Higher Occupancy ***Humanism***:
The Trade-Offs for Encouraging Middle Income Housing in a Global City

By
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Abstract

In high density urban areas where the land acquisition and construction cost components are significant relative to total development costs, the market typically supplies a high-income housing product in order to justify the risks for new construction.

In places such as New York, Tokyo, London and other land supply restricted cities, the effect of these rising costs has forced the unsubsidized middle-class to migrate further and further from the center of the city where most of the infrastructural area amenities and jobs are located. This causes extended commuting times that result in the exacerbation of pollution and wasted allocation of resources. In effect, the overall function of the city grows more inefficient.

All the while, the demographic texture of the central city becomes a polarized gathering of the wealthy elite and the service oriented subsidized poor. The lack of income diversity results in a spatial built form that also mimics this polarized condition. In these circumstances, might there be a strategy for encouraging a housing prototype that specifically targets the broad middle class market in order for cities to maintain diverse communities, a tapestry of spatial form, and a more efficient competitive city.

The hypothesis is that if housing occupancy levels can be doubled from what is currently allowed within spaces that are tighter than typical American standards, then middle-income affordability can be achieved without diminishing design quality.

This thesis investigates what flexible spatial possibilities there may be for middle-income housing based on a series of design priorities that are underpinned with an approach that advocates for a more intense occupancy use per unit of housing. Due to the augmented use intensity, flexibly designed elements are built within the spatial form of each unit. Each design variation is subsequently tested against a private sector based feedback mechanism that measures the affordability range that the design can offer. This iterative tool reveals what income groups can be supplied due to the design changes put forth by the varying design priorities.

It is the hope that this tool will enable architects, developers, and the capital markets to understand the trade-offs made from both a spatial form perspective as well as a market perspective in order to ultimately enhance the condition of the built environment.

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Finally, to my parents and close friends for inspiring me during this process and for keeping my heart and soul with a perpetually optimistic outlook.

Table of Contents:

Chapter 1: The Dilemma and the Impacts of Unaffordable Housing

New York City has been in a self-proclaimed state of emergency in regards to its housing situation since the end of World War II. Although the remainder of the nation responded to postwar housing shortages with a construction boom that left all but low-income households appropriately sheltered; in New York City developers have not even been able to produce an ample supply of housing for its middle class.

One of the primary problems that have plagued New York for much of the past decade has been its relatively low rate of new housing production[1]. Much of this problem is attributed to the relatively high cost of new housing construction and the high cost of land acquisition.

The major problems facing residents in the city concerns affordability rather than physical conditions to the existing housing stock[2]. The average quality of housing is probably the best it has ever been, however the problems of affordability have worsened in the past decade. The perception that most New Yorker residents pay too much for too little space is in fact validated through the most recent data collected in the Housing and Vacancy Survey of 1999. According to the survey 487,957 households or 27.1% of all renters, pay more than 50% of their income for rent[3]. Although the bulk of the households bearing such extreme housing burdens have very low incomes (below 50% of the Area Median Income) where targeted subsidies may address this issue, it is important to note that affordability problems plague the middle income class as well.

In 1996, one out of every five middle income tenants earning between 80 to 200 percent of the Area Median Income paid over 30% of their household income in rent[4]. Among middle income owners, the proportion paying over 40% of income towards housing was almost identical[5].

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[1] J. Salama, M. Schill, and M. Stark, *Reducing the Cost of New Housing Construction in New York City,* New York City Housing Preservation and Development, pp.ix

