

STRENGTHENING THE CONZENIAN METHOD OF MORPHOLOGICAL REGIONALIZATION

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Dissertation for obtaining the degree of
DOCTOR IN SPATIAL PLANNING

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MARCH 2022

DOCTORAL PROGRAM IN SPATIAL PLANNING

DOCTORAL PROGRAM IN SPATIAL PLANNING 2021/2022

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To my family and my brother Kutbizade,

And, in remembrance of Jeremy William Richard Whitehand.

ACKNOWLEDGMENT

My deepest thanks are, without doubt, to my excellent supervisor Professor Vitor Oliveira. He is much more than a supervisor. First, I am indebted to him for teaching me what ‘urban morphology’ exactly is. I am profoundly thankful for his dedication and friendly supervision during my research. My sincere and heartfelt gratitude and appreciation for providing me with the guidance and counsel I need to succeed in my PhD research. His critical comments, insightful suggestions, and constant encouragement have been invaluable to my research. I am grateful to him for his extraordinary support in my personal and professional life.

I present my thanks to Jeremy Whitehand, Peter Larkham, Kai Gu, Heather Barrett, and Jian Zhang for their valuable responses to my questionnaire on their work on morphological regionalization. They have made great contributions in clarifying the various terms related to the concept of morphological region.

I want to express my gratitude to my friend Sergio García-Pérez for helping me obtaining data on Antequera, and for his help in the next steps of the thesis. I would like to express many thanks to my friend Hüseyin Aslan for his help to collect material about Istanbul. I present my deepest thanks to my friend Silvia Spolaor for her great help. And, many thanks to the members of CITTA’s urban morphology group for their contributions to my research, including their constructive comments and questions.

RESUMO

Esta tese é sobre o conceito de região morfológica e o método de regionalização morfológica, propostos por M.R.G Conzen na segunda metade do século XX. A primeira parte da investigação apresenta uma revisão das regionalizações anteriores, identificando as suas principais fragilidades, incluindo a fraca relação entre cada regionalização e o corpo de conhecimento histórico-geográfico, a utilização pouco clara da linguagem e da terminologia o que dificulta a construção partilhada de uma metodologia mais robusta, e a indefinição de opções de procedimentos e etapas (incluindo a preparação de mapas de regiões, intermédios e finais).

A segunda parte da investigação centra-se na concepção da metodologia e na sua aplicação em dois estudos de caso, Istambul e Antequera (este estudo de caso foi previamente regionalizado e foram encontradas algumas fragilidades metodológicas, o que o torna numa excelente oportunidade para demonstrar a robustez do metodologia proposta). A metodologia baseia-se em dez critérios fundamentais que têm por base os três complexos de forma – o plano de cidade, o tecido edificado e a utilização do solo e do edificado. A metodologia é aplicada nos centros históricos destas duas cidades na Turquia e em Espanha, descrevendo e explicando o carácter das paisagens urbanas, com base numa hierarquia de quatro ordens de regiões.

O trabalho é concluído enfatizando a tese de que é possível desenhar uma metodologia de regionalização morfológica que possa superar as principais dificuldades de regionalizações anteriores, oferecendo uma descrição e explicação mais rigorosa da estrutura histórico-geográfica da paisagem urbana. Espera-se que isto também possa informar a prescrição de diretrizes para a conservação e transformação das formas urbanas.

PALAVRAS-CHAVE: forma urbana, morfologia urbana, abordagem histórico-geográfica, MRG Conzen, regiões morfológicas.

Abstract

This thesis is about strengthening the concept of morphological region, and the method of morphological regionalization, proposed by M.R.G Conzen in the second half of the 20th century. The first part of the research offers a review of previous regionalizations, identifying their main weaknesses, including the fragile linkage between each regionalization and the historico-geographical body of knowledge, the unclear use of language and terminology making difficult the shared construction of a more robust methodology, and the undefinition of procedural options and steps (including the preparation of intermediate and final maps of regions).

The second part of the investigation focuses on the design of the methodology and its application into two case studies, Istanbul and Antequera (this case study has been previously regionalized and some methodological weaknesses have been found, making it an excellent opportunity to demonstrate the robustness of the proposed methodology). The methodology draws on ten fundamental criteria based on the three form complexes, the town-plan, building fabric, and land and building utilization. The methodology is applied into the historical centres of these two cities in Turkey and Spain, describing and explaining the character of the urban landscapes, based on a four-tier hierarchy of regions.

The work is concluded emphasizing the thesis that it is possible to design a methodology of morphological regionalization that can overcome the main difficulties of previous regionalizations, offering a more rigorous description and explanation of the historico-geographical structure of the urban landscape. It is expected that this can also inform the prescription of guidelines for the conservation and transformation of urban forms.

KEYWORDS: urban form, urban morphology, historico-geographical approach, MRG Conzen, morphological regions.

CONTENTS

ACKNOWLEDGMENT	iv
RESUMO	v
ABSTRACT	vii
LIST OF FIGURES	xiii
LIST OF TABLES	xvii
LIST OF ABBREVIATIONS	xix

CHAPTER 1: INTRODUCTION	1
1.1. MOTIVATION	1
1.2. RESEARCH GOAL AND OBJECTIVES	1
1.3. STRUCTURE OF THE THESIS	2
1.4. RESEARCH PROCEDURES	3

CHAPTER 2: LITERATURE REVIEW	5
2.1. URBAN MORPHOLOGY	5
2.1.1. THE ELEMENTS OF URBAN FORM	7
2.1.2. AGENTS AND AGENCIES OF CHANGE	8
2.1.3. THE RELEVANCE OF URBAN MORPHOLOGY	9
Urban morphology and planning, urban design and architecture	10
Urban morphology and conservation	11
2.1.4. DIFFERENT APPROACHES TO URBAN MORPHOLOGY	11
Historico-Geographical Approach	12
Process Typological Approach	12
Space Syntax	13
Spatial Analytical Approach	14
2.2. HISTORICO-GEOGRAPHICAL APPROACH	15
2.2.1. THE ANTECEDENTS OF MRG CONZEN	15
2.2.2. MRG CONZEN AND HIS IDEAS	16
2.2.3. AXIOMS AND PRINCIPLES	17
2.2.4. CONZENIAN CONCEPTS AND TERMINOLOGY	18
Fringe Belt	18

Burgage Cycle	19
Morphological Region.....	19
Form Complexes	19
Morphological Frame.....	20
Fixation Line	20
Morphological period	20
Morphotope	21
2.3. MORPHOLOGICAL REGION	21
2.3.1. THE ROOTS OF MORPHOLOGICAL REGIONALIZATION	21
2.3.2. MRG CONZEN’S CONTRIBUTIONS.....	22
2.3.3. VARIOUS TERMS OF MORPHOLOGICAL REGIONS	22
2.3.4. THE NOTION OF HIERARCHY.....	24
2.4. APPLICATIONS OF THE CONCEPT	24
2.4.1. BRITAIN.....	25
2.4.2. ELSEWHERE IN EUROPE.....	42
2.4.3. ASIA.....	48
2.4.4. NORTH AMERICA	54
2.4.5. NORTH AFRICA	54
2.4.6. OCEANIA	56
2.4.7. SYNTHESIS.....	57
CHAPTER 3: METHODOLOGY	69
3.1. A SYSTEMATIC METHOD FOR THE IDENTIFICATION OF MORPHOLOGICAL REGIONS	69
3.2. SELECTION OF STUDY AREAS.....	72
CHAPTER 4: APPLICATION INTO ISTANBUL.....	77
4.1. DEFINITION OF THE CASE STUDY	77
4.2. INTRODUCTION TO THE URBAN ASPECTS OF ISTANBUL.....	78
4.2.1. ENVIRONMENTAL ASPECTS	78
4.2.2. SOCIAL ASPECTS	79
4.2.3. ECONOMIC ASPECTS.....	80
4.2.4. TRANSPORTS	81
4.3.THE HISTORICAL FRAMEWORK AND URBAN EVOLUTION	81

4.3.1. THE CITY OF BYZANTION	86
4.3.2. ROMAN IMPERIAL	87
4.3.3. EAST ROMAN IMPERIAL	89
4.3.4. MEDIEVAL BYZANTINE	90
4.3.5. OTTOMAN IMPERIAL	92
4.3.6. REPUBLICAN PERIOD	97
4.4. MORPHOLOGICAL REGIONALIZATION	99
4.4.1. FATIH DISTRICT - FIRST ORDER	99
4.4.1.1. Material: historical maps and streets geometry	99
4.4.1.2. Morphological regions: first-order	109
4.4.2. PANTOKRATOR-PORTA PUTEAE - SECOND ORDER	113
4.4.2.1. Material: plot layout and land and building utilization	113
4.4.2.2. Morphological regions: second-order	122
4.4.3. PANTOKRATOR-PORTA PUTEAE - THIRD ORDER	125
4.4.3.1. Material: plot layout, building coverage, architectural style, land and building utilization	125
4.4.3.2. Morphological regions: third-order	129
4.4.4. PANTOKRATOR-PORTA PUTEAE - FOURTH ORDER	134
4.4.4.1. Material: building material and height	134
4.4.4.2. Morphological regions: fourth-order	139
4.4.5. SYNTHESIS	144
CHAPTER 5: APPLICATION INTO ANTEQUERA	147
5.1. DEFINITION OF THE CASE STUDY	147
5.2. INTRODUCTION TO THE URBAN ASPECTS OF ANTEQUERA	148
5.2.1. ENVIRONMENTAL ASPECTS	148
5.2.2. SOCIAL ASPECTS	148
5.2.3. ECONOMIC ASPECTS	149
5.2.4. TRANSPORTS	149
5.3. THE HISTORICAL FRAMEWORK AND URBAN EVOLUTION	150
5.3.1. PREHISTORIC, PRE-ROMAN AND ROMAN OCCUPATION	150
5.3.2. EVOLUTION OF THE SETTLEMENT IN THE URBAN AREA OF ANTEQUERA	151
The Period until the End of the Romanization	151
Medieval Period: Antikaria and Madina Antikaria	154
The Period until 18 th Century	156

The Period from the 18 th to 20 th Century	157
5.4. MORPHOLOGICAL REGIONALIZATION	158
5.4.1. HISTORICAL CENTRE - FIRST ORDER	159
5.4.1.1. Material: expansion phases and streets geometry	159
5.4.1.2. Morphological regions: first-order	163
5.4.2. CALLE INFANTE - SECOND ORDER	167
5.4.2.1. Material: plot layout, block-plan type, and land and building utilization	167
5.4.2.2. Morphological regions: second-order	173
5.4.3. CALLE INFANTE - THIRD ORDER	176
5.4.3.1. Material: architectural style, land and building utilization	176
5.4.3.2. Morphological regions: third-order	178
5.4.4. CALLE INFANTE - FOURTH ORDER	180
5.4.4.1. Material: building material and height	180
5.4.4.2. Morphological regions: fourth-order	184
5.4.5. SYNTHESIS	186
CHAPTER 6: DISCUSSION OF RESULTS	189
6.1 COMPARISON OF THE APPLICATIONS INTO ISTANBUL AND ANTEQUERA	189
6.2 COMPARISON OF THE TWO APPLICATIONS INTO ANTEQUERA	192
6.3 CONTRIBUTION TO DEBATE	195
CHAPTER 7: CONCLUSIONS	199
REFERENCES	203
ANNEX	213

LIST OF FIGURES

Figure 1.1 The structure of the thesis.....	2
Figure 2.1 General outline for the field of urban morphology	6
Figure 2.2 Types of plan units of Alnwick.....	25
Figure 2.3 The plan divisions of Alnwick.....	26
Figure 2.4 The specific hierarchical divisions of Alnwick	26
Figure 2.5 Morphological regions of Ludlow	27
Figure 2.6 Ludlow Old Town, morphological regions.....	29
Figure 2.7 Townscape units in part of east-central Amersham.....	30
Figure 2.8 Hierarchy of morphological regions in parts of English suburbs of Barnt Green, Edgbaston and Northwood.....	31
Figure 2.9 The character areas of Barnt Green, Birmingham, England in 2005.....	32
Figure 2.10 The plan units of intra-mural medieval Worcester	32
Figure 2.11 Urban landscape units, Birmingham.....	34
Figure 2.12 Urban landscape units, Bristol	35
Figure 2.13 Urban landscape units, Bromsgrove	38
Figure 2.13 (continued) Urban landscape units, Bromsgrove	39
Figure 2.14 The Edgware 500m x 500m study area.....	40
Figure 2.15 The Docklands 500 m x 500 m study area.....	40
Figure 2.16 Character areas in south-west Stratford-upon-Avon.....	41
Figure 2.17 Part of a proposed zoning plan for the centre of Mennecy	42
Figure 2.18 Homogeneous areas of Antequera defined in the Special Plan	43
Figure 2.19 Urban landscape units, Alkmaar, Netherlands.....	44
Figure 2.20 Plan-unit boundaries in central Sibiu, Romania in 1999	45
Figure 2.21 A. First- and second-order urban landscape unit, B. First-, second- and third-order urban landscape units (in north-east) in Upplands Väsby, Sweden in 2008	46
Figure 2.22 The morphological regions of <i>Rua de Costa Cabral</i>	47
Figure 2.23 Morphogenetic plan type areas of the SNSA (A), and of the SYSA (B) in Shanghai.....	48
Figure 2.24 Principal plan components of the ancient city of Pingyao, in 2006.....	49
Figure 2.25 Urban landscape units in the Zhishanmen area, Beijing in 2006.....	50
Figure 2.26 Urban landscape units in Guangzhou. A. Hualinsi area; B. Tongfu Xilu area	51
Figure 2.27 Plan units in part of central Guangzhou in 2011.....	52
Figure 2.28 A. Morphological regions and plan units of Zuoying, B. Morphotopes of Zuoying	53

Figure 2.29 A. First and second-order urban landscape units; B. first, second and third-order urban landscape units (in north-west), Lantzville, Vancouver Island, Canada, in 2005.....	54
Figure 2.30 Form complexes and morphological regions in Cairo	55
Figure 2.31 Urban landscape units of Auckland's CBD	56
Figure 3.1 The location of Istanbul	73
Figure 3.2 The location of Antequera	74
Figure 4.1 Study area within Fatih district (left), Pantokrator-Porta Puteae region (right).....	77
Figure 4.2 Location of Istanbul within Turkey	78
Figure 4.3 Development of Istanbul (updated from Kuban, 2010)	82
Figure 4.4 The Golden Horn in 19th Century in Melling's drawings	84
Figure 4.5 The Location of the Historical Peninsula.....	85
Figure 4.6 The view from the city walls at the end of the 19 th century	85
Figure 4.7 Approximate boundaries of Byzantion	86
Figure 4.8 The map shows main arterials and places of Constantinople	88
Figure 4.9 Theodosian walls	89
Figure 4.10 Valens Aqueduct in the 20 th century	90
Figure 4.11 Constantinople in the Medieval Byzantine period, in 1422 by Tinney	91
Figure 4.12 A view of the Hippodrome and its surroundings, drawing by Coignard	92
Figure 4.13 Miniature of Istabul by Matrakçı Nasuh in 1533.....	93
Figure 4.14 <i>Topkapı</i> Palace gravure by Jean Babtiste Hilair in 1782	94
Figure 4.15 Timber houses with bay window	95
Figure 4.16 Fires at the end of 19th century.....	96
Figure 4.17. An earliest Gecekondu neighbourhoods of Istanbul, Gültepe in the 1970s	97
Figure 4.18 Skyscrapers developed in late 20 th century in Maslak	98
Figure 4.19 Kauffer map (1776)	100
Figure 4.20 A part of the Mühendishane map (1845)	101
Figure 4.21. A part of Ekrem Hakkı Ayverdi map (related parts of the map)	101
Figure 4.22 Goad's map (1904), key map (left), and a detailed part of the map (right)	102
Figure 4.23 German map (1913-1914).....	103
Figure 4.24 Necip Bey map (1914-1918).....	103
Figure 4.25 Müller-Wiener map (1922).....	104
Figure 4.26 Pervititch map (1929), key map (left), and a detailed part of the map (right)	105
Figure 4.27 Aerial photo of 1946	105
Figure 4.28 Satellite image of the study area, Istanbul	106

Figure 4.29 Age of streets	107
Figure 4.30 Age of streets (regions).....	108
Figure 4.31 Streets geometry	109
Figure 4.32 First-order of morphological regions based on town-plan (streets) in Istanbul	111
Figure 4.33 Plot area	114
Figure 4.34 Plot width.....	115
Figure 4.35 Plot depth.....	116
Figure 4.36 Land and building utilization	117
Figure 4.36 Land and building utilization (continued).....	118
Figure 4.37 General land and building utilization.....	119
Figure 4.38 Buildings with different uses: (1) and (2) are commercial, (3) and (4) are educational, (5) and (6) (Photographs by the author).....	120
Figure 4.38 Buildings with different uses (continued): (7) and (8) are religious; (9), (10), (11) and (12) are housing (Photographs by the author).....	121
Figure 4.39 Second-order morphological regions.....	123
Figure 4.40 Building coverage	126
Figure 4.41 Architectural style.....	127
Figure 4.42 Buildings with distinctive architectural style: (1) and (2) are traditional houses with bay window, (3) and (4) are single family houses, (5) and (6) are new houses with bay window, (7) and (8) are modern houses (Photographs by the author)	128
Figure 4.43 Third-order morphological regions of Istanbul.....	130
Figure 4.44 Building material	135
Figure 4.45 Buildings with different materials: (1) and (2) are made of concrete, (3) and (4) of timber, (5) and (6) of masonry, and (7) of stone (Photographs by the author).....	136
Figure 4.46 Building height	137
Figure 4.47 Buildings with different height (Photographs by the author)	138
Figure 4.48 Fourth-order morphological regions of Istanbul.....	140
Figure 5.1 Antequera case study (left), Calle Infante region (right)	147
Figure 5.2 Landscape of the Antequera Castle (Photograph by Mehling in 2014).....	150
Figure 5.3 Dolmens site of Antequera	152
Figure 5.4 Dolmens of El Romeral, Menga and Viera, Cerro de Marimacho (the hill of Antequera)	152
Figure 5.5 Dolmen of Menga	153
Figure 5.6 Dolmen of Viera	153
Figure 5.7 Roman period of Antequera.....	154
Figure 5.8 The Islamic period of Antequera	155

Figure 5.9 Urban enclosure until 18 th century	157
Figure 5.10 Urban enclosure 18 th and 20 th centuries	158
Figure 5.11 The study area in Antequera	159
Figure 5.12 The Castle of Antequera	160
Figure 5.13 Expansion phases of Antequera, from Romans onwards.....	160
Figure 5.14 A view from the west part of 20 th century built form (1940-1980)	161
Figure 5.15 A view from the west part of the building fabric in the last phase of growth (1980 onwards)	161
Figure 5.16 A view from the north part of the building fabric in the last phase of growth (1980 onwards)	162
Figure 5.17 Streets geometry	163
Figure 5.18 First-order morphological regions	164
Figure 5.19 Plot area	168
Figure 5.20 Plot width.....	168
Figure 5.21 Plot depth	169
Figure 5.22 Regions for plot layout	169
Figure 5.23 Building block-plan types.....	170
Figure 5.24 Regions for building block-plan types.....	170
Figure 5.25 Land and building utilization.....	171
Figure 5.26 Regions for land and building utilization.....	171
Figure 5.27 Different block-plan types of Antequera	172
Figure 5.28 Buildings with different uses: (1) Residential, (2) Residential with commercial uses and local services, (3) Educational, and (4) Religious.....	172
Figure 5.29 Second-order morphological regions of Antequera.....	174
Figure 5.30 Architectural styles	176
Figure 5.31 Buildings with different architectural styles: (1) and (2) traditional ordinary buildings, (3) Traditional special buildings, (4) contemporary buildings, (5) 16 th – 17 th century buildings, (6) Ruins	177
Figure 5.32 Third-order morphological regions.....	178
Figure 5.33 Building material	181
Figure 5.34 Building height	181
Figure 5.35 Buildings with different materials: (1) masonry, (2) brick, (3) stone	182
Figure 5.36 Buildings with different heights.....	183
Figure 5.37 Fourth-order morphological regions of Antequera	184
Figure 6.1 First-order regions (thesis) and homogeneous areas (Barke, 2003).....	195

LIST OF TABLES

Table 2.1 German human geography 1890–1939	16
Table 2.2 Various terms by different investigators	23
Table 2.3. The systematic form complexes as morphological regulators in the old town of Ludlow...	28
Table 2.4. The systematic form complexes as morphological regulators in central Birmingham	36
Table 2.5 The systematic form complexes as morphological regulators in central Bristol.....	37
Table 2.6 Applications of the concept (or variations of the concept) of morphological region in Britain	59
Table 2.7. Applications of the concept (or variations of the concept) of morphological region Elsewhere in Europe	63
Table 2.8. Applications of the concept (or variations of the concept) of morphological region in Asia	65
Table 2.9. Applications of the concept (or variations of the concept) of morphological region in North America	67
Table 2.10 Applications of the concept (or variations of the concept) of morphological region in North Africa.....	68
Table 2.11. Applications of the concept (or variations of the concept) of morphological region in Oceania.....	68
Table 3.1 The procedural aspects for the design of the methodology	70
Table 4.1 Population, annual growth rate of population, size of households, and dependency ratio....	79
Table 4.2 in-migration, out-migration, net migration and rate of net migration	80
Table 4.3. Labour force and price level indices for consumption expenditures statistics	81
Table 4.4 Development stages of istanbul (based on kuban, 2010; müller-wiener, 2001)	82
Table 4.5 Historical maps of Istanbul	99
Table 4.6 Characteristics of first-order regions.....	112
Table 4.7 The contribution of age of streets and streets geometry to the hierarchy.....	112
Table 4.8 Contribution of criteria (plot layout, land and building utilization).....	122
Table 4.9 Characteristics of second-order morphological regions	124
Table 4.10 Contribution of criteria (building coverage, land and building utilization plot layout, architectural style).....	129
Table 4.11 Characteristics of third-order morphological regions of Istanbul	131
Table 4.12 Contribution of criteria (building material and height)	139
Table 4.13 Characteristics of fourth-order morphological regions	141
Table 4.14 Procedural aspects of the method for the application of Istanbul	144
Table 5.1 The evolution of population (men, women and the total) over the time	149

Table 5.2 Characteristics of first-order regions.....	166
Table 5.3 Contribution of expansion phase and streets geometry to the hierarchy.....	167
Table 5.4 Characteristics of second-order morphological regions of Antequera.....	175
Table 5.5 Contribution of criteria (plot layout, building block-plan type, land and building utilization)	175
Table 5.6 Contribution of criteria (land and building utilization and architectural style).....	179
Table 5.7 Characteristics of third-order morphological regions of Antequera.....	179
Table 5.7 Characteristics of third-order morphological regions of Antequera (continued).....	180
Table 5.8 Contribution of criteria building material and height.....	185
Table 5.9 Characteristics of fourth-order morphological regions	185
Table 5.10 Procedural aspects of the method for application to Antequera.....	187
Table 6.1 Procedural aspects of the method for the application of Istanbul and Antequera	192
Table 6.2 Differences and similarities between the two applications to Antequerra	194
Table 6.3 Distinctions between the proposed methodology and other methods for identifying morphological regions.....	198

LIST OF ABBREVIATIONS

ABM: Agent-Based Models

BMCP: Beijing Municipal City Planning Commission

CA: Cellular Automata

CBD: Central Business District

CISPUT: Centro Internazionale per lo Studio dei Processi Urbani e Territoriali (International Centre for the Study of Urban and Regional Evolution)

FCTUC: Faculdade de Ciências e Tecnologia da Universidade de Coimbra (Faculty of Sciences and Technology of the University of Coimbra)

FEUP: Faculdade de Engenharia da Universidade do Porto (Faculty of Engineering of the University of Porto)

GIS: Geographic Information Systems

IBB: İstanbul Büyükşehir Belediyesi (Istanbul Metropolitan Municipality)

IFB: Inner Fringe Belt

INE: Instituto Nacional de Estadística (Statistics National Institute)

ISUF: International Seminar on Urban Form

LUBFS: Centre for Land Use and Built Form Studies

MFB: Middle Fringe Belt

OFB: Outer Fringe Belt

SNSA: Sinan Study Area

SYSA: Shanyin Study Area

UCL: University College London

1

CHAPTER 1: INTRODUCTION

1.1. MOTIVATION

A city, or town, is a densely populated area comprising mostly man-made structures that contain all society's administrative, cultural, religious, and residential functions. This means that, as Conzen stated, it is the spirit of a society or the physical appearance of social reality. As such, it is very important to maintain the structural elements of its form and *genius loci*. When I have met the field of urban morphology, I have understood that this was really my passion. It still is. I have started to investigate the change of built fabric in the context of my master thesis. After my initial and basic research on urban form, Conzenian urban morphology (the work of MRG Conzen at the centre of this approach) or, in other words, the historico-geographical approach, attracted my attention. I have concentrated my study on the main concepts developed by Conzen – the 'fringe belt', the 'morphological region' and the 'burgage cycle'. Among these, the most powerful (it is also the climax of the exploration of the physical form for Conzen) is the concept of morphological region. When I have started to review the applications of the concept world-wide, I have understood that the process of identification of regions is not very explicit in most of applications. Bearing in mind the importance of the concept for this approach, and the dominant role of this approach in the field of urban morphology, I have identified it as a research gap. This gap would certainly lead to some difficulties in the implementation of the concept in planning, which is a major concern for me. In addition to this, the hierarchy of morphological regions or the contribution of each morphological constituent identified within these regions to the hierarchy was also elusive. Furthermore, a lack of systematic methodology stimulated me to develop my thesis on this subject.

1.2. RESEARCH GOAL AND OBJECTIVES

Over the last decades, the historico-geographical approach has become one of the most substantial within the field of urban morphology. The approach is based on the seminal work of M. R. G. Conzen developed from the late 1950s onwards, and it has been mainly promoted by Whitehand from the 1970s onwards (Oliveira, 2019). Within the approach, the concept of the morphological region, and the method of morphological regionalization, stands as one of the most important in recognizing the historico-geographical structure of the urban landscape. The concept of morphological region mainly provides a method for identification and delimitation of distinct areas with distinct character and identity, and for their management. While the concept has been applied in a number of studies, its use needs to be discussed and clarified in a number of aspects.

Our thesis is that it is possible to design a methodology of morphological regionalization that can overcome the main difficulties of previous regionalizations, offering a more rigorous description and explanation of the historico-geographical structure of the urban landscape.

This can be divided into three main objectives, as follows:

- i. To review and identify the main difficulties of previous morphological regionalizations (Chapter 2).
- ii. To propose a systematic methodology based on robust criteria for a rigorous delimitation of the morphological regions (Chapter 3).
- iii. To apply the methodology into different case studies; this should include selecting one case study that has been previously regionalized and where some weaknesses have been found (Chapters 4 and 5).

1.3. STRUCTURE OF THE THESIS

The thesis is in seven chapters (see Figure 1.1). The first chapter is the introduction to research. It includes a discussion on the motivation, research aim and objectives, structure of the thesis and research procedures. The second chapter is the literature review. It comprises a general outline of urban morphology, focusing then on the historico-geographical approach, the concept of morphological region and, finally, offering a review of the major applications of the concept since 1960.

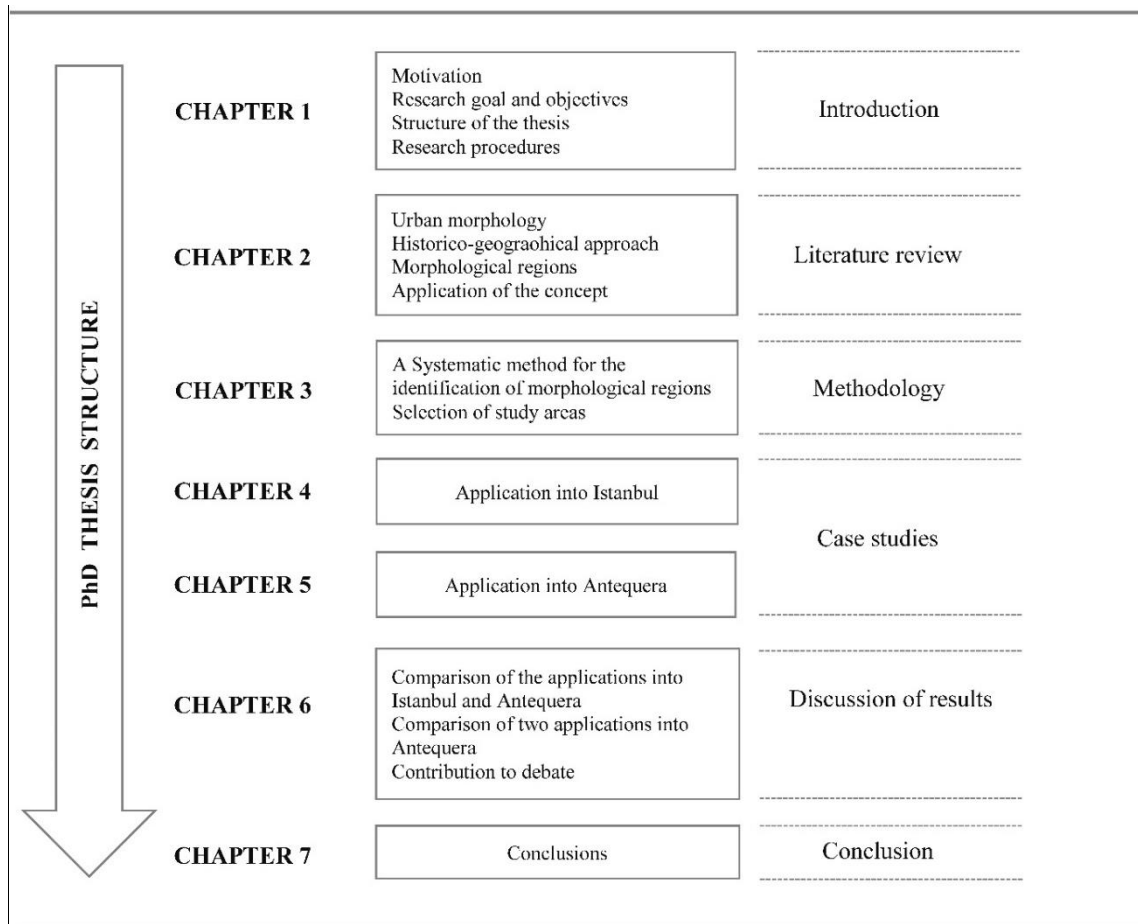


Figure 1.1 The structure of the thesis

The third chapter is the design of the methodology. It includes the definition of a systematic process for delimitation of morphological regions, and the rational for the selection of the case studies. The fourth chapter is the implementation of the methodology to the first case study, Istanbul, making evident its potential for the description and explanation of the urban landscape. The fifth chapter, very similar to the fourth in terms of structure, presents the application to the second case study, Antequera (a case study that was already explored with this concept and where some limitations have been found – the proposed methodology aims at dealing with these limitations). The sixth chapter offers a discussion of results, including the comparison of the applications to Istanbul and Antequera, the comparison of the application to Antequera with a former application of the concept to this Spanish city reported by Barke (2003), and the contribution of the proposed methodology to the international debate. The last chapter gathers the most important insights of this research work under the form of conclusions.

1.4. RESEARCH PROCEDURES

The first task of the research is the literature review. It has been concentrated on the literature of urban morphology in the scope of library surveys, databases, personal archive of my supervisor, to name the most important. We respectively focused on the studies of urban morphology, the historico-geographical approach, and the applications of the concept of morphological regions in different parts of the world. Each of these applications has been reviewed. Afterwards, a questionnaire has been prepared to bring light on the derivation process of previous applications of the concept morphological region. A set of questions has been sent to the authors of applications of the concept of morphological region. These are as follows:

- i. Which features of each form complex were used to establish the hierarchical ordering of morphological regions?
- ii. What was the weight of each form complex, and their features, in each order?
- iii. Why did you prefer the term townscape region, townscape unit, urban landscape unit, or character area to morphological region (depending on each author)? Is there any difference between the two?
- iv. How could vegetation be integrated in the criteria employed to identify morphological regions?
- v. In which conditions the boundaries of morphological regions follow streets, road centre lines or alternatively they do contain streets?
- vi. In which way did you integrate the topographic features into morphological regions?
- vii. How was the height of buildings included in the derivation process of morphological regions?
- viii. The process of morphological regions' derivation is not clear-cut to understand. Is it possible to clarify the derivation process step-by-step? Which characteristics/criteria were used to recognize the different regions and their hierarchy? (this question applies only to some authors)

This set of questions has been adapted to each study. Based on the literature review, complemented by this direct interaction with the various authors, a more comprehensive and systematic way of morphological regionalization has been proposed. The methodology is first tested in a very small area in Porto, Portugal, to validate its procedures (see Annex). Afterwards, two case studies are selected for a full implementation of the methodology. They are restricted to a size that can be covered by one single researcher. The variety of urban forms and a sound urban history have been the main concern for the selection of the case study areas – the first one is the Fatih district, called Historical Peninsula in Istanbul, Turkey. The second is historic nucleus of Andalusian city of Antequera, Spain. The selection of the second case is also due to the fact that a previous regionalization has been developed into this same area

(Barke, 2003) and some weaknesses have been found. As such, it offers an opportunity to make evident the robustness of the proposed methodology.

The empirical application of research procedures is mainly based on field surveys, compilation of historical maps, photographs and other historical evidence, as well as analysis of data obtained from local authorities. In the sequence of this process, a number of morphological analyses are carried out. In the end of the analyses, the individual intermediate maps based on the set of criteria proposed within the methodology, ranging from primary to detailed ones for each case study, are illustrated. Finally, the intermediate maps support the preparation of composite maps of morphological regions.

2

CHAPTER 2: LITERATURE REVIEW

2.1. URBAN MORPHOLOGY

A great deal has been written about the roots of the term ‘morphology’ which has been coined by Johann Wolfgang von Goethe (1749-1832), the famous German writer and scientist. Even though the term comes from a branch of biology, the general and abstract nature of morphology enabled its application in many different fields (Oliveira, 2016). The term morphology is used in geology and geography in reference to the form of natural landscapes, and in linguistics, in reference to the elements and structure of language. In each case, morphology can be considered the study of form or structure applicable to the field in question. In the context of the built environment, urban morphology means the science of urban form and structure. In its urban understanding, morphology is usually interpreted as an analytic activity – the study of the existing urban form or urban fabric (Marshall & Çaliskan, 2011). The study of urban form, frequently referred to as urban morphology, is characterized by several perspectives. It is hard to find shared definitions, by different morphological approaches, of ‘urban morphology’ and of ‘urban form’ (Oliveira, 2016).

Urban morphology is the study of the city as human habitat (Moudon, 1997). According to Kropf (2017), urban morphology is the study of human settlements, their structure and the process of their formation and transformation. It is a wide-ranging interdisciplinary field and includes specialists contributing both to academic research and professional practice on the built environment. It investigates the form and structure of cities, towns and villages, the way that they grow and change and their characteristics as human habitats. Urban morphology provides concepts and tools that reflect the different aspects and elements of urban form, the relations between them and the agents of change. The aim of urban morphological research is to contribute to an understanding of the built environment as a complex physical object, a cultural artefact and quasi-natural phenomenon similar to language (Kropf, 2017). Oliveira (2016) defines urban morphology as a science that studies the physical form of cities, as well as the main agents and processes shaping it over time. Larkham (2005) defines urban morphology as an approach for conceptualising the complexity of physical form; for understanding the physical complexity at various scales, from individual buildings, plots, street blocks, and the street patterns that make up the structure of towns, to understand the ways in which towns have grown and developed.

Figure 2.1 offers a synthesis of different aspects of urban morphology. It takes into consideration the main elements of urban form, the agents shaping urban form, the main approaches to urban morphology, the relevance of the field, and the key researchers, centres and networks of urban morphology.

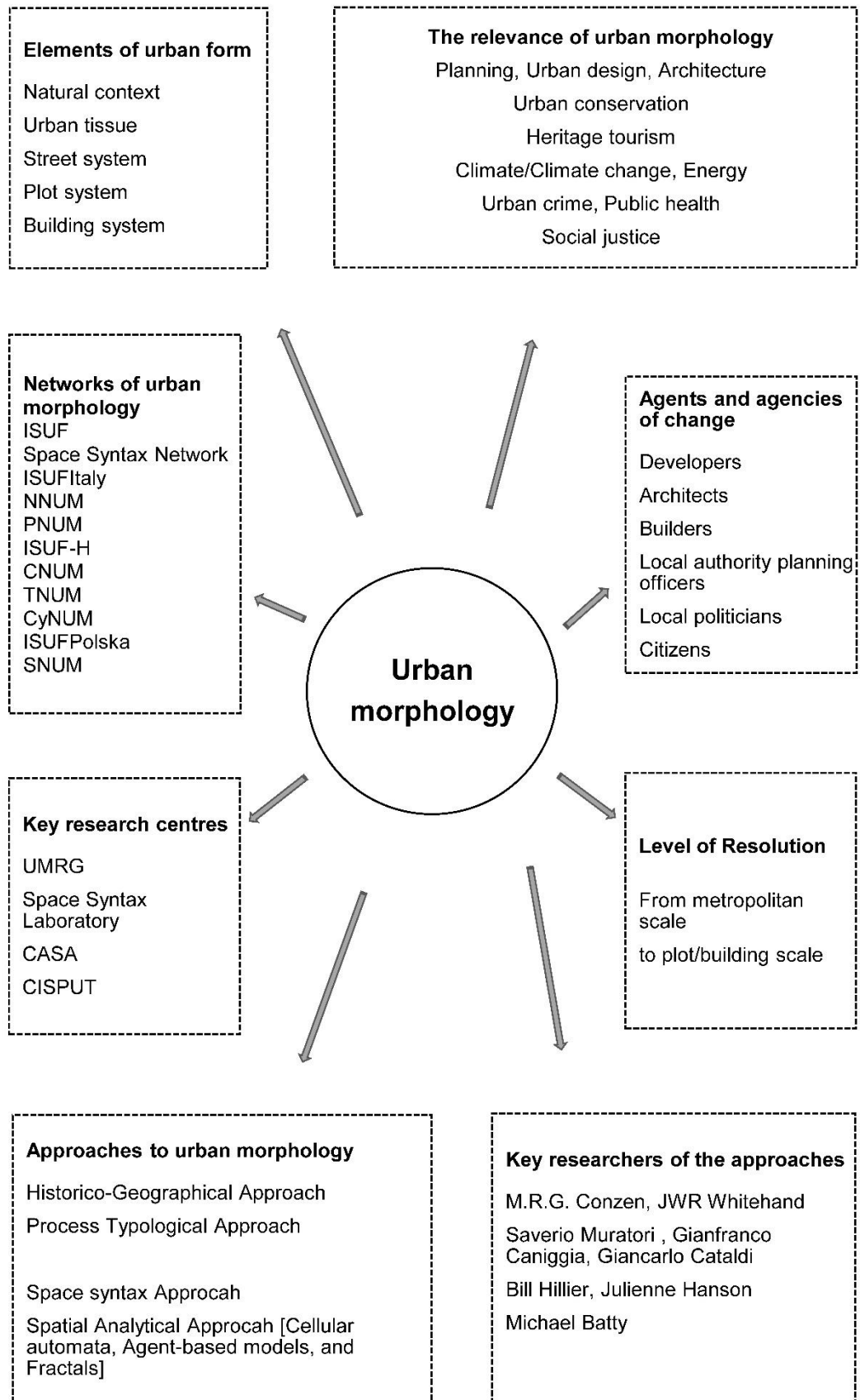


Figure 2.1 General outline for the field of urban morphology (Based on Oliveira, 2016 and Kropf, 2017)

2.1.1. THE ELEMENTS OF URBAN FORM

The elements of urban form which constitute our cities are explained in an order of increasing resolution. These are respectively the natural context as the fundamental element of built environment, urban tissue that can be differentiated from different level of resolution as an organic whole, the street system as a skeleton the urban area, the plot system arranged into street blocks, and the building system.

A city results from the transformation of the natural environment, and it is the product of a human response to specific conditions in a particular place. Understanding those conditions provides a deeper understanding of urban form (Kropf, 2017). The natural context is the first condition for the establishment and organization of the different elements of urban form. The land relief, the quality and suitability of soil and subsoil, the climate, the solar and wind exposure, the type of natural landscape - all these factors influence the location and the form of settlements (Oliveira, 2016). The principal elements of the natural environment identified by Kropf (2017) are geology, minerals and soils, landform (topography), water features with groundwater, and plant and animal communities. Particularly, topography is one the most important elements of urban landscape, and it is employed by Gu (2010) in the identification of plan units in central Auckland, New Zealand.

Kropf, strongly influenced by the Italian tradition (Oliveira, 2016), defines urban tissue as an organic whole that can be seen at different levels of resolution. The different levels correspond to the different primary elements such as materials; structures, such as walls or roofs (encompassing details of construction); rooms or spaces; buildings; plots; streets and blocks (or plot series); and urban tissue. A low level includes only streets and street blocks and a high level includes building materials (Kropf, 1996). The urban tissue is the principal constituent or unit of urban growth and transformation (Kropf, 2017). The notion of urban tissue is fundamental in urban morphological analysis. It is also the key to realizing the principles of typo-morphology within a system of form-based zoning. As a tool in analysis and explanation, it helps to understand both the physical structure and historical development of urban areas and the relation between urban areas and individual buildings (Kropf, 1996, 2017). Kropf proposed a synthesis of Conzen's and Caniggia's works providing the basis for the idea of urban tissue to be applied in zoning. This combination emerges from Conzen's ideas of plan unit and building fabric, and Caniggia's urban tissue (Kropf, 1993, 1996). In general, all cities and their tissues are constituted by a set of elements of urban form - streets, street blocks, plots and buildings which are combined in a specific way and originating different types of tissues. Some of these tissues are clearly identifiable and are able to offer their cities a unique character (Oliveira, 2016).

Streets are the public and democratic spaces of the city, the places where we all met, with all our differences, and where we all interact in social terms (Oliveira, 2016). The term street refers to the open space bounded by street-lines and reserved for the use of surface traffic of whatever kind. The arrangement of these contiguous and interdependent spaces within an urban area, when viewed separately from the other elements of the town-plan, may be called the street system (Conzen, 1960).

Streets serve many purposes besides carrying vehicles and pedestrians (Neal, 2003). Their sizes and arrangements afford or deny light and shade. And, they are places of social and commercial encounter and exchange. The street is movement; to pass, to watch - movement especially of people. A street is also a political space. Street and street block patterns reflect differences among cities beyond those of scale, complexity, available choices, and the nature of spaces. They relate to the time period of their formation, to geography, to different cultures, to city functions and purposes, to design or political philosophies, and to technological demands (Jacobs, 1993).

In morphological terms, and in a time perspective, streets are the most resistant element to change. There is a wide variety of streets, with different shapes and sizes, with different ways of relating with the other streets in the surroundings, and also with different urban functions. Streets are influenced by the buildings and all their arrangements such as by their height and by the relation between their height and

the width of the street, by the way buildings are located in plots or by the ‘doors’ that these buildings open to the street (Oliveira, 2016).

The plot system of a city is one of the most important elements of urban form, separating the public domain and the private domain, or the different private domains. Each plot is essentially a unit of land use. It is physically defined by boundaries on, or above, the ground. The arrangement of contiguous plots is evident from the plot boundaries and, when considered separately from other elements of the town-plan, it may be called the plot pattern or plot system (Conzen, 1960).

Plots or plot series have considerable resistance to change. They can be identified in terms of their relationship with the street, the orientation of plot in relation to the orientation of the street, and position, shape, dimensions and proportions of the plot. The street block which consists of one plot or can be divided into plot series is an important element of urban form in terms of its dimensions. Generally speaking, the dimension of street blocks increases from historical centres outwards (Siksna, 1997; Oliveira, 2016).

Buildings are one of the most important elements of urban form and, maybe, the most visible of these elements. Buildings tend to persist for a lengthy time span, but they are most susceptible to change than the other elements mentioned above (Conzen, 1960; Whitehand, 2009). General speaking, the city is made of two different types of buildings, ordinary and exceptional buildings. The former includes most of the buildings constituting the city and mostly buildings of residential utilization, but also commerce and services buildings. The second type includes only a few buildings of the city which can be distinguished by their shape and utilization. The position of buildings within the plots in terms of identification of street forms, building heights relation to the notion of sense of enclosure, and building façade have fundamental importance for the character of the urban landscape (Oliveira, 2016).

2.1.2. AGENTS AND AGENCIES OF CHANGE

The different agents and agencies are crucial to understand the process of urban transformation (Oliveira, 2016; Whitehand, 1992a). Urban forms are created through a process of decisions taken by individuals and groups (Larkham, 2018). According to Larkham (1996), the agents responsible for changes can be generally grouped into those involved directly or indirectly with change (Larkham, 1996). The roles of agents of change can be classified according to the functions they perform (Whitehand, 1992a) into developers, architects, and builders as direct agents; and local authority planning officers, local politicians, planners, and citizens as indirect agents (Larkham, 1996; Oliveira, 2016). These agents may be corporate or individual. Furthermore, both within and between categories of agent there may be great variability in the concentration of decision-making over time and space (Whitehand, 1992a).

Developers (or initiators) are those who decide to make a change, responsible for the occurrence of an action in the physical form of the city. The figure of the developer is heterogeneous, ranging from a property owner that promotes one single action to an individual that devotes his professional life to the launching of new developments (Oliveira, 2016). The decision to develop a particular action is influenced by many different factors such as economic factors which may vary according to the type of developer. These factors initiate the new building types and influence building density. The timing of the development is an important factor considered by developers (Whitehand, 1992a). An architect tends to act as the agent of the developer dealing with the local authority. He also has an influence in the selection of the builder. Although Whitehand and Whitehand (1983) include civil engineering contractors as a builder for some purposes (Whitehand & Whitehand, 1983), Baerwald (1981) states that builders may also be involved in the sale of property. Implicit in all this is the idea that the ‘builder’ is a major agent of change involved in all stages of the construction or alteration of a building (Larkham & Jones, 1991).

The local authority planning officer is another important agent. Even though he is identified as an indirect agent of change, he can propose a direct action on the physical form of the city. A local authority politician can have the power to act as a direct developer, although his role is mainly of indirect agent contributing to the definition of a strategic vision for the city designed within the local authority. Ultimately, he is involved in decision-making on major projects. Citizens have a role in the process of identification and construction of urban landscape as indirect agents (Larkham, 2018; Oliveira, 2016; Whitehand, 1992a, 1992b).

2.1.3. THE RELEVANCE OF URBAN MORPHOLOGY

The relevance of urban morphology can be addressed from three major perspectives: philosophical, cultural, and practical (Barke, 2018). MRG Conzen's view that the urban landscape is the 'objectivation of the spirit of society' is an important point for the philosophical basis of urban morphology. The built environment embodies the past and present efforts and aspirations of the inhabitants, and this is reflected in its physical form. This physical form then generates the spirit of place (*genius loci*). Urban morphology is important because it is based on what exists in the visual built environment. The importance of urban morphology goes beyond this and is to understand the processes that produce what exists in the built environment and how and why it changes. The third level of importance is the impact of urban form on the daily lives of its inhabitants and visitors. Patrick Geddes states the importance of urban morphology with this sentence: 'we are what we build'. This reflects the fact that human efforts and sensibilities shape the built environment. In addition, this sentence reveals his philosophical perspective on the study of urban form. He also stressed the need to enter the spirit of a city, its historical essence and continuous life, its civic character, and its collective soul (Barke, 2018; Tyrwhitt 1947).

In cultural terms, the relevance of urban morphology is closely related to the art appreciation. A specific work of art has a close relationship with an understanding of the urban landscape. An understanding of urban morphology is a precondition of appreciation of aesthetic of urban places. However, urban landscapes have a deeper cultural significance and are culturally specific works of art. Therefore, urban forms have cultural and social significance that goes beyond existing functionality and therefore have layers of meaning and significance attached to them. In this regard, in understanding the accumulated layers of meaning and the aesthetics, urban morphology offers an added value to the quality of urban life (Barke, 2018).

The practical relevance of urban morphology (something fundamental for a PhD thesis in spatial planning) is intimately related to its identification as a field of knowledge. The applicability of urban morphology provides the ability of interpretation and offers solutions to problems of the urban landscape. Urban morphology has a key relation with urban planning and it can have a wide range of applications in urban design, architecture, urban conservation, heritage tourism, climate change and energy, urban crime and public health, and social justice (Barke, 2018; Oliveira, 2016; Oliveira, 2021a). Urban morphology has an important role in understanding, perceiving, experiencing urban landscapes character, not only in terms of buildings and their architectural characteristics but also in terms of the town-plan that contains streets, street blocks, and plots. 'Urban morphology can offer professional practice a comprehensive understanding of the urban landscape by describing and explaining the territory as a whole and in its different parts, considering its evolution through time, and identifying the needs of conservation and change of the different parts - balancing social, economic and environmental aspirations with the maintenance of character and identity' (Oliveira, 2021b, p.242). The relevance of urban morphology, in practical terms, is detailed in the next paragraphs.

Urban morphology and planning, urban design and architecture

The primary aim of urban morphology is to provide a comprehensive and rigorous description of the built environment (Kropf, 2021). Urban morphology has developed a number of theories, concepts and methods that can describe and explain the dynamics of the urban landscape. This rigorous description and explanation is able to provide a number of recommendations for prescriptions in planning, urban design and architecture. Planning and architectural practice have major distinctions. Planning takes place under legislative/political frameworks, and addresses fundamental dimensions of urban life with prescriptions for the rules of their transformations. However, architecture comes into existence largely under a business framework, and focuses on the design of buildings. Urban design is somewhere between these two activities (Oliveira 2021a). The earliest examples of planning proposals stemming from applications of the Conzenian concepts in actual urban areas emerged from Conzen's own fieldwork. The morphological survey of Whitby (Conzen, 1958) formed an important part of the basis for Conzen's explication of, and conservation recommendations for, the town (Whitehand, 2021). A number of examples of application of morphological knowledge into planning, urban design and architecture are gathered in the next paragraphs.

Samuels (1999) offers a typo-morphological approach to the design of French alpine resorts. The main goal is to promote building forms that maintain the qualities of the natural environment and the distinctive character of the settlement while allowing the development of tourism. Another comprehensive example is presented by Oliveira (2006), on the incorporation of morphological criteria in the *Plano Director Municipal* for Porto. The plan addressed the maintenance of the character of the city through a form-based typological approach to zoning, and the introduction of design detail within the planning process. Samuels (2021) argues his view on the physical form of cities in two planning instruments, the *Plan d'Occupation des Sols* for *Asnières Sur Oise* (the French local land-use plan) and the Oxford West End Design Code. The method for the former is initiated from Kropf (1993) (as a member of the team commissioned for the *Plan d'Occupation des Sols* for *Asnières Sur Oise*) who derived a framework from Conzen's and Caniggias' views. An important reflection of these two plan applications demonstrates the relationship between urban morphological research and real-life consultancy work in plan and design preparation. On the other hand, Space Syntax Limited, as an architectural and planning practice company founded at University College London, bridges knowledge and action in the urban landscape. One of their flag projects is Trafalgar square, London, where they have redesigned the square surfaces to improve the flows and permanence of pedestrians.

Strappa (2021) demonstrates the link between morphological reading and architectural design in the Terni Cemetery, at different scales, starting from the urban organism to the construction and language problems. He develops a morphological reading based on the processual and typological structure of the area, and then, introduces the design and construction of the cemetery, mainly focusing on the materials in terms their continuity. Moretti (2021) explores the relationship between contemporary new urban forms and the cultural and social context. He draws attention to the link between contemporary projects and the history of the city, and its architecture, with the aspirations of its inhabitants. He mentions the redevelopment of plots by contributing the character of extant urban form and the aspiration of the owners. Holanda (2021) evaluates one house designed and used by him. The analysis is carried out mainly on the basis of space syntax theory, in both building and city scales. He analyzes it in two levels: architectural configuration, and deployment of subjects and activities in space-time. The first level is subdivided into volumetric and spatial aspects. In the second analytical level a critical appraisal is presented, made possible by the architectural experience of the place along its 21 years of use. These reveals the potential and manifestations of some aspects of Space Syntax Theory in practice.

Urban morphology and conservation

The link between urban morphology and conservation is long-established (Conzen, 1975). The importance of urban morphology for urban landscape management (and therefore for conservation) relates to historicity. The townscape is the visual repository of any town's history, but this is far more than a matter of characterful old buildings, it relates to deeper issues such as identity (Barke, 2018; Smith 1974, 1977). The aesthetic quality and cultural meaning of our surroundings is necessary to be conserved and enhanced in the urban landscape management. The potential role of urban morphology in conservation can be seen in the early works of Conzen (Larkham, 1996). Conzen (1966) addresses conservation as a theme on historical urban landscapes. The key attribute of a townscape that required management was identified as its 'historicity'. Conzen sees three principal factors as making up an urban landscape's historicity: the town-plan, building fabric and land and building utilization. In a second paper on this subject (Conzen 1975), the concern changed from a delimitation of aspects of historicity to a concern for how this historicity is shaped. It is noted that the three aspects of historicity possess differing degrees of persistence in the townscape. Conzen (1975, 2004) has presented a method of combination of the three form complexes (as mentioned above) to establish morphological regions within the urban area, Ludlow being his best example (Larkham, 1996). The regions are recognized based on an objective and scientific analysis of the town's historicity. He demonstrated how the urban landscape is historically stratified, reflecting the distinctive residues of past periods, and gives rise to a hierarchy of morphological regions.

Whitehand (2021) reminds the strong relationship between urban conservation and urban morphological research, particularly expressed in the concepts identified within the historico-geographical approach to urban morphology. The morphological region concept (a composition of three urban landscape components: the town-plan, building fabric, and land and building utilization), is a manifestation of efforts and aspirations of present occupiers of the urban landscape but also those of their predecessors. As a concept it acquires a sense of the historical dimension of human experience, and helps to stimulate a less time-bound and more integrated approach to problems. Conzen (1975) drew attention to the following aspects of conservation: (i) conservation of the physiognomic identities of urban areas and their constituent parts, entailing the establishment of spatial units of conservation; (ii) conservation of historicity and aesthetic quality as aspects of identity; (iii) conservation of the 'intelligibility' of the historical urban landscape in respect of orientation on the ground; (iv) preservation of human scale; (v) management of the building fabric by functional continuity, adaptation and concordant change; and (vi) conservation control of street spaces and street systems, and compatible traffic control (Whitehand, 2021). The identification of morphological regions enables a strong basis for fulfilling these principles.

Larkham and Morton (2021) demonstrate the relationship between urban morphology and conservation. They address the importance of morphological analysis in delimitation of conservation areas and in characterizing the urban landscape and their development and future management by local authorities. Through their work in Stratford-upon-Avon they emphasise that a morphologically trained 'by eye' inspection can identify boundaries of conservation areas as clearly as by detailed plot measurement. They indicate that the character of the urban landscape can be identified through detailed morphological study, which can readily subdivide streets into character areas, referring to morphological regions. Morphological character can inform planning and management policy and can be worded sufficiently robustly to stand at local and national levels in an adversarial planning system (Larkham and Morton, 2021).

2.1.4. DIFFERENT APPROACHES TO URBAN MORPHOLOGY

This sub-section presents the main approaches to urban morphology that have been developed over the last decades: the historico-geographical approach developed by MRG Conzen and JWR Whitehand, the

process typological approach based on the work of Saverio Muratori and Gianfranco Caniggia, space syntax which is also termed configurational approach, and spatial analytical approach which has various concepts and methods, such as cellular automata, agent-based models and fractals. Each of these approaches is described in terms of their origins, developments and main characteristics.

Historico-Geographical Approach

The historico-geographical approach, also referred as British morphogenetic approach or Conzenian approach, was developed by MRG Conzen and JWR Whitehand. Its roots go back to the works of German geographers in the beginning of the 20th century. As such, this approach is probably the oldest of this set. Morphogenetic method, conceptualization of historical development, terminological precision and cartographic representation are the main characteristics of the approach. Some crucial concepts were proposed or developed by Conzen. He puts forward the tripartite division of urban form into the town-plan (or ground plan, comprising streets, plots, and the block plans of buildings); the building fabric (the three-dimensional form); and the land and building utilization. More important than this division of urban form are the concepts Conzen developed about the process of urban development, including the fringe belt, the morphological region and the burgage cycle. In addition to these, a considerable terminology has been developed. This approach is presented in more detail in a subsequent section due to the nature of the work.

Process Typological Approach

The process typological approach to urban morphology, sometimes referred to as process typology, or processual and typological, was developed within the context of architectural education and practice starting in the first half of the 20th century, predominantly in Italy. Fundamental to the approach are the concepts of the multi-level hierarchical structure of built form and the typological process (Kropf, 2017). There is a connection between the process typological approach and historico-geographical approach.

The founder of the approach is Saverio Muratori who was a student of Arnaldo Foschini, Enrico Calandra and Gustavo Giovannoni. He is the author of the book '*Studi per una operante storia urbana di Venezia*' (Muratori, 1960) which is a classic in urban morphology. Another key contributor to the approach is Gianfranco Caniggia whose first major work on urban morphology is '*Lettura di una città: Como*' (Caniggia, 1963). He was also one of the students and assistants of Muratori.

Cataldi (2003) identifies Caniggia's major contributions to the progress of the process typological approach:

- i. the examination and development of Muratori's concepts of type, typology, structure, tissue, series, and seriality,
- ii. the setting up of the method of processual typology, including the concepts of substratum type, leading type, synchronic variant, diachronic transformation, and typological yield,
- iii. the discovery and recognition of the '*domus*' courtyard substratum as the matrix, within Roman planning, of all subsequent basic medieval and modern building types,
- iv. the distinction between basic and specialized building,
- v. the theory of 'medievalization' regarding the spontaneous utilization procedures of planned structures
- vi. the method of interpretation by phases of a town's history in connection with basic typological processes

The notion of process and organism are two main notions in this approach. The process is the whole of the diachronic (in the time) and the syntopic (in the same place) mutations of the organisms at different

scales, that is, the phases of successive transformations that explain the reality of how it is today and give directions to future changes (Strappa, 2018).

Muratori divided the city into routes, fabric (tissue - the notion of building aggregation), poles, and civil organism. The organism is identified within a hierarchical structure; the territory, urban organism, fabric (the aggregative organism), the building (base and special). The territory represents the high scale, and the building reflects the lowest scale.

Routes are the main vehicles of city life and the fundamental instrument for reading and transforming the territory (Maretto, 2018). Fabric is the notion that gives order to the matter of which the urban organism is composed. The aggregative organism represents the fundamental step that provides the measure of how the city itself is the result of a progression of successive transformations historically identified. A fabric is basically structured in 'routes', the most important of which links two poles, and basic and special building. The base building is mainly based on the type of dwelling and the type of dwelling aggregation. The special building means all the non-residential part of the built environment, also including those building types where the housing function is secondary to that which gives rise to the specialization of the type (Strappa, 2018).

Space Syntax

The quantitative approach to urban form analysis started in the 1960s, in the centre of 'Land Use and Built Form Studies' (LUBFS), at the University of Cambridge, founded by Leslie Martin. The centre formally became the 'Martin Centre for Architectural and Urban Studies' (the Martin Centre for short) in 1974. This attempt for quantification gained a new impetus with the creation of the 'Unit for Architectural Studies', at the University College London (UCL), directed by Bill Hillier. Space syntax research began in this unit, with the main purpose of understanding the influence of architectural design on the existing social problems in many housing estates that were being built in the United Kingdom (Oliveira, 2016).

Three seminal books by Bill Hillier and Julienne Hanson are important in the development of space syntax in addition to an interesting set of seminal papers published in the 1970s. The first is 'The social logic of space' (Hillier & Hanson, 1984), the second is 'Space is the machine' (Hillier, 1996), and lastly, 'Decoding homes and houses' (Hanson, 1998). In addition, an online training platform (spacesyntax.net) has been co-created by the Space Syntax Laboratory at The Bartlett, UCL and Space Syntax Limited. It introduces the fundamentals of space syntax theory and provides a unified training resource for academics and practitioners alike.

Space syntax focuses on space and on the relationships between space and movement. It offers a set of techniques for analysing spatial layouts and human activity patterns in buildings and cities. It also offers a set of theories linking space and society. Space syntax addresses where people are, how they move, how they adapt, and how they develop (Hillier & Vaughan, 2007; Oliveira, 2016).

Space syntax is built on two formal ideas which try to reflect both the objectivity of space and our intuitive engagement with it (Hillier & Vaughan, 2007):

- i. space is not a background to human activity, but is intrinsic to it.
- ii. human space is not just about the properties of individual spaces, but about the interrelations between the many spaces that make up the spatial layout of a building or a city. This is what we formally call the configuration of space, meaning the simultaneously existing relations amongst the parts which make up the whole. In other words, what happens in any individual space - a room, a corridor, a street or a public space - is fundamentally influenced by the relationships between that space and the network of spaces to which it is connected.

Space syntax comprises four fundamental components, which are used in all applications, representations of space, analysis of spatial relations, interpretive models, and theories:

- i. Representations of space: spatial elements are represented through their geometric forms and how people experience them. They can be geometrically derived (for example, point, axial line, segment, convex space and isovist) or functionally defined.
- ii. Analysis of spatial relations: relationships between spatial elements result from their configuration. These relationships can be objectively analysed using various measures, such as integration and choice. Integration is a normalised measure of distance from any space of origin to all others in a system. In general, it calculates how close the origin space is to all other spaces, and can be seen as a measure of relative asymmetry (Hillier & Hanson, 1984). Choice measures how likely an axial line or a street segment it is to be passed through on all shortest routes from all spaces to all other spaces in the entire system or within a predetermined distance (radius) from each segment (Hillier et al., 1987).
- iii. Interpretive models: spatial models are developed to analyse, describe, explain, and forecast different kinds of different socio-spatial phenomena. In practice, models are created to investigate empirical phenomena such as urban movement, urban crime, and centrality as a process as well as for general processes such as spatial intelligibility (Hillier & Vaughan, 2007)
- iv. Theories: theories of the relations between spatial and social patterns are established to explore whether and how space is internalised into socio-economic processes through which the built environment is created. This has been done in two ways. Firstly, theories can be used to look for commonalities in the pattern of models across functions and cultures. One example is the theory of the generic city. Secondly, theories can use space syntax tools to explore what happens to spatial patterns if objects in space are deployed and shaped in different ways.

The common feature of the approach is the focus on the geometric and topological attributes of built form with the aim of understanding the interrelationships between different attributes and measures, the ways in which different spatial configurations affect the use of urban environments and buildings, as well as seeking to predict and improve function and performance (Kropf, 2017). Spatial configuration is a key concept in this approach. In syntax terms, spatial configuration means relations between spaces which take into account other relations (Hillier & Vaughan, 2007). Several software tools are available to undertake space syntax analysis. The 'DepthmapX' and 'QgisSpaceSyntaxToolkit' are the key tools currently being used.

Spatial Analytical Approach

The spatial analytical approach to urban morphology focuses primarily on human activity as sets of spatial interactions. The approach makes use of a range of primarily quantitative methods such as mathematical models, in particular entropy-based, fractal and other non-linear forms, agent-based models, cellular automata, graph theory and network analysis (Kropf, 2017). The three main forms of spatial analysis - cellular automata (CA), agent-based models (ABM) and fractals - are not mutually exclusive and may be used in a complementary way. This approach is more heterogeneous than the other three former approaches. Its key researcher is Michael Batty. The aim of the approach is to uncover the principles and relationships underlying the dynamics of the system, such as the scaling laws of growth, and begins to identify the relationships between the principles to generate a more comprehensive picture (Kropf, 2017).

Artificial processes for locating urban activities based on simple rules pertaining to local circumstances give rise to complex global patterns that mirror the spatial organization of cities. These systems are called Cellular Automata. They provide a useful means of articulating the way highly decentralized decision-making can be employed in simulating and designing robust urban forms. CA can be easily programmed in a variety of software, and as such provide a suggestive way of exploring actual as well

as optimal patterns and plans (Batty, 1997). Agent-based models (ABM), are another form of analysis where agents are mobile and move between locations. These models relate to many scales, from the scale of the street to patterns and structure at the scale of the urban region (Batty, 2007). ABM models allow for the simulation of the individual actions of diverse agents, and the measuring of the resulting system behaviour and outcomes over time. Many patterns of nature can be seen as irregular and fragmented, when framed by the Euclidian geometry which is dominated by the concept of things as one, two, or three-dimensional (Oliveira, 2016). Against this background, Benoit Mandelbrot proposed a new geometry of nature based on the concept of ‘fractal’ (Mandelbrot, 1982). Fractals are objects of any kind whose spatial form is ‘irregular’, and whose irregularity repeats itself geometrically across many scales. In short, the irregularity of form is similar from scale to scale, and the object is said to possess the property of self-similarity or scale-invariance. Fractal geometry enables that to search out functions and processes which give rise to the man-made and natural patterns observed in the real world. Thus, it helps not only to describe and understand reality but also, to progress our forecasts and predictions of how the real world might evolve (Batty & Longley, 1994).

2.2. HISTORICO-GEOGRAPHICAL APPROACH

2.2.1. THE ANTECEDENTS OF MRG CONZEN

The historico-geographical approach has its immediate antecedence at the end of the 19th century originating from German human geography (see Table 2.1). Two particular texts have fundamental importance (Whitehand, 2001). The first, ‘*Deutsche Stadtanlagen*’ published by the historian Johannes Fritz in 1894, was a comparative study of more than 300 German cities. The key innovation of this study is the use of the plan of the city and of cartography as a primary source of information for urban history. The second fundamental paper, ‘*Über den Grundriß der Städte*’ published by Otto Schlüter in 1899, develops the line of research on the plan of the city initiated by Fritz, including the identification of the different parts that constitute the city centre (Oliveira, 2016; Whitehand, 2001).

In the early 20th century, Friedrich Ratzel published ‘*Die Geographische Lage der großen Städte*’, which focuses not only on the location of cities, but also on the reasons and the characteristics that lead to the selection of the original site for the foundation of human settlements (Oliveira, 2016). In 1916, Hugo Hassinger published an art-historical atlas of Vienna. He mapped the historical architectural styles and the age of the buildings in the city of Vienna. The result of this analysis is a set of plans that constitutes a fundamental element for the conservation of the built heritage of Vienna (Oliveira, 2016; Whitehand, 2007). In 1918, Walter Geisler published one of the most important texts on Danzig (present day - Gdansk). Geisler mapped land and building utilization and the number of storeys in residential buildings in inner Danzig. This was followed by Geisler’s major work, ‘*Die Deutsche Stadt*’ in 1924, culminating in comprehensive classifications of the sites, ground plans and building types of German towns (Whitehand, 2001, 2007). In 1925, Hans Dörries recovered the line of research developed by Hassinger and Geisler in the previous decade identifying in the plan of a number of historic cities the age and the architectural styles of their buildings. In 1927, Hans Bobek published a paper on basic issues in urban geography which has laid the foundations for a change of direction in one of the dominant lines of German human geography. In 1928, Rudolf Martiny published a text on the structure of German settlements. Martiny intended to define a set of generic elements on German cities. In his thesis in University of Berlin, Conzen mapped the building types in twelve towns in an area to the west and north of Berlin. He used different colours to represent the number of storeys and the different building types of these cities. In 1936, Herbert Louis published a book on the geographical structure of Great Berlin. In this book, Louis introduced the concept of *Stadtrandzone* (fringe belt), an element of urban form composed of plots with a wide variety in terms of geometry and dimensions, and whose formation at

the edge of a built-up area is associated to a period of stagnation or of slow growth of this area and to how, some years later, that same area restarts its process of growth (Oliveira, 2016).

Table 2.1 German human geography 1890–1939 (Oliveira, 2016)

Decade	Year of publication	Author (Institution)	Studies on cities
1890–1899	1894	Johannes Fritz (Strasbourg)	<i>Deutsche Stadtanlagen</i> German city layouts
	1899	Otto Schlüter (Halle)	<i>Über den Grundriß der Städte</i> On the ground plan of cities
1900–1909	1903	Friedrich Ratzel (Leipzig)	<i>Die Geographische Lage der großen Städte</i> The geographical location of large cities
1910–1919	1916	Hugo Hassinger (Vienna)	<i>Kunsthistorischer Atlas von Wien</i> Art-historical Atlas of Vienna
	1918	Walter Geisler (Halle)	<i>Danzig: ein siedlungsgeographischer Versuch</i> Gdansk: an essay on the settlement geography
1920–1929	1924	Walter Geisler (Halle)	<i>Die Deutsche Stadt: ein Beitrage zur Morphologie der Kulturlandschaft</i> The German town: a contribution to the morphology of the cultural landscape
	1925	Hans Dörries (Goettingen)	<i>Die Städte im oberen Leinetal, Göttingen, Northeim und Einbeck</i> The cities of Leinetal, Goettingen, Northeim and Einbeck
	1927	Hans Bobek (Vienna)	<i>Grundfragen der Stadtgeographie</i> Basic questions of urban geography
	1928	Rudolf Martiny	<i>Die Grundrißgestaltung der deutschen Siedlungen</i> The layout of the German settlements
1930–1939	1932	MRG Conzen (Berlin)	<i>Die Havelstädte</i> The Havel cities
	1936	Herbert Louis (Berlin)	<i>Die geographische Gliederung von Gross-Berlin</i> The geographical structure of Great Berlin

The work of German geographers in the early 20th century had a crucial importance for the establishment of urban morphology as a field of knowledge. Despite the fact that from the 1930s onwards, the morphogenetic approach would lose weight in German human geography, it would gain a new vitality in the following decades in the work that Conzen would develop in England (Oliveira, 2016)

2.2.2. MRG CONZEN AND HIS IDEAS

The main characteristics of Conzen's works are the morphogenetic method, cartographic representation and terminological precision. He argued for the tripartite division of urban landscape, into first, the town-plan, or ground plan (comprising streets, plots and block plans of buildings), secondly, the building fabric, and thirdly, land and building utilization (Conzen, 1960). Arguably most important are the concepts he developed (Whitehand, 2007). For example, the burgage cycle, the fringe belt, and the morphological region. The burgage cycle consisted of the progressive filling in with buildings of the back land of burgages, terminating in the clearing of buildings and a period of urban fallow prior to the

initiation of development cycle. The fringe-belt concept was first recognized in Berlin in 1936 by Louis, but it was developed to a far greater degree of sophistication by Conzen in his studies of the English market town of Alnwick and the major English city of Newcastle upon Tyne (Whitehand, 2001). The fringe-belt concept is linked to a basic tenet of MRG Conzen's work: the concept of the morphological frame. The climax of the exploration of the physical development of an urban area was the division of that area into morphological regions. His major work on this concept was of morphological regions in the English market town of Ludlow. He identified a five-tier hierarchy of regions. The map of morphological regions consisted of separate maps of natural substratum, plan types, building types, and land and building utilization.

Conzen's perspective on the relationship between the urban landscape and society constitutes the theoretical underpinning to conservation that Conzenian thinking can provide. For Conzen, the past provides the key to the future (Whitehand, 1992). The urban landscape management is, for Conzen, the 'objectivation of the spirit' of a society (Conzen, 1966). Observable features are expressions of that society's aspirations, efforts and experiences. This objectivation is evident across the entire range of objects susceptible to direct observation, from the smallest details of a single building to the configuration of an entire town or city. It is a form of accumulated experience and thus a precious asset. This is what provides the principal justification for its use in conservation. In this way, the urban landscape management may be seen as embodying the spirit of a society in the context of its own historical development in a particular place (Conzen, 1966; Whitehand, 1989; Whitehand *et al.*, 2011).

2.2.3. AXIOMS AND PRINCIPLES

The historico-geographical approach has a series of axioms and principles articulated by Conzen that interweave to form an insistent subtext for and underpinning of the array of key morphological concepts that he developed over several decades. These interdependent axioms and principles can be articulated as follows (MP Conzen, 2018; Conzen, 1960, 2004).

