USER GUIDE

1. LiDARMAP CONCEPT

LidarMap promote a new concept of developing applications that extract 2D and 3D information from data obtained through LiDAR technology. Specifically, stereorestitution technologies are applied to LiDAR point clouds, together with simplified procedures for rapid vectorization. *The vector data concept is based on the GIS structure and the shapefile format, which allows the addition of attributes for collecting complex and multiple informations related to the same object. Although it contains functions similar to CAD systems, it is oriented toward the GIS systems concept, featuring point, line, polygon, and GDB topologies, along with all their associated functionalities. Thanks to its highly intuitive handling and advanced navigation functions, even for very large datasets, the application can also be useful in infrastructure development project design and monitoring programs, as well as in road quality inspection and the inspection of other constructions. Mapping transport corridors or territories predominantly covered by vegetation remains one of the leading applications of such software.*

Developed primarily for extracting a wide range of geospatial information, including planimetric features and construction details, LIDARMAP provides advanced capabilities rarely found in a single software solution.

The concept of "everything within one click" is implemented through dual access to all major functions: users can activate commands either with the mouse or by pressing a corresponding keyboard shortcut. . For example:

• *Insert vertex:* ***I***	• *Move vertex:* ***M***
• *Draw point:* ***P***	• ***Draw polyLine:*** ***L***
• ***Draw polygon:*** ***G***	• *Draw Arc:* ***A***
• *Draw CurVe:* ***V***	• *Draw Circle:* ***O***
• *Draw Rectangle:* ***R***	• *Draw a line profile:*
• *EXplode polygon:* ***X***	• ***Join Polygons:*** ***J***
• *Delete Vertex:* ***D***	• *Delete selected object:* ***DEL***
• *Generate polygon empty space* ***Y***	• *Cut Polygons:* ***N***
• ***Polygone Autocomplete:*** ***H***	• ***Draw/Change 3D Fence***
• *Select any object:* ***S***	• *Select Point:*
• *Select Polyline:*	• *Select Polygon:*
• *Snap to plane:* ***1***	• *2D snapping:* ***2***
• *3D snapping:* ***3***	• *Snap to LAS points:* ***4***
• *Snap to nearby lines/vertices:* ***5***	• *Snap to Terrain:* ***T***
• *Snap to orthogonal (90°):*	• *Undo command:* ***Ctrl + Z***
• *Edit mode:* ***E***	• ***Info new version*** Update available
• *Multiple Edge Detection*	• *Abort command:* ***ESC***

What makes LIDARMAP particularly valuable is its intuitive interface and straightforward workflow. The development team has extensive experience in stereoscopic photogrammetric restitution and even broader expertise in digital mapping. Based on this experience, many traditional CAD functions that are no longer essential for modern mapping workflows have been simplified or consolidated.

For example, drawing a curved feature does not require navigating through dozens of separate commands. Using a single curve tool, together with circle and arc functions, users can create virtually any curved line or polyline.

All major functions are displayed directly on the screen and remain accessible with a single click.

The visualization and management of LiDAR data and vector layers are equally intuitive. Users can quickly change the display mode of the point cloud between RGB, intensity, classification and other commonly used visualization modes. They can also display selected LiDAR classes, hide unnecessary classes, or show only the required vector layers.

Layer colours, LiDAR class colours and the appearance of additional vector features can be changed also quickly and easily.

LIDARMAP also includes advanced editing topological functions, such as:

- *cutting a polygon using another polygon or polyline;*
- *splitting polygons or polylines using a reference polyline;*
- *generating polygons within empty areas;*
- *generating polygons using autocomplete function on polygons and polylines*
- *merging multiple polylines into a single polyline;*
- *editing and completing complex vector geometries.*
- *multiple edge detection.*

These capabilities help users efficiently complete digital maps and extract construction elements from buildings, including walls, floors, windows, doors and other structural or architectural details.



Figure 1.1 Generating the parallelepiped working volume

Most impressive, however, is the way users can navigate and inspect tens of gigabytes of LiDAR data with instantaneous visualization.

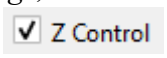
Users can define independent three-dimensional working volumes, called fences, with a parallelepiped shape (figure 1.1). Once a fence is activated, LIDARMAP loads, displays and processes only the LiDAR points and vector data located inside that selected volume.

This spatial filtering mechanism allows users to isolate a specific building, floor, façade, corridor or construction element without loading the entire dataset into active memory.

As a result, memory consumption is significantly reduced, visualization remains responsive, and editing operations can be performed faster, even when the complete project contains tens or hundreds of gigabytes of LiDAR data.

Multiple fences can be created and managed independently, enabling large datasets to be divided into smaller, well-defined working areas. Users can therefore move efficiently from one area of interest to another while preserving access to the complete project and avoiding unnecessary processing of data outside the active workspace.

By introducing 3D stereoscopic restitution directly into LiDAR data processing and vectorization workflows, ***LIDARMAP can increase productivity by approximately 30%–40% (tested by our operators).*** *This improvement results from more accurate point identification, fewer interpretation errors and a significant reduction in the time required for quality control and error checking.*

The 3D cursor automatically snaps to 3D objects such as terrain, buildings, and other surfaces. However, in stereo mode, pressing the ***Z key*** *or enabling* ***Z-axis control*** 

transfers control of the cursor's vertical movement to the trackball, allowing the user to move the cursor interactively along the ***Z axis****.*

Executable Stereoscopic Training

LIDARMAP introduces an innovative training concept based on the recording and replay of complete stereoscopic working sessions.

To our knowledge, LIDARMAP is among the first professional LiDAR mapping solutions to use executable workflow recording specifically for preserving and transferring stereoscopic working procedures.

Unlike conventional screen recording, which captures only a flat sequence of images and therefore loses the original depth perception, LIDARMAP records the actual workflow performed inside the three-dimensional environment.

The system captures the commands executed by the operator, the time intervals between actions, mouse and keyboard input, object selections, editing operations, snapping modes and the complete position, orientation and zoom level of the stereoscopic viewpoint.

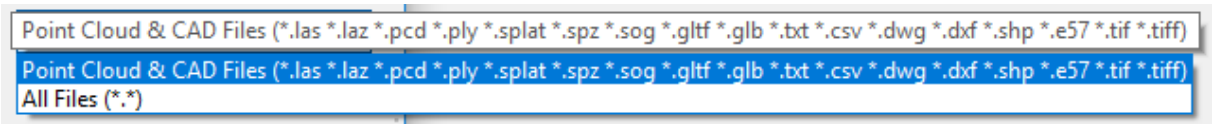
The recorded session therefore becomes an executable 3D tutorial rather than a passive video demonstration.

The proposed functionality transforms expert knowledge into a reusable and reproducible stereoscopic workflow.

The technology creates a new form of interactive technical instruction situated between a video tutorial, a software macro and an immersive simulation. Unlike a conventional macro, it preserves the temporal and visual logic of the expert's workflow. Unlike video, it preserves the native three-dimensional and stereoscopic environment.

Import/export Functions

Import: LidarMap allows users to import LiDAR files, **Gaussian Splatting files**, orthophotos, GCP files in text format and CAD files in the formats listed below:



Export: The vectors structered on layers with attributes are exported in Shape files, DXF and DWG files.

Also the user can develop, improve and export the layer structure in a text file format *.CSV that can be imported later in another similar project

2. STARTING WITH LIDARMAP

2.1 Installation

Installation begins by running the installer application received from the software provider.

Follow the instructions and select the installation location as shown in Figure 2.1. At this step, the application displays the required disk space and the available space. If the available space is sufficient, you can continue and complete the installation. Before installing a new version, make sure to uninstall the previous version.

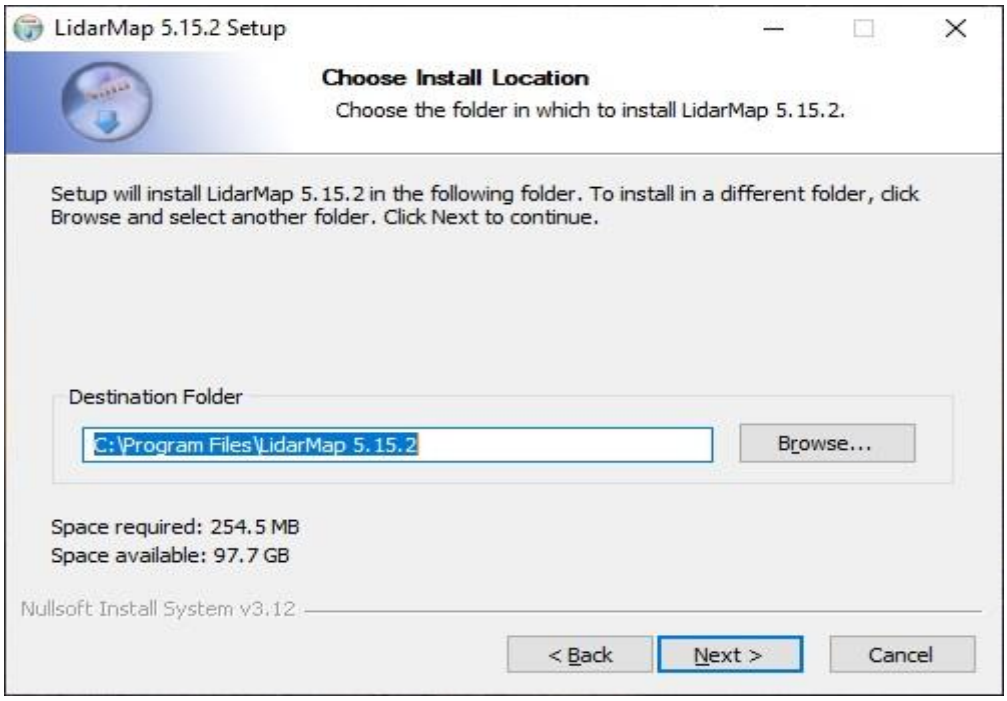


Figure 2.1 Application installation

2.2 Registering as a LidarMap user

After installation and when the application is launched for the first time, the window shown in Figure 2.2 appears. If you are not already registered from an earlier version, click the Register button.

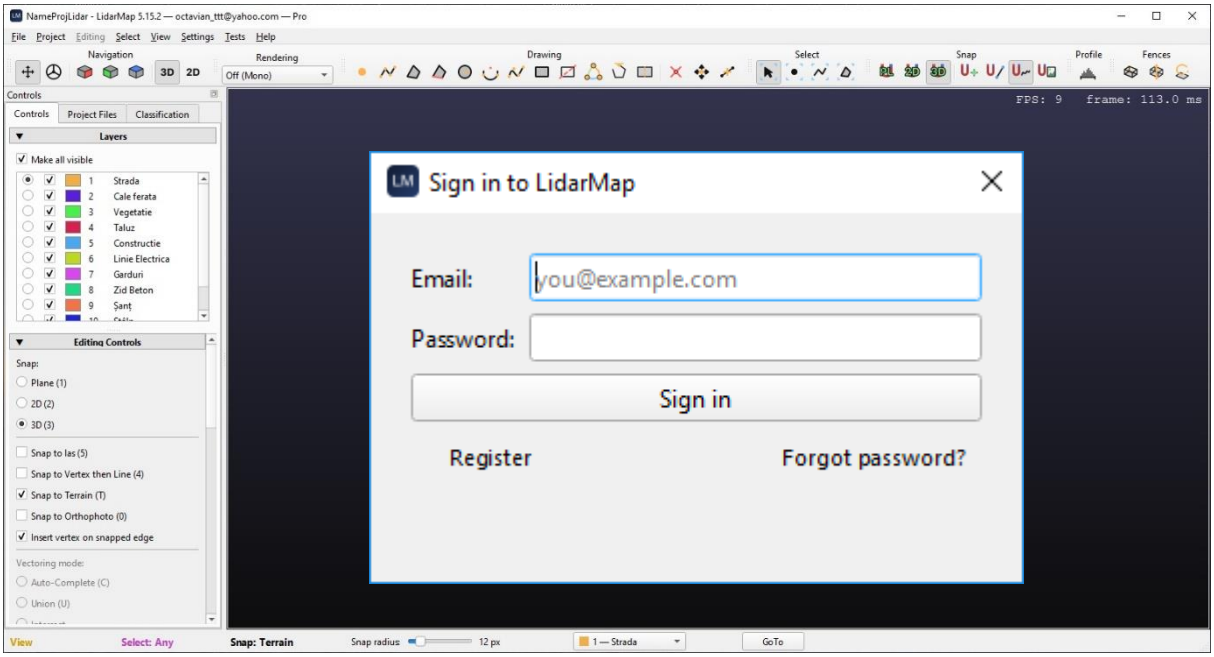


Figure 2.2 User registration

After starting the registration process, the interface shown in Figure 2.3 is displayed. Enter a password, confirm it, and create the user account by clicking Create account

