Summary

DIFFERENTIAL BALANCE OF DIGITAL HEIGHT MODELS OBTAINED FROM A LOW ALTITUDE

A sense of security is essential for every person. It is one of the main human needs without which we cannot function normally. Currently, a high level of security should be maintained in every area of human life, especially in communication, starting with driving by bicycle, by driving a car, or flying by plane.

In recent years, we have experienced significant development in communication aviation, which is one of the main elements of the global system of transport. On average, airlines around the world transport approximately 4 billion passengers a year passengers. This result is impressive because it constitutes half of the population of our planet.

However, at Polish airports, the average number is approximately 40 million passengers per year, which is more than the population of our country.

Current aircraft transport is represented by technologically advanced machines characterized by high flight speed and high level of safety. Unfortunately, traveling with them depends on other factors such as weather conditions, as well as highly qualified personnel flying. Ensure safety during air operations consists not only of trained flying personnel and a safe aircraft but also ground staff, which includes the meteorological service and air traffic control servants. The airport infrastructure, including: in particular the runway, should not be missed from above mentioned factors, as it must be kept in sufficiently good technical condition to ensure a high level of safety during the execution flight operations.

All the elements mentioned above can provide to passengers a feeling of safety only when they holistically function at the highest level. It is worth emphasizing that a runway is especially important element of airport infrastructure and should be treated as the main part of the airport. By frequent use and changing weather conditions the road surface at the starting point is indeed exposed to various types of damage and deformation.

Therefore, it is required that the relevant services constantly monitor its surface and maintain it in good technical condition. This is to maintain security at an appropriate level. Monitoring the technical condition of the runway surface is time-consuming and requires several activities, in special cases even temporary closure. To avoid such

problems, technological solutions should be sought to allow for quick and complete imaging of the examined area and the elimination of possible threats.

In the last decade, for the imaging of linear and other objects, Mobile Laser Scanning (MLS) is more and more often used, thanks to which we can obtain quasi-continuous information about the geometry of the object in the form of a scaled three-dimensional cloud of points (characterized by coordinates x, y, z) together with information about the laser beam reflection intensity at individual points, supplemented with information on the reflection angle, reflection number, number of reflections in individual places. The cloud also has important data about and the red, green, and blue color channels.

Visualization of such objects can also be performed using a drone that performs a low-altitude flight over the object under test.

The spectrum of spatial data applications in the form of point clouds obtained from MLS and drone flights is very wide, but their proper use requires knowledge of many factors affecting the quality of data and methods of their appropriate processing.

This work focuses on the use of a mobile laser scanner and the use of an aerial photogrammetry set, which imaged the airport runway. Point clouds were obtained from both devices, from which digital elevation models of various resolutions were generated. These models were compared with each other and provided information allowing for drawing appropriate conclusions.

During the analysis of the aircraft runway surface, essential to prepare this doctoral thesis, some factors that may have a significant impact on the subject of the work were analyzed. These factors were mostly the physical properties of the tested object and the weather conditions at the time of measurements. The technical parameters of the instruments used for the tests were found important and were also taken into account.

It was noticed that the data obtained from the MLS analysis and from the drone flight were characterized by appropriate quality, which is important in terms of both, the accuracy of the final product development and in comparing data from subsequent measurement cycles.

During the performance of this work, data obtained from mobile laser scanning and a photogrammetric flight were used to examine the airport runway in order to localize places where deformation and/or destruction occured.