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Department of Community and Regional Planning

The University of British Columbia, Vancouver 8, Canada

Date May 8, 1964.
ABSTRACT

It is usually contended that it is in the interest of the community to require certain minimum space standards between and around buildings to achieve safety and minimum health standards; to control the architectural design of buildings; to protect "amenity"; to limit the density of population; to reduce traffic congestion, and so on. Although safety, livability and appearance are generally accepted as the main purpose of site and space regulation, this study suggests that privacy can be accepted as suitable for control by site and space regulations.

The underlying purpose of this study, therefore, is to investigate visual, auditory, olfactory, and physical privacy within the single-family residential environment. Of particular interest to the study are the methods of achieving privacy in the open space within the dwelling yard. On this basis, the specific purposes of the study are two-fold; first, a review and analysis of existing site and space standards as they are found in the various types of land-use controls in order to determine their effect on privacy in the residential environment; and second, the formulation of a technique for site and space planning for privacy, based on a performance standards system.

The basic methods of land-use control in North America are zoning and subdivision regulations. Research shows that current techniques of zoning and subdivision regulation in low-density residential areas do not achieve the benefits originally intended as the inflexible nature of the controls lead to a visual monotony in residential development. Worthy
as some of the principles may have been at the outset, they have largely miscarried by such preoccupation with the tools of regulation that basic needs have been forgotten. One of these basic needs is privacy, which should be ensured, rather than adversely affected by site and space regulations. An owner should be able to protect his privacy without sacrificing light, air, or usability of any of the open space of his lot.

The research demonstrates that adequate space around and between buildings for functional and aesthetic purposes can be achieved with greater flexibility and without further restricting the individual's wishes in siting and building his house on the usual single-family lot, through the use of performance standards. These measure space between and around buildings in relation to the variety of functions that they are to perform, and in relation to the size and dimension of land and buildings in a given situation.

The investigation concludes that with few exceptions, present site and space standards for building and site planning are arbitrary and rigid, and that the spatial separation of buildings and yard areas resulting from the application of these standards do not encourage privacy. Further, through the existence of such regulations as those concerning enclosure limitations, the resident is restricted in his means of minimizing the opportunities for infringement of his privacy by neighbours or those passing in the street.

With regard to the statement of the hypothesis concerning performance standards, it can be concluded that in fact a technique for
site and space planning for privacy as such, can not be evolved. However, regulations that are directly or indirectly related to privacy can be formed, based on a performance standards system in order to achieve a similar end result. To this end the hypothesis is advanced:

That existing site and space standards adversely affect the privacy of open space within the residential environment; and that a technique for site and space planning for privacy can be evolved, based on a performance standards system.

Most zoning and subdivision regulations are a reasonable and fair attempt to deal with a complex problem, but the results of residential development under present controls leave much to be desired. It is probably impossible to prohibit "bad" design or to pass legislation that a certain design must be followed. However, it is desirable and highly possible that what controls we have could be more "positive" in effect to encourage and facilitate good imaginative design.

This new approach to controls, with the necessary flexibility, is a must if we are to take advantage of the past, present and future technological developments; to keep up with and give expression to the ever-changing and improving "way of life"; and to maintain as much as possible the individual's freedom of choice and expression, within his own residential environment.
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INTRODUCTION

Traditionally, community planning in Canada and the United States has been closely linked with regulations and standards laid down in by-laws, and uniformly applied throughout the jurisdiction of a given community. These specifications, usually contained in a zoning and development by-law or subdivision regulation by-law, control the way in which buildings may be sited on their respective lots and the amount of space on that lot which has to be retained as open space, unobstructed by any construction. Further they often include minimum front and rear yard dimensions as well as side yard limitations and related restrictions on the height of buildings. It is usually contended that it is in the public interest of the community to require certain minimum space standards between and around buildings to achieve safety and minimum health standards, to control the architectural design of buildings, to protect "amenity," to limit the density of population, to reduce traffic congestion and so on. Although safety, livability and appearance are generally accepted as the main purposes of site and space regulation, there are those who suggest that other factors should be included in space regulation. These characteristics, and the values they involve which were accepted as suitable for control by site and space regulations can be stated simply as the risk of fire, assurance of light and air, absence of noise, adequate privacy and the full use of land or outdoor space.

The underlying purpose of this study is to investigate visual, auditory, olfactory and physical privacy in the residential environment.
The residential environment is considered to consist of single-family dwellings only, arranged in the typical grid system of land subdivision used in North America, and of a low density similar to that normally found in R1 zoning districts. The specific purposes of the study are two-fold, first a review and analysis of existing site and space standards as they are found in the various forms of land-use control documents, in order to determine their effect on privacy in the residential environment; and second, the formulation of a technique for site and space planning for privacy, based on a performance standards system.

The validation for this study of privacy lies in the fact that privacy is not merely a question of physical distance between dwellings, the position of openings, and so on, but that it is very much concerned with relationships among people, and is a changing concept affected by varying economic and social circumstances.

The areas of greatest disagreement lie in what people really expect of residential areas in terms of safety, health standards, and space allocation. Added to this is the difficulty of determining to what extent the characteristics capable of being controlled by site and space standards, such as noise, view and privacy, do exist in the residential environment. Two assumptions, therefore, on which the study is based are that a greater degree of privacy is desired by the individual within the residential environment; and that privacy, possibly a combination of the various forms, does already exist to some degree in the residential environment shaped by present regulations.

Since the basic element of any residential district is the individual
unit composed of the dwelling, its yard and access street, the requirements of this "unit" should be paramount in establishing any regulations to control its design. The study centers on this unit over the course of the general discussion of land-use controls, but narrows the focus to the yard for the discussion of site and space regulation and performance standards. The urban residential environment is considered to consist of a series of enclosed spaces, the structures containing one or more dwelling units bounded on four sides with walls and covered by a roof, together with a series of open spaces which surround and separate the enclosed space. Open spaces are of both a public and private nature and are utilized for playground, gardens, streets, landscaping and other outdoor residential functions. To further narrow the scope of the study while attempting a thorough analysis of the subject, only that open space contained within the single-family residential lot is considered in its relationship to privacy. The two-fold function of residential open space is represented by usable open space and insulation or separation space. The former consists of living, service and landscape space; the degree and quality of privacy being most essential to those functions related to living space. In brief, both functions of residential open space are considered as they relate to the privacy of the individual or his family.

Chapter One of the study entails an analysis of existing site and space standards as they are embodied in the various forms of land-use control in North America. A discussion of the historical development of land-use controls, specifically zoning and subdivision regula-
tions is followed by a summary of the objectives and limitations of these land-use controls. Chapter Two discusses privacy as a characteristic of site and space regulation and establishes the four distinct forms of privacy which can be found in the residential environment. The effect that existing site and space standards have on privacy is assessed on the strength of the investigation here, with the intention that the adverse effects can then be eliminated through application of a performance standards approach to site and space regulation. Chapter Three briefly discusses various techniques for site and space planning, concluding with a detailed analysis of the performance standard technique and including a summary of the individual aspects of such a technique.

Although the subject of performance standards in relation to privacy in the residential environment would appear to lend itself to intensive investigation, it quickly broadens into the fields of municipal administration, law, physiology, and through the subjective implications presented through the study of privacy, into sociology, psychology, and even neuropsychiatry.

Generally the approach through literature to the subject of privacy is rather indirect. In one case privacy, along with individuality, diversity and location, is considered as an aspect of quality; in another case the approach is through a discussion of sound. Generally the method of procedure, therefore, is to investigate those aspects of site and space regulation in the residential environment which are both directly and indirectly related to the various types of privacy established; to determine the characteristics common to these aspects; and
to use these characteristics as a basis for the performance standards study.

From the foregoing discussion it can be seen that the study is structured in two distinct fields of investigation; an analysis of existing site and space standards in relation to privacy, and a discussion of the performance standards system. With this in mind, the hypothesis established for the study is stated as follows:

THAT EXISTING SITE AND SPACE STANDARDS ADVERSELY AFFECT THE PRIVACY OF OPEN SPACE WITHIN THE RESIDENTIAL ENVIRONMENT; AND THAT A TECHNIQUE FOR SITE AND SPACE PLANNING FOR PRIVACY CAN BE EVOLVED, BASED ON A PERFORMANCE STANDARDS SYSTEM.
CHAPTER I

SITE AND SPACE STANDARDS

The basic methods of land-use control in North America are zoning and subdivision regulation. Zoning is the division of jurisdiction into districts or "zones" within which permissible uses are prescribed and restrictions on building height, bulk, layout and other requirements are defined. The regulations are uniform in all districts zoned for the same use. Subdivision regulations specify minimum standards that apply to all new residential development: street design and construction, the arrangement of lots, drainage, water supply, sewerage, and in some cases street signs, tree planting, fire hydrants and street lighting. There are also fire, housing and building codes that regulate the safety, health and construction standards of new development, and that apply uniformly to the city or governmental unit involved. In Canada, land-use controls and regulations are usually contained in planning, zoning or subdivision regulation by-laws enacted in the various municipalities through the terms of reference of appropriate provincial statutes.

The primary purpose of land-use controls in both Canada and the United States has been, in the words of the traditional formula, to promote the "health, safety, morals and general welfare" of the community. They have been aimed at preventing the worst effects of uncontrolled urban and industrial development by establishing certain minimum standards of compatibility, density, light, air and space. The objectives of site and space regulations based on specification standards is normally stated as a preamble to the document to provide a basis for interpretation of building controls that follow. The Canadian
National Building Code is:

...essentially a set of minimum regulations respecting the safety of buildings with reference to public health, fire protection and structural sufficiency...(relating to) buildings and simple structures....

while the City of Vancouver Zoning and Development By-law states its objectives more specifically and is intended

...to regulate and limit the height, number of storeys and the size of buildings and other structures to be erected hereafter or the alterations of existing buildings and structures; to regulate and determine the size of yards, courts and other open spaces; to prescribe building lines to regulate and limit the density of population; to conserve and stabilize the value of property; to provide adequate open spaces for light and air; to protect and improve amenity; to lessen congestion on streets; to promote health, safety and the general welfare....

The majority of by-laws and codes utilize standards that can be easily applied. Specific set-backs, floor space ratios, lot coverages, height and width limits are all quantities which can be measured by an inspector, and thus furnish convenient building controls. Those standards which control the dimensions of residential space for the purpose of safeguarding health and safety have contributed significantly toward the determination of the visual form of the residential environment. Generally, the repeated layout of structures of similar size and shape, each conforming to specific standards of current site and space regulations has led to a visual monotony in residential development. The adverse effects that existing site and space regulations are having upon residential development have been emphasized in a report published by the Royal Architectural Institute of Canada, which states in part that:
Where municipal codes governing physical development are demonstrably linked to such future contingencies, their clauses must be respected. But this sensible linkage is hard to discover in many of the by-law restraints put upon residential area design. For instance it is commonly laid down that an access road allowance must be 66 feet wide, with all buildings set back another 25 or 30 feet from that road line. These provisions sterilize 1,000 square feet of land that some family should be allowed to enjoy. They also separate opposite house fronts by something like ten times their height, thus making illegal the grouping of houses for best effect at lowest cost. There are other examples of this unreason.

To enable the qualities of "variety" and "diversity" to be incorporated into future residential developments; thus to eliminate the basis for the charge of visual monotony, site and space regulations must be revised to include provision for a greater amount of daylight, air circulation, privacy, view, outdoor space and control of noise.

The hypothesis as established for this study is based on the assumption that the various standards concerning the siting and spacing of residential dwellings affect the privacy of the residents in their environment. The historical development of site and space regulation in Canada and the United States is examined here in order to determine the objectives and limitations of current regulations. Privacy as a characteristic of these site and space regulations is considered in Chapter Two.

I HISTORICAL DEVELOPMENT OF LAND USE CONTROL

Earliest known building laws were concerned chiefly with the prevention of structural failure and collapse. It is recorded that the Code of Hammurabi over 2,000 years B.C. stipulated that "in the case of
collapse of a defective building, the architect is to be put to death if the owner is killed by the accident; and the architect's son if the son of the owner loses his life." During the reigns of Julius and Augustus Caesar, structural failures in buildings built to a considerable height brought about laws limiting their height to 60 feet.

The British North America Act of 1867 was passed by the British Parliament to "promote the best interests and present and future prosperity of British North America by a Federal Union under the crown of Great Britain, provided such a Union can be effected on principles just to the several provinces." This Act brought together the provinces of Canada then in existence with the added requirement that "provision be made for the eventual admission into the Union of other parts of British North America." In addition to establishing the division of executive and legislative powers and responsibilities between the federal and provincial governments of Canada, the Act states the terms for provincial constitutions and the exclusive powers of provincial legislatures.

Section 92 of Part I, paragraph 13 of the British North America Act provides the authority for the provinces of Canada to enact legislation governing building regulations. This Section of the Act reads in part as follows:

In each Province the Legislature may exclusively make laws in relation to matters coming within the classes of subjects next hereinafter enumerated; that is to say

13) Property and Civil rights in the Province.

The Provincial Governments in Canada in turn vest the authority in their municipalities, through appropriate provincial ordinances, to
pass local by-laws for the control of buildings within their municipalities.

Following the American War of Independence the great estates granted by the Crown were taken over by the States and redistributed mostly in small holdings. Freehold land ownership became the accepted right of the citizen. Following confiscation of the Crown lands, the thirteen States in the years 1780-90 ceded a large proportion of their western territory to the Federal Government. In the following half century vast new lands were added by purchase or treaty. The Louisiana Purchase alone added over 500 million acres in 1803. The American Government regarded land as the most readily available source of revenue and made it available to all who were hardy enough to take it. Apart from establishing a single and reliable system of land registration and transfer and the rectilinear system of surveying introduced in 1785, the government exercised little or no control over development of the land. With regard to private land, however, the government has exercised continuous and often elaborate control over many facets of private enterprise and private development since colonial days. The Council of the Dutch Colony laid down in 1625 the type and location of houses that might be built in New Amsterdam, nearly 300 years before New York adopted its zoning by-law. The Town of Cambridge soon after its founding in the Massachusetts Bay Colony required that "houses shall range even and stand just six feet in their own ground from the street." 8

Zoning Regulations. In North America, the earliest examples of
zoning are those introduced in California towards the end of the
nineteenth century as a means of discriminating against Chinese
immigrants. San Francisco's right to impose restrictions against
the operation of laundries was upheld on the grounds that they were
a clear fire risk and public nuisance. Following this success, the
City restricted dance halls, livery stables, slaughter houses, saloons,
pool halls and other potential nuisances. A few years later Los
Angeles established the districting device on a comprehensive basis,
making the city into a single large residential zone, twenty-seven
districts in which all kinds of industry were permitted, and about a
hundred "residence exception" districts in which all but heavy and
noxious industries were allowed.

