

Parametric modelling between supputation and graphic descriptions in Antoine de Ville's Les fortifications (1628)

*Original*

Parametric modelling between supputation and graphic descriptions in Antoine de Ville's Les fortifications (1628) / Pavignano, Martino; Natta, Fabrizio; Spallone, Roberta. - ELETTRONICO. - 24:(2026), pp. 197-204. ( International Conference on Fortifications of the Mediterranean Coast FORTMED 2026 Roma (IT) 18-21 febbraio 2026) [10.4995/Fortmed2026.2026.21497].

*Availability:*

This version is available at: 11583/3007666 since: 2026-02-16T10:07:51Z

*Publisher:*

Sapienza Università Editrice - edUPV (Universitat Politècnica de València)

*Published*

DOI:10.4995/Fortmed2026.2026.21497

*Terms of use:*

This article is made available under terms and conditions as specified in the corresponding bibliographic description in the repository

*Publisher copyright*

(Article begins on next page)

# 24 DEFENSIVE ARCHITECTURE OF THE MEDITERRANEAN

Michele RUSSO, Marta ACIERNO (Eds.)





DEFENSIVE ARCHITECTURE OF THE MEDITERRANEAN  
Vol. XXIV



DEFENSIVE ARCHITECTURE OF THE MEDITERRANEAN  
Vol. XXIV

Editors  
Michele Russo, Marta Acierno  
Sapienza Università di Roma



SAPIENZA  
UNIVERSITÀ DI ROMA



*Series Defensive Architecture of the Mediterranean*

General editor: Pablo Rodríguez-Navarro

The papers published in this volume have been peer-reviewed by the Scientific Committee of FORTMED2026\_Roma

© editors: Michele Russo, Marta Acierno

© editorial team: Silvia Seller, Martina Casciola, Giovanna Ferra, Giulia Flenghi, Carlotta Mellone, Luca Martelli

© cover picture: Francesco Giampietro

© papers: the authors

© publishers: Sapienza Università Editrice, edUPV (Universitat Politècnica de València)

© Copyright 2026 Sapienza Università Editrice

Dipartimento di Storia, Disegno e Restauro dell'Architettura

ISBN: 978-88-9377-433-8 (three-volume collection)

DOI: <https://doi.org/10.13133/9788893774338>

ISBN: 978-88-9377-436-9 (vol. 24)

DOI: <https://doi.org/10.13133/9788893774369>

© Copyright edUPV (Universitat Politècnica de València) 2026

ISBN: 978-84-1396-410-2 (three-volume collection)

ISBN: 978-84-1396-413-3 (vol. 24)

edUPV Ref. 6859\_01\_01\_01

DOI: <https://doi.org/10.4995/Fortmed2026.2026.21474>

ISSN: 2792-5633 (*Series Defensive Architecture of the Mediterranean*)

Proceedings of the International Conference on Fortifications of the Mediterranean Coast FORTMED 2026

Roma, 19, 20 and 21 February 2026

CC BY-NC-SA 4.0

Legal Code: <https://creativecommons.org/licenses/by-nc-sa/4.0/legalcode.en>



## Organization and committees

### Organizing Committee

#### Chairs:

Russo Michele. Sapienza Università di Roma  
Acierno Marta. Sapienza Università di Roma

#### Scientific Secretary:

Seller Silvia. Sapienza Università di Roma

#### Topic Chairs:

Acierno Marta. Sapienza Università di Roma  
Cutarelli Silvia. Sapienza Università di Roma  
Russo Michele. Sapienza Università di Roma  
Spadafora Giovanna. Università di Roma Tre

#### Members:

Casciola Martina, Ferra Giovanna, Flenghi Giulia, Martelli Luca,  
Mellone Carlotta. Sapienza Università di Roma

### Scientific Committee

Acierno, Marta. Sapienza Università di Roma. Italy  
Almagro Gorbea, Antonio. Real Academia de Bellas Artes de San Fernando. Spain  
Barrera Vera, José Antonio. Universidad de Sevilla. Spain  
Bertocci, Stefano. Università degli Studi di Firenze. Italy  
Bevilacqua, Marco Giorgio. Università di Pisa. Italy  
Bouزيد, Boutheina. École Nationale d'Architecture. Tunisia  
Bragard, Philippe. Université Catholique de Louvain. Belgium  
Bru Castro, Miguel Ángel. Instituto de Estudios de las Fortificaciones – AEAC. Spain  
Cámara Muñoz, Alicia. UNED. Spain  
Camiz, Alessandro. Özyeğin University. Turkey  
Campos, João. Centro de Estudos de Arquitectura Militar de Almeida. Portugal  
Castrorao Barba, Angelo. Escuela de Estudios Árabes, CSIC. Spain  
Cherradi, Faïssal. Ministère de la Culture du Royaume du Maroc. Morocco  
Cirafici, Alessandra. Università degli Studi della Campania *Luigi Vanvitelli*. Italy  
Cirillo, Vincenzo. Università degli Studi della Campania *Luigi Vanvitelli*. Italy  
Cobos Guerra, Fernando. Arquitecto. Spain  
Columbu, Stefano. Università di Cagliari. Italy  
Coppola, Giovanni. Università degli Studi Suor Orsola Benincasa di Napoli. Italy  
Córdoba de la Llave, Ricardo. Universidad de Córdoba. Spain  
Cornell, Per. University of Gothenburg. Sweden  
Corniello, Luigi. University of Campania *Luigi Vanvitelli*. Italy  
Cutarelli, Silvia. Sapienza Università di Roma. Italy  
Daci, Entela. Universiteti Politeknik i Tiranës. Albania  
Dameri, Annalisa. Politecnico di Torino. Italy  
Eppich, Rand. Universidad Politécnica de Madrid. Spain  
Fairchild Ruggles, Dorothy. University of Illinois at Urbana-Champaign. USA  
Fatta, Francesca. Università Mediterranea di Reggio Calabria. Italy  
Faucherre, Nicolas. Aix-Marseille Université – CNRS. France  
Fiorino, Donatella Rita. Università degli Studi di Cagliari. Italy

