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# BIM and GIS integration for infrastructure analysis

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The use of Building Information Modeling (BIM) is certainly increasing, especially in the field of Civil Engineering and Architecture. In recent years, research for new solutions has focused on the integration of BIM and GIS (Geographic Information System), referred to as GeoBIM. Most applications focus on issues related to the import and interoperability of BIM data into a GIS environment and vice versa. Data integration in a well-designed GeoBIM should address the following aspects: i) data harmonization and consistency (e.g., accuracy estimation, geometric and semantic representation, amount of detail, geo-referencing); ii) interoperability of data coming from different sources; iii) transformation of a set of data into a standardized format. One of the most evident inconsistencies if working with BIM or GIS is in the georeferencing of data: BIM designers work in a local Cartesian system while the terrain morphology is referred to a Geodetic Reference System, in the case of Europe, and therefore also for Italy, such system is the ETRS89, realization ETRF2000. The objective of this work is to achieve a true integration between BIM and GIS through the use and combination of the strengths of both technologies: the semantic and spatial component of GIS with the 3D and detailed information coming from the BIM model. A model that meets these requirements will allow a management of the structure and / or infrastructure in a wider and more complete context; therefore, not only at the local level but will be applicable to structures that have a strong impact with the territory and located in areas subject to hydrogeological risk. One of the innovative aspects of the study is the integration of the regional Topographic Database (TDB) with the altimetric component extracted automatically from LiDAR data; the process aims to allow the reconstruction of the volumes in an automated way of each object to define the 3D spatial attribute for the purposes of three-dimensional modeling. The study area is located near the “Monti Lattari” in the Campania Region, in southern Italy. The whole area consists of areas exposed to high hydrogeological risk, characterized by the presence of a complex infrastructural network (railway, highway, national and provincial roads), rich in viaducts, tunnels and galleries. In details, the GeoBIM model of a viaduct (Olivieri Viaduct), built between the years ‘50 and ‘60, has been made. The main structure is a Maillart-arch-type bridge, made of reinforced concrete with a continuous frame deck and two access viaducts. The structural model has been generated from the point cloud acquired by Terrestrial Laser Scanner (TLS). The BIM model has been realized by using Revit software package (Autodesk), which allowed to organize the information useful to define the entire viaduct: each virtual element has been “informed” with all the parameters and characteristics of the structural elements. The next work phase was

addressed to the design of a workflow able to combine the BIM model into a GIS developed by using ESRI tools. So, the parametric model produced in Revit is transformed into a GeoDatabase.