To my family…

VISIBILITY-BASED ASSESSMENT OF URBAN FORM: AN ALTERNATIVE PERSPECTIVE FOR THE RESIDENTIAL DEVELOPMENT IN URBAN PERIPHERIES

A THESIS SUBMITTED TO
THE GRADUATE SCHOOL OF ENGINEERING AND SCIENCE
OF BILKENT UNIVERSITY
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR
THE DEGREE OF MASTER OF SCIENCE
IN
ARCHITECTURE

By
Suard Cengu
JULY 2021

Visibility-based assessment of urban form: an alternative perspective for residential development in urban peripheries

July 2021

We certify that we have read this thesis and that in our opinion it is fully adequate, in scope and in quality, as a thesis for the degree of Master of Science.

Assoc. Prof. Dr. Bülent Batuman (Advisor) _____

Assoc. Prof. Dr. Olgu Çalışkan (Co-Advisor) _____

Assist. Prof. Dr. Zühre Sü Gül _____

Assist. Prof. Dr. Zeynep Eraydın _____

Approved for the Graduate School of Engineering and Science:

Prof. Dr. Ezhan Karaşan _____
Director of the Graduate School of Engineering and Science

ABSTRACT

VISIBILITY-BASED ASSESSMENT OF URBAN FORM: AN ALTERNATIVE PERSPECTIVE FOR RESIDENTIAL DEVELOPMENT IN URBAN PERIPHERIES

Suard Cengu

M.S. in Architecture

Advisor: Assoc. Prf. Dr. Bülent Batuman

Co-Advisor: Assoc. Prf. Dr. Olgu Çalışkan

July, 2021

It is highly important for urban designers to understand how the configuration of urban fabric influences the living experience of the city dwellers. While cities change through time, their evolution may produce spaces that may not have a positive contribution or don't reach their full potential. We call these spaces as 'lost spaces'. The fragmentation that has occurred as a result of master planning implementations in western development corridor of Ankara, has produced lost spaces. This thesis aims to assess spatial configurations of

such spaces near residential buildings in Çayyolu. The chosen case study, Cayyolou, is a ‘developed’ area in Ankara which has been an outcome of the city’s urban expansion.

Urban and architectural spaces are defined by the spatial relations and social synergy stimulated by visual interaction. We have considered visibility as an indicator of ‘positive space’ and used isovists as a tool that measures visibility levels. A space that can be seen from any vantage point is defined as isovist by, and a set of such spaces defines a visual field. By utilizing computational tools and geometrical properties of isovist and isovist fields, we can identify and improve visibility of selected areas. In addition to visibility assessment of existing conditions of selected sites, this framework provides some design interventions which help improve visibility and propounds a relationship between urban spaces and visibility.

Key words: Urban Sprawl, Lost Space, Visibility, Isovists, Computational Tools

ÖZET

KENTSEL BİÇİMİN GÖRÜNÜRLÜĞE DAYALI DEĞERLENDİRİLMESİ: KENTSEL ÇEVRELERDE KONUT GELİŞİMİNE ALTERNATİF BİR BAKIŞ AÇISI

Suard Cengu

Mimarlık, Yüksek Lisans

Tez Danışmanı: Bülent Batuman

Eş Danışman: Olgu Çalışkan

Temmuz 2021

Kentsel doku biçiminin kent sakinlerinin yaşam deneyimlerini nasıl etkilediği anlamak, kentsel tasarımcılar için oldukça önemlidir. Şehirler zaman içinde değişirken, evrimleri, olumlu bir katkısı olmayan ya da tam potansiyeline ulaşmayan mekânlar ortaya çıkarabilirler. Bu mekânları "kayıp mekânlar" olarak adlandırıyoruz. Ankara'nın batı gelişim koridorundaki nazım planlama uygulamaları sonucunda meydana gelen parçalanma, kayıp mekanları oluşturmuştur. Bu tez, Çayyolu'nda bulunan konut binalarının yakınındaki bu tür yerlerin mekânsal biçimlendirmelerini incelemeyi amaçlamaktadır.

Seçilen örnek çalışma olan Çayyolu, Ankara'da "gelişmiş" bir bölgedir, ki bu bölge şehrin kentsel yayılmasının bir sonucudur.

Kentsel ve mimari mekânlar, mekânsal ilişkiler ve görsel etkileşim tarafından uyarılan sosyal sinerji tarafından tanımlanır. Görünürlüğü 'pozitif mekân' göstergesi olarak değerlendirdik ve izovistleri, görünürlük seviyelerini ölçen bir araç olarak kullandık. Herhangi bir geniş görüş sağlayan noktadan görülebilen bir mekân izovist olarak tanımlanır ve bu tip bir mekân dizimi, bir görsel alanı tanımlar. İzovist ve izovist alanlarının hesaplama araçlarını ve geometrik özelliklerini kullanarak, seçilen alanların görünürlüğünü tanımlayabilir ve geliştirebiliriz. Bu çerçeve, seçilen alanların mevcut koşullarının görünürlük değerlendirmesine ek olarak, görünürlüğü artırmaya yardımcı olan ve kentsel mekanlar ile görünürlük arasında bir ilişki öneren bazı tasarım müdahaleleri sağlamaktadır.

Anahtar Sözcükler: Kentsel Yayılma, Kayıp Mekân, Görünürlük, İzovists, Hesaba Dayalı Araçlar

Acknowledgements

I would like to express my very great appreciation to my advisors Assoc. Prof. Bülent Batuman and Assoc. Prof. Olgu Çalışkan (METU) for their supervision throughout my graduate studies. I have gained immense knowledge. I am deeply in debt to my professors for sharing their expertise in the field with me. Their instructions, advices and support have been absolutely beneficial to me and to the finalization of this Master thesis and I will always be grateful.

I would like to express my deepest appreciation to my Master thesis committee members: Assist. Prof. Zühre Sü Gül for our fruitful relationship and helful advces during my teaching assistance period. I would like to express my sincere appreciation to Assist. Prof. Zeynep Eraydın for taking the time and contributing with valid feedbacks throughout my thesis presentation.

I would like to acknowledge all the faculty, staff and members of the Architecture Department in Bilkent University. The positive energy of this department has made my graduate studies valuable, easier and unforgettable.

I owe my deepest gratitude to my Family for their unconditional love. Nothing would have been possible without their full trust and understanding in my choices. They have been my daily inspiration.

I am grateful to the unconditional support, love and patience that my Erta has given to me, motivating and encouraging me in the most difficult days.

Table of content

List of Figures:

CHAPTER 1

INTRODUCTION

As it happens everywhere, cities evolve through time, and simultaneously do the morphological configurations of a city, the needs of people living in cities change through time as well, adapting to its conditions. As the process of shaping the physical features of living environments, urban design is helpful in understanding such environments. There are numerous ways of designing, even though the aim should remain the same: to provide better living spaces for human needs. Similarly, there are numerous approaches to understanding a living environment. This thesis is one way of understanding residential settlements in south-western development corridor of Ankara, particularly Çayyolu district. The thesis focuses on visibility, more specifically isovist as an operational tool to determine the quality of residential environments in accordance to their open public spaces.

Ever since urban planning and design became a necessary profession that required human intervention, they have been linked with simplified concepts such as hierarchy, regular geometries, patterns, proportions etc. However, cities are complex environments where spatial and functional patterns emerge and evolve constantly, therefore a simple formula or description cannot be the solution to urban problems. Urban morphology is the study of human settlements along with their physical structure and their processes of formation and transformation, in which relation between urban elements and their transformation agents are articulated (Kropf, 2017). Even though most

researchers share common ground on the definition of urban morphology, various aspects or other fields related to it can help understand better the complexity of cities.

Urban morphology is an important field which is related to urban design and cities since a poor morphological understanding can lead to poor urban design outcomes. Though urban morphology and urban design diverge from each other, they are not the direct opposite of each other because morphology can be part of design process and urban design is part of what an urban morphologist interprets (Marshall & Çalışkan, 2011). However, urban morphology displays the existing reality of an actual urban area, while urban design looks forward to the future of that reality, hence this is where they point in different directions (Marshall & Çalışkan, 2011). The importance of urban morphology is highly related to practice and though computational technology has advanced; this has not stopped these fields to develop back-to-back (Oliveira, 2016). For Oliveira (2016) the relation between urban morphology and practice is weakened by the emergence of several theories, concepts and methods which are mainly associated with historical centers of small cities. Nonetheless, built heritage has to remain a fundamental concern for urban morphology but this should not prevent morphological methods to be applied in different urban contexts where new forms can be analyzed or emerge.

The term *urban design* refers to any kind of design in urban context and its scale can vary from architectural to town planning and it implies an effective solution to any urban problem (Marshall & Çalışkan, 2011). Urban design and urban morphology are linked with each other in several key ways. Both designers and morphologists are interested in answering questions related with agents,

effect and outcome of urban forms, elements, and social processes (Talen, 2018). Though both fields aim to understand the potential that built environment has on affecting choice, accessibility, opportunity, access, interaction, connection, mix etc. (Talen & Lee, 2018), urban design's priority is not to seek out the causes of such issues. Moreover, urban design deals with questions that are associated with meaning of urban form and patterns, which is its strongest linkage with urban morphology (Talen, 2018).

The urban fabric is a 'common ground' for both urban morphology and design because it is the subject of urban morphology and object of urban design (Marshall & Çalışkan, 2011). Moreover, they are both part of the same abstract medium removed from the physical reality, made up of abstract things such as geometrical shapes, dimensions, properties and conceived via mental constructions and disclosed via conceptional visual tools (Marshall & Çalışkan, 2011). This suggests that morphology and design belong together and they should be utilized for a more integrated approach regarding common urban issues. The research of this thesis uses the knowledge on urban morphology and design to assess residential areas at the peripheries of Ankara with a focus on visibility and suggests several interventions in these areas to improve their visibility level by utilizing computational tools.

1.1 Definition of the Research Problem

The changing needs of a city evolve through time playing an important role in the formation of urban characteristics. The focus of this thesis will be on both tangible and intangible aspects of urban space in a specific district of Ankara, Çayyolu. The urban expansion of Ankara has created

"lost spaces": urban morphological types that have 'lost' their identity. In his book *Finding Lost Space: Theories of Urban Design*, Tancik defines "lost space" as no-man's land that can be found along the edges of freeways as abounded waterfronts, train yards, vacated military sites mainly located at suburbs for easier access and lower costs (Trancik, 1986). We can consider these spaces as undesirable urban areas which do not have an overall positive contribution to the larger urban development and require intervention by means of redesigning the space. According to Tancik, the main cause that generates these 'lost spaces' is the modernist approach to design, meaning the dependence on the automobile, zoning and urban renewal, privatization of public space and changing land use policies especially through 20th century (Trancik, 1986).

These areas, often existing at the blurry edges of the built world, project doubts on spatial and behavioural codes, making these spaces whether vacant lots, castaway industrial sites or sloppy border areas act as refuges, mirrors (Mariani & Barron, 2013). Thus, they are containers of a fragmented shared history, which triggers memory and tries to recall and reconstruct the past. Even though these types of spaces can be categorized as abandoned, they are likely to be transformed into built, liveable spaces in the future (Mariani & Barron, 2013). These spaces are examples of "loose spaces" which have the potential of creating casual encounters, informal events and alternative activities. They are usually easily accessible, large enough and involve interesting physical features, hence "free-zones" which invite creative thinking (Groth & Corijn, 2005).

These types of areas are less expanded in concentrated areas; therefore, they are mainly found along freeways, shopping malls, railways, airports etc. which are a result of urban sprawl. Often,

they function as buffer zones since they don't have a definite role, making the place permeable and with less friction as possible. These spaces are obviously more recognizable from outside and are likely to be utilized as loose spaces for various activities and at the same time reclaimed as useful urban spaces (Mariani & Barron, 2013). Cities such as San Francisco, Liverpool, London etc. which have been recognized for containing significant number of industrial sites, have experienced redevelopments of many of their previously abandoned industrial sites, reusing the existing site and adapting to the needs of each site. However, abandoned industrial sites that experience adaptive reuse projects are just one example where lost spaces can be evident.

The type of 'lost spaces' introduced above derives from physical fragmentation that may occur in any city. Reasons for that to happen can be economical, social, political, cultural etc. Another type of 'lost spaces' can be the urban public space, which is different from the first type. Even though both types share common characteristics such as: no positive contribution, require redesign, no activity etc. they differ as well. The second type does not have to be at the edges of the city, instead its mainly in concentrated areas aiming to function as their core. They have a definite role which is to be a socially positive environment for its users, even if that's not always the case. There is some kind of duality that exist in the second type of lost spaces: on one side there are supposed to be porous, always in flux and transformative for the environment, on the other side they are as 'dead zones' in the middle of an urban settlement. It is precisely this contradiction that triggered the research to learn more about the physical conditions and the way these spaces' function and affect the everyday life of users.

Generally, the production of space in the inner parts of the city is different from the ones at the urban peripheral areas. One could expect that in the peripheries of the city in which there is enough space to design better environment, residents would live a better life. However, this is not always the case. If we consider the peripheries of Ankara, we observe that development is mainly fragmented and therefore problematic. By addressing the urban development history in Ankara, especially in Çayyolu, there can be a discussion on the specific elements of their urban form and their morphological characteristics. The urban peripheral development was on one hand supported by state to boost housing market and on the other hand by the increasing investment of capital in urban space. These urban policies, which mainly addressed the living conditions of middle- and upper-classes, consequently became the driving force in the formation of urban periphery. They also differentiated the actors which were involved in the development attitudes in such areas of Ankara, shifting from individual developers to corporate construction firms (Tekeli, cited in Erişen, 2003). Different development strategies can affect production and consumption habits which also alter urban space demands and spatial characteristics (Gültekin, 2014). One can argue that if development is totally dependent on the market, the urban morphological configurations will eventually be highly heterogenous and fragmented.

There exists a controversial relationship between the concept of enclosure and visibility. This controversial relationship has stimulated further research on the topic. On one hand enclosure is a crucial condition which ensures a sense of identity. This identity itself is a positive attribute to the environment because it makes inhabitants attach and create stronger bonds with the environment. The condition of enclosure is referred frequently in literature as a condition that ensures and creates

spaces with positive attributes. However, the concept of enclosure is itself contradictory to the concept of visibility. Enclosed spaces are only visible to buildings adjacent to the open space. The surrounding buildings take most of the positive attributes generated from that condition. Buildings that are further away from the open space are limited in several aspects: one of these aspects is visibility and it will be the focus of the research.

It was precisely the condition of spaces that ensures both enclosed and visible environment that has triggered to further explore this field. Literature on urban space suggests that enclosed spaces are crucial in giving space a meaningful presence and identity, however, the usage of computational tools also suggest that enclosed spaces are only visible for a small number of surrounding buildings. This is a controversial relationship because literature also suggests that visible spaces are vibrant environments and mixed with social interaction. A vibrant environment is what designers aim to achieve with their interventions, formations or transformations of urban fabric. I found the relationship between enclosure and visibility an ambiguous link which leaves space for further research and discussion. It was important for me to see this contradiction in the perspective of lost space because I find them to be connected and depended on each other.

A space that can be seen from any vantage point is called an isovist by definition, and a set of such spaces defines a visual field (Benedikt, 1979). Visibility is crucial in understanding urban environments and is further discussed in the third chapter. I consider visibility methods helpful in identifying both types of lost spaces, hence, the focus of this thesis is to apply visibility assessment methods by utilizing computational tools to better understand lost public spaces. In addition to

assessing their visibility level, some intervention strategies will be presented as examples of how visibility levels can be improved.

1.2 Aim of the Study and Research Questions

The main objective of this thesis is to come up with an alternative assessment method for residential areas, which is controlled and focused on visibility using the case of Çayyolu district in Ankara. Visibility is an important factor to consider while aiming to design quality urban spaces. Urban development in Turkey is partially a result of fragmented urban fabric because of planning strategies. In order to provide a new design control alternative, visibility analysis with the help of computational tools would be used as assessment of public spaces. Visibility-based design of urban form can be seen as an important added criterion to be considered for residential developments. Urban development in the peripheries of Ankara will be used as a case study in which this alternative method in contemporary urbanism can be contextualized through an integrated framework. To achieve this, it is necessary to utilize computational tools that assess the visibility level of urban environments.

This thesis will investigate Çayyolu district in Ankara, which will be discussed and evaluated by computational tools with visibility as the main focus. A morphological approach focused on visibility of building types can lead to discussions that relate to both tangible and intangible aspects of urban design. This application aims to understand the integration of visibility levels within urban planning policies.

The first research question of this thesis is '**how can we define lost urban space?**' Understanding what architectural and urban space is helps form a basis for the discussion of lost space, which is essential for the thesis. The other part related to this research question will be introducing and investigating the generative power of the computational tools that will be used: in this case Rhinoceros 3D and its plug-in Grasshopper, by utilizing isovists as a method to correlate them to the definition of lost urban space and assess the quality of urban spaces.

The second research question is **'how can the controversial relationship between enclosure and visibility be defined better?'** To define the relationship, it is crucial to understand both concepts separately and derive a common ground for both of them. The common ground is the combination of the literature background on both enclosure and visibility, and the results that come from the isovist analysis method.

The third research question is '**how can urban development patterns be produced and transformed based on visibility to create positive urban spaces?**' In order to give an answer to this question, a proper explanation of the term 'positive space' needs to be supported. Several authors have discussed the concept of positive and negative space by introducing architectural and urban case studies. The urban sprawl in Ankara is a case with various urban morphological pattern configurations, therefore creating different qualities of space. Some of these configurations will be analyzed with the help of isovists to describe the quality of space. Using the theoretical background of positive and quality space, computational tools will be used to add empirical data as result of analysis and evaluation. By investigating this question, the approach focused on urban

types and design would ground a theoretical and operational framework that can be used as a tool in multiple scales projects.

The fourth question will aim to understand if '**the isovist method is effective to indicate the quality of urban space?**' There are several ways of analyzing urban spaces to assess their quality, therefore visibility is just an alternative way of understanding spaces. If isovists are being used as the method to analyze visibility, then it's important to recognize the effectiveness of isovists as an alternative assessment strategy. Depending on their effectiveness, other alternatives may be introduced, either combined or not with isovists.

1.3 Methodology of the Research

Whenever discussions on urban design arise, the main focus is the user: people inhabiting that particular space. Therefore, the designer should propose a way of living while considering the context of a site. There is life that exists between buildings and according to Gehl (1971), life between buildings does not rely only on pedestrian traffic or social activities, but it comprises the entire spectrum of activities which make urban spaces meaningful and attractive, while observations of human behavior shows that people and human activity are the greatest object of attention and interest. Designers are deeply focused on the physical outcome of their design, and commonly tend to forget that life in buildings and between them is more essential than the spaces and buildings themselves. Therefore, the concept of lost space, introduced earlier, has initiated the research. The methodology is linked with this concept, and has stimulated the search for tools with which an outcome can be presented and discussed.

