

DESIGN POLICY AND PROCESS THROUGH INFILL DEVELOPMENT

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ABSTRACT

DESIGN POLICY AND PROCESS THROUGH INFILL DEVELOPMENT

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In the last few decades, the deterioration of the inner city and increase in population have resulted in urban decay within the city urban fabric which thereby high income citizens abandoned their houses demanding a better quality of life outside the city fabric; thereby leading the old city to be occupied by poorer households or left vacant. Urban decay is linked to suburban sprawl as the economic life is pulled out of the city, instead of a previously developed urban sites within the old city fabric. Infill development is the intervention development within vacant, abandoned, passed over or underutilized within built-up areas of existing communities in which infrastructure is already in place. It is a solution to reutilize lost spaces in existing communities and playing a critical role in achieving community revitalization, land conservation and alternatives to sprawl development. Infill development is a solution to enhance the character, viability and function of the old city aiming to increase walkability by contributing safe and attractive pedestrian environment; thereby creating new opportunities for mixed-use that recapture the sense of place which is considerably missing in urban communities. Containing far more details, this study articulates the potential and limits of infill development and its related guideline to address scattered model of urbanization, segregation and environmental pollution.

Keywords: Infill development, Urban sprawl, Urban sustainability, Environmental justice, Social equity

ÖZ

TASARIM POLİTİKASI VE GELİŞTİRİLMEME İLİŞKİN SÜRECİ

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Son birkaç on yılda, şehir içi bozulma ve nüfus artışı, kentin kentsel dokusunda kentsel bozulmalara neden oldu; bu nedenle, yüksek gelirli vatandaşlar, kent dokusu dışındaki daha iyi bir yaşam kalitesi talep ederek evlerini terk etti; Böylece eski şehir daha fakir haneler tarafından işgal edilmeye ya da boş bırakılmaktadır. Kentsel bozulma, eski şehir dokusunda önceden geliştirilmiş bir kentsel alan yerine, ekonomik yaşam şehirden çekilirken banliyö yayılımı ile bağlantılıdır. Dolgu gelişimi, boş kalan, terk edilmiş, geçilen veya kullanılan altyapının yerleştiği mevcut toplulukların yerleşik olduğu alanlarda kullanılmayan müdahale gelişimidir. Mevcut topluluklardaki kayıp alanların yeniden kullanılması ve toplumun yeniden canlandırılması, arazinin korunması ve yayılma gelişimine alternatif olarak kritik bir rol oynamak için bir çözümdür. Dolgu gelişimi, güvenli ve çekici bir yaya ortamına katkıda bulunarak yürünebilirliği artırmayı amaçlayan eski kentin karakterini, yaşayabilirliğini ve işlevini geliştirmek için bir çözümdür; Böylece, karma kullanım için, kentsel topluluklarda oldukça eksik olan yer duygusunu yeniden yakalayan yeni fırsatlar yaratmak. Çok daha fazla ayrıntı içeren bu çalışma, dağınık gelişme ve ayrışma ve çevre kirliliğinin dağınık modelini ele almak için dolgu gelişiminin potansiyel ve sınırlarını ve bununla ilgili kılavuzunu açıklar.

Anahtar Kelimeler: Dolgu geliştirme, Kentsel yayılma, Kentsel sürdürülebilirlik,
Çevre adaleti, Sosyal eşitlik

To my dear parents, Mahdi and Effat, and my love, Lina

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LIST OF ABBREVIATIONS

ABBREVIATIONS

TOD	Transit Oriented Development
SC	Smart City

CHAPTER 1

INTRODUCTION

1.1. Structural Definition of the Thesis

1.1.1. Problem Definition and the Conceptual Background

The uncontrolled expansion of low-density, single-use suburban development, which is globally known as an “urban sprawl,” is mainly shaped by settlements scattered around the periphery. Sprawled urban development tends to include all the new trends of urban developments including regional scale, speed, mass production and distribution and the merging of city and countryside (Saunders, 2005). Fragmented environment of low density cities has the same similarities; however, differences regarding dimensions of houses, the wildness of gardens surrounding them and influx of roads and parking areas can discriminate the nature of sprawl. Nowadays, suburbs tend to provide a full range of urban amenities traditionally belonging to compact cities. At their edges, and within the overlapping borders of other suburbs within emerging metropolitan regions, immense and well-equipped office parks, shopping centers and impressive commercial activities are found trying to enhance their appeal to successfully compete with the traditional shops of inner city areas (La Greca, 2009). If we explore the phenomenon of suburban commercialization deeply, we recognize the phenomenon as an awkward aspect of the impressive growth of the contemporary town. Sprawl and suburbia, ideologically rooted in an “anti-urban” sentiment, are the most recurring forms of urban expansion in many Anglo-Saxon countries, primarily the United Kingdom, Australia and those of North America. The model for such suburbias is the village, and its scientific point of view is the garden city of Ebenezer Howard and later planning concepts (Corboz, 2010). In this day, urban sprawl facing urban Europe and the most significant and indispensable issue in American cities is

highly considered as one of the crucial common challenges in the 21st century (Saunders, 2005).

In the age of global economy, the impacts of urbanization and urban life increasingly have repercussions well beyond our city boundaries, not only in the United States and Australia, but all over the world. Defined as an ecological phenomenon of the new millennium, cities have become the principal engines of economic growth in which the greatest part of humanity dwells (Newman & Jennings, 2008).

Urban planning, as a professional and academic activity in its contemporary form, evolved throughout the 20th century resulting in a great variety of urban forms which thereby received increasing attention for their indispensable effect on the built environment. The rise of “urban sprawl” in the developed world as the prevailing pattern of urban development has come under increased criticism in recent years due to its deteriorating social, economic and environmental effects. (Newman and Kenworthy, 1989, 1992; Jenks et al, 2000; Ewing, 1997; Burton, 2000; Hasse and Lathrop, 2003; Shen and Zhang, 2007). The dramatic expansion of urban development which results in the deterioration particularly, the speculation and inefficient nature of this new urban growth is the main concern, especially peripheral green field development and the loss of critical land resources with respect to population growth (Burchell et al, 1998; Sierra club, 1998). In addition, developers favor greenfield development, making a great contribution to the urban expansion, as a competitive economy due to its simplicity and more profitability to be developed and its indispensable benefits to urban society (Bereheny, 1997; de Sousa, 2000; Oxeley, 2004).

Urban sprawl is also one of the most important challenges faced by sustainable urbanism regarding urban forms and land use development. To mitigate urban sprawl, compact urban forms have been proposed as a means to promote sustainable urban development. However, the compact development approach needs to pay attention to the crucial question of commercial profitability, social segregation and desegregation

with respect to egalitarian nature of communities, cultural diversity, environmental pollution and mitigation of carbon dioxide and issues related to density (Newman, 1989).

As Williams and Sheils (2000) stated, patterns of discontinuous growth tend to emerge with low- density housing; thereby wasting open spaces and raising the desire of developers for inexpensive green-field sites resulting in “leapfrog effect”. This urban sprawl characteristic has emerged primarily due to free-market conditions in which maximizing profit imposes decisions of individuals which thereby favors conversion of rural land to commercial property due to low land values. Under these circumstances, markets may fail to provide efficient solutions to problems of resource allocation (Bramley et al, 1995; Oxley, 2004).

Furthermore, the household’s preferences for suburban living and life style choices resulting in single-family housing also promote urban sprawl through a demand for suburban and exurban living environments (Berheny and Downs, 1994; Gordon and Richardson, 1997). Such decisions of both developers and households impose various costs to the society through maximizing profits contributing to the externalities including loss of farmlands and open spaces and increased road network and congestion (Oxley, 2004).

Three types of market failure are known to lead to excessive spatial growth of cities. The first is the failure to achieve the social value and benefit of an open space due to conversion to urban space. The second is the failure to account for the social costs of congestion. The third is the failure to shift the cost of new development projects from the public sector to developers (Brueckner, 2000).

In order to control market failure and promote sustainable urban development, national and local governments have been in search of strategies to cope with urban sprawl. Among the most commonly acknowledged of such strategies is compact urban development. The concept of “compact cities” is a prevalent approach to achieve urban sustainability and low-carbon urbanism. In a series of initiatives, local and

national governments have already adopted broad policies designated to transform the morphology of urban growth, especially under the concept of compact development (Torenas and Alberti, 2000).

Most of these governmental policies tend to affect the pattern of new urban development. These policies include greenbelt development, urban growth boundaries and urban service boundaries (Rogers, 1997; Bramley et al, 1995; Downs, 1998; Brueckner, 2000; Burchell et al, 2000; Pendal et al, 2002; Talen and Knap, 2003), fiscal arrangements (Burchell et al, 2000; Knaap et al, 2005; Talen and Knap, 2003), land use controls (Landis, 1995; Pendall, 1999; Oxley, 2004), infill development (Nelson and Wachter, 2000; Smart growth principal, 2000; NAHB, 2002; Smart growth network, 2003), brownfield development (Alker et al, 2000; Greenberg et al, 2001; De Sousa, 2000; Grimski and Ferber, 2001), the imposition of development fees (Knaap et al, 2005; Burchell et al, 2000), transferable development rights (Peiser and Frej, 2003), mix-used development, transit-oriented development and affordable housing (Brueckner, 2000).

One of the most important tools to encourage compact and, thus sustainable development is of course land use planning. By means of appropriate land use planning decisions, development in peripheral lands can be controlled and urban sprawl can be alleviated. There are various objectives of land use planning such as protecting rural lands, improving the quality of the physical environment, minimizing incompatible uses (Oxley, 2004) and avoiding land use conflict. Growth control is another important tool to encourage compact and sustainable urban form (Nelson and Duncan, 1995).

The methods of growth control such as urban growth boundaries, urban service boundaries and greenbelts aim to direct new urban development into defined boundaries and prevent further urban development out of these boundaries. Urban growth boundaries (UGBs) seem to be successful to redistribute urban development from urban fringe areas to inner-cities. Such policies lead to revitalization of inner-

city areas and redevelopment of existing urban areas, in which physical urban environment has been deteriorated (Landis et al, 2002).

1.1.2. Infill Development as a Means of Addressing Urban Sprawl

The notion of infill development in urban areas is considered a crucial means to counter suburban sprawl and edge city phenomena by promoting compactness (Garreau, 1991). Although infill development as a theory and practice can be viewed as having a multitude of definitions, the main goal of this urban development practice is to address the inefficiency of dispersed patterns of urban development in terms of social and economic costs and especially in energy consumption and pollution (Rogers and fisher, 1992).

More specifically, infill development is the new development of vacant, abandoned, passed over or underutilized land within built-up areas of existing communities in which infrastructure is already available. Infill development can occur in any underutilized and abandoned parcels compared to surrounding land use activities including villages, inner city areas or any large development areas which master plan are devoted to higher densities. Infill development, often named as a mixed-use urban development, brings various activities to closer proximities in order to shorten travelling distances, promote less car-dependency and mitigate CO2 emissions (Newman, 1989).

Infill development is also a viable housing strategy technique to promote affordable housing in inner city areas. In addition, infill development is a considerable tool in inclusionary policies to integrate different classes from various backgrounds which has a large contribution in alleviating social segregation (Newman and Kenworthy, 1998).

1.1.3. Types of Infill Development

Infill development can be categorized by the following fulfillment types (Owens, 1992):

- Developing new housing in abandoned areas within existing neighborhoods.
- Redeveloping formerly developed areas.
- Subdividing existing development lots.
- Demolishing and reconstructing new housing by integrating new layouts with existing ones.

1.1.4. Advantages and Disadvantages of Infill Development

Infill development has principal benefits in terms of social, environmental and economic issues which improve urban quality of life and contribute to promoting sustainability in urban fabric. In terms of natural resources and land supplies, infill development reduces utilization of farmlands and contributes to use of land supply more efficiently. Regarding use and activity, the creation of mixed-use development increases accessibility to workplaces, which mitigate time, money and environmental pollution with respect to daily commuting and use of private cars. Concerning housing stock, infill projects strengthen property values, revitalize and redevelop older neighborhoods (Williams and Jenks, 1996).

Infill development lowers the costs of public infrastructures such as transit, sidewalks, water and sewage, schools and public safety by redirecting urban growth towards inner city areas and thus leads to a more efficient use of existing amenities. In terms of adaptive reuse, infill projects supplant brownfield and underutilized industrial areas with adaptive new functions which actually preserve urban landmarks, promote the sense of belonging and support exclusive cultural, art and educational functions. Eventually, in terms of social issues, infill development projects strengthen social inclusion and diversity by juxtaposition of different backgrounds and ethnicities which thereby prevent social segregation and keep the built environment more vibrant and more economically beneficial (Williams and Jenks, 1996).

The implementation of infill projects within urban communities contributes to a variety of benefits concerning social, environmental and economic aspects including low environmental impact, making financial sense, strengthening the local economy, sustainable modes of mobility, social inclusion and integrity (Owens, 1992).

- Low environmental impact: by use of already urbanized land and existing infrastructure, infill development alleviates environmental impacts thereby promoting resources and land preservation.
- Making financial sense: Construction in already established urban communities is much more affordable for governments to enrich the capacity of services in existing amenities.
- Strengthening the local economy: Infill development encourages diversity and affordable housing for mixed incomes thereby increasing property values and strengthening the real estate which in turn strengthens local business.
- Sustainable mobility: disintegrated cities have a negative effect on citizens who commute to inner city areas from distant, peripheral areas. Infill development provides transit-integrated urban form thereby easing accessibility to everyday activities which contributes to alleviating expenses, time and emissions related to private cars use.
- Social inclusion and diversity: infill development incorporates different classes from different ethnicities and backgrounds by promoting diversity and affordable housing which offers possibilities to citizens about utilizing amenities more evenly.

In addition to the positive attributes of infill development mentioned above, there are some disadvantages related to the control of development in urban areas. Growth control may cause lack of land development and may contribute to housing shortages thereby increasing the costs of housing development (Knaap, 1985; Fiscal, 1990).

However, planners and policy makers should consider all costs and environmental and social aspects of compact development policies and projects.

1.2. Hypothesis of the Study

This thesis argues that good infill development can prevent urban sprawl and redirect urban development from peripheral areas into inner city areas. Such an implementation would eventually make a large contribution to improve sustainability in urban areas as well as compactness of cities. Changing land use patterns is an eminent challenge for sustainability in urban planning. The reason to eagerly pursue sustainability is multiple:

- To preserve important natural habitats, wilderness and agricultural lands
- To reduce energy and materials consumption as well as GHG emissions
- To rechannel investment into existing urban areas to improve social equity and to create more balanced, diverse and livable communities (Issues central to sustainability planning, land use and urban growth, 1990).

Compact cities represent radically different models from most 20th century urbanized areas in North America (and to a lesser extent, Europe). If pursued rigorously this approach (compact cities) would call for virtually all new residents and businesses to be accommodated within the existing urban envelope through infill development and would involve a range of other urban design strategies to improve the livability of such environments. The aim would not just be compactness or density, but improved land use mix, public spaces, street design, transportation patterns and housing options. Safe neighborhoods would be essential elements as well. Some compact communities might include high- rise buildings and some not. But all would focus on infilling and improving existing urban areas and quality of life instead of allowing sprawl development across the landscape (Issues central to sustainability planning, land use and urban growth, 1990).

Sustainable land use is apt to focus on compact, balanced, mixed-use communities rather than single-use monocultures. To change land use policies in this way, we need

new concepts of property ownership, moving away from the notion that people can do anything they want with a piece of land which is theirs towards land use that balances individual, collective and ecological interests. Such a transition represents a profound ethical change to say the least.

So, this study implies that good infill development creates mixed-use communities as regards physical and social aspects thereby generating diverse urban fabric enhancing social equity and affordability in which people with various ethnical backgrounds can benefit from urban facilities more evenly. Diverse urban form includes a mixture of land uses, building and housing types, architectural types and prices or rents. This mix is once what Lynch (1981) termed “fine grained:”with elements mixed together at a small scale. If development is not diverse, the result is a homogeneous built form, a monotonous urban area, a segregation of income groups and car dependency, congestion and air pollution (**Social and design dimensions**).

This study demonstrates that effective infill development can reduce or even eliminate car dependency supplanted by sustainable transportation modes such as walking, cycling and public transportation (PT) which have a big contribution to reduce GHG and air pollution thereby potentially ameliorating the current climate change situation. Dealing with the challenges posed by climate change is a crucial part of urban sustainable development. Urban design and regional planning, by using various strategies such as infill development and transit-oriented development (TOD), can provide solutions to make our communities less vulnerable to pollution risks. Green infrastructure including gardens, parks, productive landscape, green corridors, green roofs and walls and water bodies, rivers, streams, floodplains and sustainable drainage systems play a vital role in creating climate resilient development- a role which is not sufficiently considered within mainstream planning. So:

- It looks as though TOD land- use policies stemming from urban density to promote transit use and adaptation policies that favour lower densities.

- Here is a big dilemma to find a trade-off between two conflicting needs of urban sustainability and development (**Mobility dimension**).

So, land use planning and infill development has a dominant role to shorten distances travelled in daily commuting through implementing pedestrian friendly environment such as a connected street layout, mixing of activities and high densities. Furthermore, Infill housing in urbanized areas offers socially and physically diverse environment by adopting mixed-use strategies which is accompanied by Transit Oriented Development to achieve land use integrity along development corridors to create multi-centered urban areas or “polynucleated urban forms” that functions as a self-sufficient urban community resulting in less car dependency as well as relieving the pressure of the inner city areas.

Lastly, this study asserts that effective infill development can help change consumption patterns and life styles of urban communities in such ways that use energy and natural resources more efficiently. People living in large, detached homes in suburbs generally consume much higher amounts of energy and natural resources than those living in compact and mixed communities. Moreover, peripheral development results in the loss of natural landscapes and farmlands around cities. In addition, people living in peripheral areas generally use private cars for commuting; thereby consuming more energy which contributes to more to air pollution (**Environmental dimension**).

Furthermore, considered as a deterrent for sprawled development, infill development by implementing a diversity of physical activities along urban corridors encourages people to use public transport to commute, thereby reducing the use of private car and traffic congestion which makes a great contribution to the alleviating of environmental pollution and climate change.

1.3. The Aim of the Thesis

In the direction of the problem definition, this thesis investigates the correlation between sustainable urbanization and infill development and discusses how to interfere by means of various strategies to alleviate sprawl and its prospective social, environmental, and economic damages through redirecting of urban development projects into the inner city areas. As sustainable development, in a sense, requires the renewal and reorganization of urban areas in terms of social, economic and environmental aspects, it has been recognized that such urban renewal or reorganization attempts should be combined with the key elements of sustainability. Sustainable development is a complicated notion (Weingaertner & Barber, 2010), so complex that no unanimously agreed definition of sustainability around the globe exists. There is a burgeoning trend of research aiming to conceptualize sustainable urban development and regeneration (Lorr, 2012). The most common theoretical approaches to sustainability regarding social, economic and environmental aspects are stated as follows:

Specifically, sustainable urban projects contribute to the repair of desolate context by adopting rehabilitation and adaptive reuse strategies (Ho et al., 2012) which facilitate high-quality housing and alleviate health risks for the community (Krieger & Higgins, 2002); furthermore, sustainable projects help city developers utilize the building stock and land resources more efficiently (Ho et al., 2012). Hence, urban infill development projects tend to significantly contribute to the sustainable urban development as long as it follows a sustainable path.

However, the current problem which cities face is how to achieve urban sustainability through the implementation of compact city notion. The problem of urban sustainability includes a wide range of issues operating at different levels and sectors of population which are so complex. To solve this problem, we need to deal with the

relationship between the form and location of intensification, the policy, socio-political and economic context and environmental aspects. Steps have already made in the direction of dealing with these issues in terms of social, environmental and economic access to enhance the urban quality of life. Consequently, this study explores whether infill development is a good means to achieve sustainability in communities regarding social, environmental and economic aspects and what criteria need to be considered in infill projects with respect to sustainability so as to achieve social equity and physical integrity in our communities. More specifically, the objectives of this study are as follows:

- To discuss the main advantages of infill development projects for sustainability of urban areas
- To evaluate a particular project with reference to major aspects of good infill projects, in line with literature and successful international examples
- To derive lessons for future infill projects to achieve a physically integrated, socially equitable, environmentally clean and safe urban environment.

The main intention of this study is to focus not only on the relationship between infill development and sustainable urban development but also to:

- Investigate the various dimensions of sustainability concerning social, environmental and economic aspects with respect to extension of urban fabric in peripheral areas
- Investigate how and in what circumstances infill development can alleviate these adverse situations.

Creating universal guidelines for sustainable infill development will be a challenge as said guidelines may differ from community to community or from one culture to another.

1.4. Methodology

This thesis employs a two-staged research approach: 1) A desk-based research study that focuses on the literature and strong examples of infill development projects followed by 2) An empirical study on a particular urban development project in Ankara, namely the Park Oran Project. In the empirical research, data and information on “people’s income and social status,” “energy efficiency” and “waste management” have been collected through interviews. Each interview has raised questions derived from a literature review to be asked directly to the administrative office of the Park Oran Project. The answers have been evaluated in comparison to standard values of sustainable development regarding social, environmental and economic to investigate the implementation of sustainability factors in the case study. The second component of the empirical study was a questionnaire survey conducted with 50 people living in Park Oran. The questionnaires included questions to understand the “socio economic status,” “commuting behavior” and “general living and consumption patterns” of the residents. Last but not least, the author of the thesis has also made personal observations and evaluations on site during the empirical research with the aim to produce visual materials to support the discussion and arguments.

In principle, the structure of the thesis relies upon literature readings, while the hypothesis and inferences sections have been formulated from a literature review and the onsite observations. The Park Oran Project has been selected as an exemplar of an infill and mixed-use project to complete the empirical study.

The city of Ankara has serious problems related to sustainability regarding social segregation, environmental pollution, traffic congestion and economic aspects. Currently, as the name of urban transformation so many redevelopment projects are in progress even completed and urban design as a lever in this process has a major role in transforming of Ankara’s urban fabric. The first and the most crucial role of urban design is making high enough densities to promote social equity and better

accessibility to urban amenities because of its sprawled nature resulting in extreme congestion, pollution and inequity.

One of those transformed projects in Ankara's urban fabric is Park Oran complex, formerly Turkish Grand National Assembly Housing Complex, which was designed by the famous architect Behruz Çinici and spread over an area of 25 hectares located on the Oran Road in Ankara with its rare and interesting architecture which changed it into Ankara's asset regarding its unique style and history. However, its low density did not function any sustainability in Ankara's urban fabric, so it has been transformed into a so-called mixed-use development complex which delivers high enough density.

Whether or not this density and compactness will deliver sustainability to Ankara's urban fabric is what I investigate in this study. Generally, sustainability in communities is believed to achieve through directing urban development from peripheral areas to existing urban areas through encouraging high enough densities and mixed-use development; however, there are many claims and counter-claims within compact city theory regarding whether it is sustainable or not. So, to get the related answers Park Oran Project will be evaluated based on four hypotheses through adopting the methodology mentioned above.

1.5. The Scheme of the Thesis

The thesis is organized in the following way: first, the introduction, then the body of existing knowledge including the literature review and successful international infill projects, followed by the case study analysis and finally the conclusion.

In the first chapter, brief information about the study is presented. The thesis background, rationale and problem definitions are justified with related sample urban contexts. To address solutions to the key problems caused by urban sprawl, the major hypotheses of the study have been formulated and the methodology of the research has been explained in the first chapter.

The theoretical framework is presented in the second chapter. This chapter comprises a discussion and an explanation on the related subjects of the research including paradigms of urban growth, social, environmental and economical menace of sprawl, links between TOD and climate change and urban form, accessibility, sustainable development, related policies to prevent sprawl, smart city initiatives and merits and shortcomings of infill development. The aim of compiling such a theoretical framework is to provide the reader with a sufficient knowledge base relevant to this study. The second chapter also encompasses a section devoted to successful international infill projects. This section investigates the most successful projects with respect to the parameters of sustainable development in an urban context to clarify the contributions that an infill project can make to achieve mixed-use and compact urban development.

The case study analysis, presented in the third chapter, focuses on social, economic and environmental aspects of the Park Oran Project from a sustainable development perspective by using basic information and data obtained in through of research.

The final chapter includes a brief summary of the study reminding of the problem, the hypotheses and the aims as well as a discussion of the results obtained from the assessment of the Park Oran Project. The conclusion also includes suggestions to address the shortcomings of infill projects in pursuit of sustainable and resilient urban development.

CHAPTER 2

TWO PARADIGMS OF URBAN GROWTH: SUBURBAN SPRAWL OR COMPACT CITY THROUGH INFIL DEVELOPMENT

2.1. Introduction: Tensions and Contradictions

Contemporary urban development in the world, especially in the Anglo-Saxon countries can be characterized by two paradigms. On the one hand, post-1950-style suburbanization, facilitated by excessive automobile use and highway systems which was a prevailing paradigm assessed by burgeoning urban land cover, vehicle miles travelled and new edge-city in marginal areas. Yet, at the same time there has been a tendency to sustainable urban form, featuring concepts such as smart growth, infill development, growth management, affordable housing, transit oriented development and urban growth boundaries (Goetz et al., 2011).

