

sous la direction de  
LAMIA HADDA  
SAVERIO MECCA  
GIOVANNI PANCANI  
MASSIMO CARTA  
FABIO FRATINI  
STEFANO GALASSI  
DANIELA PITTALUGA

# Villages et quartiers à risque d'abandon

*Stratégies pour la connaissance,  
la valorisation et la restauration*

TOME 1

  
FIRENZE  
UNIVERSITY  
PRESS



La collection scientifique *ricerche | architettura, pianificazione, paesaggio, design* englobe la série Études Euro-Méditerranéenne

études  
euro-méditerranéennes  
éem

La série de publications scientifiques Études Euro-Méditerranéennes a le but de diffuser à l'échelle internationale les études et les recherches résultant de la coopération scientifique et culturelle entre le Maroc et l'Italie dans le cadre de la Déclaration conjointe du 6 Juillet 2016.

Chaque volume est soumis à une procédure d'acceptation et d'évaluation qualitative fondée sur l'examen par les pairs et confiée au Comité scientifique de Firenze University Press (FUP).

Toutes les publications, en anglais, français ou italien sont en libre accès sur le Web pour promouvoir non seulement leur diffusion mais aussi une évaluation ouverte à l'ensemble de la communauté scientifique internationale.

Le Département d'Architecture de l'Université de Florence promeut et soutient cette série pour apporter une contribution visant une meilleure connaissance théorico-critique et opérationnelle autour des thèmes de l'architecture et du projet qui nécessite continuellement la comparaison avec les différentes réalités qui peuvent ainsi croiser leurs connaissances.

Les essais naissent d'une réflexion sur le patrimoine méditerranéen et proposent des idées de recherche sur des études de cas particulières par le biais d'un apport conscient des différentes disciplines architectoniques. La dimension matérielle et technique est exprimée à travers une mise en relation entre des domaines de connaissance strictement interconnectés, ce qui permet de partager non seulement des méthodes et des approches conceptuelles, mais aussi des outils d'investigation et de représentation. Les publications ont pour objectif d'étudier le sens et la signification, la continuité et la diversité culturelle de l'espace dans le bassin méditerranéen.



ricerche | architettura, pianificazione, paesaggio, design

#### **Editor-in-Chief**

**Saverio Mecca** | University of Florence, Italy

#### **Scientific Board**

**Gianpiero Alfarano** | University of Florence, Italy; **Mario Bevilacqua** | University of Florence, Italy; **Daniela Bosia** | Politecnico di Torino, Italy; **Susanna Caccia Gherardini** | University of Florence, Italy; **Maria De Santis** | University of Florence, Italy; **Letizia Dipasquale** | University of Florence, Italy; **Giulio Giovannoni** | University of Florence, Italy; **Lamia Hadda** | University of Florence, Italy; **Anna Lambertini** | University of Florence, Italy; **Tomaso Monestiroli** | Politecnico di Milano, Italy; **Francesca Mugnai** | University of Florence, Italy; **Paola Puma** | University of Florence, Italy; **Ombretta Romice** | University of Strathclyde, United Kingdom; **Luisa Rovero** | University of Florence, Italy; **Marco Tanganelli** | University of Florence, Italy

#### **International Scientific Board**

**Nicola Braghieri** | EPFL - Swiss Federal Institute of Technology in Lausanne, Switzerland; **Lucina Caravaggi** | University of Rome La Sapienza, Italy; **Federico Cinquepalmi** | ISPRA, The Italian Institute for Environmental Protection and Research, Italy; **Margaret Crawford**, University of California Berkeley, United States; **Maria Grazia D'Amelio** | University of Rome Tor Vergata, Italy; **Francesco Saverio Fera** | University of Bologna, Italy; **Carlo Francini** | Comune di Firenze, Italy; **Sebastian Garcia Garrido** | University of Malaga, Spain; **Xiaoning Hua** | NanJing University, China; **Medina Lasansky** | Cornell University, United States; **Jesus Leache** | University of Zaragoza, Spain; **Heater Hyde Minor** | University of Notre Dame, France; **Danilo Palazzo** | University of Cincinnati, United States; **Pablo Rodríguez Navarro** | Universitat Politècnica de València, Spain; **Silvia Ross** | University College Cork, Ireland; **Monica Rossi** | Leipzig University of Applied Sciences, Germany; **Jolanta Sroczynska** | Cracow University of Technology, Poland

*sous la direction de*  
LAMIA HADDA  
SAVERIO MECCA  
GIOVANNI PANCANI  
MASSIMO CARTA  
FABIO FRATINI  
STEFANO GALASSI  
DANIELA PITTALUGA

## **Villages et quartiers à risque d'abandon**

*Stratégies pour la connaissance,  
la valorisation et la restauration*

TOME 1



UNIVERSITÀ  
DEGLI STUDI  
FIRENZE

**DIDA**  
DIPARTIMENTO DI  
ARCHITETTURA

Villages et quartiers à risque d'abandon : stratégies pour la connaissance, la valorisation et la restauration: tome 1 / sous la direction de Lamia Hadda, Saverio Mecca, Giovanni Pancani, Massimo Carta, Fabio Fratini, Stefano Galassi, Daniela Pittaluga. — Firenze : Firenze University Press, 2022.  
(Ricerche. Architettura, Pianificazione, Paesaggio, Design ; 15)

<https://www.fupress.com/isbn/9788855185370>

ISBN 978-88-5518-535-6 (Print)

ISBN 978-88-5518-537-0 (PDF)

ISBN 978-88-5518-538-7 (XML)

DOI 10.36253/978-88-5518-537-0

*in copertina*


Tunisie, village berbère de Zriba el-Alia (© L. Hadda)

*FUP Best Practice in Scholarly Publishing* (DOI [https://doi.org/10.36253/fup\\_best\\_practice](https://doi.org/10.36253/fup_best_practice))

All publications are submitted to an external refereeing process under the responsibility of the FUP Editorial Board and the Scientific Boards of the series. The works published are evaluated and approved by the Editorial Board of the publishing house, and must be compliant with the Peer review policy, the Open Access, Copyright and Licensing policy and the Publication Ethics and Complaint policy.

*Firenze University Press Editorial Board*

M. Garzaniti (Editor-in-Chief), M.E. Alberti, F. Vittorio Arrigoni, E. Castellani, F. Ciampi, D. D'Andrea, A. Dolfi, R. Ferrise, A. Lambertini, R. Lanfredini, D. Lippi, G. Mari, A. Mariani, P.M. Mariano, S. Marini, R. Minuti, P. Nanni, A. Orlandi, I. Palchetti, A. Perulli, G. Pratesi, S. Scaramuzzi, I. Stolzi.

 The online digital edition is published in Open Access on [www.fupress.com](http://www.fupress.com).

Content license: except where otherwise noted, the present work is released under Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International (CC BY-NC-SA 4.0: <https://creativecommons.org/licenses/by-nc-sa/4.0/legalcode>). This license allows you to share any part of the work by any means and format, modify it for any purpose, including commercial, as long as appropriate credit is given to the author, any changes made to the work are indicated and a URL link is provided to the license.

Metadata license: all the metadata are released under the Public Domain Dedication license (CC0 1.0 Universal: <https://creativecommons.org/publicdomain/zero/1.0/legalcode>).