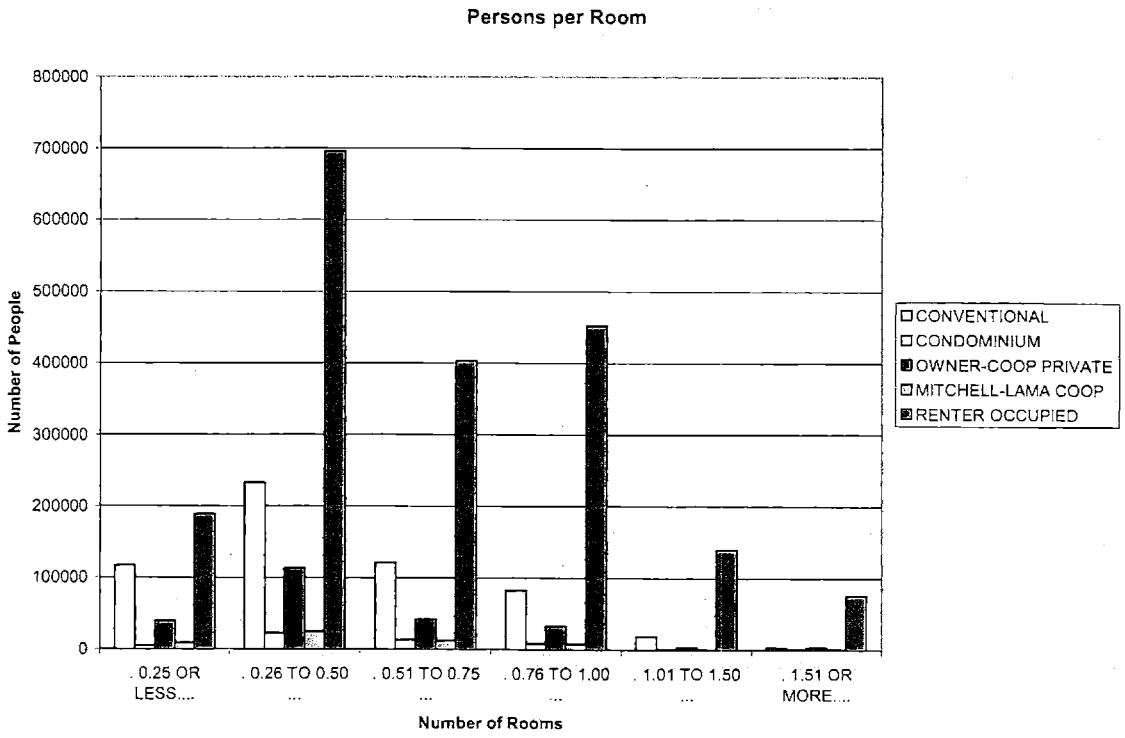
[2] IBID, pp.xi

[3] US. Bureau of the Census, 1999 Housing and Vacancy Survey

[4] Selecting income breaks for the middle class is arbitrary. This definition of middle income is the same as used by the City Council in its 1998 report, *Hollow in the Middle: The Rise and Fall of New York City's Middle Class.*

[5] IBID, pp. 4

Overcrowding has also been a serious issue. From 1996 to 1999, the number of crowded families increased to 75,515 (10.3% to 11.0%), and the number of severely crowded increased to 215,000 (3.5% to 3.9%)[6].



[1] *Housing Occupants per room across all New York City housing types*

From the chart above, we observe that more than two-thirds of New York's population lives in renter occupied units. That is to say that it is not a lack of demand for owner-occupied housing but more likely a shortage of home-ownership opportunities due to the higher hurdles to build additional ownership housing. Moreover, the bulk of occupancy levels range in the .26 to 1.00 persons per room for both owner-occupied and renter-occupied conditions.

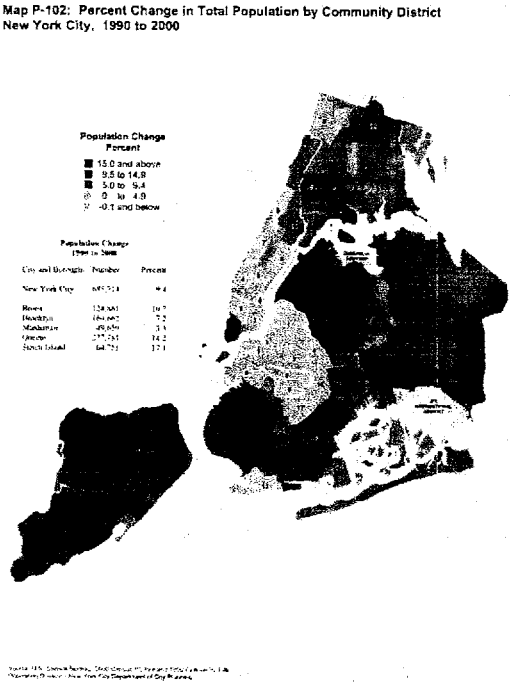
Although the U.S. today suffers from affordability issues in the housing market, New York's problems are extreme because it is not a smoothly functioning market. This is due to the various rent stabilized or rent control apartment units in the New York City region. When the shortage of new supply is

[6] Overcrowded is defined as more than 1 person per room. Severely overcrowded are more than 1.5 persons per room. For the New York City Housing & Vacancy Survey (NYCHVS), both bathrooms & closets were not counted as a room. For example, a family of 4 people in an apartment with a **living room, kitchen/dining area, a bedroom**, a bathroom, and a closet is considered a 3-room/1-bedroom dwelling unit with 1.33 persons per room.

added into the mix of this condition, it is not surprising that more and more New York households are crowding into spaces smaller and smaller each successive year.

