

THE HABRAKEN SUPPORT SYSTEM:
SOME IMPLICATIONS WITH RESPECT
TO THE AMERICAN CONTEXT

by

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Respect to the American Context

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Abstract:

This thesis begins with an examination of the housing problems in this country, past, present, and future. It then goes on to discuss and summarize the Dutch context and the work of Nikolas Habraken and the Stichting Architecten Research. The third part of the paper represents a trial modification of the Habraken system, and an investigation of the formal implications of such a system

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TABLE OF CONTENTS

Introduction.....p.4
Some Observations on the National Housing Crisis.....p.6
The Dutch Experience and the work of N.J. Habraken.....p.16
Design Decisions.....p.46
Inconclusions.....p.58

ILLUSTRATIONS

1. S.A.R. 1.01: fitting dimension*.....p.28
2. S.A.R. 1.02: dimensional grid*.....p.29
3. S.A.R. 1.03: horizontal measure*.....p.30
4. S.A.R. 1.04: vertical measure*.....p.31
5. Sector analysis**.....p.34
6. Plan, Support with Zones and Margins***.....p.35
7 Plan, " with infill.....p.36
8. Site Plan, Maarssbroek****.....p.39
9. Plan/sect., " highrise support****.....p.40
10. Plan, Apt. types, " " " ****.....p.41
11. Sects. Townhouse & Lowrise Apts. " " " ****.....p.42
12. Plans, Lowrise Apts. " " " ****.....p.43
13. Blueprint of Thesis Drawing.....p.57+

* S.A.R. " Die Werkhypothese van die S.A.R." Eindhoven:
December, 1965.

** " The Pursuit of an Idea." Plan, vol.3, 1970.

***S.A.R. "Plattegronden, Drager (1^e fase) no.59⁴,
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****deJong, van Olphen, Bax, "Maarssenbroek" , Eindhoven, 1968.

INTRODUCTION

I have been interested for some time in the problem of the Public/Private interface in urban housing, and the extent to which the individual's control over (and responsibility for) his dwelling environment (both private and communal) has been usurped by the technical/economic determinism which characterizes the building processes in this country as well as others. This thesis represents an attempt to analyse these processes, identify the nature of their malfunction, and develop a reorganizational solution. It began as a joint thesis with Douglas Govan dealing with M.I.T.'s 'Simplex' redevelopment project, in which my part was an investigation of the housing requirements and the generation of a design solution. As the project developed, a variety of factors made it apparent that A design solution was no solution at all. Most of the housing was to accommodate the M.I.T. academic community, a highly varied and mobile population, with a wide range of preferences and needs with respect to their dwellings, and correspondingly wide-ranging incomes. There is considerable annual fluctuation in the relative numbers of single, married, married w/ children; students, staff and faculty which make up this population, and any attempt (extensive questionnaire-ing notwithstanding)^{at} one arrangement and distribution of 'ideal' unit types for 'ideal' representatives of these various groups, would be not only limiting but economically risky. In the course of searching for alter-

natives, I came across what appeared to be a viable theory and methodology dealing with the problem of change, growth and the position of the individual in the urban dwelling environment, in the work of Nikolas J. Habraken. Professor Habraken is a Dutch architect, chairman of the architecture department at Eindhoven Technological university, and Director of Stichting Architecten Research, an organization funded by the 10 major architectural firms and building contractors in Holland to research housing processes. His work is relatively unknown outside of Holland, and only partially translated into English. I decided to try to relate his methodology to the problems of housing in this country in an effort to clarify for myself the nature of the malfunction, to present a summary of his work, and to identify in this context some of the problems and possibilities inherent in its application. The Simplex properties and some of M.I.T.'s programmatic requirements provide a base against which I have explored some of the physical implications of the 'adjusted' methodology.

SOME OBSERVATIONS ON THE NATIONAL HOUSING CRISIS

Anyone who is at all acquainted with the problem will preface any discussion with a recitation of its quantitative aspects and a plea for massive reallocation of federal resources and priorities toward its solution. To give a rough idea of the magnitude: at the time of the Kaiser Commission Report in 1968, there were 7.8 million poor in poor housing in this country, but in the 33 years since the first Public Housing legislation in 1937, we had built only 800,000 subsidized units - 1/10 of the need - and much of this output was not for the poor.¹

In the Housing Act of 1949, Congress ostensibly set "a decent home and a suitable living environment for every American family" ² as a top-priority goal. But in actuality, the goal was Urban Redevelopment by means of slum clearance. A site had to be "predominantly residential either before or after redevelopment", which gave rise to the concept of "one down for every one up". Aid was given to the cities on a project-by-project basis, and amounted to between 2/3 and 3/4 of the losses incurred by the local authorities in clearing, condemning, and reselling the project area to private developers. In addition, 10% of the funds were useable for non-residential purposes, and this was gradually increased until by 1959, 85% were available to projects not connected with housing.³

The result was that of the areas predominantly residential before clearance, only 50% were residential afterward. There was a large loss of urban residential acreage, and most of the acreage returned to residential use was for middle and upper income groups, representing the cities' goal of slum removal and increased tax base.

During the fifties, the only organization with any real power at the federal level (\$) was the F.H.A., and it was geared to the private market production of middle-income single family homes in the suburbs (white). This, in addition to federal Korean War belt-tightening which limited the production of subsidized units to an average of 20,000 units/yr., and a political/psychological attitude which regarded public assistance programs as part of some grand 'pinko plot', resulted in a series of redevelopment/renewal Acts which endeavored to provide 'something for everyone' who represented a power group. Since in our system money=power=more money, the low income group and their housing needs got shoved off the bottom rung of the ladder. Some recognition of the fact that a laissez-faire grants-in-aid system was compounding rather than solving urban problems was reflected in the '54 Housing Act. Here, at least, 'one down for one up' became 'one up for one down'; citizen participation in comprehensive area/neighborhood - wide planning ("workable program") involved; master planning, codes, relocation, and financial resources; conservation and rehabilitation were included. The bulk of

legislation during this period, however, was aimed at finding ways to involve the private interests in the production of housing: developers, builders, mortgage lenders, whichever group seemed to have the greatest potential for production at any point in time was the group offered 'incentives' (government guaranteed returns).

During the sixties, under Kennedy and especially secretary Weaver, there was considerable experimentation and innovation. The Housing Act of '65 introduced two new subsidy techniques, both involving rent supplements. There seemed to be some recognition at this time that one of the chief causes of the low-income housing shortage was the inability of low-income people to pay enough rent to even cover the expenses much less provide the developer with a profit. Under the rent supplement program, the tenant pays 25% of his income for rent, and the federal government makes up the difference to the market rental (controlled) of the unit: a backhanded form of income maintenance, and one which subsidizes the landlord more directly than it does the tenant, thus avoiding the pink stigma. Some effort was made to reform the federal housing bureaucracy at this time, and the Department of Housing and Urban Development (H.U.D.) was created to replace the Housing and Home Finance Agency, a cluster of agencies and their attendant interest groups which rarely acted together, with one coherent organization.

One of the brightest lights of the '60's was the

1966 Model Cities program which was designed to coordinate physical, social, and economic planning within a defined neighborhood on an ongoing basis. The most Process-oriented program to date, it allows planning and action to take place simultaneously, with feedback from the latter into the former helping to prevent the built-in obsolescence of earlier urban renewal programs which required complete and iron-clad plans before any work could proceed.

The 1968 Housing Act,⁴ on the heels of the Kaiser Report, and with the pre-election support of both the liberals and the conservatives, set a ten-year goal of 6 million units of low and moderate income housing, but what was most impressive, actually authorized large appropriations (\$) to back the programs. It was the embodiment of 'something for everyone' politics. Section 235 subsidized low-income family ownership of new and existing homes. Section 236 subsidized the interest in excess of 1% on private mortgage market financing for 'limited' dividend development of middle income rental housing. The F.H.A. was made more available in urban areas to 'shaky credit' families. 'Fanny May' (Federal Nat. Mortgage Assn.) packed up her lucrative secondary mortgage market operations and moved to the New York Stock Exchange, as 'Jenny May' (Govt. Nat. Mortgage Assn.) was born within H.U.D. to handle the special assistance, management, and liquidation duties her older sister was leaving behind.

The National Housing Partnership proposal of a "neighborhood development program" was implemented, giving greater local control and program flexibility, and rewarding steady annual performance. Finally, it extended the Model Cities, Urban Renewal, Code enforcement, and Community Facilities programs - leaving no political log unrolled.

The Housing Acts of '69 and '70 amounted to a plethora of righteous rhetoric, variations on the subsidy theme, and a freeze-dried budget. Once again, the government is using housing as a national economic remedy, instead of treating it as a social necessity and basic human right.

Housing is a process, and one in which the private and public aspects are highly interdependent and highly complex. Until a functional, dynamic balance is achieved at all levels of the public/private relation, we will continue to work at cross purposes, and the housing crisis will continue to be relegated to the role of chronic, incurable disease with occasional remissions as the result of politico/economic shots in the arm, and a long life expectancy. We need 2,500,000 new units of housing every year, but in order to accomplish this we must have a healthy, integrated production and marketing system with coherent, supportive public policy and resource allocation. We must recognize that a society which does violence to itself (creation of arbitrary 'special groups' and the creation of a 'caste' of Public Housing 'untouchables') in

an effort to simplify the planning and economize on the building and management of its basic shelter, is in effect 'building in' an infinitely greater and more costly fundamental disfunction.

Historically, our housing market has functioned on the 'filtering' principle. This involves a kind of 'hand-me-down' process, in which units filter down as people filter up, with new construction available to those who could afford it at the top of the scale. This would work beautifully if there weren't many more people at the bottom than at the top, and if units didn't drop off the market before they even reached bottom.⁵

" From the standpoint of public policy, perhaps the most critical aspect of housing market dynamics concerns the seeming inability of even the best neighborhoods either to resist permanently the forces of decay and obsolescence or to regenerate themselves without public intervention once those forces have set in. With a few notable exceptions, the residential real estate market works only once. It creates, alters, maintains, and improves, and eventually discards assets, but seems incapable of providing for their replacement on the site."⁶

As a unit filters down the income scale, there is less and less capital available for improvements and maintenance, and because elements of a dwelling with very different life spans are joined together structurally when the building is built, alterations which would keep the unit up to date are messy, disruptive and very expensive. Thus, those at the bottom of the housing ladder are offered a choice between run-down, obsolete, over-priced units on

the private market, or the dangerous, dehumanizing, stigmatized barracks existence of a Public Housing Project.

For new construction at the low end of the market to fill the housing needs of low income people, it must be competitive in quality and price with the existing stock, but it must also be produced in sufficient quantity to serve more than the hard-core problem families.⁷ This appears to be impossible to achieve under the present system. Massive amounts of Federal subsidy money have been called for as the solution to the lack of private market interest in the production of low income housing, but lack of funding is only a symptom of a deeper systemic disease, and removing the symptom will not cure the patient.

The source of the problem is, I believe, rooted in the deep antipathy and ambiguity which characterizes the relationship between Public and Private realms in this society. We see ourselves as rugged individualists in the land of opportunity, but systematically deny that opportunity to millions by imprisoning them in poverty, hopelessness, and ignorance with punitive and degrading welfare and housing systems, and inadequate-irrelevant educational systems. We have far too dense and too complex a society - the forces that propell our systems are too interdependant - to allow a laissez-faire attitude, so we effect controls; but these controls are spotty, and tend to respond to the crisis at hand rather than acting as part of a coherent organizational process.

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One of these crisis controls has been the housing project. In this country, the housing project didn't really get under way until the depression, when the nation was faced with generating public works jobs as well as the embarrassment of a middle class suddenly unable to house itself. From the beginning it was seen as an emergency measure, and project housing was seen as temporary shelter for the totally destitute who would be moving out as soon as the economy was back on its feet, and they could find work. This attitude has persisted, and the public sector still only becomes functionally involved with housing the families and individuals at the bottom of the socio/economic barrel - those completely beyond the private market. Add to this a deeply ingrained resistance to any public encroachment on private property rights, and you have a situation where the only forms of communal control over the residential environment are a grab-bag of zoning and building codes, and the lay-out of streets, utilities, and green spaces - most of which cater to the myth of the rugged individual in his rugged little single family house. This works adequately in suburbia, but how do we protect the individual's right to a home which suits his needs, taste, and budget at urban densities of 80 units/acre and higher? The response to high density living thus far has been greater and greater uniformity and the housing project both public and private. As a result of continuing the practice of private ownership of small parcels of land

into the urban context, a kind of economic/technological determinism has taken over. The owner/developer of a parcel of urban land, in order to make economic use of this extremely high priced asset, must build as cheaply as possible, as rapidly as possible, the maximum number of square feet of useable/rentable space he can afford to build on based on market demand, costs, and available financing. To hell with the guy next door. Because he is acting alone, he has no effective control over the production and marketing process, and so must design an 'ideal' unit, often years in advance of project completion. Because traditional building methods take a number of separate technological provisions: plumbing, wiring, partitions, paint, structure, and combine them on site into an homogeneous product, it is impossible to make changes at a later date which would respond to user needs, taste, or technological innovations, without major disruption and expense. In order to guarantee himself a project which will be rentable/saleable at some future date, the developer singles out a target group: elderly, low-income, middle income, high income, young singles, families with 0,1,2,or3 children. He then designs an average unit around the average requirements of an average member of one of these artificially constituted non-groups, and repeats it over and over, close packed, and as cheaply as the codes will allow, up to the number he has judged to be his economic optimum. The close

packing and repetition are dictated by the structure of the building industry, where repeated operations are seen as the only way to efficiently phase all the various operations into one homogeneous product.

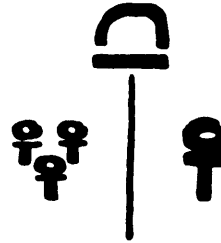
In our cities today we are housing ourselves in the antithesis of what we profess as our chosen way of life. we are building freedom and its attendant responsibility out of that part of our environment which most fundamentally embodies the relation between the two. The only possible result is a nation of environmentally disenfranchised and alienated nomads, leading to the total breakdown of community structure and general social disfunction. We must cease treating the forces governing the housing process as if they were as inexorable and inviolable as natural law, and begin to exercise rational control over the processes that form our society.

THE DUTCH EXPERIENCE AND THE WORK OF
N.J.HABRAKEN

The industrial revolution, in Holland as elsewhere, generated a vast urban proletariat incapable of housing itself. In the early years of the 20th. Century, the housing shortage became acute, and in February 1918 a Housing Congress was held in Amsterdam at which an engineer, J. van der Waerden, called for the standardization of floor plans and details, and the centralized organization of building activities and distribution of materials. He was backed by H.P. Berlage, one of the foremost architects of the time, who also saw these measures as the only way out.