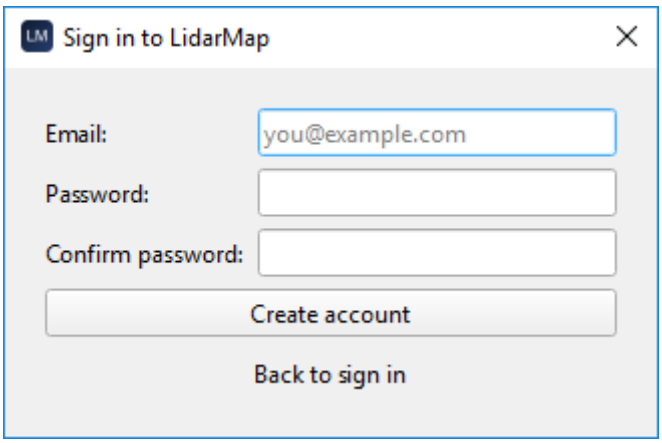


Figure 2.3 Creating a user account

2.3 Starting the application

After registering as a user and signing in, the LidarMap interface shown in Figure 2.4 opens. You can start working using three options from the File menu:

1. New Project – create a new project
2. Open Project – open an existing project
3. Recent Projects – select an existing project from a list of previously opened projects

You can also log out if you want to switch users by selecting the Log Out (user email) option shown in Figure 2.4.

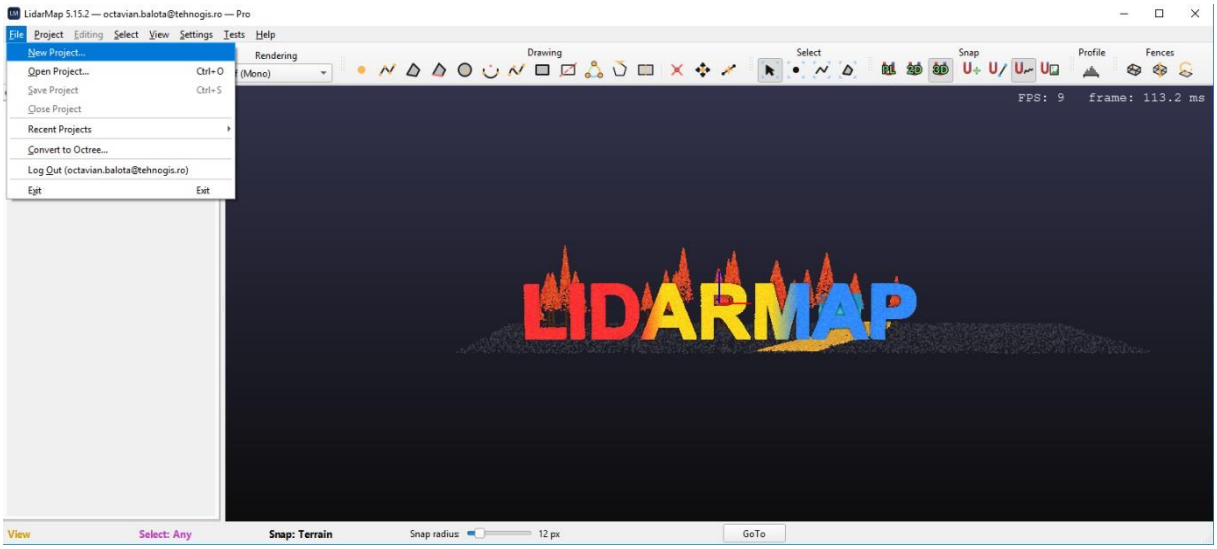


Figure 2.4 Creating a new project

When you select New Project, the interface shown in Figure 2.5 opens. Here you choose a **representative name** for your project, a **working directory**—usually the folder containing the LiDAR data you want to use—and a CSV text file describing the desired layer structure for the new project.

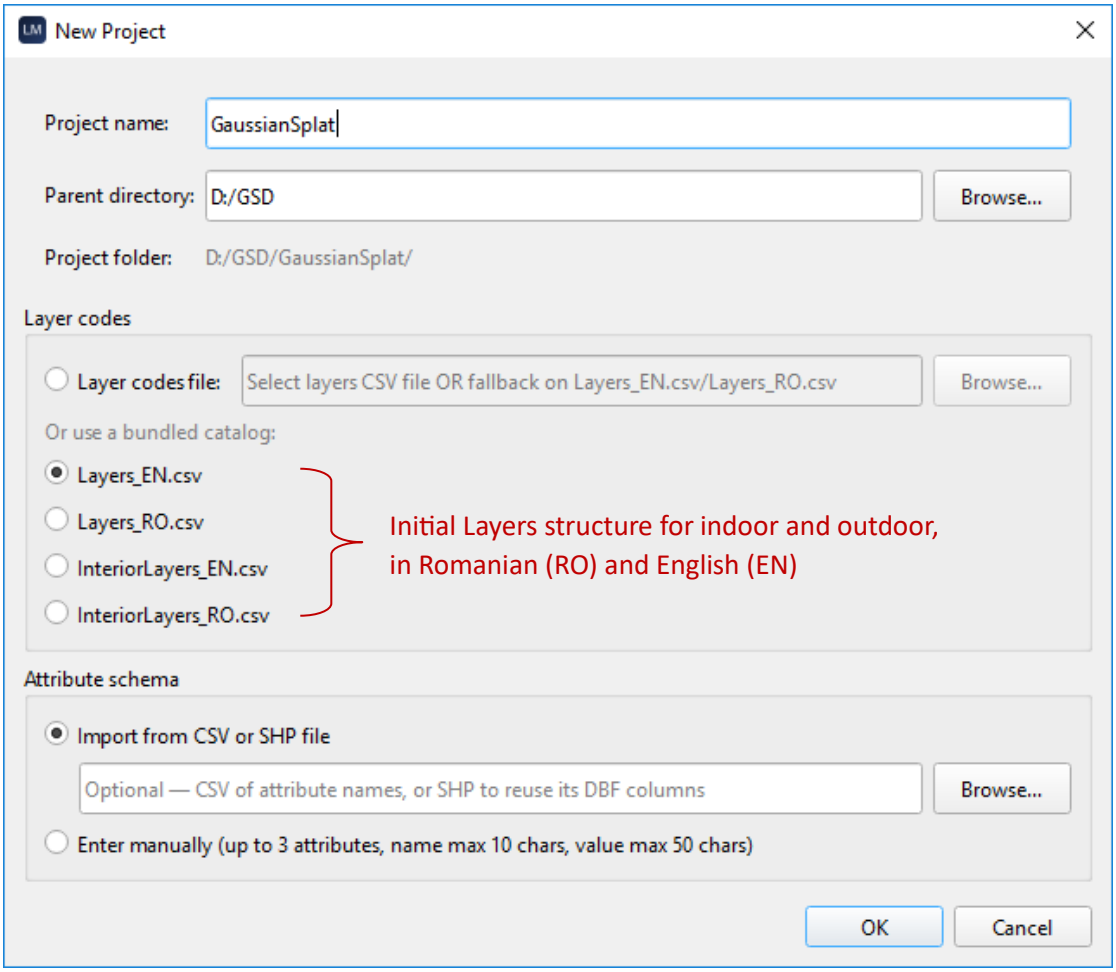


Figure 2.5 Setting the working information for a new project

LidarMap can also extract the attribute schema from an existing model shapefile. In this case, select the corresponding shapefile using the option: Import from CSV or SHP file

Although LidarMap adds three attributes to the layer structure by default, you can define three custom attributes by selecting the option:

Enter manually (up to 3 attributes, name max 10 chars, value max 50 chars)

In this case, three new fields appear in the interface shown in Figure 2.5, allowing you to define the three additional attributes (Figure 2.6).

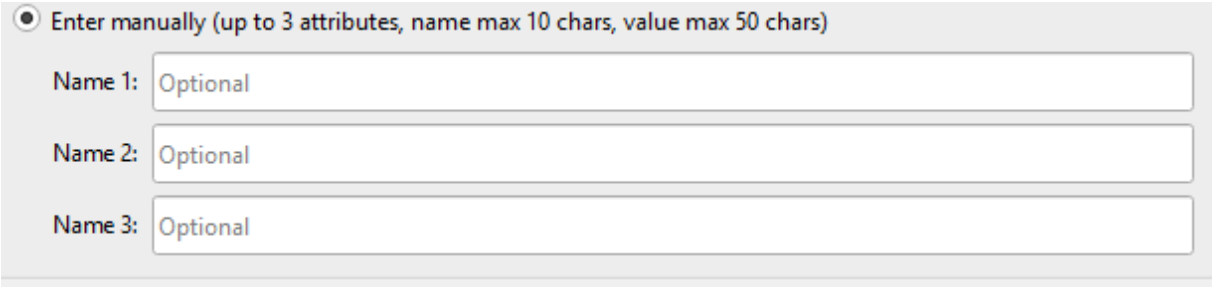


Figure 2.6 Defining additional custom attributes

To continue working on an existing project, the fastest method is to find it in the Recent Projects list (Figure 2.7) and select the desired project.

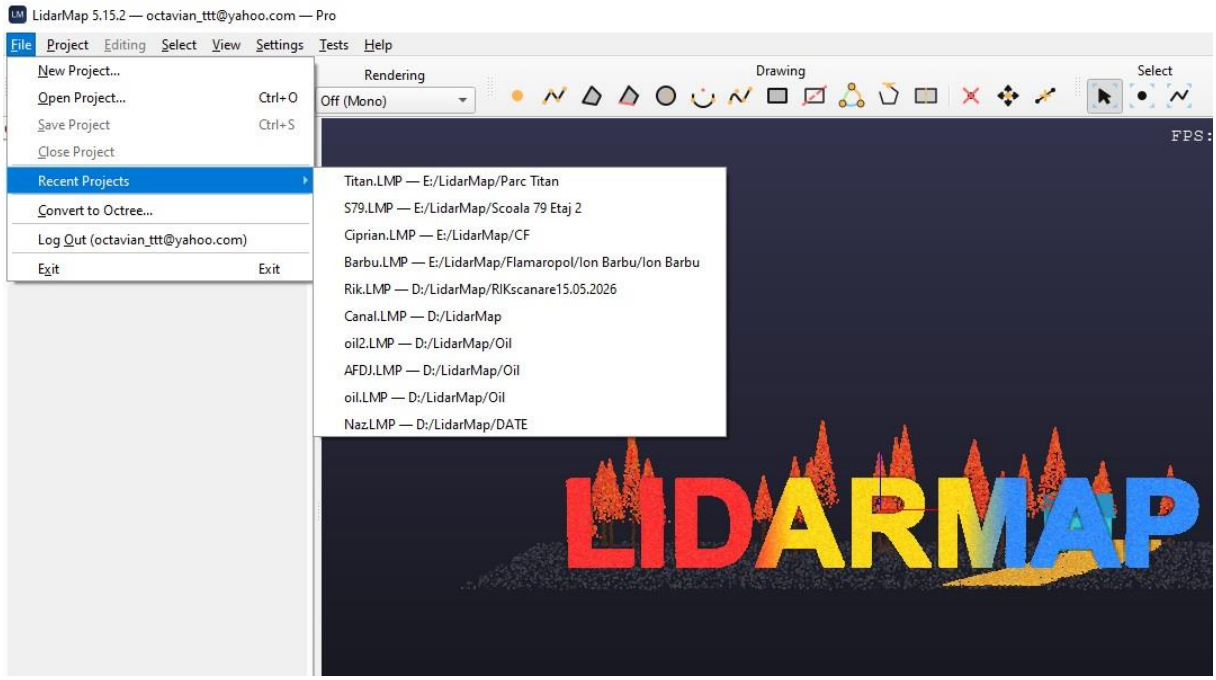


Figure 2.7 Selecting an existing project

If you create a new project, its name—for example, NameProjLidar—is displayed in the application title bar. Vector information extracted from the LiDAR data is automatically stored in a geographic database named NameProjLidar GDB (Geographical Data Base). You can then select the LiDAR data file associated with the project from the Project Files control panel. The first time a LiDAR data file is selected, it is automatically converted into an Octree structure, allowing the LiDAR data to be handled much more quickly and efficiently.

