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BIM Modeling of Site and Existing Buildings: Case Study of ESTP Paris Campus

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Abstract : Building Information Modelling (BIM) is the process of creating, managing, and centralizing information during the building lifecycle. BIM can be used all over a construction project, from the initiation phase to the planning and execution phases to the maintenance and lifecycle management phase. For existing buildings, BIM can be used for specific applications such as lifecycle management. However, most of the existing buildings don't have a BIM model. Creating a compatible BIM for existing buildings is very challenging. It requires special equipment for data capturing and efforts to convert these data into a BIM model. The main difficulties for such projects are to define the data needed, the level of development (LOD), and the methodology to be adopted. In addition to managing information for an existing building, studying the impact of the built environment is a challenging topic. So, integrating the existing terrain that surrounds buildings into the digital model is essential to be able to make several simulations as flood simulation, energy simulation, etc. Making a replication of the physical model and updating its information in real-time to make its Digital Twin (DT) is very important. The Digital Terrain Model (DTM) represents the ground surface of the terrain by a set of discrete points with unique height values over 2D points based on reference surface (e.g., mean sea level, geoid, and ellipsoid). In addition, information related to the type of pavement materials, types of vegetation and heights and damaged surfaces can be integrated. Our aim in this study is to define the methodology to be used in order to provide a 3D BIM model for the site and the existing building based on the case study of "Ecole Spéciale des Travaux Publiques (ESTP Paris)" school of engineering campus. The property is located on a hilly site of 5 hectares and is composed of more than 20 buildings with a total area of 32 000 square meters and a height between 50 and 68 meters. In this work, the campus precise levelling grid according to the NGF-IGN69 altimetric system and the grid control points are computed according to (Réseau Gédésique Français) RGF93 – Lambert 93 french system with different methods: (i) Land topographic surveying methods using robotic total station, (ii) GNSS (Global Network Satellite sytem) levelling grid with NRTK (Network Real Time Kinematic) mode, (iii) Point clouds generated by laser scanning. These technologies allow the computation of multiple building parameters such as boundary limits, the number of floors, the floors georeferencing, the georeferencing of the 4 base corners of each building, etc. Once the entry data are identified, the digital model of each building is done. The DTM is also modeled. The process of altimetric determination is complex and requires efforts in order to collect and analyze multiple data formats. Since many technologies can be used to produce digital models, different file formats such as DraWinG (DWG), LASer (LAS), Comma-separated values (CSV), Industry Foundation Classes (IFC) and ReViT (RVT) will be generated. Checking the interoperability between BIM models is very important. In this work, all models are linked together and shared on 3DEXPERIENCE collaborative platform.

Keywords : building information modeling, digital terrain model, existing buildings, interoperability
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