A Behavioural Approach to Design of High-Density Housing

by

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Department of AGRICULTURE SCIENCE (LANDSCAPE ARCHITECTURE PROGRAM)

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Abstract

Figure 1:
Nature at our doorstep

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.

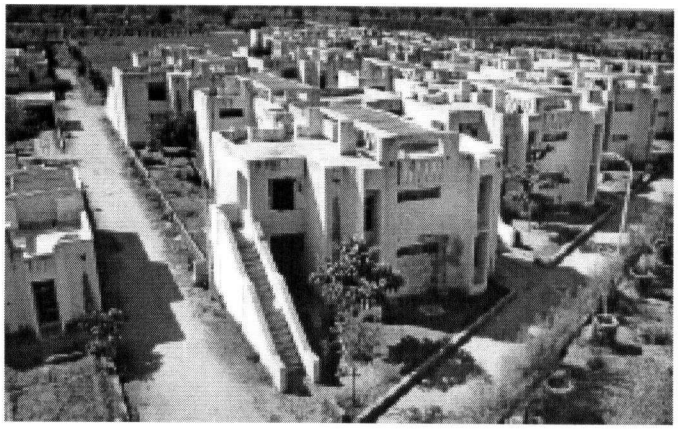


Figure 2:
High-density urban development can reduce encroachment on the open country side.

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

Figure 3:
Landscaped urban spaces are a good refuge from the closed environments of the of small apartments in high-density housings.

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 work place 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".

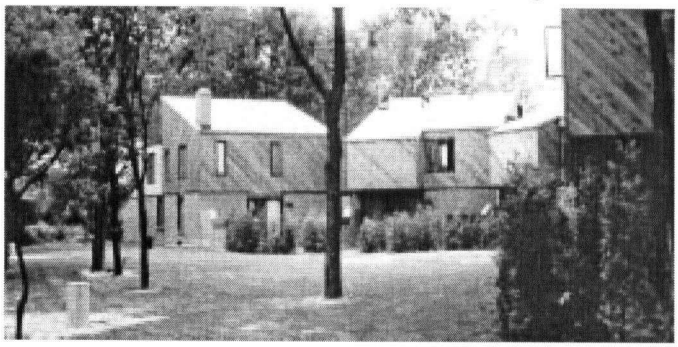
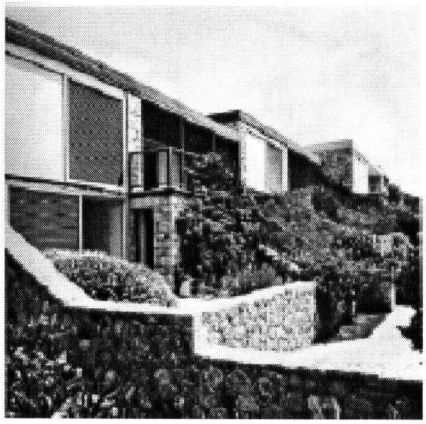


Figure 4:
Integrated architectural and landscape design can result in spaces being more used and appreciated by people, especially in high-density settings.

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 usefull 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

1.01

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 is it 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.

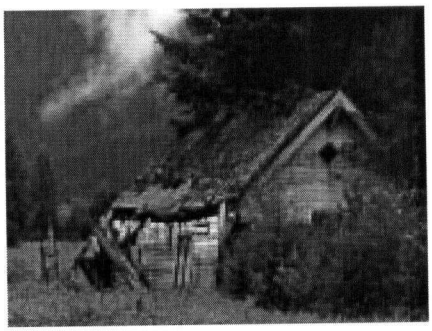


Figure 6:
We need to live in harmony with nature, to have a healthy, sustainable existance.

1.02

Literature Review

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 over-crowding, 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 work place 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.

Figure 7:
Close contact with nature is a major aspect of suburban living.

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).

1.02.1
High Density Housing

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).

Figure 8:
An institutional look gives a greater sense of density.

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 ones 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).

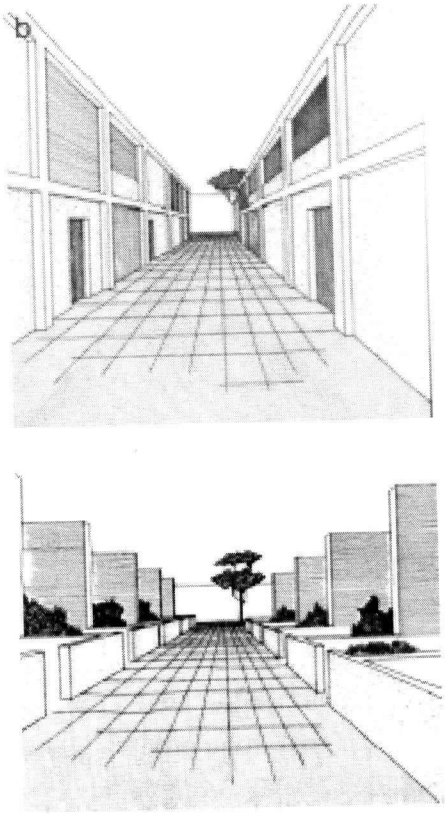


Figure 9:
Spatial structure and architectural form can also help reduce the feeling of crowdedness.

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 in 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 housings 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-

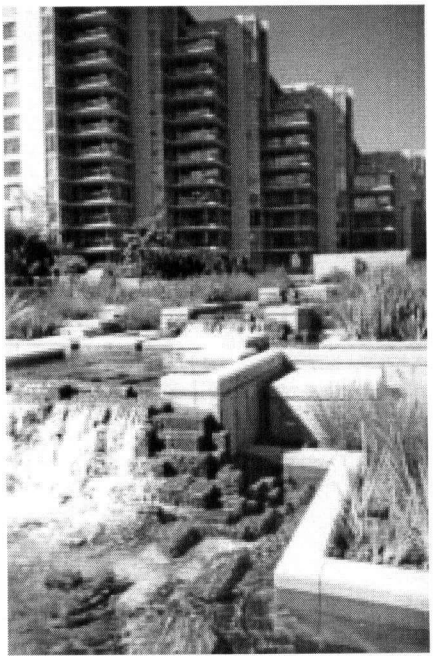


Figure 10:
Not all high-density housing is affordable.

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, its not density alone which is the cause of stress. Factors, other than high density, which attribute to stress in a crowded condition are;

Figure 11:
High-density developments can significantly reduce the cost of providing basic infrastructure, like roads, pathways, sewage lines.

a. Duration of exposure - The experience of crowded condition is affected by its duration and our advanced knowlede as to how long the experience might last.

b. Predictability - Crowded conditions are experienced more negetively 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 communioin with others.

d. Primary vs. secondary environment - Primary enironment can be described as the place where the person spends a large amount of time, has personal contacts with others and is involved

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 negetive 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?

1.02.2
Benefits Of Nature

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.

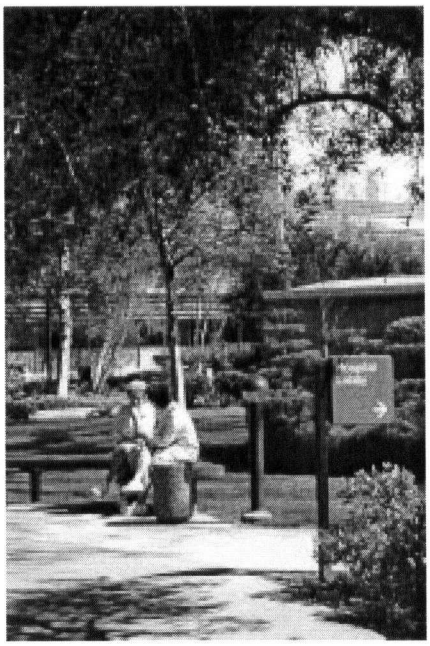


Figure 12:
Small green spaces in the hospitals are liked by the staff and the patients.

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).

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 setting have beneficial effects on human being. 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.

1.02.3
Restorative Environments

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 biophillia 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.

Figure 13:
View of natural settings from the window can be very relaxing and therapeutic.

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 also was associated with lower levels of several measures of stressful arousal (including blood pressure, skin

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 contactswith 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."

Stephen & Rachel Kaplan, 1998.

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

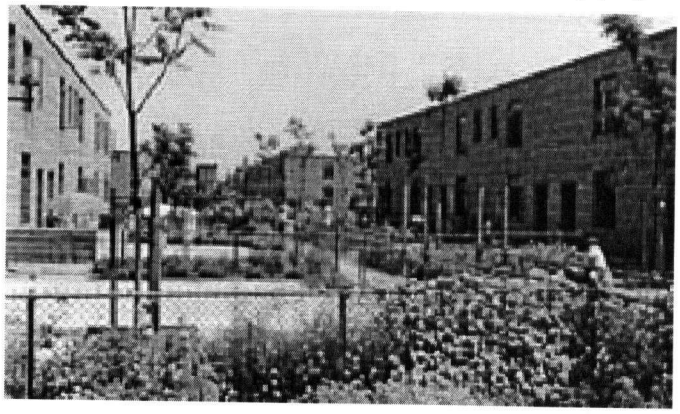


Figure 14:
Nature at our door step is not very vast and not entirely unaffected by human intervention.

Figure 15:
Small green spaces which provide multiple opportunities to gather as a group or as an individual are the most successful space.

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.

Figure 16:
Large open spaces that lack spatial definition are seldom used.

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

we need to design human environments that have restorative qualities.

1.02.5 The Need For Restorative Environments

"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 settings. Whatever the reason for our affinity to natural elements, evidence shows that natural scenes may posses 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).

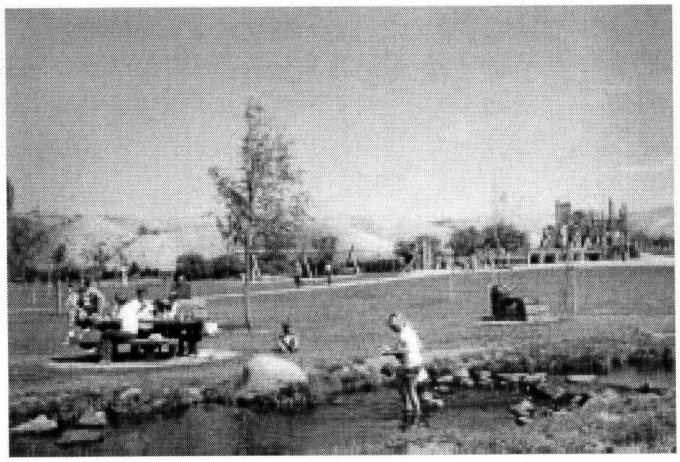


Figure 17:
Need for change from everyday life is essential for the restoration of energy and health.

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).

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, psycological 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 resotorative quality.

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

SECTION II

2.01 **Hypothesis**
2.02 **Goal**
2.03 **Objectives**
2.04 **Methodology**

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.

2.04

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 itsbeneficial 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 exisitng housing scheme. This housing scheme could have been selected from any city or region of the world. However, for the sake of convinience 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

3.01.2 Unit Size

3.01.3 Building Height

3.01.4 Affordability

3.01.5 Livability

3.02 Open Spaces

3.02.1 Site Entrance(s)

3.02.2 Common / Community Spaces

3.02.3 Group Spaces

3.02.4 Circulation spaces

3.02.5 Parking Spaces

3.02.6 Front Garden

3.02.7 Backyard

3.02.8 Entry / Front Porch

3.02.9 Terraces / Balcony

3.03 Design Criteria

3.03.1 Contribution Of The Scheme Towards The Life in The Neighbourhood

3.03.2 Social Interaction Within The Site

3.03.3 Contribution Towards The Sense Of Group And Perceived Ownership

3.03.4 Sense Of Security For The Residents

3.03.5 Way Finding and Sense Of Orientation Within The Site

3.03.6 Ease of Access

3.03.7 Sense Of Privacy

3.03.8 Level Of Maintenance Required By Each Of The Spaces

3.01

Design Issues

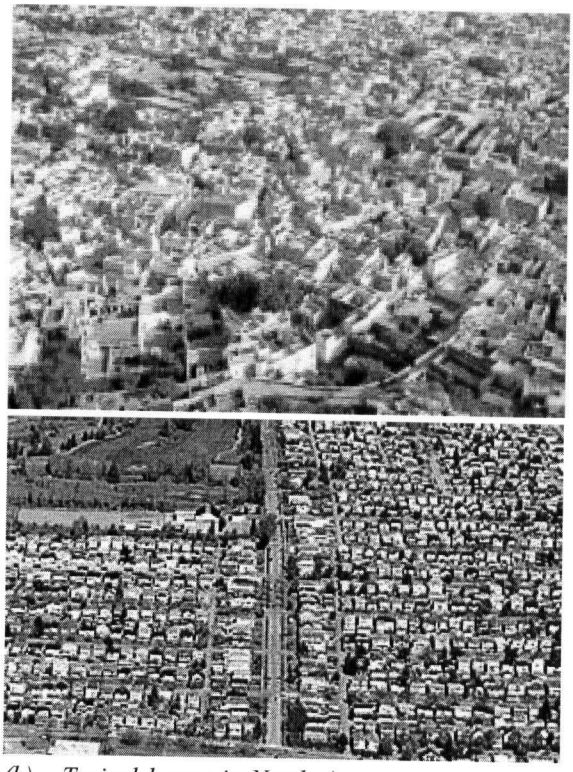
Developing housing entails not just planning the site and designing the units, but it involves another step before design, i.e. determining the target group, and that in turn determines some essential issues, like density, cost, unit sizes and essential facilities to be provided. Design comes in only 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.

Figure 18 a & b:
Density standards vary from region to region.

(a) Typical layout of old Indian cities.



(b) Typical layout in North American cities.

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 avail-able land area includes open spaces, parks, playgrounds, pathways etc.) or net density (the available land area includes

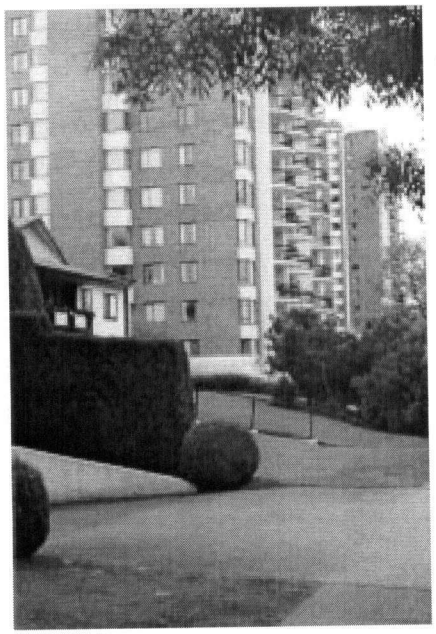


Figure 19:
High-rise buildings occupy less land but the residents are detached from the ground.

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.

Figure 20:
Small, intimate and easily accessible green spaces in low-rise high density residential settings are prefered over large undifferentiated spaces.

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.

3.01.2
Unit Size

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).

Its 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 ones' 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).

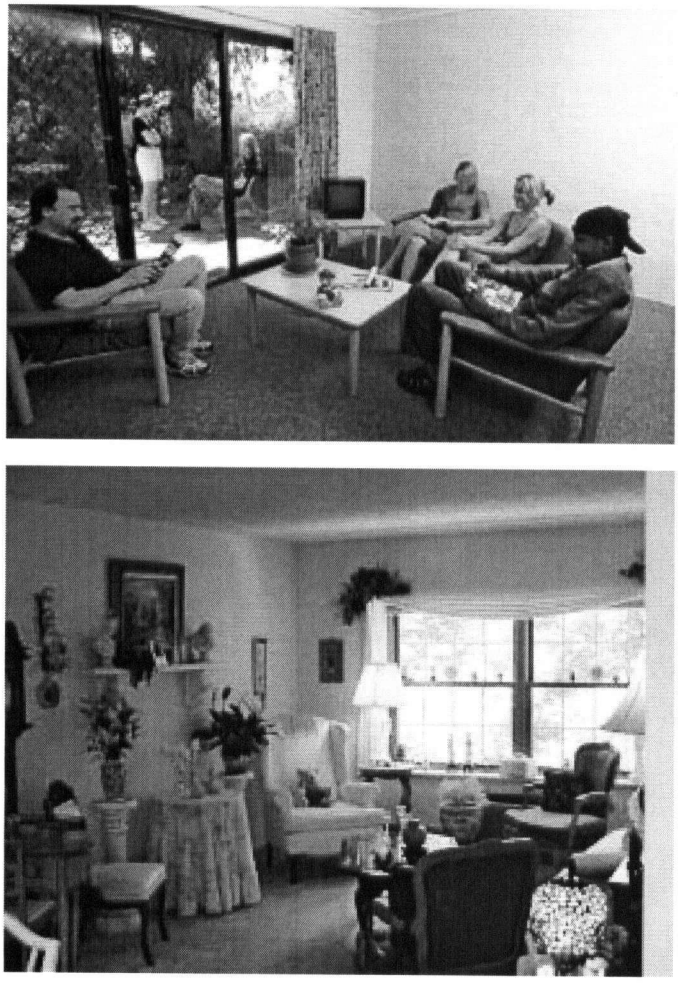


Figure 21:
Small internal spaces can be made to appear bigger by the provision of large windows and easily accessible outdoor space.

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 22:
Low-rise houses with easy access to outside green spaces are preferred to units in high-rise structures.

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?

3.01.3 Building Height

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

Figure 23:
Most of the high-rise units lack the objectively available outdoor spaces present in the low-rise or ground oriented units.

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. Its 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 upto 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-

ation of these 3 issues can very well determine the affordability of the housing units.

3.01.4 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).

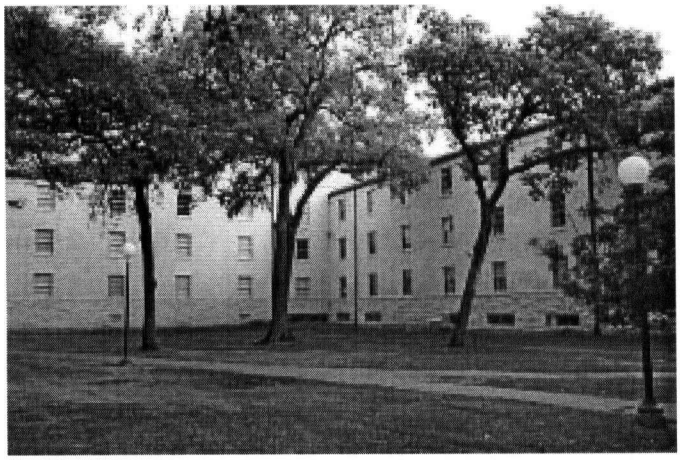


Figure 24:
More than often, the units are arranged into close packed box structures to reduce the building cost, thus rendering the surrounding spaces physically inaccessible from the units.

Having considered the major issues and provided people

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 of. Thus, rendering a technically sound design absolutely ineffective and useless.

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

Acording to this study, livable space should meet the standards of light, ventilation and comfort conditons 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.

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. Mimnimum FSR of 1.5, upto 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 upto 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.

3.02

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.

Figure 26:
Large spaces where a group can meet and interact are essential components of a successful housing scheme.

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,

Figure 27:
Designated entrances can act as very important spaces for social interaction.

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, coourtyards) 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 neigborhood and the

housing scheme, thus regulating the movement of people and vehicles within the site.

2. Act as symbol of identity and can instil a sense of pride among the residents.

3. Can act as a landmark in the neighborhood.

4. Site entrances could act as active nodes of social interaction between the residents and the non-resident, or between the residents.

3.02.2 Common/Community Spaces

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.

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.

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.

3.02.3 Group Spaces

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,

viewing gardens, roof decks etc., which are shared by asmall 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.

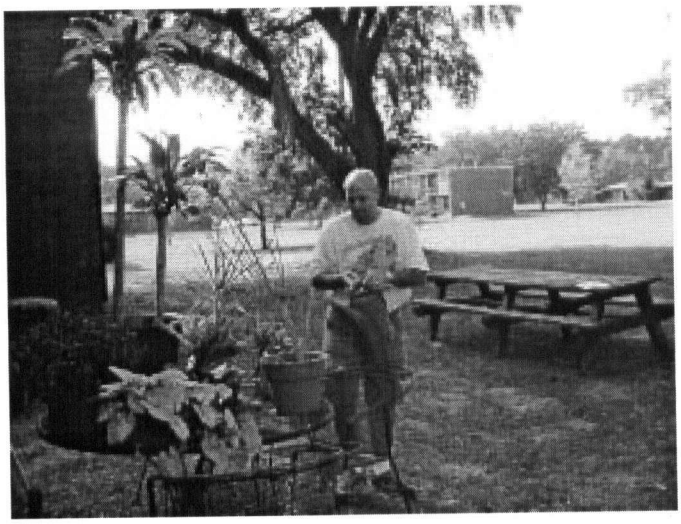
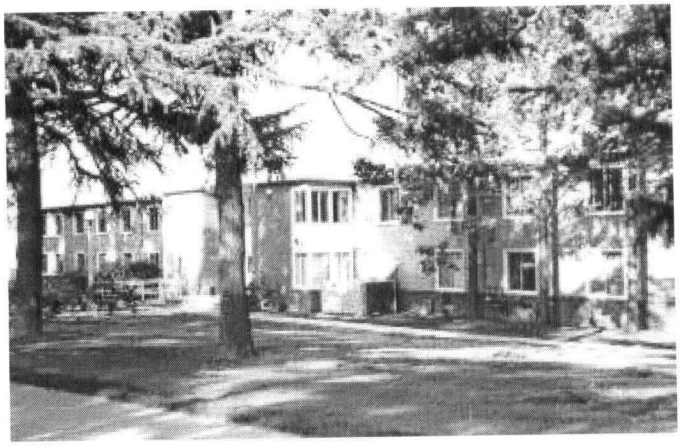


Figure 29:
Provision of small community gardens is an effective way of encouraging a sense of group ownership among the residents.

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).

Figure 30:
Separation of pedestrian and vehicular traffic is essential to ensure a safe, pedestrian friendly environment.



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. Unfortunatly 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.

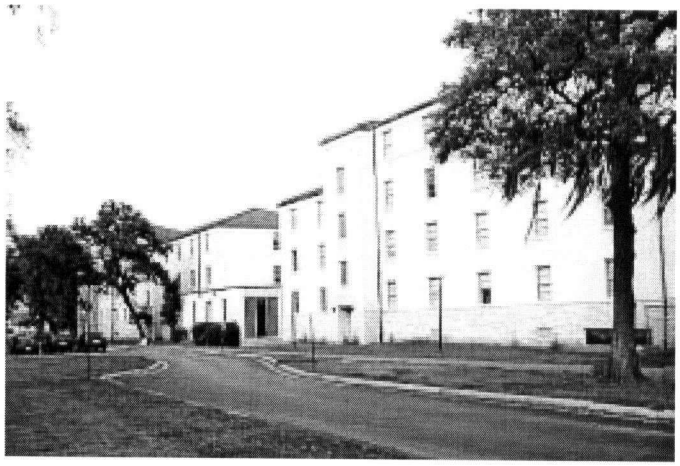


Figure 31:
Lack of adequate parking space gives an added sense of density

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

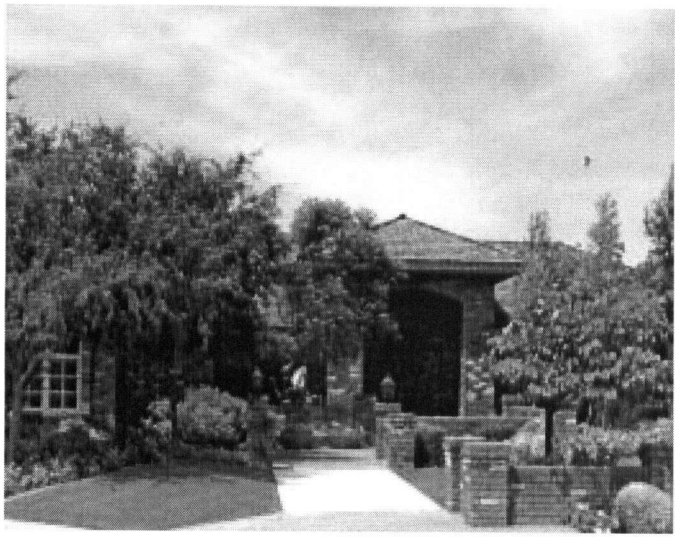


Figure 32:
The front gardens reflect the identity of the residents.

