

**Measuring the level of mixed-use and compactness of Gottera Condominium site in
Addis Ababa, Ethiopia**



Kalkidan Ketema Kebede

A Thesis Submitted to

The department of Architecture and Urban Planning and Design

School of Civil Engineering and Architecture

Presented in Partial Fulfilment of the Requirement for the Degree of Master's in Urban
Planning and Design

Office of Graduate Studies
Adama Science and Technology University

Adama, Ethiopia

July, 2021

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APPROVAL OF BOARD OF EXAMINERS

I, the advisor of the thesis entitled “**Measuring the level of mixed-use and compactness of Gottera Condominium site in Addis Ababa, Ethiopia**” and developed by **Kalkidan Ketema** hereby certify that the recommendation and suggestions made by the board of examiners are appropriately incorporated into the final version of the thesis.

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We, the undersigned, members of the Board of Examiners of the thesis by **Kalkidan Ketema** have read and evaluated the thesis entitled “**Measuring the level of mixed-use and compactness of Gottera Condominium site in Addis Ababa, Ethiopia**” and examined the candidate during open defense. This is, therefore, to certify that the thesis is accepted for partial fulfillment of the requirement of the degree of Master of Science in Urban Planning and Design.

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DECLARATION

I hereby declare that this Master Thesis entitled “**Measuring the level of mixed-use and compactness of Gottera Condominium site in Addis Ababa, Ethiopia**” is my original work. That is, it has not been submitted for the award of any academic degree, diploma or certificate in any other university. All sources of materials that are used for this thesis have been duly acknowledged through citation.

Name of the student

Signature

Date

RECOMMENDATION

I, the advisor of this thesis, hereby certify that I/we have read the revised version of the thesis entitled “**Measuring the level of mixed-use and compactness of Gottera Condominium site in Addis Ababa, Ethiopia**” prepared under my/our guidance by Kalkidan Ketema submitted in partial fulfillment of the requirements for the degree of Master’s of Science in Urban Planning and Design. Therefore, I recommend the submission of revised version of the thesis to the department following the applicable procedures.

Major Advisor

Signature

Date

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LIST OF ACRONYMS AND ABBREVIATIONS

AACPPO:	Addis Ababa City Structure Plan
AU:	African Union
ECA:	Economic Commission of Africa
FDRE:	Federal Democratic Republic Of Ethiopia
IHDP:	Integrated Housing Development Program
SPSS:	Statistical Packages for Social Science
TOD:	Transit-oriented development
OCED:	Organization for Economic Co-operation and Development
UNCEP:	University of North Carolina Exchange Program
UN-Habitats:	United Nations Human Settlements Programme

ABSTRACT

Compactness/ Compact development is one of the recent concepts on achieving sustainability in urban planning. It is characterized by three classifications is into economic density, morphological density and mixed land. And its positive implication on urban development is obtained through sustainable transport mode, improved service access, lower crime rates, social equity, a higher value of space, shorter trip length, lower energy consumption and more efficient division of local public services. And it is also expected to have a negative implication on the absence of greenery and open space and other health-wise effects it might bring. In this paper the practice of compact city development is discussed on cities in developing countries with low income like Addis Ababa, Ethiopia. The conditions in the Gottera condominium are discussed to answer the research questions how mixed and compact is Gottera condominium?, What are the evaluation variables for compact development and mixed use and what are the mechanism to practice the best mixed use and compact development? Using the mixed methodology for gathered data and analysis findings are indicated that the Gottera condominium has fulfilled some requirements of compact development and mixed use like walkability, density, mixed uses and other concepts that make a neighbourhood sustainable.

Keyword: compact development, condominium, mixed-use, sustainability, urban development.

CHAPTER ONE

INTRODUCTION

Urban design can be defined as “the coordination of essential functions in a pleasing form that improves the quality of life in an urban area” (Frederick G, 1953 p). Policy makers for the sustainability of urban areas take high-density development as a key strategy for accommodation of population growth and mitigate human impacts of the local and global environment. (Are, Elisabeth et al. 2019). As good architecture rises the physical, mental and spiritual level of occupants, urban design on a larger scale improves the life of the people.

On achieving sustainability in urban planning one of the recent concepts is compact city development. It promotes sustainability through reduction of car use, conservation of surrounding natural areas, reducing energy use in buildings, providing better capacity utilization of urban infrastructure, and maintaining a mixed land use that provides work opportunities and accessibility to service facilities and social contacts. (Are, Elisabeth et al. 2019). Sustainable development is defined as the actions taken today that should not compromise future generations in the Brundtland report and still remains a valid starting point. Its broad and one important consequence of the search for sustainable urban development has been a resurgence of interest in compact city theories and policies.

As the urban form is the spatial composition of elements that repeat, its contribution for the sustainability of the city is higher. (Jabreen, 2006). In the process of achieving sustainable urban development, scaling down to the study site, from the stated principles and sustainable urban forms by Jabreen (2006), one is compact development. Brundtland commission and UNCEP Agenda 21 stated that Compactness is nowadays as new urbanism it is taken as imperative for sustainability through waste minimization and resource conservation.

The difference in socio-economic conditions of the urban populations of developing countries has meant that compact city approaches have focused and must continue to do so on the ‘development’ side of the sustainability agenda (Junks, et al. 2004). They acknowledge that development and growth are essential for meeting existing basic human needs and those derived from population growth and rising expectations, and that this demands exploitation of natural

resources, environmental services and the use of nature as a sink. As a result, good urban design plays an important part in the economic wellbeing of a community (Junks, et al. 2004).

Therefore, this thesis studied the components of compact city development and their configuration with respect to the dimensions of urban design & requirements of the people. On this paper the benefits of practicing the compact city development approach having an objective of identifying the design gaps of condominium sites in Addis Ababa in order to explain the application of mixed-use and compact development for increasing the communities' quality of life is analyzed. The research paper is significant to evaluate the existing scale of compact and mixed development in the study area and to give recommendation for improvements in the selected studied area and other future developments.

The motivation for this study is the observation of the housing and transportation problem in Addis Ababa especially in the center of the urban areas and condominium houses and thinking of the better ways to be applicable on existing developed areas and future development. The Gottera condominium is located in the center of Addis Ababa, Kirkos sub-city and it is mixed residence with highly active economic and social activities, the vehicles, high price of rents and noise from different commercials are characteristics that brings motivation for studying its mixed-use and compact development and Secondly, to get the Master's degree along with the study's consequential benefits.

1.1. Background of the study

Many literatures on the compact city development states that the benefits and its characteristics by classifying it in to three. Those are economic density, morphological density and mixed land use (Ahfeldt, et al. 2017). Those are the broad classification made to generalize the outcome of the compact development. Describing the benefits of compact development has more positive effect in urban form than its negative effects (Ahfeldt, et al. 2017). Compact city development is expected to bring convenient life for the society through this idea the terrific and environmental air pollution caused by automobiles is to be reduced and increase in walkability is to be maintained.

The social livability in compact development area goes with economic density where productivity and innovation are practiced. Studying the neighborhood and social activities within the society and their interaction, the compact development makes the city more livable

and convenient (Shirazi, M. R, 2020). The mixed land used in the compact development is studied as that the benefits of the patterns used and the land value to be maintained while the services to be provided are placed in mixed form (Suen, I.-S, 2018). Studies and written literatures are found dominantly concerning on developed and developing countries in the world.

In Africa, the last few decades have experienced unprecedented urban growth, where a three times increase in the built-up urban area (up to 0.6 million square km of cities with million-plus populations) from the year 2000 to 2030 is projected. (Rajashree, Pankaj et al. 2014). In Ethiopia context, as it is written in the Final Summary Report of AACPPPO (2017-2027). The Addis Ababa structural plan is prepared for “improved living standards and to sustainable development “by indicating major “development activities ... to enhance the capacity of citizens for development and to meet their basic needs” taking reference (FDRE constitution art 43(1) and (4)), providing livable and inclusive urban housing and other services are goals to be achieved. So this research is done on how compactness and mixed development is being practiced with respect to the economy, environment and the socio-economic status of the city in order to meet the peoples need and study sustainability using the approach of compact city development.

1.2. Statement of the problem

In recent years a rapid increase in land values is a major obstacle that has been seen in many cities in developing countries as the demand for urban space has soared. (Junks, et al. 2004).

Cities are getting crowded and polluted because of different accommodation of peoples, vehicles and activities. And the plans of the cities are the reason for the problem. Many cities in Ethiopia are not designed under urban planning principles and guidelines rather they are established by the rough settlements of the people. Some cities are established because of industry, some are because of the natural resource of the area. Urban sprawl is continuously observed and the cities are getting bigger. Although along with expansion and urban sprawl the land value, distribution of services and transportation problems are getting bigger.

Cities like Addis Ababa where urban sprawl is highly observed and land scarcity is the biggest issue as land value is highly increased, the demand for housing, accessibility and other services are increasing from time to time because of the flow of peoples from a rural area to urban is in biggest rate. Rapid population growth brings rapid environmental deterioration and social problems which influence the social, environmental and economic sustainability of cities.

Currently on the government side the short-term focus on meeting immediate needs rather than considering longer-term issues of sustainability is likely to prove very costly in the long-term, due to the high cost and complexity of retrofitting and rebuilding infrastructure.

The designs of the condominiums and their surrounding plays a great role to make a city livable because now a days housing investment like condominium is widely undertaken and also many ongoing projects are there. They are densely occupied with the same type of functions so peoples have to go far for the sake of work, education, shopping, personal business, leisure and others activities. Through compact development, mixed-use development for the diversity of services can minimize urban sprawl and land fragmentation because it concerns on denser development in urban areas with variety of services included in one area. For rapidly growing urbanization the problems of efficient transportation, housing and other mixed uses have to design for city quality and thereby the quality of life and sustainability.

Gottera condominium is among one of the previous housing project in Addis Ababa and the compound is very active and vibrant. Different activities and services are available and it is also located in the center of Addis Ababa city, nearly to the Gottera square which makes it the very first to be chosen by the peoples. Its mixed environment indicates that it is in some degree compact and dense. The concept of compact developemnt concerns on achieving sustainable urban environment within city center through sustainable transportation and dense and mixed developments, so measuring and evaluating the compactness and mixed development in Gottera condominium site is helpful in understanding the concept of compact city development and its application in Ethiopia especially in cities like Addis Ababa.

