Density, Distribution & Cost

DENSITY, DISTRIBUTION AND COSTS

HOUSING STUDY

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1 - INTRODUCTION

The reasons for undertaking this research may be simply stated: at present the predominant forms of housing built are at two ends of the density scale - either very low or very high. Further, the small amount of housing which attempts to fill the middle ground does not satisfy the needs of occupants in general, and low income family urban dwellers in particular. Thus our attempts have been to investigate whether the characteristics of the highly favoured single family dwelling could be incorporated into housing forms in the middle range of densities.

Our original proposal of intent may be used at this stage as a guide in evaluating the study's results. The proposal was as follows:

"BACKGROUND

"The condition in the present stock of housing that prompts this research proposal is that few alternate forms of combining units exist. Of the present alternatives, myths persist about their efficacy as agents for the efficient use of land in terms of density and in terms of cost.

"The main argument advanced against low rise housing in urban areas is the allegedly much greater area requirement.

The prejudice is no doubt due to the fact that the notion of low rise housing is associated with the large suburban areas which surround cities. Evidence that the area required for concentrated low rise housing is not much greater than that required for multi-storey housing is being accumulated.[1] It is possible, it would seem, to provide two-storey housing with up to 40 units per acre. In England, back-to-back houses in working class districts in industrial cities in the nineteenth century, while falling short of many contemporary minimum standards, arrived at population densities of 600 persons or 150 units per acre.

"In terms of cost, if multi-storey housing and low rise housing are compared, the concentration of utility installations, and savings in basement space and roof area, are prima facie regarded as technical-economic advantages of the former. The latter seems costlier because of the relatively higher cost of foundations, basements and roofing, and because of the need for a private staircase in two-storey houses.

"Closer investigation, however, would reveal that the heavier load in tall buildings calls for more solid construction; as a result of by-laws and fire codes staircases are costly in tall buildings, and above fire storeys the costs of elevators

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[1] Hubert Hoffman, Row Houses and Cluster Houses, An International Survey; Sir Leslie Martin, Westminster Development

must be added. Furthermore, secondary emergency staircases are still insisted upon by building codes. The ratio of storage area of basements per unit becomes progressively smaller as the building height increases. Thus the only economic advantage might be the cost of roofing, which could conceivably be offset by other costs of heavy structures which require expensive plant for construction.

"Briefly, the generic categories of single family units that are now available to the public as users, and to development agents as builders, are:

1a - detached units.

b - multi-family low rise housing, defined as not exceeding three storeys in vertical assemblage.

2a - multi-family medium rise housing, defined as not less than three storeys and not more than four or five storeys in vertical assemblage.

b - multi-family high rise housing, defined as housing which exceeds five storeys in height, and requires mechanical means of vertical movement.

"The organizational distinction between the first category and the second, besides the physical dimension, is that in the former each unit has private access to the ground, while in the latter shared entrances to units and indirect access to the ground obtain. Under present development practices, densities in dwelling units per residential acre are roughly the following:

1a - four to five
 b - six to eight

2a - eight to twelve
 b - twelve to twenty and higher

"<u>The Research Program</u> - A

"In order to demonstrate the benefits of alternate forms of housing unit amalgamation, factors of density, distribution and cost need to be compared between those associated with present housing alternatives, and those to be explored in the second part of the study. It is intended that the explorations take account of the inadequacies discovered in part A, as well as improve upon present practices of building and land usage.

"Hence in the first phase of the study, it is proposed to record the density, distribution and cost and spatial characteristics of the housing categories listed above. Available work accomplished to date will be used in mapping this picture. Amongst the work that the research will actively exploit will be Kumove's on the characteristics of apartment dwellers, the studies of the Metropolitan Toronto Social Planning Council, Michelson's data on people and property in Toronto, DBS census district level enumeration tapes, Gerson's study on housing, and Metropolitan and City of Toronto planning board studies.

"This work and the co-operation of the agencies listed will to a large extent expedite the research described in points I, II, III, and V that follow. The material for point III and VI will be elicited from Quantity Surveyors, and through the co-operation of developers. Cadillac Construction and The Rubin Corporation have indicated their willingness to assist the study, as has the Parkdale Mobile Homes Company. Graduate students of the department of Sociology, under the direction of Dr. William Michelson, will assist in gathering the information, and processing the data for point VII.

"Specifically, the first phase of the study would, principally within the boundaries of Metropolitan Toronto, select sufficient examples of the generic categories of the housing types outlined above, in order to:

I - Accurately map densities of present, typical housing categories.

II - Record family types and sizes that inhabit these forms of housing.

III - Analyze the capital and operating costs associated with the housing types.

IV - Record size of units in each category in living space, usable space and gross space per person and per family.

V - Plot quantity and evaluate quality of outdoor space, in gross quantity and unit space per person, and assess this in terms of private, semi-private and public space.

VI - Record physical performances standards - orientation, prospect, sound insulation, etc.

VII - Elicit from users, through interviews, their perceived spatial needs, preferred housing forms, desired relationships to public and private outdoor space, range of amenities, and list considered inadequacies.

"<u>The Research Program</u> - B

"The Committee gave consideration to undertaking part B first in the form of a feasibility study. This strategy was rejected because the value of part B would not be demonstrable without establishing the facts of costs, distribution and density that currently prevail.

"In the second part of the study it is therefore proposed that, based on the findings in costs and densities in A, explorations be made in alternate forms of housing-unit amalgamations. Topologically it is possible to demonstrate more efficient forms of space distribution than those currently employed. Via explorations in space packing or solid geometry, a wide range of unit amalgamations can be shown to have the potential of increasing density. Specifically, the study will probably follow this procedure:

I - Establish the principle of efficient three dimensional geometric spatial relationships in abstract; then

II - establish the principle of efficient three dimensional geometric spatial relationships with the theoretical constraints of orientation, ventilation, access, utility services, privacy and those relevant factors discovered in A; then

III - introduce to the principles of spatial relationships the constraints of building technology and the current structure of the building industry.

"It is within these constraints that it is believed that a significant breakthrough in new housing forms may be made; housing that approximates the privacy and scale of the suburbs, yet achieves this at much greater densities (hence land conservation) and at lower costs. And this in forms which allow much greater manipulation to meet social criteria.

"To date, opposing ideals have led different authors to postulate, or at least try to justify extreme solutions - extreme concentration on the one hand,[2] and extreme decentralization on the other hand.[3] In our opinion, density should not only be appropriate but include criteria other than that of quantity - the qualitative aspects of environmental appropriateness to family type and mix, appropriate behavioural criteria such as enhanced contact making, privacy, surveillance, or other factors considered by the urban sociologist to be important. It is, in our opinion, important to destroy the false polemic of horizontal versus vertical housing.

"The building industry is geared to produce, via numbers of small and medium sized contractors, a large segment of the housing market. This operation is at present principally engaged in the construction of single family dwellings, at prices large sectors of the population cannot afford. It is for this reason that it is considered of critical

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[2] William H. White, The Exploding Metropolis

[3] Lloyd Rodwin, The Future Metropolis; Kevin Lynch, The Image of the City; L. Wingo, Cities and Space - The Future Use of Urban Land.

importance to investigate forms of housing which, while increasing densities and satisfying physical and social performance standards, can - without retooling the nation - become operational within the present structure of the industry. Furthermore, low rise housing is virtually predestined for the most appropriate application of prefabrication methods.

"Thus the resources of the contractor, entrepreneur, public agencies and the planning and design profession can be focussed on factors of density, distribution and cost in housing at present not being considered."

This resulting study essentially substantiates the hypothese on which that proposal was based. We have added to the original hypothesis, that density can be increased while maintaining or improving amenity, the further hypothesis that substantial improvement of amenities is possible at densities similar to those found in most existing low rise developments. This study also systematizes the approach to housing design thus providing a foundation onto which further information affecting the physical form of building, such as changes in legislation or additional sound feedback, may be built.

Research did not always follow the originally outlined organization of work. Although the research was divided mainly into two parts - behavioural or social and physical - a number of sub-studies were undertaken to provide information for the study as a whole.

Before being able to manipulate the physical components of housing we felt that relevant constraints established by social requirements should be set up. Thus a social survey was conducted. Surveyed were those residents of housing developments who we felt were potential occupants of the forms of multiple housing described in the original hypothesis. The incomes of these urban families ranged from $7,000. to $9,000. annually in 1968-69 (the years the survey was conducted).

The first objective of the study thus became to identify the preferences of this group of occupants; the second, to provide a systematic measure of density and to reveal alternate means of distributing building volumes; and third, to use occupant preferences to formulate types of low rise housing at equivalent or higher levels of density than are available today.

The social aspect of the study was conducted by Dr. W. Michelson of the Department of Social Science, University of Toronto. He was given a broad mandate to identify, if possible, the preferred characteristics of the single family dwelling, and areas of satisfaction and dissatisfaction in low rise multiple dwellings. It was felt that if these preferred characteristics could be abstracted from the dwelling type, it might then be possible to include them in housing of least equal density to the low rise multiple housing in common use today.

While the market itself provides, via an empirical, or informal process, information about user preferences, this process is slow and operates only on known alternatives. Thus we felt that by formalizing the market, that is, structuring the feedback from users, it might become possible to discover alternatives that have not yet been revealed.

Once preferences are clearly established, it becomes possible to measure the quality of housing at different densities. For example, it has been found that most families prefer to have a private entrance to their dwelling unit and that families with children especially value pedestrian access to outdoor, personal space. In addition, there seems to be a strong desire to accommodate, for convenience and display, the automobile in association with the dwelling. These space consuming features can be provided with each dwelling only up to a certain density, above that it obviously becomes physically necessary to discard some features. In order to evaluate housing we have established the level of density at which this must occur. The next step then is to rank, in order of priority, those amenities that will be traded for increased density. We have not done this in precise terms although the appendices do indicate these values to some extent.

Because the values established as high on user priority lists in this study and its sub-studies are not as definitive as we might have wished, our results should be termed "coarse grain". To directly link these priorities to physical design much "finer grain" information is needed. Further work based upon these foundations is required to establish definitive principles.

Many of our findings regarding preferences have often only served to confirm established knowledge. This does not mean that work was done to no avail as it is important to test conventional wisdom and re-evaluate the strength of preferences. Such results also serve to re-emphasize preferences, which, although known, are not generally incorporated in the housing now being constructed. We feel this study demonstrates that these features are indeed possible to incorporate at equivalent or even higher densities than those of the multiple housing types studied. For example, our sample group reported a high order of dislike for "garden" apartments, that is maisonettes connected by an indoor corridor; and, tenants often try to correct poorly defined outdoor personal space frequently characteristic of such multiple housing. Neither indoor corridors nor poorly defined outdoor space need be part of housing design at medium densities. Neither must the automobile be separated from the dwelling.

The density charts in Chapter 11 show space allotments for private entrance, personal outdoor space and the automobile and plot densities at which these can be accommodated. These charts have been set up so that, as further analyses of requirements establish new values, they may be modified to take account of the effect of these new values on the spatial factor. They therefore may be used as universal measures of amenity and density. For example, we have determined that the minimum personal outdoor space should be no less than the internal living space, that is, aggregated living room, dining and kitchen space. We have not determined the optimum personal outdoor space, if the optimum is larger than the minimum we have shown, the graph of density will correspondingly reduce. We also have not determined the optimum curve of shared space in relation to housing density as this is largely dependant on the provision of recreation space provided by the community. More study is required on the distribution of shared space, as there appears to be no reliable guide at present.

The term "personal" rather than "private" with regard to outdoor space has been deliberately used throughout the study as this term, we felt, more accurately describes the characteristics of desired outdoor space. "Private" outdoor space connotes only visual or aural privacy, characteristics held in less esteem than identifiable personal territory. Similarly we have termed space used in common by a group of housing inhabitants as "shared" rather than "public", as these spaces need not necessarily be public space.

We have also established a module of 12'-0" x 12'-0" as a basic measure common to internal and external space. Although the 12'-0" dimension may seem somewhat arbitrary, it is useful in that housing modules transported to the site are governed by that maximum dimension.

The social values used in this work have been derived from a survey conducted by Dr. W. Michelson and the analyses provided by Robert van Spyk. It must be noted that physical design can only be as good as the information upon which it is based. The application of social science to an applied science is yet in its infacy but we hope that the steps taken here will lead to further work that will improve the social content of the design process.

The chapters that deal with costs are not intended as quantity surveying guides for the developer. The subject has been generalized to discern areas in which the most profitable work may be undertaken. Our expectation was that cost break points could be plotted, but we found that with low rise combinations such graphs would not be meaningful. For example, it is possible to build up to six storeys with a load bearing form of structure, without increasing the square foot cost. In fact, this cost may decrease up to that height. Clearly other factors will inhibit low rise development reaching this height, such as the number of stairs people are willing to climb.

The portion of the study which has, in graphic form, plotted amenity and density is in simple form as more complex, revealing graphic descriptions can only be developed as greater insights into needs and preferences are determined. However, in order to rationalize the design process, guidelines for a computer program, which could rapidly manipulate alternate spatial arrangements to reach combinations yielding highest amenity are given in Chapter 11. Therefore we theorectically demonstrate that given preferences, which can be expressed in terms of space and dimension, desired characteristics and relationships, amalgamations which both incorporate these preferences and yield maximum densities, can be electronically generated.

Finally, we have provided theoretical schemes designed for one of the areas studied. The existing density is 17.2 dwelling units per acre and the demonstration design reaches approximately 35 dwelling units per acre, including amenities not incorporated in the built project.

As far as we can ascertain from our literature search, that while detail studies about components of the housing field exist, no study such as this exists which brings all of the components together. Thus an outline has been established which serves to identify critical areas which require further research, making possible a systematic attack on the housing field by agencies such as the CMHC, and provides guidelines for an improved design process.

The appendices include the reports covering works of Dr. W. Michelson and Robert van Spyk, a bibliography and a check list of issues that might be raised in the design of housing.

A.J.D. April 1970

Occupant Characteristics 2

2 - OCCUPANT CHARACTERISTICS

Occupant characteristics may be given in two forms: either as socio-economic data including age, family structure and income, or as activity patterns of a defined socio-economic group. Straight socio-economic data was felt to be less important in terms of design input than information on activity patterns and for that reason, although such data was used to select people to be interviewed, activity patterns only have been reported here.

Information in this chapter is based on three studies amplified in appendices A, B and C. The Michelson studies (appendices A and B) report the findings of specific areas of research, while the van Spyk study (appendix C) analyzes and assesses a broad range of information including data from Michelson's surveys. The purpose of the chapter is to pinpoint sociological findings basic to architectural needs and to outline, in general terms, resultant design considerations.

A. GENERAL ACTIVITY PATTERNS

In determining the basic activity patterns of the selected middle income group it was found that watching television followed by talking on the telephone, reading and knitting occupied most time. Playing of musical instruments, taking educational courses or the pursuit of fine arts activities rated the lowest; church attendance and employment lay in between.

Watching television was not only reported to be the most indulged activity, but was felt to be under reported possibly due to a projection of guilt feelings associated with this activity. The predominance of this activity clearly warrants greater consideration in design.

Reading, in contrast, was over-reported but nonetheless occupied on an average some 7 hours per week. No information was gleaned on where or when reading took place, but if a proportion of this time is during an afternoon rest or while in bed before falling asleep, no special design provisions for quiet need be made. Five mean hours per week, or 45 minutes per day, represents the average amount of time spent on the telephone, making it an activity of substantial proportion. Experience shows telephone users prefer privacy during their conversations. No data is available on the average length of each call but it may be presumed that many conversations are lengthy. From a cursory observation of usual telephone locations it would seem that insufficient attention has been spent to date on requirements for privacy and comfort.

Another finding which should have a profound, although non-specific, impact on design is that most women in the middle income group were found not to be employed other than as housewives. Of those who did work outside the home very few were employed on a full-time basis (see appendix C, Table 3). Thus with the mother at home much of the time, design criteria should be directed towards improving conditions for activities involving sewing, knitting, cooking and baby care. Specifically these activities call for appropriately designed work and storage space. Investigation of intermittent or special activities revealed that a significant amount of time was spent attending parties. Appendic C, Table 10, indicates this activity usually took place outside the neighbourhood, and that in approximately 48% of the instances, was 20 to 60 minutes distance away by car. Both this activity and that of visiting friends and relatives, can be assumed to be reciprocal; hence both activities require spaces which can accommodate both large and small groups of people. One way of accomplishing this would be to provide spaces which can accept alternate furniture arrangements thus making alternate activities within the same space possible. A further means of building-in flexibility would be to design space to satisfy a number of generically similar activities.

Although sports activities were found to be heavily engaged in, the analysis did not reveal type preferences or the extent to which this was a participatory or spectator activity. If the activity is participatory, provision for the storage of equipment such as skis, guns, fishing poles, golf clubs, etc., would be required.

B. SOCIO-ECONOMIC AND ENVIRONMENTAL EFFECTS ON ACTIVITY PATTERNS

Appendix A yields information about occupant activity by dwelling type (see Page 10). The survey showed that occupants of single family residential units do not engage in a greater variety or number of activities than occupants of either town houses or maisonettes, and that they tend to be more home-oriented in their activities.[1] It cannot, however, be assumed that this social behaviour was determined by house form alone.[2] The occupants of single family units surveyed were on the average older, more settled, had larger families and received relatively lower salaries than those of other dwellings. Thus the probable conclusion is that the occurrence of home-oriented activities bears more relation to socio-economic factors than to type of residence.

Findings, in fact, did show that activities varied with socio-economic conditions such as husband's education, income and age group even with occupants of very similar

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[1] Appendix C page 72
[2] Michelson, W.M. (1968) Man and His Urban Environment, Chapter 8

dwelling types. Therefore any one dwelling type will, over time, house a wide range of socio-economic status groups, age and family size groups at many stages of the family cycle. If tenancy is protracted the family structure will undergo fundamental changes, first expanding and then contracting. The design implications here are substantial. Each stage of the family cycle makes different demands on the dwelling. These can be met by building-in sufficient adaptability of space and amenity. Three typical family cycles are illustrated in Fig. 2.01. They show, for example, that a family which had 3 children might consist, over the whole family cycle, of 2 people for 9 years, of 3 people for 11 years, of 4 people for 9 years, of 5 people for 15 years. If such a family moved into a house after the birth of their first child and stayed until the last child left home, it would consist of its maximum of 5 people for less than half of its period of residence. Some of the design implications of these facts are that for at least 9 years there will be a baby in the house, there will be at least one child under school age for about 13 years and there will be, for about 10 years, 4 people having to get ready for work or school at the same time in the morning.[3]

To effectively accommodate such varying age groups, the

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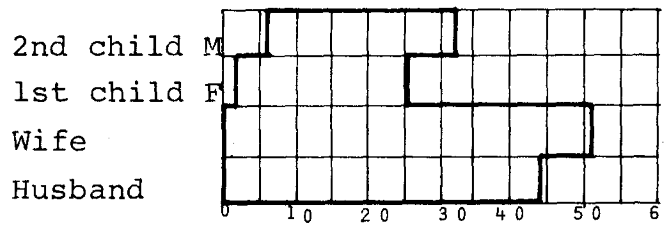
[3] Ministry of Housing and Local Government; Space in the Home, Page 7

Fig. 2.01 THREE TYPICAL FAMILY CYCLES

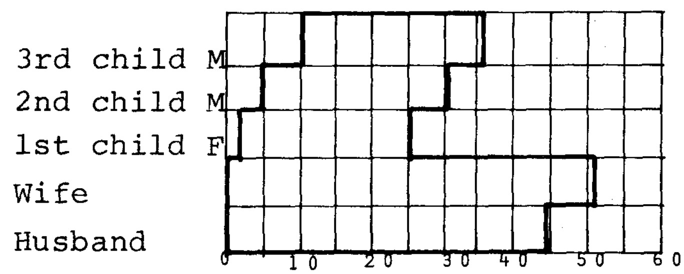
There is a child under 3 for 6 yrs.
There is a child under 5 for 9½ yrs.
There is a teenager for 11½ years.
At least three go out to work or school for 14 yrs.
The married couple are on their own for 12 years.

2 CHILD FAMILY



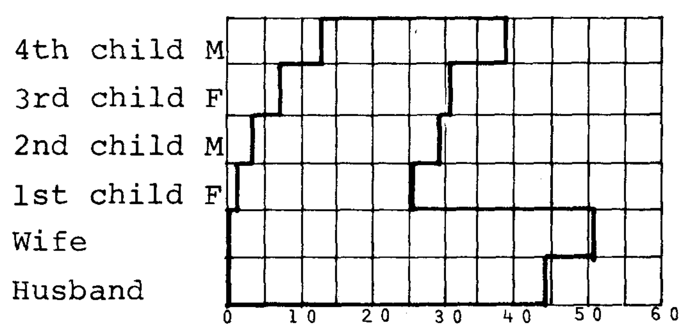
There is a child under 3 for 9 yrs.
There is a child under 5 for 13 years.
There is a teenager for 15½ years.
At least four go out to work of school for 10 years.
The married couple are on their own for 8 years.

3 CHILD FAMILY



There is a child under 3 for 11 years.
There is a child under 5 for 16 years.
There is a teenager for 17½ years.
At least five go out to work or school for 8 years.
The married couple are on their own for 6 years.

4 CHILD FAMILY



design of the dwelling unit must at least allow for supervised play areas for the very young; secluded areas for parents away from children; space for teenagers to tntertain friends or listen to music without disturbing the rest of the family. Flexibility is also a requirement in sleeping areas. While smaller children will share rooms quite happily, older children demand the privacy of their own rooms. As most families cannot afford the luxury of maintaining a room used only for guests, children's rooms should be sufficiently flexible to permit temporary doubling-up thereby freeing a room for guests.

Rising consumer expectations raise a further need for increased space. Appliances such as washers, dryers, freezers, dishwashers, refrigerators, second and third television sets and movie projectors and screens, hi-fi, hunting, camping and sports equipment, often require power supply and particular space requirements. To render a house usable, comfortable and accommodating each of the considerations listed requires a design input.

Dwelling 3

3 - DWELLING

"The quality of a dwelling is to a certain extent determined by its size, dimensions and layout ..... also ..... by internal equipment, i.e., hygenic installations and kitchen, laundry and heating facilities and by indoor climate and sound transmission".[1] The purpose of this chapter is to examine the main determinants of quality in a dwelling - space, configuration and layout - in addition to safety, health standards and service facilities.

Standards of performance for physical conditions can be exactly set; the degree to which mechanical equipment meets performance standards can be accurately measured; but as behavioral patterns are more difficult to determine so is the establishment of the appropriate physical environment, such as a dwelling's suitability for a required range and pattern of activities or its degree of real and perceived privacy. These standards will necessarily differ for each socio-economic group.

A. SPACE

Research has uncovered a number of interesting statements about space requirements and behavior:

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[1] Stokholm. Statens Institut for Byggnadsforskning Quality of Dwelling and Housing Areas.

(1) The provision of generous space standards and its advantages to child raising was found to be one of the main reasons for the overwhelming preference for the single family detatched house.[2]

(2) Residents of single family homes reported internal aspects of environment (interior spaces) to be less pressing than residents of multiple dwellings. Multiple dwelling residents indicated these internal aspects to be not only more pressing but more distressing than external aspects.[3]

(3) The desire for more space was the prime reason given for moving by owners and settled residents and was only superseded by job transfer for renters and potential movers.[4] Owners and non-movers possibly complain most about size of rooms because they do not look on their situation as temporary.[5]

(4) A real or perceived lack of space may be one of the reasons why boys who live in maisonettes have a high level of participation in outdoor hobbies. The possibility that this might result from lack of indoor space for activities in maisonettes is "partially borne out by the request of 43% of the boys ..... for larger space and for a den in their dwelling units.[6]

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[2] Michelson - Analytic Sampling, Pages 21 and 22
[3] Clinton, Alfred - Children, Their Activities and Dwelling Units
[4] Hardy, Barbara - Mimeo. Pages 17 and 19
[5] Ibid.
[6] Clinton, Alfred - Children, Their Activities and Dwelling Units

B. STANDARDS FOR MINIMUM SPACE

Standards for minimum sizes of dwellings and rooms in most planning and building codes are usually based on space allocation per expected occupant or on minimum room size established in the hope of abolishing overcrowding. It has been found, however, that these standards have been crudely based on local norms and expectations. They therefore vary widely. Often, it is the application of the standards which varies.

Most English housing is being built in close accordance with Parker-Morris standards, whereas Toronto dwellings studies were of a considerably higher standard than the minima set out in Canada's National Building Code. A comparison of these standards is revealing. (See Fig. 3.01 and Chapter 9).

C. CONFIGURATION

As important a factor for dwellings as the provision of adequate space is the appropriateness of configuration. Configuration is significant both at the scale of the house shell and at that of individual rooms or activity zones. The size of furniture and the space required for anticipated activities should determine the dimensional requirements of a room. An example of how the amalgamation of these facts determines space configurations can be found in the

Fig. 3.01 COMPARISON OF STANDARDS FOR AREAS OF DWELLINGS

	DWELLINGS STUDIED		NATIONAL BUILDING CODE STANDARDS						PARKER-MORRIS	
Dwelling Type Two Storeys	Net Areas	Storage	Given Areas		Estimated Areas		Net Area	Storage	Net Area	Storage
3P 2B	960	22*	475	+	216	=	691	45	690†	45
4P 3B	1,111	46*	556	+	223	=	779	55	800	50
5P 4B	1,277	46	637	+	231	=	868	65	910	50

* Plus basement.

† Figure calculated from one storey unit

C. CONFIGURATION (continued)

work 'Space in the Home'.[7] The main function of space in the home is to develop "room envelopes" around the activities, support equipment and furniture normally associated with use of the space.

D. LAYOUT

Closely related to size and configuration is layout. The position of doors and windows affects the use of an area considerably, as circulation patterns and furniture placement are generally determined by wall openings. Room design should be formed by furniture groupings and activity requirements rather than room design dictating furniture groupings. Although this rule does not hold as strongly when space standards are generous - for example, a large Victorian house is adaptable to many activities as a wide variety of furniture and equipment arrangement is possible in each room.

Layout also entails the relationship between rooms or activity areas. Household activities must be well understood to effectively handle the positioning of rooms and their relationships to exterior areas. The scope of the sociological study undertaken for this research did not encompass this range of factors. We have relied upon

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[7] Ministry of Housing and Local Government: Space in the Home

D. LAYOUT (continued)

Space in the Home[8] for an assessment of activity patterns. From this we can ascertain criteria for zoning for privacy and sound control, and for the location of sleeping, living and service areas.

E. DESIGN STANDARDS

Safety and health standards are well developed in Canada, and are contained in the majority of building codes which lay down minima for household equipment. The code requirements for bathroom facilities[9] are acceptable and are far more developed and specific than those applying to the rest of the dwelling unit. It is apparent that the range and pattern of activities in a household should determine sensible design standards. Information, however, is lacking about activities and we have had to rely on British research to structure our standards. The difference in life-styles of the two cultures means that we should use these standards with caution. Life styles are also deeply affected by ethnic and class background, climate and location. In order to accurately plot a set of activity patterns suited to the range of tenants likely to inhabit particular housing, detailed information is required. Until this is available, design must either depend on information known and on experience drawn from personal observation, which is

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[8] M.H.L.G. - Space in the Home
[9] Canada: National Building Code

notoriously unreliable, or on providing spaces large enough to accept a variety of activities. If methods of recording tenant satisfactions and dissatisfactions were formalized, such information could be obtained.

It is conceivable that loans by public agencies for development could be made on the condition that such information was periodically recorded in a predetermined format. This would systematize the collection of feedback on user satisfactions or dissatisfaction, making improvements at an accelerated rate possible.

4 - EXTERIOR SPACE

A. SHARED AND PERSONAL OPEN SPACE

Unfortunately, the general rule in multi-family houses is that open space is merely residual area of the site left over after buildings are positioned. Planning regulations may specify the aggregate quantity of open space required, but seldom do they provide guidelines for the quality or distribution of this space; in fact site and zoning by-laws leave little room to manoeuver. For example, side yards, set backs and coverage often leave as little as a 10'- 0" variation in positioning - hence the unvarying answers to subdivision planning. The familiar urban open space pattern resembling a sheet of dough after the cookies have been cut out is the result. Only occasionally are these spaces pleasant: they are often damp and sunless, or exposed and windy. The only improvements possible are cosmetic, those the landscaper can make.

This marshalling of houses in seried ranks causes added privacy problems with side windows facing each other, a problem which can only be solved by the use of venetian blinds or drapes that obscure the light.

External space requires at least as much programmatic and design care as interior space. Outdoor activities generate

A. SHARED AND PERSONAL OPEN SPACE (continued)

functional requirements which obviously must form the basis of any design program. There is a need for both personal and shared open space to cater to a range of activities. It is questionable whether hard lines should separate the shared and personal categories: a strong case can be made for a third type of open space - semi-personal - a transitional category. Open space as a design problem is most easily handled if approached as a response to space demands of activities ranked on a scale from private to public. In Fig. 4.01, we have made such a comprehensive, ranked list of outdoor activities likely to take place in housing areas. The notes describe the activity and suggest qualitative measures which should ensure the provision of an appropriate degree of privacy.

The quantity of space suitable for each activity and the proportions in which they should mix are, for the most part, difficult to assess and few quantitative or qualitative guidelines are available. At present planning by-laws only stipulate spaces between buildings, or control of coverage. These quantitative controls neither allow alternative space distribution systems nor do they evaluate the effectiveness of their physical results.

Fig. 4.01 OUTDOOR ACTIVITIES RANKED IN ORDER OF PRIVACY

	Rank
Sleeping	1
Clothes drying	1
Sun bathing	1-2
Eating	1-2
Drinking	1-2
Barbecuing	1-2
Home repairs, hobbies	1-2
Gardening	1-2
Reading	1-2
Snowman building	1-2
Car repairing	2-3
Car washing	2-3
Bicycle riding	2-3
Skating	2-3
Swings, jungle jims, tree climbing	2-3
Ball games	2-3
Watching: vicarious activity	2-3
Tobaggoning	2-3
Child games	1-2-3
Jogging	3
Ball games	3
Walking	3
Tennis	3
Organized sports	3

Rank: 1 - Personal Space
2 - Transitional Space
3 - Shared Space

B. PERSONAL OPEN SPACE

A factor which strongly influences the preference for single family detached housing is the existence of personal open space (the word "personal" is used, rather than private, as the single family garden is often private only in the sense of ownership). For example, low-rise multiple-housing which provides personal outdoor space more closely approximates the advantages of the preferred single family detached dwelling in this regard than those that do not. "The importance of 'private' open space cannot be too strongly emphasized".[1] How large, how private and how defined personal outdoor space should be is, at present, not well established. Further research is needed to obtain this information.

Data[2] given in this study indicates that the sample families indulged more in home-oriented entertainment, both as guests and hosts, than any other form of social activity. This often takes place out of doors, weather permitting. We may infer therefore that outdoor entertaining areas should be at least as big as total indoor living areas. For outdoor cooking, an area equalling the kitchen area might be added. A very comfortable rule of thumb might be that the minimum garden area should equal the aggregated indoor living and cooking areas. (that is, excluding

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1 Dr. W. Michelson - Interview
2 Appendix B, pp 10 - 12

B. PERSONAL OPEN SPACE (continued)

bedrooms, etc.). This would allow for planting and simple landscaping; sedentary adult outdoor activity; and space for appropriate outdoor play for a small group of young children while parents entertain indoors. "One of the problems with children in areas of other dense activity in fact is to keep them from usurping one's private area and making it common ground".[3] Obviously more active play, and play embracing a greater number of children, or activity involving equipment or balls, involves a corresponding change of scale in area and a reduction in privacy of semi-private or public space.

Questions on an appropriate degree of privacy and the means to achieve this are not easily answered. We can, however, make inferences from the following comments:[4] "Experience indicates a strong tendency to enclose and delimit private open space to enhance its utility", "Good fences make good neighbours", "Private open space increases the possibility for activity" and "A Kansas experiment with wing walls to row houses proved very successful.

These observations lend further credence to the need for personal open space in housing. This is at least true

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[3] J. D. Varey - Mimeo
[4] Dr. W. Michelson - Interview

B. PERSONAL OPEN SPACE (continued)

in the development areas which constituted the sociological survey sample. Some developments have experimented with ceding to the tenant the maintenance and development of his personal space (personal space, in these instances, being at best a 10 or 12 foot deep strip of site at the front or back of the dwelling). Almost all tenants undertook some gardening work in an effort to establish their personal space either by planting beds of flowers, or hedges.[5] One development, where all units face away from the centre of the site, gives this area over to the automobile. The result is that doors onto this central area are indistinguishable from one another. Tenants therefore planted next to their door, or in one case constructed a rockery to 'personalize' this otherwise impersonal area. This would seem to be an attempt to make a mark which says 'I live here'.

It seems, therefore, important to cede to the tenant the area adjoining his unit, to which he can justifiably respond with a 'psychological territorial claim'. We feel much can be done architecturally to give form to the private space, to suggest its bounds and thus to reinforce the occupant's sense of domain and hopefully his feelings of responsibility for that domain.

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[5] Braeburn Woods, Etobicoke

C. PUBLIC OPEN SPACE

We have selected the following quotations to establish concern for the child as an inhabitant:

"Research shows clearly that the first four or five years of a child's life is the period of most rapid growth in physical and mental characteristics and of greatest susceptability to environmental influence. Consequently it is in the early years that deprivations are most disastrous in their effects ..... Experience indicates that exposure to a wide variety of activities and social and mental interactions with children and adults greatly enhances a child's ability to learn. Few homes provide enough of these opportunities. The need is for a complement, not an alternative to family life, but the need is compelling".

"Young children, under eight or so living in high density areas, run two major risks: loneliness and the perils of motor traffic. Perhaps loneliness is the more serious of these hazards. In a recent survey in London, it was discovered that 72% of children under five years of age, living above the third storey of high blocks, played only rarely with other children of their own age, because no safe play opportunities had been provided for them.[6]

"The pattern of social withdrawal and confinement to the

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[6] Planning for Play, Lady Allen of Hurtwood

C. PUBLIC OPEN SPACE (continued)

dwelling of young mothers and children is one which invites chronic ill health and is against all tenets of good hygiene".[7]

It appears then, that it is of cardinal importance that children be catered to in group play activities both for their good and the good of the mother. It is beyond the scope of this study to establish criteria for the childrens' play area at a detailed level. We have, however, attempted to establish broad principles for size, location and the manner in which these areas should relate to housing development in general in the remainder of this chapter.

It must be noted that the majority of the opinions presented here will be those of Lady Allen of Hurtwood, expressed in her book "Planning for Play". Where other sources are used acknowledgements are made.

As a child grows older it appears that there is a definite change in play attitude. For convenience, the breakdown is: 5, 5 to 10, 10 to teens, and finally teenage. There is obviously considerable overlap, but it can be said that each group does have distinguishable requirements.

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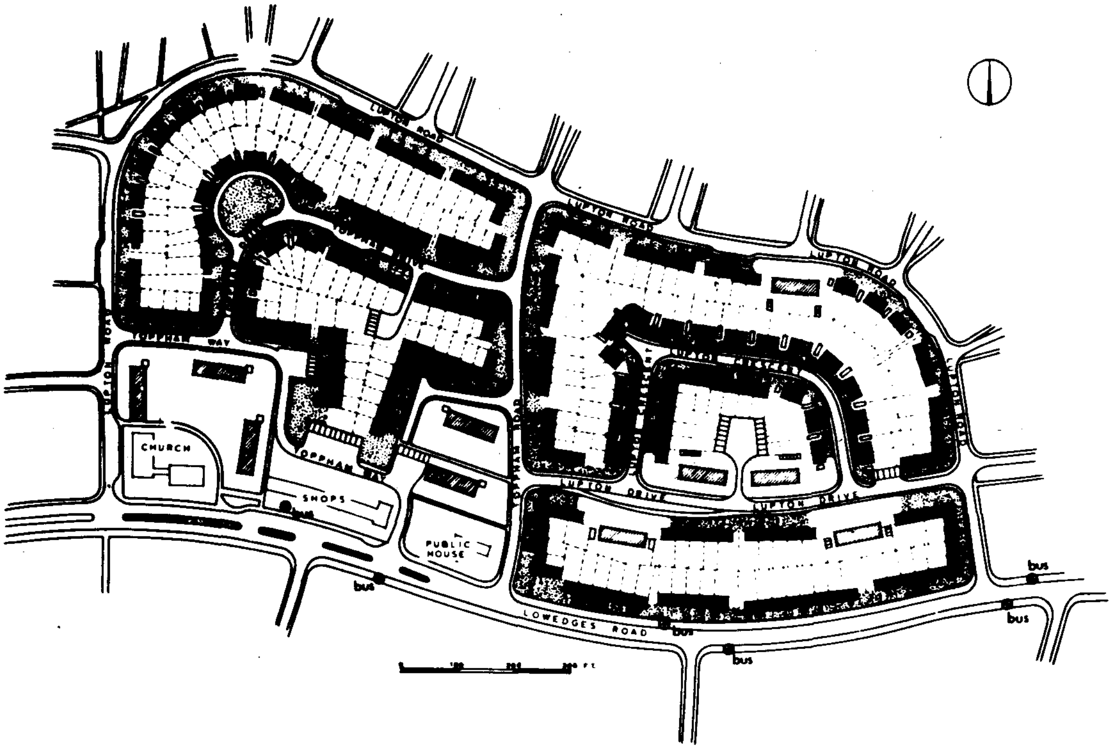
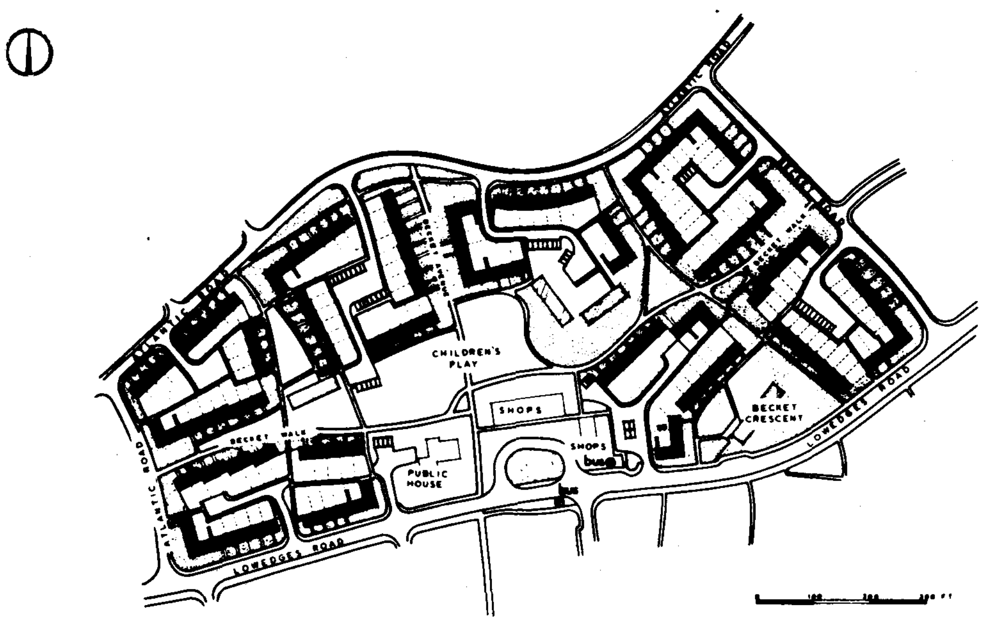
[7] Families in Flats, Dr. M. Fanning, M.V., B.S., D.P.H., British Medical Journal, November 1967.

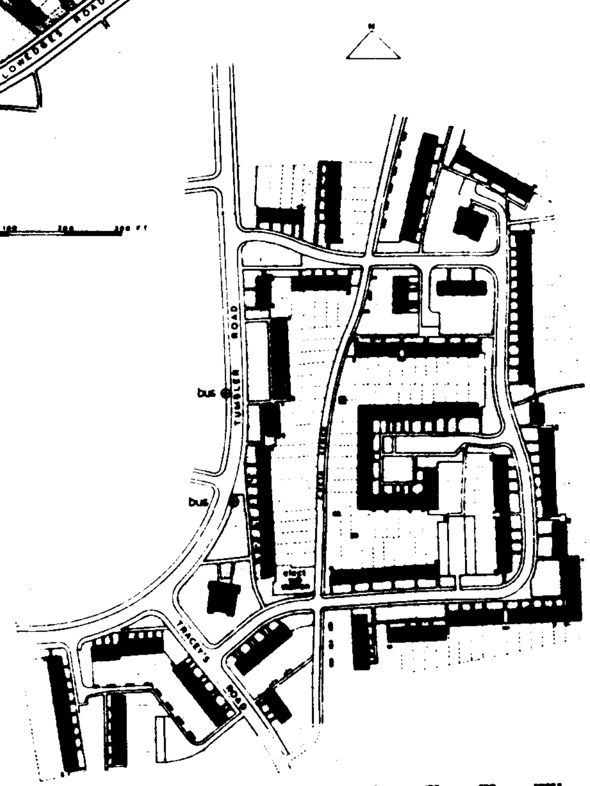


Sheffield. Greenhill-Bradway 3



Sheffield. Greenhill-Bradway 7

Fig. 4.02   RADBURN TYPE LAYOUT



Harlow. Spencers Croft

C. PUBLIC OPEN SPACE (continued)

Young children prefer to play closer to home than older children. Mothers, too, feel more secure with their young children close at hand. Older children, however, can walk a quarter of a mile to play. Facilities, therefore, for the under-tens should be located close to home and in such a way that crossing of streets can be avoided. Another factor which affects location is the time at which play occurs. Times should be related to sun angles in order to avoid excessive shading of play areas in temperate zones. Pre-school children use play facilities in the morning and afternoon, public school children play from mid-afternoon and all ages play in the morning and afternoon during summer months and weekends.

It is often said, especially of "Radburn" layouts, Fig. 4.01 that it is of no avail to provide extensive parkland as children will, in any event, play on roadways and parking courts. This claim, it would seem, has a certain validity: "The special popularity of roads and parking lots presumably derives from other attributes such as hard vertical and horizontal surfaces suitable for ball games, relative freedom from overlooking, and the attraction of motor vehicles".[8] But hard vertical and horizontal surfaces can be provided in better locations with privacy from adult interference. It is not difficult to provide interest and

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[8] Pedestrian and Vehicles on Housing Estates: A User Study A. Miller and J. Cook, H.M.S.O.

C. PUBLIC OPEN SPACE (continued)

stimulation that would successfully compete with the automobile. Conversely, if streets serving housing are designed as cul-de-sacs, designed for slow moving, easily observed traffic (no parking) it is conceivable that cars, people and play could safely mix.

The provision of appropriate play place away from roads has, however, frequently been achieved in British and Scandinavian "adventure" playgrounds. The nub of the problem is that children will continue to play in streets, and by preference, unless playgrounds have enough interest to capture their imagination.

Lady Allen of Hurtwood maintains that as playgrounds are social centres they must have sitting places and tables, shelter from draughts and whistling winds, protection from rain, adequate variety and things to do - and easy access to toilets. They must be designed, to avoid a dark and sunless atmosphere, to ensure that children can reach them in safety, to avoid nuisance to residents from noise and broken windows, and to make them visually a part of the whole environment. The most challenging problem, of course, is to "provide plenty of variety and a choice of things to do". "Planning for Play" is largely an analysis of just this problem. Using numerous examples, Lady Allen demon-

C. PUBLIC OPEN SPACE (continued)

strates not only that all this is possible, but that it is possible on a very low budget.

This concept, however, requires a radical shift in playground philosophy. Asphalt courts with wire netting fences, concrete pipes and iron tube cubist sculptures, brightly painted steamrollers and World War 11 bombers are thus considered obsolete. These are all fixed, unalterable, passive and dull. "It is the adventure playgrounds where children can do-it-themselves that are liberating - they are places where children can test themselves against new challenges in complete freedom ..... They ..... found more creative amusement on waste land. Here at least they could move things around to their liking, build houses with old bricks and timber and (when the policeman was not looking) light a fire or channel muddy water into rivulets and ponds. This is the sort of play that adventure playgrounds cater to. "The sites are usually rough, the tools strong and potentially lethal; the climbing structures, although tested by the leader, appear rickety and dangerous; bonfires might be considered a hazard, the large numbers of children of all ages working or playing singly and in groups might be thought uncontrollable at times, yet in all the ten years of experience in Great Britain, there has been nothing more

C. PUBLIC OPEN SPACE (continued)

serious than cuts and bruises, and no parent has ever made a claim". Serious accidents happen when, because of boredom, children tamper with the fixed equipment of orthodox playgrounds.

Some forms of group play are unsuitable for these specialized playground areas - football, baseball, softball, touch football and, in winter, hockey and skating. If appropriate provision is not made for these sports, they will in all likelihood occur where they will prove to be a nuisance. Obviously not every development should have to provide such extensive play amenities, but if there is no conveniently located public park for such large scale play, then an open area for similar games should be included in the program.

The need and demand for swimming pools and usable open water (splash pools) is also high. Splash pools will be used exclusively by young children and should therefore be located in positions which make general surveillance easy, unless there is professional supervision. During winter months pools can, with little trouble, be converted to excellent skating rinks and therefore splash pools should be designed to accommodate junior league hockey rink specifications. Hockey is a noisy sport; the pool should

C. PUBLIC OPEN SPACE (continued)

thus be located in a position affording least nuisance to tenants. Extra care in the siting of such an amenity is needed as this requirement would conflict with requirements for summer surveillance.

The question of whether to locate swimming pools indoors or outdoors remains unanswered. A case can be made for creating flexibility via a form of retractable or removable roof, but this involves considerable expense. The yield of increased use may prove to warrant such expense.[9] The use of roof spaces themselves, of both garage and dwellings, if sufficiently safe, is not to be ignored.

It is possible that the provision of excellent public facilities can generate administrative problems caused by the almost certain attraction to the facilities of children from surrounding housing developments. It is our feeling, however, that an open gate policy is both beneficial and would cause the least friction. It seems that these administrative difficulties would centre on the question of responsibility for maintenance and supervision of facilities, and on culpability in the event of accident. Successful precedents in which responsibility for supervision is undertaken by tenants' committees do however

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[9] L. Kumove - Social Planning Consultant - Interview

C. PUBLIC OPEN SPACE (continued)

exist. These involve the use of either volunteers or paid professional help; culpability is insurable, and a matter for negotiation by concerned groups. The provision fo these amenities is, however, made in the interests of social hygiene and they should not, in our opinion, be excluded because of administrative problems.

Circulation 5

5 - CIRCULATION

VEHICULAR

The basic information necessary in formulating standards for car storage and circulation, is the expected car ownership rate for a given socio-economic group. Planning By-Laws generally specify minimum standards for the number of parking spaces in multi-unit developments. These standards are very often inadequate as they do not take into account variables such as unit-size, family income, location relative to transit, visitor parking, or the rise in car ownership that may be expected over time.[1] Some information is available about these variables. Car ownership may be expected to rise with the increase in the unit size and family incomes, and car use, if not ownership, may be expected to decrease with locations close to urban centres and to high frequency public transport. Car ownership is expected to rise uniformly in Toronto from the 1968 ratio of .33 cars per person to .36 cars per person in 1980.[2] An application of these principles to hard figures derived from user studies will provide a more accurate guide than will the application of normal planning alone.[3]

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[1] Metro Toronto Planning Board, Apartment Parking Requirements In Metro Toronto 1968.
[2] Metro Toronto Planning Board, 1995 car ownership projection
[3] Metro Toronto Planning Board, Apartment Parking Requirements

(a) Parking Facilities

Provision of visitor praking is often inadequate: while in Metropolitan Toronto, an average of 12½ visitor spaces per 100 units would satisfy peak demand if these were exclusively used as visitor spaces.[4] There are indications that a high proportion of underground parking, with the attendant high cost to the user, forces tenants to usurp the visitors' parking on the surface.[5] This overflow also occurs when there is an under-supply of tenant parking, which is often the case. Visitors' parking requires careful location in order that accessibility to building or destination is made clear and convenient. Badly sign-posted and poorly supervised visitors' parking is a constant source of trouble.[6] In addition to visitors' parking, provision must be made for the temporary parking of service and delivery vehicles at locations close to their point of destination. In most cases the normal visitors' spaces will cater to delivery needs, as this use is unlikely to coincide with visitor use. Taxis, however, pose a special problem as they often refuse fares located in multi-unit developments as pick-up is difficult.[7] Taxis should be able to provide front door service to each dwelling unit, without being obstructed or obstructing vehicle flows. Taxis and service vehicles (particularly garbage collection) pose special problems where attempts are made

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[4] Metro Toronto Planning Board, Apartment Parking Requirements
[5] Ibid.
[6] Ibid.
[7] A. Miller & J.A. Cook, Pedestrians and Vehicles on Housing Estates: A User Study.

(a) Parking Facilities (continued)

to reduce vehicle penetration into sites.

The location of tenant parking should be as close as possible to the unit itself. There is a strong preference to have the parking for privately owned vehicles adjoining the housing unit. This, naturally, makes unloading easy and affords other forms of convenience such as weather protection. Unreasonable distance between car and house is a major cause of dissatisfaction in housing developments where this occurs. Consideration may, as an alternative solution to this problem, be given to access from the rear of the housing unit in the form of collective parking stalls. An example of this is the "Radburn" service court.[8] This does not, however, compensate in convenience for the benefit of eliminating roads in front of the house, as it would seem that immediate access to each unit is a high order priority. Where parking facilities are separate from the house, covered, all-weather access routes can, in part, compensate for the inconvenience of distance. It is difficult to assess the importance of the visual aspects of parking. Large open car lots are, for many, unsightly, as are a collection of individual garages. These questions tend to make underground parking an attractive, if expensive, alternative. Problems of public safety however, are caused

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[8] A. Miller & J. A. Cook. Pedestrians and Vehicles on Housing Estates: A User Study.

(a) Parking Facilities (continued)

by unsupervised underground garages. The status aspect of car ownership is an argument in favour of above ground parking, and a further reason to provide parking that is clearly linked to the housing unit. If underground parking is provided, the design should provide a sense of direction or orientation, be well lit and ventilated.

Provision should be made for car-washing and car tinkering.[9] These facilities are at present the exception rather than the rule. The location of these facilities depends to a great extent on decisions to either centralize or disperse the parking facilities. In the case of parking adjacent to the house, all that need be provided is space for a bench, tool storage, space in which to move around the car and power and water outlets. Where facilities are centralized, the car-washing equipment can be more elaborate and metered to offset costs. Tinkering and elementary service equipment, such as greasers, hoists, etc., could be available on a rental basis. In developments of sufficient size, these facilities could be attached to a self-service service station.

(b) Access

In order to make more of the site potentially useable

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[9] W.M. Michelson - Interview

(b) Access (continued)

for play, garden, pedestrians, etc., the proportion of site yielded to access for cars should naturally be kept to a minimum, without sacrificing accessibility. However, the amount of road and loading areas required must be determined by peak hour use or worst condition. Other considerations that must be made are the access needs of service and delivery vehicles. While on the one hand they must be able to reach points very close to their destination for loading and unloading as in the case of garbage collection, on the other hand the relationship of roadways and dwellings must be carefully considered from the point of view of noise, the nuisance of fumes and the sweep of headlamps at night.

When considering pedestrian safety, designers often take the radical decision to totally separate people and traffic. More often than not such a decision requires substantial cost and effort. In reality the effort is often wasted as children seem able to overcome any obstacle to get to where the cars are. It seems more sensible to proceed from the proposition that people and cars are in fact compatible, provided that the cars in any one location are few in number, and can only move at very low speeds. If good sight lines are added to this safety is more reasonably ensured.

PEDESTRIANS

One of the primary considerations in pedestrian circulation is safety, particularly from vehicular traffic. The degree of danger depends to a great extent on the speed and volume of the traffic, the age and agility of the pedestrians and the extent of the potential contact of the traffic and the pedestrian (e.g. crossing at a light or children playing in the street). The extent of contact or separation is the variable usually given greatest consideration in designing circulation patterns in housing. The importance of designing hazard free pedestrian routes for children is demonstrated by a study conducted in Sweden. This proved it is almost impossible to teach traffic rules to children under the age of seven. Of 350 tested not one understood the meaning of a single traffic sign that had been designed for adults.[10] The "Radburn" System aims at almost total horizontal separation of pedestrians and vehicles. A user-study, comparing the "Radburn" system with developments that do not separate vehicles and pedestrian movement, discovered that there is some evidence that the interiors of Radburn superblocks are considered safe for pedestrians and for children at play, but the safety advantages inherent in a footpath system can be of secondary importance if pedestrians have to cross peripheral roads to reach amenities.[11] Separation can also be achieved vertically, but this is usually expensive, and should be

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[10] Lady Allen of Hurtwood. Planning for Play, P. 11

[11] Miller & Cook. Pedestrians and Vehicles on Housing Estates: A User Study

PEDESTRIANS (continued)

reserved for particularly incompatible crossings, high density multi-level developments or where topographical conditions make it feasible.

The separation of modes of movement extends to childrens' cycling. They should not use high speed or high volume routes, but should be provided with special cycle paths of their own, linking up particular destinations such as shop, school, church, community-centre playground and dwelling.

Pedestrian safety extends beyond the problem of friction with vehicular traffic, to the design of the paths themselves. They must be safe for all users, from the oldest and infirm to the youngest and most robust. Dangerous or confusing discontinuities of level or direction should be avoided. If stairs are unavoidable, they should have handrails and an easy stair going. Where possible, alternative routes that provide ramps to negotiate level changes should be designed for paraplegics, baby carriages, shopping carts, tricycles and the operation of snow removal equipment.

The direction and volume of pedestrian traffic can usually

PEDESTRIANS (co.

be estimated by co. ering the desire lines between groups of dwellings and various destinations such as transit stops and shops. Paths should follow the desire lines as closely as possible. Even in pedestrian oriented "Radburn" developments it was noted that "in the great majority of cases housewives walking to the shops take the shortest routes, whether they be footpaths, garage court or road".[12] Variations from the straight line are possible and desirable as long as short cuts and cut corners are not the unplanned for result. Indirect routes which offer overhead protection, no level change, or even particular scenic surroundings would also be well used. Thus it can be seen that a network of paths giving a choice of routes, direct and indirect, would work to best advantage.

The development should be designed so that pedestrian trips are short and direct where necessary. The criteria of a five minute walk applies to most adult trips whether to shopping, public transport or recreation.

Children's trip patterns will depend to a great extent on their age. Young children will not range far from the home, but older ones will voluntarily walk a distance of 300 to 400 yards to play.[13] The trip to school may be up

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[12] Miller & Cook. Pedestrians and Vehicles on Housing Estates: A User Study. P. 1082

[13] Lady Allen of Hurtwood. Planning for Play. P. 21

PEDESTRIANS (continued)

to 15 minutes. Older children will sometimes walk farther to reach a play area of interest, but will use bicycles by preference.

Pedestrian routes should be easy to follow. Visitors must be able to find their destination with ease or at least without getting lost. This can be achieved by an easily understood path system, or by the conscious introduction of landmarks. These may be in the form of carefully grouped buildings, controlled distant views, and a use of the topography. A recognizable heirarchy of paths is invaluable as a guide. Signs may be a useful addition to a rationalized and disciplined system of routes, but should not be relied upon exclusively. Besides clarity, interest and comfort are high priorities in any well designed pedestrian system. Choices of vista and closure, a strong relationship to the ground, and a constant concern for interest and variety must not be ignored. The quality of the pedestrian ways depends as much on upkeep as it does on design for pleasure. Snow removal by mobile power equipment is an essential design consideration. Pedestrian ways must include areas for informal assembly, places for play and areas for mothers to sit while watching over their children. These routes can be used to reinforce social interaction, but the choice of alternate routes must be open to those who wish to avoid contact with others.[14]

[14] W.M. Michelson - Interview

PEDESTRIANS (continued)

Privacy of the dwelling from pedestrian routes is an important design criterion, particularly with regard to private open space. Both overlook and noise intrusion must be considered in the planning of circulation. Paths should not approach windows where the interiors are clearly visible, nor should they directly adjoin a personal open area which is not completely screened from view. The problem of overlook can be considerably alleviated by the use of level changes: A path a few feet lower than the adjoining open space is much easier to screen than one on the same level.

The use of site routes by non-residents does not become a problem unless the number involved becomes large, is very noisy, or involves a "cross-class invasion". This affects both through-pedestrian and non-resident use of facilities. One method of handling this, without resorting to gates or other artificial controls, is to locate special through paths away from the dwellings. These would appear more public and would thus increase the tolerance of intrusion on the part of the residents.

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[15] W. M. Michelson - Interview

EVALUATION CHECKLIST

(1) Is there sufficient parking to satisfy the specific car-ownership ratio of the expected Socio Economic Status tenant group, both now and in the future?

(2) Is there adequate visitors parking?

(3) Is the visitors' parking easily recognizable as such, is it in a useful location, and is it simple to find an address from this location?

(4) If the tenant parking is both under and above ground, does the ratio correspond to expected tenant desire to pay the extra premium for shelter?

(5) Is there temporary parking space for service and delivery vehicles with direct access to the dwelling unit?

(6) Could a taxi-cab park within view of any specific address, or at least be close enough that the driver can reach the address without difficulty or delay?

(7) Is there easy access to the dwelling for a) tenant parking or b) a temporary loading point, where parking is separated from the dwelling?

(8) Is there a visual relationship between dwelling and parking space?

(9) Have provisions been made for car washing and tinkering a) near the dwelling or, b) in central facilities?

EVALUATION CHECKLIST (continued)

10) Is a minimum of space used for roads and surface parking access?

11) Are the roads sufficient to provide access to the dwellings by a) future increased traffic b) large delivery vehicles, c) emergency vehicles?

12) To what extent is vehicular through traffic able to use site roads?

13) Would cars be able to reach speeds on the site roads which would be dangerous?

14) Is there an easy speed transition from collection roads to site roads to pedestrian areas?

15) Is the road pattern easily understandable and are addresses easy to find?

16) Are sight lines sufficiently well considered to ensure no safety hazard?

17) Is the degree to which pedestrians and vehicles are separated sufficient for safety? Would mothers see any potential danger to their children?

18) Is the degree of traffic separation consistent throughout or is it weakened by a few dangerous crossings?

19) Can children cycle safely around the site and to surrounding facilities? Does the design encourage them to do so?

EVALUATION CHECKLIST (continued)

20) In an emergency can one exit easily and safely from the dwelling?

21) Are there dangerous and confusing discontinuities in level or direction of the paths? Do the steps have handrails and easy goings for the elderly?

22) Can every dwelling be reached by a route without stairs?

23) Do pedestrian routes generally follow natural desire lines? Can short cuts be taken?

24) For heavily travelled routes is there an alternative covered path? Are there alternative routes to all locations?

25) Is there a direct route available for essential trips?

26) Is the pedestrian system comprehensible? Is there a recognizable network or system of paths?

27) Is there a choice of open or enclosed paths for heavily travelled routes?

28) Is public and private responsibility for upkeep clearly defined?

29) Are there many places for informal assembly? (e.g. play areas and seating?

30) Are the windows of dwellings protected from noise and visual intrusion?

EVALUATION CHECKLIST (continued)

31) Are the private open spaces protected from noise and overlook?

32) Is the use of paths by non-residents likely to annoy the tenants because of a) large numbers b) cross class invasion?

Public Safety 6

6 - PUBLIC SAFETY

Building codes generally cover the necessary requirements for protection against fire and accident. The codes specify minimum standards of combustibility in materials and methods of emergency exit. Items such as balcony heights, stair steepness and length, and standards for power outlets are also covered.

For the purposes of this study, therefore, the National Building Code of Canada is used as a governing code of practice. This does not mean that codes do not require reappraisal. On the contrary, it will be found that variances exist in the many codes used in Canada, some being over and other underdesigned; they thus require constant appraisal in terms of acceptable performance criteria.

Building codes, in the main, account for potential hazards of a mechanical nature. There are, however, other forms of hazard to public safety which must also be a concern for those designing at a scale larger than the single building.

Public misbehaviour poses a security threat to people and property. The elimination of this form of hazard is beyond the scope of this study, except where conscious design can heighten the potential for resident surveillance. Jane Jacobs[1] has pointed out the effectiveness of surveillance as a deterent to anti-social behaviour and the security afforded by "eyes on the street" or entrance way. Adequate lighting is not always adequate protection against vandalism or delinquency, nor for that matter can surveillance be considered a foolproof guard: Dr. W. Michelson cites sufficient evidence of a coincidence of surveillance and delinquency to disallow an easy acceptance of surveillance as a total solution to the problem of security.[2]

A strategic location of entrances and windows giving an overview of public ways and spaces will, however, contribute to a heightened feeling of security; security both of property and of children playing out of doors. This stratagem should include elderly people (who are likely to be at home more than younger people) at those locations in the development where they would overlook the children's playgrounds and the principal pedestrian routes. This choice of location would not only provide a security check but would also provide the enjoyment of vicarious participation for older and more sedentary citizens.

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[1] Jane Jacobs - Death and Life of the American City
[2] W.M. Michelson - Interview

Further measures for an increased sense of security would be the location of seating and rest places in areas where young people gather. Laundries and other small on-site commercial facilities can serve similar functions.

Within the home proper, mothers like to have much used rooms visually and aurally connected to that section of the garden used as play space.

Safety hazards such as unguarded, unfenced pools are prohibited by law, but great caution must be exercised in the design and location of other bodies of open water.

Frequent complaints are made in housing developments about badly lit, open air parking, public open space and pedestrian ways.[3] Standards are not readily available for this form of lighting. We may nonetheless deduct that the lighting should be sufficient to make walking at night safe and intense enough to discourage intruders without being a visual nuisance to adjacent houses.

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[3] G.D. Bacque - Toronto Real Estate - Manufacturer's Life Insurance Company

EVALUATION CHECKLIST

(1) Are senior citizens' dwellings located in such a way that they can provide surveillance of pedestrian ways and childrens' open play spaces?

(2) Are the dwelling units designed in a manner so that those units adjacent to public ways and childrens' open play space can provide surveillance without a loss of privacy?

(3) Are laundries, public seating and rest places, and on-site commercial facilities located and designed in a manner such that users can provide surveillance of public areas.

(4) Are bodies of open water located and designed so that they are not a hazard to public safety?

(5) Is the level of artificial lighting in public pedestrian routes and open spaces sufficient to (a) discourage intruders and (b) allow for the safe movement of pedestrians, yet not be too bright for nearby dwellings at night?

Built Form 7

7 - BUILT FORM

"The present housing yard-sticks, for example implicitly assume that as densities increase, houses decrease in favour of flats and low rise buildings give way to high. This is only true because of the professional separation of land use planning from its architectural implications. With favourable land-use planning, semi-detached houses can be built at 200 persons to the acre. Three storey terraces under more normal circumstances can be built up to 265 persons per acre. These are facts. And when we come down to it we shall discover that all this density business is dangerous convention".[1] "And since skyscrapers do not use central land very efficiently, the only sense that high buildings make in nucleated centres[2] is in terms of real estate speculation. In terms of accommodating built space on urban land they are extravagant and irrational gestures".[3] These propositions advanced by Sir Leslie Martin and Lionel March suggest that conventional practices and theory of built form is in need of at least deeper analysis and perhaps even revision. "...ultimately, that intricate pattern

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[1] Lionel March, Homes Beyond the Fringe, P. 336.

[2] 'Nucleated centres' is a term of convenience used to differentiate from its opposite form - linear development - March enlarges on this polarity. "The topological property of being nuclear or linear corresponds to thinking blobs, or thinking of the spaces between. I shall refer to these two distinct ways of seeing the pattern as think-blob and think-line". Lionel March, Homes Beyond the Fringe, P. 334.

[3] Lionel March, Homes Beyond the Fringe, P. 336.

of the program has to be translated into a possible range of built forms. My colleagues and I have found ourselves increasingly facing the question of whether that range of physical forms can be studied with greater accuracy. Given a highly complex problem, we have been forced to ask ourselves whether it is possible to demonstrate with greater certainty the range of three-dimensionl possibilities that are open to us".[4]

The work of Walter Gropius, in the past, analyzed the relationship between ground space and floor space, but for one built form only, that of parallel rows of slab buildings of increasing height.[5] In referring to this study Martin says, "We might increase the range of forms and examine this first at the level of geometry. If buildings are arranged in parallel rows with a conventional light angle of 45° the plot ratio for four-storey buildings will be 2:1. If we now consider a different form of building, for example, a disposition of this built space around courts, with the same angle of light and the same building height, the plot ratio will now be increased from 2:1 to 3:1. That is by a factor of 50%".[6] This crude model clearly demonstrates that different built forms use land differently, and that there is at least one built form that will use land more efficiently

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[4] Sir Leslie Martin, Architects Approach to Architecture, P. 193.

[5] Walter Gropius, The New Architecture and the Bauhaus, 1935. PP 72-73.

[6] Sir Leslie Martin, Architects Approach to Architecture, P. 195

than the slab.

It is equally clear that a systematic investigation that would yield principles that might become operational tools is required: "We need a method of reviewing, in some controlled way, the range of built forms that might be available, and of considering the choices of internal use and external environment they offer. Any attempt to define optimum conditions clearly requires an interrelated consideration of a number of factors".[7]

In developing the plan for Whitehall, Sir Leslie Martin empirically discovered that the tall slab block, so popular as a solution to office planning, had severe handicaps. He found that buildings lower than the permissible height, of some 80'-0" in height, placed around courts yielded excellent potential for internal layout, created pleasant external surroundings by virtue of view, and improved the light for internal space, yet produced floor space figures of the order of 3 to 3.5:1 - a plot ratio usually associated with tall tower forms. "What had become clear was that the choice of the built form had an important bearing on the effective land use and environment in the component parts of a city (and that some of our more usual assumptions could be seriously challenged). My colleague, Lionel March,

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[7] Sir Leslie Martin, Architects Approach to Architecture, P. 195.

extended this study mathematically and we felt it was necessary to ask, at an abstract level, if the range of built forms can now be analyzed, what built forms make the best use of land? The question requires a definition of values in measurable terms, and we are of course confronted with a great deal of prejudice. One instance of this is that tall buildings are essential for efficient land use".[8]

Lionel March investigated the question of which built forms make the best use of land by means of an abstract mathematical model.[9] In his model the spacing of built forms is not determined by sunlight or daylight considerations but a convention, the intercept rule;[10] which shares some characteristics with a view out of the built form, Fig. 7.01. We have compared forms with equal conditions of obstruction:

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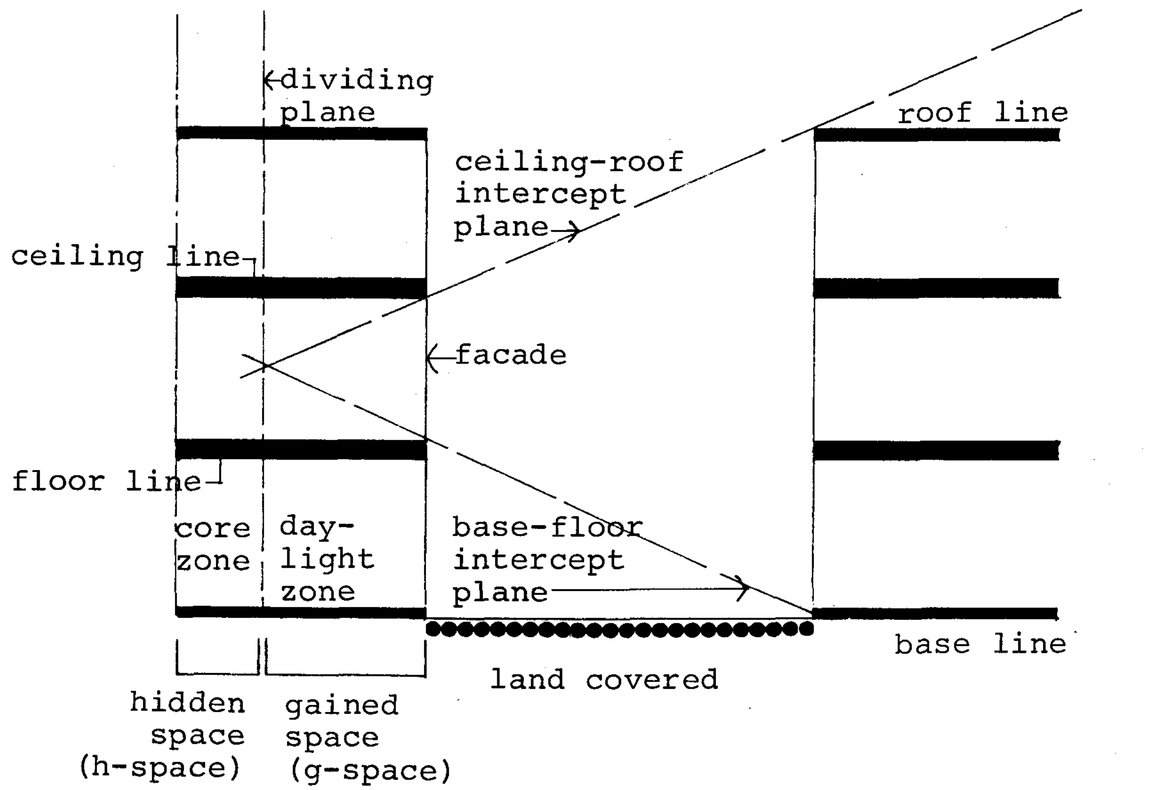
[8] Sir Leslie Martin, Architects Approach to Architecture, P. 197.

[9] Lionel March & Michael Trace, The Land Use Performance of Selected Arrays of Built Forms.

[10] The intercept convention distinguishes two kinds of space on any floor. In conventional terms these two sorts of space or zones would correspond crudely to daylit area and core area. The plane dividing these two zones occurs at the intersection of the base-floor and the roof-ceiling intercept planes. Consider a flying insect looking straight ahead out of the built form on any storey. As it moves from the centre of the form outwards, it will not be able to gain a view of both the roof and baselines of the opposite form until it reaches the point where the plane separating the two zones occurs. The planes of interception referred to above are important factors in establishing the land use indices of the set of built-forms.

Fig. 7.01 INTERCEPT RULE



this is not the same as equal angles of obstruction.[11] In analogies with bulk controls such as height, set-back, site coverage, plot or floor area ratios suggest that many current forms of development may be the least effective in using land, and that the more traditional patterns of development are likely to be better.[12]

Fig. 7.02 illustrates the six basic built forms considered by March. They constitute the complete set in this family of rectangular built forms. March does, in addition, investigate the land use performance of other non-rectangular reticulating built forms in his paper and his conclusions are listed with the general findings. An abridged form of the definitions given in the work follows:

A facade is described as any face of a built form through which a view may be gained.

A face of extension is any face to which may be added another face of extension (a face of extension may not be a facade or vice versa).

The domain is that portion of the ground plane dominated by the built form.

An array consists of identical built forms arranged along axes at right angles by infinite translations, Fig. 7.03.

These definitions are abridged, but are sufficiently accurate to discuss the work of March and Trace.

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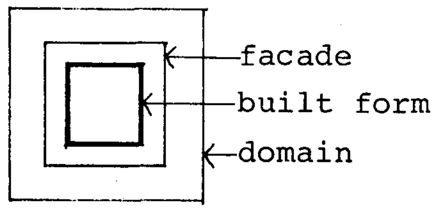
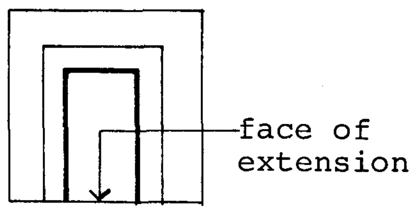
[11] Lionel March, The Land Use Performances of Selected Arrays of Built-forms. Summary.

[12] Ibid

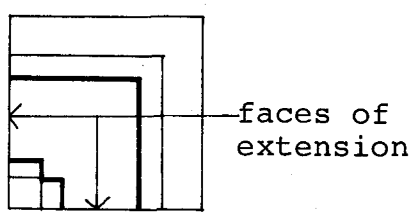
Fig. 7.02 BUILT FORM TYPES



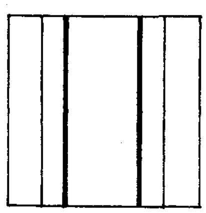
(NO) "pavilion form" isolated in the centre of its domain with four facades and no faces of extension



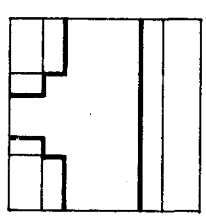
(N1) "end form" with three facades and one face of extension



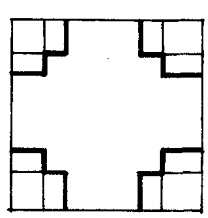
(N2) "L-form" with four facades and two faces of extension



(N'2) "terrace form" with two facades and two faces of extension

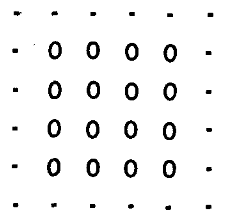


(N'3) "T form" with five facades and three faces of extension

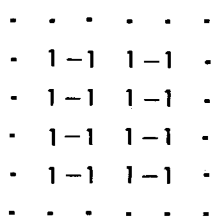


(N'4) "cruciform" with eight facades and four faces of extension

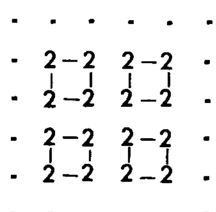
Fig. 7.03 SELECTED ARRAYS OF BUILT FORMS



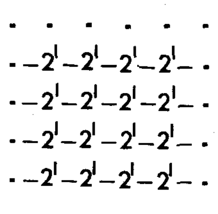
$(N0)^0$ array of "pavilions"



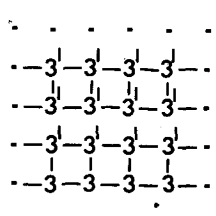
$(N1)^0$ array of "slabs"



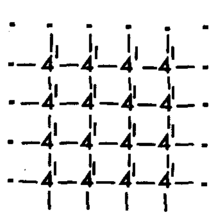
$(N2)^0$ array of "pavilion courts"



$(N'2)^0$ array of "streets" or "terraces"



$(N'3)^0$ array of "street courts" or "terrace courts"



$(N'4)^0$ array of courts

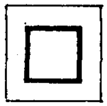
The N forms are either closed as with the "pavilion" (NO) or are able to close themselves as with the "end forms" (N1) or the "L-form" (N2). In this case closing means to combine so that no faces of extension are left open. The N' forms are open ended in that they cannot close themselves. Closed forms (N1) and (N2), the "end form" and "L-form" have to be used to effect closure, Fig. 7.04. The two forms (NO) and (N'4) represent the extremes of closure and open endedness. The terms nucleation and reticulation may be used to describe these opposing tendencies.

If we project the intercept plane, Fig. 7.01, onto the domain of the built form we may call the projection the land covered by the intercept plane. The "land covered" is thus "allowing" a view out of the built form. This covering of land is used by March as an index of land use. "...the land use performance of an array of built forms is measured by the number of times the land surface is used to allow a 'view' out of one form and over another".[13]

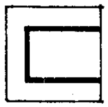
If there is one intercept plane between a built form and its neighbour then by symmetry there must be two (one from each built form). Therefore, the land is used twice. At times the land will be covered twice in one direction and

[13]Lionel March, The Land Use Performances of Selected Arrays of Built-forms, P. 13.

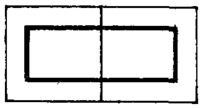
Fig. 7.04 OPEN-ENDED AND CLOSED PROPERTIES OF SELECTED BUILT FORMS



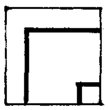
0 (NO) closed



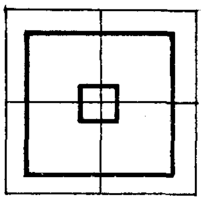
1– (N1) open ended



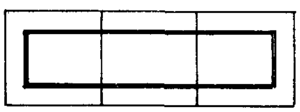
1–1 2(N1) closed



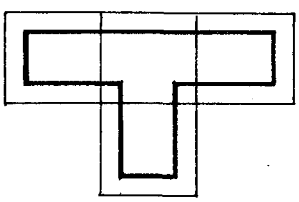
2– (N2) open ended
|



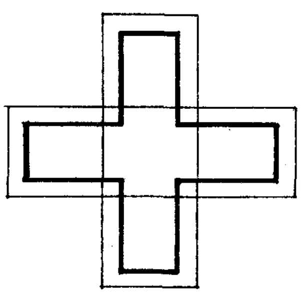
2–2 4(N2) closed
| |
2–2



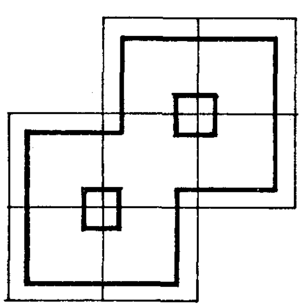
1–2'–1 2(N1).(N'2) closed



1–3'–1 3(N1).(N'3) closed
|
1



1
|
1–4'–1 4(N1).(N'4) closed
|
1



2–2
| |
2–4'–2 6(N2).(N'4) closed
| |
2–2

twice at right angles in the other direction. This land is used four times. Within this model then, land may be used four times, twice or not at all, Fig. 7.05. Here the land-use performance of the six built forms is illustrated. Double hatching indicates four times use, single hatching, double and no hatching, no use at all.

March advances three postulates of land use and built forms.
First postulate: It is impossible for any arrangement of built forms to provide unobstructed floor space exceeding four times the land area.
Second postulate: The land use performance of rectangular built forms cannot be exceeded by non-rectangular forms.
Third postulate: This is concerned with reticulation or the number of faces of extension. Thus the land use performances of rectangular built forms improve with increasing reticulation. This postulate states that composite, reticulated, forms covering as large a domain as possible will use land better than more nucleated forms.[14]

It is reported in the Land Use and Built Form studies that these postulates were tested and it was not possible to refute their validity.

Several other findings of interest and importance are made

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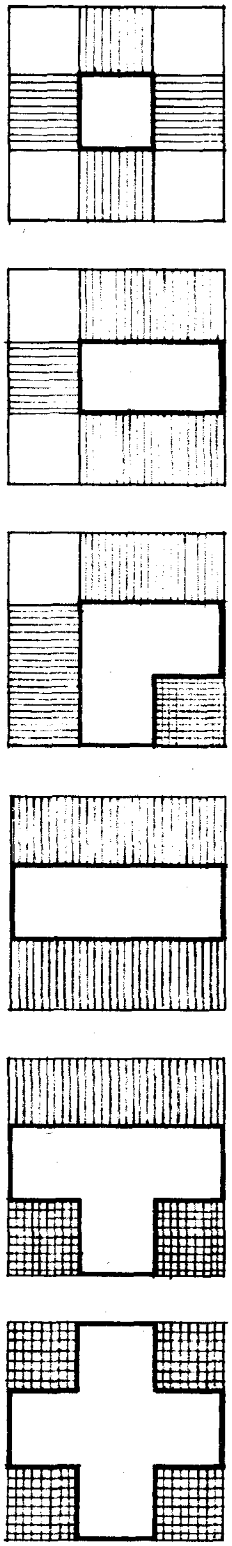
[14] Lionel March, The Land Use Performance of Selected Arrays of Built-forms, PP 79-80.

Fig. 7.05 LAND USE INDEX OF BUILT FORMS



(N0) "pavilion form" Land Use Index L = 0

(N1) "end form" L = 1

(N2) " L form" L = 2

(N'2) "terrace or sheet form" L = 2

(N'3) "T form" L = 3

(N'4) "cruciform" L = 4

by March. "...for a given ratio of built space to open space and a given ratio of g-space to total floor space the greatest amount of g-space will be proved by (N'4) (cruciform) and the least by (NO) (pavilion).[15] "This may be interpreted loosely as follows: the problem in urban areas has been to build as much daylit space as possible (Hawkes 1968 b, but see Croghan 1965) and to balance the requirements of land for building against land for open uses such as streets. At the same time, inside the building a balance has to be achieved between the space that is daylit and the areas that serve this, such as lift lobbies, cloakrooms and so on which need not be lit. That is to say a balance has to be achieved between g- and h- zones...[the analysis]...indicates that there are several geometrical constraints operative on the tower form which are likely, even in practice, to make this the <u>poorest</u> form to maximize daylit working areas. Conversely the court form is likely to be the best. This has nothing to do in itself with arguments for or against high or low buildings".[16]

March has also dealt with high and low pavilions and courts: the findings are very pertinent to the field of housing. "...[the] examples suggest that arguments concerning high rise and low rise are dependant on an understanding of the geometrical behaviour of different plan forms. It would

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[15] Lionel March, The Land Use Performance of Selected Arrays of Built-forms, P. 17.

