3D Element Acquisition
in Marushka Design

CONTENTS

# 1 Aim of the Example

In this example we will demonstrate how to acquire 3D elements from GLS. This example was created in version 4.2.1.0 and it does not have to be compatible with older versions.

2 Working with the Example

- o Unzip the contents of **3DElementAcquisition_EN.zip** into **c:\MarushkaExamples** folder. The target folder must be respected due to interconnection of paths with the project. In the case of placing the files in the different folder, it would not be possible to work with the example.

- o Open the **3DElementAcquisition_EN.xml** in Marushka Design environment.

- o Select form layer **MODEL_BUDOV**, in the context menu choose Data – Load all:
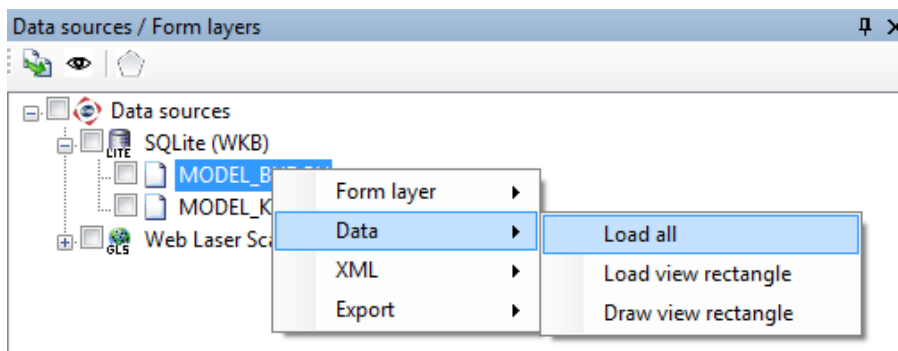
- o In map window choose "Fit all":

3 Dialog Box Sample

Fig 1: Example of definition for Z-Ortho projection with drawn rectangle "with a hole", step 1
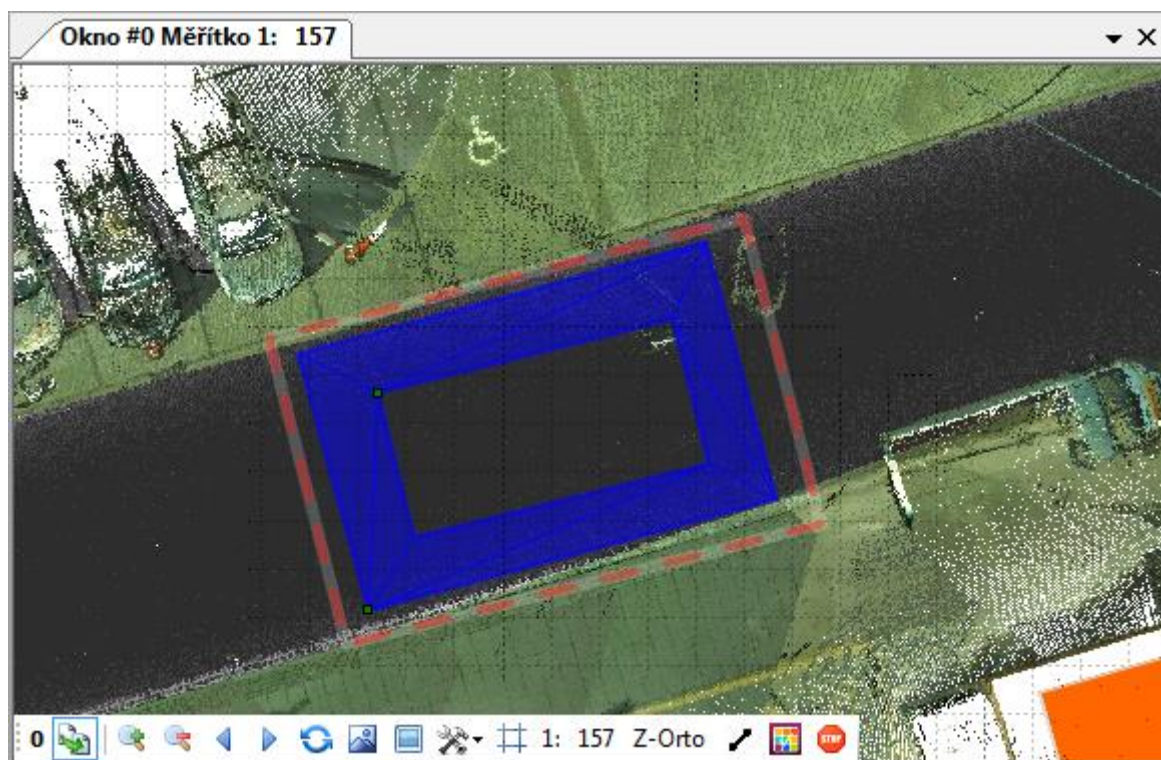

