



Point Cloud Scoping and Acquisition

Best Practice Guidelines

v1.9

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Statement of Intent

Every year the Geospatial Industry is having to adapt to the continuous advances in survey technology. Professional Land Surveyors are being asked to perform surveys using equipment and data that clients may be unfamiliar with. At the same time clients are looking to integrate and maximize the utility of survey data like never before. The technology driving this work is rapidly developing, faster than best practice standards can be communicated.

The standards below are focused on remote sensing point cloud data production. The intent is to both inform and protect the owner, service provider surveyors, and end user, when procuring and using point cloud data.

These standards aim to facilitate the process of asking for a scope and fee to conduct a survey to deliver a point cloud or derived model, such that all parties understand the steps and procedures they must take to assure the data being collected, processed, and then provided to the client, will meet the standards and accuracies being requested.

When requesting a survey involving a point cloud or derived deliverable, MALSCCE recommends using a Registered Massachusetts Professional Land Surveyor, Professional Engineer, and / or ASPRS Certified Photogrammetrist to perform the required work. The final deliverable should be accompanied by a stamped certified statement for the end use intent based on these standards.

These guidelines are seen as a living document which shall be informed and revised with continuing outreach, technology changes, and industry developments.

Table 1: Point Cloud Project Scoping Guide

Point Cloud Project Scoping Guide					
Class	Focus	Example Uses	Point cloud accuracy	Example Minimum Feature of Interest	Considerations
A	Architectural, MEP and Civil Engineering design, construction documents	Engineering level existing conditions, construction documents, model development Vertical coordination Deformation analysis and monitoring Property relation and site plan coordination	1/4" Level 1 Control Minimum	Small MEP components Structural relieving joints Verified positional locations Architectural detailing	Maximum potential for reuse across project lifecycle Full discipline coordination Least likely for required returns if scope develops Full registration to site control or grid reporting
B	Design	All of the below plus: Design development Initial coordination planning Volume Quantity	1/2" Level 2 Control Minimum	Masonry openings Large MEP systems Site positioning Coordination	Lower accuracy & spatial relation, vertical stacking Likely to require additional survey Limited alternate usage
C	Project Planning, Schematic design	Limited accuracy planning tools Demolition phasing Elevation Markups Notation Volume estimates Condition assessments	3" Level 3 Control Minimum	Initial design concept coordination Mass modeling	Floors may not stacked Will require considerable additional survey for higher end usage. Restricted alternate usage
D	Feasibility / Visualization	Site visualization, Animations, fly through, imagery	Accuracy not verified	General area context capture	Lowest costs for data accuracy. Global accuracy not verifiable Limited value to modeled elements
Notes			Point cloud accuracy: reliability of final point cloud from end to end across multiple scanning locations		

Table 2: Required Quality Control

Survey Quality Control				
Level	Survey Method	Project Control Positional Tolerance	Target Based Registration	Review
1	Closed traverse survey control with total station (differential levels recommended).	For 1/4" point cloud relative to control (survey network minimum accuracy 0.04' + 50 ppm)	Yes	PLS / PE*
2	Survey control via total station and/or Survey Grade Geodetic GPS	For 1/2" point cloud relative to control (survey network minimum accuracy 0.10' + 75 ppm)	Yes	PLS / PE*
3	Basic survey points only for geolocation or QA/QC	For 3" point cloud relative to control (survey network minimum accuracy 0.25' + 200 ppm)	Minimal (Overlap Dependent)	PLS/PE, ASPRS Photogrammetrist
4	No survey control checks		None (Overlap Only)	PLS/PE, ASPRS Photogrammetrist
Notes		To ensure point cloud data longevity, Level 1 or 2 control is recommended. See glossary for implications		*Statement of accuracy from PLS/PE recommended