- i. Systematic townscape composition (axiom 1). The townscape is composed of three systematic form complexes – the town-plan with its street system and associated plot system, building fabric with its building types, and land and building utilization pattern. They are integrated in nested spatial composition at the level of townscape elements.
- ii. The period specificity of forms (axiom 2). The observable forms are products of particular historical and cultural contexts at the time at which they were created, in conjunction with later adaptations. This calls for the identification of appropriate 'morphological periods' to clarify the broadly phased production of townscapes.
- iii. Hierarchical nesting of form complexes (axiom 3). It is an axiom of urban morphology that everywhere in the townscape the systematic form complexes are hierarchically nested in a physical sense. For example, the 'town-plan' contains both 'building fabric' as well as 'land use'; and, in turn, 'building fabric' itself contains that part of 'land utilization' that lies within it.
- iv. Secular socio-political conditioning (principle 1). The influence of socio-political organization and particularly the changing relations between society and individuals generate and distribute urban forms, reflecting community values and perception. It is a fundamental and universal principle in urban morphogenesis. Long-term changes are of particular interest.
- v. Systematically differentiated persistence of forms (principle 2). This varies greatly between form complexes and spatial structure: the town-plan is the most persistent form complex; building fabric is less persistent than town-plan; and land and building utilization is the least persistent form complex over time.
- vi. Historical stratification of townscape (principle 3): townscapes are historically stratified. This requires a genetic perspective. The townscape consists of a spatially varied mixture of different

period types and styles of layout and buildings. This stratification appears in the juxtaposition or proximity of forms from different morphological periods. Thus, over the course of the time, there is an increasing period diversity in terms of their cultural characteristics, producing many different 'form complexes' of varying spatial extent (ground plan, building fabric, and land and building utilization)

- vii. Morphogenetic priority of forms (principle 4): This differential persistence of forms influences 'how strongly' and 'how extensively in space' townscape elements contribute to the character of morphological regions within the town. The town-plan contributes to the high and intermediate ranks of morphological regions. The building fabric partakes in the town-plan's intermediate ranks to degree, but makes its major contribution in the lowest rank. The contribution of land and building utilization lies in the intermediate ranks. Thus, the town-plan contributes the most, building fabric a good deal, and land use the least.
- viii. Hierarchical nesting of morphogenetic regions (or morphological regions - principle 5): The whole urban area can be conceived as being divided into a mosaic of morphogenetic regions (see the next section), in which clusters of distinct, small-scale, relatively homogeneous units nestle within larger regions of more heterogeneous but coherent general character, defined by correspondence of the constituent units. In this regard, for example, the lowest scale of regions represented by 'morphotopes', the smallest building groups of distinctive period mixture or period dominance. They contribute collectively to the identification of 'street units' or 'precinctual units', forming significant neighbour units. The aggregation of these street units constitute 'town quarters', representing traditional plan units. And, finally, a 'major region' such as the traditional core or Old Town, comprising traditional plan units.

2.2.4. CONZENIAN CONCEPTS AND TERMINOLOGY

Fringe Belt

A fringe belt is a belt-like zone originating from the temporarily stationary or very slowly advancing fringe of a town and it is composed of a characteristic mixture of land-use units initially seeking peripheral location (Conzen, 1960). The fringe-belt concept was originally formulated by Louis (1936) recognizing the long-term significance of physical limitations on urban growth, notably city walls and the open zone beyond them upon which building was prohibited. Louis identifies, within the urban structure of Berlin, a number of land-use zones representing former peripheral urban land uses encompassed by later building accretions and the distinction between younger residential areas. Their land use varied, especially according to position within the urban area: institutions, country houses and their parks, public utilities, recreational areas, and allotment gardens were among existing or former uses. Three fringe belts were recognized and mapped: two continuous embedded belts, associated with former fortification zones, and a third less clearly defined belt. This was developed by Conzen in Britain in the post-war period and it became part of a morphological theory of urban growth and change. The concept was disseminated widely in the 1970s, although it has only been taken up by scholars outside the English-speaking world in the 1980s (Whitehand, 1988).

The conceptual terminology of fringe belt comprises the contributing features, processes and products. Contributing features of fringe belts are open spaces (cemeteries, public parks, nurseries/market gardens, allotments), industries (transport facilities, factories quarries), residential areas (low-density only, villa estates), institutions (religious retreats, military barracks, college grounds, hospitals, waste disposal plants), and recreational areas (golf courses, sports fields, riding schools) (MP Conzen, 2009, 2018). Fringe belts develop an internal history because they evolve over time. They pass through two grand stages, distinguished for analytical purposes as stages of 'formation' and 'modification'. The formation process comprises early fixation phase, expansion phase, and then consolidation phase. The modification process represents fringe-belt alienation, fringe-belt reduction and fringe-belt translation.

According to their position fringe belts can take the following designations: Inner fringe-belt (IFB), Middle fringe-belt (MFB), and Outer fringe-belt (OFB). IFB is the first, commonly closed fringe-belt surrounding the kernel of a town, with an antecedent fixation line as its backbone by which it is divided into a relatively restricted intramural and a much larger, morphologically different extramural. MBF is a secondary, usually open fringe belt situated ‘intermediately’ between the IBF and OBF of a town and separated from these more or less by other, generally residential integuments. OBF is the last, open fringe belt along the current periphery of a town (M. P. Conzen, 2009; Conzen, 1960, 2004).

Burgage Cycle

The concept of ‘burgage cycle’ (the life cycle of a plot held by a burgess) is the cyclic process of building development in a burgage or burgage series in response to changing socio-economic demands in central area in an Old Town. It covers the period from its initiation in the Middle Ages to its termination in modern slum or central redevelopment clearance. It consists of increasing repletion followed by recession and when uninterrupted, that is, when ‘normal’, passes consecutively through institutive, repletive, climax, and recessive phases measurable in terms of building coverage and followed by urban fallow in its final stage (Conzen, 1960, 2004). Here, the burgage being the landholding of an enfranchised member of a medieval borough; the cycle consisting of the progressive filling-in with buildings of the back land of burgages. The burgage cycle is the progressive built occupation of the back of the plot culminating in a significant reduction of the open space, resulting in the need to release this space and in a period of urban fallow, preceding a new development cycle (Oliveira, 2016). This cycle is a particular variant of a more general phenomenon of building repletion where plots are subject to increasing pressure, generally associated with the industrialisation of society and its impact on the urban fabric (MP Conzen, 2018; Oliveira, 2016).

Morphological Region

The concept of morphological region is, for Conzen, the climax of the exploration of the physical development of an urban area. A region is an area that has unity in respect of its form that distinguishes it from surrounding areas, based on a combination of town-plan, building fabric and land and building utilization. The method of morphological regionalization is the process of identifying and mapping the regions, proposed and developed by Conzen mainly between the late 1950s and the late 1980s. This method is articulated in a detailed way in the next sub-section (2.3. Morphological region).

Form Complexes

One of the major contributions made by Conzen is on the recognition and investigation of the ‘form complexes’, which are fundamental phenomena in urban morphology (Whitehand, 2009). The term ‘form complexes’, in other words, ‘morphological trinity’ or ‘urban landscape components’, comprises three constituents of urban landscape: town-plan or ground plan, building fabric, and land and building utilization. The town-plan can be defined as the topographical arrangement of an urban built-up area in all its man-made features. It contains three distinct complexes of plan elements (Conzen, 1960):

- i. streets and their arrangement in a street-system,
- ii. plots and their aggregation in street-blocks, and
- iii. buildings or, more precisely, their block-plans.

The term street refers to the open spaces bounded by street-lines and reserved for the use of surface traffic and whatever kind. The areas within the town-plan unoccupied by streets are street blocks. Each of these street blocks contain a group of plots or a single plot. Each plot is a unit of land use. The block

plan of buildings is the area occupied by building and defined on the ground plan by the lines of its containing walls. Building fabric is the three-dimensional composition and arrangement of buildings and other architectural structures in an urban area. It is a constituent form complex of the townscape, and a variable combination of the building type, construction materials, height (expressed in number of storeys) and architectural style. Land and building utilization is the functional purpose served by land and buildings. It is a variable combination of the land-use element complexes of property units and circulation spaces (M.P Conzen, 2018; Conzen, 2004).

Conzen had examined all of these components earlier elsewhere: ground plan and building fabric in the Havel towns, near Berlin (Conzen, 1932; Whitehand, 2009) and building fabric and land and building utilization in the English port town of Whitby (Conzen, 1932). He examined all these components in several English towns (for example, Alnwick and Ludlow).

Morphological Frame

The morphological frame is an antecedent plan feature, topographical outline or set of outlines exerting a morphological influence on subsequent more or less conformable plan development on the same site, and often passing its features on as inherited outlines (Conzen, 2004; Whitehand et al., 2016). Morphological frames, natural or man-made, are features in the landscape, which have imposed a degree of control on the orientation and outer bounds of specific urban zones within and on the margins of cities. Such frames may have an influential geometry of their own or simply provide a directional slant to the organization of streets, plots and buildings. Natural topography can play a role in ‘framing’ the town form (MP Conzen, 2018)

Fixation Line

In town-plan analysis a number of concepts are useful in understanding the evolution of urban landscapes. One prominent idea is that certain elements in the urban landscape have an unusual power to influence the form of their adjacent areas. The ‘fixation line’ is a chief element within these concepts (MP Conzen, 2018). A fixation line is often a protective linear feature, like a town wall, marking the traditional stationary fringe of an ancient town. During subsequent growth, it causes the topographical fixation of a consequent ring system of streets as the backbone of an incipient Inner Fringe Belt and as the dividing line between its intramural and extramural sites (Conzen, 2004).

Morphological period

The ‘morphological period’ refers to any period in the cultural history of an area which creates distinctive material forms in the cultural landscape to suit the particular socio-economic needs of its society. These forms survive in varying degree as residual features (Conzen, 2004). Changes in the course of time, namely, those of types of the town-plan, building types, and the location of particular types of urban land use, are not random but correspond to periods of socio-economic and cultural history which manifest themselves in the landscape as morphological periods (Whitehand, 1981).

Each morphological period is characterized by the widespread introduction of new forms: for example, new types of street layout, plot layout, building types and architectural styles. These new forms are then reproduced over variable amounts of time before being succeeded by different predominant forms in the next morphological period (Conzen, 1960; Whitehand *et al.*, 2014).

Morphotope

Morphotope, or the smallest building group of distinctive period mixture or period dominance, is the smallest urban locality or morphogenetic region within the townscape, obtaining distinctive character among its neighbours from its particular combination of constituent morphological elements. It is largely defined by the localized character of its building fabric, that is, its period-determined building types. It is also a space unit in which the three systematic form complexes of the townscape (the town-plan, building fabric, and land and building use) can still combine so as to impart to a morphological character of its own (Conzen, 1960, 2004). In purely static terms, the morphotope consists of morphologically homogeneous areas created by the physical combination of the town-plan, building fabric, and land and building utilization patterns (Whitehand, 1981).

2.3. MORPHOLOGICAL REGION

The method of articulating the development of the form of urban areas in terms of morphological regions has a long history (Whitehand, 2009). As articulated by Conzen (1975, 1988), it entails the recognition within the physiognomy of urban areas of three components, or ‘form complexes’ (Birkhamshaw & Whitehand, 2012). The combination of form complexes, namely, ground plan, building fabric, and land and building utilization pattern, occurs in a hierarchical manner. The town-plan contains and forms the general frame of the land and building utilization pattern, and the land-use units or plots, in turn, contain the building fabric. Thereby, various forms from different periods give rise to historical layering in the townscape at different levels of hierarchy (Whitehand, 1981). A morphological region is a spatial grouping of form ensembles on the principle of geographical similarities, which produces larger composite regions with their own, more general *genius loci*, such as town neighbourhoods, town quarters, the Old Town, period accretions, and fringe belts (MP Conzen, 2018; Conzen, 2004). These regions are not static phenomena. They are fluid and liable to change in extent as well as in their internal character, and their analysis and cartographic representation demand a consistent and explicit approach to the problems of reconstruction and chronology (Baker & Slater, 1992). For researchers, a region is principally a tool for understanding spatial variations between areas with recognized boundaries. For planners, boundaries are a major means of distinguishing areas to which different policies apply (Whitehand, 2009).

Some topics of the concept of morphological region are area designation, conservation area delimitation and control, character assessment, suitability and effectiveness of area preservation, enhancement strategies, urban design control and urban landscape management (Baker & Slater, 1992; Barrett, 1996; Bienstman, 2007; Jones, 1991; Whitehand, 1989; Whitehand & Gu, 2007; Whitehand *et al.*, 2011).

2.3.1. THE ROOTS OF MORPHOLOGICAL REGIONALIZATION

The method of regionalization by German geographers in relation to the natural landscapes, though not specifically concerned with the internal morphological divisions of urban areas, forms a basis for the Conzenian concept of morphological region. These regions originate from the term *Landschaft* expressed in German (Conzen, 2004). Bienstman (2007) reviewed the origins of the concept in her work on urban morphological regionalization. The philosophical concept of the, ‘objectivation of the spirit’ also has its origins in Germany.

Landschaft studies in early 20th century were a key influence for Conzen. Arntz (1999) states that Ritter (1850), Ratzel (1896), Schlüter (1899, 1906), Hettner (1927), and others, developed an academic approach to *Landschaft*, whereby places and their contents were seen as wholes, microcosms of an ordered world. This term provided geography with an object of study that united both physical and

human components. It was subsequently developed into a holistic view of the relations between people and their land and became related to *Heimatkunde* (local history) (Bienstman, 2007).

Conzen's method of morphological regionalization is similar in principle to that employed by Granö (1929) whose work had larger regional scale. However, the product in Granö's investigation was a set of many small regions. (Whitehand, 2009). Granö (1935) suggested that the *Landschaft* could be classified making use of *Komplextypen* (which could be translated as 'complex types' or Conzen's 'form complexes'). On a much larger scale than Conzen, he used four form complexes that consisted of the *Ganzheiten* (units) in the system. Those were *erdrinde* (earth's crust), *wasser* (water), vegetation (vegetation), and *umgeformten stoff* (human forms). Each of these elements was mapped. Subsequently, all were combined to identify a synthetic map without showing any boundaries. This combination, powerfully, reminds the overlapping of Conzenian mapping of form complexes to produce morphological regions. The *Landschaft* studies by geographers are developed on a large scale and focus on natural landscapes. Even so, they have influenced Conzen's works in terms of hierarchy and terminology.

2.3.2. MRG CONZEN'S CONTRIBUTIONS

As mentioned above, the climax of the exploration of the physical development of an urban area, for Conzen, was the division of that area into morphological regions (Whitehand, 2001). Conzenian townscape regions are closely related to the important philosophical concept of townscape historicity. A city's landscape is, for Conzen, the 'objectivation of the spirit' of the succession of societies that inhabits it (Whitehand & Gu, 2007). According to him, the spirit of past and current societies is summarized in the historico-geographical character of the urban landscape (Bienstman, 2007). Between the late 1950s and the late 1980s, Conzen made a major contribution to the development of morphological regionalisation. In his study of the English market town of Alnwick (1960), he delimited plan units of ground-plan type that expressed the historical grain of the town. The plan of an urban area was for him one of three urban landscape components of its morphological character, the other two being building form and pattern of land and building utilization. He examined all three components in combination based on the mapping of the results of earlier field surveys of several British towns, including Whithorn, Frodsham, Conway and Ludlow (Conzen, 1966). The later development of that study and a more detailed publication on the Anglo-Welsh border town of Ludlow (Conzen 1975, 1988) comprised the core of Conzen's thinking about morphological regionalisation and its significance for conservation planning (Whitehand, 2009). Conzen's conception has direct relevance to overcoming the practical problem of clarifying, organising and integrating the aspects of existing urban landscapes that are fundamental to a sound conservation strategy (Whitehand & Gu, 2007). Conzen's studies on Alnwick and Ludlow are reviewed in next sub-section on 'the application of the concept'.

2.3.3. VARIOUS TERMS OF MORPHOLOGICAL REGIONS

The concept of morphological region developed by Conzen has been applied into various settlements in different parts of the world. In the seminal work of Alnwick, Conzen (1960) used the term 'plan units' for identifying the distinct characteristics of the town-plan. In addition, Conzen used the term 'morphological region' and the term 'townscape region' (Conzen, 1975, 1988). In other applications of the concept in Europe and other continents, the term 'morphological region' (Conzen, 1975; Conzen, 1988; Jones, 1991; Baker&Slater, 1992; Barke, 2003; Larkham & Morton, 2011; Oliveira et al., 2015; Chen, 2018; Alsadaty, 2021), 'plan units' (Conzen, 1960; Baker&Slater, 1992; Zhang, 2003; Whitehand & Gu, 2007a; Whitehand, 2009; Zhang, 2015), 'townscape regions' (Conzen, 1988; Barret, 1996; Bienstman, 2007), 'townscape units' (Whitehand, 1989; Barret, 1996), 'urban landscape regions' (Barke, 2003), 'urban landscape units', (Whitehand and Gu, 2007b; Whitehand, 2009; Gu, 2010;

Whitehand et al., 2011), ‘urban tissue’ (Kropf, 1996), ‘character area’ (Whitehand, 2009; Birkhamshaw & Whitehand, 2012) and the last one ‘urban regions’ (Alsadaty, 2021).

Despite the fact that all of these terms are equivalent, it is worthy to elaborate on this. For example, the term ‘character areas’ is thought to be more readily understood than ‘morphological regions’ or ‘urban landscape units’ by the general public (Whitehand, 2009). In addition, when referring to the application of the concept into a planning document, Whitehand stated that the term ‘character area’ (instead of ‘morphological region’) was preferred because the plan’s predominant readership would consist of non-academics and others who are not familiar with the technical language of urban morphology. In the ‘Glossary of technical terms in urban morphology’, annex to Conzen’s (2004) ‘Thinking about urban form’, the terms ‘morphological region’ and ‘morphogenetic region’ have the same meaning.

A recent survey carried out by the author of the thesis (13 email questionnaires carried out in May 2018) reveals additional perspectives on the issue of terminology. Kai Gu presumes that the use of ‘region’ is very German-based and it creates confusion among general readers. According to Heather Barret, the term townscape is commonly used in planning (in the British context) and seeks to develop a more inclusive idea of townscape than the more superficial tradition based on looking at streetscape alone. She stated that the term townscape unit is preferable to morphological region which implied to just the physical elements of plan and form; land utilisation and the idea of meaning embodied in the physical form of the city are of crucial importance. However, despite the different interchangeably usages, Barret considers that these terms embody different ideas and this does need teasing out in the development of these concepts and ideas, and more broadly in relation to urban morphological approaches. Despite all these various usages of the concept, they all refer to the process of identifying and mapping, termed ‘morphological regionalization’, of the historico-geographical character and process of formation of geographical units. Table 2.2 illustrates the uses of the concept by different researchers.

Table 2.2 Various terms by different investigators

Various terms of ‘morphological regions’	Investigators
Morphological region	Conzen, 1975; Conzen, 1988; Jones, 1991; Baker&Slater, 1992; Barke, 2003; Larkham & Morton, 2011; Oliveira et al., 2015; Chen, 2018; Alsadatty, 2021
Plan units	Conzen, 1960; Baker&Slater, 1992; Zhang, 2003; Whitehand & Gu, 2007a; Whitehand, 2009; Zhang, 2015
Urban landscape units	Whitehand and Gu, 2007b; Whitehand, 2009; Gu, 2010; Whitehand et al., 2011
Townscape regions	Conzen, 1988; Barret, 1996; Bienstman, 2007
Townscape units	Whitehand, 1989; Barret, 1996
Character area	Whitehand, 2009; Birkhamshaw & Whitehand, 2012
Urban landscape regions	Barke, 2003;
Urban tissue	Kropf, 1996
Urban regions	Alsadaty, 2021

2.3.4. THE NOTION OF HIERARCHY

The notion of hierarchy is used in several disciplines. For instance, it is used in biological taxonomies, physics, ecological studies, linguistics and ethics. A hierarchy is a collection of parts with ordered relationships (Allen & Starr, 1982). When considering Conzen's use of a hierarchy, the ideas on hierarchical nesting of form complexes, the hierarchy of morphological regions, and morphogenetic priority and form persistence become prominent. Conzen uses the words 'containing' and 'nesting' in his works when delimiting morphological regions.

Firstly, he employs the hierarchy of form complexes which corresponds to the axiom of 'hierarchical nesting of form complexes'. The 'town-plan' contains both 'building fabric' as well as 'land utilization'; and, in turn, 'building fabric' itself contains that part of 'land utilization' that lies within it. It is possible to define form complexes systematically at different levels of specificity by describing the constituent elements through the levels of resolution (Kropf, 1996). Secondly, historical stratification of the urban landscape, reflecting the distinctive residues of past periods, gives rise to a hierarchy of morphological regions. The nature and diversity of functions and the degree of historical stratification have major bearing on the number of tiers in the hierarchy of units (Whitehand, 2009). Conzen attempts to provide general rules for a nested hierarchy of spatial units comprising four ranks, as follows: i) the Old Town, or traditional core, as a major region within the built-up area of the whole town; ii) town quarters represented by the traditional plan units; iii) street units and precinctual units forming major neighbourhood units; and iv) morphotopes or the smallest building groups of distinctive period mixture or period dominance (Conzen, 2004). Thirdly, Conzen employs a hierarchy of form persistence. In this context, the town-plan is the most persistent; building fabric is less persistent and the land and building utilization is even less persistent over time. This means that major weight is attributed to the town-plan; building fabric is the contributor to the intermediate and lowest ranks; and the land and building utilization contributes to the intermediate rank of morphological regions.

2.4. APPLICATIONS OF THE CONCEPT¹

The concept of morphological region has been advanced in Conzen's study of the English market town of Alnwick (Conzen, 1960). His more detailed study on the Anglo-Welsh border town of Ludlow (Conzen, 1975, 1988) followed the study of Alnwick. Afterwards, a number of urban morphologists influenced by Conzen have been applying the concept, or its variations, in distinct parts of the world. Here, in the context of development of the concept, each application world-wide has been examined one-by-one in terms of the following questions, in accordance with the research objectives:

- i. Where was the concept applied in terms of cultural geography?
- ii. For what purposes, and in which context, has it been tackled?
- iii. Which form complexes, or morphological constituents, have been employed for the identification of regions? How were they employed, step-by-step?
- iv. Is there any hierarchy in the delimitation of regions? If there is a hierarchy, how has it been addressed in a step-by-step sequence?
- v. How much do the other applications resemble to Conzen's applications?

These questions structure a framework for presenting the applications of the concept. The stream of this section has been formed, firstly, in a continental way (Europe, Asia, North America and Oceania), and then, chronologically. Europe has been addressed in two different parts, Britain, in which the concept has come to existence, and the rest of Europe.

¹ The contents of this section have been recently published in the paper 'The concept of morphological region: developments and prospects' (Oliveira and Yaygin, 2020).

2.4.1. BRITAIN

The case of Alnwick

Conzen's study of the English market town of Alnwick (Conzen, 1960) is widely acknowledged as ground-breaking within the field of town-plan analysis (Whitehand, 2009). According to Conzen, who led the development of research on plan analysis in part of the second half of the 20th century (Whitehand & Gu, 2007a), a town-plan can be defined as the topographical arrangement of an urban built-up area in all its man-made features containing three distinct complexes of plan elements, namely, streets, plots and the block plans of buildings (Conzen, 1960). Primarily, he analysed the characteristics of individual components of the town-plan in reference to their periods and modes of development. On this basis, the plan as a whole was examined in terms of morphogenetic types of plan-units as well as of the resulting geographical structure.

Conzen identified fourteen major plan units (only the ground plan is considered and not the building fabric or the land and building utilisation) and forty-nine sub-types, making evident the morphological complexity of Alnwick. The major types are as follows: (i) Medieval High Street Layout, with triangular market; (ii) Medieval Suburbium; (iii) Simple High Street Layout; (iv) Extramural Borough Street, with special siting; (v) Closed Fringe Belt, with consequent ring road; (vi) Traditional Arterial Ribbons; (vii) Later Alterations of Old Town; (viii) Pre-Victorian Frame Roads; (ix) Late Georgian and Early Victorian Residential Accretions; (x) Mid and Late Victorian Residential Accretions; (xi) Modern Residential Accretions; (xii) Composite Ribbons without Traditional Plots; (xiii) Intermediate and Outer Fringe Belts; and, finally, (xiv) Farmsteads and Other Agricultural Buildings (see Figure 2.2).

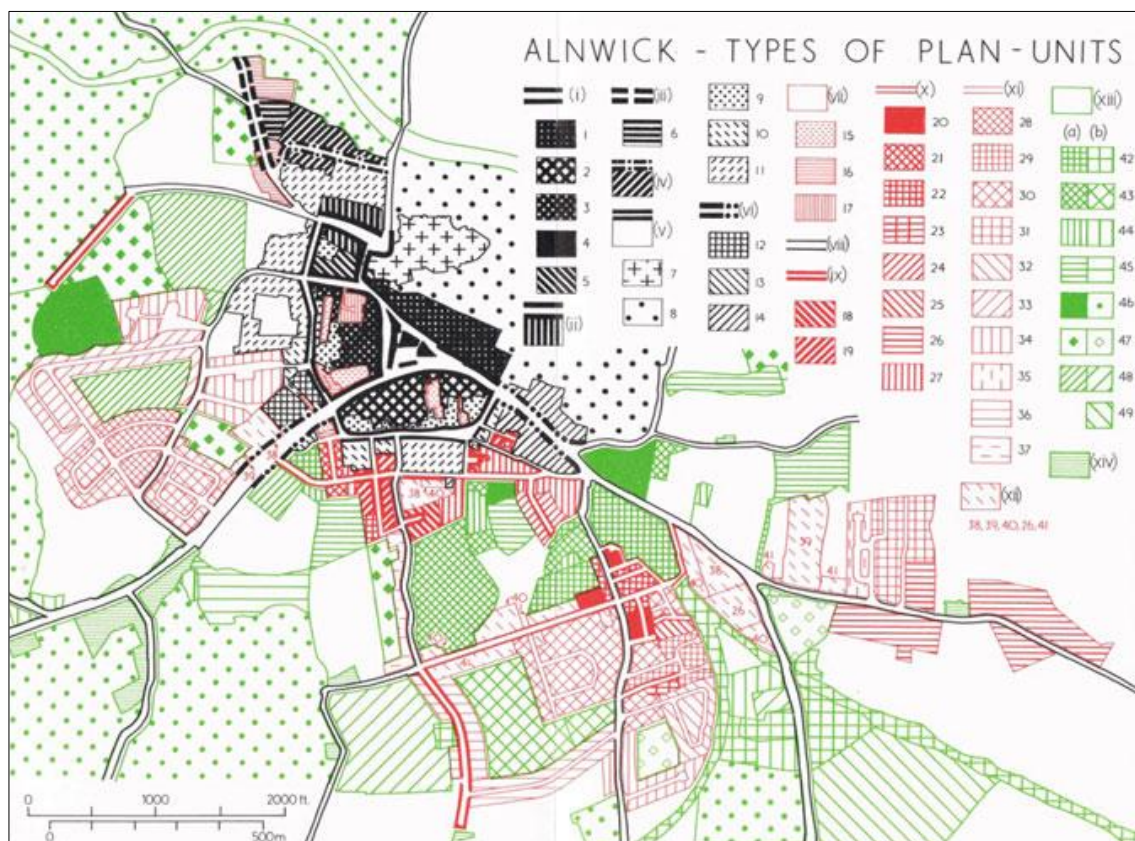


Figure 2.2 Types of plan units of Alnwick (Conzen, 1960, Fig 20)

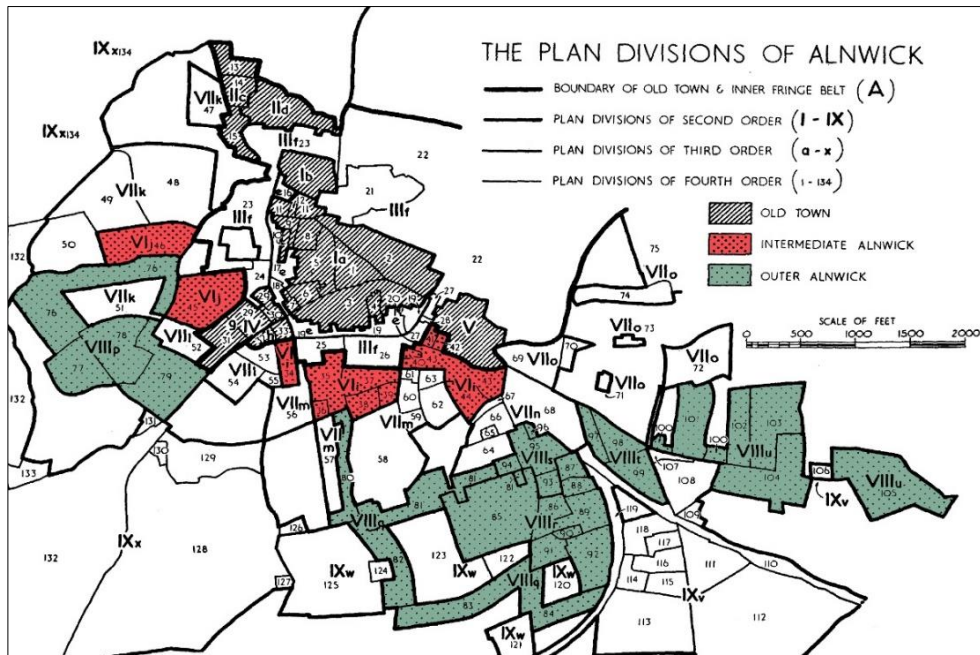


Figure 2.3 The plan divisions of Alnwick (Conzen, 1960, Fig 21 - coloured by the author)

A. Old Town and Inner Fringe Belt. I. Ancient Borough and Bailiffgate. (a) Ancient Borough. 1 Central Triangle. 2 Bondgate North Side. 3 Market Street South Side. 4 Correction House Clearance Area. 5 Fenkle Street West Side. 6 Clayport Clearance Area. 7 Bird-and-Bush Redevelopment. 8 Memorial Cottages Redevelopment. 9 Pottergate South Side. 10 Pottergate Row Clearance Area. 11 Pottergate/Narrowgate North Side. 12 Pottergate Clearance Area. (b) Bailiffgate II. Canongate/Walkergate. (c) Canongate. 13 Canongate North. 14 Central Canongate. 15 Canongate South. (d) Walkergate. III. Inner Fringe Belt. (e) Intramural. 16 Northumberland Street Intramural. 17 Dispensary Street Intramural. 18 Dispensary Street Clearance Area. 19 Green Batt Intramural. 20 Roxburgh Place Clearance Area. (f) Extramural. 21 Alnwick Castle. 22 Castle Grounds. 23 North-Western Extramural. 24 Western Industrial Area. 25 Western Green Batt Extramural. 26 Eastern Green Batt Extramural. 27 Hotspur Street Extramural. 28 Hotspur Street Clearance Area. IV. Upper Clayport Street. (g) Upper Clayport North Side. 29 Upper Clayport North-East Side. 30 Stamp's Yard Clearance Area. 31 Grosvenor Terrace/Clive Terrace. (h) Upper Clayport South Side. 32 Upper Clayport South-West Side. 33 Fire Station/Monkhouse Terrace. V. Bondgate Without. B. Outer Accretions. VI. Intermediate Alnwick. (i) Lisburn Street/Prudhoe Street. 34 King Street. 35 Howick Street. 36 Howick Street South-West Side. 37 Percy Terrace/Prudhoe Street West. 38 South Street. 39 Bungalows near Duke's School. 40 Croft Place. 41 Hotspur Place. 42 Hotspur Place South-East. 43 Prudhoe Street East. 44 Stott Street. (j) Lower Howling Lane. 45 Windsor Gardens. 46 Alwyside. VII. Intermediate Fringe Belt. (k) West Demesne Belt. 47 Canongate Allotments. 48 West Demesne Agricultural Residual. 49 Ratten Row Allotments. 50 Alnwick Cricket Ground. 51 Stamps Close Agricultural Residual. (l) Upper Clayport Belt. 52 Clive Nurseries. 53 Lisburn Terrace North Side. 54 Cadet Huts Site. 55 Lisburn Terrace South Side. (m) Southern Intermediate Belt. 56 Bellevue. 57 Dunder Hill Allotments. 58 Duke's School. 59 New Infant School. 60 Policemen's Houses. 61 Police Station and Court House. 62 Croft House. 63 Prudhoe Street Tennis Courts. (n) Wagonway Road Belt. 64 Auction Mart. 65 Houses South of Council House. 66 Council House Complex. 67 Alnwick Creamery. 68 Alnwick Station. (o) Allerburn Belt. 69 Tenantry Column Grounds. 70 Alnwick Infirmary. 71 Spring Gardens. 72 Hillcrest. 73 Allerburn. 74 Allerburn House. 75 Leeks Field Allotments. VIII. Outer Alnwick. (p) Upper Howling Lane. 76 Barresdale. 77 St. Thomas's Crescent. 78 Oak Street/Beech Street. 79 Clayport Gardens. (q) Southern Alnwick. 80 The Dunterns. 81 Swansfield Park Road. 82 Blakelaw Road. 83 Greensfield Avenue. 84 New Wagonway Road Estate. (r) Wagonway Road South. 85 St. George's Crescent. 86 York Road North Side. 87 Aydon Crescent. 88 Augur Flats. 89 York Crescent/York Road South Side. 90 Sea View Terrace. 91 Augur Terrace West. 92 Augur Terrace East. (s) Wagonway Road North. 93 Queen Street. 94 Swansfield Park Road North-East. 95 Bridge Street/Duke Street. 96 East Parade. (t) Belvedere/Ravenslaw. 97 Aydon Gardens. 98 Belvedere Terrace. 99 Ravenslaw. (u) Alnmouth Road. 100 Alnmouth Road West. 101 Alnbank/Freelands. 102 Ravensmede. 103 West Acres. 104 Central Alnmouth Road. 105 Alnmouth Road East. IX. Outer Fringe Belt. (v) Newcastle Road Belt. 106 Windy Edge Farm. 107 Royal Oak. 108 Royal Oak Nurseries. 109 N.C.C. and Esso Depots. 110 Alnmouth Line Embankment. 111 Alnwick Gasworks and Laundry. 112 Stanley Flats Agricultural Residual. 113 Alnwick Cemetery. 114 Alnwick Saw Mill. 115 Sawmill Cottages. 116 A.R.D.C., Shell and Agricultural Machinery Depots. 117 Site of New Fire Station. 118 Firemen's Houses. 119 Wooler Line Embankment. (w) Southern Outer Belt. 120 South Wagonway Allotments. 121 Alnwick Football Ground. 122 Old Fever Hospital. 123 Alnwick Secondary Modern School. 124 Blakelaw Reservoir. 125 Broad Close Agricultural Residual. (x) Western Outer Belt. 126 Hope House. 127 Camphill Cottage. 128 Swansfield Park. 129 Swansfield House. 130 Sawnsfield West. 131 St. Thomas's Farm. 132 Alnwick Moor. 133 Shepherd's Rest. 134 Hulne Park.		
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Figure 2.4 The specific hierarchical divisions of Alnwick (Conzen, 1960, Fig 21 - a follow-up Figure 2.3)

Starting from the delineated morphogenetic plan units, Conzen proposed a geographical structure of plan divisions grouped into a four-order hierarchy. The identification of divisions of first-order, denoted by capital letters, present the contrast between old kernel and new accretions. They reflect Old Town and inner fringe belt where traditional lineaments have made a major contribution and, outer accretions where modern lineaments determine the plan character.

Second-order divisions, marked with Roman numerals, have been described as Ancient Borough and Bailiffgate, Canongate-walkergate, inner fringe belt, Upper Clayport Street and Bondgate Without, intermediate Alnwick, intermediate fringe belt, outer Alnwick and, outer fringe belt. Twenty-four divisions of third-order hierarchy, marked by small letters, were identified. Finally, 134 divisions of fourth-order, marked by numbers, were revealed in terms of the complexity of third-order divisions (see Figure 2.3 and 2.4).

The case of Ludlow

Conzen mapped morphological regions, based on the combination of the town-plan, building fabric, and land and building utilization, in Ludlow (Conzen, 1975, 1988). In the first of two applications (Conzen, 1975), each element has been revealed in a five-order hierarchy with their natural substratum.

The classification of the town-plan and building fabric was based on two criteria – original functional purpose and period of origin. In contrast to the town-plan and building fabric, the pattern of land utilization did not depend on the period of origin for their classification. This classification was based on the single criterion of purpose. The major functional categories, such as residential, commercial, industrial, or community service functions, represent a high level of hierarchy of land utilization, and their subdivisions produced the detailed classification of land utilization types (see Figure 2.5).



Figure 2.5 Morphological regions of Ludlow (Conzen, 1975, Fig 1)

Table 2.3. The systematic form complexes as morphological regulators in the Old Town of Ludlow (Based on Conzen, 1988, Fig 10.3)

1	2	3	4
Systematic form complex	Degree of Form persistence	Morphological periods	Contribution to the hierarchy of townscape regions
Town plan	Maximal	High medieval 1090-1270	High rank (major genetic plan units) intermediate rank (neighbourhoods: street and precinctual units, high medieval suburbs)
		Late medieval 1270-1500 and early post-medieval	Intermediate rank (eastern Dinham transformation, Bell Lane neighbourhood) lowest rank (morphotopes of market encroachments)
Building fabric	Considerable through varying with periods	High and late medieval 1090-1500	Few but prominent public buildings and defence structures. Very few houses by external indices, but structural remains inside and at rear of many post-medieval houses
		Early modern 1500-1840	Intermediate rank, but principally lowest rank (morphotopes)
		Victorian and Edwardian 1840-1918	Lowest rank (morphotopes)
		Inter- and post-war, Post-1918	
Urban land utilization	Minimal	Pre-1840	Intermediate rank (traditional business core, traditional residential area, recreational area, castle ruins)
		Recent (20 th century)	

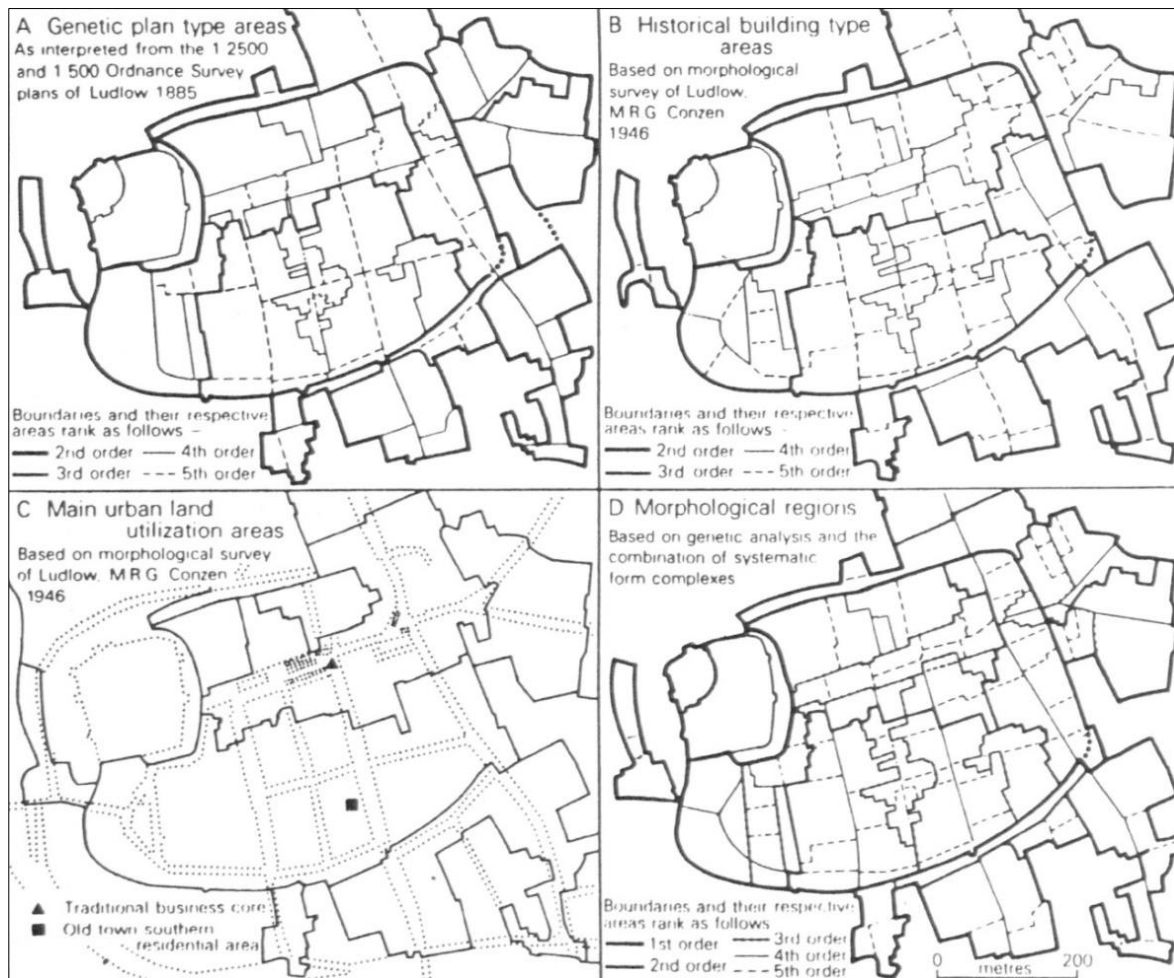


Figure 2.6 Ludlow Old Town, morphological regions (Conzen 1988, Fig 10.2)

In a second, and more detailed application (Conzen, 1988), Conzen mapped Ludlow's natural site and three 'systematic form complexes', individually, namely the ground plan with its genetic plan units (comprising site, streets, plots, and the block plans of buildings), the building fabric with its historical building types, and the generalized land utilisation pattern based on land use types. The maps of ground plan and building fabric produce its own hierarchy of regions ranging from major divisions of the town to the smallest ones. Plan units and building types contributed directly to the historical stratification of the Old Town. The land utilization pattern contributed more indirectly through its individual elements. The three maps of systematic form complexes together yield a five-tier hierarchy of morphological regions (see Figure 2.6). The boundaries of the regions on this map consider the relative contribution of ground plan, building fabric, and land and building utilisation to the historicity of the urban landscape.

In addition to the discussion above, Conzen summarized the combination of three form complexes as morphological regulators, considering the systematic form complex, the degree of form persistence, the morphological periods, the morphological constituents of historical stratification and the contribution to the hierarchy of morphological regions (see Table 2.3). The main difference between these two applications is the hierarchical regionalization of land and building utilization. While the land and building utilization map has been recognized in a five-tier hierarchy in 1975, it was not identified in a hierarchical way in 1988.

The case of Amersham

The first suburban regionalization founded on Conzenian principles was on London's rural urban fringe, Amersham, largely developed in the 20th century. In contrast to the complex interrelationship of the town-plan, building form and land utilization in traditional urban cores, in this small area, these three form complexes had essentially the same distribution. The identification of these regions (referred to in the study as townscape units) is grounded on the idea of townscape embodying the spirit of a society in the context of Conzenian historical development perspectives (Whitehand, 1989).

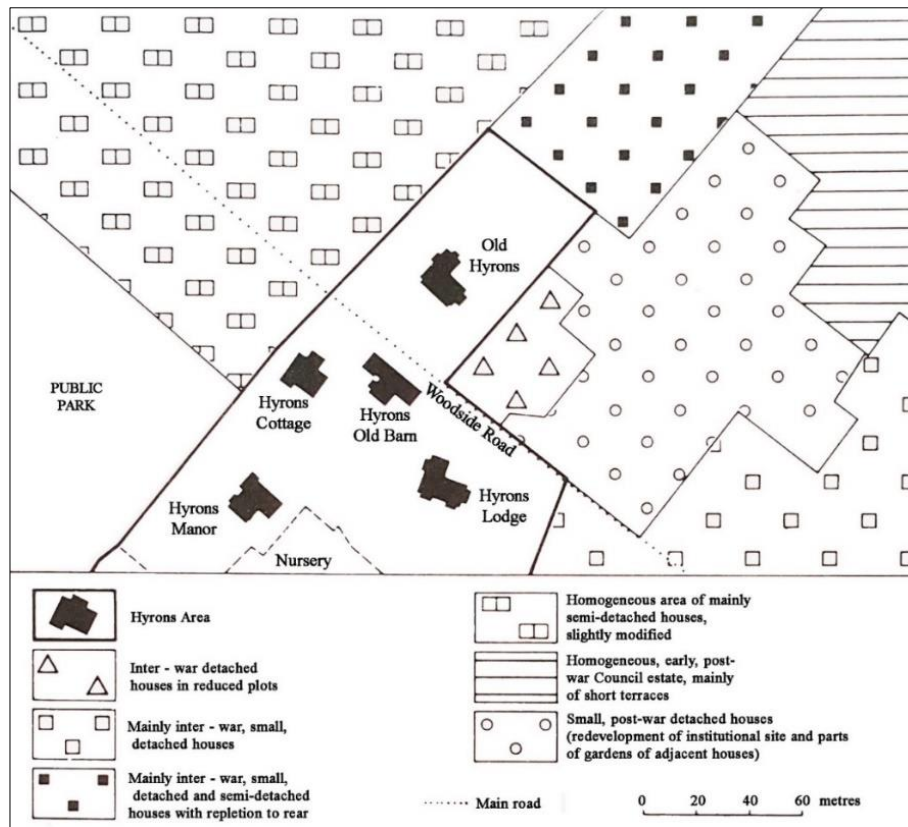


Figure 2.7 Townscape units in part of east-central Amersham (Whitehand, 1989, Fig 6)

Seven regions could be seen in part of east-central Amersham. A number of morphological constituents can be counted for derivation of regions, such as building period, dwelling types, size of building, change of plots, modification and extension of the buildings, land use and, the combination of these (see Figure 2.7). A hierarchy of regions was not identified.

The cases of Barnt Green, Edgbaston and Northwood

Jones (1991) focused on the three cases of English suburb areas: Barnt Green, Edgbaston and Northwood. These areas which have varied patterns of streets and plots and a larger variety of types of detached houses, laid-out in the late-19th century, have been subjected to great pressures for infilling, adaptation, and redevelopment in the post-war period. The morphological and historical characteristics of these townscapes have been revealed through a series of maps showing different aspects of the ground plan and building fabric: plot boundary changes in conjunction with proposed and implemented *cul-de-sac*, antecedent features and layouts, dwelling types, age of buildings and proposed and implemented

demolition of dwellings. The pattern of land utilization has not been considered in these three case studies.

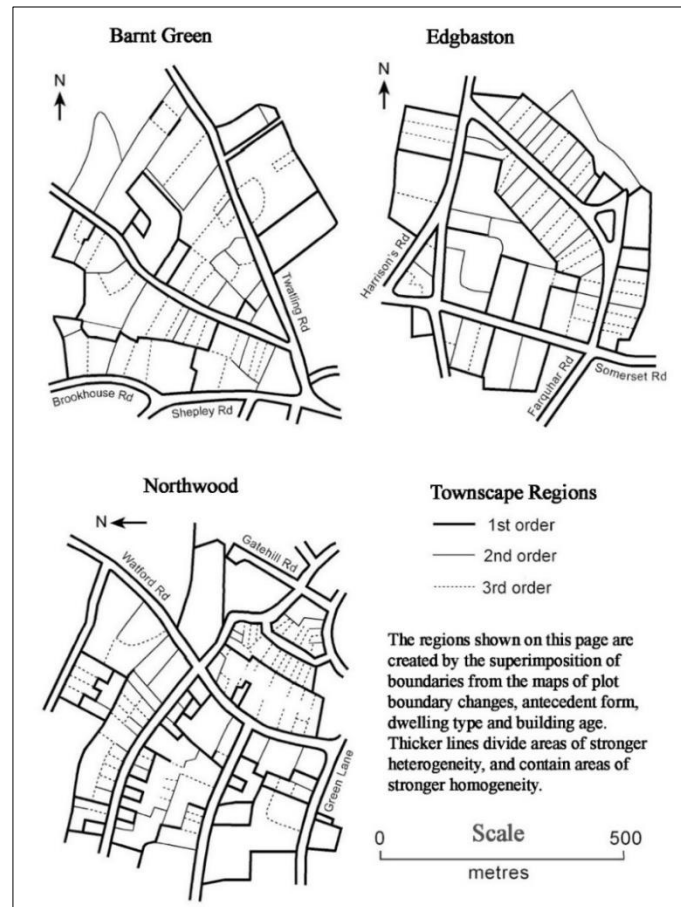


Figure 2.8 Hierarchy of morphological regions in parts of English suburbs of Barnt Green, Edgbaston and Northwood (Jones, 1991, Fig 9.8)

Afterwards, a three-tier hierarchy of boundaries has been recognized between regions based on the degree of correspondence (see Figure 2.8). Jones' maps of morphological regions represent the superimposition of plot boundary changes, antecedent form, dwelling type and building age. However, the contribution of each element to the hierarchy is elusive. The main purpose of this morphological regionalization was to analyse the consequences for the townscape of new development, how new layouts and dwellings relate to those of earlier periods, and how the nature and pressure of development vary geographically. In 2005, a four-tier hierarchy of morphological regions (or character area as referred in the study) of the suburban area of Barnt Green was recognized by Whitehand (see Figure 2.9). The map was designed for a parish plan. The character areas have been delimited according to four principal criteria: ground plan (including site), building form, land use and vegetation. Each of them has been examined individually and in combination. Nine regions with a strong presence of residence and two regions on community spaces and utilities were identified. These, respectively, are Hewell Road (mainly terraced houses), Sandhills Lane, Sandhills Road, the Croft, Blackwell Road, Fiery Hill, Lickley Approach, Bittell Road, Bittell Lane, Inner and Peripheral community spaces and utilities. Most of the main regions include second- and third-order subdivisions, and one of the regions contains fourth-order subdivisions in terms of variety of ground plan, building form, land use and vegetation (Whitehand, 2009).

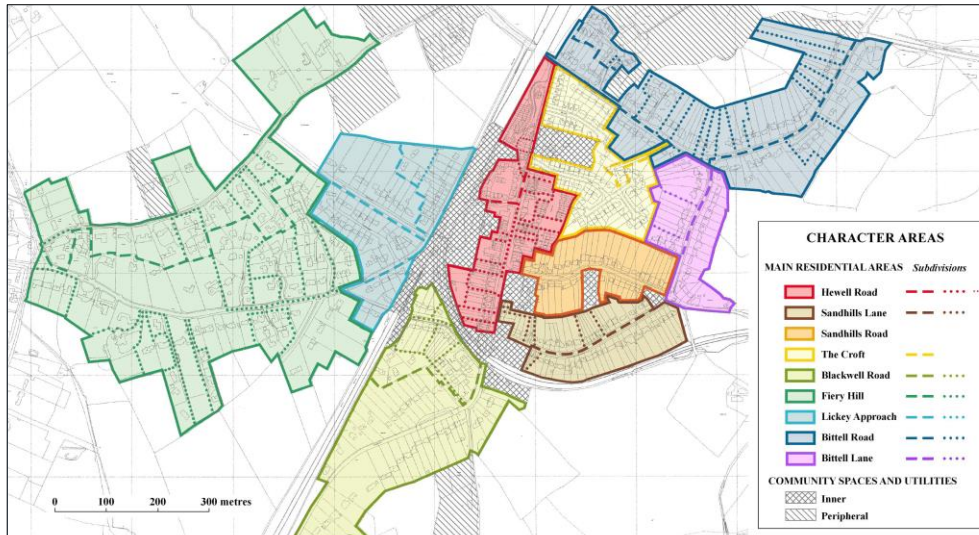


Figure 2.9 The character areas of Barnt Green, Birmingham, England in 2005 (Whitehand, 2009, Fig 5)

The case of Worcester

As in the case of Alnwick, the regionalization procedures in Worcester are restricted to plan units. The aims of this study were, firstly, to reconstruct the detailed plan of Worcester, and secondly, to examine the morphogenetic development of the city from post-Roman times to the date of that reconstructed plan. Thereby, primarily, the detailed base map of the medieval town of Worcester has been compiled with superimposition of cartographic maps and evidence of archaeological data, documentary evidence, and existent plan.

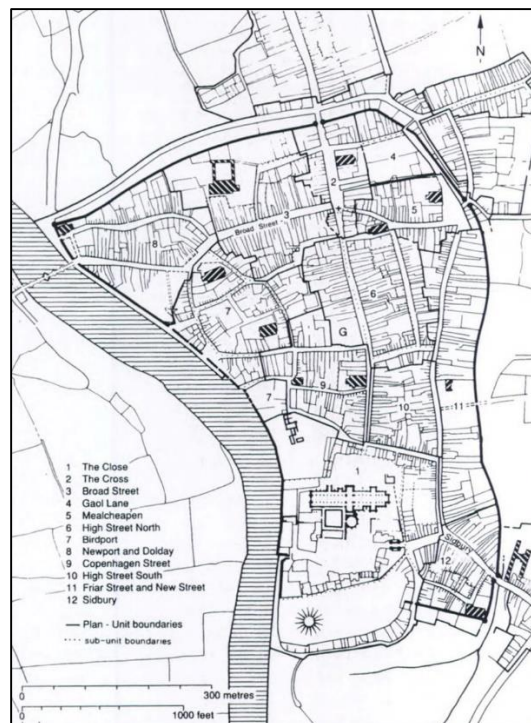


Figure 2.10 The plan units of intra-mural medieval Worcester (Baker & Slater, 1992)

In Worcester, the scale of plan-unit definition was determined by the individual street or street block. Smaller-scale variations and deviations were isolated and described as sub-units of the larger street-block units (Baker & Slater, 1992). The plan units defined in Worcester were established in a two-tier hierarchy based on the town-plan. The first-order (or plan-unit boundaries as referred to in the study) represents the area occupied by plots associated with a street or streets where the orientation, shape, and dimensions of those plots have one or more internal characteristics in common. In addition to that, the width, straightness, and orientation of streets were considered to establish first-order plan units. The function has been sometimes taken as a defining characteristic where it is apparent but, for the medieval period, this is unusual. Parish boundaries, representing secular and ecclesiastical boundaries, have been used to derive distinctive plan units, in which there is no morphological homogeneity in respect of plan form. The second-order (or sub-unit boundaries) reflects smaller-scale variations and deviations of size, shape and other internal characteristics of plots (see Figure 2.10).

The cases of Birmingham and Bristol

Barrett (1996) investigated part of the core areas of two major British cities, Birmingham and Bristol. In this study, Conzen's framework from Ludlow has been employed to assess the character of areas as the basis for decision making for urban conservation, in which preservation and enhancement of character is the key issue. Therefore, the broader townscape identity and meaning were considered, rather than just its morphological composition of constituent parts.

Figure 2.11 identifies plan units, building form units, land utilization units and, the product of the combination of these three maps, townscape units of the city centre conservation area of Birmingham. In a similar way, Figure 2.12 shows maps of each form complex and the product of their combination, townscape units of the city centre conservation area of Bristol.

Primarily, the analysis of the plan was illustrated for each area based on cartographic evidence for seven cross-sections in time, historical development of street pattern, and the phases of plot development in which the Conzenian classification (orthomorphic, hypo metamorphic, metamorphic, adaptive, and augmentative redevelopment) of the degree of change had been employed. Secondly, an analysis of building form was introduced based on morphological period divisions, such as Georgian, early-and mid-Victorian, Late-Victorian and Edwardian, Inter-war and Post-war in both conservation areas. Thereafter, the land utilization analysis was revealed based on dominant land use which consisted of the food, retail, professional and financial, other services, public and community, warehousing and storage, light industrial and, development sites (Barrett, 1996).

The next step of regionalization was the delimitation of boundaries of each form complex for each case study. In this context, a map of three-tier hierarchy of the town-plan, from first to third-order; three-tier hierarchy of building form, ranging from second to fourth-order; and lastly a map of land utilization without hierarchy were produced (Figures 2.11 and 2.12). A four-tier hierarchy of morphological regions was revealed for each conservation area. According to Conzen's framework, the highest rank of morphological regions, delimited by first-order boundaries, correspond to the major plan units. These represent initial phases in the historical development of street plan and plot pattern. Second- and third-order boundaries reflect plan changes within first-order regions caused by subsequent redevelopments and changes to existing plots. They also reflect the boundaries of land utilization units and major building form units. Fourth-order boundaries consider variations of building form and also minor differentiations of the plan. To avoid confusion in the hierarchy of units, Barret introduced a system, where lower-order units within higher-order units are labelled as sub-sets of this unit (Figures 2.11 and 2.12). Tables 2.4 and 2.5 present a set of rules for the delimitation of boundaries, considering the systematic form complexes, the degree of form persistence, morphological periods, morphological constituents of historical stratification, and the contribution to the hierarchy of morphological regions.



Figure 2.11 Urban landscape units, Birmingham (Based on Barrett, 1996, Figs 4.16, 4.18, 4.23, 4.25.)

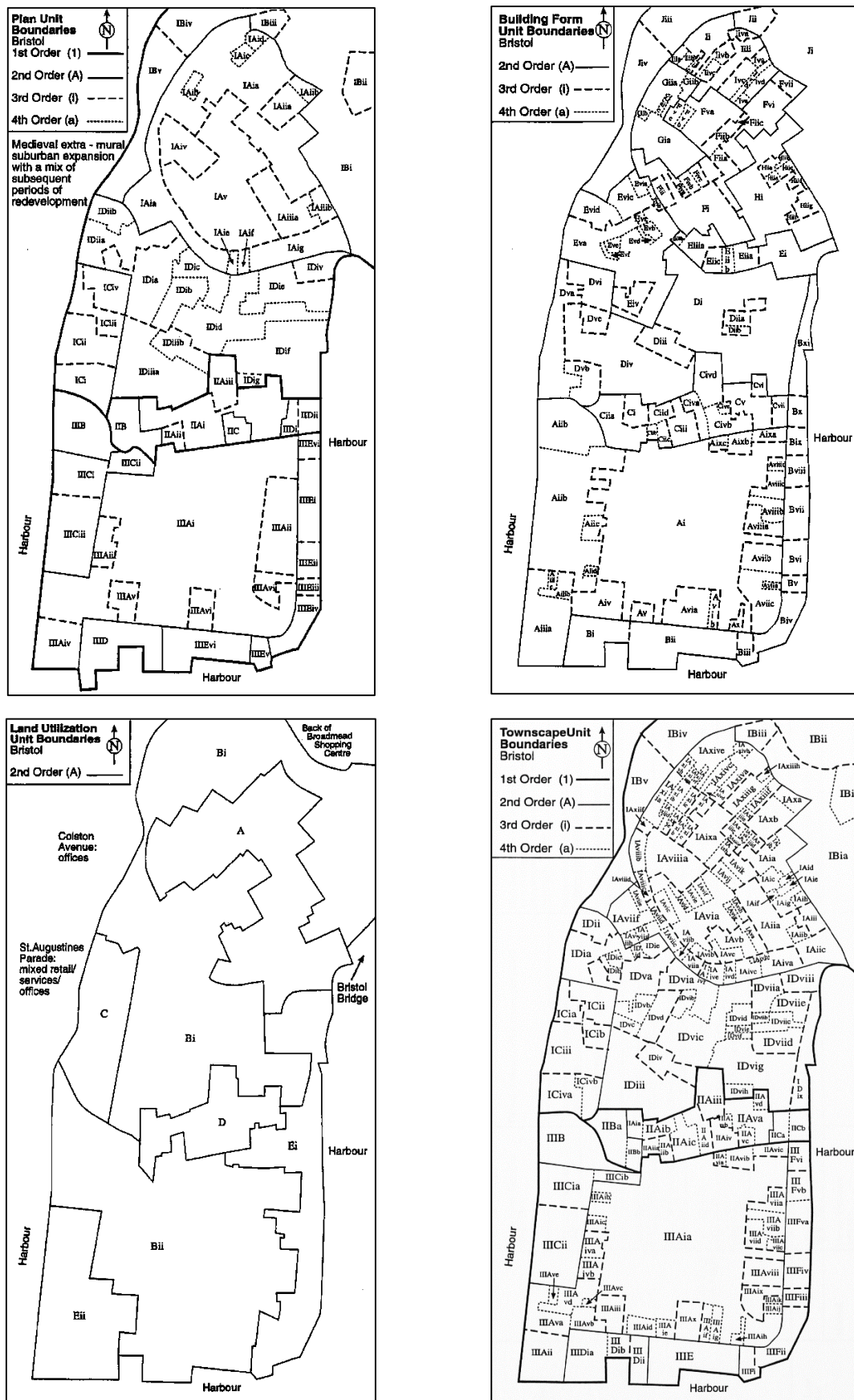


Figure 2.12 Urban landscape units, Bristol (Based on Barrett, 1996, Figs 4.17, 4.19, 4.24, 4.26)

Table 2.4. The systematic form complexes as morphological regulators in Central Birmingham (Based on Barrett, 1996, Fig 4.27)

1	2	3	4
Systematic Form Complex	Degree of Form Persistence	Morphological Periods	Morphological Constituents of Historical Stratification
Town plan	Maximal	Queen Anne- Georgian 1690-1840	General outlines of street system, plot pattern High Rank (major genetic plan units) (Phases of town development) Intermediate Rank (Neighbourhoods: street and plot remnants e.g. Newhall St, Temple St)
		Mid -Late Victorian 1840-1914	Breakthrough streets, plot transformation and redevelopment Intermediate Rank (e.g. New St, Cannon St, Colmore Estate transformations)
		Post-War 1945 -	Comprehensive redevelopment areas, minor plot redevelopment Intermediate Rank (Corporation St redevelopment), Lowest Rank (Individual redevelopment's e.g. Colmore Estate)
		Queen Anne- Georgian 1690-1840	Few but mainly prominent public buildings (Cathedral, town Hall)
Building fabric	Considerable though varying with periods	Early – Mid Victorian 1840 - 1885	1 st Phase of commercial redevelopment, isolated groups and prominent structures remaining Intermediate Rank but principally lowest rank (Morphotopes)
		Late – Victorian 1885-1914	High percentage of commercial buildings Intermediate Rank but principally lowest rank (Morphotopes)
		Inter-War 1914 - 1939	Limited redevelopment – isolated areas and individual buildings Lowest Rank (Morphotopes) (ag Bennets Hill)
		Post-War 1945-	Redevelopment of edge of area and individual offices Intermediate Rank (Edge of Area) Lowest Rank (morphotopes) Individual developments (Colmore Estate)
Urban Land utilization		Mid – Late Victorian 1840 -1914	Intermediate Rank Traditional Business Core, Civic Centre
	Minimal	Recent (20 th century)	

Table 2.5 The systematic form complexes as morphological regulators in Central Bristol (Based on Barrett, 1996, Fig 4.28)

1	2	3	4
Systematic Form Complex	Degree of Form Persistence	Morphological Periods	Contribution to Hierarchy of Townscape Regions
Town plan	Maximal	High – Late Medieval 1090-1500	High rank (major genetic plan units) Phases of town development, Intermediate rank (Neighbourhood: street and plot remnants in core and Broad Quay/Marsh Street.
		Tudor – Elizabethan – Jacobean, 1500-1690	High rank (major genetic plan units) Phase of town and development, Intermediate : street and plot remnants – King Street
		Queen Anne – Georgian 1690 -1840	High rank (major genetic plan units) Phase of town development, Intermediate : street and plot remnants Queen St/Claire St/Markets.
		Mid – Late Victorian 1840-1914	Intermediate rank (Baldwin Street/Broad Quay redevelopment, Lowest rank : individual developments e.g. Post Office, Small Street
		20 th Century 1918- High - Late Medieval 1090-1500	Lowest Rank (Morphotopes)
Building fabric	Considerable though varying with periods	Tudor – Elizabethan – Jacobean, 1500-1690	Intermediate Rank but principally lowest rank (Morphotopes) - remnants core and King Street.
		Queen Anne – Georgian 1690 -1840	Intermediate Rank (markets, cross, Queen St) but principally lowest rank (morphotopes) remnant commercial buildings: core and docks.
		Mid – Late Victorian 1840-1914	Intermediate Rank (core, Baldwin St) but lowest rank (morphotopes)
		Inter-war 1918-1939	Lowest Rank (Morphotopes)
		Post-war 1945-	Intermediate Rank (Wine Street/Baldwin St/Broad Quay) Lowest rank (morphotopes) individual development (core and Queen St)
Urban Land utilization	Minimal	Mid- Late Victorian 1840 -1914	Intermediate Rank traditional business core, dock
		Recent (20 th century)	

The case of Bromsgrove

Bienstman (2007) is the second researcher that came close to replicating Conzen's method in urban cores. In her study, she addressed two case studies, the English town of Bromsgrove and, the Dutch town of Alkmaar (see the next sub-section). Indeed, the conservation area delimitation and character assessment for the townscape management have been examined in these two towns based on Conzen's approach. The hierarchical nesting of morphological regions consists of (i) The Old Town as a whole, (ii) Town quarters (iii) Street units and precinctual units, (iv) Morphotopes, or the smallest building groups of distinctive period mixture or period dominance (Conzen, 2004). In addition to the Conzenian hierarchical framework to Old Towns, Bienstman proposed the fringe belt and residential accretions as main contributors to the major plan units. Primarily, each of the form complexes was delineated in a four-order hierarchy individually. The first-order of plan units mainly represents the Old Town as a whole, the fringe belt and, residential accretions as major regulators of the hierarchy. The second-order plan units reflect extensions of the town, and homogeneity of the town-plan. The subdivision of fringe belt was recognized in respect of fringe belt features, plot size and shape, and fringe belt alienation. Third-order boundaries of plan units represent plot layouts, and dwelling types which are delineating terraced houses with back gardens, and the historicity of buildings. Fourth-order plan units were minor divisions of the plan, that represents a certain unity, and distinction in nature from their surroundings. It remained elusive because of the subjectivity of the application of the concept. The hierarchy of building fabric was designated by the degree of unity in terms of age, style, type, utilization, material, size, and height of buildings as in the case of Alkmaar. However, the contribution of the components of building fabric to the hierarchy was not clear-cut. The non-hierarchical map of the land and building utilization reflects the delimitation of the commercial core, areas of a largely residential character, areas with mainly community functions, and an area of fringe-belt alienation. Its contribution to the hierarchy could be seen in the identification of high-rank regions (see Figure 2.13).

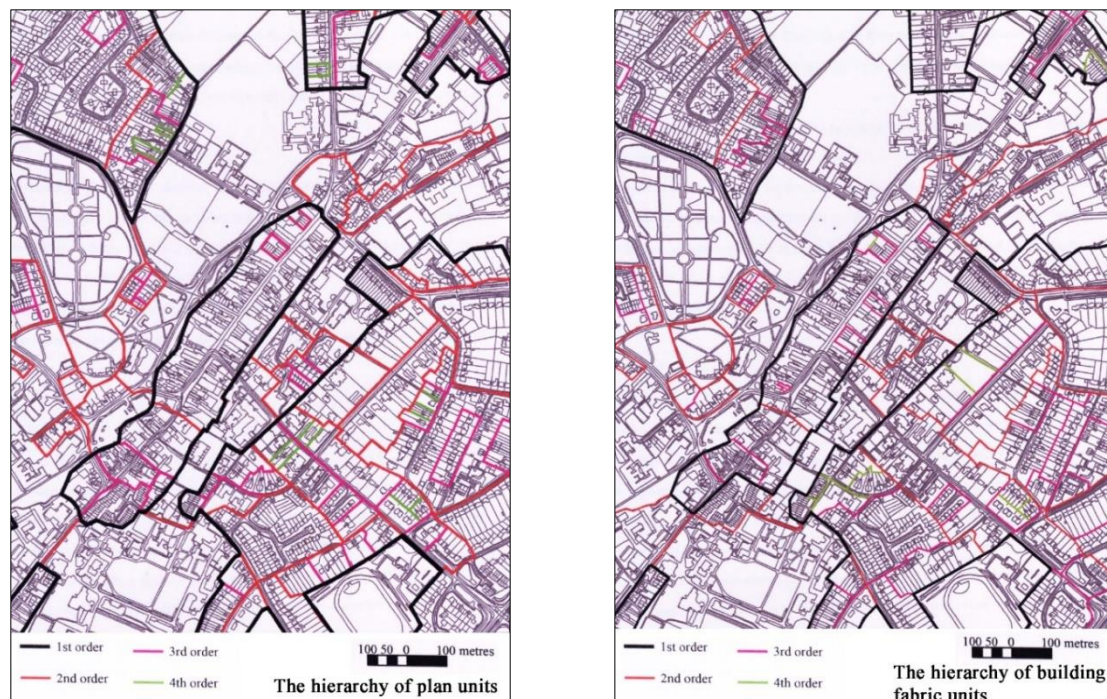


Figure 2.13 Urban landscape units, Bromsgrove (Based on Bienstman, 2007, Figs 5.16, 5.18, 5.20, 6.13)



Figure 2.13 (continued) Urban landscape units, Bromsgrove (Based on Bienstman, 2007, Figs 5.16, 5.18, 5.20, 6.13)

Using a hierarchical framework, the highest rank of regions with boundaries of first-order corresponds to the major units of the plan. Second-order units are shaped by subdivisions within these major units and are often street units or parts of streets, in which plan and building characteristics are substantially different to those in surrounding areas. Within the fringe belt, second-order plan units consist of areas with distinct character, and areas of fringe-belt alienation. Third-order regions are subdivisions within second-order regions and often reflect plot metamorphosis and redevelopment. Fourth-order regions are formed by small differentiations in the town-plan and building fabric cells.

The cases of Edgware and Docklands (London)

The focus of Larkham and Morton (2011) for these two suburb areas in London, Edgware and Docklands, was on quantifiable measures to test whether there was any difference between quantitative measuring and ‘by eye’ approaches in identifying morphological regions. The term ‘by eye’, here, is identifying boundaries by a variety of quick approaches including personal knowledge, rapid reconnaissance, and superficial cartographic convenience by practitioners (Larkham & Morton, 2011). In accordance with the main purpose of the study, a few quantitative measurements were defined: street block area, plot area, building footprint area, number of dwellings, percentage of dwelling types (detached, semi-detached), and dwelling density on the basis of the town-plan (per ha).

Edgware area represents part of a single large estate, built in a typical form of the time by a single developer in what was usually seen as one morphological period. Therefore, this area has less relation to Conzen’s approach in terms of historical layering. Building form varies, with admixture of detached and semi-detached houses as noted above. But, in a closer inspection, it reflects internal differences. Two sample blocks have been delineated for Edgware, using the common approach of roads as

boundaries (in British perception) (see Figure 2.14). In consequence of measurements, Larkham and Morton found that Block A has a slightly smaller average plot area, significantly smaller range of plot areas, a higher proportion of originally detached houses, and both larger and smaller building footprints. The visual characteristics of the streets were very similar. Some dimensions, such as street and pavement widths, were identical. The differences were not readily apparent from visual inspection alone. Larkham and Morton considered that measurable differences at that scale were not significant to inform morphological region identification. The case of Edgware suggested that these measurable data were unnecessary.

The Docklands case represents a residential development of the 1980s, that was part of the regeneration of London Docklands. In general, this area was also developed during a single morphological period as in the case of Edgware. In the Docklands, five regions (A, B, C, D and E) have been delimited. However, B is bisected by a north-south road (see Figure 2.15). The differences between these areas, identified from visual inspection for the original study in order to demonstrate clearly-distinct areas, can be tested through accurate measurements of four sample areas.