[16] Ibid

be an affront to common sense to say that building high does not use land intensively. Yet in part common sense fails us. On analysis high tower buildings would seem not to use land well, although we know they can exploit individual sites. High court forms appear to use land very much better, although it is probable that they only make sense where large areas can be developed and the roads kept to the outside of the area or built in to the structure. Nevertheless, it seems likely that low court forms with spacious courts can frequently match the performance of taller tower forms".[17]

One set of findings contains a strong indictment against usual planning regulations, that is those which attempt to establish a plot ratio, a floor space index or a floor area ratio constant. The rented areas of office buildings are those which are daylit, and in conventional buildings the essential support space containing elevators, stairs and washrooms is, of course, non rentable. As pointed out earlier these two categories of space can be compared to March's g-zone and h-zone respectively. A developer, in balancing the one category against the other, might establish a ratio of daylit area to core area which could be compared to a "free market" or a "laissez-faire" constraint. Within

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[17] Lionel March, The Land Use Performance of Selected Arrays of Built-forms, P. 64.

the logic of March's argument, a developer in order to use the land intensively, would have to use not only large sites but would have to build in court forms. By doing this, he could gain three times as much g-space or daylit space as a competitor using pavilion forms. This economy would need a site four times as large as that for the pavilion forms. "On purely geometrical grounds, we can [now] see that plot ratio control...actually discourages large scale comprehensive development unless the intensity of development is high.[18] Assuming that perimeter streets will occupy up to 25% of the site, the plot ratio required to begin to favour court forms unconditionally is 5. In terms of land use, with a plot ratio control, there is nothing to be gained by developing larger sites, or by building other than isolated blocks. On the other hand a "laissez-faire" policy of encouraging efficient buildings might, by the very logic of the geometry governing these matters, have led to both large-scale and co-ordinated environments. Here then is the paradox of a planning regulation which unwittingly may have consolidated piecemeal development rather than its opposite as intended".[19]

The illustrations in Fig. 7.06 show several methods of disposing the same amount of floor space into identical

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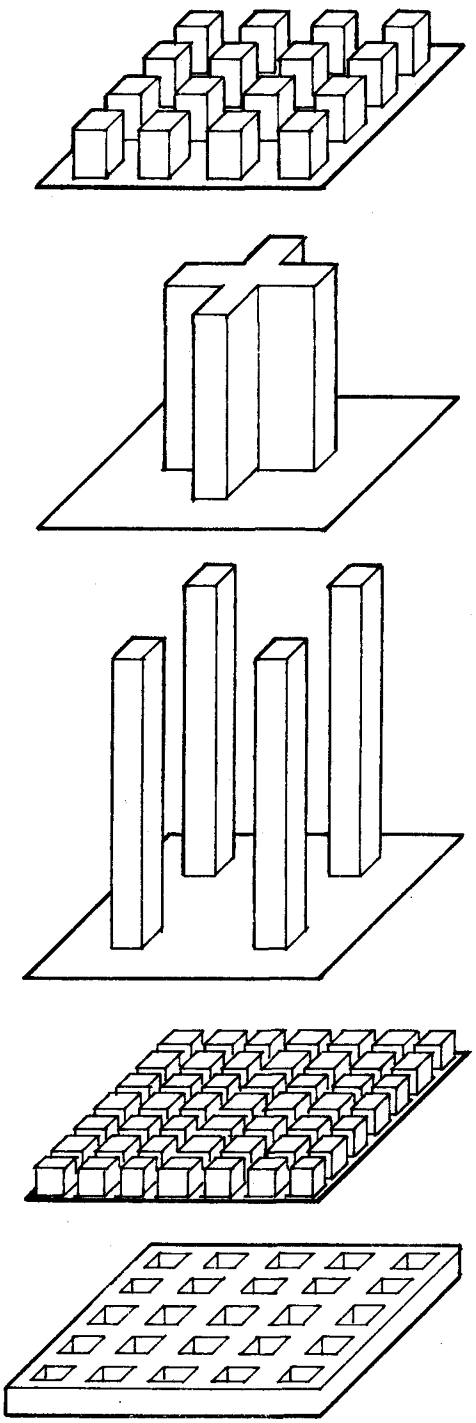
[18] and unless, of course, floor space bonuses are offered as an inducement for large scale development.

[19] Lionel March, The Land Use Performance of Selected Arrays of Built-forms, P. 61.

Fig. 7.06 FIVE METHODS OF DISPOSING 4 x PLOT AREA ON IDENTICAL LAND TRACTS



Sixteen 24 storey point blocks

One 60 storey Cartesian skyscraper

Four 96 storey point-block skyscrapers

Forty-nine 8 storey pavilions

Reticulated court form of 8 storeys.

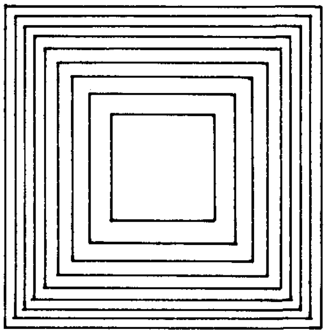
NOTE HOW DECEPTIVE APPEARANCES CAN BE

tracts of land. The floor space index is four in each case. Shown are a range of pavilions from very tall (set of four, 96 storey towers) to low and an example of a reticulated court form at eight storeys. It is thus shown that the notion that high buildings are the only effective means of achieving large bulk is patently false. There are many ways to achieve this, and the March studies systematically compare the efficiency of the land use of different built forms.

It should be noted that obstruction of the sky plane becomes unavoidable at a floor space index greater than 4. This, it is felt, should be one of the means to govern the allowable bulk for housing development. Other constraints, such as private access to each unit we have found will in themselves restrain the density to a floor space index of less than 4.

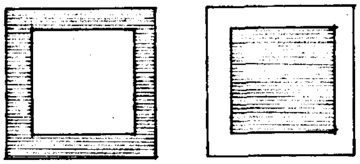
Sir Leslie Martin uses a set of concentric Fresnel squares to illustrate contrasting land use characteristics of built forms: the pavilion and the hollow square or perimeter development. Fig. 7.07 illustrates these Fresnel squares. Any annulus has an area equalling each of the others and the central square. The central square and its first annulus may be used to illustrate the contrasting hollow square and the pavilion, Fig. 7.07. The example uses a 50% land

Fig. 7.07 CONCENTRIC FRESNEL SQUARES



Each annulus and the central square have identical area.

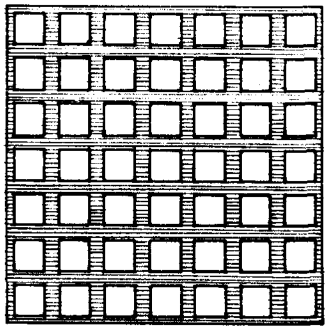
Pavilion Court form



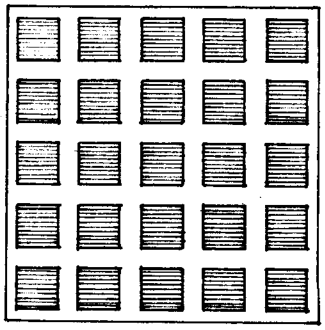
Contrasting built forms of identical area. Central square and first annulus of Fresnel series.

Fig. 7.08 RETICULATION OF COURT FORMS AND PAVILIONS

Reticulated pavilions



These diagrams reticulate the two contrasting built forms illustrated above. The shaded area represents open space which equals the area of built space (unshaded).



The pavilions are analagous to a grid-iron city pattern. The court forms yield open space that is consolidated into parcels of usable size and shape.

Reticulated court forms

coverage factor but the half of the site remaining open in the case of the pavilion is strung out around the perimeter in an unusable configuration compared to the consolidated central open space yielded by the "hollow square" development. If this form is reticulated as an array of pavilions and an array of court forms the advantages in the disposition of open space yielded by the latter is obvious, Fig. 7.08.

Thusfar we have dealt exclusively with abstracted models. The principles outlined, however, have been used as design tools in three of Sir Leslie Martin's projects[20] and in the Pollards Hill Housing Estate.[21] The latter development is illustrated in Fig. 7.09 and Fig. 7.10. This project achieves a density of 100 persons per acre and yet almost 90% of its inhabitants live in houses with private gardens and are able to park their cars at their doors. The housing groups furthermore front onto semi-private space of a scale compatible with the dwelling units. This space in turn opens onto common public space of sufficient size to accommodate a cricket field or three soccer fields depending on the season. Prior to this project, these densities had been associated only with high tower blocks.

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[20] a) Harvey Court, Gonville and Caius College, Cambridge University, England 1962.
b) Whitehall: A Plan for a National and Governmental Centre, H.M.S.O. 1965.
c) Project for the Redevelopment of the Foundling Hospital.

[21] Philip J. Whittle, Pollards Hill Housing.

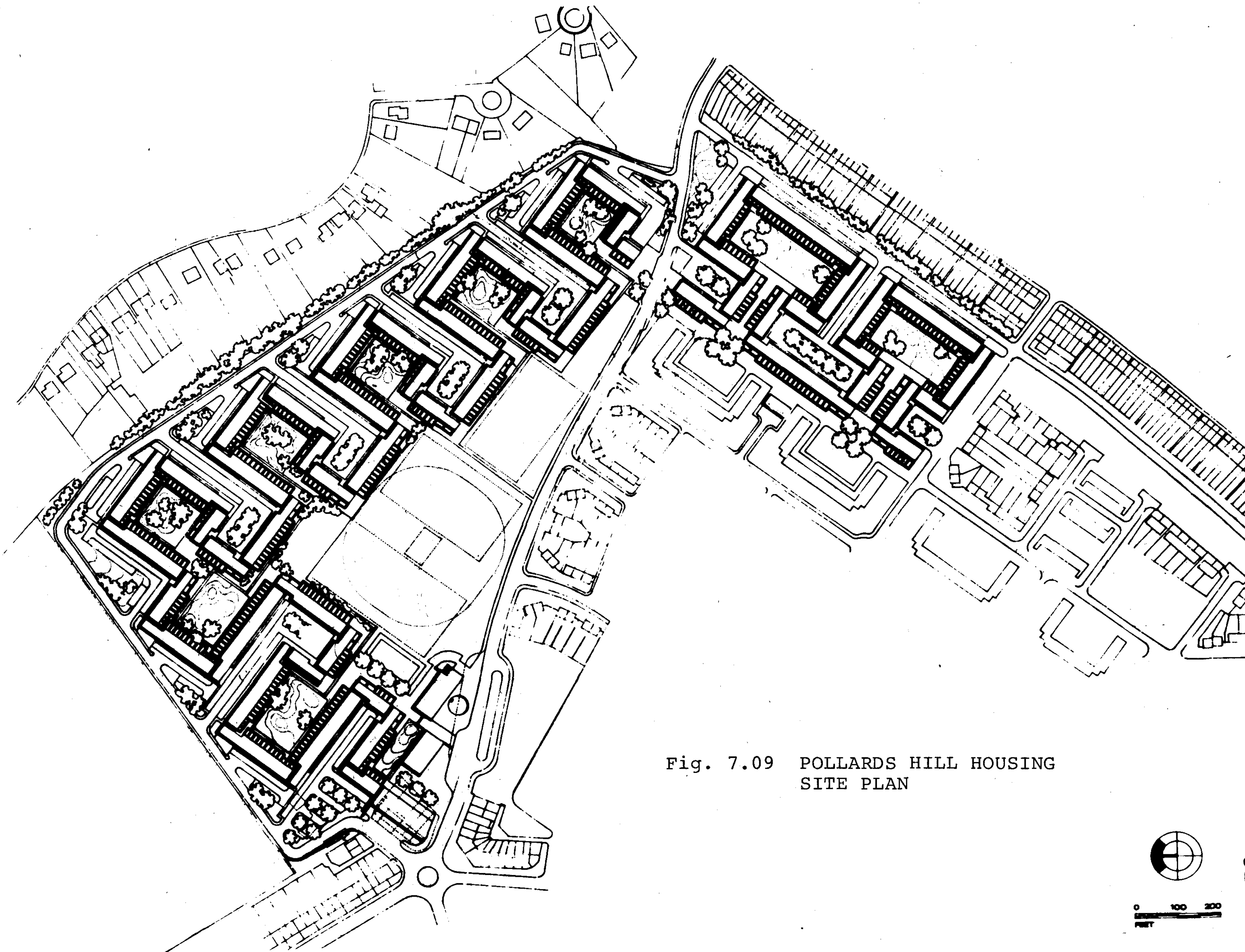


Fig. 7.09 POLLARDS HILL HOUSING
SITE PLAN

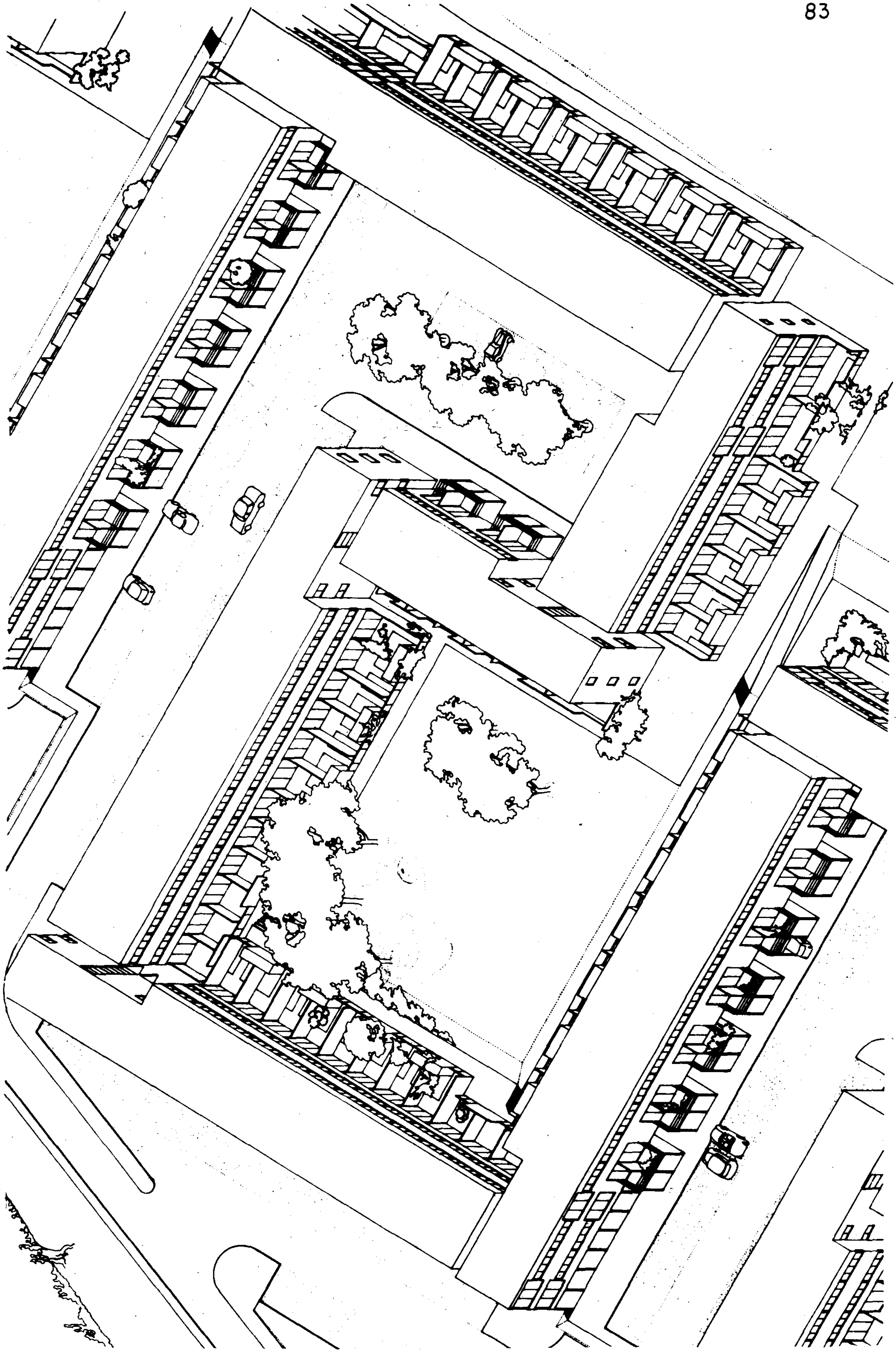


Fig. 7.10 POLLARDS HILL HOUSING

Inspection of the project shows that two simple principles have been used. One is that the development has been kept to the perimeter of the site. This has allowed the consolidation of open space at the centre while relegating traffic to the perimeter. The second principle involved is that the overall character of the built form approximates a reticulated court form. The abstract model is naturally distorted in its practical application but the pattern is unmistakeable. The potential of both of these simple design devices warrant their greater use.

It is with these guidelines that the work undertaken in this study proceeded. This study examined at some length an alternate way in which it was felt that surface area or envelope is related to volume. This was done by investigating the interfaces and range of interfaces held in common by units, and group of units, and by the range of combinations possible. This exercize, however, only resulted in showing the economic advantage of reducing the area of envelope to volume enclosed. The work of Martin and March, however, both substantiated our original hypothesis that high densities could be achieved with a low distribution of dwelling space, and that the alternative distributions revealed in those studies appeared favourable for housing requirements.

In order to test whether this is in fact true, we have extracted the salient user requirements from the social survey, and ascribed to them a space factor, and later, a locus (Chapter 11). Thus within the guidelines enunciated by the Land Use and Built Form studies, and with the constraints imposed by user requirements, and space factors, we have attempted to measure the highest densities at which the preferences can be satisfied.

In very condensed form the salient user requirements, to which a space and location factor may be allocated, are:

(a) Personal open space equal to the aggregated indoor living space.
(b) Car parking adjacent to the dwelling.
(c) A separate, unshared entrance to each dwelling.
(d) A high level of natural light.
(e) A substantial amount of shared space.

In general terms the two social criteria which have been established as important are those involving privacy (real and perceived, aural and visual) and the need for open space (shared and personal).

Zoning 8

8 - ZONING

A. PROTECTIVE STANDARDS

Codes which incorporate standards of bulk and spacing of buildings are intended to benefit the general public or some part of it. These generally protective standards may be grouped according to their areas of application: investment protection, public safety, public health, capacity of services and aesthetics.

(1) Investment Protection

The urban fabric represents a very substantial investment in property. At the very least codes attempt to maintain, and at most, enhance property values. Setbacks on adjoining properties, for example, attempt to maintain the "daylight rights" of a particular lot.

Codes stabilize the market, in that land use, coverage and "amenity" are clearly enunciated. While a particular developer will benefit from upward changes in coverage, real estate in general is enhanced as a commodity if expectations of values are satisfied.

(2) Public Safety

A simple example of the value of zoning for public safety is the establishment of controls to prevent the spread of fire from property to property. For example, there must be mandatory spacing between buildings in older sections where timber construction prevails. With other forms of containing the spread of fire now possible, this fire protection prescription becomes a restrictive control.

(3) Public Health

Regulations covering daylighting, sunlight and ventilation fall into this category. However, they are seldom given as performance criteria, for example the minimum time a room should be exposed to potential sunlight penetration.

(4) Capacity of Services

Standards in this category are used to limit the density of building, or the population within a building, to levels related to the capacities of support systems. These support systems cover drainage and waste disposal, power and water supply.

(5) Aesthetics

Although seldom stated explicitly, the implicit function of some zoning and planning laws is to reinforce conventional aesthetic wisdom. This has grown into a veneration for "pavilions" or isolated, individual and often idiosyncratic building. It is clear that tastes at other times, and in other places, have accepted the opposite: physical continuity.

B. ZONING AND PLANNING GOALS

Zones and coding are not standard across Canada. In detail a wide variety of zones and codes exist, and direct comparisons are almost impossible to make. Theoretically, at least 57 different sets of controls are possible, we have discovered. Furthermore, differing weights can be ascribed to each sub-set. However, some sets have been found, on an empirical basis, to be more effective than others, and this narrows the range to be considered. Ideally the control components should have a changing relationship to one another. This will be discussed further.

The basic components are of two kinds: geometric and arithmetic. These in turn break down as follows:

Geometric (a) absolute height limitation
(b) angles of obstruction
(c) minimum block spacing
(d) maximum block width

Arithmetic (e) floor space index
(f) built area potential

These may be combined as follows: (see next page)

a+b	a+b+c	a+b+c+d	a+b+c+d+e	a+b+c+d+e+f
a+c	a+b+d	a+b+c+e	a+b+c+e+f	
a+d	a+b+e	a+b+c+f	a+c+d+e+f	
a+e	a+b+f	a+b+d+e	a+b+d+e+f	
a+f	a+c+d	a+b+d+f	a+b+c+e+f	
	a+c+e	a+c+d+e		
	a+c+f	a+c+d+f		
	a+d+e	a+d+e+f		
	a+d+f	a+c+e+f		
	a+e+f	a+b+e+f		
b+c	b+c+d	b+c+d+e	b+c+d+e+f	
b+d	b+c+e	b+c+d+f		
b+e	b+c+f	b+c+e+f		
b+f	b+d+e	b+d+e+f		
	b+d+f			
	b+e+f			
c+d	c+d+e	c+d+e+f		
c+e	c+d+f			
c+f	c+e+f			
d+e	d+e+f			
d+f				
e+f				

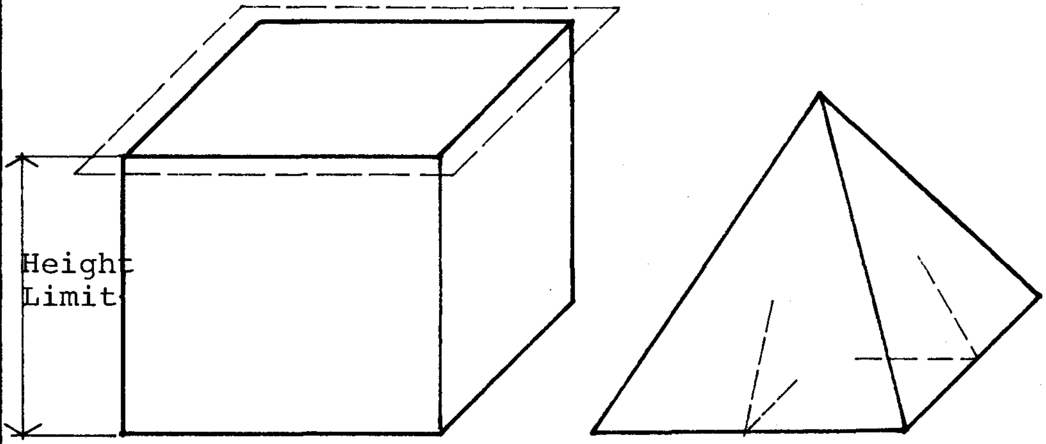
Further definitions of the control components enumerated above are:

(1) Geometric Controls

a. absolute height limitation, Fig. 8.01. This simply controls the height to which a building may rise.

b. angles of obstruction, Fig. 8.01. This control applied to a square site results in a pyramidal form. The vertical angle is generally taken from the site boundary, although other points of origin, such as road centre lines are also used. This angle dictates the distribution of bulk of a building, especially at the upper levels. The angles given in legislation are hard to rationalize on any functional base, except the crudest

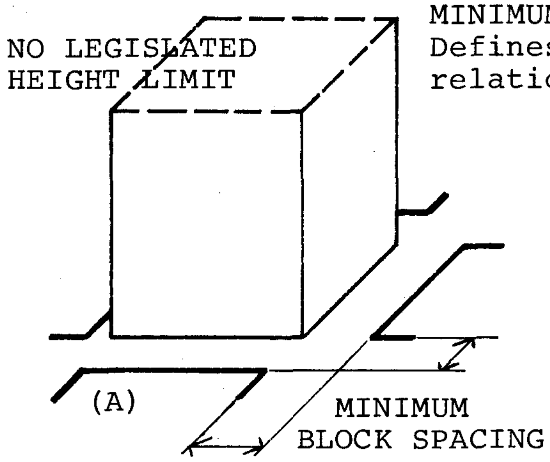
Fig. 8.01 GEOMETRIC PLANNING CONTROLS



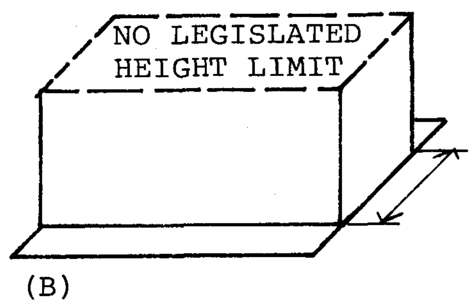
ABSOLUTE HEIGHT LIMIT
simply controls the height of a block

OBSTRUCTION ANGLES
These imply a restriction of the floor space potential at the upper floors.

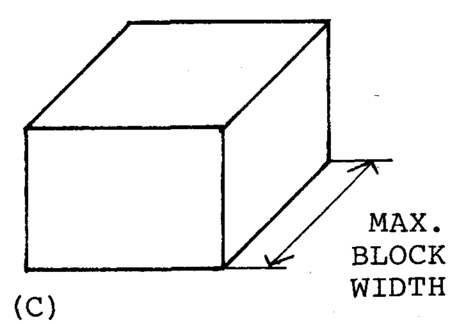
Fig. 8.02 GEOMETRIC PLANNING CONTROLS



MINIMUM BLOCK SPACING (A)
Defines plan dimensions in relation to adjacent blocks



MAXIMUM BLOCK WIDTH (B) and (C)
This limits the block area potential if one or both the site dimensions exceed the specified maximum.



provision of skylight. Changing environmental controls renders even this basic control obsolete.

c. Minimum block spacing, Fig. 8.02. These controls are generally enshrined in set back, side space, minimum court width and separation between building legislation. Ostensibly the purpose of this legislation is to ensure light, and privacy. The values given are arbitrary, and often have unexpected consequences: residual spaces are often unusable for any other purpose than 'open' space, per se.

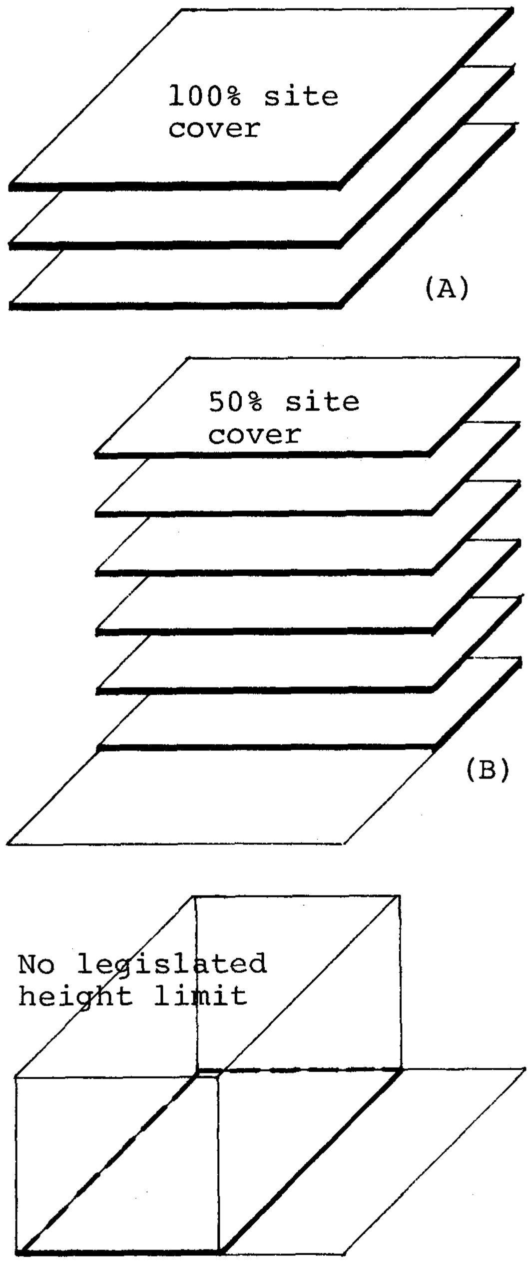
d. Maximum block width, Fig. 8.02. This control may find legal form in an absolute value or in a geometric form as a horizontal angle control.

It is important to note that the controls outlined above taken singly do not intrinsically control the amount of built space. The control of the amount of built space requires two or more geometric controls, or a combination of one or more of the controls and an arithmetic control. It should also be noted that the geometric controls suggest an actual form for building.

(2) <u>Arithmetic Controls</u>

a. Floor space index, Fig. 8.03. This sets a limit on the floor area that is to be enclosed, by making it a factor of the site area. For example, allowable floor space = 50% of the site area.

Fig. 8.03 ARITHMETIC CONTROLS



FLOOR SPACE INDEX (A) & (B)

This relates the floor area of the building to the floor area of the site, but does not define any element of the form.

Floor space index in each case is 3:1.

BUILT AREA POTENTIAL

Again relates the floor area of the building to the floor area of the site, but only in a two-dimensional manner.

b. Built area potential or coverage, Fig. 8.03. This relates floor area of a building to the area of the site. However, this is only in two dimensions. Typically this control will stipulate that the building base may only cover say 50% of the site.

Unlike the geometric controls, neither of these two suggest any form for the built space.

What must be seen is that the size of the site, using the controls described, has a significance on the outcome of the form and amount of space of a building. Dean Hawkes,[1] describes the significance of this aspect of site, building and control:

"Any site, regardless of its size, has edges which are defined by the boundaries of adjacent sites and/or by public open spaces. In Fig. 8.04 and 8.05 the effect on the build-volume potential of enlarging the scale of the mesh of public open space is illustrated, for a greatly simplified notational situation. It is assumed that the width of the open spaces is determined by some inherent characteristics of the spaces themselves and is not influenced by the areas and requirements of the sites enclosed. This is quite common practice and is used, for example, in laying down standards for

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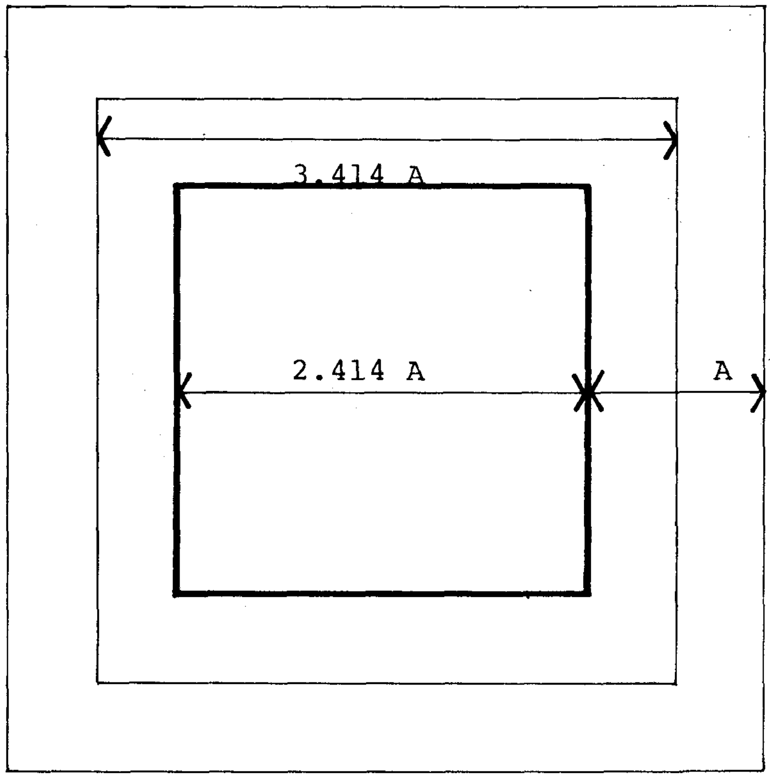
[1]Dean Hawkes, Building Bulk Legislation: a Description and analysis. Working paper #4. L.U.B.F., Cambridge 1968

Fig. 8.04

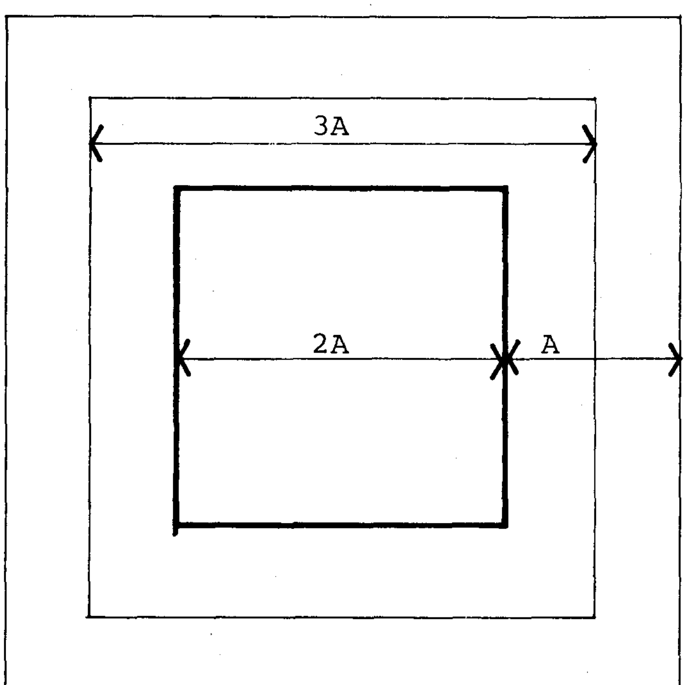


EFFECT ON BUILT AREA POTENTIAL OF INCREASING SITE DIMENSIONS WHILST MAINTAINING WIDTH OF OPEN SPACE BETWEEN SITES

Site area = 5.828A
Total area enclosed within centre lines of open space = 11.66A
Ratio of Site Area to Total Area = 1:2

Site width = 2.414 x width of open space

Fig. 8.05



EFFECTS ON BUILT AREA POTENTIAL OF INCREASING SITE DIMENSIONS WHILST MAINTAINING WIDTH OF OPEN SPACE BETWEEN SITES

Site width = 2 x width of open space
Site area = 4A
Total area enclosed within centre lines of open space = 9A
Ratio of Site Area to Total Area = 1:2.25

street widths. Additionally, it is assumed that half of the width of the public open space surrounding a site is, in some respect, 'serving' the site and therefore the area may be taken as 'belonging' to the site for the purpose of calculating site utilization. On the basis of these assumptions the figures, earlier referred to were developed. These point to the fact that increasing the size of the mesh results in more efficient land use.

"A general conclusion which may be drawn from this exercise is that in simple terms of the Built Volume Potential, it is advantageous to move towards an increase in the size of the urban mesh. As a direct consequence of an increase in the size of the basic site unit most of the geometric bulk controls which might be used result, when applied to sites in isolation, in a permissable envelope of greater potential, with the possible exception of controls specifying a minimum block spacing, or a maximum block width, whose provisions are not dependant on local conditions and are thus less easily appraised in a generalized situation. Where the context is enlarged to include the public open space about the notational site, the mathematical advantages of the larger unit are amplified.

"Within the confines of the 'traditional' bulk control techniques, it is not impossible to produce forms which do not conform to the conscious or unconscious preconceptions built into the system. If the scale of the ground mesh, for example, is modified, that is made larger, the range of options may be extended".[2]

Hawkes then refers to Sir Leslie Martin's plan for Whitehall, pointing out how the land assemblage "allowed a maximum permissible envelope, with a greater Built Volume Factor[3], to be generated" than would have been possible if the individual existing site had been returned as separate units.

It is interesting to note the distortions in a combination of geometric and arithmetic controls in Toronto: "Now let us consider the minimum setbacks required by the current by-laws. They require 20 feet front, and 25 feet rear and side setbacks. The City also now requires a minimum lot frontage of 100 feet for apartments. The average property in Toronto is about 150 feet deep, so let us consider a lot 100' x 150', developed under these regulations in Zone 5. The site area is 15,000 sq. ft., so the maximum floor area permitted is 2.5 x 15,000 or 37,500. After subtracting the setback from the 100' x 150' site, there is a building area of 50' x 150' left or 5,250 sq. ft. The setbacks alone constitute 65% of the site area. This is considerably over the 35% open space required by the by-law, and the building

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[2] Dean Hawkes, Building Bulk Legislation: a Description and analysis. Working Paper #4, L.U.B.F., Cambridge 1968

[3] Ibid

must be 8 storeys high to equal the 2.5 floor area ratio. If several adjacent plots of similar size were developed under these regulations, we would have a series of eight storey slabs 50 feet apart with virtually no usable open space". He points out that under these regulations a site 225'x270' would provide the required 35% open space in the 25 foot setback all around. While fulfilling the requirements, the space would be utterly useless.

"Several conclusions seem to present themselves from the foregoing discussion. One, there seem to be many discrepancies between the zoning regulations and the developments that result from them, and there are many inconsistancies between the regulations themselves.

"On small sites, the setback requirements are so strict that the open space requirements are thus meaningless, and the resulting development is not particularly satisfactory from an environmental point of view. Perhaps density regulations should not include setback requirements, but the level of density should be governed instead by the size of site. On small sites, it is possible to create very interesting and quite satisfactory family developments at very high densities by ignoring the setbacks. It is only possible to utilize the potential of the high densities on very large tracts of land. The larger the tract of land, the more usable the open space. A large tract of open space can serve the needs of a great number of families, whereas the same tract, if broken up into smaller lots, could only serve a fraction of those people".[4]

The concept of density control thus requires examination. This can take several forms:

(1) Floor area building bulk per unit area of the site.

(2) Units of accommodation, or persons per unit area of the site.

It is clear that if the other services and functions that are an integral part of the housing condition in general are to be considered, such as schools, transit, or sewers, a knowledge of the number of persons to be housed is of crucial importance. It is equally clear that bulk control does nothing in this regard. Conversely, the number of people per acre does not reveal building bulk. Both measures are required, and should be a function of one another, that is the <u>intensity</u> of development, for both buildings and people is necessary in establishing satisfactory housing environments.

One such form of development control was devised by the F.H.A. The F.H.A. in 1963 revised its standards for planned unit developments and multi-family housing to include a

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[4] David Mesbur, Density & Form. Working Paper, Graduate Design Studio, University of Toronto 1969

new measure - 'Land-Use Intensity' (L.U.I.). Although similar to density, L.U.I. is a more reliable measure and much broader in scope. L.U.I. means the overall structural mass and open space relationship in a developed property. It correlates the amount of floor area, open space, livability space, recreation space and car storage space of a property with the size of its site or land area. This allows new planning concepts; amalgamations of housing units in ways in which more efficient use of land can be made, while reaching higher standards in other relevant aspects of site use. The controls are arithmetic and co-ordinated. They do not suggest specific forms for the arrangement of built-space. Further guides are necessary in order to provide standards of performance to replace geometric form controls as the sole control of form. However, a description of these will be found in Chapter 7.

C. ZONING AND PLANNING CONTROLS - SUMMARY

(1) Most planning codes have been formed as responses to particular and fragmented problems: in toto they often subvert good intentions of overall control and the provision of satisfactory physical environments.

(2) Most controls are 'form-oriented', in that they generate only those arrangements of built-space that comply with the legislators' preconceptions of 'proper form', the exclusive formation of isolated, discreet pavilion buildings is a typical example.

(3) Planning controls are most often conceived and expressed graphically. This mode is extremely limiting as a planning device. Frequently the discrepancies between the aims and results of planning controls stem from this.

(4) Most residential planning controls are woven around the scale of the single family detached house and lot: Controls for large scale development are merely multiples of those used for small lots except in the respect that large land assembly is favoured. The encouragement given is in the form of increasing allowable building space with increased land ownership. A more comprehensive control is necessary, that would appropriately relate development to lot size, development intent, necessary community facilities and, when relevant, the protection of existing conditions.

(5) Frequently, the original determinants of the controls have been rendered obsolete by technical advance. Daylighting standards, for example, ignore advances made in environmental technologies that are now a common building practice. Many codes are based on these outdated formulae.

Field Analysis 9

9 - FIELD ANALYSIS

Most of the social data and analyses presented in this report are derived from surveys made for this study in the following three Toronto housing developments: Lions Gate, Etobicoke; Braeburn Woods, Etobicoke; and Donwood Terrace, Don Mills. We felt it important to survey and report on the physical environment that the social survey sample covered because:

(1) We required information about physical conditions in addition, and as a counterpart, to social conditions of the study area.

(2) There appeared to be no relationship between official standards for space minima and practice. It was felt that by measuring the spaces used in practice operational criteria could thus be established for low rise multiple housing.

(3) It was felt it would be useful to develop, from analysis of the "turf", a factor which would reliably represent areas for circulation space, closet space and internal structure and partitioning. Thus, from any set of net room areas, a gross unit area could be derived with reasonable accuracy.

(4) Quantitative information about the site could be used to measure the comparative efficiences of the three developments.

(5) We wished to catalogue the generically different plan forms used in the survey area to make comparisons possible.

(6) A part of this study involves a series of designs, the performance of the designs will need to be measured against the performance of the housing surveyed.

The results of our measurement and analysis are recorded in Figures 9.01, 9.02, 9.03, 9.04 and 9.05. Fig. 9.01 deals with two, three and four bedroom units separately: in each group it is possible to obtain a mean/median/average size for the various rooms used and for the gross dwelling unit area. A percentage value of the gross floor area is given for each dwelling type, for closet and wall area and circulation space.

Fig. 9.02 gives various measures of density for the three housing areas. The measures include persons, dwellings, habitable rooms and bedrooms, all expressed in terms of the site area. Coverage and the floor area, in addition, are given as a ratio. It is felt that all these measures

FIG. 9.01 DISTRIBUTION OF FLOOR SPACE IN SELECTED DWELLING UNITS.

	NUMBER OF BEDROOMS	2 BEDROOM		3 BEDROOMS											4 BEDROOMS			ALL TYPES		2BED	3BED	4BED
	NAME OF DEVELOPMENT	DONWOOD		DONWOOD TERRACE			LIONS GATE			BRAEBURN WOODS: TOWNHOUSE & MAISONETTES								MEAN	MEDIAN	MEAN	MEAN	MEAN
	DWELLING UNIT CODE	1	2	TH B	3	4	A	B	C	A	B	1	7	8	A3	3	10					
	# OF UNITS MEASURED	29	29	30	10	10	22	31	26	51	140	21	20	31	9	2	2	463	463	58	392	13
SQUARE FEET	KITCHEN	85	85	95	113	113	102	115	95	80	85	87	88	93	80	87	93	90	85	-	-	-
	LIVING ROOM	193	193	290	199	199	238	240	240	190	160	193	164	207	180	193	207	197	193	-	-	-
	DINING ROOM	79	79	55	106	106	114	96	124	99	85	146	124	124	99	146	124	97	87	-	-	-
	BEDROOM 1	163	163	139	168	148	193	193	208	152	129	132	132	132	160	132	132	151	135	-	-	-
	BEDROOM 2	126	126	121	152	110	125	125	110	105	123	131	130	130	152	131	131	123	122	-	-	-
	BEDROOM 3	-	-	110	95	92	113	113	110	105	103	103	111	111	105	114	115	106	105	-	-	-
	BEDROOM 4	-	-	-	-	-	-	-	-	-	-	-	-	-	94	103	111	-	-	-	-	98
	BATHROOM 1	40	45	37	41	39	48	48	44	41	42	51	51	51	41	51	51	44	42	-	-	-
	BATHROOM 2	-	-	-	-	-	19	20	18	-	31	-	-	-	-	-	-	26	-	-	-	-
	UTILITY RM / STORE	22	22	-	-	-	-	6	-	80	42	51	85	46	96	87	112	46	-	-	-	-
LINEAL FEET	CLOSETS ENTRANCE	4	4	3	4	4	4	3	3	4	4	5	4	4	4	5	4	4	4	-	-	-
	BEDROOM 1	7	7	7	7	6	9	8	12	6	6	6	6	6	6	6	6	7	6	-	-	-
	BEDROOM 2	5	5	6	5	8	5	5	5	4	6	3	3	3	6	3	4	4	4	-	-	-
	BEDROOM 3	-	-	6	3	3	5	5	5	6	4	3	3	3	6	3	3	5	5	-	-	-
	BEDROOM 4	-	-	-	-	-	-	-	-	-	-	-	-	-	6	3	3	-	-	-	-	4
	LINEN	2	-	5	3	2	2	2	3	2	2	2	2	2	2	2	2	2	2	-	-	-
SQ. FT.	GROSS INTERIOR AREA	987	978	1150	1128	1064	1274	1274	1274	1140	1112	1162	1113	1113	1332	1287	1321	-	-	983	1157	1323
	NET INTERIOR AREA	880	877	1046	1038	972	1154	1154	1147	1046	1013	1083	1029	1038	1220	1203	1238	-	-	879	1058	1220
	REM WALLS & CLOSETS	107	101	104	90	92	120	120	127	94	99	79	84	75	112	84	83	-	-	104	99	103
	CIRCULATION	172	164	199	164	165	202	203	198	194	213	189	144	144	203	159	162	-	-	168	185	190
	REM AS % OF GROSS	10.9	10.3	9.1	8.0	8.7	9.4	9.4	10.0	8.3	8.9	6.8	7.4	6.6	8.4	6.5	6.3	-	-	10.6	8.5	7.8
	REM AS % OF NET	12.2	11.5	9.9	8.6	9.5	10.4	10.4	11.0	8.9	9.8	7.3	8.2	7.3	9.2	7.0	6.7	-	-	11.9	9.3	8.4
	CIRC AS % OF GROSS	17.4	16.8	17.3	14.6	15.5	15.8	15.9	15.5	17.0	19.2	16.3	12.7	12.7	15.2	12.4	12.3	-	-	17.1	15.9	14.4
	CIRC AS % OF NET	19.6	18.7	18.9	15.8	17.0	17.6	17.6	17.2	18.5	21.0	17.4	14.1	14.0	16.6	13.2	13.2	-	-	19.2	17.4	15.6

<u>NOTE</u>: 71% of the sample had full basements. In some cases these were used for garaging, but in no cases were the basements finished by the developers. This was left up to the tenants. Due to the large number of special cases, analysis of the basement accommodation was omitted. In some of the mean and median columns values have been omitted, this is usually due to the sample being too small.

Fig. 9.02 DENSITY AND SITE ANALYSIS

	DONWOOD TERRACE	LIONS GATE	BRAEBURN WOODS
Site - Acres	9.00	5.25	25.40
Sq. Ft.	392,500	228,516	1,106,748
Units - No.	154	108	527
/Acre	17.1	20.6	20.76
Beds - No.	552	503	1,381
/Acre	61.3	95.8	54.41
Lot Area/Unit	2,550	2,115	2,100
F.A.R.	.495	.662	*
Ground Floor Area	97,300	60,225	228,152
Land Coverage	24.8%	26.4%	20.6%
Driveway + Surface Parking	65,000	40,680	
	16.6%	17.8% }	878,596
Open Space and Landscaping	230,200	127,611 }	79.4%
	58.6%	55.8%	
Parking Ratio	113%	125%	126%
Covered	-	56%	100%
Surface	100%	44%	-

* Available for 2 of the 3 sites: .656 and .405

are relevant: a measure of persons per acre does not reveal the amount of floor space allocated per person and conversely dwellings per acre does not reveal the number of people accommodated.

Figures 9.03, 9.04 and 9.05 analyze the predominant plan forms used in the three housing developments. The forms are common in current practice, with the possible exception of the back-to-back types A and A3, Fig. 9.05. This form of dwelling accounts for almost 20% of the total measured in the development. The advantages of this form include (a) little external surface exposed to weather, minimizing heat loss and (b) when aggregated, these units pack together more tightly than other forms, thus yielding higher densities.

The disadvantages include (a) the single facade gaining natural light is a severe constraint upon flexibility in laying out the plan, (b) the greater number of walls held in common increases the possibility of sound transmission and (c) there is only one alternative possible for the location of personal space or entrances.

Decisions regarding the use of this form of dwelling type obviously requires a careful consideration of the trade-offs involved.

Fig. 9.03 DONWOOD TERRACE

First Floor | Second Floor

Type T.H.B.

Townhouse

Type 1

Maisonette

Type 2

Maisonette

Type 3

Maisonette

Type 4

Maisonette

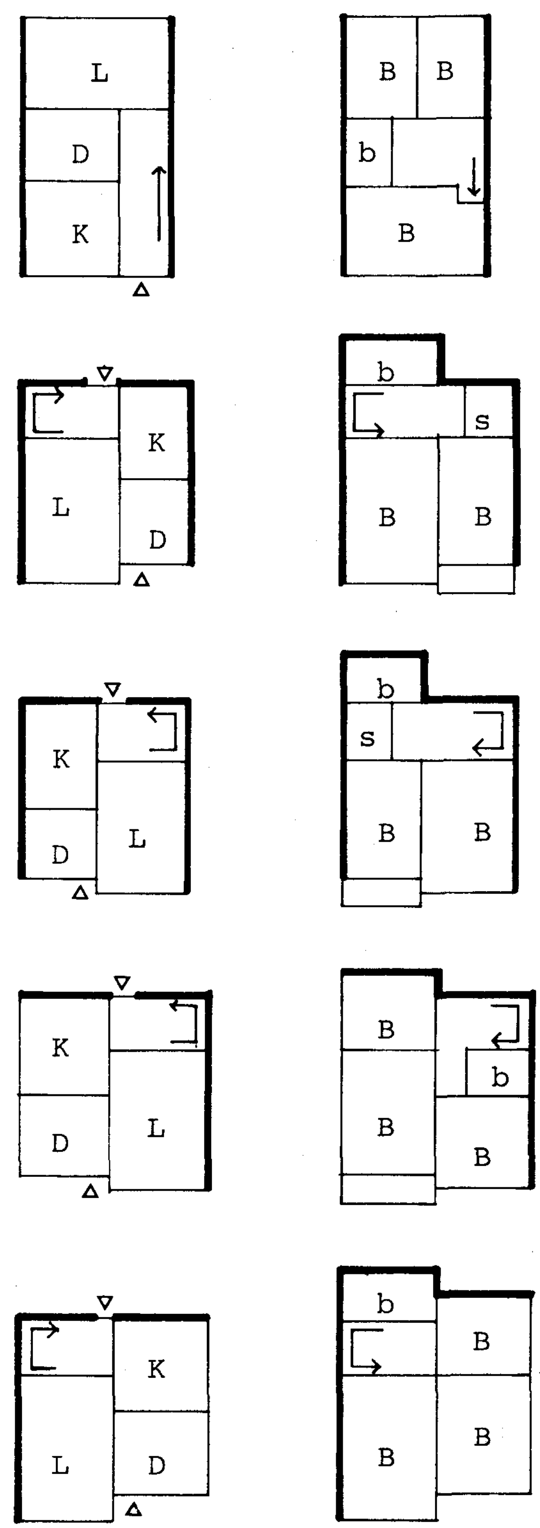


Fig. 9.04 LIONS GATE

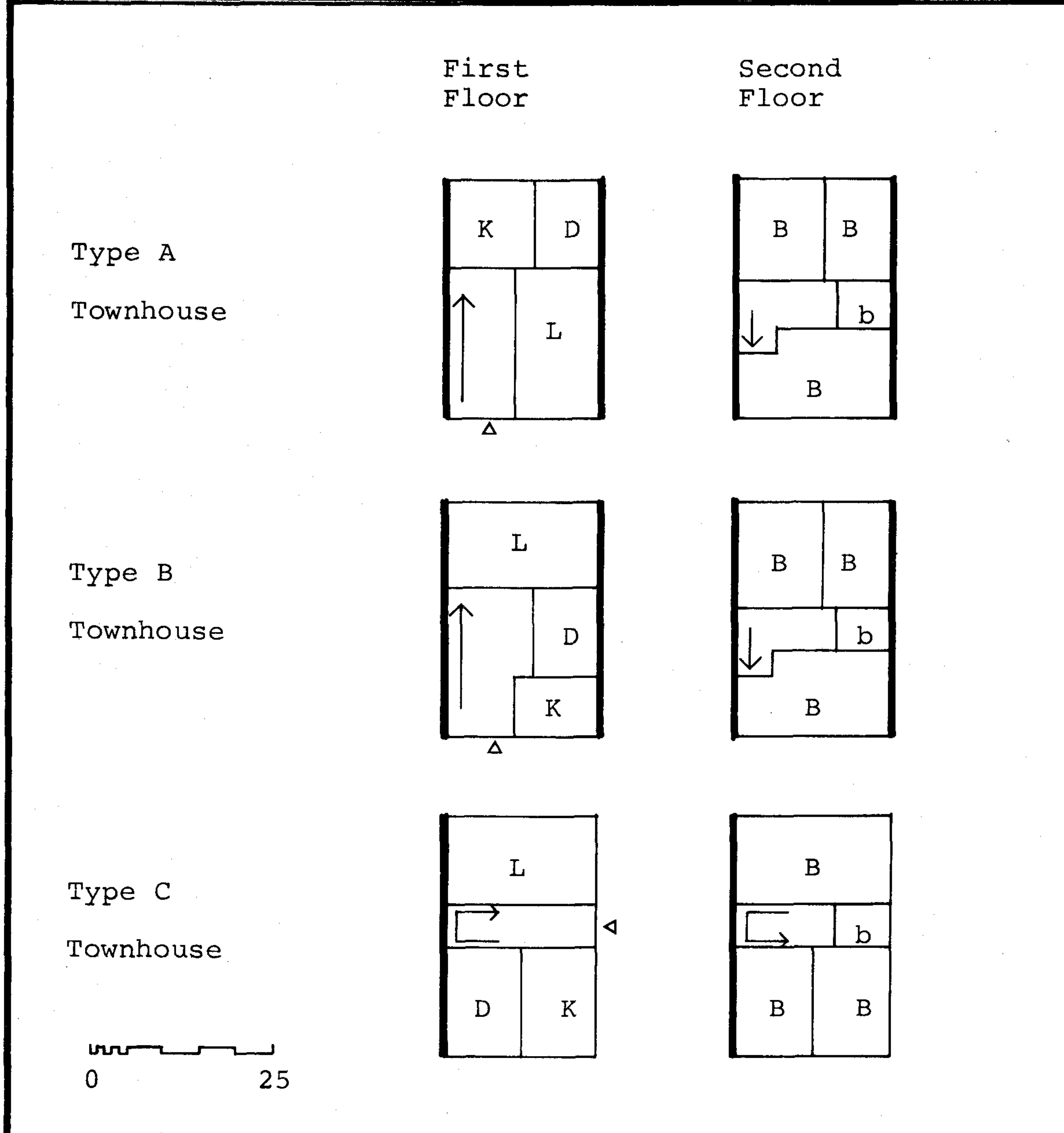


Fig. 9.05 BRAEBURN WOODS

Type B

Townhouse

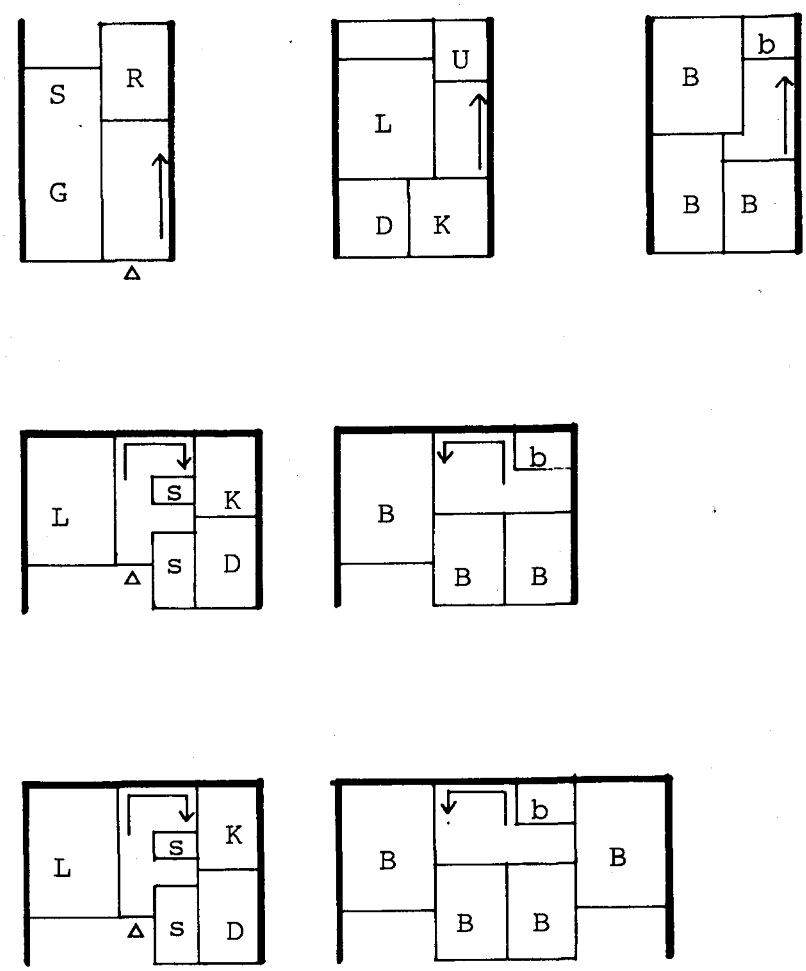
Type A

Townhouse
Back-to-back

Type A3

Townhouse
Back-to-back

0 25



It should be noted that care must be exercized when referring to Figures 9.03, 9.04 and 9.05 in conjunction with Fig. 9.01 and attempting to make space efficiency comparisons of the different plan forms. The sample size is not large enough and the controls necessary for such comparison were not built into the choice of the survey sample.

Costs 10

10 - COSTS

A SYNOPTIC VIEW OF HOUSING, WITH REFERENCE TO COSTS AND THE MANUFACTURE OF HOUSING

In reviewing any form of housing, it is clear that a number of highly interdependent factors must be considered in order to understand particular aspects as well as the general field.

For the purposes of this chapter these factors are divided as follows:
production of superstructure or shell; site or land; finance and administration; user preferences, market.

Even though all of these basic categories have several sub concerns, together they do not exhaust all of the relevant issues.

A. PRODUCTION OF SUPERSTRUCTURE

(1) Materials vs. labour costs, scale.

(2) Structural/design types.

(3) Location of production.

(4) Codes, inspection, standards.

B. SITE OR LAND

(1) Ownership.

(2) Supply.

(3) Servicing costs - utilities, roads, sidewalks, lighting, landscaping.

(4) Individual lot improvements - basements.

(5) Site costs vs. housing unit costs.

(6) Density.

C. FINANCE AND ADMINISTRATION

(1) Funding source.

(2) Eligibility and loan constraints.

(3) Land as separate from shell.

(4) Taxation.

(5) Maintenance, feed back.

(6) Combines (with pension funds, land assembly).

D. USER PREFERENCES, MARKET

(1) Demographic trends.

(2) Socio-economic groups.

(3) Location

(4) Priorities, trends, constraints.

A. PRODUCTION OF SUPERSTRUCTURE

(1) Materials vs. Labour Costs

At present Canadian and American labour costs are different with significant implications for the production of manufactured homes. In the United States, manufactured homes are more competitive with on-site construction than in Canada, because Canadian site labour is not much more expensive than factory labour, whereas in the United States site labour is 2 - 2½ times as expensive as factory labour rates.[1]

This condition, however, is not likely to remain. The supply of skilled craftsmen for on-site labour is diminishing, and construction unions have won high increases for wage contracts - as high as a total package 40% increase in 1969. While such a rise in labour costs is not expected in April 1971, when construction contracts terminate, because province-wide negotiations are probable, a 20% package rise can be expected. Thus similar wage differences between on-site labour and factory labour as exist in the U.S. is conceivable in Canada. Only intelligent guesses can be made from the projection of wage scales and the availability of skilled labour. If present trends continue then an accurate prediction can be made. Between 1963 and 1968 construction wage settlements averaged 9% per year, almost twice that of manufacturing. In 1969 the Toronto settlements ran from a low of 11% per annum to a high of 28% per annum.

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[1] National Housebuilders Association and Helyar, Vermeulen, Rae and Mauchan, Quantity Surveyors.

While systems building and manufactured components have shown substnatial savings over traditional methods in Europe, (about 20%), the situation there is not comparable. The European building industry was moving from a hand-crafted base to factory conditions, while in North America many components of the site-built house arrive complete - prefit windows, ready glazed with hardware installed and a prime coat applied, kitchen cabinets ready to hang, prefit doors, wall panelling, complete roof trusses, etc. Perhaps of even greater significance is the use of power tools on site - excavating equipment, ready mixers for concrete, power trowels, tampers, saws, nailers, staplers, and other hydraulic, pneumatic and electric equipment. These all reduce site costs, and the labour cost component, which is falling steadily - 10 years ago labour accounted for 45% of construction costs on the site, whereas they are now only 24%, and materials are 74% with 2% of costs in rental charges.

The supply of skilled labour is becoming more scarce and expensive, as are conventional materials, especially those of the organic variety, such as wood, stone or clay brick. For the most part their application was most appropriate to manual forms of labour.

That manufactured housing will bring no great savings in material or labour costs is indicated by these two facts:

(a) The residential construction industry is already efficient; in the past year the total cost of house construction rose by 4.2%, while the combined price index of materials and labour increased by 6.8%.

(b) The costs of a house, excluding land can be roughly divided as follows: 20% labour, 58% materials, 2% equipment rental, 20% in non-structural costs, such as legal fees for title transfer, building permit fees, mortgage application fees, mortgage insurance fees, surveying fees, fire and public liability insurance, selling expenses, interest charges, and, during construction, interest charges and municipal taxes.

If it is assumed that the average serviced lot now costs \$5,000. in Ontario, and the shell costs \$15,000. of the \$20,000. end-cost labour and materials together only account for \$11,700. (labour \$3,000., materials \$8,700.) or 58.5% of the total. The research conducted by the United Electrical, Radio and Machine Workers of Canada actually puts the cost of labour and materials as low as 51% of the total cost to the purchaser.

Therefore, even if savings of labour and materials are made, and these are not to be discounted, the end consequence is diminished by land and non-structural costs.

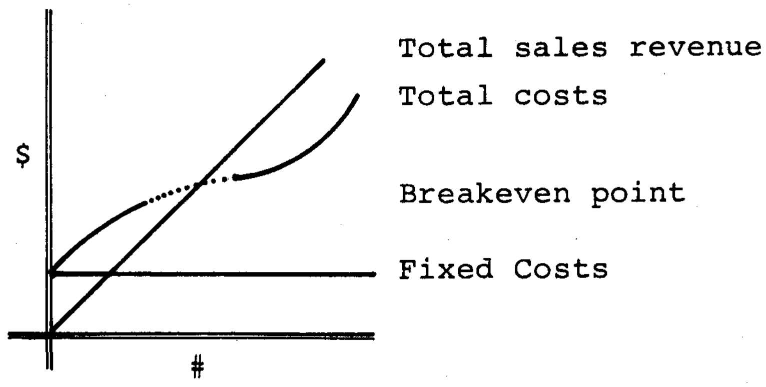
Without definitive cost figures, a review of production costs and estimating marketing costs confirms a need for high volume of sales for manufactured houses. The break-even point would, of course, be determined by the intersection of cost and revenue curves above the fixed-cost line shown in Fig. 10.01.

The scale of operation is thus critical to high productivity, not too low to be below sales revenue, and not too high to strain capacity. Allied to the output of units however, is the supply of home lots. This, because of the shortage of serviced land in Ontario, becomes the restricting factor. Not only does this limit production, but a lag-time between the output of a housing unit and its installation on site probably occurs. This is obviously a costly delay. The assurance of a market for a manufacturer, in a short lot supply condition, seems crucial.

(2) Structure/Design Types

It is a well observed fact that the structural systems and materials used in manufactured houses do not differ in any fundamental way from those used for on site construction. Therefore, to obtain a competitive edge in this area, the in-line production system must clearly show marked efficiency advantages over on-site construction: speed of construction, labour rates, reduction of wastage, critical path flows

Fig. 10.01 Cost - Revenue Curve



and scale all effect productivity. Whether the savings made here warrant the manufacture of conventional housing can only be assessed on product end-cost, which must take into account the fixed overheads of expensive lant, and transportation charges. These comparative figures are not known to us. However, some issues in principle, which affect cost, may properly be raised.

It is a well known principle in mass production that the number of variations from a standard norm must be kept to a minimum in order to reap economic benefits. Whether conventional structures and materials are used or not, this is true. At present, it would seem that the range of designs is too wide for the scale of production, because each unit is seen as a total house, and expensively varied. If the house is seen as a series of module types, where each type can be produced without variation, then cost savings will be made. These modules could be combined in different ways, and in different numbers, without adding to the cost. There might in fact be only two basic types - a mechanical/power stair module, and a living module. The living module, whether for living/dining space or bedroom space need not differ in shell form, but merely in interior partitions. The partitions could also be standard components, either flat wall or storage components. (See diagrams)

As in the principle of mass production, the construction of standard modules do not predicate a particular structural system. Without emperical substantiation, however, it would seem that the savings in material and labour to be made in conventional construction will be marginal, whereas the exploitation of the physical properties of large components, may yield more substantial savings.[2]

There are three basic forms of structure relevant to housing construction - frame, stressed skin and monolithic shell.

(a) Frame: This is the conventional method employed in manufactured housing, and, at present, represents the cheapest and simplest design: It is light, and can be perforated almost at will. However, there are span limitations. It is not an efficient structural form, (not best choice for modules to be transported; transportation often induces stresses in members the opposite of which the member must resist on site) and requires sheathing, in addition, for enclosure.

(b) Stressed Skin: This structural form has the greatest potential material savings, and possesses the additional advantage of being at once both envelope and structure. The disadvantages are that perforations must be kept to a minimum.

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[2] Cf Soviet "Block-Box" system.

(c) Monolithic Shell: This eliminates the joint problems endemic to modules which must be transported whole to sites, and can, in effect act as box beams. As in stressed skin, structures of this form reduce the allowed number of openings to a minimum.

It would seem that research and development into fundamentally different structural forms and materials is likely to yield greater savings than effort spent in refining conventional systems. But it should be remembered that recent history is littered with fruitless efforts to bring the housing industry into the 20th Century.

3. Location of Production

It is clear that transportation - location trade offs must be assessed to establish location, and generally speaking there are three alternatives for categories of the location of production plant.

(a) Central to market area, wide distribution. This in effect means that the modules to be transported should be as large as possible, light as practicable, and possess structural characteristics which resist "abnormal stresses" (roofs in tensions, floors in compression during transit). It should be noted that this means transporting empty space. The concept of nestling modules is worthy of investigation, to cut the number of trips required to install houses. The costs for this form of production are comparable to those of the mobile home industry, which, in the U.S. are figured at 50¢/mile. It has been reckoned that 300 miles is the economic cut-off point, and loads for this range between 10,000 to 22,000 lbs.

A recurrent problem in this form of housing (module transported whole to site) is the separation of joints, or pulling openings out of plumb, resulting in door and window misfits. The consequence is extra time spent on-site correcting defects, an expensive form of labour for a factory built product.

(b) In close proximity to site: This reduces the transportation problem, but frequently means the use of special transportation equipment. This equipment, limited to a few projects, has to be amortized by those projects. The application of this system is for heavy or large modules, (monolithic shell) and is limited to a range of 10-15 miles.

(c) Production means moved from site to site. The logistics of production becomes the critical issue, rather than the product and is dependent on a mobile or readily available labour force. The most logical application is for very large projects that comprise a severely limited number of module types.

4. Codes, Inspection, Standards

It has been reported[3] that the systems engineering developed for the aviation and space industries, in searching for civil applications, has rejected entry into the housing field because of the multiplicity of codes to be satisfied, conflicting standards requirements, and uneven inspection criteria. In addition, the unpredictable delays caused by approval requirements represent heavy carrying charges. This is totally unlike the production of other consumer products which satisfy continent wide standards, and require no approvals which would delay production or supply. "Automobiles would be beyond the range of the average consumer if each municipality had distinctive automobile specification requirements."[4]

Besides the codes applied to the production of the house itself, there are zoning codes applied to the subdivision of land, and the specification of site improvements (Dealt with in Section B (3)).

The stipulation by most municipalities of 60'- 0" minimum lot width has two important effects.

(a) The density is thus set at four units per acre, causing high serviced land cost per unit.

(b) The large size of lot dictates end cost to home buyer,

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[3] Aviation Week October 7, 1968.

[4] Paul Hellyer, Report of Task Force on Housing.

which in turn determines house type to suit income bracket of those who can afford this category of housing.

It is interesting to note that four dwelling units per acre is lower than Rosedale, and many parts of Forest Hill, two of Toronto's most exclusive residential areas. The density of these areas is about six units per acre, and townhouses, which are also built in Rosedale on 25'- 0" width lots, yield a density of 18 units per acre.

While increased density, it can be demonstrated, cuts cost of serviced land per unit, and can be designed to satisfy user preferences, municipalities are unwilling to allow such dense development, as this produces stains on the municipal budget which have to bear education costs. The real estate taxes of low cost, high density and large child population developments are, it appears, insufficient to meet education costs. Thus 60'- 0" lots are in effect a not so subtle form of dis criminating against low income families residing in urban areas. Other forms of discrimination are the prescription of minimum floor areas for houses, or density controls. The control of densities guarantees house size and tax return.

Developers are often accused of producing stereotyped housing. In fact, zoning by-laws stipulate the size of front, side and rear yards, which severely restrict variety. A 10'- 0" variation in position on each site is often all that is possible (Chapter 8); this also severely limits the form of house type to a single family detached bungalow isolated on each patch of land. Court-housing, for instance, besides row or terraced housing, is thus not allowed.

The advantages other forms of building distribution possess are not difficult to see - the spaces between buildings need not be residual, but designed for use, either public or private; the differentiated specifications for roads of different function would be possible and cost saving, and monotony could easily be averted. It has become clear that the general neighborhood environment is as persuasive a factor in house choice as is the unit and its cost (see C (4)).

B. SITE OR LAND

(1) <u>Ownership</u>

The ownership of land represents several disadvantages as well as advantages for the individual purchaser. The advantages are clearly that ownership represents two forms of security - social as well as financial. By and large, investments in houses are favourable ones; as hedges against inflation, and as a means to live rent free on retirement. The ownership of property means freedom of interference by landlords, and has traditionally been the way in which separation from others and privacy is assured.

The disadvantages are that for a majority of the population the purchase of a house is the largest single outlay ever made, and requires capital accumulation. (The population in regard to housing can be roughly divided into three groups, those for whom housing is no financial burden, those for whom it is a burden, but one that can be sustained as a preferential trade-off against other expenditures, and those for whom the financial burden is too great to assume).

Besides the initial or capital cost and mortgage payments, real estate taxes must also be borne. The second aspect of the disadvantage of land ownership is not intrinsically financial: it is the responsibility of maintenance. It has been found that those in the early years of family formation, and especially those in low middle to low income groups, are not interested in such activities as snow removal, gardening, site improvements or general home maintenance: their energies are, during this time, more inward family and earning directed.

A study of the mobile home industry is revealing in this regard. In 1966 the mobile house industry accounted for 22% of all single family private non-farm homes, in 1967 this rose to 32% of this market. In 1965 mobile homes accounted for 76% of all new single family homes that sold for under $12,500. If the cost figures of the industry are accurate, it would seem that mobile homes were produced for a retail cost of $10. per square foot in 1964, which included major appliances and furnishings. This figure is reported to have decreased to $8.00 in 1965, but the total price per unit has grown with an increase in the number of extras included in the sale. This figure should be compared to costs of about $12 - $14 per square foot for conventional construction, which does not include appliances and furnishings.

In comparing the mobile home retail price with a manufactured home (while understanding that different standards of construction are used for mobile homes and manufactured homes) a furnished double width mobile home unit, 24 x 60 or 1440 square feet cost $13,000. or $9 per sq ft in 1965, and a manufactured unit delivered to the site and erected unfurnished has a comparable price of $13,500. or $9.40 per square foot. If we add about $2.50 per square foot for furnishings, we have an end price of $11.90 per square foot, which is a 33% cost differential.

A further discussion on the unit and the land will be found under C. (3) and the acceptance of this form of housing under D. (4).

(2) Supply

In Ontario the Water Resources Commission virtually holds a monopoly on the supply of land for building. While it is possible for developers to assume the cost of servicing tracts of land (see (3) following) it is not possible for them to provide the trunk lines to potential housing sites. The Water Resources Commission has not been as successful as Hydro in the installation of trunk services, and hence a scarcity of serviced land in Ontario, the greatest potential market in Canada, is the result. This lack of supply taken with heavy demand, has driven the price of serviced land up. In New York State, Cornell University in its housing program has been able to produce serviced lots for $4,500 whereas in Ontario, the price is $14,500 for 60'- 0" wide lots.[5]

The long delays in approvals required for housing development is another characteristic of the Canadian, and especially Ontario, housing scene. This also restrains supply, and adds costs for carrying charges, which in turn are passed on to the purchaser.

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[5] Hellyar, Vermeulen, Rae & Mauchan

(3) Servicing Costs - Utilities, Roads, Sidewalks, Lighting, Landscaping

Processing raw acreage into registered lots with paved roads, sidewalks, services, and lighting is an integral part of traditional residential construction. The supply and improvement of land is the most troublesome and expensive factor in housing: speculation, red tape delay and excessive demands for unreasonable levels of subdivision services has meant increased costs of building lots.

It has now become customary for municipalities to pass the responsibility of providing services on to the developer. The standards imposed by municipalities on contractors are now higher than those once assumed by the municipalities themselves when they installed services. These standards are not always to the benefit of the home purchaser, even if he can afford them. For example, many municiaplities insist on a 66'- 0" width for every road, street, or cul-de-sac. Traffic demand, however, varies enormously, and savings in constructing appropriate road beds could easily be made. This in turn would allow more efficient use of land in both quantitative and qualitative terms.

(4) Individual Lot Improvements - Basements

The basement is quite distinct from the rest of the housing unit in a number of important respects.

In the first place, it represents a large percentage of the cost of materials used in the construction of the house. Secondly, it is not subject to the efficiencies affected in factory production. While power equipment is used in its construction, it is quite a distinct operation to that of the production of the superstructure.

In a sense, it can be seen as part of the land and its cost, as quite distinct from the superstructure. Further discussion on this point follows in C (1).

(5) Site Cost vs. Housing Unit Costs

"If land costs account for more and more of the price of the house, it follows that the houses themselves account for less and less. The purchaser that is, gets less and less house for his money."[6]

Since 1951, construction costs have risen by 85%, while land conservatively estimated, has risen by 300%.

It can be argued[7] that the cost of the superstructure has decreased in terms of real incomes, while that of land has not. As with the specification of 60'- 0" minimum width lots dictating the appropriate house to be placed on such a lot, in both social and economic terms, the

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6 Morris Cohen, May 1967 - Fortune
7 (NHBA)

combination of land and house unit costs makes the total outlay a formidable figure: It would be ludicrous to put a cheap house on an expensive site. And the purchaser in the lower income ranges is primarily concerned with interior space.

In contrast, mobile home units can be purchased for as little as $5,600 complete. As no land costs are involved, this form of shelter can be afforded by a large, and different market from those who purchase a $20,000 home. (See C (2) and (3)).

(6) Density

As has been noted elsewhere in this paper the most effective method of reducing lot prices, besides increasing the supply, is to increase density.

Most familiy users admittedly show a strong preference for single family homes. It must be remembered, however, that few viable alternatives exist to compare with single family houses. The forms of multiple dwellings that now exist, maisonettes or apartment blocks, do not satisfy family needs. The single most important reason for purchasing a house is still child rearing.

The planning of the general environment, the amalgamation of clusters of units, apart from the design of each unit, is the most important aspect of housing. Figures 10.02, 10.03, 10.04 and 10.05 indicate the potential of rationalizing the manufacturing process and the range of dwelling units possible without changing the module. The modules are divided into two kinds, "wet" and "dry"

The wet module (Fig. 10.02) contains the mechanical and service components, and the vertical circulation. The three cores shown vary slightly.

Core A: Square, for maximum connection possibilities, contains within the perimeter all appliances. No weatherlock.

Core B: Square, larger contained space as kitchen appliances not included; these can be contained in dry module but fixed to core "wet" wall. No weatherlock.

Core C: Rectangular, which may restrict the range of combinations possible, but a weather lock is provided. Two bathrooms, but kitchen appliances not contained within the perimeter.

The dry module is simply a standard container which can be divided for either living space or for bedrooms. The 12'- 0" width governs (highway code) but lengths up to

60'- 0" are at present permissible and practical.

Figures 10.03 to 10.05 show a range of possible combinations of the wet and dry modules. Note that the modules themselves do not change. It is here that many cost, design, user satisfaction and environmental problems can be solved. The potential for improving housing in general is greatest in this area of endeavour. However, zoning codes determine solutions at present, and do not provide incentives for developers and the private sector to be innovative, or develop alternatives to the present stereotypes.

C. FINANCE AND ADMINISTRATION

(1) Funding Source

The shortage of serviced land is one impediment to the supply of housing. Another, of equal importance, is the failure to develop a sufficient flow of mortgage funds. Mortgage fund sources are generally insurance companies, trust companies, banks, pension funds, individuals and the Federal Government. The lending institutions account for the bulk of the supply, with government acting as the residual lender.