Urban sprawl is known for its negative spatial and environmental impacts. Therefore, there have always been initiatives to address sprawl in many countries. Smart growth movement of 1990s and 2000s was more successful due to being able to deliver more tangible outcomes to prevent from sprawl and encourage infill development than previous initiatives, such as growth control and growth management initiatives of the 1960s, 1970s and 1980s. The success of smart growth is because of comprehensive coalition, comprising large sections of government, public section and specially the development community supporting the concept. This extensive association has emerged in the framework of a more widespread acceptance of neoliberal approaches to urban development (Krueger & Gibbs, 2008) and the emergence of new regionalist strategies to construct wider and stronger regional policy consensus (Goetz et al., 2011; Jonas and Pincetl, 2006). Although the previous initiatives were confrontational to the traditional development community, smart growth initiative has relied on new

non-traditional coalitions of business, government and civil community accepting smart growth as a successful model of urban development.

Key moments in history of science happen by advent of new paradigm due to scientific breakthroughs challenging current epistemologies and theories related to old paradigms (Kuhn, 1970). The process of urban development is similar to what happens in the scientific process of development. The prevailing paradigm since at least 1945 in the U.S and to some extent, all over the world, was suburban growth, which is characterized by low-density development in urban fringe areas facilitated by automobile use and highway transport (Kuhn, 1970).

Edge cities (Garreau, 1991), the peripheral city (Harris, 1997), splintering urbanism (Graham & Marvin, 2001), and edgeless cities (Lang, 2003) have been used to describe various aspects of suburbanization. One of the most important reasons aiding to suburban sprawl growth to be successful regarding profitability and popularity was economic, political, social and technological forces that have combined to support so. Most of these sectors of economy have benefited tremendously from suburban growth and the suburban population has enjoyed from the substantial improvement in terms of quality of life as compared with the past periods. Despite the improvement in quality of life related to suburban sprawl growth, those improvements have contributed to rising costs as regards economic, social and environmental costs owing to the sprawling nature of this phenomenon.

This type of growth is defined as a process which spreads development across the landscape much faster than population growth's pace. This fact is characterized by widely dispersed population in low-density development; thereby separating residential, commercial, employment land uses and a network of roads creating super blocks, sub-divisions and cul-de-sacs that limit accessibility leading to a lack of town centers or major activity nodes (Ewing et al., 2002). There are various costs with respect to urban sprawl growth including higher energy costs, traffic congestion, rising water consumption and adding new infrastructure (transport, electrical, water, sewer

systems) and public facilities (schools, libraries, etc.) into a redeveloped area (Newman & Kenworthy, 1999). In addition, there are various environmental costs including: rising greenhouse gas emissions, air pollution, water pollution, flooding, noise, erosion, loss of agricultural land, loss of open space and wetlands, loss of scenic amenities and habitat encroachment. Urban sprawl declines public health of people living in the communities with the sprawl-style development which have higher rates of obesity and higher blood pressure (McCan & Ewing, 2003). There are also various statistics and figures with regard to environmental costs of sprawl.

The acceptance of private sector-led development and public-private partnership, which are prominent features of neoliberal approaches, is a distinguishing characteristic of smart growth (A. Goetz, 2013). While other urban growth control initiatives like growth control and growth management were criticized due to their anti-business approaches, the smart growth initiatives have supported the business community. Focusing upon market-based approach, smart growth limit sprawl and encourage infill development towards inner city areas. This neoliberal turn has been a considerable contribution to smart growth objectives to be achieved based on public-private collaboration (A. Goetz, 2013).

Despite the fact that smart growth initiatives increase density in urban area, the urbanized area has an increasing rate to exceed the boundary defined by growth control and growth management initiatives. It is not clear that smart growth will be an appropriate solution to suburban sprawl growth paradigm and shift from lower-density auto oriented development towards higher density, mixed-used, transit and pedestrian-oriented growth paradigm. However, smart growth initiatives have been more successful than previous initiatives to create sustainable urban environment in which low density suburban growth paradigm is being supplanted by sustainable urban growth paradigms.

An important issue related to smart growth is how much regulatory regimes and infrastructure investment by adopting related policies will be able to deal with segregation issue to relate empirically available geographies of racial and economic segregation within specific metropolitan region.

One of the most intriguing of these assumptions is that urban growth will not be a problem if done through well planned development process through which different activities and functions will work together; thereby promoting integrity and cohesion in urban fabric. This fact can be inferred from Pollard (2000) observation:

“A fundamental premise of smart growth is that growth is not inherently harmful; rather, it is certain patterns of scattered and haphazard development that cause adverse impacts.”

Here, sustainability objectives are not simply balanced in some sort of spread sheets and there are comprehensive criteria related to sustainable urban development as regards social, economic and environmental aspects interrelated to each other, so sustainability cannot be evaluated by considering one fragment of these all. With respect to this fact, by the advent of the new- famous 3E s (ecology, economy and equity) means that these criteria are prevailing challenges to achieve sustainable urban form, which are not separated from each other. It can be implied from Fitzgerald (2011) hypothesis:

The concomitant arrival of the new- famous 3Es (ecology, economy and equity) means that certain geometries of economic development might actually improve ecological resiliency, even as certain efforts to ensure ecological resiliency might well generate new kinds of heretofore unimagined economic development that in turn ameliorates social inequities.

Any smart growth-oriented “reshaping” of urban (metropolitan) areas, especially metropolitan America, will remain ineffective without handling patterns of segregation, which are completely derived from social inequities. The metropolitan context with uneven morality rates (Waitzman & Smith, 1998), inadequate human

capital investment (Dreier et al., 2001) and abridged voting rights (Bartels, 2008), amongst many other major concerns (Li, Campbell & Fernandez, 2013), contribute to Metropolitan patterns of racial and economic segregation (Jargowsky, 1996); thereby resulting in decline of middle-class neighborhoods.

Due to its widespread diffusion, different people in different contexts have different interpretations of smart growth notion. So, the questions of transportation, health, urban design, regional governance, public finance, economic development and affordable housing are the most leading aspects which are being categorized by notion of smart growth.

Smart growth is variously described as being “eclectic”, “comprehensive” and “syncretic”, known as a containment policy in metropolitan area. In theory, metropolitan wide-containment, involves the outside use of UGBs, greenbelts and urban service areas to manipulate low-density sprawl by adopting inside policies including mixed use development, affordable housing tools, comprehensive plans, land inventories and transit oriented development (Weitz & Moore, 1998). Whether or not the urban containment policies are able to find a solution to mitigate or even eliminate segregation is still a big challenge both in academic and practice. With specific respect to race, urban containment is believed to accelerate racial desegregation, performing better than state-mandated housing initiatives. This policy might doom such efforts before these races are seriously considered. In contrast, containment strategies such as smart growth implemented by various tools including infill development, which tends to emphasize middle-income groups, accelerate strategies such as preserving open spaces, revitalizing urban areas, creating more livable urbane communities and expanding housing choices (diversity) rather than social justice concerns like “reducing racial segregation” (Nelson, Sanchez & Dawkinz, 2004).

However, there are arguments asserting such strategies like as smart growth helps forge a new segregation due to its necessary inflation in property prices which thereby

ruins egalitarian nature of communities. This fact ostensibly deters minorities in particular from home ownership (Pozdena, 2002). Most recently, though, Ruddiman (2013) offers a more ambivalent argument, navigating the terrain between Nelson's enthusiasm and Pozdena's skepticism. Using analysis of smart growth and non-smart growth communities, she concludes that neither a strong "pro" nor "con" aspect can be taken as regards UGBs as a containment tool. Actually, according to Ruddiman's ambivalent view smart growth is believed to reflect existing geographical anatomy of smart growth as a complicated policy experience in physically and socially diverse regions. However, smart growth's recent containment efforts make a great contribution to the promoting compact and even racially desegregate social fabric at least in some parts of the (sub) urban areas. At the same time, it's not clear that even if where this compact development occurs, newly compacted areas necessarily reflect class desegregation or it's not clear what kinds of smart growth spaces might emerge in the same region.

Despite the ambivalent facts related to compact development, there is a close relationship between sustainable urban development and smartly urban development projects. It can be inferred from Cf. Moore's (2010) statement:

"Where in the projects at the urban end provide a social mix and create physical infrastructure that supports a public realm, while projects at the anti-urban end seem to reinforce social homogeneity and lack of public spaces".

Normatively, advocates of smart growth and New Urbanism (NU) suggest that improved sustainability emerges organically as refashioned neighborhood spaces exhibit greater housing integration. It can be inferred from Fishman and Gechter (2004) thinking upon smart growth principles:

"NU, holds that most daily activities should be within a few minutes' walk from home or work, which in turn requires a greater mix of shops, offices, apartments and especially homes. Accordingly, the production of mixed-use neighborhoods produces

higher density mixed-use projects, which then (potentially) generates higher property values and selling prices.”

Actually, there is a close relationship between density and using of public transportation with respect to production of mixed-use neighborhoods resulting in higher density communities, which is utterly considered as a sustainable community. As Modarres (2009) suggests:

“Familiarity with public transportation, combined with the effects of income and place of residence, has made the immigrants’ lives a bit greener than these of the native-born. In fact, one factor that may contribute to their higher usage of public transportation stems from their living in neighborhoods whose densities are, on average, 2.5 times higher than those of the native-born. Immigrants, in essence, are doing precisely what planners want the rest of us to do.”

Smart growth across a metropolitan area, struggles to hinder sprawl forces producing regionally scattered and ad-hoc development, seizing new opportunities to reinvent urban areas through containment strategies generating improved compactness, mixed-use, high-density and diversity (Jabareen, 2006). However, smart growth cannot land unalloyed; it is socially mixed, what Lefebvre called “meshwork” of cities.

Where concerns of racial and economic segregation are highlighted, additional reflection is needed on how this meshwork feeds back into smart growth theorization of urban change in terms of higher levels of generalization, alternative philosophies and programs of urban sustainability (Huxley, 2008). Due to the complexity of the effects of highly varied planning regimes on city building across the metropolitan world it is impossible to be left to other fields alone, even urban planning, as crucial as these fields have been in tracking new patterns of deliberate urban change (e.g. Song, 2005).

2.2. Urban Sprawl

Development at the city edges and rural areas is sometimes called urban sprawl. Sprawl is not accepted widely by certain definitions; however, some definitions have some common elements including (Heimlich and Anderson, 2001):

- Dispersed low-density development using lots of land
- Separation and segregation of major activities such as residential, work, schools and shopping.
- Completely depended on private mobility (car dependency).

Due to remarkable similarities regarding roots and causes between urban growth and sprawl it is a big challenge to distinguish these causes. These two phenomena are highly interlinked; however, urban growth may occur without any sprawl, but sprawl has a growth meaning in its nature. Whether the growth is good or bad relies on the patterns and consequences it produces. There are some of the roots causing sprawl and they cannot result in a compact community. Most of these roots are related to restructuring of the world's economy and requirements of capitalist accumulation.

Prevailing interests of the capitalist mode of production and commodification of cities during industrial model of urbanization contributed to the crucial restructuring of land use and new definition of social meanings to the city. The commodification of the city itself through real estate including land speculation and in its residential triggering results in suburban sprawl opening up new construction and transportation markets which stimulate private consumption of household (Harvey, 1975). Implementation of this model of metropolitan development mandated the mobility of population and infrastructure to make more profit. This type of development led to massive migration, running of communities' cultures, unbalanced growth, no match between existing infrastructures and housing stock and need for new infrastructure and urban growth out of growth boundaries (Bluestone and Harrison, 1980).

2.2.1. Demographic Factors for Sprawl

Cities are places in which individuals can have a better life due to better opportunities, higher salaries, better services and lifestyles. This fact attracts poor people from rural areas. In rural areas it is difficult to enhance standard of life because farm living relies on unpredictable environmental circumstances like as flood, drought which survival becomes too difficult. By contrast, cities are much more stable places where services and wealth are centralized and social mobility is possible. Job and capital generating businesses are located in urban areas; thereby flowing foreign money into a country (Bhatta et al., 2010).

In industrialized countries future growth of urban population will be in moderation due to low rates of population growth and living of 80% of population in urban areas. In contrast, in developing countries due to transition process the rate of population growth is high, so urban global population will grow to 4.9 billion by 2030; however, rural population will decrease by some 28 million between 2005 and 2030 simultaneously (UNFPA, 2007), so population growth will be in developing countries.

This kind of population growth targeting cities usually results in uncontrolled growth which leads to sprawl. The rapid growth makes cities force their capacities to provide services and due to less income governments cannot provide basic services and spend on maintenance of cities; consequently, cities extend beyond their boundaries towards periphery which actually generates serious environmental, economic and social problems (Bhatta et al., 2010).

2.2.2. Economic Factors for Sprawl

The more the economic base expands in cities, the more demand for housing space increases (Guiliano, 1989; Bhatta et al., 2010). This encourages developers for rapid construction, which promotes disintegrated and discontinuous development due to lack of time to plan and coordinate properly among developers, governments and proponents.

Establishment of new industries in peripheral area raises impermeable urban pattern. Industry necessitates housing amenities to its workers that generally is much extended than industry itself. Transition from agricultural to industrial employment needs more housing. Single-family use and low-density industrial developments next to parking lots promotes sprawl in urban fabric. Occurrence of industrial sprawl happens owing to cheapness of property in urban fringe (Bhatta et al., 2010).

One of the major outputs of expansion of economic base in urban areas is land speculation. Speculation may lead to immature growth without proper planning. Several political election assertions may also be a source of encouraging of people who speculate land. Speculation is one of the most important factors hindering land development and produces disintegrated

An important determinant of urban development is the availability and cost of urban infrastructure. Development of community infrastructure costs in urban fringe as well as maintenance costs of public amenities are higher than the inner city areas, so the development tax at the marginal areas seems to be higher; however, development taxes in periphery are lower than the core city encouraging urban expansion (Brueckner and Kim, 2003). On the other hand, fringes are in some cases advantageous in provision of infrastructure in terms of ease and speed of infrastructure provision compared to built-up areas in inner cities. In such cases, suburban development and sprawl may be an option for built investments than inner city areas.

Likewise, property costs in the inner city areas are higher than peripheral areas which in turn encourage urban development towards peripheries. It can be implied from Harvey and Clark's (1982) following statement:

At the time sprawl occurred, the cost was no prohibitive to the settler; (rather) it provided a housing opportunity economically satisfactory relative to other alternatives. Generally, majority of urban residents seek to settle within the core city, but lower living and property cost attract them to the countryside.

Like as living and property cost, affordable housing also leads people into peripheries. The number of homes that a household with a certain percentage of median income can afford is a common measure of community-wide affordability (Bhatta et al., 2010).

Often city residents prefer second home in suburbs due to low interest and high housing demand which encourages developers to construct at the suburbs. Despite the vacancy of these homes, government is forced to provide urban amenities and services in a low-density area (Bhatta et al., 2010).

2.2.3. Physical and Spatial Factors for Sprawl

As land size and availability decrease in the inner city areas, houses do not provide affluent living spaces in inner cities as opposed to suburbs. Besides, the carrying capacity of the inner city areas might be quite limited compared to the growing need for residential areas due to population growth in developing country cities. Therefore, inner city areas may not promise too much in terms of absorbing future urban population growth and of satisfying the demand for more spacious housing.

Due to the lack of sufficient living space for residents of inner city areas in developing countries residents may have a tendency to reside in countryside to have more living space. Since property cost in periphery is less, people can buy more living space; nevertheless, depleting of more living space does not always cause sprawl. Density is a substantial challenge with respect to that issue. Developing countries cities are three times denser than developed countries (Acioly & Davidson, 1996). Higher per capita depletion of built-up area has considerable advantages in many instances and is an indication of higher living amenities in compact urban growth. Nonetheless, that kind of need for more living space causing low-density development in periphery is an indication of sprawl growth.

Present countryside's dwellers are often former urbanites looking for high quality of life in suburbia. Despite the fact that suburban life worsens traffic congestion and makes long commutes to work, moving to the suburbs is a main goal of residents, so sprawl growth will be halted as long as this perception changes and urban quality of life improves (Bhatta et al., 2010).

Sometimes physical and spatial conditions in an urban context may cause sprawl. Unsuitable physical terrains like as rugged terrain, wetlands or water bodies cause sprawl creating leap-frog development sprawl which cannot be overcome and it should be overlooked (Harvey and Clark, 1965; Barnes et al., 2001).

Transportation routes provide accessibility to periphery and construction of highways is a major factor of congestion in the city and rapid growth (Harvey and Clark, 1965) which are commonly considered in forecasting urban sprawl (Yang and Io, 2003). Unless the site is accessible, it is prohibited to construct new high-rise building by government. Narrow roads generally promote horizontal growth. This phenomenon is mostly seen in old developing countries in which planners failed to forecast the need for wider roads. Recent road-widening policies in developing countries due to economic and political constraints are being overlooked (Bhatta et al., 2010).

2.2.4. Legal and Institutional Factors for Sprawl

Generally, some disintegrated urban development occurs owing to dissimilarities in development regulations and land use policies among municipalities. Restrictive land-use policies make development jump into development or is less capable of control it (Barnes et al, 2001). In some other cases, due to less controlled and loosely regulated peripheries, many developers find these areas more suitable and profitable for new development (Harvey and Clark, 1965). This fact not only promotes sprawl but also fails to control new compact development.

Lack of proper and well-organized planning policies may also lead to sprawl pattern of urbanization. Exclusive zoning would separate residential, commercial, industrial, office, institutional and other land uses causing isolated type of development which thereby necessitates car dependency to commute between zonings creating more fuel consumption and thereby pollution. Mixed use development is a preferred panacea to solve this problem (Bhatta et al., 2010).

Successful Implementation is much more important than having a proper planning policy. Unsuccessful enforcement is one of the most important causes of sprawl pattern of urbanization in developing countries due to corruption issues related to enforcement policies (Bhatta et al., 2010).

Governments and private sector have various expectations related different developments. Sometimes, to meet their future needs they take decision at their own and this fact exacerbates if there is a shortage of proper master plan causing unplanned and uncontrolled development (Harvey and Clark, 1965).

2.3. Types of Sprawled Urban Development

2.3.1. Residential Areas

Housing is one of the most prevailing urban functions at the rural-urban fringe in recent years, consisting of large scale suburban neighborhoods. These neighborhoods generally form two types of urban patterns including new edges of existing concentric cities or an independent pattern in the urban fabric creating new centers in polycentric urban region (Boeijenga & Mensink, 2008; Lorzinger et al, 2006). On the other hand, small-scale residential developments distributed along periphery in the vicinity of small villages and cities mostly found in rural areas comprising small neighborhoods with detached houses. By the way, there are more unique and exclusive residential development devoted for high income groups characterized by specific boundaries around and by unique architecture types sometimes composed with recreational activities like as golf course (Nabielek, 2009).

2.3.2. Commercial Areas

Besides the increase in residential development, substantial growth is also seen in the form of commercial areas. Many of which are developed in the nearby motorway junctions located in the unused areas between motorways and housing districts. There are some criticisms with respect to commercial areas including regional and local scale. With respect to regional scale, open spaces along infrastructure are filled, thereby obscuring the contrast between city and countryside. In local scale, regarding design of business estates the most important criteria are function and urban and architectural design aspects which are partially considered (Hamers & Nabielek, 2006). Moreover, these districts without any accessibility to public transportation increase traffic congestion which makes a great contribution to the environmental pollution.

In recent years, considerable increase in business parks is seen at the rural-urban fringe. In the past head of national and international companies located in inner city areas; however, they are predominantly established in periphery along motorway (Hamers & Nabielek, 2006). Despite being small in aggregate surface area of these areas in comparison to commercial areas, they are easily visible due to astonishing structures. Moreover, these kinds of areas are accessed by car, thereby increasing congestion, air pollution and noise pollution (PBL, 2012). Moreover, construction of new peripheral business parks has contributed to the office vacancies in different areas.

Likewise, there has been a big increase in retail functions in peripheral lands in recent years. This phenomenon is considerably seen in European countries in which tremendous shopping malls can be found (Hamers and Nabielek, 2006). Totally, due to functional layout of these centers, public space is poorly designed and prevailed by parking areas which has a substantial contribution in traffic congestion.

2.3.3. Recreational and In-between Areas

This function includes indoor and outdoor recreational functions. Indoor recreational areas like as skiing facilities, thermal baths and multiplex cinemas, while second category includes sport grounds, natural areas and parks. Indoor activities have large parking lots and are located next to motorways and the footprint of outdoor facilities is much bigger than indoor facilities; however, construction of indoor facilities in open areas can deteriorate the landscape of city (Schuit et al, 2008).

The Most important characteristic aspect of these areas is being categorized by municipal borders and spatial fragmentation. Large scale infrastructure cuts through these areas and newly established small and large functions lay randomly distributed within them. Various samples of these areas are seen in peripheries which are also known by different functions with little in common (Frijters et al., 2004; Hamers & Rutte, 2008).

2.4. Consequences and Impacts of Urban Growth and Sprawl

Urban growth may have negative and positive impacts; however, negative impacts are dominated due to sprawl's uncoordinated and scattered nature. Positive implications of urban growth include higher economic production, work opportunities, higher quality of life because of better amenities. Urban growth has a capability of offering better facilities like transportation, sewer, water and other specialist services like as better educational facilities and health care facilities. However, in many situations urban growth is uncontrolled and results in sprawl (Bhatta et al., 2010). In what follows is a brief discussion on a range of adverse impacts and consequences of urban sprawl.

Sprawl is one of the crucial impacts of rapid an unplanned urban growth which is responsible for environmental change and form of cities. Due to rapid urbanization and unplanned urban development many countries including the US are suffering from deterioration of built environment which threatens health and quality of life. Impacts of environmental quality of sprawl are stronger than its spatial extent, the

consequences of which are evaluated based on socioeconomic and environmental impacts. These consequences sometimes overlap each other or result in indirect impacts (Kirtland et al, 1994).

The impacts of urban sprawl are one of the most controversial issues across the globe and literature. It is branded as the cause of “all of evils of modern urban life” (Clawson, 1962). This negative view can be entitled with various concepts in literature including “fighting sprawl and city hall”, “divorce your car” and “home from nowhere” (Clawson, 1962). There are numerous of points with respect to costs and benefits of sprawl. It is difficult to support all discussion either for or against sprawl due to lack of reliable empirical evidence. In a study (Chen et al., 2002), impacts of sprawl are divided into five groups including public and private capital and operating costs, transportation and travel costs, land/natural habitat preservation and quality of life and social issues (Chen et al., 2002). Discussions on impacts of sprawl are more recent in the literature. In the post war era suburbanization was evaluated and discussed in a positive way because it provided housing for burgeoning population of the cities (Clawson, 1962). However, in the contemporary urban world, sprawl is criticized for its adverse impacts on cities and their residents as well as surrounding natural areas.

2.4.1. Economic Impacts

Sprawl is blamed owing to its environmental and economic costs. Burgeoning need for public services and maintenance of such amenities like as fire-service stations, police stations, schools, hospitals, roads, water mains and sewers in countryside are issues experienced in metropolitan areas. Compared to denser areas, low density development requires more infrastructure provision (Buiton, 1994). The costs of sprawl and other studies have indicated that the more the density rises, the less costs communities will suffer (Priest et al, 1997). Inefficiency may also arise since people not living in centralized and integrated communities. It may be mentioned that in terms of community-level infrastructure, prevailing factor in costs is the degree of clustering not residential density (Peiser, 1984).

Higher densities mean shorter distances but more congestion; however, first one inundates the second. Cars are not fuel-efficient due to congestion; nonetheless, fuel consumption is eminently less in dense area. Due to the more travel distances from periphery to the inner city areas, urban sprawl causes more fuel consumption and traffic congestion (Newman and Kenworthy, 1988). There are numerous costs related water and electricity in terms of extending and maintaining the service delivery system; moreover, there is a loss in the energy. The farther from generator, the more power is lost in allocation. Therefore, increased use of energy is another important economic impact of sprawl, which is deepened in contexts where energy supply mostly comes from external sources.

2.4.2. Social Impacts

One of the major motivations to live in suburbs are access to and live in nature. Living in natural habitat is much more accessible in suburb than living in denser urban area and has related benefits regarding physical and mental aspects. Moreover, the sense of escaping from metropolitan areas and the feeling of peaceful may be restorative for people, so there can be some benefits with respect to suburban life (Furmkin, 2002). However, sprawl has numerous impacts on public health.

One of the most important features of sprawl is car dependency. There is a close relationship between lower development and car dependency, thereby causing related health hazards including air pollution, motor vehicle crashes, pedestrian injuries (Furmkin, 2002). The negative effects of air pollution like as skin disorders and breathing problems are known for everyone.

Sprawl pattern generally is a main cause for time wasting due to passing vacant lands from inner city areas to periphery (Harvey and Clark, 1965). At the same time, sprawl contributes to rising of traffic congestion and ruins social interactions (Brueckner, 2000). Sprawl mitigates opportunities for cycling and walking owing to its car-dependent feature which lengthen driving distances. Commuting of long distances is

an important major of stress and those who cannot afford living in inner city areas undergo from this stress causing negative impacts on communities.

In terms of social health, sprawl and low density development deteriorate communities' interactions and is a major effect for social segregation (Ewing, 1997). Furthermore, sprawl deepens the inequality between cities and sprawl, as wealthy citizens usually escape to suburbs. Sprawl also deteriorates quality of life and social communication.

2.4.3. Environmental Impacts

Uncontrolled sprawl has a tendency to alter ecosystems patterns and process (Grimm et al., 2000). Sprawl patterns not only mitigate the amount of forest area and open space but also disrupt ecosystem and fragment our natural habitat (Lassila, 1999). Penetration of sprawl into rural natural areas including woodlands and wetlands is one of the most important causes of our natural habitat loss. Cutting through natural areas by various infrastructures like as roads, power lines and pipe lines fragment natural habitat altering patterns of wildlife movement (Bhatta et al., 2010).