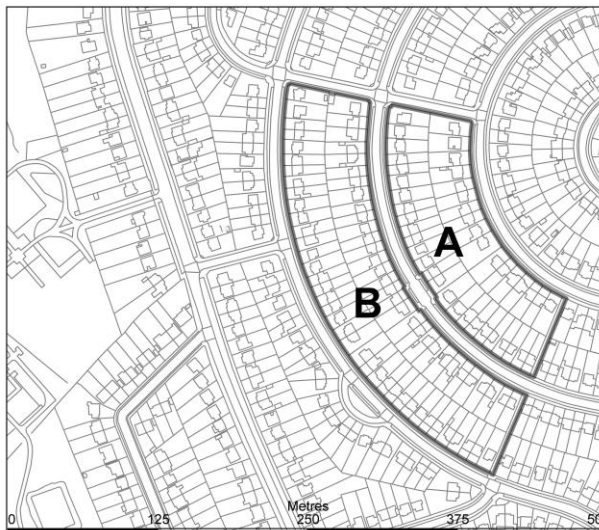


Figure 2.14 The Edgware 500m x 500m study area
(Larkham & Morton, 2011, Fig 1)

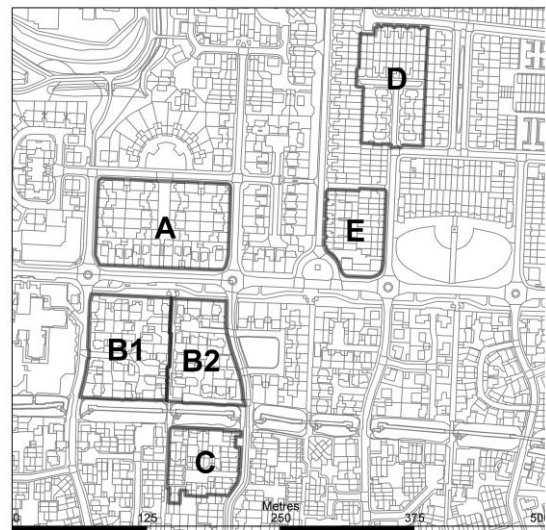


Figure 2.15 The Docklands 500 m x 500 m study area
(Larkham & Morton, 2011, Fig 2)

This first delineation was based on the town-plan form, building height, building style, and building materials. In contrast to Edgware, there were some measurable differences between the morphological regions. These represent the different phases of construction in which different designers and developers had become involved. The Docklands case resulted into a single layer of regions, without hierarchy. This case suggested that measurable data could be used to identify lower-order regions. One major issue raised here was that of whether roads have the meaning as area boundaries (Larkham & Morton, 2011).

The case of Stratford-upon-Avon

The focus of this study was an English suburb, largely created during the 20th century, in a town of medium-to-small size, Stratford upon-Avon, in central England. In this case, Birkhamshaw and Whitehand (2012) compared the morphological regions (or character areas as referred in the study) delimited by researchers with those that delimited by the local planning authority, and local residents. The map of regions in the selected part of suburban Stratford-upon-Avon was drawn in 2005, employing

a Conzenian methodology. A two-tier hierarchy of regions was identified based on the ground plan, building fabric, and land utilization. Some 40 first-order regions, varying greatly in size, were recognized. Second-order regions reflect variations of ground plan, building type or both. The morphological constituents of the second-order regions were not articulated explicitly in the paper (see Figure 2.16).

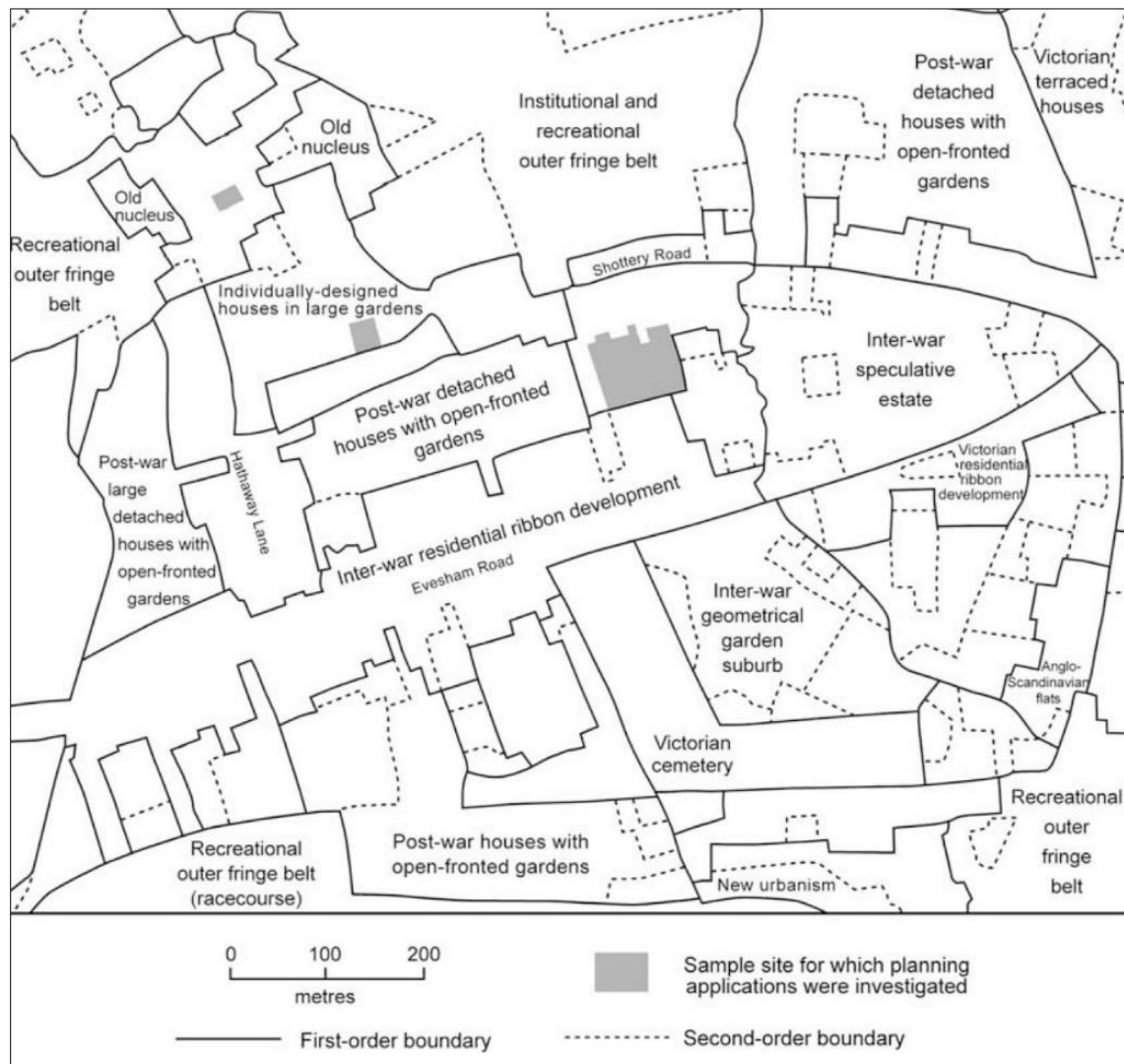


Figure 2.16 Character areas in south-west Stratford-upon-Avon (Birkhamshaw and Whitehand, 2012, Fig 2)

This comparison of characterization has revealed major differences between the three methods. The coarse delimitation by planners and the public has only a faint resemblance to the pattern of Conzenian regionalization. In the recognition of residents, the boundaries of character areas were identified through roads. In contrast, most boundaries between regions followed the rear boundaries of plots in the Conzenian delimitation.

2.4.2. ELSEWHERE IN EUROPE

The case of Mennecy, France

Kropf (1996) describes a type of morphological regionalization, developed in his PhD thesis (Kropf, 1993), and then, included in the zoning system of the *Plan d' Occupation des Sols* of Mennecy, south of Paris, France. The approach was a synthesis of Conzen's ideas on the town-plan and building fabric and Caniggia's ideas on *tessuto urbano*, providing the basis for the concept of urban tissue. This method was termed 'typological zoning'. His synthetic conception of urban tissue was described at distinct levels of resolution, and the levels corresponded to the different elements. These were streets and street blocks, plots, buildings, rooms and spaces, structures such as walls and roofs, and materials. These elements were interrelated in a hierarchy that provides a framework for levels. Kropf stated that, at the most general level, a tissue can be described as an arrangement of streets and street blocks. Greater specificity was achieved, describing the component plots, buildings, rooms, structures, and materials.

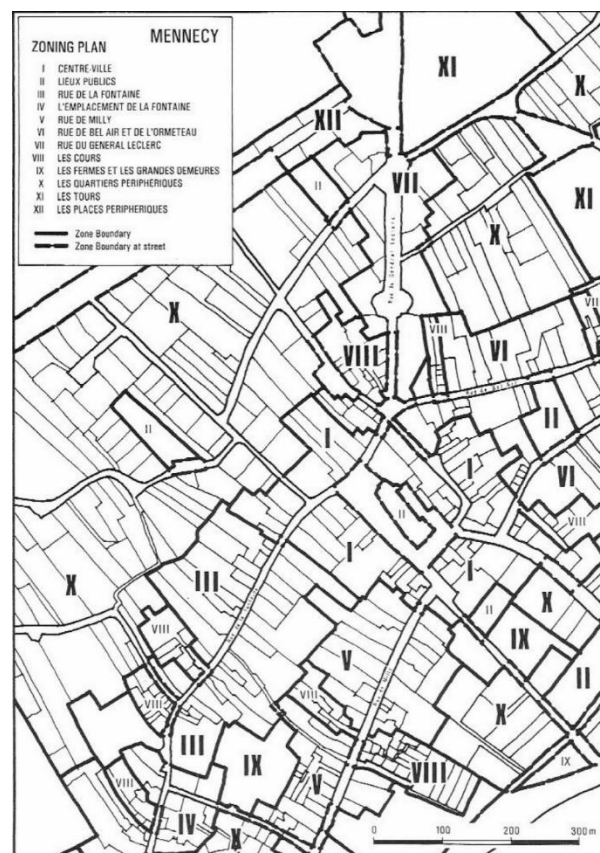


Figure 2.17 Part of a proposed zoning plan for the centre of Mennecy (Kropf, 1996, Fig 6)

Some specific characteristics were employed to describe each element, such as position, outline, and internal arrangement. The position is the element placed in an arrangement making up a larger scale entity. The outline is specified in terms of shape, size, and proportions, and limited to the two-dimensional outline on the ground plan. The arrangement is described in terms of the type of component parts, the number of parts and their relative position. The types of component parts are distinguished by their outline. In this context, Kropf defines two modes of analysis. One, geometrical analysis, is concerned with the physical structure of the elements of the town; the other, chronological comparative analysis, is concerned with the development and change of that structure through time. In geometrical

analysis, the components at the various levels of resolution were examined. This mode was framed in the terms of the synthetic conception of urban tissue mentioned above. In chronological comparative analysis, the different states of the town in time were examined in terms of growth and transformation of the town. He also described an outline to determine tissues. In consequence of these analysing processes, a range of tissues was found, and then, they were taken as a basis for applying to the form-based zones (Kropf, 1996). A number of zones were delineated with no hierarchy in the centre of Mennecy (see Figure 2.17). They were applied to the local zoning system to maintain the existing character of the town. Each zone represents a district with a distinct character, derived from its particular position and historical development.

The case of Antequera, Spain

The conservation and enhancement of the morphological inheritance as the starting point for future management, is the main concern of the morphological regionalization of Antequera in Malaga province, Spain. Barke (2003) describes the use of regionalization in the Special Plan for Antequera. The methodology resembles the one proposed by Conzen, although it lacks some methodological sophistication in the identification of a hierarchy of morphological divisions.

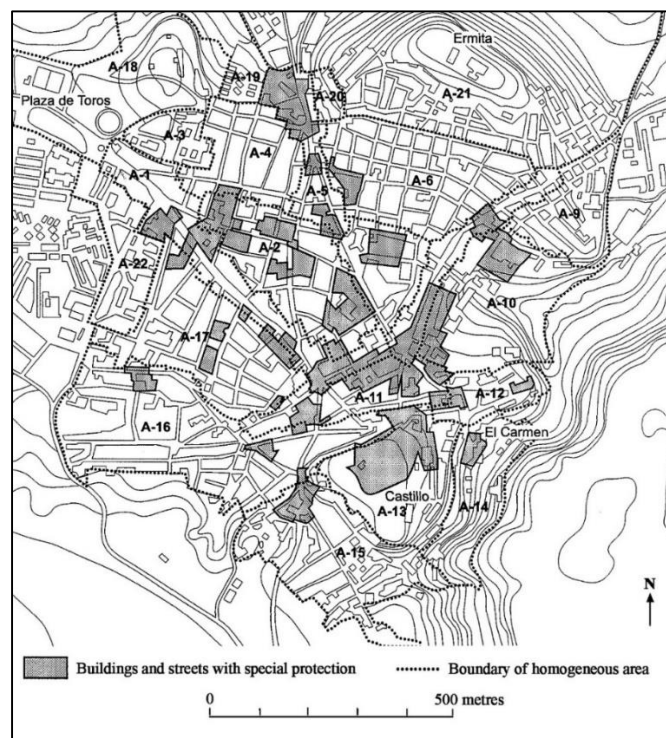


Figure 2.18 Homogeneous areas of Antequera defined in the Special Plan (Barke, 2003, Fig 1)

Two broad sets of criteria were used in the identification of morphological regions (or homogeneous areas as referred to in the study): morphological and functional criteria. The former includes the size and shape of building plots, the stage of historical development of the town-plan, the architectural style of buildings, the quality of buildings, the state of conservation of buildings and, the degree of transformation and change from the original structure. The latter comprises residential with commercial use and local services, residential with city-wide services, institutional and city and

regional services, residential with institutional and city and regional services, areas of tourist interest and residential and industrial use. These two groups of criteria were mapped individually and later, superimposed to define the 22 homogeneous regions (see Figure 2.18). Afterwards, the characteristics and conditions of each homogeneous region were assessed, and the main objectives for each area were defined. These reflect the specific interventions for the process of townscape management (Barke, 2003).

The case of Alkmaar, Netherlands

This case study had been addressed together with the case of Bromsgrove. As in Bromsgrove, each element of the urban landscape was mapped individually in a four-order hierarchy.

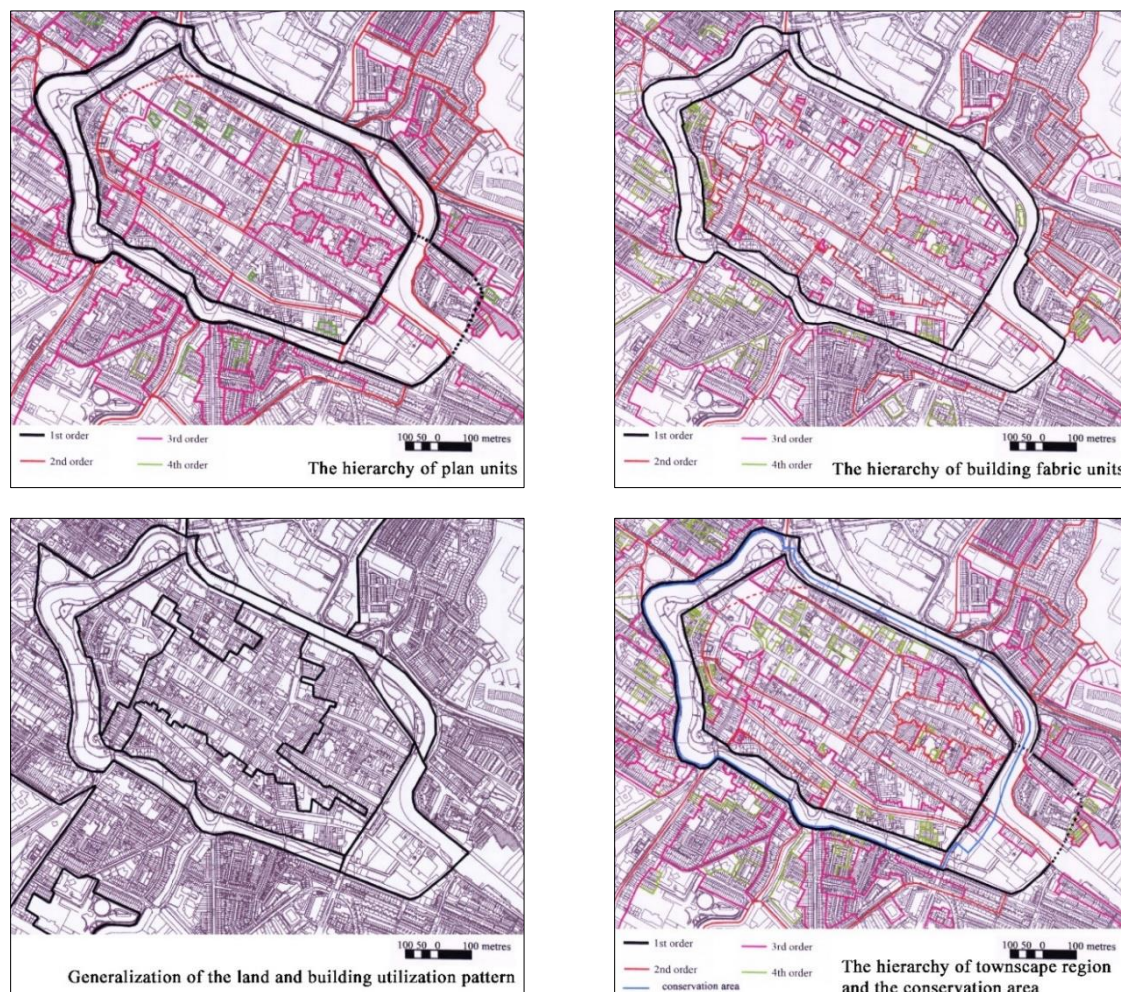


Figure 2.19 Urban landscape units, Alkmaar, Netherlands (Based on Bienstman, 2007, Figs 5.6, 5.8, 5.10, 6.1)

The first-order plan units mainly represent the Old Town as a whole, the fringe belt and, residential accretions as major regulators of the hierarchy. The secondary plan units inside the Old Town are shaped by the first and second extensions of the town. Sixteen second-order plan units were recognized within the residential accretions. The fringe belt was formed in respect of homogeneity of the town-plan. The third-order plan units within the Old Town were identified by homogeneity of buildings and plots in respect of their regularity, size and, historicity. Two third-order units were recognized within the fringe

belt; one with the 17th century street layout and original land use, and the other formed with ‘fringe-belt alienation’ to residential purposes in the 20th century. The rest of the fringe belt remained as park-like characteristic. Third-order units within residential accretions were identified in respect of street units. Finally, the fourth-order plan units have been delimited inside and outside the Old Town, usually consisting of clearly identifiable small units in terms of expansion phase and, a series of identical plots (see Figure 2.19). The hierarchy of building fabric was designated by the degree of unity in terms of age, style, type, use, material, size and, height of buildings. However, the contribution of building fabric to the hierarchy remained elusive, and there is a considerable degree of subjectivity. The non-hierarchical map of the land and building utilization reflects the main uses. Its contribution to the hierarchy is not clear-cut. By combining the hierarchical map of plan units, building fabric, and land and building utilization units, some distinct regions have been identified. First-order boundaries delimited the strongest elements in the town-plan; the final extension of the Old Town and the fringe belt. Second-order regions delimit key phases of urban expansion, which have left clear traces in the town-plan. Third-order regions were mainly areas and streets that represent a high degree of unity. Fourth-order regions were represented by minor plan differentiations and building fabric cells.

The case of Sibiu, Romania

The delimitation of plan units in Sibiu, Romania has served to highlight the way in which the recognition of types of plan units can articulate fundamental structural areal variations in historical development (Whitehand, 2009).

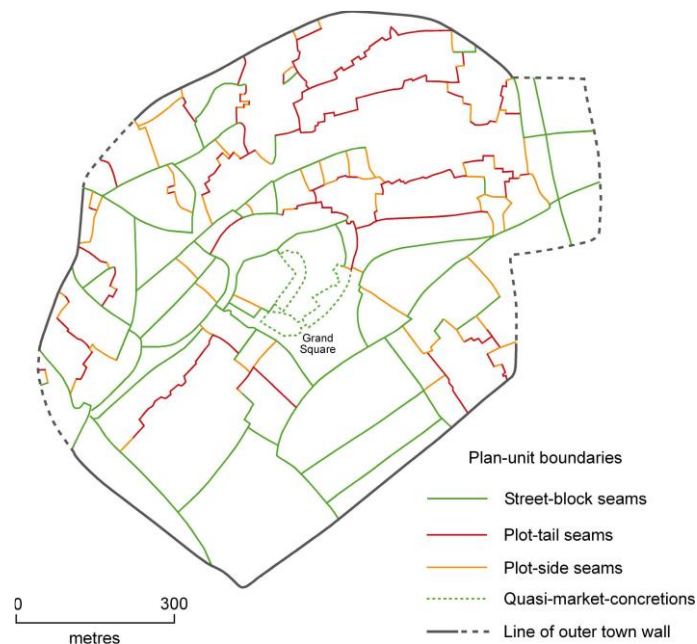


Figure 2.20 Plan-unit boundaries in central Sibiu, Romania in 1999 (Whitehand, 2009)

Three different types of plan-unit boundaries have been delineated in the centre of Sibiu. The first type of plan-units is street-block seams (following the lines of streets) with their distributions: extensions of plots from a main street to a back street, planned additions with regular street system and plot pattern, and on average larger plan units. Second plan-unit types represent plot-tail seams, and third plan-unit types reflect plot-side seams with their distributions: series of plots backing on to one another rear plot boundary, paucity of extensive planned layout, less regular street system and plot pattern, and on average

small plan units (see Figure 2.20). In this case, the building form and land utilization have not been taken into account, since the lack of comparable surveys of building form and land utilization in Sibiu at that time, the work was done. It is clear that the ground plan is both a powerful articulation of the city's long-term historical development and consistent with the principles set out by Conzen (Whitehand, 2009).

The case of Upplands Väsby, Sweden

This case is part of a comparative study that also included Lantzville, Vancouver Island. This is part of the suburban area of Upplands Väsby - north of Stockholm, in Sweden - developed over the 20th century. This very extensive area was divided into plots which were acquired by individual households. This large area consisting of detached houses was subsequently transformed to form patchworks of small distinct residential units. These new units occurred as terraced or detached houses, or series of blocks of flats: some were products of the redevelopment and infilling of existing residential areas; others were created as extensions to the existing built-up area (Whitehand, 2009). A three-tier hierarchy of urban landscape units was recognized. Primarily, a distinct classification consisting of town centre, residential, and fringe belt areas was revealed. Secondly, each of these three areas was regionalized in a two-order hierarchy (see Figure 2.21/A). This reflects variations of the town-plan, particularly plot pattern and dwelling types, in town centre, residential, and fringe belt areas. Afterwards, parts of this area were regionalized at higher level of resolution (see Figure 2.21/B), considering variations within second-order units in the external forms. These variations represent the town-plan, and external forms of individual dwellings (architectural styles, building types, block plans and building materials).

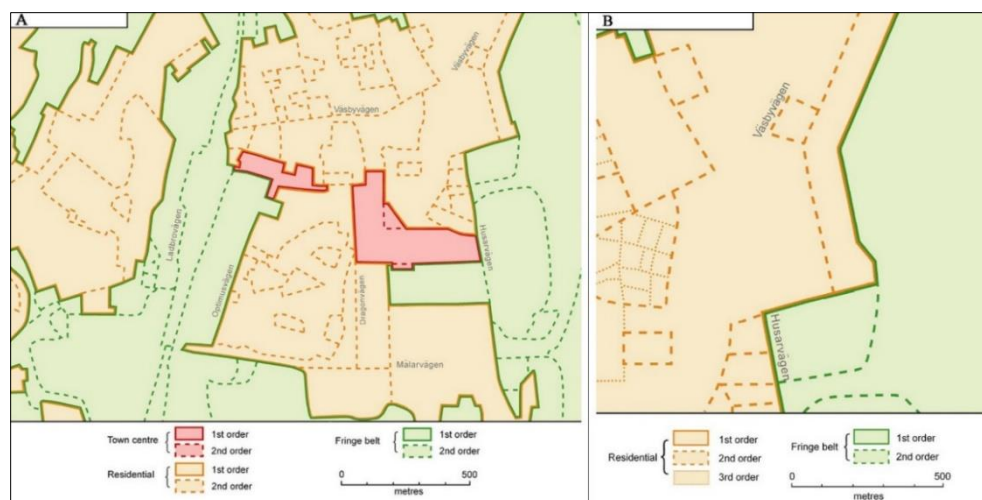


Figure 2.21 A. First- and second-order urban landscape unit, B. First-, second- and third-order urban landscape units (in north-east) in Upplands Väsby, Sweden in 2008 (Whitehand, 2009, Figs 6 and 7)

The case of Porto, Portugal

In the case of Porto, Portugal, Oliveira *et al.* (2015) compared four different approaches to urban morphology: historico-geographical, typological process, space syntax and spatial analytical. Here, the focus is on the application of the concept of morphological region proposed by Conzen. The authors followed the main guidelines offered by Whitehand (2007). A four-tier hierarchy of regions was identified based on three main elements of the urban landscape. Fourteen first-order morphological

regions were identified. The identification of first-order of morphological regions reflects the form and age of the streets, the type of plots, the building block-plans, and the position that buildings occupy in their plots. The ground plan also contributes to the identification of regions of intermediate rank. The second- and third-order regions are addressed together. They represent the ground plan, the building fabric (age, volume, and height of buildings), and to a lesser extent, the land utilization. The fourth-order regions were identified within seven first-order regions, corresponding to small differences that can be detected when walking through each of those streets. Hence, they are more clear in terms of building fabric and land utilization (see Figure 2.22).²

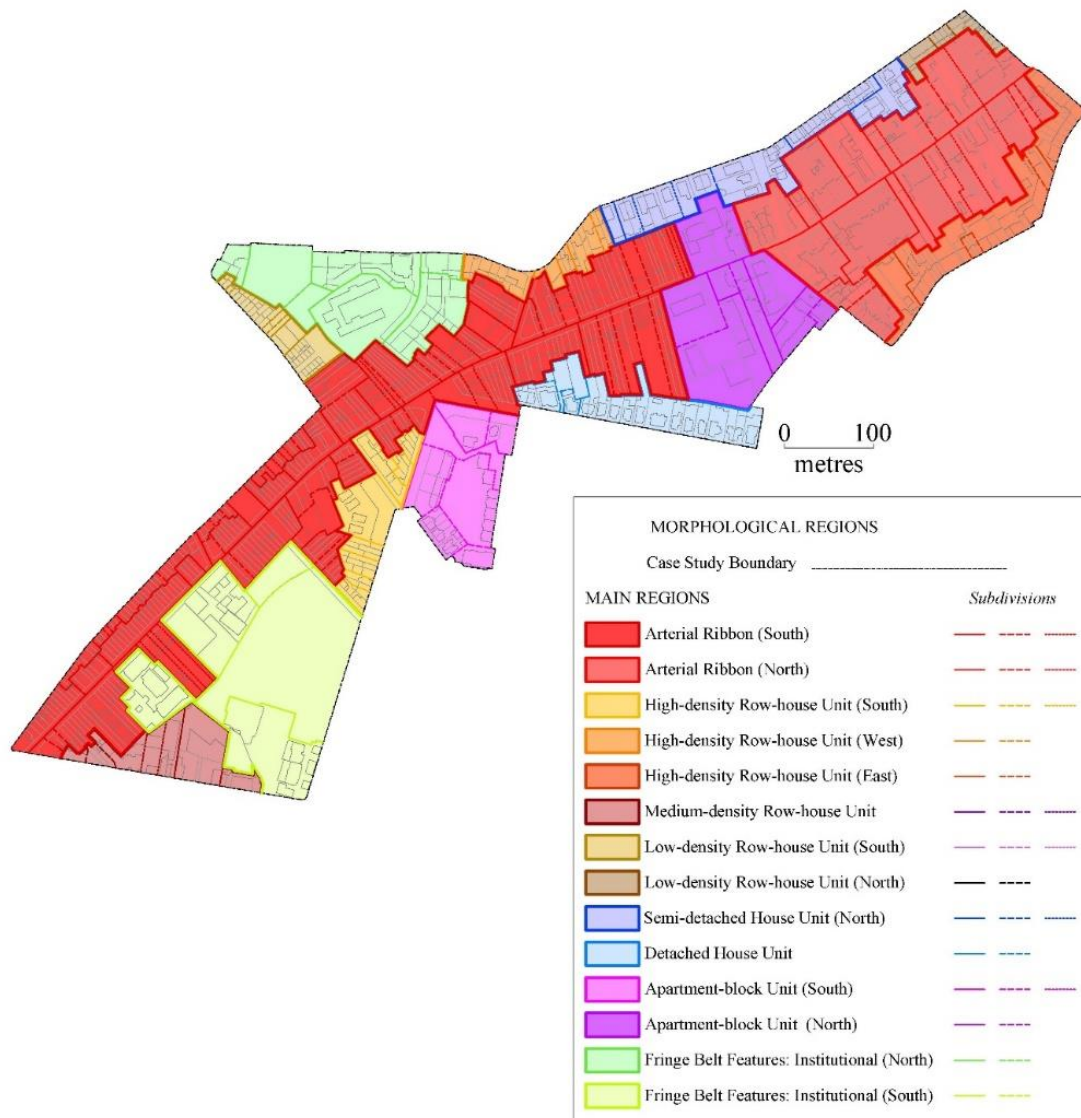


Figure 2.22 The morphological regions of *Rua de Costa Cabral* (Oliveira *et al.*, 2015, Fig 3.)

² This line of research has been subsequently developed by Monteiro and Pinho (2021) 'MAP: a methodology for Morphological Analysis and Prescription'.

2.4.3. ASIA

The case of Shanghai, China

Zhang (2003) attempted to combine Conzenian morphogenetic analysis and Lynch's ideas of the cognitive mapping of public perceptions (Lynch, 1960) for conservation purposes in two different conservation areas in Shanghai, in China (see Figure 2.23). The morphogenetic analysis of the study areas focused on the evolution of the town-plan and the existing building fabric and land-use. However, Zhang just identified a delimitation for the town-plan. The building fabric and land use classification remained as general analyses of the urban landscape. Two major factors were generally considered in defining the town-plan units: the combination of different basic plot types with basic grids; and the grid patterns and their differences in external shape and size. Due to the lack of explicit procedures, he did not come up with a hierarchical delimitation.

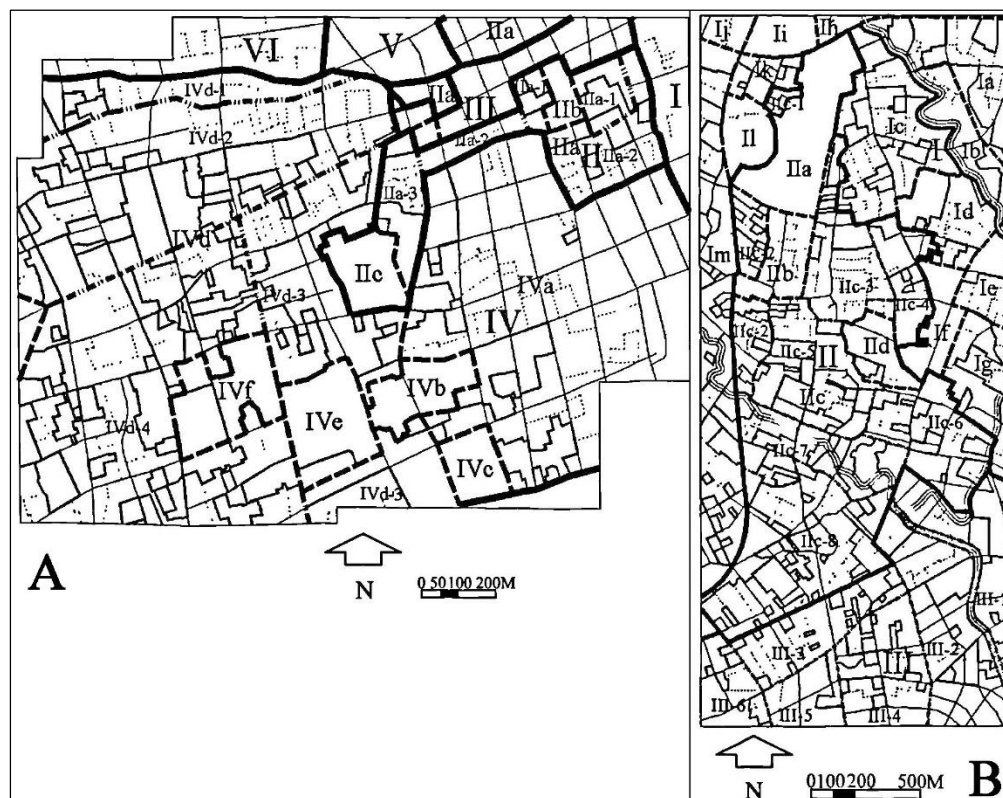


Figure 2.23 Morphogenetic plan type areas of the SNSA (A), and of the SYSA (B) in Shanghai (Based on Zhang, 2003, Fig 6.10, and 7.7)

The case of Pingyao, China

In the case of Pingyao, components and stages in the creation and transformation of the plan layout were established or inferred using Conzen's method of plan analysis. By applying this type of plan analysis, the authors have attempted to contribute to the task of tracing the historical development of Pingyao and providing foundations for its urban landscape management. The boundaries of plan units were not identified. Though these boundaries were undefined, a number of components were recognized for the delimitation of such units (Whitehand & Gu, 2007a). Five street-plan types and three plot types have been revealed. These street-plan types were square grid, residual square grid, rectilinear north-south aligned, rectilinear east-west aligned and irregular rectilinear. Courtyard plots (mainly residential), large

plots with specialized buildings, and other residential plots constitute the main plot types. Three categories of change have been recognized within courtyard plots, ranging from the essentially intact or orthomorphic to the hypometamorphic and metamorphic, as termed by Conzen. One of the most important omissions was any systematic consideration of the block-plans of buildings. Regarding building block-plans, the traditional courtyard type, and the type of *danweis* (a building unit which was created largely during the three decades after 1949) were illustrated as common types. The *danweis* reflect the 'large plots with specialized buildings' (see Figure 2.24). This application confirmed the applicability of Conzenian method and concepts in a geographical area with a markedly different cultural history. Although this study was essentially an investigation in the town-plan analysis, it provided an important basis for a comprehensive morphological analysis leading to the delimitation of morphological regions (Whitehand & Gu, 2007a).

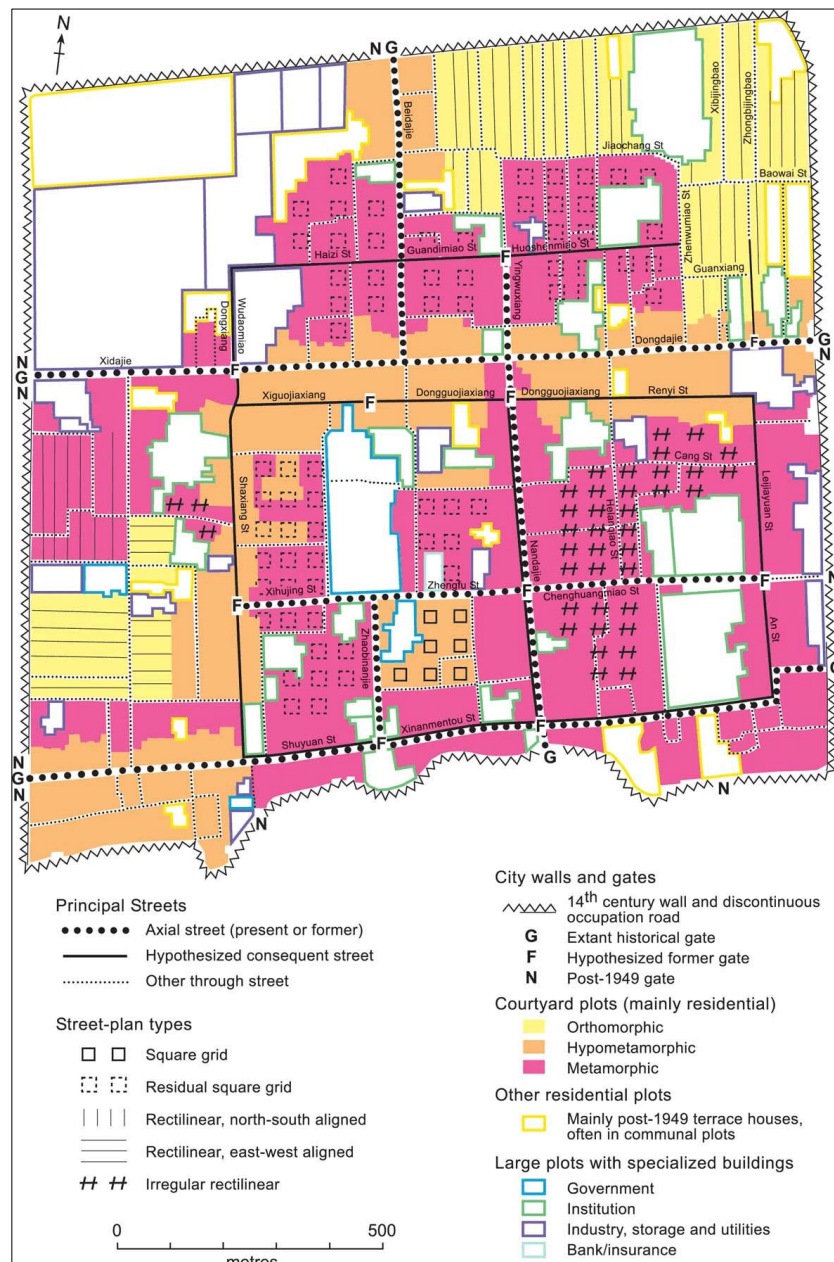


Figure 2.24 Principal plan components of the ancient city of Pingyao, in 2006 (Whitehand and Gu, 2007, Fig 5)

The case of Beijing, China

The applicability of morphological regionalization in Beijing was examined in the Zhishanmen conservation area, near the Forbidden City. Conzen's method was compared with a planning approach developed by the local authority. Firstly, maps of plan units, building types (distinguishing pre-Revolutionary, up to 1949, and post-Revolutionary), and land and building utilisation have been produced for the Zhishanmen conservation area and its immediate surroundings based on a plot-by-plot survey, historical plans and other historical records. On the basis of these three maps of the main elements of urban form, a two-tier hierarchy of morphological regions (or urban landscape units as referred to in the study) has been recognized (see Figure 2.25). Despite the fact that the main lineaments of the delimitation were related clearly to the ground plan, the relation between the three form complexes was a significant distinguishing feature. Most of the minor order units were subdivisions of the major units, and had a predominant residential character. In the comparison of the delimitations, very few of the boundaries of regions based on Conzen's method corresponded to those of the Beijing Municipal City Planning Commission (BMCPC) (Whitehand & Gu, 2007b).

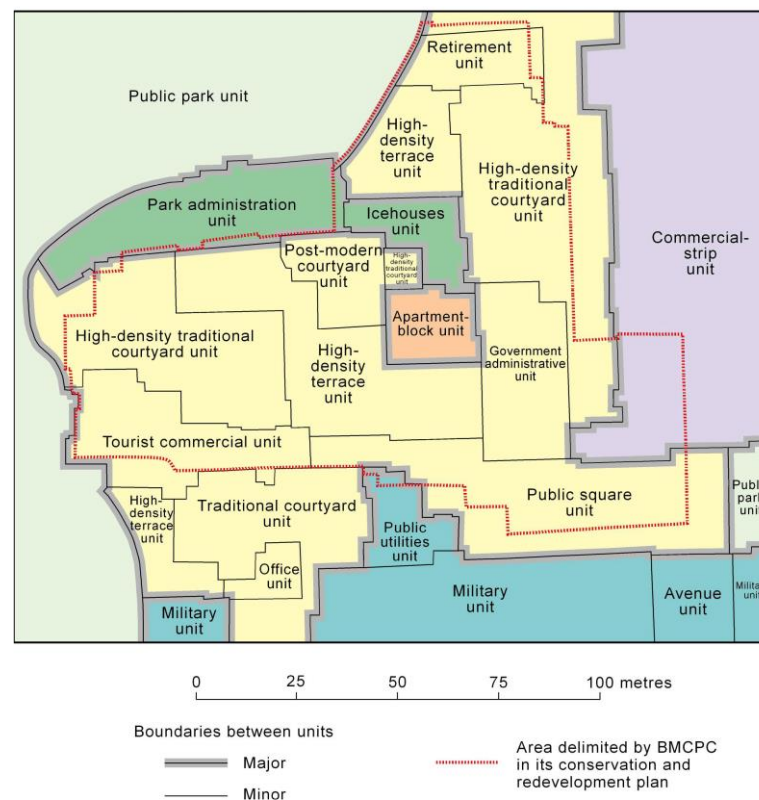


Figure 2.25 Urban landscape units in the Zhishanmen area, Beijing in 2006 (Whitehand and Gu, 2007b, Fig 7, Coloured in Whitehand, 2009)

The case of Guangzhou, China

There are two different studies that came close to replicating Conzen's method in Guangzhou, China: one was developed by Whitehand *et al.* (2011), the other by Zhang (2015).

Whitehand *et al.* (2011) suggested the basis for a solution to the problems of urban conservation in China. Two conservation areas in Guangzhou, *Hualinsi* and *Tongfu Xilu*, have been examined. Comparisons were made between the conservation proposals of the Local Authority and those based on

morphological regions. Three main elements of urban form – ground plan, building fabric and building and land utilization – have been employed to elucidate these units and to establish conservation priorities (Whitehand *et al.*, 2011).

A two-order hierarchy of the ground plan was revealed. No hierarchy was identified for building fabric, and land and building utilization. First-order boundaries of the ground plan reflect the presence of traditional areas, traditional residential areas, and inter-war thoroughfare areas lined with purpose-built shopfront buildings on the basis of pre-1949 plots and buildings. They also represent modern areas comprising commercial, institutional and residential areas based on post-1949 redevelopment which is also differing in building type and ground plan. Second-order boundaries reflect, in particular, spatial variations in plot patterns (shapes, size, notably plot depths). The geographical pattern of these plot types correlated to varying degrees of patterns of building types and land use. A much smaller number of second-order units have a predominance of plot width. Building types reflect two main periods, pre-revolutionary and post-revolutionary, and their subdivisions.

A third-order hierarchy of morphological regions was identified. The first and second-order boundaries of morphological regions (or urban landscape units as referred to in the study) consist of the plan unit boundaries. They reflect the combination of the three form complexes. The number of storeys is a major basis for distinguishing the third-order units. However, in some second-order traditional residential units, there are no third-order units (see Figure 2.26).

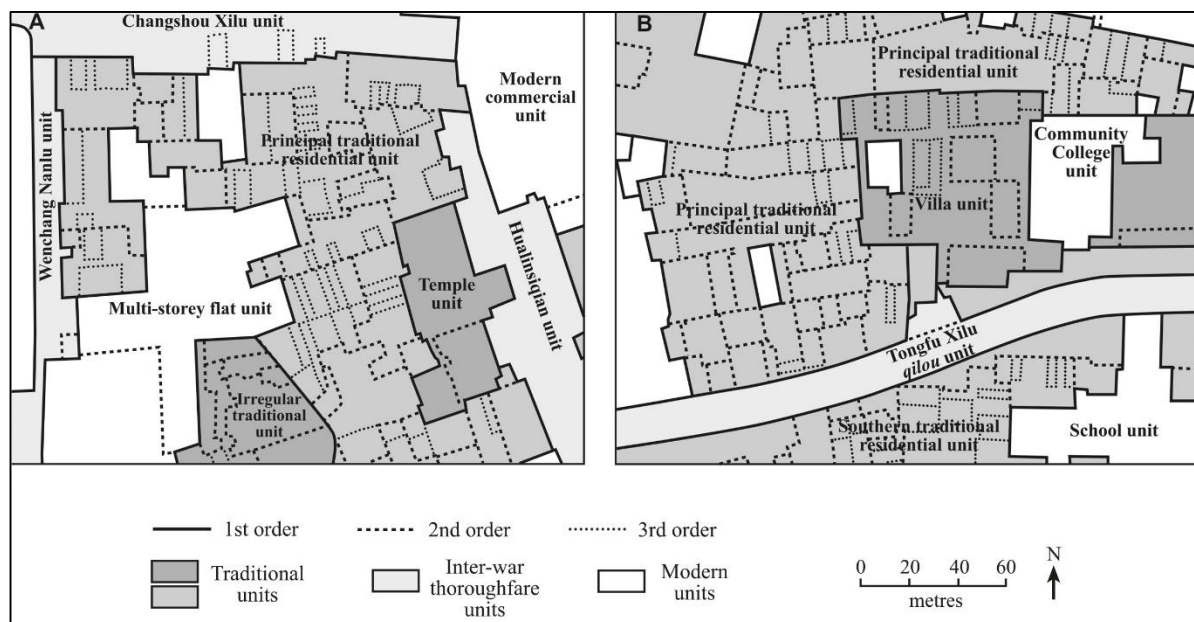


Figure 2.26 Urban landscape units in Guangzhou. A. Hualinsi area; B. Tongfu Xilu area (Based on Whitehand *et al.*, 2011, Fig 6)

Zhang (2015), explored the process of morphological change of central Guangzhou as a series of morphological periods from remote feudal times to the recent periods. The characteristics of components of the town-plan have been explored with reference to their periods and mode of development and redevelopment. The geographical structure of the built-up area was explained in terms of morphogenetic types of plan units that express key facets of economic and social processes.

The study area was divided into three major types of plan units, representing the Feudal period (pre-1912), early-modern period (1912-1949), and modern period (1950-). Afterwards, the modern period was divided into three sub-periods. Finally, Zhang identified 190 sub-types within these major plan units (see Figure 2.27).

In Guangzhou, no hierarchy of the town-plan divisions was identified. Zhang (2015) stated that the method of the town-plan analysis was successfully applied, but, the results were much more limited than those of the Alnwick study.

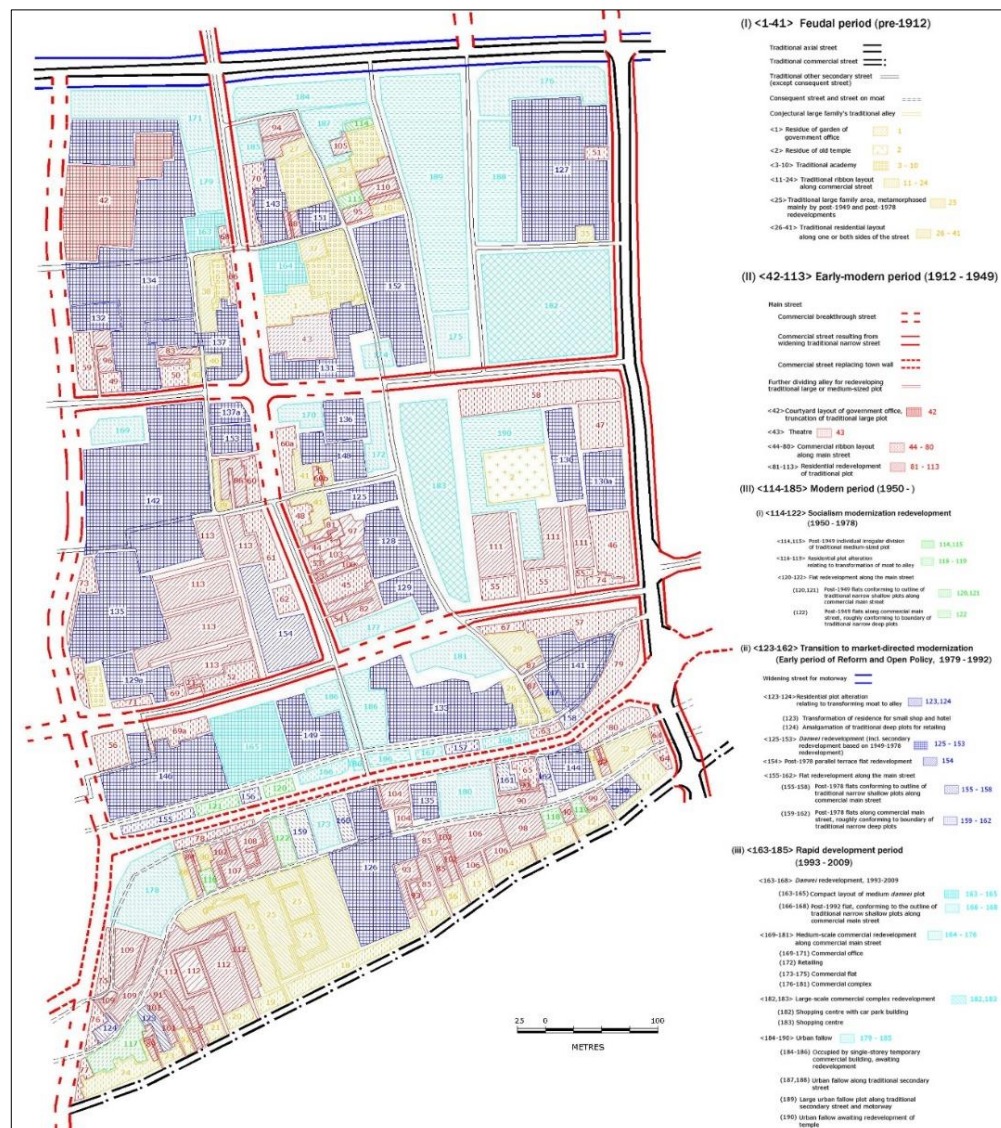


Figure 2.27 Plan units in part of central Guangzhou in 2011 (Based on Zhang, 2015, Fig 28)

The case of Zuoying, Taiwan

Zuoying is an important stronghold in the history of Taiwan and more broadly in the history of the islands of East and South-East Asia. In this case, four phases of physical change were revealed. These were Phase 1 (1719–1920) - establishment of the city wall; Phase 2 (1920–1939) - the breaking of the city walls and the construction of Zuoying Avenue; Phase 3 (1940–1949) - construction of the naval

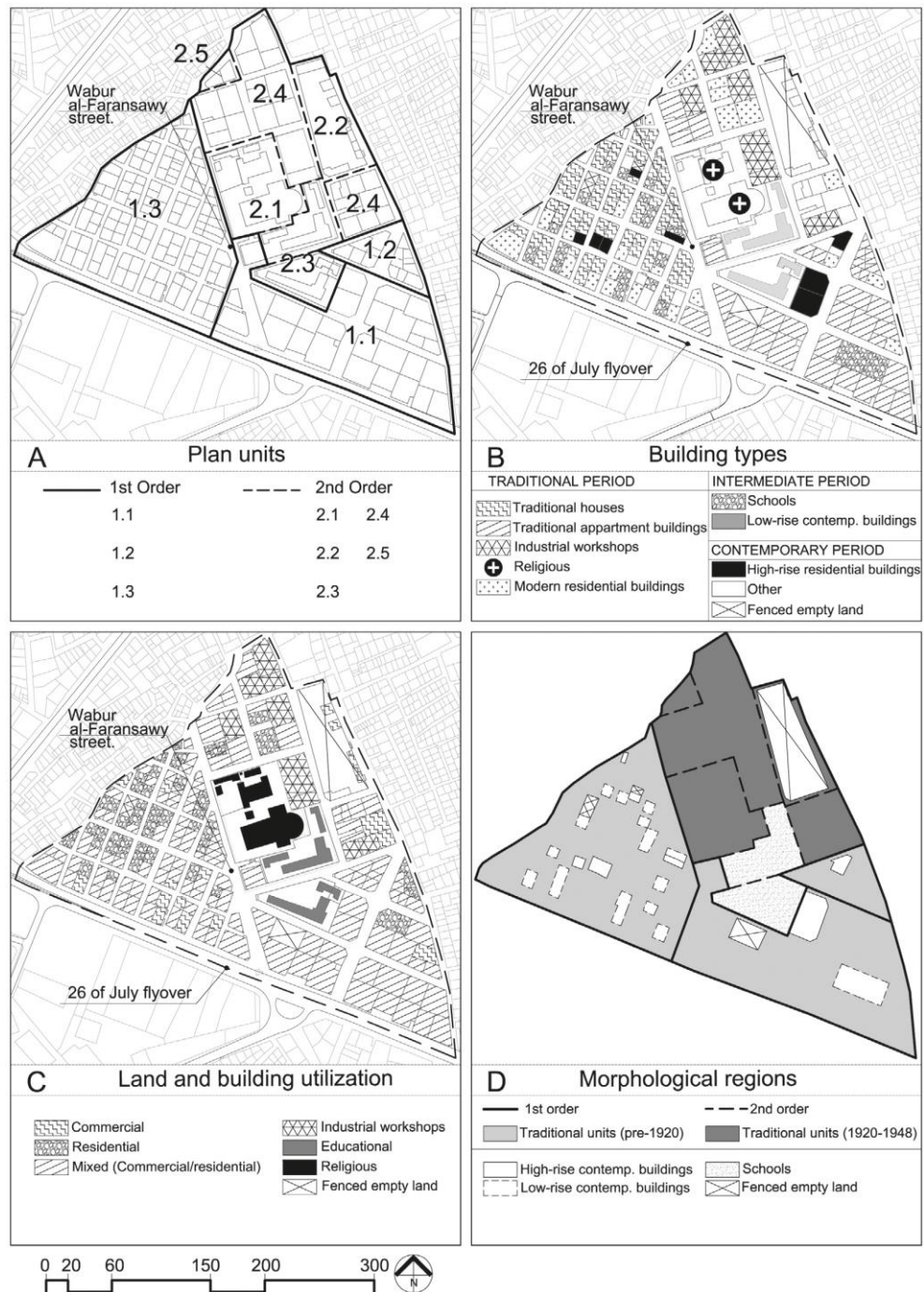


Figure 2.30 Form complexes and morphological regions in Cairo (Alsadat, 2021)

The map of building fabric (Figure 2.30-B) shows several types of building forms dating back to three morphological periods: traditional, intermediate and contemporary. These periods are then subdivided into different styles. The map of the land and building utilization (Figure 2.30-C) consists of residential units, commercial units, mixed uses, religious and educational uses, industrial use and fenced empty sites. However, the contribution of the maps of building fabric and land and building utilization in identifying boundaries remained elusive. Both form complexes are merely used to describe the recognized plan units.

2.4.6. OCEANIA

The case of Auckland, New Zealand

This case corresponds to the urban morphological regionalization of Auckland's CBD by applying the morphological ideas formulated and developed by Conzen. The recognition of the historical stratification of this physical fabric provides an important basis for an integrated framework for planning, conservation, urban design control and urban landscape management (Gu, 2010). The character of Auckland's CBD has been strongly influenced by its underlying topography. A plan unit of the area has unity in respect of its combination of characteristics of streets and plots and its topographic features that distinguish it from surrounding areas. Buildings were grouped into four broad periods, namely pioneer (1840–1880s), late Victorian and Edwardian (1890s–1910s), modern (1920s–1970s) and contemporary (post-1970s). Building height strongly influenced the skyline of an urban area. Building heights within the research area have been grouped into 1–3 storeys, 4–6 storeys, 7–9 storeys, 10–19 storeys, and 20 or more storeys. The patterns of land and building utilization has been classified as commercial, residential, institutional, public transport, and commercial and residential.

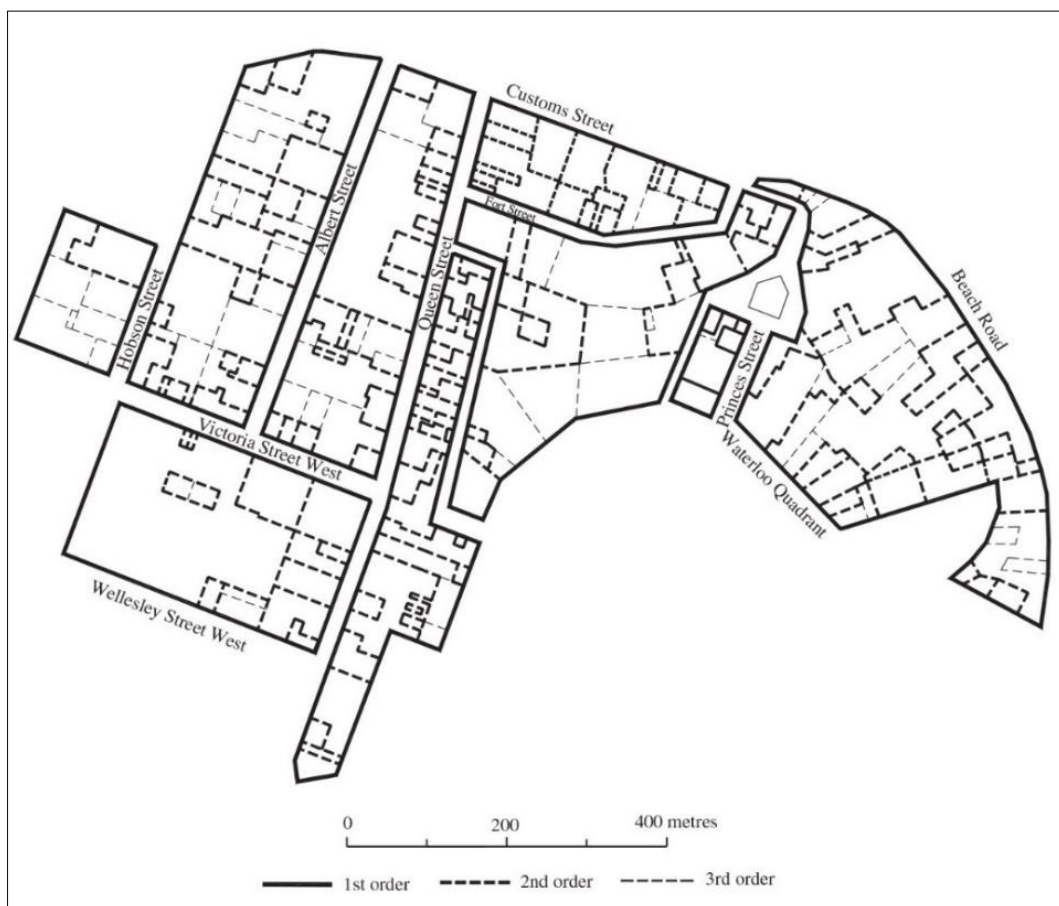


Figure 2.31 Urban landscape units of Auckland's CBD (Gu, 2010, Fig 11)

A three-tier hierarchy of morphological regions was illustrated on basis of the town-plan, building form and land utilization. The first-order boundaries of regions were derived from the analytical map of plan type areas which is representing the street system, plot pattern and topographical features of the urban landscape. The boundaries of the second-order were largely derived from the analytical map of building types considering building heights. The third-order boundaries reflect the pattern of dominant land and building utilization (see Figure 2.31).

2.4.7. SYNTHESIS³

In consequence of this systematic examination of the concept, it is evident that different researchers have used different approaches for hierarchical delimitation. The first example, Alnwick, has provided a comprehensive framework to identify the historical hierarchy of town-plan units. Conzen identified the town-plan as the topographical arrangement of an urban built-up area in all its man-made features containing three main elements of urban form. In the case of Ludlow (1975, 1988), he put forward a five-tier hierarchy of morphological regions based on three distinct maps of form complexes. The main difference between these two cases is the hierarchy of land and building utilization.

The first morphological regionalization in suburban areas was developed in Amersham by Whitehand (1989). He identified a number of morphological regions based on ground plan, building fabric, and land and building utilization. There was no hierarchy in these regions. The second study on suburban areas was developed by Jones (1991), focusing on Barnt Green, Edgebaston and Northwood. A three-tier hierarchy of morphological regions was recognized within these three suburban areas. In 2005, in Barnt Green, Whitehand identified a four-tier hierarchy of morphological regions based on ground plan, building form, land use and vegetation. In 1992, Baker and Slater developed an unusually detailed study of plan units in Worcester in an examination of the morphogenetic development of the city.

Two important examples, which strongly resemble the application of Ludlow, were developed by Barret (1996) and Bienstman (2007). Barret investigated two major British cities, Birmingham and Bristol, identifying a four-tier hierarchy of morphological regions. Each form complex has been mapped individually, and then the combination of three form complexes constituted the map of morphological regions. Bienstman (2007) examined Bromsgrove and Alkmaar, following the Conzenian principle of hierarchical nesting of morphogenetic (or morphological) regions. She revealed a four-tier hierarchy. Larkham and Morton (2011) investigated two suburban areas in London, Edgware and Docklands. They employed quantifiable measures to test whether there was any difference between quantitative measuring and ‘by eye’ approaches. Birkhamshaw and Whitehand (2012) compared the morphological regions delimited by researchers with those delimited by the local planning authority and local residents. In 2003, Barke reported a similar exercise in Antequerra. Kropf (1996) proposed a synthesis of Conzen’s ideas on the town-plan and building fabric and Caniggia’s ideas on *tessuto urbano*, and applied it in the *Plan d’ Occupation des Sols* of Mennecy. In 1999, Whitehand identified a number of plan units articulating fundamental structural areal variations in historical development in Sibiu, Romania (Whitehand, 2009). Whitehand (2009) also investigated Upplands Väsby, Sweden in 2008 and Lantzville, Vancouver Island, Canada, in 2005. In these two cases, he identified two-tier hierarchy of regions in town centre, residential and fringe belt area. Afterwards, he revealed a three-tier hierarchy of regions in residential areas. In the case of Porto, Portugal, Oliveira *et al.* (2015) revealed a four-tier hierarchy of morphological regions based on three main elements of urban form, namely, ground plan, building fabric, and land and building utilization.

In another part of the world, Asia, Zhang (2003) attempted to combine Conzenian morphogenetic analysis and Lynch’s ideas of the cognitive mapping of public perceptions. In this case, he delimited the town-plan units with no hierarchy. Whitehand and Gu (2007a) analysed the town-plan of Pingyao to provide foundations for urban landscape management. Whitehand and Gu (2007b) revealed a two-tier hierarchy of morphological regions in Zhishanmen conservation area in Beijing, based on three main elements of urban form. Whitehand *et al.* (2011) identified three-tier hierarchy of morphological regions

³ In recent years some other papers have addressed morphological regions. Yet, as these have a secondary role in the paper, it was decided not to include them. That is the case, for instance, of Kuçuk and Kubat (2014) and Allahmoradi and Cömert (2021).

in two conservation areas in Guangzhou, based on ground plan, building fabric, and land and building utilization. In 2015, Zhang employed the method developed by Conzen in Alnwick, and applied it one-to-one. In this regard, he explored the process of morphological change in central Guangzhou. Chen (2018) identified a number of morphological regions in Zuoying Taiwan, with no hierarchy. Alsadaty (2021) employed a two-tier hierarchy or morphological region based on three form complexes. But the contribution of building fabric and land utilization to his regionalization remained much elusive. Gu (2010) illustrated a three-tier hierarchy of morphological regions based on the town-plan, building form and land utilization in Auckland, New Zealand.

One significant fact is that the application procedures of the concept do not provide sufficiently explicit guidelines for the delimitation of morphological regions and their hierarchical subdivisions. Probably, this stems from some subjectivity of the concept. Nevertheless, some few cases provide a more clear-cut outline for the identification of regions (see, for example, Baker and Slater, 1992; Barke, 2003; Gu, 2010; Oliveira *et al.*, 2015). Another substantial aspect is the difficulty of implementation of morphological regionalization in different cultural geographies. For instance, the Chinese cases remained more elusive in relation to the British cases.

Tables 2.6, 2.7, 2.8, 2.9, 2.10, and 2.11, offer a complementary synthesis of these applications. They consider the investigators, publication date, place studied, term used for referring morphological regions, form complexes, hierarchy of morphological regions, morphological constituents and, finally, the contribution to hierarchy.

Table 2.6 Applications of the concept (or variations of the concept) of morphological region in Britain

Investigators	Publication Date	Place Studied	Term/s used	Form Complex	Hierarchy of Morphological Regions	Morphological Constituents (with the mapping process step by step)	Contribution to the hierarchy
Conzen	1960	Alnwick	Plan units	Town plan	4o	The units denoted by capital letters present the Old town and inner fringe belt, and outer accretions	First-order
						The divisions marked Roman numerals (See Figure 2.4)	Second-order
						The divisions marked by small letters (See Figure 2.4)	Third-order
						The divisions marked by numbers (See Figure 2.4)	Fourth-order
Conzen	1975	Ludlow	Morphological regions	Town plan (5o) Building fabric (5o) Land utilization (5o)	5o	Three urban landscape components: the town-plan, building fabric, land and building utilization	Each form complexes contributes all orders
Conzen	1975	Ludlow	Morphological regions	Town plan (5o) Building fabric (5o) Land utilization	5o	See Table 2.3 for contribution of morphological constituents	See Table 2.3 for hierarchy
Whitehand	1989	Amersham	Townscape units	Town plan, building fabric, land utilization	nh	- The region of Hyron area derived from development activities as a region - Inter-war detached houses in reduced plots - Mainly inter-war, small, detached houses - Mainly inter-war, small, detached and semi-detached houses with repletion to rear - Homogeneous area of mainly semi-detached houses, slightly modified - Homogeneous, early, post-war Council estate, manly of short terraces - Small, post-war detached houses (redevelopment of institutional site and parts of gardens of adjacent houses)	No hierarchy

Table 2.6- continued

Investigators	Publication Date	Place Studied	Term/s used	Form Complex	Hierarchy of Morphological Regions	Morphological Constituents (with the mapping process step by step)	Contribution to the hierarchy
Jones	1991	Barnt Green, Edgbaston, Northwood	Morphological regions	Town Plan Building fabric	3o	<i>Plots Boundaries change</i> -Antecedent/First cycle boundaries -New boundaries within previously undeveloped large plots -Boundaries within existing plots -Boundaries created by plot amalgamation -Land remaining fallow or undeveloped <i>Antecedent forms</i> <i>Dwelling types</i> Detached, detached (bungalow), semidetached/ linked/ terraced, apartments <i>Building Age</i> -Pre-urban (1890), late Victorian & Edwardian (1890-1914), inter-War (1918-1939), early post-war (1945-1960), late post-war (1960-)	Antecedent forms reflects the boundary of first-order regions, but, the contribution of other elements to the hierarchy is elusive
Baker, Slater	1992	Worcester	Plan units	Town plan	2o	-Width, straightness and orientation of streets -Orientation, shape and, dimensions of plots associated with a street or streets and, occasionally functions -Parish boundaries (Ecclesiastical, monastic features)	First-order
			Morphological regions			-Smaller-scale variations and deviations of size, shape and, other internal characteristics of plots	Second-order
Barret	1996	Birmingham	Townscape units	Town plan(3o), Building fabric (3o), Land utilization (nh)	4o	see Table 2.4 and Table 2.5 for morphological constituents	see Table 2.4 and Table 2.5 for contribution to the hierarchy
		Bristol	Townscape regions	Town plan (4 o), building fabric (3 o), land utilization (nh)			

Table 2.6 – continued

Investigators	Publication Date	Place Studied	Term/s used	Form Complex	Hierarchy of Morphological Regions	Morphological Constituents (with the mapping process step by step)	Contribution to the hierarchy
Bienstman	2007	Bromsgrove Alkmaar	Townscape regions	Town plan	4o	-Old Town as a whole, the fringe belt and, residential accretions as major regulators	First-order
						-Extensions of the town, homogeneity of the town-plan based on Old Town -Fringe belt features, plot size and shape and, fringe belt alienation, homogeneity of the town-plan	Second-order
						-Plot layout, plot size, regularity of plots and, dwelling types (block plan of buildings), plot metamorphosis and redevelopment	Third-order
						-Minor divisions of the plan that represent a certain unity and were distinct in nature from their surroundings in terms of expansion phase and plot layout	Fourth-order
				Building fabric	4o	-Key phases of urban expansion: Old Town, fringe belt, residential accretions	First-order
						-Degree of unity in terms of age, style, type, use, material, size and, height of buildings	Second, third and, fourth-orders
				Land Utilization	nh	-Dwellings, shops, community premises, BEPS, industrial premises, open spaces, water	Principally high rank
Whitehand	2009	Barnt Green, Britain	Character areas	Town plan, building fabric, land utilization, vegetation	4o	-Ground plan (including site), building form, land use and vegetation -A number of factors, including the presence of both purpose-built suburban roads and adapted rural lanes, and the subdivision of very large individual house plots to create Culs-de-sac of higher density detached houses	Contribution to the hierarchy remained elusive

Table 2.6 – continued

Investigators	Publication Date	Place Studied	Term/s used	Form Complex	Hierarchy of Morphological Regions	Morphological Constituents (with the mapping process step by step)	Contribution to the hierarchy
Larkham, Morton	2011	Edgware Docklands (London)	Morphological regions	Town plan	nh	Street block area, plot area (maximum, average, minimum and range), building footprint area (maximum, average, minimum and range), number of dwellings, percentage dwelling types (detached, semi-detached) and, dwelling density (per ha) on the basis of town-plan	No hierarchy
Birkhamshaw, Whitehand	2012	Stratford-upon-Avon	Character areas	Town plan Building fabric Land utilization	2o	Post-war large detached houses with open-fronted gardens, post-war detached houses with open-fronted gardens, post-war houses with open-fronted gardens, inter-war geometrical garden suburbs, inter-war speculative estate, inter-war residential ribbon development, individually-designed houses in large gardens, Victorian terraced houses, Victorian residential ribbon development, Old nucleus, new urbanism, Anglo-Scandinavian flats, institutional and recreational fringe belt, recreational outer fringe belt, Victorian cemetery	First-order
						Variations of ground plan, building type or both	Second-order

Table 2.7. Applications of the concept (or variations of the concept) of morphological region Elsewhere in Europe

Investigators	Publication Date	Place Studied	Term/s used	Form Complex	Hierarchy of Morphological Regions	Morphological Constituents (with the mapping process step by step)	Contribution to the hierarchy
Kropf	1996	Mennecy	Urban tissue	Town plan, building fabric	nh	-Main elements: streets and blocks or plot series, plots, buildings, rooms and spaces, structures such as walls and roofs and materials -Specific characteristics to describe each element: position (the element place in an arrangement), outline (shape, size and proportions) and internal arrangement (the type of component parts, the number of parts and their relative position) -The development and change of structures through time, the different states of the town in time in terms of chronological comparative analysis	No hierarchy
Barke	2003	Antequera, Spain	Urban landscape regions Morphological regions	Town plan, building fabric, land utilization	nh	-Morphological criteria: the size and shape of building plots, the stage of historical development of the town-plan, the architectural style of the buildings, the quality of the buildings, state of conservation of buildings, the degree of transformation and change from the original structure. -Functional criteria: residential with commercial use and local services, residential with city-wide services, institutional and city and regional services, residential with institutional and city and regional services, areas of tourist interest and residential, industrial use	No hierarchy

Table 2.7 – continued

Investigators	Publication Date	Place Studied	Term/s used	Form Complex	Hierarchy of Morphological Regions	Morphological Constituents (with the mapping process step by step)	Contribution to the hierarchy
Whitehand	2009	Sibiu, Romania	Plan units	Town plan	nh	<i>Three types of plan units;</i> <i>Street-block seams</i> (following the lines of streets) with their distributions: extensions of plots planned additions with regular street system and plot pattern <i>Plot-tail seams</i> with their distributions: series of plots, plan layout, street system and plot pattern <i>Plot-side seams</i> with their distributions: series of plots plan layout, street system and plot pattern	No hierarchy
Whitehand	2009	Upplands Wäsby, Sweden	Urban landscape units	Town plan Building fabric	3o	Variations of the town-plan, particularly plot pattern and dwelling types, in town centre, residential and, fringe belt areas	First-order and second-order of hierarchy (town centre, residential and, fringe belt areas)
						-Variations of the town-plan -Variations of external forms of individual dwellings. (architectural styles, building types, block plans and building materials)	Third-order
Oliveira et al.	2015	Porto, Portugal	Morphological regions	Town plan, building fabric, land utilization	4o	The form and age of the street, the type of plots, the building block-plans, and the position that buildings occupy in their plots based on the town-plan	First-order
						Ground plan, the building fabric (age, volume and height of buildings) and, to a lesser extent, the land utilization	Second and third-order
						Small differences that can be detected when walking through each of streets in terms of building fabric and land utilization	Fourth-order

Table 2.8. Applications of the concept (or variations of the concept) of morphological region in Asia

Investigators	Publication Date	Place Studied	Term/s used	Form Complex	Hierarchy of Morphological Regions	Morphological Constituents (with the mapping process step by step)	Contribution to the hierarchy
Zhang	2003	Shanghai		Town plan	nh	Street-block system, the plot pattern and building arrangement	No hierarchy
Whitehand, Gu	2007	Pingyao	Plan units	Town plan	nh	<i>Street-plan types</i> : square grid, residual square grid, rectilinear north-south aligned, rectilinear east-west aligned and, irregular rectilinear <i>Plot types</i> : Courtyard plots; plot metamorphosis (orthomorphic, hypometamorphic and metamorphic) <i>Other residential plots</i> ; post-1949 terrace houses, communal plots <i>Large plots with specialized buildings</i> ; Government, institution, Industry/storage and utilities and, bank/insurance	No hierarchy
Whitehand, Gu	2007	Beijing	Urban landscape units	Town plan	2o	-Replete, mainly residential, courtyards, terraces in replete plots, block of flats, large institutional courtyards, institutions with large building block plans, large commercial buildings, kiosks, urban fallow, public parks, post-modern courtyard houses	Major and minor order units (There is a rapport between three form complexes)
				Building fabric		-Pre-Revolutionary: commercial buildings, public service and community buildings, traditional residential courtyards, terrace houses, -Post-Revolutionary: commercial buildings, public service and community buildings, traditional residential courtyard buildings, terrace houses, apartments, infill, post-modern courtyard houses	
				Land Utilization		-Shops and restaurants, offices, residential, public and community services, open spaces, urban fallow	

Table 2.8 – continued

Investigators	Publication Date	Place Studied	Term/s used	Form Complex	Hierarchy of Morphological Regions	Morphological Constituents (with the mapping process step by step)	Contribution to the hierarchy
Whitehand et al.	2011	Guangzhou, China	Urban landscape units	Town plan (2o)	3o	<i>The rapport between ground plan, building fabric and, land use</i> -Traditional areas, traditional-residential areas and, inter-war thoroughfare areas on the basis of pre-1949 plots and buildings. -Modern areas comprising commercial, institutional and residential areas based on post-1949 redevelopment	First-order
				Building fabric (nh)		Spatial variations in plot patterns (shapes, size, notably plot depths) and their correlation with building fabric and land use <i>Pre-revolutionary building types:</i> Traditional <i>Lignan</i> house, row houses or villas, shopfront buildings, flats, institutional buildings, other building <i>Post- revolutionary building types:</i> Row house, multi storey flats, institutional/community buildings, commercial buildings, residential and commercial of 10 or more storeys	First, second and third-orders (The main lineament of third-order was the number of storeys)
				Land utilization (nh)		-Commercial, residential, mixed use, institutional/community, open spaces, other	First and second-order
Zhang	2015	Guangzhou, China	Plan units	Town plan	nh	<i>Major plan units</i> -Feudal period, early-modern period, modern period <i>Sub-plan units</i> -190 sub-types of major periods	No hierarchy

Table 2.8 – continued

Investigators	Publication Date	Place Studied	Term/s used	Form Complex	Hierarchy of Morphological Regions	Morphological Constituents (with the mapping process step by step)	Contribution to the hierarchy
Chen	2018	Zuoying	Morphological regions	Town plan Building fabric Land Utilization	nh	Street and plot types on the basis of ground plan Sub-plan units recognized within the morphological regions: reflect changes such as accretion, replacement, repletion and, adaptation in development phases Building types and land utilization: Eleven main building types, namely shop houses, other commercial buildings, markets, traditional courtyard houses, row houses, condominiums, bungalows, bunkhouses, temporary constructions, temples, and public buildings Morphotopes (revealed independently): reflects the distribution of main eleven building types and, subdivision of building types to development phases	No hierarchy

Table 2.9. Applications of the concept (or variations of the concept) of morphological region in North America

Investigators	Publication Date	Place Studied	Term/s used	Form Complex	Hierarchy of Morphological Regions	Morphological Constituents (with the mapping process step by step)	Contribution to the hierarchy
Whitehand	2009	Lantzville, Canada	Urban landscape units	Town plan Building fabric	3o	Variations of the town-plan, particularly plot pattern and dwelling types, in town centre, residential and, fringe belt areas	First-order and second-orders
						-Variations of the town-plan -Influence of individual owner-occupiers -Variations of external forms of individual dwellings. (architectural styles, building types, block plans and building materials)	Third-order

Table 2.10 Applications of the concept (or variations of the concept) of morphological region in North Africa

Investigators	Publication Date	Place Studied		Form Complex	Hierarchy of Morphological Regions	Morphological Constituents (with the mapping process step by step)	Contribution to the hierarchy
Alsadaty	2021	Cairo	Urban regions Morphological regions	Town plan	2o	Blok-plans, plots and streets laid out pre-1920 as first-order Blok-plans, plots and streets laid out between 1920 and 1948 as second-order	First-order Second-order
				Building fabric		Building forms dating back mainly to three morphological periods: the traditional, the intermediate and the contemporary	Not evident
				Land Utilization		Mixed use residential-commercial units The residential units, Religious use and educational use Industrial use and empty sites Commercial units	Not evident

Table 2.11. Applications of the concept (or variations of the concept) of morphological region in Oceania

Investigators	Publication Date	Place Studied	Term/s used	Form Complex	Hierarchy of Morphological Regions	Morphological Constituents (with the mapping process step by step)	Contribution to the hierarchy
Gu	2010	Auckland	Urban landscape units	Town Plan	3o	Streets and their arrangements Plots, their sizes and arrangements Topographical Features regarding to slope	First-order
				Building fabric		Building types: Pioneer development, late Victorian and Edwardian, modern building, contemporary buildings, surface parking, green space Building Heights and surface parking, green space	Second-order
				Land utilization		Land and Building utilization: Commercial, residential, institutional, public transport, commercial and residential, green space	Third-order

3

CHAPTER 3: METHODOLOGY

3.1. A SYSTEMATIC METHOD FOR THE IDENTIFICATION OF MORPHOLOGICAL REGIONS

Despite the recent academic interest, the concept of morphological region is still receiving insufficient attention from planning practice. It is obvious that the production of new urban forms, and the modification and conservation of existing ones should be grounded on an understanding of the present urban forms and their past development. But this elementary requirement remains unfulfilled. It has been shown in the previous section that the applications of the concept still lack clarity. Certainly, this is one of the reasons why the concept did not attract the attention of planning practitioners. Doubts on how to exactly apply the concept do exist.