García Porras, Alberto. Universidad de Granada. Spain  
 García-Pulido, Luis José. Escuela de Estudios Árabes, CSIC. Spain  
 Georgopoulos, Andreas. Nat. Tec. University of Athens. Greece  
 Gil Crespo, Ignacio Javier. Asociación Española de Amigos de los Castillos. Spain  
 Gil Piqueras, Teresa. Universitat Politècnica de València. Spain  
 Guarducci, Anna. Università di Siena. Italy  
 Guidí, Gabriele. Politecnico di Milano. Italy  
 González Avilés, Ángel Benigno. Universitat d'Alacant. Spain  
 Hadda, Lamia. Università degli Studi di Firenze. Italy  
 Harris, John. Fortress Study Group. United Kingdom  
 Islami, Gjergji. Universiteti Politeknik i Tiranës. Albania  
 Jiménez Castillo, Pedro. Escuela de Estudios Árabes, CSIC. Spain  
 León Muñoz, Alberto. Universidad de Córdoba. Spain  
 López González, Concepción. Universitat Politècnica de València. Spain  
 Marotta, Anna. Politecnico di Torino. Italy  
 Martín Civantos, José María. Universidad de Granada. Spain  
 Martínez Medina, Andrés. Universitat d'Alacant. Spain  
 Mazzoli-Guintard, Christine. Université de Nantes. France  
 Mirabella Roberti, Giulio. Università degli Studi di Bergamo. Italy  
 Mira Rico, Juan Antonio. Universitat Oberta de Catalunya. Spain  
 Navarro Palazón, Julio. Escuela de Estudios Árabes, CSIC. Spain  
 Orihuela Uzal, Antonio. Escuela de Estudios Árabes, CSIC. Spain  
 Pane, Andrea. Università Federico II di Napoli. Italy  
 Parrinello, Sandro. Università di Pavia. Italy  
 Pirinu, Andrea. Università di Cagliari. Italy  
 Piscitelli, Manuela. Università degli Studi della Campania *Luigi Vanvitelli*. Italy  
 Pompejano, Federica. Università di Genova, Italy  
 Quesada García, Santiago. Universidad de Sevilla. Spain  
 Rodríguez Domingo, José Manuel. Universidad de Granada. Spain  
 Rodríguez-Navarro, Pablo. Universitat Politècnica de València. Spain  
 Romagnoli, Giuseppe. Università degli Studi della Toscana. Italy  
 Ruiz-Jaramillo, Jonathan. Universidad de Málaga. Spain  
 Russo, Michele. Sapienza Università di Roma. Italy  
 Santiago Zaragoza, Juan Manuel. Universidad de Granada. Spain  
 Spadafora, Giovanna. Università di Roma Tre. Italy  
 Spallone, Roberta. Politecnico di Torino. Italy  
 Toscano, Maurizio. Universidad de Granada. Spain  
 Ulivieri, Denise. Università di Pisa. Italy  
 Veizaj, Denada. Universiteti Politeknik i Tiranës. Albania  
 Varela Gomes, Rosa. Universidade Nova de Lisboa. Portugal  
 Verdiani, Giorgio. Università degli Studi di Firenze. Italy  
 Vitali, Marco. Politecnico di Torino. Italy  
 Vokshi, Armand. Universiteti Politeknik i Tiranës. Albania  
 Zaragoza, Catalán Arturo. Generalitat Valenciana. Spain  
 Zerlenga, Ornella. Università degli Studi della Campania *Luigi Vanvitelli*. Italy

#### **Advisory Committee**

Pablo Rodríguez-Navarro. President of FORTMED. Universitat Politècnica de València  
 Giorgio Verdiani. Vice-president of FORTMED. Università degli Studi di Firenze  
 Teresa Gil Piqueras. Secretary of FORTMED. Universitat Politècnica de València  
 Roberta Spallone. FORTMED advisor. Politecnico di Torino  
 Ornella Zerlenga. FORTMED advisor. Università degli Studi della Campania *Luigi Vanvitelli*  
 Vincenzo Cirillo, FORTMED advisor. Università degli Studi della Campania *Luigi Vanvitelli*

**Organized by:**



**SAPIENZA**  
UNIVERSITÀ DI ROMA

DIPARTIMENTO DI STORIA  
DISEGNO E RESTAURO  
DELL'ARCHITETTURA

FACOLTÀ DI ARCHITETTURA

**Partnership:**



UNIVERSITAT  
POLITÈCNICA  
DE VALÈNCIA



UNIVERSITÀ  
DEGLI STUDI  
FIRENZE

**DIDA**  
DIPARTIMENTO DI  
ARCHITETTURA



Universitat d'Alacant  
Universidad de Alicante



**Politecnico  
di Torino**

Dipartimento  
di Architetture e Design



**DESTEC**  
DIPARTIMENTO DI INGEGNERIA  
DELL'ENERGIA, DEI SISTEMI, DEL TERRITORIO E DELLE COSTRUZIONI



**CSIC**  
CONSEJO SUPERIOR DE INVESTIGACIONES CIENTÍFICAS



UNIVERSITETI  
POLITEKNIK  
I TIRANËS



Università  
degli Studi  
della Campania  
Luigi Vanvitelli  
Dipartimento di Architetture  
Disegno Industriale



**SAPIENZA**  
UNIVERSITÀ DI ROMA

**With the patronage of:**



unione  
italiana  
disegno



**Istituto Italiano  
dei Castelli**



International Council on  
Monuments and Sites

Consiglio Nazionale Italiano  
dei Monumenti e dei Siti

**With the sponsorship of:**



**COIMA** ITALIA



**DIA**  
PREMIUM FOOD COMPANY



## Table of contents

<b>Preface</b> .....	XIII
<b>Contributions</b>	
<b>CHARACTERIZATION OF GEO-MATERIALS</b>	
Archaeometric and geophysical analyses for the study and conservation of the watchtower of St. Agatha (Red Tower) in Malta.....	5
<i>Maurizio Lazzari, Francesco Cavalcante, Emanuele Colica, Sebastiano D'Amico, Lara De Giorgi, Antonio Lettino, Giovanni Leucci, Raffaele Persico</i>	
Preliminary archaeometric analyses of reused Roman materials: the case of the tower at Via dei Montanini 16 in Siena, Italy.....	11
<i>Gioele Rossi, Fabio Gabbrielli, Marco Giamello, Andrea Scala, Enrico Tavarnelli</i>	
<b>DIGITAL HERITAGE</b>	
Architectural analysis of the Aragonese castle of Venosa. Pirro del Balzo.....	21
<i>Luis Agustín-Hernández, Michele Buldo, Marta Quintilla Castán, Javier Domingo Ballesti</i>	
Digital translation of early-modern fortification models. The case of “Della fortificazione delle citta...” by Girolamo Maggi and Giacomo Fusti Castriotto.....	29
<i>Lorenzo Belli, Piergiuseppe Rechichi, Denise Ulivieri, Marco Giorgio Bevilacqua</i>	
Watchtowers on the coast of the kingdom of Granada (Spain). Graphic documentation as a starting point for their protection and conservation. Case studies: Melicena tower.....	37
<i>Jose Antonio Benavides-Lopez, Jose Antonio Barrera-Vera, Enrique-José Fernandez-Tapia, Maria Isabel Mancilla Cabello</i>	
The digital survey for the construction of information models of fortified architecture on the island of Capri.....	45
<i>Massimiliano Campi, Carmine Gambardella, Valeria Cera, Rosaria Parente, Marika Falcone, Marica Camerino</i>	
Reconstrucción digital y análisis morfológico del trazado de la muralla de Trujillo (Perú) mediante herramientas SIG.....	53
<i>Diego Javier Celis Estrada, Teresa Gil-Piqueras, Pablo Rodríguez-Navarro</i>	
Franciscan reinterpretations: architectural adaptations and reuse of medieval fortified structures in Campania.....	61
<i>Valeria Cera, Giuseppe Antuono</i>	
The fortified island of Ortigia: rediscovering a lost heritage through digitalization and historical memory.....	69
<i>Roberta Cerruto</i>	