Recommended Certification Statement

INSERT COMPANY LETTER HEAD HERE

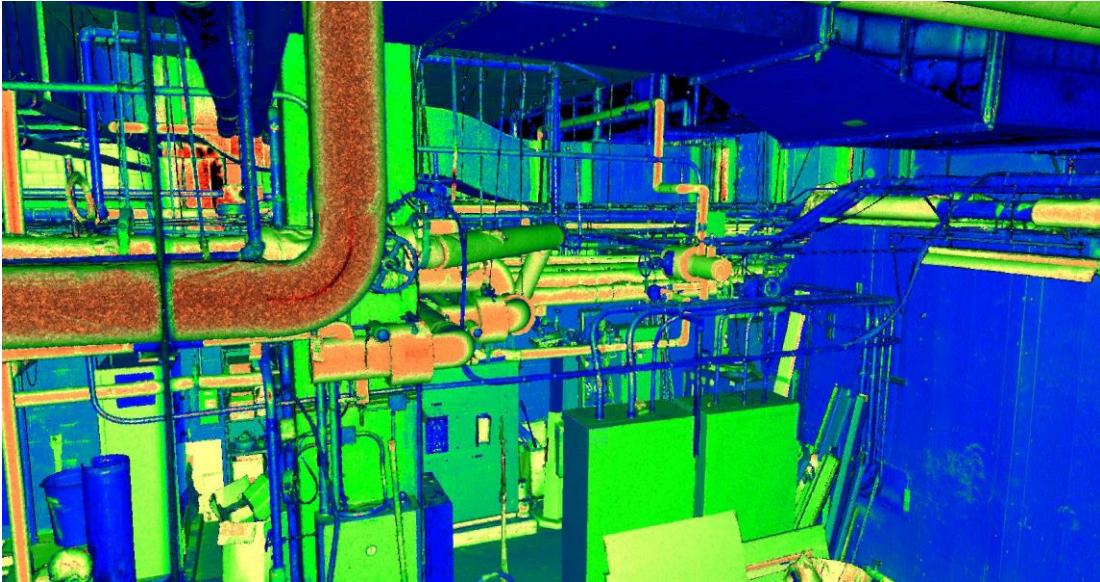
INSERT DATE

I hereby certify that the data provided meets or exceeds the accuracies specified in the MALSCE recommended guideline Class *X* Level *X*

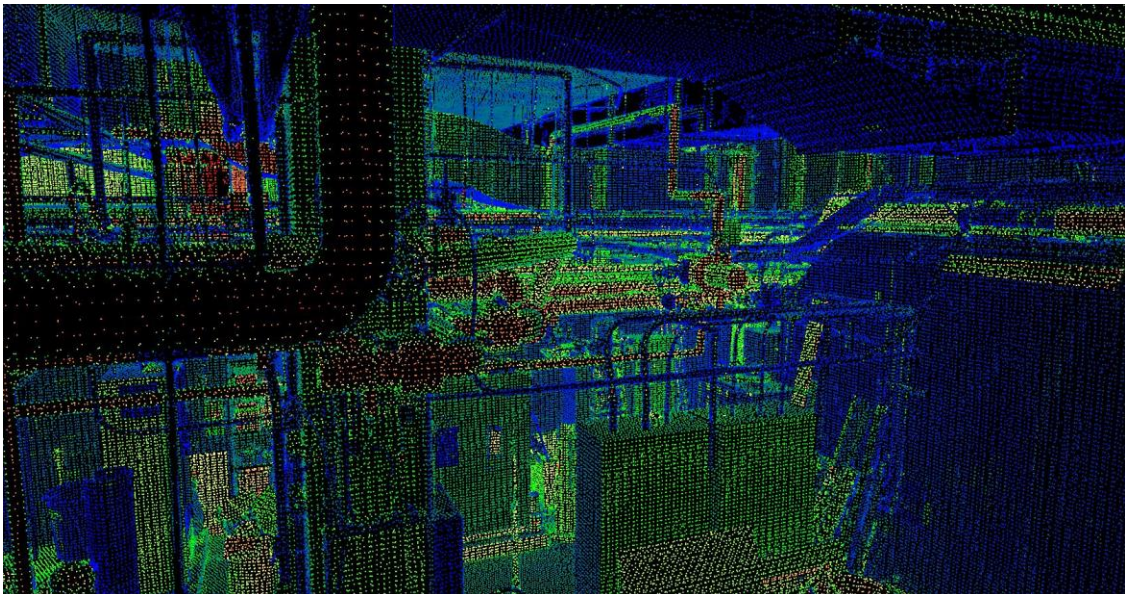
INSERT STAMP AND SIGNATURE

Point Cloud Data Examples

MEP Interior high resolution survey (1/4"+)



