HOMEWORK 1

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COURSE NAME: 3D MODELING WITH REMOTE SENSING DATA

LECTURER : ESRA ERTEN

Collecting point cloud data

Using remote sensing methods like LiDAR, photogrammetry, or laser scanning, the first stage in creating point clouds is to gather the necessary point cloud data. As a result of these procedures, point cloud databases contain millions of 3D points that were captured in a scene.

Registration

Aligning and registering the point cloud datasets comes after gathering the point cloud data. In order to accurately align the data, this procedure entails locating shared features between the datasets. You can manually register or use automatic methods to do so.

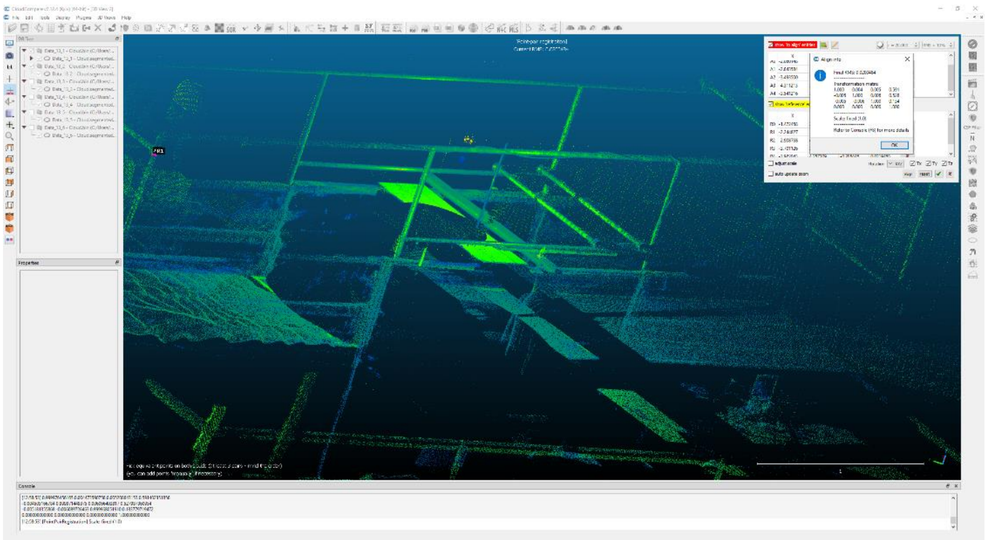

Figure 1 Aligning of 2 to 1

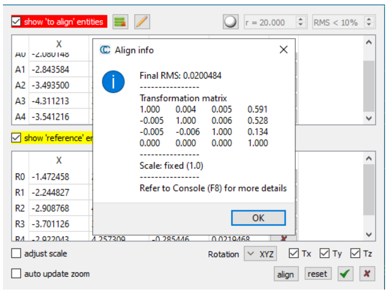

Figure 2 RMS Value of Aligning 2 to 1

