AN EVALUATION OF THE APPLICABILITY OF COMPACT CITY STRATEGIES IN SRI LANKAN URBAN FORM

CASE STUDY - BANDARAWELA TOWN , SRI LANKA

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DECLARATION

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Abstract

The study on "An Evaluation of the Applicability of Compact City Strategies in Sri Lankan Urban Form" examines the key issues related to urban form of Sri Lankan cities and evaluates the applicability of strategies adapted for compact city development by the Western Countries in addressing the issues related to barriers in optimization of scarce land resources with cost effective infrastructure usage and meeting the challenges of exorbitant land prices prevailing in urban areas as against the present practice of enforcing standards and regulations in such areas.

Urbanization and urban development is a continuous process throughout the World which is occurring in an ad hoc manner and in haphazard way if the process could not be regularized through planning which is the existing issues characterized by the urban centres of Sri Lanka, thereby mostly cities are experiencing sprawling along major transport corridors in an uncontrollable manner which does not make any sense on sustainable development, strong urban- rural linkages or economic development to the region so that the growth associated with commonly visible problems where none of the urban centers provides or act as engines of growth for their peripheral areas. This pattern of growth and inefficient use of urban space lead to a multitude of problems which in turn affects to the wellbeing of the city dwellers as well as commuters to the city daily. The projections and forecasts show that the urbanization and related issues will become a severe threat in the quality of life in the future of Sri Lankan cities unless otherwise the situation becomes unmanageable to the city administrators and the city planners together with city designers and architects as the cities make unsustainable in future.

Compact City Strategy is a basic model which involves with sustainable urban design. European Commission introduced the "Compact City" concept as the archetypal sustainable urban form for European cities by publishing the "Green paper on the urban environment" in 1990. The basic idea of this model is to have high density, mixed use development with high quality public realm. This approach to urban planning and design is well established among proponents of the New

Urbanism, Transit Oriented Development (TOD) and Smart Growth movement too. Compactness is a way to save limited resources such as land, other natural resources, and time, attracting people to enjoy with facilities developed in relation to interchanges developed in expressways and highways as well as many valuable aspects in urban areas. Compact City is a collection of coherent compact urban districts and a compact form. Increasing densities requires improving the quality of urban areas to attract people to live and work and its long term sustenance of its existence.

This study examines how to incorporate the basic concepts and strategies of Compact City Model in Sri Lankan urban form and discuss how it could be used and what limitations exists in urban design point of view. The applicability of model, methods and strategies in problem solving of the urban areas and the results anticipated in adapting of such a model will be analyzed by a case study conducted in Bandarawela Urban Council area. The research methods of the case study evolve mainly through an interview with a selected sample of knowledgeable people of the locality who have the ground based knowledge of the area, in depth interview method with the professional practitioners like planners, architects and designers who have engaged in planning and developments of urban areas and direct observations through field visits by the researcher.

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Chapter One - Introduction

1.1 The Problem

Haphazard and adhoc development is a continuous phenomenon of the urban areas in Sri Lanka although many new concepts were introduced at the initial stages of its development and the regulatory measures introduced without having necessary ingredients to apply in city designs so as physical development spread along the main transport corridors in an uncontrollable manner. The growth is leading towards individual needs finally ended up with leaving one of the common problems of sprawling along arterial roads which were acted as infrastructure corridors in urban areas which creates negative impacts to the cities. The necessary guide and required urban designs were not being able to couple with the development plans formulated by the authorities at least to the main urban centres which are very significant in certain cultural, religious, climate, terrain and functional diversities. Random scattered growth and inadequate use of space is leading to a multitude of problems which are directly affects not only to the life of the city dwellers but also many of the commuting population to such centres for their daily needs.

The need for a sustainability of cities is not look at any angle by the respective city administrators mainly due to the ignorance or lack of understanding and knowledge on the subject matter proper. In relation to the increasing issues with demand for urban land many of the cities compelled to have its own approach for high intensity of development in order to curtail geographical spread of urban activities which lacks optimum utilization of both land and the functions. If the authorities could address these issues and redirect the use of urban land by way of intensifying development permits consumption of less land and resources which are essentially needs to retain for the use of future use. There should be a proactive approach in converting lands for planned intensified development toward underutilized urban areas. There should be a mixed-use environment which caters to a variety of roles such as recreational, commercial, residential, institutional, and corporate requirements. All of these sectors appeal to have the Compact City model which would be able to solve the problems in the best possible way with a grace covering

every inch of space that is functional and at the same time in turn with its context. Compactness is one of the components required to rectify this continuous neglected urban development in order to save limited land and natural resources while making an ideal cities for better quality of life so that where everything is readily accessible with minimal effort.

The sustainable development depends on the combination of physical, economic, social and environmental elements. Urban sustainability is about environmental concerns, economic viability and social equity. The shape and density is having high relationship with the urban sustainability. There are strong arguments that compact city is the most sustainable urban form. The density and compactness needs the limits where it varies from place to place and depends on local requirements especially on the climatic, geographical and existing built environment conditions. There's a question remains on what is the spatial reference in undertaking the compaction? Is it the existing town /city limit or a region? Should it be the neighborhood, urban sub-centers, the inner city or the suburbs? As well as the question of whether compaction efforts should be concentrated on the development of new settlements or on modifying existing ones?

The question in hand today is whether we can apply the compact city strategies to control the urban sprawl in our urban areas? If so what are the conditions and limitations implied? Increasing density requires improvement of the quality of urban areas to attract people to live and work. How far can we use urban design solutions in this regard? These particular problems will be addressed in this dissertation.

1.2 Background of the study

Compact city strategy is a basic model for sustainable urban design where European Commission introduced "compact city" concept as the archetypal sustainable urban foam for European cities by publishing the "Green paper on the urban environment" in 1990. In the Netherlands, concepts for compact forms of urbanization have played a major role in strategizing for spatial planning. The Forth National Policy Document on Spatial Planning (1988) was based on the concept of the 'compact city'.

The compact city can be achieved by delivering high density, mixed use development with high quality public realm. This concept also refers to an urban form that contributes to sustainable development with the long term objectives of sustainability.

Compact city is a high density urban settlement that has evolved with central area revitalization, high density development; mixed use development instead of single function development by providing services and facilities. Increasing density requires improving the quality of urban areas in order to attract people to live and work.

The compactness, high density and mixed use development make more benefits as described below:

- The compact cities have networks of neighborhood, these neighborhoods bring work and facilities within close proximity making less driving for everyday needs and encourage walking and cycling. It reduces number of journeys by motor vehicles and the distances as well. More importantly it saves wastage of time of the people.
- It encourage re-use the previously developed lands and direct to the optimal use of the infrastructure especially the transport infrastructure by promoting public transport.
- Preservation of green space and creation of milieu for human activities.
- Compactness protects the countryside from the encroachment of urban development.
- The concentration of diverse activities instead of grouping similar activities makes the efficient use of energy.

The promotion of new concept was backed by the UN Report which indicated that the world urban population of 3 billion today is expected to reach to 5 billion (61%)

by 2030. With growing urbanization in Sri Lanka it expects to increase urban population from 20% in 2000 to 60% in 2030. The Urban population in Sri Lanka was last reported at 3,118,603 in 2010, as per the World Bank report published in 2012. In 2009 urban sector contribution to GDP were 83.3% (manufacturing, construction, and services sectors). It is expected that the structural changes that are taking place as a result of development and its unevenness has caused a rapid growth in the urban sector in the country with the complexity created through these circumstances and the unplanned development which direct for urban sprawl. The negative consequence of sprawl is that cities are facing problems in terms of living quality and environmental pollution.

Most of our urban areas are having environmental problems linked to local environmental contexts and prevailing socio-economic conditions, especially the lacking resources which are very much essential for human wellbeing (land, housing, water and energy and other infrastructure). High demand for lands in urban areas makes increasing land prices, loss of environmental sensitive areas and increasing the areas affected by natural disasters.

As cities are the engines of national economy rapid urbanization of our urban areas would needs to plan in a very systematic manner. In order to avoid negative effects of our urbanization and urban sprawl successive governments introduced the concept of sustainable cities on its agenda and are searching for novel ways to expand and develop urban areas while conserving natural resources. The formidable question of our leaders and planners is how to manage Sri Lanka's great diversity and physical restructuring while building liveable cities. Under these circumstances it needs to examine how the compact city strategy provide solution for the issues created by urban sprawl and as a sustainable city form how far it could be applicable in Sri Lankan context.

1.3 Research Hypothesis

The following hypothesis builds on for this research:

Ho : Possible to apply Compact city strategies in solving some urban issues in Sri Lankan urban centres as against

H1 :Not applicable the strategies in solving urban issues.

1.4 Methodology and Procedures

The intended methodology and the anticipated procedures of the study could be described as follows:

- Identification of Research Question
- Defining Research Objectives
- Literature survey related to the compact city concept and its applications
- Data collection related to the study area in order to identify the existing situation and issues to be addressed.

Secondary data (From relevant government and non-government organizations, researches, Papers, Reports, Books etc...)

Collect data on following aspects:

- Historical studies
- Natural environmental studies
- Socio cultural , Scio economic studies
- Activity studies
- Built environment studies
  - Map studies
  - Picturesque studies
  - Typology studies
  - Morphological studies
  - Temporal data studies

Primary data
Use interview method with a selected sample of knowledgeable people of the locality who have the ground based knowledge of the area.

Use in depth interview method with the professionals such as planners, architects and designers who have engaged in planning and developments of the urban areas.

Use direct observations through field visits by the researcher.

- Analysis
    a. Critical examination of the concept and requirements of the compact city strategy define criteria that need to be fulfilled.
    b. Critical examination of urban context related issues with special reference to case study area.
    c. Examine relevance between the criteria, possibility and issues in application of the strategy.
    d. Evaluate the urban design principles in application of compact city strategies with special referenced to the study area.

- Conclusions and recommendations

1.5 Choosing the Area for Case Study

Study chooses Bandarawela Urban Council Area as the case study area as Bandarawela is having a booming development in haphazard manner with increasing urban sprawl as a result of encroachment of surrounding natural lands of which some of them are not suitable for physical development so as it creates several issues related to environmental, social and economic perspectives.

1.6 Limitations

The limitations of the study is identified as the study do not consider much on practical implementation with special reference to existing planning policies and their implications.

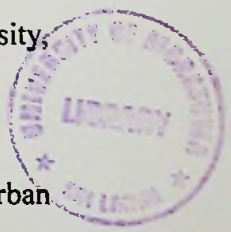
The other aspect of the limitations is evolved with non consideration of social implications in the compact city under prevailing social perspectives.

Chapter Two – Theoretical Framework

2.1 A Compact City

By 2050 there will be 9.3bn people living, breathing and consuming the planet's resources, with 75 per cent of these living in cities. The successful cities of the future will be more compact and efficient but to realize this future, it needs to overcome the paradoxes created by prosperity and connectivity. The advantages of compactness are significant: more efficient and less expensive infrastructure, utilities, and public services; more effective public transit; pedestrian-friendly, mixed-use neighborhoods; and better integrated regional economies. Compact cities, towns, and villages ease development pressures on forests and farms, helping to stabilize rural communities.

The Compact City Model becomes known as one of the solutions to face the problem of the rapid development of the decentralization outwards of the cities. The compact form has been studied in the planning literature mostly during the last twenty years, to implement the sustainability within the urban environment. It is a multi-functional dense development, encompasses varying uses such as residential, commercial, institutional and corporate, connected with a well-planned transport system. The entire city is well organized. Every component is connected with public transportation. Basic needs of life are at walking distances. Functions are mixed all over the city instead of being separated. The environment encourages social interaction (Shrivastava, P.A 2009). The basic idea of this model is high density, mixed use development with high quality public realm.



Compact City Strategy is a basic model which involves with sustainable urban design. European Commission introduced "Compact City" concept as the archetypal sustainable urban form for European cities by publishing the "Green Paper on the Urban Environment" in 1990. The European Commission and national governments in many Western Countries adopted in recent years in their development policies to promote the densification of the cities to reduce the pollution and the energy consumption (Breheny, 1996). In fact, the European Community and 'Agenda 21'

encouraged and requested the high density development as a central principle for the growth of cities (De Roo, 2000). This approach to urban planning and design is well established among proponents of the New Urbanism, Transit Oriented Development (TOD) and Smart Growth movement too.

The idea of 'Compact City' refers to medieval city or XIXth century city. The Compact City strategy focuses on the form of the city and the efficiency of the distribution of human activities within it, making optimal use of the infrastructure of the city, particularly transport infrastructure, through compact, mixed-use and dense settlement structures enabling effective use of public transport and non-car-based movement systems (EUEGUE, 2004).

2.2 Compact City Characteristics

Dantzig & Saaty (1978), give an explanation of the densification characteristics by presenting the features under urban form, spatial characteristics and the social functions as follows:

a) Urban Form:
   - High density settlements
   - Less dependence on automobile
   - Clear boundary from surrounding areas

b) Spatial Characteristics:
   - Mixed land use
   - Diversity of life
   - Clear identity

c) Social Functions:
   - Social fairness
   - Self-sufficiency of daily life
   - Independence of government.

The three main aspects of the Compact City as identified by the Burton in 2002 has the characteristics of a high-density city, a mixed-use city, and an intensified city. These three characteristics are considered as main indicators of identification or differentiation of compact city from one another, through which we are able to analyze the magnitude of compactness in a particular urban area. However Jane Jacobs in 1961presented four main essential conditions to generate a mixed-use development, which generates 'exuberant diversity' in city's districts such as:

- Each district has to serve more than two different functions to ensure the presence of people on diverse schedules and have different purposes for being in that place;
- The possibility to turn corner should be recurrent, so the blocks must be short;
- The building of a district must be vary in age and conditions; and
- There should be a dense presence of people, including the residents.

While arguing and developing the different ways of differentiation of compact city the Neuman, M (2005) forwarded a comprehensive list of characteristics of the compact city that can be used as a guide for future research in the subject of compact cities. The characteristics forwarded by Neuman were based on reviews of practice, research, literature, and his observations. In his arguments he stated that many of the characteristics could be distinguishable in any city. These characteristics could also be used to guide the physical design and planning criteria for the measurement of status of a new town. They are:

- High residential and employment densities
- Mixture of land uses
- Fine grain of land uses (proximity of varied uses and small relative size of land parcels)
- Increased social and economic interactions

- Contiguous development (some parcels or structures may be vacant or abandoned or surface parking)
- Contained urban development, demarcated by legible limits
- Urban infrastructure, especially sewerage and water mains
- Multimodal transportation
- High degrees of accessibility: local/regional
- High degrees of street connectivity (internal/external), including sidewalks and bicycle lanes
- High degree of impervious surface coverage
- Low open-space ratio
- Unitary control of planning of land development, or closely coordinated control
- Sufficient government fiscal capacity to finance urban facilities and infrastructure.