In general urbanization and in particular sprawl patterns deteriorate farmlands and open spaces (Berry and Plaut, 1978). For example, 7 million acres of farmland, 7 million acres of environmentally sensitive land and 5 million acres of other lands are predicted to be depleted by urban growth in the US between 2000 and 2025 (Bruchell et al, 2005). Land use policies and different taxes make financial pressures forcing farmers to sell their lands to speculators. Furthermore, small parcels of farmlands are replaced with residential developments contributing to loss of agricultural land each year. This means loss of fresh local food and natural habitat and diversity. Existence of farms provides green space which stable economy of rural areas and preserves rituals in terms of lifestyle (Bhatta et al., 2010).

There is a direct correlation between land surface temperature and impermeable surface in terms of rising temperature in the sprawled area (Weng et al, 2007). On warm days, urban areas are 6-8 degrees warmer than surrounding areas. This

phenomenon known as an urban hot Island is caused by two factors. Firstly, dark surfaces like as roads absorbing heat and radiating it. Secondly, outward sprawl increases urban heat island regarding geographic extent and intensity due to tree-cutting and road construction. In addition, sprawl pattern necessitate longer distances to travel causing more fuel consumption and greenhouse gas production which contributes to global climate change and warming (Bhatta et al., 2010).

Sprawl is a major factor of air pollution due to car dependency increasing fuel consumption which results in emissions of greenhouse gases (Stoel, 1999). Urban sprawl makes a great contribution to deteriorating of air quality by promoting car dependency, thereby scattering air pollutants in the atmosphere contributing to global warming and serious health problems (Frumkin, 2002). Likewise sprawl has major effects on water quality and quantity. Due to construction of roads and parking lots, rainwater and snowmelt can't soak into the ground increasing the volume of urban runoff water. So, urban areas are exposed to flood hazard regarding erosion and inundation (Jacquin et al, 2008). This phenomenon substantially increases the flow waters in wetlands ruining natural habitat and leads to an increase in water pollution derived from runoff contaminated with garden chemicals (Lassila, 1990; Wasserman, 2000). Furthermore, heavy rainstorms cause human sewage to enter waterways.

2.5. Policy Responses to Address Urban Sprawl

2.5.1. Sustainable Urban Development

The concept of sustainable development was defined in 1987 in a UN report, titled "Our Common Future", which is also known as the Brundtland Report. According to this seminal definition, sustainable development is "the development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (UN, 1987). The concept of sustainable development is further defined in a way to be characterized by three major pillars as follows: social well-being, economic prosperity and environmental protection. As described in a report by the U.S. National Research Council, sustainability as a goal and a process improves

economy, environment and society in favor of current and future generations (UN, 1987). As a goal, sustainability meets society's basic economic and social needs without using up the natural resources and environmental quality that are essential to meet such needs in future. Furthermore, as a process, sustainability provides innovative tools, models and approaches to meet the above-mentioned goals while enhancing economic circumstances and protecting natural resources (UN,1987).

The concept of sustainability was further developed at the 1992 Earth Summit in Rio de Janeiro, where 179 nations advocated the principles of Agenda 21, which emphasized “the right to development must be fulfilled so as to equitably meet development and environmental needs of present and future generations” (UN, 2011). The rapid increase in world's population and consumption levels since the Rio Summit make sustainable development as an urgent need and goal for all nations. Majority of the future population increase will happen in developing countries where hundreds of millions of people need more access to food, clothing and shelter as well as sanitation, education, health care, energy, communication and consumer goods. When this issue is accompanied with the high level of natural resource consumption in developed countries, it becomes obvious that the stress on global ecosystem will intensify. This is further deepened by the adverse impacts of global warming and climate change. The pursuit of sustainable development requires sound and holistic approaches and policies to be implemented at global, national and local levels.

Transition from hunter-gatherer societies into settled societies based on agriculture has contributed to emerging of economic and social interactions in cities. During industrial era cities have grown larger and larger due to its social and economic opportunities offering for the world's population (Newman and Jennings, 2008). But cities now have a big effect on natural habitat due to exhausting of fossil fuels and natural resources at increasing rate. They must provide opportunities and be sustainable at the same time. In other words, cities are in a position to reduce their adverse environmental impacts and also to develop innovative solutions and policies to widespread the implementation of sustainable development. Such solutions and

policies that can help cities move towards sustainability should focus on the following policy domains (Newman, 2008):

- Providing infrastructure to enable sustainable energy, water and transport to be more accessible and promoting energy efficiency and waste management to mitigate ecological impact.
- well designed and efficiently available of infrastructure to all.
- Innovation and deploying of latest technology through research and development.
- Investment into these new technologies through tax incentives and making people change their behavior through price signal motivation.
- Regulations of high enough standards for sustainable technologies to cover their externalities.
- Education programs to change households and communities' behavior in depleting of natural resources and encourage communities to use sustainable modes of transportations and energies.

An important priority is urban infrastructure, which covers transport-related issues as well. Private cars are preferred for long distances due to their high speed compared to other sustainable modes and people don't like to commute more than an hour a day on average (Newman & Kenworthy, 2015). So, modern electric rail system or Bus Rapid Transit (BRT) can produce an urban corridor which can mitigate the traffic congestion in inner city areas if implemented properly. Similarly, a good bicycle system and walkable urban environment leads to decreasing car dependent trips in people's daily habits. Cities in which sustainable transport modes are implemented, land use tends to cluster around it (Newman & Kenworthy, 2015). These type of solutions can be put in place if the city is planned and designed in appropriate ways. Thus the design of the city is highly related to its major infrastructure.

If a city constructs highways only, it favors suburbanization, distributes density in suburban areas and produces low density urban fabric. Density and transport networks

are closely linked. Planning of cities should not to be car dependent if the aim is to address urban sprawl. This would also be an effective strategy to decline a city's carbon footprint. For example, "transit oriented development" indicates a declining rate in households' private car use in half and residents save 20% on their household income by having one less car per household (The center for transit oriented development, 2004). All in all, since we have sustainable development as a goal and a process for a better future, various concepts and policy responses or frameworks targeting the city level have been developed to address urban sprawl and its associated problems. In the following sections, a compilation of such concepts and policies are presented.

2.5.2. Compactness and Compact Urban Development

Compact urban fabric is a widely acceptable strategy which tend to form various sustainable urban forms; thereby minimizing transport of energy, water, materials, products and people (Elkin, McLaren and Hillman, 1991). Moreover, it refers to integrated urban fabric suggesting urban development has to occur next to existing amenities (Wheeler, 2002). Intensification, which is an important tool to achieve compactness by means of increasing the density of development, can help utilize urban land more efficiently and thereby develop previously undeveloped land and existing infrastructure (Jenks, 2000).

Compactness follows four major targets: the first, probably the most widespread characteristic of compact city is preserving of rural areas (McLaren, 1992). The second is to ameliorate quality of life regarding social interactions and convenient access to urban amenities. The third is to promote energy efficiency by mitigating energy consumption and providing acceptable densities which will be able to support district heating systems and the fourth is to mitigate environmental pollution by shortening the travel distances and wiping out the car dependency (Williams et al., Burton and Jenks, 2000; Pratt and Larkham, 1996). So, compactness is a crucial means to achieve sustainability in our built environemnt. Compactness, density, diversity and

highly integrated urban pattern are substantial criteria of each sustainable community generating walkable city and eliminating car dependency and promoting diversity (Dumreicher et al., 2000).

Communities developing their urban environment to achieve compactness are supposed to encourage income and ethnic diversity by assimilating housing diversity, condominiums and townhomes along with single-family dwellings. Affordable housing is expected to be incorporated to the process of urban compactness projects since it has been mentioned in the charter of new urbanism as an essence of social diversity (Grade, 2004). In the interview with Clark Wagner, the urban design director at the city of Gaithersburg, Maryland, affordable housing is mentioned as a substantial principal to achieve compactness (Wagner, 1999). Implementation of affordable housing has local and non-local implications in terms of social equity. Urban de-concentration programs through incorporating affordable housing in suburban developments should address problems regarding urban decline and concentration of low income groups in inner city areas (Downs, 1999; Rusk, 1999). However, policies that promote mixed-income developments in suburbs are not likely to be adopted without “not in my backyard” (NIMBY) opposition, expressed as follows by Downs (1999):

“High percentage of poor people who might be so deconcentrated are minorities. Many suburban oppose having these people enter their neighborhoods and central city minority politicians oppose the resulting loss of their political support.”

Despite supporting greater variety of housing, this has not prepared population diversity. It’s believed that the aim of encouraging income and ethnic diversity will need more than provision of mixed-income housing (Gordon and Richardson, 2000). Despite the fact that urban designers hope that implementation of affordable housing in mixed-use communities will mitigate social inequity and segregation, thereby low income people will accommodate near jobs, absence of adoption of any related policies makes it less accessible to low income groups.

To achieve compactness, communities should be designed to promote sustainable mode of transportation including walking and public transport (PT). Infill development projects are generally identified as transit-oriented developments and are located near transit stations to facilitate accessibility which encourage use of public transport; however, existence of such projects in urban fringe with no accessibility to public transport is also observed.

Density is a crucial aspect of compact urban development and a substantial typology related to sustainable urban form which is defined as a ratio of dwelling units to land area. At certain densities (thresholds), people living within a given area can interact in an acceptable level which is needed to generate urban functions or activities viable (Carl, 2000). Density and dwelling type are two important factors affecting sustainability of urban environment in terms of consumption of energy, materials and housing land, transportation and urban infrastructure (Walker and Rees, 1997). High density and integrated urban form preserve natural resources and habitat, thereby providing compactness contributing to social integrity and equity and mitigating land segregation. Implementing of rising density policies and renovation of inner city area contribute to energy consumption, as inferred from Newman and Kenworthy (1989) statement:

“Some policies can save significant amounts of energy, mainly by increasing the urban density, strengthening the city center, extending the proportion of a city that has inner-area land use, providing a good transit option and restraining the provision of automobile infrastructure. They advocate a policy of new mass rail transit systems for the inefficient cities.”

2.5.3. Mixed-use Urban Development

Mixed-use development and higher density communities incorporate a variety of activities and functions in a way to realize the idea of sustainable urban growth. The concepts of compactness, mixed-use development and higher densities have been considered to be applied in tandem in most of the contemporary urban development

projects. Mixed-use development or diversity of activities such as residential, commercial, industrial, institutional and transportation amenities allow compatible land uses to locate in close proximity to one another, thereby decreasing the travel distances between activities (Parker, 1994).

Mixing use development encourages cycling and walking by locating various amenities in reasonable distances (Thorne and Filmer-Sankey, 2003). Furthermore, mixed land use contributes to revitalizing urban decay, thereby enhancing security in public spaces in favor of disadvantaged groups (Elkin et al., McLaren and Hillman 1991). Design principles of mixed-use development have a special emphasis on pedestrian-oriented development which designs streets and public spaces as places of shared use. Furthermore, public parks and community gardens are developed so as to be accessible to all and civic, institutional and commercial buildings are provided within walking distance.

Mixed-use development also promotes diversity in urban areas. As Jacobs (1961) argues in the following quote, diversity over urban space enables walking; thereby providing significant advantageous that cannot be found in suburban developments:

In dense, diversified city areas, people still walk to an activity that is impractical in the suburbs and in most of grey areas. The more intensely various and close-grained the diversity in an area, the more people walk. Even people who come into a lively, divers area from outside, whether by car or by public transportation, walk when they get there.

Without diversity, the urban system declines as a place to live. Although there are similarities between diversity and mixed land uses; they are not necessarily the same. The single issue that distinguishes both terms from each other is “**multidimensional aspect**” (Turner et al., 2001). Diversity of activities promotes further desirable urban features such as variety of housing types and architectural styles, high densities, household sizes, ages, cultures and incomes. So, diversity represents social and cultural context of the urban area comprising a mixture of land uses, housing types,

architectural styles and rents. Otherwise, homogeneity of built environment often produces unattractive and monotonous urban environment which lack of affordable results in social segregation and job imbalances (Wheeler, 2002).

2.5.4. Transit Oriented Development (TOD)

Transport is a substantial issue for environmental debate with respect to achieving compact urban form (Jenks et al., Burton and Williams, 1996). The form of our cities generally reflects the transport system which was dominant at different period of development process (Barret, 1996). Sustainable urban form had better contribute to walking, cycling and efficient public transport and must have a compactness, thereby facilitating social interaction and access to amenities minimizing resulting external costs and mitigating carbon emission simultaneously (Elkinet al., McLaren & Hillman, 1991). Sustainable transport has a direct relationship with equity, accessibility and urban quality of life which can be implied from Jordan and Horan (1997) statement:

Sustainable transportation is defined as transportation services that reflect the full social and environmental costs of their provision that respect carrying capacity and that balance the needs for mobility and safety with the needs for access, environmental quality and neighborhood livability.

Land use planning has a dominant role to achieve integrity and compactness. In other words, the less the physical separation is, the lower the travel needs, met by walking, cycling and environmentally friendly transport. Implementing pedestrian-friendly features such as a connected street layout, mixed use development, high dense urban environment, traffic claiming tend to decline car dependency in urban fabric and mitigate air pollution. TOD principally encourages higher density urban development along mass transit routes so as to create development corridors that are served by properly constructed public transportation modes. TOD idea is further supported by some other design principles like density increase around stations, easy access to and

egress from stations, etc. So, people have a good motivation to leave car dependency and use public transport more to commute.

2.5.5. Smart City Initiatives

Smart city is an avant-garde notion dealing with uncontrolled urban development aiming to address contemporary urban issues regarding sprawl and its related social, environmental, and economic aspects with special emphasis on technology initiatives to achieve sustainability, believed to optimize the use and exploitation of both tangible (transport infrastructures, energy distribution networks, natural resources) and intangible assets (human capital, intellectual capital of companies and organizational capital in public administration bodies). Production and allocation of energy, transportation and logistics, waste management and pollution control are dominant aspects dealt directly with this notion.

Earning data from different sources such as sewers, parking spaces, security cameras, and traffic lights, smart city notion focuses on the importance of comprehensive planning and control and the central function of ICT (Information and communication Technology) systems improving productivity through automatic routine processes and making managers make crucial decisions, planning and control activities. In cities, ICT contributes to sustainability, thereby solving the emerging problems of urban living such as solving morning traffic or mitigating energy use.

The domains of smart city are classified as hard or soft in relation to the ICT systems. Hard domains include office and residential buildings, energy networks, natural resources, energy and water management, waste management, environmental issues, transport facilities, sustainable mobility and logistics. So, deployment of ICT systems, accompanied by appropriate policy interventions and urban planning contribute to urban sustainability (McKinsey Global Institute, 2011; McAfee and Brynjolfsson, 2012). However, soft domains include education, culture, policies which enhance self-sufficiency, inventiveness and social cohesion, as well as communication between local administrators and the people (e-government).

Allowing citizens to make their own decisions by providing access to data is another position related to smart city investing in soft urban living domains to achieve sustainability which is related to welfare and social inclusion policies, culture and education. Determined by political authorities and by the urban ecosystem of citizens, ICT is a general purpose technology as a complementary to human and organizational capital relying on each city's need and life habits (Bresnahan and Traitenberg, 1995). Since ITC is unable to transform cities without human capital another part of study focuses on human capital to improve city viability.

2.6. Infill Development

Infill development is one of the major strategies or policy responses to address urban sprawl and improve sustainability of urban environments. Various research and academic work have been on this subject worldwide in the recent years. Considering the widespread attention given to the concept of infill development, the study focuses particularly on infill development as a strategy to address urban sprawl. Infill as being the main focus of this thesis, different aspects of infill concept are argued here in a particular section.

2.6.1. Background and Purpose

In the last few decades, deterioration of the inner cities and burgeoning growth of urban population contributes to decay within existing urban fabric. High income citizens abandoned their houses to find a better quality of life in peripheral areas, which lead to old city to be occupied by poor household or left vacant. Urban decay highly contributes to suburban sprawl since affordable life is scattered out of the city instead of previously developed inner city areas. Infill development is the redevelopment of vacant, abandoned and bypassed land within existing communities in which amenities are already in place (Aly & Attwa, 2013).

Infill development has a substantial role regarding community revitalization and recapturing the value of land by means of filling gaps in existing communities and is an important alternative to prevent sprawl development. Infill development enhances

urban quality of life by reusing of existing amenities, promoting safe and attractive pedestrian environment by enhancing walkability and recapturing the sense of place by promoting mixed-use development. Infill development aims to enrich the character, viability and function of the old city (Aly & Attwa, 2013).

Adaptive reuse and urban revitalization are related concepts to infill development. Infill focuses on redevelopment of underutilized areas within previously developed and existing infrastructure; however, adaptive reuse addresses the issue of building use and design. Implementation of both infill development and revitalization contributes to efficient use of existing infrastructure causing strong community function (Williams, 2007).

Infill development is implemented by different techniques in different scales. Yet, there are two general approaches mostly used to promote infill development including infilling in special area within particular areas in municipality which are related to infill development orders and as a second approach, defining areas of infill development. Flexibility of infilling process regarding zoning and design standards with respect to existing infrastructure is the most essential aspect of successful infill development. The following questions can help us figure out whether infill development is a proper strategy to enhance our communities' social and physical structure (Williams, 2007):

- Will the project recapture the value of the place and provide self-sufficient local economy?
- Will the project contribute to the adaptive reuse of existing nearby buildings such as cultural centers, museums, libraries and underutilized infrastructure such as transportation system, sidewalks and roads, sewer, water and other amenities?
- Will the project provide livable community by promoting the pedestrian friendly and well connected streets?
- Will the project create jobs and provide public space to enhance sociability?

- Will the project contribute to the mitigating of sprawl and preserving of farm lands and open spaces?
- Will redevelopment of the land assist in ameliorating of public health?

Urban planning has addressed urban decay by infill development, thereby increasing density and revitalizing neighborhoods aiming to ameliorate sprawl pattern (Faris et al., Robinson & Cole, 2000). Infill development has the crucial role in providing density and integrated urban form focusing on the existing community fabric to fill gaps in the neighborhood and integrate neighborhoods to each other and into inner city areas. Despite many advantages of infill development, there are a number of disadvantages and barriers hindering its development regarding political, economic and logistical barriers which are mentioned as follows.

2.6.2. Benefits and Downsides of Infill Development

Infill development as a strategy to overcome the urban environmental issues and address the problems urban sprawl are known or believed to deliver a list of tangible outcomes and benefits (Aly and Attwa, 2013):

- Enriching the compactness of urban form through promoting high density with mixed land uses, thereby enhancing the character of place and respecting historic preservation.
- Causing public transportation being used more efficiently and encouraging walkability and sustainable mode of transportation, utilizing existing amenities and mitigating the need for costly new infrastructure in nearby areas, thereby enhancing social interactions as well as feeling of safety and the sense of belongingness.
- Maintaining spatial continuity to streetscape enhancing viability and function of existing communities.
- Presenting compatible uses complementing existing community attributes and needs through increasing housing diversity and improving the quality of building stock and renovation and restoration of inner city areas.

- Promoting the economic health through utilizing public facilities and merging new life into communities.
- Aiming to retrieve marginal and abandoned areas so as to conserve environmental resources, economic investment and social fabric.

Infill development is considered a key strategy that helps develop a compact city, which has been accepted as the most sustainable pattern of urban development. However, the theoretical part of the compact city concept has not been confirmed widely by empirical research, which thus has made compactness one of the most controversial concepts in academic debate. Infill development and thereby compact city are believed to reduce private car and mitigate the level of GHG and other emissions released into the atmosphere. The counter-arguments are that compactness increases traffic congestion causing greater local air and noise pollution and ruins urban green space. Infill development is also believed to enhance economic diversity and attractiveness of each community, thereby supporting local economy. However, it is argued that infill projects increase land prices and makes housing much more expensive (Ally & Attwa, 2013).

Social equity is one of the four tenets of sustainable development (Elkin et al, 1991). It refers to policies providing equalizing for different classes in society (Laws, 1994). Social equity is essential to achieve sustainability in urban communities because deprivation is the major cause of environmental degradation and resource exhaustion (Holmberg et al, 1991). Proponents of infill development argue that infill projects enrich social and cultural diversity and activity by generating more livable, safer and socially equitable environments. The counter-arguments in this respect are that infill housing and higher densities cause more crime and deprive disadvantaged from their rights and make them suffer from land prices, noise and pollution. Due to overcrowding and lack of privacy compactness is argued to be socially unfavorable and unacceptable (Burton, Williams & Jenks, 2010). Furthermore, they argue that urban consolidation would end egalitarian nature of cities in which distribution of land is nearly equal for affluent and poor people. If higher density policies are implemented

and imposed on cities via infill projects, middle class and rich would benefit, thereby holding their house and other properties depriving poorest class from their private space (Stretton, 1994)

As mentioned above, there are various claims and counter-claims with respect to infill development and compactness in urban form as well as difficulties related to implementation of the compact development owing to prospect lifestyles and the unconformity between strategic benefits and disadvantages at the local level (Kenworthy, 1992). The problems related to infill and compact development are summarized as follows (Burton, Williams & Jenks, 2010):

- Lack of any proof in terms of whether compactness and infill are sustainable or not,
- Social acceptability and feasibility of compactness are not clear,
- Lack of any tool to implement infill development and compactness successfully.

2.6.3. Market Factors for Infill Development

Growth in centrality located office employment generates market for infill housing. Proximity to employment centers and transit hubs and vital institutions like hospitals or universities, have always captured an infill market (Suchman and Sowell, 1997). Lifestyle is the most important factor that developers consider more than proximity to jobs. As such, they are selling location, proximity to culture, walking neighborhoods and nightlife; infill housing is building on existing assets of immediate neighborhoods and community (Danielson et al., Lang and Fulton, 1999; Heron, 1998). Downs (1997) notes that good economy situation in inner city areas accelerates back-to-the-city phenomenon. However, he also mentions that weak down-towns will not attract strong infill development patterns.

Surprisingly, deteriorated infrastructure, patterns of disinvestment and abandonment and a lack of supporting facilities are the most important deterrents that hinder the development process in many inner-city areas. Furthermore, many developers prefer

suburban greenfield sites due to economic situation, household income level, community participation and housing requirements (Suchman and Sowell, 1997). While urban and inner-suburban development is emerging as a desirable market for growing demographic groups, even larger portion of the population still choose to live in the suburbs or on the suburban fringe.

2.6.4. Design Principles of Successful Infill Projects

Infill projects should enrich the design and functioning of the existing communities. Although infill development includes various forms and interpretation, there are common principles that appearance and functions of infill projects should take into account.

2.6.4.1. Social Aspects

Diversity is an important aspect on infill development. As infill projects aim to incorporate people from different social, economic and cultural backgrounds, a range of housing types at different price levels should be provided in infill projects. Such diversity in housing provision helps strengthening the personal and societal connections and interactions which is substantial for a livable community (McGraw, 2000).

Sense of place, which should be reflected in infill development, is the degree to which settlement can be achieved and mentally differentiated and structured in time and space by residents, the degree of which their mental structure connects with their values and concepts (Lynch, 1981).

Public participation is another crucial factor for successful infill development. As infill projects take place in existing built up areas or neighborhoods, participation of the local community to the project may have a dominant effect in successful implementation of the project. Participation is especially important for the infill planning process, before specific projects are proposed. Cooperative work with the

community to gain their trust is highly crucial (Aly and Attwa, 2013). Along with this, **political support and commitment** not only from public sector but also from local communities also increase the chance of success in infill development (Faris, J. Terrence, 2001).

2.6.4.2. Design Aspects

How well new development fits unto existing fabric is an important consideration for infill projects. **Compatibility** is the keyword to address this concern. Pattern, alignment, size and shape are the most crucial criteria related to compatibility measuring. These criteria indicate the relationship between new pattern and old tissue without considering any architectural style (Aly and Attwa, 2013). Density increases in an inevitable outcome of infill development. Although infill could be developed at low density patterns; nonetheless, owing to the high costs of infill land, infill development generally happens at higher densities promoting smart growth (Ewing and Reid, 1996). **Identity**, which means contribution to a desired character, is more important than compatibility, in which change is expected while continuation of existing community character is a priority in established neighborhood (Aly and Attwa, 2013).

Zoning regulations should support infill projects and include a clear articulation of intent that reinforces the provisions in the comprehensive plan of the project. There are many zoning options available including changing an existing zone, or creating a new zone, an overlay zone or a floating zone. The use of administrative waivers provides a more “user-friendly” regulatory environment that increases speed and certainty. **Urban design codes** by serving substantial guides for changes improve economic health and tuneful evolution of any neighborhoods (McGraw, 2000). Unlike sprawl, smart growth and infill development have special emphasis on **public realm** so as to maximize the provision and use of public spaces (Ewing and Reid, 1996). The design of infill projects should ensure **a secure environment**, considering entrance to

the public realm provide better opportunity for community interaction (McGraw, 2000).

2.6.4.3. Use and Activity Aspects

Mixed use is one of the main features of a successful infill project. Promoting the creation of mixed use development that meet the daily life needs of citizens in walking distances decreases travel distances (McGraw, 2000). **Land property value** increases after infill projects as infill development strengthens local economy. Therefore, infill development should include a range of activities that attract investors and residents (Aly and Attwa, 2013). **Adaptability should be taken into consideration in order** to create developments with more clear functions and developments that can offer flexibility in design and use (Aly and Attwa, 2013).