Fig 2: Example of definition for Z-Ortho projection with drawn rectangle "with a hole", step 2
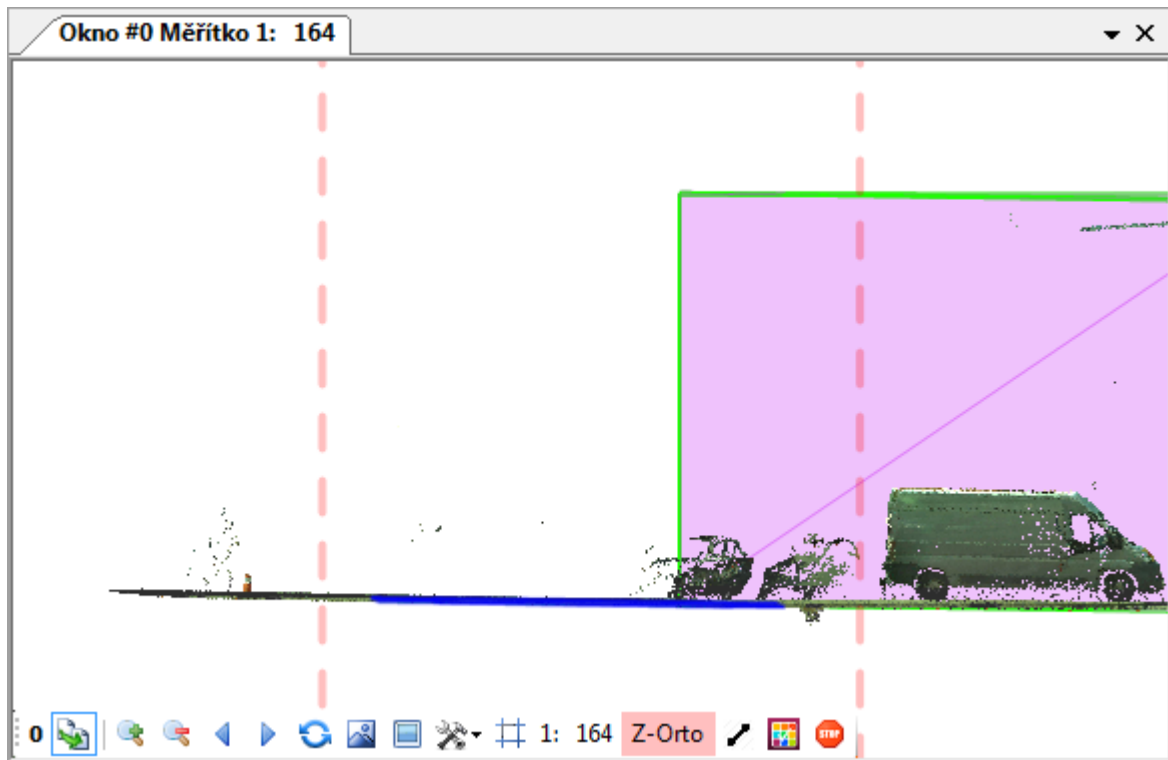
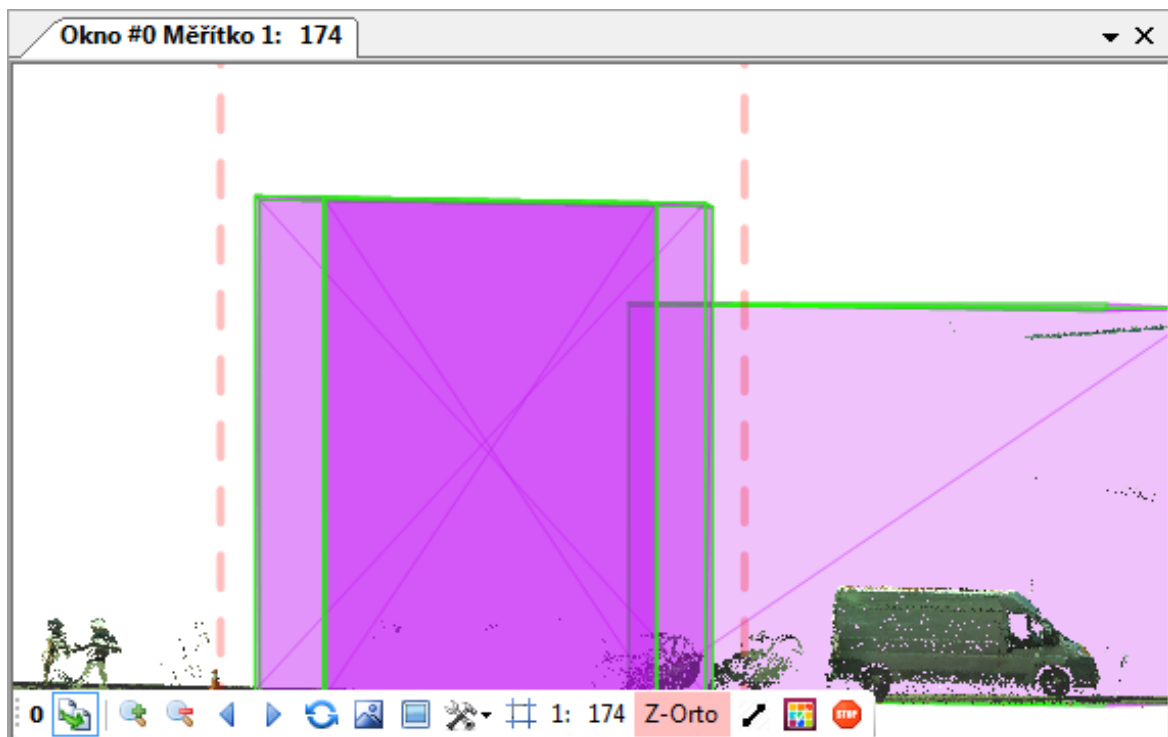Fig 3: Example of Z-ortho projection (cut)