The central argument of this document is that it is possible to offer a more applicable and explicit method of morphological regionalization, by proposing some new inputs. In this context, a systematic approach for the identification and delimitation of morphological regions has been proposed. The approach is based on a set of criteria aiming at clarifying the application of the method step-by-step. The general scheme for the identification of morphological regions is in Table 3.1. The Table, demonstrating the procedural aspects of the design of the methodology, includes form complexes and their persistence, contribution of form complexes to the hierarchy, morphological constituents, criteria, and description for criteria. The proposed scheme incorporates the essence of Conzenian axioms and principles that were explained in sub-section 2.2.3. For example, the first and fourth columns of the Table are grounded on the axiom of ‘systematic townscape composition’ which consists of three systematic form complexes, namely, the town-plan, the building fabric, and the land and building utilization. The second column is directly related to the principle of ‘systematically differentiated persistence of forms’. The third column is directly based on the axiom of ‘hierarchical nesting of form complexes’ and on the principle of ‘hierarchical nesting of morphogenetic regions’. Before identifying the different criteria, one by one, it should be noted that this approach is intended to have a low level of subjectivity. It is not possible to completely erase the subjectivity, because it reflects the nature of human activities. But, compared with other applications of the concept described, it adds a considerable degree of objectivity.

Ten criteria have been identified for the establishment of morphological regions. These are as follows: i. the age of streets/expansion phase of the city, streets geometry, plot layout (area, width, depth), building block-plan types, building coverage, and position of buildings – based on the town-plan; ii. architectural style, building material and building height - based on building fabric; and, finally, iii. land and building utilization. This set of criteria put establishes a fundamental basis for the foundation of a more systematic and robust methodology for the identification and delimitation of morphological regions.

Table 3.1 The procedural aspects for the design of the methodology

Form complexes	Persistence	Contribution to the hierarchy	Morphological constituents	Criteria	Description for criteria
Town-plan	Maximal	High Intermediate Low	Streets	Age of streets / expansion phases	Development stages of urban landscape and their subsequent changes and redevelopments
				Streets geometry	Geometrical arrangement of street pattern (grid, organic...)
			Plots	Plot layout (area, width, depth)	A combination of plot layout based on its internal characteristics
			Buildings	Building block-plan type	Building footprint, two-dimensional pattern of buildings
				Building coverage	Ratio of building footprint to plot area (the value ranges from 0 to 1)
				Position of buildings	Distance between plot frontage and building front line
Building fabric	Considerable	Intermediate Low	Buildings	Architectural style	The building period/age/architectural characteristics
				Building materials	Building material or construction type of building, (concrete, timber...)
				Building height	Number of storeys
Land and building utilization	Minimal	Intermediate	Utilization	Utilization – general and detailed	Generalized and detailed land and building utilization (residential, commercial, green areas...)

i. Age of streets/expansion phases

The first step in the analysis that leads to the identification of morphological regions comprises an examination of historical town plans and archival materials that may provide a base for the understanding of the historical and morphological development of the area. It also includes the subsequent alterations and replacements in the physical form. This criterion is directly related to the Conzenian principle of ‘historical stratification of townscape’ and ‘period specificity of forms’ which requires a morphogenetic perspective. Accordingly, the urban landscape consists of a spatially varied mixture of different period types and styles of layouts and buildings. In the course of time, there is an increasing period diversity in terms of their cultural characteristics, producing many different ‘form complexes’ of varying spatial extent. This criterion, as a morphological constituent of the form complexes, highly contributes to the hierarchy. The change of plots within the main phases contributes in lower orders.

ii. Streets geometry

Streets affect the orientation and accessibility of people and traffic and affect the location of activities. Streets constitutes street blocks that represent a group of contiguous plots or a single plot. Although it

is one of the most important aspect of form, streets geometry was not objectively employed in the identification of morphological regions. This criterion contributes to the high level of hierarchy of morphological regions.

iii. Plot layout

The arrangement of plots is examined in terms of their size and dimensions, including area, width, and depth. This consideration represents the importance of plots in relation to streets, and their geographical and geometrical characteristics. This criterion mainly contributes to the high and intermediate levels of hierarchy.

iv. Building block-plan type

The block-plan of buildings is one of the most important elements of the ground plan. It was identified by Conzen as the area occupied by a building and defined on the ground by the lines of its containing walls. Different types of block-plan contribute to the production of different types of the built environment. This criterion is examined in terms of those morphological elements (such as detached houses, apartment blocks, terrace buildings, or any other classifications). This criterion mainly contributes to the high and intermediate levels of hierarchy.

v. Building coverage

Building coverage is the extent of a plot covered by a building or a structure⁴. It also expresses the extent of a plot that is open. It provides a direct relationship between the plot and the building. Larkham and Morton (2011) explore the use of plot area and building footprint area. They did not examine the relationship between these two morphological elements. However, this relationship provides an important input for planning and design. Its contribution to the hierarchy of morphological regions is at the medium and low levels.

vi. Position of buildings

The position of buildings provides an important base for the alignment of buildings. It usually has been part of planning and development control (Oliveira, 2013). The distance between the plot frontage and the front line of the building designates the position of buildings. This criterion would contribute to the intermediate and low levels of the hierarchy.

vii. Architectural style

The architectural style refers to the predominant appearance of a building. Architectural style or building style usually follow fashions in architecture and art at a given time. Architectural style could be identified in terms of different periods, ages, and architectural characteristics. This is the most significant morphological criterion on the building fabric. It contributes to intermediate and low levels of hierarchy.

⁴ The range value of building coverage is between zero and one ($0 < \text{plotcoverage ratio} \leq 1$: value range)

viii. Building materials

Building materials constitute another morphological feature of the building fabric. This criterion is examined in terms of the construction material or construction type which also indicates different historical periods. Its contribution is to the low level of morphological regions.

ix. Building height

Urban morphologists argue that buildings should be regarded three dimensionally. But in practice, they are grouped according to only their age or period. Some urban morphologists argue that building heights (as in the case of building material) are also significant as architectural style in defining the character of the urban landscape. This criterion contributes to the hierarchy in low level.

x. Land and building utilization

The land and building utilization is the least persistent form complex of the urban landscape. It is one of three fundamental categories of phenomena in urban morphology together with the town-plan and building fabric. It contributes mainly to the intermediate level of hierarchy.

All these criteria have been proposed in respect of the hierarchy of form complexes, historical stratification and persistence of forms, as well as other axioms and principles of the historico-geographical approach. Each criterion is mapped individually in respect of the methodology proposed. Then, each of these maps is combined based on morphological constituents and form complexes. After this combination, these intermediate maps are superimposed for producing the map of morphological regions ranging from first-order to fourth-order.

3.2. SELECTION OF STUDY AREAS

The transformation of the urban landscape is sustained by a combination of distinct but concurrent morphological processes affecting the accumulation, adaptation, persistence, and replacement of forms. Historical stratification is made more emphatic by the variety of types of localized mixing and period heterogeneity of forms. This gives rise to a whole hierarchy of morphological regions (Conzen, 2004). In this regard, and bearing in mind the application of the methodology proposed in last section, it seems appropriate to select historic cases made of rich morphological periods. In this regard, two study areas are chosen for the implementation of the methodology. The first is Istanbul (see Figure 3.1), one of the most important cities worldwide over 1500 years. The second is Antequera (see Figure 3.2), a city that has a great urban history and that has been previously regionalised – and where some methodological weaknesses have been found.

Istanbul was founded in the promontory on the tip of the so-called historical peninsula and lays on the heritage of Roman, Byzantine, and Ottoman empires. The district of Fatih, as the core of the city, reflects the oldest landscape of today's Istanbul. The city of Byzantium was established in 659 BC by a Greek group. The incorporation of the city by Roman in the 1st century BC caused the loss of its autonomy. There are no archaeological remains of the city of Byzantium, before the city's destruction by Roman (Magdalino, 2007). The city has been the capital of the empire by Constantine in the early stages of the 4th century. Constantinople (the subsequent name of the city Byzantium, and the second name of today's Istanbul) has been the capital of Roman and Byzantium empires for one millennium (Magdalino, 2007; Karakuyu, 2015). Its most thriving period as East Roman capital was between its foundation and the

mid-6th century (Magdalino, 2007; Karakuyu, 2015). Afterwards, the city suffered from pressures from Islamist Ottomans and the Catholics of the Western Mediterranean, and a set of natural events. As in the former period, Constantinople's physical form would be lost in the early Middle Ages. The city was invaded by the Ottomans in the mid-15th century. After the invasion, the city was renamed Istanbul (which has its origins in Greek). In Ottoman Istanbul, the *mahalle* (neighbourhood) has been the building block of the city. In the *mahalles*, there were a great number of culs-de-sac or dead-ends, which is a feature of the Islamic concepts of family privacy and private ownership. One century after the invasion, the reign of Süleyman the Magnificent is the peak of the Ottoman Empire. The process of modernization and westernization of Istanbul started with the 'tulip period' in terms of lifestyle, and with the *tanzimat*, in terms of structural reforms (Çelik, 1993; Yılmaz, 2015). The *Tanzimat* period led the changes in the street patterns, in the scale of the building fabric, with increasing building footprints and heights (Magdalino, 2007; Karakuyu, 2010; Kiper, 2015; Tanyeli, 2015).



Figure 3.1 The location of Istanbul

By the end of the Ottoman empire, the capital was transferred to Ankara. In the 1930s, the first systematic attempts for spatial planning started to be developed. While the implementation of planning proposals was delayed due to the lack of resources, the transformation of the city continued over the 20th

century. This contains the substantial transformation of the physical form of Istanbul, such as the destruction of parts of the city wall, the construction of new streets planned for cars, the loss of Ottoman residential architecture within the historical centre, and the foundation of the *gecekondu* (squatter settlements) due to the high rates of population growth and economic insufficiencies of inhabitants. (Kuban, 2010; Müller-Wiener, 2001).

A study area of about 285 hectares in Fatih district has been selected. It is made of different characteristics of forms, and different periods including the Roman Imperial, the Byzantium (early Byzantium and medieval), the Ottoman Imperial and the modern Republican periods. This historical stratification with substantial alterations provides a basis for a full implementation of the proposed methodology.



Figure 3.2 The location of Antequera

Antequera is an Andalusian city with a great historical and artistic heritage. It has the legacy of Romans, Muslims and again Catholics. It is established at the crossroads of Malaga, Granada, Sevilla, and Cordoba. While Antequera had cave settlements in the early ages, the first known settlement dates to the Copper Age. It was built on a promontory in the vicinity of *Rio de la Villa*, neighbouring *Cerro del Castillo* during this period. The city has been an important settlement for the Roman due to its location at the crossroads of many important routes and extraordinary agricultural potential. Roman ashlar were

reused in the rebuilding of the castle. The first settlement of the Roman is in the 1st century AD. During the Roman period, the city was also in the castle and became an important geographical centre for the Roman. The Middle Ages corresponded to a dark age for Antequera. The simultaneous invasion of the Vandals and Visigoths caused the destruction of many historical sources.

By the occupation of Arab Muslims, the city entered a new period. During this period, the population of the city increased. This increase led to the construction of a new wall around the Castle. This caused the emergence of the Arab '*madina*'. The consolidation of Antequera as an Islamic urban nucleus was achieved by the combination of several basic aspects. These are well-defined places, occupation of steep slopes and being in the vicinity of the river. In this Arab city, key elements of urban form included the mosque, administrative centres and bazaar. Social activity spaces were arranged around the mosque. Near the mosque, an open prayer area called '*musalla*' was formed. Commercial life was organized between this area and the main entrance of the city. In the mid-15th century, Antequera was exposed to the pressures of Christians coming from Granada. During this period, the castle and city walls were rebuilt. As the population started to live outside the walls, the 'interior' of the city walls and the castle were abandoned. While the Arab-Islamic heritage was not very apparent but important in the early stages, new needs have caused the destruction of the Arab core. Until the 18th century, the city continued to grow outside the city walls. The former Suburbs of *Albaicin* and *San Juan* were consolidated as neighbourhoods. Antequera had grown towards the south of the existing city. Limits have been steep slopes. The northward growth of the city was along the roads to Seville and Cordoba. The street system between the neighbourhoods has been arranged compatible with topography. From the 18th century until today, the city has been consolidated. The city centre was formed and consolidated between *Estepa* and *Cantareros*. The transformation of single-family houses into multi-family houses has brought the greatest changes in the urban fabric; it began to change radically in this period (Junta de Andalusia, 1995).

The historic nucleus of Antequera, of about 170 hectares, is selected for identifying and delimiting first-order morphological regions (this was also the focus of Barke, 2003). Based on the establishment of these regions, the *Calle Infante* region (a first-order region) is selected for further morphological analysis in terms of its form variety. This provides a basis for a full implementation of the methodology proposed.

4

CHAPTER 4: APPLICATION INTO ISTANBUL

4.1. DEFINITION OF THE CASE STUDY

The initial approach into Istanbul is in two parts. The first part (4.2) focuses on the general aspects of the city. These are environmental, social, economic aspects and transports. The second part (4.3) is related to the development and evolution of Istanbul urban form. The selection of Fatih district is based on its multi-layered form. A particular area within Fatih district, delimited by Theodosian Walls in the west, Golden Horn in the north, *Fevzi Pasha* Street in the south, and Ataturk Boulevard in the east, is selected for identification of the first-order morphological regions. After the identification of first-order regions, the *Pantokrator-Porta Puteae* region is selected for lower-level analysis. The variety of urban forms of this area provides a basis to establish morphological regions based on the proposed criteria in chapter 3. The *Pantokrator-Porta Puteae* region mainly corresponds to *Cyballi* and *Zeyrek* neighbourhoods (Figure 4.1).



Figure 4.1 Study area within Fatih district (left), Pantokrator-Porta Puteae region (right)

4.2. INTRODUCTION TO THE URBAN ASPECTS OF ISTANBUL

Istanbul has a special place in the world history due to its urban landscape values, natural beauty and geographical location that have been the stage for different cultures in the past. The special strategic geographical location of Istanbul, cultural-historical characteristics, dynamic population and economic potential, makes Istanbul one of the most important metropolis of Turkey and the world.

At this stage, it is important to mention the influence of Dogan Kuban's book 'Istanbul, an Urban History: Byzantion, Constantinopolis, Istanbul' on this thesis (Kuban, 2010). It is, perhaps, the most precious book written on Istanbul urban history. It presents the essence of an historical image of a unique world city, Istanbul, in a physical, social, and cultural framework.

4.2.1. ENVIRONMENTAL ASPECTS

Istanbul, formerly Constantinople, ancient Byzantion, is located between Asia and Europe. It is situated in Marmara which is one of the seven geographic regions of Turkey and provides a passage between the Balkan Peninsula and Asia. Istanbul is topographically bordered with the Black Sea in the north, the *Kocaeli* Mountain Ranges in the east, the Marmora Sea in the south, and drainage divide of *Ergene* Basin in the west (Figure 4.2). It is the largest city and the principal seaport of Turkey. Istanbul has been home to different cultures and civilizations for thousands of years. It was mainly constructed on the heritage of Roman-Byzantine developments. This creates a multi-layered historical urban and cultural landscape.



Figure 4.2 Location of Istanbul within Turkey (Map of Turkey, n.d.)

Istanbul lies between $41^{\circ} 33' - 40^{\circ} 28'$ northern parallels and $28-30$ eastern meridians. It is under the influence of both the Black Sea and Mediterranean climatic zones. Two main winds and one secondary wind are important factors in the micro-climate of the city. The dominant north-easterly- wind brings in cold weather. The west-north westerly wind is also a cold wind and the harbinger of rain. The south-

westerly wind is warmer and may also bring rain. Istanbul has a rather mild, but changeable climate. A short spring is often followed by hot and humid summer. The fall is longer. Winter is rarely very severe, though Istanbul now and then experiences heavy falls of snow. The yearly average temperature is 14 °C. The humidity is often high, but it is usually moderated by frequent winds. There are a few climatic zones. The Marmora, Black Sea shores and the Islands of Istanbul have a warmer, more Mediterranean climate (Istanbul Valiligi, n.d.-a).

4.2.2. SOCIAL ASPECTS

Istanbul is a centre with a high population density, as the major metropolitan regions of Europe. According to the last census, its population is approximately 16 million inhabitants. This means that one-fifth of the Turkish population lives in Istanbul. Table 4.1 presents the population (number of inhabitants), annual growth rate of population, average size of households, and the dependency ratio. While the annual population growth rate was 9.8 per thousand in 2008, it became 30 per thousand in 2019. On the contrary, the average size of households has gradually decreased. It is observed that the total age dependency ratio is gradually decreasing. While the child dependency ratio is decreased, elderly dependency ratio is increased gradually.

Although Istanbul resembles other major cities by these demographic characteristics, it shows a different characteristic with the rapid population increase; and it continues to receive migrants. Rapid population growth and ongoing migration to Istanbul have a strong impact, both in positive or negative ways. Table 4.2 shows in and out immigration, net migration, and rate net migration to Istanbul. It is important to highlight that the Syrian war had a great effect on in and out-migration after the period of 2015-2016.

Table 4.1 Population, annual growth rate of population, size of households, and dependency ratio (TÜİK, n.d.)

Year	Population (number of inhabitants)			Annual growth rate of population (per mille)	Average size of households	Total age dependency ratio (percent)	Child dependency ratio (percent)	Elderly dependency ratio (percent)
	Population (Total)	Population (Male)	Population (Female)					
2008	12 697 164	6 386 772	6 310 392	9.8	3.8	42.1	34.6	7.4
2009	12 915 158	6 498 997	6 416 161	17.0	3.8	42.0	34.3	7.6
2010	13 255 685	6 655 094	6 600 591	26.0	3.7	41.7	33.8	7.9
2011	13 624 240	6 845 981	6 778 259	27.4	3.6	41.1	33.2	7.9
2012	13 854 740	6 956 908	6 897 832	16.8	3.6	40.8	32.7	8.1
2013	14 160 467	7 115 721	7 044 746	21.8	3.5	40.5	32.3	8.2
2014	14 377 018	7 221 158	7 155 860	15.2	3.5	40.4	32.1	8.3
2015	14 657 434	7 360 499	7 296 935	19.3	3.5	40.4	31.6	8.7
2016	14 804 116	7 424 390	7 379 726	10.0	3.5	40.2	31.3	8.9
2017	15 029 231	7 529 491	7 499 740	15.1	3.4	40.3	31.0	9.2
2018	15 067 724	7 542 231	7 525 493	2.6	3.4	40.4	31.1	9.4
2019	15 519 267	7 790 256	7 729 011	29.5	3.3	40.1	30.4	9.7

Table 4.2 In-migration, out-migration, net migration and rate of net migration (TÜİK, n.d.)

Year	In-migration	Out-migration	Net migration	Rate of net migration (per mille)
2007-2008	374 868	348 193	26 675	2.1
2008-2009	388 467	348 986	39 481	3.1
2009-2010	439 515	336 932	102 583	7.8
2010-2011	450 445	328 663	121 782	9.0
2011-2012	384 535	354 074	30 461	2.2
2012-2013	437 922	371 601	66 321	4.7
2013-2014	438 998	424 662	14 336	1.0
2014-2015	453 407	402 864	50 543	3.5
2015-2016	369 582	440 889	- 71 307	-4.8
2016-2017	416 587	422 559	- 5 972	-0.4
2017-2018	385 482	595 803	- 210 321	-13.9
2018-2019	498 676	378 305	120 371	7.8

Both formal and non-formal education activities are not adequately developed in Istanbul. It is striking that schooling rates in formal education are not at a desired level, particularly in the pre-school and secondary education levels. The number of institutions and trainees receiving certificates within the scope of non-formal education activities remains at a very low level compared to the population of Istanbul. Istanbul is a leader in education with a high number of universities. There are 57 universities in Istanbul, including 13 publics and 44 private institutions. This means that 30 percent of the universities in Turkey is hosted by Istanbul. The city is among the least developed regions of Europe in terms of the number of active member of R&D centres and the percentage of university graduates in the total population, which are used as manpower indicators. The presence of a high number of universities and the concentration of academics in Istanbul offers various economic and social opportunities.

4.2.3. ECONOMIC ASPECTS

Istanbul offers the highest contribution of the total gross domestic product of Turkey - 22 percent. In other words, more than one-fifth of the national income is produced in Istanbul (a similar percentage to the rate of the population living in the city). The city is prominent in trade, business, investment, industry and production, and finance. It also is a great touristic destination due to its cultural, natural characteristics, and historical urban landscape, such as the Bosphorus, Islands, and Historical Peninsula. In particular, iconic buildings and sites, such as Hagia Sophia, Hagia Irene, Roman walls, and archaeological sites drive a strong cultural tourism. In addition, it has opportunities for congress tourism, cruise tourism, yacht tourism, medical and golf tourism (Istanbul Valiligi, n.d.-a).

Table 4.3 shows that the unemployment rate has generally decreased over the last years. It is also observed that the employment rate has increased over the years. However, there is a different situation in the price level indices for consumption expenditure. If the price level indices for consumption expenditures of a country or a city is more than 100, it is considered expensive. If it is less than 100, it is considered cheap. In this case, it is understood that the purchasing power of those living in Istanbul has decreased over the years (ISTKA, 2011). As the sectoral distribution of employment is an important indicator in showing the structure of the basic economic activities, the ratio of the employees in the industry, commerce and the financial sector to the total workforce was examined. 32 percent of the

workforce in Istanbul works in the industrial sector, 60 percent in the services sector, and 8 percent in the agricultural sector (TÜİK, n.d.).

Table 4.3. Labour force and price level indices for consumption expenditures statistics (TÜİK, n.d.)

Year	Unemployment Rate (percent)	Employment Rate (percent)	Price level indices for consumption expenditures
2008	11.2	41.3	114.2
2009	16.8	38.8	114.3
2010	14.3	41.0	114.3
2011	11.8	43.1	113.7
2012	11.3	45.3	113.1
2013	11.2	46.4	113.3
2014	no data	no data	114.6
2015	12.9	47.4	114.5
2016	13.5	48.7	114.2
2017	13.9	49.4	114.8
2018	12.5	48.9	114.7
2019	14.9	46.8	-
2020	12.7	43.6	-

4.2.4. TRANSPORTS

One of the most important problems of Istanbul is the lack of transports infrastructures. The increasing private car ownership is one of the greatest threats, in the absence of fast and comfortable public transportation systems. The share of land transportation is around 87 percent; the rate of sea and railway access remain quite low. The inadequate integration amongst different transportation types is a great problem. The development of transportation system that increases the quality of urban life and provides a high level of accessibility for all segments of the society is one of the priorities of the city (IBB, 2011).

4.3.THE HISTORICAL FRAMEWORK AND URBAN EVOLUTION

Various Greek colonial cities have been established in different periods within today's Istanbul. The oldest is probably Chalcedon (today's *Kadıköy*) which was founded in the 7th century BC. Another one is *Chrysopolis* that was built on the steep slopes of today's *Üsküdar*. The third is *Sycae* which is the first core of today's *Galata*. There is not much information about these colonial cities. These settlements remained as outskirts of Byzantium, and then of Constantinople (see Figure 4.3) (Müller-Wiener, 2001).

Galata was surrounded by a wall in the Constantinian period. It became a city with all its outer neighbourhoods in the period of East Roman Imperial. Galata, after being given to the Genoese in the 13th century, has developed into an important trade centre on its own, and after that, it has engrossed the trade of the city, throughout the Ottoman period. In the beginning of the 14th century, the city walls of Galata were expanded and strengthened (Kuban, 2010). Chalcedon, located between the *Haydarpaşa* and *Kalamış* bays, was a small city containing all the elements of a Greek site. It survived unchanged, and it has not developed itself throughout the entire history of Constantinople (see Figure 4.2). There is no information about its boundaries. After the foundation of Chalcedon, Byzantium was founded in 659 B.C. by *Byzas* from Megara. Byzantium, which means the location of *Byzas*, become the city's name. The area where today is the *Topkapı* Palace and Hagia Sophia was the core of the Byzantium settlement.

The boundaries of Byzantion, as a city in the classical and Hellenistic eras, were *Sarayburnu-Eminönü* in the north, *Çemberlitaş* in the west and *Ahırkapı* in the south. The city had a commercial harbour known as Strategion on the Golden Horn coast. The history of Istanbul begins with the establishment of city of Byzantion, and it continues through the Republican city of Istanbul (see Figure 4.3).

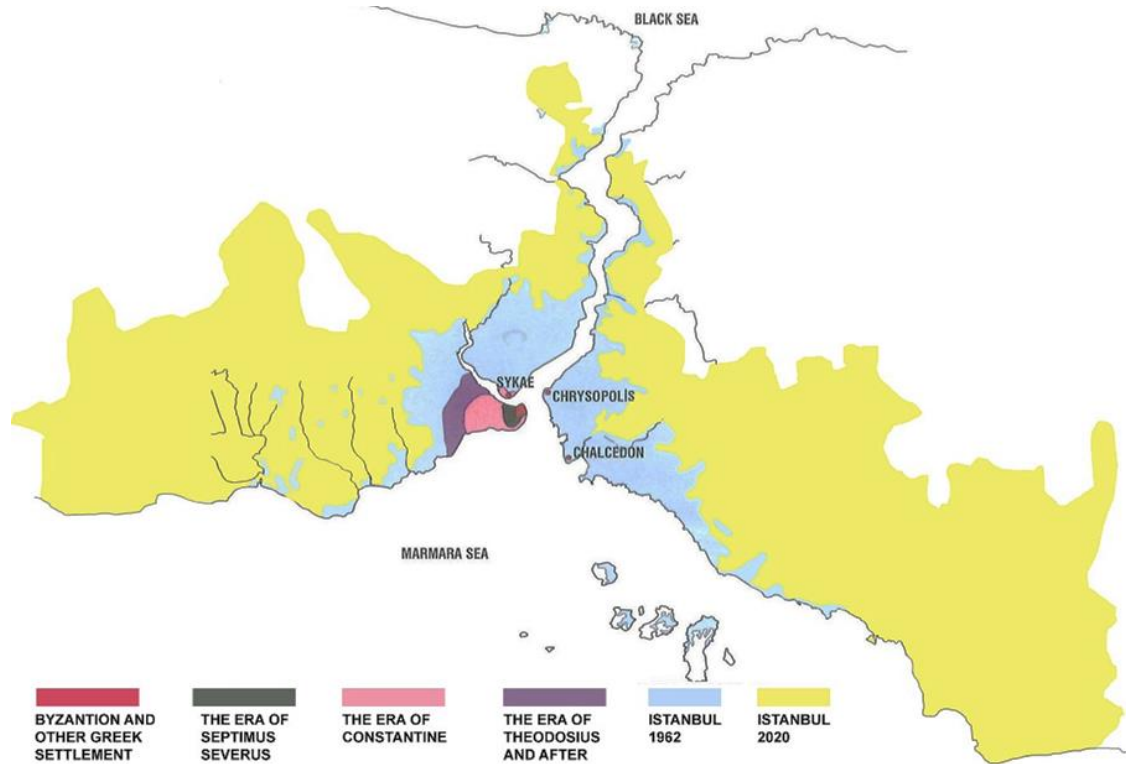


Figure 4.3 Development of Istanbul (updated from Kuban, 2010)

Table 4.4 Development stages of Istanbul (based on Kuban, 2010; Müller-wiener, 2001)

City name	Settlement stages	Year/century
Byzantion	Early settlements	before 7 th century B.C.
	The city of Byzantion	659 B.C.-
Constantinopolis	Roman Imperial	196 A.D -(330)
	East Roman Imperial	4 th -7 th century
	Medieval Byzantine	565-1453
Istanbul	Ottoman Imperial	1453-1923
	Republican Period	1923- present (2021)

Since its foundation, Istanbul has been called by different names under the reign of different states. These names are, respectively, Byzantion, Constantinople in the Roman and Byzantium periods, and Istanbul in Ottoman and Republican periods (see Table 4.4).

The Roman Republic, spreading from Italy to the western and eastern Mediterranean in the last two centuries B.C., became the protector of Byzantion. Afterwards, it was occupied by the Roman Empire in 196 A.D. The city walls of Byzantion and special buildings were destroyed by the Roman conquest (Yılmaz, 2015a).

The city's name of Constantinople is given by the great Roman emperor 'Constantine I'. The history of Constantinople begins with changing of its name and the repairing of Byzantium walls in 324. The city was declared as a new administrative centre in 328, and a magnificent restructuring process began. The information about the city plan cannot be accessed from today's dramatically changed plan. However, it can be assumed that the city was built according to a pre-designed scheme. This scheme was not a grid plan used by the Romans in the construction of the city during the Imperial periods. On the contrary, it is a scheme that envisages the main streets separated from each other like an electric fan, and the large streets crossing them (Kuban, 2010). The *Mese* street, Augusteion (parade ground), Forum Constantine, the Constantinian walls, Hagia Eirene Church, the Great Place, the Temples of *Rhea* and *Tykhe* were the first urban landscape elements of Constantinian period. Hippodrome and Zeuxippos Baths, the constructions of which initiated by Septimius Severus (Roman emperor), are also completed in this period. In addition, many state offices such as Senate, Milion, Praetorium, Capitol are built. In this meantime, the members of the important families of Rome are encouraged to migrate to Constantinople and to be placed in new palaces built in the city (Karakuyu, 2010).

One of the elements determined the urban environment since the 5th century to the present day is the Theodosian walls surrounding the city. The area of the city is increased from 6 square kilometres to about 14 square kilometres by the construction of the walls. The position of neighbourhoods within the town-plan and building forms are still unknown. Although the most important role of Constantinople is both the capital and the place where the emperor resides, the city cannot be underestimated as an economic centre. The rapidly growing population required large ports and warehouses. The construction and development of the city of Constantinople were not easy at all. Earthquakes and major fires periodically caused significant destruction in the city. This also enables emperors to put into practice what they want to build. Constantinople was still a walled city in the Byzantine period, as in the Roman period. As in every large city, a couple of neighbourhoods or villages around the city were found outside the walls. But these were not organic parts of the city. Throughout the entire Byzantine history, *Hebdomon* (today's *Bakırköy*) was the most important external quarter (Müller-Wiener, 2001).

Istanbul was invaded by the Ottomans in 1453. The city walls and Emperor palaces were destroyed during the occupation. The city became the capital of the Ottoman Empire in 1457. A mosque, built in 1458-59, was the first building erected by the Ottomans in the city. Later, a *madrasah* and *Kulliyah* (Ottoman social and religious complex) were built (Kuban, 2010). Before 1453, there were large fields, gardens and open spaces in the region delimited by the Theodosian walls. After the Ottoman occupation, Turks, Armenians, Jews, and Greeks have settled in this new Istanbul. During the Ottoman period, on one hand, development continued within the walled city, and on other hand, the Golden Horn, the Bosphorus shores, the surroundings of the *Galata* walls, *Üsküdar* and neighbouring beaches on the Anatolian side grew as new neighbourhoods outside the city walls. During all these new structurings, religious buildings brought an Ottoman face (mixture of mainly Turkish culture, and to a less extent Arabic and Persian culture) to Istanbul at the end of the 15th century; this was reinforced by the foundation of schools, *madrasahs* and baths. In the early 16th century, the construction of *Beyazıt Kulliyah*, the *Fatih Kulliyah*, and another *Kulliyah* built on Forum Tauri, was one of the largest structural features that distinguished Constantinople and Istanbul. There was no forum in the Ottoman city. There was no large square for people to interact. Social interaction took place in the mosques and their surroundings. In a way, large *Kulliyahs* correspond the forums of the old city. A new development of land transportation, which has not been observed in the late ages of Byzantine, came into existence (Müller-Wiener, 2001; Kuban, 2010; Karakuyu, 2015).

In the 17th century, the city started to expand along the shores of the sea, leaving the walled area. This has made sea transport significant for the city. In addition, the city was made up of narrow, curved streets

during this period and there were no vehicle roads. The roads were designed for horsemen or pedestrians traffic. The trend that characterizes the general development of the 18th century is that the city organically integrates the Bosphorus and the Golden Horn into its structure. This century is a period marked by many fires, and many buildings were burned and disappeared (Küçükspahioğlu, 2015). It is also a century when military structures intensified and started to form an architectural image of the city. In the 19th century, Sunni-Ottoman building structure began to transform into western structure. In this century, a plan that can be considered as the initial planning document of Istanbul was prepared by Moltke. Wide roads and squares were proposed by this failed plan. The neighbourhoods formed in the west of the Theodosian walls in that century, did not grow. Outside the city walls, there were gardens and orchards. After the Republic, prior to Second World War, planning thoughts ignored the oriental character of the city predicted to open the surroundings of *Kulliyah*. This intervention to the historical fabric has also eliminated the last peculiar structural features of Istanbul. The westernization process of the city has continued to the present day with similar interventions of an increasing intensity (Yılmaz, 2015a; Kuban, 2010). In a different framework, this loss of identity is described by Orhan Pamuk's 'Istanbul: Memories and the City'.



Figure 4.4 The Golden Horn in 19th Century in Melling's drawings (Cezar, 2002)

Historical Peninsula as the grain of Istanbul

The political development process of the Historical Peninsula (its boundaries correspond to Fatih district) as we know it today began with the Byzantine city, and following its position as an administrative centre in the Roman, Byzantine and Ottoman eras, has reached to this day, within the boundaries of the Republic of Turkey (see Figure 4.5 for the location of Historical Peninsula). The development of the Historic Peninsula was shaped by the influences of the cultural and institutional heritage of different eras. Consequently, the traces of history in the Historical Peninsula are multi-layered.



Figure 4.5 The Location of the Historical Peninsula (Google Earth, 2020a)



Figure 4.6 The view from the city walls at the end of the 19th century (Evren, 2010)

Original Istanbul, which is currently known as ‘Historical Peninsula’, displays a unique silhouette with its renowned ‘seven hills’ rising from an altitude of 45 to 85. The Walls which are one of the significant symbols of the Historical Peninsula have existed among the basic spatial elements of the city throughout history; in addition to providing their primary function of defence, they have also determined the size and development of the city. Other structural elements of the city such as ports and infrastructure systems for provision of water were established in the Roman era and developed and extended by engineering, particularly in the Byzantine and Ottoman eras. Religious structures and public spaces were shaped according to the topography of the city.

4.3.1. THE CITY OF BYZANTION

The foundation of Byzantion dates to 659 B.C., with the small villages founded around the entrance of the Bosphorous by several groups of immigrants using trading routes between Asia Minor and Europe. Some of these immigrants tilled the soil on the Asian side, others were fishermen and traders. One of these settlements, on the European side, became Byzantion (Müller-Wiener 2001). The city of Byzantion, the Megaran colony on the Bosphorus, occupied an important place in the history of classical antiquity, but it lives now only in the pages of history. The site of the Acropolis on top of the plateau, the location of the harbour at the foot of the Acropolis, the line of its sea walls and its western land walls are all known, but any reconstruction of the city remains as a purely literary endeavour.

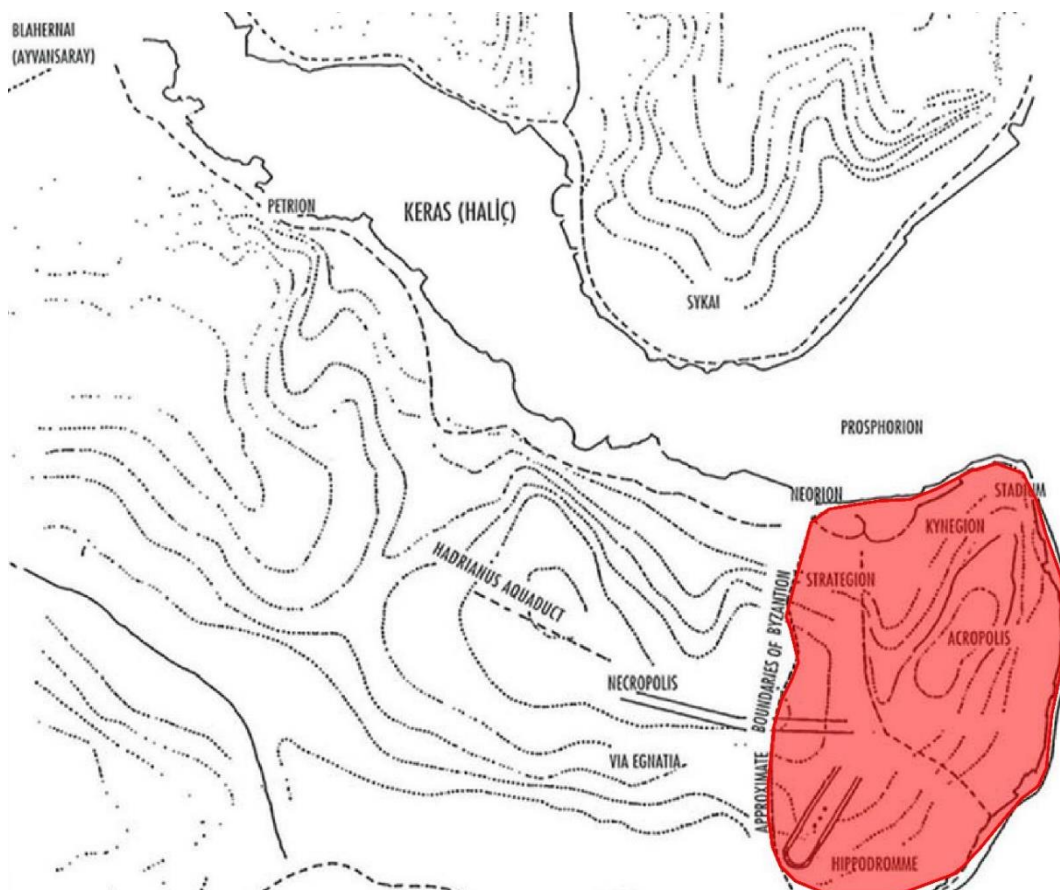


Figure 4.7 Approximate boundaries of Byzantion (Coloured from Kuban, 2010)

Byzantium in the classical period was a city with an estimated population of 20.000 people. The topography of the site clearly indicates the approximate alignment of the Acropolis walls, at least on the east and west (see Figure 4.7). For most scholars, it corresponded roughly to the two inner sections of the Topkapı Palace. According to Pseudo Codinosas, the city walls started from the apex of the promontory on the shore and proceeded westward as far as the Eugenios Tower (the last tower on the mouth of the Golden Horn) where they changed direction, turning to the south and ascending towards the Strategion. Near the Strategion there was a gate which corresponded to an arch, which become to be known as the 'Arch of Urbicius' in the Middle Ages. The walls ascended further in the same direction to reach the Chalcoprateia quarter of the later periods. Then, they proceeded towards the Milion of the Roman period which corresponded to another gate of the old city. The sea walls were not so high as the land walls and were protected by breakwaters. These walls had twenty-seven towers. This whole area is more or less identical to the palace precinct of the Ottomans (Kuban, 2010). The second walls system of the classical period was about 5 km long, and defined a much larger precinct. This enclosed the First Hill and part of the second, and the valley in between, thus following a course which corresponded roughly to the present-day *Babiali* Street. Septimius Severus is known to have destroyed the walls of the city and the major buildings of the Greek period, but the extent of this destructive action is uncertain (Janin, 1950). Byzantium had two harbours: Neorion at the west and, adjacent to it, Bosporion at the east (Wissova, 1839).

4.3.2. ROMAN IMPERIAL

Constantinople was a Roman city, like Rome, Timgad or the Hellenistic cities transformed into Roman cities (such as Gerasa, Antioch and Ephesus). By decision of Constantine I, the capital of the Roman Empire was transferred to the city of Byzantium in 324. The new capital was the result of the will of a single man. The foundation and reconstruction of the new capital was one of the greatest decisions of history. Constantine I brought a large number of people, mostly from the Balkans to his new capital (Dagron, 1974; Mango & Hawkins 1964). Many projects and building activities started by Constantine I were finished by Constantius II, such as the city walls, the Great Palace, and many churches. The new city was modelled, in a certain manner, after the image of Rome. Totally destroyed in the early Middle Ages, the shape of the Constantinian city is only vaguely known. The length of the new city walls was 2,5 km further west. On the Golden Horn, the city walls started from a point at present-day *Cyballi*, west of Atatürk Bridge. Near to this point there was the Gate of Petron (present-day *Cyballi Kapısı*), and from the shore rising towards the hilltop, passing to the east of the *Sultan Selim* Mosque, the wall followed its course towards the south, west of the present Fatih Mosque. From there, it descended to the valley below the presented by Menderes Boulevard and climbed up the opposite hill towards the south, passed the western side of *Davudpaşa* Mosque near the ruins of the present-day *İsa Kapı* Masjid, and reached the Marmora Sea at Rabdos (present-day *Etyemez*) (see Figure 4.8) (Kuban, 2010).

The wishes of Constantine, which were certainly followed by his son, the aristocracy and the dignitaries of state, were realised in the early monumental development of the city. The quarter of Constantine was full of palaces, baths and churches in the 4th and 5th centuries. Within the city of Constantine, the *Mese* (*Via Egnatia*) was the main street of the city. Since that period, the peninsula has a main road. The city did not have a developed industry like the great Hellenistic-Roman cities of the Near East, such as Ephesus, Antioch or Alexandria, but its attraction as a capital and its large population made the city a large market and within a century from its foundation both its industrial output and its commerce had risen to a level comparable with other cities of the Mediterranean basin (Emecen, 2015; Karakuyu, 2015). The water requirement of the city is supplied by many large cisterns and the construction of

underground pipes lined outside the walls. By the aqueduct constructed by Valentinianus (Valens Aqueducts) between 368 and 373, the architecture reaches its peak.

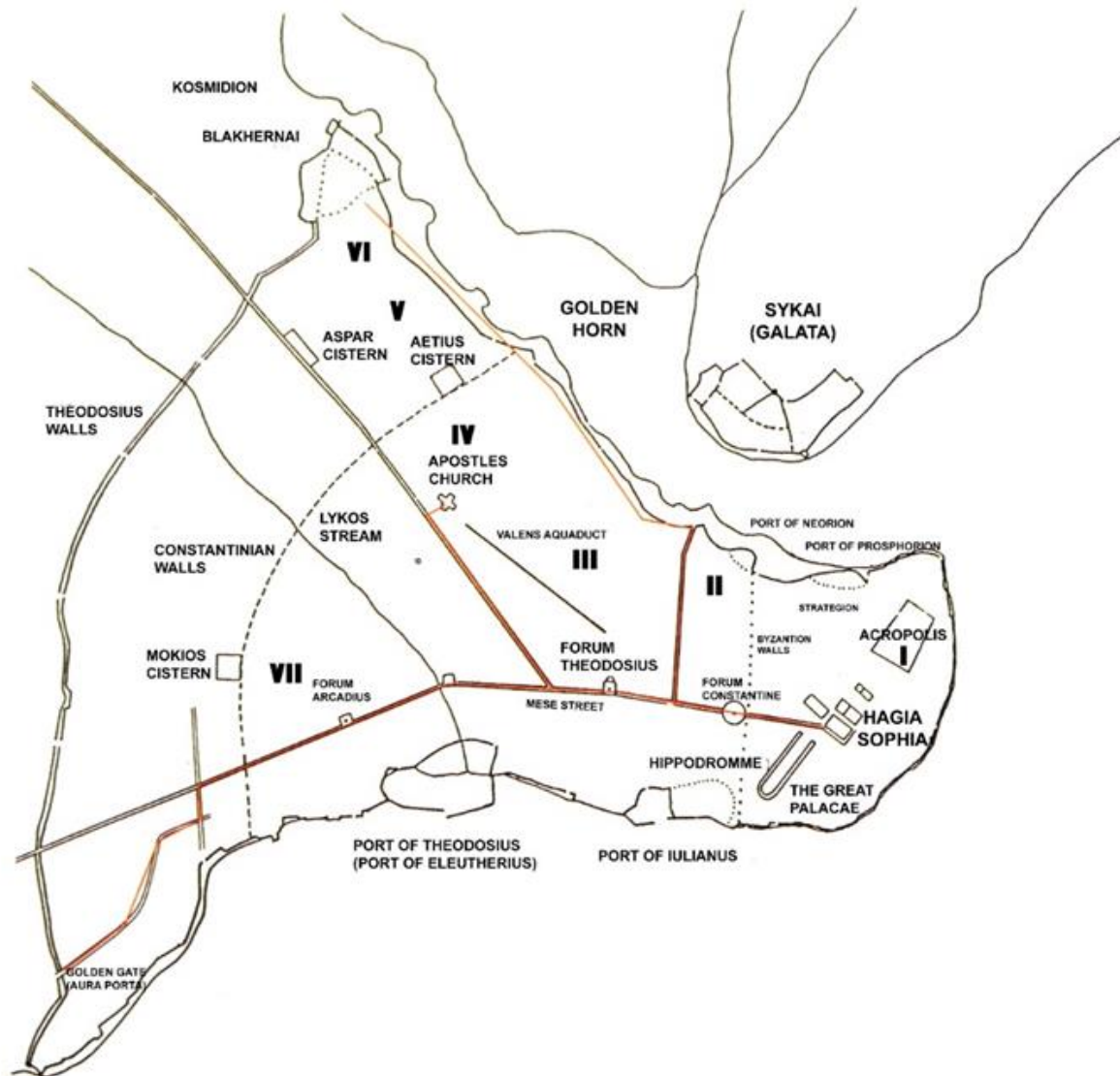


Figure 4.8 The map shows main arterials and places of Constantinople (Kuban, 2010)

The Theodosian walls defined, and still define, the city of Constantinople physically, symbolically and historically. Before the construction of the Theodosian walls, the city had developed in the Constantinian precinct in line with the vision and scheme envisaged by Constantine I and followed by Constantius II. The Theodosian walls were completed between 410-442 as a protection against the Huns. The walls are about 19 km long and enclose an area of about 1,400 hectares. The first walls were partly destroyed by an earthquake in 447 and were repaired and a second wall system was added under Theodosius II (see Figure 4.9). The layout of the Theodosian wall system was dictated by the nature of the terrain and defensive requirements, and not by the increase in the city population.

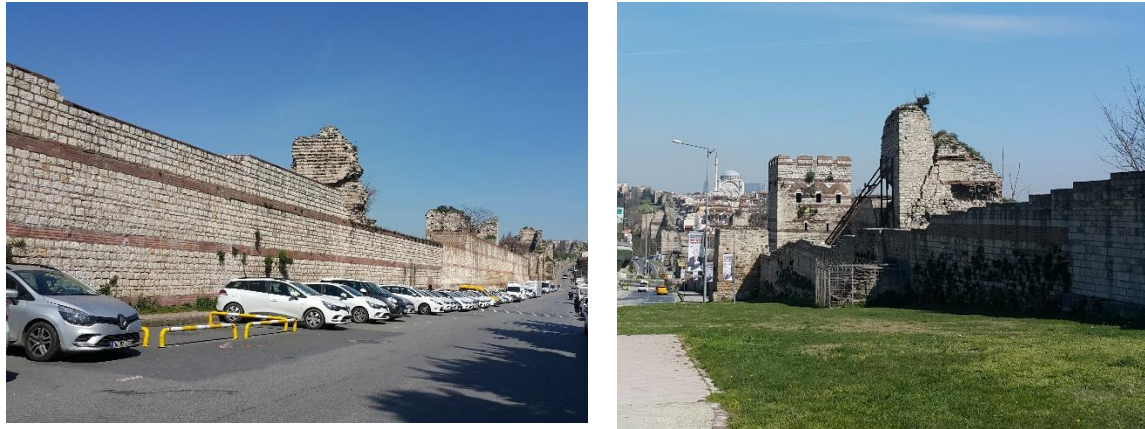


Figure 4.9 Theodosian walls (Photographs by the author)

The area between the Constantinian Walls and the new walls had never been properly developed. No important building has ever been built in this part of the city. The western limits of the city established by the Theodosian walls remained unchanged until the 20th century. It seems that the walls blocked the development of the city towards the west. Constantinople, a city of singular unity, owes its millennial life to its walls. The still existing walls of the city (see Figure 4.7), the largest defensive system of Late Antiquity, the relics and witnesses of Roman grandeurs, are pagan testaments, even if their builder was a Christian emperor.

4.3.3. EAST ROMAN IMPERIAL

There are two Constantinople: Roman and Byzantine. Although there are a remarkable number of continuing patterns between the two, there is a basic difference between them. The first is Roman in character, an extension of pagan Rome into a Christian world followed by its gradual elimination. The other is a medieval city where Rome became a legend and an archaeological fragment. The symbols of these two cities are still alive. Rome still exists in the walls, Byzantine in the *Parecclesion* of the Church of the Monastery of *Chora* (present-day *Kariye* museum). Instead of the volumetric vigour and masculine articulation of classical Roman architecture, the 4th and 5th centuries saw the unfolding of a new spatial concept where the wall surfaces became part of the spatial configuration of interior spaces. The walls, structurally articulated, were replaced by smooth wall surfaces with revetment of marble mosaic or fresco. As an urban landscape, late Roman Constantinople survived for only four centuries. The character of Roman monumentality is easily recognised in the many fragments preserved in museums, such as the carved pilasters from the Palace of *Boucoleon*, the Grandiose capitals of the memorial columns, the remains of the Triumphal Arch in *Beyazit* and the walls of the city. In the 6th century, there were still temples to Apollo, Artemis and Aphrodite on the Acropolis.

The peninsula was roughly divided into four parts: The first part, corresponding to the first administrative Region remained in the precinct of old Byzantion. The commercial quarters were naturally located on the Golden Horn. The second and the third parts consisted of residential quarters lying along the Marmora and the Golden Horn, built on the terraced slopes of the hills descending to the sea. The fourth part lay on the central axis of the peninsula, forming a triangle that included the main communication axes of the city, the Via Triumphalis or the *Mese*, along which, in the 4th and 5th centuries, were concentrated the forums and the major administrative buildings.

The most characteristic urban aspect of Constantinople was the dominant role played by the porticoes. Since the foundation, their number had greatly increased. High colonnades with lofty columns, high entablature adorned with statues, high painted ceilings, the arched gates of the forums and their surrounding porticoes these obviously Hellenestic elements of light and shade, all constituted the most rhythmical element of the architectural history. The high point of the rebuilding the city in this period was the construction of St. Sophia. It remains as the unique instance of the physical and spiritual boundary where Rome infused its grandeur into the Christian world.

4.3.4. MEDIEVAL BYZANTINE

Medieval Byzantine survived between 565 and 1453. A great crisis in the life of the capital occurred in the mid-8th century. In 740 the city walls were severely damaged by an earthquake and the local population was unable to rebuild them. Old monuments were abandoned or used for different purposes. The amphitheatre fell into ruin. A section of the Bath of Zeuxippos was used as a military barrack, another section as a prison. The water supply to the city was no longer capable of carrying the burden of the great public baths. The main water supply to the city, the Valens Aqueduct (see Figure 4.10), become unusable and the city did not have builders to repair it. From the period extending from 565 to the 10th century, no remarkable work of architecture has survived, except in documents, and perhaps as archaeological remains waiting to be unearthed. The city walls were the main support and protector of the Byzantine state. They formed the mainstay of the defence of the capital and the state. The city walls were continuously repaired by the emperors (Magdalino, 2007).



Figure 4.10 Valens Aqueduct in the 20th century (IBB, 2019)

After the 10th century, monasteries became richer. Exempt from taxes, endowed with privileges and connected to great families, they remained rich institutions until the Latin occupation. In 1204 the Monastery of Pantokrator was one of richest landowners in Constantinopolis.

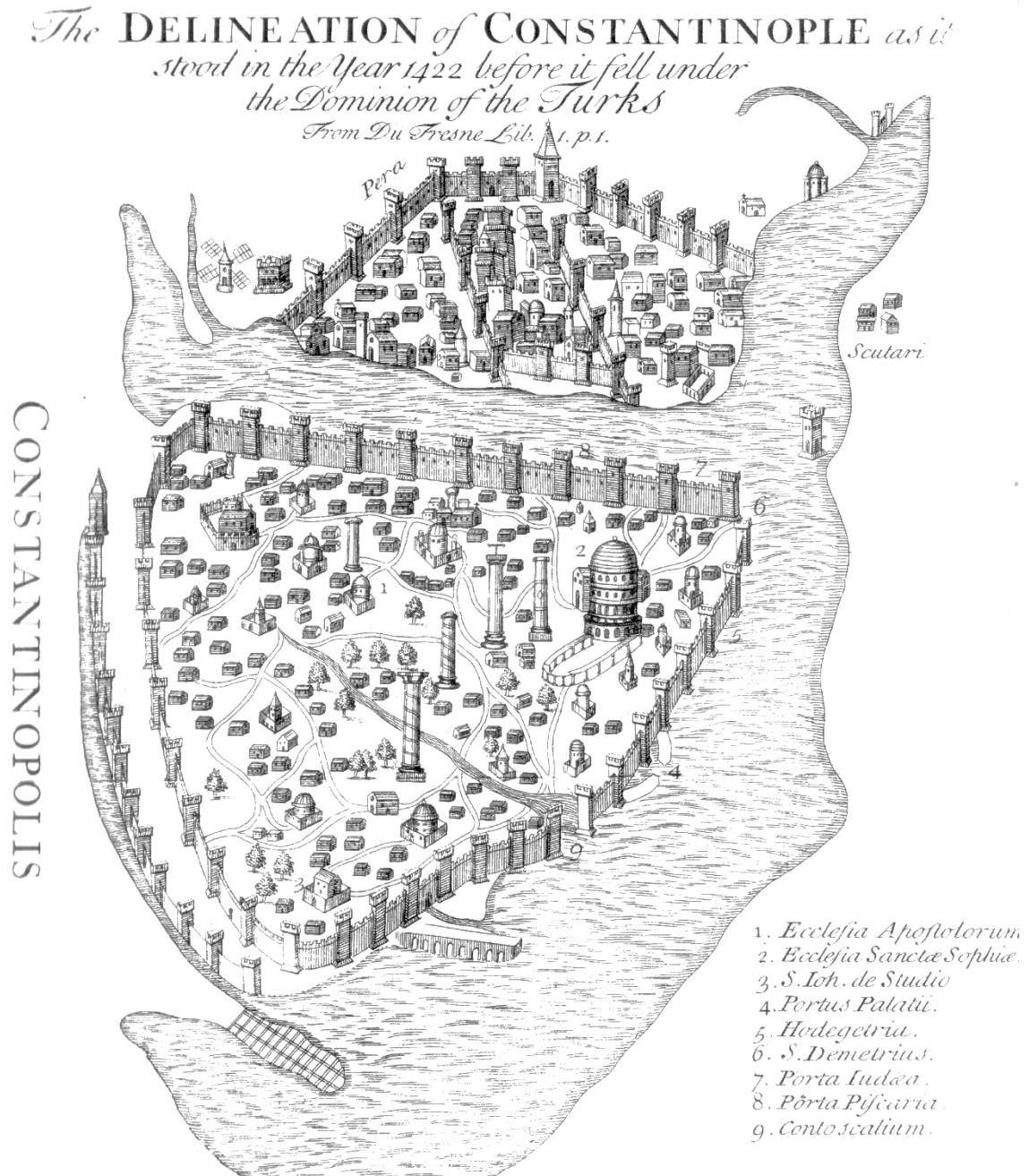


Figure 4.11 Constantinople in the Medieval Byzantine period, in 1422 by Tinney (Gilles, 1729)

The foundation of monasteries by great aristocratic families became an important social and urban feature of the Middle and Late Byzantine periods. All the surviving medieval churches of Istanbul are built in a mixed construction of brick and stone. From the 9th century to the end of the 12th century the Middle Byzantine architecture and art of the capital was created. The architecture of the Middle Byzantine period did not possess the Late Roman grandeur, either in dimensions or in execution. It

presents a mixture of spirituality and poverty. The emperors and the people used the old monuments as a quarry for new buildings. The following gravure in the Figure 4.11 offers a general view of Constantinople in 1422 before its fall under Ottoman hegemony. It includes the city walls, main buildings and monuments, and axes of the city from the Medieval Byzantine period.

In the Middle Byzantine and later periods, the residences of wealthy citizens may have consisted of atrium houses of Roman type or multi-storey stone houses with large central halls, perhaps with galleries. The standard house probably consisted of two storeys, with a ground floor for service rooms, storerooms, stables or workshops if any, and a first floor, or upper floors, as living quarters. They were narrow-fronted rectangular buildings. From Justinian (Byzantine emperor) onwards there were regulations controlling the distance between houses (about 3-4 m.), and forbidding the building of projections or balconies in narrow streets, or of outside stairs (Kuban, 2010). The Crusaders destroyed Constantinople. All the monuments embellishing the public places, the porticoes, the Hippodrome were pillaged. The Latins did not build anything in the city. They simply converted some Byzantine churches for the practice of the Catholic rites.

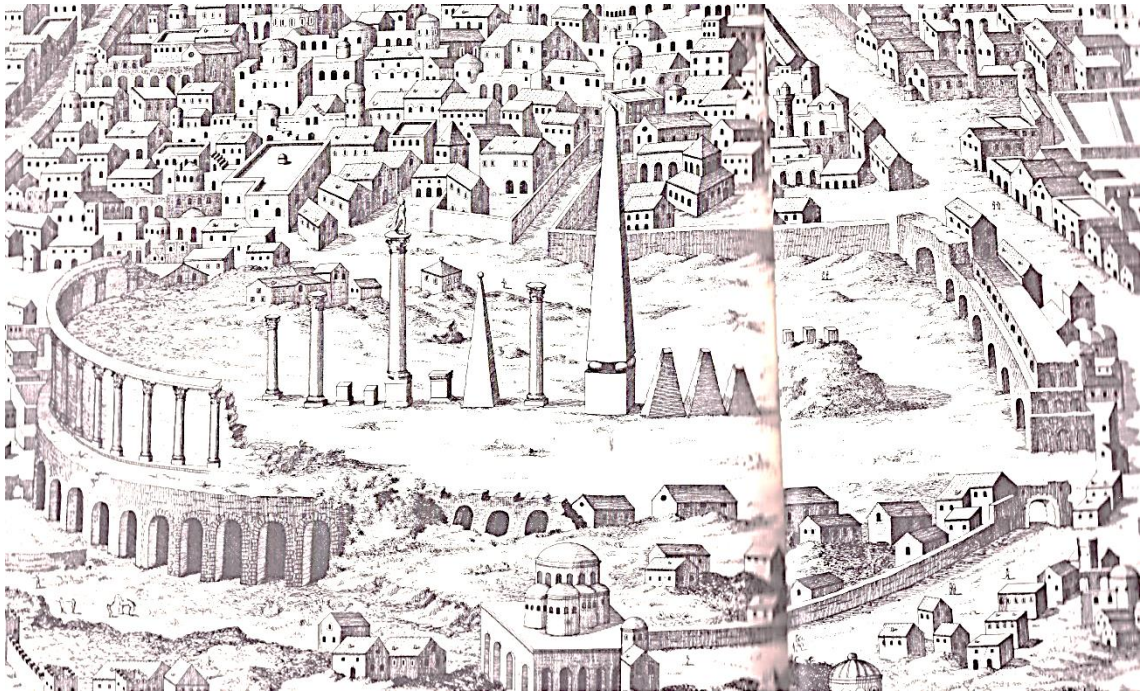


Figure 4.12 A view of the Hippodrome and its surroundings, drawing by Coignard (Emecen, 2015)

4.3.5. OTTOMAN IMPERIAL

By the collapse of Medieval Byzantine, and by the invasion of Ottomans, the common characteristics of Islamic cities were partly implemented in Istanbul. The quarter (*mahalle*) as the socially definable unit of the city has the mosques in its centre. The system of *Vakıf* (pious foundations) for the city's welfare, another Muslim institution, found its most developed implementation in Istanbul. The founding of *mahalles* was the mechanism of growth of the Ottoman Istanbul. The *mahalles* were both a social and physical entity. The larger social content of the city was distributed between the mosque and the *Kulliyah*, the *Çarşı* (Bazaar) and the *Saray* (Palace). The *mahalle* was the urban institution corresponding to a rather compact social group. The bazaar by inducing exchange of goods, the palace by imposing injunctions were the catalysts (Kuban, 1968). The division of *mahalles* according to the ethnic origin or religion of their inhabitants is historically attested, but there were also *mahalles* of mixed

groups living in the same quarter, especially in the commercial districts. In the *mahalles*, there were a great number of culs-de-sac, or blind alleys, a characteristic of Islamic cities, which had much to do with the Islamic concepts of family privacy and private ownership. The cul-de-sac was not a street, it was an outlet from a house or a group of houses, so there were no planned squares, only an open space around the local masjid, or public fountains (Akbar&Shaw, 1988).



Figure 4.13 Miniature of Istanbul by Matrakçı Nasuh in 1533. The miniature is an important source demonstrating the topographical structure of Istanbul and its most important buildings of the period. In the miniature Fatih, Galata and Üsküdar were drawn indicating their general views (Matrakçı, 1976 (1533))

From the conquest onwards the basic urban features of the city remained in their historic places. The densest of the residential quarters was on the southern slopes of the Golden Horn. The residential and monumental concentration of the first period was along the ridge of the peninsula, from St. Sophia to *Edirnekapı* (Charisius Gate). On the Marmora shores, there were the Christian quarters of Greeks and Armenians. The most radical change from the Byzantine to the Ottoman period was the development outside the walls. The trend to extend beyond the walled enclosure led to the foundation of new quarters.

A radical change in the city's history took place with the beginning of the construction of the Imperial Palace, later called *Topkapı* Palace (a gravure of the palace from 1782 in Figure 4.14). (Kuban, 2010, Gülersoy et al., 2008). A considerable number of the urban elements in the structure of the early Turkish period were inherited from the Byzantine city. Some were the outcome of the topography of the site, according to which the city's texture was organically shaped through the centuries: the location of the harbours, the thoroughfares and the site of the old forums, which had been built on the plateaus or in the valleys. There were important monumental remains, which symbolised the long past of the city: the walls, St. Sophia, the Holy Apostles, the memorial columns, the ruins of the Hippodrome and churches.

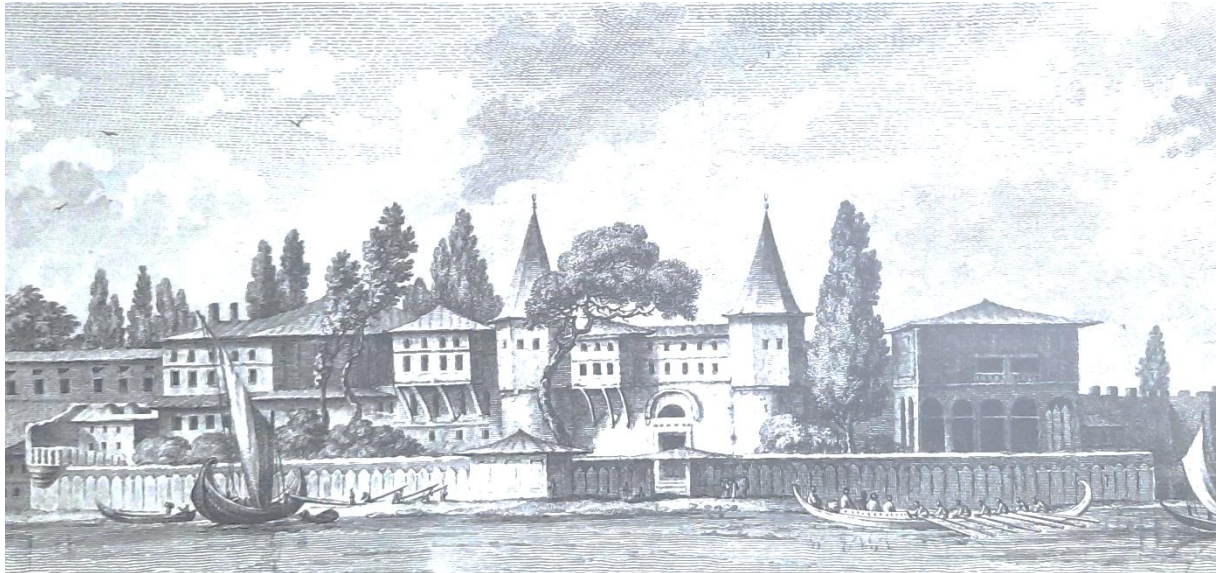


Figure 4.14 *Topkapı* Palace gravure by Jean Baptiste Hilair in 1782 (Sevim, 2002; Gouffier, 1822)

The houses in three storeys, with a ground floor gallery, a projecting *cumba* (bay window) (see Figure 4.15) on the top floor, rectangular framed windows, wooden revetments of the exterior walls and classical window patterns were typical house characteristics of 17th century. Istanbul has always been in a continuous activity of rebuilding, and houses were completed in a short-term. The building materials had to be easily available and cheap. The process of construction had to be rapid. Timber construction was the ideal system to answer the demands. Timber construction must have been quite common in the middle Byzantine period, but in late 14th and early 15th centuries timber could not be provided in sufficient quantities for the construction works in the city. According to the observations of early travellers, the houses in Istanbul were of mixed construction and in small size, but larger buildings, such as caravanserais, *hans* and the shops, were built in rubble and mud brick and plastered over, and had floors and roofs of timber. In Ottoman Istanbul, timber was the main building material for houses from the 17th to the 20th century (see Figure 4.15).

