Picking the Right Lidar Density for Your Project

SURDEX CORPORATION

Lidar data has an extremely wide range of applications, from hydrological modeling to bridge construction and countless other assessment, management, design and planning uses. After deciding that lidar data will help with whatever task you face, the next step is to design your acquisition plan. This includes determining the appropriate point density and accuracy that will meet your needs. The U.S. Geological Survey (USGS) uses a quality level (QL) system for lidar data that consists of four levels, detailed in the table below. Each QL has specific density and accuracy requirements. The majority of Surdex's clients seeking lidar data opt for QL2 lidar data, although some opt for QL1 lidar data for specialized applications.

The main factors that determine the ideal point density and accuracies for a given project are hydro feature collection parameters, desired classification scheme, desired feature fidelity and contour interval. Each factor will vary based on your desired end use. More precise hydro feature collection parameters (i.e., lower minimum feature width or area) and more precise contour intervals require a higher point density and/or increased accuracies. The same applies for more elaborate classification schemes with a higher level of sub-categorization (i.e., low and high vegetation broken into separate classifications).

Although 2 points per square meter (ppsm) lidar data serves the needs of many of our clients' projects, including large-area elevation modeling for environmental assessments, certain landscapes require higher point density data. In areas that have extremely varied terrain and areas that are extremely flat, a higher point density may be necessary to sufficiently capture all changes in elevation. Project areas with dense trees—especially places with evergreen trees where leaf-off collection is not possible—also may necessitate high point density data collection.

Lidar Accuracy Requirements				
	QL0	**QL1**	**QL2**	**QL3**
Relative	≤ 4cm	≤ 8cm	≤ 8cm	≤ 16cm
Absolute	≤ 5cm	≤ 10cm	≤ 10cm	≤ 20cm
Density and Spacing Requirements				
	QL0	**QL1**	**QL2**	**QL3**
Density	≥ 8 ppsm	≥ 8 ppsm	≥ 2 ppsm	≥ 0.5 ppsm
Spacing	≤ 0.35m	≤ 0.35m	≤ 0.71m	≤ 1.41m

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Higher density and/or higher accuracy lidar is especially common with engineering applications. Departments of Transportation, the U.S. Army Corps of Engineers and private engineering firms need very precise and accurate data for roadway and bridge construction, waterway management and various other tasks. Clients interested in developing a 3D model of a city would also likely require higher point density data, depending on the end use of the model.

There are several factors that determine what lidar point density, as well as accuracy, are ideal for your project; however, what is ideal may not always line up with what is within your budget. Clients who are interested in lidar data collection should consider the possibility of breaking up their project area into different QLs. This option may be ideal if the project area is fairly large, but more accurate/precise data is only needed in specific portions of the project area. For example, 8ppsm data acquisition could be planned for areas of anticipated bridge construction or over an airport, and 2 ppsm data would be planned for all other areas with no business reason for more dense data. Other cost relief may be found in a Broad Agency Announcement (BAA) grant through the USGS (read more on this in our "Obtaining Federal Funds for Elevation Data – BAA Grants" handout on our website's "Resources" page). Whatever data needs and funding limitations you face, Surdex can help plan a custom project that is right for you so you obtain the most value from your project.
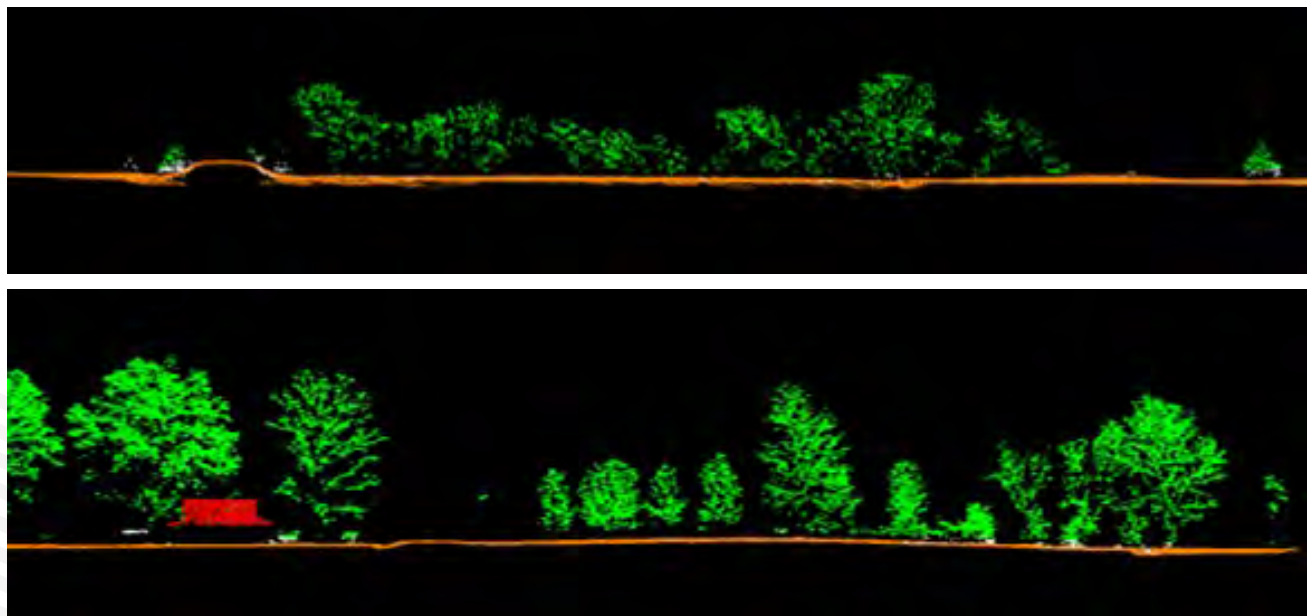
QL2 lidar point cloud (top) versus QL1 lidar point cloud (bottom)