MEP interior lower resolution survey (3")



Exterior façade high resolution survey (1/4" +)



Exterior façade lower resolution survey (3")



UAV Topography, high resolution survey (3")

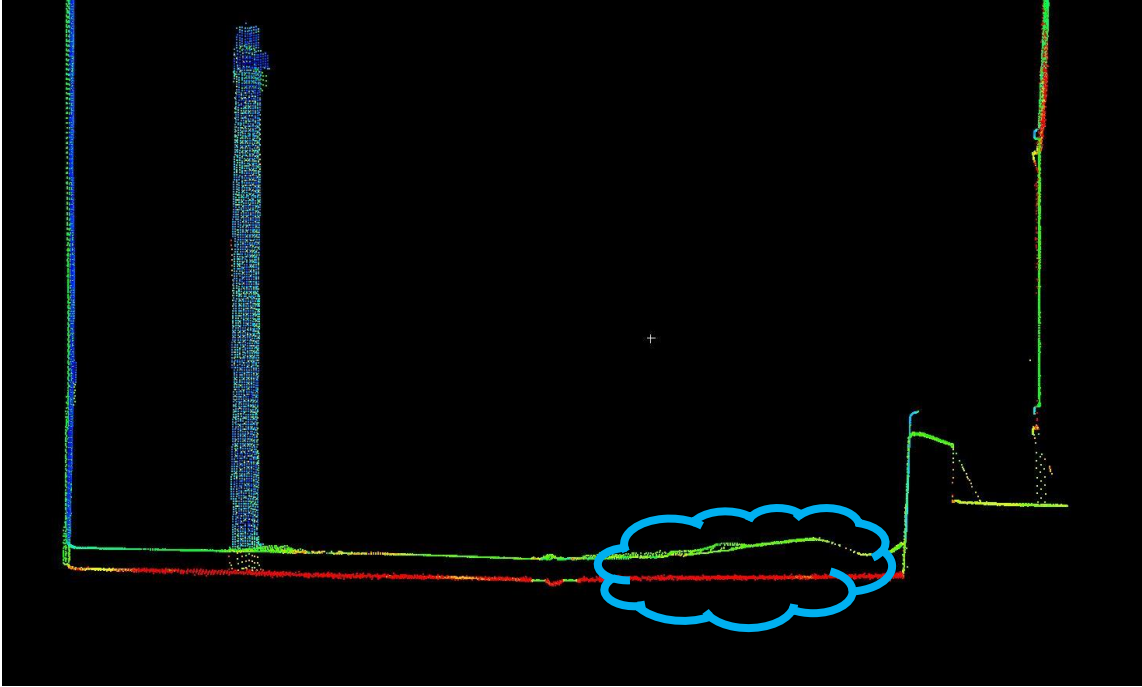


UAV Topography, lower resolution survey (6 inch resolution)