© 2022 Author(s)

Published by Firenze University Press

Firenze University Press

Università degli Studi di Firenze

via Cittadella, 7, 50144 Firenze, Italy

[www.fupress.com](http://www.fupress.com)

*This book is printed on acid-free paper  
Printed in Italy*

*progetto grafico*

**didacommunicationlab**

Dipartimento di Architettura  
Università degli Studi di Firenze

Susanna Cerri  
Federica Aglietti

*Imprimé sur papier de cellulose  
pure Fedrigoni Arcoset*



---

## SOMMAIRE

---

### Préfaces

Giuseppe De Luca	16
Niccolò Casiddu	19
Costanza Milani	22
Mounsif Ibnoussina	23
Stefano Baccelli	25

### Présentation

La régénération des villages est un élément d'un projet de croissance durable et équitable	29
Saverio Mecca	

### Tome 1

#### Cultures pour la conservation et la valorisation du patrimoine à risque d'abandon en Italie

Dialogue around abandonment	37
Marco Abbo, Francesca Luisa Buccafurri	
Le musée diffuse: stratégie pour valoriser les villages à risque d'abandon. L'étude de cas de Pitigliano entre patrimoine matériel et immatériel	49
Laura Aiello	
The church of S. Giovanni Battista Decollato at Mensano (Siena): an assessment of the structural condition of the church and adjacent buildings	63
Alessandra Angeloni, Andrea Giannantoni, Michele Paradiso	
Recompose the minor places, the value of the dictionary logic of architecture	77
Enrico Bascherini	
Enhancement strategies for historic towns. A proposal for the village of San Giovanni Lipion	85
Anna Chiara Benedetti, Giorgia Predari, Riccardo Gulli, Felice Monaco	
The digital documentation of the mountain village of Rocca Ricciarda: between medieval and modern archeology	97
Matteo Bigongiari	

<b>Recovery and enhancement strategies for the villages of the Ligurian hinterland. The case study of the Fontanabuona valley</b> Roberto Bobbio, Paolo Rosasco	111
<b>Knowledge and strategies for conservation of historic technologies</b> Teresa M. Campisi	123
<b>Explorer les villes abandonnées, préserver la mémoire des lieux: le cas d'étude de Santa Margherita dans la vallée du Belice en Sicile</b> Alessio Cardaci, Antonella Versaci, Luca Renato Fauzia, Michele Russo	137
<b>Paysage sans paysans: lectures de projet</b> Claudia Cavallo, Caterina Lisini	153
<b>Mountainous abandoned areas and territorial fragilities. Cultural preservation, reuse, improvement strategies</b> Valentina Cinieri, Alisia Tognon	169
<b>The permanence of form. A methodological proposal for the re-signification of depopulated small towns of Sardinia</b> Giovanni Battista Cocco, Ester Cois, Caterina Giannattasio, Andrea Pinna, Valentina Pintus	179
<b>Landscape and cultural identity - some cases of western Liguria</b> Lorenza Comino, Simona G. Lanza,	193
<b>Réflexions sur les tremblements de terre, abandons et identité à travers quelques études de cas en Irpinia</b> Giovanni Coppola	209
<b>Traditional masonry buildings on the Tuscan Apennine Mountains. The abandoned villages around Firenzuola</b> Michele Coppola, Letizia Dipasquale	229
<b>The safeguard of built heritage in archeological sites, an interdisciplinary approach based on light-weight uav photogrammetry and terrestrial laser scanning survey.</b> Carlo Costantino, Angelo Massafra, Davide Prati, Simone Garagnani, Giovanni Mochi	242
<b>Slow mobility as a connection driver for fragile territories between coastline and inner areas</b> Domenico D'uva, Chiara Ravagnan, Chiara Amato, Giulia Bevilacqua	259
<b>An innovative analysis tool for the small towns' valorization: the Riccia municipality's case study</b> Pierfrancesco Fiore, Emanuela D'andria	273



<b>Montecastelli Pisano and Cerbaiola: virtuous surviving examples of two small old villages.</b> Fabio Fratini, Oana Adriana Cuzman, Silvia Rescio	287
<b>A modern architecture in the historical building of Uglianfredo</b> Pierpaolo Frediani	301
<b>Les processus d'abandon et de resignification des lieux après le tremblement de terre: deux études de cas siciliennes en comparaison</b> Nadia Frullo	311
<b>L'abandon des villages en Italie, depuis les années '50 et '60 à travers des cas en Ligurie.</b> Caterina Gardella, Silvana Vernazza	325
<b>The S. Appiano Pieve in Barberino Val d'Elsa (Tuscany, Italy): restoration and enhancement for a sustainable reuse</b> Sara Garuglieri, Valentina Puglisi	333
<b>Villas, bâtiments ruraux et architectures militaires entre abandon et récupération: l'habitat historique rural dispersé de l'île Palmaria (La Spezia - Italie)</b> Carlo A. Gemignani, Luisa Rossi	345
<b>Holistic Approach to the Mediterranean Architectural Heritage at risk of abandonment: the case study of Montalbano Elicona (Italy)</b> Maria Luisa Germana'	359
<b>Autour des villages historiques abandonnés: valorisation, mise en réseau des ressources et stratégies communes de gestion du paysage</b> Adriana Ghersi	375
<b>Back to the small villages. Critical issues and prospects for a post-Covid re-appropriation of built heritage in the marginal internal areas in Lombardy</b> Mariacristina Giambruno, Sonia Pistidda	389
<b>A Methodology for the Seismic Risk Assessment of Pompei's Archaeological Site</b> Nicola Ruggieri, Stefano Galassi, Eloisa Fazzi, Giacomo Tempesta	403

## **Tome 2**

### **Cultures pour la conservation et la valorisation du patrimoine à risque d'abandon en Italie**

<b>Agri-industrial dynamics and Settlement heritage at risk. The case of the Albenga sub-region Giampiero Lombardini</b>	<b>17</b>
<b>The “Canto di Stampace” – a case study for the requalification and urban reconnection of the City of Pisa through the ancient defensive structures Laura Marchionne, Elisa Parrini</b>	<b>33</b>
<b>Modern and industrial: the new abandonment. The case of the canavese area Rossella Maspoli</b>	<b>47</b>
<b>New proximity tourism opportunities. Hydroelectric heritage: a new alliance between owners and tourist/citizens Manuela Mattone, Elena Vigliocco</b>	<b>65</b>
<b>Revitalization Strategies between Culture and Social Marginalisation. The Case of the Historic Centre of Cosenza Annunziata Maria Oteri, Nino Sulfaro</b>	<b>79</b>
<b>Quota: a mountain village’s struggle for survival Giovanni Pancani</b>	<b>91</b>
<b>The village of Strumi near Poppi, searching the remains of the ancient Abbey of San Fedele in Strumi Giovanni Pancani, Giacomo Talozzi</b>	<b>125</b>
<b>Castel Focognano, survey and documentation of a central Apennine borough which has fallen from the provincial capital to a pe- ripheral hamlet, now at risk of abandonment Giovanni Pancani, Gianfilippo Valentini</b>	<b>139</b>
<b>Multilevel analysis for the protection of the architectural heritage of small villages Barbara Paoletti, Marco Tanganelli</b>	<b>153</b>
<b>Territorial Capital: a source for the revival in inner areas Angela Parisi</b>	<b>165</b>
<b>Permanence in absence. Preservation of historic and environmental heritage of Val Cervo (Piedmont, Italy). Gianfranco Pertot</b>	<b>177</b>

