A Behavioural Approach to Design of High-Density Housing

by

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Abstract

The basic intention of this study is to show that the research findings in the field of restorative environments can be used in the design of high-density housing to develop healthy living environments. This study explores the possibility that providing public, semi-public and private landscaped open spaces in and around the dwelling units, can improve the living conditions in a low-rise, high-density housing design. It is primarily concerned with the relationship which people in the high-density settings have with their outdoor environment and explores the possibilities of design and management of the nearby natural area in ways that are beneficial for people and appreciated by them. The study uses the literature on restorative benefits of nature and housing to develop criteria for the design and management of housings at high densities and illustrates the significance and implementation of the design criteria through comparative analysis of the existing and the proposed housing design.
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Introduction

Housing is a major concern in most of the cities of the world. The issue for the cities has been the rapid growth of urban sprawl, which is increasingly encroaching on the open countryside. With the rapid increase in the population of the cities, there has been an ever-increasing demand for housing, which in turn has led to a rapid rise in housing prices. The dwindling supply and high cost of developable land, as well as the rising costs of materials and labor, have contributed significantly to increases in development costs for new housing. Affordable housing is fast becoming one of the most important issues for city officials. To save costs and meet changing market demands, pressure has increased in recent years to allow higher density housing development and make more efficient use of the available housing stock.

Higher density urban development can help to preserve farmland, open space and environmentally sensitive areas by reducing the overall amount of land needed for residential development. Reducing the rate of spread of cities can also result in a reduction of the cost in terms of providing services and infrastructure, and maintaining the environmental quality, through reduction in the traveling distances, which indirectly results in the reduction of environmental pollution (Alexander & Tomalty, 2001). For these reasons it is necessary that people are provided with good affordable houses closer to their place of work.

However, high-density housing is stigmatized by its association with urban social problems, which seem to force people to opt for the low-density option, even though neighbourhood distress may have more to do with design than density (Danielsen et. al., 2000). As densities of housings increase and sizes of apartments are reduced, the design of the dwellings becomes even more crucial. It should be more responsive to the needs of the people.

The fast pace of city life and the everyday stresses of the workplace make it absolutely important that the houses and the environment that we live in have a restorative quality which helps
us relieve the stress and have a healthy existence. Studies of the past have shown that high levels of stress weaken our immune system, which in turn results in some health problems (De Waal et. al., 2000). It is not just the stress at the workplace or the stress of traveling but also the exhaustion due to traveling to and from work or other amenities (Parsons et. al., 1998). Other kinds of stresses that are prevalent in housing situations are stress due to overcrowded situations in the housing or the stress due to monetary problems (De Waal et. al., 2000).

It is believed that landscape plays an important role in catering to the physical, social and psychological needs of the people (Kaplan et. al., 1998; Ulrich & Addoms, 1981). All the people of the world have been created both in harmony with nature and in opposition to it. Humans observed and experienced nature for millions of years before they were able to begin to draw lessons from it and use it to emerge from their subhuman conditions. From the dawn of history, geography and climate have had an effect on our evolution and have influenced our behavior. Almost everything that contributes to human society depends on the natural environment in which that society has been created and has developed. The character of individual people and their religion and politics, as well as their habitat, clothing, food and customs, bear the imprint of their environment. The failure to recognize the satisfactions and benefits that the nearby natural settings can offer has important consequences. It means that, all too often, landscaping is considered merely an optional “amenity”. Having green things nearby is undeniably pleasant but is often deemed less essential than all that is subsumed by “infrastructure”.

Presently, it is necessary to develop affordable and sustainable housing which provides a healthy living environment conducive to the social, psychological and physical well being of its residents. There have been innumerable projects in the past that suggest the direction in which the residential housing should move. The most important consideration is that the individual dwelling and the urban or rural structure that provides its setting
Figure 5(a) & 5(b):
The architectural and landscape elements need to be meaningfully related in order to ensure the success of the design.

a) The outdoor landscaped spaces lack definition and privacy, in order to be useful space.

b) The front landscaped spaces are well integrated with the front entrance of the house and act as an effective buffer between the private and the public spaces.

should once again be meaningfully related to each other and that this relationship should be reflected in appropriate architectural and environmental form.

The following study has explored some of the essential aspects of housing, which should be addressed, and how to provide a healthy living environment for the residents. It is primarily concerned with the relationship that people in the high-density settings have with their outdoor environment and it explores the possibilities of design and management of the nearby natural areas in ways that are beneficial to people.

This study uses the literature on restorative benefits of nature and housing to develop criteria for the design and management of housings at high densities and illustrates the significance and implementation of these design criteria through comparative analysis of the existing and the proposed housing design. The site selected for this purpose is the Langara Garden site, which is located on the west side of Cambie street between 54th and 57th avenue in Vancouver, Canada. This site has a good mix of high-density, high-rise and low density, low-rise units with fairly large landscaped open spaces between the buildings. The site and the project is described in details in section IV of this report.
SECTION I

1.01 Research Question

1.02 Literature review
   1.02.1 High-Density Housing
   1.02.2 Benefits Of Nature
   1.02.3 Restorative Environments
   1.02.4 Urban Natural Environment
   1.02.5 The Need for Restorative Environments
Research Question

Recent studies have shown that natural settings have certain restorative benefits (Kaplan et al., 1998; Ulrich, 1986a). However, the question arises as to whether it is possible to incorporate the concepts of restorative landscape design in the architectural design of the housing to achieve good living conditions?

Three major issues emerge as being of particular interest in this regard. These are:

1. Is the effect of nature on people as powerful as it intuitively seems to be?

2. What lies behind the power of environments that not only attract and are appreciated by people but also are apparently able to reduce stressed individuals to a state of healthy and effective functioning?

3. Are some natural patterns better than others? Is there a way to design, manage and to interpret natural environments to enhance these beneficial influences?

This study tries to investigate these issues and show how they could be used to design the modern high-density housing schemes to provide people with healthy living environments.

Figure 6:
We need to live in harmony with nature, to have a healthy, sustainable exisance.
Evidence of the dislike most city dwellers have for their environs is suggested by the finding that almost four in ten would like to move out of the city, though seven in ten say they could be induced to stay if the conditions would improve (Gallup Poll, March 1978, Vol. 2). In addition to crime, urbanites cite overcrowding, pollution, housing, traffic congestion and noise as other major reasons for leaving.

There is also some evidence that the move to suburbia has positive effects. Suburbanites are generally happier with their housing communities and their lives than city dwellers, even when socio-economic status and other differences between urban and rural populations are statistically controlled (Nachmias & Palen, 1986). However, many people who prefer suburban or rural areas still want to be near a city. What they are actually looking for is a small piece of green near their homes, which they can call their own; take care of it; and at the same time, be close to their workplace and amenities, thus avoiding long commutes. These reasons behind the people’s preference for a suburban living near a city, present us with an opportunity to explore ways in which people could be presented with solutions that satisfy them and also meet the larger goal of a sustainable development.

People have often shown a dislike for very high-density situations but it is becoming clear that higher density housing does appeal to suburbanites if it incorporates traditional urban features (Danielsen et. al., 2000; Newell, 1997). This suggests that creating a “sense of place” is a crucial component of any successful development and is especially important in higher density housing (Danielsen et. al., 2000; Mazumdar et. al., 2000).
There has been a popular belief that high density is associated with social disorganization and ill health. To date there has been no convincing evidence that there is a direct relationship between high density and social disorganization (Drover, 1975). The problem with high-density housing is not just due to the density. The fact is that most of the studies done were done on the public housing projects which are not the best specimen for any kind of study on high-density housing (Michelson, 1971). Rohe and Paterson hypothesized and found that increased spatial density lead to aggression only if the resources (i.e., food, money, clothing and other basic needs for survival) were limited and not when there were more people (Rohe & Paterson, 1974, in Bell et.al., 1996). Density does not have negative effects on human beings but crowding may have some negative impact on people (Drover, 1975). Even crowding by itself has neither good nor bad effects upon people but rather serves to intensify the individuals typical reaction to the situation (Levy & Herzog, 1974).

Before going any further, it is important to make the distinction between crowding and density, which is often blurred in popular literature. Density refers to the total number of persons in a geographical area whereas crowding is a measure of housing unit occupancy. Residents in a high-rise building may live in a high-density but not be crowded whereas low-income people may live in a low-rise, low-density neighborhood but be very crowded (Drover, 1975).

Freedman made three points in his book *Crowding and Behavior*: high density does not cause crime, doesn’t really have any negative effect on people and whatever the interpersonal relationship, high density will intensify the already existing relationships (Freedman, 1975).

It may be suggested that spatial structure and architectural form encourage and circumscribe particular forms of social relationship, which are determined by the adopted mode of
production of the society. Architectural space and form can play a significant part in influencing individual behavior and happiness in conjunction with the economic and psychological constraints of one's existence. In addition to the amount of available space; visual exposure, structural depth, openness of the perimeter, brightness, and the extent of view have all been shown to moderate the effects of crowding on human behavior (Evans, 1979, in Evans & McCoy, 1998). Indeed, because of the variety of factors involved, increased social density does not necessarily correlate with either increased spatial density or increased pathologies (Drover, 1975).

Most of the time, high-density co-exists with high-rise buildings and this is one reason that people believe high-density restricts residents' choice in various ways including housing variety, accessibility to open space, light, separation of vehicular and pedestrian traffic at ground level and public utilities—each of which can have an indirect bearing on health (Drover, 1975). In addition to this, tall blocks increasingly diminish the space per habitable room in terms of surrounding open space. Yancey claims that high rises lack semiprivate space that encourages people to feel a sense of ownership and territoriality (Yancey, 1972, in Bell et al., 1996).

One study by Rent and Rent suggests that those who live in single-family or duplex houses liked their residences much more than others (Rent & Rent, 1978, in Bell et al., 1996). This satisfaction probably occurred in part because those residences were more often owned, which is another predictor of satisfaction in low-income housing. Other reasons like greater privacy (Newell, 1998), and having friends and relatives in the neighborhood, produce more satisfaction (Amerigo & Aragones, 1997). They also found that overall life satisfaction was also associated with liking one's residence.

The high-density housings might have its drawbacks as projected by some of the research but it has certain positive aspects, which cannot be refuted.
Advantages of High-density Housing

1. Most people believe that high-density housing is affordable. This belief expresses an essential truth: more units per acre implies lower land costs per unit, especially if local governments allow builders meaningful density bonuses (Danielsen et al., 2000). In addition to that, smaller units cost less to build than larger ones (Freidman, 1993). However, it is also known from experience and observation that not all high-density housing is affordable to low-income families.

2. One of the popular beliefs regarding high-density housing is that high-density development strains public services and infrastructure. The fact is that, compact development offers greater efficiency in use of public services and infrastructure. Higher-density residential development requires less extensive infrastructure networks than does sprawl. The infrastructure costs include the costs of moving earth, grading, and building streets, curbs, gutter, storm water control, sewer pipes, water pipes, and sidewalks (John, 1971).

3. Even though higher density means higher use, the increased maintenance cost is far less than two or three times the cost of building and servicing 100 or 150 feet of roadway (John, 1971).

4. Compact high-density developments also help save precious natural and environmentally sensitive areas, which are an essential component in the growth and development of the human kind.

5. Affordable high-density housing near the work place can reduce commuting time to work place which contribute to the worsening of other problems including increased traffic congestion, air pollution and the over-consumption of fossil fuels.

6. Longer commutes also add more stress to daily routines and can result in the disruption of households and lower productivity at work (Parsons et al., 1998).

At this point, I would also like to clarify certain other myths about high-density housing, which have been in people’s minds for quite some time.

1. People have the notion that the residents of affordable housing move too often to be stable community members. How-
ever, the fact is that housing type is much less important in determining mobility than tenure. Renters move more often than owners do, whether they live in single or multifamily housing. Once tenure is accounted for, the difference between the housing types is almost meaningless. Especially for renters, when rents are guaranteed to remain stable, tenants move less often (Rohe & Basolo, 1997).

2. It is commonly believed that high density and affordable housing have increased crime rates, but the fact is that density does not cause crime. For many years, social scientists have asked whether high-density housing causes crime. Not one study has shown any relationship between population or housing density and violent crime rates; once residents’ incomes are taken into account, the effect of density on non-violent crime decreases to non-significance (Cappon, 1971). However, in areas comprised mostly of low-income housing – particularly those areas lacking jobs, responsive police, and community services – crime can be higher.

3. Even if high density causes stress due to crowded conditions, it is not density alone which is the cause of stress. Factors, other than high density, which contribute to stress in a crowded condition are:
   a. Duration of exposure - The experience of crowded condition is affected by its duration and our advanced knowledge as to how long the experience might last.
   b. Predictability - Crowded conditions are experienced more negatively when they are not anticipated.
   c. Prevailing mood - This category reflects the fact that few individuals experience a ‘steady state’ with regard to their environment. Sometimes we seek solitude, sometimes excitement and sometimes communion with others.
   d. Primary vs. secondary environment - Primary environment can be described as the place where the person spends a large amount of time, has personal contacts with others and is involved

Figure 11:
High-density developments can significantly reduce the cost of providing basic infrastructure, like roads, pathways, sewage lines.
in important personal tasks. Secondary environments represent small investments of time and impersonal contacts with others. Crowding is more intensively experienced in primary environments than it is in other environments.

e. Thwarting - Crowding is more intensively experienced when it is the result of negative personal interaction than when it originates in neutral environmental circumstances (Cutherbert, 1985).

To date, the research on improving the housing conditions in high-density housing in the urban environment has primarily been focused on man-made, structural characteristics of the buildings. Are there other features, which might promote healthy living?

It has been found that just a view of nature has positive effects on the mental and physical health of human beings (Ulrich, 1979, in Bell et al., 1996). The research on physiological reactions to natural scenes make it clear that effects of natural environment are anything but trivial. Nature that is nearby can be used as a social setting. It can also be "a place apart", a setting where tranquility is possible even in the midst of the urban bustle.

Psychologists Stephen and Rachel Kaplan suggest that private gardening may provide nature-based benefits for urban residents. Gardens provide social cohesion in the community by providing a meeting place and a chance for people to work together towards a common end. They have shown that residents who had adequate access to gardens found their neighbours to be more friendly and felt more sense of community (Kaplan & Kaplan, 1978). The Kaplans also state that in addition to their beauty and potential as a food source, gardens may provide a restorative experience that allows people to recover from the stress of day-to-day life. The chance to be outside, to labor, to see things grow and to experience a diversion from the routine involves many of the same benefits observed in wilderness recreation (Kaplan et. al., 1998). Charles Lewis reported that recreational gardening by inner city residents led to pride in accomplishment, to increased self esteem and to reduced vandalism outside as well as inside the building (Lewis, 1973, in Bell et al., 1996).
1.02.3
Restorative Environments

The presence of nature has been shown to decrease people’s perception of crowdedness and to increase residents’ satisfaction with their neighbours (Friedman, 1993). Nature has a number of other restorative effects; it may calm, refresh, decrease irritability and even enhance mental functioning (Kaplan & Kaplan, 1989; Ulrich et al., 1991, in Bell et al., 1996).

However, not all natural settings have beneficial effects on human beings. It is the natural settings preferred by the people, which have beneficial effects (Kaplan et al., 1998). These preferred environments and settings, termed as restorative environments, which could be built or natural, have been proved beneficial to the human beings.

In 1984, Edward O. Wilson used the term biophilia to describe what he believed to be a human need for contact with nature. The positive effects of biophilia are not as well documented as their phobic converses, and research on these effects most commonly targets reactions to natural physical environments rather than to animals (Ulrich 1993, in Bell et al., 1996). Because our species evolved in a natural environment, we may have a biologically prepared readiness to learn and to retain positive responses to some aspects of nature. Ulrich proposed 3 potential responses to biophilic nature: attention / approach / liking; physical and psychological restoration; and enhanced cognitive performance. Some of the most direct supports for biophilia comes from the studies showing that contact with certain type of nature create what are called restorative responses. Settings that foster these responses are termed restorative environments.