After conversion, the data is displayed using a selected mode, for example by classification as shown in Figure 2.8. For efficient use of the application, RGB visualization is recommended and can be set from

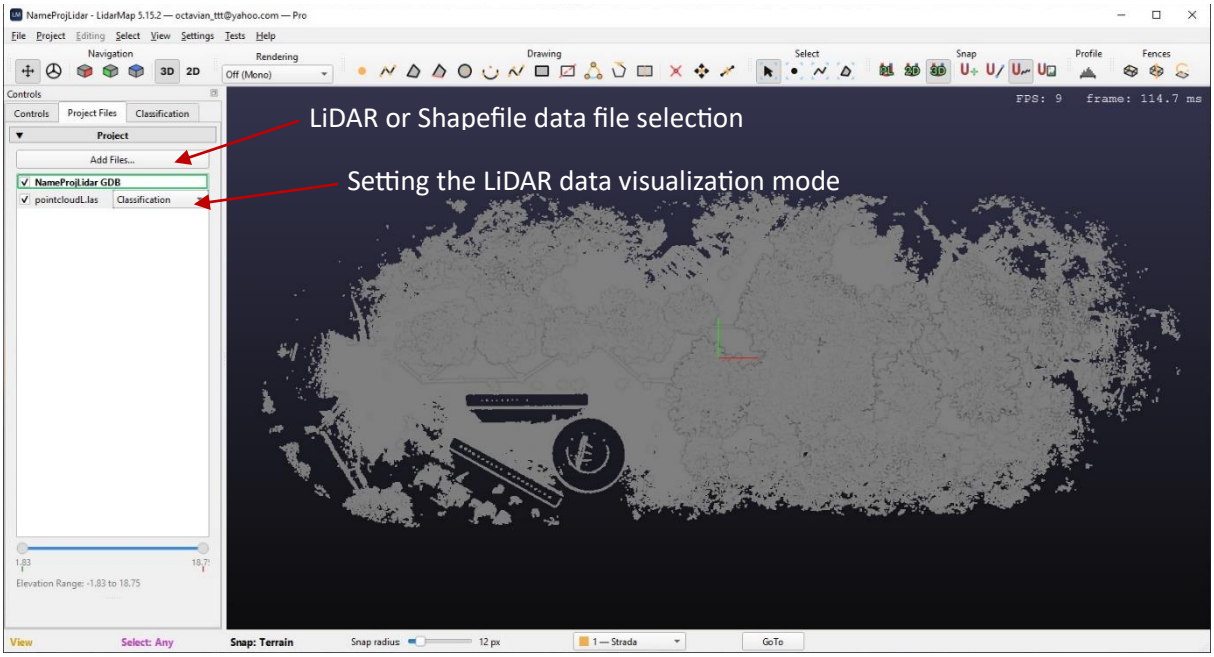


Figure 2.8 Selecting a LiDAR data file and display mode

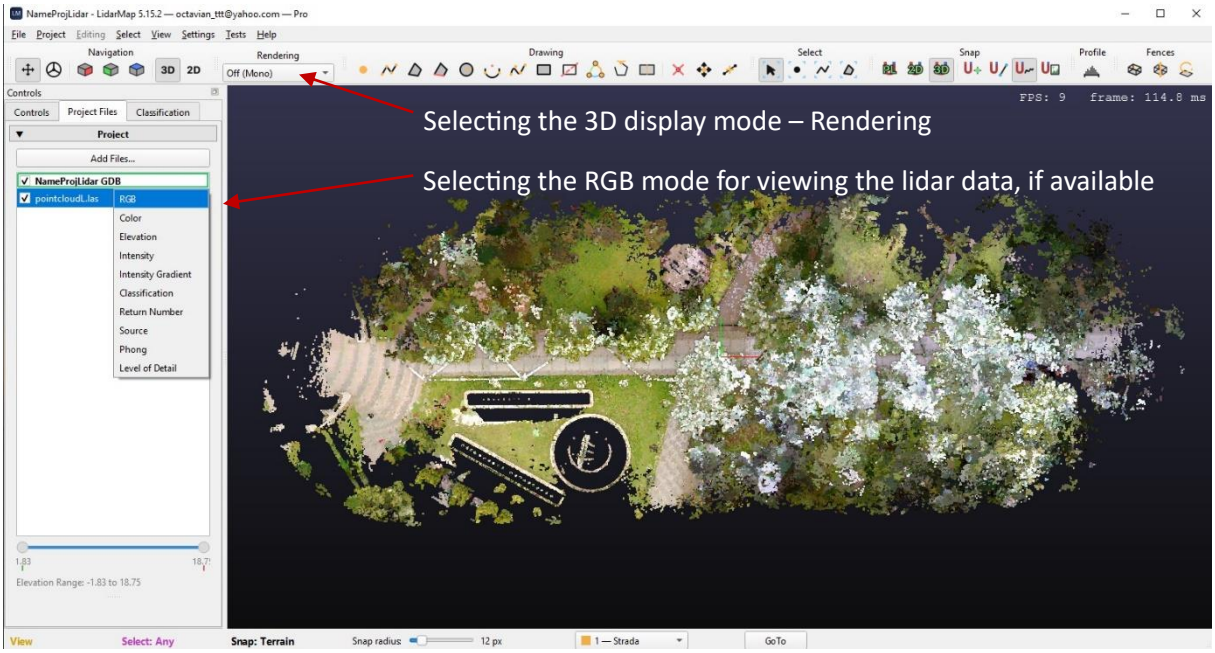


Figure 2.9 Selecting RGB display and 3D rendering mode

For efficient and fast vectorization, stereoscopic 3D display is recommended. The most commonly used modes are Crystal Eyes and Interlaced, which require dedicated 3D monitors.

The Rendering type required for 3D visualization can be selected from the menu toolbar (Figure 2.9) or from the Controls tab, where additional parameters can be configured. It is recommended to keep the default values (Figure 2.10).

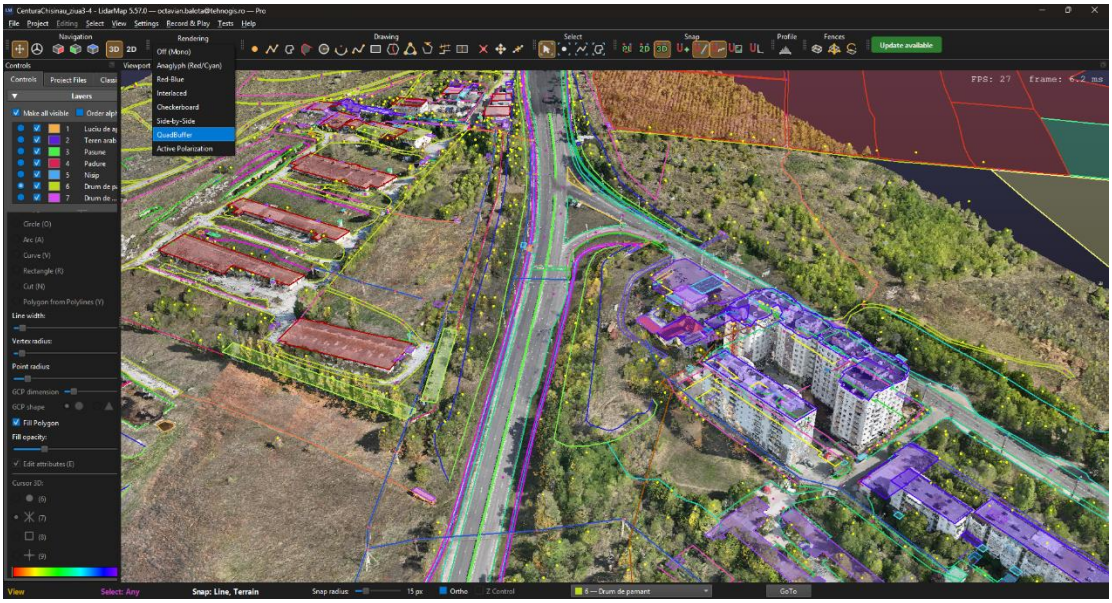
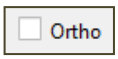


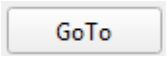
Figure 2.10 Selecting the 3D display mode and corresponding parameters

IMPORTANT: While working in LidarMap, the status bar at the bottom of the application continuously displays useful information, including:

- The current working mode: Edit or View
- In Edit mode, the active editing command (Draw Curve, Draw Polygon, etc.)
- The active Snap types (LAS Points, Vertex/Line, Ground)
- The active working layer (which can also be changed here)
- The snap radius in pixels, applicable to all snap types 

- The ground coordinates of the cursor position
- The orthogonal vectorization mode (right-angle drawing when enabled): 

- The checkbox for enabling trackball control of the cursor along the Z axis: 

- A shortcut for navigating directly to specified coordinates, using the button: 

The final step in preparing the application for vectorization is selecting the classes visibility and colors, if the LiDAR data file is classified. This is done in the Classification tab (Figure 2.11).

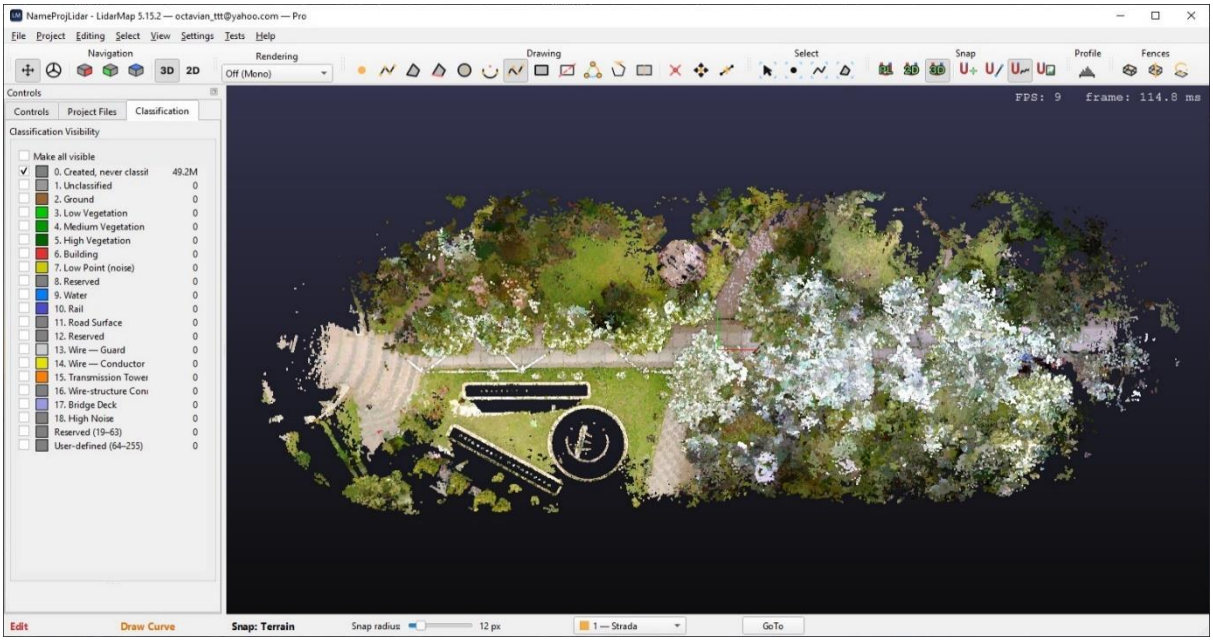


Figure 2.11 Selecting classes to display from the LAS file

3. APPLICATION INTERFACE AND CUSTOMIZATION

3.1 Customizing the toolbar

The toolbar can be adapted to each user's workflow. Right-clicking the top toolbar opens a list of button groups, which can be shown or hidden by checking or unchecking them. This makes it possible to simplify the interface so that only frequently used commands remain visible.