At the same time a similar device for regulating the height and
bulk of buildings was developed in the eastern states. In 1885 the
State of New York limited the height and bulk of buildings. In 1889
Congress restricted the height of buildings in parts of Washington.
In 1898 Massachusetts restricted buildings around Copley Square in
Boston to a height of 90 feet, and by 1913 twenty-two cities had en­
acted height controls, a number of them combining this control with
some form of districting.

The beginning of contemporary by-laws involving site and space
standards is usually considered to be 1916, the year in which New York
City passed the first city zoning by-law. Except in a few leading
cities that have substantially revised their zoning ordinances in recent
years, the model of New York continues to be followed. Attempts to
modify private property rights under the pretext of defending property
values is characteristic of the early exponents of zoning as indicated in a preliminary report by the New York Commission on Building Districts and Restrictions which states in part:

New York City has certainly reached a point beyond which continued unplanned growth cannot take place without inviting social and economic disaster. It is too big a city, the social and economic interests involved are too great to permit the continuation of the laissez-faire methods of earlier days. There is too much at stake to permit a habit of thought as to private property rights to stand in the way of a plan that is essential to the health, order and welfare of the entire city and to the conservation of property values. 9

The Commission recommended three types of zoning districts: residential, business and unrestricted. Separate height and bulk districts were also recommended with more detailed restrictions. This ordinance of 1916 remained in force until 1961 with over 2,000 amendments. A proposal for a zoning resolution presented in 1958 by the New York firm of architects, Voorhees, Walker, Smith and Smith best serves to illustrate the form and intent of residential site and space regulations, and is referred to in the latter part of this Chapter.

It was noted earlier that the provinces of Canada draw authority for the control of buildings and the making of building regulations from the British North America Act. In turn, through separate provincial statutes, they pass on this authority to their municipalities. Some provinces delegate this authority in one general Act such as the Municipal Acts of British Columbia and Manitoba. Others provide a series of special Acts, each pertaining to a specific level of municipality, as for example, Saskatchewan's City Act, Town Act, the Village Act and Rural Municipality Act. In some provincial legislation there is a requirement permitting the use and adoption by municipalities of nationally
known codes and standards such as the National Building Code, the Canadian Electrical Code, and Canadian Standards Association standards. Planning and zoning by-laws may also be enacted in Canadian municipalities through the terms of reference of appropriate provincial statutes. Every province except Quebec and British Columbia has a special planning act for this purpose; Quebec municipalities derive these powers by virtue of the provisions of the Municipal Code, the Cities and Towns Act, or special charters which allow them to exercise authority over land development. Planning legislation is a part of British Columbia's Municipal Act or can be made to apply to the unorganized areas of this Province by the Local Services Act.

**Subdivision regulations.** These are the controls governing not the use of land or the type of buildings, but the pattern of development, the layout and dimensions of streets and lots, and the provision of a minimum level of services. They occupy a somewhat anomalous position between the building code and the zoning by-law. The basis for subdivision control is land registration. The early systems dealt only with the mechanical and legal details of the registry of deeds and survey methods, but gradually regulation of street widths and other details of layout were introduced. The earliest example was in 1882, when the Village of Oak Park, Illinois, required plots to be filed in advance of sale and to conform to certain standards of layout. Sub-division controls established by the Corporation of the Township of Richmond, British Columbia, in its Subdivision Control By-law are intended to "regulate the Subdivision of Land and to establish a standard of services to be provided in new subdivisions." 10 The use of this system to enforce rational street lay-
outs and more recently, to require reasonable standards of development, came later than the use of zoning controls. As stated earlier, the City of Vancouver combines both zoning and subdivision or development regulation in a single by-law.

Other methods of land use control. Before reviewing the objectives and limitations of current standards involving site and space regulation in the residential environment; it should be noted that there are a number of other methods of land-use control that establish standards and are therefore of interest to this study. The first method is that aspect of the urban renewal programme where there exists a contractual relationship between a public authority and a private developer. Under urban renewal some agencies believe that the opportunity should be taken to exert the maximum possible control over the quality of the new development. In these cases the redevelopment plan spells out in very considerable detail the controls necessary to bring about the desired type of development.

The second type of controls are those which private developers impose on themselves and their customers. Many of America's most exclusive residential neighbourhoods are governed by a formidable array of restrictive covenants that cover everything from painting the front door to hanging out the washing. An example of private controls that include a list of restrictive covenants are those established by America's largest developers, Levitt and Sons, the builders of Levittowns. The restrictions they enforce include the following:

(a) You may add an ATTACHED room or garage to your house. It must be similar in architecture, color and material to this original dwelling, and the addition must not project in front of the dwelling at all.
(b) On an interior lot, a rear addition may project up to 15 feet, provided that there is then left at least 20 feet of open rear yard. A side addition must leave at least 6 feet of open yard on each side, and a total of 13 feet on both sides.

(c) On a corner lot each side of the house facing a street is considered a front. If your house fronts on two streets, a side or rear addition must leave at least 6 feet on one interior side and 20 feet on the other. If you bought one of the corner properties fronting on three streets, you must leave at least 6 feet on the interior side.

In all cases these private controls were enforced in addition to the existing zoning ordinance and building code of the township.

11 OBJECTIVES AND LIMITATIONS OF LAND USE CONTROLS

As the foregoing section of this chapter illustrates, the history of regulations governing the materials and methods of construction has progressed through two clearly defined stages of development: "primitive standards" and specification standards. A third stage, that of performance standards will be considered at length in Chapter Three. Contemporary site and space controls appear, therefore, to have evolved from these early efforts of communities to protect themselves against hazards to safety and health which might otherwise arise if development by the individual land-owner was uncontrolled. In an attempt to safeguard the general welfare of the public, residential building regulations enforce standards related to spatial separation as well as to structural safety. Although both forms of control are exercised in modern building regulations, it is the effect of spatial separation that is considered in this study, primarily the controls on the dimensions of space which are involved in site and space regulation.
Zoning regulations. The traditional zoning by-law includes detailed "dimensional" controls that specify the building height in feet or stories; minimum depth of side, front and rear yards; minimum lot size and frontage, and percentage of the lot to be left as open space. The standards vary according to the zoning use district. Contemporary by-laws retain most of these controls, especially in low-density residential areas, but it is now customary to allow greater latitude in design and layout by introducing the floor area ratio device. This control of use, height and area of buildings is generally considered under two major classifications: use regulations and bulk controls of regulations.

The basic measure for controlling land use by zoning is to establish land use-zoning districts. Under traditional practice, each district is theoretically allocated to one predominant land use, together with appropriate related uses and other uses needing the same type of environment. The use districts have usually been arranged in a progression from those uses which involve less nuisance to those which involve more. The less-restrictive districts, however, generally permit the uses allowed in the more restrictive districts.

Within the framework of zoning districts there are two general methods of regulating use: the listing of specific uses which shall be permitted or excluded; and the designation of performance standards which shall be met by permitted uses without specific listings. The former is the only method in common use in Canada and the United States. Performance standards as a method of land use control, and as a basis for site and space planning are discussed in Chapter Three.
The terms "bulk controls" or "bulk regulations" are used in this study to mean those regulations which affect the volume, shape and spacing of buildings on the land, as distinguished from the use controls described above, which regulate the activities permitted on the land and within buildings. The basic objectives of bulk control, as stated in the Harrison, Ballard and Allen report are:

To regulate the volume of buildings. Such regulation is necessary to limit the concentration of people and their activities and thus to limit the loads imposed on traffic, transit and service facilities. Such limitation not only can prevent excessive congestion but affords an advance measure of possible requirements for social, sanitary and utility services.

To afford access of light and air into buildings and the space surrounding them.

To provide open space for the use of residents. This refers to the provision of open space immediately outside the dwelling which is large enough in area and sufficiently uncluttered with accessory buildings, driveways, etc., so that the occupants actually have a place for outdoor recreation, both active and passive, and for gardening, clothes drying, etc.

The traditional approach has been to control bulk indirectly, by setting a maximum limit on permitted height, and by requiring yards and courts of specified sizes. Such controls attempt to achieve the desired objective—limitations on density, sufficient light, air and open space—by prescribing only one way to reach those objectives. Experience has shown that the results of these controls are not altogether satisfactory.

Yard requirements specifying the minimum distance between lot lines and the nearest projection of any building wall are to be found in the majority of the zoning by-laws or ordinances in North America. The yards are intended to provide a fixed minimum amount of open space;
this can be considered available as permanent open space providing a basic source of light, air, view and privacy to the occupants of adjacent premises, and can be developed for use of the occupants of a given lot. The yards also provide fire separation and side access for building maintenance and repair.

The side yard requirement is usually imposed for reasons of fire protection and provision of light and air, for the rooms facing the sides of the lots. With the predominant lots of 40 and 50 ft. widths, in most parts of Canada and the United States, a 10 per cent or more clearance requirement leaves 32 and 40 ft. or less for the building. Design within this width requires minimum room dimensions and space-saving devices which lead generally to an unimaginative plan. The front yard set-back, intended as a minimum usually, more often than not has become a maximum for economic reasons, resulting in the monotonous alignment of building fronts, street after street. This would indicate the extent to which a repetitious front yard set-back helps to establish the "character" of a residential area, desirable or otherwise.

Rear yard requirements are not too prevalent, but where they occur with excessive set-backs, disadvantages are evident. When the lot fronts south, an excessive rear yard requirement prevents the exploitation of southern exposure, with adequate outdoor living space. Much of the "livability" quality of the integrated indoor-outdoor living space is thus lost.

Lot areas, building coverage and building volume regulations or floor space ratio are grouped together for this analysis. The intention of these minimum and maximum requirements is to control density and also
to assure enough open area to provide necessary yards and a suitable
house grouping on the lots. There seems to be no reasonable objection
except when by-laws definitely state exact dimensions for the height,
width and depth to control building volume and coverage. Obviously,
unless these dimensions are wholly adequate, limitations are imposed
on the design of the house. The floor space ratio is an index figure
which expresses the total permitted floor area as a multiple of the
area of the lot. For example, with a floor space ratio of 1.0, the
permitted floor area equals the lot area. As shown in Figure 1, Page
20, a floor space ratio of 1.0 would also apply to a two-storey build­ing
covering 50 per cent of its site, or to a 10 storey building
covering 10 per cent. Since the control of building volume is of con­
cern in all types of use districts, the bulk regulations for each dis­
trict specify the maximum permitted floor space or area ratio for the
district.

In some cases a zoning or development by-law may establish min­
imum floor area requirement and minimum cost of house; the first
"designing" at another level but related to physical design. The
"qualitative character" of a residential area, which the by-law attempts
to establish through means of minima becomes a means towards economic
and social segregation. With regard to the minimum cost requirement,
many deserving home-owners are forced to forego other amenities and
even necessities in order to be able to "afford" the floor space to live
in the area.
FLOOR SPACE RATIO

From Harrison, Ballard and Allen, Plan for Rezoning the City of New York, p. 44.
In order to provide open space outside the dwelling suitable for the use of residents for outdoor living activities, a control is necessary which can be related to the number of people using the space, and can regulate the quality of the space. Generally, the provision of outdoor living space is treated merely as a by-product of other controls such as yard requirements and coverage limitations. The advantages of a more direct control for adequate outdoor space are being increasingly recognized; both the New York City Zoning Ordinance and the Philadelphia Zoning Ordinance have controls of this general nature, and the new zoning ordinance for Rye, New York, requires open space for each dwelling in multiple-dwelling districts. Since the amount and form of open space within the residential environment would appear to affect privacy directly, the consideration of usable open space is fully investigated in Chapter Two.

In summary, the effect of the basic bulk control devices is to set up a rigid building envelope. On a given piece of land they specify the exact location, size and shape for permitted building. The building forms prescribed, particularly set-backs, are uneconomical, not especially attractive visually, and in fact do not achieve the best results in terms of potential light and open space. Finally, the regulations found in most zoning or development ordinances and by-laws are not only rigid but unnecessarily complicated.

Subdivision regulations. Subdivision regulations are the controls which govern not the use of land or the type of buildings, but the pattern of development, that is, the layout of streets and lots and the provision of a minimum standard of municipal services. Used in conjunction
with the building code and zoning by-law, subdivision regulations are the concern of this study in that they determine the spatial separation of residential units through allocation of lot sizes, and street, lane and sidewalk widths. Subdivision regulations may also deal with other aspects of development which can affect the privacy of the resident within the residential environment. These are the preservation of fine trees, the prohibition of "promiscuous bulldozing", the levelling of development sites and the shearing away of hilltops.

In Canada, the subdivision of large parcels of land into individual lots has normally preceded the construction of housing units. Generally, the small-scale speculative builder conforms to the minimum specifications since any extra set-back means increased cost in providing utilities, sidewalk and driveway paving, grading and topsoil. The Royal Architectural Institute of Canada Committee of Inquiry noted the following practice which is common in current residential development in Canada.

The developer decides what plot dimensions he can sell to prospective dwelling owners. He shows the tract of land to technical advisors: salaried or consultant surveyors, site planners, utility engineers. About a third of his land will have to be dedicated for thoroughfares and public open space. The remainder of his tract will ask to be divided for the optimum sale of plots of the chosen size. It is possible, and not uncommon, for a whole township to be reduced to little pieces of identical dimensions: on each plot only one sort and size of house can be built.