<b>Vulnerability of historical centers: the case of Camerino (Marche Region)</b>	189
Enrica Petrucci, Lucia Barchetta, Diana Lapucci	
<b>Beyond the earthquake: Knowledge for restoration.</b>	205
<b>The case-study of Cornillo Vecchio (Amatrice, Italy)</b>	
Renata Picone, Luigi Veronese, Mariarosaria Villani	
<b>Traces of history in the semi-abandoned villages</b>	219
<b>hit by the earthquake: elements for a conscious restoration</b>	
Daniela Pittaluga	
<b>Knowledge methods for the protection</b>	233
<b>of minor historical centres affected by earthquakes</b>	
Giorgia Predari, Cristiana Bartolomei, Cecilia Mazzoli, Caterina Morganti, Giovanni Mochi	
<b>The identity survey for the sustainable enhancement</b>	247
<b>of the historical contexts, small towns, and villages.</b>	
Paola Puma	
<b>Garfagnana, a project for the rebirth</b>	265
Marco Ricciarini, Adelaide Tremori	
<b>Community engagement for the enhancement of rural heritage systems:</b>	277
<b>Pantelleria as case study</b>	
Marco Rossitti, Francesca Vigotti	
<b>La communauté patrimoniale vaudoise,</b>	293
<b>entre phénomènes de vivacité culturelle et dépeuplement</b>	
Riccardo Rudiero	
<b>Territoires en déclin: changements démographiques</b>	309
<b>et crise des villages et des villes moyennes dans l'intérieur de la Sicile</b>	
Deborah Sanzaro	
<b>Return to the Inner Area sin the post covid:</b>	325
<b>rehabilitate the wide spread building between challenges and potential conflicts</b>	
Benedetta Silva	
<b>Wounded places: from devastation to warning</b>	339
Simona Talenti, Annarita Teodosio	
<b>The Village of Monterano: Identity Features and Restoration</b>	353
Barbara Tetti	
<b>Planning and managing the heritage-led regeneration of inner areas.</b>	365
<b>The sextantio experience in santo stefano di sessanio</b>	
Andrea Ugolini, Chiara Mariotti	

- The Castle of Sant'Apollinare in Marsciano (PG), 381  
survey, documentation and proposal to enhance the culture of the olive tree in a medieval village at risk of abandonment after seismic events  
Gianfilippo Valentini
- Fragilities and resources of depopulated mountain villages: 393  
consequences of reactivation initiatives on the architectural heritage. The case of northern Belluno province  
Caterina Valiante
- Archipelago Campania. 407  
Abandoned villages and conservation strategies for needs of post-pandemia tourism  
Elena Vitagliano

**Tome 3****Cultures pour la conservation et la valorisation du patrimoine à risque d'abandon en Europe**

<b>Resilient techniques and methods to support a resilient lifecycle of villages and neighborhoods</b> Fabrizio Ivan Apollonio, Marco Gaiani, Simona Tondelli	17
<b>Abandoned villages in the area of Granada. The forgotten heritage of Tablate</b> Antonio Benavides López, Emma Verdelli, Giorgio Verdiani	35
<b>Beyond the no name house. New studies: Utrera</b> Vidal Gomez Martinez, Blanca Del Espino Hidalgo, María Teresa Perez Cano	47
<b>Toward sustainable regeneration of historic endangered towns: strategies for increasing resilience</b> Silvia Fineschi, Domenico Debeneditis, Laura Burzagli, Miguel Reimão Costa, Christian Degriigny, Silvia Rescic, Maria Dolores Robador, Cristiano Riminesi	61
<b>Reuse as a model for the preservation of rural architecture</b> Saša Mihajlov, Marina Pavlovic', Andjelija Milasinovic'	73
<b>Traditional spanish architecture “on the edge”: an analysis of benchmarks related to conservation policies</b> Camilla Mileto, Fernando Vegas, Valentina Cristini, Lidia Garcia	83
<b>New tourism models as a mechanism for the conservation of cultural heritage: the case of Cádiz</b> Pilar Miguel-Sin Monge, Gema Ramírez Pacheco	91
<b>Dhoksat, architecture through centuries</b> Elisa Miho, Joana Lamaj	103
<b>Towards a multidisciplinary approach for conservation of cultural settlements in Albania</b> Joli Mitrojorgji	117
<b>A ‘filter building in the Cabanyal Quarter on Valencia</b> Giulia Pettoello	133
<b>Effects of abandonment in the city of Pula after Italian exodus</b> Sara Rocco	145

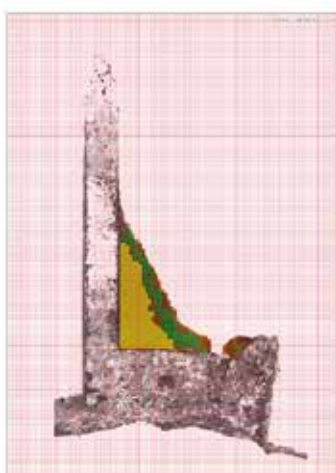
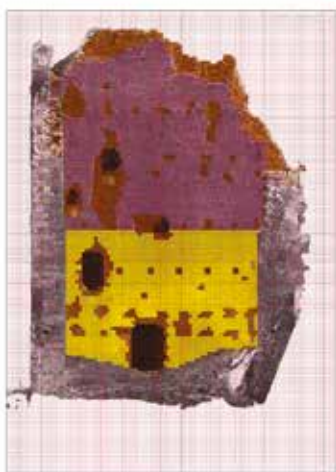
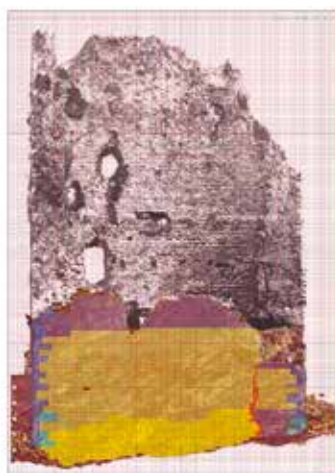
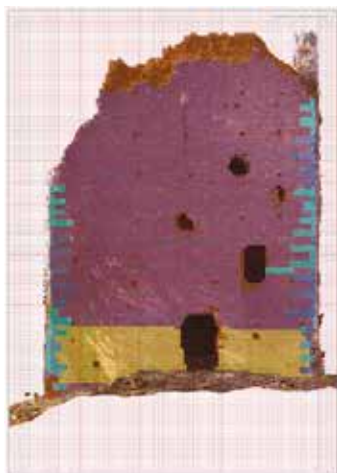
## **Cultures pour la conservation et la valorisation du patrimoine à risque d'abandon en Maghreb et Moyen-Orient**

<b>Vernacular architecture of the Souf region (Algeria): urban morphology, architectural features and constructive technique</b> Cheima Azil, Luisa Rovero, Boualem Djebri, Fabio Fratini, Giulia Misseri, Ugo Tonietti	159
<b>A la mémoire de Sainte Crispina; Etude de la basilique paléochrétienne de Theveste</b> Fatima-Zahra Boughanem, Etienne Wolff	171
<b>L'architecture traditionnelle des villages perchés du centre-nord tunisien: le cas de Zriba el-Alia</b> Lamia Hadda	183
<b>Chellah, splendeur et déclin d'une ville mérinide</b> Lamia Hadda	199
<b>With the key on the heart, between the pain of loss and future hope</b> Osama Hamdan, Carla Benelli, Luigi Marino	213
<b>Abandon de Ksour Sahariens entre indifférence et désintéressement</b> Fatma-Zohra Haridi, Ali Boulemaredj, Ala Eddine Laouier, Amira Ouled-Diaf, Amel Saifi	229
<b>L'abandon progressif des héritiers des habitations des quartiers d'origine coloniale. Cas de la cité tlijjene (ex cité Levy) setif</b> Amina Haouche	241
<b>Quelles stratégies pour la conservation et la mise en valeur des ksours du Sud-est de la Tunisie: cas de Béni-Khédache</b> Faiza Matri	255
<b>Réinvestir le patrimoine abandonné pour faire face à l'urgence du COVID 19: cas du village AZRO (Haut Atlas de Marrakech, Maroc)</b> Karima Mazirh, Mounsif Ibnoussina, Rachida Kasimi, Omar Witam, Mohamed Nocairi, Oksana Rybak-Turchanina	271
<b>Tourism Marketing in the Mediterranean Arab Countries: A Strategy to Restore Internal Regions at Risk of Abandonment</b> Wassila Ouaar	285
<b>On the edge of nothingness. Types and forms of Berber villages from the High Atlas to the Sahara</b> Alberto Pireddu	297