1.3.Objectives of the research

General objective

To identify the design gaps of condominium sites in Addis Ababa in order to explain the application of mixed-use and compact development for increasing the communities' quality of life.

Specific objectives

1. To measure how compact is Gottera condominium site.
2. To evaluate how compact development is applied in the condominium housings of in the study area.
3. To identify the mechanisms to adapt best mixed-use compact development in the condominium neighborhood of the study area.

1.4.Research questions

This paper is interested in determining how well compact city development influences local city development and the community. Particularly to answer the following questions

1. How compact is the selected study area?
2. What are the evaluation variables for the compact development application in the selected site?
3. What are the mechanisms to exercise best mixed-use and compact development in the condominium neighborhood of the study area?

1.5.Significance

The outcome of the study will be very important to insight the following main reasons along the study routes.

To understand the current condition of the existing housing and related services along the study area are designed and provided safely and assessing the density of housing with respect to the area and other significant services will be helpful to understand the usage of resource effectively or will identify if there is a gap.

The finding of this research will help the future development of condominium housing to be sustainable and effective in terms of cost, land and so on. And also it could be a significant input for plans of mixed housing development in the central urban areas regarding the provision of a walkable urban environment. Finally it helps to insight the concerned government body and the community that walking is the best transportation mode and inclusive pedestrian is a must in the design of urban areas to create livable and walkable neighborhood and urban environments.

1.6.Scope of the study

The study had framed the magnitude of the assessment both thematic and spatial scopes as follows:

Thematic scope

Thematically the study has focused on the compactness and mixed development analysis of Gottera condominium in Addis Ababa, investigating the density of housing and other services, the walkability of the site and its integration with the big developments around the surrounding through analysis of its different routes of the condominium site and facilities which make the life of the households better and the transportation system easier.

Spatial scope

The spatial scope of the study is the compound of Gottera condominium with an area of 135,255m² which has 78 condominium blocks and 6 communal spaces within 13 parcels.

1.7.Limitation of the study

Getting the appropriate measurement of the walkability due to the lack of walk score tool developed in our country Ethiopia. Getting detail and full information of standards to be applied in any condominium housing in the context of our country.

1.8. Organization of the Thesis

The thesis is categorized into five chapters. Each chapter systematically and effectively examines the content and data of the study accordingly. The fundamental chapters in this paper are further demonstrated as follows.

Chapter One: The introduction chapter of the study introduce the thesis by lighting the main topic of the study, research problems, objectives, questions, significance, scope, and research design in detail.

Chapter Two: Literature Review chapter discusses key definitions, theories and emerial review concerning on compactness, mixed development, condominium housing.

Chapter Three: Research Methodology is a chapter that discusses the methodology of the research. The chapter explains the methods used for the study and the process of data collection and analysis in detail.

Chapter Four: Result and Discussion is a chapter that discusses the results of qualitative and quantitative data findings..

Chapter Five: Conclusion and recommendation is the concluding part of the thesis. The chapter made a conclusion based on the findings from the literature review, the case study of Gottera condominium site, and the results of the discussions. Additionally, recommendation are given for future development.

CHAPTER TWO

LITERATURE REVIEW

The concept of urban planning began to evolve in the second half of the 19th c. as a reaction to industrialization which created inequality in the living conditions of the people. On achieving sustainability in urban planning one of the recent concept is compact city development. There are different authors who wrote on this approach based on its meaning indifferent parts of the world, based on its applicability, based on its outcomes whether it is positive or negative on the city or area it is to be practiced. In history compact city development is defined as a development on the urban form which is characterized by compactness (OECD 2012, p15). In recent times it is defined as a development which has dense and proximal development patterns, urban areas linked by a public transport system and accessibility to local services and jobs as characteristics. (OCED 2012, p15).

2.1. Theoretical Review

2.1.1. Compact city

Compact city development is broad concept with different characteristics in urban design. A Compact city is defined by Burton, (2002) as “a relatively high density, mixed-use city, based on an efficient public transport system and dimension that encourage walking and cycling”. This compact city model plays a vital role in concurrent urban planning as it brings many outcomes like increase in productivity, along with economic density, innovation and competition increase within the society using the people’s potential to innovate and create new business opportunities (OECD, 2012, p15). The compact city consists of various elements such as high density, mixed uses, public transportation, accessibility, social equity, and urban containment (Matthey-Doret, 2015).

Compactness is described as the minimization of energy, material, water, products and peoples. (Jabreen, 2006). According to OECD (2012) and UN-Habitat (2014 a) the characteristics of the compact city are discussed as heterogeneity and diversity of urban functions, socio-demographic layers, modes of infrastructure, modes of accessibility to utilities, Density, including proximity to other agents, facilitation of networking and communication, the intensity

of shared resources and information and accessibility through networkability, diversity of trajectories and self-organizable.

Compact city is mentioned as one of the sustainability imperatives of resource conservation and waste-minimization in the Brundtland Commission report and the UNCED Agenda 21 proposals published in the late 18 and the early 19. The compact city can promote sustainability by reducing the amount of travel and shortening commute time; decreasing car dependency; lowering per capita rates of energy use; limiting the consumption of building and infrastructure materials; mitigating pollution; maintaining the diversity for choice among workplaces, service facilities, and social contacts; and limiting the loss of green and natural areas. (S.E. Bibri et al., 2020). A compact city is also referred to as a city of short distances, in contrast to a car-oriented and urban sprawled modern city of the world (Jenks, 2019). It can be characterized by an efficient, multifunctional, and multi-modal transport system, while fostering relatively high population densities.

By multiple analyses of quality the outcomes of compact city development is found to be positive from the following categories. The positive intends to indicate that the sustainable transport mode, improved service access, lower crime rates, social equity, higher value of space, shorter trip length, lower energy consumption and more efficient division of local public services. While the negative indicates the problem that the compact city development may bring like some negative effects on the health, subjective wellbeing, terrific flow and open space preservation. The characteristics and outcomes of the compact development indicates a more positive effect on the area based than the individual based (Ahfeldt, Gabriel et al. 2017). The compact city development has a positive impact on the consumption of transport energy by reducing the need to travel (Brehery, 1995).

2.1.2 Mixed-use Development

Different thought about mixed-use development tells as it is a complex urban development concept which integrates multiple dimensions and aspects. According to Jill (2007) having this complex urban development in a given area has its own positive and negative impact on the occupants or users. He mentioned, economic vitality, social equity, and environmental quality are the advantage whereas cultural and economic forces are the drawbacks. The advantage of

mixed-use in one's country maybe it's the main problem in another country, therefore Jills finding may vary from country to country.

Mixed-use is defined as a type of development that mixes several lands uses together and it has some similarity with multiple-use. (Herndon, 2011). But further examinations on the concept of mixed-use reveals, it has different meaning to that of multiple use. According to Levitt and Schwanke (2003), multiple-use development doesn't consider integration, density and compatibility of land uses as compared to mixed use development. Different writers have different suggestion about the unity of uses in mixed use development. Levitt and Schwanke (2003) in his paper suggest that, integration of at least three substantial revenue- producing uses should have to be integrated in mixed-use. However, according to (e.g. Hoppenbrouwer and Louw (2005)) having two compatible uses within a mixed-use neighborhood is already adequate.

The contained urban land in compact settlements which is shared by more people with high density may have higher land prices not affordable to disadvantageous groups. Noise pollution is also a major concern in mixed land use areas and conflict may occur with diversified uses. Adaptability to compact living, high density and mass transit is highly culturally and regionally dependent. Compact forms may be more prone to devastation in case of disasters. Thus, the constraints lie in the provision of open spaces, overcrowding, complex urban management, increased land prices, pollution, regional adaptability, disaster resiliency. (Rajashree, et al. 2014).

The characteristics and outputs of the compact city development are theoretically synthesized by being classified in to three. The classification is in to economic density, morphological density and mixed land guided by the theoretical literature and policy reports Churchman (1999) and Neuman (2005). By classifying the outcomes for both individual-based (productivity, innovation, and wellbeing) and area-based (pollution and equality). The summary of the principal compact outcomes lists productivity, innovation, the value of space, job accessibility, sustainable mod choice, health and wellbeing under individual based outcomes and service access, the efficiency of public services, social equity, safety, open space, pollution reduction, energy efficiency, and terrific flow as area-based outcomes.

i. Mixed Residence

The concept of mixed residence implies the integration of different but compatible activities inside residential neighborhoods. This limits trips by encouraging working, living and getting services nearby. The inherent idea embedded within the concept of mixed-use or ‘mixity’ is the creation of a vibrant environment. This requires mixing residential housing with commerce and a local market complete with but not limited to lower-level services, access and local streets, community open space and playgrounds, and a neighborhood park.

2.1.3 Compact city and Sustainable Development

Sustainable compact-city development relies on severe restrictions on individual car use, a well-developed public transportation system, and walkable neighborhoods and urban areas and also on the importance of public transportation and non-motorized travel for compact-city livability. However, at the same time, they perceive heavy restrictions on car use as a severe obstacle to increasing the attractiveness of urban environments to wider groups of people. Car sharing is a measure used to mitigate the needs for individual car ownership, but several respondents strongly argued for facilitating neighborhoods for private cars. (Are, et al. 2019).

The sustainable development concept, which became popular in 1987, has been identified as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (World Commission on Environment and Development, 1987). In a while, the concept of sustainable development, which is premised on three main pillars: economic development, social equity and environmental protection, (International Institute for Sustainable Development, 2010) has turned into a global guiding principle for many disciplines, including urban planning and development.

The sustainability benefits of compact city can be discussed by classifying into three. Environmental sustainability, economic sustainability and social sustainability. The table 2.3 shows the three main sustainability benefits of compact city.

Table 2.1 the main sustainability benefits of the compact city.

