Tools

Control Point Comparison QA-QC Analysis

BSAU | AWG

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An important evaluation to make when performing a QAQC analysis of a LIDAR data set is a control point comparison. When discussing control points and LIDAR data, there are typically two types of points that need to be considered independently.

Control Points: The monuments or markers used to control the LIDAR collection or validation point collection for a project.

Checkpoints (aka Validation Points): Those 3-dimensional point locations collected for use in the validation of the LIDAR point cloud over the project area.

The control points form a basis to evaluate the absolute vertical position of the data set, while the checkpoints are used to verify that the vertical accuracy throughout the project area meets the contractual specifications. Those specifications typically refer to the fundamental vertical accuracy derived from the QAQC checkpoints. The fundamental vertical accuracy, as defined by the ASPRS, is the vertical accuracy in open terrain at a 95% confidence level with a normal distribution of error.

LP360 provides a specific toolbar to perform the QA/QC of a LIDAR dataset using control points:

Figure 1 - LP360 Control Points Toolbar

The control points are added via a shapefile with the elevation in the shape or a selected attribute. The name of the control points comes from the labeled field, typically Name, and must be unique. The arrows allow for a visual evaluation of the control point location, including elevation against the LIDAR data set (In figure 3 the control point is overlaid on the LIDAR data using the symbol). The visual QAQC allows for a qualitative review of the LIDAR and control points for possible errors as well. In addition the views will assist in determining the twenty (thirty recommended) distributed worse points to use in the analysis as per the ASPRS Vertical Accuracy Reporting Guidelines.

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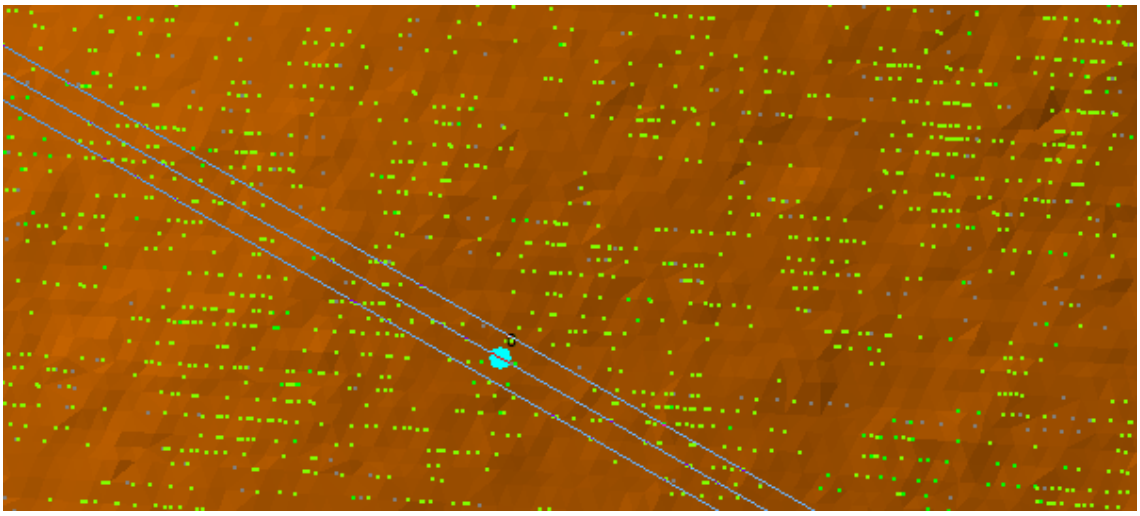