Opposition to this scheme was strong, and in a later speech to the Society for Commerce, Industry and Municipal Interests in the Hague, Berlage sensitively defines the nature of this opposition:

" The laborers, and now I come to the core of the resistance, see in the monotony which they fear in the rows upon rows of identical bigger and smaller houses, an onslaught upon their individuality, their liberty and their dignity as human beings; this kind of housing reduces man to a herd animal, a drudge, a serf. And this is understandable. For, having emancipated themselves from the guardianship' under which they had been for such a long time and from a high-handed relief system, they fear losing again the voice



and initiative with respect to their homes, which they have by now obtained. And now the proposed house - once even characterized in a revolutionary journal as standing for: one uniform, one feed, one fold - suggests a cellular prison." 8

Habraken cites this conflict "between man on the one side, and the method of combatting the housing shortage on the other side", as well as the duration of this unresolved struggle, as an indication that the two are fundamentally connected, and he suggests that the "apparent impossibility of remedying (the housing shortage) is caused by the discord between man and method".⁹ The method he is referring to is the housing project, which depends on the elimination of the voice and initiative of the occupants with respect to their private and communal environments, for its technical and economic viability. He goes on to say "there is a crisis because the interrelation of forces which are active in housing has become a problem. Like all fundamental problems, our housing problem is one of relation.... The entire housing process deserves our attention. ... It is a process which on the one hand is influenced by rational forces of a structural, financial, and organizational character, but in which, on the other hand, stimuli are active which are rooted in the fundamental human relations, and which seem rather to be of a biological character."¹⁰

Because the housing project has come to be identified with the housing process to the extent that the project

is now equated with the process, our ends and means have become confused, and we are "imprisoned within the limits of one aspect of the housing process and therefore lose sight of the process in its fullest scope." Every force in man's physical, technical, political, social, economic matrix bears on the manner in which he houses himself. The means he chooses can, therefore, be taken as the material and organizational representation of those forces. 11

" a housing project is indeed the result of the forces which operate in the housing process, but only after one force has been eliminated from the process, for a housing project is only possible if the individual, the occupant, does no longer concern himself with the way in which the building of his dwelling is effected." 12

" Living is an act that takes place in both spheres (private/public). A home connects the two spheres. Terminus of a series of communal services; start of a personal enterprise. This even obtains in our communal housing projects; mass production housing. But the transition point has reached an extreme. The sphere of the individual is almost lost. The occupant is almost eliminated." 13

A central element in Habraken's theory, is the concept of the "natural relation" of man to his material environment.

" A relation is naturally based on action, and, after all, dwelling is doing something. It is the sum of human activities within a demarked space, inside a sheltering environment made by man. The acts of man also have their impact on the environment itself. Because man wants to possess his environment, he gets hold of it. He papers his walls, hits nails into them, arranges the chairs, hangs curtains. Presently some structural alterations are made, the floor is removed. 18

is renewed, the heating system improved, the lighting altered. No demarcation line can be drawn to mark the transition into the activities which we call building. ...dwelling is building." 14

It is the absence of this reciprocal, 'natural relation' between the dweller and his dwelling place which impairs the housing process. If people lived in accordance with the laws of the housing project method of building, there would be no problem supplying them with the needed units; but "it is evident, even to the simple-minded, that the result is something which is not in keeping with what may be expected of a town and of housing. Evidently, life resists the consequences of this method, and so prevents the emergency measure, chosen for its high productivity, from being truly productive." 15

In order to achieve the uniformity and repetition dictated by the project method, the designer must design the ultimate unit for an arbitrarily segregated segment of society and close-pack it into "blocks for bachelors, small families, large families, incomplete families, old people, socially deficient people, career women, elderly couples and artists. ...society, left to itself, would never arrange itself in that way. It is not a matter of answering the question how it should be arranged. ...this only indicates that matter is not given the form which fits society, but that society is forced to adapt itself to the method which claims to build dwellings to suit the people." 16

If there is a necessary reciprocity between the

individual and his dwelling unit, there is also a necessary reciprocity at the level of population and town. " it is then possible for society, via the individual which is its smallest entity, via the dwelling which is the smallest entity of the town, to reflect itself in the shape of the town. ...A town is, if the natural relation is present, an organism which is never quite finished but which renews itself continually and which grows incessantly, ever different and ever the same."¹⁷

But the development project is a rigidly pre-determined, homogeneous configuration, and doomed to stand as such until it deteriorates to the point of being a menace to the health and safety of the inhabitants.

"No new face, new technical finds, no new amenities, no new conceptions of living can touch it, unless the area as a whole is again tackled as another big redevelopment project."¹⁸ The occupant who's life style no longer fits his dwelling unit can only try to move to a better project. Because the only up-to-date units are in projects recently redeveloped, "the system is an open invitation to a continuous game of musical chairs."¹⁹ And there is always a state of emergency with respect to the removal of the most battered chair and the dislocation of its occupant.

The housing project method also makes experimentation in housing a very risky proposition. A manufacturer cannot try out a new product on a small scale for a short period of time, and by the time it has been evaluated on a large scale (for better or worse, that project is stuck with it) it

has, in all likelihood, been rendered obsolete.

" In this way, the development project totters cumberously from one disruptive renewal to the next, in an everlasting feverish pursuit of reality; ever groping and seeking, theorizing and rationalizing in a stubborn endeavor to catch the incidental and the changeable in institutionalism and generalizations." 20

Some prerequisites, then, for the formation of community, are: "freedom of combining", freedom of the individual to renew and alter his environment as his needs change, and Time.

" It is imperative that in time the area can renew part after part, can alter detail after detail. If this is not possible, the area must be redeveloped by the time the trees, planted when the area was new, are full-grown. The people need more time to grow into a community than the housing project blocks to get dilapidated." 21

" The modern dweller is a nomad who wanders about without taking part in the growth of his environment; he therefore needs not blame himself for the shabbiness of it." 22

There are those who argue that repetition and uniformity in development projects are necessary adjuncts to the mechanized building industry and to industrialization. They are not. It came about through the attempt of a non-mechanized building industry to organize an traditional building process which was (and still is) anything but coherent (many separate operations and materials requiring on-site combination into an homogeneous entity). The only way to achieve the required increase in output was to standardize and repeat each man's operation, which

naturally resulted in uniform homogeneous entities.
Factory production implies the off-site manufacture of parts or components which are later combined to form a conglomerate whole.

" The machine can produce uniform parts which, provided the fit in a coherent system, allow an endless variation of forms. The development project, however, in no way guarantees a coherent system of building by suppressing variations in form. ...to apply factory production successfully, it is necessary that we find a method which is founded on this production ... As long as we do not do so, our attempts in the field of housing will remain as ambiguous as the results of the motorcar industry would be if it should attempt to manufacture the seventeenth century coach by means of an industrial production system." 23

At this point we are engaged in an effort to bend industrial process to mass produce a building product: the dwelling unit. We must realize that should we be able to accomplish this, we will have coerced both industry and the building process into roles unnatural to them, and the individual will be inextricably pigeon-holed in the Housing Project.

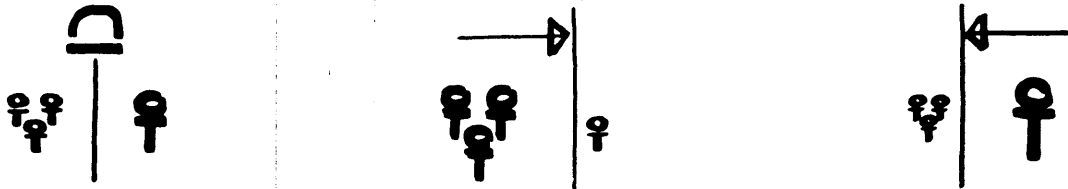
" Building is by nature something different ~~from~~ industrial production.

In industrial production the product is mobile and the system is stationary.

In building the product is stationary and the system mobile.

Our Material surroundings are brought into being by the application of both systems." 24

Habraken has identified two spheres in which man relates to and forms his dwelling environment: public and private.



"Living is an act that takes place in both spheres.
A home connects the two spheres;
A home is the environment of a family, and is part of a communal environment;
A home has an interior and an exterior;
Terminus of a series of communal services;
Start of a personal enterprise.

Living cannot take place exclusively in one sphere;
Living exclusively in a communal sphere is tantamount to living in a barracks.
Living exclusively in an individual sphere is tantamount to exile.

A home must therefore be built in both spheres.
It cannot be built in one sphere only.
An individual who builds his own house completes his home in the sphere of the community
A community that builds houses must allow them to be completed in the individual sphere." 25

Change must be a continual process for healthy functioning in both spheres, but it should be recognized that it occurs at a very different rate in each. The physical fabric of a town embodies a community's institutions, zones its activities, determines its densities, lays out

its services and circulation. It is a supporting infrastructure which must bridge generations of individuals, and as such change happens much more slowly (or if rapidly, on a much larger scale) than it does in the sphere of the individual who begins life as child in a family, and then in turn is single, married, married with children, married, single again before being permanently housed in the cemetery. More than that, within each of these phases of his life, changes will probably occur in his income level, preferences, and space requirements.

Industrial production is ideally suited to the fabrication of relatively small, finished, dimensionally consistent parts or components - consumer durables in a class with furniture and major appliances, but space-defining and including such items as: cupboard walls, kitchen units, wet cells, sleeping cells. These could be bought, sold, traded, rearranged, replaced, discarded, according to the needs and tastes of the individual and/or his family independantly of each other and of the supporting communal infrastructure.

The building process demands directed, planned, coordinated, collective activity toward the goal of a fixed, integrated structure with a long life span. This process is best suited to the communal sphere. At low, suburban densities, this means roads, bridges, and special community buildings. At urban densities, it implies three-dimensional real estate. The responsibility

for expensive, infrastructural
permanence is appropriately communal
and continuous across generations
of inhabitants.

" Our housing will benefit if the
right production systems work in
each of the two spheres, and these
systems are each given the task
which belongs to the appropriate
sphere.

What should the architect
substitute for the two question
marks?

If he fits a Dwelling into the
(upper)group, mass housing
production ... is inevitable.
If he fits a Dwelling into the
(lower)group, a sort of caravan
site develops.

Therefore we do not make dwellings.
We make supports and detachable
units.

We make completed and recognizable
things, each belonging in its own
sphere, created in accordance with
its own pattern of relationship.
We can only make objects, products,
things.

We cannot make homes.
A home is not a thing.

A home is an act.

The dwelling is part of that act.

The dwelling is an act.

That is why you cannot make a home
for someone else. ...

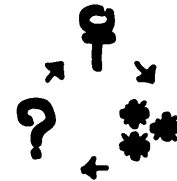
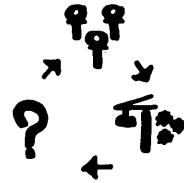
You can make supports or detachable
units.

You can provide opportunity for the
creation of dwellings. ...

You can guide technique to produce
the things with which people can
really live.

Because living somewhere is an act.
Committing this act is a need (the
elementary, essential need).

You can make technical things which
make the act possible." 26



Having presented his theoretical base, Habraken goes on to examine and define several requirements which he feels the system must meet, as well as^{to} suggest ways in which he feels these requirements can be operationally coped with.

Obviously, if the dual production method is to work at all, there must be guarantees to the manufacturer that his products will fit into the built Supports. This requires dimensional coordination. Habraken suggests the use of the international system of modular coordination developed after W.W.II. This system is only coercive if it is used to pre-determine all possible sizes and shapes of materials and elements in a 'tight fit' system. It can also serve as a set of rules governing the placement, relative to each other, of the Support structure and infill materials.

" The position of the material ... is even more important than its size. As long as its position is clear, one must have as free a choice as possible in the matter of its size (and shape).

In order to attain this end, two aids have been introduced: the 'fitting dimension' and the tartan grid.

...in using a tartan grid, it is easy to decide upon conventions about the way material is placed in the grid, so that without being exactly acquainted with the measurements of the material their minimum and maximum measurements will, in any case, be known. ...by agreeing on where material will end in a certain band...for instance the 10cm band in a 10/20 grid....In a 10/20 grid, when the materials begin and end in a 10cm strip,

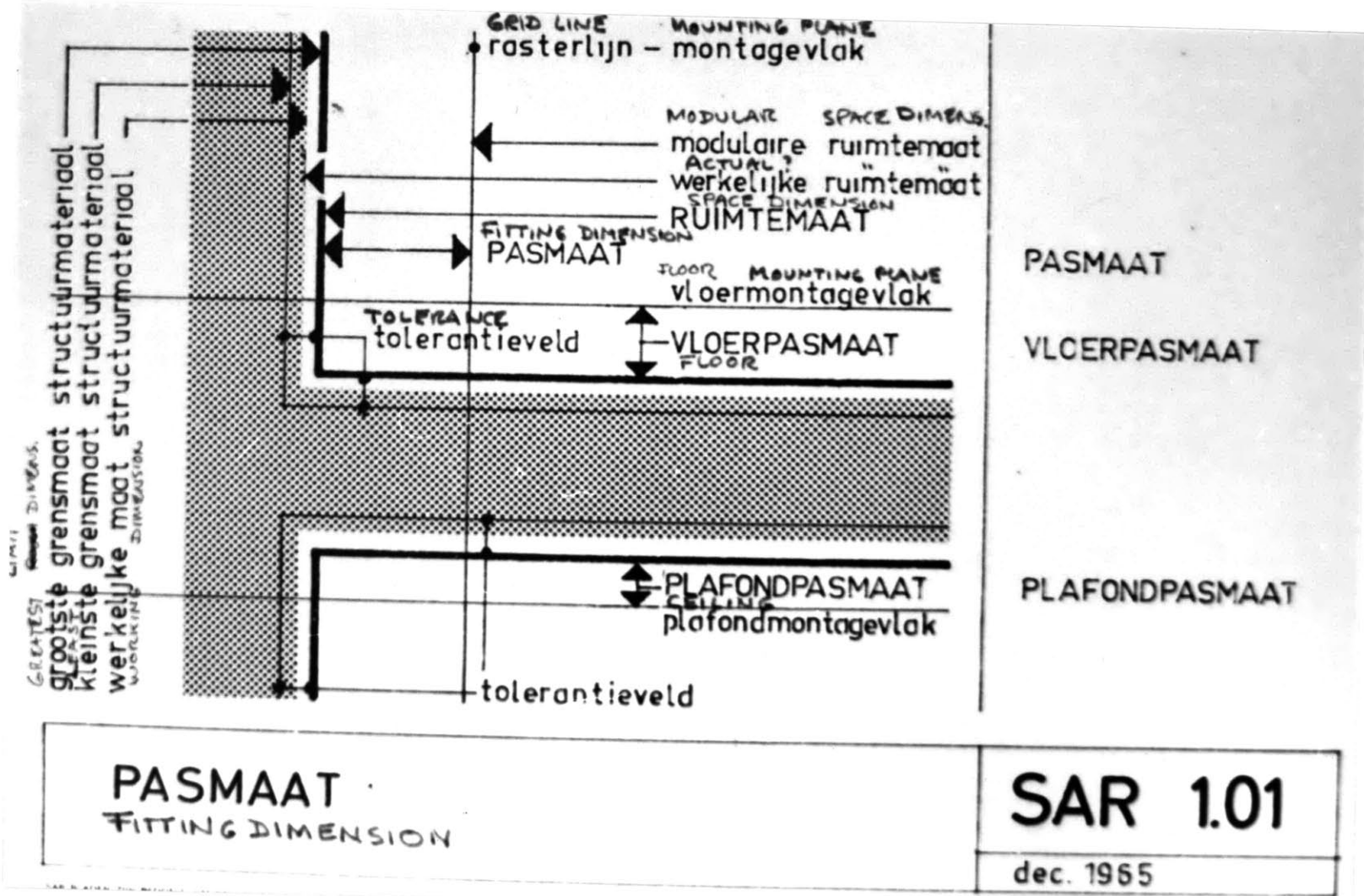
the minimum dimension of the material will always be $(n \times 30) - 10$ and the maximum $(n \times 30) + 10$." 27

