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Aspect of spatial location of permanent GPS antennas by using visibility analysis

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Spatial configuration of DGPS permanent reference station elements has an effect on performance of the entire system. Arrangement of station elements, such as broadcast antenna and reference masts, requires allowance and further linking together number of technical, operational and terrain factors. Some technical and operational factors as a rule are determined by equipment manufacturer, however terrain factors are conditioned by terrain character of the future reference station site. Terrain character is a composition of its surface shape and all geographical features situated within the reference station surroundings. These factors often can cause certain difficulties during recommended elements' arrangement of the planned reference station. Additionally, some preferred location aspects should be taken into consideration due to future exploitation, maintenance or technical supervision of system elements.

This elaboration presents applications of visibility analysis in planning spatial location of reference station GPS antennas. Visibility, or view-shed, analysis is usually available in various computer programs of Geographic Information System environment. It can be performed from any point situated in three-dimensional space of elaboration range. In the case of such elements as permanent GPS antennas, application of visibility analyses solves a problem of their location with allowance of surroundings and geographical features, which can cause limitation of visibility of satellites and multipath received at the reference station. By performing this kind of analyses can be determined the three-dimensional position of GPS antennas, which meets such requirements as recommended horizon visibility.

Accuracy of view-shed analysis depends mostly on spatial accuracy of digital surface model of land cover, which consists of natural features, like trees, and artificial ones like buildings, masts and other constructions. One of the essential elements of digital surface model is a terrain shape, which can play an important role in determination of the proper observation points. Directly an indirectly, as an element of digital surface model, character of terrain can be a reason of potential horizon shielding or it just makes difficult an installation of reference mast with GPS antennas. In connection with these aspects of view-shed analysis, in this work was presented also method of elaborating digital surface model, which is a basic material during performing this kind of analyses.

A visibility analysis was performed on the example of possible correction of Leica GPS antennas position, which are an element of DGPS reference station in polish place Dziwnow. As a main criterion were assumed the recommendations of equipment producer. Apart of performed view-shed analysis, some aspects of present reference station location or terrain forestation ware discussed.