2.3 Advantages of Compact City

There are various advantages of having compact cities which provides many benefits as well to the city dwellers of the compact city which are cited as:

- less car dependency
- low emissions
- reduced energy consumption
- better public transportation services
- increased overall accessibility
- re-use of previous developed land
- high quality of life
- preservation of green space (Bradecki, T ,2009).

In relation to the densities the higher population densities normally lead to economic growth and some efficiency gains may be possible for the provision of services

through increasing population density in cost effective manner and it also make Improvements to social equity.

Compact city promotes mixed use development where it attracts mixed-use buildings for housing, retail, commercial, offices which are needed to encourage local employment and to augment the economic sustainability of local businesses because of their location in the proximity of a heavy concentrated population. Arbury in 2005 states that "Mixed use development can provide very significant benefits, in terms of promoting vitality and diversity".

The reduction of the need to travel to work and routine activities is another advantage of the mix use form (Evans & Foord, 2007), so as instead of driving every day the mixed-use promotes the walking and cycling modes. It made possible by the concentration of activities hosted in new buildings erected in spaces left empty by brown field areas. "The increased use of existing buildings or sites; changes of use, etc which lead to an increase in activity; and increased in the numbers of people living in, working in, or travelling through an area "(Williams *et al.*, 1996).
The level of social segregation also possible to reduce by dense urban form, where the communities are more mixed and not spatially segregated, as the phenomenon of segregation apparently is a result of the decentralization.

2.4 Compact City Skeptics

The benefits of compact cities as described earlier also produced its negative impacts as well. In case where compact city policies had been implemented, follow-up studies began to show that the predicted benefits were not happening as they expected and that the claimed benefits of urban compaction are at the very least romantic and dangerous, and do not reflect the hard reality of economic demands, environmental sustainability and social expectations (Thomas and Cousins, 1996: 56).

The arguments with regard to environmental quality of the compact city indicated that although it 'saves' the countryside from greenfield development and that the number of car trips per person are reduced in the overall context it has been questioned by empirical evidence that the reality is not as expected in terms of environmental quality. Williams (1999: 172) states that 'recent research in three London Boroughs which had been intensified over a ten year period showed no reductions in car use. Travel patterns were so complex, due to lifestyle shifts such as cross-London commuting and increased journeys for leisure, that no relationship could be found' Indeed, although traffic emissions may be reduced by the compact city, there is a potential for more people to experience remaining emissions because of higher population densities. Neuman, M (2005), questioned, is the compact city a healthy city? The health of a city is determined by many factors. Only some factors are affected by density or compactness but most often, dense cities are unhealthy.

Reductions in dwelling sizes due to increased densities; health risks associated with residential overcrowding or the closer proximity of residential areas to industrial areas in 'mixed-use' developments; higher crime rates commonly linked with high density living; as well as increasing potentially negative impacts on social segregation and housing affordability as those are all clearly undesirable social outcomes that could potentially arise from the compact city model (Burton, 2000).

There are many questions remain around to what extent the Compact City widens beyond the increase of the density of the population, and how, when and under which factors or indicators it is possible to claim that a city is 'compact'. Does the compactness have to be measured by the scale of a city? Or by its capacity of how many and what kind of functions can be fitted in? What is its intensity? are the issues raised by Thomas & Cousins in 1996.

2.5 The Urban Sprawl

Urban sprawl is a common phenomenon when city is expanding towards outwards from the city centre. How the 'urban sprawl' can be defined? The most common definition which can be found in dictionaries and on the web claims that urban sprawl is the "unplanned, uncontrolled spreading of urban development into areas adjoining the edge of a city".

The European Environmental Agency (EEA) defines the phenomenon of urban sprawl as the "physical pattern of low-density expansion of large urban areas, under market conditions, mainly into the surrounding agricultural areas".

In the actual literature and in the urban planning doctrine, there is no an accepted idea of what urban sprawl is, how it develops, how it can be measured, and in which forms can be considered sustainable, or not. The process of urban sprawl is very hard to be defined, as it occurs in several diverse shapes and its multidimensional phenomenon formed by different parameters (Bernhardt, 2007).

Neuman, M (2005), described Urban sprawl results from the confluence of several factors such as:

- the lure of cheap open land outside the city advances in transportation
- easily available capital to buy property
- the rise of the real estate developer
- mass production of housing, and
- always-present image of the single family home.

The spread of cities across the countryside was propelled by the impetus of depopulating large, congested, polluted and crime-ridden industrial cities since nineteenth century. Further he illustrates the characters of urban sprawl as follows:

- Low residential density
- Unlimited outward extension of new development
- Spatial segregation of different types of land uses through zoning

- Leapfrog development
- No centralized ownership of land or planning of land development
- All transportation dominated by privately owned motor vehicles
- Fragmentation of governance authority of land uses among many local governments
- Great variances in the fiscal capacity of local governments
- Widespread commercial strip development along major roadways
- Major reliance on a filtering process to provide housing for low-income households.

2.6 Precedents

Precedents studies were taken based on several studies, especially the studies of (Shrivastava P.A 2009 & Cereda v., 2009). There no evidence found from Sri Lanka in this regard.

2.6.1 Vidyadhar Nagar Township, Jaipur, India

The Vidyadhar Nagar Township in Jaipur, India was the project which briefed to plan the view of Vidyadhar Nagar. It's about 3.5 km northwest of the parent city of Jaipur and would accommodate over a 100,000 people on a 400 hectare site. The aim of the master plan was to have environmental quality, a healthy and pleasant environment, and efficiency in use of resources, ease and convenience to the people, image ability, flexibility and feasibility.

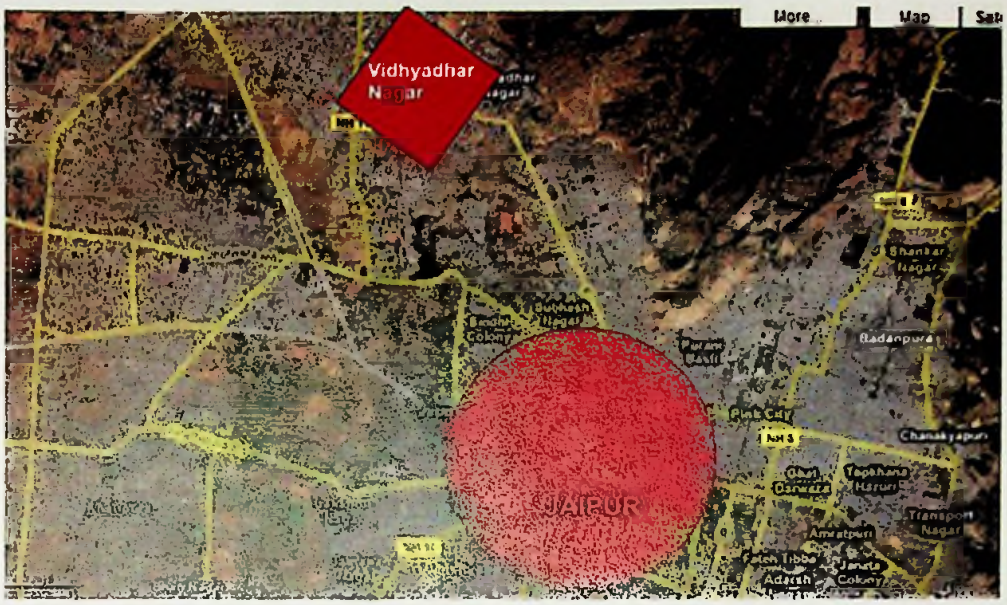


Fig 2.1: The relationship of Vidhyadhar Nagar and Jaipur, India

The fundamental premise of this project was to develop Vidhyadhar Nagar as an energy conscious city that is in-built with recovering the greater forces of nature. A Compact City model with a linear centre that has easy access to all parts of the town through pedestrian and open space networks was designed and implemented under the Vidyadhar Nagar project.

2.6.2 The Greenwich Millennium Village, London

The project on Greenwich Millennium Village in London was an important attempt to create higher density sustainable housing in one of the London's largest brown field sites – the Greenwich peninsula. The objective of this government sponsored competition was to create a compact city; high density, environmentally and socially sustainable forms of urban development and set new standards of design for buildings on the peninsula's good transport connections.

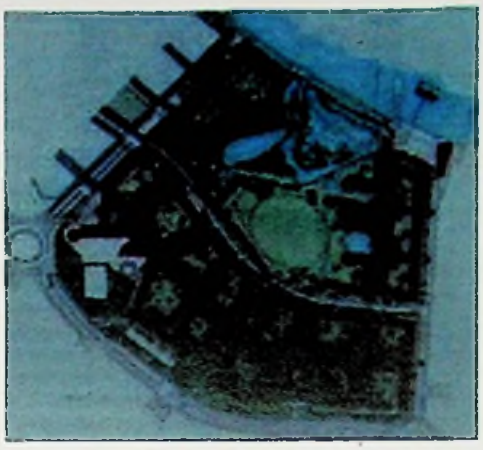


Fig 2.2: Master Plan for Housing, Greenwich Millennium Village

2.6.3 Curitiba, Brazil

Curitiba, Brazil was an attempt made to impose a 1942 plan by the French town planner, Alfred Agache. The earlier plan was concentric: to go from one district to another, traffic, both public and private, had to pass through the center, which would certainly soon become congested. The new plan was set up on the principles of linear radiation from the core of the city along five identified structural axes.

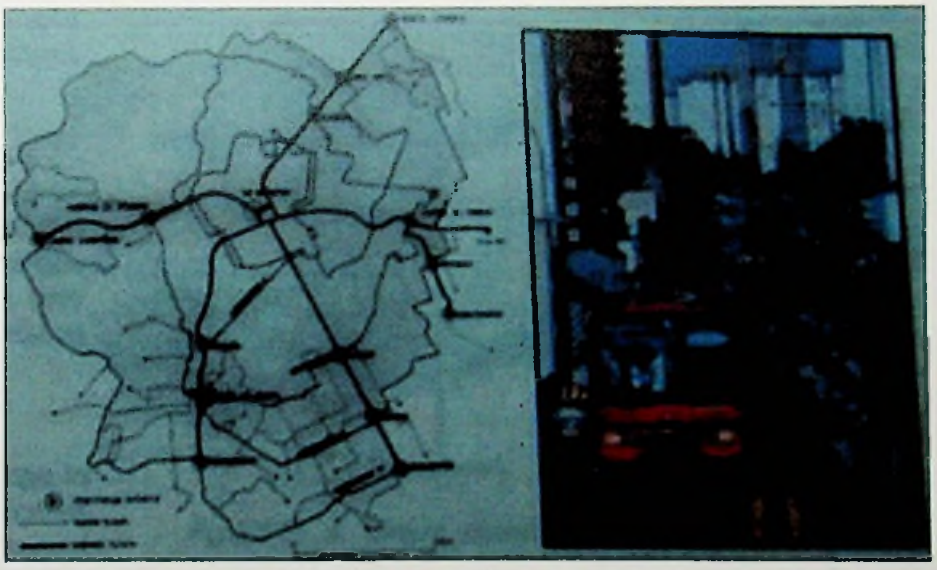
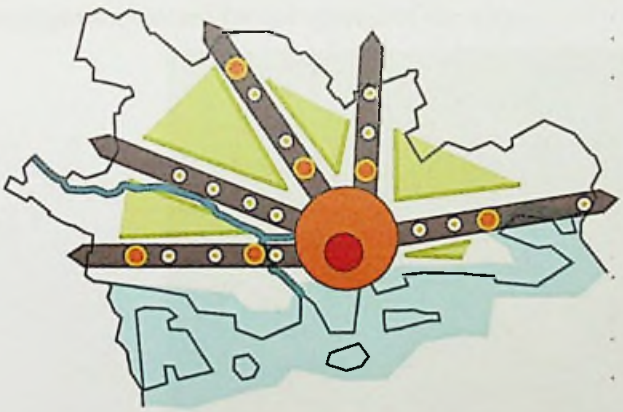


Fig 2.3: Structural Axes radiates in five direction from the City Centre
Structural Axes contain the maximum densities and serviced by a Bus Transit

2.6.4 Gothenburg

Gothenburg is a city situated near the mouth of the river Göta älv, in the south-west of Sweden in the Västra Götaland County, and is the second largest city after Stockholm, with a surface area of 450 sq. km. The population is about 491,000 in the municipality, with a density of 1084 inhabitants/sq. km, the 80% Swedish and the 20% from other countries, and about 900,000 in the region. Furthermore, Gothenburg is the largest student city in Sweden, with 61,000 students, as the Chalmers University is well known internationally, and the major amount of people between 20 and 30 years. The city is well connected by road and rail to Oslo, Copenhagen and Stockholm. It is also the biggest harbor in Scandinavia and its importance is also due to the fact that it is in a distance of 500 kilometers from the 70% of the industries in the Nordic countries.

The Compact City model is the main strategy used for the planning system of the city, and it aims at the combination of environmental, social and economic dimensions to get a more sustainable development of the city.



Source: Comprehensive Plan for Gothenburg, Del 1, 2008

Fig 2.4: Gothenburg City Model

The compaction strategy is a brand new system which came into force in Gothenburg only four years ago, when the old Comprehensive Plan -1999 has been revised and mostly changed into clearer strategic proposals

. The most important objectives of the Comprehensive Plan are:

- Build and develop centrally
- Complement and mix
- Develop the Gothenburgness
- Strengthen public transport
- Concentrate on key nodes
- Reserve outer areas for future development

2.6.5 Amsterdam

Amsterdam is the Capital City of the Netherlands, and it is situated in the north of Holland with a population of about 750,000 inhabitants with a density of 5,809 inhabitants /sq.km. It is known as the greatest planned city of northern Europe, with a good economy and its tolerant character. Amsterdam can be defined as a Compact City due to the reasons of both for its dense urban form and for the compact policies that have been implemented since the seventies. In fact, the Netherlands is considered to be among the initiators of the idea of the Compact City, with diverse concentration policies to implement the economy and the social problems, like the segregation caused by the spread of the city.