Environmental sustainability
Lowering per capita rates of energy use and requiring less and cheaper per capita infrastructure provision
Lowering energy consumption and reducing pollution due to the proximity to workplaces, services, facilities, and public spaces
Decreasing travel needs and costs and shortening commute times
Minimizing the transportation of energy, materials, water, and products due to the compactness of the built environment
Optimizing the efficiency of the public transport system
Limiting the consumption of building and infrastructure materials
Reducing car dependency and thus CO ₂ emissions through encouraging walking and cycling
Conserving energy by combining heat and power provisions made possible by population densities
Reducing the pressure on ecosystem services and biodiversity provided by green and natural areas.
Limiting the loss of green and natural areas
Protecting rural and agricultural land from further development
Economic sustainability
Supporting local services and businesses through population densities, i.e., providing a larger customer basis for commercial activities
Revitalizing city centers through the promotion of densely built dwellings, shops, businesses, and accessible infrastructure and facilities
Extending and enhancing public transportation infrastructure and facilities
Creating proximity between employees and their workplaces
Promoting greater diversity among employers and thus greater diversity of job possibilities
Increasing the likelihood of workers finding jobs that match their skills, which results in higher productivity
Maintaining the diversity for choice among workplaces, service facilities, and social contacts

Social sustainability
Creating a better quality of life through more social interaction, community spirit, and cultural vitality due to the proximity to facilities, services, amenities, workplaces, public spaces, public transportation, as well as the opportunity for walking and cycling
Reducing crime and providing a feeling of safety through natural surveillance
Improving social equity through better access to services and facilities and flexible design of housing in terms of mixed forms and affordability
Enhancing social cohesion through a sense of belonging and connectedness
Supporting human, psychological, and physical health through ready access to open green space, walkability in neighborhoods, and social contact
Enhancing livability in terms of social stability and cultural and recreational possibilities
Healing spatial segregation by forging the physical links and bridging barriers between communities

Source: S.E. Bibri et al. (2020)

2.1.4 Connection and Movement

According to Llewelyn – Davies Urban Compendium book 2008 for any development to be successful good connection and access is the basic thing. Walking, cycling and public transport have to be in favor so that all forms of movements to be achieved. The quality of movement can be defined in terms of some consideration that can be taken as evaluation variables. When one talk of circulation one need to consider the

- Access and mobility, walking, cycling, public transport, private vehicle, interchanges.
Permeability, barriers, rights of way and boundary treatment.

i. Walkable neighborhood

A neighborhood can be called walkable through measuring how many peoples actually walk, compared to how many drive in the area. When neighborhoods are walkable they bring different benefits to one’s health, financial wellbeing, communities and global preservation. Walkability is measured through different mechanisms and walk score is a tool designed to promote pedestrian oriented communities in developed countries. Using data like city boundaries, neighborhood boundaries, population data and walk score algorithm. The walk score algorithm measures the walkability through proximity to amenities through sending amenities to nearby

to be registered on the website. So this practice of improving walkability through measuring it on websites has been worked on in different worlds of developed countries but in case of our Country Ethiopia this website is not begin to be sated.

2.1.5 Condominium Housing

Practicing in 2005, to solve the housing problem of Addis Ababa city it has announced the “Integrated Housing Development Program (IHDP)”. In this program the government provided low cost condominium housing for the home seekers. This form of housing tenure which is called Condominium has individual housing units which contains communal areas and elevator in some sites, playing area, commercial units and other facilities in common. In condominium site there is no individual ownership over plots of land i.e. the land is owned by all member of the household or house owner (UN-HABITAT, 2011). That’s why in terms of ownership, condominium homeowner differs from individual parcel homeowners. In addition to this most of the condominiums have residential units and commercial units together.

The condominium site has ten percent commercial units, and those commercial units are located at ground level and in some place, they are located on the first floor. These commercial units are sold, not rented, and the plots of land for commercial use are leased (UN-HABITAT, 2011). Those commercial units that have limited size or small size are not appropriate for large-scale industrial enterprises and therefore can only accommodate small businesses which do not require special spaces or service provision. The type of commercial units listed in IHDP are small shops, restaurants, pharmacies, salons and music shops. According to the development program there are no restrictions on commercial types and activities and this may have its own impact on the day to day activities of residents of the site (UN-HABITAT, 2011).

2.1.6 Theories related to Mixed Use and Compact Development

Related theories and concepts which are advocated by James Howard Kunstler are Transit-oriented development (TOD), Smart Growth, New Urbanism and Intelligent Urbanism. These theories were derived from research into efficient old and new cities. (Caleb, 2009)

The Smart Growth theory has a concept that elaborates and indicates that the intensification and sustainable transportation has an advantage for future sustainable development. It is an urban planning and transportation theory that concentrates on growth in the center of a city to avoid

urban sprawl; and it advocates compact, transit-oriented, walkable, bicycle-friendly land use, including neighborhood schools, streets that work for everyone, mixed-use development with a range of housing choices. (Caleb, 2009)

Transit-oriented development is an urban design principle on its own so that it can also be a feature in other related theories such as Smart Growth. Transit-oriented development (TOD) is a residential or commercial area designed to maximize access to public transport, and mixed-use/compact neighborhoods tend to use transit at all times of the day. TODs generally are expected to be located within a radius of one-quarter to one-half mile (0.4 to 0.8 km) from a transit stop. The standard location of TODs are considered to be an appropriate scale for pedestrians.

Pedestrian and bicycle-friendly are the sustainable transportations because instead of driving using biking and walking transportation can reduce emissions, save money on fuel and maintenance and foster a healthier population. Pedestrian and bicycle-friendly improvements include bike lanes on main streets, an urban bike-trail system, bike parking, pedestrian crossings, and associated master plans.

2.2. Contextual review

According to AACPPPO (2017-2027) one of the major challenge in residential areas is how and where to provide housing for the current as well as future demand and it is found that For Addis Ababa, vertical densification is the only available option. And also in a city like Addis Ababa where the proportion of street is limited and the provision of public transport is grossly lacking, mixed-use development is almost the only sane option available. The concept of mixed-use usually applies when the residential function is found mixed with other compatible activities. The mixed-use concept limits trips, encourages working, living and getting service nearby.

The inherent idea embedded within the concept of ‘mixed use’ or mixity is the creation of a vibrant environment (economically and socially). To meet these important planning objectives, mixed residence land use is very important. Understanding the nature, level and form of mixity is, therefore, necessary to manage how to develop it well. This will in turn prevent it from becoming a liability for development. In this regard, the Structure Plan foresees mixity in two forms- in land subdivision plan (from Structure Plan up to detail plan) and in a single building.

Densification on the existing built- up area is the available option to accommodate future urban growth. The housing density is the number of residential housing units in a designated land area. The Structure Plan AACPPO (2017-2027) sets three levels of gross density for mixed residential land use. These are High-Density Mixed Residence, Medium Density Mixed Residence and Low-Density Mixed Residence.

High density mixed residence

According to AACPPO (2017-2027. p 46) High density mixed residence land use is located at a depth of up to 80m or 120m along mass transport corridor. On the ground floor of the buildings the land use will be commercial activities and businesses or the function at human scale will be commerce to make the street-level activity lively. 50% residence is to be accommodated in any developments of high-density mixed residence building. **150 housing units per hectare (150hu/ha)** is the minimum gross density for high-density mixed residences.

Medium and low density mixed residence

The proposed minimum gross densities for medium and low-density mixed residence are **100 hu/ha and 50hu/ha** respectively. The percentage of floor area to be occupied by residence in medium and low-density mixed residence buildings shall be **60%** of the total floor area. In order to meet the target of providing working and living space for the population the proportion of both density and floor area have to be strictly managed. AACPPO (2017-2027)

According to AACPPO (2017-2027) the mixed residence zones are classified according to their density as follows.

Table 2.2 Residence share in building inside a mixed residence land use

Mixed residence zone	Mandatory share of residence from total floor area
High density mixed residence	50%
Medium density mixed residence	60%
Low density mixed residence	60%

Source: AACPPO (2017-2027)

Table 2.3 Share of the built-up area, green and street network in mixed residence land use

Uses	Proportion	Remarks
Built up area	40%	All mix of use are included here
Green are, open space, plaza, etc	30%	
Street network	30%	

Source: AACPPO (2017-2027)

2.3. Empirical review

In different cities of the world compactness is measured using different indicators. Those indicators of a compact city include compactness, accessibility, the transport system, and urban regeneration with the development of brownfield lands and public spaces. The attributes to determine urban compactness include population densification, activity concentration, public transport intensification, city size and accessibility, and socioeconomic welfare targets.

i. Munich city, German

This case study is the overview of the practice of compact development in Munich city which is studied by Sanaa Anabtawi. (2018). The case study doesn't mention the citations because the aim of the study was to look at the practical practice and lessons to be adapted. Munich is the third largest city in German, and it is located in the south-east of Germany.



Figure 2.1 Munich city location

The area of the city is 310 km² and it is a densely populated city with an average density of **4,500 inhabitants/km²**. Munich is classified as a growing city and expected to maintain this growth pattern in the future. The projections show that a population increase of 15.4% is estimated for the period 2013 to 2030. Munich city is one of the cities which are acknowledged for their sustainable development and use of an advantageous approaches of urban developments. Compact development is referred

as one exemplar in Munich city for achieving high-quality and sustainable urban life.

According to Munich city administration and some scholars, the success of Munich in keeping the city both compact and attractive is the result of its long tradition and distinctive planning approach as well as its contemporary urban development policy.

Drawing on City of Munich (2015a, p.17), the following rules are used for city development

1. Maintaining a poly-central development trend;
2. Minimizing the consumption of Greenfield sites at the city outskirts and concentrating development within existing municipal area.
3. Promoting densification of housing development in strategic locations, such as those located around the public transportation routes;
4. Preserving and extending the green areas and parks within the city;
5. Seeking measures to further integrate the functions within existing areas.

The guideline “**Compact, Urban, Green**” is used in development of Munich city and it is described by each words standing for rich concept of compact development.

Urban containment, utilization variety and quality enhancement, as well as providing multi-modal mobility options were the guidelines Munich city used. Munich city faced four big barriers are and the mitigation mechanisms to overcome those faced problems are indicated in the table 2.4.

