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CREATION OF A THREE-DIMENSIONAL POINT CLOUD MODEL OF THE RESIDENTIAL COMPLEX "OZERA JOZEFA"

Geodetic works were carried out at the address Hordynskykh 15a Street, in the city of Lviv. The residential complex "Ozera Jozefa" is an upscale, club-type building situated in a cozy green corner of Lviv, near the Piskovi Ozera Park. The building has 6 floors and an underground parking facility, accommodating only 20 apartments. The construction technology is based on monolithic-frame construction.

The building is equipped with a modern ventilated facade system, the main advantage of which is the free circulation of air between the facing and the wall. This allows for the efficient removal of moisture and condensation from the facade structure. Additional insulation is provided by a layer of mineral wool. This system helps to retain heat in the rooms during winter and prevent wall overheating in the summer. Additionally, it offers high sound insulation. To develop the facade, windows, and door openings, it is necessary to create a point cloud 3D model of the structure.

For the control and transformation of the 3D model into the construction coordinate system, special marks are affixed to the facade of the building, as indicated in Figure 1 by black and red circles. The red circles denote the reference marks. Using the Trimble M3 electronic theodolite and geodetic reverse sighting, the coordinates of the control marks were determined in the construction site coordinate system.

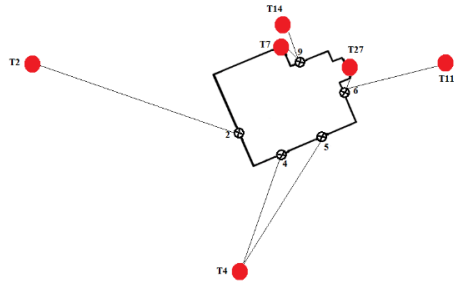
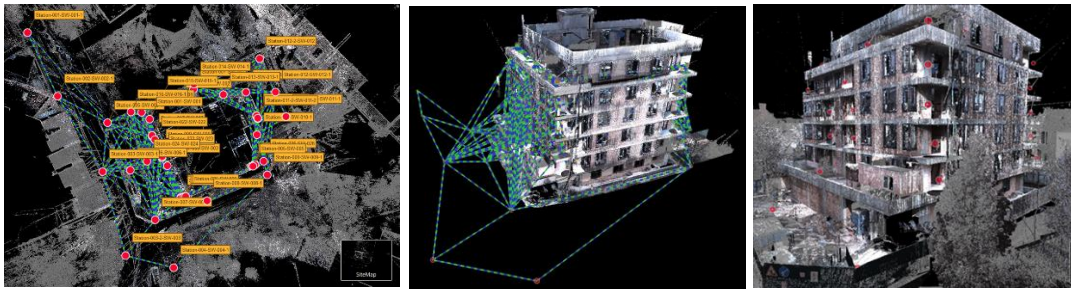


Figure 1 – Scheme of Control Point Reference

The next step involved conducting observations with the terrestrial laser scanner Leica ScanStation C10, following the methodology outlined in [**Ошибка! Источник ссылки не найден.**]. The layout of the scanning stations is illustrated in Figure 2.



a b c

Figure 2 – a – Scheme of the laser scanning network (orthogonal projection), b − Scheme of the laser scanning network (perspective projection), c – View of the scanning station placement in Leica REGISTER 360 software

3D scanning of facades is a modern method for conducting coordinate measurements and acquiring data to construct three-dimensional digital models of objects. The scanning network consisted of 28 stations, ensuring the representation of all necessary structural elements of the building, as well as providing efficiency and cost-effectiveness in the conducted work. The

selection of stations aimed to capture the maximum area reflected in the scans. Additionally, color photographs were taken to apply real colors to the 3D model.

The acquired data were processed using the Leica REGISTER 360 software. Scanning stations were positioned on each balcony, as illustrated in Figure 2c. The final editing of the 3D model was performed in Autodesk Recap software. The subsequent figure presents the results of the engineering survey (Fig. 3).

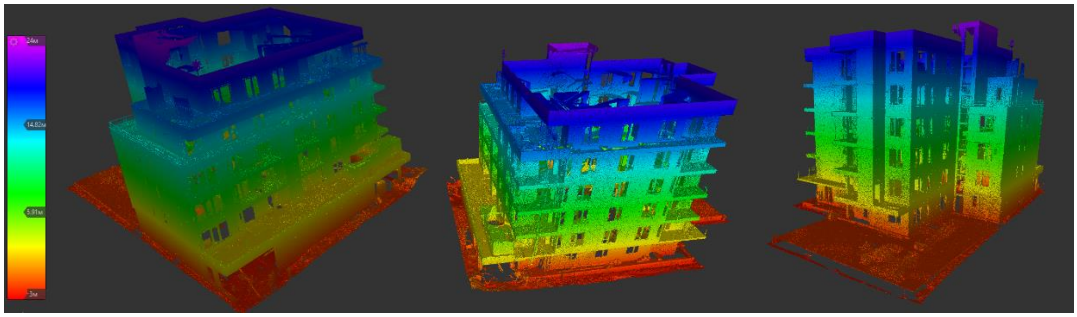


Figure 3 – 3D Model of the residential complex (points colored according to their respective heights)

At the current moment, the building is partially adorned with facade elements, windows, and door structures, as depicted in Figure 4. These were designed based on the constructed point cloud 3D model.

a b

Figure 4 – a – Photo of the residential complex in 2022, b – Photo of the partially adorned building with facade, window, and door structures in 2023

Summing up the results of the work, it is important to highlight the advantages of terrestrial laser scanning, including high accuracy and data collection efficiency. This method allows for measuring complex shapes and objects, as well as conducting data collection remotely, without direct contact with the object.

Starting with the reconnaissance of the object, a network of terrestrial laser scanning was established, comprising 28 stations. Using an electronic tacheometer, a planimetric and height geodetic network was set up, serving as the basis for subsequent laser scanning. After analyzing the obtained data, the internal convergence of the network was 0.007 m, and according to the reverse sighting control, the root mean square error was 0.015 m.

References:

1. Shylo Y.O. (2021) "Methodology of Spatial Scanning Using the Leica ScanStation C10 Laser Scanner: Guidelines for Laboratory Work in the Educational Discipline 'Laser Scanning' for Students of the Full-time and Part-time Forms of Study of the First (Bachelor's) Level of Higher Education in the Specialty 193 'Geodesy and Land Management.' Lviv, Lviv Polytechnic Publishing House, - 24 p.