L'activité de restauration de Piero Sanpaolesi au Moyen-Orient, quelques exemples pour mieux comprendre et protéger l'architecture méditerranéenne Francesco Pisani	315
Les conflits religieux et sociaux comme cause de la transformation et de l'abandon récent de certains établissements byzantins en Asie Mineure Emanuele Romeo	331
Le rôle des vulnérabilités sociales et physiques dans la construction de la catastrophe sismique de 2003 à Boumerdes (Algérie) Farida Sehili	345
La cité minière de Djerissa, un patrimoine industriel en abandon Sana smadah	363
De l'abandon à la valorisation: Le noyau historique de Testour entre dynamique et dysfonctionnement Hazar Souissi Ben Hamad	377
A modern neighborhood for prosperity. The case of the International and Permanent Fair of Lebanon in Tripoli by Oscar Nie- meyer Joe Zaatar	389
L'architecture des villages ruraux en Arménie centrale: relevés et interventions pour une stratégie de développement durable Marta Zerbini	399







**LEGENDA**

- M1 - Resin
- M2 - Resin with particles present in suspension
- M3 - Particulate with particles suspended in resin matrix
- M4 - Resin with particles embedded in a matrix of mineral fibers and/or fibers, fibers and/or particles embedded in a matrix
- M5 - Resin with a M1, M2, M3 or M4 matrix and particles suspended in resin matrix
- M6 - Resin with a M1, M2, M3 or M4 matrix and particles embedded in a matrix
- M7 - Resin with a M1, M2, M3 or M4 matrix and particles embedded in a matrix
- M8 - Resin with a M1, M2, M3 or M4 matrix and particles embedded in a matrix
- M9 - Resin with a M1, M2, M3 or M4 matrix and particles embedded in a matrix
- M10 - Resin with a M1, M2, M3 or M4 matrix and particles embedded in a matrix
- M11 - Resin with a M1, M2, M3 or M4 matrix and particles embedded in a matrix
- M12 - Resin with a M1, M2, M3 or M4 matrix and particles embedded in a matrix
- M13 - Resin with a M1, M2, M3 or M4 matrix and particles embedded in a matrix
- M14 - Resin with a M1, M2, M3 or M4 matrix and particles embedded in a matrix
- M15 - Resin with a M1, M2, M3 or M4 matrix and particles embedded in a matrix
- M16 - Resin with a M1, M2, M3 or M4 matrix and particles embedded in a matrix
- M17 - Resin with a M1, M2, M3 or M4 matrix and particles embedded in a matrix
- M18 - Resin with a M1, M2, M3 or M4 matrix and particles embedded in a matrix
- M19 - Resin with a M1, M2, M3 or M4 matrix and particles embedded in a matrix
- M20 - Resin with a M1, M2, M3 or M4 matrix and particles embedded in a matrix

---

# THE SAFEGUARD OF BUILT HERITAGE IN ARCHEOLOGICAL SITES, AN INTERDISCIPLINARY APPROACH BASED ON LIGHT-WEIGHT UAV PHOTOGRAMMETRY AND TERRESTRIAL LASER SCANNING SURVEY: THE CASE STUDY OF MONTE LUCIO

---



Carlo Costantino, Angelo Massafra, Davide Prati, Simone Garagnani, Giovanni Mochi

Università degli studi di Bologna-Italia

Elevations-characterization analysis of "Monte Lucio" tower, from top left: east elevation; north elevation; west elevation; south elevation; internal east elevation; north internal elevation; internal west elevation; internal south elevation - (Graphic Elaboration, 2018 © Paolo Faccioli).

This paper introduces a well-defined working pipeline oriented to a multidisciplinary approach to analyze the structural behaviors of the Archeological Heritage through complementary and integrated studies. The geometrical and deterioration data pertaining to a medieval tower in "Monte Lucio" (Reggio Emilia, Italy) were joined in an accurate 3D model to be used for structural analysis, starting from the complementary use of a terrestrial laser scanning (TLS) with UAV air photogrammetry. Meanwhile, an interdisciplinary collaboration between different professional figures such as archeologists and chemists was established to get information relating to masonry stratigraphy and mortar typology. This allowed the material characterization fine-setting for parameters then embedded into structural models, usually the most complex operation in historical buildings. This led to classify the different brick typologies and the elevations' characteristics in a 10x10 cm pixel matrix, identifying each slice uniquely by using different colors. The matrix was then imported in MATLAB, assigning coordinates and mechanical characteristics to each pixel, according to material typology. Finally, the model was imported in Abaqus Unified Fea to perform "Pushover analysis" and to calculate the distribution of horizontal forces to evaluate possible prevention measures to be taken. In conclusion, through the adoption of different combined digital survey technologies and multidisciplinary data sharing, the proposed workflow proved to be efficient in the case study presented.

**Keywords:** Cultural Heritage, Terrestrial Laser Scanning, UAV, Aerial Photogrammetry, Archaeological Site

## Introduction

### State of the art

Restoration of Cultural Heritage is a complex theme, especially when it affects archeological ruins. It requires close collaboration among various professional figures in order to get a complete and reality-based cognitive framework about the examined objects and to develop analysis models that respond to the actual building's behavior (Dall'Asta et al., 2018). Historical masonry ruins are challenging because of many factors: only a few fragmented and disconnected structural elements often remain, geometries of buildings are usually irregular, a careful historical analysis is essential to determine construction phases and related vulnerabilities, mechanical properties of deteriorated materials are not known, and in-depth studies



**The tower of "Monte Lucio" ground and aerial pictures.**  
- (Photos, 2018 © Davide Prati and Simone Garagnani).

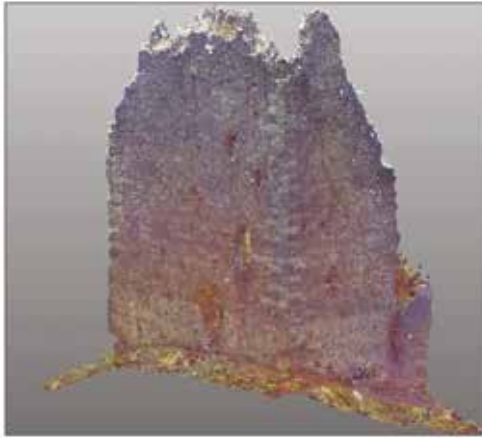


**Comparison between the two point clouds: realized in Faro Scene from data acquired by the terrestrial laser scanner, (on the left); Created in Agisoft Metashape using the acquired aerial images (on the right)**  
- (Graphic Elaboration, 2018 © Paolo Faccioli).

are necessary to estimate them. Due to these reasons, an accurate but simple analysis is essential to understand all the possible variations and uncertainties of the parameters that describe the problem (Lourenço and Roque, 2006).

There are numerous studies in the field of vulnerability analysis of historical buildings that use innovative tools, software, and procedures (Yekrangnia and Mobarake, 2015; Valluzzi, 2006; Lourenço and Roque, 2006; Betti and Vignoli 2011; Galassi et al., 2019), but in most of them, the building is interpreted as a unique case that needs a specific interdisciplinary study.