With the use of computational tools, we can analyze and simulate urban forms that give us a better understanding of the quality of urban space before construction. Computational tools provide a significantly relevant basis in design context by providing us with the usage of design codes on multiple scales to generate a framework for analyzing and designing. Isovists have been selected as a tool that measure visibility of an environment and are a major part of this research.

This thesis research is a combination of analysis and design strategies utilizing computational tools: Rhinoceros 3D and Grasshopper software. Architectural or urban forms should not be seen as a system composed of predetermined ideal forms, but rather a dynamic system of changes that generates complex outcomes. The computational tools mentioned above allow researchers and designers to explore these tools by analyzing and creating a variety of forms depending on what the focus is.

The focus of this thesis is to use a framework based on visibility analysis through the case study of urban typologies of Çayyolu district. The formal arrangement of urban component can affect its visibility, therefore, by analyzing the morphological components of sample areas in the district, new forms can later be generated to increase the level of visibility. The aim is to come up with an improved range of visibility in each specific site. The sites that have been selected as case studies share common characteristics: residential areas, some of them have public open space as their core development, scale, repetitive building types. This research aims to provide an alternative approach which shows the effect of urban design on visibility within these scenarios and simultaneously open discussion on urban type formation.

1.4 Structure of the Research

The thesis is composed of five chapters. Following the introduction, the second chapter starts with an inclusive literature on the concept of lost space within the context of urban sprawl. After defining lost spaces, the chapter will continue with a theoretical framework on urban sprawl. Then urban sprawl of Ankara and its specificities will be discussed with a focus on pattern formation of urban types at the peripheries of Ankara, more specifically Çayyolu. These urban types will be discussed in terms of lost spaces.

The third chapter will focus on principles of successful urban places, visibility and isovists. They will be discussed in the context of urban design and its relation to geometrical forms. The isovist analysis method will be introduced to measure the quality of space, which will be understood as a morphological indicator of 'positive space'. The isovist analysis will show results that can be interpreted as a positive or negative space.

In the fourth chapter, the potential of isovist fields in assessing visibility levels of urban forms based on algorithms will be discussed. Along with the literature review, the initial phase of the proposed model in this research thesis is the analysis part, which is completed by the use of modelling software: Rhinoceros 3D and Grasshopper in which a code has been implemented. The following part is a combination of a set of design strategies and usage of the power of computational tools to analyze these sites before and after such design strategies have been presented with the main emphasis on increasing their visibility level. In this way, the chapter will end with a short discussion on the potential of computation and benefits of using computational

tools in design. The algorithmic code will be applied to selected sites in Ankara. After the application, a reflection on form variations will be presented in the chapter.

Conclusion will discuss the critical aspects of the proposed method while evaluating its potential to analyze and assess outcomes as part of the alternative design approach. It will also include the limitations of the proposed model and further research on the topic along with the potential application of the method,

CHAPTER 2

‘LOST SPACE’ AS BY-PRODUCT OF URBAN SPRAWL

2.1 Lost Space: A theoretical Perspective

The city has always been an attractor to migrate for a better life, easier wages and more facilities for their inhabitants. Therefore, urbanization as a process has taken place both as planned and spontaneous development in different places all around the world. A city is generated by its society, making the whole process of urbanization to be addressed as one of the most crucial elements of urban planning. Adapting to changes of city life has created alternative urban patterns. Cities that went through the process of urbanization or continue to do so are associated with new altered and manipulated urban forms and volumes that affect the urban morphology of their city. The modern origins of urban planning aiming to control the disordered industrial city were linked with massive challenges of urban growth.

Even though cities may not continue with rapid urbanization and uncontrolled growth, ones that experienced such transformations are also associated with areas that generated meaningless, mistreated or neglected urban spaces. It is crucial to define two main types of lost spaces: first one being the one with a lost function which has become derelict, while the second one is the result of fragmented development. Fragmentation itself is mainly considered to be related only to the physical boundaries of a space, however, there exist spaces which are the ‘central’ part of an urban design, still feel detached. I will deal with both types of lost spaces for this thesis. It is important

for urban designers and planners to prevent the emergence of fragmented urban landscape that are both physically and functionally disconnected. According to Loukaitou-Sideris (1996), who refers to the first type of lost spaces, argues that places such as corporate plazas, car parks, parks and public housing estates are a result of poor management and are usually associated with poor physical condition. There is usually no clear description who is responsible for their management, therefore they are consequently neglected. On the other hand, the type of lost space which is fragmented is not necessarily in poor physical conditions. They can be in good physical conditions but they don't function at the performance level they are intended to.

Understanding how urban spaces have originated and evolved through time will help better define what lost spaces are. Abandoned areas which can be considered lost spaces are usually areas that exist in the urban environments which make no positive contribution to the surrounding area or its users (Trancik, 1986). Usually, these spaces are associated with functions: underutilized plazas, parking lots, abandoned waterfronts, industry complexes, deteriorated parks, edges of freeways etc. that nobody cares to maintain and are left abandoned.

There are also such that have no specific function. Loukaitou-Sideris (1996) names these environments with no specific function as ambiguous in the city because they resemble "in-between" spaces which are underutilized and often deteriorating with human waste and lack public interaction. However, the regeneration of such urban areas can revitalize both the physical built environment and the socio-economic structure of the society, if combined with integrated visions to resolve the urban problems of such cities. Franck and Steven (2007) even suggest that these

types of spaces allow spontaneous events to happen so people can relax and have other activities without permission. It is common to hear architects and planners talk about such underutilized or unused spaces that can provide different uses and activities which can easily contribute to community development. However, lost spaces have the potential of becoming public if they are carefully integrated with the existing urban fabric of each site. The focus of this thesis will be both types of lost spaces: spaces that are designed to function as public spaces for people to interact and socialize, but are not utilized as they should and the ones that are left and have no positive or no contribution at all.

In order to define what lost urban spaces are, one needs to understand what urban space is initially. Moughtin (1992) presents two different views in understanding what a city is: in the first one the city is seen as an open landscape in which buildings are introduced as three-dimensional objects, while in the second view he sees the city as a public space in which streets and squares appear to be carved from a mass block of material. In the first view, buildings are positive elements and space is the general background, while in the second view space itself is seen as a positive element in which building facades are two-dimensional space framers. For Moughting (1992), the second view which is derived from cities like Florence, Assisi and Oxford, can become the model for further development of our cities because it is grounded on an urban lifestyle with a long and well-known cultural heritage.

Squares are an essential spatial type of urban space and one predominant quality of squares is their sense of enclosure. For Moughtin (1992) enclosure is the purest interpretation of a sense of place

and the urban square can be considered as an outdoor room. The way corners are treated defines its sense of enclosure: more open corners of the square create less sense of enclosure, otherwise its stronger. Alkhresheh (2007) argues that even if the same ratio is achieved but with a different scale, the same sense of enclosure does not exist, therefore there should be some height limitations and size of open spaces to create better living environments.

According to Gehl (1987) the fact that there are different ways in which human activities occur between buildings and spaces, is what makes urban spaces successful. Montgomery (1998) argues that when designing a new urban space, it's crucial to consider physical form, activities that occur between buildings and the image of the place, all of them integrated with each other. It's not views that define a successful urban space, but the cohesiveness and unity created within any urban composition. Nonetheless, if the composition of buildings makes the spaces around them visible, it can become a stimulation for social activities.

It's the field of urban morphology that studies human settlements and the whole process of their formation and transformation (Kropf, 2017). Analyzing morphological configuration of a city helps in understanding less meaningful urban spaces since research on urban morphology aims to better evaluate the built environment not only as a physical presence, but as a cultural artifact and phenomenon. However, the complex view of morphology is the product of both built environment and a thoughtful effort to take nature into consideration (Kropf, 2017). Urban morphology is strongly connected with fields of city planning, urban design and architecture. In addition to that,

it is a valid reference for studies which include energy use, microclimate, human movement, acoustics and land value (Kropf, 2017).

It is common in big cities to observe significant amount of left-over, unused spaces either in the center or in its peripheries. The changing patterns in economy, industry and employment patterns have affected for worse the issue of lost space in big cities (Trancik, 1986). Even though Trancik mainly discusses the type of lost spaces that are left-over areas, it is important first to find these void spaces and then build a framework of interconnected spaces that have the potential of generating new urban centers and simultaneously new investments. In most cases, these lost spaces are urban areas that are unpopular, in need of redesign and make no overall positive contribution to users, which Trancik (1986) calls 'anti-spaces'. Both types of lost spaces have the same potential and offer great opportunities to designers for further development and become integrational environments for their urban tissues.

According to Trancik (1986) modern movement in design during 20th century unintentionally contributed to the creation of lost outdoor space. This happened because modern movement principals were different from the urban design principles of the Medieval or the Renaissance cities, which were generally low and horizontal. As we know, the traditional European city consisted of horizontal blocks creating an urban pattern with a sense of enclosure. On the contrary, the modern cities are a different story, where the low-rise pattern is not always present. Trancik (1986) further argues that modern city is an environment of high-rise blocks where its dweller does not have the ability to socialize in communal areas around the street, which was characteristic of

the Medieval and the Renaissance cities. Nevertheless, his claim is not an implication that modern movement has been a failure and that famous works of the period should be rejected; rather, like any other great movement, it was mostly concerned with giving humans a solid reference.

Exterior space should work as a driving force that defines architecture at its borders. It is the principle of enclosure that defines open space and creates connections between spaces, something which is present in preindustrial cities. It is important to understand that spaces between buildings should be utilized by people who inhabit them and function as places for interaction. One can acknowledge the fact that in development of peripheries of Ankara, especially in the focus area of this thesis there are vast land not properly enclosed by buildings. These physical conditions contribute to the actual state of these areas; with no proper function and a lack of human activity, therefore lost.

Modern movement has produced urban spaces which are different from the spaces that traditional cities had. According to Trancik (1986), the modern city is a city filled with high towers competing with each other and lack spatial integrity. Modernism swept away the traditional urban pattern established by streets, replacing them with a system of vehicular highways which altered the fundamental relationship between buildings and routes (Marshall, 2005). The issue is to achieve directional continuity in a city where the urban solids are vertical objects with no sense of enclosure and the space left behind has no clear shape (Trancik, 1986). Accordingly, in order to create a successful street in the city of high-rise buildings, there needs to be a transition from low to high-

rise building types where the low type responds to street level and high-rise accommodates more private needs. In this way, an integration between public and private needs would be accomplished.

A similar condition to what is mentioned above is seen in Çayyolu that is in the focus of this research. There are no traditional urban patterns that could have been referenced from the Turkish experience on city planning, rather building types and street network patterns that are common in urban design. Trancik (1986) argues that American cities have neglected the main street while shifting focus on the suburban shopping centers leaving vacant buildings and indeterminate public spaces on the main street. The historical pattern of accessibility which was focused on the centers of the built settlements, was distributed around the peripheries allowing roads to have their own fluid geometry, while buildings were seen as sculptured forms flowing in space (Marshall, 2005).

One should not forget that architectural space is an important human invention which has played a critical role throughout history. Space created by modern movement creates a feeling as it is ever present, abstract and untouchable, meaning it is indefinite and cannot be conceived as having a definite form, therefore cannot carry meaning (Peterson, Barnett and Littenberg, 2020). The concept of an endless space is still present today and it seems to be the default condition for most planning and urban design. However, architectural and urban space made by human involvement is defined and has a geometric order that can still be useful.

Space as an idea can be described as the intangible qualifier of our vision of form, location and dimension which establishes a relative measure among physical things. Modern architecture and

contemporary society have accepted the destruction of traditional volumetric space created historically (Peterson, Barnett & Littenberg, 2020).

Peterson, Barnett and Littenberg (2020) consider modern space as *anti-space* that is always opposing the characteristics of *space.* Anti-space is formless, continuous and infinite, characteristics which are opposing to the characteristics of space, which is finite, formed and discontinuous. For that reason, space is wiped out by the presence of anti-space. Hedman and Jaszweski (1984) argue that out of miles of new streets built, endless buildings and numerous serious efforts to create plazas, there are very few examples that offer the excitement of a comprehensively experienced three-dimensional space. Modern space, along with its modern way of living is conceived only in terms of anti-space. Since space is conceived as something that has definite forms, it has properties which are tangible, i.e., proportion, scale, size and shape. All these physical characteristics have limits, giving space an identity and value with their presence, while anti-space lacks it.

Renaissance plazas, especially the ones in Italy, are good examples of valuable public spaces and are different spatial creations from plazas that emerged by the modernist approach. According to Hedman and Jaszweski (1984) the Renaissance plazas of Italy are the most accomplished spatial creations because their three-dimensional space offers a positive experience by involving the visitor with special significance to each movement. For Hedman and Jaszweski (1984) it is common to encounter dimensionless spaces during the modernist design approach where people are supposed to walk for miles and encounter no significant change. It is true that most of the time

people dwell in neither extremely positive nor negative spaces, rather somewhere in-between where spaces are not so dimensionless or exceptionally appealing.

2.2 Urban Sprawl: A Historical Perspective

Urban systems have always had the tendency to evolve and emerge in various ways, one of them being urban sprawl. Urban sprawl is generally understood as the expansion of geographic extent of built environment, often associated with low-density residential housing (Rafferty, 2020). Squires (2002) describes urban sprawl as a pattern of urban development linked with low-density, suburban development occurring in the periphery often surrounding a deteriorating city. Ewing (1997) defines urban sprawl as a form of development that is associated with leapfrog development, commercial strips, low-density, automobile dependence and limited public open spaces. However, in dense metropolitan areas, sprawl is related more to the need of a better living space and other amenities, relying more on private automobile transportation. Additionally, existing urban sprawls have been correlated with high pollution and extensive usage of energy, adding to the environmental footprint of metropolis (Rafferty, 2020). According to Nielsen (2017), there are five main characteristics that are associated with sprawl: ***location*** of the development which is on the peripheries of urban areas, ***low-density*** development both residential or commercial, its architectural ***similarity***, ***affordability*** for the working class and its ***social homogeneity***. Nevertheless, it should be understood that urban sprawl does not follow similar development patterns everywhere in the world. Even though the typical urban growth in third world is a peripheral expansion should not be defined as the typical urban sprawl with the

characteristics mentioned above because the agents of urban growth differ from developed countries.

There are also extreme cases where physical expansion goes beyond population growth: the case of Philadelphia Metropolitan Region. The city was a compact city; however, the population growth was associated with uncontrolled urban patterns and land consumption outpaced population growth. The expansion of the Philadelphia Metropolitan Region is a notable case of urban sprawl which helps understand and explain the problematic better.

The emergence of the term 'urban sprawl' in the 20th century as the main form of urban expansion in developed countries, has resulted in increased criticism because of negative economic, social and environmental effects. This dramatic expansion has occurred in many countries all over the world, even though operating differently, it has been of high interest and debate because of the problems related to urban sprawl. Williams and Shiels (2000) argue that urban patterns formed by discontinuous growth create low-density housing with wasted open space and developers are attracted to inexpensive greenfield sites, which results in a leapfrog effect as areas grow larger. Brueckner (2000) further suggests that excessive spatial growth of cities results in the loss of social value of an open space when converted in urban use and social costs of congestion.

Discussion on urban sprawl is highly linked with the term 'suburbia'. Suburban development can relate to most characteristics mentioned above, however, ***peripheral location*** is the most fundamental of all. Suburban development is located between the city and the country, or in other cases between the city and nature (Harris, 2010). Being peripheral makes suburbs less accessible

to other parts of the city, but most of the residents' everyday needs are fulfilled by existing facilities (Harris, 2010). Some other features of suburban development are; generation of residential densities that are intermediate between those of the city and the country, they are usually criticized for being uniform and associated with social boundaries (Harris, 2010). It is crucial to keep in mind that suburban development it is context specific and it cannot be the same everywhere, however, at some extend there are similarities. Similar features can be recognized in our selected area of Çayyolu. Suburban typologies can be either voluntary by state or entrepreneurial investments, or involuntary. The selected site, even though fragmented, it is a voluntary suburban development.

2.2.1 Urban Sprawl in Ankara

History has demonstrated that urban sprawl does not follow similar development patterns all over world. The five characteristics mentioned above refer to the urban sprawl in USA, however, there are commonalities with the urban sprawl in Ankara as well. The economic limitations of the Turkish middle class could not effort single houses, therefore, the urban sprawl in Ankara does not follow its western counterpart. This economic and social situation has had its effect on urban morphology of Ankara's suburbia.

Until the beginning of 20th century, the macroform of Ankara did not change much; however, in 1923 the city became the capital of the Turkish Republic, therefore its importance changed to a greater extent. Being the capital of the newly-born Turkish nation-state, Ankara was built as a symbol of the young nation. In the first half of the century, the city experienced growth due to

state-led modernization, while in the second half uncontrollable expansion with new squatter areas was the distinctive characteristic (Batuman, 2013).

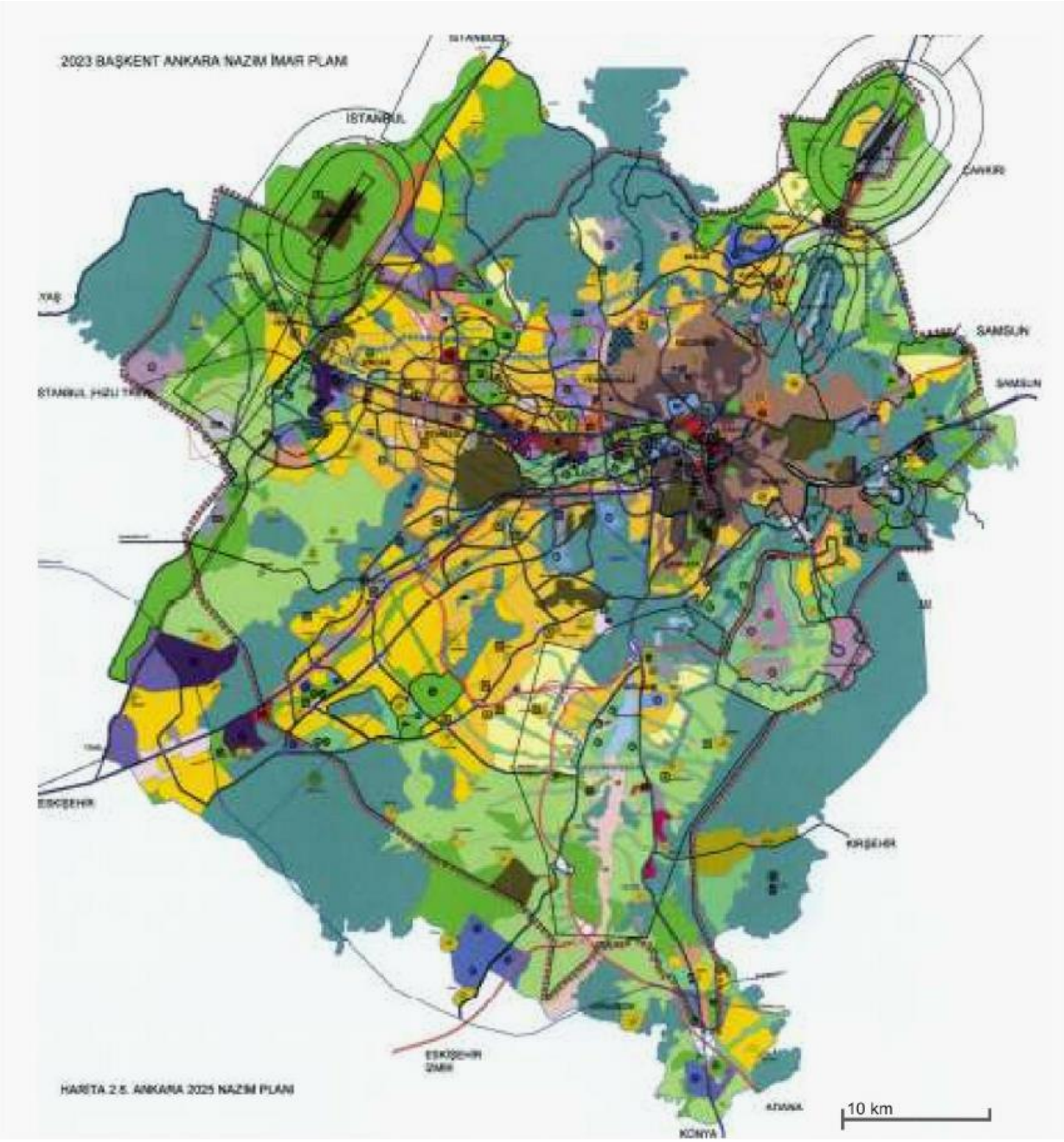
The government's aim was to create a model modern city that would serve as a base for future development in the country, by addressing themes such as planning, transportation, public administration and housing. However, the uncontrolled expansion of the city associated with inefficiency in transportation and housing lead to a weak planning implementation (Batuman, 2013). The increase in population with need for housing has continued all throughout 20th century. Several development plans were introduced and implemented in the following years; however, the latest development plans are relevant since in those plans, we can discuss sprawl. These plans are: 2025 Plan of Greater Ankara Municipality (1995) and 2023 Başkent-Capital-Ankara Master Plan (2006).