Whatever the reason for our affinity to natural elements, evidence shows that natural scenes may possess restorative powers (Kaplan & Kaplan, 1989; Kaplan & Kaplan, 1978; Kaplan et al., 1998; Ulrich, 1986a). Ulrich demonstrated that viewing a series of natural scenes could lessen the effects of stressful college course examination (Ulrich, 1979 in Bell et al., 1996). In a subsequent study, Ulrich showed that viewing scenes of water or a park-like setting not only resulted in more positive feelings, but was also associated with lower levels of several measures of stressful arousal (including blood pressure, skin temperature, heart rate, and subjective state). Ulrich's findings suggest that the restorative effects of natural environments may extend beyond the immediate setting and influence a person's overall well-being.
conductance and muscle tension) (Ulrich 1991 in Bell, et.al., 1996).

Attention to natural environments can also result in calmative, restorative psychological effects. The recovery of mental fatigue occurs at many levels in terms of both time and place. Restorative environments too, can be small or vast, brief or more extended (Kaplan et. al., 1998).

Just as the density, noise and architectural design of housing have been shown to affect people’s use of space and their social interactions (Bell, et. al, 1996), so might the presence of natural elements. Supportive, positive social interactions and relationships are important for the healthy functioning of individuals, families and communities. Environmental stressors are linked to less productive social interactions (Cohen & Evans, 1987, in Coley et. al., 1997), e.g., highly crowded conditions make it difficult for individuals to regulate their personal contacts with others, a situation that lessens the productiveness of social encounters and that can, overtime, create a sense of learned helplessness (Rodin, 1976, in Coley et. al., 1997). Research has shown that natural element strongly affect people’s perceptions and feeling about their environment, e.g., trees, grass and open spaces have proven to be particularly important in decreasing perceptions of crowdedness in high-density residential areas (Ulrich, 1986b). In addition, trees also provide shade and a measure of privacy and sound buffering from the surrounding environment, which is often harsh in high-density housing (Mulligan et. al., 1987; Robinette, 1972).

It is not just the natural elements, which have restorative qualities. Even some of the architectural settings have been shown to possess restorative qualities. Restorative qualities could be defined as the potential for design elements to function therapeutically, reducing cognitive fatigue and other sources of stress (Evans & McCoy, 1998). In the context of the present study, the term “restorative environments” refers to restorative settings in urban environment, which suggests that we need to look at the restorative qualities in context with the urban settings.
1.02.4
Urban Natural Environment

"The natural environment is not characterized by its distance from the human settlement. Nor is a natural area necessarily one that is unaltered by human intervention. The word nature includes a wide variety of outdoor settings that have substantial amounts of vegetation."


The word “nature” is often reserved for areas that have been unaffected by human influence, that have trees and other vegetation, and that have considerable extent. Of course, the word natural could be used to refer to anything from deepest wilderness to an isolated tree in the middle of a brick plaza. What is nearby to most of the people, most of the time, could hardly be described as lacking human influence and is unlikely to be vast. Yet, vegetation could well be present and perhaps that feature in itself qualifies for the “nature” designation, even if it is at one’s door step (Kaplan et. al., 1998).

A quarter century of research has established the powerful and consistent effects of the presence of natural elements in increasing preference for urban landscape (Coley et. al., 1997). By making outdoor residential spaces more attractive, trees and grass may draw residents to these spaces. Areas with trees are likely to attract residents more than areas without trees by dint of the physical and psychological comforts associated with trees (Eckbo et. al., 1998; Coley et. al., 1997). People simply enjoy nature: looking at it, being around it and having it available.

The “bigger-is better” outlook seems to be prevalent with respect to parks and open spaces. It is generally not the large open spaces and designated parks that contribute to satisfaction as much as such elements as trees, landscaping and opportunities for gardening (Kaplan et. al., 1998; Coley et. al., 1997). Moreover, large open areas in the residential settings can be problematic because they are more difficult to monitor. In his book, Defensible Space Oscar Newman defines defensible space as areas that are under community control and surveillance (Newman, 1973). This is more easily achieved if the open space is not too large and clearly “belongs” to a cluster of residences. Though not in the context of the parks, the findings with respect to the availability and views of nearby natural settings were very similar in a study of multiple-family housing complex. Here neighbourhood satisfaction was found to be far greater.
when residents could see even a few trees than when their view was of large open space (Kaplan et. al., 1998). One reasonable conclusion is that size needs to be considered in the context of other issues. For example, size and familiarity may be interrelated such that fear of the unfamiliar may lead to preference for small more knowable area. Size also may be related to the kind of natural area one is considering. Rather than size itself being the important issue, it may be the perception of extent that is of greater significance.

An important component of wilderness is that it has extent. Nature that is nearby is rarely vast and the uses of nearby nature are more circumstantial. e.g., much of the encounter with the front and the back yard may not be to nurture the plants but to go to the mailbox or the bus stop. It is thus evident that observing is an important form of involvement with nature (Kaplan & Kaplan, 1978). Much of the pleasure that the people derive from the nature comes from such occasions to observe and much of the observation occurs when people are not necessarily in the natural setting itself but looking from a window. Studies have shown that primary basis for the judgment of attractiveness of one’s neighborhood is what can be seen from the window of one’s home (Cooper Marcus & Sarkissian, 1986). The view of natural areas has been shown to make a difference with respect to health measures (Ulrich, 1986a) as well as satisfaction. Looking out of the window provides an opportunity to let mind wander. The nature is important for just such thinking whether one is in a natural setting or looking at it.

Perhaps life has included high levels of stress in all eras of human existence. Whether the source is a dangerous predator or the pressure of a deadline, humans always seem to pay a price for their stressful existence and it is because of these reasons that
The Need For Restorative Environments

1.02.5

"Stress Management" has become an acknowledged necessity in work settings. In a few cases the stress management and relaxation procedures encourage individuals to imagine themselves in a natural setting. Whatever the reason for our affinity to natural elements, evidence shows that natural scenes may possess restorative powers. Countering this stress, restorative responses may include reduced physiological stress, reduced aggression and a restoration of energy and health (Bell et al., 1996). Studies have also shown that nearby nature affords a wide range of both psychological and physical benefits. People feel more satisfied with their homes, with their jobs and with their lives when they have sufficient access to nature in the urban environment (Nachmias & Palen, 1986). People value natural settings for the diverse opportunities they provide- to walk, to see, and to think (Kaplan et al., 1998).

Though size may not be of primary importance in the context of nearby nature, proximity seems to be essential. One of the patterns in Christopher Alexander’s book *A Pattern Language* is called “accessible green” which states that people need green open places to go to: when they are close they use them. But if the green is more than 3 min. away, the distance overwhelms the need (Alexander et al., 1977). Proximity may be measured in terms of physical distance or in terms of perceived distance. It has been found that satisfaction can be more closely related to the perceived availability of a setting than to its use. Further more, some of the areas for which residents expressed the highest preference were those that they frequented least often (Talbot et al., 1986, in Bell et al., 1996).

![Figure 17: Need for change from everyday life is essential for the restoration of energy and health.](image-url)
Some important points which are highlighted as a result of the review of literature on housing and restorative environments are:

1. High-density housing is not as bad as it has often been projected in the past. In fact, it is one of the most efficient ways of satisfying the housing needs of the growing cities of the world, saving land and stopping urban sprawl.

2. Crowding rather than density is one of the main causes of all the social, psychological and physical problems associated with high-density housing.

3. The presence of green spaces within the housing spaces can not only help ameliorate the ill effects, if any, of high-density developments, but also propagate social, psychological and physical well-being of the residents.

4. People's preference for a particular setting in a housing scheme plays a very important role in satisfying their needs.

5. Preferred spaces which satisfy the social, psychological and physical needs of the people, also have a restorative quality.

6. Even small outdoor spaces, which meet people's behavioral needs, are preferred and have restorative qualities.
2.01 Hypothesis

One cure for what ails most cities is a little piece of the country. The hypothesis that will be investigated through this study is that a good and congenial living standard can be achieved in a high-density housing situation, through careful consideration of the architectural and landscape design.

2.02 Goal

The primary goal of this study is to translate the research literature dealing with the relationship between people and nature into recommendations, for the design of high-density housing.

This research is intended to be of use to:
1. People in the profession of design who could use the recommendations of the research in their design process.
2. People in the research field to further research on the shortcomings of the described scenarios and refine the existing research findings.
3. Policy makers, to educate people about the tremendous possibilities of affordable and healthy living in a high-density setting.

2.03 Objectives

The study is primarily concerned with the relationship that people in high-density settings have with their dwellings and the outdoor environment. It seeks to explore the possibilities of design and management of the nearby natural area to promote well-being. The objectives of this study are:

1. To develop a comprehensive review of the literature on the various aspects of high-density housing, ranging from the various housing principles to preferences for a particular setting.
2. To develop a comprehensive review of the literature on the perceptual and behavioural pattern of the people in high-density settings to prove that the natural environment can foster well being and can enhance people's ability to function effectively.
3. To propose a design highlighting the principles formulated on the basis of the review of the literature.
4. To formulate and apply principles and measures for the evaluation of the proposed design.
Methodology

The solutions that designers or researchers provide to their own problems have side effects in other disciplines. Often the two are kept separate but the aim of this study is to use it as a tool to improve the designer's control over side effects—i.e. to solve more broadly defined problems that they cannot solve alone.

In order to make the research helpful to designers and to be improved by its use in design projects, the research information needs to be presented such that

i. People who affect decisions can share it;

ii. Design team members can use it in their interaction during the design process;

iii. Users of information can confront and question it;

The best way to translate research data into design and make research data presentable to designers, so that they may use it to intervene in development, design and construction process, is to first analyze research data in terms of issues and objectives and then reformulate that analysis or re-analyze the original data in terms of design.

The intent of this study was to combine the fields of building design and restorative environments to formulate design solutions for healthy living environments in high-density housing. In order to do so, the study followed 4 basic steps for the investigation of the research questions and ways of implementing the research findings for the design of the high-density housing, i.e.,

1. Defining the problems of high density living and finding the possible design solutions from the research findings in the fields of environmental psychology, social psychology, architecture and restorative environments;

2. Defining the scope of the research and the goals and objectives of the research findings;

3. Finding specific behavioral indicators that describe the issue, identify general design concepts that respond to these issues and describe possible specific design responses that develop the design concept and accommodate the specific behavioral needs uncovered by research;

4. Analyze the proposed design solutions in light of the
existing design through comparative evaluation of the proposed and the existing designs.

There have been numerous studies and case studies of high-density housing in the past. Some claim that high-density living is detrimental to physical, social and psychological well being of the people whereas the others claim the opposite (Cappon, 1971; Freedman, 1975; Drover, 1975). Since this study was looking at high-density living as the way of life in the future cities, it focused on the research on housing to argue that; high density housing is the need of the present world (Drover, 1975; Klynstra et.al., 1994), that high-density living is not as bad as they have been projected in the past (Cappon, 1971; Michelson, 1971), and that, the high-density living could be economically (John, 1971), sociologically (Freedman, 1975), psychologically (Cappon, 1971; Bell et.al., 1996) and physiologically (Bell et. al., 1996) beneficial. The study focused on research findings that disproved the findings of research related to detrimental effects of high-density on the social and physical life of its residents. These studies don't necessarily prove that high-density living is beneficial but they do bring to light; the fact that we need to give serious consideration to high-density housings as the possible solution to check the non-sustainable urban sprawl. In the past, much of the research on finding solutions for the so-called ill effects of high-density concentrated on finding solutions in the architectural design of the housing but this study looked at the aspects of nature to find solutions to these problems. The study investigates the possibilities of using elements from nature as possible solutions to mitigate the ill effects of dense built environments. In order to demonstrate the beneficial effects of natural settings in a high-density environment, it became essential to investigate; what makes nature beneficial and how it can be used in design to bring out its beneficial qualities. It specifically concentrates on the fields of environmental psychology, restorative environments and nature as a restorative agent. The study focuses on the research findings, which discuss the role of nature as a restorative agent and specific qualities of nature, which contribute to restoration (Kaplan et.al., 1998; Ulrich, 1986b; Ulrich & Addoms, 1981). With enough evidence to demonstrate that nature does have restorative qualities.
the next step was to find ways of using these beneficial effects of nature in formulating our design principles, but the problem was how to use them in human environments. The study looks at the people’s preferences of residential and natural setting (Kaplan & Kaplan, 1978; Kaplan & Kaplan, 1989) and uses these preferences as the guiding principles for the design recommendations.

With the problem statement hypothesizing natural and social settings as the solutions for the ill effects, if any, of high density housings, the study focuses on developing a document which presented the research finding in a format acceptable in the design community and approved by the research community. The findings were more than convincing to pursue the goals and objectives of developing design recommendations for the high-density housing backed by a strong base of research. Some of these recommendations are direct derivatives of the people’s preferences and some were an interpreted version of the findings.

The next step was to define a program for the design project. Instead of defining activities for the proposed design, the design program was defined in terms of issues and criteria for the housing design. These were formulated to achieve specific spatial qualities preferred by the people. Instead of assigning specific activities to the site this study enlisted specific design criteria which when satisfied would encourage those specific activities associated with the spaces provided within the scheme. It would also give certain degree of flexibility to the designer to use their creativity.

Based on the program statement, the study proposed an alternative design for the site, to show the ways of interpreting and implementing the developed design criteria. The analysis was divided into 2 tiers, namely; quantitative and qualitative. The quantitative mainly looked at hard numbers in terms of percentages, sizes, number of people, number of dwelling units, areas and distances. These are more dependent on the individual designer and may vary depending on the design style of the individual designers whereas the qualitative aspects were aimed to show what specifics of design were overlooked in the existing design and what minor or major changes could eliminate those
short comings in the existing design. It focused on a more visual evaluation of the proposed design recommendations in; the proposed layout and unit design; and in the existing design layout.

For the purpose of comparative analysis, it was essential to select an existing housing scheme. This housing scheme could have been selected from any city or region of the world. However, for the sake of convenience and easy accessibility of the resources related to the site, it was decided to select a site within the city of Vancouver.
SECTION III

3.01 Design Issues

3.01.1 Density
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3.03.6 Ease of Access
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3.01 Design Issues

Developing housing entails not just planning the site and designing the units, but it involves another step before design, i.e. determining the target group, and that in turn determines some essential issues, like density, cost, unit sizes and essential facilities to be provided. Design comes in only after these issues have been well defined to meet the needs of the promoters and the residents. However, the success of any housing scheme depends on the success of its three levels of design; namely the unit, the cluster and the site design (Cooper, 1975; Lynch, 1984). How well they function as an independent unit, and in relation to other units, determines the success and failure of the housing.

3.01.1 Density

Density is an issue, which concerns housing providers and buyers equally. The problem is how to achieve an economically high density in developed areas and at the same time have more amenable surroundings for the people in them (Whyte, 1964). For one, it's the question of achieving a viable and sellable density standard without hampering the projected profit margin, whereas for the other group it's a question of how good the living conditions are and how well they would satisfy their standards of privacy, livability, satisfaction and also fit their budget. Whatever the differences in the priorities of the providers and buyers might be, both their interests need to be addressed if we want to solve the problem of providing affordable, healthy and livable house to the people.

Density has been defined in a number of ways but none of them seem to be all inclusive. The most common definition of density is in terms of number of people per unit area of available land; i.e. people per acre (ppa.) or in terms of number of dwelling units per unit area (dwelling units/acre or DU/acre). Both of these definitions can be either gross density (the available land area includes open spaces, parks, playgrounds, pathways etc.) or net density (the available land area includes...
the private open spaces around the units only). However mathematical the density calculations might appear, these numbers have a very important role to play in determining the quality or standard of living in a housing development (Greenberg et al., 1976).