The progressive development and dissemination of digital survey techniques permitted to know in-depth historical buildings identifying anomalies, organization, and state of deterioration of their elements, providing very accurate data and obtaining results that correspond as much as possible to the effective structural behavior (Fregonese et al., 2013; Prati et al., 2019). The use of photogrammetry and terrestrial laser scanning has been extensively investigated over the years (Koch et al., 1998; Bucksch et al. 2007; Pfeifer et al., 2007; etc.). Recently, the spread of UAVs (Unmanned Aerial Vehicles) proved to be effective in the field of photogrammetry (Murtiyoso et al., 2017), so several studies explored the potentialities of its complementary use with a terrestrial laser scanner (Pueschel et al., 2008).



Historical investigations and tests on materials are also fundamental to gain a detailed knowledge of archeological sites. Investigations allow reconstructing the evolution of the building phases to make qualitative hypotheses on the organization of materials in stratigraphies while tests give quantitative information about the mechanical properties of materials, which can be integrated with geological analyses.

### **The Case Study: The Tower of “Monte Lucio”**

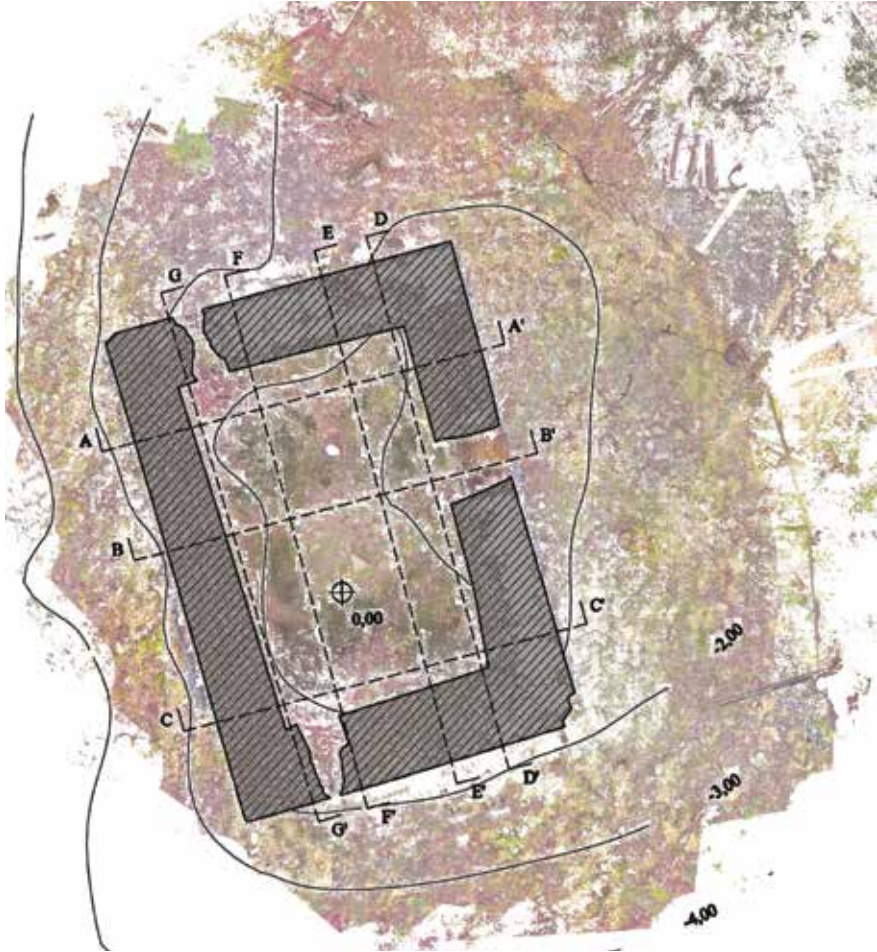
The case study presented in this work consists of a medieval tower located on the top of “Monte Lucio”, one of the four hills between the Po Valley and the Apennines, south of Quattro Castella in the province of Reggio Emilia, Italy. Thanks to their strategic position, these hills are characterized by a significant amount of medieval buildings, such as rural houses, towers, villages, and fortifications, many of which are in a state of ruin.

The scarce archival sources on “Monte Lucio” mention a first village over the hill, probably devoted to military function, around the end of the 13th century (Salimbene, 1882; Bandieri, 2017). The original construction of the tower might be dated back to that period and it was probably inspired by the castle or of the medieval tower-house, a typological multi-level dwelling that was commonly used to control the area since the 12th century militarily (Fabbri F., 1960). In the following centuries, different owners followed one another to manage the fortress of “Monte Lucio”, changing its role from a military outpost to an agricultural center, until it was restored in 1497. However, it seems that the site fell into disuse between the 15th and the 16th century, slowly reaching the current state of ruin (Bandieri, 2013). Since 2011, an archeological two years long excavation project has been carried on to





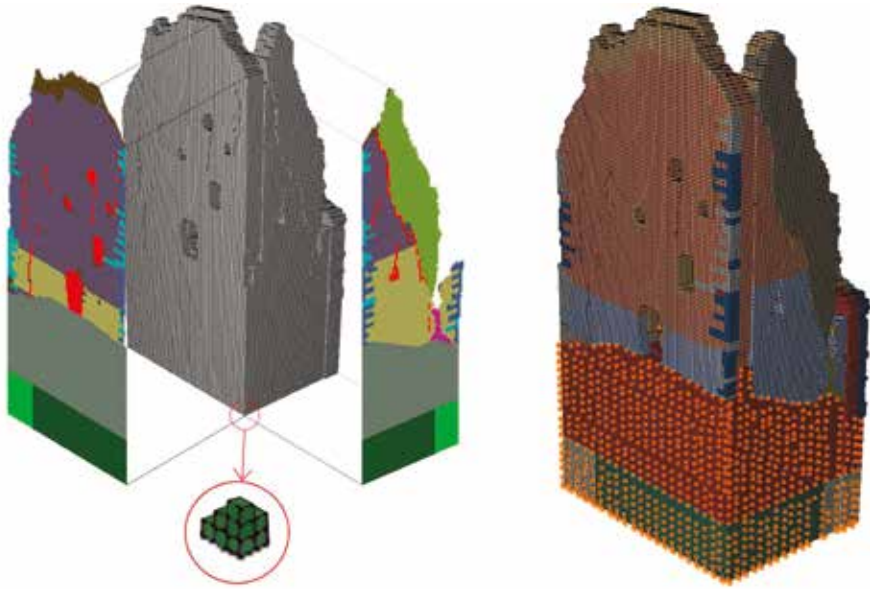
**The tower of "Monte Lucio" ground and aerial pictures.**  
- (Photos, 2018  
© Davide Prati and Simone Garagnani).



**Creation of the Matlab model starting from the elevations-characterization analysis (on the left) Finite element model in which the different materials and the ground and foundation bonds are applied (on the right) - (Graphic Elaboration, 2018 © Paolo Faccioli).**

provide important information about the historical site, encouraging different research activities (Augenti et al., 2012).

The tower is located on the highest point of the area, about 309 meters above the sea level, in a predominant position over the other ruined buildings. It has quite a small rectangular plan, about 5.8 x 8.6 meters, and a maximum height of about 13 meters. Nevertheless, the original construction was likely 16 meters high (Ballardini, 2016). The building is currently in critical condition: large portions of masonry from all four facades, the roof, and the internal floors fell to the ground. In addition, an evident material



detachment is shown on the north and south facades, walls display a series of vertical cracks, and one of them is strongly inclined towards the outside. Most of these problems are caused by the position near the hill slopes, where the ground is gradually collapsing down to the valley.