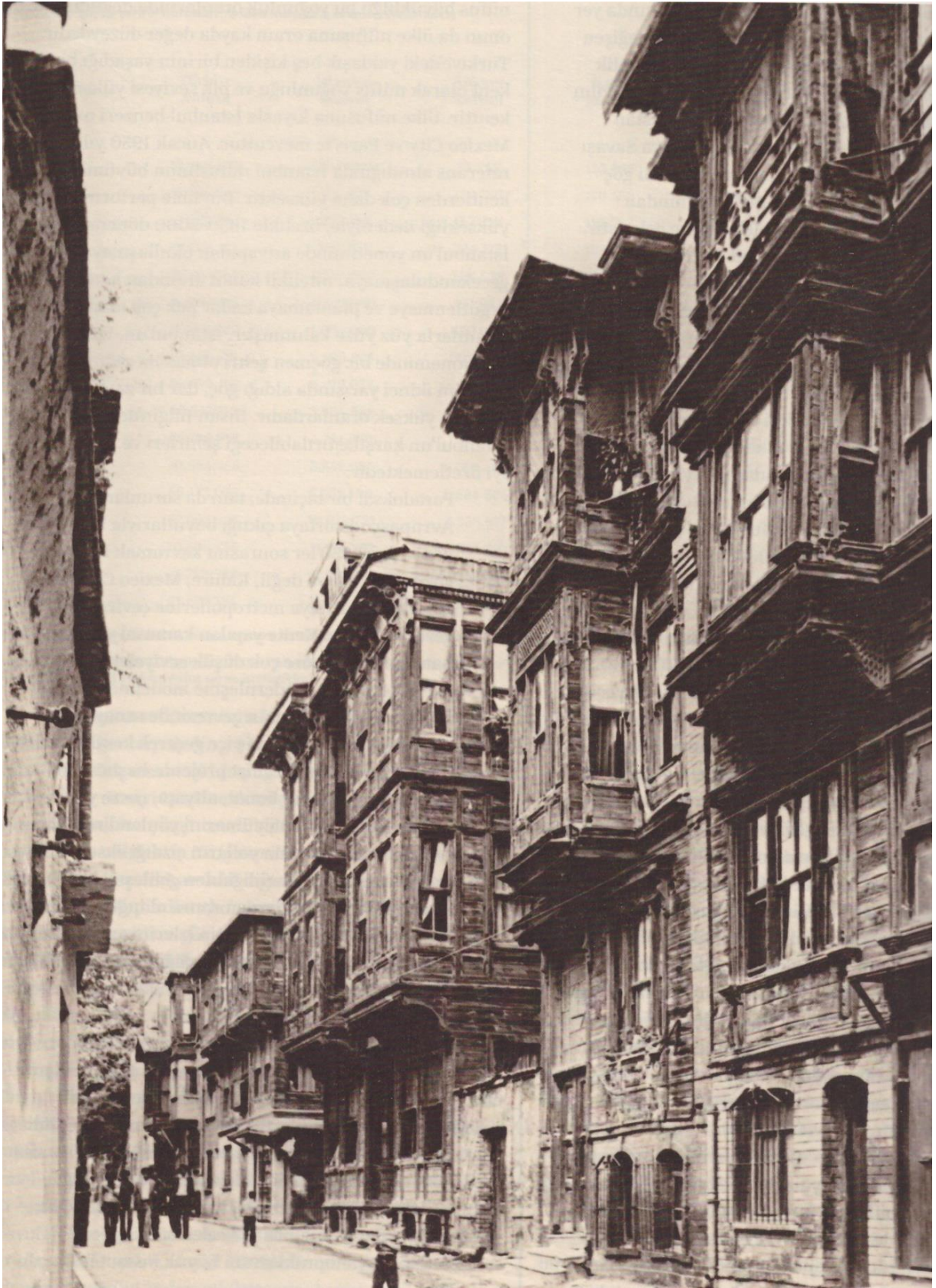


Figure 4.15 Timber houses with bay window (Arlı, 2015)

There are two aspects of Istanbul in the second half of the 18th century. The one is on the urban scale, the outcome of the development of modern military establishments, second is an artistic style, which radically changed the architectural character of the city. Both were of French origin. They were introduced by French architects, engineers, army officers and artists. In the 19th century, the planning efforts concentrated on improvements of the streets. The old street network, embedded in the culture of the society, was the backbone of the historical structure of the city. The concept of a street, accepted as an urban amenity and more important than houses for the welfare and functioning of the city, has never become a part of the urban concept of traditional society in which man was still the member of a small group of citizens living in a quarter. Contemporary planners, using Western models, prepared plans for better communications, pedestrian precincts, sidewalks and street patterns, but lack of maintenance and all sorts of violation by the users such as illegal occupation of sidewalks by shopkeepers, or parking vehicles, and substandard constructions quickly disfigure their concept shortly after the implementation. The late 19th and early 20th century maps of the city show the old pattern of streets cut by grid-iron patches. These patches are the burned down areas of the city. This is where modernisation efforts were concentrated and partly realised. Today it is impossible to imagine such great conflagrations burning down several thousand buildings. Both the grid plan and the military barracks were incompatible with the traditional character of the urban landscape. The organic pattern of classical Istanbul shaped through the individual acts of house owners was utterly contrary to the straight lines of the grid system, and the military barracks destroyed the scale of the traditional environment in which the largest buildings were volumetrically unoffending.

As a result of the fires (see Figure 4.16) and continuously changing population, Istanbul has never preserved its stock of traditional houses. In fact, at the end of the 19th century, there were very few remaining from the first half of the century. Between the first Constitution of 1876 and the beginning of the First World War, Istanbul had been almost entirely rebuilt. The traditional building material, wood, was partly replaced by stone or brick masonry. Timber was still the favourite material for private houses. Typologically, 19th century Istanbul presents three basic forms of dwellings. Single houses, in wood or masonry, terraced houses, composed of single dwellings, and apartment houses. The traditional houses of two or three storeys, represent a stage of development in the traditional dwelling typology (Eldem, 1954).



Figure 4.16 Fires at the end of 19th century (Cezar, 2002)

4.3.6. REPUBLICAN PERIOD

By the collapse of the Ottoman Imperial, and moving the new capital to Ankara, Istanbul lost its historic and almost eternal status. In the history of the Republic, two periods should be strictly separated. The first period was the foundation of the new state, the Republic. The second period was the post-Second World War Turkey, with its multi-party regime and capitalistic outlook. The city has always been a political instrument in history but in this specific post-war context, rapid change coincided with other historical changes which greatly amplified its impact. Firstly, the rate of immigration for a recently developing industrial society exceeded controllable limits. Secondly, political democracy was in its infancy. Thirdly, the city image imported from the West, and especially from America, was totally alien to Turkish tradition (Gül, 2017).

The historical quarters were destroyed by the bulldozer and car-based approaches. There was no single square worthy of being named a square and ‘the city became uglier every year’. The major mosques were restored but the restoration techniques were deplorable, and the new mosques of lamentable taste, poor imitations of classical mosques, added to the unplanned growth of modern residential and commercial buildings, destroying the beautiful landscape as defined by the ancient mosques. The historical quarters became slums. In the 1940s and 1950s, however, there was no danger of total destruction as a result of the opening of a few boulevards, but this intervention model, which is called the bulldozer-for-car based approach, changed its early lenient physiognomy in later decades.

Old Istanbul was a pedestrian city. In the 1950s it was served by the old train way and ferry systems. The old Istanbul as a city of pedestrians, could not allow the development of a healthy transport system without being destroyed. With a conscious plan of preservation, some areas could have been preserved. A large road was opened by bulldozers in an old city. This same feeling of devastation was common when *Millet Caddesi* (Avenue of the Nation) which linked *Aksaray* to *Topkapı* and *Vatan Caddesi* (Avenue of the Motherland), names recalling Baron Haussmann's boulevards, brought the image of a highway into the oldest part of the city. These two broad avenues ended at *Aksaray*, and destroyed it.



Figure 4.17. An earliest Gecekondu neighbourhoods of Istanbul, Gültepe in the 1970s (Kuban, 2010)

They also brought all the traffic of Thracian Turkey directly into the very core of the old city without any hindrance, through the recently improved *Londra Asfaltı* (London Asphalt), an eminently proper appellation. Istanbul had been transformed in half a decade from a city of buildings to a city of roads. After the Second World War, squatter settlements (*Gecekondı*) (see Figure 4.17) of several thousand people were founded mostly on the west of the city. These were the workers seeking jobs in the new industrial areas around the Golden Horn. Those peasants coming with their families were occupying the public land and building their one-room houses, by the common labour of the family members (see an example in Figure 4.17). They were not irregular shelters composed of scrap materials. They were one or two-roomed houses, in the outskirts of the city, carelessly built. In the first period, the governments saw this as a mild disease, and tried to help them to improve their quarters (Kubat, 1999; Kuban, 2019; Müller-Wiener, 2001).

The new face of Istanbul's streets is defined by the apartment and office buildings constructed along with them. In the old, tortuous, narrow streets the height of buildings may rise up to five storeys. In average and wider streets, they are eight to ten storeys high but they inevitably have narrow façades because they are built on the old sites of two or three-storey wooden houses or smaller apartments of the early 20th century. This creates a strange façades architecture because the proportion between height and width changes one-sidedly. In the development of the contemporary city, the formal decisions are dominantly vertical.

The skyscraper was introduced to Istanbul by the great hotels, starting in the Taksim area. In the late 1980s, high office blocks became fashionable for big banks and holdings (see Figure 4.18). Neither their form nor their technique have any peculiarity to Istanbul. The latest symbols of contemporary Istanbul are the malls. They were introduced in the mid-1980s with the development of a consumer society and international trade. Like the skyscrapers, they have no peculiar characteristics.



Figure 4.18 Skyscrapers developed in late 20th century in Maslak (Projekspert, n.d)

4.4. MORPHOLOGICAL REGIONALIZATION⁵

4.4.1. FATİH DISTRICT - FIRST ORDER

The first step of the morphological regionalization, constituting a first-order analysis, is based on the historical framework of the city and the geometry of its streets. Firstly, the focus is on historical maps and cartographic analysis of streets geometry. The morphological analysis, framed by the two fundamental criteria, leads to the production of the map of morphological regions. Complementary to the map, each of the identified regions is described, in terms of their fundamental characteristics, in a synthesis table.

4.4.1.1. Material: historical maps and streets geometry

There are two criteria for establishing the first-order morphological regions in Istanbul: age of streets and streets geometry. Age of streets is considered as the main criterion. A set of historical maps, which are directly related to the study area, is gathered as the basis for the identification of morphological regions.

Historical maps

The maps for streets age are produced based on a set of historical maps of Istanbul. In addition to the maps listed in Table 4.5, there are some other maps. Yet, some of these are not accessible, and others have a low resolution disabling their use for the identification of morphological regions. The next paragraphs describe the maps listed in Table 4.5.

Table 4.5 Historical maps of Istanbul

Historical Maps	Date
Kauffer map	1776
Muhendishane map	1845
Ekrem Hakkı Ayverdi map	1875-1882
Goad's map	1904
German map	1913-1914
Necip Bey map	1914-1918
Wofrang Müller-Wiener map	1922
Pervititch map	1922-1945
Aerial photo	1946

Kauffer map

The first scientific map of the city was prepared by a French civil engineer, François Kauffer. The map was produced at the 1/25.000 scale. It includes streets and special buildings (palaces, mosques, churches, etc). Kauffer's life, like many other French specialists at the service of the Ottoman court, is an illuminating account of the social milieu in late 18th century Istanbul, and illustrates the nature of the mechanism of Ottoman-European cultural relationships. Kauffer came to Istanbul in 1776, and started

⁵ The contents of this section have been submitted for publication in the paper 'Conservation and change in planning practice: the case of Istanbul' (Yaygin and Oliveira, 2021).

to prepare the first studies on the Bosphorus at that time, but he returned home, and came back in 1784 as the secretary of Choiseul de Gouffier when the latter was appointed ambassador in Istanbul.



Figure 4.19 Kauffer map (1776) (IBB, 2019)

Map of Mühendishane

This map was prepared by students of *Mühendishane-i Berrî-i Hümayun* (Imperial Naval Engineering) in 1845. It is at the scale of 1/2.000 and consists of two parts, south and north. The former covers the southern parts of the Bosphorus. The historical peninsula, walled city, and its immediate surroundings are in this part of the map. The latter covers the area between Rumelian fortress and poplars. Almost all the ports, piers, castles, bastion, fish traps, fountains and mansions lined up along the Anatolian and Rumelia shores of the Bosphorus are in the northern map. This is the first map prepared by Ottomans, and shows the characteristics of a city plan. It is important by its drawings, contents, details, building, streets and location definitions. The map has a significant role for the history, geography, topography, place names, hills, valleys, cemeteries, streams, roads and also the mosques list of Istanbul. The map also includes much other information about the city and its surroundings.

Ekrem Hakkı Ayverdi map

There is no certain information about who elaborated this map – perhaps it has been prepared by the students of *Mühendishane-i Berrî-i Hümayun* (Imperial Naval Engineering) – or when. The date is estimated from the buildings included in the map. The name of the map comes from the man who had an investigation about it. The map only covers the historical peninsula. It is drawn on 20 honey-coloured sheets in size of 45x60. There is no scale for the map, but, it is assumed a 1/2.000 scale. It includes streets and their names, mosques, madrasahs, baths, schools, palaces, and mansions.

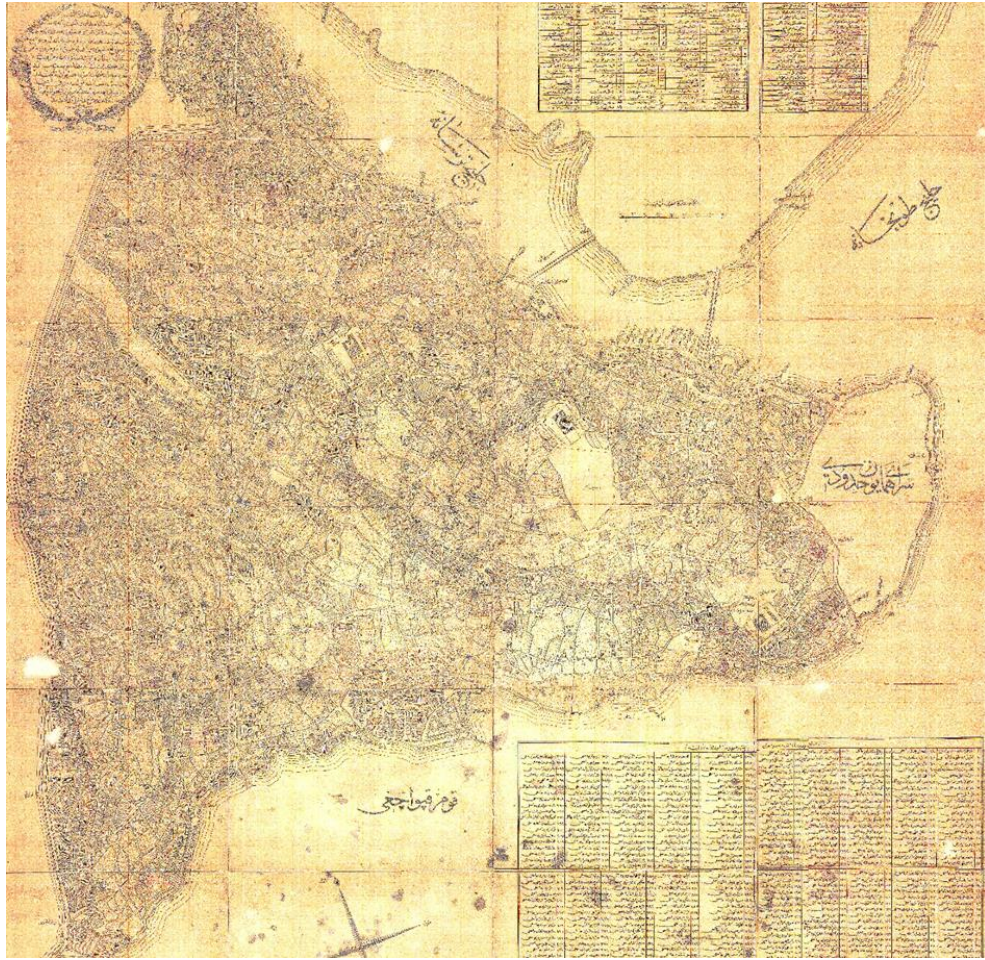


Figure 4.20 A part of the Mühendishane map (1845) (IBB, 2019)



Figure 4.21. A part of Ekrem Hakkı Ayverdi map (related parts of the map) (Ayverdi, 1958)

Goad's map

The map was prepared by Charles Edward Goad in 1904 for fire insurance. The map covers the area between *Eminönü*-Golden Horn and *Divanyolu*. The production of this map was directly connected to the emergence of an insurance economy at the end of the Ottoman Empire, which was itself an expression of the weight of Western and European interests in the region. The map includes streets and their names, plots, special buildings and their names, ordinary buildings (for the first time), and squares.

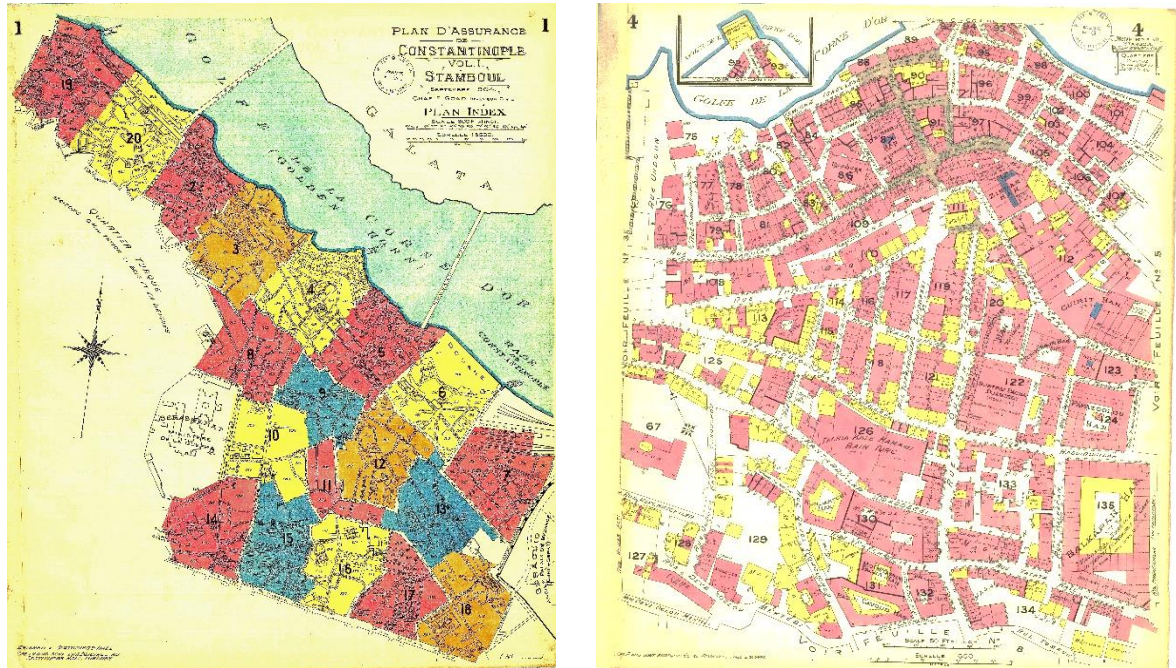


Figure 4.22 Goad's map (1904), key map (left), and a detailed part of the map (right) (IBB, 2019)

German maps

A set of German maps for Istanbul were prepared by the company *Deutsch Syndikat für Staebaliche Arbeiten* in 1913-1914 before the First World War. The information obtained from the measurements of the company has been sent to Germany, and the maps were produced there. Later, Ottoman Turkish copies were created. These maps are prepared in colour, at 1/1.000 and 1/500 scales. In these maps, official buildings, religious and military structures, and public buildings are shown with their names and gauges. The material of these structures is not specified on the maps. Street block and plot information is not represented in the German maps. Also, baths and houses are not drawn (with a few exceptions).

Necip Bey map

This map is known by the name of Engineer Necib Bey, manager of Istanbul municipal authority map branch. The maps prepared between 1914 and 1918 were drawn by the City Maps Delegation Science Institute and printed in Vienna. There are copies in French and Ottoman. The map is produced at 1/5.000 scale. Its focus is on street, street blocks, special buildings, and open spaces.

Wolfrang Müller-Wiener map

The map prepared in 1922 was drawn by Wolfrang Müller-Wiener. The map is produced at 1/5.000 scale. Its focus is on street, street blocks, special buildings, and open spaces. It includes the names of important places of the city.

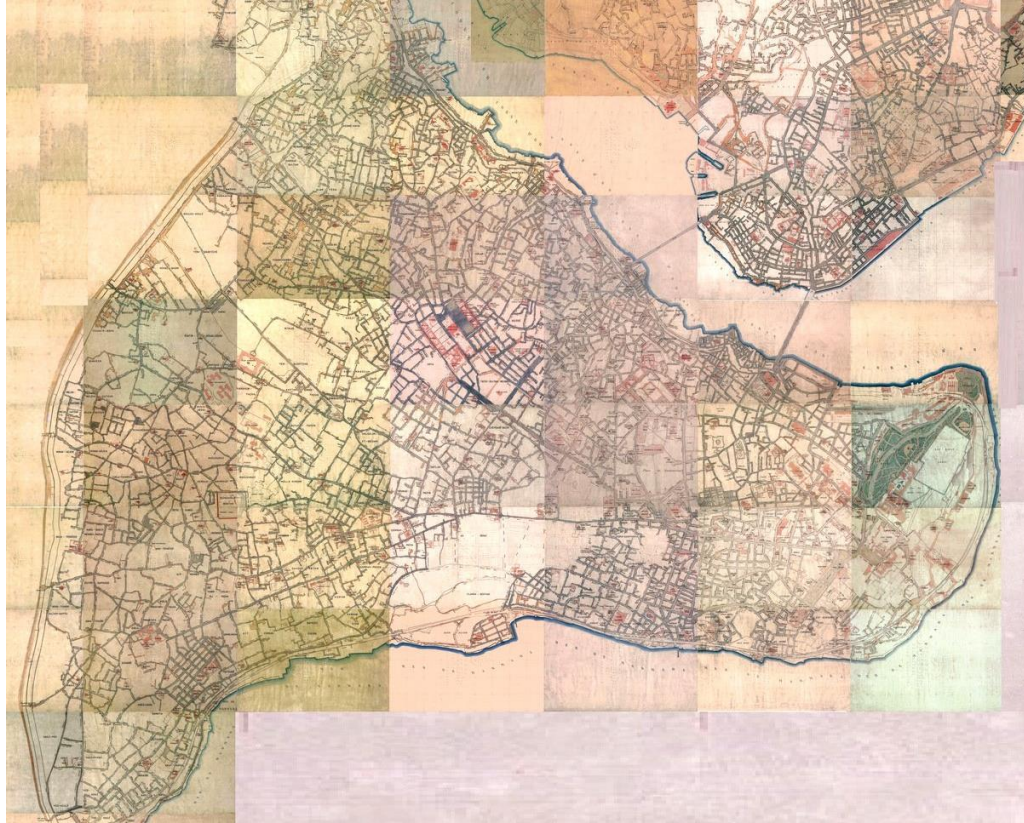


Figure 4.23 German map (1913-1914) (IBB, 2019)



Figure 4.24 Necip Bey map (1914-1918) (IBB, 2019)

Pervititch map

This map was prepared by Jacques Pervititch, in 1929. The Pervititch map consist of a series. The only plan related to our case study is the one prepared for the *Fatih-Aksaray* zone. The production of this map, as the maps by Goad, was directly connected to the emergence of an insurance economy. These maps are prepared in coloured way. Pervititch maps have a better quality than those of Goad, varying from 1/250 to 1/1.000 scales.

Aerial photo of 1946

This satellite image (Figure 4.27) was taken by the General Directorate of Mapping in 1946. The image is in black-white, and it shows the case study, with Golden Horn and its surroundings. When looking at the aerial photo, the surroundings of the study area are not completely fulfilled. Particularly the south of the area presenting some orchards and empty places.

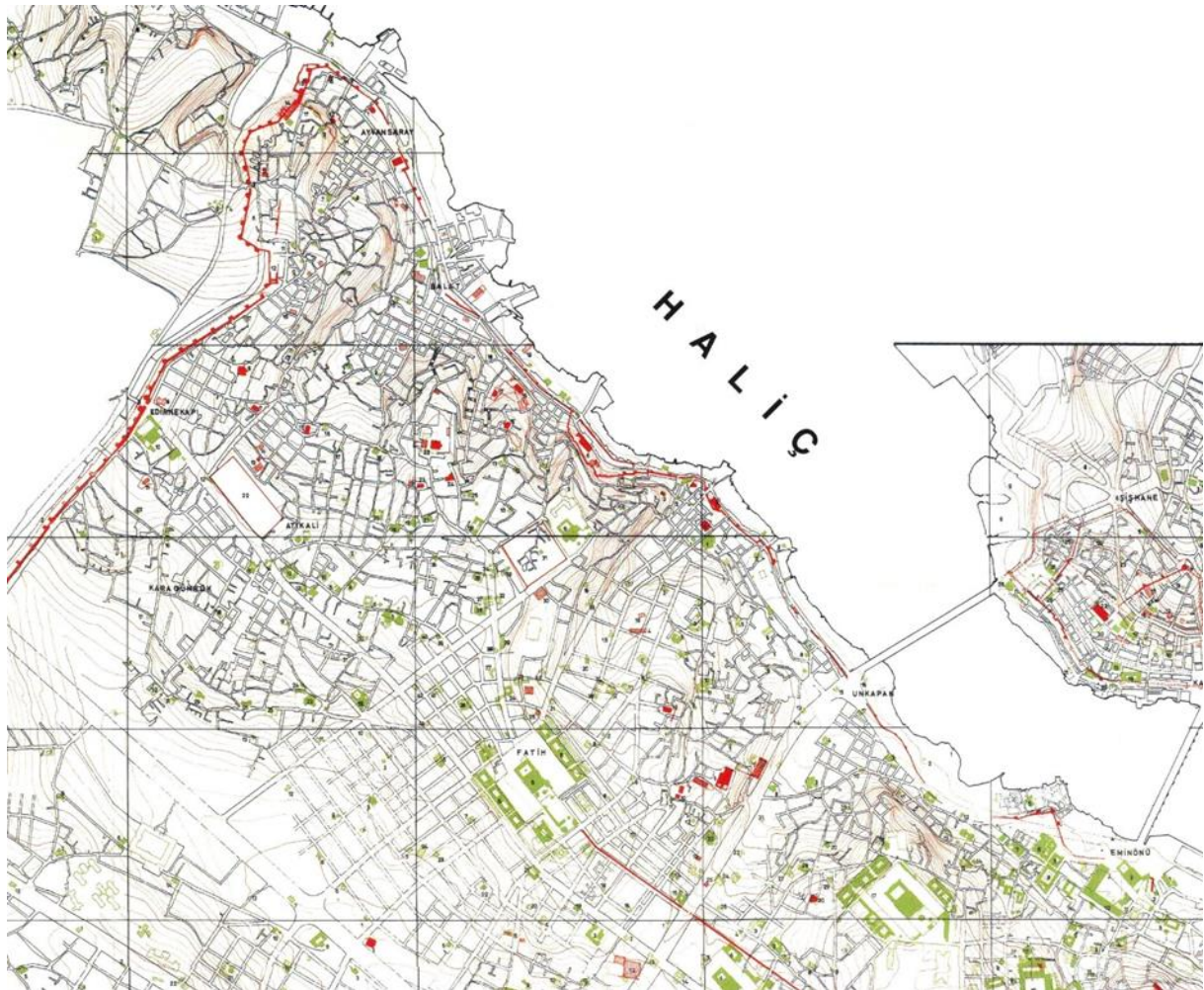


Figure 4.25 Müller-Wiener map (1922) (IBB, 2019)

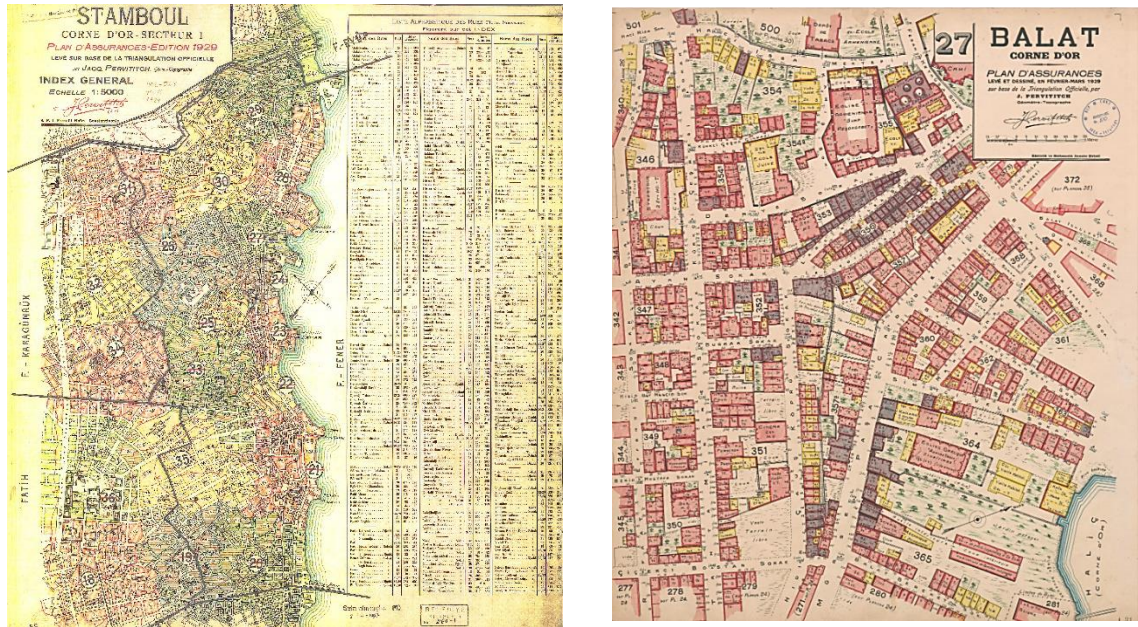


Figure 4.26 Pervitch map (1929), key map (left), and a detailed part of the map (right) (IBB, 2019)



Figure 4.27 Aerial photo of 1946 (General Directorate of Mapping, 1946)

Age of streets

The analysis of this set of historical maps leads to the elaboration of the map for the age of streets (see Figure 4.28). There are few unchanged streets after Kauffer's map (1776). The map of *Mühendishane* (Engineering) (1845), Ekrem Hakkı Ayverdi (1875-1882), and Goad's map (1904) together yield the same interval. The German map (1913-1914), Necip Bey (1914-1918), and Wofrang Müeller-Wiener together revealed another category. Pervititch (1929) introduced a category on its own. Finally, the aerial photo (1946) only corresponds to two main axes, delimiting the study area at south and west (see Figure 4.21). By the designation of streets age, a general map of regions is illustrated. It contributes to the first-order of morphological regions. Five regions are identified, based on the age of streets (see Figure 4.30).



Figure 4.28 Satellite image of the study area, Istanbul (Google Earth, 2020a)

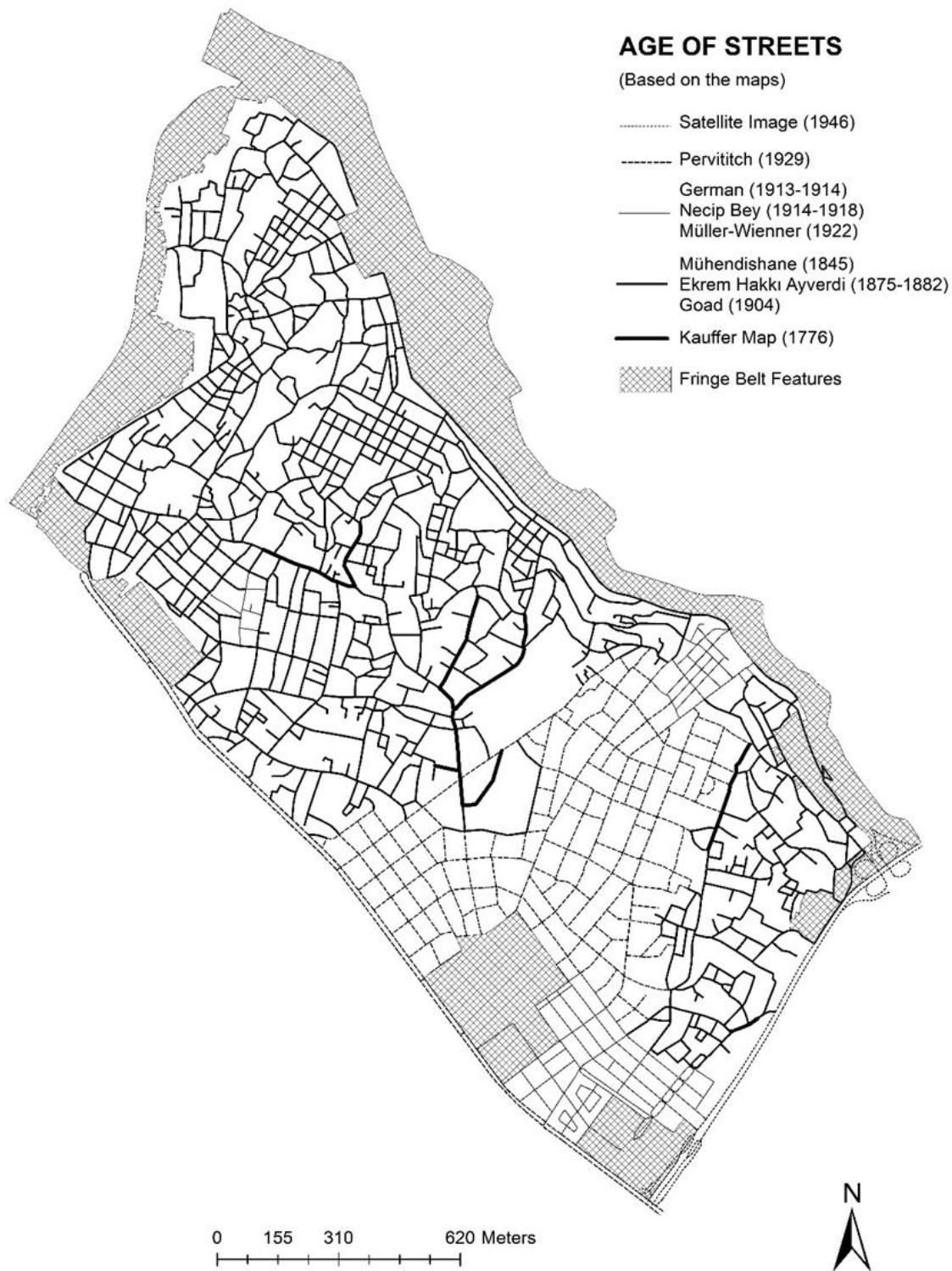


Figure 4.29 Age of streets

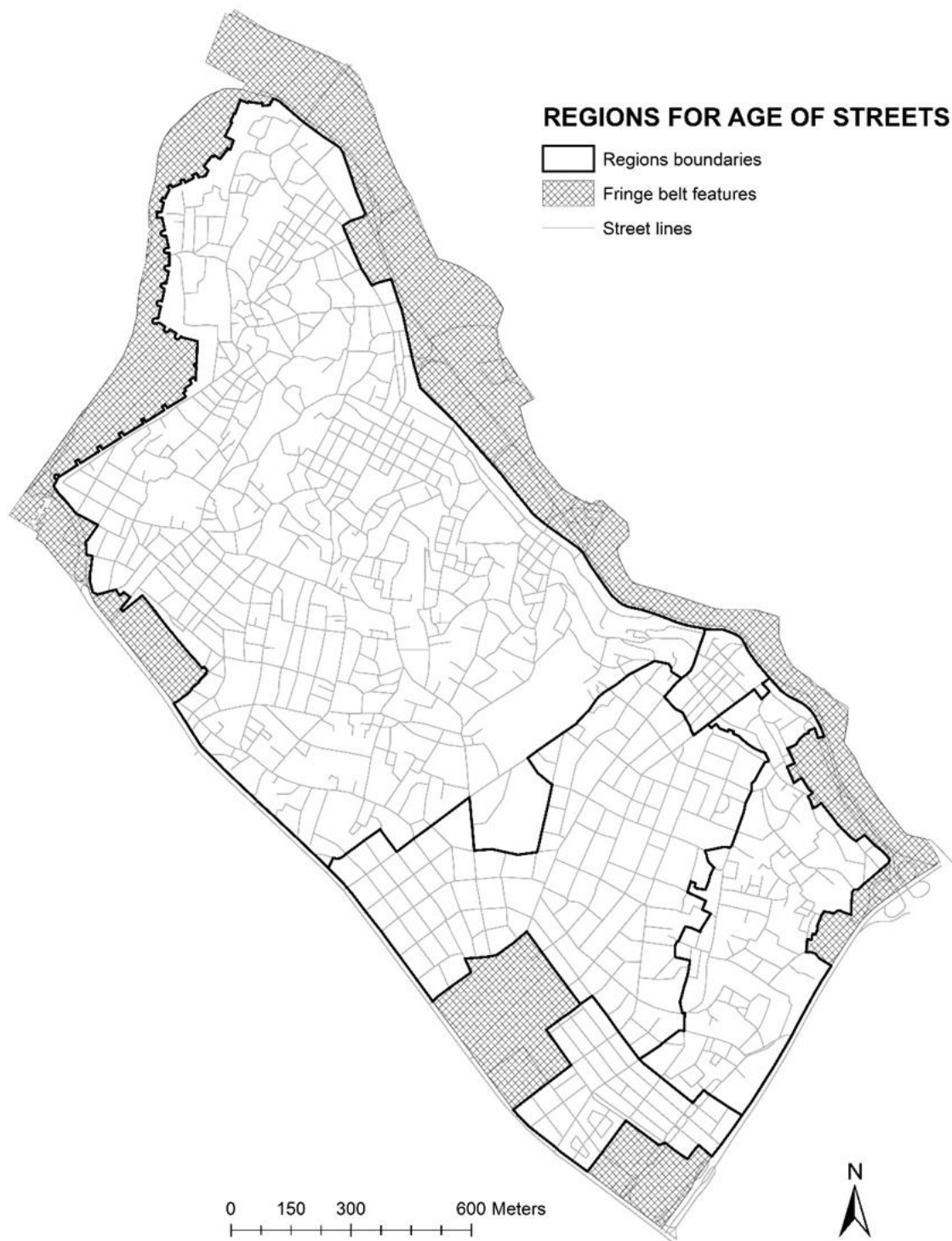


Figure 4.30 Age of streets (regions)

Streets geometry

The second criterion of the methodology is streets geometry. There are three types of street patterns in the study area. These are gridiron, loose grid, and dead-ends. Each of these patterns is regionalized in Figure 4.31.

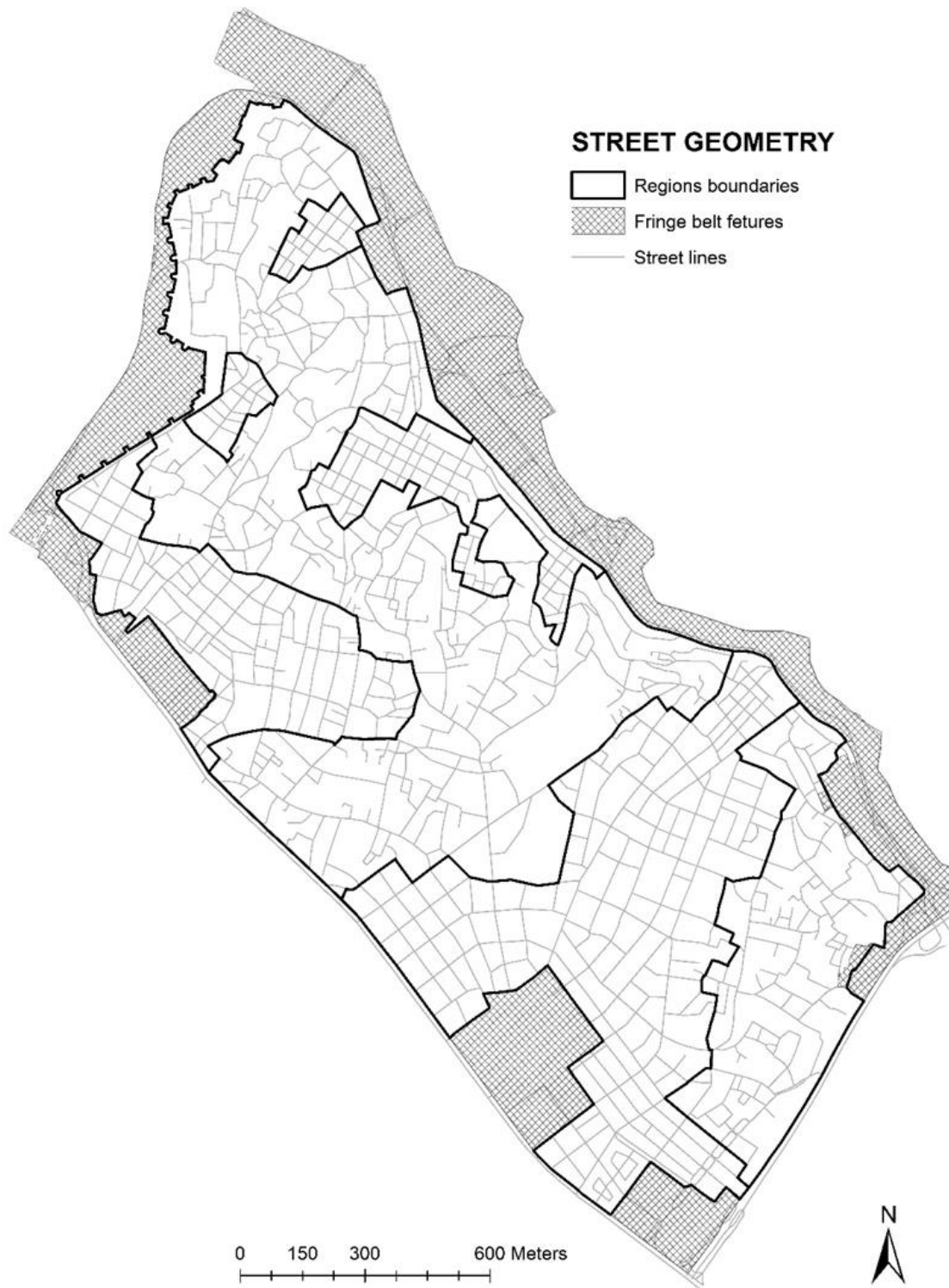


Figure 4.31 Streets geometry

4.4.1.2. Morphological regions: first-order

The first-order morphological regions are the product of two criteria based on the town-plan – age of streets and streets geometry. The first-order regions are identified through the combination of these two

criteria. In other words, the overlap of the maps for age of streets and streets geometry produces the map of first-order morphological regions (see Figure 4.32, as a result of Figures 4.30 and 4.31).

Ten regions are identified (Figure 4.32). These are Constantine-Valens Aqueduct, Ayia Theodosia, Pantokrator-Porta Puteae, Yavuz Sultan Selim Road, Balat-Ahrida Temple, Ebu Zerr el-Gifari, Palatium Constantini (Constantine Palace), Draman Road, The Ecumenical Patriarchate Pammakaristos-Panagia Vlaherna, and some fringe belt features. The names of these regions are related to the importance of special buildings, such as monasteries, churches places and temples, and streets (original names are preferred to keep a relation with the spirit of the place).

Constantine-Valens Aqueduct and Ayia Theodosia regions have similar characteristics in terms of streets age and streets geometry. Both are based on the period revealed by the German (1913-1914), Necip Bey (1914-1918) and Wolfrang Müller-Wiener (1922) maps. They represent loose grid street patterns (see Table 4.6). The Constantin-Valens Aqueduct is a consolidated region with modern buildings. It is a residential area with commercial uses. Two sub-areas can be distinguished: the upside and downside of *Serdab* street. Some adjacent facilities, like the rectorate of *Fatih Sultan Mehmet* University, and Fatih Mosque complex, and the aqueducts within it, give the region a special value. *Ayia Theodosia* is a relatively small region. It is a consolidated area with traditional and contemporary buildings. It contains residential and commercial uses. It is worth emphasizing its location bordering the Golden Horn. The riverside is a lively space in terms of commercial uses.

The region of *Pantokrator-Porta Puteae* has dead-ends street pattern. Its streets age is based on the maps of *Mühendishane* (1845), Ekrem Hakkı Ayverdi (1875) and Goad (1904). This is a unique region in terms of the diversity of building fabric. It is mainly a residential area with commercial uses on the east and north. It contains a variety of buildings with different floors and different construction types. It includes some inner plots and empty spaces for new urban actions. Buildings in bad condition are open to new interventions. Its proximity to the Golden Horn, and commercial uses and local services on the east side makes it attractive. The Ottoman bath, special façades of buildings and streets themselves are some important elements to highlight.

Yavuz Sultan Selim Road region has the characteristics of streets age dating to the Pervititch map (1929). It is a region that distinguishes itself due to its loose grid street pattern. It is a consolidated area with some empty spaces. These spaces have the potential for new actions or interventions. Apartment blocks are dominant building types in the region. It is a residential area with strong commercial uses and local services that are expanded in the whole region.

The regions of Balat-Ahrida Temple and Ebu Zerr el-Gifari have characteristics from the *Mühendishane* (1845), Ekrem Hakkı Ayverdi (1875) and Goad (1904) maps. They have a gridiron street pattern. Balat-Ahrida Temple is a region with very regular streets. It includes commercial uses and local services. Its location in the proximity of the Golden Horn makes it a valuable and lively region. It is also a modest region with its colourful houses and narrow stone-paved streets. Popular cafes and modern galleries are located on the same streets as the old grocers. Structures of synagogues and Byzantine churches reflect the cosmopolitan history of the region, which is the home to Jewish, Greek and Armenian communities. It is an important region, especially for the film industry. Ebu Zerr el-Gifari is relatively a small region with its regular streets. It is a consolidated area including residential and commercial uses.

Palatium Constantini (Constantine Palace) region, next to the Theodosian walls, has loose grid street pattern. The maps of *Mühendishane* (1845), Ekrem Hakkı Ayverdi (1875) and Goad (1904) are another distinctive features for the identification of the region in terms of its streets age. The region is a consolidated area with some empty plots, presenting the potential for action.

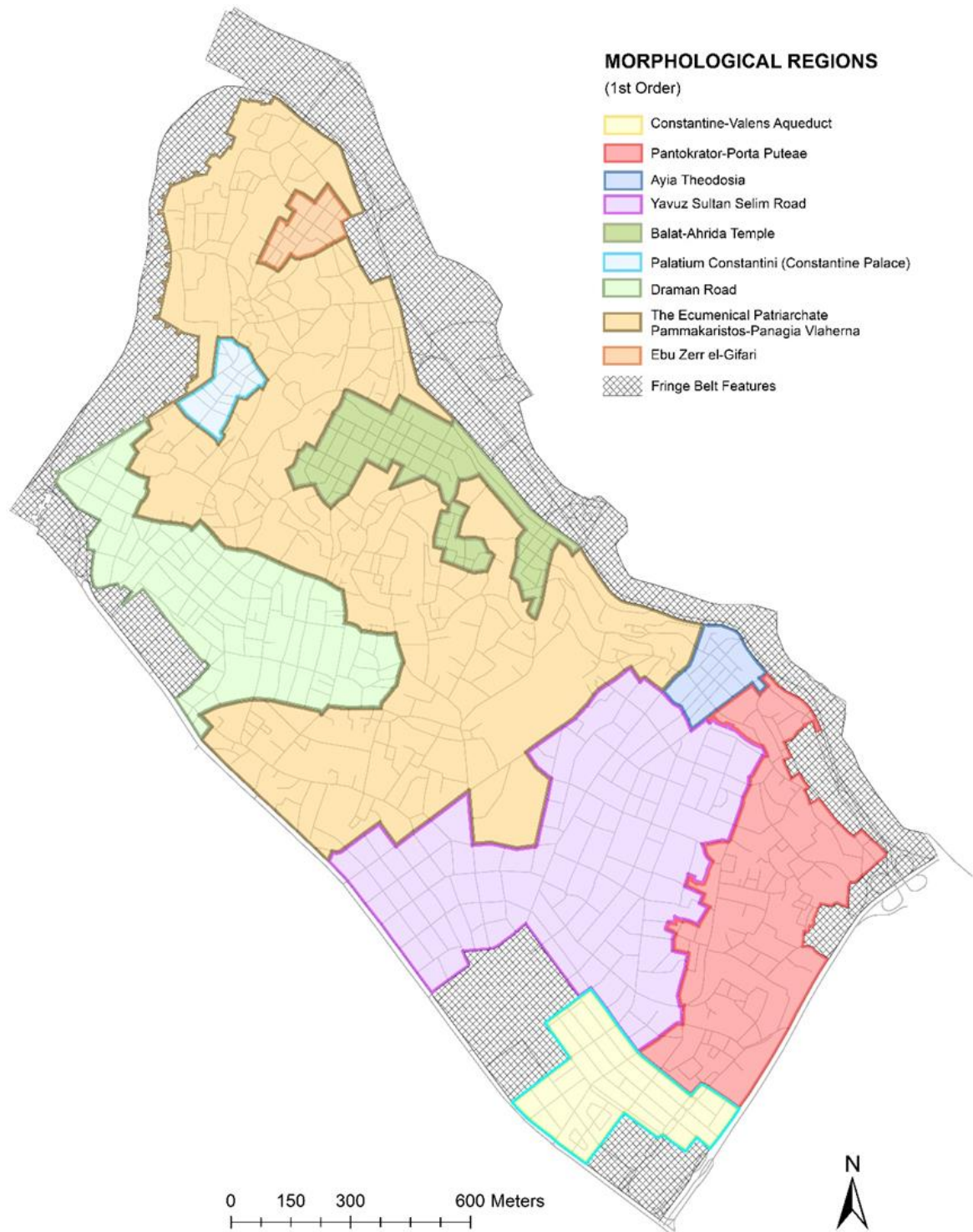


Figure 4.32 First-order of morphological regions based on town-plan (streets) in Istanbul

Loose grid and dead-ends(few) street patterns provide a distinguished feature to the *Draman Road* region. Its streets age is based on the maps of *Mühendishane* (1845), Ekrem Hakkı Ayverdi (1875) and Goad (1904). The consolidated region has residential with spread commercial uses and local services.

The Ecumenical Patriarchate - Pammakaristos-Panagia Vlaherna has mainly dead-ends street pattern. Kauffer's map, in addition to the maps of *Mühendishane* (1845), Ekrem Hakkı Ayverdi (1875) and Goad (1904), provides a distinctive feature to the region. This is the largest first-order morphological region of the study area in Istanbul. It is an area that allows the possible actions and interventions in the historic urban landscape, considering the character of the area. As a residential area with distinctive utilization, it provides a lively space for urban life. It is worth highlighting the mosques of Yavuz Sultan Selim, *Fethiye*, and *Kariye*, Private *Fener* Greek Secondary School and High School, the Virgin Mary Bloody Church as substantial visual elements of the urban landscape. The area is surrounded by different fringe belt features. Recreational usages take place on the west lies along the Theodosian walls. On the northern side, there is the Golden Horn river and green spaces that enclosing the area. Institutional features are on the east side, and religious features are on the southern part of the area with their distinctive characteristics. They are community spaces free access and facilities.

The characteristics of these ten first-order regions are identified in Table 4.6.

Table 4.6 Characteristics of first-order regions

Morphological regions (First-order)	Age of streets (based on the date range of the maps)	Streets geometry
Constantine-Valens Aqueduct	1913-1922	Dense Loose grid
Ayia Theodosia		
Pantokrator-Porta Puteae	1845-1904	Dead-ends
Yavuz Sultan Selim Road	1929	Loose grid
Balat-Ahrida Temple	1845-1904	Gridiron
Ebu Zerr el-Gifari		
Palatium Constantini (Constantine Palace)	1845-1904	Loose grid
Draman Road	1845-1904	Loose grid - Dead-ends(few)
The Ecumenical Patriarchate Pammakaristos-Panagia Vlaherna	1776 and 1845-1904	Dead-ends

The first and second criteria of the methodology based on the town-plan, which are age of streets and streets geometry, together contributed to the hierarchy of regions high level (see Table 4.7).

Table 4.7 The contribution of age of streets and streets geometry to the hierarchy

Criteria	Contribution to the hierarchy
Age of streets	High
Streets geometry	High

4.4.2. PANTOKRATOR-PORTA PUTEAE - SECOND ORDER

4.4.2.1. Material: plot layout and land and building utilization

Due to the large size of the study area, the analysis of second-order regions focuses on one first-order region, Pantokrator-Porta Puteae located in the *Cyballi and Zeyrek* neighbourhoods. The selection of this region is due to its diversity of urban form. The name of the region has a close relationship with the Pantokrator Monastery. The monastery is a religious building from the Eastern Roman period. The church consists of three separate chapels. It is the largest surviving old church in Istanbul after *Hagia Sophia*. It is a special building made of bricks. It is the first building that was converted from church to mosque.

Plot layout as a component of the town-plan, and land and building utilization are the two criteria for mapping the second-order regions. Cartographical and areal analyses based on plot layout and land and building utilization have been carried out. Plot layout is in a set of sub-criteria: plot area, plot width, and plot depth. These are three important morphological constituents for characterizing the plot layout as a whole. Three intervals are used to produce the map of the plot area, plot width, and plot depth using natural breaks in ArcGIS.

Plot area is categorised as small, sometimes very small, (between 0-368 m²); medium (between 369-1186 m²); and large (between 1187-3337) (see Figure 4.33). Small and medium plots mainly consist of residential and commercial functions. Large plots mainly correspond to fringe belt features, including institutional, educational, and religious. Plot width is classified in narrow (between 0-15 m), medium (between 16-30 m), and large (between 31-140 m) intervals (see Figure 4.34). As in the case of the plot area, plot width and depth have a relationship with the land and building utilization. Plot depth has short (between 0-15 m), medium (between 16-30 m), and long (between 31-116 m) size categories (4.35). These three maps of plot layout (area, width, depth) are the first contributors to the second-order morphological regions.

Figure 4.36 shows the current distribution of detailed land and building utilization. It is based upon fieldwork developed in March 2019 and information received from Istanbul local authority. The study area includes a wide range of functions, from advertising agencies, automotive services to residential, commercial, and social uses. Figure 4.37 presents the generalized land and building utilization. It is classified as commercial, housing, and four categories of fringe belt uses (educational, institutional, religious, and warehouses). These fringe belt categories are derived from both uses and contiguousness. For instance, educational and institutional uses, which are next to each other, are addressed together in educational-institutional category (there was no need to recognize two different categories in this stage).

Commercial uses are mainly located around Atatürk Boulevard and Golden Horn – two lively corridors of the area. Those taking place around Atatürk Boulevard are consisted mostly of new constructions. The others are in historical buildings and mainly in a bad condition of conservation. The area is surrounded by fringe belt features. These features are institutional, educational, religious, and green spaces. Warehouses next to the commercial area are in a very bad condition, creating an unsafe area. Housing is distributed in the whole area. Some residential functions have commercial uses on the ground floor (see Figure 4.37).

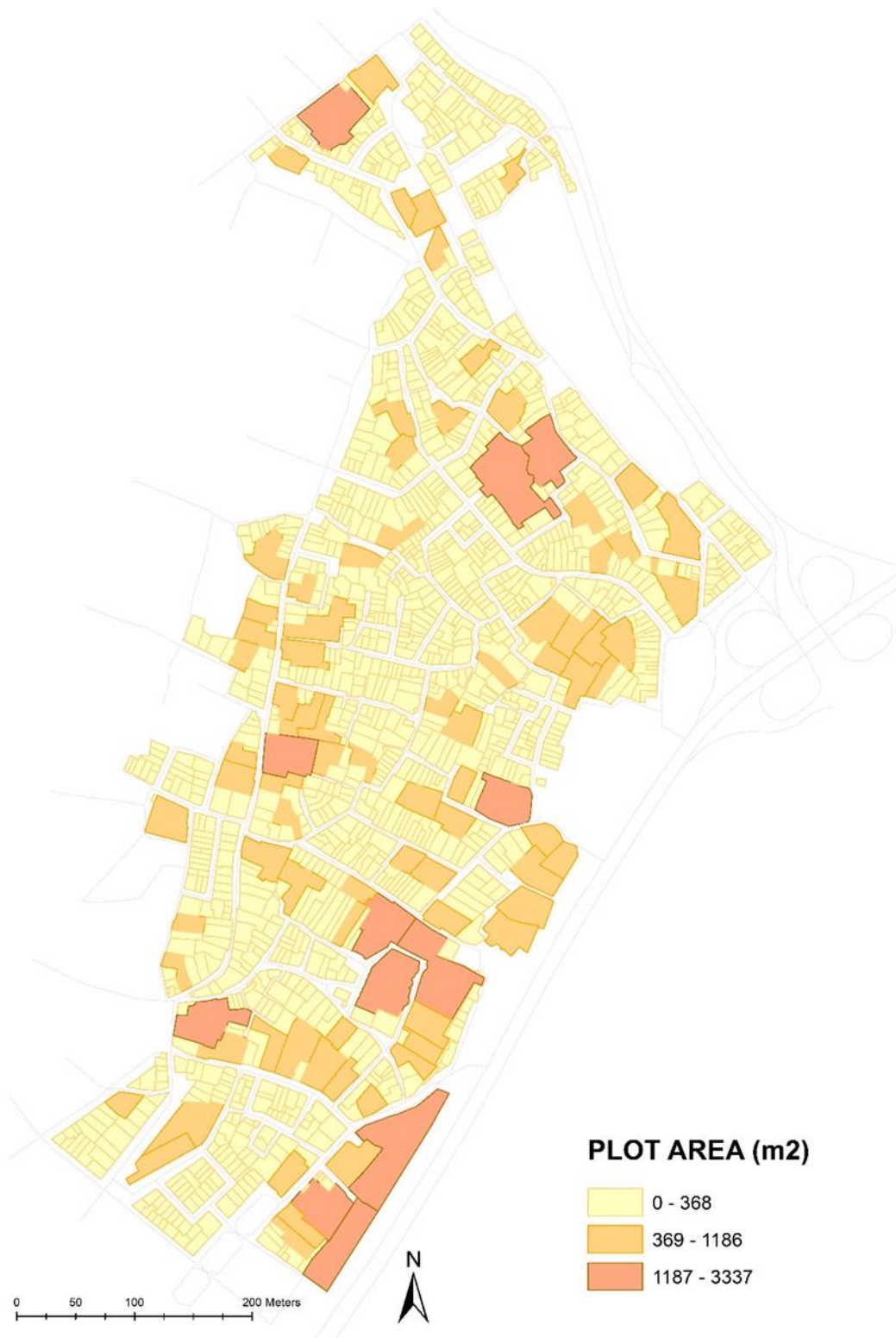


Figure 4.33 Plot area

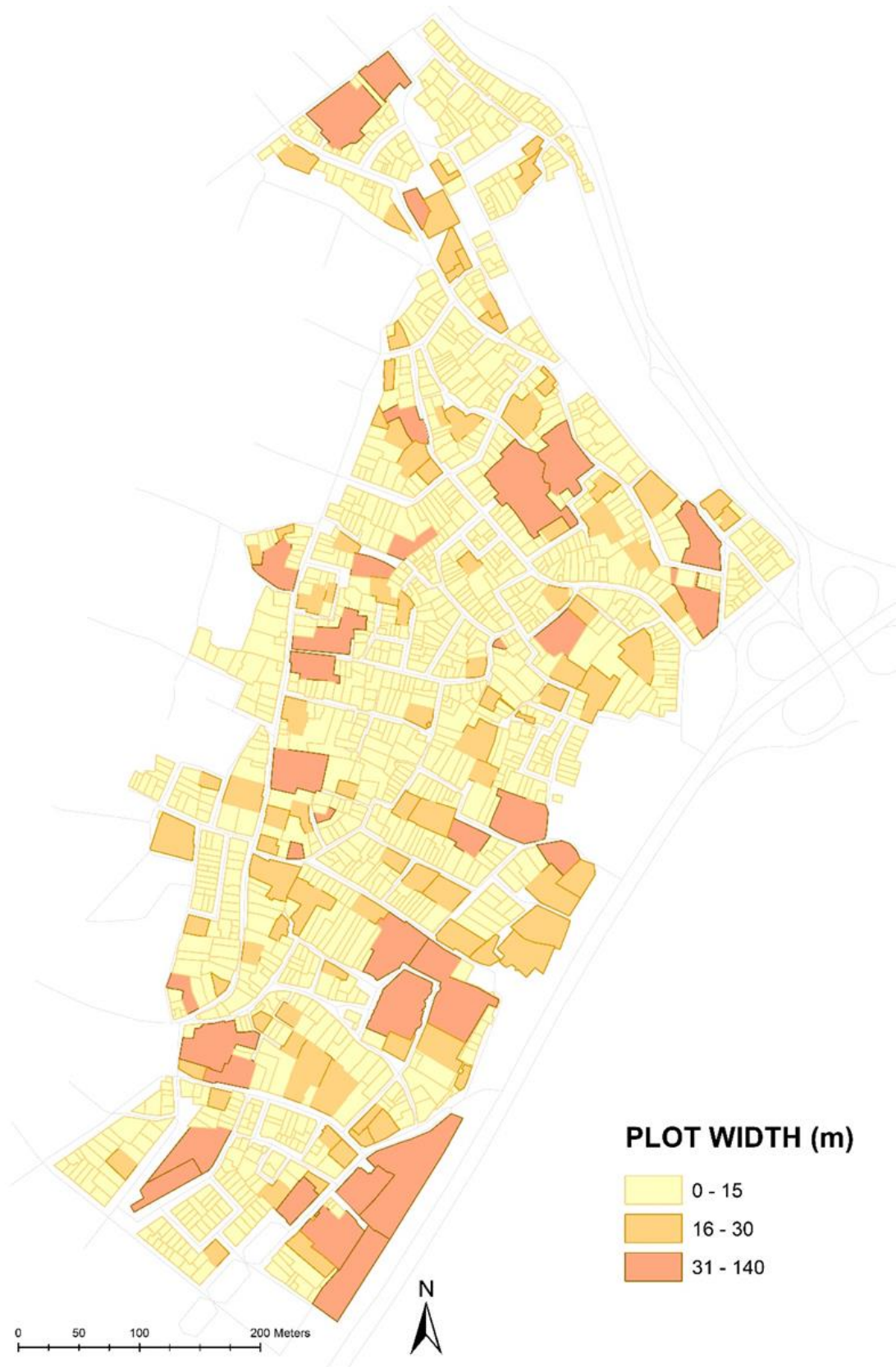


Figure 4.34 Plot width

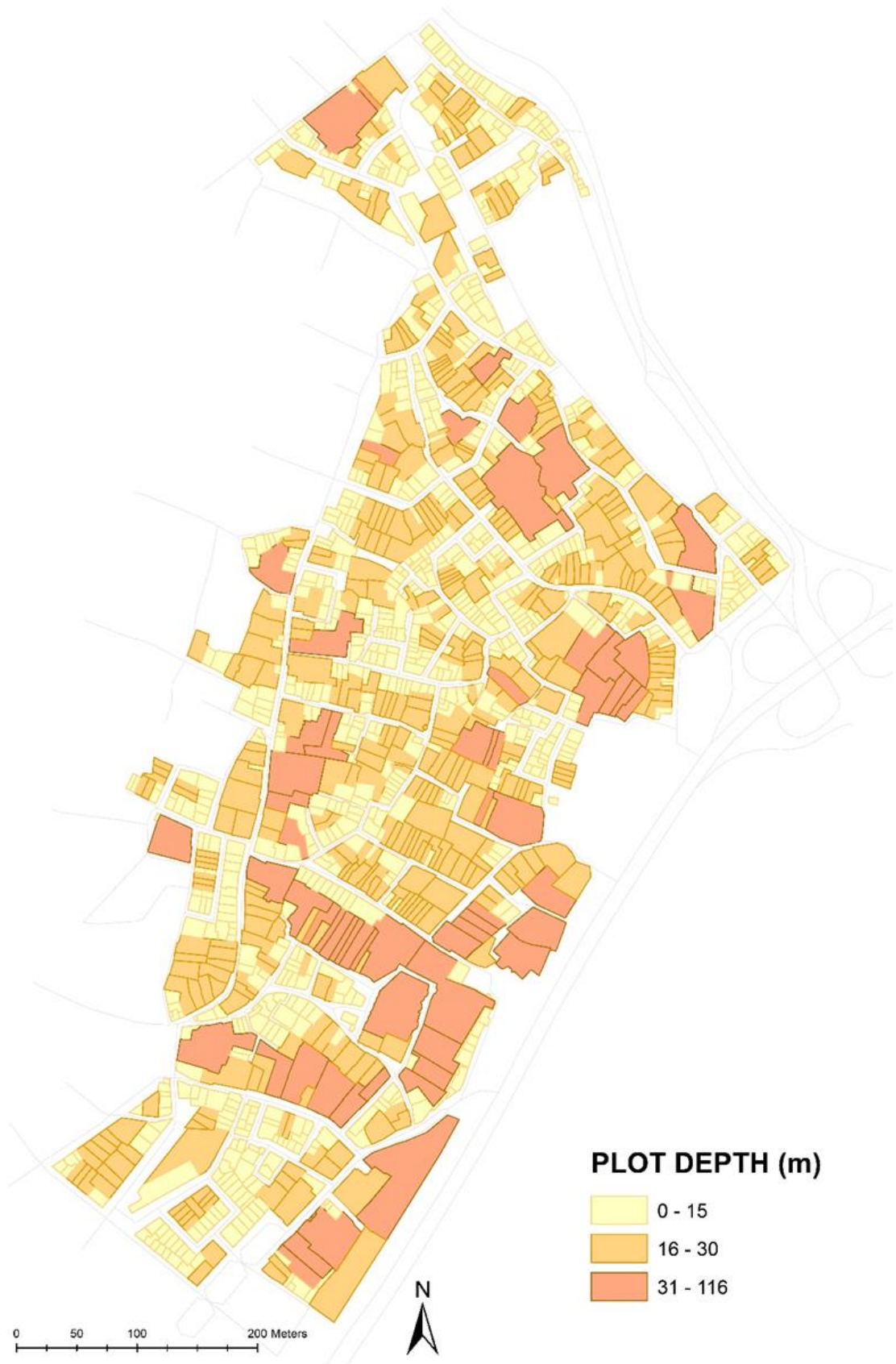


Figure 4.35 Plot depth

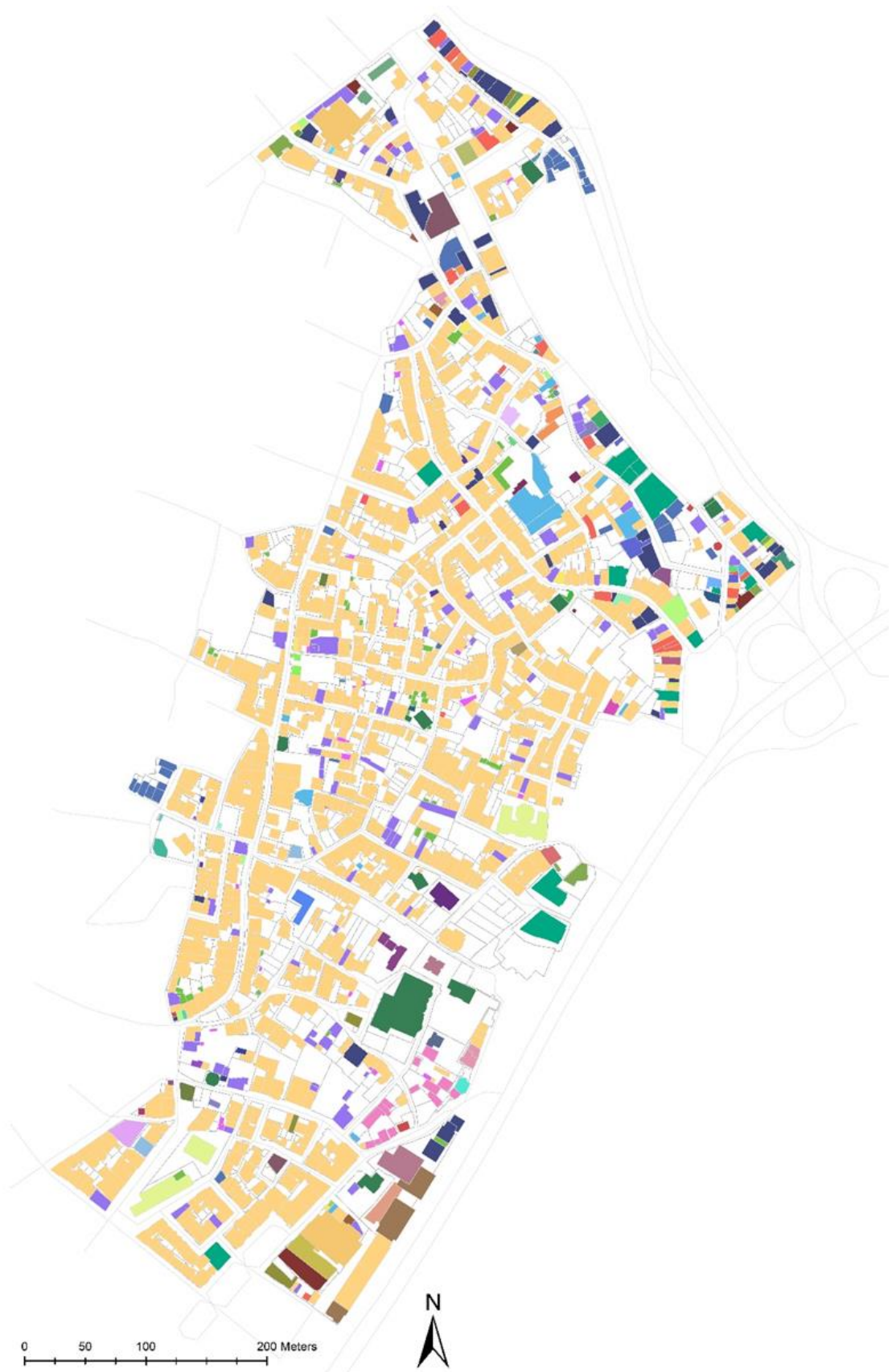


Figure 4.36 Land and building utilization

DETAILED LAND AND BUILDING UTILIZATION



Figure 4.36 Land and building utilization (continued)

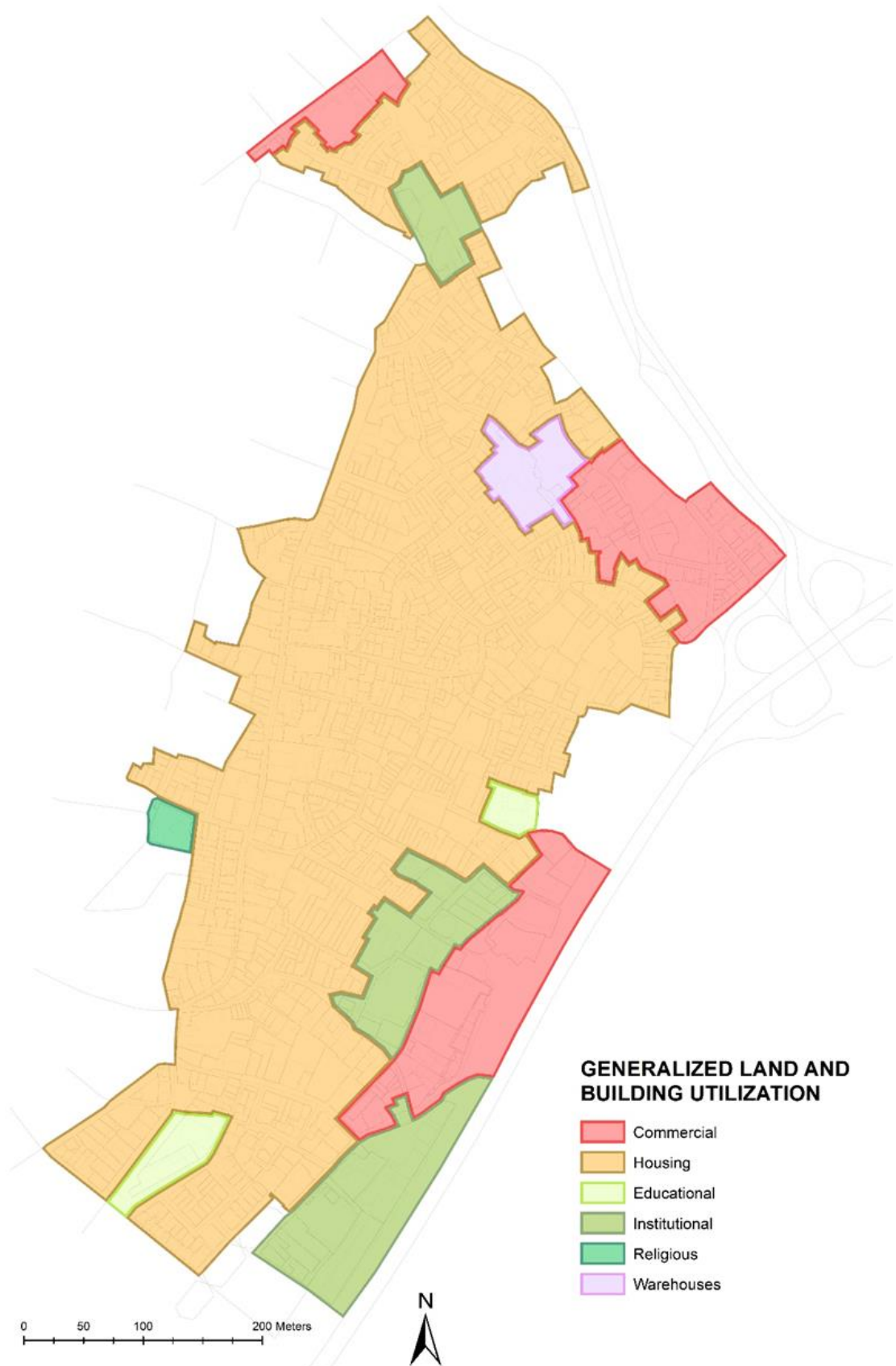


Figure 4.37 General land and building utilization



(1)



(2)



(3)



(4)



(5)



(6)

Figure 4.38 Buildings with different uses: (1) and (2) are commercial, (3) and (4) are educational, (5) and (6)
(Photographs by the author)



(7)



(8)



(9)



(10)



(11)



(12)

Figure 4.38 Buildings with different uses (continued): (7) and (8) are religious; (9), (10), (11) and (12) are housing
(Photographs by the author)

4.4.2.2. Morphological regions: second-order

The map of second-order morphological regions consists of the superimposition of two criteria, plot layout and land and building utilization. In other words, the maps of the plot area, plot width and plot depth, and the map land and building utilization together yield the map of second-order morphological regions.