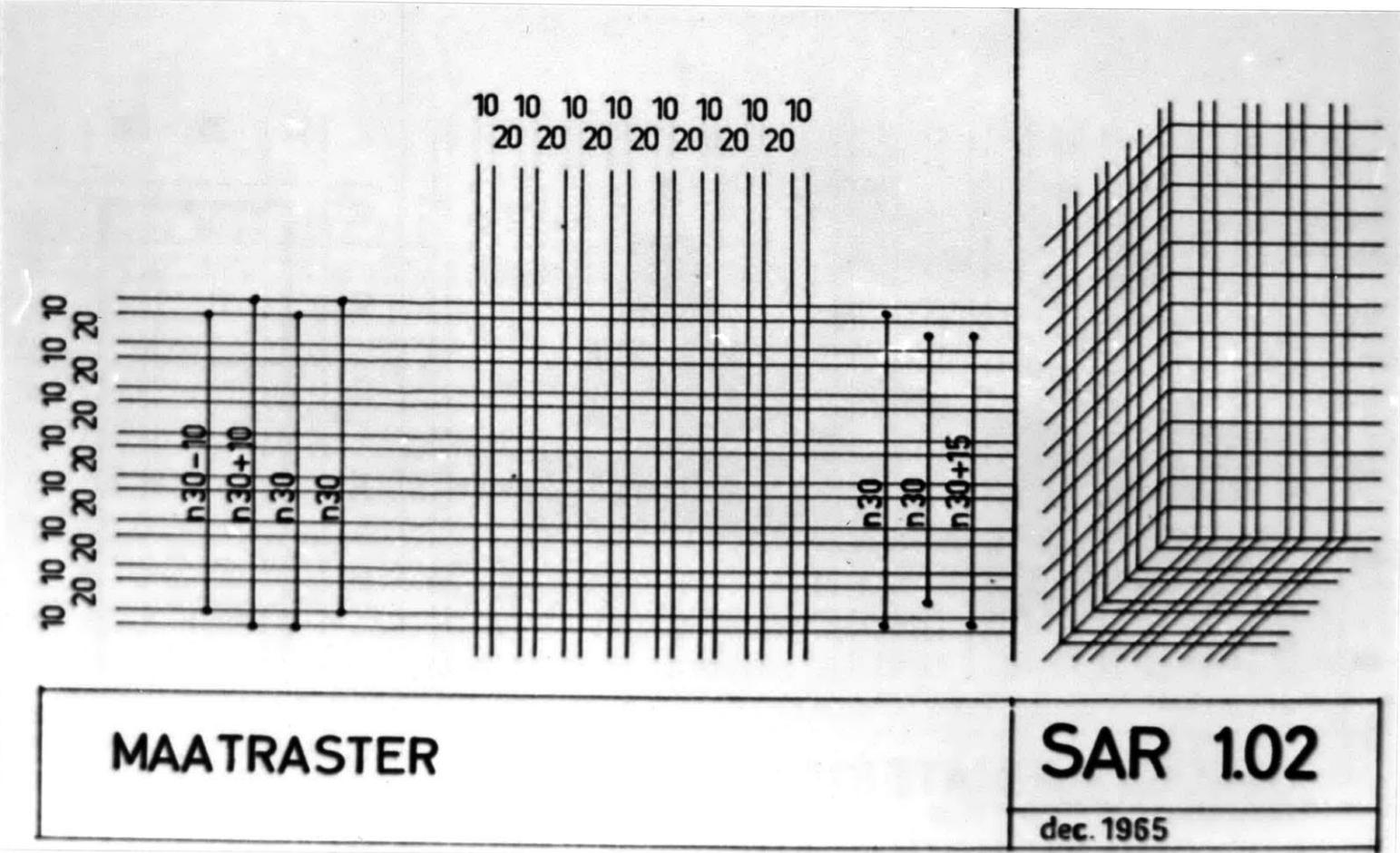
This also establishes the characteristics of the space dimension between two such elements. In the above example, it would always be $(n \times 30) - 10$ plus $2 \times p$, the 'fitting dimension'.

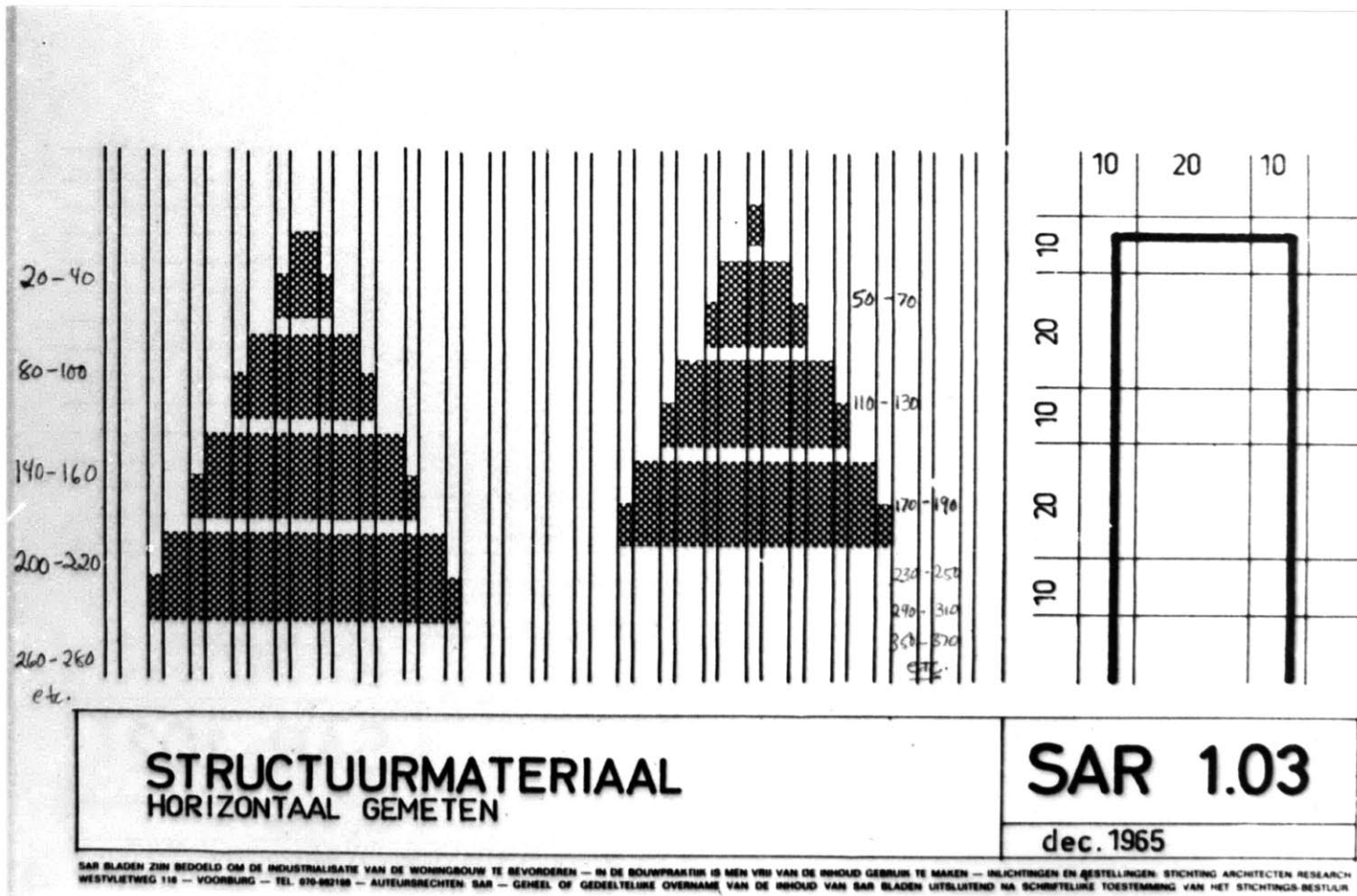
The 'fitting dimension' establishes the exact dimensions of the material by fixing the dimension of the space between that material and the next line of the grid. If structural material ends in a 10cm strip, the 'fitting dimension can vary between 0 and 10cm. "This ('fitting dimension') makes it possible to place non-modular structural material in a modular grid." 28

(See fig.1) a,b,c,d)

The Zones and Margins are guidelines which establish the possible relative sizes and positions of the use spaces within the Support and with respect to the general zoning of the town fabric. They are very general space/use designations which are then made more specific by both the design of the Support structure and the placement of the infill elements. In a linear organization of dwelling sites, these zones and margins form continuous bands of a predetermined thickness depending on their utility value. There is a margin space between every two zones in which the components are placed which serve the zones on either side and define the limits of those (always free) spaces. If you define an Alpha zone as containing living





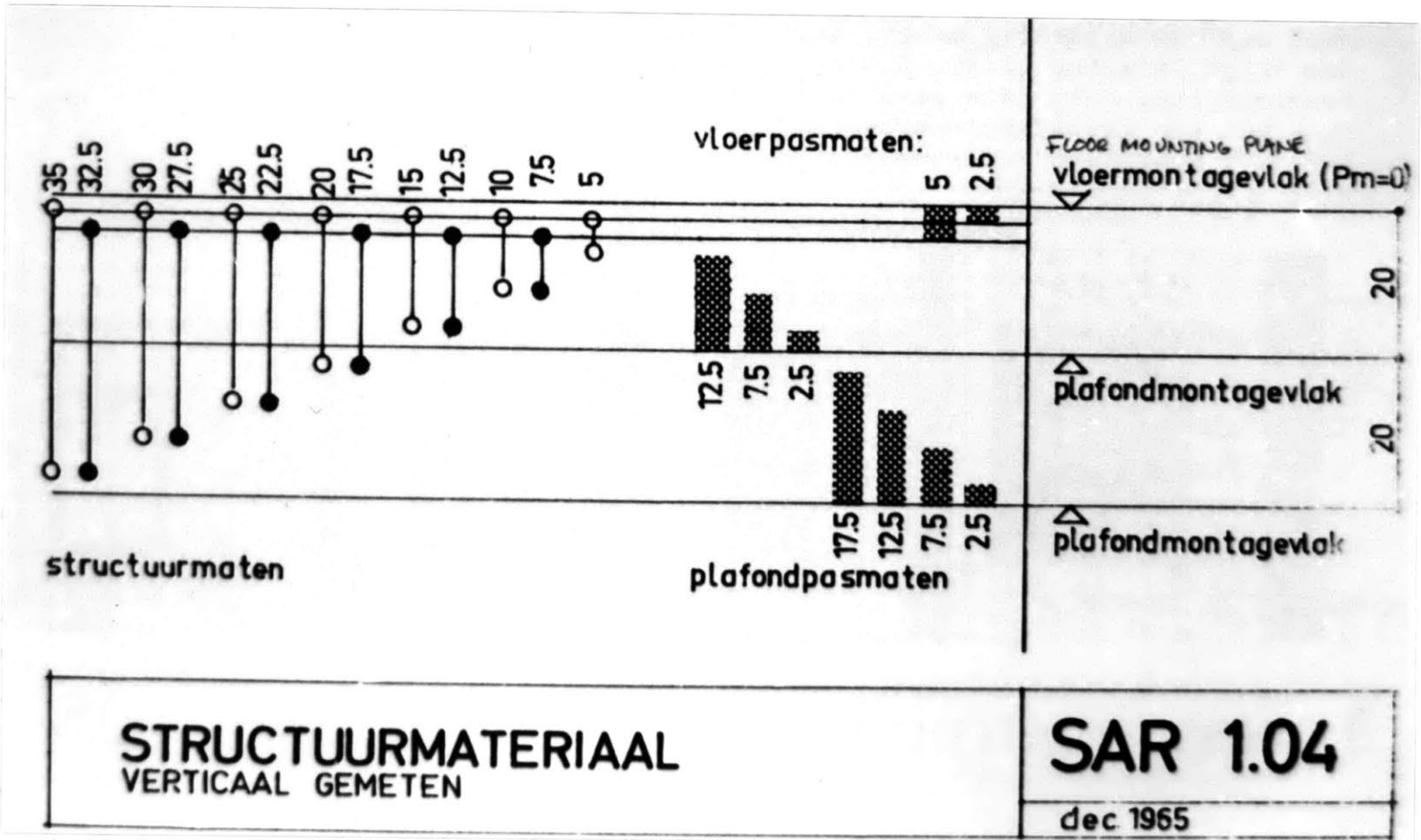


**STRUCTUURMATERIAAL
HORIZONTAAL GEMETEN**

SAR 1.03

dec. 1965

SAR BLADEN ZIJN BEDOELD OM DE INDUSTRIALISATIE VAN DE WONINGBOUW TE BEVORDEREN — IN DE BOUWPRAKTIJK IS MEN VRIJ VAN DE INHOUD GEBRUIK TE MAKEN — INLICHTINGEN EN AANBEVELINGEN: STICHTING ARCHITECTEN RESEARCH WESTVLIETWEG 118 — VOORBURG — TEL. 070-982198 — AUTEURSRECHTEN: SAR — GEHEEL OF GEDEELTELINGE OVERNAME VAN DE INHOUD VAN SAR BLADEN UITSLUITEND NA SCHRIFTELIJKE TOESTEMMING VAN HET STICHTINGS-BESTUUR



spaces requiring outside exposure (living room, bedrooms), and a Beta zone as containing spaces which could be internal (kitchen, laundry, bath, eating); an apartment block with gallery/street access along one face of the support would order its zones and margins as follows: Gamma zone(public circulation/gallery), Gamma-Beta margin (transition space between public and private), Beta zone (see above), Beta-Alpha margin, Alpha zone(see above), Alpha-Delta margin(transition between private inside and private outside space), Delta zone (private outside space, balcony or garden). An Alpha-Beta-Alpha arrangement is possible when the units work on an entry system with access near the middle of the apartment and outside exposure on both sides of the block. This configuration may also be applied to a gallery access system if the gallery is not enclosed and if the Gamma-Alpha margin is designed to provide adequate visual and acoustical privacy. The depths of the zones and margins are determined both as a function of space and dimension standards set by codes and as a function of the requirements for the accommodation and grouping of furnishings (beds, couches, tables, chairs, appliances) and infill components (storage walls, wet cells, kitchens etc.).