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.

3.02.7
Entry / Front Porch

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).

Figure 33:
An independent entrance to the unit gives a sense of identity to the resident.

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.

3.02.8 Back yard

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

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.

Advantages :

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

3.02.9 Patios, Terraces and Balcony

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.

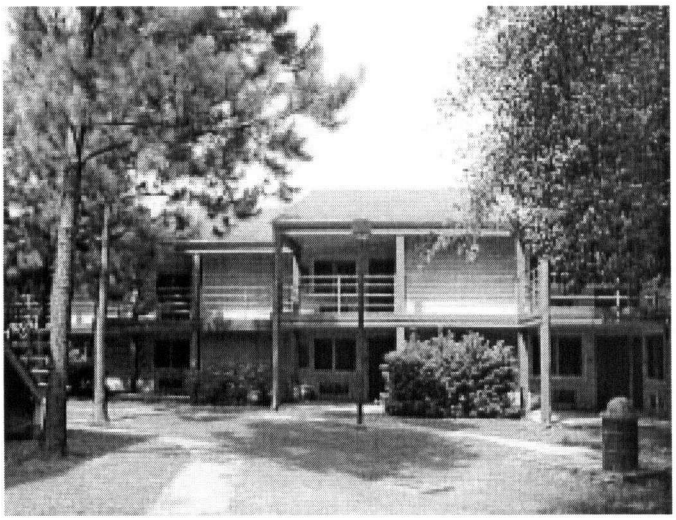


Figure 35:
Outside patios, terraces and balconies should be provided with the units above ground level.

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 houing 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 obivious and not so obvious needs of the residents to ensure the success of the scheme as a whole.

3.03

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).

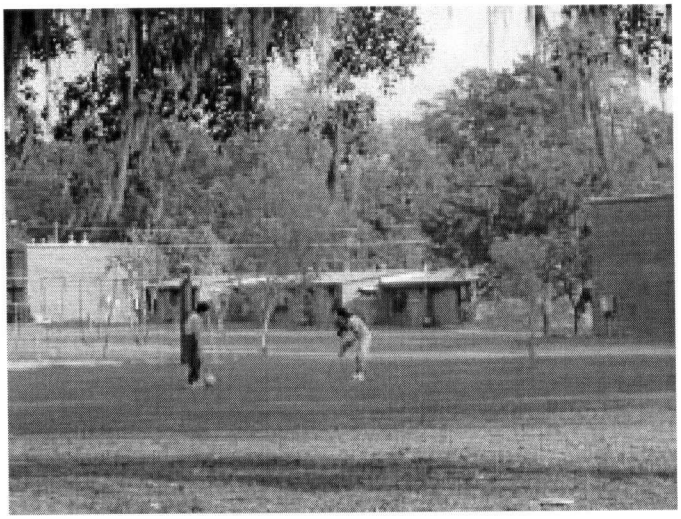


Figure 36:
Outdoor recreational spaces are an essential component of a housing scheme.

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;

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.

3.03.1 Contribution of the scheme towards the life in the neighborhood

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).

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

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).

Figure 38:
Units opening on to the major streets add to the life of the street and neighbourhood and increase the safety and security of the streets.

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 to 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).

Figure 39:
Visual access of the common spaces from the individual units encourages social interaction among the residents and also improves the safety and the security of thespaces.

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).

Figure 40:
Designated seating areas within the scheme can become important socially active spaces.

<u>Desired Objectives :</u>

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).

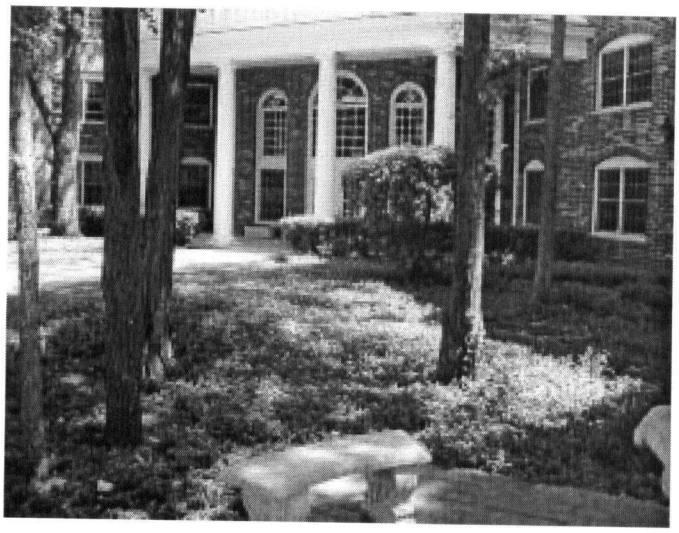


Figure 41:
Designated spaces near the entrance can be important social interaction spaces.

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).

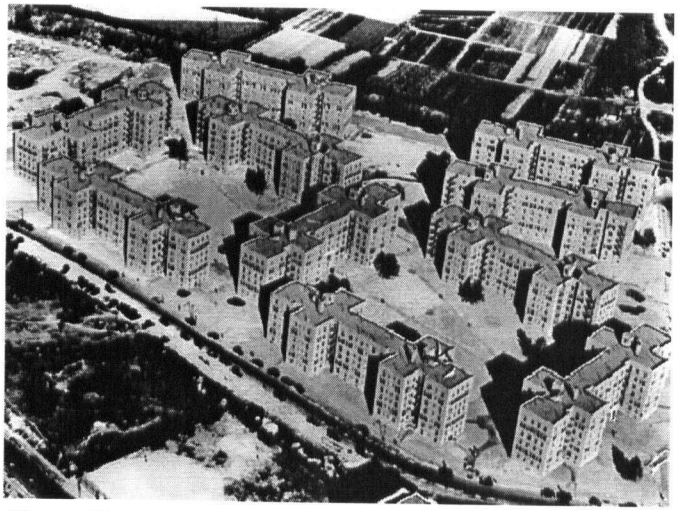


Figure 42:
Undifferentiated, large open spaces shared by a large group are not advisable

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,

community gardening, garage sales, barbeque etc (Cooper, 1975).

17. Provide a direct connection from the private yard to the communal space (Cooper Marcus & Sarkissian, 1986).

18. Provide pathways and sidewalks to accommodate the predictable pattern of pedestrian movement (Cooper Marcus & Sarkissian, 1986).

19. Provide small outdoor, multi use parking lots in close proximity to the units, in addition to the basement parking (Cooper Marcus & Sarkissian, 1986).

20. Provide spaces like planting beds and community garden spaces for the residents to add to the communal landscaping (Kaplan et.al., 1998).

21. Provide terraces and balcony over looking the streets / pathways (Cooper Marcus & Sarkissian, 1986).

22. Provide opportunities for controlled interaction between the units or between the units and the nearby streets or walkways.

23. Provide open air eating/gathering spaces witha variety of outdoor seating, like benches, picnic tables, barbeques and covered patios (Cooper Marcus & Sarkissian, 1986).

3.03.3 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 ones lawn and garden, making improvements to ones 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 instill 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 dispaly subunit identy 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 mail box, 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. Variaton in material treatment of the landscape and architectural spaces can create a sense of group identity.

3.03.4 Sense of security for the residents

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).

36. Avoid creating unnecessary spaces devoid of any visual surveillance (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.

3.03.5 Way-finding and sense of orientation within the site.

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)

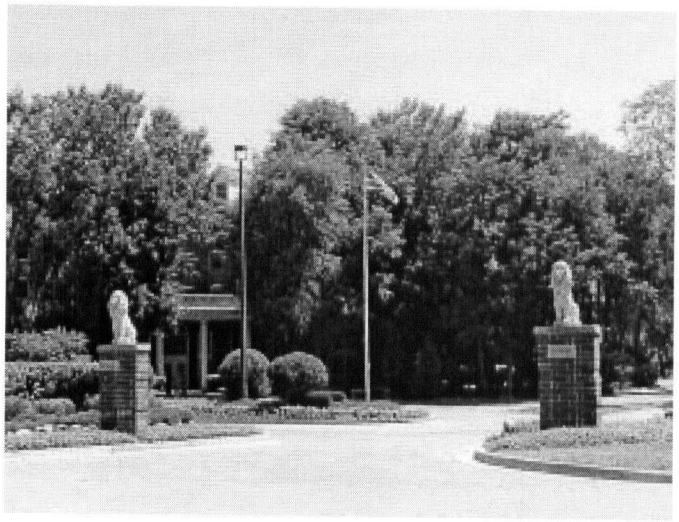


Figure 43:
Distinctive feature at the entrances or otherwise can act as landmarks in the neighbourhood.

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).

Figure 44:
Views and focal points along the pathways assist in way finding.

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 land marks 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 through out 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).

3.03.6 Ease of access

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 sight lines 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.

unit. The surrounding spaces act as an extension of interior spaces into the outdoor open spaces. Visual accessibility may also reduce a sense of crowding or claustrophobia (Whyte,1964). For individuals with children it becomes easier minding the children when the children can move safely out from home into the courtyard or play area shared by a small group of neighbors (Cooper, 1975).

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).
53. Provide communal spaces in close proximity to the units (Newman, 1973).
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).

I 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).

Figure 46:
Providing a separate private entrance to the units can be an effective way of encouraging people to claim ownership of the immediate surroundings.

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 theresidents.

Possible design solutions :

56. Arrange dwelling units in such a away 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 dont 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 domainof 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).

Figure 52:
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 up keep.

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 plant in the form of topiary to reduce the manitenance 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)**

4.01

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)

	Area (Hectares)	Population (Projected)	Density (people/Hectare)
Southeast False Creek (Cambie to Main)	20	4,250	212
False Creek South (Granville to Cambie)	32	4,100	128
False Creek North	67	14,500	216
Downtown South	52	11,000	211
Coal Harbor	17	3,500	206
West End	194	38,000	196

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

Density (Type)	Housing Type	Building Height (Storey)	Density (Dwellings/Hectare)
Low	One-Family detached	1-2	43-48
	Two-family	1-2	48-84
Medium	Row house, garden apartment	2-3	72-144
	Walk-up apartment	3-4	120-192
High	Multi-family	5-10	192-360
	Multi-family	10-16	360-480
	Multi-family	over 16	480-1680

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 land-marks, 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.

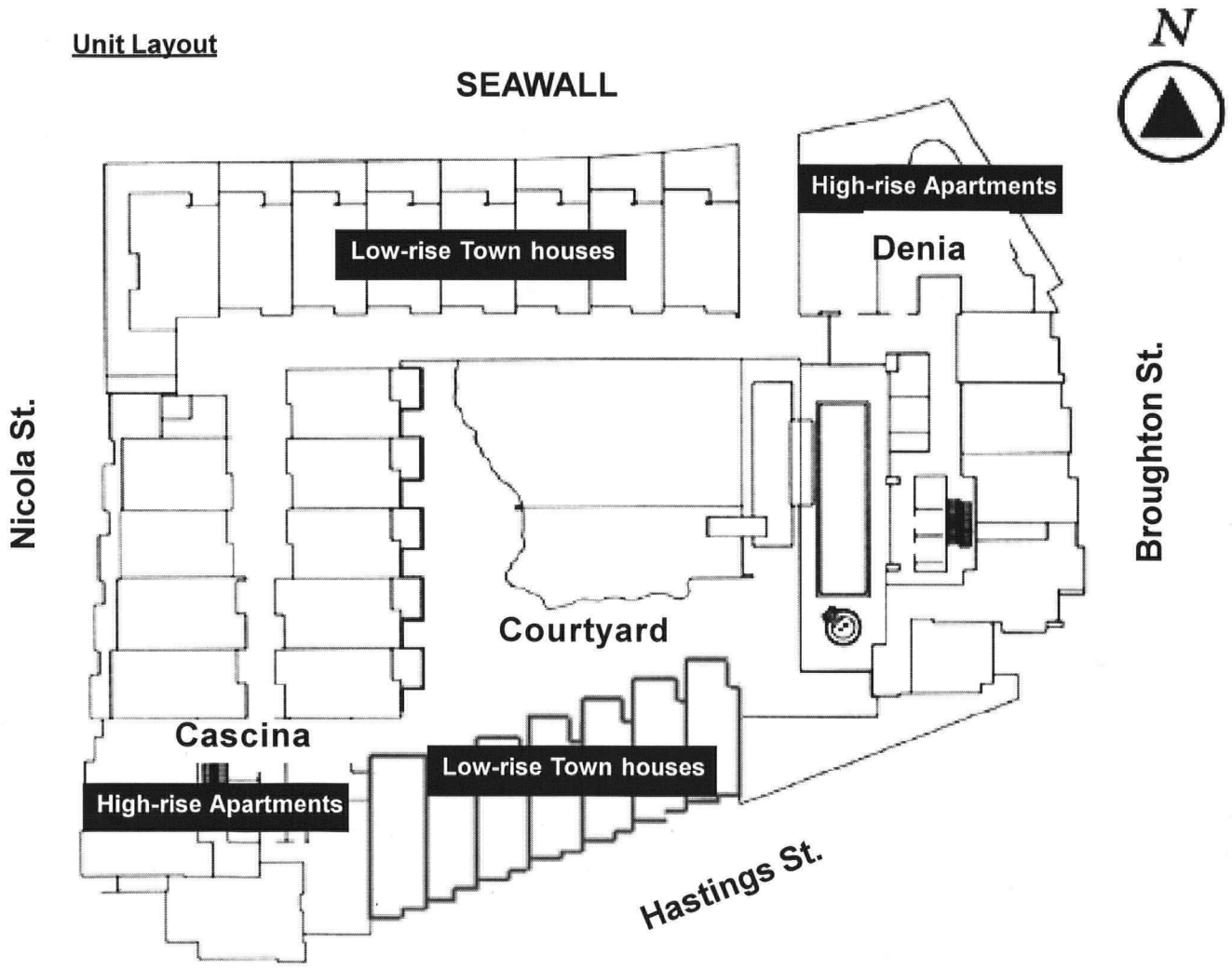
Built in	:	1968
Address	:	57th Ave and Cambie Street, Vancouver,Canada
Site Area	:	22 Acres
Density*	:	Approx. 30 Dwelling Units / acre
Unit Mix	:	1, 2, 3 bedroom Units (in 2 story houses and 18 storey High Rise)
Floor Space Index		: 0.76
Plot Coverage		: Approx. 25 %

** Gross Density of Units.*

View of the housing scheme

This particular project was selected because it is a good example of typical high-density development going on in the Vancouer downtown area. It consists of high-rise apartments and low-rise town houses.

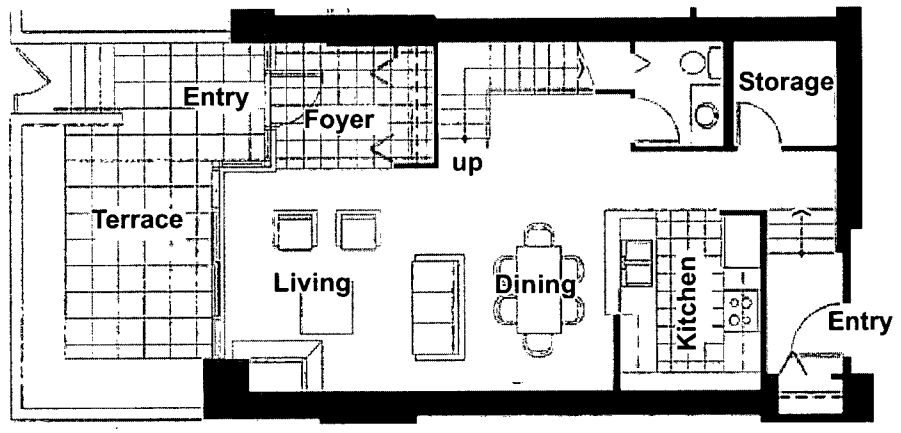
Unit Layout



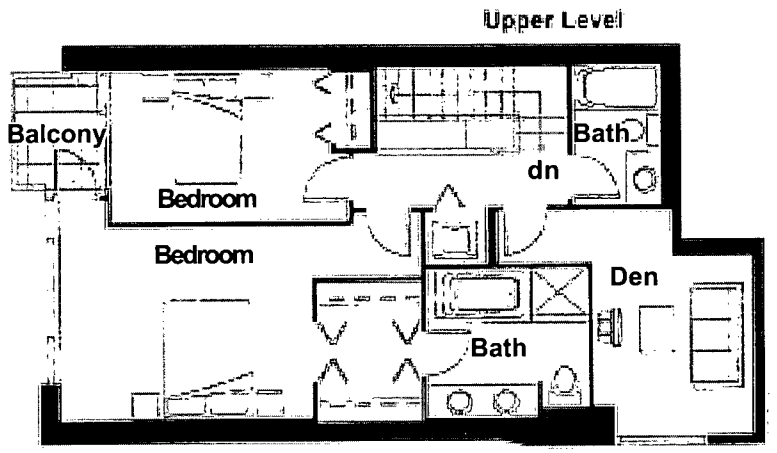
Cascina Denia

Nicola Townhomes
TH06
2 Bedroom + Den+ Balcony
1570 sq.ft.

Ground Level



Upper Level

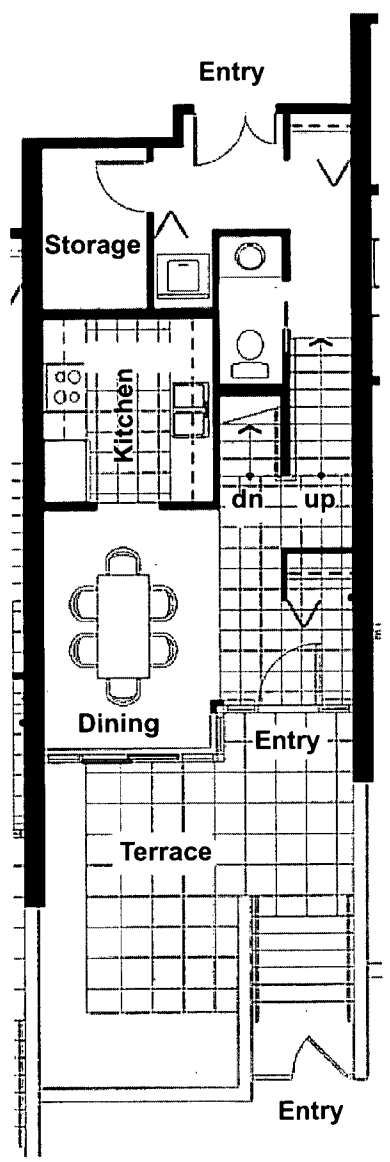


Note : The basic layout of all the other 2 bedroom townhomes on Nicola streeet is the same but they have different areas.

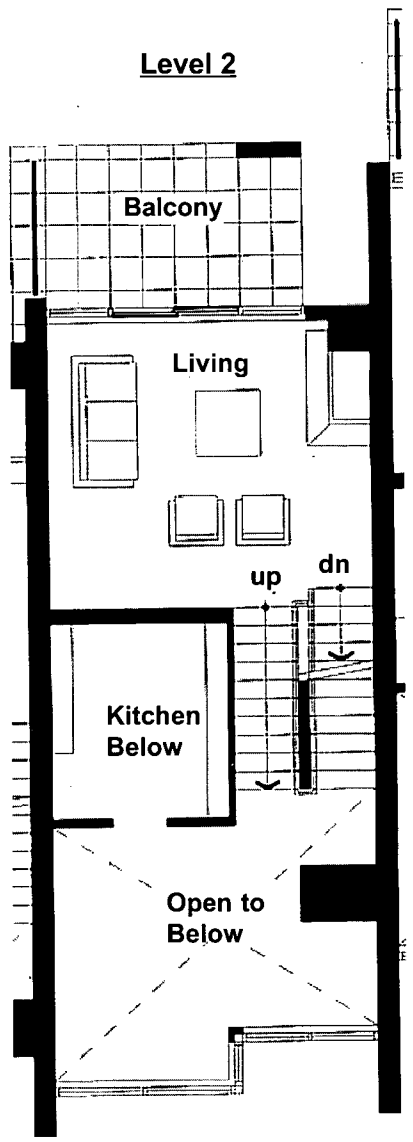
HastingsTownhomes
TH 02,03,04,05 &06
2 Bedroom + Den + Balcony
1400sq.ft.

Typical Plans of the Town house units.

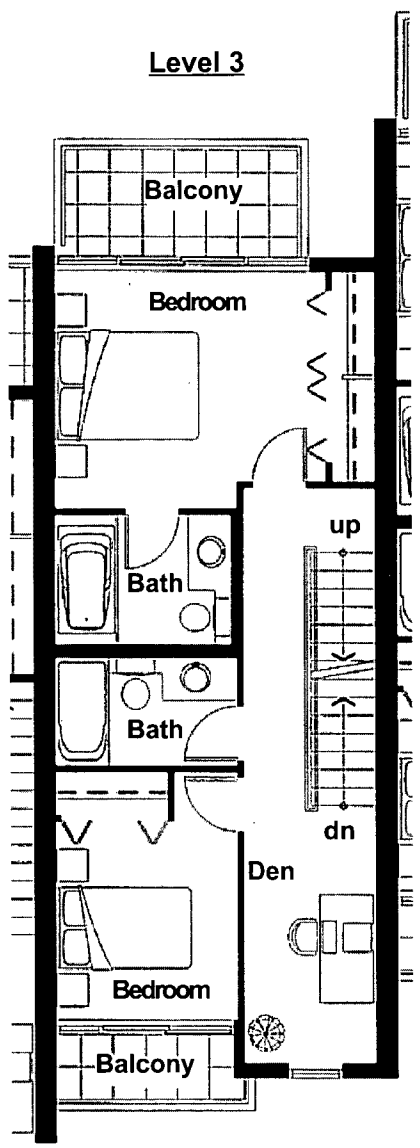
Level 1



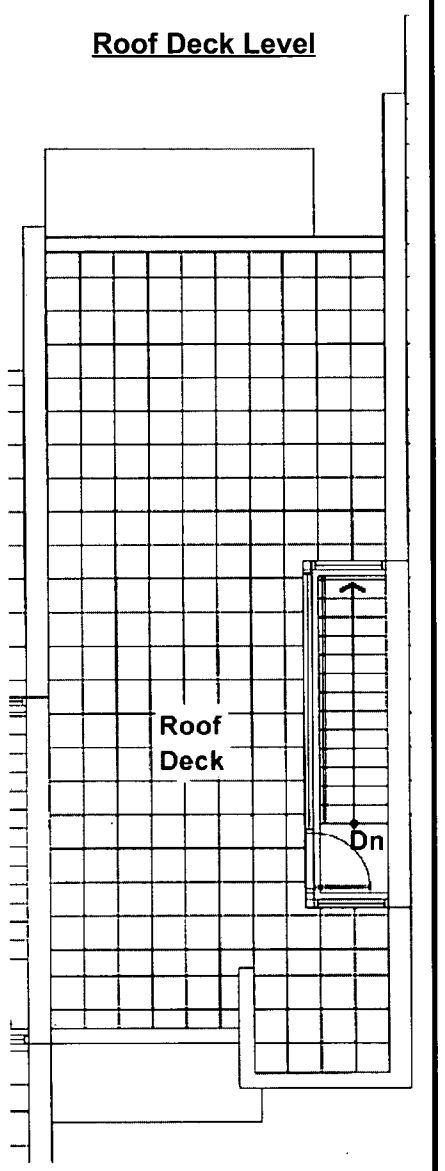
Level 2



Level 3



Roof Deck Level



Note : The plan of the High-rise Apartments have not been shown because the study doesnt recommend high-rise apartments.