Given that the population of New York grew 9.4% in the last decade, (7,322,564 in 1990 to 8,008,278 in 2000), even though there has been an increased inventory of housing stock by 44,000 dwelling units (2,995,000 in 1996 to 3,039,000 in 1999), it is not surprising that vacancy rates were at an all time low of 3.19% in 1999(decrease from 4.01% in 1996).

The fact that housing consumes such a large proportion of family incomes implies that these households have fewer resources remaining for life's other necessities. Recent research suggests that high housing cost burdens may also have an important effect on the health of urban households[7]. High housing costs also force households to live in areas that negatively affect their social mobility. Higher housing costs can contribute to the spatial concentration of poverty[8].



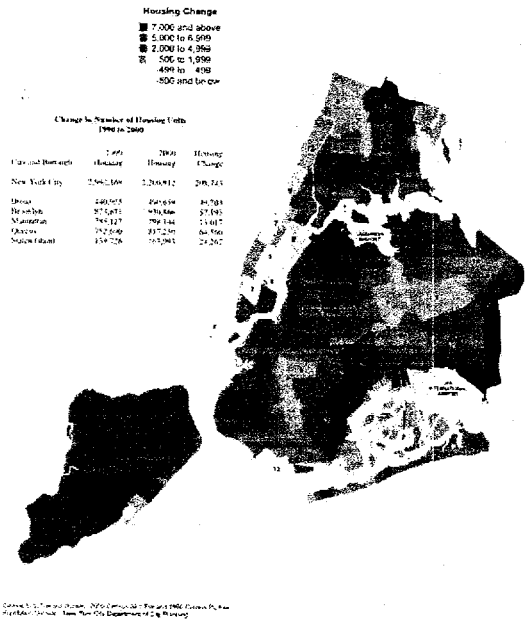
[ii] Population Change across 5 boroughs

[7] J. Salama, M. Schill, and M. Stark, *Reducing the Cost of New Housing Construction in New York City,* New York City Housing Preservation and Development, pp.6

[8] William J. Wilson, *The Truly Disadvantaged: The Inner City, The Underclass, and Public Policy,* vol. 8, no. 4 (1998)

According to Census data that observes demographic migration throughout the 5 boroughs, we see that the majority of the outer boroughs saw the greatest increase in population change over the past decade. Although the city as a whole increased 9.4%, in contrast Manhattan only had a 3.3% increase. This outward shift of population corresponds with the available supply of new housing constructed over the past decade. This migration pattern also indicates the stratification of the city across income groups.

Map H-101: Change in Number of Housing Units by Community District
New York City, 1990 to 2000



[iii] *Change in number of housing units across five boroughs*

When looking at the change in the number of housing units in the past ten years, the 5 boroughs had a cumulative increase of 7%. The outer boroughs matched or were above the average increase change, but in contrast Manhattan had a mere increase of 1.7% in new housing supply.

It is safe to say that although there is a dire demand for housing in central city locations, the burdens and hurdles of constructing new residential developments in Manhattan at a cost effective method has yet to be achieved. Without various methods of substantial public subsidy, there is little hope for the private sector to supply new housing to match the demand.

The impacts of a middle class migrating further from the central city are arguably far from a beneficial urban condition. In fact, a case can be made that this threatens the economic viability of the city. Middle income households frequently adapt to the high cost of housing by moving to the suburbs. In many instances they experience significantly longer commutes to their jobs. In addition to wasted time, these longer commutes consume valuable energy and generate pollution. High housing prices are also correlated with increased wages for employees in cities; households who live within the city need to be compensated for the relatively higher cost of housing, while those who commute will require additional pay for the cost of commuting[9]. As a reaction to this, many firms have moved their operations away from New York City in order to economize on their payroll.