Table 2.4: Mitigation mechanisms of the compact city policy implementation barriers

Barriers	Mitigation mechanism
Social resistance	Quality oriented urban development and densification. Regular publicity of urban planning and development information. Citizens’ involvement in planning and decision making.
Financial limitations	Established grants from national and state governments to finance a share of public investments. Rules to share the costs of development with the beneficiaries (investors, owners).
Loss of public open space	Adopting a guiding principle of creating an interconnected series of public spaces and natural areas of diverse functions and properties. Binding landscape plan integrated with the land use plan, comply the rule of providing 17m ² of green public space per inhabitant. Long-term projects embedded in the PM to enhance green areas serving economic prosperity and ecological and recreational purposes.

	Urban redevelopment projects. The urban development agreements and urban development measures stipulate financing the cost of open spaces. Seeking external experts' opinion to search further potentials for providing public open spaces.
Reducing speculation impact	Transparency and publicity of long-term plans, Properly calculated and collected land taxation, Urban development measures allowing the forced development of strategic locations for the common interest, Socially Equitable Land Use principles requiring the share of costs and benefits of development.

- Lessons learned from the Munich's compact city development is that the preparations of guidelines is essential for urban development. Especially when compact development is proposed it should have to give concentration on the issues that the compact developments might bring negatively to the urban livability. Those issues are discussed in the previous literature part and they are losing of open spaces, greeneries, house affordability and also social problems. So in the Munich's city compact development beside the barriers faced the mechanism to mitigate are prepared in detail as it is showed in table 2.4. So this practice is taken as a good example of compact city application. Therefore the guideline that are used as a rule can be practiced accordingly in the case of developing Countries like Ethiopia and can be scaled down to the case of Addis Ababa selected study area.

2.3.1. Summary and Gaps of the Literature

According to Jabreen (1992. p39.) For achieving sustainable urban forms compact development of built environment is an acceptable strategy. Compact city concerns on Density, mixed Land Use, Sustainable Transportation and intensification of built environment in urban areas for effective land resource conservation and sustainable future development.

Generally the above reviewed literature has its perspective and methodologies to investigate the benefit and ways of practicing mixed-use and compact development in urban areas for achieving of sustainability. Dominantly it focuses on the positive outcomes and the negative outcomes but does not discuss the mechanisms to mitigate and minimize the negative outcomes of compact development in the urban areas. And also studies focuses more on the developed world and give lesser attention for developing countries.

CHAPTER THREE

MATERIALS AND METHODS

A research methodology is the systematic, theoretical analysis of the methods applied to a field of study. (Irny and Rose, 2005). It comprises the theoretical analysis of the body of methods and principles associated with a branch of knowledge. Typically, it encompasses concepts such as paradigm, theoretical model, phases and quantitative or qualitative techniques (Irny and Rose, 2005). This chapter will define what information is needed to answer the research question and which method is needed to be applied for the thesis to gather the information needed.

This research has the objective of studying the compactness and mixed development of condominium neighborhoods with resident's perception of how well is their condominium dwelling related and use the advantage of the external commercial unit. All mixed residential neighborhood in this case condominium site has different context. The variation comes in different reason such as a period or time of the development, location of the development, area of the development etc. in order to understand the impact commercial unit on resident's privacy the use of survey method is very essential.

3.1 Description of the study area

Addis Ababa is the capital city of Ethiopia. It is not only the capital city of Ethiopia, but also the political and social capital of Africa, the set of many regional and international organizations like AU, ECA, and other UN agencies and diplomatic missions. The city covers area of 51948.85 hectare which is about 32 percent of the total area of the country. And Kirkos sub city covers area of 1464.76 hectare which is about 2.81% is the total land area of the sub city.

The site is located in Addis Ababa, Kirkos Sub city Woreda 04.



Figure 3.1 Regions in Ethiopia (source: internet)



Figure 3.2 Sub city in Addis Ababa (source: internet)



Figure 3.3: Google view of Gottera condominium, (source: areal view map)

The site studied is located at about 400 m from the Gottera square road which is in the southern part of the Kirkos sub city. The site encompasses about 135,255 m².

3.2. Criteria for selection the Gottera condominium

The main reason to select the Gottera as a case is first, the site is in the center of the Addis Ababa city and secondly the neighborhood is highly developed when we compare it to other condominium site therefore the output of this study will help for new (undeveloped) and also developing sites as a case to understand the concept of compact and mixed development. Finally the condominium has a different character in that it is highly vibrant and active, has different services, therefore these characteristics makes it different comparably.

3.3. Type and strategy of the research

In terms of ontology the research is intended to bring constructive truth. In terms of Epistemology knowledge is subjective, and meaning comes from the interaction between people and reality. The research strategy will be the case study. The research approach is inductive and case study method is used at both qualitative and quantitative levels. The study analyzes the process of adopting compact development using the selected site Gottera condominium site as a case.

3.4. Source of Data

3.4.1 Primary data source

Interview and informal discussion with residents, were used to study area condominium owner association officials. In addition to this primary data were collected through Personal Observation of the Built environment including sketching, mapping, taking photographs to understand the spatial characteristics of residential and commercial unit.

3.4.2 Secondary data source

Books, published journals articles, official reports concerning government bodies, published and unpublished research papers written on compact and mixed use were used to understand the theoretical background, review international experience and study the contextual background of the research.

3.5. Sample of the population

Simple random sampling was used for the research. Purposive sampling were used to determine the sample size for the study from the total number of households living in condominiums based on the sites area and population size they hold.

3.5.1. Sample size

That portion of the population that is studied is called a smaller of elements drawn through a definite procedure from an accessible population. According to the Addis Ababa housing development project office the total number of households Gottera Condominium site is 2433 within seventy-eight (78) blocks.

The sample size of this study is determined by precision level 9%. The level of precision is the range in which the true value of the population is estimated. Therefore, the sample size calculated by 91% confidence level and precision level of $\pm 9\%$.

According to Yemane (1967) the formula to determine and calculate the sample size

$$n = \frac{N}{1 + N(e)^2}$$

Where; n = sample size,

N = the total survey area population,

e = level of precision. Total survey area household population of condominium is 2434 and level of precision is 0.09.

$$n = 2434 / 1 + 2434(0.09)^2 = 117.$$

3.6 Data analysis

The data collected from both primary and secondary data sources were analyzed accordingly using the concept of compactness to be evaluated using the density, mix-use, scale and permeability, walkability as the predominant urban variables. The density were evaluated or measured through density of population, density of built form, the density of housing. The mixing of uses can be measured as it can be both horizontally and vertically and it is categorized as commercial, residential, recreational, institutional and industrial uses (Coupland, 1997). Scale is determined by plot ratio, and housing density.

Analysis result of the land use, density, transportation, accessibility and mixed-use land

Table 3.1: Variables to be measures

INDICATORS	
Characteristics	Variables
Landscape ecology	Land use and land cover
Density	Gross population density
	Built-up area density
	Land use split up

	Average land consumption per person
Transportation network	Mode share
	Average trip length
	Road network density
Accessibility	Services accessibility
	Public transport accessibility
Mixed use land consumption	The ratio of residential to non-residential use
	The ratio of built-up to open area

Source: Nadeem, M.; Aziz, A.; Al-Rashid, M.A.; Tesoriere, G.; Asim, M.; Campisi, T. (2021) Scaling the Potential of Compact City Development

3.7. Materials / Project Instrument

The instruments that are used for the project from start to completion are:

- Gathered data's on the study area
- GIS software for generating maps and analysis.
- Adobe illustrator for presentation preparation.
- SPSS software for data analyzing
- Microsoft word for report preparation.
- Microsoft power point for presentation.

CHAPTER FOUR

RESULT AND DISCUSSION

The studies were done on the compactness and mixed development of the Gottera condominium site which includes the subjective study on the perception of households and workers on the compactness and mixed development and the objective study of sustainable built environment results are discussed hereunder. In addition to this background information about respondent demography and spatial data were presented.

Gottera Condominium is located in Kirkos sub-city near to the center of the city. The number of population and blocks in this condominium houses are 2433 household and 78 respectively.

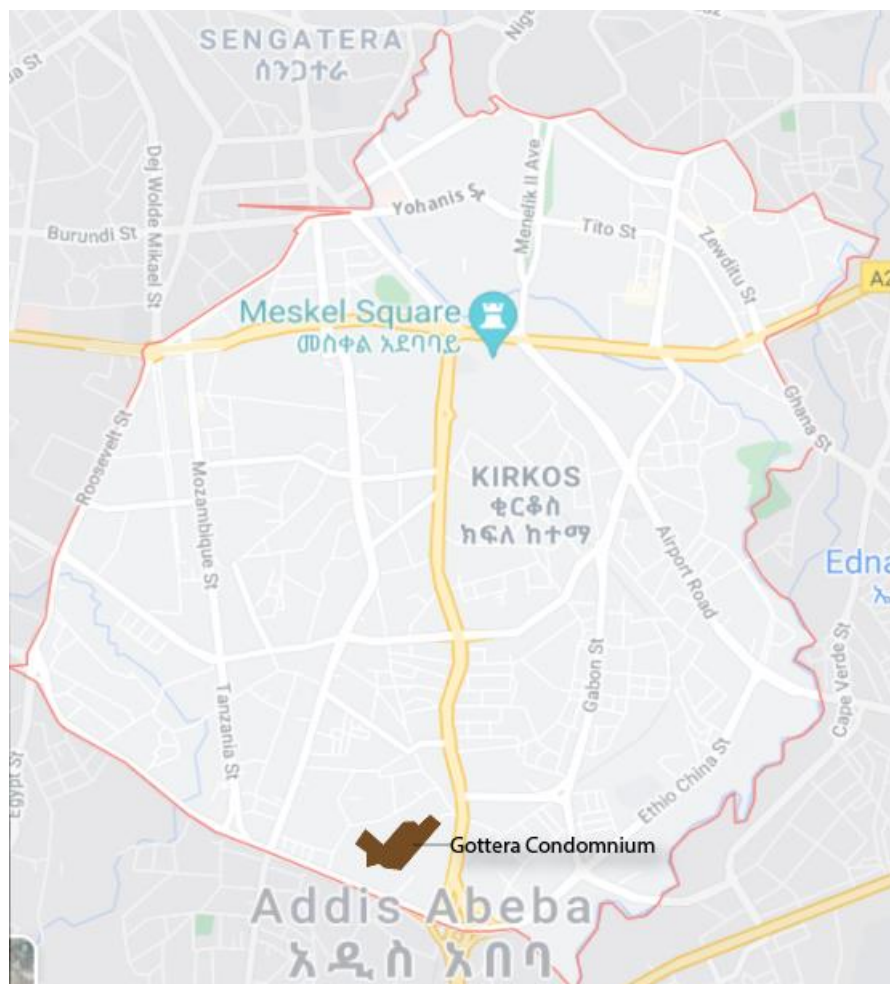


Figure 4.1 location of study area (source: google map)

4.2. Questioner survey results

The age of respondents participated in the questioner have high percent of young, adult and older peoples respectively. This shows that in this condominium compound the peoples live are younger and the number of elder peoples is small. Age distribution is used as an input to determine the choosability of the site by different peoples with different age, to indicate if it is comfortable or not and for which age group. The age distribution of respondents the survey is shown in the table 4.1

Table 4.1: Age Distribution

Age distribution of respondents		
Age	Frequency	Percentage (%)
>20	0	0
20-30	48	41
30-40	30	25.6
40-50	25	21.3
>50	14	11.1
Total	117	100

Source: Field Survey, 2021

In the survey done on the household different blocks are taken just by random selection and about 13 blocks are being surveyed. But different peoples in cafeteria and on-road also are interviewed for generalization of the responses of the respondents.