Cascina Denia

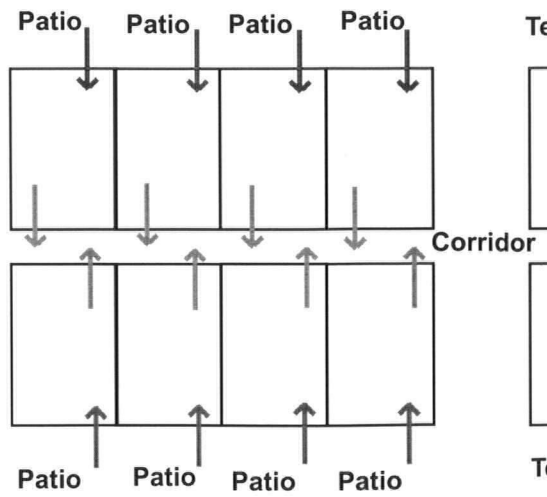
Typical Floor Plans of Ground Level Duplex Units

The ground floor units have access from the street through a patio. the rear access opens into a shared corridor.
The upper level units have access through the common shared corridor. These upper level units have terrace or balcony which overlook the street.

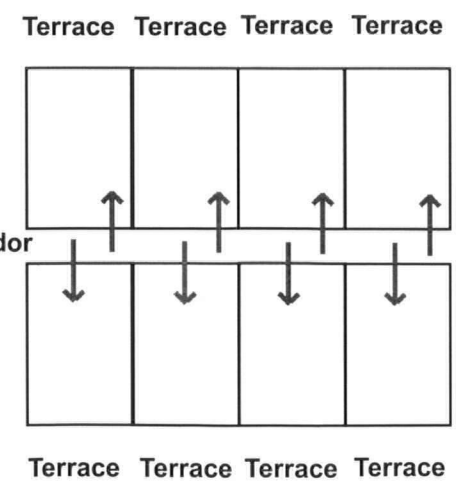
Views of the Front entrance to the units of different building in the Arbutus Walk project

View of the units above the commercial area.

Schematic Layout of the Ground Floor Units



Schematic Layout of the Upper Level Units



The Arbutus Walk

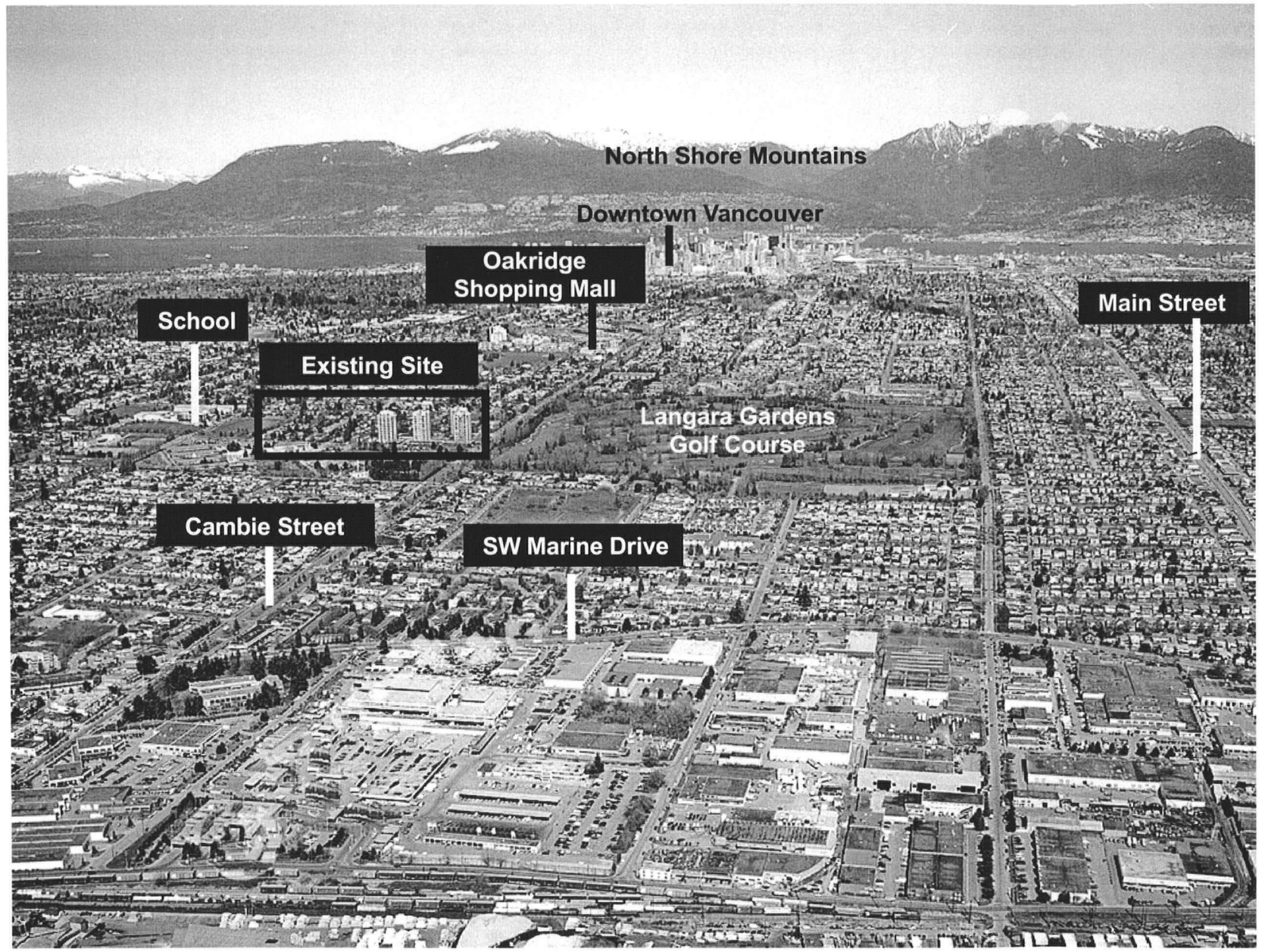
For a project of this scale, which was designed in 1968, using the revolutionary idea of combining high-density and low-density developments was an accomplishment in itself. In comparison to the projects done in the more recent times, this existing project seems to fall short of the current expectations 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.

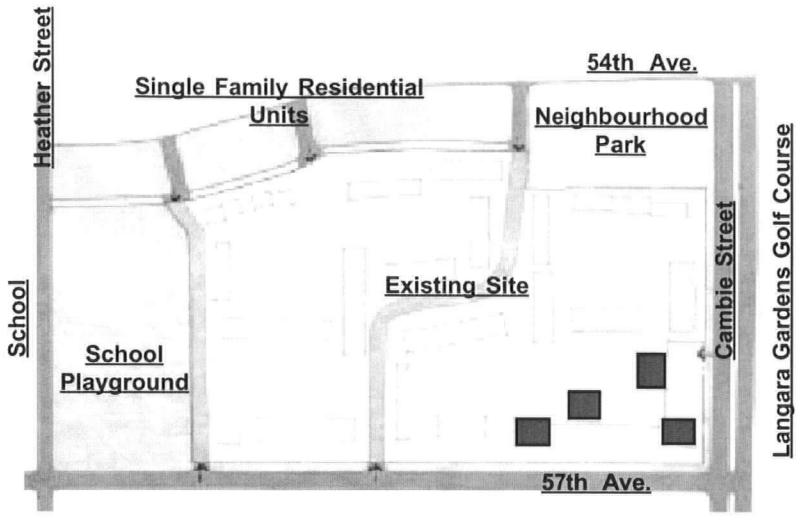
The existing design consists of high and low rise buildings, accommodating approximately 676, 1,2,and 3 bedroom units.

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.

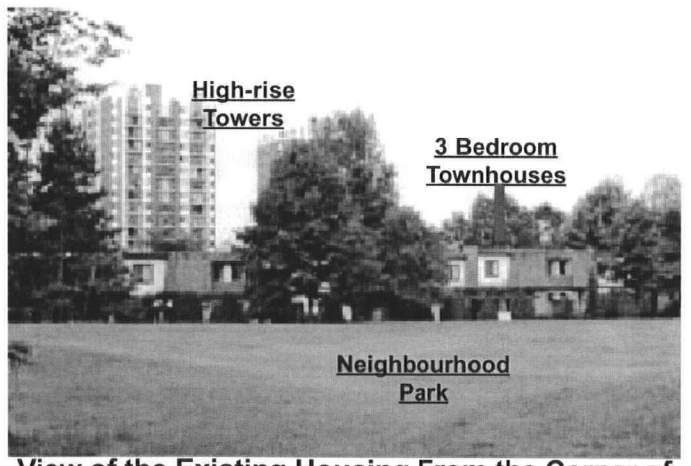


Ariel View (www.globalairphoto.com)



Context Plan

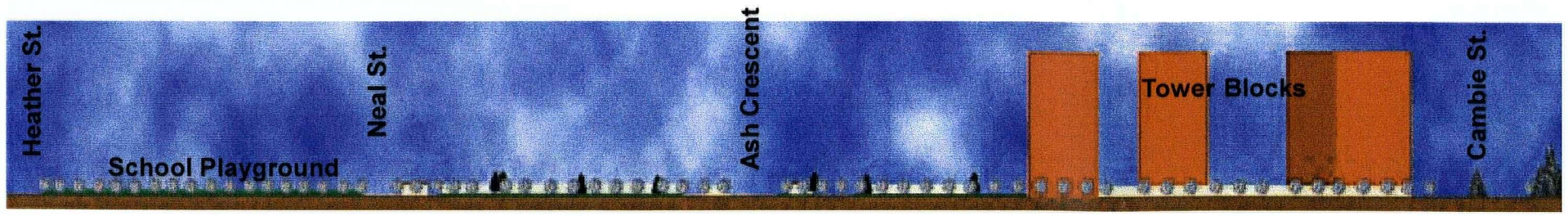
NORTH



View of the Existing Housing From the Corner of 54th Ave. & Cambie Street

The Context

E1



Site Elevation (Looking South From 57th Avenue)

Site Plan

Salient Features:

The existing design occupies an area of approximately 22 acres at an overall density of 30 dwelling units per acre.

It consists of 18-storey tower blocks, which cover an area of approximately 2 acres and low-rise garden apartment and townhouses.

The community / Common facilities provided for the residents are:

i. Swimming Pool.
ii. Fitness Club.
iii. Shopping area.
iv. Off site Golf Course.

Parking is provided in the basement.

Primary access to the units is through the pathways from the streets and basement parking.

a - 3 Bedroom Townhouse

b - 1/2 Bedroom Garden Apartment

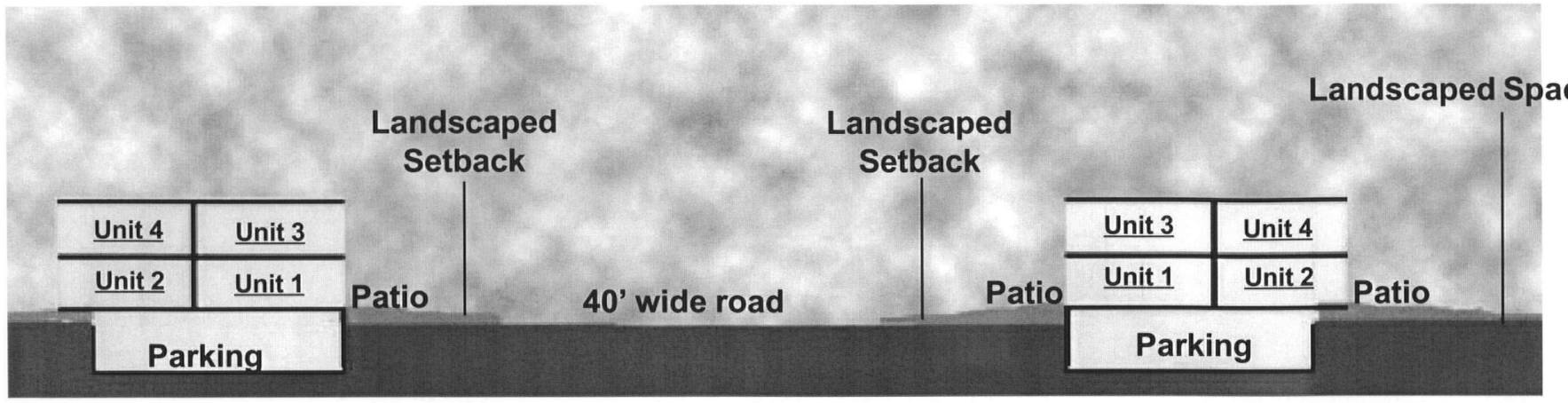
c - Tower Blocks

● Basement Parking Entrance

sp - Swimmimg Pool

NORTH

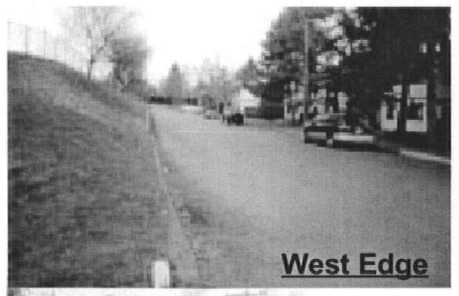
Existing Design



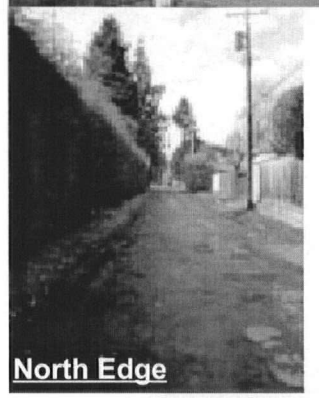
(A) Section Across Ash Crescent

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

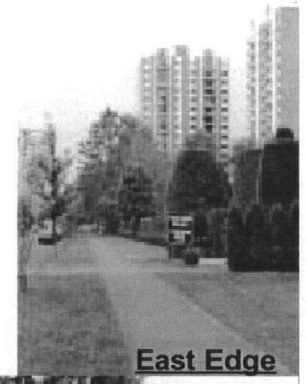
(C) Views of a Typical Open Space within a Cluster of Units



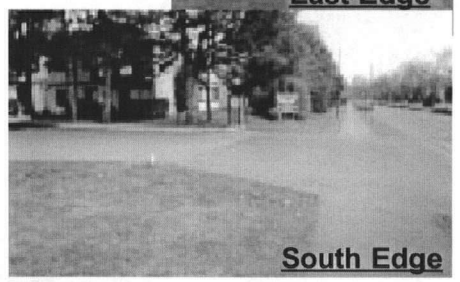
West Edge



North Edge

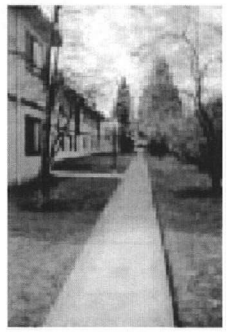


East Edge



South Edge

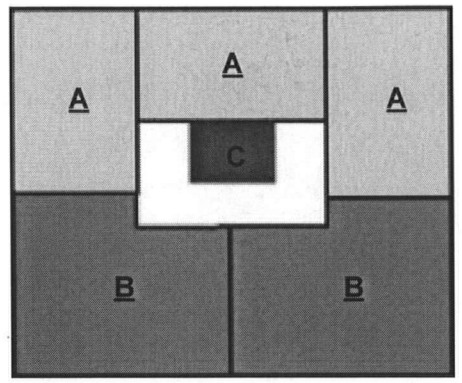
View of the Side walk along 57th Ave.



(D) Typical Pathway layout - illstructured and lacking the friendly human scale

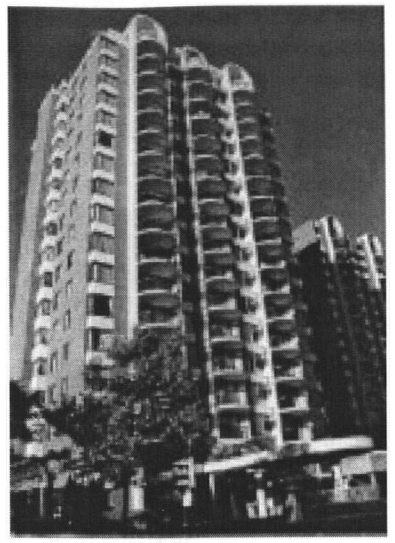
Existing Site Sections and Views

E3



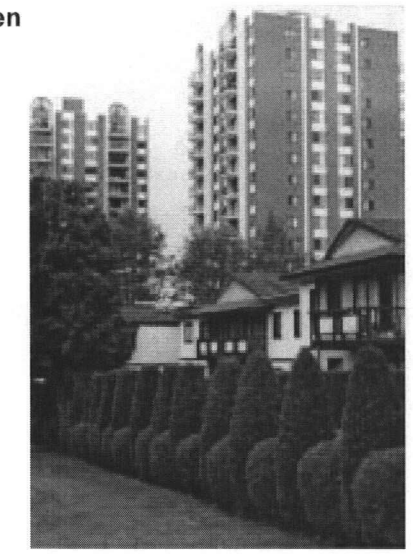
Typical Unit Layout on each Floor
(C- Elevator Shaft)

View of Entrance to the Tower Blocks

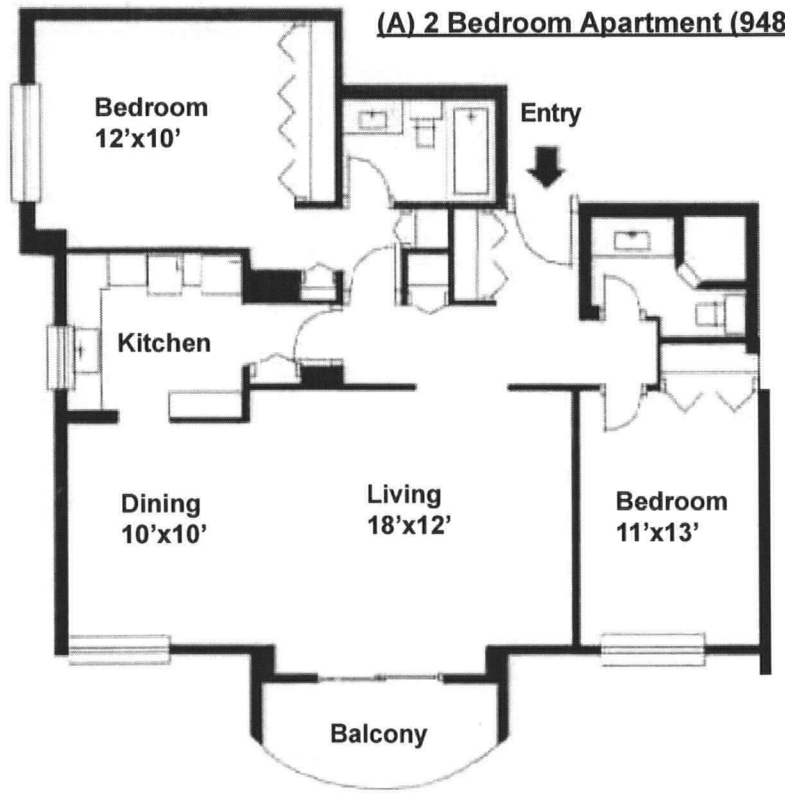


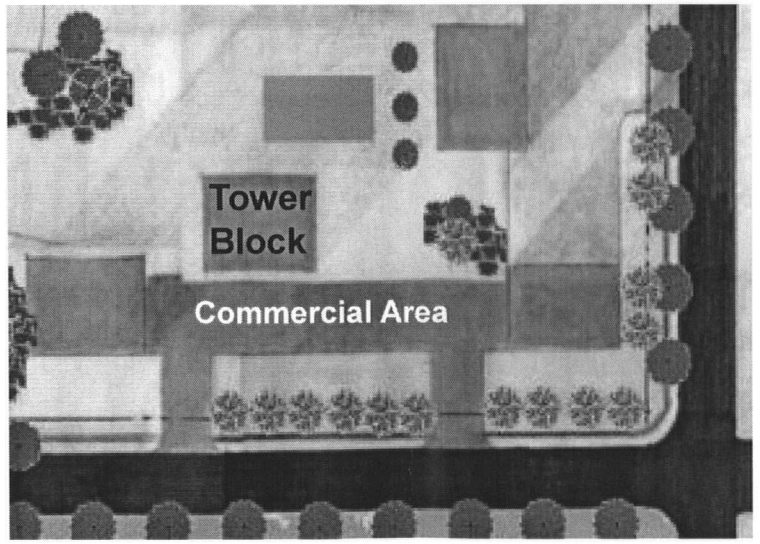
View of the Tower Block

View of the 1/2 bedroom Garden Apartments with the High-rise towers in the Background



(A) 2 Bedroom Apartment (948 sq. ft.)



