Element Box select Yes.
- 6. On the Aerial Tools Dialog box click the **Refresh** button in Point Clouds area. It may take a few minutes to update if you are loading several files at once. Click **Cancel** on the Attach Point Cloud Reference File dialog box, this box may pop up several times just continue to hit cancel until it no longer comes up.
- 7. Click **Done** on the Aerial Tools Dialog Box and the application will close.
- 8. To make the points easier to see, go to the View Attributes dropdown and set the *Point Cloud Presentation Style* to Elevation. To change the display click on the Magnifying Icon under Point Cloud Presentation. Select the desired look under Depth and Colorization and click Save Settings. For more information about Point Clouds go to Section 4 Working with Point Clouds. You can also set this from the Point Clouds dialog, choose *Settings>Presentation* and select Elevation. Right click to apply to open views.

Aerial Tools
Google Earth
Synchronize
Boundary Element Base Map
Place Set Show Display
Datasets
CT 2004 Orthos; 5 FT Point Clouds
CT 2012 Orthos CT 2016 Orthos CRCOG 2009 Orthos USGS Topos Intended to support mapping at 1:2400 scale (1 in Refresh Clip Display Point Clouds 5 FT Point Clouds. For CTDOT Internal use only! Contact CTDOT Manager of Central Surveys with questions @ 860-594-2510
Refresh Indices
Display Help Done



3.2.3 Re-Projecting Data

At this point you must have the needed point clouds attached. You are currently working in the NAD 83 coordinate system and will follow this part of the workflow only if you need to repoject these files to a different system. Most needed reprojections will be English NAD 83 – NAVD 88 to English NAD 27 to NAVD 29. But in some cases the English NAD 83 – NAVD 29, English NAD 27 – NAVD 88 and metric reprojections may be needed.

3.2.3.1 Convert to Metric

If you need to work in metric you will need to change your working units, select *Settings > Design File*. Click on Working Units and change as follows.

Format: *MU* Master Unit: *Meters* Sub Unit: *Centimeters* Accuracy: *.123*

Category	Modify Working Unit Settings
Active Angle Active Scale Angle Readout Axis Color Element Attributes Fence Grid	Linear Units <u>Format:</u> MU <u>Master Unit:</u> Meters <u>Sub Unit:</u> Centimeters <u>Accuracy</u> 0.123 <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u> <u>Custom</u>
Isometric Locks Snaps Stream Views Working Units	Advanced Settings Resolution: 10000 per Distance Meter Working Area: 9.0072E+008 Kilometers Solids Area: 1 Kilometers Solids Accuracy: 1E-008 Meters <u>E</u> dit
	Focus Item Description
	Specifies the largest measuring unit, for example, Meters or Feet used in the design.

3.2.3.2 Horizontal Re-projection

- 1. To change the Coordinate System, select *CTDOT Utilities > Earth Exploration > Geographic Tools*.
- 2. On the Geographic Tool Box choose Select Geographic Coordinate System.



3. On the Geographic Coordinate System Tool Box select From File.



4. Browse to 05.0 - Workspace Resources 3_Workspace_V8i Standards seed and select the needed Geospatial File.



5. On the Geographic Coordinate System Changed dialog box select Reproject the Data to the new Geographic Coordinate System and select OK.

6. Update the name of your model in the Models Dialog box to match the reprojection.



🗇 Mod	els			
En Acti	ive File	· 🗅 🖻 🖅 🔀		
Туре	2D/3D	Name		Description
٥	Ĩ	USFeet CT NAD83		Master Model
			Modify to match d USFeet CT NAD	latum)27

3.2.3.3 Vertical Re-projection

1. Check the correct NAVD is being used. Select *CTDOT Utilities > Earth Exploration > Geographic Coordinate System Details*. Change the Vertical Datum to the required NAVD and select OK.

🧏 Geographic Coordinate System Pre	operties 🗖 🖻 🕱
Coordinate System	*
Datum	*
Ellipsoid	*
Coordinate System Modifiers	
Vertical Datum	Manonal Geoderic Venical Darum of 1929
Vertical Datum Local Transform Type	North American Vertical Datum of 1929

2. On the Geographic Coordinate System Changed dialog box select Reproject the Data to the new Geographic Coordinate System and select OK.