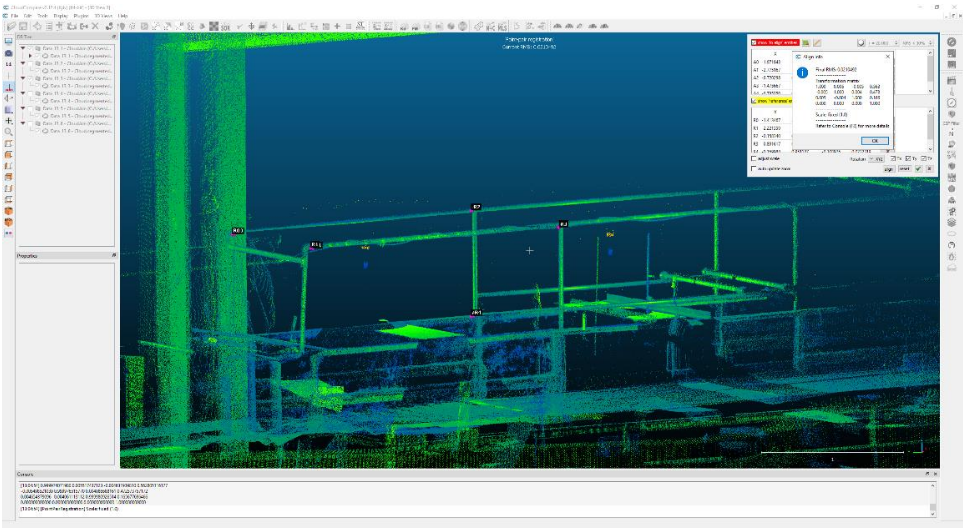

Figure 3 Aligning of 3 to 1

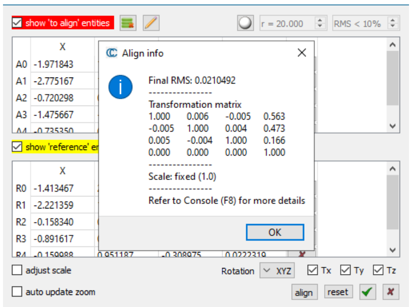

Figure 4 RMS Value of Aligning 3 to 1

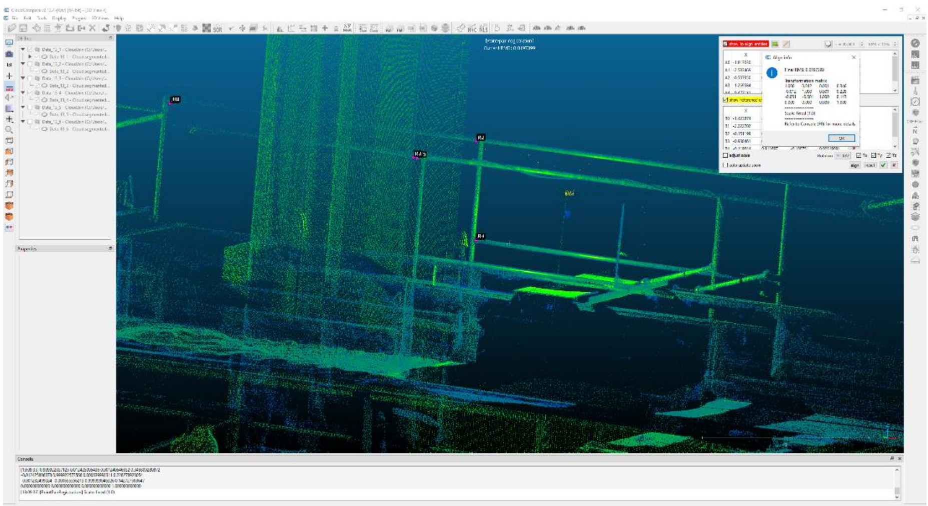

Figure 5 Aligning of 4 to 1

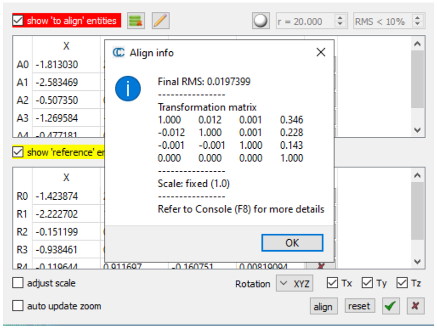

Figure 6 RMS Value of Aligning 4 to 1

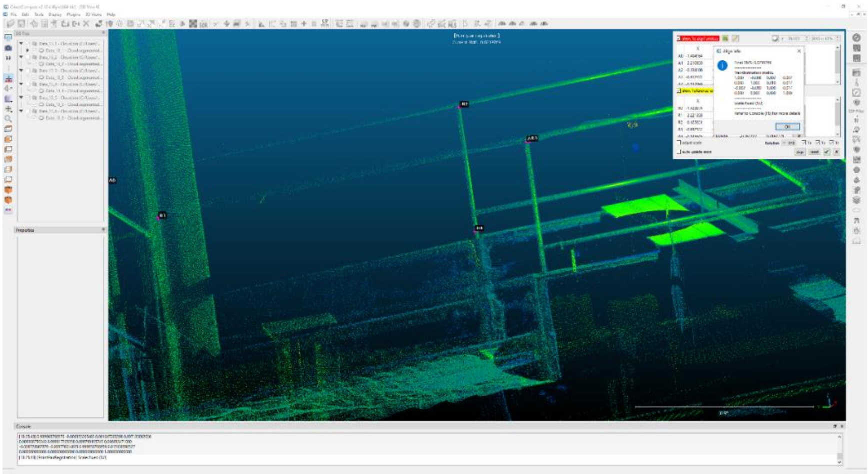

Figure 7 Aligning of 5 to 1

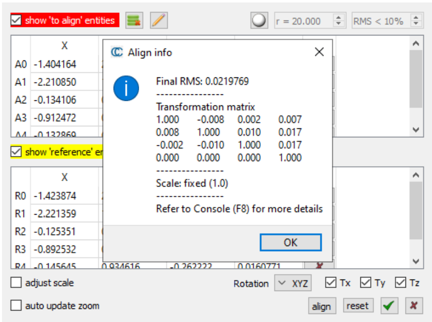

Figure 8 RMS Value of Aligning 5 to 1

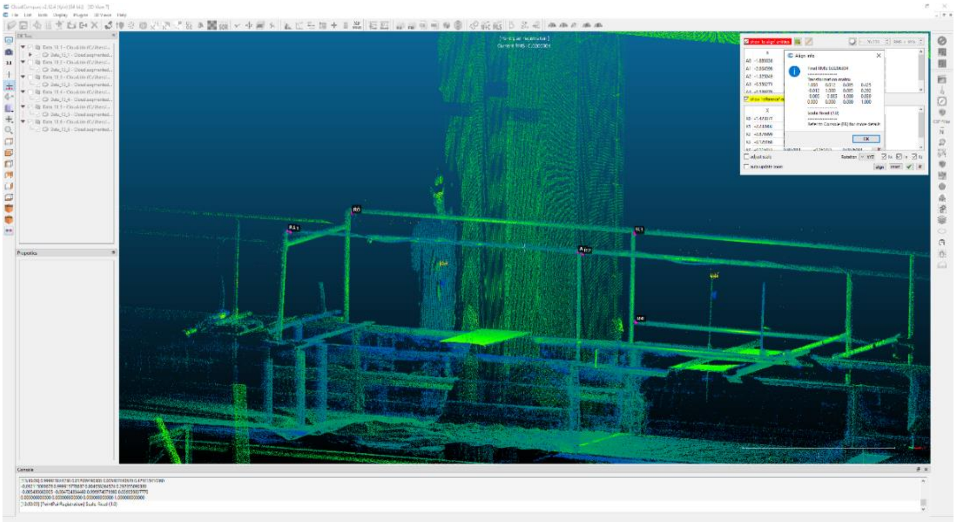

Figure 9 Aligning of 6 to 1

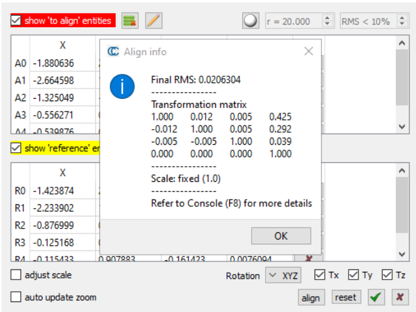

Figure 10 RMS Value of Aligning 6 to 1

Filtering

When the point cloud datasets have been registered, the data must then be filtered to remove any noise, outliers, or errors. Points that do not fall within a predetermined range of values or are inconsistent with nearby points are removed throughout this phase.