Kruja Castle in Albania: digital technologies for the knowledge and valorisation of the fortified heritage..... <i>Angelo De Cicco, Andrea Maliqari</i>	77
Monastic Fortifications in the Judean Desert ( <i>al-Barriyya</i> ): 3D geo-mapping and Virtual Heritage for the assessment of dynamic heritage values ..... <i>Raffaella De Marco</i>	85
Eastern Elba: The Birth and Transformations of Portoferraio and Its Military Architecture ..... <i>Tommaso Empler, Adriana Caldarone, Pasquale Micelli</i>	93
The medieval museum of Casentino valley: the case study of Romena castle as a design and research lab..... <i>Alessio Fantoni</i>	101
The coastal tower of San Giovanni in Ugento (Le): historical investigations, architectural survey and digital restoration ..... <i>Ivan Ferrari, Francesco Giuri</i>	109
Historical-architectural analysis and digital documentation of the military complex and Norman castle of <i>Civitas Allipharum</i> ..... <i>Raffaella Fiorillo, Angelo De Cicco</i>	117
The Castellina of Norcia: from historical knowledge to digital valorization ..... <i>Francesca Funis, Valeria Menchetelli, Serena Pallotti</i>	125
Defending the Venetian Lagoon: Digital Reconstruction of the Early Modern Fortress at the <i>Lido</i> ..... <i>Ludovica Galeazzo, Gianlorenzo Dellabartola, Federico Panarotto</i>	133
Virtual Tours and BIM as Heritage Tools: The Case of Forte San Giovanni..... <i>Riccardo Maria Giannelli, Volha Petravets, Maksim Afonchanka, Michele Codeglia, Daniela Barbieri, Norbert Frroku</i>	141
Digitization of fortifications using UAV and TLS for conservation, diagnosis and structural analysis: the case of the Castles of Callosa del Segura and Forna..... <i>José Antonio Huesca-Tortosa, Yolanda Spairani-Berrio, María Isabel Pérez-Millán, Carlos Pérez-Carramiñana</i>	149
Geospatial analysis of the visual domain exercised by the Trigueros castle and its insertion in the castral system of the county of Niebla in the 15th Century ..... <i>Juan José Fondevilla Aparicio</i>	157
The bunkers of Clot de Galvany, Mediterranean Wall, 1937-1938..... <i>Andrés Martínez Medina, Giancarlo Sanna, Pablo Jeremías Juan Gutiérrez</i>	165
Methodologies for the valorisation of research applied to the fortified heritage. The INFORTREAT project ..... <i>Alessandro Meloni, Martina Rinascimento, Marco Giorgio Bevilacqua, Roberta Spallone</i>	173
The Guglielmi Castle on Isola Maggiore: from Architectural Survey to a Proposal for Valorization and Communication..... <i>Valeria Menchetelli, Francesco Cotana, Chiara Spipoli</i>	181
Sacrum et Munitum: architecture between faith and defense. The case of the Church of Saints Peter and Paul in Agrò ..... <i>Sonia Mercurio, Marinella Arena</i>	189
Parametric modelling between supputation and graphic descriptions in Antoine de Ville's Les fortifications (1628)..... <i>Martino Pavignano, Fabrizio Natta, Roberta Spallone</i>	197

Strategy and optimisation of the surveying process using SfM photogrammetry: the case of Alcudia de Veo Castle (Castellón).....	205
<i>Ana Pérez-Vila, Teresa Gil-Piqueras, Pablo Rodríguez-Navarro</i>	
Endangered fortifications: The kulla of northern Albania in survey and conservation .....	211
<i>Edmond Pergega, Blerina Tabaku, Saimira Arapi, Gjergji Islami</i>	
Advanced digital modelling of the Torre del Mar (Borriana, Castellón): from digital fabrication to immersive experience through eXtended Reality (XR) .....	219
<i>Enrico Pupi, Roberta Spallone, Teresa Gil-Piqueras, Pablo Rodríguez-Navarro</i>	
Patterns of settlement in rural Andalusia in the Cocentaina region (Alicante).....	227
<i>Santiago Quesada-García, María Lozano-Gómez</i>	
LiDAR sensors and mobile mapping for the survey of historical architecture: the case study of the Castellare degli Ugurgeri - Siena (Italy).....	235
<i>Gioele Rossi, Jacopo Bruttini, Fabio Gabbrielli, Marco Giamello, Enrico Tavarnelli</i>	
Bastion survey protocol: operational activity framework for multi-scale surveys of fortified walls .....	243
<i>Michele Russo, Gabriella Caroti</i>	
Stone sentinels: the coastal towers of Forio d'Ischia .....	251
<i>Patryk Rynkowski, Francesca Romana Stabile, Daniele Calisi</i>	
Defensive architecture between land and coast: the tower of Sessa Aurunca and the tower of Lago Patria .....	259
<i>Michele Sabatino, Maria Prisco</i>	
The Alcamo Stronghold: Multi-Scalar Survey and Hybrid Representation of the Sardinian Defensive Front (1942–1943).....	267
<i>Giancarlo Sanna, Andrea Pirinu, Andrés Martínez Medina, Nicola Paba</i>	
New perspectives on the Theodosian Land Walls of Istanbul through digital photogrammetry.....	275
<i>Mustafa Sayan, Zeynep Eres</i>	
The Pietrenere Coastal Battery in Taureana di Palmi (RC) .....	283
<i>Francesco Stilo, Lorella Pizzonia</i>	
Semantic representation of historical architectural heritage with digital modeling methods: The Aragonese Tower in Bitonto (Bari).....	291
<i>Riccardo Tavolare, Giovanni Mongiello</i>	
Fortification, transformations, disasters, a complex vicissitude for the Krujë Fortress in Albania .....	299
<i>Giorgio Verdiani, Stéphane Giraudeau, Elisa Miho</i>	
Consistence of memories and lightness of the present: the Rigena Tower in Larnaca, Cyprus .....	309
<i>Giorgio Verdiani, Alexia Charalambous</i>	
Digitally Reframing Coastal Fortifications: Enhancing Visibility and Meaning in the Mediterranean Landscape .....	317
<i>Giorgio Verdiani, Ylenia Ricci, Andrea Pasquali</i>	
The Montalbano Fortress in La Spezia, third session and last notes.....	325
<i>Giorgio Verdiani, Ludovica Marinaro</i>	
The Castelluccio of Gela: from documentation to digital rediscovery .....	333
<i>Antonella Versaci, Alessio Cardaci, Paola Cammilleri</i>	

## CULTURE AND MANAGEMENT

Defending the Langhe: the potential for castle networks within regional and cultural development policy ..... 343  
*Fabio Ambrogio, Emanuele Romeo*

Ancona: from fortress city to an inclusive city of the future. Military heritage as a driver for urban identity, experimentation, exploration, and regeneration..... 351  
*Giovanna Badaloni*

The Night of Fortresses: A transnational model for sustainable and inclusive cultural heritage management..... 359  
*Gorana Barišić Bačelić, Đurđa Vrljević Šarić*

Interdisciplinary methodological perspectives in university research. The ForteMare project: an ongoing research path..... 367  
*Zaira Barone, Clelia La Mantia*

Wartime landscapes and cultural heritage: the Gustav Line's Abruzzo segment between historical memory and territorial development ..... 375  
*Annalisa Colecchia*

Participatory Model for the Management and Enhancement of the Cultural Heritage of Mussomeli (CL): The Manfredonian Castle as a Driver of Widespread Tourism..... 383  
*Mariateresa Galizia, Gloria Russo, Graziana D'Agostino, Giuseppe Maria Spera*

The fortress *Le Castella* on the Ionian Sea. Results of a diagnostic plan ..... 391  
*Caterina Gattuso, Domenico Gattuso*

Analysis and proposals for Genoese Walls and Forts Park..... 399  
*Massimo Malagugini*

The Museum of Defensive Systems in Europe, in the Citadel of Alexandria ..... 407  
*Anna Marotta*

A proposal for regional development: towards a network of 'fortresses/faro' in the Alessandria area .. 415  
*Anna Marotta, Piera Migliore*

Heritage education and dissemination in the castles of the province of Alicante (Spain) and the voivodeship of Pomorskie (Poland) ..... 423  
*Juan Antonio Mira Rico, Agnieszka Kowalska, Monika Rogalewska*