NOTE: If you need to use The Aerial Tools Application again it is recommended you start with a brand new DGN file.

3.2.4 Creating a Terrain from Point Clouds

- 1. On the MicroStation Task menu select *Civil Tools > Terrain Model* and select the **Create from Point Cloud** Icon.
- 2. On the Create Terrain From Point Cloud dialog box select the following: Filter: None Feature Definition: EX_TERR_Triangles Edge Method: No Removal
- 3. Click on the **Import** Button and triangles will appear on your screen.

NOTE: If the file spins out and you experience a crash the file you are trying to create maybe too big. Go to <u>Section 5.1</u> for directions on how to reduce the size of the import.

- 4. You should now detach the POD file so only the Terrain is in the files.
- 5. Hoover over the triangles and set the Terrain active. The Terrain is now part of the MicroStation DGN. This file can be referenced in and used as the existing terrain for an OpenRoads preliminary design work.



Kreate Terrain From Point Cloud	ł	- • •
III 🗙 🕂	Options	
Point Cloud	Terrain Models	^
	Append to existing Terrain Model	
	Terrain Model to append to	
	Filter	*
	Filter	None
		TestFilter
	Feature Definition	*
	Feature Definition	EX_TERR_Triangles
	Include Spot Features	No Feature Definition
	Triangulation Options	
	Edge Method	
		EX_TERR_Contours
		EX_TERR_Triangles
		Hundrein Display
D:\Users\Richardeh\AppData\Loca	\Temp\Point Cloud.xyz	.::

Chapter 4 Working with Point Clouds

A point cloud is a data file which can include a large number of points on the surface of an object. A point cloud is a set of vertices in a 3D coordinate system and these vertices are defined the by X, Y and Z coordinates. Point clouds are usually created by 3D scanners. These devices measure a large number of points on the surface of an object and output a point cloud as a data file. The point cloud represents the visible surface of the object that has been scanned or digitized. Point clouds are used for many purposes, especially to confirm measurements between the DGN model and the real world.

Point Clouds (4 of 4 listed)						x
<u>Fi</u> le <u>E</u> dit <u>V</u> iew <u>S</u> ettings <u>Ut</u> ilities						
🗄 • 🔚 🦥 餐 🗇 🧔	A					
File Name	Description	0	2	ł	Ĵ	
CT_5ft_0410720544_2.pod		100	\checkmark	\checkmark	\checkmark	
CT_5ft_0410720544_3.pod		100	\checkmark	\checkmark	\checkmark	
CT_5ft_0410720544_5.pod		100	\checkmark	\checkmark	\checkmark	
CT_5ft_0410720544_6.pod		100	\checkmark	\checkmark	\checkmark	
12345678 2 3						

Section 4.1 Point Cloud Display

- 1. Select the View Attributes icon on your View window.
- 2. For Point Cloud Presentation select Elevation.
- 3. To change the display click on the Magnifying Icon under Point Cloud Presentation. Select the desired look under Depth and Colorization and click Save Settings.

4. Tip: You can also set this from the Point Clouds dialog, choose *Settings>Presentation* and select Elevation. Right click to apply to open views.



27)			G Point Cloud Prese	Ε
Niew Attributes - View 1			Presentation Style Tools	-
View Number: 1 🗸 🖳 🖏			🍖 종 🙉 🖾 🗔 🎺	
Presentation		H = ^		
Display Style: (Wirefram	ne Display)	- 9	Presentation Style List	-
ACS Triad	East Cells		Presentation Styles	
			🗄 🖓 RGB Color	
Background				
Boundary Display	i Grid			
🔟 Camera	嶺 Level Override:	s 👘		
Clip Back	Line Styles		Classification & Intensity	
Clip Front	Line Weights			
Clip Volumo	Markora			
Constructions	Patterns		RGB	~
Default Lighting	💽 Tags			
H Dimensions	A Text		Active	
🔐 Data Fields	¹ ← Text Nodes		Intensity	~
Displayset	Transparency		Active Off	
			Colorization Hue	
Global Brightness: 👾 🧹		-> 🖗	Offset 50	
			Range 14	
			Elevation	^
Point Cloud Presenta	tion	^	Active On	
Style: 🚳 Elevation		- 9	Depth 10	
(none)			Start 0	-
RGB Color			Colorization Soft Hue	
Intensity			Clamped No	
Elevation				
Classification			Classification	^
Elevation & Intensi	ty		Active Off	
Classification & Int	ensity			