2.6.4.4. Access and Linkage Aspects

Parking regulations have to be adjusted to accommodate infill development, because parking requirements can hinder infill projects. **Integration** of the new infill project into the existing pattern and infrastructure through planning and urban design should be promoted. This could be supported by community engagement and provision of public amenities (Aly and Attwa, 2013). **Walkability** in and to infill project sites is a merit that should be looked for. High density communities encourage walkability and using of public transportation, thereby alleviating carbon emissions (Aly and Attwa, 2013). Last but not the least, infill projects have to be well connected to surrounding roads and sidewalks, providing the area with enhanced **connectivity** (Ewing and Reid, 1996).

2.6.5. Barriers to Successful Infill Development

Barriers that hinder the process of urban infill development are listed as follows: land assembly and infrastructure cost, municipal social goal and regulatory policies, difficulty of finding developers, complexities of public-private partnership, excessive

risks, resistance from local residents and stakeholder conflicts and political constraints. This does not mean that suburban development is usually free of problems. Suburban developers have to deal with various issues including farmers and land speculators, planning commissions and council for a rezoning and coping with residents' concerns about traffic congestion and adjusting of new development with existing pattern.

Urban infill development in built up areas is so complicated. Apart from related barriers in terms of redevelopment of inner city areas and inner-suburban areas and different problems including crime, poor schools, racial tensions, high tax rates and cheaper outlying- suburban alternatives, we come across other issues and other barriers discussed in previous research (Calthrope, 1993; Hudnut, 1998; Loessberg, 1995; Suchman, 1997).

2.6.5.1. Land Assembly Cost Barriers

Land assembly at an affordable cost is a substantial barrier in inner city areas. Suchman and Sowell (1997) suggest that being underutilized land in inner city areas is a big advantage. Developers generally pay from 0.25\$ to 4\$ per square foot for open land in marginal areas. Site assembly includes acquisition, relocation, demolition, clearance and site preparation in a built-up areas costing nearly 15\$ per square foot in peripheral areas. Some residential and commercial relocation are necessary for such an assembly. (Farris, 2001).

To avoid assembly problems, city authorities and developers prefer brownfield sites including abandoned housing developments, factories, warehouses, schools, dump sites, railroad lines, canals, parking lots, military bases/defense plants or waterfronts in either private or public ownership which are valuable inner-city land and redevelopment are not applicable without public assistance (Suchman and Sowell, 1997). Determining whether contaminations exist in built up inner city areas is much more expensive than periphery. Moreover, hazards will be done as long as demolitions are done, thereby making projects less applicable (Simons and Sharkey, 1997). The

value of the site for reusing developments is less than the cost of demolished land assembly. So, to rehabilitate and preserve land and assemble deteriorated tissue in which the market doesn't support all costs land write-down is vital (J. Terrence Farris, 2001).

2.6.5.2. Land Assembly and Site Preparation Barriers

Coping with negative spillover effect and assembling a large area to invest is a substantial deterrent, thereby development generally is inhibited by which in surrounding neighborhoods (Downs, 1997). An infill project should create its own environment (Suchman and Sowel, 1997).

Based on prisoner's dilemma theory two nearby property owners are confined in their investments by other developers (Hartshorn, 1992). On successful and redeveloped infill project will be affected adversely by nearby obsolete property. So both property owners are in dilemma: if both improve their property they will benefit from each other's investment. The dilemma will be more complicated for all property owners in the same neighborhood. Unanimous decision-making is necessary to enhance neighborhood's values. Negative externalities of infill housing will be eliminated through various policies like as urban renewal, rehabilitation and community development programs (J. Terrence Farris, 2001).

Existing infrastructure is underutilized and need to be renovated. Reusing of infrastructure in redevelopment process is impossible and upgrading of existing infrastructure is mandatory (Colean, 1953). Many infill advocates insisting on reusing existing infrastructure; however, many practitioners declare that infrastructure can be obsolete. High density infill housing on built-up area mandates further amenities to be built including alley upgrades, underground cable or drainage to follow market demand for off-street parking and garbage removal (Simons and Sharkey, 1997).

Projects including reuse of urban fabric constitute new problems regarding demolition, salvage, removal and the assemblage of sewer and water system. Developers must care about removing necessary issues, not removing old

infrastructure or other obstacles (Suchman and Sowell, 1997). Holdouts generally give resistance to infill development projects. If a public purpose (typically blight elimination) exists, eminent domain will deal with this problem. Approval of city plans, blight designation and condemnation process are time wasting issues. Many central city inner-ring suburban communities have organized these processes; however, they cause a substantial transaction cost that many developers don't know (Aly and Attwa, 2013).

2.6.5.3. Development Barriers

Urban infill housing projects generally attract unique developers. Big metropolitan cities have a potential to attract big developers; however, cities with small market are not able to attract local developers permanently except some profitable projects (Suchman and Sowell, 1997). But infill necessitates local developers to specialize infill housing. Majority of smaller local developers do not have enough capital and participate in development process just to have some contributions for their hometowns. So many designers get frustrated in this process due to lack of quality. Some of whom prefer preserving built environment and put the historic values as the center hub of community. Many are intrigued by evolving new urbanist principles of infill (Aly and Attwa, 2013).

Developers generally have a few roles in infill housing projects and redevelopments of inner city areas. Power brokers including city mayors, politicians, administrative officials, the financial and corporate community, the media and so on directly deal with infill projects (Farris, 2001). Sometimes, nonprofit housing corporations perform development generally undercapitalized and affordable housing oriented market (Miles, 2000). Many developers to get involved in the local community need to have access to capital and be able to tackle the barriers and a large tendency to construct efficiently, compared with the standard suburban, large scale developers (Danielsen et al., Lang and fulton, 1999).

2.6.5.4. Political Barriers

Zoning and subdivision regulations regulate new development. Unlike infill housing done in a cooperative work, all developments built are simultaneously part of a new life with positive externalities benefiting every one's investment. Simultaneous investment contributes to cause deterrent for infill housing projects. Compared with suburban development, higher risk in an area needing revitalization is presented by property owners who make decisions (Aly & Attwa, 2013). High quality local staff with understanding of development economics and city administration with supporting plans are inevitable factors to incorporate public-private financing. Legislative communities need to support public-private partnership and infill housing projects in a long term (J. Terrence Farris, 2001).

Regardless of the citywide implications, cities have council members approving or rejecting development projects. This power sometimes is abducted, thereby having a substantial effect on a developer's demands. This power has the potential to be exploited by public officials (J. Terrence Farris, 2001). Besides, many residents do not approve to have higher density housing nearby, even if it is more highly valued and generally are opposed to construction of mixed uses and commercial/industrial uses nearby (Danielsen, Lang and Fulton, 1999). Owing to residents' disapproval over new infill development increasing the density of their neighborhood more than it is, infill housing in the existing communities are too difficult to achieve (Langdon, 1998).

Due to political and philosophical complications of resettlement, land assembly is a difficult task. Politicians refuse tackling relocation. Even if relocation were beneficial in terms of financial and physical issues, social equity and segregation would be inevitable (Rohe and Mouw, 1991). Moreover, questions like as "where to relocate" and "whether the area should be redeveloped" cause a big deterrent. Without relocation and eminent domain infill housing is impossible. Gentrification contributes to dilemma for landlords, policy makers and neighborhood leaders. Despite deterioration of existing tenant's situation due to rising rents, rising values in property

are evident as consequences of gentrification reversing urban decay (Gunnels, 2000; Hunsberger, 1998; Wyly and Hammel, 1999). Lang, Hughes and Danielsen (2000) believe:

“The risk of attracting the middle class to the city through infill development is outweighed by the even greater risk of losing a chance to secure a larger tax base.”

2.6.6. General Guideline to Evaluate Infill Development Projects

Based on what we discussed comprehensively about infill development and its types, merits, benefits, shortcomings and its relationship with sustainable development to promote compactness in urban fabric the outcome of these discussions is submitted as a guideline offering related criteria to evaluate infill development projects in communities by considering four important categories including **mobility, use and activities, diversity and energy efficiency**:

Table 2.1. *General guideline to evaluate infill development projects*

CATEGORIES OF EVALUATION	CRITERIA FOR EVALUATION AND THEIR IMPORTANCE
MOBILITY	Accessibility: good access to urban facilities within project area
	Walkability: pedestrian access in and around the project area to meet daily needs
	Parking: reduced parking to promote public transit use
	Public transportation: to mitigate air pollution
	Connectivity: to reduce travelled distances
	Network of streets: to design interconnected street system
	Car dependency: to alleviate environmental pollution
	Integration: to promote social equity
Renewal of infrastructure: to promote smarter infrastructure	
USE AND ACTIVITIES	Mixed use: to reduce commuting distances
	Landscape connectivity: to create a linked system of natural areas and parks.
	Public amenities: to create local services and amenities within a five-minute walk (400 meters)
	Vitality: to create vibrant public spaces
	Well-integrated function: convenient access to public amenities

	Comprehensive plan: to promote social and physical integrity
DIVERSITY	Social inclusion: to incorporate different ethnicities
	Housing types: to create various housing types
	Architectural styles: promoting heterogeneous architectural styles
	Affordable housing: promoting economical housing for each category
	Interconnected urban landscape: to create connected landscape
	Density: to promote compactness
	Sense of place: to recapture the value of land
ENERGY EFFICIENCY	Improvement of energy efficiency: to reduce using of fossil fuels
	Reduce waste management: eliminating environmental pollution
	Recycling: self sufficiency
	Waste collection program

2.7. Successful Infill Projects

2.7.1. Hammarby Sjostad, Stockholm

The city of Stockholm has implemented a comprehensive masterplan in order to mitigate greenhouse gas emissions and alleviate climate change through adopting

sustainable urban policies approaches regarding ecological benefits, efficient resource use, mixing of activities and social equity. The current urban redevelopment project in the city's southern district, Hammarby Sjostad, is a successful model as an adaptive reuse in Brownfield site which helps us understand integrated approaches to address uncontrolled urban sprawl issues. According to initial assessments, the area has alleviated the use of non- renewable energy from 28 to 42 percent and 29 to 37, thereby reducing the rate of global warming from 29 to 37 percent (Suzuki et al., 2008).

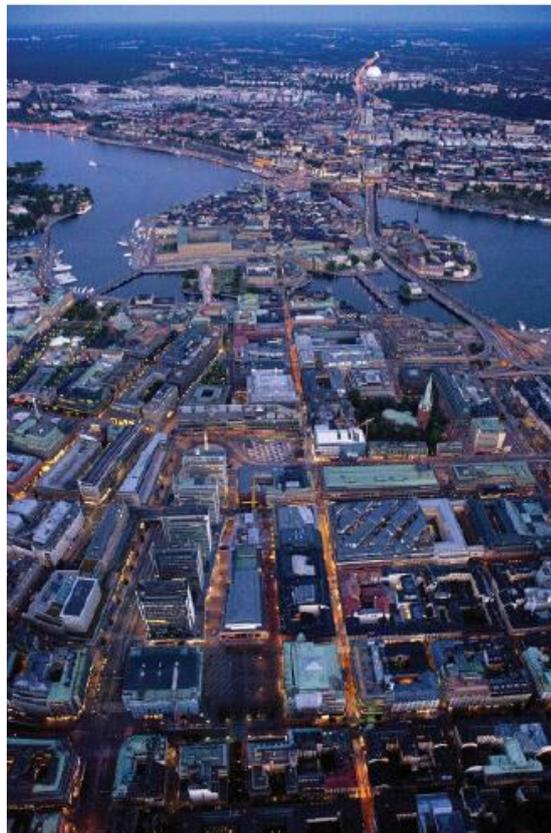


Figure 2.1. Stockholm cityscape (Source: Photo by Lennart Johansson, Stockholm city planning administration)

2.7.1.1. Stockholm's Approaches to Sustainable Development

By 2030, as a result of burgeoning urban population city will come across different challenges regarding globalization, trade shifts, migration, growing numbers in elderly

and related environmental issues (city of Stockholm, 2007). Consequently, the city of Stockholm adopted six main principles to deal with related consequences listed as follows:

- Sustainable mode of transport
- Less dangerous material for buildings
- Efficient use of energy and resources
- Sustainable land use planning
- Less environmental impacts through waste management
- Healthy indoor environments

Besides above principles, Stockholm has implemented main policies to deal with climate change through inviting individuals and experts, adoption of biofuels, the management of cooling and heating system, and encouraging less car dependency (City of Stockholm, 2003).

2.7.1.2. Approaches to Sustainable Urban Development

Due to traditionally dominant land use planning, Stockholm can easily implement integrated land use and transportation. In 1940, Stockholm devoted 70 percent of land for future development, thereby preventing land speculation and enhancing city's redevelopment strategies (Cervero, 1998).

With a special emphasis on adaptive reuse and redevelopment of Brownfield areas in inner city areas, abandoned industrial harbor next to the inner city of Stockholm are being redeveloped and integrated to the city through a new rapid tram system and also have a direct access to other public transportation modes. In addition, other areas which are in the planning stage are being devoted for mixed use development with socially and architecturally diverse ambience (Suzuki et al, 2008).

Hammarby is one of the current redevelopment projects representing integrated urban master planning, innovative technology, environmental awareness and social integration which follows main objectives of sustainable urban design including

reusing of Brownfield, encouraging transportation hub next to development areas, recapture the value of community and sense of belonging, integrating of industrial archeology into existing urban fabric, establishing focal points and economically self-sufficient community to meet local demands (Suzuki et al., 2008).

2.7.1.3. Hammarby Sjöstad

The aim of the project is to transform abandoned industrial area into a livable and mixed-use development through extending the inner city into the waterfront, thereby revitalizing ecosystem and preserving existing ecosystem. Moreover, about 11,000 new residential units and 200,000 square kilometers of new offices and amenities will be created (Fryxell, 2008).



Figure 2.2. Residential area and cityscape of Hammarby (Source: Photo by Lennart Johansson, Stockholm City Planning Administration)

The urban vision and concept for this development belongs to the early 1990s. The extension of the inner city of Stockholm towards the waterfront has necessitated planned infrastructure and building designs which contributes to a new layer to Stockholm's development regarding modern, semi open zones including a mix of traditional inner-city perimeter blocks and open and contemporary urban zones. This project offers a good connectivity in street layout, block lengths, building heights and densities with considering openness, sunlight, parks and water views; moreover, the area is well connected to the public tramline which thereby makes Two-thirds of all

resident trips through public transportation, bicycles and walking while only one-third of trips are made by car (CABE, 2009).

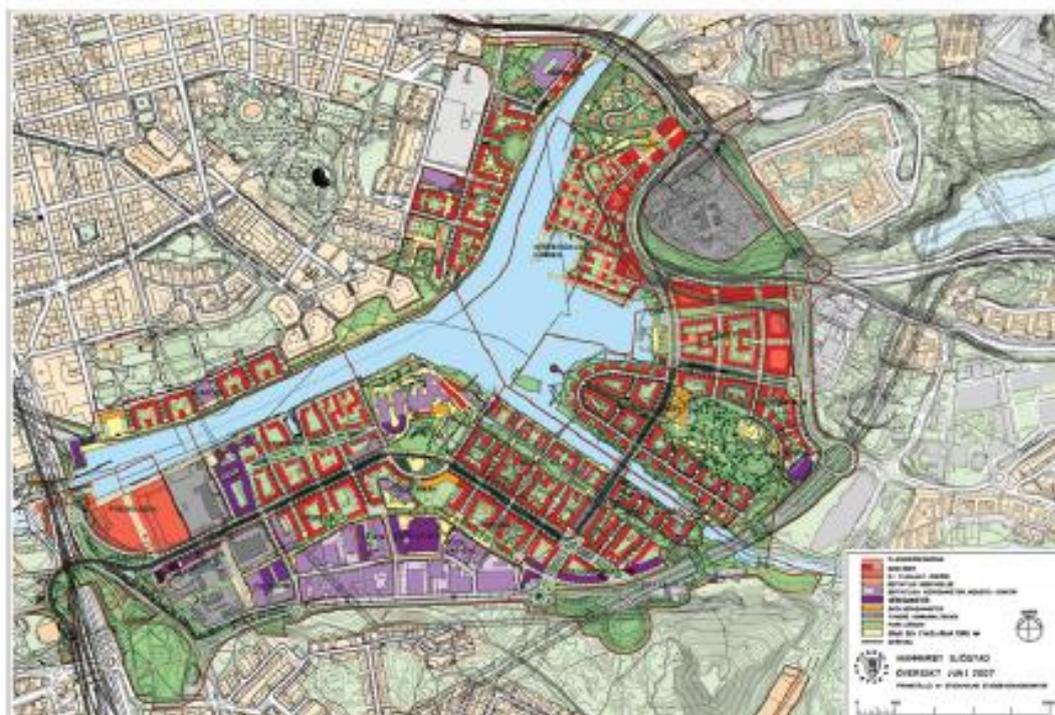


Figure 2.3. Master plan of Hammarby Sjöstad, Stockholm (Source: Stockholm City Planning Administration)

Significant use of public transportation and mixing of activities have respectively contributed to the mitigating of car dependency and environmental pollution and promoting the use of ground floors along main streets which encourages people to walk and cycle to visit streets.

The city has assigned special subsidies to attract shops and services; furthermore, areas of economic activities were established in the development's early phase. Urban and architectural designs were implemented along waterfront, all of which were created by different designers so as to enhance diversity and create livable and high quality built environment (Suzuki et al., 2008).

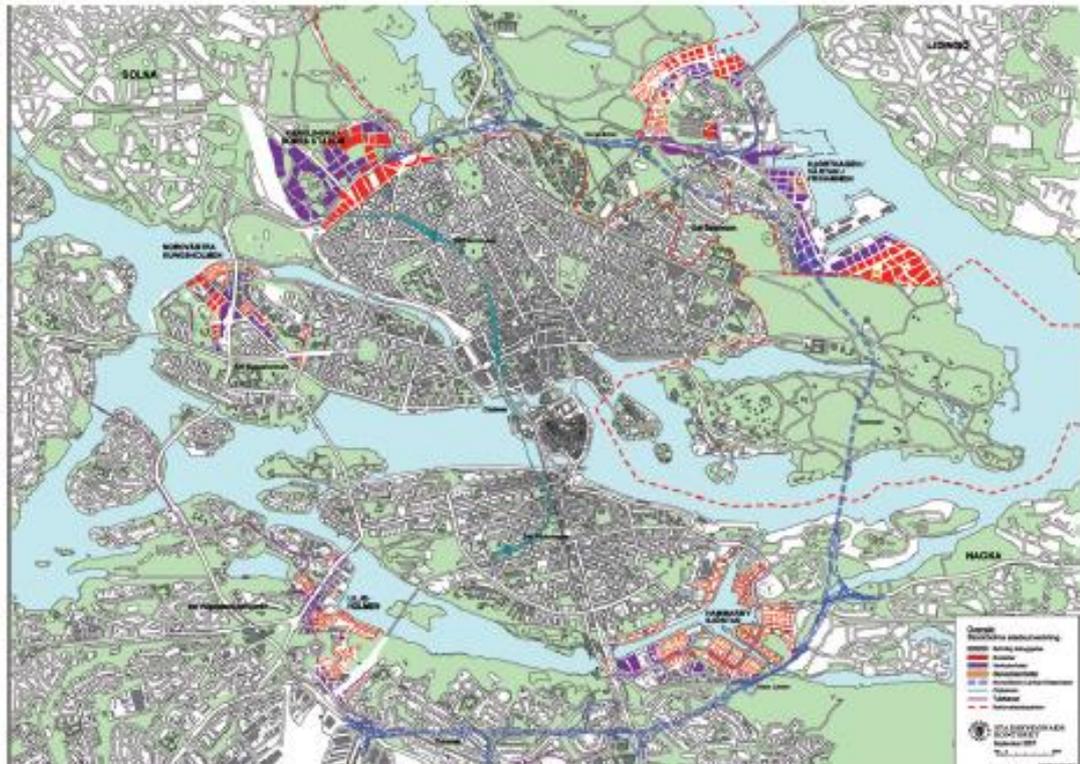


Figure 2.4. The inner city of Stockholm and adjacent development areas (Source: Stockholm city planning administration)

Regarding environmental aspects Hammarby is aimed to be twice as more sustainable than Swedish best practice in 1995, which the average annual rate of energy use in redeveloped areas is 200 kilowatt-hours per square meter. Swedish development practices produce an efficiency of 120 kilowatt-hours per square meter which related energy use for Hammarby is about 100 kilowatt-hours per square meter. In addition to energy efficiency, this project sets other objectives as follows (Suzuki et al, 2008):

- Water conservation
- Reuse and reduction of waste
- Emissions reduction
- Reduction of dangerous materials in construction
- Promoting renewable energy sources

- Encouraging of integrated public transport

2.7.1.4. The Hammarby Model

In order to optimize the use of resource and reducing waste, this projects aims to create an urban metabolism to consume inflowing resources and use outflowing wastes in cyclical systems with special emphasis on sewage processing and energy provision as follows (Suzuki et al., 2008):

- Building materials: To prevent leakage of hazardous materials into the environment only eco-friendly materials are used.
- Water and sewerage: Hammarby has its own wastewater treatment plant in four new and different processes which are currently being used.
- Biogas: The wastewater from one household are used for cooking and mostly exhausted in eco-friendly cars and buses.
- Green spaces: Roofs covered in sedum which absorbs rainwater, thereby preventing added pressure on the wastewater treatment plant and help collect rainwater.
- Waste: All disposal materials such as food waste, newspapers are separated and deposited in buildings. Related refuse chutes are linked to underground vacuum-powered pipes leading to a central collection station and a controlling system sends the waste system to large containers. Containers are collected by vehicles and there is no for need collection workers to lift heavy materials.
- District heating and cooling: Waste water and local waste are used for heating, cooling and power.
- Electricity: Solar energy is the source of electrical energy.

2.7.1.5. Vision

The three main visions for the area are as follows: (Suzuki et al., 2008):

- Efficient use of resources
- Alleviating of gas emission to deal with climate change

- Adjusting the area to the effects of climate change

In other words, this project emphasizes on energy efficiency, less car dependency, climate change adaptation and resiliency, and the maintenance of high quality lifestyles as well as implementation of integrated process and cooperation among private, public and academic stakeholders.

2.7.1.6. Design Evaluation According to Principles on Successful Infill Development

Table 2.2. Hammarby's design evaluation

Criteria	Evaluation of Hammarby
Accessibility, connectivity, network of streets, integration, walkability, public transport, car dependency	<ul style="list-style-type: none"> • Extension of the inner city of Stockholm towards the waterfront has necessitated planned infrastructure and building designs. • Well- organized regarding the inner city network of streets, block lengths, building height and densities; thereby offering openness, sunlight, parks and water views. • Well- connected to the public tramline. • Two-third of all resident trips is made through PT, bicycle and walking while only one-third by car.
Mixed use, landscape variety, vitality, well-integrated	<ul style="list-style-type: none"> • Transforming of abandoned industrial areas into mixed use.

function and comprehensive plan	<ul style="list-style-type: none"> • Ground floors of buildings along main streets are used for commercial use to encourage people to walk and cycle to visit streets.
Social inclusion, housing types, architectural types, affordable housing, urban landscape, density, sense of place and diversity	<ul style="list-style-type: none"> • Urban and architectural designs were implemented along the waterfront by different designers to enhance diversity and create a livable and high quality built environment.
Energy efficiency, reduce waste management and recycling	<ul style="list-style-type: none"> • Attempting to make an urban metabolism to consume inflowing resources and using outflowing wastes in cyclical systems to optimize the use of resources and minimize waste.

2.7.2. False Creek North

Location: downtown Vancouver, Canada

Date: 1987-2020

Size: 83 hectares (204 acres)

Activity: 69% residential, 16% office, 4% retail, 7% mixed use, 4% others

Vancouver aiming to become the world's greenest city by 2020 and the example of False Creek North is one of projects which prove density has a major role to achieve that goal.



Figure 2.5. Vauban cityscape (Source: Eric Firely & Katharina Gron, the urban master planning handbook)

The development of the 166 acres of the Concord Pacific Place site is a breakthrough in redevelopment history of the False Creek. It was used as a port to fulfill industrial activities due to its proximity to protected water, since it has been founded in 1886. Successively, during 1960 crucial decisions were made to redevelop the entire zone, thereby pushing Vancouver's development plan back which was based on resource-exporting economy to corporate center. An official development plan was approved in 1974 and the construction of a housing area started a couple of years later, which was inspired by Christopher Alexander's 'pattern language'. Granville Island was part of this plan and developed into a mixed-use and a national park (Firley & Gron, 2013).



LEFT: Map of the Expo '86 site, held on land that had been acquired by the Province of British Columbia.

BELOW: Masterplan for False Creek North, as illustrated in the city's ODP (Official Development Plan). Most of the area consists of Concord Pacific Place, the northeastern edge being developed separately.