The implications and impacts of an inadequate supply of housing are serious. They are real and will impact the future of the shape of the city significantly. The big question is how will this future of a global city be shaped? Will the city maintain a healthy balance of moderate and middle-income communities? Will there be a method introduced so that the private markets can be induced by the public sector to provide access to housing for the creative class, the service class, and the intellectual talent that a city such as New York thrives upon. These are the questions that this thesis wishes to address.

[9] William C. Wheaton, *Urban Economics and Public Policy,*

Chapter 2: The Cost of Residential Construction in New York City

One of the reasons why the supply of housing has lagged behind demand in New York City is the high cost of construction[10]. In many parts of the city, housing developers are unable to build market rate housing units without some form of subsidy. The reason for this is that the market rents or sales prices in those parts of the city are not high enough to justify the amount it would cost to construct and maintain the housing[11]. According to one local developer, in order to build a **1,000 square foot unit** with a total development cost of $135 per square foot, what is considered a very low cost two-bedroom rental apartment in New York City, would still require a minimum rent of $2,100 per month[12]. Even in this favorable interest rate environment, the cost of capital and operating expenses push the rental boundary to unreasonable rates. What is more unreasonable is that only those households earning over $83,000 per year would be able to afford this unit, assuming a 30% rent to income ratio[13].

Construction cost data collected by R.S. Means Co., a firm that publishes standard reference volumes on hard construction costs, suggests that New York City is the highest in the nation even after excluding land acquisition costs. On average, the cost of new low-rise and high-rise construction in 21 comparative cities, costs on average 25% less than New York does[14]. The second most expensive city to build is San Francisco. However San Francisco is still 7 percent lower than New York on a cost per square foot basis.

One of the major components to the cost of new construction is labor[15]. Consistent with the R.S. Means hard construction data, pay scales for hourly unionized pay is highest in New York City as well. The differentials on a percentage basis between the cities with respect to wage rates for each trade follows a similar differential pattern reflected in the R.S. Means chart.

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[10] J. Salama, M. Schill, and M. Stark, *Reducing the Cost of New Housing Construction in New York City,* New York City Housing Preservation and Development, pp.15
[11] IBID, pp. 15
[12] IBID, pp.15
[13] IBID, pp.15
[14] IBID, pp.16
[15] IBID, pp. 18

Median Cost per Square Foot for New York City and 21 Cities				
Location	RS Means Median Cost/Sq. Ft. 1 to 3 story	% below NYC	RS Means Median Cost/Sq. Ft. High-Rise	% below NYC
New York City	$69.50		$101.00	
Bronx	$66.00		$95.50	
Brooklyn	$66.50		$96.00	
Manhattan	$69.50		$101.00	
Queens	$66.50		$96.00	
Staten Island	$66.50		$96.50	
Atlanta	$46.00	34%	$66.50	34%
Baltimore	$47.50	32%	$69.00	32%
Boston	$60.50	13%	$87.50	13%
Chicago	$57.00	18%	$83.00	18%
Cincinnati	$48.00	31%	$69.50	31%
Cleveland	$52.00	25%	$75.50	25%
Dallas	$44.50	36%	$65.00	36%
Denver	$48.50	30%	$70.00	31%
Detroit	$54.50	22%	$79.00	22%
Houston	$46.50	33%	$67.00	34%
Jersey City	$57.50	17%	$83.50	17%
Los Angelos	$57.50	17%	$83.50	17%
Miami	$45.00	35%	$65.50	35%
Philadelphia	$57.00	18%	$82.50	18%
Phoenix	$46.50	33%	$67.00	34%
Pittsburgh	$53.50	23%	$77.50	23%
Portland	$55.00	21%	$80.00	21%
San Diego	$55.50	20%	$80.00	21%
San Francisco	$64.50	7%	$93.00	8%
Seattle	$54.50	22%	$79.00	22%
Washington	$49.50	29%	$71.50	29%
Average	$53.20	25%	$77.09	25%

[iv] RS Means 1998 Data

When including soft costs and land acquisition prices into the equation, the differential between New York and the other cities substantially widen. Given the relatively inelastic supply of vacant and unencumbered land in New York City, many of the potential cost savings aspects that are proposed could be capitalized in the value of land. Residual land value creation is the key and ultimate component within the total development cost equation (Total Development Costs = land acquisition + hard construction + soft costs) to which this proposal hopes to accommodate.