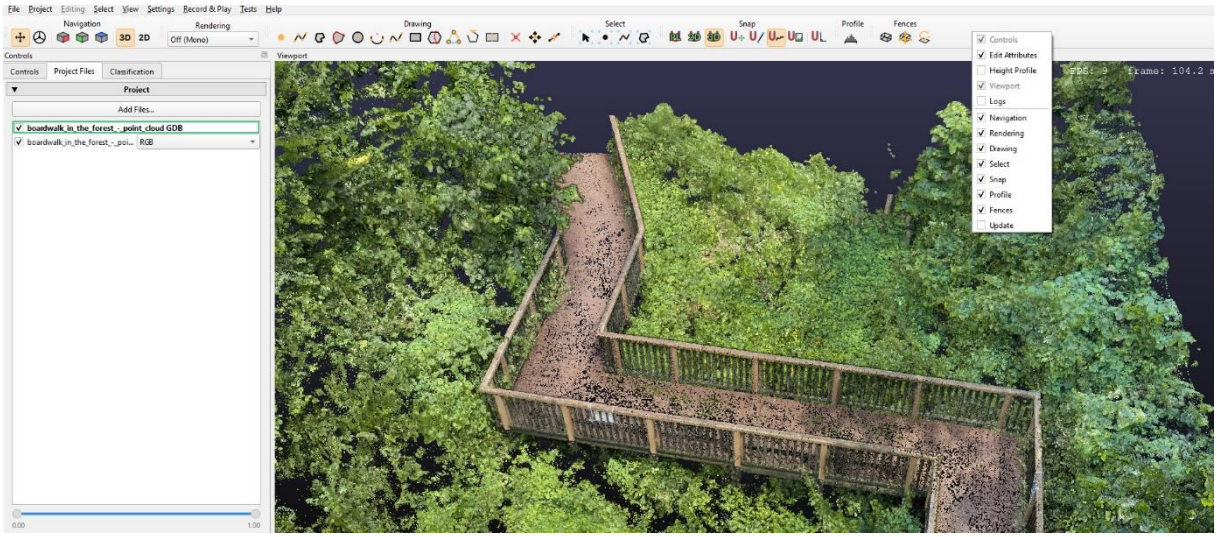


Figure 3.1 Customizing the toolbar

3.2 Updating the application

To upgrade to a newer version of the application, use the update option available in the top toolbar. The Help menu contains the Check for Update command.

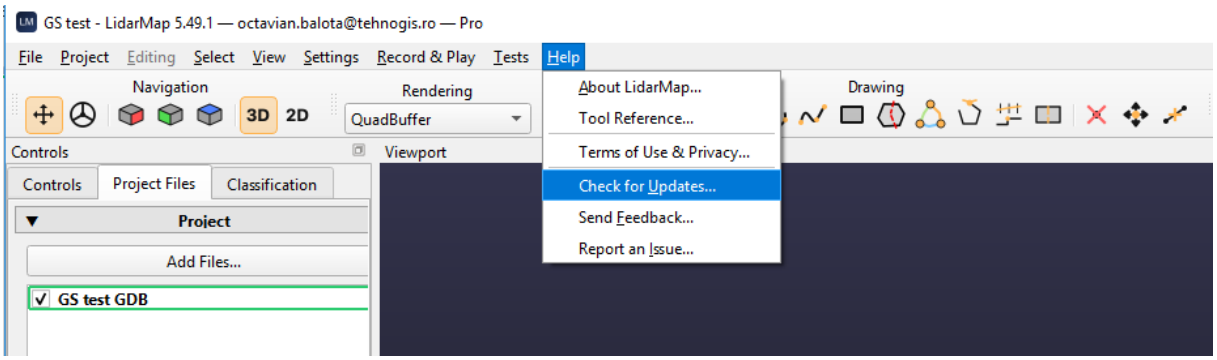




Figure 3.2 Application update command

4. STEREOSCOPIC 3D VISUALIZATION

LidarMap provides several stereoscopic 3D display modes. The stereoscopic mode is selected from the Rendering menu and depends on the computer configuration and the available stereoscopic equipment.

4.1 Off (Mono) mode

Off mode provides a 3D perspective view without requiring special equipment, such as a 3D monitor or stereoscopic glasses. It is compatible with any monitor and computer. Stereoscopic display is disabled in this mode.

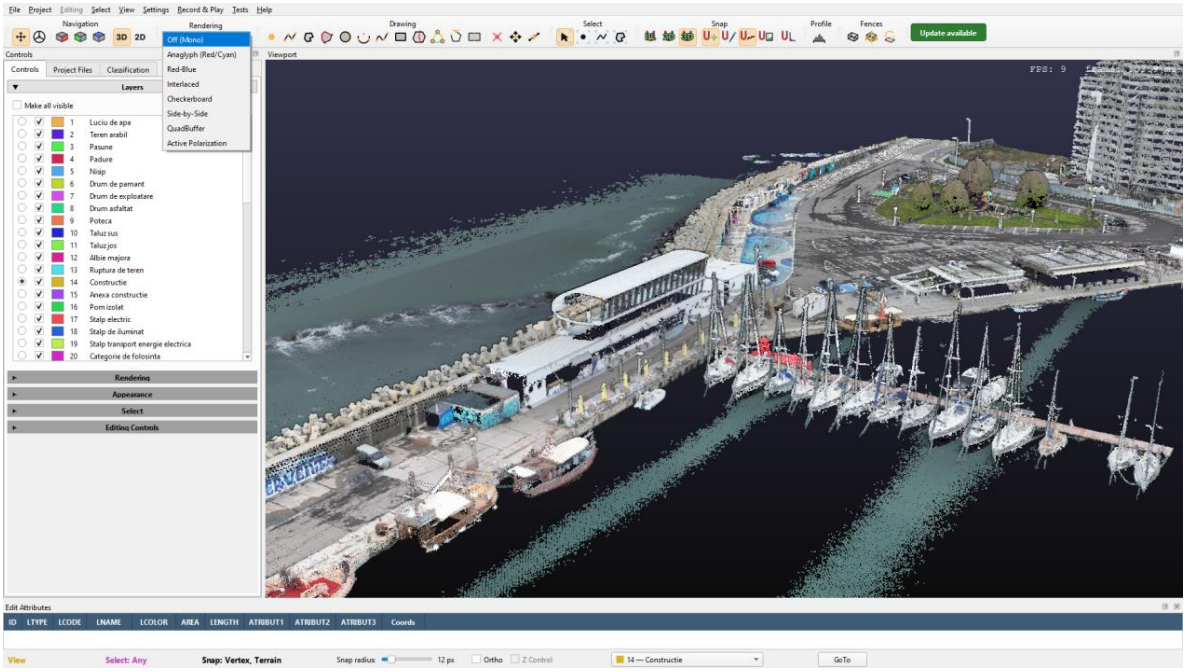


Figure 4.1 Rendering mode – Off

4.2 Anaglyph (Red-Cyan)

Anaglyph (Red-Cyan) mode uses anaglyph glasses with different color filters for the two eyes: red and cyan. Chromatic separation of the images creates depth perception and a stereoscopic effect.

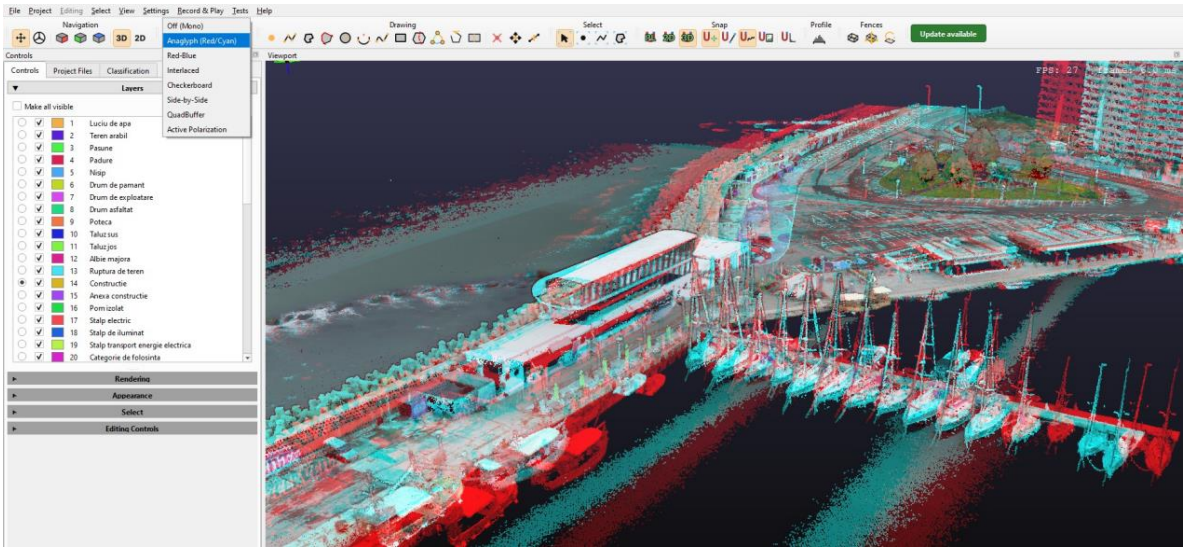


Figure 4.2 Anaglyph (Red-Cyan) mode

4.3 Red-Blue

Red-Blue mode uses anaglyph glasses with red and blue filters. The images for the two eyes are separated chromatically to produce the stereoscopic effect.

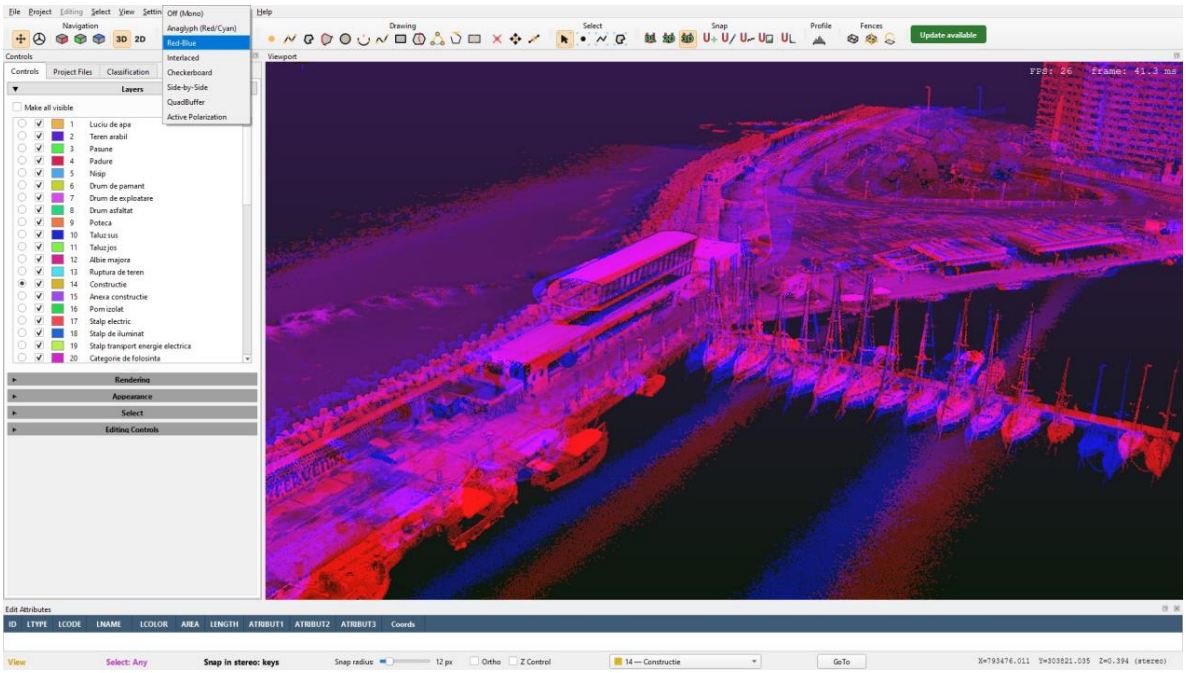


Figure 4.3 Red-Blue mode

4.4 Interlaced

Interlaced mode divides the display into alternating horizontal lines to deliver separate images to the left and right eyes. It is used with passive 3D systems featuring a polarization filter on the screen and passive polarized glasses.

