



BUILDING ON FIRM FOUNDATIONS

THE COMBINATION OF PLANNING RULES AND A COUNTRYWIDE PROJECT TO PREPARE FOR FLOODS MEAN THAT LIDAR IS BECOMING INCREASING POPULAR IN POLAND. DOMINIK WESOŁOWSKI EXPLAINS HOW IT CAN BE USED TO GENERATE THE ALL-IMPORTANT DOCUMENTATION NEEDED FOR BUILDING PROJECTS

In Poland, urban planning analysis is often the first and most important stage during construction. Spatial policy is established by a local spatial management plan, which determines if a particular plot can be used for development and what type of building is allowed.

It is worth getting acquainted with this document before buying a plot and an architectural design. However, in practice, only about 30% of the country is covered by such a document. In its absence, municipalities issue conditions of development and spatial management for each plot. This is one of the documents the owner has to provide to the local government to get a building licence. This document does not interfere with the right of ownership, so anybody can request it.

Conditions of development and spatial management, just like the local spatial management plan, determine the parameters of new buildings, which can't be different from buildings in their nearest neighbourhood.

Many factors must be taken into consideration during the preparation of this document. Some of them, such as location and distances from borders, can be measured on a map. But others require making more detailed measurements of building height or roof slope angles, for example. Field measurements are usually made at this stage, which significantly lengthen the whole procedure.

ISOK

Between 2009 and 2015, Poland realised a huge project, the purpose of which was to create an IT System for Protecting the Country against Emergencies (the Polish acronym for which is ISOK). This system contains information on threats to the economy, environment and society, especially those related to floods.

Creation of the system required obtaining actual and accurate data and so LiDAR data was collected for about 93% of the country. It is now available from the Central Surveying and Cartographic Documentation Centre in LAS format and conforms to the 1.2 standard published in 2008 by ASPRS. Each point, except XYZ coordinates, has RGB and intensity values and has been classified.

The point clouds were collected in two standards: standard II describes large cities, while standard I refers to other areas. The area of each file refers to the corresponding map sheet. For data in standard II, flights were performed in perpendicular strips to reduce gaps. Parameters of the point clouds in these standards are shown in Table 1.

The availability of the data means it is no longer used just for ISOK, but supports companies, universities and local governments.

Point clouds obtained from airborne laser scanning (ALS) provide very good information about objects in space, but making the detailed

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	STANDARD I	STANDARD II
POINT CLOUD DENSITY	4pts/m ²	12 pts/m ²
ZRMS	0.15m	0.10m
XYRMS	0.5m	0.4m
MAP SHEET	1:2,500	1:1,250
APPROXIMATE FILE SIZE	400MB	200MB

measurements necessary for determining development conditions requires using special software. A growing number of local governments, including the largest cities in Poland (Warsaw and Cracow) and smaller municipalities, use the LiMON Viewer Pro software for this.

Urban planning

The first step to be taken in an urban planning study is to determine its scope. This area is defined in regulations and must not be less than three widths of the parcel front (so not less than 50m). Defining the scope of analysis requires using the reference data. LiMON Viewer Pro supports vector and raster formats. It also allows the user to add data from WMS services (see Figure 1), which are provided by national and regional geoportals and significantly broaden the range of information about the terrain. This data may contain information about outlines and the numbers of plots/buildings, land use, utilities and much more.

Moreover, the program supports all EPSG coordinate systems and allows you to transform point clouds between them. This feature is very important in Poland, because many coordinate systems are currently in use. The area of interest can be precisely defined using the measuring tools in LiMON Viewer Pro, too.

The second step is to define the building line by extension of the line determined by existing buildings. LiMON Viewer Pro allows you to create point, line and area markers, which can be exported to SHP or KML format and then processed in a GIS.

For new buildings, the permissible height of the upper edge of the front elevation is also determined based on the corresponding height of the buildings on the neighbouring plots. LiMON Viewer Pro's 'Relative height marker' tool allows the user to do this by indicating one point on the ground and a second one on the top of the roof. The relative height between the two points is then automatically calculated.