If residual land value can be created (residual land value = + Net Present Value), then there is the possibility for such a project to move forward. Given

that New York City's private land costs among the highest in the nation, in order to extract positive NPVs for most any site in city requires densities or specifically Floor Area Ratios (FAR) that are very high. However, given the zoning restrictions on building height limits and FARs, this undermines the supply of new housing because residual land value can not be created within the given density constraints.

It is the view of this thesis that residual value can be created within a given FAR, if the volumetric space is parsed out into smaller units. Pieces of a chicken cost more than a whole chicken intact. Hence this allows for greater generation of cash flow when there are more units within a finite fixed variable for FAR. In the case of this thesis, the FAR has been held as a constraint (FAR=6) in order to maintain:

a) reasonable building volume relative to site context
b) test to see whether higher occupancy within given volume is enables affordability
c) allows the possibility for positive NPV project

However, this project should pursue publicly owned vacant lots in order to bid for land acquisitions that may be inspired to take upon a project that is positively beneficial for the overall health and welfare of the city. When the FAR is fixed and the income group is limited, even though the project may be positive NPV, but it is not a substantially positive amount. Therefore, it is unlikely that this type of housing would be able to outbid alternative uses on a given site under a purely private auction. More importantly though is the fact that, since there is a profit being made (however small) then the need to lean on scarce public resources becomes less of an issue. In essence, the private markets can potentially be induced to build this type of housing if there is some form of residual land value created.

Therefore, a case can be made to the city for advocating a housing prototype that would not outbid a housing development under a purely private auction for land, but if a given lot were to be sold at the ***city's residual land value***, given the circumstances of beneficial objectives, then there is enough of a public/private incentive to move forward on such a proposal.

In order to do this, and in order to maintain low hard construction costs, this **housing proposal looks towards prefabricated modular systems as a means for achieving a lower cost per square foot construction method as well as a maintaining a higher quality of housing.** Furthermore, with an automated housing production system the cost of labor can also be diminished and streamlined, such that the benefits and economies of scale to pre-fabricated housing can add to the quality of design and maintenance of value.

Unlike historical examples of pre-fabricated housing systems relied upon after World War II, that have the indelible quality of austerity and chilly callousness, **it is the hope of this thesis to offer a housing design that is humane and flexible for the occupants that inhabit the space.** If the quality of space is not of a decent standard, then all of the aforementioned public benefits and private profit issues will be irrelevant because no one will demand poorly designed and poor quality middle income housing. If poor quality middle income housing is proposed, then middle income households will continue to opt for the alternative to live in the suburban communities from the central city. Thus, this constrained optimization problem of middle income housing would essentially not be optimal. Therefore, design quality is an essential component that must be in equilibrium with the cost vs. quality balancing trade-off.

One of the immediate trade-offs as will be elaborated in chapter 6, is this cost vs. quality balance. In order for housing to be built within the capacity of the middle income group[16], where there is a limit to what households can afford (in terms of debt service payments toward a mortgage), **the typical middle-income household can consume approximately one-third the space than the current existing standard of a typical American unit**[17]. This is because of the cost constraints held to maintain a feasible method to achieve this type of affordable housing.

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[16] Income break of middle income group is defined by author as 60-200% of Area Median Income. Definition of middle income group is subjective; however it is typically defined as 80-200% of AMI in New York City. The lower bound of 60% was used to see whether or not this lowest threshold could be achieved. 60% of AMI is typically defined as low-income in New York City.

[17] This calculation will be explained further.

Although the space within a unit is smaller than the standard American apartment (approximately 1000SF for 2 people, 1 bedroom unit), this does not mean that the quality of space has to be mitigated. In fact, due to the disciplined attitude toward reducing household housing consumption, it has allowed the household to enhance the quality of design elements within their unit. This intelligent allocation of resources is essentially allowing a middle-income household to be able to live within their constrained means, building equity over time, but at a higher marginal quality of life on a daily basis. Essentially this means that a family at 80% of the Area Median Income is getting to live within a space that is designed for a family that can afford an 80% AMI standard of space.

This is a better solution than a subsidized apartment where a household lives in a unit that would not be affordable to them under standard market circumstances. For example, why does it make sense for a family at 80% of AMI to consume housing that requires 220% of AMI just to maintain the unit? Although a subsidy allows the household to afford a higher form of housing than under normal circumstances, this subsidized household can not afford to enhance their living environment at a consistent standard. As a result, equity building becomes a struggle (or more precisely impossible) and this household struggles to keep up appearances with its neighbors.

