

A Complete Guide to Generating Floor Plans from Point Clouds Efficiently

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The preparation of floor plans from scanned point clouds is an essential process in rehabilitation projects, heritage documentation and Scan-to-BIM processes. This article describes a complete workflow that transforms a dense point cloud into an accurate, editable 2D representation in CAD, ideal for architects, engineers, and technicians working in built environments.

The screenshots are made with Aplitop's tcp PointCloud Editor, but the procedures could be applied in any point cloud software. The data from the scanned clouds is courtesy of Leica Geosystems Spain.

1. General Workflow

The process begins with capture using terrestrial laser scanners or SLAM handheld scanners, generating a three-dimensional point cloud. The ultimate goal is to generate a vector floor plan with reliable information about structural geometries and architectural elements. The flow is structured in the following stages:

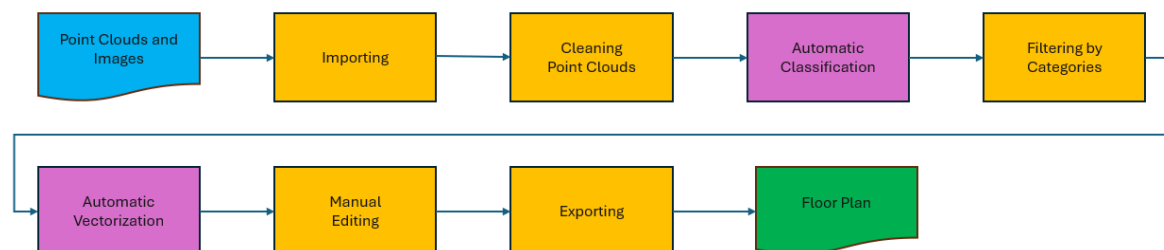


Figure 1. General Workflow

2. Data Import

The usual input formats are LAS/LAZ, E57 or files in proprietary format exported from scanners. When importing, it is essential to preserve RGB color, and attributes such as intensity, distance to the scanner, and normals, if available.

In addition, it is advisable to import the associated images captured by the scanner, to facilitate visual recognition during editing.

The software should allow you to visualize the cloud with inspection, cropping, and logging tools if you are dealing with multiple scans.

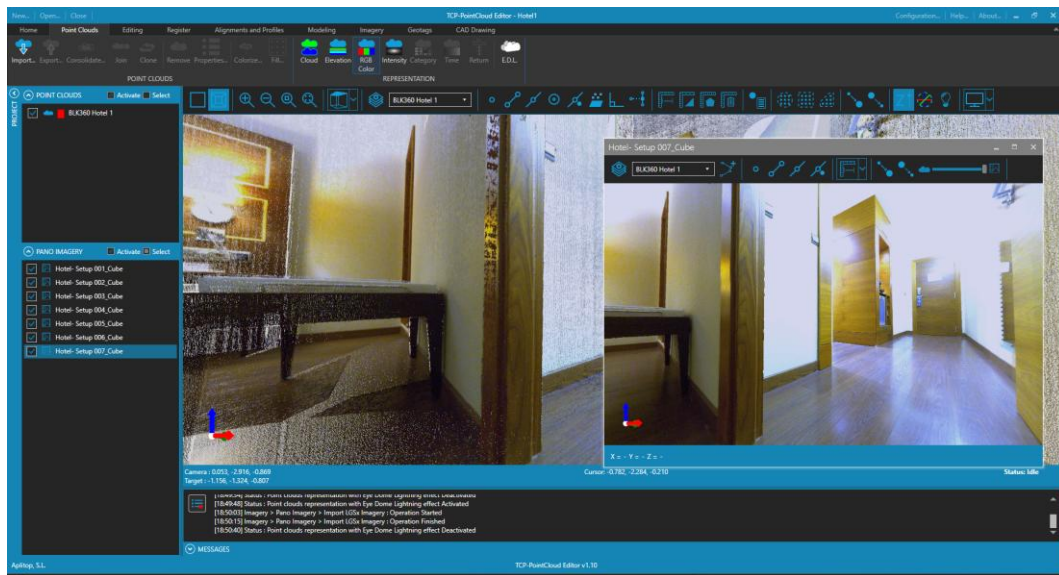


Figure 2. Point cloud and imported images

3. Cloud Cleanup

The quality of a scanned point cloud can be compromised by noise, isolated points, and low-density areas, making downstream processes such as classification and vectorization difficult. To ensure an accurate and efficient database, the following cleaning techniques are applied:

3.1 Removal of points outside the area of interest

Hand tools are used to cut out points that are outside the spatial boundaries defined for the project, such as areas outside the building or non-relevant levels.

