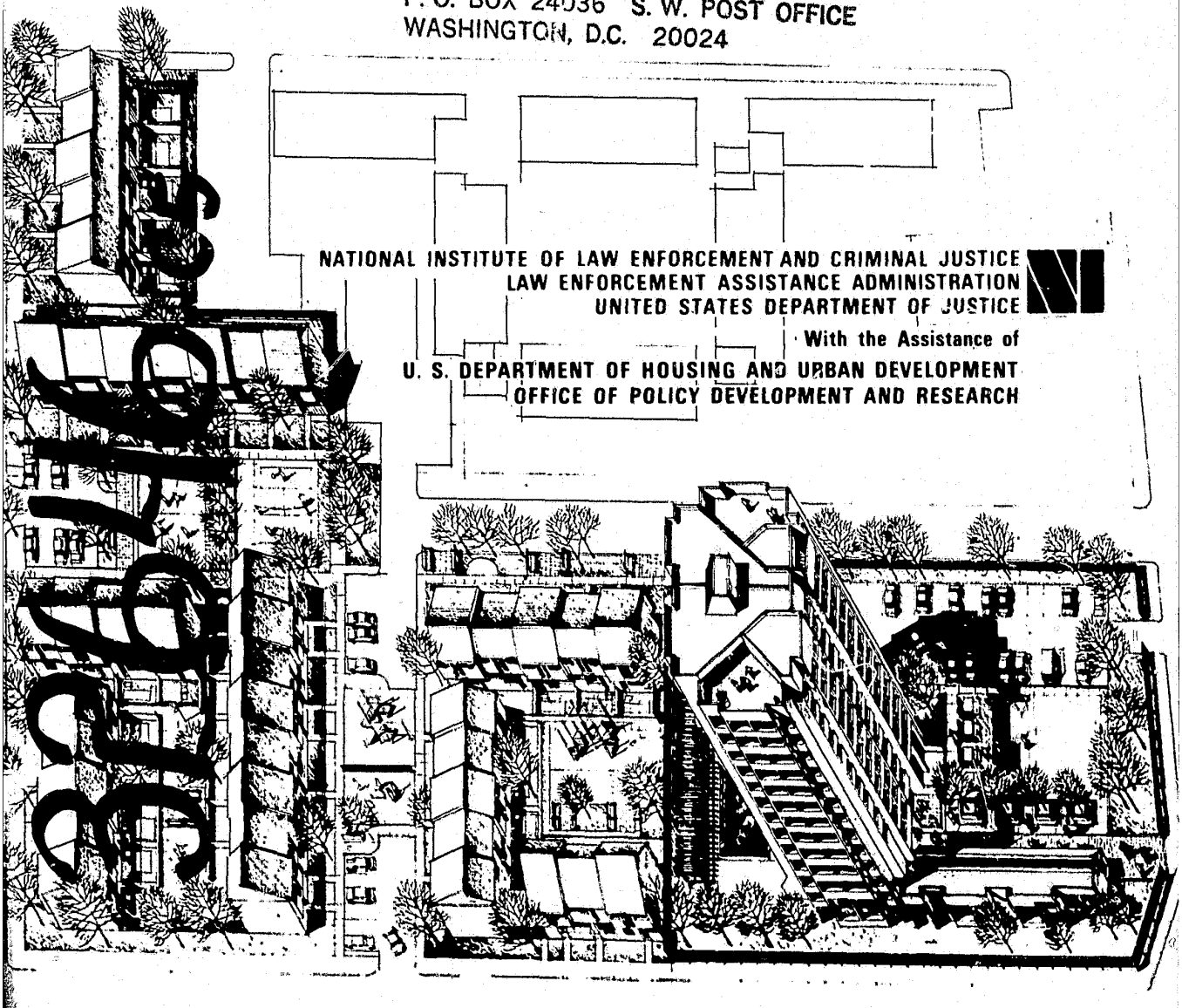
DESIGN GUIDELINES FOR CREATING DEFENSIBLE SPACE



NATIONAL INSTITUTE OF LAW ENFORCEMENT AND CRIMINAL JUSTICE
LAW ENFORCEMENT ASSISTANCE ADMINISTRATION
UNITED STATES DEPARTMENT OF JUSTICE

With the Assistance of

U. S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
OFFICE OF POLICY DEVELOPMENT AND RESEARCH

DESIGN GUIDELINES FOR CREATING DEFENSIBLE SPACE

OSCAR NEWMAN

NATIONAL INSTITUTE OF LAW ENFORCEMENT
AND CRIMINAL JUSTICE

Gerald M. Caplan, *Director*

LAW ENFORCEMENT ASSISTANCE
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April 1976

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The author wishes to acknowledge the administrators and staff of the National Institute of Law Enforcement and Criminal Justice and the Department of Housing and Urban Development for the financial support necessary to the development of this handbook. In particular, the author wishes to thank Gerald Caplan, Director of the National Institute, for his continuing interest in this area of research on crime prevention. The idea for this handbook was Mr. Caplan's, and his personal involvement in the many aspects of our other research activity has been both encouraging and productive. Thanks are due as well to Fred Heinzelmann and Richard Rau of the National Institute for their assistance in administrative matters, their research guidance, and their review and comments on the drafts of this handbook.

Charles Gueli, Director of the Office of Community Design at HUD, was an active supporter of this project and developed the idea for Chapter 5 of the manual: Prototypical Designs for Two New Housing Projects. He was also instrumental in providing funds for its preparation via the Office of Policy Development and Research at HUD. The author is indebted to James McCullough, Director of Architecture and Engineering of the Housing Production and Mortgage Credit Office of HUD, and Albert Stephens, also of that office, for their very detailed criticism, review, and editing of the first draft of this manual.

George Feddish, Director of Technical Services of the New Jersey Housing Finance Agency, also gave the entire manual a technical review. Both he and William Johnston, Acting Director of the New Jersey Housing Finance Agency, made the site in Newark available for the development of one of the prototypes. Harold Egenes, Director of the Indianapolis City Planning Commission and Karl Beck, the Director of the Indianapolis

Housing Authority, made the housing site in Indianapolis available for our second prototype study.

The staff of the Institute for Community Design Analysis who participated most directly in the preparation of this manual were Allan Christianson and Max Kawer, both architects. They collaborated in the preparation of the graphic materials and assisted in the development of the plans and drawings presented here. They share as well responsibility for some of the dimensioning and code confirmations necessary to meet local cost and code requirements. All the graphics in this manual were given a final rendering by Allan Christianson. Karen Franck, an environmental psychologist on our staff, was kind enough to provide continuing editorial advice and criticism while the manual was in preparation. She reviewed each draft and offered suggestions both for the addition of new material and the restructuring of chapters. Sue Fox served as technical editor and took on the laborious process of preparing this manual for final publication.

Addendum 3, on door and window construction and hardware, is an excerpt from the more comprehensive *Model Security Code For Residential Areas* prepared by our Institute with funds provided by the Ford Foundation.

Our government sponsoring agencies request that I mention that the photographs of housing in countries outside the United States are from my own personal collection, taken on trips abroad which were not financed by any public agency. Some of the other graphic material that appears in the handbook is from previous projects of mine, which also were not financed by our present sponsoring agencies. Finally, I should like to thank our Institute's Board of Directors for their assistance throughout: James H. Scheuer, Bernard Spring, William Porter, and Lisa Taylor.

Jo-Ann Cella was our able Administrative Assistant.

Oscar Newman
New York
December 1975

FOREWORD

In the past five years, crime has increased more rapidly in residential areas than in commercial or other sections. Sixty-two percent of all burglaries and a high percentage of all robberies now take place in residential areas. Most of this crime is concentrated in the low and moderate-income sections of the nation's cities, the same areas that contain most of the Federally assisted housing. Finding more effective ways to reduce crime in both new and existing government-assisted housing will help those who suffer most from crime. Equally important, it can halt the abandonment of badly needed housing, a growing problem in many cities.

One fact is clear: law enforcement agencies cannot do the job alone. Recent research findings underscore the point. A Police Foundation study in Kansas City, for example, found that altering routine patrol – either increasing or decreasing it – did not noticeably affect crime patterns. Research on police response time, sponsored by the National Institute of Law Enforcement and Criminal Justice, tentatively shows that the greatest delay occurs between the time a crime occurs and the report is made to police. Thus, for many crimes, speedy police response may not make a difference in the outcome. Similarly, Institute-sponsored research on the criminal investigation process suggests that even the best detectives cannot solve many crimes.

Given the inherently limited role of police, what other approaches can we take to prevent and reduce residential crime? During the past five years, the National Institute has supported research in "Defensible Space," which has examined residential crime patterns and the social and physical factors that correlate most strongly with crime. From this research have come architectural design concepts that foster a more proprie-

tary attitude by residents toward their buildings and neighborhoods and enhance safety.

Based on material produced by the original Institute study, a series of reports and handbooks have been published by a number of government agencies and foundations to help improve security in housing developments. With the publication of this handbook, *Design Guidelines for Creating Defensible Space,* a comprehensive outline now exists for programming and designing new housing developments to reduce vulnerability to crime. The handbook was prepared for architects, developers, housing agencies, and community groups to demonstrate how the problems of residential security can be addressed in the initial planning and design stages. It presents alternative plans and designs for housing that can be built at costs equivalent to and in some cases lower than existing housing.

The Design Guidelines have already evoked considerable interest. In reviewing the manuscript, the office of Policy Development and Research of the Department of Housing and Urban Development suggested adding another chapter and contributed funds for its preparation. Their involvement made possible Chapter Five, which presents design plans for specific housing projects. Another HUD office, Housing Production and Mortgage Credit, is producing a 90-minute, 16mm color film to be used with this manual to train HUD staff members throughout the country who are involved in reviewing and approving new housing developments.

The National Institute is pleased to have played a role in this important research.

Gerald M. Caplan
Director
National Institute of Law Enforcement
and Criminal Justice

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OSCAR NEWMAN

INTRODUCTION

Purpose of the Handbook

The traditional means for providing security in residential environments has been the after-the-fact employment of fences, alarms, hardware, and security personnel. This traditional approach is akin to the shoring up of inadequately designed building structures after they have been occupied—a circumstance most professionals would find intolerable and would view as a demonstration of poor initial design. This handbook was prepared for architects, developers, housing agencies, and community groups to demonstrate how to address the problems of security in residential environments in the initial stages of the design and planning process.

The achievement of security in the initial design of housing requires an understanding of many factors: the security needs and concerns of different types of resident groups; the use each group makes of its respective home environments; the capacity each group has to contribute to its own security; the building types available to answer the needs of different groups at different densities; the design options possible in site planning; and finally, how all these interact to maximize residents' control of their living environments.

This handbook examines how these different social, physical, managerial, and economic factors combine to produce secure housing. It also examines security hardware requirements and those building and site plan configurations that produce the most effective and economical use of security personnel. More specifically, however, this handbook demonstrates how the physical form of housing developments, when addressed to the needs and life-styles of particular types of residents, gives each group natural and continuing control of its

living area. The purpose of defensible space design is to enable residents to become the critical force in providing their own security.

The achievement of security in housing has become a critical issue in the past few years because as a nation we have begun to witness the large-scale failure of low- and moderate-income developments—a failure increasingly attributable to rising crime and vandalism rates. The lack of security in housing has produced high vacancy rates and heavy financial losses to management. In some instances it has led to the complete abandonment of housing projects. In the periods before abandonment, residential developments that suffer high crime rates have been found to receive only minimal use by their residents. The areas outside the dwelling units go unused—whether laundry rooms, lounging areas, parking lots, or playgrounds. These areas are also heavily vandalized. Residents living in an insecure housing environment withdraw from each other and from all areas beyond the interior of their homes. They are frightened to make the trip from their homes to neighboring streets, to shopping areas, or to the transportation facilities that will take them to other parts of the city. If they can afford to, they abandon their homes as well. This handbook is a guide, therefore, not only on how to make residential developments more secure but also on how to make them more livable.

We have tried to produce a set of guidelines for designing secure housing developments for all income groups. For low-income residents living in ghettos, experiencing the nation's highest crime rates and least able to afford costly hardware and security personnel, this handbook provides a means for ensuring their own security—in most instances from crime generated by their own neighbors. For moderate-income families, living adjacent to poverty areas and fearful for the future viability of their neighborhoods, this handbook suggests means for improving not only the security of their homes but the safety of the surrounding streets and of community facilities. For the low-income elderly, who are victimized at three to five times the rate of other low-income housing residents, this handbook provides low-cost solutions that are based on successful models in operation in high-crime areas in many cities throughout the country. For working singles and couples, whose homes are highly vulnerable to burglary during the

hours they are away at work, this handbook provides specific guidelines on how to design and secure their home environments. Finally, for middle-income families living in single-family houses in both urban and suburban areas, this handbook provides guidelines for techniques other than the traditional alarm systems.

The theoretical and factual bases used in developing these guidelines are the result of more than five years of research into the security problems of existing housing developments throughout the country by the staff of the Institute for Community Design Analysis and other groups. The methodology and findings from these years of study are discussed in the following publications. A list of other relevant studies appears in the bibliography at the conclusion of the manual.

1. *Defensible Space: Crime Prevention through Urban Design,* Oscar Newman. New York: Macmillan, 1972.
2. *Architectural Design for Crime Prevention,* Oscar Newman. Washington, D.C.: U.S. Government Printing Office, No. 2700-00161, 1973.
3. *A Design Guide for Improving Residential Security,* Oscar Newman. Washington, D.C.: U.S. Government Printing Office, No. 2300-00251, 1973.
4. *A Model Security Code for Residential Areas,* Oscar Newman and Stephen Johnston. New York: Institute for Community Design Analysis, 1975.
5. *Residential Crime,* Thomas Reppetto. Cambridge, Mass.: Ballinger Publishing Co., 1974.
6. *Defensible Space Modifications in Row-House Communities,* Imre R. Kohn, Karen A. Franck, and Arlen Sue Fox. Research report to the National Science Foundation. New York: Institute for Community Design Analysis, 1975.

Evidence directly supporting particular design guidelines is either placed within the text of this manual or cited in footnotes. When the common experience of various housing management agencies is the only basis for a design guideline, it is so stated.

The study of the effect of architectural design on the prevention of crime is a new field and, present evidence notwithstanding, many of the directives presented here await more rigorous testing. Further analysis and experimental work are still in progress by our group and others and will, no doubt, both refine and modify some of these recommendations. Our two sponsoring agencies

felt, however, that the experience of many housing authorities and management groups was sufficiently explained by the hypotheses and findings from our previous work to warrant the production of a handbook at this stage. The demand for a handbook of design guidelines for new housing, in which the past experiences of housing management are summarized, is particularly important to the Housing Production and Mortgage Credit Division of the Department of Housing and Urban Development; in many ways this edition has been produced in response to their particular concern that future housing avoid the most obvious mistakes of the past.

Defensible Space

Defensible space is a term used to describe a residential environment whose physical characteristics—building layout and site plan—function to allow inhabitants themselves to become the key agents in ensuring their own security. However, a housing development is "defensible" only when residents choose to adopt this intended role—a choice that is facilitated by the development's design. Defensible space therefore is a sociophysical phenomenon.

The physical elements that are used to create defensible space have a common goal: to release the latent sense of territoriality and community among inhabitants so as to allow these traits to be translated into inhabitants' assumption of responsibility for preserving a safe and well-maintained living environment. A defensible housing complex has the appearance of being composed of small, defined areas controlled by specific groups of residents. The effect is an environment that is intensively utilized and continually monitored by its inhabitants. Residents and nonresidents alike should feel that they will be recognized easily by other residents and that their presence can be questioned.

By creating housing projects that are defensible architects can facilitate residents' adoption of territorial attitudes and policing measures, which, in the end, are the strongest deterrents to criminal and vandal activity. This is accomplished by designing housing developments in which dwelling units are grouped together to facilitate associations of mutual benefit; by delineating areas for particular functions; by clearly defining paths of movement; by defining outdoor areas of activity for particular users through their juxtaposition with interior living areas; and by providing inhabitants with natural opportunities for the continued visual surveillance of these public areas, in buildings and outside them.

The determination of what constitutes acceptable behavior in a particular area around the home begins when a resident is able to conceptualize that an area is within his realm of concern and control and that he has the right to monitor behavior in it in a critical and questioning fashion. It is possible, through physical design, to create a situation in which both inhabitant and stranger can perceive that a particular area is under the undisputed sphere of influence of a specific group of inhabitants. This influence can be made so clearly evident that residents will not only feel confident but may even feel obliged to question the comings and goings of people so as to ensure the continued safety of areas that they have assumed are assigned to them. Any potential intruder can be made to anticipate that his presence will be questioned and challenged, to the extent that he will be deterred from even contemplating entry into defined areas.

Defensible space can be made to operate in an evolving hierarchy from area to area in a collective human habitat—to extend by degrees from apartment unit to public street. Its design techniques are as applicable to low-density garden apartments and row-house developments as they are to projects composed of high-rise apartment buildings. The common corridor shared by a small cluster of apartments on each floor of a multistory building is the first communal area beyond the apartment unit into which occupants can be made to extend the realm of their homes and the zone of felt responsibility. The second area is the common entry and circulation paths within their buildings. The third area can be created through the clustering of buildings to define a project's grounds and its entry. The final level in the hierarchy can be created at the interface where the housing development stakes its claim on the surrounding urban streets and community facilities.

The purpose of defensible space design is to return to the use of residents those previously public areas beyond the doors of individual apartments: the hallways, lobbies, grounds, and surrounding streets: areas that in most contemporary housing design are beyond their control.

The following design mechanisms, acting both separately and in combination, contribute to the creation of defensible environments.

1. The assignment to different resident groups the specific environments they are best able to utilize and control, as determined by their ages, life-styles, socializing proclivities, backgrounds, incomes, and family structures.
2. The territorial definition of space in residential developments to reflect the zones of influence of specific inhabitants. Residential environments should be subdivided into zones toward which adjacent residents can easily adopt proprietary attitudes.
3. The juxtaposition of dwelling interiors with exterior spaces and the placement of windows to allow residents to naturally survey the exterior and interior public areas of their living environments and the areas assigned for their use.
4. The juxtaposition of dwellings—their entries and amenities—with city streets so as to incorporate the streets within the sphere of influence of the residential environment.
5. The adoption of building forms and idioms that avoid the stigma of peculiarity that allows others to perceive the vulnerability and isolation of a particular group of inhabitants.

The subdivision of residential environments into areas defined for the specific use of small groups of similar families can increase the frequency of use of these areas and the range of options available to its users. When a small, rather than large, number of similar families shares an area, their ability to control it is enhanced; they can more easily assume responsibility for maintaining it; and feel more comfortable about acting to ensure its safety. Finally, in a small grouping each family feels free to use the collective space for a wider range of activities—many of which involve outsiders as well as immediate residents. Conversely, when a large number of families shares a large undefined area, no family feels it can control the use of that area; the range of possible activities is limited; disputes arise over rights to use the space and the nature of acceptable usage; the space suffers vandalism; and few residents are concerned for its safety or continued maintenance.

Guidelines and Their Function

Design guidelines are a recent innovation in design methodologies employed by architects and urban designers. Their purpose is to systematize program formulation and statement. The use of design guidelines is intended to clarify and make more manageable the relationship between the clients' needs, on the one hand, and the basic configuration of designs on the other. From the viewpoint of architects, design guidelines are intended to make programmatic objectives both clearer and more operational. From a clients' perspective design guidelines are intended to provide a framework for evaluating an architect's design proposals.

Design guidelines are statements about the organization and positioning of activity areas and their linkage with one another. Guidelines are intended to provide an indication of the generic rather than the specific physical form appropriate to needs of different human activities. Primarily, design guidelines frame programmatic objectives for architects and planners to follow in developing their designs for buildings and developments. They are also intended as a means for clearly ranking alternatives. They may be used as a comparative model, providing evaluative criteria for assessing the quality of different proposals in meeting the programmatic needs of different client groups. Design guidelines are justified in the text by reference to the experience that generated them. The set of design guidelines for a given program of space needs is intended to provide a set of rules for the development of a particular class of design solutions, not a unique solution.

Architects will find that the guidelines in this handbook generally can be incorporated into the development of residential designs without restricting either their own compositional predilections or their philosophical commitments in providing for the needs of residents. It is hoped that designers will find that the rules set forth here do not neutralize other design heuristics or prevent the inclusion or linkage of desired activity areas. As should become clear later in this manual, it is hoped that the design guidelines presented here will ensure that physical amenities, once provided, will actually see the use intended.

The Structure of the Handbook

Chapter 1, The Pattern of Crime in Cities and Residential Areas, summarizes the growth of American population and its concentration in urban areas; the polarization of urban populations, with higher-income groups moving out to the peripheral urban areas and lower-income groups occupying the older central areas; and the resultant construction of high-density housing developments in the 1950s and 1960s. The chapter also discusses the rise in the nation's crime rate and the increase of crime in residential areas. The major and concluding portion of the first chapter summarizes the findings of earlier research into social and physical factors, and their combinations, that correlate most strongly with crime rate.

In Chapter 2, The Evolution of Multifamily Housing, a history of contemporary housing is presented, with a discussion of the factors most influential in the evolution of current prototypes. All housing types are classified into four basic categories, determined both by the density of the population they can house and by the nature of the psychological environments they create. The factors that determine residents' ability to control areas in the interiors of their buildings and the exterior grounds surrounding them are discussed, and the concepts of private, semiprivate, semipublic, and public spaces are introduced and defined.

In Chapter 3, Design Guidelines for Buildings, the four categories of building defined in Chapter 2 are examined in terms of the suitability of each type to residents of different ages, family structures, backgrounds, and life-styles. The ways in which residents of different ages and life-styles use their environments are discussed in terms of the resulting vulnerability of their homes to crime and vandalism. A matrix of the different building types as related to different types of resident is presented, and combinations in the matrix are rated from "strongly recommended" to "not recommended." The chapter then concludes with design guidelines for making different building types secure for different types of resident. The specific design guidelines for each recommended building type/resident group combination are then presented at length. These include:

1. Single-family houses for families with children.
2. Garden apartments for families with children and for the elderly.
3. Medium-high-rise buildings for the elderly and for middle-income families with few children.
4. High-rise for the elderly and for middle-income working couples and singles.

Chapter 4, Site-Planning Design Guidelines, discusses both general site-planning principles and those that relate specifically to particular resident-type/building-type combinations. The concept of zones of influence is developed, along with the consequent requirement that housing developments be laid out so that all areas are clearly defined as being in the realm of influence of particular groups of residents. The reasons for making residential groupings as small as possible are explained. The rationale behind the placement of amenities such as parking, play equipment, and seating within these assigned areas is formulated and the means for accomplishing it illustrated by example. The design mechanisms necessary to the incorporation of streets into the zones of influence of neighboring housing are explained and illustrated.

Chapter 5, Prototypical Designs for Two New Housing Developments, applies all the different defensible space findings and guidelines developed in the earlier chapters to the programming and design of two new housing developments. The purpose of this chapter is to demonstrate which of the design principles come into play at different stages in the design process and how all the principles interact to produce a final integrated design product.

The two housing developments used as prototypes here are real and will be built shortly: one development is in Newark and the other in Indianapolis. The programs and sites for these developments are typical of most low- and moderate-income housing built in urban areas.

Addendum 1, The Comparative Costs of Different Building Types, provides a brief comparison of the construction costs and development costs for three different building types: row houses, walk-ups, and high-rises. The results of two government studies are quoted. The conclusions indicate that walk-up units are less costly

both to build and to maintain than either high-rise buildings or row houses. High-rises prove to be more costly to build and maintain than the other two building types.

Addendum 2 discusses basic design principles for central mailboxes, doors, and windows in multifamily buildings.

Addendum 3, Construction Materials and Methods, includes information for the design and specification of doors and windows, and their associated framing and hardware, necessary to the achievement of security. The chapter is broken down into four articles, each framed to follow the format of standard building codes. Each article begins with a comprehensive set of definitions and illustrations. Articles 1 and 3, respectively, deal with door and window construction, including: types of materials; construction methods; glazing; framing in walls; door and window types, their resistance capacities to forcible entry, and their use in different areas of a residential building. Articles 2 and 4 are devoted to door and window hardware respectively, and include a discussion of hinges, locks, closing hardware, intercoms, padlocks, and keying systems. The hardware needs of all the different types of door and window found in a residential building are discussed in terms of security. Special provisions have also been formulated in each of the articles to cover high-crime areas.

Addendum 4 is a more detailed graphic presentation of the alternative means for developing one-acre sites discussed in Chapter 2.

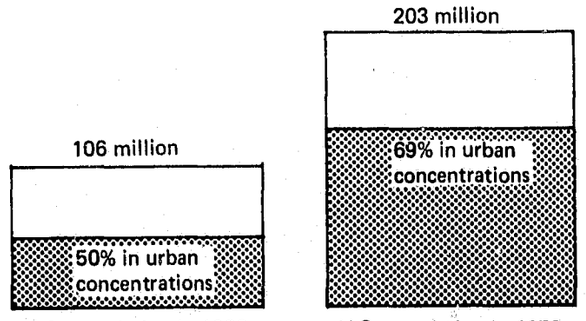
1

THE PATTERN OF CRIME IN CITIES AND RESIDENTIAL AREAS

Population Growth and Concentration

The concentration of large populations in urban centers is a comparatively new phenomenon even in contemporary U.S. history. Fifty years ago, 50% of the population of the United States, then 106 million, lived in the urban areas; by 1970 our nation had grown to 203 million, and 69% of the population lived in urban concentrations (see Table 1.1).

Table 1.1: U.S. Population Residing in Urban Concentrations

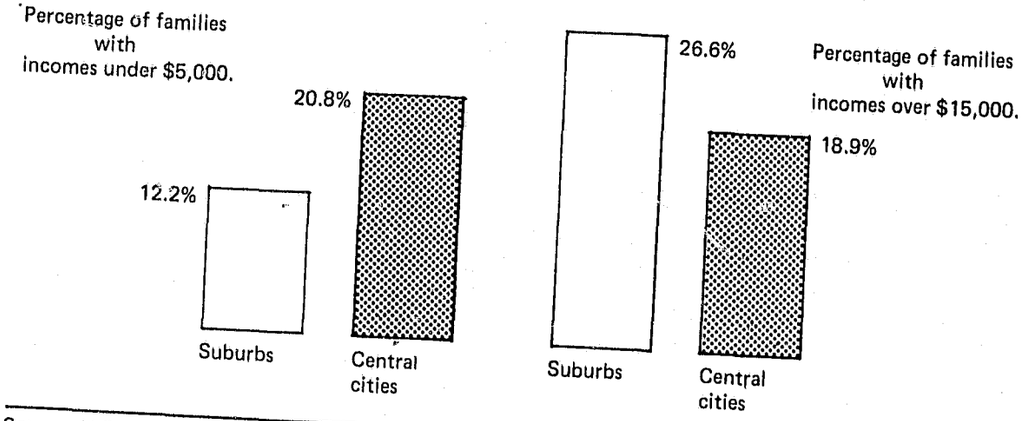


Source: U.S. Bureau of the Census. Urban concentrations, defined by the Bureau of the Census as Standard Metropolitan Statistical Areas (SMSAs), include proximate groupings of 50,000 population or more.[1]

During the last 30 years we have also seen major shifts both in the location and in the characteristics of the population living within the newly evolved metro-

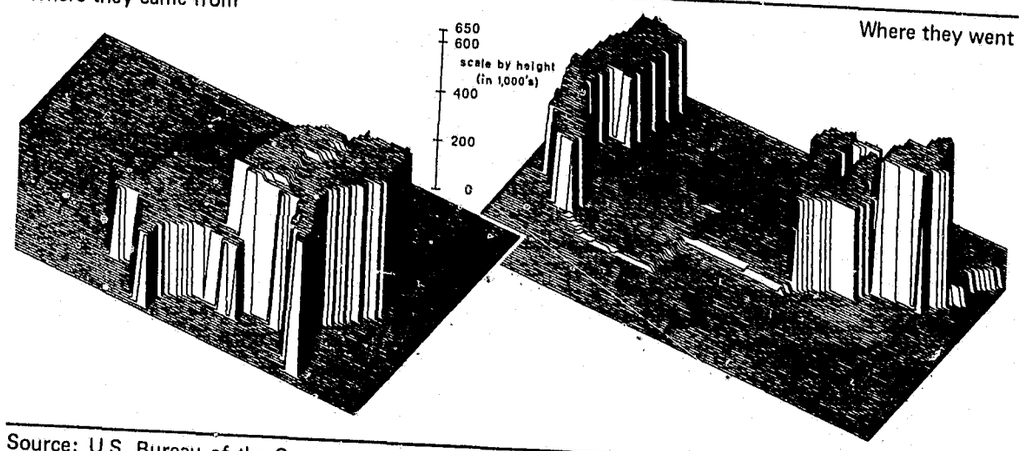
politan areas. The immigrating populations from small towns and rural areas have tended to be of lower income and have moved in to occupy the older central areas of our cities.[2] In turn, the existing middle-income urban populations have been moving out to the suburban areas surrounding the central city (see Tables 1.2 and 1.3).

Table 1.2: Location of Income Groups in Suburbs versus Central City



Source: U.S. Bureau of the Census, 1971b.[3]

Table 1.3: Movement of Negroes, 1960-1970



Source: U.S. Bureau of the Census and Harvard University Mapping Service—Laboratory for Computer Graphics.

Federally Assisted Housing Programs

To house the large influx of low- and moderate-income families into our cities the federal government provided direct funds to municipalities for the construction of public housing projects for low-income families. Substantial subsidy programs were also created for the construction of moderate- and middle-income developments.

Most of the public housing projects built in the 1950s and 1960s were constructed in inner-city areas. Many of these projects were large in size, consisting of more than 400 units. Some were constructed at high densities, using high-rise, elevator buildings. The moderate- and middle-income developments were built at somewhat lower densities, but were located in urban areas, in some cases adjacent to public housing projects.

The housing environments we have been building during the last 50 years in response to the concentrations of population in metropolitan areas have taken a variety of forms. Many of these forms, built at densities ranging from 50 to 250 dwelling units to the acre, are very new. Our experience with them dates, literally, from the time of their construction as little as 20 years ago. Some of these high-density environments bring people into contact with each other in totally new ways —some of which have been found to be disturbing. In building at high densities we have been creating new options in our living environments, just as we have been removing old ones. It is not certain that we have gained more than we have lost. It is clear, however, that high-density housing is more than the simple accretion and concentration of single-family housing.

High-density housing is normally the by-product of two factors: the universally perceived desirability of certain locations and the comparative income of the resident population. Competition for a particular parcel of land in a choice location drives up its cost. The high cost, in turn, restricts the purchase of the land either to those who are rich or to those who are prepared to share that parcel with many others. Obviously, the lower the income group, the higher the number of residents who must be brought together to share the cost of expensive land. The operation of these mechanisms has created many of our most serious housing problems; inevitably a large percentage of the lowest-income groups in metropolitan areas have had to live in the highest-density

housing. Moreover, this group has been least able to cope with the problems of high-density living, for two reasons: first, its members lack the supplementary funds necessary to make high-density residential environments work; second, many are strangers both to the city and each other and are inexperienced with high-density urban living.

Growth of Suburban Areas

It was inevitable that the concentration of population in metropolitan areas would lead to increased housing densities in central city. But now the suburbs, long a haven for low-density single-family housing, are also witnessing the construction of multifamily housing as a matter of course. The indications are that as the suburbs continue to accommodate a higher percentage of metropolitan population growth, the density of suburban housing will begin to rival that of central city.

Between 1950 and 1970 the percentage of the U.S. population living in metropolitan areas increased from 63% to 69%. During the same period, the percentage living in central cities dropped from 36% in 1950 to 31% in 1970, while the percentage living outside the central city climbed from 27% in 1950 to 37% in 1970 (Table 1.4).

Table 1.4: Shifts in Location of U.S. Population, 1950 to 1970

Location	1950	1960	1970
Standard Metropolitan Statistical Area	62.5%	66.7%	68.6%
Central cities	35.5%	33.4%	31.4%
Outside central cities (suburbs)	27.0%	33.3%	37.2%
Nonmetropolitan areas	37.5%	33.3%	31.4%
Total population	100%	100%	100%

Source: Percentage rates derived from data shown in U.S. Bureau of the Census.[4]

In the decade 1900 to 1910 the central areas of our cities absorbed 72% of urban growth, while the suburbs absorbed only 28%. In the decade 1960 to 1970 the central areas of our cities absorbed only 16% of all metropolitan growth, while the suburbs absorbed 84%.[5]

This shifting of growth patterns and concentrations has been somewhat beneficial in that the pressure is easing for increased construction of high-density housing in central cities.

With our recent recognition of the need for conservation of energy and natural resources the move toward increasing the density of suburban housing will likely be given even greater impetus. A study recently completed by the Real Estate Research Corporation, *The Costs of Sprawl*,[6] demonstrates that higher-density housing costs less to build and maintain. Higher-density housing also requires lower initial investment and maintenance costs for roads and utilities and results in substantially less consumption of fuel and power over the long run. It should be noted that what the above research group defined as high density was, in fact, comparatively low density by the standards considered in this book. Although they included every housing type (from single-family homes to high-rise apartments) the densities they studied range from three to 30 dwelling units per acre.

Crime and Its Location

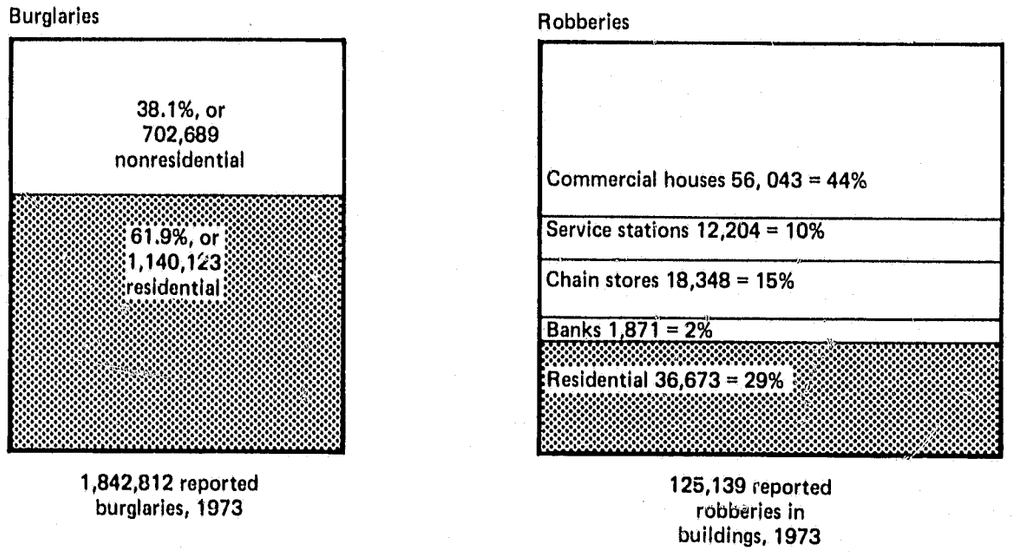
Parallel with the growth and concentration of our population, our nation has, in the last 10 years, been experiencing a rapid rise in its crime rate. Serious crimes have gone from 4.5 million to 10 million between 1964 and 1974; even allowing for the nation's growth in population, the rate of serious crimes is 91% higher today than a decade ago.[7] Although it is difficult to determine to what degree these differences are the result of changes in police crime-reporting practices, it appears unlikely that the full extent of the increase can be attributed solely to improved police and FBI recording procedures.

The commercial areas of our cities normally experience the highest crime rates, particularly when surrounded by low-income residential communities. Within residential areas crime rate tends to vary inversely with the income of the population: the lower the income of the population, the higher the crime rate. Thus the low-income populations living in and around a central city experience a high crime rate, while middle- and upper-income populations living at the periphery of the city and in the suburbs experience low crime rates. An exception to this pattern occurs when higher-income en-

claves are located within the core area of a central city; in this case the middle-income population is also likely to experience a high crime rate.

Increasingly over the last 10 years there has been a shift of crime from commercial to residential areas. The 1973 F.B.I. *Uniform Crime Reports*[8] showed that 61.9% of all burglaries took place in residential areas. The reports also showed that robberies committed in residential areas accounted for 29.0% of all robberies taking place in buildings; this included banks, chain stores, commercial houses and service stations (Table 1.5).

Table 1.5: Residential Crime as a Percentage of Total Crime



Source: FBI, Uniform Crime Reports, 1973.[9] Totals represent reported crime from 4,343 agencies representing a population of 128,611,000.

More disconcerting still is the rate of increase of crimes taking place in residential areas as compared with crimes in nonresidential areas. FBI statistics show that residential robbery increased by 105% between 1967 and 1972, while the over-all robbery rate increased by 85%.[10] Similarly, during the same period, residential burglary increased by 73% while over-all nonresidential burglary increased by only 46%.[10a]

Crime and Housing Abandonment

Whereas the original occupants of public housing included only a small percentage of welfare and broken families, over the years the percentage of these families has increased, so that they are now the majority. The peculiar mixture of large concentrations of low-income families located in high-crime areas, in building forms that make inhabitants peculiarly vulnerable to criminal activity, has produced housing developments with very high crime and vandalism rates. As a result these projects are being abandoned by their residents. Many large high-rise public housing projects have vacancy rates of 25% and more; they include Cabrini Green in Chicago, Columbus Homes and Stella Wright in Newark, The Plaza in San Francisco, Raymond Rosen and Schuylkill Falls in Philadelphia, and Columbus Point in Boston, to name only a few. The 2,740-unit Pruitt-Igoe project, built in St. Louis in 1957, has now been totally abandoned and is being torn down (see Figure 1.1).

Figure 1.1: The demise of Pruitt-Igoe. The replacement cost today of the 12-story project would be $60 million. Its vacancy rate, seldom below 25%, rose finally to 85%; after three salvage efforts the decision was made to tear it down.

High crime and vandalism rates are making these projects unlivable, even for families who have little choice in housing.[10b] Once the process of community disintegration has gotten underway it is almost impossible to reverse. New families cannot be enticed to move into these developments and existing families only wait for an opportunity to move out. Vacant units are vandalized to the point at which they cannot be rehabilitated easily, and criminals, vagrants, and drug addicts use the vacant units as a base of operation against residents.

Although nothing equivalent to the failure of our nation's large high-rise public housing projects can be found in moderate- and middle-income housing developments, the problems they face are equally serious. In a current survey of 236 housing developments by the office of the Assistant Secretary of HUD for Housing Management it was determined that between 200 and 250 developments face foreclosure in the next two years. The primary source of their problems is high crime and vandalism rates, which in turn have produced high vacancy rates. Foreclosure of these projects will mean that the government will come into receivership of from 400 to 500 million dollars worth of abandoned housing.

Many of the moderate-income developments that suffer high crime and vacancy rates are located adjacent to public housing developments.[11] The management of some of these projects blame their failure on this proximity. Adjacent residential communities, composed of privately owned single-family houses, are also suffering serious crime problems and are being abandoned by their middle-income residents—sometimes on a mass scale.

Growth of Police Forces

In an effort to deal with the nation's residential crime problems municipal police forces have been increased in size from 340,000 men in 1967 to 445,000 men in 1974, at an increase in cost from $3 billion to $8.6 billion.[12] But police manpower deployment and effectiveness studies conducted in Kansas City revealed that doubling manpower for patrolling in residential areas has had no measurable effect on the reduction of crime.[13]

In a recently completed study of residential crime in the Boston area the author concluded that:

> Although police are commonly thought of as the first line of defense against crime, their actual effectiveness against residential crimes seems extremely doubtful. Of approximately 2,000 police reports on burglaries analyzed for this study, less than one percent of the crimes were discovered in progress by patrolling police. An additional six percent were discovered while still in progress by citizens who summoned the police, and the remaining 93 percent of the crimes were not discovered until sometime after they were committed. Only four percent of the cases surveyed resulted in arrests, of which approximately half took place at the scene of the crime, and the other half, through detective follow-up investigation.[14]

It is clear that a better understanding is needed of the nature and extent of the crime problems suffered by low- and moderate-income communities living in federally assisted housing. From this understanding a set of remedies and guidelines can be developed both to help salvage existing housing and to ensure that newly constructed housing will avoid some of the more obvious of the old mistakes. Over the last five years an interdisciplinary team of architects, planners, and psychologists has been studying the crime patterns in low, moderate-, and middle-income housing developments in cities throughout the country in an endeavor to isolate the particular social and physical mechanisms that most strongly predict crime.

The original defensible space study concentrated on the problems of security in public housing projects. The subject matter of this handbook has been expanded from the earlier work to include a discussion of middle- and upper-income housing, ranging in type from single-family housing to high-rise apartment buildings. In addition, the ages and life-styles of residents have been considered with respect to variations in their use of their environments and their resultant vulnerability to crime.

The most extensive portion of our research into the effects of the design of environment on resident behavior and vulnerability focused on public housing projects in New York City; the primary data source included 150,000 units. Public housing in New York is different from that in most other cities in that New York has an allowable tenant income of up to $12,000 a year; this means that many tenants are equivalent to moderate-income groups in other cities.

This study of public housing in New York City was supplemented by firsthand examination of the experience of housing authorities and moderate-income developments in many major cities, including Boston, Chicago, Cleveland, Indianapolis, Jersey City, Joliet, Miami, Newark, Philadelphia, San Francisco, and Washington. Knowledge of the security problems of middle- and upper-income housing developments is the result of years of consulting performed for housing management agencies, architects and planners, and the Department of Housing and Urban Development.

The following pages summarize some of our findings.

Effect of Socioeconomic Factors

Early in our analysis it became clear that the social characteristics of the resident population were stronger predictors of crime rate than the physical characteristics of design. Varying aspects of a family's makeup, income, and age of its members affect its adaptability to different environments and its vulnerability to crime.

Table 1.6 is a summary of a multivariate stepwise regression analysis of the effect of different social and physical variables on the crime rates of housing projects. The purpose of a stepwise regression analysis is to determine, in instances when many different variables are interacting to produce certain effects, which effects can be assigned to particular variables; which variables correlate with each other; and which variables are most dominant in predicting a particular effect. The social variables prominent in predicting crime rate in most categories of crime were, in order of importance:

1. The percentage of resident population receiving welfare (excluding elderly).
2. The percentage of families headed by a female receiving welfare through the Aid to Families with Dependent Children (AFDC) program.
3. The per capita disposable income of the project's residents.

The degree of correlation between each of these three social variables, shown in Table 1.7, is very high.

Table 1.6: Crime Rates as Explained by Social and Physical Variables

Social and Physical Variables	Correlations with Dependent Variables: Indoor felony rate	Indoor robbery rate	Robbery rate	Felony rate
Percentage of population receiving welfare	[1][a].51	[1] .46	[1] .47	[1] .54
Building height (number of units per entry)	[2] .36	[2] .36	[2] .36	[5] .22
Project size (number of apartments)	[3] .27	[3] .26	[3] .25	[3] .22
Percentage of families with female head on AFDC	[4] .44	[4] .41	[5] .36	
Number of publicly assisted projects in area	[5] .25	[5] .26	[4] .33	
Felony rate of surrounding community				[2] .41
Per capita disposable income				[4] .49
Multiple regressions	.68	.66	.66	.67

Source: N.Y.C. Housing Authority Police data for 1967; 87 Housing Projects.[15] .01 level of significance at ± .27; .05 level of significance at ± .21.

[a]Numbers in brackets indicate rank order of correlation in creating stepwise multiple regressions.

Table 1.7: Correlation Coefficients of Social Variables

Social and Physical variables	1.	2.	3.
1. Percentage of families with female head on AFDC	1.00		
2. Percentage of population receiving welfare	.72	1.00	
3. Disposable income per capita	−.89	−.73	1.00

Source: NYC Housing Authority Tenant Data, 1967. N = 87; ±0.27 produces significance at the .01 level.

In recognizing the socioeconomic factors that are normally designated as critical in predicting crime rate—that is, families with a high, internally generated vulnerability to crime—it is also important to understand the causal mechanisms in operation. These families share many of the following characteristics: they are poor; they are female-headed households; they are black or

Puerto Rican; they have a high percentage of teenage children; and they receive welfare in one form or another. The high correlation of each of these characteristics with crime rate, and with one another, has also been established in other studies.[16] Attempts at determining causal explanations for the above correlations have suggested some of the following: that female heads of household are vulnerable to criminal attack and are only minimally able to control their teenage children and/or boyfriends; that the criminal activity of the poor is tolerated, if not condoned, among the poor; that the poor, and particularly the poor of racial minorities, are unable to demand much in the way of police protection; that crime against residents in ghetto areas requires minimal skill and risk; that poor teenagers, who are most of the apprehendees (75% in New York and Boston), are deprived of even minimal recreational facilities and job opportunities; that poor residential neighborhoods are deficient in amenities and opportunities common to middle-income communities.

Concentrations of high percentages of families sharing the above characteristics have been shown to produce residential environments that suffer very high crime rates. The majority of inhabitants in such communities, who, although poor, are not criminals, are unable to enforce conventional middle-class moral attitudes. The continuation of past policies that concentrate such families in vulnerable residential environments, old or new, will not achieve the goal of creating stable, low-crime communities. The mixing of low-income families in middle-income developments, in numbers that maintain stability, may have become a national necessity.

Effect of Physical Factors

Although the strongest predictors of crime rates in residential areas are the socioeconomic characteristics of the resident population, the form of the living environment also strongly affects the vulnerability of housing occupied by all socioeconomic groups. The impact of physical design on security is not restricted to the peculiarities of any one population, income, age group, or urban locale.

Table 1.6 also shows three physical variables that are prominent in explaining crime rates. They are, in order of importance:

1. The height of the buildings in the development (building height correlates very highly with the number of apartments sharing a single entry to a building).
2. The size of the housing project; that is, the total number of dwelling units making up a project. This factor is important when the project consists of low-income and welfare families because the variable is a measure of the concentration of low-income population in a particular area. Here it is considered a physical variable because it can be controlled through physical planning.
3. The number of other publicly assisted housing projects in the area; this variable is a further measure of the same phenomenon in (2) but in this case extending beyond the confines of the particular project.

A seventh factor that predicts crime rate somewhat independently is the felony rate of the precinct in which the project is located. This has not proved to be a very significant measure for two reasons: precincts tend to be large and to incorporate within them areas suffering very divergent crime rates; and as much of the crime in a low-income housing project is generated by its own residents, the effect of crime rates in distant areas of the same precinct is probably minimal.

The above analysis suggests that there are two classes of physical variables that contribute to crime rates: the first involves physical characteristics that reinforce or counteract social weakness and pathology; the second is a class of specific physical elements that work to prevent or encourage social control of the environment by its inhabitants. The first class of physical variables is a facet of the social variables: if it is known that certain social characteristics produce a crime-prone population, then we can expect that a large concentration of families sharing these characteristics will reinforce criminal opportunities. The significance of this finding is not simply that the presence of more pathology creates proportionally more crime, but that it creates an increase in the rate of crime. Thus the larger the low-income project, or the more the project is surrounded by other low-income projects, the higher will be the number of crimes per thousand population.

This is explained by the fact that large low-income projects tend to degenerate into conglomerations of the most helpless of our society, the elderly poor and fami-

lies with female heads of household. Such projects house, as well, concentrations of teenage children, the most crime-prone element of any society, who, in this instance, are unencumbered by the presence of a restricting resident adult male population. Women living on the federal AFDC program also may have boyfriends who come and go, or just hang around. These men have been identified by project police and residents as another source of criminal offender.

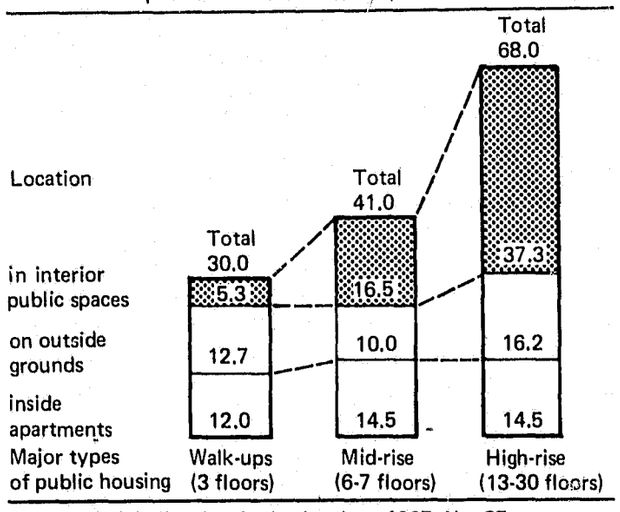
The subculture so created not only operates against the majority of other project residents who are trying to maintain a crime-free existence; it may also work against the surrounding community. Some criminals make use of the large, anonymous environment of the housing project as their base of operation. A large housing project composed solely of low-income residents produces a subculture that, although not condoning crime, is incapable or unwilling to pay the price of resisting it.

The most fascinating set of variables to come out of our analyses are of the second group: those physical design features that have been found to assist a resident population, regardless of income level or family structure, to achieve behavior along the lines desired by the noncriminal majority. The central physical variable here is the number of residents who share a defined environment. The smaller the number of families sharing a facility, whether it is a demarcated portion of a project's grounds or the access and circulation space within a multifamily building, the stronger are their feelings of possession, and, ultimately, of concern, control, and responsibility. This explains why, when only two families share a landing in a walk-up building, both will maintain the hallway outside their apartment doors. It may also explain why play equipment that is located in a defined area designated for the use of a small number of families is well used, respected, and preserved. Even when this equipment is also made accessible to outside children, they in turn are required to use it in accordance with the rules set down by the residents bordering the facility.

In a high-rise building in which more than 100 families with children share an entry, it is difficult for residents to distinguish neighbor from intruder, or to attempt to enforce an acceptable code of behavior, or even to feel comfortable about questioning the presence or activities of others.

In addition to the fact that multifamily buildings experience higher crime rates than walk-ups or single-family buildings, it is important to know that they are also vulnerable to different types of criminal activity. Most of the crime experienced by residents of single-family buildings is burglary. These burglaries are normally committed when members of the family are either away from home or asleep. By contrast, the residents of multifamily dwellings experience both burglaries and robberies (muggings). The higher crime rate in multifamily dwellings (Table 1.8) is, in large part, attributable to such robberies. The interior common circulation spaces (lobbies, hallways) are the areas where most robberies are committed, as well as the areas where criminals wait to follow residents into their apartments for the purpose of burglarizing them.

Table 1.8: Public Housing Crime in Relation to Building Height (Felonies per Thousand Families)[18]



Source: N.Y.C. Housing Authority data, 1967; N = 87.

Of a total of 8,611 felonies reported in all New York City Housing Authority projects in 1969 (excluding intrahousehold incidents), 3,786, or 44%, were committed in the interior public areas of buildings. Of the crimes committed in interior public areas, 3,165, or 84%, were robberies. The breakdown by location of the felonies taking place in interior public areas was: elevators, 41%;

hallways, 22%; lobbies, 18%; stairways, 9%; roof landings, 2%; and other, 8%.

As will be demonstrated in detail later, it is possible to achieve densities as high as 70 units to the acre and still design buildings that are less than six stories in height and have interior circulation areas serving only eight to ten families per entry. These buildings will cover more of the project grounds than do high-rise buildings, but the grounds area that is left over will likely get more intensive use. Building entries and play areas can not only be designed to serve a limited number of families, they can be positioned to face surrounding streets. Placed in this way, the building entries will enjoy the added safety of street patrols and, in good symbiotic form, residents will in turn provide the street with additional surveillance. Also to be demonstrated later, the territorial domain of the dwelling can be made to encompass the street.

It is important to note, too, that although size correlates highly with crime rates in low-income projects, housing projects that are broken up by streets and composed of buildings six stories in height or less have crime rates similar to those in smaller projects.[19] The subdivision of the project and the lower height ameliorate some of the effects of the over-all size of the development.

Interaction of Social and Physical Factors

Thus, although the socioeconomic characteristics of the resident population are, as independent factors, the strongest predictors of crime rate, the physical characteristics of the buildings and project can strongly counterinfluence the social. The size and form of residential environments occupied by low-income families can either ameliorate or aggravate many of the problems they face. Decline of facilities therefore is not a constant relating to percentage of welfare families alone, but interacts with built form and management practices.

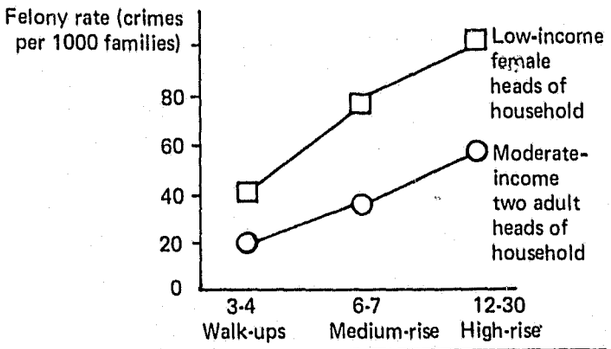
The more complex and anonymous the environment, the more difficult it is for a code of behavior following societal norms to become established and to be maintained. It is difficult for moderate-income families with two adult heads of household to cope with crime and vandalism problems in poorly designed environments; but when poor and broken families are grouped together in such a setting the results prove disastrous. The public

housing projects now being abandoned consist of the worst mixture of social and physical aggregates.

It is in the examination of the combined effect of the social characteristics of the residents and the physical characteristics of the project design that our findings prove most interesting. Whereas low- and moderate-income residents of high-rise buildings will always experience more crime than those living in walk-ups, intact and moderate-income families fare better in high-rises than do broken and low-income families. Our findings indicate that the crime rate suffered by middle-income families in a 20-story building is similar to that experienced by a low-income family in a six-story building.

Table 1.9 summarizes the interaction of social variables with physical variables to affect the frequency of occurrence of felonies. It shows that a population consisting of many low-income and welfare families is most vulnerable to poor building design. Although well-structured, middle-income families suffer higher crime rates in high-rise buildings than they do in walk-ups, the rate does not increase as dramatically as it does for low-income families.

Table 1.9: Variations in Crime Rate as Affected by Different Combinations of Socioeconomic Groups and Building Types



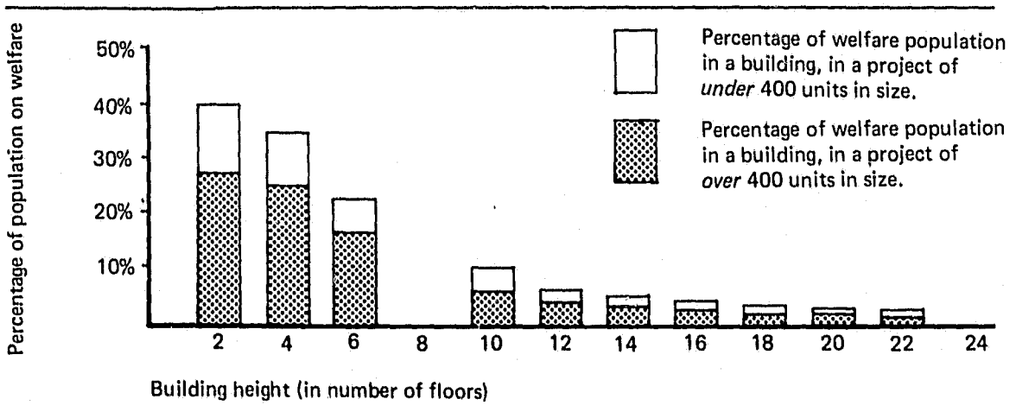
Source: N.Y.C. Housing Authority data, 1969; N = 87 projects, significance at .01 level.[19]

The countervening effect of physical variables on socioeconomic variables can also be seen in the degree of mix of low- and middle-income families that is possible

in different building types while still maintaining a stable, low-crime community. One welfare family can normally be accommodated easily in a middle-income walk-up building designed with only six families sharing an entry. In this situation it is comparatively easy for the five middle-income families to set the standards of acceptable behavior in the public areas of the building and grounds and to exert social pressures to see that these standards are enforced. By comparison, in a high-rise building designed with 72 families sharing an entry, the presence of 12 welfare families—the same percentage as the one in six—normally would be more than enough to produce high vandalism and crime rates and cause the building to deteriorate quickly. The introduction of this number of welfare families would in this circumstance cause the middle-income families to move. The immediate effect of their move would be a high vacancy rate, which many building owners would resolve by filling the vacancies with still more welfare residents. In as little as three years a previously stable middle-income building can become totally occupied by welfare residents and the landlord resigned to a quick tax write-off period, minimal maintenance, and early abandonment.

Table 1.10 is a hypothetical representation of the countervening effect of two physical factors on the percentage of low-income welfare residents that can be housed in a stable mix with moderate-income residents.

Table 1.10: Percentage of Welfare Residents in Stable Mix, as Affected by Building Height and Project Size[a]



[a]Hypothetical representation based on the experience of housing managers of moderate-income housing containing a percentage of leased public housing units, New York City.

Neighborhood Cohesiveness: Life-Styles

There are social factors other than income, family structure, and ages of residents that predetermine a community's susceptibility to crime.[21] A high degree of recognition among neighbors has been shown to produce comparatively low crime rates. The extent to which recognition occurs among neighbors is in turn a product of the following:

1. The degree of similarity between them as defined by shared ages, life-styles, and backgrounds.
2. The number of years of continued residence in the same building or housing development.
3. The degree of interaction among them resulting from similar life-styles—particularly as expressed in their sharing common needs for and use of facilities in their immediate residential environments.

Critical to any understanding of the factors affecting the occurrence of crime and vandalism in housing developments, therefore, is a knowledge of the comparative suitability of different housing types to the needs of different residents. The housing environments that most fall prey to criminal activity are inevitably those that are designed without adequate consideration of the life-styles and capabilities of the future occupants.

Defensible space design is an endeavor to find ways to subdivide and assign areas, which would otherwise be nebulous and public, for the shared use of particular groups of residents. If a common purpose exists among proximate dwellers in the form of a need for communal activity areas adjacent to their own dwelling units, then space can be designated for that purpose and removed from the category of nebulous classification. For example, a group of families with young children will need space outside their dwelling units where children can run around and play together. These families may share nothing more than this need, but this fact alone allows designers to define a collective area around the families' dwellings and designate it for this purpose. If it is a genuine and continuing need, the residents will identify with the space, adopt it as their own, and work to ensure that it remains safe, secure, and usable. This collective play space then becomes an extension of the individual dwellings into the outside world. It also provides a buffer between the world and the dwellings and may become the first of a growing hierarchy of collectively

assigned areas in previously public space. If one can create further such buffers through the extension of this principle, then a good portion of previously unusable public areas can be assigned or redesignated for particular residents so as to be under their supervision and control.

In contrast, the greater the disparity in life-styles and needs among neighbors—that is, the less they have in common—the smaller is the grouping that can share a spatial collective. In a building with 50 families, one maverick in the group may be all that is needed to destroy the viability of a collective area and cause all other participants to withdraw from its use.

One is led to deduce that in a postindustrial society such as ours, in which most proximate dwellers are strangers to one another, the best way to ensure that neighbors share similar needs is to group dwellings together for residents of similar life-style characteristics. In practice the opposite happens. Most multifamily buildings are intentionally designed to be occupied by a mix of family types; that is they are normally designed with apartments ranging from efficiency units to four-bedroom units. This is considered good real estate sense. Also, to the extent to which this policy is ever considered philosophically, it is justified as a desire to create an over-all habitation including young people, families with children, and elderly, to give each age group a sense of people of all other age groups. It is also said that this form of integration, in contrast to segregation by age group, will prevent any age group, such as the elderly, from feeling that its members are living in isolation, or that society has ostracized them. The planning ideal behind this sort of thinking is to create, in the modern world and among total strangers, the same cross-section of age groups living together as existed in societies of extended families. The image is one of the elderly living among young families, playing with and caring for their grandchildren; of respected elders who are a source of wisdom and are recipients of reverence. It is an ideal that unfortunately depends for its existence on a more stable, static society, one in which neighbors are related by birth, live in extended families, and follow life-cycles in which the ritual of interaction is largely predetermined.