It is well known that the supply is inadequate and irregular. The economic tap has been used to control the economy

Fig. 10.02 Wet Module

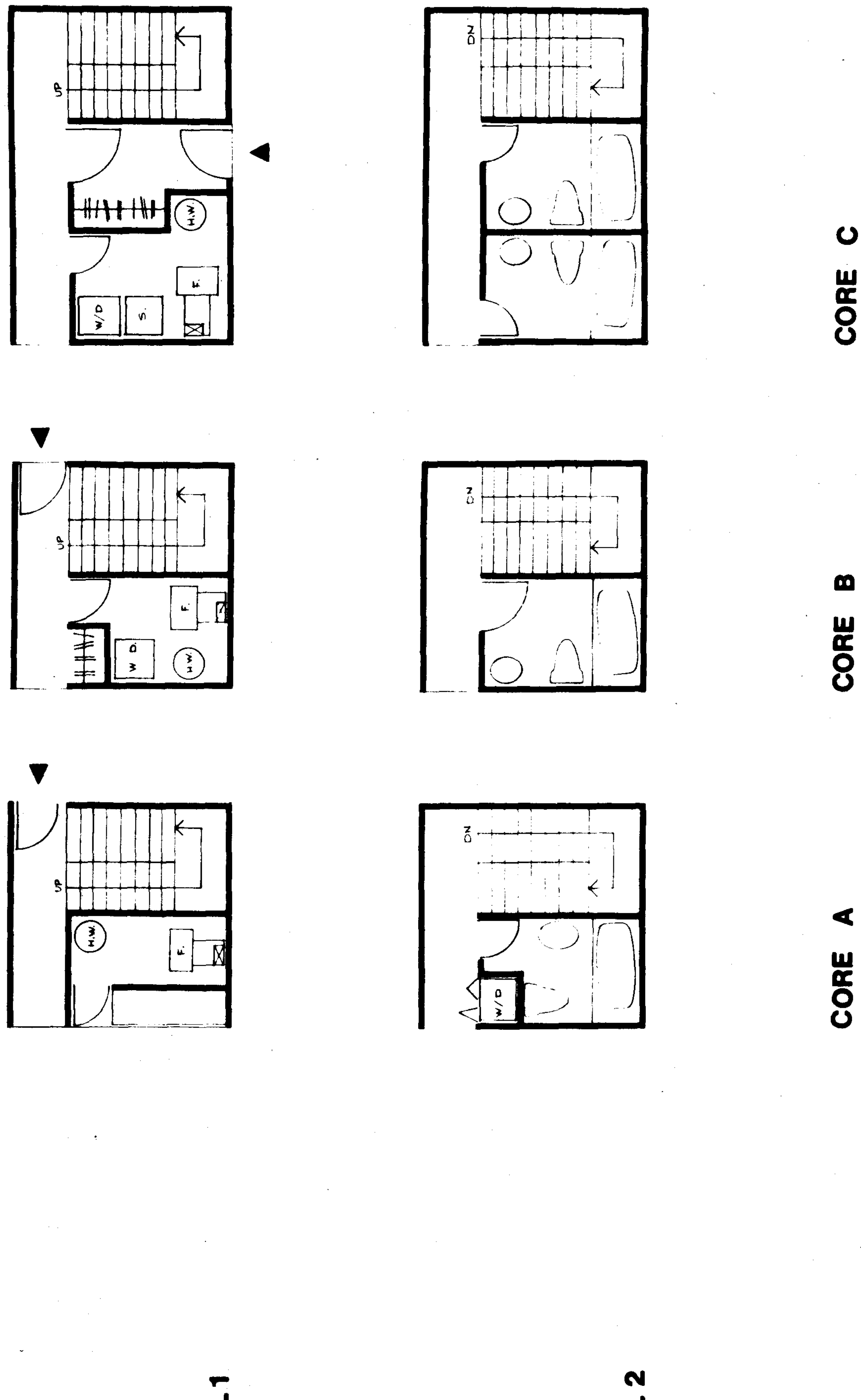


Fig. 10.03 Wet and Dry Modules

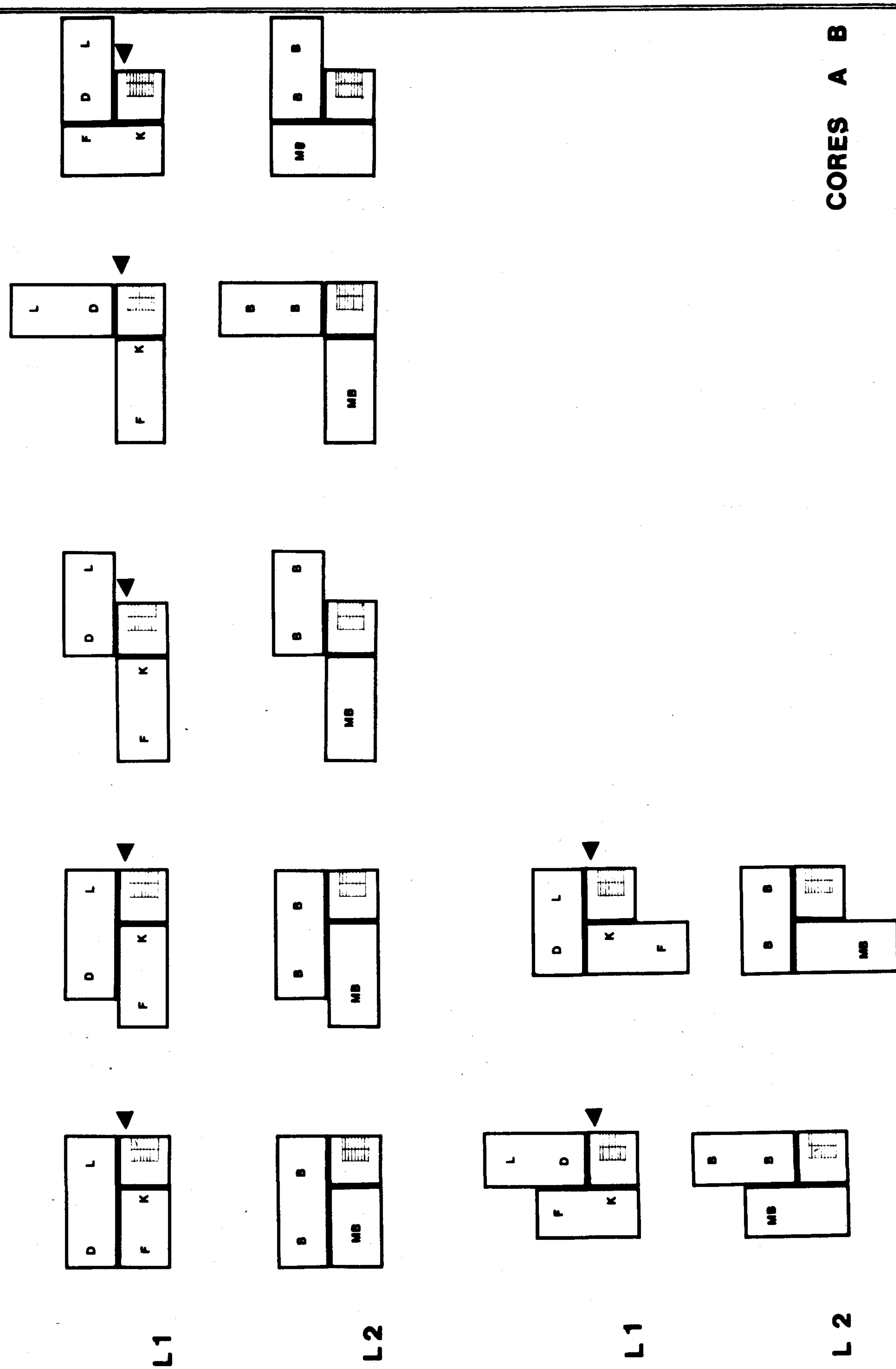


Fig.10.04

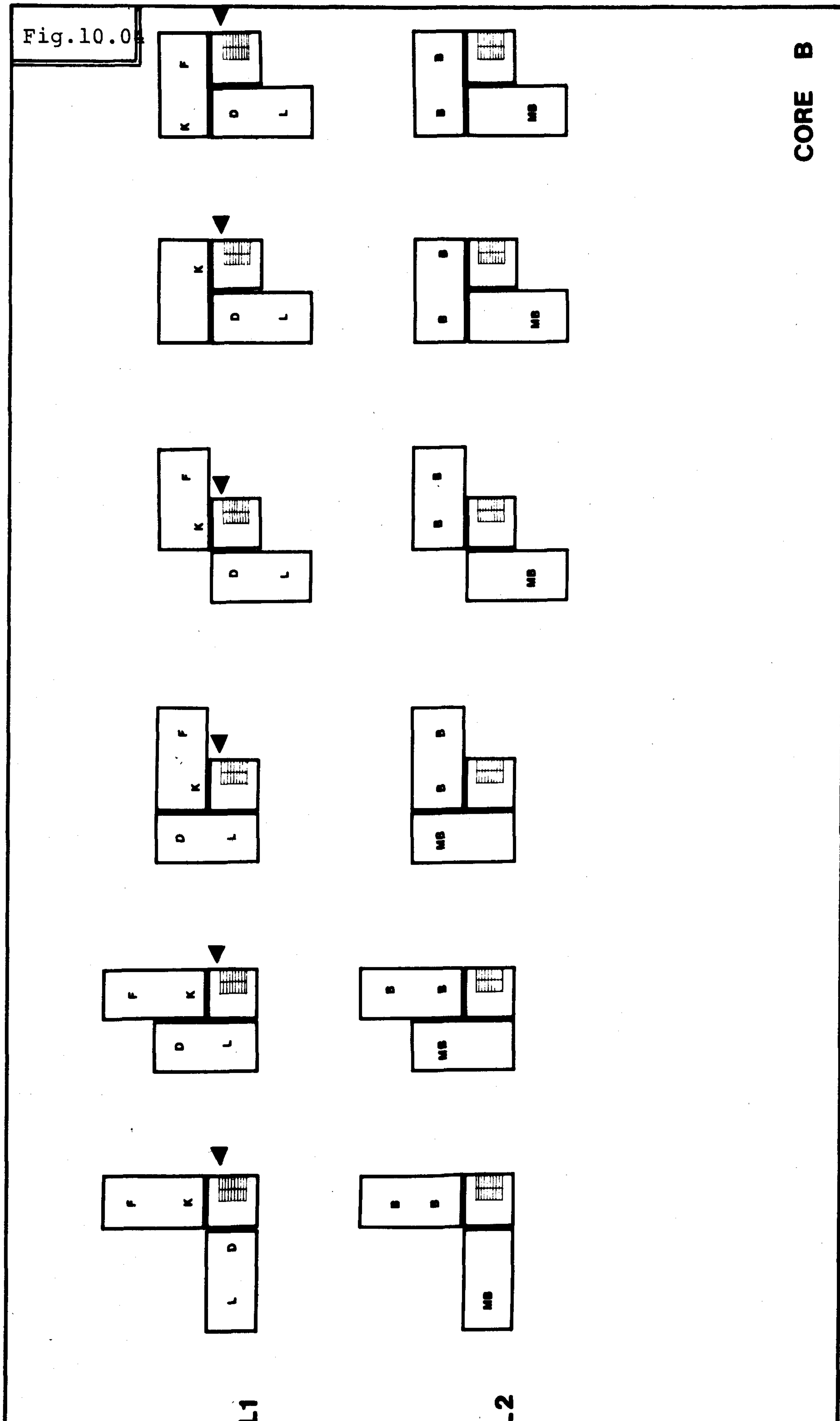
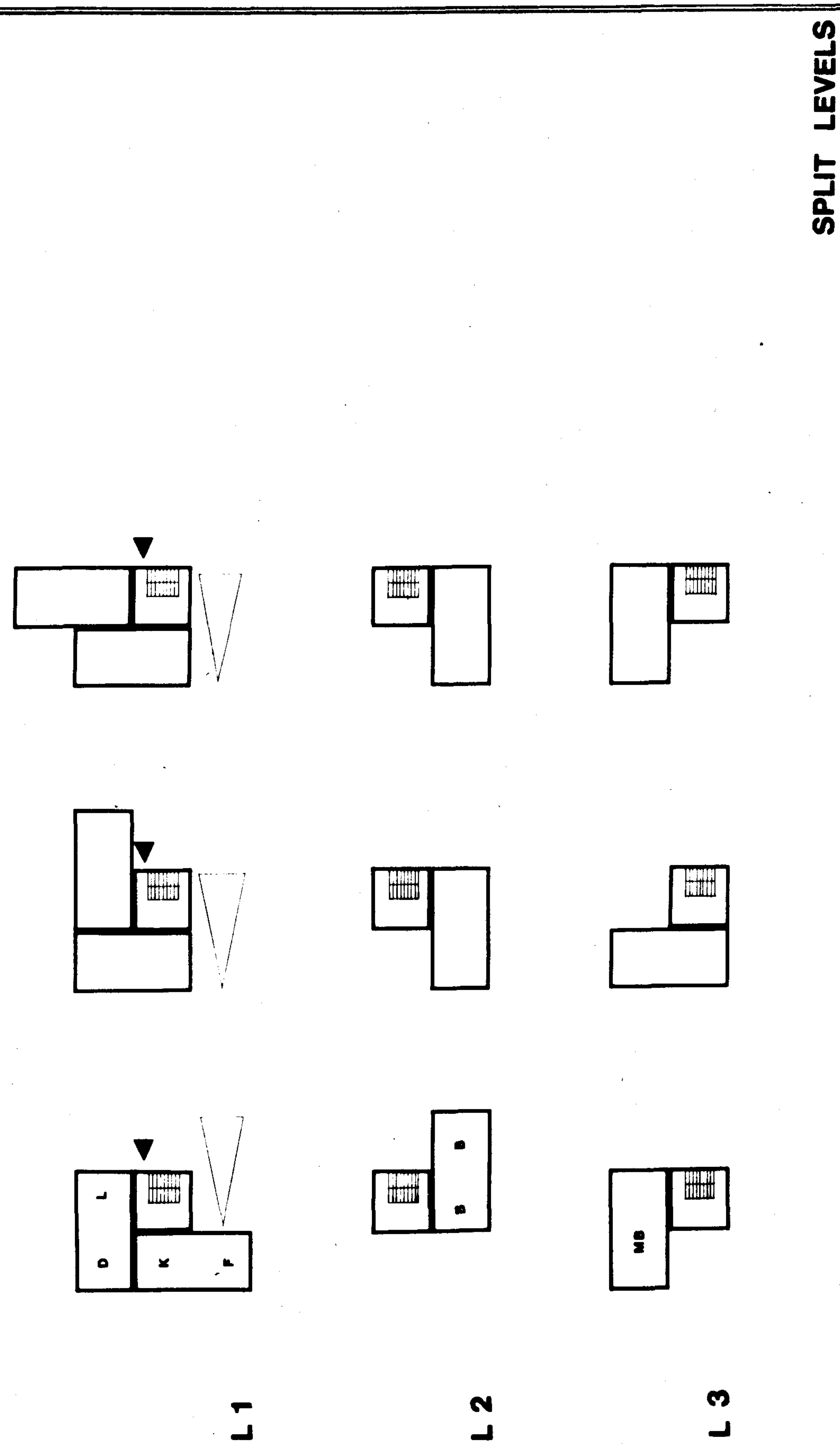


Fig. 1005 Wet and Dry Modules



rather than in relation to the needs of the housing market. Periodic shortages disrupt efficiency, employment, capability and hence the price of the end product. The allocation of residual funds has also been erratic. It has been estimated that[8] efficiency has as a consequence been held to 75% of potential.

Private enterprise has been keen to supply housing under the limited divident provisions of the NHA, but Federal funds are unavailable for this.

Condominium legislation permits the sale of units in multiple housing - (satisfying the strong drives for home ownership) it is predicted that such forms of housing could cut custs, but lending institutions to date have not shown a willingness to invest in this form of housing.

It is perhaps only an unfamiliarity with the operation of such arrangements that causes this hesitancy, and much could be done to encourage investments in condominium via a careful exposition of this form of ownership.

Lenders do, however, prefer large single loans on multiple developments - there is in this way less administration,

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[8] (NHBA)

and the lending institutions are able to participate in the equity of such schemes.

The largest single untapped source of potential mortgage funds lies in the assets of pension funds. At present, only 11% of their total assets of some $8 billion are invested in residential mortgages. Many pension funds are apparently loaded with 4½ to 5% invesements, whereas 10% yields can be expected from mortgage loans. In addition, such investments would be protected by mortgage insurance.

(2) Eligibility and Loan Constraints

While down payments are down[9] making purchases more widely possible, the amounts required are still higher than most can afford. In addition, borrowing costs are up - the increased cost is often more than many families can or are willing to pay.

Yet it is still a cheap form of borrowing. Other consumer goods are financed at rates in excess of mortgage rates. The current NHA rate is 9-3/4%, while consumer goods credit charges are 12 - 18%. And a house appreciates in value, an appliance or auto does not.

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[9] June 1969 amendments to the NHA.

It is a fact that personal disposable incomes are increasing faster than the cost of housing. However, other demands are making inroads into consumer spending. The proportion of the GNP spent on housing is declining, while the amount spent on consumer goods and travel is increasing. This suggests that improvements in either or both marketing methods and product are required.

Those purchasing mobile homes, as has been noted, have a total cost of about $5,000 - $6,000. The down payment is 20%, the rest is financed on a 7-year note at 14% interest. This means roughly a $100 per month charge. There is, of course, the additional trailer park rent to be borne.

(3) Land as Separate from Shell

The preceding section has shown how the large sums borrowed for home purchase are broken down in the case of mobile home purchase, bringing this form of home financing into line with other consumer goods.

We have also seen the distinction drawn between the site and its associated basement, and the construction of the superstructure, (B. (4)) and the anomaly of manufactured homes requiring extensive and costly site work.

We thus can conceive the two elements - site and superstrucure, or lot and house, as separate components, the one permanent, the other impermanent.

It can also be seen that improved sites can be owned separately from the building or house unit, as in the case of trailer parks. That is the sites can be owned and maintained (an undesirable responsibility for many) by large development companies, and the house modules by individuals, (satisfying the drive for ownership, or privacy).

This conception frees housing from the land on which it sits. This conception is probably the most potent operational change for the future. In this way only permanent site work might be subject to inspection by local authority, the modules then considered as personal property, as a refrigerator is, and not subject to a multiplicity of codes. The life span differentials between components (10 - 15 years) and modules (20 - 25 years) and site improvements (50 years) could be accommodated by differential replacement, and allows "trading up".

It is also conceivable that components need not, as in the case of the land, be owned: an appliance component could be owned by a large company, as a telephone is owned, and rented to a user, reducing capital outlay and further reducing the tax base. The utility company can depreciate units faster than a private individual can, and can thus upgrade faster, again as the telephone example demonstrates.

In fact mobile home owners trade-in units about once every three years, not in order to move, but in order to trade up. Unlike conventional housing, the life expectancy of mobile housing is only 15 years.

The operation of trailer parks at present is a land holding operation, and a means of covering costs for long term speculation: It is clear that any land between Oshawa, Barrie and the Niagara peninsula will be urban land in the near future. The change in density or housing form at that time will not be difficult to achieve, as the mobile home is not tied to its site as conventional housing is. Breakthroughs in technology (G.E. individual sewage disposal) may also reduce servicing costs at future dates, rendering such land even more valuable.

(4) Taxation

Canadian municipalities rely on property tax for the bulk of their revenue. This revenue must pay for police, fire protection, garbage collection, street cleaning, sewage, water supply and education. Small houses send as many, and sometimes more, children to school as large houses on large lots do. It would seem that the revenue from small houses is not enough to bear a municipality's costs.

It is clear that an examination of tax sharing formula between the three levels of government is necessary for a solution to this problem. While the problem persists it can be said that there is legislation against the small home owner in low income brackets.

Roughly half of a municipal budget goes to meet education costs. Industrial and commercial areas do not, as a rule, send children to school. This is the reason that large developers are required to provide some industrial and commercial components in a development package. The ratio often used is 60% housing to 40% industrial-commercial. Redrawing boundaries will help to provide a more diverse and balanced tax revenue base, a strategy now being advocated by d'Arcy McKeogh, Minister of Municipal Affairs. The effort to spread the tax burden is especially important for dormitory areas, areas of growth near established urban centres.

Another solution is to rob Peter to pay Paul - the Provincial government could assume the responsibility for the provision of education. This would spread the costs of education across the population, and relieve the tax on houses. If the concepts in C. (3) are developed, or if mobile home sales take an even larger segment of the market, such a tax solution will be inevitable.

Local governments have ceased issuing debentures to cover land development costs when it became the practice to pass these costs on to the developer. Yet local governments are still short of funds for trunk line installation.

Imposts, or cash levies, based on the number of building lots in new subdivision, or the number of units in multiple dwelling projects, are also used to raise municipal revenues, and often run as high as $1500 per unit.

Other financial discouragements are placed in the way of home owners, discouragements that favour rental accommodation: Owners of rental property may charge property taxes and mortgage interest against income tax, while home owners may not.

Lastly, the 11% Federal Sales Tax on building materials does not help to lower house costs. Some provinces in addition have sales taxes which include the 11% Federal Sales Tax. This is remarkable when shelter, food, and clothing are considered basic necessities. The forms of housing a nation builds are largely determined by the forms of financing available and promoted.

(5) Maintenance, Feedback

It has been reported that mobile home owners change their units about once every three years. On the prairies it has also been found that one of the principle reasons for moving is an unwillingness of the home owner to take on major repairs. Consequently, the concept of materials reclamation by the vendor should be considered, especially if a system of interchangeable parts is employed.

In any event maintenance by the vendor or lessor is a very powerful form of feedback and cause for owner or user satisfaction.

There is also a need for formalized post sales follow up, a monitoring of defects. In order to meet user requirements, an institutionalized and permanent research program should be instituted.

It has been demonstrated that prospective buyers are very much influenced by the attitude of the house vending company; confidence that after sales there will be access to an interested and enthusiastic organization is a powerful selling point.

(6) Combines (with pension funds, land assembly)

To date the profit in development has been in the land. Presently large profits lie in financing, (10%) although many lenders are unwilling to tie up funds for any length of time while short term investments yield as much, and more, profit. While the spread between on-site labour costs and factory wages is not great, low profit yields are sustained by the manufacturer of house units. Evidence that this need not necessarily be so is that in the U.S. companies which only produce manufactured homes appear to be successful.

While the profit margins remain low in Canada for producers of manufactured housing, it would seem that arrangements with institutions in one or both of the problematic, but profitable, areas would be to their advantage, that is in the supply of money or land.

D. USER PREFERENCES, MARKET

(1) Demographic Trends

The greatest change in demographic charts in the recent past is the growth of the under 30 and over 65 groups. Further, the under 30 group is the largest absolute segment of the population, and is about 60% of the total. While disposable incomes for the under 30's group is growing, this group is at the family formation stage and at the lower levels of potential earning curve.

Both of these groups value time and convenience over status and maintenance, and cost over aesthetics. Hence, the mobile home success story.

Because of the low cost of this form of housing, easy maintenance or replacement, turn key operation, ease of acquisition and speed of installation, aesthetic or social concerns have not been a drag on sales.

This does not mean that chaotic trailer parks or poorly designed units are inevitable. What it does mean is that we no longer need believe in the myth that only pseudo-colonial homes can be marketed successfully.

(2) Socio Economic Groups

An idealistic myth is that it is desirable to provide a mix of socio economic groups in development. Empirical evidence is that members of a particular socio-economic group tend to gravitate to "territories" established by that group.

There are a number of reasons for this tendency, which need not be touched on here. However, it is important to note that there are sufficient differences in life-style between different socio-economic groups to warrant differences in the physical design of the unit and the environment in which the unit resides. For example, socio-economic groups on the lower end of the scale tend to be more street-oriented in outside activity patterns, while those at the other extreme tend to be private yard or garden oriented. All, however, venerate the provision of private outdoor space, as shown elsewhere in this research study.

(3) Location

Over 70% of the population now live in urban areas in Canada and the U.S.A., and by 1980 this figure will be 80%. "Of the one million dwellings to be built in the next five years, 20 - 25% will be in Metro."[10] Individual home ownership of single family homes in this context is not, and will not be possible for low to middle income groups, especially those with children of school going age. In

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[10] H. Hignett, President, CMHC.

Canada at large 8% of families live with other families, in Metropolitan Toronto, it is as high as 16%. Forms of multiple accommodation for families will have to be developed to satisfy demand: At present (Dec 1969) the average price of houses in Metro reached $29,982. It is not certain that industry can meet this demand given the shortage or unreliability of the supply of mortgage funds or lack of serviced land, but the market is there. "Housing is the only major industry failing to participate in the greatest economic boom the world has ever known"[11]

It is clear that at the macro level the greatest demand for housing is and will be in and near established urban areas. At the micro level there are other patterns of settlement of equal significance: There are preferences of location distant from, or in close proximity to community facilities, and other location options, which have been accurately plotted.[12] Further, there are the levels of desired mix with other activites, and relation to the different modes of transportation. All of these are factors in making housing choice and planning for the economic and environmental success of housing.

(4) Priorities, Trends, Constraints

In summary, it can be seen that in Canada it is difficult at present for the manufactured home to compete with the

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[11] G.T. Bogard, Head, Urban Development Division, General Electric

[12] Dr. Michelson

on-site construction home, although material and on-site construction costs are rising; that the lack of supply of money and serviced land are equal impediments to the growth of the housing market, and that because education costs are borne by municipalities only particular income brackets, and hence house types, are encouraged. These types are not the type that represents the largest potential market, which is the large under 30's and over 65's groups, who value time and cheapness more than status and maintenance, and who either do not wish to, or cannot make, large down payments for very large financial commitments. Hence the concept of separating super-structures from the site emerges, as an answer which breaks down the size of investment, and treats the house shell as a consumer product. This product can be produced en masse, with variations made by combining a few basic units in different ways, rather than varying each unit. The importance of planning the amalgamation of many family units thus becomes important in order to create desirable neighborhood environments, and to economize on land servicing.

The implication for development combines, production units and taxation is therefore not inconsiderable.

The market at present being satisfied is the static one, and one for which the nature of the manufacturing process is not best suited.

A much larger and more dynamic market is available. This market's priorities are not those of the middle income and age group, and it is for this group that the manufactured home is best suited. This application also requires much research and development in both physical and behavioral aspects, but promises the greatest rewards in environmental planning, and new technologies and materials exploitation.

It should again be emphasized that while a house or car can be manufactured, land cannot. We can calculate manufacturing costs accurately, but we cannot do so for land over any length of time.

Finally, it would seem that a low cost, national or continent wide, market with assured outlets or contracts should be the target for manufactured homes.

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Demonstration 11

11 - DEMONSTRATION

The general requirements revealed in the preceding chapters are, in this portion of the work, first given specific dimension; second studied in terms of density and height; third applied to prototype housing configurations; and fourth used in a demonstration design. The demonstration design uses a previously surveyed site, Donwood Terrace.

Part A introduces area standards for the various elements of the dwelling; interior living and sleeping, exterior personal space, car parking and street allowance.

Part B uses the area standards as a basis for a mathematical model. This is accomplished by viewing all land use as quantifiable modules and by ascribing a number of quantifiable modules to the dwelling. Thus the site may be seen as a support to measureable volumetric content, volumetric content to which user requirements have been attached.

Part C examines the effects of including shared space as an additional space consuming element. As explained elsewhere, while we could not determine the shared space model with as much confidence as we can the other spatial factors, Fig. 11.17 we believe provides a basis for establishing a reasonable amount of shared space for various levels of density.

Part D illustrates the fact that once standards of space allocation are established, the height of buildings may be accurately predicted. Height is perhaps the most important factor affecting the provision of amenities approximating those of the single family dwelling.

Parts A to D formulate a comprehensive model of quantitative requirements. However much of the work done in this study has been aimed at establishing qualitative requirements: Part E concisely lists these qualitative requirements.

Part F combines the quantitative and qualitative aspects into a comprehensive design. The steps taken in this design process were to:

(1) establish workable dimensions for the dwelling unit
(2) establish site organization alternatives
(3) establish vertical dwelling unit distribution alternatives and methods of devising short walk-up conditions for relatively high (6 storeys) buildings.
(4) Derive site plans from the preceding steps, and related quantitative data.

Part G lists salient factors which at present determine dwelling configurations and groupings - zoning and setback regulations and construction costs.

Finally, Part H outlines a method of manipulating the total list of quantitative and qualitative requirements simultaneously.

A. DWELLING UNIT AREA STANDARDS

Generic Plans: Two and Three Storey Houses (National Building Agency U.K.) has been used as the foundation for our subsequent work. This Generic Plans study has dealt with room arrangements, generalized amalgamations and given all the alternative relationships. As the dimensions of particular rooms and the total dwelling unit sizes are smaller however, than those acceptable in Canada, we have correspondingly increased these dimensions. This does not reduce the worth of the system of revealing the range of alternate space arrangements comprehensively.

The dimensions used are shown in Fig. 11.01. These dimensions modify the NBA standards by increasing them (see Chapter 9) to standards based on general use (Chapter 9, Fig. 9.01; Chapter 3, Fig. 3.01).

Fig. 11.01 AREA SPACE REQUIREMENTS			
No. People	No. Bedrooms	Sq. Ft. (British)	Sq. Ft. (Canadian)
2			
3			
4	2	800 or less	1008 - 1024
5	3	910 - 1010	1152 - 1280
6	4	990 - 1050	1296 - 1536
7			

DIFFERENCES IN THE AREA STANDARDS

1. Storage areas are not included in the Br. figures given, thus direct comparison to Cdn. totals cannot be made.
2. Minimum bedroom dimensions have been increased from the Br. 6'-6" to the Cdn. 8'-0".
3. In the Br. tables entrance space is considered part of the dining or living area. The Cdn. standards show the entrance space separate from the total living space.
4. In the Br. tables the living space assigned to 2-bedroom units is the same as that assigned to 4-bedroom units. This study uses a size adequate for a 4 bedroom house for all units.

Our social survey has established that minimum outdoor personal space should equal aggregated interior living space. In the case of four bedroom units, however, we have assumed that it will be necessary to increase this minimum and we have done so by adding to outdoor space the space equivalent to a large bedroom.

<u>Generic Plans: Two and Three Storey Houses</u> has been found to be deficient in one important aspect. It neglects to assign space to the automobile. We have corrected this

omission by assigning the appropriate space and this becomes a further element to be manipulated in the amalgamation of all the elements of the dwelling.

Fig. 11.02 SPACE ALLOTMENTS BY CATEGORIES

	No. of bedrooms/dwelling		
	2	3	4
Int. living & sleeping space	1008	1152	1296
Ext. personal space	432	432	576
Auto parking space	288	288	288
Street allowance per unit	360	360	360
Total space/dwelling	2188	2232	2520

B. DENSITY

Using the area standards given in Fig. 11.02 coverage can be plotted on one axis, as shown vertically in Fig. 11.03. The coverage of the dwelling unit includes the built area, the personal exterior space, auto parking space and a proportional amount of street space. On the other axis, shown horizontally in Fig. 11.03, the density in dwelling units per acre is indicated. The resultant curve indicates diminishing coverage with increased density.

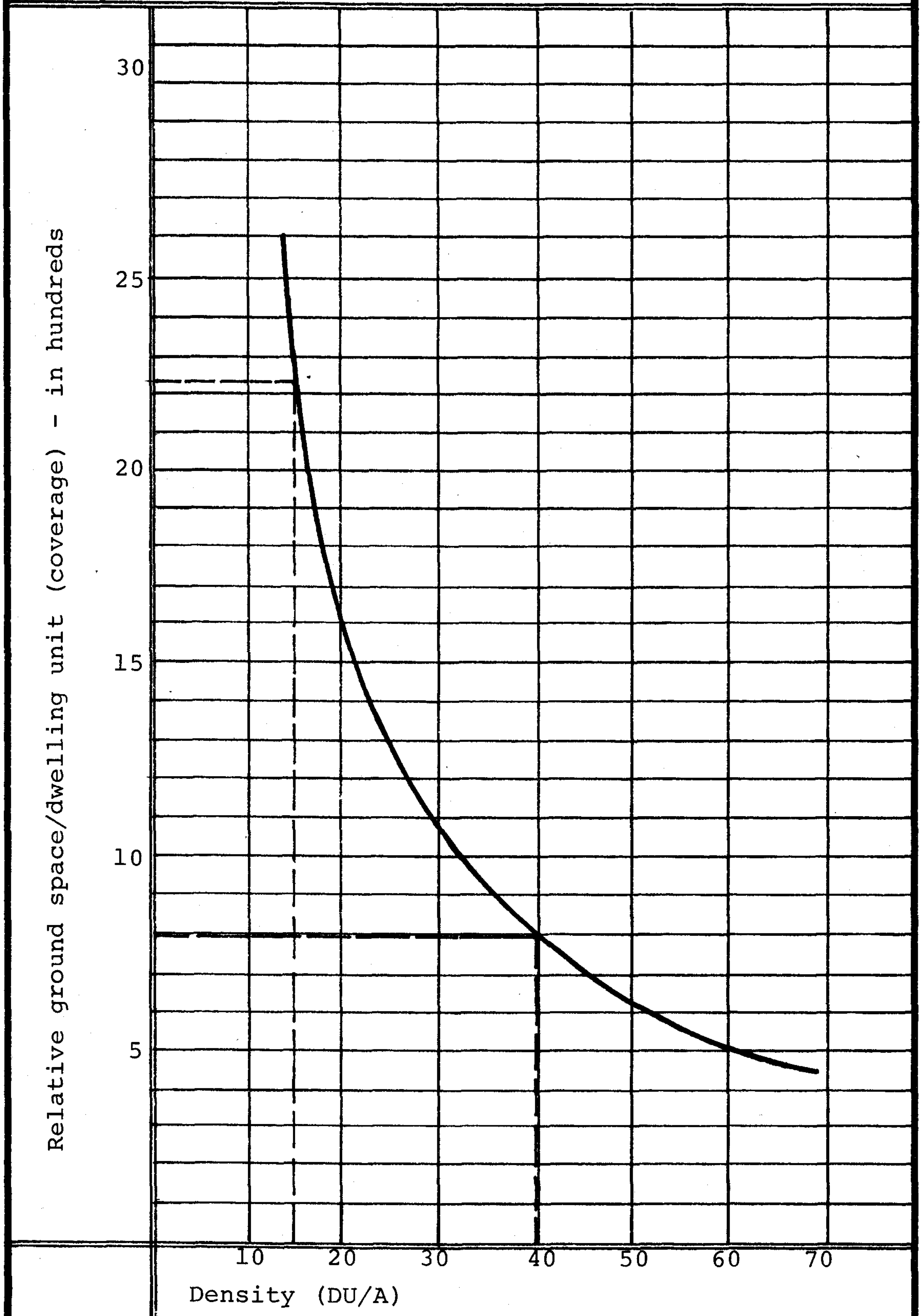
Example 1:

Vertical Axis: coverage of 2,232 sq. ft. all at grade.
Horizontal axis: maximum density with above coverage is 15 dwelling units per acre.
Note: 2,232 sq. ft. is the minimum inclusive area (refer to Fig. 11.02). If the coverage is less than 2,232 sq. ft. some accommodation must be located above or below grade.

Example 2:

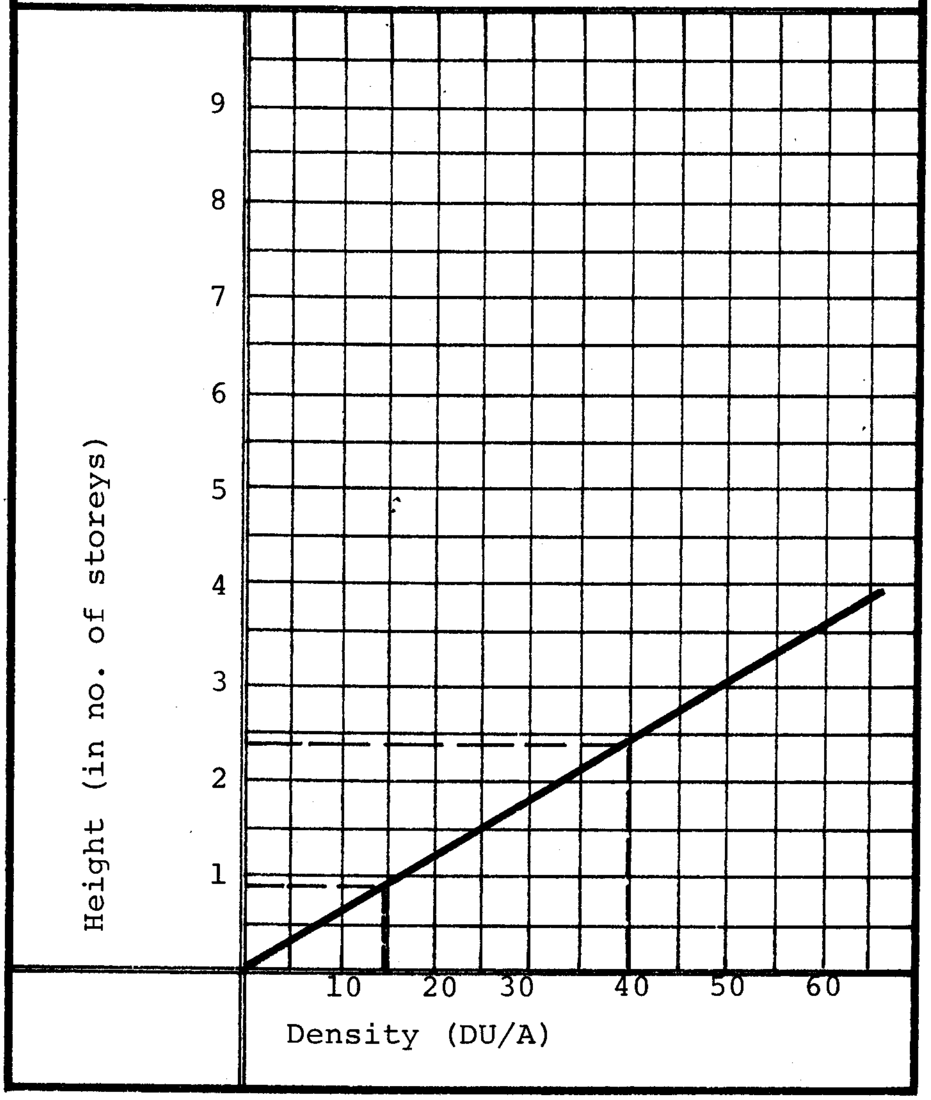
Horizontal Axis: density of 40 dwelling units per acre.
Vertical Axis: coverage of 800 sq. ft.
Note: If 432 sq. ft. is the area assigned to personal open space, and 288 sq. ft. to parking and 360 sq. ft. to street, the total at grade is 1,224 sq. ft. There is, therefore, in this example, a 424 sq. ft. deficiency at grade. As some redistribution of space must take place an increase in floors to reduce the coverage is required. In this example 2½ storeys would be necessary to accommodate 40 dwelling units per acre. It will then be seen that not all those spaces assumed to remain at grade may do so.

Fig.11.03 BASIC DENSITY CURVE



The previous examples indicate that with constant areas per dwelling unit, height is a function of density. Fig. 11.04 plots this relationship.

Fig. 11.04 DENSITY-HEIGHT RELATIONSHIP



The theoretical curve given in Fig. 11.03 can be read off exactly. The answers are not, of course, practical - for example two and a half storeys would not be built. Fig. 11.05 illustrates that equal volumes may be distributed in a variety of ways while satisfying practical requirements.

Fig. 11.05 INTERPRETATION OF THE DENSITY CURVE

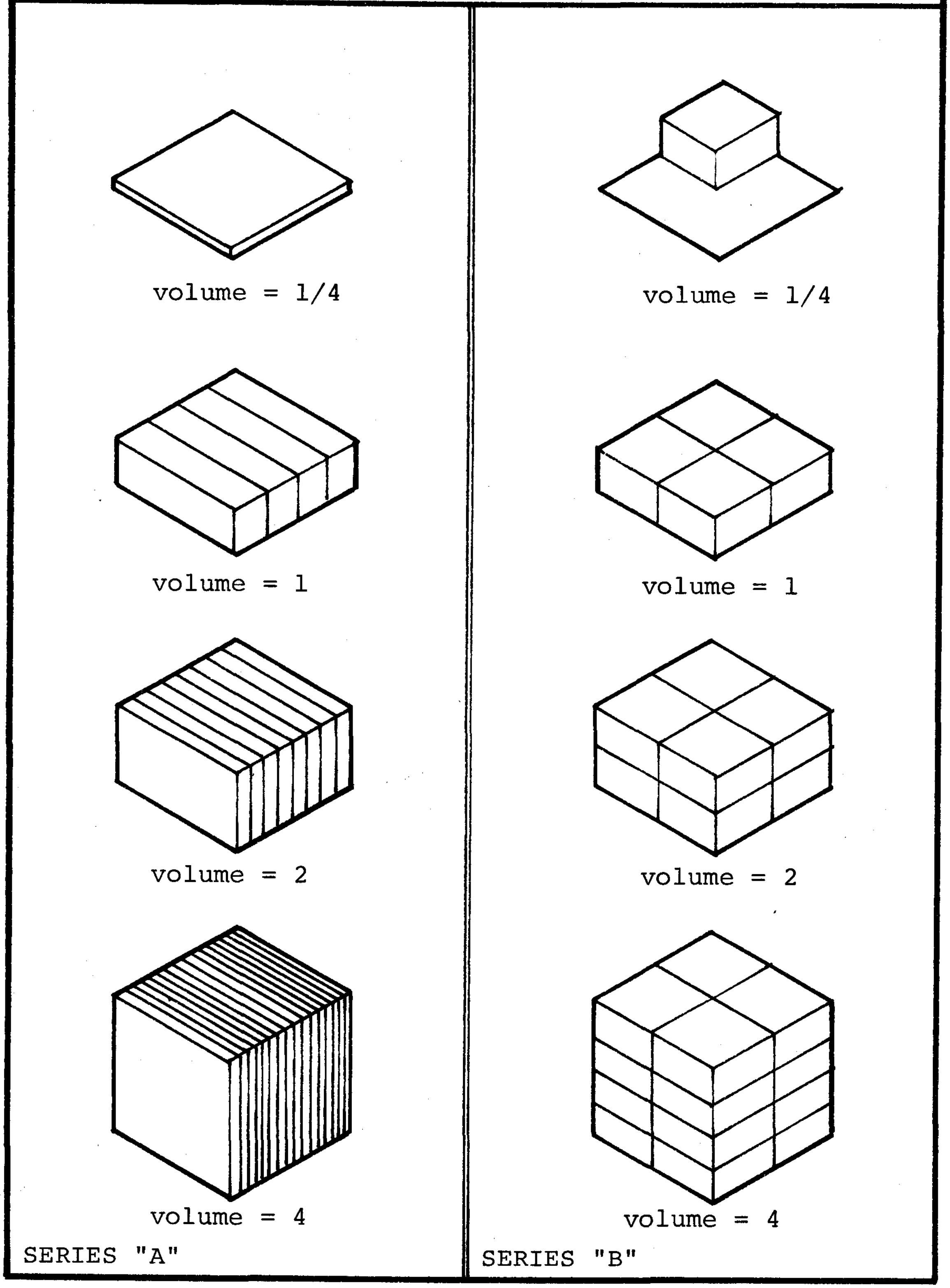
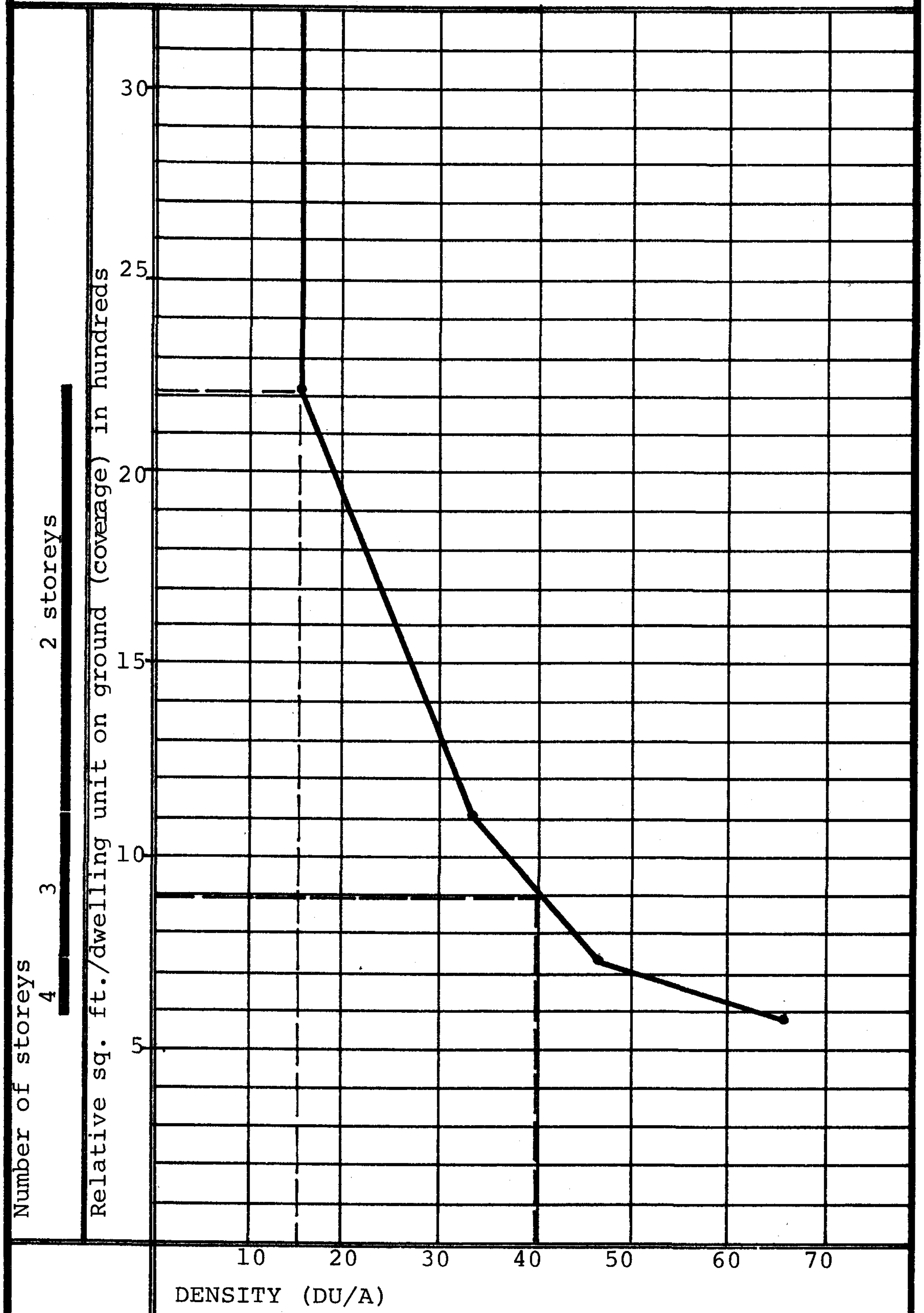


Fig. 11.06 is similar to Fig. 11.03 that plotted coverage versus density. As we have noted, it is impractical to read off fractions of storeys. Thus, Fig. 11.06 adds a bar chart which gives the height range in which the building volume may be accommodated.

Fig. 11.06 DENSITY CURVE SHOWING STOREY HEIGHT



C. SHARED SPACE AREA STANDARDS

In addition to the provision of personal space, there is clearly a requirement for shared space. Previous chapters have described shared space uses such as playgrounds, recreation, and shopping.

We have also noted that no definitive guidelines exist that provide criteria for shared space. However, the Federal Housing Administration in the United States has developed a mathematical model that does allot "public" space in relation to building height. This model is called the Land Use Intensity Scale (Fig. 11.07)

Fig. 11.08 is extracted from the Land Use Intensity Scale.

Fig. 11.07 LAND USE INTENSITY SCALE

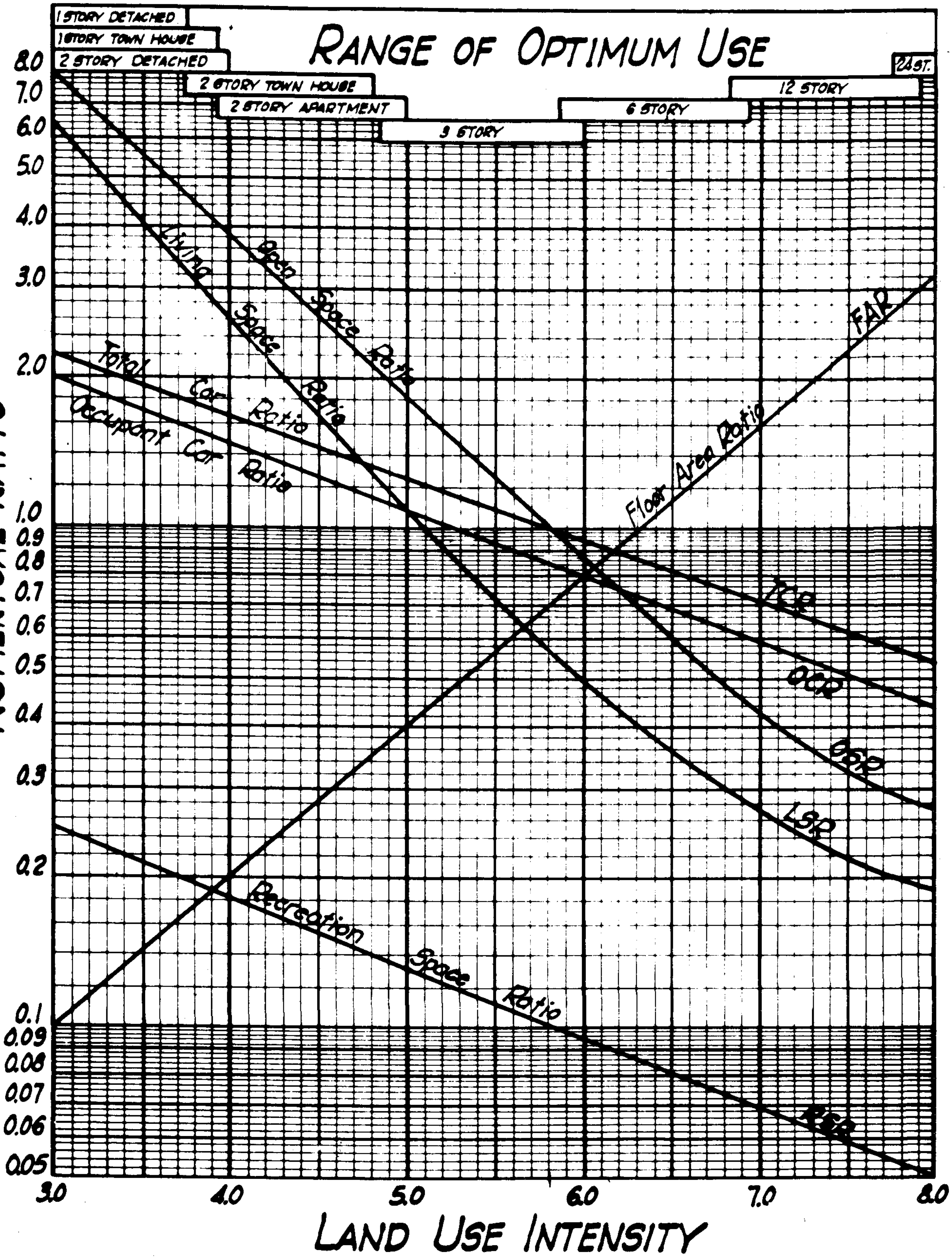


Fig. 11.08 LAND USE INTENSITY SCALE EXTRACTS

	2 storey	3 storey	6 storey	12 storey
OSR	3	1.5	.6	.35
LSR	2	.8	.4	.25
RSR	.2	.15	.08	.065
FAR	.3	.5	1.	2.2

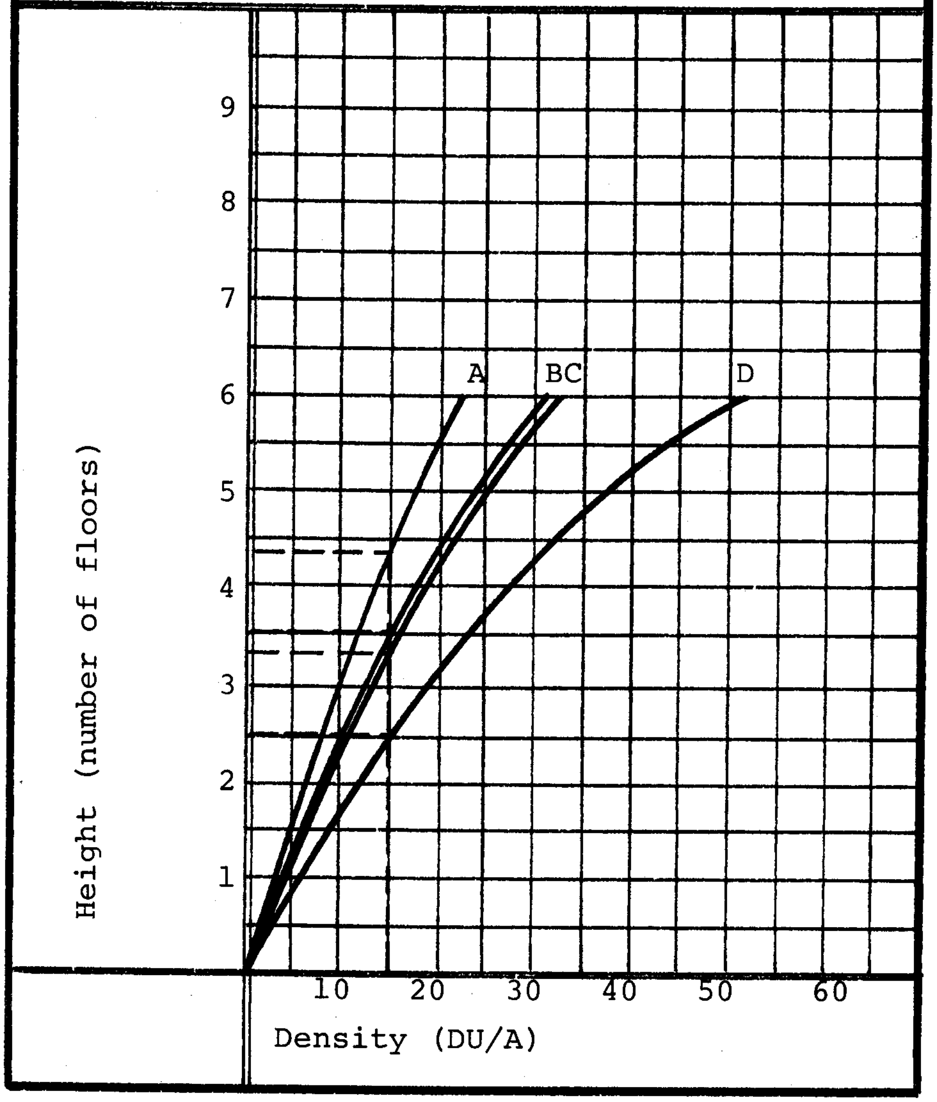
OSR - Minimum sq. ft. of open space on the site divided by sq. ft. gross floor area.
LSR - Minimum sq. ft. non vehicular outside open space divided by sq. ft. gross floor area.
RSR - Minimum sq. ft. of recreation space required divided by sq. ft. gross floor area.
FAR - Gross floor area on all storeys divided by land area on the site.

Shared space requirements extracted from the Land Use Intensity Scale have been added to dwelling area standards, personal outdoor space, parking requirements and street allocation per unit in Fig. 11.02. The resultant curves thus indicate different relationships between density and height to those in Fig. 11.09.

Example:

Horizontal Axis: 15 dwelling units per acre.
Vertical: Open space ratio (including exterior personal space) 3½ floors.
Open space ratio (excluding exterior personal space) 4½ floors
Living space ratio (including exterior personal space) 2½ floors
Living space ratio (excluding exterior personal space) 3¼ floors

Fig. 11.09 EFFECTS OF L.U.I.S. FACTORS

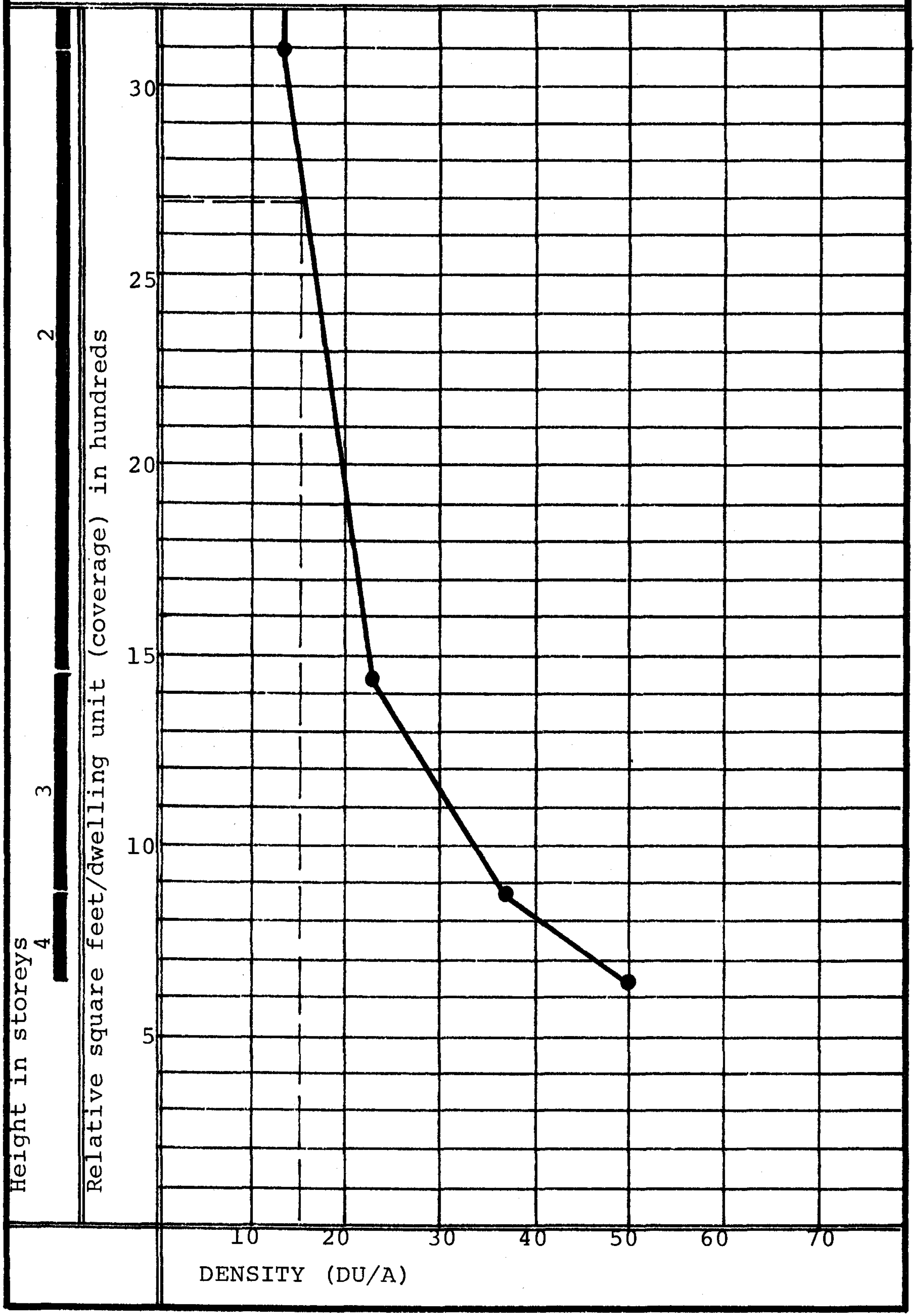


A - OSR exclusive of exterior personal space
B - OSR inclusive of exterior personal space
C - LSR exclusive of exterior personal space
D - LSR inclusive of exterior personal space

There are differences between the standards adopted for this study and those given in the Land Use Intensity Scale as the Land Use Intensity study does not make sufficient distinction between the characteristics of outdoor space. For example, the Outside Space Ratio

(OSR) includes all exterior space, such as parking, streets and play areas; Living Space Ratio (LSR) includes all "non vehicular" outdoor space. Thus it may be assumed that the LSR is the sum of all shared and personal exterior space. Fig. 11.10 indicates the consequence of applying the LSR to the density curve of Fig. 11.03.

Fig. 11.10 DENSITY CURVE INCLUDING LSR (INCLUSIVE)



As the Land Use Intensity Scale appears to be the only open space guideline available, besides the standard zoning codes, (See Chapter 8), and as these standards are not definitive or broad in nature (this study did not independently establish standards for shared outdoor space), Figures 11.11 and 11.12 examine some alternative standards of outdoor space and their impact on density.

In order to examine alternatives, two assumptions have been made:

(a) 30 families require one large play area adequate for team sports (this has been taken at 150 x 150' 0") and one small play area for shared childrens play space (50 x 50' 0").

(b) 75 families require the same shared space as those given for 30 families.

Example:

Figure 11.11 (ratio based upon assumption of 30 families).
Horizontal Axis: 15 dwelling units/acre.
Vertical Axis: 2100 sf/unit. 6 floors.

Example:

Figure 11.12 (ratio based upon assumption of 75 families)
Horizontal Axis: 15 dwelling units/acre.
Vertical Axis: 2100 sf/unit. 2½ floors.

Fig. 11.11 BASIC DENSITY CURVE (WITH 30 FAM. RATIO FOR OPEN SPACE)

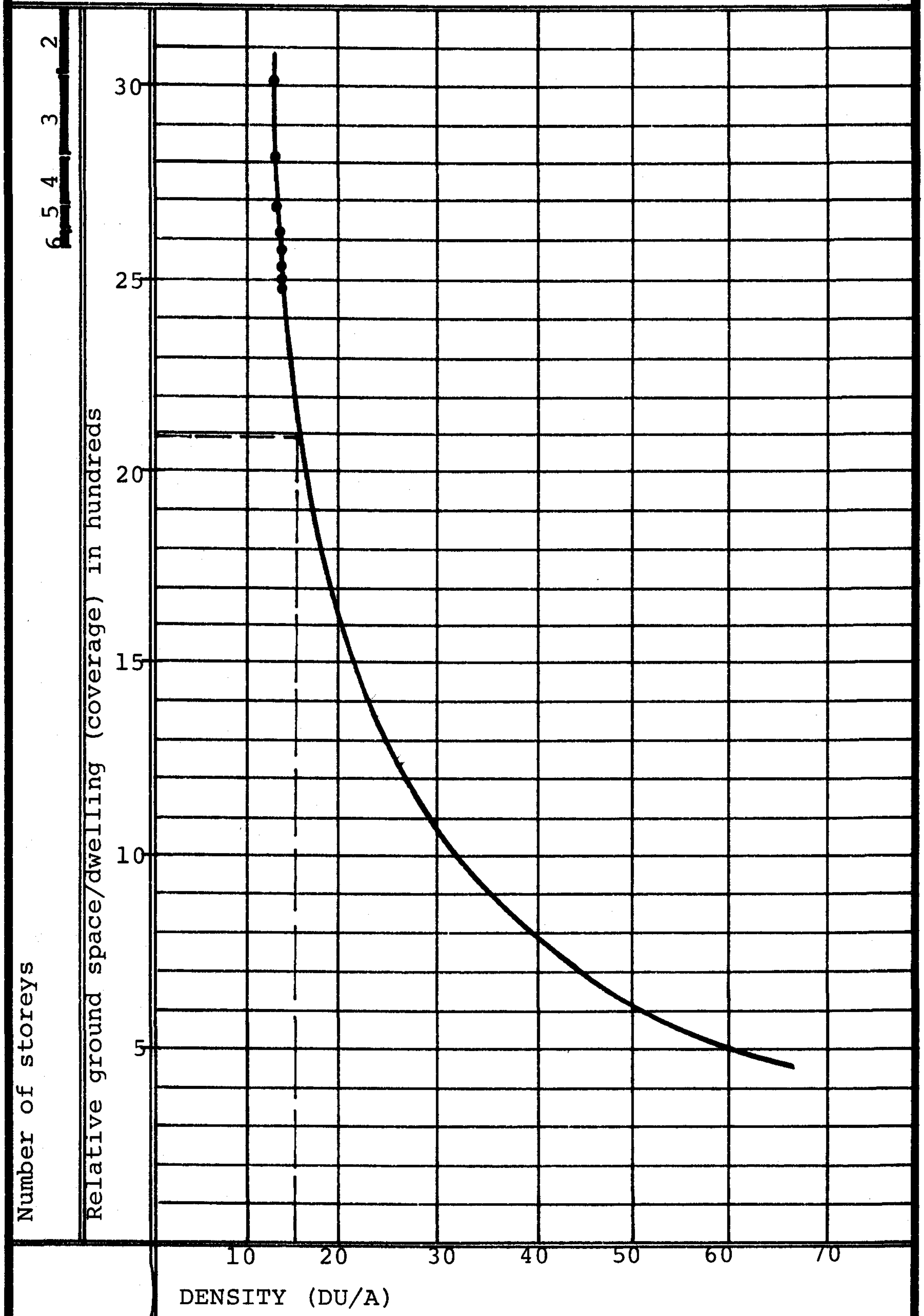


Fig. 11.12 BASIC DENSITY CURVE (WITH 75 FAM. RATIO FOR OPEN SPACE)

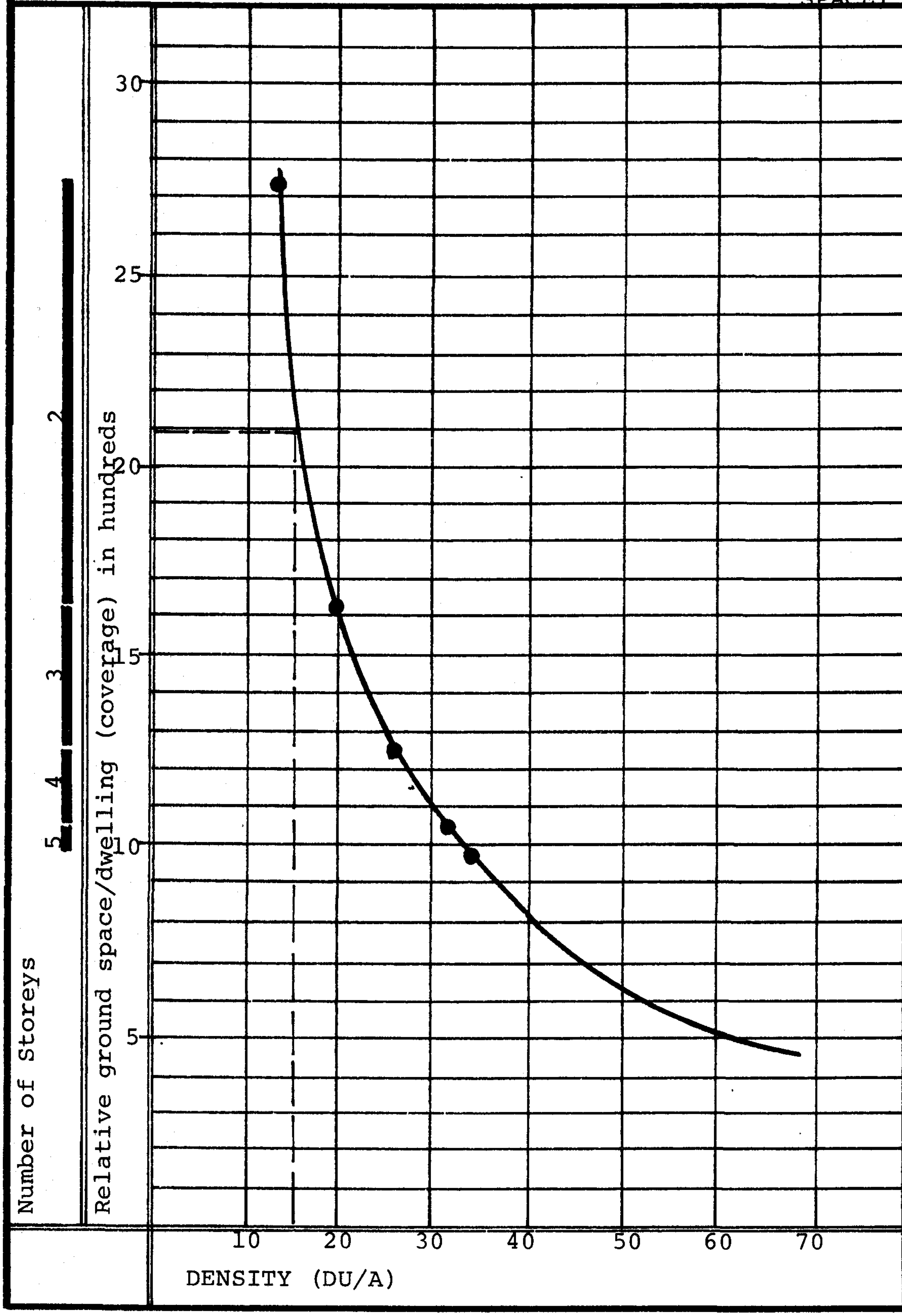
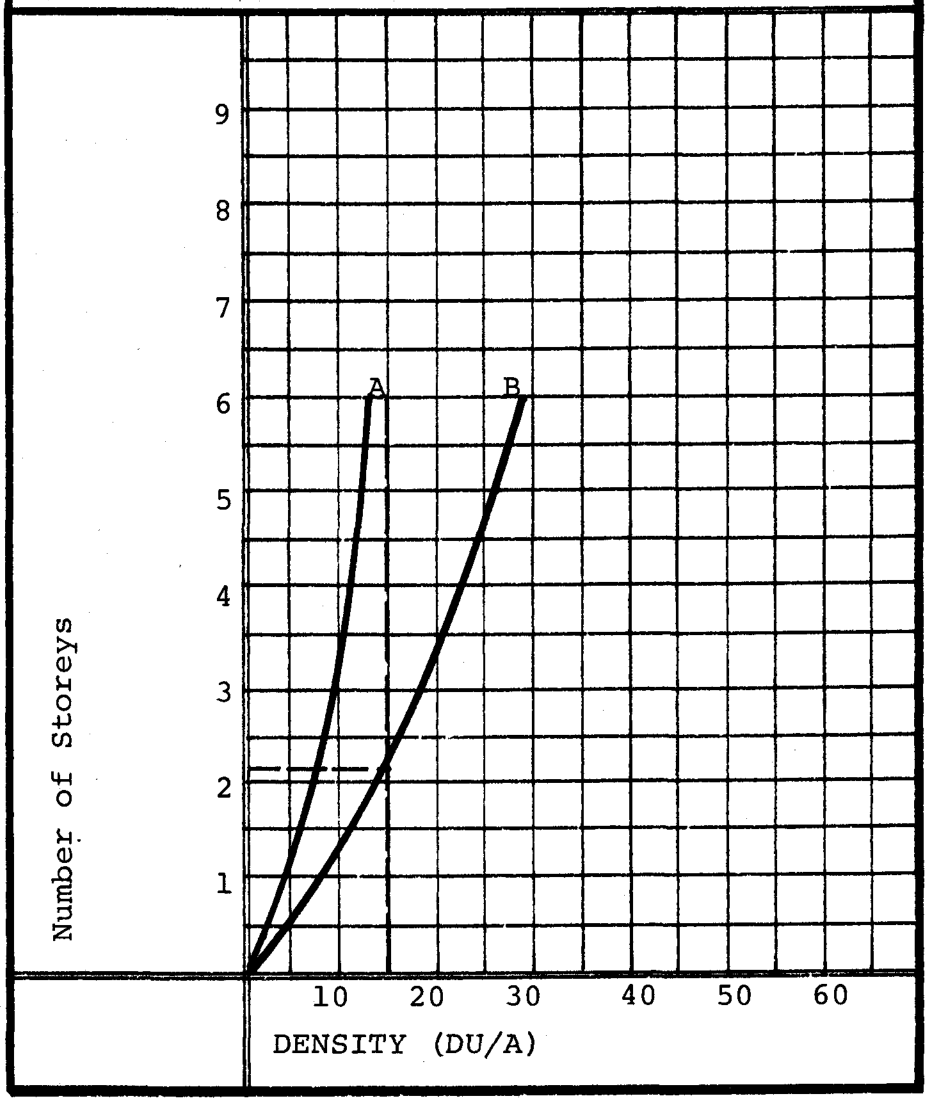


Fig. 11.13 is a graph which plots two curves, one for assumption (a) (30 families) the other for assumption (b) (75 families) and indicates density in the horizontal axis and height on the vertical axis for the two curves. The impact of the change in shared exterior space can be seen to be substantial as height changes from 2½ to over six storeys.

Fig. 11.13 EFFECTS OF SHARED-SPACE ASSUMPTIONS



A - assumption that 30 families support specified amount of shared space.

B - assumption that 75 families support specified amount of shared space.

The Land Use Intensity Scale and its "open space" has been discussed, together with alternate values for shared exterior space as shown in Figures 11.11 and 11.12. As another experiment aimed at determining a workable shared space ratio, we have taken the Living Space Ratio (LSR) as including the personal exterior space. This total has been divided into exterior personal and shared space. The personal exterior space is that given in Fig. 11.02 (432 sf/3 bedroom dwelling). The remaining exterior shared space is illustrated in Fig. 11.14. Fig. 11.15 shows the values for this formula in relation to density and number of storeys.

On trial, the values of Fig. 11.15 had the effect of producing, in our opinion, too little shared space. It should be clearly stated that "too little" is only based upon experience, and is in no way definitive. If we examine Figures 11.34 - 11.39 it will be seen that the broken line on the figures represents the inadequate amount of shared space that the graph 11.15 produces, and the solid line shows the amount of shared space 11.17 produces.

Fig. 11.14 EFFECTS OF ADJUSTED SHARED-SPACE RATIO

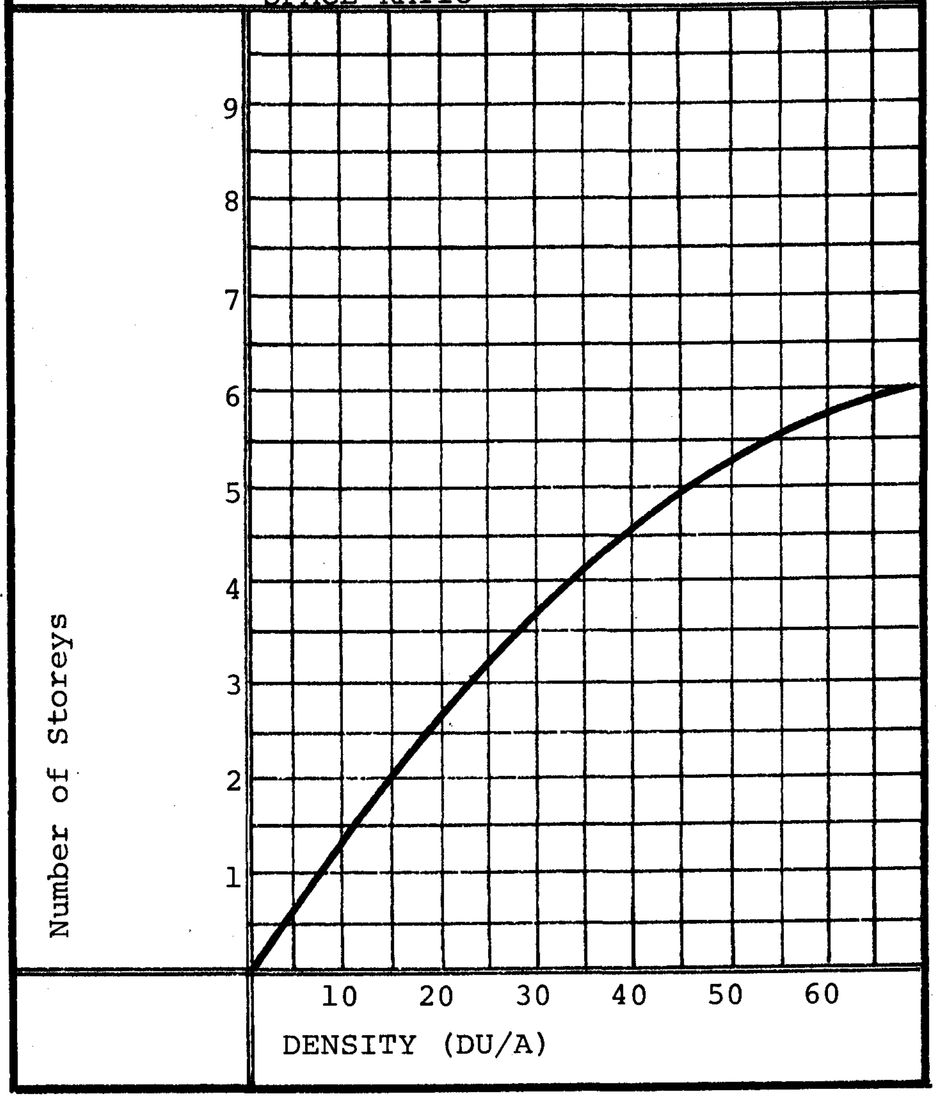
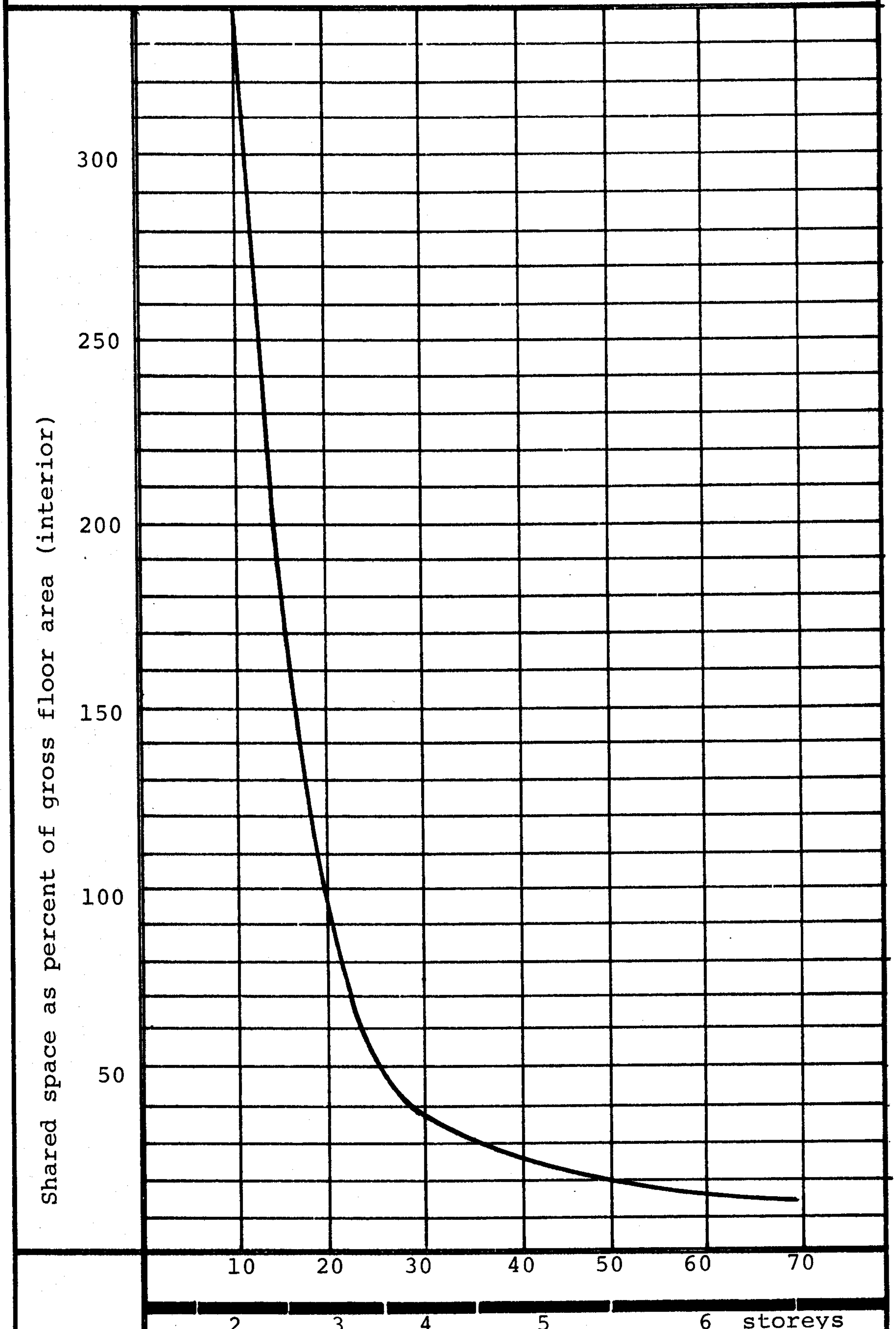


Fig.11.15 VALUES FOR ADJUSTED SHARED-SPACE RATIO



These experiments in apportioning shared space have exposed a fundamental deficiency in existing guidelines covering density. It is clear that density is governed by the amount of space maintained as open space in relation to built space. We have shown that codes (a) make no distinction between the different categories of open space required and (b) do not provide guides to the distribution of open space other than as setbacks, or coverage ratios.

While guidelines can be established by arithmetical models, or speculation about the quality, quantity and distribution of open space, they have not authoritatively established satisfactory standards based upon user needs: This can only be empirically determined.

In the absence of such difinitive principles, we have put forward the following general hypothesis: The amount of personal space must remain constant, that is for every dwelling unit a fixed amount of personal exterior space must be provided, but the amount of shared space may diminish as density increases.

The rate at which this decreases has not been difinitively established. Whether the decrease on a graph should be in a straight line, a curve or a curve that straightens out (i.e., above the provision of a certain amount of shared open space no further provision need be made) is not known.

However, in an attempt to establish a useable guideline, Figures 11.16, 11.17 and 11.18 suggest a standard on which to test performance.

These figures, in addition, deal principally with low rise development, as this is the form of building with which we are most concerned in this study.

Fig. 11.19 illustrates the volumetric consequence of this shared space standard.