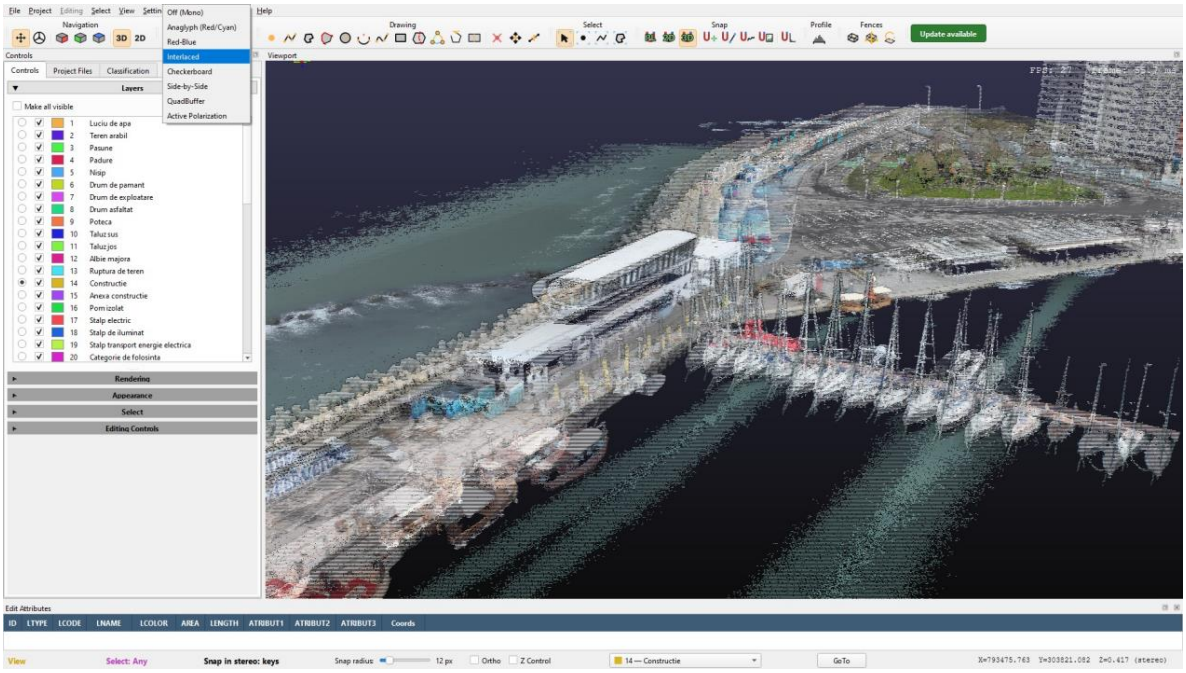


Figure 4.4 Interlaced mode

4.5 Checkerboard

Checkerboard is available as a stereoscopic rendering mode in LidarMap for monitors that support this type of rendering.

Checkerboard stereoscopic 3D is a display method in which the images for the left and right eyes are interleaved like the squares on a chessboard.

In practice, pixels alternate as follows:

- one pixel for the left eye;
- the next pixel for the right eye;
- on the following row, the pattern is reversed.

To display the image correctly in 3D, the monitor or display system must be able to direct these two sets of pixels to the corresponding eyes. This generally requires a checkerboard-compatible 3D monitor and glasses compatible with that system.

Compared with Interlaced, the difference is:

- in Interlaced mode, separation takes place between alternating horizontal lines;
- in Checkerboard mode, separation takes place pixel by pixel, both horizontally and vertically.

The disadvantage is that the effective resolution for each eye is reduced, because each eye receives only about half of the pixels.

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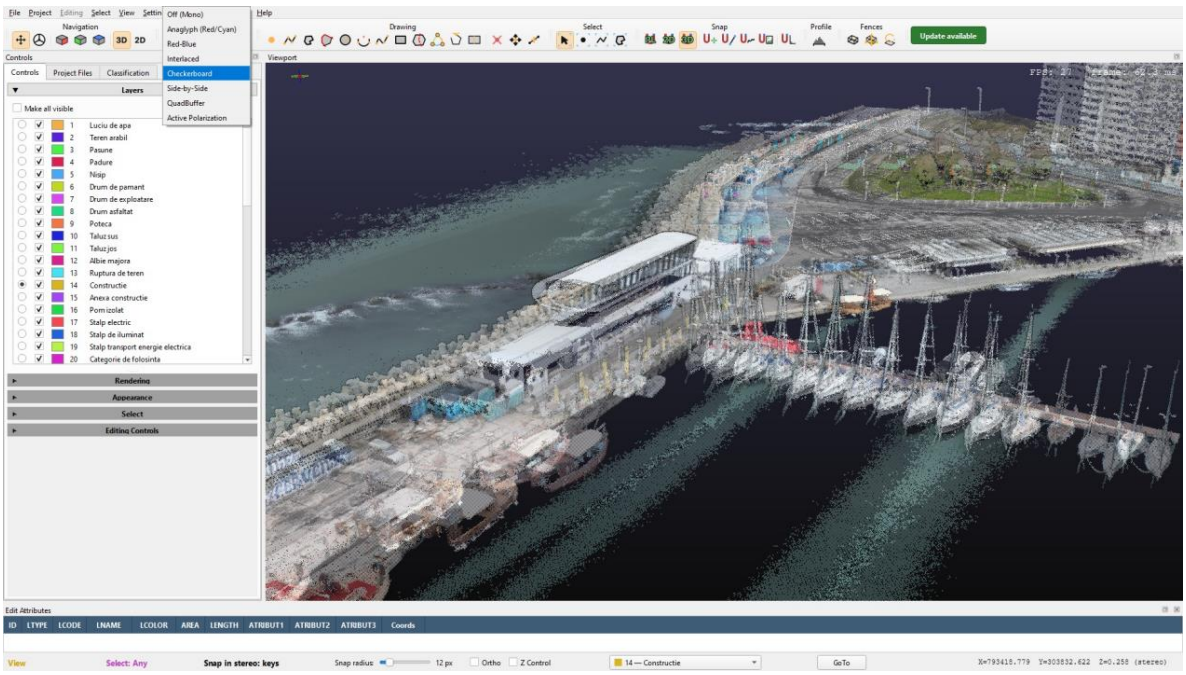


Figure 4.5 Checkerboard mode

4.6 Side-by-Side

Side-by-Side mode enables true 3D visualization of the point cloud and vectorization using a 3D cursor. It requires a 3D monitor that supports Side-by-Side mode and compatible 3D glasses.

In LidarMap, the stereoscopic window can be moved onto a stereoscopic monitor that supports Side-by-Side mode by dragging and dropping the window using its viewport title bar.

In this mode, other controls, such as the toolbar and menus, cannot be viewed correctly because of the stereoscopic display. They can therefore remain on a separate conventional monitor to avoid interfering with stereoscopic viewing.

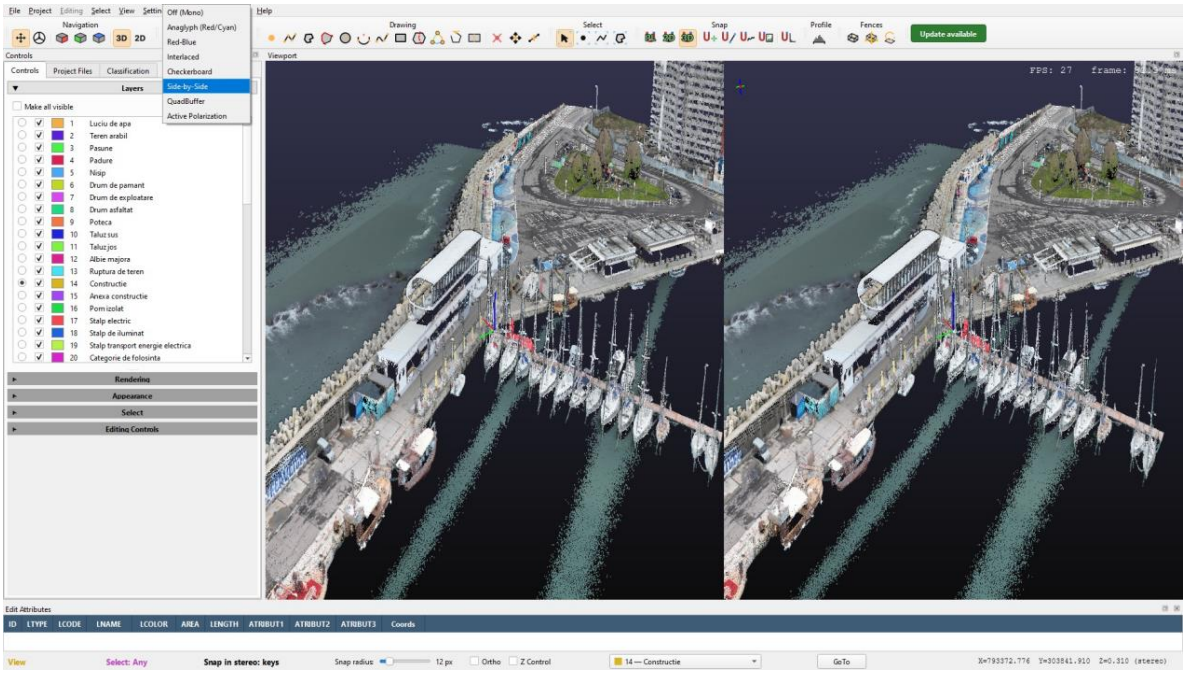


Figure 4.6 Side-by-Side mode

4.7 QuadBuffer

QuadBuffer Stereo is one of the most “native” methods of 3D stereoscopy for professional OpenGL applications. It is used with a graphics card and driver supporting OpenGL QuadBuffer stereo, together with a compatible 3D monitor (e.g., PluraView or NVIDIA 3D monitors). The graphics card simultaneously maintains four image buffers: front-left, front-right, back-left and back-right. Hence the term quad-buffer.

The main advantage is that each eye receives a complete, independent image rather than an interleaved one, as in Interlaced or Checkerboard modes. Consequently, QuadBuffer provides excellent image quality and an accurate 3D cursor for photogrammetry, CAD, 3D GIS and stereoscopic vectorization.

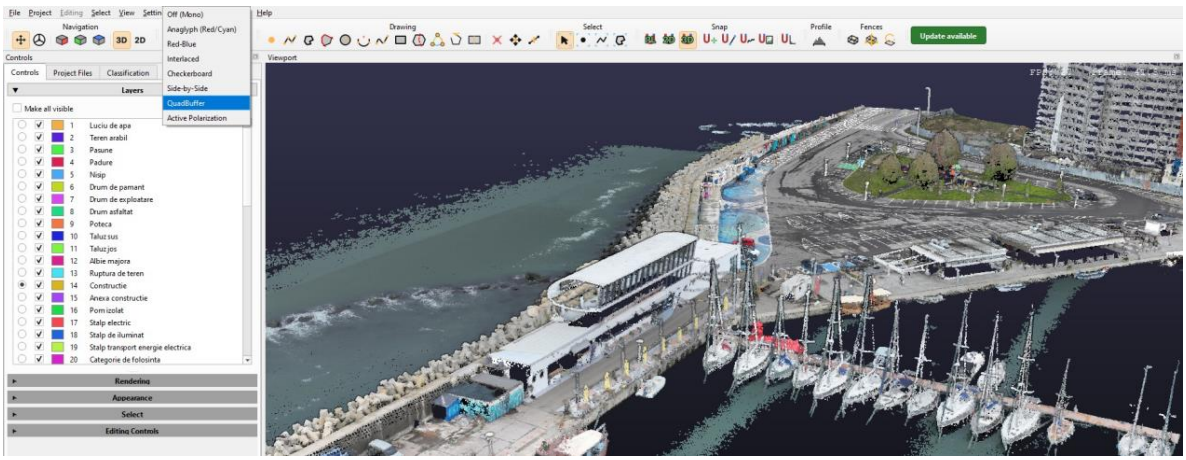


Figure 4.7 QuadBuffer mode

4.8 Active Polarization

Active Polarization is a function that resets systems using passive polarized glasses when the stereoscopic model is displayed incorrectly, typically with the view reversed. This function forces synchronization of the 3D images with the monitor.