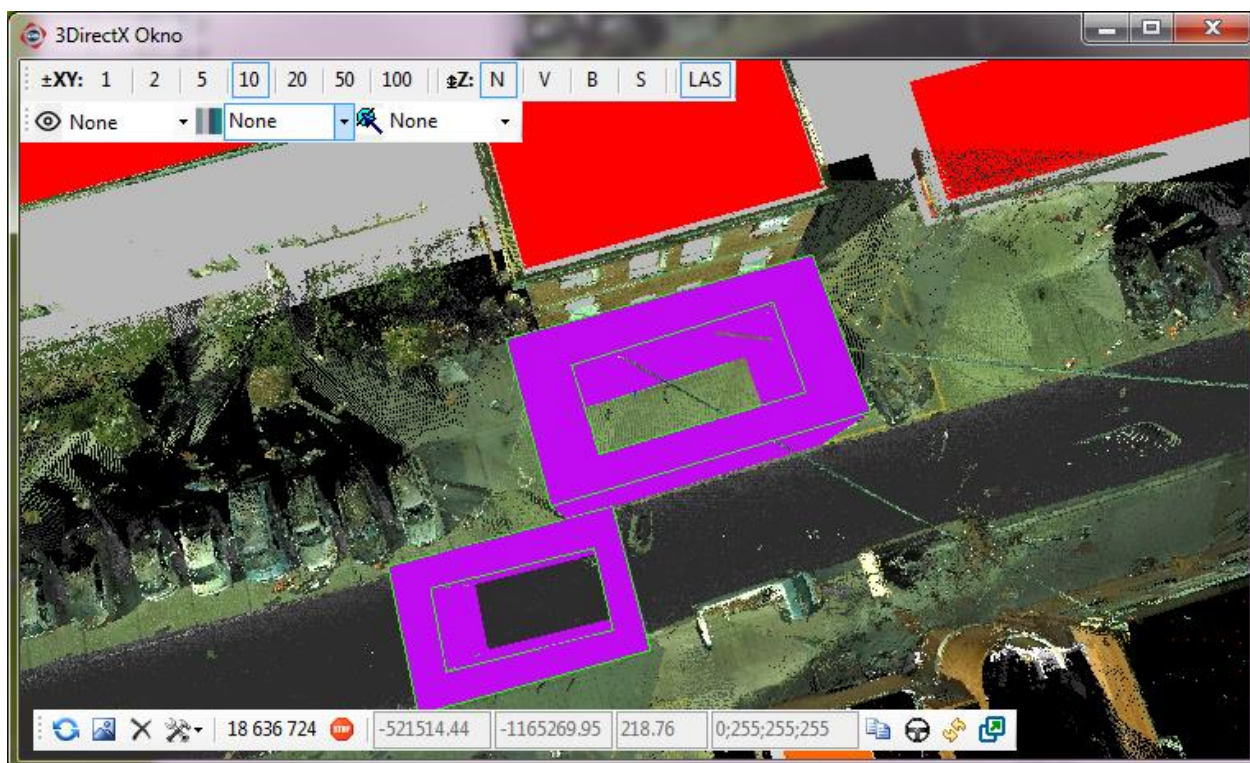Fig 4: Example of Z-ortho projection (CreateWalls)