Clearly there are social benefits to subsidies and it is not the view of this author to undermine various low-income subsidy programs. The hope is to clarify the fact that if there is a true motivation to enhance the quality of life for such demographic households, then a disciplined approach to wealth generation should be considered. Moreover, most subsidy programs have a limited life. Therefore, what initially appears to be a beneficial outcome for those households with less choice is in fact not entirely true because these subsidies are not in perpetuity.

New York City's Mitchell-Lama program for cooperative middle-income housing is an example of this case. The cooperative structure has a limited term and is due to expire within the next five years. As a result, the potential

displacement of hundreds of households in the near future of New York City is a real impact to consider.

This is the fundamental difference for why a disciplined approach to housing consumption in a form of perpetual ownership is important aspect to this thesis. **In return for the reduced consumption of residential space, households will have access to the immediate area amenities and conveniences for living closer to their workplaces. This trade-off will work if and only if, the design is humane.**

Chapter 3: Historical Methods for Increasing the Housing Supply

Public intervention into the private housing market in America is a patchwork of local, state, and federal programs[18]. At the federal level, public intervention dates back to the Great Depression, when banks were foreclosing on defaulted mortgages at an alarming rate. Each of the various public programs that make attempts to influence the private markets concentrates on the following five objectives:

1. Increase housing supply
2. Reduce housing cost
3. Improve housing quality
4. Eliminate slums
5. Revitalize neighborhoods

In 1933 Congress began the process of creating a stable supply of mortgage money by enacting legislation that insured bank deposits, thereby giving depositors the confidence they needed to keep their money in the bank. It went on to assure home buyers and builders that they could obtain this money from lending institutions by insuring mortgages that met standard lending practices[19]. It also created a secondary market for federally insured mortgages, allowing financial institutions that needed cash to sell standard mortgages to those with enough surplus cash to buy them. In addition to making sure that the financing would be available, Congress greatly expanded the market for additional housing by reducing the size of the down payment on a house with a federally insured mortgage. By extending the term of the mortgage, it also reduced the monthly debt-service payments on that mortgage. As a result, millions of households could afford to own a house[20].

The reform in lending practices initially applied to one- to four-family houses, not to multi-family apartment buildings. **Consequently, this extraordinary increase in the housing supply occurred largely outside dense urban areas[21].** By

[18] Garvin, Alexander, *The American City: What Works What Doesn't,* Kingport Press, pp.196
[19] IBID, pp.196
[20] IBID, pp.196
[21] IBID, pp.196

1960, single-family houses represented 77 percent of the nation's housing stock[22]. Had a similar approach been adopted for financing multi-family housing, millions of apartments would have been created and the shortage of housing in central city conditions would not have become so serious[23].

The creation of a stably supply of mortgage money market began with laws that were intended to increase depositor confidence in financial institutions. The Federal Home Loan Bank Act of 1932, the Homer Owners Loan Act of 1933, the Glass-Steagall Banking Act of 1933, and the Banking Act of 1934, all helped financial institutions to attract deposits. Without these actions, depositors would have withdrawn all of their money, leaving most financial institutions without sufficient capital. Instead, depositors maintained savings accounts that provided the money used to refinance home mortgages when they came due[24]. Now that the financial institutions had the capital supply, they needed to be coaxed into investing a major portion of this money into housing. Congress provided the necessary inducement by enacting the National Housing Act of 1934, which created the Federal Housing Administration (FHA). Section 203 of this act created a mortgage insurance system that, for a small premium charge, provided participating lenders with insurance on 90 percent of the appraised value of one- to four-family houses. When a bank foreclosed on a mortgage, it could transfer the mortgage to the FHA and in exchange obtain most of the money it had lent[25]. By insuring such a large portion of the downside risks associated with the loan, Congress made the act of investing in single-family homes safe.