In Habraken's application of this methodology, the support structure then serves to define the limits of the zones and margins (and their general spatial character), and also the limits of each "sector" of the zone/margin

ribbon.

" ...a dwelling is a support structure can always be seen as a combination of more than one 'sector'. These 'sectors' are very often determined by the structural material. For instance by the positioning of columns or of load-bearing walls. In this way, the 'sectors' in a structure are in fact the spatial units used to build up the structure." 29
(see fig. 2,3,4.)

If one dimension, the depth, is set by the zone/margin arrangement, the second dimension, the width, of any freely partitionable area is set by the placement of vertical bearing elements of the support structure.

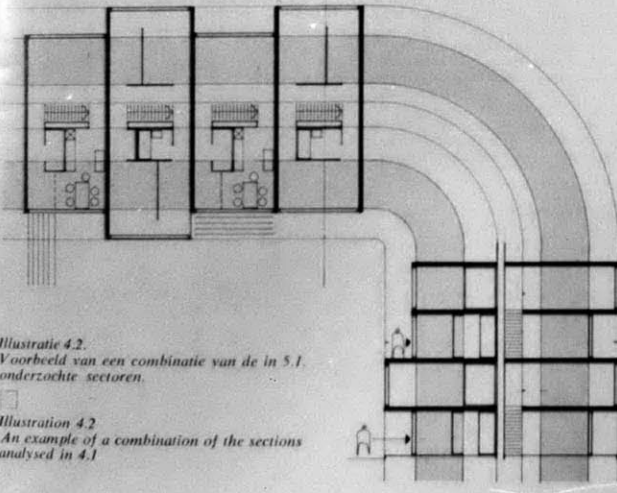
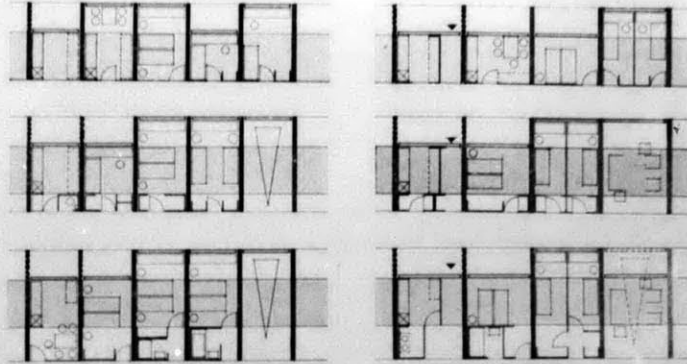
" ...the 'sector' is the smallest recognizable spatial unit used in building up the support structure.
...at this point the support structure is to be defined as an architectural and spatial theme, by the aid of which, complete systems of support structures can be developed into urban units without the necessity of designing the dwellings beforehand. Up to now, the architect and the town planner have for the most part been engaged in linking together dwellings which had already been designed. From now on they can do their work by means of a system of combinations of 'sectors'
...the 'sector' has become an indispensable link in the continuity of the smallest to the largest dimensions." 30

A well-designed structure must point...to the possible positionings of the (detachable units). A structure can be considered good when it succeeds in creating a great number of lay-out possibilities by the use of a minimum number of detachable units." 31

All studies carried out by Habraken et al that I have seen, are based on this last principle, and seem as a result to bely their intended flexibility. The fact that this rigid 'sectoring' is built into the permanent structure

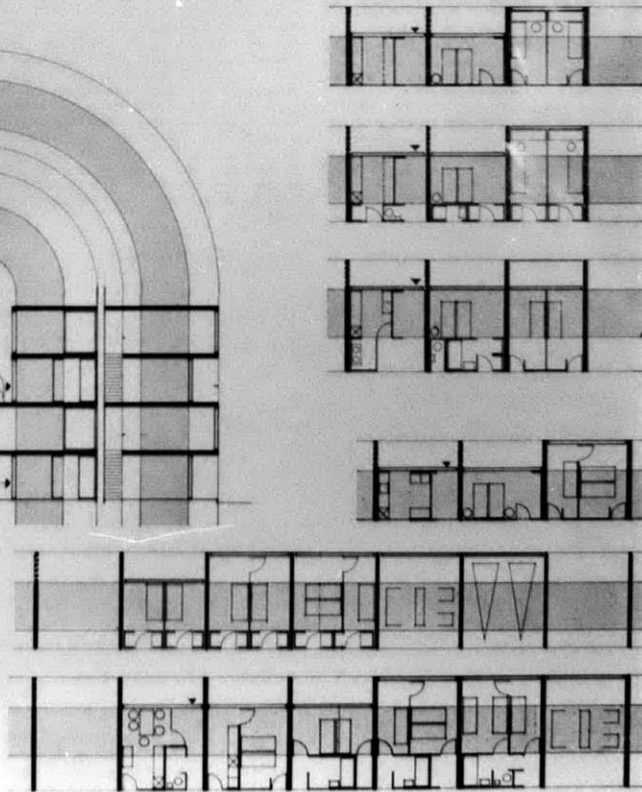
Illustratie 4.1.
 Een analyse van a-sectoren van respectievelijk
 3 m, 3,90 m, 4,50 m en 4,80 m breed bij eenzelfde
 zónering.
 Studie voor de N.V. Elementum, Maassluis -
 maart 1968.

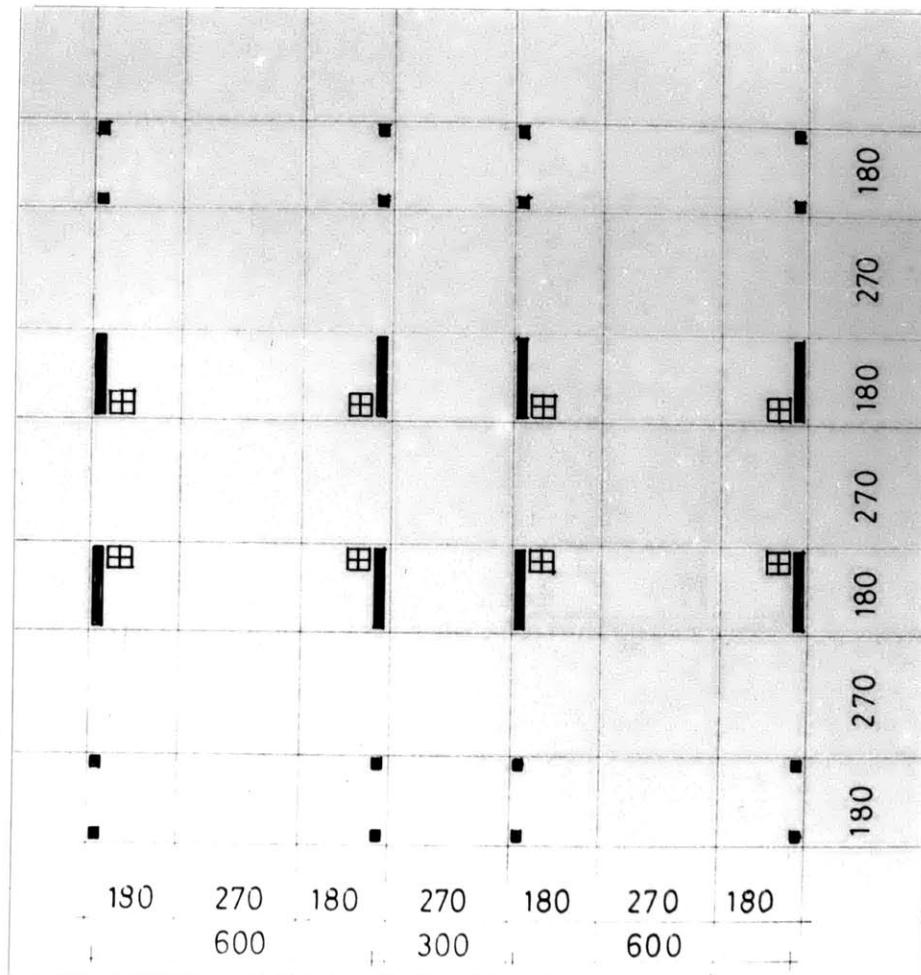
Illustration 4.1
 An analysis of a-sections in an identical
 zoning by a width of 3 m, 3,90 m, 4,50 m and
 4,80 m respectively.
 A study undertaken for Elementum Ltd.,
 Maassluis, march 1968 (Larsen-Nielsen system).

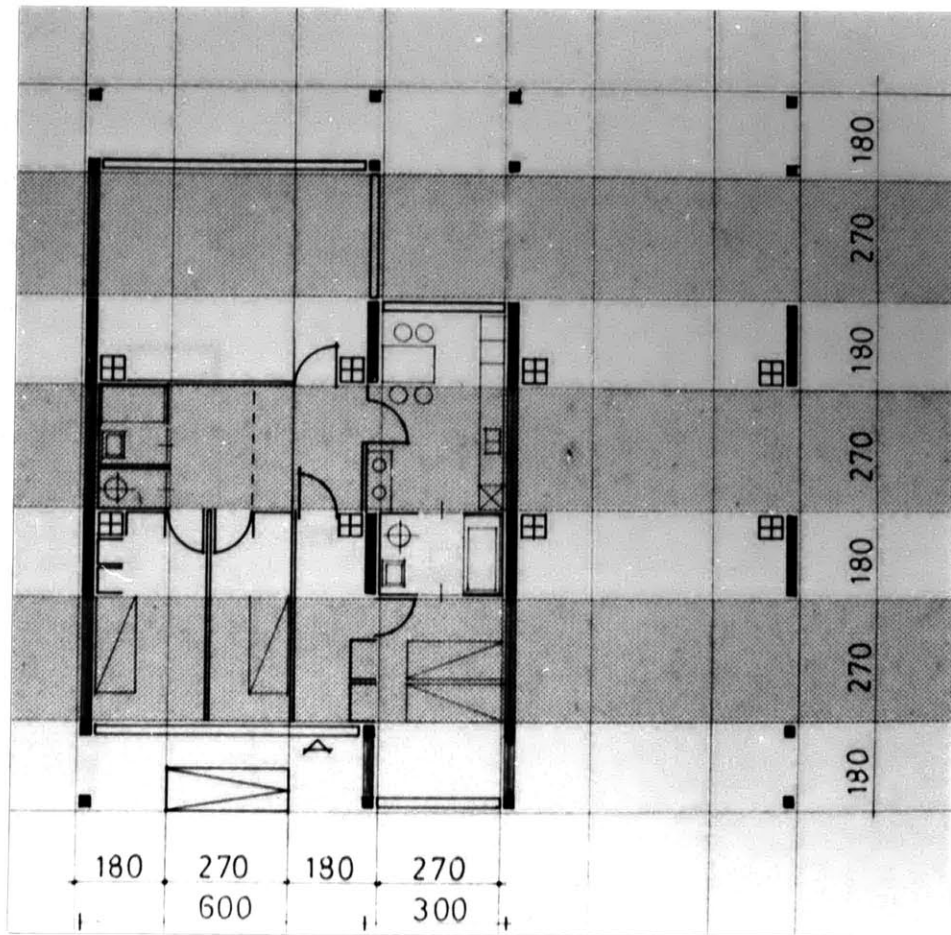


Illustratie 4.2.
 Voorbeeld van een combinatie van de in 4.1.
 onderzochte sectoren.

Illustration 4.2
 An example of a combination of the sections
 analysed in 4.1







of the Support, effectively prevents any real(change of use) freedom of combining in the horizontal plane, and, more than that, restricts it in the very direction in which expansion of space could occur in a linearly developed structure. Rigorous layering of 'sectors' in the vertical direction also inhibits 'freedom of combining' of uses and spaces in this dimension. All the Supports, for this reason, tend to resemble and function almost as rigidly as the standard residential development. The essential differences do represent a major and desirable departure from standard practice insofar as:

- 1) The occupant is given a considerable measure of control over the arrangement and equipping of his unit.
- 2) This includes the rearrangement and re-equipping of that same unit, which would allow him to stay in one place despite a change in life-style.
- 3) The determination of the numbers and proportions of various unit sizes need not be made until the Support structure is complete, and can therefore reflect accurately the market demand at that time.
- 4) Continuous, incremental change can occur throughout the development with respect to no.3 (above) as well as with respect to the infill of the individual units; preventing the inexorable process of deterioration and obsolescence inherent in the housing project.

However, the fact that the defined 'sectors' are residential

in scale and quality, effectively prevents the re-ordering of the Supports for non-residential uses. The communal fabric is therefore unable to respond to changes in population and socio/economic structure within the context of its three-dimensional real estate - its organizing urban fabric. This no doubt reflects current practice in Dutch new-town planning: the zoning of separate areas for residential, commercial, and industrial uses. (see plans and sections of Maarssenbroek new town by De Jong, van Olphen and Bax: fig. 5 - 9)

At this point it should be noted that Habraken's theory concerning the application of the sweeping changes he calls for, involves the interim design and construction of residential support structures on the zone and margin system which would be conventionally infilled until such time as there would be sufficient support structures to guarantee a market to the manufacturers of detachable units. At this point, the design of the components would begin to provide feed-back to the design of the supports, and this reciprocal research and development would make possible the freer design of the supports.

"We get away from the block of flats.
The supports form an urban tissue.