Figure 2 - Horizontal Control Point Location

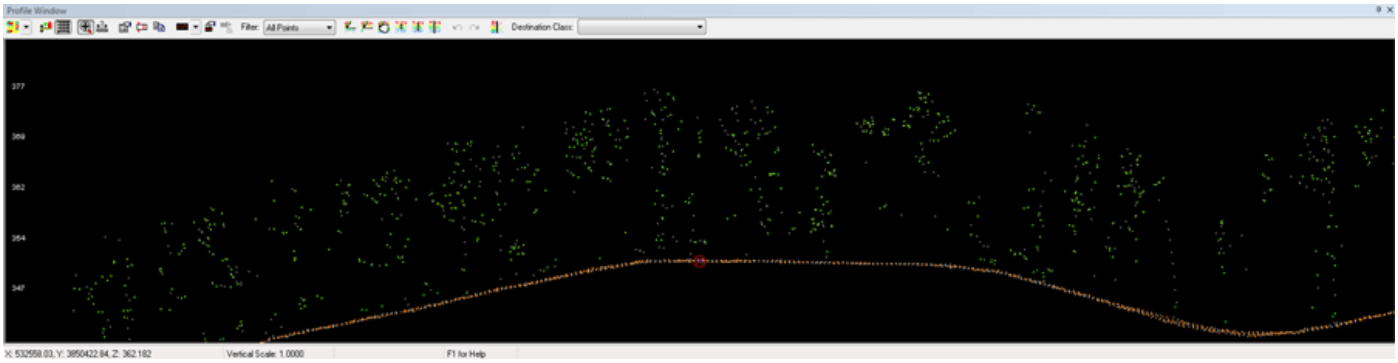

Figure 3 - Control Point Vertically Compared to LIDAR Data

Quantitative analysis is performed by executing a control point report against the ground surface generated using one of two methods, Triangulation (TIN) or Inverse Distance Weighting (IDW). The report yields the error calculated from the surface to the control point. For ease of analysis the control point report list is linked to the views and can be driven by double-clicking on a point in the list.

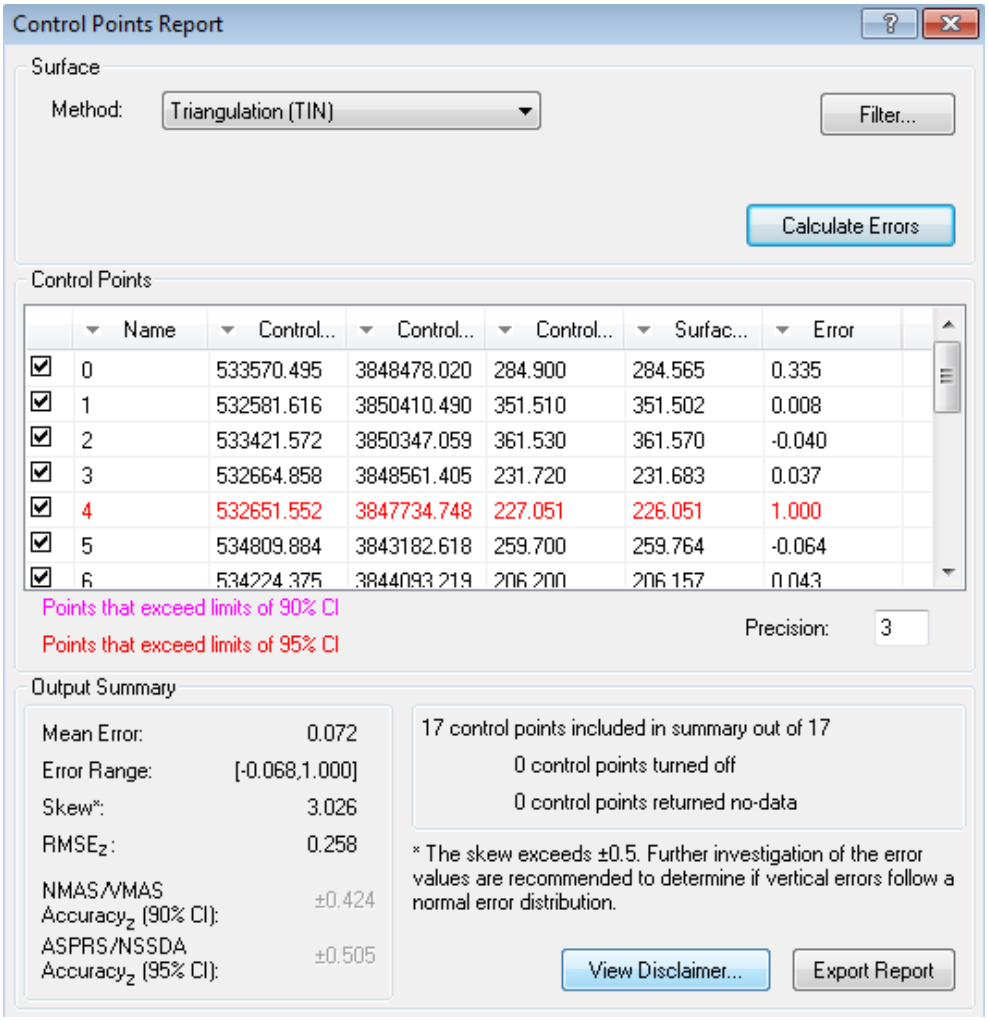

Figure 4 - Control Point Report

The output summary contains statistical information to assist with the analysis. For instance, the skew (skewness or asymmetry of distribution) can be used to evaluate if there is a normal distribution of the reported errors. A skew close to zero with a mean equal to the median estimates a symmetric distribution.

Those points in the list which exceed the 90% and 95% confidence levels are highlighted for specific review by the user.