In the world in which we live neighbors are not normally related to each other, do not share a common past, culture, or ethnic root; thus the mixing of different age groups may prove a highly *undesirable* proposition to each age group.[22/23] The respect for the elderly by children and young adults is in these circumstances minimal. The relationship actually may become openly hostile if there is a racial difference between the very young and the very old.[24] Reciprocally, the tolerance among the elderly for noise and activity generated by children and young adults who are unrelated to them, is next to nonexistent. In a mix of different family types, the needs of each age group for areas outside the dwelling is decidedly different. Children want areas they can run around in, yell, throw a ball—activities that frighten and antagonize the elderly, who are sensitive to sound, see and move about with increased difficulty, and are afraid of physical contact and falls because their limbs break easily.

Putting different age groups or different life-styles together may not produce the utopia predicted. It is certainly not the mechanism for encouraging their interaction or the adoption of communal spaces outside the private dwelling. And it will not result in the development of a buffer of collective, semiprivate realms outside the individual dwelling to replace the amorphous public space increasingly making no-man's lands of our cities. Two American families of different ages may be as disparate in their need for and use of space outside their individual dwelling units as the populations of two widely divergent cultures.

It may be that the loss of the extended family is a highly undesirable by-product of the contemporary industrialized world. But for the moment it is our reality. It is also unlikely that this pattern will be reversed either by universal acclaim or by fiat. We may therefore have to conclude, albeit reluctantly, that the most desirable way to construct residential environments in today's world is to cluster similar occupants together so that at a certain scale, say 50 to 150 dwelling units, we create groupings that house occupants identified by a similarity in age and family structure, if nothing more. In this way we can begin to create areas outside the dwelling unit for the collective use of neighbors.

Elderly persons living together in their subenvironment, families with children in theirs, newly married couples and singles in theirs, may sound like a planning program that is simplistic, if not regimented. But this segregation does not need to be the pattern beyond the scale of each grouping; the individually segregated

groups in their microenvironments can be juxtaposed with other types of groups to produce an integrated society at the macro scale.

The limit on the number of families that can be combined into a collective habitat for any group type is governed by the extent of the uniformity among the families in that type: that is, uniformity in shared needs, ages, and life-styles. Among the elderly, for instance, uniformity is very pervasive and embraces many aspects, including age, physiological characteristics, life-styles, and codes of behavior. In this setting a grouping of 150 to 250 families may be both workable and desirable. Among child-oriented families with different ages, backgrounds, values, and incomes, a grouping of six to 12 families may be the upward limit of that family type.

The Ameliorating Effects of High Income

The most common counterargument to defensible space findings is that upper-income families can and do live in high-rise buildings successfully without experiencing any of the problems endemic to public housing. However, there are generic conditions present in high-rise luxury buildings that are not present in low- and moderate-income developments, making one workable and the other not. Luxury high-rises always have a resident superintendent, and usually one or two porters, who maintain and control the use of the interior public areas of the building. The entry to the building is controlled by doormen, often around the clock, who act as the building owners' or residents' agent. There are few families with children living in luxury buildings. And, most importantly, there are few criminals in residence who are so unskilled as to have to make their livelihood by victimizing their neighbors.

Low- and moderate-income housing projects, by comparison, have a maintenance staff that normally works from 8:00 A.M. to 4:00 P.M., and seldom, if ever, on weekends. Management and staff are absent at exactly those times of the day and week when they are most needed and when they can best perform a deterrent function. The cost for doormen of individual buildings is prohibitive even for moderate-income buildings. In many single-headed households the mother may be away working once the children are a little older, and among moderate-income families with two adult heads of household it is not uncommon for both adults to be working.

In the design of a middle- to high-income development, the effective use of security personnel requires as well the provision of physical counterparts, hardware, alarms, fences, to complete the security system. The effective screening of all entrants to a building by a doorman requires a very different physical setting from the one advocated for creating a natural defensible space. A walled compound with a single entry is the design model that will give a doorman most control.

By contrast, when available operating budgets make it impossible to hire a doorman to screen all entrants to a building, a different ordering principle is required: one in which the physical environment is broken down into defined enclaves that can be readily controlled and monitored by the residents themselves.

The Resident Criminal and Vandal

There is another critical factor that differentiates low- and moderate-income housing projects from middle- and upper-income projects. In low- and moderate-income housing members of the resident population themselves often prey upon their neighbors. This is not to say that a higher prevalence of thieves exists among low-income populations. In any group the criminal element forms a small percentage of the population. Among low-income populations however, one finds criminals who are so unskilled that they engage in burglary, muggings, and mailbox theft among their own neighbors.[25/26]

In a low-income, anonymous, high-rise housing environment, teenage children living among families with few male heads of household, playing in areas distant from home, soon learn that there are few restraints on their behavior.[27] Everything is theirs for the doing or taking; they can rip off a building and its residents with little concern for possible repercussions. If an honest cost accounting were done, the destruction wrought by children in elevator buildings would make any building economist question whether ever to put families into high-rises again. Unfortunately, the men who estimate the cost of buildings for construction are not the same men who estimate the cost of their maintenance. Those

in charge of developing new housing normally get credit only for the number of new units they make available; they are seldom around three to five years later to pick up the pieces.

Even in middle-income high-rise housing projects with a high percentage of resident preteen and teenage children, the youth will commit petty thefts and acts of vandalism, often simply for amusement or peer group approval.[28] If middle-income housing complexes are also located in low-income areas, these anonymous high-rise buildings, unsecured by round-the-clock doormen, are easy prey for neighboring teenage children and criminals.

It is also our hope that the housing proposed here will give young residents the opportunity to learn what it is to have one's own individual and identifiable living environment—a particular place that one can call one's own and from which one can derive pride and satisfaction. In learning of one's own rights—and of the pride of identity with a particular place—perhaps one also learns to respect the rights of others. The provision of such living environments may, if only in a small way, begin to address some of the root causes of crime.

In designing a housing development for a low-income population, or for a middle-income population that cannot afford doormen, it is important to create an environment in which the design assists residents in their ability to recognize one another. With few residents sharing an entry and fewer still a corridor, it is easy for a common code of behavior to come into being. Pressures can then be easily exerted to restrain resident vandals and criminals from activities affecting the project. Among new or transient residents, developing and enforcing a code of area usage that is acceptable to all or most may be difficult because of their different values, goals, and life-styles. But the simple, universally shared desire to make the building and grounds safe and secure, especially for young children, may be the only common base necessary for cooperation among residents in creating and applying such a code. With a commonly shared set of values, preventing crime in a development will then depend both on the residents' ability to observe and monitor their neighbors and on their willingness to censure unacceptable conduct. This later point, like the knowledge of commonly shared values, can be reinforced by the nature of a project's design. The use of security personnel in low-income buildings is not often

economically feasible; however, should funds be made available for this purpose, screening may not be highly effective because doormen are limited in their ability to protect inhabitants against resident criminals.

Displacement

It has been suggested that improving the security of one residential area only leads to the displacement of crime to other areas, that is, that one residential area is made secure at the expense of another; that crime that is prevented in one area is displaced to a neighboring residential area or to adjoining commercial establishments. There is evidence to suggest that this may be so, particularly as regards the activities and motivations of older, "professional" criminals. But there is also evidence suggesting that both younger and poorer criminals operate in areas close to their homes; most crimes in moderate- and low-income residential areas are committed by teenagers who live nearby.[29/30] It is not clear to what extent teenage residential crime may be, in fact, stimulated by the opportunities we ourselves have created in our new housing developments. Moreover, young criminals are strongly motivated by peer-group pressure and the excitement and challenge of committing crimes. It is our contention that hardening particular target areas close to home, and making the risk of apprehension greater and more evident, can act as a strong deterrent against this type of criminal behavior.

We know that high crime rates are a critical factor in the abandonment of residential areas and in consequent societal losses greater than the sum total of individual losses from crime. The home environment must be made secure for its inhabitants or society cannot continue to function. It is hoped that the design guidelines presented here will not only provide more secure and vandal-free buildings but will provide as well the mechanisms for stabilizing neighborhoods. The securing of a succession of buildings and developments can lead eventually to the preservation of an entire neighborhood.

Footnotes

1. U.S. Bureau of the Census. Data for 1920 are for 212 areas categorized as metropolitan by the Census Bureau in 1960. Data for 1970 are for 230 areas categorized as metropolitan in 1970. A Standard Metropolitan Statistical Area is a proximate grouping of 50,000 population or more.
2. U.S. Bureau of the Census, *Demographic, Economic, and Revenue Trends for Major Central Cities.* Washington, D.C: U.S. Government Printing Office, 1971a, p. 2.
3. U.S. Bureau of the Census, *1970 Census of Population and Housing.* Washington, D.C.: U.S. Government Printing Office, 1971b.
4. U.S. Bureau of the Census, *Statistical Abstract of the United States* (93rd ed.). Washington, D.C.: U.S. Government Printing Office, 1973.
5. Anthony Downs, *Opening up the Suburbs.* New Haven: Yale University Press, 1973, p. 199.
6. Real Estate Research Corporation, *The Costs of Sprawl.* Washington, D.C.: U.S. Government Printing Office, 1974.
7. FBI data for crime increase, cited in *U.S. News and World Report* (December 16, 1974). p. 31.
8. *FBI Uniform Crime Reports, 1973.* Washington, D.C.: U.S. Government Printing Office, 1974, Table 22, p. 120. Table 1, p. 58 of this report lists 382,683 robberies and 2,540,907 burglaries nationwide.
9. Ibid., Table 22. Robbery totals presented here exclude the classifications of Highway and Miscellaneous Robberies, which together total 203,663. The Miscellaneous category includes crimes in other buildings not listed, or unclassified by location; the Highway category includes street crimes, which also could have occurred in streets within or bordering residential areas.
10. FBI Uniform Crime Reports, 1972. Washington, D.C.: U.S. Government Printing Office, 1973, pp. 17, 20.

10[a]. LEAA Victimization Studies indicate that crime that goes unreported may be as high as two to three times that of reported crime. See, for example, *Criminal Victimization Surveys in 13 American Cities.* Washington, D.C.: U.S. Department of Justice, Law Enforcement Assistance Administration, National Criminal Justice Information and Statistics Service, June 1975.

10[b]. The author's personal survey of over 250 housing developments throughout the United States. This preliminary survey also indicates a strong relationship between high crime rates and high vandalism rates.

11. Federally assisted housing developments that are coming into HUD receivership in Newark, San Francisco, and Chicago, to name only a few cities, border on high-rise public housing.
12. *U.S. News and World Report* (December 16, 1974).
13. George L. Kelling et al., *Kansas City Preventive Patrol Experiment.* Washington, D.C.: The Police Foundation, 1974.
14. Thomas A. Reppetto, *Residential Crime.* Cambridge, Mass.: Ballinger, 1974, p. 50.
15. Oscar Newman, *Final Report of the Project for Security Design in Urban Residential Areas.* New York: Institute of Planning and Housing, New York University, 1973. Regression results, pp. 8-11.
16. Reppetto, *Residential Crime,* pp. 40, 42, 44.
17. Oscar Newman, *Defensible Space.* New York: Macmillan, 1972, Table A6, pp. 235-236.
18. Ibid, Figure 17, p. 33.
19. Oscar Newman, *Architectural Design for Crime Prevention.* Washington, D.C.: U.S. Government Printing Office, 1973, p. 114.
20. Institute for Community Design Analysis, unpublished study of New York City Housing Authority Data, 1969.
21. Reppetto, *Residential Crime,* pp. 36, 48.
22. Irving Rosow, *Social Integration of the Aged.* New York: The Free Press of Glencoe, 1967, p. 336.
23. Mark Messer, Engagement with Disengagement. Paper presented at the 1966 Annual Meeting of the American Sociological Association, Miami Beach, Florida.
24. In a June 1971 interview with Harry Fialkin, Chief of Statistics of the New York City Housing Authority, he revealed that whereas the crime rate experienced by the elderly was normally about 3.5 times that experienced by other housing authority residents, when white elderly were a minority living among black families with teenage children, crime against the elderly climbed to 5 times the average.
25. W. Fairley and M. Liechenstein, *Improving Safety in Urban Apartment Dwellings.* New York: New York City Rand Institute, 1971. Table 10, p. 25, shows that 55.6% of arrestees in New York City Housing Authority Projects live in the same project.
26. Reppetto, *Residential Crime,* p. 40, 52. An analysis of all arrests for burglaries in the large housing project used in the study revealed that of 78 persons arrested, 30% were under 17, and 70% were between 17-24 years of age. 81% of all persons arrested were residents of the project.
27. New York City Housing Authority Police statistical summaries for 1970 show that 30.2% of all felony apprehendees are under 15; 75.6% of all felony apprehendees are under 21.
28. Reppetto, *Residential Crime,* p. 21.
29. Ibid., Chapter 2: Offender Behavior.
30. Ibid., pp. 16, 23, 24. Reppetto found that: young burglars engage in criminal activity in a haphazard fashion; prefer easy targets within walking distance from their homes; and are easily deterred by evidence of risk or unfamiliar neighborhoods.

2

THE EVOLUTION OF MULTIFAMILY HOUSING

A superficial glance at the variety of urban housing being built today suggests that there is an infinity of types available. More careful examination, however, reveals that there are only a small number of prototypes in common use, although there are many variations available within each type. Examined from the perspective of the effect of the design of environment on the behavior, attitudes, and vulnerability of residents, the number of residential prototypes of significant difference can be limited to four: (1) single-family houses; (2) walk-up apartments; (3) medium-rise elevator buildings; and (4) high-rise elevator buildings. Single-family houses include detached, semidetached, and row houses. Walk-up apartments include flats, garden apartments, and galleria buildings. Medium-rise buildings are generally accepted as being over three stories in height, but less than 10, and may or may not have an elevator. Medium-rise elevator buildings are normally six and seven stories in height, the upward limit of operation for a hydraulic elevator. High-rise buildings include all buildings serviced by mechanical elevators having variable voltage control, which is usually required for elevators having speeds in excess of 150 feet per minute. These residential buildings normally begin at 10 stories in height and may run as high as 30 to 60 stories.

The following is a discussion of these four prototypes and the basic subclasses within each, their evolution, and the comparative differences in the living environments and urban fabrics they produce.

The Single-Family House

Figure 2.1 shows a few farmhouses along a road in northern Holland. It illustrates the traditional concept of the single-family house. Each of the houses is located on its own farm, or, to put it another way, on a piece of property that is owned by a particular family. Within the interior three-dimensional envelope of each house is the private world, or domain, of that family. The land on which the farmhouse sits is equally private. The land may be defined by fences or simply by the edge of the public road or ditch that passes along it, but each family determines the nature of the activity that can take place on its own property, just as it does for the interior of its home.

Figure 2.1: Farmhouses in northern Holland.

Figure 2.2: Eighteenth-century Dutch single-family houses in an urban setting.

Figure 2.2 illustrates a row of eighteenth-century Dutch houses located in the town serving the farm community just shown. This is an urban setting of a different scale and density. In comparison to the farmhouses, which occupy 5 to 50 acres of land each, this setting is quite dense, housing about 30 to 35 units to the acre. However, in spite of the fact that the density is several hundred times that of the farm community there is, in the urban setting as in the rural one, a very clear notion of defined property. Each one of these row-house units serves a single family. Everything that is within the exterior walls that define the house is unmistakably understood as belonging to a particular family. There is no question as to who has the right to determine the nature of use of the interior areas: it is dictated by the members of the family themselves. In front, the windows of each dwelling unit face the street directly, minimally encumbered by curtains or blinds. At the rear of each is a yard that belongs to the occupant family as its exterior private space. This yard abuts other yards and houses on both sides and opposite in what we have come to know as a typical row-house pattern.

At the front of each house there is a little extension of the private realm of the dwelling out into the street, in the form of a stoop. The street that runs between the units is public in that it is for the collective use of all the residents on the street or in the village, or of outsiders, for that matter. The public street is a means for getting from one residence to another or to any part of the town and the outside world. Theoretically, everyone is free to walk along this street without being interfered with and without having his presence questioned. However, should a passerby decide to arrest his movement along the street and move from the walk onto a stoop, even though he is still in a public space he will be perceived as moving from a zone that is essentially public and as transgressing into the private domain of the individual family unit. A passerby who is not recognized as a resident of the street would be required, with such movement from the central portion of the street, to make his intentions clearly known. It is unlikely that a stranger would be able even to stand in one spot on the cobbled portion of the walk for very long without being questioned by someone, whether a resident of the dwelling or a neighbor.

The central portion of the street allows for a range of activities to occur within it without question; the cobbled portion of the street has a more limited use; it is a space that will tolerate only a limited range of activities.

Actually, because of its narrow dimensions, this street, composed of single-family dwellings closely facing the opposite windows and entries, is much less public than one might at first suspect. The 20-foot space separating the houses keeps the public street very much within the sphere of influence of adjacent houses. The juxtaposition of the dwelling units to the street is too close for residents to tolerate activity in the street that they perceive as a departure from their communal norm or as threat to the privacy of their individual dwelling units.

The stoops and the change in paving texture are devices of demarcation that create buffers between the public street and each household; these marking mechanisms are symbols defining the zones of influence of the private dwellings within the public street. These symbols reinforce residents in their notion that they have the right to question the activity taking place on the brick portion of the street as well as on the more adjacent cobbles and stoops.

Figure 2.3: Semidetached housing in urban America, circa 1920, built at 12 dwellings to the acre.

It would probably be difficult to determine how supportive laws are of the residents' posture in proscribing certain activities permitted on the public street in front of their dwellings, but it is an interesting question to explore further. What constitutes people's understanding as it has evolved over time may be very different from what has a basis in law. If, for example, these residents objected to someone hanging around on the public portion of their street and called the police, the police would come and probably urge the trespasser on his way. But if the stranger persisted and went to court, the residents and police might be hard pressed to make a case of it.

Figure 2.3 is a view of a semidetached American house built in the 1920s at a density of 12 dwellings per acre. This is a solution that falls between the detached house and the row house in comparative density and luxury. Again we see very clearly defined grounds in front and back, and a stoop. The street is wider here, and the sidewalk farther from the house. The change in level also contributes to the disassociation of the dwelling from the street. As in the narrow Dutch street, the sidewalk still is within the sphere of influence of the abutting house, but much less so because of the increased distance. Also, because a 40-foot road separates the two sidewalks, it is only one house, rather than two houses, that genuinely abuts each sidewalk. Here the planted areas defined the private terrain of each dwelling. The stairs and landing work exactly as the stoop does in the Dutch street, in providing an extension of the dwelling into the street. In this case, however, the legal property line of the dwelling actually extends to the sidewalk.

Figure 2.4 shows several turn-of-the-century American row houses. The dwellings were built for moderate-income and skilled working-class families and achieve a density of 32 units to the acre. Less generous and expensive than the semidetached houses shown in Figure 2.3, they nevertheless contain all the mechanisms identified for the Dutch eighteenth-century houses: the stoop and fenced-off grass areas create a semiprivate buffer zone between the private dwelling and the public street; and the close juxtaposition of dwellings to street brings the sidewalk into the sphere of influence of the dwellings. The rear yards are the private outdoor space of the dwelling's inhabitants and are accessible only from the interior private space of the house.

Looking at the entire city block (Figure 2.5) and from it to the fabric of the city that is composed of these blocks, one finds that almost all of the ground area has been designated as the private space of particular families. Very little is left over as public street and sidewalk. In fact, because of the close juxtaposition between dwellings and sidewalk and the unbroken, continual run of individual dwellings along the sidewalk, much of the public street falls under the penumbra of private dwelling units.

Figure 2.4: Turn-of-the-century row houses, at 32 units to the acre, built for working-class populations.

Figure 2.5: A block of row houses, built in America at the turn of the century for moderate-income populations.

Figure 2.6: Aerial view of a few blocks of New York City brownstones, now converted to flats.

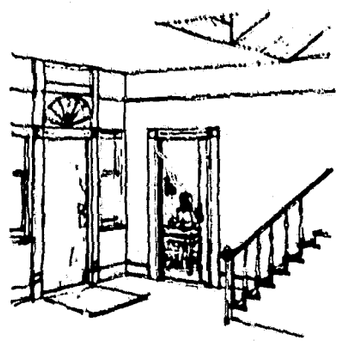
The Walk-up

Figure 2.6 shows a few blocks of old three- and four-story brownstones, a New York idiom of the row house. These old, individual family brownstones have been subdivided and turned into flats, and are now occupied by four to 10 families rather than one. Access to the flat of each family is from an interior vestibule, staircase, and corridor. The process of subdividing these houses for multifamily occupancy generated a very significant transition: an entirely new phenomenon was created that has no counterpart in any of the single-family houses discussed so far. These buildings have areas in their interiors that are public in nature; that is, they do not belong to any one family. In truth, these areas are more semiprivate than public because they form a collective realm shared by only a small group of families.

The creation of a living environment that has interior areas within a building that are not part of the private realm of a particular family represents a radical break from traditional building practices. Note that this break in tradition is not limited to the building interior. The grounds around the building, because they are shared by many families, have an equally ambiguous quality: it may not be clear to whom the grounds belong or how they can be used. Not surprisingly, therefore, one finds that when the rear yards are not assigned to individual families they are used primarily to hang the wash and as storage areas; collectors of junk would possibly be a more accurate designation. No resident maintains these areas or feels comfortable in using them for prolonged periods of time.

Should the building owner happen to live in the building, say at the ground level—which was traditional for a long while—or should the building owner acquire an agent such as a superintendent or a concierge to maintain the building or to act on his behalf, then the owner or agent undertakes the control of the interior public areas of the building and the grounds around it. The people who come through the entry vestibule are screened (Figure 2.7). The nature of the activity permitted in the interior public circulation areas is, under these circumstances, determined by the owner or agent. Although the individual flats or apartments in this building are still the private domain of the families who occupy them, their realms now do not naturally extend beyond the doors of their apartments. If there is no resident owner or concierge, these interior spaces are more readily accessible to anyone than the interior of any single-family house, and their maintenance is subject to residents' whims. The grounds, if unassigned, suffer a similar fate.

Figure 2.7: Concierge, or building owner, controlling entry from ground-level apartment of a converted brownstone or tenement.



These converted brownstones can house from four to 10 families per building and provide as many as 200 units per acre of land, in a design prototype that is less than adequate for families with children because of the lack of ground space. They function best when occupied by single people or families with few children.

The three- to four-story multifamily residential structure known interchangeably as walk-ups or flats is a common idiom of the higher-density middle-income housing built in the 1920s. It has produced a residential environment similar in scale to the single-family house, but able to provide for from 35 to 60 families to an acre

Figure 2.8: Multifamily three-and-a-half-story walk-up in St. Louis, Mo.

Figure 2.9: Lobby of multifamily three-and-a-half-story walk-up.

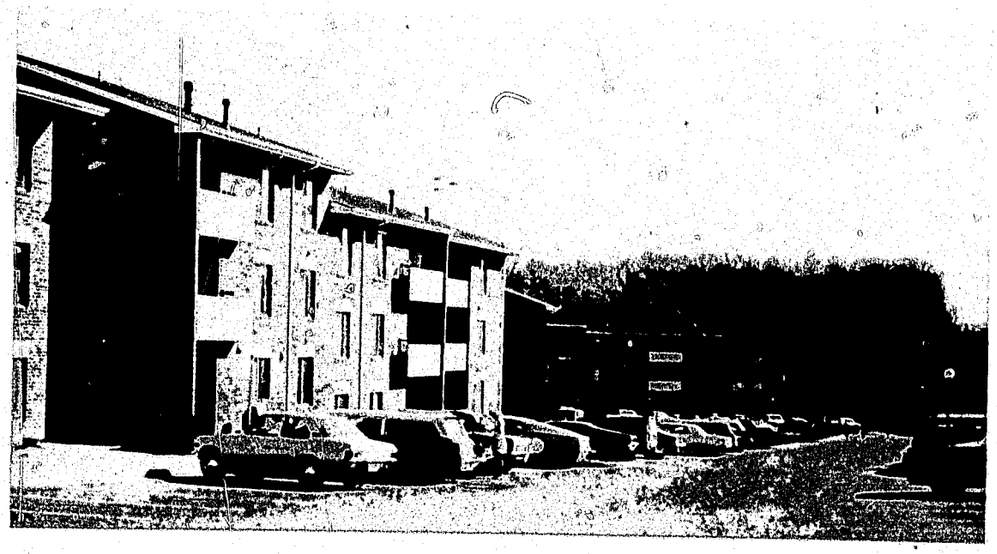
Figure 2.10: Corridor of multifamily three-and-a-half-story walk-up.

of land. A turn-of-the-century walk-up apartment building for middle-income families is shown in Figure 2.8. This housing type is normally wide and deep (100 feet by 60 feet), and provides a large, comfortable alternative to the single-family house. A variety of devices have been used, both in the layout of the interior circulation areas and in the provision of large exterior balconies, in an endeavor to capture some of the flavor of the single-family dwelling unit. The interior lobbies are spacious and occasionally treated as small courtyards (Figure 2.9). Many of these lobbies are glazed at the rear of the building, allowing in light, and provide access to an exterior courtyard that can be used in pleasant weather. At each floor level entries to individual apartments are defined by separate alcoves, and occasionally by a transitional step or two. In general, the treatment of the common corridors and lobbies is sumptuous, involving carpeting, the placement of chairs and side tables, ornamental lighting, and textured wall surfacing (Figure 2.10). A very real endeavor has been made, through interior design and decorating techniques, to create the feeling of the inside of a home, even in the public circulation areas. Each building serves from six to 12 families and the superintendent and his family occupy the basement apartment. The three-and-a-half-story walk-up apartment blends in unobtrusively with neighboring single-family housing. Few of these buildings, however, have provided adequate outside play facilities. They have worked best when placed opposite city parks.

In suburban development today, the most typical walk-up is the garden apartment (Figure 2.11). This prototype has a density limit of about 35 units to the acre. In the garden apartment illustrated each entry, expressed by recessed alcove on the facade, serves only six families, two per floor. The lobby contains the intercom, mailboxes, and stroller storage room. A common stair in the entry hall serves all six apartments. There is normally also a second exit from the entry hall, leading to the outside area at the rear of the building.

Possibly the most important feature of this design is that typically only two families are grouped together to share a corridor at each floor level. It is therefore not unusual in these buildings for families to extend their proprietary feelings out of their apartments and into the corridor; many residents see the corridor landings as an extension of their private realm. In garden apartment schemes of this design it is common for occupants to include the corridors outside their apartments in their weekly cleaning and to place some personal items, such as a welcome mat, plant, or wall hanging, in this space. With only six families sharing an entry, it is comparatively easy for all of them to come to recognize and know one another, and equally simple for an implicit understanding to grow up among them as to what constitutes acceptable usage of these common interior areas.

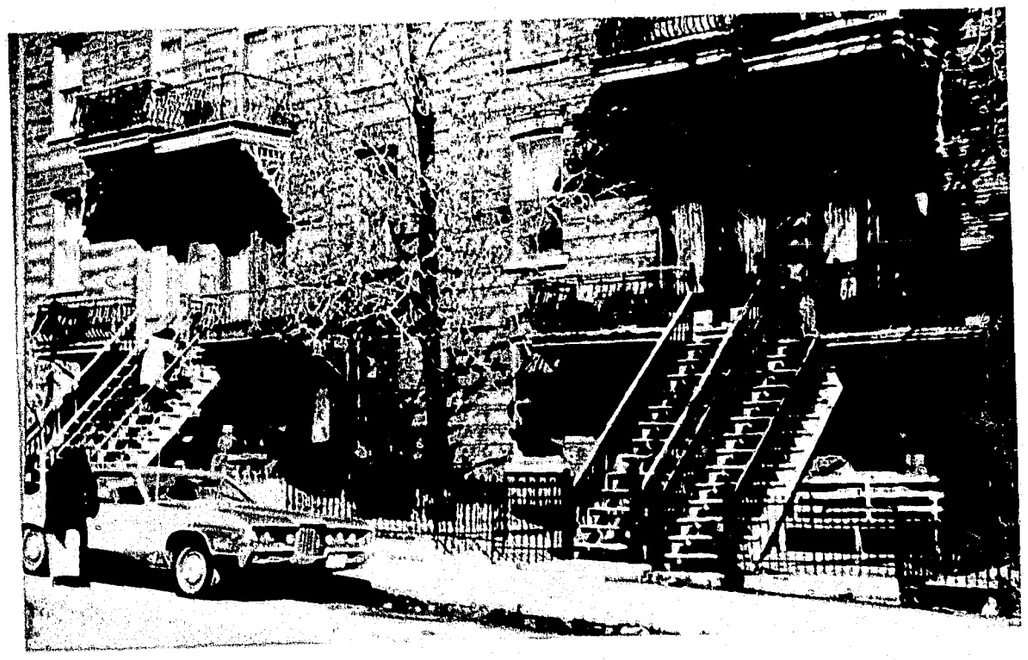
Figure 2.11: Contemporary suburban garden apartment, or walk-up, built at 35 units to the acre.



The grounds outside the garden apartment building, as shown in this photograph of a typical suburban prototype, normally have parking areas opposite the front entries and common green areas opposite the rear. The grounds areas are in this case public in nature, in that no attempt has been made to assign any portion of them to individual residents on the ground floor, to the six families sharing an entry, or to the residents of the building as a whole.

An interesting variation of the three-story walk-up, which manages to avoid interior public circulation spaces, evolved in Montreal. Figure 2.12 shows a view down a typical urban street composed of these flats. The ground-floor unit is entered from its own fenced-off patio. The second- and third-floor units share a common exterior stair that springs from the public sidewalk to a balcony serving two entry doors. One of these doors enters the second-floor unit; the other leads to an interior staircase, which leads up to the third-floor flat. This interior stair is, of course, within the private realm only of the family occupying the third floor. This building type is unique in that it achieves a very high density (up to 65 dwelling units per acre) while totally avoiding the creation of any interior public circulation areas.

Figure 2.12: Walk-up flats in Montreal, built at 50 units to the acre. All entries face onto the street; there are no interior public spaces.



Windows from all the units face the street, the ground-level patios, and the second-floor balconies. Note that the family occupying the ground-floor flat has the use of the front grounds, appropriately fenced off. At the rear of the building the ground-floor family again has exclusive use of the grounds. The families living on the second and third floors are compensated by having their own private balconies, front and rear.

It is interesting that this building form should have evolved in Montreal, of all places, for the climate there is severe in the winter and the accumulated ice and snow make the use of the exterior stairs somewhat hazardous. In fact, this building type recently has been outlawed in Montreal for exactly this reason. It remains, nevertheless, a most intriguing prototype, better suited to warmer climates.

The construction technique, too, is very economical, in that it makes use of a continuous slab of building to which individual wooden balconies and stairs are affixed. More costly and elaborate variations exist, on slightly larger sites, as seen in Figure 2.13. Here the entry to the upper two floors is past a small transitional buffer area rather than immediately off the street.

The European variation of the walk-up flat is the galleria block, which takes two forms: those built with one-story apartments and those with two-story apartments (or maisonettes). Figure 2.14 illustrates a small four-story walk-up building composed of single-level

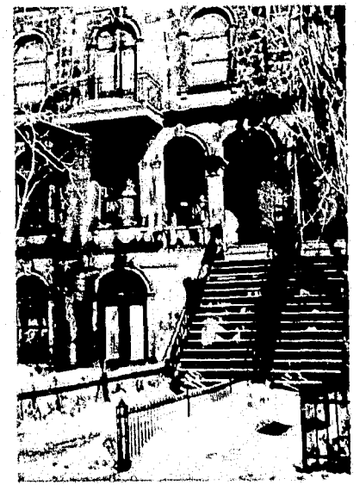


Figure 2.13: A more elaborate three-story walk-up in Montreal. The site is larger than that in Figure 2.12, allowing a buffer area between the sidewalk and the stairs.

Figure 2.14: Example of a four-story walk-up in London. Each apartment is on only one level, and all entries are off singleloaded corridors facing the street.

apartments. All units are accessible from a staircase at the far end of the building and the common gallery at each level. Aside from the half-hidden stair, there are no other interior public areas. The windows and entries of the units face the public access galleries. This prototype can house as many as 60 families to an acre of land. The grounds at the front and rear are for the common use of all the residents in the building and are symbolically fenced off.

Figure 2.15 shows the two-story apartment or maisonette variation of the gallery block. The four-story building consists of a two-story dwelling unit (maisonette) sitting above another two-story unit. Access to the upper maisonette unit is by staircase. The lower maisonette unit has the private use of some of the grounds, front and rear.

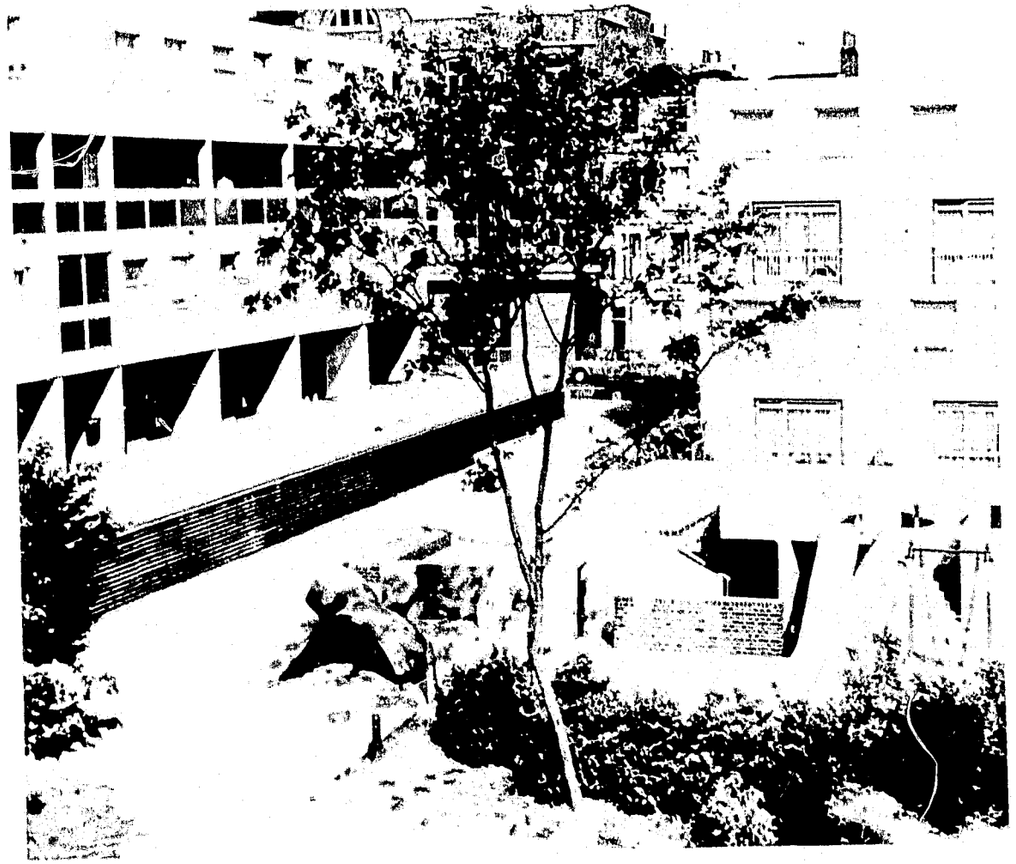


Figure 2.15: European walk-up flats of the maisonette (two-story apartment) type.

Figure 2.16: Five- and six-story tenements on the Lower East Side of Manhattan in New York City.

The Medium-Rise Building

Figure 2.16 is an aerial view of a grouping of tenements located on the Lower East Side of Manhattan in New York City. These were constructed at the turn of the century for low-income families. They were designed for multiple-family occupancy and accommodate from 10 to as many as 24 families per building entry. Twenty-four families per building entry is typical of old-law tenement buildings built in New York before 1890. In terms of building types responding to the demands of density, the tenement environment represents a quantum jump in the number of families sharing the interior public areas of a building and the grounds around it. Because of the large number of people involved in this sharing, the interior circulation areas are very public. It is unlikely that the owner of the tenement is in residence here, although there may well be a resident family assigned the duty of superintendent. The concierge, or superintendent, in residence existed in multifamily buildings both in Europe and America in the nineteenth century. It is a tradition that came into being with the evolution of high-density housing and unfortunately has been abandoned in contemporary federally assisted housing. The concierge's (or superintendent's) responsibilities involve not only taking care of the building and

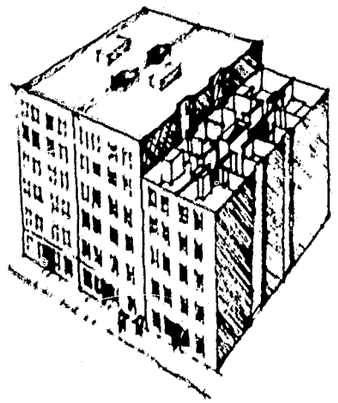


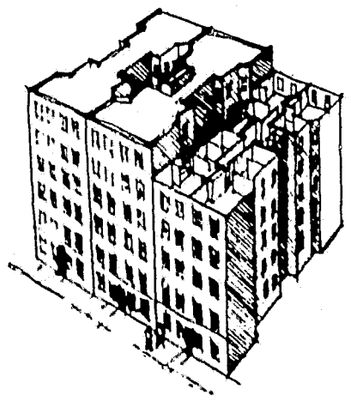
Figure 2.17a: Isometric drawing of old-law tenements built before 1890.

keeping it clean, but more importantly screening people who enter and leave. With as many as 24 families, or 100 and more persons, sharing an entry the tenement produces a collective living environment in which it is difficult for residents to recognize other residents and even more difficult to distinguish intruders from the friends of other residents.

The typical five- or six-story old-law tenement is 25 feet wide and 90 feet deep. It houses four families per floor, for a total of 20 to 24 families per building and as many as 400 families per acre. The so-called new-law tenements, which are an improvement on the tenements built before 1890 in that they let in more light and air, nevertheless have been built to house more than 100 families per acre of land (Figure 2.17). The six-story air shafts and the spaces at the rear of the buildings are paved at the ground level; in a short time after the buildings were occupied these areas became covered with glass and litter. The sidewalk and city street are the only places for occupants of these buildings to sit or children to play; the stoops and the sidewalks in front thus became the converging area for residents of every age group. As long as there was little automobile traffic, the streets themselves were useful play areas.

The inadequacy of tenement housing for families raising children led to the public housing movement, and with that the advent of the high-rise building. The need to rehouse most of the families living in the dilapidated tenements meant, if one were to use the same urban sites, finding a building form that could reproduce equal densities.

Figure 2.17b: New-law tenements, built after 1890.



The low cost of hydraulic (direct-plunger) elevators, compared with electric (wire-rope-suspended) elevators, led to the wide-scale adoption of the six- and seven-story residential building; 70 feet is the effective height limit of the hydraulic elevator. The medium-rise elevator buildings normally had double-loaded corridors and took the form of a cross. Figure 2.18 illustrates cruciform buildings and plan.

The buildings house eight families per floor, a total of 56 families sharing a building entry. One elevator serves all the families in the building. The double-loaded corridors (apartments on both sides of a central corridor) are dark and narrow, but not so long in this building type as they are in slab buildings. The corridors at each level and the common lobby serve too many families to allow any of them to feel comfortable about extending their

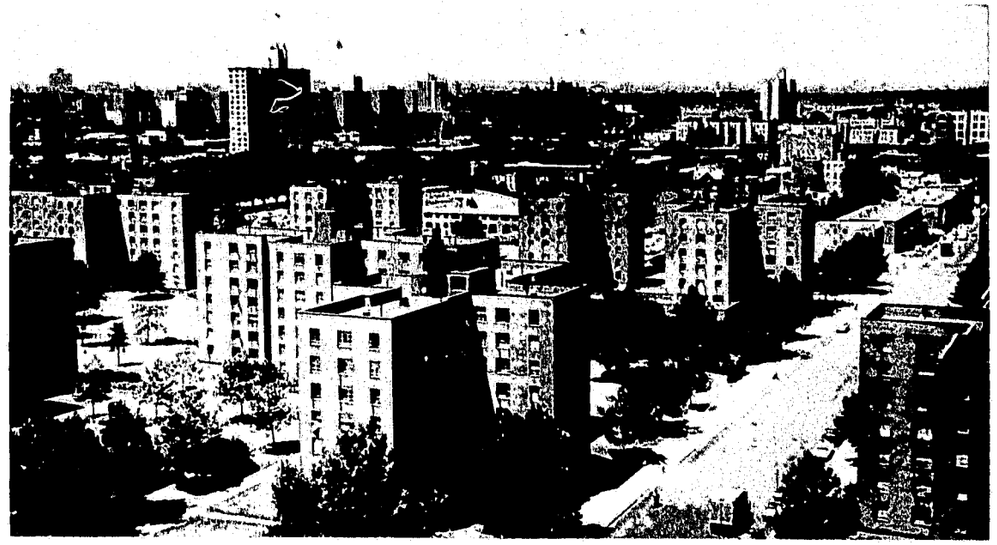


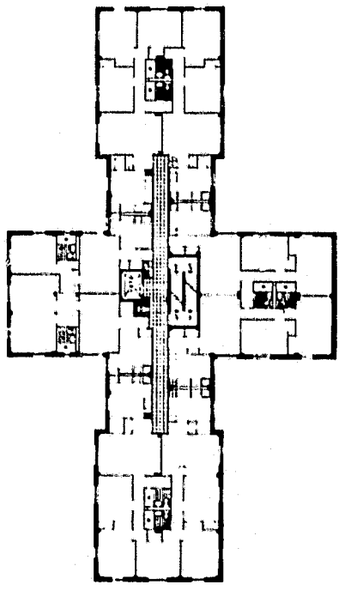
Figure 2.18a: Seven-story cruciform buildings, with mechanical elevators and double-loaded corridors.

realm of concern outside their individual apartments.[1] As a result, these public areas, which include as well the elevators and stairs, must be cleaned and maintained by management. These areas are also very prone to vandalism. The elevators in particular are an attractive plaything for children, and their continual breakdown and repair are very costly. Finally, because these common circulation areas are so public and yet hidden from the view of residents, these areas prove to be where most crimes in high-rise projects take place, particularly robberies, assaults, and rapes.[2]

The medium-rise elevator project shown in Figure 2.18a achieves a density of a little under 50 units per acre. Different from walk-up schemes, it frees a high percentage of the land for parking and recreation (14% land coverage, compared with 33% land coverage for three-story walk-ups built at the same density). In the scheme illustrated, the architects have left all the grounds areas open and unassigned to any particular building. As a result, parents are somewhat apprehensive about allowing their younger children to play unattended on the grounds below.[3/4/5] Even though there are more grounds available in a seven-story scheme, an equivalent population living in a three-story walk-up at the same density and with less open areas available will likely have more children out playing on the grounds.

The medium-rise elevator building does not match the density of the six-story tenements. Not surprisingly, electric (wire-rope-suspended) elevators, which have no limiting effect on height, were adopted as the logical next step in the evolution of urban housing.

Figure 2.18b: Typical floor plan of cruciform building with double-loaded corridors.



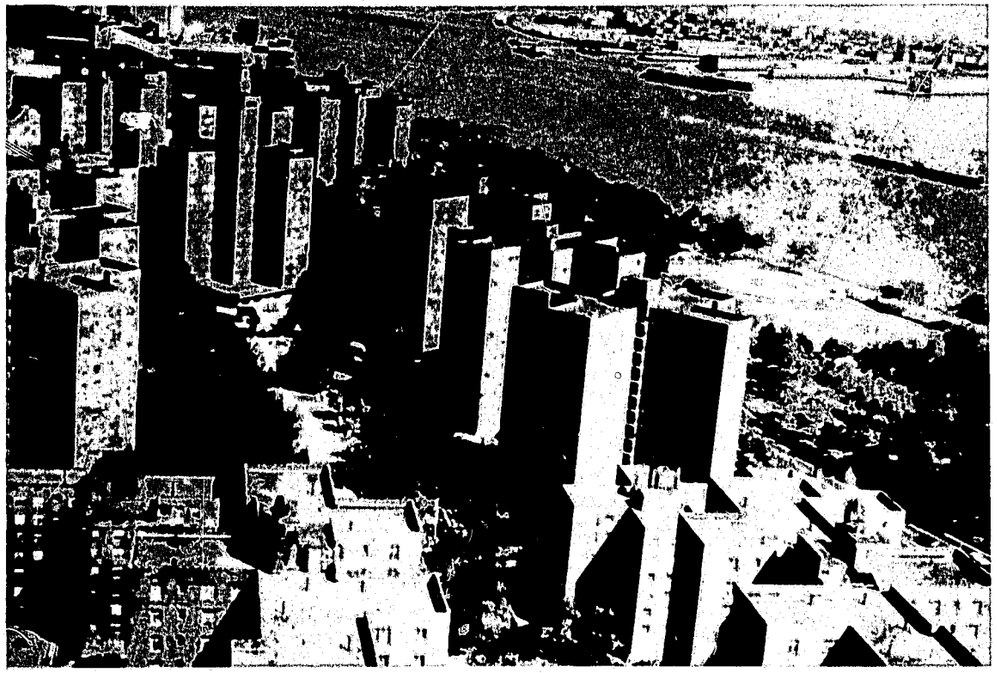


Figure 2.19: Jacob Riis Houses, one of the first high-rise public housing projects; it was built at 100 units to the acre. (In the foreground is Lillian Wald Houses, another public housing project.)

The Elevator High-Rise Building

Figure 2.19 shows a public housing project on the Lower East Side of Manhattan. The buildings are 13 stories in height and house nine families per floor, for a total of 117 families per building entry. The project is built at 100 units to the acre—the same density as the tenement slums it replaced. What this solution provides is green areas and open space for sitting, play, and parking. It is accomplished at the price of raising families into the air and away from the ground.

From our perspective the resulting residential environment is little better than the tenements it replaced and, in some important respects, worse. The high-rise elevator building forces more than 500 people to share a common building entry and interior circulation space. The exterior grounds and interior circulation areas are, as a result, anonymous and virtually accessible to anyone. There is no understanding of the nature of acceptable usage of these areas, and no way for residents to influence or control activity taking place there. There are simply too many people sharing access to any building

and the grounds of the project. As in the tenements, the large number of residents complicates the recognition process among neighbors and discourages opportunity for the development of a commonality of goals and interests among them. For such agreement to take place, too many people would be required to concur on any program framing acceptable usage and control; any such program would be difficult to agree upon in prolonged, structured meetings, let alone something that could grow from casual, ad hoc concurrence among neighbors. Not surprisingly, the history of crime and vandalism in public housing parallels the history of high-rise buildings designed for low-income families with children. The additional height of the high-rise block is what makes it a less useful environment for families with children than the six-story tenements. The high-rise blocks provide more room per family in each apartment, more light and air, and better utilities, but the increased distance to the ground makes access to play areas difficult for young children and complicates their supervision by parents. The very public nature of the interior circulation areas has also produced places where residents are very vulnerable to criminal activity.

Summary

A person's claim to a territory diminishes proportionally as the number of people who share that claim with him increases. The larger the number of people who share a territory, the less is each individual's felt rights to it. With only a few families sharing an area, whether the interior public space of a building or the grounds around it, it is relatively easy for an informal understanding to be reached among the families as to what constitutes acceptable usage. When the numbers increase, the opportunity for reaching such an implicit understanding diminishes to the point at which no usage is really permissible while every use is possible. The larger the number of people who share a communal space, the more difficult it is for people to identify it as being in any way theirs or to feel they have a right to determine the activity taking place within it. It is also easier for anyone to gain access to and linger in the interior public areas of a building shared by 24 to 120 families than it is in a building shared by six to 12 families.[6]

The evolutionary process in housing we have been examining was affected by two forces working together to compound the problem: (1) the desire to improve the standards of individual dwelling units; and (2) the need to house families at increasing densities. In many ways the density of working-class housing, in the form of the tenements built 100 years ago, is only now being reached again with the advent of 20- and 30-story high-rises. The individual apartments in tenements were woefully inadequate in terms of size: as little as 300 square feet served a family of five. Daylight and plumbing were even more minimal. Today the apartments in 30-story high-rise blocks, built at 200 units to the acre, are 800 to 1200 square feet in size, receive abundant light, are supplied with the modern plumbing facilities, and are serviced by high-speed elevators. The inadequacies of some of today's high-rise buildings have to do with their inability, in many ways unpredictable, to meet conditions that became evident only after these new environments were occupied.

Figures 2.20 through 2.23 illustrate the four categories of building under discussion. The most significant characteristics of each prototype and the density range possible within each are illustrated in a comparative fashion.

From a security point of view, the primary difference between a single-family building and a multifamily building is that in the single-family building all the interior spaces are the private domain of the occupant family, whereas in the multifamily building interior circulation areas within the building are shared by many families. Similarly, the grounds surrounding a single-family unit are understood as being for the private use of the occupants of that dwelling unit, while the grounds surrounding a multifamily building are seen as space for the collective use of all the building's inhabitants. Control over the use of grounds surrounding a multifamily building must be maintained continually by the building's management. Because of the multiplicity of users, access to and use of the interior, common circulation areas of a multifamily building are open to all the members of the families occupying the building, their friends, and, of course, strangers. Control of access can be limited but this requires an agent of management.

In the ensuing discussion of the design of residential buildings and their site planning, reference will be made to spaces both within buildings and outside them as pri-

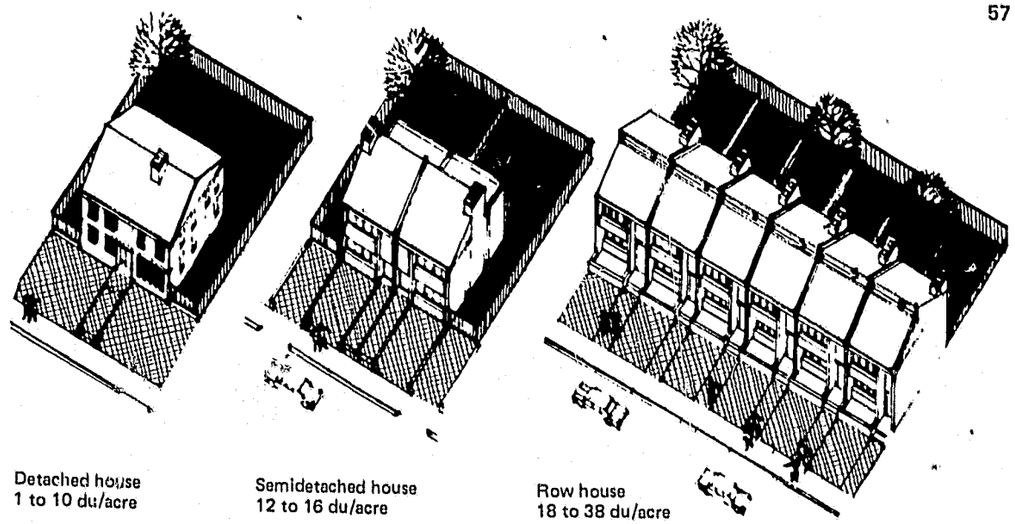


Figure 2.20: Single-family houses.
- All interior spaces are within the private domain of the family.
- All grounds around the contained unit are for the private use of the family.
- There is a direct abutment between private grounds and the sidewalk.
- The domain of the house encompasses the street.

Private Semiprivate Semipublic Public

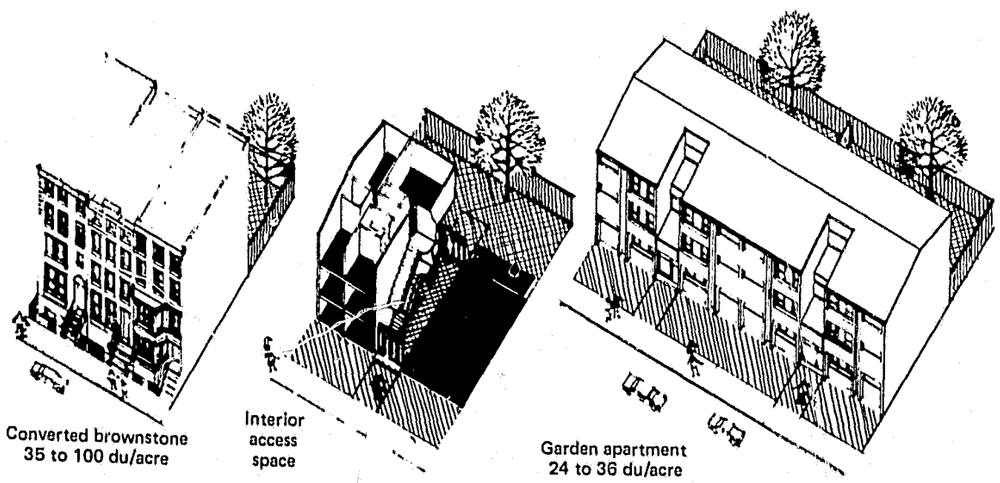


Figure 2.21: Walk-up apartments.
- Private space is within the apartment unit only.
- The interior lobby, stairs, and corridor are semiprivate.
- Grounds can be designated for one family but are commonly shared by all the families in the building.
- Only a small number of families (three to six) are required to share interior space and grounds.
- The street is within the sphere of the dwelling.

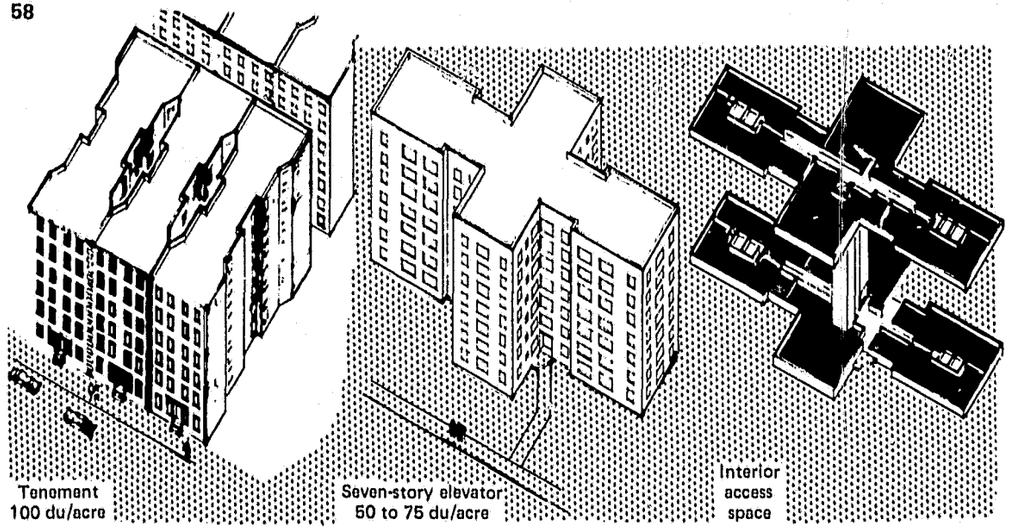


Figure 2.22: Intermediate high-rise buildings.
- Private space exists only within the apartment units.
- The interior circulation spaces, stairs, lobby, elevators, and corridors are shared by many families and so are semipublic in nature.
- The grounds vary in nature from semipublic to public.
- The street is only marginally associated with the domain of the building or project.

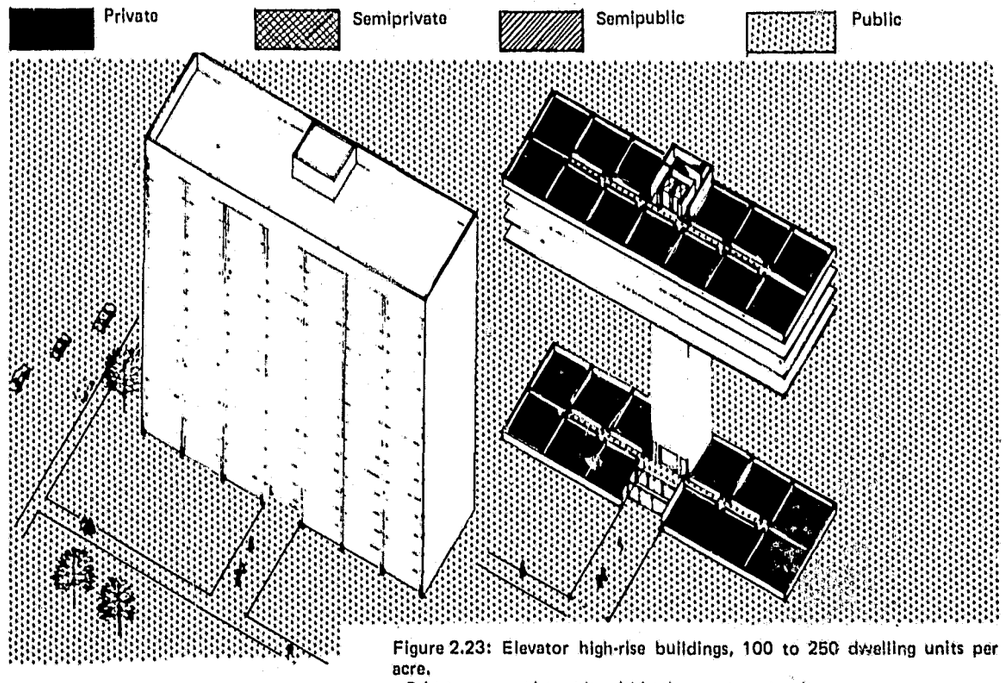


Figure 2.23: Elevator high-rise buildings, 100 to 250 dwelling units per acre.
- Private space exists only within the apartment units.
- The interior circulation spaces and the grounds are public in nature.
- There is no association between buildings and street.

vate, semipublic, and public. Although these terms evoke some meaning for everyone, the particular meaning of each is unlikely to be universally shared. Table 2.1 was prepared in an endeavor to establish a base line of common definition and understanding.

Table 2.1: Comparative Levels of Privacy in Locations Within and Outside Buildings

	Location	
Designation	Within the Building	Outside the Building
Private areas	The interior of a single-family house, or the interior of an apartment in a multifamily building.	The grounds area outside a single-family house, or ground-floor apartment in a multiple dwelling, that is fenced off by a real barrier, is available for the use of one family, and is only accessible from the interior of that family's unit.
Semi-private areas	The interior, common circulation areas and common resident use rooms within a multifamily building to which access is possible only on the approval of an agent representing either the management or the residents.	The grounds area outside a multifamily building that is fenced off by a real barrier and is accessible only from the private or semiprivate zones within the building.
Semi-public areas	The interior, common circulation areas and common resident use rooms within a multifamily building to which access is possible only with a key or on the approval of residents via an intercom, buzzer-reply system.	The grounds area outside a multifamily building that are accessible from public zones but are defined as belonging to the house or building by symbolic barriers only.
Public areas	The interior common circulation areas and common resident use rooms within a multifamily building to which access is unrestricted.	The grounds areas outside a multifamily building that are undefined as being associated with any building or building entry in any real or symbolic fashion.

Essentially, crime prevention occurs *when* and *where* residents feel capable of assuming authority for determining the type of activity allowed in the nonprivate areas surrounding their dwelling units. One assumes that within the private areas of their dwellings, as defined by walls and entry doors, they control these options totally. In buildings housing many dwellings, there are interior and exterior zones that do not clearly belong to the residents of any particular dwelling and are assumed to be nonprivate in nature. Traditionally in multifamily housing these zones (grounds, lobbies, corridors, stairs, elevators, garages) were intentionally held as public, and anyone was allowed access to them. In some middle-income buildings and in virtually all upper-income buildings, control of access to the interior public areas of a building is assumed by the building owners or their agents—doormen, elevator operators, superintendents, porters. They all function to supervise these spaces and to control the nature of the activity, and the participants, allowed within them.

In multifamily housing the rash of criminal activity has brought with it a change in management attitude and with it the advent of tenant patrols. Tenant patrols function in a variety of ways, but they all illustrate this essential change in management policy: tenants are allowed to dictate access to and type of activity acceptable in areas that were previously public. The control of the interior public areas in multifamily dwellings occurs more naturally in buildings where only a few families share an entry. In buildings where 15 or fewer families share an entry there is seldom any need for doormen or tenant patrols.