Section 4.2 Using Point Clouds

The Point Clouds tools allow you to import, control, visualize and manipulate point cloud images. You can import a point cloud into a DGN and use it as a visual reference. The Point Cloud dialog (File > Point Clouds), along with the Point Cloud toolbox (Tools > Point Cloud), lets you control all aspects of attaching and manipulating point cloud image files. A point cloud is treated as any standard element and can be part of a model or level. MicroStation Point Clouds are POD files, this format allows you to work with huge point clouds at a great performance.

You can open multiple point cloud files simultaneously. Also, you can batch convert multiple point clouds files either to one POD file, convert the data to AACII format or create a terrain model.

То	Select in the Point Cloud toolbox
Open the Point Clouds dialog, which is used to control the display of the point clouds.	Open Point Clouds Dialog
Opens the Open dialog, which allows you to attach a point cloud.	ttach Point Cloud
Detach a point cloud.	Detach Point Cloud
Clip a point cloud.	Clip Point Cloud
Delete a clip from a point cloud.	Delete Clip from Point Cloud
Open the Point Cloud Presentation dialog.	Cont Cloud Presentation

Section 4.3 Modifying a Point Cloud

A point Cloud and be clipped and the density of the points can be filtered down. This may need to be done on extremely large data sets so when the terrain gets created you will have manageable size data. OpenRoads Terrains and be much larger than the traditional InRoads DTMs. OpenRoads Terrain uses a scalable technology allowing for much larger files. There is a limit, please do not try to get a surface from point clouds for the entire state of Connecticut, your computer and the software will surely lock up.

 Select *Edit > Clip* in the Point Clouds dialog box, in the Clip Point Cloud Dialog box select the placement method.

2. Highlight all the point clouds and select File > Export. In the Export Point Cloud box set the following: Format = Pointools POD (*.pod) Region Filter = Clip Density = set as desired Click OK.

3. Select No Wizard and OK, when the next box appears select your project folder and rename the clipped POD file. C lick Save.



4. In the Point Cloud dialog box attach the new clipped POD file and compare. Make sure you are happy with the density of the new POD file. The key is to flush out as many points as necessary but still maintain the same basic contour lines. When you are satisfied detach all the unneeded POD files.

Folder			Save
Richard, Elair	ne - OpenRoads SS4	Select	Cancel
Name:	Job399376_ct2016_lidar_raw.pod		
Description:	Job399376_ct2016_lidar_raw		
File Name:	Job399376_ct2016_lidar_raw.pod		
Format:	*.pod	Format	
Application:	Department:		
<none></none>	Image: second	•	

Chapter 5 Filter Descriptions

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.

No Filter – No filtering is applied

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

Section 5.1 Bentley Recommendations for Creating a Large Terrain from a Point Cloud

Always use the "Tin Filter". Input the "Z" Tolerance. Always use the "Coarse" option. Always use "Reinsert Points" option.

Do not specify a feature definition; change it after the import is complete.



Edge Method	None
Contours	Off
Triangles	On
Triangle Vertices	Off
Flow Arrows	Off
Low Points	Off
High Points	Off
Boundary	Off
Spot	Off
Feature Name	Point Cloud
Feature Definition	EX TERR Triangles 🚽
	😵 No Feature Definition 🔺
	No Feature Definition Components Existing Terrain Display
	No Feature Definition Components Existing Terrain Display EX_TERR_All EX_TERR_NI
	No Feature Definition Components Existing Terrain Display EX_TERR_All EX_TERR_Bound EX_TERR_Cound
	No Feature Definition Components Existing Terrain Display EX_TERR_AII EX_TERR_Bound EX_TERR_Component EX_TERR_Component
	No Feature Definition Components Existing Terrain Display EX_TERR_All EX_TERR_Bound EX_TERR_Cont EX_TERR_Cont EX_TERR_Cont EX_TERR_Cont
	 No Feature Definition Components Existing Terrain Display EX_TERR_All EX_TERR_Bound EX_TERR_Contol EX_TERR_Contol EX_TERR_Triangle

