

INTEGRATION OF 3D CITY MODELS AND 3D PHOTOGRAMMETRIC DOCUMENTATION OF CULTURAL HERITAGE STRUCTURES

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ABSTRACT:

Topographic spatial data could be nowadays quite easily visualised in three-dimensional forms. Beside this, photogrammetric documentation of cultural heritage structures and items is also more often accomplished in forms of 3D models. Thus, it is only a question of a technique how to integrate different 3D data into one system. The purposes for integration of these data may be different. We may only visualise the existing data or we can use the models like a spatial information system. Quite many spatial data may be already available, collected by different institutions and enterprises, using different technologies. Thus, it is advisory to set some common rules for creation of topologically consistent 3D models. Photogrammetry is useful and from many aspects the optimum technique for bulk data acquisition in topographical applications and in close-range applications like architectural and archaeological photogrammetry. The results of photogrammetric survey may be in different forms (vector – raster, 2D – 3D, analog – digital, etc.). From technological point of view, it is no more a problem to merge together different kinds of data into one information system. In the paper, the approaches of data integration and data visualisation in Slovenia are presented, demonstrated on an example of the municipality of Ljubljana, the capital of Slovenia. A 3D city model of Ljubljana was recently created using the already available topographical data: digital elevation model, digital orthophoto map, register on buildings. A very detailed technical documentation of the dome of Ljubljana was integrated in the 3D city model, consisted of a 3D model of the exterior and interior, maps of all facades and interior walls, digital orthophotos of frescos, many horizontal and vertical cross sections, etc. A 3D model of the church serves as a spatial reference and assures consistency of different kinds of technical documentation of the church. More detailed compilation of the interior will be produced in the future (decoration, furniture, etc.). New documentation could be easily added to the existing one. We may call this a level of detail of the documentation. The city model as well can consist of different levels of details. On example of buildings, we may have buildings presented as simple cubes or with simplified roofs or with a lot of details. All these data can be integrated in one system. In the example of the Ljubljana model, approx. 80.000 buildings were visualized in the model, in different levels of details. Some special computer application programs were developed for generating the 3D model from the existing data. A digital elevation model with a grid cell of 25 m was available, as well as a colour digital orthophoto map in scale 1 : 5000 which was draped onto the digital elevation mode. For the entire territory of Slovenia, data on buildings are available from the Cadastre on buildings. Data were collected with stereo-photogrammetric method, i.e. a shape of a building and three heights as attribute data (on the terrain, on the drip, on the ridge of a roof). Using these data, we can create a 3D model in a simple form. The data on buildings are connected with land cadastral data (parcel numbers) and record on spatial units (house numbers, administration units, ...). The Municipality of Ljubljana had already available some 3D buildings models of some city areas in more details. These data were integrated in the model as well. The problem was that these models were not always topologically consistent thus we had to check and correct the models. On the basis of these examples, some practical and simple rules were prepared for creation of 3D models, which will be shortly presented in the paper. In the 3D model of Ljubljana, proposals of environmental plans in some city areas were entered, that enable the citizens of the city to discuss on the proposals. An equipment and computer programs for 3D stereo viewing (on computer or in large screen) was developed in Slovenia, enabling also the measuring system in the model (coordinates, lengths, areas, volumes). Land cadastral data (shapes of parcels, parcel number, etc.) were integrated in the model as well as some other spatial data. In general, any data that is georeference could be integrated in the model. The presented example is thus an integration of topographical and cultural heritage data, it represents not only the visualisation aspect but also a measuring system and connection of different data. It is not a 3D GIS yet, but it has some features of a 3D information system. The main problems and our own solutions in generating 3D models will be pointed out in the paper.