Synopsis of Densities Achieved by Different Building Types

Figure 2.25 through 2.36 together frame a synoptic view of what the different housing types under discussion would each produce on the typical acre of urban land illustrated in Figure 2.24. In this set of illustrations the density range is from six units to the acre for the single-family house in Figure 2.25, to 108 units to the acre for the high-rise in Figure 2.36. The most important lesson is that at the middle-density range, at which most urban housing is built, 25 to 70 units to the acre,

Detailed plans of Figures 2.25 through 2.36 appear in Addendum 4.

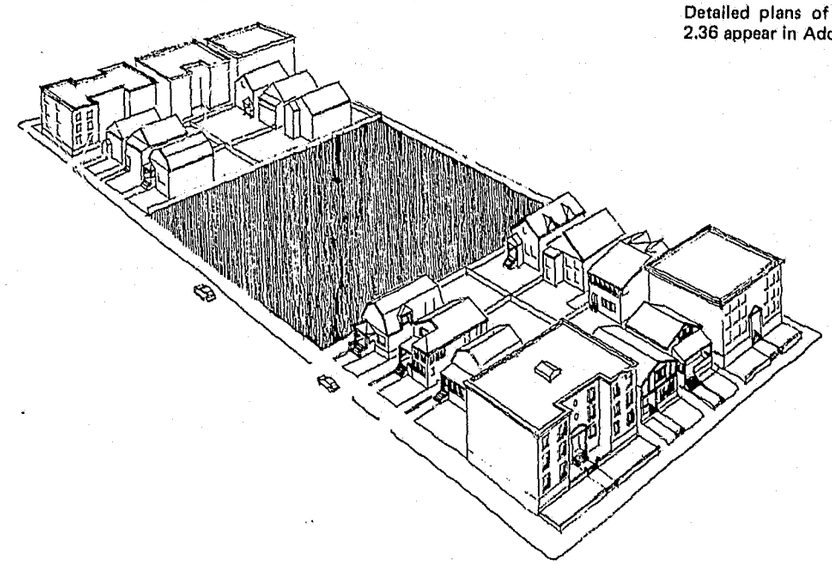


Figure 2.24: Typical city block, 200' X 600' showing a one-acre (218' X 200') vacant site in the center. Figures 2.25 through 2.36 show how the site could be developed in densities ranging from six to 103 dwelling units to the acre.

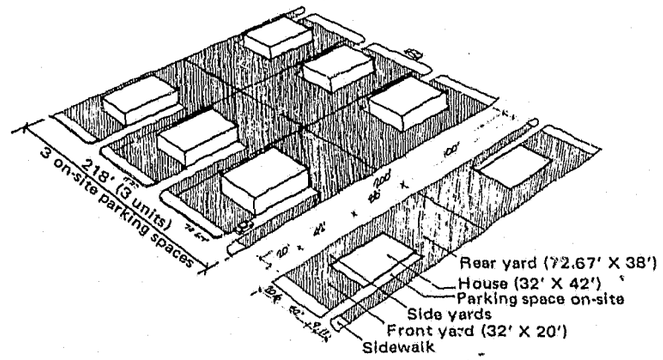


Figure 2.25: Detached houses, one story. Six units per acre.
- Detached houses on 1-acre site
- Site dimensions: 218' X 200' = 43,600 sq. ft.
- 3 units per side = 6 units per acre
- Typical interior unit dimension 30' X 40' = 1,200 sq. ft.
- 1,200 sq. ft. = 3-bedroom unit
- Parking: 6 on-site spaces

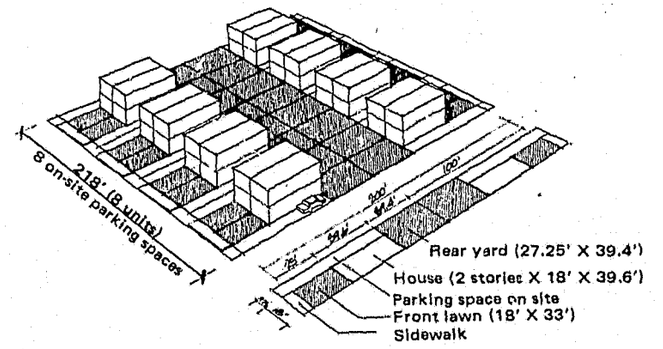


Figure 2.26: Two-story semidetached houses, 16 units per acre.
- Semidetached on 1-acre site
- Site dimensions: 218' X 200' = 43,600 sq. ft.
- 8 units per side = 16 units per acre
- Typical interior unit dimension: 17' X 37.6' X 2 stories = 1280 sq. ft.
- 1200 sq. ft. = 3-bedroom unit, + 40 sq. ft. of stairs per floor
- Parking: 16 on-site spaces

Figure 2.27: Two-story row houses, 18 units per acre.
- Row houses on 1-acre site
- Site dimensions: 217' X 200' = 43,400 sq. ft.
- 9 units per side = 18 units per acre
- Typical interior unit dimension: 23' X 28' X 2 stories = 1288 sq. ft.
- 1,200 sq. ft. = 3-bedroom unit, + 40 sq. ft. of stairs per floor
- Parking: 22 on street parking spaces

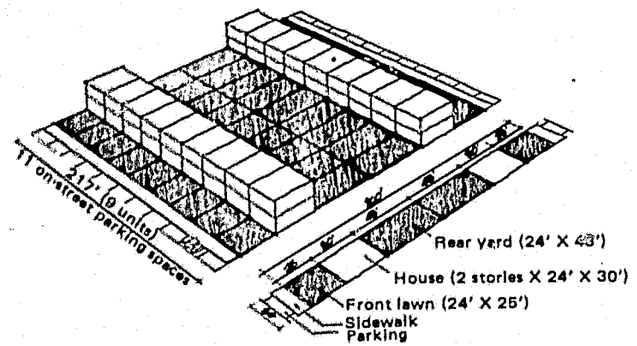


Figure 2.28: Two-story row houses, 24 units per acre.
- Row houses on 1-acre site
- Site dimensions: 217' X 200' = 43,400 sq. ft.
- 12 units per side = 24 units per acre
- Typical interior unit dimensions: 17' X 37.6' X 2 stories = 1280 sq. ft.
- 1200 sq. ft. = 3-bedroom unit, + 40 sq. ft. of stairs per floor
- Parking: 22 on-street parking spaces

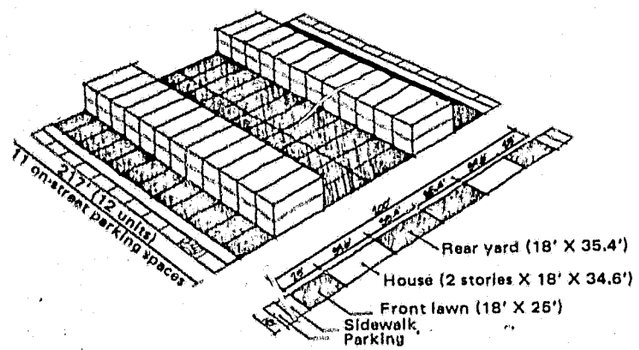


Figure 2.29: Three-story row houses on modified city block, 38 units per acre.
- Row houses on 1-acre site
- Site dimensions: 267' X 163' = 43,321 sq. ft.
- 19 units per side = 38 units per acre
- Typical interior unit dimensions: 13' X 34' X 3 stories = 1326 sq. ft.
- 1200 sq. ft. = 3-bedroom unit, + 40 sq. ft. of stairs per floor
- Parking: 13 spaces per side (on street), total = 26 spaces

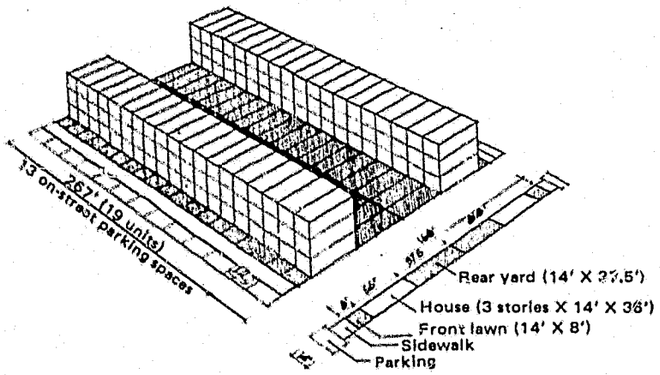


Figure 2.30: Garden apartments, 36 units per acre.
- Garden apartments on 1-acre site, 6 units per entry
- Site dimensions: 218' X 200' = 43,600 sq. ft.
- 18 units per side = 36 units per acre
- Typical interior unit dimensions: 29' X 41.4' = 1,202 sq. ft.
- 1,200 sq. ft. = 3-bedroom unit
- Parking: 10 spaces each side street = 20 spaces, + 16 spaces on interior of site, total = 36 spaces

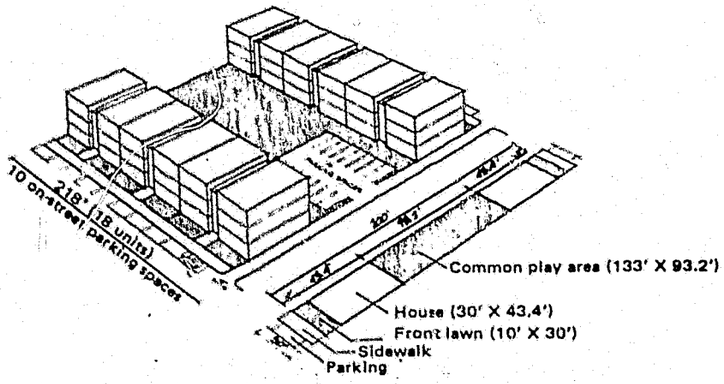


Figure 2.31: Medium high-rise apartments, 35 units per acre.
- Apartments on 1-acre site
- Site dimensions: 218' X 200' = 43,600 sq. ft.
- Six stories, six apartments per floor = 35-36 units per acre
- Typical interior unit areas (per floor): 2 apartments @ 1,200 sq. ft.; 4 apartments @ 1,280 sq. ft.
- 1,200 sq. ft. = 3-bedroom unit
- Parking: 44 on-site spaces

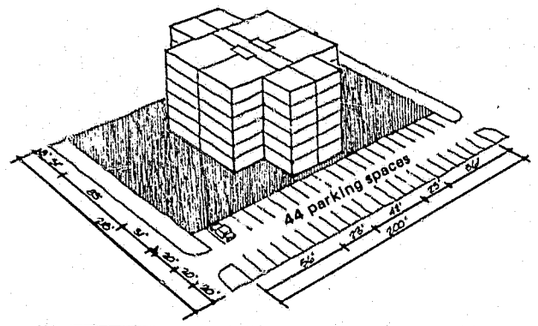


Figure 2.32: Medium high-rise apartments, 55 units per acre.
- Apartments on 1-acre site
- Site dimensions: 218' X 200' = 43,600 sq. ft.
- Seven stories, eight apartments per floor = 55-56 units per acre
- Typical interior unit areas (per floor): 4 apartments @ 1,202 sq. ft.; 4 apartments @ 1,227 sq. ft.
- 1,200 sq. ft. = 3-bedroom unit
- Parking: 44 on-site spaces

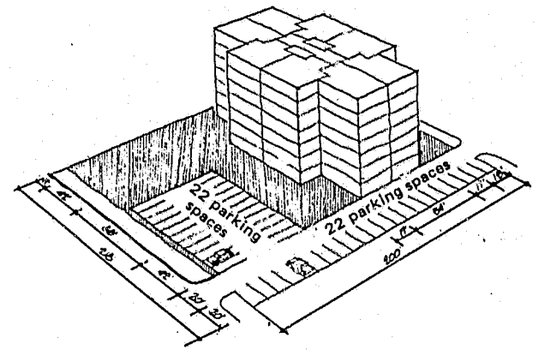


Figure 2.33: European walk-up, 56 units per acre.
- Walk-up apartments on 1-acre site
- Site dimensions: 218' X 200' = 43,600 sq. ft.
- 28 units per side = 56 units per acre
- Typical interior unit dimensions: 27.7' X 43.4' = 1,202 sq. ft.
- Typical interior unit dimensions, duplex: 13.35' X 48.0'. X 2 stories = 1,282 sq. ft.
- 1,200 sq. ft. = 3-bedroom unit, + 40 sq. ft. stairs per floor for duplex
- Parking: 22 spaces per side (on street), total = 44 spaces

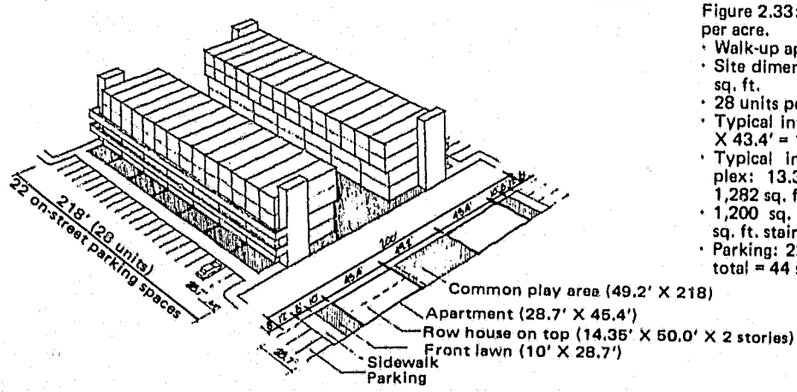


Figure 2.34: High-density walk-up, 72 units per acre.
- Walk-up apartments on 1-acre site
- Site dimensions: 218' X 200' = 43,600 sq. ft.
- 36 units per side = 72 units per acre
- Typical interior unit dimensions; 29' X 41.4' = 1,201 sq. ft.
- Typical interior unit dimensions, duplex: 29' X 22.2' X 2 stories = 1,288 sq. ft.
- 1,200 = 3-bedroom unit, + 40 sq. ft. stairs per floor
- Parking: 30 spaces on site + 20 spaces on street, total = 50 spaces

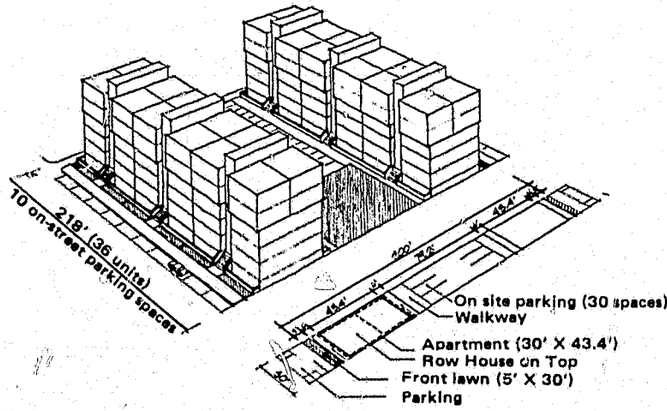


Figure 2.35: Twin-tower apartments, 94 units per acre.
- High-rise apartments on 1-acre site, two 12-story buildings
- Site dimensions: 218' X 200' = 43,600 sq. ft.
- 47 units per tower = 94 units per acre, 4 units per floor
- Typical interior unit dimensions: approx. 40' X 32' (unit actually 1194 sq. ft.)
- 1,200 sq. ft. = 3-bedroom unit
- Parking: 20 on-site spaces per side, total 40 spaces

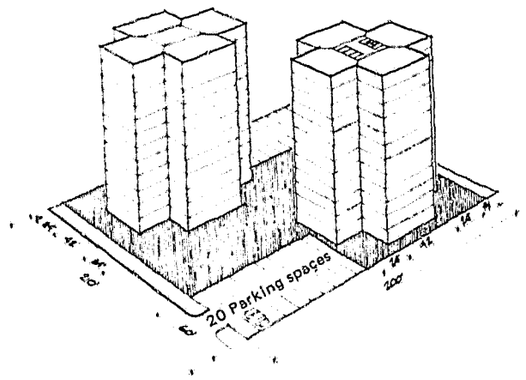
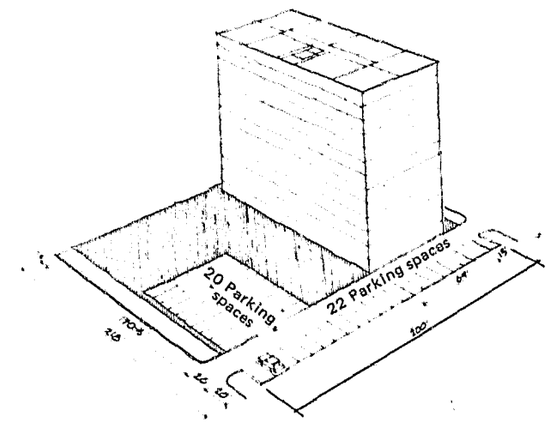


Figure 2.36: High-rise apartments, 103 units per acre.
- Apartments on 1-acre site
- Site dimensions 218' X 200' = 43,600
- 13 stories, 8 apartments per floor = 103 units per acre
- Typical interior unit dimensions: 4 apartments @ 33' X 36' = 1,188 sq. ft.; 2 apartments @ 25.5' X 47.3' = 1,211 sq. ft.; 2 apartments @ 31.5' X 38' = 1,197 sq. ft.
- 1,200 sq. ft. = 3-bedroom unit
- Parking: 42 on-site spaces

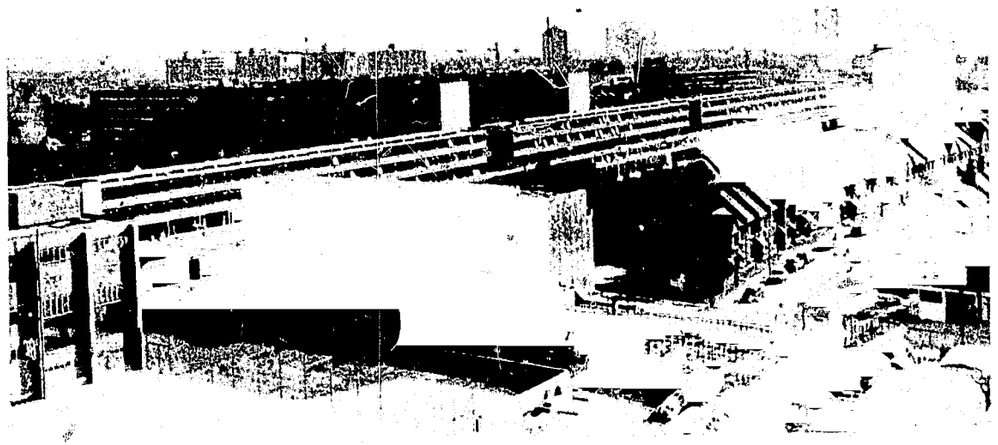


there is a variety of different housing types available, each with its own potential advantages and disadvantages. Given the problem of designing a development at 35 units to the acre, many architects have opted for a six-story scheme (Figure 2.31), but could have achieved a slightly higher density with a three-story row-house solution, as shown in Figure 2.29, or a garden-apartment scheme, as shown in Figure 2.30. This range in options and environments is perhaps most startlingly demonstrated in Figures 2.37-2.42. Figure 2.37 is a view down a turn-of-the-century row-house street in London toward a housing project that is being built to replace it.

An aerial view of this new high-rise project is shown in Figure 2.38. The interesting, if frightening, point is that both the row houses and the high-rise are built at the same density: 36 units to the acre. The high-rise scheme was built at a much greater cost than the row houses because of the need for elevators and heavier foundations, and the provision of multilevel car parking and elevated sidewalks. The row-house scheme gives every family a piece of ground in front and back that they themselves maintain and that can be used for a variety of purposes. This ground area is useful play space

Figure 2.37: View down a turn-of-the-century row-house street in London toward a new housing estate. The old and the new are both built at 36 dwelling units to the acre.

Figure 2.38: The first stage in the construction of the Aylesbury Estate in Southwark, London, built at 36 dwelling units to the acre.



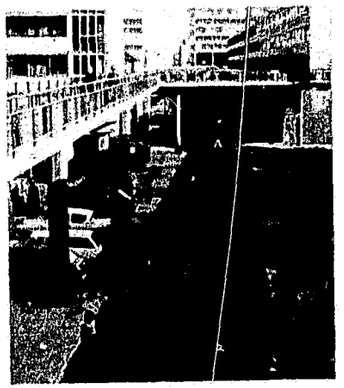


Figure 2.39: Photograph of Aylesbury with children playing in the street.

for very young children but is inadequate for older children who need larger, collectively accessible, play areas. The high-rise frees more communal ground area, but the children still do most of their playing in neighboring streets, and residents will not park their cars in the provided elevated garages because of vandalism and theft (Figure 2.39). As much parking and collective play space is actually provided in the row-house scheme as in the high-rise, but it is in the form of street paving—an unacceptable solution. (In actual fact, strictly residential streets can be designed to produce minimal through traffic and so faciliatate their double use as play areas.)

Figures 2.40, 2.41, and 2.42 show a garden-apartment scheme, also built at 35 units to the acre, that provides both outdoor private areas for each family and collective areas for groupings of 80 families. All parking areas are at the ground level and the collective play areas are separated from vehicular traffic. Individualized, private outdoor areas are provided in the form of patios at the ground level for ground-floor residents and balconies for families on the second and third floors. The collective courts at the rear of the dwellings are large enough to bicycle in or throw a ball around, and contain play equipment for six- to twelve-year-olds. Note too that front access to each building entry is from the street or parking area and egress to the play courts is from a rear entry opposite. This prototype is also illustrated, positioned on one acre of land, in Figure 2.32.

Figure 2.40: View of an interior court of the St. Francis Square project, San Francisco.

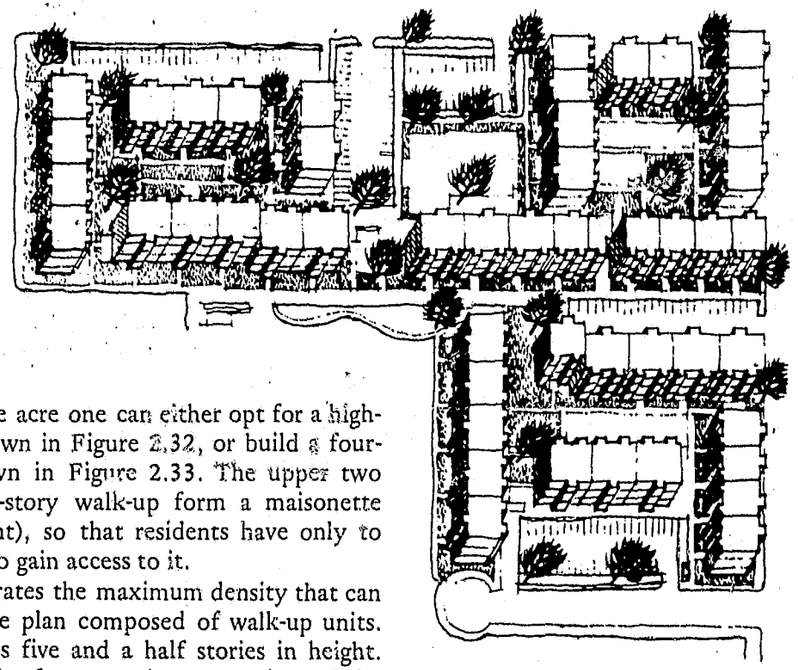


Figure 2.41: Site plan of St. Francis Square. This three-story walk-up is built at 35 units to the acre. The grounds are subdivided into three courts, each shared by approximately 80 families. The buildings are in turn subdivided so that only six families share a common entry.

At 55 units to the acre one can either opt for a high-rise solution, as shown in Figure 2.32, or build a four-story walk-up, shown in Figure 2.33. The upper two stories of the four-story walk-up form a maisonette (two-story apartment), so that residents have only to walk up two floors to gain access to it.

Figure 2.34 illustrates the maximum density that can be achieved in a site plan composed of walk-up units. This building type is five and a half stories in height. The upper two stories form a maisonette unit, and the lowest story is sunk half a floor below the ground to keep the over-all height down. The family that occupies the maisonette unit must walk up a total of three and a half floors, half a floor outside the building and three floors inside the building. This building type achieves a density of 72 dwelling units to the acre but may be considered too high to be acceptable as a walk-up by American families.

Beyond 72 units to the acre an architect will have to resort to elevator buildings. Figure 2.35 illustrates a 12-

Figure 2.42: View of St. Francis Square from the street.

story twin-tower, point-block scheme that will be built at 94 units to the acre. Figure 2.36 illustrates a 13-story double-loaded corridor scheme at 103 units to the acre. The twin-tower scheme contains four families per floor for a total of 48 families per building, and is preferable to the double-loaded corridor scheme, which houses six families per floor for a total of 103 families per building. However, it should be noted that the double-loaded corridor building is less costly to build than the twin-towered point-block scheme because it has less peripheral wall, less foundations, and a less costly elevator and service core than the two towers combined.

The next chapter, Design Guidelines for Buildings, discusses the problems and potentials of each of these building types and how each can be used for a range of different age groups, family types, and income groups.

Footnotes

1. Oscar Newman, *Architectural Design for Crime Prevention.* Washington, D.C.: U.S. Government Printing Office, 1973, Chapter 4, The Pattern of Fear in Housing, pp. 88-95.
2. Ibid., pp. 7, 12.
3. Anthony F. C. Wallace, Housing and Social Structure: A Preliminary Survey with Particular Reference to Multi-story, Low Rent Public Housing Projects. Philadelphia: Philadelphia Housing Authority, 1952.
4. Edward T. Hall, *The Hidden Dimension.* Garden City, N.Y.: Doubleday, 1966, p. 159.
5. Oscar Newman and George Rand, Premodification Interviews at Bronxdale. New York: Institute for Community Design Analysis, 1972. Unpublished study of areas children are allowed to play in by themselves in a project composed of medium-rise elevator buildings.
6. A related study by W. H. Ittelson, H. M. Proshansky, and L. G. Rivlin (Bedroom Size and Social Interaction of the Psychiatric Ward. *Environment and Behavior,* December 1970) involves the significance of numbers in determining felt rights and permitted usage. They examined the use of psychiatric facilities in New York hospitals and found that as the number of patients sharing a bedroom increased, there was a corresponding decrease in interaction and activity and an increase in the time that patients spent doing nothing or sleeping. It appears that the greater the number of patients placed in a bedroom, the less options each patient felt he had in the use of the room and the types of activity he could engage in.

3
DESIGN GUIDELINES FOR BUILDINGS

The Selection and Allocation of Building Types

Two factors are critical in the selection of building types in any housing development: the density requirements and the characteristics of the resident population. Each building type has a density range at which it can be built. It also has certain inherent advantages and limitations related to the characteristics of its future population. Different building types are more or less suitable to the needs of different resident types.

For example, if a multifamily building is to be occupied by an income group whose rentals or maintenance payments are such that they can afford to employ doormen or porters, then the control of the semiprivate spaces within the building and its surroundings can be assigned to these agents of management. All potential users of these spaces, whether they are residents, friends of residents, or strangers, will be screened by these agents who are authorized to control access to or use of common facilities. This means that high-rise buildings are a potential option for high-income tenants, particularly those with few children.

The use of a doorman to screen all entrants to a multifamily dwelling and its grounds is an effective means for securing these environments. When the use of such security personnel is feasible, the larger the grounds and the number of dwelling units entered through a common portal controlled by a single doorman, the greater the economy. There is a point, however, beyond which the number of persons sharing a single building entry becomes too large for any one man to screen effectively, say beyond about 100 families. In a 200-unit building, for example, it would be preferable to divide it into two and have two doormen, each handling 100 units.

If a multifamily dwelling is to be occupied by an income group whose rentals will not afford them the use of security personnel to control access to individual buildings, then the smaller the number of families sharing an entry, the greater the natural control possible by the residents. Intercom buzzer-reply systems work best when as few families as possible share an entry. The optimum number will vary with family type: children are notoriously negligent in the use of intercoms; the elderly, by contrast, are very conscientious. The maximum number of families with children in buildings with an intercom should be limited to 50.[1] The maximum number of all-elderly families in a similarly equipped building can approach 150 and achieve the same comparative control.[2] The same principles hold in laying out the grounds of a development composed of multifamily buildings and in defining their entries. In nondoorman situations every attempt should be made to assign the grounds of a development to a small number of specific families. The grounds assignment should encompass the entire area around each building entry.

The Elderly and Working Adults

For one type of low-income resident and one type of moderate-income resident, it is possible to duplicate the safe high-rise building that is provided for upper-income residents. Whereas the high rents paid by upper-income tenants normally affords them the use of doormen, porters, and resident superintendents, low-income, retired, elderly individuals, grouped in their own building, are able to act as their own doormen. Moderate-income working adults occupy their environment so minimally, with concomitantly low maintenance costs, that management can usually afford to provide them with a doorman, particularly if a large number are grouped together and if there are few, if any, children in the building.

In the use of high-rise buildings for the elderly and for working adults lies much of the answer to the problem of building high-density urban housing for low- and moderate-income residents while still providing walk-ups for families with children. The upper density limit for three-story walk-up buildings for families with children is about 50 apartment units to the acre. But in the heavily built up areas of many major U.S. cities we are required to build at 100 units to the acre and more in order to justify the high land-acquisition costs. By designing a development as a mixture of walk-ups for families with children at 50 units to the acre and high-rise for the elderly (or working adults) at 150 to 250 units to the acre, one can achieve an average density of about 100 units to the acre, depending on the percentage of units assigned to each family type.

Low-income elderly, living together in a high-rise building exclusively their own, can be comfortably housed at 200 to 250 families to the acre, and without the benefit of doormen. For one thing, their appearance as elderly differentiates them from all potential intruders who are likely to prey on them. The elderly are also mostly retired and so have much of their time to spend socializing with each other. It is common for them to set up a table near the building entry for community activity purposes; such a table also serves as a screening station. Most importantly, the elderly are uniformly conscientious about security and will, when asked, keep emergency exit doors locked and unused. By 11:00 P.M. a community of elderly will all be in bed, and the main door to the building can be locked.

Assigning all elderly to one building need not necessarily result in their feeling totally isolated. The all-elderly building in fact, can be placed adjacent to buildings housing families with children. Within the elderly building and its environs there will be a strong sense of security. Those who desire contact with young families can find it in common park areas provided for the use of all residents in the larger development. In interviews conducted by several study groups it was found that many elderly express a clear preference for living among other elderly and having contact with younger families only at their own choosing.[3] Other elderly, however, find such environments stigmatize them as old, and the limited contact of other elderly boring.[4] This latter group might well be placed in high-rises for young families without children.

Once they have experienced it, the elderly show a strong preference for elevator buildings over walk-ups because they can then avoid the use of stairs completely. The elderly also benefit by being together under one roof in that ancillary services can be provided that are not possible in buildings where the elderly are few. A health clinic, a meal service center, and other special amenities for the elderly can be justified in all-elderly

CONTINUED

1 OF 3

high-rise buildings. There is one final reason for advocating the housing of the elderly exclusively in their own buildings: in buildings where the elderly are mixed with families that have teenage children and few male heads of household, the crime rate suffered by the elderly climbs as high as five times that experienced by the average project resident.[5]

Grouping moderate-income singles and young married couples without children in high-rises can also produce a highly desirable living environment, and one that is comparatively easy to secure. Different from an all-elderly high-rise, however, a building housing residents who are mostly out working during the day requires a doorman to screen all entrants. This is because most burglaries are committed against unoccupied premises and because burglary rates increase as the degree of occupancy decreases.[6] The operating budget of such a building, even for moderate-income tenants, may allow for a doorman if there is a sufficient number of units sharing an entry. The fact that there are no children in residence to distract his attention with their comings and goings allows the doorman to operate more efficiently and helps to assure that emergency exit doors are not used or left open.

Families with Children

By contrast, families with children have a life-style and needs that are very different from both of the groups just discussed. Like the elderly, child-oriented families occupy the environs of their dwellings continually and intensively. However, unlike the elderly, children cannot be counted on to be conscientious about rules involving the use of entry doors and exits. They are also easily frustrated by intercoms, and parents will not always entrust them with a key. To facilitate their access to multiple dwellings children will vandalize locking hardware and intercoms; they will place chewing gum in the latch portion of the lock, twist doors on their hinges, and break out the glass panes that provide access to the interior knobs of doors controlled by intercoms. In large multiple-dwelling buildings occupied primarily by families with children the use of doormen is of great help, but it is by no means as effective as would be the same building occupied exclusively by elderly or working adults.

A high-rise building occupied by families with children and with no funds for doormen creates a situation in which the interior common circulation areas are virtually public in nature.

Buildings designed with as few apartment units as possible sharing a collectively defined territory—both within the building and on its outside grounds—are a critical requirement to the successful creation of secure environments for families with children. Families with children who cannot afford the use of doormen and elevator operators should be placed in nonelevator buildings with as few families as possible sharing a common entry. Single-family row houses are the preferred solution, followed by walk-ups. Obviously, the cost of the land will determine the density required and, as a consequence, the height of the walk-up. As was demonstrated earlier, a three-story walk-up can produce a density of 35 units to the acre; a five-and-a-half-story walk-up will produce a density of 72 units to the acre.

Shared Life-Style

As was discussed earlier, the lower the number of people sharing a particular building, its entry lobby, and its associated amenities, the greater the residents' ability to distinguish and recognize the other inhabitants with whom they share facilities.

The ability to come to recognize one's neighbors is of course not determined solely by the number of families sharing a common environment. Similarities of life-styles, ages, backgrounds, and socializing proclivities among neighbors are also determining factors; recognition among neighbors also increases with the length of residency.

In discussing the varying vulnerability to crime of different ages and life-styles we assumed that each building is occupied by a distinct and uniform group. In practice this tends to be true in walk-up buildings, which are normally occupied by families with children, but it is rarely true of high-rise buildings, which are normally designed to contain a range of different apartment sizes, ranging from efficiencies to four-bedroom units. This peculiar attribute makes high-rise multifamily buildings all the more vulnerable, for not only is there a large number of families sharing an entry, there is also a great variation in ages and family types among the residents—in-

cluding singles, families with children, and elderly.

The two key factors that inhibit neighbor recognition are both present in this case: a large number of families living in a single anonymous building and few among them sharing a common age or life-style. With this melange it is also difficult for management to adopt policies that would make the high-rise building livable for one particular group or another: the elderly fall easy victims to criminals and demand a high degree of security; young singles and couples are usually cavalier about security and are away much of the time; children are constantly running in and out of a building and resent being interrupted in their free and easy access to their apartment units. One final problem makes the residents of a mixed high-rise environment very vulnerable—the children render the intercoms and doormen so ineffective as to make the unoccupied apartments of working couples very vulnerable to burglary. In a similar way, the elderly are most readily victimized in the interior circulation areas of high-rise buildings that have been rendered public and open to virtually everyone by the children of their neighbors.

Another advantage, already noted for all-elderly buildings, accrues from housing like groups together: amenities—from recreation areas to lounges—can be designed to address the specific needs of a particular group. These amenities, when properly positioned on the grounds adjacent to the entry of a building, or off the lobby or elevator area within a building, will serve the additional purpose of improving security by increasing residents' sense of territory. Residents' use of these amenities with some regularity will also provide a natural form of surveillance and screening. The uniformity of age and life-style among residents that simplifies recognition and encourages development of acquaintanceships can be further enhanced through the provision of communal facilities that bring residents together.

All these arguments seem to lead to the inevitable conclusion that the grouping of residents by uniformity in age and life-style is a preferred, if not essential requirement for the provision of a utilitarian and safe environment. This is in fact a major recommendation of this book, but with some exceptions; for example, elderly and working adults without children can be grouped reasonably well together. But most important, even when people sharing a similar age or life-style are intentionally grouped in their own building, it does not mean

that buildings serving different groups cannot be located adjacent to each other. This will allow people to seek out the companionship of other age groups at their own choosing, rather than having it forced upon them.

Table 3.1: Recommended Family-Type Allocations by Building Type

Family Type	Building Types					
	1. Single-family	2. Walk-ups	3. Medium High-Rise		4. Elevator High-Rise	
			Doorman	Non-doorman	Doorman	Non-doorman
Families with children	**	**	*	●	●	■
Elderly	*	■	**	*	**	*
Working adults	■	●	**	■	**	■

** strongly recommended
* recommended
● barely acceptable
■ not recommended

Table 3.1 summarizes the recommendations of this chapter. It lists the four categories of building types and juxtaposes them against the three basic family types identified by their life-styles. The two categories of high-rise—3 and 4—have been further broken down into nondoorman and doorman buildings. These are the only two building types in which the use of doormen can be economically justified. For moderate- and low-income groups it is likely that the only building category that would actually be able to afford doormen is the elevator high-rise.

For families with children, single-family houses, walk-ups, and medium high-rise buildings with doormen are recommended. Medium high-rise buildings without doormen (50 dwelling units per entry, maximum) are considered barely acceptable, but for middle-income families only.

For the elderly, virtually every building type is recommended except walk-ups, so long as the buildings are kept exclusively for the elderly. The high- and medium-rise elevator buildings with doormen are the ones most strongly recommended for the elderly.

Single-family homes and high-rise buildings without doormen are not recommended for working adults. Walk-ups are considered barely acceptable. The ideal environment for this group is a high-rise building provided with round-the-clock doormen.

Design Principles for Different Family-Type/ Building-Type Combinations

The first and most critical requirement for the design of secure residential environments is the selection of the building type most suited to the life-styles and needs of the intended occupants. All other design guidelines are only supportive of this basic requirement. The second principle follows from the first: families sharing similar life-styles and a jointly held need for areas outside the confines of their own dwelling units should be grouped together—to the exclusion of families with different life-styles and spatial needs.

A third organizing principle is to design each building so that as many of the areas outside the dwelling units as possible are assigned to specific groups of residents. These areas include both the circulation and communal areas within the building and the grounds surrounding the building.

The fourth basic design principle is to assign these nonprivate areas to the smallest group of residents possible. Interior and exterior areas that cannot be made private by being assigned to individual families should be assigned to small groups of families to make them semiprivate, as opposed to either semipublic or public. These third and fourth directives can be accomplished either through the subdivision of buildings or through the use of doormen. The degree of subdivision required, or the need for doormen, is dependent on the life-styles and socioeconomic characteristics of the resident population.

The building-type/family-type combinations selected for discussion include:

1. Single-family houses, for families with children (or for the elderly).
2. Walk-ups, for families with children.
3. Medium high-rise without doorman, for families with few children (or for the elderly).
4. Elevator high-rise with doorman, for working singles and couples (or for the elderly).
5. Medium and high-rise without doorman, for the elderly.

Design guidelines for single-family houses, for families with children (or for the elderly)

Single-family buildings, whether consisting of detached houses, semidetached houses, or row houses, are a very secure and vandal-resistant building type when occupied on a continuing basis. By their nature the interiors of these buildings and the grounds upon which they sit are for the private use of one family. If positioned so that the entrances face the street and the private grounds abut the sidewalk, the zone of influence of the private home can be made to encompass a portion of the public street. Single-family houses are primarily susceptible to burglary, particularly when residents are away or asleep. The buildings should therefore be designed and positioned, and the grounds around them so defined, as to minimize this susceptibility.

A burglar will attempt entry through any opening that presents itself: a door, window, vent, or hatch. First, he will try an opening that is hidden both from the view of the street and from other neighbors.[7] Second, he will select the opening that allows him the quickest and easiest access. An unlocked door, open or unlatched windows, are all welcome invitations. Windows or hatches that lead into a basement, or windows off second-floor balconies, or carport roofs are equally welcome, if somewhat more difficult. In principle, a single-family house should be positioned so that the front part of the house is as close to the street and as visible as possible. This portion of the house should be fitted with very solid doors and windows and accompanying secure hardware. The sides and rear of the house, which are normally not used by the occupants for access, should be sealed off with a fence or shrubbery designed so that it is difficult to scale.

Single-family buildings should not be set back more than 25 feet from the street. If a private buffer area between the dwelling and the street is desired in the form of a front lawn, it is important that this not interfere with the visibility of the windows and doors that face the street. To facilitate natural surveillance from the

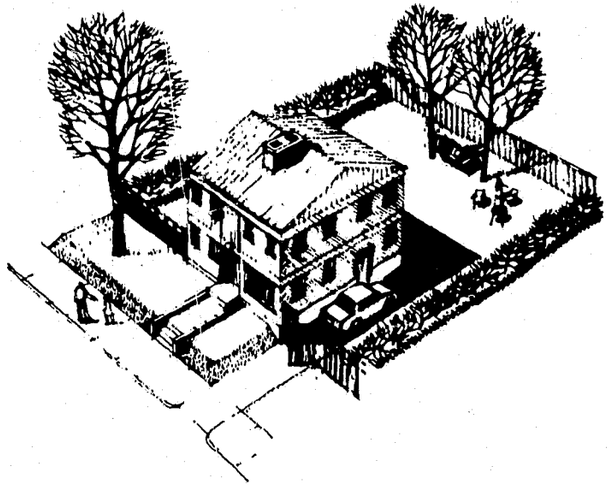


Figure 3.1: Single-family house positioned with entry facing the street and high fence defining rear yard.

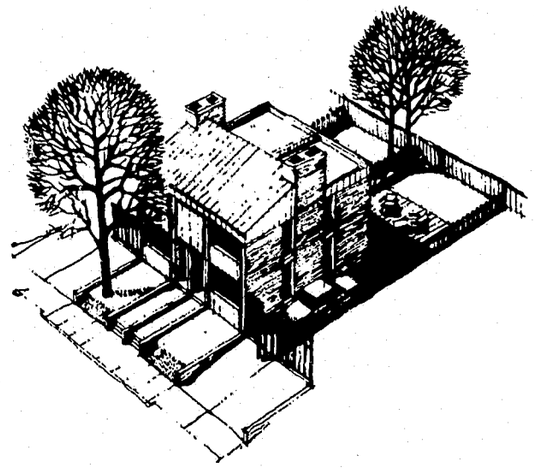


Figure 3.2: Semidetached houses occupied by two families. High fence at front of house defines rear yard.

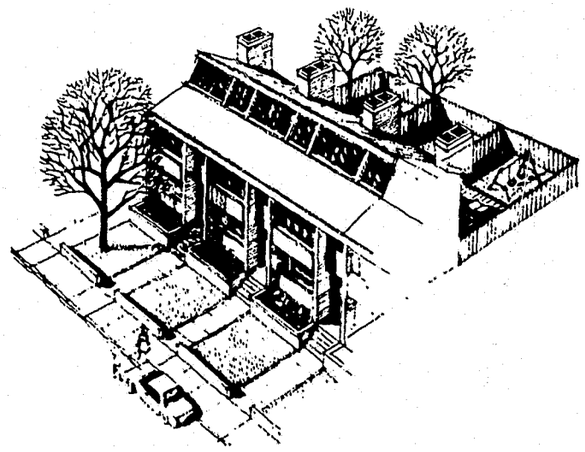


Figure 3.3: Row houses; the buildings themselves define rear yard.

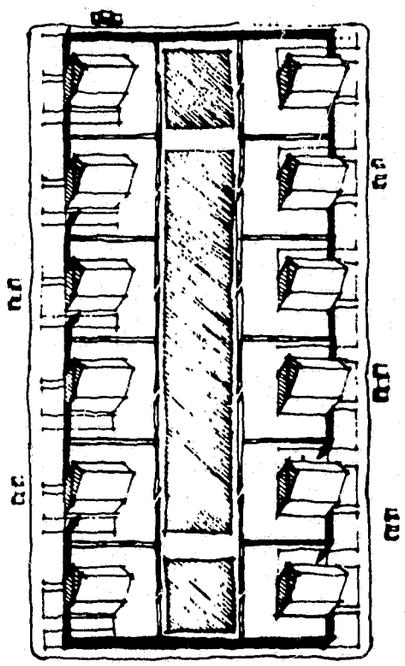
street and from houses opposite, no shrubs or trees should be placed on the front lawn that will screen the fronts of the houses from the street (see Figures 3.1, 3.2, 3.3).

The side and rear walls of single-family dwellings and the side and rear portions of their grounds are not so readily visible from the streets as is the front of the house. These side and rear areas are where burglars can work unnoticed. In most subdivisions the rear and sides of a dwelling are usually visible only from the rear and sides of neighbors' dwellings. The fronts of dwellings, by contrast, are visible both from the dwelling units across the street and by people in the street. As most residents come and go from their dwellings via their front walks, the front zone of the house is comparatively heavily trafficked and surveyed. Most importantly, it is surveyed by neighbors. Neighbors whose homes face a common street and who use the street continually to gain access to their homes come to know each other quickly and learn the typical comings and goings of adjacent residents.[8/9]

Most single-family residents use the rear grounds of their homes as private outdoor extensions of their dwellings. This is in part a convention that has arisen because the rear yard is less trafficked and less visible than the front of the house. Convention reinforces use, just as use reinforces convention. Many residents, in an effort to ensure the privacy of the rear yard area, further screen it from view with high shrubs or wood fences, thus further diminishing their contact with their neighbors to the rear. The irony is that the higher the rear fence, the greater is the need for the fence. That is to say, the more the area at the rear of the dwelling is hidden from the view of neighbors—who might provide a natural form of surveillance—the greater is the need to make this area truly inaccessible. It is important to keep in mind that rear yards never receive the intensity of surveillance that front yards do. Some single-family home developments have been designed with communal paths or play areas running between two juxtaposing rear yards, and to this extent the rear yards receive some additional traffic and surveillance (see Figure 3.4).

In summary, if residents of single-family homes desire to have their rear yards as private outdoor spaces, partially or totally screened from view, they should be fenced off by real barriers so as to make access by out-

Figure 3.4: Block of single-family houses with common rear play area serving all residents of the block.



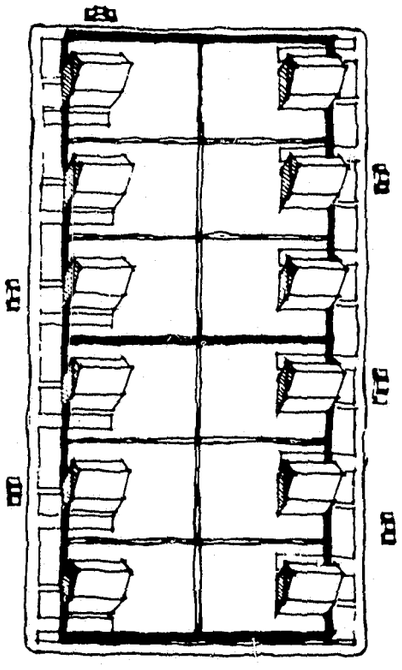


Figure 3.5: Block of single-family houses in which a common high fence, running along the front of the houses, defines the rear yard areas. An additional high fence has also been run *across* the block so as to further subdivide the number of families combined in a cluster.

siders impossible. Ideally, these real barriers should also enclose most of the side yard areas as well. The most effective and least-cost means for accomplishing this, in the cases of single-family detached or semidetached houses, is to run a six- to eight-foot fence between neighboring houses parallel with and close to the front face of the buildings (Figure 3.4 and 3.5). This is neither possible nor required in a row-house complex, as the buildings themselves prevent access to the rear yards (Figure 3.3). This communal restriction of access to the rear yards then enables all the residents to use low fences, or nothing at all to define their own rear yard areas. However, the basic principle of subdividing collective grounds for the use of as few families as possible still holds, and in the case of a long city block it may be desirable to run a high fence across the block in one or two places so as to cut this communal rear yard area in half or in thirds (Figure 3.5). Clearly, this will depend on the degree of commonality of interests among neighbors in the block.

From a security point of view, it is not recommended that a pedestrian path serving the rear yards of neighboring dwellings connect with a public street. In the block of housing that has been developed with a collective recreation area at the rear (Figure 3.4), the communal area should be sealed off from access to the public street.

In a row-house scheme the judicious placement of a small stretch of common high fence will succeed in limiting access to the rear yard areas of an entire block of houses (see Figure 3.6). In this case the fencing defining the individual rear yards need not be anything more than symbolic in nature. It should be remembered, however, that collective areas, even when made up of individual rear yards, are not totally private. The success of the common high fence in keeping the collective rear yard area secure and vandal free is still dependent on the number of private yards that are linked together; the income of the occupant families; and the degree to which they share common life-styles and values.

The doors and windows in the front portion of a single-family house face grounds areas that are easily accessible and so should be well secured and lighted. By contrast, the doors and windows at the side and rear portions of the house need not be as well lighted or secured if high fencing is used as recommended. This of course requires that the fencing defining the privacy of

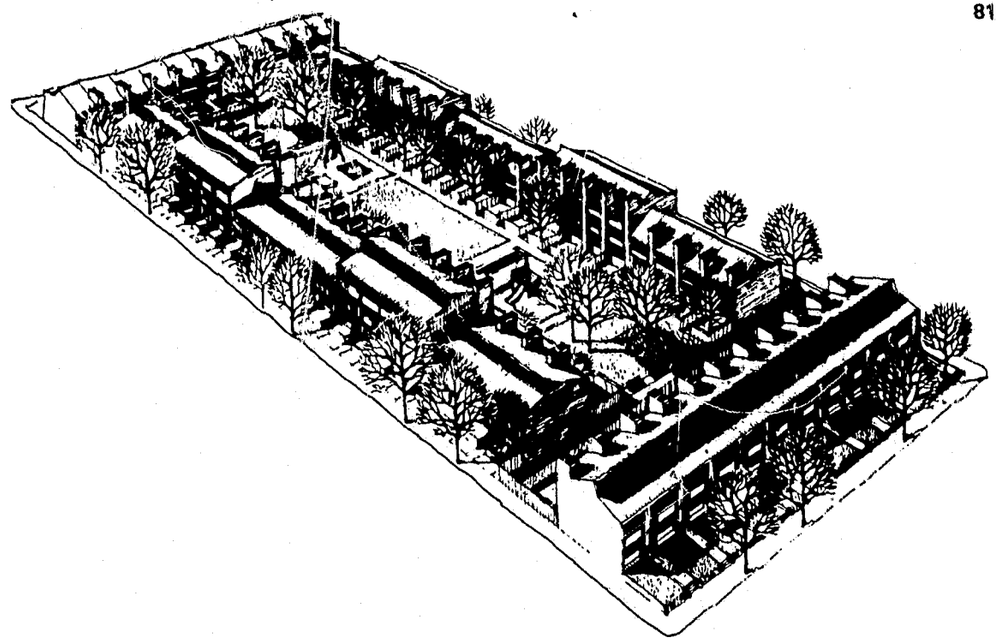


Figure 3.6: City block developed as row houses. Four small sections of high fencing, placed at the four corners of the block define all the rear yard areas as private.

the side and rear areas be genuinely restrictive of access.

Specifications for materials and hardware for use in windows, doors, and other openings appear in Addendum 3. If high fencing is used to restrict access to the side and rear yards as recommended, then less stringent standards can be applied for materials and hardware for openings located in these areas.

For single-family houses there is no effective difference in design between what is required for families with children or for the elderly.

Design guidelines for walk-up buildings, for families with children

In walk-up buildings the interior circulation areas—lobby, corridors, stairs, and landings—are not private but are for the common use of all families that share the entrance to a particular building. If the number of families is kept small, these common circulation areas can be designated semiprivate. However, if the number of units that share an entry is much greater than 15, these areas will approach being semipublic in nature. (The actual number of families that makes these areas fall into one category or another is again dependent on the degree to which the families are uniform in their values and life-styles.)

Figure 3.7: Walk-up building with central double-loaded corridor, end stairs, and two common entries serving all 48 apartments.

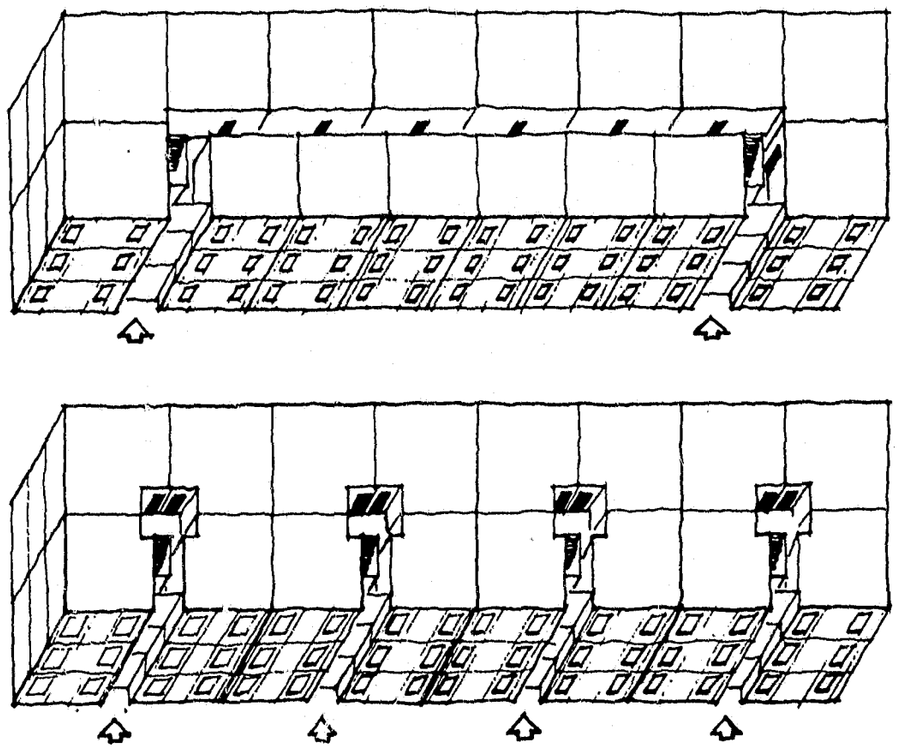


Figure 3.8: Walk-up building of identical external dimensions to the building shown in Figure 3.7, but with four separate entries and stairs, each serving only 12 families.

A walk-up building may be designed in two distinctly different ways: as a single entity with a full-length central corridor and end stairs serving the entire building (Figure 3.7); or subdivided so that stairs serve only a limited number of apartment units (Figure 3.8). Both building types in this comparison have exactly the same three-dimensional volume and contain the same number of dwelling units. In the first case (Figure 3.7) the common stairs and central corridor serve all 48 families living in the building. In the second case (Figure 3.8) each stair serves only a small number of families: four at each level, or 12 families for the full three stories. In most localities across the country the building codes permit three-story buildings using the design principles advocated in Figure 3.8 to be designed with only one stair per entry.

A limited number of apartments per floor (two to four), grouped around a shared staircase, facilitates the development of territorial and proprietary feelings in residents, which in turn increases their sense of responsibility for ensuring the safety and maintenance of the interior areas of their building. The long, double-loaded corridor building shown in Figure 3.7 should be avoided; this prototype has a history of being unsafe and evokes little enthusiasm among residents for assisting management in the maintenance of corridors and stairs. In general, the increased cost of additional stairs required in the solution shown in Figure 3.8 is offset by the savings resulting from the elimination of portions of the long corridor in Figure 3.7.

Where the weather permits, designs can be developed for three-story walk-ups that allow the vertical access stairs and landings to be open rather than enclosed. This increases the surveillance potential, but also complicates the task of defining the vertical circulation area as semi-private. One way to compensate for this lack of definition is to place amenities on the landings. This helps to further designate the landings as extensions of the private space of each dwelling. For example, the landing at each level, if large enough, can be used as a play area for very young children and as an outside dining area (Figure 3.9).

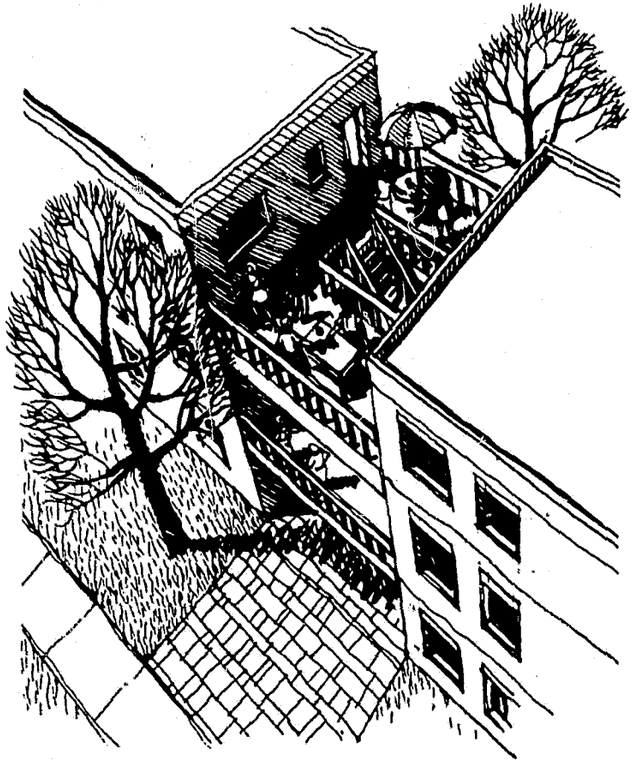


Figure 3.9: Outdoor landings extend the private space of dwelling units.

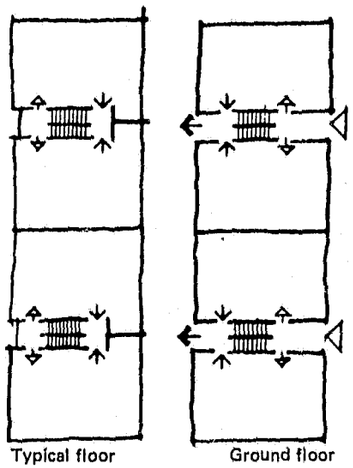


Figure 3.10: Four- to five-story walk-up, using scissor stair. (a) typical floor; (b) ground floor.

If the size of dwelling units in a walk-up approaches 1000 square feet, then it is possible to design the vertical circulation stairs with only two units per floor rather than four. This allows each apartment to have cross ventilation.

It is important to note that those building codes that permit the use of only one access stair, as in the subdivided walk-up we are advocating in Figure 3.8, also limit the height of a building to three stories, or a total of 40 feet.[10/11/12] For this type of housing these height restrictions create an effective density limitation of 45 units to the acre for an apartment size of 600 square feet, and a density of 35 units to the acre for units of 1200 square feet. If the density is increased by increasing the building height, the codes require the provision of a second means of egress from each dwelling unit. The two solutions shown in Figures 3.10 and 3.11 are acceptable ways of answering the code requirements for walk-up buildings that are over three stories in height.

The solution illustrated in Figure 3.10 provides two separate means of egress, with accompanying sets of stairs, from each apartment dwelling; for this solution the building codes require that the two exits from each apartment be no less than 15 feet apart. To conserve space, the two sets of stairs have been arranged in a scissor-stair configuration. One stair leads out to the main entry door in the front of the building; the second stair leads to the door at the rear of the building. This scissor-stair solution provides an important additional benefit in that once a person has entered either stair, he must follow it out to its specific exit. If, for instance, access to the rear area of the building is to be restricted to residents only, then residents can use one door in their apartment to get out the front door of the building and the other door in their apartment for access to the semiprivate yard at the rear. In the site plans illustrated in Figures 3.12 and 3.13, this exit system would make the interior rear yard areas accessible to residents only. The system has one drawback: visiting friends whom residents want to invite into the rear yard area must come up to their apartment, through it, out the other door, and down the rear stairs in order to gain access to the rear yard.

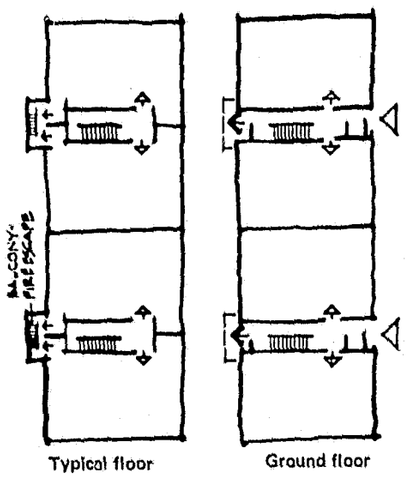
MAIN ENTRY TO BUILDING

EXIT FROM BUILDING

APARTMENT ENTRY

APARTMENT EXIT

Figure 3.11: Four- to five-story walk-up, using exterior balcony fire escape. (a) typical floor; (b) ground floor.