Fig. 11.16 EFFECTS OF SHARED-SPACE RATIO

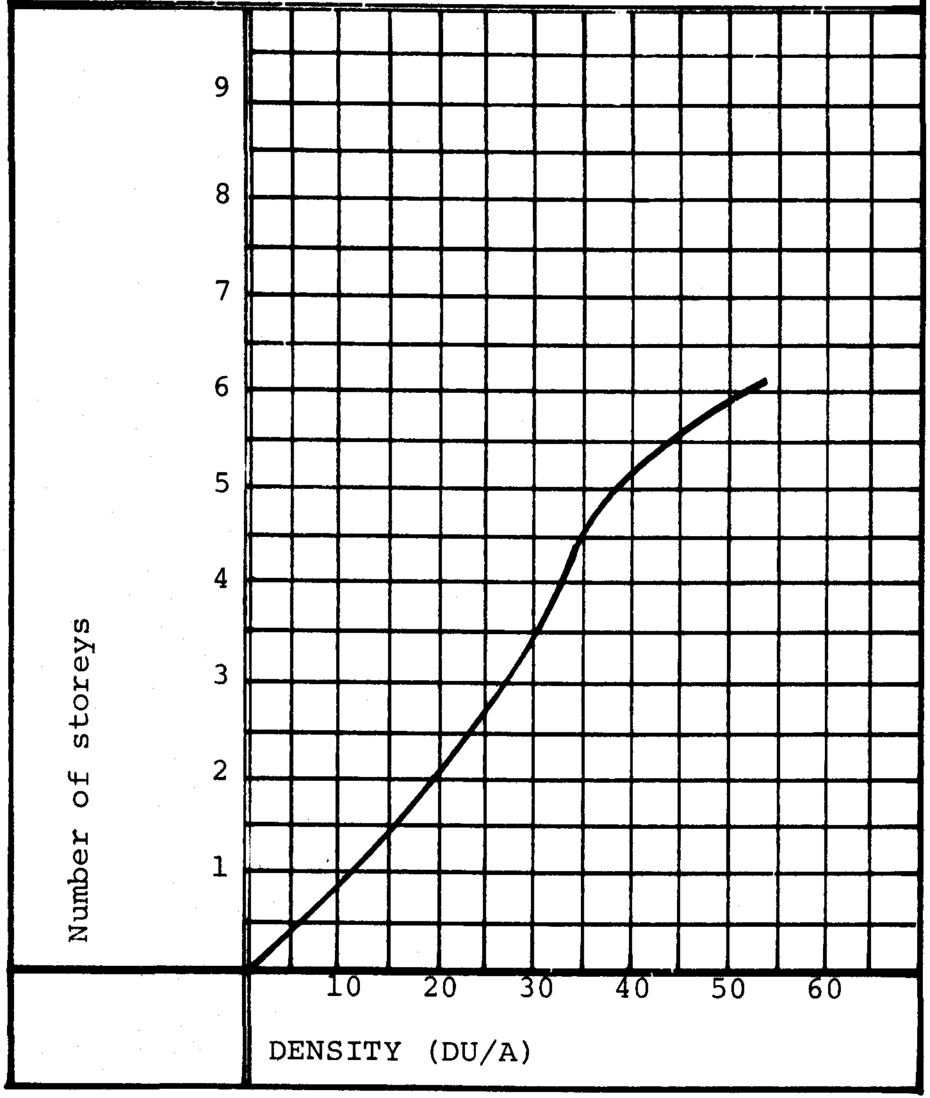


Fig. 11.17 VALUES FOR ACCEPTED SHARED-SPACE RATIO

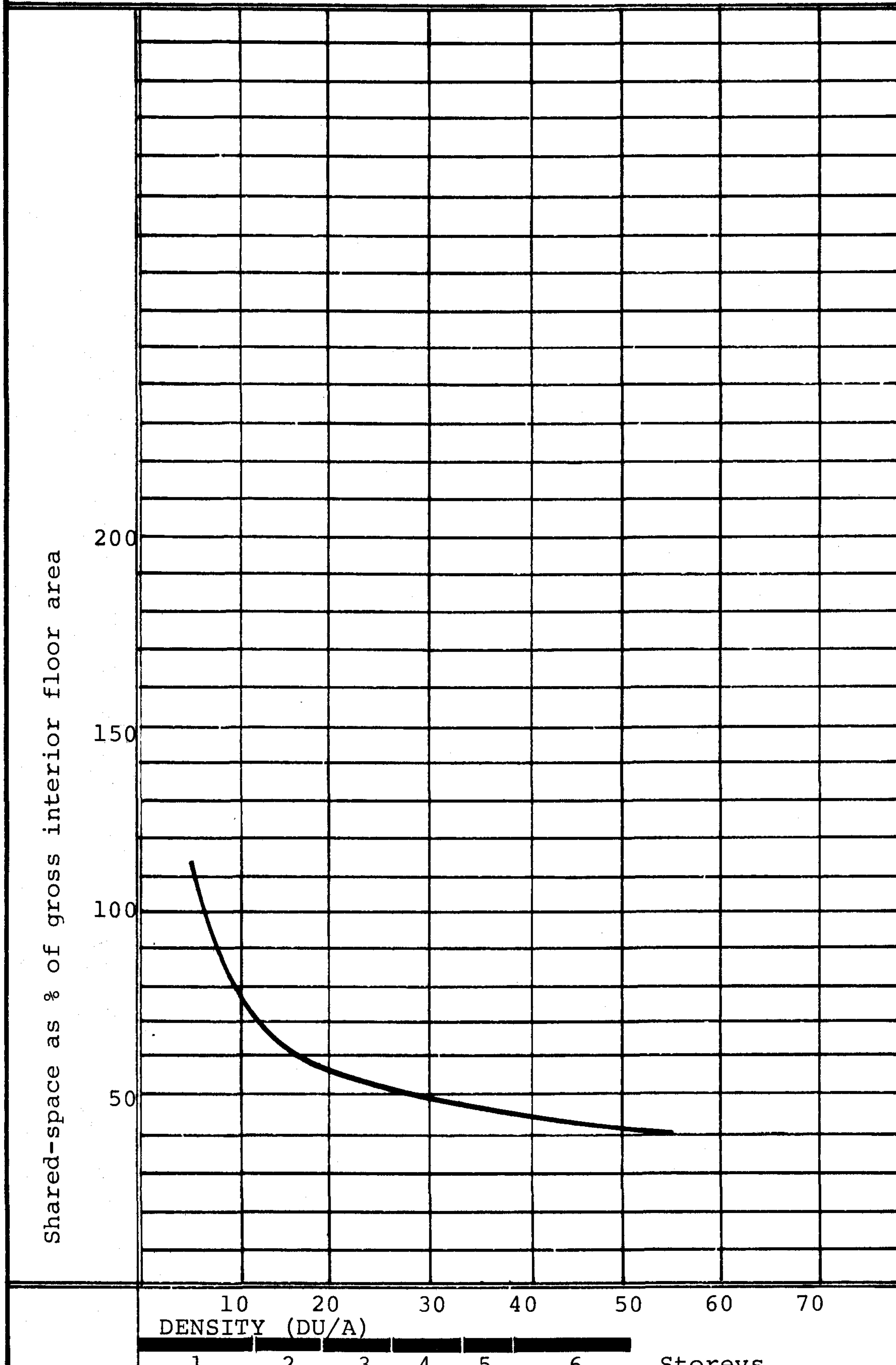


Fig. 11.18 BASIC DENSITY CURVE INCLUDING ACCEPTED SHARED-SPACE RATIO

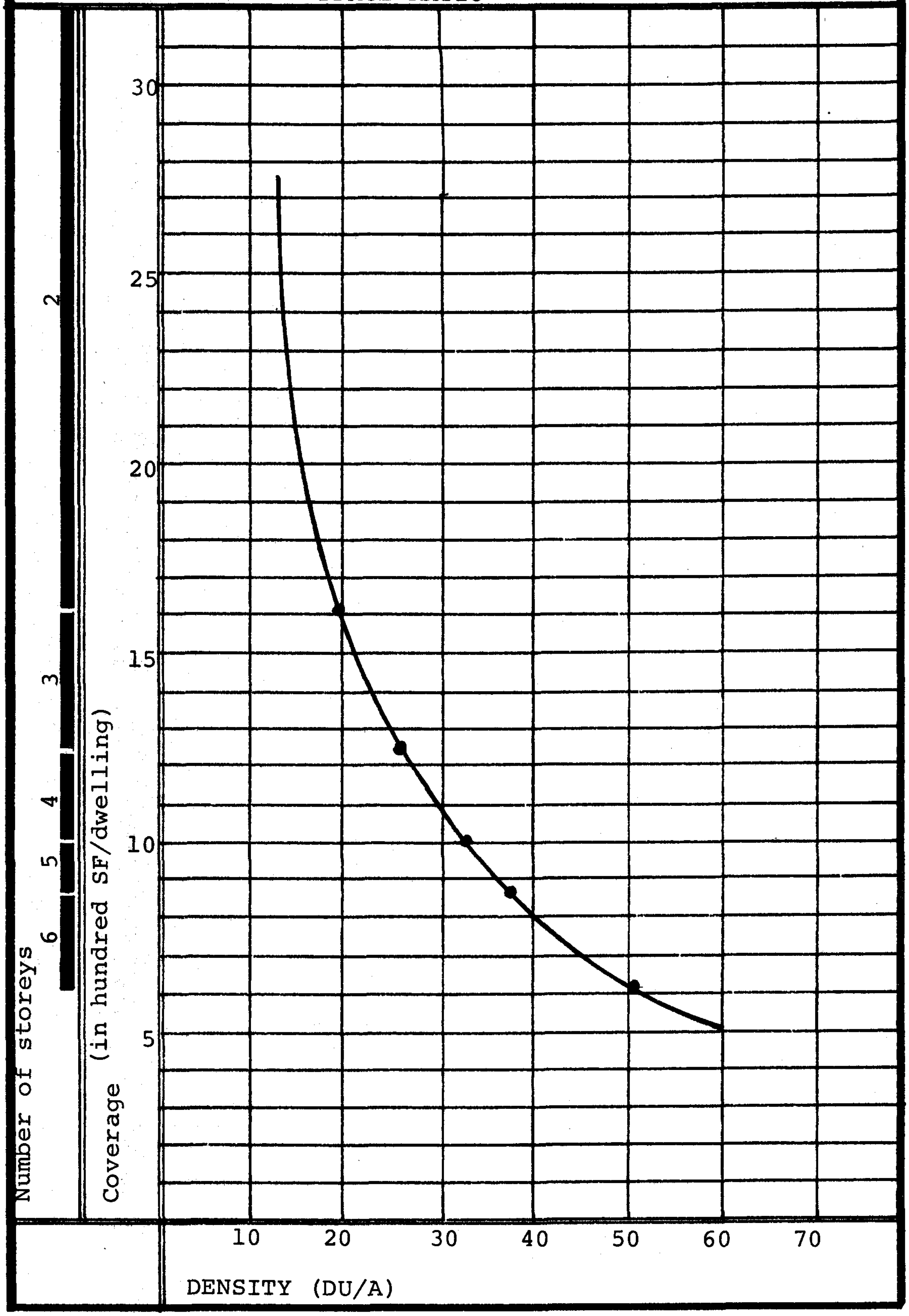
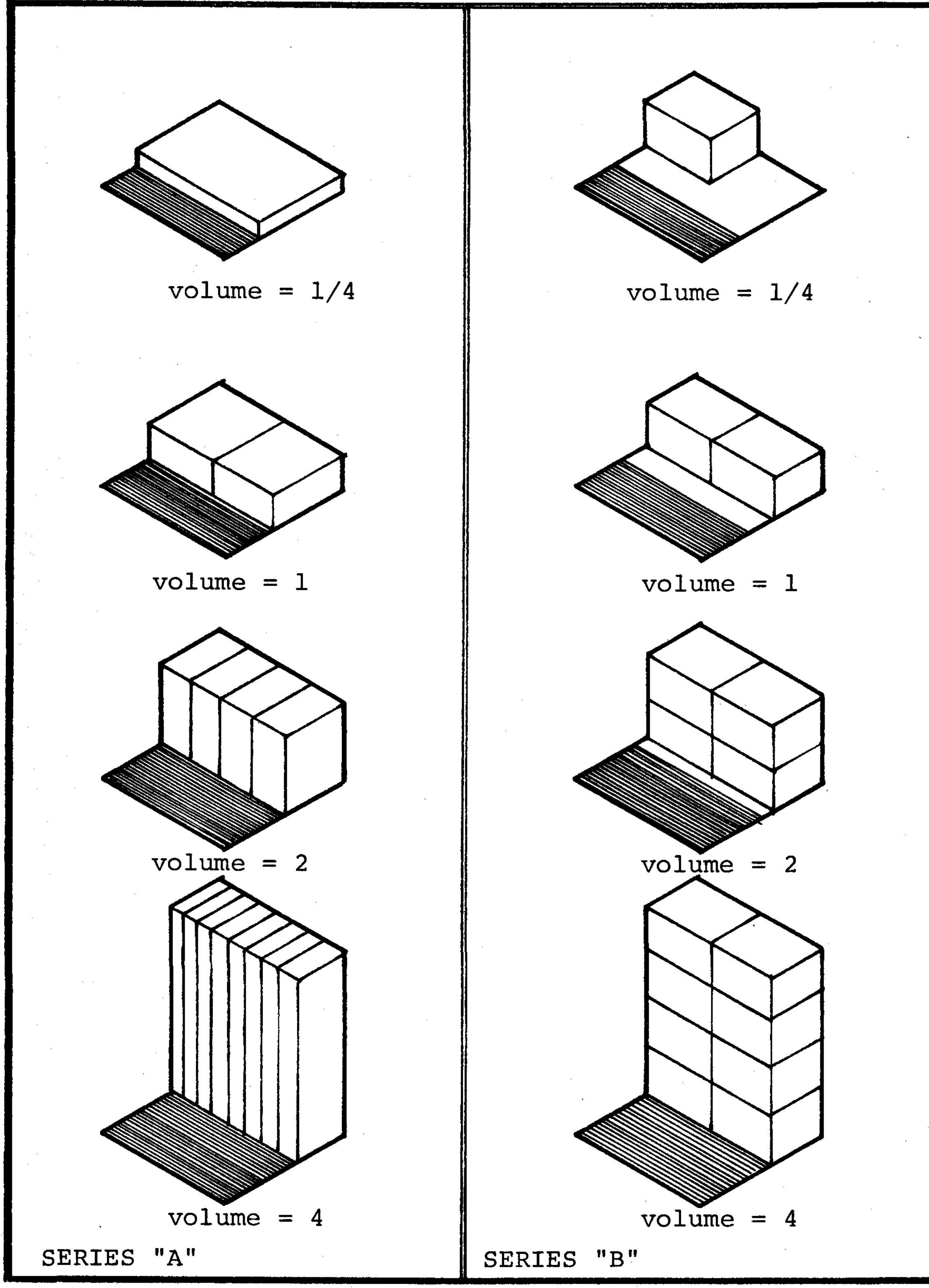


Fig. 11.19 INTERPRETATION OF THE DENSITY CURVE



D. HEIGHT.

The minimum dwelling area for personal and shared space has been established; thus the only variable left is height. While maintaining the constants, and varying height, we can demonstrate the impact of height upon density. Fig. 11.20 illustrates the percentage increase in density as height increases. This curve does not include a shared space factor.

Fig. 11.20 RATE OF DENSITY INCREASE BY VERTICAL EXPANSION

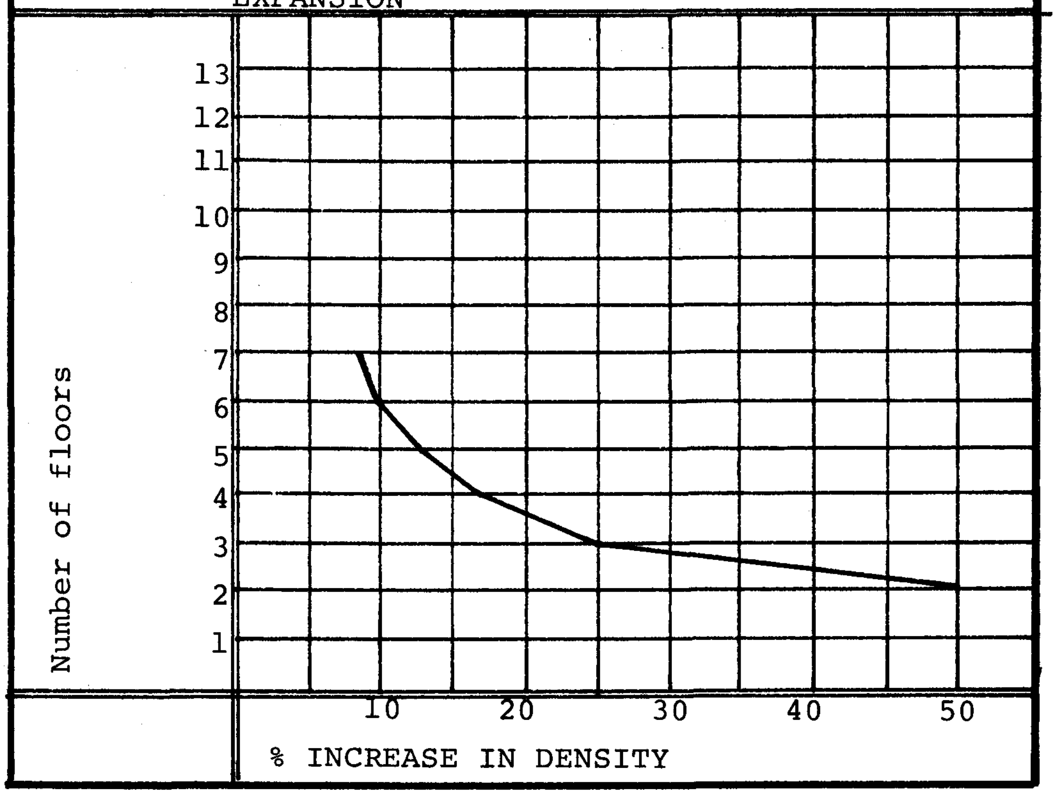
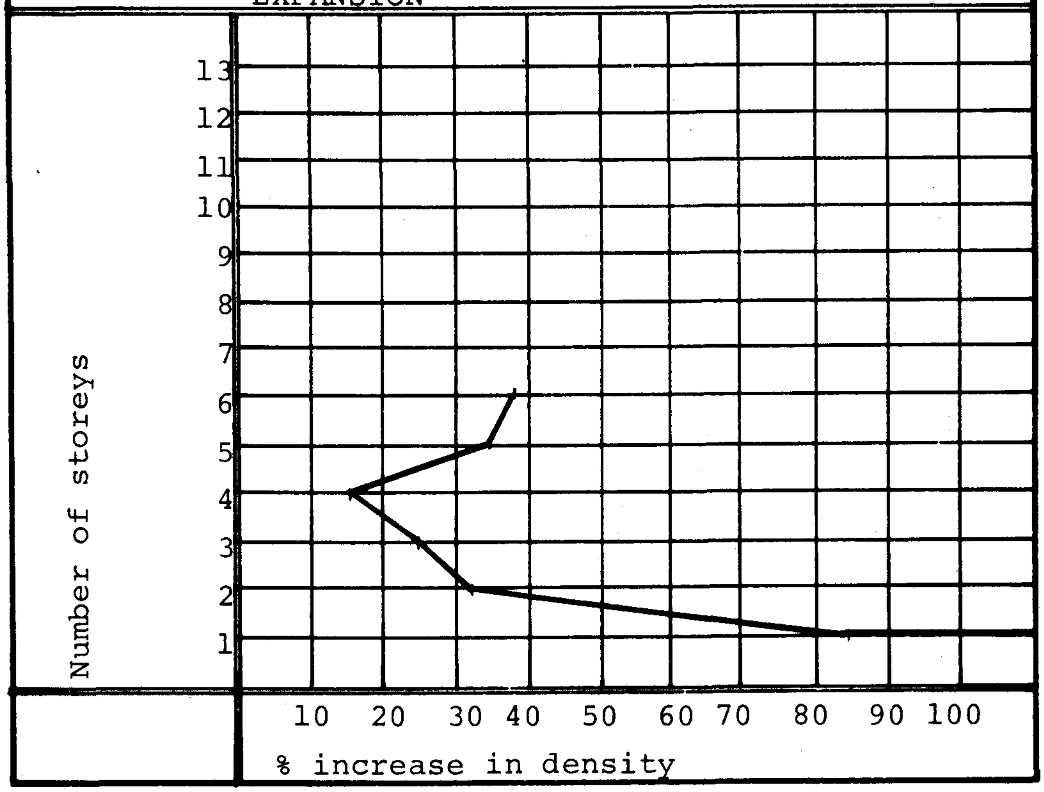


Fig. 11.21 illustrates the percentage increase in density as height increases. This curve includes a shared space factor.

Fig. 11.21 RATE OF DENSITY INCREASE BY VERTICAL EXPANSION*



* Including shared-space ratio (Fig. 11.17)

From Fig. 11.20 it can be seen that the greatest rate of density occurs when a second storey is added to the first; subsequent height additions clearly increase the density at a diminishing rate. When the shared space factor is taken into account, the curve is not a constant one.

Above six floors, if we increase shared space in accordance with the provisions of Fig. 11.20, it becomes impossible to add to the building bulk. Thus either this height becomes the limit, or the formula which allocates shared space must diminish the amount of shared space, as density increases, at a greater rate than we have shown. The rate at which it <u>should</u> decrease can only be determined by behavioural criteria. These at present do not exist.

E. QUALITATIVE REQUIREMENTS.

The following issues are those, extracted from surveys and research published material (Appendix E) which were felt to be most salient. A broad list of all issues may be found in Appendix D.

The issues which follow are not listed in order of priority, but are grouped in the following categories: Play, Recreation, Community Facilities, Proximity to Service Facilities, Land Use Intensity, Density and Distribution, Dwelling Privacy, Orientation, Floor Space Requirements, Movement and Access. It is as well to once again note that the evidence supporting this synthesis is, at times, "coarse" and at other times "fine" in the amount of supportive detail.

(1) Play

Chapter 4 discusses children's play patterns. These play patterns divide into age groups requiring different considerations.

The youngest child group (up to 5 years) cannot be expected to play outside the dwelling without being accompanied by an adult, except where such space is immediately adjacent to and easily surveyed from the dwelling.

The next oldest group (5 - 10) needs somewhat larger play spaces, more equipment and less supervision, although this does not mean no supervision. Supervision need not be of the constant visual form, so these play areas may possibly be located only within hearing range of the dwelling. Play for this group is noisier than the younger set.

Older children (over 10) need substantially larger play areas, as by this stage children have better small muscle control and need more gregarious activity - this means team and ball games. This group requires almost no supervision or restraints on play.

(2) Recreation

Adult activity patterns may be divided into two categories - independent and gregarious. Both of these categories cover a wider range of activities, than those of children and therefore the requirements are different. Adults use more indoor facilities when these are available, and more extensively use outdoor facilities. Their activities range from gardening and sunbathing to the participation in associations and entertaining. They therefore require facilities such as swimming pools, tennis courts and meeting places. Of course, these would not be exclusively for adult use, as overlap occurs.

As for children, the spatial forms which accommodate range of activities varies from the small, intimate space adjacent to the dwelling which can be used as private or personal family space, to grounds more remote from the dwelling which accommodate noisier activites of s shared nature, to wilderness areas where once again independent activities are possible. It may therefore be said that the controls and surveillance necessary are in inverse proportion to the size, and distance of play or recreation space from the dwelling. It may also be said that the size of roads and the speed of vehicles in relation to play and recreation space should be in direct proportion to the size and distance from the dwelling of the play and recreation space.

(3) Community Facilities

The amount of and distribution of community facilities required for various levels of density have not been investigated in this study, except as noted in the next section of this chapter. However, it is as well to note that shopping, going to church, visiting clinics or libraries, etc., can also be interpreted as subtle forms of recreation. It would do well to challenge the now conventional segregation of these activities and facilities from housing and the possibility of achieving a higher degree of mix and more random distribution attempted, contributing to a richer and more varied pattern of development.

Towns which grew up on the empirical basis of convenience, before zoning codes were established, are worthy of study. We suspect that this historical pattern contains satisfactions now unrealized by single use zoning. The "non-conforming" use is frequently truer to the life of an area than is the official plan.

(4) Proximity to Service Facilities

Appendix A gives evidence that criteria may be established which help determine the location of dwellings in relation to service facilities. Here "proximal" families are defined as those within walking distance from some shopping and service business (5 minutes or 1/4 mile). As proximity to shopping or business areas usually means higher land values and, consequently, higher density development, the need to incorporate the benefits of single family dwelling into other housing types is further emphasized.

Appendix B also gives evidence of the types of service required in a neighbourhood.

The selection of a home in a particular area often depends of the range of services provided in that area. The location of services implies constraints on housing arrangement: the increase in vehicular volumes, and accessibility of services from housing will affect layouts, especially if pedestrian access to service is to be encouraged. Because of economic considerations, utility and movement requirements have tended to be concentrated, but as noted before, the alternative of distributing these services for social and environmental qualities must also be considered.

(5) Land Use Intensity

Land use and densities are controlled by zoning by-laws as they prescribe land use and the amount of floor space allowable on any particular parcel of land. There are often, in addition, setback requirements, and bonuses are given if either large setbacks are provided or for developments on large parcels of land. The net effect is to encourage very large scale development in the form of either isolated or tower structures, or isolated dwellings fixed in the centre of each lot. These crude by-law controls do not encourage alternative building space distribution nor do they take into account the useability of the remaining site.

The U. S. Federal Housing Administration's Land Use Intensity Scale, Fig. 11.07, was developed in an effort to improve the controls on housing development so that amenity and use are taken into account for both dwelling and site. Alternate criteria for allocation of shared space are also discussed in Part C of this chapter.

(6) Density and Distribution

Perimeter distribution resolves the conflicting demands of high densities while providing amenities approximating those of the private detached dwelling. The chapter on Built Form (Chapter 7) has already illustrated the effectiveness of its use as opposed to the use of the isolated pavilion. Chapter 7 also has shown that repeated configurations at the perimeter further increase density, at the same time as creating more opportunities to differentiate and define spaces adjacent to the dwelling. Our demonstration examples in Fig.   indicate the potential of this form of building distribution.

(7) Dwelling Privacy

Appendix A establishes some desirable characteristics of the individual dwelling unit. The following synthesis of the studies is an attempt to establish acceptable levels of amenity.

a. Acoustical Privacy

(i) Movement Channel to Dwelling

Both high velocity traffic and trucks in low gear generate unacceptable noise levels in excess of 65 decibles thus indicating that streets associated with dwellings should not be arterial.

Where unacceptable noise levels are generated, devices such as distance, landscape screening and location of bedrooms on the side of the dwelling away from the source of the noise should be employed.

Extended, uninterrupted and regular facades along streets should be avoided as these tend to amplify noise problems by the resultant reverberation making the street a rectangular sound chamber.

(ii) Public Space to Dwelling

Public spaces and shared spaces, especially play areas or shopping can be expected to generate high noise levels and therefore should be carefully located.

(iii) Dwelling to Dwelling

It has been found that the greatest concern regarding noise is not for that which is generated by neighbours, but for the restraints that tenants must place upon themselves if it is understood that noise transmission can occur between units. There are two forms of noise transmission, air borne, and structural borne. Air borne noise can only be effectively dampened by mass - for example heavy or masonry walls. Acoustically absorbant surfaces surrounding the source of sound help, but cannot be relied upon for non-stationary sources of noise. Structural borne noises can only be effectively prevented by separation, or discontinuity in the structure. The importance of acoustical privacy between dwellings cannot be overemphasized if multiple dwelling structures are to compete favourably with the single family house.

(iv) Dwelling to Public Space

Sound transfer from inside to outside also diminishes the dwelling privacy. Although this sort of noise transference does not necessarily constitute a noise problem, it is one of the psychological aspects of privacy.

(v) Within the Dwelling

Information yielded by a national manufacturer[1] reveals that manufactured homes which make a clear separation between sleeping and living areas have the highest sales. Those which make this separation not merely by zoning or partition, but by a mediating space, such as a mud room, pantry, or family room have proven to be more successful yet. As this evidence indicates, users make a clear distinction between these two general categories of activity, and it can be inferred that the separation of these areas is a vehicle for visual and aural privacy.

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[1] Beaver Lumber Company

b. Visual Privacy

(i) From outside to Inside

Visual privacy for the dwelling itself is obviously not difficult to provide - blinds, drapes or shutters are devices which easily correct this potential problem. However, designs which take into account visual privacy not only avoid the need for drapes or blinds but allow the provision of good natural light. When it is not desirable for sight lines to be directed into the dwelling, windows can be placed above eye level. A drawback here, of course, is that this only allows light in, while not allowing a view of the exterior. The whole problem is further complicated by the fact that the desire for total visual privacy is not uniform. It is an observable fact that many "picture windows" are used not so much for inhabitants to look out as for a display of taste symbols: carefully draped curtains, an ornamental table and lamp or other artifacts.

It is possible, of course, to accommodate both of these conflicting demands with a large expanse of glass above eye level to admit light, and an eye level section divided in such way as to leave permanent apertures for looking out, with the rest able to be used as a "picture" window or shuttered at will.

Fish-eye apertures in the front door allow a secure scrutiny of visitors.

(ii) Dwelling to Dwelling

This privacy problem is greater than the one created by occasional visual intrusion from the outside. Facades which must face neighbouring dwellings should allow total visual privacy. This can be accomplished again by windows which admit light above eye level, yet can be screened at eye level. The overlook problem, however, may also be solved by juxtaposition and careful attention to sight lines.

(iii) From Inside to Outside

Views which provide contrasts in focal ranges have long been accepted as a way in which to avoid visual monotony. The close view can indeed be short, only a few feet from the window, as attested by the success of this form of design in many European examples. For contrast distant views should be of as great a length as possible. If the distant view must be relatively short, so must the close view be shortened to maintain this contrast. Apart from the above design considerations to render outdoor personal space useful for infant play, there should be clear surveillance of that area from the indoor areas where the mother is likely to spend her time.

(iv) Outside Space

Where courts or yards are located adjacent to streets or other dwellings, extensive screening assists maintenance of privacy. Moderate grade changes help a great deal but zoning of outside personal space away from potential sources of visual intrusion is the best method of solving the problem.

Visual privacy is not required for all outside personal space, as evidenced by front porch sitting. The elderly, for example, enjoy activity vicariously and should be provided with such personal space, protected from physical intrusion, in positions which overlook action. These may either be on the street side of the dwelling or away from it if that is where play areas and pedestrian paths are located.

At best personal outdoor space should accommodate both requirements, those of total visual privacy and partial or controlled visual privacy.

The problem of overlook of outside space from neighbouring dwellings is almost unavoidable without constricting the orientation of dwelling units. It must nevertheless constitute an important design consideration as it is one of the factors that have made the single family detached dwelling an overwhelmingly preferred mode of housing. Of first importance is the provision of outside, defined personal territory; visual privacy ranks second.

F. DESIGN DEMONSTRATION.

As a foreward to part F. Design Demonstration, we note once again the detached single family house grouping in the form of traditional distribution, Fig. 11.22. Previous chapters in this study have described the low yield that this form of housing distribution affords in terms of density and exterior space amenity. Fig. 11.23 illustrates the same number of houses, in semi-detached form, as the detached houses in Fig. 11.22. This common method of increasing side yards (and density potential) is generally considered to be lacking in amenity, insofar as lost personal exterior space is concerned.

Fig. 11.22 DEMONSTRATION OF 20 DETACHED DWELLINGS

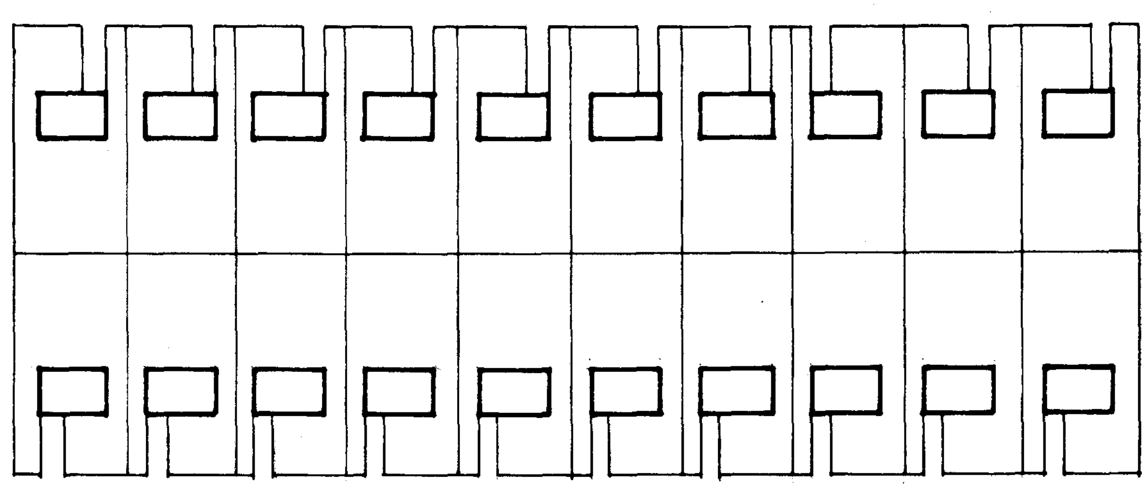


Fig. 11.23 DEMONSTRATION OF 20 SEMI-DETACHED DWELLINGS

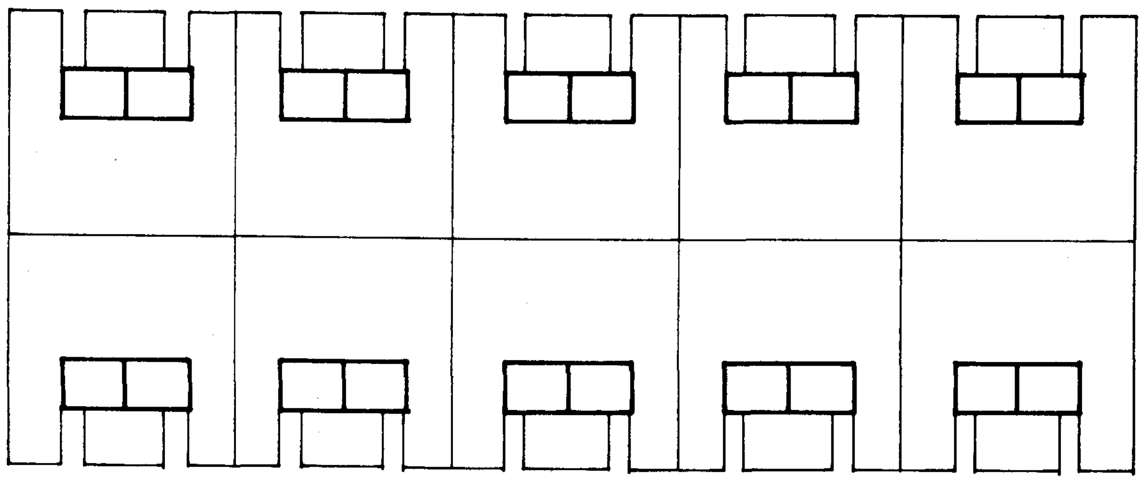


Fig. 11.24 is a graphic representation of the distinctions made between the various modules of space that comprise the dwelling. The module has been taken as a 12' square in plan. This size is not an absolute standard and may be varied according to the demands of other factors, such as manufacturing or building convenience. In fact, in Sections F and G of this chapter a 16'-10" square module has been used.

Modules clearly do not give a plan arrangement. The justaposition of activities that are housed in the modules depend on the qualitative requirements of relationships, service, access, visual and aural privacy, view and orientation.

The relationships between modules can be organized by zonal grouping. The alphabetical code in Fig. 11.24 is given for this purpose. Thus it is possible to ascribe a position on the site to zones according to requirements. All previous figures made no locational distinction between the zones, but merely aggregated them for gross density measurement except for shared open space (see Fig. 11.17). The following work makes locational distinctions.

Fig. 11.24 MODULAR BREAKDOWN OF SPACE ALLOTMENTS PER DWELLING UNIT

Space	Number of Modules (1)	Zone Code Letter (2)
Living	1.33	A
Dining	.66	A
Kitchen	.66	A
Bedroom	1.	B
Bedroom	1.	B
Parent's bedroom	1.5	B
Bath & storage	.5	B
Stair or bath & storage	2 (1.0) (3)	B
Personal exterior space	3.	C
Garage	2.	D

(1) Refer to fig.   for space allotment zoning code.
(2) Module is 12' x 12'.
(3) Assumed to occur on each floor.

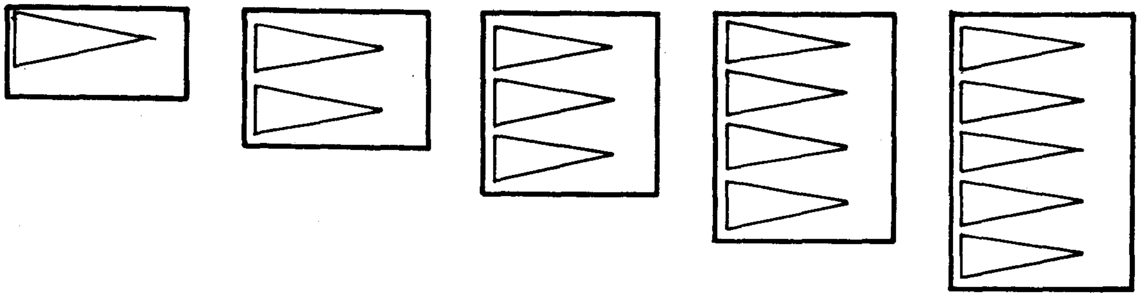
Fig. 11.25 MODULAR BREAKDOWN FOR ALL LAND USE CATEGORIES (12' x 12' MODULES)			
	Number of Bedrooms		
	2	3	4
A Interior living space	3	3	3
B Interior sleeping space	4	5	6
C Exterior personal space	3	3	4
D Auto parking space	3	3	3
E Street space allowance	2½	2½	2½
F Shared exterior space	10*	4*	4*
TOTAL NO. OF MODULES	25½	20½	22½

* estimate for 3 storey dwelling

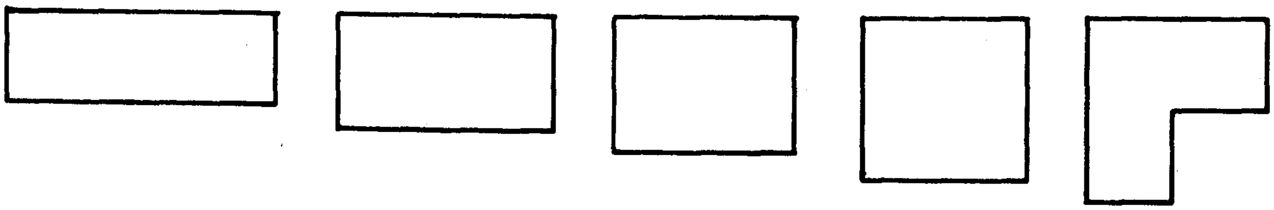
In order to improve on this condition, in terms of both increased density and improved amenity, the following three scales of form are examined: Unit Scale (1 unit), the Grouping Scale (2-6 units), and the Site Scale (up to 300 units).

(1) Unit Scale examines the dwelling unit as a prototype in isolation from both neighbouring dwelling units and a site. A module system is developed to make the work more comprehensible. Configuration constraints such as parking, personal open space requirements and bedrooms are illustrated, Figures 11.26 and 11.27.

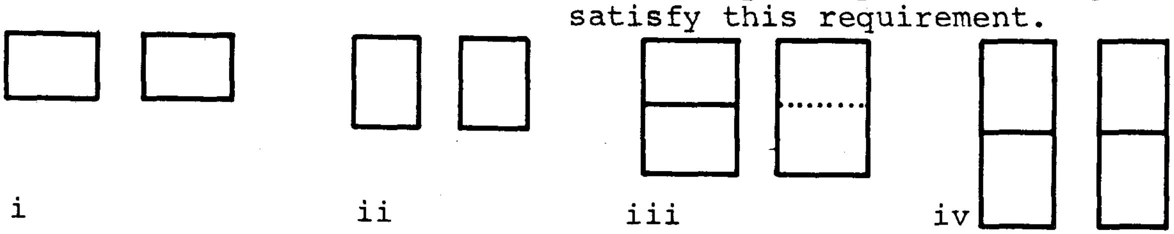
Fig. 11.26 CONFIGURATION CONSTRAINTS



PARKING The width of a parking space dictates the minimum width of a dwelling unit. In stack schemes of 2 to 3 dwelling units, the number of cars to park requires a unit 4 modules wide. If this width is excessive, parking should be separated from dwlg unit

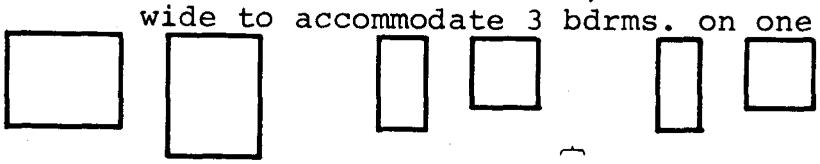


EXTERIOR PERSONAL SPACE Each family has at least one exterior personal space of 3 modules within the unit. The minimum dimension for this space to be usable is 12'. Many acceptable configurations satisfy this requirement.



i ii iii iv

BEDROOMS Since 12' is the minimum width of exterior personal space, living space and parking, the 9' wide unit, Dia. i is unacceptable. A 3 floor, 4 bedroom unit can be 12' wide consisting of 2 upper floors of 2 bdrms. each. A 2 floor, 3 bdrm. unit must be 18' wide to accommodate 3 bdrms. on one floor.



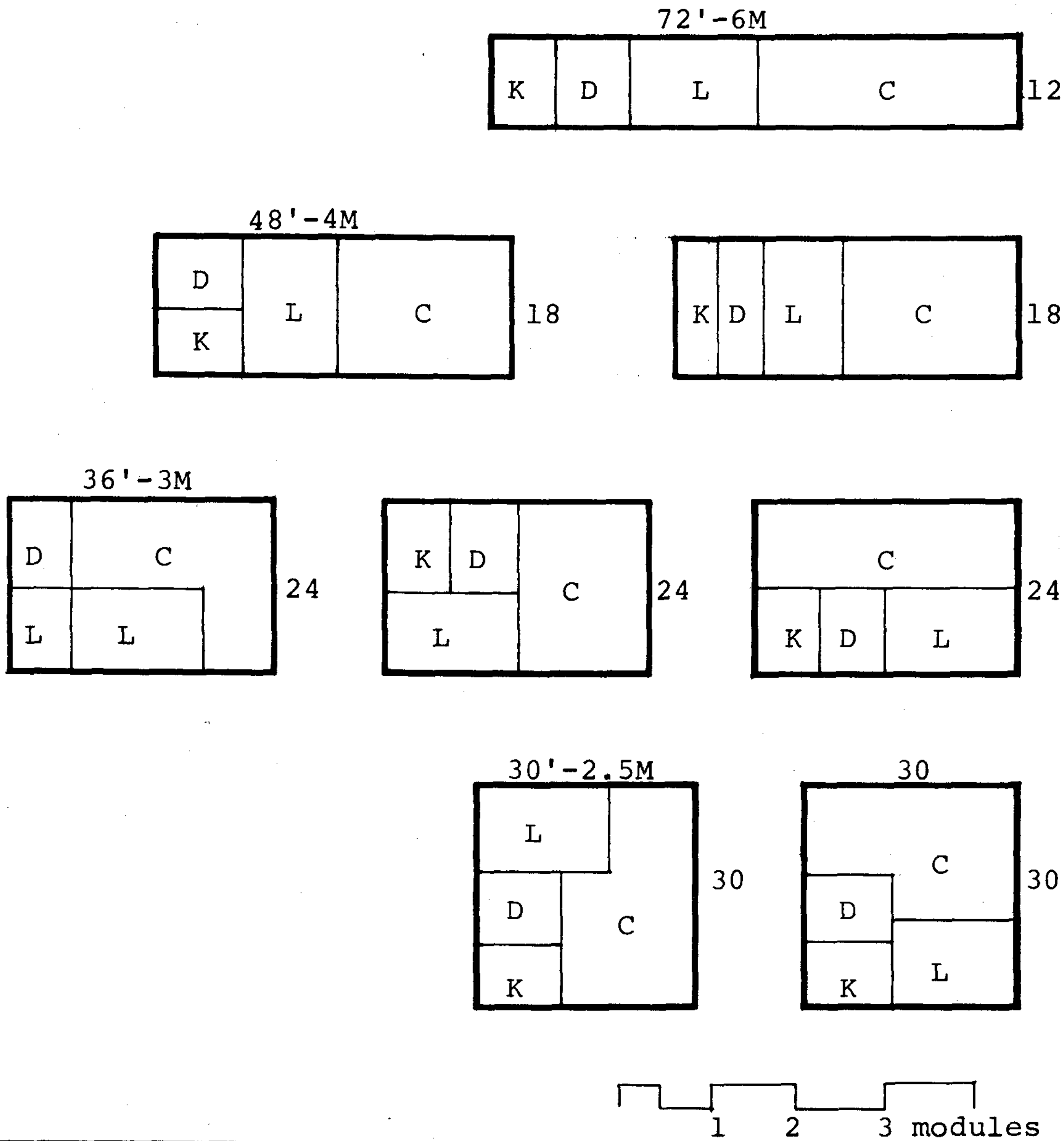
LIVING Living space = min. dimension of 12'

DINING KITCHEN

Both dining and kitchen are allocated .5 to .75 of a module.

1 2 4 6 modules

Fig. 11.27 CONFIGURATIONS OF DWELLING UNIT MAIN FLOOR

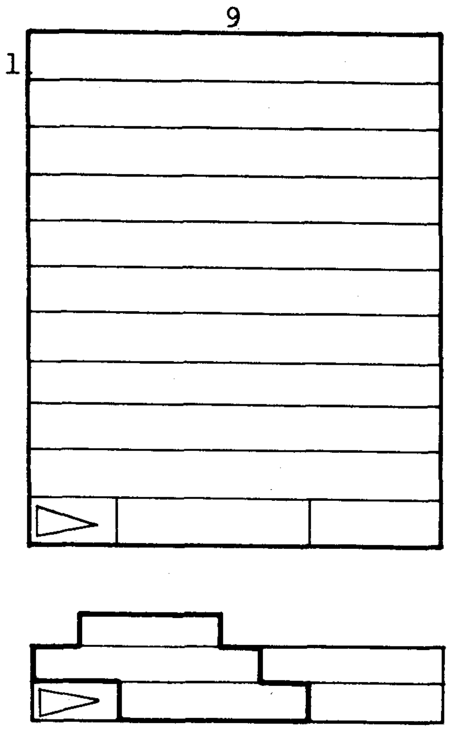


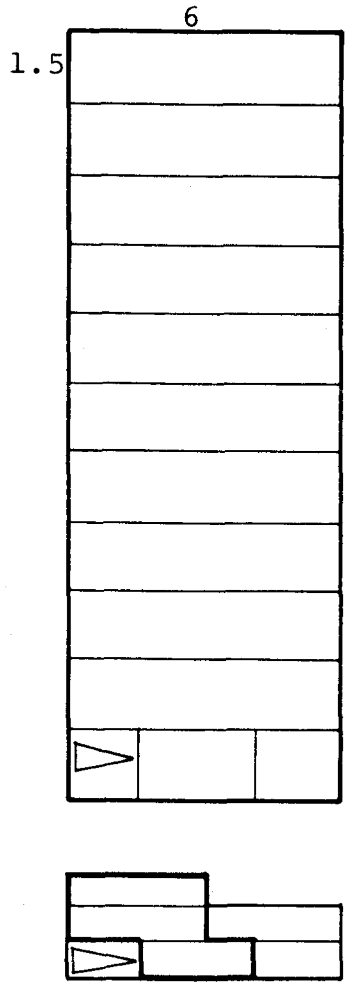
Once the unit width has been determined, its length is automatically fixed as the main floor contains 6 modules. The wider the unit, the more flexible the floor plans became. The next page illustrates four different 9 module dwlg. unit configurations each in a series 11 units long. A comparison between the 1x9 module unit and the 3x3 module unit shows that in series over 11 units, the 1x9 module costs less for perimeter + party walls. Moreover, the 1 module frontage means less roadway + services length per unit. In conclusion, the 3x3 unit provides a better internal layout potential, and offers a greater grouping diversity. The 1x9 unit is the most economical in series of 11 or more.

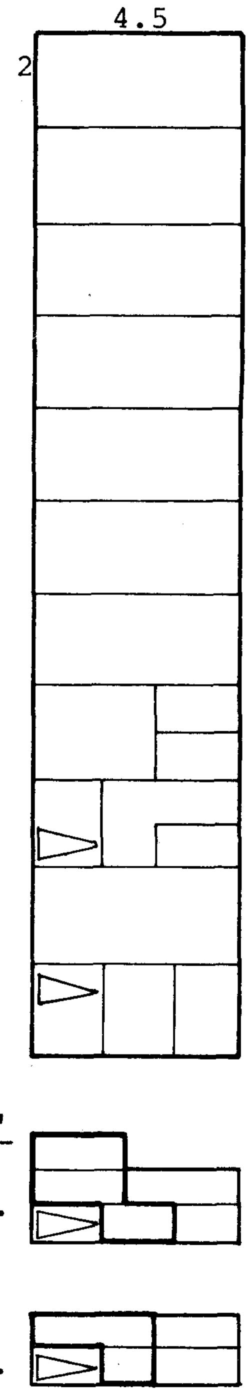
(2) Grouping Scale then combines dwelling unit prototypes of various configurations into different size groupings, Figures 11.28-11.33. The impact on density of shared space ratio requirements is illustrated in prototype groupings, Figures 11.34-11.39. Conclusions on the value of increasing height and altering grade elevations are reached, Figures 11.40-11.46.

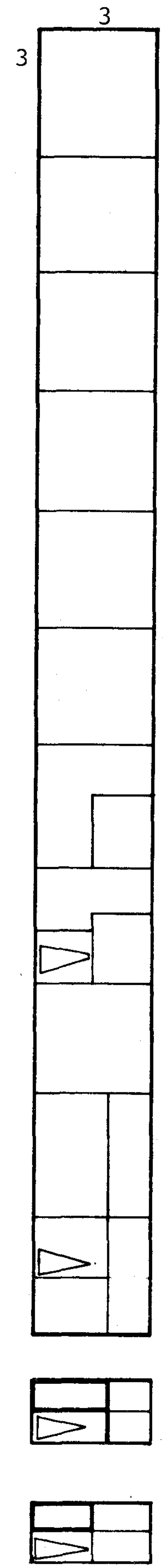
(3) Site Scale illustrates the impact of specific site requirements on prototypically large groupings of 200-300. Several different approaches to large scale grouping are shown for the same site. Resulting densities and open space ratios are plotted comparatively. Finally both qualitative and quantitative values of the solutions are evaluated, Figures 11.48-11.61.

Fig. 11.28 COST COMPARISON OF PERIMETER AND PARTY WALLS AS CONFIGURATION DETERMINANTS









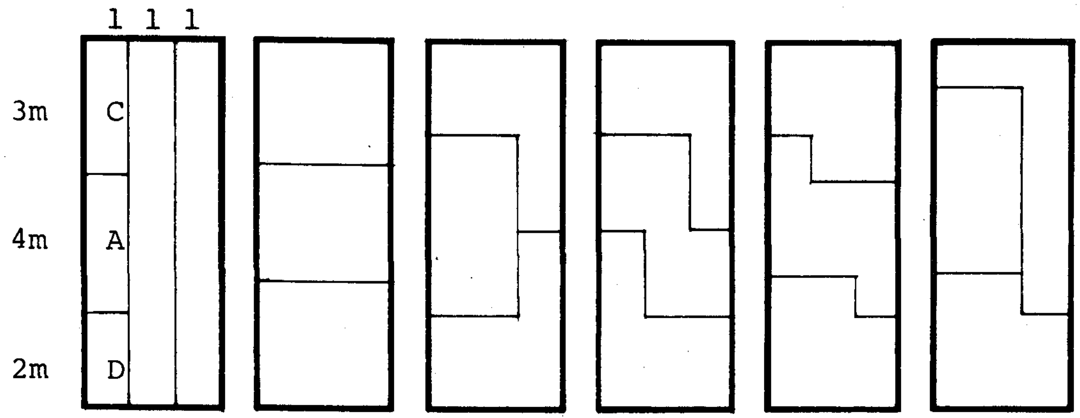
1x9 mod.

Party Wall @ $18/lin'	Perim. Wall @ $30/lin'	
432'	336'	
$ 7,776.	$10,080.	5 DU
$ 17,856.		
1,080'	480'	
$19,440.	$14,400.	11 DU
$ 33,840.		
1,512'	576'	
$27,216.	$17,280.	15 DU
$ 44,496.		

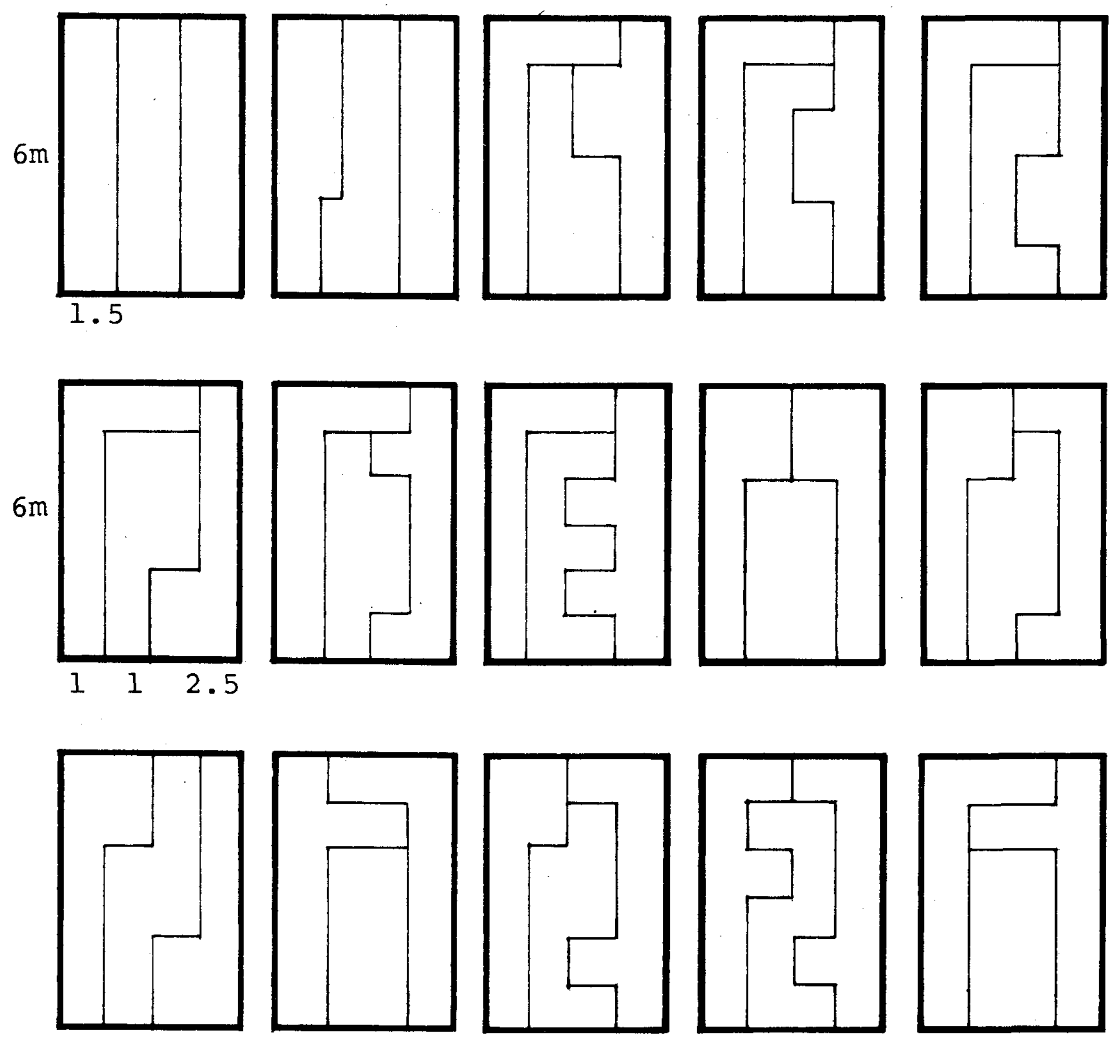
3x3 mod.

Party Wall @ $18/lin'	Perim. Wall @ $30/lin'
72'	288'
$ 1,296.	$ 7,740.
$ 9,036.	
360'	864'
$ 6,480.	$25,920.
$ 32,400.	
504'	1,296'
$ 9,072.	$38,880.
$ 47,952.	

Fig. 11.29 RECTANGULAR GROUPING OF 3 AND 4 DWELLING UNITS



27 sq. module (3x9) groupings of 3 dwelling units



27 sq. module (4.5x6) groupings of 3 dwelling units

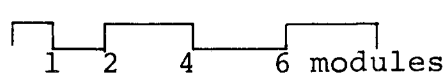
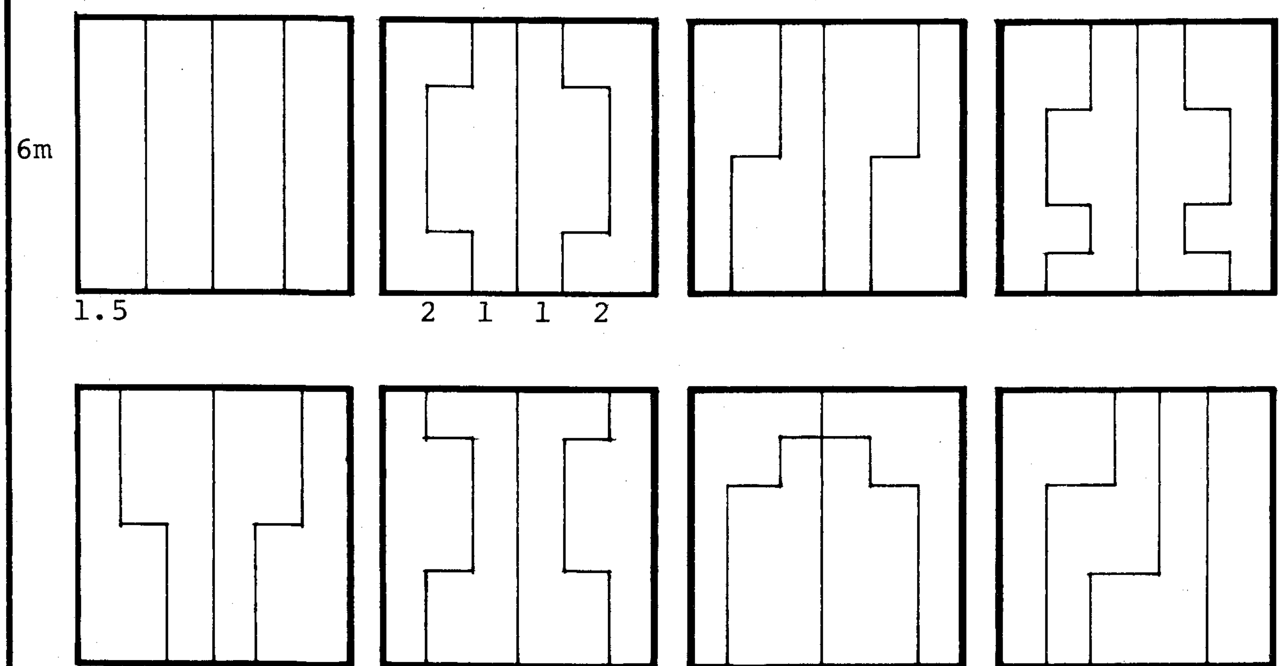
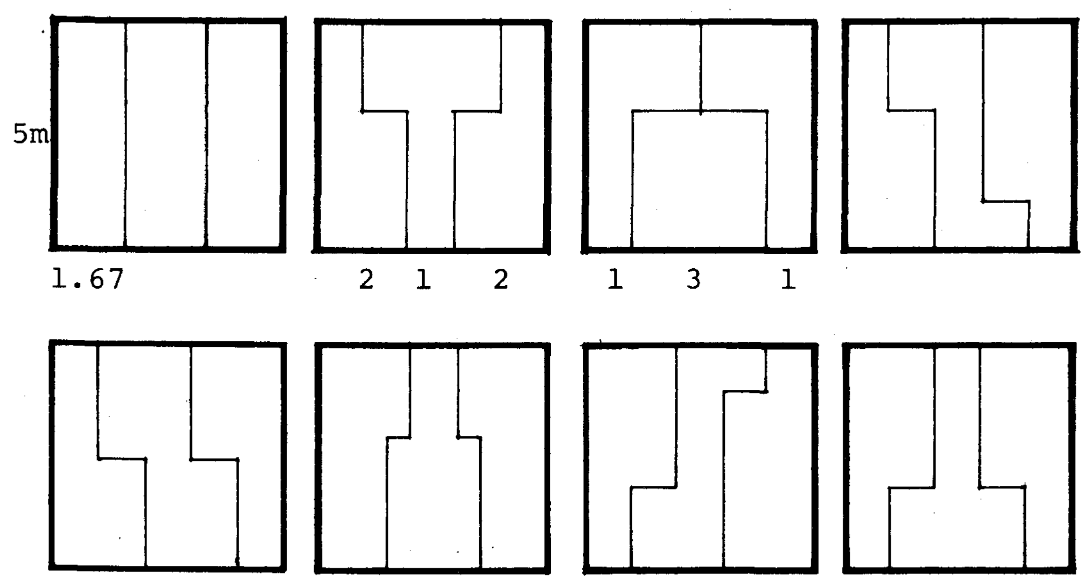


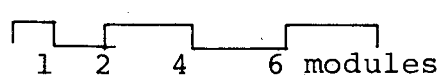
Fig. 11.30 RECTANGULAR GROUPING OF 3 AND 4 DWELLING UNITS (CONTINUED)



36 sq. modules (6x6) groupings of 4 dwelling units



25 sq. modules (5x5) groupings of 3 dwelling units



The first two groupings in Fig. 11.31 show two configurations for 9 dwelling units of 9 modules each (3 modules of exterior personal space included).

In the first diagram, shared space surrounds the grouping. In the second diagram, the shared space is shown distributed within the grouping. In the third diagram, the number of dwelling areas is increased from 9 to 22 although each dwelling unit is still 9 modules.

Clearly the amount of usable shared space within the group has increased in a ratio greater than 22:9. The implication is that there is a logarithmic increase in the size of shared space as the number of dwelling units is increased arithmetically.

Fig. 11.31 GROUPED DWELLINGS (CONTINUED)

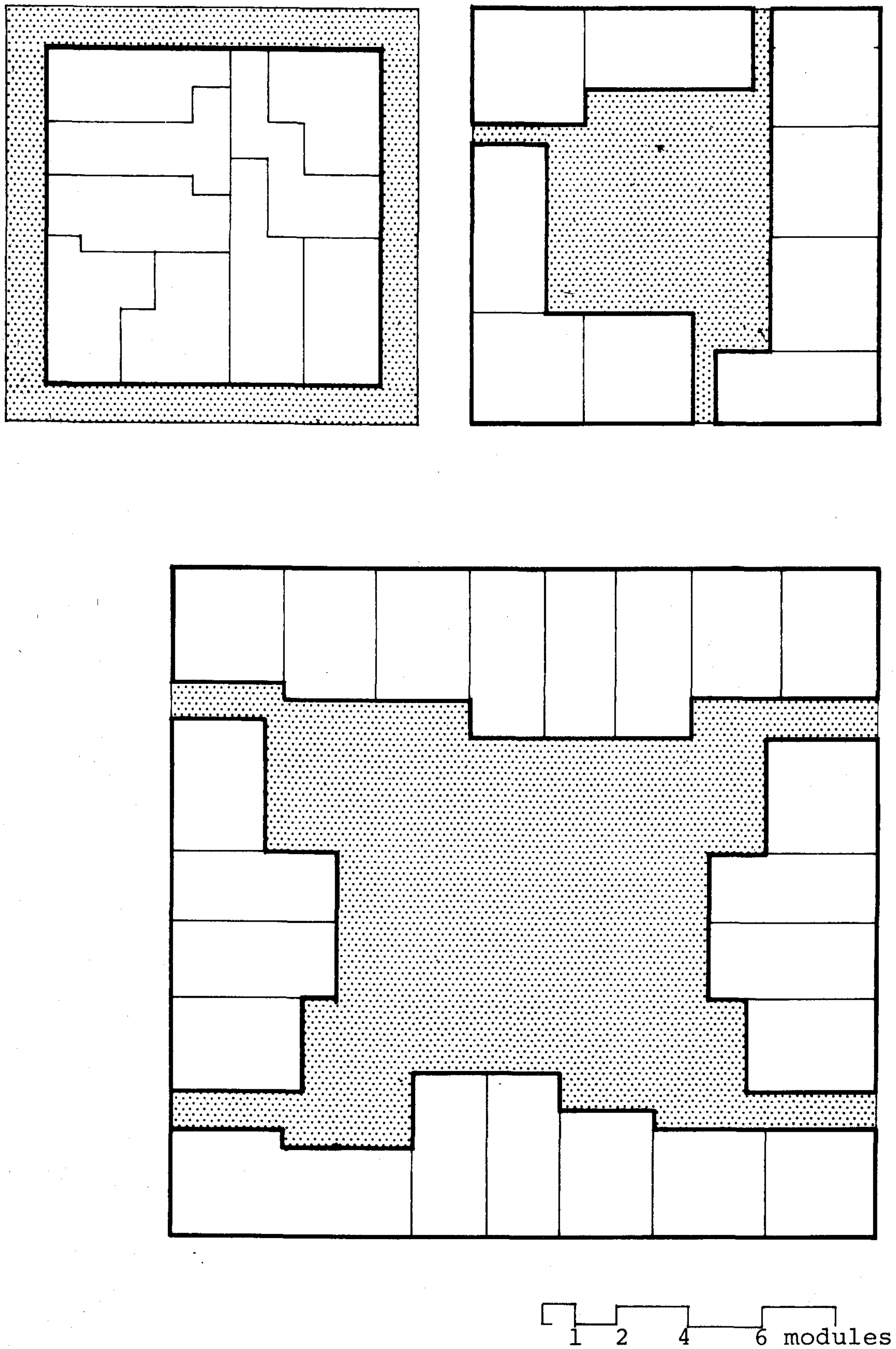
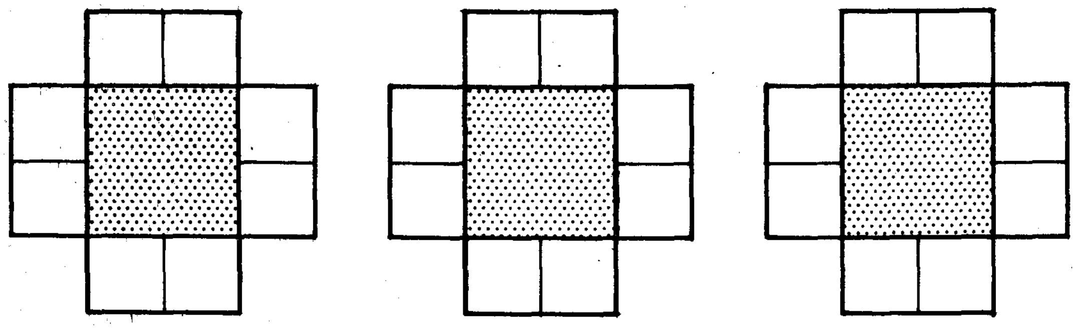
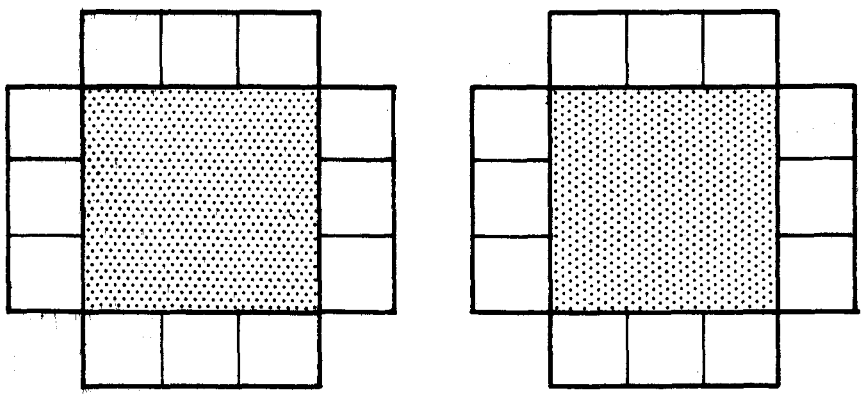


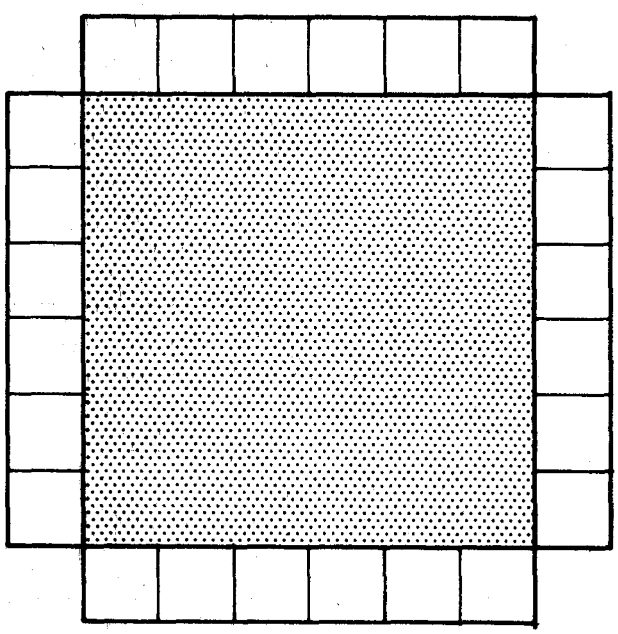
Fig. 11.32 GROUPED DWELLINGS - THEORETICAL



24 Dwelling units in 3 groups of 8
Total public shared space is 3 x 4 = 12



24 Dwelling units in 2 groups of 12
Total public shared space is 2 x 9 = 18

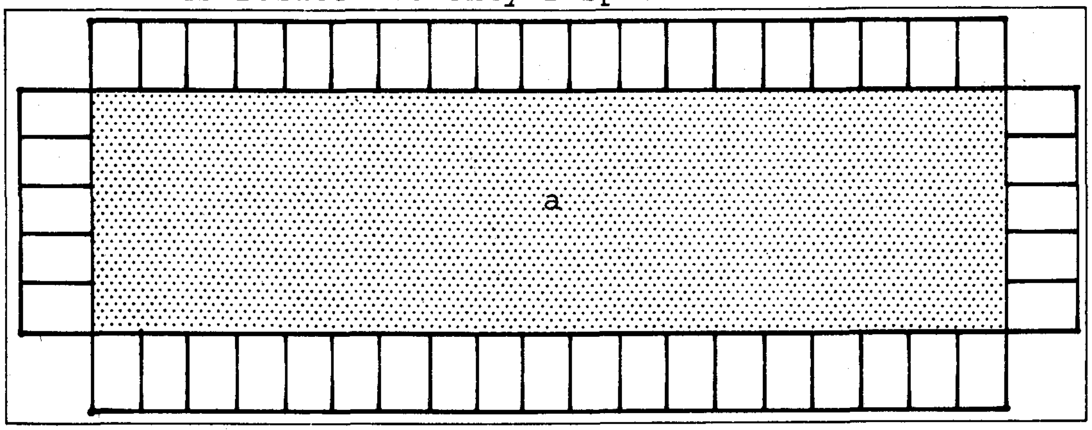


24 Dwelling units in 1 group of 24

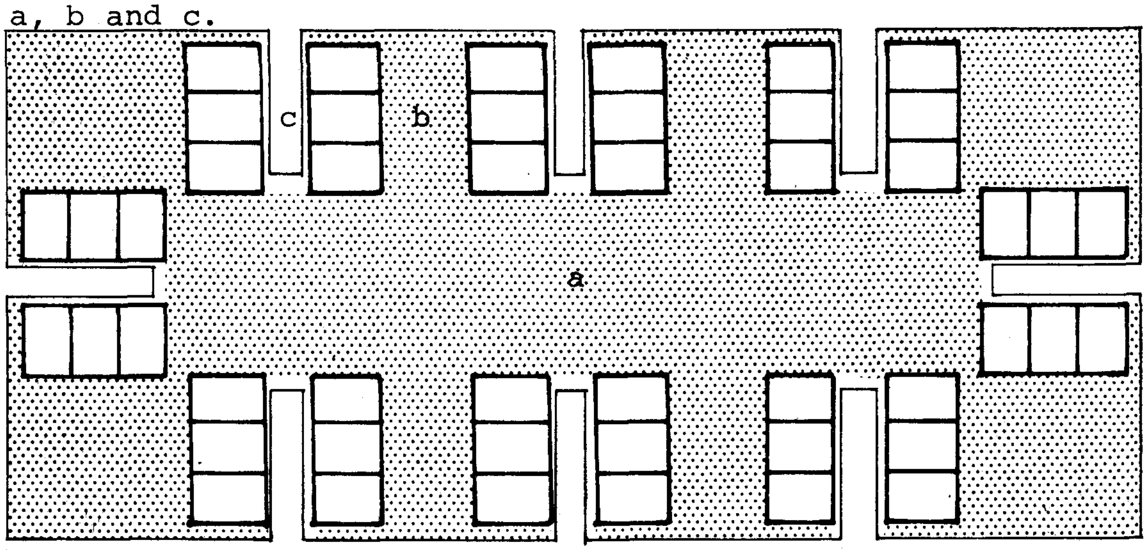
Total public shared space is 6 x 6 = 36

Fig. 11.33 48 DWELLING UNITS AROUND THE PERIMETER OF A SITE

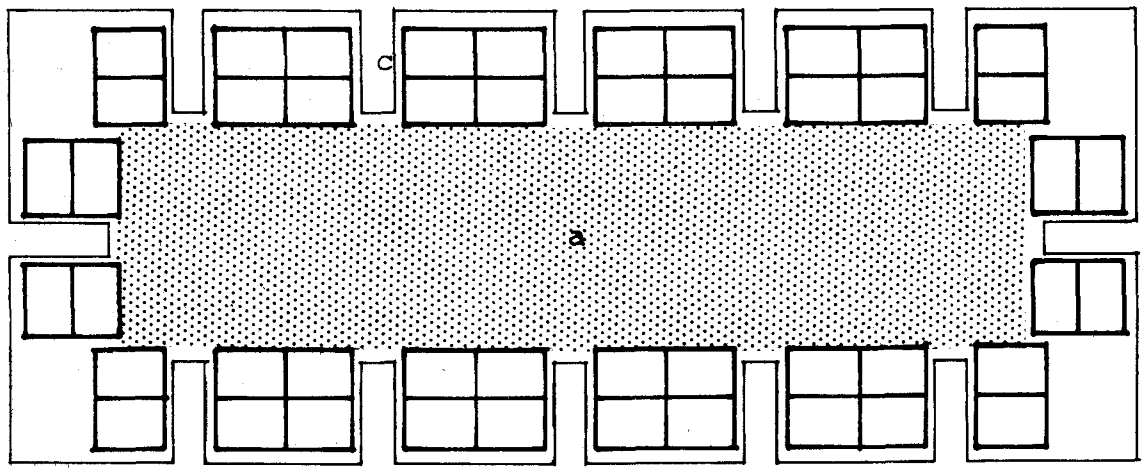
A - Each unit is related to only 1 space - a



B - Clusters of 6 units back-to-back around an intermediate space b. Thus each unit is related to 3 different spaces a, b and c.



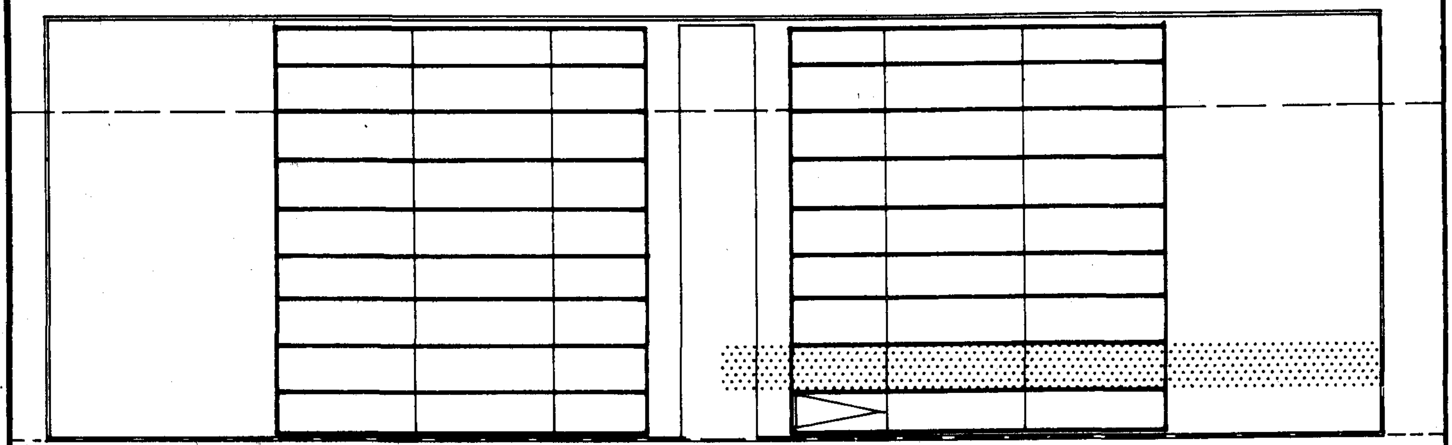
C - Each unit is related to 2 spaces - a and c.



In the following series of diagrams (Figures 11.34 through 11.39) we have taken the acceptable cul-de-sac grouping to illustrate the inter-relationships of density and the zones of land use, Fig. 11.25. The current organization of 6 land use zones is to group zone A and zone B (interior living and interior sleeping) into a building volume, while zones C to F are distributed on the remaining site plane. By changing this distribution of land use zones, density can be increased while maintaining the relationships between zones present in the detached dwelling.

The shaded areas of the following figures represent the space allotment of one dwelling unit in street allotment, parking, interior and exterior personal and shared space.

Fig. 11.34 CURRENT LAND USE PRACTICE



- Two storey building volume
- One dwelling unit high
- Density 18 DU/A
- Shared space ratio .60 x gross interior floor area
- Street, parking and shared space on ground

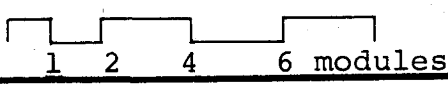
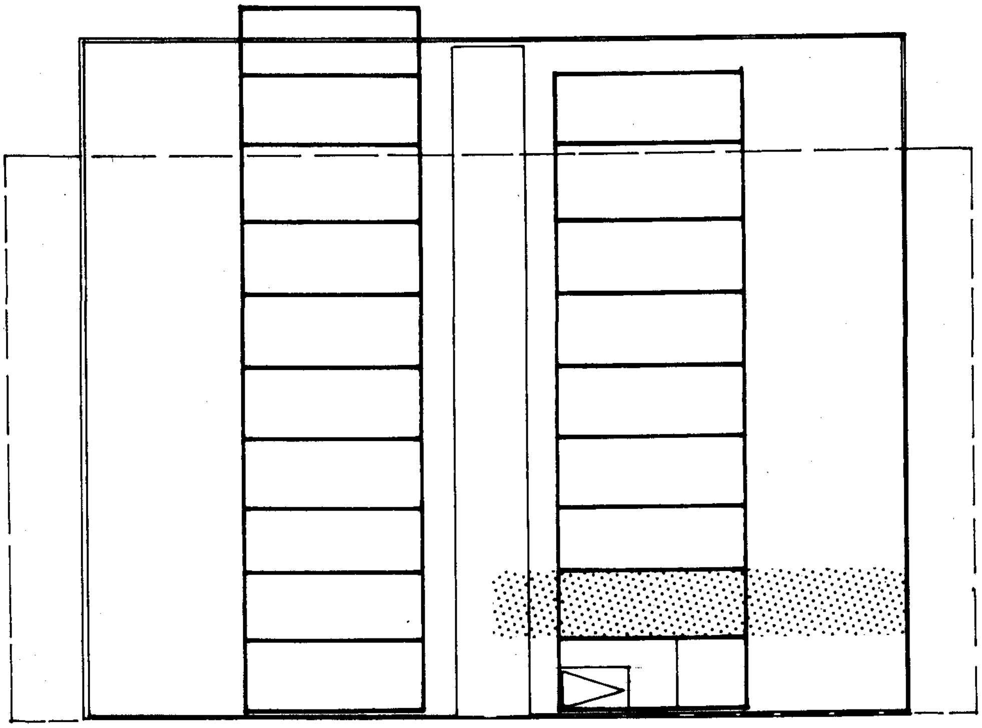
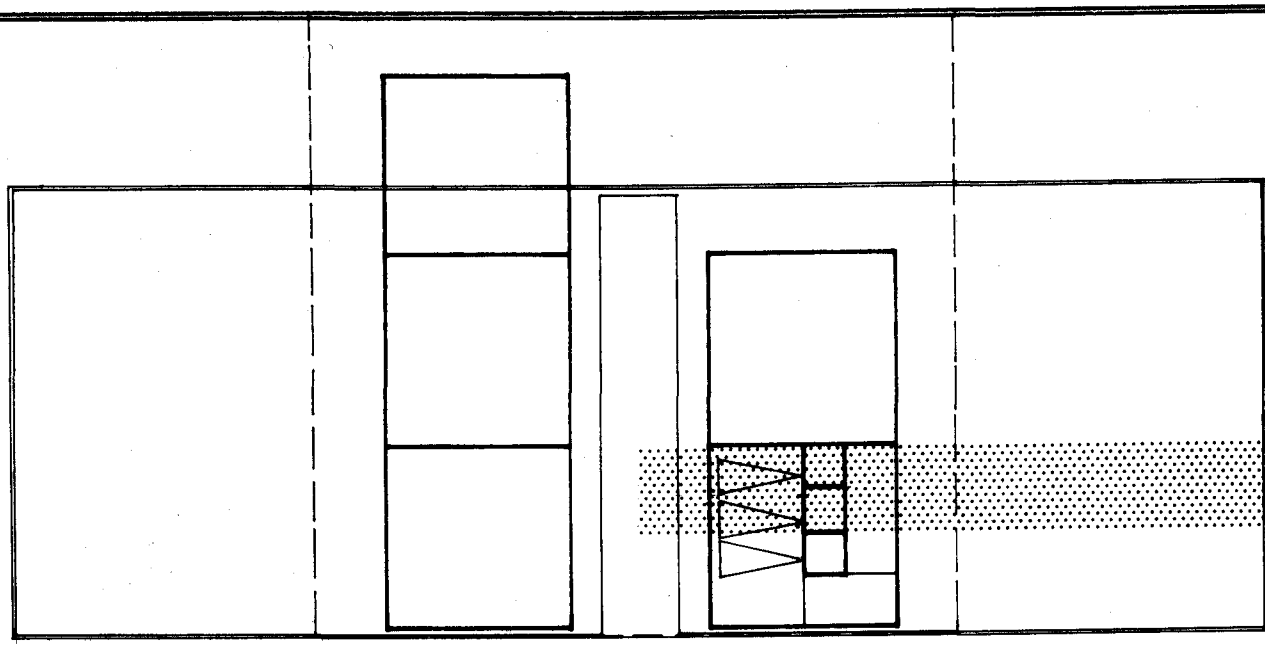


Fig. 11.35 CURRENT LAND USE PRACTICE



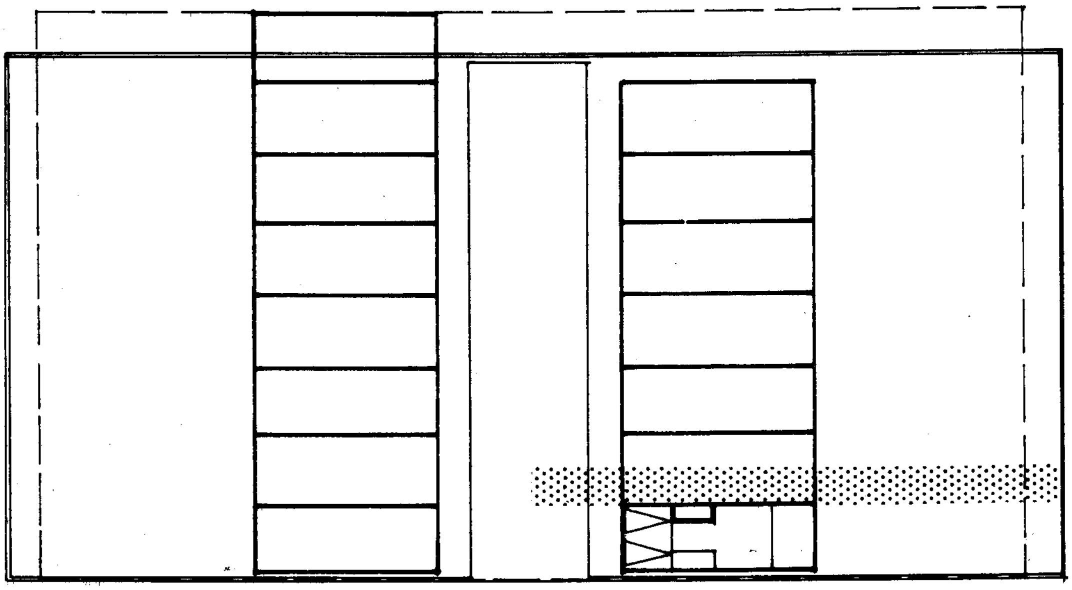
- Three storey building volume
- One dwelling unit high
- Density 19 DU/A
- Shared space ratio .55 x gross interior floor area
- Street, parking and shared space on ground

Fig. 11.36 CURRENT LAND USE PRACTICE MODIFIED



- Four storey building volume
- Three dwelling units high
- Density 15 DU/A
- Shared space ratio .50 x gross interior floor area
- Street, parking and shared space on ground, but walk up situation to dwellings and exterior personal space contained within building volume.

Fig. 11.37 CURRENT LAND USE MODIFIED



- Four storey building volume
- Two dwelling units high
- Density 30 DU/A
- Shared space ratio .50 x gross interior floor area
- Street, parking and shared space on ground, but walk up situation to dwellings and exterior personal space contained within building volume.