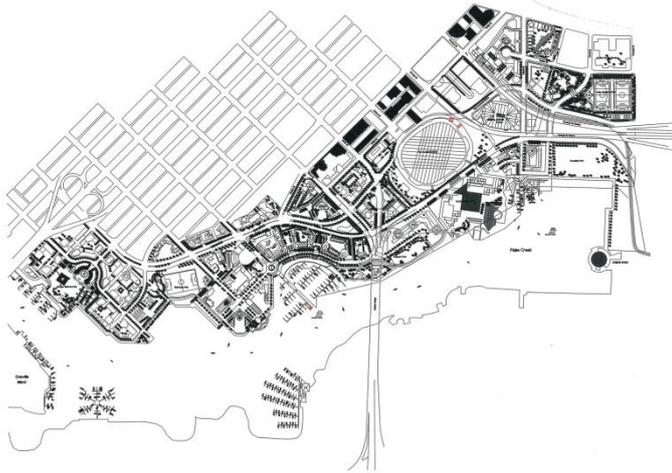


Figure 2.6. Masterplan for False Creek North (Source: Eric Firely & Katharina Gron, the urban master planning handbook)

In the northern part, a radical high-rise redevelopment surprised the city in aspiration of pure CIAM in 1969. Intensifying and accelerating the process of development for a zone that would have a crucial impact on the future of downtown, City authorities assigned 94 acres of False Creek holdings for residential development. However, due to being unprofitable, the project was never implemented. In the beginning of mid-1970, using the area for a major exhibition was a dominant desire and finally in the 1986 the opportunity for using the land to meet such a need was met with the 1986 World's Fair Expo (Expo 86) which was eventually implemented on the site (Firley & Gron, 2013).



Figure 2.7. View from the waterfront promenade of the towers along Marinaside Crescent and Quayside Neighbourhood (source: Eric Firely & Katharina Gron, the urban master planning handbook)

British Columbia Ltd, a dedicated development company, was founded in 1980 by the province so as to elaborate design alternatives for the exhibition and render a plan for a new multi-functional stadium (BC place), the most advantageous development of the whole site. For some economic and political interests, city's vision has changed place plans resulting in a one-sided implementing of 13 planning principles to redevelop False Creek North. The local planning community was used to high-rise component even in the early stages because it was tested in the Downtown Peninsula's West End. As a result, the area of Granville slopes has been re-zoned based on certain urban design principles as follows (Firley & Gron, 2013):

- The protection of corridors' view
- The strengthening solar use by reduction of shadows
- The proving integrity between high-rise and historic layout
- The definition of maximum building heights
- The definition of collaborative planning culture

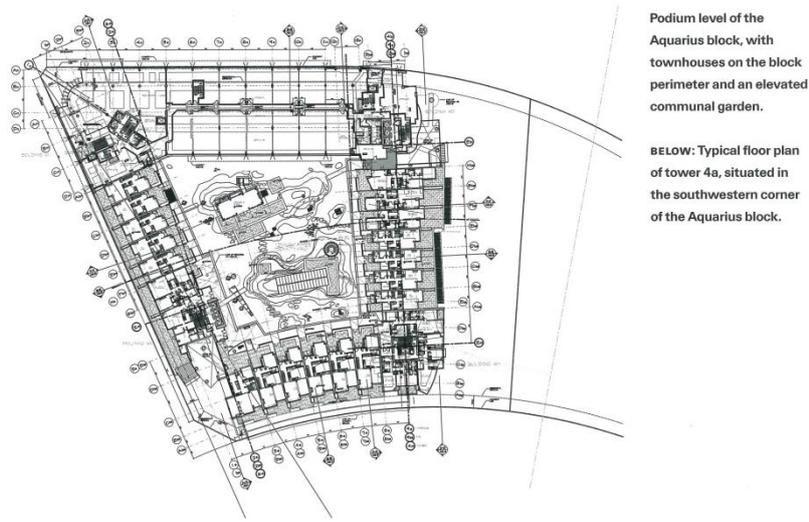


Figure 2.8. Podium level of the Aquarius block, with townhouse on the block perimeter and an elevated communal garden (Source: Eric Firely & Katharina Gron, the urban master planning handbook)

2.7.2.1. Project Organization

After the conclusion of Expo 86, BC decided to sell the site and asked to three developers to submit their proposals in the summer of 1987. Having resigned from BC Place, Stanley Kwok was hired to prepare the concept design as a mandatory part of the proposal. Kwok decided to envision the creation of artificial residential islands in front of the northern shore and Pacific Boulevard implementing through Lagoons Scheme, which was not appreciated by city due to its exclusiveness contradicting urban principles it defined. The aim of the plan was to extend inner city towards the waterfront area in order to offer mix of uses, thereby providing accessible and

pedestrian friendly public area. Over the next years, interdisciplinary collaboration adopted an ODP (Official Development Plan) to implement all of mentioned demands (Firley & Gron, 2013).



Figure 2.9. Process diagrams (Source: Eric Firely & Katharina Gron, the urban master planning handbook)

2.7.2.2. Urban Form (Connectivity)

The most crucial public achievements of adaptive reuse of former Brownfield and inaccessible area is to extend the city's pattern towards the waterfront through a rapid transit system connecting the site to the inner city area and the eastern part of Vancouver. Furthermore, The Millennium line and Canada line strengthened these links in 2002 and 2009 through serving the more centrally located Yaletown-Roundhouse resulting in a good connection between Vancouver and the airport (Firley & Gron, 2013).

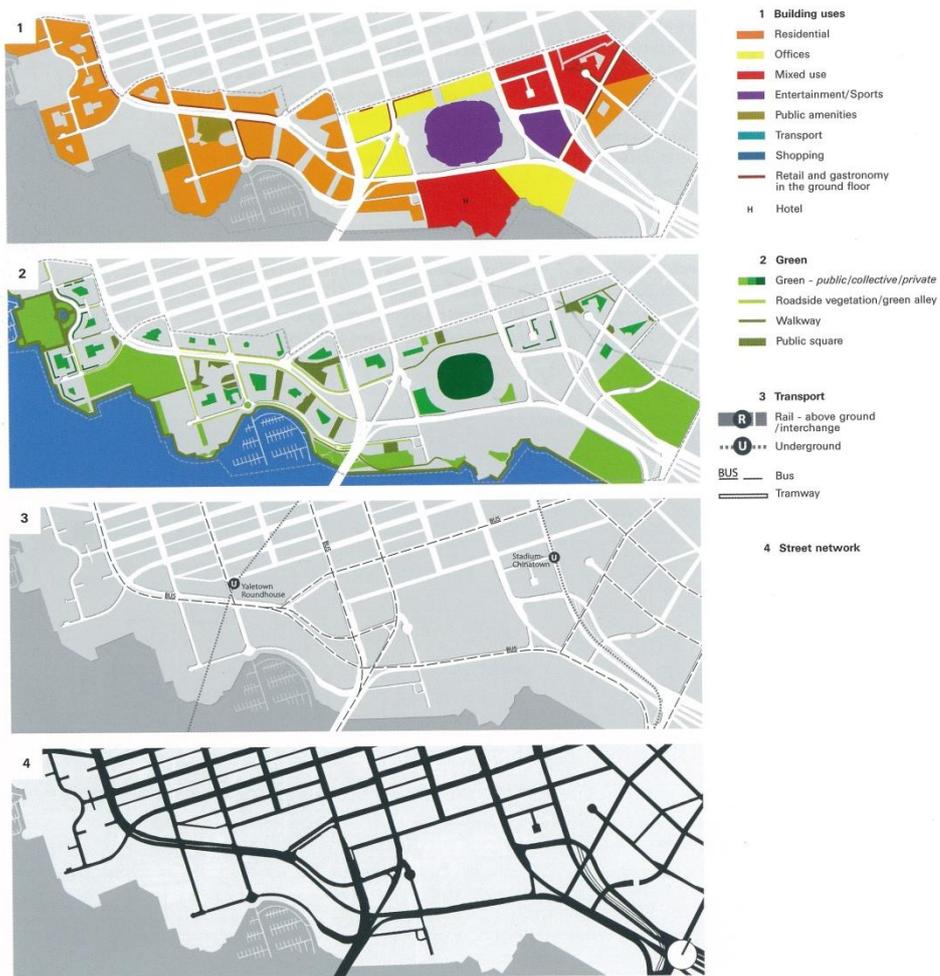


Figure 2.10. Analysis diagrams (Source: Eric Firely & Katharina Gron, the urban master planning handbook)

2.7.2.3. Conclusion

Generally, False Creek North, considered as a successful infill project, provides major public amenities derived from successful financial goals and self-declared urban principles. The development's positive image is based on unique urban qualities that are a consistent urban design vision. This project is appreciated in so many aspects due to its pragmatic effects as follows (Firley & Gron, 2013):

- Redevelopment of inner city area which is supported politically, thereby providing residential densification in lower public cost (affordable housing)
- Offering more diversity through the participation of numerous landlords and piecemeal development
- Public participation which results in a collaborative work between the city and developers

2.7.2.4. Design Evaluation According to Principles on Successful Infill Development

Table 2.3. *Design evaluation of False Creek North*

Criteria	Evaluation of False Creek North
Accessibility, connectivity, network of streets, integration, walkability, public transport, car dependency	<ul style="list-style-type: none"> • Enhancing accessibility and connectivity of site to the city center and the eastern part of Vancouver through rapid transit system • Extension of the inner city towards waterfront • Providing walkability through well-connected street layout • Making an integration land-use pattern
Mixed use, landscape variety, vitality, well-integrated function and comprehensive plan	<ul style="list-style-type: none"> • Adopting re-zoning regulations to change land use pattern from abandoned industrial area to mixed-

	use development to promote environmental health
Social inclusion, housing types, architectural types, affordable housing, urban landscape, density, sense of place and diversity.	<ul style="list-style-type: none"> • Promoting a socially and architecturally diverse environment and physical infrastructure. • Enhancing accessibility. • Promoting affordable housing
Local participation	<ul style="list-style-type: none"> • Encouraging public participation

2.7.3. Vauban

Location: FREIBURG, GERMANY

Date: 1994-2010

Size: 41 HECTARES (101 ACRES)

One of the world's most famous examples which offers socially and architecturally diverse urban environment stemmed from piecemeal approach of planning which is combined with public participation and advanced building technologies.



Figure 2.11. Vauban cityscape (Source: Eric Firely & Katharina Gron, the urban master planning handbook)

Current development area earned their reputation after the Second World War with the transformation of German barracks into French barracks and the city bought the land from the federal state in 1994 due to its development potential and convenient location. As such, Stuttgart office Kohlhoff together with the landscape architect Luz & partner and the traffic engineer won the competition held the same year. The city authority's policy related to development process is piecemeal sale of plots and undertaking of the construction through earning money made from this process (Firley & Gron, 2013).

Selling prices of the lands bought at a low price had been fixed by an expert for future development. The city took the best architectural and social concepts owing to fixed prices. The vast majority of the site was cleared except natural features and former barracks used for construction of student dorms. These plots received little interest

and were transformed into additional residential space due to high prices and less connectivity. Vauban's connectivity to the city center through a purpose-built tram was one of the crucial issues in terms of sustainability fulfilled in 2006 (Firley & Gron, 2013).



Figure 2.12. Aerial view of the site in the early 1990s and the Kohlhoff master plan from 1994 (Source: Eric Firely & Katharina Gron, the urban master planning handbook)

2.7.3.1. Project Organization

In the process of development majority of projects are masterplanned by architects resulting in earning the certain degree of professional maturity. In addition, the clients' aim is to prevent formation of free standing houses and privatization which has a big contribution in social and physical fabric of built environments (Firley & Gron, 2013).

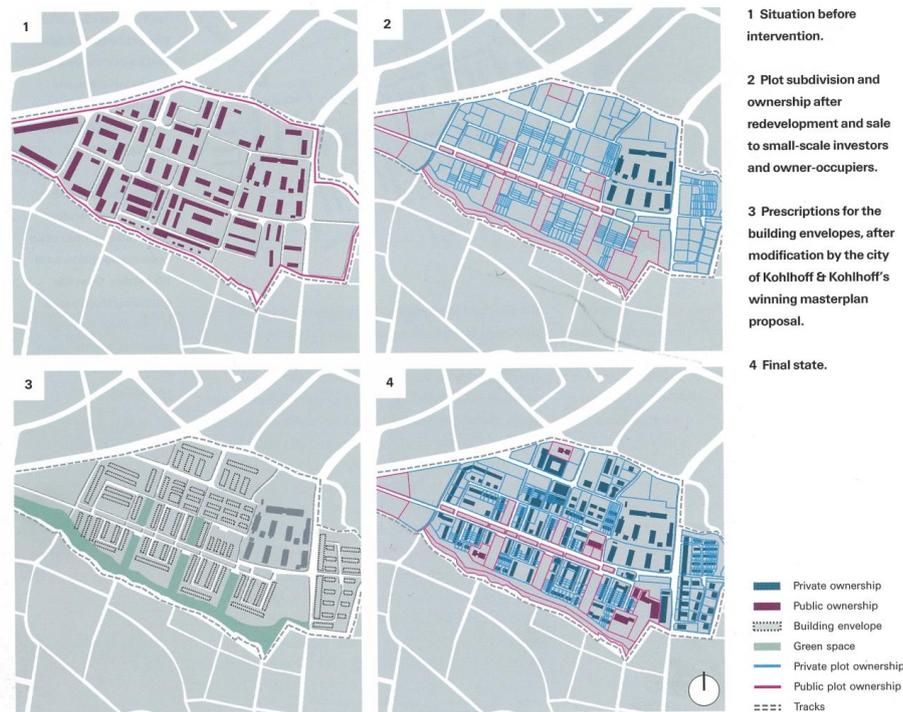


Figure 2.13. Process diagram (Source: Eric Firely & Katharina Gron, the urban master planning handbook)

2.7.3.2. Urban form (Connectivity)

As a result of abandonment of business activities in Vauban's northern sector, a central east-west corridor concentrates on retail which literally represents the district's major backbone accommodating the new tram line and the centrally located Alfred Doblin Platz. A closed longitudinal building protects the eastern site of district and its solar village from the noise of Merzhauser Strasse. A stream forms the southern boundary of the site. Three green corridors leading perpendicularly from the stream's protected biotope northwards through the settlements creating the backbone of the area's landscape design allowing the southern mountain winds to sweep through the urbanized zone. In addition, it provides urban fabric in terms of ecological benefits and urban aesthetic (Firley & Gron, 2013).



Figure 2.14. Analysis diagram (Source: Eric Firely & Katharina Gron, the urban master planning handbook)

In terms of urban form, the built plan and narrow linear buildings remind the historic notion of 1920s and 1930s German Zeilenbau. The new development depends on east-west-oriented slabs providing exposure to natural light for majority of dwellings. Moreover, the aesthetic quality of landscaping affects considerably area's living quality of life due to neutral urbanism. In terms of mobility and transportation, Vauban pushes private transport into background element by means of (Firley & Gron, 2013):

- Well-connected and easily accessible streets
- Pedestrian-friendly walkways
- Accommodating the large majority of the district's cars through above-ground parking garages

The existence of the area's ecological construction contributes to mitigating car-dependency.



Figure 2.15. A long structure delimits the areas to the east along Merzhauser Strasse as major connection to the city center. It is a hybrid building and accommodates housing above office and retail uses (Source: Eric Firely & Katharina Gron, the urban master planning handbook)

2.7.3.3. Architectural Typologies and Energy Efficiency

The residential part of development offers a large variety of designs and densities, including traditional apartment blocks, one-family terraced houses and small-scale apartment buildings which are accessible by exterior staircases. Based on German legal norms, buildings in Vauban use energy more efficiently and consume less than 65 kilowatt hours per square meter per annum which is provided by efficient insulation and communal heating stations. Moreover, buildings in Vauban follow passive house standards which produce energy and share it directly into the public network and the owners are compensated by an above-market sale price (Firley & Gron, 2013).



Figure 2.16. Two mixed-use buildings in the north of Vauban (Source: Eric Firely & Katharina Gron, the urban master planning handbook)

Based on new building techniques, back to individual heat production through appropriate insulation from central heating system can mitigate the amount of energy; thereby alleviating the necessity to install underground networks. The sustainability is not restricted to energy consumption. One of the most visible of Vauban's features is well-designed trenches creating rain and groundwater cycles. In private lots, cisterns collect rainwater to be used by local residents and green roofs act as a filter to prevent inundations in case of heavy showers (Firley & Gron, 2013).



Figure 2.17. Conversion of former barracks buildings into student dormitories (Source: Eric Firely & Katharina Gron, the urban master planning handbook)

2.7.3.4. Conclusion

Vauban is not dense enough to be considered urban. Nevertheless, the point that relates it to the topic of this study is the way of addressing family living in a green urban environment. Despite its unique model as a densified suburb, it should be considered a smaller central development because of the level of diversity and integrity offered by the project. Moreover, in the process of development, Berlin municipality sold land to private owner-occupiers, thereby facilitating individually designed one-family

houses. Eventually, densification is one of the major controversial issues for our cities futures and whether consolidation is an effective strategy to achieve sustainability or not is a big mystery; however, it cannot be the only strategy to achieve diversity and social inclusion. Vauban is a dense and architecturally diverse suburb and as a struggling urban center tries to attract middle classes (Firley & Gron, 2013).

2.7.3.5. Design Evaluation According to Principles on Successful Infill Development

Table 2.4. Design evaluation of Vauban

Criteria	Evaluation of Vauban
Accessibility, connectivity, network of streets, integration, walkability, public transport, car dependency.	<ul style="list-style-type: none"> • Reconnecting the urban environment to the downtown area by implementation of public transport (tram) • Mitigating car dependency through a well-connected and accessible street layout, and pedestrian friendly walkways
Mixed use, landscape variety, vitality, well-integrated function and comprehensive plan	<ul style="list-style-type: none"> • Reducing car-dependency through landscape variety • Promoting mixing of activities to make inclusive urban environment which is architecturally and socially diverse
Social inclusion, housing types, architectural types, affordable housing, urban landscape, density, sense of place and diversity.	<ul style="list-style-type: none"> • Dense and architecturally diverse suburb which attracting middle class (affordable housing)

	<ul style="list-style-type: none">• Variety of housing types and architectural typologies promote diversity in Vauban
Energy efficiency	<ul style="list-style-type: none">• Using energy more efficiently through appropriate insulation and a communal heating• Implementing so-called passive house standards to create energy and sharing it

CHAPTER 3

CASE STUDY

3.1. City Profile: Ankara

3.1.1. History

Before the First World War, Ankara was a small Ottoman city with a population less than 30,000 people. After the collapse of the Ottoman Empire, Ankara became a destination for Republicans to pursue a war of independence due to its prime central Anatolian location (Fig.1). By 1923, the city, already declared the capital of the Turkish nation-state, had started to accommodate growing numbers of migrants accelerated by an influx of state officials from Istanbul.



Figure 3.1. Map of Turkey with the location of Ankara indicated by a star (Source: Google Earth)

In 1924, the German city planner Carl Christoph Lorcher prepared Ankara's city plan. In the following year, an additional area of four million square meters was assigned

for settlement, so Lorcher started to redevelop his existing plan to include this newly attached area - Yenişehir (literally New City in Turkish) to include governmental buildings and residential areas for state employees (Fig. 2).



Figure 3.2. An excerpt from the Lorcher Plan in 1924. While the town was developed around the old citadel, the train station, pictured center left, was still beyond the city limits (Source: Cengizkan, 2004)

As the population rose to 75,000 people by 1927, a shortage of housing brought an urgent need for a comprehensive city plan. Consequently, in 1927 a famous German architect, Herman Jansen, created a plan which upheld the old Citadel's central role and designated the area of Yenişehir for high-income groups (Fig.3).

Table 3.1. *The population of Ankara between 1927 and 2010*

Year	Population	Year	Population	Year	Population
1927	74,553	1965	905,660	1997	2,917,602
1935	122,720	1970	1,236,152	2000	3,202,362
1940	157,242	1975	1,606,040	2007	3,763,591
1945	226,712	1980	1,800,587	2008	4,194,939
1950	288,536	1985	2,228,398	2009	4,306,105
1955	451,241	1990	2,559,511	2010	4,431,719
1960	650,067				

After 1945, economic and political policies which were compatible with the Western world emerged which helped the Democratic Party to come into power and make the market more integrated with the global economy. As a result, American funds flowed into Turkey. Istanbul, the country's industrial and business center, was promoted regarding urban development and therefore received most public investment rather than Ankara, the country's political and administrative center (Batuman, 2012).

Despite Istanbul receiving the majority of public investments, Ankara transformed significantly during the 1950s and Kizilay, the central hub of Yenisehir, was accepted as the central business district. Turkey's first skyscraper was built in Kizilay along with bank branches, upper class hotels and restaurants, advertising, real estate and other various offices. The placement of these businesses shifted the heart of Ankara from the old city core, Ulus, to Yenisehir (Batuman, 2012).

By the second half of the 1950s, Ankara had become a large city with a population of half a million and in the following decades, the city faced continuous expansion, bypassing 1 million residents by 1970. Due to Ankara's rapid population growth during and after the 1950s, its urban development during this period of time is examined in this study in regards to planning, transportation, local administration and housing.

3.1.2. Planning

In 1965, the recently established Ankara Master Plan Bureau, resolved to find solutions to the spatial organization and urban growth of the city. They identified the open area towards the West as a possible space for urban expansion as it was not yet surrounded by squatter sites (Fig.4).

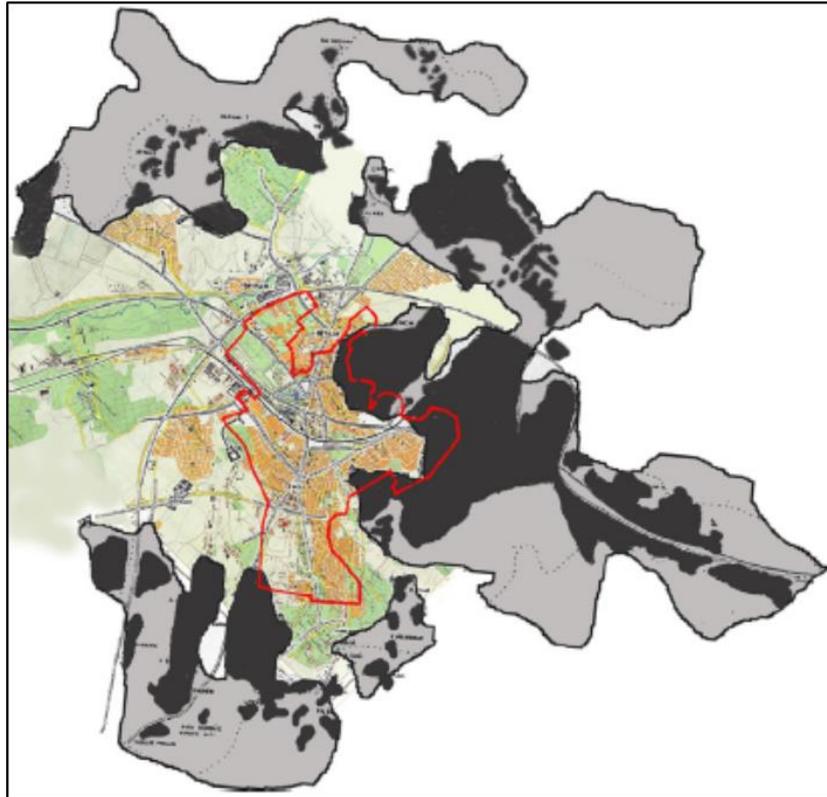


Figure 3.4. The expansion of Ankara and the growth of the squatter areas. The red boundaries show the limits of the Jansen Plan. The squatter areas, of 1965, are indicated by dark shaded areas whereas the light shaded areas show their extent in 1990 (Source: Cengizkan, 2004)

This plan, which played an eminent role in directing the city's development towards peripheral areas during the 1970s, was officially approved in 1982. The most important results of this plan were suburban sprawl and the movement of industry in the western axis towards peripheral areas which continued throughout the 1990s.

During the 1980s, development of residential zones was permitted by the municipality in the periphery, marking the beginning of sprawl growth in Ankara's suburban areas. In 2005, the area controlled by the municipality was officially enlarged (Fig.5).

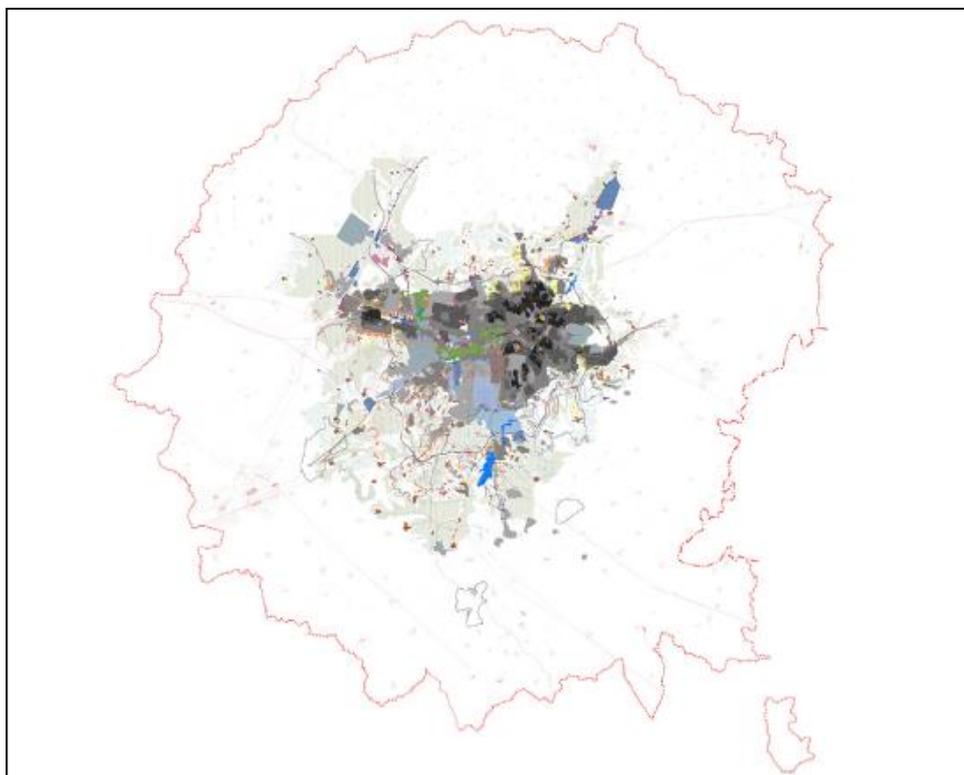


Figure 3.5. The municipal borders of Ankara in 2005 (Source: Ankara Greater Municipality)

While 86% of industrial businesses were within a 10-kilometer radius in 1988, by 2007 only 17% were within a 6-kilometer radius a disparity which induced 58% of the industrial workforce to move from the city center to peripheral residential areas (Bostan, Erdoğanaras & Tamer, 2010).