Fig 5: Example of acquired (drawn elements "with a hole") in 3D window, acquired objects are depicted in pink color
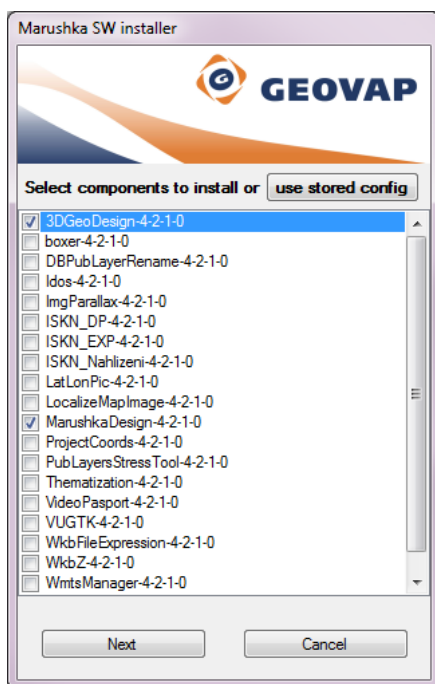

Fig 6: Marushka Design installation dialog box

4 A Brief Description of the Example in Marushka Design

This example describes how it is possible to acquire 3D element from GLS point cloud in Marushka Design. Based on the spatial information, form 3D point cloud it is possible to acquire vector drawing and perform a variety of operations with it. Now, it is possible to draw 3D elements type box, rectangle, polygon and circle.

This example includes a database *in SQLite (WKB)* with two form layers. The first layer is called *MODEL_BUDOV* and contains 3D model building data, which are already triangulated and serves as an example of how vector data can be obtained from scans. This layer was acquired from GLS point cloud. The second layer is called *MODEL_KRESBA* and was created to store 3D elements.