III SUMMARY

The basic methods of land-use control in North America are zoning and subdivision regulation. These regulations are usually contained in planning, zoning or subdivision control by-laws, which in Canada are enacted in the various municipalities through the terms of reference of
appropriate provincial statutes. The majority of by-laws and codes utilize standards that can be easily applied, such as specific set-backs, lot coverages, and height and width limits. These inflexible controls have led to a visual monotony in residential development which can be eliminated only through changes to existing site and space regulations to include provision for a greater amount of daylight, air circulation, view, outdoor space, privacy and control of noise.

The history of regulations governing the materials and methods of construction has progressed through two clearly defined stages of development: "primitive standards" and specification standards. Existing site and space controls have evolved from efforts of communities to protect themselves against hazards to safety and health. The residential building regulations enforcing these control standards are related to spatial separation as well as to structural safety. It is the effect of spatial separation that is investigated in this study; primarily the controls on the dimensions of space which are involved in site and space regulation.

An attempt has been made to outline the basic principles which lie behind land-use control in North America. As the site and space regulations that most directly affect privacy within the residential environment are contained in the bulk regulations of zoning by-laws or ordinances, the objectives and limitations of current zoning regulations have been discussed in detail. Privacy as a characteristic of these site and space regulations is considered in Chapter Two.
CHAPTER II

PRIVACY AS A CHARACTERISTIC
OF SITE AND SPACE REGULATION

Generally, the accepted purpose of site and space regulation within the residential environment are to provide for adequate safety, livability and appearance. Structural sufficiency, safety against fire and safety against health hazards are currently the basis for those laws in Canada and the United States which deal with the construction and use of buildings. The majority of by-laws and codes include only those standards which are easily applied, a necessary consideration for an acceptable standard. Specific set-backs, floor space ratios, lot coverages, height and width limits are all quantities which can be measured easily by an inspector, and thus furnish convenient building control techniques. Abstract concepts such as aesthetics are not incorporated into building regulations owing to their seemingly arbitrary nature and the lack of common agreement on the constitution of such things. However, the Corporation of the District of West Vancouver, British Columbia, includes within its zoning by-law clauses which acknowledge the preservation of the "character" of each district and the suitability of a building to its physical environment:

... it appears advisable and expedient to make regulations and divide the Municipality into districts as hereinafter provided ... having due regard to:

(b) The prevention of the overcrowding of land and the preservation of the amenity of residential districts;

(e) The character of each district, the character of the buildings already erected, and the peculiar suitability of the district for particular uses ...
The values considered here include more than simply the concept of safety against fire and health hazards.

The consensus of opinion expressed in the writings annotated in a bibliography on performance standards for space and site planning for residential development, was that site and space regulations should be designed to protect the dwelling unit against fire, to ensure that each dwelling unit has adequate light and air, and to guard each dwelling unit from undue noise. In addition, some authorities thought that privacy was a value that regulations should ensure. The area of greatest disagreement among works reviewed lies in what people really expect of residential areas in terms of safety, health standards, amenity and space allocation. It seems very difficult to formulate lasting or meaningful space standards for siting and building in residential areas without a more clearly defined statement as to what objectives these regulations are required to achieve. Closely allied with this problem is the fact that there is little evidence as to the impact of specific site and space planning standards upon the occupants of single-family housing. The characteristics and dimensions of open space in the residential environment are briefly reviewed here in order to establish a basis for an analysis of privacy as a characteristic of space regulation.

I CHARACTERISTICS OF OPEN SPACE IN THE RESIDENTIAL ENVIRONMENT

For purposes of this study the residential environment is considered to consist of two types of spaces: enclosed and open. Enclosed space is that contained within buildings having one or more dwelling units,
while open space is that which surrounds and separates the enclosed spaces. "Space" in this study is considered in its three-dimensional rather than its two-dimensional sense; the term "area" being used for the latter. In order to focus the scope of research and concentrate on that type of space which is more closely related to site and space regulation, enclosed space is not considered in this study. Further, the study is concerned only with the open spaces within the single-family residential lot. Consideration of privacy in the multi-family residential environment would entail problems and situations beyond the limits established for this study.

Open Space. Open space has a two-fold function: first, it contains outdoor areas, usable open space in which activities related to residential living can take place, and second, it acts as a barrier or circulation space between enclosed spaces, insulating the activity in one dwelling unit from its neighbour or permitting the penetration of air and sunlight into the enclosed spaces. In addition to its physical meaning, space can be considered in terms of ownership; both public and private open spaces are considered in this study. The two functions of open space, usable open space and insulation space, are analyzed in greater detail in Figure 2, page 27.

In considering open space in the residential environment the concept of "usable open space" arises in connection with current zoning by-laws or ordinances. In the words of one planner:

The usable open space principle is simply a requirement that some compact, level, unobstructed area of specified minimum dimensions shall be provided somewhere on each apartment building site. The required area should not be devoted to service drive-
FIGURE 2

COMPONENTS OF RESIDENTIAL SPACE
ways, off-street parking space, greenery, drying yards, recreation space and other leisure activities normally carried on outdoors. Minimum yards, although providing desirable separation of buildings, do not necessarily create space that can be used. The usable open space, therefore, is added to the yard requirements that, in a high-density residential area, do not accomplish what conventional yard requirements do in lower-density areas.

"Usable open space" is further analyzed in the lower half of Figure 2, page 27. The quality of privacy is more essential to those functions listed under the heading "Living Space." A diagram illustrating the various component functions of "usable open space" with reference to single and multi-family dwellings is presented in Figure 2, page 27.

In brief, therefore, the urban residential environment for purposes of this study is restricted to open spaces, around and between single-family dwellings on their individual lots. These usable and insulation spaces are of both a public and private nature.

II PRIVACY IN THE RESIDENTIAL ENVIRONMENT

The concept of privacy is closely related to livability, the provision of which, in turn, is accepted as an objective of site and space regulation. The livability of the single-family form of housing can be analyzed from the social, physical and economic points of view. For the purposes of this study, livability refers only to the external physical qualities of the residential environment, taking into account such factors as spaciousness, site characteristics and visual appearance of buildings. Privacy is only one aspect of housing quality; in combination with other
aspects such as individuality, diversity, location and so on, it contributes to the physical livability of the residential environment.

An attempt is made at this time to isolate and define the various types of privacy, and to determine which of these directly relates to open space in the single-family residential environment. The analysis of privacy types is followed by a discussion of the extent to which these selected types of privacy are affected by existing site and space standards relating to the residential environment.

The concept of privacy in the residential environment is an extremely complicated subject, since it is not merely a question of a minimum physical distance between dwelling units or the relationship between windows and doors. This is because privacy is very much concerned with relationships between people and because it is a changing concept affected by economic and social circumstances. K. Izumi, in a study concerning the architectural design of facilities for the mentally ill, established three orders of privacy. First, there is that privacy sought by an individual based on purely instinctive grounds. This seeking of privacy is essentially based on fear and takes the form of hiding, and in most cases it is security from visual interference. The second form of privacy stems from the psychological make-up of the particular individual. This is subject to both instinctive needs and to sociological pressures, but it is also related to a person's intellectual capacities. The third order of privacy emanates from the habits and traditions of the individual's particular social environment.

Margaret Willis, a sociologist, carried out a small scale survey
of what people want in terms of privacy. All those interviewed were asked to define privacy, and the replies obtained seemed to fall into three distinct categories. These categories are related to the above orders and are as follows: privacy within the home, the physical privacy of not being overlooked and privacy in regard to the relationships with other people such as neighbours.

From the above discussion, the particular forms or kinds of privacy emerge, in part related to the various perceptual senses. Briefly, these are visual privacy, olfactory privacy, acoustical or auditory privacy and a kind of physical privacy. This study of open space in the single-family residential environment is concerned with visual, auditory and physical privacy, and to a lesser extent with olfactory privacy. For many kinds of human activities the privacy requirement would involve combinations of these three types of privacy.

**Visual privacy.** Visual privacy in the residential environment involves both being able to observe others from the dwelling lot and being overlooked by others. In the first case, the ability of an individual to see activities in neighbouring yards, or cars passing on the street or lane can result in a loss of privacy to both the viewer and the viewed. The person or persons likely to observe the individual's private outdoor activities can be classified in two groups: The individual's adjacent neighbours, and the general public passing on adjacent rights-of-way. Willis suggests that the place in which the individual is observed also makes a difference. "For instance, there is less criticism of being looked at in a rear yard from the windows of neighbours' houses than being visible across a number of yards."
It would appear, therefore, that the perceptual privacies of the individual are related to his emotional, intellectual, and other capacities at any given time and in any given situation. Izumi suggests, "that most people do not mind visual observance of their action if they know they are doing it properly or know that they are doing it better than can be done by the observer." There is also the phenomenon whereby one person, in seeking too much visual privacy, creates a situation which in itself becomes an intrusion of his neighbour's privacy.

**Auditory and olfactory privacy.** Auditory and olfactory privacy are obviously concerned with the quantity and quality of sounds and smells in their relationship to privacy in the residential environment. Although both these forms of privacy assume greater importance in a discussion of enclosed spaces, they do affect apparent outdoor living space; that enclosed space which is open to observation through windows or other openings, and the open spaces on the dwelling site. Chermayeff and Alexander in their book, "Community and Privacy" present the case for auditory privacy. Under present conditions, man is beginning to lose his capacity to discriminate between sound and noise—between the desirable and the irrelevant. Some sounds are deliberately selected for their meaning, such as conversation and the sound of the radio; others are treated as noise and deliberately rejected. Two examples of the latter are the sound of traffic and the noise of dogs barking. Between these extremes, there is a huge class of intermediate sounds, which because a person is always straining to understand them, hoping either to select or to reject them,
produce a constantly disturbing interference. The most annoying noises are those which are murky or half-clear and those which are sudden, clear enough to represent the possibility of an accident, but not clear enough to remain mysterious and frightening. This incidental noise, produced by all kinds of domestic equipment, by neighbours, by heavy trucks outdoors and by distant aircraft, is beyond control by the resident and the further away the source of noise from the individual the more difficult it is to control.

Olfactory privacy means the absence of objectionable or unwanted smells, and similar to auditory privacy, is difficult to achieve in the single-family residential environment. The degree of this form of privacy required by an individual, varies according to the activity he is undertaking and his traditional experiences. For example, the smell of a neighbour's burning leaves might not be objectionable when one is working in the yard, but becomes objectionable and an intrusion of privacy when one is eating in an outdoor dining area. Smoke, garbage odours, and automobile exhaust fumes all have some detrimental effect in varying degrees on the enjoyment of private open spaces in the residential environment.

**Physical privacy.** The type of physical privacy previously mentioned is to some extent a combination of these other forms of privacy. Although the literary research undertaken for performance standards for space and site planning for residential development failed to produce a satisfactory definition of physical privacy, nevertheless for the purposes of this study it is taken to involve the security gained, in a physical sense, through enclosure. Robert D. Katz suggests that for some
urban dwellers physical privacy is synonymous with anonymity, but anonymity does not mean that all windows and doors must remain shut, blinds and curtains drawn, and all activities must take place within the confines of the dwelling unit. 10

In a survey of attitudes toward lot-privacy conducted among residents of detached or single-family dwellings by the New Haven City Plan Commission, 11 it was found that almost two-thirds of the sample wanted a yard with shrubbery around the edges and some fencing to give privacy, but open in small places to the neighbours. About one-third desired a lot almost totally enclosed with wall or shrubbery for complete privacy, and less than one-tenth wanted a yard mostly open to the neighbours, with planting around the house. The desire for privacy and enclosure was found to vary with income and social class. In a study of fifty families in New York State, Virginia Cutler found that exactly one-half of the people in lower-class families complained about the lack of privacy in comparison with only 10 per cent of the middle class and none of the upper class. 12 Thus it would appear that conceptions of privacy and adequate space have different class meanings; and there is little evidence that these assume drastic importance in family adjustment provided that some adequate space standards are met and that the class culture does not demand private space for highly individual personal activities. F. Stuart Chapin, for example, observes:

Thus privacy becomes a value. One may question the validity of imputing to others the desires, needs, and wants that are characteristic in this respect of nervously high-strung, sophisticated and responsive intellectual persons. Perhaps the common run of home occupants is not as sensitive to deprivation of privacy as some, but it is safer to assume that some individuals born to
the common run of humanity will be sensitive . . . . Privacy is needed for thinking, reflection, reading and study, and for aesthetic enjoyment and contemplation. Intrusions on the fulfillment of personal desires need to be shut off . . . .

In brief, then, the quantity and quality of all forms of privacy required by an individual varies, first according to the activity he wishes to perform; second, according to his assessment of the activity in moral terms and third, according to his acceptance of the person likely to observe his activity. For the purposes of site and space control in the single-family residential environment, the privacy between the individuals of the same family within the dwelling unit is of less concern than the privacy required by a family as a whole from either the public at large or neighbouring dwellings. The activities which are performed within the open space, and which require privacy in some form are summarized in the lower half of figure 2, page 27. The various alternative methods of achieving visual, auditory, olfactory and physical privacy in the open space within the residential environments are considered in the following section.

III METHODS OF ACHIEVING PRIVACY

Having established four forms of privacy within the residential environment, consideration is given to the various methods whereby these forms of privacy might be achieved by and for the resident. The final section of the chapter will then involve the application of existing site and space regulations to these methods in order to determine how and to what extent existing site and space standards affect the privacy of open space within the single-family residential environment. Although privacy in general is considered to consist of combinations in
Varying degrees of its four characteristics or forms; it is worthwhile to consider each form by itself when determining methods of achieving privacy. The methods that are, in fact, common to all forms of privacy then assume greater importance and become the basis for further analysis.