3.1.3. Transportation

Due to rapidly increasing migration to Ankara during the 1950s and onward, the pre-existing public transport infrastructure grew further inadequate. To meet their transportation needs, newcomers invented their own solution for commuting: a

dolmuş (mini-bus) system. In addition, the first proposal for a subway system was prepared in 1972 (Çubuk & Türkmen, 2003). However, due to economic constraints, construction could not begin until of the 1980s.

Through a lack of efficient public transit and an ever-rising population, traffic congestion became a serious problem in the 1990s. In an attempt to alleviate congestion, 109 vehicular bridges and tunnels along with 93 pedestrian overpasses (17 of which were in the central hub) were built and the main arteries linking the periphery to the inner city area were widened between 1994 and 2009 (Öncü, 2009).

Table 3.2. *Number of cars and total motorized vehicles in Ankara (Source: Ankara Great Municipality)*

YEAR	NUMBER OF CARS	TOTAL NUMBER OF VEHICLES
2004	696,175	936,936
2005	798,690	1,008,546
2006	783,198	1,085,151
2007	820,355	1,143,379
2008	854,691	1,193,038
2009	887,703	1,234,695
2010	924,000	1,285,661
2011(August)	970,287	1,347,151

However, during the early 2000s, the rapid-fire growth of shopping malls constructed in peripheral areas, which reached 28 by the end of 2010, further perpetuated the reliance on private cars for transportation. The number of private cars increased

approximately 40% between 2004 and 2011, reaching 970,287 by August 2011 (Table 3.2).

3.1.4. Housing

The burgeoning urbanization of Ankara resulted in substantial increases of land values in the 1950s, so it became increasingly difficult for middle-income groups to own a house in inner city areas and often forced them to peripheral zones (Öncü, 1988).

Squatting emerged as an informal housing trend for the urban poor to survive. Despite the “Gecekondu Act” of 1966 aimed at preventing new squatting sites from being built, the number of squatters rose from 70,000 in 1960 to 240,000 in 1980. In 1965, 65% of Ankara’s population was accommodated in squatting sites (Akçura, 1971). Eventually, squatting sites were transformed into rent-producing spaces by private developers. These transformations resulted in redevelopment of gecekondu in the form of four and five story apartments and in this way urban space was commoditized (Türel, 1994).

3.2. Development Plan of Ankara: From Compact to Transit Corridor Development and Issues of Sustainability

Since the 1970s, Ankara’s planning committees have aimed to transform the compact and problematic urban form into a controlled decentralization along two main corridors (western and southwestern). Corridor development is one alternative to compact urban development which enables high-capacity and high-quality public transport service along a linear form and multi-centered urban areas or polynucleated urban forms (Jenks, 2000) thereby functioning as a network of self-sufficient settlements (Jenks and Burgess, 2000; William et al., 2000). A mix of land uses bring workplaces, services and residential areas together which can be efficiently accessed by foot or public transport thereby promoting self-sufficiency in urban communities and reducing dependency to the city center amenities.

Residential growth was promoted along the western and southwestern corridors of Ankara, backed by new town centers and workplaces, including industry, government offices and ministries (Jenks, 2000). However, the extent of success in creating a desired urban pattern in terms of social, environmental and economic aspects along two corridors is questionable and will be analyzed in this section regarding sustainability and lack thereof.

Due to the location of most businesses, services and amenities in the inner city area (Kizilay), rapid population growth caused problems in the 1970s ultimately creating urban growth in marginal areas. In order to mitigate the rising issue of air pollution within the city center, corridor development took center-stage. The western corridor was planned for the decentralization of industrial estates, while the southwestern corridor was assigned for decentralization of government offices; furthermore, the southwestern corridor accommodated university campus areas (Babalik, 2013). Figure 3.6, below, shows Ankara's corridor development plan for 1990.

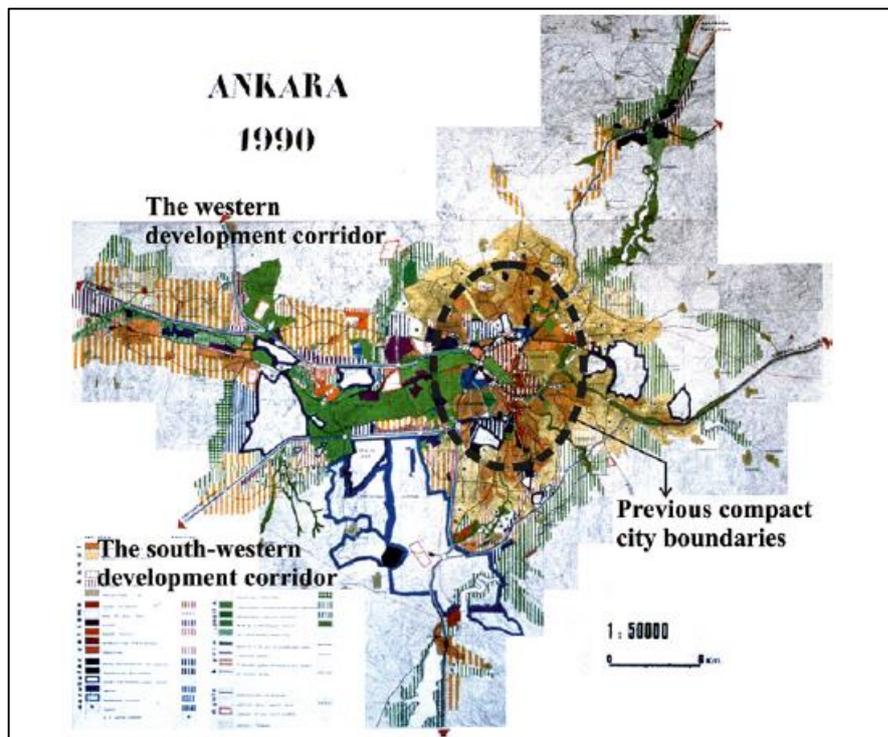


Figure 3.6. Ankara's corridor development plan prepared (Source: Babalik, 2013)

In terms of residential development and transportation patterns, the southwestern corridor saw market-led development; however, the western corridor development was assigned for social housing funded by the government. Metro lines were proposed for both corridors to connect work places, residential and commercial centers with each other and with the city center; however, the western line received priority, opening in late 1997 (Babalik, 2013).

3.2.1. Resulting Urban Pattern and Sustainability

The western and the southwestern corridors of Ankara ultimately became the two main development corridors of the city. The population along the western corridor rose above 1 million in 2000, around 29% of total population of Ankara compared to 140,000 (4%) in the southwestern corridor. This section explores the relative contribution that these two corridors have made to the social, environmental and economic aspects of Ankara's urban form (Babalik, 2013):

- **Density:** Due to the existence of a metro line and mass housing (social housing) projects, the western corridor has experienced a considerably higher density of development, averaging 225 persons per hectare compared with the inner city area of 111 persons per hectare (Ankara Greater Municipality, 2007). The cause of such a density disparity is rooted in the southwestern corridor's market-oriented and car-dependent urban structure, reinforced by the lack of a transit system along that corridor. Figure 7 shows the less-dense pattern evident along the southwestern corridor compared to the strikingly denser residential pattern along the western corridor.



Figure 3.7. Patterns of development in the Southwestern and Western corridors (Source: Babalik, 2013)

- Diversity: Regarding diversity, the western corridor is more successful than the southwestern corridor due to the existence of residential areas and industrial centers. Instead of commercial cores such as new town centers, large-scale shopping centers have opened along this corridor. Consequently, a certain level of mixed-used development has been achieved along this corridor.
- Car dependency and work-home behavior: Half of the population living in the western corridor work along the same development. However, only 6% of southwestern residents work close to home and 73% commute to the city center for work, a direct consequence of the limited level of mixed-use development.
- Socio-economic differences: Social housing and mixed use development strategies in the western corridor resulted in a middle-income character and public transit-dependency while market-lead development in the southwestern

corridor resulted in a higher-income residential profile, encouraging a car-oriented urban pattern and social segregation).

- Design: Currently the metro plays a surprisingly insignificant role regarding transport along the western corridor, accounting for only 10% of commuting along this corridor, as opposed to some 76% made by bus and minibus. In 2008, only 3.8% of all commuting was by the metro, decreasing to 3.3% in 2012 (Özgür, 2010). The cause for such a disparity is due to the inaccessibility of metro stations for those residing in new developments.
- Environmental aspect: Air pollution is a significant problem for Ankara and has been one of the most critical problems for the last 30 years. Due to great efforts, emissions started to decrease in 1989 and reached the minimum value in 1993 and 1994 (Hizel et al., 2000). However, the issue is yet again on the rise and based on significant report from the Organization for Economic Cooperation, air pollution in certain areas of Ankara has exceeded national air quality standards (Direskeneli, 2009).

The lack of any comprehensive plan coupled with strict planning control and market-led development in Ankara has resulted in a fragmented urban pattern and segregated social fabric which promotes car dependency. This assessment implies that Ankara has serious problems in terms of pollution, social cohesion, traffic congestion, a pedestrian-friendly urban environment and economic aspects, so it needs to be regenerated through adaptable infilling projects to achieve more social inclusion, a much more integrated urban pattern and environmentally-friendly development. Surprisingly, many construction projects in architectural and urban scales are being implemented around cosmopolitan areas in the name of redevelopment projects. Nonetheless, most of these projects fail to make significant contributions to the sustainability of those areas.

One of these redevelopment projects is called the Park Oran Project (the former Turkish Grand National Assembly Housing Complex), an area of 25 hectares located on Oran Road in the southern corridor of Ankara. The aim of this section is to

determine the contribution this infilling project has made to the sustainability of Ankara's urban form in terms of mobility, use and activity, social inclusion and energy efficiency based on proposed guidelines by the researcher.

3.3. Park Oran (Parliamentary Housing)

3.3.1. Background

The Turkish Grand National Assembly Housing Complex, which was designed by the famous architect Behruz Çinici, was completed in 1984. The Complex was spread over an area of 25 hectares located along Oran Road in Ankara and consisted of three-story villas of 140 square meters (see Fig.8) designed to house parliamentary and other government officials.



Figure 3.8. Parliamentary Housing (Source: http://www.mimarizm.com/makale/lojmanlar-millet-meclisi-nin-miydi-donem-meclisinin-mi_114097)

Because the project was realized as a contemporary interpretation of the neighborhood concept, it emphasized the traditional courtyard-house relations of Anatolian residential architecture (Fig.9 and Fig.10).



Figure 3.9. Parliamentary Housing (Source: http://www.mimarizm.com/makale/lojmanlar-millet-meclisi-nin-miydi-donem-meclisinin-mi_114097)



Figure 3.10. Parliamentary Housing (Source: <http://www.mimarizm.com>)

In the course of 20 years, these houses that hosted hundreds, perhaps thousands, of government officials of all parties were vacated in 2003 with the so-called "political decision" of Hasol (Source: http://www.mimarizm.com/makale/lojmanlar-millet-meclisi-nin-miydi-donem-meclisinin-mi_114097).

Transformed into a residential complex by Akturk Yapi in 2007, Park Oran now includes 17 residential blocks along with office buildings and commercial sites on a construction area of 16,000 square meters and an aggregate site area of 146,000 square meters. The newly developed Park Oran completely altered the original blueprint of the parliamentary site. (See Fig.11 and Fig.12 for a comparison of the two plans and Fig.13 for plot subdivision).

The Park Oran Project has been chosen for evaluation due to being the best possible example of an attempt at infill design within Ankara's city limits. To determine how much this redevelopment project contributes to Ankara's sustainability, Park Oran will be explored through four different hypotheses including mobility, activity, diversity and energy efficiency based on data achievements, questionnaires and illustrations. In this section, the efficacy of Park Oran as an infill development project will ultimately be assessed.



Figure 3.11. The Park Oran complex before Yapi's 2007 intervention (Source: Researcher)

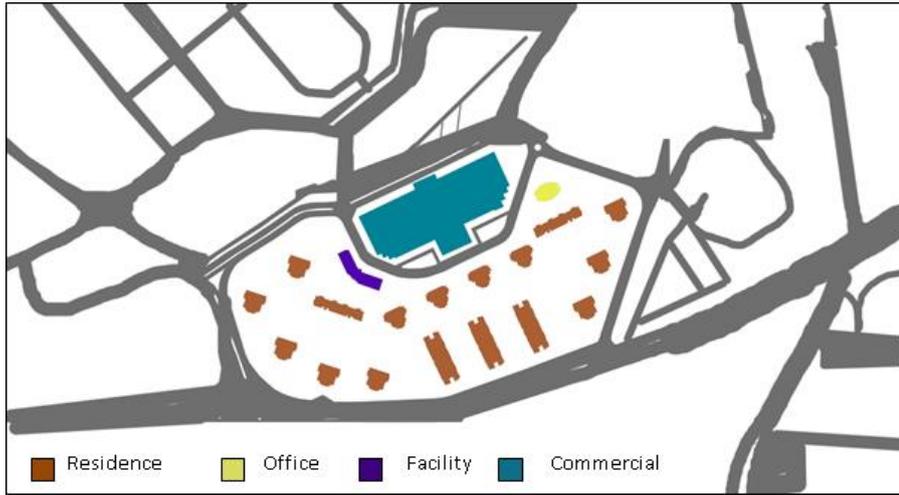


Figure 3.12. The re-developed Park Oran, post-2007 (Source: Researcher)



Figure 3.13. Park Oran plot subdivision and ownership after redevelopment (Source: Google Maps and Researcher)

3.4. Results from Questionnaires

The results of the questionnaires are based on data and information collected from 50 Park Oran residents regarding “income and social status,” “energy efficiency,” “waste management,” “socio-economic status,” “commuting behavior” and a “general

evaluation.” The results are divided into two parts. The first part, is categorized in three sections (corresponding to the first three as mentioned above) with each section including several items as follows:

I. Income and social status of residents

- Average rents or sales prices of houses
- Amount of monthly membership or residence fee
- Total number of cars owned by residents
- Existence of people from different backgrounds (for example, foreigners, black people, and non-Muslims)
- Existence of conflicts or disputes between residents, locals and foreigners

II. Energy efficiency

- Further details about district heating and cooling systems
- Quantitative data about energy use
- Annual energy used for heating and cooling of dwellings
- Annual electricity consumption
- Whether or not there are special measures to improve energy efficiency such as better insulation or window systems

III. Data and information about waste management

- Any special measures to reduce waste generation
- Any special measures to recycle and reuse wastes
- Special waste collection programs

With respect to average rents or sales, average monthly rents vary in the range between 2000 TL and 22,500 TL (related year, 2015) and are summarized below in Table 3.3 with respective unit sizes:

Table 3.3. Unit sizes and rent prices of Park Oran (Source: Researcher)

Unit Size	Price	Unit Size	Price
1+1	2,000 TL	4+1	5,000 TL
2+1	2,750 TL	5+1	18,000 – 20,000 TL
3+1	4,000 TL	Duplex	22,500 – 25,000 TL
Additional costs: - Monthly residential fees vary between 280-310 TL and 600 TL.			

Related to existence of people from different backgrounds and associated conflict, various people from various religions and ethnic groups live together and there does not appear to be any serious conflict between these people; however, there are some problems related to the habits, rituals and ways of life which are disturbing to other residents such as food rituals and pet ownership.

With respect to energy efficiency, the district heating system is central and there are four main sources of heat; each one feeds five blocks and residents pay for the amount of energy they consume. The required electricity is bought from a private company that is a distributor of energy, a strategy that is more economical and less expensive when compared to relying on the city's public electricity network.

In terms of fuel (natural gas), the Allocator Company provides natural gas to the blocks. Due to considerable quantities of fuel use, the complex can benefit from discounts in the fuel prices, resulting in an economic situation for the inhabitants.

In terms of improved energy efficiency, better insulation and window systems have been considered to prevent wasting energy in floors and units.

The annual energy use for heating and cooling is 2,688,777m³ and annual electricity and water consumption is 4,871,473 kWh and 360,202m³ respectively.

With respect to waste management, there are no special measures to reduce waste generation and no special measures to recycle and reuse waste. However, there is a special waste collection program to collect generated waste. Special boxes are located in front of each building so as to sort and collect a variety of wastes including paper, bottles, and cans then based on a special program these wastes are delivered to the municipality to be recycled.

Part Two of the evaluation of this case is based on information retrieved from survey questionnaires conducted with 50 people in terms of “socio-economic status,” “commuting behavior” and a “general evaluation.” The results are as follows:

Socio-economic status: Residents of Park Oran are mostly temporary dwellers who reside in between a period of 6 months to 5 years, some of whom are tenants and some of whom are owners of units. Generally, residents possess more than one car and some have up to seven cars per each unit. As a result, finding ample parking is a large issue and many people have even resolved to parking around the site that seems to contradict the aesthetic of the residency. However, there is a possibility to rent an extra parking area to accommodate cars by paying.

Commuting behavior: The work places of residents are located in various regions of Ankara and only a few residents have a home office. Generally, inhabitants of Park Oran use their own vehicles to commute and unsurprisingly their answers to the question of “How often do you use your car?” is “every day.” In some samples, residents report being driven to their workplaces by their companies’ special, private cars. However, carpooling is not a widely seen phenomenon and family members generally use their own cars for daily commuting.

The most important issue related to this case study is the use of public transportation. Park Oran residents generally do not prefer to use public transport for daily commuting to work, university, schools and various activities owing to the deficit in direct accessibility to various parts of Ankara from this area. Although bus stations and other public transport stations exist near Park Oran, they are not regularly scheduled and

residents must wait a considerable length of time in order to access their destinations. Therefore, people favor using their own cars. However, when travelling to the city center, residents do report using public transit in as a means to avoid traffic and parking hassles.

Another important issue related to the Park Oran region is traffic congestion during specific times of the day (mainly morning and evening hours). The routes used to reach this area are also home to three main governmental workplaces, leading to serious traffic problems during peak commute hours and in turn negatively affecting people in the surrounding areas of Park Oran.

People generally go shopping three or four days a week, sometimes even every day, to the markets and the shopping mall in the vicinity of this complex. In contrast to their daily car-driven commutes to work, the residents usually walk to go shopping because they can meet their all needs within walking distances.

3.5. Evaluation

The Park Oran Project has been evaluated with respect to the New Urbanist Principles adopted from The Charter of the New Urbanism with respect to basic information gathered and questionnaires conducted with 50 residents. The key parameters used for evaluation are as follows:

- **Connectivity:** An interconnected network of streets can be designed to encourage walking, reduce the number and length of automobile trips and conserve energy.
- **Walkable Urban Pattern:** Many activities of daily living could occur within walking distance, allowing independence to those who do not drive, especially the elderly and youth.
- **Public Place and Community:** Streets and public spaces should be designed as places of shared used. Properly configured streets and squares encourage walking and enable neighbors to know each other and protect their communities.

- **Diversity:** Within neighborhoods, a broad range of housing types and price levels can bring people of diverse ages, races, and incomes into daily interaction thereby strengthening the personal and civic bonds essential to an authentic community.
- **Self-Sufficiency:** New development should be organized as towns and villages with their own urban edges and planned for a job-housing balance not as bedroom suburbs.
- **Density and Public Transportation Hub:** Appropriate density and land uses should be within walking distance of transit stops, permitting public transit to become a viable alternative to the automobile.
- **Urban Corridors:** Properly planned and coordinated urban corridors result in more organized metropolitan structure thereby revitalizing and relieving urban centers.
- **Urban Design Codes:** The economic health and harmonious evolution of neighborhoods and districts can be improved through graphic urban design codes that serve as predictable guides for change.

Based on these principals, new development should:

- 1) Include parks and community gardens
- 2) Promote streets and public spaces as places of shared use
- 3) Be designed to encourage walking thereby reducing car dependency
- 4) Be designed as a mixed-use development
- 5) Be compact and with higher population densities
- 6) Include civic, institutional, and commercial buildings within walking distances
- 7) Not lead to sprawl
- 8) Minimize environmental deterioration
- 9) Be designed in such a way that children can walk or bicycle to school

- 10) Encourage infill development over peripheral expansion
- 11) Be designed to encourage use of transit and reduce dependence on automobiles
- 12) Provide affordable housing
- 13) Accommodate ethnic diversity
- 14) Restore existing urban centers within metropolitan regions
- 15) Reorganize sprawling suburbs into neighborhoods and districts

All of characteristics mentioned above are the main characteristics of sustainable urban development achieved through compact city notions using infill development strategies, all of which are categorized in four groups as follows:

- **Mobility (Urban form and connectivity)**
- **Use and activities (Mixed use)**
- **Social inclusion and integrity (Diversity)**
- **Environmental dimension and energy efficiency**

The evaluation of Park Oran in terms of its strengths and weaknesses as an infill project, and therefore significance of its contribution to the sustainability of Ankara's urban pattern, will be based on the four above criteria.

3.5.1. Mobility (Connectivity)

Mobility and transportation is one of the most crucial aspects related to urban form. How we implement and organize mobility directly affects urban form; hence, there is a considerable connection between urban form and transport systems. The form of each city reflects its former dominant transport system in its developmental stage. Sustainability in mobility is defined as diminishing mobility and traffic congestion as well as promoting convenient accessibility to different parts of the city; consequently, a sustainable urban form must encompass all modes of related transport such as walking, cycling and appropriate public transport.

To achieve such a breakthrough in sustainability, successful infill projects are generally being located in areas where various transport modes are nearby and where the infill project can be considered a central place (hub) of this transit-oriented development thereby reducing, even eliminating, the use of private cars for residents' commuting. As an alternate to private cars, people use alternative and more sustainable modes of transport such as walking and cycling, which contributes to rising social interactions as well as creating environmentally friendly areas.

Therefore, one of the most crucial characteristics of successful infill development projects is to enhance urban mobility and accessibility in order to reduce the use of private cars. Such a reduction generates more livable urban communities in which residents use walking, cycling and other sustainable transport modes for commuting.

Walking is one of the healthiest, lowest-carbon forms of transportation yet it works best on a smaller, neighborhood scale. In order to link multiple walkable neighborhoods together, more rapid forms of transportation are necessary to handle the millions of trips within a modern city. Generally, all major cities include a mix of three transportation modes. To most cities, the automobile is a reality, mass transit is a necessity, and an efficiently walkable community is non-existent. The historical, path-dependent layering of three types of cities is contributing to the growth of polycentric cities or nodes that are connected to each other. A strategy of densifying today's polycentric cities is called transit-oriented development (Washburn, 2013).

With respect to the Park Oran sample, in order to assess the mobility criterion which directly affects urban pattern and form, the utilization of public transport, the location of the project in the vicinity of public transit (PT) stations, the ease of access to the city center and the use of sustainable modes of transportation such as walking and cycling will be evaluated in order to determine the contribution of this development to the sustainability of Ankara's urban form.

A reflection of the extent to which Park Oran has contributed to the sustainability of Ankara's urban form in terms of mobility is as follows:

One of the priorities which is necessary to be implemented in each infill project in order to achieve sustainability in urban fabric is accessible public transportation aiming to provide social and physical integrity between an infill project and nearby neighborhoods so that everyone can equally benefit from facilities. Furthermore, accessible transportation makes a great contribution to the reduction of segregation in urban communities. To achieve such a breakthrough, infill projects should be located in a central place of development surrounded by various types of public transportation.