Table 4.2 shows the types of blocks being surveyed, all the three block typologies are being surveyed and among 43 blocks of typology one 55 households, from 8 blocks of typology two 31 households and from 27 blocks of typology three 31 households are taken as respondents. The survey was conducted considering the blocks which have services and which are residential only. This shows that the survey is taken from different types of houses and parcels so that different point of view can be obtained from the peoples who responded.

Table 4.2: Block types

Block type		
Type	Frequency	Percent
Type one	55	47.4
Type two	31	26.3
Type three	31	26.3
Total	117	100

Source: field survey, 2021

Table 4.3 explains the housing ownership of the surveyed houses. From the total of 117 respondents 68 which is 58.1% are tenants and 41.9% are owners. This shows that the site is dominated by the tenant as compared to owners. From this survey result it is found that tenants are dominating the compound even if the price of rent is higher relative to the other condominium sites in Addis Ababa. This indicated that the people who are living in this compound have medium and high income. The monthly rent prices of the dwellings are shown below and it is comparably expensive.

Table 4.3: Ownership of houses

House ownership		
	Frequency	Percent(%)
Tenant	68	58.1
Owner	49	41.9
total	117	100

Source: field survey, 2021

Table 4.4: Rent prices of the dwellings

House type	Price (birr)	House type	Price (birr)
Studio	6500-7500	Two bed room	10000-13000
One bed room	7500-9000	Three bed room	12000-13500

Source: Gottera houses administration office, 2021

Table 4.5 illustrates the reasons why peoples living there choose to live there, most of the respondents in this condominium site are tenant. From the total of 117, 91 of them gets the dwelling unit by means of renting. But the reasons they come to live in this compound is that it is easy access to the work. Peoples who owned the house by lottery and purchase are 13 and 12 respectively. This shows that most owner of the houses of Gottera condominium does not live there they are rent their house and live in another area. And it implies that the site is located in the center of the city and peoples choose it because of its proximity and easy accessibility to their work place.

Table 4.5: reason to live there

Reason to live there		
	Frequency	Percent
Family	24	21.1
Easy access to work	67	57.9
lottery	13	10.5
purchase	12	10.5
Total	117	100.0

Source: field survey, 2021

Table 4.6 shows they housing types surveyed, the number of housing type of the Gottera condominium is shown with the frequency and percentage. The survey result of the housing type of respondents of 117 units 47.4 % has one bed room type which is about almost half of the respondents number and the housing type of studio, two bed room and three bed room is 10.5%, 26.3% and 15.8% respectively. Taking the proportion of the number of housing type in the compound the household surveyed are from each types of dwellings and the peoples who have one-bed room house are more frequently surveyed. This analysis result helps to determine the level of life status of the respondents comparing the housing type and the number of family member living.

Table 4.6: Unit type

House type		
Type	Frequency	Percent
Studio	13	10.5
One bed room	55	47.4
Two bed room	31	26.3
Three bed room	18	15.8
Total	117	100.0

Source: field survey, 2021

The number and types of housing are listed in the table below table 4.7.

Table 4.7: Gottera house type

No	Housing type	Number of units	Percentage of Units (%)
1	Commercial unit	294	11.87
2	Studio	440	17.77
3	One bed room	983	39.70
4	Two bed room	468	18.9
5	Three bed room	291	11.75

Source: Gottera houses administration office, 2021

The family member number is related to the age of the peoples as young peoples are dominating the site the percentage of family member three, four, two, one and five is 31.6%, 26.3%, 21.1%, 15.8% and 5.3% respectively. This survey result shows that the families with high number of family member living in the compound are very small. This implies that the majority of households are young and more of educated peoples and workers.

Table 4.8: Family member surveyed

Family member		
	Frequency	Percent
One	18	15.8
Two	25	21.1
Three	37	31.6
Four	31	26.3
Five	6	5.3
Total	117	100

Source: field survey, 2021

The time spent to reach work place is the one concern of compact development which depends on the transportation system they use. And as the survey report indicates the peoples travel 10-20 minutes and 20-30minutes are 62.6% while respondents who pass 5-10 minute to reach work are 25%. And respondents who travel 30-45 minute and above (>45) minutes for one way travel to work place are 6.3% and 6.3% respectively. This shows that the time taken to reach work is comparably good but not fully with the requirement 10-20 min for reaching work place.

Table 4.9: Time to reach work of Respondents

Time to reach your work place		
	Frequency	Percent
5-10 min	29	25
10-20 min	36	31.3
20-30min	36	31.3
30-45min	8	6.3
>45min	8	6.3
Total	117	100

Source: field survey, 2021

From the survey result 51.2 % of the respondents have the private automobile and 48.8 % of respondents use public transportation and walking. This implies that more than half of the households have their private automobile which shows that they have high income

Table 4.10: Numbers of Owners of vehicles

Having car		
	Frequency	Percent
Yes	60	51.2
No	57	48.8
Total	117	100

Source: field survey, 2021

The mode of transportation the surveyed respondents use to go work place is dominated by private car because 51.2% of respondents have a private automobile. 34.2% of respondents use Public transportation for going to work. And the sustainable modes of transportation which are

walking and bicycling are 17.2% and 2.5% respectively. The above analysis is related to this result and many peoples have a private car so they use their car to go work. This results from the congestion of automobiles during the time to go work and return from work in the compound as well as in the city.

Table 4.11: Mode of transportation to go work

Mode of transportation do you use to go to work		
	Frequency	Percent
Walking	20	17.2
Private automobile	54	46.1
Public transportation	40	34.2
Bicycle	3	2.5
Total	117	100

Source: field survey, 2021

From the survey respondents who have children are 62.3% and who don't have children are about 37.7%. This implies that the majority of the households are young and have children. And having the children has many requirements like playground, schools nearby and other facilities also it indicated the weather the compound is comfortable to grow children or not.

The types of school where children of respondents learn is related to the age of children and from the total survey result 68 children are going school. And from those number of children 34% is going to secondary school, 27% are going to kindergarten while 25 and 14% are going to primary school and higher education respectively. This data helps to evaluate the availability of services like school, playground, health center on the surrounding of the site.

Table 4.12: School levels children go

School children's go		
	Frequency	Percent
Kindergarten	18	27
Primary school	17	25
Secondary school	23	34
Higher education	10	14

Total	68	100
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Source: field survey, 2021

The transportation mode children use to go to school is dominated by public transportation, private automobile and walking which is 41.2% and followed by 32.3% and 26.5% respectively. This survey result implies that children use more of public transportation for school which indicates the schools are somehow not in shorter distance and the compound has easy access to public transportation.

Table 4.13: Transportation used for children school

Transportation for schooling		
Transportation	Frequency	Percent
Walking	18	26.5
Public transportation	28	41.2
Private automobile	22	32.3
Total	68	100

Source: field survey, 2021

The travel time to school is dominated by the travel time of 10-20 min which takes up 30.9% and it is followed by 20-30 min which is 23.5% and the longer travel time 30-45 min and >45min are 14.7% and 11.8% respectively. The shorter travel time which is 5-10 min is 19.1 % of the total percent. This result implies that most of the students reach school in less than 30 minutes which is considered to be good but not that compact and also there are students who spend more than 30 minutes even more than 45 minutes which is very hard and can be taken as a big problem. And also it indicates that the schools nearby are not enough or there is no school in the standard maximum distance from the compound of the condominium.

Table 4.14: Time spent to reach school

Time spent to reach school		
Time	Frequency	Percent
5-10 min	13	19.1
10-20 min	21	30.9
20-30 min	16	23.5
30-45min	10	14.7
>45min	8	11.8
Total	68	100

Source: field survey, 2021

As survey result indicates 60 respondents of 117 have private automobile so the money they expend on fuel was studied and as it is shown on the above table different ranges are answered. The highest amount of money spent in one month is 5000 birr and the smallest money spent is 1000 as respondent's feedback.

Table 4.15: Money spend on fuel

Money spent on fuel		
Cost	Frequency	Percent
1000 -1500	3	5
1500-2000	10	16.7
2000-2500	13	21.7
2500-3000	11	18.3
3000-3500	7	11.7
3500-4000	5	8.3
4000-4500	6	10
4500-5000	5	8.3
Total	60	100

Source: field survey, 2021

For peoples who have no car to reach to the transportation place from their home is surveyed and it was found to be in a range of 1-5 min and 5-10 min which has a value of 52.65 and 47.4% respectively.

Table 4.16: Time spent to reach Transport station

Time to reach transport station		
	Frequency	Percent
2-5min	30	52.6
5-10 min	27	47.4
Total	57	100

Source: field survey, 2021

For the children going school using transportation the daily transportation cost is dominated by 10-20br which is 39.3% and 40-50 br which is 25%. 20-30 br is spent by 21.4% respondents and 30-40br,>60br are spent by 10.7% and 3.6% respondents respectively.