The living area is a whole." 32 *27-30*

Much more than the simple separation into two spheres of products and production methods would seem to be prerequisite to the achievement of a truly flexible, loose-fit system. Government-level policy decisions,



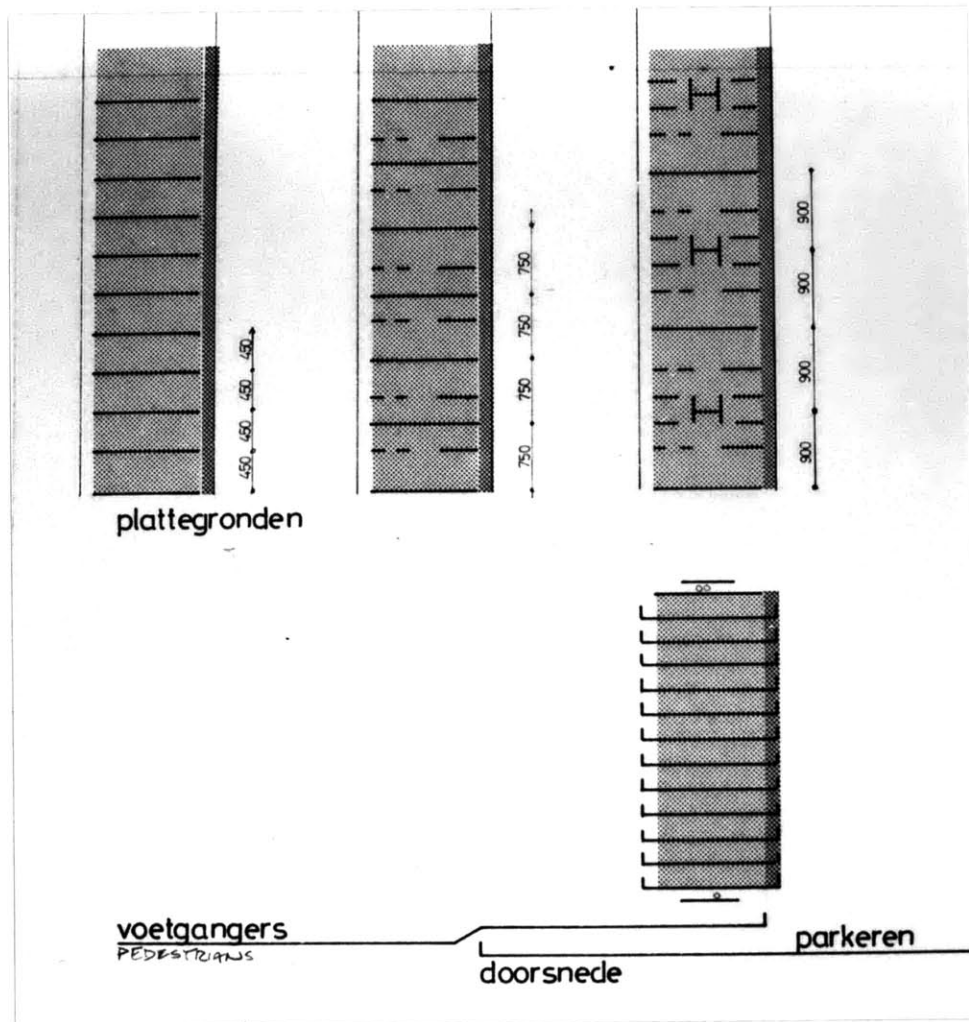
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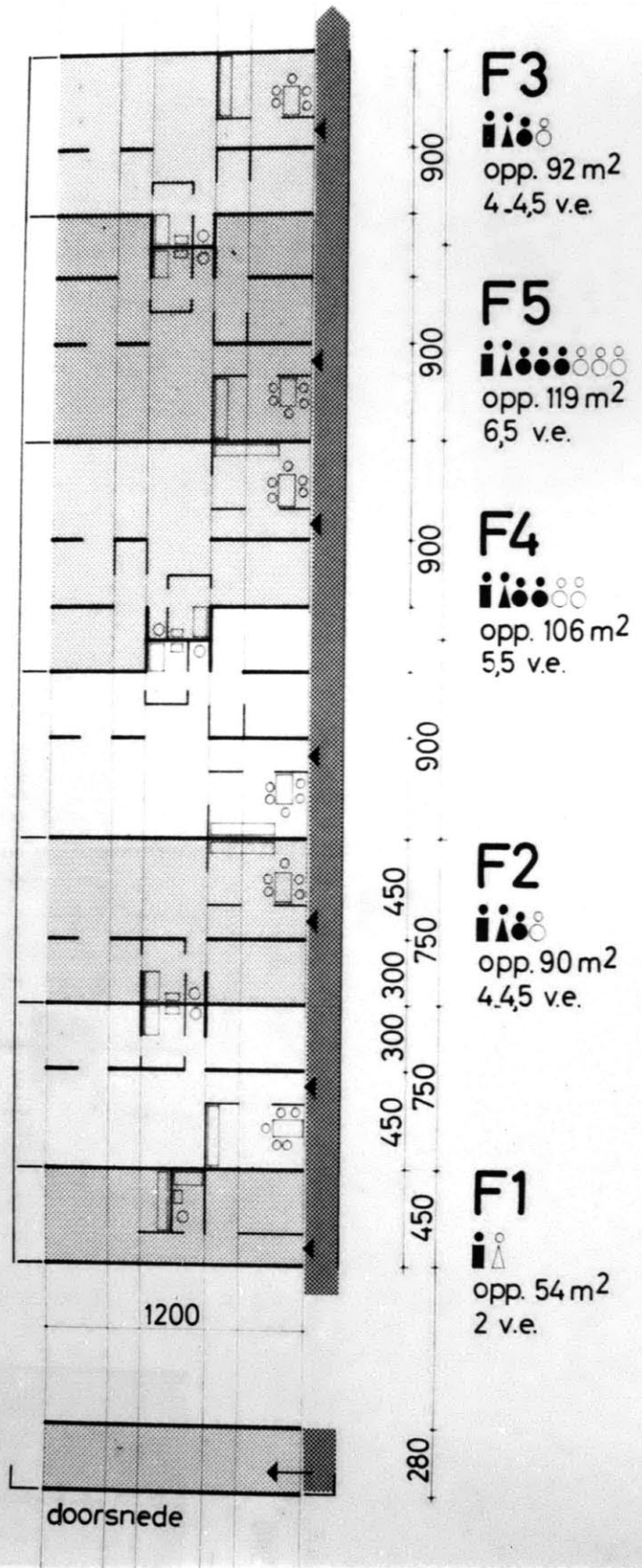
Fig. 5

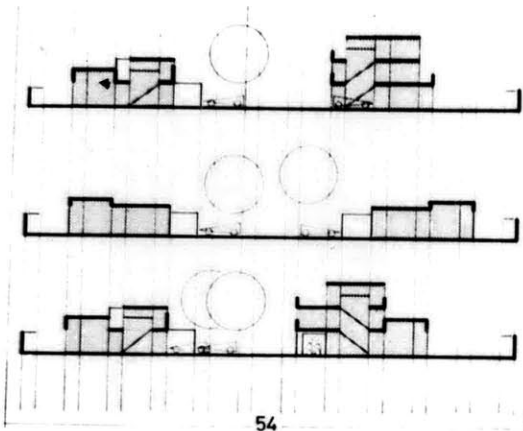
SCHAAL: 1:10.000
PLAN MAARSSBROEK



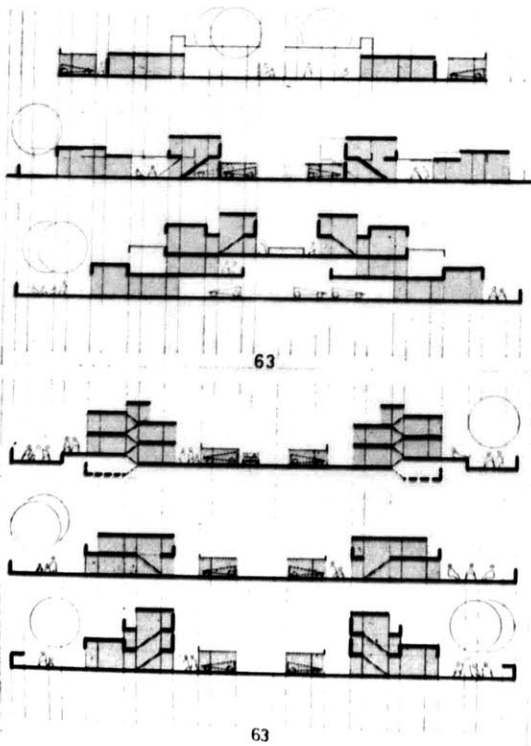
architecten: de JONG - van OLPHEN - BAX





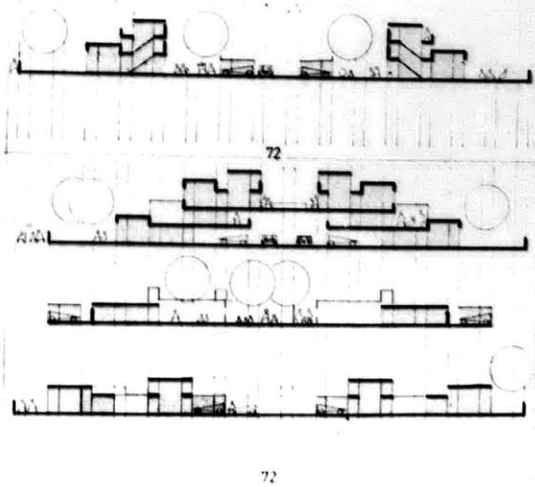


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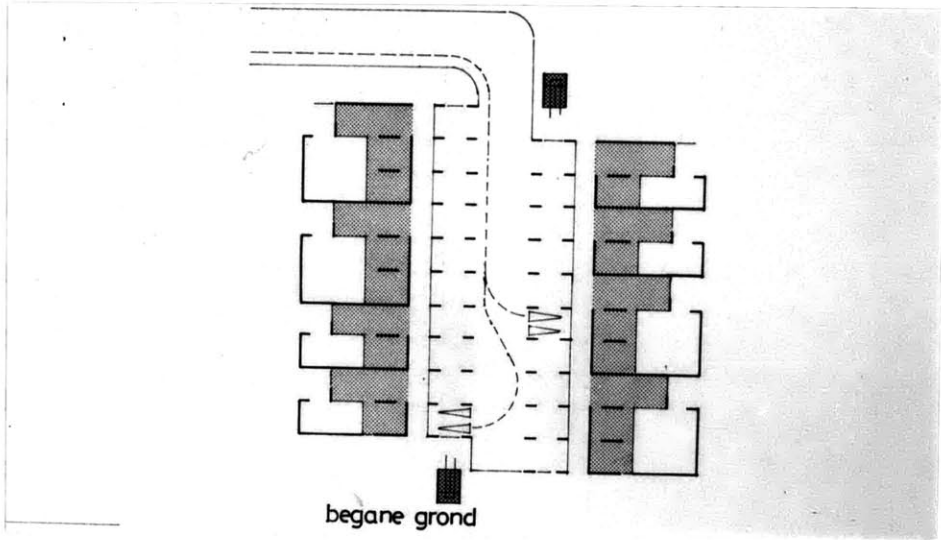
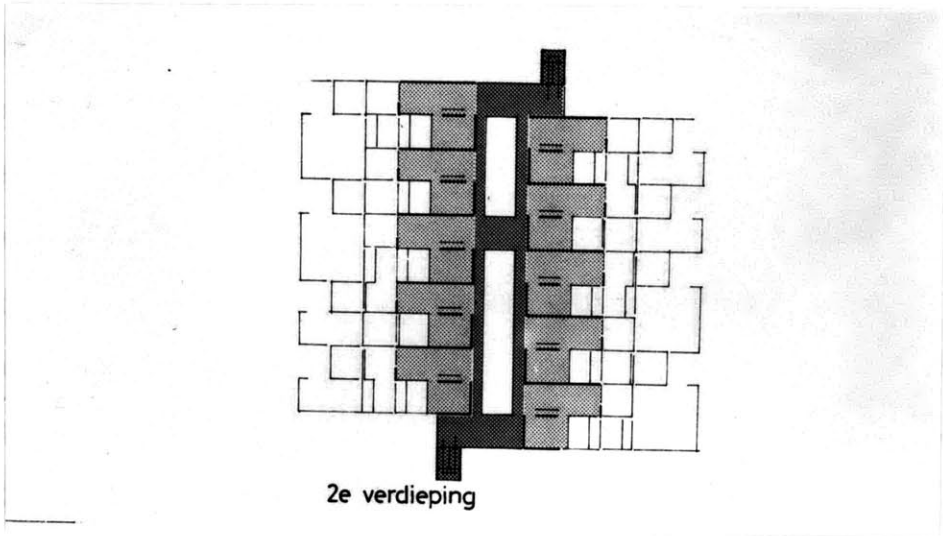
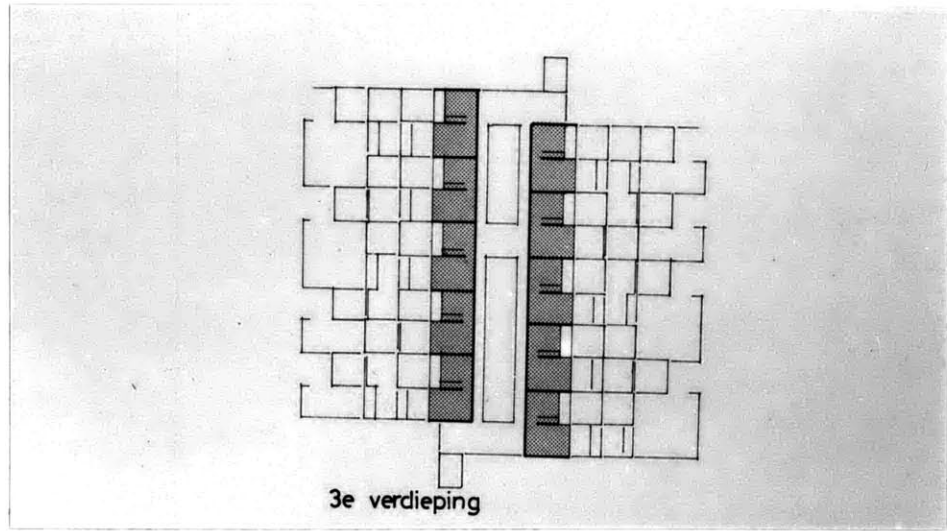


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72

Illustraties 2.3-a, 2.3-b, 2.3-c, 2.3-d, 2.3-e
 Een studie van diverse mogelijke
 stedenbouwkundige profielen bij verschil-
 structuurvormen, allen gebaseerd op een
 continue zonerings.
 Studie voor het plan Maarssebroek,
 architectencombinatie de Jong, van Olphen,
 Bax - 1969.