NMAS/VMAS Accuracy(z) (90% CI):
The vertical accuracy of the surface for 90% confidence level.
RMSE(z) × 1.645

ASPRS/NSSDA Accuracy(z) (95% CI):
The vertical accuracy of the surface for 95% confidence level.
RMSE(z) × 1.96

During the analysis points may be removed if there is a suitable explanation for their exclusion from the analysis. The result is an automatically updated summary and a resulting fundamental vertical accuracy calculated from the RMSEz.

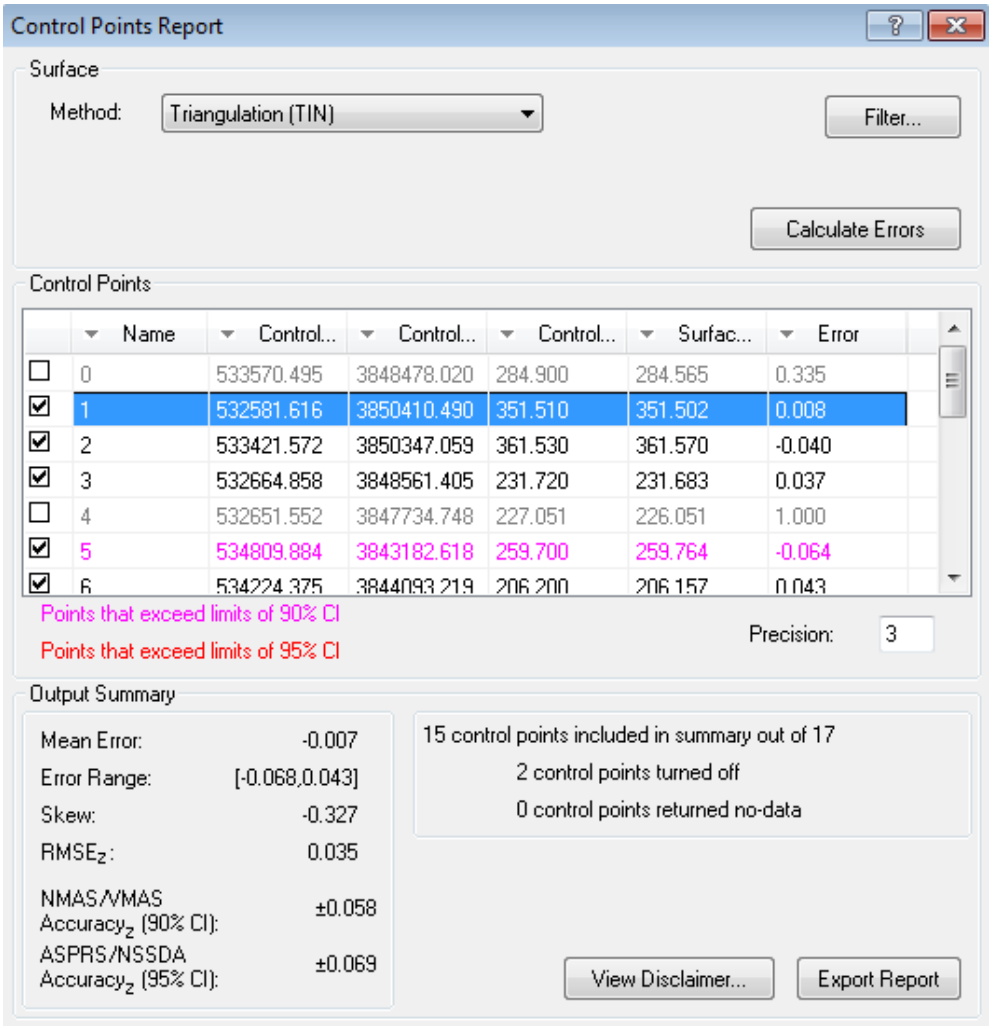

Figure 5 - Fundamental Report

This report can be exported for inclusion within a project QAQC report.

In addition to the fundamental vertical accuracy the guidelines recommend supplemental and consolidated vertical accuracies be reported as well. Supplemental reporting covers each of the major land cover classes in a project area as agreed upon by the data vendor and user. The consolidated reporting is a combination of all of the supplemental points along with the fundamental ones. The inclusion of these additional vertical accuracy reporting allows for users of the data to have a better understanding of the data accuracy and how that applies to their intended use.

Supplemental vertical accuracy analysis requires executing the report and analysis for each supplemental category. The error results are then exported and an additional calculation executed to determine the accuracy(z) using the 95th percentile method as the supplemental, and similarly consolidated, do not follow a normal distribution of errors due to their nature. Likewise, to determine the consolidated vertical

accuracy one would combine all of the supplemental and fundamental points into a single shapefile and perform the analysis.

For more information on the widely used standards for vertical accuracy reporting please refer to the following organizations:

American Society for Photogrammetry and Remote Sensing (ASPRS)
Federal Geographic Data Committee (FGDC)
United States Geological Survey (USGS)