To understand 20th century urbanization in Turkey, it is crucial to consider post-WWII and post-1980 developments because of their particular significance on urban development and their effects on society. The period between post-WWII and 1980 is a period which is considered as characterized by populist modernization because of Turkey's transition into multi-party system in 1946. Changes in the political system meant that economic and political relationships with the Western world aimed further integration with the global market since a new party – the Democratic Party – came into power in 1950 (Batuman, 2013).

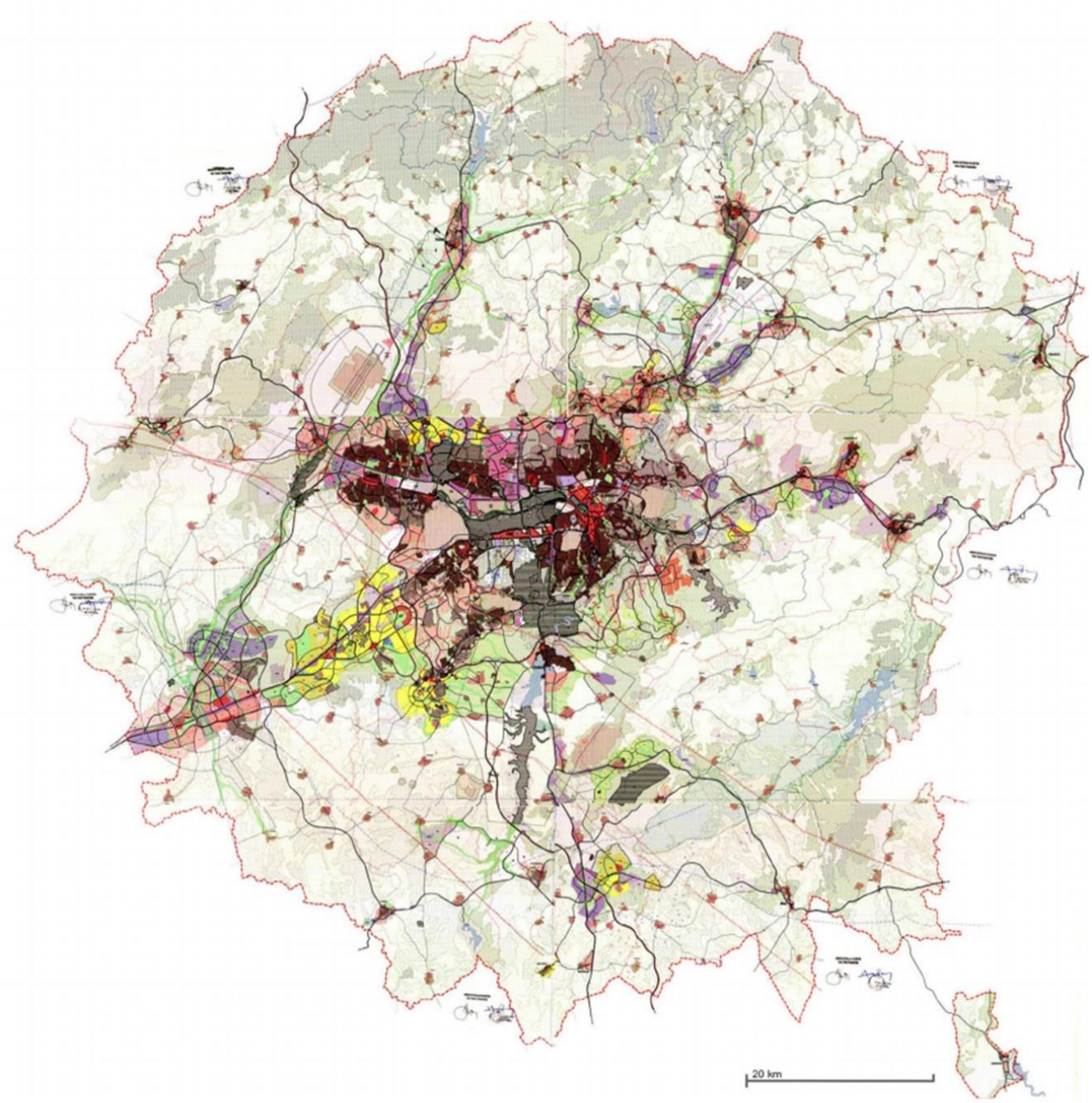
New policies implemented by the government at the time created job opportunities for people, hence resulted in the emergence of squatter houses also known in Turkish as "gecekondu" around

the city. The rapid migration from rural to urban areas made it difficult for planning mechanisms to deal with such quick urban transformation, hence, a dual spatial structure emerged. On the one hand there were middle classes, and on the other the squatter surrounding them (Baş, 2003). This informal employement was characterized by small-scale service enterprises mainly from immigrants that lived in squatter areas and became an important part of urban life and economy. A total population of 289,000 in 1950 was already beyond what was projected by the Jansen plan for 1980 and it reached 650,000 by 1960 (Batuman, 2013).

Between 1950s and 1980s the dominant urban form was established by mechanisms associated with economic reasons. The dynamics and city form of this period are linked with the Turkish term "yap-satçı" which means "builder-seller" i.e., property developer. The term itself is interesting because it displays the circumstances of capital accumulation and construction method of the period. Consequently, the city became a product of "yap-satçı" type of housing supply, hence damaging the previous urban structure of detached private houses on an individual urban plot. Since small-scale developers focusing on single parcels weas the main housing supply method, the monotonous image of apartment block would dominate the urban form (Baş, 2003). There was no individualism anymore, rather apartment owners with their apartment numbers and this type of small entrepreneurship transformed the overall city structure.



(**Figure 2.1.** 2025 Plan of Greater Ankara Municipality, 1995. Source: ABBISDB, cited in Çalışkan, 2009)



(**Figure 2.2.** 2023 Başkent-Capital-Ankara Master Plan, 2006. Source: ABBISDB, cited in Çalışkan, 2009)

Ankara 2025 Plan Schema was not approved as the legal development plan by the Ministry of Public Works, even if it reflected a truly radical appraoch of deconcentration which aimed to improve the unbalanced distribution of population by establishing new nodes, axes, and attraction areas (Ankara Büyükşehir Belediye Başkanlığı, 1997). However, in this plan the already established peripheral nodes and axes are present and are given the necessary importance which reinforces the deconcentration approach. This plan was followed later with another development plan that focused on a rather rational accord.

There was a demand for a new master plan and in 2006, Ankara Greater Municipality proposed a new master plan: the 2023 Başkent-Capital-Ankara Master Plan. The plan differed from previous ones because it was rather a reasonable compromise between centrality and decentrality in managing growth (Çalışkan, 2009). The plan displays a bottom-up approach combining 15 different development plans produced by local municipalities in Ankara, however, it is not just a combination of these plans, but a revision that ensures spatial coordination among them. The rapid dispersion which was also stimulated by increase in private car ownership, planned developments in the outskirts of the city and a total projected population to reach up to 6.5 million in 2023 within the entire area governed by the plan, the plan suggested an intervention to better control the urban development in the fringes of Ankara since it presented a threat to agricultural land, water reservoirs and forests (Çalışkan, 2009).

The urban development plans of Ankara as the capital city of Turkey through 20th century have been insufficient in implementation. Even though attempted to be built as a model city that would

serve as a model for further urban development around the country, the plans proposed turned out to be ineffective because of continuous migration and the pressure of land speculation (Batuman, 2013). During the 20th century, especially in the postwar era, the city had to deal with spontaneous rapid growth until 1980's (Batuman, 2013). Although planning efforts have been significant and legal obligations, the number of partial plans and plan modifications that have occurred suggests that planning efforts have failed to achieve what they aimed. Şahin (2007) shows that 3954 plans revisions or modifications were made between 1985 and 2005, which illustrate the ineeffectiveness of the plans.

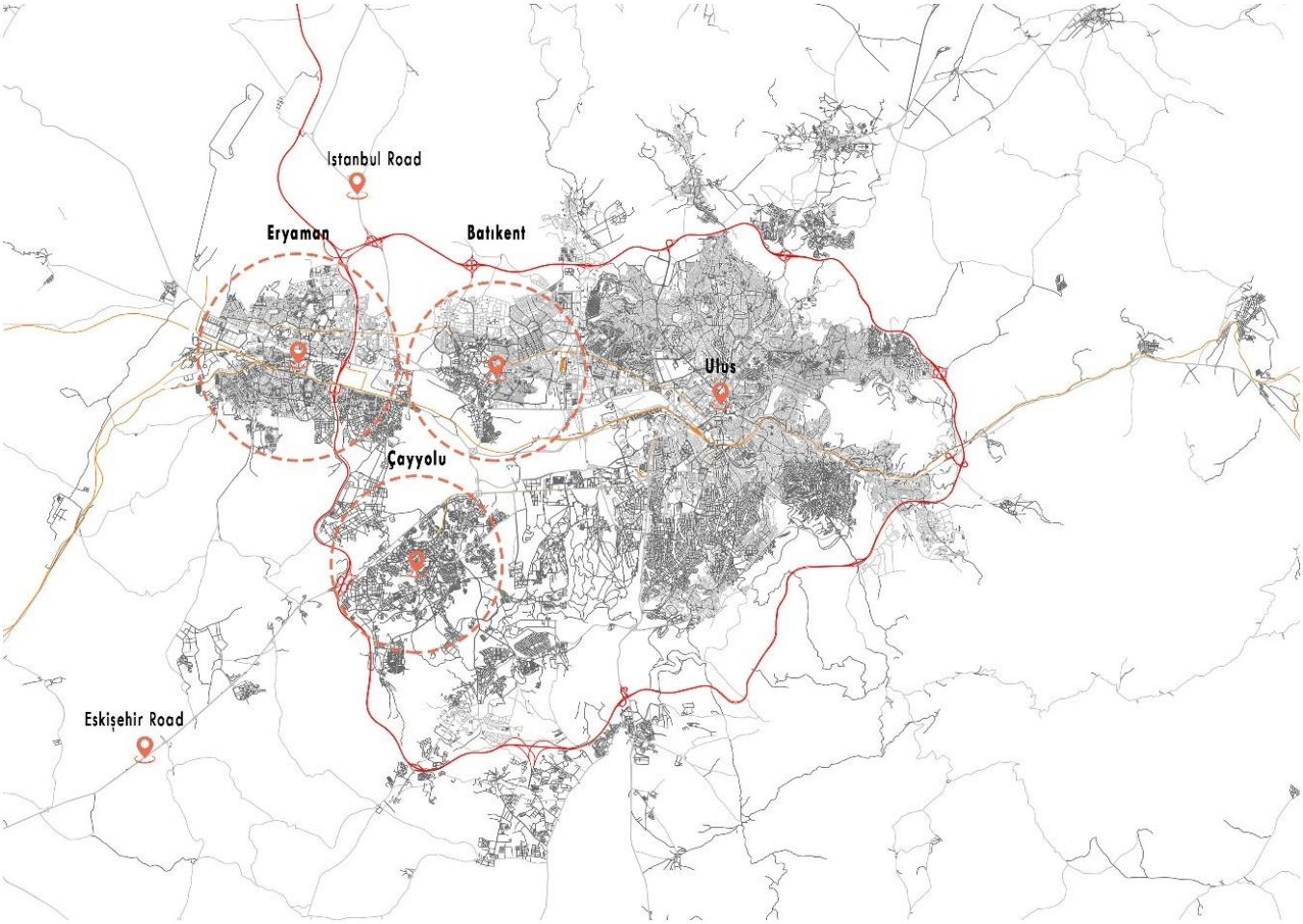
Master planning experience in Ankara shows that the evolution of urban form changed not only the scale of the whole entity, but its complexity increased as well. The different subsegments of the entire body diversified the spatial form of the city, therefore continuously emerging demands were not compatible with conventional approaches and tools of plan intervention in Turkey (Çalışkan, 2009). Turkey is a case where planning tools and control mechanisms are not always efficient and compatible with the urban forms created by emerging socio-spatial dynamics such as squatter houses, inner migration, high-rise financial districts etc. Nevertheless, Turkey is not a special case since similar problems occur almost everywhere with varying degree.

Alternative approaches need to be applied to comprehend the dynamic character of developing cities like Ankara. Even though these programmatic approaches can be produced for specific sites either in the core of the city or in the peripheries, they should be elaborated within a holistic approach which responds to urban patterns. This new perspective would require a new framework

which would combine large and intermediate-scale programming that are integrated within existing situation and are flexible enough to adapt to future directions.

The current urban problems that exist in cities with rapid and fragmentary development can be shifted into opportunities even if they seem difficult. The conventional large-scale master planning proposals for Ankara have proven to be inefficient in providing a system of consistent and complex fragmentation of urban environments. A new way of understanding the whole city form that redefines large-scale planning and is context-sensitive morphological approach is needed. If such an approach is properly executed, the fragmental parts in the city would no longer be fragmented but would work as essential parts of a unified urban structure. The following part of the thesis will advance to the analysis of peripheral development of Ankara, specifically Çayyolu district and the lost spaces.

2.3. Formation of Çayyolu District in the Peripheries of Ankara



(**Figure 2.3.** Overall urban development of Ankara.)

While the developments along Istanbul Road, which include Batıkent and Eryaman areas have mostly been based on public property developments, the peculiar case of Çayyolu along Eskişehir Road was intended to develop on private initiative. Other residential developments include Yaşamkent, Alacaatlı, Ümitköy and Beysukent, similar to Çayyolu, mostly based on private sector development (Ünver, 2019). Formation of Çayyolu has started around 1970's and has continued

through time, however it can be observed that there are various building types which display the change in contexts through time and role of the actors who played their part. In 1980's the housing sector went in deep crisis, therefore 'Mass Housing Law' and 'Housing Development Administration of the Republic of Turkey' (TOKI) was created in 1984 which changed the regulatory context and the responsibilities of the actors. TOKI played a crucial role in suburbanization of Ankara, including Çayyolu district. In Çayyolu there are three significant types of residential unit production: cooperatives, mass housing for workers and mass housing for government employees which were based on cooperation founding credit and willingness of people to buy with the option of loan repayable in instalments (Ünver, 2019). This situation suggests that there was a supply-demand relationship between society and resources, therefore the production of space in western Ankara started to transform from small scale apartment buildings to larger scale projects using significant amount of cheaper land to further develop.

In the development of Çayyolu suburbia, the public sector played a crucial role since it allowed and encouraged development. Developers followed up the opportunities created by the policies of the Municipality of Greater Ankara to take advantage and benefit economically. These policies had their consequences on the urban transformation of the city. Çayyolu district has several residential units which vary and can be depicted as neighbourhoods. Some of the residential unit developments in Çayyolu that can be considered as neighbourhoods are: Ümitkent Site, Mutluköy Housing Cooperative, Mesa Koru Housing Estate, Konukent I and Konukent II Sites. Emlak Bank whic provided loans and MESA as a construction company played a crucial role in the developments of new residential units in Çayyolu which were mainly for middle and upper-middle

classes (Ünver, 2019). A chronological development analysis of the formation of Çayyolu, would define its development in three main stages; pre-1985, 1985-1994 and post- 1994 periods (Kızıltaş, 2010).

2.3.1 Three Main Development Periods of Çayyolu and its Districts

The pre-1985 period can be considered as a build-up of block scale partial plans as an outcome of the division of labour between low-budget capital and corporate capital. The way Çayyolu started to take shape is exactly the shift from small properties which gave way to large ones, forming a part of Ankara's periphery today. The physical development of Çayyolu has occurred through fragmented and partial plans mostly initiated by small groups who aimed for a house and used the advantages of housing cooperative and organizations (Erişen, 2003).

After the 1980s the corporates had an impact on the urban development of the area and a growth based on accumulation of large pieces of land instead of small parcels can be noticed (Tekeli, cited in Erişen, 2003). As mentioned above, this was highly supported by the increased effort in the sector of mass housing projects. The first residential unit development projects in Çayyolu were concentrated on land-ownership at a neighbourhood scale planned via partial plans (Kızıltaş, 2010). Nevertheless, larger scale housing projects started developing such as Ümit Housing Cooperative (approximately 4 ha), General Directorate of State Hydraulic Works and Turkish Petroleum Corporation Mass Housing project (approximately 81 ha) approved in 1973 and Yenikent Bahceli Evler Housing Cooperative for 5006 housing plots which was approved in 1980 (Kızıltaş, 2010). During late 1970s and 1980s MESA development company collected parcels at

affordable prices and produced housing projects for upper-middle and high-income groups and the strategy was to produce high-density low-rise apartment blocks (Kızıltaş, 2010). MESA Koru Housing Estate is one of the residential development projects planned in 1978 where a combination of low-rise units and high-rise apartment blocks were produced. It was later followed by Konutkent I and Konutkent II residential projects. The pre-1985 period is mainly linked with development of the area by using vast parts where the main actor was the cooperative development.