The solution illustrated in Figure 3.11 allows for direct access to the rear of the building at the ground level. This means that anyone who has or can gain access to the front door of the building has automatic access to the rear of the building and the interior grounds at back. This has some security drawbacks.

In this latter solution the second means of egress from each apartment required by the fire code is provided via a balcony on which there is a fire escape leading down to the rear of the building. In actual design the fire escape, for security reasons, should not descend all the way to the ground level, but be provided with a counterbalanced set of stairs that descends under human weight to provide access to the ground below.

As in a row-house scheme, large portions of the grounds of a walk-up development can be removed from the public domain and designated for the semiprivate use of residents. This requires that the buildings be positioned to encompass interior grounds areas, and that secondary exits be provided from the interiors of buildings to the contained areas at the rear of the buildings (see Figures 3.12 and 3.13). These interior grounds can be designed to serve either the collective needs of the

Figure 3.12: Site plan of walk-up with rear entries exiting to a common rear yard.

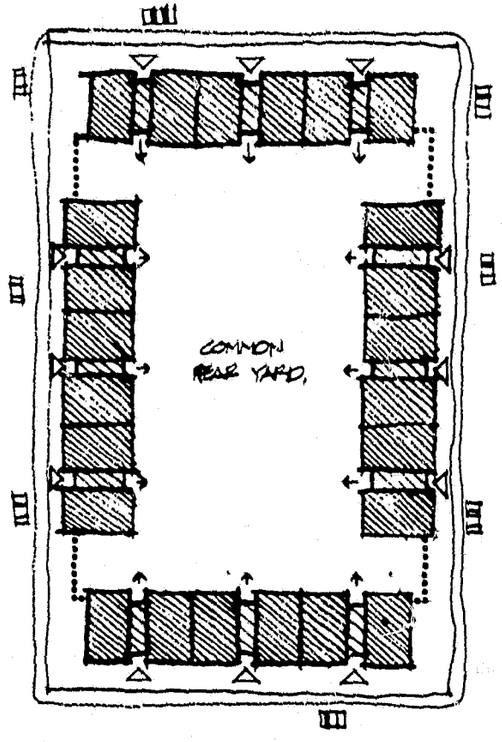
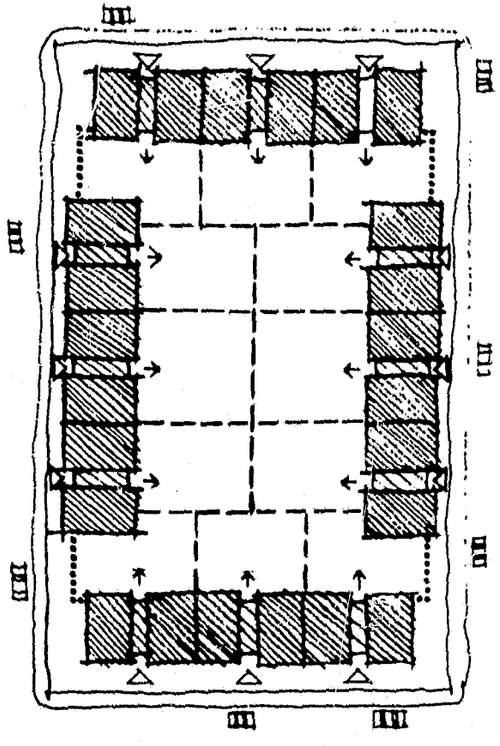


Figure 3.13: Site plan of walk-up with rear entries exiting to semiprivate rear yards.



residents sharing a group of entries, as shown in Figure 3.12, or they can be subdivided to serve the residents of single building entries, as shown in Figure 3.13. The first solution allows for the provision of large play facilities, such as ball fields and basketball courts, which clearly cannot be accommodated within the limited space available in the subdivided grounds. The large common play area in Figure 3.12 will, however, require a maintenance staff, whereas the subdivided grounds of Figure 3.13 are more likely to be cared for by individual residents, particularly if the buildings are cooperatively owned or occupied by the owner in residence.

Design guidelines for elevator buildings: basic principles

In general, high-rise buildings should be designed so that as few families as possible share a building entry, the use of an elevator, and the use of corridors at each level. This rule is particularly important when the high-rise building will not be supplied with a doorman; when a doorman is provided, economics dictate that as many families as possible be grouped together to share a common entry. But the basic rule of limiting the number of families sharing a corridor and building lobby still holds, and a compromise must be reached between the cost of the doorman and the minimization of maintenance costs for the interior circulation areas of the building.

There is another factor that makes it difficult to limit the number of families that share an entry to a building: the economics of operating elevators efficiently and providing emergency stairways. First, a minimum of 40 to 50 families is required to justify the provision of an elevator. Second, elevators are most efficient if two or more are banked together. This banking reduces the waiting time, even when the number of families using an elevator remains the same; for example, three elevators grouped together to serve a high-rise building with 150 families will provide faster service than the same three elevators placed separately to serve 50 families each (Figure 3.14).

Nevertheless, if the economics of building management do not allow for a doorman, the solution that separates the elevators is preferable. By cutting the building into three sections vertically, three distinct entrances are created, each serving only 50 families and

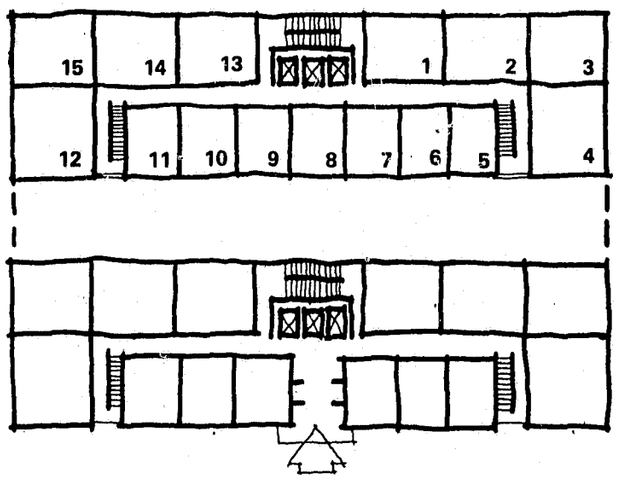


Figure 3.14a: Typical floor and ground floor plan: three elevators banked in a 10-story building serving 149 families, at 15 families per floor (14 families on the ground floor).

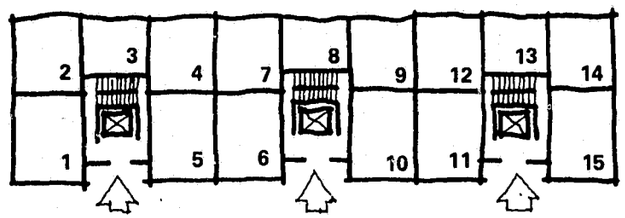


Figure 3.14b: Ground floor plan; three elevators, each serving only one-third of the building, or a total of 50 families per entry. The entire building block serves 150 families.

each provided with its own elevator. The buildings in this comparison have almost the same number and size of apartments (149 versus 150) within the same three-dimensional envelope. However, the building with three separate entrances must provide additional emergency fire stairs and additional incinerator shafts. The vertically subdivided building shown in the solution in Figure 3.14c employs scissor stairs behind the elevators in each vertical block. The cost of the extra stairs is counterbalanced by an extra apartment and the reduction in the length of the required corridors in the plan in Figure 3.14a and b. However, it should be kept in mind that not all municipalities have fire codes that allow the use of centrally located scissor stairs as shown. Some codes require that fire stairs be placed at the end of each corridor. In such instances none of the solutions in Figure 3.14 will prove acceptable.

The lobbies of elevator buildings should be designed and positioned so that as much of the interior of a lobby as possible, including the vestibule, mailroom, and elevator waiting area, are clearly visible from outside the

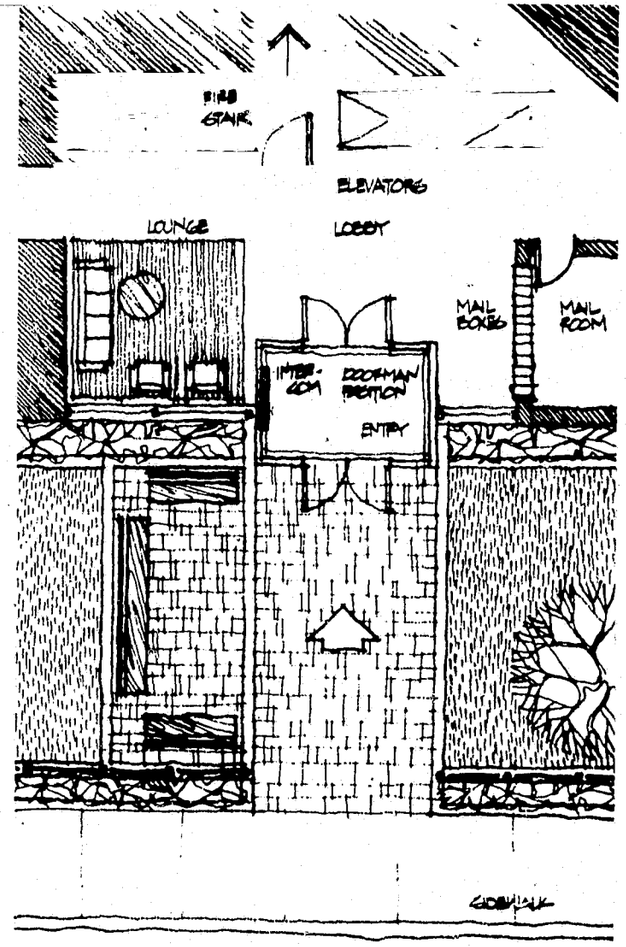


Figure 3.15: As much of a building's lobby area as possible should be visible from the street or entryway.

building (Figure 3.15). The entry to the building and the lobby area should be located parallel to and a short distance from a well-trafficked public walkway or street. Lobbies should not be designed with elevator waiting areas that are hidden from view around a corner from the main entry door. When this occurs residents are required to enter the building with no knowledge of what awaits them and they are visually isolated from observation by persons outside the building while waiting for an elevator.

When the provision of a doorman is possible, the positioning of the elevator waiting area and mailroom adjacent to the entry vestibule will also allow these areas to be supervised by the doorman at the entry. For the same reason, emergency exit doors and fire stairs are best located where they can be seen from a position as close to the main entry door as possible. Secondary exit doors should not be placed on the opposite side of the

building from the main entry door: this positioning encourages residents to make use of the emergency exit doors when they provide a short-cut to outside activity areas. When the codes allow it, the secondary fire stairs should be designed to exit on the same side of the building as the main entry and as close to the main entry as possible. This will discourage residents from substituting secondary exits for the main entry door and will facilitate the natural surveillance of the secondary exits by other residents or allow full control of the exits by a doorman (Figure 3.16).

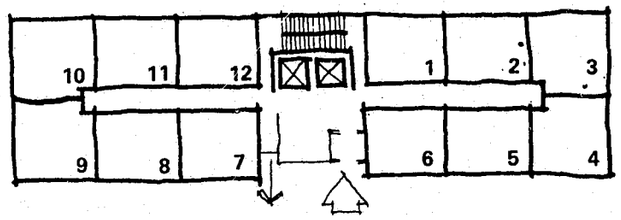


Figure 3.16: Ground-floor plan of a high-rise elevator building in which the secondary exit from the building has been placed 15 feet from the main entry. This is only permitted by building codes in some municipalities.

When codes require that a secondary exit door be positioned on the opposite side of a building, the grounds at the rear of the building should be fenced off and provided with only one exit. This exit should be positioned in front of the main entry to the building, requiring those who use the secondary exit door to walk around the building to the main entry, where they can be scrutinized by other residents and by a doorman (see Figure 3.17).

If parking is provided on the grounds adjacent to the building, the entry to the parking area should be placed near the building entry to facilitate surveillance (Figure 3.17).

Design guidelines for medium high-rise buildings, for families with few children (or for the elderly)

Elevator buildings to be used by families with children should follow these rules.

1. As few families as possible should be assigned to an entry, with a total of no more than 50 families per entry.
2. The entries should be controlled by doormen, if possible.
3. Six- and seven-story elevator buildings are acceptable without doormen, whereas buildings 10 stories

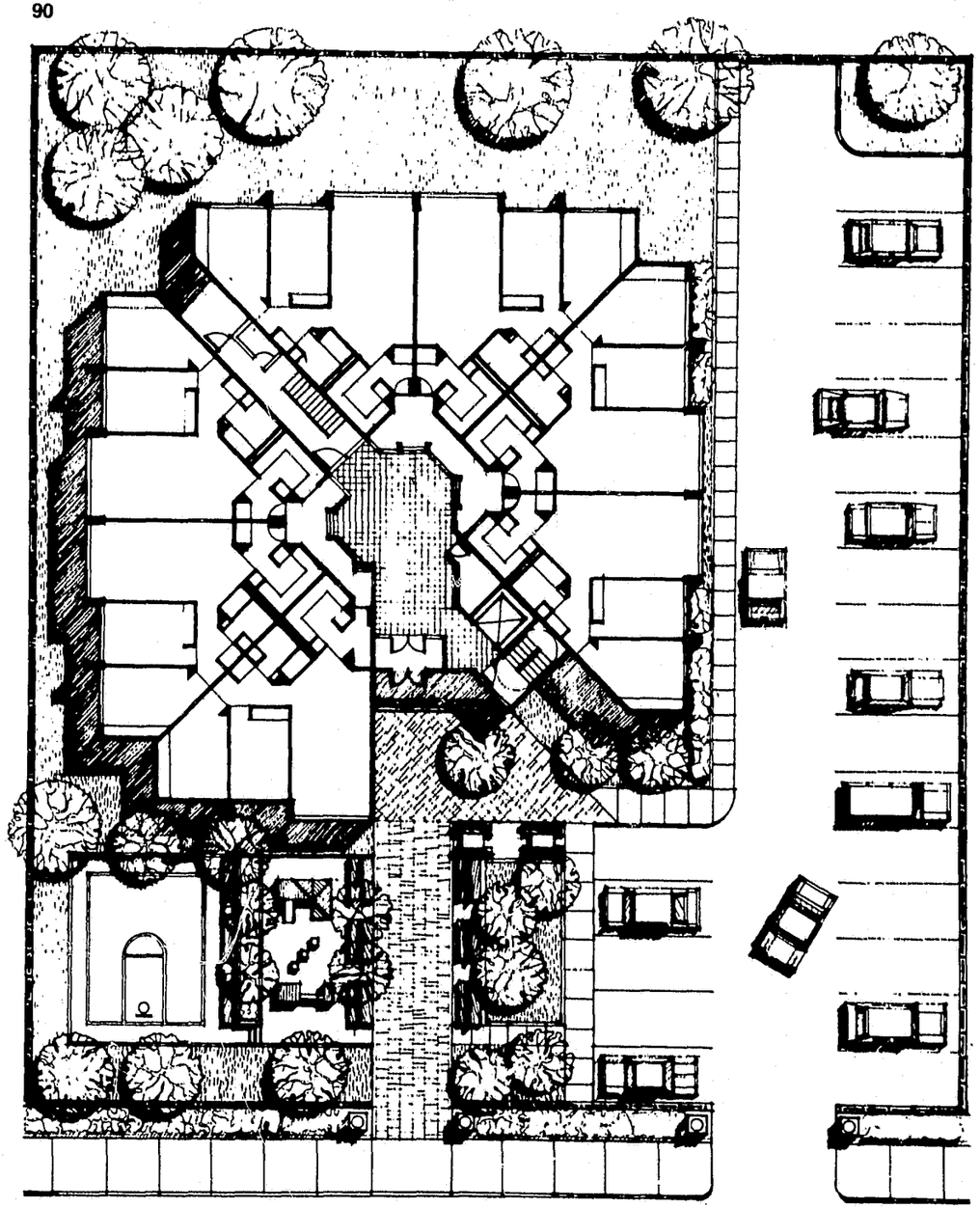


Figure 3.17a: Ground floor and site plan of seven-story high-rise for families with children. The grounds have been fenced except for two entries.

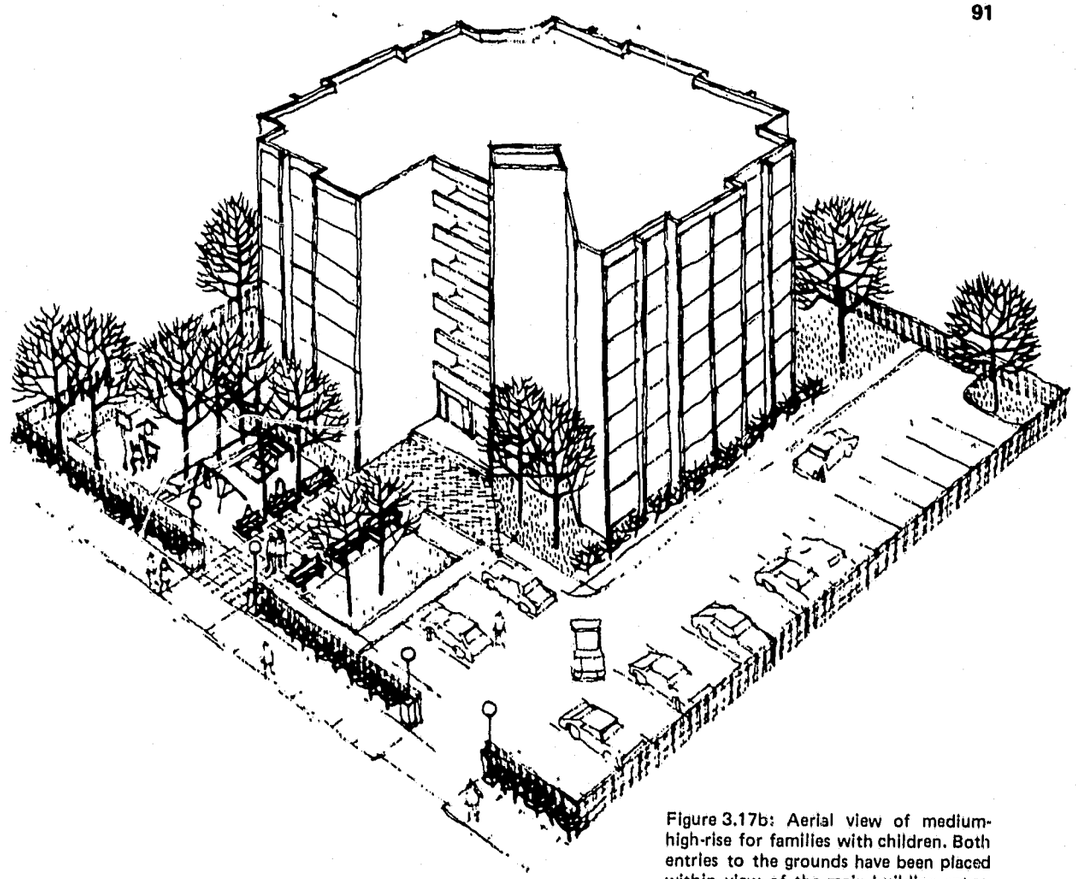


Figure 3.17b: Aerial view of medium-high-rise for families with children. Both entries to the grounds have been placed within view of the main building entry.

and higher contain too many families sharing an entry, and the reliance on elevators is nearly total. Most residents would not be able to gain access to their apartments when the elevators malfunctioned, a common enough occurrence with children in residence.

4. Single-loaded corridor buildings with open stairwells are preferred to double-loaded corridor buildings with sealed-off fire stairs.

Figure 3.17a and b illustrates a ground floor and site plan of a seven-story elevator building designed for families with children. The apartments have been laid out so that only seven families share a floor, and the entrance to each apartment faces the other apartment entrance across a common interior square. The traditional long, double-loaded corridor common to slab buildings has been eliminated and has been replaced by the interior square, from which steps lead to small landings, each of

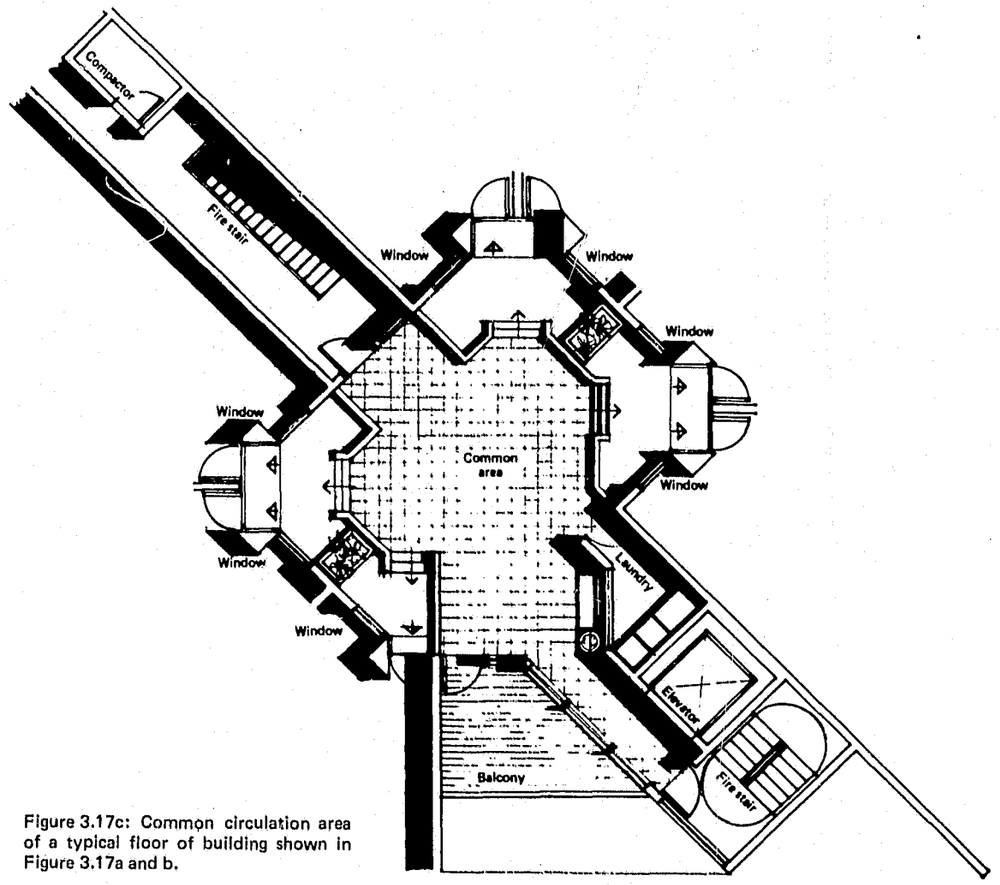


Figure 3.17c: Common circulation area of a typical floor of building shown in Figure 3.17a and b.

which serves one or two apartments (see Figure 3.17c). Each apartment has been provided with a fireproof, unbreakable plastic window looking from the kitchen of the unit into the common central square. At the ground level the entry doors, lobby, and elevator waiting area are all visible from the street and are in close proximity to each other so that residents can effectively control circulation to all these spaces.

In this particular plan the two fire stairs have been separated from each other to meet the more typical code requirements. One of the stairs has been placed adjacent to the elevator, and access to and egress from it are past the front door. The second fire stair, leading to an exit at the opposite side of the building from the first, is visible from the front door. The entire site has been surrounded with a six-foot fence, so that the only access to the grounds—both pedestrian and vehicular—is opposite the main entry door. All entrance points to the

building have thus been placed under greater surveillance and control. A doorman, if available, would be most effective if positioned in the vestibule of the building, adjacent to the intercom connected to each apartment. The central mailbox is positioned on the opposite side of the intercom and is designed following the directives discussed in Addendum 2.

Play facilities for young children and teenagers are immediately in front of the building, as are sitting areas for adult residents (Figure 3.17a and b).

Design guidelines for elevator high-rise buildings with doorman, for working singles and couples (or for the elderly)

From the viewpoint of their security needs and their life-styles, working singles and couples are the population group most reasonably accommodated in high-rise buildings. This population normally shows little desire for or interest in maintaining grounds around a building and tends to prefer housing located adjacent to high-intensity urban activity areas. Working adults also tend to use their residential accommodations very much like a hotel suite.[13] The amenities they prefer within and around their buildings are also those characteristic of hotels: cafeterias, swimming pools, shopping, dry cleaning and hairdressers' shops, recreation areas, and theaters.

In designing a secure building for this client group it is essential to keep in mind that the minimal way in which they use their apartments makes the buildings they occupy very vulnerable to criminal activity. By definition, it is also reasonably likely that a good portion of the members of this population group will be at an early period in their careers and thus quite mobile, moving from job to job frequently and changing their residences accordingly. This frequent change of address further limits their ability to come to know or recognize their neighbors. Also, as young adults, this resident group will be coming and going with their friends at all hours of the night, and they are likely to have many different and changing friends who often may be given the keys to their buildings and apartments.

It is therefore essential, in designing a high-rise for working singles and couples, to operate under the assumption that such a building is critically dependent on doormen to achieve any form of security whatsoever. All access to such a building, whether from the street, garage, or parking areas, should be past a doorman who is present around the clock. In this case the larger the number of apartments that can be grouped together to share a common entry, the more economical will be the use of the doorman. There is an upward limit, however, somewhere around 100 to 150 units, beyond which the doorman will not be able to function efficiently. This upward limit is determined by a doorman's ability to recognize and remember residents by sight. His ability in this regard is a function of the number of residents, his intelligence, and the rate of change-over of residents.

In a large building, if a doorman is not able to recognize most residents by sight so that each resident or guest has to be identified by intercom or credentials every time he or she enters the building, the situation can become unworkable. Between 5:30 P.M. and 7:00 P.M., when most residents return home and guests come to dinner, the lines of people waiting at the entry to be recognized and admitted will become very long, just as their tempers become short. Doormen function best in situations when they are able to recognize most residents and their guests and can admit them with a nod. This means that the number of residents to be screened by any one doorman should not be excessively large.

If there is a basement garage provided in the building and no attendant in the garage, the elevator should not be designed to operate so that it goes directly from the garage to each resident floor. Rather, the garage elevator should be designed to come up to the lobby of the building only, requiring residents to transfer at this level to the elevators that will take them up to their apartments. The transfer of elevators in the lobby should take place in full view of the doorman. A compromise, which admittedly is open to a degree of failure, is to have a door in the garage that leads to the elevators under the surveillance of the doorman via closed-circuit TV. The door can then be activated electrically by the doorman upon his recognition of a resident.

If genuine security is desired in a high-rise building occupied by working singles and couples, a policy should be adopted whereby all guests are admitted on the approval of residents only—through intercom communication with the doorman. This requires the installation of a two-way intercom connecting the lobby to each apartment. The main panel of the intercom should be positioned adjacent to the doorman at the main entry door (see Figure 3.15). Buzzing a resident in his apartment and his identification and approval of guests waiting in the lobby is a time-consuming procedure that puts a further limit on the number of apartments that can be handled by one doorman. The normal remedy is to schedule two doormen during the hectic evening period. This is usually accomplished by overlapping shifts.

Design guidelines for medium- and high-rise buildings without doormen, for the elderly

Different from a high-rise to be occupied for singles and working couples, a building for the elderly can be designed with the knowledge that many of the residents will be retired or near retirement and will, as a consequence, spend a good deal of their time in and around their building. Different also from families with children, who tend to be inwardly oriented, the elderly are more gregarious and tend to spend more time seeking out the companionship of other families and individuals living in the building with them. It is not uncommon in an all-elderly high-rise building to find that the residents know virtually all other people living in the building with them.[14] High-rise buildings for the elderly should therefore be designed to facilitate the gathering of residents in the common circulation areas: the grounds around the entrance, the lobby and mail room, the elevator area, and corridors at each floor of the building. Areas within the vicinity of the main entrance, both inside the building and out, should be provided with seating and tables. An excellent position for a lounge area is on the ground level off the main entry and facing the elevators and mail rooms (Figure 3.18). In this way the

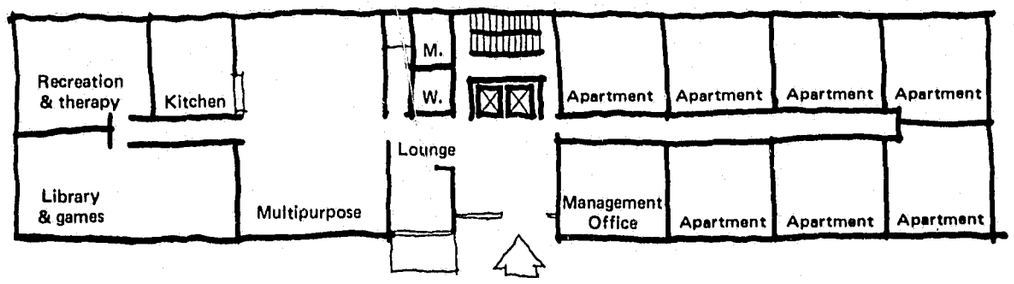


Figure 3.18: Ground floor of high-rise for the elderly, showing the location of the lounge area, multipurpose room, and library in relation to the entry, elevators, and mail room.

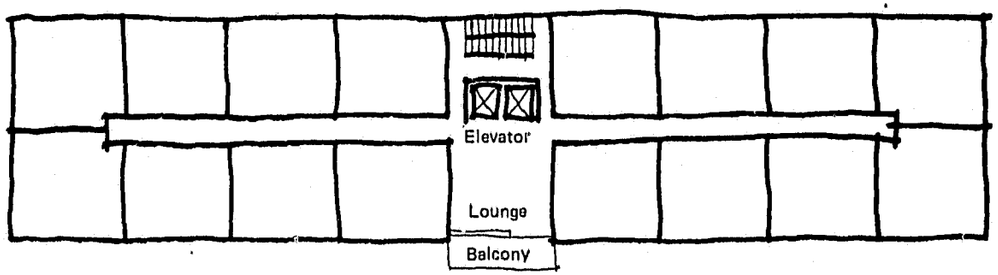


Figure 3.19: Typical floor of high-rise for the elderly, showing location of a lounge area adjacent to the elevators.

lobby of the building and the more traversed areas at the ground level will be under one form or another of continual observation by residents. The positioning of lounge facilities near the main entry is particularly important if the building cannot afford doormen and the residents are required to fulfill this function themselves.

At each level of the building above the ground floor, the architect should provide a small lounge area near the elevator (Figure 3.19). This space is intended to function, in part, like the larger lounge area provided at the ground level—that is, as a place for residents to gather informally. In a double-loaded corridor building the lounge area on each floor can be greatly enhanced by being associated with an outdoor balcony, or at least a glazed area looking out to the view and to the area on the grounds around the entry of the building (Figure 3.20).

Figure 3.20: Lounge and laundry room located opposite elevator area on typical floor of high-rise for the elderly.

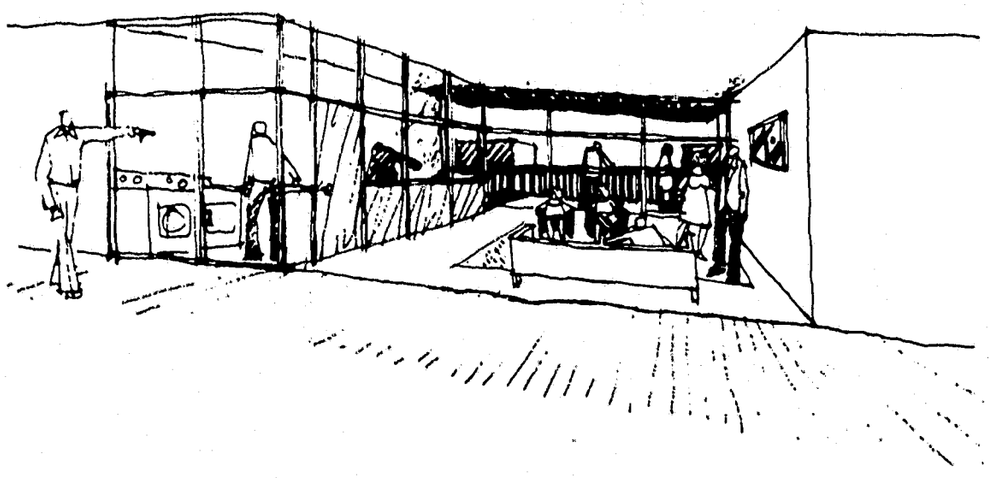


Figure 3.21: Typical plan of single-loaded corridor high-rise building.

A preferable alternative to the double-loaded corridor high-rise building is the single-loaded corridor building (see Figure 3.21). This solution has proved somewhat dangerous when provided for families with children in the public housing projects of our country. It has resulted in housing authorities fencing off the open balcony areas from floor to ceiling (Figure 3.22). European experience with single-loaded corridor high-rise buildings occupied by families with children has not been so drastic as the American experience, but their buildings are rarely higher than six floors, (see Figure 3.23).

In single-loaded corridor buildings the fire code allows standard windows to be placed in the dwellings looking out onto the corridor. This provides a natural and effective means for residents to survey activities taking place in the corridors. It is an effective solution for security so long as the average resident is home a good part of every day. If more residents are off at work than at home, their apartments would be made even more vulnerable by the presence of corridor windows. This suggests that single-loaded corridor buildings are ideal for elderly; usable for families with children so long as the buildings are no higher than seven stories; and not recommended for working singles and couples who are away from home most of the day.

Figure 3.23: Single-loaded corridor in an English high-rise project, occupied by moderate-income families with children.

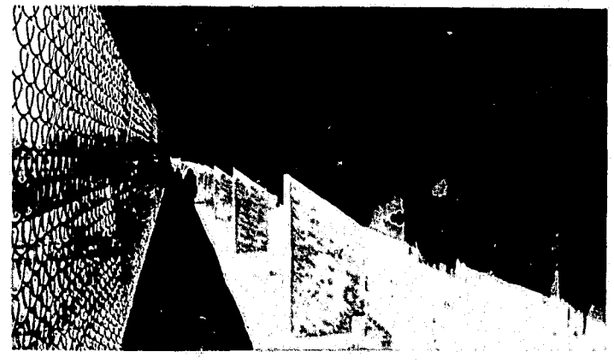
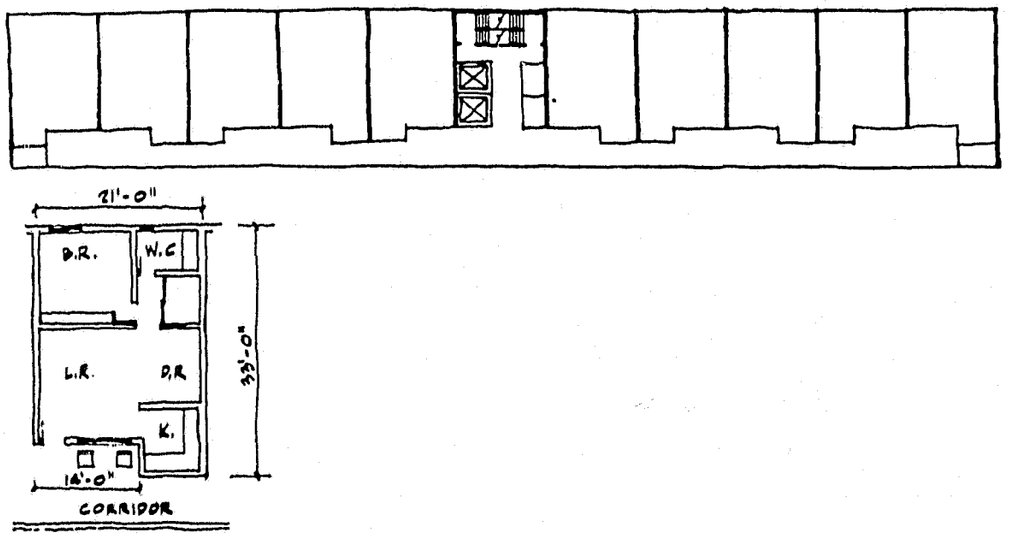


Figure 3.22: Floor-to-ceiling fencing in a single-loaded corridor of a high-rise public housing project Schuylkill Falls, Philadelphia.

Figure 3.24: View of a single-loaded corridor in a high-rise for the elderly.

Some designers of single-loaded corridor buildings for the elderly have made an effort to individualize the entrance to each apartment by providing setbacks from the corridor. These setbacks can accommodate occasional lounge chairs. This encourages residents to use the corridor and actually enables them to extend the private domain of their apartments into the corridor (Figures 3.24 and 3.25).

Figure 3.25: (a) Plan of single-loaded corridor in the high-rise for the elderly illustrated in Figure 3.24. (b) Plan of typical apartment.



Footnotes

1. Institute of Planning and Housing, Intercom Effectiveness Study, Addendum B, *Final Report on Project for Security Design of Urban Residential Areas.* New York: New York University, 1973. The study examined the experience of the New York City Housing Authority over three years with intercoms installed in buildings in nine housing projects. The study determined that there are many factors that contribute to the success of intercom installations in reducing crime and in remaining operational. The nature of the installation contributes in some ways to success, as does the location of the main entry door and secondary exits. The strongest physical determinant was the number of units sharing an entry.

   The social factors that correlated most strongly with success were: (1) the percentage of welfare families in the project, which correlated negatively with success; (2) the percentage of teenagers in the project, which correlated negatively with success; (3) the percentage of elderly in the project, which correlated positively with success. The number of 50 families with children sharing an entry as the upset limit for the successful operation of intercoms is derived from informal interviews with housing authority management and observation of the success and failure of installations in comparable housing projects located in the same areas of the South Bronx (Bronxdale and Monroe) housing families with similar socioeconomic characteristics but in buildings in which the number of families sharing an entry varied (±50 units per entry versus ±100 units per entry).
2. All buildings for the elderly housing 150 and more units per entry, were uniformly found to have successfully operating intercoms in housing projects located in the following cities: Chicago, Boston, New York, Jersey City, Cleveland. These were observed in visits by staff of the Institute for Community Design Analysis and were verified by housing management as a condition that was typical over the years the intercoms had been in installation. Some of the high-rise, all-elderly projects supplied with intercoms in New York City, Boston, and Cleveland are located in the high-crime areas.
3. Messer, Engagement with Disengagement. (See footnote 23, Chapter 1.)
4. Susan R. Sherman, The Choice of Retirement Housing among the Well-Elderly. *Aging and Human Development* (1971), Vol. 2, pp. 118-138.
5. See footnote 24, Chapter 1.
6. Reppetto, *Residential Crime*, pp. 49, 61.
7. Ibid., Chapter 2, Offender Behavior.
8. Theodore Caplow and Robert Forman, Neighborhood Interaction in a Homogeneous Community. *American Sociological Review* (1950), Vol. 15, pp. 357-366.
9. Imre R. Kohn, Karen A. Franck, and Arlen Sue Fox, *Defensible Space Modifications in Row-House Communities.* Unpublished report of a study evaluating the effects of modifications in two New York City housing projects. New York: Institute for Community Design Analysis, 1975.

10. HUD, Minimum Property Standards, 1973, Vol. No. 4910.1
11. Building Officials & Code Administrators International, Inc., *Basic Building Code/1970.*
12. New York City Building Laws, Vol. 1, 1972.
13. Nelson Foote et al., *Housing Choices and Constraints.* New York: McGraw-Hill, 1960.
14. Informal interviews conducted in 1973-74 with residents of all-elderly buildings in public housing projects in New York and Jersey City, by staff of the Institute for Community Design Analysis, are supported by Richard Lamanna's study, Value Consensus Among Urban Residents, in which he found that older people were significantly more likely to rate the opportunity for socializing as a factor in their choice of a living environment than were families with children. *Journal of the American Institute of Planners* (1964), Vol. 36, pp. 317-326.

4

SITE PLANNING DESIGN GUIDELINES

Chapter 2 explains how the dictates of density can lead to the design of high-rise buildings. Once the requirement of building at 50 dwelling units to the acre or higher is set by the cost of the land, many architects respond with the use of high-rise elevator buildings. For instance, Pruitt-Igoe in St. Louis, a 12-story project, was built at only 47 dwelling units to the acre. As the density discussion in Chapter 2 demonstrated, projects can be built at 50 dwelling units to the acre without exceeding a three-story height.

The primary objective in building a high-rise at this density was to free as much ground space as possible for play areas, greenery, and parking. What was not recognized was that different building types have different capacities for enabling residents to develop associations with adjoining grounds. Ground area free of buildings is an unquestionable resource. But the quantity of available open space is in itself a marginal factor in determining residents' concern for and use of the grounds adjoining their buildings. Rather, it is the degree to which residents identify these grounds as being their own that most influences the nature and extent of their use of ground facilities.[1]

In developing the high-rise solution to family housing, architects hoped that they could answer the need for higher densities while producing a living environment even more desirable than the traditional row house. Le Corbusier's conception of the high-rise residential environment, sitting free of the grounds below, was a solution internally consistent with the needs he hoped to satisfy and with his philosophic vision of the new contemporary man no longer tied to his own individual hearth and garden. It was a solution based, as well, on a

utopian view of society: a vision of all men living communally, sharing identical wealth, values, and concerns. In his plans Le Corbusier intentionally strove to disassociate residents from any individual involvement with the grounds below. He viewed the grounds as a continuum of publicly owned open space: of trees and grass growing freely between and under buildings. This was a strange conception to come out of a country like France, where every square foot of ground and building is specifically assigned for the private use of particular parties and jealously guarded by individual owners or concierges. Figure 4.1 shows Le Corbusier's design for Unité Habitation, in contrast to a traditional four-story building commonly constructed before World War 2. The traditional buildings are tied to the grounds; Le Corbusier's Unité begins nearly where the tops of the older buildings leave off.

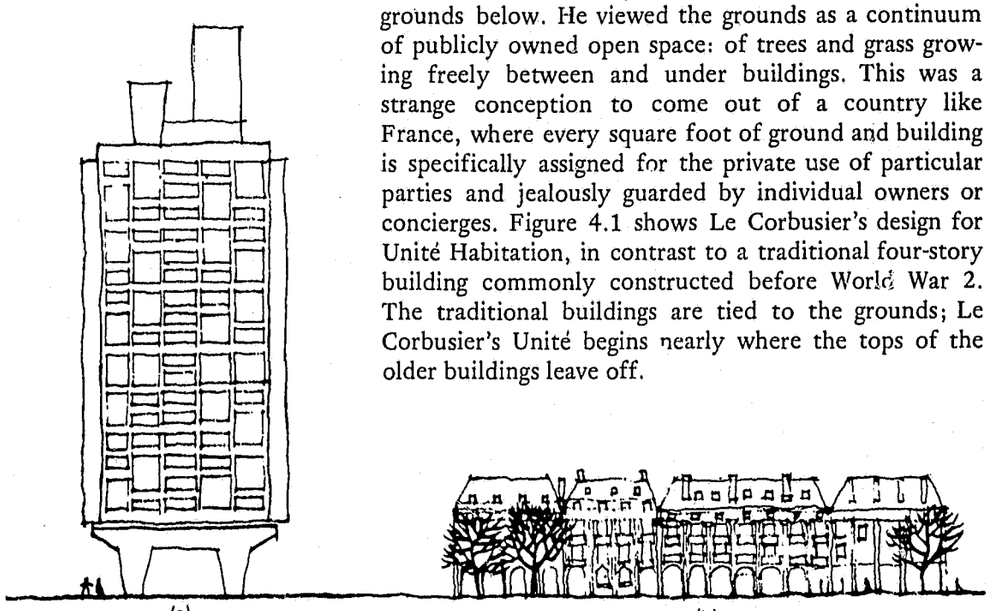


Figure 4.1: (a) Unite Habitation; (b) Traditional four-story walk-up.

Public housing authorities in St. Louis, Chicago, and Philadelphia—to name only a few—who constructed housing following Le Corbusier's model, are now contemplating abandoning them. Many are already 30% to 40% vacant. In St. Louis, at Pruitt-Igoe as elsewhere, reality proved different from Le Corbusier's dream. The bountiful grounds, trees, and recreation areas were quickly vandalized because residents could not identify with and care for any area—and management could not

Figure 4.2: Photograph of nebulous unassigned areas of a housing project.

afford to maintain and watch over the grounds on a continuing basis. In Pruitt-Igoe many of the play areas went unused because parents would not allow their young children to play where they could not be supervised. The distance to the grounds was too great and the interior public areas of the buildings were too dangerous to allow children to go through them alone. The grounds below were too open, anonymous, and unrelated to the apartments of any particular group of residents to allow for the development (or enforcement) of any set of rules for play area use.[2/3] Children did most of their playing inside the apartment units and in the corridors, leading to the rapid deterioration of the buildings.

In many housing superblock designs, even those composed of low buildings, there is seldom any attempt to assign different areas of the site to the residents of particular buildings (Figure 4.2). Everything is left open and access is unrestricted, even symbolically. The play equipment placed on the open grounds is assigned to no particular group and is inevitably quickly vandalized and destroyed. Trees, lights, and benches suffer similar fates. The grounds are read by residents as no man's land; residents have no feelings of association with them and cannot conceptualize having any responsibility for the activities that take place there.[4] Children rain bottles and garbage down on anything that moves within range.

In Pruitt-Igoe the "river of trees," as the grounds were poetically identified by the architects, became a sewer of broken glass and garbage (see Figures 4.3 and 4.4). In public housing the response of the management of superblock projects increasingly has been to remove

Figure 4.3: Reality at Pruitt-Igoe: the river of trees became a sewer of glass and garbage.

Figure 4.4: Architect's vision of Pruitt-Igoe; the grounds were designated as "a river of trees."

Figure 4.5: Aerial view of a housing project, showing the virtual wall-to-wall asphalting of the grounds area.

the vandalized play equipment and pave the grounds between the buildings with asphalt (Figure 4.5).

Middle-income developments built along a similar model fare better than do public housing projects, but this is conditional on the availability of funds for the continued maintenance of the grounds and for housing guards.

The North Beach public housing project in San Francisco (Figure 4.6) was constructed a few years before the Pruitt-Igoe project, at the same density, and at a lower cost. Like Pruitt-Igoe, the North Beach project is occupied by low-income residents, most of them black and many of them on welfare, yet it survives today at full occupancy with few crime and vandalism problems. This project demonstrates that it is possible to design

Figure 4.6: Site plan of North Beach.

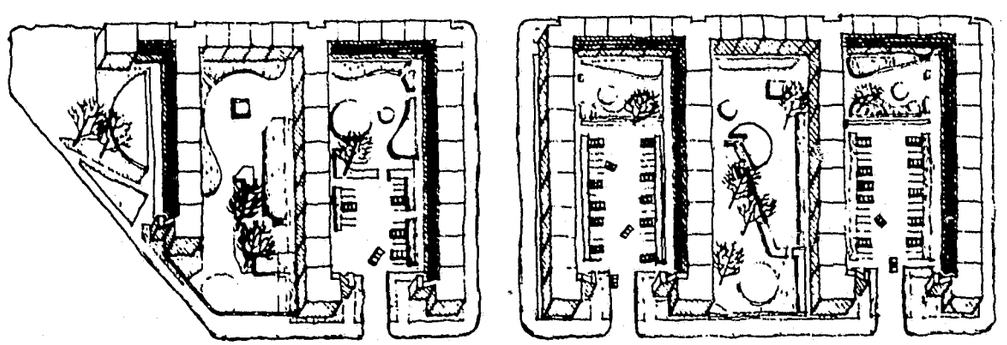


Figure 4.7: Play areas surrounded by and designated to particular buildings at the North Beach project.

housing at a density of 50 dwelling units to the acre and still keep all the buildings low and close to the grounds. Most importantly, the buildings are arranged so that all the grounds areas of the site are subdivided and assigned to particular groups of residents (Figures 4.6, 4.7, and 4.8). There are few exterior areas that are left unrelated to a particular cluster of apartments.

Creating Zones of Influence

In laying out the site of a housing project, buildings should be positioned and grounds subdivided and allocated so that residents perceive particular areas of the project as being under their specific sphere of influence. The entries to buildings and the paths approaching them should be directly related to the grounds areas assigned to particular residents. Play and parking areas should be placed within these defined zones, as this will further assist residents in adopting proprietary attitudes and in exerting their territorial prerogatives. These attitudes on the part of residents will, in turn, serve as natural deterrents to crime and vandalism.

A zone of influence on the grounds of residential developments is an area, within the immediate vicinity of a building, that is perceived by the building's residents as an extension of their dwellings. As such, the zone is likely to experience more intensive use, surveillance, and care on the part of adjacent residents.

Figure 4.8: View of the entry court at the North Beach project.

Number

Of all the mechanisms that contribute to the creation of zones of influence, number is the key. The fewer the families that share the entry to a building, the greater will be each family's association with the grounds below and the greater will be their desire and ability to participate in maintaining the grounds and guaranteeing safety. In the development of a project, therefore, the designer should choose a building prototype that satisfies the density requirements but minimizes the number of families that have to share a building entry. Buildings should then be so positioned that the grounds around the buildings are easily perceived as having been designated for the use of families in particular buildings.

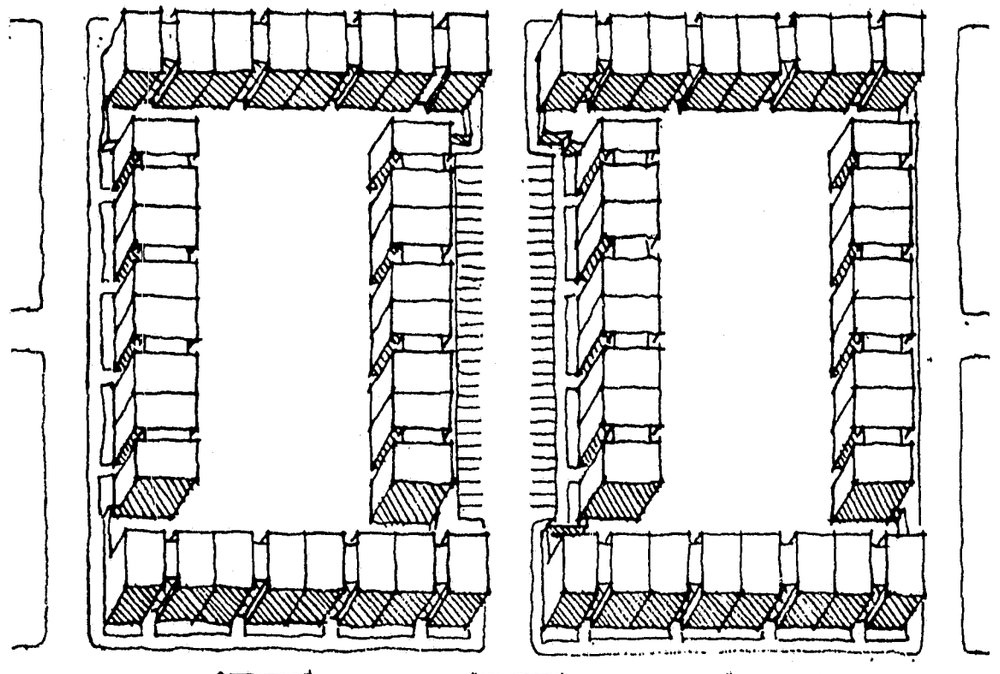
All other things being equal, the smaller the number of individuals required to share a particular facility, the greater will be each individual's feeling of possession. When only a few residents share a facility, each feels he has an important role in determining the nature of the use of that facility. Also, the fewer who share a facility, the more responsible is each sharer in preserving its condition. For example, if a site planner can provide 10 pieces of play equipment for the use of 100 families, he can either place all 10 in one central area to serve the entire 100 families, or he can divide up the 10 pieces of equipment so that each piece is assigned for the use of a specific group of 10 families. The second choice is the preferred one to ensure both the use of the equipment and its longevity.

However, not all amenities can be allocated with this range of choice. Some large facilities, such as basketball courts or ball fields, must serve a large group of families to justify their inclusion in a site plan. However, rather than group two or three such large facilities together, as is commonly done, it is better to assign each of them to the smallest possible group of families.

Assignment of Grounds

To create easily perceived zones of influence, a project site should be subdivided so that *all* the ground areas are related to particular buildings or building clusters. No area should be unassigned or simply left public in nature. Figures 4.9 and 4.10 compare two planning layouts for the same site and at the same density; each accomplishes a different end. In Figure 4.9 most of the

Figure 4.9: Grounds areas are all assigned to particular buildings. Streets are encompassed within the sphere of influence of the dwellings.



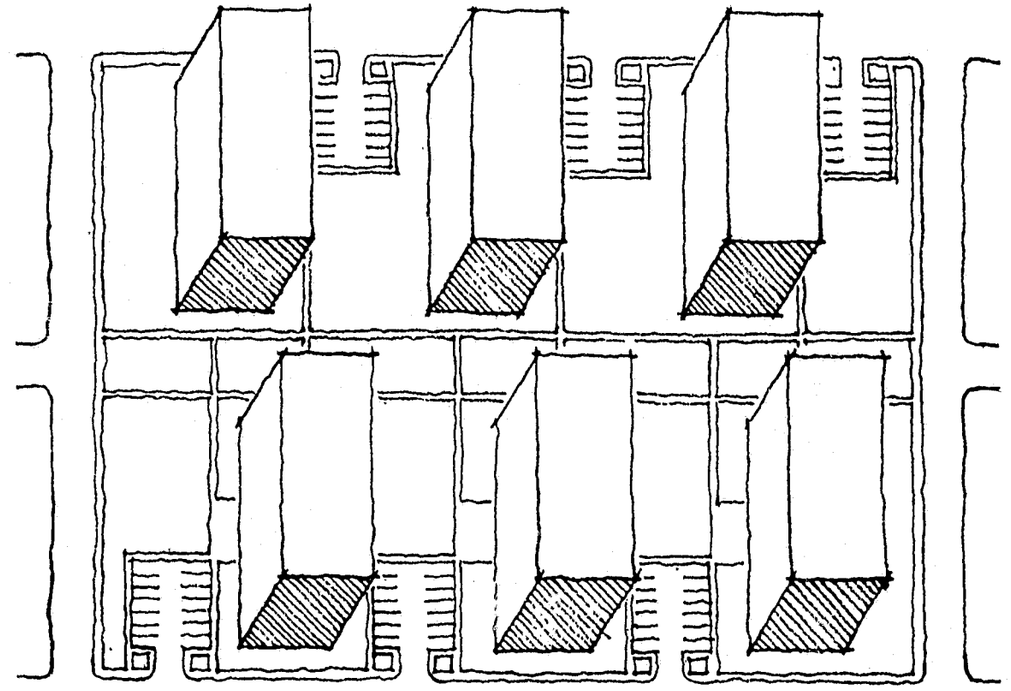


Figure 4.10: Grounds areas are intentionally left open and unrelated to particular buildings. The streets do not relate either to the buildings or the project grounds.

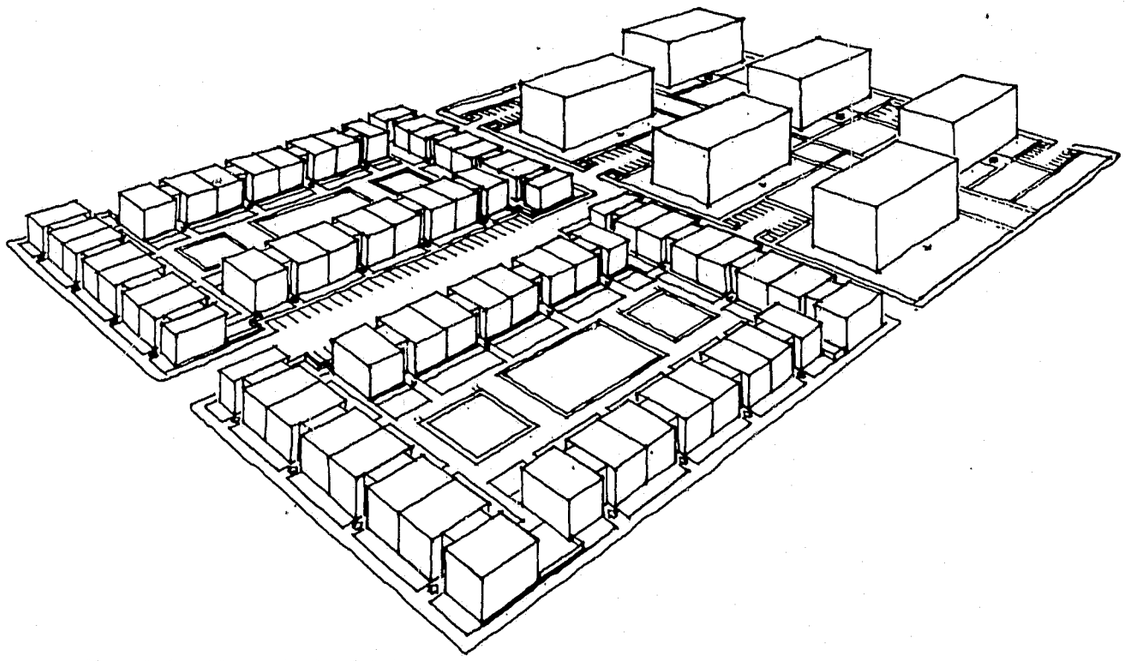


Figure 4.11: View of the interior grounds of the walk-up scheme shown in plan in Figures 9 and 10.

ground areas and, by their juxtaposition, the adjacent streets, are assigned to particular buildings. The placement of the buildings themselves serves to break up the grounds and to define their use and their users. The buildings, streets, and grounds are designed as interrelated entities. By contrast, Figure 4.10 illustrates a site plan in which most of the ground area is unassigned and therefore public in nature. Figure 4.11 is an aerial view of the site plan of Figure 4.9; the grounds around the buildings have been subdivided to serve the needs of the residents of individual buildings, and a common interior area serves all the buildings together in the provision of a larger amenity: a ball field. These interior grounds are accessible only through the separate rear exits from each building's interior semiprivate space.

Means for Defining Zones of Influence

The physical boundaries necessary to the creation of zones of influence can be defined either by real or symbolic barriers. Real barriers include elements like buildings, fences, and walls. They require entrants to possess one of the following: a mechanical opening device; a

familiar face or voice; or some other means of identification to indicate a legitimate right to entry. That is, access to a residential environment through a real barrier is only possible with the approval of its occupants: either with a key; by acceptance by the residents' or building owner's agent; or by electronic signal, activated by resident or agent, that opens a locked barrier.

Symbolic barriers, on the other hand, define areas or relate them to particular buildings without physically preventing intrusion. Symbolic barriers include elements like low fences, shrubs, steps, changes in ground level, changes in paving texture, light standards, open portals, and so on (Figure 4.12).

The success of symbolic barriers, in contrast to real barriers, is dependent on the following conditions: (1) the ability of intruders to perceive and take heed of the meaning of the symbols; (2) the evident capacity of the inhabitants of the defined space or their agents to maintain control of the space that is being symbolically identified; and (3) the capacity of the defined space to require the intruder to make his intentions obvious; that is, the space must be defined so as to have a low tolerance for ambiguous use. Many of these components work in concert: a successful symbolic barrier is one that has all of these conditions in operation together.

Transitional Spaces

In existing housing developments the subdivision of grounds into distinct clusters, defined by real barriers, may be difficult to achieve after the fact of construction. In this case it may be possible to create a series of symbolic boundaries that define a hierarchy of increasingly private zones in transition from public street to private building and apartment. We have called this hierarchy zones of transition.

As a design tool, symbolic barriers achieve their greatest utility when used to define the boundaries of zones of transition. These boundary definers act as interruptions in the sequence of movement along access paths. They create perceptible zones of transition from public spaces to spaces intended for private or semiprivate use.

