



POLITECNICO
DI TORINO

Honors thesis

Master in Architecture Heritage Preservation and
Enhancement

Abstract

**From point cloud to UrbanBIM
Integrated 3D survey techniques for the generation of a
multiscale city model in a post-seismic scenario.
The case study of Norcia (PG)**

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The Italian Cultural Heritage have been severely affected in recent years by numerous and disastrous seismic events, whose devastating effects have caused profound territorial and social changes on the one hand, and on the other, in the worst case, have led to the total destruction of precious examples of this heritage. Events of this magnitude have oriented research by Geomatics towards the study of possible significant strategies to be adopted in post-earthquake emergency situations, in order to offer their contributions in terms of risks assessment, damage assessment and disaster management. The scenario that made these strategies possible to develop is represented by the city of Norcia (PG), a municipality in Central Italy that was hit in October 2016 and January 2017 by a seismic swarm that left an indelible mark on the Norcina community, destroying buildings and monuments symbol of the city. Particularly, this thesis means to exploit Geomatics' innovative 3D survey techniques to create a workflow capable of generating a multi-scale model of city useful, at different levels, for the management of post-earthquake events and more generally as a support of *Disaster Management* operations. Particular attention was given to the processing of the data obtained from the 3D survey campaign, a phase that allowed to obtain the first useful processing, at different scales, for the analysis and reconstruction in 3D environment of Norcia.



Figure 1: Dense Point Cloud of the square of S.Benedetto di Norcia (10.444.874 punti) – Agisoft Photoscan.

The phase that followed the elaboration of the 3D survey data concerned the choice of the method to be used for the generation of the urban model, experimenting and evaluating the level of interoperability included between the data coming from the world of BIM and spatial data of GIS systems. In this context, the aim to create a parametric model, easily implementable, manageable and shareable, in perfect line with the new standards and standardized procedures that now regulate the world of construction, led to the choice of a BIM approach for the realization of the *UrbanBIM* model of the city of Norcia.

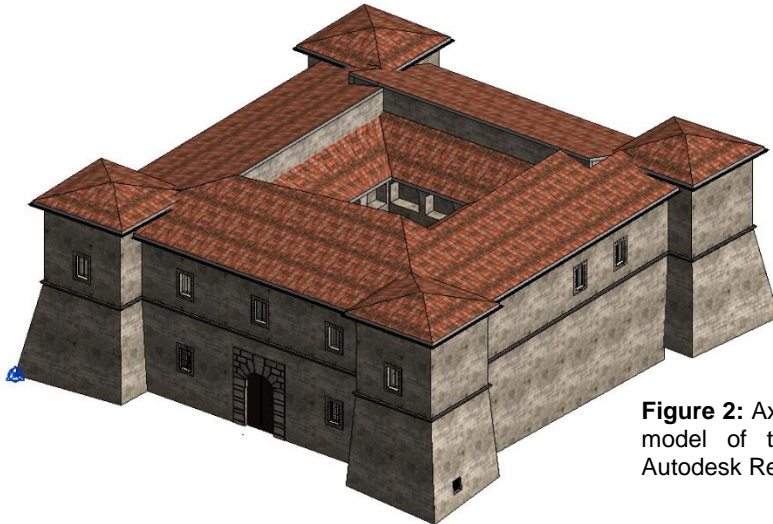


Figure 2: Axonometric view of the BIM model of the Castellina fortress – Autodesk Revit 2017.

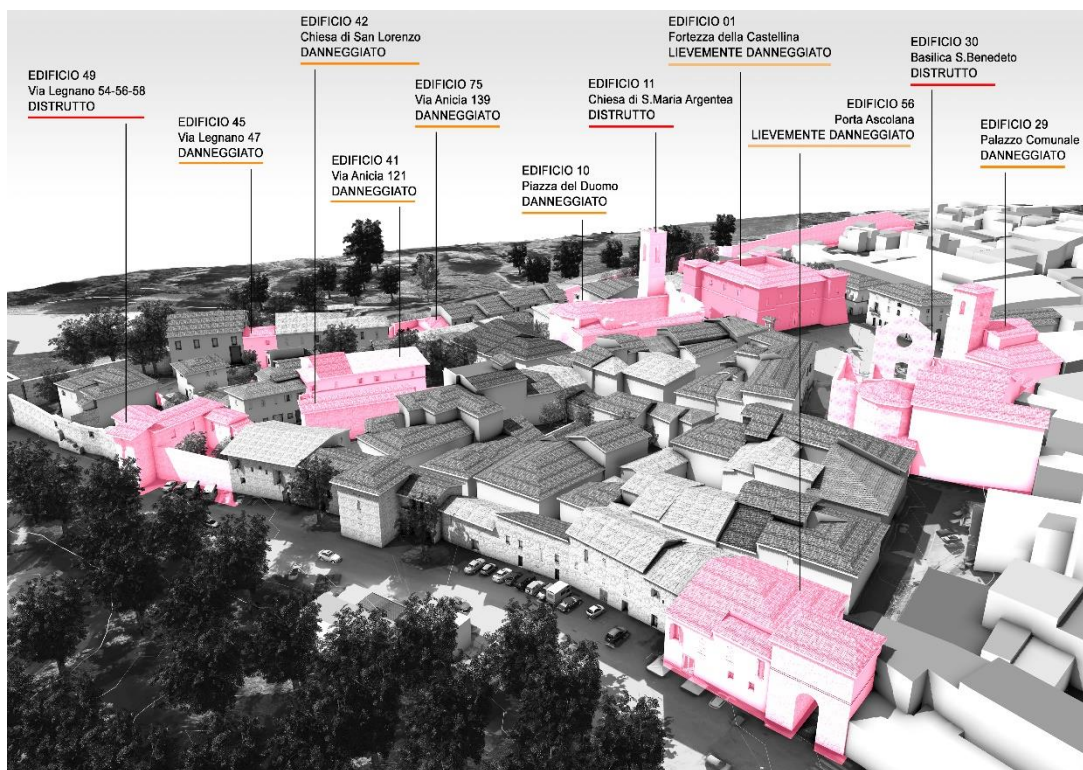


Figure 3: Localization, in the UrbanBIM model, of all buildings belonging to ZR that have suffered damage identified by UAV – Autodesk Infravorks 2018.