Authorities of the municipalities in Ankara were determined to control any action within their boundaries, while outside borders were left as a decision to the central government and this approach had a significant impact on the district of Çayyolu (Kızıltaş, 2010). The 1985-1994 period can be seen as a dual formation, both inside and outside the municipality borders. As mentioned above, the planned formation was inside the borders defined by the municipality of the time, while the partial plans formations were outside the boundaries. The master plan named 'Çayyolu Mass Housing Development Plan' aimed to unify all the pre-existing expansion and provide housing for mostly middle-income groups (Kızıltaş, 2010).

'Çayyolu Mass Housing Development Plan' approved in 1986 was a master plan prepared for the area within the boundaries of the Greater Municipality and it covered approximately 450 ha of land where 140 ha were state property (Kızıltaş, 2010). During the development of the master plan which was planned for a population of 47,500 people and approximately 9,946 dwellings, there was the tendency of exceeding the boundaries of the Greater Municipality planning growth outside the boundaries (Erisen, 2003). Çayyolu Mass Housing Plan was considered to be a convenient

solution for middle and upper-middle classes that wanted to differ themselves at the peripheries from the rest of society. With increased infrastructure costs, it became hard for middle-income groups to own a house in the city center, thus they started looking for opportunities at areas where prices were affordable (Batuman, 2013). Therefore, suburban development in Çayyolu gained a significant stimulation at that time.

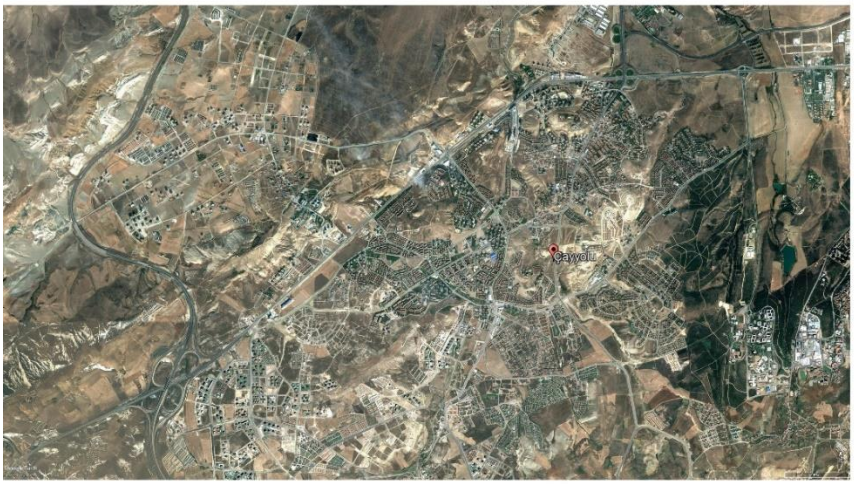
The Çayyolu Mass Housing Plan contributed to further development of suburbia in that area. Better road condition and communal alternatives were crucial factors in urging people to move for a different lifestyle. In addition to that, owning a car and a house has always been seen as a good investment, and that triggered further urban expansion at the peripheries (Erişen, 2003). The low-density life style at the edges of the city was driven by improvements in transportation and communication, offering people cleaner, safer and more luxurious environments.

Besides urban development inside municipality borders, there were developments outside borders as well. As mentioned previously 'yap-satçı' (builder-seller) type of actors had been active throughout this time, hence, transforming the overall structure of the city where these kinds of partial plans developments were approved by government. Different from previous partial plans, these ones did not meet the minimum criteria of 15 ha that was required to be considered as neighborhood unit (Kızıltaş, 2010). These partial plans remained smaller, bounded within cadastral parcels because cooperatives and developers collected individual parcels and developed them individually.

The post-1994 period is a period of increased speculation for the south-western corridor with property developers as the main actors instead of cooperatives. 1994 was an important year because a decline in terms of construction in Ankara could be noticed, later followed by a boost in 2002 (Balaban, 2008). Development of this district intensified more during 2000's with the development of Yaşamkent and Beysukent. The south-western corridor became an area where the urban formation was fuelled by the desire of upper-income groups which were looking for a better lifestyle at the peripheries (Kızıltaş, 2010).

The urban expansion that occured in Çayyolu through housing cooperatives or mass housing projects which became an alternative for middle and upper-middle classes has created fragmentation in the outskirts of the city. This fragmentation has increased the heterogeneity of the area leaving the previous dual structure of the urban space into a variety of urban forms. However, the suburban lifestyle in Çayyolu has provided residents of a similar background in terms of social and occupational structure a clean social environment (Erişen, 2003). As mentioned previously, Turkish suburbanization has occurred differently from the western conterparts evolving mainly in high-rise high-density developments and ocassionally two-storey garden houses. Even though there were already existing squatter settlements on the peripheries of the city, that did not stop construction activities to occurr.

Çayyolu, 2003



Çayyolu, 2010

Çayyolu, 2021

(**Figure 2.4.** West-Eastern development corridor on the last two decades, Source: Google Earth)

(**Figure 2.5.** Urban development of Çayyolu district.)

The overall Çayyolu development is composed of three main districts: Ümitköy-Beysukent, Çayyolu and Yaşamkent along the Eskişehir road. The first district is made up of two subdistricts as the name suggests: Ümitköy and Beysukent. Ümitköy is developed along a mixed-use street, while is constructed with relatively larger housing areas. However both these subdistricts are developed on partial plans of different scales and policies.

The second district in Çayyolu is developed mainly according to 'Çayyolu Mass Housing Plan' which initiated in 1985 followed by Konukent I-II and KORU housing estates developed by MESA (construction company) later integrated in 'Çayyolu Mass Housing Plan' in 1990. In addition to

these housing developments ILKO and Park Street and environs were integrated as partial plans (Kızıltaş, 2010). The Park Street and environs also were aimed to make a buffer zone between Çayyolu and Alacaatlı district.

The third district is made of Yaşamkent and Alacaatlı subdistricts. The first developments date back after 1985 where expansions in this area have been based on partial plans. Yaşamkent is an example of such approach. The preparations and implementations of the plan have been prepared and implemented according to different stages, therefore modifications have occured through time (Kızıltaş, 2010). Alacaatlı villages which is as well a subdistrict is based on partial plan development and its boundaries extend further until 'Çayyolu Mass Housing' area and aims a homogeneous density around the area (Kızıltaş, 2010).

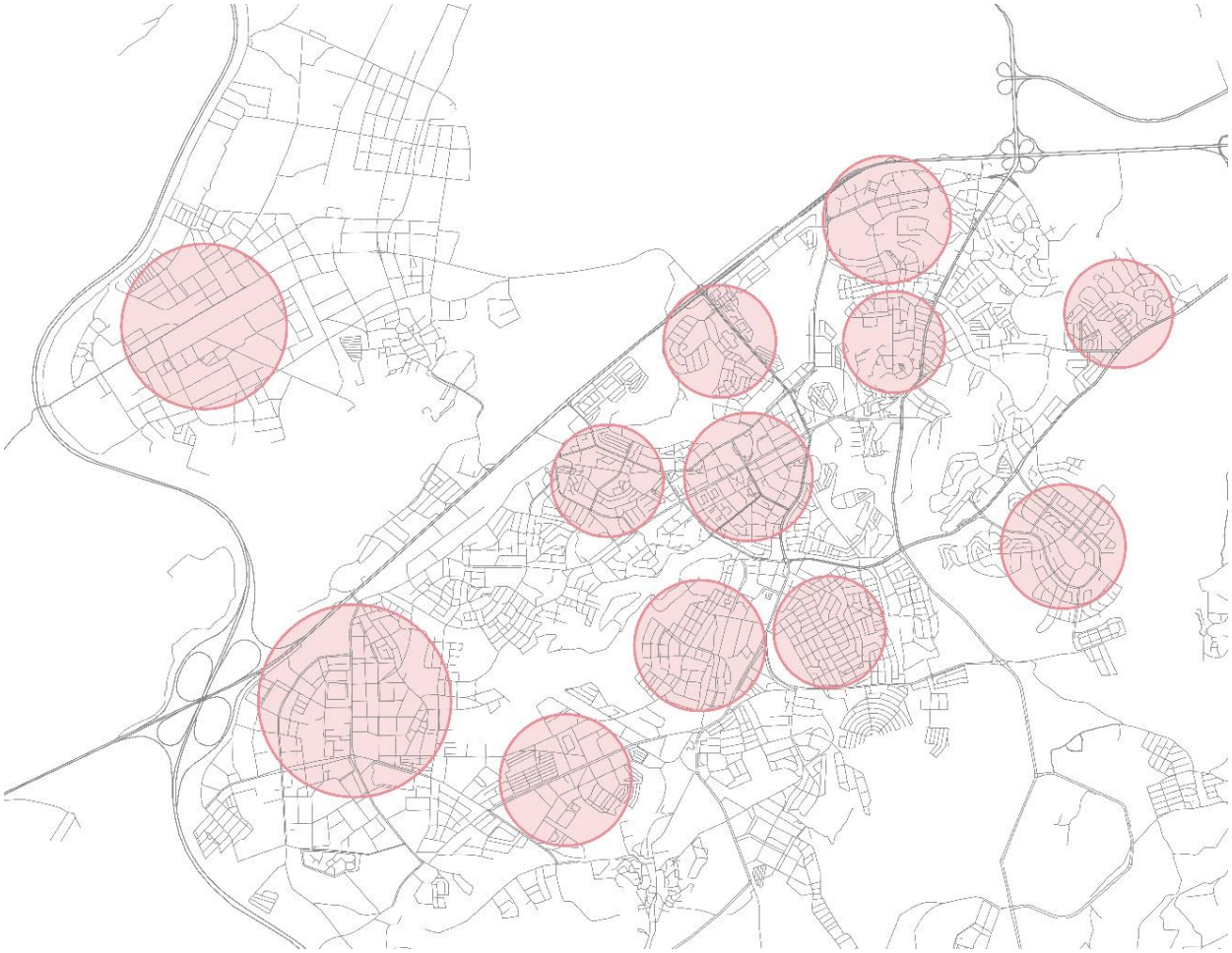
2.4. Patterns of Peripheral Formation of Ankara and Types of Lost Space

If one tries to explore the urban spatial formation of Ankara, especially in the areas where urban expansion has occurred, one can notice a sense of homogeneity that exists throughout these expansions. The main reason for this is the phenomenon of standardization, because uniform standard forms have been created with land readjustment processes (Baş, 2003). Mass housing was highly dependent on standard techniques of production, and even though peripheral areas were large enough to experiment with form and patterns, it is not the case in Ankara and Turkey. Therefore, standardization in Turkey has produced spaces that created problematic-built environments. Where spatial plans are designed with no coherence to connectivity, complexity and variable unity with the existing urban fabric, then it is common to have spatial problems.

The reason behind the lack of variety in urban patterns of periphery is the design method itself, where morphological configurations are determined by the border definition of roads as the main factor. Çalışkan (2012) analyzed the morphology of residential units in the peripheries of Ankara in five different levels to find differences and similarities: plot layout, street pattern, pedestrian network, figure-ground relationship and massing. According to Çalışkan (2012), coherence is a condition of morphological unity, where all essential elements interact with each other and are integrated to form modules of a higher level. If such a morphological condition is met, then spatial configuration of urban and architectural elements would be well achieved.

In the analysis of the pattern formation, Çalışkan found out that the main problem with coherence in all layers is that they do not provide the sense of an interior space that can be seen as the interface of building unit integration. In addition, the massing layer has a weak coherence which is the lack of diversity in building units and sloppy connections between large and smaller units (Çalışkan, 2012). A huge number of sampling sites are composed of same reparative unit type which results in a lack of complexity for systematic entirety. Since development plans in Turkey and Ankara specifically, have always been associated with partial plans or modifications of smaller scales, this has resulted in designs that at times have not taken into consideration outer reference to the site morphologically within the context of urban fabric. Alexander (1987), prefers to call this fragmented spatial structure as ‘piecemeal growth’, which for him is incoherent and scattered, and can produce assemblies rather than coherent wholes if powerful generating methods are not properly linked to the piecemeal process.

The urban patterns in the periphery of Ankara are highly determined by the road system making it the first and major binding factor that limits the possibilities of alternative forms in developing sites is the border definition of the road system (Çalışkan, 2012). Vast amount of land in the peripheries is transformed by larger scale plans, however, a significant number of sites have been developed separately leading to no outer morphological reference within the urban context. Because building blocks are defined by a close loop of roads, the street system which works as a boundary not free from the road surface has a negative effect on possible alternative complexities between buildings (Çalışkan, 2012). This makes the road system the basic element for formation of ensembles.



(**Figure 2.6.** Selected areas of lost spaces.)

The diagram above shows the areas that are the focus of this research. All these areas are part of this developed corridor and are selected as areas with problems, previously named as lost spaces. Some of the selected areas contain the first type of lost space, while some others the second type as described previously. Even though the selected areas are more structured as urban tissues rather than the surrounding areas, they are not singled out to show categorical changes, rather to make the problematic addressed in this research more visible. In addition, strategic solutions will be introduced to make these urban tissues more valuable in terms of visibility.

Çayyolu is a district which has resulted from the city's urban expansion. Urban expansion is linked with matters that require attention: change of land use, energy demand and fossil fuel consumption, modification of the rural surfaces, vegetation, physical and social changes. Planned extension of the city during the last decades of 20th century has left large amounts of developable areas without serious construction barriers such as natural or topographical ones. The rapid development process in the area has been associated with a series of fragmentary plans, which has resulted into a nonintegrated whole. Additionally, the limited economic situation of Turkish middle class has affected the suburban extension of the city including this district, creating a hybrid type of urban ensembles. Nevertheless, this condition of hybrid urban ensembles has created urban spaces where some of them can be considered as positive, while a number of them can be seen as negative spaces. For these reasons, Çayyolu has been selected as a case study which is worth analyzing and further development proposal are presented for the future.

When analysing the urban morphology of a site, either uniform or mixed pattern formations can be noticed. While analysing different parts of a plan, the uniform patterns are clearer to grasp because the component plants are essentially of same shape and size. In most cases, uniform patterns derive as a result of single effort of design and production coming from the same agent (Kropf, 2017). Many areas, however, appear as a product of several agents with distinctive characteristics which is also the case in Çayyolu. In many cases, these agents are involved in transformations of already existing urban fabric. The scenario of mixed or heterogenous pattern formations includes areas which are often subject to transformations, mainly the oldest settlements of the city because of their constant need for repair, replacement or extension.

The fundamental assumption is that areas composed of different regular patterns suggest different phases of growth and transformation of cities. However, regularity does not necessarily assure planning because planned patterns may also look ‘irregular’ (Kropf, 2017). According to Kropf (2017), an urban area can be rational without the need of being uniform if the area includes a characteristic mixture of elements that are included during a period of piecemeal development. In this mixture, some of the elements may be predominant while others exceptional. A common example of mixed type is a specific route which leads into a town that for a long period of time has undergone several piecemeal developments, making the whole process consistent. Another case where significant variation and heterogeneity exists, tissues may still be distinct but at the same time share common characteristics. The common feature can be a specific house type, however, in some areas semi-detached or terraced houses may also exist.

(**Figure 2.7.** Existing Street Network producing lost spaces.)

The diagram above shows a number of selected areas of similar scale that have an already established street network. The street network is different from site to site; some of them being more regular street patterns than others. In any case, isovist analysis will be applied to each site to assess the quality of their open spaces regarding their visibility level. In the less regular or less established street networks we can see a larger number of areas that are left over spaces, while in the more established street patterns there are central spaces that should function as areas of social interaction.

(**Figure 2.8.** Type I and Type II lost spaces.)

The diagram above show both types of lost spaces which are mentioned previously. The first type of lost areas which corresponds to ‘left-over’ can be seen in different parts of Çayyolu district. There are other pieces of land which are totally undeveloped, however, the ones selected are in close proximity to roads or streets. They can be found in between two developed urban settlements and still have no function. They can be found near road junctions which usually is a valuable piece of land, and still have no contribution to the overall urban environments. The selected areas do not have major topographical obstacles, which means that they could have been developed.

The second type of these lost spaces that one can come across in Çayyolu differs from the first type, but both of their contributuons to the whole urban tissue can be improved. The second type is the central core of the residential develompents there, however, it has few positive contribution to the residents since these spaces are not being utilized at their full potential. They are usually in a smaller scale and are surrounded by residential units, whereas the first type can be found anywhere with varying scales but still in valuable land areas. The identification of both these types of spaces in Çayyolu district is important because it will later be linked with their visibility analysis. The analysis will show that the proposed public spaces are not visually accessible by the majority of surrounding residential units, making these spaces less utilized.

CHAPTER 3

INTERVISIBILITY AS TYPO-MORPHOLOGICAL INDICATOR OF 'POSITIVE SPACE'

3.1 Enclosure and Visual Openness: Indicators of Urban Space Quality

One of the most important features of experiencing a city are enclosure and visual openness. Both allow people to understand the living conditions of the built environment and create both physical and visual interaction between people that experience any space. So, they restrain what can be seen in a physical built environment. Simultaneously, enclosure and visual openness do not only restrain, but also reveal what can be seen depending on the spatial configuration of the built environment or spatial location of the observer. Therefore, the spatial configuration, which affects the degree of enclosure of a space, directs the visual field of the passerby. According to Ewing and Handy, enclosure is the degree to which street and other public space are visually defined by buildings, wall and other vertical elements (Ewing & Handy, 2009). Schultz (1976) as well described enclosure as the boundaries of an open space, which can be the built environment or landscape elements. Since urban environments face challenging changes that come with urban growth, the visual characteristics of such environments change as well. Therefore, the visual openness and enclosure are important characteristics which forge physical space that has an undeniable effect on human interaction (Tara, 2015).

Visual openness and enclosure are crucial indicators of the quality urban space because inhabitants behave differently according to the physical properties of a specific environment. The psychological reason why they are crucial to take into consideration, is the effect they can have on human safety. According to Stamps (2005), enclosure can be accepted as the geometrical properties of a three-dimensional environment which affects safety by either limiting or allowing locomotion, which he calls it '*permeability theory'*. For this thesis, the geometrical properties of what is visible from a specific point location remains as one of the interests of this topic exploration. In his research on the topic, Stamps (2005) found out that elongated spaces restrict lateral movement and prevent escape, therefore having a direct impact on enclosure and its impressions of perceived safety. Human safety is not a concern for this thesis, nonetheless, perception of space is connected with the morphological configuration of urban plots, blocks, neighborhoods etc. It is important to understand how many measures are necessary to describe isovists. In many cases, results from geometry and psychology suggest that few variables can be sufficient. However, computational geometric measures are not a problem nowadays since various alternative environments can be simulated in a short time.

As mentioned previously, the enlargement of urban development because of the increase in population, can have an effect on spatial organization which can be easily noticed in the structure of open and built areas. While analyzing the existing urban fabrics to evaluate the open spaces in relation to the urban pattern, three main components are taken into consideration: the street network, buildings and city blocks. Research on urban morphology has been linked with human perception studies and environmental cognition because the physical and non-built space affect

human behavior (Kaya & Mutlu, 2016). The multidisciplinary studies, which include fields of urban planning, urban design, architecture and other related fields, have made a significant contribution to the study of urban morphology through time. Analyzing and understanding these spaces in terms of visibility, open space dimensions, enclosure etc. can be helpful in understanding the dynamic character of urban space. Nowadays, computational tools can be used to simulate environments with several variations to visual properties to understand urban spaces and optimize for better results, hence, the interest of this thesis.