Fig 2.5: Amsterdam Housing Typology

Chapter Three – The Methodology

3.1 Introduction

The chapter two described in detail the compact city concept by giving definitions, characteristics, advantages and skeptics of the concept and also described comprehensively on the urban sprawl and its nature. Accordingly it was concluded that there's no universally applicable indicators to claim on any urban area of its compaction or its sprawling effects. It is in this context there is a question on what is the spatial reference in undertaking the compaction, is it the existing town /city limit or a region, should it be the neighborhood, urban sub-centers, the inner city or the suburbs. There is also another question on whether compaction efforts should be concentrated on the development of new settlements or on modifying the existing ones. There are questions on what is the limit of density and use mix to consider an urban area as a compact city and also how to define unique way to measure the sprawl. Therefore, as Beruhandt, 2007 stated that these processes are vary and very hard to be defined as it occurs in several diverse shapes and in its multidimensional phenomenon, formed by different parameters.

This study comprehensively analyze this situation and comprehend the parameters that are required to be used in analyzing the levels of compaction of cities in Sri Lankan context by studying the applicability of these diverse definitions for the selected study area. This study will be useful to define and establish an acceptable base which is suitable for Sri Lankan urban related situation to distinguish both these phenomenon (compact/sprawl) prior to its applicability in the study area. Analyzed the applicability of compact city concept under following indicators which were derived from the characteristics discussed by Neuman.M in 2005 excluding the social, economic and financial aspects in this dissertation.

1. Use mix
2. Densities
3. Proximity to urban services
4. Development pattern

5. Urban infrastructure
6. Transportation
7. Accessibility
8. Planning policies
9. Natural environment

As he stated that many of the above characteristics could be nearly any city and they can also be used to guide the physical design and planning criteria for a new town. Here it studies the suitability of the study area by evaluating the existing situation under each indicator towards compact city concept and possibilities of application the concept under each indicator by analyzing the study area.

In order to study the relevance of the concept several layers and databases of the study area were created by the author using GIS technologies using 1:5000 scale digital database as the base map for the study which were prepared and compiled in 1997 by the Survey Departments using 1:20,000 aerial photographs of 1992 and 1993 with field verifications in 1998. For the analysis of these data were considered as the base year situation in 1998 and the author updated the data using Google images and field visits to provide current situation in order to understand the magnitude of changes occurred in compaction and sprawling. However there is a limitation of the extraction of building layer as only the visible buildings were plotted and created its related databases without due regard to balance components of buildings due to the limitation of time for field verification.

3.2 Analyzing the indicators

3.2.1 Mixture in land/ building uses

In Sri Lankan context of its urban areas especially in local level regional centers it does not show much of difference between the land use and building use once they plot on a map. The reason behind this is that the most of buildings are having single uses. Less number of high-rise buildings in most of these urban areas as it contributes to this situation. Thereafter the study focuses on the use mixture by

paying more attention on horizontal use mix than the vertical use mix. At this stage the study examines the building uses with quantitative data (number of buildings) under dominant uses and their spatial distribution pattern within the study area to get an idea of existing situation. Mixture within and around the center are also be addressed in this analysis.

At the next stage the study covers the quantitative data about use mix in vertical form, and studied the number of multipurpose buildings and what are the available mixed uses within its vertical domain. It studies how the prevailing use mix arranged within the building in general terms.

3.2.2 Densities

The existing building densities were studied and analyzed the trends in densities in relation to the pattern of development during past few years. It calculates existing building density and density of the new developments and density levels prevailed in the past with conclusion on the density of the building in relation to the said temporal data. Finally the study analyses the way the developments continued and its relationship with compact city strategies.

The study also calculates the floor area of each building in the study area and examines how the floor area density spatially distributed within the center and the periphery of the study area. Then it calculates the height of each building and how the height densities spatially distributed within and around the center.

Further it calculates the concentration pattern of population in the study area on the basis of the assumptions made in relation to the residential use floor area and evaluates the population density with its spatial distribution throughout the study area.

3.2.3 Proximity

In compact cities the location of urban services are expected to establish within the walking distances from the residents. Therefore the study analyzes the residential neighborhoods and the proximity of the locations of the services of the town for day today needs of the resident population of the study area in order to get an idea of the applicability of the concept in terms of proximity.

3.2.4 Development pattern

In addition to above factors the study examines the existing development pattern, evaluating the vacant or abandoned lands/buildings, adjoined developments, developments types, contained developments, legible limits of developments along transport corridors, edges and the legible limits, solid void relationships etc in addition to the magnitude of the infill, extensions and leapfrog developments occurred during the last 15 years within the Bandarawela UC Area.

3.2.5 Urban infrastructure

Under the urban infrastructure the study concentrated its analysis especially on distribution of electricity and water mains as these two important infrastructure facilities have direct linkage with the compact city concepts as it attracts heavy population to the city. This study searches about the existing situation and the issues derived under these two components of the urban infrastructure.

3.2.6 Transportation

Public transportation is promoting in compact cities. The study examines the existing transportation methods, possible transportations methods and the existing issues related to transportation of the study area.

3.2.7 Accessibility

There should be a great accessibility in compact cities for each and every parts of the city so as this study analyses the pattern of accessibility of the study area with roads network, street connectivity (internal/external), including foot paths, step roads etc.

3.2.8 Existing planning policies and implications

In order to get an idea on how the existing planning policies and implications would impact on compact city strategies, are they supportive to compact city strategies or not the study examines the prevalent planning policies and their implications over the proposed concepts.

In order to arrive at a conclusion on applicability under above aspects this study conducts pre planned systematic in-depth interviews with the selected sample consisting people who have the ground based knowledge of the locality, various professionals involved in the development of the area and the officials of the local authority (Municipal council) and other related institutions. Based on the discussions with them the study comes to a conclusion in applicability of the concept under each aspect which was described above.

Chapter Four – Case Study Analysis in Bandarawela Municipal Council Area

4.1 Introduction

In the chapter on theoretical framework it is studied in detail on the compact city concept and urban sprawl characteristics as well as how the concept of compact city could be applicable as a solution for the growing problems in relation to urban sprawl in many cities. Then in the next chapter it analyzed in detail how to study the prevailing compact characteristics and sprawling characteristics in our urban areas together with methodology adopted to study the possibilities of application of compact city strategies as a solution for the growing issues in connected with urban sprawl in Sri Lankan urban form. In this chapter, the chapter on case study analysis will describes the methodology which it used in this study in relation to face to the prevailing situations of the Bandarawela Urban Council.

4.2 Situational Analysis of Bandarawela Municipal Council Area

Bandarawela Municipal Council (MC) Area has an undulating land terrain with varying altitude ranging between 1,128m and 1,341m above Mean Sea Level (MSL) with an average mean height of the town as 1,220m. It lies in between North longitude 6^0 - 7^0 and East latitude 80^0 - 81^0.

Due to the high altitude, the area has a mild weather condition throughout the year with an average temperature of 15^0 C – 30^0 C. Hence Bandarawela has become more popular among local/foreign visitors as a tourist destination based on natural gifts of weather and especially the scenic beauty and cool climate; it is popular among the Sri Lankan citizens as well and select as the destination to spend their vacations with family members. As a result the tourism sector represents a significant growth in the region. One of the important tourist routes of the country is also running through the town to the destinations of Colombo, Kandy, Nuwara Eliya, Bandarawela, and locations in down south/East consists of Tissamaharamaya, Kataragama, Wellawaya, Buttala, Moneragala, Arugambay etc. Furthermore, Bandarawela is connected to the regional towns and villages by road and by rail.

According to the historical evidence of this town, the name had been evolved with the name of paddy fields which belongs to a person called "Bandara", and "Wela" means the paddy field. Accordingly the name of the town formed as "Bandarwela". During the period of British administration the town had been transformed into a services provided town to the surrounding tea estates and the settlements located around the area.

At the beginning the town was governed by Badulla local board and in 1933 it was formed as a mini urban council consisting of numbers of wards. In 1939 it was formed as an Urban Council (UC) consisting 7 wards. Bandarawela UC was declared as an urban development area under the Urban Development Authority (UDA) in 1980. It was an Urban Council until 2010 and promoting as a Municipal Council (MC) with an expansion of the area up to 747 ha from 246ha. The population of the Municipal Council area is about 50000 in 2011.

Most main town centers of hill country in Badulla District such as Badulla, Bandarawela, Haputale, Diyatalawa and Welimada are having some individual conventional characteristics and are functioning as regional service centers. The commercial developments of these centers, have distorted conventional characteristics in the built form mixed up with ad-hoc development. The physical arrangement and the general appearance of the town center have not created a unique image so as this situation is severely affected to the overall characteristics of the area. Bandarawela town is acting as the main commercial center of the hilly area of Badulla District with a booming economy with very vital role in the regional context as one of the main service centers of the region. Trade and commerce, retail and wholesale activities, institutional, educational and tourism sectors contribute to the wealth of Bandarawela town.

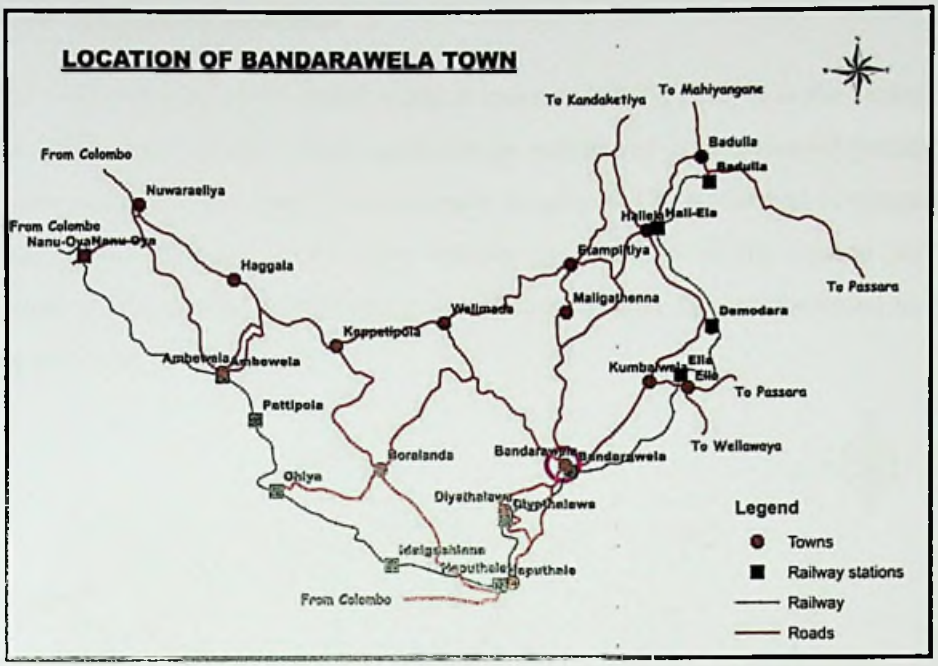


Fig 4.1 Location of Bandarawela

4.2.1 Study Area

For this study it takes Bandarawela town center and outer area which can be physically considered as the Bandarawela urban area. Availability of digital data was also considered in this selection.

Most active area for the said activities or the town center needs to be derived in order to fulfill the requirements of the study. Author used the general knowledge of the area and conduct some discussions with the professionals engaged in the developments and planning in the areas and demarcated the town center area consisting 117.3 ha in extent which will be referred as the "center" herein after in the study. It lies along the physical prominent features of the town such as roads, railroads and lot boundaries etc.

4.2.2 Bandarawela Town

The selected area for the detail study is indicated in Fig 4.2. It is the central area of the Municipal Council which consist large number of nonresidential properties and physically abutting to each other in many locations. The horizontal compactness and vertical development is the main criteria for selection of the central part of the Bandarawela for the detailed study in addition to other factors discussed in detail in the later part of the chapter.

Fig 4.2: Location Map of Bandarawela Town Centre with Topographic Information

4.3 Analyzing the Compact City indicators

4.3.1 Mixture in land/ building uses

As shown in the Fig 4.3 it can be observed that the use mix in horizontal form of the town center is more complex as it consist of more uses than in the outside areas.

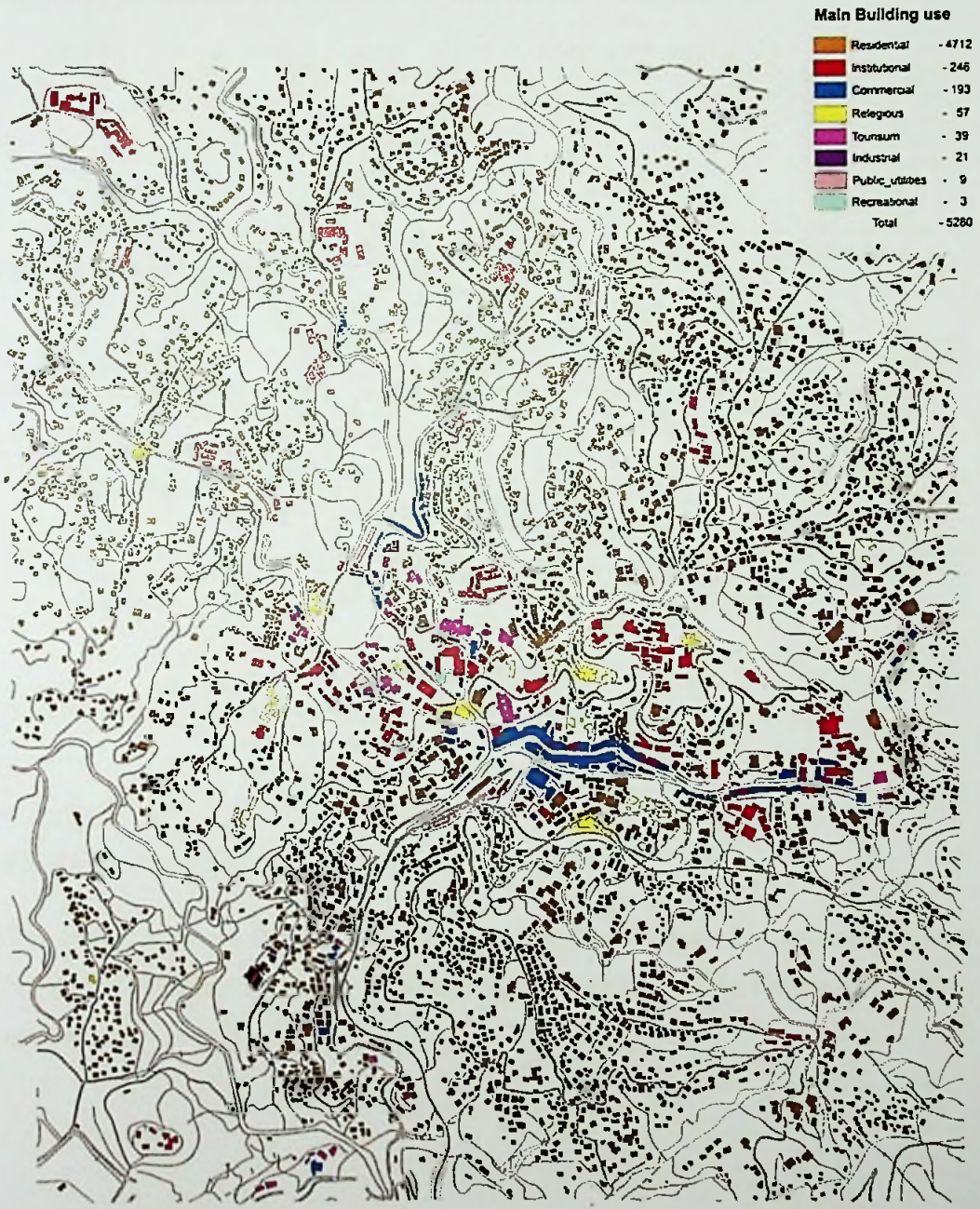


Fig 4.3: Building Use of Bandarawela Town Centre

The reason behind this situation is that the natural compactness at the center is due to the mountanious and non avilability of flat lands in surrounding areas.