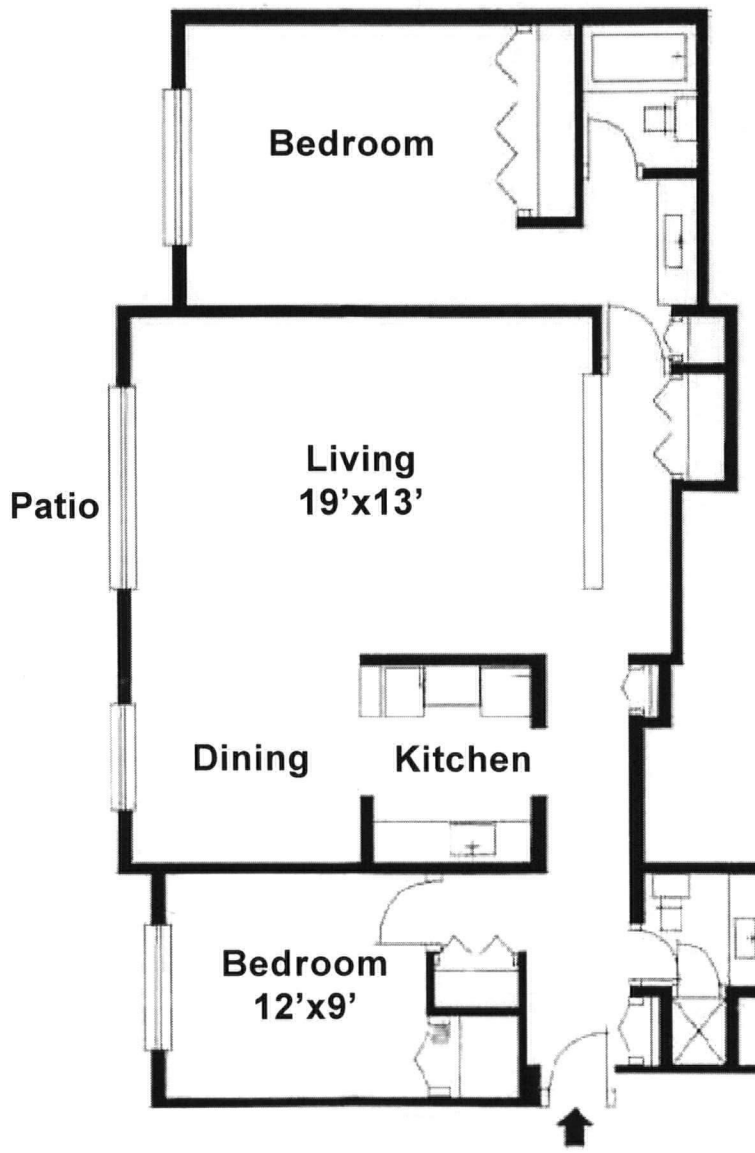


Layout of the 4 High-Rise Tower Blocks

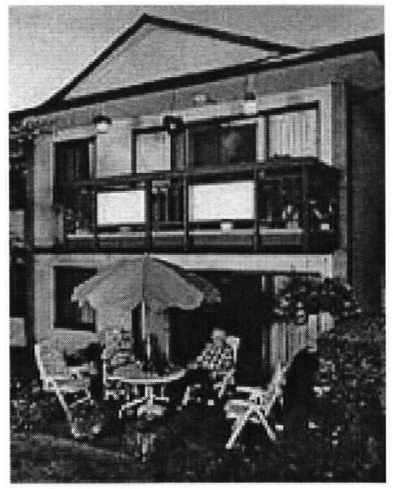
NORTH

(B) 1 Bedroom Apartment (727 sq.ft.)

Existing High-Rise Apartments



Typical Plan -2 Bedrooom Apartment (977 sq. ft.)



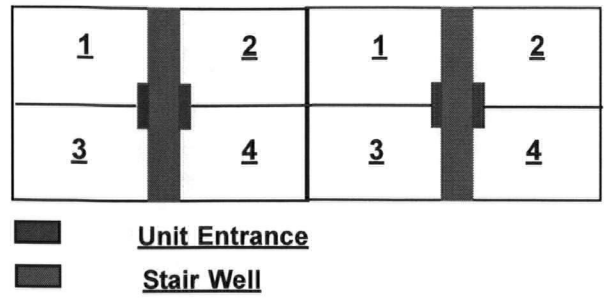
View of the Patio of a Typical Unit

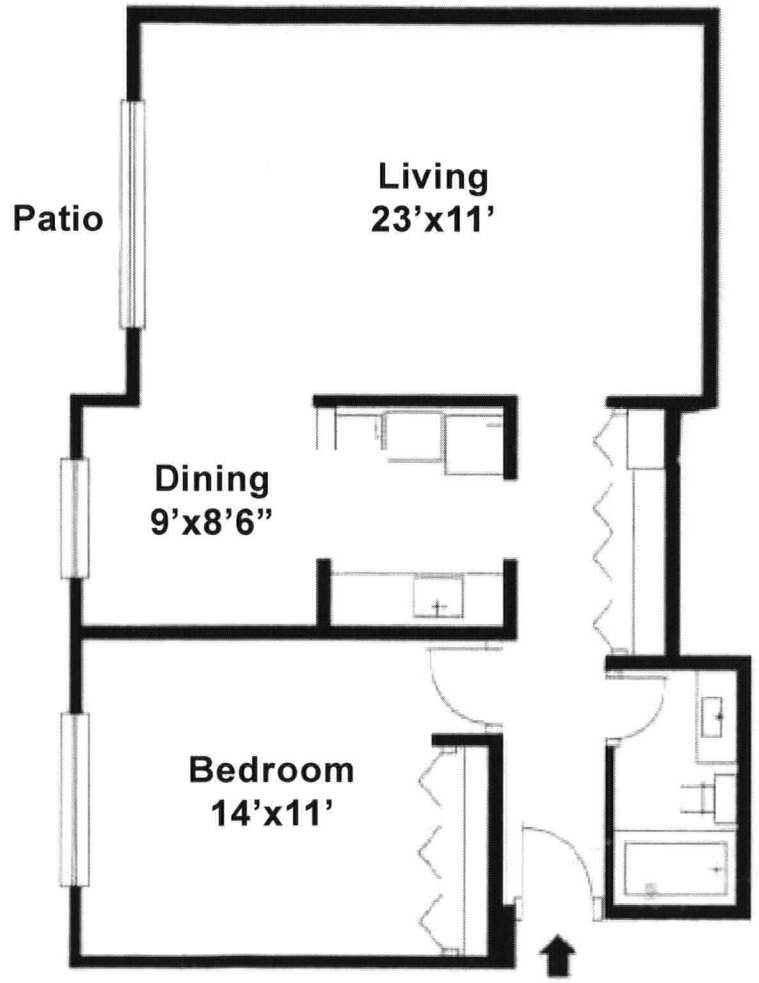
View of The Entrance

Typical Block Layout

NORTH

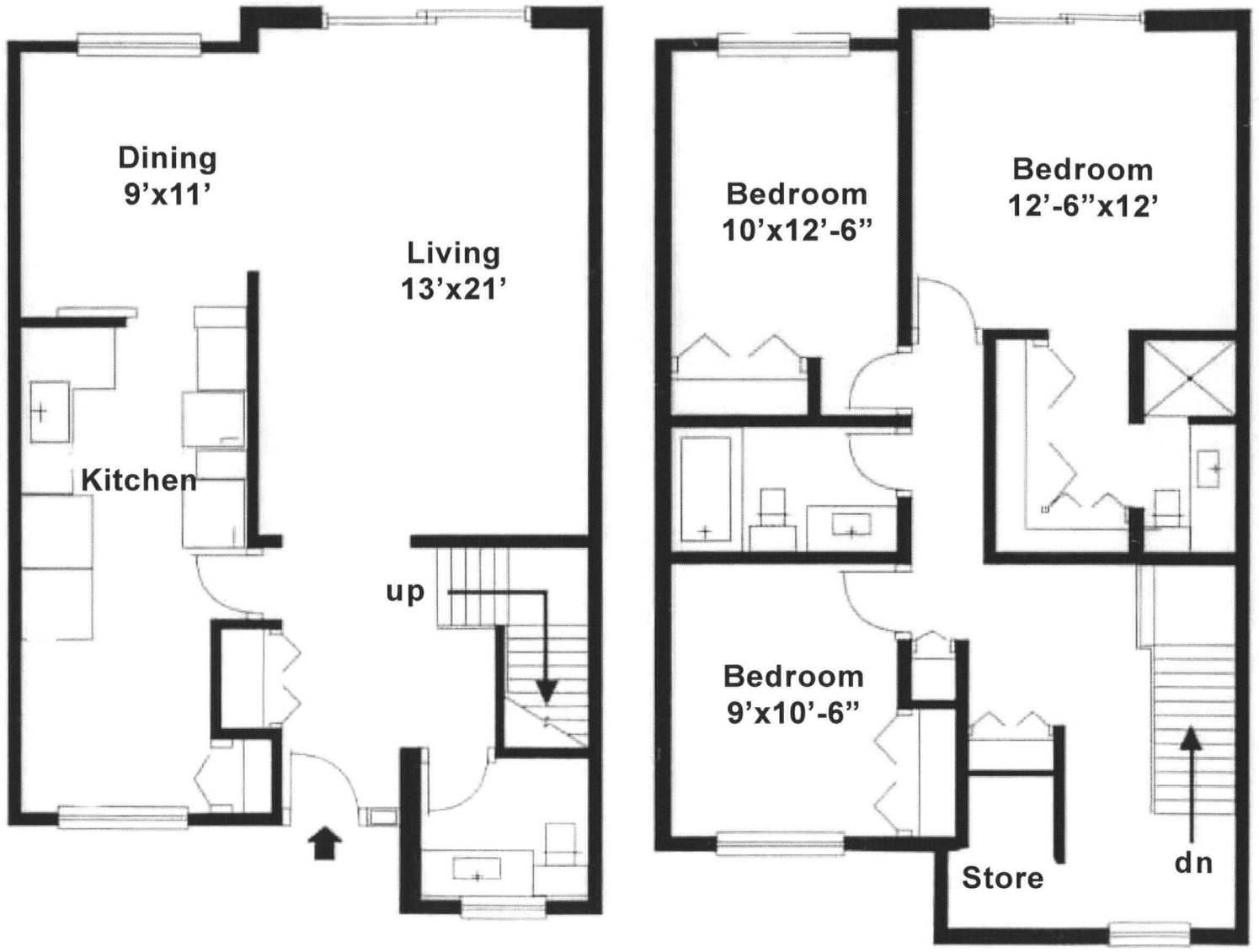
Typical Unit Layout



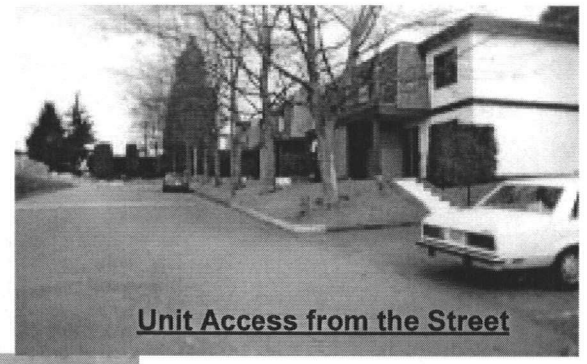


Typical Plan -1 Bedrooom Apartment (927 sq.ft.)

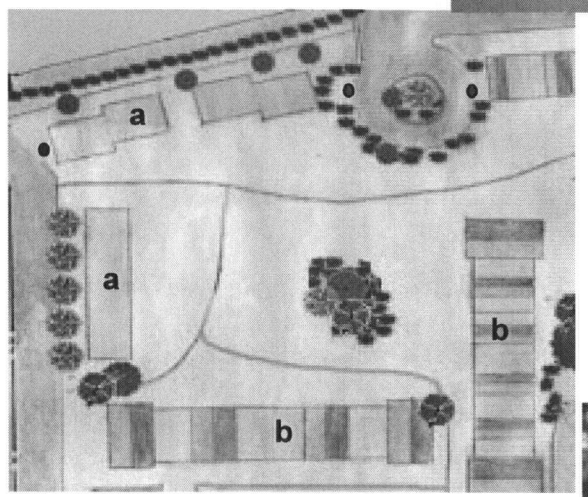
Existing Garden Apartments

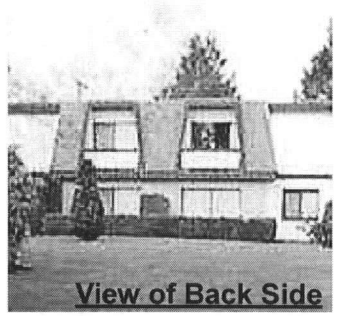


Typical Plan



Unit Access from the Street





View of Back Side

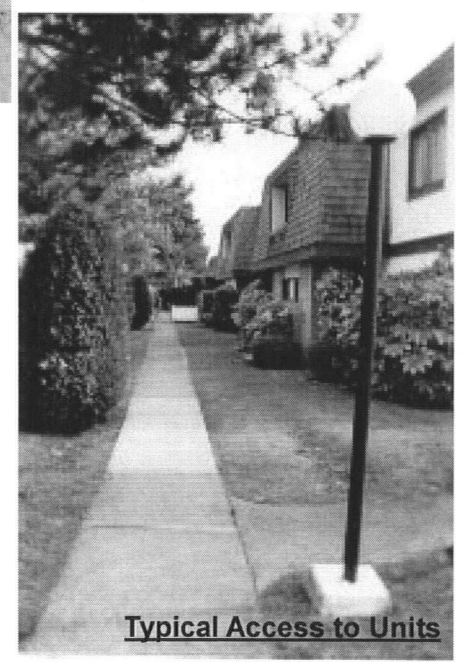
Typical Layout

a - 3 Bedroom Townhouse

b - 1/2 Bedroom Garden Apartment

● Basement Parking Entrance

NORTH



Typical Access to Units

Existing 3 Bedroom Town Houses

E6

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.

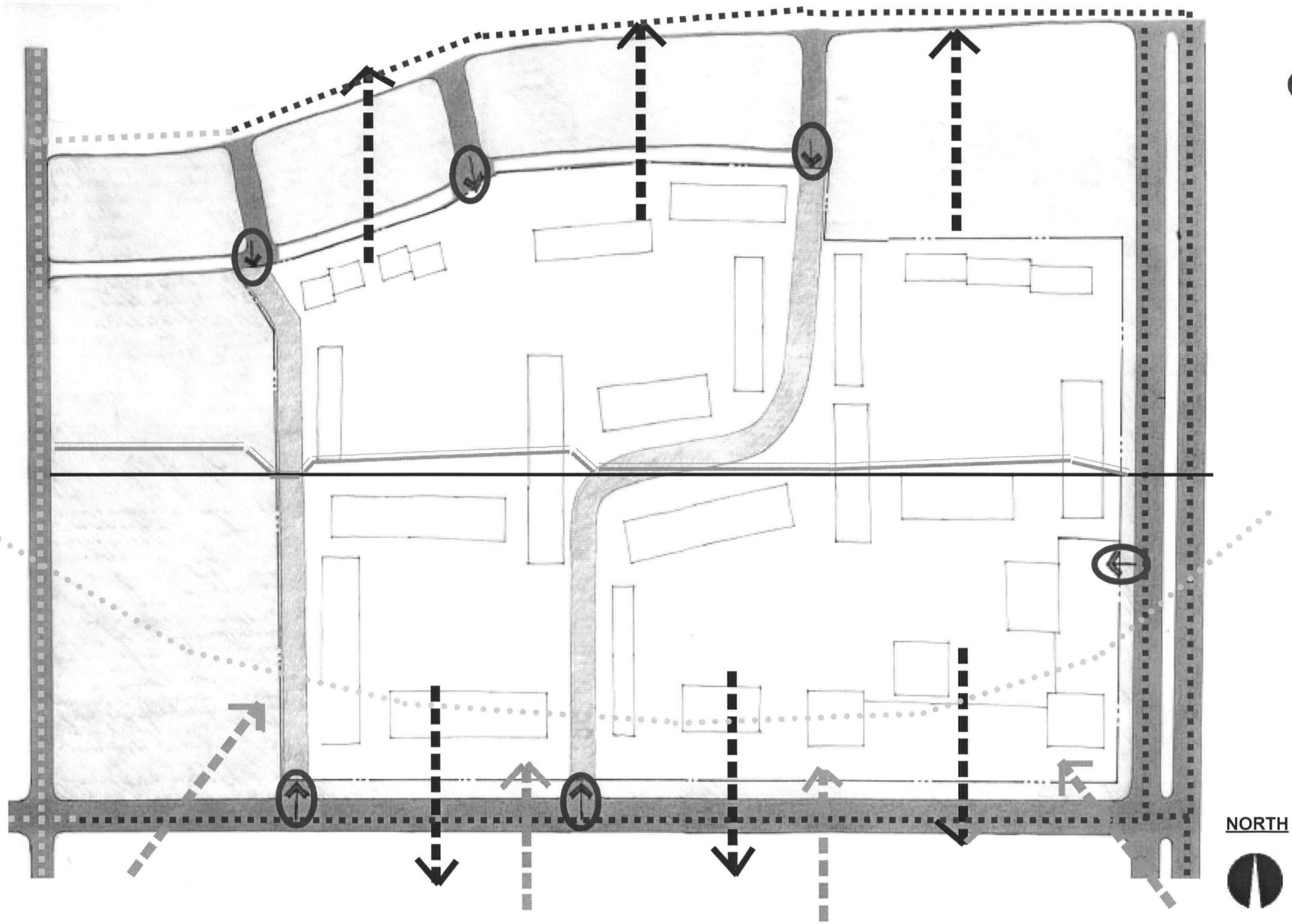
2. To separate unrelated activities from each other both in space and in time because it is extremely important to separate unrelated activities as much as possible, in both dimensions, so that they do not interfere with each other, not even accidentally.

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 amenitis and facilities have been docu



Index

- Major Entry Points
- Existing Land Profile
- Major View Directions
- Major Vehicular Approaches
- Minor Vehicular Approaches
- Wind Direction
- Sun Path

NORTH

Analysis - Existing Site Plan

P1

mented, in order to give an idea of the location and general context for the proposed design. (Refer Drawing # P1)

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 Elevation Looking South from 57th Avenue

Site Plan

Salient Features:

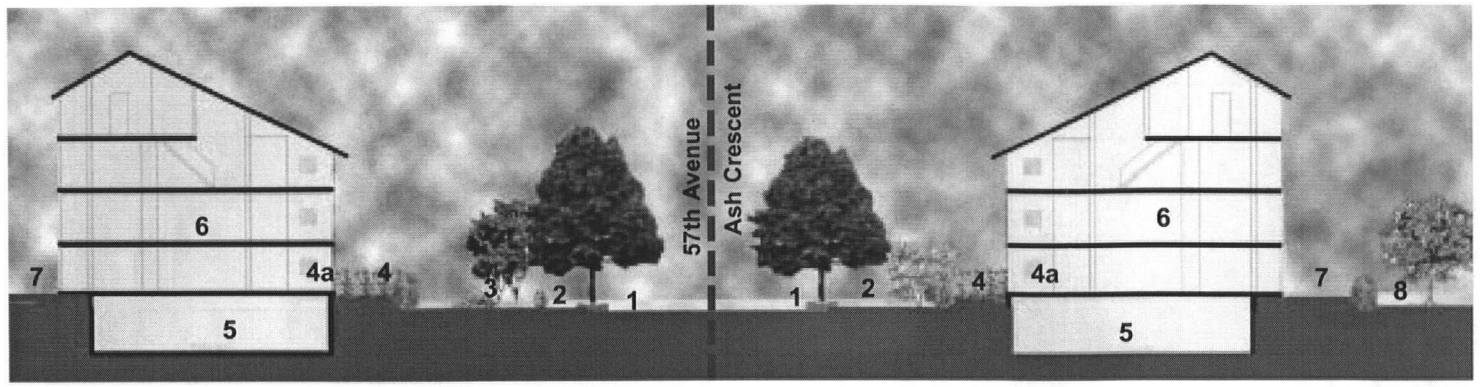
The proposed design occupies an area of approximately 22 acres at an overall density of 60 dwelling units per acre.

It consists of 4-storey stacked row houses arranged along the streets.

Parking is provided in the basement and on street.

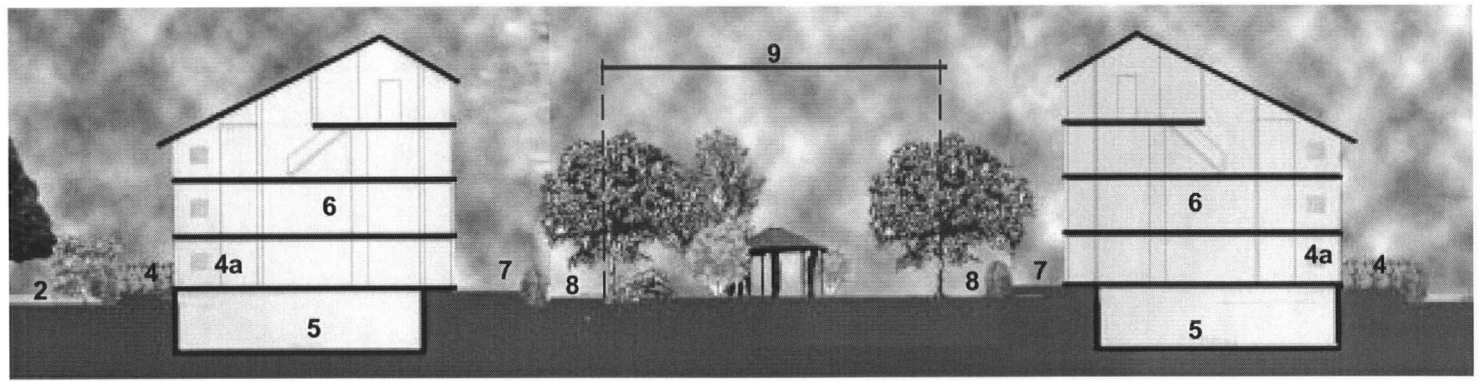
Primary access to the units is from the major streets.