Nineteen second-order regions are identified in this map (Figure 4.39). Three of these are commercial: Commercial (east), Commercial (north), and Commercial (south). Nine regions are residential: Housing - Large plots (East), Housing - Large plots (South), Housing - Large plots (West), Housing - Mixed sizes plots (North), Housing - Mixed sizes plots (South), Housing - Small plots (North), Housing - Small plots (Middle), Housing - Small plots (South), and Housing - Very small plots. Seven regions have fringe belt features and warehouses: Fringe Belt Features: Educational (North), Fringe Belt Features: Educational (South), Fringe Belt Features: Institutional (North), Fringe Belt Features: Religious, Fringe Belt Features: Institutional (South), Fringe Belt Features: Institutional (Middle), and Warehouses. The names of these regions are related to plot sizes and land and building utilization.

Commercial (North) has large plot area and width, and long plots. Commercial (South) consists of large and small plot area, medium and narrow plot widths, and long plots. Commercial (East) has large and small areas, large and narrow plot widths, and short and medium plots.

The characteristics of the region of Housing - Large plots (East) are medium plot area and width, and long plots. Housing - Large plots (South) region has medium size, medium width, and long plots. Housing - Large plots (West) region consists of large plots, medium plot widths, and medium and long plots. The region of Housing - Mixed sizes plots (North) mainly has small, narrow, and short and medium length plots. Housing - Mixed sizes plots (South) are consist of small sized, narrow and widish plots. The length of plots for this region is short, medium, and long. The region of Housing - Small plots (North) shows small, narrow, and medium length plot characteristics. The regions of Housing - Small plots (Middle) and Housing - Small plots (South) demonstrate small, narrow, and short and medium-length plot characteristics. Housing - Very small plots region has very small plots. It also has narrow and short plots.

Warehouses have large and long plots. Its constructions are in very bad condition. Fringe Belt Features: Educational (North) correspond large and long plots. The plots of the region of Fringe Belt Features: Educational (South) and Fringe Belt Features: Religious are medium-sized, large width, and long. Fringe Belt Features: Institutional (North) consist of medium and long plots. The regions of Fringe Belt Features: Institutional (South) and Fringe Belt Features: Institutional (Middle) mainly have larger and medium width and long plots. The plot size is distinguishable feature for these regions.

The plot area and plot width contributed high to the hierarchy of morphological regions. Plot depth has less contribution to the hierarchy. Plot orientation and plot shape have no contribution to the hierarchy of the regions. The contribution of land and building utilization is also high.

Table 4.8 Contribution of criteria (plot layout, land and building utilization)

Criteria	Sub-criteria	Contribution
Plot layout	Plot area	High
	Plot width	High
	Plot depth	Low
Land and building utilization	-	High

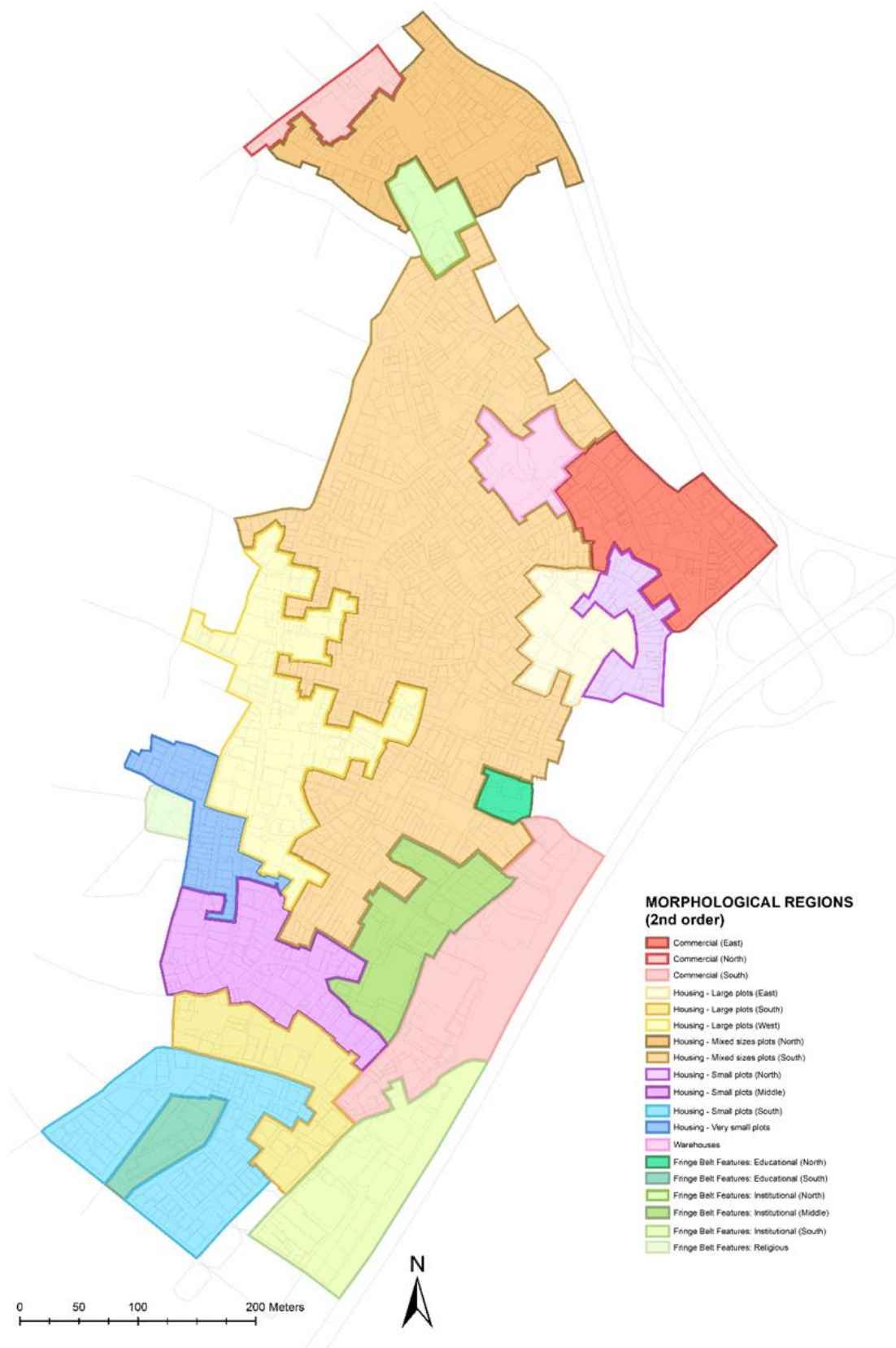


Figure 4.39 Second-order morphological regions

Table 4.9 Characteristics of second-order morphological regions

Regions	Plot layout			Land and building utilization
	Area	Width	Depth	
Commercial (North)	Large	Large	Long	Commercial
Commercial (South)	Large, small	Medium, Narrow	Long	
Commercial (East)	Large, small	Large, Narrow	Medium, Short	
Housing - Large plots (East)	Medium	Medium	Long	Housing
Housing - Large plots (South)	Medium	Medium	Long, medium	
Housing - Large plots (West)	Large	Medium	Long, medium	
Housing - Mixed sizes plots (North)	Mainly small	Narrow	Medium, short	
Housing - Mixed sizes plots (South)	Mainly small	Medium, Narrow	Long, Medium, short	
Housing - Small plots (North)	Small	Narrow	Medium	
Housing - Small plots (Middle)	Small	Narrow	Medium, short	
Housing - Small plots (South)				
Housing - Very small plots	Very small	Narrow	Short	
Warehouses	Large	Large	Long	Warehouses
Fringe Belt Features: Educational (North)	Large	Large	Long	Educational
Fringe Belt Features: Educational (South)	Medium	Large	Medium	
Fringe Belt Features: Institutional (North)	Medium	Medium	Long	Educational, Institutional
Fringe Belt Features: Institutional (Middle)	Large, medium	Large	Long, medium	Religious, Educational, Institutional
Fringe Belt Features: Institutional (South)	Large	Large	Long, medium	Religious, Institutional
Fringe Belt Features: Religious	Medium	Medium	Long	Religious

4.4.3. PANTOKRATOR-PORTA PUTEAE - THIRD ORDER

4.4.3.1. Material: plot layout, building coverage, architectural style, and land and building utilization

The identification of third-order morphological regions is based on four criteria. Two are based on the town-plan. The architectural style is based on building fabric, and the last one is the land and building utilization. This level of hierarchy includes the three urban landscape components together.

The map of building coverage is categorised in three intervals. The low interval is between 0 and 0.30, medium interval is between 0.31 and 0.60, and the highest interval is between 0.61 and 1 (see Figure 4.40). Plots mostly have a high ratio of building coverage. Only a few plots have low building coverage. Buildings of low coverage are in proximity of institutional buildings.

Plot layout contributes to third-order regions. In this regard, the layout, which could not be analysed in the second-order, is included into third-order analyses for the identification of morphological regions. Plot area has a small contribution to this analysis while it provides a substantial contribution to the second-order regions. Land and building utilization is an important criterion for the third-order analysis. The detailed land and building utilization is addressed in this level of analysis. The utilization, which is not legible at the upper level, is considered for third-order analysis. This map provides an important basis to reveal third-order morphological regions.

The map of architectural style is based on general characteristics and features of the buildings of the area. There is no clear information about the architectural style of Istanbul. Looking at both scientific publications and data provided by local authority, there is no exact definition of architectural styles. This map is prepared based on the analysis of residential buildings and others which are identified within third-order analysis. The map of architectural style is categorised in eight styles (see Figure 4.41). The first is modern or contemporary style, gathering most buildings of the area (see Figure 4.42, number 8 and 9). These buildings are a reflection of the republican era, fundamentally the second-half of that period. The second is new houses with bay window (see Figure 4.42, number 5 and 6). These are a kind of replication of traditional houses with bay window. These are also erected recently. Third is single family houses. This name is not very suitable to identify an architectural style, but, as indicated previously it is not very possible to put a good name for architectural characteristics in Istanbul. Perhaps, this could be an optimum name to identify this sort of buildings. There is not very clear identification as in European cases. Fourth is traditional houses with bay window (see Figure 4.42, number 1 and 2). This style demonstrates a typical building of Ottoman culture. These buildings are the oldest style determined in the area. The bay window extending towards the street with its details, adds richness to the exterior of the building. It is an important element that shapes the streetscape in Ottoman cities. It gives a dynamic view to the streets. In addition, the bay window increases the internal volume of the building and creates additional space. It is also an element used to let more sunlight into the building and to create a lightened and spacious area. Fifth is historical ruins which are not very proper to identify as an architectural style, but has a distinctive characteristic. Sixth is the ottoman bath, there is only one building in this style. Seventh is architectural style of mosque. It is identified as another style due to it is also determined within third-order analyses. The last one is ramshackle buildings which are could not identified within other styles.

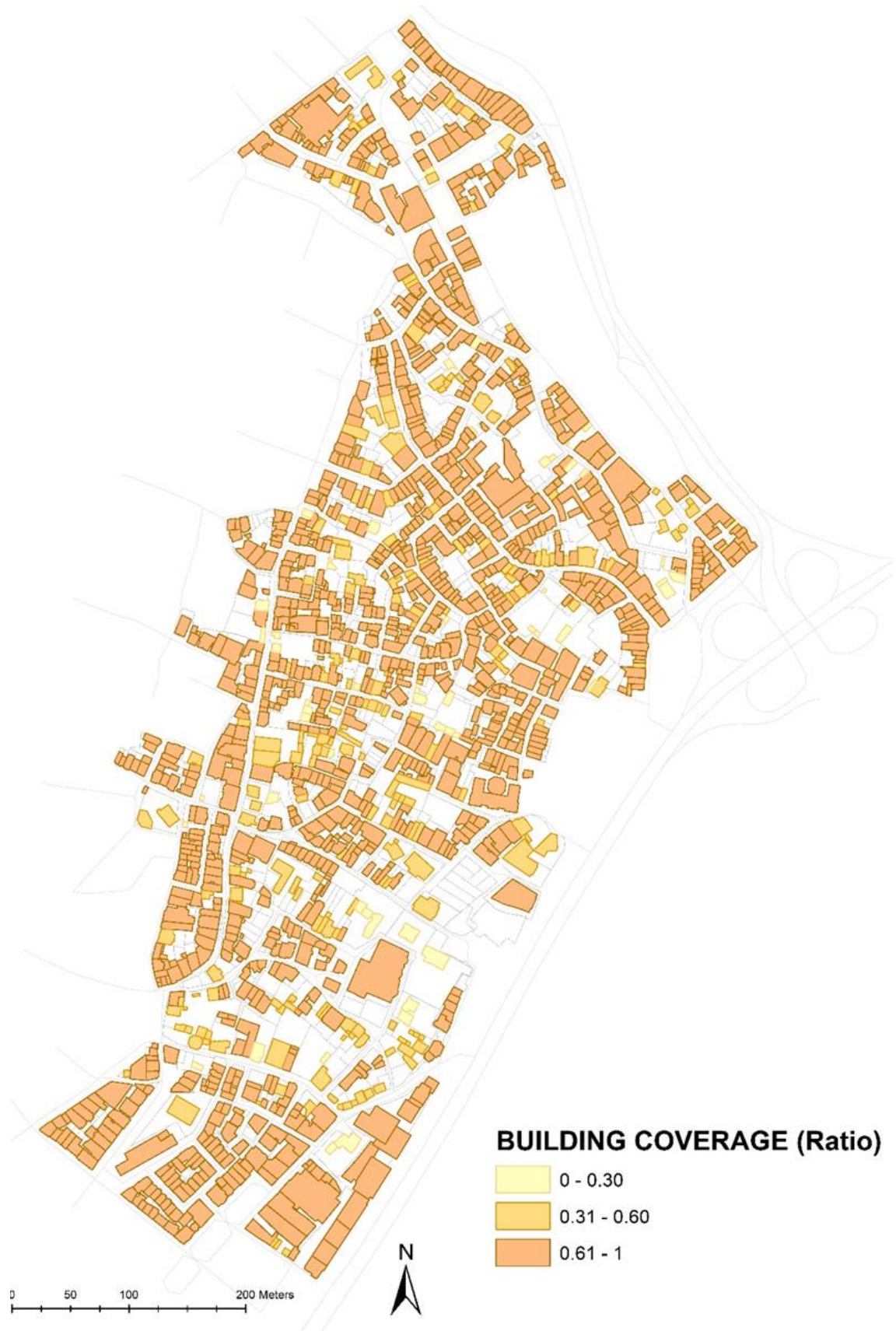


Figure 4.40 Building coverage

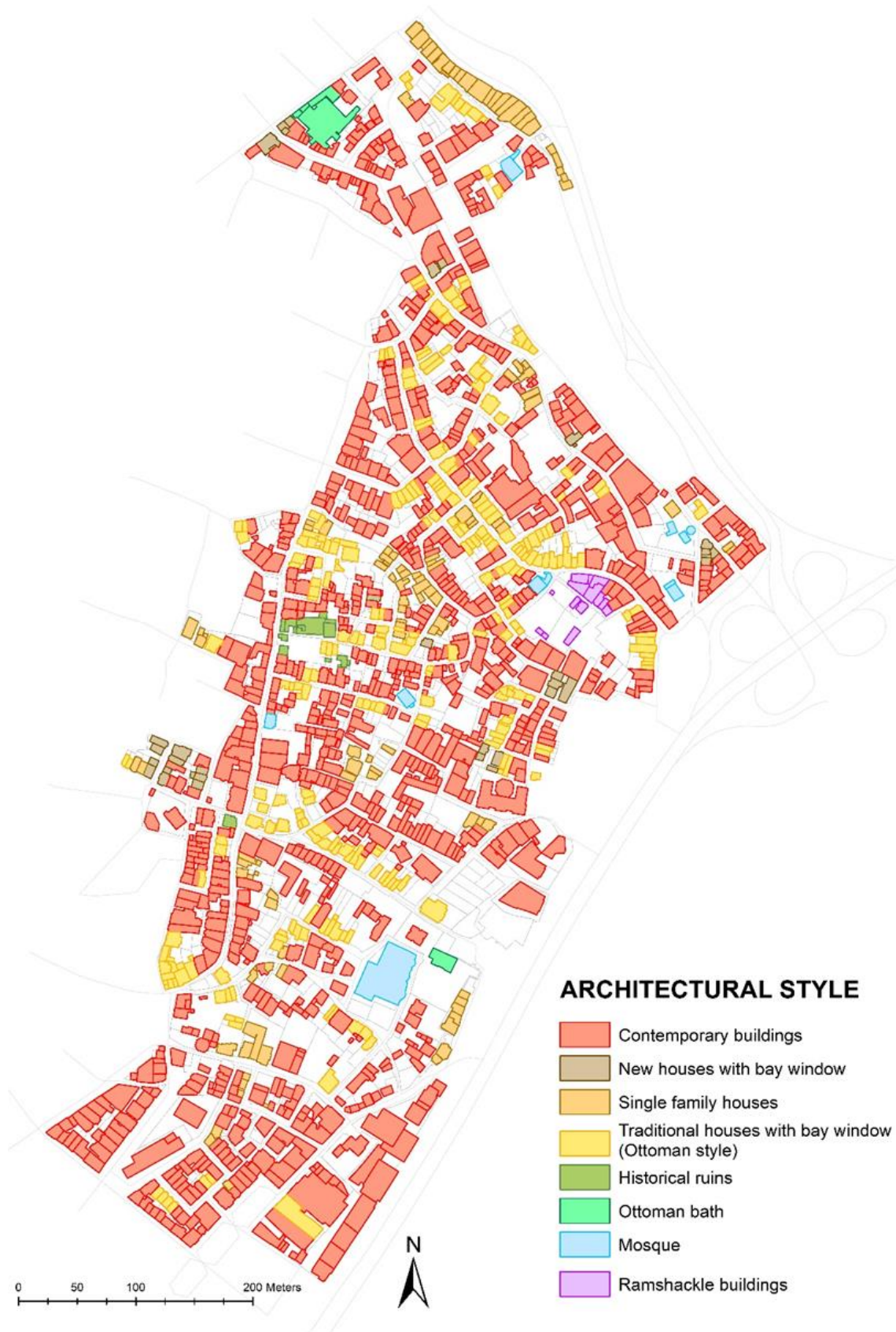


Figure 4.41 Architectural style

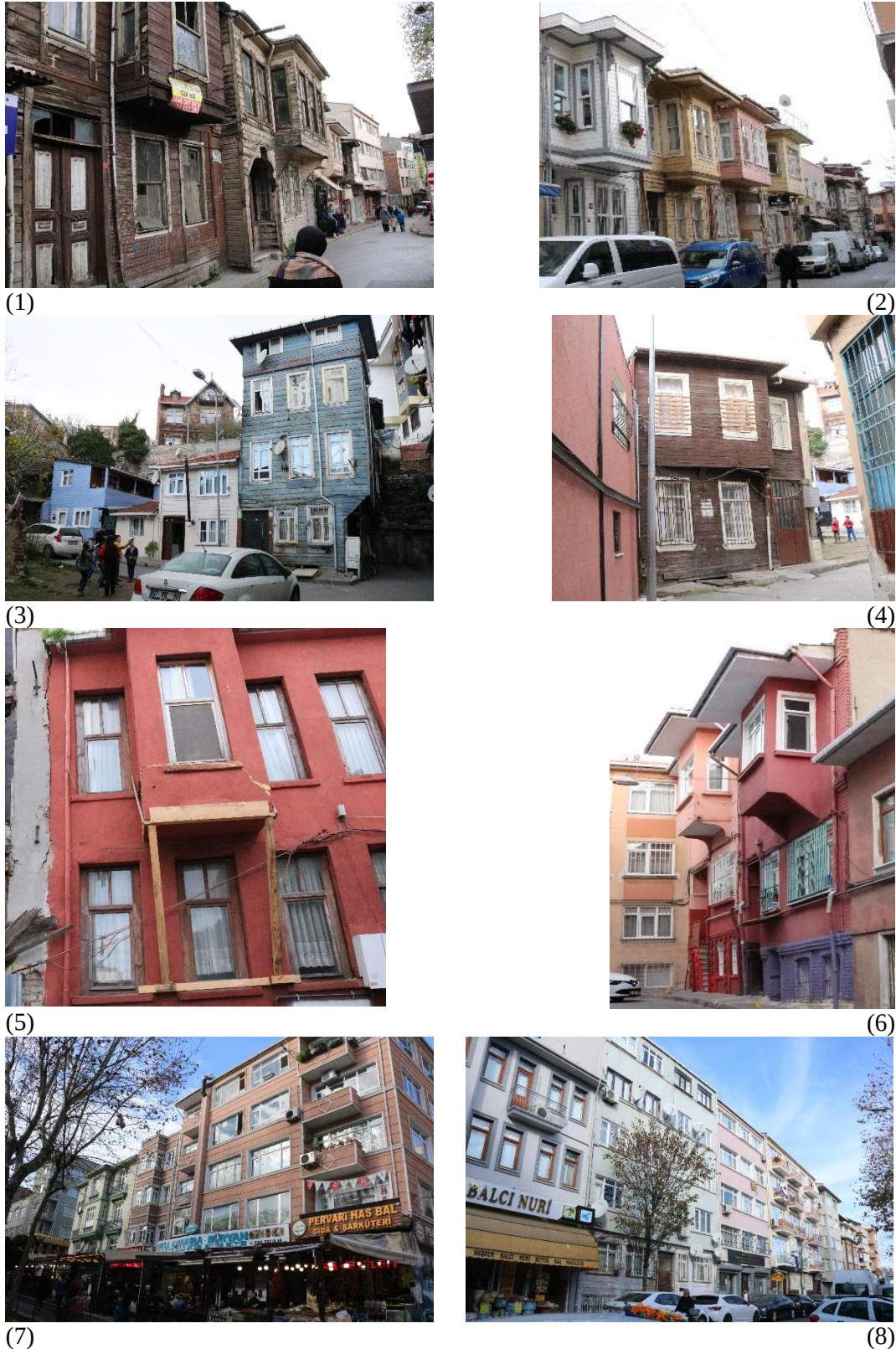


Figure 4.42 Buildings with distinctive architectural style: (1) and (2) are traditional houses with bay window, (3) and (4) are single family houses, (5) and (6) are new houses with bay window, (7) and (8) are modern houses (Photographs by the author)

4.4.3.2. Morphological regions: third-order

The diversity of building fabric in Istanbul study represents a major challenge in establishing third-order regions. This variety results from a series of transformations occurred in the area over time. The combination of four criteria contributed to the hierarchy of third-order regions: plot layout, building coverage, architectural style, and land and building utilization. Instead of the superimposition of third-order analyses to establish morphological regions, each criterion is applied one by one. The complexity of building fabric did not allow to make the regionalization in terms of architectural style. And, the less contribution of other criteria also gave rise to apply each criterion step-by-step. Firstly, the building coverage, which constitutes a homogeneous area, delimited the third-order morphological regions. Secondly, land and building utilization and plot layout is considered. The contribution of plot layout to third-order is restricted to merely commercial regions. Finally, the criterion of architectural style is applied. The contribution of each criterion is presented in Table 4.10. Building coverage contributed to the hierarchy of third-order of regions in a low level. Land and building utilization, and particularly architectural style supported the hierarchy in a high level. Plot layout did not make a great contribution to the identification of third-order regions. The application of these criteria divided second-order morphological regions into third-order regions demonstrating the complexity of the urban landscape. Figure 4.43 indicates the second-order regions and their subdivisions as third-order regions. Second-order regions are tagged in Roman numbers, and third-order regions are tagged in Arabic numerals. Where the second-order regions are not divided, they are only tagged in Roman numbers.

Table 4.10 Contribution of criteria (building coverage, land and building utilization plot layout, architectural style)

Criteria	Contribution
Plot layout	Low
Building coverage	Low
Architectural style	High
Land and building utilization	High

Table 4.11 indicates characteristics of third-order regions. It includes regions' name and attribution of plot layout, building coverage, architectural style, and land and building utilization. Based on this framework, except of the regions of 'Warehouses, Fringe Belt Features: Educational (North), Fringe Belt Features: Educational (South), and Fringe Belt Features: Religious', all other regions have third-order subdivisions. The region Housing-Mixed sizes plots (South) has a great differentiation in terms of architectural characteristics. Its division is mainly on this basis. The regions of Housing –Small plots (North) and Housing-Very small plots is only divided based on architectural features.

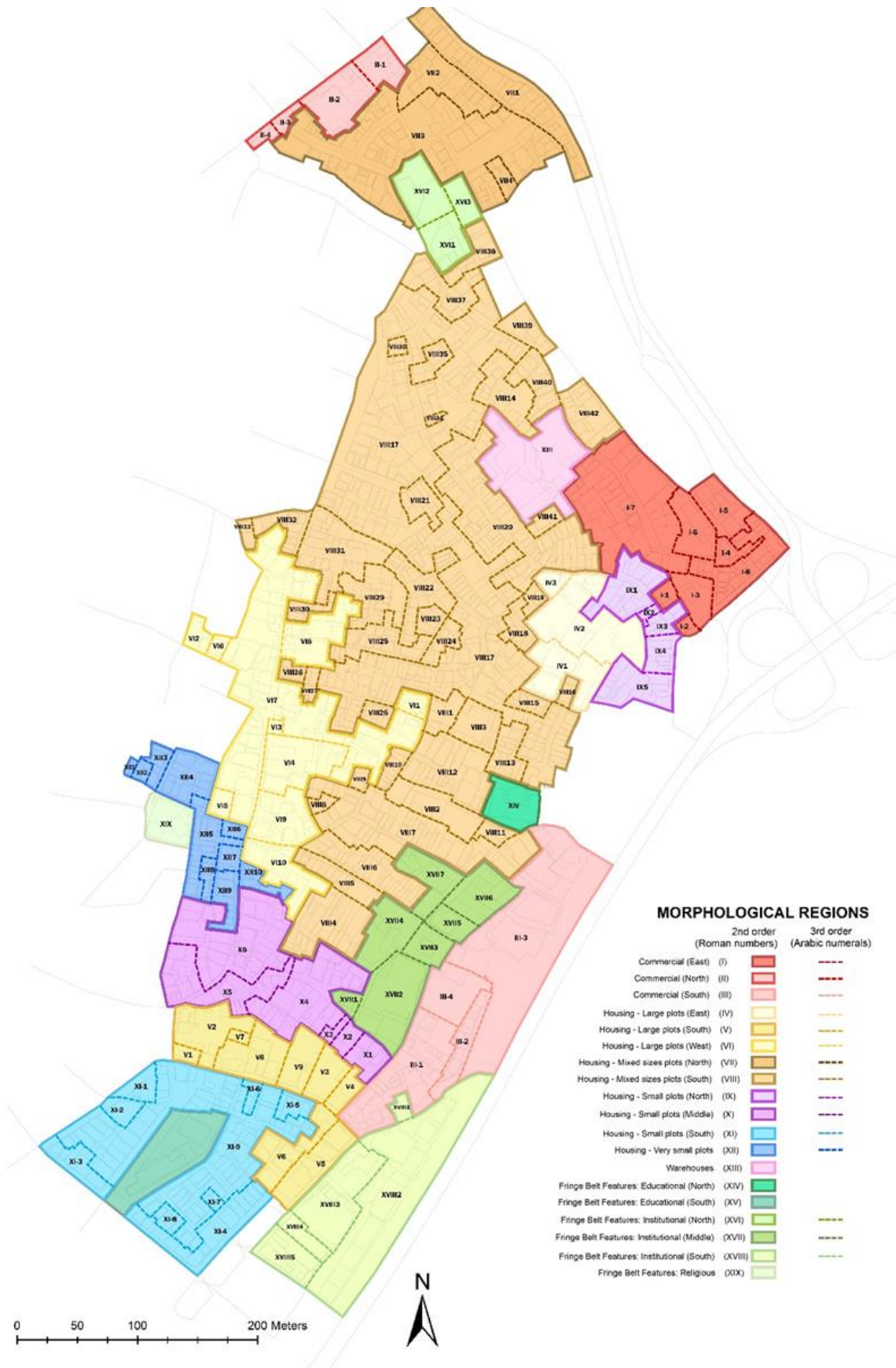


Figure 4.43 Third-order morphological regions of Istanbul

Table 4.11 Characteristics of third-order morphological regions of Istanbul

Regions	Building coverage	Land and building utilization	Plot layout	Architectural style
I-1	High	Commercial	Medium	Modern
I-2	High	Commercial	Medium	Modern
I-3	Low	Religious	Medium	Mosque
I-4	High	Commercial	Small	New houses with bay window
I-5	High	Commercial	Medium	Modern
I-6	Medium	Religious	Medium	Mosque
I-7	High	Commercial	Medium	Modern
I-8	High	Commercial	Small	Modern
II-1	Medium	Commercial	Medium	Modern
II-2	High	Commercial	Large	Ottoman bath
II-3	High	Commercial	Small	New houses with bay window
II-4	High	Commercial	Small	Modern
III-1	Medium, high	Commercial	Small	Modern
III-2	Medium, high	Commercial	Small	Single family houses
III-3	Medium, high	Commercial	Medium	Modern
III-4	Medium, high	Commercial	Medium	Ottoman bath
IV1	High	Commercial	ndf	Modern
IV2	Low	Commercial	ndf	Modern
IV3	Low	Religious	ndf	Mosque
V1	Medium	Religious	ndf	Mosque
V2	Medium	Housing	ndf	Single family houses
V3	Low	Parking area	ndf	-
V4	High	Housing	ndf	Traditional houses with bay window
V5	High	Commercial ground floor	ndf	Modern
V6	High	Housing	ndf	Modern
V7	Medium	Housing	ndf	Traditional houses with bay window
V8	Medium	Housing	ndf	Single family houses
V9	Medium	Housing	ndf	Modern
VI1	High	Religious	ndf	Mosque
VI2	High	Housing	ndf	Single family houses
VI3	High	Religious	ndf	Mosque
VI4	Medium	Housing	ndf	Modern
VI5	High	Green space	ndf	-
VI6	High	Housing	ndf	Traditional houses with bay window
VI7	High	Housing	ndf	Modern
VI8	High	Housing	ndf	Ruined houses
VI9	High	Housing	ndf	Traditional houses with bay window
VI10	High	Housing	ndf	Modern
VII1	High	Housing	ndf	Single family houses
VII2	High	Housing	ndf	Traditional houses with bay window

Table 4.11 Continued

Regions	Building coverage	Land and building utilization	Plot layout	Architectural style
VII3	High	Housing	ndf	Modern
VII4	High	Housing	ndf	Modern
VIII1	Low	Housing	ndf	Traditional houses with bay window
VIII2	Medium	Housing	ndf	Modern
VIII3	Low	Housing	ndf	Modern
VIII4	High	Housing	ndf	Traditional houses with bay window
VIII5	High	Housing	ndf	Modern
VIII6	High	Housing	ndf	Traditional houses with bay window
VIII7	High	Housing	ndf	Modern
VIII8	High	Housing	ndf	Traditional houses with bay window
VIII9	High	Housing	ndf	Single family houses
VIII10	High	Housing	ndf	Single family houses
VIII11	High	Housing	ndf	Single family houses
VIII12	High	Housing	ndf	Modern
VIII13	High	Housing	ndf	New houses with bay window
VIII14	High	Housing	ndf	Traditional houses with bay window
VIII15	High	Housing	ndf	Traditional houses with bay window
VIII16	High	Housing	ndf	New houses with bay window
VIII17	High	Housing	ndf	Modern
VIII18	High	Housing	ndf	Traditional houses with bay window
VIII19	High	Housing	ndf	Modern
VIII20	High	Housing	ndf	Traditional houses with bay window
VIII21	High	Housing	ndf	Traditional houses with bay window
VIII22	High	Housing	ndf	Single family houses
VIII23	High	Housing	ndf	Modern
VIII24	High	Housing	ndf	Single family houses
VIII25	High	Housing	ndf	Traditional houses with bay window
VIII26	High	Housing	ndf	Traditional houses with bay window
VIII27	High	Housing	ndf	Traditional houses with bay window
VIII28	High	Housing	ndf	Modern
VIII29	High	Housing	ndf	Modern
VIII30	High	Housing	ndf	Modern
VIII31	High	Housing	ndf	Traditional houses with bay window
VIII32	High	Housing	ndf	Modern

Table 4.11 Continued

Regions	Building coverage	Land and building utilization	Plot layout	Architectural style
VIII33	High	Housing	ndf	Traditional houses with bay window
VIII34	High	Housing	ndf	Traditional houses with bay window
VIII35	High	Housing	ndf	Traditional houses with bay window
VIII36	High	Housing	ndf	Traditional houses with bay window
VIII37	High	Housing	ndf	Traditional houses with bay window
VIII38	High	Housing	ndf	Modern
VIII39	High	Housing	ndf	Traditional houses with bay window
VIII40	High	Housing	ndf	Single family houses
VIII41	High	Housing	ndf	Modern
VIII42	High	Housing	ndf	Modern
IX1	High	Housing	ndf	Modern
IX2	High	Housing	ndf	Traditional houses with bay window
IX3	High	Housing	ndf	Modern
IX4	High	Housing	ndf	Traditional houses with bay window
IX5	High	Housing	ndf	Modern
X1	Medium	Housing	ndf	Traditional houses with bay window
X2	Medium	Housing	ndf	Modern
X3	Medium	Housing	ndf	Traditional houses with bay window
X4	High	Housing	ndf	Modern
X5	High	Housing	ndf	Traditional houses with bay window
X6	High	Housing	ndf	Modern
XI-1	High	Educational	ndf	Fringe belt feature
XI-2	High	Commercial	ndf	Modern
XI-3	High	Commercial ground floor	ndf	Modern
XI-4	High	Commercial ground floor	ndf	Modern
XI-5	High	Housing	ndf	Traditional houses with bay window
XI-6	High	Housing	ndf	Single family houses
XI-7	High	Housing	ndf	Traditional houses with bay window
XI-8	High	Housing	ndf	Traditional houses with bay window
XI-9	High	Housing	ndf	Modern
XII1	High	Housing	ndf	Traditional houses with bay window

Table 4.11 Continued

Regions	Building coverage	Land and building utilization	Plot layout	Architectural style
XII2	High	Housing	ndf	Single family houses
XII3	High	Housing	ndf	Modern
XII4	High	Housing	ndf	New houses with bay window
XII5	High	Housing	ndf	Modern
XII6	High	Housing	ndf	Ruined houses
XII7	High	Housing	ndf	Traditional houses with bay window
XII8	High	Housing	ndf	New houses with bay window
XII9	High	Housing	ndf	Modern
XII10	High	Housing	ndf	Single family houses
XVI1	High	Educational	ndf	Fringe belt feature
XVI2	High	Institutional	ndf	Fringe belt feature
XVI3	High	Green space	ndf	Fringe belt feature
XVII1	High	Educational	ndf	Fringe belt feature
XVII2	High	Religious	ndf	Mosque
XVII3	Low	Institutional	ndf	Fringe belt feature
XVII4	Low	Educational	ndf	Fringe belt feature
XVII5	Medium	Housing	ndf	Traditional houses with bay window
XVII6	Low	Ruins	ndf	-
XVII7	Medium	Institutional	ndf	Fringe belt feature
XVIII1	High	Religious	ndf	Mosque
XVIII3	High	Religious	ndf	Mosque
XVIII2	High	Institutional	ndf	Fringe belt feature
XVIII4	High	Commercial	ndf	Traditional houses with bay window
XVIII5	High	Commercial	ndf	Modern

ndf: non-distinctive feature

4.4.4. PANTOKRATOR-PORTA PUTEAE - FOURTH ORDER

4.4.4.1. Material: building material and height

Building material and height are two fundamental criteria to carry out the fourth-order analysis. These two criteria are the most detailed, raising the topic of precision of the character appraisal of the urban landscape. Both maps are based on fieldwork. The map of building materials is categorised into four different classes: timber, stone, concrete, and masonry (see Figures 4.44 and 4.45). The first two are traditional materials, the last two are contemporary. The analysis of building materials indicates that most of them are masonry buildings. Buildings made of timber and concrete have a similar distribution in the area. There are only a few buildings made of stone – the most important is the baths, erected in the Ottoman period. The map of building height is categorised into eight different classes ranging from 1 to 8 storeys (see Figures 4.46 and 4.47). A large percentage of buildings are 1 to 3 storeys. Buildings with 4 and 5 storeys are in medium extent. Buildings with 5 or more storeys are in a small percentage.

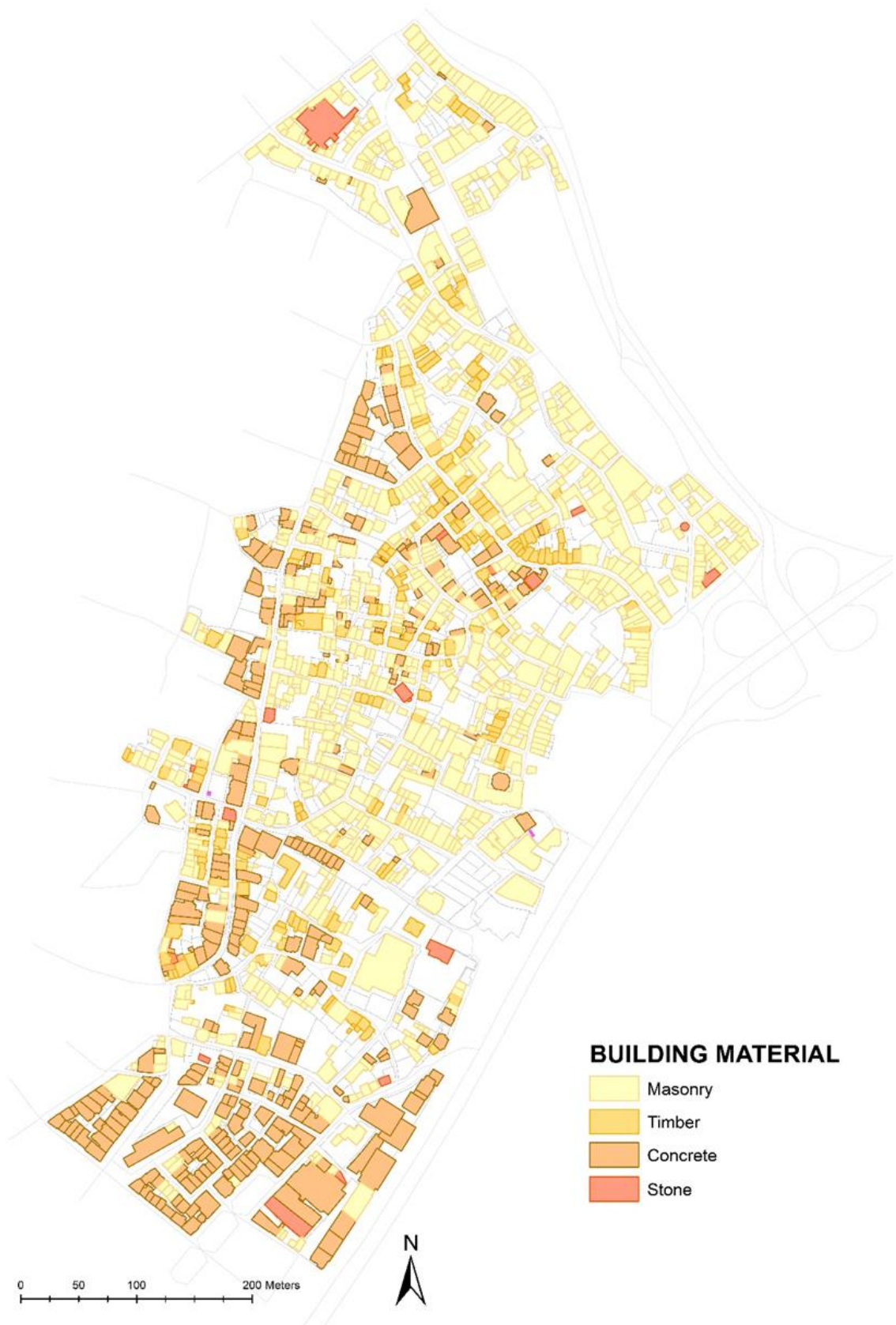


Figure 4.44 Building material



(1)



(2)



(3)



(4)



(5)



(6)



(7)

Figure 4.45 Buildings with different materials: (1) and (2) are made of concrete, (3) and (4) of timber, (5) and (6) of masonry, and (7) of stone (Photographs by the author)

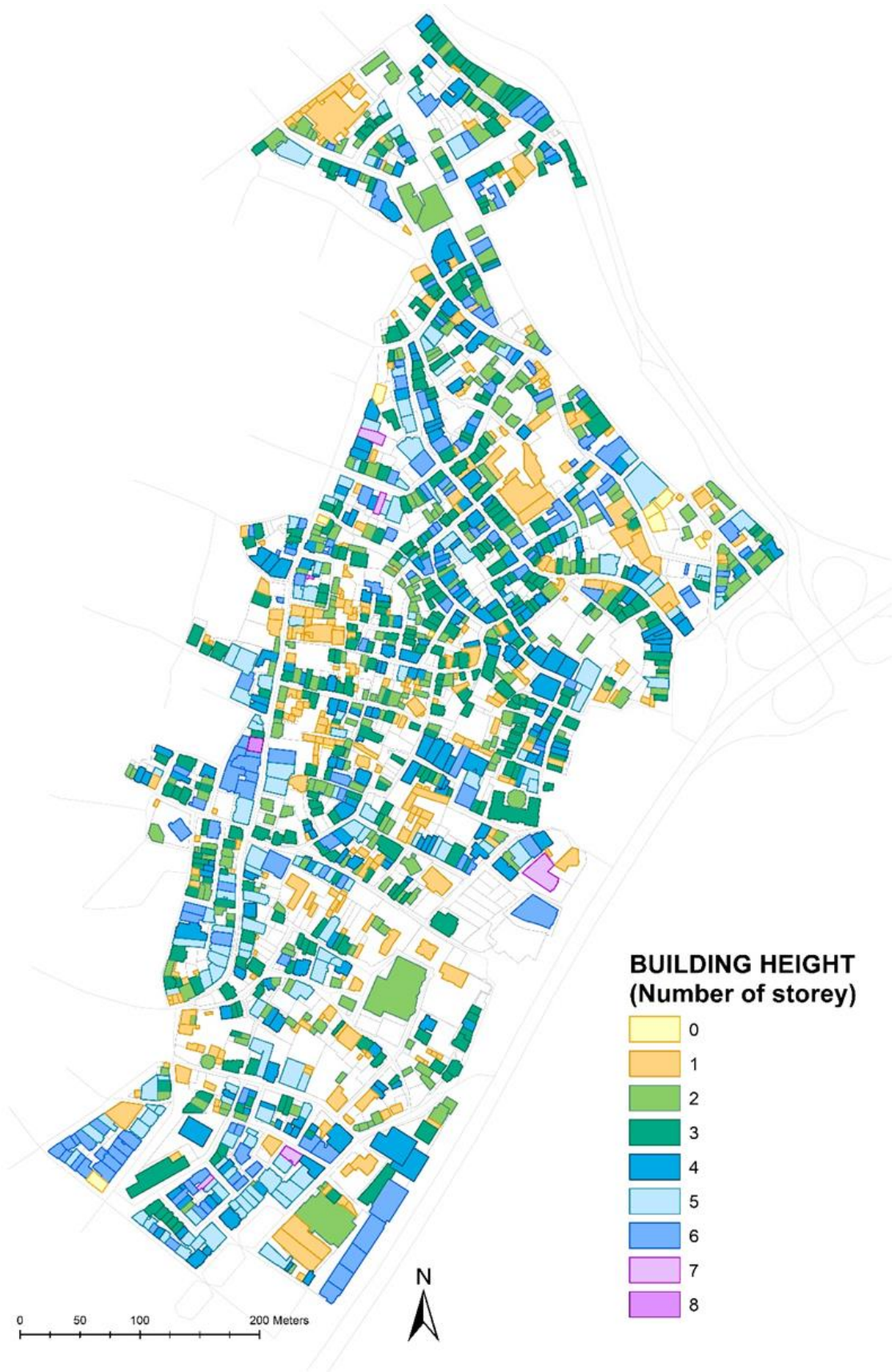


Figure 4.46 Building height



(1 storey)



(2 storey)



(3 storey)



(4 storey)



(5 storey)



(6 storey)



(7 storey)



(8 storey)

Figure 4.47 Buildings with different height (Photographs by the author)

4.4.4.2. Morphological regions: fourth-order

The last level of analysis of Pantokrator Porta Puteae (*Cyballi and Zeyrek* neighbourhoods) is the fourth-order morphological regions. The identification of fourth-order regions is based on building material and height. This corresponds to the subdivision of third-order regions. Where third-order regions have different characteristics in terms of material and height, fourth-order regions are delimited. Instead of the overlap of the maps of building material and height to establish morphological regions, each criterion is applied one-by-one: first, the building material is applied, and then, the building height is applied. This is due to the very complex characteristics of the study area. Looking at the map of building material or height, it is not possible to draw the boundaries for each material or for each storey to create an individual regionalization. The contribution of each criterion is presented in Table 4.12: building material contributed medium and building height contributed low. These two criteria contributed low when compared with the previous criteria in the identification of higher orders. The application of these criteria divided third-order morphological regions into fourth-order regions. Figure 4.48 presents the fourth-order morphological regions. In this map, second-order regions are tagged in Roman numbers, third-order regions are tagged in Arabic numerals, and fourth-order regions are tagged in small letters.

Table 4.12 Contribution of criteria (Building material and height)

Criteria	Contribution
Building material	Medium
Building height	Low

Based on the criteria of building material and height, five third-order regions are subdivided into fourth-order regions. These are respectively Commercial (East), Housing-Large plots (West), Housing-Mixed sizes plots (North), Housing-Mixed sizes plots (South), and Housing-Small plots (Middle). Particularly, the regions of Housing-Mixed sizes plots (North), Housing-Mixed sizes plots (South) diversify in terms of material and height. Table 4.13 demonstrates characteristics of fourth-order morphological regions. It also reveals the building material and height of third-order regions. Buildings within Commercial (East) and Housing-Large plots (East) regions are made of masonry. Their building height are ranging from 2 to 5 storeys. Commercial (North) and (South) include buildings with masonry and stone construction. Housing-Large plots (South) has buildings made of masonry and concrete. Housing-Large plots (South) consists of buildings with masonry and concrete material, and has a large extent of 5 and upper storey buildings. Housing-Large plots (West) includes a mixed material, and building heights within this region are mainly 2-3 and 5 and upper storey. Housing-Mixed sizes plots (North) mainly consists of masonry material, and it has various building heights. Housing-Mixed sizes plots (North) is made of buildings with various material and mainly 2-3 storey. Housing-Small plots (Middle) is made of buildings with 2-3 storey, and timber, masonry and concrete material. Housing-Small plots (North) indicates various storeys and masonry. Housing-Small plots (South) has buildings with masonry and concrete material and 3-4, and 5 and upper storeys. Housing-Very Small plots region includes buildings with timber and masonry material and mainly 2-3 storeys. At the end of this regionalization, the map of morphological regions (see Figure 4.48) provides a full implementation of the method for characterization landscape of the Istanbul area. This composite map is a product of eight criteria on the basis of three urban landscape components. The hierarchy of this map is based on the hierarchy of form complexes, the hierarchy of form persistence, and the hierarchy of historical stratification.

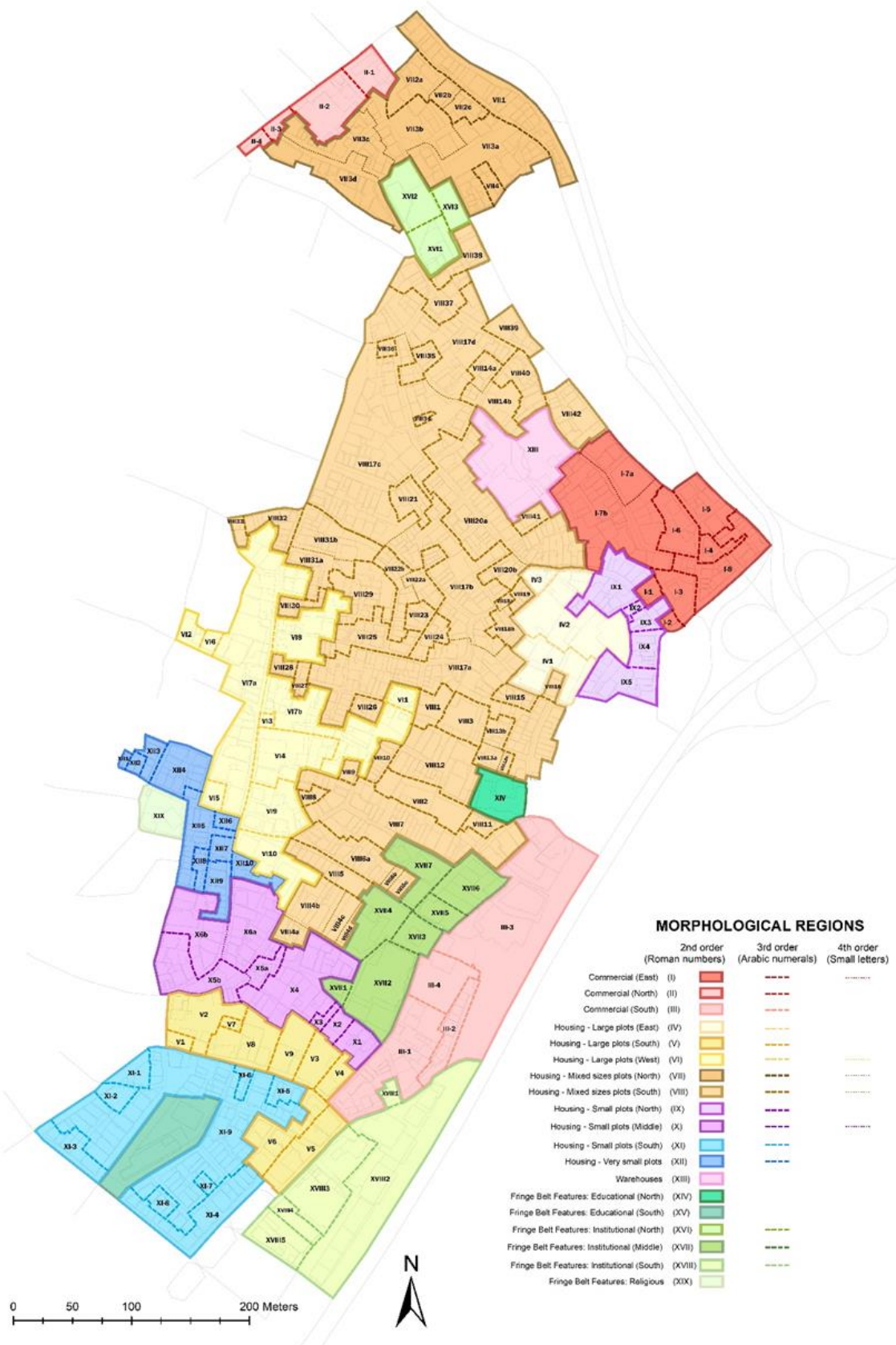


Figure 4.48 Fourth-order morphological regions of Istanbul

Table 4.13 Characteristics of fourth-order morphological regions

Regions	Building material	Building height (number of storeys)
I-1	Masonry	2
I-2	Masonry	4
I-3	Masonry	•
I-4	Masonry	2-3
I-5	Masonry	2
I-6	Masonry	•
I-7a	Masonry	3
I-7b	Masonry	2
I-8	Masonry	2 and 5
II-1	Masonry	2
II-2	Stone	•
II-3	Masonry	2
II-4	Masonry	2
III-1	Masonry	2
III-2	Masonry	3
III-3	Masonry	5 and upper
III-4	Stone	•
IV1	Masonry	4
IV2	Masonry	2
IV3	Masonry	•
V1	Masonry	•
V2	Masonry	2-3
V4	Masonry	2
V5	Concrete	5 and upper
V6	Concrete	5 and upper
V7	Masonry	2
V8	Masonry,	3-4
V9	Concrete	5 and upper
VI1	Stone	•
VI2	Masonry	3
VI3	Stone	•
VI4	Concrete	5 and upper
VI6	Timber	3
VI7a	Concrete	5 and upper
VI7b	Masonry	2-3
VI8	Stone	2
VI9	Masonry	2-3
VI10	Concrete	5 and upper
VII1	Masonry	2-3
VII2a	Timber	2
VII2b	Masonry	4
VII2c	Timber	2
VII3a	Masonry	2-3
VII3b	Masonry	5 and upper
VII3c	Masonry	2-3
VII3d	Masonry	3-4
VII4	Masonry	2-3

Table 4.13 Continued

Regions	Building material	Building height (number of storeys)
VIII1	Timber	2-3
VIII2	Masonry	2-3
VIII3	Masonry	2-3
VIII4a	Timber	2-3
VIII4b	Masonry	2-3
VIII4c	Timber	2-3
VIII4d	Masonry	2-3
VIII5	Concrete	5 and upper
VIII6a	Masonry	2-3
VIII6b	Timber	2-3
VIII6c	Masonry	2-3
VIII7	Masonry	Mixed
VIII8	Masonry	2-3
VIII9	Masonry	4
VIII10	Masonry	2-3
VIII11	Masonry	2-3
VIII12	Masonry	4-5
VIII13a	Masonry	2
VIII13b	Timber	3
VIII13c	Timber	3
VIII14a	Timber	2
VIII14b	Masonry	2
VIII15	Masonry	3
VIII16	Masonry	3
VIII17a	Masonry	2-3
VIII17b	Concrete, masonry	4
VIII17c	Concrete	5 and upper
VIII17d	Masonry	2-3
VIII18a	Masonry	2-3
VIII18b	Timber, masonry	2-3
VIII19	Concrete	3-4
VIII20a	Timber	2-3
VIII20b	Masonry	2-3
VIII21	Masonry	2-3
VIII22a	Masonry	3-4
VIII22b	Timber	2
VIII23	Concrete	3
VIII24	Timber	2-3
VIII25	Masonry	2-3
VIII26	Timber	2-4
VIII27	Timber	2-3
VIII28	Masonry	2-3
VIII29	Masonry	2-3
VIII30	Masonry	2
VIII31a	Timber	2-3
VIII31b	Masonry	2-3
VIII32	Concrete	3-5

Table 4.13 Continued

Regions	Building material	Building height (number of storeys)
VIII33	Timber	2-3
VIII34	Timber	4
VIII35	Timber	3
VIII36	Timber	2-3
VIII37	Timber	2-3
VIII38	Masonry	2-3
VIII39	Masonry	2
VIII40	Masonry	1-2
VIII41	Concrete	3-5
VIII42	Masonry	2-3
IX1	Masonry	2
IX2	Timber	3
IX3	Masonry	2
IX4	Masonry	4
IX5	Masonry	2
X1	Timber	3
X2	Masonry	2
X3	Timber	2
X4	Concrete	2-3
X5a	Masonry	2-3
X5b	Timber	2-3
X6a	Concrete	2-3
X6b	Concrete	5 and upper
XI-2	Masonry	2
XI-3	Concrete	5 and upper
XI-4	Concrete	5 and upper
XI-5	Masonry	3-4
XI-6	Masonry	3-4
XI-7	Masonry	4
XI-8	Masonry	3
XI-9	Concrete	5 and upper
XII1	Timber	2
XII2	Masonry	4
XII3	Masonry	3-5
XII4	Timber, masonry	2-3
XII5	Masonry	2-3
XII6	Stone	2
XII7	Timber	2-3
XII8	Timber	2-3
XII9	Concrete	5 and upper
XII10	Timber	2-3

- The height of buildings in these regions cannot be identified in terms of the number of storeys

1. Roman numbers show second-order (I,II,III,IV)

2. Arabic numerals show third-order (1,2,3,4)

3. Small letters show fourth-order (a,b,c,d)

4.4.5. SYNTHESIS

This chapter presents the first application of the criteria-based methodology, proposed in Chapter 3, to analyse the Fatih district, with a focus on *Cyballi and Zeyrek* neighbourhoods. The morphological analysis provides a detailed visualisation of the spatial variations in the area. The maps prepared in the different stages of the regionalization process were largely based upon fieldwork in March 2019, in particular the recording of data on building fabric, land and building utilization. Within these, the town-plan maps have been produced mainly based on documentary research. The morphological analysis has led to the delimitation of a hierarchical order of regions, which was created through an analysis of the town-plan, a survey of the building fabric and a survey of the land and building utilization. Of these three analyses of the tripartite division of the urban landscape, the town-plan has proven to be of major significance, as Conzen has always put major emphasis. In other words, the town-plan, in this case, confirms its role as a major contributor to the structuring of the urban landscape. The land and building utilization has been the secondary contributor, and finally, the building fabric has been the last contributor to the structuring of the urban landscape (this is important to highlight because it is not always like this).

A four-tier hierarchy of regions has been identified. In the first-order, the age of streets and streets geometry shaped the boundaries of regions. The map of age of streets draws on the maps produced in different periods. The map of streets geometry is produced based on the data obtained from Istanbul Municipality. These two maps together yield the first-order of morphological regions.

Plot layout and land/building utilization, are two criteria to subdivide *Pantokrator-Porta Puteae* (in *Cyballi and Zeyrek* neighbourhoods) into second-order regions. The maps produced for the plot layout and land and building utilization together established the second-order regions. Here, the contribution of land and building utilization is high. Plot layout provided less contribution.

Table 4.14 Procedural aspects of the method for the application of Istanbul

Form complexes	Persistence	Morphological constituents	Criteria	Contribution to the hierarchy
Town-plan	Maximal	Streets	Age of streets / expansion phases	First-order
			Streets geometry	First-order
		Plots	Plot layout (area, width, depth)	Second- and third-orders
			Building coverage	Third-order
Building fabric	Considerable	Buildings	Architectural style	Third-order
			Building material	Fourth-order
			Building height	Fourth-order
Land and building utilization	Minimal	Utilization	Utilization – general and detailed	Second- and third-orders

The map of third-order regions is produced based on plot layout, land and building utilization, building coverage, and architectural style. The contribution of plot layout remained low. The land and building utilization and architectural style had the higher contribution to the hierarchy. Finally, two criteria are used for identifying fourth-order regions - building material and building height. Looking at the map of fourth-order regions, the contribution of building material is higher than of building height.

The application of the methodology to Istanbul demonstrates that a criteria-based methodology provides a more explicit implementation of the morphological region concept. The procedural aspects of the method are gathered in Table 4.14 addressing form complexes, persistence of form, morphological constituents, criteria, and their contribution to the hierarchy of morphological regions. The application also shows that the production of the map of morphological regions does not always result from the overlap of different intermediate maps – the first-order is identified by superimposing the analyses, but the identification of further regions is carried out by the application of each analysis one-by-one. This is mainly due to the complex urban form of this millenary city. Compared with European applications, the application to Istanbul seems more difficult.

5

CHAPTER 5: APPLICATION INTO ANTEQUERA

5.1. DEFINITION OF THE CASE STUDY

Antequera, a remarkable centrality with respect to the southern half of Andalusia, is the second case study for implementing the proposed methodology. The city is located in the Malaga Province, Andalusia, Spain. Antequera is only 47 kms from the *Costa del Sol* and has a population of over 41.318 inhabitants. This case study is selected based on the previous work reported by Barke (2003) included in the Literature Review. He analyzed the historical centre and the Special Plan for Antequera (Antequera, *Plan Especial de Proteccion, Reforma Interior y Catalogo del Centro Historico*), and the establishment of homogeneous areas. The area (and its boundaries) studied by Barke (2003) is the case study of this research. The analysis of first-order regions is carried out for the entire historical centre. However, due to the size of this centre (and as in Istanbul) the subsequent analysis of lower orders is only developed in ‘*Calle Infante*’ (a region with a strong diversity of forms). The region of *Calle Infante* is surrounded by streets of *San Miguel*, *Camberos*, and *Encarnacion* on the south; *Calle Calzada* on the east, streets of *Estrella* and *San Bartolome* on the west; and streets of *Infante don Fernando*, *Comedias* and *Lucena* on the north (see Figure 5.1).

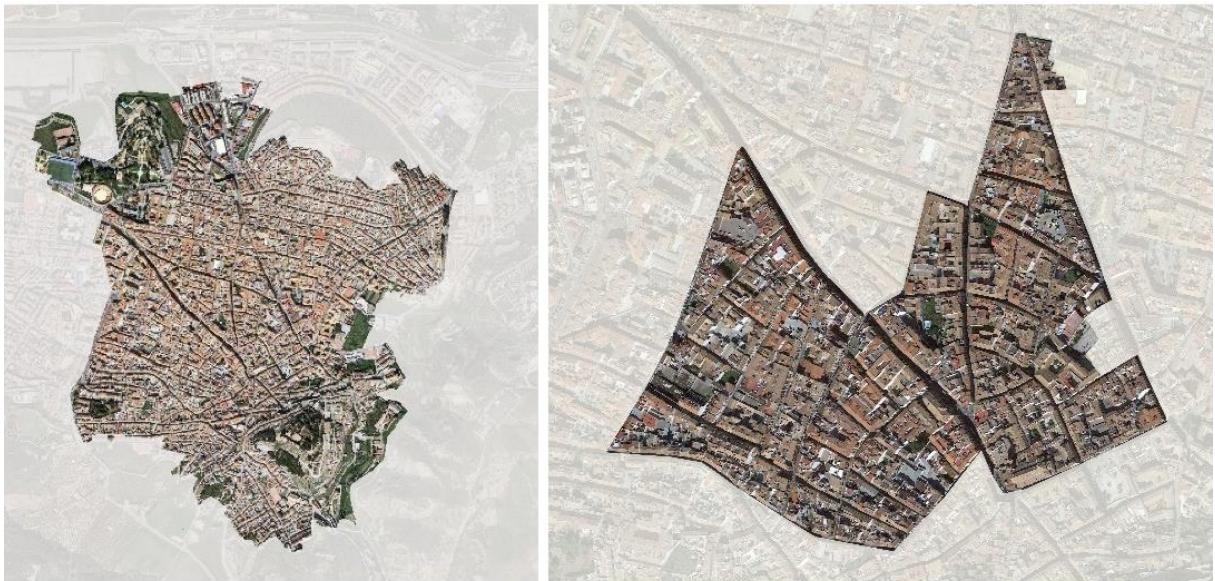


Figure 5.1 Antequera case study (left), Calle Infante region (right) (Google Earth, 2020a)

5.2. INTRODUCTION TO THE URBAN ASPECTS OF ANTEQUERA

The location of Antequera, between the Seville-Cordoba countryside to the north and the *Béticas* mountain to the south, provides the city not only a remarkable spatial centrality with respect to the southern half of Andalusia, but also an important strategic situation. Antequera, Malaga province, is in the autonomous community of Andalusia, northwest of Malaga, at the foot of the *Sierra del Torcal*. Neolithic dolmens (Menga, Viera, and El Romeral) attest the prehistoric occupation of the site. The city, known to the Romans as *Anticaria* and to the *Moors* (a member of a northwest African Muslim people of mixed Berber and Arab descent) as *Madinah Antakira*, was reconquered for Christian Spain by the *Infante Don Fernando* in 1410, after which it served as a religious and seigniorial centre. Examples of its 16th century architecture include the churches of *Santa Maria la Mayor* of *San Francisco* and of *San Sebastian*. Agriculturally based, Antequera produces olives, cereals, asparagus, fertilizers, sugar, ice cream, Christmas candles, woolen blankets, and cotton goods. *El Torcal* Nature Reserve, known for its massive and distinct limestone rock formations, lies 9 miles south of Antequera.

5.2.1. ENVIRONMENTAL ASPECTS

Antequera is 749.34 km², in the autonomous community of Andalusia, located in the north of the province and at an average altitude of 575 meters above sea level. In terms of the surface area, it is the 24th largest city in Spain (it is a very small city when compared to Istanbul). Antequera is in a strategic geographic enclave, standing in the centre of Andalusia, where the main roads connect Malaga, Cordoba, Granada, and Seville. Its natural limits are: to the north and north-west the Cordoba and Seville countryside, to the south the mountains of Malaga and the *Guadalhorce* valley, to the west and south-west the foothills of the *Serranía de Ronda*, and to the East the lands of Loja. In addition, the *Vega de Antequera*, watered by the *Guadalhorce* River, is a fertile agricultural area that provides cereals, olive oil and vegetables in abundance (Análisis Territorial, 2017). The climate of Antequera is continental, with an average annual temperature of about 20°C, with long, hot summers and winters in which frosts are quite frequent. Regarding rainfall, it is moderate and distributed irregularly in time and space, with two maximum rainfalls in autumn and spring separated by an almost absolute summer drought. Humidity ratio is between 10 and 40 percent for the minimum rates, and between 55 and 90 percent in maximum rates for summer (Foro-Ciudad.com, n.d.-a). The dominant geomorphological processes and forms in Antequera can be considered of essentially structural origin, since the petrological determining factor, together with the dynamics of river erosion, dominates the modeling action of the relief. The most prominent modeling forms for their profusion and uniqueness are the carstic forms of the *Sierra del Torcal*.

5.2.2. SOCIAL ASPECTS

Antequera was one of the centres linked to the beginning of Andalusian nationalism. The Federal Constitution of Antequera was drafted in 1883 and the so-called Autonomous Pact of Antequera was agreed upon in 1978, which led to the achievement of autonomy for Andalusia. According to the data published by the *Instituto Nacional de Estadística* (INE) in 2020, the number of inhabitants in Antequera is 41,318 inhabitants more than in 2019. The population density is almost 55 inhabitants/km². The most populated area of Antequera is the old town, the city centre. The rest of the population is concentrated in the districts and, to a lesser extent, in farmhouses and other rural dwellings. Table 5.1 presents the population of Antequera from 1900 to 2020.

Table 5.1 The evolution of population (men, women and the total) over the time (Foro-ciudad.com, n.d.-b)

Year	Male	Female	Total
1986	19.994	20.738	40.732
1990	20.604	21.259	41.863
1995	19.715	20.482	40.197
2000	19.866	20.73	40.596
2005	21.247	21.959	43.206
2010	22.256	22.978	45.234
2015	20.224	20.917	41.141
2020	20.215	21.103	41.318

The Antequera region once enjoyed a great artisan tradition that has been lost. At present, the most relevant artisan workshops are dedicated to wooden furniture, forging, stone and marble work, and making regional costumes. New workshops have also appeared focused on textile crafts, ceramics, and leather. Also, it is worth highlighting the schools-workshops located in the region, for the work they are developing in the recovery of artisan trades and for their contribution to the rehabilitation of buildings in the city.

According to the data published by the INE from the 2020 municipal register, 20 percent of the inhabitants have emigrated to Antequera from different parts of Spain, 10 per cent from other municipalities in the province of Malaga, 6 percent from other provinces in the community of Andalusia, about 4 percent from other autonomous communities and 7 percent from other countries (Spanish Statistical Office, n.d.) The analysis of the evolution of employed population according to activity sectors in the last 30 years reveals a continuous decrease in the importance of the agricultural sector, maintenance of the construction sector, slight increase in those employed in construction, and considerable growth in those employed in the service sector.

5.2.3. ECONOMIC ASPECTS

The *Vega de Antequera* gives the city its main source of wealth, providing cereals and oil. The passage through the valley of the river Guadalhorce allows an increasingly thriving orchard, with asparagus and potatoes being the main products. Despite its traditional dedication to agriculture and crafts, Antequera always had an industrial vocation. In the area called La Ribera, it can be seen the remains of factories of what was one of the most important wool textile productions in Antequera. The conversion into agriculture made the industry fail. Despite this, small family workshops have persisted, as in the case of the manufacture, a great tradition in Antequera, which today is sold throughout Spain, Europe, and part of America. Due to its geographical location, the Antequera region arouses great interest among investors in the economy, especially in the distribution, logistics and transport sectors (Municipio de Antequera, n.d.)

5.2.4. TRANSPORTS

The city is located 45 km from Malaga and 115 km from Cordoba, cities with which it is communicated by high-speed train and the A-45 highway. It is 160 km from Seville, and 102 km from Granada, with which it is communicated through the A-92 motorway. Due to its strategic communications situation, with 4 airports located approximately 1 hour away and on the railway line of the Port of Algeciras,

Antequera is emerging as an important logistics infrastructure centre, with several business parks and the new Andalusia Logistics Centre (Análisis Territorial, 2017).

5.3.THE HISTORICAL FRAMEWORK AND URBAN EVOLUTION

The book ‘Antequera, Plan Especial de Protección, Reforma Interior y Catálogo del Centro Histórico’ (Junta de Andalucía, 1995) has a great influence on this part of the work, on the historical framework and urban evolution. It is the most substantial reference for Antequera. The origin of Antequera is evident in the promontory settlement phase. These settlements are characterized by having easy access, defending the perimeter in a natural way, and being close to natural sources. The presence of man is witnessed in the tumulus of the Menga and Romeral Caves. It is at the beginning of the Iberian period when the promontory settlements are consolidated, and a more complex phase of territorial structure is established. The territorial structure after the ancient period is completed by the settlements, communities, exploitation of land and crops, constituting the territorial system by which man re-knows the territory where he sits. The Roman occupation, and especially the Muslim occupation, left a mark that can be perceived with great clarity, and can lead to a greater economic understanding of the territory. The Muslim routes of communication invariably followed the Roman lines (Junta de Andalucía, 1995).