Symbolic barriers, in creating zones of transition, serve a common purpose: to inform people that they are passing from a public space, where the range of possible activity is large and not normally open to question, to a

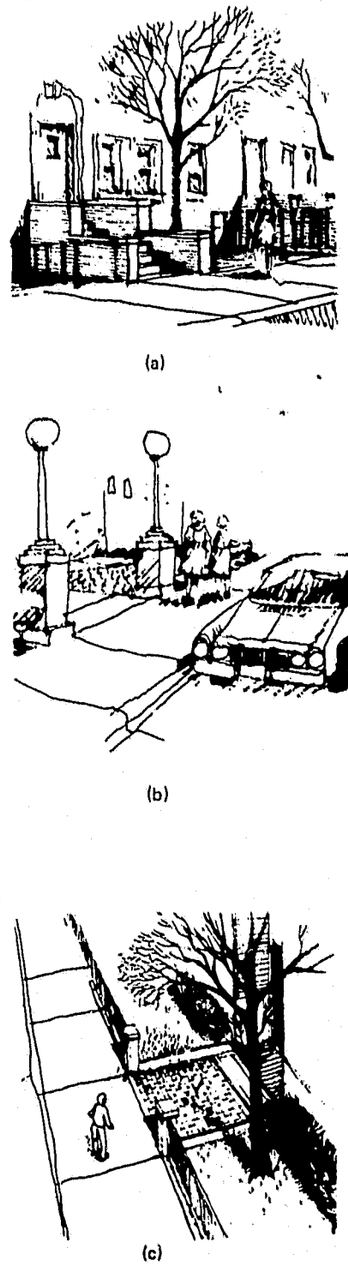


Figure 4.12: Examples of symbolic barriers. (a) Change in level; (b) lights and standards used to define transitional space; (c) low walls, posts, and change in texture used to define transition.

private space where one's activity is limited to what is considered acceptable by residents. Within these defined private spaces, one's presence requires justification. When moving through a sequence of territorially defined areas—from a public street to a building and dwelling unit—one experiences these symbolic barriers as a matter of course; behavior and expectations change accordingly.

Many opportunities exist for creating zones of transition by the use of symbolic barriers. They occur in the transition from public street to the semipublic grounds of the project (Figure 4.13); in the transition from outdoors to indoors; and in the transition from the semipublic area of a building lobby to the more private corridors of each floor. Symbolic barriers can also be used by residents as boundaries in defining areas of comparative

Figure 4.13: Numerous devices are available to indicate transition areas in existing developments.

safety (Figure 4.14). Parents commonly use symbolic barriers to delimit the areas in which young children are allowed to play. For example, a mother will say, "Don't play outside the hedge," or "Play on the patio, but don't go down the steps." Similarly, because symbolic barriers force an outsider to realize that he is intruding on a semiprivate domain, the barriers effectively confine behavior to that which outsiders deem the residents will find acceptable.

Figure 4.14: Patio and play area as symbolic barrier defining area of transition.

The Reinforcement of Zones of Influence by Placement of Amenities

The creation of zones of influence through the subdivision of grounds can be further reinforced if amenities directed to the needs of intended residents are located within these zones. The placement of sitting areas, play facilities, and parking areas within the defined zones gives residents a further sense of identification with these areas. Such identification with particular facilities further reinforces residents' claim to the territory. The presence of residents involved in various activities in a particular area, whether children at play or adults sitting around and talking, serves to reinforce these feelings of territorial control. It also brings these areas under surveillance by other family members. If these amenity areas are juxtaposed with building entrances and with windows from adjoining apartments, there is further likelihood that these areas will receive casual surveillance and screening.

The site plan of a housing project must answer many criteria, some generated by external conditions such as vehicular access and servicing and others generated by the needs of the residents for ancillary outdoor activity areas. The nature of the juxtaposition of these outdoor areas with the interiors of apartments is critical to determining the degree to which residents will adopt these areas as theirs. It may seem an obvious requirement, but buildings should be grouped so as to allow the adjacent open space to be used for various activities related to the specific needs of different residents.

Often architects and site planners are content with producing site plans in which the grounds satisfy only a beautification or compositional function. It is not uncommon to see site plans for proposed projects with the grounds labeled simply as "active" or "passive" space,

without any consideration given to the actual activities intended, the age and characteristics of the intended users, or the means of access to these areas from the dwellings. Well-designed and clearly allocated recreation facilities improve the security of an area by creating outdoor extensions of the dwelling unit that residents can identify with and control. Distant and undefined recreation and green facilities, whose intended users are unclear, often go unused or are vandalized. These areas also attract vagrants, spark disputes over rights among potential users, and often create more problems than they solve.

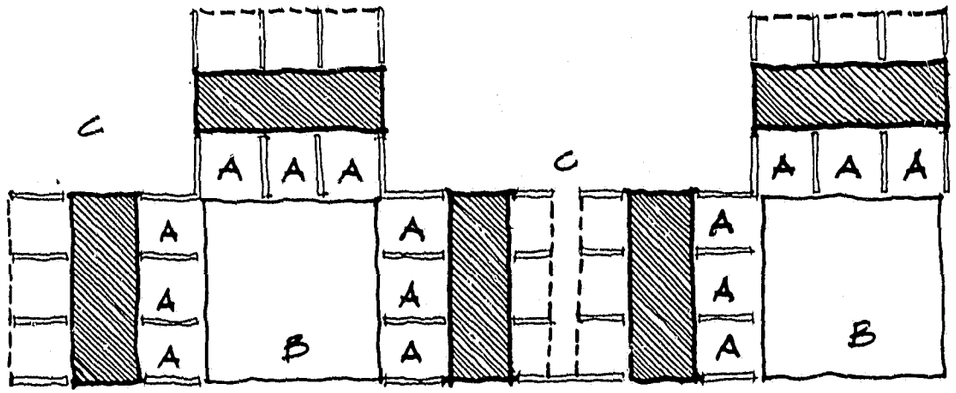


Figure 4.15: Site plan showing location of amenities for different users. Areas marked A are for preschool children; B, for six- to 12-year-olds; C, for adults.

Figure 4.16: Perspective of play area as buffer.

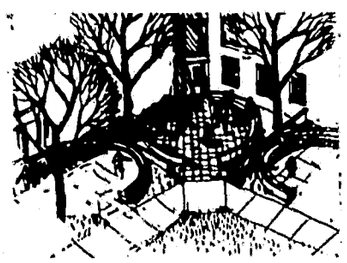


Figure 4.15 illustrates a housing project site plan with outdoor areas designed and positioned to meet the needs of a range of particular users. Areas labeled A, placed adjacent to the entry to each subbuilding, are allocated for the use of one- to five-year-olds, with accompanying seating for adults. The larger areas, B, in the center of each cluster of three building blocks, are provided with play facilities serving six- to twelve-year-olds; the areas labeled C are intended as decorative green areas and for the quiet use of adult residents. These latter areas may also be provided with barbecuing facilities and with some seating, but are for the most part simply heavily planted. It is essential that control to these C interior areas be limited, with access to them available only from the building interiors.

The following suggestions for grounds design relate to the needs of different age groups. First, small children, one to five years of age, have been found to show a preference for playing in outdoor areas immediately adjacent to their dwellings—preferably just outside the door—in both single-family units and in multiple dwellings.[5] As Figures 4.16 and 4.17 illustrate, the careful allocation of such facilities can also serve to create a semiprivate buffer zone separating the private zone of the building interior from the more public zones of the project and surrounding street. These play areas for young children should also be related to the interior circulation areas of a multifamily building and to the windows of the apartments of intended users. This juxtaposition of interior and exterior facilities provides the opportunity for easy, continous monitoring of outdoor areas by residents within the building. An additional security benefit accrues from this juxtaposition: the entry to the building now also falls under the continous observation of residents.

Tot lots should be designed with clearly demarcated peripheries so as to both protect the activities taking place within them and to discourage very young children from wandering off. The provision of rows of benches is one way of satisfying this demarcation requirement while also providing for the needs of accompanying adults (Figure 4.18).

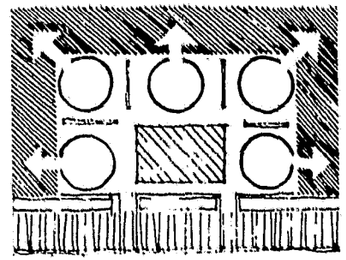


Figure 4.17: Play areas as buffers to building entries.

Figure 4.18: Tot lot with bench around it.

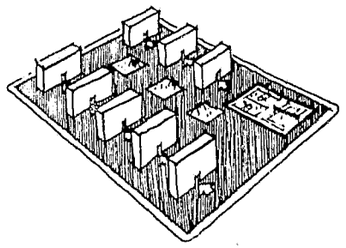


Figure 4.19: Housing project site plan in which teen play facilities have been located at the periphery of the project and intentionally disassociated from all buildings.

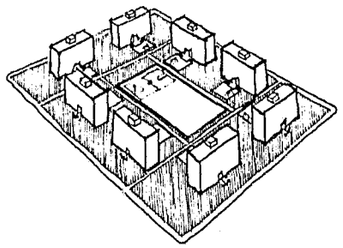


Figure 4.20: Housing project site plan in which teen play facilities have been centrally located so as to be related to all the buildings.

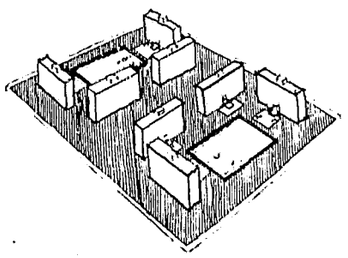


Figure 4.21: Housing project site plan in which teen play facilities are bordered on three sides by buildings and entries.

Because of the noise generated by teenagers and because of the possible damage a ball can do, play areas for 13- to 18-year-olds should not be located immediately adjacent to buildings. However, this does not mean that teen play facilities should be placed in isolated areas of the housing development, totally disassociated from all dwellings (as in Figure 4.19). Isolated play facilities often prove to be neglected, vandalized, and underused. In projects where the teen play area appears to be a no-man's land, fights for turf rights among competing groups of teenagers have, in many instances, ended with the decision by the management to remove the play equipment. Ideally, teen play areas should be bordered on two to four sides by dwellings (see Figure 4.20 and 4.21). The windows and entries of at least some of the dwellings in the complex should face onto the play area. In order to minimize the noise problem discussed earlier, these play areas should have a 30- to 40-foot buffer between them and the nearest building.

A teen play area should be large enough to house the play facilities normal to this group: basketball, handball, baseball, and football, when possible. It should be noted, however, that housing developments in dense urban settings can normally only accommodate basketball and handball courts.

Benches should be placed around teen ball fields to allow other teenagers to gather and watch. In the evening hours the benches expand the use of these areas for social gatherings when groups are not playing ball. The benches also serve as a simple device for allowing both sexes to get together. They are useful in allowing tired players to catch their breath or just as a place for piling up clothes and equipment (Figure 4.22). A few benches placed around a basketball court can turn it into a small teenage center.

Figure 4.22: Use of play areas and adjacent benches.

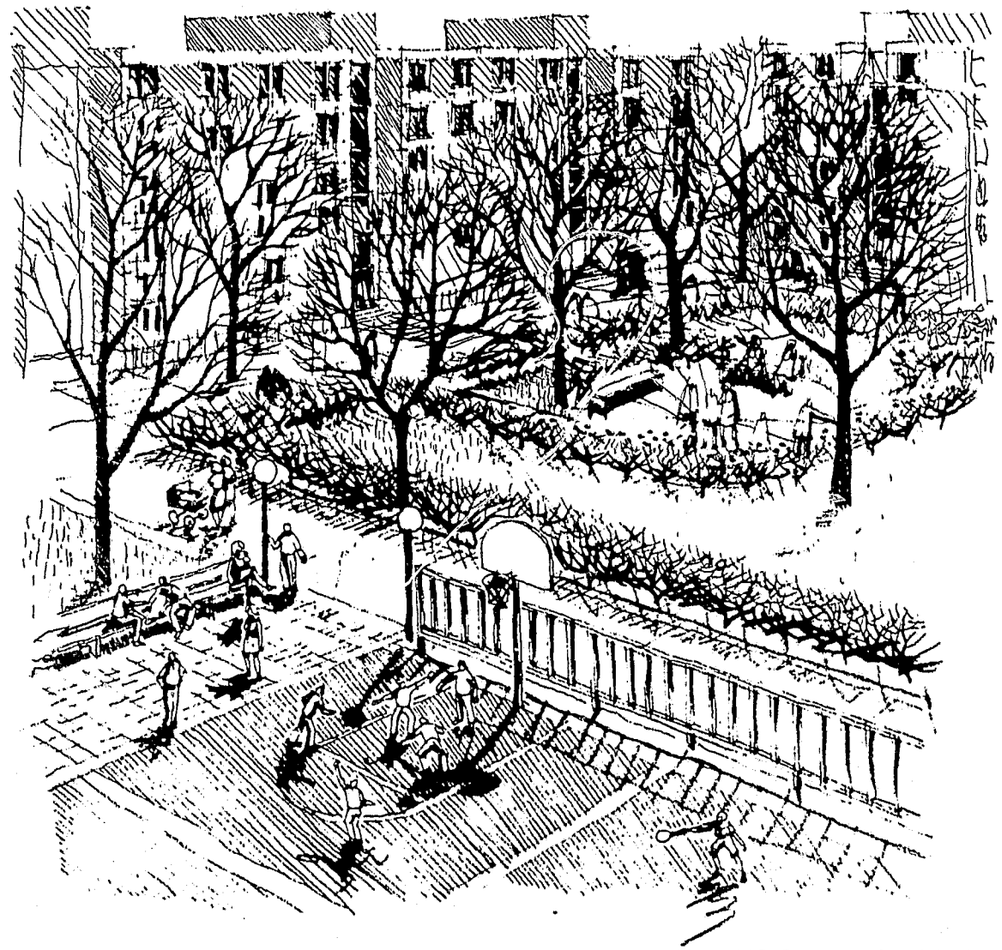


Figure 4.23: Green areas for adult leisure are screened by shrubbery and further "protected" by provision of nearby areas for active play.

Flowering, green areas from which children are restricted are the pride of the elderly and, inevitably, a thorn in the side of every active child looking for somewhere to play. Shrubs and fences, judiciously placed, can help to protect such green areas from play. However, the only effective means for preserving these areas as green spaces for quiet sitting is to provide adequate play areas and equipment for youngsters nearby (Figure 4.23).

Incorporating the City Streets into the Zone of Influence of Residents

The zone of influence of a residential building can be made to encompass the adjacent city street if the building and its entry are carefully designed and positioned. Residents who live in buildings that are closely juxtaposed and related to the city streets are more likely to perceive the adjacent sidewalk as an extension of their homes. It is thus possible to encourage residents to extend their concerns and responsibilities to include some of the street area.

Inwardly facing housing projects—that is to say, developments that have been designed intentionally with building entries placed only off paths that are internal to the project—produce peripheral city streets that are truly public. These city streets are devoid of any association with any buildings and, as a result, receive no surveillance from adjacent homes.

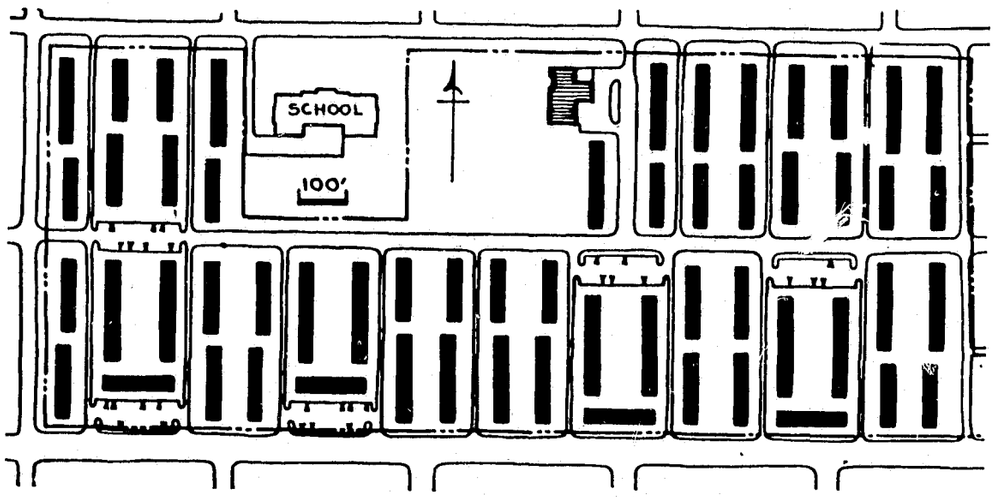


Figure 4.24: Site plan from early HUD manual, showing buildings facing street on end only. (Source: *Public Housing Design*, National Housing Agency, Washington, D.C., U.S. Government Printing Office, 1946.)

Following the directives of early planning manuals, many housing projects were intentionally designed to look inward on themselves (Figure 4.24). Buildings usually met adjacent streets only at one end; entrances and windows faced only the project interior, and, as a result, residents had no view of bordering streets. Figure 4.25 illustrates both outward and inward facing projects.

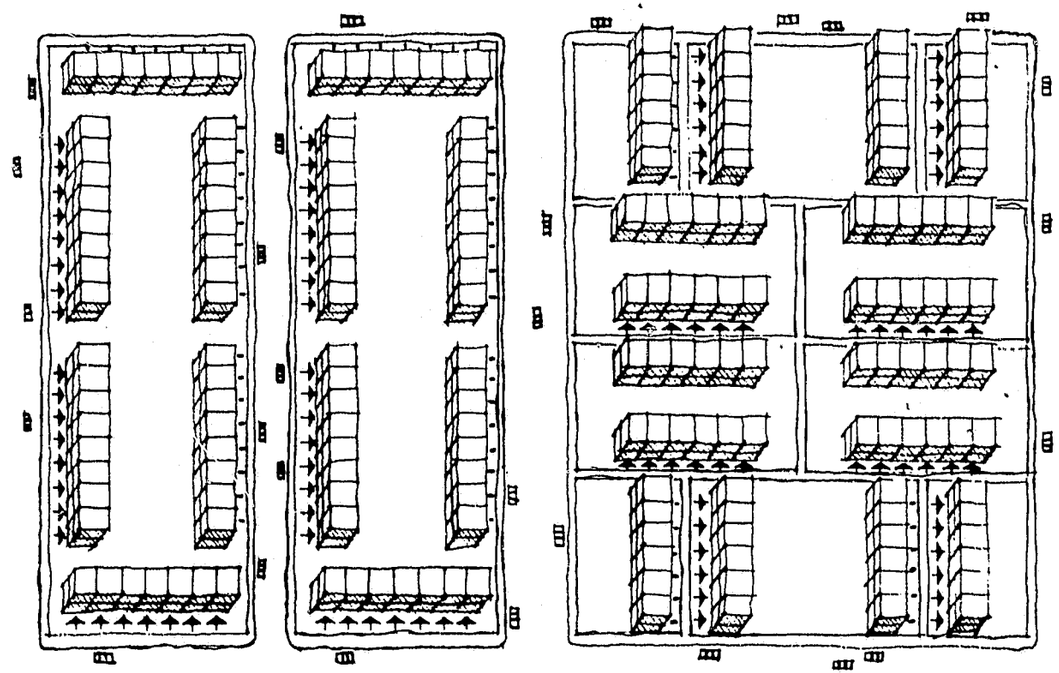


Figure 4.25: (a) Outward facing project; (b) inward facing project. Arrows designate entries.

Figure 4.26 illustrates two approaches to the site planning of a six-block residential area. Both site plans house the same number of people and provide similar amounts of parking. The plan on the left illustrates a superblock, created by closing off existing streets. Although the closing of the streets and the use of high-rise buildings were intended to free large areas for recreational use, these areas are not always adopted by residents for these purposes, as explained earlier.

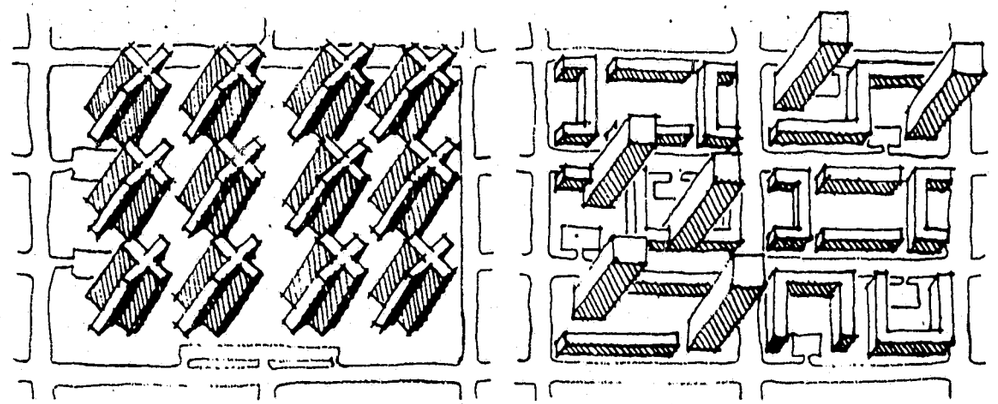


Figure 4.26: (a) High-rise superblock, formed by closing off public streets; (b) site plan incorporating public streets and combining various building types.

By contrast, the plan on the right achieves the same density through a mixture of walk-ups and high-rises. Each building type is intended to serve the family type most comfortably housed within it. All existing streets have been maintained to provide parking, circulation, open space, and recreation facilities. Although the buildings cover more of the grounds area than those in the plan on the left, the grounds that are provided are more clearly related to specific buildings and have been allocated for the recreational use of particular groups of inhabitants. As a consequence, the smaller grounds area of the plan on the right is more likely to receive more intensive use than the larger, more nebulous and undefined grounds of the open plan on the left.

There are three separate design directives under discussion in the above comparison. Although they operate together, it is important to keep our understanding of them separate. The first directive stems from the realization that for families with children, high-rise buildings—because of the apartments' distance from the ground, because the buildings house so many families per building entry, and because they include interior circulation areas that are public in nature and difficult to control—make use of grounds areas difficult. The second directive that makes the plan at the left inadequate is that the buildings are unrelated to specific portions of the site, while in the plan at the right each building cluster encompasses its own grounds area. The third directive relates to the positioning of buildings so that they include the city streets within the perceived zones of influence of as many residents as possible. In the plan on the left, the buildings turn away from surrounding streets, while in the plan on the right all entrances face the street. Also, the lower the buildings, the less is the distance most inhabitants are from adjacent city streets. This distance is made shorter still by the fact that the facades of most buildings in the plan on the right are close to the streets.

There are two factors that contribute to bringing city streets within the zone of influence of a development's residents: (1) the close juxtaposition of the building with the street so that as many apartment interiors and building entries as possible face the street, and (2) the choice of a building prototype in which as few families as possible share the entry to a building. This gives each family a greater sense of identity with the grounds outside the building and hence the street. Figure 4.27 illustrates the operation of these two factors in a single drawing. It shows two housing projects across the street from one another; both are designed at the same density and with similar parking provisions. The high-rise project on the left has all building entries facing the interior grounds of the development. Parking for this project has been designed as a continuous strip along the street, further disassociating the buildings from the street. The project on the right achieves the same density but is only three stories in height. All the buildings and their entries are juxtaposed with the city streets. Each building entry has been designed to serve only six families. Finally, small play and sitting areas have been provided near each entry as amenities within the sphere of influence of each of the six families.

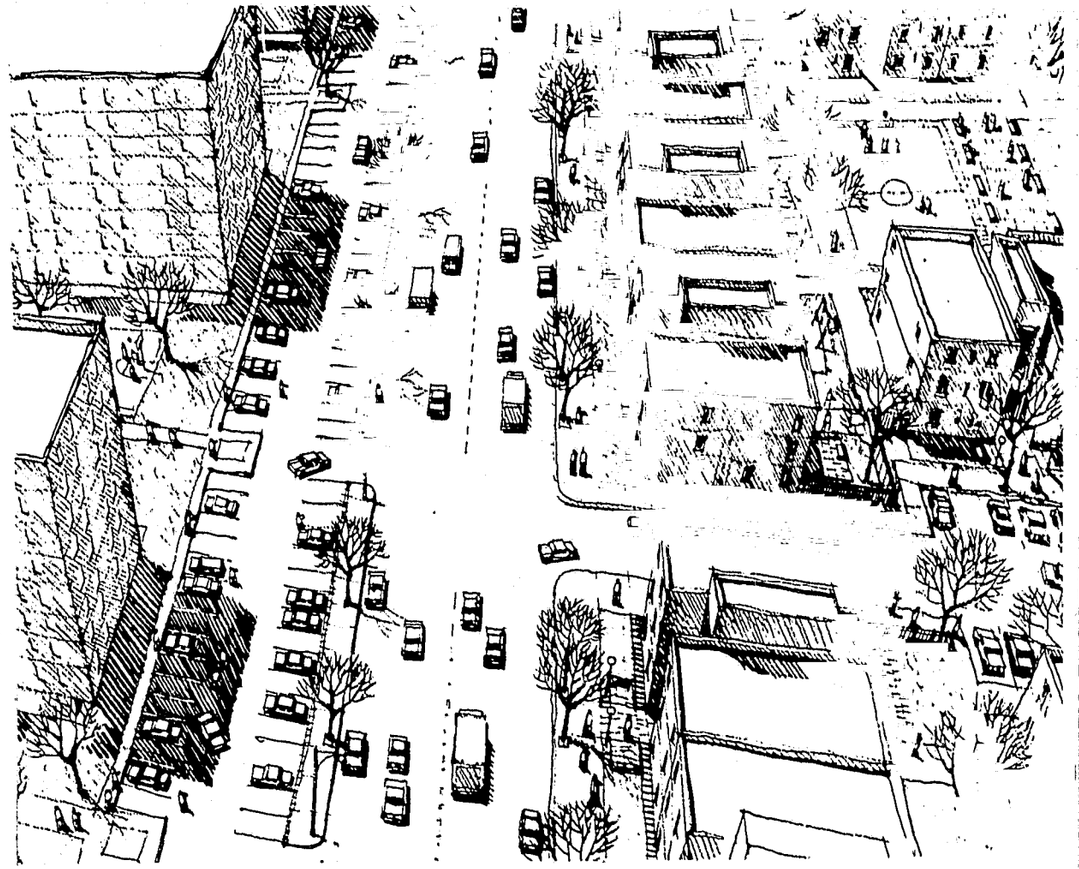


Figure 4.27: The project on the left is turned in on itself, away from the public street, while that on the right is designed to bring the street within the control of the residents.

The residents in their apartments in the walk-ups are a very short distance from the surrounding streets, and because of the positioning of the entries, play areas, and parking, the neighboring streets are very much more

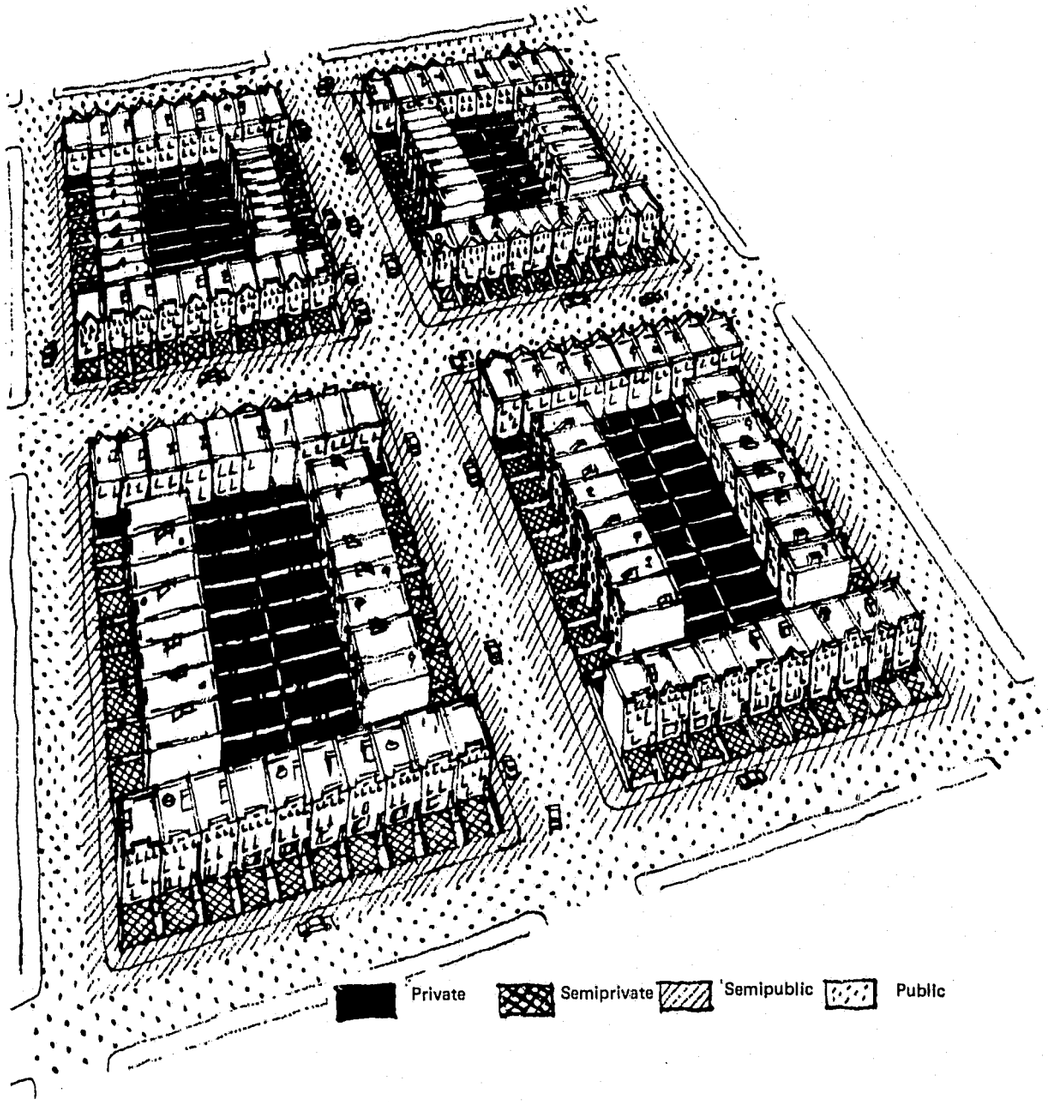


Figure 4.28: Four-city-block row-house development; the street and grounds are encompassed within the domain of the dwellings.

within the sphere of influence of inhabitants than are the surrounding streets for residents in the plan on the left.

Figures 4.28, 4.29, and 4.30 graphically summarize the major site-planning guidelines that are essential in incorporating the grounds and streets of a housing development into the sphere of influence of inhabitants.

These guidelines are:

1. The choice of building types and the subdivision of the grounds of a development so that as few families as possible share a common entry.
2. The positioning of buildings, shrubs, and fences so as to clearly define particular areas of a site for the use of specific families.
3. The choice of building types and their positioning so as to develop close physical associations between the interior areas of buildings and the adjacent grounds.
4. The placement of amenities—recreation, parking, planting—within the areas defined for the use of particular inhabitants.
5. The positioning of buildings and their entries so as to incorporate the city streets into the sphere of influence of adjacent inhabitants.

All three illustrations show the same four-block area of a city developed in different ways. Figure 4.28 is an illustration of row-house development at 24 units to the acre. The site has been subdivided so that all grounds areas, except for the streets and sidewalks, are assigned to individual families. The front lawns, because they are private, need only be symbolically defined. The rear yards are accessible from the interior of the dwelling units only. The close juxtaposition of each dwelling unit with the sidewalk and street, the entry to each unit facing the street, the *private* grounds of the individual unit immediately abutting the sidewalk, and finally the family car parked on the street immediately in front of each house, all contribute to the incorporation of the sidewalk (and the area where the car is parked) into the sphere of influence of the inhabitants of the dwelling. Residents' attitudes suggest that even this sidewalk and parking area are semiprivate in nature. Looking at the four-block area as a whole, we find an urban fabric in which most of the outdoor areas and all of the indoor areas are private. In addition, a good portion of what is legally public space is viewed by residents as an extension of their dwellings and under their sphere of influence; they are concerned about ensuring its safety and act to maintain it. In actual fact only the central portion of each street is truly public in nature. If the street were narrow, even the activity in this central portion would be considered to some degree accountable to neighboring residents.

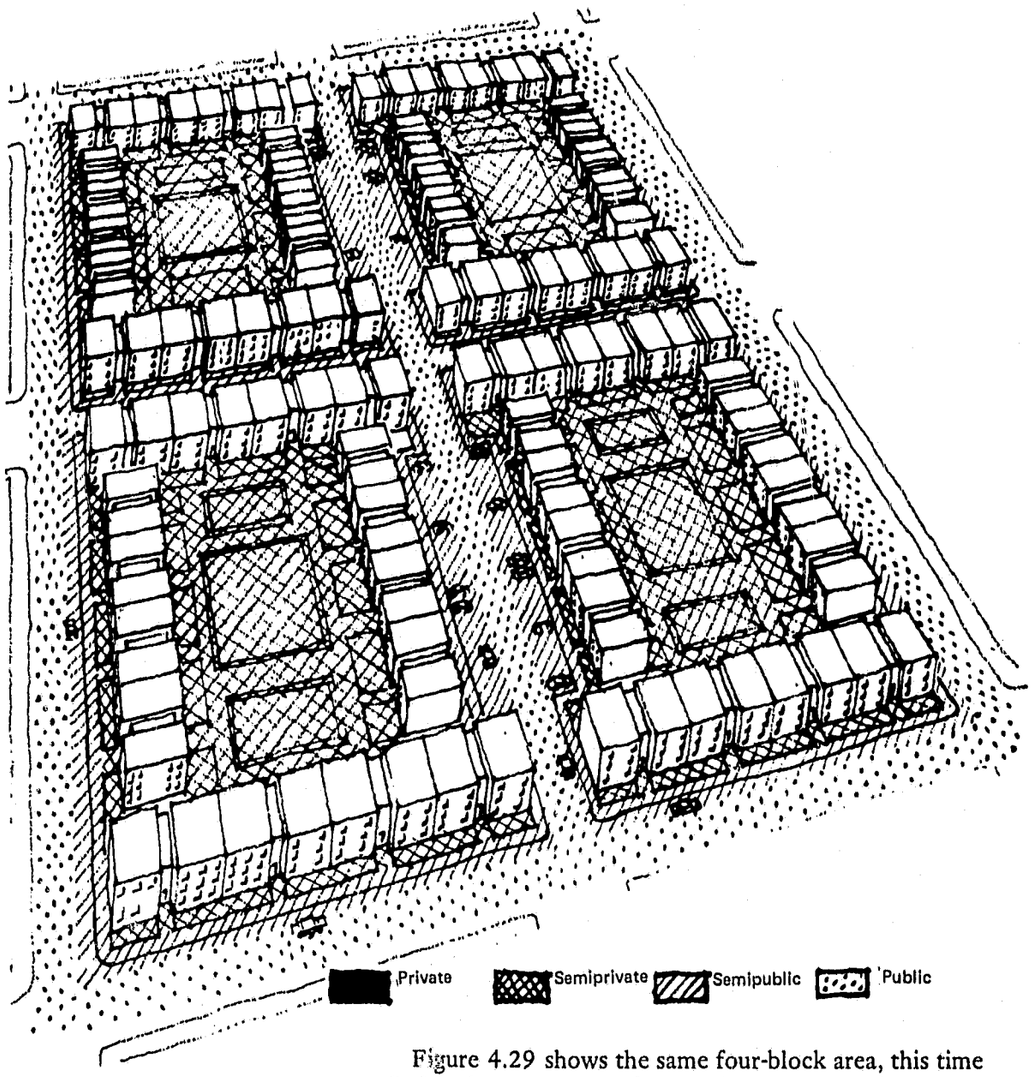


Figure 4.29: Four-city-block walk-up development; the streets and grounds are encompassed within the domains of the multifamily dwellings.

Figure 4.29 shows the same four-block area, this time designed to accommodate a three-story garden apartment scheme at 36 dwellings to the acre. The grounds area has been assigned both to individual families and to small groups of families. The front lawn adjacent to each building entry is the collective area for that entry's inhabitants. The small patios adjacent to each building at the rear are the private outdoor areas of the families living at the ground level. The large rear courts contained by the four buildings are each the collective recreation area of 96 families. These rear courts are only accessible from the semiprivate interior circulation space of each building shared by six families. As in the row-house scheme in Figure 4.28, all the entries face the street, but the entries now serve six families rather than one family, and are thus semiprivate rather than private. Parking again is on the street immediately in front of each dwelling. Because of the semiprivate nature of the grounds, the sidewalk and streets are not the clear extensions of the private realms of the dwelling units that they are in the row-house scheme; but even with all these limitations, the sidewalk and parking zone on the street will be considered by many residents as space over which they exert some control.

Figure 4.30 is the same four-block area shown in Figures 4.28 and 4.29, but now developed as a high-rise superblock at a density of 50 dwelling units to the acre. Each building entry serves 100 families by means of an interior circulation system consisting of a lobby, elevators, and corridors that are semipublic in nature. The grounds around the buildings are accessible to everyone and are not assigned to any building. The residents feel little association with or responsibility for the grounds. They feel even less association with the surrounding public streets. Not only are the streets distant from the units, but no building entries face them. The grounds abutting the sidewalks of the city streets are already public in nature, so the streets are public too. This design succeeds in making virtually the entire ground surface area of the four-block urban area public in nature. All the grounds of the project must be maintained by management and patrolled by police or a hired security force.

From a patrolling policeman's point of view, the row-house and garden-apartment schemes illustrated in Figures 4.28 and 4.29 are superior to the superblock configuration in Figure 4.30 because most of the grounds in these schemes are assigned to residents and controlled by them. The front entrances of row houses and of garden-apartment units are easily surveyed by patrolling police cars. Well-lighted front doors and paths, with lights over the entrances, also allow cruising police to perceive immediately any peculiar activity taking place on the street and near each building. The positioning of front entrances along the street also provides the streets with continuous natural supervision by residents.

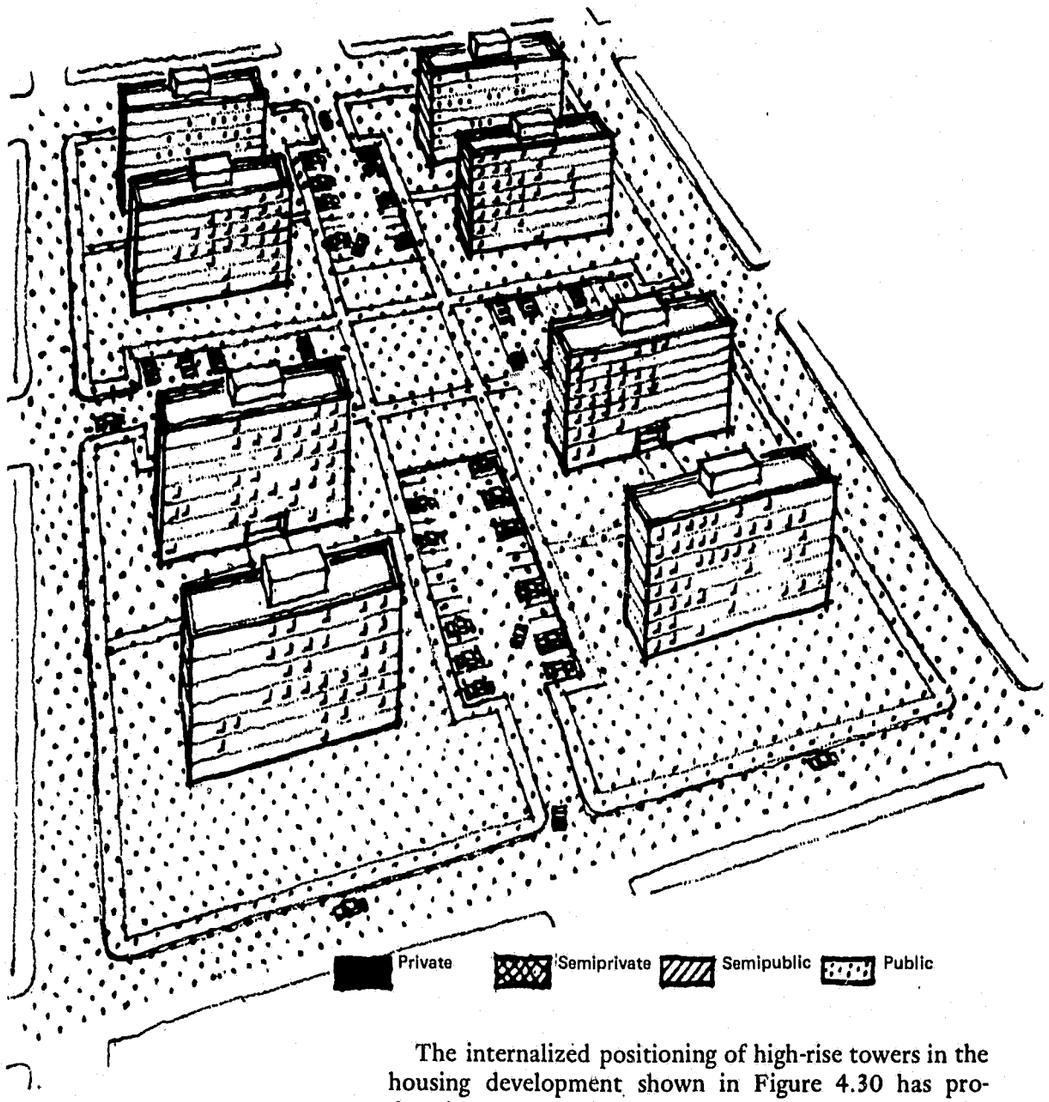


Figure 4.30: Four-city-block high-rise development; the streets and grounds are public in nature.

The internalized positioning of high-rise towers in the housing development shown in Figure 4.30 has produced a system of off-street parking and access paths that involve many turns and blind corners. Residents frequently complain about the dangers of using these parking areas and the circuitous paths, especially in large projects where the building entries face the grounds rather than the street. The proclivity of landscape designers for positioning shrubs exactly at turns in the paths increases the hazards of these access routes. This problem does not arise in the traditional row-house pattern, where buildings are set back only a few yards from the street, nor does it occur in high-rise projects where entries face the streets or are slightly set back from them. In these latter cases residents are able to scan the terrain they are about to use; they are able to move in a straight line from the relative safety of the public street to what they can observe to be the relative safety of the well-lighted lobby area in the interior of their buildings.

Buildings and parking areas located on the interior grounds of large projects tend to have a higher crime rate than those bordering or facing the surrounding streets. Residents identify the interior zones of large public housing projects as the most unsafe areas—as do residents in the surrounding community.[6] Despite the added protection of these grounds by Housing Authority police in New York, tenants of such projects prefer to use routes that lead to city streets rather than to take short-cuts through the interior project grounds.

Footnotes

1. Kohn, Franck, and Fox, *Defensible Space Modifications.*
2. Leon Kumove, A Preliminary Study of the Social Implications of High Density Living Conditions. Toronto: Social Planning Council of Metropolitan Toronto, 1966 (mimeo).
3. Lee Rainwater, *Behind Ghetto Walls.* Chicago: Aldine-Atherton, 1970.
4. In a comparison of tenant identification with and use of grounds in three N.Y.C. housing projects—a walk-up, a medium-rise, and high-rise (Brownsville, Van Dyke, and Bronxdale)—residents in the walk-ups (Brownsville) were found to participate in grounds cleaning and in planting flowers, etc. They also found these grounds safe. Residents at Bronxdale, a seven-story medium-rise with many moderate-income residents, did not view the grounds below as safe or feel they could control activity there. They also did not participate in any ground maintenance or planting. Residents in Van Dyke (a high-rise) rated the grounds as even more unsafe than did residents at Bronxdale, and felt even more disassociated and lacking in the ability to control activity there; their young children were not allowed down to the ground without an adult. Unpublished final report of research activity at the Institute of Planning and Housing, New York University, between June 1, 1970 and June 24, 1971, to the National Institute of Law Enforcement and Criminal Justice - NI-70-082.
5. Department of the Environment, Design Bulletin 27, *Children at Play.* London: Her Majesty's Stationery Office, 1973.
6. Newman, *Architectural Design for Crime Prevention*, pp. 92-94.

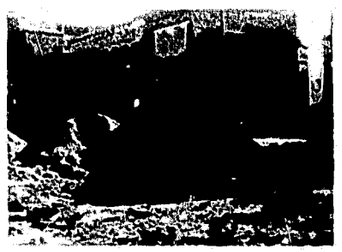
5

PROTYPICAL DESIGNS FOR TWO NEW HOUSING PROJECTS

In this final chapter we apply the different defensible space design principles developed in earlier chapters to the programming and design of two new housing developments. Our purpose is to demonstrate which of the principles come into play at different stages in the design process and how they all interact to produce a final integrated design product. The two housing developments used as prototypes here are real and will be built shortly: one is in Newark and the other in Indianapolis. The programs and sites for these developments are typical of most low- and moderate-income housing built in urban areas.

The site in Newark is located in an inner-city urban renewal area. It consists of seven and a half acres, made up of portions of four city blocks. The site presently contains the remnants of badly deteriorated nineteenth-century housing, which is slowly being cleared away (Figure 5.1). The new project will house a mix of both low- and moderate-income families and will use both New Jersey State Housing Finance Agency assistance and Federal Section 8 housing subsidies. The developers in Newark are required to achieve an over-all density of at least 40 units to the acre in order to pay for the cost of the land. This means that a total of 300 units (40 units/acre X 7½ acres) will have to be accommodated on the site.

Figure 5.1: Deteriorating housing on existing site in Newark.



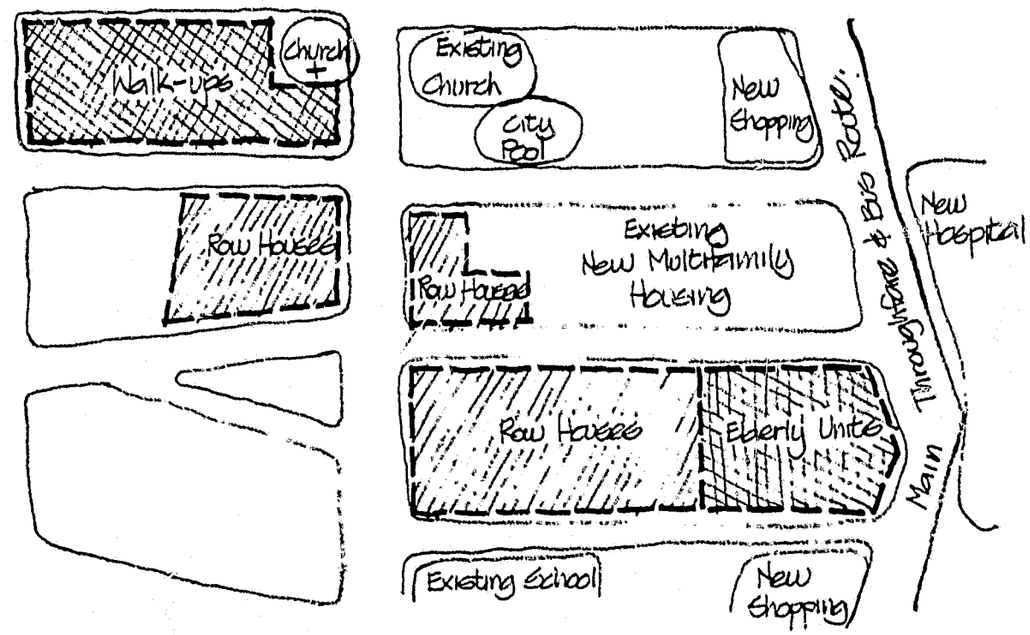
The local community organization, a nonprofit group acting as the developer in Newark, desires to provide housing for a variety of different family sizes and age groups. It is committed to housing about 140 elderly families and 160 families with children. In response to the anticipated demand for housing from the community it was desirable that half the elderly apartments be efficiency units and half one-bedroom units. The family

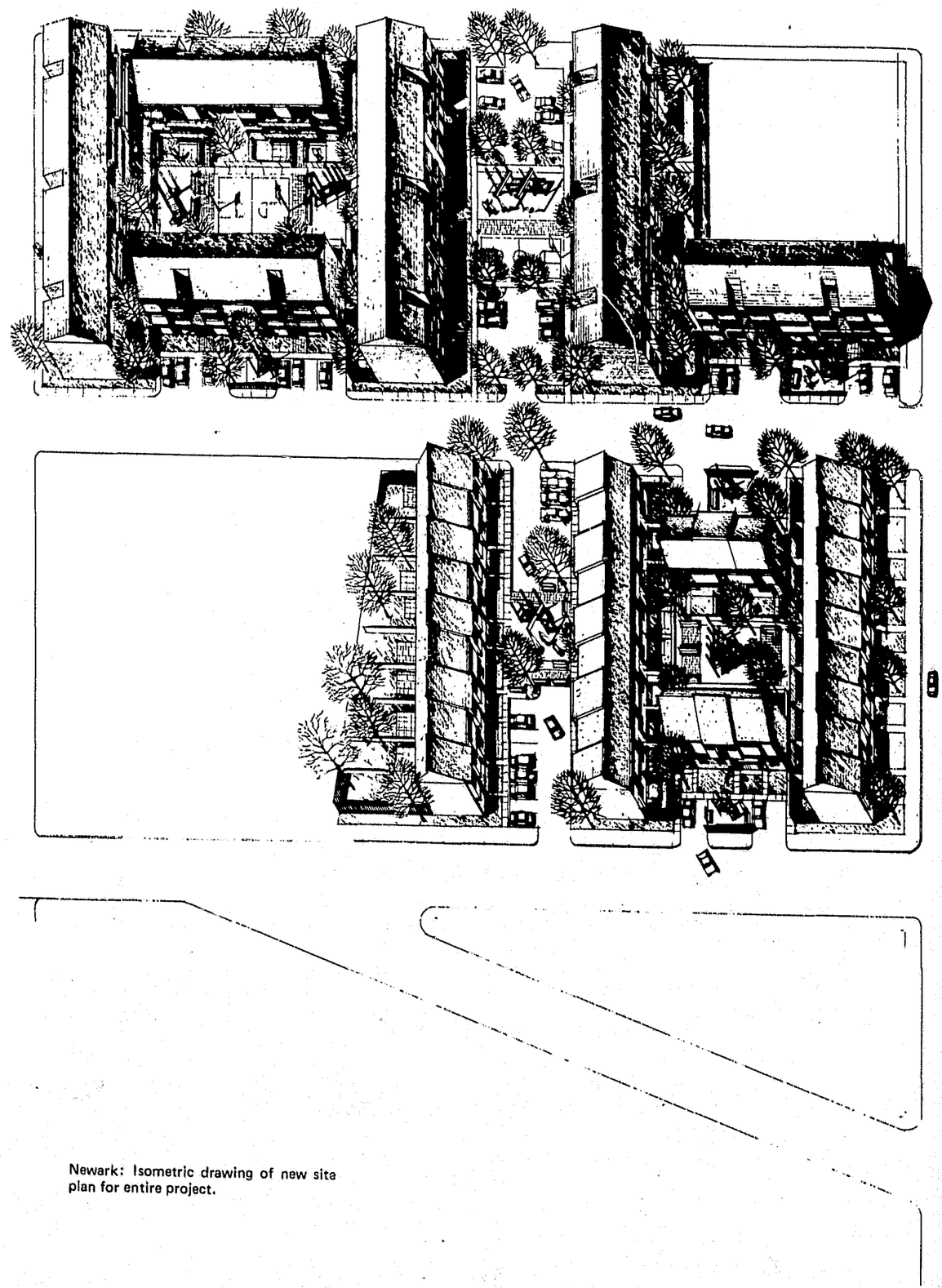
units will be provided as follows: 30% two-bedroom units, 50% three-bedroom units, 17% four-bedroom units, and 3% five-bedroom units.

Design Process: Newark

In the rank order of priorities set down in earlier chapters, the first design decision requires the separation of families of differing age groups and life-styles: in this case the separation of the elderly from families with children. A corollary to this design decision is the proper assignment of the different family types to the building types most suited to their needs. Thus the 140 elderly families will be placed in a single high-rise building and will be given a distinct and separate portion of the site for their own use. The building for the elderly and its associated grounds will be placed on the portion of the site that abuts the main through street in the area. This portion of the site is also directly opposite a new hospital and adjacent to the planned future shopping facilities (Figure 5.2). With this positioning the elderly will have easy access to mass transit facilities (buses) and be within easy walking distance from both shopping and medical facilities.

Figure 5.2: Rationale for the location of housing types in Newark. The units for the elderly were positioned within walking distance to the hospital, shopping, and the bus stop. The large family units (row houses) were positioned adjacent to and near the school.





Newark: Isometric drawing of new site plan for entire project.

An aerial view of the entire four-block development being proposed for the City of Newark. The high-rise for the elderly is located in the lower right-hand corner of the drawing. The three-story walk-ups are all located within the block in the upper left-hand corner of the drawing. The remainder of the project consists of row-house units. Only one portion of one existing street is being closed to through traffic. The major through street passes to the right of the high-rise building for the elderly.

The placement of elderly in their own high-rise building at a comparatively high density in turn allows us to house the families with children at lower densities in either row houses or walk-up units.

In the planning of the family units the second design principle comes into play: to minimize the number of persons sharing the entry to a building. Thus the families with a large number of children will be housed in the larger dwelling units, and these will all consist of row houses in which each family has its own entry. The families with few children will be housed in the smaller dwelling units, and these will be placed in three-story walk-ups. All the four- and five-bedroom units will therefore be built as row houses and all the two-bedroom units will be built as walk-up apartments.

Following this principle further, it is desirable that as many of the three-bedroom units as possible be built as row-house units. Because of the density requirements, the actual percentage of three-bedroom units that could be designed as row houses versus walk-ups was determined by what preliminary sketch plans revealed was the largest number of row-house units that could be accommodated on the site while still allowing us to meet the required over-all density and code requirements. These trials revealed that 60% of the three-bedroom units could be accommodated in row houses, while the remaining 40% had to be walk-up units (Table 5.1).

Table 5.1: Breakdown of Elderly, Row-house, and Walk-up Units, by Apartment Size

<table>
<tr><td rowspan="2">144
ELDERLY
UNITS</td><td rowspan="2">100% of
Elderly units
High-rise</td><td>50% 1 B.R. units</td></tr>
<tr><td>50% Efficiency units</td></tr>
<tr><td rowspan="4">172
FAMILY
UNITS</td><td rowspan="2">40% of
Family units
Row houses</td><td>3% 5 B.R. units</td></tr>
<tr><td>17% 4 B.R. units</td></tr>
<tr><td rowspan="2">60% of
Family units
Walk-ups</td><td rowspan="2">50% 3 B.R. units</td></tr>
<tr><td>30% 2 B.R. units</td></tr>
</table>

The third design principle is to assign as much as possible of the grounds of the project to specific residential units for the residents to both maintain and control. Parallel with this, it is desirable to group housing units into small clusters. The small size of the groupings enables the residents to readily identify one another; allows each family to feel some personal attachment to the shared grounds areas; and allows families to perceive themselves as part of an identifiable communal unit that is smaller than the total project.

For this cluster arrangement to work, the families that are grouped together must share similar needs for activity areas outside their dwelling units. The fact that the initial design guidelines advocate first the separation of families by type and second the assignment of different families types to the building types most suited to their needs creates a near certainty that those families who find themselves grouped together will share similar needs for communal areas outside their dwellings.

In the Newark plan the elderly units, the row-house units, and the walk-up units (or garden apartments) are grouped into their own "clusters." A "cluster" is a group of housing units that have been positioned to share the use of a particular grounds area. The grounds area assigned to a particular cluster is best defined physically by having the housing units themselves surround the grounds area to be shared. Real and symbolic barriers are used to further define the shared grounds areas. The entries to buildings and the windows of the dwelling units face onto the shared grounds areas. Finally, these assigned areas have facilities placed within them that address the recreation and parking needs of the adjacent residents.

Assignment of Grounds

As all the units for the elderly will be located in the high-rise building, and as the ground floor of the high-rise will be used for communal activities, it is impossible to subdivide and assign the grounds around the high-rise to individual elderly families, or even to small groups of these families. The grounds are therefore designed for the collective use of all the elderly residents within the high-rise building. This is a feasible solution because of the nature of elderly residents. The grounds area surrounding this building will be clearly separate and de-

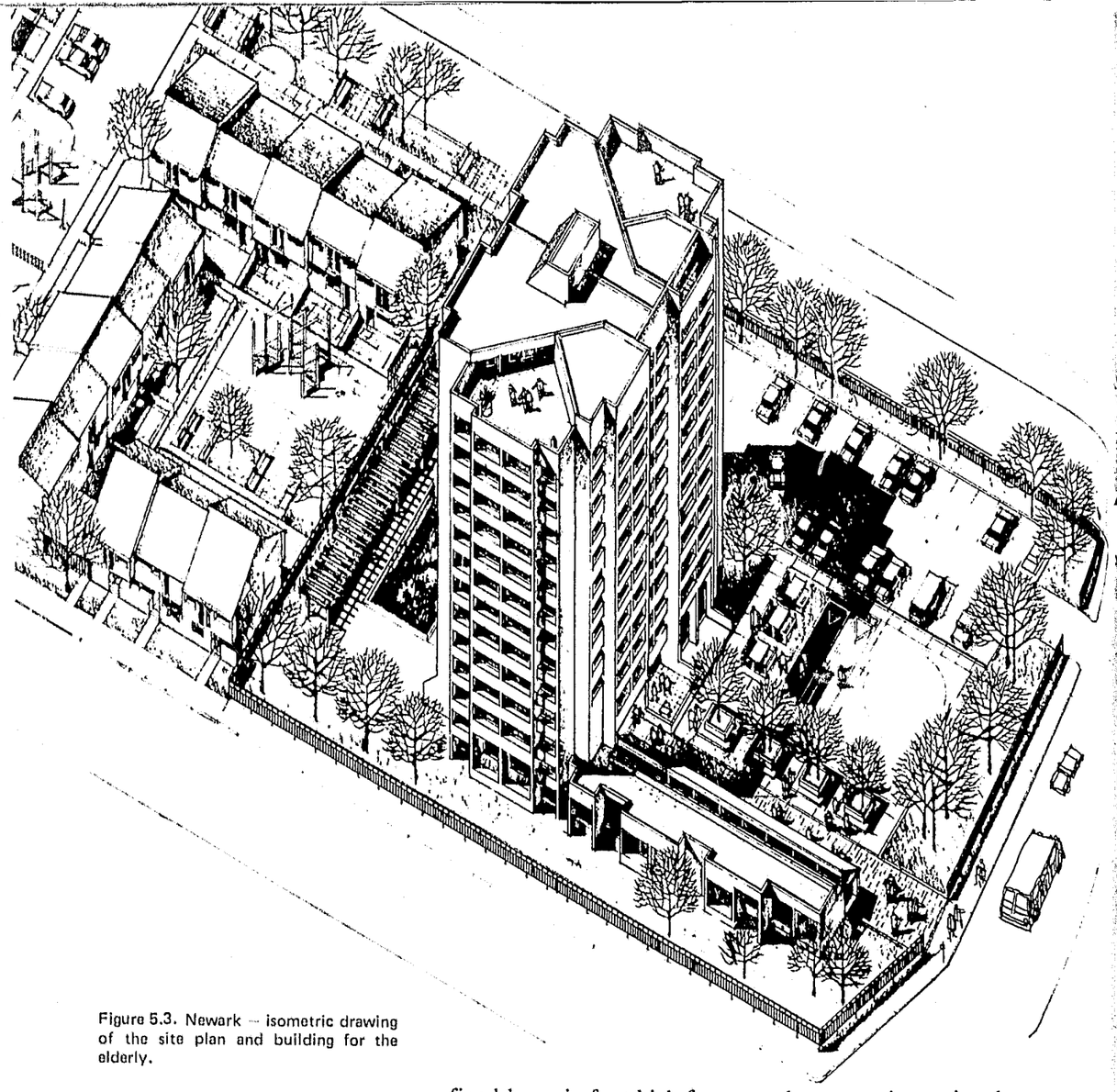


Figure 5.3. Newark — isometric drawing of the site plan and building for the elderly.

fined by a six-foot-high fence, so that access is restricted to the two designated entry portals of the site (Figure 5.3).