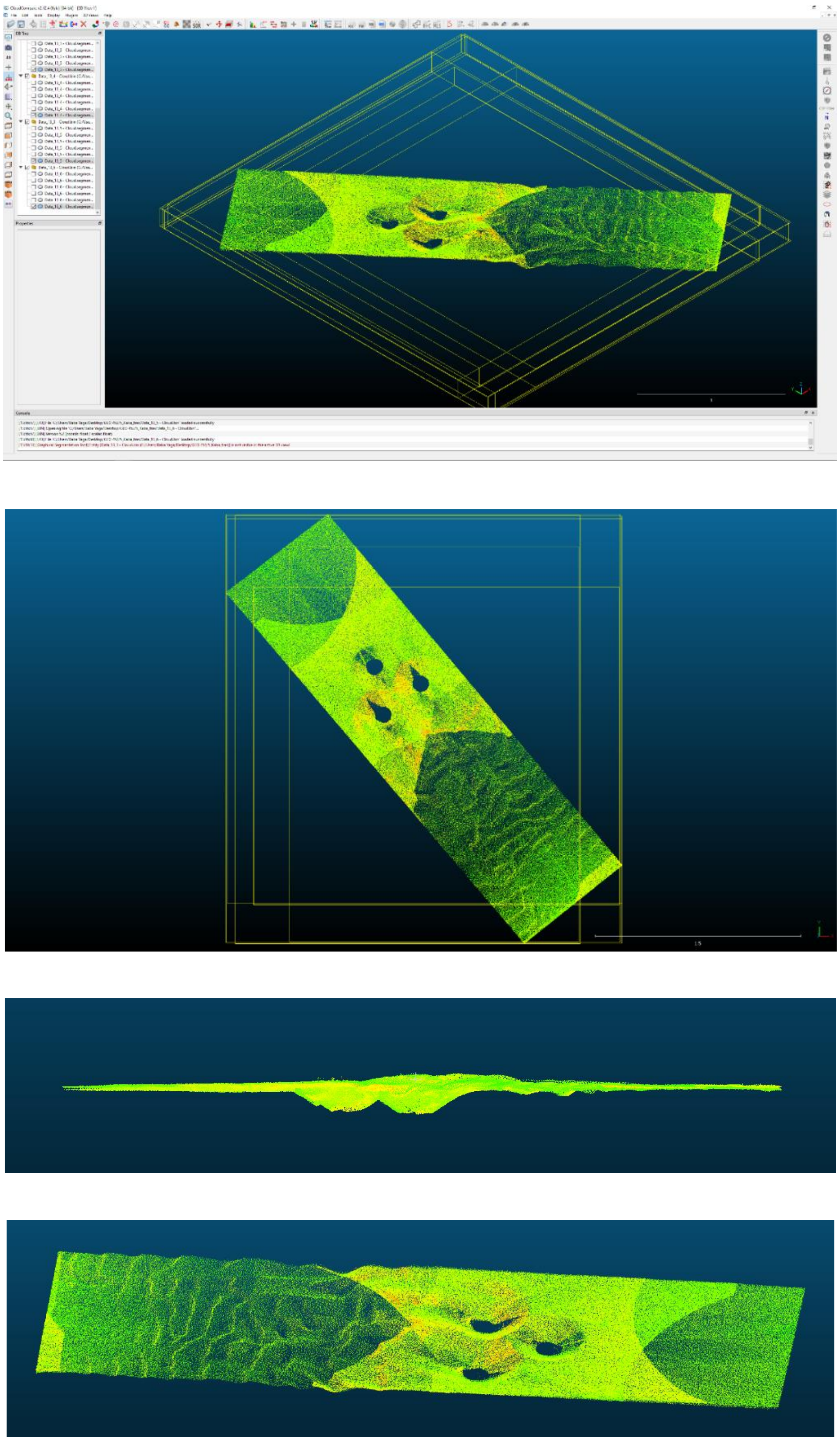

Figure 11 Filtered Noise, Outliers and Errors of Data Clouds

Merging

The point cloud datasets are integrated into a single, unified point cloud model after filtering. To build a seamless 3D model, this procedure combines the filtered information, accurately aligns them, and removes any overlapping data.

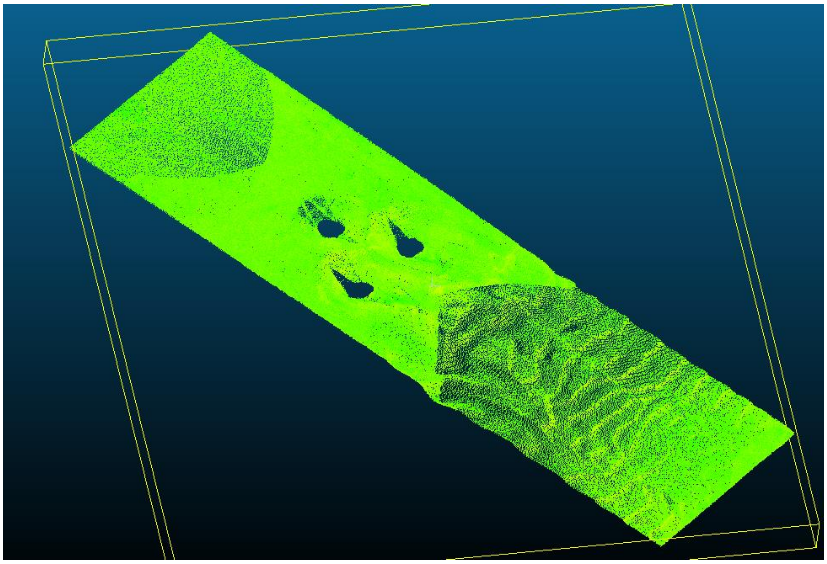

Figure 12 Merged Data Clouds

Surface creation

The next stage is to build a surface model using the point cloud data after it has been