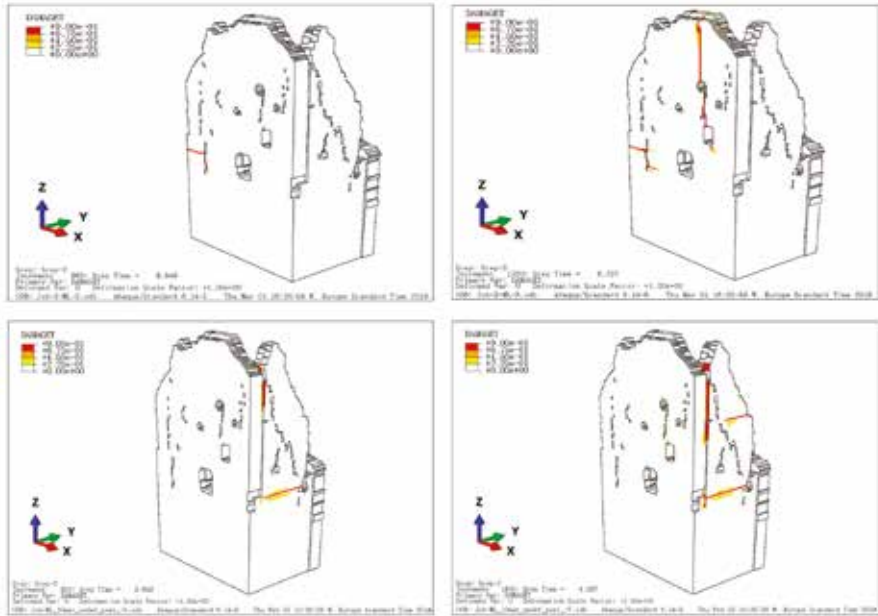
### **The Equipment: Terrestrial phase-shift laser Scanning and UAV air photogrammetry**

The difficulties in accessing the tower by land have led to the complementary use of terrestrial laser scanner with UAV air photogrammetry:

A “Faro Cam2 Focus 3D 150” laser scanner was used for the terrestrial survey. The contained size (24 cm x 20 cm x 10 cm) and the outstanding portability of this tool (5 hours of autonomy and 5 kg of weight) allowed surveying the tower quickly, despite the difficulty of operating in this area. The instrument offers accurate geometric data (linear distance error of  $\pm 2$  mm for a measure among object and scanner in a range between 10 m and 25) with the possibility of obtaining the detailed coloring of the point cloud.

A DJI Phantom 4 was used to carry out the aerial photogrammetry. This is a small drone (29,0 x 29,0 x 18,0 cm), 1380g in weight (battery and propellers included) with a maximum load of 300g, enough to fit a GoPro Hero 5 action camera with digital gimbal stabilization. Although this camera is characterized by an ultrawide field of view (FOV) considered in lens

**Pushover analysis in Abaqus Unified Fea: upper, the analysis carried out in the x-direction; below, the analysis carried out in the y-direction**  
 - (Graphic Elaboration, 2018 © Paolo Faccioli).



calibration, the 4K highest resolution ensured an ideal outcome by overlapping the pictures of at least 50%, with a proper resolution for photogrammetric purposes.

### The workflow

This study illustrates an interdisciplinary workflow for vulnerability and safety analysis of ruins in archaeological sites, based on the collaboration between different figure to obtain the following complementary studies:

The Survey of the Ruins (Planning, acquisition, modeling);

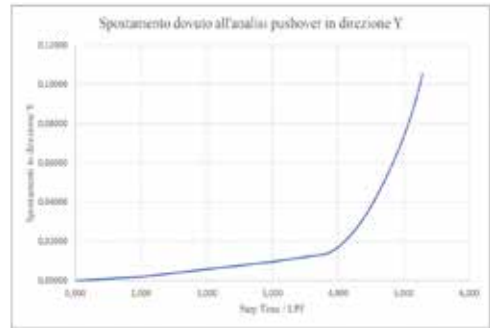
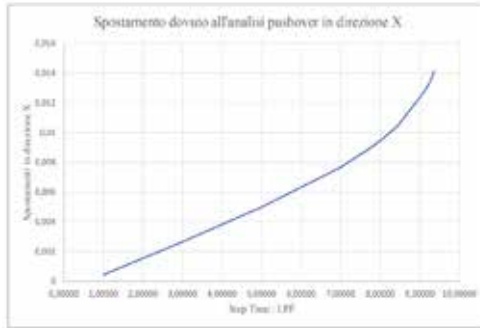
Archeological Study, Historical Investigation and Material Analysis;

Structural Modelling and Analysis.

### The Data Collection: The Ruin Survey

The main obstacles to survey operations were the remote location of the hilltop and the presence of invasive shrubs. Consequently, the survey was carried out at the end of autumn to minimize the vegetation interference.

The complementary use of terrestrial phase-shift laser scanning with UAV air photogrammetry has permitted to obtain a highly detailed 3D model: the terrestrial laser scanner, at



a close distance from the tower, offers extremely accurate geometrical data of the basement, becoming less accurate on the upper parts; on the opposite, the UAV air photogrammetry provides highly defined 3D model of the top of the tower. In order to minimize accuracy gaps in point clouds authored with different techniques, some ground control points were measured to evaluate their mutual distances and to set their coordinates for the aerial photogrammetric survey. Thus, alignment and registration of the upper point clouds and the lower ones were successful, with a satisfactory RMS value for each aligned scan.

This survey approach has allowed a deep understanding of the construction concerning wall thickness and masonry stratigraphy. It has also highlighted the anomalies and irregularities in element laying and allowed locating openings as well as possible. The final data merging of both the point clouds in a 3D model has been employed to produce the façade elevations as the structural analysis starting point.

### The Archeological Study, Historical Investigation, and Material Analysis

The stratigraphical analysis of “*Monte Lucio*” was key to recreate the original aspect of the building. Probably the tower contained three wooden ceilings, and its height allowed the visual contact with the surrounding settlements of “*Monte Zane*” and “*Bianello*”. The walls, which taper towards, are characterized by the presence of numerous putlog holes, placed at approximately one meter between one row and the other. The current access of the tower is not the original one that probably was located in the south or west wall of the building at a higher place through a drawbridge.

Two main masonry typologies are present in the tower of “*Monte Lucio*”. The first, most common, is contemporary to the settlement on the hill, according to literature sources, during the 13th century. The brickwork consists of local sandstone cobblestone, not manufactured or only splitting, laid on horizontal mortar beds of variable size. The corner quoins,





The current wall condition of the tower of "Monte Lucio" – (Pictures, 2018 © Davide Prati & Simone Garagnani).

instead, are made up of sizeable squared sandstone elements hewn by expert stonemasons. The core of rubble masonry is characterized using similar sandstone in regular courses, unlinked to the outer shell. In the south wall, affected by notable collapses in the 14th century, the second masonry typology is present, made up of waste material from the previous collapse alternated with new bricks, arranged chaotically (Augenti, 2012).

Following the stratigraphic analysis, five mortar samples were collected. These samples were taken to carry out the chemical and petrographic analysis from the corresponding different stratigraphic units of the tower. The samples collected from the north wall, reveal an unusual feature in medieval times, the use of hydraulic lime mortar, obtained from the calcination of local limestone with high clay percentage. The mortar samples taken from the south wall, in which the second masonry typology of the 14th century is present. The courses are bounded with aerial lime-based mortar of medium-low quality, produced with local raw materials and traditional methods. The third mortar typology has been identified as a modern product of the industrial age between the XIX and the XX century, consisting mainly of a mixture of lime and cement, probably used to fill the collapse of some sandstone elements (Bandieri, 2016).

### **Structural Modelling and Analysis**

The external and internal elevations of the tower were produced from the 3D TLS survey. The masonry was divided within a 10 x 10 cm grid, based on the different brickwork, on the typology of elements, and to the state of conservation, using different colors. Therefore, the masonry parts, preserved in the best possible way with limestone elements and the abundant presence of hydraulic mortar, were diversified from the wall portions in which the mortar is less used. Afterward, the squared sandstone quoins bounded as orthogonal devices with heading and stretching stones. were diversified from those significantly damaged and less resistant. Then, the portions present in the north and south facades were detected, where fallen materials filled the large cracks caused by the beginning of the west wall overturning.