The rear courts of both the row houses and the walk-up units are designed so that only a small number of families are grouped together to share a court. The smaller the number of units that are grouped together in a court the greater the likelihood that each family will identify with the communal play area provided and that all families will agree on a rule system for the use and maintenance of the communal grounds. The local code

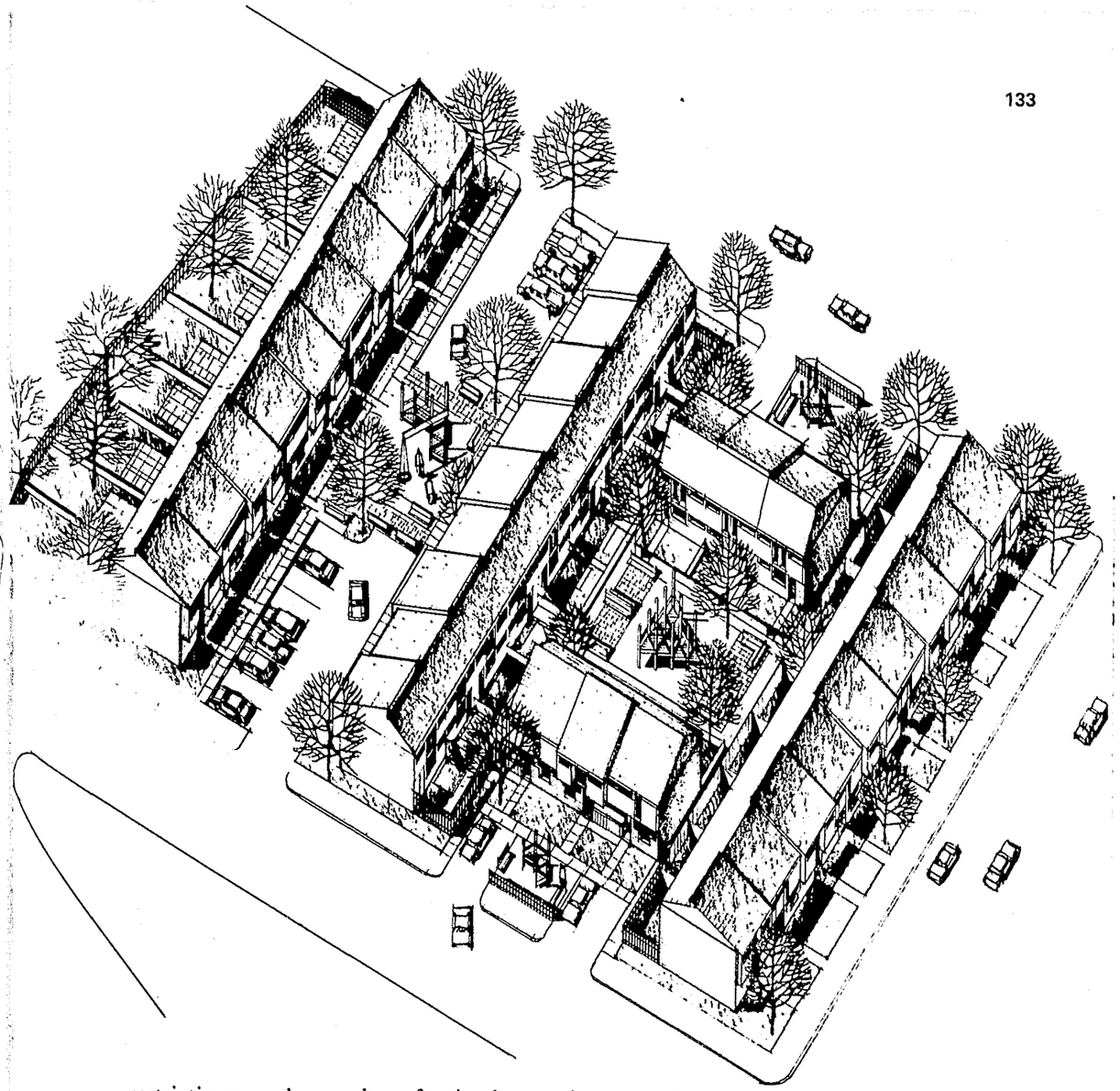


Figure 5.4: Newark — isometric drawing of row-house cluster.

restrictions on the number of units that can be grouped within a single building, the size and depth of each block of the site, and the defensible space principle advocating small clusters, together produced the solution presented.

In order to provide the maximum amount of juxtaposition between dwelling unit windows and enclosed rear grounds (and to minimize the amount of fencing needed) both the row-house and the walk-up buildings themselves were used as the dominant elements for defining the rear courts (Figure 5.4).

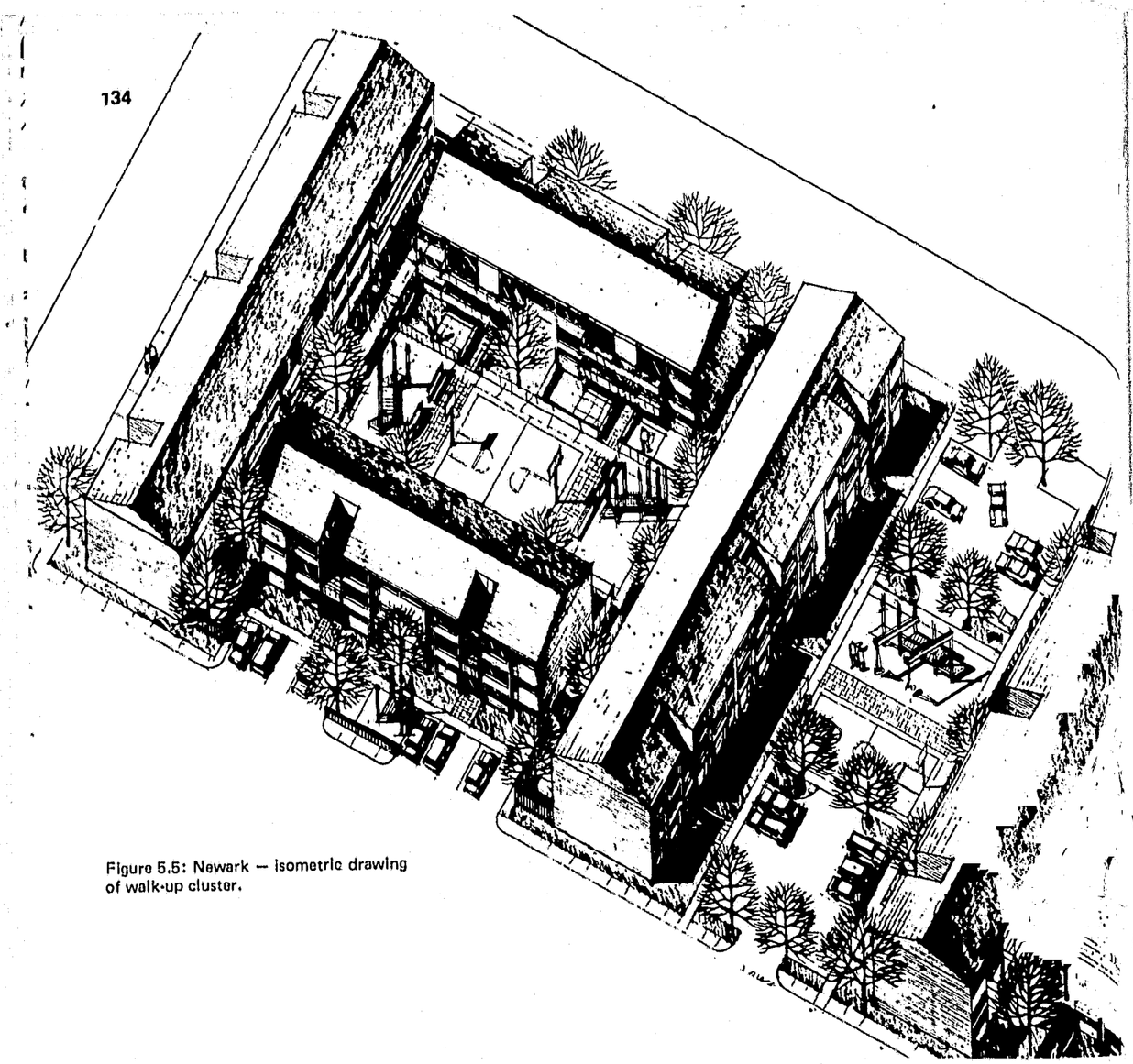


Figure 5.5: Newark — isometric drawing of walk-up cluster.

In addition to the collective grounds shared by all the families in a cluster, the families living in the row-house units have each been assigned their own individual grounds in front and in back of their units.

In the walk-up units the families on the ground level have been given their own outdoor patios at the rear of their units. The families on the second and third floors have large balconies that face the enclosed rear courts (Figure 5.5). Communal areas both at the rear and front of the walk-up units have also been provided for the use of small clusters of families.

The Building for Elderly Families

As mentioned earlier, the elderly complex in the Newark project was designed to form a distinct and separate portion of the site. The density of the elderly complex, if calculated independently, is 107 units to the acre. Because the elderly building is intended to function without hired security personnel, the buildings and grounds have been designed to aid the residents in controlling their own environment. The grounds of the complex have been designed with only one access area (two portals) facing the major public artery. The pedestrian and vehicular entries are adjacent to each other and positioned opposite the building entry so as to facilitate natural surveillance by residents sitting in the lobby or on the grounds of their building. The path between the public street and the building entrance forms a short straight line so as to allow residents and visitors to view the walk, building entry, lobby, and elevator waiting area before leaving the public street.

The lobby of the building is provided with seating areas and card tables to encourage residents to gather informally in and around the entry and elevator waiting area. This helps to create a condition whereby residents can easily and continually monitor everyone coming into the building (Figure 5.6).

The ground floor of this building has been given over entirely to communal facilities directed to the needs of the elderly residents. The area immediately to the left of the entry door will house the building's administration offices and a medical suite. Opposite the entry is a set of doors providing access to the grounds at the rear of the building. These rear grounds are designed for comparatively passive activity, in contrast with the grounds in front of the building, which contain play courts for active games.

To the right of the elevators are a kitchen and dining area, designed to seat and serve about 100 persons at any one time.

Sofas, card tables, and a library are located to the right of the main entry, opposite the elevators. The front of the building opposite the elevators (the side facing the street) is glazed floor to ceiling to allow visual surveillance and easy monitoring of outdoor and indoor activities by residents.

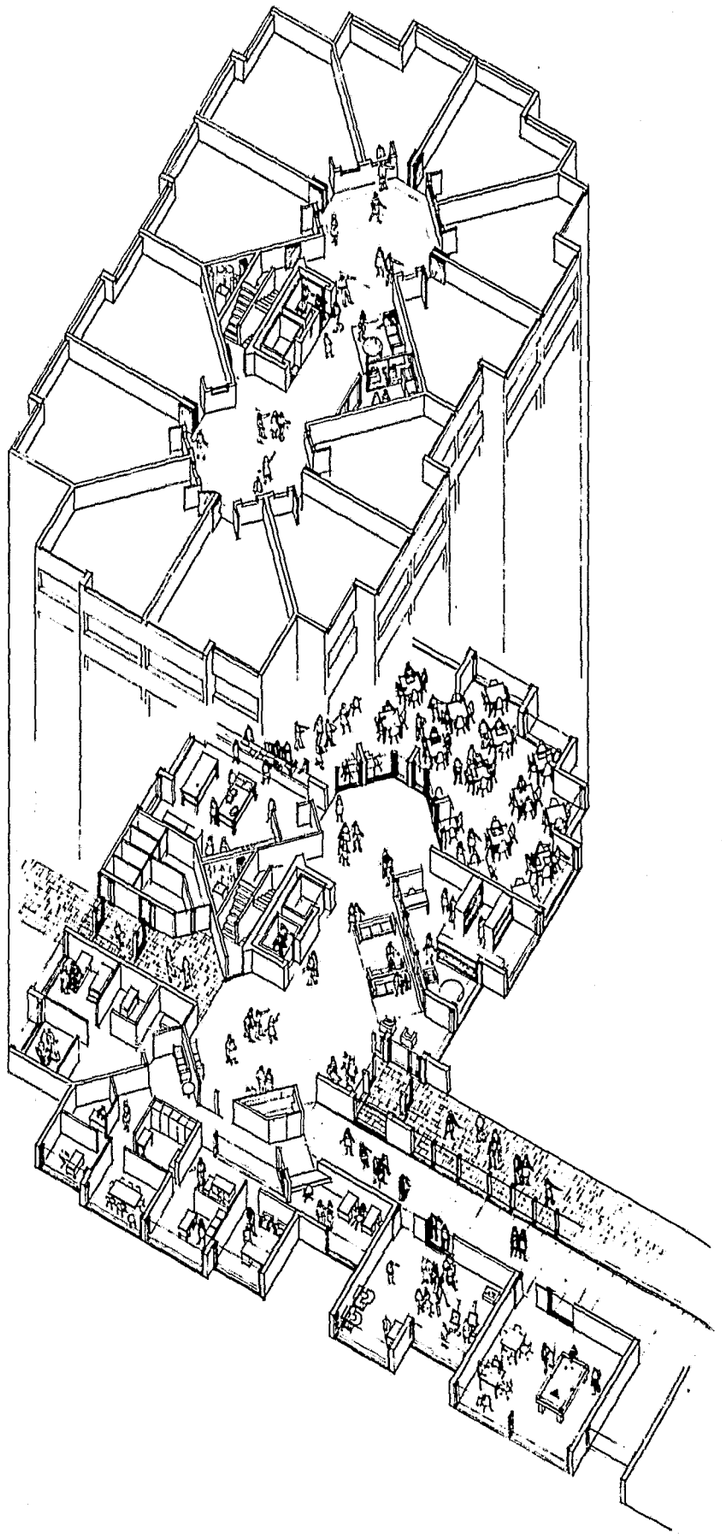


Figure 5.6: Newark — isometric drawing of the elderly building, showing interior of ground floor.

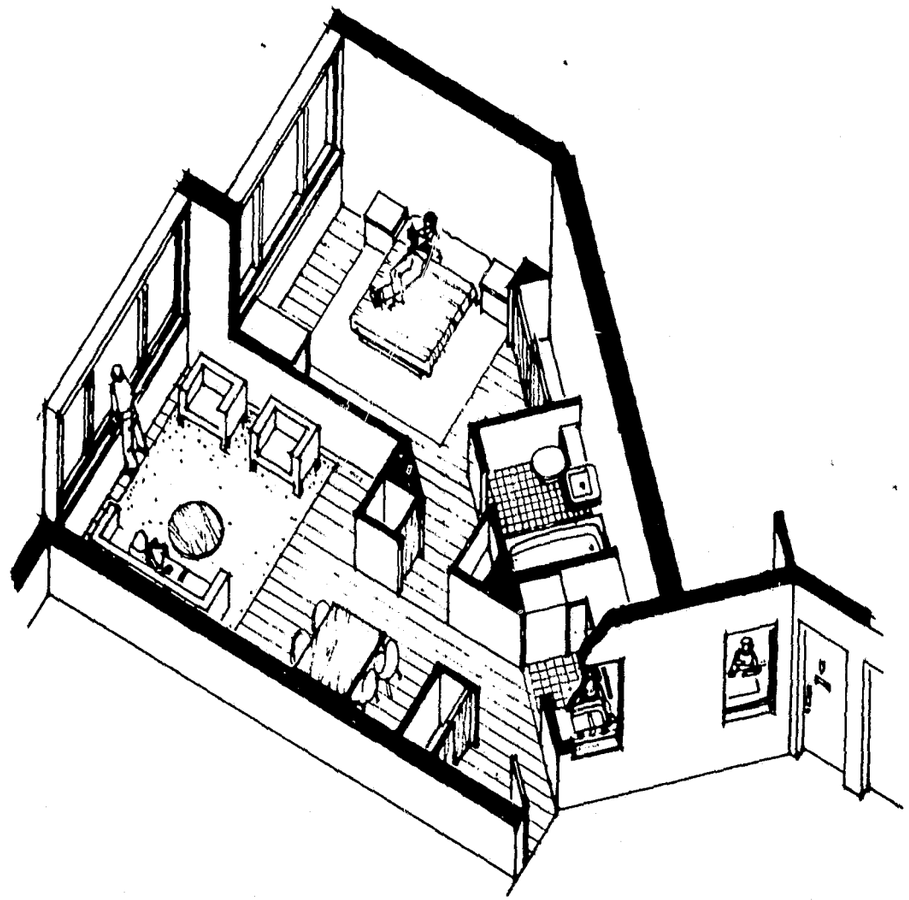


Figure 5.7: Newark — isometric drawing of an elderly apartment unit.

The ground floor of the building has been given an additional wing that extends along the entry walk. This wing houses arts and crafts and game rooms. Although this additional wing may be seen as somewhat of a luxury by some communities, it is justifiable here because this building will serve a wider function as a golden-age center for the surrounding community.

The community circulation area of the typical floor of the building was designed as an alternative to the standard long, double-loaded corridor building. In this floor plan all of the 12 apartment units have their doors opening onto interior courts (Figure 5.6). There are two courts per floor, each court serving six apartment units. Each apartment unit has been provided with a window that faces onto its court. The windows are located in the kitchen area of the apartment units, adjacent to the entry door. These windows are made of a nonbreakable, fire-resistant glass (Figure 5.7).

On each floor the area opposite the elevator has been provided with a sofa, chair, and table. The common laundry facilities for each floor are also located here, behind glass partitions. From the window of each unit it is possible to see every door and window in a six-unit court. In addition most residents can, from their windows, observe activity in the elevator area, the lounge, and the laundry room.

Different from families with children, who tend to be inwardly oriented, and different from working singles and couples, who tend to be career oriented and so occupy their apartments minimally, the retired elderly are gregarious. The elderly, who normally live alone once their children are grown and gone, actively seek out the companionship of other elderly. The layout of the individual floors and of the entire building is directed at providing opportunities for residents to get together. Many people are shy by nature, and although they may desire the companionship of others they are reluctant or incapable of striking up conversations with strangers or otherwise initiating contact. On each floor of the building sofas have been placed opposite the elevators and adjacent to the laundry room to invite residents to sit in the public area and so provide the opportunity and excuse for meeting other residents.

Similarly, the windows of each unit allow residents to both see out and be seen. A resident busying himself or herself in the kitchen can see the comings and goings of other residents, can see other residents sitting in the lounge area at the elevators or going to do their wash. Residents can use the excuse of face-to-face contact as an opportunity to join others in different activities. In standard double-loaded corridor buildings residents are hidden behind their locked and blind apartment doors. The opportunities or excuse for chance encounters between residents are limited, thus further reinforcing residents' feelings of being isolated and forgotten.

The wedge-shaped plan of each elderly apartment unit was dictated by the desire to group the units so as to create the two interior courts at each level. The kitchens of the units were placed near the entry door for the visual opportunities just noted. Residents who desire privacy within their kitchens can hang a curtain over the window and pull it closed when they please.

The lounge and activity areas on the ground floor of the building and the grounds around the building provide additional opportunity for chance encounters among residents.

By facilitating observation in the public areas of the building, by enabling residents to recognize their neighbors easily, and by stimulating the use of the common public circulation areas outside the individual apartment units, this design enables residents to survey and control the use of the public areas of the building and its grounds—thus improving the building's security.

Design of the Row-House Units

The governing principle in the site planning and design of the row-house units is that a large portion of the grounds surrounding each unit be assigned for the use of individual families. Further, it is desirable that much of the grounds at the rear of each unit be made private in nature—that is, that the grounds at the rear serve as the private outdoor space of each family. To ensure both the genuine privacy of this outdoor space and the security of the doors and windows in the rear of the dwelling unit, there can be no access available between the private rear yard areas and the public streets in front of the units. Thus the only access to the private area of the home and its rear yard must be through the front door of the unit.

In the traditional single-family house there are normally two doors to the unit: a front door and a side or rear door. This allows members of the family to use the side or rear door for everyday access to the unit, while the front door is used only for occasional formal access by guests or visitors. In this traditional arrangement the formal part of the house is adjacent to the front door of the unit and contains the formal living room and dining area of the house. These are rooms that are not in continual use by all the members of the family, or, to put it another way, rooms that the family's children occupy only with adult supervision and control. By contrast, the side or rear door of the traditional single-family house normally opens on to the kitchen and the informal dining and living areas of the house.

Figure 5.8a: HOME: the private realm of each family.

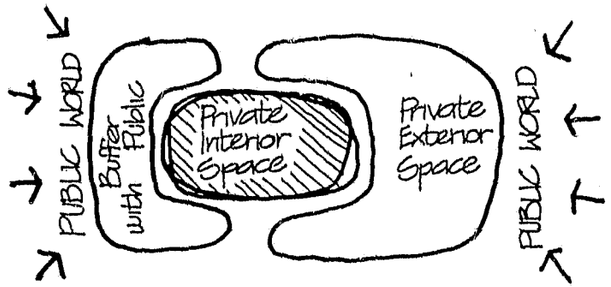
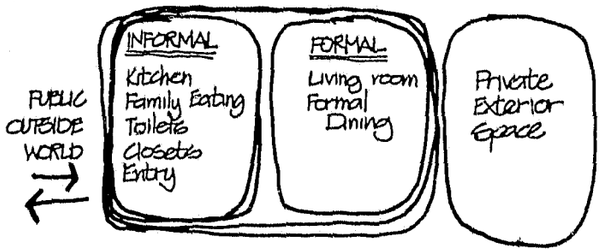
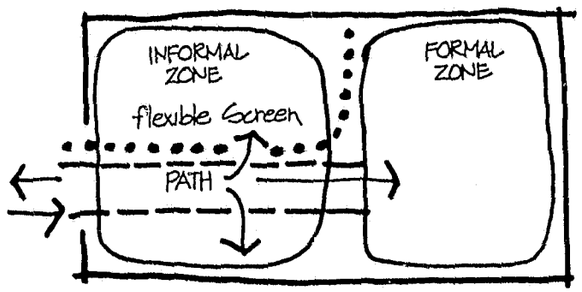


Figure 5.8b: The informal and formal zones of HOME.



- The INFORMAL ZONE is heavily trafficked — it should relate directly to the outside world.
- The INFORMAL ZONE is a work area — it is normally cluttered and unkempt. It is not for *show* but for *use*. The FORMAL ZONE is for *show*.

Figure 5.9: Access to formal and informal zones.



- If only *one* entrance is available from the public outside world, then the path from that one entrance must lead to *both* the *informal* and *formal* zones of HOME.
- The cluttered *informal* zone must on occassion be shut off from view.

In our design of the single-family house with only one entry to the public street, therefore, it was necessary (1) to position the more informal, frequently used, and heavily trafficked areas of the house adjacent to this entry (Figure 5.8); (2) to allow direct access to the formal areas at the rear of the house from this same door, while screening off the informal areas that are normally in a state of disarray (Figures 5.9 and 5.10).

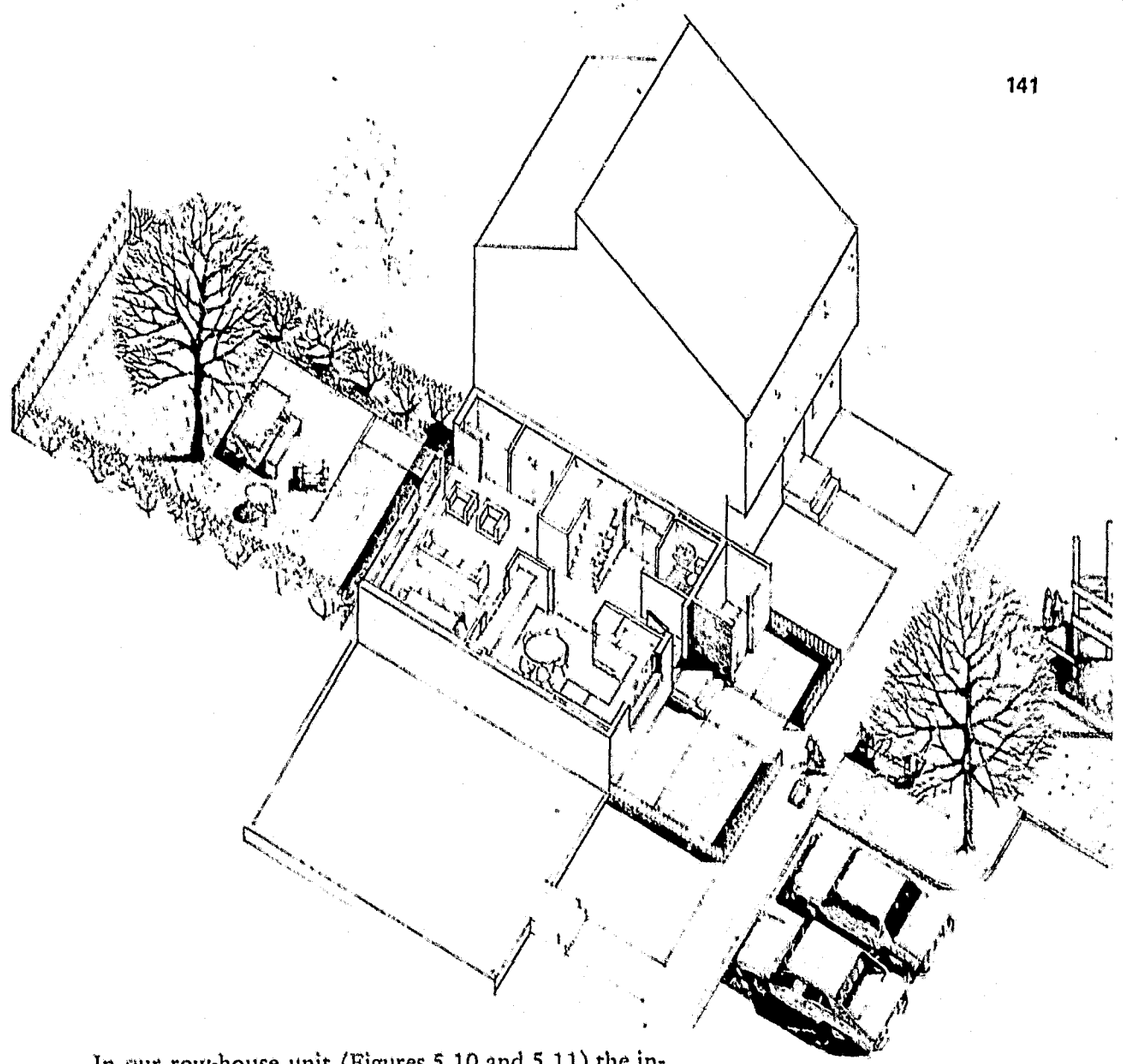


Figure 5.10: Newark — isometric drawing of row-house ground floor.

In our row-house unit (Figures 5.10 and 5.11) the informal wing of the house, the kitchen and family dining area, are located in the front of the house immediately to the left of the entry to the street. The formal wing of the house, the living room and formal dining area, are located at the rear of the house facing the private rear yard of the family. There is a short central corridor that leads directly from the entry to the formal living area. The informal kitchen/dining area is provided with sliding doors to allow it to be sealed from view quickly and completely.

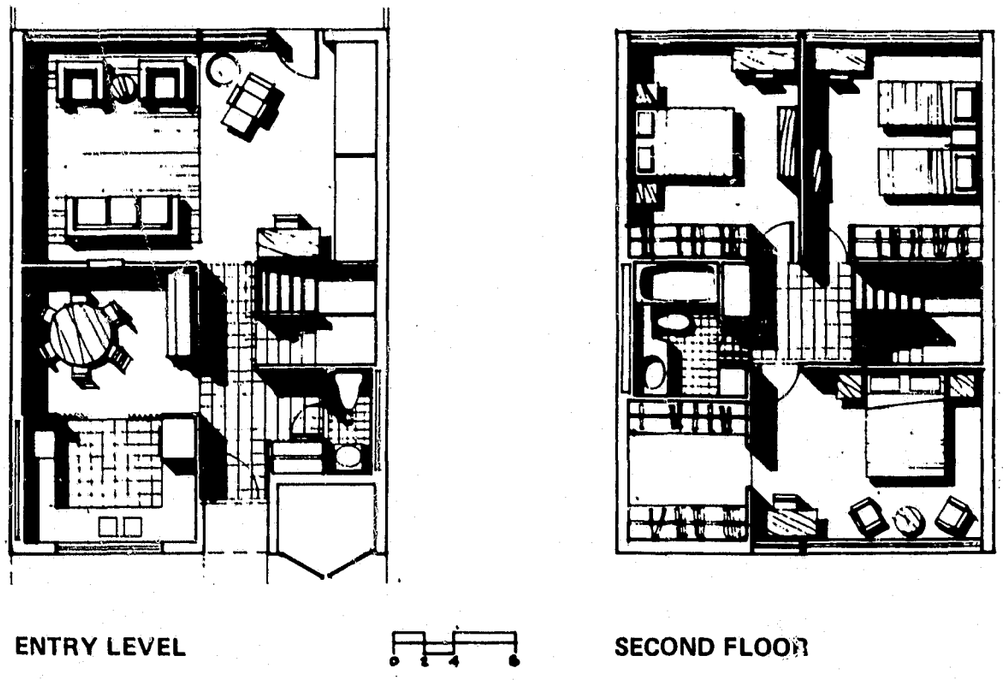
Immediately to the right of each unit's public entry door is a clothes closet and a bathroom containing a toilet and basin. Children can thus clean up just as they enter and before being allowed access to the remainder

of the house. With this positioning of the ground-floor bathroom children also can dash into the house, relieve themselves quickly, and go back out to play without having to take off their cold- or wet-weather clothes and without having to track through the rest of the house. The front portion of the house containing the kitchen/dining area, bathroom, and clothes closet is floored with tile so it can be washed down and cleaned easily. This area has also been positioned so as to allow the adult in charge of the house, who will normally be working in the kitchen/dining area, to supervise children's outdoor play in front of the unit and to control access to the rest of the house. It is not uncommon for members of families with children to take meals independently of one another and at varying times of the day. The design and positioning of the informal kitchen/dining area facilitates the preparation and eating of snacks on the run.

Access to the bedrooms on the second floor of the unit is by a stairway off the same entry vestibule. This was designed to allow children and other family members to go to their rooms directly without having to go through the formal part of the house.

The formal area at the rear of the house contains a living room and an area for formal dining. This formal

Figure 5.11a: Newark — plan of entry and upper levels of typical three-bedroom unit.

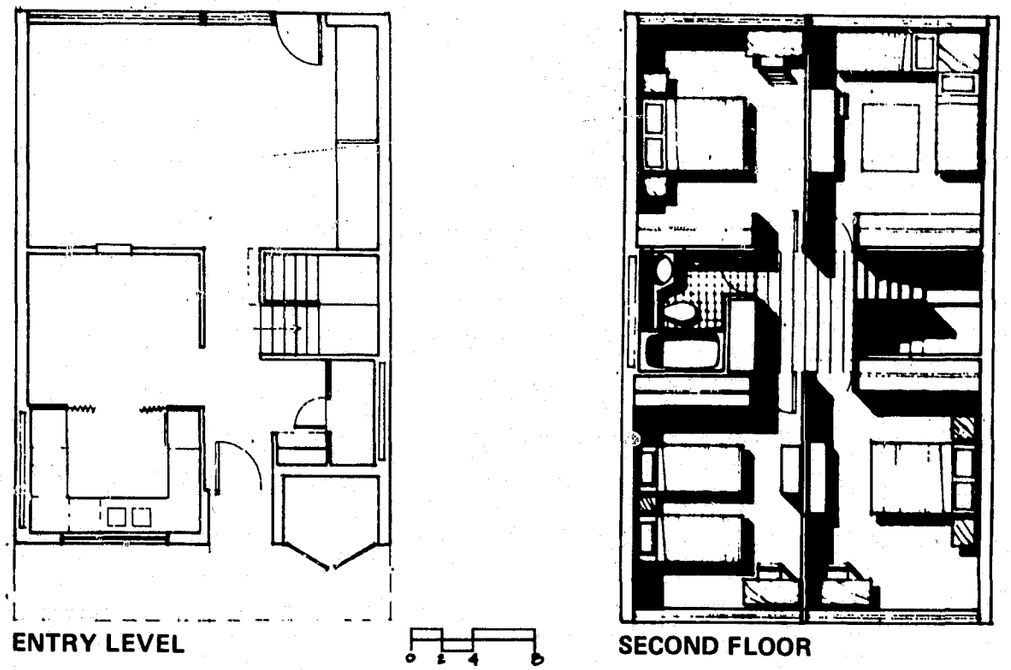


dining area is positioned to allow the easy passage of food across the counter from within the kitchen. Sliding panels at counter level are provided to allow for the passage of food and for sealing off the kitchen. The entire rear wall of the living room has been designed with windows looking out to the private yard at the back. This provides a strong association between the dwelling-unit interior and the family's private outdoor grounds, and serves also to expand the feeling of space in the living room.

As all the row-house units are actually quite small, an endeavor was made to produce as spacious a feeling as possible by creating long sight lines throughout each house. On entering a unit one can see a relatively long distance in two directions: through to the living room and into the rear yard, and up the stairs to the second floor. Through the use of these long sight lines the structure and layout of the entire row-house unit is made comprehensible at a glance.

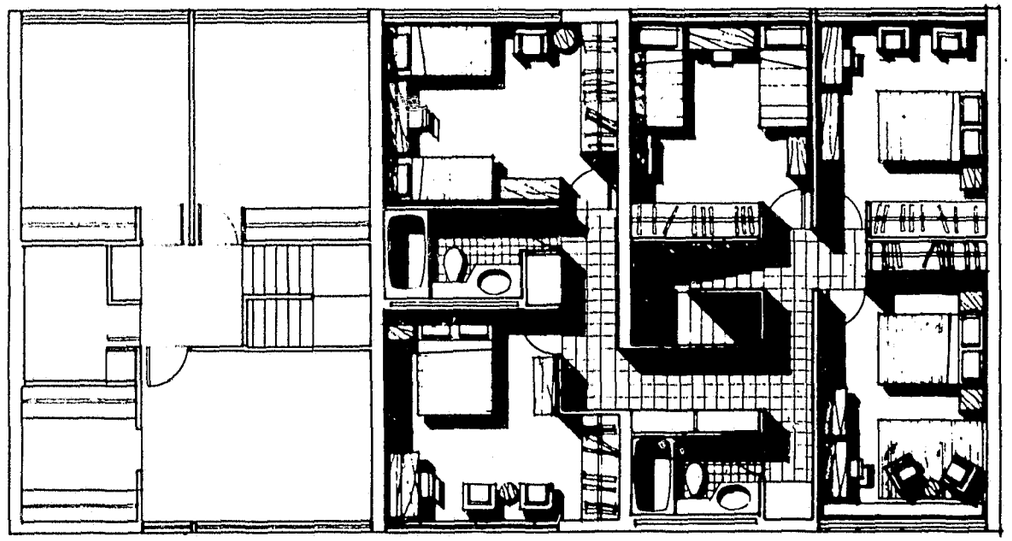
In order to achieve some of the cost benefits of mass production the three sizes of row-house units (three, four and five-bedrooms, Figures 5.11a, b, c) have all been designed to use the same ground floor plan. The four-bedroom unit (Figure 5.11b) cantilevers slightly

Figure 5.11b: Newark — plan of entry and upper levels of typical four-bedroom unit.

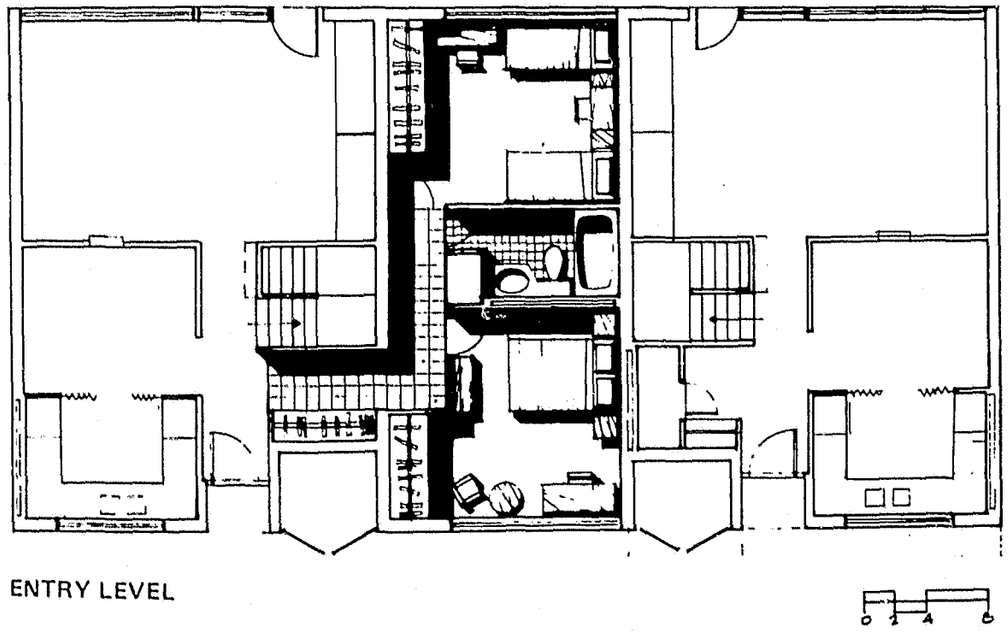


over the end walls, and the five-bedroom units (Figure 5.11c) make use of a single-floor extension that is located to one side, alternately at the ground level and at the first-floor level. These extensions key together to produce a single two-story volume.

Figure 5.11c: Newark — plan of entry and upper levels of typical five-bedroom unit.



SECOND FLOOR



ENTRY LEVEL

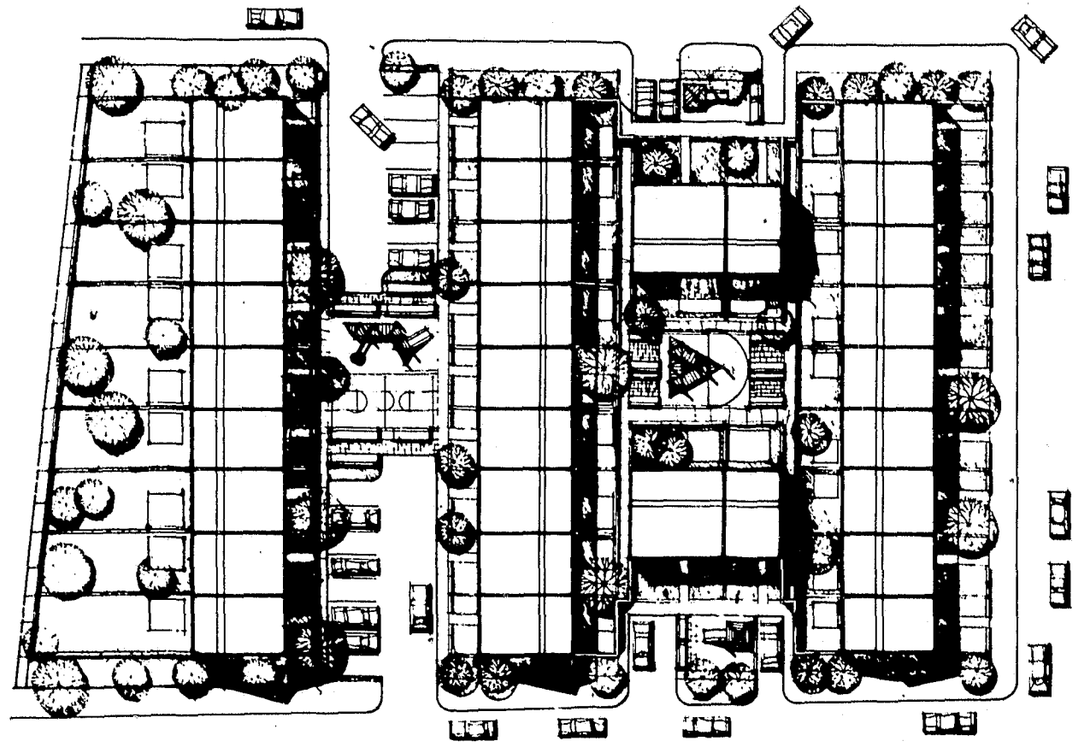


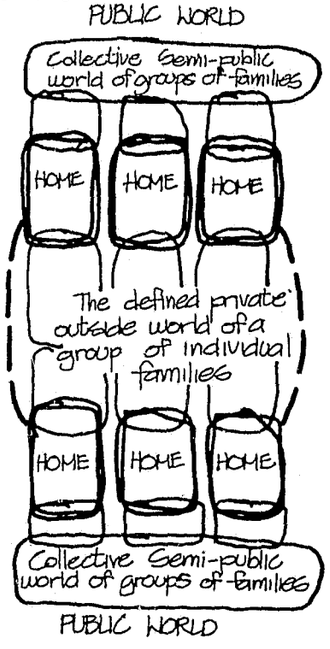
Figure 5.12a: Newark -- Site plan of a row-house cluster, including parking and play areas.

The private yard at the rear of the row-house unit is intended as quiet space for the use of the family, away from the tumult of children at play. This place is intended to be used for outside family dining in warm weather; as a place where the adults of the family can have a quiet drink at the end of the day, alone or with company; and as a place where a very young child—up to four years of age—can be left outside to play alone in safety.

Play areas for children three to 10 years old are provided in the common interior courts behind the individual rear yards (Figure 5.12). Access to these play courts is via each family's private yard. Play areas for older children are located at the front of the dwelling units, where children have more ready access to other children and can observe outdoor activities.

Parking space for each family's car has been located immediately in front of the family unit. Both the older children's play areas and the parking spaces are within view of the kitchen window of each unit. This both facilitates surveillance and sets up a direct association between the dwelling unit and these outside areas. This positioning, and the associations they are intended to encourage, will serve to extend the zone of influence of the dwelling unit to include the street.

Figure 5.12b: Organization of row-house grouping.



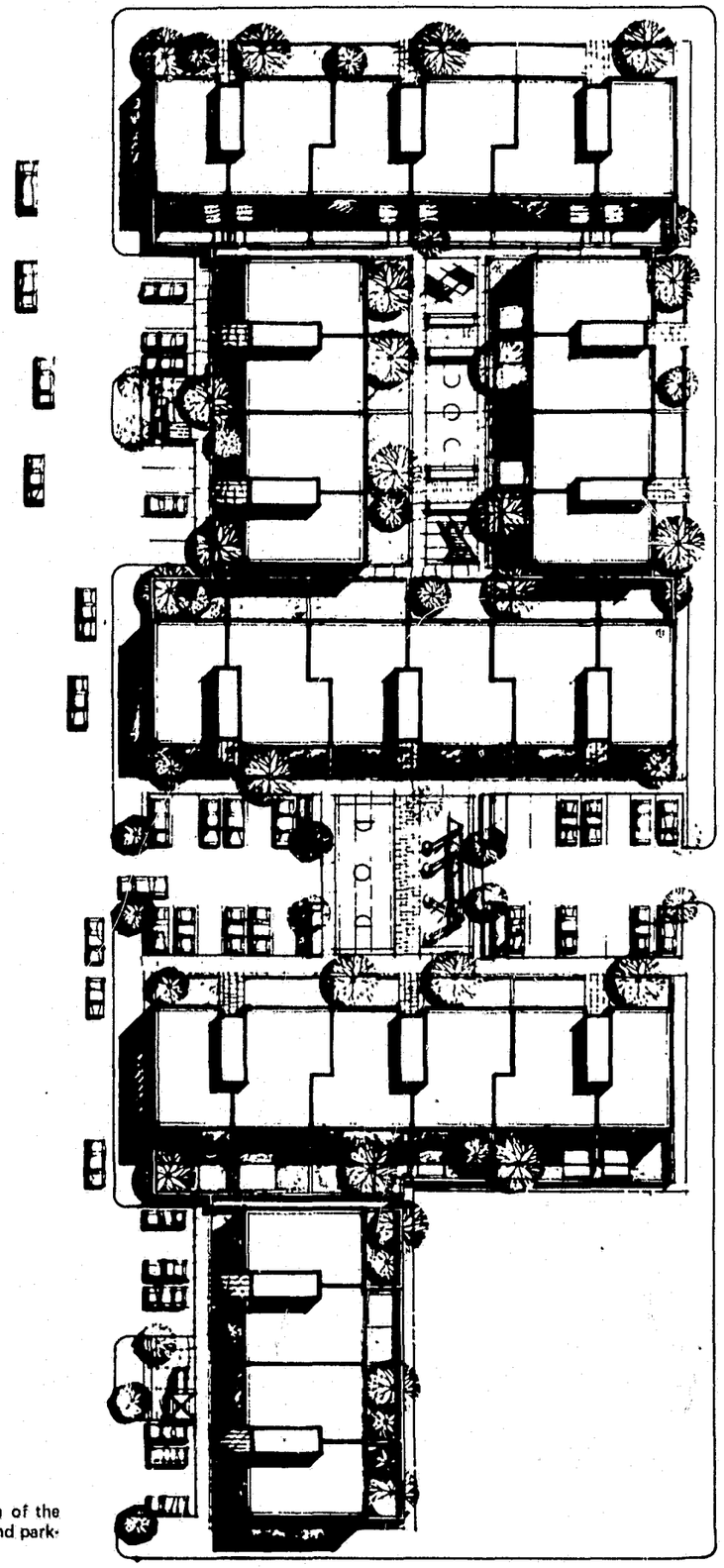


Figure 5.13: Newark — site plan of the walk-up cluster, including play and parking areas.

The parking requirements in Newark are for 0.5 cars off-street parking spaces per unit. The 50% allowable on-street parking will be curbside parking in front of the entries to the units. To accommodate the 50% off-street parking, while still answering our own requirement of locating parking space in front of the unit, we have created cuts in the existing city blocks for access and parking. These cuts also provide play areas and access to the front doors of the units.

Design of the Walk-up Units

The walk-up units (Figures 5.13 and 5.14) are grouped together on one city block of the Newark site. The configuration of the blocks of buildings is similar to the row-house units, in that buildings are grouped together to create interior courts. Access to these interior courts

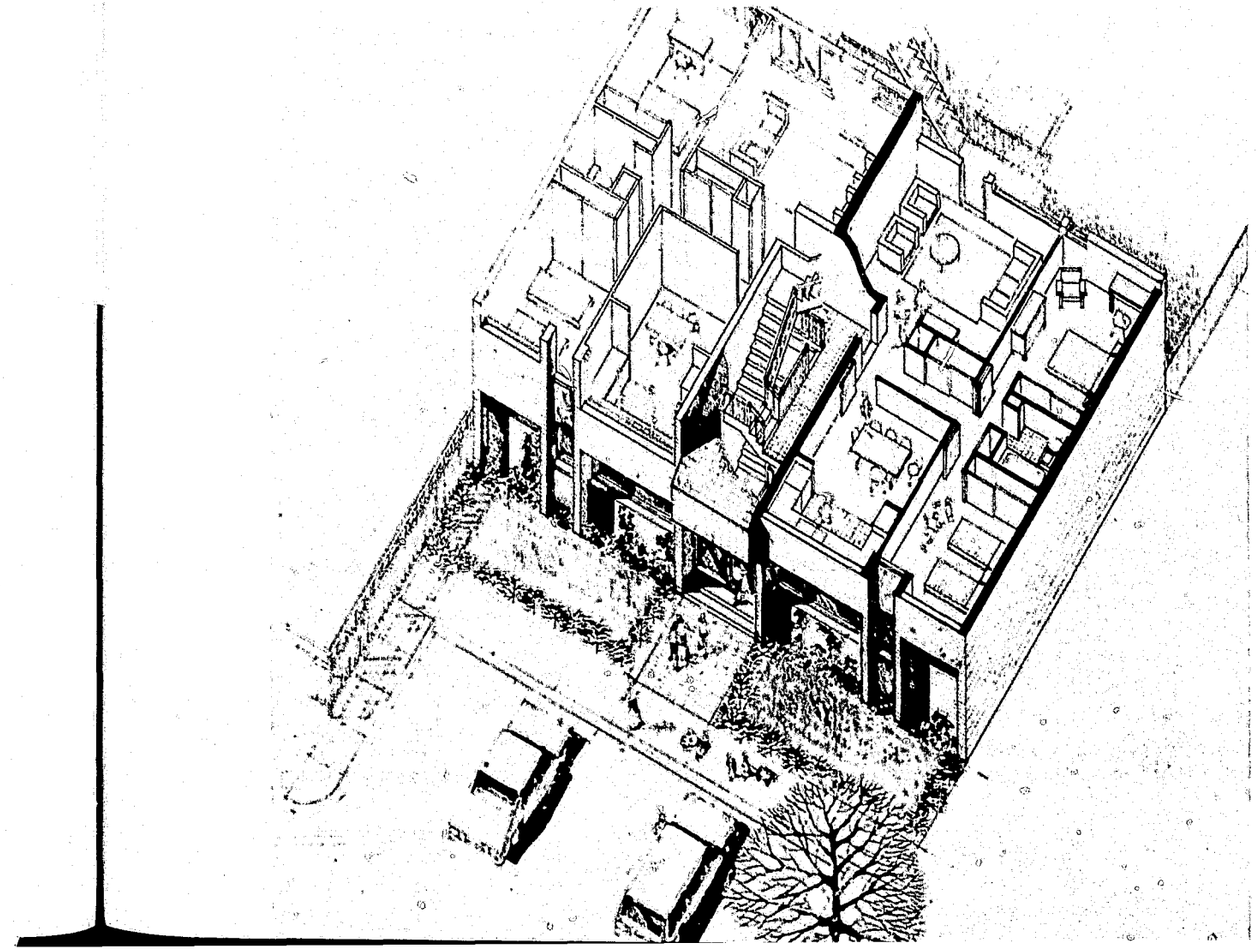
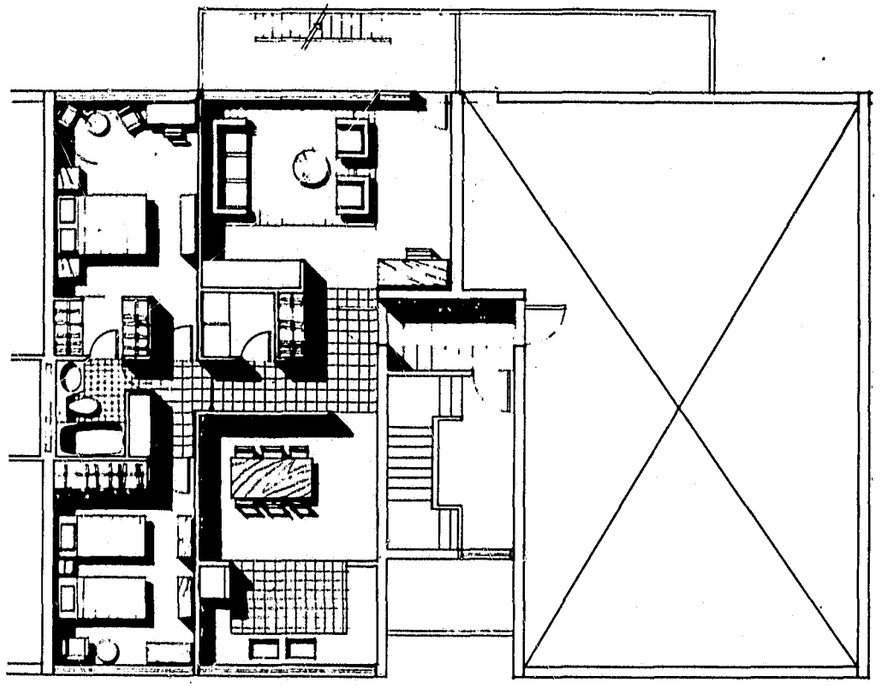
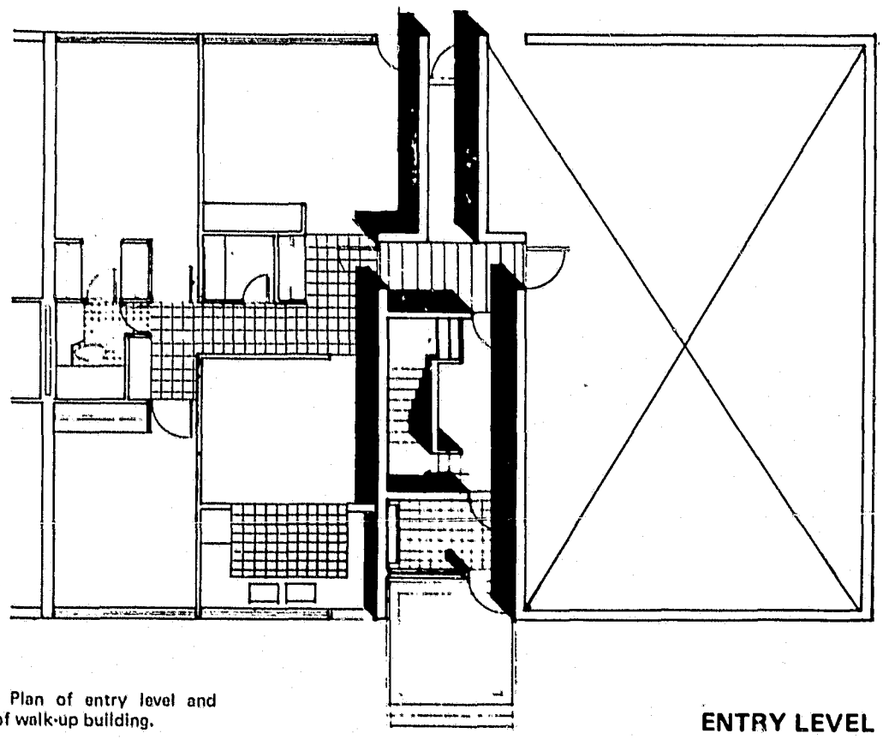


Figure 5.14a: Newark — isometric drawing of walk-up, showing interior of building and apartment.



TYPICAL FLOOR



ENTRY LEVEL

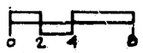


Figure 5.14b: Plan of entry level and typical floor of walk-up building.

is provided only through the interior lobby of each of the buildings serving six families. As in the row-house blocks, a six-foot-high steel fence between the buildings restricts access to these rear courts from neighboring streets.

The walk-up buildings have their entries defined by setbacks in the facade of the building (Figure 5.14). Each entry serves six families, two per floor for a total of three floors. The entry door to each apartment unit immediately abuts the central access stair. This provides residents with mutual supervision of the common access stair and the apartment door opposite their own. It also brings much of this semiprivate vertical circulation space into the zone of influence of the apartment units.

The apartment unit itself is laid out so that the entry door is central to the apartment. This allows residents and guests direct access to either the kitchen/dining area, the living room, or the bedrooms and washroom from the entry position. The apartments are designed with the kitchen windows facing the front of the building and adjacent to the building entries to facilitate residents' surveillance of their building entries, their cars, and the children's play areas located in the more public area of the site.

The living rooms of the apartment units face the common rear court shared by 60 families. The stair leading from the balcony to the grounds below also provides the required second means of egress from the second and third floor apartments in the event of fire.

Each of the families occupying the ground-floor apartments is provided with a small patio at the rear of the building. The patio is accessible from a door in the living room. Families living on the second and third floors have openings off their living rooms that face onto the rear communal court.

Some play areas are provided at the front of buildings, but most play facilities for all age groups are provided in the interior courts common to four buildings

Design Process: Indianapolis

The sequence of design principles employed in the development of the Newark project was also followed in the design process for Indianapolis project. The primary differences in the two designs result from the different nature of the two sites and the variation in the housing program and density requirements.

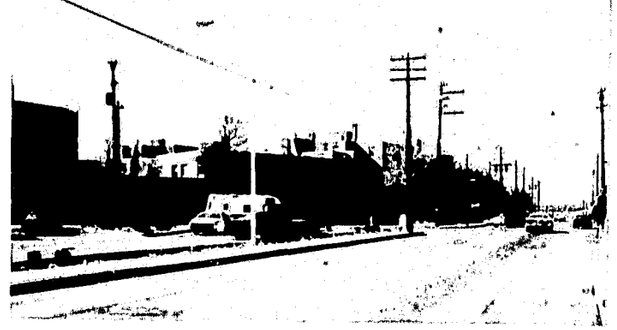


Figure 5.15: Existing site in Indianapolis, showing some of the former housing project.

The Indianapolis site is being developed solely as public housing. The Indianapolis Housing Authority desires to provide housing for large, low-income families and for elderly. The site, 11.5 acres, consists of one large parcel of land uninterrupted by any city streets. (This excludes the portion of the site assigned for commercial uses.) The site was previously occupied by a public housing project that was built in the late 1930s and is now being demolished (Figures 5.15 and 5.16).

The density requirements in Indianapolis are significantly lower than those in Newark, 21 units per acre over all, versus about 40 units per acre. The Department of Housing and Urban Development will be providing funds for the construction of the project. Because of the strong demand for housing by families with children, the Housing Authority has set down the following program for the family units: 60% three-bedroom units, 30% four-bedroom units, and 10% five-bedroom units. Ten % of all these units are to be designed for the use of families with a handicapped person in the household. The lower density requirement has allowed us to place all the units that will be occupied by families with children in row-house buildings. (The row-house units, considered independently of the building for the elderly, achieve a density of 12 units per acre.)

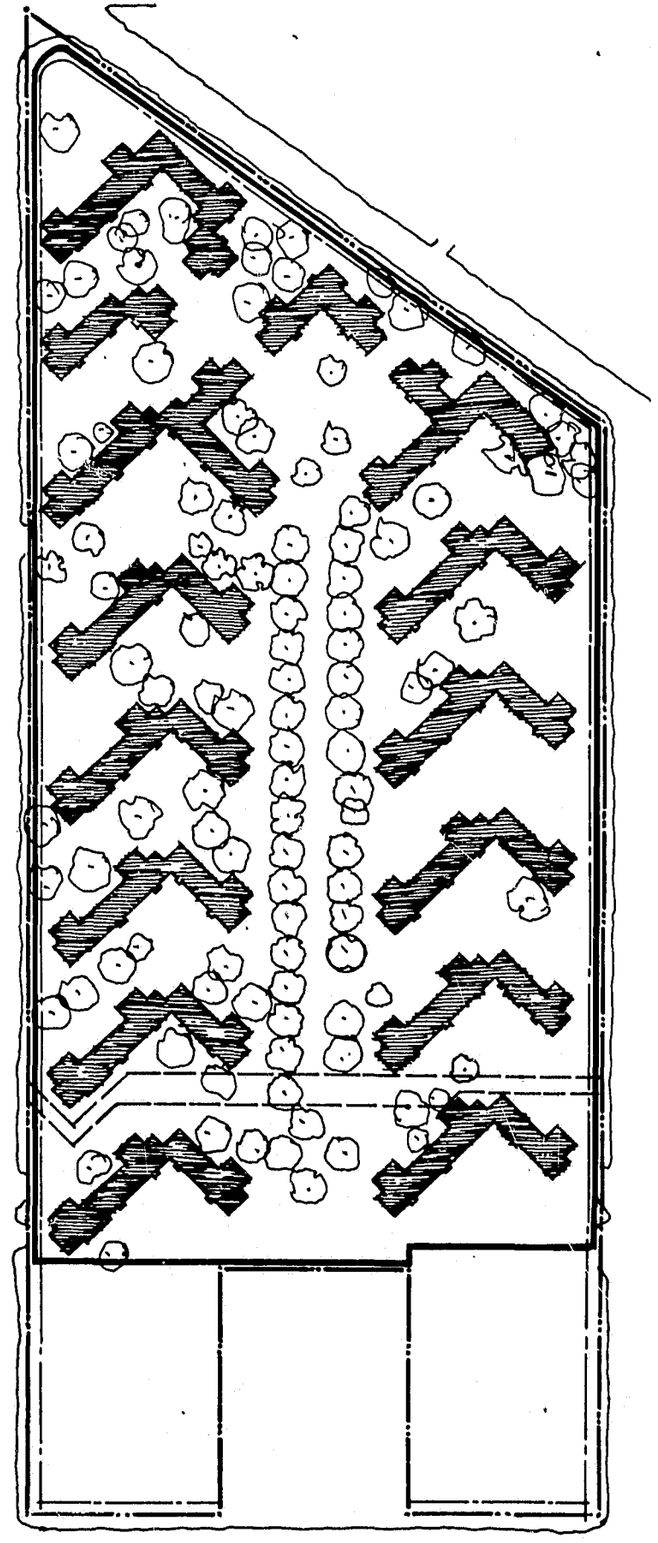


Figure 5.16: Indianapolis — site plan of existing project.