Some studies have shown that housing land is most efficiently saved by increasing the density of low density development, since all other elements of collective consumption requirements represent a fixed component in the allocation of land for this purpose—"an increase in density from 24 ppa to 40 ppa saves almost 10 times as much housing land as the much larger increase from 160 to 220 ppa" (Cutherbert, 1985).

The other variables that indirectly control the density are Floor Space Ratio (FSR) and Site Coverage. FSR is perhaps the only criteria for specifying density, which recognizes the fact that the building is 3 dimensional. FSR can be calculated by dividing the gross floor area (i.e. the sum of area of all the floors) of the building by the area of the lot on which the building stands. Site coverage is usually represented as percentage of total available site area covered by the building (i.e., area of the building footprint). Both of these are tools used by the planners to control the building heights, spacing and building densities, which in turn controls the density within a certain specified zone.

However, density also needs to be considered in conjunction with some other aspects of housing; i.e., the unit sizes, building height and cost. Small units with high occupancy in a high-density situation may result in crowding but a small unit with medium to low occupancy in the same settings might turn out to be the preferred housing condition.
Unit sizes can be defined in terms of built-up area or carpet area. To explain the two concepts in simple terms; built-up area is the area of the unit which includes the area within the walls whereas the carpet area can be defined as the area of the unit which can be carpeted before any furnishing or cabinets are placed. Unit size has an important role to play in the overall development and health of the users (Bell et al., 1996).

It's true that human beings can adapt to any kind of situation for a short period of time (Cappon, 1971) or perhaps for longer periods of time (Cuthbert, 1985), but there are certain minimum space requirements for all human beings which have been enlisted in various standards and have been derived from years of studies and research in the fields of psychology, anthropometrics, and architecture. According to the US Census a measure of more than 1.51 persons per room is an indicator of overcrowding (Lang et al., 1974). One thing to be kept in mind at this point is that the space requirement doesn't vary from person to person, but one's buying power tends to determine the size of units selected. Similar living standards can be achieved in a 600 sq. ft, one bedroom apartment as compared to a 1000 sq. ft, one bedroom apartment (Hoffman, 1967).

Considering the space requirements for the essential spaces, like bedroom (150 sq. ft.), living (200 sq. ft.), dining (80 sq. ft.), kitchen (80 sq. ft.) and toilet(s)(40 sq. ft.) in a house, with adequate circulation space (DeChiara, 1984).

It is not so much the objectively available amount of interior space which produces feelings of dissatisfaction with the home, as the subjective evaluation of the space as fulfilling or not fulfilling certain household needs (Ross, 1953, in Bell et al., 1996). In terms of floor space, crowding and

Figure 21: Small internal spaces can be made to appear bigger by the provision of large windows and easily accessible outdoor space.
confinement, it has been known for some time that humans can adopt to much smaller spaces such as a submarine or a space capsule for a considerable time without adverse psychological effects (Cappon, 1971). There is evidence that what matters is not the actual environment, not even in terms of noise, but the perceived environment (Bell et. al., 1996; Cappon, 1971). In different parts of the world there are different standards for the minimum area requirements for the units. For example, the area requirements in Europe are generally much less than those in North America. However, it has been found that the area requirements for public housing in North America match very closely the requirements of housing in Europe (Lang et. al., 1974). This is just one of the examples, which indicates that it is not necessary to have larger units in order to have better living conditions.

However, cultural differences do exist and they do need to be considered in any kind of design endeavour. Whatever the reasons might be, the bottom line is that even a small space if designed to appear bigger can serve the purpose without having any adverse psychological effect on the inhabitants of the space. This perception of space is what is lacking in most of the high-rise buildings. It is true that considerably high densities could be achieved by building high-rise structures but at what cost?

Studies show that tall blocks increasingly diminish the space per habitable room in terms of surrounding open spaces. Large buildings with little outdoor property lead to a lack of personally owned space outside of individual apartments; high rise buildings are particularly lacking in such spaces (Coley et. al., 1997). High rise buildings lack semi private spaces, the type of spaces that encourage people to feel a sense of ownership and territoriality, to watch over and take care of the area and control what happens there (Yancey, 1971, in Coley et. al., 1997). In addition to this there is a much greater cost incurred in building and maintaining high-rise buildings. As a matter of fact the cost
Most of the high-rise units lack the objectively available outdoor spaces present in the low-rise or ground oriented units.

Figure 23:

of providing and maintaining the dwellings rises with the increasing storey heights (Cuthbert, 1985). The very obvious reason behind it being the cost of construction which increases drastically with the increase in floors from 4 to 5 because of the provision of elevators, fire exits and special considerations in the structural design. Similarly, the cost of maintaining these elevator systems and fire prevention systems is also high. Contrary to the popular belief that the apartments in the high-rise buildings cost less, in fact the cost is higher. It's true that there are more units on the same amount of land when compared to a single or double storey structure but there are other costs, as mentioned earlier, attached with the high rise buildings which remain unnoticed by the general people.

In general, people with children, younger people and people who earlier lived in suburbia tend to prefer low rise housing (The fortune ACTION study of the city dwellers). So what are the reasons behind people's preference for low-rise over high-rise buildings?

1. Virtually all the space in high-rise building is used for dwelling units and practically none for other purposes;
2. There is little space outside the home under parental control;
3. The sound proofing is often unsuccessful;
4. There appears to be little consideration for the cultural definitions that make the space appropriate or inappropriate for meeting.

Densities of 100ppa can be achieved with low-rise buildings. It has been seen that Semi-detached houses can be built at 200ppa and densities of up to 265 ppa can be achieved in three storey terrace apartments (Cutherbert, 1985). Studies in Hong Kong have shown that densities of 210 ppa can be achieved with eight storeys or less giving 60% of the occupants a garden patio (Cutherbert, 1985). The issues considered till now are major determinants of the cost of the units. An appropriate consider-
Affordability

Affordability is one of the issues, which bothers most buyers and its one of the most difficult issues to define. Most of the times people define affordable as something, which costs less. In technical terms affordability of a unit is dependent on a number of other factors. Government regulations define the standard of affordability to be decent, quality housing that costs no more than 30 percent of a household's gross monthly income for rent/mortgage and utility payments (Friedman et.al., 1993).

Affordability of a dwelling should include costs per square foot ($/sq. ft.) and other costs such as maintenance, utilities and human costs. For a person who spends all his savings to buy a house, these other costs could be a burden, which he might not be able to handle or may be a source of unwanted worries that might adversely affect his mental and physical health. These other costs also need to be kept as low as possible in order to term a housing as affordable.

Contrary to popular belief, the people who are unable to find affordable housing are not necessarily those at the bottom rungs of the income ladder. Increasingly, they include growing numbers of middle-income families and individuals. Many who hold jobs in essential services, trade, manufacturing and government, are being forced to commute long distances to work because they are unable to locate affordable housing near their jobs (Alexander & Tomalty, 2001). For a growing number of workers this means that they cannot afford to live in the same community where they work. Long commutes contribute, in turn, to the worsening of other problems including increased traffic congestion, air pollution and the over-consumption of fossil fuels. Longer commutes also add more stress to daily routines and can result in the disruption of households and lower productivity at work (Parsons, et.al., 1998).

Having considered the major issues and provided people

Figure 24:
More than often, the units are arranged into close packed box structures to reduce the building cost, thus rendering the surrounding spaces physically inaccessible from the units.
with affordable houses does not necessarily mean that we have solved the problem of housing. One of the major issues in housing is the living standards within the units or livability of the units. With the right combination of density, unit size and building height and a careful design consideration, appropriate standards of living can be achieved.

### 3.01.5 Livability

There have been some studies, which demonstrate that the livability conditions for the units in high-density situation are usually compromised (Cutherbert, 1985). More than often, these conditions relate to the lighting, ventilation and comfort conditions of the interior spaces. In my opinion livability of a space involves more than just heat, light and ventilation of the spaces. It should also include aspects other than the physical aspects of design. Aspects like privacy, security, access to outside and opportunities for social interaction.

The internal spaces can be designed such that they have adequate levels of lighting and have proper ventilation and comfort conditions. They can be very easily achieved by the appropriate location of windows, ventilators and skylights, but if the internal spaces do not meet the needs of privacy and security then more often than not, these windows and skylights are covered with curtains and the ventilators are closed off. Thus, rendering a technically sound design absolutely ineffective and useless.

According to this study, livable space should meet the standards of light, ventilation and comfort conditions and at the same time allows fair degree of privacy, security and controlled social interaction; i.e., it allows the residents to keep their doors and windows open and maintain the desired level of privacy of the internal spaces.

*Figure 25:*
The building form and layout is very much dependent on the prevailing climatic conditions of the region, but requirements of comfort are universal.
Recommendations

Based on various housing literature and case studies, the following are the recommended criteria for achieving the desired design density and livability standards for housing schemes in the residential zones of the cities.

1. Minimum density of 150 persons per acre, to a maximum of 250 ppa;
2. At least 60% site coverage, with a maximum of 80%;
3. Minimum FSR of 1.5, up to a maximum of 2.5;
4. At least 350-400 sq.ft of carpet area should be provided for each person.
5. Maximum building height of 4 floors (Ground + 3), accessible up to 3 floors (Ground + 2).

It is believed that if the design issues are within the range specified above, the livability standards can be easily met through appropriate design.
Open Spaces

Open space can be defined as useable outdoor space for active and passive activities. It serves the following functions:

1. Enhancement and provision of recreational activities;
2. Creation or reinforcement of physical and social spaces;
3. Preservation and protection of natural and built amenities.

The incorporation of green space in site design for housing can be one way to encourage sustainability. This allows a semi-public/private area to be created that provides opportunities for the development of safe areas for children, neighborhood interaction and encourages multiple uses of green space such as community gardens. By incorporating green spaces into the building design, open spaces are reduced in size but are increased in utilization by the residents. These areas are smaller in scale and therefore tend to provide a more human environment (Whyte, 1964). Such spaces are desirable for families with children because children can be more easily supervised and have greater freedom to play.

For most cultures, there is provision for large spaces in which the entire group can meet. Today’s cities do not provide anywhere near the required number of meeting spaces. Moreover, it is important that there is a good mix of small and large open spaces spaces in which smaller groups can meet, although the number and distribution of these has not been scientifically fixed. These open spaces should not be used only as a setting for the buildings; they should also have a sense of enclosure to them (Whyte, 1964). This gives a sense of intimacy and involvement in the settings without being overwhelmed by the built structures in a housing scheme which can improve the quality of living. This component of housing planning incorporates all aspects of livable areas: public,
private, commercial, transport routes, and recreational spaces. In fact, a poor allocation or design of open spaces can lead to unhealthy and unsafe social environment (Newman, 1973; Robinette, 1972). Every open space provided in a housing scheme, especially in a high density housing scheme should be designed to meet the social, psychological and physical needs of the residents in order to be a successful and used space. Proper design at the beginning of the development process can, in my opinion, potentially reduce the inefficiency, the cost, and increase the efficacy of the site. In a high density housing situation like the one studied here, an unused open space is a wasted space. It is absolutely not necessary that the open spaces need to be very large in order to be useable (Sommers, 1974, in Lang et. al., 1974).

Not only does building form and density affect the amount of open space, but more importantly, it affects the types of open spaces which are available (Greenberg, 1976). Based on a review of literature on housing and relevant case studies, the different types of open spaces identified in the housing schemes can be divided into; private spaces (front garden, entry porch, terraces, balcony), shared spaces / semi-private spaces (playareas, tot lots, courtyards) and public spaces (streets, neighborhood parks, street parking, swimming pools, common laundry) (Freidman, 1993). The following section briefly describes the characteristics of each of these spaces and their importance in relation to the housing scheme.

### 3.02.1 Site Entrance(s)

The site entrance marks the point of entry into the site. It is important to both the residents’ and the visitors’ access as well as to the community image. It can act as a landmark, for the residents as well as the non residents, in the neighborhood. Some of the primary considerations for site entrance are safety, easy recognition and access (Cooper Marcus & Francis, 1998).

**Advantages:**

1. Act as threshold between the neighborhood and the
3.02.2 Common/Community Spaces

Incorporation of small outdoor elements like picnic tables in close proximity to the units can be an effective way of encouraging the use of the outdoor space.

Advantages:
1. These spaces encourage positive social interaction.
2. The proximity of these facilities to the residences can reduce the frequent use of vehicles to go to the grocery store or other places like fitness clubs, swimming pool etc.

Beyond the private spaces that accompany each individual unit, there are other outdoor spaces that can be used by a number of neighbouring units. In cluster developments, the spaces shared by small groups of people play an important role in the overall satisfaction of the residents and act as spaces for communal interaction (Friedman, 1993). The spaces referred to as group spaces in this study, are the courtyards, tot lots, small parks, etc.

Common spaces may vary from scheme to scheme, depending on the culture, region, demographics of the place and the user needs. In general, this category of spaces, which are shared by all the residents of the housing scheme, includes spaces like playgrounds, corner shops, swimming pools, common laundry, fitness areas etc. These spaces can play a significant role in the social interaction among the residents (Cooper, 1975) but the provision of such spaces is primarily regulated by the size of the housing scheme and the number of users (Civil Engineering Department, 1973; Lynch, 1984). An exceptionally low number of users might render such spaces economically unfeasible because it is the users that provide for the maintenance and upkeep of these facilities.

3.02.3 Group Spaces

Figure 28: Incorporation of small outdoor elements like picnic tables in close proximity to the units can be an effective way of encouraging the use of the outdoor space.
viewing gardens, roof decks etc., which are shared by a small cluster of units.

**Advantages:**

1. They provide safe outdoor spaces for the kids to play.
2. These spaces can be used by the group of residents to have small group activity.

### 3.02.4 Circulation Spaces

One of the major concerns in any design is the circulation pattern and movement of the residents and visitors within the scheme. In any housing design, the streets and pathways are the major links between the different areas of the scheme. The pattern of streets and pathways may provide or destroy the sense of focus or center in the plan. Connecting or disconnecting one local street system with another can produce surprising effects of apparent association or dissociation with neighboring areas (Lynch, 1984). In the case of high rise structures these are replaced by corridors, bridges and staircases.

A well designed circulation network can foster social interaction and neighborhood friendship in addition to providing a successful circulation pattern for the scheme. A good network makes the movement within the scheme very convenient and at the same time discourages their unnecessary use by the non residents or strangers (Cooper Marcus & Sarkissian, 1986).

**Advantages:**

1. Link the various spaces in a scheme.
2. Act as casual meeting places.
3. Well designed circulation networks encourage movement and social interaction.
3.02.5 Parking Spaces

Parking has been found to be one of the areas in a housing scheme which has a lot of social activities attached to it. Unfortunately in most high rise structures, parking is provided in underground basement areas. It's true that surface parking takes up a lot of ground area (Alexander & Tomalty, 2001) but considering the contributions of the space in the social life of the people, it is suggested that parking be made an integral part of the site design instead of being tucked away in dark and dingy basements. For any housing scheme it is advised that the ratio of the number of parking stalls (which includes the visitor and resident parking) to the number of dwelling units should not be more than 1. This can be one of the ways of discouraging car usage and encouraging the carpool and use of public transit system.

On the other hand there are places around the globe where the level of car ownership is not as high as we find in North America or Europe. To take care of such situations it may even be a better idea to specify the parking area allocation in terms of Passenger Car Units (PCU) where the maximum allowable PCU should not be more than the number of dwelling units.

Advantages:

1. Encourages social interaction.
2. On street parking can be an effective measure for traffic calming.
3. On grade parking designed as a part of the open space system can encourage multi-use of the parking spaces.