**Visual privacy.** An individual's right to privacy in his own house is fully recognized in our society, by the requirement of legal entry before intruding, and his land is protected by the prohibition against trespassing. Although not as specifically established, the protection of visual privacy to a height not detrimental to others also appears defensible. It is safe to say that it would be legally difficult to destroy all hedges and fences on the grounds that one owner has a visual right to his neighbour's land. As far as light and air are concerned there is no practical distinction between a dense hedge, a picket fence and a garden wall. A number of zoning by-laws accept a fence (the term "fence" to include hedges, trellises, louvres, rows of trees and walls) to a maximum height of 6 feet," in any required side or rear yard or along the edge of any such yard," 14 For this study, the average eye level is assumed to be 5 2 feet above ground, and as current by-laws accept a wall or hedge above eye level, practical indifference as to what is on the other side of the wall may also be granted.

It is proposed therefore, that this height of visual privacy be recognized at 10 feet above natural grade, above which neither solid planting nor structural barrier to light would be permitted. This is based on the assumption that eye level when one is standing in private open areas in the yard, such as a patio or terrace, is 7 feet. Serious loss of light or air by raising the maximum height to 10 feet would be difficult to
establish. Further, experience indicates that most single-family houses have a vertical sidewall dimension of approximately 10 feet: an 8 foot ceiling height which is standard, and an additional 2 feet of height which is usually required to raise the floor of a building enough above grade and to construct an adequate roof. On this basis a low structure without windows can be placed on any side or rear property line without damage to the visual privacy of neighbours.

Visual privacy involves both being able to observe the activities of neighbours or those people passing by, and being observed by others. Visual intrusion of private open space can obviously be decreased, and in some cases eliminated through the use of screens. As discussed, the screening member might be a form of fence, accessory building, or a part of the main dwelling. In the single-family housing development of today, a 10 foot high fence would provide adequate visual privacy of open space for the dwelling resident; the obvious exception being an adjacent two-storey dwelling with side yard windows. Visual privacy can also be achieved through recessing open areas and accentuating the variation in ground level with an enclosing screen. However this method is rather uneconomical and can be applied only to small areas of the site.

Auditory and olfactory privacy. In the residential environment most noises that are liable to affect privacy are made or controlled by humans. Hence the existence of a noise problem depends on human variability in the production as well as the perception of noise. It is not possible, in any practical sense, to eliminate noise entirely; the objective must be to reduce the probability of disturbance by sound to some sufficiently small fraction of people and time. There are three basic categories of residential noise problems:
1. Noise originating in one dwelling and heard in adjacent dwellings.
2. Noise originating outdoors and heard in nearby dwellings.
3. Noise originating in one dwelling and heard in outdoor living areas of nearby dwellings.
4. Noise originating outdoors and heard in nearby or adjacent outdoor living areas.

This study is concerned with the third and fourth categories; consideration of the aspects related to the first and second categories would entail problems and situations beyond the limits established for research. The available methods for achieving auditory privacy through the control of outdoor noises are: reduction at the source; use of spatial separation; and the use of obstacles between the source and residential property.

Experience shows that reducing noise at its source within the residential environment is extremely difficult in that there are normally a great number of individual noise sources. A more reasonable approach to the problem would be through the combined use of spatial separation and sound baffles.

Generally, two common sources of noise in the residential environment are neighbouring dwellings and traffic. Where spatial separation is not possible due to a limited site area, a possible approach is to design residences and outdoor areas to minimize interference with each other. For example, houses built to look inward on an enclosed or partly enclosed court may provide considerable shelter from surrounding sources of noise. In the case of traffic it is suggested that if residential streets were reduced in width, the resultant reduction in the volume of traffic, and slower speeds would decrease the noise in the front and side yard areas.
With regard to the use of fences and walls as sound baffles, L. Beranek suggests that if a solid wall can be built to extend about 5 to 10 feet above and beyond the line of sight between a noise source and the receiver, and if the wall can be located within 10 to 20 feet of either the noise source or the receiver, that wall will provide a noise reduction of about 5 to 10 decibels. As shown graphically in Figure 3, page 39, if the height of the wall increases and the distance from the wall to either the source or the receiver decreases, the wall becomes even more effective. For lower walls and greater distances, however, the wall becomes less effective. The latter case exists in most rear yards where a 4 to 6 foot wall or fence is placed on the rear lot line; screening little of the noise from the lane or neighbouring dwellings.

Studies on residential noise control indicate that occasional trees and shrubs will have no effect, and thick hedges that may serve as complete visual barriers will have almost no measurable effect. It takes large thickness (50 to 100 feet thick) of dense growth in order to obtain any significant amount of noise reduction, and even then a solid wall would be better and less expensive.

It would appear therefore, that acoustical or auditory privacy can be achieved in only a limited number of ways. The obvious method involves the use of the building bulk as a barrier, and facing a blank wall to the noise source. In turn, in order to create usable private space, the building would have to be placed on or near the lot line. Spatial separation is shown to be ineffective with regard to the short distances involved in residential lay-out. Recessed areas can also provide a
REDUCTION OF NOISE BY WAILS OR FENCES

FIGURE 3

EFFECTIVE BARRIER HEIGHT IN WAVELENGTHS

DECREASE IN INTENSITY IN DECIBELS
measure of auditory privacy; high cost and limited area being negative factors here. The principles involved in auditory privacy also apply in some degree to olfactory privacy.

Physical privacy. Individuals experience their environment and each other by means of their physical senses, i.e., their senses of sight, hearing, smell, touch and taste. These physical senses might be compared with the transmission path referred to in the case of sound. In addition to these five main senses there appears to be, under certain conditions, a sixth by which an individual may be conscious of the presence of others without verification by any of his physical senses. In such a case the individual's "sense of awareness" could be said to be operative. This phenomenon which best describes physical privacy involves each of the other forms of privacy to some degree. The methods of achieving physical privacy therefore are those common to these forms.

It has long been maintained that privacy is obtained in the residential environment simply by employing open space to separate two dwelling units. Within the dimensions of the residential environment this statement does not appear to be true as the foregoing discussion indicates that physical barriers or structure orientation could be employed more effectively as substitutes for open space. Further, employing such methods would be consistent with other characteristics, such as fire, light and air, that were accepted as suitable for control by site and space regulation. The following section involves an analysis of existing site and space regulations in order to determine their effect on the privacy of open space in the single-family residential environment.
IV PRIVACY AS A CHARACTERISTIC OF SITE AND SPACE STANDARDS

Research for this study has failed to find a definition of "adequate privacy" in relation to the residential environment. The degree of privacy required by individual members of a family or by the family as a group within the open spaces of the individual dwelling lot varies with the activity performed, and with who is observing the activity.

Privacy can be considered a quality having more in common with visual aesthetics than such characteristics of space regulation as fire, light and air. Like aesthetics, adequate privacy can not be guaranteed by regulation for every case. However, a positive contribution towards residential privacy in open space could be made if site and space regulations were so formulated that they no longer exerted an adverse effect on residential privacy. The fact that existing site and space standards adversely affect the privacy of open space within the residential environment will be difficult to establish owing to the highly subjective nature of the characteristic. However, it is probable that the effects on the various forms of privacy of variations in spatial elements could be determined.

This final section of the Chapter will therefore attempt to assess to what degree site and space regulations in use today, affect privacy. This approach is based on the assumption that the examples of residential development, particularly higher density development, which are criticised as lacking in privacy, are largely shaped by site and space regulations.

The elements of the single-family residential site that are controlled and shaped by existing zoning regulations include the spatial arrangement of both principal and accessory buildings on the site, and the landscape features of the site. The former element is influenced by yard
requirements, height limitation, standards of floor area or cubage and separate rules for accessory buildings. The latter element involves fences, patios and terraces, and sidewalks and drive-ways. Subdivision regulations control building density, orientation of the lot, and dimensions and form of the streets, lanes and public walks. These various elements which appear to have some effect on the amount and form of privacy within the residential environment are now analyzed individually. Using a typical residential lot layout as a framework for the analysis, value judgments are set forth as to the extent to which privacy is affected.

For this analysis a typical one family dwelling schedule has been drawn up, based on a number of existing zoning by-laws and subdivision regulation standards.
TABLE I
LOT AND STREET SPECIFICATIONS BASED ON EXISTING REGULATIONS

<table>
<thead>
<tr>
<th>Density</th>
<th>6 lots per gross acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum lot size</td>
<td>7200 square feet</td>
</tr>
<tr>
<td>lot width</td>
<td>60 feet</td>
</tr>
<tr>
<td>lot depth</td>
<td>120 feet</td>
</tr>
<tr>
<td>Height restriction</td>
<td>35 feet</td>
</tr>
<tr>
<td>Building coverage</td>
<td></td>
</tr>
<tr>
<td>main building</td>
<td>33%</td>
</tr>
<tr>
<td>accessory buildings</td>
<td>8%</td>
</tr>
<tr>
<td>total</td>
<td>41%</td>
</tr>
<tr>
<td>Front yard set-back</td>
<td>25 feet</td>
</tr>
<tr>
<td>Rear yard set-back</td>
<td>25% of lot depth or 25 feet</td>
</tr>
<tr>
<td>Side yard</td>
<td>not less than 10% width of lot; maximum width not to exceed 5 feet</td>
</tr>
<tr>
<td>Accessory buildings</td>
<td></td>
</tr>
<tr>
<td>Maximum height</td>
<td>10 feet</td>
</tr>
<tr>
<td>front set-back</td>
<td>70 feet</td>
</tr>
<tr>
<td>lot line clearance</td>
<td>3 feet; 5 feet if lane abuts</td>
</tr>
<tr>
<td>clearance from main building</td>
<td>10 feet minimum</td>
</tr>
<tr>
<td>Street width</td>
<td>50 feet</td>
</tr>
<tr>
<td>Paving width</td>
<td>30 feet</td>
</tr>
<tr>
<td>Sidewalks</td>
<td>two at 5 feet</td>
</tr>
<tr>
<td>Utilities buried in centre of street</td>
<td></td>
</tr>
<tr>
<td>Lot lines to be at 90 degrees to street line</td>
<td></td>
</tr>
<tr>
<td>Enclosure limitations</td>
<td></td>
</tr>
<tr>
<td>fence</td>
<td>Maximum 4 1/2 feet high in front yard; maximum 6 feet high in rear and side yard</td>
</tr>
<tr>
<td>Landscaping</td>
<td>maximum 4 1/2 feet high in front, side and rear yard</td>
</tr>
</tbody>
</table>
The overall site layout conforming to the specifications in Table 1 is illustrated in Figure 7, page 47 which shows three spatial arrangements possible under the given specifications. The site and space regulations define a restricted building space envelope (Figure 5, page 46) within which the maximum building volume obtainable on the specified lot is shown in Figure 4, page 45. Although there would be numerous variations of the spatial arrangement of the dwelling on the site illustrated, it is felt that the three shown in plan and elevation (Figures 6 and 7, page 47) are a satisfactory basis for the analysis. The analysis is considered under the following general headings:

1. Spatial arrangement of lot;
2. Landscape features;
3. Spatial characteristics of street.

It should be noted here that the following analysis includes only those characteristics of site and space regulation which appear to have some direct effect on privacy. As the study progresses it becomes clear that an investigation of privacy also involves other factors such as lot servicing, parking space for automobiles, lot access, fire separation between dwellings, building materials, aesthetics and so on. In each case these simultaneous factors are simply noted but not discussed at length.

**Spatial arrangement of lot.** The critical factor in the spatial arrangement of the lot with regard to privacy is the yard requirements. Rigid yard provisions force the dwelling into the centre of the lot.
FIGURE 4
MAXIMUM BUILDING VOLUME OBTAINABLE
ON A 60' x 120' LOT
FIGURE 5
BUILDING SPACE ENVELOPE FOR 60' x 120' LOT
FIGURE 6
SPATIAL ARRANGEMENT UNDER CURRENT REGULATIONS - ELEVATION

FIGURE 7
SPATIAL ARRANGEMENTS UNDER CURRENT REGULATIONS - PLAN

scale 40 feet = 1 inch
It therefore can be only a lump, outlookin in all directions and exposed to view and lack of privacy from all directions. As the building arrangement in Figure 8, Page 49, illustrates, front yards lack privacy from the street. The front yard requirements force all buildings into a line, with only slight variation possible. With the excessive set-back requirements and conditions of the present regulations, the owner of the lot need not own his front yard, since the community, in effect, takes over the use for all practical purposes, and yet does not use it.

Typically, side yards separating buildings are too narrow either for privacy or for any tangible use of the land area. The area of these side yards generally accounts for about 10 per cent of the total lot area. They have no other useful function that a firewall could not equally perform. The width of the yards is usually not great enough to create usable open space; if anything, their narrowness accentuates the feeling of crowdedness.

Rear yard requirements have similar negative features; they force the buildings into a line and make even full front yard development impossible. The rear yard set-back requirements restrict the shape of the dwelling to the point that most yards are rectangular in shape, making the formation of intimate open space virtually impossible through the use of the building itself. As shown in Figure 9, page 49, the rear yards amount to about fifty per cent of the total lot area, and are valuable for outdoor activities. However, even this area becomes in most instances ill-used open space because the five abutting neighbouring properties rob their potential users of all privacy.
FIGURE 8

SPATIAL ARRANGEMENT OF LOT

FIGURE 9

REAR YARD ARRANGEMENT

From Norbert Schoenauer, "Streetscape and Standards"  
The Canadian Architect, pps. 37, 39.
The effect of accessory buildings on neighbours as to light, air and privacy is not different from that of a main structure. These buildings could become a form of buffer, insuring both visual and auditory privacy to the owner; but exist under present regulations as small islands in the rear or side yards.

**Landscape features.** Restriction of the maximum height of fences to six feet in most rear and side yards would appear to limit the individuals chances for visual privacy. Figure 10, page 51, shows that under present regulations it is possible to witness activity at neighbouring upper storey windows, and conversely, be seen or looked over from this level. Although some measure of privacy could be gained through enclosure of the front yard with the allowable fence of 4½ feet, few residents wish to destroy the "open" aspect of the front area if it is in fact part of an overall development scheme.