The example further includes a *Web Laser Scan Service* data store in GLS format. This data store therefore contains scanned 3D points. Those points are displayed in levels 0 – 8 and are defined by the degree of dilution. Layer 0 shows all measured points, layer 1 contains each 2nd measured point, layer 2 contains each 3rd measured point. These layers were created primarily due to the loading speed and also because of the ability to quickly load and identify data.

3D Window Control

The **DirectX** window is started from Marushka Design *3D Design ~ DirectX* menu. This window serves as a main map window for displaying point clouds in a 3D window. The window is command using:

- *Left mouse button* – rotation with the whole map around the center cross
- *Right mouse button* – vector shift in x and y, during sideway shift keeps z
- *Middle mouse button* – *moves* vector in x and y, keeps z
- *Both left and right mouse button simultaneously* – snap on points or vectors
- *ESCAPE key* – deletes the last acquired point
- *CTRL key + left mouse click* – move of center cross (map center)
- *A key* – draws the drawn line to the center of the cross
- *Mouse wheel* - zoom

DirectX window is controlled ale using toolbar down in the map window.

- Refresh
- Fit all
- Clear All
- Settings (click button)
- 3 718 650 - Number of currently displayed point in map window
- Copy active point into the clipboard
- Track along 3D line
- Synchronize with window #0
- Move window to position
- Is displayed only after exceeding critical number of points

| Background color |
| Point size ▶ |
| Snap tolerance (cm) ▶ |
| Point type ▶ |
| Track speed (m/sec.) ▶ |
| Z-far ▶ |
| Vertices 3D cross ▶ |
| Vertices color |
| Show 3D panel |
| Transparency |

`210309.62` `5338316.88` `132.62`   - Coordinate values x, y, z

`0` `...` `...` `...` ◀ ▶ ↻ `...` `...` `...`- `#` `1: 1 301` `Z-Orto` `/` `...`
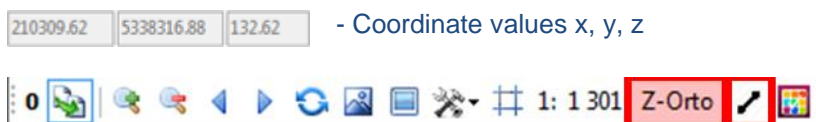
Set Z-ortho definition line (3D Profile Window Control)

Within the project, it is possible to determine a cut for Z-ortho projection. This feature is triggered by clicking the icon `Z-Orto` on the main map window. Then, using left mouse button draw two points of the line and set the width of the displayed section. In the main map window will be displayed cut with two vertical axes and an active `Z-Orto` icon. This window is controlled the same way as all the other Marushka Design windows. It is possible to turn off the window by clicking on Z-Ortho icon.

Definition of Z-ortho to general plane

Within the project, it is possible to select your own design plane by entering a line. This line is drawn, so that the user clicks in the panel in the main map window on icon `/`Z-ortho to general plane and then on button `Z-Orto` Set Z ortho definition line. Then, it is necessary to define a plane by three-points, it is recommended to define it in DirectX window or in Z-ortho cut window. In rare cases, it is possible to define this plane in a 2D window, but it is not recommended. Then, it is possible to acquire elements that are drawn into this plane.

Operations with elements

For operations with elements it is necessary first to select element (elements) using selection. Operations with elements are started from menu **Modify**.

In this example is the mostly used subcategory Position, which includes 3 functions.

Method **Move** allows moving the element or group of elements. Using parameters, it is possible to set, if the method should at the same time create walls (*CreateWalls*), if the original element should be erased after move operation (*DeleteSouceElements*) or to which physical layer (table) the result would be saved (*ResultLayer*). Setting the parameter *CreateWalls* to value "true" causes generating of walls perpendicular to the main plane. The user determines how high the walls are to be in the 3D window, or in the cut window, the resulting height determines the mouse drag and consequent click.