Table 4.17: Transportation cost to reach school

Daily transportation cost to reach school		
Cost (birr)	Frequency	Percent
10-20	11	39.3
20-30	6	21.4
30-40	3	10.7
40-50	7	25
50-60	0	0
>60	1	3.6
Total	28	100

Source: field survey, 2021

The peoples living in the compound have a feeling that they are in a place much better than other condominium sites in Addis Ababa because of different service available in the compound.

Table 4.18 services of the condominium

The Condominium has enough services		
	Frequency	Percent
Yes	103	88.2
No	14	11.8
Total	117	100

Source: field survey, 2021

The survey done on the people's perception of the services available in the compound is highly dominated by the answer **yes** for the question "is the services provided in the compound are enough?" which is 88.2% of the total respondents respond **yes** and the other 11.8% respondents answered **no**. the peoples who believe the services are not enough and adequate gave their opinion which makes them say no. so below the lists respondents believe they lack are:

- Sporting field
- Playground for the children
- Communal buildings for the use of the residents
- Utilities like water and electricity.

Along with the service in the compound respondents the problem they face for living in the compound and they responded to the following points as a problem.

1. The high number of cars going in and out in the compound is a problem for children movement.
2. Crime is what peoples living there complained that thieves are making them insecure especially regarding on the spare parts of vehicles.
3. The maintenance of the buildings is not done and the buildings are old.
4. The utility lines are not designed well so when damages happen it affects the other dwellings and maintenance is somehow difficult.
5. The communal buildings are rented for the use of bank, restaurants, gym and the housing administration of the Gottera condominium so residents couldn't use it for its design purpose.

6. The noise of the commercial units on the ground floor is disturbing the residences nearby and the residence on the first floor.

4.2. Building Block Area Analysis

The analysis of the built up area with respect to the total area of the compound and the density of the building blocks.



Figure 4.2 blocks on the site

The Gottera condominium has generally three typologies which are different by their size, shape, number of units. The three typologies also have different forms within them which have the variance in the placement of stair, the use of the building some buildings have both the services and the housing whereas some block have only housing function.

Among 78 block which are built in the Gottera compound, there are 43 blocks of typology one. And 14 blocks of them are only residential buildings they don't have floors for services. And

other 20 blocks are blocks having residential uses and service floors together. The service floor is on the ground floor of all the building blocks which takes up about 20% of the blocks they are in. the third type of block among those typologies is the block which differs by the direction of its stair.

- T16(R+S) – There are 20 of block with this typology and one block has an area of 290m^2
- T16 (R) –There are 14 block and each block have an area of 293m^2
- T18 (R) –There are 2 blocks and each block have an area of 266m^2
- T18 (R+S) – there are 7 blocks and each block have an area of 267m^2
- M -1 (R) – there are 7 blocks and each block have an area of 250m^2
- M -1 (R+S) - there are 3 blocks and each block have an area of 250m^2
- M – 2 (R) – there are 7 blocks and each block have an area of 310m^2
- M-2 (R+S) – there are 20 blocks and each has an area of 301m^2
- Communal – there are 5 blocks and each has an area of 215m^2 and one communal 65.8m^2 .

Total built up area

TOTAL built up of residential blocks is **22993m^2**

Communal building = **1141m^2**

Total built up area= **24134m^2**

$135,255 - 24134\text{m}^2 = 111,121\text{m}^2$ is left for greenery, street, parking and open spaces

4.3. Walkability Analysis

The tool for walkability measure, walk score is not available which needs to be developed for improving walkability but through the proximity of services to the residential areas and transportation places it can be measured. So walkability of the Gottera condominium has been found to be good because different services which are needed daily like shops, mini markets, cafeteria, bank and other are in the compound within 100 m-200m radius. So the placement of those services encourages walking.

4.4. Permeability

Permeability of the Gottera condominium site is analyzed through observation of the physical infrastructures of in the compound. The condominium has no fence and the entrances are made

just by simple symbols. The access for vehicles is open in one side to the main road from Gottera Square to Meskel square. The surrounding streets are not on use to get in to the compound and only road for pedestrian there are two entrances in southern and western side of the site. For that reason the permeability of the compound is been found good. Because the longest side of the compound is 524 meters and the longest width is 323 meters the distance from the main road to the each parcels is different for different parcels this indicates that inclusive pedestrian needs to be applied for sustainable livability.

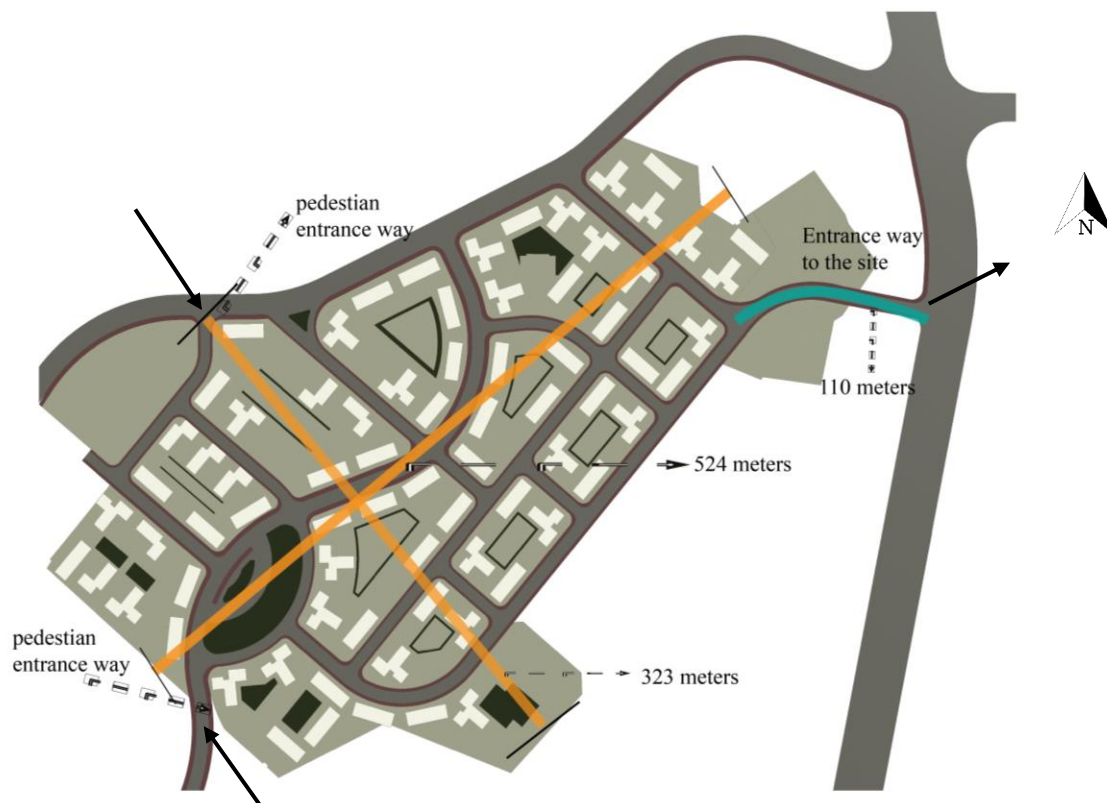


Figure 4.3: Access ways to the site

The pedestrian walkaway design of the site has enough width for the pedestrian to use it but it does not consider the disables and bicycle lane as for sustainable walkable environment the pedestrian way has to be inclusive.



Figure 4.4: Pedestrian ways



Figure 4.5: Inclusive pedestrian

As it is written in Final Summary Report of AACPPPO (2017-2027). Standards to be followed while designing and implementing pedestrian walk ways:

- Pedestrian ways should be raised 15-20cm above the carriage way.
- The capacity of pedestrian lane should be 30 to 50 persons per minute.
- The gradient of continuous ramps should not be steeper than 10%.
- Cars should not be allowed to jump raised curb stones to park.

4.5. Mixed Development in the Compound

Gottera condominium neighborhood have 13 parcels and in each parcel have different number of commercial units. In every parcels there are commercial units according to the road they are facing.



Figure 4.6:location of mixeduse in the condominium site

Table 4.19: Commercial units on parcels and blocks

No.	Parcel Number	Number of Commercial Unit	Block Number
1	13	27	44 – 49
2	1	5	1 – 3
3	2	16	4 – 7
4	3	13	8 – 10
5	4	6	11 – 13
6	12	21	14 – 22
7	5	46	23 – 30
8	6	18	31 – 35
9	7	38	36 – 43
10	8	40	50 – 56
11	9	34	57 – 65
12	10	18	66 – 71
13	11	12	72 – 78

Source: Field survey, 2021

42 block which faces the road that passes between the parcels have service floors on their ground floor and different kinds of business are provided for the peoples living there. Figure 4.18 show some pictures taken in the compound while walking though the compound.



Figure 4.7: Site pictures

The number of commercial units, studio, one-bed room, two-bed room, and three-bed room in Gottera condominium is 294, 440, 983, 468 and 291 respectively. Table 4.24, shows that 11.87% of the units in this condominium site are provided for commercial purpose.

Table 4.20: the number and percentage of commercial units in Gottera condominium

No	Housing type	Number of units	Percentage of Units (%)
1	Commercial unit	294	11.87

(Source: House owner association of Gottera condominium site, 2021)

On the commercial units many services are provided with good standard. The variety of services are provided repeatedly within different parcels.

Table 4.21 services available in the condomium site

Barber shop	laundry	Day care	Ds TV
Cafeteria	Post office	Bar	Liquor store
Restaurant	Bank	Game zone	Photo studio
Burger house	Mini market	Cultural cloth house	Furniture house
Coffee house	Juice house	Bakery	Beauty salon
Fruit shop	Clothe shop	Music house	Betting house

Source: field survey, 2021

The locations of services within the compound are distributed in the way they can be easily accessible for different blocks. The figure below figure shows the distribution of the services.



Figure 4.8: services in the compound

Figure 4.21 shows the greenery in each parcels within the compound that are surrounding the parking area and the trees surrounding the blocks. The information from Gottera housing association was that the parking areas in the between of every blocks in the parcels were proposed for greenery but ignoring the plan they are on the use of parking because of high number of vehicle within the compound. This results not to follow the proportion to be followed while designing urban areas.