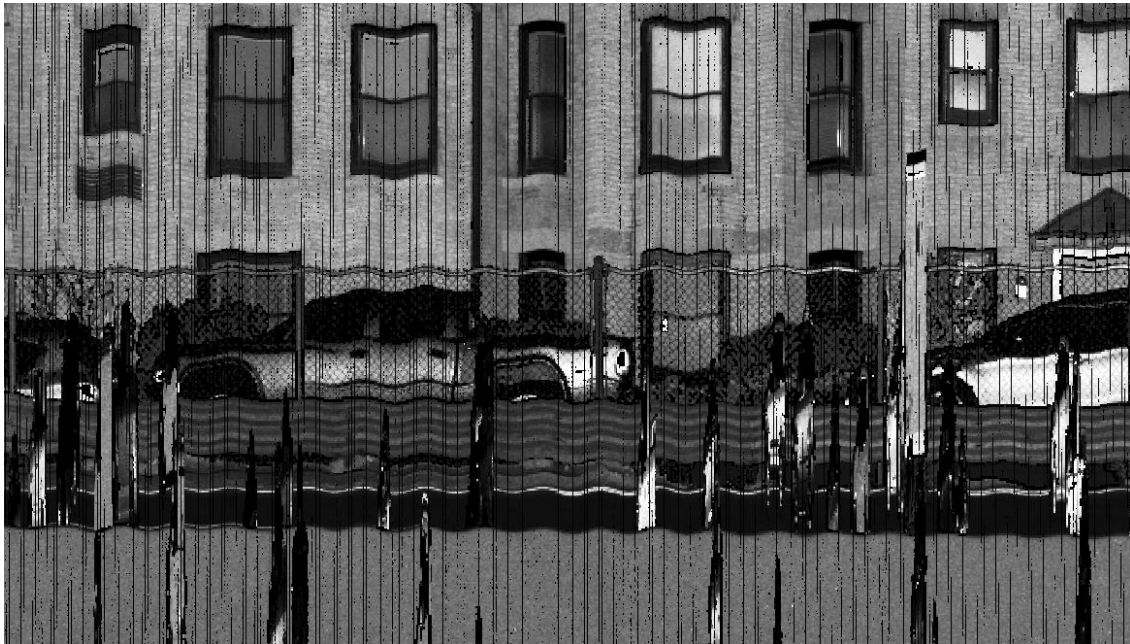


Examples of errors and issues with point cloud data

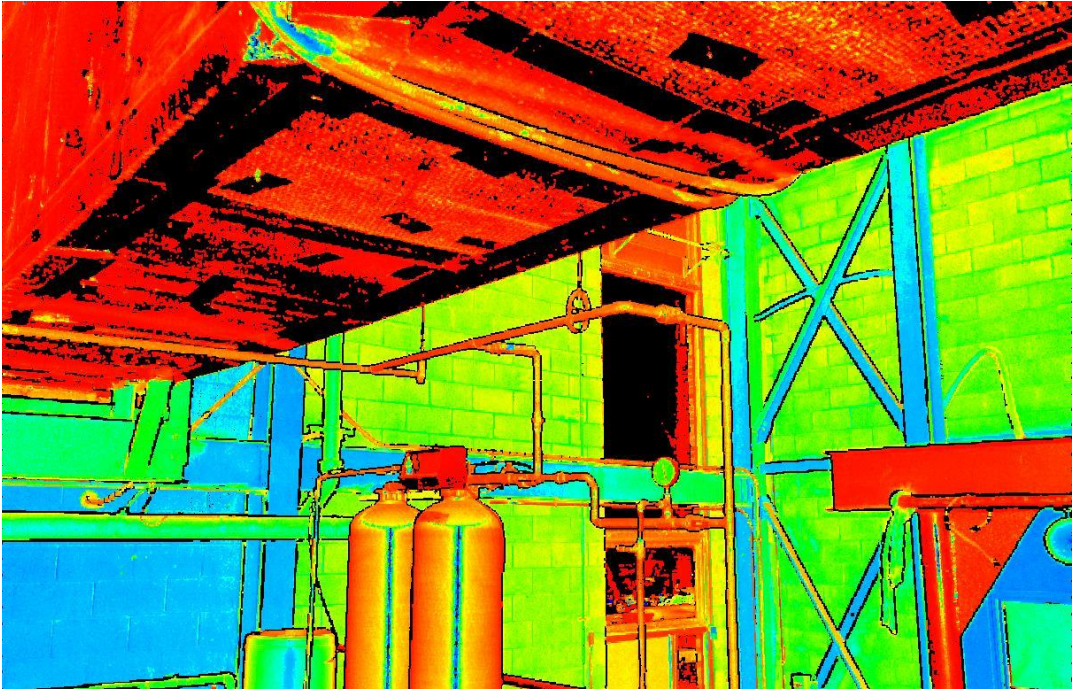
Point cloud separation issues due to insufficient survey control or scan target checks