## MISCELLANY

Rocks, settlements and fortifications in Calabria, between tangible and intangible protection..... 433  
*Rosario Chimirri*

Adaptive Reuse and Musealization Strategies for the Rocca di Sala in Pietrasanta..... 441  
*Andrea Crudeli*

The submerged wall of the Bocagrande canal in Cartagena de Indias, a defensive work by the military engineer Antonio de Arévalo (1769-1788)..... 449  
*Jorge Galindo-Díaz, Joan Fontás-Serrat*

Thaddeus' Tower. A modern-era defensive structure in Burriana (Castellón, Spain)..... 457  
*Jose Manuel Melchor Monserrat*

The Castle of Casertavecchia: ongoing research between archaeological excavation and digital surveying..... 463  
*Ornella Zerlenga, Nicola Busino, Domenico Iovane, Rosina Iaderosa*

## Parametric modelling between supputation and graphic descriptions in Antoine de Ville's *Les fortifications* (1628)

Martino Pavignano<sup>a</sup>, Fabrizio Natta<sup>a</sup>, Roberta Spallone<sup>a</sup>

<sup>a</sup> Politecnico di Torino, Department of Architecture and Design, Turin, Italy, [martino.pavignano@polito.it](mailto:martino.pavignano@polito.it), [fabrizio.natta@polito.it](mailto:fabrizio.natta@polito.it), [spallone@polito.it](mailto:spallone@polito.it)

*How to cite:* Pavignano, M., Natta, F. & Spallone, R. (2026). Parametric modelling between supputation and graphic descriptions in Antoine de Ville's *Les fortifications* (1628). In: Russo, M. & Acierno, M. (eds.) *Defensive Architecture of the Mediterranean*, vol. XXIV, Proceedings of FORTMED - Fortification of the Mediterranean Coast, 19-21 February 2026, Rome. Rome-Valencia: Sapienza Università Editrice / edUPV

<https://doi.org/10.4995/Fortmed2026.2026.21497>

### Abstract

This paper examines Antoine de Ville's *Les fortifications* (1628), a landmark of the French school of military architecture, notable for merging geometric constructions with tabular calculations, the "supputation par les Sinus." Using parametric and algorithmic modelling, the study translates de Ville's design principles into a modular digital workflow that employs historical units of measurement and dimensions to reconstructing both plan and section of regular fortresses. The method proceeds from data input to two- and three-dimensional construction and ends with Building Information Modelling (BIM) export. This approach validates the consistency of de Ville's values, identifies points of variation, and allows parametric control of elements such as the orillon. Beyond reconstruction, the models enable enriched analysis of bastioned systems and are made available through web-based BIM platforms. The research demonstrates how early modern treatises can evolve into interactive resources, bridging historical building knowledge with contemporary tools for study and dissemination.

**Keywords:** VPL, BIM, regular fortresses, Antoine de Ville.

### 1. Introduction

The research presented here is part of the two-year PRIN 2022 project entitled "INFORTREAT: Reconstructing the Early Modern Bastioned Front." This project aims to develop information models for the utilization of constructive knowledge in fortified architecture treatises from the 16<sup>th</sup> to 18<sup>th</sup> centuries.

The project's overarching objective is to facilitate access to constructive knowledge pertaining to military architecture, as elucidated in early modern

treatises, by utilizing three-dimensional digital information models. These models are designed to be consulted and interrogated by scholars, practitioners, and the broader community.

The project's initial phase comprises an exhaustive examination of military treatises from the 16<sup>th</sup> to 18<sup>th</sup> centuries in Italy, France, the Netherlands, and Spain. This aims to identify the geometric constructions for profiling the bastion system and

the technological, material, and construction indications for the sections of the system itself, as proposed by the different authors. The objective is to identify recurrent methodologies and techniques, explicit or implicit derivation relationships between one treatise and another, and elements of innovation and originality in fortification techniques.

In this context, the present contribution focuses on a critical analysis of the first book of the treatise on military architecture, *Les fortifications du Chevalier Antoine de Ville* (de Ville, 1628).

**2. De Ville’s treatises in the panorama of theories on military architecture**

Born in 1596, Antoine de Ville was a member of a noble family from Toulouse, France. Educated by the Jesuits, he was trained in scientific topics, such as Mathematics, Geometry, and military architecture as well. After his studies, he undertook a career in the military field, serving in the French, Piedmontese and Venetian army, both as field officer and military engineer. The second service (in Piedmont) granted him the title of *Knight of the Order of St. Maurice and St. Lazarus* on 1626 (Pernot, 1987). During his life, he authored quite a few publications regarding military topics. Among them, his first one was *Les fortifications du Chevalier Antoine de Ville*, published in Paris in 1628, after his first return in France. This treatise was followed by the volume *De la Charge des Gouverneurs des Places*, published in Paris in 1639. Both treatises obtained a good success at their time, the second one being republished many times and still in use until the 60s of the 19<sup>th</sup> century (Pernot, 1987). He died in Paris in 1656.

His publishing activity positions de Ville among the founding fathers of the *alla moderna* fortified architecture of the so-called French School. His figure must be put next to those of Claude Flaman (ca. 1570-1626) and Jean Errard de Bar-Le-Duc (1554-1610), the very first representatives of this school, Blaise François Pagan (1604-1665), de Ville’s contemporary and mentor of both Nicolas-François Blondel (1618-1686) and Sebastien Le Prestre de Vauban (1633-1707), who would have become the most important, and best known professional of the French school between 17<sup>th</sup> and 18<sup>th</sup> centuries.

De Ville’s treatise has already been analysed, both for its structure and for its contents (Pavignano, Spallone 2025), but it is worth recalling that the *in-folio* volume counts to 441 numbered pages and it is

illustrated with 55 copper engraved plates, 45 are on a single sheet, and 10 are on a double sheet. Still, it is important to remember that the succession of topics reflects de Ville’s idea to define an all-inclusive discussion on fortification design and the management of sites and fields operations.

As already highlighted, de Ville explicitly refers to previous works by Dürer (1527), Errard (1600), Marlois (1628) (Pavignano, Spallone 2025).

**3. Fortification design of regular fortresses by supputation**

As previously discussed, de Ville proposed his personal design methodology for the regular fortifications based on the inner polygons used to define the shape of the plan. To this extent, the sides of the regular figures were supposed to sustain both the half gorges and the curtains of bastioned fronts. De Ville used the King’s foot as basic unit of measurement, which is equal to 0.32484 meters (Martini, 1883), and Geometric paces as its 5x multiple (de Ville, 1628). The Author also imposed two specific dimensions for sides, originating two main defensive systems (differing only in their sizes): Royal and Ordinary, as synthesized in Tab. 1. For reference, contemporary authors like Adam Freitag (1635) defined up to three different dimensions like *grand*, *moiene*, and *petit Royals* (for regular fortifications).

Regular fortification type	Polygonal sides length		
	Geometric paces	King’s feets	Meters (approx)
Royal	180	900	292.36
Ordinary	150	750	243.63

Tab. 1- Main dimensions of regular fortresses sides equal to the sides of the polygons used to design the plans (elaboration by M. Pavignano).