Because of the urban sprawl that has occurred through time in Ankara, there are large open spaces which are fragmented and discontinuous that have caused management difficulties for traditional urban planning strategies. However, fragmentation is not seen only in these left-over types of spaces, which have been discussed in previous chapter, but can be present in small scale, in places which are supposed to function as public areas. The word fragmentation and its concept stand for a physically existing problem that planners and designers aim to solve; however, fragmentation can be seen as any problem that has created spaces which functionally exclude each other. It is exactly in the context of this thesis to reveal these specific areas that are present in the peripheries of Ankara, Çayyolu area more specifically, and consider them in design projects as a testing operational tool which focuses on visibility.

It is clear that openness to neighboring or distant views does have an effect on the quality of living environment. Therefore, the composition of buildings in relationship to other nearby buildings has

an influence on spatial openness. This makes visibility an important parameter to be considered in design to preserve a healthy and satisfactory living environment.

In high-density environments, characteristics associated with visibility are an important virtue in creating better living environments. In addition to that, they may influence economic attractiveness, making that environment more desired by residents. The common assumption is that lower visual exposure and more visual openness to the view will make the area more tempting to live in and consequently affect its values. Visual exposure is normally defined as the visual penetration into one's privacy by being observed from external spaces like other buildings or streets, while visual openness measures the area or length from the built facades where views can be observed (Shach-Pinsly, Fisher-Gewirtzman, & Burt, 2011). Different morphological configuration in urban settlements, have the power to change the quality of the environment by allowing different levels of visual exposure and visual openness, consequently, affecting people's choice.

3.2 The Capabilities of Visibility Analysis based on Isovist and their Representation

Space the main concern in urban design, architecture and other related fields, because of its direct relation to humans. Therefore, providing tools and methods for designers to analyze would help in understanding spaces better. Visibility analysis is important for urban designers, however, in most of the cases, this analysis is used in the spectrum of public safety, traffic, vistas and advertising (Bilsen & Stolk, 2007). Nevertheless, the potential of isovists, as a visibility analysis method, should not be reduced to a tool which can 'measure' spatial awareness and well-being.

Most of the research on the topic is two-dimensional based approach. The encouragement to focus on visibility analysis comes from the needs that fields such as urban design, design thinking, agent-based modeling have in today's overall design approach (Bilsen & Stolk, 2007). However, this approach does not necessarily mean that the role of the designer needs to be replaced with the computer, but to provide valuable tools which can be used during the design process.

Visibility can also be associated with other less related fields to urban design such as pedestrian movement, ecology, criminology etc. From the computational point of view, most researches are based on multi-agent parameters, meaning that more input parameters from the environment will eventually give result in a more sophisticated outcome. By using the potential of isovists as a visibility analysis tool, multiple design alternatives for the fields of urban design, architecture and landscape design can be computationally generated. From a practical point of view, new typologies with distinctive spatial characteristics can be simulated and analyzed for a more comfortable living environment.

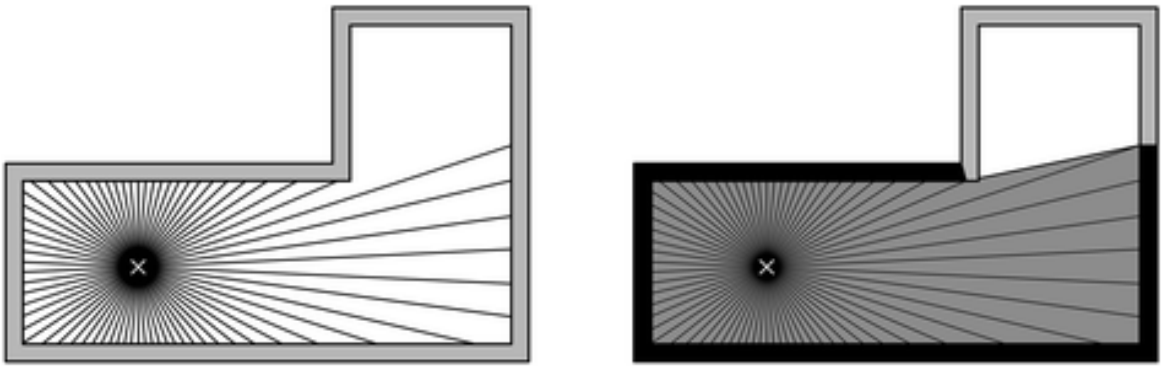
Visual perception is a human experience that is crucial in defining the spatial characteristics of an urban or architectural space. In big cities is common to experience uncontrolled development which drives fragmentation of spaces that can block views towards valuable landscape. In practice it is common that designers don't prefer to use specialized analysis software because they are more difficult to use in the beginning, however, the computing power of such tools allows the designer to go back and forth during different stages of design and at the same time generate several options. Being able to analyze, measure and compare results from techniques of measuring visual openness

and visual exposure, in any environment, either architectural or urban scale, can influence the future development of urban environments.

Today we live in complex cities in which we try to understand the relationship between physical, social and functional aspects of the urban environment. Problems such as physical and social segregation, condition inequalities and accessibility have been treated as crucial problems which derive from different factors such as economic conditions, social and cultural difference, locational advantages, among several others. Even though the combination of such diverse experiences can generate heterogeneity and urban intensity, along with it cultural, economic and social differences emerge through these segregation-generating instruments. Visibility analysis methods can be utilized to analyze how these factors mentioned above may be related to spatial segregation of different income groups.

The visibility of a space or object has been introduced as a methodological approach to encompass analytical techniques such as intervisibility, isovists, viewshed and visibility graphs. Intervisibility analyzes if a point can be seen from another, while viewshed for example considers the area of the surface that is visible from a point location. As we know, isovist as a concept has been defined from Benedikt (1979) as the volume of space representing the visual field of an observer from a specified origin. Several variety matrixes have been used from researchers to explain different characteristics of visible space and this includes matrixes like binary viewsheds, visual openness and visual magnitude.

It is crucial for planners, urban designers and architects to understand the influence that urban structure has on a resident's experience living in those areas. Nowadays, by the use of computers, designers have the option of calculating physical properties that can be related to the emotional aspects that urban morphology might have on a resident. Many scholars suggest using isovists as a method to come up with an objective analysis of the environment that one tends to work on.



(**Figure 3.1.** Construction of Isovist through radial lines, Source: Ostwald & Dawes, 2018)

The image above, adopted from Christensen (2010) as cited by Ostwald and Dawes (2018) shows the construction of a single isovist by using radial lines. The radial lines form a surface of visibility which depends on the surrounding obstacles; walls in the image above, but can be anything that prevents people from seeing beyond that. This is one of the simplest representations of an isovist, however it is important to understand the concept. The object inside the isovist polygon generated from the observation point means that the object is visible.

A common way to represent isovists in analysis is by using the concept of ***neighborhoods*** and ***clustering***. As mentioned previously, an isovist is defined as a set of points or vertices and these vertices are associated with regular units used to divide space, and for each unit a geometrical shape is defined (Batty, 2001). In this way we can see the original form of an isovist as a polygon

and the regular subdivision of space from which the polygon is approximated and the units as part of the polygon which define the vertices of the isovists visibility graph. This theoretical interpretation allows us to utilize the analysis of isovist fields in terms of their shape, meaning the convexity of individual isovists.

When Benedikt first introduced his concept of isovist, while analyzing them, he concluded that there are geometric measures from where isovist fields could be derived from, which include area and perimeter as well. In addition to ***area*** and ***perimeter***, other geometric measures can contribute in isovist analysis. These measures include ***occlusivity***, which is the length of occluding boundaries within isovist, variance and skewness of the radial distance around each vantage point and ***compactness*** measure called circularity which is defined as the ration of the square of perimeter to area (Batty, 2001). McElhinney and Psarra (2014) define compactness as the extent to which a step away from a current isovist is likely to expose visual information in which higher or lower levels of convexity (degree of intervisilibity) occur. Occluded radial lengths are the edges of an isovists which are not physically defined and during movement, previously unseen spaces are revealed and for each isovist occlussivity coefficients can be established (McElhinney & Psarra, 2014). These statistical measures are important because characteristics of area and perimeter show 'how far we can see' and 'how much we can see' within an isovist field. Following the concept of neighborhood, area can be calculated as the number of vertices within the neighborhood while

perimeter can be computed directly by rotating the distance from the vantage point to the perimeter around the circle.

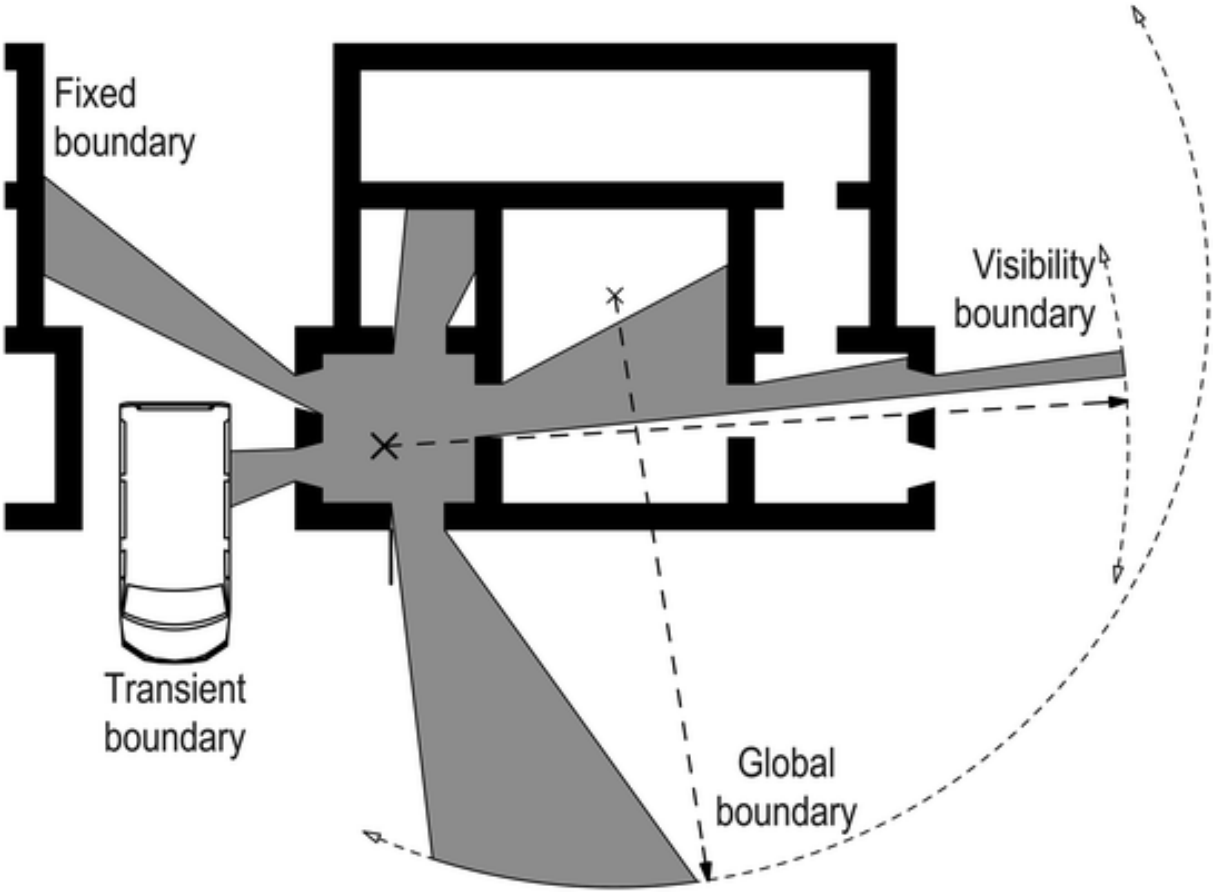
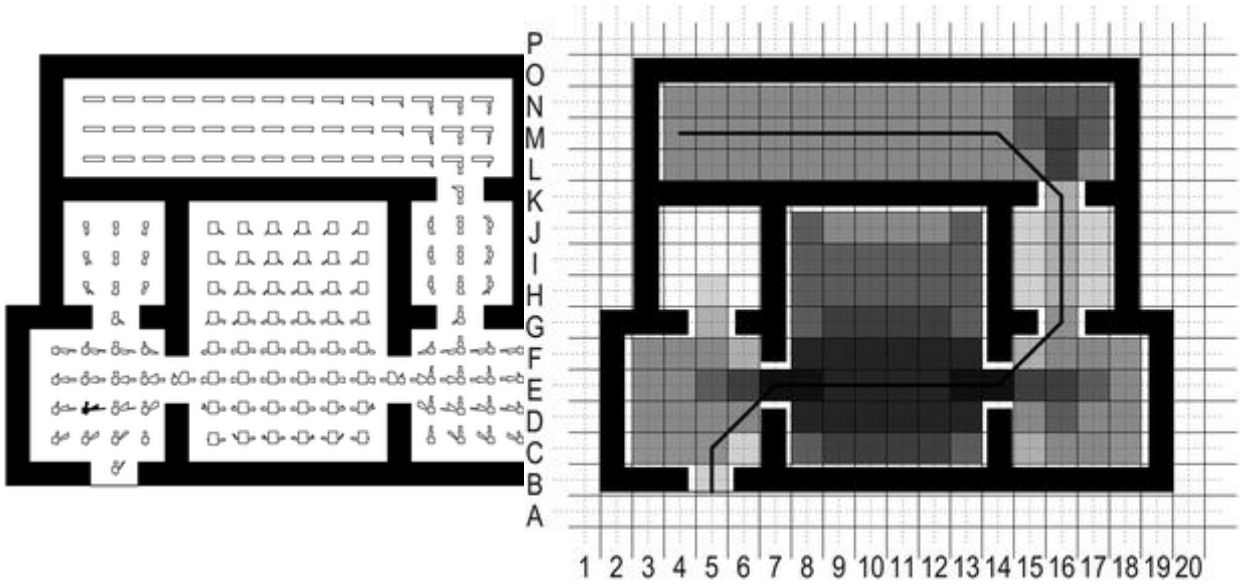


Figure 3.2. Different types of isovist boundary conditions, Source: Ostwald & Dawes)

The image above, adopted from Christensen (2010) as cited by Ostwald and Dawes (2018) shows the different types of boundaries that an isovist can deal with. The most important one is the fixed boundary which is usually an opaque surface of any kind that is fixed and does not allow visibility radial lines to pass through. This is the only type of boundary that is being considered for the research of this thesis, however, there are other boundaries; transient boundaries that are objects in movement, visibility boundary that is a fixed distance from the observation point which humans can see and global boundary which is the global perimeter surrounding the environment (Ostwald & Dawes, 2018).



(**Figure 3.3.** Representation of Isovists as set of isovists (left) and shading pixels (right), Source: Ostwald & Dawes, 2018)

The image above, adopted from Christensen (2010) as cited by Ostwald and Dawes (2018) on the left displays the visible surface (scaled down) of each isovist taken from each observation point, while the image on the right is a visual representation of isovist data based on colored pixels that

represent the value of each isovist from that observation point. The set of isovists on the left correlates with the colored pixel representation because the biggest surfaces have a darker color. On the contrary, lighter colors depict smaller isovist areas. The colored pixel method is crucial for this research because all the analysis of the selected areas is shown using this method.

3.3 Definition of Isovists

Most common name in literature related to isovist and isovist fields is Benedikt (1979), who described an isovist as the set of all points visible from a given vantage point in space. From this clear definition we can understand that isovist hence defines a field of vision from which several geometrical properties like area or perimeter can arise from isovists analysis. In other words, one can describe isovist fields as the spatial union of any particular geometrical property which is derived from every vantage point in an environment. McElhinney and Psarra (2014) re-formulate the definition of isovist as a bounded set of points all visible from a vantage point to a set of bounded points which have the same properties mentioned above but also including regions of points that can be intervisible within each other. In most cases isovist computations have been used for analyses to understand space, therefore this method can be useful for this research. This assessment method based on visibility that could be relevant to architects and urban designers for a better approach to design.

The selected district, Çayyolu, is a case of urban morphological explorations in Ankara. By analyzing the current condition of specific parts of this district with isovist component in software, I will be able to address visibility discussions while referring results and later propose an

alternative approach to urban design. To clearly understand the space generated from the urban morphological conditions of the site, an analysis of space can begin with spatial relations based on homogenous and indivisible unit such as a grid (Batty, 2001). Some other researchers like Turner, Doxa, O'Sullivan & Penn (2001), use isovist analysis in a similar way, however their intention is to explain the convexity of a space. According to Batty (2001) though, convexity is not the most significant factor in defining the quality of a space, while other measures related to isovists like distance, area and compactness illustrate a better explanation to the characteristics of a building or outdoor space. The analysis used in this research is focused only on the colormap as the end result to be interpreted, even though such data can be obtained.

3.4 Potential of Isovist Fields

The rapid and ever ending changes of any urban context, are failed to be accomplished by traditional planning tools. Therefore, new methods of spatial analysis can be used to support other alternative perspectives, where design methods are able to respond faster and more accurately to the needs of each site. The properties of spatial configuration can be separated in two main factors: the surface characteristics which include materials, textures and color, and spatial elements with their size and configuration. As Gehl (1987) has underlined, spatial configurations have an effect on the behavior of people and it is a crucial factor in determining lively and thus socially sustainable environments.

Computer-based generative methods used in layout design are important to support complex design processes where several numbers of parameters are taken into account (Koenig &

Schneider, 2012). Since isovist is a tool to measure visibility, Koenig and Schneider suggest this method can also be referred as “Visibility Based Design”. They argue that one can evaluate a configuration based on isovist fields by using average, minimum, maximum values and standard deviation of the frequency distribution of the individual isovist properties. By using the area and compactness properties of isovists, one can describe the characteristics of urban space and compare different urban morphological configurations.

It is of a great interest to designers to understand how urban layouts can be generated according to specifically defined isovist properties. In the framework introduced by Koenig and Schneider (2012), a fixed number of buildings is represented in an urban layout where buildings are positioned and scaled randomly as long as they do not overlap or stay within positioned boundary. As researchers state, the main goal of this research method is to find out which spatial patterns can be generated by taking into main consideration the isovist field properties. As mentioned earlier, the spatial configuration of urban elements is important in designing and building cities, therefore it becomes necessary in today’s peculiar urban requirements that these methods develop to generate a variety of patterns based on specific requirements.

Isovists are the main focus of this thesis and it is important to understand the power of isovists. In this thesis isovists are not used as a generative tool because the thesis deals with already existing neighborhood-scale sites with established street networks. It rather deals with visibility assessment of several urban residential typologies contextualized in each site in order to rank them according to visibility performance. Visibility plays an important role in well-functioning of urban public

spaces. Since the aim of this thesis is not to redesign the open public space, only some intervention design strategies such as infill development, new urban residential building types and changes in street network are being applied in some of the sites and isovists are utilized as a tool that measures visibility. It is believed that such intervention could affect the human activity of each urban public space.