The most important effect of this legislation was that it converted the desire of homeownership into a consumer demand[26]. In effect, by reducing the down payment on a home mortgage to 10% of the overall value, the government dramatically increased the number of people who could afford to make such an initial payment. In addition, by extending the amortization period

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[22] U.S. Department of Commerce, Bureau of the Census, *Statistical Abstract of the United States*, Washington, D.C., 1978, pp. 789-792
[23] Garvin, Alexander, *The American City: What Works What Doesn't*, Kingport Press, pp.196
[24] IBID, pp.196
[25] IBID, pp.196
[26] IBID, pp.197

of the loan over 35 years, the fixed monthly payment toward the house was also dramatically decreased, thereby increasing the number of people who could afford such a structure on home mortgages.

Construction lenders could depend on the eventual sale of a house that met FHA specifications because the purchaser could depend on an FHA mortgage. Consequently, commercial banks decreased the amount of developer equity required for construction financing, thereby dramatically increasing the number of entrepreneurs who had the equity capital with which to enter the home-building industry. No housing program has been more successful in increasing housing supply[27]. Between 1934 and 1991, the FHA insured mortgages on more than 19.7 million single-family houses[28].

In 1948, hoping to stimulate apartment-house construction, Congress revived the little-used FHA 608 Program, which had originally been enacted during the war. The 608 Program provided 90 percent insurance on the estimated cost of development. Land values were established on the basis of an appraisal of current market value. Developers who had purchased land some years earlier at a substantially lower figure were able to withdraw in cash the difference between the required equity investment and the appraised value of the property at the mortgage closing. Had this not been the case, they would have sold their land at a profit and never contemplated the risks of apartment house construction[29]. This program, during its six years of existence, financed 464,000 new multi-family dwelling units.

Cash advanced during construction was based on FHA appraisers who estimated cost of the work. Consequently, builders who were able to build below the prevailing area costs, and below the estimates of an FHA appraiser, were able to make a profit during construction. This whole practice led to an intricate web of collusion and fraud among loan officers, appraisers, contractors, and developers. The fraud was committed by overestimating the total project

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[27] IBID, pp.197

[28] According to the US Department of Housing and Urban Development, Information Systems Division, between 1934 and 1990, 19,687,309 one-family home mortgages had received FHA insurance. Of these, 15,587,556 were insured under the FHA 203 program.

[29] Garvin, Alexander, *The American City: What Works What Doesn't,* Kingport Press, pp.199

costs. Rather than blaming the crooks who had profited from the scams, public officials questioned the validity of the whole program and in 1954, allowed the program to fade away[30].

As a replacement, Congress revitalized the 207 Program. The 207 Program was initially an FHA insured program, specifically geared for unsubsidized multi-family housing for one-to-four family houses. Similar to the 203 Program, it provided insurance on 90 percent of value. The existing multiple dwelling units were not eligible for this program, only new construction. Thus unlike the owner of a single-family house with an FHA insured mortgage, the owner of an apartment building with an FHA-insured mortgage could not depend on finding a buyer who could obtain similar financing.

When the program was revitalized, cost certification and rents were regulated. Far fewer developers were willing to deal with the additional requirements, paperwork, and permitting time. The new procedures increased the opportunities for discretionary action by government officials, a few of whom were willing to act only when helped along with an extra "fee" to cover their troubles[31]. So even though corruption was not eliminated, mass generation of FHA-insured market-rate mortgages for multi-family housing was.

The beauty of the New Deal and banking legislation during the 1930s, allowed market forces to supply housing at sub-urban or rural locations that were easily accessible and inherently attractive. However, those market forces were precluded from operating in the central sections of our cities, with their preponderance of older apartment buildings[32]. The bias against cities was not only a matter of inadequate FHA programs for existing and new multi-family housing, it was also the product of prevailing underwriting practices.

The FHA-insured mortgages could not exceed 90 percent of "appraised value". If this value was assessed too low, then the mortgage issued would not suffice for the funds necessary to finance the development. While the FHA had standardized the elements of required bank appraisals, the amount of the loan

[30] IBID, pp.199
[31] IBID, pp.199
[32] IBID, pp.201

depended on the judgment of those approving it. That judgment involved an estimate of the property, the borrower, and the neighborhood[33].

Interestingly, borrowers may be found deficient not solely based on net worth, project based net income, or credit history. The FHA Underwriting Manual specifically stated that "if a neighborhood is to retain stability, it is necessary that properties shall continue to be occupied by the same social and racial classes," and recommended "suitable restrictive covenants"[34]. The Underwriting Manual also specified neighborhood criteria, that downgraded "older properties, crowded neighborhoods, and lower-class occupancy" common in urban areas[35]. It is saddening to realize that the FHA used its underwriting practices to discriminate against cities and major urban centers, while enhancing the efforts toward the financing of suburbanization.