De Ville related such dimensions to the ballistic aspects of defence conducted using firearms, primarily defining the range of the muskets as reference invariants of the defence, thus of the fortification design itself (de Ville, 1628). In fact, sides measuring 180 paces did consent muskets’ flanking, since muskets’ range was far superior (de Ville, 1628). We have already exposed his methodology via graphic analysis (Pavignano, Spallone, 2025). By redrawing de Ville’s instructions, we obtained the generic geometric

concatenation originating the regular fortification design of a regular polygon (with bastions and curtains). Still, we discussed the very novelty of de Ville's methodology – or better a consequence of this – being the *supputation par les Sinus* (de Ville, 1628) of each single geometric element of the plan of a regular fortress. In fact, the Author deconstructed the bastioned front into segments, listed in Fig. 1, and calculated each of them starting from the internal angle of the chosen regular polygon, proceeding from the hexagon up to the dodecagon (de Ville, 1628) then resuming all the calculations in a table (Pavignano, Spallone, 2025). This led de Ville to be the first to expose this kind of calculated tabular data, thus offering the readers both a graphic procedure and a numerical one, by mean of lines lengths and angular values (Mišić, Obradović, 2025).

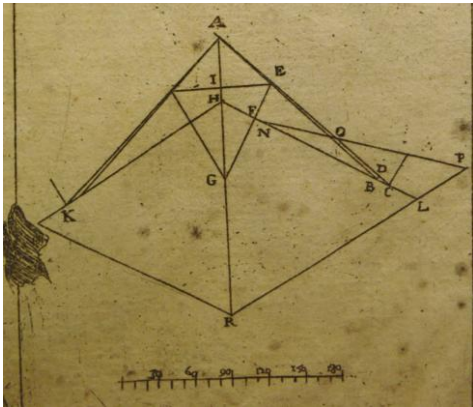


Fig. 1- de Ville's graphic deconstruction of the bastioned front. (de Ville, 1628, planche 32)

De Ville then applied both the geometric procedure and the *supputation* to the design of the planar development of regular fortification. He also provided a graphic procedure to define the *profil* or *orthographie* (cross section) of a bastioned front.

The Author presented his idea at the very beginning of his treatise, as a complement to the graphic procedure used to design the regular plans visually described in *figure 2* of the *planche 1* of the treatise. According to the text, we can draw the entire cross section of a fortified front starting from the setting of the horizontal ground level CE, then we can proceed with drawing of the rampart, the parapet, the ditch and all the other elements by easily using dimensions provided (de Ville, 1628). Our graphic analysis of de Ville's *profil* is presented in Fig. 2.

The figure contains also the dimensions of main elements and integrates some visual information on the structure of the wall, specifically on the presence of counterforts. To interpret the Author's design procedure, we must highlight that he provided dimensions while discussing the *profil*, then he might have provided other information within the punctual description of each element on the dedicated paragraphs. For example, he indicated the ditch width to be 26 paces (or 130 feet) at page 20, but he then described ditches' width to be ranging from 15 to 30 paces (75-150 feet) in the dedicated paragraph (de Ville, 1628), relating this 15-30 range to different types of terrain hosting the ditch. To better clarify this discordance, we resume in Table 2 the minimum and maximum dimensions found within the text, thus providing a complete lookout for possible variations. We can observe that such variations in dimensions of every element are common to all the treatises on military architecture, since each project should have been designed according to the building sites' orography and material characteristics. Data in Table 2 are used to define the parametric modelling presented in the next paragraph.

It is worth mentioning that de Ville did not enter the detail of the description of how walls must be built, except for the thickness of the structure and as well as the dimensions of reinforcing buttresses. In fact, he states to only describe shapes (geometries) of the elements and the materials to build them, not how the walls should be constructed (i.e. how to use bricks or stones blocks), since those aspects belong to civil architecture and to the art of masonry (de Ville, 1628).

Nonetheless, the Author discussion on buttresses provides some interesting hints on his structural conception. First, de Ville states that earth is the best material to counter gun shots, especially those of big cannons. It derives that the masonry structure of walls had to be used mainly as constraints for the earth-made ramparts, these lasts to be built with the earth excavated from the ditch (de Ville, 1628). Following the Italian tradition, de Ville highlights the possibility to build counterforts with different planar shapes and suggests the dimensions of the parallelepiped-shaped ones to be built approximately with a horizontal section of 7/8 by 4/5 feet and a vertical one of 35 feet (or 7 paces), basically the same height as the *chemin des ronde* upper level. Buttresses should be spaced 15-20 feet away from one another.

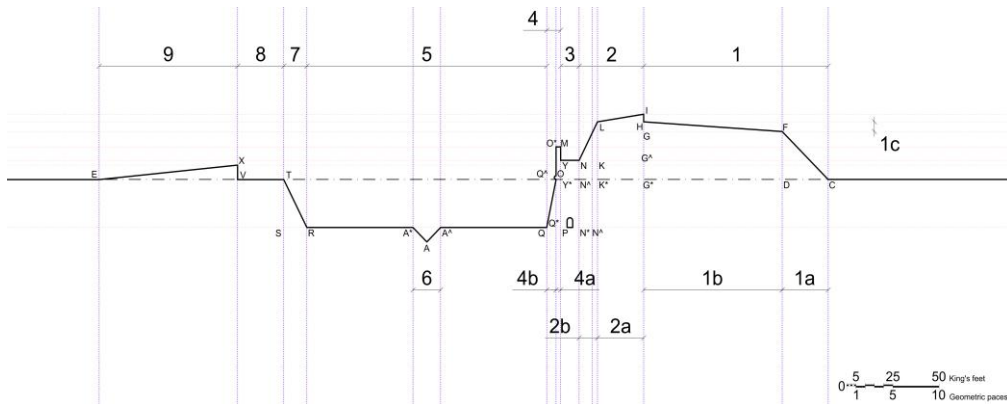


Fig. 2- *Profil* or *orthographie* (cross section) redrawing and reconstruction with elements nomenclature and elements' minimum and maximum dimensions both for widths and heights (graphic analysis and elaboration by M. Pavignano 2025)