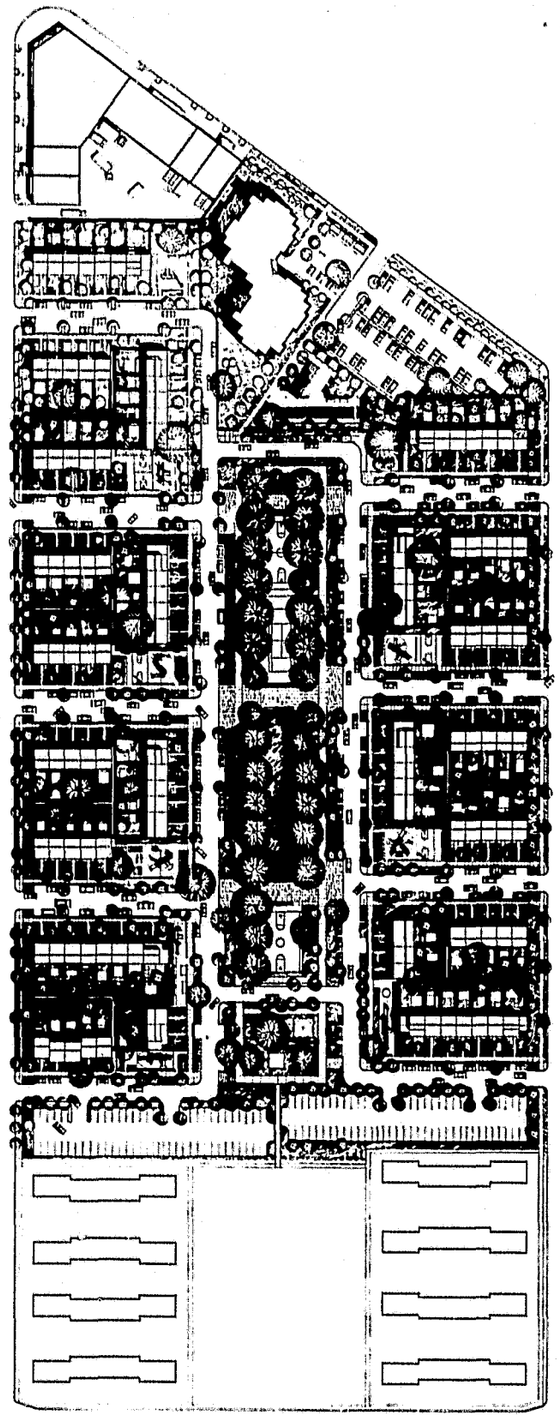


Figure 5.17: New site plan for Indianapolis.

Site-Planning Restrictions

There are two restrictions that are peculiar to the site in Indianapolis and that contribute significantly to the resultant plan (Figure 5.17): First, the existing public housing project site has no city streets running through it. There is, however, an existing large central mall that forms a spine through the site (Figure 5.18). In the 40 years the project has been in existence the mall has produced two magnificent rows of trees. The designers felt the mall was an unparalleled resource that had to be saved and utilized to the full in the new plan.

The second site-plan restriction was imposed by the City Highway Department, which had developed plans for expanding the width and traffic flow on the two streets bordering the length of the site: Blake and Locke Streets. The Highway Department would not allow any parking whatsoever on these two streets because the streets are to serve as primary traffic arteries. One of our basic site-planning principles requires that families be able to park their cars in front of their dwelling units.

The combination of these two restrictions resulted in our decision not to place any units with their entrances facing onto either Blake Street or Locke Street. This is unfortunate because these two streets are, as a consequence, deprived of supervision by neighboring residents and fall into the category of truly public streets. The side walls and fenced rear yards of some units abut these streets but this is hardly equivalent.

Figure 5.18: The existing mall at Indianapolis.

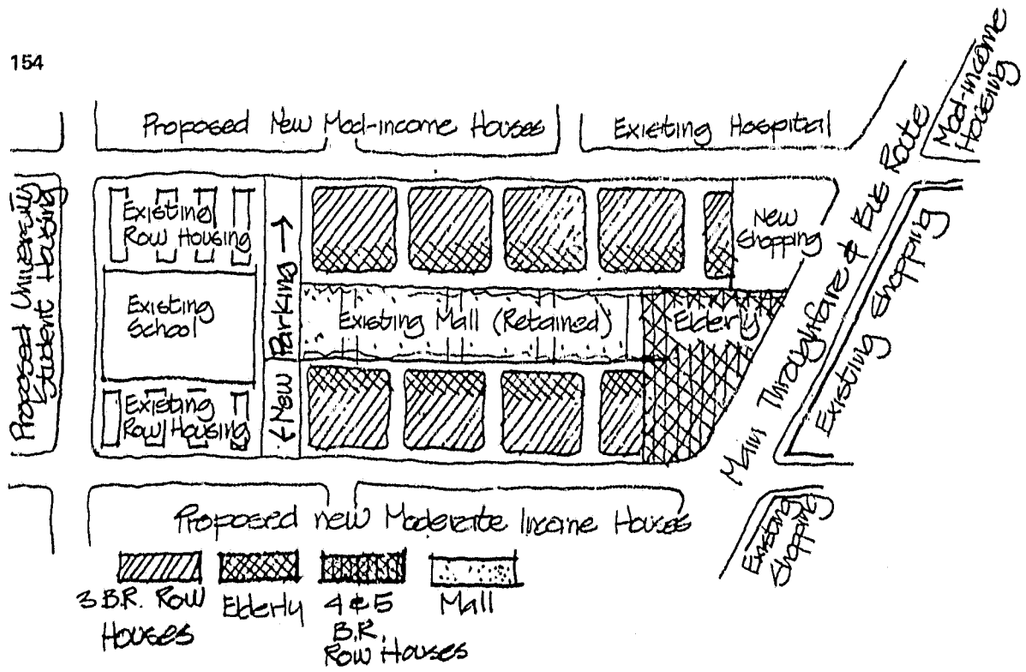


Figure 5.19: Indianapolis — rationale for the location of housing types. Units for the elderly are located on the through street, walking distance from shopping, the hospital, and the bus stop. The large row-house units are placed opposite the existing mall and teen play facilities.

The Row Housing

The design and site planning of the row-house units in Indianapolis follow the cluster rationale used in Newark. The large four- and five-bedroom units in Indianapolis will most probably serve older families that have some teenage children. These larger dwelling units are therefore positioned to face the mall. Much of the grassed area between the rows of trees in the mall will be used for teenage play areas (Figure 5.19).

Different from the existing housing project, we have developed a system of streets to penetrate the entire site (Figure 5.17). This will allow residents to drive their cars directly up to their houses and to park their cars there. It will also greatly facilitate police patrolling of the project; police will be able to drive their cars past the front windows and door of each unit and past each parked car. The rear windows and doors of the units achieve their security by being fenced within clusters. To discourage traffic through the project, the system of streets has been designed with T intersections. (The variations to the typical clusters that appear on the plan are the result of an existing utility right-of-way through the site.)

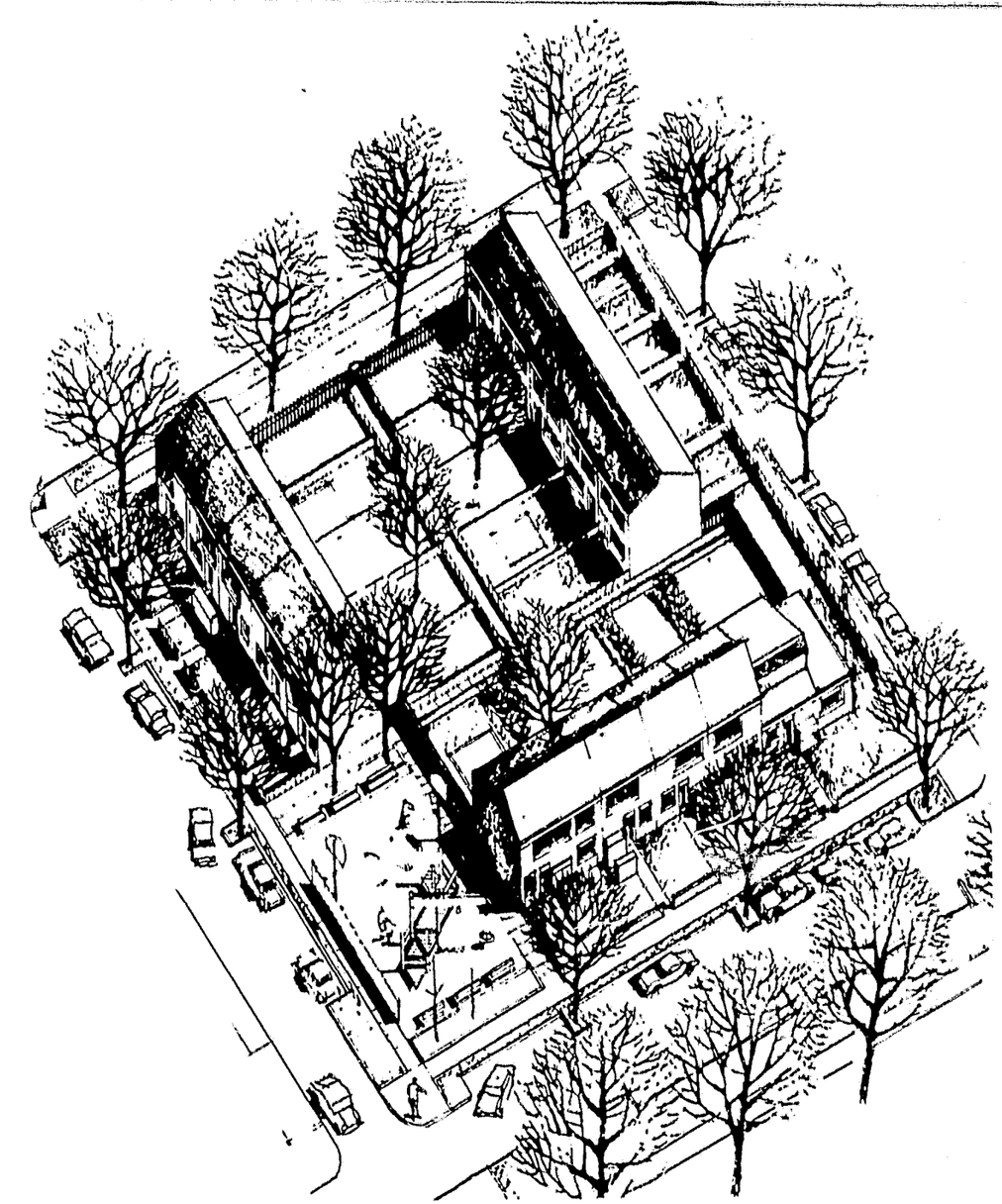


Figure 5.20: Indianapolis — isometric drawing of a typical cluster.

Because of the lower density requirements and the lack of existing streets, there were very few restrictions imposed on the size and form of the clusters in the Indianapolis project. It was thus possible to design the clusters more comfortably and to put play facilities, even for the young children, outside the private interior courts. Each cluster block is provided with a play facility for young children located at a street corner adjacent to the housing units (Figure 5.20). The Housing Author-

its staff felt from their experience that no play areas should be placed in front of the windows of any of the units, a practice we would have preferred. A compromise was reached that resulted in the positioning of the young children's play facilities adjacent to two sets of units but facing their side walls only. These play areas can still be supervised, but only from dwelling units across the street.

The parking ratio required in this site plan is off-street parking for 1.5 cars per unit. This is provided by parallel parking in lanes set back from the streets.

The Building for the Elderly

Housing for the elderly is placed on its own portion of the site and is located on the main street that borders the project and has bus service. A portion of the total site is intended to be set aside for a small neighborhood shopping area; this shopping area is also located on the main thoroughfare and is adjacent to the elderly site.

As in the Newark project, all units for the elderly will be placed in a single high rise building on 1.7 acres. The program calls for 126 elderly units, 50% efficiencies and 50% one bedroom units. This achieves a density of 74 units per acre. Because the municipal building by-laws require that no apartment building for the elderly be constructed above seven stories in height, we have had to modify the 12 story building used in the Newark project (Figure 5.21).

Remnants of the Existing Public Housing Project

A small portion of the existing housing project consists of older row house units and a public school, both of which will be rehabilitated. The principles used in redesigning the site plan for these existing units is similar to the principle employed in the development of the site plan for the new units. The back yards will be made private and will be clustered together through the use of fencing. Front yards will be defined by new curbing. As much of the grounds as possible will be assigned to the residents to both maintain and control.

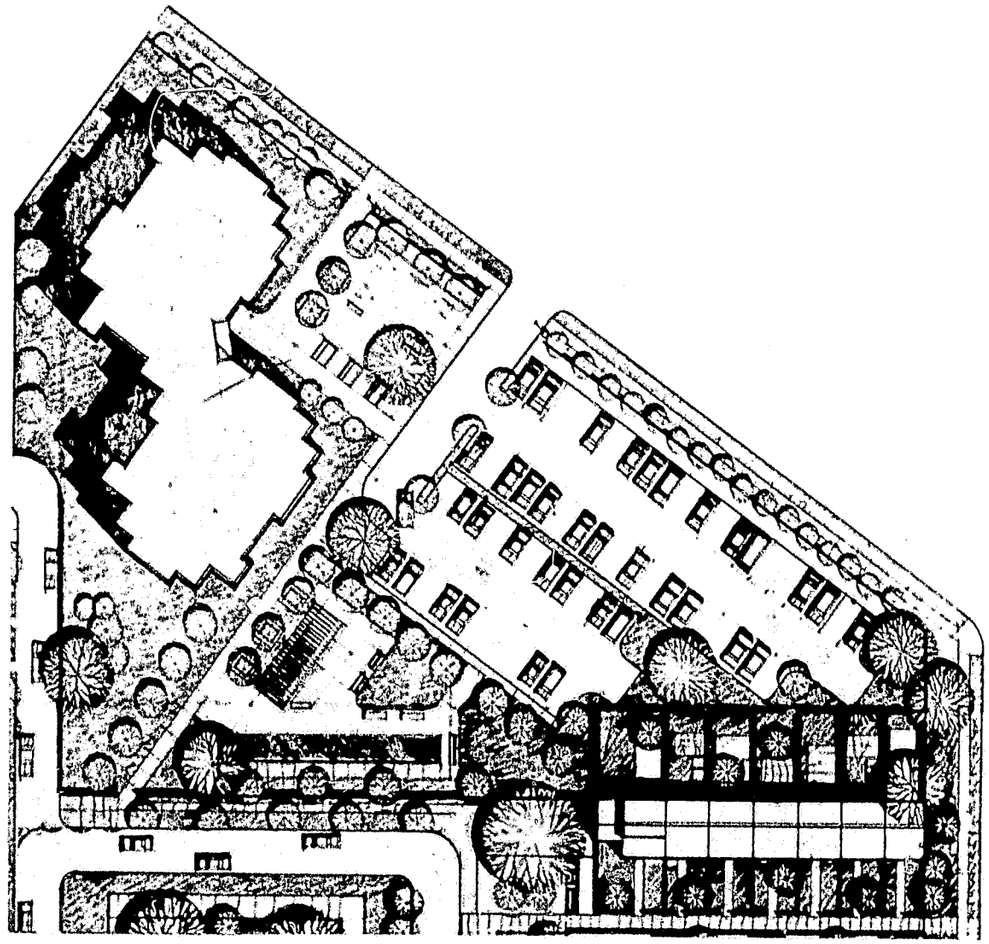


Figure 5.21: Indianapolis — site plan of the building for the elderly.

Unfortunately, no provision was ever made for off-street parking for these older, existing row-house units. The Highway Department requires that off-street parking be provided for these units at a ratio of one car per unit. The only solution we found even barely acceptable is the one shown in the site plan: that of creating a large new parking area bordering the existing row-house units and facing the new row-house units. This solution is unfortunate; it is contrary to our site planning principles, which require automobiles to be parked immediately in front of dwelling units.

ADDENDUM 1

THE COMPARATIVE COSTS OF DIFFERENT BUILDING TYPES

For a good many years it was accepted as general wisdom in the building profession that high-rise buildings cost less to build and maintain than walk-ups. This view is often the result of inappropriate comparisons between the over-all "development costs" of a housing development and its "construction costs" and between the maintenance costs of buildings occupied by different family types. Development costs include the cost of the land; construction costs are exclusive of land costs. The higher the cost of a piece of land, the less will be the development costs per unit if more units can be put on the same piece of land. For example, the construction costs per unit may be higher in an elevator building than in a row-house building, but still result in lower development costs per unit in the high-rise as a result of lower land costs per unit. In a high-density scheme the savings on land costs per unit may produce a lower over-all development cost per unit than a low-density scheme, even when construction costs per unit are higher.

A true comparison of the construction and development costs of various building types should only be made when the density of the high-rise scheme and the walk-up scheme are identical. In that instance the land costs per unit would be the same and could be cancelled out of the equation. Comparable densities in walk-ups and high-rises occur at the upper limits of the walk-up prototypes and the lower limits of the high-rise prototypes. Such a comparison therefore may serve little more than to satisfy academic curiosity.

Comparison of construction and development costs of different building types is still further complicated by the different mortgage financing arrangements provided under different housing programs, each producing different sets of financial benefits. There are also signifi-

cant variations both in the quality of construction and the quality of materials used in different developments. These variations will, in two identically planned developments, produce different costs and life expectancies. Finally, building codes throughout the country require that buildings above three stories in height be of fireproof construction; this normally entails the use of higher fire-rated materials, more stairs, heavier walls and supporting structures. Higher buildings also require, as intrinsic to their construction, the use of heavier foundations, the provision of elevators, additional emergency fire stairs, and the provision of incinerators.

From all of the above it should be clear that within the scope of this handbook it is impossible to undertake an exhaustive comparison of construction costs for different building types. However, a few recent studies have appeared on the subject and their conclusions are quoted here for general information.

The National Commission on Urban Problems prepared an exhaustive comparison of the cost of different housing types across the nation built under various government assistance programs.[1] Two of their concluding tables are presented here (Tables A.1 and A.2).

Table A.1: Development Cost by Type of Building[2]

FHA 207 – 231 Multi-Unit Programs	Development Cost Per Unit		
	High	Median	Low
1966 HUD study, 196 projects	$36,001	$16,524	$ 7,702
1962-66 medians,87 projects	41,269	15,110	8,102
Elevator	41,269	20,826	12,464
Walk-up	20,954	13,388	8,102
Row	19,767	13,227	8,111

Table A.2: Construction Cost per Square Foot by Type of Building[3]

FHA 207 – 231 Multi-Unit Programs	Dollars/Sq. Ft.		
	High	Median	Low
1966 HUD study, 196 projects	$20.88	$12.49	$ 7.74
1962-66 medians, 87 projects	$21.66	$10.16	$ 6.70
Elevator	$21.66	$14.35	$10.16
Walk-up	$12.90	$ 9.61	$ 6.70
Row	$13.63	$ 9.66	$ 8.25

Both tables show, first, that the range in costs within any building type, including elevator buildings, walk-ups, and row houses, is sufficiently large as to make a low-priced elevator building less expensive than a high-priced row house or walk-up. Nevertheless, Table A.1 shows that in a comparison of over-all development costs per unit, row houses cost slightly less than walk-ups, and walk-ups, in turn, cost significantly less than elevator buildings. Table A.2, comparing construction costs per square foot, shows that walk-up units are less costly than row-house units, and row-house units less costly than elevator buildings.

The Housing Development Administration of the City of New York recently undertook a comparative study of both the development and maintenance costs of different housing types.[4] Their study, based on 1973 construction experience, does not appear to be either so comprehensive or so rigorous as the study by the National Commission on Urban Problems. Their conclusions are quoted here for information purposes only.

The HDA study compared three-story, three-family homes with Mitchell-Lama (state subsidized) high-rise buildings, and determined that the three-story buildings, selling at approximately $100,000, were "among the best housing buys available." Development costs for the walk-ups and the high-rises were calcualted on the basis of land costs at 20% to 25% of the total development costs. Furthermore,

1. Development costs for a conventionally built three-family home are approximately $6,900 per room as compared with current estimates of $11,900 per room in a high-rise Mitchell-Lama building.
2. Maintenance and operation costs of three-family homes are approximately $135 per room per year, compared with high-rise Mitchell-Lama, which costs substantially in excess of $200 per room per year. The saving to three-family homes is the result of several factors, among them:
   - the willingness and ability of homeowners to make small repairs;
   - the absence of common spaces that require maintenance;
   - the absence of elevators and other complex systems;
   - the small-scale nature of the housing, which encourages individual concern for proper maintenance.

Both of the above studies appear to share similar conclusions: that the three-story, multifamily walk-ups are the least costly means of providing medium-density housing. Walk-ups are less expensive to build and to maintain than both row houses and high-rises. Costwise, the three-story walk-up manages to achieve an excellent compromise between the two-story row house and the high-rise apartment, in that it does not require the elevators or elaborate fireproofing of the high-rise, nor the extensive foundations, roofing, and exterior walls of the row house.

Footnotes

1. Elsie Eaves, *How the Many Costs of Housing Fit Together.* Research Report No. 16, prepared for the consideration of the National Commission on Urban Problems. Washington, D.C.: U.S. Government Printing Office, 1969.
2. Ibid., Table 30, p. 56.
3. Ibid., Table 42, p. 64.
4. Mayor's Policy Committee, *Housing Development and Rehabilitation in New York City.* November 1974.

ADDENDUM **2**

BASIC DESIGN PRINCIPLES FOR MAILBOXES, DOORS, AND WINDOWS IN MULTIFAMILY BUILDINGS

Central Mailboxes

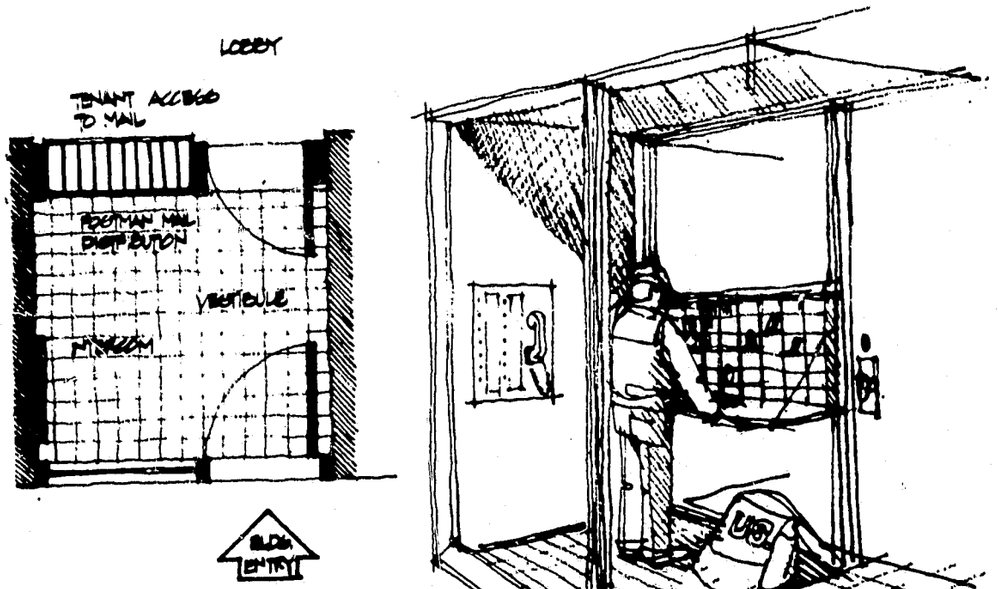
Central mailboxes are very vulnerable to criminal attack in that the individual doors to each compartment are readily pried open. It is both costly and difficult to make the door hinges and locking devices for each mailbox compartment of heavy-gauge steel and supply each with a quality lock.

In buildings without doormen central mailboxes are commonly placed in the entry vestibule of the building, outside the keyed main entry door to the building. Ideally, the central mailbox should be placed in the lobby of the building behind the keyed door so as to minimize the burglary of mail. To do this, however, requires that the mailman be given a key to the main door of each apartment building. This is considered both an added burden on the mailman and poor security in that it exposes the mailman to potential robbery for possession of the keys. The master keying of main entry doors to a few apartment buildings is, of course, even more dangerous in that it minimizes the effectiveness of all the locks in the entry door system. Another solution in current practice is to place a key to the entry door to each building in a keyed metal box placed in the wall next to the outside entry door. The postman is given a key to this box. This key opens every such box for every building.

A modified solution to this problem holds some promise. This involves the use of rear-loading rather than front-loading central mailboxes, and their installation in a way that is not normal in current practice. Rear-loading mailboxes are normally installed in a mailroom within the lobby of a high-rise building provided

with a doorman. The postman has the key to the mailroom and feeds each compartment of the mailboxes from the back while he himself is locked within the mailroom. The modified solution requires that the rear-loading, central mailbox be installed within a wall that is common to both the entry vestibule and the lobby inside the keyed, main entry door to a nondoorman building (see Figure A.1). The rear panel of the central mailbox is made of heavy-gauge steel and flush with the wall in which it is placed. The hinges of the rear panel are of the hidden type, and the lock activates two deadbolts to keep the rear panel firmly locked in position and invulnerable to prying. The lock on the rear panel should have at least six pins.

The mailman is supplied with the key to each rear panel and feeds mail into each compartment from the back, while standing in the vestibule area.



Doors

Each apartment in a walk-up building has its own door or doors that lead into the common circulation areas. These doors must be solid, hung on equally solid frames, with good quality hardware, and be provided with good quality locks, a peephole viewer, and a chain. All these have been specified more fully in Addendum 3.

Window Guards

The ground-floor apartments in a multiple dwelling are the ones most frequently burglarized.[1] The windows of ground-floor apartments should therefore be made of quality material, should be properly hung, and provided with quality closing and locking hardware. In high-crime areas it may be desirable to provide ground-floor apartment windows with strong screens or protective steel grills. However, these screens or grills must not interfere with the ability of residents to open or close the windows for ventilation; one or two screens should be easily removable from inside the apartment to allow egress as an emergency exit in case of fire. The number of windows required for fire emergency exit is normally specified in local fire codes. Specifications for grills and locking hardware for windows appear in Addendum 3.

Footnote

1. ICDA studies of the location of burglary in both the high-rise elevator buildings and the walk-ups at Van Dyke houses in Brooklyn over a two-year period revealed that the ground-floor units suffered from one and one-half to five times the burglary rate of the units in the floors above (averaging three times).

ADDENDUM 3

CONSTRUCTION MATERIALS AND METHODS

*Addendum 3 contains four articles concerned with the design, construction and installation of doors and windows [including locks and other hardware] in dwellings.**

Articles 1 and 2 deal with construction and hardware requirements for doors. While these two articles include standards for entry doors to private dwellings, they are primarily devoted to providing security for the many kinds of doors that exist in multiple dwellings.

Articles 3 and 4, dealing with construction and hardware requirements for windows and other glazed openings, contain provisions that apply equally to private and multiple dwellings.

ARTICLE 1 DOOR CONSTRUCTION

Section 100 General

100.0 Intent: It is the intent of this article to establish minimum requirements for the construction of doors, door frames, and walls near doors which will insure reasonable resistance to attempts at forcible entry and which will create surveillance possibilities by providing means for seeing through doors.

100.1 Scope: The design, construction, installation and maintenance of all dwelling unit entry doors, common entry doors, fire stair doors, exitway doors, tenant use room doors, common interior doors, building service room doors and other doors, as defined in this Security Code, shall comply with the requirements contained in this article.

*The material included in Addendum 3 is from Oscar Newman and Stephen Johnston, *Model Security Code for Residential Areas.* New York: Institute for Community Design Analysis, 1974, Articles 7 to 10. The *Model Security Code* was prepared under a grant from the Ford Foundation.

CONTINUED

2 OF 3

100.2 Definitions

Accessible Balcony: A balcony in a dwelling unit located within 18 feet of ground level or within 10 feet of any fire escape or other structure.

Hollow Core Door: A door constructed of two thin sheets of wood, hardboard, or other material attached to the outside of a frame of separated wood blocks, leaving hollow spaces between the blocks.

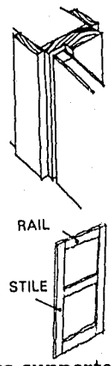
Jamb: One of the two vertical members of a door or window frame.

Mail Slot: A metal plate with a slot to allow the passage of mail through a door.

Panel Door: Any door fabricated of one or more relatively thin panels held in position by *Rails* and *Stiles*.

Patio Type Sliding Door: A sliding door consisting of a single, very large transparent panel in a frame (a type commonly used to give access to patios or yards of *Private Dwellings*). Single *Patio Doors* have one fixed and one movable panel while double *Patio Doors* have two movable panels.

Rabbeted Jamb: A door *Jamb* constructed so that the portion of the *Jamb* forming the door stop is either part of the same piece as the rest of the *Jamb*, or is securely set into a deep groove in the *Jamb*. The stop is not a separate piece of material nailed, screwed, glued, or otherwise attached to the surface of the *Jamb*.



Rail [of a Door]: A horizontal framing member extending the full width between the *Stiles* and framing into them. There are usually three *Rails*, top, bottom, and center (which supports the lock).

Rail Door: A door made of a single sheet of tempered glass supported by metal *Rails* at top and bottom.

Solid Core Flush Door: A door constructed of wood blocks or strips, which completely fill the core of the door between two sheathing sheets.

Stile [of a Door]: A vertical framing member at each side of a door, extending the door's full height. See also *Rail*.

Vision Panel: A fixed transparent panel of glazing material set into an otherwise opaque wall, partition, door; an unopenable window.

Section 101 Dwelling Unit Entry Doors: Swing Type

101.1 General: Any swinging door, including both leaves of a double door, providing access to a dwelling unit shall be considered a dwelling unit entry door and shall be required to meet the construction requirements set forth in this section and the hardware requirements contained in Article 2.

101.1 Resistance to Forcible Entry: Any swinging door used as an entry to a dwelling unit (either a private dwelling or a dwelling unit in a multiple dwelling) shall be at least as resistant to attempts at forcible entry as one of the following:

(a) a solid core flush door with a minimum thickness of 1-3/8 inches, or

(b) a panel door with a minimum stile and rail thickness of 1-3/4 inches and a minimum panel thickness of 3/4 inch. The combined area of the panels should not exceed 50% of the total door area.

Two kinds of metal doors normally exceed the above requirements and are recommended for use as dwelling unit entry doors: hollow steel flush doors and "kalimein" doors. Kalimein doors are solid core wood doors with steel sheets laminated to both sides.

Use of other less secure doors, such as hollow core wood doors or wood panel doors with panels less than 3/4 inch thick, is acceptable if the outside face of the door is covered with 16-gauge sheet steel (or its equivalent in strength) attached with round head bolts spaced around the entire perimeter of the door at minimum 10" centers. The head of each bolt is to be placed on the outside face of the door, one inch in from the edges.

HIGH CRIME AREA In high crime areas, modify Section 101.1 by deleting all of paragraph "(b)", which allows the use of panel doors. In the final paragraph substitute "12-gauge" for "16-gauge", and "6-inch center" for "10-inch centers".

101.2 Resistance to Forcible Entry: Exceptions: A swinging dwelling unit entry door opening onto an exterior private area shall be at least as resistant as a 1-3/4 inch thick hollow core door to attempts at forcible entry.

101.3 Openings: A dwelling unit entry door shall have openings in it of only the following types:

(a) an optical door interviewer meeting all requirements set forth in Section 207, or

(b) a single mail slot having maximum finished opening dimensions of 1/2 inch by 6 inches, and located not closer than 18 inches to any required locking device. The above dimensions may be increased if a sturdy metal box or deflecting baffle is installed behind the slot so as to restrict access through the slot to the door's locking hardware as effectively as the 1/2 inch by 6 inch slot.

(c) glazed vision panels which meet all requirements set forth in Section 101.4

HIGH CRIME AREA

It is suggested that conventional double-loaded interior corridors in multiple dwellings be designated **High Crime Areas** per se. Such a designation would limit openings in most apartment doors to optical interviewers or mail slots.

101.4 Vision Panels: A dwelling unit entry door may have glazed vision panels if such panels meet the conditions described in the following chart.

SUMMARY OF VISION PANEL REQUIREMENTS IN EXTERIOR DWELLING UNIT ENTRY DOORS

STANDARD SECURITY CODE RESTRICTIONS

	Nature of Exterior Area		
	Public or Semipublic	**Semiprivate**	**Private**
Maximum Allowable Area of Glazing	50% of Door Area	90% of Door* Area	90% of Door* Area
Required Resistance to Breakage	Vandal-Resistant Glazing Material	Vandal-Resistant Glazing Material	Break-Resistant Glass
HIGH CRIME AREA			
Maximum Allowable Area of Glazing	(None permitted)	50% of Door Area	90% of Door* Area
Required Resistance to Breakage		Vandal-Resistant Glazing Material	Vandal-Resistant Glazing Material

Section 102 Dwelling Unit Entry Doors: Sliding Type

102.0 General: Any sliding door providing access to a private dwelling unit from a yard, patio, accessible balcony, or which is otherwise accessible from the outside, shall be considered a dwelling unit entry door. It shall meet the construction requirements set forth both in this section and in Section 101, and it shall meet the hardware requirements contained in Article 2.

102.1 Resistance to Forcible Entry: Each sliding dwelling unit entry door shall be constructed and installed so that when it is in the locked position, it can withstand a force of 500 pounds applied in any direction to any nonglazed portion of the door without disengaging the lock or allowing the door to be opened, lifted out of its track, or otherwise removed from the door opening.

102.2 Patio Type Sliding Doors: Single sliding patio doors shall be installed so that the movable section of the door slides on the inside of the fixed section.

Double sliding patio doors shall be locked at the top or bottom meeting rails.

*The limitation of glazed area to 90% effectively requires a bulky frame around an "all-glass" door.

102.3 Vision Panels: As with all dwelling unit entry doors, vision panels in sliding doors must meet the area and materials requirements contained in Section 101.

> *A serious shortcoming of most existing American "security codes" is the lack of consistency between the rigid front door requirements and the much weaker, patio type, sliding door provisions. Presumably, ease of enforcement is the motivation.*

Section 103 Common Entry Doors in Multiple Dwellings

103.0 General: Any common entry door in a multiple dwelling shall meet the construction requirements set forth in this section and shall meet the hardware requirements contained in Article 8. Main entry doors, exitway doors, service doors, and garage doors are defined as types of common entry doors. Any common entry door wider than five feet shall be considered equivalent to a garage door and as such, shall be required to meet all of the construction requirements contained in Section 107.

103.1 Resistance to Forcible Entry: Each common entry door shall be at least as resistant to attempts at forcible entry as a solid core flush door with a thickness of 1-3/8 inches, except that it may contain vision panels as described in 103.2.
The lock stiles of any common entry door shall be at least five inches wide to allow for the installation of a heavy-duty mortise lock set. Any all glass doors or rail doors shall be made of tempered plate glass with a minimum thickness of 3/4 inch.

103.2 Vision Panels: Requirements for vision panels in common entry doors in multiple dwellings are as follows:

(a) **Main entry doors** shall contain vision panels, at least as resistant to breakage as break-resistant glass, securely fitted into wood or metal frames. The vision panels shall be of a size and configuration such that at least 75% of the area of the door higher than two feet above floor level is transparent. In dwellings where the lobby door is a double door, both the active and inactive leaves shall conform to this visibility requirement. Rail doors may be installed as main entry doors, providing they meet the resistance to forcible entry provision in Section 103.1.

(b) **Exitway doors** shall have no vision panels or other openings.

(c) **Service doors** shall have no vision panels or other openings.

(d) **Garage door** vision panel requirements are contained in Section 107.

(e) **Other common entry doors** routinely used by tenants to gain access to the building shall each contain a vision panel (or panels) having a minimum area of 200 square inches;

the vision panel shall be at least as resistant to breakage as break-resistant glass and shall be centered approximately 4'-6" above the floor.

HIGH CRIME AREA — In high crime areas, modify Section 103.2 by substituting "vandal-resistant glazing material" for "break-resistant glass."

Section 104 Common Interior Doors

104.0 General: Any common interior door in multiple dwellings shall meet the construction requirements contained in this section and the hardware requirements contained in Article 2. Dwelling unit entry doors opening onto interior semipublic areas and building service room doors are specifically excluded from the common interior door category.

104.1 Resistance to Forcible Entry: Construction requirements for common interior doors are related to whether such doors are required to be fitted with locking devices:

(a) **Doors with locking features** Any common interior door in a multiple dwelling required by other provisions of this Security Code to be fitted with a locking device of any kind shall be at least as resistant to attempts at forcible entry as a solid core flush door with a thickness of 1-3/4 inches, except that it can contain vision panel(s) as described in this section. Types of common interior doors for which locking devices are generally required include fire stair doors, tenant use room doors, mail room doors, and doors connecting enclosed garages to interior semipublic areas.

(b) **Doors having no locking features** Common interior doors which are not required by other provisions of this security code to be fitted with locking devices shall have no minimum construction requirements except as required by municipal building codes or other legal regulations. Note that door closing devices or simple latching mechanisms are not to be considered locking devices in this section. Common interior doors for which locking devices are generally not required include doors to garbage chute rooms.

104.2 Vision Panels

A large number of crimes, such as robberies, assaults, and rape occur on the steps or landings of the enclosed fire stairs and other interior semipublic areas of modern elevator buildings. It is the intent of this section to limit the privacy afforded criminals in fire stairs and other interior semipublic areas by requiring large vision panels in all common interior doors. These transparent panels will specifically allow a person to observe the area beyond a door before opening it and will increase natural suveillance of fire stairs and other areas by residents during routine use of the corridors.

All common interior doors in a multiple dwelling shall be fitted with a vision panel (or panels) having a minimum glazed area of 250 square inches centered approximately 4'-6" from the floor. Requirements for glazing material are as follows:

(a) **Fire stair doors** Vision panels in fire stair doors shall be made of vandal-resistant glazing material.

(b) **Other doors with locking features** Vision panels in common interior doors fitted with locking devices as described in Section 104.1 (a) above shall be as resistant to breakage as break-resistant glass.

(c) **Doors having no locking features** Vision panels in common interior doors not fitted with locking devices as described in Section 104.1 (b) above need not be made of break-resistant glass.

HIGH CRIME AREA — In high crime areas, modify Section 104.2 by substituting "vandal-resistant glazing material" for "break-resistant glass" in all places where it occurs.

104.3 Fire Resistance: All common interior doors containing the required vision panels shall meet all minimum fire resistance standards for fire stair doors.

Because it is imperative that the fire resistant character of the fire stair enclosure be maintained at all times, it is recommended that vandal-resistant glazing material be installed in the fire stair doors in any building likely to suffer from extensive vandalism. For example, a 1/4 inch thick lexan sheet sandwiched between two thicknesses of wired glass is extremely difficult to break through.

Section 105 Tenant Use Room Doors in Multiple Dwellings

105.0 General: Any door providing access to a tenant use room in a multiple dwelling shall be required to meet the construction requirements set forth in this section and the hardware requirements contained in Section 201.

105.1 Resistance to Forcible Entry: Each tenant use room door shall be at least as resistant to attempts at forcible entry as a solid core flush

door with a thickness of 1-3/4 inches. The tenant use room door may, however, contain vision panels as described in Section 105.2.

105.2 Vision Panels: Any vision panel installed in a tenant use room door shall be a single panel of vandal-resistant glazing material having a minimum area of 250 square inches. Doors containing these vision panels shall meet all required minimum fire resistance standards for such doors.

Section 106 Building Service Room Doors in Multiple Dwellings

Building service rooms must be made secure in order to protect stored supplies, tools, records, and so on.

106.0 General: The doors to any building service room in a multiple dwelling shall meet the construction requirements set forth in this section and the hardware requirements contained in Article 2.. Common types of building service rooms are: store rooms, offices, slop-sink rooms, electrical and other closets, workshops, boiler rooms, etc.

106.1 Resistance to Forcible Entry: Each building service room door shall be at least as resistant to attempts at forcible entry as a solid core flush door with a thickness of 1-3/4 inches. The building service room door may, however, contain vision panels as described in **Section 106.2.**

106.2 Openings: There shall be no openings larger than one inch by 6 inches in any building service room door. Any such opening shall be located at least 24 inches from any locking device.

106.3 Vision Panels: Any vision panel installed in a building service room door shall be made of vandal-resistant glazing material and shall be protected by a metal-mesh grille window guard meeting all requirements of Section 406.

Section 107 Garage Doors

107.0 General: Any door providing access for automobiles to an enclosed garage area directly accessible to the interior of a dwelling shall meet the construction requirements contained in this section and the hardware requirements contained in Section 201. Any common entry door wider than five feet shall also meet these requirements.

Access from the enclosed garage space to the dwelling is intended to include either direct access into a dwelling unit, in the case of a private dwelling, or access into an interior semipublic area, such as a lobby, corridor, stair, or elevator, in the case of a multiple dwelling.

107.1 Resistance to Forcible Entry: Each garage door shall be constructed and installed so it is as resistant to attempts at forcible entry as a solid core flush door and when locked, a force of 500 pounds can be applied in any direction without disengaging the lock, or allowing the door to be opened or removed from the door opening.

Each sliding or overhead rolling door shall be installed so that when it is locked, the door cannot be lifted or pulled from its track or rail while withstanding a force of 500 pounds applied in any direction.

107.2 Openings: Any unglazed opening, larger than 100 square inches, in a garage door shall be protected by metal-mesh grille or metal bar window guards meeting the requirements contained in Section 406 and Section 407. In no case shall any opening be located closer than 36 inches to a door's locking mechanism.

107.3 Vision Panels: All glazed vision panels shall be made of vandal-resistant glazing material. Any vision panel, larger than 100 square inches, in a garage door shall be protected by a metal-mesh grille or metal bar window guard meeting the requirements contained in Section 406 and Section 407. In no case shall any vision panel be located closer than 36 inches to a door's locking mechanism.

107.4 Exceptions: Nonopaque garage doors, such as open metal grille doors, are acceptable if the door meets the resistance to forcible entry requirements contained in Section 107.1, and if it is solid (opaque) within 36 inches of the door's locking mechanism.

Section 108 Double Doors

108.0 General: When double doors are installed in a door opening controlled by the provisions in this article both the active and inactive leaves of the double doors shall meet the requirements for a single door except where a specific exception is stated in Section 108.1.

108.1 Exceptions

(a) The inactive leaf of a pair of double doors providing access to a tenant use room is not required to have any vision panel.

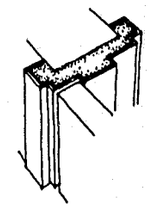
(b) Only one leaf of a pair of double doors providing access to a building service room shall be fitted with an opening, as described in Section 106.2.

Section 109 Door Frames

109.0 General: Door frames of all doors subject to the provisions contained in this article shall meet the requirements contained in this section.

109.1 Resistance to Forcible Entry: Door frames of all doors subject to the provisions of this article shall be made either of solid wood with a minimum thickness of two inches, or of solid wood covered with sheet steel having a minimum thickness of 18-gauge.

Hollow steel frames fabricated from sheet steel with a minimum thickness of 16-gauge are acceptable, but only if the hollow space inside and behind the frame is filled with cement grout or a similar crush-resistant material for the entire space within 12 inches above and below the strike.



109.2 Protection of Strike: Jambs for all doors subject to the provisions of this article shall be constructed or protected to prevent violation of the function of the strike.

109.3 In-Swinging Doors: All in-swinging doors shall have rabbeted jambs.

109.4 Out-Swinging Doors: All out-swinging doors shall be constructed or modified to have a piece of metal that covers the opening between the door and its frame at the area of penetration of the bolt or latch, and that can deter the insertion of tools, thus preventing the exertion of pressure against the bolt or latch.

109.5 Clearance Between Door and Frame: Clearance between the edge of any door and its frame, when the door is in its closed position, shall not exceed 1/8 inch along the hinge and lock sides and 1/4 inch at the top and bottom.

Section 110 Wall Construction

The primary focus of this article is on doors, but some attention must be given to walls. Although it is not commonly done, it is relatively easy to kick or otherwise break through a conventional stud and plasterboard wall. Similarly, glazed openings in walls near doors offer a convenient means of criminal entry.

110.0 General: With the intent of minimizing opportunities for break-ins through walls, the provisions contained in this section provide construction standards for walls enclosing dwelling units and for walls near doors in certain kinds of rooms in multiple dwellings.

110.1 Dwelling Unit Walls: Any wall forming part of the enclosure of a dwelling unit and separating it from the exterior of a building, another dwelling unit, or from a corridor normally accessible to other tenants or the public shall be as resistant to attempts at forcible entry as a four-inch thick masonry (concrete block) wall.

It is assumed that fire-resistant construction [commonly required in multiple dwellings] and conventional exterior wall construction techniques will render most dwelling units adequately secure from attempts at breaking through a wall. It is felt that the section above will not affect the construction of most new dwelling units.

110.2 Openings near Doors: No unglazed openings in the enclosing walls of any dwelling unit, tenant use room, or building service room in a multiple dwelling shall be installed within 36 inches of any door providing access to the dwelling unit or room in question, unless the opening is protected by a metal-mesh grille window guard meeting the requirements of Section 406.

110.3 Vision Panels near Doors: No windows, vision panels, or other glazed openings in the enclosing walls of any dwelling unit, tenant use room or building service room in a multiple dwelling shall be installed within 36 inches of any door providing access to the dwelling unit or room in question, unless the vision panel is made of vandal-resistant glazing material. If the glazed opening is larger than 100 square inches, it shall be additionally protected by a metal-mesh grille window guard meeting the requirements of Section 406.

This provision will prevent criminals from gaining access by breaking a window and reaching through to release a door's locking mechanism.

110.4 Lobby Walls: The walls of the main entry lobby of a multiple dwelling shall be glazed so that at least 75% of the lobby floor area and all elevator doors (or the ground floor portion of the general circulation stairs, in the case of a nonelevator building) shall be visible from a position immediately outside the main entry door. In addition, a portion of lobby floor area opposite the elevator doors (or general circulation stairs in nonelevator buildings) shall be visible to a pedestrian approaching the main entry door from the adjacent public street, sidewalk, or other normal pedestrian access routes to the door.

ARTICLE 2 DOOR HARDWARE

Nearly all existing municipal security codes deal primarily with door locks and other hardware. The hardware provisions of this article incorporate requirements from the best of these codes.

Section 200 General

200.0 Intent: It is the intent of this article to establish reasonable minimum requirements for the installation of locking devices, hinges, interviewers, and other hardware on doors in all dwellings. All doors of the various categories governed by this Security Code shall be fitted with hardware in accordance with the provisions contained in this article.

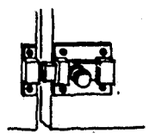
200.1 Scope: The design, installation, and maintenance of all locks, keys, hinges, door closing devices, buzzer-reply intercom systems, optical door interviewers, chain door interviewers, and other hardware for doors in dwellings, as required by this Security Code, shall comply with the requirements in this article.

In any situation where ambiguity exists about the requirements for a piece of door hardware, which is installed or to be installed in a dwelling, the enforcing agency shall determine the reasonable requirements for such a piece.

200.2 Definitions:

Active Leaf [of a Double Door]: The leaf of a *Double Door* that must be opened first and is used in normal pedestrian traffic. This leaf is the one to which a lock is attached.

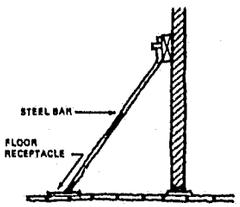
Bolt: A metal bar that slides in a controlled way into a locked position and restrains a door (or window) from being opened; any locking device employing a *Bolt.*



Bore-in Lock: see *Key-in-the-Knob Lock*

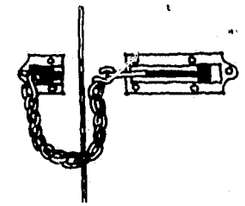
Box Strike: A *Strike Plate* with a metal throat or housing, fully encasing a *Deadlocking Latch* or *Dead Bolt* when in the locked position.

Buttress Lock: A very strong lock for swinging doors, characterized by the use of a movable steel rod fitting into metal receiving slots on the door and on the floor.



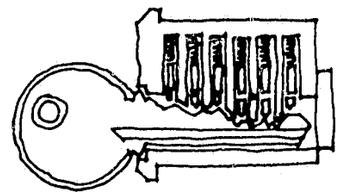
Buzzer-Reply Intercom System: An electrically powered communication system composed of two parts: a two-way audio intercom, allowing a person at the *Main Entry Door* of a *Multiple Dwelling* to speak to a person within each dwelling unit; and an *Electric Strike,* allowing a person in any dwelling unit to unlatch the *Main Entry Door* remotely.

Chain Door Interviewer: A device consisting of a chain attached at one end to a door *Jamb;* the other end of the chain is attached to a keyed metal piece which slides along a slotted metal plate mounted on a door. The interviewer allows the door to be opened slightly to permit visual identification but restrains it from being opened fully.

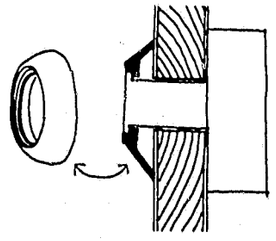


Change Key: A key operating only one lock of a set of locks, as compared to a *Master Key,* which can operate many locks.

Cylinder [of a Lock]: The part of the *Lock Set* containing the keyway. The insertion and turning of the correct key aligns the *Pins* to allow the *Cylinder* to turn, thus activating the locking mechanism.

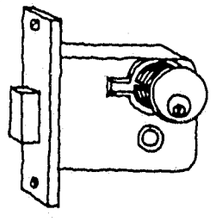


Cylinder Guard: A hardened metal ring, surrounding the exposed portion of a lock *Cylinder,* fastened to protect the *Cylinder* from being wrenched, turned, pried, cut, or pulled at with attack tools.

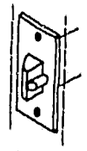


Cylindrical Lock: See *Key-in-the-Knob Lock*

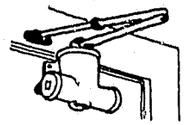
Deadbolt: A *Bolt* that is not beveled; has no automatic spring action; operated by a key *Cylinder,* thumbturn, or lever; and is positively held fast when in the projected position.



Dead Latch: see *Deadlocking Latch*



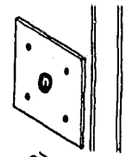
Deadlocking Latch: A *Latch*, the *Bolt* of which is positively held in the projected position, and may be retracted only by a key or knob. It cannot be retracted by pressure applied to the *Latch* itself.



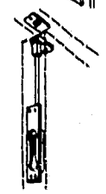
Door Closer: A device other than a *Spring Hinge* that closes a door automatically.

Door Closing Device: Either a *Door Closer* or a *Spring Hinge*.

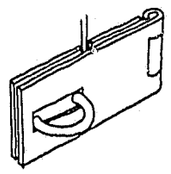
Electric Strike: An electrical device replacing a conventional *Strike Plate* and allowing a door to be opened by electric switches located in convenient places (switches are commonly pushbuttons located in individual dwelling units in *Multiple Dwellings*).



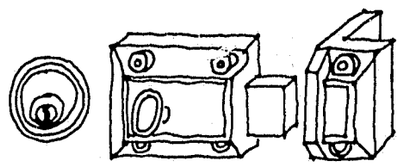
Escutcheon: A plate or shield installed to protect a lock, for example, a metal plate around a keyhole in a door or one protecting the opening in the *Bolt* area.



Flush Bolt: A manually operated *Deadbolt* on the *Inactive Leaf* of a *Double Door* fitting into the head of the door frame and threshold of the door with activating lever in the side edge of the door leaf.

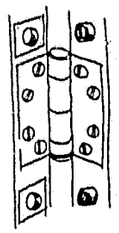


Hasp: A metal fastening device consisting of a slotted metal plate fitting over a metal ring. In the closed position, a padlock locks the two parts together, thus securing a door or window.

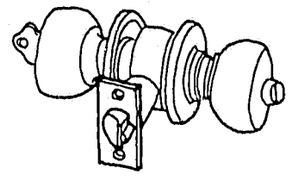


Horizontal Bolt: A type of *Rim Lock* characterized by a horizontally moving *Deadbolt* which is operated by a turnpiece on the inside and a key on the outside.

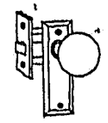
Inactive Leaf [of a Double Door]: The leaf of a *Double Door* that is bolted when closed; the *Strike Plate* is attached to this leaf to receive the *Latch* and *Bolt* of the *Active Leaf*.



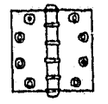
Jimmy-Pin: A method of securing a door against being removed while locked. Sturdy projecting screws are screwed into the butt or hinge edge of a door near each hinge. When the door is closed, the projecting screws fit into holes specially placed in the door *Jamb* so that the door cannot be removed even if the hinge pins are removed.



Key-in-the-Knob Lock: A general name applied to several kinds of locks having the keyway located in the center of the outside doorknob. Among the several kinds of *Key-in-the-Knob* locks are the tubular, bore-in, and cylindrical locks.



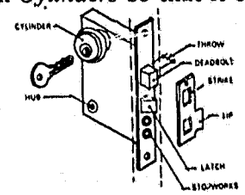
Latch: A device for automatically retaining a door in a closed position when it is shut; a *Latch* generally has no locking function.



Leaf Hinge: The most common type of hinge, characterized by two flat metal plates or leaves, which pivot about a metal hinge pin.

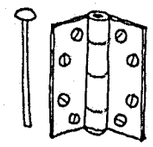
Lock Set: A lock, complete with trim, such as knobs, handles, and *Escutcheons*.

Master Key: A key that fits several lock *Cylinders* so that it operates more than one *Change Key* lock.



Mortise Lock: A lock mortised into a door, rather than applied to its surface, as in the case of a *Rim Lock*.

Optical Door Interviewer: A small protected hole set into a door at eye level to facilitate the visual identification, from within, of a person outside the closed door.



Pin [of a Hinge]: The small metal rod serving as the axis of a hinge, thereby allowing the hinge (and attached door or window) to rotate between open and closed position.

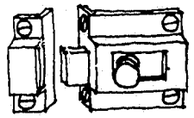
Pins [of a Lock]: Sliding pins inside a lock *Cylinder* arranged so that small springs keep them from rotating, except when the pins are raised by the insertion of the correctly shaped key. For illustration, see *Cylinder*.

Primary Lock: As used in this Security Code, *Primary Locks* are locks which operate in conjunction with a door *Latch*. *Primary Locks* include *Mortise Locks*.

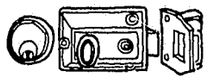
Rim Lock: A lock installed on the surface of a door rather than being mortised into it. *Rim Locks* are commonly used as *Secondary Locks.*

Secondary Lock: A lock installed on a door to supplement the *Primary Lock* and used for the purpose of keeping the door locked rather than shut. *Secondary Locks* are usually *Rim Locks* of one of the following types: *Horizontal Bolt,* or *Vertical Bolt.*

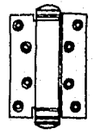
Slide Bolt: A simple *Bolt* operated directly by hand without using a key, a turnpiece, or other activating mechanism.



Spring Bolt: A type of *Rim Lock* which contains only a spring loaded, beveled *Latch* as a locking mechanism.



Spring Hinge: A hinge containing a spring so that it automatically closes the door to which it is attached.

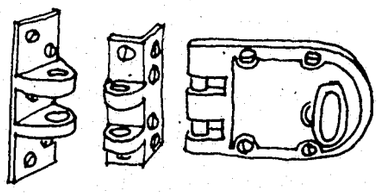


Stopworks: A mechanism in a lock, including a pair of buttons on the door edge. The buttons can be operated to freeze the outside knob controlling the *Latch.*

Strike Plate: A piece of metal secured to a door *Jamb* housing a door *Latch* or *Bolt* in the closed or locked position. (See also *Box Strike*).

Throw [of a Bolt or Latch]: The outward movement of a *Bolt* or *Latch;* the distance such a *Bolt* or *Latch* travels from the unlocked to the locked position.

Vertical Bolt: A common type of *Rim Lock* utilizing two *Deadbolts* which move vertically into two circular holes in the strike portion of the lock attached to the door *Jamb.*



Section 201 Locks for Doors

The most obvious and effective means of making any enclosed area secure is to install good locks on the doors. This section deals with the kinds of locks to be used on various categories of doors in dwellings. However good the locks, they are only effective if properly installed and placed in doors which, with their frames, adequately support the locks.

201.0 General: All exterior doors in private dwellings and all dwelling unit entry doors, common entry doors, fire stair doors, exitway doors, tenant use room doors, building service room doors and garage doors in multiple dwellings shall be fitted with locks meeting the requirements contained in this section.

Unless specifically noted there is no restriction against installation of secondary locks, such as rim locks or buttress locks, on any doors.

The following types of locks and associated hardware have inherent advantages or disadvantages to them and are either recommended or not recommended for the reasons given below:

Vertical Bolts: The complete interlocking of the bolts and the strike in an engaged vertical bolt lock makes it very resistant to attempts at forcible entry. Vertical bolts are highly recommended for use as secondary locks.

Spring Bolts: Spring bolts do not contain a deadlocking latch and are easily defeated. They have limited utility as security devices.

Slide Bolts: Slide bolts can normally only be activated from inside and are therefore of limited utility.

Key-in-the-Knob Locks: Key-in-the-knob locks are not recommended because, even in the case of good quality locks, the protruding knob, which holds the lock, can be easily gripped with a tool and twisted to overcome the lock.

Cylinder Guard: A cylinder guard is to be used when the cylinder protrudes beyond the face of the door, as is the case of a cylinder containing five or more pins used in a standard door.

201.1 Dwelling Unit Entry Doors: Swing Type: Each swing type dwelling unit entry door shall be fitted with an automatic deadlocking latch having a minimum throw of 1/2 inch. Each door shall also be fitted with a deadbolt, which has a minimum throw of 3/4 inch, which imbeds itself in a box strike set within the door jamb at least 5/8 inch, and is constructed with hardened steel inserts or the equivalent to deter attempts at cutting or sawing. The latch and deadbolt may be contained within one lock or separate locks. Both the latch and the deadbolt shall be operable only by key from outside the door and without use of a key from inside.

Each swinging dwelling unit entry door shall be fitted with a door closing device, as defined in Section 204, which will automatically close and latch a door left ajar.

HIGH CRIME AREA

In high crime areas, modify section 201.1 by adding the following sentence:

"No stopworks mechanism shall be installed on any dwelling unit entry door."

Because of the possibility of a tenant using the stopworks only to "freeze" the outside doorknob when leaving an apartment, stopworks shall not be installed in areas subject to high burglary incidence. If a dwelling unit entry door can only be locked by turning a key to engage a deadbolt, the false sense of security created by use of stopworks cannot lead to a burglary.

201.2 Dwelling Unit Entry Doors: Sliding Type: Any sliding door providing access to private dwelling units from streets, yards, corridors, patios, accessible balconies, etc., shall be fitted with a primary lock utilizing a bored cylinder, which has at least five pins and is operable from outside by key and from inside by knob, handle, or other device. The lock shall contain a deadbolt of hardened steel or have hardened steel inserts to deter attempts at sawing. The deadbolt shall engage the box strike sufficiently to prevent its being disengaged by any possible movement of the door within the space or clearances provided for normal installation and operation of the door. When in the locked position, the lock, stile, and door frame shall be able to withstand attempts at forcible entry, as described in Section 102.1

Patio type sliding doors (that is, doors with large transparent panels) shall be reinforced at the lock, stile, and strike area, if necessary, to meet the requirements of this Security Code. No removable bolts or screws shall be accessible on the outside of the door.