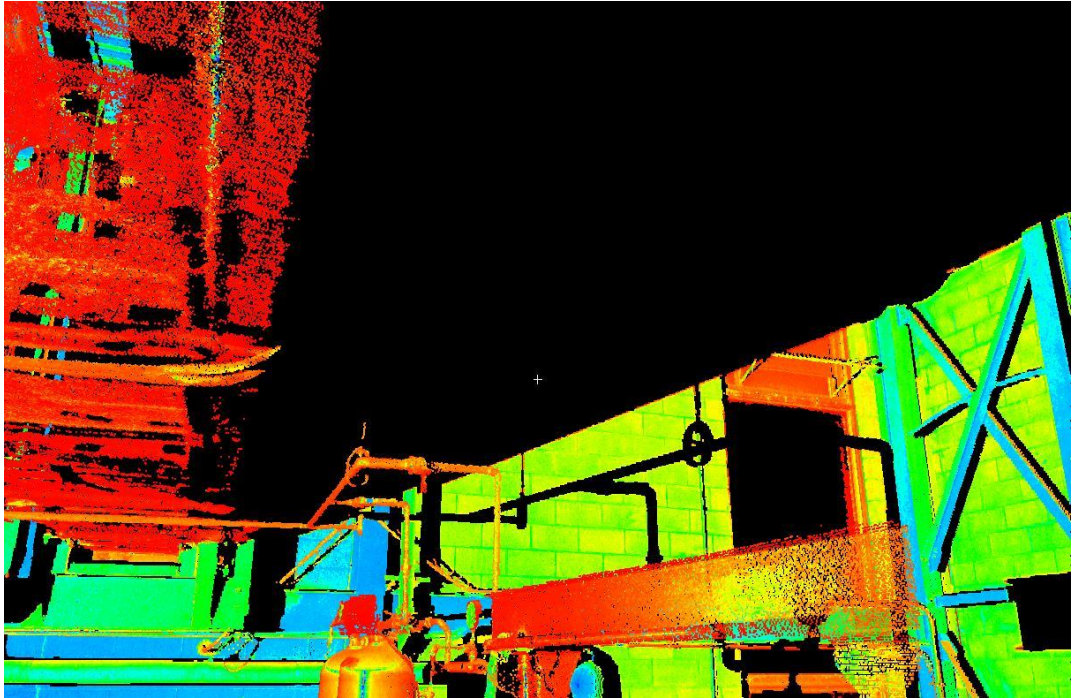
Poor quality data possibly caused by vibration at time of scanning, wind buffeting, or sensor errors



Shadow areas or blind spots caused by blocking objects. Particularly important for above ceiling MEP. Often obscured from just floor level scanning



Scanning location view



Shadow/blind spot area

Glossary

MALSCE: Massachusetts Association of Land Surveyors and Civil Engineers

PLS: Professional Land Surveyor

PE: Professional Engineer

ASPRS: American Society for Photogrammetry and Remote Sensing

PPM: Parts per million

Minimum feature of interest: smallest element of target survey area that needs to be clearly defined in the point cloud

MEP: Mechanical, Electrical, and Plumbing (also referred to as MEP/FP for Fire Protection)

UAS: Unmanned Aircraft System or drone

AEC: Architecture, Engineering, and Construction industry

Bibliography:

U.S. Institute of Building Documentation

[Level of Accuracy Specifications](#)

BIM Forum (U.S. Chapter of buildingSMART International)

[Level of Development Specifications](#)

ASPRS

[Accuracy Standards for Digital Geospatial Data 2014](#)

Code of Massachusetts Regulations Title 250 CMR

[250 CMR](#)

Caltrans Office of Land Surveys Manual

[Laser Scanning](#)