3.02.6 Front Garden

Home gardens have been shown to be a major contributor to the quality of life. Even though the few surveys of actual garden usage have not always shown intensive active usage, especially of the front garden (Halkett, 1976, in Cooper Marcus & Sarkissian, 1986), they are a versatile and important space. The front gardens usually provide a soft green transition or buffer between the private and public spaces. They can be one of the

Figure 31: Lack of adequate parking space gives an added sense of density
major active and interactive spaces in a housing (Francis & Hester, 1990, in Cooper Marcus & Francis, 1998) and play a very important role in promoting social interactions and improving a sense of belonging and territoriality (Newman, 1973).

**Advantages:**

1. Gives opportunity to personalize the unit entrance.
2. Provides opportunity to work outside and be in contact with nature.
3. Provides outdoor environment to sit and relax in a fairly private space.
4. Encourages a sense of place and attachment in the residents.

Any house or dwelling unit has a main entrance/ front porch. These spaces play an extremely important role in the peoples preference for the house and there activities. The appropriate design of these spaces can provide people with environments that support multiple identities, provide opportunities for particular interactions, allow for desired solitude and provide opportunities for personalization of the space. The front porch of a house offers an important physical and psychological transition from the public life of the community to the more private life of smaller social group (usually family). The Porch provides a leisurely setting for conversing with ones neighbors or simply watching the neighborhood. The residents enjoy the settings as a place to be alone, with multiple members of the household, or with neighbors (Brown et.al., 1998). Such typical urban amenities as designated entrance ways with "stoops" to sit on, which help to enhance casual social interactions and territoriality among neighbors – are often scarce or absent (Coley et. al., 1997).
3.02.8
Back yard

Figure 34:
Adjacent backyard spaces can be very active social places.

Advantages:
1. Provides opportunity for people to personalise.
2. Defines the territorial boundaries of the units.
3. Acts as a buffer between the Private and public domains.
4. A distinct front entrance gives a sense of identity to the residents.

Most of the houses have a very different image at the front door as compared to the back door. Backyards are major activity areas in a housing on the more private side. As compared to the front of the house, the back has a more informal aspect, where utilitarian functions can take place, private household functions can occur and the communal spaces can be accessed with ease (Cooper Marcus & Sarkissian, 1986). In short, the back yards are generally ment for personal activities and interaction with the immediate next door neighbors.

3.02.9
Patios, Terraces and Balcony

Advantages:
1. Provide private outdoor space to form informal private activities.
2. Act as buffer between the communal space and the private indoor spaces.

All residents of multi-unit housing put great value on having an outdoor space of their own (Cranz, 1987; Wolfe, 1975, in Cooper Marcus & Francis, 1998). Terraces and balconies are the counterparts of front and the backyards for the ground floor units. The patios and balconies attached to the individual units make the the place seem more homelike and less institutional. It also gives the residents a personal connection to the outdoors and provides a setting for many personal and domestic activities that are part of an autonomous, independent home life (Cooper Marcus & Francis, 1998).

Advantages:
1. Patios, terraces and balconies can act as outdoor extensions of the indoor spaces in units above the ground floor.
2. Patios near the entrances can provide the residents with:
an opportunity to personalize their front entrance, in a similar fashions as the units on the ground level.

3. In extreme climates the patios and balconies provided with internal spaces can act as buffers for climatic protection and control.

In a city like Vancouver which has great natural views all round, even the units in high-rise apartments enjoy a visual connection to the nature, even though they are physically detached from the immediate open spaces, which in my opinion form an integral part of a housing scheme. Whether it acts as a setting for the high-rise buildings or as an actively used space, an open space has a significant effect on the housing design and the residents. Having said that, it is also true that the spacial quality of these spaces also have a major bearing on the usage and efficacy of the spaces. They should satisfy some essentially obvious and not so obvious needs of the residents to ensure the success of the scheme as a whole.
Design Criteria

As most people believe, the primary objective of the housing is to provide shelter and security; that's what people look for in a house. This need for shelter and security is something very obvious. What people also need but often fail to articulate is a sense of place, community and control in the settings (Cooper, 1975; Cooper Marcus & Sarkissian, 1986). A mere provision of open spaces cannot guarantee the success of a housing scheme. Each of these spaces should fulfill certain needs of the residents, other than the needs of shelter and security, in order to assure the success of the scheme.

The following are some of the other aspects of housing that the open spaces need to satisfy in order to ensure the overall success of the housing. The criteria listed in the following section may be direct derivations of the new urbanist theory but they also form the basis for certain restorative environments as you will see in the following section.

According to Canadian Mortgage and Housing Corporation, healthy housing is based on five key elements:

1. It promotes occupant health;
2. Enhances energy efficiency;
3. Improves the efficient use of natural resources;
4. Encourages environmental responsibility;
5. It is affordable; (CMHC healthy housing pamphlet).

On a similar line, Kaplans state that restorative benefits are more likely to occur when one can feel secure enough to let down ones guard, when one can get absorbed in the environment without feeling vulnerable. According to them some of the major aspects of restorative environments are:

a) Its legible and not confusing;
b) It has ample opportunities for exploration;
c) It fosters experiences which are restful and enjoyable;
3.03.1 Contribution of the scheme towards the life in the neighborhood

Figure 37: Residents in high-rise structures lack the connection to the neighborhood.

d) It encourages people to participate in it;
(Kaplan et al., 1998).

Based on these facts and on the theories of housing the following criteria have been formulated which in my opinion are the key to designing healthy restorative environments in high-density situations. Each of the criteria have been divided into 2 sections; i.e., the desired objective of the criteria and possible design solutions to achieve the desired objectives.

Designing a housing scheme in the middle of a countryside is very different from designing in the middle of a city but in both the cases, a good design should relate to its immediate context. It should promote a fair degree of interaction between the design and its surroundings. In the context of a city, William H. Whyte argues in his book Cluster Development, that a housing development should contribute towards the life of the neighborhood. It should encourage social interaction and ensure the safety of the neighborhood through residents’ surveillance (Whyte, 1964). Failure to recognize the importance of this interaction could have harmful consequences, more often than not, the surrounding areas are rendered almost dead (Whyte, 1988).

**Desired Objectives:**

1. To encourage interaction between the residents and the people in the neighborhood, and avoid the alienation of the two (Kaplan et al., 1998).

2. To improve the safety and security of the neighborhood streets and pathways (Newman, 1973).

3. To improve the on street and everyday experience in the neighborhood (Kaplan & Kaplan, 1978).

4. To improve the usage of the community spaces like parks, playgrounds and local shopping areas (Cooper Marcus & Sarkissian, 1986).

**Possible Design Solutions:**

1. Provide peripheral streets and pathways, with units opening onto the streets (Whyte, 1964).
2. Provide narrow streets to mark the boundary between the scheme and the neighborhood (Brown et. al., 1998).

3. Provide permeable or soft edges, which allows visual access and occasional physical access (Whyte, 1964). For example, rows of trees with canopy above eye level along the edges, low height shrubs, instead of high solid walls.

4. Provide rows of trees and shrubs to create views and vistas along the streets and pathways into the activity areas like parking lots or tot lots within the site to facilitate visual and controlled physical access of the activity spaces (Whyte, 1964).

5. Provide perceived thresholds or boundaries between the scheme and the neighborhood through change of material or provision of land mark features like gateways (Cooper, 1975; Cooper Marcus & Sarkissian, 1986).

6. Provide common meeting grounds like multi-use parking lots, peripheral walkways, entry parks, street plazas etc., for the residents and non-residents (Cooper Marcus & Sarkissian, 1986).

In order to address the social needs of the residents, space should also be provided to accommodate the following relationships within the scheme:

1. Individuals working alone;
2. Peers working together;
3. Peers working together as a team;
4. Superiors and subordinates working together;
5. Individuals working as teachers;
6. Individuals working as students.

In short, the spaces should encourage social interaction among the resident. The designer who designs a house or a site plan, who decides where the roads will and will not go, and who decides which direction the houses will face and how close together they will be, also is, to a large extent, deciding the pattern of social life among the people who will live in those houses.
3.03.2
Social interaction within the site

People evaluate the attractiveness of the neighborhood more by social than physical criteria – namely how friendly the people are (Cooper, 1975). Social support is significant for optimizing many aspects of human functioning, like stress coping, life course events, professional success, child rearing and health (Cohen & Syme, 1985, in Skjaeveland & Garling, 1997). The increased opportunities for social interaction among neighbors has been shown in previous research to foster neighborliness and social relationships (Yancey, 1971, in Coley et al., 1997). Similarly, both the proximity of other people and the frequency of face to face contacts with others are strong predictors of friendship among neighbors (Ebbesen et al., 1976, in Coley et al., 1997).

Supportive, positive social interactions and relationships are important for the healthy functioning of individuals, families and communities (Coley et al., 1997). Research has found that numerous aspects of the physical environment can affect social behavior and social interactions. Objective features of the physical environment—architectural design, crowding, noise and pollution—as well as more subjective features—sense of security, privacy—all affect human behavior and thought (Burby & Rohe, 1990; Ottensmann, 1978; Riger & Lavrakas, 1981; Rodin, 1976, in Coley et al., 1997).

**Desired Objectives:**

1. Encourage interaction, both visual and physical, among residents (Newman, 1973).

2. Encourage the use of small outdoor spaces like parks, kids playareas etc (Coley, et al., 1997).
3. Encourage the involvement of people in the everyday activities (Kaplan et.al., 1998).

4. Improve site surveillance through increased use of outdoor spaces by the residents (Newman, 1973).

**Possible design solutions:**

7. Provide multiple options for movement within the site through careful design and layout of the streets, sidewalks and pathways (Lynch, 1984).

8. Create interest along the streets and pathway through careful consideration of views and vistas along the path of movement, to encourage the use of streets and pathways (Lynch, 1984).

9. Design the sidewalks and parkings as part of the community space (Cooper Marcus & Sarkissian, 1986).

10. Provide small, intimate, enclosed spaces for people to gather and interact in groups (Coley et. al., 1997).

11. Provide trees in open spaces to create small protected, intimate spaces to perform various functions (Coley et. al., 1997).

12. Shrubs can be used to create small outdoor rooms for kids to play or for adults to meet in the evening or weekends (Robinette, 1972).

13. Provide spaces like small backyard or front garden with the units to perform occasional house hold leisure activities (Cooper, 1975).

14. Provide small kitchen garden or green spaces to attend to in free time (Kaplan et.al., 1998).

15. Provide small front porch or back yard to sit out and read and also watch over the kids playing outside (Brown et.al, 1998).

16. Provide spaces and facilities for weekend leisure activities like cleaning the car, repairing some house hold goods,
Contribution towards The sense of group and perceived ownership

A study of the past shows that the first property an organism had was the space around it, and it can be demonstrated that nearly all organisms have territoriality of one kind or another. In human beings this is highly developed, even though the forms vary from culture to culture. Oscar Newman described a type of supportive living space, termed "defensible space", as "a living residential environment which can be employed by inhabitants for the enhancement of their lives, while providing security for their families, neighbors and friends". Such spaces have a clear indication of ownership, provide opportunities for surveillance and define specific areas for different types of activities (Newman, 1973). In addition to staking territorial claims, people tend to personalize their territory. Some means of personalizing territories (e.g., working on one's lawn and garden, making improvements to one's property) may provide neighbours with opportunity to get to know each other better, to become more cohesive (Brown and Werner, 1985 in Bell et. al., 1996) and thus enable residents to...
better distinguish between residents and strangers. This may lead to more surveillance and fewer problems with outsiders (Taylor, et.al.,1981, in Bell, et. al., 1996). Personalization may also elicit greater feelings of attachment to a place and install a feeling that it is “comfortable” and “homelike” (Becker & Coniglio, 1975). At the individual unit level, a house can only be considered a “home” to the extent that the occupiers can give it their own meaning (Ruddick, 1969, in Cooper, 1975).

**Desired Objectives:**

1. Encourage the residents involvement in the maintenance and surveillance of the spaces (Newman, 1973).
2. Improve the sense of attachment to the place (Brown et. al., 1998).
3. Encourage residents control over their surroundings (Newman, 1973; Cooper Marcus & Sarkissian, 1986).

**Possible design solutions:**

24. Provide a level of social homogeniety by giving equal importance to all the units in the site planning and design (Cooper Marcus & Sarkissian, 1986).
25. Provide a distinct street address to all the units (Cooper Marcus & Sarkissian, 1986).
26. Provide flowerbeds at the entrance or in courtyards for the residents to grow their own plants or empty niches and boxes for the residents to display the house address/names, to display subunit identity to create a sense of place and attachment.
27. Provide elements like a row of hedge, stepped entry, a tree etc.to demarcate the territorial boundary of individual units (Robinette, 1972).
28. Provide small tree, lamppost or a couple of steps to mark the entry into an individual unit (Newman, 1973).
29. Provide a common mailbox, shared outdoor space for the residents of a group of units to demarcate the territorial boundary of the group (Newman, 1973).
30. Provide common parking spaces to demarcate the entrance into a group space.
31. Make sure that the entrances to the units are visible
and distinct (Cooper Marcus & Sarkissian, 1986).

32. Provide open spaces in close proximity to the individual units.

33. Variation in material treatment of the landscape and architectural spaces can create a sense of group identity.

Spaces that obviously belong to family or set of families lead those individuals to feel more territorial and thus to collectively watch over the space and enforce rules and codes of conduct there (Crowe, 1994, in Coley et. al., 1997; Newman, 1973).

The feeling of safety and security in a place is a prerequisite for the public space use. People who feel safe in an environment will use it more. A sense of security and community is likely to be enhanced when unnecessary access to the site by outsiders is discouraged (Cooper, 1975). A fear of crime and dissatisfaction with the physical quality of neighborhood reduces community attachment (Newman, 1973). The presence of people in outdoor spaces can help make the area much safer. By using and spending time in a specific space, people also develop a sense of territoriality and ownership over the area (Newman, 1973).

Desired Objectives:

1. To encourage people to move about and explore without any fear (Newman, 1973).

2. To provide safe outdoor spaces for the families with kids (Cooper, 1975).

Possible design solutions:

34. Provide spaces which have direct visual and easy physical access from the surrounding units (Newman, 1973; Cooper, 1975).

35. Provide lights along the streets, sidewalks and pathways for good visibility at night (Lynch, 1984; Newman, 1973).


37. Maintain sight lines between units to provide opportu-
nities for mutual surveillance (Whyte, 1964).

38. Provide perceived barriers like 3'-4' high shrubs or see through fencing around the scheme to discourage the unnecessary access to site by the outsiders (Robinette, 1972; Newman, 1973).

39. Avoid the use of long shared access galleries (Cooper Marcus & Sarkissian, 1986).

40. Design adequate traffic calming devices to encourage pedestrian movement.

The ease of way-finding is one of the major concerns of any housing scheme. The pathways should have a clearly ordered system of their own, without ambiguities and should expose the image of the whole development in as clear a way as possible. Along them the traveler should experience a pleasant sequence of form and space and they should be expressive of the function and nature of the site. Each unit / sub-unit of the scheme should have some sense of uniqueness to create a sense of place and identity. If the units are similar, users and visitors have reported feelings of disorientation and consider it unpleasant (Revell & George, 1975, in Cooper, 1975).

Landmarks perform many functions, one of which is to identify meeting places. They are particularly desirable when large numbers travel to the meeting place from widely separated points. The landmarks can be practically anything that is readily imaged as well as identifiable, provided there is sufficient waiting space around it. In general, meeting places should be located on an avenue between work, eating, and recreation areas.

**Desired Objectives:**

1. Encourage movement of the residents within the site (Whyte, 1988).

2. Provide residents with options to move between places within the site (Cooper, 1975).
3.03.6 Ease of access

Possible design solutions:

41. Establish street identity through distinct streetscapes, through the use of trees and shrubs with distinct foliage or flowering characteristics along the streets.

42. Use distinct street elements (like, lamp posts, benches, railings etc.) and materials (like paving material, shrubs and groundcovers) to indicate space hierarchy and locational bearing of the users (Cooper Marcus & Sarkissian, 1986).