Figure 4.9: Green area on the site

Table 4.22: Green areas in each parcel

Greenery area in 13 parcels			
Parcels	Area	Parcels	Area
P 1	126.2 m ²	P8	316 m ²
P2	115 m ²	P9	240 m ²
P3	115 m ²	P10	501 m ²
P4	121.7 m ²	P11	414.7 m ²
P5	252 m ²	P12	662.1 m ²
P6	185 m ²	P13	353.1 m ²
P7	745 m ²		
total	1659.9 m ²	Total	2486.69 m ²
total	4147 m²		

Source: field survey, 2021

The green area of the park area is 3000 m² the total green area of the compound is

$$4147 \text{ m}^2 + 3000 \text{ m}^2 = 7147 \text{ m}^2$$

So the green area of the compound is **5.3%** of the total area.

The green area within each parcel is reduced from the design proposed for the purpose of parking and the area which was left for greenery is now on the use of parking in the compound. Due to the high number of car going out and in in the compound the roads are also being used as a parking.



Figure 4.10: Parking areas in the condominium compound

4.6. Findings

In this research, a set of indicators adapted from the Scaling the Potential of Compact City Development used for studying the case of Lahore, Pakistan(Nadeem, M.; Aziz, A.; Al-Rashid, M.A.; Tesoriere, G.; Asim, M.; Campisi, T. 2021) which includes landscape ecology, density measurement, density distribution, transportation network, accessibility and mixed land consumption, was analyzed using SPSS. The above derived indicators were used to assess the existing level of compactness and the potential of compact development in the Gottera condominium.

i. Landscape ecology

Sum of built-up area=24134m²

Total area= 135,255m²

When we look at the land use and land cover of the study area

Table 4.23: Built-up area and greenery

Built-up	Vegetation (green)
24134	7147

ii. Density

The density and the spatial distribution of land uses are the core components of a compact city. Four sub-indicators, namely, gross population density, built-up area density, land use breakup, and average land consumption per capita were considered to comprehend the density pattern. It is recommended that the population density within a sustainable neighborhood should be at least 15,000 peoples per km².

Gross population density = population / administration area

The total population of the study area is to be estimated $2433 \times 5 = 12,165$

$$12165 / 135 \text{ km}^2 = 90$$

Built-up area density = population / built up area

$$12165 / 24.134 \text{ km}^2 = 504$$

Average land consumption per person (m²) = area / population

$$135,255 / 12165 = 11.1$$

Which means 12165 person per 13.5255ha which indicates that it is highly dense by having

899 person/ ha.

According to the UN-Habitat, the area of open spaces should be at least 15% for the sustainable city.

iii. Transportation Network

Transportation network shapes urban forms. In this context, a relationship between transportation networks and urban form is valuable to determine the accessibility and connectivity required for sustainable compact development.

The total area taken by the roads is calculated as **22100m²**.

The road taken per person is $22100 / 12165 = 1.8 \text{ m}^2 / \text{person}$

The transportation mode used as data surveyed indicates that 60% of the population have private automobile and the other 40% of the population use public transportation for moving from place to place. To reach public transportation the average time taken is **5-10min** which is taken as good for accessibility. The share of public transportation is 34.1% whereas the share of private transportation is 46.2%.

iv. Accessibility

The Gottera condominium site is accessible from the main road which goes to the Meskel flower by road with length of 100meter and it has also connected roads with the nearby collector road. It has good accessibility but the southern part of the condominium is far from the main road in which the condominium is accessed and the southern side road which connects the compound to the main road going to Kera is not used for vehicles it is used only for pedestrian easy accessibility to the site.

The services accessibility: There are different services around the study area. Taking 400m radius of in every direction from the site the institutions around are studied. The illustration below shows the services near the site is a radius of 400 meter. According to UN – habitat, the walking distance to essential services can measure walkability in a neighborhood, usually from 400 to 450 m in compact city development. So services which are necessary for the peoples living, having child, working should be in the radius of 400 m. so the figure below shows the services available around the condominium compound.

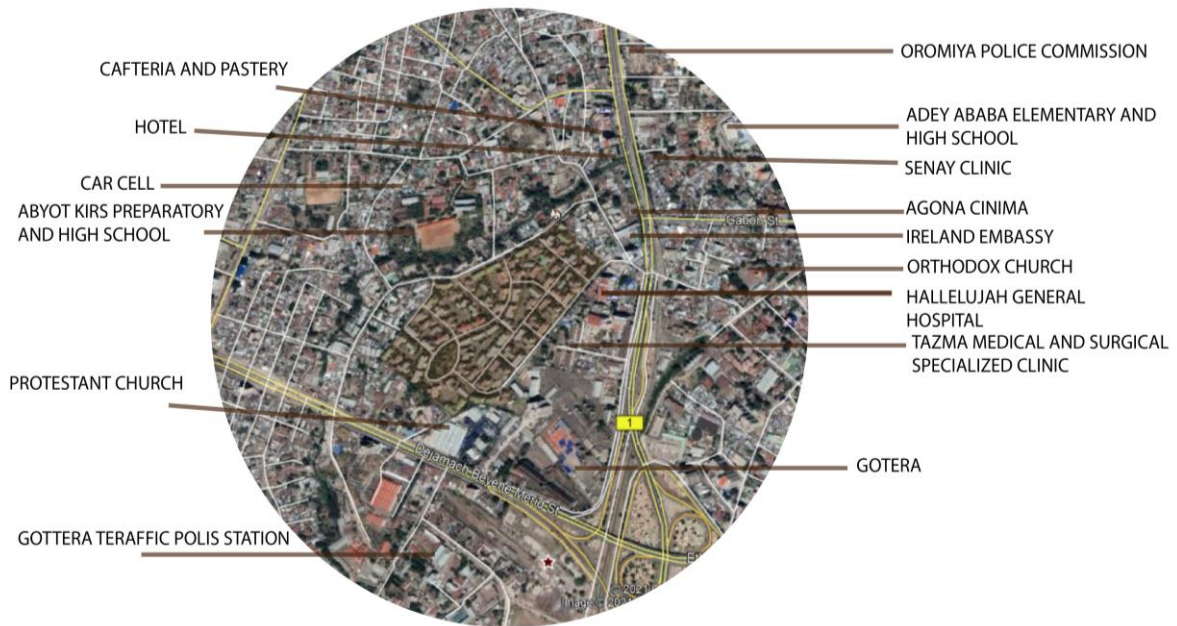


Figure 4.11: Services in the surrounding

v. Mixed land use

According to Jabreen, (2006) The ratio of residential to non-residential use and the built-up area ratio to the open area are essential components in a compact urban form of the city.

The ratio of residential to non-residential use is

Residential area is $294/2139$ (nonresidential) = 0.13 this is for the housing blocks.

The ratio of built-up to non-built-up area is $24,134/ 106,008 = 0.23$

Table 4.4: Variables studied with standards

Variables	Standards	Results
Gross Population Density (Persons/km ²)	15,000 persons/km ²	90
Built-Up Area Density (Persons/km ²)	15,000 persons/km ²	504
Average Land Consumption per Person (m ²)	40 m ²	11
The Ratio of Residential to Non- Residential Use	One time	0.13
The Ratio of Built-Up to Open Area	Three times	0.23

Source: Nadeem, M.; Aziz, A.; Al-Rashid, M.A.; Tesoriere, G.; Asim, M.; Campisi, T. (2021) Scaling the Potential of Compact City Development

4.6. Discussion

The average land consumption per person is 40 m² for Gottera condominium, which is far less than that in developed world cities. The car parked in the compound account for about 900 this indicates that the land which is left for parking is big and it is using the land proposed for greenery. Thus, significant portion of the land is taken for the parking because of high amount car presence.

The road taken per person was 1.8 m²/person, which is less than that of compact cities like London, San Francisco, and Sydney. It is estimated that the residential to non-residential use ratio is 0.13, and the ratio of built-up to non-built-up area is 0.23. This ratio shows that a high proportion of the area in Gottera condominium site lies vacant.

Finally the study has inferred indicators of compact development and it is found that Gottera condominium is partially compact. The findings and discussions of the research are to answer the research questions placed before so each questions are answered and discussed as follows.

1. How compact is the selected study area?

This research question is addressed by quantitative and qualitatively gathered data from the peoples living in there and the house owner association of Gottera Condominium. The compact development has been evaluated through density, land use mix, walkability and other indicators to find out how it is compact and sustainable.

2. What are the mechanisms to exercise best mixed-use and compact development in the condominium neighborhood of the study area?

The compactness and mixed-use practice in the Gottera condominium site is an exemplary for other condominium sites in Addis Ababa. It has adequate services which can be called as highly mixed residential area. From the literatures and case study made the mechanisms to adapt best compact development is to prepare guidelines that considers and constitutes the society, and design rules that can overcome problems came due to the compact development application like open space scarcity, loose of greenery, housing affordability and other challenges. Increasing the walkability through designing inclusive pedestrian is one of the mitigation ways for walkability problems in the site.

3. What are the evaluation variables for the compact development application in the selected site?

The determining factors are the indicators listed in the finding to determine whether the study area is compact or not. This factors are the variables that are evaluated and result the quality of life for the society. Those factors are density (density of the total site to the population, density of the buildings to the total site, density of the building to the population, density of the commercials to the residence), diversity of services, accessibility (permeability, easy ways to services) , walkability(inclusive pedestrian), adequate transportation (public transportation availability, easy access to public transportation). Those factors are directly contributor to the sustainable and livable neighborhood.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

5.1. Conclusion

The broad scope of this study was to assess the mixed use and compactness of the built condominium neighborhood site in urban environment which is indicated through sustainable transportation, intensification and mixed use developments for sustainable and energy efficient future urban development. The conclusions are made based on the following observations:

Regarding the sustainability of transportation accessibility, permeability, inclusiveness of pedestrian walkway and quality of streets are analyzed and it is found that it has good accessibility. This status of the Gottera condominium does not fulfil the sustainable transportation concept of compact development.