**Spatial characteristics of street.** The need for immediate access to and shelter for the automobile as close to the dwelling unit as possible in conjunction with front and rear yard set-back regulations has led to loss of privacy within the open space of the lot. In many cases, the extensive access drive required breaks up usable open space while the presence of the automobile on the lot affects both the aesthetic character of the yard as well as visual and auditory privacy. The present width of residential street rights-of-way encourages excessive speed and volume of traffic which in turn results in greater traffic noise and fumes.

Although not every aspect of site and space regulation in the residential environment has been investigated in the foregoing discussion
FIGURE 10
ENCLOSURE HEIGHT LIMITATIONS
it is judged that these regulations do in fact adversely affect the privacy of the resident. Initially they restrict the buildable area, thereby preventing the individual from creating usable open space or enclosure through building orientation. Present yard requirements prohibit building at the lot lines further decreasing the possibility of privacy through the use of the building bulk as a baffle or screen.

V SUMMARY

Site and space regulations should be designed to protect the dwelling unit against fire, to ensure that each dwelling unit has adequate light and air, and to guard each dwelling unit from undue noise. In addition, privacy is a value that regulations should ensure. The shape and form of open space within the residential environment is controlled by existing site and space regulations. Open space contains usable open space in which activities related to residential living can take place, and it also acts as a barrier or circulation space between enclosed spaces; those spaces contained within buildings. The quality of privacy is more essential to the living, dining and recreation space contained within usable open space.

Four types of privacy can be established as directly relating to open space in the single-family residential environment. For many kinds of human activities in the residential area, the privacy requirement would involve combinations of visual, auditory, olfactory and physical privacy. The quantity and quality of all forms of privacy required by an individual varies, first according to the activity he wishes to perform, second, according to his assessment of the activity in moral terms and third, according to his acceptance of the person likely to observe
his activity. Analysis shows that physical barriers or structure orientation can be employed effectively as substitutes for open space or spatial separation.

Research has failed to determine a definition of "adequate privacy" in relation to the residential environment. Similar to aesthetics, adequate privacy cannot be guaranteed by regulation for every case. However, a positive contribution toward residential privacy in open space can be made if site and space regulations were so formulated that they no longer exerted an adverse effect on residential privacy.
CHAPTER III

TECHNIQUES FOR SITE AND SPACE PLANNING

From the discussion contained in Chapter Two concerning existing site and space regulation within the single-family residential lot, it has been shown that these specifications result in monotonous and rigid spaces between buildings and along streets. This is particularly true of residential areas that have been built in large groups of single units; the typical World War Two housing subdivision in Canada falls into this category.

The overall effect of these regulations which are contained in both zoning and subdivision control by-laws, has been to limit the privacy of the individual within the residential environment by restricting the way in which dwellings and their accessory buildings may be sited on their respective lots, and by controlling the amount of space on the lot that must remain open and unobstructed by any construction. The literature examined for a recent study of space and site planning tends to suggest agreement that:

With few exceptions, present space standards for building and site planning are arbitrary and rigid and fail to accomplish the generally accepted purposes of improvement in livability, safety and appearance of new residential districts.¹

The regulations that have the greatest effect on the privacy of open space within the residential environment are those contained in current zoning by-laws. A design study made for the Philadelphia Housing Association ² shows alternative ways of developing a sample tract in accordance with the best planning practices. Existing zoning
and subdivision regulations were disregarded. Results of the study clearly show that these regulations do interfere with good neighbourhood design, and that there are better ways to design and develop residential land.

In recent years many effective innovations to site and space regulations have been introduced in zoning and subdivision by-laws both in Canada and the United States. Their main purpose has been to achieve adequate space around and between buildings for functional and aesthetic purposes, allowing greater flexibility without further restricting the individual's wishes in the siting and building of his house on the single family lot. The case is effectively presented by Herman Ranes, Planning Consultant, in a discussion of current zoning problems in which he states:

The time has come when we must re-evaluate our zoning ordinances and base our zoning regulations on realistic and comprehended general plans. We must regulate the use of land on a more imaginative basis which accepts and propagates new concepts.

The most significant trends in the current revision of the zoning system therefore are an attempt to relate controls more closely to planning criteria, and to make controls more flexible without greatly extending the discretionary power of the planning authority.

Three concepts related directly to the site and space development of the single-family residential site, and therefore indirectly with privacy within the open space on the site are reviewed below. These concepts or techniques are: cluster housing, bulk controls, and performance standards. The latter method of site and space planning will be discussed in detail, since earlier studies indicate
That performance standards are a more flexible and effective method of establishing desirable space and site requirements; that they in fact embody the general principles contained in the aforementioned techniques.4

I. CLUSTER HOUSING

The major objectives in the search for better methods of developing residential land areas, according to Max S. Wehrly, should include: reductions in the mounting costs of providing and maintaining streets, utilities, and services; more variety and amenity; the creation of permanent open space; and flexibility in planning, which will release residential development from its present straitjacket of subdivision and zoning regulations based on rigid specifications for the individual lot.5 The cluster method of planning for residential development has been advanced as satisfying most of these objectives.

The cluster principle is based on the arrangement of dwellings in groups, courts or clusters on smaller sites than those required by conventional subdivision planning or zoning specifications. The resulting differential in lot areas is then consolidated into open space for conservation and recreational uses for the common benefit of the adjacent residents. The overall density, that is, the total number of families to the acre in the development remains substantially the same as in a conventional layout.

It has been shown in Chapter One that most regulations are still based on individual lot specifications for minimum width, depth,
and area, which are then applied in a blanket fashion to the entire development. The cluster concept seeks to realize the development objectives by grouping dwellings within and around open space, with greater economy in streets and utilities and with substantial increase in the attractiveness and livability of the entire development.

Figures 11, 12, 13, page 58, illustrates three treatments of a site with similar overall area and density. Figure 13, page 58, illustrates the cluster development concept, with surrounding common areas.

The principal advantages of the cluster concept include flexibility in arranging building and open-space areas to fit the physical characteristics of the site; variety and diversity of site and architectural grouping; preservation of natural and topographic features, and freedom from through traffic. These advantages are illustrated graphically in Figure 14, page 59, which shows three cul-de-sac arrangements that provide a cluster of family dwellings.

A number of communities are experimenting with zoning code provisions that will permit so-called integrated, community or planned-unit development. While details vary, all have the common objectives of providing flexibility in layout, design and usage within a specific project by permitting departures from conventional lot-by-lot development, while retaining comparable densities of population within any given area. Obviously, if this type of development is to be realized in areas where regulations of public land use are in effect, provisions permitting cluster planning must be present in zoning and subdivision regulations. An example of an amendment to subdivision regulations to provide for cluster development is found in Appendix A, page 99.
FIGURE 11
RECTILINEAR PLAN

FIGURE 12
CURVILINEAR PLAN

FIGURE 13
CLUSTER HOUSING

From Christopher Tunnard and Boris Pushkarev, Made America, p. 111.
FIGURE 14
CLUSTER HOUSING VARIATIONS
From John O. Simonds, Landscape Architecture, p. 204.
The town of Guildford, Connecticut, "in order to avoid a stereotyped suburbia and preserve the sense of space which is so attractive in the town at present" has laid out a 102-lot subdivision in conformity with the new cluster principle. The amendment, permitting variation in residential density, is to existing subdivision regulations and permits the community to acquire open land in a manner previously not possible.

Before discussing the relationship of the cluster housing concept to the amount and form of privacy acquired within the open space of the dwelling site, a review of a related approach, that of the "integrated lot" is of some value to the study. In an effort to improve, among other things, the opportunities for out-door expansion on the subdivision lot without decreasing the number of lots available, experiments have been made with the integrated lot in which interior lots are formed by opening four or more lots from a common driveway approach. Figures 15 and 16, page 61, show a parcel of land originally laid out in 70-foot by 100-foot lots, which was divided into an equal number of parcels under the "integrated lot" method. The outdoor areas around the house become useful in at least three, and in many cases four directions rather than two; the square shape of the lots lends itself to a more open and imaginative house design. At least half the houses achieve a measure of auditory privacy in that they are well removed from the noises of street traffic.

It can be seen from the foregoing discussion of cluster housing that this concept of residential land development requires
FIGURE 15
INTEGRATED LOT SUBDIVISION CURRENT LAND SUBDIVISION AND BUILDING SITING PRACTICE

FIGURE 16

From Urban Land Institute, New Approaches to Residential Land Development, p. 71 and p. 72
new regulations; standard zoning by-laws and ordinances make no provision for the unusual cluster method. Further, the concept requires a major redistribution of land area, and is not simply a new technique that can be applied directly to current site and space regulations governing residential development in a grid system. However, the opportunities for increased privacy within the residential environment that are presented are of interest to the study and are briefly discussed here. The amendments to the Guildford Subdivision Regulations included minimum yard requirements that specified the following:

- Front yard - 20'
- Side yard - 10' (save that garages or carports upon adjacent lots may join at the property line or be grouped on land away from the individual lot)
- Rear yard - 25'

The aspects that are of interest to this study of privacy are the minimum front yard requirement of 20 feet and the allowance that garages or carports on adjacent lots may join at the property line. The former regulation in effect decreases the site area within which it is most difficult to create private open space; while the latter exception to the minimum side yard dimension provides an opportunity to create private areas behind the screen formed by the garage or carport.

In conclusion, it is assessed that the cluster housing concept does not in fact provide a substantially greater degree of privacy to the resident in the residential environment. While it is true
that the front yard set-back has been decreased, thereby giving the resident a better opportunity to develop private areas in a larger rear yard; the side yards are still maintained and are of little value as private open space. Further, clusters create some problems of a psychological nature. In an undifferentiated line of houses, each family possesses to some extent the anonymity of a horizontal apartment house. In a cluster, a small group of families who may have no reason at all to belong together are singled out and brought into physical proximity; a condition that is resented by some home-owners, especially if adequate privacy within the lot is not inherent in the site plan.

II. BULK CONTROLS

Current techniques of zoning, as discussed in Chapter One, have not achieved the benefits originally intended. Worthy as some of the principles may have been at the outset, they have largely mis-carried by such preoccupation with the tools of zoning that the basic needs have been forgotten. In review, the conventional tools of zoning include: minimum yard requirements; classification of structure in terms of occupancy; separate rules for accessory buildings; height limitation, and minimum standards of floor area or cubage. The dis­cussion of privacy in Chapter Two judged that these tools are inadequate to satisfy current needs, specifically the need for privacy within the residential environment.

A consideration of bulk controls as a technique for site and space regulation includes a discussion of floor area or space ratio, usable open space, access of light and air, and the premium or bonus
concept. Not all of these innovations to site and space regulations are untried; the City of Vancouver, British Columbia, for instance, specifies a maximum floor space ratio in its current Zoning and Development By-law.\(^7\) Although the concept of usable open space was discussed as an objective of zoning regulations in Chapter One, it has not been used as far as can be determined, in Canadian zoning by-laws, and only in the few mentioned in the United States. The discussion of performance standards as a method of site and space planning involves the use of a number of these bulk controls, but it is felt that a statement of their principles is of value to the study and can best be presented at this time.

**Floor area ratio.** The general quality of space and openness of an area is dependent on the bulk of buildings in relation to the land area. The floor area or space ratio is a ratio between the aggregate of all floor areas of a building, including outside walls, to the area of the lot within property lines. A floor area ratio of 1.0 means that on a 7,200 square foot lot, 7,200 square feet of floor area may be built on one floor, or 3,600 square feet on each of two floors, etc. A floor area ratio of 0.50, which is the maximum ratio specified in the Vancouver By-law (One-family Dwelling District Schedule), means that 3,600 square feet may be built on the same lot in one or more floors. The City of Toronto Zoning By-law includes a section dealing with floor area ratio provisions (Appendix B, page 101). Zone 1, which is suburban low-density development and similar to the type of area under study, has a floor space index (the ratio of the total gross floor space of the building to the net lot area)
of 0.35.

Advantages of this control lie in the fact that crowding of the lot or neighbourhood can be prevented, while leaving reasonable latitude to the owner in the design of his structure. While not completely comprehensive in its scope, it does require fewer supplementary controls in low-density areas than other devices. Since it should be applied to all covered areas including garages, carports, porches, breezeways and other accessory buildings such as garden houses, tool sheds and studios, special provisions for control of such related bulk are unnecessary.

In review, the floor area ratio is preferred over maximum site coverage regulations (the percentage of land occupied by structures) because the latter fails to reflect above-ground development. On the other hand, floor area ratio does not reveal the amount of open space available on a site. A one-storey building that covers 100 per cent of a site and a two-storey building that covers 50 per cent of a site both have a floor area ratio of 1.0. Because neither floor area ratio nor coverage alone describes the characteristics of residential development, they are often used in combination. Another frequent combination is floor area ratio and usable open space.

**Usable open space.** The manner in which open space is used is often more critical than its area. In order to provide open space outside the dwelling suitable for the use of residents for outdoor living activities, a control is necessary which can be related to the
number of people using the space, and can regulate the quality of the space. The proposed plan for rezoning New York by Harrison, Ballard and Allen defined usable open space in regulations specifying that:

- to be considered usable, open space shall not be occupied by an accessory building, off-street parking or loading space or service driveways; shall provide access for all occupants of the building; and shall conform to certain minimum dimensions.

The usable open space device, regulated on a per dwelling unit basis, is a brake on any tendency to squeeze an excessive number of small dwelling units into a building, a tendency not regulated by the floor space ratio.

The City of Toronto includes specifications for minimum landscaped open space which are included in a section of the zoning by-law with floor area ratio provisions (Appendix B, page 101). In this document, "landscaped open space" is defined as:

- open, unobstructed space on a lot which is suitable for the growth and maintenance of grass, flowers, bushes and other landscaping and includes the part of a lot unoccupied by any building or structure... and any surfaced walk, patio or similar area but does not include any driveway or ramp, whether surfaced or not, any curb, retaining wall, motor vehicle parking area or any open space beneath or within any building or structure.

The minimum landscaped open space required for a zone 1 area (suburban low density), under the Toronto by-law is 30 percent of the area of the lot.