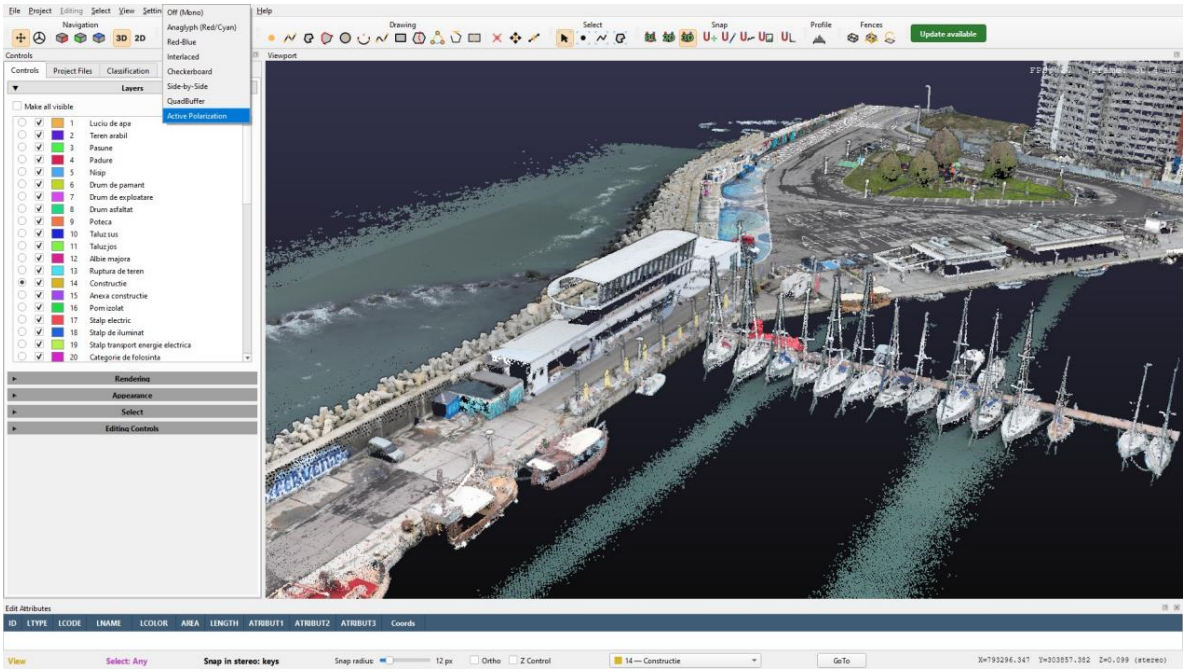
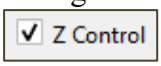


Figure 4.8 Active Polarization

IMPORTANT: When any of these 3D modes is activated, the 3D cursor automatically snaps to the 3D model, either to the ground surface or to any other object in the model located along the viewing direction of the camera, just as in the Off (Mono) 3D perspective mode.

However, to take full advantage of the stereoscopic viewing capabilities, LidarMap provides the option to lock the cursor's Z coordinate and enable a trackball device to control the cursor's movement along the Z axis.

The trackball can be activated simply by pressing the **Z key** or by clicking the **Z Control checkbox** in the bottom status bar: 

The trackball can be alternately enabled and disabled by pressing the **Z key** repeatedly.

To use this feature, the operator must configure the mouse and trackball devices in the **Controls** panel (Figure 4.9), which can be accessed through the **Settings** menu.

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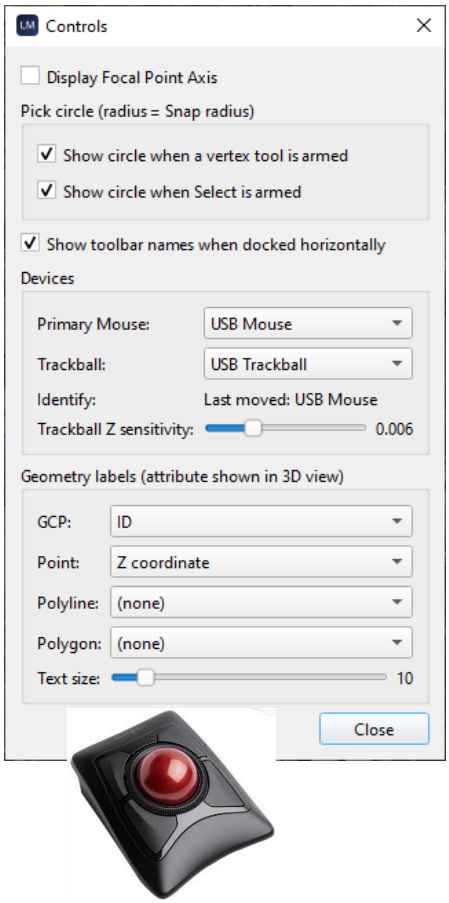

Figure 4.9 A trackball and Controls tab

5. IMPORTING DATA

5.1 Import GCP file in text format

Din tab-ul Add file , figura 5.1 se selectează fișiere de tip text, de exemplu fisierul GCP.txt sau reperi.txt. Automat se deschide fereastra din figura 5.2 unde poti decide daca fisierul text contine nori de puncte in format text sau puncte de control.

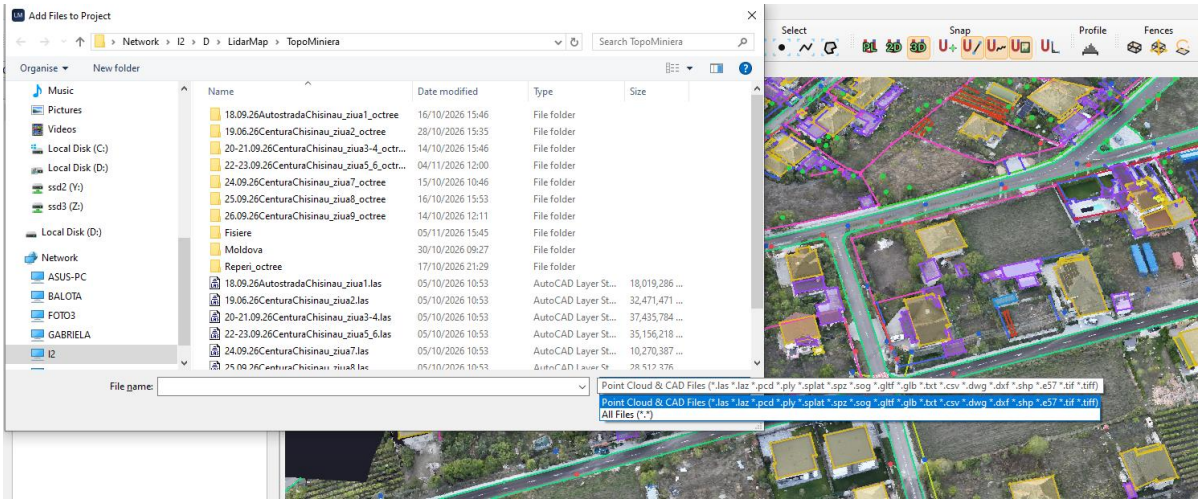

Figure 5.1 Importing geospatial information files

Dacă selectăm puncte de control, putem selecta coloanele corespunzatoare fiecarei coordonate si putem ignora coloane cu alte informații (figura 5.2)

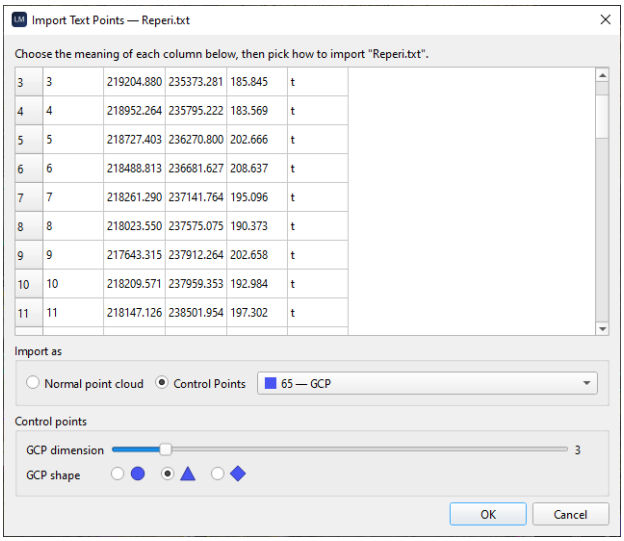

Figure 5.2 Importing GCP files

6. RECORD & PLAY

The Record & Play function records the activities performed during visualization and vectorization so that the work sequence can be played back later.

6.1 Record Session

The Record Session command records the commands used during visualization and vectorization and allows them to be played back later.