The automobile dependency of the inhabitants is higher and it is creating high congestion, high gas emission and high cost of fuel. The intensification of the buildings and population of the compound is analyzed and it is found that the density of buildings to the total area indicates that it has medium density population. The density of the population to the dwelling and the total site area shows that the site is high density residence and according to the AACPPPO (2017-2027). **(150hu/ha)** is the minimum gross density for high-density mixed residences. So this indicates that the Gottera condominium site fulfills the density of residences requirement of the compact city policy.

In Gottera condominium it is partially a problem that the proposed green areas are minimized and are used for the purpose of parking. The mixed use distribution in the site is found to be 20% commercial 80 % residential for the blocks with commercial units on the ground floor. And the distribution of commercial units is found to be good and enough as variety of services are provided and easily accessed in the compound.

Generally, from the indicators evaluated and measured to indicate the Gottera condominium mixed-use and compact development the research indicates that it is partially compact which means some evaluation indicates that Gottera condominium fulfills the compact requirement and some did not, and the concepts that are not fulfilled are the challenges for the compound to be

livable and sustainable because the questions raised by the inhabitants are regarding the sustainable transportation and open space provisions for children and also for other communal activities.

5.2. Recommendations

The following is a list of recommendations for Addis Ababa integrated housing development office and also for future related research.

- The housing corporation should have to design guidelines and strategies for urban areas housing development to meet the housing needs and sustainable environment.
- The walkways of every street in and out of the condominium neighborhood have to be designed and built considering the disables and the bicycle lanes to make it inclusive.
- The designs of the mixed residences have to consider easy and efficient use of land and accessibility to the public transportation. The transportation availability in the city have to be given attention. And from every condominium housing nearly the government should provide public transportation to different parts of the city.
- The designs of the housing units have to be as per the standard and wide enough to accommodate the family members for comfortable movement in the house and also using the rooms for why they are designed.
- The buildings construction have to be given serious attention that it has to be constructed with enough quality so that the cost for maintenance could be reduced and the buildings be durable for long period of time.
- Waste managements of the neighborhood have to be managed and have one line because it have a significant role for the beauty of the city.
- The costs of houses have to be managed by the Government so that every society can get the opportunity or the means of loan be prepared for the people to own the houses.
- Tools like walk score be beneficial if developed in order to understand the status of walkability and improve the non-motorized and sustainable transportation.

Code: ASTU /SM-R282/21

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Appendix

Appendix 1: Research Interview Questionnaires

Aim of this study is to conduct a research on “mixed development and compactness of the Gotera Condominium” for the partial fulfillment of the requirement of a Master’s Degree in Urban Planning and Design in Adama Science and Technology University. Hence, the quality of this research highly depends on your duly and positive response, the researcher would like to thank you in advance for your full co-operation. The questioner is prepared to find out how mixed and compact is the site and the effect it has on the residents life. Therefore, the following questions will help the researcher to study and evaluate the level of compactness and mixed development in the condominium site. Therefore please answer the following questions completely as possible.

Your information will only be used for academic purposes and will be kept confidential.
Thank you for being kindly to answer this questionnaire.

Name of researcher_ Kalkidan Ketema Kebede _ ID No. Pgr/19204/12

How compact is the Gotera condominium?

Interviewee name: _____

Sex: F M (circle one)

Interviewer name: _____

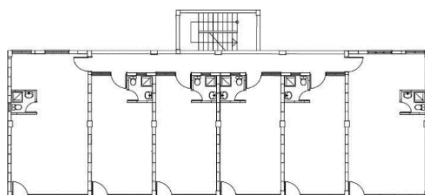
Age: < 20, 20-30, 30-40, 40-50 and above
50 (circle one)

Position/job: _____

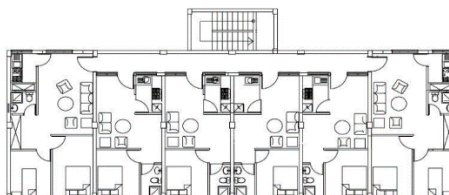
Date: _____

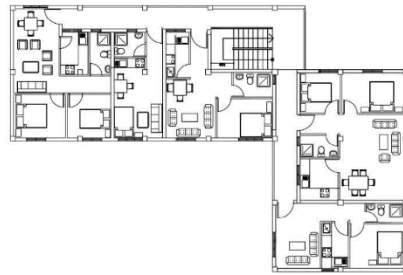
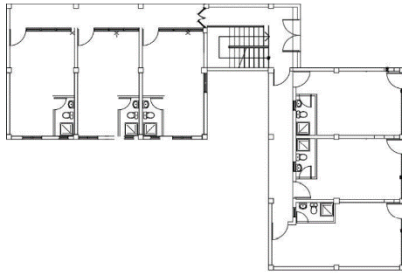
1. Block number _____

2. Block Type: ☐ 1. Block type one ☐ 2. Block type two ☐ 3. Block type three

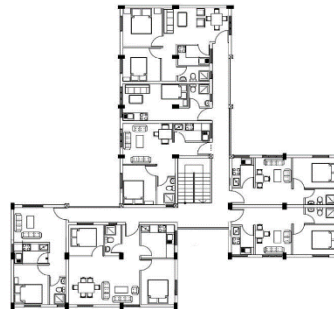
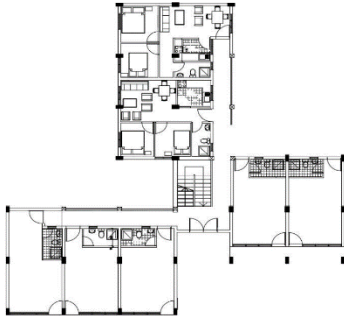


Typology 1





Typology 2



Typology 3

3. Tenure type: ☐ 1. Owner ☐ 2. Tenant ☐ 3. Other
4. When did you start to live here?
☐ 1. Recently ☐ 2. One year ago, ☐ 3. Two years ago, ☐ 4. Three years ago, ☐ 5. Four years ago, ☐ 6. Five years and above
5. The reason to come to this site ☐ 1. Family ☐ 2. For easily access to work place ☐ 3. Lottery ☐ 4. Purchase ☐ 5. Other _____
6. What is your houses number of your bedroom/ typology?
☐ A, studio ☐ B, one bed room ☐ C, two bed room ☐ D, Three bed room
7. How many family member do you have? _____
☐ A, two ☐ B, three ☐ C, four ☐ D, five ☐ E, six ☐ F, above six
8. What do you do for living?
☐ A, government employee ☐ B, non-government employee ☐ C, private job
9. How many hour does it take you to reach your work place?
☐ A, 5-10min ☐ B, 10-20min ☐ C, 20-30min ☐ D, 30-45min ☐ E, above 45 min

10. What mode of transportation do you use? (motorized or non-motorized transportation)

☐A, walking ☐B, public transportation ☐C, private car ☐D, bicycle

11. How much money do you spend for transportation per a day?

☐A, <10br ☐B, 10-20br ☐C, 20-30br ☐D, 30-40br ☐E, 40-50br ☐F, 50-60br
☐G, above 60

12. Do you have children? ☐ A, yes ☐ B, no

13. If No 12 is yes how many?

☐A, one ☐B, two ☐C, three ☐D, Four ☐E, Five ☐F, >5

14. How many of them go to school?

☐A, all ☐B, _____ of them

15. How many are going to

☐Kindergarten ☐primary school ☐secondary school ☐higher education.

16. What mode of transportation do your children use to go to school? (motorized or non-motorized transportation)

☐A, walking ☐B, public transportation ☐C, private car ☐D, bicycle

17. How many hour does it take them to reach school?

☐A, 5-10min ☐B, 10-20min ☐C, 20-30min ☐D, 30-45min ☐E, above 45 min

18. How much money do you spend for transportation to school for children per a day?

19. ☐A, <10br ☐B, 10-20br ☐C, 20-30br ☐D, 30-40br ☐E, 40-50br ☐F, 50-60br
☐G, above 60

20. Do you have a car? ☐A, Yes ☐B, No

21. If for question no 10 is yes, how much money do you spend for fuel per day, week or month? _____br.

22. If for question 10 answer is no, how many hour do you walk to get to transportation place?

☐A, 2-5 min ☐B, 5-10min ☐C, 10-15min ☐D, above 15 min

23. Do you believe the condominium have enough services?

☐A, Yes ☐B, No

24. If for number 23 is no, what services do you believe are lack?

25. What are big problems you face while you live in this compound

Appendix 2: The availability of service (checklist)

How mixed is the Gottera condominium

The availability of service

Services		Yes / no	Number
School	Kindergarten		
	Primary school		
	Secondary school		
Clinic/hospital			
Pharmacy			
Market			
Gathering places/ assembly hall			
Communal places			
Banks			
Daycare			
Park/ recreational area			
Play ground			
Shops			
Restaurants			
Cafeteria			
Game zone			
Laundry			
Other			

Appendix 3: Field survey of built environment (Checklist)

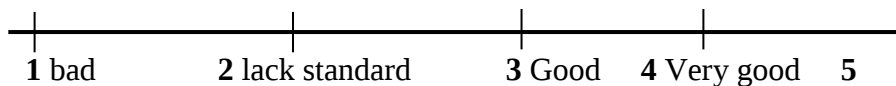
Country: _____

City/town: _____

Region: _____

Surveyed by: _____ date: _____

Rating scale:



Excellent

Elements to check	Features to check	yes	No	Need improvement	Rating	Remark
Inclusive pedestrian	Have pedestrian walk way					
	Have disable walkway					
	Have bicycle way					
Accessibility	The condominium is easily accessed from main road					
	Community services are located nearly for the building block					
Safety	Is the condominium safe and secure 24 hours?					
	Does the compound has its own fence					
Varity and diversity	Does different types of shops there?					
	Does different kinds of cafeteria there?					

	Does different kinds of communal spaces there?					
Permeability	Does the condominium block and internal street achieve permeability?					
landscape	Does the compound have enough greeneries, seating areas and shades?					
	Does the compound have different kinds of vegetation, trees, and flowers?					
Utilities	Does the condominium have good drainage system?					
	Does the condominium have enough electricity for residences and also commercials?					
Public spaces	Does community seating areas are there in the compound?					
	Is there any playground for children?					