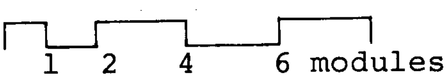
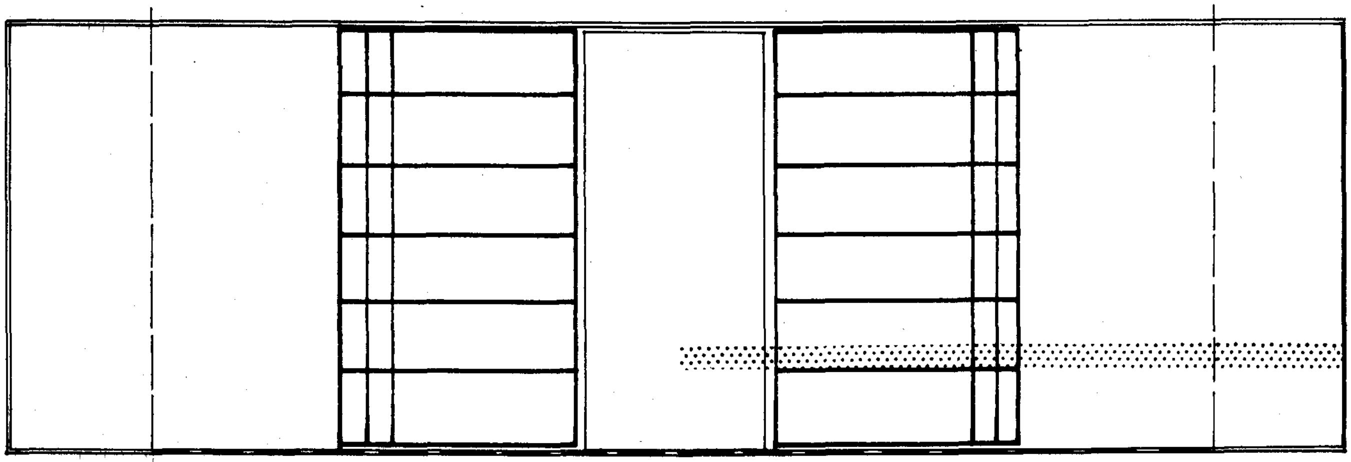


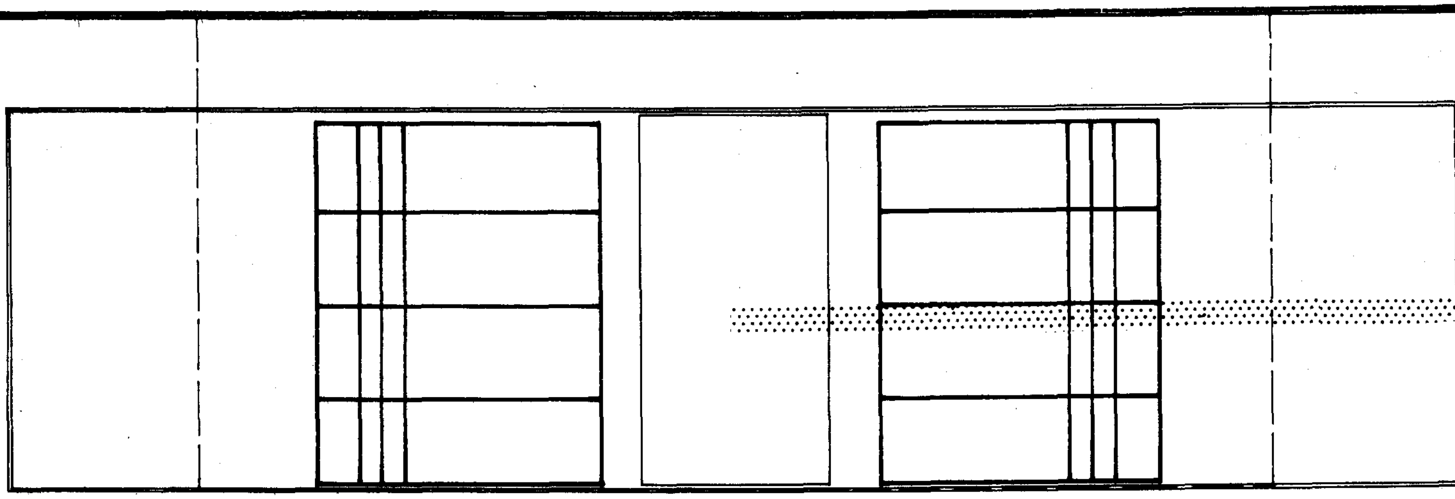
Fig. 11.38 LAND USE ALTERNATIVE

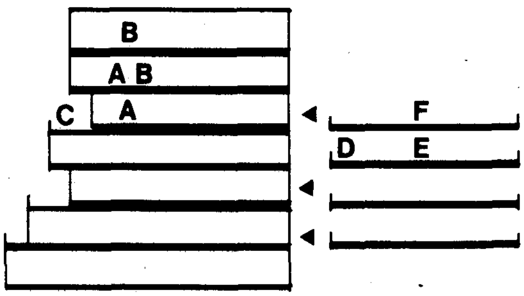


- Six storey building volume
- Three dwelling units high
- Density 36 DU/A
- Shared space ratio .45 x gross interior floor area
- Interior living and sleeping, exterior personal, parking, street and part of shared space contained within a building volume.

1 2 4 6 modules

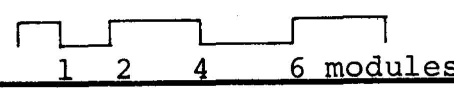
Fig. 11.39 LAND USE ALTERNATIVE





Building Volume

- Density 24 DU/A
- Shared space ratio .40 x gross interior floor area



It is clear that if density is increased, either an increasing amount of the land is covered by building, or the height of the building increases. It has been demonstrated, however (Chapter 7) that alternate methods of distributing the same space are possible, and that substantial volumes can be had at low building profiles - volumes which are usually accommodated in tower structures. The postulate that up to four times building coverage is permissible in that the sky or intercept plane is not obstructed provides building volumes which would accommodate high dwelling unit densities - 70 or 80 dwelling units per acre.

However, the constraints imposed by the requirements revealed in this study, for example pedestrian access to grade, the provision of a certain amount of personal outdoor space for each dwelling unit and the accommodation of the automobile in association with the dwelling unit, make it impossible to reach a coverage ratio of 4:1.

The requirements can be easily met by putting each unit within reach of ground level. This will yield densities, inclusive of the other requirements stipulated in this study and seldom provided in current practice, of some twenty-five dwelling units per acre.

If the device of using elevated planes for access or open space is used, such as the roofs of parking structures, thus making an increase in building height possible, densities of some thirty-five dwelling units per acre can be easily reached, while including all the specified amenities, and a large amount of shared space.

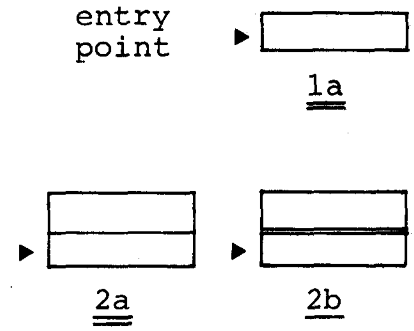
The following diagrams show configurations for dwellings at increasing heights in order to achieve increasing density while maintaining amenity. This is done by first providing a range of section prototypes, Fig. 11.40 and then illustrating plan forms the different section configurations can accommodate, Figures 11.41 to 11.46.

Fig. 11.40 SECTIONS

1a - Dwelling unit entries on grade.

1a - No dwelling unit more than one storey from grade.

It is assumed that increased height provides increased density. In order to achieve 6 storey schemes yet retain every dwelling unit's entry on or near grade, one must split grade into two or three artificial grades.



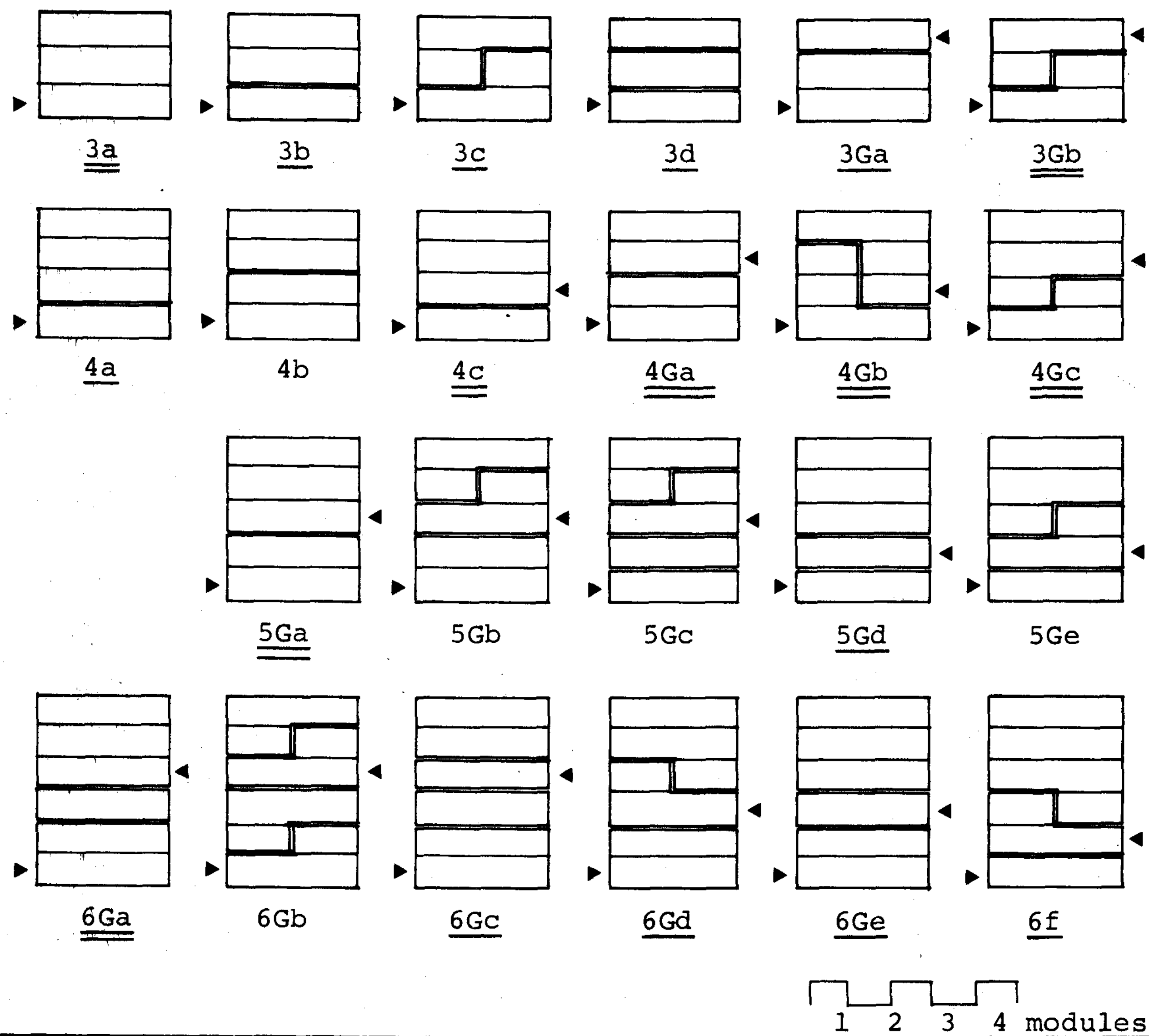


Fig. 11.41 DWELLING UNIT PROTOTYPES - 1 FLOOR

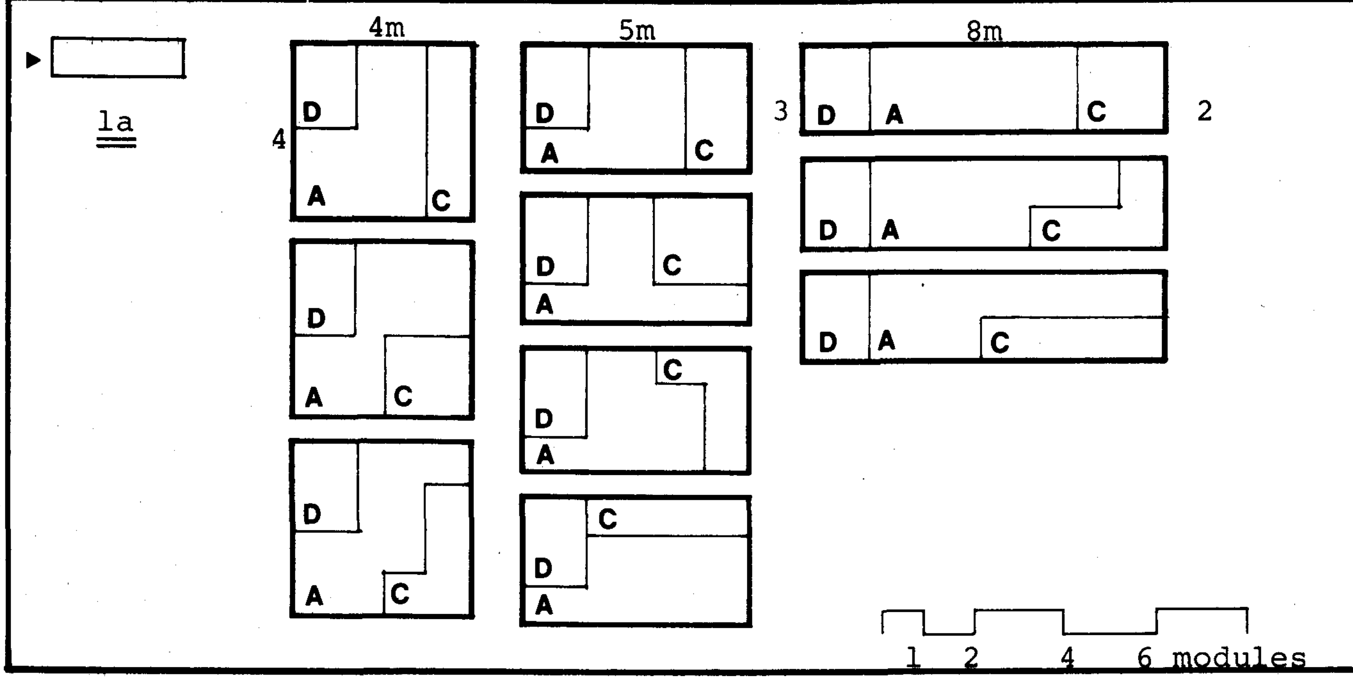


Fig. 11.42 DWELLING UNIT PROTOTYPES - 2 FLOORS

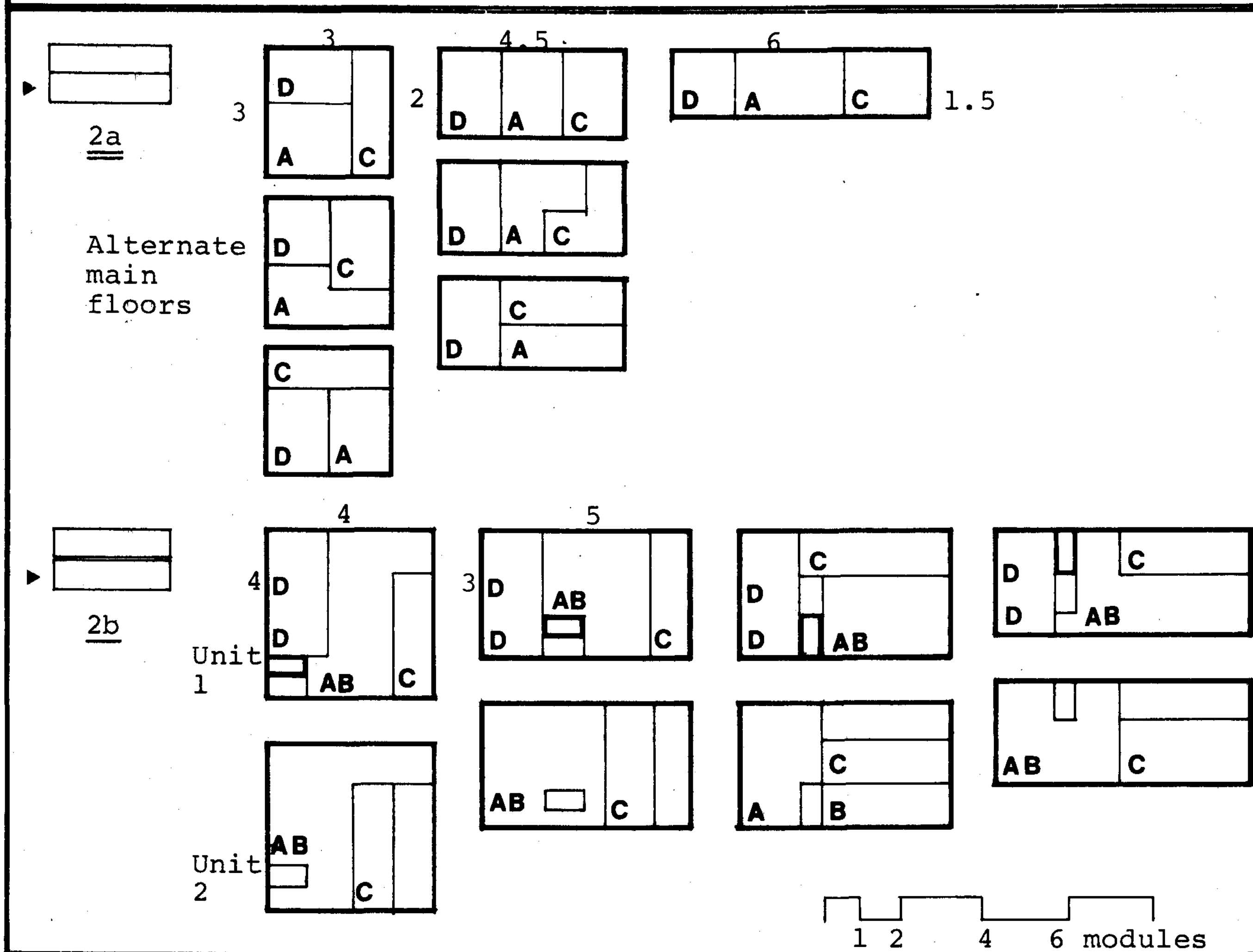


Fig. 11.43 DWELLING UNIT PROTOTYPES - 3 FLOORS

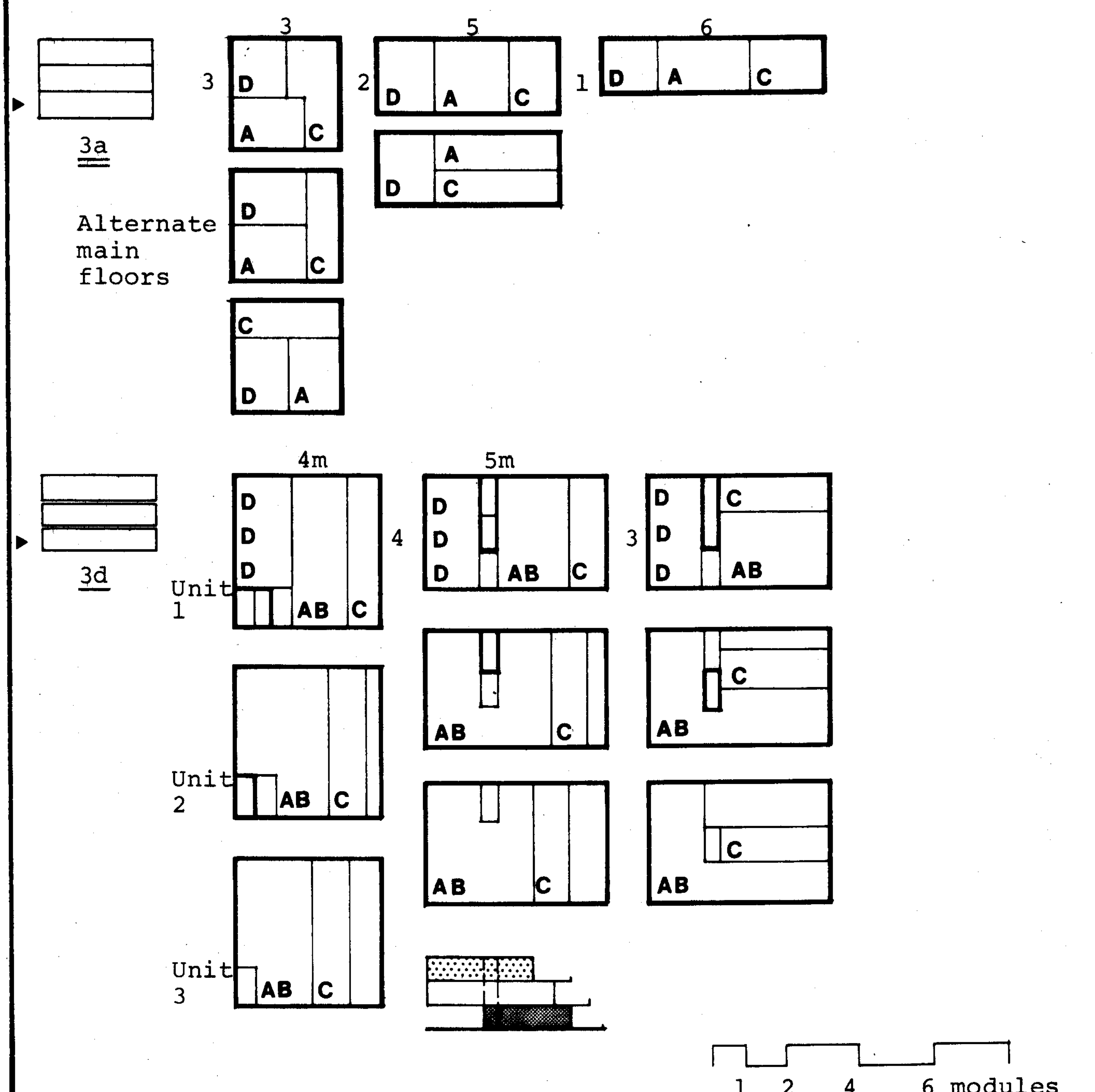


Fig. 11.44 DWELLING UNIT PROTOTYPES - 4 FLOORS

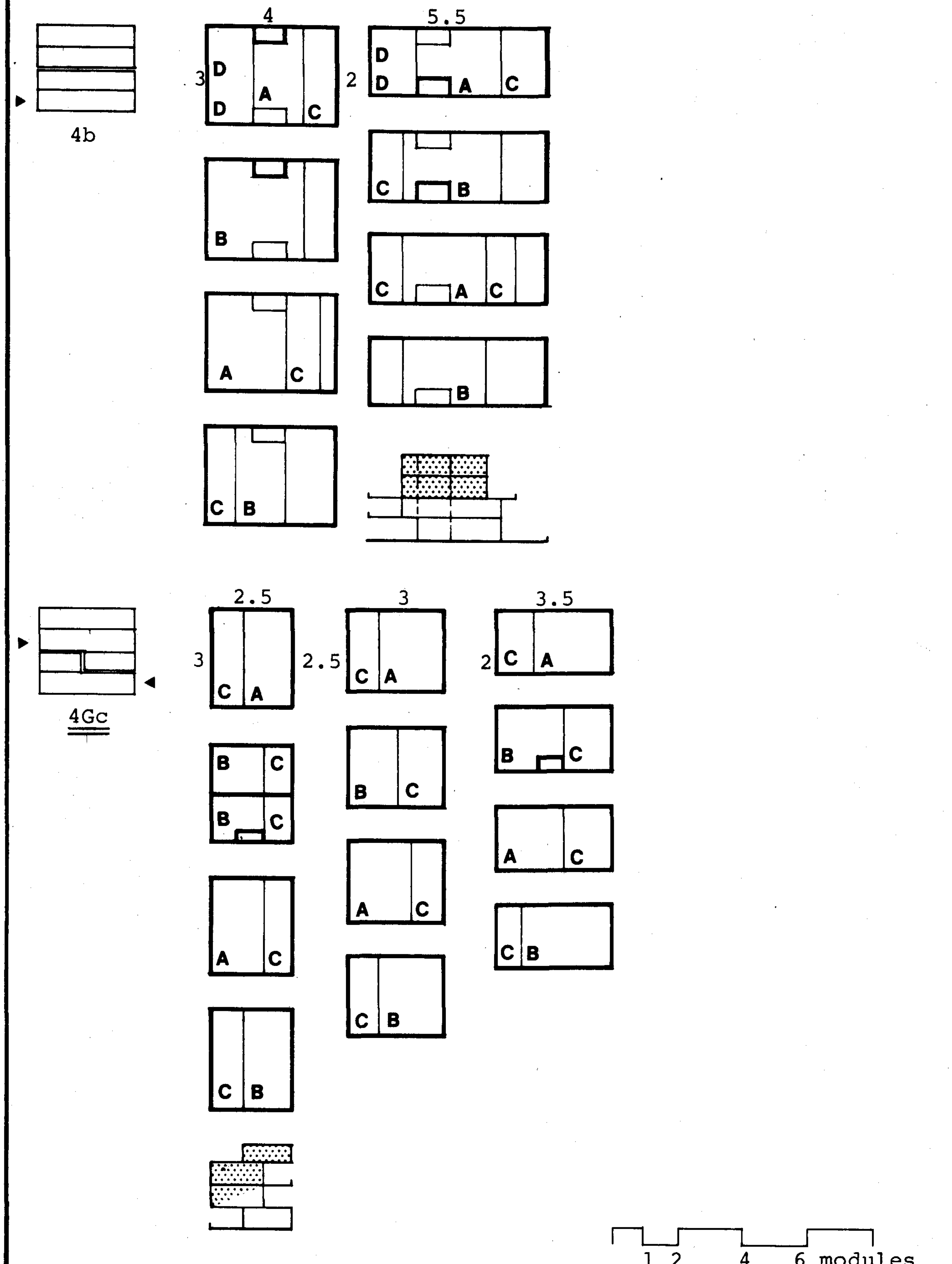


Fig. 11.45 DWELLING UNIT PROTOTYPES - 5 FLOORS

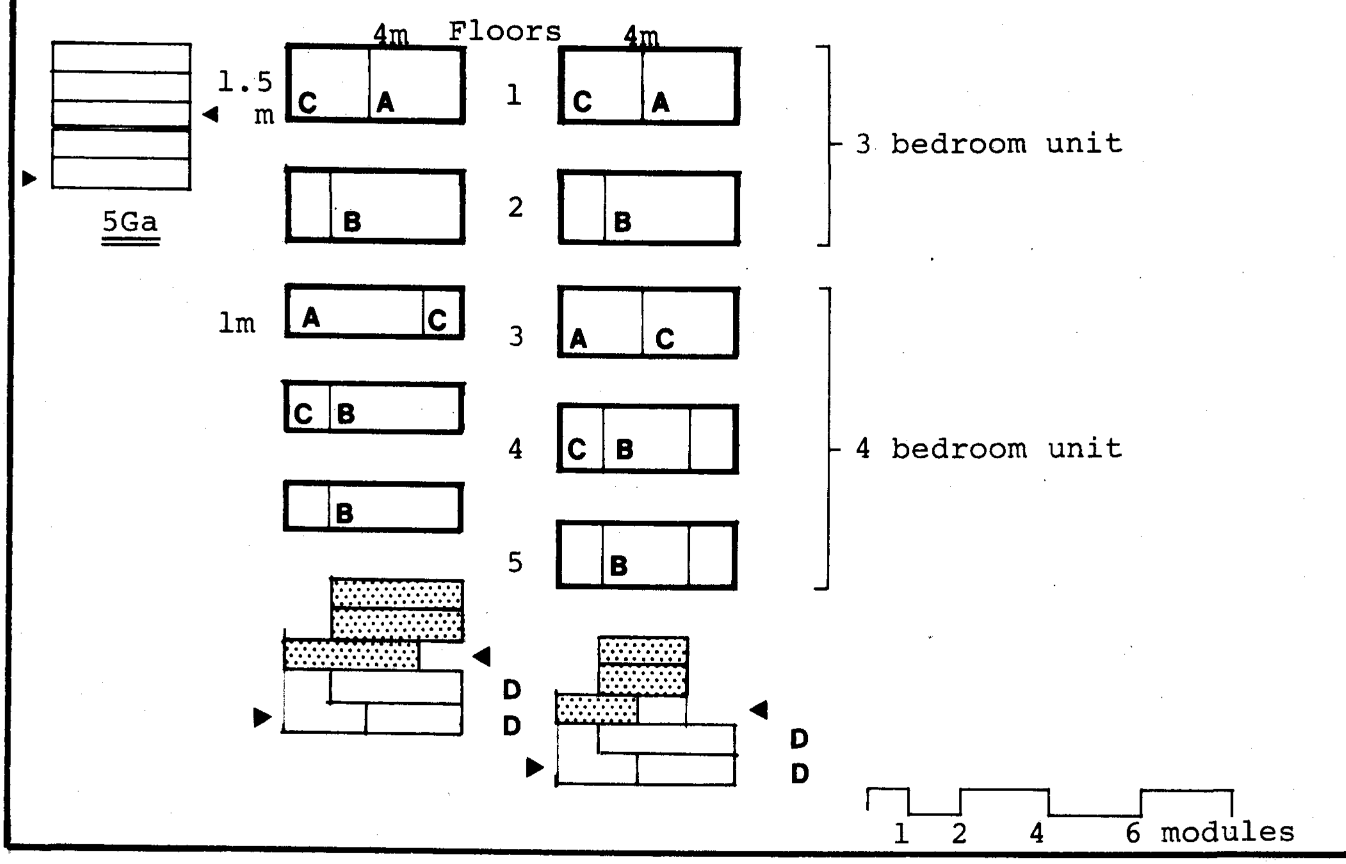
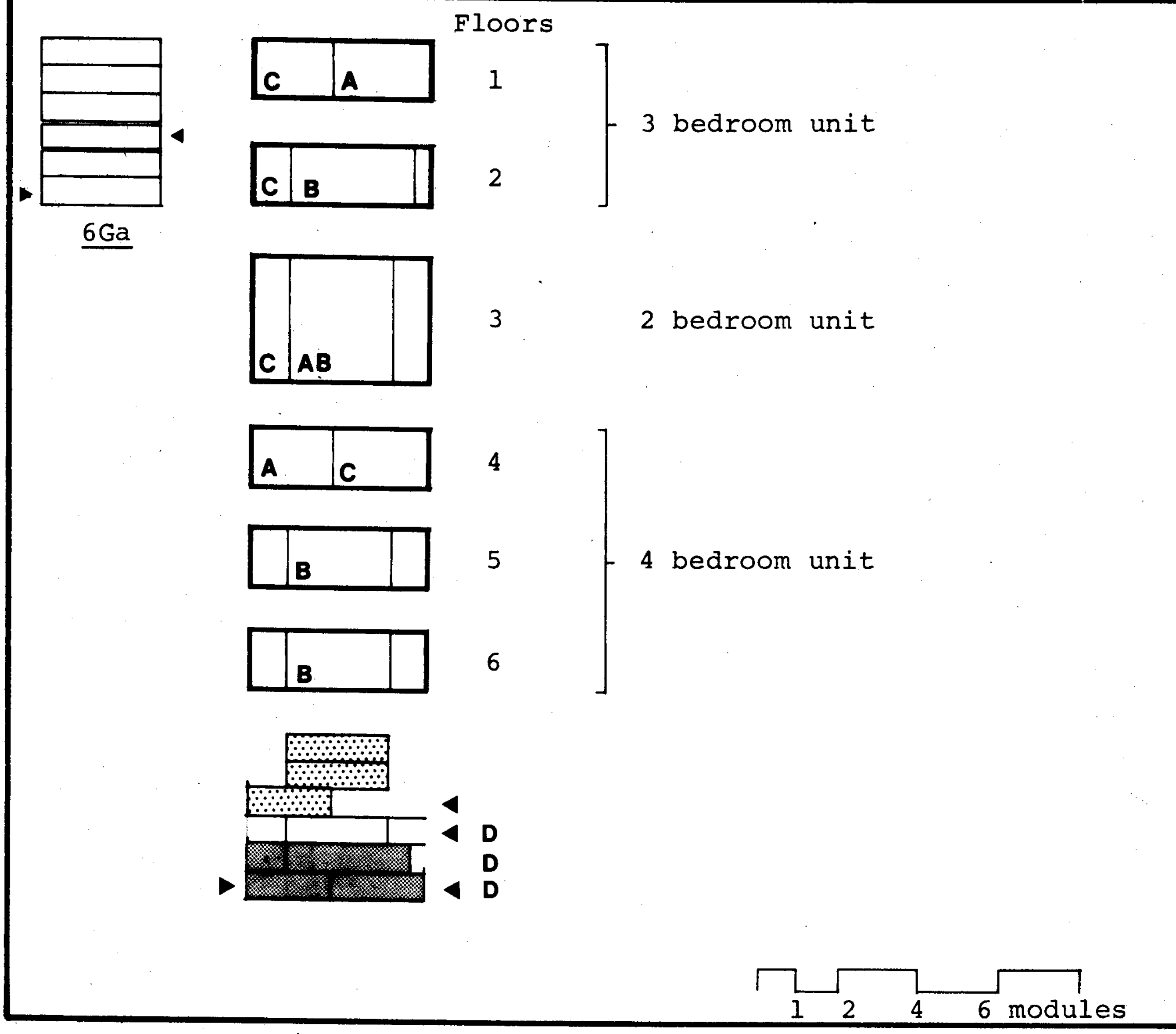


Fig. 11.46 DWELLING UNIT PROTOTYPES - 6 FLOORS



DONWOOD TERRACE

This development (statistical information on following data sheet) is built on a nine acre site. The density is 17.2 dwelling units per acre.

The development makes no provision for exterior space; has no designated children's play areas; contains a large number of maisonette or garden apartments (broken line on plan), i.e. dwelling units accessible via a common interior corridor; organizes parking on group lots rather than making provision for parking in association with the dwelling; makes no provision for vehicular access to each dwelling; bisects the site with a roadway; allows one visitor/delivery parking space for every five units (two building blocks have no delivery or visitor parking); and makes no distinctions between forms of public or shared open space.

The site is one that slopes towards a ravine. No recognition of this topographical feature is made, in that building groups face this natural amenity end-on, and pedestrians from half the housing must cross the one internal access road to reach the ravine.

Further, no principle can be discerned in the distribution of dwelling units, housing forms, open space, or their relationships.

The following list is the breakdown of the accommodation, by block, for Donwood Terrace:

Maisonettes

Block	Bedroom Units
A	2
B	3
C	3 + study
D	2
E	3
F	3
G	3
H	3
K	2
L	3
M	3

2 Bedroom units in maisonettes	64	
3 Bedroom units in maisonettes	55	
3 Bedroom units + study in maisonettes	5	
	124	Total Maisonettes

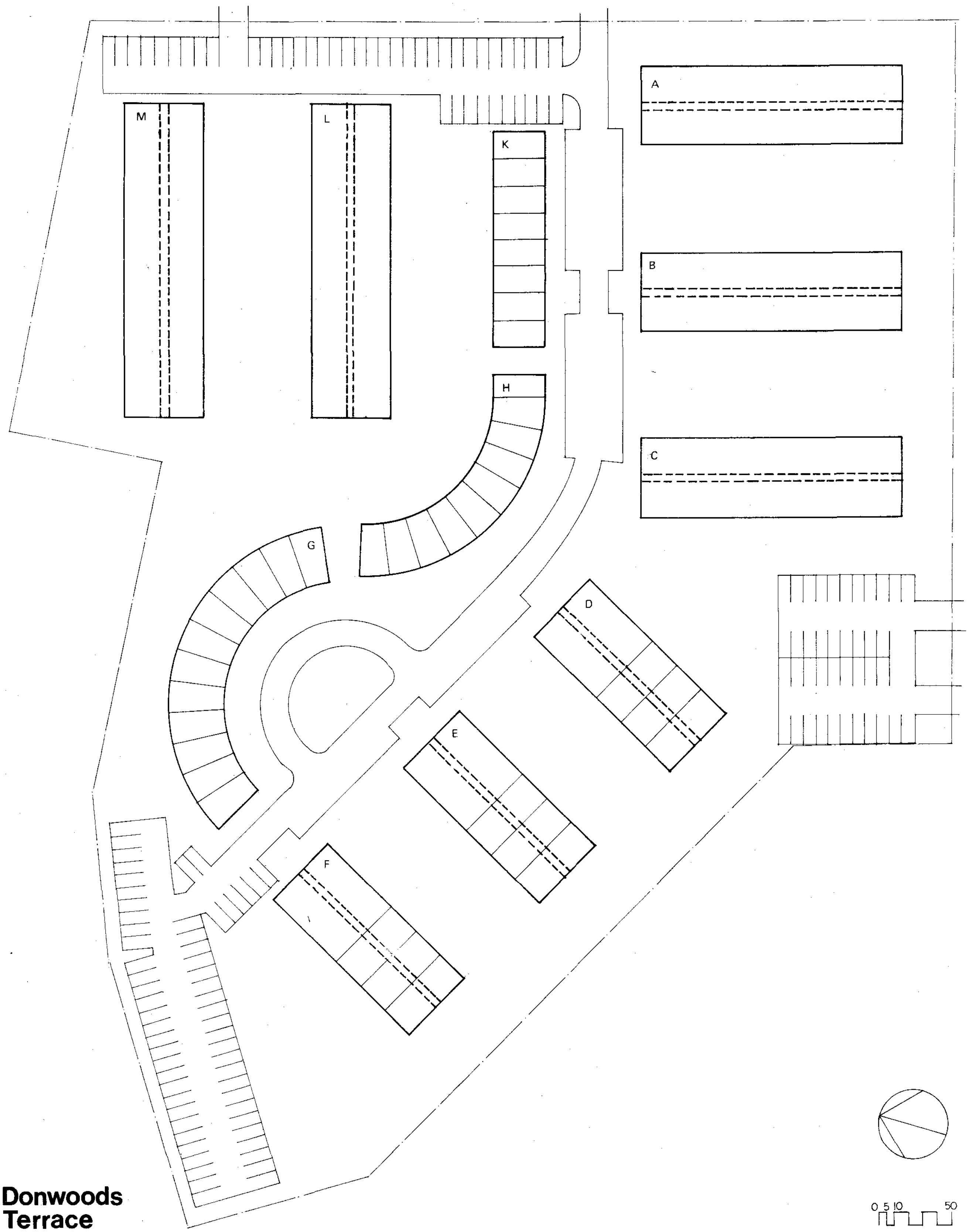
Terrace Housing

Block	Bedroom Units
G	3
H	3
K	3

3 Bedroom units in terraces	30	Total Terrace Units
	154	TOTAL UNITS

DONWOOD TERRACE HOUSING: DATA SHEET

Interior living and sleeping space per dwelling unit (DU)	1,115 sq. ft.
Number of units	154
2 Bedroom	64
3 Bedroom	90
4 Bedroom	0
Exterior personal space/DU	0
Exterior shared space/DU	1,663.8 sq. ft.
Parking allowance/DU	226 sq. ft.
Street allowance/DU	163 sq. ft.
Building height	2 storey
Shared exterior space ratio	1.49
Density DU/Acre	17.2



Donwoods
Terrace

SCHEME A*

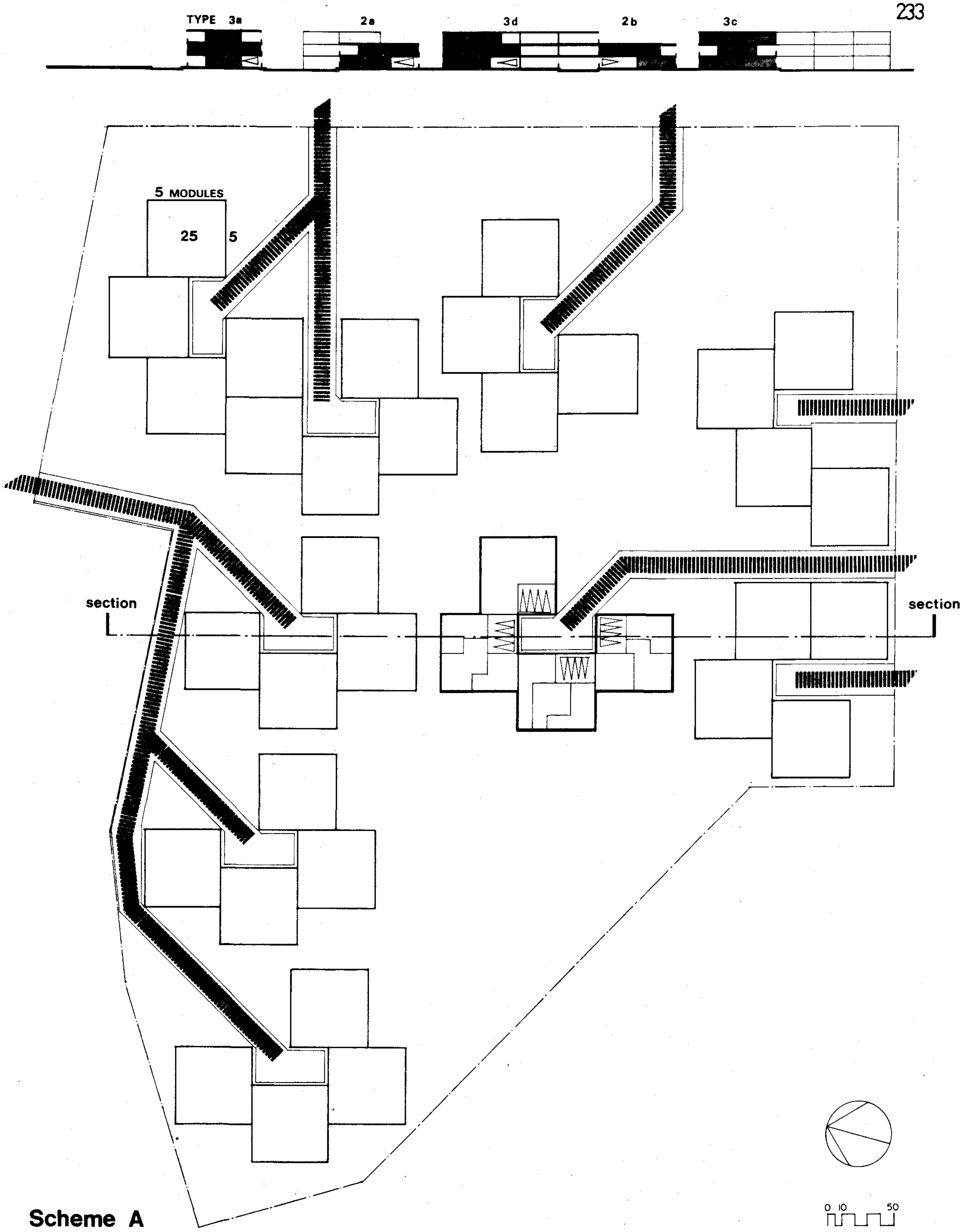
Scheme A is a series of housing clusters at densities comparable to densities yielded by row housing. The cluster is an alternative in that there is, on the part of some users, a resistence to row housing. While row or terrace housing is economic in the amount of exposed, or unshared perimeter, the cluster form illustrated is a tight cluster and has some degree of shared wall or perimeter. The configurations in this form of housing can be varied widely, and the automobile can be contained within a court made by the group. The shared space ratio for this scheme is high (1.23) while the roads, which are cul-de-sacs, are a small proportion of the site. It is possible to walk to the ravine without crossing a road.

The clusters, as can be seen, can be grouped in varying unit amounts. The range prospect and aspect possibilities are almost those of the detached dwelling unit.

* All the demonstration schemes include a space allowance and desired location for personal exterior space, direct private entrance, automobile parking in association with the dwelling and qualified shared open space.

SCHEME A - DATA SHEET

Interior living and sleeping space per dwelling unit (DU)	
3 Bedroom	1,152 sq. ft.
4 Bedroom	1,296 sq. ft.
Number of units	108
2 Bedroom	0
3 Bedroom	72
4 Bedroom	36
Exterior personal space/DU	
3 Bedroom	432 sq. ft.
4 Bedroom	576 sq. ft.
Exterior shared space/DU	1,500 sq. ft.
Parking allowance/DU	240 sq. ft.
Street allowance/DU	295 sq. ft.
Building height	3 storeys
Shared space ratio	1.23
Density DU/Acre	12



Scheme A

SCHEME B

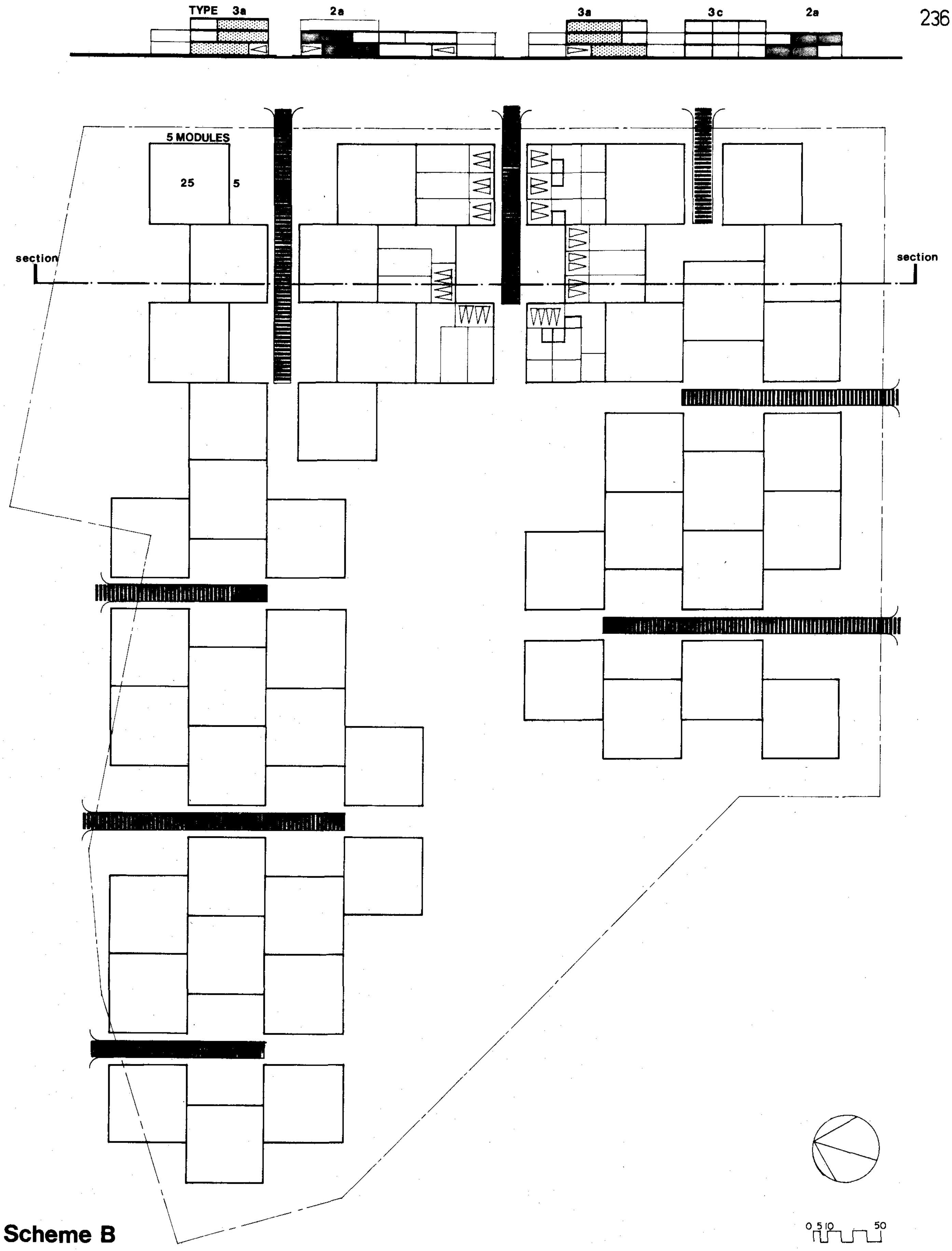
Scheme B distributes the groups, or clusters of housing units, generally on the perimeter of the site, except where the contours fall to the ravine on the south west. Each dwelling unit, in addition, includes a personal exterior space area. Access roads are short cul-de-sacs branching off roads which surround the site on three sides. Automobiles are accommodated with each dwelling unit, around an open court. Thus access to the shared space, on the interior of the block and continuous with the ravine which lies off the property, is ensured from the short roads and all dwellings.

The basic quantitative comparison with Donwood Terrace is as follows:

	Dwelling Units	Density: DU/Acre
Donwood	154	17.2
Scheme B	153	17

SCHEME B - DATA SHEET

Interior living and sleeping space per dwelling unit (DU) 3 Bedroom	1,152 sq. ft.
Number of Units	153
2 Bedroom	0
3 Bedroom	153
4 Bedroom	0
Exterior personal space/DU	432 sq. ft.
Exterior shared space/DU	970 sq. ft.
Parking allowance	324 sq. ft.
Street allowance/DU	300 sq. ft.
Building height	3 storeys
Shared space ratio	.84
Density DU/Acre	17



Scheme B

SCHEME C

Scheme C generally distributes the groups around the outer sector of the site. The configuration of the groups is a direct consequence of the module amalgamations, i.e., the form is generated by the plans. This group form has a wide variety of combinations, and, in addition, makes it simple to change the group direction. If a few performance criteria are established, such as the number of facades which must remain "open", density and amenity can be precisely controlled.

Access is mainly by spurs or cul-de-sacs from the perimeter.

It can be seen that even with a large amount of personal space per dwelling (576 sq ft) a small amount of shared space (a ratio of .298) and a small street allowance, a scheme of efficient land use is demonstrated. The shared space ratio, is, however, low for the resultant 26.2 dwelling units per acre.

While a strong plan form is demonstrated, it cannot be held to be intrinsically one generic form or another, as the combinations possible are wide.

This repetitive use of modules makes possible the use of standard manufactured components.

SCHEME C - DATA SHEET

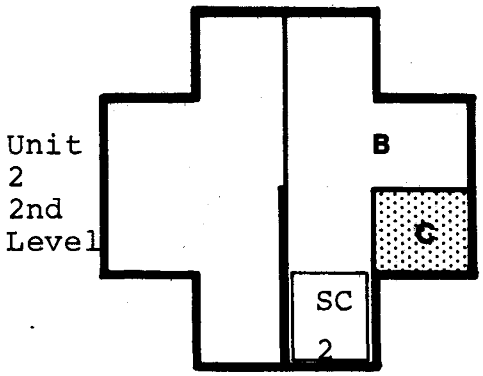
Interior living and sleeping space per dwelling unit (DU) 4 bedroom	1,296 sq. ft.
Number of Units	236
2 Bedroom	0
3 Bedroom	0
4 Bedroom	236
Exterior personal space/DU	576 sq. ft.
Exterior shared space/DU	387 sq. ft.
Parking allowance/DU	288 sq. ft.
Street allowance/DU	156 sq. ft.
Building height	4 storeys
Shared space ratio	.298
Density DU/Acre	26.2

UNIT PLANS OF CRUCIFORM DESIGN

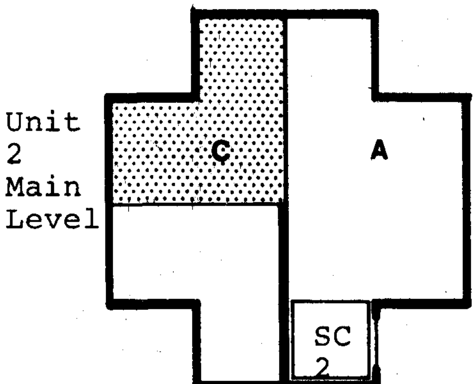
The plan below has a ground floor area of 12 modules. Therefore for a single family on two floors, the unit is oversize. It should be 9 modules.

However for 2 families on four floors, the 12 modules is the correct amount (see Fig. 11.44). Therefore, the four floor scheme is deployed on the site.

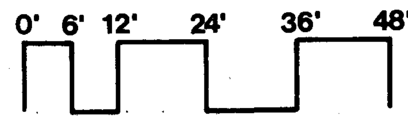
SC - stair and service core for unit.

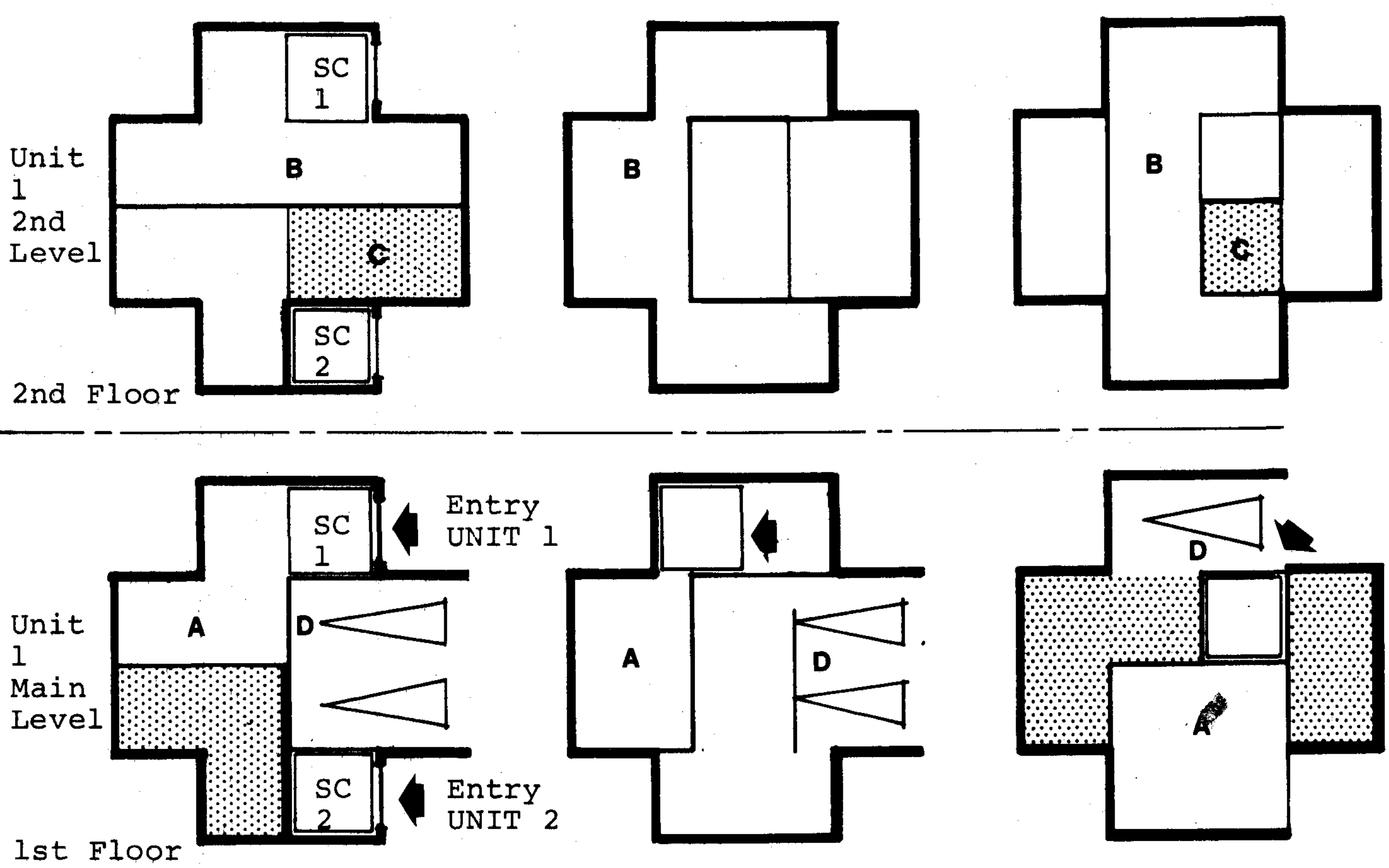


4th Floor



3rd Floor

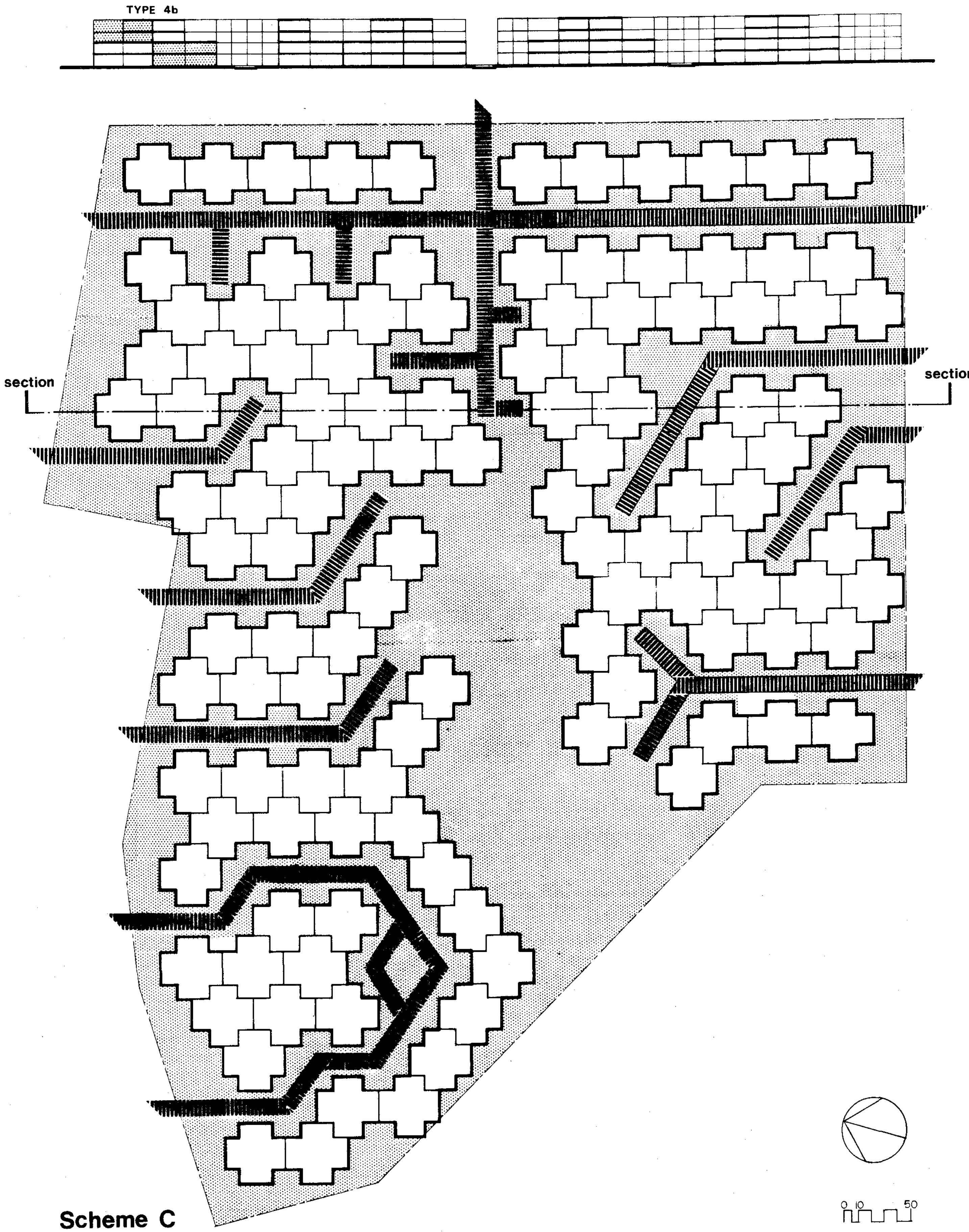




4 FLOOR SCHEME

2 FLOOR SCHEME

2 FLOOR SCHEME



Scheme C

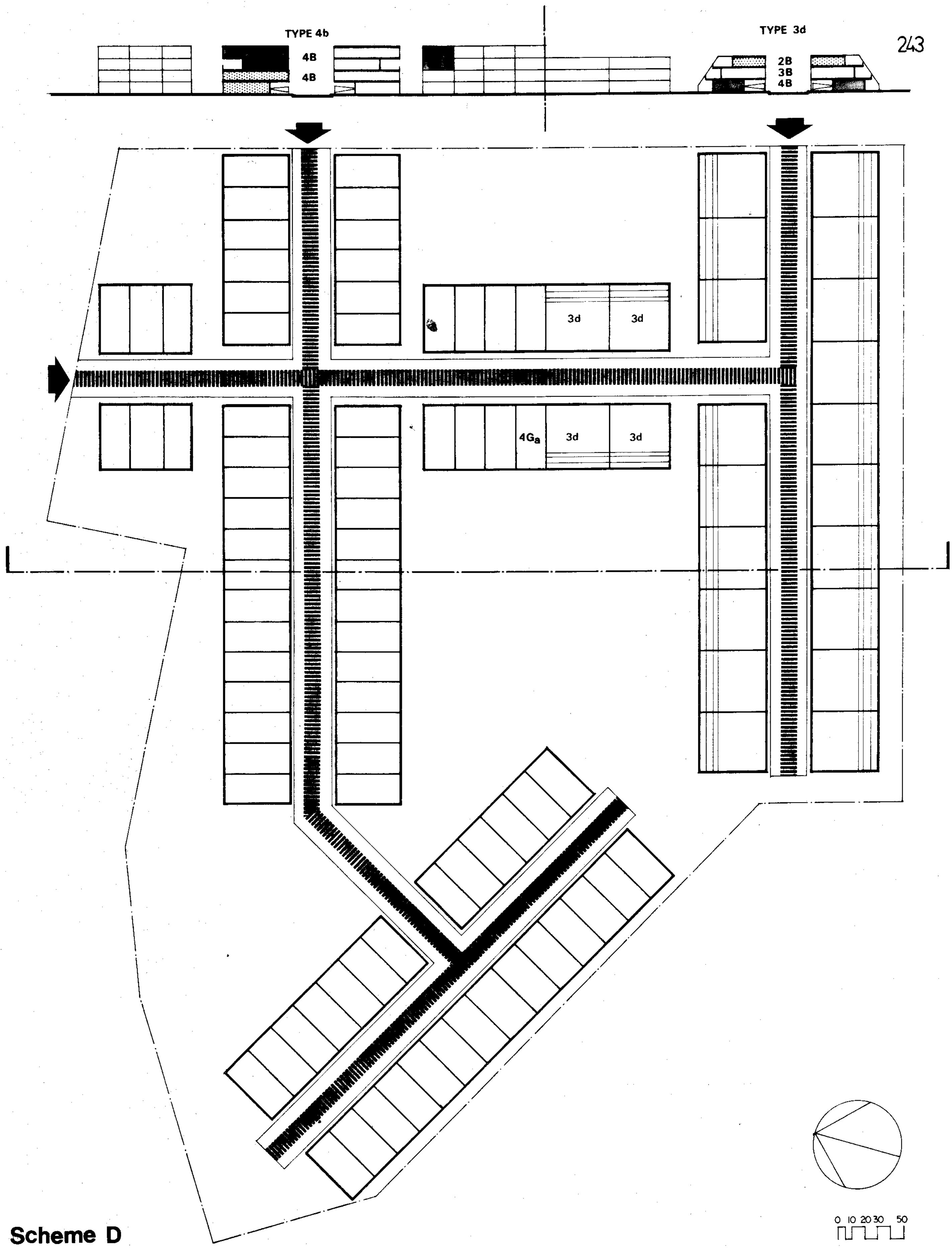
SCHEME D

Scheme D is essentially a row house walkup scheme. The automobile and personal exterior space is accommodated at grade. The shared space ratio for this scheme is relatively high: (.48) this is in part due to maintaining a short distance between dwellings on either side of the roadway (36'- 0").

In comparing this scheme with Donwood Terrace it should be seen that while the density of Scheme D represents a 50% increase, the amenities, specified in the study are, in addition, included and the shared space is improved in distribution and quality.

SCHEME D - DATA SHEET

Interior living and sleeping space per dwelling unit (DU)	
4 Bedroom	1,296 sq. ft.
Number of Units	230
2 Bedroom	0
3 Bedroom	0
4 Bedroom	230
Exterior personal space/DU	576 sq. ft.
Exterior shared space/DU	610 sq. ft.
Parking allowance/DU	324 sq. ft.
Street allowance/DU	179 sq. ft.
Building height	4 storeys
Shared space ratio	.48
Density DU/Acre	25.5



Scheme D

SCHEME E

Scheme E distributes housing on a road system which penetrates the site. The automobile has direct access to each unit, and is accommodated at grade. Each unit contains 3 modules of exterior personal space for 3 bedroom units, 4 modules for 4 bedroom units and all have direct access to grade.

Two building heights for this distribution are shown on the data sheet. It will be seen that the densities reached are 32 dwelling units per acre for the 3 storey scheme, and 40 dwelling units per acre for the four storey scheme.

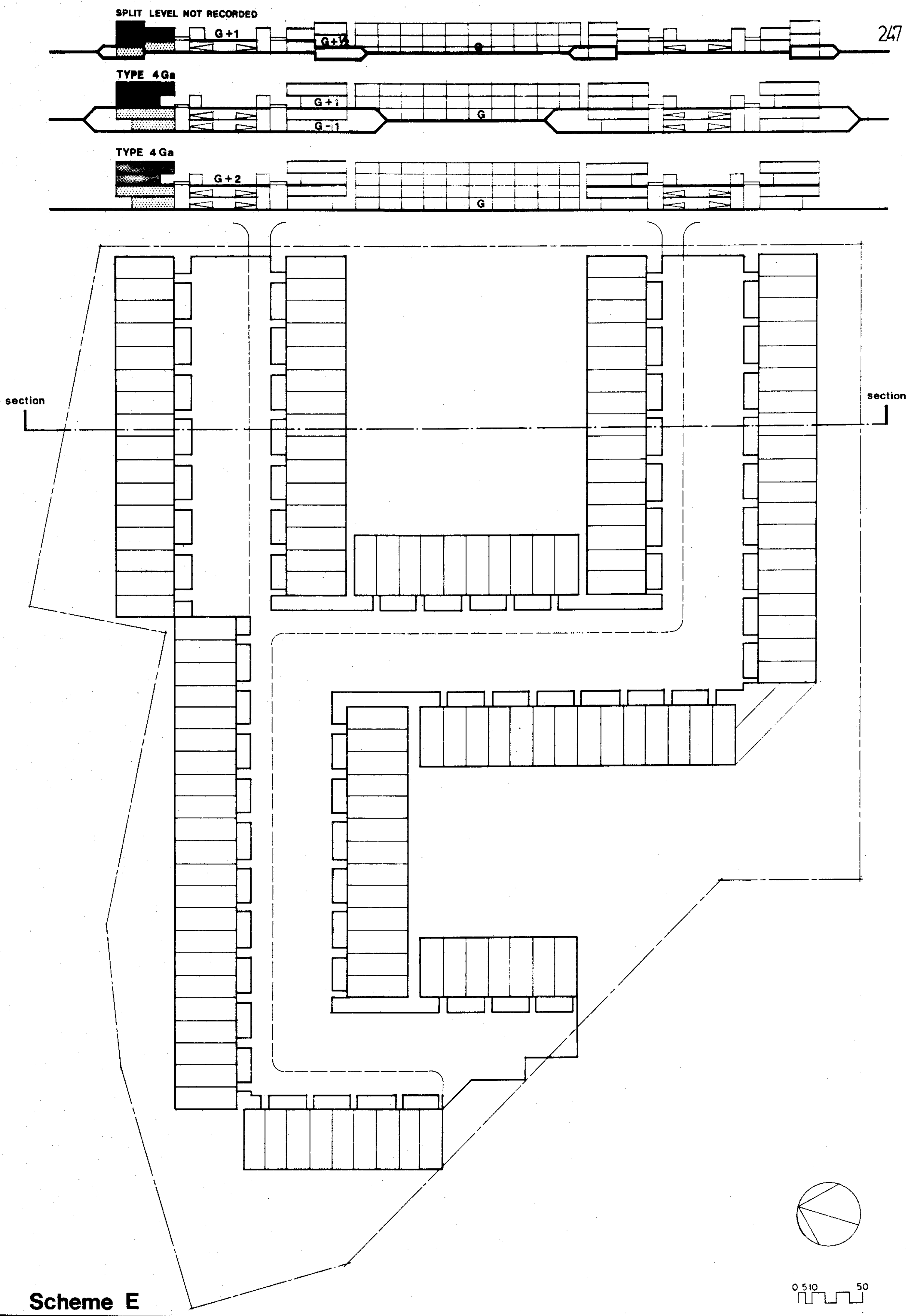
Scheme E should be compared to Scheme D. Scheme D has no parking structures, and therefore the height of the two units is kept 2 floors from grade and the automobile. Scheme E provides a parking shelter over the access road, and hence puts open space at each dwelling unit's level. As the automobile is separately housed, it can be accommodated in a structure which is cheaper than the dwelling structure, and allows a greater freedom in manipulating the dwelling plan.

SCHEME E - DATA SHEET 3 STOREYS

Interior living and sleeping space per dwelling unit (DU)	
2 Bedroom	1,008 sq. ft.
3 Bedroom	1,152 sq. ft.
Number of Units	280
2 Bedroom	140
3 Bedroom	140
4 Bedroom	0
Exterior personal space/DU	432 sq. ft.
Exterior shared space/DU	320 sq. ft.
Parking allowance/DU	120 sq. ft.
Street allowance/DU	120 sq. ft.
Building Height	3 storeys
Shared space ratio	.28
Density DU/Acre	32

SCHEME E - DATA SHEET 4 STOREYS

Interior living and sleeping space per dwelling unit (DU)	
3 Bedroom	1,152 sq. ft.
4 Bedroom	1,296 sq. ft.
Number of Units	360
2 Bedroom	0
3 Bedroom	180
4 Bedroom	180
Exterior personal space/DU	
3 Bedroom	432 sq. ft.
4 Bedroom	576 sq. ft.
Exterior shared space/DU	250 sq. ft.
Parking allowance/DU	360 sq. ft.
Street allowance/DU	180 sq. ft.
Building height	4 storeys
Shared space ratio	.22
Density DU/Acre	40


SPLIT LEVEL NOT RECORDED
G + 1
G + ½
G
TYPE 4 Ga
G + 1
G - 1
G
TYPE 4 Ga
G + 2
G
section
section
0 5 10
50

Scheme E

SCHEME F

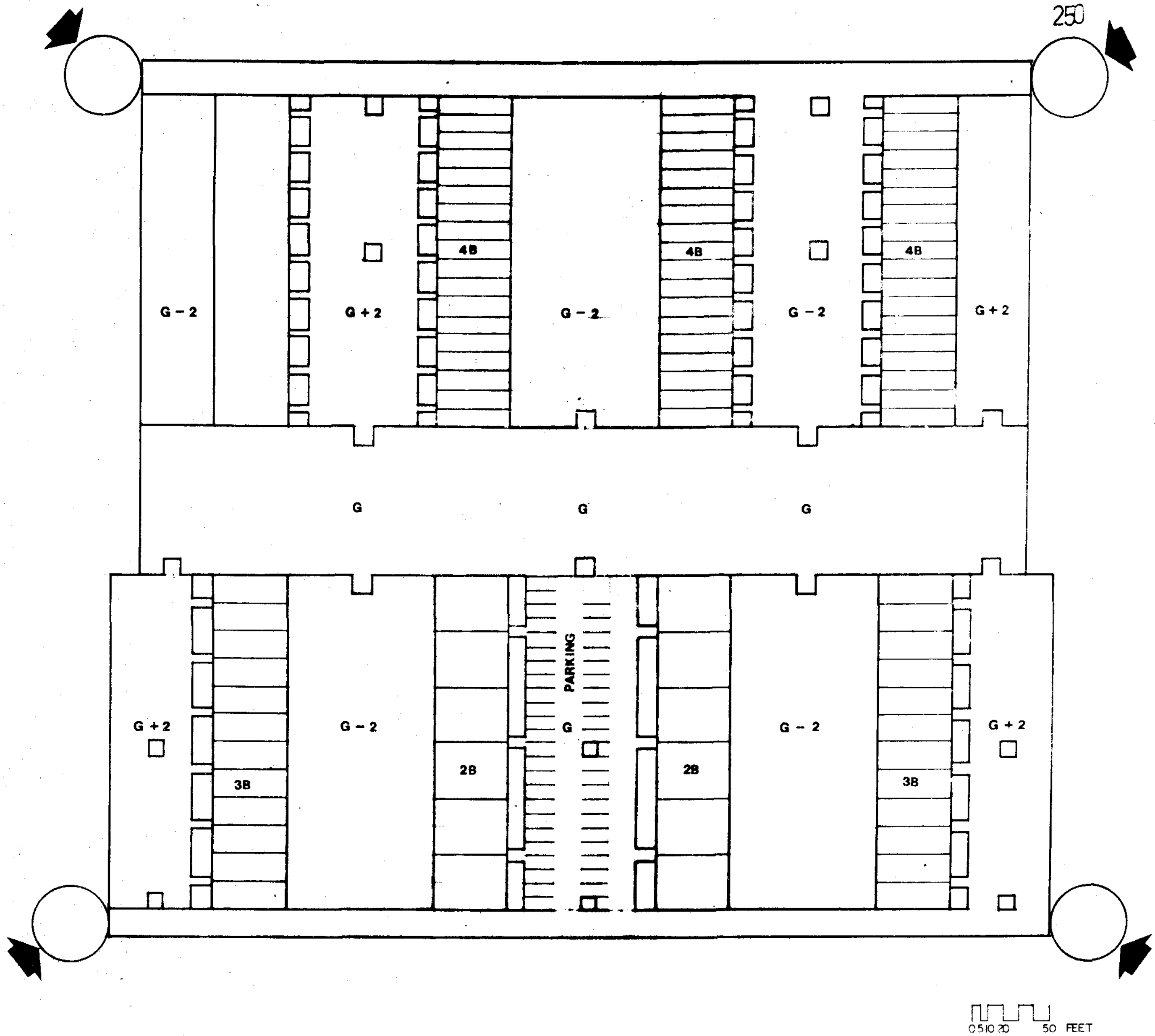
Scheme F is a medium rise (6 floors) scheme for which detailed information is available in the prototype study, previous page.

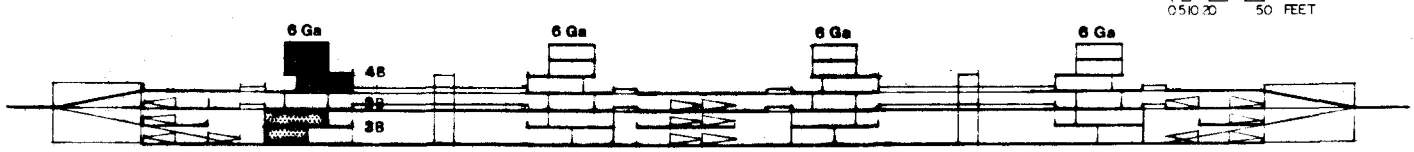
The scheme demonstrates the design and cost advantages of using the excavated land as nearby fill: The soil taken from G-2 and G+2 is deposited on G. No soil leaves the site. The consequence is that each unit is at one of the three new grade levels. The excavated area of G+2 is used as a parking structure. The roof of this parking structure forms the shared open space for the 4 bedroom units, and G-2 grade is used by the 3-bedroom units as shared space. G is shared as a middle ground for all units, and is at the level of the two bedroom units.

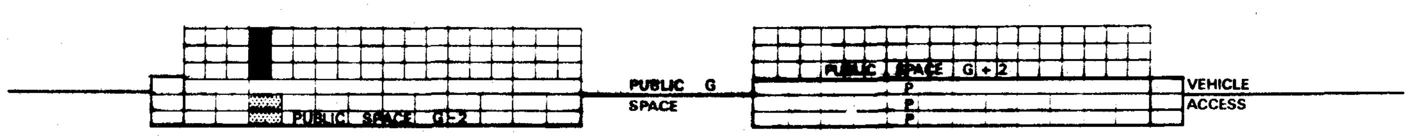
The distribution of the buildings is in rows served by culs de-sac.

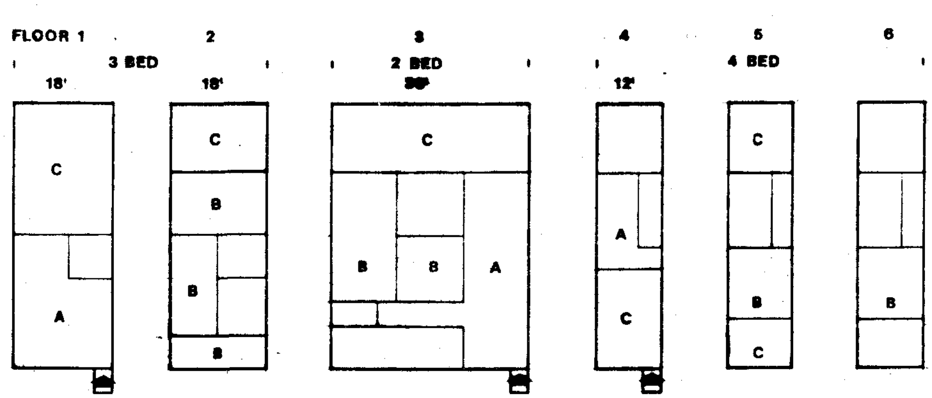
SCHEME F - DATA SHEET

Interior living and sleeping space per dwelling unit (DU)	
2 Bedroom	1,008 sq. ft.
3 Bedroom	1,152 sq. ft.
4 Bedroom	1,296 sq. ft.
Number of Units	312
2 Bedroom	0
3 Bedroom	104
4 Bedroom	208
Exterior personal space/DU	
3 Bedroom	432 sq. ft.
4 Bedroom	576 sq. ft.
Exterior shared space/DU	510 sq. ft.
Parking allowance/DU	420 sq. ft.
Street allowance/DU	150 sq. ft.
Building height	6 storeys
Shared space ratio	.42
Density DU/Acre	34.6



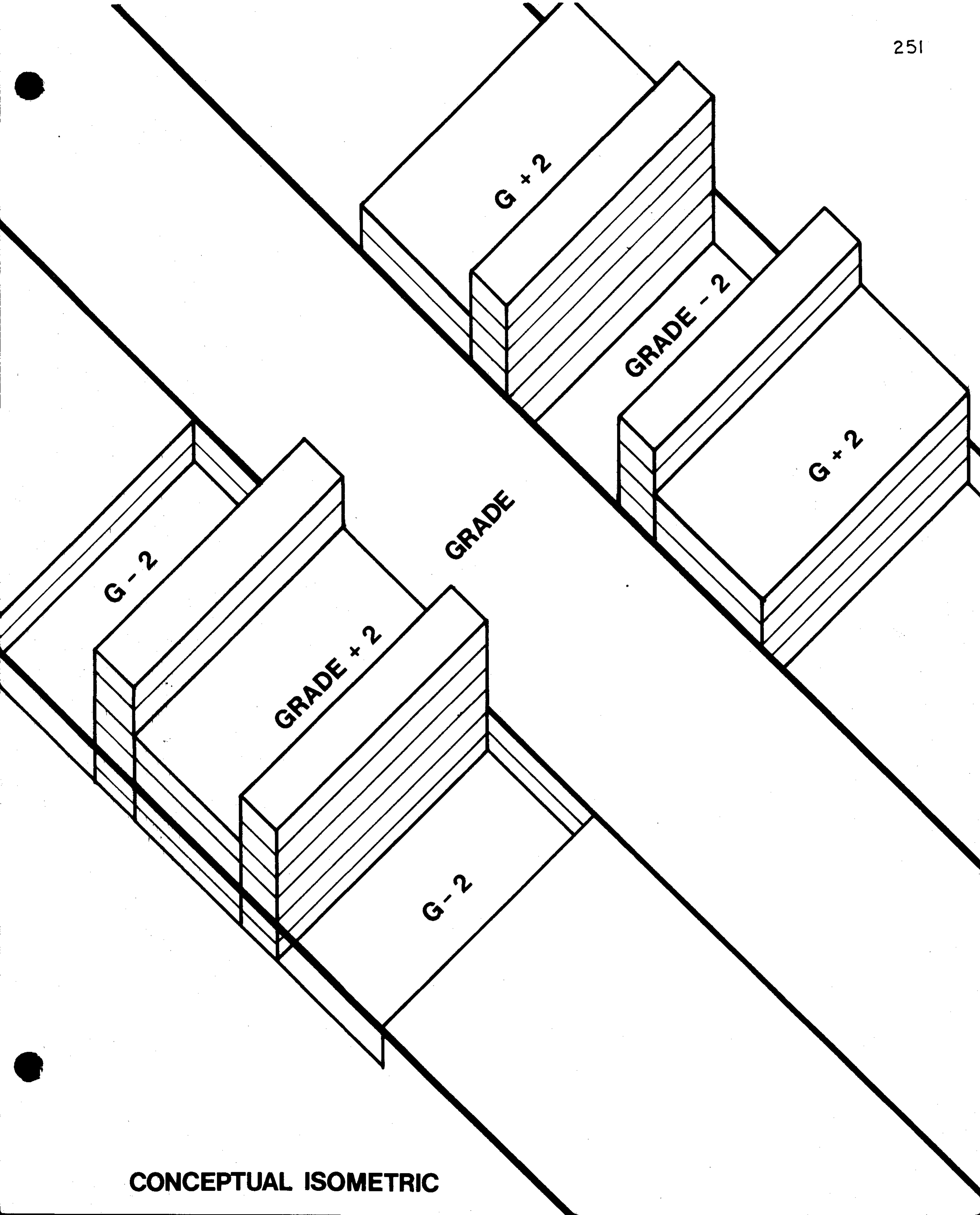




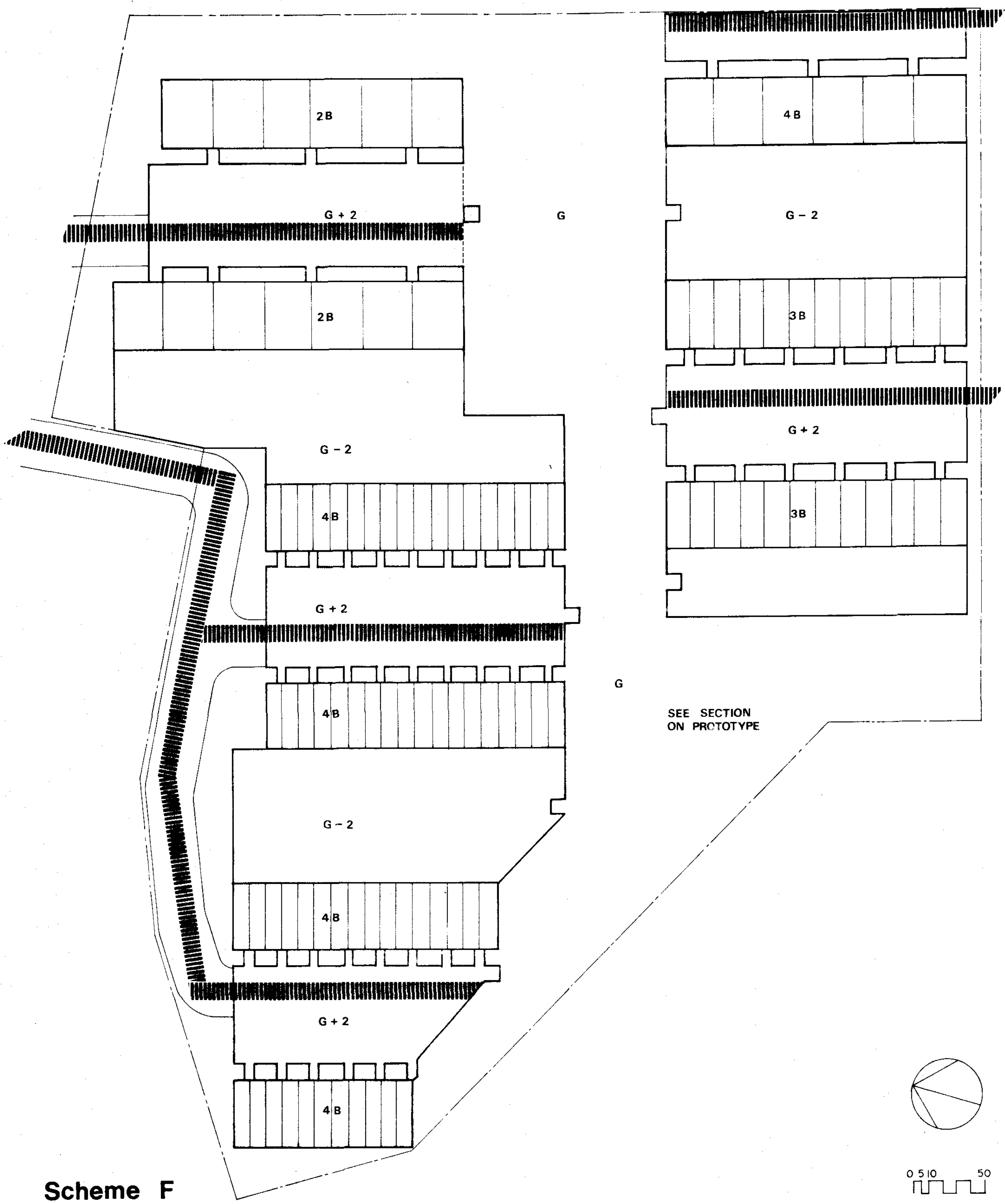


FOR APPLICATION
SEE SCHEME F

PROTOTYPE



CONCEPTUAL ISOMETRIC


2B
G + 2
G
2B
G – 2
4B
G + 2
4B
G – 2
4B
G + 2
4B
4B
G – 2
3B
G + 2
3B
G
SEE SECTION
ON PROTOTYPE
0 5 10 50

Scheme F

SCHEME G

Scheme G distributes the building on the perimeter of the site, and the shared and personal exterior space on the interior of the site. Traffic is kept to the outside, and pedestrian access to the ravine on the inside. A maximum dimension between units is achieved. The plan is divided into two, in order to demonstrate two alterantive building heights with the same coverage.