Based on successful infill projects and prevailing criteria with respect to the implementation of sustainable development, each infill project must be located in a central place of transportation facilities including metro stations, railway stations, and trams in order to be capable of contributing to integrity in urban areas (transit-oriented development). However, the Park Oran Project has weak capabilities related to public transportation. The project area is not surrounded by any modes of public transport other than three or four public buses, which consume an exorbitant amount of time for passengers to travel to various parts of the city. In order to access the bus route, residents must exit Park Oran and walk to the main road (see Fig.14):

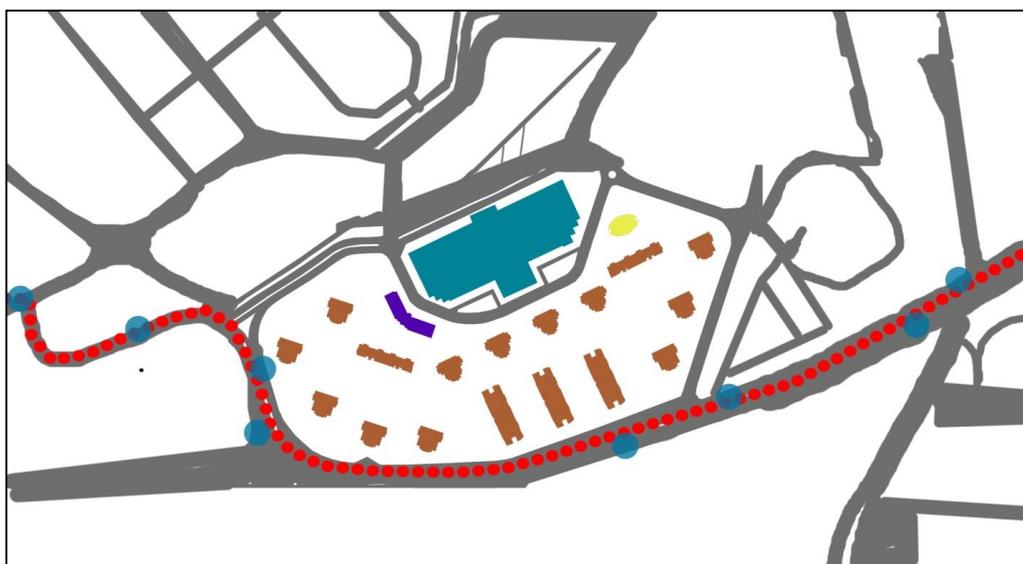


Figure 3.14. Bus route and bus stops in Park Oran (Source: Researcher)

As a direct result of such extremely limited public transportation, the Park Oran development has been lead to be an isolated enclave that has weak integrity and accessibility with neighborhoods nearby (see Fig.15). Moreover, the central car park area, which was built to accommodate residents' cars, is not enough space to meet their needs. Due to this space deficiency, residents park their vehicles around the Park Oran area which results in problems such as traffic and deterioration of landscaping aesthetic.

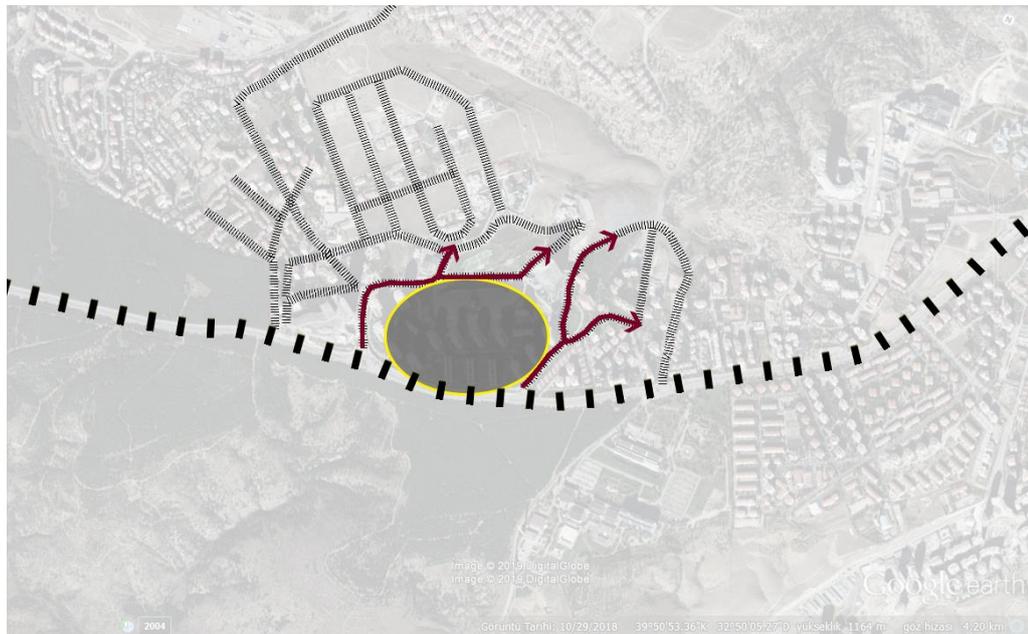


Figure 3.15. The weak integrity of Park Oran to nearby areas as evidenced by isolation, limited roadways, and lack of walkable paths (Source: Researcher)

Consequently, as related to mobility, the Park Oran Project does not make any contribution to the enhancement of urban quality of life due to the lack of convenient and reasonable accessibility between this area and other neighborhoods. This lack of accessible and efficient public transit has resulted in other related problems with sustainability including car dependency, energy efficiency issues, air pollution, health problems, and social segregation in Ankara's urban fabric.

One of the most crucial aims of infill development in urban fabric is to enhance integrity in terms of spatial and social aspects generally fulfilled by the accompaniment of public transportation which provides possibilities for various classes to benefit from amenities equally. In sharp contrast to the aim of infill development projects, Park Oran does not have the capability of providing integrity with Ankara's urban form and, with the nearest metro station in Kizilay over 10 kilometers away, presents itself instead as an isolated enclave. Thus, it can be seen that the sustainable transport supposed to unify Park Oran to various parts of the urban fabric, particularly to the inner city area of Kizilay, is in absence (see Fig.16), compared to successful infill projects such as Hammarby or Vauban which are well-connected to whole parts of their respective cities and the inner city areas with integrated tram lines.

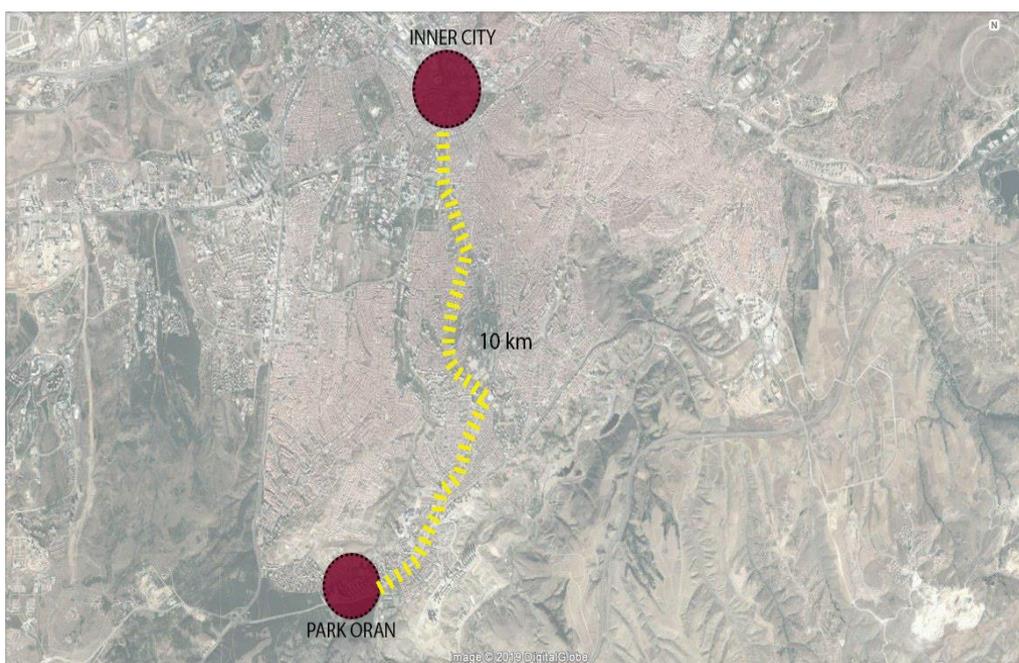


Figure 3.16. Weak integrity of Park Oran with the inner city, Kizilay (Source: Researcher)

Within successful infill projects, a network of streets allows pedestrians, cyclists and motorists to move safely and comfortably through a neighborhood, therefore

encouraging pedestrian-friendly, car-free lifestyles. Most people will walk a distance of approximately one-quarter of a mile before turning back or opting to drive or ride a bike rather than walk. The maximum average block perimeter to achieve an integrated network is 1,500 feet with a maximum uninterrupted block face or ideally 450 feet, with streets at intervals no greater than 600 feet apart along any one single stretch. A street network is, naturally, a connected web of streets, set-up logically for multiple routes but not necessarily a strict Cartesian grid.

When discussing walking habits and street networks in the Park Oran complex, residents responded, unsurprisingly, that they tend to drive more and walk less. However, due to the location of different amenities in the shopping mall next to the complex, people are able to meet their basic needs in walking distances. Yet, this type of walking does not imply that the design of the existing development has promoted walking through an integrated network to other parts of the urban fabric; on the contrary, this development solely promotes an internal walkable network.

Based on the questionnaires' achievement and the researcher's own interpretations, the use of public transportation is one of the most significant shortcomings of the Park Oran project yet the factors which created this problem is aim of this study. Firstly, as mentioned above, the nearest metro station is the Kizilay station and dwellers do not have any accessibility to it. Secondly, the method of public transportation offered to dwellers is a public bus which provides accessibility to the city center. However, this bus that is linked to Park Oran is only indirectly connected to other regions outside the heart of the city; in other words, reaching the downtown area is a mandatory step before proceeding to other parts of the city. As evidenced by the questionnaires, occasionally residents use indirect public transport when heading directly to the the city center due to the hassle of driving a private vehicle in extreme traffic congestion and the existing parking problems in the downtown area.

To summarize, Park Oran as an infill project does not make any contribution to the sustainability of Ankara's urban form in terms of mobility due to inaccessible public

transportation and weak integrity with other parts of Ankara and instead results in problems related to energy efficiency, social and physical segregation, environmental pollution and traffic congestion.

To solve these problems, the implementation of convenient and accessible public transportation such as metro lines and tramlines that connect Park Oran to the heart of the city and surrounding areas of the city would be a necessary step (see Fig.17). In the case of Park Oran, the most convenient accessible mode of transportation would be creating a tramline through this project so as to enhance the connectivity and integrity. However, due to political and governmental issues, construction of such a tramway may be nearly impossible. Consequently, the Park Oran development can be considered as a complex for single-family use which has considerable problems with respect to sustainable mobility – a problem which could be solved by ameliorating the transportation infrastructure.



Figure 3.17. Proposal for public transportation for Park Oran (Source: Researcher)

3.5.2. Use and Activities: Mixed-use Structure

Effective infill developments create mixed use and heterogeneous urban environments (neighborhoods) in which different elements of urban fabric are well-integrated. To evaluate whether or not this aspect has been implemented in Park Oran and how much this design aspect promotes sustainability in Ankara's urban community, the layout of this development and allocation of various functions and activities there have been analyzed by using guiding principles of mixed-use structure.

As a reminder, mixed-use, or heterogeneous zoning, generates compatible land uses to be located in nearby areas thereby decreasing the distances travelled between activities. This type of development includes diversity of functional land uses such as residential, commercial and institutional and those related to transportation. Reducing the need for travel is the most important aim of sustainable urban form and mixed land use has a prominent role in achieving it. If public transport and non-motorized journeys are to be encouraged, distances between activities need to be reduced, which is possible with higher densities of development. As such, diversity of development makes a great contribution to reducing distances between activities by minimizing their separation thereby encouraging walking, cycling and public transport.

As can be seen in the following layout (Fig.18), office buildings, residential areas and a shopping center (Panora) are located nearby Park Oran and residents can access these areas by foot.



Figure 3.18. The possible connection between the mixed-use development in Park Oran
(Source: Researcher)

This type of development technically meets one of the parameters of mixed-use development: residential, shopping and workplaces are located within close proximity of each other. However, the other parameter, regarding a reduction in the need to travel long distances by private vehicles, remains in question for Park Oran.

As evidenced by the questionnaire completed by Park Oran dwellers, they regularly go shopping in the vicinity of Park Oran where there are amenities such as supermarkets and a shopping mall. While dwellers may be capable of meeting buying groceries and other essentials for daily life within walking distances, only a fraction of their social lives can take place within walkable distances. Furthermore, this type of walking (to and from the Panora shopping mall or grocery store) does not influence the vibrancy of this urban environment nor the connectivity to the surrounding built environment; rather, it results in profit-oriented development.

Moreover, for a true mixed-development to exist, dwellers do not need to commute to their workplace or to leisure activities (for example) because all these facilities are

offered in close proximity to their living areas. However, the majority of Park Oran residents' workplaces are located outside of the Park Oran area, with a tendency to work in the inner city area or other parts of the city such as Bilkent, Beytepe, Çayyolu, Incek, Ümütköy, and Eskişehir Yolu. Based on the location of these distant and scattered workplaces, the result is that activity in and around Park Oran does not truly fulfill its role as a mixed-use development.

Apart from residential and office activities, commercial oriented activity is another aspect included in mixed-use development to provide vibrancy and integrated social fabric. According to successful infill projects, the aim of commercialization of mixed-use development is not to commodify the community and leave social activities to profit-led interactions. On the contrary, mixed-use development provides a fabric in which different people from different backgrounds with different levels of income can socialize. In the Park Oran sample in terms of commercial activity, dwellers are able to meet their basic daily needs from the shopping mall or grocery stores but interaction between different groups is profit-oriented, so the social aspect of interaction is missing here.

As seen in successful infill projects such as Vauban and Hammarby, the mixture of activities in these developments results in sustainable habits in terms of mobility and socialization. For example, in the Hammarby infill development, people can work in close proximity to their living areas and the extension of the inner city by the lake results in walkable and vibrant fabric which enables people to interact in a walkable, interconnected community extending and integrated to the city. Similarly, Vauban's urban landscape is a means to mitigate car dependency and promotes sustainable modes of transportation like walking. Despite the fact that Park Oran residents can access Panora mall on foot, there is weak socialization, even no interaction, within walking distances and people cannot access any public amenities within 400 meters, the key threshold to measure walkability.

The only places in which interaction can occur is in the Panora shopping mall and some other markets which, for the most part, only higher income groups can afford. Park Oran itself is a sample of an isolated, gated community which people are separated from other social communities. Due to rapid urbanization and market-led development, the lack of any comprehensive plan and well-integrated functions has resulted, and has therefore caused, people living in Park Oran to suffer from weak socialization (see Fig.19):

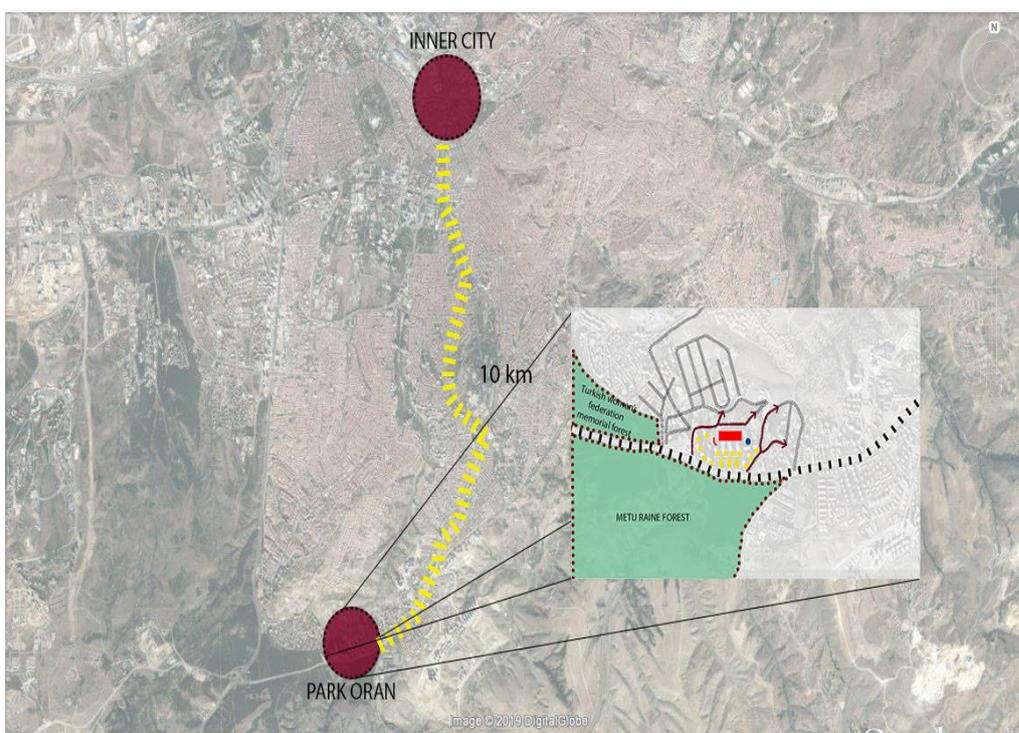


Figure 3.19. The layout of the Park Oran in relation to the Inner City (Kizilay) (Source: Reseacher)

Despite its physical isolation, Park Oran residents reported being satisfied with social activities and leisure amenities offered within the development. However, the kind of socialization witnessed in this sample is not overall satisfactory from the standpoint of mixed-use development due to its exclusive nature and being reserved for dwellers only. In addition to this finding, people living within Park Oran also appreciate the

neighboring forests, the METU Forest and the Turkish Women's Federation Memorial Forest (see Fig.20). Although these forests are not directly within the gates of Park Oran, they do have some contribution to diversity in landscape, at least from a visual perspective.

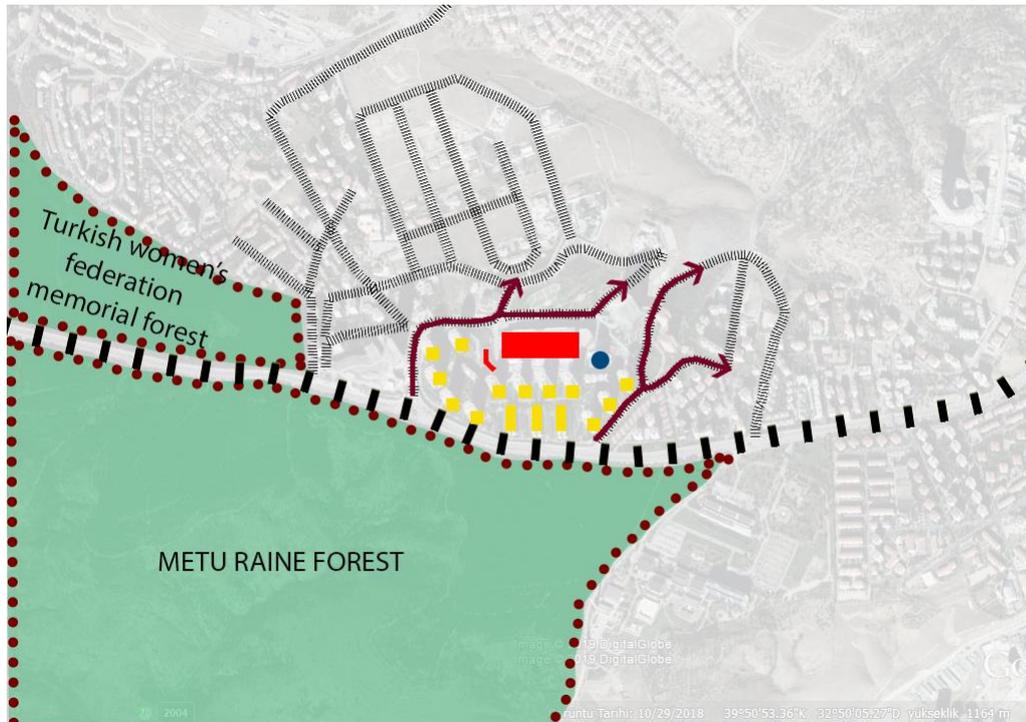


Figure 3.20. Two forests neighboring Park Oran (Source: Researcher)

Consequently, the evaluation about whether this development is sustainable with respect to design principles and mixed-use implementation is divided into two categories. In terms of providing accessible spaces for dwellers to meet their most essential needs and to attend to leisure facilities and social activities within walking distances, Park Oran does have a positive contribution to sustainability in urban fabric. In contrast, in terms of providing capabilities for dwellers to work in a close proximity to their residential areas and interact with different social groups, this project has evaluated Park Oran as unsustainable despite the existence of nearby office buildings.

A suggestion that can be proposed to ameliorate the problems generated related to the workplaces of dwellers is for administrators and policy makers to adopt policies which enable dwellers to work in close proximity to their residential district. Otherwise, the development will have a market-led function such as a single development which will only generate related problems, especially traffic congestion, air pollution and inefficient use of energy.

3.5.3. Diversity: Social and Physical Inclusion and Integrity

Diversity and vitality are two separate concepts that make a significant contribution to the activities in urban communities. Vitality refers to the number of people in and around the street (pedestrian flows) across different times of day and night, making use of amenities, the presence of a vibrant street life and, in general, the extent to which a place is assessed as alive. There are some similarities between diversity and mixed-use development; however, diversity is a multidimensional phenomenon promoting further desirable urban features, including a greater variety of housing types, building densities, household sizes, architectural styles, social inclusion, ages, cultures and incomes. In other words, diversity represents the social and cultural context of the urban form and how different people with different backgrounds communicate with each other.

In the long term, urban vitality can be achieved by a diversity of land uses. So, a combination of activities results in successful urban communities. This mixture needs a wide diversity of ingredients, which in turn is dependent on sufficient levels of demand to sustain wide-ranging economic activity (Montgomery, 2007). Urban populations living in close proximity can support this economic activity by means of establishing places such as cake shops, cinemas, clubs, delicatessens, galleries, international grocery stores, pubs, and teahouses. Easy travelling distances between established places and relatively large numbers of people with different proclivities are the most crucial criteria to sustain vitality.

While vitality is assessed by measuring flows and movement, the uptake of facilities and the existence of ‘things to do,’ diversity ranges across a far wider criteria and includes the following (Jacobs, 1961):

- The extent of variety in primary land uses, including residences
- Locally independent businesses, particularly shops
- Alternatives in the existence of evening and nighttime activities
- The availability of cinemas, theaters, wine bars, cafes, pubs, restaurants and other cultural facilities offering different kinds of services in terms of price and quality
- The availability of spaces including gardens and squares which enable people to participate
- Patterns of mixed land ownership so that self-improvement and small-scale investment in property is possible
- The availability of different unit sizes of property with different degrees of cost
- A variety of building types, styles and design
- The presence of an active street life

As a result, the more a place is complex, the more livable and vibrant that place is. Moreover, a complex transaction base is a crucial feature of creating successful urban community. All transactions must not be in monetary form; instead, urban areas are meant to provide spaces for social transactions. But without a transaction base of economic activity, it is impossible to create a successful urban place. So, opening up the possibilities for transaction to occur in longer and different times of day and evening, economy of urban places tend to establish a diverse urban pattern (Montgomery, 1994).

A lack of concentrated diversity can put people into automobiles for all their needs. Jacobs (1969) believes that in dense, diversified city areas people work in them, an activity that is impractical in suburbs and in most grey areas. The more intensely

various and close-grained diversity an area has, the more walking, and thus sustainability, will exist. Without diversity, an urban system declines as a living place and a place to live.

From a construction standpoint, diverse development contains a mixture of land uses, building and housing types, architectural styles and rents. If development is not diverse, homogeneity of a built environment results in pure and monotonous urban landscapes thereby generating many socio-economic problems, including lack of affordable housing for middle-level income groups, class and racial segregation and job-housing imbalances which result in increased driving, congestion and air pollution.

There is a direct relationship between infill development and social inclusion because it is believed that effective infill development creates mixed-use and heterogeneous urban fabric which enhances social equity, cohesion, integrity and affordability resulting in an appropriate urban environment for people from different backgrounds to interact. Hence, social inclusion and cohesion are the most crucial factors addressed in all urban redevelopment processes as important criteria to improve sustainability and quality of life.

What is offered by social inclusion and diversity is to incorporate ethnic groups with different backgrounds in a socially and physically integrated community so as to utilize urban amenities evenly thereby alleviating social segregation and enhancing social interaction, resulting in a heterogeneous built environment.

To provide social inclusion within a built environment, there exist a set of criteria including affordable housing, existence of people from different backgrounds, interaction between foreigners and people of different religious faiths, creating work opportunities, establishing mixed-use development and mixing various classes with different levels of affordability.

Due to its eminent desire to achieve sustainability in Ankara's urban communities, there is a comprehensive attention towards diversity within Park Oran. To assess if

social inclusion has been appropriately implemented here and to see to what extent this factor contributes to the community's integration, the following criteria related to Park Oran have been analyzed: average rents and sale prices of homes, the amount of monthly membership or residence fee, the total numbers of cars owned by residents, the existence of people from different backgrounds, the existence of foreigners, any evidence of conflict or disputes between local residents and foreigners, building and housing types, the variety in architectural styles, density, along with a sense of place. In addition, complementary criteria, which are derived from Jacobs (1961), will be used for assessment in the following parts.

3.5.3.1. Affordable Housing

One of the most effective factors that contribute to the social inclusion of a place is affordable housing, a construct that can incorporate various groups of people from different incomes and backgrounds in an inclusive community with diverse tastes and preferences. The provision of affordable housing and accommodation of ethnic diversity has local and non-local implications for social equity. Mixed-income, transit-oriented development offers opportunities to effectively address communities' burgeoning affordability crises by dealing with housing and transportation costs while extending access to jobs, educational opportunities and prosperity for the range of income groups living in our urban community (Farr, 2008).

Consequently, diversity or mixed-income, transit-oriented development will address the problems of worsening congestion, burgeoning unaffordability and the income gap between low-income and high-income residents as long as it offers truly affordable housing, an accessible and reliable base of transit riders, broader access to opportunities and protection from displacement (Farr, 2008).

Based on information gathered by the researcher from the administrative office of Park Oran, the average monthly rents of the units within the complex vary between 2,000 TL (for a 1+1) to 20,000 TL (for a 5+1) and 25,000 TL (for duplex units). Homes available for purchase start at 782,000 TL and increase based on their area and

function, up to 2,195,000 TL. With respect to these prices, the membership or residence fees vary between 280 TL to 600 TL. The total number of cars used regularly by residents is between 3,500 and 4,000 cars (Data collected year, 2015).