Isovist analysis traditionally focuses on only capturing the visible volume of a space from a specific location in any environment. The flexibility of isovist analysis has allowed researchers to adapt to new methods and develop new ones by testing their hypotheses (Ostwald and Dawes, 2018). This flexibility has resulted in a growing number of distinctive applications of approaches that try to analyze aspects of spatial experience, as is the case with this thesis.

CHAPTER 4

AN ALTERNATIVE METHOD FOR THE GENERATION OF 'POSITIVE FABRICS' IN URBAN PERIPHERIES

The urban sprawl in Ankara occurring in the peripheries of the city has created large land areas that are in between built environments. These spaces are a result of discontinuous and fragmented development plans that have transformed the peripheries, specifically Çayyolu district. An important factor that triggered the separation of residential complexes are the topographical obstacles that are common in Ankara. At the selected district, we notice that land areas which are open and unbuilt are mainly areas where planners face topographical difficulties. This makes those areas difficult to access for developers and users at the same time. Nevertheless, the selected sites, in which topography should not be considered as the main obstacle, lost spaces emerge as well. The focus of this research is to identify several of these lost areas in between built environments, as well as to focus on the open space that is a 'designed' space with the intention to be used by the users of each developed area. Since most of these built environments are constructed in areas with no major topographical difficulties, they can be considered as 'flat' areas. Therefore, each open space within each developed neighborhood is supposed to be working as an open space, where people interact and socialize with each other and having a positive impact on the built environment. The main hypothesis of this research is that both these types of spaces; in-between lost spaces and open spaces that are designed to be functioning as such, they don't function accordingly. According to Gehl (1987), spatial configuration can have an effect on the behavior of people

becoming a crucial factor for creating livable and sustainable environments. To analyze these spaces, isovists are utilized as a method which indicates positive spaces by calculating the areas of numerous isovists. Utilizing these geometrical properties and results from the analysis gives an alternative perspective if such spaces have positive effects on the surrounding urban fabrics or not. The proposed model is an alternative way of understanding spaces, more specifically open spaces for residential units, however, it can be implemented in any type of space: architectural or urban scale. Additionally, it's an operational tool to combine theoretical discussion on urban space with analysis method that it totally dependent on geometrical properties of urban space, making it practical for planners.

4.1 Selection of the sites

The selected residential sites belong to Çayyolu district in the peripheries of Ankara and they are selected as case study because of all the reasons mentioned in previous chapters. However, the main reason these areas are chosen to be studied is because they are spaces in-between urban fabrics that are left not clearly defined or have open spaces that are intended to work as public spaces where residents living there can socialize with each other. In both cases, we believe they do not function as such and we are interpreting isovists as tools that help define our hypothesis.

The most important criterion for selection has been the scale of the site. It was crucial to look for residential sites that have the appearance of a neighborhood scale and have a considerable amount of built area with open public space for its residents, that we believe its lost because of the typological configuration.

Another important criterion for the selection of the sites has been the morphological configuration. Therefore, we have been looking for urban fabrics in which the shape of the residential unit varies. The difference in the urban configuration can be observed in residential units that vary from low-rise to mid-rise and high-rise units. The differences in shape affects not only the open spaces nearby these areas, but their visibility level as well. The height of residential units may change the volume of built areas; however, the analysis of this research has been focused on two-dimensional urban configuration and their visibility performance is not affected.

Street network also can be seen as an indicator that helped in selecting areas. Street network itself is not a criterion for selection, but it was helpful because it suggests different urban configurations. For example: we can observe lost spaces of type I near irregular street formations. This suggests that development near those areas has been fragmented and we notice the existence of areas with no function. In areas in which the urban fabric is clearly fitted into a designed street network we observe more dense environments that share a common public space and this is linked with the type II lost space. For both types of lost spaces interventions have been proposed to improve their visibility level because they are seen as areas which have potential for improvement.

4.2 Method: Visibility Based Design

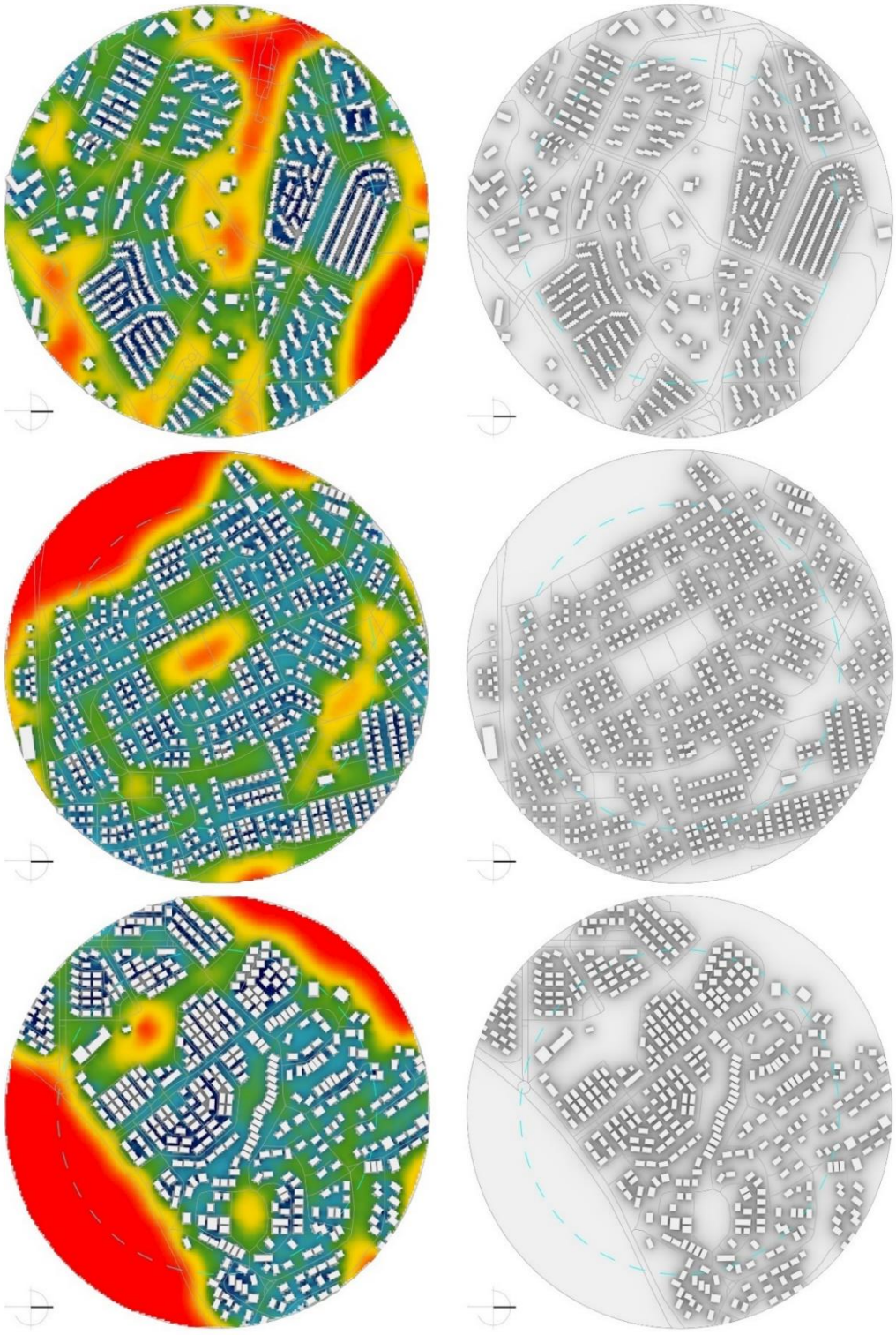
To better evaluate an entire spatial configuration, it is necessary to analyze spatial configuration from more than one point of view, therefore isovist field method is used, which was introduced by Benedikt (1979) and later explained with computer-aided calculation by Batty (2001). Several input parameters are needed to be computed with Rhinoceros 3D and Grasshopper as operative

tools. These input parameters include an analysis boundary which mainly includes the region of open public space for residentials of each site, obstacle curves which are urban context of the site, cell size which is the size of the cell that we want to display it (smaller cell size means more cells to be displayed, like pixels), and a point inside the boundary analysis (location is not important). Some other inputs which are not primary compared to the ones mentioned above are: viewing range, viewing angle and precision. The higher the values, more information will be displayed. We use 100, 360, 360 numeric values accordingly.

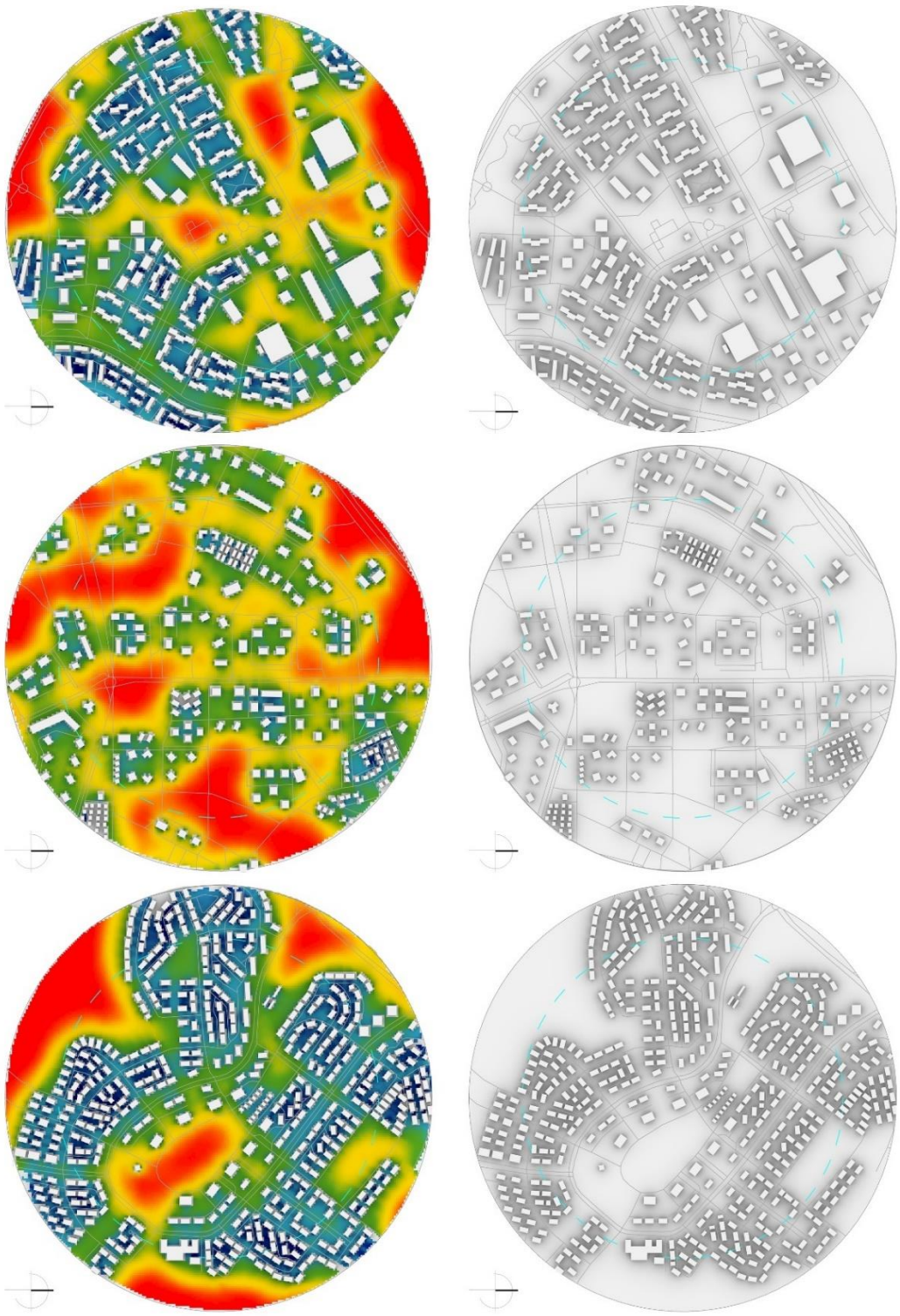
All these input parameters are utilized by the isovist component which comes from *DeCodingSpaces* that is an addon of Grasshopper created to understand spaces, hence the name. After parameters are inputted at isovist component, it returns geometrical properties that are derived from an isovist polygon such as area, perimeter, compactness, circularity, convexity, occlussivity, skewness, elongation etc. by computing mathematical operations that are embedded in the component. For this research we are using the outputs from the calculation of isovist areas derived from isovist field analysis and interpreted as an indicator of positive space. The numeric results received from the component are later displayed in color to make it easier to understand. Blue color corresponds to lower numeric values, while red color corresponds to upper numeric values. Part of data collection is OSM (open street map) which is a data source of a web-based user interface where geographical information is available and important for designers. ELK, another addon of Grasshopper is utilized to generate the already existing road system.

4.3 Application of the Method on the Selected Sites

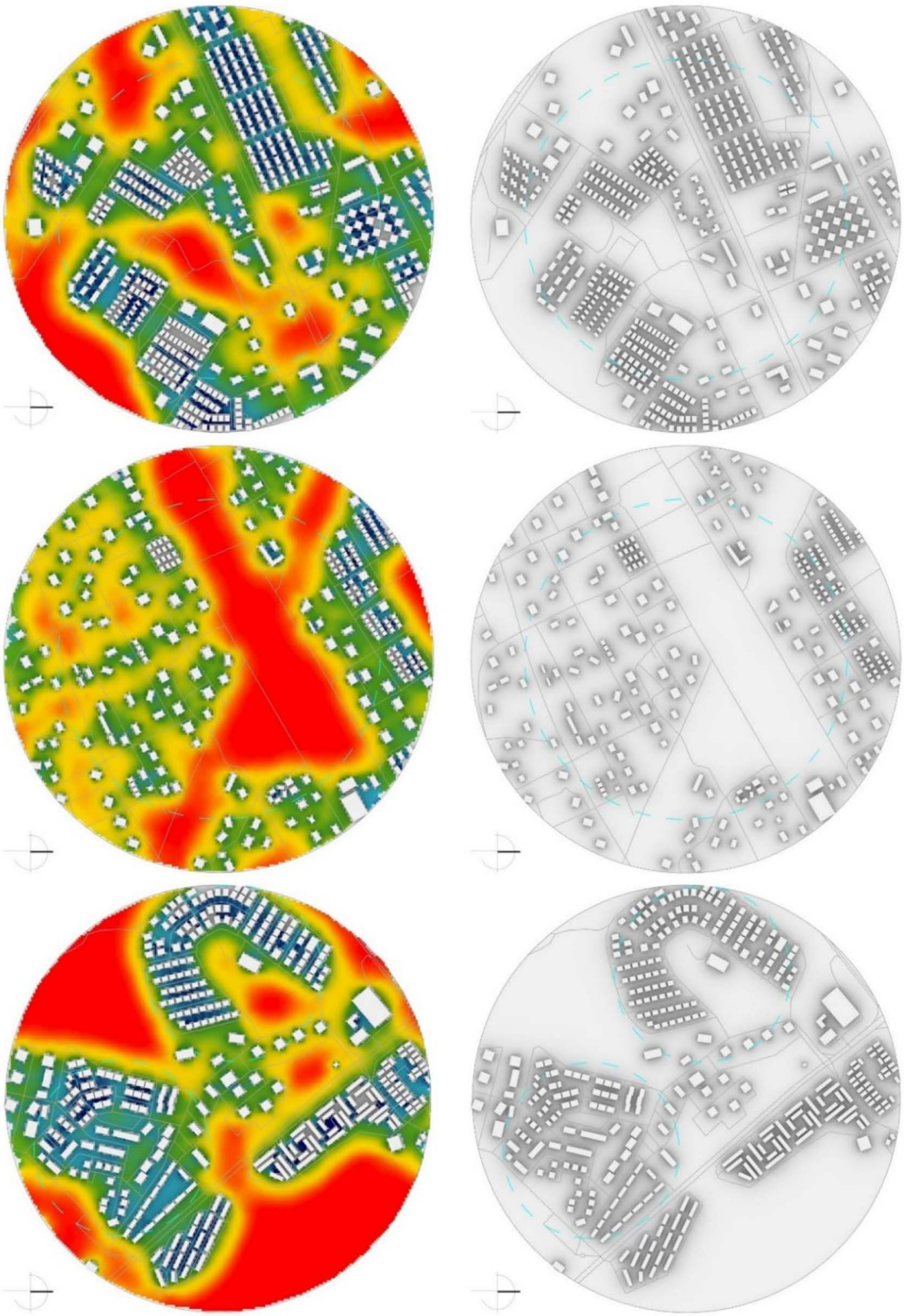
The images below show the actual conditions of each twelve sites chosen as examples for this research. Each site has been analyzed in terms of their visibility level. All of them have been analyzed in a larger context, however, a smaller portion has been shown. The analysis below shows us similarities as well as differences among the sites which will be discussed later. The classification of the sites is not a black and white situation: this means that in each site we can find pieces of land that could be considered lost and could be part of either type I or type II. I intend to clarify that from the observation of the sites there can exist both types of lost spaces, however, the research has been simplified in either one of them in order to focus more on the problematic. In addition to that, I don't claim that the selected twelve areas are the only areas in which we could discuss the concept of lost space. I believe that there can be found other areas with the similar problematic even in other parts of the city. Also, the separate representation of the twelve sites in four different pages does not show that there is a reason for it, just fits better with the format.