3.2 Elimination of isolated points

Statistical filters, such as *Statistical Outlier Removal* (SOR), are used to analyze the average distance of each point to its nearest neighbors. Points whose average distance exceeds a defined threshold are considered outliers and are eliminated.

3.3 Suppression of low-density areas

Areas with low point density may indicate unreliable data or noise. Local density analysis techniques are applied to identify and eliminate these regions, thus improving the uniformity of the cloud.

The combination of these automatic and manual methods allows you to obtain a clean point cloud ready for the next stages of the workflow.

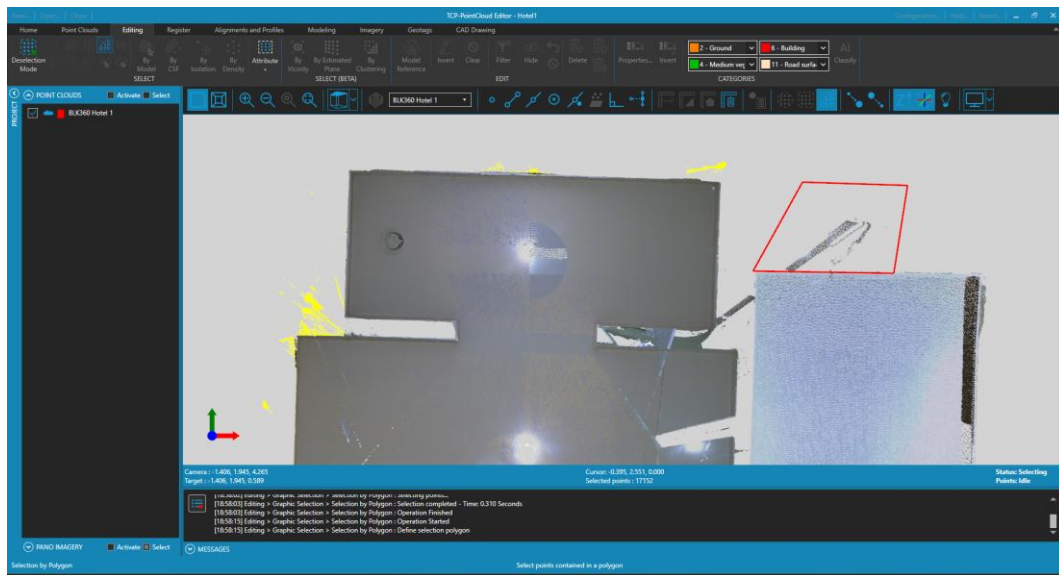


Figure 2. Cleaning of points outside the area of interest

4. Classification of Points

Point cloud classification is critical for identifying and segmenting architectural elements such as walls, floors, ceilings, doors, and windows. This process facilitates the generation of accurate and detailed models of buildings.

4.1 Traditional geometric methods

Geometric approaches are based on the detection of structural features using algorithms such as *RANSAC (Random Sample Consensus)*, which allows the identification of predominant planes in the point cloud, commonly associated with elements such as walls and floors. These methods are effective in environments with well-defined and less complex geometries.

4.2 Machine learning-based approaches

Machine learning methods, such as deep neural networks, have proven effective in semantic classification of point clouds. These approaches allow different architectural components to be automatically identified and labeled, even in environments with complex geometries or incomplete data.

4.3 Practical considerations

The choice of classification method depends on several factors, including the quality of the point cloud, the complexity of the environment, the performance of the software, and the available computational resources. A combination of geometric and machine learning methods can work well, although manual editing will almost always be necessary.