Proposed Design

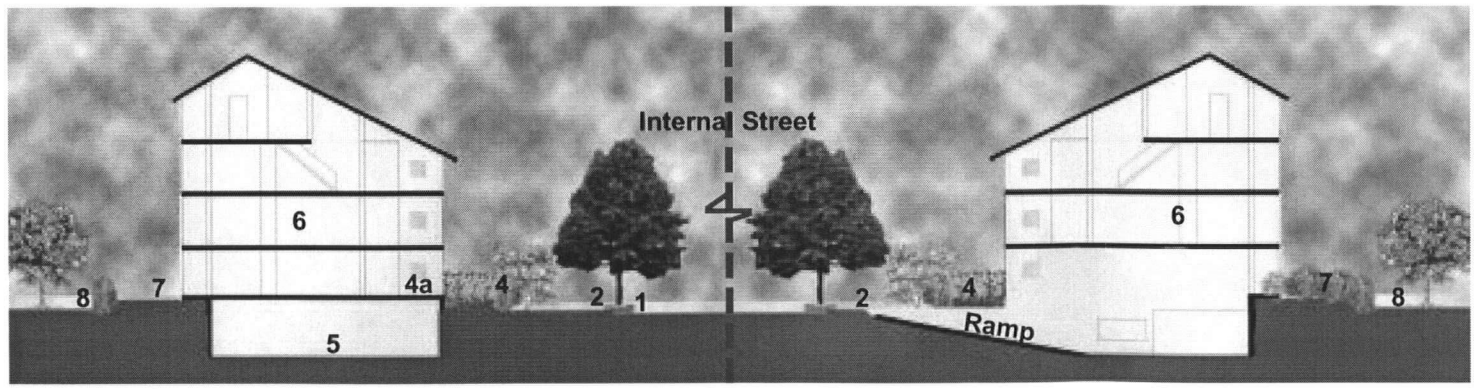


Typical Section Through an External Street

Typical Section Through an Internal Street



Typical Section Through a Green Space

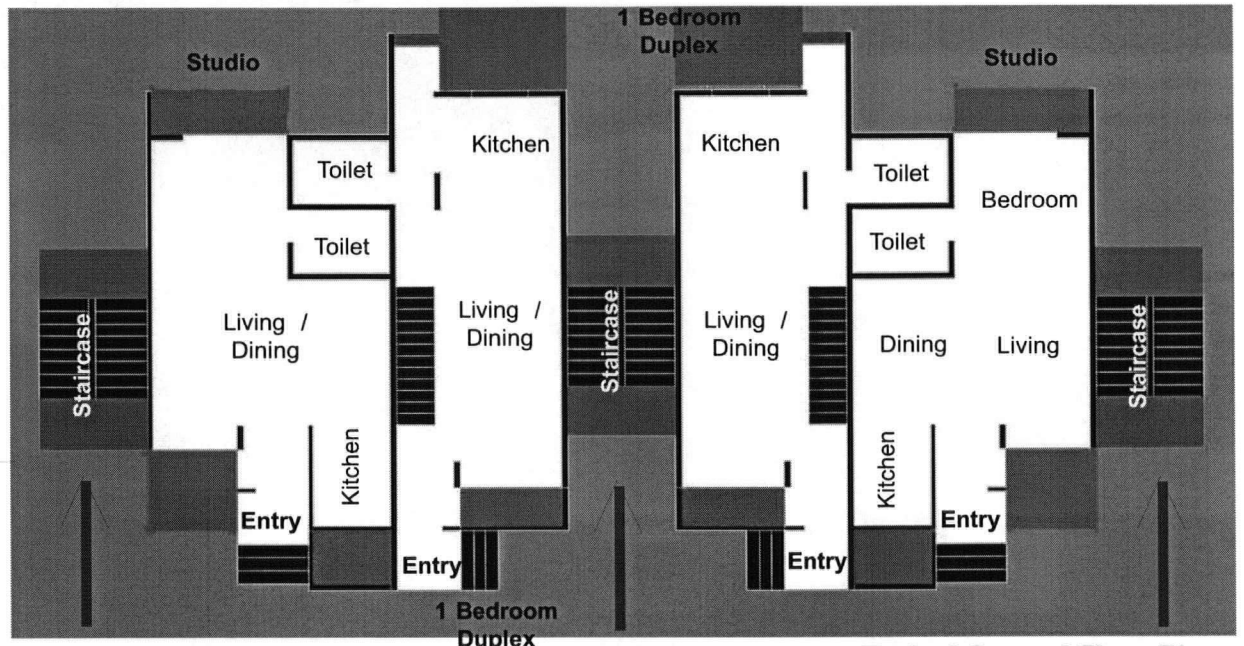


Typical Section

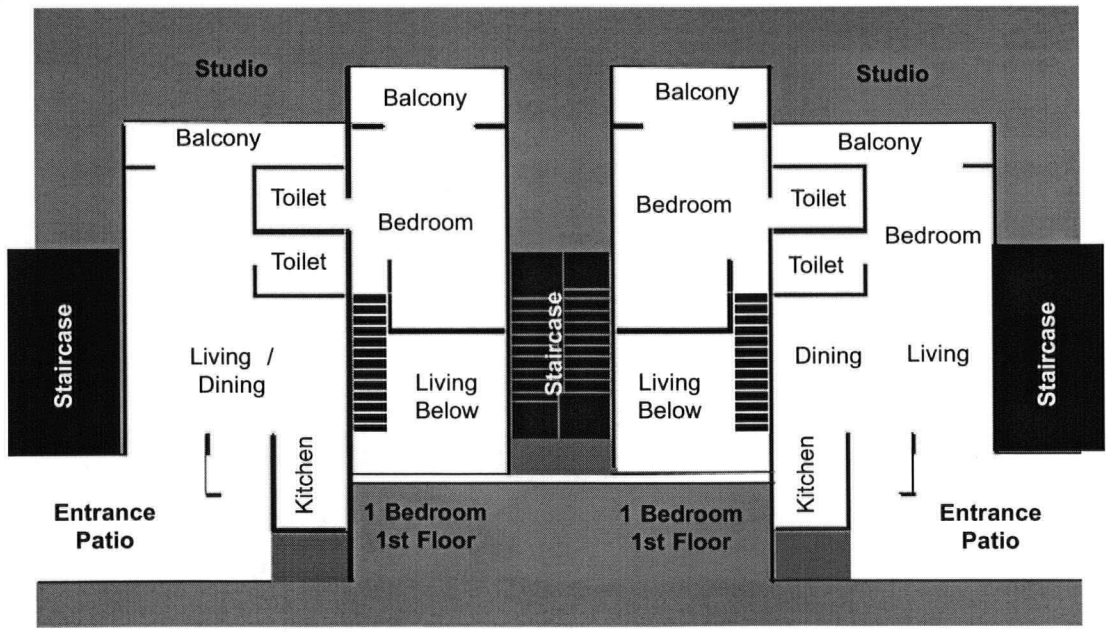
Index

1 - Street Side Parking
2 - Sidewalk
3 - Vegetative Buffer Zone
4 - Front Garden
4a- Front Entry Porch
5 - Basement Parking
6 - Dwelling Units
7 - Backyard
8 - Pathway
9 - Common Green Space

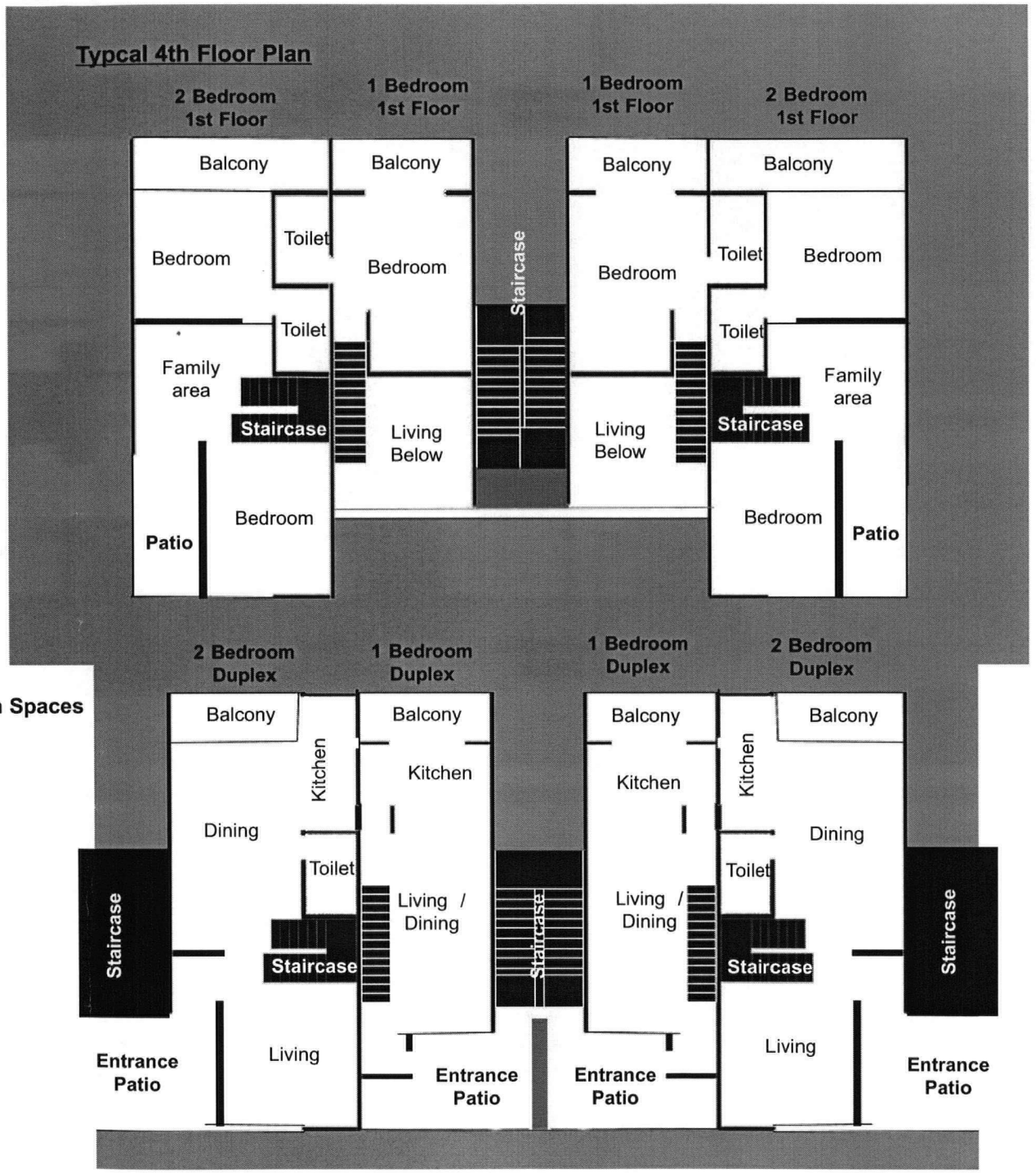
Proposed Sections



Typical Ground Floor Plan



Typical Second Floor Plan

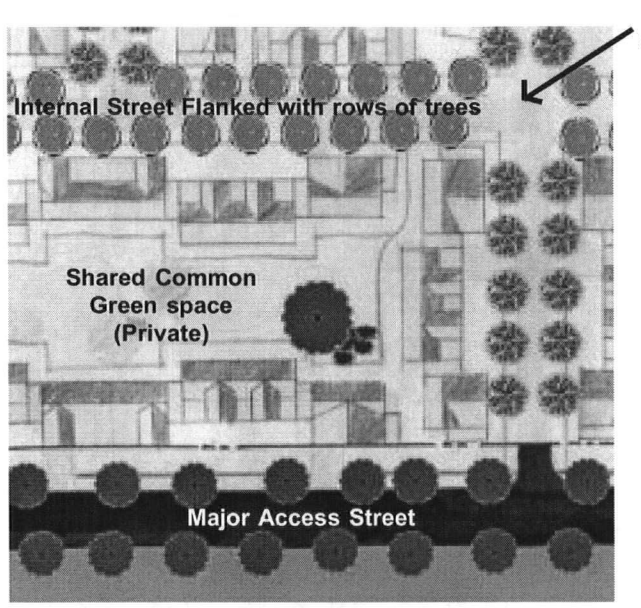


Typical 3rd Floor Plan

Index

Green Spaces

Proposed Unit Design

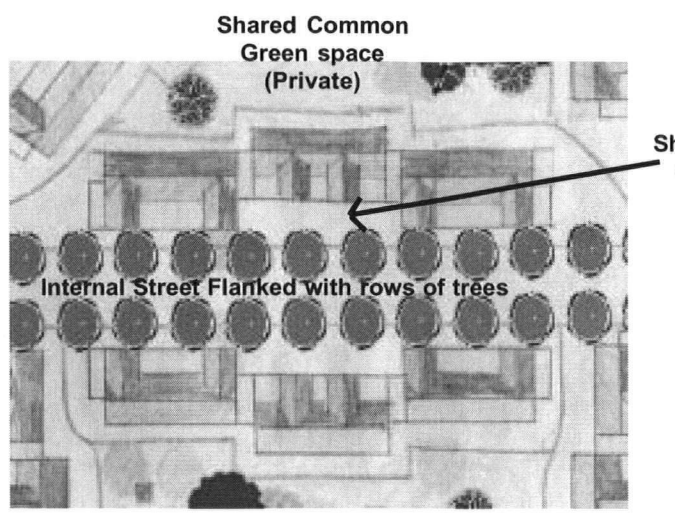


(A)

Units facing the major access streets:

The units are arranged in rows facing the streets with a deeper setback, as compared to the units arranged along the internal streets.

The visual access from the sidewalk into the private spaces has been maintained but only controlled physical access has been provided in the form of access through the building and not through pathways connecting the sidewalk to the internal pathways.

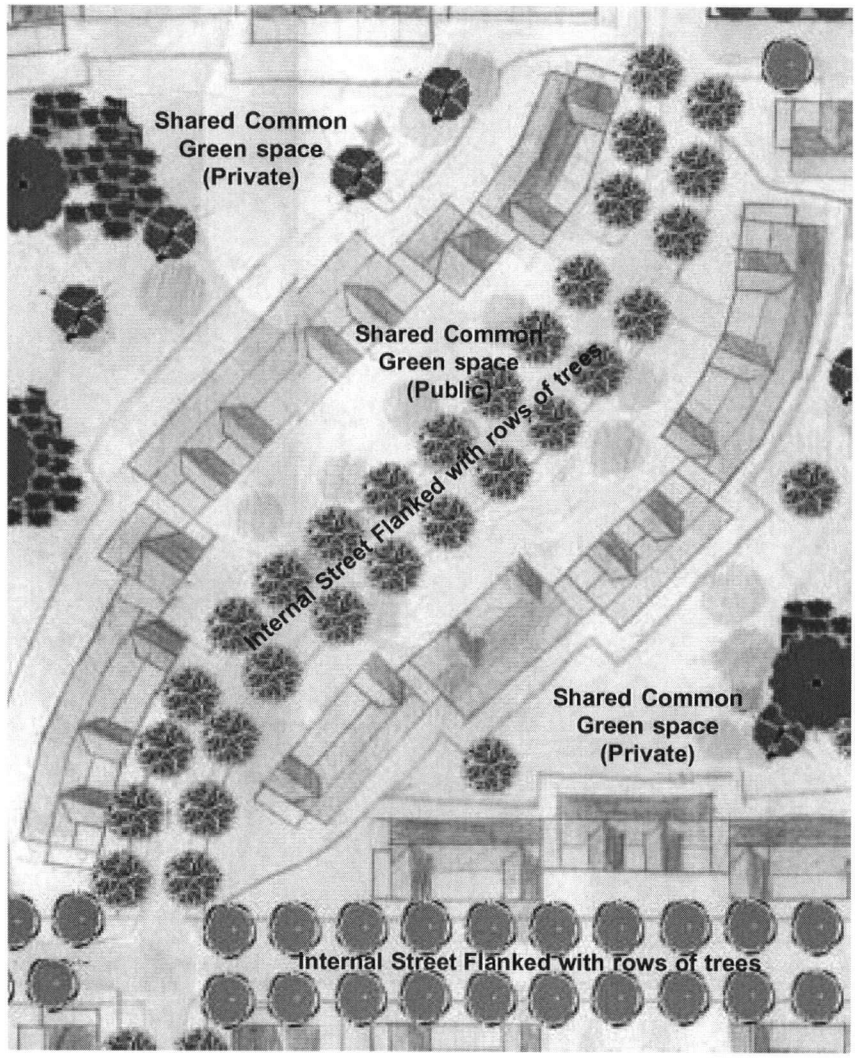


(B)

Units facing the internal streets: Option 1

The units are arranged in rows facing the streets with a lesser setback, as compared to the units arranged along the major access streets.

The visual access from the sidewalk into the private spaces has been maintained and direct physical access has been provided in the form of access through the building and through pathways connecting the sidewalk to the internal pathways.



(C)

Units facing the internal streets : Option 2

As in the Option 1, The units are arranged in rows facing the streets with varying setback to create a communal open space at the front of the units.

The visual access from the side walk into the private spaces has been maintained and direct physical access has been provided in the form of access through the building and through pathways connecting the sidewalk to the internal pathways.

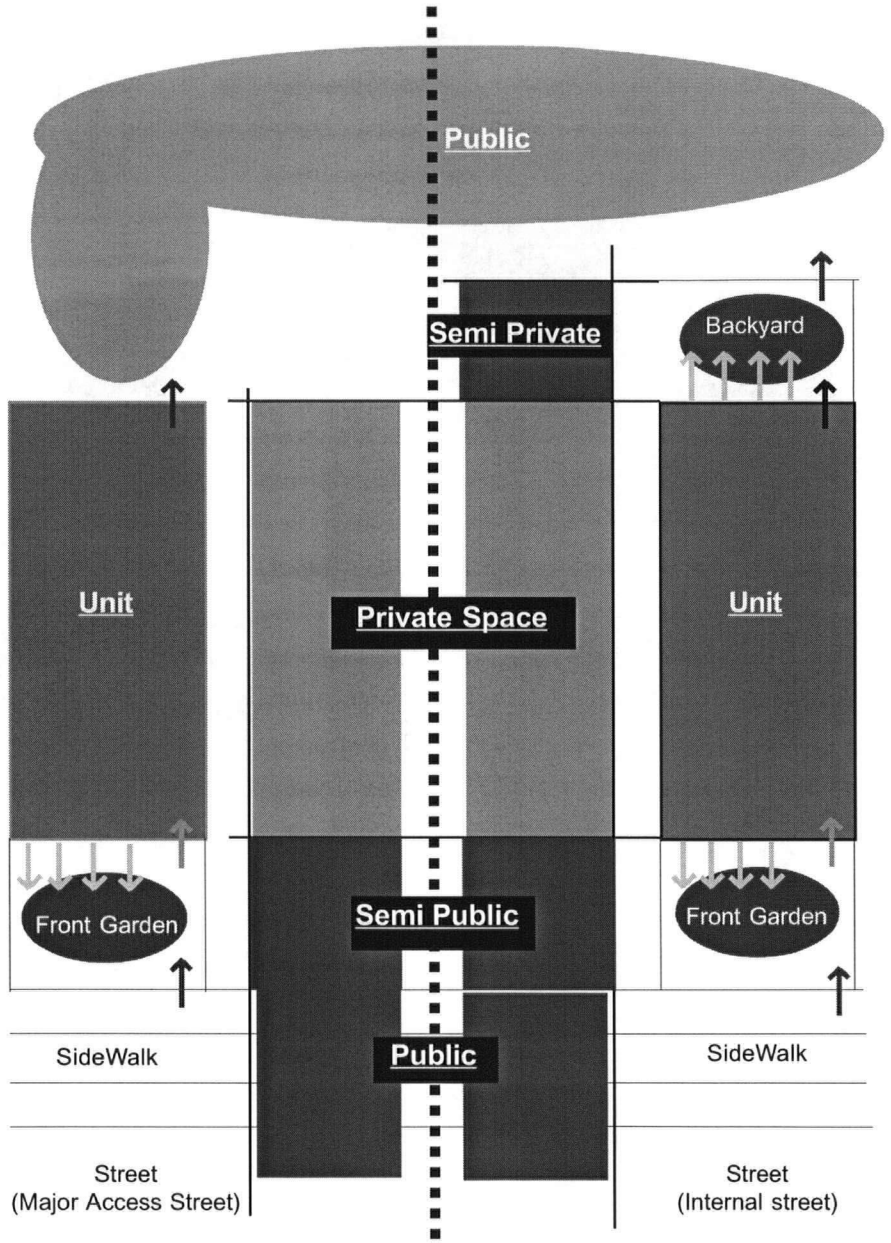
Proposed Unit Layouts

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.

Schematic Sketch 1 - Ground Floor Units

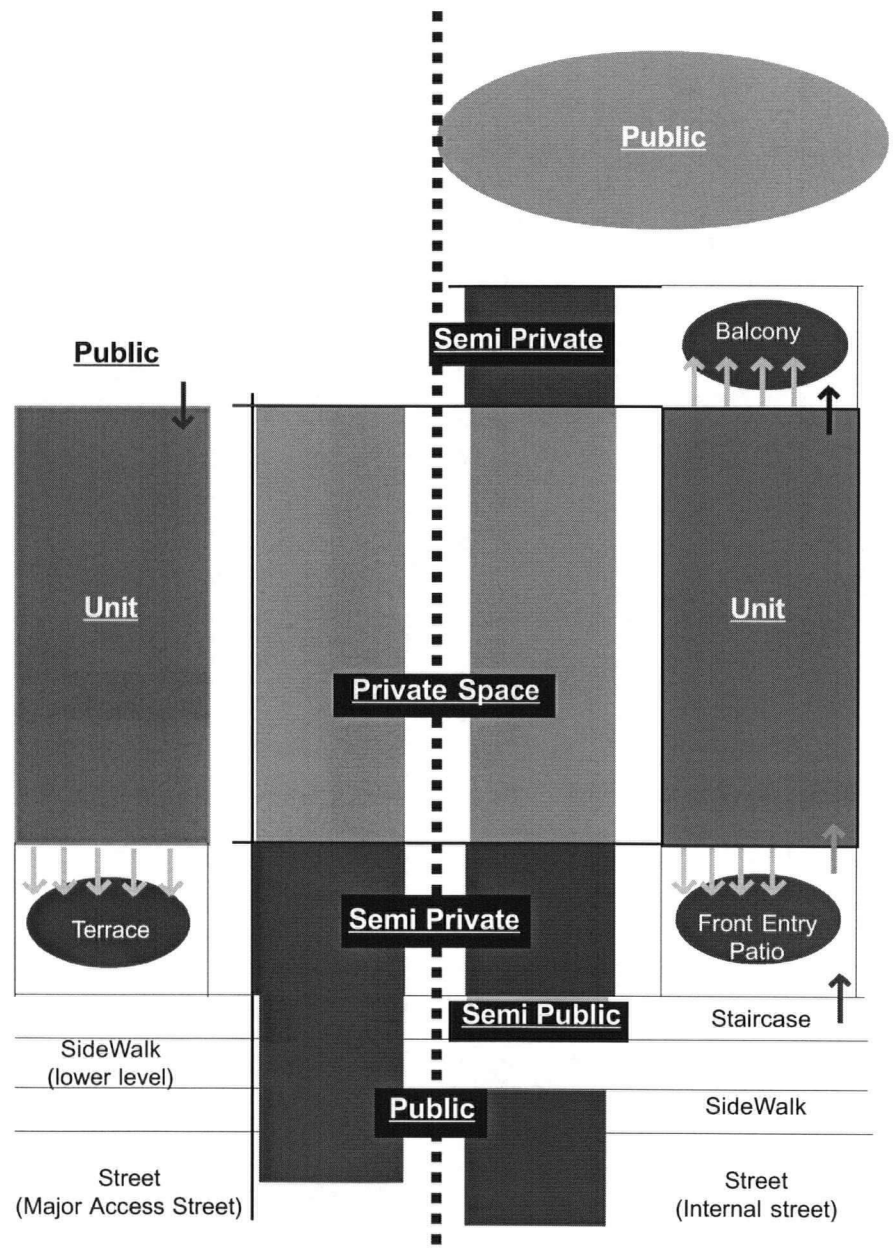


Current Trend **Proposed Plan**

Even though the unit design of the proposed design was inspired by the current trends in the unit design, the overall design of the scheme was more influenced by the recommendations of the study. In comparison to the current trends in high-density housing, the proposed design has some significant differences.

1. Most of the current trends advocate the use of high-rise apartments mixed with low-rise town houses. Whereas, the study recommends a maximum building height of 4 storeys because according to the literature study (refer Section I) high-rise apartments are not a good environment to raise a young family. Based on this fact, the proposed design uses the stacked row houses as the prefered building type for the project.
2. Leaving aside the units in the apartment buildings, if we look at the unit plans of some of the town houses and walk-up units (refer to schematic sketch 1), in the existing and the proposed design, we notice that the units on the ground floor have individual entrance patios, which are accessible from the living space. However, the existing unit designs lack the transition space between the public street and the internal spaces of the units.
3. As seen in the sketch 1, the basic layout of the units in the proposed design is same as that of the current unit designs, but the proposed unit design has a better hierarchy of privacy.
4. The proposed unit has a better visual access to the public spaces on the private side of the unit, thus encouraging the use of those common spaces.
5. In case of the current designs the front entry of the units open on to the major access streets whereas, in the proposed design the streets are internal streets, which are less public than the major access streets.
6. In the proposed design, even the units on the upper floors have an entrance patio, whereas in the current designs the upper floor units are accessed through shared corridors.