The chief purpose in treating open space as an affirmative requirement—rather than the residual product of interacting coverage, yard and court requirements—is to ensure that the individual open spaces on any lot shall actually be of size and shape that can be used. An aggregate unobstructed area meeting the requirements but
scattered in bits and pieces on various sides of a building would be meaningless.

Access of light and air. The commonly used by-law techniques for controlling daylighting are mainly attempts to express the basic geometry of daylight transmission within the context of the architecture of the street. Their origin evidently lies in the early tenement house laws that very sensibly expressed open space requirements as a function of building height and street width. When applied to the case of parallel rows of attached or close buildings of equal height the common code techniques are able to provide close control of outdoor space for daylighting standards as the problem has only one variable. The principal difficulty is with free-standing buildings that require daylight access on all sides.

Only a brief discussion of commonly used by-law techniques for daylight access is included here since a following section on performance standards refers to them. An example of daylighting provisions found in current by-laws is contained in Appendix C, page 104. Of the four basic techniques, two—yards and set-backs, and height limitations, have been discussed in Chapter One. Restated here, the commonly used by-law techniques are the following:

1. Yards and set-backs

   Yards and set-back requirements are commonly expressed simply as linear values but may be expressed angularly, or in detailed and graduated form to provide greater flexibility and particularization in siting.

2. Height limitations
In combination with yard, set-back and court requirements, height limitations describe an envelope of space within which a building may be built.

3. Vertical and average light angles

Yard and height limitations are expressed equally well and with some increased flexibility in application by vertical angles measured either from lot lines or road centre lines to the building cornice. The vertical angle is a more direct, effective and flexible expression of how natural light actually reaches dwellings than are height and yard expressions.

4. Horizontal areas or angles of daylight access

This device is normally specified as one or two horizontal arcs of given radius that must be obtained within an overall horizontal limiting arc or light acceptance angle measured at the window, or at the centre of a rooms' exterior wall.

Based on these techniques, Charles K. Agle has proposed two controls suitable for single-family residential development, which are worth consideration in the study of privacy. The first is that of a construction "tent" as illustrated in Figure 17, page 69, which would control bulk and assure neighbours of adequate light. No structure would extend outside this "tent" which is comprised of planes sloping inward and upward at an angle of 45 degrees from the vertical and beginning at lines 10 feet above natural grade on all property lines. The relationship between this control and the degree of privacy achieved through its regulation, particularly in side yard areas, is discussed in the following section on performance standards. A second control put forward by Agle concerns windows in relation to property lines and is related to the vertical and average light angles discussed earlier. Where facing property lines, except on the street side, the sill of windows should not be below a 45 degree
FIGURE 17
LIGHT ANGLE ABOVE TEN FEET

FIGURE 18
WINDOWS IN RELATION TO PROPERTY LINE

From Charles K. Agle, A New Kind of Zoning, pps. 244, 252.
plane sloping downward and inward from a line 10 feet above the grade on the property line. This is illustrated in Figure 18, page 69.

If the window is to the floor, this means that the wall must be 10 feet away from the side line. If a clerestory window is used at 7 feet from the ground, as illustrated, the wall may be within 3 feet of the line. The neighbour may then protect his privacy or build his house to a 10 foot height on the property line without destroying the light of the first owner.

Premium or bonus concept. Perhaps the most attractive innovation to existing site and space regulations is a provision that allows a "bonus" in permitted height and bulk when the developer devotes more land to open space than is strictly required. These incentives, if included in local by-laws, would encourage private developers to engage in proper site planning and space layout.

A second form of this concept is suggested by R.D. Cramer, and involves compensatory setbacks. In an attempt to create greater flexibility in residential zoning, he advocates allowing a certain portion of a house to protrude into the front yard area if in exchange a second portion stays well behind the setback line, giving at least the original total area of the front yard, perhaps more. The same treatment, illustrated in Figure 19, page 71, can be extended to the back yard and to side yards. This system would produce a more varied frontal effect in the street, and in terms of livability, would give the owner a better chance to develop the property to suit his needs and likes.
FIGURE 19

COMPENSATORY SET-BACKS

From Richard D. Cramer, "Zoning and What We Can Do to Improve It."
The foregoing discussion has involved a review of site and space regulation techniques, some in practice today, others proposed and involving major variations to the existing zoning and subdivision regulations. In every case, however, the regulations suggested within these techniques will to some extent affect the degree of privacy available to the resident. An attempt is made in the following section of this Chapter to combine in performance standards, the most promising of these techniques in order to evolve a technique for site and space planning based on a performance standards system.

III. PERFORMANCE STANDARDS

The expression "Performance Standard" is taken from building code terminology. Modern building codes are written more in terms of what materials and methods of construction will do— their performance under stated conditions— rather than in specific descriptions of materials and building methods.

As stated briefly earlier, building codes have passed through three stages. In the first or "primitive" stage, for example, the code stated that a wall between two dwelling units should be made of brick or stone. Realizing that not all walls of brick or stone acted alike, it was then necessary to state how the wall was to be constructed. This was the second stage, the "specification" code. New materials and techniques have been advanced to fulfill these specifications, so that now the concern is no longer that control should govern not the "use" but rather the "effect."

Some parts of the current zoning by-laws have reached the "specifi-
cation" stage; side yard requirements, for example. The typical zoning by-law specifies that "there will be two side yards, each of which will be not less than five feet in width." This is a specification standard, as a minimum acceptable width has been specified. In comparison, an example of a standard related to the primitive stage would state that "side yards must be furnished." However, the present side yard regulation does not indicate what the house and lot orientation should do, which is to assure adequate light and air to the neighbouring site, and from the point of view of this study, to assure adequate privacy for the dwelling inhabitants.

The ideal zoning performance standard will substitute a quantitative measurement of an effect for the qualitative description of that effect that has been used in the past. It will not use the terms "limited," "substantial," "objectionable," or "offensive." Instead, it will establish definite measurements, taken by standardized methods with standardized instruments, to determine whether the effect of a particular use is within predetermined limits, and is therefore permissible.

Performance standards have been developed in North America to deal with the following types of potential nuisance: noise, vibration, smoke, dust, and other particulate matter, odour, toxic and noxious matter, fire and explosive hazards, humidity, heat and glare, and radiation hazards. Most standards are highly technical and there is no point in setting them out in detail in this study. The most thorough-going examples are in the Chicago and proposed New York by-laws; the New York provisions governing noise are contained in Appendix D, page 106. Research indicates that no city has abandoned traditional use district boundaries, but several have
adopted performance standards to provide a higher degree of differentiation among industrial zones and to allow the least noxious of these close to residential districts. An example of this type of standard appears in the City of Edmonton Zoning By-law and is reproduced in part in Appendix E, page 108.

The chief difficulty observed in regard to performance standards is not so much in the preparation of scientific standards, but in their administration. The skill required goes far beyond the competence of the average zoning enforcement officer. Some cities have met this problem by submitting all such cases to a private consultant and requiring this developer to pay the fees.

Residential performance standards. The literature examined in the course of a bibliographical analysis of performance standards for space and site planning for residential development tends to suggest agreement that:

Experience with siting regulations during the past thirty years indicates the essential need for more flexibility in the standards upon which these regulations are based as well as in their administration, bearing in mind the unique characteristics of most residential sites and the new large scale of residential developments that often involve several hundred units.

To help accomplish these ends, first, the controls should not place limitations on good design as do the present regulations. While establishing a "minimum", they should not prohibit the "maximum." Second, the provisions need to be expressed in terms quite definite, but also "suggestive." For example, in the residential environment, instead of a specification for a roadway reading, "required a 20 foot width of pavement," it could be stated in this fashion: "required two moving
lanes" indicates quite definitely that they are not for parking and implies the need for providing additional space for this purpose. The direct reference to performance is precise and a more positive means of stimulating and encouraging development of better designs.

In order to propose a range of specific performance standards related to site and space regulation, which will be designed to achieve greater privacy within the residential environment, it will be necessary to establish specific criteria on which to base these standards. Due to the extremely subjective nature of privacy and the conclusion that an absolute definition of adequate privacy can not be found, a performance standard based directly on privacy will not be possible. Unlike noise and smoke, privacy cannot be measured or directly related to standards for control. It appears to be more reasonable therefore, to improve privacy in residential development by correcting the adverse effects of current site and space regulations through the use of flexible performance standards.

Having related privacy, through its various forms, to such aspects of the residential environment as noise, odour, spatial separation, street access and enclosure, it is proposed that performance standards that relate to these aspects will, in fact achieve a greater degree of privacy than now exists within the residential environment shaped by present regulations. The limitations imposed on the study are reflected in the form of the performance type standards that are to be proposed, in that in concentrating on the characteristic of privacy, other equally important aspects will appear to have been ignored.

Recapitulating, a proposed technique for site and space planning for
privacy in single-family residential areas based on a performance stand-
ards system must involve: the physical provision of adequate space for
building, access and outdoor activities; and the provision of maximum
freedom in the choice and development of the lot, dwelling and access
street. The problem is two-fold: the first is, how many types of spec-
ifications are necessary or desirable, and the second is, in what terms
would these be expressed. The minimum resort to spatial dimensions is
desirable, but unfortunately, there seems to be no substitute for space
standards that will convey the desired "qualitative" provisions while
assuring provisions of adequate absolute space. In view of the above,
an attempt is made in the following discussion to evolve a method of
specification that will assure the provision of adequate space and the
other material requirements, while maintaining that freedom so essential
for the individual.

A provision for open space involves establishing a minimum lot area,
subject to considerations relative to the locality and the larger resid-
ential areas. A space provision also includes the availability of a
variety of lot sizes and types or shapes in any one area in order to avoid
monotony under development. This means that the density established by
the minimum must be modified to allow for the variety since any variation
from the minimum will require additional area. The suggestion is that the
overall density requirement be expressed in terms of dwelling units per
gross acre, \( \frac{1}{4} \) in relation to the minimum lot area specification.

Other provisions for the lot should include a minimum width for
the lot, with any other space requirements such as access to the rear of
the lot added to this. Further, the minimum lot width should not be a
frontage requirement in order to encourage variability in site dimensions. The provision of light and air and other elements dependent upon the vertical projection of building area will require maximum flexibility in the control measures, if imaginary lines of restrictions are not to become real obstacles. Therefore, in addition, the floor area ratio device is recommended.

The floor area ratio, that is, the total floor area of all storeys used for residential purposes divided by the area of the residential land to control density, with an additional index of floor area per person is recommended by the Harrison, Ballard and Allen report. As a result of this type of control, it is suggested that both light and air are automatically provided for without any further rear, front or side yard requirements. The fact that his neighbour can also build where he desires will persuade the home owner to place his own dwelling so as to protect his own access to light and air, should he have a window adjacent to his neighbour.

Since the practice has been to eliminate the rear lane in recent subdivision development, an essential provision for reasons of safety is an access to all parts of the lot without the necessity of going through the building. This provision is over and above the minimum building lot width.

The construction "tent" to control bulk that was discussed earlier is recommended here in conjunction with the floor area ratio. No structure would extend outside this "tent" which is comprised of planes sloping inward and upward at an angle of 45 degrees from the vertical and beginning at lines 10 feet above natural grade on all property lines. Finally,
where facing property lines, except on the side street, the sill of windows should not be below a 45 degree plane sloping downward and inward from a line 10 feet above the grade on the property line. No additional control of the height of the dwelling is necessary in that the floor area ratio and the light plane will control it adequately.

Performance standards regulating the design of the access street in the residential environment are not considered in this study although a provision for parking requirements, for instance, would affect privacy. The placing of parking facilities appropriately near the street would remove the problem of the automobile intruding on both visual and auditory privacy.

The foregoing provisions are summarized in Table II, page 79. In order to illustrate graphically the technique with regard to the manner in which privacy has been achieved, Figures 20 and 21, page 80, show three single-family residential dwellings in plan and elevation, sited according to the proposed specifications.

In brief, then, the advantages of the proposed provisions with regard to privacy can be stated as follows:

1. The flexibility obtained through availability of various lot sizes permits greater facility in exploiting minute natural features of the site. Landscaping can be employed to achieve visual and auditory privacy.

2. With a variety of lot sizes, even though the same mass of width of building is used, variations are possible, since the remaining open spaces will differ. A greater proportion of usable open space will be provided within the lot area.

3. Provision of garage or carport, convenient to both street or dwelling is possible with very little encroachment on valuable lot space. Spatial separation between automobile facilities and usable open space that is possible will increase the possibilities for auditory and physical privacy.
TABLE II

SUMMARY OF TECHNIQUE FOR
SITE AND SPACE PLANNING

Required Standards for the Lot

1. Overall density in terms of dwelling units per gross acre.
2. Minimum lot area.
3. Minimum buildable lot width.
4. Floor area ratio.
5. A free and clear access to all parts of the lot other than through the building. Width determined by local requirements; in addition to minimum lot width.
6. Light angle above 10 feet—no structure or part of a structure may be built outside a plane sloping inward at an angle of 45 degrees from the vertical and beginning at a line 10 feet above natural grade on all property lines.
7. Windows in relation to property lines. Window sills not to be below a 45 degree plane sloping downward and inward from a line 10 feet above grade on property line.
8. Enclosure limitations—maximum 10 feet above grade for fences, above which neither solid planting or structural barrier to light permitted; all yards.
FIGURE 20

SPATIAL ARRANGEMENT UNDER PROPOSED REGULATIONS - ELEVATION

FIGURE 21

SPATIAL ARRANGEMENT UNDER PROPOSED REGULATIONS - PLAN
4. Provision of more building space, permitting uncramped planning of dwelling, facilitates the evolution of the "informal" plan which includes private open space as an extension of enclosed space; and which provides better opportunities to use the form of the building to create private usable open space within the lot.

5. Enclosure limitations will increase the opportunity for an individual to enlarge his usable open space, and will increase the degree of visual, auditory and in some instances, olfactory privacy.