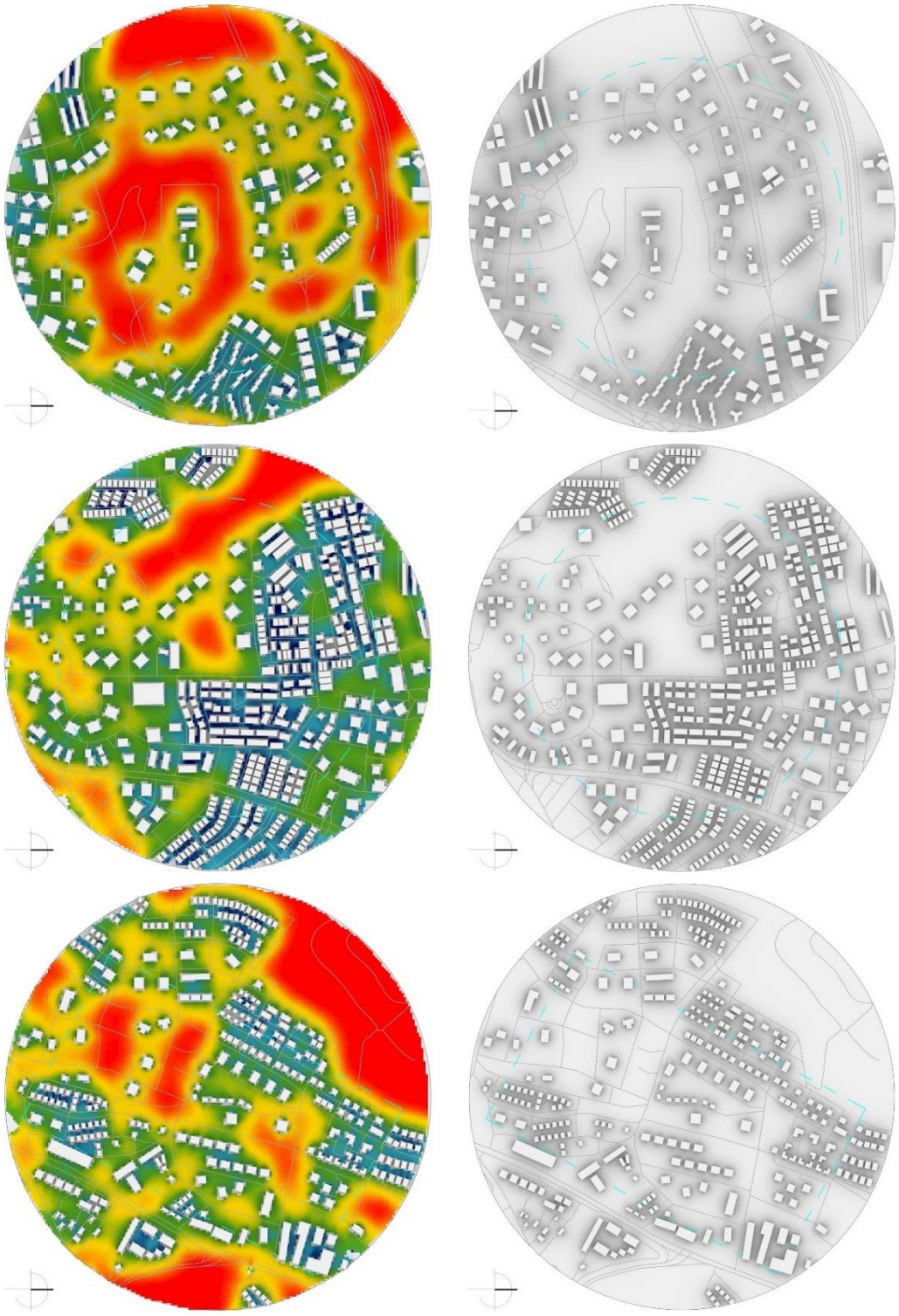
(**Figure 4.1.** Isovist Field Analysis of Three Sites A)



(**Figure 4.2.** Isovist Field Analysis of Three Sites B)



(**Figure 4.3.** Isovist Field Analysis of Three Sites C)



(**Figure 4.4.** Isovist Field Analysis of Three Sites D)

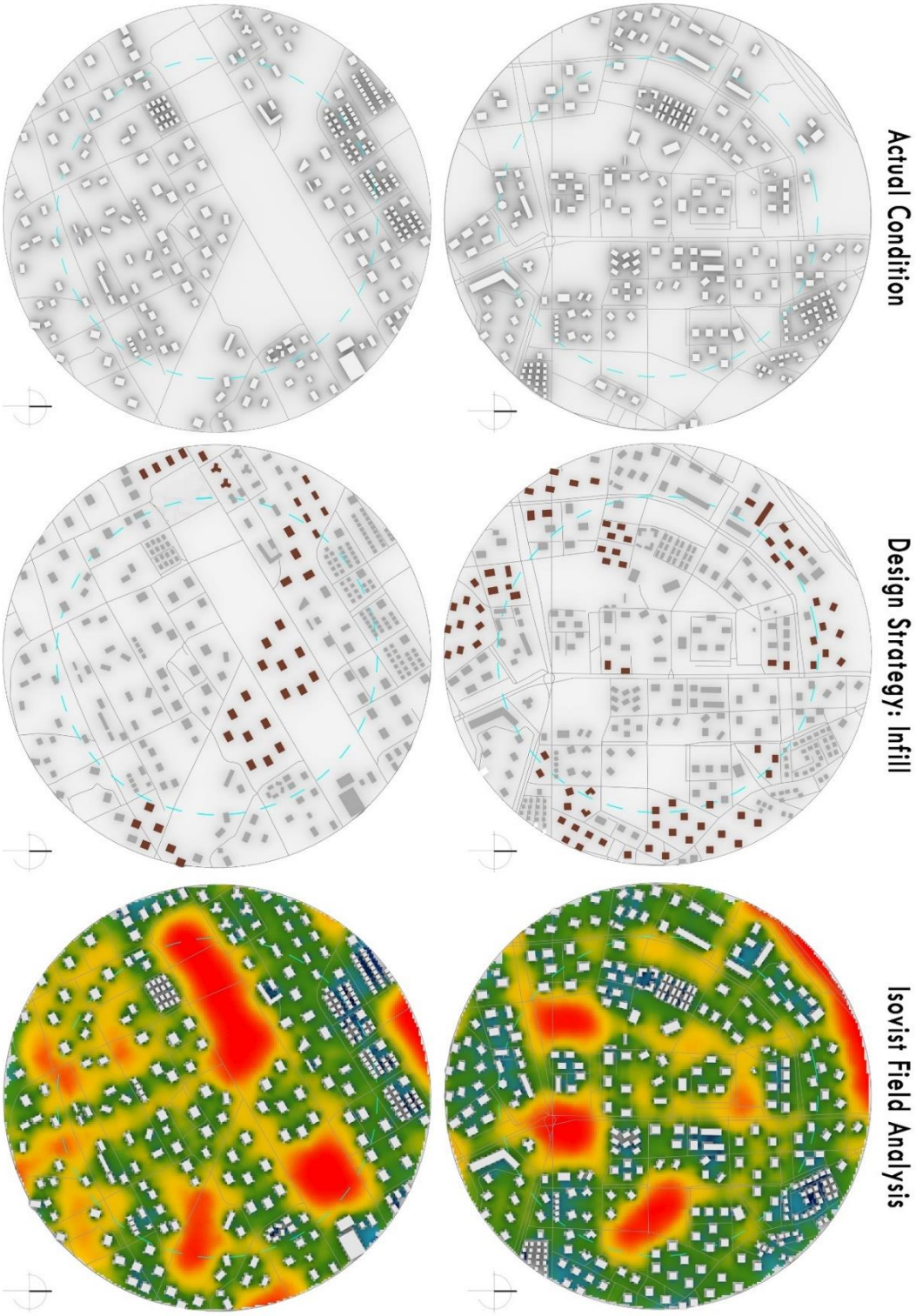
The images above are a visibility analysis which utilizes isovists as a tool. The outcome of each analysis is displayed in colors; from blue to red. These are the actual conditions of each selected site. There are twelve sites that have been selected to analyze. Each site has its own urban configuration which makes it distinguishable from the other ones; some of them are denser and buildings are attached or close to next building, some are less dense and there are more open space in-between buildings, some follow a designed grid while others are scattered all around and, in some cases, the open public space is central to the surrounding urban fabric.

These actual conditions affect the visibility level and this can be seen from the colored analysis. The blue color shows the smallest areas of an isovist, while the red color shows the largest area of an isovist. The analysis is a sum of isovist areas from which the average area has been derived, as explained in third chapter. From this analysis we understand which areas are more visible and which ones less. However, these colormaps need to be interpreted properly in order to understand its relation with the concept of lost space. According to the analysis, red colors indicate that those particular spots are highly visible, therefore, they should indicate highly interactive environments. However, this is not always the case. We need to keep in mind that a specific distance (100 meters) has been taken as an optimal value that people can see and recognize. This is not a usual situation in urban environments since it is quite unlikely that there is no other building in a radius of 100 meters. However, vast land areas in-between built environments in the selected case study emerge as red spots, but this occurs because there are few buildings in a close proximity to them. This does not mean that those are highly visible, since there is nothing to be seen from.

Another emergence of red spots is also when there are designed residential areas in which the open public space is visible. And this is understandable because central areas should be visible for people to interact. However, we believe that these public spaces can be improved regarding visibility. The appearance of blue surfaces shows that those areas are less visible. We see this case mainly in the spaces between residential units that are in close proximity to each other and especially near buildings that are farer from open spaces. Those areas are usually surrounded by other buildings in close proximity from each direction. Several design strategies will be implemented for some of the sites to improve the visibility of each site.

4.4 Design Strategies

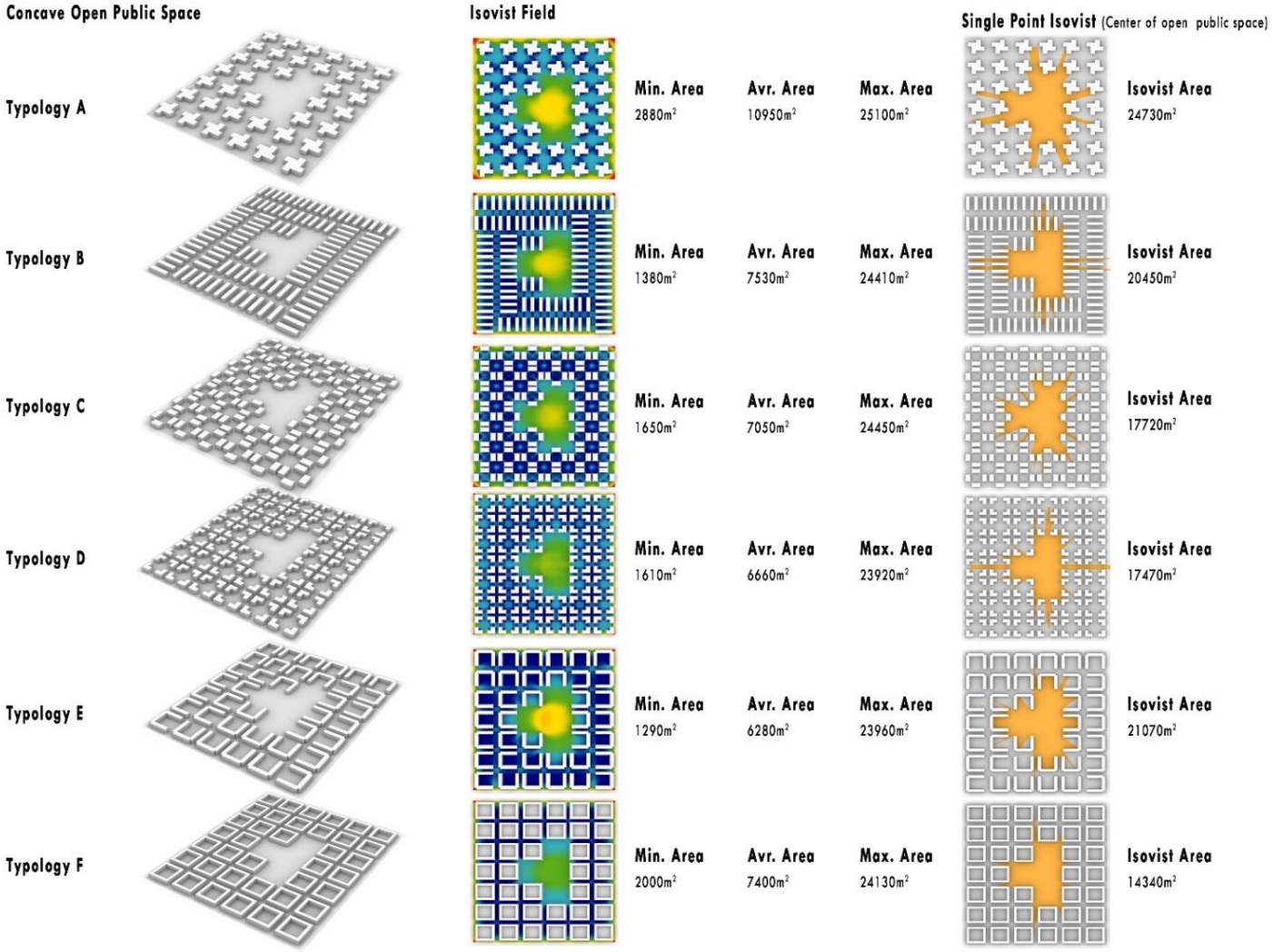
Three strategies have been used to increase the visibility level on each site. These three strategies are: ***Infill Development***, ***Building Types*** and ***Street Network***. Twelve sites have been selected to analyze and for half of them one of these strategies has been implemented to increase their visibility level. Different from the other two strategies, ***Infill Development*** is the 'realistic' solution because nothing different has been introduced, rather, infill of already existing building types in areas that are defined by the existing road and street system. This strategy has been used in sites in which there are areas which are in between built fabrics and can be considered as left-over since they have no clear function.



(**Figure 4.5.** Infill Strategy Examples in two sites)

In the image above, ***Infill development*** strategy has been used for two sites. This strategy can be used mainly for sites in which there are vast areas of land which do not have a specific function and are not integrated into the existing fabric. They are rather there as an outcome of partial development. The strategy here is a continuation of the existing building types and it does not follow any rules, however, the idea is to use this strategy so vast areas of land can become highly visible environment that could stimulate social activities.

This strategy is more relevant for the first type of lost space since the first type is linked with physical fragmentation in which pieces of land in between buildings with no function, can be found. This leaves spaces for infill development. The idea is not to produce new building types, rather add more of the existing building types in the chosen areas to control the open spaces in between buildings. This control would ensure urban open spaces for the residential units that have a sense of enclosure, scale, variety in shape and are in close proximity to the nearby buildings. This would not change the already established urban fabric, but the interventions would affect the visibility level and enclosure of the scaleless and uncontrolled left-over spaces near buildings. A control over such left-over spaces could ensure an integrity between the existing and proposed infill development because building would be in close proximity with each other and their open spaces would be reachable physically and visually. Any type of space that feels reachable is definitely an environment that provides positive attributes to its inhabitants.

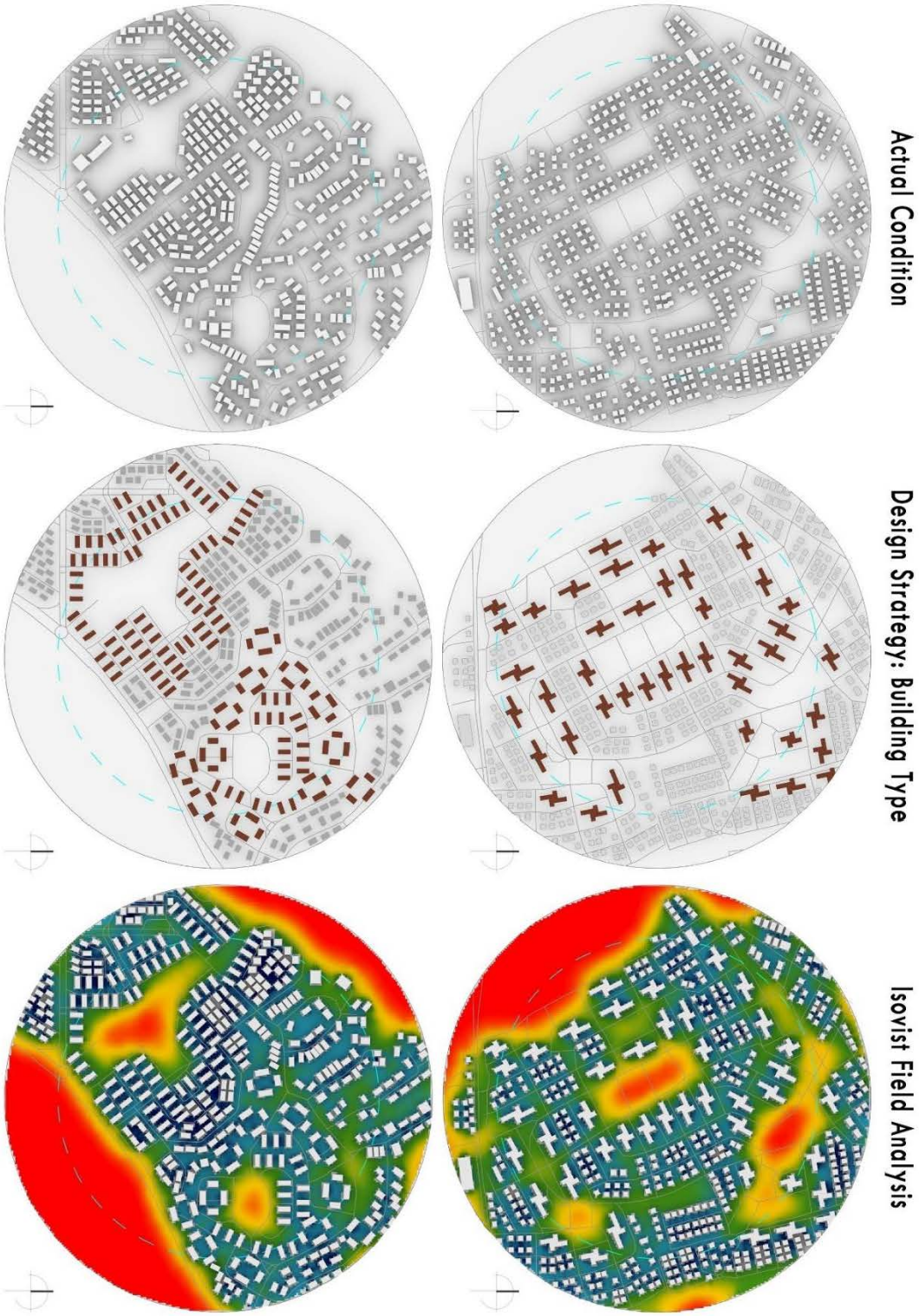


(**Figure 4.6.** Visibility comparison of different building types)

The image above is a study of six various building types that are common in residential buildings. The reason behind this study is to assess the visibility performance of each type by utilizing isovists. We can observe that some building types perform better and others less if put in the same region of analysis. They all have the same Floor Area Ratio (FAR). For example: typology A is