Illustrations 2.3a, 2.3b, 2.3c, 2.3d and 2.3e
 A study of the various possible profiles for
 town-planning in different structures, all based
 on a continuous zoning.
 A study made for the town-plan of Maarsse-
 broek by the architects' combination of De Jong,
 Van Olphen, Bax - 1969.



especially concerning subsidy requirements, could have enormous effect on both marketing and production in both spheres: Public/Support and Private/component.

- 1) Linkage of all Government subsidies for urban renewal and redevelopment projects with required adherence to a system of dimensional coordination based on the international modular coordination rules, and using the metric system, would be the first prerequisite for adoption of this system in the United States and Canada.
- 2) Heavy change in emphasis from a predominantly rental unit oriented subsidy system, to one which subsidized already established condominium/co-op methods of urban dwelling ownership. Ownership of a piece of his environment correlates closely with an individual's sense of having a stake in and responsibility for the quality of his environment.
- 3) The Development (currently under way) and universal adoption of a National building code which reflects performance standards rather than standard practice and materials.
- 4) One of the most frequently heard objections to a loose-fit system such as this, is that the initial cost to build would be prohibitively high. There is no question that it would be far higher than the cost of a conventionally built housing project, but since the life span of a public support would be

counted in generations, as opposed to 20 years or so for the conventional project, this difference could be reconciled by financing which recognized the extended functional and economic viability of the supports, and allowed the city or town to amortize the cost over several generations.

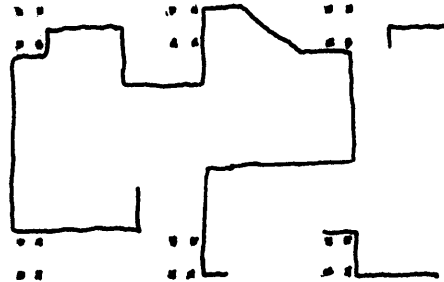
Considerably more flexibility, even in the initial phases, can and should be built into the Supports. If we take as a requirement for the formation of community that the institutions, activities, and social groups must be free to combine and recombine; we must, from the outset, design and build Supports which make this possible.

DESIGN DECISIONS

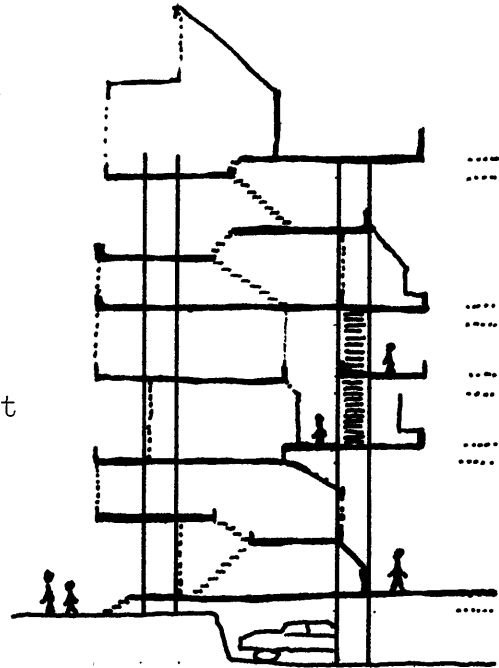
I. Intentions:

Within some organizational and programmatic constraints, to design a Support structure which contains within it greater actual and potential 'freedom of combining' than those so far designed by the Habraken group.

This implies that horizontal space/use continuities beyond the limits of the structural bay dimension should be built into the system as a medium life-span flexibility factor, buildable and demountable independantly of the Support. Vertical space/use continuities should be built into the system by means of the provision of zones in the Support with height dimensions allowing changes of level with spatial continuity (at least 20' to allow duplex units). These zones should occur: 1) at or near grade to allow large units with children



easy access to outside play, as well as to accommodate uses requiring greater-than-domestic ceiling height. (church, school, office, store, compatible industry). 2) At the roof level to relate large-family and/or luxury penthouse duplexes to roof gardens and/or play areas. as well as to take advantage of the vertical continuity inherent in being on top. 3) Between public circulation zones at different levels where they are connected by exterior stairs. Other intentions developed from site and programmatic requirements. 1) To continue the grid of streets and residential blocks forming Cambridgeport's organizational fabric into the new development as an aid to interaction between new and old. 2) To accommodate a range of uses: parking, office, school, retail, residential (owned and rental), and recreational.



3) To accomodate a range of users from low to upper-middle income, young transient to middle-aged resident, single, married without children, married with children; the exact relative proportions of which cannot be determined as early as the planning stage, and could not be expected to remain constant once the development was planned and built.

II. Means

A. Linear organization of Supports and use of linear structural elements to define them, in order to relate to the street grid and to avoid the rigid division of spaces across the growth direction of the structure which is inherent in a bearing wall system.

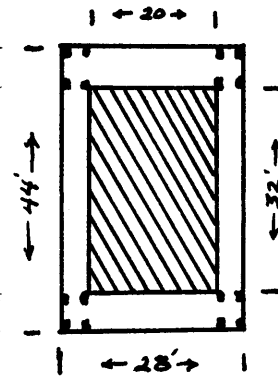
(see fig. 10, drawing)

note: feet and inches chosen in order to explore the problems and possibilities connected with the use of a non-metric dimensional agreement system.

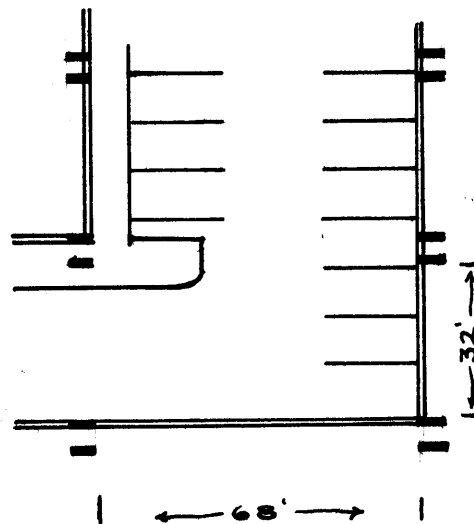
B. Structural Bay Dimension, 24'X 38'o.c., reflects both the desire to continue roughly the same dimensional rhythm as

exists in the Cambridgeport residential fabric with respect to average frontage widths of the dwelling units. (20'-25'); as well as the previously stated need to accommodate a range of residential and non-residential uses:

1) a considerable range of apartment sizes and shapes from a minimum 32'X20' (640 sq ft) efficiency, to an outside 44'X 28' (1232 sq ft) three-bedroom unit, can be laid out by using only the margins produced by the doubled column and beam bents at each bay.

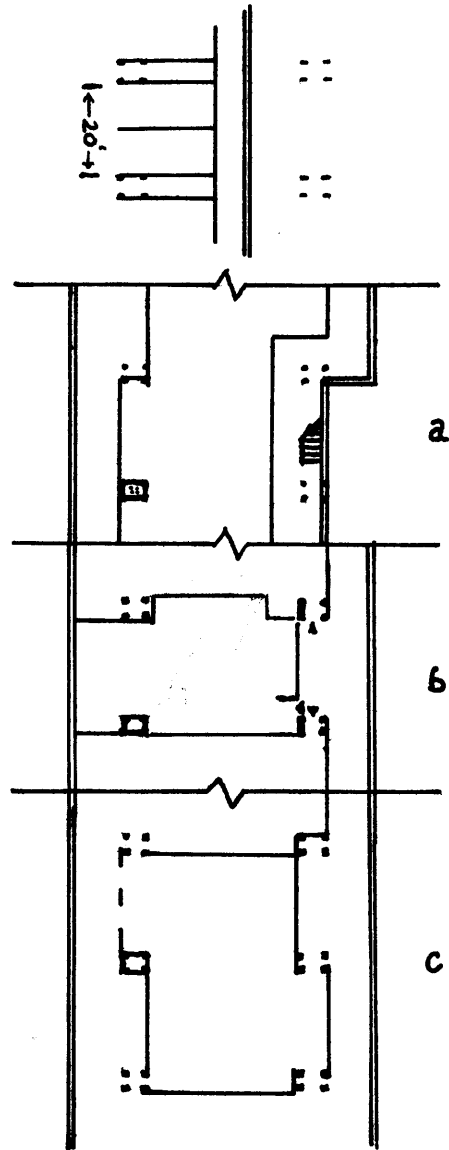


2) Tripling the bay and spanning the 68' with double-T slabs provides a parking garage dimension of 68', or two rows of 90° cars, 3/bay, and a 20' driveway down the middle, plus an 8' wide pedestrian walkway along one side.



3) The 20' clear inside dimension of the standard bay parks 2 cars/bay under the linear blocks of the Support.

4) The full bay depth of 44' plus two, 10' cantilevers at each side gives: a) exterior, private and public zones for the residential uses. b) a 56' deep office floor plus an 8' wide access gallery or corridor. c) two standard bays give a 44' X 32' clear space (~1400 ') for a school classroom and its associated storage space. d) this space is also suitable for small bar, restaurant, and retail uses.



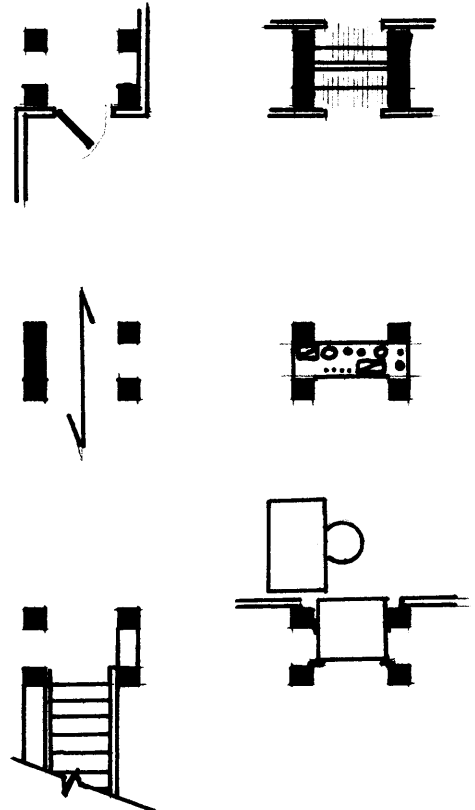
C. Load-bearing capacity of 200lbs./sq. ft. to accommodate the heaviest potential use load, in this case, light industrial. This easily accommodates library stacks, warehouse storage, places of public assembly, schools, laboratories, etc., as well as possible vertical extension of the support in areas of

lighter loading (garages, etc.)

D. An Arrangement of Structural Elements which serves the two-way zone/margin organizational principles, both horizontally and vertically.

1) Column/beam arrangement is the result of both the requirement that the Support provide within it a distribution system for utilities allowing 'plug in' on a regular and flexible basis, and that it reflect the Zone/margin organization, but not dictate spatial configuration. It also is the result of a sense that a column ought to do more than get in the way. The column group consists of 4, 1'square elements which define a space with ~4'X6' outside dimensions. This can contain: vertical utility shaft, entry/exit, stair-landing, window-seat, closet, desk, coffee machine, water

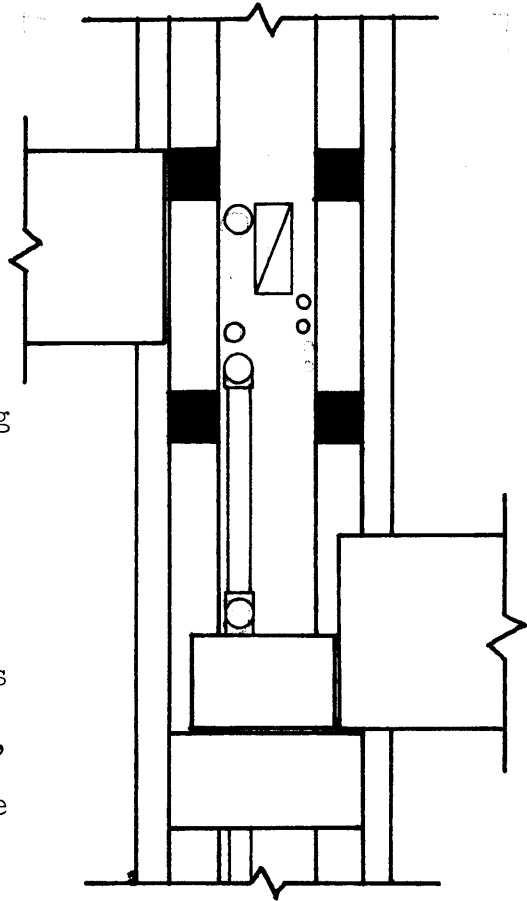
note: structural material begins and ends in a 4" strip of the 4/8 tartan grid.



cooler, phone booth, etc.
 It also carries a pair of beams which: a) provide for between-the-beams horizontal distribution of utilities in a 4' wide service margin occurring every 24' o.c. along the support. This greatly increases the flexibility of the system, by allowing the placement of 'wet' components either at the vertical riser, or anywhere along the service margin. There is sufficient depth (2'8") to allow waste pipes to run the whole length at the required pitch, but codes dealing with venting would have to be revised.

b) allow each bay to function independantly of its neighbor with respect to differential loading and level changes.

2) Floor Slabs are 8" pre-cast flexicore, 4' wide, and 20', 21', 25', and 29' long. Small, lightweight steel deck units,

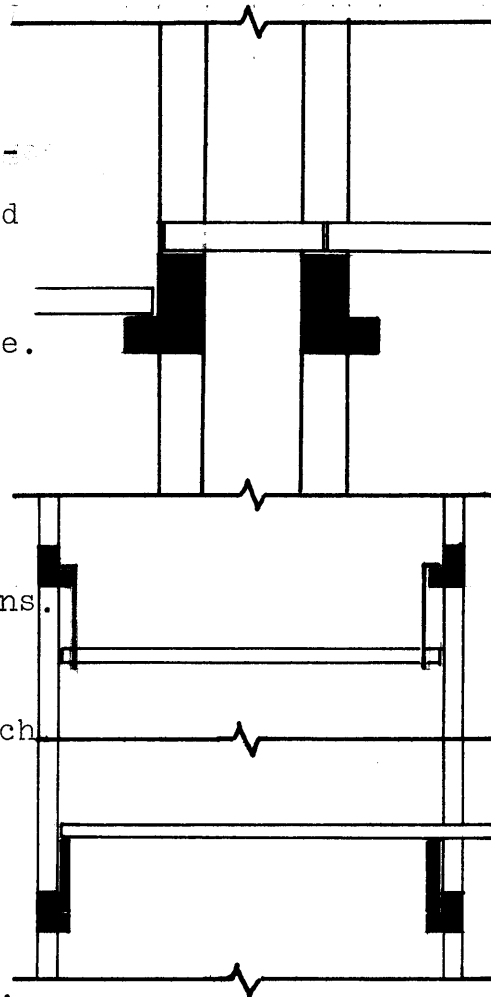


3'x4' and 2'x4', cover the service margins. The long slabs either rest on the flange or pass over the top chord of the beam which is 24" deep overall, with an 8" flange.