The scheme on the north-west section is 6 storeys in height, with a correspondingly higher parking structure in association with it. Thus no one need walk up more than one floor from the car to the dwelling unit. Personal exterior space is directly associated with each unit.

The scheme on the south-east section is 4 storeys in height and a correspondingly lower parking structure. The same amenities as those in the first scheme are maintained. There is, in addition, a larger shared space ratio for this scheme as the density is lower.

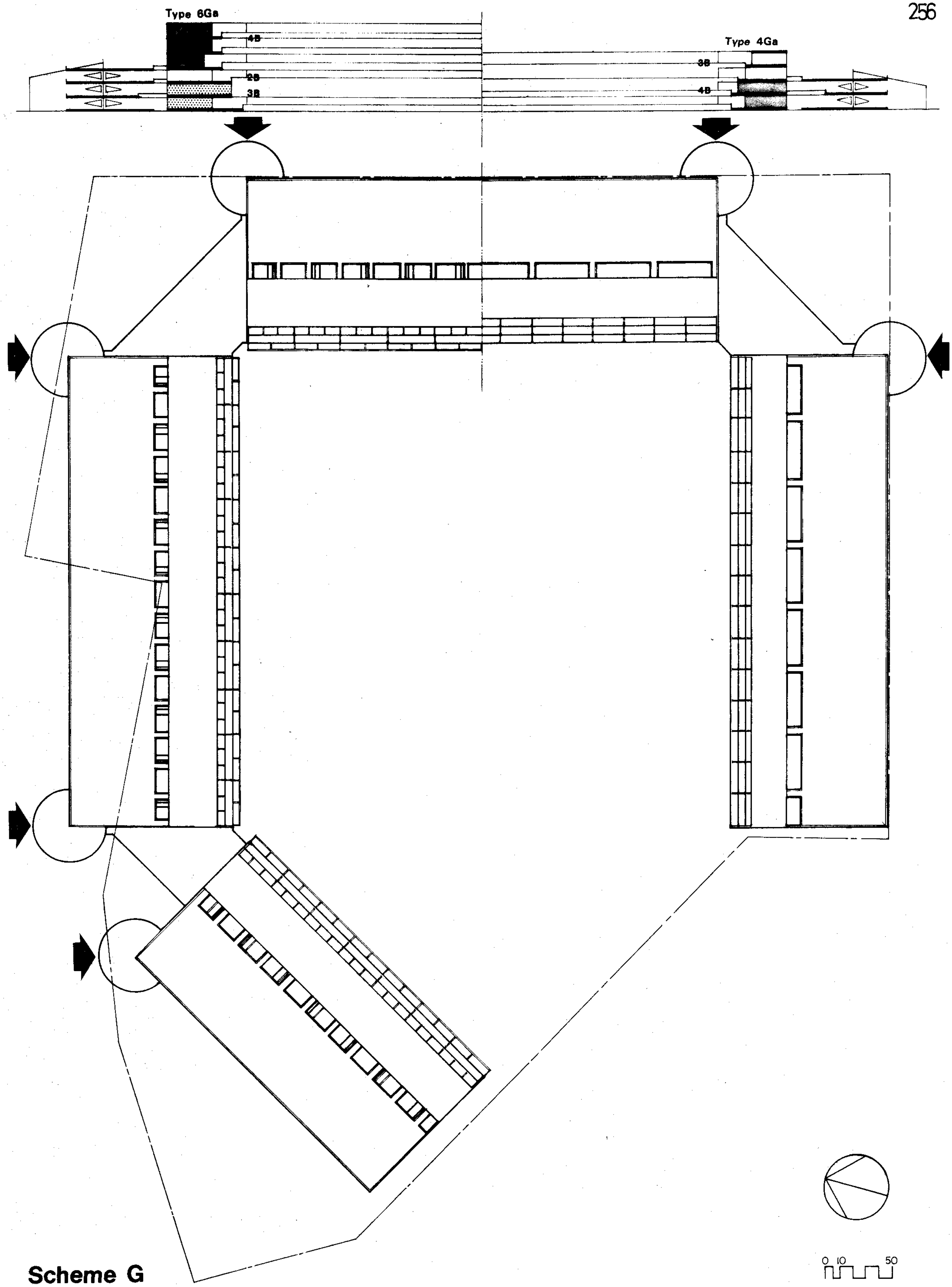
The generic group form of this building distribution is the row house.

SCHEME G - DATA SHEET 4 STOREYS

Interior living and sleeping space per dwelling unit (DU)	
3 Bedroom	1,152 sq. ft.
4 Bedroom	1,296 sq. ft.
Number of Units	110
2 Bedroom	0
3 Bedroom	55
4 Bedroom	55
Exterior personal space/DU	
3 Bedroom	432 sq. ft.
4 Bedroom	576 sq. ft.
Exterior shared space/DU	650 sq. ft.
Parking allowance/DU	440 sq. ft.
Street allowance/DU	240 sq. ft.
Building height	4 storeys
Shared space ratio	1.06
Density DU/Acre	12.2

SCHEME G - DATA SHEET 6 STOREYS

Interior living and sleeping space per dwelling unit (DU)	
2 Bedroom	1,008 sq. ft.
3 Bedroom	1,152 sq. ft.
4 Bedroom	1,296 sq. ft.
Number of Units	222
2 Bedroom	37
3 Bedroom	74
4 Bedroom	111
Exterior personal space/DU	
2 Bedroom	432 sq. ft.
3 Bedroom	432 sq. ft.
4 Bedroom	576 sq. ft.
Exterior shared space/DU	650 sq. ft.
Parking allowance/DU	720 sq. ft.
Street allowance/DU	360 sq. ft.
Building Height	6 storeys
Shared space ratio	.535
Density DU/Acre	24.7



Scheme G

SCHEME H

Scheme H is a modification of the prototype figure illustrated on the previous page. Both arrange dwelling units in a series of "squares". The squares contain parking structures. The roof of the parking structures are used as open space for the upper units, the grade used as open space for the lower.

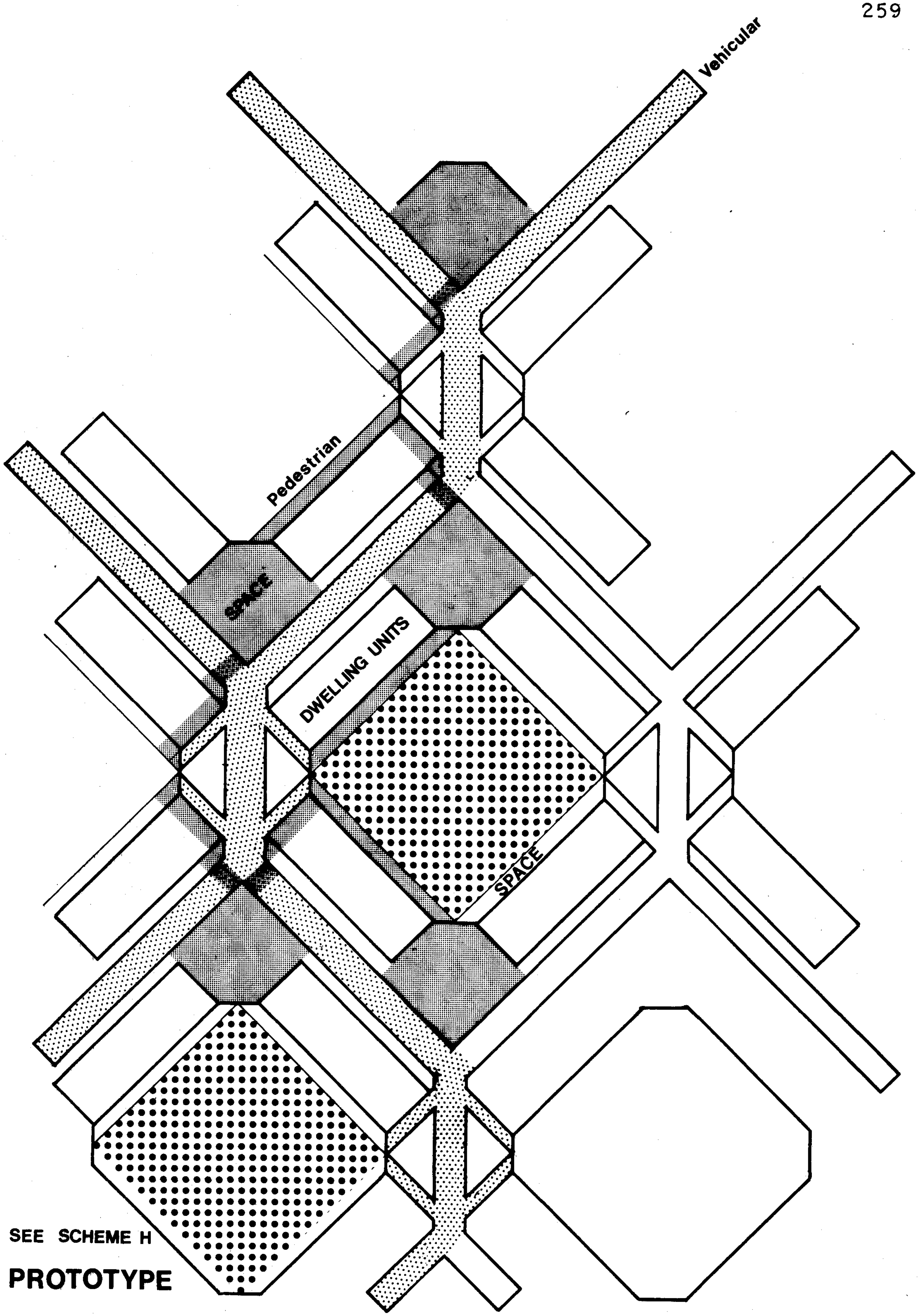
The parking structures, in addition, house the access routes for automobiles, thereby freeing more of the site for shared space.

Scheme H makes a large parking allowance (545 sq ft per dwelling unit) and has a high proportion of street to dwelling unit. The shared space ratio, is, however, high at .42 for the 26.8 dwelling units per acre. It is clear that this is achieved at some cost.

The prototype illustrates a dual movement system separating pedestrian from vehicle. This prototype is better applied in a larger site than Donwood Terrace where the number of intersections becomes disproportionate to the straight runs of road and where the vehicular volume is not large enough to require such a great degree of pedestrian-vehicular separation.

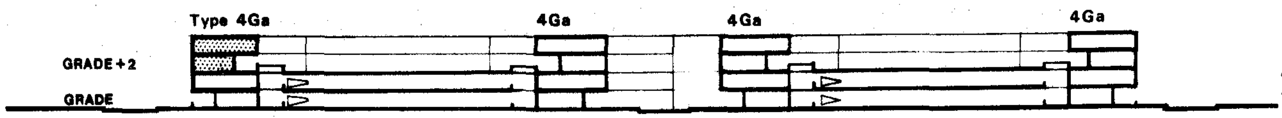
SCHEME H - DATA SHEET

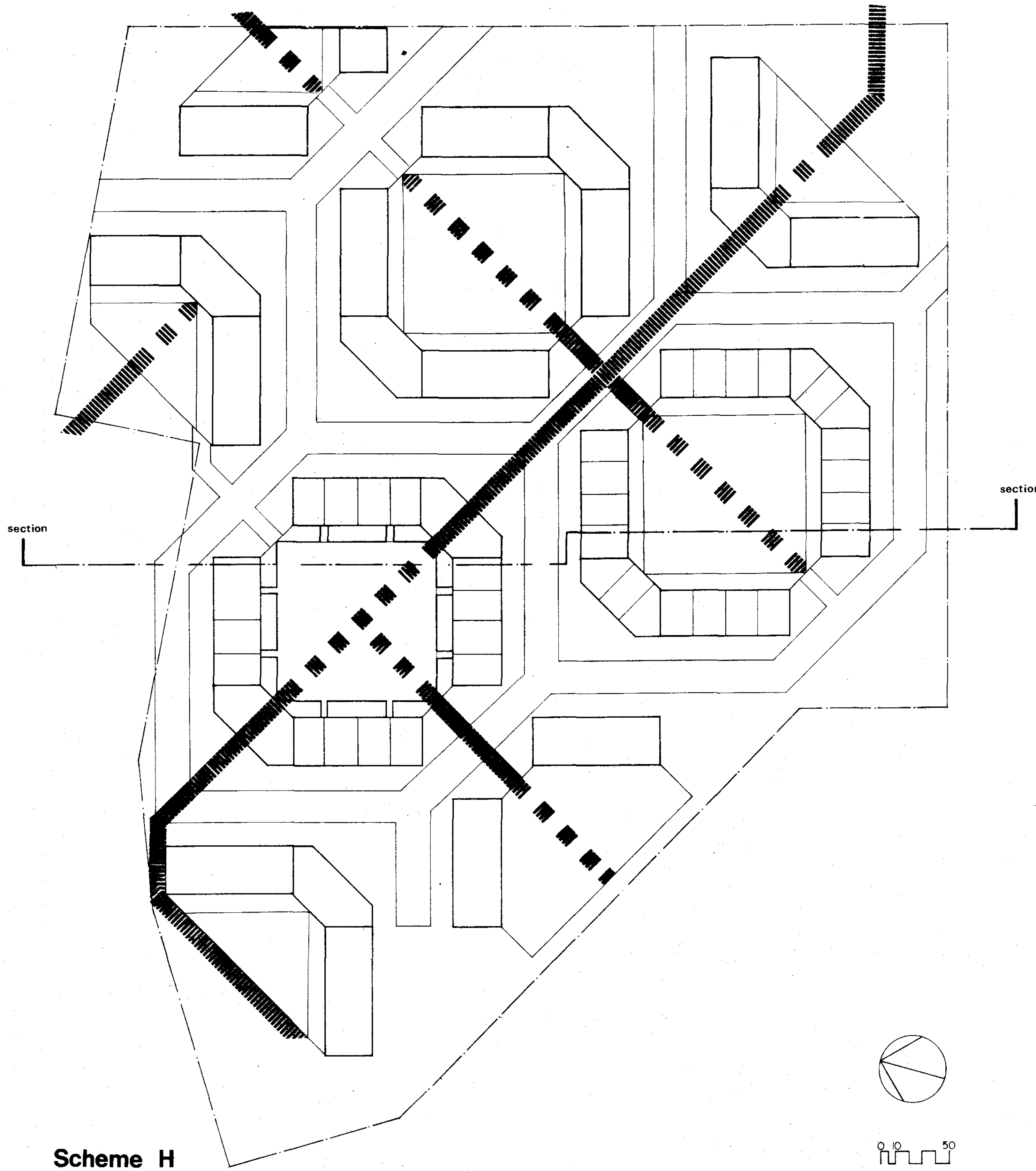
Interior living and sleeping space per dwelling unit (DU)	
3 Bedroom	1,152 sq. ft.
4 Bedroom	1,296 sq. ft.
Number of units	242
2 Bedroom	0
3 Bedroom	121
4 Bedroom	121
Exterior personal space/DU	
3 Bedroom	432 sq. ft.
4 Bedroom	576 sq. ft.
Exterior shared space/DU	545 sq. ft.
Parking allowance/DU	505 sq. ft.
Street allowance/DU	290 sq. ft.
Building height	4 storeys
Shared space ratio	.42
Density DU/Acre	26.8



SEE SCHEME H

PROTOTYPE





Scheme H

G. ZONING AND COST

This section of the study reveals the impact of current restraints of costs and zoning codes. The aspects dealt with are: zoning and the density ranges encouraged in each category of the Toronto zoning by-law; setback ordinances and their effect on the land use ratios used in this study; and a comparison of costs in some dwelling unit arrangements and the variables within these arrangements. (See Chapters 8 and 10)

(1) Zoning & Density Ranges

Zoning regulations are the most powerful existing factor governing density. Using Toronto Zoning Regulations, Fig. 11.62 illustrates probable densities in each zoning area, and densities possible by taking all the dwelling unit area requirements stipulated in this study into account. The figure also indicates the probable height of such structures for areas suggested in this study and illustrated in Fig. 11.02.

The column in Fig. 11.62 headed "Interpolated Density" makes size adjustments to each dwelling: for example norms in current use in Toronto today are considerably smaller than the acceptable dwelling unit sizes established in this study.

The Toronto Apartment Owners Association has stated that one and two bedroom unit apartments are the predominant forms of housing now being constructed. If the standards of dwelling size given by this study were to be constructed, the density, in terms of people per acre, would equal the density of people housed in the one and two bedroom apartment units. This is because a 600 sq ft two bedroom apartment usually houses two people. This study's dwelling unit of 1152 interior square feet, designed for families, probably houses four people. Thus the density of people per acre would be equivalent: 50 four person units of 1152 sq ft each produce a total of 57,600 sq ft which would house 200 people. The same square feet total, divided by 600 sq ft produces 96 units. Using a two persons per 600 sq ft unit, there will only be 192 people per acre.

The reasons for increasing the units rather than the people per acre is obvious - the extra space required in family dwellings does not yield proportionately higher revenues than smaller one and two-bedroom apartments.

Example:

Bachelor Apartment of 300 SF @ $80.00/month	$.27 rent/SF
2 Bedroom apartment of 524 SF @ $120./month	.23 rent/SF
3 Bedroom (study standard) of 1152 SF @ $230. /mo.	.22 rent/SF

It should be noted that this smallness in size of apartment units was a high ranking dissatisfaction expressed by those interviewed in the study sampling.

Fig. 11.62 TORONTO PLANNING ZONES - EXTRACTED DATA				
ZONING DISTRICT	AREA ALLOWANCE	PROBABLE EXISTING DENSITY	INTERPOLATED DENSITY	PROBABLE HEIGHT - EXISTING
R.1	.35x land area	10 units/acre	7 units/acre	1 storey
R.1A	.6	24	12	3
R.2	.6	24	12	3
R.3	1.0	40	20	5
R.4	2.0	80	40	9
R.4A	2.5	100	50	12

CHARACTER OF EACH ZONE
R.1-Single family detached
R.1A-Single family detached, duplex, apartment
R.2- Single family detached, duplex, apartment
R.3-Duplex, apartment, schools, colleges, prof. offices
R.4-Duplex, apts., schools, offices, stores, etc.
R.4A-Apartment, stores, offices

While it is understandable that developers wish to maximize their profit by building the greatest number of units, it should also be noted that neither do the present zoning codes encourage the types of dwellings in demand by the sector of the population studied in this research, nor do they encourage the dwelling types that maximize density in low rise construction as revealed in this study (Fig. 11.20). A description of the effects of zoning regulations can be found in Chapter 8.

(2) Setback

Setback requirements greatly restrict building location For example, on a suburban lot of 60'- 0" width, the front and sideyard setbacks often leave only a 10'- 0" variation possible in house location.

Setback requirements also mean that only one possible distribution of building space is allowed. This is to use the rectangular, isolated structure positioned near the centre of the site. Of course, setbacks by their strict location directives also dictate density. Thus height becomes the only salient variable, and this too is often restricted.

The analyses of the Martin-March work, Chapter 7, show that equivalent, and increased densities,may be obtained by perimeter distribution or repeated courthousing. These alternatives also allow other considerations relevant to social needs, such as useful outdoor space, orientation, and various forms of privacy, to be taken into account.

If we take Toronto codes as an example, setback regulations can take up to 62% of the site area for ½ acre lots, 41% for one acre lots, 33% on two acre lots, and 31% on three acre lots. If we use the shared space ratio taken as standard in this study, over 40% of the site is required for public shared space. This means that the activities accommodated by exterior shared space must probably take place on areas adjacent to streets and buildings. This location of spaces is not ideal for these activities as pointed out elsewhere. (Chapter 4).

It will also be seen that the codes favour large developments by providing bonuses to those who assemble large tracts of land. This does not qualify the use to which open space is put, but creates fragmentary development. Instead of tying increments of development into a larger community whole, it handicaps the small developer in his provision of adequate amenities.

The survey (Appendix A) covered families in the $7,000 - $9,000. annual income bracket. Many requirements for these families, in terms of housing, are, it may be assumed, similar to those in other income brackets, but the burden of housing costs are higher for this group than for higher income groups. Cost comparisons between different forms of housing is therefore in order: in the following figures (11.63 - 11.72) we have compared the costs of houses used as a theoretical base for this study with (a) each other; (b) single family detached houses; (c) multiple family housing in current use.

There are two categories of cost. The first, constant cost factors, include appliance and mechanical components. The second, variable cost factors, are affected by configuration: an extended perimeter as a ratio of floor area, a plan arrangement which extends partitions, and openings as a ratio of floor area increases costs.

The theoretical examples shown in Figures 11.64 - 11.71 are generalized house types, and not definitive design solutions. They have been formed by arranging various modules of interior and exterior space.

It can be seen that the same floor area can be distributed in different ways, for example, as a square or as an elongated rectangle. While the roof and floor costs can thus also be considered as constants, differences will occur in the amount of perimeter wall for the square or the rectangular plan. It has been found, however,[2] that no appreciable costs are added to the construction until a 3:1 length to width plan ratio is exceeded.

---

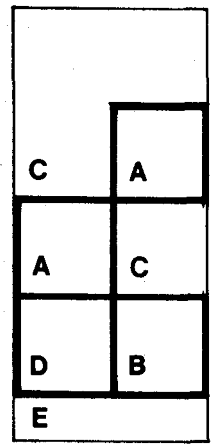
[2] Helyar, Vermeulen, Rae & Mauchan, Quantity Surveyors

Fig.11.63 COST BREAKDOWN - PLAN "a"

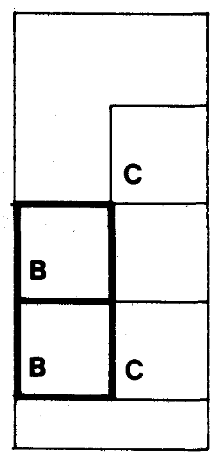
Area	Quantity	Unit Cost	Cost	%-Total
CONSTANTS:			11276	46%
Area:			5640	23%
Slab on grade-house	512	.45	230	
Suspended floor slab	1024	.95	973	
Suspended roof slab	768	1.10	845	
Roof finish	512	1.80	922	
Trafficable deck	256	2.55	653	
V.A.T. floor finish	152	.41	62	
Carpet floor finish	1384	.70	969	
Ceiling finish-house	1536	.55	845	
Patio	256	.55	141	
Packages:			5636	23%
Stairs	1	120	240	
Washrooms	2	94	188	
Roof hatch	1		107	
Electrical system	1		750	
Mechanical system	1		1250	
Kitchen	1		840	
Utility Service:		2261	2261	10%
VARIABLES:			12415	51%
Perimeter:			8498	35%
Foundations	136	6.75	918	
Exterior walls	2527	2.50	6317	
Finish - exterior walls	2527	.50	1263	
Plan arrangement:			3917	16%
Windows	234	4.00	936	
Doors at exterior	63	4.50	284	
Interior partitions	1304	1.20	1565	
Interior doors	210	3.20	672	
Closet doors	180	2.00	360	
Grading			100	
SUBSIDIARY ELEMENTS:			1179	4.85%
Garage:			1092	4.5%
Slab on grade-garage	256	.52	133	
Garage door	56	2.15	120	
Steel beam at garage	28	4.50	126	
Pipe col. & footings			5	
Ceiling finish at garage	256	1.90	486	
Floor finish at garage	256	.08	20	
Garage partitions	144	1.40	202	
Pavement on site:			87	.35%
Asphalt paving	40	.40	16	
Sod	248	.08	20	
Sidewalk	88	.58	51	
Deduct for party walls	480 SF	$1.20	$ 576	2.2%
TOTAL			$24294	

Fig. 11.64 2 STOREY DWELLING
16' MODULAR ALLOTMENTS

PLAN
a



FIRST FLOOR PLAN



SECOND FLOOR PLAN

Fig. COLLECTED DATA
& COST ESTIMATES

GENERAL DATA

No. of Bdrms.	4
Gross fl. area	1696 SF
Land req'd(dwlg)	2304
Shared space	2544

COST DATA

Const. cost	23733
Cost/SF $13.95	
Land cost	12120
Total cost	$35853

COST BREAKDOWN	%	%
Constant		38
Area	26	
Packages	12	
Variable		49
Perimeter	35	
Layout	13.5	
Subsid. elem.		6.1
Garage	5.6	
Paving on site	.4	
Util. Services		10

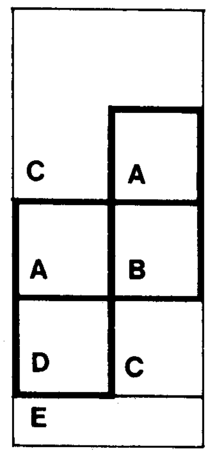
VARIABLES

Am't of perim. walls	1920 SF
Am't of party walls	960 SF

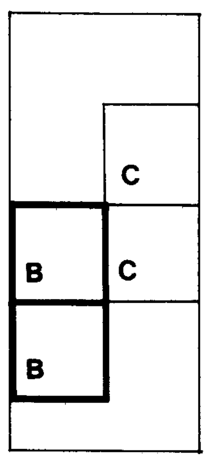
Fig.11.65 2 STOREY DWELLING 16' MODULAR ALLOTMENTS

PLAN

b



FIRST FLOOR PLAN



SECOND FLOOR PLAN

Fig. COLLECTED DATA & COST ESTIMATES

GENERAL DATA		
No. of Bdrms.	4	
Gross fl. area	1648	SF
Land req'd(dwlg)	2304	
Shared space	2472	

COST DATA	
Const. cost	23103
Cost/SF $14.02	
Land cost	11940
Total cost	$35043

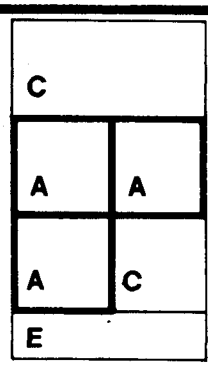
COST BREAKDOWN	%	%
Constant		38
Area	26	
Packages	12	
Variable		46
Perimeter	33	
Layout	13.5	
Subsid. elem.		5.5
Garage	5	
Paving on site	.5	
Util. Services		10

VARIABLES		
Am't of perim. walls	1600	SF
Am't of party walls	960	SF

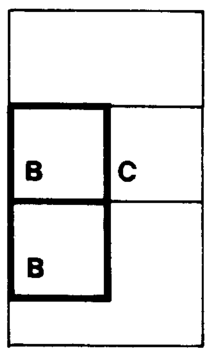
Fig.11.66 3 STOREY DWELLING
16' MODULAR ALLOTMENTS

PLAN

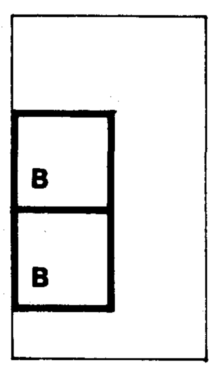
C



FIRST FLOOR PLAN



SECOND FLOOR PLAN



THIRD FLOOR PLAN

Fig. COLLECTED DATA & COST ESTIMATES

GENERAL DATA	
No. of bdrms.	4
Gross fl. area	1792 SF
Land req'd(dwlg)	1792
Shared space	896

COST DATA	
Const. cost	24294
Cost/SF $13.55	
Land cost	6720
Total cost	$31014

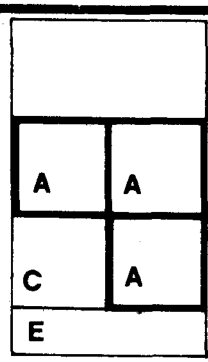
COST BREAKDOWN	%	%
Constant		46
Area	23	
Packages	23	
Variable		51
Perimeter	35	
Layout	16	
Subsid. elem.		5
Garage	4.5	
Paving on site	.5	
Util. Services		10

VARIABLES	
Am't of perim. walls	2084 SF
Am't of party walls	1120 SF

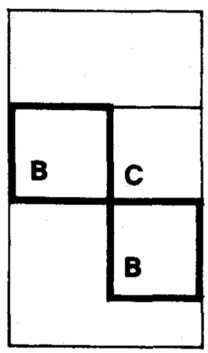
Fig.11.67	3 STOREY DWELLING 16' MODULAR ALLOTMENTS

PLAN

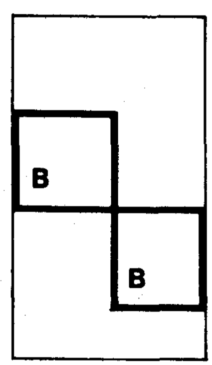
d



FIRST FLOOR PLAN



SECOND FLOOR PLAN



THIRD FLOOR PLAN

Fig.	COLLECTED DATA & COST ESTIMATES

GENERAL DATA

No. of bdrms.	4
Gross fl. area	1936 SF
Land req'd(dwlg)	1792
Shared space	968

COST DATA

Const. cost	26512
Cost/SF $13.99	
Land cost	6900
Total cost	$33412

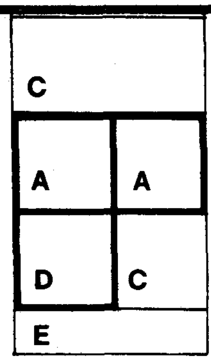
COST BREAKDOWN	%	%
Constant		35
Area	22.5	
Packages	12.5	
Variable		51.5
Perimeter	38	
Layout	13.5	
Subsid. elem.		5.5
Garage	5.2	
Paving on site	.3	
Util. Services		10

VARIABLES

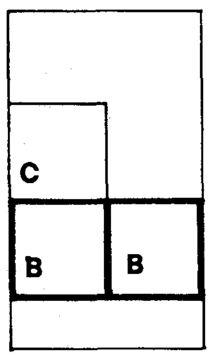
Am't of perim. walls	2820 SF
Am't of party walls	1120 SF

Fig.11.68 3 STOREY DWELLING
16' MODULAR ALLOTMENTS

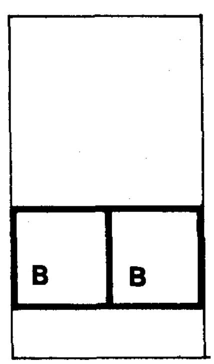
PLAN
e



FIRST FLOOR PLAN



SECOND FLOOR PLAN



THIRD FLOOR PLAN

Fig. COLLECTED DATA
& COST ESTIMATES

GENERAL DATA		
No. of bdrms.	4	
Gross fl. area	1792	SF
Land req'd(dwlg)	1792	
Shared space	896	

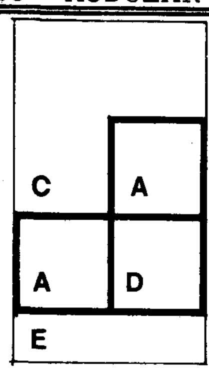
COST DATA	
Const. cost	24264
Cost/SF $13.55	
Land cost	6720
Total cost	$30984

COST BREAKDOWN	%	%
Constant		41
Area	23	
Packages	18	
Variable		51
Perimeter	35	
Layout	15.5	
Subsid. elem.		4.8
Garage	4.5	
Paving on site	.3	
Util. Services		10

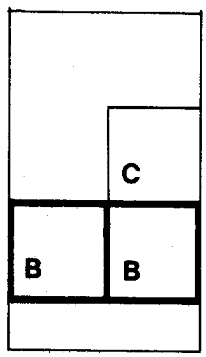
VARIABLES	
Am't of perim. walls	2050 SF
Am't of party walls	1120 SF

Fig.11.69 3 STOREY DWELLING
16' MODULAR ALLOTMENTS

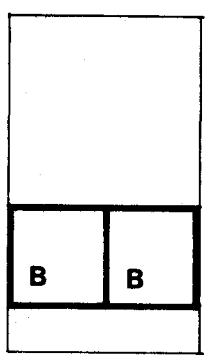
PLAN
f



FIRST FLOOR PLAN



SECOND FLOOR PLAN



THIRD FLOOR PLAN

Fig. COLLECTED DATA
& COST ESTIMATES

GENERAL DATA

No. of bdrms.	4
Gross fl. area	1792 SF
Land req'd(dwlg)	1792
Shared space	896

COST DATA

Const. cost	24354
Cost/SF $13.60	
Land cost	6720
Total cost	$31074

COST BREAKDOWN	%	%
Constant		37
Area	23.5	
Packages	14	
Variables		51.5
Perimeter	35	
Layout	17	
Subsid. elem.		4.5
Garage	4.1	
Paving on site	.3	
Util. Services		10

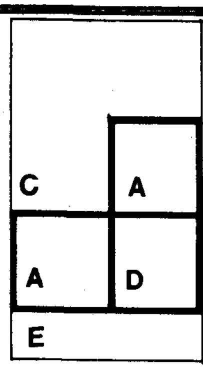
VARIABLES

Am't of perim. walls	2050 SF
Am't of party walls	1120 SF

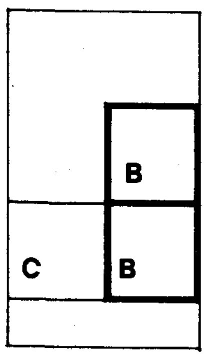
Fig.11.70 3 STOREY DWELLING 16' MODULAR ALLOTMENTS

PLAN

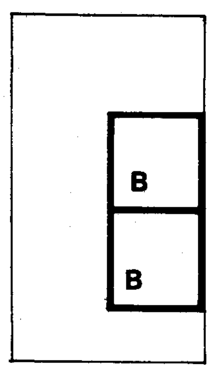
g



FIRST FLOOR PLAN



SECOND FLOOR PLAN



THIRD FLOOR PLAN

Fig. COLLECTED DATA & COST ESTIMATES

GENERAL DATA	
No. of bdrms.	4
Gross fl. area	1792 SF
Land req'd(dwlg)	1792
Shared space	896

COST DATA	
Const. cost	24359
Cost/SF	$13.60
Land cost	6720
Total cost	$31079

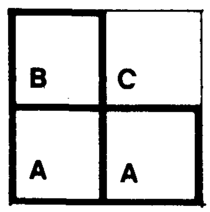
COST BREAKDOWN	%	%
Constant		37
Area	23.5	
Packages	14	
Variables		51.5
Perimeter	35	
Layout	17	
Subsid. elem.		4.5
Garage	4.1	
Paving on site	.3	
Util. Services		10

VARIABLES	
Am't of perim. walls	2050 SF
Am't of party walls	1120 SF

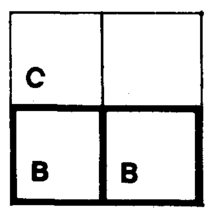
Fig.11.71 2 STOREY DWELLING
16' MODULAR ALLOTMENTS

PLAN

h



FIRST FLOOR PLAN



SECOND FLOOR PLAN

Fig. COLLECTED DATA & COST ESTIMATES

GENERAL DATA

No. of bdrms.	3
Gross fl. area	1325 SF
Land req'd(dwlg)	1024
Shared space	1988*

COST DATA

Const. cost	19265
Cost/SF $14.55	
Land cost	7530
Total cost	$26795

COST BREAKDOWN	%	%
Constant		43
Area	28	
Packages	15.5	
Variable		56
Perimeter	36	
Layout	20	
Subsid. elem.		.29
Garage	-	
Paving on site	-	
Util. Services		-

VARIABLES

Am't of perim. walls	1440 SF
Am't of party walls	960 SF

* or less in multi-level stack

Fig. 11.72 COMPARATIVE TOTAL COSTS (1)		
	CONST. COST/SF	COST/DU INC. LAND
Avg SFD, Toronto/70	$ 14.75 (2)	$34,200. (3)
Avg apt unit, Tor/70 (4)	11.60	-
Dwelling Type a	13.95	35,853.
" " b	14.02	35,043.
" " c	13.55	31,014.
" " d	13.70	33,412.
" " e	13.55	30,984.
" " f	13.60	31,074.
" " g	13.60	31,079.
" " h	14.55	26,795. (5)

(1) Figures by the Toronto Real Estate Board for average apartment and house prices in Toronto.
(2) Cost given is for "speculative NHA" housing (1200 SF); "superior quality" price per SF (1970) is $16.80.
(3) Based on $2.50 per SF land price and on 60' x 110' building lot.
(4) Figure given is for two 10 storey apartments; over 10 storeys, cost per SF is $14.50.
(5) Does not include street allowance, auto parking allowance.

H. GENERATING A HOUSING SYSTEM

It is clear that a wide variety of module combinations is possible to form the dwelling unit, and that an almost equally wide variety of dwelling unit combinations are possible to form horizontal and/or vertical unit groupings.

If desired characteristics can be ascribed to the different categories of modules, and constraints placed upon grouping alternatives, it becomes possible to program a generating system that would rapidly consider and select acceptable alternatives and present these in ranked order.

This program would be the basis for dealing with the complexity of the many alternatives possible. With the aid of the electronic computer, the rules and parts (requirements and modules) become the tool for exploring, testing and evaluating a great number of arrangements in order to arrive at acceptable land use and density solutions.

It must be stressed that the rules and parts, or requirements and modules, are still the important ingredients. These are only as good as the information upon which they are based. This study has attempted to extract from social surveys such information. That this information can be improved there is little doubt, however, the system for using such information is a valid one.

"In any design problem, certain requirements have to be met by the designer or architect. The interaction between individual requirements makes it difficult to fulfill them all. When these requirements are few, as in the design of a simple product, the solution remains readily within the reach of the designer's immediate ability. But how does he proceed when confronted with a complex problem ..... ?" [3]

"It appears that the clue to intelligent behaviour, whether of men or of machines, is highly selective search, the drastic pruning of the tree of possibilities explored. For a computer to behave intelligently it must search problem mazes in a highly selective way, exploring paths relatively fertile with solutions and ignoring paths relatively sterile". [4]

It is well understood that housing covers many fields and embraces a wide range of influences. The following pages are confined, however, to (a) generating the units, (b) generating the horizontal grouping of these units, (c) generating the vertical grouping (stacking) of the units.

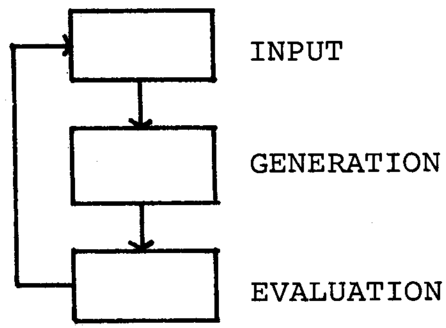
Further, the rules and parts are confined to the findings of this study. However, in all three generation cycles, the steps shown in Fig. 11.73 must be taken.

---

[3] Computer Augmented Design; A Case History in Architecture; by Bierstone, Edward and Bernhaltz, Allen (Design Quarterly P. 41 66-67)

[4] Artificial Intelligence; Bierstone, Edward and Bernhaltz, Allen; Computer Augmented Design; A Case History in Architecture (Design Quarterly, P. 6 - 7.

Fig.11.73 TYPICAL CYCLE IN COMPUTER OPERATION



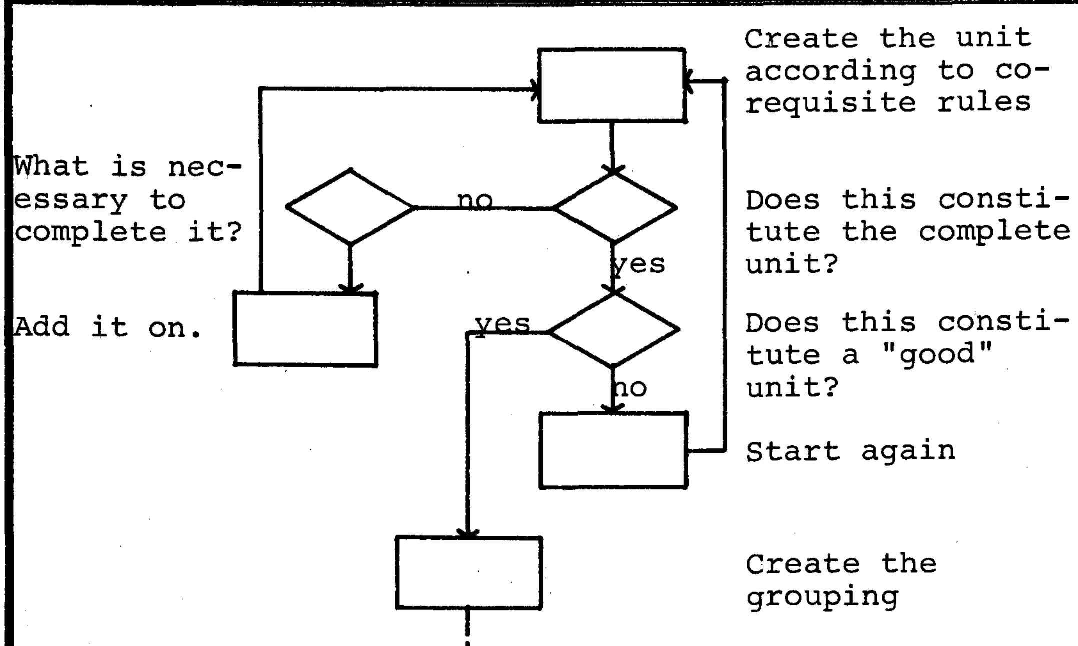
The above illustration represents the cyclical process within each stage of the program for a generating system. It contains both the basic generating system and the practical limitations that will be placed on the generating operation.

Figure 11.74 is a more detailed description of the third (evaluation) step shown in Figure 11.73.

The evaluation process is broken down into two forms. The first is a process which tests the validity of a generated solution. This process assures that all the rules have been applied.

The second is a process which judges whether a solution is one which satisfied all the rules (including additional, evaluative limitations). This step can conceivably rank in order of priority the solutions as they meet the rules and limitations.

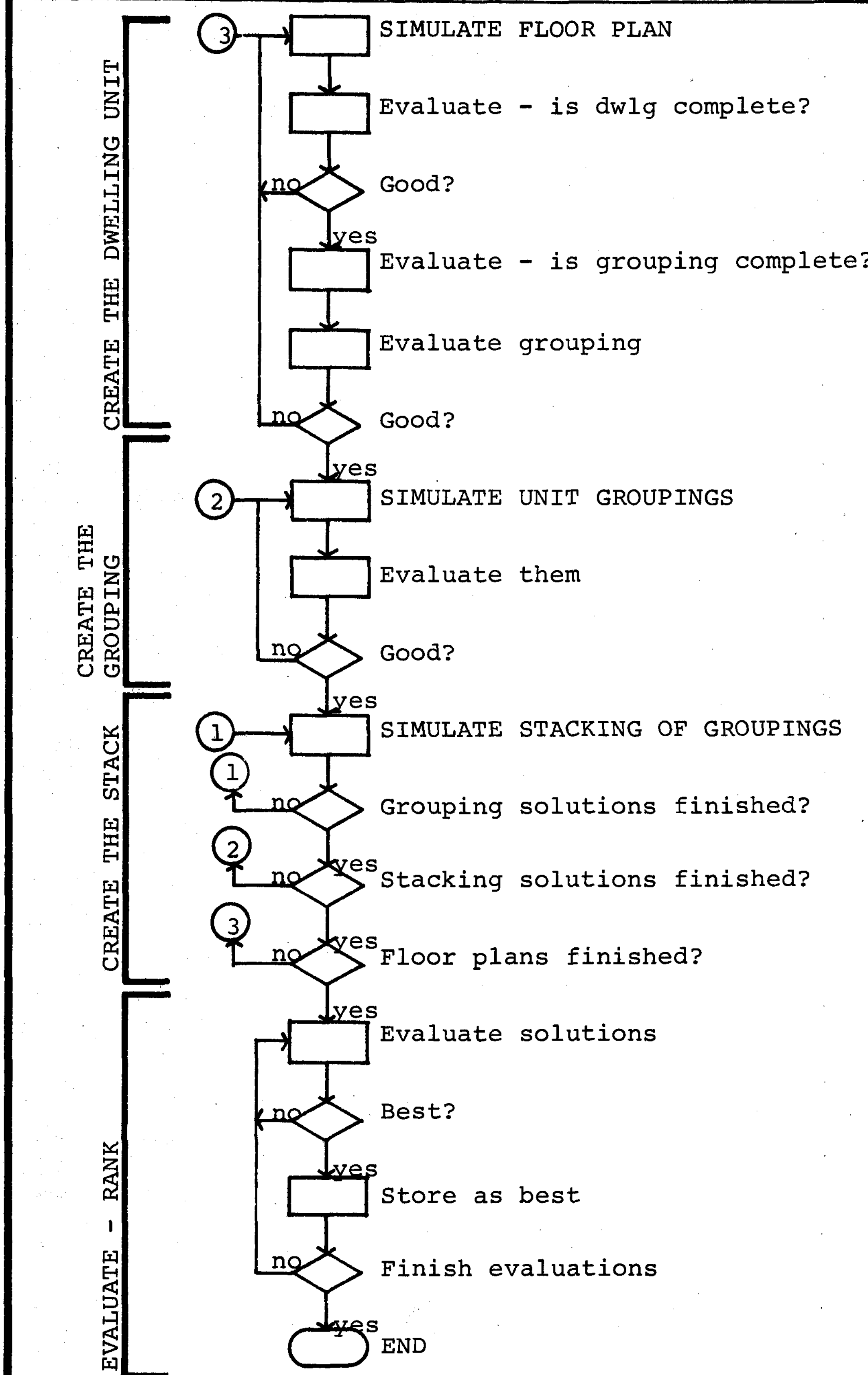
Fig.11.74 DETAIL OF EVALUATION OPERATION



Evaluative process is built into program to eliminate unuseful solutions and to speed up progress towards our goal of complete and feasible alternate solutions.

The previous pages of this chapter generalized the steps to be taken in order to generate a housing system. The following outline, within the confines of the study, is a more particular description of the steps to be taken in generating a such system.

Fig.11.75 OUTLINE OF COMPUTER PROGRAM FOR STACKED DWELLING UNITS



PROGRAM OUTLINE

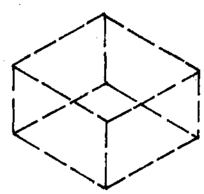
(1) Input - Dwelling Unit Cycle.

a. Proportion grid (3 dimensional):

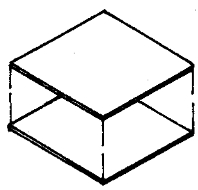
square,
rectangular,
non grid positions, etc.

b. List Module Types and Assign Names:

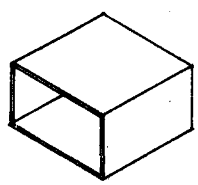
Fig.11.76 CATALOGUE OF PARTS FOR THE GENERATING SYSTEM PROGRAM



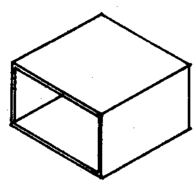
Open module
256 SF
LAND USE ZONE "F"



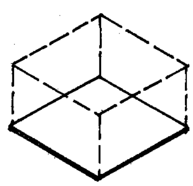
Access module
256 SF
LAND USE ZONE "E"



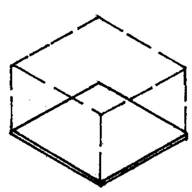
2 Bedroom module
256 SF
LAND USE ZONE "B"



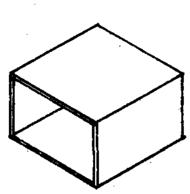
Master bedroom module
256 SF
LAND USE ZONE "B"



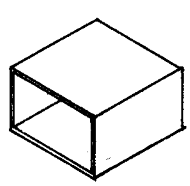
Terrace-or-balcony module
256 SF
LAND USE ZONE "C"



Terrace module
256 SF
LAND USE ZONE "C"



Dining-kitchen module
256 SF
LAND USE ZONE "A"



Living area module
256 SF
LAND USE ZONE "A"

c. Read Interface Matric of Horizontal Module Fits:

(The example input in Fig. 11.77 is for a 16-foot square grid containing 3-bedroom dwellings and 2 modules of exterior space).

Fig. 11.77 HORIZONTAL INTERFACE MATRIX OF DWELLING FITS WITHIN THE UNIT

	Living	Dining Kitchen	Terrace	Terrace-Balcony	M. Bedroom	2 Bedrooms	Access	Open
Open	0	0	+1	0	0	0	+1	0
Access	0	0	-1	-1	0	0		
2 Bedrooms	0	0	0	0	0			
M. Bedroom	0	0	0	0				
Terrace-Balcony	0	0	0					
Terrace	+1	0						
Dining Kitchen	+1							
Living								

LEGEND: -1 Unacceptable fit
0 Acceptable fit
+1 Necessary fit

d. Read Interface Matrix of Vertical Module fits.

(The example below is for vertical relationships within the dwelling unit, between first floor and second floor).

Fig.11.78 VERTICAL INTERFACE MATRIX OF DWELLING FITS WITHIN THE UNIT

ABOVE / BELOW	Living	Dining Kitchen	Terrace	Terrace-Balcony	M. Bedroom	2 Bedrooms	Access	Open
Open	0	0	+1	0	0	0	0	
Access	0	0	-1	0	0	0		0
2 Bedrooms	0	0	-1	0	0		0	0
M. Bedroom	0	0	-1	0		0	0	0
Terrace-Balcony	0	0	-1		0	0	0	0
Terrace	-1	-1		-1	0	0	0	0
Dining Kitchen	-1		-1	-1	0	0	0	0
Living		-1	-1	-1	0	0	0	0

LEGEND: -1 Unacceptable fit
0 Acceptable fit
+1 Necessary fit

e. Other Input for Generating or Evaluating:

Limitations on outside configuration of the dwelling unit.
Limitations on orientation to sunlight, view.
Limitations on number of floors per dwelling.
Limitations on voids within the bounds of the dwelling.
Density level desired.

(2) Evaluate Dwelling Unit Cycle.

a. Is the dwelling complete?

b. Is the density level satisfied? (Typical evaluation question from above list).

(3) Input - Grouping Cycle:

a. Read dwellings from previous cycle.

b. Read interface matrix of horizontal fits between dwelling units.

(The examples input below is for the previous 3-bedroom units with 2 exterior modules each).

Fig.11.79 HORIZONTAL INTERFACE MATRIX OF FITS BETWEEN DWELLING UNITS

	Living	Dining Kitchen	Terrace	Terrace-Balcony	M. Bedroom	2 Bedrooms	Access	Open	Open shared
Open shared	0	0	-1	-1	0	0	0	0	0
Open	0	0	0	0	0	0	0	0	
Access	0	0	-1	-1	0	0	+1		
2 Bedrooms	0	0	0	0	0	0			
M. Bedroom	0	0	0	0	0				
Terrace-Balcony	0	0	-1	-1					
Terrace	0	0	-1						
Dining Kitchen	0	0							
Living									

LEGEND: -1 Unacceptable fit
0 Acceptable fit
+1 Necessary fit

c. Other Input:

Limitations on outside configuration of the grouping.
Limitations on orientation to sunlight, view.
Limitations on number of dwelling per grouping.
Limitations on locations and/or configuration of access spaces.
Limitations on allowable heights of various configuration of access spaces.

(4) Evaluate Grouping Cycle:

a. Is the grouping complete?

b. Is the density level satisfied? (Typical evaluation question from above list).

c. Does the grouping allow expansion vertically to provide the density desirable? (Typical evaluation question from above list).

(5) Input - The Stacking Cycle:

a. Read groupings from previous cycle.

b. Read interference matrix of vertical fits between groupings. (The example below is again for the 16 foot modular grid).

Fig.11.80 VERTICAL INTERFACE MATRIX OF FITS BETWEEN DWELLING UNITS

ABOVE / BELOW	Living	Dining Kitchen	Terrace	Terrace-Balcony	M. Bedroom	2 Bedrooms	Access	Open	Open shared
Open shared	0	0	-1	-1	0	0	0	0	0
Open	0	0	-1	0	0	0	0	0	0
Access	-1	-1	-1	-1	-1	-1	0	0	0
2 Bedrooms	0	0	-1	0	0	0	0	0	0
M. Bedroom	0	0	-1	0	0	0	0	0	0
Terrace-Balcony	-1	0	-1	-1	0	0	-1	-1	-1
Terrace	-1	0	-1	-1	0	0	-1	-1	-1
Dining Kitchen	0	0	-1	0	0	0	0	0	0
Living	0	0	-1	0	0	0	0	0	0

LEGEND: -1 Unacceptable fit
0 Acceptable fit
+1 Necessary fit

c. Other Input:

Limitations on height allowable or required.
Limitations on overhang.
Limitations on orientation to sunlight, view.
Limitations on outside configurations of stack.

(5) Evaluation - Stacking Cycle.

a. Is the stack complete?

b. Is the density level satisfied? (Typical Evaluation question).

c. Rank and compare with other stacks.

The program for the computer augmentation shows the centrality of "requirements". The program can never create density requirements. It can only test the hypothesis that for a given set of carefully stated requirements there are possible combinations of the basic modular parts which satisfy the requirements. In defining the program's rules, the designer must identify every requirement he intends to satisfy. In trading off requirements (or reducing limiations in the input cycles) the designer must realize the price he has paid for greater density.

Appendix A

ANALYTIC SAMPLING FOR DESIGN INFORMATION: A SURVEY OF HOUSING EXPERIENCE

Few today will quibble with the assertion that special markets for housing reflect special social needs in housing. Almost everybody recognizes the need for some "behavioral input" to design. The social component is on the verge of becoming a conventional part of design programming.

But while few would demean the importance of social considerations in the outline of design, it is a more serious question from where the content in this area stems. Social scientists have long chided designers for their use of personal, class-biased, and unsubstantiated insights as a chief source of social facts. On the other hand, the results of potentially exhaustive research on the part of social scientists are meaningless to designers without the necessity to start almost from scratch in explaining in what context the research is relevant and where it is not. Despite agreement on "motherhood", it is rare to find social data available to "plug into" any specific, ongoing design program.

BACKGROUND

In the summer of 1967, Canada's Central Mortgage and

Housing Corporation contracted to the Centre for Urban and Community Studies of the University of Toronto for a project which would culminate in plans for lower cost, higher density low-rise multiple dwellings than were currently on the market. These multiple dwellings were to be built without the need for re-tooling the housing industry, and they were to provide the aspects of "environment" that people commonly opt for when they seek single family units. The target population for these units was the middle-income Canadian family (earning $6,500 to $9,000) who was too rich for public housing but yet too poor to receive government mortgage assistance on new single family homes, which were thus placed beyond the reach of most of them. Although a design study, one of its attractions was its plan to incorporate the findings of related disciplines.

The typical problem of sociological <u>content</u> was present at the outset. Although sociological data were considered desirable for the study, it was an open question as to what kind would be useful and how they would be collected. One form of response to this problem was my commitment of the practical half of the year's work of my graduate seminar in urban sociology to this endeavour. In professional-client manner, this group was to translate the expressed needs of the architect for social data into an appropriate study, which they would carry out with his financial backing. In addition, apart from the way that the architect framed the question, the study had to be sociological in substance, so as to represent more than superficial information collection and be of intrinsic interest to sociologists (including the participants) as well.

It was obvious that we could not possibly provide all desirable sociological information to the architect. Indeed, given the amount of time and manpower available, the focus had to be narrow. Yet, the services of such a group doing research "custom made" for a design project went beyond what was otherwise available to the architect. Indeed, the rarity of this enterprise meant that there were few guidelines to follow.

THE STUDY

In response to the architect's request for knowledge of aspects of environment that serve positive purposes in the lives of the type of people for whom he would be planning, we first created a frame of reference on which to build a study. We decided to study the effect on this kind of family of various physical components of environment which the architect could (if he would) incorporate into his design. This effect is not a simple dichotomous one -- does it work, doesn't it work? Rather, components of environment were viewed as either facilitating or hindering social contact, routine activities, and the like. We had a multitude of expectations of ways in which variations of certain aspects of environment would influence neighbourhood interaction, shopping, child raising, and the like. Thus, our first question was, "All else being equal, what differences can we find in the lives of middle class families which are accountable to clearcut differences in environment?"

However, to clearly answer the architect's needs, we had to have some way of <u>evaluating</u> the answers to this first question. How important to family satisfaction are these relationships and activities found in specific settings? What aspects of current environment are related to current surroundings and activity?

To answer questions of this sort, particularly given the practical context, we decided it would be necessary to study families who varied little from one another on most major sociological factors, but who lived in settings which contained the necessary physical variation. Thus, our frame of reference centered on the <u>relationship of physical setting, social interaction and activity, and conceptions of satisfaction among a homogeneous stratum of middle class families currently subject to varying home environments.</u>

The subject matter required intensive interviewing. Hence, the number of people our twenty-two students could contact in the two weeks they had available for this was limited. Yet, the framework of the study was analytic -- to compare subgroups with respect to one factor regarding a second factor (or even a third as well); analysis of this kind requires substantial numbers of respondents. Therefore, we had to have a way of selecting people to interview which maximized analytic power while at the same time it minimized the total number of people sampled.

Conventional sampling procedures would not have alleviated this problem. Random sampling of the population of a metropolitan or even suburban area would have produced a set of families whose surroundings were highly skewed with respect to environment; to get even a small number, for example, living in low-rise dwellings but <u>without</u> direct access to the outside world would have required a huge total sample. Furthermore, random sampling would not have served to minimize social differences among families.

One technique commonly used to select subjects for study with specific social characteristics is Social Area Analysis (Shevky and Bell, 1955). This technique, however, takes census tract aggregates as its smallest unit and is hence insensitive to the many aspects of physical environment which differ within the boundaries of tracts. Choosing areas for study on this basis, then, would again require a costly overshooting of our mark.

It is common to use a stratified sample in studies whose primary framework is the comparison of phenomena with respect to subgroups which are not found in equal numbers in the population. Stratifying means that the researcher specifies the number of people in each subgroup to be contacted, this number is relatively similar for all subgroups, thus guaranteeing the ability to perform analyses which might not have been possible with a straight random sample. If, for example, a researcher wishes to compare billionaires with civil servants, he will find few billionaires for comparison if he takes subjects at random from the population. On the other hand, if he specifies he wants 50 billionaires and 50 civil servants, it may mean taking 90 per cent of all billionaires and .09 per cent of all civil servants[1]; but this procedure makes analysis more feasible without resorting to an astoundingly large sample size.

In the present study, a stratified sample with respect to social characteristics would have been inappropriate. However, the same approach was applied to the components of physical environment. We decided to choose a sample of families on the basis of physical characteristics of their home environment. Steps were also taken to assure relative homogeneity among the subjects.

We searched out relatively small clusters of housing which differed as follows:

1) housing type (single family, town house, maisonette). Inherent in these variations of low-rise housing are the presence and absence of party walls and the presence and absence of direct access to the outside.

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[1] These figures are purely imaginary.

2) <u>open space (private vs shared).</u> Some units (i.e. all single family homes and some maisonettes) had well defined private open space; the others did not.

3) <u>access to community facilities (close vs distant)</u> Some housing units (of all types) had stores, schools, and the like immediately adjacent; the others were sufficiently removed to require transportation to reach them.

4) <u>tenure (owner vs rented).</u> Some of all housing types were rented. A number of single family homes and town houses were "owned".[2]

The selection of housing clusters was such that these several components of environment, while at times related to one another, were not synonymous with one another -- an important difference in assessing relative effect. Units were selected for study so there would be sufficient numbers for comparisons with respect to all these factors, while staying within the maximum possible sample size of 230. Within each stratum houses were selected by random means.

At the same time, however, criteria were established so as to homogenize the sample. All housing units were in

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[2] Although the town house units preceded the legalization of condominia in Ontario, an arrangement was made between the developer and his customers which ammounted to the functional equivalent.

the mid-suburban band around Toronto, and monthly rents, where applicable, were in the $180-220 range. Only families with children living at home were studied, and all housing units had either three of four bedrooms. Homes were chosen for study whose interior space and bedroom count paralleled those of the apartments and whose monthly cost, if sold today, would be comparable. Known "ethnic areas" were avoided. The resulting families interviewed strongly approximated the architect's trarget population.

Within each household, the wife was selected for interviewing -- on the basis that she was most subject to environmental influences.

In the event of a childless household, a vacancy, a refusal, or a respondent who could not be found at home within the two-week interview period, alternative addresses were preselected. Their numbers were limited by the supply within categories, and the total number of completed interviews was 173 (75 per cent).

The sample interviewed represented the physical strata as intended. About 50 per cent of the respondents lived in town houses, with about 25 per cent each in single family houses and maisonettes. About 60 per cent were located distant from community facilities; about 40 per cent were close. About 70 per cent rented; about 30 per cent owned. About 35 per cent had private open space; about 65 per cent did not.

Each interview consisted of several parts: 1) factual material about the family, 2) residential history, 3) satisfaction with environment and plans for the future, 4) nature and extent of interpersonal relations, 5) activity patterns, and 6) perceptions of the ideal. Interviews averaged 45-60 minutes.

The interview period was the last two weeks in February. It included the coldest week of the year. Since we believed that use of environment is affected by weather conditions, much of the interview was repeated with most of the same respondents the last week of June. The differences were substantial at times and are reported elsewhere.[3] They suggest a greater impact on interaction and activity of immediate environment in the winter than in the summer. Nonetheless, with the exception of only one or two stable, objective factors pursued only in the summer interviews, the data reported

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[3] "Space as a Variable in Sociological Inquiry: Serendipitous Findings on Macro-Environment", paper prepared for presentation to the 1969 meeting of the American Sociological Association.

here is uniformly based on the February interviews.

Given the complexity of the frame of reference and the multiplicity of variables considered, a total list of our expected results would be overly long. In brief, we expected that housing types with direct access to the ourdoors would be associated with greater satisfaction and use of outdoor environment than homes without direct access; town house dwellers would find their situation better for sociability but worse for overall satisfaction than residents of single family homes due to party walls. We expected that neighbor contact would be higher among those with private open space, as would home based family activity. We expected that people close to community facilities would both value and use them more than people who chose to live more distant from them. Finally, we anticipated that owners would make more of both formal and informal contacts with others in their neighborhood, putting down roots in the process, than would renters.

FINDINGS

The results are of three types. First, what differences in social activity vary systematically with aspects of the home environment? Second, what is the relation of these physical components to residential satisfaction and to conceptions of ideal environment? Third, in what way does the relation of environment and satisfaction reflect an activity pattern consonant with that environment? I shall outline the results with respect to these questions one by one.

1. Environment and Behavior

The interrelations found between each component of environment studied and relevant behavior will be summarized and then discussed.

a. Housing Type

First, residents of single family and town houses predominantly meet their neighbors outside while people in maisonettes meet them inside. This appears largely a function of direct access, or lack of it, to the outside. Given the winter setting, it is perhaps no wonder that the same two categories meeting neighbors outside are the ones who resort most frequently to the telephone. It would appear that having common indoor space is at least conducive to contact, if all else is favorable for it.[4] Nonetheless, it is quite another question as to whether this environmentally enhanced

[4] The literature suggests neighbors will have intense interaction if they perceive themselves as in the same boat and have mutual needs requiring assistance.

social activity		single family	town house	maison-ette	chance occurrence of difference (from X^2 calculations
1.	where meet neighbors	outside	outside	inside	.02
2.	use of telephone	highest	high	low	.001
3.	hours spent sewing or knitting	high	high	low	.01
4.	effect that another home would have on undertaking desired activities	little difference	some difference	some difference	.01

contact is regarded as favorable contact, even in the winter; evidence to be introduced below would indicate the contrary.

A further evidence of relative isolation among those living without inside space shared with neighbors is the amount of time devoted to sewing and knitting.

Those in single family homes and town houses spend more time in this fashion than do those in maisonettes.

While contact with other people seems associated with access to the outside, activity appears related to another component of housing -- the existence of party walls. When asked, "What difference would living in another type of home make to doing more of what you want?", about three quarters of single home residents answered "no difference". In contrast only about 50 per cent of the residents of the multiple dwellings thought that there would be no difference; 50 per cent thought that there would be one.

I interpret this to mean that those living in multiple dwellings have had a chance to experience desires for activity which have been frustrated by their real or potential impingement on proximate neighbors, while residents of single family homes have had less of both this type of frustration as well as the experience of closer physical contact with neighbors. This is particularly supported by the past experience of the people sampled. Residents of single family homes have lived in significantly fewer different types of housing than have the others, with town house dwellers the most "well-rounded"; fully 72 per cent of the latter have lived in three or more different housing types, compared to only 32 per cent of the former.

Furthermore, research elsewhere indicates that residents of multiple dwellings find self-imposed need for self-restraint in activity even more odious than the objective bother emanating from neighbors (Raven, 1967).

Table 1 gives some additional perspective on the differential impact of housing types. Respondents were asked why they chose their present home. Several reasons were typically given, and these were categorized as to whether they referred to the home itself or to the surrounding neighborhood. People were also asked if they planned to move again within the next five years; although this question can be interpreted literally (and *should* be in cases), it is also of great use as a barometer of residential satisfaction. These items indicate that the internal aspects of environment are more pressing (and distressing) to residents of multiple dwellings than are external aspects, while the reverse is true of residents of single family homes. To be precise, 44 per cent of people choosing a multiple dwelling for a reason having to do with the unit itself now intend to move, while only 33 per cent of those choosing one for neighborhood reasons are so inclined. This compares to a 17 per cent future mobility rate among home dwellers who cited reasons having to do with the home and a larger 29 per cent rate among those citing factors in the neighborhood.

Although these differences by housing type are logical and the sample was designed so as to provide similar respondents in each physical category, it must still be questioned whether the findings discussed might not find their explanation in whatever minor demographic or socio-economic differences remain to differentiate respondents from another. For this reason, similar tables were run substituting some of these latter variables for the physical variables. Are these differences in activity tied more closely to age, family size, occupation, education, and the like?

In fact, only one of the differences is related to one of these personal attributes. The more skilled the occupation of the husband in the family the more his wife feels a new home would affect the commencement of new activities.[5] Nonetheless, the relationship of proposed new activities to housing type is far stronger than it is to husband's occupation, thus making it highly unlikely that occupation is a crucial intervening variable in this sample.[6]

b. Access to Community Facilities

With respect to specific leisure time activites, one mark of this particular sample is that they are not particularly active. Nonetheless, there are substantial differences in activity according to access to community facilities, such as schools, stores, etc. According to the nature and intensity of the activity, categories were devised to divide active participants from minimal or, in some cases, non-participants. Uniformly, the percentage of participants in the activities listed among people with easy access to community facilities was 20 points higher than among people distant from them.

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[5] $.05 > X^2 > .02$

[6] Some additional differences in residential background by housing type are worth noting, although they would not appear to affect the foregoing arguments. Maisonette, town houses, and single family house residents represent a decreasing order of distance of their current home from the immediate past home. Although no more than 30 per cent of people in any of these current house types owned their previous homes, twice as many single family <u>and</u> maisonette dwellers owned than did town house dwellers.

This does not mean that people living right next to suburban centers are active solely by virtue of that fact. Indeed, some of these activities are neither found in or aided by the particular facilities found there. What it may indicate more accurately is that people with more generally active life styles seek out convenient locations -- even <u>within</u> suburban areas. They may not be as active as downtown cliff dwellers, but they are more so than their fellow suburbanites. Given that there are forces in the housing market that send young families to the suburbs, there are still life style differences among them that require differential physical surroundings.

In advancing reasons for having chosen their current home, people were much more likely to specify factors having to do with the housing unit, as opposed to the surrounding neighborhood. Nonetheless, significantly more people[7] living close to community facilities cited neighborhood reasons than did those distant from them.

Table 2 hints more closely at the relationship involved between life style and access to community facilities. We would expect that people living close to facilities

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[7] $.001 > X^2$

social activity	access: close	access: distant	chance occurrence of different (from X^2 calculations)
1. arts and crafts	some	little	.001
2. pleasure reading	much	some	.02
3. educational courses	some	little	.01
4. attend plays and concerts	majority	majority	.01
5. associations and meetings	some	few	.05
6. general use of neighborhood	extensive	moderate	.05
7. frequency visit relatives inside neighborhood vs relatives outside	almost equal	outside much more	.01
8. frequency visit friends vs relatives outside neighborhood	friends more than relatives	equal	.001

who are active and people living distant from them who are inactive would <u>both</u> be more satisfied with their environment than inactive people living close and active people at a distance. With respect to two discretionary activities in which there is some degree of participation, this relationship holds well. Those who shopped for clothes or went to restaurants at least once a month were considered active; those going less frequently were deemed inactive. The active-close and inactive-distant categories were considered congruent; the others, incongruent. As Table 2 points out, people in congruent categories are less likely to want to move in the future than are those in incongruent categories. The same relationships hold within all categories of access. Although these phenomena must obviously be approached with caution by such indirect measures, it would appear that the match between life style and environment is one that entails affective consequences.

In addition to satisfying a particular life style, location near community facilities is without question of some instrumental value. In suggesting reasons why they might move in the future, only 6 per cent of those close to facilities cited "neighborhood" reasons for moving, while 21 per cent of those distant from them did so. Furthermore, we expected that this would be particularly relevant for young mothers who might otherwise be housebound. In families with children only 1-6 years of age, the same 6 per cent of respondents close to facilities referred to the neighborhood as a reason for moving; however, among those more distant, 47 per cent of the young mothers noted the neighborhood in this connection.

In addition to the information in participation in selected activities reference to visiting patterns also sheds light on the respondents. First, relatively few respondents had relatives living in their neighborhood. Slightly more people living close to facilities had more close relatives living inside their neighborhood than out than did those "distant"; however, these people with easy access to facilities saw these relatives far more frequently than did those without easy access -- far greater than would be suspected merely from the numerical availability of relatives. The presence of these facilities may serve as a medium in which close relatives spend time without making inroads in their respective time schedules.

However, when people go outside their own neighborhood for contact, those located close to facilities, the ones with generally more active life styles, spend time more frequently with non-related friends than with kin. "Swinging" is apparently not rooted in kinship. Those distant from facilities, who in addition do not have an immediate location in which to meet their relatives, are evenly divided in the time they spend with kin and nonkin.

None of the differences involving location are explained by whatever demographic or socio-economic differences exist within the sample. In addition, residential background does not vary by location.

c. Open Space

There is a parallel between some of the findings on housing type and on open space. With respect to housing type, the presence of shared walls was related to a feeling among many that another housing type would permit respondents activities in which they desired to participate. In the present case, sharing of outside space rather than inside acoustics presents the same difference in the sample.

social activity	open space: private	open space: shared	chance occurrence of difference (from X^2 tests)
1. desire to undertake new activities	great	near unanimous	.001
2. effect that another home would have on undertaking desired activities	little difference	some difference	.05
3. number of neighbors known	many	some	.05

Those with private open space do not by and large think another type of home would enable new activities, while those sharing space are more likely to think so.

There are several reasons why this could be interpreted as more a function of house type than of open space. First, the question about the effect of another home refers specifically to the home, even though outside space is often considered one aspect of it. Second, the statistical relationship of house type with effect on activity is stronger than that of open space with effect on activity, at the same time that there is a strong but not complete association between current house type and type of open space.

Nevertheless, in addition to a literature which stresses that people cherish private open space for what they wish to do on it (Wallace, 1952; Kumove, 1966; Michelson, 1966), data from this study ties family activity to private open space. Although the majority of respondents claimed that they wanted to participate in new activities, the percentage of people without private open space who wanted this was significantly higher than those who had their own plot; in fact, only 5 per cent of this "frustrated" group did not want to add some new activity. It would appear that lack of private open space does inhibit some activity, although provision of it is no automatic panacea. Furthermore, this desire is not one which is related to housing type according to the present data.

We anticipated (c.f. Fanning, 1967) that private open space would serve as a catalyst to bring neighbors together more than would shared open space. People do not need an excuse to remain outdoors on their own turf; casual contacts made there are not hurriedly terminated through lack of a socially acceptable excuse to stay put.

This expectation was backed by the data, in that people with private open space knew significantly more neighbors than did those who shared open space.

d. Tenure

social activity	tenure: own	tenure: rent	chance occurrence of difference (from X^2 test)
1. plays and concerts	don't attend	do attend	.001
2. frequency visit relatives outside neighborhood vs frequency visit relatives inside	outside <u>much</u> greater than inside	outside greater than inside	.01

In this context, we expected a variety of evidence connecting home ownership to interactions with others in the neighborhood and to activities in that area. The data did not confirm these expectations. Of the two differences in the sample statistically related to tenure, one is substantively irrelevant and the other, if considered relevant, is converse to expectations; owners have less to do with relatives in their neighborhood than do renters. The small package of findings generally backing expectations with respect to the three previous aspects of environment is lacking for tenure.

2. Environment, Satisfaction and the Ideal

a. Satisfaction

The previous section outlined findings on environment and behavior. In the present section, I shall temporarily ignore the previous one, asking if there are relationships between current environment and people's conception of the ideal. Then in the next section, all these factors will be brought together again.

Two measures of satisfaction -- both indirect -- were used. The first, as already detailed, is intention to move within the next five years. The second is an index calculated from answers to questions asking whether the following were satisfactory, unsatisfactory or of no importance: a) layout of interior, b) size of rooms, c) front entrance, d) interior noise transmission, e) noise from outside, f) parking, g) outside space, h) outside design and appearance of housing, i) quality of schools, j) distance to shopping, k) distance to family, l) recreation, m) privacy, n) type of neighbors, and o) cost or rent. The index was computed as follows:

$$\frac{\text{number of unsatisfactory items}}{\text{number of unsatisfactory plus satisfactory items}} \times 100$$

It is more properly an "index of dissatisfaction".

As Table 3 points out, the first, intention to move, is related to current dwelling type, tenure, and open space. Satisfaction is distributed pretty well as expected. For families of this type, single family housing has long been the ideal in North America, and the more self-contained the unit which approximates it, the more the satisfaction; the greater satisfaction with the town house than with the maisonette reflects this. Ownership has likewise been an ideal held high and an economic advantage. Possession of private open space, while typically a concomitant of housing type, no doubt reflects this with respect to satisfaction, although it may reflect family activity as well.

The index of dissatisfaction is not related to any of the variables mentioned so far. That it does not work similarly to the first measure can be explained with reference to its content, in that discreet items may carry different weight with respect to the several aspects of current environment, even though their sum varies directly with intentions to move. It is worth noting, however, that the index varies significantly with the length of time people have lived in their current residences. The longer they have stayed, the lower (i.e. more satisfied) is their index score.[8] This, of course, gives a partial vote of confidence to market mechanicms. I shall return later to this factor -- length of residence.

b. The Ideal

As in all studies I know (c.f. Lansing, 1966), a strong majority of these respondents stated that they would like to live in a single family home in the future. This choice was made by 85 per cent of the families, with the remainder opting for a duplex, triplex or row house. No-one wanted to live in a multi-family walkup apartment. The reasons advanced most strongly for this choice were privacy and independence, the desire to own or to invest in real estate, the single home as a status symbol, internal space, and private open space.

As in the other studies, too, variations within the sample did not account for differences which upset the strength of this asserted ideal (c.f. Michelson, 1968).

However, to probe more deeply the basis on which people choose their ideal, we asked people to select the best and worst of four photographs illustrating respectively, a single family house, a town house, a

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[8] $F=5.06>F^{2}, 158\ (.05) = 3.07$

maisonette, and an unfamiliarly designed, "futuristic" multiple dwelling. Respondents were told that each dwelling was of equal size internally and would cost the same to buy or rent, as desired. One question about the pictures was general, "In which would you most like to live?" As expected, consistent with the nonpictorial question, 83 per cent chose the single family home, with most of the remaining choices falling to town houses. The major reason advanced was privacy.

The other basis for judging these pictures was much more specific. While the single family home was given a plurality of positive choices with respect to each, the variation in its strength of supporting is revealing:

Privacy-91% chose single family home
Best for raising children-90%
Most easily do the things you want to-87%
Best outside design-50%
Best contact with neighbors-40%

These require brief explanation.

It is obvious that of these factors, privacy and child-raising are paramount considerations underlying the preference of this type of sample for a single family home. The respondents most commonly cited the lack of party walls in explaining why they considered the single family home more private. For childraising, 31 per cent cited having a private yard, 19 per cent claimed more living space, and 15 per cent valued freedom of interference from landlords. Maisonettes were felt the worst for childraising due to a feeling that there is no place for children to play; they are also felt crowded and confining.

For activities single homes again led because people did not feel there was a need there to restrain their own noise. A substantial minority also felt they would be more free due to ownership status.

With respect to contact with neighbors, single family and town houses were mentioned almost equally, because, although proximate, people were not forced into contact -- as respondents felt was the case in maisonettes, with access out only to central hallways. Indeed, our data in section 1 bears them out.

In short, the traditional popularity of the single family home was upheld by the present data. Moreover, these data went on to suggest which of several housing goals these preferences reflect most strongly, as well as what environmental aspects are associated with them.

However, the analytic framework of this paper is to ask what influence current environment has on these conceptions of the ideal. Since there was such wide agreement with respect to privacy, childraising, and home activity -- always crucial factors in family choice of single homes -- there is insufficient dissent for analysis. There is, however, considerable difference of agreement with respect to outside design and contact with neighbors. Furthermore, since the housing market frequently prevents people from achieving their ideal, it is quite conceivable that people preferring some other type of housing on these additional grounds may well be open to the possibility of living in something other than a difficult to achieve ideal.

<u>Current location</u> and <u>open space</u> were strongly related to preferences for the <u>outside design</u> of something other than single family homes (i.e. usually town houses). People living <u>close</u> to community facilities and/or <u>without</u> private open space were more likely to prefer the town house than single family.[10] Since these people

[10] It is important in interpreting this result to know that "location" and "open space" are independent of one another in this sample. X^2 test differences in both cases are better than the .05 level with respect to design preferences.

have already opted for a convenient location and densities, doubtless at the expense of other available environmental goals, they may well be the first to compromise from their structural ideal.

Some data on past residential experience lends credence to this assertion. Table 4 shows the variation in percentage of people living in single family housing intending to move by the housing type which immediately preceded the current one. According to this criterion, people who have had experience in multiple dwellings are less "satisfied" with single family housing than are those who moved from another single home. They might be more likely to deviate from the public ideal in the future.

The reverse is true among those distant and/or who have had private open space. Sixty-four per cent of those distant, for example, prefer the design of the single family home, comparpared to only 45 per cent of those close to facilities.

With respect to <u>contact with neighbors</u> -- the second aspect of housing choice on which there was a diversity of opinion -- <u>current housing type</u> strongly influenced preferences. Those in single family homes thought these dwellings best for contact, while a majority of residents of both town houses and maisonettes thought the town house best.[11] The maisonette was downgraded by all for the reasons advanced earlier.

In addition, we asked about people's desires to rent as opposed to buying in a hypothetical new high density development. Again, there was great difference in the performance of respondents according to location. Of those now close to facilities, 86 per cent would rather rent such a residence, while only 53 per cent of distant respondents would want to rent.[12] Although current location vis a vis facilities is not related to current tenure, this latter factor is also directly related to desire to rent or own in such a future development -- however not as strongly.[13]

We investigated as well whether demographic or socio-economic variations within this sample varied with choices of the ideal. The level of the husband's education did vary with preference for outside design; the better educated the man, the more likely he was to choose a town house. Education does not, however,

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[11] .05>2>.02

[12] .02>2>.02

[13] .05>2>.02

appear to be a strong independent factor because its relationship with outside design is no stronger than that of two physical variables, one of which is also related to education (present possession of open space) and one of which is independent of education (present access to facilities).