Schematic Sketch 2 - Upper Level Units



Current Trend **Proposed Plan**

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 :

	Existing	Proposed
Site Coverage	25%	40%
Density (DU/acre)	30	60
Floor Space Ratio	0.76	1.1
Total # of units	676	1100
# of Street Access	3	7
# of units / cluster	40	24-28
% of ground oriented units	20%	35%
Total Street Length (m)	500	1300
Pathways (m)	2000	6000
Street Intersections (#)	3	13
Total Parking (#)	1000	1000
Green / Open Spaces (acres)	13	8.5

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.

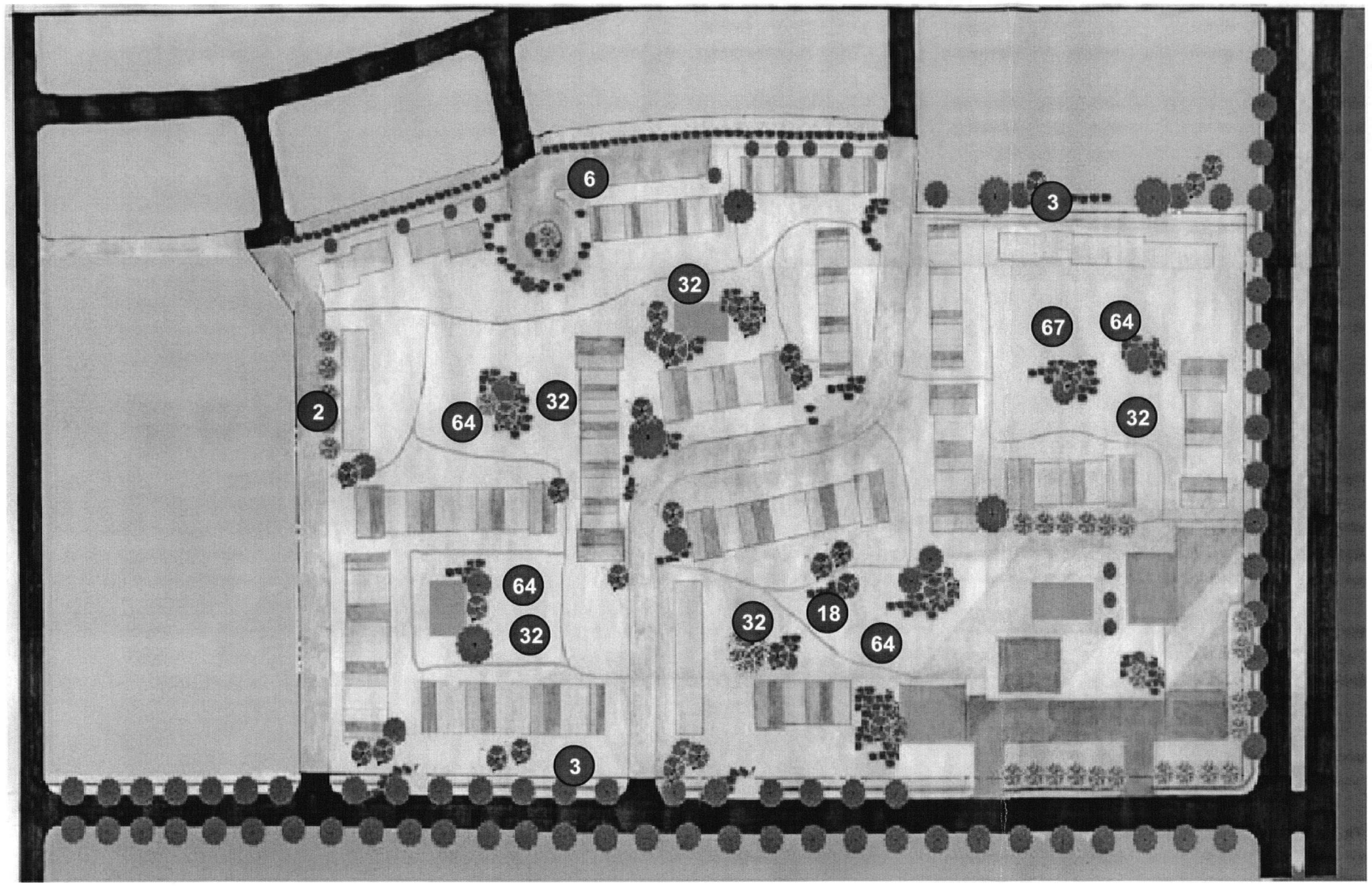
d. The streets are oriented in the NS and EW directions (49) thus assisting in the movement of pedestrians and vehicles through the site.

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).*

Note : The numbers indicated on the plan refer to the numbers of the design solutions(section 3.03) that the design satisfies.



NORTH

Unit Layout Plan

This drawing of the existing design illustrates the fact that the existing design does satisfy certain criteria established in Section 3.03. For example:

i. The existing design has soft permeable edges (3) and also has common gathering spaces (6) to encourage interaction.

ii. The open spaces are provided in close proximity to the units (32) to encourage the use of outdoor open space.

iii. The pathways are arranged to meet the predictable movement patterns (18) of the people.

iv. The spaces have direct visual access from the units (64), which ensures the safety of the outdoor spaces.

v. The design has some spaces, which are small and easily manageable (67).

However, there are certain aspects of design, which have been overlooked in the existing design, which affect the success of the other design interventions, mentioned above. Some of the aspects, which have been ignored, are;

i. The soft edges and common meeting areas lack accessibility and the sense of security, which is very essential to encourage the use of the space.

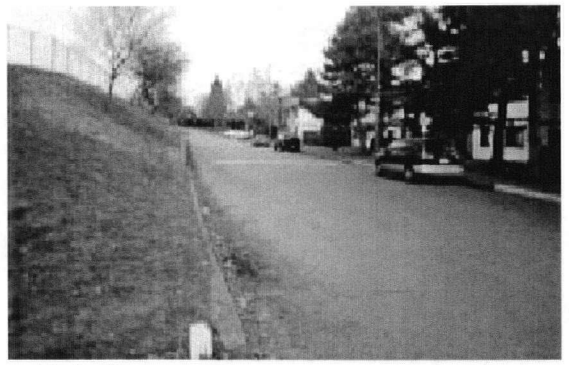
ii. The open spaces and pathways lack definition, human scale and hierarchy of privacy.

iii The arrangement of pathways and open spaces is such that it affects the internal privacy of the units.

iv. The units lack individuality because of the lack of distinct streets entrances to the units.

Existing Site Design

(A) View of a Peripheral Street

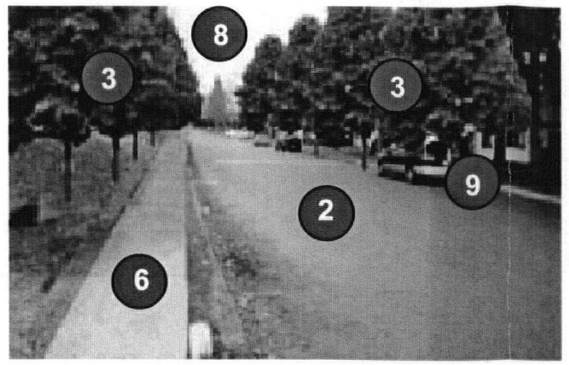


Existing

The existing streets are very wide and are not pedestrian friendly.

The separation from the neighbourhood in the form of the raised side is too strong and isolates the neighbouring areas from the housing.

There are no sidewalks along the streets.



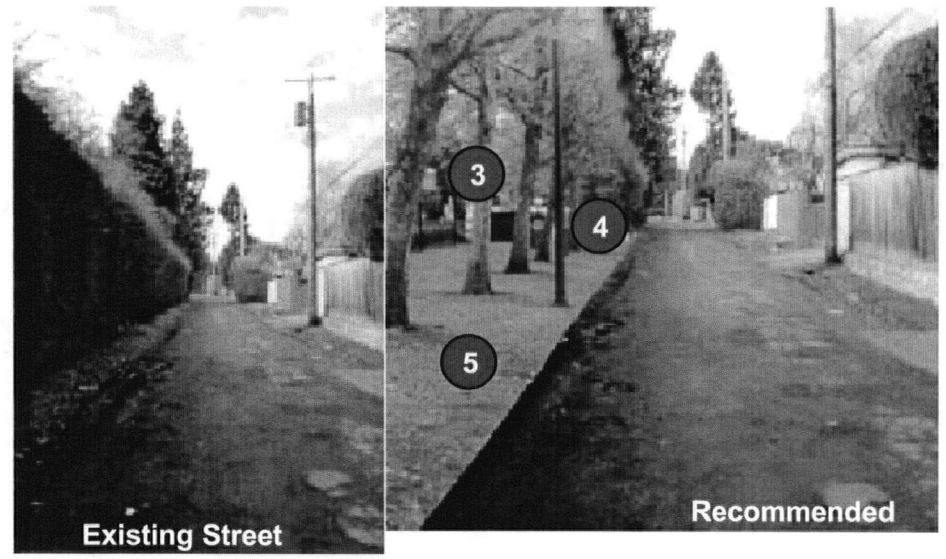
Recommended

The following are some of the suggested changes:

The provision of sidewalks along the streets (6) would encourage the pedestrian movement.

The row of tree (3) defines the streets and the view (8) along them and also helps in reducing the perceived width of the road (2).

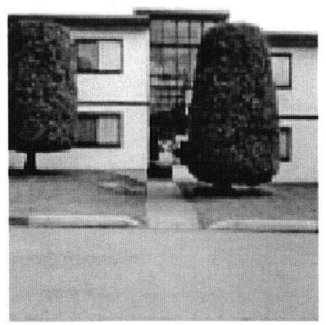
(B) View of a Neighbourhood Street on the north Side



The existing boundary between the housing and the neighbouring street is defined by a row of tall hedge with no visual or physical access. This renders the neighbourhood street dead and compromises the safety.

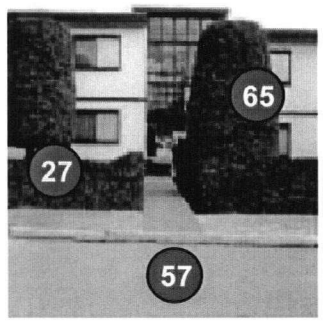
A simple design intervention of providing a more soft edge (3) which allows visual access (4) and marks the threshold (5) between the site and the neighbourhood can increase the use of the street and improve the safety on the street. It may also result in better social interaction between the site and the neighbourhood.

(C) View of a Typical Entrance to the Garden Apartments



Existing

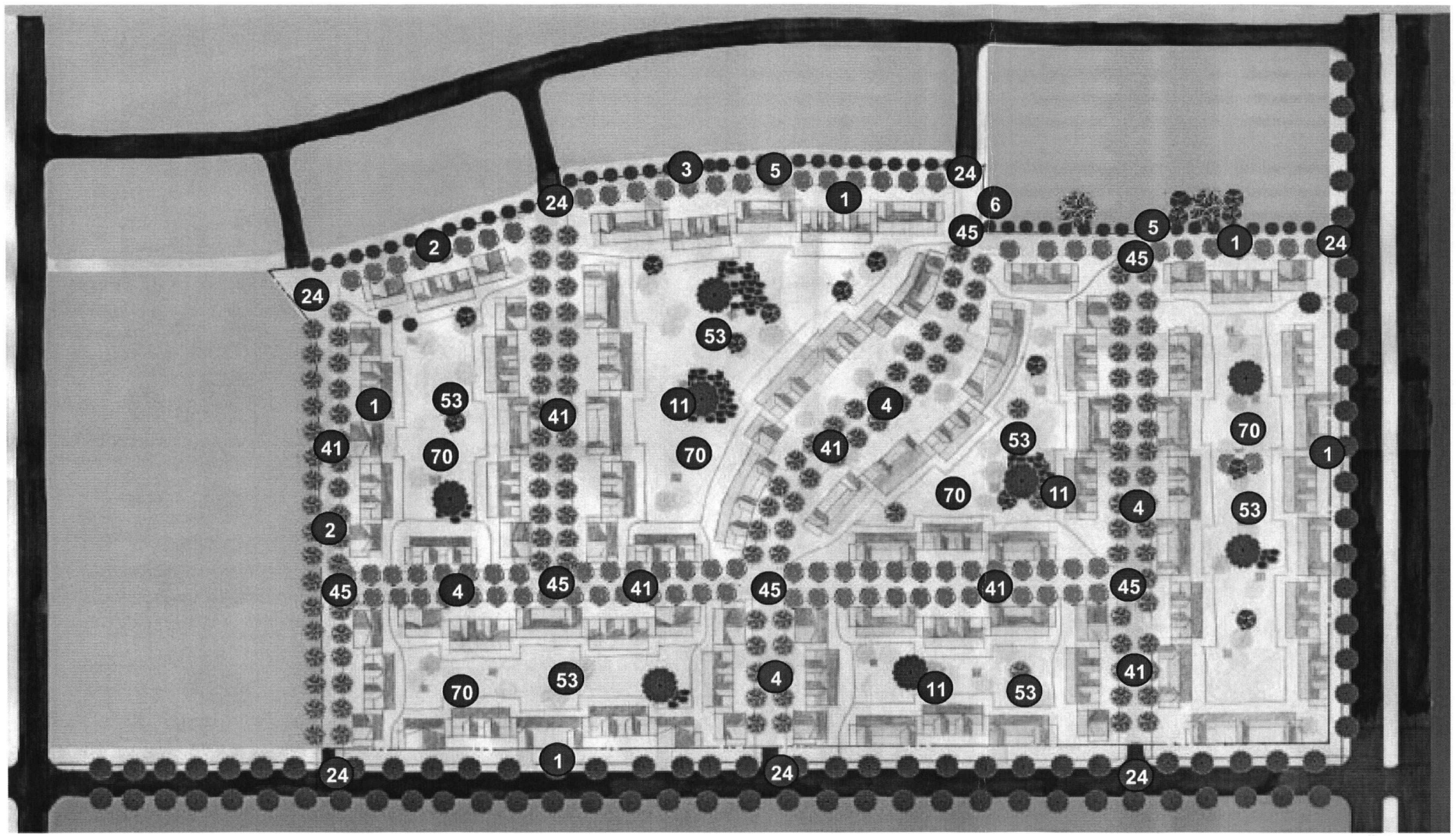
The existing entrances to the units lack definition and the transition from the public to the private domain. It can be improved by:
Providing a row of hedge (27) to define the path of entry and also to demarcate the boundary of the adjacent units without affecting the visual accessibility from the units.
Providing a level change (57) in the form of a step acts as a symbolic boundary between the public and the private domains.



Recommended

Note : The numbers indicated on the plan refer to the numbers of the design solutions(section 3.03) that the design satisfies.

Note : The numbers indicated on the plan refer to the numbers of the design solutions(section 3.03) that the design satisfies.



Unit Layout Plan

Design Highlights

The proposed design has higher length of internal streets with higher number of street access (24) into the site, which maximizes the number of units which have a street frontage.

Each of the streets have a different streets character(41) which gives a sense of individuality to the units and the group.

The pathway system accommodates the predictable movement pattern of the residents (44) to encourage the use of the pathways.

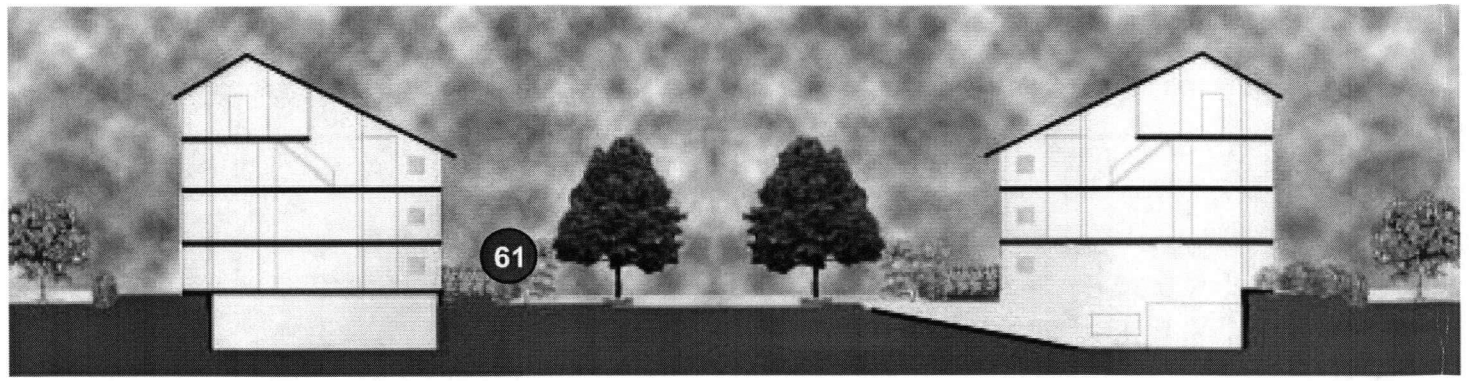
The open spaces are in close proximity to the units (53) and are varied in size and shape to create interest in the landscape and also assist in the maintenance (70).

The trees and other landscape elements have been used judiciously to create useable outdoor spaces (11).

The elaborate network of streets sidewalks and pathways ensure the easy accessibility of the various spaces within the scheme and in the neighbourhood.

NORTH

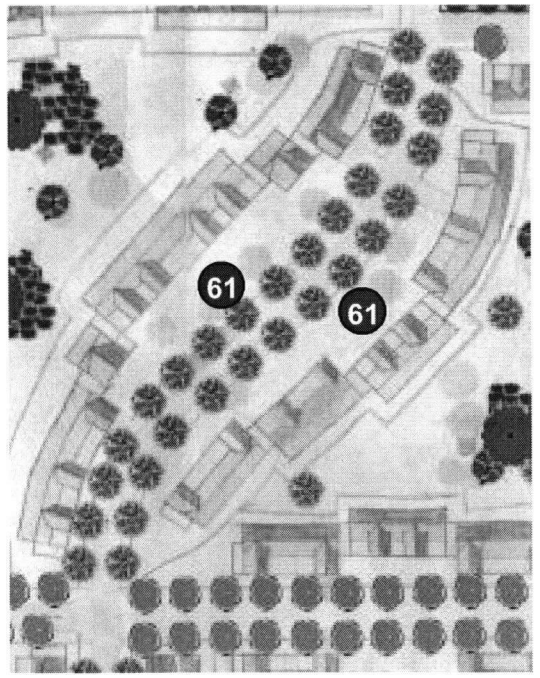
Proposed Site Design



Units facing the internal streets:

The units are arranged in rows facing the streets with a lesser setback, as compared to the units arranged along the major access streets.

The visual access from the sidewalk into the private spaces has been maintained and direct physical access has been provided in the form of access through the building and through pathways connecting the sidewalk to the internal pathways.



Units facing the internal streets :

The units are arranged in rows facing the streets with a lesser set back as compared to the units arranged along the major access streets.

The visual access from the side walk into the private spaces has been maintained and direct physical access has been provided in the form of aceess through thebuilding and through pathways connecting the sidewalk to the internal pathways.

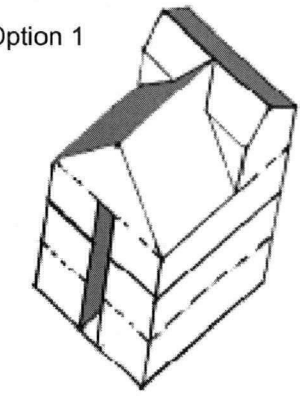
Units facing the internal streets :

The units are arranged in rows facing the streets with a lesser set back as compared to the units arranged along the major access streets.

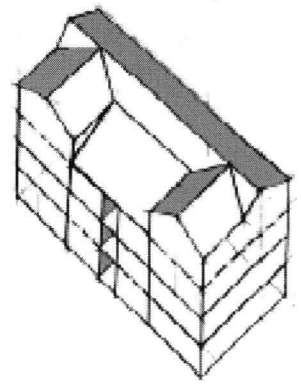
The visual access from the side walk into the private spaces has been maintained and direct physical access has been provided in the form of aceess through thebuilding and through pathways connecting the sidewalk to the internal pathways.

Proposed Unit Layouts

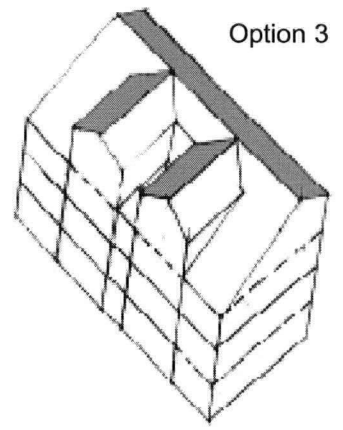
Option 1



Option 2



Option 3



6.01.1(b)
Unit Design and Layout

Quantitative:

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

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:

	Existing	Proposed
Street dimensions		
Right of Way (m)	18	18
Carriageway (m)	12	6
Sidewalks (m)		1300
On street Parking (#)	100	250
Street Trees (#)		1 / parking
Street Lights(#)		1 / parking

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.