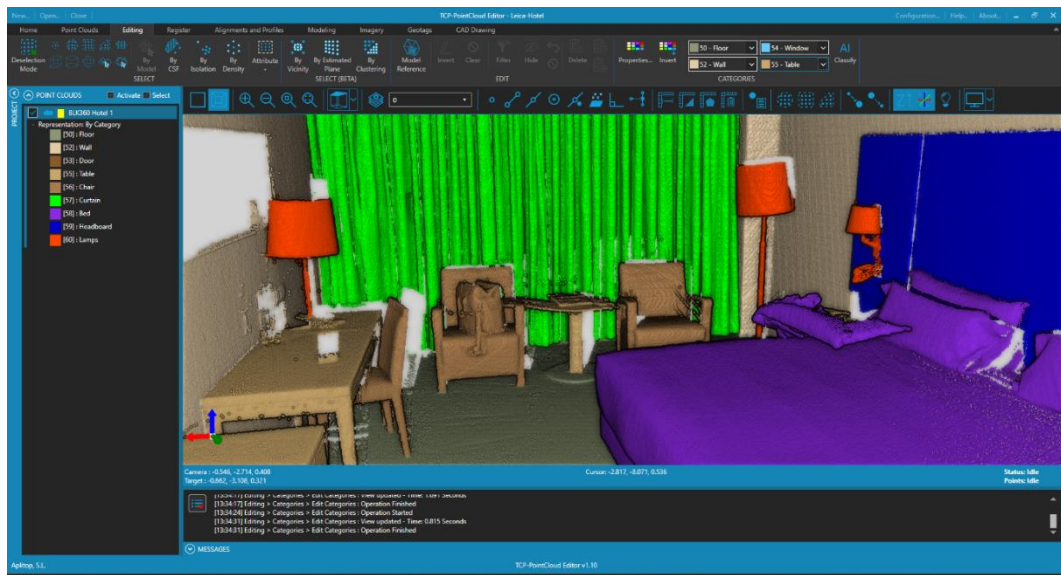


Figure 3. Points automatically classified and edited later

5. Filtering categories of interest

After the classification of points, it is advisable to establish the representation of the cloud with a color based on its category, for a more intuitive interpretation.

Then, only those that should appear on the floor plan are left visible. Typically, the following are selected:

- Intersections of walls with the horizontal plane
- Door and window openings
- Columns and pillars

Categories such as floor, ceiling, furniture, unclassified objects and other elements that are not part of the main architectural structure are often hidden.

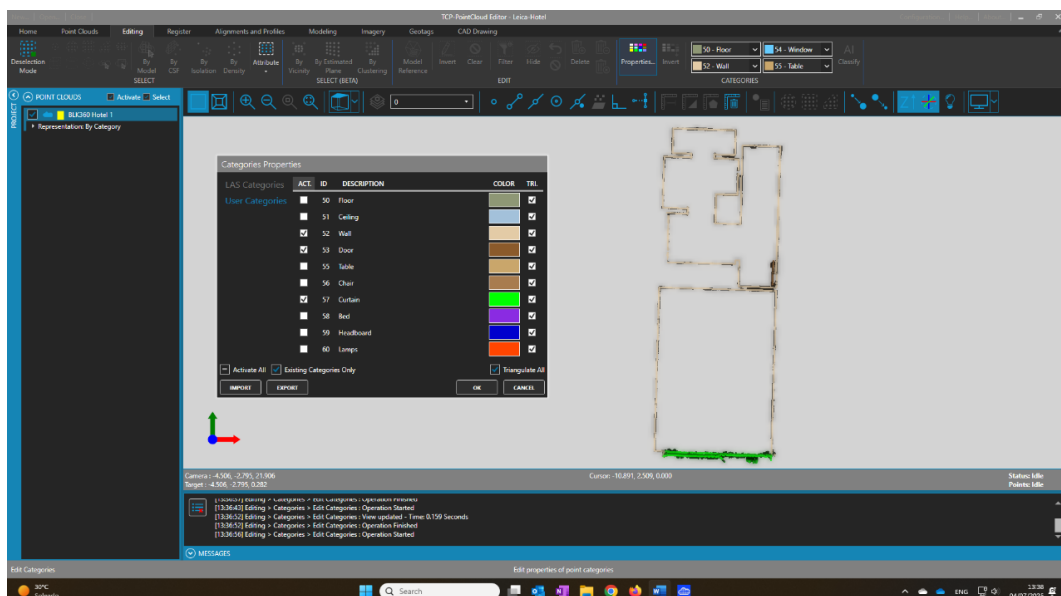


Figure 4. Cloud floor plan view with some categories hidden

6. Automatic vectorization

A horizontal section is then generated at a certain height (e.g. 1.00 or 1.20 m) to obtain a more accurate projection.

The filtered cloud is converted into vector geometries (lines, polylines) using edge detection and geometric fitting algorithms.

The quality of the result depends on point density and sharpness of the edges in the cloud.