* all vertical changes occur on an 8" module. All slabs bearing directly on beams are given welded moment connections. Slabs hung from the flanges of beams above, and slabs which rest on spur-walls (precast) which in turn rest on beam-flanges, are smooth surface, tongue and groove, steel deck.

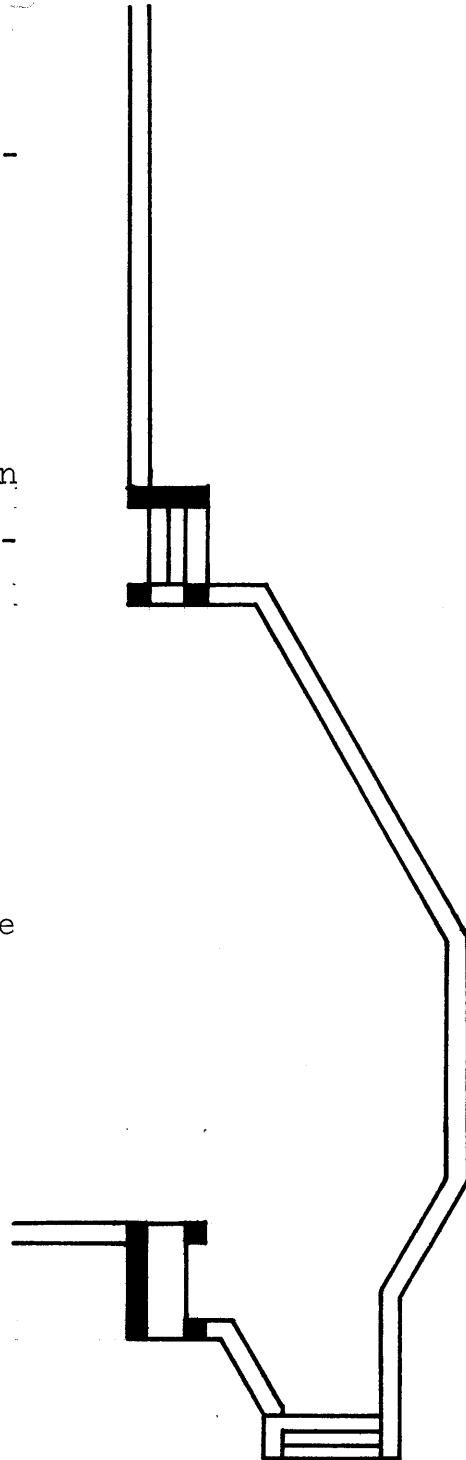
they are given a non-integral topping and are potentially removeable independant of the support structure. They are a form of structural infill, and part of the moderate life span flexibility provision.

3) Horizontal Shear should be taken out of the structure by means of pre-cast or cast-in-place shear walls and panels.



These occur as required in short dimension of the column group to tie the bents together; and across the bays, with care taken that they do not impair flexible unit arrangements. Elevator shafts and public stair-runs can function in this capacity, as can cast-in-place slabs in the public circulation areas. If column and beam bents are cast-in-place, shear resistance would be adequate in the short dimension of the structure due to the doubled moment joints at each end of each bent.

4) Special Definitions can and should be made by the Support in response to local conditions and topography, at grade and within the public spaces. These definitions need not conform to the dimensional agreements unless they directly abut a potential or actual dwelling 'site'.



E. Short and Medium Life Span

Infill Elements for definition

of space/use configurations

within the Support.

1) Medium life-span, structural (see fig. 10, dwng)

al infill: a) party walls,

b) steel deck and hangers(see II,D,2), c)spur walls (see II,

D,2), d) interior stairs for

units with changes in level.

note: all infill of this type occupies an 8" strip on the 4/8 grid and is on an 8" vertical module

All of these elements imply a

certain degree of connection

to the Support, but may be

altered or removed without

impairing the structural

integrity of the Support it-

self. Closure infill could

fall into this category or

into:

2) Industrialized Components

and non-structural infill.

I am far from qualified to

discuss the actual engineering

of these components, except to

say that for the purposes of

this study I assumed them to

be consumer-durable, finished

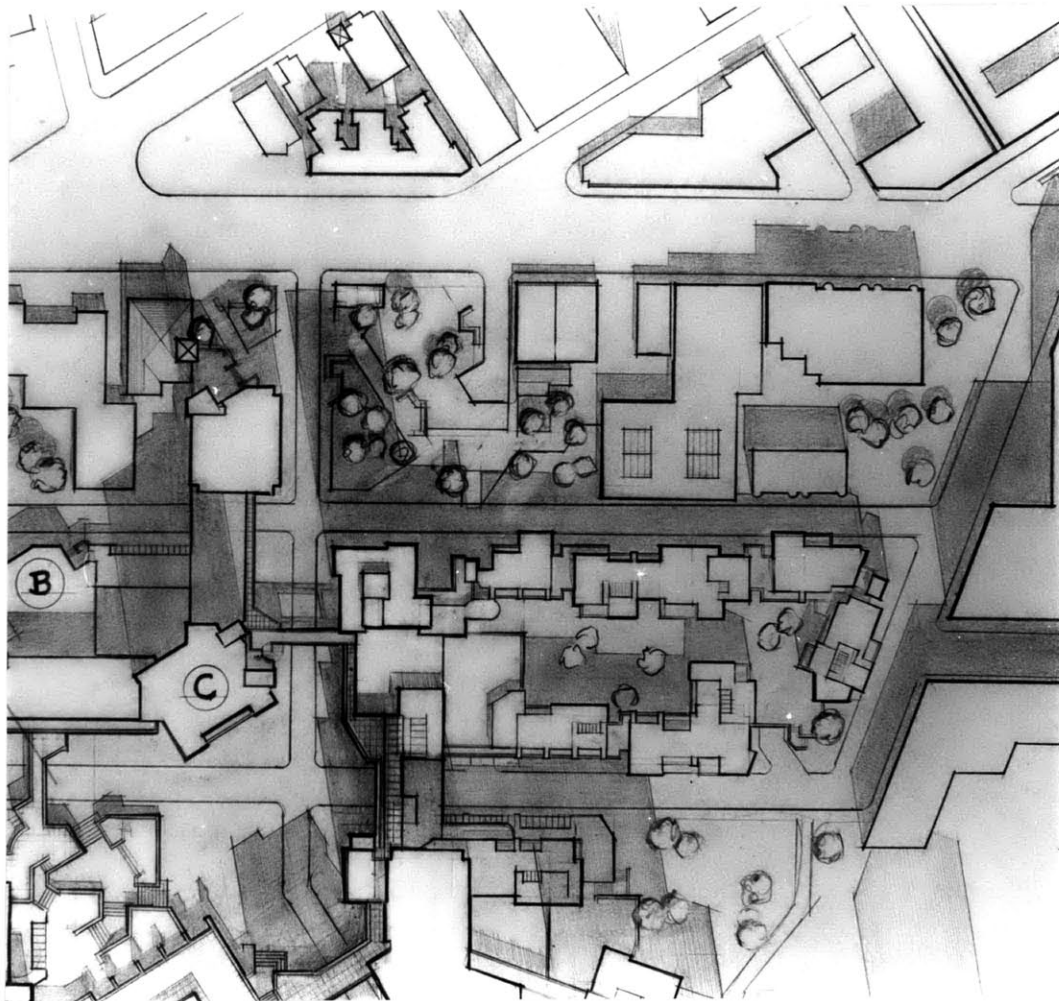
products with both utility and

space-defining characteristics capable of being carried in and out of the occupant's front door. In the case of kitchens and wet cells, they would break down for shipping and delivery and reassemble inside the unit. This would allow a variety of kitchen and bathroom layouts from one 'family' of components. Their horizontal dimensions would conform to the 4"/8" tartan grid, and be $(n \times 12) + 4"$ or $(n \times 12) - 4"$ or $(n \times 12)"$ overall. Their vertical dimensions would always be multiples of 8", with a 7'4" maximum height (extendable to the ceiling by means of fill-strips).

(see fig. 10, dwng)

Industrialized closure infill, could take the form of prefabricated window walls with variable interior and exterior finish, window type, size and placement. It would follow the

rule for structural infill, and occur only in the 8" band of the 4"/8" grid. Conventional, built infill is, of course, also possible.



INCONCLUSIONS

I. Growth

The problem of growth, from neighborhood to town to city to metropolitan area, seems to me to be involved with hierarchies of organization and identity. As one moves from commercial center to residential neighborhood the interface between private and public realms shifts from favoring the former to favoring the latter. For this reason, a Support structure would grow more pervasive as density (and public use) increased, and less coercive as density decreased and private use predominated. Ultimate density could thus be controlled by the Supports, allowing neighborhoods of low density and high individual input to be planned and provided for within a denser, more commercially oriented and public-ally controlled urban matrix. It would be possible to determine the point beyond which the neighborhood would become too big to function as such, and the Support could limit the ultimate size of these areas without compromising the inhabitants' freedom of dwelling or combining within that neighborhood, or the location and number of schools, shops, churches, clinics, etc. included in that neighborhood.

Unlimited growth is now, almost without exception, recognized as undesirable. Unbalanced, unchecked growth is like a cancer. If we do not achieve a working balance in the human and physical ecology of the city - one in which all forces can play continuous and mutually beneficial roles -

the cancer will kill.

II. Change

Change is one of the most basic requirements life makes of individuals, communities, and institutions. Any physical environment which shackles the ability of any of the above to respond to or to effect change, does violence to the society it purports to house. Change, however, occurs for different reasons and at different rates for each - most rapidly for the individual, and most slowly for social institutions and the community as a whole. It would seem reasonable, therefore, to develop a physical matrix that was responsive to this state of affairs. If industrial manufacture, with its attendant research and development organizations, is most responsive to the rapidly changing needs and preferences of the individual consumer, then the building industry is best suited to the community's needs for a durable, one-off physical fabric, capable of organizing and servicing, but not strait-jacketing the uses and users which inhabit it. At urban densities, this would require a three dimensional, built community fabric: complete and incomplete, changeable and changeless, figure and ground.

III. Reciprocity

To what extent should the Supports allow one man's dwelling configuration to require his neighbor's adjustment

to that configuration? To what extent should the Supports demand the adjustment of its inhabitants' dwellings to its peculiarities?

The Support structure cannot and should not be neutral. It grows from and makes a specific, formal response to the geographic, economic, social, and technological conditions at the time and place in which it is built. The configurations of use within the Support cannot help but respond to it. For this reason, the Support structure must not be so specific or particular as to preclude change and recombination of its uses and users as required for the healthy functioning of the community.

To this end, it seems reasonable to propose the addition of a third flexibility factor, between the short range industrial components and the long range Supports: built infill. Just as we can build, demolish and rebuild on the ground, it should be possible to build, demolish and rebuild within the Supports (but structurally independent of them), level changes, party walls, closure infill of a special nature, fire walls, and definitions of moderately long life span in general. It seems to me that reciprocal definition occurs most naturally between these elements of built infill and the Support structure, and then again between the built infill and the components. This mediating type of definition is, I believe, essential to flexible functioning of the system. Some built mediation is required in order to fit the components to the Support, so

it would seem reasonable to make more of it than that, and develop a threshold realm of reciprocal definitions between the realms of individuals and between the individual and the public structure, or Support.

IV. Continuity: visual, spatial, developmental.

The visual continuity of the Support structure should give the inhabitant (or visitor) his reference bearings in the environment with respect to both location and public vs. private 'territory'.

Spatial continuities, both horizontal and vertical, are essential to flexibility of uses and to the freedom of combination and recombination which is vital to the accommodation of community life cycles. The Support should accommodate uses whose spatial requirements extend beyond the proportional/dimensional definition of the structural bay by reason of growth or minimum functional dimensions. It should be possible for the residential occupant to acquire the property next door (up, down, or sideways) for needed expansion, just as it must be possible for the commercial and institutional users to do the same.

Developmental continuities imply room to grow, and clear directions to grow in, both for the Support structure and for the infill elements. Parts of the Support should be left unbuilt and parts un-infilled, and this implies that the Support be both incomplete and complete enough to sustain both: a delicate imbalance. The preplanning of such

a matrix would involve the resolution of inclusive complexities in an organized indeterminacy.

One of the chief arguments against the Habraken un-system is that it advocates 'settled down', old-time provincialism in the face of a technology which provides greater and greater mobility and, through transportation and media, a 'global village'. The counter argument is that this increased immediacy and accessibility of all the problems and conditions of the world results in a kind of defensive alienation in which the individual, painfully aware of his personal inefficacy in the face of globally proportioned situations, retreats into apathy and cynicism which only his identification with and control over his own territory in the form of home and community (immediate) can alleviate. It seems to me that some form of direct control over whatever part of the environment he was inhabiting at any point in time, and a secure sense of that environment's continuity, would offer the individual a chance to affect positively at least a small part of the global environment, and thereby reinforce his involvement in and responsibility for that environment.

FOOTNOTES

1. Edgar F. Kaiser, Chairman, A Decent Home, Report of the President's Committee on Urban Housing, Washington, D.C., 1968. p.53-92.
2. Ibid.
3. William Grigsby, Housing Markets and Public Policy, (Philadelphia: University of Pennsylvania Press, 1963)ch.7.
4. Kaiser.
5. Grigsby, p
6. Grigsby, p.251.
7. Grigsby, p.
8. Nikolas J. Habraken, The Supports and the People, (Amsterdam: Scheltema & Holkema ltd.,1961), p.2.
9. Ibid., p.3.
- 10.Ibid., p.6.
- 11.Ibid., p.8.
- 12.Ibid., p.8.
- 13.Habraken, The Three R's of Housing, (Amsterdam: Scheltema & Holkema, 1970), p.5.
or: " Forum", vol.xx, no.1, Dec.'66.
- 14.Habraken, The Supports and the People, p.13.
- 15.Ibid.,p.15.
- 16.Ibid.,p.16.
- 17.Ibid.,pp.17-18.
- 18.Ibid.,p.19.
- 19.Ibid.,p.20.

20. Ibid., p.22.
21. Ibid., p.23.
22. Ibid., p.24.
23. Ibid., pp.27-28.
24. Habraken, Three R's of Housing, p.19.
25. Ibid., p.4.
26. Ibid., p.29.
27. Habraken, "the Pursuit of an Idea", Plan, III, 1970, p.207.
28. Ibid., p.208.
29. Ibid., p.186.
30. Ibid.
31. Ibid., p.192.
32. Habraken, The Three R's of Housing, p.36-37.