201.3 Common Entry Doors in Multiple Dwellings: Each common entry door including any main entry door, shall be fitted with a deadlocking latch with a minimum 1/2 inch throw, which allows egress from inside the building to the outside, or to a garage area by operating a knob, lever, or other device. Use of a key in a lock utilizing a bored cylinder with a minimum five-pin tumbler operation is necessary to gain access from the building exterior (or garage area) to the building interior. Each common entry door shall be fitted with a door closing device as described in Section 204.2. All common entry doors shall be openable from the interior without the use of keys.

HIGH CRIME AREA

In high crime areas, modify Section 201.3 by adding:

In addition, each main entry door shall be fitted with a buzzer-reply intercom system, as described in Section 205. All main entry doors fitted with electric strikes shall open toward the outside of the building.

201.4 Fire Stair Doors in Multiple Dwellings: Each fire stair door providing access between a corridor within the building and an enclosed, fire resistant exitway system shall be fitted with a latch with a minimum 1/2 inch throw and a door closing device, as described in Section 204.3.

In the case of any fire stairs leading directly to the exterior of the building without passing through the ground floor lobby and main entry doors, the fire stair doors on the lower six floors shall be as described above, except that deadlocking latches shall be used, thus allowing egress from the corridor into the exitway system, but requiring a key to gain access from the exitway to the corridor.

No secondary locks shall be installed on any fire stair door.

201.5 Exitway Doors: Any swinging door leading from an enclosed exitway directly outdoors or via any corridor, hall, or room that forms part of the fire resistant exitway system, shall be fitted with a deadlocking latch with a minimum 1/2 inch throw, which allows egress to the outside by operating a knob, lever, or other device, but cannot be opened from the outside. There shall be no knob, handle, lever, keyway, or any other hardware on the outside of any exitway door.

No secondary lock shall be installed on any exitway door.

201.6 Tenant Use Room Doors in Multiple Dwellings: Each swinging door providing access from an interior common circulation area to a tenant use room shall be fitted with a lock having a deadlocking latch with a minimum 1/2 inch throw, which allows egress from inside the room by operating a knob, lever, or other device, but requires a key to operate the latch from outside the room.

Each tenant use room door shall also be fitted with a secondary lock, having a deadbolt with a minimum one inch throw, which imbeds itself in the box strike at least 5/8 inch, and which has hardened steel inserts, or the equivalent, to deter attempts at cutting or sawing. This secondary lock shall be operated by a key, which differs from the key that opens the deadlocking latch.

The intent of this two key requirement is to provide for flexible control of tenant access, ranging from [1] accessibility to tenants with keys either at all times or only at times scheduled by the building maintenance staff, to [2] accessibility to tenants only according to schedule or individual request [full control by the building maintenance staff].

201.7 Building Service Room Doors: Each swinging door giving access to a building service room shall be fitted with a lock having a deadbolt with a minimum one inch throw, which imbeds itself in the box strike at least 5/8 inch, and which contains hardened steel inserts to deter attempts at cutting or sawing. Such locks shall be operated by key from the outside.

201.8 Garage Doors: Overhead garage doors operated by electric power shall have no control switches mounted outside the door other than key operated control switches.

Each manually operated overhead garage door shall have locking slide bolts on both sides of the bottom bar.

Each chain operated rolling overhead garage door in a dwelling shall be provided with either a cast iron keeper and pin for securing the hand chain, or with locking slide bolts on both sides of the bottom bar.

Each crank operated rolling overhead garage door in a dwelling shall be provided with a means of securing the crank handle or the operating shaft, or shall be provided with locking slide bolts on both sides of the bottom bar.

Each swinging, sliding, or accordion type garage door or any exterior door more than five feet wide in a dwelling shall be secured either with a padlock and hasp or with a cylinder lock containing a deadbolt with a one-inch throw, if the door is not otherwise controlled or locked by electric power.

201.9 Padlocks and Hasps: All padlocks installed in compliance with requirements contained in this Security Code shall have a hardened steel shackle with a minimum five-pin tumbler operation and a key that cannot be removed when the padlock is in an unlocked position. In order to make unauthorized key duplication more difficult, serial numbers on padlocks shall be filed off. Padlocks shall be installed only in conjunction with hardened steel hasps designed so that no mounting bolts or screws are exposed when the hasp is in the locked position.

The nonremovable key provision is designed to prevent an unlocked padlock from being stolen either to be [1] returned after a duplicate key has been made, or [2] replaced with a weaker temporary lock which might allow an easier break-in.

Section 202 Master Key System

Use of a master key system by authorized personnel can help make maintenance operations in a multiple dwelling simpler, but the danger of improper unauthorized use of a lost or stolen master key far exceeds the value of the system in most circumstances. Prevention of possible misuse of a master key that can open dwelling unit entry doors can only be avoided with certainty if there is a flat ban on the use of master key systems on these doors in multiple dwellings.

202.0 General: Any system of similar locks on doors in a multiple dwelling shall be fitted with cylinders operable by a master key only to the extent allowed by the provisions contained in this section. In most situations the use of master key systems is prohibited.

202.1 Dwelling Unit Entry Doors in Multiple Dwellings: No system of master key operated cylinders shall be installed as the only approved lock on the entry doors of dwelling units in any multiple dwelling. Each dwelling unit entry door shall be fitted with a lock meeting the requirements contained in this Security Code operable only by a change key unique to the cylinder of that particular lock.

In all leased or rented dwelling units lock mechanisms and keys shall be changed at the expense of the owner or his designated agent upon change of tenancy. This provision shall not apply to hotels or other such multiple dwellings having transient occupants.

202.2 Tenant Use Room Doors in Multiple Dwellings: Tenant held master keys for locks on tenant use room doors shall be allowed only when all doors to each room thus protected can be additionally locked by maintenance personnel, as described in Section 201.6.

Through use of a master key, tenants have convenient access to several tenant use rooms when these rooms are scheduled for individual tenant use. At all other times maintenance personnel can lock the rooms.

202.3 Building Service Room Doors in Multiple Dwellings: Use of a master key system for locks on buildings service room doors in multiple dwellings shall be allowed on all such rooms, except those containing valuable, small-scale, easily stolen items, such as tools, building supplies, spare parts, or fixtures, and so on. Rooms with such articles shall be fitted with change key locks satisfying the requirements of **Section 201.7.**

Thefts or damage resulting from a lost or stolen master key which opens rooms such as electric closets and sink closets are not likely to be serious because these rooms do not contain portable items of value.

202.4 Exceptions: Some of the restrictions on the use of master key systems in multiple dwellings shall be waived if the building has a regularly scheduled, 24-hour doorman or guard on duty in the lobby. Specific exceptions shall be approved by the enforcing agency.

Section 203 Hinges

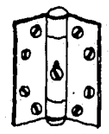
The pins in conventional leaf hinges can be easily removed with a simple prying tool such as a screwdriver. Leaf hinges can be made more secure either by mechanical modification of the hinge pins so they are difficult or impossible to remove, or by mounting the pins on the inside of the door. Other special door mounting techniques will render a door impassable even if exposed pins are removed.

203.0 General: Hinges on all swinging doors described in Section 201 shall be constructed, modified, or installed so that the hinges cannot easily be removed, broken, or dismantled by a person outside a locked door. Access through the door opening is thus prevented.

Each hinge installed according to this Security Code's provisions shall be mounted so that none of the bolts or screws attaching the hinge to a door or frame is accessible from the outside when the door is in a locked position.

203.1 Out-Swinging Doors: Out-swinging doors shall be fitted with hinges having nonremovable hinge pins.

Conventional hinge pins can be made nonremovable either by peening both ends, or by drilling and tapping a tiny nonremovable machine screw into the middle of each pin.



203.2 In-Swinging Doors: In-swinging doors are not required to be fitted with hinges having nonremovable hinge pins.

203.3 Garage Doors: Any rolling, accordion, or otherwise hinged garage door shall be fitted with nonremovable hinge pins if the hinges are exposed when the door is in the locked position.

203.4 Exceptions: Provisions for nonremovable hinge pins, included elsewhere in this section, may be waived if sturdy "jimmy-pins" are installed on the door.

Section 204 Door Closing Devices

204.0 General: If a door must remain closed when not in actual use, a reliable mechanical door closing device shall be attached to the door to insure its automatic reclosure after each opening. Provisions in this section list the required operating characteristics and installation locations for door closing devices.

Although spring hinges adequately close most doors, heavily used doors, such as those in lobbies of multiple dwellings, may require door closers.

204.1 Dwelling Unit Entry Doors: Each swinging dwelling unit entry door, in both private and multiple dwellings, shall be fitted with a door closing device which can close and latch the door when it is left ajar six inches (that is, when the lock edge of the door is six inches from the door frame).

204.2 Common Entry Doors in Multiple Dwellings: Each swinging common entry door in a multiple dwelling shall be fitted with a door closing device capable of closing and latching the door no matter how far ajar it may be left.

204.3 Fire Stair Doors and Exitway Doors in Multiple Dwellings: Each fire stair or exitway door in a multiple dwelling shall be fitted with a door closing device capable of closing and latching the door no matter how far ajar it may be left.

204.4 Tenant Use Room Doors in Multiple Dwellings: Each tenant use room door in a multiple dwelling shall be fitted with a door closing device capable of closing and latching the door no matter how far ajar it may be left.

Door closing devices on some tenant use room doors may be fitted with checking devices which allow the doors to be kept in an open position.

204.5 Building Service Room Doors in Multiple Dwellings: Each swinging door on a building service room in a multiple dwelling shall be fitted with a door closing device capable of closing and latching the door no matter how far ajar it may be left.

Section 205 Buzzer-Reply Intercom System

205.0 General: Each main entry door in a multiple dwelling required by this Security Code to have a buzzer-reply intercom system shall be fitted with an electric strike which can be activated from any dwelling unit, in combination with a two-way audio intercom system, as described in this section.

205.1 Electric Strike: Each buzzer-reply intercom system shall include a sturdy mortise-type electric strike securely installed in the door frame and operated by an activating system, as described in Section 205.2. The electric strike design shall be coordinated with the door hardware design and shall operate with a deadlocking latch.

205.2 Activating System [for Electric Strike]: Each electric strike shall have a system of activating switches and connecting wiring, which operates the electric strike to release the main entry door latch. An activating switch shall be installed inside each dwelling unit to which a main entry provides access.

205.3 Audio Intercom System: Each main entry door in a multiple dwelling required to have a buzzer-reply intercom system shall also be fitted with a two-way audio intercom system. This system allows a person standing just outside the main entry door to converse with (that is, to hear and be heard by) persons inside any dwelling units to which that main entry door provides access. Voice clarity should be at least as good as conventional telephone standards.

The main entry hardware for any such intercom system shall include recessed speakers and microphones, as well as vandal-resistant selector

buttons. All main entry equipment shall be installed so that it is protected from the weather. Such installation is commonly in an enclosed vestibule just outside the main entry door.

Section 206 Double Doors

206.0 General: When a double swinging door, rather than a single swinging door, is installed in a door opening, the active and inactive leaves of the double door shall meet the requirements of this section.

206.1 Active Leaves: The active leaf of any double door governed by the provisions of this Security Code shall meet all the door construction requirements in Article 1 (except the inactive leaf of the double door rather than a door jamb shall contain the strike), all the requirements for door hardware in this article.

206.2 Inactive Leaves: The inactive leaf of any double door, governed by the provisions of this Security Code, shall meet the door construction requirements in Article 1 and the hinge requirements in Section 203. In addition, each inactive leaf shall be fitted with hardened steel top and bottom flush bolts each having a minimum 5/8 inch throw. These bolts shall be received by metal reinforced holes set into floors or wood door frames; receiving holes accurately cut into sturdy metal frames are also acceptable.

Section 207 Optical Door Interviewers

207.0 General: Unless stated otherwise, each dwelling unit entry door (in both private and multiple dwellings) shall be fitted with an optical door interviewer meeting the requirements of this section.

207.1 Optical Door Interviewer Construction and Installation: Each optical door interviewer shall be installed in a hole having a maximum area of 2 square inches, drilled or otherwise cut through the door. The optical door interviewer shall be located midway between the door's two sides and approximately 4'-9" above floor level. The interviewer shall be designed and constructed so that no bolts or screws are exposed on the outside of the door. The edges of the interviewer case shall be beveled to inhibit attack with a gripping tool. The gross area of the actual opening through the case shall not exceed 1-1/2 square inches. This opening shall be protected by one of the following means:

(a) a sturdy metal grille with no opening larger than 1/8 inch, rigidly fixed to the interviewer,

(b) a single thickness of vandal-resistant glazing material securely fixed into the interviewer, or

(c) an optical lens (with a maximum lens diameter of 1/2") providing a "wide-angle view" from inside the door, securely fixed into the interviewer.

HIGH CRIME AREA

In high crime areas, make the following changes:

Change the maximum area of the hole in which the optical interviewer is installed from two square inches to 1/2 square inch.
Change the gross area of the actual opening of the interviewer case from 1-1/2 square inches to 1/4 square inch.

Delete all of the final sentence including, as well, items (a), (b) and (c) and substitute "This opening shall be filled with a system of optical lenses, which provide a 'wide-angle' view (minimum 90°) from inside the door, securely fixed into the interviewer."

207.2 Exceptions: The following kinds of dwelling unit entry doors are not required to have optical door interviewers:

(a) common interior doors in private dwellings giving access from attached garages, enclosed porches, and other enclosed areas;

(b) exterior doors in private dwellings which are not usual entrances for persons other than members of the household (for example, doors giving access directly into bedrooms or dressing rooms, or access from second level decks, and so on).

The following exception is not recommended, but some municipalities may decide to allow chain door interviewers:

(c) any dwelling unit door fitted with a chain door interviewer which meets the requirements in Section 208.

Section 208 Chain Door Interviewers

A chain door interviewer differs from the optical door interviewer described in Section 207 in that it requires the door to be opened slightly for visual inspection. Because chain door interviewers are generally cheaply constructed and easily overcome, they provide a false sense of security; therefore, chain door interviewers are not recommended.

208.0 General: Any dwelling unit entry door fitted with a chain door interviewer instead of an optical door interviewer, as described in Section 207, shall meet the requirements for strength, construction, and installation contained in this section.

208.1 Construction and Installation: Any chain door fastening device shall be designed and constructed so that the keyed metal piece at the end of the chain fits snugly into the slotted horizontal slide track. Installation shall be adjusted so that a maximum door opening of two inches is permitted when the chain is engaged in the slotted track, and the free end of the chain cannot be removed from the track except when the door is fully closed.

208.2 Horizontal Slide Track: The horizontally mounted slide track portion of the interviewer, which is installed on the door near the locking edge and receives the keyed piece at the end of the chain, shall be securely attached to the door and shall be solidly constructed so that it meets the requirements of Section 208.4.

208.3 Chain: The chain portion of the fastener shall be made of hardened steel, which can resist attempts at cutting and sawing and can support a dead load of 800 pounds without breaking.

208.4 Resistance to Forcible Entry: The installed fastener must be able to withstand an 800 pound force applied to any point on the door's exterior, while the door is opened the two inch maximum. The fastener should not break, pull free, or otherwise allow the door to open under these conditions.

ARTICLE 3 WINDOW CONSTRUCTION

A very common mode of criminal entry into residences is that of forcing, breaking, or opening windows that are inadequately protected. Use of break-resistant glass in windows accessible from public areas will serve as a strong deterrent. Even greater security can be achieved by using vandal-resistant or unbreakable glazing material [at several times the price of conventional glass].

Section 300 General:

300.0 Intent: It is the intent of this article to establish minimum standards for the materials and methods of construction of windows, skylights, and other glazed portions of dwellings, which will provide reasonable resistance to attempts at forcible entry through windows or other glazed openings.

300.1 Scope: The provisions of this article shall govern the design, construction, and installation of windows, skylights, and hatchways, as defined herein, including specific requirements for window frames and glazing materials.

300.2 Definitions

Accessible Window: Any window located less than 18 feet above ground level or within 10 feet of any fire escape or other structure.

Break-Resistant Glass: Any glass (or *Glazing Material*) which, because of its thickness or special fabrication treatment, is at least as resistant to breakage as conventional, 1/4 inch thick plate glass.

Casement Window: A window hinged on one side to allow it to open (see illustration, page 197).

Double-Hung Window: A sliding window composed of upper and lower sections which slide past each other vertically in grooves (see illustration, page 197).

Glass Substitute: Any transparent material, other than glass, fabricated in thin sheets and used as a *Glazing Material* (as in windows) in the same ways that conventional glass is used.

Most glass substitutes are plastics which are more resistant to breakage than glass, but less resistant to scratching and discoloration.

Horizontal Sliding Window: A window composed of two sections, one or both of which slides horizontally past the other. One or both of these window sections can be designed to be removed from the inside only (see illustration, page 197).

Jalousie Window: A *Louvered Window* made of heavy glass slats with metal end supports only (see illustration, page 197).

Laminated Glass: A kind of specially fabricated glass with two layers of glass sandwiched around a tough, transparent bonding layer. Some kinds of laminated glass are very difficult to break through, and therefore, are considered to be *Vandal-Resistant Glazing Material.*

Louvered Window: A window of which the glazed area consists of horizontal louvers of glass supported by metal frames (see illustration, page 197).

Pivoted Window: A window which opens by pivoting about its own horizontal or vertical axis (see illustration, page 197).

Skylight: A glazed opening located in the roof of a structure.

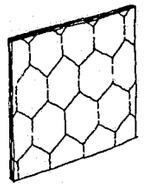
Unbreakable Glazing Material: Any glass or *Glass Substitute* that can withstand sustained attack with blunt pounding tools without breaking.

This type of material is generally guaranteed by its fabricator to be unbreakable. Most unbreakable glazing material can, however, be overcome by drilling, cutting, burning, and other means.

Vandal-Resistant Glazing Material: Any glass or other glazing material which when hit, scratched, punctured, or otherwise damaged, substantially delays an intruder from gaining access to a room, building, or other enclosed area. (see also *Laminated Glass*).

The important feature of vandal-resistant glazing material is that although it can eventually be broken, the process of breaking it takes so much time, trouble, and noise that it provides substantial security in many instances.

Wired Glass: Glass manufactured with a layer of meshed wire approximately in the center of a 1/4" thick sheet.



The standard mesh is approximately 1-1/4" by 1/8" made of Number 24 wire.

Wire-Reinforced Glazing Material: Glass or *Glass Substitute* fabricated with wire mesh encased within the thickness of the *Glazing Material* (see *Wired Glass* above).

Section 301 Construction of All Windows

301.0 General: Windows installed in dwellings shall be designed, constructed, and installed according to the requirements of this article in order to provide reasonable resistance to attempts at forcible entry.

301.1 Resistance to Forcible Entry: Each window shall be constructed and installed so that when it is in the locked position, the nonglazed portions of the window can withstand a force of 100 pounds applied in any direction, without disengaging the lock, or allowing the window to be opened or removed from its frame.

301.2 Window Frames: Frames for all dwelling windows shall meet the requirements contained in Section 305.

301.3 Hardware: Windows governed by provisions of this Security Code shall be fitted with locking devices as required in Article 10, and shall be constructed so that when the device is locked the window cannot be opened or removed from its frame.

301.4 Glazing Material: All windows in dwellings shall be glazed with glass or a glass substitute meeting the requirements contained in Section 306.1.

Section 302 Construction of Accessible Windows

The problem of insuring that a window can withstand attempts at forcible entry is a legitimate concern only in those cases where it is likely that an intruder might actually attack the window. This section attempts to define the categories of accessible windows likely to require protection, and describes protection requirements in terms of materials and methods of construction.

302.0 General: In addition to the requirements in Section 301, all accessible windows must also meet all requirements contained in this section.

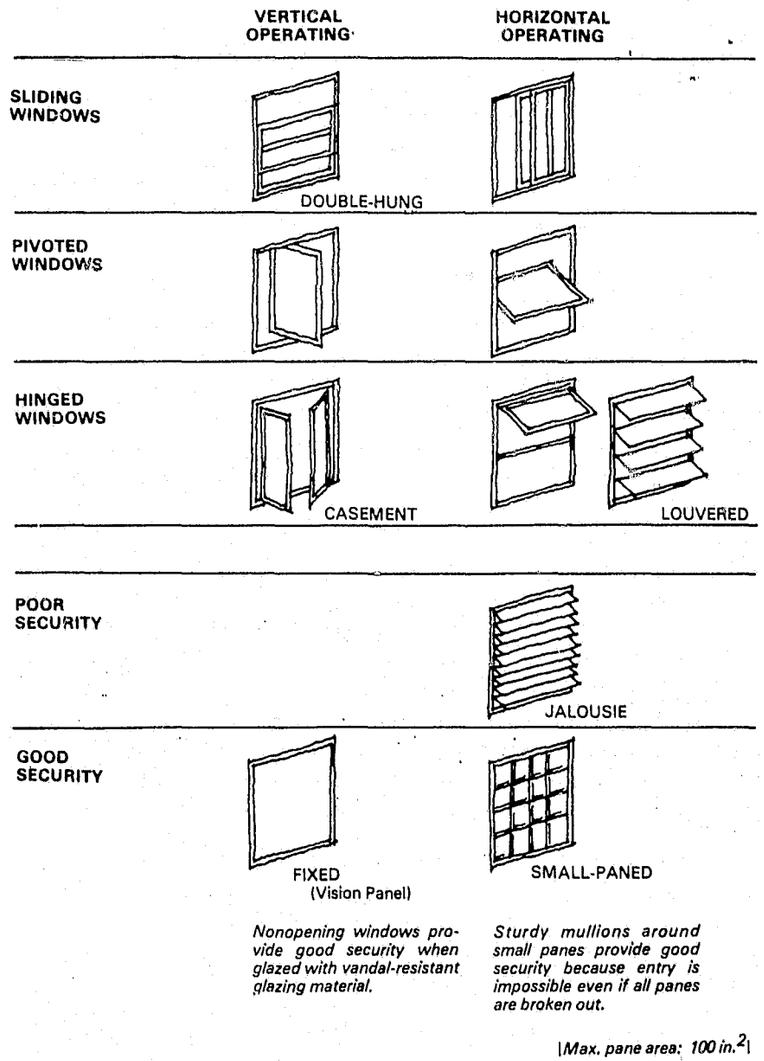
301.1 Resistance to Forcible Entry: Each accessible window in a dwelling shall be constructed and installed so that when it is in the locked position, the nonglazed portions of the window can withstand a force of 200 pounds applied in any direction without disengaging the lock or allowing the window to be opened or removed from its frame.

302.2 Louvered Windows: Louvered windows shall not be used in accessible window locations, unless they are protected by window guards meeting the requirements contained in Section 302.5.

302.3 Hardware: Each accessible window shall be fitted with hardware, as described in Article 4.

302.4 Glazing Material: Each accessible window shall be glazed with a material as resistant as break-resistant glass to attempts at forcible entry.

CONVENTIONAL WINDOW TYPES



Nonopening windows provide good security when glazed with vandal-resistant glazing material.

Sturdy mullions around small panes provide good security because entry is impossible even if all panes are broken out.

(Max. pane area: 100 in.²)

HIGH CRIME AREA In high crime areas, modify Section 302.4 by substituting "vandal-resistant glazing material" for "break-resistant glass."

302.5 Exception: Window Guards: An accessible window in a dwelling need not meet the requirements of this section if the window is protected by a window guard meeting the requirements of Section 403.4

302.6 Exception: Exterior Private Areas: An accessible window need not meet the requirements in this section if the window faces an exterior private area.

Section 303 Construction of Skylights

The primary concern of this article is windows, but skylights comprise a category of glazed openings that share constructional similarities and security problems with windows.

303.0 General: The design and construction of any skylight providing a potential means of access from the roof to the interior of a dwelling shall be in accordance with the provisions contained in this section.

303.1 Resistance to Forcible Entry: Each openable skylight in a dwelling shall be constructed and installed so that its nonglazed portions can withstand a force of 500 pounds, applied in any direction, without disengaging any locking device or allowing the skylight to be opened or removed from its frame; openable skylights shall meet this requirement when they are in the locked position.

303.2 Hardware: Each openable skylight and each openable portion of a fixed skylight shall meet the hardware requirements contained in Section 403.

303.3 Glazing Material: Movable and nonmovable portions of any skylight shall be glazed with vandal-resistant glazing material, with no single panes of glazing material larger than 100 square inches. Adjacent panes larger than 50 square inches shall be separated by support members which are as resistant as a 1/4 inch square steel bar to bending, breaking, and sawing.

303.4 Exception: Window Guards: An openable skylight is not required to meet the requirements in Section 303.1 or Section 303.2, if the skylight is protected by a window guard that meets the requirements in Section 403.4.

Section 304 Construction of Hatchways and Other Unglazed Openings

Although hatchways and other openings governed by this section are specifically defined as being unglazed, they are included in this article because their security considerations are similar to those of skylights and windows.

304.0 General: The design and construction of any hatchway or other unglazed opening providing a potential means of access into a dwelling's interior shall meet the requirements contained in this section.

304.1 Resistance to Forcible Entry: Each hatchway shall be as resistant as a hollow core metal door, fabricated from 10-gauge sheet steel, to attempts at forcible entry. A wood hatchway will be acceptable if its outside face is covered with 16-gauge sheet steel (or the equivalent in strength) attached with round head bolts placed around the entire perimeter of the hatchway at minimum 10" centers. The heads of the bolts are to be placed on the outside face of the hatchway one inch in from the edge.

304.2 Hardware: Each hatchway installed in any dwelling shall meet the hardware requirements of Section 404.

304.3 Air Vents and Miscellaneous Unglazed Openings: Any unglazed openings, such as air vents or ducts, larger than 100 square inches shall be protected by a metal-mesh grille window guard meeting the provisions contained in Section 406 or a metal bar window guard meeting the requirements contained in Section 407.

Section 305 Window Frames

305.0 General: Frames for openable windows, skylights, and hatchways in dwellings shall be designed and constructed so that they allow windows, skylights, and hatchways to be opened only from the inside. Each frame shall also provide security against attempts at forcible entry to the extent required by the provisions of this article.

305.1 Maintenance: Frames of all windows, skylights, and hatchways shall be maintained by periodic painting, repair, or replacement so that they meet the requirements of this section at all times.

Section 306 Glazing Materials

The primary functions of any window or other glazed area are [1] to allow light rays to pass through an otherwise opaque part of a building or enclosure, and [2] to allow for temporary openings in the weatherproof enclosure which permit ventilation, emergency escape, etc. This section is primarily concerned with establishing resistance to breakage standards which will provide security when glazed areas are closed and locked.

306.0 General: The specific categories of transparent glazing materials defined in this section which are to be installed in windows, skylights, and vision panels, according to the provisions of this Security Code, shall meet the requirements for strength and resistance to breakage contained in this section.

306.1 Comparative Resistance to Breakage: Examples of Glazing Materials: The following is a list of the more commonly available glazing materials, arranged in descending order of resistance to breakage:

Highest Resistance: "Unbreakable"

vinyl-bonded laminated glass (1/2" thickness or more)
acrylic plastic sheets: "Plexiglass", "Lexan", etc. (3/8" thickness or more)

Medium Resistance: Vandal-Resistant"

wired glass (1/4" thickness)
laminated glass (approximately 1/8" thickness)
acrylic plastic sheets (approximately 1/8" thickness, depending on specific chemical characteristics)

Medium Resistance: "Break-Resistant"

plate glass (1/4" thickness)
conventional window glass (more than 1/4" thickness)
tempered plate glass (3/16" or more)

ARTICLE 4 WINDOW HARDWARE

Because the noise of breaking glass and the appearance of a broken window are liable to attract attention, burglars and other criminals prefer to enter windows by overcoming hardware, rather than by breaking glass. In situations where glass is broken, illegal entry is most often accomplished by reaching through a relatively small hole to release the window's lock or latch. Consequently, a sturdy, key operated window lock which cannot be released by reaching through a hole in the glass should offer substantial security against break-ins at a relatively low cost.

Section 400 General

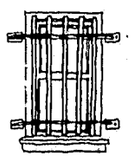
400.0 Intent: It is the intent of this article to establish minimum requirements for the design and installation of locking devices and other hardware on designated windows and other glazed openings in all dwellings.

400.1 Scope: The provisions of this article shall govern the design, construction, installation, and maintenance of all locks, keys, hinges, and other hardware on windows of dwellings as required by this Security Code.

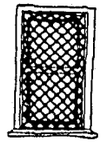
400.2 Definitions

Crescent Sash Lock: A simple *Latch* conventionally not requiring a key for its operation, used on *Double-Hung Windows.*

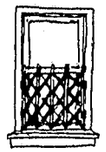
Metal Bars [Window Guard]: A grid or other configuration of sturdy metal bars permanently installed across a window or other opening in order to prevent entry through the opening.



Metal-Mesh Grille [Window Guard]: A sturdy grille of expanded metal or welded metal wires permanently installed across a window or other opening in order to prevent entry through the opening.



Sliding Metal Gate [Window Guard]: An assembly of sturdy metal bars jointed so that it can be moved to and locked in a position across a window or other opening, in order to prevent unauthorized entry through the opening.



Window Guard: A strong metal grid-like assembly which can be installed on a window or other opening; types of *Window Guards* include *Metal Bars*, *Metal-Mesh Grilles*, and *Sliding Metal Gates*.

Section 401 Hardware for Windows

401.0 General: Any window which can be opened or which contains a movable portion allowing a part of the window to be opened shall meet the construction requirements of Section 301 and the hardware requirements of this section.

401.1 Locks: Each window in a dwelling shall be fitted with a locking device which can prevent the window from being opened or removed from its frames when in the locked position, while withstanding a force of 100 pounds applied in any direction.

> *Simple, lever operated locking devices such as crescent sash locks, slide bolt locks, thumbscrew locks, and pin-type locks, are acceptable on all windows except accessible windows.*

Section 402 Hardware for Accessible Windows

402.0 General: Any accessible window (as defined in Section 300.2) shall meet the construction requirements contained in Section 302 and the hardware requirements contained in this section.

402.1 Locks: Each accessible window in a dwelling shall be fitted with a sturdy locking device operated by a key from the inside. This locking device shall prevent the window from being opened or removed from its frame, while withstanding a force of 200 pounds applied in any direction to a nonglazed portion of the window.

> *Key operated pin-type locks or key operated crescent sash locks are permitted for accessible windows.*

402.2 Keys: The key which operates the cylinder on a window lock in 402.1 shall not be kept permanently in either the cylinder keyway or any location within three feet of any glazed portion of the window.

> *Keys should be kept at least three feet away from windows to prevent a criminal from breaking a small hole in the glass, reaching in, and using the key to unlock the window. In order to use the window as an emergency exit a key which operates the cylinder of each window lock should be permanently kept in the same room as the window and in a location that is visible or otherwise known to persons who use the room.*

402.3 Hinges: Any accessible casement window or other accessible window that opens by swinging on hinges shall be constructed with the hinge pins on the inside of the closed window or fitted with nonremovable hinge pins. All screws or bolts used to attach hinges to windows or to window frames shall either be nonremovable or shall be inaccessible from the outside when the window is in its closed position.

402.4 Exception: Window Guards: An accessible window is not required to meet the construction requirements contained in Section 302 or to be fitted with window hardware, as described in this section, if the window is protected by one of the following window guards:

(a) a sliding metal gate covering the entire window and meeting all the requirements of Section 405; or or

(b) a permanently installed metal-mesh grille covering the entire window and meeting all the requirements of Section 406; or

(c) permanently installed metal bars covering the entire window and meeting all the requirements of Section 407; or

(d) any other configuration of metal window guard device approved in writing by the enforcing agency, as being as resistant as metal-mesh grille or metal bars to attempts at forcible entry.

402.5 Exception: Special Window Construction: An accessible window is not required to be fitted with window hardware, as described in this section, if it is designed and installed with a configuration of sturdy window frame and small opening glazing support elements, which effectively forms a system of steel bars in the window opening. Such a small paned window construction must be approved in writing by the enforcing agency, as being as resistant as metal-mesh grille or metal bar window guards to attempts at forcible entry.

402.6 Exception: Exterior Private Areas: An accessible window is not required to be fitted with window hardware, as described in this section, if the window faces an exterior private area as defined in

Section 403 Hardware for Skylights

403.0 General: Any skylight located in the ceiling of any room in a dwelling unit, or in the ceiling of a tenant use room, building service room or an interior semipublic area in a multiple dwelling shall meet the hardware requirements contained in this section and the construction requirements contained in Section 303.

403.1 Locks: Any skylight governed by the provisions of this section, openable or containing a movable portion that allows a part of the skylight to be opened shall be fitted with a sturdy locking device operated by a key from the inside. This locking device shall prevent the skylight from being opened while withstanding a force of 500 pounds applied in any direction. A padlock and hasp meeting the requirements contained in Section 201.9 is acceptable for use as a locking device on a skylight.

403.2 Keys: The key that operates the cylinder on a skylight lock shall not be kept permanently either in the lock cylinder or within three feet of any glazed portion of the skylight.

Because a skylight is not considered to be an emergency exit there is no requirement that the keys be kept in an available location within the room served by the skylight.

403.3 Hinges: Any skylight governed by the provisions of this section which opens by swinging on hinges, shall be fitted with nonremovable hinge pins.

403.4 Window Guards: Each skylight exempted from the glazing requirements of Section 303 shall be protected by one of the following window guards:

(a) a sliding metal gate covering the entire skylight and meeting all the requirements of Section 405; or,

(b) a permanently installed metal-mesh grille covering the entire skylight and meeting all the requirements of Section 406, or

(c) permanently installed metal bars covering the entire skylight and meeting all the requirements of Section 407; or

(d) any other configuration of metal window guard device approved in writing by the enforcing agency as being as resistant as metal-mesh grilles or metal bars to attempts at forcible entry.

Section 404 Hardware for Hatchways

404.0 General: Any hatchway located in the ceiling or roof of any room in a dwelling unit, any tenant use room, building service room, or enclosed interior semipublic area in a multiple dwelling shall meet the construction requirements contained in Section 304 and the hardware requirements contained in this section.

404.1 Glazed Hatchways: For the purposes of this Security Code, a hatchway containing any glazed panels shall be considered a skylight, and as such, shall be required to meet the provisions contained in Section 403.

404.2 Opaque Hatchways: For the purposes of this Security Code, a hatchway contains no glazed panels. Unless specifically prohibited by applicable law or ordinance each hatchway shall be secured with a sturdy locking slide bolt or a padlock and hasp, as described in Section 201.9.

Section 405 Sliding Metal Gate Window Guards

405.0 General: Any sliding metal gate window guard used to protect any window, vision panel, or skylight against forcible entry shall meet the requirements of this section.

405.1 Construction of Sliding Metal Gates: Sliding metal gate window guards shall be equipped with metal guide tracks at the top and bottom and fitted with either a cylinder lock or a padlock and hasp, as described in Section 201.9.

405.2 Resistance to Forcible Entry: Any sliding metal gate installed as a window guard in fulfillment of the requirements contained in this Security Code shall be designed and installed so that the gate, in a locked position, cannot be opened or lifted from the track when a force of 500 pounds is applied to it in any direction.

Section 406 Metal-Mesh Grille Window Guards

406.0 General: Any window, vision panel, skylight, or other opening to be protected against forcible entry by a metal-mesh grille window guard shall meet the requirements of this section.

406.1 Mesh Dimensions: The minimum dimension of the metal members of a mesh grille shall not be less than 1/8 inch and the maximum dimension of an opening between the mesh members shall be two inches.

406.2 Mesh Material and Installation: The metal mesh grille shall be fabricated of steel, bronze, or other strong metal similarly resistant to stress. Grilles installed on the outside of windows shall be attached with round head bolts set through walls, or with nonremovable screws set into sturdy anchors.

406.3 Resistance to Forcible Entry: The mesh shall be installed so that it can withstand a force of 500 pounds applied in any direction.

Section 407 Metal Bar Window Guards

407.0 General: Any window, vision panel, skylight, or other opening which is to be protected against attempts at forcible entry through the installation of metal bars shall be fitted with hardware meeting the requirements in this section.

407.1 Bar Dimensions: Metal bars shall be at least 1/2 inch in diameter, or one inch by 1/4 inch flat steel. The spaces between adjacent bars shall not exceed five inches.

407.2 Bar Material and Installation: The bars shall be fabricated of steel, bronze, or another strong metal similarly resistant to stress. A bar shall be installed by imbedding each end at least three inches into masonry or by bolting through at least four inches of wall thickness. If not imbedded in masonry, bars shall be attached with nonremovable bolts.

407.3 Resistance to Forcible Entry: The bars shall be installed, braced, and supported so that they can withstand a force of 500 pounds applied in any direction without substantial deformation or movement.

ADDENDUM 4

DETAILED SITE PLANS

Figure A4.1 (Fig. 2.25, p. 61): Detached houses, one story, six units per acre.
- Detached houses on 1-acre site
- Site dimensions: 218' X 200' = 43,600 sq. ft.
- 3 units per side = 6 units per acre
- Typical interior unit dimension 30' X 40' = 1,200 sq. ft.
- 1,200 sq. ft. = 3-bedroom unit
- Parking: 6 on-site spaces

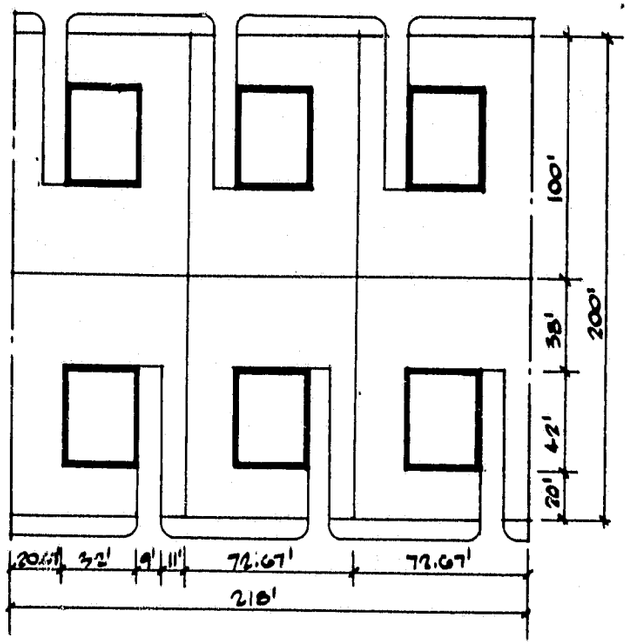


Figure A4.2 (Fig. 2.26, p. 61): Two-story semidetached houses, 16 units per acre.
- Semidetached on 1-acre site
- Site dimensions: 218' X 200' = 43,600 sq. ft.
- 8 units per side = 16 units per acre
- Typical interior unit dimension: 17' X 37.6' X 2 stories = 1280 sq. ft.
- 1200 sq. ft. = 3-bedroom unit, + 40 sq. ft. of stairs per floor
- Parking: 16 on-site spaces

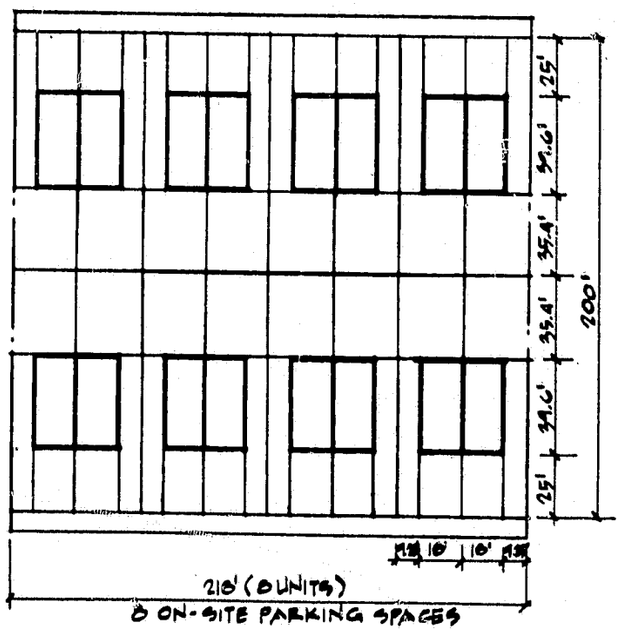


Figure A4.3 (Fig. 2.27, p. 62): Two-story row houses, 18 units per acre.
- Row houses on 1-acre site
- Site dimensions: 217' X 200' = 43,400 sq. ft.
- 9 units per side = 18 units per acre
- Typical interior unit dimension: 23' X 25' X 2 stories = 1288 sq. ft.
- 1,200 sq. ft. = 3-bedroom unit, + 40 sq. ft.
- Parking: 22 on street parking spaces

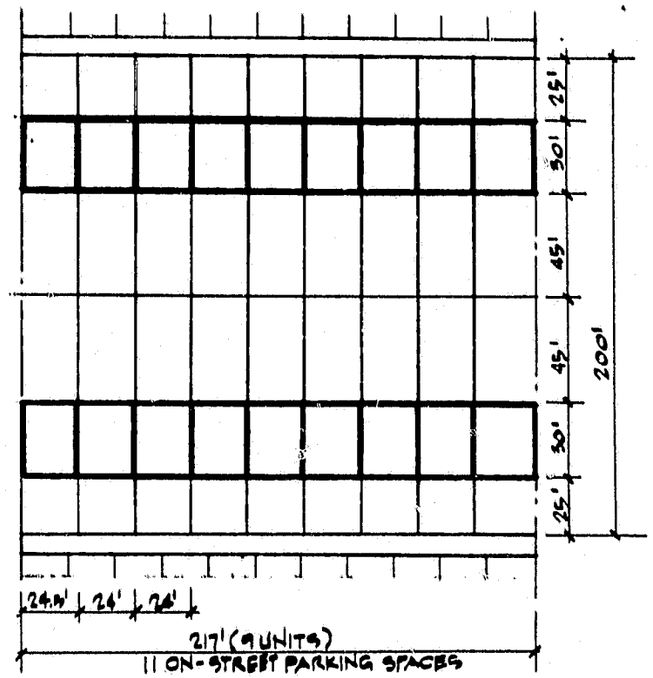


Figure A4.4 (Fig. 2.28, p. 62): Two-story row houses, 24 units per acre.
- Row houses on 1-acre site
- Site dimensions: 217' X 200' = 43,400 sq. ft.
- 12 units per side = 24 units per acre
- Typical interior unit dimensions: 17' X 37.6' X 2 stories = 1280 sq. ft.
- 1200 sq. ft. = 3-bedroom unit, + 40 sq. ft. of stairs per floor
- Parking: 22 on-street parking spaces

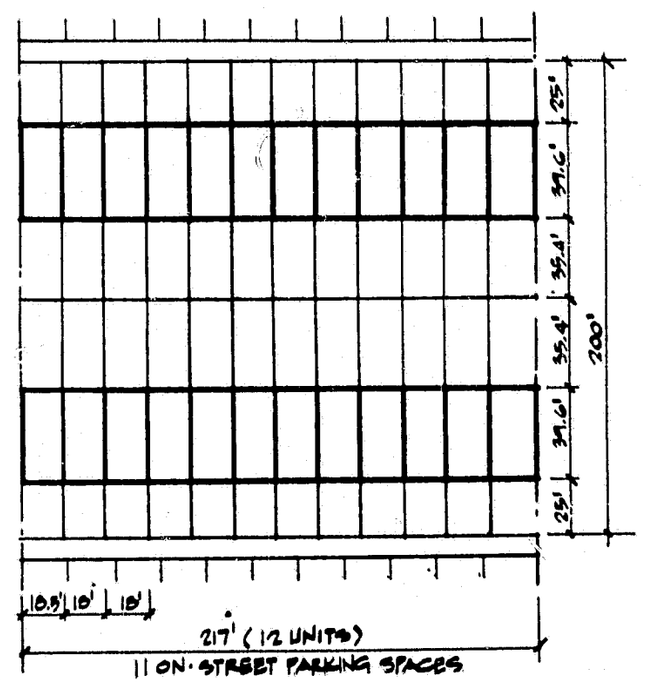


Figure A4.5 (Fig. 2.29, p. 62): Three-story row houses on modified city block, 38 units per acre.
- Row houses on 1-acre site
- Site dimensions: 267' X 163' = 43,321 sq. ft.
- 19 units per side = 38 units per acre
- Typical interior unit dimensions: 13' X 34' X 3 stories = 1326 sq. ft.
- 1200 sq. ft. = 3-bedroom unit, + 40 sq. ft. of stairs per floor
- Parking: 13 spaces per side (on street), total = 26 spaces

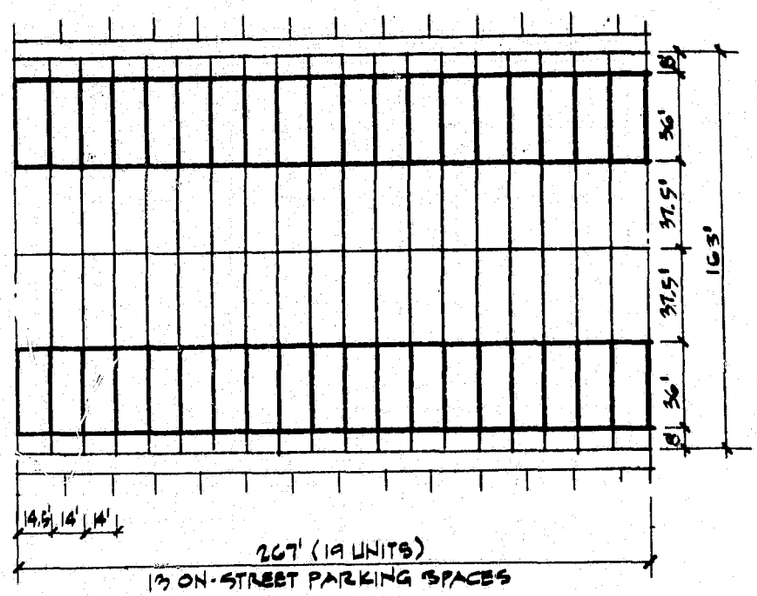


Figure A4.6 (Fig. 2.30, p. 62): Garden apartments, 36 units per acre.
- Garden apartments on 1-acre site, 6 units per entry
- Site dimensions: 218' X 200' = 43,600 sq. ft.
- 18 units per side = 36 units per acre
- Typical interior unit dimensions: 29' X 41.4' = 1,202 sq. ft.
- Parking: 10 spaces each side street = 20 spaces, + 16 spaces on interior of site, total = 36 spaces

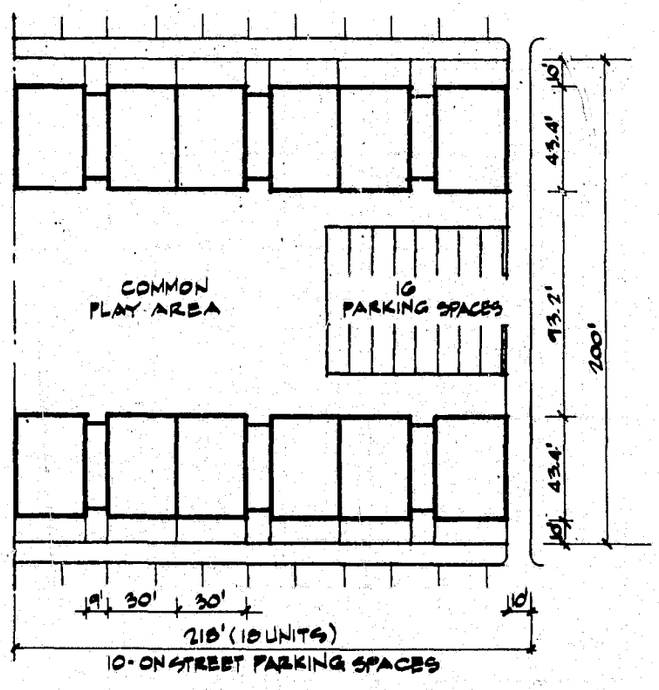


Figure A4.7 (Fig. 2.31, p. 63): Medium high-rise apartments, 35 units per acre.
- Apartments on 1-acre site
- Site dimensions: 218' X 200' = 43,600 sq. ft.
  Six stories, six apartments per floor = 35-36 units per acre
- Typical interior unit areas (per floor): 2 apartments @ 1,200 sq. ft.; 4 apartments @ 1,280 sq. ft.
- 1,200 sq. ft. = 3-bedroom unit
- Parking: 44 on-site spaces

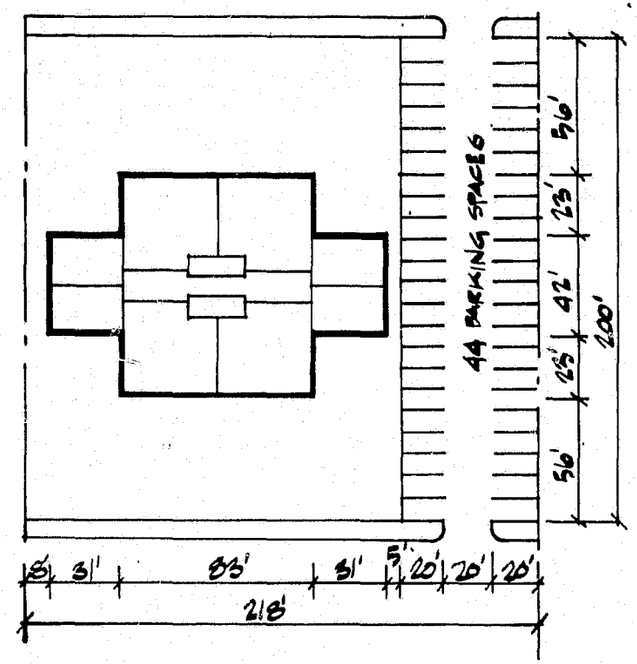


Figure A4.8 (Fig. 2.32, p. 63): Medium high-rise apartments, 55 units per acre.
- Apartments on 1-acre site
- Site dimensions: 218' X 200' = 43,600 sq. ft.
- Seven stories, eight apartments per floor = 55-56 units per acre
- Typical interior unit areas (per floor): 4 apartments @ 1,202 sq. ft.; 4 apartments @ 1,227 sq. ft.
- 1,200 sq. ft. = 3-bedroom unit
- Parking: 44 on-site spaces

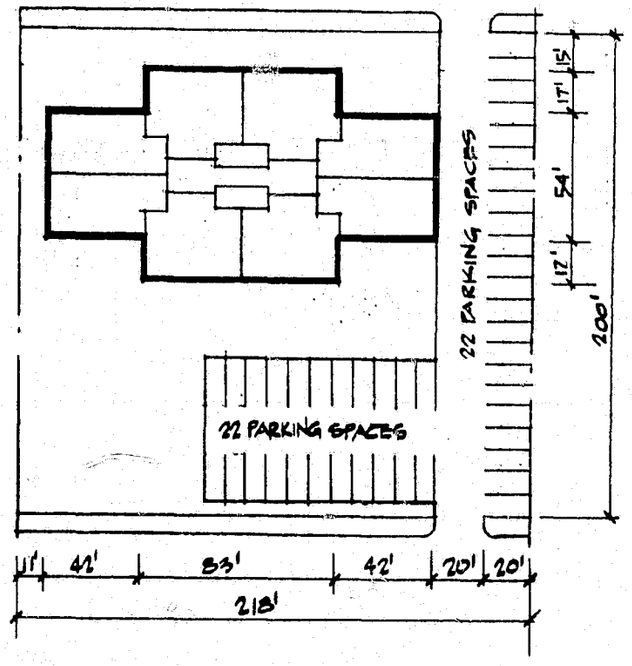


Figure A4.9 (Fig. 2.33, p. 63): European walk-up, 56 units per acre.
- Walk-up apartments on 1-acre site
- Site dimensions: 218' X 200' = 43,600 sq. ft.
- 28 units per side = 56 units per acre
- Typical interior unit dimensions: 27.7' X 43.4' = 1,202 sq. ft.
- Typical interior unit dimensions, duplex: 13.35' X 48.0' X 2 stories = 1,282 sq. ft.
- 1,200 sq. ft. = 3-bedroom unit; + 40 sq. ft. stairs per floor for duplex
- Parking: 22 spaces per side (on street), total = 44 spaces

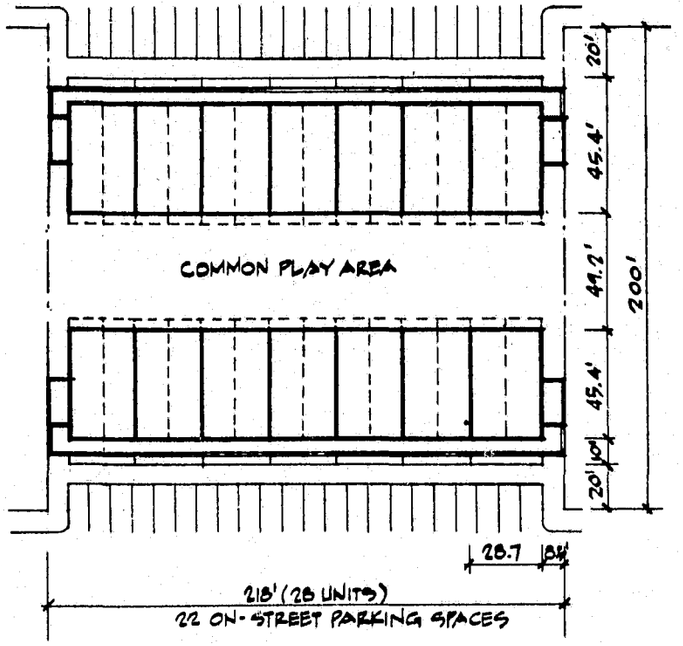


Figure A4.10 (Fig. 2.34, p. 63): High-density walk-up, 72 units per acre.
- Walk-up apartments on 1-acre site
- Site dimensions: 218' X 200' = 43,600 sq. ft.
- 36 units per side = 72 units per acre
- Typical interior unit dimensions; 29' X 41.4' = 1,201 sq. ft.
- Typical interior unit dimensions, duplex: 29' X 22.2' X 2 stories = 1,288 sq. ft.
- 1,200 = 3-bedroom unit, + 40 sq. ft. stairs per floor
- Parking: 30 spaces on site + 20 spaces on street, total = 50 spaces

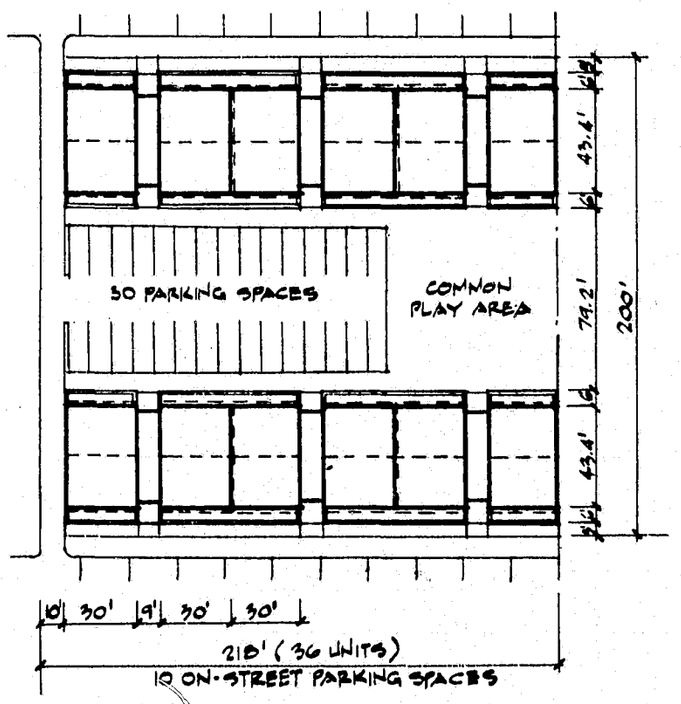


Figure A4.11 (Fig. 2.35, p. 64): Twin-tower apartments, 94 units per acre.
- High-rise apartments on 1-acre site, two 12-story buildings
- Site dimensions: 218' X 200' = 43,600 sq. ft.
- 47 units per tower = 94 units per acre, 4 units per floor
- Typical interior unit dimensions: approx. 40' X 32' (unit actually 1194 sq. ft.)
- 1,200 sq. ft. = 3-bedroom unit
- Parking: 20 on-site spaces per side, total 40 spaces

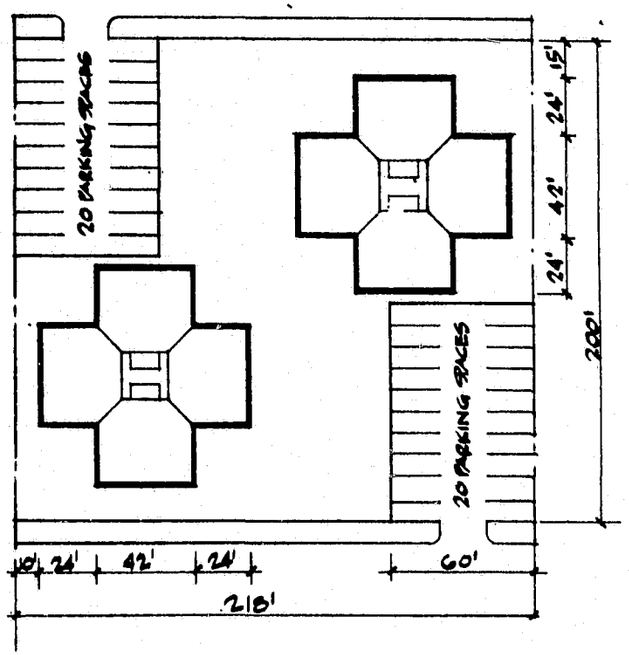
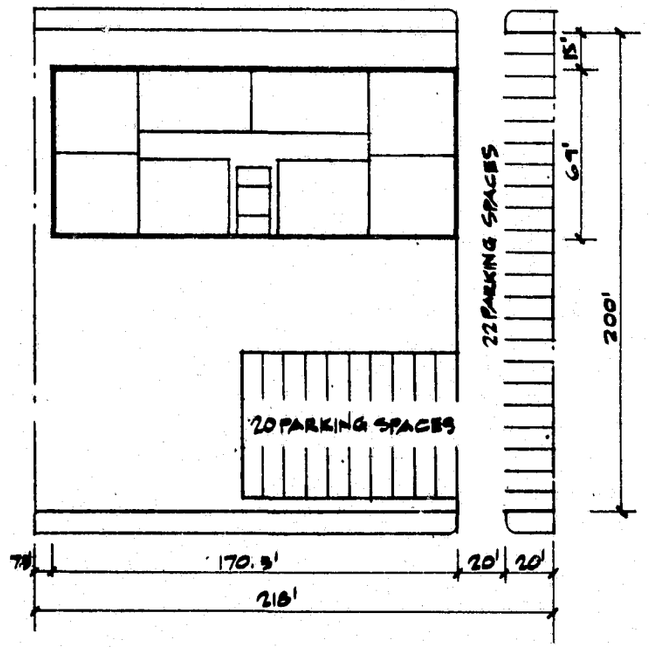


Figure A4.12 (Fig. 2.36, p. 64): High-rise apartments, 103 units per acre.
- Apartments on 1-acre site
- Site dimensions 218' X 200' = 43,600 sq. ft.
- 13 stories, 8 apartments per floor = 103 units per acre
- Typical interior unit dimensions: 4 apartments @ 33' X 36' = 1,188 sq. ft.; 2 apartments @ 25.5' X 47.3' = 1,211 sq. ft.; 2 apartments @ 31.5' X 38' = 1,197 sq. ft.
- 1,200 sq. ft. = 3-bedroom unit
- Parking: 42 on-site spaces



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END

7 illustrations