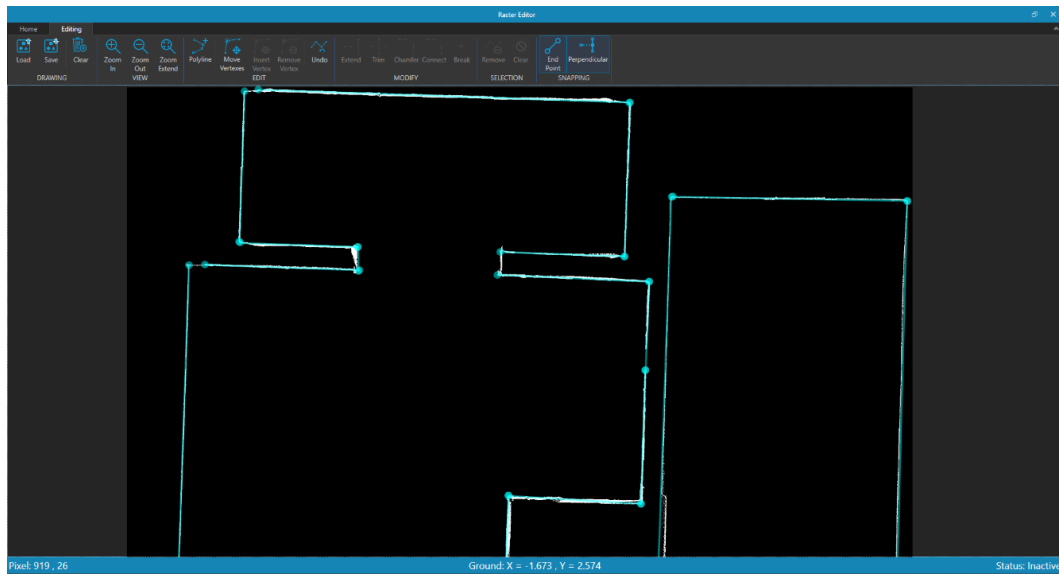


Figure 5. Editing of vectorized lines generated automatically

7. Manual editing

The edit phase allows you to review, correct, or complete automatically generated entities. Although vectorization algorithms can offer good results, it is common to find imperfections, omissions, or incomplete geometries that need to be refined to ensure the accuracy of the plane.

Typical tasks include:

- **Adjustment of polylines to incomplete walls:** joining segments that do not intersect or extending lines to reach other architectural references.
- **Redundant entity removal:** Cleaning up duplicates, overlapping lines, or strokes that don't add value to the rendering.
- **Continuity verification and contour closure:** verification that the geometries that represent rooms or closed areas are well defined.

In this phase, annotations, dimensions, textual references or symbols can also be incorporated according to the graphic standard of the project.

Advanced CAD tools allow you to apply geometric constraints such as perpendicularity, parallelism, or alignment, making it easy to accurately and consistently edit the final drawing. This fine control is especially relevant in environments with orthogonal geometries or strict presentation regulations.

8. Export

In CAD environments, the vectorized plan can be exported as a DWG or DXF file, allowing it to be edited later to add dimensions, furniture and other details.

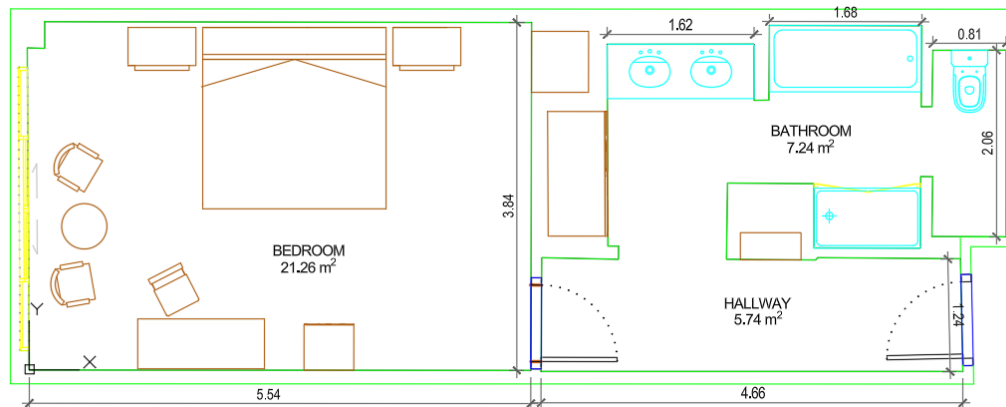


Figure 6. Final CAD drawing

The 2D polylines created in the vectorization stage can be moved to their real level on each level of the building, and then vertically extruded according to the height of each floor, generating 3D polylines that will serve as the basis for the creation of a digital twin.

Geometric information can also be imported into GIS flows, adding additional attributes for spatial analysis or cadastral management.

For BIM environments, vector entities can be converted into parametric objects for integration into platforms such as Revit, Archicad or Allplan.

9. Conclusions

Transforming a scanned point cloud into a vector floor plan is a process that combines automation and expert technical intervention. The availability of classification algorithms, intelligent vectorization, and accurate editing has made this workflow more accessible and robust.

Understanding and mastering each of the phases is essential to achieve professional and reliable results, maximizing productivity through the use of appropriate tools.