For method copy can be set the same parameters as for the Move method and its behavior will be affected in the same way. If the copy method is applied to more than 100 elements at a time, the polygon is moved, showing the combination of limiting rectangles of the elements. This measure is primarily applied due to speed of loading.

For the rotate method, in addition to the previous methods it contains the Angle parameter, which specifies the angle at which the element will be rotated. The *DeleteSourceElements* and *ResultLayer* are identical for these methods.

Methods created for drawing in 3D

- **Box 3D** – this method allows to draw a rectangle that is perpendicular to the edges of the map window

- **Rectangle 3D** – allows to define a rectangle

- **Polygon 3D** – allows to draw a polygon

- **Circle 3D** – allows to draw a circle in 3D, but it is necessary, so that the circle is drawn in the defined general plane or cut, otherwise the circle will not be rendered

How To Acquire Elements in 3D

1. Load the *MODEL_*BUDOV form layer form the data store *SQLite (WKB)* using action *Data – Load all.*

2. Zoom in to a scale about 1: 200 and retrieve data from the GLS data store from Layer 0 using the Data – *Load View Rectangle*.

3. Now from the menu *Draw ~ Area* select one of the drawn methods *Box3D*, *Rectangle3D*, *Polygon3D* and *Circle3D* and draw it above the GLS point cloud.

4. Draw another element in the same way as in the previous step, but place it inside the previously drawn element in order to create a "window" or a "hole".

5. Select both drawn elements using selection of elements (*Tools ~ Selection*).

6. Join both elements to collection (*Modify ~ Complex ~ Group 3D rings*). The result should look like a blue polygon with hole on figure 1 and 2.

7. Define a new plane, from which you will create walls by clicking on button Z-Orto n the main map window toolbar and select area, which you will want to display. The plane is defined in two steps, namely: drawing the line in the map window (Fig 1) and definition of cut width (Fig 2).

8. Next, start the Z-orto window (Fig 3 and 4), in menu choose *Modify ~ Position ~ Copy* and set parameter *CreateWalls* to value '*True'*.

9. Using the left mouse button grab the selected element (one element will be selected) and move it to you desired position (as in Fig 4).

10. In the way, it is necessary to draw also other types of 3D elements. It should be possible to combine them and do a variety of operations with them.

Comments:

Attention, building models are triangulated, so it is not recommended to perform operations with them, because they do not have to behave as a standard. You can try operations from menu item *Modify* on 3D elements, you will draw by yourself.

If the user is drawing, the drawing will snap on individual points of GLS point cloud or to the general Z-ortho plane in case, if it is defined.

If a user presses a SHIFT key, while drawing, the drawing becomes perpendicular to the map window frame. If the user presses the ALT key, the drawing is perpendicular to the last drawn line.

Geovap Technology Line

After measuring data using the LYNX mapping system, basic data processing (trajectory calculation, raw point calculation and photo calculation) is performed in the manufacturer's software. Additionally, post processing is also performed, again in the manufacturer's software. Its result is a point cloud in a desired coordinate system, which can be refined using ground control points. In addition to point cloud, the picture from the camera with coordinates and angle of rotation for each picture.

Subsequently, classification may or might not be applied, which is a breakdown of points, for example, points in terrain line and point above terrain. Classification is performed in Microstation software in combination with Terrascan.

The so processed point cloud (refined, classified, transformed into desired coordinate system, possibly also colored according to photos) enters into another post processing, e.g. into 3D Design. Here are point clouds connected using the Web laser scan service data source, other items like map layout, trajectory images and others are connected using standard database.

Because of massive data management, a web-based custom system is used and is intertwined with 3DGeoDesign technology. In this way, it is possible to maintain data cloud storage in GLs format.

The trial version of Marushka Design and Marushka can be downloaded here: http://install.geovap.cz/mdinstall/marinstall.exe.

GEOVAP

To install Marushka Design successfully, it is necessary to select version of your operating system correctly. Next, it is necessary to select both modules 3DGeoDesign and MarushkaDesign, see Fig 6 and Marushka Design should be installed including those modules.