According to Fig 4.4 it can be seen that most of the important buildings are covering several activities of the town which are located within this identified town center area and the variance of the uses is higher at the center of the town.

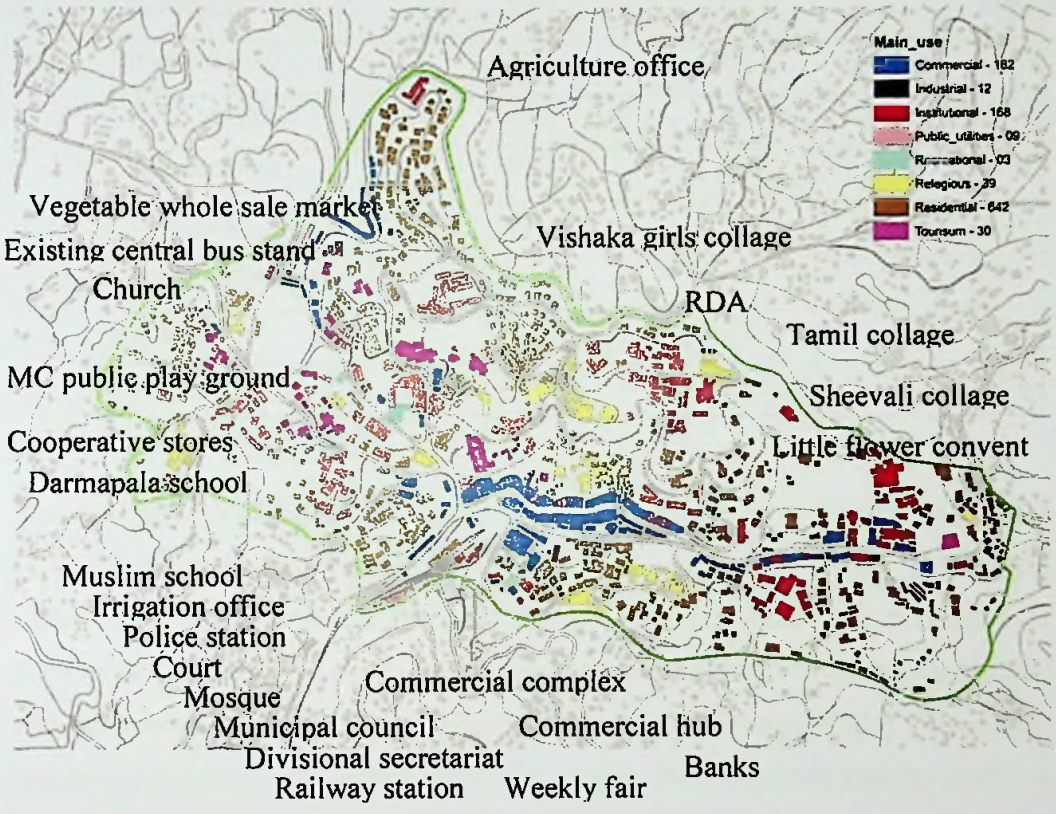


Fig 4.4: Building Use in Bandarawela Town Center

The table 4.1 shows the number of buildings in the study area as against the total number of buildings in the MC area with regard to its percentage share to the total in each use.

Table 4.1: Number of Buildings in Each Category by MC Area and Study Area

Use	No. of building in the area	No. of buildings at the center	Percentage of building at the center
Commercial	193	162	84%
Industrial	21	12	57%
Institutional	246	168	68%
Public utilities	09	09	100%
Recreational	03	03	100%
Relegious	57	39	68%
Residential	4712	642	14%
Tourisum	39	30	77%
Total	5280	1065	20%

Source: By the Author

The total number of buildings at the center represent only 20% of the total number of buildings of the strudy area (MC Area) but when considering the persentages under each use it can see that every use except those residential use represents over 50% of the total buildings of the study area. Especialy public utilities, recreational and commercial uses occupy a higher percentage of buildings. About 14% of the residential buildings are located within the center. This expressed that the center is attracts more users than surrounding areas which are residential in dominance. It can be concluded that the center has a great mixture in number of uses which is the more prominent character of a compact city.

The use mix described above is a horizontal use mix when considering the dominant use of the buildings. Mixture of uses within the building is a most important aspect in compact city strategies. Therefore it is very important to study the vertical use or mixture within buildings.

Accordingly the study examines the quantitative data about use mix in vertical form and also the number of multipurpose buildings and the available mixed uses within its vertical domain. Further it will examine how the prevailing use mix could be arranged within the building in general terms.

Fig. 4.5: Building Use in the Town Centre of Bandarawela

Identified central area for the study is flat in land terrain which is supportive for high rise developments. The existing uses having a great mix and they can be taken as the possible use mixture as well.

In further analysis the study counts the total number of buildings which is having more than single use and evaluates what are the mixtures in the use for the purpose of understanding the magnitude of the single use against multi use of the buildings. Use mix in vertical domain is very difficult to find in this area and only 33 numbers of buildings were able to found having vertical use. Following Table 4.2 illustrates the use mix in vertical form.

Table 4.2: Use Mix of Vertical Form in Town Centre

Use mix	Number
Commercial/institutional	30
Commercial/ Residential	02
Commercial / recreational	01
Total	33

Source: By the Author

The Fig. 4.5 and Table 4.2 demonstrate that the number of mixed used buildings in the centre of the town is insignificant in the study area. Another important factor that it needs to be noted in this study area is that it can be seen that the residential use is not mixing with other uses as the area is still characterized by rural type of development and the people are more preferred in living in single story detached houses. This factor is negatively affected in the suitability of compact city strategies in Sri Lankan urban form.

4.3.2 Densities

In this background it studies existing building densities and trends in densities with the development during past 15 years. It calculates existing building density and density of the new developments and existed density in the past and give some conclusion with the density of the building with relation to the said temporal data

and analyses the way the developments goes and its relationship with compact city strategies.

Table 4.3: Comparative Trend Analysis of the Development of Buildings

	1998		1998-2013		2013	
	Center	Outer	Center	Outer	Center	Outer
Number of Buildings	674	2599	391	1616	1065	4215
Ground cover floor area	156580	342925	69141	215623	225721	558549
Total floor area	241699	434301	151799	302943	393488	737254
Plot coverage	13.34%	5.66%	5.89%	3.56%	19.24%	9.22%
FAR	0.21	0.07	0.13	0.05	0.34	0.12

Source: Bandarawela MC and the Author

Note:

Total floor Area was calculated using the number of floors in each building by assuming each floor is having the equal amount of floor areas

Plot coverage = Ground Floor Area / Total Land area * 100

FAR (Floor Area Ratio) = Total Floor Area / Total Land Area

Land Area of Town Center = 1,173,379 sq. m and Surrounding Outer Area = 6,060,621 sq. m.

4.3.3 Spatial and Temporal Distribution Pattern of Building Development

The Fig 4.6 and Table 4.3 were derived by using GIS technologies and related software. It clearly shows how the development occurs in the study area and also in the center during past fifteen years (1998-2013) and states of its spatial locations at present.

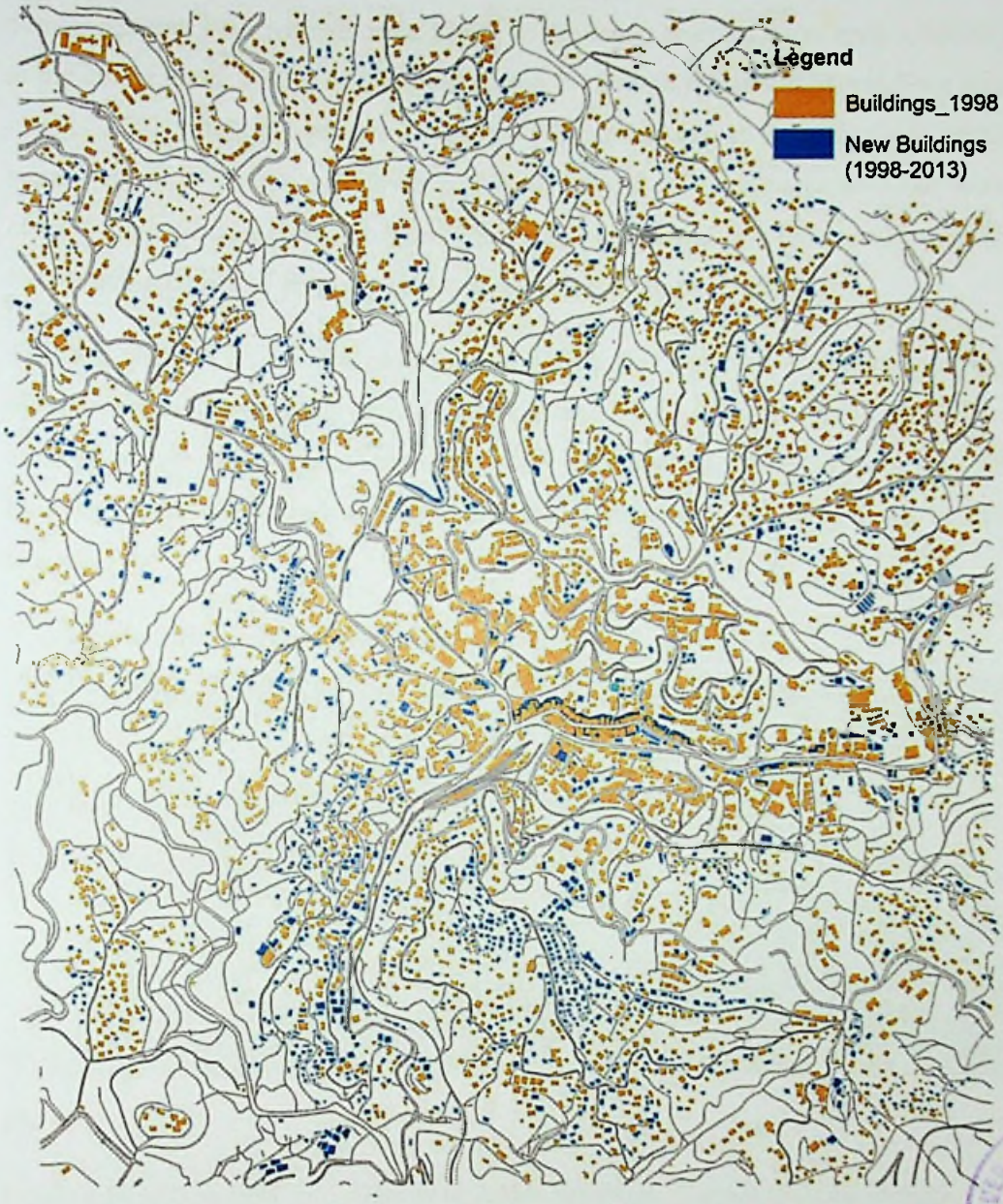


Fig 4.6: Spatial and Temporal Distribution Pattern of Building Development

Approximately about 20% of the buildings were constructed up to 1998 and also a similar percentage at the center but when considering the plot coverage and the FAR it can be clearly seen that the compactness or the higher density is located at the center. The plot coverage of the center in 1998 also indicated that the plot coverage were more than two times higher than the outer area of the study area. By added new buildings during the fast fifteen years and the current situation are also indicated the

similar pattern. FAR is three times higher at the center than the outer area. Currently at the center about 19.2% of the ground area is covered by buildings and floor area ratio is 0.34. Although figures are very low when compared to compact cities which were evolved in Europe and developed countries, when it compares with our town centers this figures are much higher. Then this background provides positive marks for the applicability of compact city strategies in Bandarawela town.

The Fig. Nos 4.7, 4.8 and 4.9 indicated that the building densities spatially distributing within the study area. The darker area shows the dense areas and lighter areas show less dense areas. These maps were prepared using GIS software and the buildings were considered as points and floor areas were not considered at this analysis.

Building densities in Bandarawela Town Centre

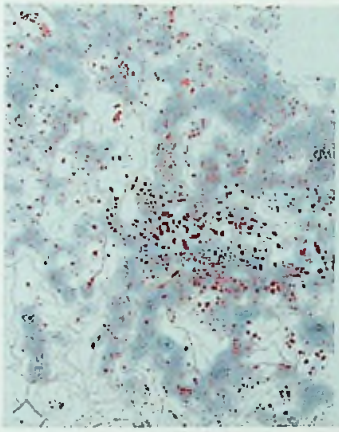


Fig 4.7:

Building Density in 1998 2013

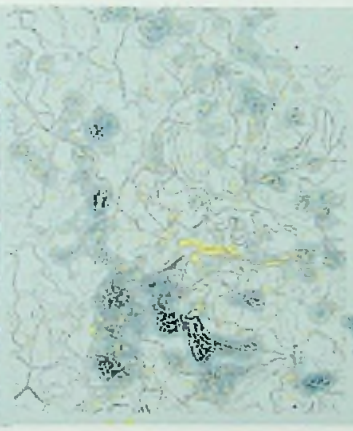


Fig 4.8:

Density of Added Buildings during 1998-2013

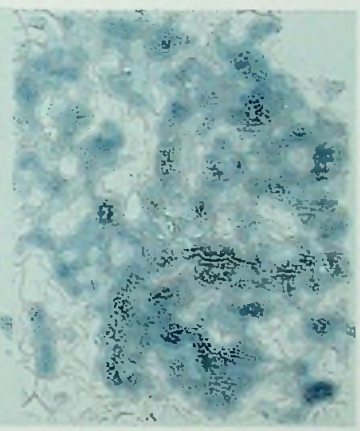


Fig 4.9:

Current Building Density

Above maps does not provides a clear picture about the compaction at the center because it considered only the number of buildings. Then the study calculates the floor area of each building in the study area and examines how the floor area density is spatially distributed within the center and the periphery of the study area. The Fig 4.10 was developed accordingly.