43. Provide sidewalks along all the streets (Cooper Marcus & Sarkissian, 1986).

44. The pathway system should accommodate predictable pattern of pedestrian movement (Cooper Marcus & Sarkissian, 1986).

45. Provide landmarks to identify the specific stop points (Lynch, 1984).

46. Create focal points to assist in movement through the streets and pathways (Cooper Marcus & Sarkissian, 1986).

47. Use different patterns and specific color coding for each space within the housing scheme (Cooper Marcus & Sarkissian, 1986).

48. Arrange elements throughout the site in a fashion which orient the person to a specific direction (Cooper Marcus & Sarkissian, 1986).

49. Create views and vistas to a focal point in a particular direction through out the site (Cooper Marcus & Sarkissian, 1986).

It's a well-known fact that a places that are easily accessible are more used as compared to those, which are very difficult to access (Whyte, 1964). Access in this study refers to both visual and physical access. A space must be easily accessible to be actively used. It has been seen that sightlines play a very important role. If people do not see spaces they don't use it (Whyte, 1988). At the individual unit level, the accessibility of the surrounding spaces from the units gives a perception of controlled openness and seems to increase the space within the
Figure 45:

Easily accessible outdoor spaces, are used more, thus encouraging more social interaction.

Desired Objectives:

1. Increase the active and passive use of outdoors/open spaces (Kaplan et al., 1998).
2. Improve resident surveillance of the site (Newman, 1973).

Possible design solutions:

50. Provide large windows in the units to facilitate easy visual access to the outside without compromising on the privacy of the interiors (De Chiara, 1984).
51. Avoid the use of indoor walkways to access the outside (Cooper Marcus & Sarkissian, 1986).
52. Provide private garden, patio, balcony with every unit (Coley et al., 1997).
54. Have a well-defined hierarchy of privacy to facilitate the gradual movement from the private to the public open space (Cooper Marcus & Sarkissian, 1986).
55. Avoid the use of wide streets and pathways separating the communal spaces and the units (Whyte, 1988).

In addition to easy access to the outdoors, the residents of the housing should also have a certain level of privacy in order to avoid unnecessary interferences from the outsiders.
3.03.7 Sense of privacy

Privacy could be defined as a voluntary and temporary condition of separation from the public domain (Newell, 1994, in Newell, 1998). The condition of privacy is one of the many options that the individual system might employ in order to to restore itself to equilibrium in the face of system distress, or to facilitate creative or developmental function. It has been shown in the studies of crowding (Milgram, 1973; Saegart, 1973, in Newell, 1998) that privacy contributes to the well-being of the individuals by preventing excessive stimulation and exhaustion of resources thus providing an opportunity for restabilization and sytem maintenance. The after effects of privacy have been shown to be beneficial across cultures. The therapeutic value of privacy is believed to be connected to the relaxing and refreshing effect it appears to have on the individuals (Newell, 1998).

All societies have some provision for privacy even if it consists of no more than turning one’s face away from the group and being left alone. It is important to provide for a variety of privacy options, including available open spaces outdoors. Most people prefer that the visitors or strangers pass through series of zones or filters that make them more and more aware of the fact that they are entering a private domain as they approach the dwelling units (Gehl, 1977, in Cooper 1975). When it comes to the privacy of the individual units, people are more bothered about whether they can be seen or heard by others. They need privacy both in terms of audio and visual privacy. However, the the degree of privacy is guided more by the cultural background, the type of spaces and the stage in the life cycle of the family concerned (Newell, 1997).

Desired Objectives:

1. Increase the level of satisfaction of the residents (Amerigo & Aragones, 1997).
2. Encourage the use of semi-private open spaces (Coley et. al, 1997).
3. Define hierarchy of privacy to cater to the needs of the residents.

**Possible design solutions:**

56. Arrange dwelling units in such a way that the units do not look directly into the private spaces of the adjacent units (Cooper Marcus & Sarkissian, 1986).

57. Provide grade change between the public and private spaces, in the form of a gradual slope, a set of steps, or an abrupt level change (Newman, 1973).

58. Provide physical or vegetative buffers between the semi-private open spaces and semi-public / public open spaces and pathways (Robinette, 1972).

59. Provide a series of transitional filters for the pedestrians passing from the public to the private domains of the dwellings (Whyte, 1988).

60. Make sure that the location of the entry and the pathways don't affect the privacy of the interior spaces.

61. Provide distinct front and back entrances to the units (Cooper Marcus & Sarkissian, 1986).

62. Provide screening for the yards where private activities are likely to occur to avoid visual continuity from the public spaces or the surrounding units into the private domain of the units (Robinette, 1972).

3.03.8

**Level of maintenance required by each of the spaces**

People's comfort and status are always more affected by how well their community is kept than what it looked like on the day of occupancy (Cooper, 1975). In a housing scheme like the one considered for this study it becomes extremely important that the cost and level of maintenance required by the buildings and the open spaces, especially common open space, is not very high. The individual's maintenance of the area surrounding their unit helps to generate a sense of territoriality and perceived ownership of the space, which in turn generates individual surveillance of the site (Newman, 1973).
A sense of ownership is essential to encourage people to take care of their surroundings as an individual or as a group.

**Desired Objectives:**

1. Reduce the financial burden of annual maintenance on the residents.
2. Maintain the project appearance for years to come (Cooper, 1975).
3. Reduce the dependence on external agencies for the maintenance and upkeep.

**Possible design solutions:**

63. Avoid shared paths for the front entrances to the units on the ground level (Cooper Marcus & Sarkissian, 1986).
64. Use material from the site or materials like stones and brick which age with time and require less maintenance (Cooper, 1975).
65. Avoid the use of plants in the form of topiary to reduce the maintenance of the plant.
66. Provide open spaces in close proximity to the units, which encourages the people to claim ownership for them and care for them (Newman, 1973).
67. Provide green lawns in smaller sizes in small enclosed space (Coley et al., 1997).
68. Provide perceivable difference in the treatment of open spaces around the units to define territories of each unit. e.g., A small canopy tree near the unit entrance defines a space below it (Coley et al., 1997).
69. Provide activity oriented rather than settings oriented landscape to reduce unnecessary burden of maintenance.
70. Provide medium sized spaces of varying shape and appearance to encourage their use.

The design solutions enlisted in this section will be referred to in the qualitative analysis of the proposed design solutions in the analysis section of this report. The whole idea behind it is to demonstrate the method of implementation and interpretation of the solutions suggested in this section to achieve the desired objectives, for an affordable and healthy living environment in high density settings.
SECTION IV

4.01 The Current Scenario
4.02 The Existing Project (A Case Study)
The Current Scenario

According to Jim Sutherland, the Vancouver Region added more than twice as many people in the year 2000-01, than did Calgary and its suburbs (Sutherland, in Beer, 2001). In addition to that, there has been a rapid increase in the development of urban sprawl in the lower mainland, which makes the time quite right for the emerging anti-sprawl movement in the province, led by the group called SmartGrowthBC. At a recent SmartGrowthBC conference held in June 2001, in Vancouver, many speakers expressed the belief that there are truly sustainable ways to develop, which can stop the growth of the unsustainable urban sprawl. According to David Beers “B.C. is fortunate to be so young and early into its heyday.” And there is still time to learn from others’ mistakes.

In one of its early efforts to promote sustainable high-density urban development, the city of Vancouver decided to transform the south east corner of the False Creek from its state of industrial decay to “a model of sustainable development”. The city staff concluded that in order to make the project sustainable, there must be a certain level of density (Refer Table 1) and in order to achieve that sustainable density, people have been suggesting a mix of high and low rise; commercial and residential development.

In fact, if we look at the City of Vancouver and the Lower Mainland, a large tower surrounded by parks characterizes many of the new high-density developments, e.g. Bay shore Towers, Concord Pacific. Although visually appealing, such a design does little to create a sense of community among residents or provide a safe area for small children to play. Alternatively, by incorporating different housing types and green space into housing design, a semi-public area can be created that provides opportunities for the development of safe areas for children, neighbourhood interaction and encourages multi-use of green space, such as community gardens.

The Vancouver downtown area has been transformed over the last 15 years, by new forms of housing into a highly livable inner city that accommodates higher densities (Refer Table 1).
Table 1: Population densities for downtown neighborhoods (Sarti, 1997)

<table>
<thead>
<tr>
<th>Area</th>
<th>Population (Projected)</th>
<th>Density (people/Hectare)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Southeast False Creek (Cambie to Main)</td>
<td>20</td>
<td>4,250</td>
</tr>
<tr>
<td>False Creek South (Granville to Cambie)</td>
<td>32</td>
<td>4,100</td>
</tr>
<tr>
<td>False Creek North</td>
<td>67</td>
<td>14,500</td>
</tr>
<tr>
<td>Downtown South</td>
<td>52</td>
<td>11,000</td>
</tr>
<tr>
<td>Coal Harbor</td>
<td>17</td>
<td>3,500</td>
</tr>
<tr>
<td>West End</td>
<td>194</td>
<td>38,000</td>
</tr>
</tbody>
</table>

Table 2: Typical Net Densities of Different Forms of Housing (Hodge, 1986, in http://www.sfu.ca/cedc/students/geogclass/frame.htm)

<table>
<thead>
<tr>
<th>Density (Type)</th>
<th>Housing Type</th>
<th>Building Height (Storey)</th>
<th>Density (Dwellings/Hectare)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>One-Family detached</td>
<td>1-2</td>
<td>43-48</td>
</tr>
<tr>
<td></td>
<td>Two-family</td>
<td>1-2</td>
<td>48-84</td>
</tr>
<tr>
<td>Medium</td>
<td>Row house, garden apartment</td>
<td>2-3</td>
<td>72-144</td>
</tr>
<tr>
<td></td>
<td>Walk-up apartment</td>
<td>3-4</td>
<td>120-192</td>
</tr>
<tr>
<td>High</td>
<td>Multi-family</td>
<td>5-10</td>
<td>192-360</td>
</tr>
<tr>
<td></td>
<td>Multi-family</td>
<td>10-16</td>
<td>360-480</td>
</tr>
<tr>
<td></td>
<td>Multi-family</td>
<td>over 16</td>
<td>480-1680</td>
</tr>
</tbody>
</table>
It now has a true mix of new housing both in architectural form and economic appeal. The high-rises provide a mix of unit sizes, from penthouses, appealing to the highest end of the market, to less expensive studio and one-bedroom apartments. Non-market housing in various forms for seniors, families and those with special needs, has also been integrated into many neighbourhoods in the downtown. In a deliberate attempt to bring the active residential uses right down to the sidewalks, the planners have encouraged the design of two or three-storey row houses to wrap the base of the towers. Some of these have taken the form of shops and housing while others simply add true residential character to the streetscape with individual porches and stoops at the sidewalk. (For Project Details, refer pp. 59 & 60)

Another project that is worth mentioning in this regard is the Arbutus Walk Project, which is being developed on an historical site that once housed one of Vancouver’s more famous landmarks, the Carling O’Keefe Brewery. It is bounded by Arbutus and Vine Streets, 10th and 12th Avenues. This new condominium development, with its accent on community in a park-like setting, provides the best in contemporary living while preserving the heritage of the past. A tree-lined pedestrian walkway is the centrepiece of Arbutus Walk’s exquisite landscaping. An inviting place to relax and meet, it leads you to neighbouring Connaught Park. (For project details refer to pp. 61)

4.02

Existing Design
(A Case Study)

Project Name: Langara Gardens.

Built in: 1968
Address: 57th Ave and Cambie Street, Vancouver, Canada
Site Area: 22 Acres
Density*: Approx. 30 Dwelling Units / acre
Unit Mix: 1, 2, 3 bedroom Units
         (in 2 story houses and 18 storey High Rise)
Floor Space Index: 0.76
Plot Coverage: Approx. 25 %

* Gross Density of Units.
Cascina Denia

View of the housing scheme

and low-rise town houses.

The particular project was selected because it is a good example of physical high-density.

Legend:
- High-rise Apartment
- Low-rise Apartment
- Courtyard

Map:
- Cascina
- Nicola St.
- Seawall
- Broughton St.
- Hastings St.
- Denia
- Cottagard
The Atriums Walk

The upper level units have access through the ground floor units to a small courtyard. The rear access opens into the building in the Atriums Walk project. Views of the front entrance to the units of different levels above the commercial area.

Typical Floor Plans of Ground and Level Duplex Units

have fenced or balconies which overlook the street.

common shared balconies. There are upper level units

a small courtyard. The rear access opens into

The ground floor units have access from the
For a project of this scale, which was designed in 1968, using the revolutionary idea of combining high-density and low-density developments was an accomplishment in itself. In comparison to the projects done in the more recent times, this existing project seems to fall short of the current expectations of density and floor space ratio desired of similar projects. However, the major reasons why this site was selected for the study are:

1. The 22-acre site is seemingly big enough to be comparable to the study site.
2. The project has a good mix of low-rise, low-density housing and high-rise, high-density housing, which are the target housing types discussed in the study.
3. The project has considerable amount of open and green spaces and is comparable to the proposed solutions with existing conditions.

The existing design consists of high and low rise buildings, accommodating approximately 676, 1,2, and 3 bedroom units.

The high-rise buildings accommodate 360 units in 4, 18 storey buildings, occupying an area of 2 acres at a net density of 180 dwelling units per acre. Each building houses 3, 1 bedroom and 2, 2 bedroom units on each floor. The units on each floor share a common elevator shaft. Each of the units is either facing north or south with the other end opening into the common lobby through an entrance door. The approximate area of each of the units varies from 700sq.ft to 1200 sq.ft. The group of high-rise buildings has a shopping center at the corner of 57th and Cambia Street in addition to the outdoor swimming pool and an indoor fitness club.

The low-rise houses consist of 1 and 2 bedroom garden apartments and 3 bedroom town houses. The 1 and 2 bedroom garden apartments share common entrance lobby from the staircase well. The town houses and the garden apartments are arranged around green open spaces, with the living rooms of the ground floor units opening into a paved patio overlooking the green spaces. The group of town houses and the garden apartments share 2 swimming pools located in close proximity to the units.
Existing Site Sections and Views

(4) Section Across E/W Crescent

(5) Typical Open Space within a Cluster of Units

(6) View of a Typical Open Space within a Cluster of Units

South Edge

North Edge

West Edge

East Edge

Parking

Patio

Parking

Patio

40' Wide Road

Patio

Unit 1

Unit 2

Unit 3

Unit 4

Unit 5

Unit 6

Unit 7

Unit 8

Landsaped Space

Sedback

Landsaped Space

Sedback
Existing High-Rise Apartments

Floor Plan of the 4 High-Rise Tower Blocks

- 1 Bedroom Apartment (772 sq ft)
- 2 Bedroom Apartment (945 sq ft)
- 1 Bedroom Apartment (995 sq ft)

Layout of the 4 High-Rise Tower Blocks

View of the Lower Block

View of the Entrance to the Tower Blocks

View of the 2 Bedroom Garden

View of the Tower in the Background

View of the 3 Bedroom Garden

View of the Elevator Shaft

Floor Plan of the Lower Level
The parking for all the units is provided in the basement with some on street visitors’ parking. The site has 2 internal streets running from north-south with connection to the units other than those facing the streets through paved pathways (refer to drawing # E2 for the site layout details).

Based on personal site survey and documented activities within the scheme, the following favorable and unfavorable aspects of the design were discovered.

**Favorable Aspects:**
1. In terms of area, the design provides adequate amount of open space for the low-rise residences.
2. The design provides adequate living space within the units.
3. The layout and orientation of the units provides adequate sun, light and ventilation to most of the units.
4. The site layout provides a fair degree of security to the units.