What education and occupation did explain solely is whether extra features or cost were more important goals in housing (within limits). The relation was in the direction obviously anticipated; lower strata emphasized cost more strongly.

3. Environment, Activity, and Satisfaction

I have traced relationships between current environment and activity, then of environment and satisfaction. It is entirely possible for various components of environment to accommodate or make difficult given activities, as in the first section, without general housing satisfaction being involved in any way. It is also possible for environment to have intrinsic forms of satisfaction or dissatisfaction, as in the second section, without having to involve activities. Nonetheless, the question remains as to whether an activity congruent with a given setting makes a difference with respect to satisfaction, as would be expected from the model proposed.

Given the results of the previous two sections, the first positive finding regarding the interrelationship of these three types of factors comes as no surprise. A desire to undertake activities currently dormant, closely related to the absence of private open space, is also significantly related to intention to move[14] In other words, people who lack private open space are more likely both to want and to desire to move, with the desire for activity intimately related to the desire to move. In short, the restriction of activity brought on by lack of private open space matters with respect to residential satisfaction -- as measured here. In this case, the shoe pinches.

Somewhat more positive is the relationship involving education and preferred outside design of housing. Within our sample, the lower a man's education, the more hours a week he watched television. Furthermore, the more he watched television, the more likely he was to prefer the outside design of a single family house. What this adds

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[14] $.05 > X2 > .02$

up to is that education varies directly with preference for some other housing design and inversely with television viewing, which itself is inversely related to an unconventional design preference.

These two packages of interrelationships indicate that leisurely activity is a mediating variable operating between formal characteristics of a person or his setting on the one side and his satisfaction or preferences, on the other. It is clear also that the bluntness of the measures of satisfaction used in this study may have brought to light only a small part of this effect, in comparison to the number of differences in activity and interaction shown related to components of environment in the first section of findings.

POSTSCRIPT

Although the intent of the study design was to maximize variation in physical environment and to minimize it with respect to the demographic and socio-economic characteristics of the people interviewed, at least one potentially relevant factor was not controlled -- <u>length of residence.</u> Several writers, for example, have recently stressed that many aspects of behavior at any single time in a new housing development are a consequence of the newness of the place; when lawns aren't yet seeded and friendships haven't matured, life is different than when they are. (c.f. Clark, 1966; Gans, 1967)

As indicated before, length of residence turned out, quite logically, to be related to residential satisfaction. As a postscript, there are two aspects concerning length of residence which deserve mention.

First, to what extent does this factor actually underlie one of the environmental variables which accounted for differences in activity? Not at all. It does not account for any of the cited differences more strongly than the environmental variables.

However, it is worth noting that participants in associations and meetings acts as a mediating variable with respect to length of residence and satisfaction. The longer a person has been in his present residence, the more he participates in associations [15] and the less he wants to move, [16] with the extent of his participation inversely related to moving.[17]

Second, length of residence may be an index of different ways of life. It would be tautological to claim that recent movers had lived in more houses lately than non-movers. What we found, however, was a huge difference between these groups in the number of <u>different types</u> of housing which they have experienced in their lifetime. As Table 5 demonstrates, those who who have lived only a short time in their current home have lived in significantly more types of housing than have those whose stays are of longer duration. Sixty-four per cent of those who have lived in their present homes less than three years have lived in three or more different housing types, compared to exactly half that percentage (32%) of those who have lived there more than three years. They also make distant moves than the more stable subgroup.

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15 $.05 > X^2 > .02$

16 $.05 > X^2 > .02$

17 $.02 > X^2 > .01$

One possible explanation is that the residents of short duration are "organization men" -- transferred frequently from one managerial niche to another -- or families undergoing changes in composition. However, length of residence is not related <u>in any way</u> to socio-economic or demographic differences within the sample. Therefore, we can only speculate in closing about the existence of a segment of the population which, although indistinguishable by standard sociological variables, changes environment more and enjoys it less.

TABLE 1--Per Cent Planning a Future Move by Current Housing Type and Reasons for Choosing Current Housing

Reasons for Choice of Current Housing	Current Housing Type	
	Single Family	Multiple Dwelling
Home	17% (N=66)	44% (N=178)
Neighborhood	29% (N=21)	35% (N=48)

TABLE 2--Per Cent Planning a Future Move by Activity and Congruence of Participation

Activity	Participation Level and Location	
	Congruent	Incongruent
1. Eating at restaurants	31% (N=91)	41% (N=61)
2. Shopping for clothing	33% (N=72)	37% (N=82)

TABLE 3--Per Cent Planning a Future Move by Selected Aspects of Environment

aspect of environment	intend to move	do not intend to move or don't know	%	N	chance of occurrence of difference (from X^2 test)
A. Housing type:					
1. single family	18%	72%	100%	45	.001
2. town house	33%	67%	100%	81	
3. maisonette	60%	40%	100%	40	
B. Rent-Own:					
1. rent	41%	59%	100%	118	.02
1. own	25%	75%	100%	53	
C. Open Space					
1. private	25%	75%	100$	60	.05
1. shared	44%	56%	100%	103	

TABLE 4--Intention to Move by Immediate Past Housing Type (Single Family Residents Only)

Intention to Move	Previous Residence	
	Single Family	Other
Plan to move within five years	13%	27%
Do not plan to move within five years or don't know	87%	73%
100% =	23	22

TABLE 5--Number of Different Housing Types Inhabited in Lifetime by Length of Present Residence

Number of housing types	Length of residence	
	under 3 years	over 3 years
1 or 2	36%	68%
3 or more	64%	32%
100%=	119	53

X^2=13,78>$X^2_{.001}$ (10.83)

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Appendix B

SPACE AS A VARIABLE IN SOCIOLOGICAL INQUIRY: SERENDIPITOUS FINDINGS ON MACRO-ENVIRONMENT

In recent years various researchers have utilized space as a relevant variable in sociological inquiry. In some cases they have examined its impact as a determinant of various types of behavior (cf. Whyte, 1956: Ch. 25). In others space is conceived as a factor limiting (but not determining) the occurrence of phenomena in the traditional action systems (cf. Michelson, 1968). In still others it is a medium whose use reflects and demonstrates established cultural patterns (cf. Sommer, 1968). In all these cases, however, consideration of space adds to a more complete explanation or clarification of sociological phenomena than is possible with only conventional, non-spatial variables.

The exact conceptualization and theoretical contribution of the spatial component varies greatly by the level of environment pursued. For example, the studies of "proximate" environment -- that *within* buildings and, frequently, rooms -- has for the most part centered on the translation of conventional norms into spatial configurations. Hall, for example, points out the extension of culture into such spatial parameters as conversational distance and office furniture placement, parameters which are diplomatically touchy if misunderstood (Hall, 1966). Sommer, in addition, has provided a wealth of information on the ways that usage of existing space (e.g., chairs in libraries) follows along lines of desired interpersonal relations (e.g., uninterrupted privacy, study dating, etc.; cf. Sommer, 1968).

At the other extreme studies of macro-environment -- that beyond the residential block and on outwards to the city as a whole -- have dealt <u>less</u> with spatial expression of cultural behavior and much more with the <u>match</u> of people's characteristics and activities with aspects of their broad urban setting. While nondeterministic, these studies by and large demonstrate the higher level of congruence of a given environment with some social patterns than with others. Bell, for example, documents the fit of nuclear family oriented people and activities with the physical nature of suburbia (as contrasted with cliff dwelling consumption and career-oriented people; Bell, 1958). Abu-Lughod shows the proclivity of older but not elderly couples for the activies of the central city (Abu-Lughod, 1960), while Michelson provides evidence of higher levels of dissatisfaction among those recent movers from multiple dwellings to single family homes who <u>don't</u> enjoy some typical pleasures of suburbia -- backyard cookouts, gardening and handyman activities (Michelson, 1967).

Between these extremes lies the immediate environment -- broadly, the area abutting the residence within about a block. Although the typical macroscopic approach has been applied fruitfully to this level, it is best known for the deterministic stance of studies in the late 1940's and 1950's (cf. Festinger et al., 1950; Caplow and Forman, 1955; Kuper, 1951; Merton, 1948). When Whyte, for example, claims that families living on corners will be more isolated than those living in the middle of blocks regardless of the desires of those involved, he is leaving little to voluntary behavior (Whyte, 1956: 381-2). In recent years investigators have greatly modified this stance, suggesting its occurrence only under specific social conditions, usually including population homogeneity and turnover (cf. Gans, 1961). Nonetheless, when applicable, this is still a way in which saptial patterns bear upon social interation.

I have deliberately avoided the word "neighborhood" to this point. While a meaningful spatial entity to many people, its placement into a level of environment is made difficult by its subjective usage. To some, neighborhood is restricted to the immediate environment. To others it is more macroscopic, although generally not of the broadest scale. To still others it does not exist at all. And to still others it is a social, not spatial, phenomenon. A case might be made for giving the neighbourhood unit concept, as used in urban planning, status as a level of its own, restricting macro-environment to still larger areas. I prefer, however, to avoid potentially misleading (and certainly elastic) concepts, and hence will restrict levels of environment to the three very general ones -- proximate, immediate and macroscopic -- for the purposes of this discussion. (See, for example, Keller, 1968; Lee, 1968).

In short, space has been used as a variable which relates to social behavior in diverse ways, in part according to the level of environment investigated. In this paper, I shall depart somewhat from past studies by focusing attention on levels on environment per se, rather than one one set of relationships within a particular level. The findings to be presented below are serendipitous in that the study from which they stem was designed primarily to assess relationships involving the immediate environment but produced data which unexpectedly shed light on macro-environment in comparison with the next lowest level.

THE PROBLEM

The research problem has both pragmatic and theoretical aspects. To begin with the former, the problem was to design low-rise multiple dwellings for middle income families at a higher density than is presently found, which would be less costly than at present and which would nonetheless include various features that these families would seek in higher priced dwellings. The Principal Investigator sought sociological data as one of his design inputs and was pledged the assistance of students in a graduate seminar in urban sociology in whatever way the students felt would be fruitful in line with gaining relevant sociological experience.

The students, under my guidance, designed and carried out a study to investigate hypothetical relationships, all else held constant, of specific objective characteristics of people's current residential environment with their formal and informal interation and activities, with residential satisfaction (or, conversely, "strain") as a potential ultimate factor stemming from the empirical matching of the first two sets of variables. Although not attacking a completely new question, the researchers conceived residential environment far more specifically than had previous studies.

Although the project was primarily designed according to the above framework, a second consideration led to the

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[1] Tomah (1964), for example, attempted to separate environmental factors from population factors in explaining levels of participation.

data considered here. Since a vital aspect of home environment is outside space (cf. Fried and Glecher, 1961; Hartman, 1963; Michelson, 1966), and since its social utilization should be thought to vary greatly in northern climates according to the time of year, certainly social interaction and activity could not be taken as static and insensitive to this factor. Indeed, in practical terms, our architect would be misled if he were planning for an unchanging social situation, even though it was our impression that, except in the most extreme climates, the public would choose housing on the basis of summer conditions, regardless of how small a percentage of the yearly weather that might represent. We therefore thought it highly desirable to gather similar data at two different times of year.

This secondary intent is of sociological concern in its own right inasmuch as the interaction provides virtually no clue whatever as to seasonal shifts in participation, let alone their relationship to their physical setting. Although authors frequently compare rates of participation from place to place, class to class and the like between studies, it is practically unheard of for them to state at what time of the year their own interviewing was conducted, let alone what difference that might make in their results. The closest we have seen anyone come to this question are the assertions that certain activities take place at ritual occasions written into the calendar (Klapp, 1959) and that school vacations influence the activities of children (Lundberg et al., 1934); although valid, these are still questions quite apart from the influence of regularly shifting, normal weather conditions in Northern climates.

This paper will focus entirely on seasonal differences as a possible intervening variable with respect to social participation (one of the most conventional clusters of sociological variables), differences which will shed light on the nature and relevance of macro-environment. Results stemming from the primary intent of this study are reported elsewhere.[2]

METHODOLOGY

Consistent with the primary and secondary aims of this study, a sample of women in Metropolitan Toronto was interviewed twice in 1968. The first time was at the end of February which included the coldest week in the winter. The second time was during the last week of June -- warm summer weather, by and large occurring before the normal mass exodus to vacation areas. The first interviews were conducted by graduate students, the second by professional

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[2] "Analytic Sampling for Design Information: A Survey of Housing Experience", to appear in the proceedings of the first annual conference of the Environmental Design Research Association held in Chapel Hill, North Carolina, June 8 - 11, 1969.

interviewers.

The sample of 173 was stratified according to residential area which built into the study workable categories of residential environment. The four areas -- all at suburban locations considerably removed from the city center -- varied according to the following factors: housing type (single family, town house, maisonette); access to open space (private, public); access to community facilities such as stores and schools (immediately at hand, driving distance away); and tenure (owner, renter).[3] Although related, these distinctions did not coincide exactly in the areas chosen for study.

Although varying in these several ways, the sample was relatively homogeneous in SES and family composition through the choice of housing units of approximately equal monthly cost (about $180 to $220 a month), inside space (large apartments, small homes) and number of bedrooms (3 and 4). Resulting data on occupation of head of household and income confirmed this intention. Only 2 percent of the families had incomes under $5,000 a year, and only 16 percent earned over $10,000. Although nearly 80 percent of the time husbands had completed Grade 13 -- preparation for college -- only 17 percent had a B.A. or

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[3] Social Area Analysis, although commonly used in relatively similar situations, was rejected as an inappropriately blunt instrument with which to sample physical environments incorporating the details reported here.

higher degree. Over 80 percent had from two to four children living at home; 74 percent of the children were between the ages of one and twelve. Furthermore, the architect's wishes guided sampling within predominantly WASP areas.

Once an address was selected (randomly within a given area), an alternate was chosen in case a household did not have children living in the home. Preselected alternate households were also substituted in case of a vacant home or refusal. However, the number of alternates was limited by the supply within strata and the total of 173 households represented 75 percent of the original sampling frame. It does not, however, represent a bias in the various selection criteria.

The June follow-up resulted in 130 completed interviews. Virtually all the loss in the sample was a consequence of either subsequent moves or absence from home during the ten day period allocated to this phase of the research; refusals were minimal. Comparisons of winter to summer activity are based only on those who were interviewed twice.

A straightforward interview schedule was used in both waves of the study. In February questions centered on

1) background data on the respondents, 2) their residential history, 3) their interpersonal relations, 4) their activities and 5) their perceptions of present and ideal environment. An interview averaged about 45 to 60 minutes. In June the focus was on the last three of these areas, and an interview required about 30 minutes.

HYPOTHESES

Our expectations, and hence results, were with respect to three questions: 1) What kinds of activity and interaction characterize these people? 2) How does this vary by season? 3) What does this say about levels of environment? Let's examine them one by one.

First, in order to understand fully behavioral changes from season to season, there must be a basic behavioral pattern to consider. Studies have graphically demonstrated that the occupants of different areas of cities exhibit markedly different activity patterns and interpersonal relations. These variations, which reflect differential weighting of roles, each of which has activity and interaction components, are often called "life styles".

Therefore, as a first step in assessing the "behavior baseline" of the present sample, we had specific expectations concerning the kind of life styles held by the mid-suburban families making up the sample. On the basis of a wide variety of studies taking into consideration SES, housing location and family composition (cf. Bell, 1958; Bell, 1968; Young and Willmott, 1957; Bott, 1957), we hypothesized that the families' daily lives would strongly reflect nuclear family pursuits relatively close to home and would weakly reflect commercialized recreation or cultural activities. This would be consistent with Bell's hypothesis of suburban "familism" as opposed to center-city "consumership" or "careerism" (Bell, 1958).

Second, we hypothesized behavioral shifts from winter to summer as follows:

(a) "Friends" would gain in frequency seen at the expense of visits to "relatives" as a consequence of increased exposure in warm weather and the voluntaristic, elastic nature of the tie.

(b) Similarly, both "friends" and "relatives" within the respondents' neighborhood would gain in "exposure", while visits with those outside would suffer relatively.

(c) Functions performed within the neighborhood would increase in the summer.

Third, implied by these detailed hypotheses is the additional hypothesis, bringing in levels of environment, that warmer weather not only induces greater contact among people sharing the immediate environment but also that this level of contact is more significant relative to the macro-environment in people's lives during the summer than the winter. Conversely, we expected that during periods of colder weather spontaneous interaction will decline relatively in favor of more formal, planned and distant contacts. Quite specifically we expected for this reason that the distance between a respondent and those who are depended on for help would decrease in the summer.

FINDINGS

(a) Life Style

As a first indication of the life style broadly characterizing this sample, Table 1 shows the percentage of respondents reporting at least minimal participation in each of a number of activities. In this case minimal participation is defined as at least several times a year or more frequently for non-intense activities and as an hour in a typical week for intense activities. To count, minimal participation had to be reported in only one of the two interviews.

TABLE 1: Minimal Participation in Selected Activities (in %)

A. Complete participation:	%	N. Responses
1. shop for sundries	100	114
2. shop for groceries	100	116
3. watch television	100	130
4. pleasure reading	100	128
5. telephoning	100	130
B. Majority participation:		
6. shop for clothes	97	101
7. sew or knit	87	130
8. attend parties or suppers in the home	68	127
C. About 50 percent participation:		
9. attend church/synagogue	53	128
10. sports (attendance or participation)	52	127
11. eat in restaurants	48	126
12. employment	42	130
D. Low participation:		
13. attend associations or meetings	38	125
14. attend movies	29	125
15. take educational courses	23	129
16. arts and crafts	21	130
17. play musical instruments or sing	12	130
18. attend plays or concerts	12	126

In this form the data strongly support our expectations that this is a home-based, familistic sample. Bypassing activities with either obligatory or near-universal participation, greatest participation is in parties or suppers in the home, definitely a discretionary activity. Furthermore, not only does a large proportion of this sample engage in home entertainment, but it does so frequently. In the summer wave, for example, 52 percent reported attending such a party at least once a month. On the other hand, attendance at other discretionary activities such as formal associations, movies, educational courses and cultural presentations is relatively low.

The high incidence of home entertainment is borne out by the frequency with which people have contact with various types of people. As reported again in the summer wave, 80 percent spent time with friends within their neighborhood at least once a month, and 98 percent reported at least minimal personal contact with friends outside their neighborhood. Although few of these people had relatives within the neighborhood, 90 percent made personal contact with relatives outside it at least several times a year.

Comparison of these figures with those reported by other workers is complicated by several factors. First, the intent of this sample was to minimize social differences among respondents, so as to maximize observation of behavioral differences stemming from carefully controlled variations in their environment. Hence the present sample represents, by and large, middle-class, relatively young women in suburban locations. Since the major import of other studies is that participation varies greatly by the particular combination of roles played (see especially Scott, 1957), this makes the present data difficult to compare with that stemming from more heterogeneous populations.

A second difficulty preventing exact comparison of these data is the extreme variation from researcher to researcher in categories of participation and frequency of participation; frequently studies deal only with formal membership, and others deal only with attendance. Still another difficulty is the passage of time from study to study during which living conditions have changed and opportunities for participation shifted.[4]

Nonetheless, whatever comparison is feasible would indicate that these data support our original notions of life style

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[4] See, for example, the shifts in membership documented by Babchuck and Booth (1969).

within the sample. For example, the frequency of interaction with neighbors reported here sppears higher than that in other studies. Tomeh reports a third of her sample (including 26 percent of her suburban contingent) never see their neighbors, as compared to 20 percent here who see them less than once a month (Tomeh, 1964: 31). Visiting with non-proximate friends is also higher in the present sample than in Tomeh's, although both percentages are high. On the other hand, there is virtually no difference between the two studies with respect to visiting with relatives. The interaction rates with kin are comparable and are slightly higher than those reported by Greer for the part of his sample deemed high on familism (Greer, 1956: 22).

With respect to activities reflecting life style, a brief comparison of the present sample with others would support our first hypothesis. For example, it would appear that our respondents made far less use of commercial recreation facilities than did the women reported by White (White, 1956: 147). They attended meetings of organizations less frequently than did the respondents cited by Reissman, of whom 45 percent attended "frequently"; only 38 percent of the present sample attended more frequently than once a year (Reissman, 1954: 80). On the other hand the present sample appears to do more pleasure reading than Reissman's, and its rates of church attendance and leisure spent at home appear comparable to the figures reported by White and Reissman.

Therefore, our expectation that this sample of suburban families would strongly show nuclear family pursuits relatively close to home and show only weakly more formal or commercialized activities seems justified. It is a moot point in this argument, however, as to whether people selected themselves for this general location on the basis of their life style or whether their life style is but a reflection of relative isolation[5] -- due to market conditions. At the time of this study the mortgage and housing markets were so high in Toronto that young families in this income bracket desiring single family housing (or larger homes, for those already owning them) had to make large down payments (20 - 35 percent) and accept high interest rates (upwards of eight and a half percent) for most purchases. Indeed, this sample was chosen by our architect and his contractors because middle income families typically had little housing choice; they were too poor for government mortgage assistance and too rich for public housing. That, nonetheless, familistic life styles emerged is significant.

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[5] See these arguments in Gans (1967).

(b) Seasonal Variation

Participation in selected activities was analyzed in categories centering around the following midpoints (for non-intense activities): 1) once a week or more, 2) once a month, 3)once a year or less. The last category was regarded containing people inactive with respect to a given activity. Similar categories based on hours per week were made for intense activities. Shifts in participation were deemed as having occurred if a person moved from one category to another. Table 2 indicates the extent of change among merely these three categories from February to June.

The amount of change is considerable. Since the amount of change is highly dependent on the nature of the activity concerned, changes cannot be dismissed as a reflection only of low reliability from one interview to the next. For example, the least amount of change occurs with respect to activities which either are non-discretionary or in which few respondents participate. The greatest amount of change from one season to another is with respect to activities which are clearly discretionary.

The extent that the rate of participation reported by individuals varies according to the period interviewed is indicated in Table 3, which takes as its base only those

TABLE 2: Extent of change in frequency of participation in selected activities, February versus June, 1968 (in %).

Activity	shift of category	Same Category active	Same Category inactive	N
1. shop for sundries	7%	93%	0%	114
2. play musical instruments or sing	8	4	88	130
3. attend plays or concerts	9	3	88	126
4. shop for groceries	14	86	0	116
5. attend movies	18	11	71	125
6. arts and crafts	18	3	79	130
7. take educational courses	19	4	77	129
8. attend church or synagogue	21	32	47	128
9. attend associations or meetings	24	14	62	125
10. employment	27	15	58	130
11. eat at restaurants	31	17	52	126
12. attend parties or suppers in the house	37	31	32	127
13. sew or knit	39	48	13	130
14. sports (attendance or participation)	39.5	12.5	48	127
15. shop for clothes	47	50	3	101
16. telephoning	49	51	0	130
17. watch television	54	46	0	130
18. pleasure reading	57	43	0	128

TABLE 3: Extent of change in frequency of participation in selected activities among at least minimal participants, February versus June, 1968 (in %).

Activity	shift of category	same active category	N
1. shop for sundries	7%	93%	114
2. shop for groceries	14	86	116
3. attend church or synagogue	40	60	68
4. sew or knit	45	55	113
5. shop for clothes	47	52	98
6. telephoning	49	51	130
7. watch television	54	46	130
8. attend parties or suppers in the home	55	45	86
9. pleasure reading	57	43	128
10. attend movies	61	39	36
11. employment	63	37	64
12. eat at restaurants	64	36	61
13. attend associations or meetings	64	36	47
14. play musical instruments or sing	67	33	15
15. attend plays or concerts	73	27	15
16. sports (attendance or participation)	76	24	66
17. take educational courses	83	17	29
18. arts and crafts	89	11	27

reporting at least minimal participation during one of the two interview periods. With respect to only two activities did less than 40 percent of participants show a significant change in their frequency of participation, and these two involved the necessities of life.

That individuals changed their frequency of participation does not necessarily mean that net shifts in the patterns of an aggregate occur from season to season. To what extent, then, do seasonal shifts reflect a balance of greater or lesser participation in a given activity, conforming with the pattern of the second hypothesis and its component parts? Taking the base of participants who were "active" in the varios activities in either February or June from Table 3, a shift in the frequency of performance of an activity was noted if 10 percent more people increased or decreased their participation from season to season than did the reverse. The results appear in Table 4.

In general, more of these activities suffer net decreases in participation from winter to summer than the reverse. The single greatest decrease among these women is in employment, with almost five times as many of them lightening this load as adding to it. This is not, however, accompanied by a general increase in the pastime activities inventoried here.

The greatest single increase in activity in the summer is in the realm of sports. This almost undoubtedly involves outdoor participation, since the major form of indoor spectator sport in Toronto comes during the colder months -- hockey. On the other hand, the decreases are all with respect to indoor activities. These would all support the general hypothesis of an increase in activities utilizing the immediate, outdoor environment -- although indirectly. While an increase in church going does not support the hypothesis, its explanation may lie in its semi-obligatory character which may become more pressing in the absence of meetings of other formal organizations. Pleasure reading may increase in the summer months because it is easily portable to outdoor locations given the time to do so; however, there is no way of substantiating this from the data gathered.

In any case, the data so far show that social participation is more seasonally volatile than sociological literature has acknowledged. More light can be shed on behavioral shifts from winter to summer and their connection to levels of environment by investigating our more specific expectations on the frequency of differing types of interpersonal contact.

We expected more of an increase in neighboring among "friends" than among "relatives" from winter to summer. This was based on the premise that "blood is thicker than water" and that, hence, cold weather inhibits contact less among relatives than among friends; good weather, on the other hand, would influence contact among friends more than among relatives.

As Table 5 indicates, the reverse was shown. The data enabled a comparison of whether the respondents saw friends or relatives living within their neighborhood more frequently and the extent of change in this relationship from February to June. The change of seasons saw more people have the balance flipped in favor of relatives than in favor of friends. This may be a function of the fact that only small percentage of people had relatives living in the neighborhood and that the initial balance in favour of friends made a net change to the contrary more likely statistically.

However, the same relationship occurs when viewing the frequency of visiting friends and relatives living outside the respondents' neighborhoods. People who began seeing relatives outside more frequently than friends only with the onset of summer were found more frequently than people who experienced the reverse change.

Nevertheless, to reflect fully a greater impact of the immediate, outdoor environment, both relatives and friends "inside" should gain in frequency seen at the expense of their counterparts "outside". Indeed, the immediate environment, as expected, was more of a meeting ground in summer than in winter; whereas only 42 percent of the respondents met their neighbors outside in the winter, 60 percent did so in the summer. But, as Table 5 demonstrates, the relative shift of activity was in a more outward direction. More people had the balance of their interpersonal contact changed from inside to outside their neighborhood in the summer than the reverse whether friends or relatives were considered.

Although the above findings are with respect to <u>frequency</u> of interaction, similar results would be expected with respect to the <u>number</u> of friends inside and outside one's neighborhood. If the immediate, outdoor environment is more salient in a person's life in the summer than in the winter, then good weather should increase the number of friends reported within one's own neighborhood much more than outside it. Yet, once again, the reverse finding appeared. More people had the number of their friends change from greater inside to greater outside in the summer than had the reverse occur.

In short, all expectations of seasonal shifts in the locational balance of interpersonal contact based on exposure provided by the immediate, outdoor environment were unsupported. Although differences were at times narrow, the reverse relationship occurred consistently. These unexpected results continue when the notion of function is added to that of frequency and smount of contact.

We expected, for example, that people's use of their own neighborhood would increase as of the end of the June interview. Yet those who answered the question "What use do you make of areas outside your home but in the neighborhood?" with "none" increased from 22 percent to 28 percent from February to June. It certainly did not decrease as expected. In addition, as might be expected from the data on interaction, the percentage of people who used their neighborhood for "visiting neighbors and the like" decreased from 8 percent to 2 percent (N=124).

This is further substantiated by answers to the question "How many people in this neighborhood do you know and say hello to?" While 62 percent of the respondents (N=128) cited the same number during both interviews, only 14 percent gave a larger number in June than in February while 23 percented cited fewer.

(c) Levels of Environment

The data from this study clearly indicate a decreasing functional salience of the immediate environment in the lives of these respondents with good weather. The final specific hypothesis with which we started had to do with the distance between a respondent and those relied upon for crucial functions. It was expected that this distance would decrease in the summer due to more spontaneous outdoor contact with immediate neighbors. This hypothesis was upheld in part.

The distance between respondents and those to whom they would turn for assistance in an emergency decreased for slightly more people than it increased. This distance decreased for 21 percent, increased for 18 percent and remained the same for 51 percent.

Nonetheless, acceptance of this hypothesis must be tempered by the fact that the distance from a respondent to the person she knows best in her neighborhood increased more frequently than it decreased from February to June (17% - 13%).

That assistance in an emergency, of all the relationships studied, alone turns inward on balance during the warmer months can be explained in terms of the neighboring function.

TABLE 4: Net shifts in frequency of participation in selected activities among at least minimal participants from February to June, 1968 (in %).

activities	increased participation	decreased participation	net shift	N
A. Increased participation from winter to summer.				
1. sports (attendance or participation	52%	24%	+24%	66
2. attend church or synagogue	28	12	+16	68
3. pleasure reading	35	22	+13	128
B. Decreased participation from winter to summer				
1. employment	11	52	-41	54
2. arts and crafts	30	59	-29	27
3. take educational courses	31	52	-21	29
4. attend associations or meetings	23	41	-18	47
5. telephoning	17	32	-15	130
6. play musical instruments or sing	27	40	-13	15
C. No marked change from winter to summer				
1. shop for sundries	3.5	3.5	nil	114
2. attend movies	30.5	30.5	nil	36
3. shop for clothes	24	23	+ 1	98
4. shop for groceries	6	8	- 2	116
5. attend parties or suppers in the home	26	29	- 3	86
6. eat at restaurants	30	34	- 4	61
7. attend plays or concerts	33	40	- 7	15
8. watch television	23	31	- 8	130
9. sew or knit	27	18	+ 9	113

TABLE 5: Change of balance in location and type of personal contacts, February to June, 1968 (in %).

location or type of dominant personal contact	type of change A	B	no change	N
1. Frequency visit friends inside neighborhood versus relatives inside A) Change from relatives to friends B) Change from friends to relatives	12%	19%	68%	130
2. Frequency visit friends outside neighborhood versus relatives outside A) Change from relatives to friends B) Change from friends to relatives	19	27	54	130
3. Frequency visit relatives inside neighborhood versus relatives outside A) Change from outside to inside B) Change from inside to outside	6	15	78	130
4. Frequency visit friends inside neighborhood versus friends outside A) Change from outside to inside B) Change from inside to outsite	22	23	55	130
5. Number of friends inside neighborhood versus number of friends outside A) Change from outside to inside B) Change from inside to outside	15	23	62	130

As Keller sums up the existing literature, one of the prime functions of the proximate neighbor is that of supplying such assistance (Keller, 1968). Indeed, neighbors typically fear to have their relationship become highly personal lest it turn sour and ruin a valuable mutual aid relationship. Since warmer weather does put neighbors together more frequently in absolute terms, it is therefore not surprising that the distance from a respondent to the person to whom she turns in an emergency would decreast at that time even though average distance travelled to friends, relatives and others increases at the same time.

Looking at the salience of different levels of environment more broadly, this study started out with the assumption that for women with families in suburbia, who were expected to exhibit familistic life styles (and did so), the immediate, outdoor environment would be highly important for behavior. Indeed, we expected that its salience to these women's lives would be demonstrated by comparable data gathered in winter and summer.

We did not gather time budget data and hence have no way of comparing absolute use of this level of environment at these two times. Indeed, despite the findings reported here, I would still expect much more use of this environment in June than in February, as the data on where neighbors are met suggests.

Nonetheless, while these findings are serendipitous and not systematic, they report in consistent although not dramatic fashion the declining importance of the immediate, outdoor environment to these women relative to more macroscopic levels of environment. In this perspective it would appear that the rigors of winter inhibit use not only of the immediate, outdoor environment but even more so of the macro-environment. Moreover, it would appear that the permeability of macro-environment improves to a much greater extent in the warmer seasons than does that of the immediate environment. For example, although people may come in contact with their immediate neighbors much more easily in summer than in winter, they find by the same token that their ability to visit friends across town is improved to an even greater extent. As a result, the latter type of interaction increases more significantly than the former.

What this implies is that the immediate environment plays a more crucial role in the women's lives in the winter than in the summer. If relatively cut off from the larger part of metropolitan surroundings in the winter, a woman is forced to a greater extent to find companionship and service in the more immediate area -- even though this might still be more difficult in the winter than in summer.

This suggests that the popular standards for designing and choosing a local area might be turned on its head, at least as far as its consequences are concerned (as opposed to its public support). In northern climates the local neighborhood might well be geared to maximize winter rather than summer use if the choice were required.

It is neither possible nor desirable to generalize to a larger population what these data on white, suburban, middle class mothers with familistic life styles demonstrate. Nonetheless, the pattern by which our original hypotheses on environment were rejected is highly suggestive of the importance of macro-environment in the lives of those people thought most dependent on immediate environment. Although it is without question premature to herald the onset for the whole population of "community without propinquity" (Webber, 1963), the notion that close personal relations can exist in cities even though the persons partaking in them are not geographic neighbors, it is clear that the macroscopic level of environment is highly relevant for the present sample and that, furthermore, its permeability is related to weather conditions more so than is that of the immediate environment; both interaction and activity are consequently affected. In addition the concept of "community without propinquity" is more variable even for those to whom it applies than has been previously suggested.

That these factors play such a role is relevant both for the designer faced with the satisfaction of human needs and for the sociologist who must account for the range of factors which make intelligible his statistics.

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CHAPTER I

INTRODUCTION

Over the past few years, process-oriented urban research has increasingly taken on a systems theory format. The city is viewed as a systems aggregate of sub-systems, each of which is amenable to the study of a particular phenomenon or sets of phenomena. Of the many possible urban systems, several have received particular attention. Michelson (1968) for example, distinguishes a physical and a behavioral urban system in an attempt to evaluate their mutual interdependence. The former physical system is defined roughly as those aspects of the physical environment pertinent to human behavior, while the behavioral system is viewed as a composite of social, cultural and personality variables (see also Studer, 1967). Fisher (1968) and Schofer (1968) similarly distinguish a physical and a human system, and suggest that these are linked by an "activity" system. In the same vein, Chapin regards the functional organization of the city as "an urban activity system", of which the human system, defined in terms of what people do in the city, is the most important sub-system. This human activity system links the economic and institutional systems.

Whatever their specific purpose, these systems are all by definition behavioral. They are designed to relate components and their attributes through concepts of flow, feedback, equilibrium, etc.: they are " ... composed of <u>component parts</u> each of which has a distinctive behavioral functioning, which are assembled together in some discernable <u>topology</u> or structural form. The topology constrains the functioning of the components, and affects their actual behavior." (Ellis, 1968, p. 2) These systems are interdependent and operate within the overall system. Their boundaries however, tend to be arbitrary, and it is often difficult to see the logic that separates urban systems from their environment, defined as "The set of all objects a change in whose attributes affect the system and also those objects whose attributes are changed by the behavior of the system." (Hall, 1968, p. 83) In general then, systems are bounded sets of variables selected for the specific purpose of the description and analysis of their internal interaction and their external relationships with the overall system or other systems.

Chapin's pioneer work on urban activity systems focuses on between systems or external relationships. He defines human activity analysis as "... a methodology for the analysis of human behavior patterns which has relevance for the spatial arrangement of the city ... (i.e.) an approach for defining activity patterns which has predictive significance for urban spatial structure in the metropolitan area ..." (Chapin, 1966, p. 7) He is therefore primarily concerned with macroscopic implications of activity patterns, even though he recognizes "internal" relationships (relationships between activities).[1]

However, in the social sciences the term "human behavior" has a different connotation. It refers to some form of stimulus-response framework which ties values, needs, motivations, etc. to specific human activities. While this interpretation of "behavioral" is entirely amenable to the above systems formulation, it essentially refers to human action at a microscopic scale. This means that it emphasizes the methods by which individuals arrive at their activity patterns.

The present paper focuses on the latter microscopic aspects of human activities. It regards activities as outputs from a behavioral system - the individual decision maker and his attributes - in the context of environmental or "external" inputs. Why emphasize the role of the individual in creating activity systems? Surely not because of the inherent superiority of microscopic behavioral research. The contributions of macroscopic research to urban theory are beyond question. However, as geographers seek to refine their tools and to develop theories, their knowledge of the internal operation of "black boxes" increases. This is an inevitable result of scientific curiosity and also of the recognition of a need for improved planning inputs. It is contended that an understanding of how and why people "behave" the way they do will increase

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[1]This approach can also be considered microscopic, since activity analysis is based on the observed behavior of individuals rather than aggregates of individuals.

our predictive capabilities by showing the effects of component and parameter changes on system functioning.[2]

Thus, the present paper is concerned with the factors affecting the activity selection process. The main aim is to explain observed activity patterns and in this sense the measurement of activities can be regarded as an end in itself. The activities in which an individual engages are the outcome of a complex set of interdependent factors. These include his personal attributes such as values, goals, attitudes, etc., as well as his perceived social and physical environment. Correlations of these variables with the activity output may provide important insights into their "restraining" and "enabling" power. This is illustrated by recent studies on man-environment relationships. Both Studer (1967) and Sommer (1968), for example, admonish architects and designers for their failure to incorporate human livability requirements into their designs: "The detection, isolation and structure of environmental problems grow out of an analysis of human behavior systems. It is only through an analysis of this class of variables that quantities, qualities and relationships of elements in the designed environment can be properly determined." (Studer, 1967, p. 3) Hall (1966) stresses the importance of perceived space in his study of "proxemics", while Ardrey (1966) contributes less rigorous biological illustrations of "territoriality". Finally,

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[2] For further discussions of the planning implications of systems theory approaches see MacKinnon (1968) and Forrester (1968).

Michelson (1968) notes that behavior patterns may be used to examine experiental congruence, i.e. the degree to which the physical environment allows people to do what they want to do. He agrees with the above authors that "Experiental congruence of people and environment is the research approach that is basically needed to form specific physical plans for the future." (Michelson, 1968, Ch. 2, p. 31) Even though Michelson does not focus on activity systems per se, his study is the most comprehensive with regards to man-environmental relationships since it reviews most input and systems variables mentioned above. In the present paper emphasis is placed on both the internal design and the external arrangement of the physical dwelling unit.

The study of activity systems is clearly contingent on detailed information about the individual's activities. Before one can analyse behavioral patterns, one must know what they are. The key concept here is the activity "inventory". The inventory differs from the commonly used term activity "budget" in that it comprises as many activity parameters as possible, rather than focusing on frequency and duration. The term activity system cannot be used here, since we are not primarily concerned with relationships between activities.

It may be recalled that Chapin's macroscopic approach hinges on the use of the activity inventory for the explanation of urban form and function. The inventory may therefore be regarded as a means to the study of a variety of urban phenomena.

This also applies to the use of the inventory as a set of supplementary independent variables for research control purposes. Commonly used socio-psychological indices of age, income, sex, etc., provide only the crudest information about individuals. Once the key discriminating activities have been identified according to their socio-psychological connotations, they can be used to provide finergrain population breakdowns. These applications of activity analysis as "a means" are contingent on a concise and efficient methodology for collecting and processing activity data and on our ability to interpret this data.

The present study does not purport to develop a theory of human activity systems. It is exploratory in nature and touches on a broad and by no means fully comprehensive range of problems involved in activity analysis. Where possible, tentative solutions are suggested and empirical tests of their feasibility are applied. In the main however, the paper aims at surveying the potential of the activity systems approach to a number of research problems of urban form and structure.

In spite of the obvious limitations in research of the exploratory kind, one may argue with Cattell (1966) that this research is essential in the formative stages of any scientific development. Premature standardization in approach and technique may unduly limit the potential of an approach. A broad scope need not detract from logical coherence and pertinence in the guidelines developed.

The latter is ensured by focusing in the first instance on the practical aspects of activity analysis: how can activities be measured, and to which aspects and levels of the urban environment do they pertain? Chapter II therefore discusses an elementary activity typology. The second step in activity analysis, discussed in chapter III, involves speculations about one possible starting point for the explanation of activity patterns. It views activities as the outcome of complex individual decision processes and it notes characteristics of the decision maker and his inputs. Several empirical relationships are hypothesized. Chapter IV outlines the survey format and the research procedures used in the study. It includes a cross-comparison of the independent variables, designed to eliminate redundant variables. Empirical findings are reported in chapter V.

CHAPTER II

A TYPOLOGY OF HOUSEHOLD ACTIVITIES

The aforementioned activity "inventory" comprises activities engaged in by individuals or groups of individuals during an arbitrary period of observation.[3] Homans (1961) regards all behavior as activities, including emotions, states of mind, eye blinking, etc. These are clearly of no direct consequence to urban form and function, and the sub-set of activities here relates closely to the popular notion of activities as "things which people do in their daily life routines."[4] This covers an extremely broad range of activities: shopping behavior, travel, recreating, socializing (both within and outside the home), holidaying, and so on. The discussion below is therefore restricted to the most elementary activity characteristics. Further detail must be inserted in research covering any one particular activity or group of activities. However, an elementary activity typology is an essential starting point for the development of activity analysis.

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[3] In chapter III this inventory will be called the activity "bank", under the assumption that observed behavior reflects behavioral predispositions, or the range of perceived behavioral alternatives.

[4] The discussion of individual activity patterns, here refers to the head of the household and/or his spouse. In some cases the activities of children are included.

The individual activity inventory may be defined as the location of the individual in a multi-dimensional activity space.[5] Each activity can be plotted according to its temporal characteristics, its spatial patterning, and its "meaning": the three major dimensions of the activity space. Jointly, they make up the individual's <u>activity space</u>. The former two are self explanatory. Obviously, all activities occur in time and space. However, they do not all exhibit significant regularities in time and space, i.e. their patterns may be too irregular for meaningful generalization, or they may occur at levels which are not significant for urban analysis. The former case is illustrated by attending weddings and funerals, the latter by going on a European holiday.[6] The typology is aimed at recognizing salient regularities in patterns of activities emitted by individuals, and at gauging the similarities in these patterns between individuals.

The "meaning" dimension of activities is less obvious. Activities can be described in common language; thus we can catalogue activities according to their general nature (recreation, personal care, shopping, etc.), and their specific type (i.e. going to a show, dressing, visiting a drugstore, etc.). However, these categories are entirely arbitrary and they only provide information about their relative importance in the form

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[5] The use of this abstract space is discussed by Perroux (1950). In contrast, Hitchcock applies the term in its strictly spatial sense, as indexed by (1) average distance to out of home activities, and (2) number of different non-work trips (Hitchcock, 1968, p.3).

[6] This is not to say that these activities are devoid of sociological content.

of general activity counts (i.e. the number of people involved in certain activities, or the frequency of occurence of an activity per 100 man-days, etc.). In the following chapter it will be argued that the meaning of activities, defined as subjective and individual activity weightings, can only be inferred from activity counts when they are viewed in conjunction with spatial and temporal activity patterns. In other words, the relative importance of activities as measured by their frequencies and spatial patterning, can be considered a surrogate measure of their "meaning". Conversely, the meaning of activities allows the prediction of their temporal and spatial behavior, given a particular urban setting. The three hypothetical and non-rigorous dimensions are therefore interrelated, even though they contain distinct sets of activity characteristics. The third dimension is clearly the most important one; However it need not be considered explicitly in macroscopic research of the kind suggested by Chapin since its interpretation presents as yet insurmountable problems; we are constrained to consider only the former two dimensions here. Chapter III presents a conceptual schema for the analysis of the third dimension.

Two final concepts must be defined at this point. Chapin suggests that the basic unit of analysis in activity research is the episode, defined as "... a reasonable homogeneous interval in the life time of an individual, an interval of time which is devoted to a single dominant purpose."[7] (Chapin, 1966, p. 8) He finds that this avoids the confusion between activity as a discreet observation and as a classification of the nature of the event. The above three dimensions are therefore more appropriately called episodinal dimensions.

Furthermore, Chapin distinguishes "within" and "between" interactions. Within interactions refer to the activity proper, or, in his macroscopic scheme, to landuse: "Activities spatially localized within defined activity zones..." (Chapin, 1965, p. 229). Between interactions refer to communication or more specifically to transportation: "... effort spent in movement is usually considered as a means of engaging in an activity rather than as an end or an activity in itself." (Chapin, 1965, p. 230) In the present paper both the trip to an activity and the activity itself are considered an integral part of the activity selection process. Thus the duration of an episode devoted to shopping will include both the time spent travelling to and from the store and the time spent inside the store.[8] The above distinction is therefore not adhered to here.

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[7]Episodes frequently contain several closely related activities. In these cases the activity that initiated the chain of activities is considered the dominant purpose of the episode. For example, there is a difference between going for a drive and doing some shopping along the way, and driving to a shopping center. The former involves recreation, the latter shopping as the dominant activity.

[8]Travel may in itself be the dominant purpose of a trip (see footnote 7).

The Time Dimension

Since Chapin's episode has been adopted as the basic unit of observation, "time" becomes the most dominant activity dimension. This dimension can be described in terms of frequency and duration or "span" characteristics.

In a general sense "... we may look at human activity in varying perspectives by shifting the time scale successively from the day, to the week, to the year, and to the full span of man's life." (Chapin, 1968, p. 13) These scales may be illustrated by sleeping, grocery shopping, holidaying, and moving, respectively. Chapin argues that the motivation-choice-activity cycles operating at the first three scales are similar to those operating at the last scale. However, the literature traditionally separates these two levels (i.e. shopping and travel studies versus migration and mobility research) - this convenient cutoff point is maintained here. Too little is known about short-term behavior to relate it directly to behavior in the long run. They may be similar in their basic behavioral aspects, but they involve different criteria and decision processes. (i.e. deliberate versus habitual, etc.) Clearly, the decision to move and the choice of a location are of a much more critical nature than the selection of daily life activities; the mover has to choose a site and a location which best accommodates the activities in which he wishes to engage.

The unit of measurement varies from activity to activity. Some activities, such as eating, personal care, watching TV, knitting, etc., take place several times a week or daily. Their patterns can be more meaningfully expressed in duration rather than in frequency, i.e. the number of hours per week or the average number of minutes per day per activity. For want of a better term, these activities are classified as "daily" activities. This does not mean that they occur daily, but that on the average they preempt noticeable proportions of the daily 24 hour period available to the household.

Other activities, such as attending sports and plays, and going to movies, take place less frequently. Hence they are measured on the basis of their weekly, monthly, or yearly frequency. The average number of minutes per day spent on these activities is clearly negligible in most cases. For these activities the shorthand term "monthly" is used. In summary, high frequency "daily" activities are measured in terms of duration, while low incidence "monthly" activities are measured in terms of frequency.[9]

Since daily activities are measured on an interval scale in this study, a variety of statistical techniques can be applied to comparison and aggregation of household data. However, monthly activities are usually measured on an ordinal scale, and one is limited to non-parametric techniques. In a later section of this paper a method for converting the latter ordinal data to interval data will be proposed. This method remains

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[9]With a few daily activities, the frequency of occurence is also significant. This is illustrated by the difference between people who shop for groceries once a week and those who shop several times a week. However, this will be reflected in the average activity span.

fairly rudimentary and improvements are contingent on improved data collection procedures.

Two other activity characteristics are closely related to the time dimension: Sequence and periodicity. Whether activities occur at random or regular intervals, their incidence may be clustered.[10] Where these clusters reflect some planned organization of activities relative to each other, their sequencing in time may provide clues as to the organizational processes and criteria involved. In probabilistic terms, two activities A and B are independent if $P(A/B)=P(A)$ or if $P(A/B) \rightarrow P(A)$ above a certain threshold. For example, watching TV and going to the drugstore are usually independent. The latter qualification is inserted because activities with similar frequencies may be in harmony and hence falsely suggest dependence.

Where activity A and B are closely related $P(A/B)$ will approach $P(A)*P(B)$ and vice versa. This is for example normally the case with preparing food and eating, personal care and getting up or going to bed, etc. Thus the outcome of one activity is preparatory to the next activity. If more than two activities are linked in this manner, a chain is established and graph theory terminology of vertices and edges can be used. In fact, graph theory provides several powerful methods for recognizing chains among the many possible activity linkages

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[10] These clusters are functional and distinct from the arbitrary groupings discussed in previous sections.

(see Huff, 1961; Ogilvie, 1968).[11] Similarly, one may speak of a tree if activity A is more likely to be preceded or followed by activity B,C, or D, than by any other activities. Again, this type of cluster analysis depends on improvements in data collection and processing.

Most activities are recurrent. They can therefore be compared and grouped on the basis of their periodicity. They may range from the completely stable, with regular occurrences over time, to the completely unstable, where occurrences approach randomness. Given the week as a basic unit period of observation, one may for example recognize; (1) sustained activities (activities occurring throughout the period of observation, i.e. sleeping, eating, etc.), (2) intermittent regular activities (those occurring at certain regular intervals, such as shopping for groceries making telephone calls, going to church, etc.), and (3) intermittent irregular activities (activities which may or may not occur during the weekly period, i.e. holidaying, attending plays and concerts, etc.) This approach is felt to be more rigorous than elementary frequency measures discussed in previous sections. However, the study of activity periodicity requires in most cases extended periods of observation. Proposed urban monitors or urban panels show promise in this direction, even though at this time there is no

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[11] For a detailed review of classificatory techniques of potential use to activity analysis, see Land and Williams (1966). Some techniques used in demography also show promise for activity analysis. See Sheps (1966) on the person years concept.

concensus about the level of detail these complex census techniques are to cover (Worrall, n.d.).

The Spatial Dimension

Household activities may be viewed as complex sets of household linkages with services, facilities and people in the urban environment. Each individual link connects an origin -- usually the home (Hemmens, 1966; Marble, 1967) -- with an activity site or a location some distance away. This activity location may be a point unit, such as a retail establishment or a place of employment, but it may also be a more or less defined area, as in the case of some outdoor recreation activities, shopping chains, and urban travel in general. The spatial dimension of activities then, refers to the spatial distribution of both types of activity locations.

The pattern of activity locations, or in Chapin's terms the "within" component of urban interaction, appears particularly amenable to macroscopic research of the location and landuse type. However, these studies emphasize second order links, i.e. relationships "within" landuses (e.g. the hierarchical distribution of retail establishments), and "between" landuses (e.g. the location of wholesale versus retail establishments).[12] The present study is primarily concerned with first order linkages between the home and urban activity locations.

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[12] It should be noted that many of these studies include aggregate indices of first order links between individuals and elements in their physical and social environment, e.g. measures of population potential, hinterland, accessibility, etc.

The urban landscape presents an almost unlimited number of possible activity locations. However, no individual has information about all these locations and he makes selections from a limited range of perceived alternatives: these constitute his potential activity locations (Berry, 1969, p. 205) or his action space. This space can be defined as "that area with which the individual has contact and within which his activities take place." (Wolpert, 1965, p. 163) This definition is however slightly ambiguous and may be interpreted to mean the same as Brown's awareness space, comprising both direct contacts (the "activity space") and indirect contacts (the "indirect contact space"). The latter contacts cover "Locations about which the household has perceptions as the result of second-hand contact through such channels as acquaintances' experiences, mass media, or advertising." (Brown, 1968, p. 6) In the present context, we shall distinguish the activity space, defined as the empirically observed pattern of activity linkages, from the above action or awareness space which index the sum total of the individual's knowledge about his environment. It is assumed that the former adequately reflects the latter.[13]

Horton and Reynolds suggest that the individual's activity space is a function of his activity requirements on the one hand and his time and space preferences on the other. He defines time preferences as the "... weighing of time

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[13] For a further discussion of the realm of social interaction see Webber, 1964; 1967.

allocations for various types of activities," and space preferences as the "cognitive image of the urban environment." (Horton and Reynolds, 1968, p. 3; see also Marble, 1967, p. 36; Boulding, 1961) The activity requirements and these preferences are affected not only by the individual's physical environment, but also by his group membership, his socio-economic status, his stage in the life cycle, etc. (Horton, and Reynolds, 1968, p. 4). Individuals who are similar in these respects will therefore likely share their activity space to some degree. This implies that, given a particular physical urban context and a relatively homogeneous or controlled population, observed activity spaces may provide insight into both activity requirements and time and space preferences. In other words, the concept of activity space allows one to study the role of environmental and perceptual constraints on the behavior of homogeneous populations. These constraints will be discussed at some lengh in chapter three.

Insofar as direct and indirect contacts are accurately reflected in an individual's activity space, it may be called his "information field". Several attempts at measurement have been made, using such surrogate measures as migration, mobility, travel, etc. (Hagerstrand, 1968; Marble and Nystuen, 1963; Pitts, 1963) Empirically derived mean information fields in general substantiate Horton's premise of similarity between individual information fields. Morrill and Pitts (1967) conclude that while individual spheres of contact are unique, they may be considered as chance variants of the overall or mean information field.

However, the mean information field approach has neither been tested on activity data, nor been used extensively for analytical purposes. Its merit for activity analysis is therefore subject to speculation. One might prefer finergrain techniques (see for example Neft, 1966).

In summary, it has been argued that (1) the individual's activity space is a sub-set of his awareness space and that the former reflects the latter fairly accurately, (2) this activity space is shared to a large degree between members of a relatively homogenous population and can be approximated by the mean information field, and (3) the activity space can be used to examine environmental and perceptual constraints on the activity selection processes of this population.

The above remarks pertain to activities in the urban environment at large. However, many activities take place in or near the home. How can these be included in the above activity framework?

In a previous section, the term "space preferences" was defined as the "cognitive image of the urban environment." This image informs the individual of where particular activities may best take place. In some cases any location will do, but in others only a few alternatives are open. The relative number of perceived locational alternatives may be called the space-specificity (SPS) of an activity. It is suggested that this concept bridges the gap between the macro and micro scales of the activity space; its implications are therefore briefly discussed below. It may be noted, that while several indices of SPS may be calculated, the remarks below provide only general guidelines as to the potential uses of the concept.

The design professions traditionally distinguish three levels of physical -- objectively measurable -- space. These are: (1) Internal space (space within the home), (2) External space (the urban environment at large) and (3) the interface between the two or Marginal space (the arrangement of dwelling units, their exits, front and backyards and that part of the neighborhood linked by frequent interaction between neighbors).[14] The latter division is a vague but nonetheless realistic level of space.

Some activities, such as visiting a movie theatre, shopping, working, etc., predominantly take place in external space. With most of these activities the individual may chose from a relatively large number of widely scattered potential activity locations (the sub-set of possible activity locations that is included in his awareness space). On the other hand, activities

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[14] These three levels of space are applied to all physical structures. However, buildings such as offices, movie theatres, shopping centres etc. are here considered as activity locations external to the physical dwelling unit. Their internal arrangement is reflected in the space preferences of the individual since they form part of his "cognitive image" of the urban environment (see p. 18).

such as sleeping, watching TV, cooking, predominantly take place in internal space. Here the individual considers only one activity location. Finally, there are some activities which usually (but not always) occur in marginal space, i.e. relaxing, barbecuing, chatting with neighbors, strolling, etc. Despite the occurrence of overlapping one readily notices that certain activities predominate at particular scales of urban space, and that the number of alternative locations considered decreases as one moves from the macroscopic to the microscopic level.[15] Similarly, the SPS of an activity may be taken to index the urban scale at which that activity is likely to occur. It is hypothesized that there is an inverse relationship between the activity SPS and the scale of urban space.

This relationship is distorted by three major factors: (1) activities may be non-discretionary in their spatial patterning, e.g. socializing may take place not only at home but also at a number of other locations, (2) some activity locations are scarce, e.g. theatres for the performing arts (this scarcety is inversely related with city size) and (3) individuals may vary widely in their activity SPS.

The first two factors can be resolved by focusing on discretionary activities. In connection with the third factor, one may recall a previous argument (p. 18) which suggested common denominators underlying the structure of the activity

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[15]The term "scale" refers in a general sense to the aforementioned division of the urban environment into space internal, proximate and distant relative to the dwelling unit.

space and space preferences. Individual differences in overt activity SPS's may therefore be regarded as chance varients of some mean set of space specificities for a hypothetical homogeneous population. For example, an individual may habitually visit one movie theatre making this activity highly space-specific. Other members of the population may on the average visit ten different movie theatres during the period of observation. This provides the standard SPS for movie going for that population. In general, activities can be located on a continuum ranging from a highly space-specific to a random distribution (the latter may occur anywhere in the urban environment). The SPS rating thus provides a means for synthesizing the spatial behavior of all activities irrespective of their scale of occurrence. It may therefore serve two purposes (1) description and comparison of the spatial behavior of individual activity spaces, and (2) analysis of the physical and socio-psychological constraints on the patterning of the action space. One may ask for example; how do different groups vary in their space-specificities, and to which factors may these differences be attributed? One could expect low income groups to exhibit a great degree of SPS in most of their activities since they tend to frequent few locations in external space and many of their activities "belong" in internal and marginal space. Conversely, high income groups tend to exhibit more exploratory behavior and regard different (fewer?) activities as belonging in internal and marginal space.

A substantial amount of work will be required to develop the concept of SPS. One may find encouragement in the results obtained in studies of the internal design of dwelling units. Several British reports note that the internal arrangement of dwellings must be designed to facilitate the activities in which the residents wish to partake. (e.g. Hole and Attenburrow, 1966) This means that it should separate incongruent activities (i.e. such highly space specific activities as cooking, sleeping, studying, watching TV), and allow the joint occurrence of congruent activities (less space specific activities such as socializing, relaxing, reading, knitting, etc.).

In summary, the present chapter has presented some activity characteristics which need to be considered in gauging the individual or group activity inventory. Rather than focusing on tried measures of the time and space characteristics of activities, an attempt has been made to cover a broad range of criteria and techniques. This purports to the general aim of the present paper to assess the potential of the activity approach for urban analysis, and to provide general guidelines for future research. Chapter III proposes a behavioral schema for the analysis of household activities.

CHAPTER III

A BEHAVIORAL APPROACH TO ACTIVITY ANALYSIS

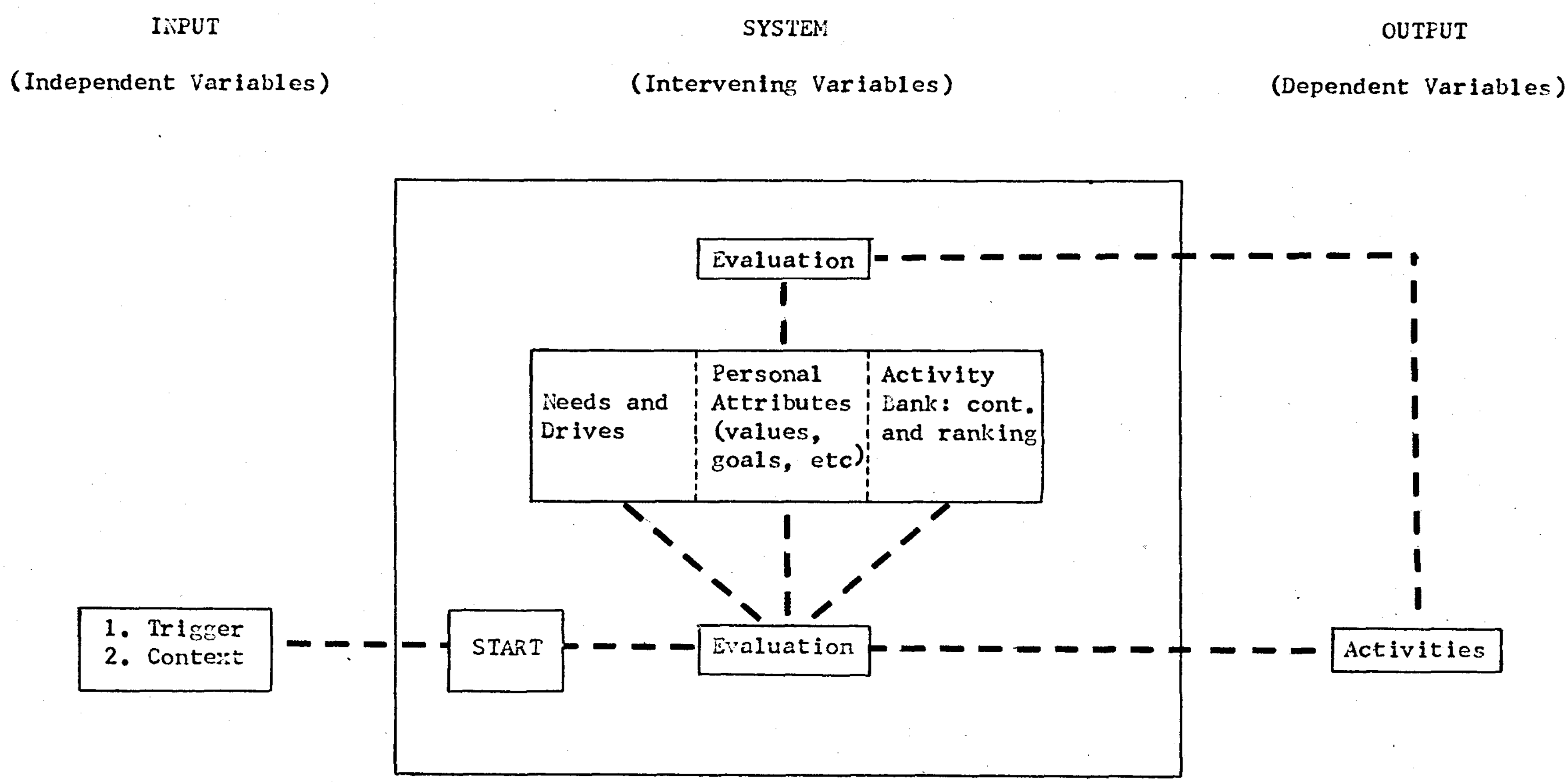
The previous chapter discussed some salient attributes of household activities. The typological organization imposed on activities serves two purposes. Firstly, it allows a detailed factual statement of how people "behave" in their urban environment. This is an initial step toward behavioral complement of theories of urban form and function. Secondly, it is preliminary to the study of the decision processes that underly the organization of activities. The present chapter assumes information regarding activity inventories and discusses how these reflect on the nature and operation of individual activity selections. The heuristic schema presented below is aimed at providing a logical framework for the most important factors involved. Some of the constraints on activity selections will be covered in detail, and hypotheses will be tested on empirical data presented in chapter V. The schema does not purport to be a decision theory of behavior, since several important concepts have been deleted for the sake of brevety.

The individual decision maker can be regarded as an activity selection system which receives inputs from its environment and produces outputs in the form of activities. In operational terms, antecedents (stimuli) are independent variables impinging on the system, which consists of arrays of intervening variables and which produces responses (behavior) as dependent variables (Tolman, 1951, p. 279). Inputs, outputs, and major systems components are diagrammed in figure 1. The activity inventory discussed earlier is the systems output. Two kinds of inputs are shown: (1) triggering events of stimuli, (2) perceived environmental constraints. The latter constraints connote perceived limitations imposed on behavior by the physical, socio-cultural, and economic environment. The feedback cycle constitutes a third "input". It informs the individual of his performance in the existing context, and allows him to monitor and update type (2) inputs. The central box in the schema contains the intervening variables. These "convey the notion that postulated states, conditions, or processes intervene between the behavior and its observable correlates or antecedents." (Engel, 1968, p. 21) The evaluation mechanisms of the system are integral with the individual's characteristics, which are here conveniently broken down into three categories: (1) basic needs and drives, (2) personal attributes of values, goals, attitudes, personality, etc., and (3) a hypothetical central storage unit for perceived behavioral alternatives. These components will be more fully covered in the ensuing sections.

The Measurement of Systems Variables

The components and parameters of the behavioral system cannot be measured directly. Personal attributes such as attitudes, values, etc., and evaluative processes of maximization,

Fig. 1: An Input-Output Model of the Activity Selection Process



satisficing, etc., although quite plausible, are hypothetical constructs inferred from input-output relationships. The divergence between behavioral theories is attributable to this lack of direct access to the system. However, many of these theoretical constructs are eminently useful insofar as they may be identified with measurable entities, and lend themselves to the prediction of observable events (Sheldon, 1951). Thus, the utility of particular concepts discussed here depends on how accurately and efficiently they model processes tested empirically.

The study of behavioral systems can follow two strategies. Most detailed and accurate are inferences based on controlled experiments, where behavioral outputs can be related directly to specific stimuli. Experiments in perception, learning, and many other subjects of psychology have in this manner provided insight into the memory and visual characteristics of the system. However, the abundance of stimuli impinging on the system in the urban environment precludes recognition of all but the most elementary systems characteristics. Notable examples are the so-called impact studies which attempt to isolate changes in behavior and systems components (attitudes, values, etc.) following major environmental changes (e.g. floods, tornadoes, urban renewal, high-way construction, etc.). These studies are accurate only insofar as observed changes are attributable to the postulated causes.

In most cases such well defined stimuli are not available, and systems characteristics are inferred solely from response patterns. This second strategy is adopted in the present paper. It basically involves the testing of theoretical systems attributes against empirically observed behavior patterns. If one finds for example, that activities vary according to some measure in the "attitude" systems component (where all individual attributes are viewed as interdependent parts of the system), one may suggest that (1) the attitude measure describes a "real" systems component in that it allows behavioral systems to be distinguished from one another, (2) the attitude component influences in some predictable manner the observed behaviors, and (3) attitudes affect some activities more than others. This last finding is most important for behavioral theories. In the above example, it throws light on the functioning of the attitude component. It therefore allows redefinition and refinement of the concept in terms of its bearing on activities, and so "the spiral of interdependence of outcomes, measurement and theories continues." (Isard and Dacey, 1962, p. 71)

The above strategy assumes a steady state, i.e. the systems parameters (and here also the systems inputs) are assumed to remain fixed within certain bounds for the period of observation. Herbst observes that "the empirical study of behavior principles will need to be based on the study of individual cases over a period of time during which, as far as possible, parametric steady state conditions are maintained." (Herbst, 1961, p. 74) Uncontrolled changes will decrease the reliability of the findings (for the compounding effect of such measurement errors, see Alonso, 1968). The span of the observation period is important, since a long span allows recurrent behavior to be checked for random variations which would otherwise enter systems parameters.

Postulates

The motive force of the system derives from two generally accepted postulates: (1) people seek to optimize, maximize or satisfice their utilities. While behavioral theories differ in their definitions of the means and ends of behavior, they all recognize man's basic need for satisfaction, comfort, happiness, etc. (Isard and Dacey, 1962, p. 2). There is no general theory of behavior that postulates grief or dissatisfaction oriented behavior (for a complete review of decision theory see Edwards, 1967). It follows that (2) the behavior systems tend toward steady state conditions of greatest satisfaction and least stress; "The system, in other words will operate so as to incorporate one set of activities, maintain its activity rate within a certain range, and create certain types of interlinkage between activities, and so as to eject other activities, resist changes in the activity rate, and avoid the formation of other types of activity structure." (Herbst, 1961, p. 78) Thus an individual's behavior space, defined earlier as the set of behavioral alternatives from which he is likely to choose, is bounded by a flexible region of increasing strain beyond which the system can no longer maintain steady state conditions. Changes in the systems variables, parameters or outputs will occur in an attempt to reestablish some equilibrium (Herbst, 1961, p. 81). This semi-permanent set of activity alternatives characterizing the steady state has variously been called the "activity pool" (Herbst, 1961, p. 193), the "habitual response" phase of development (Golledge, 1967, p. 117), and the "object orientation" (Parsons, 1951, p. 10). In this chapter it is called the activity bank, a term which conveys the notion of a temporarily constant stored array of behavioral alternatives perceived by the individual. This activity bank plays a central role in the activity selection process.

The Activity Bank

The activity bank contains all behavioral alternatives open to an individual, including both activities which the individual emits or has emitted in the past and activities which are unfamiliar but congruent with his personality. If studied over a long enough span observed behaviors (activity inventories) will likely approximate the activity bank content. In any case they will indicate which activities are congruent and which are incongruent to the individual. In a sense the activity inventory provides direct access to the behavioral system since it relates directly to one of the systems components (the hypothetical "bank"). Consequently, it will also relate to other systems components (needs, values, attitudes, etc.) and the nature of the activity selection process (the evaluation boxes and feedback cycles).

The activity bank can be thought of as an array of activities accompanied by an array of subjective activity valuations. The first array is the _content_ of the bank. The second array represents the "state" of the individual, i.e. his behavioral predisposition at a point in time. This array is called the activity _ranking_ of the bank. It is a function of the individual's level of deprivation and his time and space preferences (see chapter II).

The activity rankings are not entirely voluntary. Some activities are relatively fixed in space and time. Man's functioning as a biological organism compells him to engage in certain activities at regular intervals, e.g. sleeping, eating, relaxing, and associated activities of dressing, cooking, etc.[16] These essential activities are common to all population strata and they are here called _basic_. For people of the same socio-economic class and at the same stage in the life cycle, the episodinal characteristics of these activities are relatively _fixed_, i.e. they will show small variations in their use of time and space. However, these characteristics may vary considerably between groups. For example, large lower class families will appear to spend more time on basic activities than small upper class families because of their frequently marginal facilities (one bathroom, small and poorly equipped kitchens, etc.)

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[16] In his discussion of inate biological rhythms, Dubos suggests that many other activities may be associated with man's biological functioning. (Dubos, 1965, p. 42 ff.) However, these less obvious cases need not concern us here.

and the obvious demands of child-raising and care for the elderly.

Chapin refers to basic activities as obligatory, as against activities such as watching TV, attending shows, socializing, etc. which are discretionary and which are allocated to free time (time left after completion of basic activities). These are called non-basic activities here since the above argument showed that all activities are more or less discretionary. The episodinal characteristics of non-basic activities are relatively *flexible* since they (1) are less vital to the functioning of the organism, (2) tend to change over time, and (3) differ widely in type and frequency from one individual to the next.[17]

In general, non-basic activities tend to be more flexible in their episodinal characteristics than basic activities, both in terms of irregularities in individual behavior patterns and variations between individuals. An individual may attend, for example, shows at irregular intervals even though his overall attendance may be much higher/lower than that of other individuals. Thus the terms basic and non-basic refer to activity types, while fixed and flexible connote the episodinal differences between these types.

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[17] Obviously, some or possibly all non-basic activities may be basic (i.e. vital) to the mental health of the individual. Since there is little specific information about this, the term basic refers specifically to activities essential to the physical well being. Even though it is felt that the basic is an improvement on the obligatory - discretionary classification (at least in its descriptive content), further research is required for a more rigorous definition of these two distinct sets of activities.

The data allow the following hypotheses to be tested[18]

1) Basic activities are more fixed than non-basic activities. In other words, their episodinal characteristics will show greater regularity than those of non-basic activities.

2) Basic activities account for a large part of the time budget available to the individual, i.e. they will occur more frequently than non-basic activities.

Systems Operation

The activity selection mechanism can be activated by internal triggers (physiological needs and drives) and external triggers; "The environmental entities (physical, social, and cultural objects and processes) presented to the individual actor at the given moment." (Tolman, 1951, p. 280) The start box in the schema is therefore linked with the needs component and the external input. These triggers do not in themselves determine the course of action selected, although in many cases habitual response patterns are set up (in particular with basic activities, see Golledge, 1967).

Whatever the activating event may be, the individual will tend to select (habitually or deliberately) a course of action from among the alternatives stored in his activity bank. The outcome of this selection depends on his subjective activity rankings. Homans describes the process in terms of cost-benefit analysis. Each activity is associated with an expected reward (satisfaction or positive reinforcement) and a perceived cost

[18] For a discussion of the data and the survey see chapter IV.

(energy expenditure) relative to all other activities. The individual will maximize his satisfaction (or minimize his stress) if he chooses an activity which has greater profit than the alternatives which he forgoes by selecting that activity (Homans, 1961, p. 59).[19]

As mentioned earlier, the expected rewards or activity rankings (the utility of each event X the probability of its occurrence) depend on the state of the individual.[20] This state varies according to three major kinds of variables (others, less relevant to the present study have been omitted):

1) The level of deprivation. The more often an individual has been rewarded in a particular stimulus situation in the recent past, the less valuable the reward associated with this activity is likely to be.

2) The individual's personal attributes, such as personality, values, attitudes, etc. Chapin, for example, notes behavioral differences concomitant with a need for achievement (personal fulfillment) and status (socio-economic rank).

3) The individuals's place in the social system (and as we shall see later, his place in the physical and economic system as well): "... an executive... measures

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[19]Homans does not endorse the behavioral assumptions of classical economic theory but merely uses the terms in analogy with his transactional theory of social behavior.

[20]The activity rankings at a given point index one state, the given state, where the term state refers to the variables that underly changes in the activity rankings.

achievement by the power and responsibility he has in the company... and the brick mason's need for achievement is reflected in the pride he takes in the craftmanship he brings to building a wall or a chimney..." (Chapin, 1966, p. 13)

Clearly, the above variables will elicit different behaviors (and hence different behavior rankings) even though the basic motivations underlying different selections may be similar. Measurement of these hypothetical systems variables may therefore be related to systems outputs. They are not discussed in detail here since the data available does not allow these variables to be tested. However, in a later section selected "external" systems constraints will be reviewed.

The activity selection process can be modelled as a Markov process. Isard postulates a matrix with the rows depicting a finite number of behavioral alternatives (the action space), and the columns depicting the environment which also assumes a finite number of states. The individual searches the cells of the matrix with the aid of his "outcome function", which represents his limited knowledge of the consequences of each cell (Isard and Dacey, 1962, p. 3). This outcome function is synonimous with our activity rankings, or the state of the individual at a given point. In summary, the activity selection process (the behavioral system) can be viewed in terms of three major sets of variables; external inputs (environmental states), stored behavioral alternatives (the activity space), and the subjective ranking of these alternatives relating the two.

Clearly, activities are the product of an extremely complex set of factors. It is not possible to do justice to the vast number of studies on the subject of decision making and on the psychological aspects involved in the space available here.[21] The above outline is merely meant to provide a theoretical backdrop for the empirical research in chapter V.

One final aspect must be mentioned. An individual's activity rankings are influenced by the positive or negative feedback he receives: Activities may be deleted or inserted, or activity attributes may be modified. For example, parking problems in a downtown area may cause an individual to change to suburban facilities (the distance and location attributes), or he may decrease the number of downtown shopping trips (the frequency attribute).

Systems Constraints[22]

The previous section introduced a general behavioral approach to activity analysis and noted some of its salient elements and processes. Two major influences on the choice of activities

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[21] An extension of the above schema would include considerations of 1) intuitive behavior, i.e. the aforementioned habitual response patterns, 2) search behavior, i.e. the testing of new activities, locations, etc. (see Gould, 1967), 3) the planning of activity trees and chains (see Miller et. al., 1960), and 4) risk and uncertainty.

[22] For further discussion of the system and its constraints see T. Bunting. (1969) "Household Activity Systems": A Behavioral Approach to Urban Interaction," Ph.D. research proposal; Department of Geography. University of Toronto (Mimeo.)

from among perceived behavioral alternatives were postulated: the individual's attributes and his environmental context. The present section reviews selected aspects of the latter environmental inputs for the purpose of hypothesis generation.

Systems constraints are defined as the boundary values of systems variables that delineate the individual's activity space under steady state conditions. Insofar as these constraints consist of relatively permanent individual attributes of values, attitudes, personality, etc., they may be thought of as "internal" to the systems (i.e. systems variables). In part however, they are external in that they derive from the individual's awareness of his environment. For the ensuing argument, "external" constraints are defined as comprising those systems variables which can meaningfully be related to the individual's momentary context (systems inputs). Thus, activities are affected by internal or personal limitations and external or environmental limitations.

The present discussion is limited to three broad categories of external constraints: (1) physical, (2) social, and (3) economic. These sets of constraints are called "spaces". Thus an individual's activity space is constrained by his perceived location in physical, social, and economic space (see page 8 for a further discussion of the abstract space). The questions asked in this section are; how are the individual's activities affected by his environment, and to what degree do environmental constraints allow the prediction of behavior (i.e. what is the relative importance of "internal" constraints versus that of "external "constraints)?

I Physical Space

Each activity has a time cost associated with it, i.e. the amount of time spent travelling to the site and the duration of the activity (see page 12). According to the arguments in the previous section, the individual intuitively selects the activity or group of activities that optimize in some sense his utilities, and by definition minimize his time costs.[23] These time costs are not constants since both travel and duration can be modified within limits. However, these limits may be quite narrow where few suitable activity locations are available or where habitual behaviors are predominant. Since the selection of some activities precludes the occurrence of others, and since activities must be traded off on the basis of their time costs, the distribution of specific activity locations is likely to affect the choice of activities. This agrees with an earlier argument that activities are influenced by space and time preferences -- both of which are a function of the preceived environment (see page 17). The data used in this study contain only one variable pertaining to the broader environment (proximity of the home to services and facilities) and this relationship is not tested here (see chapter IV).

One factor has not been mentioned above: the attractiveness

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[23]Other costs such as dollars spent, inconvenience, etc. are implicit in utility. These will be covered in a later section.

or perceived suitability of available activity locations. This becomes increasingly important when the above argument is applied to the marginal and internal space of the dwelling unit.[24] For example, the public space adjacent to a townhouse may be used for entertaining, barbecuing, and relaxing, but townhouse residents may think these activities incongruent with public space. While theoretically a large number of diverse activities may take place in different dwelling types, the spatial arrangement of these dwellings may be congruent with some activities, incongruent with others (e.g. the head of the household can have his hobby shop in an apartment, but most cases this would not occur because of the possibility of bothering neighbors).

According to literature and the findings of Comment report number 1 (see preface) the North American myth of the single family dwelling is still alive. This suggests that people who have achieved this ideal will be more home-oriented than those who are still "unsettled". The data afford a breakdown of the sample according to dwelling type; single family, townhouse and maisonnette.[25] This relationship can therefore be tested, and it is hypthesized that;

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[24] The previously stated argument regarded space as a medium with objectively quantifiable characteristics, while here it is considered more of a variable (see Michelson, 1968, Chapter 2).

[25] Single family units are surrounded by private open space whereas townhouses and maisonnettes are now dwellings with little private open space. In addittion, the last mentioned type has a common entrance corrider for access to individual units (see Chapter IV for more detail).

3) Single family units are conducive to indoor and marginal activities, i.e. single family residents will show a greater proclivity for home-oriented activities than town house or maisonnette residents.

4) Single family residents will spend more time on basic activities than maisonnette or town house residents since these were shown to predominate in or near the dwelling (page 20).

5) Single families will therefore show less flexibility in their activity inventories (both in terms of the number of activities -- since according to (5) they have less time available -- and in terms of the variations of activity attributes). See the discussion of basic activities on page 32.

However, if part of the reputation of the single family unit is based on its inherent characteristics, an alternative hypothesis may be suggested:

6) Single family residents will engage in a greater variety of activities because the superior design of the dwelling is congruent with a larger number of activities. The converse of 5) will therefore also hold true.

II Social Space

An individual's social space is defined roughly as his perceived socio-economic status or class. There are a variety of indices of socio-economic class, each suited to a particular use (see Miller, 1964; Lazarsfeld, 1955, Chapter 10; Jackson, 1968; Engel, 1968, Chapter 3). In general they include highly interdependent variables of income, education, and occupation. The present paper does not calculate an overall SES index, but rather analyses these three independent variables individually.

SES indices are not merely social science tools for comparing relatively homogeneous groups of people according to material signs of their position in society. They appear to reflect the way in which people themselves perceive society as being structured. Haer (1966) for example, concludes from his survey of perceived social strata that differences in SES constitute real social boundaries.[26] Yet there is little consensus in the interpretation of SES. Michelson suggests -- to mention one example -- that these indices "measure such intangible elements as power, prestige, respect, and honor by means of occupation, education, and income primarily, although housing and neighborhood conditions also play a part in some measures." (Michelson, 1968, ch. 5, p. 1) However, there is general agreement that people of different SES tend to behave differently and that homogeneous groups behave alike: "All of the people who make up a social class _tend_ to behave like one another. That is, they have similarities in personality, in manner of dress and language, in values, in possessions, and in the activities they undertake." (Engel, 1968, p. 265) The latter note is of prime concern in this section.

Since the sample was deliberately kept homogeneous with regards to SES, the analysis cannot cover the whole range of SES (see the following chapter). However, the middle-class group studied does exhibit considerable variation, and may be subdivided into lower and upper middle class. The former instance is characterized by blue collar or clerical occupations,

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[26]The criteria most frequently mentioned were: financial (57%), character and attitudes (41%), position or status in society (17%), education (15%), and occupation (7%) (Haer, 1966, p. 262).

incomes less than approximately $7,500 ann., and education of the husband and/or wife up to grade twelve. The latter is characterized by professional and managerial workers, incomes in excess of $9,000 annually and post secondary education for husband and/or wife.

How will upper and lower middle class people differ in their activities? Some guidance is provided by Pirie's remarks:

> "Lower class people like to watch T.V., or go to the movies. In general they are non-readers, in the sense that they do not care to read.... the typical middle class man plays Canasta, rummy or poker; he watches T.V. and goes to the movies and the bowling alley... The middle class family is a child-centered family, and the wife, to a large extent, is a home-oriented person... The upper middle class group... is composed of professional people: doctors, lawyers, professors, executives... They play bridge, and Scrabble; drink cocktails; go to plays, museums, symphonies, and art galleries; belong to golf clubs, yacht clubs, and college clubs." (Pirie, 1966, p. 257)
> "In general, the higher the social class, the more active the use of leisure time." (Engel, 1968, p. 265)

Since the upper-lower distinction used here is rather vague and does not lend itself to comparison with the existing literature, no specific hypotheses are formulated. Instead, chapter V presents descriptive activity profiles associated with these two SES levels.