Element de Ville's terminology English translation	ref. Fig. 2	ref. <i>Profil</i> horizontal segment vertical segment	Width		Height		Dimensional variations for parametric design					
			min u	max u	min u	max u	horizontal direction	min u	max u	vertical direction related to ground line CE	min u	max u
Rempart ou contre-escarpe et pente Rampart including its counterscarp and its pente	1	CG' - DF   G'H	20 paces 100 feet	25 paces 125 feet	5 paces 25 feet	6 paces 30 feet	CG' -	20 paces 100 feet	25 paces 125 feet	DF   and G'H	5 paces 25 feet	6 paces 30 feet
Monté du rempart Counterscarp of the rampart	1a	CD -	5 paces 25 feet	5 paces 25 feet	5 paces 25 feet	5 paces 25 feet	CD -	5 paces 25 feet	5 paces 25 feet	DF	5 paces 25 feet	5 paces 25 feet
Rempart Rampart excluding its counterscarp	1b	FG - DF   G'H	15 paces 75 feet	20 paces 100 feet	5 paces 25 feet	6 paces 30 feet	DG' -	15 paces 75 feet	20 paces 100 feet	DF   and G'H	5 paces 25 feet	6 paces 30 feet
Pente du rempart vers la place Inclination of the upper level of the rampart	1c	FG - GH	15 paces 75 feet	20 paces 100 feet	1 paces 5 feet		FG -	15 paces 75 feet	20 paces 100 feet	G'H	6 paces 30 feet	
Parapet ou contre-escarpe Parapet including its counterscarp	2	HILN - HI	7 paces 35 feet		0 paces 4 feet		G'N -	7 paces 35 feet		KL   G'I	6 paces 30 feet	6.8 feet 34 feet
Parapet Parapet excluding its counterscarp	2a	HL - HI	5 paces 25 feet				G'K -	7 paces 35 feet		KL   G'I	6 paces 30 feet	6.8 feet 34 feet
Contre-escarpe du parapet Counterscarp of the parapet	2b	KN - LK	2 paces 10 feet		0 paces 0 feet	4 paces 20 feet	KN -	2 paces 10 feet		N'N'   K'L	2 paces 10 feet	6 paces 30 feet
Muraille Wall including the Chemin des ronde	4	NYMO'QOP	5 paces 15 feet	5.6 paces 18 feet	2 paces 10 feet	7 paces 35 feet						
Chemin des ronde Chemin des ronde	3	NY -	2 paces 10 feet		2 paces 10 feet		NY -	2 paces 10 feet		N'N'	1.6 paces 8 feet	2 paces 10 feet
Parapet du chemin des ronde Parapet of the chemin des ronde	4a	MO' -	0.5 paces 2.5 feet		1.4 paces 7 feet	1.6 paces 8 feet	MO' -		0.5 paces 2.5 feet	Y'M	3.4 paces 17 feet	3.6 paces 18 feet
Cheminise Mantlet wall	4b	QQ' -	1 paces 5 feet		5 paces 25 feet		QQ' -	1 paces 5 feet		O'O	-5 paces -25 feet	
Fossé Ditch (excavated in earth)	5	QR -	25 paces 125 feet	30 paces 150 feet	5 paces 25 feet	7 paces 35 feet	QR -	25 paces 125 feet	30 paces 150 feet	Q'Q'	-5 paces -25 feet	-7 paces -35 feet
Fossé Ditch (carved in stone)	5	QR -	15 paces 75 feet	20 paces 100 feet	5 paces 25 feet	7 paces 35 feet	QR -	15 paces 75 feet	20 paces 100 feet	Q'Q'	-5 paces -25 feet	-7 paces -35 feet
Cunette ou petit fossé Small ditch	6	A'A' - A	3 paces 15 feet	4 paces 20 feet	1.5 paces 7.5 feet		A'A' -	3 paces 15 feet	4 paces 20 feet	A	6.5 paces -32.5 feet	
Contre-escarpe du fossé Counterscarp of the ditch	7	RS - ST	2.5 paces 12.5 feet		5 paces 25 feet	7 paces 35 feet	RS -	2.5 paces 12.5 feet		ST	-5 paces -25 feet	-7 paces -35 feet
Chemin couvert ou Corridor Walkway	8	TV - ST	5 paces 25 feet	6 paces 30 feet	0 paces 0 feet	0 paces 0 feet	TV -	5 paces 25 feet	6 paces 30 feet		0 paces 0 feet	0 paces 0 feet
Espalade Slope	9	VE - VX	15 paces 75 feet	20 paces 100 feet	1.5 paces 7.5 feet		VE -	15 paces 75 feet	20 paces 100 feet	VX	0 paces 0 feet	1.5 paces 7.5 feet

- this sign indicates an horizontal segment  
| this sign indicates a vertical segment

min and max values for the entire fossé

min and max values are related to the rampart's

min and max value to be related to different levels

min value derived from graphic analysis of pl. 1

Tab. 2- Synoptic table of elements' dimensions and their identification in de Ville's *profil* (cross section) (analysis and elaboration by M. Pavignano 2025). Columns contain: elements' names; letters to identify them on the graphic analysis of the *profil* (cross section) presented in Fig. 2; width and height (minimum and maximum) as described by de Ville; dimensional variations for parametric design elaborated based on de Ville's dimensions referred to the ground level

#### 4. Parametric Modelling and Algorithmic Procedures

This research utilizes a visual algorithmic approach to digitally model the de Ville's

fortification system. The methodology is based on a unitary visual algorithm that integrates the entire construction process, from input data to output generation and export to other software.

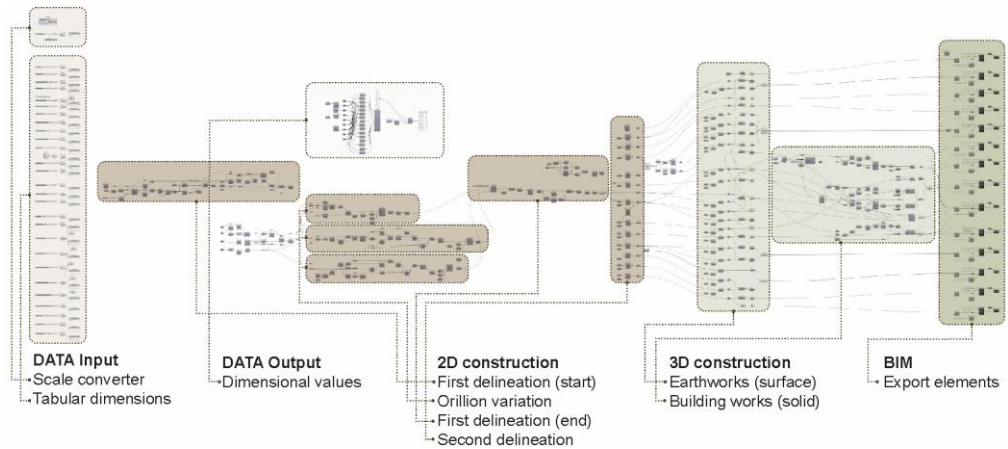


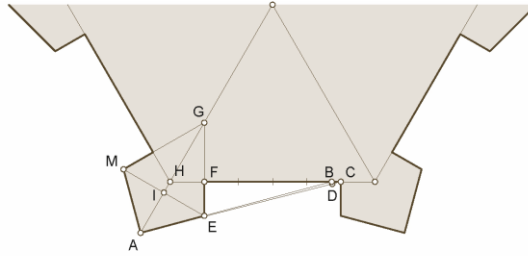
Fig. 3- Visual algorithm of A. de Ville's fortification system (graphic elaboration by F. Natta)

The workflow is meticulously divided into distinct modules for data input, two-dimensional and three-dimensional construction, and final data export to other software platforms (Fig. 3). This modularity is key to the system's flexibility and transparency, making it possible to trace the digital model's lineage directly back to de Ville's original geometric principles. A critical aspect of this modelling process is the direct integration of de Ville's historical units of measurement. The input data, which serves as the foundational control for the entire model, rigorously adheres to de Ville's geometric system. Specifically, the geometric pace is employed for defining the base polygon of the fortification, while the King's foot (*ped du roi*) is used for all remaining dimensions. By using these units, the model not only faithfully reproduces de Ville's designs but also provides a powerful tool for analyzing his design logic. The parametric nature of the algorithm allows for the continuous control of the model, enabling researchers to test and verify the geometric relationships and dimensions outlined in de Ville's treatise. The model directly incorporates the dimensions and variations (Tab. 2) to establish a verifiable link between the historical text and its digital reconstruction.

The power of the algorithmic approach is further demonstrated by its ability to generate a bidimensional development of the fortress. This procedural step is essential for systematically verifying the tabular dimensions of individual elements as the base polygon changes. De Ville himself addresses a range of polygons, from a hexagon to a dodecagon, in *Les fortifications* (de

Ville, 1628; Mišić, Obradović, 2025). Our model automates the generation of these variations, extracting all relevant values algorithmically. The results provide a direct comparison between de Ville's original values and those produced by the digital model (Tab. 3). The analysis of this data reveals a consistent and controlled delta of variation across most elements, except for one specific value that shows a more significant deviation. This finding not only validates the accuracy of the algorithmic reconstruction but also highlights potential points of interest for further historical or technical investigation within de Ville's original work.