Figure 6.1 Accessing the Record & Play function

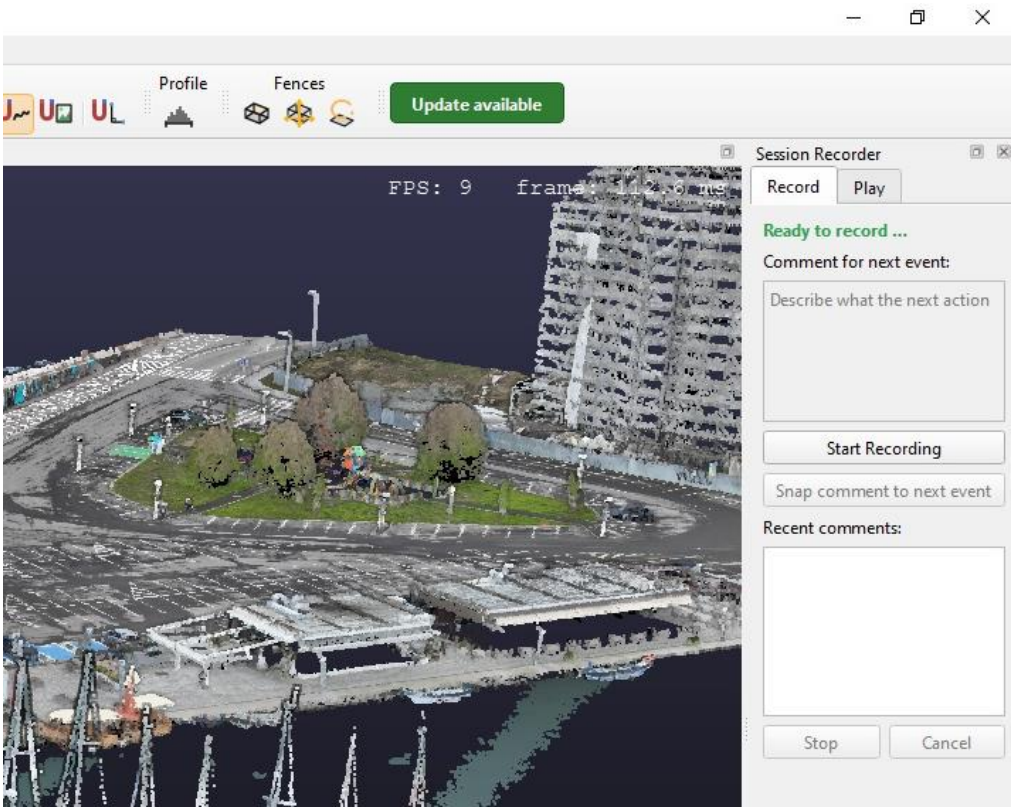

Figure 6.2 Session recording window

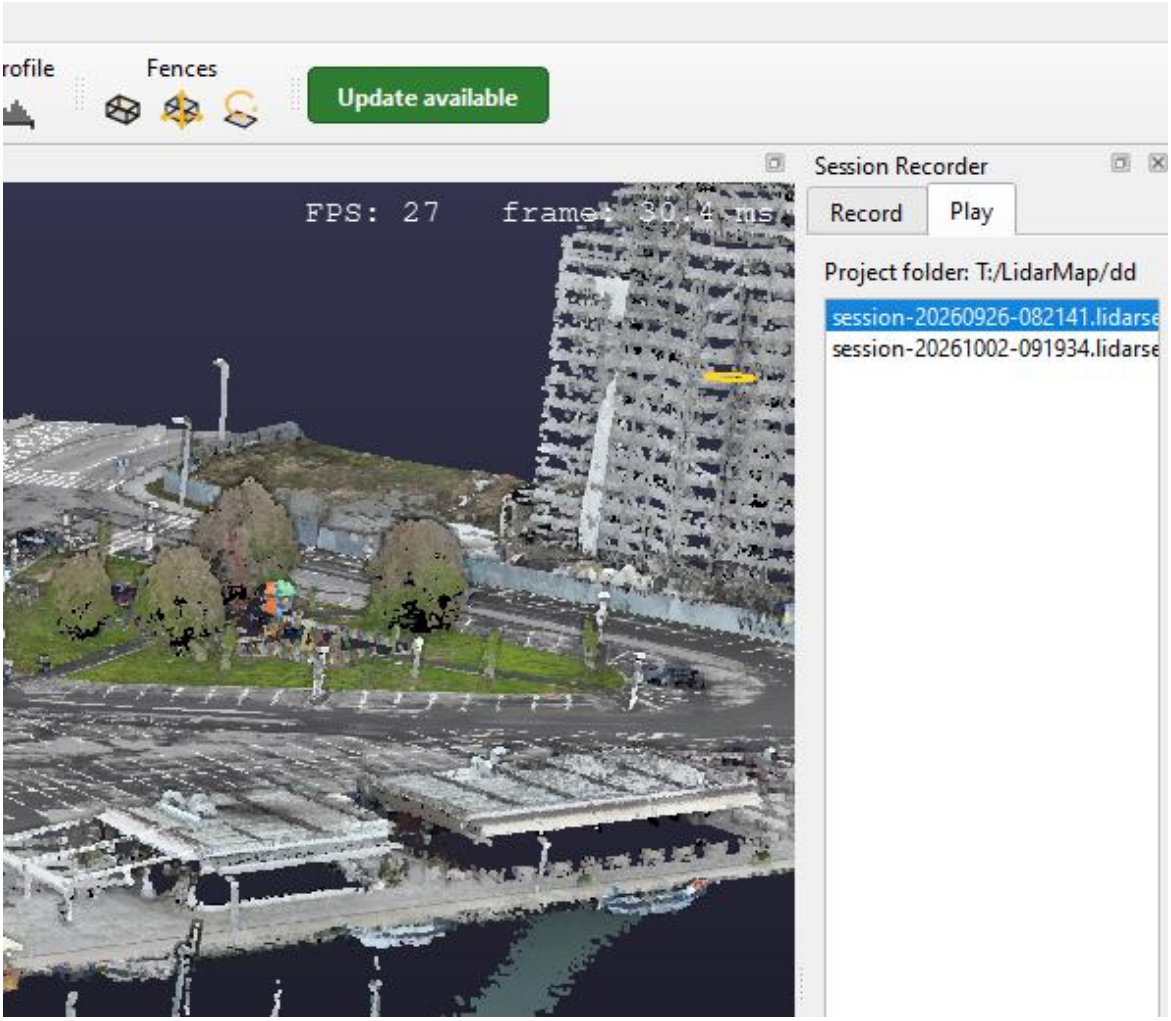

Figure 6.3 Session playback window

7. EXPORTING AND MANAGING VECTOR DATA

7.1 Export to Shapefile format

From the Project menu, vector data can be exported in Shapefile (.shp) format. The user can choose a single file containing the geometries or separate files according to geometry type: point, polyline and polygon.

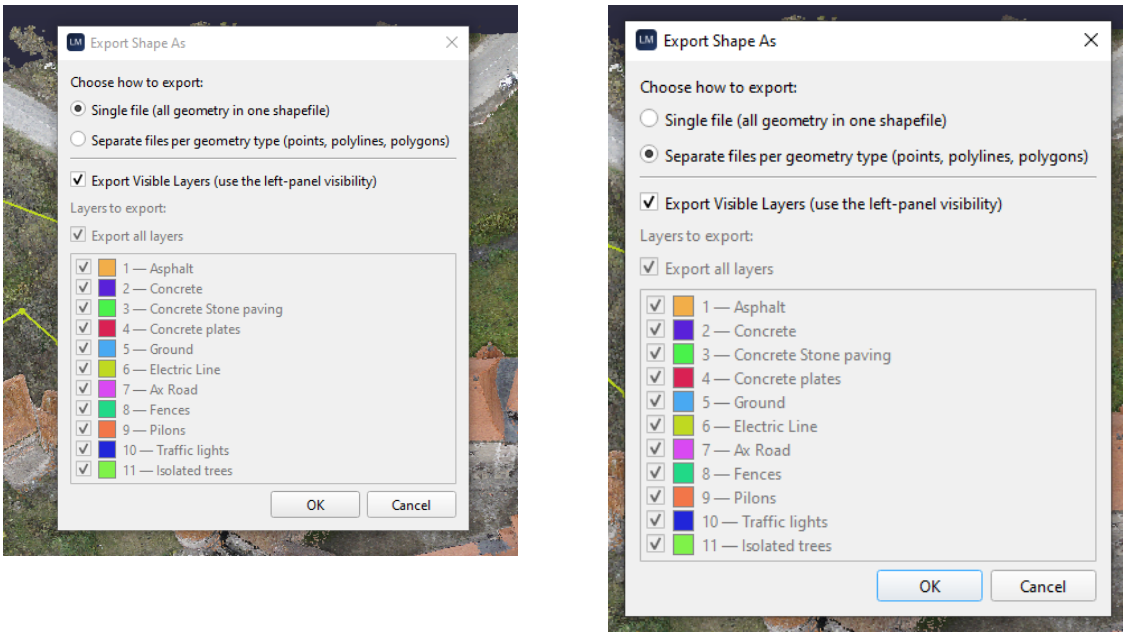

Figure 7.1 Shapefile export – geometry organization options

7.2 Export to DXF/DWG format

LidarMap also supports exporting vector data in DXF/DWG format. In the export dialog, the layers to be included in the resulting file can be selected.

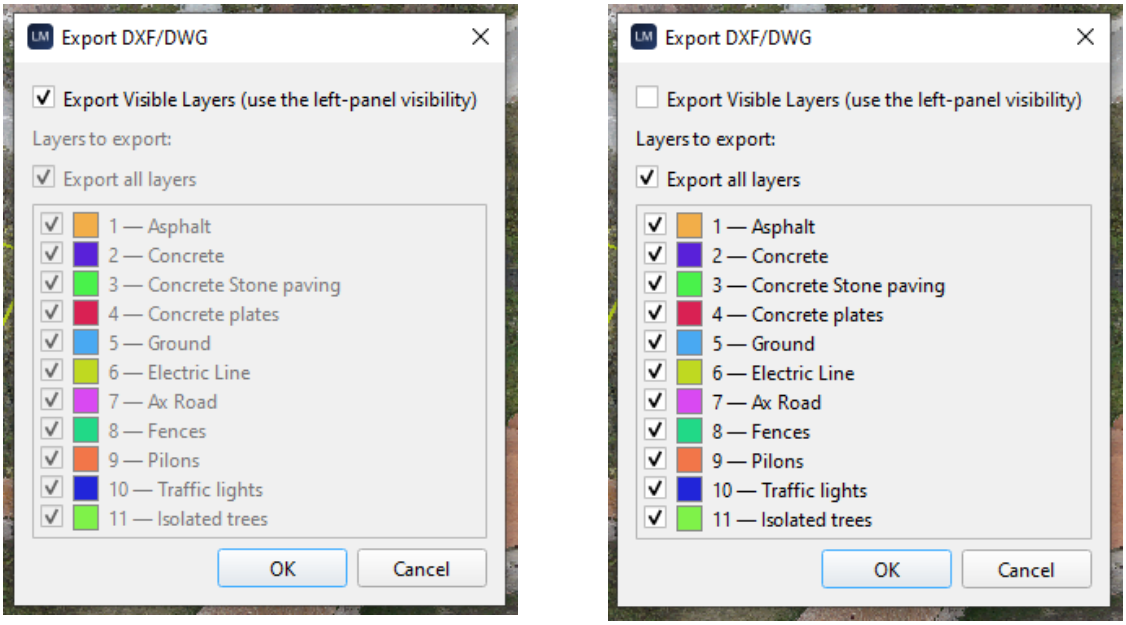

Figure 7.2 DXF/DWG export and layer selection

7.3 Selecting layers for export

When exporting, the Export all layers option can be used to include every layer, or only the required layers can be selected.

7.4 Shape DBF Data – viewing and editing attributes

In the Project menu, the Shape DBF Data window allows users to view the features in shapefiles together with their attributes. The feature type, code/number, name, area, length and X, Y, Z coordinates are displayed.

Additional attributes can be added. The total area and total length are calculated at the bottom of the window. Features can be selected, and their X, Y, Z coordinates can be inspected and modified when necessary.