assembled. During this procedure, algorithms are used to create a surface mesh that joins each point in the point cloud model. To generate a model that is more exact and detailed, the surface mesh can be further improved.

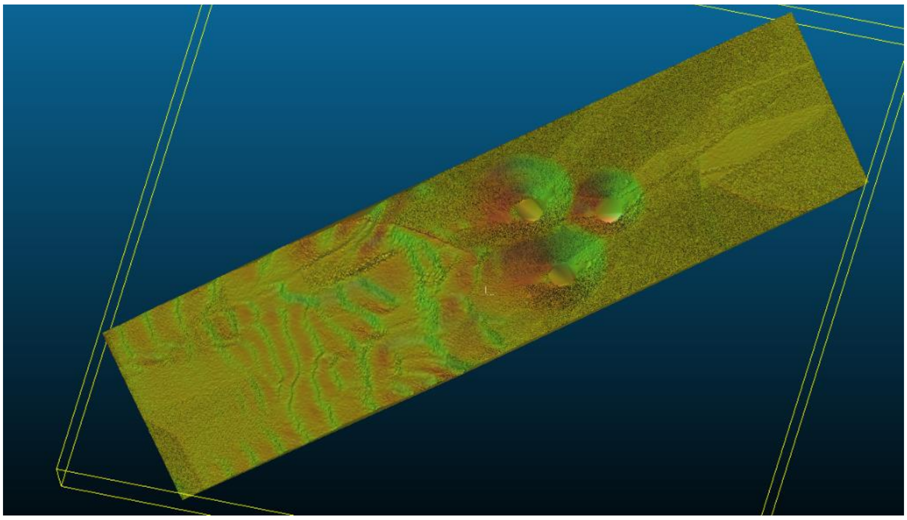

Figure 13 Created Surface from Merged Point Clouds

Texturing

Applying textures to the model comes next after building the surface mesh. This procedure uses satellite photos, aerial photography, or other sources to provide color and texture data to the surface mesh.