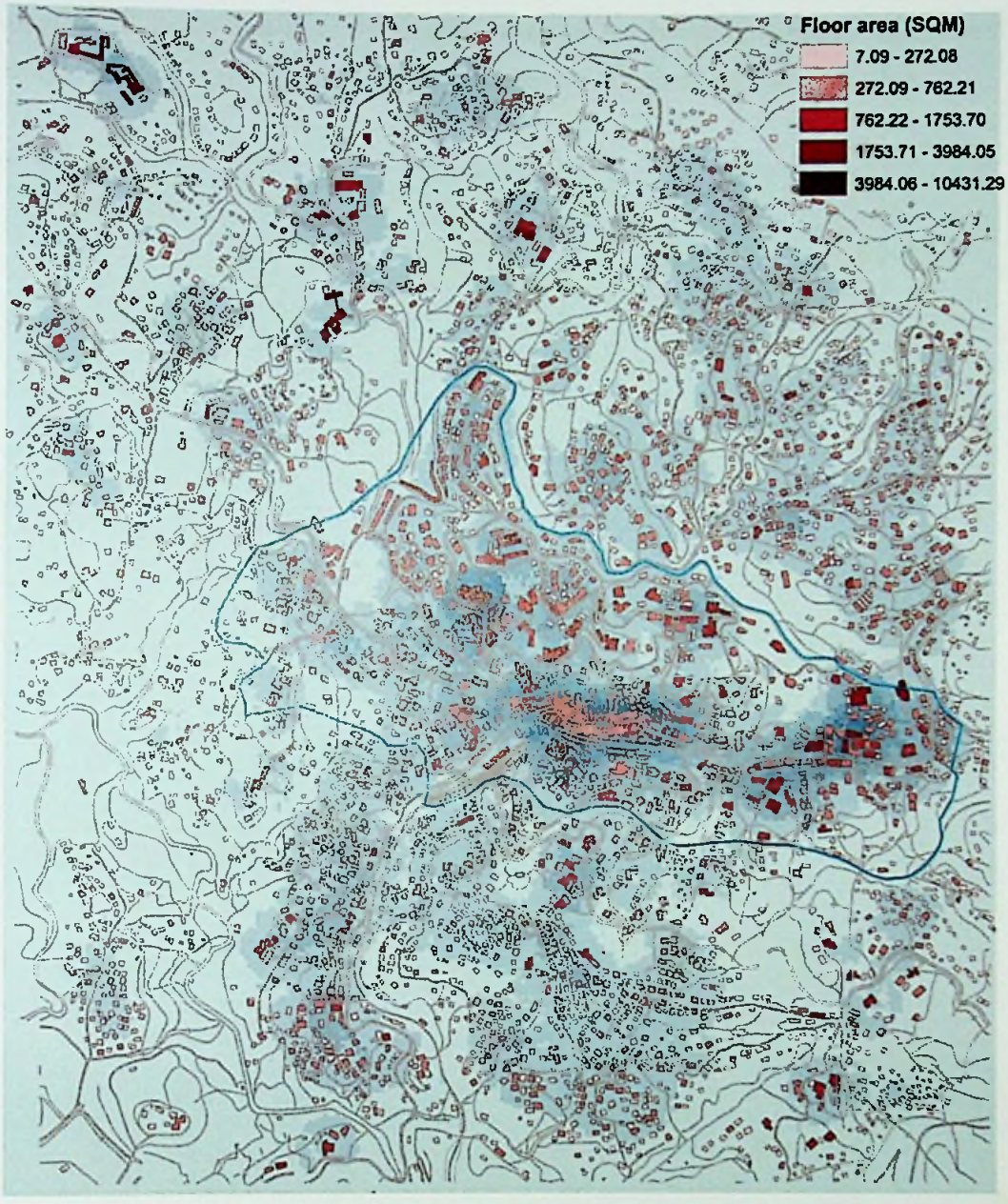


Fig 4.10: Floor Areas of Buildings in the Town Centre of Bandarawela

Fig. 4.11 shows the height density at the center when considering the floor area of the buildings. Especially the public buildings and commercial buildings have contributed maximally in compaction. The upstairs of buildings at the center also supported to the densification at the center. Therefore the study focused on the height of the buildings and derived a map showing the height of the building by

number of floors and how the height factor of the building spatially distributed within the study area. It clearly shows that there is a high density at the center.

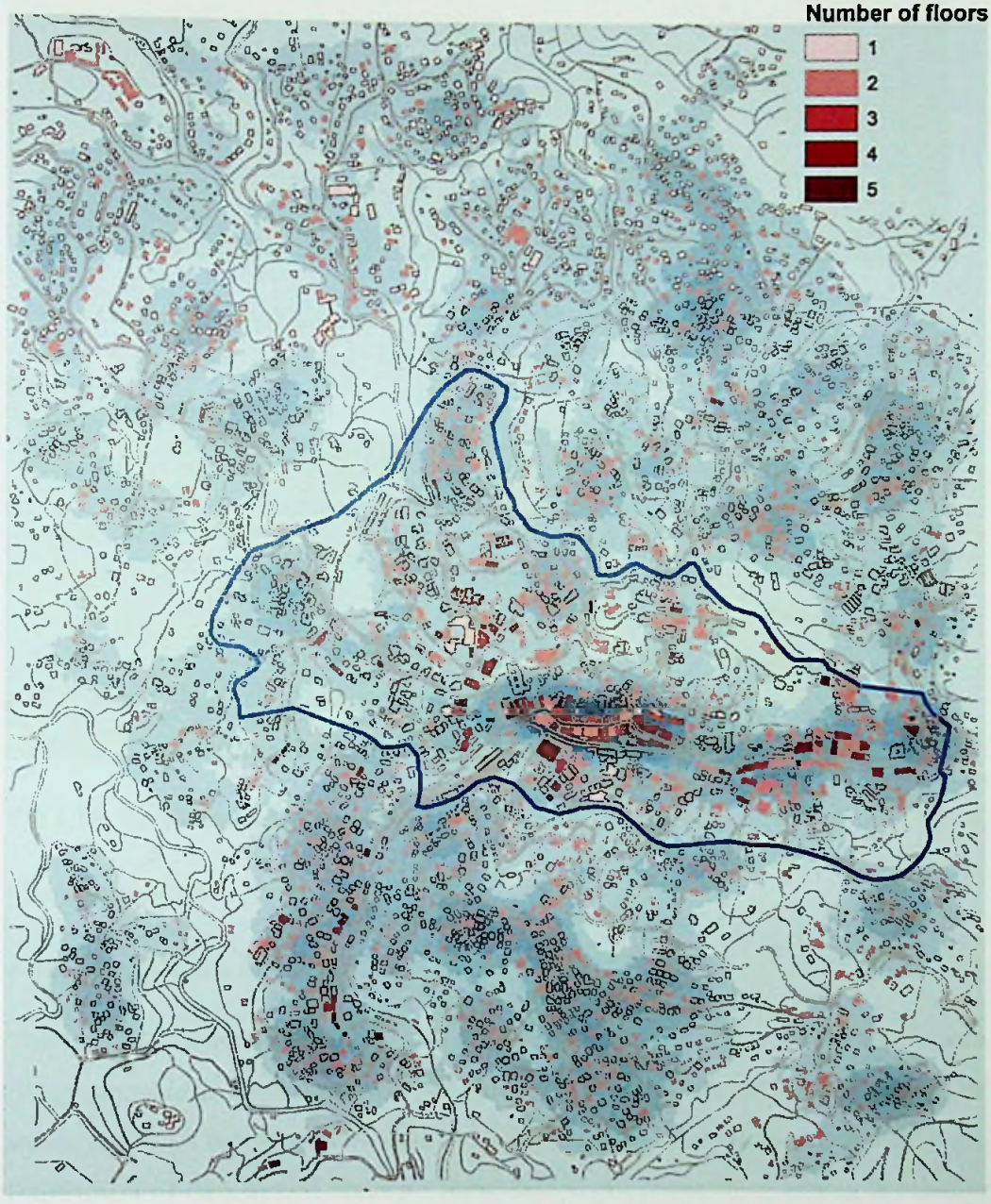


Fig 4.11: Height Density and the Floor Area of the Buildings – Bandarawela Town

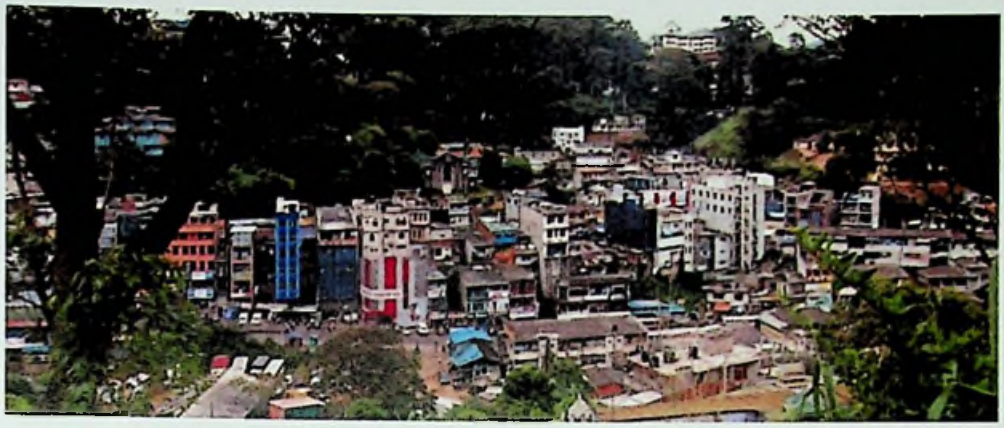


Fig 4.12 Compacted town Centre

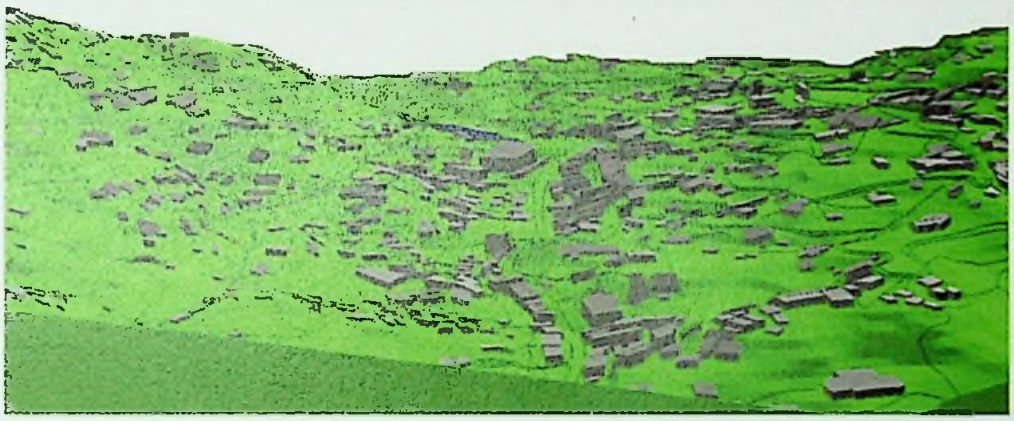


Fig 4.13: Town center as seen from top of Badulla road side

(Cross section of town center)

4.3.4 Population Density

The latest demographic data on both the study area and for the center area is not freely available as these areas were demarcated by the author for the purpose of the study. Although the population data available on GN divisions is published by the Department of Census and Statistics these date is not presently available in relation to the individual building level. For this study it needs to calculate the density in its spatial terms therefore the study calculated the population of each residential building adopting different assumptions. These calculations are also based on the available population data in the Department of Census and Statistics. It assumes that

the average residential floor space per person as 40 sq. m which means that each and every 40 sq. m. of residential floor space has a person.

There are 4,712 residential buildings within the whole study area and at the center it has 642 such buildings which are about 13.6% of the total residential building in the area. According to the calculations using the above assumption the population of the area comes to about 3,541 out of 20,277 people living in the study area which is about 17.4% of the total population living in the study area. It clearly shows that the majority of people are living in the outer skirts of the area. On the other hand when its compare the floor areas with population, the total floor area at the center becomes 393,488 sq. m with only 3,541 people living in it, i.e. at the center there are much more other uses.