The most important tool of the program is the Document module. This enables the simultaneous, precise measurement of building parameters and the creation of documentation. The program allows you to work in many 3D windows, so you can determine the range and thickness of a cross-section in one window and keep an eye on its current appearance in another window.

When buildings are not in line or they are curved, it is impossible to present all of them in one cross-section. Here, the 'Broken cross-

section' tool (see Figure 2) is very useful. This function allows the user to define a cross-section as a broken line and present these objects in one document

The regulations require the determination of roof geometry. Angle of inclination, height of the main ridge, arrangement of the roof surfaces as well as direction of the main ridge relative to the front of the plot must be accurately determined. These parameters can be measured in the Document module.

District analysis

The work of urban planners is not limited to issuing location decisions. Elaboration of local land management plans requires data analysis for individual districts or even the whole city area. In this case, many files need to be loaded at the same time, which often leads to decreasing performance or errors. Moreover, many local governments do not have the advanced PC hardware necessary. Due to these limitations, LiMON Viewer Pro has its own algorithms of data arrangement and display, which provide smooth operation on datasets exceeding billion of points without decrease in performance.

The name of each file of LiDAR data corresponds with the map sheet, so searching for appropriate file requires the knowledge about location of these sheets and takes time. LiMON Server is a solution that simplifies work with large datasets. All files are stored on the server, so individual workstations do not need large storage space and data access is possible from anywhere. Rather than requiring the user to search for specific files, the user simply draws a rectangular area in the appropriate place and the corresponding files are automatically downloaded from the server

LiDAR in Poland

Interest in LiDAR data has been growing in Poland in recent years. An increasing number of local governments have decided to obtain actual data for their needs. LiMON Viewer Pro enables the control of the quality of these data, by making density maps that provide information about the number of points per square metre. It also enables the user to assess the density of the resulting point cloud.

Implementing LiMON Viewer Pro brings measurable benefits for local governments. It allows them to reduce the need for expensive and time-consuming fieldworks. Moreover, institutions and citizens can begin their investments earlier than ever.

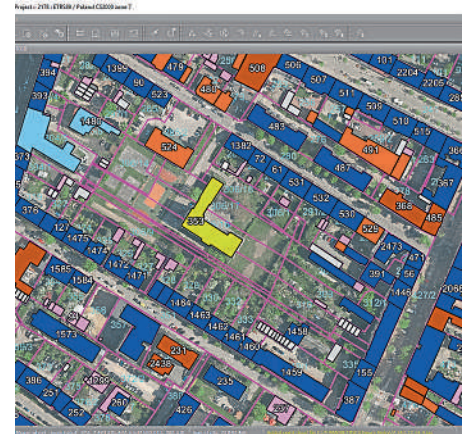


Figure 1. LiDAR data with WMS layer

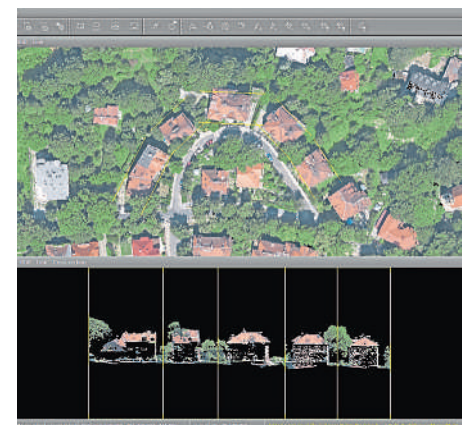


Figure 2. Broken cross-section

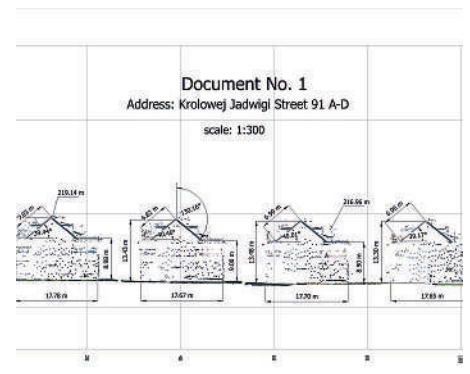


Figure 3. The Document module

INTEREST IN LIDAR DATA HAS BEEN GROWING IN POLAND IN RECENT YEARS

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