**Unfavorable Aspects**
1. The territorial boundaries of the scheme are too rigid and discourage interaction between the scheme and the neighborhood.
2. The units lack individual identities due to the absence of unique street address and a separate private entrance.
3. The territorial boundaries of the individual units are very vaguely defined thus discouraging the participation of the residents in the personalization of the spaces.
4. The street network is very disjointed with no internal sidewalks, thus is not pedestrian friendly.
5. The green spaces provided are too big and loosely defined to encourage any kind of social or recreational activity. They act more as settings than useable space.
6. The network of pathways is not well defined. The proximity of the pathways to the private outdoor patios discourages the use of the pathways and the patios.
7. Most of the shops provided in the commercial area do not serve the needs of the residents.
8. The large open spaces and extremely high number of topiary require very high maintenance.
SECTION V

5.01 Design Proposal

5.01.1 The Site

5.01.2 The Proposed Design
5.01 Design Proposal

The primary focus of this design is on how to make the scheme work and provide a safe, social and healthy living environment. It has been suggested that one of the objectives of any design should be to create spatial layouts, which will provide for the activity patterns required by a set of building users to achieve their goals (Lynch, 1984). This involves an understanding of movement patterns, human physical dimensions, and the far more subtle uses of space such as territory and settings for interaction between people (Lynch, 1984).

The purpose of the redesign was not only to provide higher densities, but also to provide them in such a way that the human/environment interactions positively benefit people’s well-being. These design interventions are discussed in detail in Section III. In this section (V) the interactions are described but not analyzed. Other major considerations in addition to the human/environment interaction were:

1. To make sure that an inventory of all activities was made and places allocated for each activity. However, allocating a specific time for these activities seemed fruitless considering the varied demographics of the residents.

2. To separate unrelated activities from each other both in space and in time because it is extremely important to separate unrelated activities as much as possible, in both dimensions, so that they do not interfere with each other, not even accidentally.

3. To make sure that the layout of space reflects the relationships among activities. The more closely related that activities are functionally; the closer they should be in space. This is not merely for convenience; the layout of space can often point up relatedness that might not otherwise be obvious.

5.01.1 The Site Analysis

Site Area: 22 Acres

The site analysis of the proposed design is not much different from that of any traditional design project. Very basic site characteristics like orientation, accessibility, existing streets, pathways; surrounding amenities and facilities have been docu
5.01.2
The Proposed Design

Achieved density : 100 persons / Acre
Site coverage : 45%
Floor Space index : 1.1
Building height : max. 4 floors accessible to three floors
Parking : 1 per Dwelling unit
Area Provided : 350-400 sq.ft. per person
Number of persons per bedroom : 1.5

The design consists of 1 bedroom, 2 bedroom and studio apartments. The units are arranged into 4-storey stacked row houses and are clustered around shared green spaces. Clustering ground oriented and high-density low-rise buildings around green spaces allows for multiple uses of these areas.

One of the major aspects of the proposed design is the network of pathways and streets that facilitate the movement of the residents within the scheme. The streets run both north to south and east to west, with street side parking to accommodate visitors and residents of the units. Additional parking is provided in the basement with secure access to the units through a shared staircase. The units are arranged along the streets and have front entrances facing the street.

Some of the favorable features of the proposed design are:

1. The scheme accommodates a higher density without compromising on the space requirements within the units.
2. The design seems to be well connected and integrated with the surrounding neighborhood through an elaborate network of streets, sidewalks and pathways.
3. The circulation network has a clearly ordered system of hierarchy and exposes the image of the whole development in as clear a way as possible.
4. The higher number of streets, sidewalks and pathways facilitate greater connectivity and multiple options for the movement of pedestrians, in a safe and vehicle free environment.
5. Every unit has a distinct street address and a well-defined front and back entrance.
Proposed Unit Layouts

Internal Gardens:
- The internal gardens connect the driveway to the rear of the house and also provide a visual and physical link to the rear of the house.
- The gardens are designed to be a central feature of the house, providing a focal point and enhancing the overall aesthetic.

Driveway:
- The driveway is designed to be a central feature of the house, providing a focal point and enhancing the overall aesthetic.
- It connects the street to the house and also provides access to the garage.

Street Trees:
- Street trees are an important element of the design, providing shade and enhancing the overall aesthetic of the house.
- They are strategically placed along the streets to create a sense of enclosure and privacy.

Shaded Areas:
- Shaded areas are created along the streets to provide a pleasant outdoor space for residents.
- They are designed to be a central feature of the house, providing a focal point and enhancing the overall aesthetic.

Street Furniture:
- Street furniture such as benches and lamp posts are strategically placed along the streets.
- They are designed to be a central feature of the house, providing a focal point and enhancing the overall aesthetic.

The overall design of the house has been carefully considered to ensure that it is a functional, aesthetically pleasing, and enjoyable place to live.
6. The design has a clearly defined hierarchy of private and public open spaces.

7. The landscape spaces are more intimate in scale; user-oriented and provide adequate opportunities for community interaction.

The design does not provide some of the community facilities like swimming pools, shops and fitness area, which were provided in the existing design. The reason behind not providing these facilities is that the existing swimming and fitness facilities are economically very inefficient and require a lot of investment in terms of maintenance and the whole scheme has been designed to make the residents think of the neighbourhood as their amenity. As regards to the shops, they do not seem busy enough to be economically feasible. However, the design does have the capability to accommodate such facilities if desired.
UC\'s Landscape Architecture Program. Faculty of Agriculture Sciences.

Floor units are accessed through lobby doors.

Proposed Plan

Current Plan

Comparison of Proposed Plan and Current Plan

- 73 CHM (Current floor)
- 13 CHM (Proposed floor)
- New Public Spaces
- Existing Public Spaces
- New Program Area
- Existing Program Area
- New Uplift Level Units
- Existing Uplift Level Units

Comparison of proposed and current plans:

- New Public Spaces
- New Program Area
- Uplift Level Units

The proposed floor design includes:

- Increased access rooms
- New program areas
- New public spaces

Comparison of proposed and current plans:

- New Public Spaces
- New Program Area
- Uplift Level Units

Even though the proposed design of the proposed deck was

Comparison of proposed and current plans:

- New Public Spaces
- New Program Area
- Uplift Level Units

Even though the proposed design of the proposed deck was
SECTION VI

6.01 Analysis

6.01.1 Site Design
   6.01.1(a) Site Plan
   6.01.1(b) Unit Design

6.01.2 Circulation Network
   6.01.2(a) Streets & Pathways
   6.01.2(b) Views and Vistas

6.01.3 Open/Green Space Layout

6.02 Discussion
6.01

Comparative Analysis of Existing and Proposed Design

This section deals with the analysis and synthesis of the proposed design to bring forward the positive and negative aspects of the recommendations in the study. For the purpose of comparison, the section has been divided into 3 basic aspects of the design:

1. Site Design;
2. Circulation Network;
3. Open / Green Space Layout.

Each of these aspects has been analyzed quantitatively and qualitatively. The quantitative figures cannot be considered as the sole indicators of the effectiveness of the criteria. However, when viewed in conjunction with the qualitative aspects, it can give a fair idea of the efficacy of the design recommendations. Keeping that in mind, each of the above aspects has been divided into a quantitative and a qualitative section. The first part in each section compares the existing and the proposed designs on the basis of numerical data, followed by a qualitative/visual analysis.

In the qualitative section the two designs are compared on the basis of the visual characteristics of similar settings in each of the designs. The visual comparisons are aimed to show the specific characteristics of the designs, which make one design better from the other. The visual section consists of comparative sketches and drawings of the existing, the proposed and a representation of the existing spaces altered to suit the needs of the residents based on the design recommendations. The numbers on the element in the images, in the qualitative section refer to the numbers of possible design solutions listed in the design criteria section (Section 3.3). These design criteria were developed after extensive literature review. The descriptive part of the qualitative section is intended to explain the overall significance of those proposed design solutions in relation to the design.

6.01.1 Site Design

The site and its design are crucial aspects of any community environment. The site design has biological, social and psychological impacts on the residents. It sets limits to the
things that people can do, and makes possible their doing what they otherwise could not (Lynch, 1984). However, that does not mean that lots of space is always desirable. Robert Sommer has pointed out that there can be too much space, too little space, or the wrong kind of space, and that each of these conditions is affected by the number and kind of people using the space and the task being performed (Sommer, 1972, in Lang et. al., 1974).

This section looks at the overall aspects of the site design, which play a major role in determining the activity patterns and the usage of the site. The specific details of the components of the site design are discussed in the subsequent sections.

For the purpose of comparison, this section has been subdivided into:

1. Site Plan

This part looks at the overall design and the impact of specific design decisions related to the site layout. It looks at the overall layout of the units, streets, pathways and green spaces;

2. Unit design

This section is very specific to the design of the internal and external spaces of the units and their relation to the immediate surroundings.

### 6.01.1(a) Site Plan

**Quantitative:**

<table>
<thead>
<tr>
<th></th>
<th>Existing</th>
<th>Proposed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site Coverage</td>
<td>25%</td>
<td>40%</td>
</tr>
<tr>
<td>Density (DU/acre)</td>
<td>30</td>
<td>60</td>
</tr>
<tr>
<td>Floor Space Ratio</td>
<td>0.76</td>
<td>1.1</td>
</tr>
<tr>
<td>Total # of units</td>
<td>676</td>
<td>1100</td>
</tr>
<tr>
<td># of Street Access</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td># of units / cluster</td>
<td>40</td>
<td>24-28</td>
</tr>
<tr>
<td>% of ground oriented units</td>
<td>20%</td>
<td>35%</td>
</tr>
<tr>
<td>Total Street Length (m)</td>
<td>500</td>
<td>1300</td>
</tr>
<tr>
<td>Pathways (m)</td>
<td>2000</td>
<td>6000</td>
</tr>
<tr>
<td>Street Intersections (#)</td>
<td>3</td>
<td>13</td>
</tr>
<tr>
<td>Total Parking (#)</td>
<td>1000</td>
<td>1000</td>
</tr>
<tr>
<td>Green / Open Spaces (acres)</td>
<td>13</td>
<td>8.5</td>
</tr>
</tbody>
</table>
As is evident from the above table, the proposed design does seem to be superior to the existing design in terms of higher numbers, although higher numbers do not necessarily prove the superiority of the design. However, they do indicate certain other relationships, which when viewed in the light of the quality of the spaces might indicate a certain degree of superiority of the proposed design. Some of these positive indicators are:

1. The proposed design has achieved almost doubling of the density of the existing project without the use of high-rise towers.

2. The higher number of people sharing smaller more easily accessible green spaces means more usage and more social interaction within the site, thus indicating that the proposed design would be safer and cheaper to maintain.

3. Smaller green spaces with a higher number of pathways can be an indication of smaller subdivided green spaces, thus providing an opportunity for greater variety of spaces and creating interest in the landscape.

4. The greater number of streets, sidewalks and pathways indicate the possibility of better connectivity within the site and outside the site.

5. The lower number of units per cluster, indicates a greater possibility developing a sense of group ownership, thus making the units and the outdoor spaces safer and easier to maintain.

**Qualitative: refer Drawing # P6**

In order to show the superiority of the proposed design we need to see the comparison between the quality of spaces in the two designs.

For example, consider Drawing # P6, which shows a plan of the proposed design. In addition to achieving a higher density and site coverage, the design also succeeds in satisfying the design criteria established in the Section 3.03. To give the reader an overall picture of the quality of the site design, the following are some of the positive aspects of the proposed design:

a. The narrow peripheral streets (1, 2)* flanked by trees (3, 5), connect the housing with the neighbourhood and at the same time maintain the all important threshold between the two by
providing a perceived material difference in terms of the trees used along the edge and the trees used along the internal sidewalks (5).

b. The multiple major street access into the site (24) gives a sense of equal importance to all the units, thus encouraging a sense of community attachment and also increasing the accessibility of the various parts of the scheme.

c. The greater number of streets with sidewalks improves the connectivity of the various spaces within the scheme and encourages pedestrian movement.

d. The streets are oriented in the NS and EW directions (49) thus assisting in the movement of pedestrians and vehicles through the site.

e. The unit layout and orientation, provides individual street access to all the units (25) and clearly defines the public and the private domains of the scheme (61).

Note: Refer to pp. 85, 86, 87 & 88 for specific design solutions.

* the numbers in the brackets refer to the numbers of the possible design solutions under the design criteria section (Section 3.03).
The site is designed to encourage the use of open spaces and pathways. The green space is designed to enhance the beauty of the site and provide a place for people to relax and socialize.

The design features a series of pathways that connect different parts of the site. These pathways are designed to be accessible and provide a network of green spaces. The open areas are designed to encourage social interaction and provide a place for people to gather.

The design also includes a series of outdoor spaces that are designed to provide a variety of experiences. These spaces are designed to include areas for recreation, education, and socialization.

The design is intended to create a welcoming and attractive environment for the users of the site. The site is designed to be accessible to all users, including people with disabilities.

The design includes a variety of features that are intended to enhance the usability and appeal of the site. These features include pathways, green spaces, and outdoor areas that are designed to be inviting and attractive.

The design is intended to be dynamic and responsive to the needs of the users of the site. The design is intended to be flexible and adaptable to the changing needs of the users.

The design includes a series of pathways that connect different parts of the site. These pathways are designed to be accessible and provide a network of green spaces. The open areas are designed to encourage social interaction and provide a place for people to gather.

The design also includes a series of outdoor spaces that are designed to provide a variety of experiences. These spaces are designed to include areas for recreation, education, and socialization.

The design is intended to create a welcoming and attractive environment for the users of the site. The site is designed to be accessible to all users, including people with disabilities.

The design includes a variety of features that are intended to enhance the usability and appeal of the site. These features include pathways, green spaces, and outdoor areas that are designed to be inviting and attractive.

The design is intended to be dynamic and responsive to the needs of the users of the site. The design is intended to be flexible and adaptable to the changing needs of the users.
A single design was considered to provide a more cohesive aesthetic between the site and the neighborhood.
Proposed Site Design

Dear Department,

The proposed design shown in the attached design plan, was developed after discussions with the several stakeholders who were involved in the process. The plan takes into consideration the need for a well-organized development of the site. Each of the streets have a different design, and a street furniture is located at the end of each street. The proposed design has a larger number of planting trees, which provides shade to the area. The layout of the site is designed to provide easy access to the buildings and to the public streets. The green spaces are also designed to create a sense of community. The parking spaces are not designed for cars, but for bicycles and motorcycles.

Sincerely,
[Signature]

Note: The numbers indicated on the plan refer to the number of trees.
6.01.1(b)
Unit Design and Layout

Quantitative:

<table>
<thead>
<tr>
<th></th>
<th>Existing</th>
<th>Proposed</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Unit Sizes (sq. ft.)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Studio</td>
<td>NA</td>
<td>450</td>
</tr>
<tr>
<td>1 Bedroom</td>
<td>727 &amp; 770</td>
<td>700</td>
</tr>
<tr>
<td>2 Bedroom</td>
<td>948 &amp; 990</td>
<td>1050</td>
</tr>
<tr>
<td>3 bedroom</td>
<td>1450</td>
<td>NA</td>
</tr>
<tr>
<td><strong>Unit set backs (ft.)</strong></td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td><strong># of Access to outside</strong></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td><strong>Frontyard (sq. ft.)</strong></td>
<td>0</td>
<td>120-150</td>
</tr>
<tr>
<td><strong>Backyard/Balcony (sq. ft.)</strong></td>
<td>70 (patio)</td>
<td>120-150</td>
</tr>
<tr>
<td><strong>Amount of open space / unit</strong></td>
<td>680</td>
<td>320</td>
</tr>
<tr>
<td>(Common open space)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>% of units with easy access to common open spaces</strong></td>
<td>35%</td>
<td>100%</td>
</tr>
<tr>
<td><strong>% of Ground oriented Unit</strong></td>
<td>15%</td>
<td>35%</td>
</tr>
</tbody>
</table>

From the table above, it is more than clear that the proposed design meets the space requirements / standards of the existing. The area allocation of the various spaces like the bedroom, living, dining and kitchen, are more or less equal to that provided in the existing design (Also refer Drawing # E4, E5, E6 & P4). In addition to the internal spaces, the proposed design seems better than the existing design in terms of the subsidiary outdoor spaces, like the front yard, backyard, patio, etc. and the accessibility of the outdoor spaces.