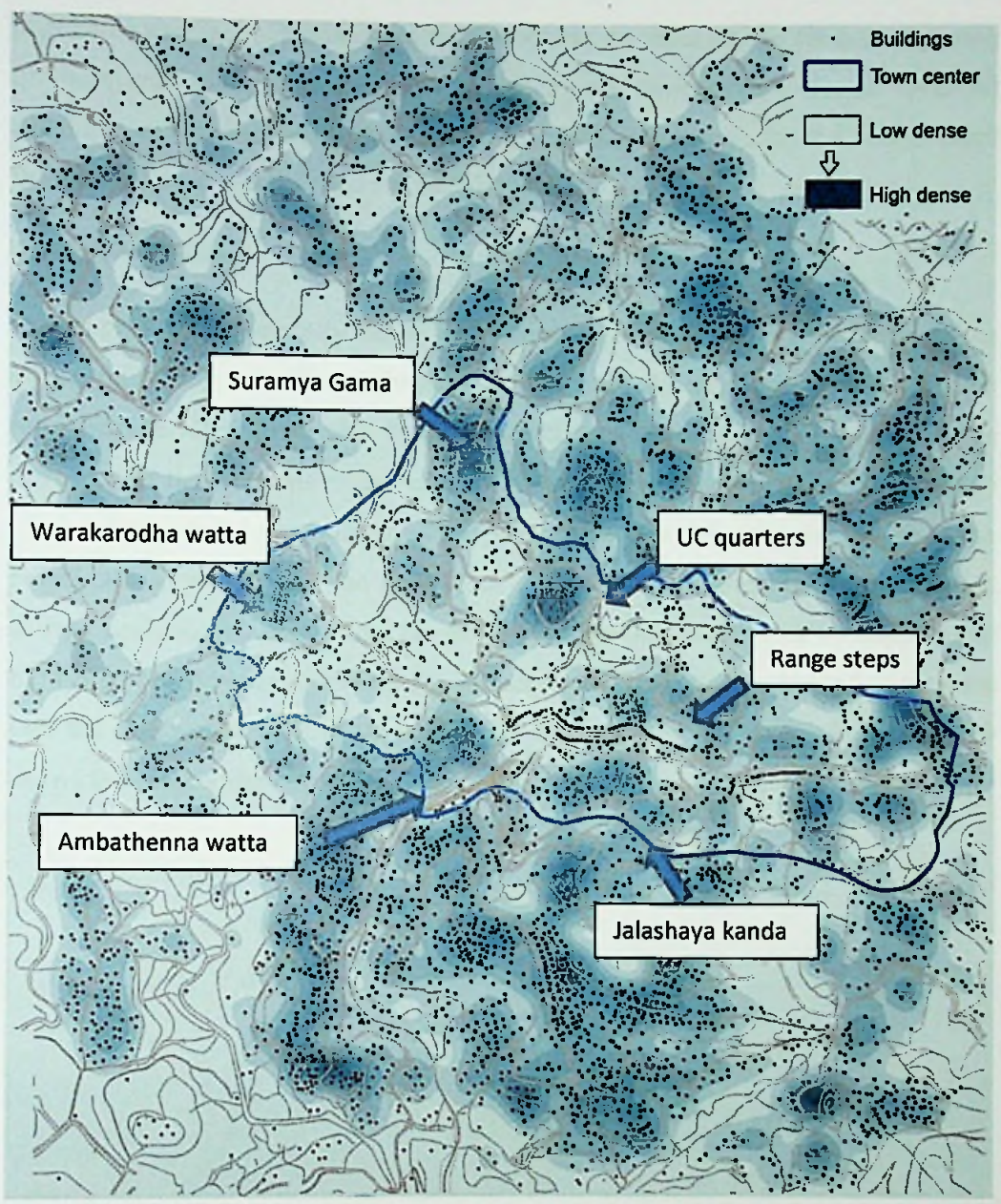


Fig 4.14: Population Density in the Study Area

When considering the population density it can be seen that the density is higher in the areas adjoining to the center. At the center only few pockets of densely populated areas could be found and other areas are having less dense in terms of population. The pockets of densely populated areas in the center are part of Ambathenna watta, Warakarodha watta (Muslim people), Range steps (Muslim people), Suramya Gama ,UC quarters area and Jalashaya kanda . In conclusion the

population density of Bandarawela town indicates negative impact for the adaptation of the compact city concept. But the outer area development creates sprawled development and has shown severe sprawling impact in relation to the development that has occurred and the need for the compaction.

4.3.5 Proximity

In compact cities the daily needs and the other services should be provided in walking distances from the neighborhoods. Therefore it needs to analyze and see the proximity between these two factors i.e., the residential neighborhoods and the proximity of the locations of the services of the town for the provision of day to day needs of the residing population of the study area. For this purpose it derives the neighborhood areas using the population of high density areas by the population density analysis. It assumes that the town center as the service area by clipping out the neighborhood area at the center (The services of the town is located compacted into the center area as it illustrates in the use mix analysis given above). Fig 19 shows the neighborhood areas and the service area of the town center.

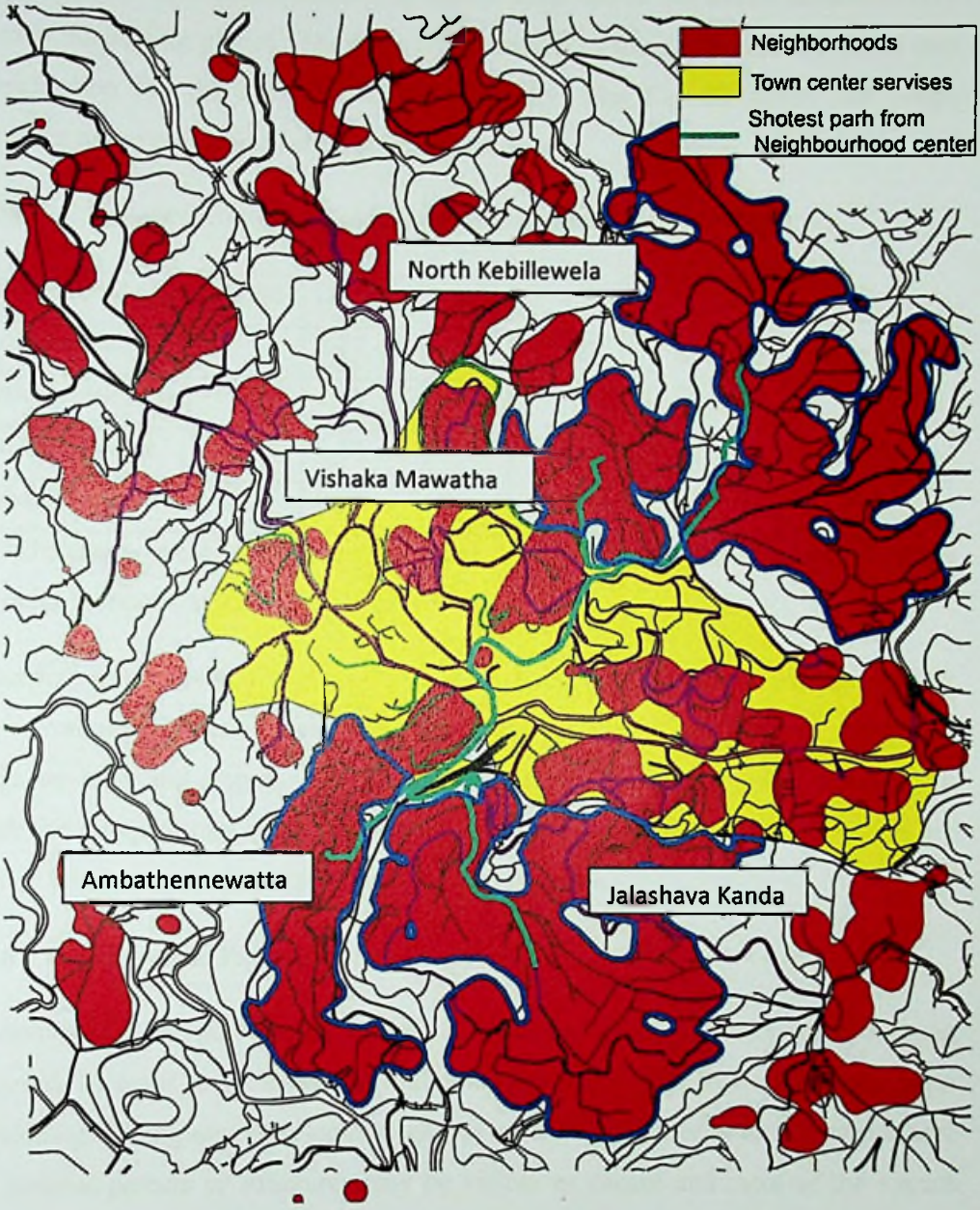


Fig 4.15: Residential Neighborhoods and the Service Centre of the town

In analyzing the distance between these two factors it needs to consider the roads distances to such facilities from the residential areas as the study area is having an

undulating terrain with difficulties to easily walk hence the aerial distances may provide misleading picture. The total road network of the study area has taken into consideration for the analysis of the proximity. The Fig 20 shows the rough distances to the center from each neighborhood.

Table 4.4: Distance from the closest main neighborhood to the town center

Name of the Neighborhood	Distance km *
Vishaka mawatha	1.27
North Kebillewela	1.45
Jalashaya Kanda	1.14
Ambathennewatta	0.62

*Distances were calculated the road distance from the centers of main neighborhoods to the town center

According to the above distances existing closest neighborhoods of the town center are in walking distances (less than 1.5km), but the area is not flat and the access roads are hilly and sloppy it needs to develop public transportations for them to reach the compact city requirements. Residents of those neighborhoods which are located within center can walk to their day today needs.

4.3.6 Development Pattern

As described in the previous paragraphs at the center a dense development has been occurred. In outer areas separated individual buildings with less density are been developing. Contiguous development can be seen in the center in to a certain extent but isolated parcels or structures may be visible as vacant and most of the vacant buildings are in under construction stage. There is a possibility of filling these gaps in order to meet the compact city requirements. But here it needs a careful consideration as it needs to response the natural environment, because the area consisted of landslide prone areas and need to protect the natural scenic views.

For the Study of existing development pattern it studied the Solid Void relationships through creating a Nolli map as indicated in Fig 4.16.

Fig 4.16: Solid Void relationships indicated in Nolli Map

The development pattern is entirely depending on the terrain factor so the development is corresponded to that form accordingly. There is no planed nature of

the build form evolved through access roads formed with the pattern of undulating terrain. Buildings are scattered all over the area. The limits or the edges are not clear and hard to find legible limits.

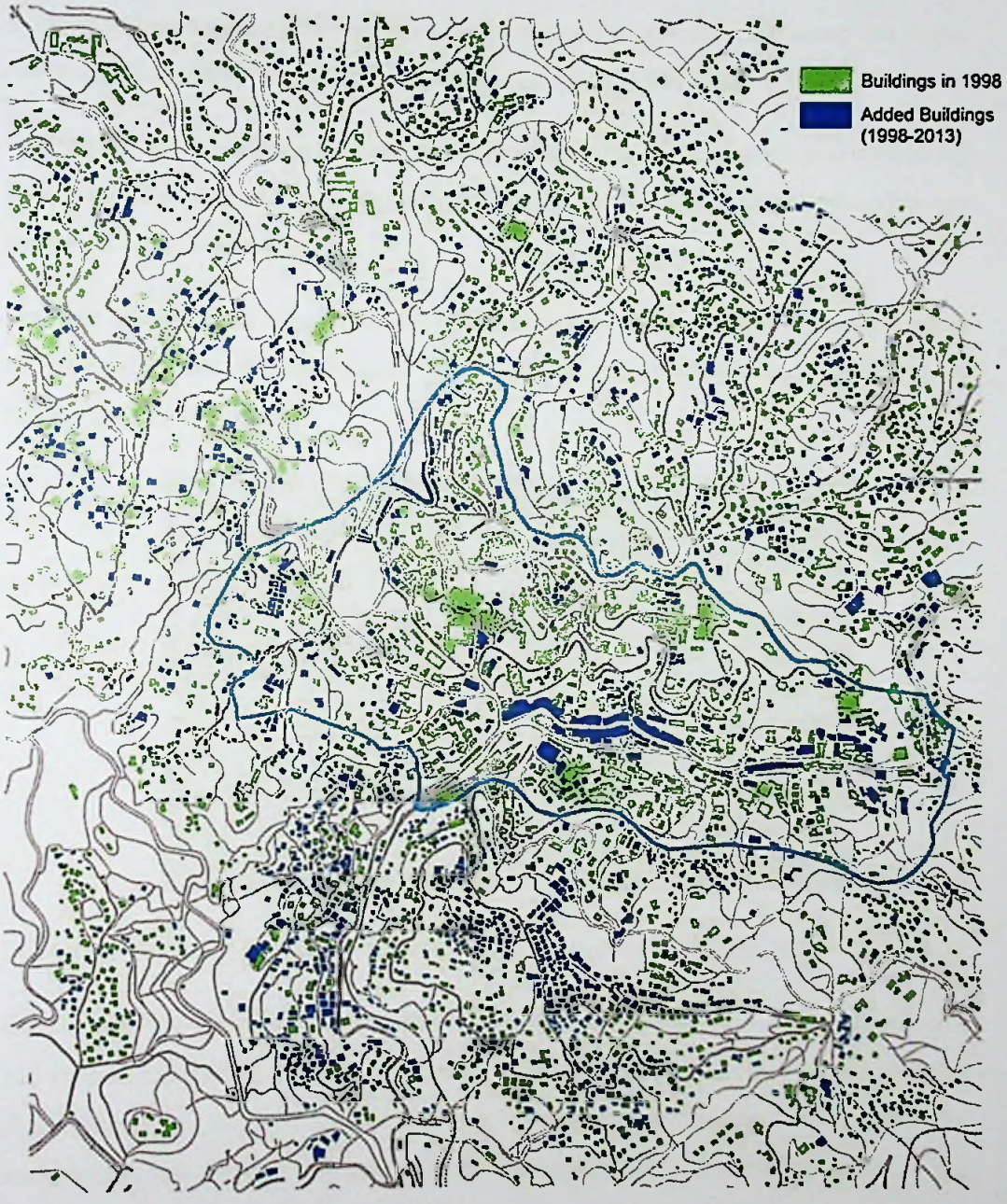


Fig 4.17: Development Pattern corresponding to the Land Terrain

At the center there are lot of infill's and extensions. In the outer areas there are lots of new developments so as leapfrog developments has been taken place during the past 15 years.

Widespread commercial development could be seen as a wider strip along the major roadways along Haputale road, Badulla road and Welimada road.

Residential uses in surrounding areas make urban sprawl and encourage encroaching to agricultural and steep lands located in the surrounding neighborhood areas separated by individual houses.

No high density flats or apartments are still visible in the area so as having rural characteristics and the attitudes of the people is still dominant to have living in individual housing units.

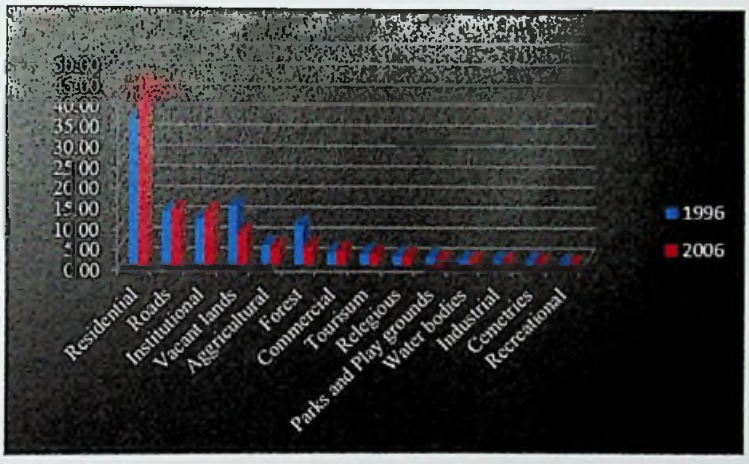


Fig 4.18: Percentage Share of Each land Use Category in 1996 and 2006

Considering the growth of residential uses and the decrease of vacant, agricultural and forest land during the period between 1996 and 2006 it clearly shows that the decentralize or sprawl development is occurring in Bandarawela town by encroaching the surrounding areas. This background emphasizes the need of the compaction of Bandarawela town.