IV. SUMMARY

The overall effect of present site and space regulations, which are contained in both zoning and subdivision by-laws, has been to limit the privacy of the individual within the residential environment by restricting the way in which dwellings and their accessory buildings may be sited on their respective lots, and by controlling the amount of space on the lot that must remain open and unobstructed by any construction. In recent years many effective innovations to site and space regulations have been introduced in zoning and subdivision by-laws, both in Canada and the United States. These concepts or techniques include cluster housing, bulk controls, and performance standards.

The cluster housing concept of residential land development requires new regulations; standard zoning by-laws and ordinances make no provision for the unusual cluster method. The concept requires a major redistribution of land area, and is not simply a new technique that can be applied directly to current site and space regulations governing residential development in a grid system.

The regulations suggested within the bulk control techniques, effect, in some degree, the privacy available to the resident. Some
of these site and space regulation techniques are in practice today, while others proposed are not, and will involve major variations to the existing zoning and subdivision regulations before they can be put into effect. The most promising of these techniques is the proposed performance standards.

The ideal zoning performance standard will substitute a quantitative measurement of an effect for the qualitative description of that effect that has been used in the past. It will establish definite measurements, taken by standardized methods with standardized instruments, to determine whether the effect of a particular use is within predetermined limits, and is therefore permissible.

In order to propose a range of specific performance standards related to site and space regulation, and designed to achieve greater privacy within the residential environment, it will be necessary to establish specific criteria on which to base these standards. Due to the extremely subjective nature of privacy and the conclusion that a definition of adequate privacy can not be found, a performance standard based directly on privacy will not be possible. Unlike noise and smoke, privacy can not be measured or directly related to standards for control. It appears to be more reasonable to improve privacy in residential development by correcting the adverse effects of current site and space regulations through the use of flexible performance standards.
CHAPTER IV
SITE AND SPACE PLANNING FOR PRIVACY

Most zoning and subdivision regulations are a reasonable and fair attempt to deal with a complex problem, but the results of residential development under present controls leave much to be desired. It is probably impossible to prohibit "bad" design or to pass legislation that a certain design must be followed. However, it is desirable and highly possible that what controls we have could be more "positive" in effect to encourage and facilitate good imaginative design.

This new approach to controls, with the necessary flexibility, is a must if we are to take advantage of the past, present and future technological developments; to keep up with and give expression to the ever-changing and improving "way of life"; and to maintain as much as possible the individual's freedom of choice and expression, within his own residential environment.

The still prevalent preference for a single-family dwelling is based largely on the privacy it offers. This study has attempted to analyze this highly subjective characteristic of site and space regulation with the hope that a technique for site and space planning could be established that would ensure the privacy inherent in the single-family site development, and would create an opportunity for the individual to achieve privacy in other forms of residential housing.

I. APPRAISAL OF THE STUDY

The basic methods of land-use control in North America are zoning and subdivision regulation. These regulations are usually contained in planning, zoning or subdivision control by-laws, which in Canada are
enacted in the various municipalities through the terms of reference of appropriate provincial statutes. The majority of by-laws and codes utilize standards that can be easily applied, such as specific setbacks, lot coverages, and height and width limits.

Ideally, low-density zoning and subdivision regulation should provide:

1. **Assurance of light and air.** An owner should be protected from loss of light and air because of the proximity, bulk or shape of his neighbour's house.

2. **Privacy.** An owner should be able to protect his privacy without sacrifice of light, air or usability of any of the open space of his lot.

3. **Full use of land.** An owner should be enabled to develop fully his open land as practical garden, leisure or play space. He should not be required to sterilize much of it.

4. **Freedom of design.** Without infringing on his neighbour's rights, an owner should be free to build his house in one, two or more storeys and of any shape he pleases.

5. **Protection of Neighbourhood Character.** Development of new structures and re-use of old ones should be consistent and in a manner not detrimental to the character of the neighbourhood.

Contrary to the above, the research has shown that current techniques of zoning and subdivision regulation in low-density residential areas have not achieved the benefits originally intended, the inflexible nature of the controls leading to a visual monotony in residential development. Worthy as some of the principles may have been at the outset, they have largely miscarried by such preoccupation with the tools of regulation that basic needs have been forgotten.

The conventional tools include (1) minimum yard requirements, (2) classification of structure in terms of occupancy, (3) separate regul-
ations for accessory buildings, (4) height limitation, and (5) minimum standards of floor area or cubage. Most of these tools have been found to be inadequate to satisfy the present day needs of the individual as outlined above.

The history of regulations governing the materials and methods of construction has progressed through two clearly defined stages of development: "primitive standards" and specification standards. Existing site and space controls have evolved from efforts of communities to protect themselves against hazards to safety and health. The residential building regulations enforcing these control standards are related to spatial separation as well as to structural safety. It is the effect of spatial separation that was investigated in this study; primarily the controls on the dimensions of space which are involved in site and space regulation.

Site and space regulations should be designed to protect the dwelling unit against fire, to ensure that each dwelling unit has adequate light and air, and to guard each dwelling unit from undue noise. In addition it was felt that privacy was a value that regulations should ensure. The underlying purpose of the study was therefore to investigate visual, auditory, olfactory and physical privacy within the context of the residential environment. The study considered the residential environment to consist of single-family dwellings only, arranged on the typical grid system of land subdivision common to North America, and of a low density similar to that normally found in the "highest" order of residential zoning classification. The specific purpose of the study
were two-fold; first a review and analysis of current site and space standards as they are contained in the various forms of land-use control documents, in order to determine their effect on privacy in the residential setting; second, the formulation of a technique for site and space planning for privacy, based on a performance standards system.

The research demonstrated that adequate space around and between buildings for functional and aesthetic purposes can be achieved with greater flexibility and without further restricting the individual's wishes in siting and building his house on the usual single-family lot. Such flexible standards are usually referred to as performance standards since they measure space between and around buildings in relation to the variety of functions that they are to perform and in relation to the size and dimension of land and buildings in a given situation. In the post-war decade, performance standards were used in the siting and building of industrial and commercial structures. This experience demonstrated that performance standards provide a more flexible framework for the designer of individual buildings or groups of buildings and also enable government agencies to administer regulations effectively.

Since the basic element of any residential district is the individual unit composed of the dwelling, its yard and access street, the requirements of this "unit" should be paramount in establishing any regulations to control its design. The study was centred on this unit over the course of the general discussion of land-use controls, but narrowed the scope to the yard for the investigation of site and space regulation in relation to privacy, and performance standards.
II. VALIDITY OF THE HYPOTHESIS

The hypothesis established for the study directed research into two fields. The first, that of site and space standards, involved an investigation into the factors that might have determined the spacing of residential buildings in the past, and into factors that should be operative today in this determination. The basic assumption upon which this aspect of the hypothesis was based was that some measure of privacy is possible within the residential environment shaped by existing standards of site and space. In review, the hypothesis in part stated:

That existing site and space standards adversely affect the privacy of open space within the residential environment;

The investigation concludes that with few exceptions, present site and space standards for building and site planning are arbitrary and rigid, and that the spatial separation of buildings and yard areas resulting from the application of these standards do not encourage privacy. Further, through the existence of such regulations as those concerning enclosure limitations, the resident is restricted in his means of minimizing the opportunities for infringement of his privacy by neighbours or those passing in the street.

The conclusions supporting this statement of the hypothesis related to site and space standards can be summarized as follows:

**Existing yard requirements.** These adversely affect privacy in that they restrict the siting of the building. Front yard requirements, while creating some measure of visual and auditory privacy through spatial separation of the street and building, do not provide usable open space in terms of privacy. Front yard set-backs, by aligning dwellings at a distance of 20 or 30 feet from the front lot line, restrict the size of the rear yard and minimize the opportunity for private usable open space, enclosed by portions of the building. Where garages are attached to the main building, which is positioned by yard requirements, auditory and visual privacy are lost through the presence of the automobile well within the lot area. Side yard requirements create little usable open space of a private nature.
on the average lot. Without a dividing fence, and used as a lot access, the side yard becomes an acoustic trap, lacking in all forms of privacy. Rear yard requirements, applying to both the main and accessory buildings, force these buildings into the usable lot area, resulting in small, irregular yard shapes devoid of visual, auditory or physical privacy, and lacking the opportunity of attaining these forms of privacy.

2. **Existing enclosure limitations.** With regard to fence, wall or landscape heights, these limitations minimize the opportunity for the resident to achieve visual or auditory privacy. The present height restriction on fence or wall dividers restricts visual privacy within the lot in both open space as well as enclosed space.

3. **Existing minimum building and lot area, and cubage standards.** These restrict flexibility in building design and site layout. Usable open space for outdoor activities is limited through rigid spatial arrangement of building on the lot.

4. **Existing height limitations.** Height limitations in conjunction with yard requirements restrict physical privacy through overlooking. Large wall areas adjacent to the property line adversely affect acoustics, and thus privacy of open space.

By no means comprehensive, due to the highly subjective nature of privacy, the above summary of conclusions supports the hypothesis that existing site and space standards adversely affect the privacy of open space within the residential environment.

The second field of investigation established by the hypothesis was that of performance standards as a technique for site and space planning. The section of the hypothesis relating to this states:

that a technique for site and space planning for privacy can be evolved, based on a performance standards system.

The thesis has followed through the steps of the performance approach to establish type standards for site and space regulation. Throughout the analysis, the main concern was to provide flexibility in the provisions, in order to adjust to the extremely variable requirements of privacy. An attempt has been made to show graphically the application
of the proposed standards in order that the reader might compare the building and site planning possibilities under the present and proposed regulations.

Admittedly, the proposed standards do not guarantee greater privacy any more than the present standards; nor would, it is suggested, the strict application of the standards result in less privacy. But, under the proposed type regulations, as far as can be shown, the designer has much more freedom, essential if he is to design for privacy. Any limitations still apparent are mainly due to the inability to extract for control, the essential elements related to privacy.

The general conclusions, therefore, concerning this field of research can be stated as follows:

1. The most evident weakness of performance standards in their relationship to privacy at present, seems to lie in the matter of a reliable and detailed scientific measurement of privacy. Adequate privacy could not be defined, and the study could not propose a method for measuring privacy.

2. There would appear to be real difficulties in the application and enforcement of this type of site and space standard, due to its flexible nature.

With regard to the statement of the hypothesis concerning performance standards, it can be concluded that in fact a technique for site and space planning for privacy as such, can not be evolved. However regulations that are directly or indirectly related to privacy can be formed, based on a performance standards system in order to achieve a similar end result.

Finally, conclusions concerning the study as a whole can be stated. Similar to aesthetics, adequate privacy can not be guaranteed by regulation for every case. However, a positive contribution towards
single-family residential privacy of open space can be made if site and space regulations were so formulated that they no longer exerted an adverse effect on residential privacy. Further, site and space standards of traditional specification and performance type, appear to lack the necessary scientific basis for effectiveness as techniques for site and space planning. Performance standards in particular will require a more scientific basis for measurement before they will prove to be reliable and effective within the process of community planning.

III. SUGGESTIONS FOR FURTHER RESEARCH

The area of greatest disagreement lies in what people really expect of residential areas in terms of privacy. It would appear difficult to formulate lasting or meaningful site and space standards for siting and building in residential areas, without a more clearly defined policy of what these regulations are to achieve. Closely allied with this concept is the fact that little is apparently known of the impact of certain space and site planning standards upon people. For instance, research for this study found an area for discussion in the field of psychiatry -- the need of neuro-psychiatric patients for privacy. Further research therefore is required concerning the impact of certain space and distance dimensions upon people.

Additional research could be instigated with regard to the integration of zoning and subdivision controls, or at least a better co-ordination between the two. The requirements of the street, the lot and the dwelling must be considered together; this is difficult under present conditions, since regulations pertaining to the site are contained in
zoning by-laws, while street and development standards are found in sub-division controls. Research could be applied to the proposal that performance type building codes be adopted, and that zoning and subdivision controls complement these.

IV. CONCLUDING NOTE

No one argues for the abandonment of standards. Clearly some type of development controls are necessary, especially in urban areas. To be of maximum value, standards should be periodically examined, revised and brought up to date. Since no particular standard in isolation is entirely adequate and reliable, standards should be used in combination, and above all, with discretion.

With a better set of standards, flexible enforcement, more consideration of the essential ingredients of the qualities which describe a "better" residential environment, and the granting of more freedom to designers, it is hoped that the quality of both single-family and multi-family housing will be improved.

One obvious reason for less rigid site and space standards is that housing sites, objectives and building programs are rarely identical. A design based on a specific and unique program which allows for future adaptations and which in addition, recognizes the special characteristics of the dwelling site, is likely to be one which is highly livable, providing many of the aspects of quality, including privacy in its many forms.

The most evident weakness of performance standards at present seems to lie in the matter of reliable and detailed scientific measurements of certain aspects of space use. The natural sciences will have to provide
those responsible for framing performance standards with more exact and relatively simple techniques for measuring noise, dust, glare, wind, exposure, etc. The social sciences will have to develop meaningful techniques of measuring and describing such concepts as privacy, intimate views, sense of enclosure, before performance standards for residential areas can become effective.
FOOTNOTES
FOOTNOTES

CHAPTER I


6 Ibid.

7 Ibid., p. 82.

8 Delafons, op. cit., p. 18.

9 Ibid., p. 21.

10 The Corporation of the Township of Richmond, Subdivision Control By-law No. 1639 (Richmond, British Columbia: The Corporation of the Township of Richmond, 1959), p. 1.

11 Delafons, op. cit., pp. 77-8.

12 i.e., The ratio between the total floor area of the building and the ground area of the site.

13 Harrison, Ballard and Allen, Plan for Rezoning the City of New York (New York: City Planning Commission, 1950), p. 44.

14 Royal Architectural Institute of Canada, op. cit., par. No. 52.
CHAPTER II


CHAPTER III


14 Gross acre as used here includes streets, lanes, easements, and other access ways, but not parks, play grounds or tot lots, etc.