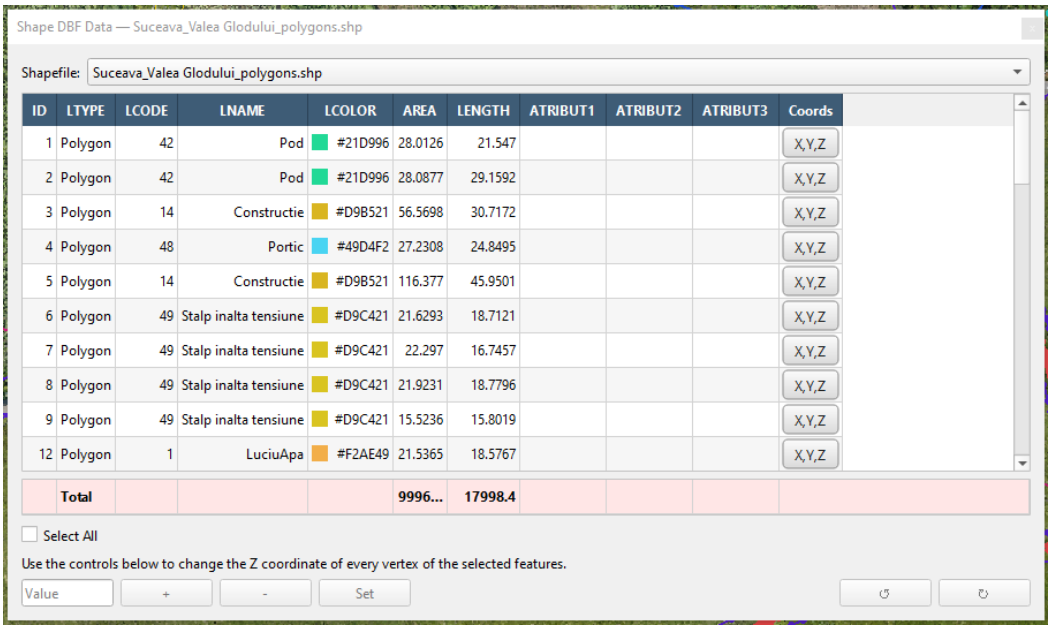

Figure 7.3 Viewing attributes in Shape DBF Data

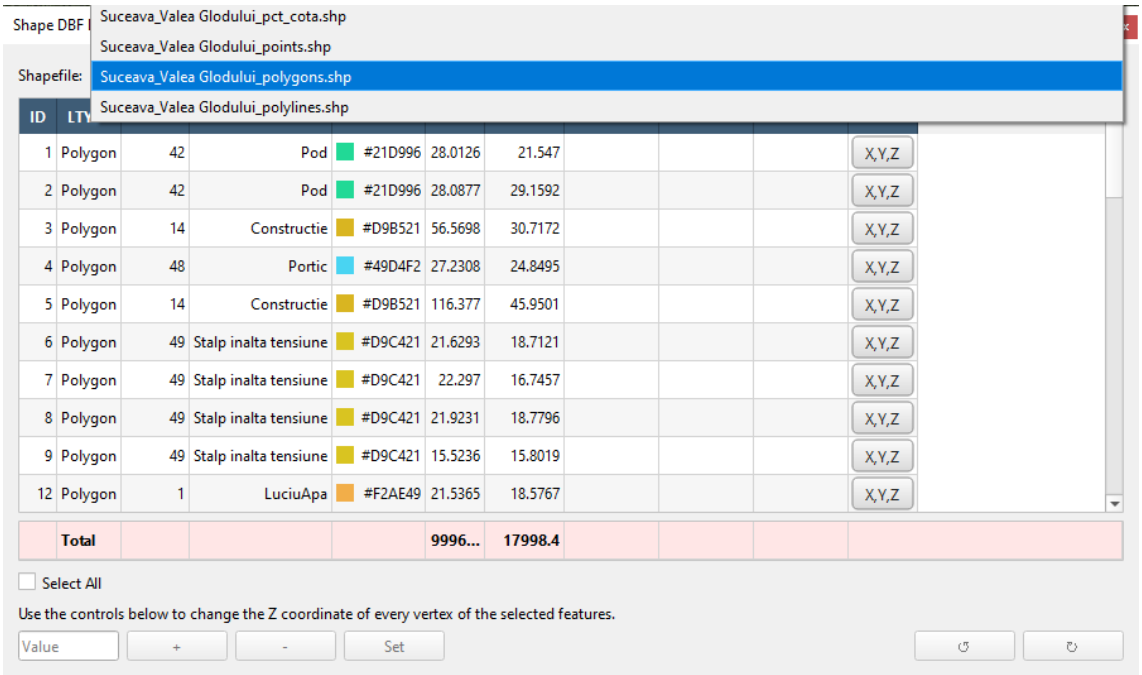

Figure 7.4 Selecting a file and features in Shape DBF Data

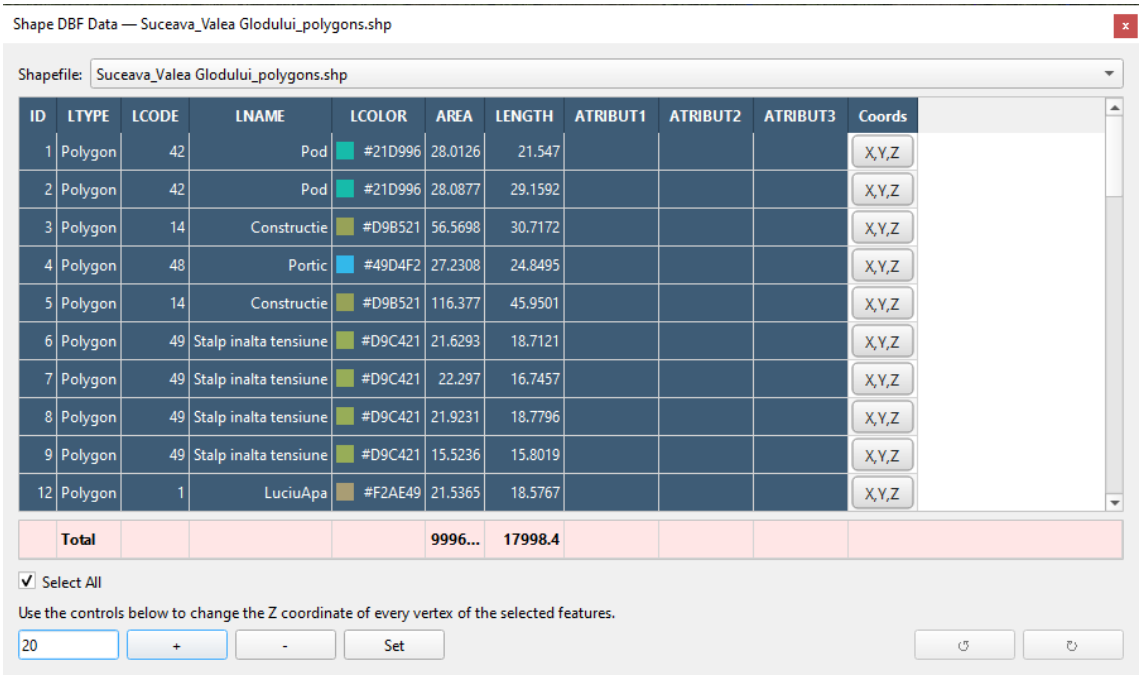

Figure 7.5 Selecting multiple features for editing

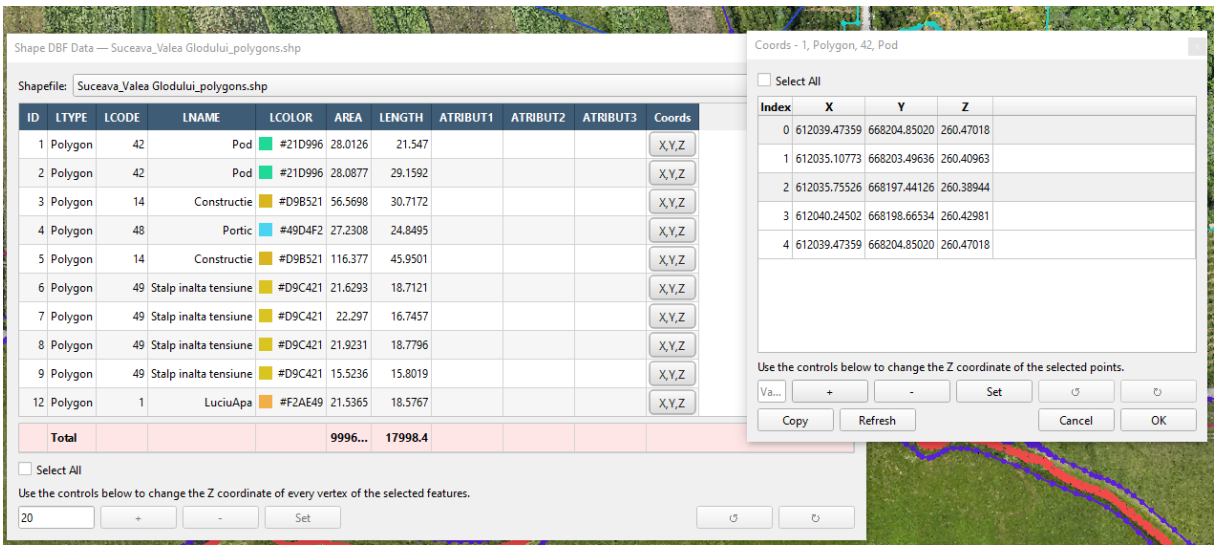

Figure 7.6 Editing the coordinates of a feature

7.5 Geometry types associated with codes

For each code, the geometry type can be defined as Point, Polyline, Polygon or a combination of these types.

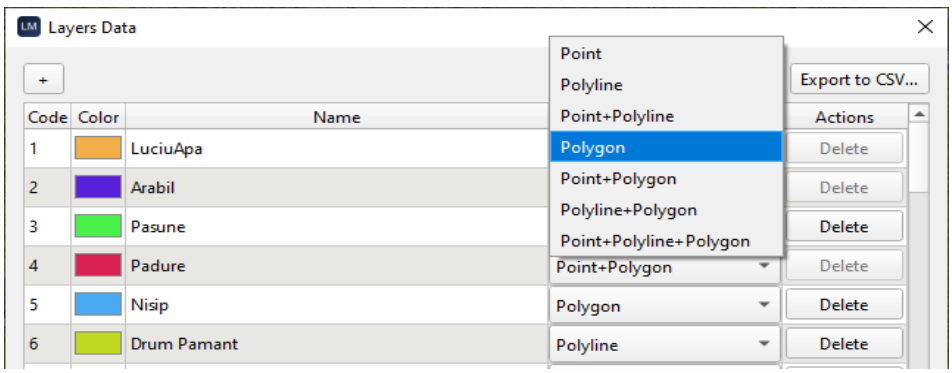

Figure 7.7 Selecting the geometry type for a code

7.6 Layers Data – managing the layer structure

The Layers Data option in the Project menu allows users to manage the list of codes and layers. From this window, layers can be added, deleted or modified, their colors can be changed, and the list of codes can be exported to a .csv file for reuse in other projects.

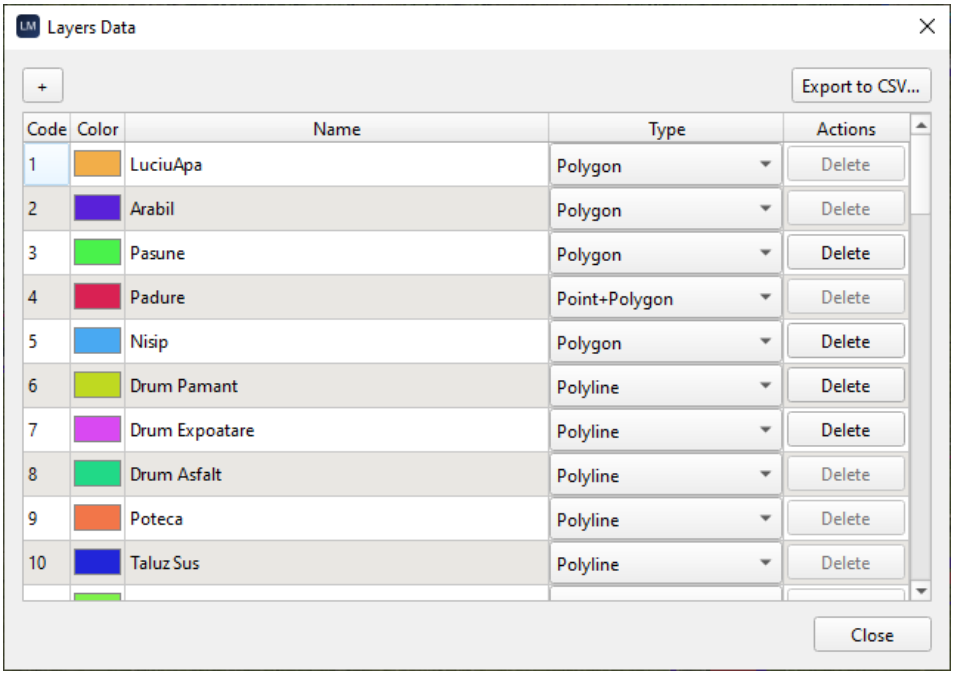

Figure 7.8 Layers Data window

To add a new layer, click the "+" button. In the Add Layer window, enter the code and name, select the geometry type and color, and then click Create. The new layer is added in the last position in Shape DBF Data.

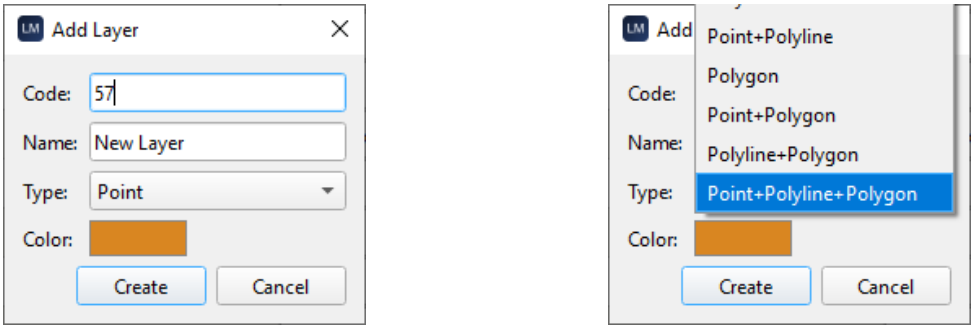

Figure 7.9 Adding a new layer and selecting its geometry type

8. RECOMMENDED WORKFLOW IN LIDARMAP

Based on the functions described in this documentation, a complete workflow can be organized as follows:

• Install the application; when installing a new version, uninstall the previous version first.

• Register the user and sign in to LidarMap.

• Create a new project or open an existing one from Recent Project.

• Define the working directory and layer structure using a CSV file or a template Shapefile.

• Select the LiDAR file; on first use, it is converted to an Octree structure.

• Choose the point-cloud display mode, including RGB, classification and, if the necessary equipment is available, a stereoscopic mode.

• Select the visible LiDAR classes and their display colors.

• Define 3D Fence volumes, where necessary, to limit the active working area.

• Vectorize and edit features using the drawing, selection, Snap and editing commands.

• Check codes, attributes, areas, lengths and coordinates in Shape DBF Data.

• Manage the layer structure using Layers Data.

• Export the result to Shapefile or DXF/DWG, including all layers or only selected layers.

• Optionally, record the working session using Record & Play for later playback of the operations.

8.1 Information to monitor in the status bar

During operation, the application's bottom status bar displays the active mode (Edit or View), current editing function, active Snap types, working layer and the cursor's ground coordinates.

8.2 Working with large datasets

For large LiDAR datasets, the Octree structure and 3D Fence volumes restrict the data displayed and processed to the area of interest, making navigation and editing easier in extensive projects.