In this compaction it needs to be harmonized with the area without being an alien development at the center because there is need to protect the existing natural

characteristics of the area. i.e there should be a compaction at the center and edge needs to be undefined. This requirement goes totally adverse the compact city concept which is the edge needs to be clearly defined.

In conclusion of the analysis of development pattern of Bandarawela town it gives both positive and negative remarks in the application of compact city strategies.

4.3.7 Urban infrastructure

This Study considered especially the availability of electricity and water supply mains as the most important infrastructure facilities to attract heavy population and physical development. Both of these infrastructure facilities have appropriately reached to the end users located in the area and therefore they are having a greater relationship in compacted and sprawled situations.

As described in the development pattern in the foregone analysis the development of the study area has a scattered nature of its spatial dispersion. When the electricity and water supply lines have to be distributed throughout the area it created several issues as indicated below:

- High cost for the supply and for the maintenance
- High wastage due to long distance (Especially the water)
- Problems in continuous supply (low water pressure for the high elevated areas)
- Damaging the aesthetic quality (Electricity lines)
- Damaging the other infrastructures (Roads).

Fig 4.19: Utility lines creating disturbances

In this background compact cities provides a real solution for the above issues not only for water and electricity in general terms other infrastructure provision also can be efficiency and sustainable in compacted situations.

4.3.8 Transportation

Very well planned and well equipped public transportation is a must in compact cities. Here it evaluated the physical arrangement of public transportation routes of the center. Fig 4.20 demonstrate the transportation arrangement of the town center.

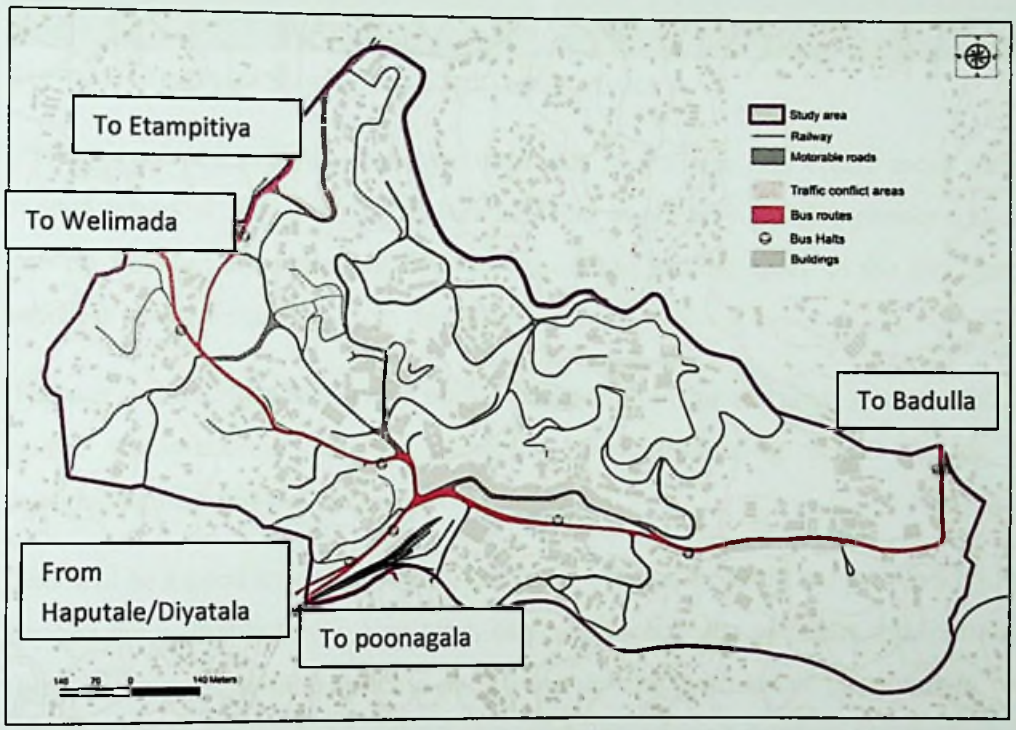


Fig 4.20: Transportation arrangement in Bandarawela town center

Public transportation (bus) is the major mode of transportation of the commuter population of the town. But public transport routs are confined only to the main roads of the town using Badulla road, Heeloya road, Poonagala road, Haputale/ Diyatalawa road, Welimada road and Etampitiya road. Majority of the other roads are not used for public transportations. Most of them are access routes for the surrounding residential neighborhoods. Private transportation modes and walking is dominant on these routes. Most of the neighborhood people use their own vehicles

and hired vehicles for the purpose of traveling. Cycling is rarely use as the roads are hilly.

Fig 4.21: Congested Roads from Land Transportation

Privately owned vehicles dominate the roads in the area and create more traffic related issues at the center of the town. There is a heavy parking problem at the center. Vehicles are searching for freely available parking space in the city centre which is a very frequent seen in this town center.

There is a possibility to provide public transportation for the areas not covered by public transportation and by connecting the surrounding neighborhoods by introducing a shuttle bus service.

This will be a good solution for the daily transportation needs of the people who live beyond the walkable limits from town center. Development of public transportation (bus) is the most suitable method as railway development is not possible and cost effective. The reasons behind the non-availability of such services are the lack of resources and less consideration of the problem by the authorities.

Although public transportation is the very important aspect in compact city strategies this background provides negative signs for the applicability of the concept in this study area. But the possibility for shorter distance public transportation and the existing traffic related issues provides greater avenues for the applicability by emphasizing the needs of promoting public transportation.

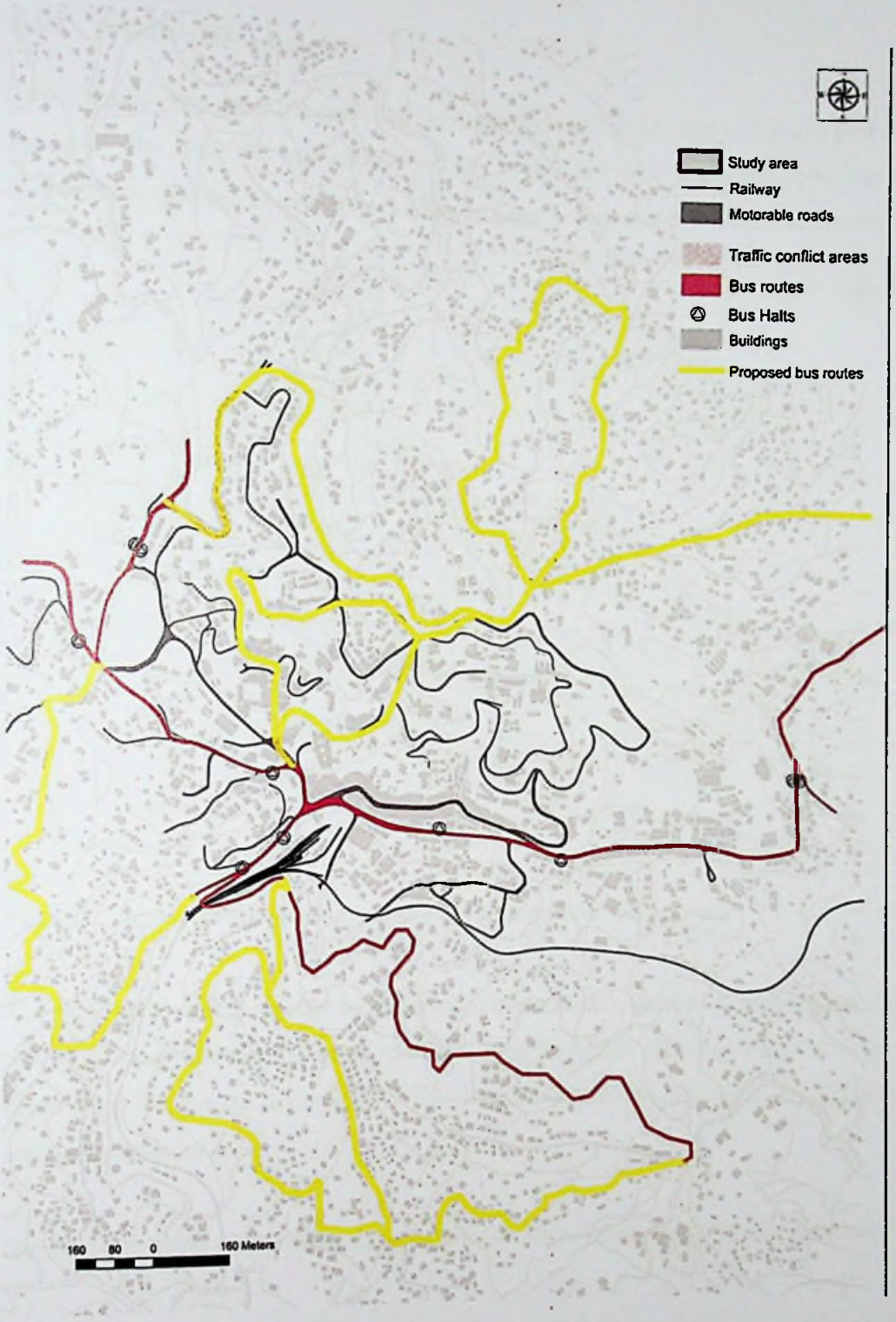


Fig 4.22: Possible routes for the introduction of public transportation

4.3.9 Accessibility

There should be a great accessibility in compact cities for its each and every part of the area. The study on accessibility of the study area with roads network, street connectivity (internal/external), including foot paths, step roads etc. were analyzed.

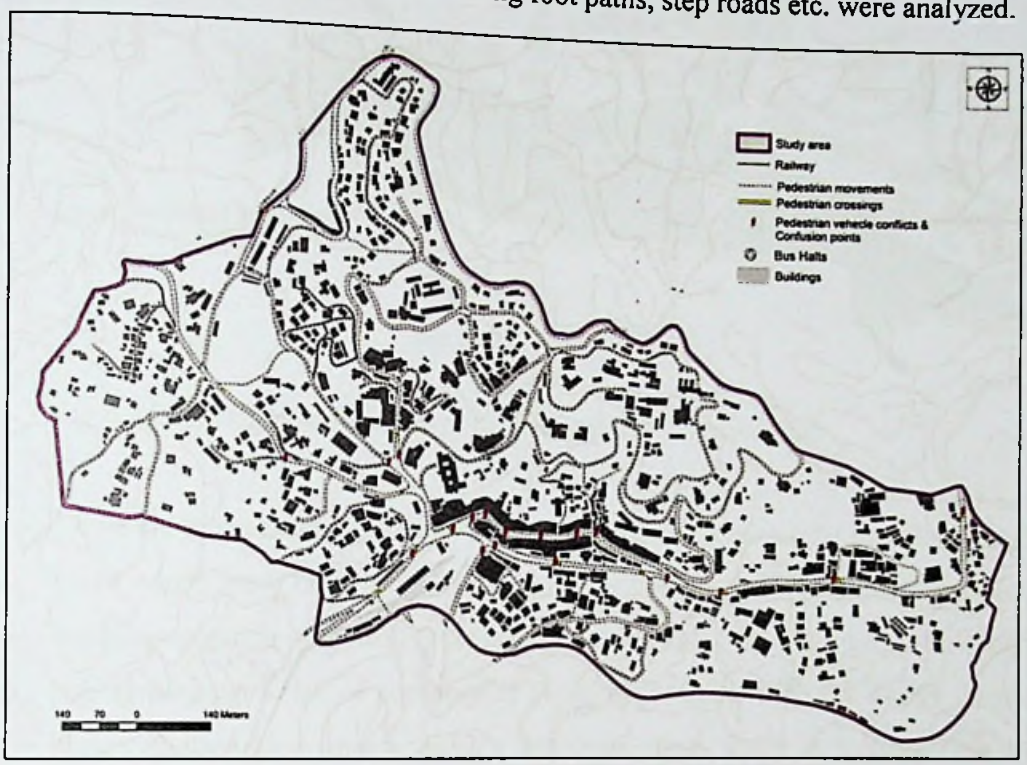


Fig 4.23: Access and movement pattern of Bandarawela town center

Then it clearly visible that the area consisted of undulating terrain is creating natural barrier for the accessibility in to some parts of the town. Existing built form also creates barriers for the accessibility. This background discourages the compact city application for the area.

But there are some possibilities for accessibility improvements as illustrated below.

1. Introduction of back lanes for the areas which are having accessibility issues

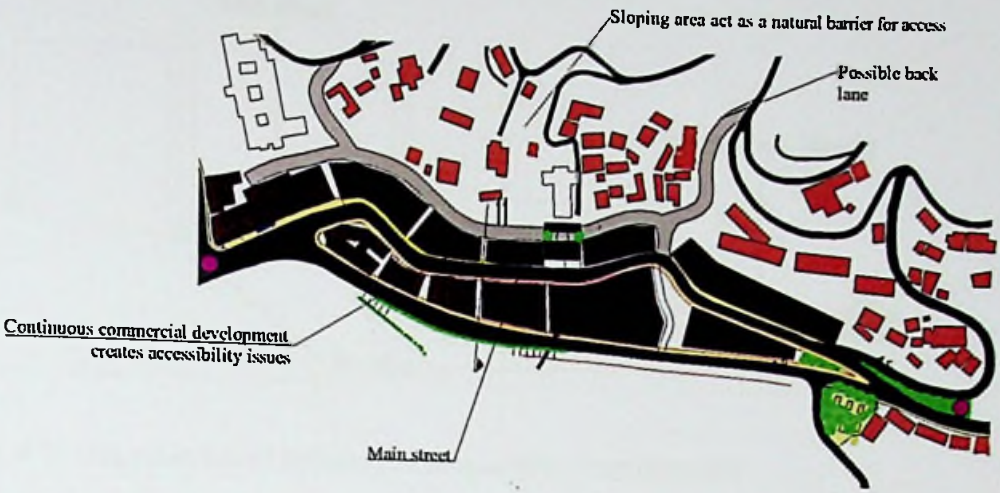


Fig 4.24: Back lane development for accessibility improvement

There are some areas formed by higher demand for commercial use alone main roads which were built in unplanned manner without keeping gaps in between buildings creating accessibility issues for the rear side of the buildings. This high rise continuous stripe of commercial buildings coupled with the sloppy terrain makes the problem much severe. For these areas there is a possibility of introducing back lanes as illustrated with a real example of the study area. These back lanes can be give the access at the different levels of the building using terrain and it can be used to increase the use mix at different levels of the buildings too.