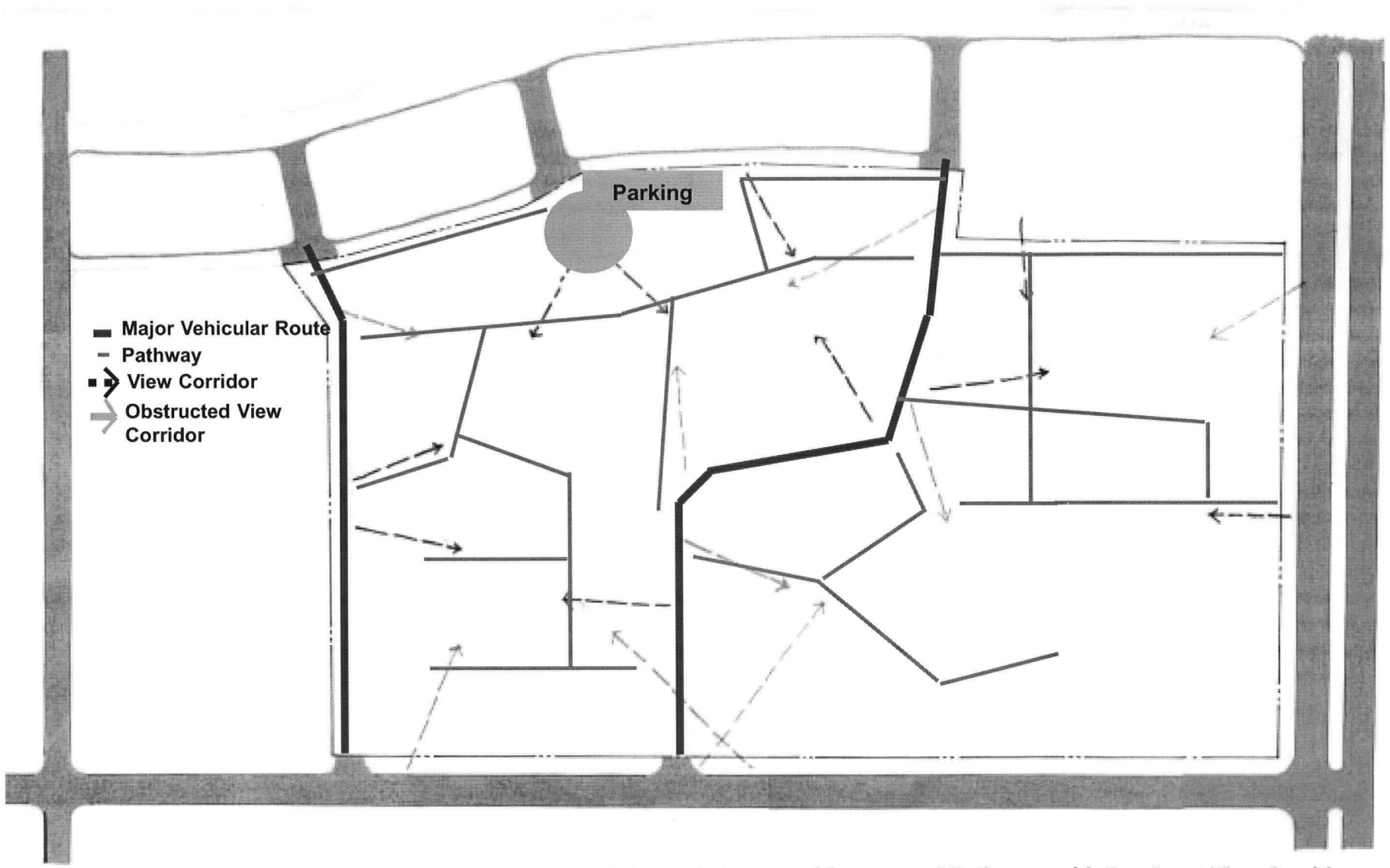
c. The different material treatment for the parking lane and the streets (6) acts as an effective traffic calming device (40) in addition to giving a perception of a narrower street (55). This reduces the perception of wide separation between the 2 sides of the streets and encourages across the street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



Schematic Layout of Streets and Pathways with Dominant View Corridors

NORTH

The existing design does not have an elaborate network of peripheral streets, internal streets and intersections to facilitate easy vehicular access to all the units.

The design doesn't have any sidewalks, which discourages the pedestrian movement on the streets.

The pathways connecting the streets to the internal units lack definition and do not assist in way finding due to the lack of landmarks and variety in the landscaped spaces.

The pathway system does not accommodate the predictable movement pattern of the residents because the view corridors do not closely follow the pathways network within the site. This hinders the easy movement of people within the site and makes way finding very difficult.

The network of streets and the street elements lack the connection between the site and the neighbourhood.

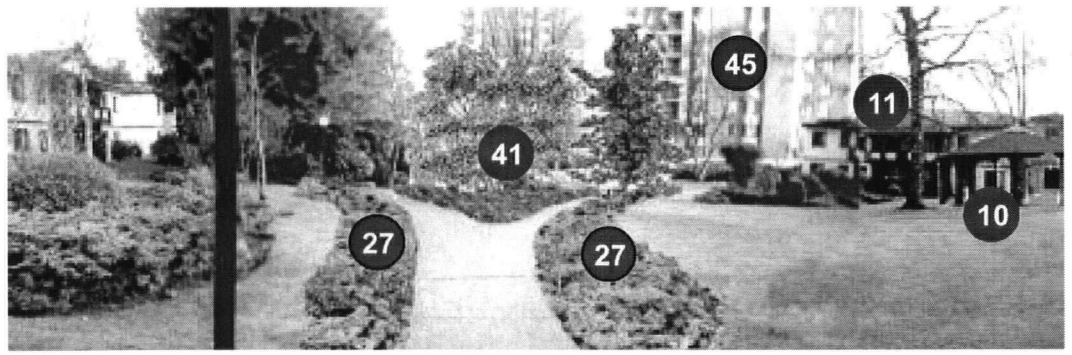
The design had ample opportunity to create interesting view corridors but the views have been obstructed by undue use of grade changes.

Existing Circulation Network

(A)

Existing

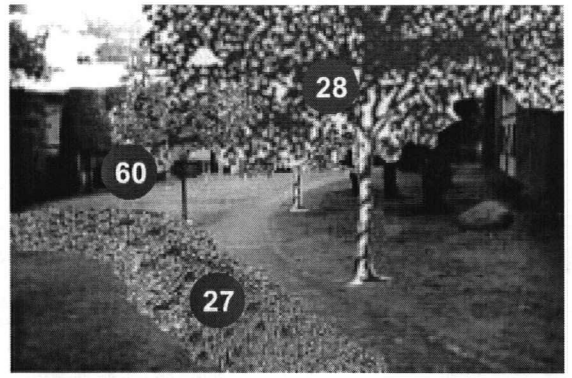
The large undifferentiated open spaces lack the human scale, which encourages the use of these spaces. The spaces are more like setting to the units than being a useable space.
The provision of a row of shrubs (27) along the pathways defines the pathways as well as the green spaces.
The provision of small structures (10) and or trees to define spaces (11) for groups to interact can encourage the use of the outdoor space.
The provisions of trees to act as landmarks can create interest along the pathways and also assist in way finding (41 & 45).



Recommended

(B)

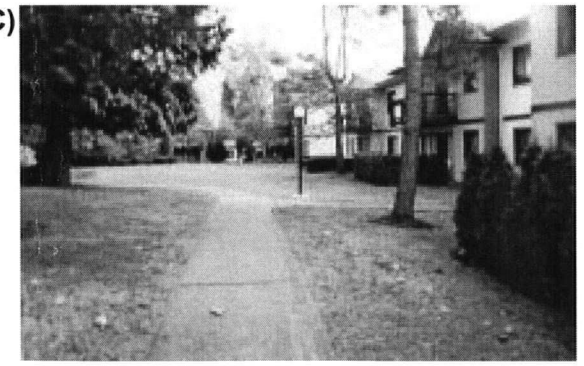
Existing



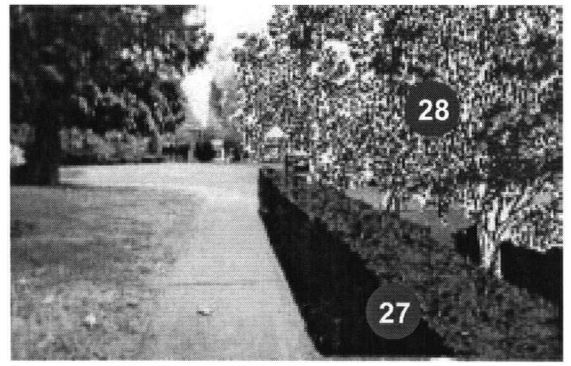
Recommended

In the above situation a provision of a row of shrubs (27) along the pathway defines the pathway in addition to defining the boundary between the public and the private domains.
The tree (28) defines the pathway space in addition to acting as a visual barrier between the pathway and the adjacent units, thus maintaining the privacy of the internal spaces of the units (60).

(C)



Existing



Recommended

The grade difference between the public pathways and the adjacent private spaces should be such that the private spaces are always at a vantage point. Especially when the pathways are very close to the private open spaces.
A row of shrubs and trees could be used to mark the boundary between the public and the private domains and also to protect the privacy of the internal space.

Note : The numbers indicated on the plan refer to the numbers of the design solutions(section 3.03) that the design satisfies.

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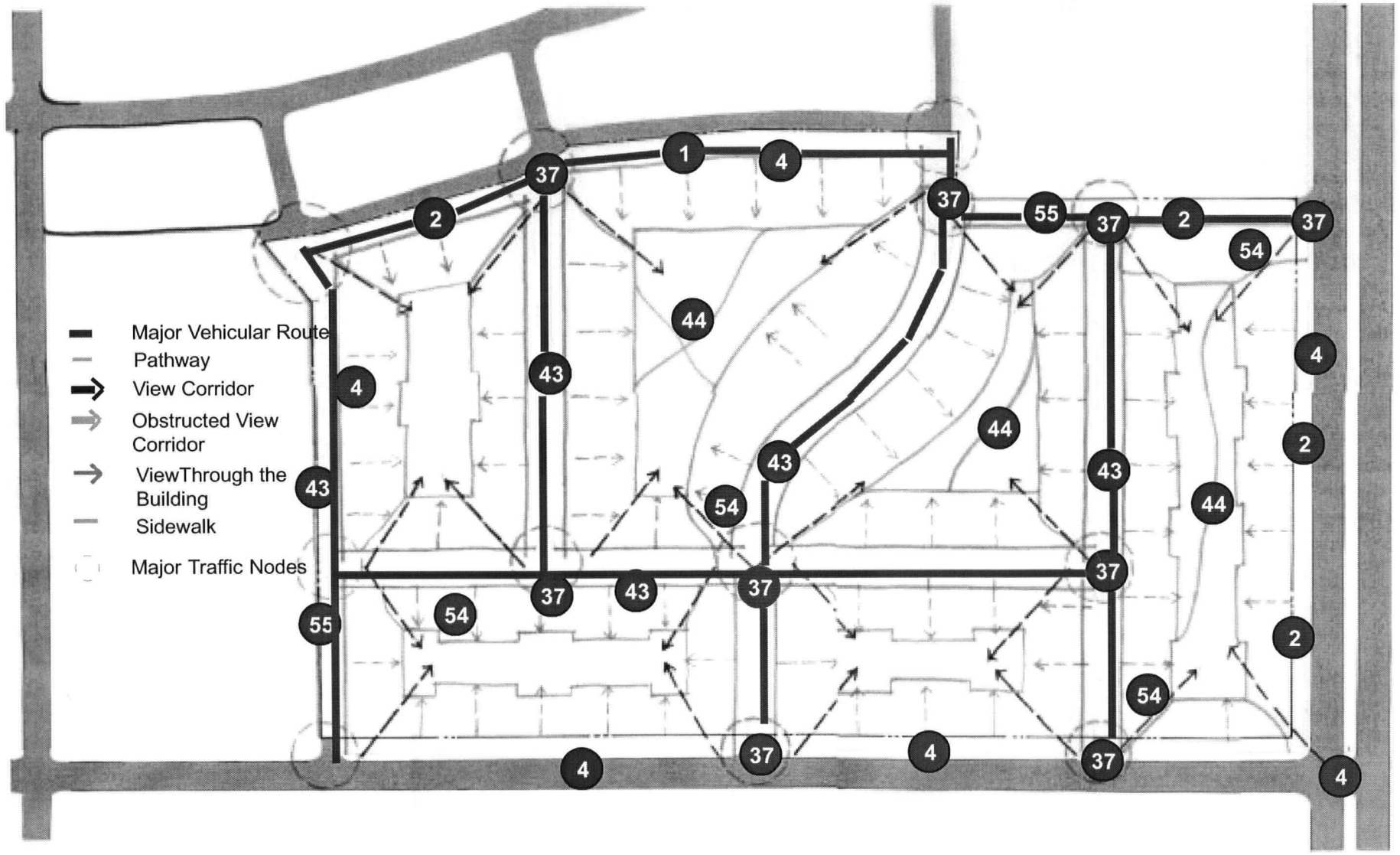


(B) Streets, Sidewalks and Pathways Layout

NORTH

Design Highlights

The proposed design has an elaborate network of peripheral streets (1), internal streets (43) and intersections (37) to facilitate vehicular movement through the site.

The design also has an elaborate network of sidewalks (43) and pathways (54) to facilitate safe pedestrian movement.

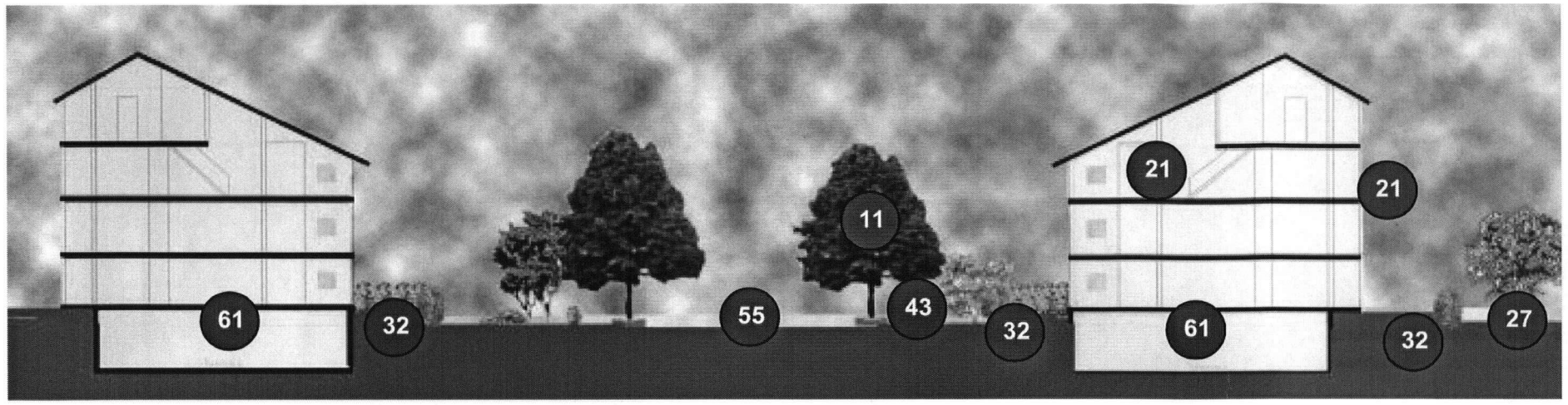
The pathway system accommodates the predictable movement pattern of the residents (44) to encourage the use of the pathways.

The network of streets and the street elements maintains the visual connection between the site and the neighbourhood (2, 4).

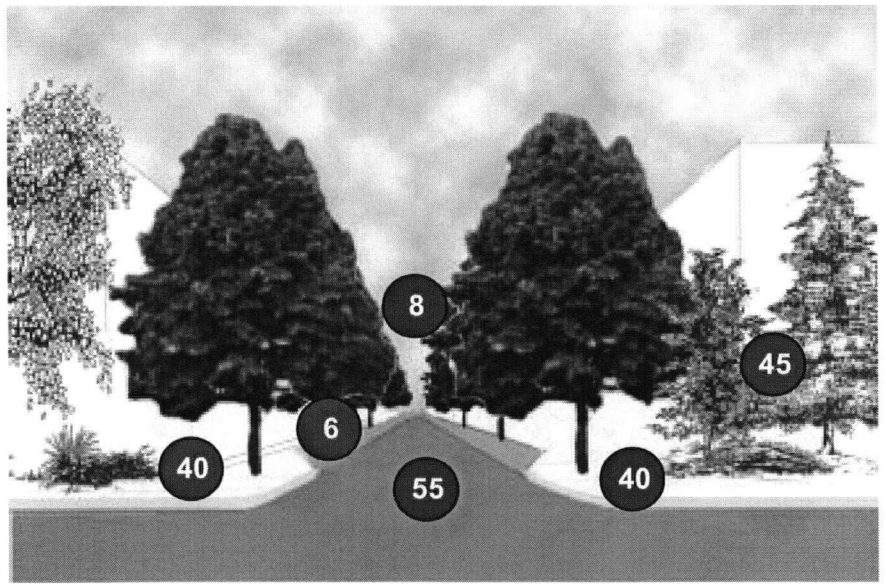
Another major aspect of the design is that the view corridors closely follow the pathways network within the site. This helps in the movement of people within the site and is also helpful in way finding.

Proposed Circulation Network

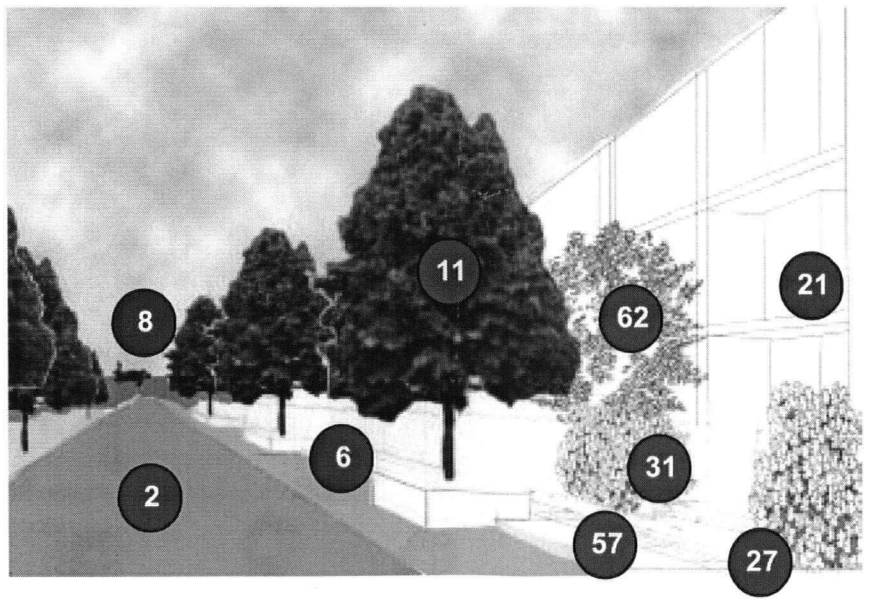
(A) Typical Section Through the Street



(B) View of a Typical internal Street



(C) View of a Typical Street



Some of the major highlights of the streets in the proposed design are:

The narrow carriageways (55) with on street parking (6) make the streets more pedestrian friendly and can encourage pedestrian movement.

The sidewalks along the streets (43) are helpful in separating the pedestrian and vehicular traffic.

The rows of trees define social spaces below them (11) in addition to creating strong directional views and vistas (8).

Carefully located landscape elements (45) can act as landmarks and assist in way finding.

Adequate traffic calming measures (40) make the streets safer for the pedestrians

The visual accessibility of the sidewalks, streets and pathways (21) increases the safety of those spaces.

The open spaces close to the units (32) act as buffer between the public streets and the private spaces of the units.

A minor grade change (57) can act as a boundary defining elements.

Stepped entrance (31), row of shrubs (27) and low canopy trees help maintain the privacy of the units in addition to acting as a buffer between the public and the private spaces.

Note : The numbers indicated on the plan refer to the numbers of the design solutions(section 3.03) that the design satisfies.

6.01.2(b)
Views and Vistas

Quantitative:

	Existing	Proposed
Views		
Along the streets	20	250
Along Pathways	15	100
Vistas		
Along the streets	4	12
Along Pathways		20

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.

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).*

6.01.3
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:

	Existing	Proposed
Total area (acres)	13	8.5
Major Activity areas (#)	6 (undifferentiated)	6 (subdivided)
Structures(#)		
shelters	1	28
benches / street elements		50
play equipment		1 / playarea

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 :

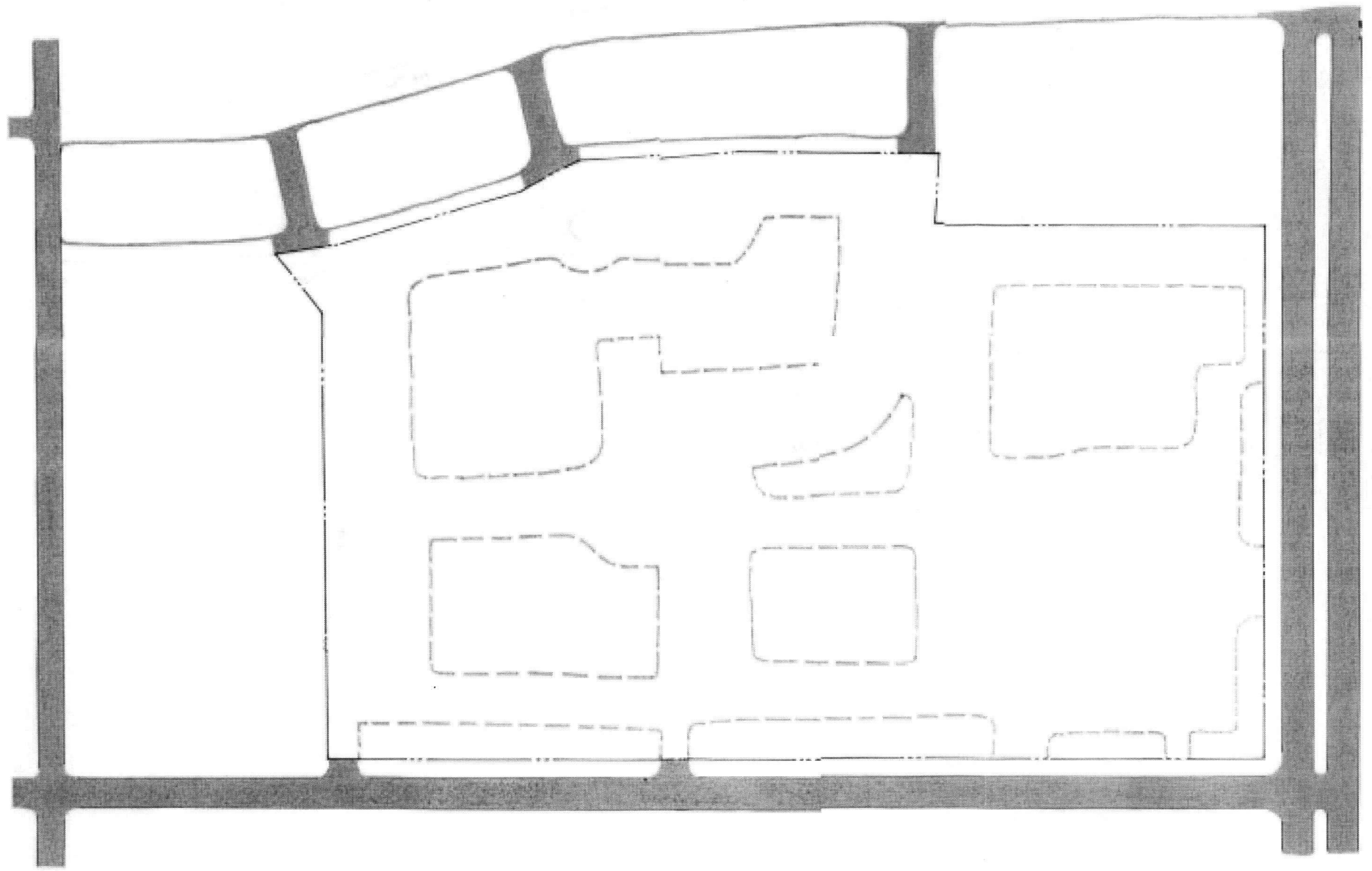
a. The open spaces provided within the scheme are very functional and user oriented (32, 10, 27, 11)*.

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).

Note: Refer to pp. 99, 100, 101 & 102 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).*



Open Space Distribution Plan

The Existing design doesn't provide a distinct front and back yards to the units.

The open spaces in the existing design are very large in size, undifferentiated and do not have a uniformly defined hierarchy of privacy.

When viewed in conjunction with the existing unit designs, the design lacks the uniformity in providing similar quality of outdoor spaces to all the units.