5.3.1. PREHISTORIC, PRE-ROMAN AND ROMAN OCCUPATION

The first known signs of human settlement in the municipal area of Antequera seem to date back to the Middle Paleolithic (up to 35,000). During the Neolithic period (approximately 5500-2500 BC), the habitat continued in the caves of the limestone massifs and in open-air settlements. Some of these caves were used as graves, according to the study of materials located in the Torcal chasms.



Figure 5.2 Landscape of the Antequera Castle (Photograph by Mehling in 2014)

There is some evidence of Neolithic locations in *the Cueva de la Bracelet* (Cave of the Bracelet), the caves of *Marinaleda-Cuerda*, the pit of *Hoyo del Tambor*, and *Cueva del Toro* (Cave of Toro). The

presence of caves and manifestations enter the Culture of the Caves, culturally framed in a middle and final Neolithic. With the arrival of metallurgy, the Chalcolithic (approximately 2500-1800 BC), new larger human settlements seem to shape up in Antequera, perhaps, motivated by a population growth and the appearance of a ruling class with a certain economic power. Agriculture, rather than stock-breeding, was tested on the fruitful Antequera plain. The Bronze Age (approximately 1800-700 BC) supposes the entrenchment and consolidation of the population for Antequera, marking the beginning of a stable habitat in the *Cerro del Castillo* (Castle Hill) that will last until today (Junta de Andalucía, 1995).

The Iberian world usually sits a top easily defended rocky promontories. Thus, it is observed the traces of their stay in sites located at high elevations, in the case of the Castle of Antequera, *Cortijo del Castillon*, or in *Aratispi*, where the old fortified enclosure composed of large stones covered by other smaller ones.

The presence of the Roman world in the municipal area of Antequera is fully demonstrated from its beginnings in the Republican era to its end, through a series of archaeological remains and news referred by classical sources. Thus, it is known that, in its vicinity, a series of Roman cities or municipalities were located, some of which had great importance.

5.3.2. EVOLUTION OF THE SETTLEMENT IN THE URBAN AREA OF ANTEQUERA

The Period until the End of the Romanization

The first signs of human settlement detected in the municipal area of Antequera seem to go back to the Middle Paleolithic and the presence of Neolithic habitats or burials in the caves of the limestone chasms is reliably documented. However, to find a stable human settlement in the area where Antequera is located today, there is a need to go to metallurgic moments, already at the end of the third millennium. Thus, the first remains found are in the *Cerro de Marimacho* or *Cerro de Antequera*, which is located in the vicinity of the Dolmens of Menga and Viera (González et al, 2014; López, 2015; Lozana et al, 2014).

Its privileged geographical location, in the historical communication corridor between Upper and Lower Andalusia, has historically provided it with great cultural and economic treasures, such as the numerous archaeological remains of various periods discovered on the territory. The Dolmens of El Romeral, Viera and Menga (see Figure 5.4, 5.5, and 5.6), the *Efebo* of Antequera (Ephebe of Antequera) and many other pieces in the City Museum are good examples of this. Antequera stretches out over the slopes of a hill at the foot of the *Sierra de El Torcal* (Torcal Mountains – see Figure 5.3) in a network of streets of different character according to the historical period of their construction, scattered with countless monuments of interest.

The first known population settlement in the urban area of Antequera dates back to the Copper Age, and it is located on a dominant promontory over the *Rio de la Villa* (Villa river) and the plain of Antequera, eccentric with respect to the current city. During the Bronze Age, at least in its initial times, the settlement seems to continue in the same place of *Cerro de Marimacho* (see Figure 5.4).

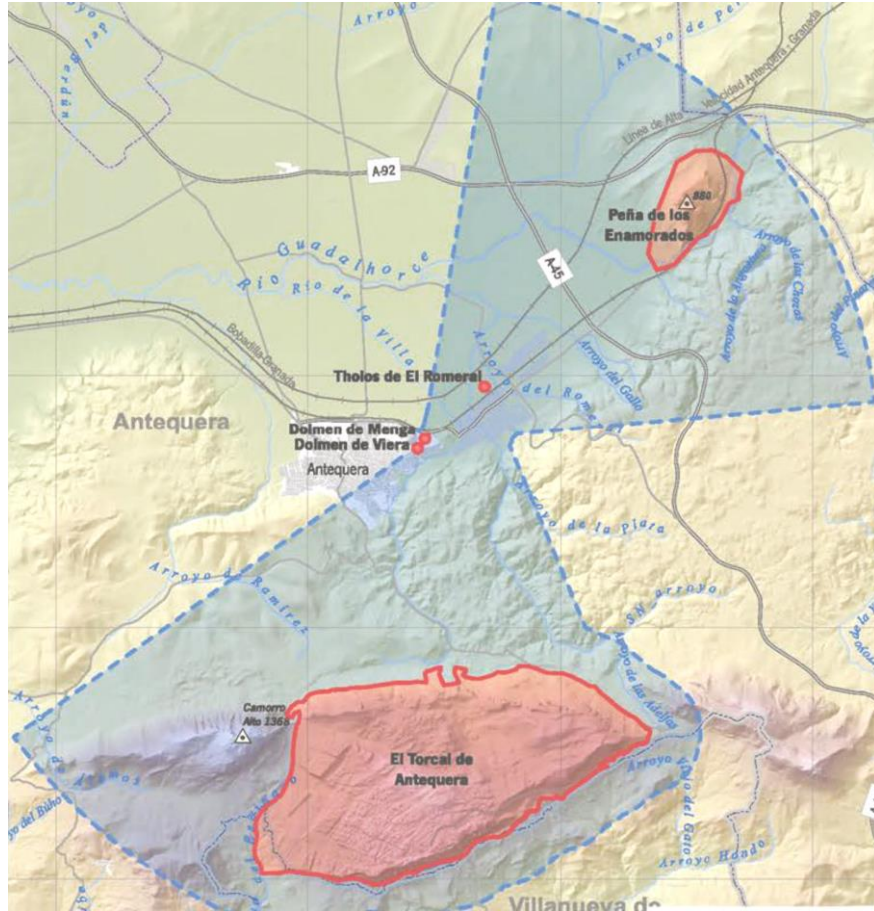


Figure 5.3 Dolmens site of Antequera (UNESCO, 2016)

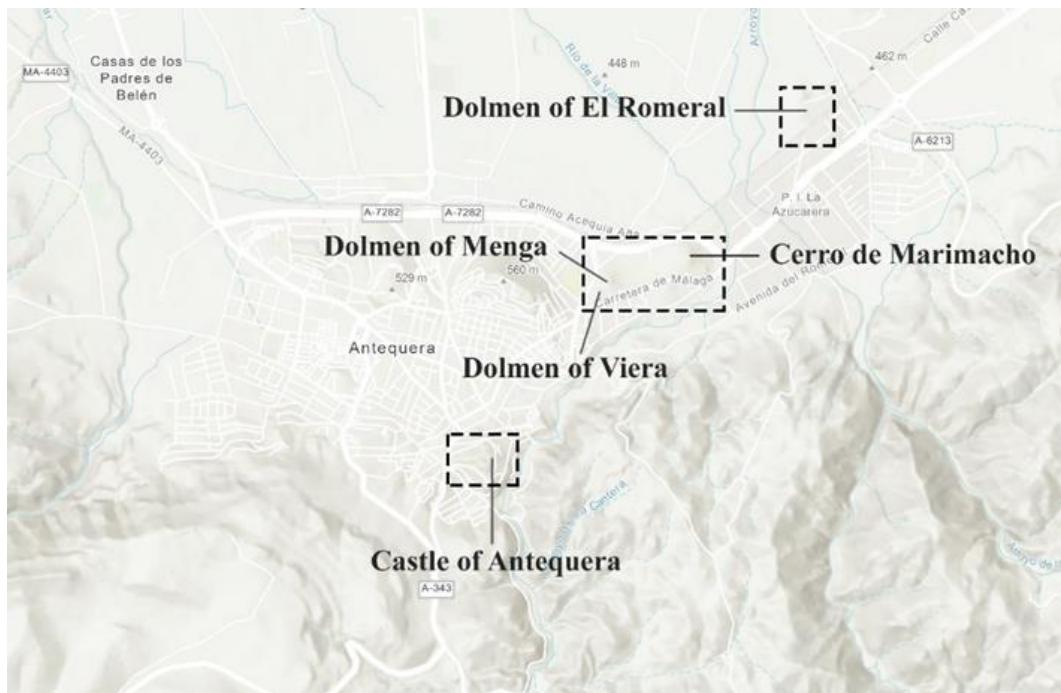


Figure 5.4 Dolmens of El Romeral, Menga and Viera, Cerro de Marimacho (the hill of Antequera) (drawings by the author)

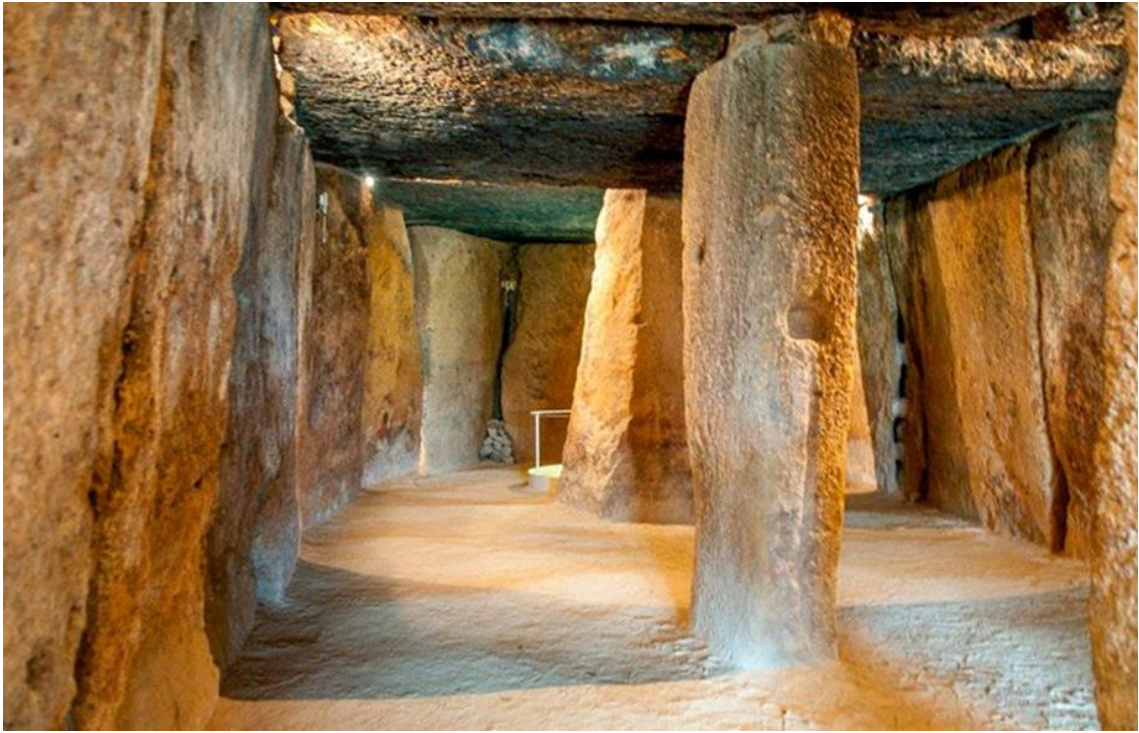


Figure 5.5 Dolmen of Menga (The UNESCO Awarded Dolmens, n.d.)



Figure 5.6 Dolmen of Viera (The UNESCO Awarded Dolmens, n.d.)

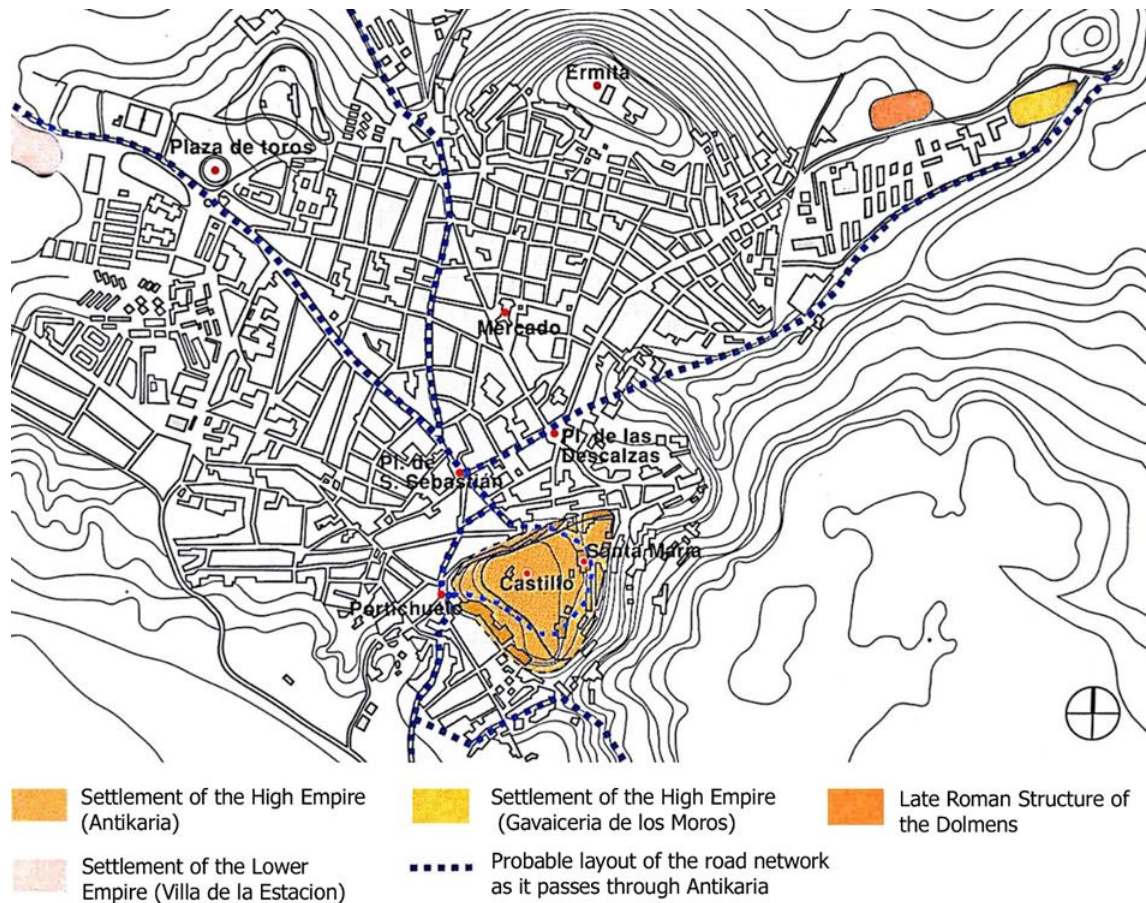


Figure 5.7 Roman period of Antequera (Junta de Andalusia, 1995)

In the final moment of this stage, a new settlement emerges on a promontory near *Rio de la Villa*, neighbouring *Cerro del Castillo* and, more specifically, the rocky massif that dominates its southern side (see Figure 5.7). But, there is no tangible urban fabric of this period in the area. In its origin, perhaps it encompassed the entire area of the top of *Cerro del Castillo*. This same area was later occupied by the Iberian indigenous element, which represents the passage or transition from Prehistory to Protohistory. The fact of being a crossroads, the extraordinary agricultural potential of Antequera, in addition to other reasons, must have made Antikaria an important Roman city. The Roman ashlar were reused in the erection of the castle and medieval walled enclosure. This, together with the appearance of Roman ceramics on the surface, leads to be considered that this is the area where the primitive Roman settlement of Antikaria was located in the 1st century AD. The archaeological works expand the area of the Roman city, although much remains to be done and discovered to define its superficial extension and urbanism (Junta de Andalusia, 1995)

Medieval Period: Antikaria and Madina Antikaria

The Middle Ages generally lacks suitable historical sources for its study. In the case of Antequera, this fact is confirmed for the period between the 5th and 11th centuries. The occupation of the Roman Antikaria by Vandals and later by Visigoths are confirmed by evidence; on the one hand, the preserved archaeological remains, some in the Municipal Museum of Antequera and others used as construction

materials by the Arabs; on the other hand, the fact that the name has remained unchanged after the Muslim invasion. This transmission of the name of the place shows a constant in its use, although the idiosyncrasies of its inhabitants were notably different. In the first third of the 13th century, the Nazari kingdom of Granada, which is the last stronghold of Hispanic Islam that included the provinces of Almeria, Malaga, and Granada, was configured. Therefore, Antequera, after the conquest of Cordoba and Seville by the Christians, remained as a frontier plaza. This condition is reflected in the continuous attacks suffered by both Christian and Muslim troops at moments of internal conflict within the sultanate. Once the presence of a Hispano-Gothic habitat on the top of the hill has been witnessed, although no architectural relics are preserved, it is possible to suppose that the barbarian groups adapted perfectly to the urban kernel of the late Roman period, without introducing significant changes in the arrangement of the urban space. It seems that the major morphological changes in this site are due to the encasement carried out during the Cordoba caliphate. On the other hand, since ancient times, it would also be the administrative, religious, intellectual, and a communication centre, where regional exchange networks and distant trade routes converged (Belmonte and Casares, 1990).

The transforming element of the primitive settlement was the population growth in mid-13th century. The continuous imminence of the peasants to the fortified nucleus, supported the fixation of houses in the vicinity of the walled enclosure. On the other hand, the immigrant groups coming from the recently conquered lands represented a considerable increase in population. This increase in the population forced to build a wall surrounding the neighbourhoods or suburbs (*al-rabad*) that had been created around the fortress, thus giving rise to the establishment of the '*madina*' (the Arab town) (see Figure 5.8).



Figure 5.8 The Islamic period of Antequera (Junta de Andalusia, 1995)

When the wall of the '*madina*' was built, the upper enclosure became a fortress (*al-qasaba*), residence of the governor of the city, the centre of the political power, and the last defensive stronghold of the

urban enclave. The area enclosed by the double wall ring was 63,140 m², according to Leopoldo Torres Balbas, who estimated that 2,200 inhabitants could reside inside it, with an approximate number of homes of 367, considering six people per home. The consolidation of 'Antakira' as a city is due to the aggregation of some basic aspects that characterize the Islamic nucleus. These are settling in well-defined places, generally of old ancestry, occupying the slopes of steep hills, next to a meander in the vicinity of a river, and so on.

The Madina Antakira included the mosque, the administrative centres, the souks, the *alhondigas* (complexes for sale, purchase and storage of cereals and other food) and the *alcaiceria* (a commercial precinct in ancient Islamic cities where high-priced items were sold). Therefore, a multifunctional character in the adaptation of the physical space to the social lifestyle of the Muslims was intertwined for easy access and the constant change of activities. The centre of social activity was arranged around the mosque. Near the mosque, there was a cult centre in the open air (called *musalla*). Between the 'musalla' and the main entrance (*Puerta de la Villa*), the commercial life was organized, driven by an internal road linking *Puerta de la Villa* with that of Malaga and with another called *de las Bastidas*, demolished in mid-19th century. The Islamic view of urbanism was decisive in Antequera. According to Torres Balbas, the houses were small, arranged around a central courtyard, one or two storeys, and included small rooms (Junta de Andalusia, 1995).

In the mid-15th century, Antequera suffered strong pressure from Granada. Incursions by Christians were organized towards Muslim territory. During this period, the walls and towers of the castle were rebuilt. The wall that surrounded the town, since the population began to live outside the walls, was abandoned. From that moment on, a process of progressive deformation began. The urban development of Antequera from that moment onwards is supported by the growing immigration of settlers in search of fertile lands. The city would be born effectively in the late 15th century, producing an explosion of the commercial world derived from the transformation of products from its rural environment. Such urban development was conditioned by various historical, geographical, and economic factors, which influenced the growth of the city. At first, the Islamic heritage was important, although not determinant. Yet, the new needs destroyed the Arab nucleus and much of the original layout has been lost.

The Period until the 18th Century

Until the early 18th century, the city began to take shape beyond the walls that enclosed the Arab city. The old suburbs of Albaicin and San Juan, and the association between them around Santa Maria de Jesus, in Portichuelo, begin their consolidation as neighbourhoods. The city of the 18th century gradually occupies the south of the city, in the highest part, with better orientation and sunlight. The limits are the steepest slopes along the old road to Malaga. The north extensions of the city begin towards the roads to Seville and Cordoba, occupying the church of San Sebastian and its square. There is also the isolated suburb of San Pedro next to San Zoilo. The road network resulting from that growth was determined by topography and the desire for connection between neighbourhoods, especially through San Sebastian and El Portichuelo, which acted as nodes of the system. The streets adapt to the contour lines, but not totally, due to that need for association in growth. The streets to the north of the Castle (Herradores, Colegio, Rio) and those that run halfway up the river are adjusted to the contour lines. The rest are of with two superimposed networks, one radial with two clear centres, San Sebastian and El Portichuelo, and the other longitudinal in a west-east direction (see Figure 5.9).



Figure 5.9 Urban enclosure until 18th century (Junta de Andalusia, 1995)

The resulting street blocks are the most irregular and narrow of the city and reflect the style of the architecture of the time. The dominant number of storeys in the entire area is one or two. In addition to all this, the form of these neighbourhoods is made up of generally sloping streets, the width of the plot ordered every eight or ten meters; rectilinear streets, with a few entrances and exits, which is what you see in Arab cities.

The Period from the 18th to 20th Century

Since the late 18th century, there was not a substantial growth. Since then, the city centre is structured between the *Estepa* and the *Cantareros* (see Figure 5.10). The greatest renovation of the city has taken place in this area. The area ranges from *Porterías*, *San Pedro* and *Belen* in the north, to *Higueruelos*, *Plaza de las Descalzas* and *Plaza de San Sebastian* in the south, had great transformations (see Figure 5.10 – the area almost correspond to the white circle with black contour). The transformation with the greatest impact occurs when the use of dwellings is changed from single-family to multi-family, which is the greatest differential characteristic of this area (Junta de Andalusia, 1995).

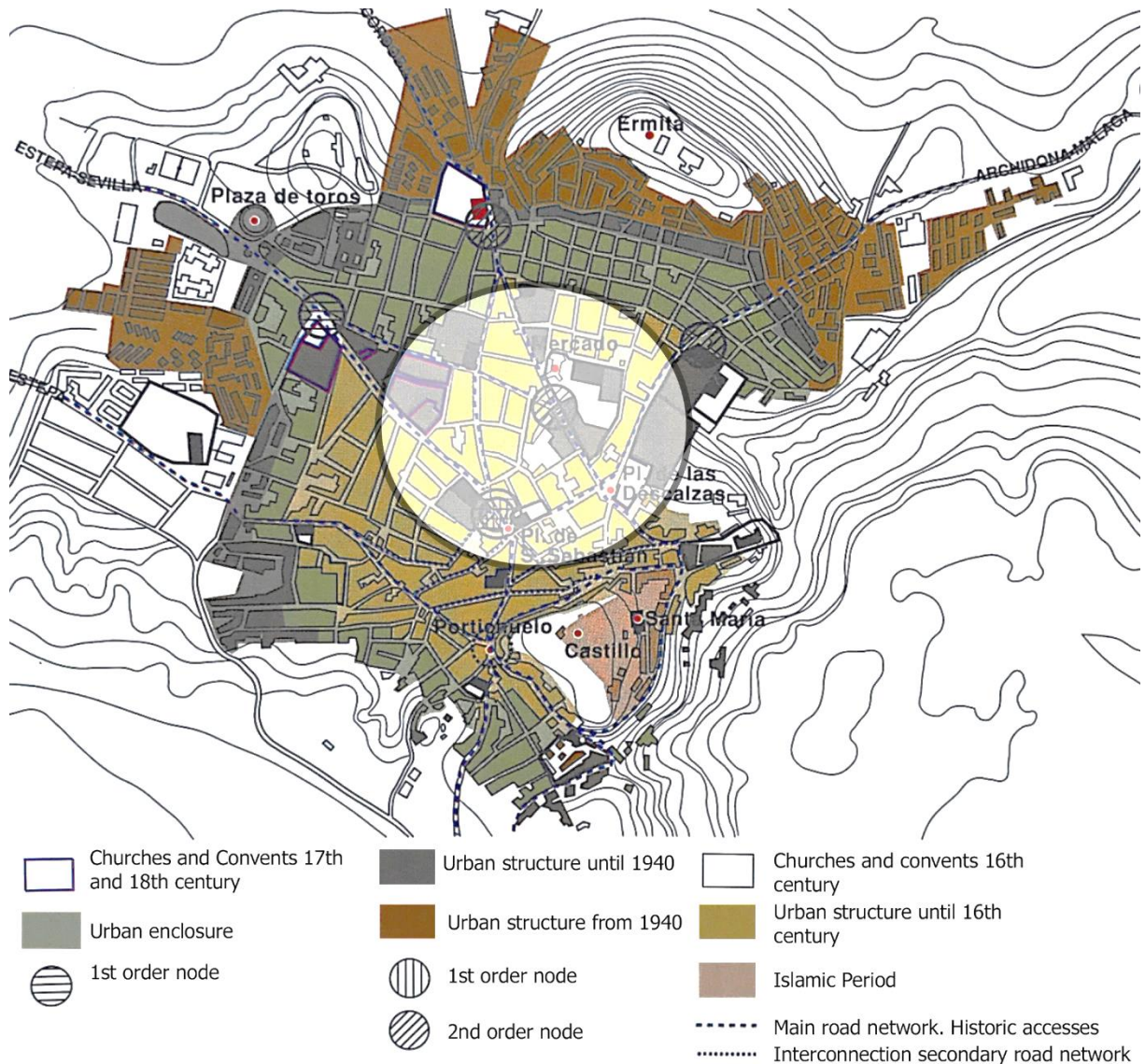


Figure 5.10 Urban enclosure 18th and 20th centuries (Junta de Andalusia, 1995)

5.4. MORPHOLOGICAL REGIONALIZATION

The study area consists of the historical part of Antequera; its roots go back to the first settlement of Romans and Muslims. The area is about 168 hectares. The boundary of the area is restricted: to the east with Avenida de la Legion, to the west with the Calle Granada, to the north with the Ermita Hill, and to the south with the edge of the built area (see Figure 5.11). The analysis of the historico-geographical structure of the urban landscape reveals a four-order hierarchy of morphological regions, as illustrated in the next sub-sections.

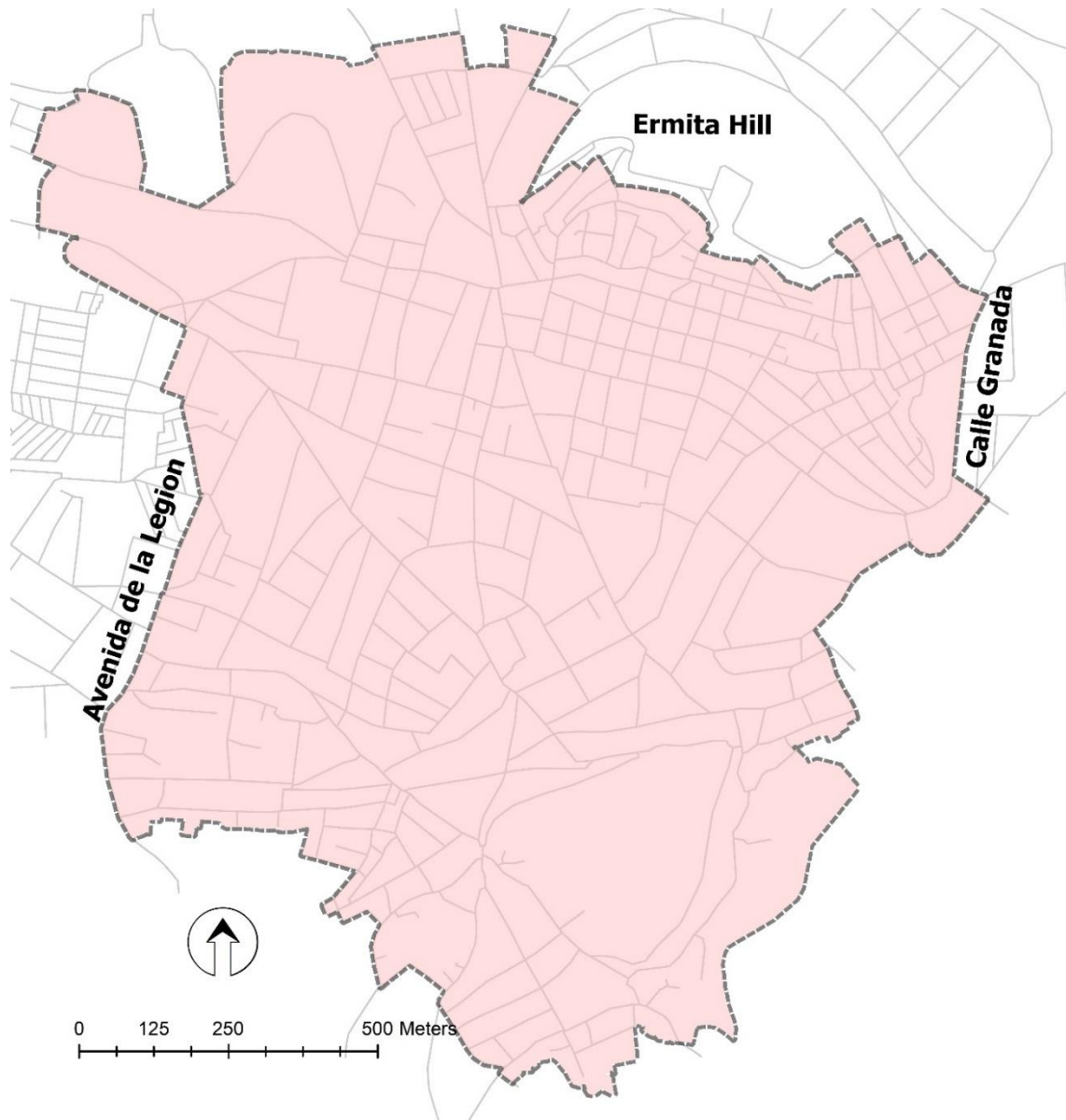


Figure 5.11 The study area in Antequera

5.4.1. HISTORICAL CENTRE - FIRST ORDER

Two criteria support the identification of first-order morphological regions of Antequera. These are the main expansion phases of the city and its streets geometry. The map of morphological regions is revealed based on this set of data. The map is complemented by a table where each of these regions is described.

5.4.1.1. Material: expansion phases and streets geometry

Expansion phases

There are six expansion phases in Antequera, ranging from the Roman and Muslim period to the present days. The first is the Roman and Muslims period, which span the period from almost 200 B.C. to 15th century. The first settlement of Roman and Muslims was on the hill where the Castle stands today (see

Figures 5.12, and 5.13). The roman occupation started in 200 B.C. until the fall of the Roman Empire in 410. After that, the city was occupied by Visigoths in 419, and it was under the hegemony of Visigoths until 716. The city was then invaded by Muslims, becoming part of the Umayyad Caliphate under the name ‘*Madina Antakira*’. The occupation of Muslims continued until the 15th century.



Figure 5.12 The Castle of Antequera (Dukas, n.d.)

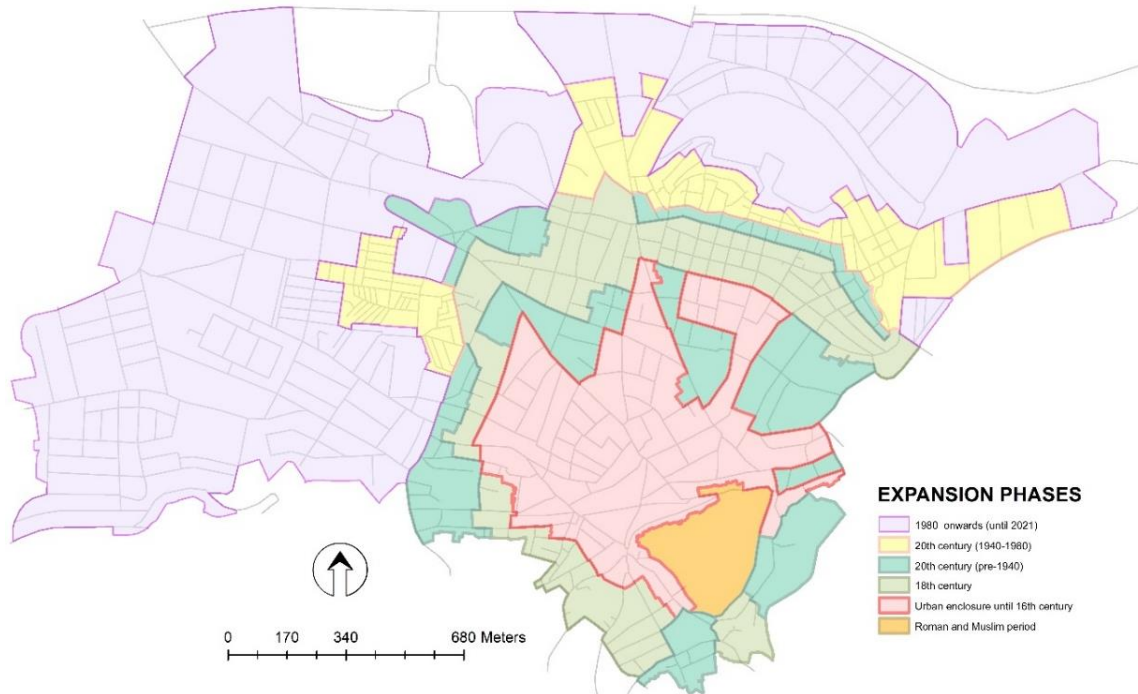


Figure 5.13 Expansion phases of Antequera, from Romans onwards



Figure 5.14 A view from the west part of 20th century built form (1940-1980) (Google Earth, 2020b)

By the end of Muslims hegemony in the city, and in general in Spain, the city started to be shaped around the castle. The city consists of mainly irregular street patterns. The 18th century city enclaves the built area of the previous period. That area stood as the peripheral area of the city until its consolidation. The north part of this area has a more regular street pattern, particularly when compared with the southern parts. The city of the 20th century is grouped into two different categories: pre-1940, and 1940-1980. The built area pre-1940, partially, is the transformation of the built area of the previous period. It shows a different character when compared to the former fabric. The southern parts are shaped on a rugged terrain including the small river *de la Villa*. The next emergence of the built area is between 1940 and 1980. There are two formations of this period. The first is at the west, and the second is at the north, represented in yellow in Figure 5.13 and illustrated through its building fabric in Figure 5.14.



Figure 5.15 A view from the west part of the building fabric in the last phase of growth (1980 onwards) (Google Earth, 2020b)



Figure 5.16 A view from the north part of the building fabric in the last phase of growth (1980 onwards)

The last expansion phase is the period from 1980 onwards. Compared with the former expansions, in this stage, there is a great formation of built form with a different character. The phase includes the last two decades of the 20th century and the first two decades of the 21st century. The expansion in the west is larger than that in the north. Looking at the west part of built form in the last phase, there is a more regular street pattern, and mainly two-storey buildings (see Figure 5.15), and fringe belt features. The north part of the expansion phase has a relatively more irregular street pattern, and buildings with larger block-plans (see Figure 5.16).

Streets geometry

The second criterion is streets geometry. This criterion contributes as one of the first inputs for first-order regions. Ten different arrangements are delimited based on streets geometry of Antequera historical area (see Figure 5.17). These distinct street patterns are tagged with different names, ranging from A1 to A10. The first one, A1, is a large area, corresponding to the first settlement of the city, the castle. A2, north of A1, is the second area, with a very irregular streets geometry, including the 16th century built form. A3, west of A1, has a more irregular pattern, and has some dead-ends streets. A4, south-east of the castle, has a few loose streets. A5 constitutes the largest street pattern and it is more regular than the previous ones. A6 has a regular streets geometry, mainly constituting rectangular street blocks in the south-west and north-east directions. A7 has the most regular streets geometry, constituting a grid street pattern. A8 has a denser pattern. A9 consists of a more warped pattern. And A10 has a sparse street pattern.

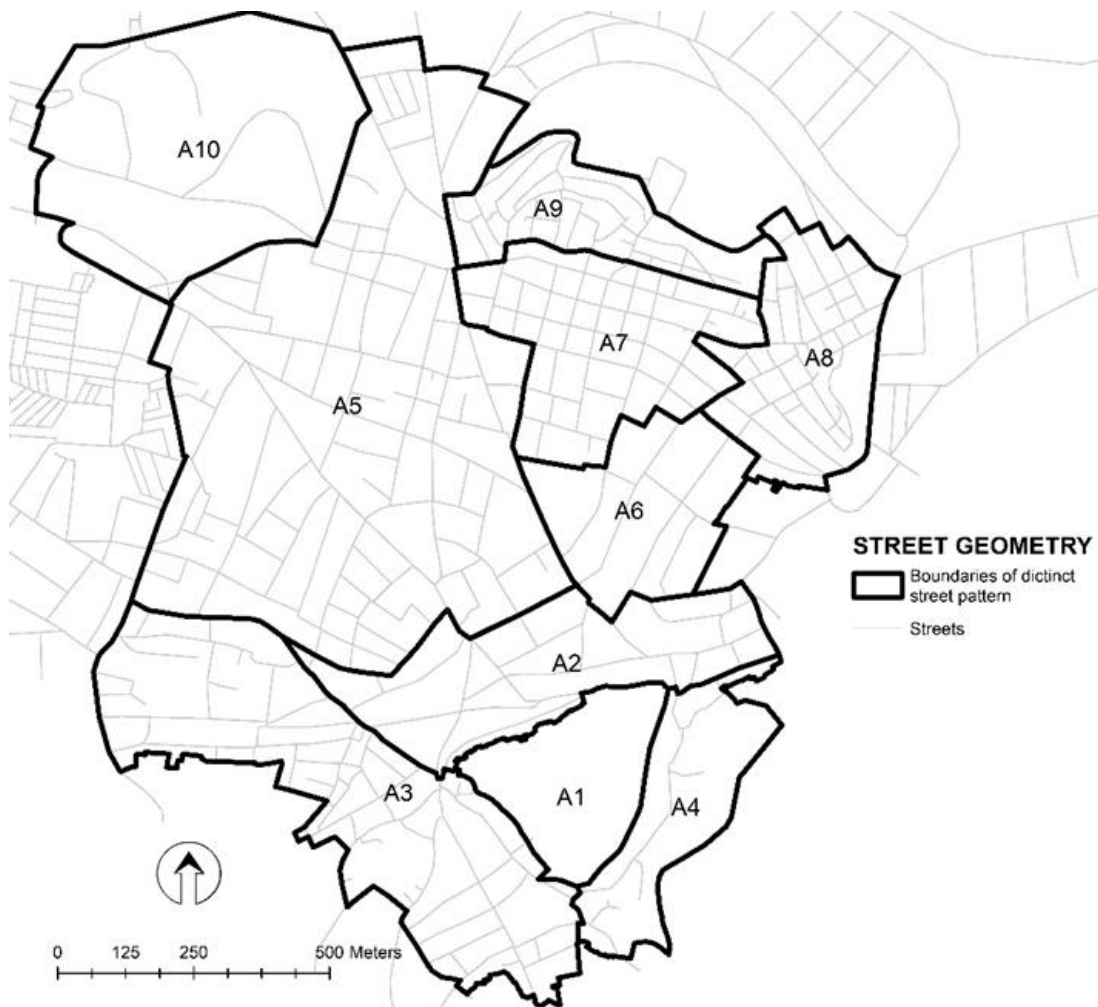


Figure 5.17 Streets geometry

5.4.1.2. Morphological regions: first-order

The first-order morphological regions are delimited based on two maps, expansion phases and streets geometry. First-order regions are designated by the superimposition of these two maps. In other words, the map of expansion phases and the map of streets geometry together yield the map first-order morphological regions.

Fifteen first-order regions are identified in the historical core of Antequera (Figure 5.18). These are El Castillo, Santo Domingo, Calle Infante, San Pedro, Portichuelo – San Miguel, Parroquia de La Santísima Trinidad – San Bartolome, Puerta de Granada, El Rio, Madre de Dios de Monteagudo, San Francisco, Avenida Legion, Calle Fresca, Avenida Estacion, Cerro de la Vera-Cruz, Parque – Plaza de Toros. The regions' names are related with the importance of special buildings, streets, or topographical elements.

The first and oldest region is El Castillo, emerging from its own streets geometry, and Roman and Muslim settlement traces. It includes the fortress of Antequera, and partially the ancient city of Arabs Madina. The region that is based on the historical origin of the city and has important archaeological remains. It is possible to differentiate the castle, church of Santa Maria, the plaza of Santa Maria, and the Roman baths of Santa Maria. The area includes significant historical monuments, free spaces with some streets, and popular houses.

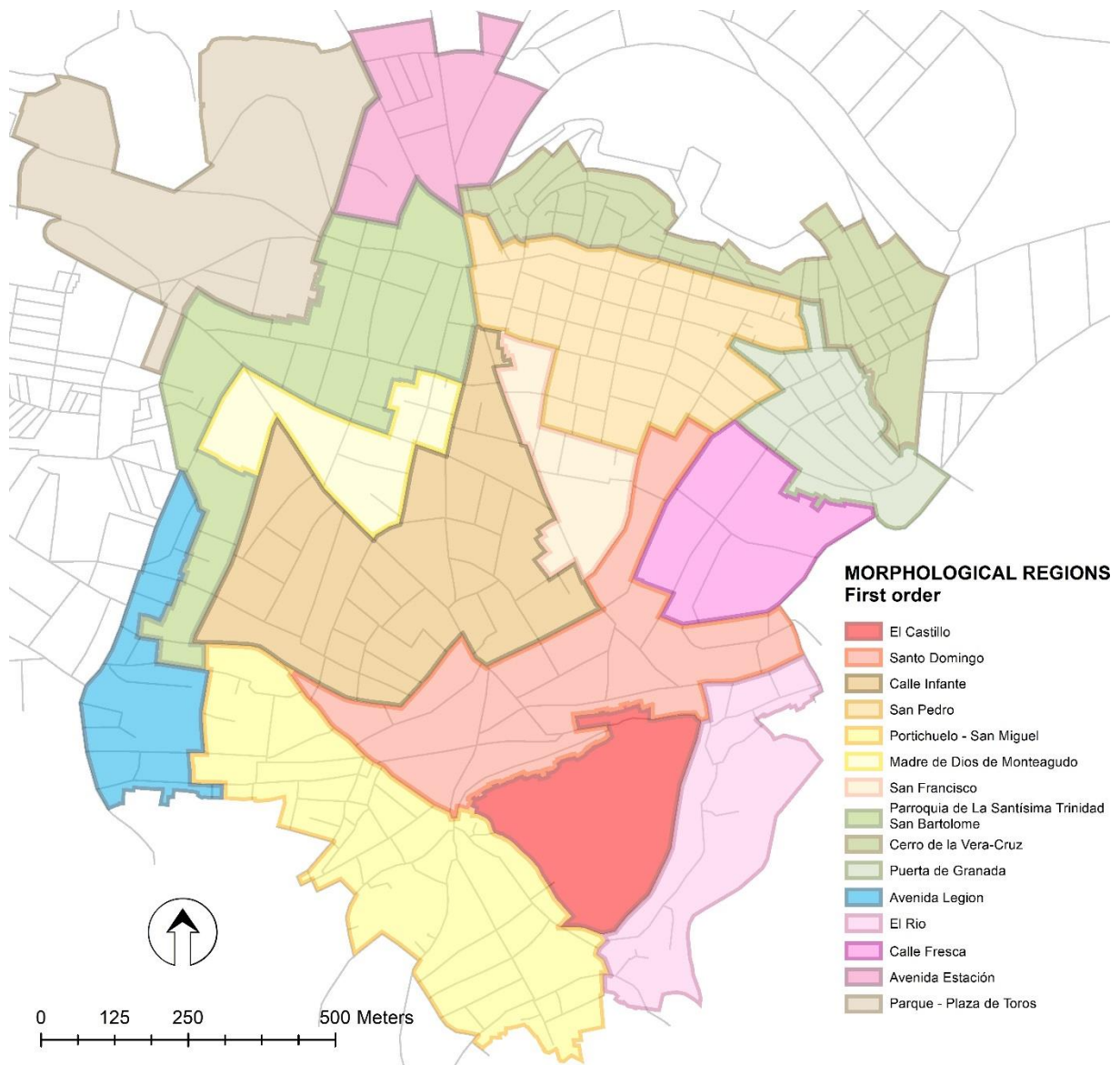


Figure 5.18 First-order morphological regions

Santo Domingo is a region, contiguous to El Castillo, with an irregular street pattern and street blocks. It includes urban areas of interest such as Santo Domingo plaza and convent, the Museum, the church/convent of Catalinas, nodes such as the Cuesta de Barbacanas and Cuesta de Rojas, and the plaza of Coso Viejo. It is a residential area with some equipment and spaces of interest, with a quiet and relatively lively environment.

Calle Infante has the 16th century built form and an irregular and geometrical streets geometry. It is the largest region in the historical area. It constitutes an urban complex of interest. It is a consolidated area with some voids that present opportunities for action. Calle Infante is the main street with commercial, administrative, and professional services. The region contains the most representative landmarks, such as San Agustín Convent, Palacio de los Marqueses de Villadarias, and Convento de la Encarnación (Convent of the Incarnation).

San Pedro is a region of 16th century, which was an isolated suburb of the city. It also contains 18th century building fabric and 20th century building fabric. It has a more regular street system. The region is a consolidated area with some ruins or empty interior spaces. It exhibits an urban complex of interest around the Plaza de San Pedro. It would be differentiated between the upper part of Fuente and Juan Casco streets, with more popular houses with two floors, and the lower part of San Pedro street with most of three floors. The area is a quite compact residential area. The church of San Pedro should be highlighted as a landmark or significant element.

Portichuelo – San Miguel is also a region, expressing an irregular street pattern and 16th century traces of built form. Streets geometry has been the dominant criterion for identifying the region. Looking at the urban landscape, this characteristic area would be determined as a different morphological region, even if it consists of three different expansion phases. The region is a consolidated historical area, with modern actions, typological ruptures, and extensions in single-family dwellings. It is an urban area of residential buildings and historical monuments. There are some voids that present opportunities for potential actions. It is worth highlighting the church of San Miguel, the church of San Juan, Plaza Espiritu Santo, Portichuelo Chapel and the Palace of the Escalonias as spaces of interest. It could be divided into two subareas, one to the east and the other to the west of Maria la Vieja street in terms of its characteristics.

Parroquia de La Santísima Trinidad – San Bartolome, which is a region from 18th century, comparatively demonstrates a geometrical and irregular street pattern. It is a consolidated region with some interior plots and with some voids that present opportunities for action. It consists of residential utilization with concentrated facilities, and with commercial uses. The region maintains its homogeneity and avoids aggressions. It is worth emphasizing the Parish of La Santísima Trinidad Antequera as an important element. Puerta de Granada is a region that product of 18th and rarely 20th (pre-1940) built form, and has a denser street pattern. It is a consolidated region of popular housing. It is a peripheral area with exit roads. The east blocks can be differentiated from the rest of the region. The region has significant environmental value in terms of urban image. It embodies Puerta de Granada (the Granada door) as one of the most attractive elements of the region.

El Rio region takes place on a rugged terrain, having a few loose streets, and 18th and 20th (pre-1940) traces. It is a region along the river, with possible recovery for urban extensions, and great opportunities for action. It constitutes a space of interest. It is a low-density area, with large open slopes descending towards the river, with orchards and rustic buildings for livestock. The church of El Carmen and its surroundings could be distinguished as a sub-area. This part of the region is mainly residential. The church of El Carmen and its square, Water House Workshop School, and Exhibition Hall of El Henchidero can be pointed out as important elements. Historical and cultural value of the old manufactories provide an additional significance to the region.

Madre de Dios de Monteagudo is a product of 20th century (pre-1940) building fabric and a partially regular street pattern. It is mainly a residential area with shopping streets and services. It includes some empty plots for new actions. It is delimited with Picadero street on the west, Comedias and Lucena streets on the east, Calle Infante street on the south and Cantareros on the north. It contains important representative landmarks and facilities, such as the church of Madre de Dios, Torcal Municipal Theater, the City Hall, the church of Nuestra Señora de los Remedios, the church of San Juan de Dios, Madre de Dios de Monteagudo convent.

The name of San Francisco region comes from a special square, which is an outcome of 20th (pre-1940) century pattern. It is a consolidated region of urban complex of interest. It is an area that reflects busy and lively urban life with the market and commercial area. The Market, the church of San Zoilo,

Municipal Library of San Zoilo, Plaza San Francisco and Plaza de Fernandez Viagas can be highlighted as spaces of interests.

Table 5.2 Characteristics of first-order regions

First-order regions	Expansion phase	Streets geometry	Dominant criterion
El Castillo	Roman and Muslim Period	A1	Expansion phase
Santo Domingo	Urban enclosure until 16 th century	A2	Expansion phase Streets geometry
Calle Infante	Urban enclosure until 16 th century	A5	Expansion phase Streets geometry
San Pedro	Urban enclosure until 16 th century 18 th century 20 th century (pre-1940)-rarely	A7	Streets geometry Expansion phase
Portichuelo – San Miguel	Urban enclosure until 16 th century	A3	Streets geometry Expansion phase
Parroquia de La Santisima Trinidad – San Bartolome	18 th century	A5	Expansion phase
Puerta de Granada	18 th century 20 th century (pre-1940)-rarely	A8	Streets geometry Expansion phase
El Rio	18 th century 20 th century (pre-1940)	A2, A4	Streets geometry Expansion phase
Madre de Dios de Monteagudo	20 th century (pre-1940)	A5	Expansion phase
San Francisco	20 th century (pre-1940)	mainly A6	Expansion phase
Avenida Legion	20 th century (pre-1940)	A5	Expansion phase
Calle Fresca	20 th century (pre-1940)	A6	Expansion phase
Avenida Estacion	20 th century (1940-1980)	A5	Streets geometry Expansion phase
Cerro de la Vera-Cruz	20 th century (1940-1980)	A8, A9	Expansion phase Streets geometry
Parque – Plaza de Toros	20 th century (pre-1940)-rarely 1980 onwards (2021)	A5, A10	Expansion phase Streets geometry

Regions of Avenida Legion and Calle Fresca have 20th (pre-1940) century form with different street patterns. The region Avenida Legion is a consolidated area with some inner plots, and empty spaces for urban actions. It lies along the east side of Avenida Legion street. The region is a popular residential area with commercial uses and local services on the north. The Calle Fresca is a consolidated region with some voids that present an opportunity for action. It has residential utilization with exit streets. The east side of the region is mainly greenery areas. It is worth mentioning the convent of Santa Eufemia, Museum and Chapel of Blessed Mother Carmen of the Child Jesus, Convent of the Victory

Avenida Estacion and Cerro de la Vera-Cruz are two regions, demonstrating the characteristics of the period of 1940-1980. Both have different street patterns, indicated in the following Table. The region of Avenida Estacion is an area has residential with commercial uses and local services, consisting of relatively larger blocks. It is a peripheral region that has a direct connection to the city core. It is possible to distinguish as two sub-areas, the west and east of Avenida Estacion. The region Cerro de la Vera-Cruz is a consolidated residential area. It is possible to distinguish two sub-areas, east and west of Calle

de la Cantera. It is worth highlighting the hermitage of La Vera Cruz. It has magnificent views of urban landscape, particularly, to the castle.

Parque – Plaza de Toros is identified as a region from 20th century (pre-1940) and the last development period, even if the Plaza de Toros (bullring) built in 16th century. The surroundings of the Plaza, the street pattern around it, and the general configuration of the area gave rise to establish this region in a different way. The built stage of the Plaza gives the region a distinct characteristic. It mainly consists of free and public greenery areas. It can be subdivided into two subareas, the area of the Park and Plaza de Toros its east and south parts. It is an urban recreational landscaped area, with mass services and facilities (such as Plaza de Toros, and soccer field). The east of the Plaza de Toros constitutes an area of local services and institutional uses. The region has an opportunity to design some possible actions.

The identification of morphological regions, as a composite map of expansion phases and streets geometry indicated distinct dominance in the hierarchy. Table 5.3 shows how they contributed. The first criterion, expansion phase, contributed to the hierarchy of regions in a very high level. Streets geometry supported the hierarchy of regions in a high level.

Table 5.3 Contribution of expansion phase and streets geometry to the hierarchy

Criteria	Contribution to the hierarchy
Expansion phase	Very high
Streets geometry	High

5.4.2. CALLE INFANTE - SECOND ORDER

5.4.2.1. Material: plot layout, block-plan type, and land and building utilization

The Calle Infante, one of the first-order regions, is selected to proceed with lower-order analysis. The selection of this region arises from the variety of form. It is not only different in terms of the town-plan, but also the building fabric and land and building utilization. The name of this region comes from its main street. The Calle Infante don Fernando is one of the main streets and one of the longest of Antequera. It goes from the Alameda de Andalucía to the Plaza de San Sebastián. The City Hall, the Church of San Juan de Dios, the Casa de los Pardo, the Convent of the Remedies, the Museum of the Trompo, the Convent of San Agustín and the Casa Boudéré are located on the street.

Plot layout, building block-plan type, and land and building utilization are three fundamental criteria for identifying second-order regions. Three intervals are used to produce the map of plot layout (area, width, and depth) based on natural breaks in ArcGIS software. The plot area is categorised as small (between 15-331 m²), medium (between 332-971 m²), and large (between 972-4333) (see Figure 5.19). Small plots mainly consist of residential utilization, medium plots are products of residential, and residential with commercial uses and local services. The fringe belt features correspond to large plots. Plot width is categorised in narrow (between 1-10 m), medium (between 11-25 m), and large (between 26-126 m) intervals (see Figure 5.20). A large number of plots has medium width. Plot depth has short (between 1-20 m), medium (between 21-33 m), and long (between 34-91 m) categories (5.21). Deep plots are mainly larger. These three maps (plot area, plot width, and plot depth) together yield the map of regions for plot layout. First, the map of plot area is addressed. Three different categories for their size are delimited in a general way. The same procedure applied for plot width as a second, and plot depth as a third. Plot area is the most important one, and plot depth is the least important (see Figure 5.22).

Building block-plan type is the second contributor to second-order morphological regionalization. Three different types are identified in this area (see Figure 5.23). Type 1 consists of small, mainly arterial

block-plans. Type 2 mainly corresponds to larger block-plans with courtyards. Type 3 is made of special block-plans with large courtyards (see Figure 5.27). Figure 5.24 presents the regionalization for distinct block-plan types.

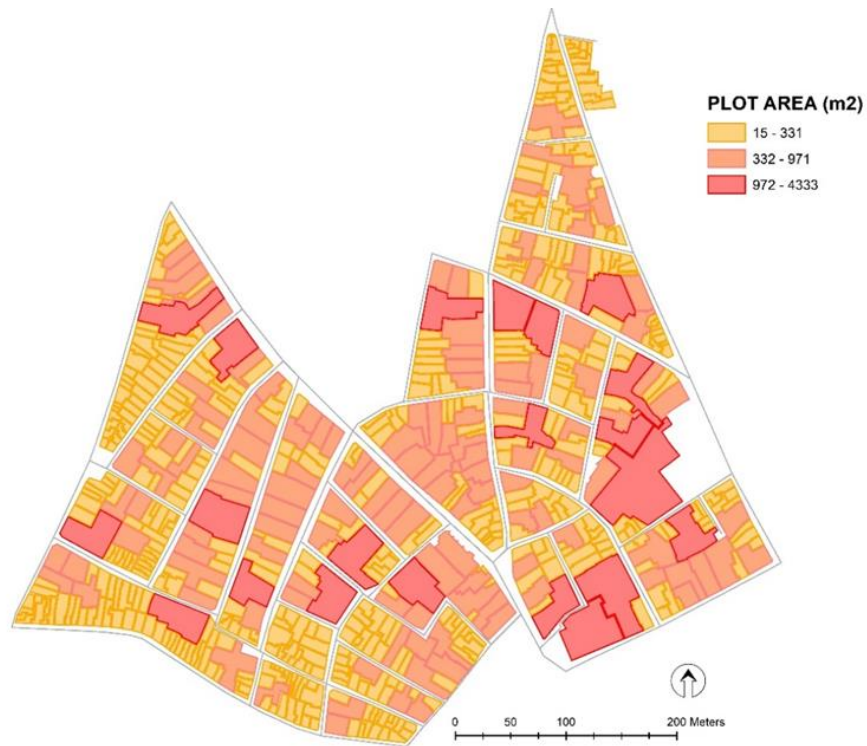


Figure 5.19 Plot area

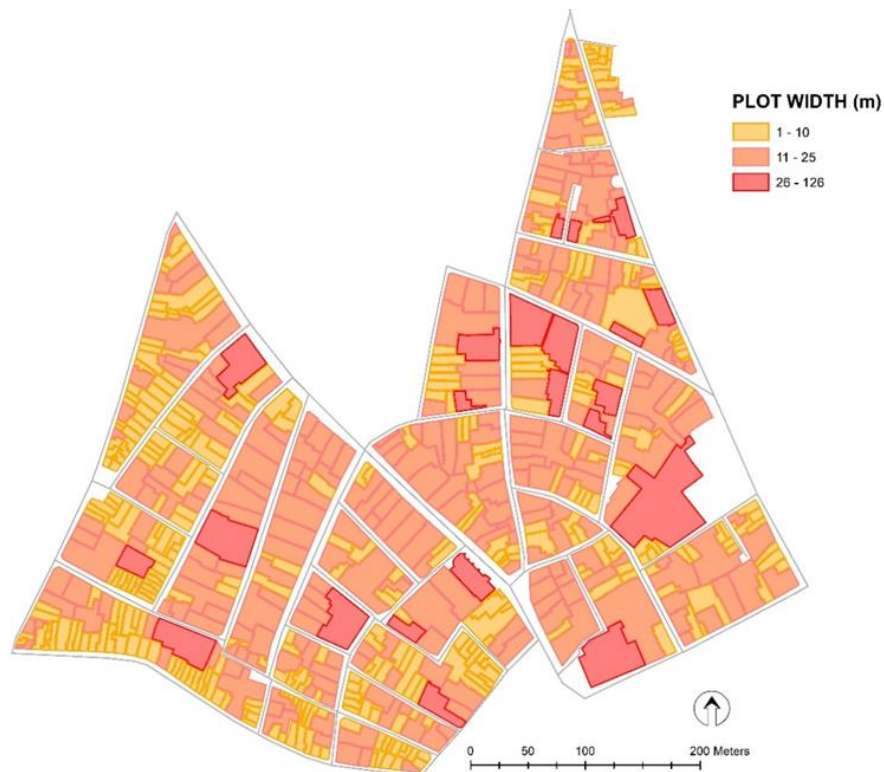


Figure 5.20 Plot width

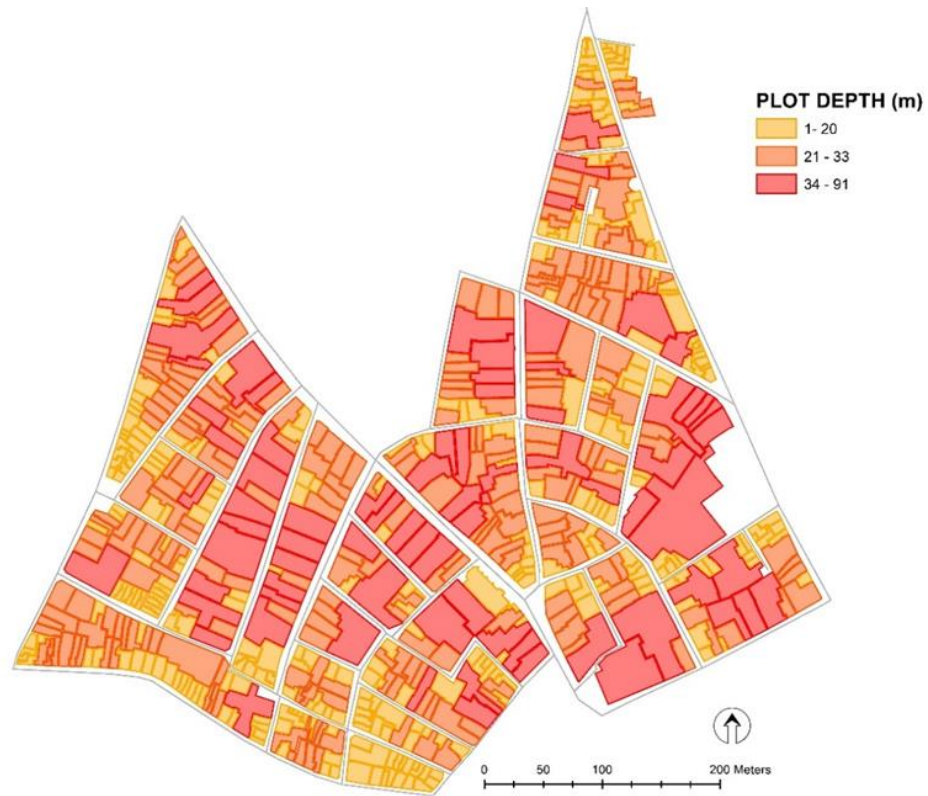


Figure 5.21 Plot depth



Figure 5.22 Regions for plot layout

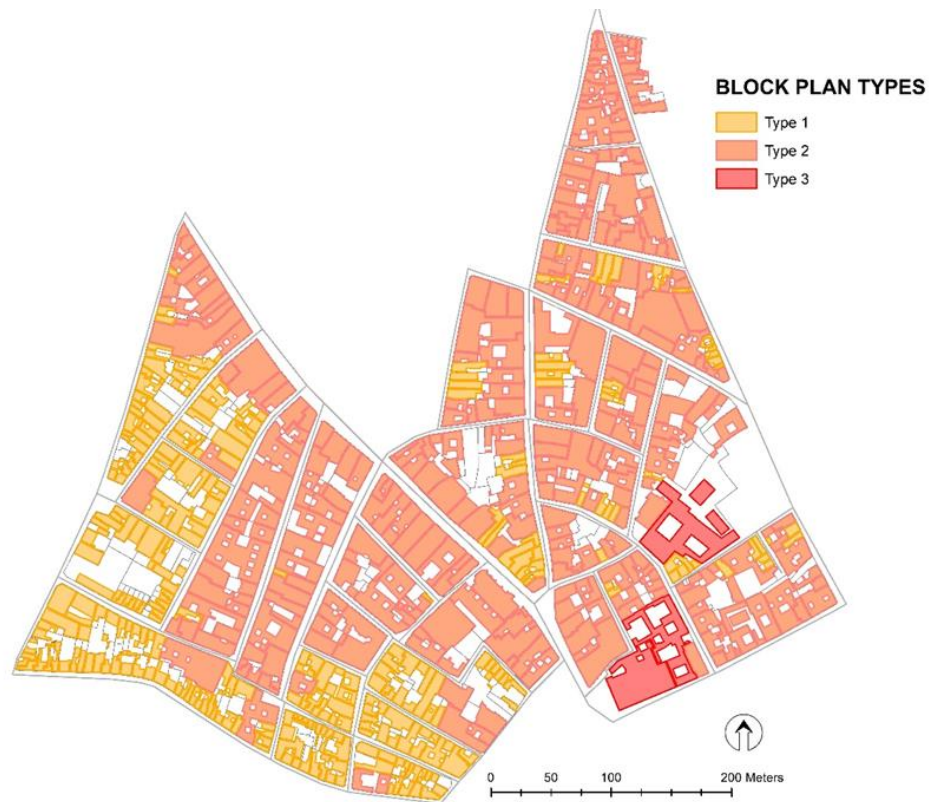


Figure 5.23 Building block-plan types

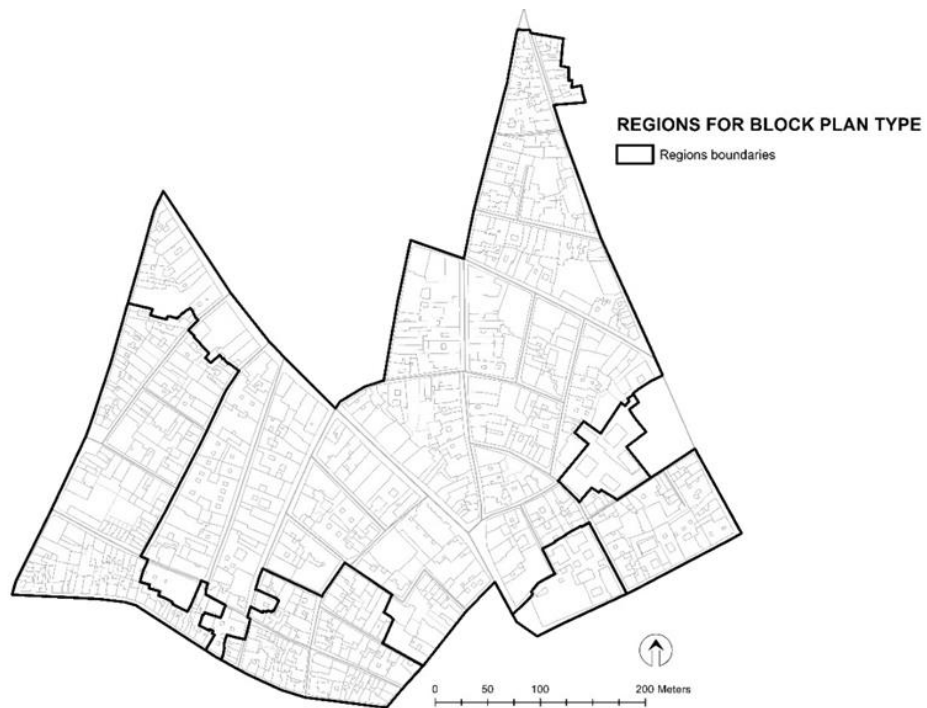


Figure 5.24 Regions for building block-plan types



Figure 5.25 Land and building utilization



Figure 5.26 Regions for land and building utilization



Figure 5.27 Different block-plan types of Antequera (Google Earth, 2020b)



(1)



(2)



(3)



(4)

Figure 5.28 Buildings with different uses: (1) Residential, (2) Residential with commercial uses and local services, (3) Educational, and (4) Religious (Google Earth, 2020b)

Figure 5.25 shows the current distribution of land and building utilization. It identifies the residential, residential with commercial uses and local services, residential with institutional uses, commercial uses and local services, educational, institutional, one ruined plot which does not have an active function (see Figure 5.28). Southwest of the area is mainly residential. The northwest of the area consists of mainly residential with commercial uses and local services. Particularly, both sides of Calle Infante don Fernando, Calle Diego Ponce, Calle Lucena, and Calle Calzada have a high number of residential buildings with commercial uses. The pattern of land and building utilization constitutes the basic map for second-order morphological regions (see Figure 5.26). These three maps, plot layout, block-plan types and land and building utilization together provide a basis for regionalization of different characters of urban landscape based on the town-plan.

5.4.2.2. Morphological regions: second-order

The map of second-order morphological regions is a product of the superimposition of three criteria: plot layout, building block-plan type, and land and building utilization. Three maps based on these criteria (Figures 5.22, 5.24 and 5.26) are overlapped, providing the boundaries for second-order regions. The three intermediate maps have almost the same importance.

Ten second-order regions are identified in Calle Infante (see Figure 5.29). These are Housing - Small plots (south), Housing - Small plots (North), Housing - Medium plots (North), Housing - Medium plots (South), Housing - Medium plots (west), Mixed use - Small plots, Mixed use - Medium plots (East), Mixed use - Medium plots (Centre), Fringe Belt Features: Institutional, and Fringe Belt Features: Religious (see Figure 5.29). Five regions are only residential. Three of the regions have mixed uses, having residential with commercial uses and local services. Two regions have fringe belt features, with religious and institutional functions.

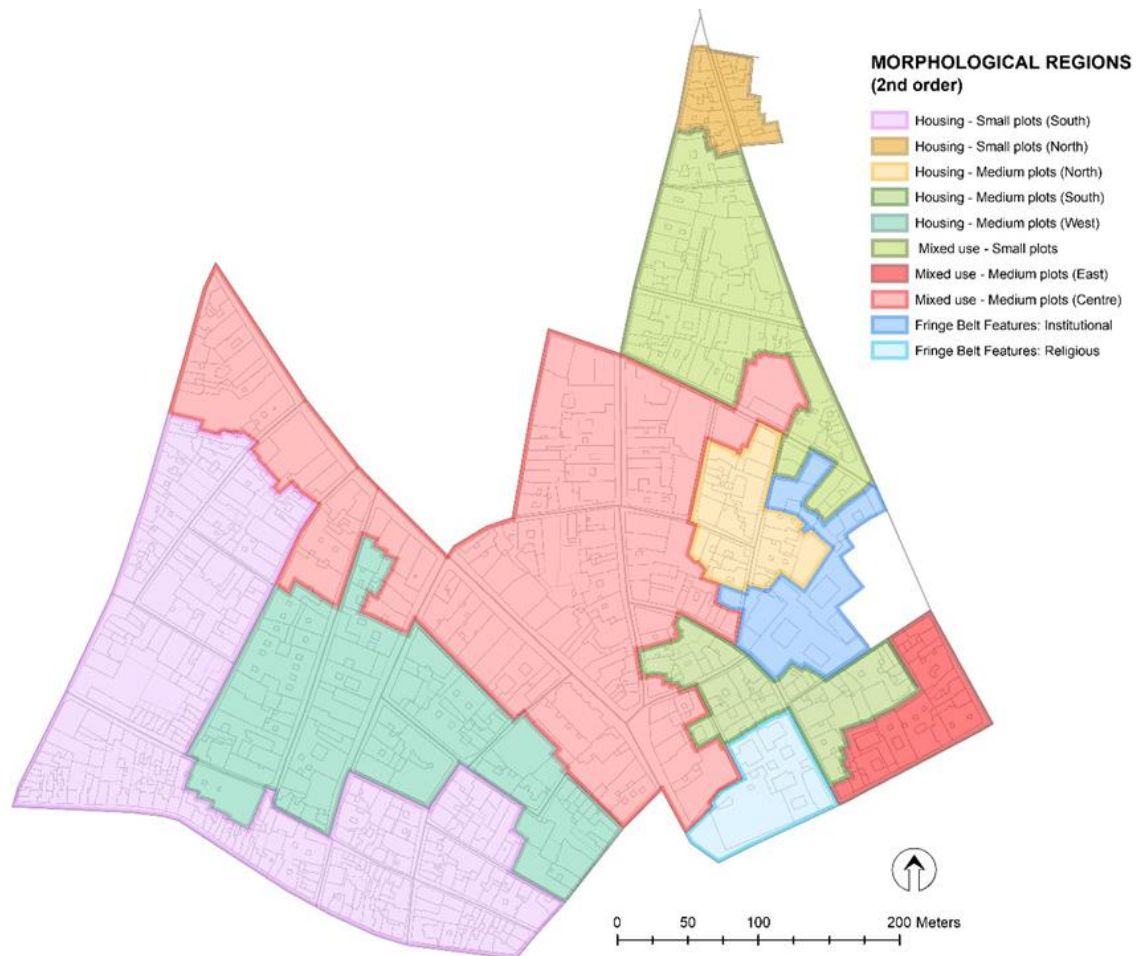


Figure 5.29 Second-order morphological regions of Antequera

Housing - Small plots (south) has small size, narrow and medium width, and short plots. This region has residential utilization and illustrates the Type 1 of block-plan type. Housing - Small plots (North) has a layout with small size, narrow and short plots. It illustrates Type 2 and residential character. The character of Housing - Medium plots (North) corresponds medium plot size and width, and short plot depth with showing Type 2 block plan type and residential function. Housing - Medium plots (South) and Housing - Medium plots (west) have similar character in terms of plot layout, block plan type and land and building utilization: medium size and width, medium and long plot depth, and Type 2 block plan type. The characteristics of the region Mixed use - Small plots are small plot size, medium plot width and depth, Type 2 block plan type, and the utilization of residential with commercial uses and local services. The regions Mixed use - Medium plots (East) and Mixed use - Medium plots (Centre) have common characteristics. They have medium plot size and width, medium and long plots, Type 2 block plan type, and utilization of residential with commercial uses and local services. Differently from Mixed use - Medium plots (Centre), Mixed use - Medium plots (East) includes narrow plots, too. Two regions demonstrating fringe belt features are Fringe Belt Features: Institutional, Fringe Belt Features: Religious. The initial one includes a religious building and an educational building in addition to institutional uses. It has large plot size, medium and large plot width, and long plots. It shows Type 3 block plan type different than the other regions. The latter region has similar characteristics with the initial one. The only difference is that this region has religious use (see Table 5.4).