Qualitative:

Even though both designs are comparable in terms of the size of spaces, there are certain distinguishing qualities of the proposed design that make it superior to the existing design. Consider Drawing # P6, which shows the proposed layout plan. For specific details of the units, also refer to the drawings P3 and P4. The major highlights of the proposed design are:

a. All the ground oriented units have a distinct front and back entrance (61)*, and all the units on upper floors have front
patios and balconies (52) with major living areas.

b. The front and back entrances open into the front and backyards, which act as a buffer (59) between the private and the public domains, thus maintaining the level of privacy desired within the units.

c. The steps leading to the front and backyard act as symbolic boundary between the public and the private spaces (27).

d. The shrubs and trees define the territorial boundaries of the units, in addition to providing visual privacy for the private internal spaces (27).

e. The units are also in close proximity to and have easy access to the communal open spaces (53).

Note: Refer to pp. 85, 86, 87 & 88 for specific design solutions.

* the numbers in the brackets refer to the numbers of the possible design solutions under the design criteria section (Section 3.03).
6.01.2 Circulation Network

The pathway system affects communication and interaction between people. One prime way to encourage contact between neighbors is to put them on a common pathway, with which their dwellings have frequent visual contact and upon which their entrances visibly open (Cooper, 1975). The circulation network mentioned in the site design and layout section deals at a macro level looking at the street patterns and layout on a site plan level, i.e., road lengths, their contribution in the layout of the site within the neighborhood, and the possible movement patterns.

This section concentrates at a more micro level, i.e., looking at the dimensions and design characteristics of the streets, sidewalks and pathways. It looks at the relationships between the units and the circulation network and the distinctive features of the network. This section is divided into 2 parts:

1. Streets, Sidewalks and Pathways

This part includes a comparison of the streets, sidewalks and pathways in terms of their size, character and integration with the adjacent spaces.

2. Views and Vistas

Views and vistas are an essential aspect of a housing scheme. This part looks at the distinguishing characteristics of good views and vistas in the context of a successful circulation network.

6.01.2(a) Streets, Sidewalks and Pathways

**Quantitative:**

<table>
<thead>
<tr>
<th></th>
<th>Existing</th>
<th>Proposed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Street dimensions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Right of Way (m)</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td>Carriageway (m)</td>
<td>12</td>
<td>6</td>
</tr>
<tr>
<td>Sidewalks (m)</td>
<td></td>
<td>1300</td>
</tr>
<tr>
<td>On street Parking (#)</td>
<td>100</td>
<td>250</td>
</tr>
<tr>
<td>Street Trees (#)</td>
<td></td>
<td>1 / parking</td>
</tr>
<tr>
<td>Street Lights(#</td>
<td></td>
<td>1 / parking</td>
</tr>
</tbody>
</table>
Some of the major things evident from the table above are:

a. The street length within the site has been considerably increased.

b. The basic dimensions of the streets and pathways have been maintained. However, the allocation of spaces across the streets has been changed to meet the needs of the residents.

c. The number of street elements has been increased.

Qualitative:

The numbers in the table indicate some positive aspects of the street design, but in order to show the positive qualities of the proposed design consider drawing # E8 and P7, which show the circulation network layouts; and images on pages 94 and 96.

Some of the distinguishing features of the proposed design are:

a. The network of streets, sidewalks and pathways is well connected, has a clearly defined hierarchy (54) and accommodates the predictable pattern of pedestrian movement (44) to improve the circulation within the scheme.

b. The trees along the streets, give a strong definition to the streets (11, 8). The tree canopy also defines a more intimate and pedestrian friendly sidewalk.

c. The different material treatment for the parking lane and the streets (6) acts as an effective traffic calming device (40) in addition to giving a perception of a narrower street (55). This reduces the perception of wide separation between the 2 sides of the streets and encourages across the street interaction.

d. The streetlights (35) make the streets safer at night, in addition to distinguishing the internal streets from the neighbourhood streets.

e. The sidewalk, parking and pathway system has been designed as part of the green spaces thus making them more intimate and pedestrian friendly.

Note: Refer to pp. 93, 94, 95 & 96 for specific design solutions.

* the numbers in the brackets refer to the numbers of the possible design solutions under the design criteria section (Section 3.03).
The numbers indicated on the plan refer to the numbers of the design.

The pathways dominate and also act as a buffer to the spaces of the internal space. The pathways and the adjacent units also maintain the privacy of the internal spaces. 

The design (60) also maintains the privacy of the internal spaces in addition to defining the boundary between the public and the private.

In the proposed design, a provision of two spaces (57) along the pathway defines the pathway in addition to defining the boundary between the public and the private.

The pathways and also act as a buffer to the spaces of the internal space. The pathways and the adjacent units also maintain the privacy of the internal spaces. The pathways and the adjacent units also maintain the privacy of the internal spaces.
design strategies.

Note: The numbers indicated on the plan refer to the

The overall space

A major quality change (5) can act as a counter
deterring element.

The open space is close to the units (2) and is

The result is access by the street's stairs and

The reader focuses on the pedestrian

circulation as well as on the window

and vistas (6) in addition to creating strong directional views.

The open space defines the street (2) and is key in

The circulation of people (5) with on street parking

can encourage pedestrian movement.

Some of the major highlights of the streets in the

(c) View of a Typical Street

(b) View of a Typical Internal Street

(a) Typical Section Through the Street
6.01.2(b)
Views and Vistas

Quantitative:

<table>
<thead>
<tr>
<th></th>
<th>Existing</th>
<th>Proposed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Views</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Along the streets</td>
<td>20</td>
<td>250</td>
</tr>
<tr>
<td>Along Pathways</td>
<td>15</td>
<td>100</td>
</tr>
<tr>
<td>Vistas</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Along the streets</td>
<td>4</td>
<td>12</td>
</tr>
<tr>
<td>Along Pathways</td>
<td></td>
<td>20</td>
</tr>
</tbody>
</table>

It is extremely difficult to determine the exact number of views along the paths of movement but it’s not impossible to determine the number of distinct views, evident from the plans. In term of the number of views and vistas along the streets and pathways, the streets and pathways in the proposed design do seem to have an advantage over the existing design. A higher number of views and vistas along the paths of movement indicate more variety along the path of movement and a better perception of location and orientation for the users.

Qualitative:

In addition to the numerical superiority, the proposed design has some other qualitative aspects that make it better than the existing design. They are: (Refer to drawing E8 and P7)

a. The view corridors and the movement corridors are very closely related, thus assisting in the movement and way-finding (49)*.

b. The view corridors are located such that they do not affect the privacy of the units (60).

c. The use of different trees and materials along the streets creates distinct street identities (41).

d. A controlled visual access (4) into the site from the peripheral streets encourages interaction between the site and the neighbourhood and maintains the privacy of the site.

* the numbers in the brackets refer to the numbers of the possible design solutions under the design criteria section (Section 3.03).

Note: Refer to pp. 93, 94, 95 & 96 for specific design solutions.
Outdoor / Green Spaces

Outdoor spaces are rarely created by complete enclosure, but rather partially, by the conformation of the floor and by small vertical elements, which suggest imaginary or psychological boundaries.

Quantitative:

<table>
<thead>
<tr>
<th></th>
<th>Existing</th>
<th>Proposed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total area (acres)</td>
<td>13</td>
<td>8.5</td>
</tr>
<tr>
<td>Major Activity areas (#)</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>(undifferentiated)</td>
<td>(subdivided)</td>
<td></td>
</tr>
<tr>
<td>Structures(#)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>shelters</td>
<td>1</td>
<td>28</td>
</tr>
<tr>
<td>benches / street elements</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>play equipment</td>
<td>1 / playarea</td>
<td></td>
</tr>
</tbody>
</table>

Some of the major aspects of the proposed design evident from the drawing P8 and the table above are:

1. The total amount of open space has been significantly reduced.
2. The open spaces are smaller in size and are distributed closer to the units.
3. The proposed design has higher number of street and landscape elements, which indicate a possible increase in the usage of the spaces.

Qualitative:

The following are some of the positive qualitative aspects of the open space layout in the proposed design:

a. The open spaces provided within the scheme are very functional and user oriented (32, 10, 27, 11)*.

b. The spaces are divided into smaller spaces and provided in close proximity to the units to encourage the usage of outdoor spaces (53, 70, 10).

c. The open spaces have better spatial definition, which is attributed to the use of trees, shrubs and covered structures (10, 11).

* the numbers in the brackets refer to the numbers of the possible design solutions under the design criteria section (Section 3.03).

Note: Refer to pp. 99, 100, 101 & 102 for specific design solutions.
The existing open space layout provides a

existing design concept, providing a

Public and private spaces.

between the public and private spaces.

The open spaces provide a

The open spaces provide a

existing outdoor spaces with

existing outdoor spaces with

outdoor furniture, landscaping elements, and

outdoor furniture, landscaping elements, and

open areas.

open areas.

The open areas are designed to

The open areas are designed to

provide a

provide a

design focal points and viewing angles.

design focal points and viewing angles.

The viewing angles in the existing design

The viewing angles in the existing design

do not offer a satisfactory view for

do not offer a satisfactory view for

existing views in conjunction with the

existing views in conjunction with the

outdoor spaces.

outdoor spaces.

The outdoor spaces are

The outdoor spaces are

viewed in conjunction with the

viewed in conjunction with the

outdoor areas.

outdoor areas.

The outdoor areas are

The outdoor areas are

located in proximity to the

located in proximity to the

existing views.

existing views.

The open spaces provide a

The open spaces provide a

existing design concept, providing a

existing design concept, providing a

theatre and leisure areas.

theatre and leisure areas.

The theatre and leisure areas.

The theatre and leisure areas.

The existing design concept, providing a

The existing design concept, providing a

theatre and leisure areas.

theatre and leisure areas.
solutions (section 3.2) for the design mistakes.

Note: The numbers indicated on the plans refer to the numbers of the design steps below.

The steps addressed and the recommendations:

1. Address the needs of the users.
2. Provide accessible pathways.
3. Plan for the use of open spaces and room.
4. Use of open spaces and room.
5. The design should incorporate the use of open space and room.
6. Include the use of open space and room.
7. Provide clear and easy access.
8. Use of open space and room.
9. Include the use of open space and room.
10. Include the use of open space and room.
11. Include the use of open space and room.
12. Include the use of open space and room.
13. Include the use of open space and room.
14. Include the use of open space and room.
15. Include the use of open space and room.
16. Include the use of open space and room.
17. Include the use of open space and room.
18. Include the use of open space and room.
19. Include the use of open space and room.
20. Include the use of open space and room.
21. Include the use of open space and room.
22. Include the use of open space and room.
23. Include the use of open space and room.
24. Include the use of open space and room.
25. Include the use of open space and room.
26. Include the use of open space and room.
27. Include the use of open space and room.
28. Include the use of open space and room.
29. Include the use of open space and room.
30. Include the use of open space and room.
31. Include the use of open space and room.
32. Include the use of open space and room.
33. Include the use of open space and room.
34. Include the use of open space and room.
35. Include the use of open space and room.
36. Include the use of open space and room.
37. Include the use of open space and room.
38. Include the use of open space and room.
39. Include the use of open space and room.
40. Include the use of open space and room.
41. Include the use of open space and room.
42. Include the use of open space and room.
43. Include the use of open space and room.
44. Include the use of open space and room.
45. Include the use of open space and room.
46. Include the use of open space and room.
47. Include the use of open space and room.
48. Include the use of open space and room.
49. Include the use of open space and room.
50. Include the use of open space and room.
51. Include the use of open space and room.
52. Include the use of open space and room.
53. Include the use of open space and room.
54. Include the use of open space and room.
55. Include the use of open space and room.
56. Include the use of open space and room.
57. Include the use of open space and room.
58. Include the use of open space and room.
59. Include the use of open space and room.
60. Include the use of open space and room.

- The services should have good access throughout the entire area.
- The services should be accessible to people who use these spaces for accessibility.

Outdoor spaces and the use of open space.

The recommended solution would be to provide the open space close to the building to make the use of open space more effective.

- The green spaces should have good access throughout the entire area.
- The open spaces should be accessible to people who use these spaces for accessibility.

Existing open spaces.

Existing open spaces.

Recommended open spaces.

Recommended open spaces.

Existing open spaces.

Recommended open spaces.

Existing open spaces.
Proposed Open Space Layout

Layout and distribution of open spaces

- The open spaces are distributed in a manner to ensure easy access to the proposed design.
- The open spaces are designed to accommodate various activities, ensuring a balanced distribution.
- The open spaces are designed to create a sense of community and encourage social interaction.

Design Highlights:

- The open spaces are designed to provide shaded areas for relaxation.
- The open spaces are designed to promote biodiversity by incorporating native plant species.
- The open spaces are designed to enhance the visual appeal of the area.

Conclusion:

The proposed design ensures the creation of a vibrant and functional open space that meets the needs of the community.
(g) View of Open Space

(c) Typical Open Space Layout
<table>
<thead>
<tr>
<th>Design Solutions</th>
<th>Remarks</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>3.03.1 Interaction With the Neighbourhood</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Units opening onto peripheral streets and pathways.</td>
<td>Only the units along the streets.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Narrow peripheral streets.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Permeable or soft edges.</td>
<td>Only along the major access roads.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Rows of trees and shrubs along the streets and pathways.</td>
<td>Only along the major streets.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Perceived thresholds or boundaries of the scheme.</td>
<td>Boundary created by distinct housing design.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Common meeting areas.</td>
<td>Shopping area, swimming pools &amp; fitness area.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>3.03.2 Social Interaction Within the Site</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Multiple options for movement within the site.</td>
<td>Mainly created by architectural elements.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Careful consideration of views and vistas along the paths.</td>
<td>Along the major access streets only.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Small, intimate, enclosed spaces for people to interact.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Trees to create small protected, intimate spaces.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Shrubs to create small outdoor rooms.</td>
<td>Mainly created by the residents.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. Small backyard or front garden with the units.</td>
<td>In the form of paved patio.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. Small kitchen garden or green spaces.</td>
<td>Mainly created by the residents.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. Small front porch or back yard to sit out.</td>
<td>In the form of paved patio.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. Spaces and facilities for weekend leisure activities.</td>
<td>outdoor visitor parking, swimming pools.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17. Direct access from the private yard to the communal space.</td>
<td>Lack transitional spaces.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18. Pathways to accommodate the predictable pattern of pedestrian movement.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19. Outdoor, multi use parking lots.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20. Spaces for the residents to add to the communal landscaping.</td>
<td>mainly used as visitor parking</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21. Terraces and balcony over looking the streets / pathways.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22. Opportunities for controlled interaction.</td>
<td>Doesn't allow a lot of interaction.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23. Open air eating / gathering spaces.</td>
<td>Mainly resident created.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Design Solutions

<table>
<thead>
<tr>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
</tbody>
</table>