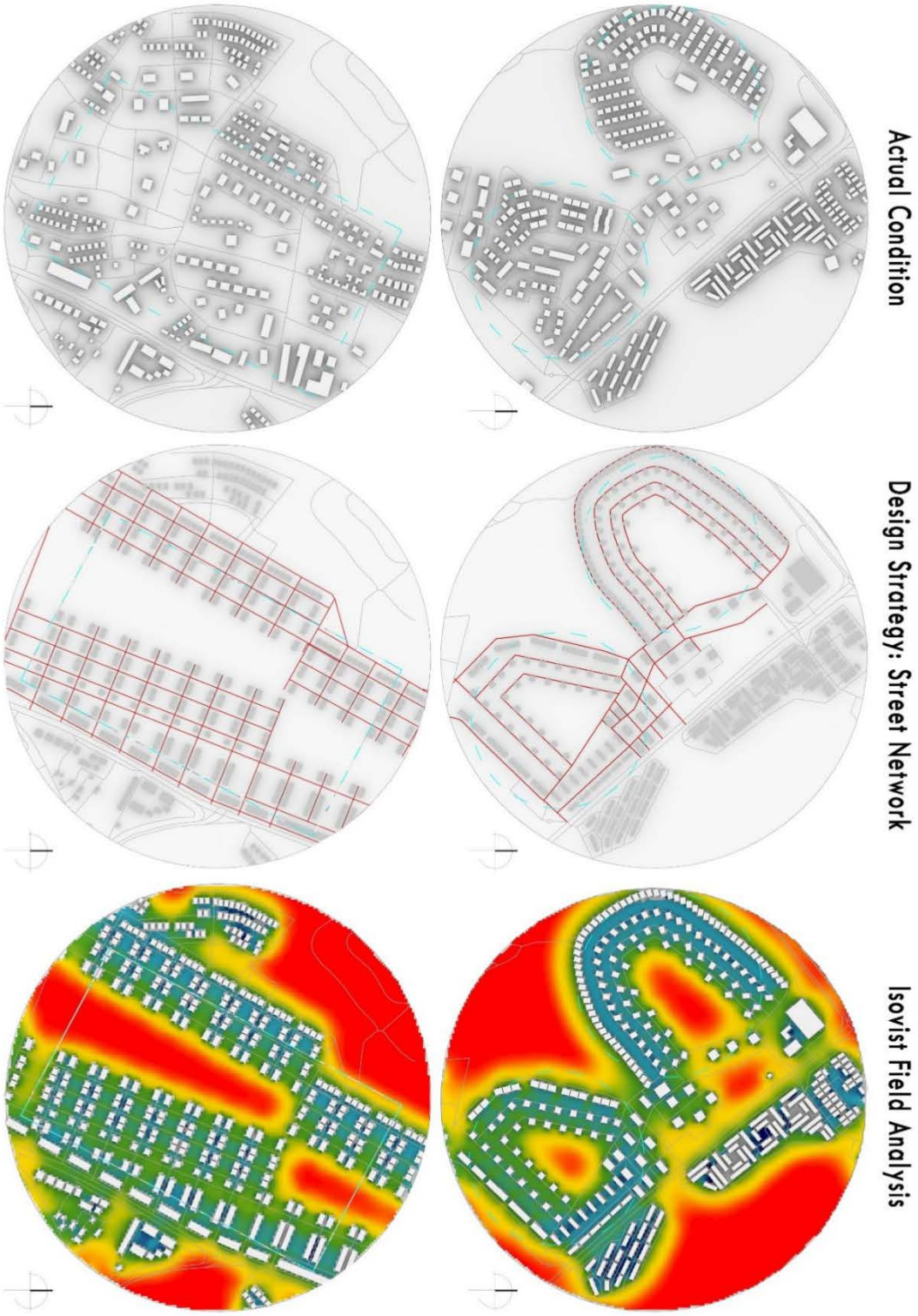
the best performing one because the average area of isovist is higher than others and simultaneously it allows the open space at some extent to be seen further away from the first row of buildings. In addition to that there are no blue areas which means that most of the area is significantly more visible in comparison to other types. The least performing one is typology F: the courtyard shape building only allows the adjacent façade to the public open space to be visible. This condition would limit the visibility of a site where courtyard shape buildings would be present, however, this is not to say that typology A is a better building shape than typology F. The analysis suggests that in terms of visibility, the first typology performs better than the last one.

Therefore, ***Building Type*** strategy is derived from this study. Some of the better performing building types have been utilized in proposing new building types at the exact location of already established built fabric. The building type strategy, focuses only on the building typology that are surrounding the open public space of each site. Therefore, this strategy is associated with those areas that are designed but their central parts are not being utilized at their full potential for social interaction. We can observe difference in the visibility level when this intervention is done. Firstly, this strategy is relevant to dense environment that are surrounding the open space and by altering a significant portion of building types, the open space becomes significantly more visible. We don't observe significant changes in areas that are further away from the open space because the intervention is following the same FAR, therefore the overall urban fabric is still dense, nonetheless, the change for better in the public open spaces is an important positive outcome. The selected building types are not chosen to show them as the perfect solution, rather a different alternative that would increase visibility level and as an example of this strategy.



(Figure 4.7. Building Type Strategy Examples in two sites)

The other strategy (displayed below) focuses only on ***Street Network*** of the selected sites. This strategy does not interfere with any infill or new building types. However, we can see that the existing street network has affected the visibility level in a negative way. The strategy focuses on changing only that. By doing that, buildings which were close to each other and denser now can have more 'freedom'. This condition of freedom also means that buildings can have a different location or orientation that significantly changes the overall visibility of the site. Therefore, the street pattern in this case is just a tool that ensures us to rearrange the location and orientation of the buildings. We are not focusing on designing the street pattern itself, it is rather seen as a tool that can significantly change the urban fabric. This change is linked with a change in visibility as well: in this case for improvement. We can notice a positive change in the analysis of the site with the revisions made. This strategy would deal better with the areas which are almost non-visible and could better define central areas of such residential environments. Similar to the other strategies, this one as well does not imply the 'perfect' solution to the site, however, it is a demonstration that if such strategies would be considered, the visibility of the urban fabrics could be improved.



(**Figure 4.8.** Street Network Strategy Examples in two sites)

CHAPTER 5

CONCLUSION

The last chapter points out the understanding of computational tools in urban design and a possible linkage between residential building types, isovists as a method to assess their visibility level. By comparing different residential types using isovists as an assessment tool, I believe a relation between positive/negative public spaces can be found in order to define which urban spaces would be defined as 'lost' spaces. The analysis of these spaces shows that if such public spaces are not treated or designed properly, run the risk of turning into lost spaces. Most importantly, this testing operational tool can be applied in different urban contexts as a methodology that can contribute to design fields such as urban design and architecture.

Nonetheless, it is important to understand both the benefits and limitations of this operational tools. This methodology is only focused on one aspect of human perception which is visibility, therefore it should be understood and not misinterpreted. Even though visibility is a vital human perception, it is still one of several perception. It is an important one in the field of design because it is easily connected with aspects of design and is helpful in understanding and assessing spaces. However, it is still just one small portion of design, therefore, the claim of the research should be limited to that perspective. These claims and results will be discussed further and in more detail in which a general evaluation of the research will be displayed along with the limitations and potential application of the method.

5.1 General Evaluation

The research of this thesis was initiated by an interesting perspective of observing urban spaces: ‘lost space’. The whole concept of lost space has been put into a cycle of discussion along concepts of visibility and enclosure. Visibility and enclosure have a controversial relationship because on one hand enclosed spaces are spaces that have a clear identity and function accordingly. On the other hand, visibility is a crucial factor in assessing environment, but enclosed spaces are visible mostly for the adjacent urban fabric of an open space. This relationship is linked in this research with the concept of lost space. It is precisely the interesting and controversial relationship of these concepts that come together to create a beneficial outcome.

Throughout the research we learned that this relationship is not a clearly defined one. This means that all concepts mentioned above are important on their own and are a reference to improve urban environments, however, merging them all together makes it difficult to decide on one specific solution. The fourth chapter introduces strategies to improve the visibility level lost spaces at residential areas that have been the focus areas of research, while taking into consideration the concept of enclosure as well. Those strategies are general strategies that can be applicable in different environments and their efficiency varies according to the site context.

The first strategy (Infill development) is applicable in urban contexts in which there is considerable amount of land to construct so there is a better control over undeveloped pieces of land. However, this strategy cannot be applicable in dense environments. The other strategy (Building types) is applicable and more suitable for dense environments which shows that if building types were to

be altered with no other changes in the urban context, there could be improvements in visibility levels. Still, it is important to acknowledge that the expectation in dense environments should be lower because it is extremely difficult to achieve major differences without having major changes in urban fabric. The last strategy (Street network) does not necessarily focus on street network per se. It is rather a difference in building orientation and location that simultaneously transforms the street network. This strategy could be applicable anywhere and the changes in outcome are better, however, we should understand that this type of transformation would be extremely difficult to be achieved in real life because it is close to re-designing the whole site. This makes both building type and street network strategy experimental.

It is important to understand that the aim of this research is not to come up as the ideal solution for the selected sites. It is rather a possible observative way how these residential areas can be improved and be an alternative or complementary tool for future developments. It can also be acknowledged as an assessment strategy to prevent the emergence of dysfunctional public spaces. Keeping that in mind, the outcomes of this research are limited. Nonetheless, there are differences between the urban types that have been analyzed. The visibility areas change according to types and for that reason three intervention strategies have been used to increase their visibility. Therefore, the method can be considered for further application in the field of design.

5.2 Limitations of the Method

To understand the application of this method in urban design, it is important to state the limitations of the method as well. Urban design is a field of design that concerns with the urban space and

well-functioning of cities, towns or any urban settlement. Because of its general description, it is understandable that to design functioning urban spaces, it is important that many aspects of design should be considered. There are general aspects that are considered in design: environmental, social, functional, aesthetic peculiarities of any space, in addition to several more detailed elements that can be considered for a specific site. Considering all these, it is impossible to claim that the results or suggestions of this thesis are the solution to urban design in order to better public spaces.

Contrarily, this is an alternative perspective that aims to detect existing public or left-over spaces which can be considered lost because of their lack of utility for inhabitants. This alternative perspective is only focused on visibility making the whole research focused on a single parameter. As mentioned above, the field of urban design is a complex one, therefore any type of research should be specific and associated with clear claims. The claim of this research is to propose a strategy that detects public spaces near residential areas that because of conditions mentioned along the text, they could be considered lost spaces. However, the detection of this lost spaces is only focused on visibility, therefore each claim is a result of this visibility analysis and should not be interpreted differently.

Additionally, the research is a two-dimensional one. We acknowledge the fact that the third dimension is crucial when discussing urban space quality. However, this research was structured in a two-dimensional approach because of the lack of further computational tools and therefore has other limitations. A three-dimensional research would have given us further results that could

have been discussed in further details and could be linked with other aspects of design. Hence it is important to acknowledge both positive and negative aspects of the research.

Furthermore, there is no intention of providing an ideal solution related to urban morphology or design, rather an alternative design control mechanism based on visibility performance of residential urban typologies that can be helpful to the field of urban design. Considering that only residential areas are taken into consideration, this research does not look at other urban typologies, however, this method can be applicable to other typologies as well.

5.3 Potential Application of the Method

Computational tools nowadays are quite powerful and can provide various outcomes as the end product. The diverse implication of computational tools means that they are applicable at different contexts and can be used for different purposes. In this research isovists have been used as a testing method to analyze the visibility performance of each residential site to find a relation between residential unit areas and their open public space. Additionally, the same method with the same operational tools can be used to analyze visibility performance of other typologies such as city centers, retail areas, campus or institutional developments, and mixed developments. This makes the method flexible since it can adapt to different morphological configurations and scale. In addition to that, the results are fast and accurate.

Most of architectural and urban design offices prefer using traditional approaches while designing since they are usually sufficient and feel more comfortable rather than incorporating advanced tools. Even though they seem sophisticated at first, they are helpful in resolving many different

challenges by allowing the designer to explore few issues at the same time and when third dimension comes into play it becomes significantly important because of the results that can be achieved. Computational processes are able to address a complexity of parameters much greater than human cognitive capabilities, however, critical human thoughts are important in using computational tools.

Isovists are just a small portion of what computational tools are capable of achieving and the applicable interface of these tools allows users to create interactive design iterations while providing a transparent design process. Their usage is mostly related with design; however, they can become common in both analysis and generation process. They can become efficient tools to explore new spatial forms and patterns in architecture and urban design, therefore new spatial possibilities can emerge. This is the case with this thesis as well where different urban types that share common characteristics are being used to provide an alternative urban development for each selected site. Each alternative urban development provides different urban patterns that undeniably affect urban space and life of residents.

REFERENCES

Alexander, C. (1987). *A new theory of urban design*. New York: Oxford University Press.

Alkhresheh, M. M. (2007). *Enclosure as a function of height-to-width ratio and scale: Its influence on user's sense of comfort and safety in urban street space*. Gainesville, Fla.: University of Florida.

Balaban,O. (2008). Capital Accumulation, State and the Production of the Built Environment, Unpublished Phd. Dissertation, Middle East Technical University, Ankara.

Baş, Y. (2003). *Designing urban space with the tools of the development legislation*. Middle East Technical University, Ankara.

Batuman, B. (2013). City profile: Ankara. *Cities, 31,* 578-590.

Batty, M. (2001). Exploring isovist fields: space and shape in architectural and urban morphology. *Environment and Planning B, 28,* 123-150.

Benedikt, M. L. (1979). To take hold of space: isovists and isovist fields. *Environment and Planning B: Planning and Design, 6,* 1, 47-65.

Van Bilsen. A., Stolk, E. (2008). Solving Error Problems in Visibility Analysis for Urban Environments by Shifting from a Discrete to a Continuous Approach. *2008 Internatıonal Conference on Computational Sciences and Its Applications.* 523-528.

Cullen, G. (1971). *The concise townscape*. London: Architectural Press.

Çalışkan, O. (2009). Forming a capital: Changing perspectives on the Planning of Ankara (1924-2007) and lessons for a new master-planning approach to developing cities. *Footprint,* 5, 23-54.

Çalışkan, O. (2013). Pattern formation in urbanism: A critical reflection on urban morphology, planning and design. Phd. Dissertation, TU Delft, Delft.

Çalişkan, O., & Mashhoodi, B. (2017). Urban coherence: A morphological definition. *Urban Morphology, 21,* 2, 123-141.

Erişen, O. (2003). "Suburbanization in Turkey within the process of Integration to Global Development and New-Lifestyle Settlement". Unpublished Master Thesis. Ankara: Middle East Technical University.

Ewing, R., & Handy, S. (2009). Measuring the Unmeasurable: Urban Design Qualities Related to Walkability. *Journal of Urban Design, 14,* 1, 65-84.

Ewing, R. (1997). Counterpoint: Is Los Angeles-Style Sprawl Desirable? *Journal- American Planning Association, 63,* 1, 107-126.

Franck, K. A., & Stevens, Q. (2007). *Loose space: Possibility and diversity in urban life*. London: Routledge.

Gehl, J. (2011). *Life between buildings: Using public space*. Washington, D.C: Island Press.

Groth, J., & Corijn, E. (2005). Reclaiming urbanity: Indeterminate spaces, informal actors and urban agenda setting. *Urban Studies, 42,* 3, 503-526.

Gültekin, A. T. (2014). *Recent sprawl and shrinkage policies deployed in the sphere of urban management in Turkey: The case of Ankara*. Saint Petersburg, Russia: European Regional Science Association

Harris, R. (2010). Meaningful types in a world of suburbs. In M. Clapson. (Eds.), *Suburbanization in Global Society*. (pp. 15-47). Bingley, UK: Emerald Group Publishing, Ltd.

Hedman, R., & Jaszewski, A. (1984). *Fundamentals of urban design*. Washington, D.C: Planners Press, American Planning Association.

Kaya, H. S., & Mutlu, H. (2017). Modelling 3D spatial enclosure of urban open spaces. *Journal of Urban Design, 22,* 1, 96-115.

Kızıltaş, Aybike Ceylan. (2010). "Role of Design Control on Urban Form: Çayyolu Ankara". Unpublished Master Thesis. Ankara: Middle East Technical University.

Kropf, K. (2017). *The Handbook of Urban Morphology*. Chichester, UK: John Wiley & Sons, Ltd.

Koenig, R. & Schneider, S. (2012). Exploring the Generative Potential of Isovist Fields - The Evolutionary Generation of Urban Layouts based on Isovist Field Properties. In *3Oth International Conference on Education and Research in Computer Aided Architectural Design in Europe*. 356-364.

Loukaitou-Sideris, A. (1996). Cracks in the city: Addressing the constraints and potentials of urban design. *Journal of Urban Design, 1,* 1, 91-103.

Mariani, M., & Barron, P. (2014). *Terrain vague: Interstices at the edge of the pale*. London: Routledge.

Marshall, S. (2015). *Streets & patterns*. London: Spon Press

Marshall, S., & Çalışkan, O. (2011). A joint framework for urban morphology and design. *Built Environment, 37,* 4, 409-426.

McElhinney, S., & Psarra, S. (2014). Just around the corner from where you are: probabilistic isovist fields, inference and embodied projection. *The Journal of Space Syntax*. 5, 109-132.

Montgomery, J. (1998). Making a City: Urbanity, Vitality and Urban Design. *Journal of Urban Design, 3,* 1, 93-116.

Moughtin, C. (1992). *Urban Design: Street and Square*. Architectural Press.

Nielsen, E. S., & Springer International Publishing. (2017). *Smart Growth Entrepreneurs: Partners in Urban Sustainability*. Cham Springer International Publishing

Oliveira, V. (2016). *Urban Morphology: An Introduction to the Study of the Physical Form of Cities*. Cham: Springer.

Ostwald, M. J., & Dawes, M. J. (2018). *The mathematics of the modernist villa: Architectural analysis using space syntax and isovists*. Cham: Springer.

Peterson, S., Dennis, M., Barnett, J., & Littenberg, B. (2020). *Space & anti-space: The fabric of place, city and architecture*.

Rafferty, J. P. (2020). *Urban sprawl*. *Encyclopedia Britannica*. https://www.britannica.com/topic/urban-sprawl

Salingaros, N. A. (2000). Complexity and Urban Coherence. *Journal of Urban Design, 5,* 291-316.

Şenyapılı, T. (1981). *Gecekondu çevre işçilerin mekanı*. Ankara: Orta Doğu Teknik Üniversitesi Mimarlık Fakültesi.

Shach-Pinsly, D., Fisher-Gewirtzman, D., & Burt, M. (2011). Visual Exposure and Visual Openness: An Integrated Approach and Comparative Evaluation. *Journal of Urban Design, 16,* 2, 233-256.

Squires, G. (2002). *Urban sprawl: Causes, consequences and policy responses*. Washington: Urban Institute Press.

Stamps, A. (2005). Enclosure and Safety in Urbanscapes. *Environment and Behavior, 37,* 1, 102-133.

Şahin, S. Z. (2007). "The politics of Urban Planning in Ankara between 1985 and 2005". Unpublished PhD Dissertation. Ankara: Middle East Technical University.

Talen E. (2018) Urban Morphology in Urban Design. In: Oliveira V. (eds) *Teaching Urban Morphology*. The Urban Book Series. Springer, Cham.

Talen, E., & Lee, S. (2018). *Design for social diversity*. Routledge, New York.

Tara, A. (2015). Visual Openness in Urban Environments: Measuring Visual Openness and Visibility to Natural Landscapes in a Changing Urban Landscape in Gold Coast, Australia. *The International Journal of the Constructed Environment, 6,* 3, 25-40.

Trancik, R. (1986). *Finding lost space: Theories of urban design*. New York: John Wiley & Sons.

Turner, A. Doxa. M, O'Sullivan. D, Penn. S. (2001). From isovists to visibility graphs: A methodology for the analysis of architectural space. *Journal of Planning Literature, 16,* 1, 80-163.

Ünver, Ece. (2019). "Investigation of the neighbourhood unit in the western fringe of Ankara". Unpublished Master Thesis. Ankara: Middle East Technical University.