The digital dialogue between the historical calculations (*supputation*) and our parametric model confirms the consistency of de Ville's design principles. Beyond mere reproduction, the visual algorithm provides a fertile ground for design analysis and variation. A specific example is the parametric control over the orillon a distinctive feature of the bastioned front. Following the guidelines and drawings in de Ville's *planche 1*, the algorithm allows for the dynamic variation of the orillon's geometry. This functionality (Fig. 4) demonstrates how algorithmic modelling can move beyond simple representation to become a tool for exploring the design possibilities and variations inherent in historical architectural treatises. This approach aligns with similar research on other treatises, such as those by Sardi and Guarini, where parametric modelling is used to verify and interpret historical dimensions (Rechichi et al., 2024; Spallone et al., 2025).



	6	7	8	9	10	11	12
<b>EB</b>	115p, 4pi 188,26m -0,18m	90p, 4pi 147,54m -0,06m	78p, 2pi 127,34m 0,00m	71p 115,30m 0,01m	66p 107,34m -0,14m	62p, 3pi 101,68m -0,01m	60p 97,46m -0,01m
<b>FB</b>	111p, 4pi 181,85m -0,26m	85p, 4pi 139,26m 0,10m	72p, 2pi 117,64m -0,05m	64p, 2pi 104,50m 0,10m	58p, 4pi 95,64m -0,14m	53p 89,24m -3,16m	52p 84,40m 0,05m
<b>BC</b>	8p, 1pi 13,05m 0,26m	34p, 1pi 56,65m -0,10m	47p, 3pi 77,26m 0,05m	55p, 3pi 90,40m -0,10m	61p, 1pi 99,27m 0,14m	65p 105,66m -0,09m	68p 110,50m -0,05m
<b>HF=FE</b>	30p 48,72m 0,01m	30p 48,72m 0,01m	30p 48,72m 0,01m	30p 48,72m 0,01m	30p 48,72m 0,01m	30p 48,72m 0,01m	30p 48,72m 0,01m
<b>HG</b>	60p 97,44m 0,01m	69p, 1pi 112,29m 0,11m	78p, 2pi 127,31m 0,02m	87p, 4pi 142,45m 0,15m	97p 157,67m -0,12m	106p, 1pi 172,94m -0,45m	116p 188,25m 0,16m
<b>GF</b>	52p 84,40m 0,06m	62p, 2pi 101,18m 0,17m	72p, 2pi 117,64m -0,04m	82p, 2pi 133,87m -0,04m	92p, 1pi 149,96m -0,21m	101p, 4pi 165,95m 0,60m	112p 181,85m 0,06m
<b>GE</b>	82p 133,12m 0,06m	92p, 2pi 149,91m 0,17m	102p, 2pi 166,36m -0,04m	112p, 2pi 182,60m -0,04m	122p, 1pi 198,69m -0,21m	131p, 4pi 214,67m 0,60m	142p 230,57m 0,06m
<b>IG</b>	71p 115,29m 0,03m	83p 135,06m -0,25m	94p, 3pi 153,70m -0,05m	105p, 3pi 171,59m -0,07m	116p, 4pi 188,96m 0,42m	126p, 4pi 205,98m -0,03m	137p, 1pi 222,72m 0,12m
<b>IH</b>	11p 17,85m 0,02m	13p, 4pi 22,77m -0,36m	16p, 1pi 26,38m -0,07m	17p, 4pi 29,14m -0,22m	19p, 3pi 31,30m 0,54m	20p, 3pi 33,04m 0,42m	21p, 1pi 34,47m -0,03m
<b>IE=IA</b>	41p 66,56m 0,03m	40p 65,04m -0,07m	39p, 1pi 63,66m 0,01m	38p, 2pi 62,45m -0,08m	37p, 4pi 61,40m 0,00m	37p, 1pi 60,48m -0,06m	36p, 4pi 59,68m 0,09m
<b>AH</b>	52p 84,41m 0,05m	53p, 4pi 87,81m -0,43m	55p, 2pi 90,05m -0,07m	56p, 1pi 91,59m -0,31m	57p, 2pi 92,70m 0,53m	57p, 4pi 93,52m 0,36m	58p 94,14m 0,06m
<b>AE</b>	58p 94,13m 0,07m	56p, 2pi 91,98m -0,38m	55p, 2pi 90,03m -0,05m	54p, 1pi 88,32m -0,29m	53p, 2pi 86,83m -0,10m	52p, 3pi 85,53m -0,10m	52p 84,40m 0,06m
<b>AB</b>	173p, 4pi 282,40m -0,11m	147p, 1pi 239,52m -0,44m	133p, 4pi 217,37m -0,05m	125p, 1pi 203,63m -0,28m	119p, 2pi 194,17m -0,24m	115p, 1pi 187,21m -0,10m	112p 181,86m 0,05m
<b>DC</b>	7p, 4pi 12,65m 0,02m	32p, 4pi 53,57m -0,30m	45p, 3pi 74,02m 0,04m	53p 86,27m -0,19m	58p, 1pi 94,44m 0,09m	61p, 4pi 100,27m 0,11m	64p, 2pi 104,64m -0,04m
<b>AD</b>	173p, 4pi 282,38m -0,09m	147p 239,05m -0,29m	133p, 1pi 216,24m 0,10m	124p, 1pi 201,83m -0,10m	118p 191,74m -0,09m	113p, 1pi 184,22m -0,36m	109p, 4pi 178,36m -0,02m
<b>AC</b>	181p, 3pi 295,02m -0,07m	179p, 4pi 292,62m -0,59m	178p, 4pi 290,26m 0,15m	177p, 1pi 288,10m -0,29m	176p, 1pi 286,18m 0,00m	175p 284,49m -0,26m	174p, 1pi 283,00m -0,06m

From A. de Ville's table – values of magistral line elements (p = Pas géométrique; pi = Pied de Paris)  
 From algorithmic model – values obtained via geometric construction following A. de Ville  
 Difference – table value (converted to metric units) minus algorithmic model value

Tab. 3- Values of magistral line elements according to A. de Ville's system (elaboration by F. Natta)

The foundational algorithmic model, which is independent of orillon variations, is fully functional for any base polygon ranging from a hexagon to a dodecagon (Fig. 5). It systematically divides the fortification into its constituent parts, reflecting the meticulous detail found in de Ville's treatise. This includes the individual 'parametrization' of

elements such as the counterforts and the vaulted corridor, as explicitly depicted in de Ville's *planche 13* and meticulously integrated into our algorithm. This modular approach ensures that each component can be studied and analyzed individually, providing an unprecedented level of detail in the digital reconstruction.