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B. ARCH. THESIS 1971

KEY



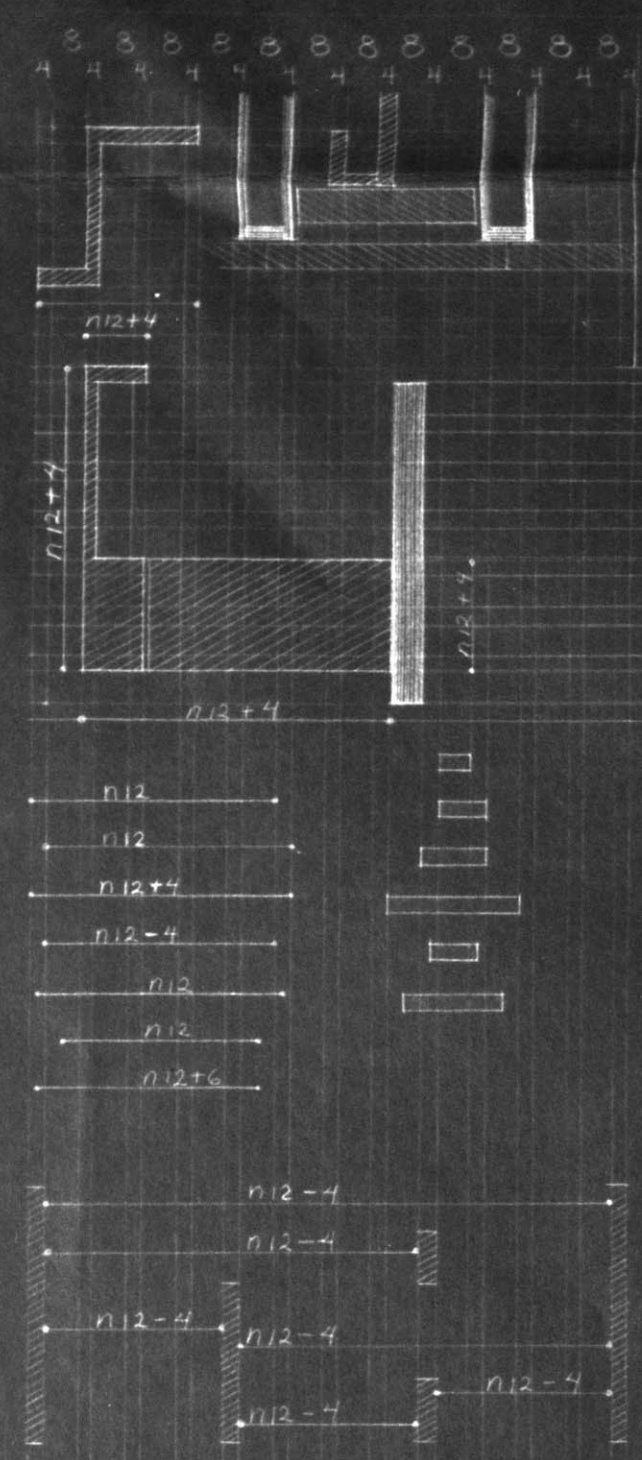
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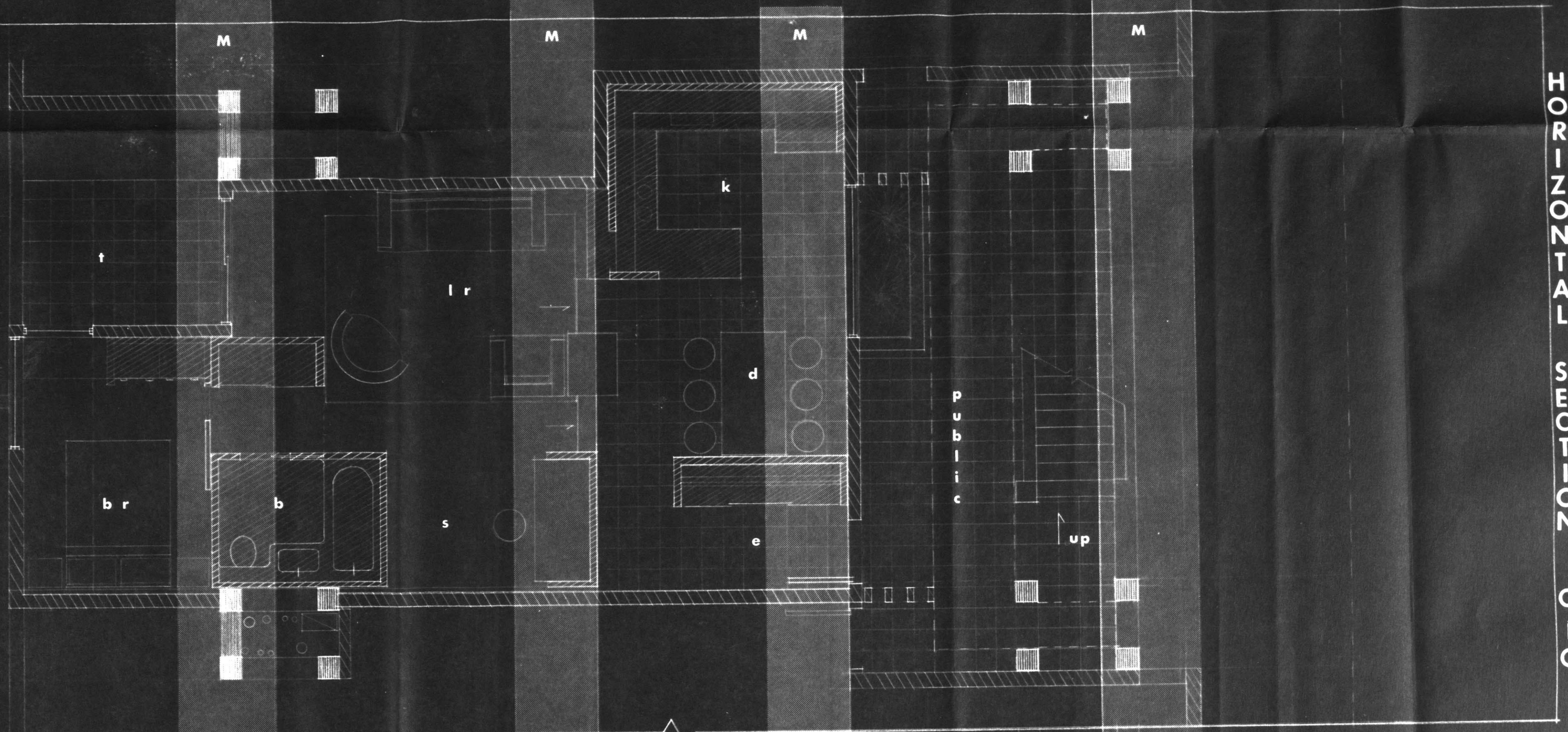
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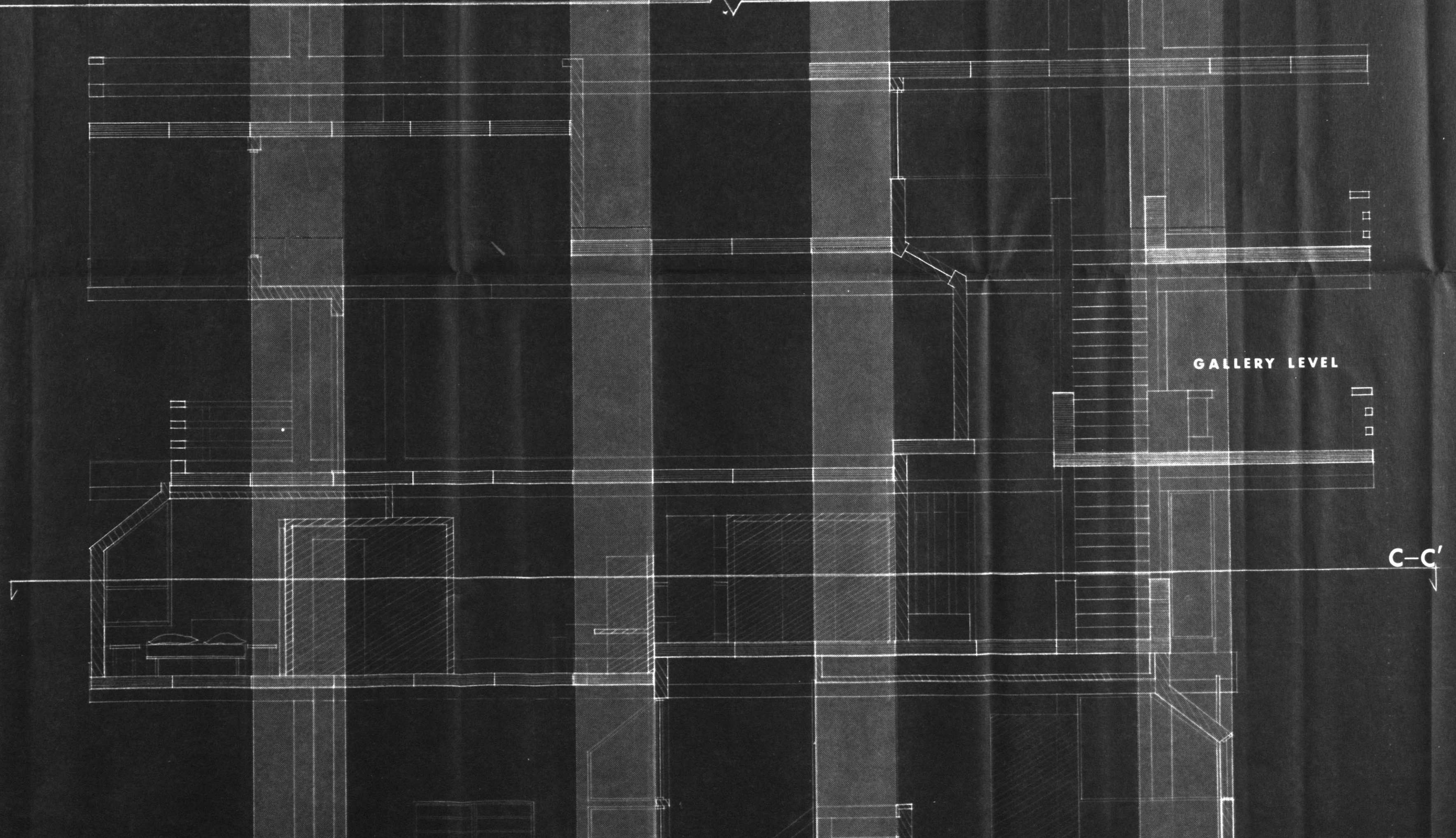


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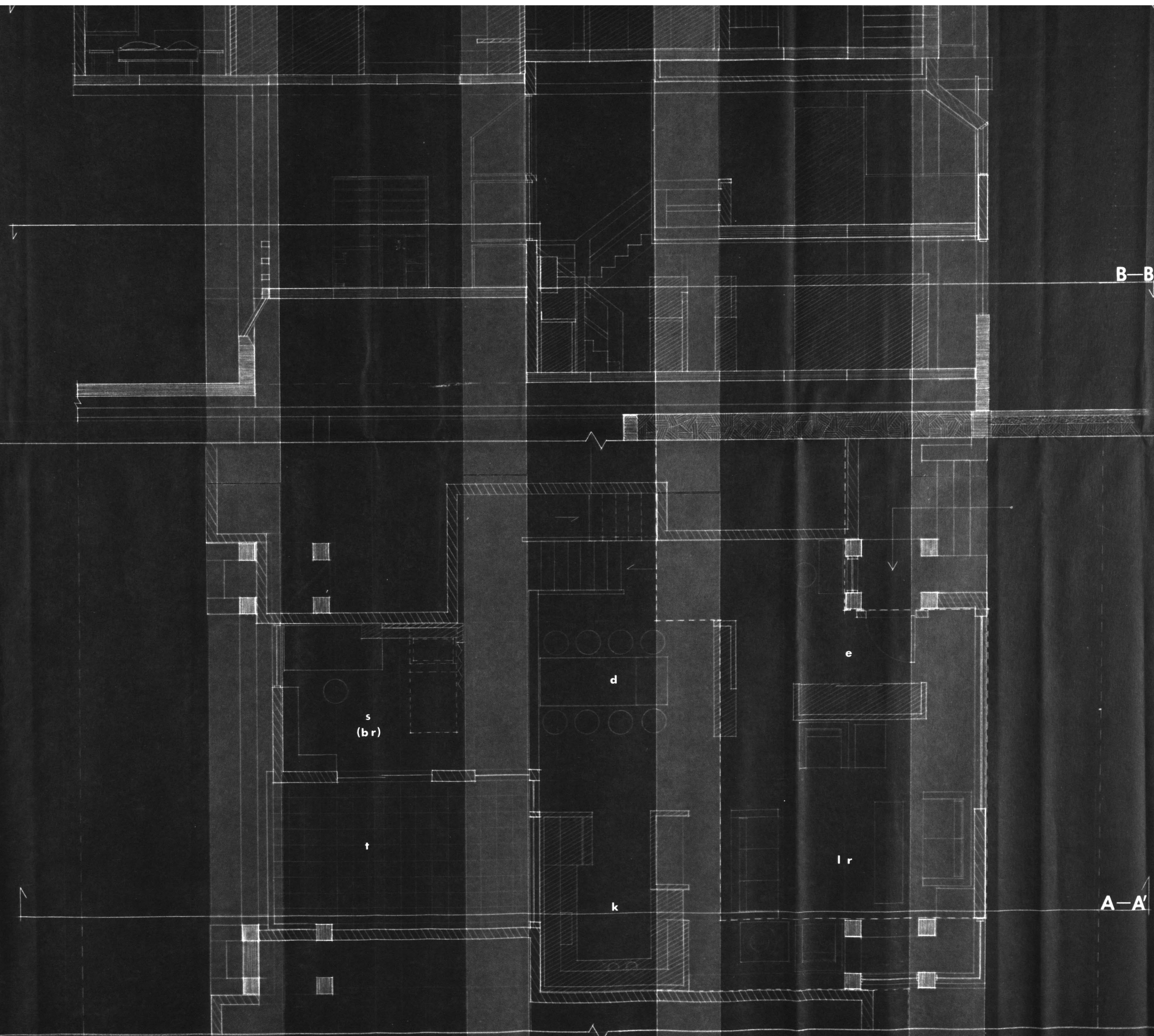


HORIZONTAL SECTION C-C'

VERTICAL SECTION A-A'



SECTION
A-A'



B-B'

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