III Economic Space

Each activity has an economic cost and a perceived cost; These two may vary considerably. A classical example of this is the public-private transportation problem. The cost of public transportation is frequently lower than that of running a car (ignoring car pools, kiss'n-ride, and other convenience factors), whereas often the reverse is thought to hold true. This can be attributed to the car operator's failure to make detailed cost calculations, and to the fact that public transportation requires direct outlays of small sums of money. It is therefore here assumed that costly activities are activities which require immediate dollars and cents expenditure (some forms of education, such as short lecture series, plays, movies, etc.). One would expect higher incomes to be associated with a high frequency of participation in "costly" activities. Income is closely related to aforementioned socio-economic indices and its bearing on activities is discussed in conjunction with them (chapter V).

IV Life Cycle

One final control variable lends itself to analysis: stage of the life cycle. The set of behavioral requirements changes with the stage in the life cycle. Meyer recognizes four distinct stages in the adult cycle, two of which are relevant here: 1) Young adulthood (20-35) and 2) the middle years (35-50) (Meyer, 1966, p. 219). Families in the first stage are in a state of flux; "These are active days for most families, and the adults are involved in dovetailing the many developmental tasks of the family... (they) do not have the time available to carry on the activities they followed prior to their marriage." In short, these families are likely to be home and career oriented. Families in the second stage have become more settled and have developed lasting social ties, even though rapid changes in the family and career continue to occur. The children are now older and more time will be available for leisure activities.

Again, the above age categories do not entirely follow on with those used in the study, and direct comparisons are difficult. On one hand, younger families are expected to be more active -- as a carry-over from their childless period -- while on the other hand older families are more likely to have the funds and free time for a variety of activities. The author has therefore elected to examine activity profiles for different age groups, rather than to test specific hypotheses.

CHAPTER IV

SURVEY AND RESEARCH PROCEDURE

The present component study analyses data selected from a large scale survey designed and administered by professor W. Michelson's graduate Urban Sociology class, of the sociology department, University of Toronto. The fieldwork was completed during the month of February after several weeks of design and questionnaire pretesting. This survey has been described in detail in component report number I (Van Spyk, 1969) and the discussion here is limited to aspects pertinent to the analysis in chapter five.

The survey was aimed at investigating sociological concomitants (behavior and preferences) of features in the built environment. The sample of 230 families was therefore stratified with respect to three major physical variables:

1) Dwelling type. The three dwelling types covered -- single family, town house, and maisonnette -- differed in type of outdoor access and the number of shared walls.

2) Proximity to services and facilities. Some of the families lived within walking distance of community facilities, others required some form of transportation.

3) Outdoor open space. Some units had private outdoor space (all single family dwellings and some maisonnettes), while

others had no private outdoor space.

Three major Toronto sample areas were involved. Braeburn woods in the Northwestern part of Metropolitan Toronto had town houses and maisonnettes (owned and rented). These were distant from facilities and services, but had a great variety of open space. A Mixture of owned and rented single family dwellings were found in the Lions Gate develepement in Scarborough, close to the Northeastern limits of the metropolitan area. Finally, rented town houses and maisonnettes were found in the Cloisters of the Don sample tract, towards the North-central limit of Toronto. These were close to a variety of shopping and service facilities. It may be noted that all three sample tracts were in the suburbs. Central-city patterns differ in several respects, and a much greater sample would have been required for the separation of the two.

The sample was controlled by the random selection, within the above sample areas, of families which were (1) married, with children living at home, (2) WASP, and (3) earning approximately $7,500 annually. It was felt that this sample was representative of groups with limited means but with upward social mobility.[27] Most of the questions pertaining to control variables, including age, education, etc. were precoded and inserted at the beginning

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[27] The aim of the study was to provide sociological design inputs for cheaper and denser low rise dwelling types than presently available in the Toronto market. The above population sector was thought to benefit most directly from improvements in housing, since their choice in the market is limited: they earn too much for public housing and too little for government mortgage assistance.

of the questionnaire. However, the respondents were expected to be somewhat reluctant in answering questions regarding income and religion (the latter is not used here), and hence the modified Q-sort used was inserted near the end of the interview, when it was felt the respondent would be more at ease. Appendix III lists the independent variables incorporated in the summary deck and the number of respondents falling into each of the categories.

Of the projected 230 families, 173 useable interviews were obtained. The 25% sample decay was due to the absence of respondents, families without children, vacant dwellings, and refusals. Only housewives were interviewed; they were thought to be more knowledgeable about the amenities and disamenities of the home and the attitudes of other members of the family since a large proportion of their lives takes place in the dwelling.

The diverse backgrounds represented in Michelson's graduate class ensured a well thought out and broad coverage of the research problem.[28] However, redundancy had to be balanced with brevity -- a key consideration in all questionnaire surveys. The activity section, which formed only one of the many parts of the

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[28] The questionnaire reflected the design "by committee" procedure, and the lack of training of the interviewers resulted in occasional serious flaws in the returns (missing observations, incorrect responses, etc.).

questionnaire, was therefore drastically limited in terms of the activities covered and the detail of the schedule. Most of the questions were precoded (a practice which, while efficient, does not allow experimentation with the categories used by returning to the original questionnaires). Part of the interview schedule is reproduced in appendix II. The frequencies shown in appendix III exhibit considerable skew in some activities. This was partly caused by attempting to summarize data consistantly, but it also reflects the initial categories used (for frequencies of the raw data, see the descriptive tables presented in appendix I and chapter 5).

Analytical Procedure

The raw data was coded by Michelson's graduate class and key punched at the Ontario Institute for Studies in Secondary Education. Their IBM 360 computer was used to generate frequency tables (using a Datatext subroutine) and to generate a summary data deck covering most of the variables. The BMD 08D Chi-square program was run on the University of Toronto Institute of Computer-sciences' IBM equipment to test relationships within and between the sets of dependent and independent variables. Significant relationships were entered in a 80 X 80 binary matrix which was subjected to principal components analysis. The outcome of this experiment is not reported here, since essential program modifications could not be made in time. However, the technique revealed several salient clusters in the data structure. Psychological non-metric scaling techniques and graph theory algorithms may similarly be applied where the ordinal and nominal nature of the data impedes the use of multivariate techniques.

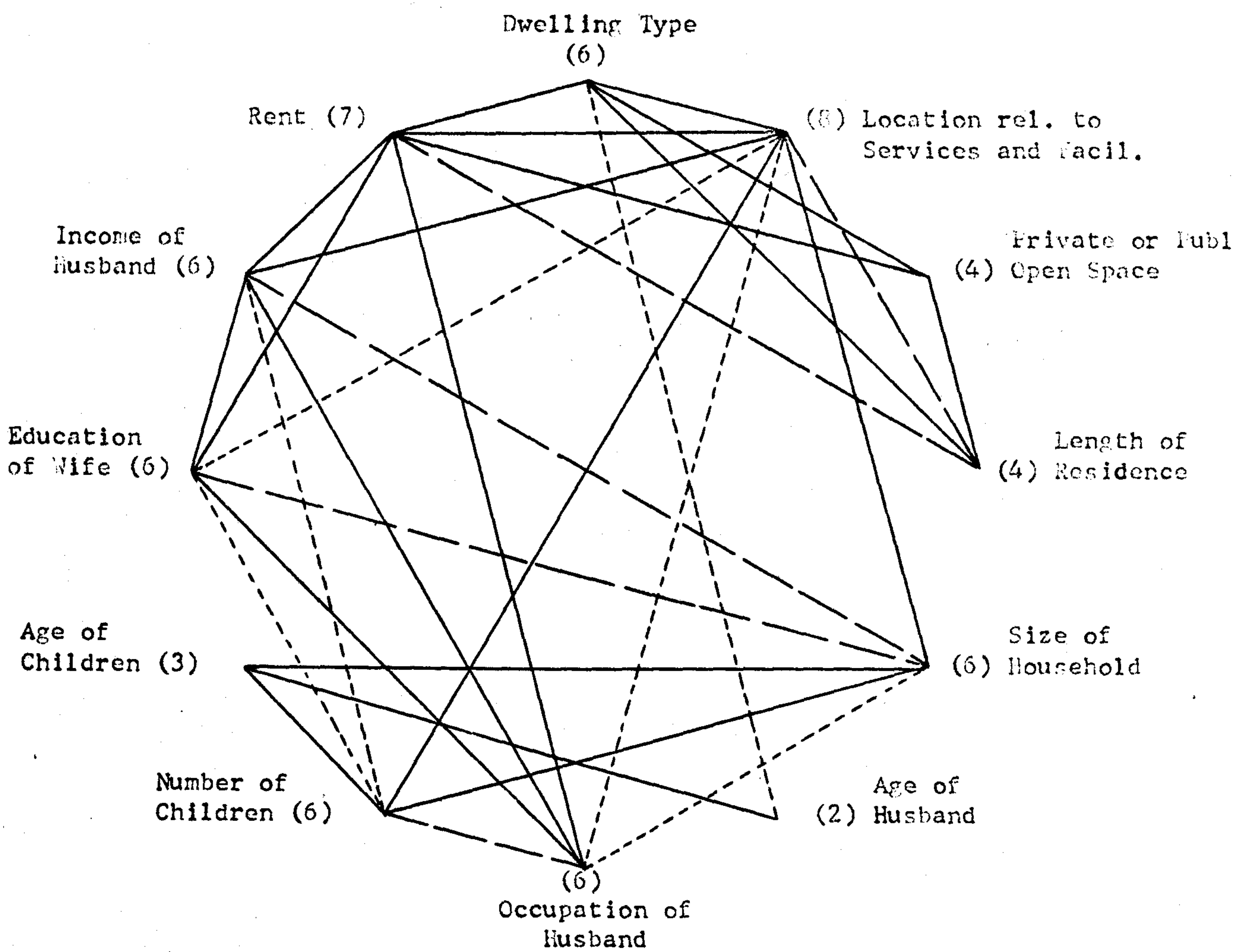
While consistent rules were adhered to in generating the summary deck, the problem of low cell frequencies was severe. However, chi-square tests run by Michelson's groups on reorganized data corroborated the significant relationships found in the summary deck. Inconsistencies appeared only in marginal relationships. While shortcomings in the data and techniques are obvious, the findings essentially agree with the activity literature (see chapter V).

Control Variables

The present discussion of the 'within' structure of the control or independent variables serves two purposes. Firstly, the amount of data to be analyzed made economy measures imperative. Hence the question was asked; which independent variables are most representative of the set of all eighteen control variables? Those selected were used in most of the study, with occasional cross checks on the remaining variables. Secondly, the 'within' structure describes the nature of the sample more adequately than mere frequency distributions. It shows clearly the pivotal variables, and the sample differences they index.

Figure 2 shows the independent variables considered here and the strength of their interrelationships. It is derived from the Chi-square tests which also formed the binary input for

Fig. 2 : Significant Relationships between Independent Variables.



Chi-square levels of significance:

———— = .001
— — — = .02
- - - - - = .05

The variable Shared Facilities, not shown here, was related to Dwelling Type (.001) and Open Space (.05).

the principal components analysis. Subsequent tables in this section also derive from the Chi-square results.

The structure of the independent variables is fairly straightforward. Most socio-economic and life cycle variables are highly interrelated. The prime pivotal variable, however, is Location relative to Services and Facilities. It ties in the physical with the sociological variables to a greater extent than any of the other variables. As we shall see below, this variable concisely indexes major differences between two sub-groups of the sample. The variable Dwelling Type is related with fewer independent variables. However, it is of prime consideration here since it is expected to index major within-home activity differences (and subsequently variations in out-of-home activities - see chapter III). A third variable -- public or private Open Space -- is included since it proved highly significant in another analysis of the same data (Bunting, 1968). It appears of limited importance in figure 2, but this may be caused by the diverging grouping criteria used in this study. These three independent variables are briefly discussed below. The percentages in tables 1 and 2 have been selected so as to clearly indicate the direction of the interrelationships.

1) Dwelling Type. According to table 1 this variable summarizes a number of physical dwelling characteristics and several respondent characteristics. The single family dwelling unit profile presents a picture of a low cost dwelling, surrounded

TABLE 1

CORRELATES OF DWELLING TYPE [a]

Independent Variables	Level of Signific.	Dwelling Type: Single Family	Town House	Maisonnette
1. Monthly Housing Cost	.001	-$175 75%	$175-$224 78%	$175-$224 84%
2. Open Space	.001	Private 100%	Public 92%	Public 82%
3. Proximity to Community Services and Facil.	.001	Close 50%	Close 33%	Close 28%
4. Shared Facilities	.001	None 65%	Func. Spec. 43%	Func. Spec. 74%
5. Length of Residence	.001	3-25 yrs. 67%	1-3 yrs. 49%	-1 yr. 52%
6. Age of the Husband	.05	41-60 yrs. 46%	-40 yrs. 80%	-40 rs. 68%
7. Occupation of Husband	n.s.	Managerial 41%	Managerial 51%	Managerial 61%
8. Income of the Husband	n.s.	-$7000 51%	-$7000 47%	-$7000 34%
9. Number of Children	n.s.	1-2 49%	1-2 40%	1-2 44%

[a] The entries in this table show the proportion of respondents living in the dwelling type indicated in the column headings, who have the indicated independent characteristic. For example, the first row shows that 75% of all single family unit residents spent less than $175 monthly on housing costs, while 50% of the town house residents and 84% of the maisonnette residents spent between $175 and $224 monthly.

by private open space and lacking in shared facilities. It is generally distant (i.e. beyond walking distance) from Community services and facilities. The single family sample area appears to be older and more stable than the other two areas; the length of residence is comparatively high and almost 50% of the husbands in this group fall between the ages of 41-60. The socio-economic status of these residents is comparatively low. A large proportion of respondents are in clerical and sales occupations and the majority have annual incomes of less than $7,000. The surprisingly small number of children living at home suggests that they have already mostly left the home.

In contrast, the maisonnette profile presents a picture of a highly mobile and well to do group at an earlier stage in the life cycle. This dwelling type is generally found to be distant from community services and facilities and has more private open space than the town house unit, but less than single family dwellings.

The town house profile appears to warrant its position in the table. In many respects its characteristics lie between those of the single family and maisonnette profiles. It is similar to the single family unit in having proximity to services and facilities and the lack of shared facilities. However, its socio-economic and life cycle characteristics appear more akin to the maisonnette profile.

In summary, the variable, dwelling type, appears to index two main sample differences: 1) physical dwelling characteristics, and 2) socio-economic and life cycle characteristics. It clearly illustrates salient distinctions between the single family unit and its residents and the other two units.

2) Location relative to community Services and Facilities. This variable loads on both dwelling type and housing costs, but it is mainly associated with life cycle characteristics (table 2). The interpretation presents difficulties since both single family units and town houses are found proximate to services and facilities. The profiles presented in table 2 therefore obscure some of the above mentioned differences between dwelling types. Compared with the distant location, the proximate location is associated with higher monthly housing costs, long duration of residence, high income of the husband, advanced education of the wife, small family size and number of children, and a high proportion of husbands in managerial and professional occupations. The long duration of residence appears inconsistent with the other variables. This is probably caused by the inclusion of single family residents most of whom had lived in their dwelling for many years. In short, a proximate location appears associated with young upwardly mobile families, and a distant location with an older and more settled group. Chapter V reviews Michelson's (1969a) argument that the proximate location is congruent with an active or cosmopolitan life style and the distant location with a relatively inactive or local life style. It will be shown that the proximity of local facilities per se does not induce an active life style, but that people with an active

TABLE 2

CORRELATES OF PROXIMITY TO COMMUNITY SERVICES AND FACILITIES

Independent Variables	Level of Signific.	Location[a]		
		Proximate		Distant
1. Dwelling Type[b]	.001	SF 40%	TH 42%	Maisonnette 72%
2. Monthly Housing Cost	.001	$225+ 29%	$175-$224 38%	$175-$224 60%
3. Length of Residence	.02	3-25 yrs. 44%		-3 yrs. 83%
4. Income of the Husband	.001	$7-10,000 44%		-$7000 63%
5. Education of the Wife[c]	.05	-SS 66%		-SS 82%
6. Number of Children	.001	1-2 65%		3-4 56%
7. Occupation of Husband	.05	Managerial 61%		Managerial 41%
8. Household Size	.001	1-4 61%		5-6 59%

[a] Proximate locations are within walking distance of community services and facilities, distant locations require some form of transportation.

[b] These abbreviations refer to single family, town house, and maisonnette units.

[c] -SS means that they have senior matriculation or less.

orientaticn seek convenient locations.

3) Open Space. This variable indexes the difference between the single family unit and the other two types. All single family units have private open space whereas the town house and maisonnette types have very little or no private open space. Furthermore the dwellings with private open space have no shared facilities (e.g. shared entrances, laundry facilities, etc.) and relatively low monthly housing costs (see table 1). They are associated with long duration of residence as well.

In summary, the variables -- Dwelling Type, Location relative to Services and Open Space -- appear to form adequate controls for socio-economic and dwelling type variations within the sample. However, several additional independent variables are included in chapter V. It should be noted that the reported outcomes are highly contingent on the detail of the survey and the groupings of categories adopted for the Chi-square tests. Categories which were too fine would have resulted in marginal expected frequencies while too broad categories would have obscured important relationships. A not always successful attempt has been made to find the optimal level of aggregation. Most conclusions are tentative and require substantiation through additional research.

CHAPTER V

EMPIRICAL FINDINGS

Appendix I and the questionnaire excerpt in appendix II show that several episodinal characteristics were covered in the survey. A detailed discussion of all of these character-isitics falls outside the scope of this paper. The author has therefore elected to focus on duration and frequency charact-eristics. The remaining attributes are summarized in table 10 (Appendix I) and will here only be mentioned where needed to avoid ambiguities in the definition of activities. The analy-sis presented in this chapter is by no means exhaustive. Its major purpose is twofold: the recognition of salient activity traits of the sample, and the illustration of the type of in-formation that may be obtained through activity analysis.

The chapter is divided into three sections. Section one describes the duration of daily activities and the frequency of monthly activities (both basic and non-basic).[29] Section two analyses the correlations of non-basic dependent varia-bles with the independent variables discussed in chapter IV. Finally, section three reviews elementary activity preference information.

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[29]The reader may recall that daily activities are common-ly measured in number of hours per week and monthly activities in weekly, monthly, or yearly frequency of occurrence (see page 12). Basic activities comprise activities judged essential to the physical functioning of the human organism and non-basic or discretionary activities are free choice activities (see page 32).

Frequency characteristics of the Activity Inventory

Table 3 summarizes the number of hours per week spent on selected non-basic daily activities (one basic activity - employment - is also included). The mean duration is shown to vary considerably between activities and they are all positively skewed because of the influence of a few high values. Most time is spent in watching T.V.; Its frequency distribution is approximately normal with the median value approaching the mean and a coefficient of skewness of 1.13. Due to th perceived stigma attached to watching T.V. and its "time filler" function, (see Chapin, 1966, p. 3) it is likely that this activity was under-reported. More accurate measurements may increase the degree of skewness but they would almost certainly result in higher mean values (see also the section of activity preferences).

Employment shows the second highest mean duration and an equally low coefficient of skewness. The low median value and high standard deviation reflect the fact that most of the housewives interviewed did not have a job and that very few working housewives had full time employment (see Fig. 3). The third most time consuming activity - reading - is approximately normally distributed, but the 18% of non-participants and several high values cause increased skewness. Since most of the respondents liked reading (see section three) and people often feel they should do more reading (Chapin, 1966, p. 32) this activity was probably over-reported.

TABLE 3

BEHAVIOR OF "DAILY" ACTIVITIES[a]

Parameters	TV	Knitt.	Music	Arts	Educ.	Reading	Church	Teleph.	Emp.[b]
N	171	166	165	166	168	171	167	169	163
Mean number of hours per week	14.67	5.02	.36	.72	.79	7.22	.89	5.09	12.35
Median	12.00	2.00	.00	.00	.00	6.00	1.00	3.00	.00
Standard Deviation	11.80	9.33	1.65	2.01	3.20	7.06	1.29	10.18	18.46
Skew	1.13	4.87	6.11	3.25	8.12	1.81	2.27	6.28	1.22
Kurtosis	.93	31.12	42.43	11.74	78.70	5.09	6.61	45.09	.60

[a]For an explanation of the term "daily activity" see the text.

[b]The abbreviated column headings read as follows: Knitting, Education, Telephone, Employment. All activities are more fully described in table 10.

Knitting, sewing and making telephone calls are similar in terms of their mean duration of 5.02 hours and 5.09 hours per week respectively (they are, however, not statistically related). The median values and coefficients of skewness indicate that most respondents spent relatively little time on these activities and that only a few spent a great deal of time on them. The use of the telephone appears less than one would expect in the suburban location of the sample tracts. However, it is consisten with sample characteristics noted below. As with most surveys of the present nature, the bias introduced by selective recall of activities cannot be assessed. In general the relative ranking of activities in terms of their duration is not likely to be greatly affected since most respondents engaged in several but not all of the activities listed. The figures presented in table 3 can therefore be considered fairly accurate and representative of the total sample.

The mean duration of the remaining activities is uniformly low. Mean and standard deviation values confirm that of the few participants, most spent little time on these activities. The relativly large spread in the time spent on educational courses confirms that these were followed outside the home and hence necessitated a certain ammount of time spent on travel. In contrast, playing musical instruments and fine arts activities took place in the home surroundings and generally did not seem to involve taking special courses.(see table 10 in appendix I). Approximately 50% of the respondents attended church at least one hour per week, with few attending more than two hours per week.

The above findings are depicted graphically in figure 3. The origin of the curves or the Y-axis indicates the percentage of non-participants. The slopes of the curves indicate the duration characteristics of the activities and their curvature the nature of the distribution of responses: a normal distribution would form a straight line. It is suggested that graphs of this kind are well suited to the comparison of activity characteristics of different samples.

In summary, participation was highest for watching T.V., making telephone calls, reading and knitting respectively; it was lowest for playing musical instruments, making educational courses, and fine arts activities. Employment and church-going fall between these extremes. It appears that a decrease in participation is associated with a decrease in the time spent on activities and - in the case of high (80-100%) and medium (50-60%) participation activities - an increase in the variability within the sample. In general, the respondents appeared to engage in few daily non-basic activities in which considerable variation was shown.

Tables 4, 5 and 6 present the frequency of occurrence of selected monthly activities. Although the analysis in section two focuses on non-basic activities (i.e. discretionary), several basic and social interaction variables have here been included for comparative purposes. The social interaction variables have been given a separate heading since they do not

Fig. 3: Percentage Ogives for the Average Weekly Duration of Selected Daily Activities.

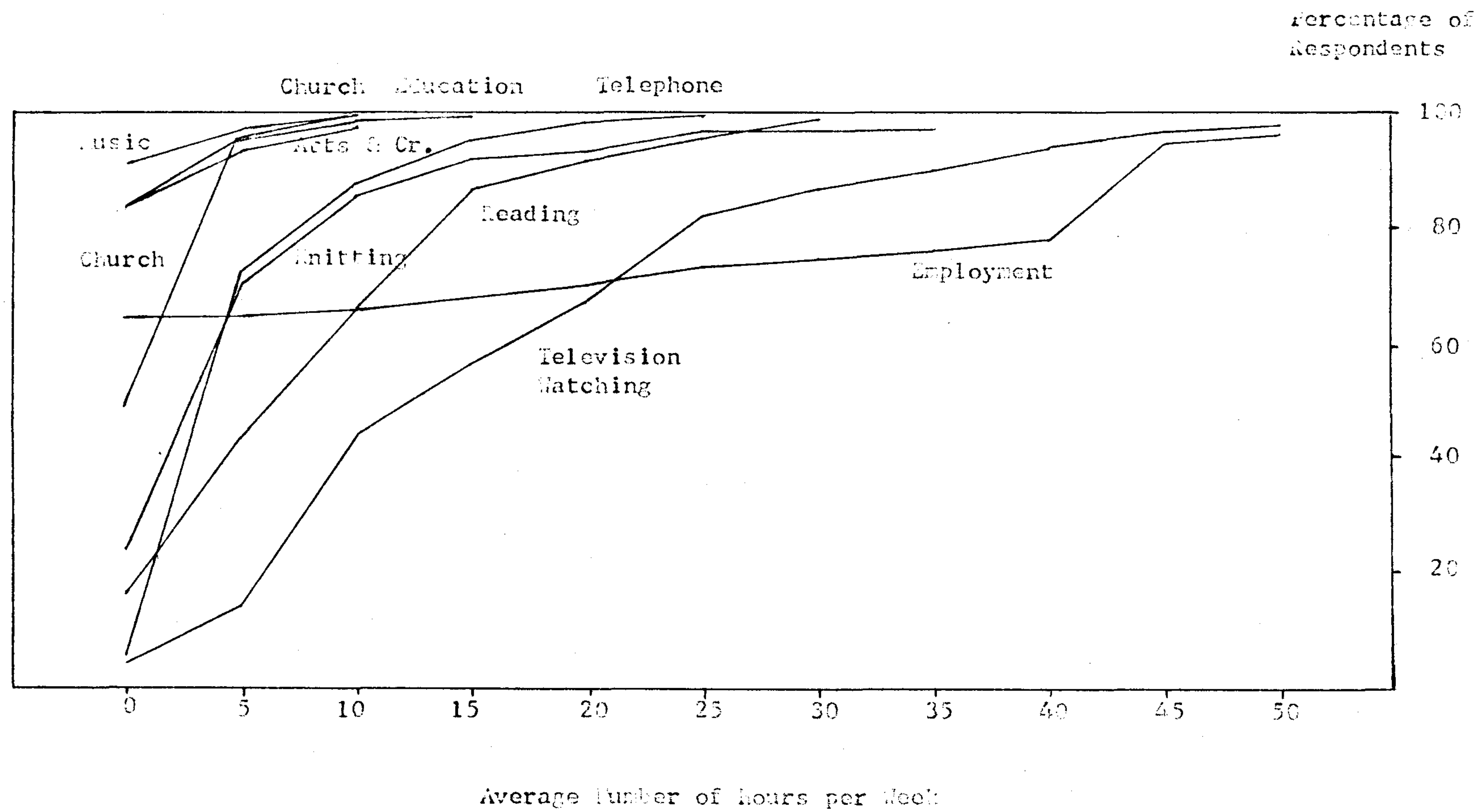

TABLE 4

FREQUENCY OF PARTICIPATION IN MONTHLY BASIC AND NON-BASIC ACTIVITIES
BY NUMBER OF RESPONDENTS

Activities	Basic Activities				Non-Basic Activities						Social Interaction[a]			
Frequencies	Drug Store	Clothes	Groc.	Phys.	Sports	Parties	Mov.	Restaur.	Meetgs.	Plays	RI	RO	FI	FO
1. Once a day or more	3	1	5	-	5	-	-	-	1	-	3	-	16	-
2. Sev. times a week	39	11	21	-	10	4	-	-	13	-	4	11	25	3
3. Once a week	47	27	105	4	23	19	3	10	11	1	10	26	32	22
4. Sev. times a month	19	35	18	7	8	33	13	21	15	4	3	30	28	40
5. Once a month	18	40	4	38	4	40	19	30	11	10	5	27	22	42
6. Sev. times a year	10	23	-	67	23	42	63	55	12	31	3	26	10	33
7. Once a year	2	-	-	12	38	13	36	26	32	47	-	8	1	3
8. Varies or Depends	-	1	-	5	-	-	-	-	-	-	-	-	-	-
9. Never	-	-	-	-	59	19	35	27	73	75	143[b]	44[b]	38[b]	29[b]
Sample size	138	138	153	133	170	170	169	149	168	168	173	172	173	172
Total % active	100	100	100	100	65	88	79	82	56	55	17	75	79	83
Median class	3	4	3	6	7	5	6	6	7	7	0	4	3	4

[a]Social interaction has been given a separate heading since it does not clearly fall into either the basic or non-basic categories. It is included here for illustrative purposes.

[b]These respondents stated that they had no friends/relatives inside or outside the neighborhood, and hence could not participate.

TABLE 5

FREQUENCY OF PARTICIPATION IN MONTHLY BASIC AND NON-BASIC ACTIVITIES BY PERCENTAGE OF RESPONDENTS.

Activities	Basic Activities				Non-Basic Activities						Social Interaction			
Frequencies	Drug Store	Clothes	Groc.	Phys.	Sports	Parties	Mov.	Restaur.	Meetgs.	Plays	RI	RO	FI	FO
1. Once a day or more	2	1	3	-	3	-	-	-	1	-	2	-	9	-
2. Sev. times a week	28	8	14	-	6	2	-	-	7	-	2	6	15	2
3. Once a week	34	20	69	3	14	11	2	6	7	1	6	15	19	13
4. Sev. times a month	13	25	12	5	5	19	8	12	9	2	2	17	16	23
5. Once a month	13	29	3	29	2	24	11	18	6	6	3	16	13	24
6. Sev. times a year	7	17	-	50	14	25	37	33	7	18	2	15	6	19
7. Once a year	1	1	-	9	22	8	21	15	19	28	1	5	1	2
9. Never	0	0	0	0	35	12	21	16	44	45	83	25	22	17
Total[a]	98	101	101	101	96	101	100	100	100	100	101	99	101	100

SUMMARY PERCENTAGE TABLE

High frequency[b] (weekly: 1,2,3)	64	29	86	3	23	13	2	6	15	1	10	21	53	15
Medium freq. (monthly: 4,5)	33	54	15	34	7	43	19	30	15	8	5	33	29	47
Low freq. (once a year or never: 6,7,8)	1	18	0	59	71	45	79	64	70	91	86	45	29	38

clearly belong in either the basic or the non-basic categories. They are not essential to the physical subsistance of the respondents, but they may be thought essential to the mental well being of a person (see p. 32).

According to table 4 the participation in basic activities was 100%. Participation in non-basic and social activities ranged from 75% to 88% with the exception of sports (65%), attending meetings (56%), and attending plays and concerts (55%). Only few respondents visited relatives within the neighborhood (17%) since most relatives lived outside this area.

Median class figures in table 4 and the percentage summary of table 5 indicate that basic activities occured more frequently than either non-basic or interaction activities. This confirms hypothesis 2 and suggests that at least in terms of frequency of occurrence, the basic non-basic distinction is a viable one, reflecting marked differences between the two sets of activities. The high median class values and percentages for social interaction activities suggest a similarity with basic rather than non-basic activities, although participation remains low in most cases.

While these relationships clearly hold for the total sample population, it is shown below that for participants the

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Note with tables 4 and 5: The abreviations read as follows: Grocery shopping; visiting the physician; attending movies; restaurants; meetings; visiting friends and relatives inside the neighborhood; outside the neighborhood.

social interaction variables - already important in the case of visits to neighborhood friends - now become the most important activity (see table 6). As expected, the basic activity of visiting the physician rates quite low; 50% of the respondents reported seeing their doctor only two or three times a year. Similarly, shopping for clothes has a lower frequency than grocery shopping or going to the drugstore. The above frequencies appear intuitively correct. Unfortunately, incompatibility with activity categories used in other studies (e.g. Chapin, 1966; Hithccock, 1968) does not permit verification of the values shown.

Basic activities were expected to be more regular or clustered in their frequencies than non-basic activities (hypothesis 1). The data bears this out: non-basic activities (both daily and monthly) show increased variations in their frequency of occurrence. According to table 5, attending plays and concerts, meetings of associations, and movie-going, occured least frequently and having parties with other people most frequently (see also the median class values in table 4). The last mentioned activity is clearly social and could have been included under the social interaction heading. Table 10 suggests that most parties were attended outside the neighborhood, with 48% of the respondents spending between 20 and 60 minutes on travel by car.

Visiting restaurants has a low rating but shows an increase in the medium frequency in the summary of table 5:

30% of the respondents reported participating several times a month or at least once a month. Participating in or attending sports is split with 71% attending rarely and 28% attending frequently (at least once a week). Unfortunately, the data do not reveal whether participation is active or passive or the kinds of sports involved. The latter is particularly important, since one may expect a considerable difference in the kinds of people that engage in golf, tennis and yachting on the one hand, and hockey, fishing and hunting on the other. Appendix 1 shows that the sports activities occurred during the week as well as on the weekend and that in most cases these required (61%) between 10 and 60 minutes of travel by car. Several respondents (21%) reported using local facilities for sports (this accounts for the 27% who reported spending less than 5 minutes in getting to the location for the activity). Since only 65% of the respondents engaged in sports of any kind, the community facilities appear remarkably important. Again, the failure to extract information on the types of sports activities involved does not allow an estimate of the influence of the availability of local sports facilities. In the case of limited availability the high use of local facilities for sports implies a marked community orientation of the respondents.

The large number of frequency categories make tables 4 and 5 rather difficult to interpret. Table 6 therefore condenses these categories by applying different weightings and summarizes frequency of occurrence in terms of average number of days

TABLE 6

FREQUENCY OF PARTICIPATION IN MONTHLY BASIC AND NON-BASIC ACTIVITIES BY MEAN NUMBER OF DAYS PER YEAR PER RESPONDENT FOR THE TOTAL SAMPLE AND FOR PARTICIPANTS.[a]

Activities	Basic Activities				Non-Basic Activities						Social Interaction			
	Drug Store	Clothes	Groc.	Phys.	Sports	Parties	Mov.	Restaur.	Meetgs.	Plays	RI	RO	FI	FO
Total Sample	69.1	36.3	64.8	8.5	28.0	19.6	6.4	12.3	20.0	2.7	13.4	24.8	69.7	20.8
Participating Respondents only	69.1	36.3	64.8	8.5	42.9	22.1	8.0	15.0	35.4	4.9	77.1	33.4	89.3	25.0

[a]These frequencies were calculated in the following manner: Each of the frequency categories was expressed in number of days per year by applying different weightings. Thus entries in row one - respondents who engaged in the activities once a day or more - were multiplied by 365. The other weightings were; 2) several times a week; 130 (2.5 days x 52 weeks), 3) once a week: 52, 4) several times a month: 36 (3 days x 12 months), 5) once a month: 12, 6) several times a year: 3, 7)once a year: 1, 9) never: 0. These frequencies were totalled for each activity and divided respectively by the total number of respondents for that activity and the number of participating respondents. The weightings remain crude even though they are based on careful interpretation of the survey returns. Category 8 was deleted because of low frequencies, see table 4.

per year per respondent for all monthly activities. The values in the second row of table 6 are higher than the overall values of row one since non-participants have been excluded. In general, the relative importance of non-basic and interaction activities versus basic activities increases for participants. The frequency patterns of table 6 agree closely with those of tables 4 and 5, however the activity of attending parties and suppers is shown here to be the third most frequent activity, next to attending meetings and sports. This may be attributable to the selected weightings (see footnote with table 6); however few respondents fall in frequency categories with the highest weightings (entries in category 1 were multiplied by 365 and entries in category 2 by 130) and errors in the remaining weightings will have only a marginal effect on the outcome.

The social interaction activities warrant closer examination. Tables 4 and 5 show that visits to friends within the neighborhood were as important as most basic activities, while visits to friends and relatives outside of the neighborhood occurred relatively infrequently. This agrees with the first row of table 6. However, when calculated for participants only, visits to friends inside the neighborhood become more important than any other activity (at least in terms of its frequency of occurrence) and visits to relatives increased notably to become the second most important activity. In contrast, the time spent on visiting friends and relatives outside of the neighborhood remained as low as that of most non-basic activities. This first suggests that social interaction is very important in the daily life of respondents who partake of social activities. They may therefore aptly be included in the basic category. This is further illustrated by the relatively low frequency of going to movies, restaurants, and plays - activities which do not necessarily involve a great deal of social interaction. Secondly the sample appears predominantly neighborhood oriented in its activities - a trait which explains the high use of community facilities for sports. Since the attending of parties was earlier shown to be associated with the extra-neighborhood acquaint nces and friends, it may be added that the social interaction within the neighborhood is probably casual and a part of the daily life routine. Thus the sample provides ample evidence for an extensive network of perhaps superficial interaction. This contravenes the commonly held view of suburbanites as being mainly nuclear family oriented, although the strength and frequency of interactions in the community do not appear to be as strongly developed as in ethnic and low income areas.

These findings suggest that many respondents considered some degree of community involvement desirable. If this is true of most suburban areas, the planning policies for new communities must clearly cover non-basic as well as basic activity requirements. Accessibility to community services and facilities remains of prime importance, but the physical design of the community should be congruent with the desire for social interaction of its inhabitants. As Michelson suggests, the physical plant does not determine the social structure of communities and the frequency of interactions; it can however impede or facilitate certain types of social activities, particularly under conditions of socio-economic homogeneity and rapid population turnover (Michelson, 1969, Ch. 8).

In summary, the data supported the two hypotheses of chapter V. Several arguments have been presented for the inclusion of social activities in the basic category. The sample was shown to exhibit low levels of participation in most non-basic activities and a high degree of neighborhood orientation. Social activities in general were found to be more important than activities of a non-social nature (excluding some basic activities).

Constraints on the Selection of Activities

It has been suggested in the previous chapters that several "internal" and "external" constraints operate on the activity selection process. It was hypothesized that these constraints would be reflected in the relationships between independent variables which characterise the individual and his environmental setting, and the dependent variables - the activities. Tables 7 and 8 summarize the statistically significant relationships of selected independent variables of residential context, life cycle, social class, and life style, with all non-basic or discretionary activities covered by the survey. Several independent variables not immediately relevant to the present study have been deleted. This is compensated for by the high degree of interrelatedness of the independent variables of dwelling type and location relative to services (see chapter IV).

The activity profiles of four key independent variables, (dwelling type and age, education and occupation of the head of the household) and the three independent variable profiles associated with the most discretionary activities (watching T.V., making telephone calls and attending plays and concerts) hav been completed by the insertion of all non-significant relationships. While in some cases these are tenous, the majority exhibit clear trends. The tables are self-explanatory. Only a few of the inplications will be covered here in order to test hypotheses of chapter III.

1) Present Residential Context. Single family residents engaged frequently in only three out of fourteen activities: fine arts activities, reading, and making telephone calls. This substantiates hypothesis 6 and also hypothesis 4 since these activities appear predominantly home-oriented. However, alternate hypothesis 7 must be rejected on the basis of the present data: single family unit residents clearly did not partake of a greater variety or number of activities than either town house or maisonnette residents. At the same time, they do not fall in the lowest frequency category in more than four out of fourteen activities - playing musical instruments (here anomalous because of the very low over-all participation), going to movies and plays. This indicates that single family residents are associated with a low frequency of outgoing activities. This corroborates with the earlier finding that

TABLE 7

INDEPENDENT VARIABLES ASSOCIATED WITH LONG DURATION OF DAILY ACTIVITIES AND HIGH FREQUENCY OF MONTHLY ACTIVITIES (NON-BASIC)

	Independent Variables	Longest Duration of Daily Activities (One Week Total)								Highest Frequency of Monthly Activities					
		TV 13-60 hrs	Knitt. 4-90 hrs	Music 1-20 hrs	Arts 1-20 hrs	Educ. 1-35 hrs	Reading 7-40 hrs	Church 1-10 hrs	Teleph. 6-100 hrs	Sports Mo+	Parties Mo+	Mov. Mo+	Restaur. Mo+	Meetgs. Mo+	Plays[a] MO+
Present Residential Context	Length of Residence	-1 yr. 53%			3-25 yrs ‡26%				3-25 yrs 24%					3-25 yrs *46%	-1 yr 15%
	Shared Facilities	Non-Spec. 67%							None 19%	Non-Spec. *47%			Non-Spec. *67%		F. Spec. 12%
	Dwelling Type[b]	TH 53%	TH *39%	TH 12%	SF 20%	TH 20%	SF 48%	SF/TH *54%	‡SF ‡31%	M 34%	TH/M 58%	TH/M 21%	TH ‡39%	TH 67%	M 14%
	Monthly Housing cost	-$175 *60%							‡$175 ‡30%						‡$225+ ‡17%
	Location of Serv. & Fac.	Distant 51%			Close ‡28%	Close ‡28%	Close *58%		Close 23%					Close *42%	Close ‡14%
Life Cycle	Household Size	7-9 64%							5-9 24%		1-4 *65%				1-4 11%
	Age of Husband	-30 yrs 56%	30-40 yrs 41%	41-60 yrs 14%	41-60 yrs 20%	-30 yrs 24%	41-60 yrs *55%	41-60 yrs 47%	-30 yrs 31%	-30 yrs 38%	-30 yrs *84%	-30 yrs *43%	-30 yrs 40%	41-60 yrs 35%	41-60 yrs 12%
Social Class	Education of Husband[c]	-SS ‡57%	-SS 77%	SS+ *26%	-SS 20%	SS+ ‡21%	SS+ *58%	SS+ *61%	-SS 25%	-SS 73%	-SS 47%	SS+ *37%	SS+ 49%	-SS/SS+ 30%	‡SS+ ‡24%
	Education of Wife	-SS *55%		‡SS+ ‡21%		SS+ ‡33%					SS+ 73%				SS+ ‡20%
	Income of Husband	-$7,000 *56%		$10,000+ *21%					-$10,000 21%						$10,000+ ‡29%
	Occupation of Husband[d]	Bl. Col. *58%	Bl. Col. 88%	Manag. 12%	Cler. 23%	Man. & Cler. 20%	Manag. 47%	Manag. 53%	Cler. 75%	Manag. *39%	Manag. *66%	Bl. Col. 23%	Manag. 49%	Manag. 36%	Manag. 14%
Life Style	Number of Cars											2 Cars *25%	2 Cars *41%		2 Cars ‡27%

TABLE 8

INDEPENDENT VARIABLES ASSOCIATED WITH SHORT DURATION OF DAILY ACTIVITIES AND LOW FREQUENCY OF MONTHLY ACTIVITIES (NON-BASIC)

	Independent Variables	Shortest Duration of Daily Activities (One Week Total)								Lowest Frequency of Monthly Activities					
		TV 0-12 hrs	Knitt. 0 hrs	Music 0 hrs	Arts 0 hrs	Educ. 0 hrs	Reading 0-6 hrs	Church 0 hrs	Teleph. 0-1 hr	Sports Yr-	Parties Yr-	Mov. Yr-	Restaur. Yr-	Meetgs. Yr-	Plays[a] Yr-
Present Residential Context	Length of Residence	3-25 yrs 58%			1-3 yrs **97%				-1 yr 38%					-1 yr *78%	1-3 yrs 95%
	Shared Facilities	None 56%							non-Spec. 47%	None *81%					Non-Spec. 100%
	Dwelling Type[b]	M 59%	M *40%	SF/M 95%	M 90%	M 89%	M 55%	M *63%	M **68%	SF/TH 30%	SF 49%	SF 83%	M **68%	M 84%	SF 98%
	Monthly Housing cost	$175-224 *59%							$175-224 **47%						$175 **100%
	Location of Serv. & Fac.	Close 58%			Distant **92%	Distant **90%	Distant *64%		Distant *38%					Distant *77%	Distant **97%
Life Cycle	Household Size	1-4 55%							1-4 38%		7-9 *76%				7-9 100%
	Age of Husband	41-60 yrs 49%	-30 yrs 34%	-30 yrs 97%	-40 yrs 85%	31-60 yrs 85%	-40 yrs **59%	-40 yrs 47%	31-40 yrs 39%	31-40 yrs 73%	31-60 yrs *48%	41-60 yrs *88%	31-60 yrs 36%	-40 yrs 71%	-30 yrs 93%
Social Class	Education of Husband[c]	SS+ **71%	SS+ 34%	-SS *95%	SS+ 92%	+SS *83%	-SS *61%	-SS *64%	SS+ 50%	SS+ 37%	SS+ 57%	-SS *86%	-SS 69%	-SS/SS+ 70%	+SS **98%
	Education of Wife	SS+ *70%		+SS **96%		-SS **89%					-SS *48%				+SS **94%
	Income of Husband	$10,000+ *71%		-$7,000 *97%					$10,000+ 44%						-$7,000 **98%
	Occupation of Husband[d]	Manag. *62%	Man. & Cler. 27%	Bl. Col. 100%	Bl. Col. 92%	Bl. Col. 92%	Cler. & Bl. Col. 58%	Cler.& Bl. Col. 50%	Manag. 42%	Bl.Col. & Cler. *78%	Bl.Col. & Cler. *42%	Man.& Cl. 77%	Bl.Col. & Cler. 70%	Cler. 77%	Bl. Col. 100%
Life Style	Number of Cars											No Cars *100%	No Cars *100%		No Cars **100%

Notes with tables 7 and 8: The entries in table 7 show the proportions of respondents with the indicated independent characteristics who engage in the high frequency activities indicated in the column heading. That is to day that more respondents with these characteristics partake in these high frequency activities, than respondents falling in different classes of the same independent variables. Conversely table 8 shows the independent correlates of low frequency of occurrence. The manner in which the percentages have been obtained is illustrated by the relationship between the educ. of the husband and the number of hours spent reading.

Weekly No. of Hours Spent Reading	Husband Educ. Less than Gr. 12	Husband Educ. Post Secondary	Total	Column Percentages	
11-40	18	16	34	20	42
7-10	17	6	23	19	16
3-06	24	9	33	26	24
0-02	33	7	40	35	18
Total	92	38	130	100	100

The column percentages show that the greatest population of avid readers (7-40 hrs.) is found in the high education group (58%) and the greatest proportion of low readers (0-6 hrs.) in the lower education bracket (61%). These are the percentages found in the tables.

Levels of significance are based on chi-square tests and are indicated by asterisks: * =.05, ** =.02, *** =.001.

[a]Most headings are self-explanatory. The abbreviated headings read as follows: knitting and sewing; taking educational courses; making tel. calls; attending movies, restaurants (and nightclubs), and meetings of associations. For further detail, see appendix II.

[b]The abbreviations stand for Single Family dwelling, Town House and Maisonnette.

[c]A minus sign preceding the independent characteristic reads: "less than", a plus sign following it "greater than", This also applies to other rows and the column headings SS means Secondary school graduation (grade 12).

[d]Three categories are used: They cover the following occpations.

Man.; Manager, Proprietors, Professional and Tech. workers.
Cler.; Clerical, sales and service workers.
Bl.Col.; Skilled blue collar workers (craftsmen) and semi-

single family residents tend to emphasize activities that take place in the home setting. None of these relationships are significant; this trend can therefore not be attributed solely to the characteristics of the single family unit. Table 1 indicated that the single family population was older and more settled, with a relatively low income and a large family. One would expect these people to be less outgoing and focus on in-home type activities. An explanation must therefore be sought in the socio-economic characteristics of this group rather than the nature of the physical dwelling unit.

Town house residents engaged frequently in a variety of both in-home and out-of-home activities. Furthermore, this group is not associated with any low frequency of occurrence, except in the case of sports where the proportion is similar to that of single family residents. Maisonnette residents are associated with frequent participation in two outgoing activities: attending sports and plays. In addition, they have in common with town house residents a high frequency of attendance at parties and movies. These two groups therefore appear equally outgoing, although the percentages for maisonnette residents are consistently lower. However, they differ considerably with regards to homeoriented activities. Whereas town house residents show a variety of frequent activities of this type, maisonnette inhabitants are related to low frequency (or more accurately, low duration) of all home oriented activities. While the figures should be interpreted with

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skilled blue collar workers (e.g. production).

caution due to the bias in the data and flaws in the survey and analysis procedure, this trend appears too strong for mere coincidence.

Table 1 does not provide a clear explanation; the maisonnette and townhouse groups are similar, with the former slightly more mobile and better-off than the latter group. The dwellings however, differ in two vital respects. Maisonnettes have shared access to the dwelling and virtually no private open space while town houses have private open space and in all cases separate entrances. Component report 1 found considerable dissatisfaction with the shared entrances of maisonnettes; people generally preferred to have their own entrance in addition to private open space. (Van Spyk, 1969) With due caution it may be suggested that the single family unit contains most of the environmental prerequisites for home-type activities (this is consistent with several findings in report 1), while the maisonnette with its lack of private access and outdoor space is lacking in these respects. The town house incorporates features of both and can with some stretch of the imagination be considered an intermediate type. This would then explain the home orientation of single family residents, the out-of-home orientation of maisonnette residents, and the combination of these two found in the activities of town house residents. As yet, one cannot place much confidence in these findings. They are supported to some extent by the data but many dwelling and sample characteristics have not yet been controlled for. The above relationships imply a direct effect of the physical environment on the behavior of people - a condition rarely encountered in reality.

One other environmental characteristic is mentioned here due to its strikingly uniform pattern: proximity of the dwelling to community services and facilities. High participation is clearly associated with a proximate location while low participation is correlated with a distant location (i.e. where a walk of more than ten minutes would be required). Furthermore, the activities that relate to location are all cultural or educational in nature. The obvious exception is watching T.V. for which the close-distant relationship is reversed.

None of these activities require community facilities (excepting perhaps meetings of associations) and the high frequencies cannot be attributed to the proximate location _per se_. An explanation must therefore be sought in the characteristics of people who live in close proximity. On analyzing different data of the same sample, Michelson found that people with an active life style tend to seek active or central locations. Table 1 supports this conclusion; the proximate group is higher than the distant group in education, income, and professional status - characteristics which point at an increased preference for cultural and educational activities. Thus proximity to services and facilities appears congruent with an active life style, while a distant location is congruent with a relatively inactive life style. The degree of congruence of these variables was shown to have a statistically significant bearing on overall residential satisfaction (Michelson, 1969[a], p.13 ff.).

Although the so-called active life style is here lacking in detail and little is known about the locational structure of respondents, the strength of the relationship does imply a pronounced differentiating effect of the physical environment. This tentative conclusion warrants further investigation.

2. Stage of the Life Cycle. As expected, older respondents (41-60 yrs.) engage frequently in home-oriented and relatively sedentary cultural activities, while young respondents (less than 30 years of age) partook frequently in outgoing activities. The latter group also watched T.V. a great deal and attended educational courses -- both typical of the early child raising years when the family is tied to the home and concerned with building a career -- but they spend little time on such activities as knitting, playing musical instruments and attending plays and concerts.

Respondents in the 31-40 year group do not present a clear pattern of high and low frequencies. They fall roughly between the above two categories. A composite index of stage of the life cycle composed of household size, age of the children, and several other sociological variables would have been preferable since age alone does not accurately reflect the changes that occur as people progress through the cycle.

3. Social Class. Only the two completed profiles for education and occupation of the husband are discussed here. The correlates of the education of the wife and income of the

husband are conclusive and require little commentary. The data do not support the expected relationship between high income and high frequency of participation in the so-called costly activities (see p.43). The criterion of an immediate financial expenditure does therefore not seem relevant in the context of the activities considered here. As expected, high income relates to "cultural" activities - playing musical instruments, attending plays and concerts - while low incomes are associated with watching T.V. and using the telephone.

The respondents with post secondary school education frequently partook of the same number of activities as their less educated counterparts, although their activities were predominantly of a more "cultural" nature. These include playing musical instruments, education, reading[30] and attending restaurants, movies and plays. Going to church is also associated with a better education. Most of these correlations are significant but the proportion of participants in high frequency activities is comparatively low for this upper middle class group. This could mean that its members vary considerably in the activities they select. Greater homogeneity in this respect would have resulted in higher percentages, unless these activities were of a specialized nature so reducing participation. It is not apparent whether the high loading on attending movie theatres is incongruent with the upper middle class image.

The lower middle class group comprises respondents who

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[30] Where reading involves more than a look at a magazine or a newspaper it is considered a cultural activity.

did not proceed beyond highschool graduation. As expected, its members spent considerable time on T.V. watching, telephone conversations, sports activities and parties. These activities conform to the lower class image described in chapter III. In addition, they spend a great deal of time on knitting, sewing and fine arts activities. The former activity may be the result of economic necessity (incomes have been shown to be rather low for this group see table 1), but the latter activity appears incongruent. However, it is accepted that in some suburban circles it is fashionable for the housewives to have a creative hobby. The high levels of community involvement noted earlier provide a proper setting for the adoption of such activities (Katz and Lazarsfeld, 1955). Only two educational classes were used and the correlates of low duration and frequency in table 8 form a mirror image of table 7. The very high percentages found for several activities associated with low education, and for some associated with high education, show that there are activities in which the members of either group enage rarely or not at all. In other words, some activities "belong" in the upper middle class group (e.g. playing musical instruments, attending movies and plays), while others "belong" in the lower middle class group (e.g. fine arts activities). It may be noted that according to table 8 the better educated respondents claim the greatest number of "exclusive" activities, i.e. their proportion of respondents reporting low involvement in activities is consistently lower than that of the less educated group. A similar trend is discernable in table 7, although the percentage differences are not as pronounced. The occurrence of some activities may therefore be said to index socio-economic class. It was with this in mind that the profiles for watching T.V., making telephone calls and attending plays and concerts were filled out with non-significant entries. As tables 7 and 8 show, these activities are indeed discretionary in this respect with the first two related to low status characteristics and the third, high status characteristics. Activity data are therefore clearly complementary to traditional measures of social class. It is contended that their main advantage over these traditional measures lies in their ability to integrate environmental variables with life cycle, social class, and life style variables. Even the relatively crude activity inventory used in the present survey clearly presents a wealth of information about the respondent's overall situation. Hopefully, the interpretation of such inventories will become a routine matter, providing a key to the individual's activity selection process and the social physical and economic forces impinging on it.

The above findings are fully supported by the correlates of the husband's occupation, in spite of the highly aggregated categories employed (see the note with tables 7 and 8). All but five activities show a correlation between high frequency, duration, and the managerial professions. As expected, the exceptions are watching T.V., knitting and sewing, movie-going (all of which are associated with blue collar workers) and fine arts activities and education (associated with clerical workers). Because of the poor quality of the data only three relationships were found to be significant. However, several approached significance, and trends could in most cases be readily recognized. Table 8 illustrates that several activities are relatively exclusive to the managerial class (e.g. movies, parties), while others predominate in the blue collar class (watching T.V., knitting etc.) and the clerical class (fine arts, use of telephone, etc.)

4. Life Style. The number of cars owned was thought indicative of the life style of respondents. Only three relationships were found significant (due to the small number of two car families). They suggest that people with an active life style, i.e. those who have more than one car, spend significantly more time on outgoing activities. The reader is reminded that the precentages in tabel 7 do not indicate the proportion of respondents with two cars: they indicate the proportion of two car families that engage frequently in the activities noted in the column headings.

Activity Preferences

The preceding section discussed the activities in which the respondents engaged. The section was mainly descriptive and few detailed explanations were attempted. However, ample evidence was presented showing the importance of a variety of constraints in the selection of activities. These constraints can brought into focus by examining activity preferences, i.e. the activities in which people would like to engage (or on which they would like to spend more time), but which have for some reason been foregone. Table 9 shows that respondents wanted to spend more time on reading (19%) and sports (14%). These were important first, second, third and overall choices. This does not imply that the respondents thought these activities more important than others; unless they were visually blind, completely occupied with basic activities, or inefficient in their use of free(i.e. discretionary)time, more time could have been allocated to them. The lack of opportunities does not appear to play a role; most respondents reported spending a considerable amount of time on reading and many participated in sports. It is probable that the respondents projected their guilt feelings, i.e. they felt they should read and engage in sports more often. There is no question of a constraint here, but rather of a wish to conform to a culture which values self-development and outdoor activities.

Similarly, the first, second and overall choice for new activities desired are highest for education and sports. The third choice adds music and plays. Obviously, to be of use preference information must be taken beyond the projective stage. Methods for achieving this do not seem to be available at present, even though Chapin (1966) and Priemus (1968) have made considerable progress through the use of gaming techniques.

In conclusion, the present chapter has highlighted the duration and frequency attributes of selected non-basic activities.

TABLE 9

NUMBER AND PERCENTAGE OF RESPONDENTS PREFERRING
SELECTED NON-BASIC ACTIVITIES

Activities	Daily Activities															
	TV		Knitt.		Music		Arts		Educ.		Reading		Church		Teleph.	
Spend more time on:																
1st. choice	3	2%	15	9%	3	2%	5	3%	5	3%	25	15%	1	1%	-	
2nd. choice	-		3	10%	-		3	10%	-		8	27%	-		-	
3rd. choice	-		3	3%	-		-		2	20%	1	10%	-		-	
Total	3	2%	21	12%	3	2%	8	4%	7	4%	34	19%	1	0%	-	
New Activities Desired:																
1st choice	-		11	7%	8	5%	14	8%	24	14%	2	1%	-		-	
2nd. choice	-		2	5%	3	7%	4	9%	13	30%	1	2%	-		-	
3rd. choice	-		-		4	36%	1	9%	1	9%	-		-		-	
Total	-		13	7%	15	8%	19	10%	38	20%	3	2%	-		-	

TABLE 9 (Continued)

Activities	Monthly Activities							
	Sports	Parties	Movies	Restaur.	Meetgs.	Plays	None	Total
Spend more time on:								
1st. choice	19 11%	4 2%	4 2%	2 1%	-	4 2%	59 36%	149 100%
2nd. choice	4 13%	-	-	3 10%	2 7%	1 3%	-	24 100%
3rd. choice	2 20%	-	-	-	-	1 10%	-	9 100%
Total	25 14%	4 2%	4 2%	5 3%	2 1%	6 3%	59 32%	182[b] 100%
New Activities Desired:								
1st. choice	46 28%	1 1%	-	-	2 1%	2 1%	34 20%	144 100%
2nd. choice	8 18%	2 5%	1 2%	-	1 2%	3 7%	-	38 100%
3rd. choice	-	-	-	-	-	1 10%	-	7 100%
Total	54 29%	3 4%	1 0%	-	3 2%	6 3%	34 18%	189[b] 100%

[b]The total number of responses is greater than the sample size of 173 since the respondents were allowed to make three selections.

In spite of the severe data limitations, several salient activity characteristics and relationships have been recognized. The activity profiles in tables 7 and 8 showed particular promise for further work in activity analysis, even though the present analysis has stopped short of their intrinsic detail.

CHAPTER VI

CONCLUDING REMARKS

The present study has attempted to develop a behavioral approach to problems of urban form and function through the analysis of household activities. This approach hinges on the notion of the individual decision maker as an activity selection systems which receives inputs from its environment and produces outputs in the form of activities. Systems characteristics are regarded as variables that intervene between independent input variables and dependent output variables. The nature and measurement of these three types of variables have been discussed in detail, and hypothesized relationships have been tested on the empirical data. The results of the study are subject to several limitations and caveats. Several theoretical and operational problems must be resolved before the apparent potential of household activity analysis can be realized. These are briefly reviewed here following the same input-output format used earlier in the behavioral model of the activity selection process.

Systems outputs comprise the activities in which people engage during their daily life routines. They exclude activities which are not relevant to urban research and include activities taking place within the home. At present, activity inventories can be obtained only though questionnaire surveys. This imposes limits on the span of the observation period, the type and number of activities covered, the sample size, and the reliability of the returns. These problems were particularly severe in the data used for the present study; the questionnaire had not been disigned specifically for activity analysis and the field work and coding were largely performed by untrained personnel. These deficiencies can be easily avoided in future research; such problems as projective responses and selective recall are more difficult to control in questionnaire surveys. They can however be minimized by a carefully thought out and balanced survey incorporating cross checks and techniques designed specifically for activity research.

In order to be useful to empirical investigation, the data must be organized in some fashion. Several elementary activity categories have been suggested in chapter II. These categories proved useable, but their obvious shortcomings indicate the need for more rigorous distinctions. Chapin (1966) and Bunting (1969) suggest that discriminant analysis and factor analysis of sets of activity chacteristics may be used to reveal the structural characteristics of activity attributes, thus providing a more formal basis for activity analysis. The stringent data requirements of such multivariate techniques reinforce the importance of improved survey procedures.

Systems inputs refer to the physical, social and economic constraints impinging on the individual decision maker.

These constraints are exceedingly difficult to measure since they are highly complex and subjective. However, the traditional categories of dwelling type, social class, stage of the life cycle and life style appeared in this study to be meaningful in terms of activity analysis. They can therefore be used to control for external constraints where required by the nature of the research problems at hand. The fact that they have not noticeably changed over the past two decades suggests that the returns on attempts at refinement are marginal at best. However, renewed interest in the physical environment and its import in human behavior and well being holds promise for increased knowledge of this variable.

The system refers to the individual decision maker and his personal characteristics of needs, personality and the activity bank - the stored array of behavioral alternatives, and their subjective ranking. Despite the lack of detail, the behavioral model serves two purposes: (1) It conveniently links input and output variables and (2) it provides a theoretical framework for the analysis of individual differences given the input conditions covered under (1). These purposes are suggestive of the two levels at which the activity analysis seeks broad categories of explanations for activities in which people engage in their urban environment. The study of systems variables differs in that it implies a search for variations in the individual's characteristics within categories of input variables (i.e. within different socio-economic classes, neighborhoods, etc.). The former approach is relatively macroscopic, even though it is based on observed individual behaviors, while the latter approach is clearly microscopic and attempts to improve the explanatory and predictive power of the model through the analysis of personality traits (i.e. values, attitudes, motivations, etc.). It is doubtful that at present the system can be taken much beyond the theoretical level. The piecemeal nature of sociological and psychological studies of decision making and personality characteristics indicate that much work remains to be done before even the most elementary systems variables can be modelled accurately.

In summary, the behavioral approach to activity analysis appears to hold considerable promise for urban research. This study has shown that activity analysis provides a detailed account of man's interaction with his urban environment, including not only the urban landscape at large but also the internal arrangement of dwelling units. The approach does not produce "hard" design inputs since many of the variables involved are subject to rapid change. However, careful interpretation of the findings allows the designer to recognise and subsequently incorporate into the design significant trends regarding the layout of dwelling units and their external arrangement. Futher development of the approach is contingent on improvements in survey procedures and the theoretical framework. It is of comfort to know that even under the most severe limiting conditions of data and analysis as found in the present study, the analysis of activities may lead to tangible results.

APPENDIX 1: EPISODINAL CHARACTERISTICS OF SELECTED DAILY AND MONTHLY NON-BASIC ACTIVITIES BY NUMBER AND PERCENTAGE OF RESPONDENTS.

TABLE 10

EPISODINAL CHARACTERISTICS OF SELECTED DAILY AND MONTHLY NON-BASIC ACTIVITIES
BY NUMBER AND PERCENTAGE OF RESPONDENTS.

Episodinal Characteristics		Daily Activities															
		TV		Knitt.		Music		Arts		Educ.		Reading		Church		Teleph.	
Occurrence:	N	154	%	118	%	13	%	26	%	25	%	123	%	81	%	135	%
1. Week		24	16	64	54	1	8	13	50	21	84	27	21	-	-	36	27
2. Weekend		11	7	11	9	-	-	2	8	2	8	4	3	69	85	3	2
3. Both		119	77	42	36	12	92	11	42	2	8	97	76	12	15	93	69
Mean class		2.6		1.8		2.8		1.9		1.2		2.5		2.1		2.4	
Location:	N	135	%	101	%	10	%	24	%	24	%	107	%	67	%	119	%
1. Close local		-	-	-	-	-	-	1	4	7	29	-	-	36	54	-	-
2. Closest large		-	-	-	-	-	-	-	-	4	17	-	-	10	15	1	1
3. Further		-	-	-	-	1	10	1	4	11	46	-	-	20	30	-	-
4. Home		135	100	100	99	9	90	22	92	2	8	107	100	-	-	118	99
5. Varies		-	-	1	1	-	-	-	-	-	-	-	-	1	1	-	-
6. Other		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mean class		4.0		4.0		3.9		3.8		2.3		4.0		1.8		4.0	

Episodinal Characteristics		Monthly Activities											
		Sports		Parties		Movies		Restaur.		Meetgs.		Plays	
Occurrence:	N	81	%	170	%	114	%	126	%	68	%	63	%
1. Week		18	22	6	4	27	24	9	7	53	78	18	29
2. Weekend		37	46	112	79	69	60	94	75	6	9	26	41
3. Both		26	32	24	17	18	16	23	18	9	13	19	30
Mean class		2.1		2.1		1.9		2.1		1.3		2.0	
Location:	N	78	%	135	%	100	%	116	%	59	%	63	%
1. Close local		18	23	9	7	5	5	14	12	29	49	5	8
2. Closest large		13	17	3	2	5	5	7	6	3	5	1	2
3. Further		27	35	33	24	57	57	50	43	14	24	49	78
4. Home		2	3	3	2	-	-	-	-	-	-	-	-
5. Varies		18	23	86	64	33	33	45	39	13	22	8	13
6. Other		-	-	1	1	-	-	-	-	-	-	-	-
Mean class		2.8		4.2		3.5		3.5		2.4		3.0	

TABLE 10 (Continued)

Episodinal Characteristics	Daily Activities																Monthly Activities											
	TV		Knitt.		Music		Arts		Educ.		Reading		Church		Teleph.		Sports		Parties		Movies		Restaur.		Meetgs.		Plays	
Travel Mode: N	0	%	0	%	1	%	3	%	21	%	0	%	68	%	0	%	66	%	118	%	88	%	98	%	58	%	55	%
1. Walk	-	-	-	-	-	-	-	-	1	5	-	-	8	12	-	-	6	9	5	4	-	-	2	2	8	14	2	4
2. Car	-	-	-	-	1	100	3	100	17	81	-	-	60	88	-	-	55	83	96	81	82	93	87	89	45	78	52	95
3. Public Transp.	-	-	-	-	-	-	-	-	2	9	-	-	-	-	-	-	-	-	2	2	3	3	2	2	-	-	1	2
4. Multiple	-	-	-	-	-	-	-	-	1	5	-	-	-	-	-	-	2	3	4	3	-	-	1	1	1	2	-	-
5. Delivery	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	1	2	-	-
6. Varies	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	5	11	9	3	3	5	5	3	5	-	-
Mean class	0		0		2.0		3.0		2.1		0		1.9		0		2.1		2.4		2.2		2.2		2.1		2.0	
Trip Duration:	0	%	0	%	1	%	3	%	20	%	0	%	74	%	0	%	68	%	102	%	89	%	90	%	55	%	51	%
1. 1-5'	-	-	-	-	-	-	-	-	4	20	-	-	31	42	-	-	14	21	6	6	5	6	5	6	17	31	1	2
2. 6-10'	-	-	-	-	-	-	2	67	3	15	-	-	22	30	-	-	6	9	4	4	6	12	11	12	10	19	2	4
3. 11-20'	-	-	-	-	-	-	1	33	8	40	-	-	11	15	-	-	20	29	15	14	23	18	15	17	11	20	7	14
4. 21-30'	-	-	-	-	1	100	-	-	4	20	-	-	4	5	-	-	13	19	34	33	24	32	28	31	9	16	28	55
5. 31-60'	-	-	-	-	-	-	-	-	1	5	-	-	6	8	-	-	9	13	15	15	16	15	18	20	4	7	11	22
6. 60+'	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	4	3	3	-	-	-	-	-	-	-	-
7. Varies	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	4	25	24	26	16	13	14	4	7	2	4
Mean class	0		0		4.0		2.3		2.7		0		2.1		0		3.3		4.6		4.1		4.1		2.8		4.1	

APPENDIX II: EXCERPT OF THE INTERVIEW SCHEDULE

Form W

CENTRE FOR URBAN AND COMMUNITY STUDIES

UNIVERSITY OF TORONTO

PROJECT: "HOUSING: A STUDY IN DENSITY, DISTRIBUTION AND COSTS"

Address: ____________________

Date: ____________________

Time In: ____________________

Time Out: ____________________

Interviewer: ____________________

* * *

Dwelling Type 1. S.F. 2. T.H. 3. Mais

Location 1. Close 2. Distant

Open-Space 1. "Private" 2. Other

I'm from the Ceetre for Urban and Community Studies of the University of Toronto. We're conducting a survey of families with children sponsored by the Central Mortgage and Housing Corporation. Do you have children? (IF YES) I'd like to ask you some questions about your housing. It would take about an hour. Could we do that now?

IF NO: Could I make an appointment with you to return at a more convenient time?

[IF NECESSARY: Everything you say will be kept in complete confidence. You were picked by random procedures, and it is highly important to the outcome of the study that we speak with you personally.]

[TO INTERVIEWER: It is crucial that interviews be completed with the target respondents. Accommodate yourself to their desires and show that you care, so as to minimize refusals.

1. First, could you tell me who lives in this home.

	Relation	Age	Sex	Occupation or Type of School
A				
B				
C				
D				
E				
F				
G				
H				
I				

2. In which of these housing types have you lived since your marriage?

a.	**Single family**	1. Yes	2. No
b.	**Row house**	1. Yes	2. No
c.	**Duplex or triplex**	1. Yes	2. No
d.	**Walk-up apartment**	1. Yes	2. No
e.	**Flat**	1. Yes	22 No
f.	**High rise apartment**	1. Yes	2. No
g.	A room in someone else's home.	1. Yes	2. No

NOTE THE PARTICULARS OF ANY UNUSUAL ANSWERS TO # 2.

12 (continued)

Furniture and its arrangement:

h. colours of couches or draperies
1-bright
2-subdued

i. patterns of fabrics
1-large
2-small

j. general atmosphere of the room
1-warm
2-cold
3-don't know

k. is the furniture arranged around the walls or in clumps to devide up the room into two or more areas?
1-around walls
2-clumps
3-mixed
4-don't know

l. please note presence or absence of deliberately symmetrical or asymmetrical arrangements. (e.g. if a wall has a fireplace in the middle with a buffet on either side and a picture above each buffet, then that is deliberately symmetrical, but if above one buffet there is an irregular arrangement of pictures of different sizes and shapes, then that is an attempt at asymmetry)
1-noteworthy symmetry
2-noteworthy asymmetry
3-mixed arrangements
4-don't know

m. furniture
1-curvilinear 2-rectangular
1-carved wood 2-wood of simple form

n. neatness
1-definitely yes
2-definitely no
3-don't know

o. Is respondent cooperative and interested
1-definitely yes
2-uncertain
3-definitely no

Please describe any features of the room that are particularly striking to you.

13. Where do you usually go for: (IF RESPONDENT GOES TO MORE THAN ONE PLACE IN ANY CATEGORY CHECK COLUMN 2 - GET THE DETAILED INFORMATION ON THE PLACE VISITED FREQUENTLY)

	Multiple 2	Where do you go? 3	How do you go? 4	How long does it take? 5	How often do you go? 6	Is this the closest place you could go for it? 7
a) Sundries(cigarettes extra milk,etc.						
b) Drug store						
c) Clothes						
d) Groceries						
e) Physician						

See category in #14.

14. I am going to read you a list of activities, Pleas tell me how often you partake in the activity.

Activity	How often? 1. once a day 2. several times a week 3. once a week 4. several times a month 5. once a month 6. several times a year 7. onee a year or less	Do you usually do it during the week or on weekends? 1. week 2. weekends 3. both	Where do you do it.	How long does it take you to get there? How do you go?
a. participating in or watching sports in person				
b. attending parties or suppers at homes with other people				
c. going to movies				
d. going to restaurants, night clubs				
e. attending meetings of associations				
f. attending plays or concerts				

15. I am now going to read you another list of activities. Please tell me <u>how many hours a week</u>, if any, you partake in this activity.

Activity	How many hours?	Do you usually do it during the week or on weekends?	Where do you do it?	How long does it take you to get there? How do you go?
a. employment				
b. sewing, knitting,				
c. watching television				
d. playing a musical instrument				
e. arts and crafts (e.g. painting, ceramics, photography)				
f. educational courses				
g. pleasure reading				
h. church or synagogue				
i. telephone				

16. Are there any activities that are importent to you that I haven't mentioned?

If so:

Activity	How often or How many hours?	Do you usually do it during the week or on weekends?	Where do you do it?	How long does it take you to get there? How do you go?

APPENDIX III: EXCERPT OF CODEBOOK FOR THE SUMMARY DATA CHECK (INCLUDING FREQUENCIES)

Category I; Independent Variables		Number of Respondents
1) Dwelling Type		
	1. single family	49
	2. townhouses	82
	3. maisonnettes	41
2) Location		
	1. close to services/facilities	57
	2. distant	99
3) Open Space		
	1. private	60
	2. other	104
4) Shared Facilities		
	1. none	80
	2. function-specific areas	78
	3. non-specified areas	15
5) Duration of Residence		
	1. 1 year or less	58
	2. between 1 and 3 years	161
	3. 3-25 years	53
6) Household Size		
	1. 1-4	74
	2. 5-6	82
	3. 7-9	17
7) Husband Age		
	1. 30 years or under	32
	2. 31-40 years	81
	3. 41-60 years	49
8) Husband Occupation		
	1. managerial, proprietary, professional, technical	81
	2. clerical, sales, service, skilled blue collar	53
	3. semi-skilled blue collar, unskilled student, housewife, unemployed	26
9) Number of Children in Family		
	1. 1-2	79
	2. 3-4	76
	3. 5-7	17

		Number of Respondents
10)	Age Distribution of Children	
	1. all 1-6 years	
	2. all 7-15 years	
	3. all 16 or over	
	4. oldest 7-15, youngest 1-6	
	5. oldest 16+, youngest 1-6	
11)	Wife Education	
	1. S.S. level or less	129
	2. post S.S. or equivalent	41
12)	Husband Income	
	1. less than $7,000 p.a.	71
	2. $7,000 - $9,999	61
	3. $10,000 or more	28
13)	Monthly Housing Cost	
	1. less than $175	60
	2. $175 - $224	83
	3. $225 and over	23
14)	Number of Cars Owned	
	1. one	122
	2. two or more	33
	3. none	5
15)	Husband Education	
	1. S.S. level or less	92
	2. post S.S. or equivalent	38
Category II:	Intervening Variables	
16)	Shop Where for Sundries	
	1. close	158
	2. further	9
17)	Shop How Often for Sundries	
	1. weekly or more frequent	144
	2. monthly	5
18)	Shop Where for Clothes	
	1. close	66
	2. further	71
19)	Shop How Often for Clothes	
	1. weekly or more frequent	39
	2. monthly	75
20)	Shop Where for Groceries	
	1. close	117
	2. further	45

		Number of Respondents
21)	Shop How Often for Groceries	
	1. weekly or more frequent	131
	2. monthly	22
22)	Sports - Frequency	
	1. weekly or more frequent	38
	2. monthly	12
	3. yearly or less	61
	4. never	59
23)	Parties/Suppers - Frequency	
	1. weekly or more frequent	23
	2. monthly	73
	3. yearly or less	55
	4. never	19
24)	Movies - Frequency	
	1. weekly or more frequent	3
	2. monthly	32
	3. yearly or less	99
	4. never	35
25)	Restaurants - Frequency	
	1. weekly or more frequent	10
	2. monthly	51
	3. yearly or less	81
	4. never	27
26)	Associations/meetings - Frequency	
	1. weekly or more frequent	25
	2. monthly	26
	3. yearly or less	44
	4. never	73
27)	Plays/Concerts - Frequency	
	1. weekly or more frequent	1
	2. monthly	14
	3. yearly or less	78
	4. never	75
28)	Sewing/Knitting	
	1. none	38
	2. 1-3 hours	72
	3. 4-90 hours	56
29)	Television Viewing	
	1. 0-5 hours	42
	2. 6-12 hours	46
	3. 13-20 hours	43
	4. 21-60 hours	40

		Number of Respondents
30)	Music Training	
	1. none	150
	2. 1-4 hours	10
	3. 5-20 hours	5
31)	Arts and Crafts	
	1. none	138
	2. 1-4 hours	17
	3. 5-20 hours	11
32)	Educational Courses	
	1. none	140
	2. 1-3 hours	19
	3. 4-35 hours	9
33)	Pleasure Reading	
	1. 0-2 hours	50
	2. 3-6 hours	44
	3. 7-10 hours	37
	4. 11-40 hours	40
34)	Church/Synagogue	
	1. none	83
	2. 1-2 hours	69
	3. 3-10 hours	15
35)	Telephone	
	1. 0-1	55
	2. 2-5	77
	3. 6-100	37
36)	Number of Activities Desired to Take Up or Spend More Time On (Range: 0-6)	
	0.	5
	1.	19
	2.	4
	3.	4
	4.	2
	5.	-
	6.	4
37)	Home Type Most Likely to Affect Activities Positively	
	1. larger house	14
	2. smaller house	5
	3. S.F.	28
	4. multiple-unit dwelling	0
	5. location, not type, is important	0

		Number of Respondents
38)	Positive effect of a Different Home Type on Activities	
	1. better for leisure and recreation	33
	2. better for children	8
	3. better for housekeeping, maintenance	6
	4. no difference made	91
39)	Frequency of Visiting friends/inside vs. Relatives/inside	
	1. F/I LT. R/I	15
	2. F/I EQ. R/I	35
	3. F/I GT. R/I	123
40)	Frequency of Visiting friends/outside vs. Relatives/outside	
	1. F/O LT. R/O	55
	2. F/O EQ. R/O	34
	3. F/O GT. R/O	84
41)	Frequency of visiting friends/outside vs. Friends/inside	
	1. F/O GT. F/I	108
	2. F/O EQ. F/I	30
	3. F/O LT. F/I	35
42)	Frequency of visiting relatives/inside vs. Relatives/outside	
	1. R/I LT. R/O	118
	2. R/I EQ. R/O	45
	3. R/I GT. R/O	10

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Appendix D

D - CHECK LIST

The following is a list of issues which might be considered as a general list covering the field of housing developments:

1. Scale of built form.
2. Physical order and variety.
3. Dwelling individuality.
4. Proximity of parks, commonage or ravines.
5. Planting and vegetation.
6. External stimuli and environment.
7. Olfactory environment.
8. Indoor/outdoor transition space,weather locks.
9. Public/private transition space.
10. Site allocation per building.
11. Space allocation per person.
12. Space distribution - dwelling section.
13. Space distribution - building group section.
14. Space distribution - dwelling plan.
15. Space distribution - building group plan.
16. Building group bulk.
17. Building group height.
18. Building group depth.
19. Building group spacing and arrangements.
20. Sun penetration - dwelling.
21. Solar exposure - exterior space.

22. Pedestrian path lighting.
23. Street lighting.
24. Proportion of site used as pedestrian ways.
25. Proportion of site used as automobile accommodation.
26. Proportion of site used as vehicle access.
27. Proportion of site at ground level covered by building.
28. Dwelling identity.
29. Site identity.
30. Site maintenance.
31. Site levels.
32. Views from site.
33. Views from dwelling.
34. Wind speed levels.
35. Daylighting levels in habitable rooms.
36. Proportion of ground surface planted.
37. Proportion of ground surface grassed.
38. Exterior meeting places.
39. Emergency exits from dwelling.
40. Movement paths for elderly and paraplegics.
41. Distance and ease of adult pedestrian trips.
42. Distance and ease of child pedestrian trips.
43. Distance and ease of trip to and from parking.
44. Distance and ease of trip to and from public transportation.
45. Clarity of path systems.
46. Access to public recreation open space.
47. Vehicular and pedestrian movement segregation.

48. Pedestrian safety from traffic.

49. Path and road system for children's cycling.

50. Access for emergency vehicles.

51. Ease and safety of vehicle ingress and egress.

52. Relationship of through vehicular traffic to site.

53. Access to buildings from main distributor roads.

54. Trucking access.

55. Parking on site roads.

56. Speed of traffic on local and access roads.

57. Automobile parking.

58. Appearance of car accommodation.

59. Casual parking.

60. Increasing car ownership rates.

61. Mechanized street cleaning.

62. Ease and safety of on-site car use.

63. Location of car storage.

64. Sight-lines for on-site driving.

65. Ease of access for visitors.

66. Garbage disposal.

67. Garbage storage.

68. Means and policy in housing allocation.

69. Facilities management and maintenance.

70. Building management and maintenance.

71. Site management responsibility.

72. "Car tinkering" facilities and space.

73. Sheltered access to storage.

74. Ground level storage for dwellings not at grade.

75. Storage for large equipment.

76. Deliveries to dwelling.

77. Piped and cable services.

78. Garden equipment storage.

79. Planting adjacent to homes.

80. Shared open space.

81. Personal open space.

82. Group indoor play facilities.

83. Swimming pools and usable water.

84. Equipped group indoor play space.

85. Shared space for active sports.

86. Shared play space.

87. Public toilets.

88. Quality and control of microclimate.

89. Semi-supervised play space for young children.

90. Supervised group play facilities.

91. Supervision of personal play space.

92. Site privacy.

93. Outdoor drying facilities.

94. Diversity and range of local activities.

95. Noise transmitted through walls.

96. Noise from pedestrian routes.

97. Noise from recreation spaces.

98. Noise from site roads and traffic.

99. Ventilation.

100. Quality of external building materials.

101. Security from crime.

102. Appearance of external built spaces.

103. Caretaking.

104. Vandalism.

105. Interference by outside groups or persons.

106. Accident prevention.

107. Infestation prevention.

108. Fire hazards.

109. Entrance privacy.

110. Inside visual privacy.

111. Inside aural privacy.

112. Size, intensity, mix, types of groupings.

113. Social contacts.

114. Social interaction.

115. Family territoriality.

116. Keeping pets.

117. Tenure.

118. Average length of tenure.

119. Socio-economic status of locality.

120. Mean age and age mix of locality.

121. Car ownership.

122. Wage earner statistics.

123. Occupancy: vacancy rates.

124. Dwelling size mix.

125. Relationship of development to built and natural environment.

126. Local soil condition.

127. Topography.

128. Site area.

129. Site shape.

130. F.A.R. and zoning.

131. Land use controls.

132. Net density - new.

133. Net density - existing.

134. Convenience of work trips.

135. Maintenance and management costs.

136. Rent or sale price structure.

137. Rate of depreciation.

138. Site development cost.

139. Building costs.

140. Land costs.

141. Mortgage rates.

142. Ownership.

143. Effective life span of surrounding development.

144. Housing layout alternatives.

145. Housing for elderly and disabled.

146. Relationship of through pedestrian traffic to site.

147. Convenience shops - food sources.

148. Laundry facilities.

149. Formation of rules and regulations.

150. Overshadowing.

151. On-site commercial facilities.

152. Signage.

153. Identifiable personal domain.

154. Utilization of roof decks as usable open space.

155. Visual quality of roof-scape.

156. Glare from car lights at night.

157. Car washing.

158. Snow removal, road and path clearing.

159. Surveillance.

160. Public seating.

161. Child day care facilities.

162. Dimensions of wheel chairs.

163. Drinking fountains and toilets for play areas.

164. Public telephones.

165. Street furniture.

Appendix E

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