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DIGITAL EARTHQUAKE-DAMAGED BUILDING USING HBIM, COMMON DATA ENVIRONMENT(CDE) AND EXTENDED REALITY (XR): THE CHURCH OF SAN FRANCESCO IN ARQUATA DEL TRONTO[1]

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Abstract:

The central of Italy, on 24 August 2016, was hit by a 6.0 magnitude earthquake that devastated Arquata del Tronto, Amatrice, Norcia and Accumuli (Ascoli Piceno). On October 30th, the strongest quake of magnitude 6.5 in Norcia razed to the ground the hamlet of Arquata, collapsing houses and causing serious damage to one of the most representative buildings of the local community: the church of San Francesco. In this tragic context, the municipality commissioned the research to support the preliminary restoration phase. The methodological approach flows into a research and development phase supported by the latest generation tools and methods for sharing data in interactive and digital form such as 3D survey (terrestrial and mobile laser scanning, terrestrial and UAV photogrammetry), heritage building information modelling (HBIM), virtual and augmented reality (VR-AR). The integrated approach between advanced 3D survey techniques and digital information models (HBIM) has made it possible to define digital data flows capable of communicating a large amount of content, from material and decay analyses to the identification of historical phases of the main wall partitions. The digitization and management process envisaged the application of four distinct phases correlated with each other by a gradual morphological - typological deepening. The first step involved a phase of 3D data collection.

Thanks to the integrated use of laser scanners (terrestrial and mobile), total station and photogrammetry (terrestrial and UAV) it was possible to define an environment characterized by a large number of point clouds (primary data sources) able to describe through points the internal and external geometry of the church. The next step involved the semantic enrichment of 3D parametric objects (information mapping). The historical and material analyzes have been reported and linked within the HBIM project to communicate not only geometric values but specific characteristics capable of supporting the choices for the preliminary conservation plan. In particular, the material analyses were represented volumetrically where it was possible with the aim of communicating not only a two-dimensional representation but also 3D objects capable of appropriately representing and sharing the quantities relating to the different materials and construction technique. The three-dimensional representation of the analysis carried out through the building archaeology highlights cognitive uncertainties. When the stratigraphic units of the 2D drawings “are transformed” into HBIM objects, along with geometrical data, two aspects are particularly significant since they can be embedded in the model: i) material and constructive techniques; ii) chronological data. Finally, through a common data environment (CDE) and new levels of interactivity, it was possible to lay the foundations for new eXtended reality (XR) environments capable to share a huge amount of complex data sets to support the preliminary design phase of the restoration and conservation process.

Keywords: 3D survey, scan-to-BIM, HBIM, building archaeology, common data environment (CDE), eXtended reality (XR)

[1] Please check its full version at the *Virtual Archaeology Review*: BUILDING ARCHAEOLOGY INFORMATIVE MODELLING TURNED INTO 3D VOLUME STRATIGRAPHY AND EXTENDED REALITY TIME-LAPSE COMMUNICATION. https://polipapers.upv.es/index.php/var/article/view/15313

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