Another color was linked with the masonry portion of the north facade rebuilt after the collapse, characterized by a mixed composition of recovery-collapsed materials and bricks, bounded by a not particularly resistant mortar. Finally, the significant cracks, the partial collapses, and the missing stone elements were detected along with the presence of putlog holes and the masonry invaded by vegetation.

The matrix was further simplified to use the elevations in structural software, removing the background photo of the tower and approximating the Intermediate situations to worse conditions. Accordingly, using MATLAB, the elevation images were transformed in a matrix, in



↑  
**Design of the new steel truss tower. Section view** (on the left); **Top view** (on the right) – (Graphic Elaboration, 2018 © Paolo Faccioli).

which each element of 10cm x 10cm side was reduced to a point with geometric coordinates and mechanical characteristics corresponding to the type of material to which it refers. Each elevation was then inserted in a three-dimensional space, obtaining the walls thicknesses by reproducing the images in succession along the z-axis, till reaching the opposite façade. The software automatically creates the model in CAE (Computer-Aided Engineering) format so that it can be used in Abaqus Unified FEA (Finite Element Analysis) in order to carry out the structural analysis.

Afterward, the ground and foundation bonds are applied in the finite element model along with the loads to carry out the analysis: a linear analysis, both static and dynamic, was performed to observe the building response to seismic actions and to verify the model and data correctness. Subsequently, the non-linear static analysis was carried out applying an inverse triangular profile load, first in the X direction than in the Y direction, increasing the horizontal acceleration from 0 to 10 m/s<sup>2</sup>, a very high value in order to provide an amplified view of structural behavior.

By confirming the hypothesis on the building structure, the analysis has highlighted the north and east walls possible overturning risk toward the outside of the tower, suggested

by the crack formation along the weakest portions of masonry (already damaged portions or near the openings). The presence of overturning mechanisms has been further confirmed using the linear kinematic analysis in accordance with Italian law in the field of structural safety (Norme Tecniche delle Costruzioni, 2018), which demonstrated the need to insert tie rods in a hypothetical restoration project in order to guarantee seismic safety.

### **The enhancement and renovation project proposal**

The presented analysis shows that the tower's most significant problem consists of the possible overturning of the north and east walls toward the outside of the building. Moreover, the timber ceilings are completely missing inside the fortress, and masonry walls are, in general, not attached to the other ones. Another critical issue is the degradation on top of the walls, where some stones could involve dangerous situations in case of strong wind or seismic events.

In order to limit the danger caused by the top-stones possible collapsing, the protection on top of the walls should be realized by using a thin layer of fiber-reinforced mortar, reinforced with a fine stainless-steel net, to give tensile strength and to improve the connection between the walls at the top.

The construction of a stainless-steel truss-tower inside the historic building is considered to solve the wall overturning (Jurina, 1996). The new structure, with a square base of side 3.5 meters and a maximum height of 10.5 meters, contributes to stability transferring the loads that were previously supported only by the historic building. A 1-meter gap is left between the two structures, the masonry one and the steel one, to insert four bond-beams and connect them to the towers. These elements improve the joining between the walls, their collaboration, and the entire building's structural behavior in case of seismic loads. The bond-beams are connected to the masonry through many anchor plates placed 10-15 centimeters inside the putlog holes, so that the anchor plates of the tie rods are not visible on the external facades (Jurina, 1996). The rigid tie rods connecting the two structures absorb the horizontal actions both in the external and internal direction of the building. The anchor's insertion in the masonry involves the hydraulic mortar injection, with a composition similar to the original one, which also improves the overall masonry strength.

Inside the steel structure, the realization of a metallic staircase allows reaching all three different floors that would be used both for studies and maintenance interventions. The stair furthermore offers the possibility to the public to visit the historical tower and enjoy a panoramic view of the surrounding area. Thanks to the use of steel elements, the whole intervention is almost entirely reversible and modifiable.



## Conclusions

This paper illustrated an integrated multidisciplinary approach to analyze the structural behaviors of the Archeological Heritage, involving engineers, architects, archaeologists, historians, and chemists with the aim to achieve a full knowledge of the studied ruin through complementary studies concerning of geometrical shapes, building evolution, masonry and stone stratigraphy, characterization of the materials properties.

The proposed methodology was applied to a complex case study that required an exhaustive research; the medieval tower located in the archaeological site of “*Monte Lucio*”. The complementary use of terrestrial phase-shift laser scanning with UAV air photogrammetry allowed to obtain accurate dimensional data, including the detailed information on the inaccessible tower top; An exhaustive stratigraphic analysis was carried out through laboratory tests on the mortar that made it possible to date the different construction phases of the tower and to obtain the characterization of the properties of the materials. All this information was transformed in MATLAB and was used in *Abaqus Unified Fea* to perform structural analysis in order to evaluate possible intervention strategies to be taken in the enhancement and renovation project proposal.

In conclusion, the exposed approach introduces a well-defined working pipeline oriented to a tight collaboration between different disciplines to produce digital models to perform in-depth vulnerability analysis of ruins. The relative cheapness of equipment and the reduced time spent in surveys and elaborations guaranteed by the use of well-integrated software suggest that the presented multidisciplinary approach represents an efficient approach in damage prevention for archaeological sites and enhancement strategies.

## Acknowledgments

The authors are grateful to Paolo Faccioli for his work and his renovation project proposal on the tower of “*Monte Lucio*” produced during his Master thesis, and to Professor Giovanni Castellazzi for his support during the structural analysis.

## Bibliography

- Augenti A., Fiorini A., Galetti P., Mancassola N., Musina G., 2012. *Scavo di Monte Lucio, Quattro Castella (RE)*, in VI Congresso Nazionale di Archeologia Medievale, Firenze, 2012, pp. 233-237.
- Dall'Asta A., Leoni G., Meschini A., Petrucci E., Zona A., 2018. *Integrated approach for seismic vulnerability analysis of historic massive defensive structures*. Journal of Cultural Heritage 35 (2019) 86–98. <https://doi.org/10.1016/j.culher.2018.07.004>.
- Ballardini D., 2016. *Ipotesi ricostruttiva delle principali fasi edilizie del castello di Monte Lucio. Un contributo delle discipline tecniche alla ricerca archeologica ed alla valorizzazione dei beni culturali*. Master's Thesis, University of Bologna, Bologna, Italy.
- Bandieri C., 2013. *La chiesa del castello di Monte Lucio (Quattro Castella, RE). Analisi dei materiali e delle tecniche costruttive*. Degree Thesis, University of Bologna, Bologna, Italy.
- Bandieri C., 2017. *Produrre malte in Appennino Reggiano (XII-XIV). Storia e archeometria delle tecniche del costruire in tre casi di studio*. Master's Thesis, University of Bologna, Bologna, Italy.
- Betti M. and Vignoli A., 2011. *Numerical assessment of the static and seismic behaviour of the basilica of Santa Maria all' Impruneta (Italy)*. Construction and Building Materials 25(12):4308–4324. <https://doi.org/10.1016/j.conbuildmat.2010.12.028>
- Bucksch A., Lindenbergh R.C., Van Ree J., 2007. *Error Budget of Terrestrial Laserscanning: Influence of the Intensity Remission on the Scan Quality*. <https://doi.org/10.13140/RG.2.1.1353.3525>.
- Fabbri F., 1960. *Quattro Castella-Storia e Leggenda*, Reggio Emilia 1960.
- Faccioli P., 2018. *La Torre di Monte Lucio a Quattro Castella (RE). Rilievo, analisi storica e valutazione delle condizioni di sicurezza ai fini di una proposta per la fruizione dell'area*. Master's Thesis, University of Bologna, Bologna, Italy.
- Fregonese L., Barbieri G., Biolzi L., Bocciarelli M., Frigeriand A., Taffurelli L., 2013. *Surveying and Monitoring for Vulnerability Assessment of an Ancient Building*. Sensors, 2013, 13, 9747-9773. <https://doi.org/10.3390/s130809747>.
- Galassi S., Ruggieri N., Tempesta G., 2019. *Ruins and Archaeological Artifacts: Vulnerabilities Analysis for Their Conservation Through the Original Computer Program BrickWORK*. In: Aguilar R., Torrealva D., Moreira S., Pando M.A., Ramos L.F. (eds) Structural Analysis of Historical Constructions. RILEM Bookseries, vol 18. Springer, Cham. [https://doi.org/10.1007/978-3-319-99441-3\\_197](https://doi.org/10.1007/978-3-319-99441-3_197).
- Jurina L., 2013. *Forte Fuentes a Colico. Un consolidamento in itinere*. Structural ed. De Lettera.
- Jurina L., 1996. *Il confinamento laterale delle pareti in muratura mediante tiranti inseriti nelle "buche pontae"*, in Gambarotta L. (a cura di), *La meccanica delle murature tra teoria e progetto*, Pitagora Editrice, Bologna, 1996, pp. 559-568.
- Jurina L., 1996. *Il consolidamento strutturale della torre San Dalmazio a Pavia, in Realtà e prospettive della costruzione metallica nell'architettura, nelle infrastrutture e negli impianti industriali: Giornate italiane della Costruzione in acciaio: Riva del Garda, 15-18 ottobre 1995: XV Congresso CTA, ACAI*, pp. 257-270.

