Application of 3D terrestrial laser scanning for measurements of buildings, situated in area, covered with bushes – technical difficulties, solutions and implementation

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1. The aims of the paper

This study has the following tasks:

-to perform contactless measurements of buildings, which were **hard to access**;
-to **assess and analyse** the obtained quality of the conducted geodetic measurements;
-to find **solutions** for the technical issues, caused by the bushes;

This study was focused on **high-quality outdoor** terrestrial laser scanning.

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2. 3D terrestrial laser scanning of the buildings. Technical difficulties

In the process of laser scanning, the presence of **(tall) bushes** all around the buildings had to be taken into account, fig. N 1.

Fig. 1 The point cloud and the bushes around the buildings

The bushes, having **various heights and density**, were one significant technical difficulty to be solved.

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3. Creation of the point cloud. Solutions of the technical issues

The point cloud was done in a **different**, **time** and efforts **consuming way**.

In this specific case the application of the spheres for the registration process was **not possible**.

No matching spheres existed in the adjacent scans

- due to the **obstructions**, caused by the bushes.

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4. Creation of the point cloud. Solutions of the technical issues

The creation of the full point cloud was done via:

a) "registration using planes" software option;
b) the measurements from the redundant scan;
c) the common situation, created from the measurements and later on involved.

The technical issues were **solved** via:

- the existence of redundant information;
- the software possibilities;
- certain operator's decisions.

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5. Results from 3D terrestrial laser scanning. Analysis

Creation of the full model. Results

The full model was created via the registration of already created scans, fig. 2.

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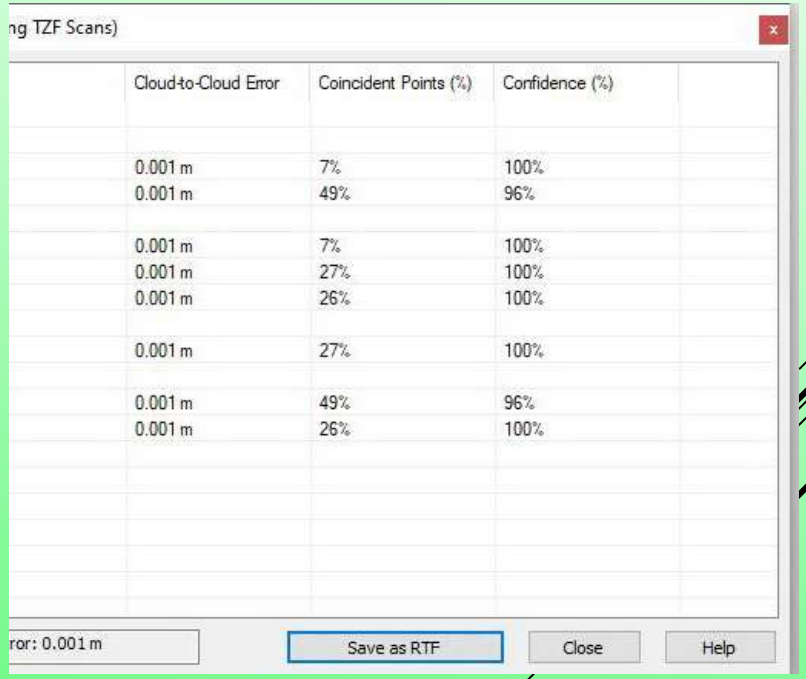

Fig. 2 Registration using planes, of all stations

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6. Results from 3D terrestrial laser scanning. Analysis

Georeferencing of the point cloud

was done with created for network of control points.

Some of them **were excluded** from the calculations in order to be obtained better quality results, fig. 3.

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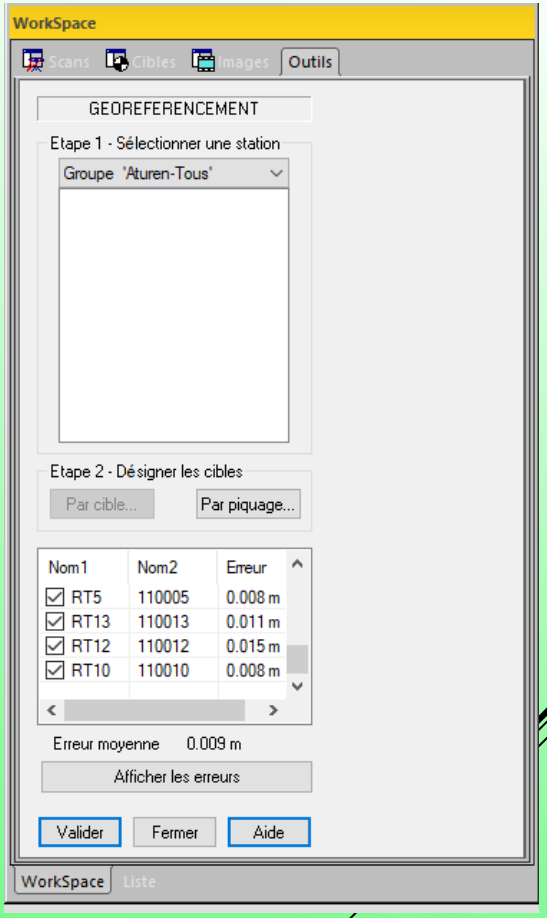

Fig. 3 Quality results from georeferencing of the point cloud

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7. Conclusion

The full digital model was not created in the "classical", fast way (using artificial targets). The bushes **imposed**:

-replacement of target-based registration with **registration using planes**;

-**three registrations** using planes instead of application of target-based one;

-**more computational time**, required for registration using planes process.

-**human decisions/intervention** for the specific way of measurements and data processing.

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It could be noted the high accuracy, which was obtained:

a) **1 mm** in the registration process;

b) **9 mm** in the georeferencing of the point cloud.

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7. Conclusion

The data from this terrestrial laser scanning was represented in the plane.

The information was used for **further geodetic activities.**
Based on:

-the geometry of the object;
-the technical difficulties (solved during the data processing);
-the taken decisions in the area of terrestrial laser scanning,

it could be noted, that the geodetic measurements were done in a **reasonable time** (due to the bad weather conditions) and **excellent quality** results were obtained.

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Thank you for your attention!

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