Table 5.4 Characteristics of second-order morphological regions of Antequera

Regions	Plot layout			Building block-plan type	Land and building utilization
	Area	Width	Depth		
Housing - Small plots (South)	Small	Narrow, medium	Short	Type 1	Residential
Housing - Small plots (North)	Small	Narrow	Short	Type 2	Residential
Housing - Medium plots (North)	Medium	Medium	Short	Type 2	Residential
Housing - Medium plots (South)	Medium	Medium	Medium, long	Type 2	Residential
Housing - Medium plots (west)	Medium	Medium	Long	Type 2	Residential
Mixed use - Small plots	Small	Medium	Medium	Type 2	Residential with commercial uses and local services
Mixed use - Medium plots (East)	Medium	Medium, narrow	Medium, long	Type 2	Residential with commercial uses and local services
Mixed use - Medium plots (Centre)	Medium	Medium	Medium, long	Type 2	Residential with commercial uses and local services
Fringe Belt Features: Institutional	Large	Medium, large	Long	Type 3	Institutional
Fringe Belt Features: Religious	Large	Medium, large	Long	Type 3	Religious

Table 5.5 Contribution of criteria (plot layout, building block-plan type, land and building utilization)

Criteria	Sub-criteria	Contribution
Plot layout	Plot area	High
	Plot width	Medium
	Plot depth	Low
Building block-plan type	-	High
Land and building utilization	-	High

The contribution of criteria used for second-order regions is presented in Table 5.5. Plot area has a high contribution to the hierarchy, plot width has a medium contribution, and plot depth has a low contribution. Building block-plan type had a high contribution. Land and building utilization had a high contribution.

5.4.3. CALLE INFANTE - THIRD ORDER

5.4.3.1. Material: architectural style, land and building utilization

Two criteria are addressed for third-order analysis, architectural style and land and building utilization. The map of architectural style is prepared based on the general characteristics of buildings. Five distinctive architectural styles are identified in Antequera (Figure 5.30). The first is contemporary buildings, gathering a reasonable number of buildings in the area (Figure 5.31). The second is traditional ordinary buildings, in which function is related to life activities and dwelling (Figure 5.31). The third is traditional special buildings (Figure 5.31). Special buildings are the non-residential parts of the built environment, including the building types where the housing function is secondary to that which gives rise to the specialization of the type. The fourth is the 16th -17th century churches (Figure 5.31). Finally, the fifth is ruins, which are not proper to identify as a distinct architectural style. There is only one building within this class. Land and building utilization is the second criterion for the third-order analyses (Figure 5.26). The usages, which are not legible at the upper scale, are considered for third-order regionalization. This map provides a small contribution to the third-order regions.

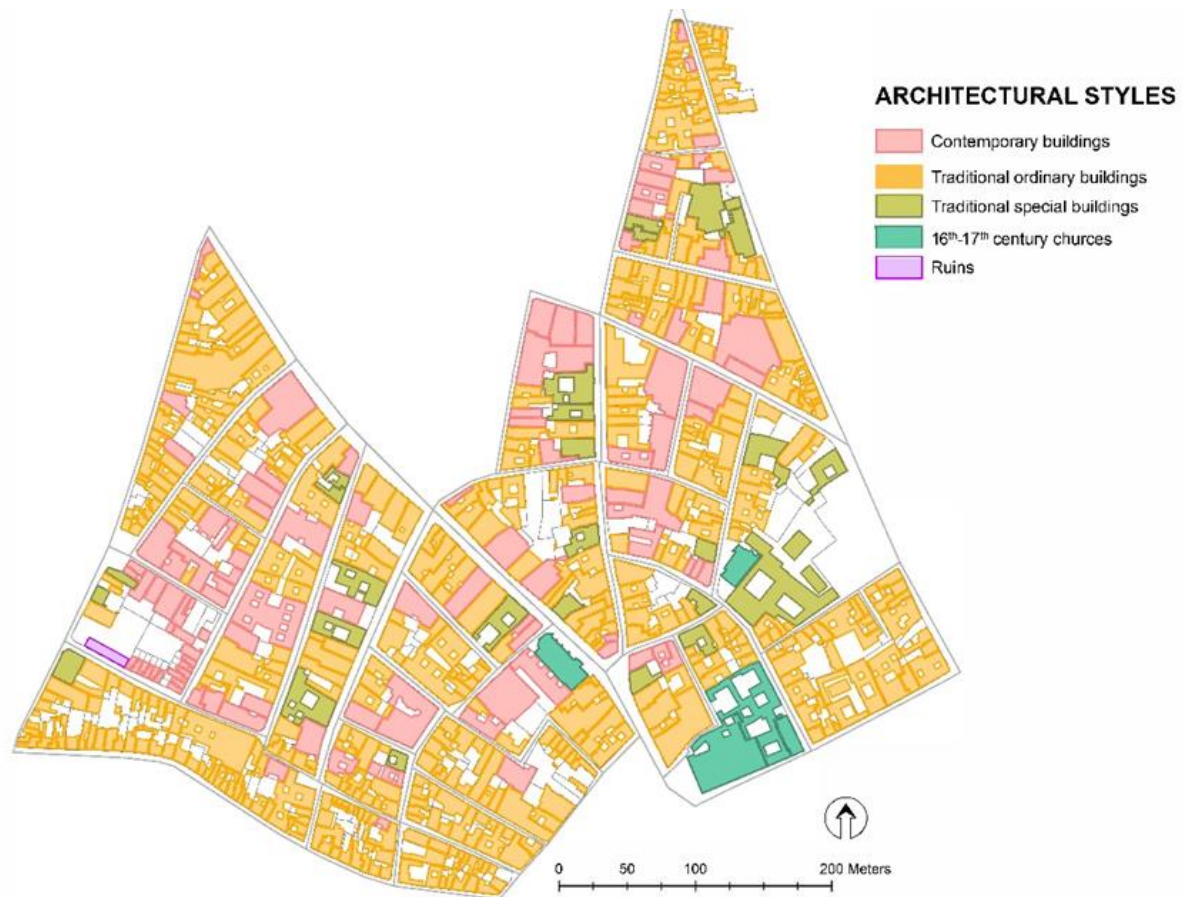


Figure 5.30 Architectural styles



(1)



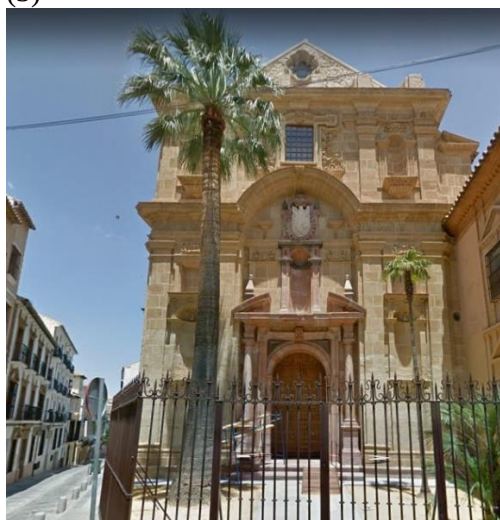
(2)



(3)



(4)



(5)



(6)

Figure 5.31 Buildings with different architectural styles: (1) and (2) traditional ordinary buildings, (3) Traditional special buildings, (4) contemporary buildings, (5) 16th – 17th century buildings, (6) Ruins (Google Earth, 2020b)

5.4.3.2. Morphological regions: third-order

The identification process of third-order regions is based on two criteria: architectural style, and land and building utilization. Only seven second-order regions are divided into third-order regions. In third-order analysis, instead of the superimposition of the criteria to identify morphological regions, each criterion is applied one-by-one. Firstly, architectural styles are delimited where they constitute similar group of buildings. Secondly, land and building utilization is addressed. In third-order regionalization, architectural style and land and building utilization had a strong relationship. In other words, different utilizations matched with architectural styles in lower-order analyses. The contribution of each criterion is identified in Table 5.6. The architectural style contributed high to the hierarchy of third-order regions, and building utilization supported low the hierarchy of regions. In Figure 5.32 second-order regions are tagged in Roman numbers, and third-order regions are tagged in Arabic numerals. Where the second-order regions are not divided, it is only tagged in Roman numbers.

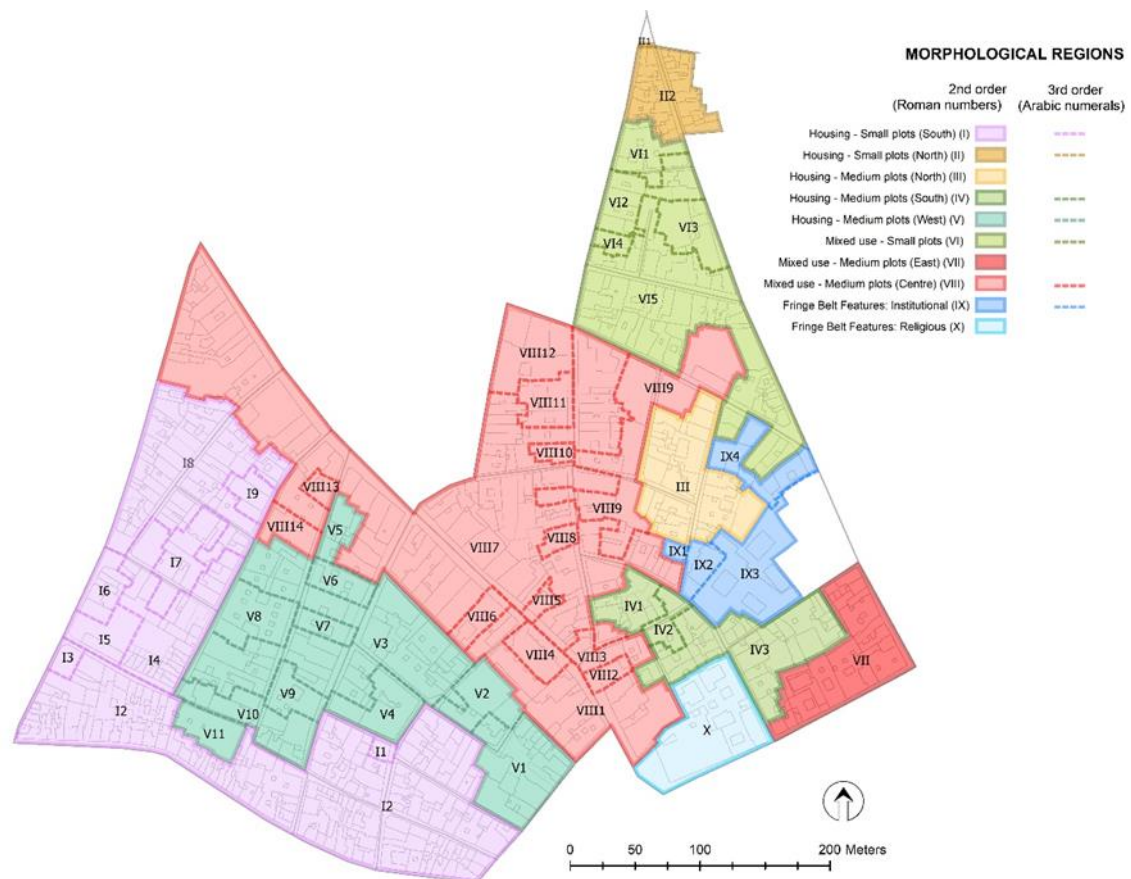


Figure 5.32 Third-order morphological regions

Table 5.7 identifies the main characteristics of third-order regions. It includes the regions' names, architectural style, and land and building utilization. On this basis, except the regions 'Housing – Medium plots (North)', 'Mixed use – Medium plots (East)', and 'Fringe Belt Features: Religious', all other morphological regions have third-order subdivisions. There were no distinguishable features based on architectural style, and land and building utilization to subdivide these three regions. The Mixed use – Medium plots (Centre) region particularly had a great differentiation on both sides of 'Calle Lucena and

Calle Infante' based on architectural style. The region Housing – Medium plots (West) also has an important division based on contemporary buildings and traditional special buildings.

Table 5.6 Contribution of criteria (land and building utilization and architectural style)

Criteria	Contribution
Architectural style	High
Land and building utilization	Low

Table 5.7 Characteristics of third-order morphological regions of Antequera

Regions	Architectural style	Land and building utilization
I1	Traditional special buildings	Residential
I2	Traditional ordinary buildings	Residential
I3	Traditional special buildings	Residential
I4	Contemporary buildings	Residential
I5	Ruins	Ruins
I6	Traditional special buildings Traditional ordinary buildings	Institutional Commercial uses and local services
I7	Contemporary buildings	Commercial uses and local services
I8	Traditional ordinary buildings	Residential
I9	Contemporary buildings	Residential
II1	Traditional special buildings	Institutional
II2	Traditional ordinary buildings	Residential
IV	Traditional ordinary buildings	Residential
IV1	Traditional ordinary buildings	Residential
IV2	Traditional special buildings	Residential
IV3	Traditional ordinary buildings	Residential
V1	Traditional ordinary buildings	Residential
V2	Contemporary buildings	Residential
V3	Traditional ordinary buildings	Residential
V4	Contemporary buildings	Residential with commercial uses and local services
V5	Traditional ordinary buildings	Residential
V6	Traditional special buildings	Institutional
V7	Traditional special buildings	Institutional
V8	Contemporary buildings	Residential with commercial uses and local services
V9	Traditional special buildings	Institutional
V10	Traditional ordinary buildings Contemporary	Residential
V11	Traditional ordinary buildings	Residential
VI1	Traditional ordinary buildings	Residential with commercial uses and local services
VI2	Contemporary buildings	Residential with commercial uses and local services
VI3	Traditional special buildings	Institutional
VI4	Traditional special buildings	Institutional
VI5	Traditional ordinary buildings	Residential with commercial uses and local services
VII	Traditional ordinary buildings	Residential with commercial uses and local services

Table 5.7 Characteristics of third-order morphological regions of Antequera (continued)

Regions	Architectural style	Land and building utilization
VIII1	Traditional ordinary buildings	Residential with commercial uses and local services
VIII2	Traditional special buildings	Institutional
VIII3	Contemporary buildings	Residential with commercial uses and local services
VIII4	16 th -17 th century churches	Religious
VIII5	Traditional special buildings	Residential
VIII6	Traditional special buildings	Institutional
VIII7	Traditional ordinary buildings	Residential with commercial uses and local services
VIII8	Traditional special buildings	Institutional
VIII9	Contemporary buildings	Residential with commercial uses and local services
VIII10	Traditional special buildings	Institutional
VIII11	Traditional special buildings	Institutional
VIII12	Contemporary buildings	Residential with commercial uses and local services
VIII13	Traditional special buildings	Institutional
VIII14	Contemporary buildings	Residential with commercial uses and local services
IX1	Traditional special buildings	Institutional
IX2	16 th -17 th century churches	Religious
IX3	Traditional special building	Educational
IX4	Traditional special buildings	Institutional
X	16 th -17 th century churches	Religious

5.4.4. CALLE INFANTE - FOURTH ORDER

5.4.4.1. Material: building material and height

Building material and height are two fundamental criteria to develop the fourth-order analysis. This last step of morphological regionalization is based on the division of third-order regions into fourth-order regions, addressing the most detailed features of buildings. In Calle Infante there are three main building materials: brick, masonry, and stone. Figure 5.33 presents the distribution of different materials in the area. The first is a residential building with masonry. The second is a traditional building made of brick. The third is the church of *Parroquia San Sebastian* in the San Sebastian square. This church is in the heart of the city. Most buildings in the area are made of masonry. Few buildings are made of brick, and three religious buildings are made of stone. The map of building height is categorised into six classes ranging from 1 to 6 storeys (Figure 5.34) Figure 5.36 presents buildings with different heights. A large percentage of buildings have 2 and 3 storeys. Buildings with 4 and 5 storeys are less. Buildings with 1, 5 and 6 storeys are in a small percentage. Building height is a substantial aspect of morphological regionalization. When other applications of the concept address the building fabric, they mostly do not include the height of buildings.

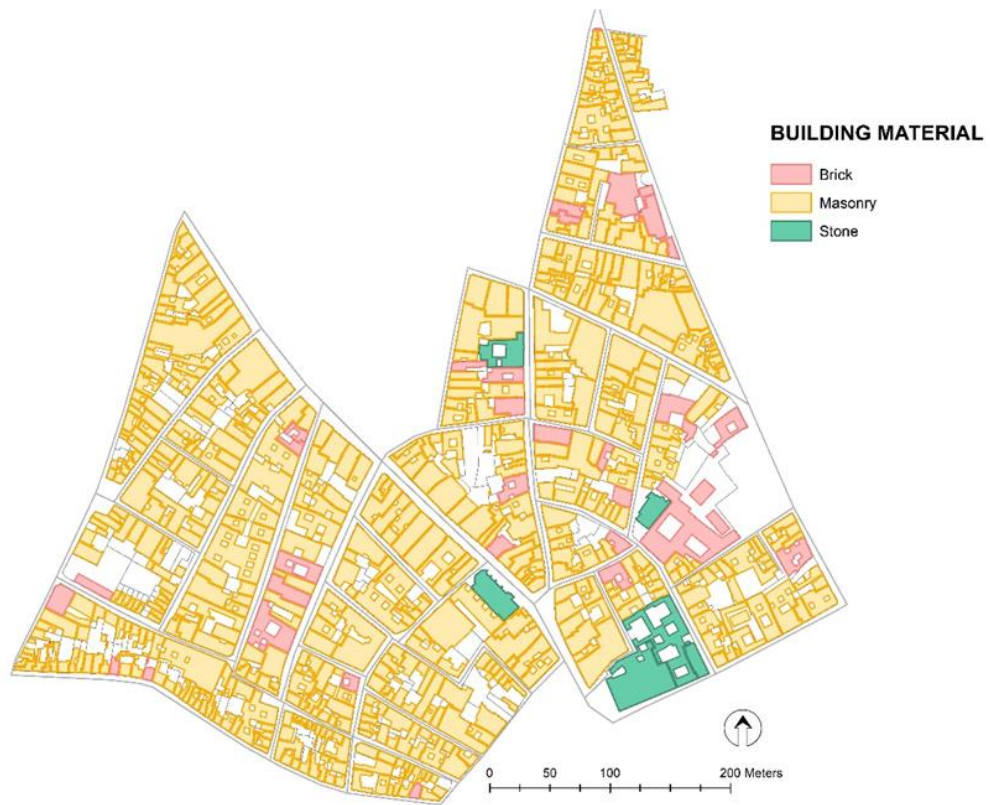


Figure 5.33 Building material

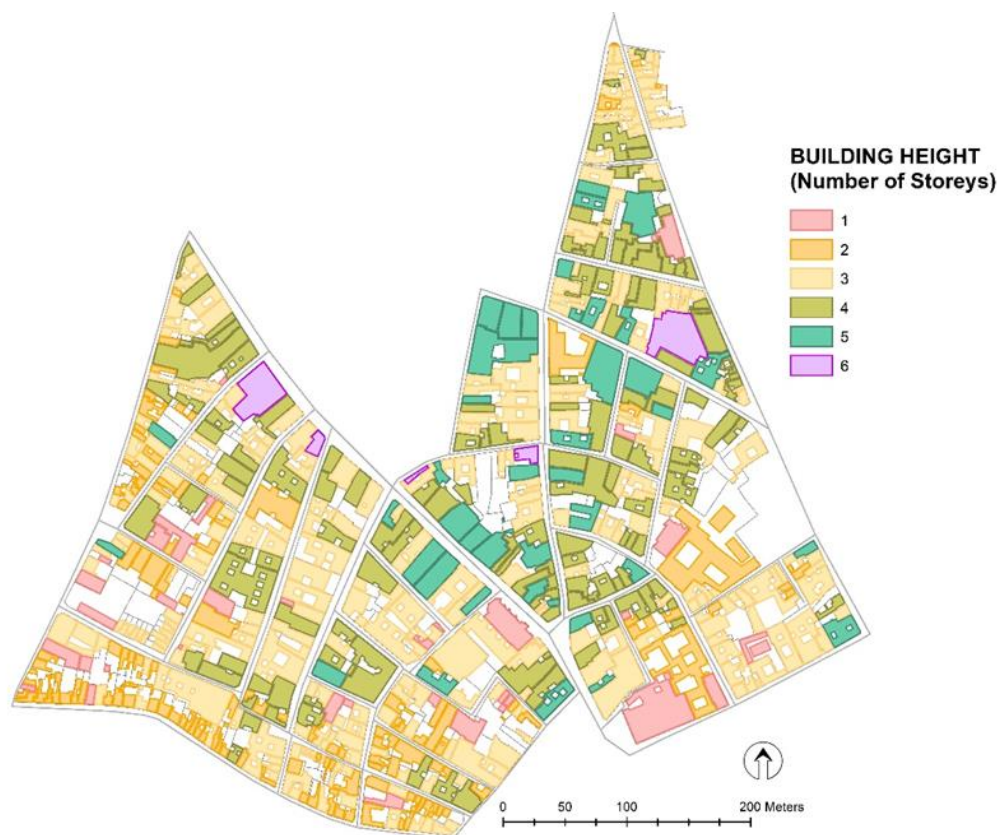


Figure 5.34 Building height



(1)



(2)



(3)

Figure 5.35 Buildings with different materials: (1) masonry, (2) brick, (3) stone (Curioso, 2015; Google Earth, 2020b)



(2 storey)



(3 storey)



(4 storey)



(5 storey)

Figure 5.36 Buildings with different heights (Google Earth, 2020b)

5.4.4.2. Morphological regions: fourth-order

The identification of fourth-order regions is based on building material and height. Where third-order regions have different characteristics in terms of material and height, fourth-order regions are identified. Instead of matching the maps of building material and height, each criterion is applied one by one to establish the fourth-order morphological regions. Firstly, the building material is applied, and then, building height. This implementation sequence comes from the importance of characteristics of buildings for the area. Table 5.8 shows the contribution of each criterion to the hierarchy of morphological regions. Building material contributed high, building height contributed less.

The implementation of these two criteria divided third-order morphological regions into fourth-order regions (Figure 5.37). In this map, second-order regions are tagged in Roman numbers, third-order regions are tagged in Arabic numerals, and fourth-order regions are tagged in small letters. Five third-order regions are subdivided into fourth-order regions. These are respectively Housing - Small plots (South), Housing - Medium plots (west), Mixed use - Small plots, Mixed use - Medium plots (East), and Mixed use - Medium plots (Centre). Table 5.9 shows the characteristics of fourth-order morphological regions based on building material and height.

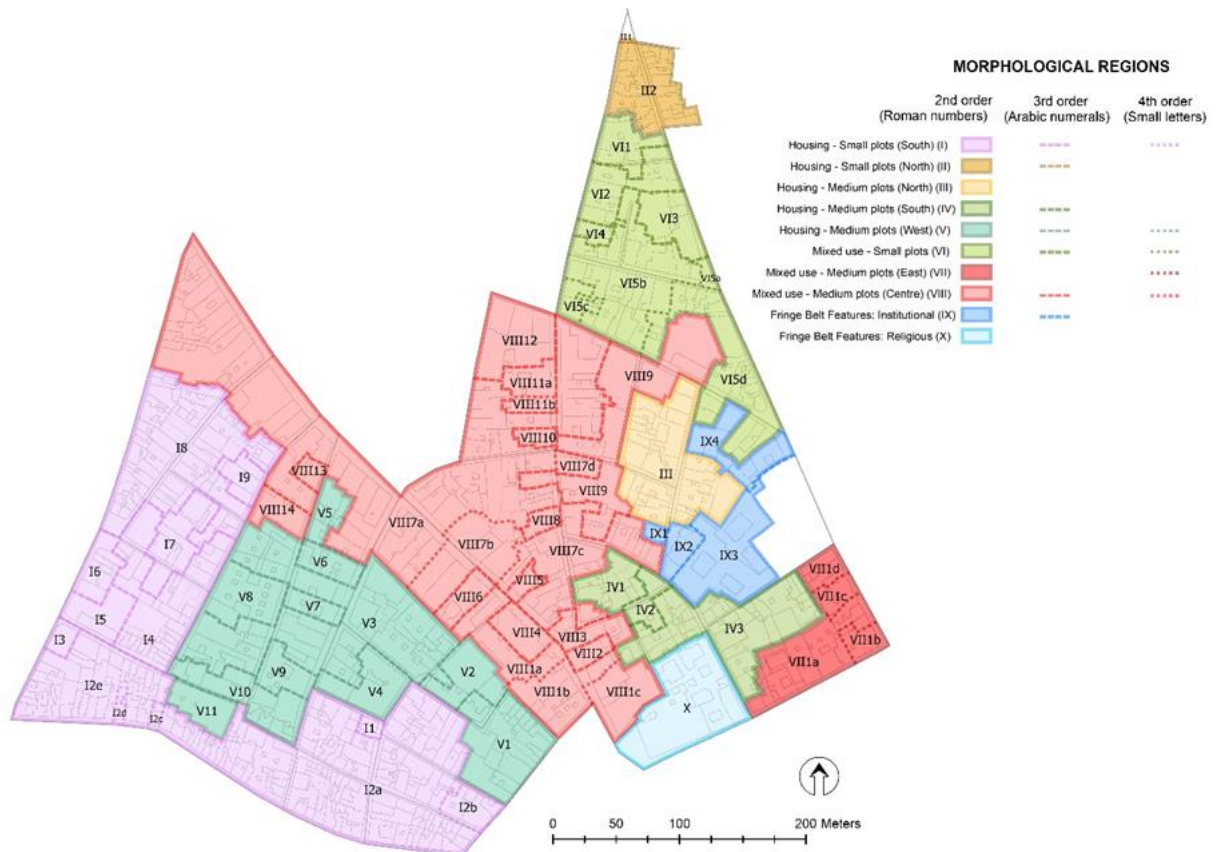


Figure 5.37 Fourth-order morphological regions of Antequera

Table 5.8 Contribution of criteria building material and height

Criteria	Contribution
Building material	Medium
Building height	Low

Table 5.9 Characteristics of fourth-order morphological regions

Regions	Building material	Building height (number of storeys)
I1	Brick	3
I2a	Masonry	2 and 3
I2b	Masonry	4
I2c	Brick	2
I2d	Brick	2
I2e	Masonry	2
I3	Brick	3
I4	Masonry	3
I5	Brick	1
I6	Masonry	3
I7	Masonry	1 and 2
I8	Masonry	2 and 3
I9	Masonry	4
II1	Brick	1
II2	Masonry	3
III	Masonry	3 and 4
IV1	Masonry	4
IV2	Brick	4 and 5
IV3	Masonry	3 and 4
V1	Masonry	3
V2	Masonry	3
V3	Masonry	4
V4	Masonry	3
V5	Masonry	3
V6	Masonry	3
V7	Brick	3
V8	Masonry	4
V9	Brick	3
V10	Masonry	4
V11	Masonry	3
VI1	Masonry	4
VI2	Masonry	3 and 5
VI3	Brick	4 and 5
VI4	Brick	3
VI5a	Brick	4
VI5b	Masonry	4
VI5c	Masonry	3
VI5d	Masonry	4
VII1a	Masonry	3
VII1b	Masonry	5
VII1c	Brick	3
VII1d	Masonry	3
VIII1a	Masonry	3
VIII1b	Masonry	4
VIII1c	Masonry	3
VIII2	Masonry	3
VIII3	Masonry	4
VIII4	Stone	1

Table 5.9 Continued

Regions	Building material	Building height (number of storeys)
VIII5	Brick	3
VIII6	Masonry	3
VIII7a	Masonry	3 and 4
VIII7b	Masonry	5
VIII7c	Masonry	3 and 4
VIII7d	Brick	4
VIII8	Brick	3
VIII9	Masonry	4 and 5
VIII10	Brick	3
VIII11a	Brick	3
VIII11b	Stone	3
VIII12	Masonry	5
VIII13	Brick	3
VIII14	Masonry	2
IX1	Brick	3
IX2	Stone	1
IX3	Brick	2
IX4	Brick	3
X	Stone	1 and 2

5.4.5. SYNTHESIS

This chapter presents the second application of the methodology, identifying a hierarchical order of morphological regions in the study area of Antequera. The morphological analysis reveals a spatial distinction of the physical form of the area. The representation of the maps in this chapter was based on the archival documents, the municipal online system of Antequera, and google earth. The town-plan maps have been illustrated based on the materials that provided from the municipal online system of Antequera. The morphological analysis has identified a hierarchical order of morphological regions, through the mapping the town-plan, building fabric and land and building utilization. As in the case of Istanbul, the analyses of three urban landscape components has demonstrated a great significance. The town-plan supports its role as a major contributor to the urban landscape. The secondary contributor is the land and building utilization, and the building fabric has been tertiary contributor to the townscape (The contribution of building fabric is not always like this. When the building fabric created larger homogeneous areas, it could contribute in upper orders). A four-order of hierarchy of regions has been introduced. The maps of expansion phases of the area and the streets geometry together identified first-order morphological regions.

The Calle Infante region is addressed for lower-level analyses. It allows implementing the criteria proposed for the methodology with its diversity of form. The plot layout, building block-plan type, and land and building utilization are three criteria to identify second-order regions. The contribution of plot layout, block-plan type, and land and building utilization to this identification is high. The land and building utilization (to less extent), and architectural style together yield the map of third-order regions. The land and building utilization contributed to the hierarchy in low-level. The architectural style had a higher contribution to the hierarchy. The criteria are supported the fourth-order regions are building material and height. These criteria have been applied to subdivide third-orders into fourth-orders. The contribution of building material is higher than building height.

The implementation of the methodology to Antequera has demonstrated that the establishment of morphological regions is based on the superimposition of the maps crated for first- and second-orders.

But, the illustration of third- and fourth-orders is not based on matching the maps. Each criterion is applied one-by-one. This arises from the heterogeneity of forms. In third-order regions, the architectural style and land and building utilization are applied simultaneously. In the fourth-order regions, first, building material is applied, then, building height is applied. The procedural aspects of the application into Antequera are presented in Table 5. 10 considering form complexes, persistence of form, morphological constituents, criteria, and their contribution to the hierarchy of morphological regions.

Table 5.10 Procedural aspects of the method for application to Antequera

Form complexes	Persistence	Morphological constituents	Criteria	Contribution to the hierarchy
Town-plan	Maximal	Streets	Age of streets / expansion phases	First-order
			Streets geometry	First-order
		Plots	Plot layout (area, width, depth)	Second-order
		Buildings	Block plan type	Second-order
Building fabric	Considerable	Buildings	Architectural style	Third-order
			Building height	Fourth-order
			Building material	Fourth-order
Land and building utilization	Minimal	Utilization	Utilization – general and detailed	Second- and third-orders

6

CHAPTER 6: DISCUSSION OF RESULTS

This chapter is in three parts. Firstly, Istanbul and Antequera, examined in Chapters 4 and 5, are compared to understand how the proposed methodology responds to different geographical contexts, and what is particular of these contexts and what can be generalized to other applications. Secondly, the present application of Antequera is compared with the first application to this Spanish city published by Barke (2003). Barke addressed the Special Plan for Antequera, which aims at dealing with the problems of urban conservation in the historical centre of Antequera. In this comparison, the distinctions between the two methodologies/approaches based on the concept of morphological region are explored. Thirdly, we go back to previous applications of the concept, described in Chapter 2, making explicit what is the contribution, or added value, of the proposed methodology. We address the applications that have stressed the systematization of the method, namely Conzen (1975, 1988), Barret (1996), and Bienstman (2007).

6.1 COMPARISON OF THE APPLICATIONS INTO ISTANBUL AND ANTEQUERA

The concept of morphological region has been applied into different geographical contexts since its first implementation by Conzen (1960) in Alnwick. While it has been mostly applied into European cities, it was also disseminated into Asia, North America, and Oceania over last decades. The concept proved to be quite robust in these applications into different geographical contexts.

Istanbul is one of the largest cities in the world and has more than 1500 years of a singular urban history. The Andalusian city of Antequera is a centrality in Malaga Province, Spain. These are two very different cities. The population in Istanbul is much higher than in Antequera: the former is around sixteen million; the latter is about 41.300 (380 times higher). Istanbul has been the land of three main empires; Byzantine, Roman and Ottoman. Antequera was also the land of Romans, Muslims, and Catholics. In this regard, both cities have a long-established history, and cultural and historical values.

In terms of data, the process of obtaining information for the application of the methodology was not as easy as expected. Historical data for Istanbul is mainly gathered from libraries and online sources, recording information for the city. Historical maps and base maps (streets, plots, and buildings) were obtained from the local authority of Istanbul and online sources. Other information resulted from fieldwork (March 2019). Historical data and maps for Antequera were mainly obtained from online sources. Here, the book about the ‘Special Plan for Antequera’ has been one of the most important sources. The base maps were acquired from the QGIS plug-in ‘Spanish Inspire Cadastral Downloader’. This proved to be an important advantage.

In terms of the study area, in Istanbul, the main area of urban landscape significance was an important part of the old city, delimited by Theodosian walls and the River of Golden Horn, and underwent great changes after the establishment of the Republic. The boulevard of Ataturk and the *Fevzi Pasha* street are the other two axes delimiting the area. In Antequera, the main area of urban landscape significance was the 16th century area, including the ancient street of Calle Infante Don Fernando, associated with the first phase of the Roman and Muslim's period.

The character of the urban landscape in the two study areas derived from the unique combination of the three townscape form complexes (the town-plan, building fabric, and land and building utilization), which was the material expression of particular socio-economic and cultural contexts of specific morphological periods within the two cities. Separate analysis of the three form complexes, based on a set of criteria, formed the basis for the process of delimitation of morphological regions. This involved the detailed analysis of the nature and timing of the development and transformation of the town-plan, using cartographic evidence backed up by documentary sources. Of the three analyses, the study of the town-plan proved to be the most important for the identification of regions of urban landscape significance. The role of the town-plan in containing the other form complexes, and its persistence, confirmed its predominance in a hierarchy of form persistence.

In Istanbul, the town-plan is made of larger morphological regions. This is particularly related to the data obtained. For example, we have acquired more detailed historical data about Antequera in terms of expansion phases and the subsequent changes in the town-plan. Despite many interventions in Istanbul, there are no tangible and detailed sources about changes and redevelopments in some historical periods. The building fabric is more legible in Antequera than in Istanbul. In Antequera, it constitutes more homogeneous areas, while in Istanbul the complexity of building fabric is higher. This stems from the changes and continuous interventions in the area, which has occurred in course of the time. Land and building utilization has more identifiable patterns in Istanbul than in Antequera. In particular, land and building utilization for first-order regionalization was more apparent in Istanbul.

In both cities, the criteria-based methodology – the combination of a set of criteria on the town-plan, building fabric, and land and building utilization – has been employed. In Istanbul and Antequera, seven common criteria, and one independent criterion for each of these, were established. The common criteria are as follows: i. street age/expansion phases, streets geometry, plot layout – based on the town-plan; ii. architectural style, building material, and building height – based on the building fabric; and iii. land and building utilization. In addition, building coverage is employed in the identification of morphological regions in Istanbul, and the building block-plan is considered in the establishment of regions in the urban landscape of Antequera.

The first criterion of the methodology, which reveals the historical expressiveness of the urban landscape, is applied into the two cities in different ways. In Istanbul, a set of historical maps are analysed to obtain the age of streets. The regionalization of this criterion is based on the map of streets age. In Antequera, the expansion phases are addressed to regionalize the historical expressiveness of the urban landscape. This difference stems from the availability of data collected from archives of local authorities and online sources. In terms of streets geometry, Antequera has more distinctive street patterns than Istanbul. The establishment of regions is carried out by the superimposition of two maps in both areas: age of streets and streets geometry. There is a difference between the number of regions in both areas. Although Istanbul area (Fatih) is larger than Antequera area (historical centre), the number of morphological regions is higher in Antequera than in Istanbul. In Istanbul, ten morphological regions are established, in Antequera, fifteen regions are identified. This somehow reveals how urban spaces are related – higher in Istanbul. The process of character delimitation was more simple in Antequera than in Istanbul, due to the high complexity of form in the Turkish city.

Two criteria were used for identifying the second-order regions of the Istanbul area (Pantokrator Porta Puteae): plot layout, and land and building utilization. Three criteria were used in identifying regions in the Antequera area (Calle Infante): plot layout, building block-plan type, and land and building utilization. The use of the building block-plan type in Antequera is due to the more precise distinguishable form of block-plans in the Spanish city. Plot area has been the most important sub-criterion within the plot layout. Land and building utilization contributed more to the hierarchy of regions in Istanbul than in Antequera, particularly for the identification of second-order regions. Building block-plan type has been an important element in the establishment of regions in Antequera, providing an additional perspective in relation to buildings. The second-order regions in Istanbul present more intricate boundaries.

Third-order morphological analysis explores further details in the character of the urban landscape, according to the hierarchy of form complexes. Four criteria are used in Istanbul. These are as follows: i. plot layout and building coverage – based on town-plan; ii. architectural style – based on building fabric; and iii. land and building utilization. Here, the three types of form complexes are addressed for the identification of regions. In Antequera, only two criteria are considered: architectural style, and land and building utilization. In Istanbul, plots are quite complex to be addressed in only one order (they were employed in describing three orders). Building coverage was only relevant in Istanbul. The architectural style has been the most important element in defining third-order regions in both cities. It can be argued that this is one of the most substantial aspects of the character of the urban landscape.

Building material and height are two criteria for the delineation of fourth-order regions in Istanbul and Antequera. Building material provided a stronger contribution to the hierarchy in Istanbul than in Antequera. In terms of building height, Istanbul is more complex than Antequera.

The implementation of the methodology in both cities provided an important basis for the delimitation of regions and character assessment of the urban landscape. The complex nature of the urban landscape in both areas, created by the transformation of the town-plan and long-term building replacement, was revealed in the morphological analysis, and was reflected in a high number of morphological regions. The application of the methodology into two cities, with different needs, showed that there is no requirement to include all criteria defined in Chapter 3. Indeed, each case would have some criterion different than the other: in Istanbul, the building block-plan type and the position of buildings are not included; in Antequera, the building coverage and the position of buildings are excluded. The position of building is excluded for both cases – this is because the two areas were historical areas of cities and the position of all buildings was almost the same.

For the first- and second-order morphological regions, the maps are superimposed to create the regionalization. But, for third- and fourth-order regions, each criterion is applied one-by-one, in both cases. In addition to common contributions of form complexes to the hierarchy of morphological regions, the contribution of the town-plan, and land and building utilization in Istanbul was slightly higher than in Antequera. Both areas shared similar contributions of building fabric to the hierarchy of morphological regions. The delineative tables included in Chapters 4 and 5, based on proposed criteria and form complexes, for each order of morphological regions, contributes to the character assessment of the areas. In Antequera, the methodology is implemented in a simpler, more definitive, and delineative way. The high complexity of the urban landscape of Istanbul increased the difficulty of the implementation of the methodology. Table 6.1 presents the procedural aspects of the methodology for the application of Istanbul and Antequera.

Table 6.1 Procedural aspects of the method for the application of Istanbul and Antequera

Form complexes	Persistence	Contribution to the hierarchy	Morphological constituents	Criteria	Applicability of criteria in Istanbul	Applicability of criteria in Antequera
Town-plan	Maximal	High Intermediate Low	Streets	Age of streets / expansion phases	Yes	Yes
				Streets geometry	Yes	Yes
			Plots	Plot layout (area, width, depth)	Yes	Yes
			Buildings	Building block-plan type	No	Yes
				Building coverage	Yes	No
				Position of buildings	No	No
Building fabric	Considerable	Intermediate Low	Buildings	Architectural style	Yes	Yes
				Building height	Yes	Yes
				Building material	Yes	Yes
Land and building utilization	Minimal	Intermediate	Utilization	Utilization – general and detailed	Yes	Yes

6.2 COMPARISON OF THE TWO APPLICATIONS INTO ANTEQUERA

The historical centre of Antequera has been the object of a regionalization two decades ago. Back then, Barke (2003) has pointed out a number of weaknesses in this process: the methodology used in Antequera to define homogeneous areas lacked the identification of a hierarchy of morphological divisions derived from the degree of coincidence between the three ‘form complexes’. The degree of homogeneous areas unity was less apparent than it would be in a Conzenian methodology. The notion of a hierarchy of divisions was not formally recognized, nor was the principle of morphogenetic priority.

The selection of Antequera as a second case study is an additional way of validating the robustness of the methodology proposed in this thesis. The methodology described in Barke (2003) was used to deal with the problems of urban conservation in Antequera. The methodology was adopted by the Special Plan for Antequera and has a resemblance to that formulated by Conzen (1975, 1988) in identifying morphological regions as the starting point for the management of the urban landscape.

The next paragraphs offer a methodological comparison. Firstly, this thesis discusses a proposal that aims at strengthening the methodological procedures of Conzenian morphological regionalization. Barke (2003) describes a methodology that has a correspondence to the Conzenian approach, but lacks the methodological sophistication of the Conzenian formulation. Both studies focus on the historical nucleus of Antequera, assessing the character of that urban landscape. There are a few common criteria, and a set of different criteria. In this thesis eight criteria, on the basis of three form complexes, are used for the establishment of regions: the age of streets /expansion phases, streets geometry, plot layout, block plan type, architectural style, building material, building height, and land and building utilization. In the Special Plan, two broad sets of criteria were used in defining the homogeneous areas: morphological and functional criteria. The former includes the size and shape of plots, stage of historical development of the town-plan, architectural style of buildings, quality of buildings, their state of conservation, and the degree of transformation and change from the original structure. The functional uses: are residential with commercial use and local services; residential with city-wide services; institutional, and city and regional services; residential with institutional and city and regional services; areas of tourist interest and residential; and finally, industrial use.

In this thesis, fifteen first-order regions are identified within the historic nucleus of Antequera. One first-order region, Calle Infante, is selected and addressed for the identification of second-, third- and fourth-order morphological regions. Twenty-two homogeneous areas of varying size and character were defined by the Special Plan. In both studies, the three form complexes (town-plan, building fabric, and land and building utilization) are used for the identification of morphological regions. The boundaries of first-order regions described in this thesis are based on two criteria (other criteria are employed for the identification of lower-orders). The boundaries of homogeneous areas of the Special Plan are based on six morphological and six functional criteria. The approach in this thesis involves the identification of a hierarchy. In the Special Plan the approach involves mapping and superimposing each of the morphological criteria and each of the functional criteria to identify distinct areas, with no hierarchy. An urban landscape needs to be managed with the required enhancement strategies to the interventions at different levels of scale. In this regard, the character assessment or delimitation for urban landscape management should follow the hierarchy of form complexes, the hierarchy of historical stratification, and the hierarchy of form persistence, by describing the constituent elements through the levels of resolution. This means that some individual buildings that have architectural, cultural, or symbolic significance may gain special protection by delimiting lower-order morphological regions based on the building fabric. A hierarchical mapping provides more insights into the geographical and historical nature of the urban landscape.

When compared with the Special Plan, this thesis attributed more weight to the town-plan. The town-plan contains three distinct complexes of plan elements: (i) streets and their arrangement in a street system; (ii) plots and their aggregation into street blocks; and (iii) buildings or, more precisely, their block-plans (Conzen, 1960). Considering the three elements constituting the town-plan, streets (and all other parts of the system of public space) have a higher permanence in time, as they represent the most significant economic effort of a society in the process of city-building. The layout of streets can last for centuries, even surviving natural catastrophes and human-made disasters. Streets support the different flows of a city, allowing access to the different plots, buildings, and activities of the urban system. In this sense, each street would be important by itself and by its relationships with other streets, both in the immediate surroundings and in the whole urban system (Oliveira, 2021c; Hillier and Hanson, 1984; Hillier, 2007; Marshall et al., 2018). In the Special Plan, the morphological criteria and functional criteria were given equal status.

The implementation process in the Special Plan remained elusive. It does not provide a clear implementation way for establishing homogeneous areas. On the contrary, the application in this thesis deals explicitly with the methodological procedures and their implementation step-by-step. It addresses all processes of morphological analyses by mapping all criteria and their superimposition. Table 6.2 offers a synthesis of the differences and similarities between the two applications to Antequera, highlighting the most important aspects.

Table 6.2 Differences and similarities between the two applications to Antequera

Proposed methodology	Special Plan
One of the key concerns is strengthening the methodological procedures	The method has a resemblance to the Conzenian formulation
It aims at assessing the character of the urban landscape	It aims at assessing the character of the urban landscape
Eight criteria are used	Two broad sets of criteria are used: morphological criteria (six), and functional criteria (six)
15 first-order regions are identified	22 homogeneous areas are identified
Three form complexes are used for the delimitation	Three form complexes are used for the delimitation
First-order regions are based on two general criteria	Homogeneous areas are based on twelve criteria in total
Hierarchical mapping	No hierarchy
The contribution of the town-plan is stronger	Criteria have equal weight
The implementation process is addressed step-by-step	The implementation process remains elusive

Figure 6.1 shows the superimposition of the morphological regions of the two applications into Antequera. In the proposed methodology, the character of first-order regions reflects the many preceding years of the city's outward physical growth and changes in the urban landscape. These regions have a strong linkage to the historico-geographical framework by including the stratification of the city. It is a framework that provides a strong basis for heritage protection grounded on the historico-geographical unity of what is being protected. The boundaries of the regionalization of the Special Plan, in contrast, does not demonstrate the role of historical stratification vigorously, although the stage of the historical development of the town-plan is identified as one of the criteria.

The boundaries of both regionalizations have a common ground in a few delimitations, and do differ in most of regions. One of the reasons for this is the number of criteria used. In the Special Plan regions are identified in one level by superimposing morphological and functional criteria. On the contrary, the proposed methodology addresses only two criteria (expansion phases and streets geometry) which demonstrates the strong contribution of historico-geographical emphasis to the urban landscape. This provides a simpler and strong basis for urban landscape management, with lower-level regions acting complementary to the first-order regions.

The region of El Castillo is almost delimited in the same way (a very small building group on the north-east of the region is not included in the region of the Special Plan). The region of San Pedro also shares close boundaries. El Rio region, different from the Plan regionalization, has two additional small areas, on the south, and on the north of the region. Finally, when looking at the adjacent of the Castle, particularly the north of the El Castillo region, the historical core is differing. The boundaries of both regionalizations are different due to the methodological procedures employed for their identification. However, a hierarchical mapping of morphological regions, based on a more robust set of criteria, a

more explicit mapping of those criteria, and with a clear identification of the process of regionalization in addition to the strong link with the historico-geographical framework, provides a more powerful basis to planning practice.

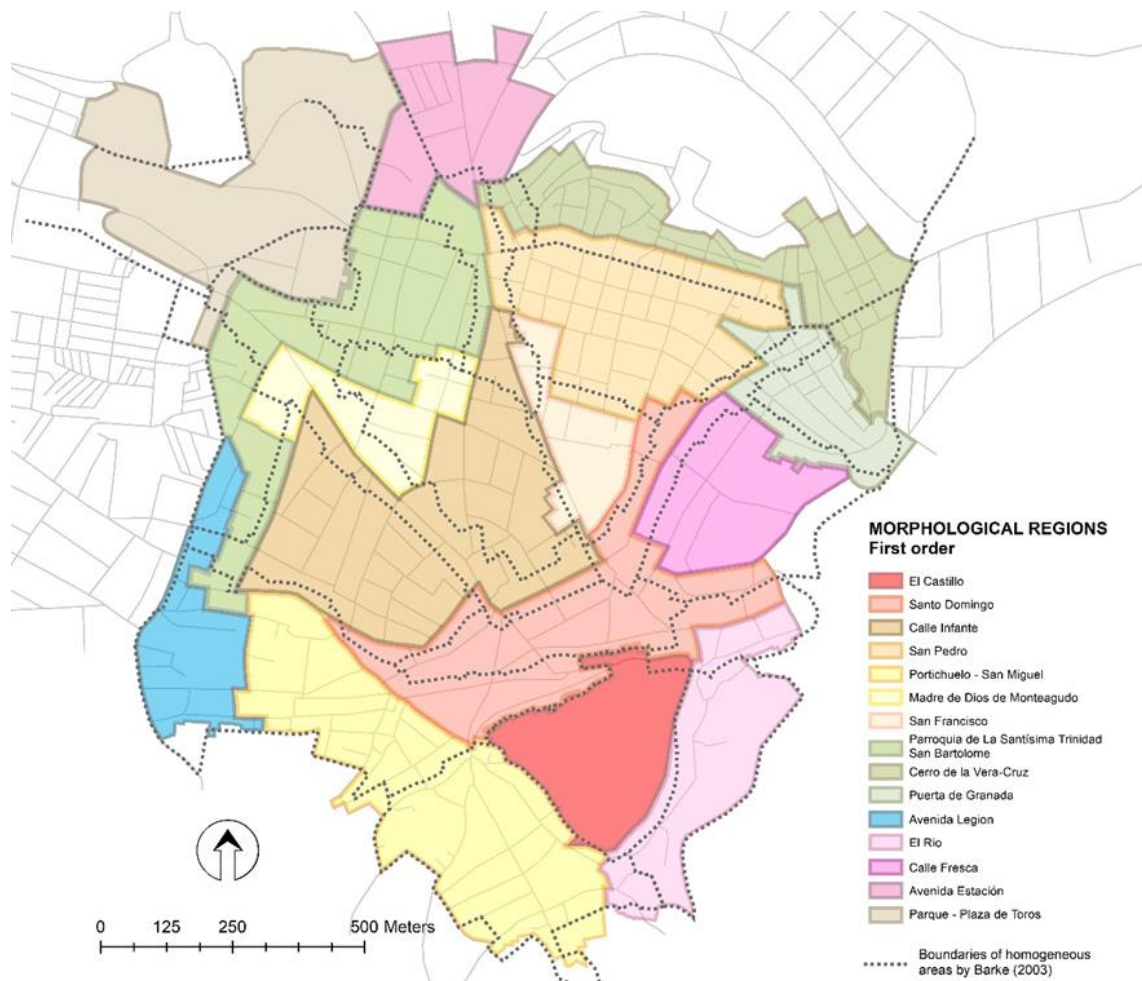


Figure 6.1 First-order regions (thesis) and homogeneous areas (Barke, 2003)

6.3 CONTRIBUTION TO DEBATE

The concept of morphological region and the method of morphological regionalization have a central role in identifying the historico-geographical structure of the urban landscape. While their relevance has been demonstrated in a number of applications in different geographical and cultural settings, this thesis addresses some major challenges in the implementation of the concept and method. Despite a large number of applications, the concept still needs rigorousness and more explicit methodological procedures for its application in planning practice. According to Kropf (2019), the significant contribution that urban morphology has made to the understanding of cities has been possible because it provides a rigorous approach to the study of urban form. Many papers on morphological regionalization do not offer a rigorous explanation of how the method is used. A number of questions arise. What is the purpose of the regionalization? What are the main criteria? While there is not a straightforward line of application, can the sequence of steps be made explicit? How is each form complex being identified? Does it have a hierarchy? How is it mapped? How does each form complex

contribute to the hierarchy of regions? How is the composite map of regions produced? The applications to Istanbul and Antequera offer comprehensive answers to this set of questions.

The three main applications dealing with the systematization of the method of morphological regionalization are Ludlow by Conzen (1988), Birmingham and Bristol by Barret (1996), and Alkmaar and Bromsgrove by Bienstman (2007). The concept of morphological region (or of plan unit, to be more rigorous) was proposed by Conzen (1960) in his seminal study 'Alnwick, Northumberland: a study in town-plan analysis', for understanding the historical and geographical nature of the urban landscape as a whole. Conzen defines the plan unit as an individualized combination of streets, plots and block-plans of buildings in a particular area of the town/city, having a morphological homogeneity that is distinct from its neighbours. He maps a four-tier hierarchy of units based just on the town-plan. Fifteen years after the publication of the Alnwick study, the first of his two texts on Ludlow was published (Conzen, 1975, 1988). In these two texts, he introduced an innovative emphasis on the three form complexes, mapping morphological regions, based on the combination of town-plan, building fabric, and land and building utilization. Conzen (1975) maps each of the complexes individually. Each map includes a hierarchy of units ranging from the first-order to the fifth-order. The three maps of form complexes together reveal the basis for the preparation of a fourth composite map of morphological regions. As in the case of Alnwick, the discussion of methodological procedures is implicit in the first study on Ludlow. In the second application to Ludlow, Conzen (1988) makes more explicit the rationale for morphological regionalization. He relates the three form complexes with the degree of form persistence and the morphological periods of the town, with the morphological constituents of historical stratification and, with their contribution to the hierarchy of morphological regions. While maintaining the main pattern and hierarchy of regions of the study in 1975, the second application differs in the hierarchical regionalization of land and building utilization. The three texts written by Conzen represent the progressive construction of a body of knowledge and theory. It starts with a focus on plan units, is then enlarged to the three form complexes, and ends with an attempt at the systematization of the method. Although Conzen (1975, 1988) mapped three form complexes individually, he did not delineate how the morphological constituents (streets, plots, buildings) are individually mapped and combined. In this regard, a precise guideline is not given by Conzen, but it is evident that the map of morphological regions is dependent on the contributions that the form complexes make to the character of the urban landscape. In addition to Conzen's perfectionism, it is evident that the procedural aspects of the concept of morphological region and the method of morphological regionalization should be more explicit for facilitating its implementation in the urban landscape.

Barret (1996) has sought to demonstrate the relevance of detailed urban morphological analysis of local urban landscape development to the assessment of the character of conservation areas, and to the formulation and application of conservation policies to preserve and enhance this character. Her research addresses the character of two study areas, the Colmore Rowand Environs Conservation Area (central Birmingham) and the City and Queen Square Conservation Area (central Bristol). This provides the basis for an assessment of the effectiveness of local conservation management in preserving or enhancing character within these areas. Barrett developed a number of methodological procedures, the main contribution of her work, very close to those used by Conzen (1988) in Ludlow. A four-tier hierarchy of morphological regions for each area was identified. The town-plan was examined in terms of expansion phases and their changes and redevelopments within these main expansion phases. She addressed expansion phases for first-order plan unit boundaries, and other changes of plots and redevelopments are considered for the establishment of lower-order plan units. The main building form units are defined by the major periods of building fabric development and replacement, with lower-order units formed where this period homogeneity has been weakened by subsequent redevelopment. The delimitation of land and building utilisation units for both study areas reflects the general form of land

utilisation. As a result, the hierarchical regionalization of the town-plan and building fabric is based on the main developments and their subsequent changes and redevelopments. However, the intermediate maps for regionalization of plan units and building fabric units do not exist. This part of the research remained obscure in terms of procedural aspects. The problem of the time-consuming process of morphological regionalization is still in progress in her research. The contribution of each morphological constituent in the hierarchy of regions is ambiguous, despite a clear contribution of form complexes.

As in the case of Barret (1996), Bienstman (2007) has explored a method for the delimitation of distinct areas within historical towns that contain a conservation area which was strongly influenced by Conzenian idea of morphological regions. The relevance of these ideas in the assessment of the character of historical urban landscapes and in the delimitation of conservation areas was investigated. The pattern of character areas identified was subsequently used as a basis from which the formulation and application of policies and guidelines for townscape management, to preserve and enhance the character identified. An attempt is made to use the character areas identified as a basis for the formulation of guidelines for urban landscape management, and to contribute to the problems of conservation area delimitation and character assessment. The method employed by Bienstman does not put forward a clear representation of procedural aspects of morphological regionalization. The hierarchical representation of plan units and building fabric units remained elusive. There is no clear guideline on how the morphological constituents contribute to the hierarchy of units. This also gives rise to subjectivity in the establishment of morphological regions. In addition, the methodology employed by Bienstman is time-consuming.

In this thesis, a systematic methodology for the delimitation of distinct morphological regions is explored to address the fundamental challenges of morphological regionalization. The implementation of the methodology into two cities, Istanbul and Antequera, confirmed its strengths. Firstly, a set of robust criteria based on morphological constituents of each form complex are identified to provide a basis for systematization of the concept. The preparation of a composite map of morphological regions is first, based on the application of each criterion, and then, based on form complexes. This provides a more rigorous implementation of the concept, and delineation and mapping of morphological regions. The sequence of steps of mapping regions enables an explicit implementation. The individual maps of each morphological constituent (intermediate maps) are defined by straightforward criteria. This is a substantial novelty. The identification of hierarchy and the contribution of each morphological constituent to the hierarchy is more explicit than in previous studies. A more objective perspective is taken into consideration in the method proposed in this thesis and its application into two cities. The method deals explicitly with the problem of subjectivity. When comparing the proposal with previous applications, Istanbul and Antequera case studies are more objective, due to the use of robust criteria. This contribution is a part of a collective construction to make morphological regionalizations more robust and more attractive to a wider readership of academics, practitioners and, even, citizens. Employing GIS tools provides the basis for a less time-consuming process. The possibilities of using these tools as an aid to the identification of morphological regions provide great opportunities for the process of overlaying maps. It also contributes to increasing the degree of objectivity.

Table 6.3 offers a synthesis of the main differences between the methodology proposed in this thesis and other methods reviewed in Chapter 2. The table collects a set of arguments justifying why the method proposed in this thesis enables a more robust implementation of the concept of morphological region. With a robust methodological framework, we aim at providing a sound and explicit basis for the future management of urban landscape and planning practice

Table 6.3 Distinctions between the proposed methodology and other methods for identifying morphological regions

	The proposed methodology	Other methodologies for morphological regionalization
i.	The identification of a set of main criteria provides a more robust and systematic way of implementing the concept	In most cases, a systematic set of criteria is not identified
ii.	The preparation of the map of morphological regions is based on the application of each criterion (based on form complexes) - this offers a higher precision to the identification of regions	The production of the map of morphological regions is based on form complexes (an not on criteria) - this can lead to less precision
iii.	The sequence of steps of the mapping process are explicit	In almost all cases, the sequence of steps of the mapping process is elusive
iv.	The individual maps of each morphological constituents (intermediate maps) are defined by simple criteria	In most cases, the production of individual maps of morphological constituents (intermediate maps) does not exist
v.	The identification of a hierarchy and the contribution of each morphological constituent to the hierarchy are more explicit	In some cases, the identification of a hierarchy and the contribution of each morphological constituent to the hierarchy is less explicit
vi.	The methodology minimizes the problem of subjectivity by proposing explicit criteria	In most cases, subjectivity has remained as an important problem
vii.	Using GIS tools enables a decrease in time-consuming (and increases objectivity)	In most cases, there is a time-consuming process
viii.	Clarification of the concept makes it more robust and more attractive to a wider readership of academics, practitioners, and citizens	The concept has not sufficiently attracted attention by academics, practitioners, and citizens due to its inexplicit procedures

7

CHAPTER 7: CONCLUSIONS

The historico-geographical approach to the study of urban form developed by MRG Conzen gave rise to what was to become known as the Conzenian school of urban morphology (Whitehand, 2021). Among the aspects that were important for Conzen was the embodiment in urban landscapes of not only the efforts and aspirations of their present occupiers but also those of their predecessors. This enables people to take root in an area, acquiring a sense of the historical dimension of human experience. It also helps to stimulate a less time-bound and more integrated approach to problems; and for Conzen this was an important basis for urban planning, especially to urban conservation. For Conzen, historical urban landscapes were assets to society both intellectually and as emotional experiences. These benefits of the ‘objectivation of the spirit’ were fundamental for a strategy for planning and conservation (Whitehand, 2021; Conzen 1966). This objectivation of the spirit generates the spirit of place, or *genius loci*, which demonstrates the strong historicity of the urban landscape (Conzen, 1966). Historicity is not only pertinent to an architectural character, but to the historical associations of all urban landscape components, as a narration of past urban social life linked to the generation and usage of the urban landscape. In this way, the urban landscape management may be seen as embodying the spirit of a society in an urban landscape historicity (Barret, 1996; Conzen, 1966; Whitehand, 1989; Whitehand et al., 2011). This approach enables the basis to link the historico-geographical structure to its future urban landscape management. Under this framework, two prominent concepts developed by Conzen are the ‘objectivation of the spirit’ and ‘morphological regions’. Distinctions in the historical expressiveness of urban landscape form the basis for recognizing morphological regions for the identification of the different characters of an urban area. The concept of morphological region and the method of morphological regionalization delineate the dynamic structure of the urban landscapes. The concept provides a combination of three urban landscape components: the town-plan (or ground plan, consisting of streets and their arrangement in a street system, plots and their aggregation in street-blocks, and block-plans of buildings), building fabric, and land and building utilization. Its goal is to provide a full description and explanation of the historico-geographical structure of the urban landscape. For Conzen, these three urban landscape components are linked hierarchically.

Despite the large number of applications of the concept of morphological region and the implementation of the method of morphological regionalization, there is only a relatively small set of studies that develop a systematic effort to explain the main criteria supporting regionalization: the notable sequence of applications by Conzen (1988), Barrett (1996) and Bienstman (2007). The key problems in identifying morphological regions in a townscape are terminological distinctions, procedural aspects, and the clarification of regionalization. **In this context, this thesis has been devoted to strengthening the concept of morphological region and the method of morphological regionalization making these more systematic and robust.** The literature review indicated the need for clarification of mapping

morphological regions. This thesis, first, addressed the terminological confusion that has been associated to the concept worldwide. The use of distinct terms for the concept gives rise to problems for the construction of a common body of knowledge. And, it creates confusion among urban morphologists, academics, and practitioners. Then, it focussed on the procedural aspects of the concept and the method of morphological regionalization. Many applications on the concept of morphological region are not supported by a rigorous method. Our first contribution is on the clarification of regionalization for a wider readership of academics and practitioners.

In the review of applications of the concept, the use of nine different terms was identified. In addition to 'morphological region', the most frequent terms are 'plan units' and 'urban landscape units' (a term promoted by Whitehand and Gu, 2007b). In addition, the terms of townscape regions, townscape units, character area, urban landscape regions, urban tissues, and urban regions are the other terms employed by different researchers. While the use of 'plan units' is due to a major focus on the town-plan, the utilization of the 'urban landscape units' is justified by the purpose of integrating the method into townscape management and conservation. The use of the term 'character area' is preferred by some authors due to the predominant audience consisting of non-academics and others who are not familiar with the technical language. The term 'townscape' is commonly used in the British planning context. Therefore, a few researchers used this term instead of morphological regions. Despite these different labels, all indicate the product of morphological regionalization. **This thesis aggregated and clarified these distinct terms and their rationale. This is a relevant contribution of the thesis.** It is important that the introduction of new terms, with no significant difference, in terms of contents, be avoided, as it prejudices the robust definition of a coherent body of knowledge. If new terms are needed for the description and explanation of a particular case study, it should always be related to the original term of 'morphological region'. The terminology should be clear and be related to the historico-geographical body of knowledge. It is argued that the terminology of morphological regionalization should be explicit and shared by different researchers.

The methodology proposed in this thesis is applied into two study areas. The first is the Fatih district, the historical core of Istanbul, Turkey. The second is the historical nucleus of the Andalusian city of Antequera, Spain. In Istanbul, eight criteria were identified for the implementation of the method. These are the age of streets, streets geometry, plot layout, building coverage, architectural style, building material, building height, and land and building utilization. In Antequera, expansion phases, streets geometry, plot layout, building block-plan type, architectural style, building material, building height, and land and building utilization are identified. A four-tier hierarchy of regions has been recognized in both areas. **Through the recognition of morphological regions in Istanbul and Antequera, the thesis offers 'particular' insights into both cities. This is another substantial contribution of the thesis.**

The analyses of the three form complexes have confirmed to be of major importance, as Conzen has always argued. **The town-plan was the first contributor, land and building utilization was second, and building fabric is the last contributor to the character of the urban landscape** of the historical areas of Istanbul and Antequera. This is an important conclusion to highlight, because it is not always like this. When the building fabric constitutes large homogeneous areas, it contributes to upper orders. In addition to the contribution of form complexes, it is substantial to mention that the previous situation is also acceptable for criteria. For example, expansion phases are very important in the identification of regions. When small changes occur within expansion phases (such as changes of plots) and were detected, they contribute to lower orders. The delimitation of morphological regions in Istanbul and Antequera highlighted some differences in terms of their characteristics of the physical form. Istanbul is a more complex built environment than Antequera. This complexity is a result of human interferences and natural disasters (earthquakes, fires, and so on) in the course of time.

The implementation of the methodology to Istanbul and Antequera demonstrated that the identification of morphological regions is not always based on the superimposition of criteria or form complexes. In these two applications, the first- and second-order morphological regions are delineated by superposition of maps of different criteria. However, the third- and fourth-order regions are delimited on an individual basis by implementing distinct criteria. This conclusion has been revealed by the force of the systematic effort of the methodology.

Another important conclusion is that the set of criteria contained in the proposed methodology differs from one case study to another. This shows that it is not always mandatory to use all proposed criteria (in the design of the methodology) for the identification of morphological regions in an urban landscape. It demonstrated that the contribution of the criteria and form complexes to the hierarchy of morphological regions could be different, based on the city under analysis. The number of criteria also varies based on the townscape explored. The combination of three urban landscape components (the town-plan, building fabric, and land and building utilization) should consider the interpretation of form complexes that stress the major significance of the degree of form persistence. The town-plan, as a part of morphological regionalization, is of crucial importance to the character of the urban landscape, as it comprises two other form complexes, and establishes a framework for development. The number of orders in the hierarchy of morphological regions relates to the hierarchy of form complexes, the hierarchy of form persistence, and the hierarchy of historical stratification, in addition to the area or city explored.

A comparison between the proposed methodology and the regionalization of the Special Plan for Antequera makes evident two important aspects. Firstly, the application of the concept in the scope of this thesis confirmed that the town-plan is emphasised in terms of its hierarchical significance and persistence. Secondly, **the implementation of the proposed methodology stresses the importance of a hierarchical designation of morphological regions, instead of a non-hierarchical identification.** The identification of the hierarchy plays a crucial role in delineating smaller regions focusing on the building fabric. These small regions might have a substantial role in the assessment of the character of the urban landscape. When they are not recognized in townscape characterization, they would have been excluded from the character assessment of the townscape.

The methodology proposed in this thesis aims at supporting the process of designing guidelines for planning practice, including conservation. In this way, the methodology intends to contribute to finding effective solutions for major planning problems. **A map of first-order morphological regions, mainly based on the town-plan elements, can be the basis for the preparation of a map of planning zones as a key tool to urban landscape management, providing the definition of regulations for the conservation or transformation of existing urban forms, and the design of new forms with a strong relationship with extant physical form.** This is of great relevance for spatial planning, where regulations on urban form tend to be very generic and do not acknowledge the specific character of the urban landscape. A map of hierarchical morphological regions with a strong theoretical background (a combination of the criteria-based on three form complexes) enables a basis for more effective planning decisions and the promotion of a planning culture where the urban character is considered in urban landscape management. These are very important conclusions of this thesis. It can contribute to an effective conservation area delimitation and management where the character assessment considers the historical background of the urban landscape, and where the town-plan is effectively considered (streets and plots assuming their importance in the process of city-building).

In synthesis, the most important conclusions of this thesis are as follows: i. the application of the proposed methodology shows that the use of fundamental **criteria** enables a more robust and systematic method; ii. the **mapping of each criterion** individually offers higher accuracy for the establishment of morphological regions in a townscape; iii. a methodology with a clear **sequence of steps** for mapping morphological regions confirmed a more explicit identification of the urban landscape character; iv. defining a hierarchical ordering of morphological regions by applying each criterion, and then morphological constituents, provides more clarity and legibility in the understanding of urban landscape; v. explicit criteria minimize the problem of subjectivity in the identification of regions; vi. the use of GIS tools provides a less time-consuming process.

In addition to the important conclusions identified above, the prospects for future studies should be outlined. It is argued that three main lines should frame research in the near future. The first, following the line of this thesis, should continue to make the Conzenian concept and method more systematic. The second should involve the automation of the process using GIS tools, remote sensing, and special algorithms – the challenge for this line of research is keeping the core characteristics of the concept and method. The third line should involve the coordination and combination of morphological regions with other approaches developed under the framework of other morphological approaches.

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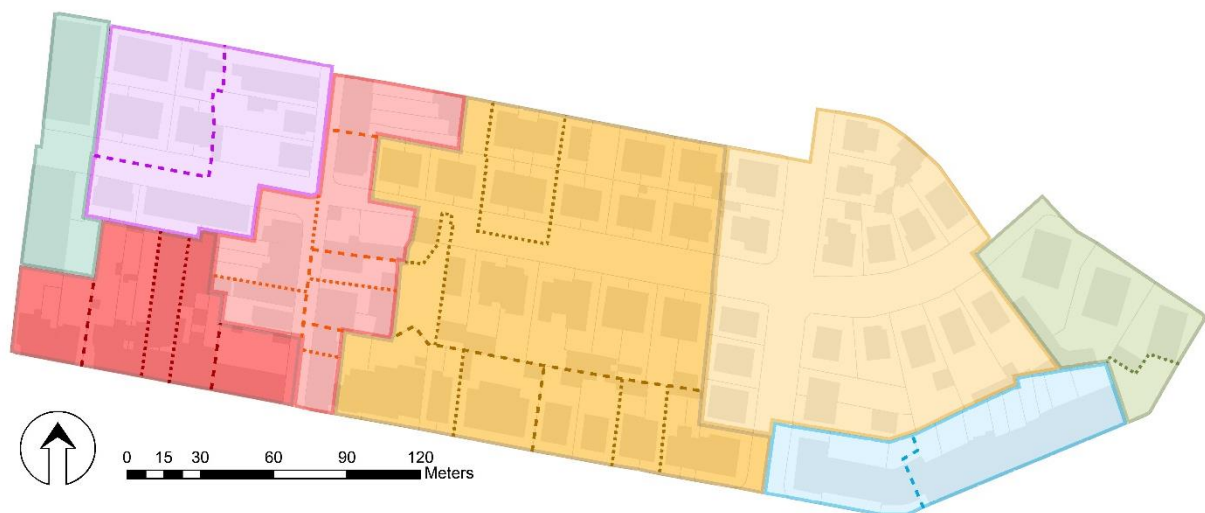
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ANNEX

Morphological Regions in Porto

This annex briefly presents a pilot application of the methodology into a small area in Porto, Portugal, for validating the procedural aspects of the methodology. In this application, two initial criteria (expansion phases or street ages, and streets geometry) are not included in the establishment of morphological regions due to the small size of the area. In addition, the building material criteria is not addressed due to the absence of data. The establishment of the hierarchy of regions is based on the town-plan (plot layout, building block-plan type, building coverage, position of buildings), building fabric (architectural style, building height), and land and building utilization. A three-tier hierarchy of morphological regions was identified. The plot layout contributed to the first- and second-order morphological regions. The building block-plan type contributed to the first- and third-order regions (to a lesser extent). The building coverage had a small contribution to the hierarchy of regions. The position of buildings was an important criterion for the identification of morphological regions. The architectural style affected the second-order regions. The building height identified third-order morphological regions. The distribution of land and building utilization informed third-order morphological regions. This application provided a learning experience for what we would be the implementation of the methodology in Istanbul and Anterquera.



PORTO MORPHOLOGICAL REGIONS

	First-order	Second-order	Third-order
Row Houses Unit (East)			
Row Houses Unit (West)			
Detached Houses Unit			
Semidetached Houses Unit			
Detached / Semidetached Houses Unit			
Apartment Block Units (East)			
Apartment block units (West)			
Apartment Block Units (South)			