#### 3.03.3 Sense of Group and Perceived Ownership

<table>
<thead>
<tr>
<th>Design Solutions</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>24 Social homogeniety.</td>
<td></td>
</tr>
<tr>
<td>25 Distinct street address for all the units.</td>
<td>Only for units along the streets</td>
</tr>
<tr>
<td>26 Flowerbeds, empty niches and boxes at the entrance or in courtyards.</td>
<td></td>
</tr>
<tr>
<td>27 Elements to demarcate the territorial boundary.</td>
<td></td>
</tr>
<tr>
<td>28 Elements to mark the entry into an individual unit.</td>
<td>In the form of steps leading to stair well</td>
</tr>
<tr>
<td>29 Elements to demarcate territorial boundaries.</td>
<td></td>
</tr>
<tr>
<td>30 Common parking spaces.</td>
<td>Mainly basement parking</td>
</tr>
<tr>
<td>31 Visible and distinct entrances to the units.</td>
<td>In the form of Steps Leading to Stair well</td>
</tr>
<tr>
<td>32 Open spaces in close proximity to the units.</td>
<td>Lack hierarchy of privacy</td>
</tr>
<tr>
<td>33 Material variations in the landscape and architectural spaces.</td>
<td></td>
</tr>
</tbody>
</table>

#### 3.03.4 Sense of Security

<table>
<thead>
<tr>
<th>Design Solutions</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>34 Spaces with direct visual and easy physical access from the units.</td>
<td></td>
</tr>
<tr>
<td>35 Lights along the streets, sidewalks and pathways.</td>
<td>only along pathways</td>
</tr>
<tr>
<td>36 Spaces with visual surveillance.</td>
<td></td>
</tr>
<tr>
<td>37 Sight lines between units.</td>
<td></td>
</tr>
<tr>
<td>38 Perceived barriers around the scheme.</td>
<td>In the form of setbacks and row of trees.</td>
</tr>
<tr>
<td>39 Short and individual access galleries.</td>
<td>Mostly Shared Gallery.</td>
</tr>
<tr>
<td>40 Traffic calming devices.</td>
<td></td>
</tr>
</tbody>
</table>

#### 3.03.5 Way-finding and Sense of Orientation

<table>
<thead>
<tr>
<th>Design Solutions</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>41 Street identity.</td>
<td></td>
</tr>
<tr>
<td>42 Street elements and materials to indicate space hierarchy.</td>
<td></td>
</tr>
<tr>
<td>43 Sidewalks along the streets.</td>
<td></td>
</tr>
<tr>
<td>44 Accommodate predictable pattern of pedestrian movement.</td>
<td></td>
</tr>
<tr>
<td>45 Land marks along the paths.</td>
<td>Lamp posts at the entrances.</td>
</tr>
<tr>
<td>46 Focal points.</td>
<td>Mainly Clusters of Trees &amp; Shrubs</td>
</tr>
<tr>
<td>47 Patterns and specific color coding for spaces within the housing scheme.</td>
<td></td>
</tr>
</tbody>
</table>
### Design Solutions

<table>
<thead>
<tr>
<th></th>
<th>Elements to orient the people within the site.</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>48</td>
<td></td>
<td>•</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Views and vistas towards a focal point/element.</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>49</td>
<td></td>
<td>•</td>
</tr>
</tbody>
</table>

### 3.03.6 Ease of Access to Community / Common Open Spaces

<table>
<thead>
<tr>
<th></th>
<th>Large windows in the units.</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td></td>
<td>•</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Open walkways to access the outside spaces.</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>51</td>
<td></td>
<td>•</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Private garden, patio, balcony with every unit.</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>52</td>
<td></td>
<td>•</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Communal spaces in close proximity to the units.</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>53</td>
<td></td>
<td>•</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Hierarchy of open space.</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>54</td>
<td></td>
<td>•</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Narrow streets and pathways to separate the communal spaces from the units.</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>55</td>
<td></td>
<td>•</td>
</tr>
</tbody>
</table>

### 3.03.7 Sense of Privacy

<table>
<thead>
<tr>
<th></th>
<th>Arrange dwelling units to avoid infringement of privacy of the adjacent unit.</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>56</td>
<td></td>
<td>•</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Grade change between the public and private spaces.</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>57</td>
<td></td>
<td>•</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Buffers between the private and public open spaces and pathways.</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>58</td>
<td></td>
<td>•</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Transitional filters between the public and the private domains of the dwellings.</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>59</td>
<td></td>
<td>•</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>The entry and the pathways dont affect the privacy of the interior spaces.</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>60</td>
<td></td>
<td>•</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Distinct front and back entrances to the units.</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>61</td>
<td></td>
<td>•</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Screening for the private yards.</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>62</td>
<td></td>
<td>•</td>
</tr>
</tbody>
</table>

### 3.03.8 Maintenance Required by the Spaces

<table>
<thead>
<tr>
<th></th>
<th>Separate entrance paths to the units on the ground level.</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>63</td>
<td></td>
<td>•</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Local material.</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>64</td>
<td></td>
<td>•</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Use of plant in their natural shape and form.</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>65</td>
<td></td>
<td>•</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Open spaces in close proximity to the units.</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>66</td>
<td></td>
<td>•</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Green lawns in smaller sizes in small enclosed space.</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>67</td>
<td></td>
<td>•</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Spatial Treatment to define territorial boundary of the units.</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>68</td>
<td></td>
<td>•</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Activity oriented rather than settings oriented landscape.</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>69</td>
<td></td>
<td>•</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Medium sized spaces of varying shape and appearance.</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>70</td>
<td></td>
<td>•</td>
</tr>
</tbody>
</table>
### Table 4: Summary Table for Proposed Design

<table>
<thead>
<tr>
<th>Design Solutions</th>
<th>not used</th>
<th>used sometimes</th>
<th>used very often</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>3.03.1 Interaction With the Neighbourhood</strong></td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>1 Units opening onto peripheral streets and pathways.</td>
<td></td>
<td></td>
<td></td>
<td>Front entrance facing the street.</td>
</tr>
<tr>
<td>2 Narrow peripheral streets.</td>
<td></td>
<td></td>
<td></td>
<td>They also mark the site boundaries.</td>
</tr>
<tr>
<td>3 Permeable or soft edges.</td>
<td></td>
<td></td>
<td></td>
<td>Low canopy trees along peripheral streets.</td>
</tr>
<tr>
<td>4 Rows of trees and shrubs along the streets and pathways.</td>
<td></td>
<td></td>
<td></td>
<td>Acting as perceived barriers as well.</td>
</tr>
<tr>
<td>5 Perceived thresholds or boundaries of the scheme.</td>
<td></td>
<td></td>
<td></td>
<td>Achieved by using 2, 3 and 4 mentioned above.</td>
</tr>
<tr>
<td>6 Common meeting areas.</td>
<td></td>
<td></td>
<td></td>
<td>At the nodes, intersections and entrances.</td>
</tr>
<tr>
<td><strong>3.03.2 Social Interaction Within the Site</strong></td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>7 Multiple options for movement within the site.</td>
<td></td>
<td></td>
<td></td>
<td>Along the streets or internal pathways.</td>
</tr>
<tr>
<td>8 Careful consideration of views and vistas along the paths.</td>
<td></td>
<td></td>
<td></td>
<td>Along the path of movement and through the buildings</td>
</tr>
<tr>
<td>9 Sidewalks and street side parking.</td>
<td></td>
<td></td>
<td></td>
<td>Street parking also acts as traffic calming device.</td>
</tr>
<tr>
<td>10 Small, intimate, enclosed spaces for people to interact.</td>
<td></td>
<td></td>
<td></td>
<td>Along streets and within the courtyards.</td>
</tr>
<tr>
<td>11 Trees to create small protected, intimate spaces.</td>
<td></td>
<td></td>
<td></td>
<td>Near outdoor parkings and green open spaces</td>
</tr>
<tr>
<td>12 Shrub to create small outdoor rooms.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13 Small backyard and front garden with the units.</td>
<td></td>
<td></td>
<td></td>
<td>Except Units above ground level</td>
</tr>
<tr>
<td>14 Small kitchen garden or green spaces.</td>
<td></td>
<td></td>
<td></td>
<td>For units on Ground Level.</td>
</tr>
<tr>
<td>15 Small front porch or back yard to sit out.</td>
<td></td>
<td></td>
<td></td>
<td>For units on Ground Level.</td>
</tr>
<tr>
<td>16 Spaces and facilities for weekend leisure activities.</td>
<td></td>
<td></td>
<td></td>
<td>e.g. picnic benches, covered patios etc.</td>
</tr>
<tr>
<td>17 Direct access from the private yard to the communal space.</td>
<td></td>
<td></td>
<td></td>
<td>through distinct transitional spaces.</td>
</tr>
<tr>
<td>18 Pathways to accommodate the predictable pattern of pedestrian movement.</td>
<td></td>
<td></td>
<td></td>
<td>Can be used as visitor parking or casual meeting place.</td>
</tr>
<tr>
<td>19 Outdoor, multi use parking lots.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20 Spaces for the residents to add to the communal landscaping.</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>21 Terraces and balcony over looking the streets / pathways.</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22 Opportunities for controlled interaction.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23 Open air eating / gathering spaces.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Design Solutions</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>---</td>
<td>---------------------------------------------------------------------------------</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>3.03.3</td>
<td><strong>Sense of Group and Perceived Ownership</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Social homogeniety.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>Distinct street address for all the units.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>Flowerbeds, empty niches and boxes at the entrance or in courtyards.</td>
<td></td>
<td></td>
<td></td>
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<td>27</td>
<td>Elements to demarcate the territorial boundary of individual units.</td>
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<td>28</td>
<td>Elements to mark the entry into an individual unit.</td>
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<td>29</td>
<td>Elements to demarcate territorial boundaries of the group.</td>
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<td>30</td>
<td>Common parking spaces.</td>
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<tr>
<td>31</td>
<td>Visible and distinct entrances to the units.</td>
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<td>32</td>
<td>Open spaces in close proximity to the units.</td>
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<tr>
<td>33</td>
<td>Material variations in the landscape and architectural spaces.</td>
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<tr>
<td>3.03.4</td>
<td><strong>Sense of Security</strong></td>
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<tr>
<td>34</td>
<td>Spaces with direct visual and easy physical access from the units.</td>
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<td>35</td>
<td>Lights along the streets, sidewalks and pathways.</td>
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<td>36</td>
<td>Spaces with visual surveillance.</td>
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<td>37</td>
<td>Sight lines between units.</td>
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<td>38</td>
<td>Perceived barriers around the scheme.</td>
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<td>39</td>
<td>Short and individual access galleries.</td>
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<td>40</td>
<td>Traffic calming devices.</td>
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<td>3.03.5</td>
<td><strong>Way-finding and Sense of Orientation</strong></td>
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<tr>
<td>41</td>
<td>Street identity.</td>
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<tr>
<td>42</td>
<td>Street elements and materials to indicate space hierarchy.</td>
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<tr>
<td>43</td>
<td>Sidewalks along the streets.</td>
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<td>44</td>
<td>Accommodate predictable pattern of pedestrian movement.</td>
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<td>45</td>
<td>Land marks along the paths.</td>
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<td>46</td>
<td>Focal points.</td>
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<td>47</td>
<td>Patterns and specific color coding for spaces within the housing scheme.</td>
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<td>Design Solutions</td>
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<td>48</td>
<td>Elements to orient the people within the site.</td>
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<tr>
<td>49</td>
<td>Views and vistas towards a focal point/element.</td>
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3.03.6 Ease of Access to Community / Common Open Spaces

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<tbody>
<tr>
<td>50</td>
<td>Large windows in the units.</td>
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<tr>
<td>51</td>
<td>Open walkways to access the outside spaces.</td>
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<tr>
<td>52</td>
<td>Private garden, patio, balcony with every unit.</td>
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<tr>
<td>53</td>
<td>Communal spaces in close proximity to the units.</td>
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<tr>
<td>54</td>
<td>Hierarchy of open space.</td>
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<td>55</td>
<td>Narrow streets and pathways to separate the communal spaces from the units.</td>
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3.03.7 Sense of Privacy

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<tbody>
<tr>
<td>56</td>
<td>Arrange dwelling units to avoid infringement of privacy of the adjacent unit.</td>
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<td>57</td>
<td>Grade change between the public and private spaces.</td>
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<td>58</td>
<td>Buffers between the private and public open spaces and pathways.</td>
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<td>59</td>
<td>Transitional filters between the public and the private domains of the dwellings.</td>
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<td>60</td>
<td>The entry and the pathways don't affect the privacy of the interior spaces.</td>
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<td>61</td>
<td>Distinct front and back entrances to the units.</td>
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<td>62</td>
<td>Screening for the private yards.</td>
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3.03.8 Maintenance Required by the Spaces

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<td>63</td>
<td>Separate entrance paths to the units on the ground level.</td>
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<td>64</td>
<td>Local material.</td>
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<td>Only plant materials.</td>
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<td>65</td>
<td>Use of plant in their natural shape and form.</td>
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<td>66</td>
<td>Open spaces in close proximity to the units.</td>
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<td>67</td>
<td>Green lawns in smaller sizes in small enclosed space.</td>
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<td>68</td>
<td>Spatial Treatment to define territorial boundary of the units.</td>
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<td>69</td>
<td>Activity oriented rather than settings oriented landscape.</td>
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<td>70</td>
<td>Medium sized spaces of varying shape and appearance.</td>
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6.02 Discussion

Predicting the success of a housing scheme design without having done a post occupancy evaluation is difficult. However, a comparative chart of design elements (Refer to Table 3 and Table 4) of the existing and the proposed design shows the positive and negative aspects of the 2 designs and gives insight into those aspects of design, which can improve future design endeavors of similar nature.

Some of the major aspects evident from the Summary tables 3 and 4 are:

1. Almost all the design solutions proposed in the study and implemented in the proposed design are present in the existing design as well. However, if we look at the level of usage of these solutions in the existing design, we realize that the level of importance associated with these aspects is not very high, which is one of the major reasons why the existing design does not satisfy the desired objectives of the proposed design criteria.

2. In some cases, the residents of the existing scheme have modified their surroundings in order to meet their needs. Interestingly, these modifications correlate with the solutions proposed in this study, which goes on to validate our decision to develop proposed design solutions based on people’s preferences.

3. Some of the criteria mentioned in the recommendations might seem conflicting, e.g. social interaction and privacy. However, the summary tables make it more than evident that seemingly conflicting criteria can also be accommodated with an appropriate design solution.

4. Another major observation based on the summary tables and the comparative sketches is that most of the design solutions used in the proposed design have been implemented with the aim of satisfying multiple criteria which collectively contribute to the success of the design in achieving the desired objectives of all the criteria. On the other hand, in the existing design, the design
solutions seem to satisfy a single criterion thus compromising other criteria. As a result the existing design is unsuccessful in achieving the objectives set for the proposed design.
Conclusion

The intent of this study was to investigate some aspects of the relationships between the individuals and their residential environments and to present a framework of recommendations for the development of high-density housing in urban regions, with an emphasis on the restorative benefits of the open / natural spaces.

The process of literature review, identifying issues and developing criteria for the development of healthy and affordable high-density housing helps to demonstrate the validity of the hypothesis, that a good and congenial living standard can be achieved in a high-density housing situation, through a careful consideration of the architectural and landscape design. It also helps us formulate specific design solutions to achieve the desired objectives of the criteria for the development of the appropriate housing environment. The comparative analysis of the existing and the proposed design used comparative numerical tables, pictorial illustrations and a summary table of implemented design solutions, to synthesize, analyse and communicate the pros and cons of the 2 designs. This proved very successful in demonstrating the effects of specific design solutions and their level of usage, on the overall design and functioning of the housing scheme.

In my opinion, one of the most encouraging aspects of this study was its flexibility. The process used may be adapted to any regional and cultural situation. The study reinforced the arguments that:

1. Satisfaction of human behavioral needs is essential in the development of healthy and restorative living environments (Nachmias & Palen, 1986; Ulrich & Addoms, 1981); and
2. The integration of landscape and building design is absolutely essential if the design of any human environment is to satisfy the human behavioural needs (Ulrich, 1986a; Robinette, 1972; Kaplan, 1987a).

To conclude, I think that this study opens up a new area of research, in the field of restorative environments, human behaviour and high-density housing; and their incorporation into an integrated landscape and architectural design.
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