- Koch R., Pollefeys M., Van Gool L., 1998. *Automatic 3D Model Acquisition from Uncalibrated Image Sequences*. Computer Graphics International, Proceedings, 597-604. <https://doi.org/10.1109/CGI.1998.694318>.
- Lourenço P.B. and Roque J.A., 2006. *Simplified indexes for the seismic vulnerability of ancient masonry buildings*. Construction and Building Materials 20, 200–208. <https://doi.org/10.1016/j.conbuildmat.2005.08.027>.
- Murtiyoso A., Koehl M., Grussenmeyer P., Freville T., 2017. *Acquisition and processing protocols for UAV images: 3D modeling of historical buildings using photogrammetry*. ISPRS Annals of Photogrammetry, Remote Sensing and Spatial Information Sciences. IV-2/W2. 163-170. <https://doi.org/10.5194/isprs-annals-IV-2-W2-163-2017>.
- Nuove Norme Tecniche per le Costruzioni (New Technical Standards for Construction)*, 2018. DM Ministerial Decree, Roma, Italy, 17 January 2018.
- Pfeifer N., Dorninger P., Haring A.P., 2007. *Investigating Terrestrial Laser Scanning Intensity Data: Quality and Functional Relations*. Presented at the Proceedings International Conference on Optical 3-D Measurement Techniques VIII, Zurich (CH).
- Prati D., Zuppella G., Mochi G., Guardigli L., Gulli R., 2019. *Wooden trusses reconstruction and analysis through parametric 3D modeling*. The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences, 2019, XLII-2/W9, pp. 623 – 629. <http://dx.doi.org/10.5194/isprs-archives-XLII-2-W9-623-2019>.
- Pueschel H., Sauerbier M., Eisenbeiss H., 2008. *A 3D model of Castle Landenberg (CH) from combined photogrammetric processing of terrestrial and UAV-based images*. The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences, Vol. XXXVII, 93-98.
- Salimbene (da Parma), 1882. *Cronaca di Fra Salimbene Parmigiano: dell'ordine dei minori / volgarizzata da Carlo Cantarelli sull'edizione unica del 1857; corredata di note e di un ampio indice per materie*, Battei, Parma.
- Yekrangnia M. and Mobarake A., 2015. *Restoration of Historical Al-Askari Shrine. II: Vulnerability Assessment by Numerical Simulation*. American Society of Civil Engineers. [https://doi.org/10.1061/\(ASCE\)CF.1943-5509.0000751](https://doi.org/10.1061/(ASCE)CF.1943-5509.0000751).
- Valluzzi M. R., 2006. *On the vulnerability of historical masonry structures: analysis and mitigation*. Materials and Structures, 2007 40, 723–743. <https://doi.org/10.1617/s11527-006-9188-7>.



Finito di stampare da  
Officine Grafiche Francesco Giannini & Figli s.p.a. | Napoli  
per conto di FUP  
**Università degli Studi di Firenze**



**Lamia Hadda**, PhD et professeur agrégé en Histoire de l'architecture à l'Université de Florence, Département d'Architecture. Elle enseigne Culture Euro-Med à l'École EuroMed d'Architecture, de Design et d'Urbanisme de l'Université Euro-méditerranéenne de Fès-Maroc. Membre du collège doctoral en Architecture et membre du laboratoire Dar|Med.

**Saverio Mecca**, Architecte et professeur en Production de bâtiments à l'Université de Florence, Département d'architecture. Membre du Conseil exécutif de l'ISTEA et du Comité scientifique international sur le patrimoine architectural en terre ISCEAH-ICOMOS. Directeur du laboratoire Dar|Med du Département d'architecture.

**Giovanni Pancani**, Architecte et PhD, professeur agrégé de Relevé architectural à l'Université de Florence, Département d'Architecture. Il s'occupe des protocoles de certification des relevés par scanner laser et de la valorisation et conservation du patrimoine culturel de l'architecture méditerranéenne.

**Massimo Carta**, Architecte et PhD, professeur agrégé en Urbanisme à l'Université de Florence, Département d'architecture. Il enseigne Urbanisme à l'École EuroMed d'Architecture, de Design et d'Urbanisme de l'Université Euro-méditerranéenne de Fès-Maroc et à l'UNSBC de Tirana (Albanie).

**Fabio Fratini**, Chercheur du CNR-ISPC, Institut des Sciences du Patrimoine Culturel. Son activité de recherche porte sur l'archéométrie des matériaux utilisés dans l'architecture monumentale et vernaculaire et sur l'étude de dégradation finalisé à la conservation du patrimoine. Il est membre du Comité Permanent du RIPAM.

**Stefano Galassi**, Architecte et PhD, chercheur en Sciences du bâtiment à l'Université de Florence, Département d'architecture. Il enseigne Mécanique des structures à l'École EuroMed d'Architecture, de Design et d'Urbanisme de l'Université Euro-méditerranéenne de Fès-Maroc. Membre du collège doctoral en Architecture et membre du laboratoire Dar|Med.

**Daniela Pittaluga**, Professeur agrégé de restauration à l'Université de Gênes et responsable scientifique des projets de recherche. Membre et réviseur du comité scientifique des séries éditoriales, des revues nationales et internationales et membre du comité permanent du RIPAM.

Villages et quartiers à risque d'abandon sont aujourd'hui une problématique commune à des nombreuses régions de la Méditerranée, considérée comme un point stratégique dans les nouvelles politiques européennes. L'abandon progressif des zones internes est une constante dans les pays caractérisés par le sous-développement économique, avec les phénomènes d'émigration et de fragmentation du patrimoine culturel. Cela entraîne des problèmes d'architecture et de gestion du territoire. L'objectif principal de ce travail de recherche est de créer un espace de discussion qui comprend l'étude du patrimoine architectural et du paysage ainsi que les témoignages démo-ethno-anthropologiques.