APPENDICES
APPENDIX A

AMMENDMENT TO SUBDIVISION REGULATIONS

FOR CLUSTER DEVELOPMENT*

Section 9—CLUSTER DEVELOPMENT

1. "In order to promote the health and general welfare of the community and to preserve and make available Open Space, the Town Planning Commission may grant a developer the right to vary the residential density within a tract to be developed, leaving a substantial area free of building lots; the right to vary the density shall be subject to the following conditions:

   (a) "An overall plan of the entire tract showing roads, lot lines, lot areas, easements, encumbrances and other relevant data shall be submitted in accordance with Sections 6, 7 and 8 of the Subdivision Regulations save that locations of individual houses, structures, areas of shrubs and/or trees to be retained, location of single trees of 15" diameter or more, existing contours and proposed grading, drainage and landscaping shall be shown also.

   (b) "Overall density shall not exceed that of the zone in which the land occurs. The houses in the proposed sub-division shall be grouped in clusters. Cluster development shall not be permitted in Zoning Districts in which the minimum lot requirement is less than 20,000 square feet. Minimum lot size shall be 15,000 square feet in a zone requiring normally a 20,000 square feet lot minimum and provided that a piped water supply is available. Elsewhere the minimum lot area shall be two-thirds of the minimum normally required in the Zoning Districts in which the land occurs.

   "Minimum yard requirements in a Cluster Development shall be:

   Front yard—20'

   Side yard—10' (save that garages or carports upon adjacent lots may join at the property line or be grouped on land away from the individual lot)

   Rear yard—25'
(c) "In cases where a developer has designed special groups of dwellings and garages, the Commission after inspecting plans and elevations may grant smaller lot minimum sizes than those in paragraph (b) provided that the sanitary systems are approved by the Town Health Officer, that the overall density does not exceed that permitted within the Zoning District in which the land occurs or that the layout is not detrimental to the health and general welfare of the community.

(d) "The balance of the land not contained in the lots or within the road rights-of-way shall be contiguous and of such condition, size and shape as to be usable for recreation. Such land shall be held in corporate ownership by the owners of lots within the development and the developer shall incorporate into the deeds of all property within the development a clause giving to the owners an interest in such open land which shall be used for recreational purposes only. (No structure save those incidental to the recreational use shall be permitted thereon.) "Open land shall be a minimum of 3 acres and shall be subject to taxation. In the case of such tracts of 5 or more acres the developer may petition the Town to take over the land to be used in perpetuity as Open Space.

(e) "Approval of a subdivision of the Cluster Development principle shall include the levying of a bond by the Town Planning Commission to cover the cost of road work and site improvements."

*From Urban Land Institute, New Approaches to Residential Land Development, pp. 81-82.
Appendix B

City of Toronto Zoning By-Law

Floor-Area Ratio Provisions*

Section 4 (12)

(a) No person shall, on any lot, in any V.1, V.2, V.3 or V.4 area, as the case may be, erect any C. building or C. structure having a greater gross floor area than as follows:

- V.1 areas: \[3 \times \text{area of the lot}\]
- V.2 areas: \[5 \times \text{area of the lot}\]
- V.3 areas: \[7 \times \text{area of the lot}\]
- V.4 areas: \[12 \times \text{area of the lot}\]

(aa) No person shall, on any lot in any L.1, L.2, L.3 or L.4 Zone, as the case may be, erect any non-residential building or non-residential structure having a greater gross floor area than as follows:

- L.1 Zones: \[1.0 \times \text{area of the lot}\]
- L.2 Zones: \[2 \times \text{area of the lot}\]
- L.3 Zones: \[3 \times \text{area of the lot}\]
- L.4 Zones: \[4 \times \text{area of the lot}\]

(b) No person shall on any lot in any zone 1, zone 2, zone 3, zone 4 or zone 5 area, as the case may be, erect any R. building or R. structure or any residential building or structure having a greater gross floor area or so that the lot has lesser landscaped open space than as follows:

<table>
<thead>
<tr>
<th>Zones</th>
<th>Maximum gross floor area</th>
<th>Minimum landscaped open space</th>
</tr>
</thead>
<tbody>
<tr>
<td>zone 1 areas</td>
<td>0.35 times the area of the lot</td>
<td>30% of the area of the lot</td>
</tr>
<tr>
<td>zone 2 areas</td>
<td>0.6 times the area of the lot</td>
<td>30% of the area of the lot</td>
</tr>
<tr>
<td>zone 3 areas</td>
<td>1.0 times the area of the lot</td>
<td>30% of the area of the lot</td>
</tr>
<tr>
<td>zone 4 areas</td>
<td>2.0 times the area of the lot</td>
<td>35% of the area of the lot</td>
</tr>
<tr>
<td>zone 5 areas</td>
<td>2.5 times the area of the lot</td>
<td>35% of the area of the lot</td>
</tr>
</tbody>
</table>

(c) For the purposes of this By-law,

(i) "gross floor area" means, in the case of a C. building or C. structure other than a residential building or structure, the aggregate of the areas of each storey
above grade measured between the exterior faces of the exterior walls of the building or structure at the level of each storey; and, in the case of an R. building or R. structure or a residential building or structure, means the aggregate of the areas of each floor, whether any such floor is above or below grade, measured between the exterior faces of the exterior walls of the building or structure at the level of each floor, exclusive, however, or any part of the building or structure below grade which is used for heating equipment, the storage or parking of motor vehicles, locker storage and laundry facilities, children's play areas and other accessory uses or used as living quarters by the caretaker, watchman or other supervisor of the building or structure;

(ii) except where an area is designated on a District May by the symbol "Z.1", "Z.2", "Z.3", "Z.4" or "Z.5", as the case may be,

Zone 1 area means any R.1 district;

Zone 2 area means any R.1A or R.2 district;

Zone 3 area means any R.3 district; any R.4 or R.4A district also designated as a V.1 area and any C.1 district also designated as a V.1 area;

Zone 4 area means any R.4 or R.4A district also designated as V.2 area; any R.4 or R.4A district (except those lying south of Bloor Street East and West, between the east limit of Spadina Avenue and the west bank of the Don River) also designated as a V.3 or V.4 area; and any C.1 district also designated as a V.2 or V.3 area;

Zone 5 area means any R.4 or R.4A district lying south of Bloor Street East and West, between the east limit of Spadina Avenue and the west bank of the Don River, also designated as a V.3 or V.4 area; and any C.1 district also designated as a V.4 area;

(iii) "landscaped open space" means open, unobstructed space on a lot which is suitable for the growth and maintenance of grass, flowers, bushes and other landscaping and includes the part of a lot unoccupied by any building or structure by reason of the operation of subsections (3), (4) or (5) of this section and any surfaced walk, patio or similar
area but does not include any driveway or ramp, whether surfaced or not, any curb, retaining wall, motor vehicle parking area or any open space beneath or within any building or structure.

*From City of Toronto Zoning By-Law No. 20623, April 13, 1959.*
APPENDIX C

CITY OR TORONTO ZONING BY-LAW

DAYLIGHTING PROVISIONS*

Section 4 (3)

(a) Subject to the provisions of paragraphs (b), (c) and (d) and of subsections (4) and (6), no person shall, on any lot in any R district, erect or use any building or structure any part of which projects beyond any of the angular planes constructed in the manner hereinafter described in this paragraph; but in no case shall any part of a building or structure be erected closer to any lot line than the distance of twenty-five (25) feet.

The hereinbefore referred to angular planes shall be constructed over the lot from each lot line at natural or finished ground level, whichever is the lower, at a vertical angle of sixty (60) degrees above the horizontal and measured perpendicular to the lot line or, in the case of a curved lot line, perpendicular to the tangents of all points of the lot line;

(b) Where a lot line of an inside lot coincides with a street line, the angular plane may be constructed from the centre line of the street instead of the lot line or from any intervening line parallel to the centre line of the street provided that (i) the distance between the line on which the plane is constructed and the lot line does not exceed thirty-three (33) feet, (ii) the vertical angle of sixty (60) degrees is constructed perpendicular to the line on which the plane is constructed or, in the case of a curved line, perpendicular to the tangents of all points of the curved line and (iii) in no case shall any part of the building or structure be erected closer to the lot line than the distance of twenty (20) feet;

(c) Notwithstanding the provisions of paragraphs (a) and (b) of this subsection but subject to the provisions of paragraph (d), any part of a building or structure may project beyond any prescribed sixty (60) degree angular plane if, in each case, (i) the projection through the plane subtends a horizontal angle not exceeding eighty (80) degrees formed by lines drawn from a point on the line on which the sixty (60) degree angular plane is constructed opposite to the centre of the projection,
(ii) the extremities of the projection are enclosed by the arms of such eighty (80) degree horizontal angle; and (iii) no part of the building or structure is erected closer to any lot line than the distance of twenty-five (25) feet (twenty (20) feet where the lot line of an inside lot coincides with a street line);

(d) Where part of a building or structure projects through the sixty (60) degree angular plane in the manner permitted by paragraph (c), no other part of the building or structure within a distance of one hundred (100) feet of either side of the projection shall project beyond a forty (40) degree angular plane, constructed from the line from which the sixty (60) degree angular plane was constructed and in a manner similar to that prescribed in paragraphs (a) and (b) for sixty (60) degree angular planes, unless the extremities of the projection through the forty (40) degree angular plane are enclosed by the arms of the horizontal angle constructed pursuant to paragraph (c).

*City of Toronto Zoning By-Law No. 20623, April 13, 1959.*
APPENDIX D

Extract from zoning ordinance, City of New York

PERFORMANCE STANDARDS REGULATING NOISE *

Definitions

For the purpose of this Section, the following terms are defined:

Decibel

A "decibel" is a unit of measurement of the intensity of sound (the sound of pressure level).

Sound Level meter

A "sound level meter" is an instrument standardized by the American Standards Association, which is used for measurement of the intensity of sound and is calibrated in decibels.

Octave Band.

An "octave band" is one of a series of eight bands which cover the normal range of frequencies included in sound measurements. Such octave bands serve to define the sound in terms of its pitch components.

Octave band analyzer.

An "octave band analyzer" is an instrument used in conjunction with a sound level meter to measure sound in each of eight octave bands.

Impact noise filter.

An "impact noise filter" is an instrument used in conjunction with the sound level meter to measure the peak intensities of short duration sounds.

Method of measurement.

For the purpose of measuring the intensity or frequency of sound, the sound level meter, the octave band analyzer, and the impact noise filter shall be employed. The "flat" network and the "slow" meter response of the sound level meter shall be used. Sounds of short duration, as from forge hammers, punch presses, and metal shears, which cannot be measured accurately with the sound level meter, shall be measured with the impact noise filter as manufactured by the General Radio Company, or its equivalent, in order to determine the peak value of the impact.
For sounds so measured, the sound pressure levels set forth in Section 42-213 (Maximum permitted decibel levels) may be increased by six decibels.

**Maximum permitted decibel levels.**

In all Manufacturing Districts, the sound pressure level resulting from any activity, whether open or enclosed, shall not exceed at any point on or beyond any lot line, the maximum permitted decibel levels for the designated octave band as set forth in the following table for the district indicated.

In the enforcement of this regulation, sounds produced by the operation of motor vehicles or other transportation facilities shall not be included in determining the maximum permitted decibel levels.

**Maximum Permitted Sound Pressure Levels (in decibels)**

<table>
<thead>
<tr>
<th>Octave Band (cycles per second)</th>
<th>District M1</th>
<th>District M2</th>
<th>District M3</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 5</td>
<td>79</td>
<td>79</td>
<td>80</td>
</tr>
<tr>
<td>75 to 150</td>
<td>74</td>
<td>74</td>
<td>75</td>
</tr>
<tr>
<td>150 to 300</td>
<td>66</td>
<td>68</td>
<td>70</td>
</tr>
<tr>
<td>300 to 600</td>
<td>59</td>
<td>62</td>
<td>64</td>
</tr>
<tr>
<td>600 to 1200</td>
<td>53</td>
<td>56</td>
<td>58</td>
</tr>
<tr>
<td>1200 to 2400</td>
<td>47</td>
<td>51</td>
<td>53</td>
</tr>
<tr>
<td>2400 to 4800</td>
<td>41</td>
<td>47</td>
<td>49</td>
</tr>
<tr>
<td>above 4800</td>
<td>39</td>
<td>44</td>
<td>46</td>
</tr>
</tbody>
</table>

**Special provisions applying along district boundaries**

Whenever a Manufacturing District adjoins a Resident District, at any point at the district boundary or within the Residence District, the maximum permitted decibel levels in all octave bands shall be reduced by six decibels from the maximum levels set forth in Section 42-213 (Maximum permitted decibel levels).

* From Jolin Delafons, *Land-Use Controls in the United States,* Appendix p. XV.
APPENDIX E

PERFORMANCE STANDARDS PROVISIONS

IN

CITY OF EDMONTON ZONING BY-LAW *

Section 28 (1) Performance Standards

Subject to all other provisions of this By-law on any site, in any district defined, designated or described in this By-law as an M-1 Industrial District, a person will be issued a permit only for the uses more particularly described in Subsection (3) of this Section, and only if the use and operation proposed for a site is conducted at all times so as to ensure that the use and operation will not cause nor permit any external objectionable or dangerous condition apparent beyond any building housing processes wherein such effects may be produced, including but without limiting the generalities thereof, the following objectionable features, namely:

(1) Noise
(ii) Vibration
(iii) Smoke, dust and other kinds of particular matter
(iv) Odour
(v) Toxic and noxious matters
(vi) Radiation hazards
(vii) Fire and explosive hazards
(viii) Heat, humidity and glare.

(2) The Following Regulations Apply to Every Development in All M-1 Districts

(a) Appearance

(i) All buildings shall be of good architectural design to the satisfaction of the Director.
(ii) All yards shall be landscaped, and the entire site and all buildings maintained in a neat, tidy manner including the trimming and upkeep of landscaped areas and the removal of debris and unsightly objects.
(iii) All storage, freightage or trucking yards shall be enclosed or completely screened by buildings, trees, landscaped features, or fences or a combination thereof.

* From City of Edmonton Zoning By-Law p.
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BIBLIOGRAPHY

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