2. Possible arcades developments along stripes of buildings

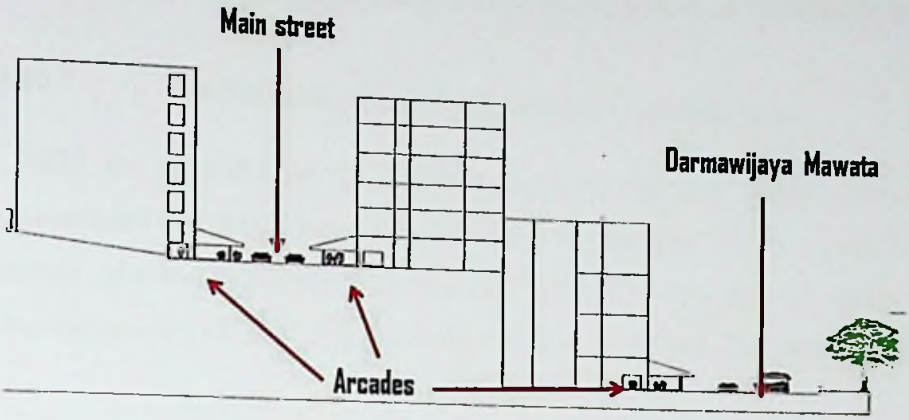


Fig 4.25: Introduction of arcades for accessibility improvement

The individually developed continuous commercial buildings alone main roads can be link with introduction of arcades improving the accessibility for all parts of them.

3. Possible overhead connections using natural level drops

As the area is undulating in terrain it creates natural level drops which can be used to provide access for the upper levels of the building. This can give more ground floor feeling at the higher levels of the buildings.

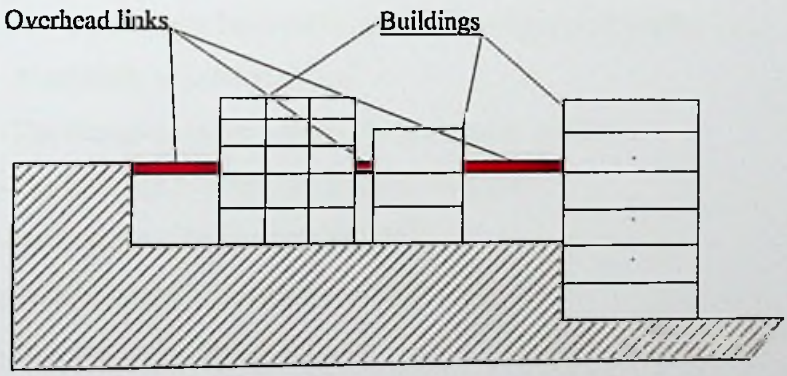


Fig 4.26: Overhead connections using natural level drops for accessibility improvement

4.3.10 Existing Planning Policies and their Implications on Compact City

4.3.10.1 The National plan and the regional structure plan

In 1977 the Presidential Task Force on Housing and Urban Development recommended that there should be a National Spatial plan for Sri Lanka. Then the National physical planning Development (NPPD) was set up under T&CP (Amendment) Act of 2000 to prepare and implement the National physical plan.

National plan for the future for Sri Lanka that is sustainable with a high quality of life and a strong economy with the following stratergies.

-Fragile environments are protected

-Strong regions with development potential work together to provide the basis for a diverse economy that includes an industrial , agricultural, plantation , fishing and tourism industries.

-A network of cities towns and villages

-The rural areas are protected

-The coastal fragile areas are free from inappropriate development

-The settlements have minimal threat of natural disasters.

-A network of infrastructure

-The transport system helps the settlement problem.

-The best use is made of offshore resources.

-National security is strengthened.

-Development of Air & Sea transport services.

-Improve social harmony.

All the above objectives are ensure that there will be a balance between protection & production

Accordingly five metropolises were identified in sri lanka. The central area of the country area including Badulla district fallen under central fragile area which is no any major developments projects are coming in to this area and development needs

to be controlled to meet the requirements of fragile area. Meanwhile the Regional structure plan for Uva province prepared by NPPD has proposed to reduce the population in Bandarawela DS division up to 50000 which is 65112 of the current population.

Hence the national and regional plans gives positive influencers towards compaction instead of developments occurring encroaching the natural lands.

Regional structure plan of NPPD has identified Bandarawela as a second order town of the province which can be have urban characteristics. Therefore it needs to be developed as an urban agglomeration giving positive marks towards compact city.
In this background application of compact city is the most suitable way of achieving the proposed plans.

4.3.10.2. UDA regulations

Existing planning policies are not considering increasing the use mixture in our urban areas. According to the UDA land use zoning regulations it gives demotion influences towards compact city. But those regulations anyway do not direct in to a monotonous zoning, it gives variety of allowable uses with each zone.
Mostly in our regional service center type towns like Bandarawela we can find the zones such as Residential/Mixed residential/Primary residential, Commercial, Institutional, Recreational, and industrial.

But within these zones it allows the several uses within it as example we can find some allowed commercial and institutional and Industrial (minor) uses within residential zones and vice versa. This background positively remarks the compact city.

On the other hand although such planning regulations were existed there is lot of practical issues in implementation. As many of the uses derived by the demand and improper zoning decisions has caused to violate the regulations and goes for

mixtures in use. Sometimes they happen in unauthorized way. This back ground also provides positive marks towards compact city.

There are three categories of buildings has identified in UDA regulations. The category "A" is high rise buildings which are having over five floors or the building which exceeds 15 meters above the adjoined street. There are some other regulations are applied for those high rise buildings, but any way the high rise buildings are allowed by UDA regulations.

According to the UDA general regulations Floor area ratio (FAR) permissible on any site shall not exceeds 2.75; this is a negative influence for compact city concept. But the law has given provisions to amend the limits by UDA development plans under consideration shall contain the maximum floor area ratio permissible on any site, this regulations provides sufficient legal background for high dense development once it is identified by the development plans gazette by UDA.
The access regulations and subdivision regulations ensures the sufficient access for all parts of an urban area which is a must in compact city concept.

Building typology plays an important role in applying compact city strategies as the compaction directly relates with the buildings. It needs to meet the requirements of high dense developments giving sufficient attention on natural environmental conditions minimizing the damages and obstructs on it. The planning policies and regulations should be capable of handling these requirements. But Either UDA building regulations nor any other planning policies in Sri lanka not much considering on building typologies which is must in compact cities. This background gives a negative influence in application of compact city strategies.
But there are provisions to introduce special urban designs in UDA development plans. These urban designs can give different type of building typologies as guide lines or regulations. They can be made considering the compaction, environmental, social and other requirements.

Chapter Five – Conclusions and recommendation

Based on the analysis done for the study area in the previous chapter it has come in to following conclusions under each compact city indicator for the evaluation of the applicability of compact city strategies in Sri Lankan urban form.

5.1 Conclusions

5.1.1 Mixture

1. Existing horizontal use mix at the center gives positive marks for compaction
2. Existing vertical mix gives a negative marks
3. Hilly areas of the surrounding and the flat land at the center reinforces the natural compactness
4. Residential uses are not merging or compacted with other uses
5. Residential buildings developing in the surrounding area creates sprawled environment. Compact city concept will be a good solution for it.

5.1.2 Densities

1. FAR at the center (.034) and the FAR of the outer area (0.12) describes the compactness at the center. The FAR Existed in1998 and the FAR of the added buildings in between 1998-2013 are also were 2 or 3 times greater at the center than in the outer area.
2. Plot coverage is also over 2 or 3 times higher at the center. Both of these gives a positive marks for compact city applicability
3. When considering the number of buildings. Always it is over 2 times higher in the outer areas of the town center. This describes the magnitude of the urban sprawl and the need of the compactness.
4. Development trend of the outer area (residential buildings) also describes the intensiveness of the sprawled condition.
5. Building height factor figures gives the higher buildings are located at the center.
6. Few neighborhoods were developed adjoined with the center gives positive remarks for compact cities

7. There are also few pockets of dense residential areas at the center which can be used to increase the residential use at the center by applying densification strategies.
8. The 07 number of residential neighborhoods at the center area within walking distances for all urban center service. This is a plus mark for compaction.
9. Adjoined neighborhoods are not within walking distance to town center services and it is a negative remark for compact city
10. Sloppy/ hilly roads are barrier for walkability and for cycling
11. Surrounding neighborhoods can be link with town center services using public

5.1.3 Development pattern

1. Roads are formed responding to terrain and it acts as a barrier to compact city developments reducing the design freedom as a compact city
2. Lots of gaps between buildings can be found and it is a weakness in applying compact city strategies and there is also an opportunity to fill these gaps to meet the compactness requirements
3. At the town center there have been occurred lot of infill's and extensions during past 15 years and it is a positive remark for compact city.
4. New developments and leapfrog developments happened in outer area of the center and it gives sprawled development and exhibit the need of compactness.
5. Encroachment of natural lands agricultural lands and disaster prone (landslide hazardous) lands of the surrounding area of the center emphasize he need of compaction.
6. High density residential use strategies are still not applied in Bandarawela town.
7. Increasing figure of residential use during 1996-2006 and decreasing in agricultural vacant and forest lands figures gives evidence and shows the need of compact cities.

8. Need of protecting scenic views and Landslides vulnerable sloppy terrain act as a barrier for high rise developments.
9. There is a requirement of making the compaction in a harmonized manner with the periphery without being an alien development at the center because there is need to protect the existing natural characteristics of the area. This requirement is adversely influence in application of compact city concept for the study area because the edge cannot be clearly defines.

5.1.4 Infrastructure

1. Experiencing hardness of infrastructure provision to the scattered end uses demanding for compactness.

5.1.5 Transportation

1. Most of the commuter population using public transportation modes is plus mark of compact city
2. Not having a well-planned transportation network, most residential neighborhoods are not covered this is negative mark
3. Possibility of providing public transportation shuttle type bus services for the surrounding neighborhood is a good sign for compact city applicability.
4. Surrounding and residential population uses privately owned vehicles or hired vehicles those who are living beyond the walkable limits from town center is minus mark for us

5.1.6 Accessibility

1. Some areas are not accessible due to terrain and many other reasons is negative mark
2. There are some possibilities existed for accessibility improvements as follows
    - Introduction of back lanes for the areas which are having accessibility issues
    - Possible arcades developments along stripes of buildings

- Possible overhead connections using natural level drops

5.1.7 Existing Planning Policies

1. National plan needs to control the development in Bandarawela area to protect the natural lands as the town is fallen under the central fragile area of the town, this is a positive influencers towards compaction instead of developments occurring encroaching the natural lands.
2. NPPD regional structure plan has identified Bandarawela as a second order town. This gives positive mark for the applicability of compact city.
3. Although UDA regulations are to control the development there some favorable regulations to the compaction and also they are adjustable through a development plan to meet the requirements of a compact city.
4. UDA building regulations or any other planning policies in Sri lanka not much considering on building typologies which is must in compact cities. This background gives a negative influence in application of compact city strategies.
5. The current provisions to introduce special urban designs for specified areas in the UDA development plans can be used to introduce compact city friendly building typologies.

5.2 Recommendation

Most of the above conclusions under each compact city indicator are favorable in application of compact city strategies in the study area. Therefore, In conclusion it can be accepted the hypothesis H0 which is Possible to apply Compact city strategies in solving some urban issues in Sri Lankan urban centers subject to above facts. Here, the planner and the urban designer have a big role to play in applying those strategies. Planning and urban design intervention in this regard is must because each and every indicator of compact city is closely related to them. i.e they cannot be practically implement without those interventions. It needs to analyze further in detail to come in to conclusion that this the ultimate solution for most issues in Sri Lankan urban foam as the most issues are differ from place to place and time to time.

Bibliography

ARBURY, J, 2005, *From Urban Sprawl to Compact City – An analysis of urban growth management in Auckland*, MA thesis (Geography and Environmental Science), University of Auckland.

BERNHARDT, J, 2007, *Urban Sprawl: origins and environmental consequences*, Master Thesis, Blekinge Tekniska Högskola.

BRADECKI, T, 2009 , *Urban Open Space And The Compact City Case Studies in Poland* , Silesian University of Technology, Faculty of Architecture, Chair of Urban and Spatial Planning,

BREHENY, M, 1996, *Centrists, De-centrists and Compromisers: view on the future of urban form*, The Compact City - a Sustainable Urban Form? - Edited by Mike Jenks, Elizabeth Burton and Katie Williams, E & FN Spoon, London.

BURTON, E, 1999, *The Compact City: Just or Just Compact? A Preliminary Analysis*, Urban Studies 2000 (www. sagepublications.com)

CEREDA, V, 2009 *Compact City and Densification Strategies The Case of Gothenburg*, Thesis, Master of European Spatial Planning and Regional Development

DE ROO, G, 1996, *Environmental Policies in the Netherlands: Too Good to be true*, Ashgate, London.

EUEGUE, 2004, *'Urban Design For Sustainability' Final Report of the Working Group on Urban Design for Sustainability*, European union expert group on the urban environment.

JACOBS, J, 1964, *The Death and Life of Great American Cities*, Harmondsworth Penguin, London.

NEUMAN, M, 2005, *The Compact City Fallacy.* Journal of Planning Education and Research

SHRIVASTAVA, P. A, 2009, *exploring compact city: reconfiguring the compact city*, Ball state University, Muncie, Indiana

THOMAS, L. and **COUSINS**, W., 1996 'The Compact City: a successful, desirable and achievable urban form?' in Jenks, Burton and Williams (eds.) *The Compact City: a sustainable urban form?* E & FN Spoon, London

WILLIAMS, K, **BURTON**, E, **JENKS**, M, 1996, *Achieving the Compact City through Intensification: an acceptable option?*, in Jenks, M., Burton, E. and Williams, K. (eds.) The Compact City: a sustainable urban form? E & FN Spoon, London.