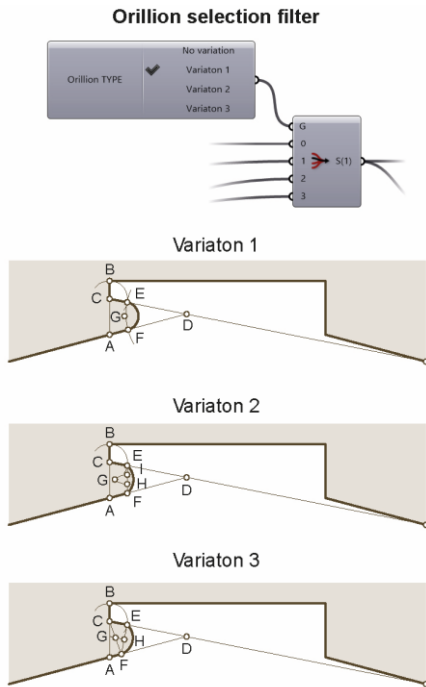


Fig. 4- Orillion variation and visual algorithm control nodes (graphic elaboration by F. Natta)

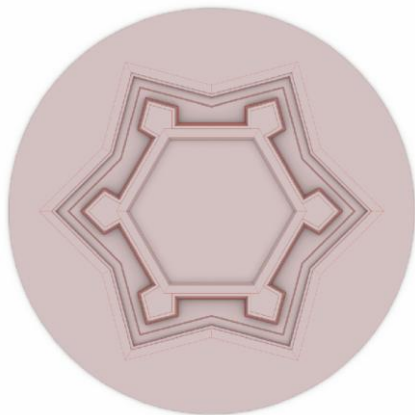


Fig. 5- Parametric model of A. de Ville's fortification system (graphic elaboration by F. Natta)

### 5. Algorithmic Modelling of De Ville's Fortifications

The culmination of the algorithmic modelling process is the export of the generated data into a Building Information Modelling (BIM)

environment. This step is a crucial transition from purely geometric representation to a semantically enriched, information-based model. BIM provides the framework for organizing and classifying the digital assets, transforming historical plans into a modern, usable database. The models are exported with a clear hierarchical structure, primarily divided into two main families: 'Base Wall' and 'Topographic Solids'. The 'Base Wall' family is a comprehensive collection of all masonry components, including the main curtain wall, the cordon, the parapet, the patrol path, the counterforts, and the 'void' that represents the vaulted corridor. The 'Topographic Solids' family, on the other hand, comprises all the earthworks and stone foundations, such as the glacis and other ground-level elements. This division facilitates the management and analysis of the different material and structural components of the fortification (Fig. 6) (Rechichi et al., 2024; Spallone et al., 2025).

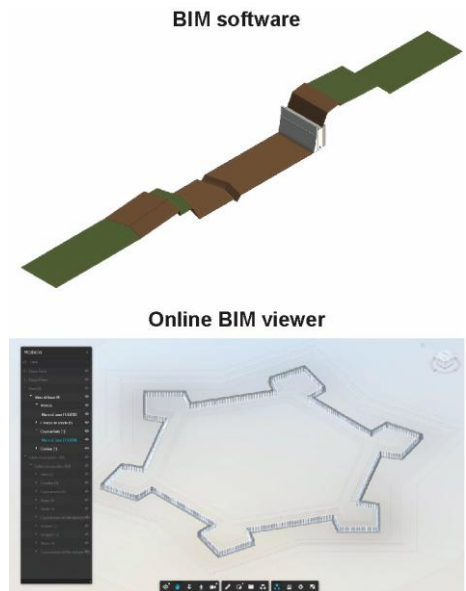


Fig. 6- BIM section (extract from Revit) and BIM viewer interface (extract from BIMViewer) of de Ville's model (graphic elaboration by F. Natta)

The final and arguably most impactful potential of this research is the export of the model to a web-based BIM application (Rechichi et al. 2025). This functionality allows for the online consultation of the model (Fig. 6), democratizing access to the rich historical content. By creating an interactive, web-based platform, this project makes it possible for a

global audience to explore de Ville's fortifications in a 3D environment, gaining a deeper understanding of the design principles and construction techniques of the 17<sup>th</sup> century. This digital dialogue between historical sources and modern technology not only preserves cultural heritage but also transforms it into a dynamic, educational, and research-oriented tool.

## 6. Conclusions

De Ville's graphic and tabular approach set a standard for technical presentation of fortification design in the early 17<sup>th</sup> century. Data provided in the treatise can act as a solid base for three-dimensional verification of numerical values defined by *supputation* and by graphical and textual analysis of the book and its illustrations.

This work benefits from the scientific approach defined in previous studies and continues with the validation and verification of the scalability of the method of model implementation through parametric modelling and information enrichment through BIM.

The method is under development by the research group of the broader PRIN project, and sheds light on possible future developments in relation to the efficient interoperability between the two systems.

## Acknowledgement and credits

The study is part of the activities of the PRIN 2022 project INFORTREAT. Reconstructing the Early Modern bastioned front. Information models for the fruition of constructive knowledge in FORTified architecture TREATises (16th-18th Century), CUP I53D23005420006, funded by the European Union – Next Generation EU, A.I.: R. Spallone, Politecnico di Torino.

This contribution, whose authors shared the methodological framework, was written by M. Pavignano (par. 2-3), F. Natta (par. 4-5), R. Spallone (par. 1). Par. 6 was written by all the authors.

Fig. 1 is courtesy of Biblioteca Reale di Torino, all rights reserved.

## References

- de Ville, A. (1628) *Les fortifications du chevalier Antoine de Ville*. Lyon, Scipion Iasserme-I. Barlet.
- Martini, A. (1883) *Manuale di metrologia*. Torino, Loescher.
- Mišić, S. & Obradović, M. (2025) Geometry of bastion fortifications magistral line: influences and development. *npj Heritage Science*, 13(12).
- Pavignano, M. & Spallone, R. (2025) Antoine de Ville and the 'supputation' of the regular fortress (1628). In: Zerlenga, O. & Cirillo, V. (eds.) *Defensive Architecture of the Mediterranean*. Vol. XX, 10-12 aprile 2025, Caserta. Caserta - Valencia, DADI\_PRESS, edUPV (Universitat Politècnica de València), pp. 245–252.
- Pernot, J.-F. (1987) La guerre et l'infrastructure de l'État moderne: Antoine de Ville, ingénieur du Roi (1596?-1656?), la pensée d'un technicien au service de la mobilisation totale du royaume. *Revue d'Histoire Moderne & Contemporaine*, 34(3), 404–426.
- Rechichi, P., Miele, V. & Bevilacqua, M. G. (2024) Modelli informativi digitali di architettura militare della prima età moderna. Il caso del Corno Dogale di Pietro Sardi. In: Bergamo, F., Calandriello, A., Ciammaichella, M., Friso, I., Gay, F., Liva, G. & Monteleone, C. (eds.) *Misura / Dismisura | Measure / Out of Measure*. Milano, Franco Angeli, pp. 3603–3626.
- Rechichi, P., Miele, V. & Bevilacqua, M. G. (2025) Digital dialogues between Military Architecture Treatises. The case of "Le Fortificazioni..." by Bonaiuto Lorini and "La Fortificazione guardia difesa et espugnatione delle fortezze..." by Francesco Tensini. In: Zerlenga, O. & Cirillo, V. (eds.) *Defensive Architecture of the Mediterranean*. Vol. XX, 10-12 aprile 2025, Caserta. Caserta - Valencia, DADI\_PRESS, edUPV (Universitat Politècnica de València), pp. 1165–1172.
- Spallone, R. & Vitali, M. (2024) "Prima daremo le regole universali, indi le misure particolari". Geometry, ballistics, and construction for fortresses' design in Guarini's *Trattato di Fortificatione*. In: Bergamo, F., (eds.) *Misura / Dismisura | Measure / Out of Measure*. Milano, FrancoAngeli, pp. 621–642.
- Spallone, R., Vitali, M., Natta, F. & Pupi, E. (2025) Parametric variations of the "delineationi seconde delle fortezze, e dell'ortografia loro", from the *Trattato di Fortificatione* by Guarini. In: Zerlenga, O. & Cirillo, V. (eds.) *Defensive Architecture of the Mediterranean*, Vol. XX, 10-12 aprile 2025, Caserta. Caserta - Valencia, DADI\_PRESS, edUPV (Universitat Politècnica de València), pp. 1213–1220.