The implication related to cost of Park Oran is that this residential area is not an affordable one and people from various incomes, especially lower and middle level groups, are unable to afford these residential units. Consequently, the first step to achieve social inclusion and diversity along with a chance for variety in primary land uses is abolished due to non-existent opportunities of affordable housing. As a result, people outside high-income social groups cannot afford the high cost of living, which further promotes social segregation rather than social inclusion in Park Oran.

3.5.3.2. Density and Social Inclusion

Density is a means aiming to reduce per-capita resource use resulting in local, regional and global benefits such as mitigating carbon dioxide levels and greenhouse gas emissions and alleviating congestion produced by human activities. Furthermore, higher density developments generate less urban runoff, so local density has a global benefit. However, in some situations global benefits appear to be in direct conflict with local benefits because neighbors believe that dense developments threaten their quality of life and destroy the egalitarian nature of the built environment. As such, tradeoffs when it comes to increasing density include lack of open space in dense urban developments, increasing costs of properties and pushing people out of developments' boundaries.

Density, social inclusion and ethnic diversity, which incorporate people from various backgrounds in the same community, are all crucial aspects resulting in diversity. Those factors not only incorporate different people with different tastes and affordability in an inclusive community, but also provide diverse opportunities and amenities which people can access in walking distances.

Based on Newman and Kenworthy (2006) and Banister (2008), the acceptable density to mitigate car dependency and encourage public transport in industrialized cities

starts at 35 or 40 persons per hectare. The corresponding density in Park Oran is 273 per hectare (4000/14.6). This density is reasonably high considering that the density in the inner city is 247 persons per hectare (Ankara Greater Municipality, 2007). However, these figures on their own cannot be used to determine whether or not a built environment, Park Oran, achieves diversity and social inclusion. In other words, an area with high density does not necessarily imply diversity.

In order to determine whether or not Park Oran can be considered diverse and socially inclusive, a closer examination of the populations living within the complex has been made. As gathered from the questionnaires, there are many residents from different backgrounds, races and religions living in Park Oran. Residents did not report any serious disputes between foreigners and local residents other than some complaints in terms of cultural differences, which generally have been resolved. While this finding may indicate that residents are capable of living harmoniously with each other, their interactions with each other on deeper levels still remains in question.

While it can be claimed that ethnic diversity exists within Park Oran, it is important to note that this ethnic diversity is derived from a design feature of the complex, rather than the community members themselves. Park Oran is purposefully assigned as a living space for people working in embassies of foreign countries, well-off foreigners working in Ankara and other high-income groups. While one of the unifying priorities for these groups of people is living in Park Oran, their priority to live in this exclusive complex in no way relates to their desire to contribute to ethnic diversity. For true diversity to exist in a well-integrated and socially inclusive environment, the desire for diversity must stem from the community members themselves.

Despite the considerably high population density in Park Oran, there is little to no interaction between local residents and visitors to the area, which is derived from the business-oriented, transactional nature of the community. Furthermore, private space dominates public place around Park Oran owing to the fact that residents use their

private automobiles to enter their residences without meeting other social communities.

Aside from urban population density, urban landscape density is an influential factor relating to social inclusion. Urban landscape, like other public areas, can act as a lever to enhance social interactions within a community. In Park Oran, the density level of landscape is relatively high. In addition, based on the residents' assessments, the existence of the METU Forest nearby Park Oran is pleasing. Nonetheless, the existence of these urban landscapes do not enrich the sense of place and interaction in the community because they serve mainly for aesthetic purposes rather than spaces to be used (see Fig.21). In other words, these landscapes largely have a passive role. Furthermore, the landscaping within Park Oran exists within a physical boundary, a gated-community, thereby keeping visitors and residents separated – a physical separation which contributes to the segregation and social isolation of the Park Oran community.

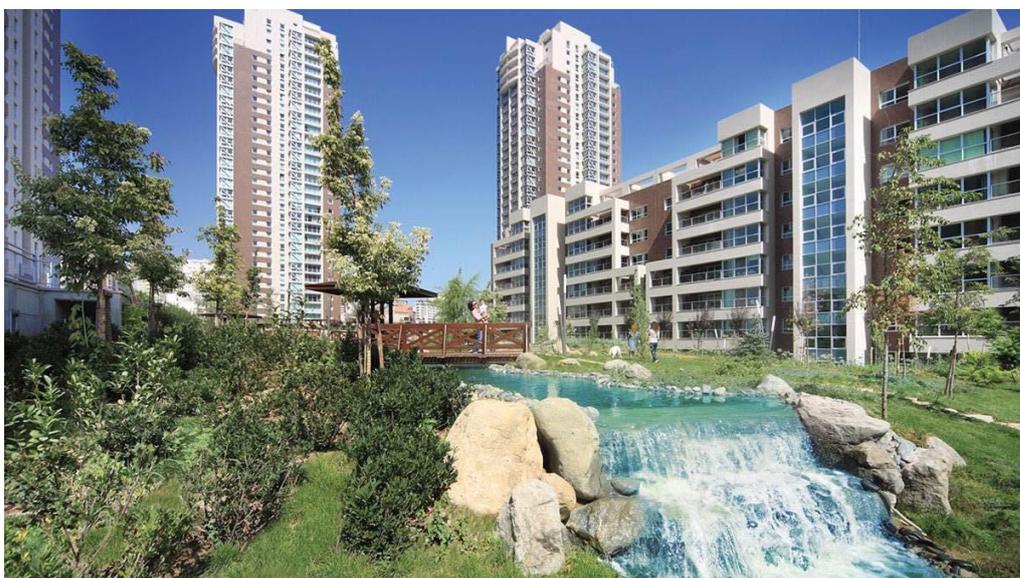


Figure 3.21. Landscape design within Park Oran (Source: www.timplatform.com)

Consequently, based on findings related to density, despite the fact that the level of density is considerably high in Park Oran, social interaction and social inclusion is quite low. Lack of affordable housing and efficient public transportation has

contributed to Park Oran becoming a privatized, isolated community which shares more characteristics to suburban development rather than integrated urban design. Furthermore, while ethnic diversity can be observed among the residents of Park Oran, it remains solely surface-level as residents do not actively choose to create and be part of a vibrant, inclusive community of diverse members.

3.5.3.3. Architectural Style, Landmarks and Visual Stimulation

Another critical issue with respect to the diversity, and thus inclusivity, of a built environment relates to visual aspects and includes the variety of housing types, architectural styles and preservation of a community's heritage. These factors generate heterogeneous communities and provide a large contribution to the creation of attractive and vibrant urban forms.

One of the main aims of sustaining architectural heritage is to create a spatial structure of places, landmarks and experiences for each community that has the power to evoke a strong sense of history and orientation (Montgomery, 2007). Sustainable cities have always been places which indicate strong elements of culture, technology, engineering, innovation, civilization and cosmopolitanism. However, in the process of capitalism and market-led development, many cities have been treated as commodities resulting in monotonous, none-place suburban communities with no integrity to other activities in an urban fabric. But, in order to successfully achieve diversity, complexity and cohesion, rather than considering individual buildings, we should consider the city as whole.

According to the data obtained from Park Oran residents, the architectural style of Park Oran is one of the most frequently complained about features. The entire architectural typology of all the buildings in the Park Oran Project buildings are identical; they are mono-cultural, international modern architecture which include seventeen homogeneous blocks (see Fig.22). Moreover, there is no relationship between the currently existing towers and the former unique architectural history of the space.



Figure 3.22. Architectural homogeneity of the Park Oran Project (Source: Park Oran website)

When successful infill projects such as Germany’s Vauban are examined, different strategies such as adaptive reuse and infilling, which preserve the architectural heritage of the site, can be seen. For example, in Vauban, military buildings within the site were repurposed into student dormitories thereby promoting diversity and evoking a strong sense of history of the place. In sharp contrast, the Park Oran Project, which was formerly parliamentary housing with a unique architectural style, is now dominated by a mono-cultural modern architectural type which fails to incorporate any history or preservation of the prior built environment – a consequence of rapid market-led development accompanied by the destruction of the formerly existing parliamentary community. As a result, this mono-cultural architecture does not convey any message to its residents nor overall to the city fabric and even hides the history of the place.

The lack of diversity in architectural style, improper integrity and missing public transportation does not evoke any sense of orientation. Furthermore, the physical

barrier built around Park Oran blocks non-residents from coming and participating in different activities, so a sense of place is absent in the Park Oran development. Moreover, residents must commute to their workplaces by private cars. Despite the fact that the level of density in Park Oran is considerably high, this density failed to contribute to sustainability. In addition, the reason behind the choice to reside in Park Oran is financially driven, not based on residents' desires for interaction and participation in any social activities. In conclusion, density in numbers is not enough to achieve sustainability. Prior to making a dense environment we must provide integrity, affordability, a mixture of activities and vibrancy. Only when those aspects are fulfilled, will we be able to achieve density that results in sustainability.

3.5.4. Energy Efficiency

This section explores the level of energy consumption in Park Oran based on sustainable development norms, improvement of energy efficiency and recycling programs and compares Park Oran's energy efficiency to the successful sustainable development projects comprehensively explored in this thesis, namely Vauban in Germany and Hammarby in Sweden.

A direct relationship exists between density, environmental issues and energy efficiency. The greater the density, the less energy related to heating and commuting are depleted which preserves natural resources and alleviates carbon emission. Relationships between population density and natural resource consumption can be elaborated as follows:

- The energy and natural resource consumption of people living in large, detached homes in suburbs is generally much higher than people living in compact and mixed communities.
- Suburbs and peripheral developments result in loss of natural lands and farmlands around the cities.
- People living in peripheral areas generally use private cars for commuting, consuming more energy and contributing more to air pollution.

To evaluate the contribution of the Park Oran Project to sustainability in terms of environment and efficiency, the following parameters are considered:

- District heating and cooling systems
- Quantitative data about energy use including annual energy used for heating and cooling, and annual electricity consumption
- Whether or not there are special measures to improve energy efficiency such as better insulation and window systems
- Any special measures to reduce waste generation, to recycle and reuse wastes
- Any special waste collection programs

In the Hammarby Project, rainwater is not connected to a sewage system; instead, rainwater is collected and purified through a sand filter and released into the nearby lake, thereby reducing pressure on the wastewater treatment. In terms of energy production, solar energy is the main source for generating electricity. One square meter solar cell module generates around 100 kilowatt-hours per year, which is equivalent to the energy used by three square meters of housing space (around 30 kilowatt-hours each). Solar panels are used to heat water which often provide sufficient energy to meet half of the annual hot water requirements.

Wastewater from Hammarby's treatment plant also fuels the production of district heating in the heat plant and cooling in the district cooling network. Food waste, newspapers, papers and other discarded materials are separated and stored in different refuse chutes which are connected to underground vacuum-powered pipes leading to central collection station. Waste is sent to large containers by an advanced control system and containers are collected.

In Vauban, all buildings are low-energy constructions. According to German legal norms, they must consume less than 65 Kilowatt hours per square meter per annum which is possible through efficient insulation and a communal heating station situated

in the northern part of the site. Furthermore, Vauban's passive houses are another efficient structural form that, like solar houses, create and share energy. The reason why Vauban is energetically successful is that all new constructions must follow passive house standards.

In Park Oran, the heating system is based on four central sources, each of which feeds blocks of residencies. Individual units pay for their heating based on individual consumption. Electricity for the units is purchased from a private company unlike sustainable projects like Vauban and Hammarby which generate their own. Fuel in the form of natural gas, is provided by the Allocator Company. Due to the considerable quantity of natural gas consumed, Park Oran benefits from discounted fuel prices, an economical aspect related to energy for the residents. In terms of improving energy efficiency, better insulation and window systems have been considered to prevent energy from being wasted through the physical structure of the buildings.

In terms of quantitative consumption data, the annual energy use for heating and cooling is 2,688,777m³ and annual electricity consumption is 4,871,473 KWh. According to successful sustainable projects, the annual norm for energy consumption is 65 kilowatt hours per square meter. Based on the aggregate construction area of Park Oran (16,000 square meters), the per annum energy consumption is around 305 kilowatt hours per square meter. This level of consumption, around 4.5 times higher than sustainable norms, indicates that Park Oran's consumption of energy by far surpasses the accepted level for sustainability and cannot be considered as having an efficient consumption of energy.

With respect to waste management, there are no special measures to reduce waste generation and no special measures to recycle and reuse wastes; however, there is a special waste collection program to collect generated wastes. Special boxes are located in front of each building to wastes such as papers and bottles in distinct receptacles. The wastes are then taken by a special program and are delivered to the municipality to be recycled.

Ultimately, based on the criteria for infilling guidelines which have been explored in the Park Oran redevelopment project, this project can now be assessed in terms of whether or not it makes any contribution in the Ankara urban fabric regarding sustainability and if so, to what extent and based on what criteria can Park Oran be evaluated as a sustainable development. Related guidelines, which have been derived from comprehensive exploration of infilling and its role in making sustainable communities (much of which has been described in Chapter 2), were prepared by the researcher in the form of a sustainability criteria chart (Table 3.4). The following outcome is the result of the comprehensive assessment of the Park Oran redevelopment project, results which are further discussed in Chapter 4 (Conclusion).

Table 3.4. Sustainability guidelines and the general evaluation of Park Oran (Source: Researcher)

Criteria	Evaluation of Park Oran	
	Δ= strong ○= acceptable □ = weak	
Mobility (Urban Form and Connectivity)		
• Accessibility		□
• Connectivity		□
• Independence from private		□
• Integration		□
• Network of streets, roads, paths		□
• Parking availability		□
• Public transport access and		□
• Renewal of infrastructure		□
• Walkability		□
Use and activity (Mixed Use)		
• Compatibility		□
• Comprehensive plan		□
• Landscape variety	○	
• Public amenities	Δ	
• Vitality		□

• Well-integrated function		□
Diversity		
• Affordable housing		□
• Architectural styles		□
• Density	Δ	
• Housing types		□
• Income level variety		□
• Sense of place		□
• Social inclusion		□
• Urban landscape	Δ	
Energy Efficiency		
• Improvement of energy efficiency		□
• Recycling program		□
• Reduction in waste and waste	Δ	
• Self-generated energy		□
• Waste collection program	Δ	

In conclusion, according to the general evaluation submitted above, the extent of this project's contribution to the sustainability in the Ankara urban fabric is summarized as the following (Table 3.5):

Table 3.5. Contribution of Park Oran regarding sustainability in Ankara's urban fabric
(Source: Researcher).

<p>Sustainable elements</p>	<p>Landscape variety Public amenities Urban landscape Density Reduction in waste and waste management Waste collection program</p>	
<p>Unsustainable elements</p>	<p>Accessibility Parking Connectivity Network of streets Integration Walkability Public transport Renewal of infrastructure Car dependency Mixed use Vitality Well-integrated function</p>	<p>Compatibility Comprehensive plan Walkability Social inclusion Vitality Housing types Architectural styles Recycling Affordable housing Income level variety Sense of place Recycling</p>

CHAPTER 4

CONCLUSION

“Spaces conceal their contents by means of meanings, by means of an absence of meanings or by means of an overload of meaning..... spaces sometimes lie just as things lie, even though they are not themselves things.”

(Henri Lefebvre, The Production of Space)

The final chapter summarizes the Park Oran case study in order to be reminded of the key problems, discusses the survey results, responses and evaluation and suggests related policies with respect to sustainable urban growth design guidelines in inner city areas in order to prevent the extension of urban territories towards peripheral areas and wilderness.

In the beginning of the study, the problem presented was urban sprawl growth in peripheral and suburban areas, known worldwide as the uncontrolled expansion of low-density, single- use suburban development, built and scattered around the countryside.

Such excessive spatial growth is knowingly caused by three types of market failure related to failures in benefitting from open spaces, accounting for social costs of congestion, and relying on the public sector to account for costs of new development (Brueckner, 2000).

To address the problem of environmentally and socially destructive urban development projects, various policy instruments must be developed and integrated with the land use approach in order to work towards achieving sustainable urban

development projects. Otherwise, future projects will be ineffective solutions to the most pressing design problems and will eventually lead to market failure.

Subsequently, this thesis has hypothesized that problems related to urban sprawl can be alleviated by adopting four parameters of infill development regarding mobility, use and activities, diversity and energy efficiency. The benefits of infill development, as hypothesized in this thesis, are as follows:

- **Mobility:** Effective infill development can reduce even eliminate car dependency and can be supplanted by sustainable transportation modes such as walking, cycling and public transportation (PT) thereby ameliorating the current climate change crisis.
- **Use and activities, Diversity:** Strong infill development creates mixed physical and social communities, thereby generating heterogeneous urban fabric which enhances social equity and affordability.
- **Energy efficiency:** Effective infill development can help change patterns and lifestyles of urban communities in such ways that encourage more efficient energy and natural resource consumption.

In chapter 2, sprawl threats regarding social, environmental and economic aspects were discussed including its consequences for both developing and developed countries ranging from ruining social communities to exacerbating diminishing natural resources. Without the adoption of appropriate policies and instruments to alleviate related social, economic and environmental effects of urban sprawl, a growing availability of capital resources will continue to have an adverse impact on urban environments.

As a means to ameliorate the harmful impacts of urban sprawl, chapter 2 presented a special emphasis on infill development, including its identifying background, merits and shortcomings and its relationship with sprawl growth. At the same time, it is important to note the barriers of infill development related to sociability, comfort and aesthetics, function of activities as well as access and connectivity.

In order to better understand the merits and beneficial features of infill development projects on an international scale, three successful infill development projects (Hammarby, False Creek North, and Vauban) were selected and analyzed based on a defined set of infill design guidelines.

The Hammarby project, which was analyzed and studied thoroughly in this research study, is one of the most successful infill projects which contributes to sustainable urban development in inner city area in Stockholm based on this study's infill design guide line including mobility and urban form, use and activity and mixed-use development, diversity and architectural typology and environmental aspects and energy efficiency.

The Hammarby project in Stockholm, Sweden, one of the most successful infill development projects worldwide, contributes to sustainable urban development through its connectivity, transformation of land-use, diversity in design, and energy efficiency and water management. The merits of Vauban, located in Freiburg, Germany, include being well-connected, energy efficient, architecturally diverse, and socially inclusive, all key attributes of successful infill development. Similarly, to Hammarby and Vauban, False Creek North in Vancouver, Canada offers connectivity, design diversity and, a particular highlight of this project, affordable housing.

The Park Oran is the infilling project in the Ankara which was comprehensively analyzed in chapter 3 based on four proposed hypotheses to understand whether this infill project contributes to compactness and sustainability. The findings of the case study, presented in chapter 3, demonstrate that Park Oran, although the best possible example of infill development in Ankara, Turkey, fails on many levels to meet the guidelines for sustainable development. Although Park Oran Project may facilitate a mixed-use environment and allow residents to easily access food and shopping within walking distances, the development lacks accessibility, convenient public transportation, affordability, and diversity- key features of successful infill projects.

Instead, the Park Oran Project seems to have fallen victim to financial-oriented development- a complex built for profit rather than sustainability.

While this study has focused mainly on planning and design guideline that would contribute to the more sustainable communities, to achieve urban sustainability's goals that guideline needs to be supported with transport policies encouraging the use of public transport, walking and cycling. Furthermore, it is clear that policy makers have to incentive affordable housing in the proximity of work places, thereby reducing car dependency which is a major reason for environmental pollution. The policies fulfilled in Vauban and Hammarby projects to shorten distances travelled by citizens which have made a great contribution to alleviating environmental pollution.

These findings indicate that it is impossible to attain a social and physical diversity in the new development when development is left to market forces. Market-lead development results in more car dependency accompanied by no comprehensive and strict planning control which fails to integrate urban environment. With respect to this study finding, creating a dense mixed-use development along sustainable transit corridors favored by high-income residents may not be feasible. Consequently, it is important to change commuting patterns of citizens of such areas towards less car dependency in order to achieve urban sustainability objectives.

Deciding the location and form of future developments has serious impacts on future residents' lives regarding social, environmental, economic and health-related aspects. In order for future communities to have positive impacts for their residents (and the environment), they must achieve these objectives:

- Be located close to transportation hubs so as to promote walking and cycling, thereby alleviating car dependency and promoting a more efficient use of energy.
- Be designed for social diversity and inclusion in architecturally diverse communities so as to make a sense of place and affordability, thereby allowing

residents benefit from amenities more evenly as compared private communities.

In order for Park Oran to become a successful example of infill development and join the ranks of cornerstone projects such as Hammarby, this complex should adopt principles and guidelines of infill design. Below are suggestions for improvement:

- Integrate Park Oran to the inner city areas through convenient public transport such as tram line to mitigate car dependency
- Create mixed densities and work and commercial opportunities in the proximity of Park Oran to promote social diversity and inclusive urban environment in self-sufficient community
- Incentivize affordable housing policies so that middle-income residents can afford living in Park Oran and similar mixed-use developments
- Enrich housing types and architectural styles so as to promote diversity and vibrancy to prevent mono-cultural and monotonous life
- Integrate Park Oran to the social and physical fabric to encourage new urbanity
- Change the energy consumption pattern towards less dependency on fossil fuels through offering appropriate substitutes such as solar energy

To conclude, infill development includes a range of strategies and criteria which promote sustainability in urban fabric and help protect our health, natural environment and natural resources which makes communities more livable, economically stronger and more socially divers. Additionally, promoting sustainable modes of transportation and efficient energy use are critical and timely outcomes of infill development projects.

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APPENDICES

Questionnaire Regarding Park Oran Households

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PARK ORAN KONUTLARI KULLANICI ANKETİ

Sayın Park Oran Sakini,

Hadi Javani, Orta Doğu Teknik Üniversitesi, Şehir ve Bölge Planlama Bölümü, Kentsel Tasarım Yüksek Lisans Programına kayıtlı bir öğrencidir. Öğrencim Hadi Javani, yüksek lisans tez çalışmasında; kentsel dönüşüm projelerinin sürdürülebilir kentsel gelişmeye olan katkılarını tespit etmeyi ve bu projelerden daha etkin yararlanabilmek için stratejiler geliştirmeyi hedeflemektedir. Alan araştırmasını, Park Oran Konutları özelinde yapmakta olup, veri toplamak amacıyla bu anket çalışmasını yürütmektedir.

Anketin amacı; Park Oran Konutları sakinlerinin gündelik yaşamlarında kentin diğer çalışma ve yaşama bölgeleri ile nasıl ilişki kurduklarını ve Park Oran Konutlarında yaşama tercihinde nelerin etkili olduğunu anlamaktır. Katılanların kimlik bilgilerine ve özel yaşamlarına ilişkin sorular ankette yer almamaktadır. Elde edilen bilgiler sadece ilgili tez çalışmasında ve akademik amaçla kullanılacak olup, üçüncü şahıslar ya da başka kurumlar ile paylaşılması söz konusu değildir.

Öğrencimin anket çalışmasına katılma nezaketini gösterdiğiniz için teşekkür ederim.

08/12/2015

Saygılarımla,


Doç. Dr. Osman Balaban
Öğretim Üyesi - Tez Danışmanı

ANKET SORULARI

- 1- Kaç yıldır Park Oran Konutlarında oturmaktasınız?
- 2- Ev Sahibi: Kiracı: Diğer:
- 3- Özel aracınız var mı? Evet: Hayır:
- 4- Cevabınız evet ise, sahip olduğunuz araç sayısı:
- 5- İşyeriniz hangi semtte (Ankara'nın neresinde çalışıyorsunuz)?:
- 6- İşinize nasıl gidip geliyorsunuz?
Özel Aracımla: Yürüyerek: Toplu Taşımayla:
İşyeri Servisi: Araç Paylaşımı: Diğer:
- 7- Özel aracınızı ne sıklıkla kullanıyorsunuz?
Her gün: İki günde bir: Haftada birkaç kez:
Haftada bir kez: Ayda birkaç kez: Diğer:

8- Aile fertleriniz ne sıklıkla özel araç kullanıyor?
Her gün: İki günde bir: Haftada birkaç kez:
Haftada bir kez: Ayda birkaç kez: Diğer:

9- Toplu taşıma (otobüs, metro, dolmuş) kullanıyor musunuz? Evet: .. Hayır:

10- Cevabınız evet ise; hangi sıklıkla ve hangi toplu taşıma aracını kullanıyorsunuz?

11- Cevabınız hayır ise; toplu taşıma kullanmama nedeniniz nedir?
.....

12- Ne sıklıkla alışverişe gidersiniz?
Her gün: İki günde bir: Haftada birkaç kez:
Haftada bir kez: Ayda birkaç kez: Diğer:

13- Alışveriş için genellikle nerelere gidersiniz?

14- Alışveriş yapmaya nasıl gidip geliyorsunuz?
Özel Aracımla: Yürüyerek: Toplu Taşımayla:
Taksiyle: Araç Paylaşımı: Diğer:

15- Park Oran çevresinde, **yürüme mesafesinde** günlük ihtiyaçlarınızı karşılamaya olanak verecek imkanlar var mı? Evet: Hayır: Kısmen:
.....
.....

16- Park Oran Konutlarında yaşamın sizi en çok memnun eden yanları nelerdir?

17- Park Oran Konutlarında yaşamın sizi memnun etmeyen yanları varsa bunlar nelerdir?

Figure 0.1. Questionnaire regarding Park Oran households