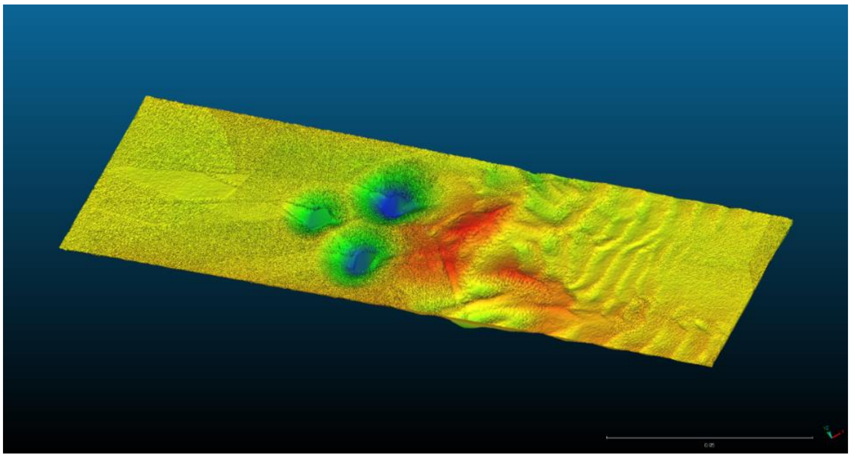

Figure 14 Color and Texture Added to the Mesh

Volume Calculation

To calculate the volume of objects or terrain features, 3D models built from remote sensing data are used. This can be done by measuring the volume of a single object or piece of terrain, or it can be done by comparing two or more 3D models to see how their volume has changed over time. The green places in the image are lower than the red and yellow places, while the red places are higher than the yellow ones. The blue ones represent the pole pits and are the lowest places. Looking at Figure 14, the parts of our project area in front of the pit are high and red, while the remaining areas generally have small height differences and are yellow. Volume of Project volume and surface is calculated by Cloud Compare Program. At Figure 15 is show that volume result is 2.851. Surface result is 3.114.