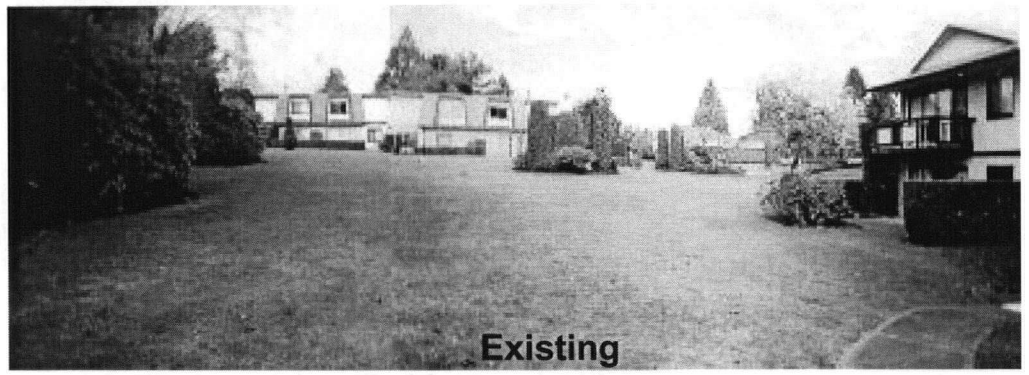
The existing outdoor spaces lack the variety in outdoor spaces due to lack outdoor structure, landscape elements and space defining elements like trees, shrubs etc.

The private open patios and the balconies lack the desired level of privacy due to the proximity to the public pathways and a lack of buffer elements, like trees, shrubs etc., between the public and private spaces

The on street parking spaces have not been integrated into the open spaces, which might encourage the multiple use of the parking space.

NORTH

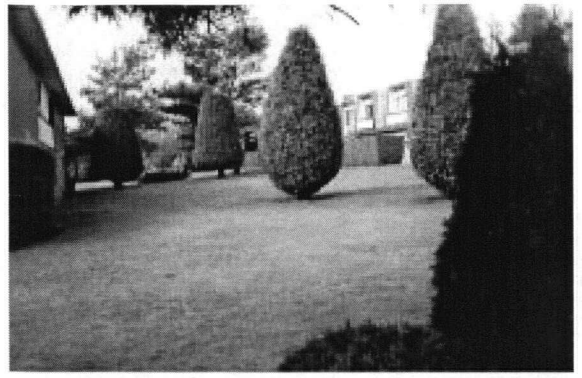
Existing Open Space Layout



The undifferentiated open spaces adjacent to the private outdoor space are a common feature in the existing design. This kind of situation discourages the residents to use the private outdoor spaces and at the same time it discourages the other people to use these spaces for leisurely activities.

The recommended solution would be to provide the open space close to the units (32) but maintain the degree of privacy between the private outdoor spaces (52) through the use of vegetative buffers (58).

The green spaces should have good access through well-defined pathways (27), which do not interfere with the privacy of the units (60).



Existing Open Spaces

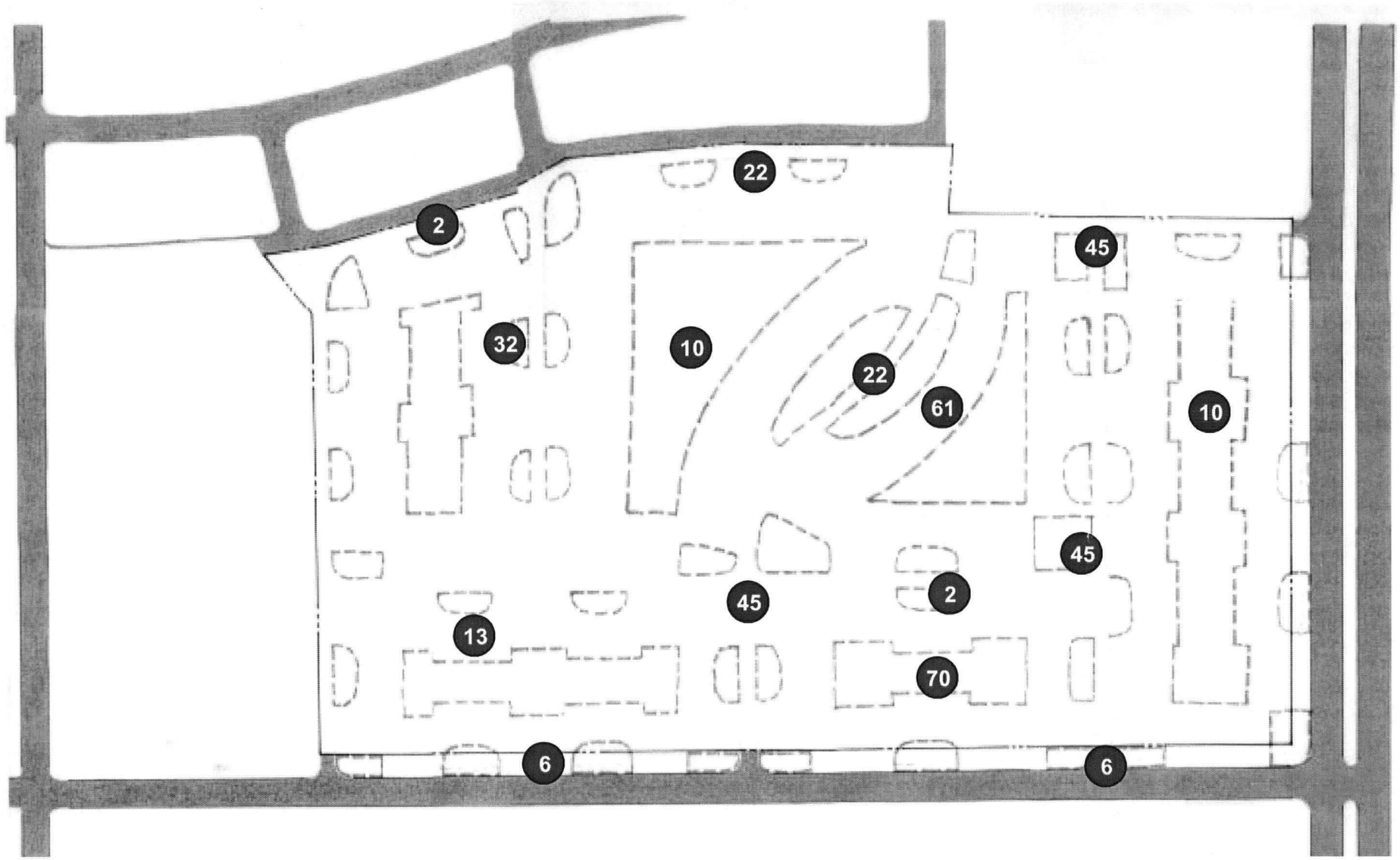
The amount of open spaces provided within the scheme is more than adequate but they act as mere settings for the units. Some of the major drawbacks of most of the open spaces provided within the scheme are:

The Spaces require a lot of maintenance.
The spaces act more as settings than useable space.
The Spaces lack the visual surveillance.
The spaces lack variety in terms of useable activity spaces.

The use of landscape elements, like the structure shown above, through out the site could have improved the use of the open spaces and encouraged social interaction within the site.

There are some situations in the existing design where the relationships of the spaces, hierarchy of privacy and the scale of the spaces has been adequately addressed but it has not been followed consistently through out the site.

Note : The numbers indicated on the plan refer to the numbers of the design solutions(section 3.03) that the design satisfies.



Layout and Distribution of Open Spaces

Design Highlights

On of the major aspects of the proposed design is the provision of individual front and back yards for all the ground oriented units.

The open spaces in the proposed design are distributed in smaller sizes throughout the site and have a clearly defined hierarchy of privacy.

When viewed in conjunction with the proposed unit designs it becomes clear that the hierarchy of privacy in the outdoor spaces is closely related to the hierarchy of spaces within the units.

The larger common spaces (10) are differentiated into smaller spaces through the use of landscape elements and covered structures to provide the residents with a variety of open space and create an interest in the landscape.

The safety and privacy of the common spaces have been maintained through the arrangement of the units, which separate the more public street spaces from the common outdoor spaces.

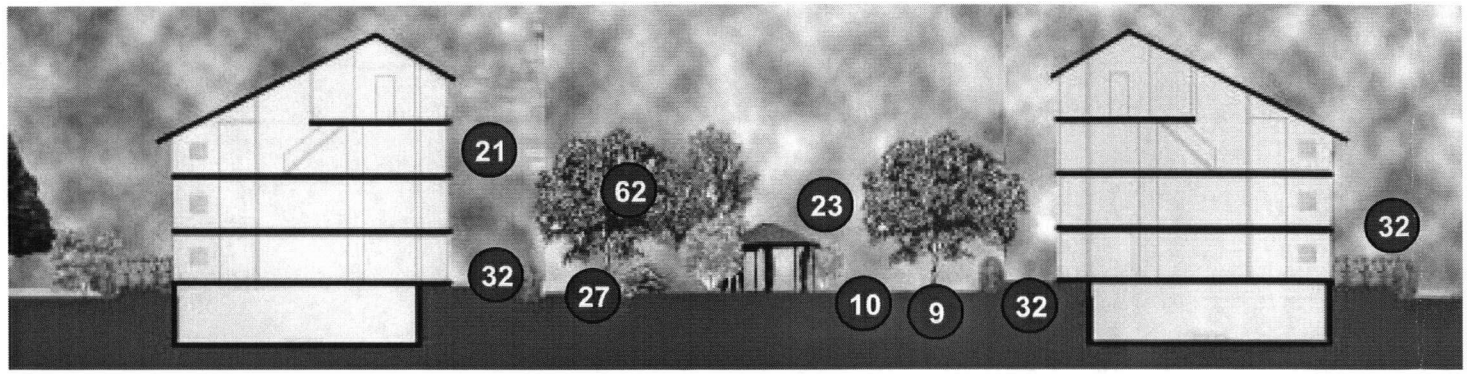
The on street parking and the sidewalks, indicated in the Drawing # P7 have been designed as a part of the open spaces.

Note : The numbers indicated on the plan refer to the numbers of the design solutions(section 3.03) that the design satisfies.

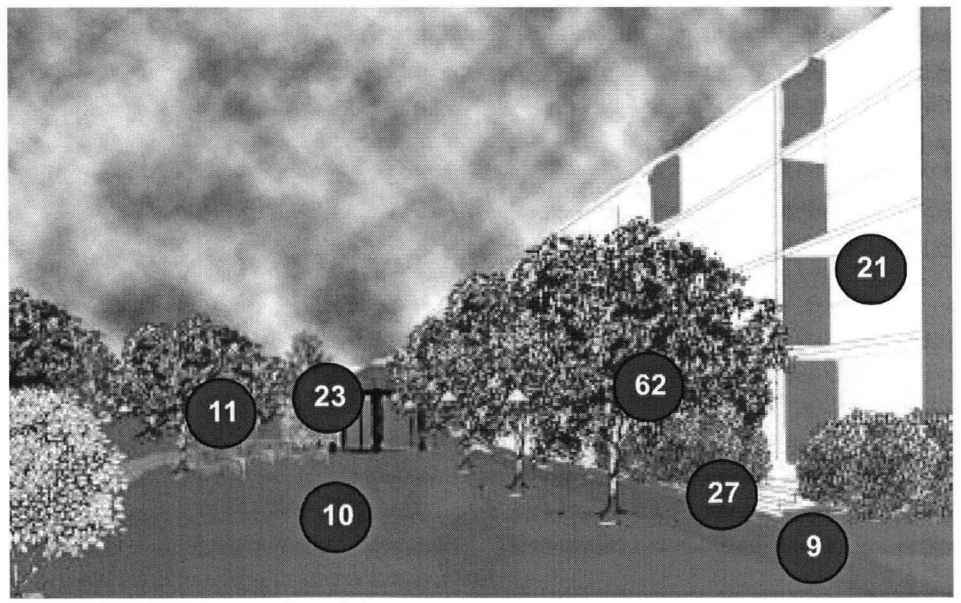
NORTH

Proposed Open Space Layout

(A) Typical Section Through the Open Space



(B)View of Open Space



Some of the major aspects highlighted in the sketches (A) and (B) are:

The open spaces provided in close proximity to the units act as buffer between the private and public spaces and also provide an opportunity to move out into the open.

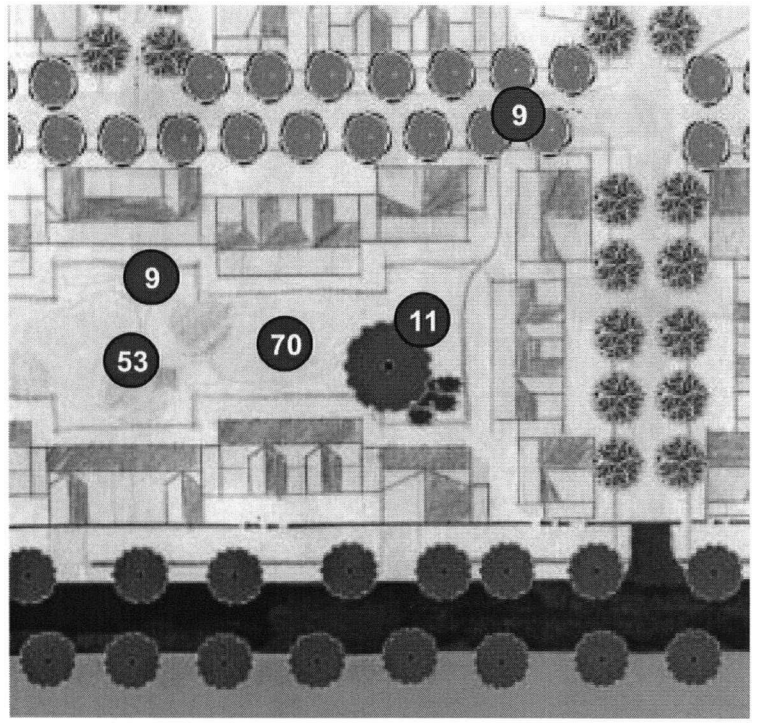
The space defining elements like the trees (62) and covered structure (23) add variety to the open spaces in addition to defining spaces, which can encourage social interaction.

The trees (62) also help in maintaining the privacy of the balcony and other private spaces of the units.

The pathways are integrated with the open spaces (9) and are very successful in connecting the different units and the open spaces.

The small, manageable open spaces (10) are inviting to people and are easier to maintain. The row of shrubs and a couple of steps (27) act as symbolic boundary between the public and the private spaces.

(C) Typical open Space Layout



If we consider a typical plan of a cluster of units, the open spaces are internally connected to the street and sidewalks (9) and have a variety (53) in space allocation through varied use of space defining elements (11).

It is also evident from the plan that the spaces are not very big (70) which helps in keeping the maintenance low.

Note : The numbers indicated on the plan refer to the numbers of the design solutions(section 3.03) that the design satisfies.

Table 3: Summary Table for Existing Design

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

		Design Solutions	0	1	2	3	Remarks	
3.03.3		**Sense of Group and Perceived Ownership**						
	24	Social homogeniety.		●				
	25	Distinct street address for all the units.		●			Only for units along the streets	
	26	Flowerbeds, empty niches and boxes at the entrance or in courtyards.	●					
	27	Elements to demarcate the territorial boundary.		●				
	28	Elements to mark the entry into an individual unit.		●			In the form of steps leading to stair well	
	29	Elements to demarcate territorial boundaries.	●					
	30	Common parking spaces.				●	Mainly basement parking.	
	31	Visible and distinct entrances to the units.		●			In the form of Steps Leading to Stair well	
	32	Open spaces in close proximity to the units.				●	Lack hierarchy of privacy.	
	33	Material variations in the landscape and architectural spaces.		●				
3.03.4		**Sense of Security**						
	34	Spaces with direct visual and easy physical access from the units.				●		
	35	Lights along the streets, sidewalks and pathways.			●		only along pathways	
	36	Spaces with visual surveillance.			●			
	37	Sight lines between units.		●				
	38	Perceived barriers around the scheme.			●		In the form of setbacks and row of trees.	
	39	Short and individual access galleries.	●				Mostly Shared Gallery.	
	40	Traffic calming devices.	●					
3.03.5		**Way-finding and Sense of Orientation**						
	41	Street identity.	●					
	42	Street elements and materials to indicate space hierarchy.	●					
	43	Sidewalks along the streets.	●					
	44	Accommodate predictable pattern of pedestrian movement.		●				
	45	Land marks along the paths.		●			Lamp posts at the entrances.	
	46	Focal points.		●			Mainly Clusters of Trees & Shrubs	
	47	Patterns and specific color coding for spaces within the housing scheme.	●					

		Design Solutions	0	1	2	3	Remarks	
	48	Elements to orient the people within the site.		●			High Rise tower act as Directional Elements	
	49	Views and vistas towards a focal point/element.		●			mainly through buildings.	
3.03.6	**Ease of Access to Community / Commom Open Spaces**							
	50	Large windows in the units.			●			
	51	Open walkways to access the outside spaces.		●				
	52	Private garden, patio, balcony with every unit.				●		
	53	Communal spaces in close proximity to the units.			●		Except for the units above 2nd floor in the Towers	
	54	Hierarchy of open space.		●			Created by the Residents of some units.	
	55	Narrow streets and pathways to separate the communal spaces from the units.		●				
3.03.7	**Sense of Privacy**							
	56	Arrange dwelling units to avoid infringement of privacy of the adjacent unit.				●		
	57	Grade change between the public and private spaces.		●				
	58	Buffers between the private and public open spaces and pathways.		●			Created by the Residents of some units.	
	59	Transitional filters between the public and the private domains of the dwellings.		●			Created by the Residents of some units.	
	60	The entry and the pathways dont affect the privacy of the interior spaces.		●				
	61	Distinct front and back entrances to the units.	●					
	62	Screening for the private yards.		●			Created by the Residents of some units.	
3.03.8	**Maintenance Required by the Spaces**							
	63	Separate entrance paths to the units on the ground level.	●				grouped for 8 units for low-rise units.	
	64	Local material.		●			Plant Material only.	
	65	Use of plant in their natural shape and form.		●				
	66	Open spaces in close proximity to the units.				●	Lack hierarchy of privacy	
	67	Green lawns in smaller sizes in small enclosed space.		●				
	68	Spatial Treatment to define territorial boundary of the units.		●			Created by the Residents of some units.	
	69	Activity oriented rather than settings oriented landscape.		●			Created by the Residents of some units.	
	70	Medium sized spaces of varying shape and appearance.		●				

Table 4: Summary Table for Proposed Design

		Design Solutions	not used	used sometimes	used very often	always used	Remarks
			0	1	2	3	
3.03.1	**Interaction With the Neighbourhood**						
	1	Units opening onto peripheral streets and pathways.				●	Front entrance facing the street.
	2	Narrow peripheral streets.			●		They also mark the site boundaries.
	3	Permeable or soft edges.			●		Low canopy trees along peripheral streets.
	4	Rows of trees and shrubs along the streets and pathways.				●	Acting as perceived barriers as well.
	5	Perceived thresholds or boundaries of the scheme.				●	Achieved by using 2, 3 and 4 mentioned above.
	6	Common meeting areas.			●		At the nodes, intersections and entrances.
3.03.2	**Social Interaction Within the Site**						
	7	Multiple options for movement within the site.				●	Along the streets or internal pathways.
	8	Careful consideration of views and vistas along the paths.			●		Along the path of movement and through the buildings
	9	Sidewalks and street side parking.				●	Street parking also acts as traffic calming device.
	10	Small, intimate, enclosed spaces for people to interact.			●		Along streets and within the courtyards.
	11	Trees to create small protected, intimate spaces.			●		Near outdoor parkings and green open spaces
	12	Shrubs to create small outdoor rooms.			●		
	13	Small backyard and front garden with the units.			●		Except Units above ground level
	14	Small kitchen garden or green spaces.			●		For units on Ground Level.
	15	Small front porch or back yard to sit out.			●		For units on Ground Level.
	16	Spaces and facilities for weekend leisure activities.			●		e.g. picnic benches, covered patios etc.
	17	Direct access from the private yard to the communal space.				●	through distinct transitional spaces.
	18	Pathways to accommodate the predictable pattern of pedestrian movement.				●	
	19	Outdoor, multi use parking lots.				●	Can be used as visitor parking or casual meeting place.
	20	Spaces for the residents to add to the communal landscaping.			●		
	21	Terraces and balcony over looking the streets / pathways.				●	
	22	Opportunities for controlled interaction.			●		
	23	Open air eating / gathering spaces.				●	

		Design Solutions	0	1	2	3	Remarks	
3.03.3		**Sense of Group and Perceived Ownership**						
	24	Social homogeniety.				●		
	25	Distinct street address for all the units.				●		
	26	Flowerbeds, empty niches and boxes at the entrance or in courtyards.				●		
	27	Elements to demarcate the territorial boundary of individual units.				●		
	28	Elements to mark the entry into an individual unit.				●		
	29	Elements to demarcate territorial boundaries of the group.				●		
	30	Common parking spaces.				●	In basements and along the street.	
	31	Visible and distinct entrances to the units.				●		
	32	Open spaces in close proximity to the units.				●		
	33	Material variations in the landscape and architectural spaces.				●		
3.03.4		**Sense of Security**						
	34	Spaces with direct visual and easy physical access from the units.				●		
	35	Lights along the streets, sidewalks and pathways.				●		
	36	Spaces with visual surveillance.			●			
	37	Sight lines between units.		●				
	38	Perceived barriers around the scheme.				●		
	39	Short and individual access galleries.				●	With shared stair well.	
	40	Traffic calming devices.				●		
3.03.5		**Way-finding and Sense of Orientation**						
	41	Street identity.				●		
	42	Street elements and materials to indicate space hierarchy.				●		
	43	Sidewalks along the streets.				●		
	44	Accommodate predictable pattern of pedestrian movement.				●		
	45	Land marks along the paths.			●			
	46	Focal points.			●		Maily Landscape Elements.	
	47	Patterns and specific color coding for spaces within the housing scheme.	●					

		Design Solutions	0	1	2	3	Remarks	
	48	Elements to orient the people within the site.				●		
	49	Views and vistas towards a focal point/element.				●		
3.03.6	**Ease of Access to Community / Commom Open Spaces**							
	50	Large windows in the units.				●		
	51	Open walkways to access the outside spaces.				●		
	52	Private garden, patio, balcony with every unit.				●		
	53	Communal spaces in close proximity to the units.				●		
	54	Hierarchy of open space.				●		
	55	Narrow streets and pathways to separate the communal spaces from the units.				●		
3.03.7	**Sense of Privacy**							
	56	Arrange dwelling units to avoid infringement of privacy of the adjacent unit.				●		
	57	Grade change between the public and private spaces.				●		
	58	Buffers between the private and public open spaces and pathways.				●		
	59	Transitional filters between the public and the private domains of the dwellings.				●		
	60	The entry and the pathways dont affect the privacy of the interior spaces.				●		
	61	Distinct front and back entrances to the units.				●		
	62	Screening for the private yards.				●		
3.03.8	**Maintenance Required by the Spaces**							
	63	Separate entrance paths to the units on the ground level.				●		
	64	Local material.		●			Only plant materials.	
	65	Use of plant in their natural shape and form.				●		
	66	Open spaces in close proximity to the units.				●		
	67	Green lawns in smaller sizes in small enclosed space.				●		
	68	Spatial Treatment to define territorial boundary of the units.				●		
	69	Activity oriented rather than settings oriented landscape.				●		
	70	Medium sized spaces of varying shape and appearance.				●		

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, analyseand 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 arguements 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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