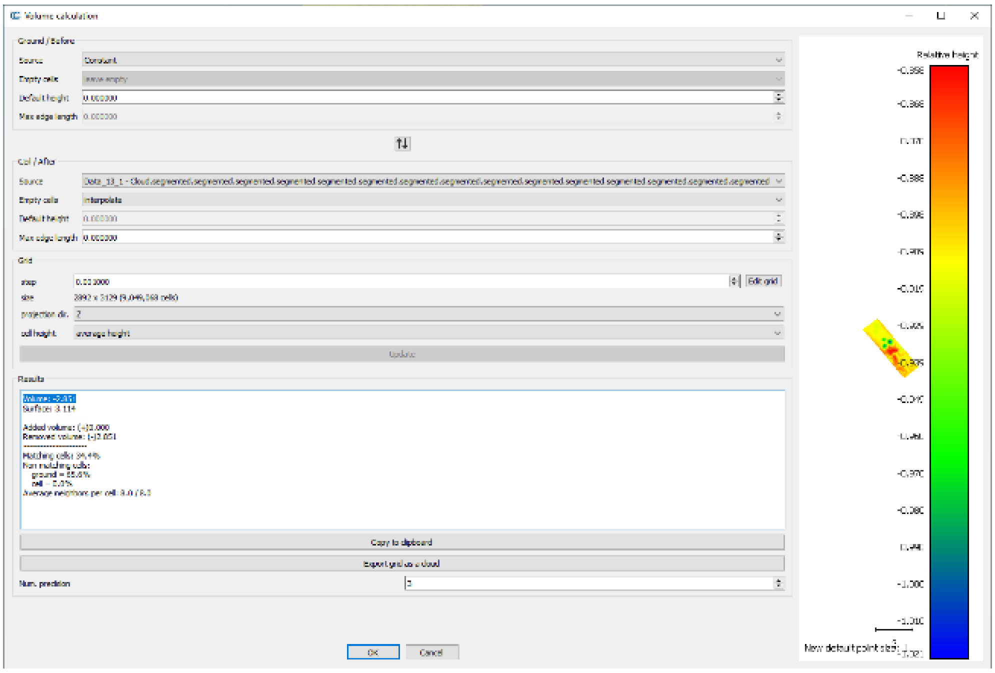

Figure 15 Calculated Volume and Settings

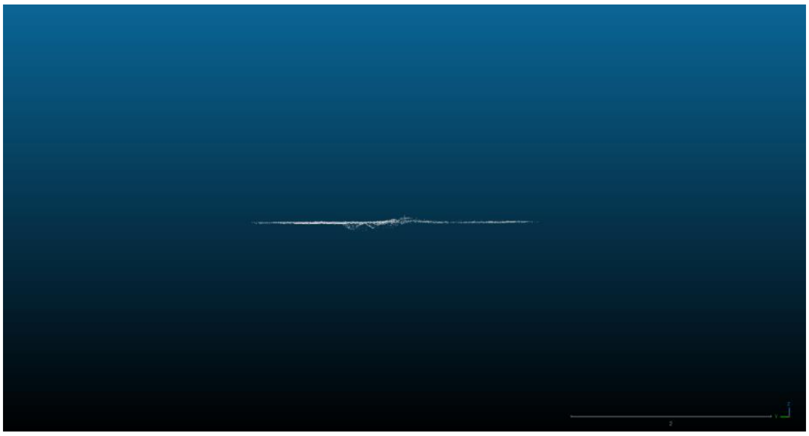

Figure 16 Volume Showed from Side

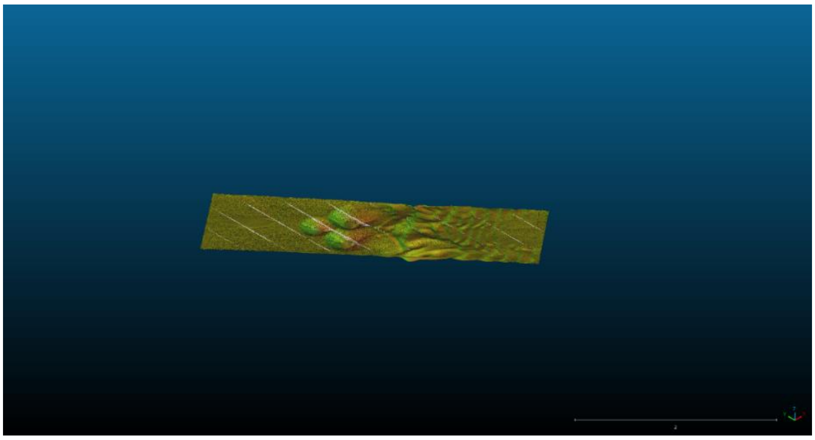

Figure 17 Volume Showed on Mesh Model from Side

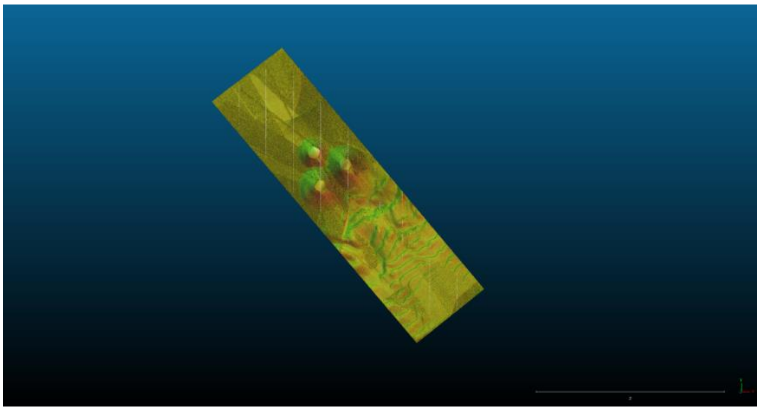

Figure 18 Volume Showed on Mesh Model from Top

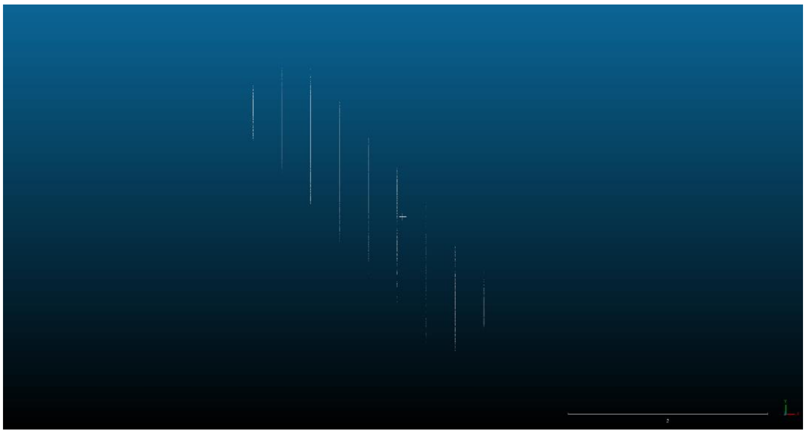

Figure 19 Volume Showed from Top

Contouring

Using 3D models made from remote sensing data, contouring includes creating maps that illustrate changes in slope or elevation. This can be accomplished by using a 3D model analysis to produce a map of contour lines by connecting locations of equal height with a sequence of lines. These contour lines can be used to pinpoint slopes, height differences, and other geographical features.

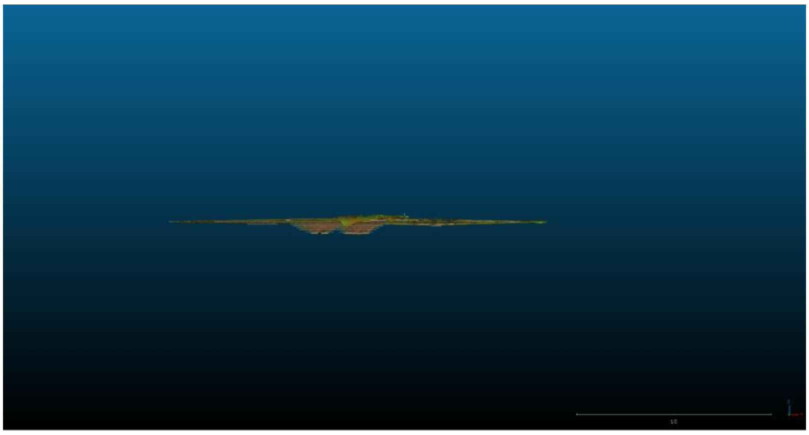

Figure 20 Contour Lines Showed with Mesh Model from Side

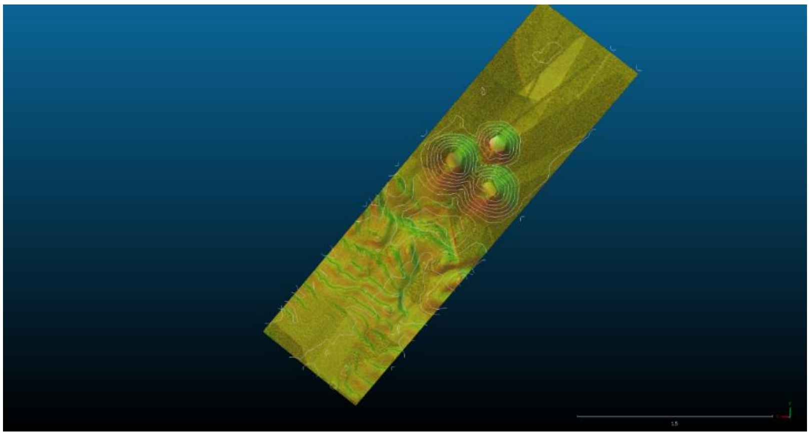

Figure 21 Contour Lines Showed with Mesh Model from Top

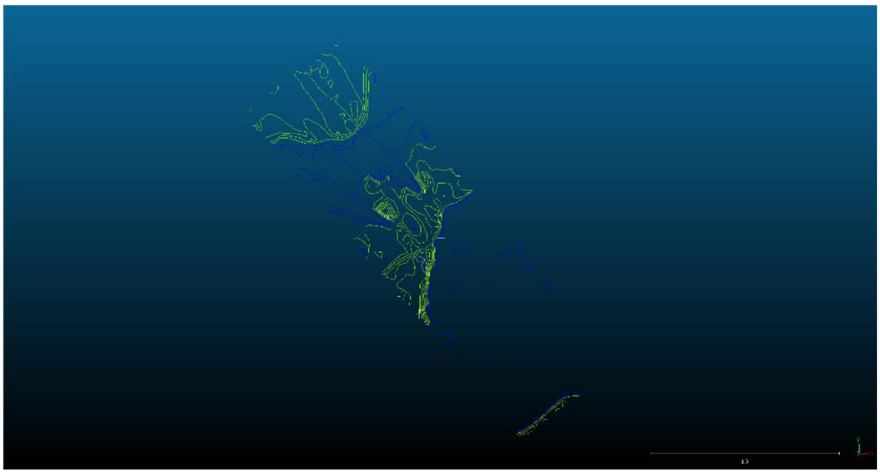

Figure 22 Contour Lines Showed with RGB from Top

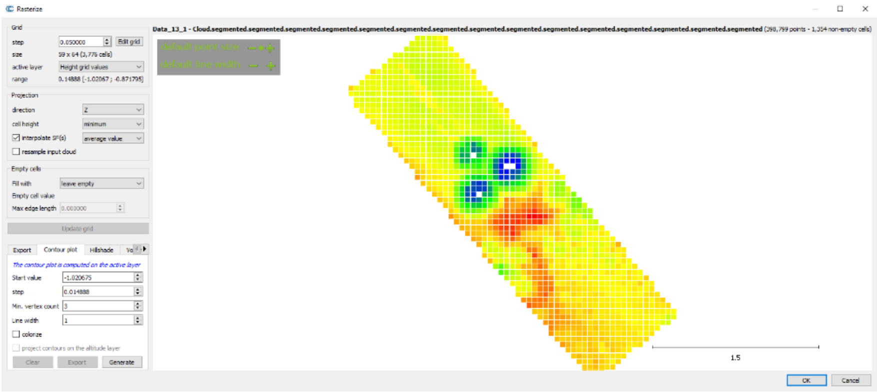

Figure 23 Contour Lines Calculations and Settings

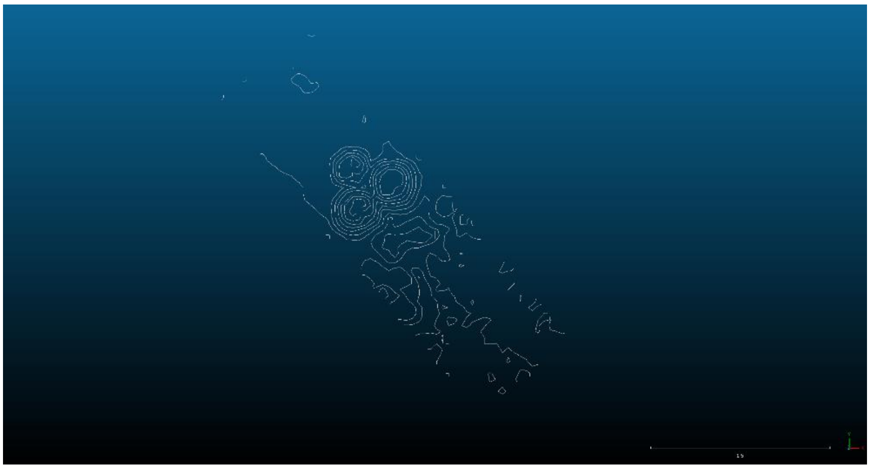

Figure 24 Contour Lines Showed with from Top

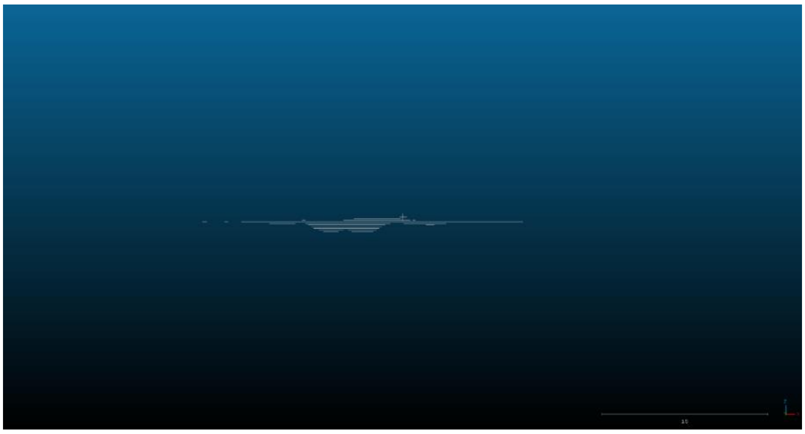

Figure 25 Contour Lines Showed with from Side

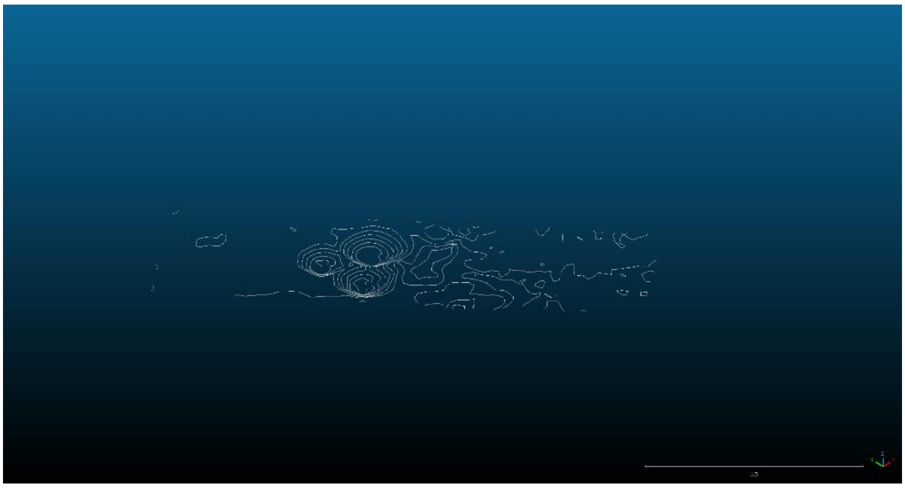

Figure 26 Contour Lines Showed with from Top Front

Validation

The built point cloud model must be validated in order to confirm its accuracy. In order to increase the model's accuracy, this step entails comparing the point cloud model to additional data sources, such as ground truth data gathered through field surveys.

Aim of the Project

The aim of 3D modeling with remote sensing data is to create accurate and detailed 3D models of real-world environments using data collected from remote sensing techniques such as LiDAR, photogrammetry, or laser scanning. Remote sensing data provides a wealth of information about the environment, including the location, shape, size, and texture of objects and terrain features.

The 3D models created from remote sensing data can be used in various applications, such as urban planning, architecture, engineering, environmental management, and natural resource management. For example, 3D models can be used to analyze the impact of proposed building construction on the environment, or to monitor changes in land use and land cover over time.

The aim of 3D modeling with remote sensing data is to create accurate and detailed models that can be used to make informed decisions about the environment and improve our understanding of the world around us. By using remote sensing data to create 3D models, we can better visualize and analyze complex environments, leading to more effective decision-making and improved outcomes for society. In this project, it was desired to create a more accurate and understandable 3D model by using a few dirty or faulty point clouds.