This systematic urban policy that has induced sprawl and generous consumptions of housing might need to be reconsidered. If the priority, on a macro—level, is to diminish wasting resources and stop urban sprawl, then this nation should reconsider its methods to the amount of housing consumed by an average household. This issue is particularly important under specific conditions where a city has grown to the point where commuting times have gotten so long, where people prefer to move out of the city just because the city's boundaries have grown too far for households to feasibly live within reason. In a city such as New York, there are middle class households that commute two and a half hours just to get to work. After a given period of time, this standard of living will grow undesirable to the point where this household may choose to live and work elsewhere. In essence, cities can grow horizontally to the point where they become less competitive and attractive. Therefore, a strategy to advocate from a higher concentration of people closer to the center seems like a reasonable proposition given the previously mentioned aspects and conflicts to suburbanization.

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[33] IBID, pp.201
[34] IBID, pp.201
[35] IBID, pp/201

Chapter 4: Rental vs. Homeownership: The Issue Of Tenure Choice

New York City has been a transitional city for many years as a place where young professionals come to live out their early careers or various other aspirations. These individuals have little initial intention of staking their claim in a permanent form of housing such that they would be induced to buy a property in the central city.

Alternatively, young professionals may make an investment in a residence so that they can begin to establish equity in a hard asset such that they can use the wealth generated to trade up in a higher quality of housing in the future. If the monthly mortgage payment is cheaper than payments of monthly rent, then this proposition would be most attractive.

For families that can not afford the major initial payment for a home mortgage in a single-family house, have limited choice as to where they can live. So the more affordable ownership can be offered, this would allow for the possibility of diverse communities in our cities. There are great hurdles to surpass in order for the structuring of the ownership to be feasible. However, if there is an opportunity to advocate for an affordable proposal, the idea would be most effective if the ownership structure were to remain in perpetuity.

As another demographic profile, there are many families that are simply urbanely inclined where their jobs and lives revolve around the city for some duration of time. Artists, teachers, advertising agents, publishers, musicians, fire-fighters, doctors, and other service oriented professionals who do not earn the income ranges demanded by the market rate housing offered, vitally require an alternative in order for this group of people to remain a viable component for the growth and sustainability of an intellectual class in an ever progressive city.

Home-ownership makes sense because they need to develop real equity such that when the residents either decide to move or upgrade their housing consumption and housing quality, they are afforded to do so. A rental structure of housing does not enable their tenants to ever gain this capacity. Furthermore, home-ownership encourages households to have a disciplined savings behavior

which promotes economic growth from which all households can benefit[36]. Therefore, if a typology of housing can be structured such that it encourages equity (wealth) building in order for upward socio-economic mobility, then this assistance would make sense from the perspective of the overall welfare of a city.

From a deeper economic perspective, US tax policy has set up a system where renters cannot deduct rent from their taxable income, while in contrast homeowners can gain from deducting mortgage interest and depreciation tax shields. As a result, renters face an after-tax annual housing cost that is **20-30% greater** than that of the identical owner-occupier of the same unit house for the same owner[37]. Therefore, there is an actual penalty for being a renter!

It has been estimated that the owner-occupied share of US housing would be more on the order of 50-55% instead of the actual 67%, if it were not for these income tax based cross-subsidies to ownership[38].

As seen from chapter 1, two thirds of New York City's population lives in rental units. Although New York has been a transitional city such that rental apartments may be in higher demand due to the dynamics of a population that changes dramatically over a period of ten to twenty years, it is hard to imagine that within the 66% of renters, none of this group desires to own housing in New York. In fact, the opposite scenario is rather likely. Due to the high hurdles of ownership in a city where mortgage payments are astronomical relative to other regions of the country, most households just can not afford to buy a place in New York and are stuck with the predicament of renting. Hence it is the view of this author that if middle-income affordability is achieved, then a strategy to encourage equity ownership is in greater demand and is going to maintain the long-term benefits towards the benefits of a community and a city at large.

[36] Geltner, David, *Housing Economics Lecture*, 2003, pp. 22
[37] IBID, pp.19
[38] IBID, pp.19

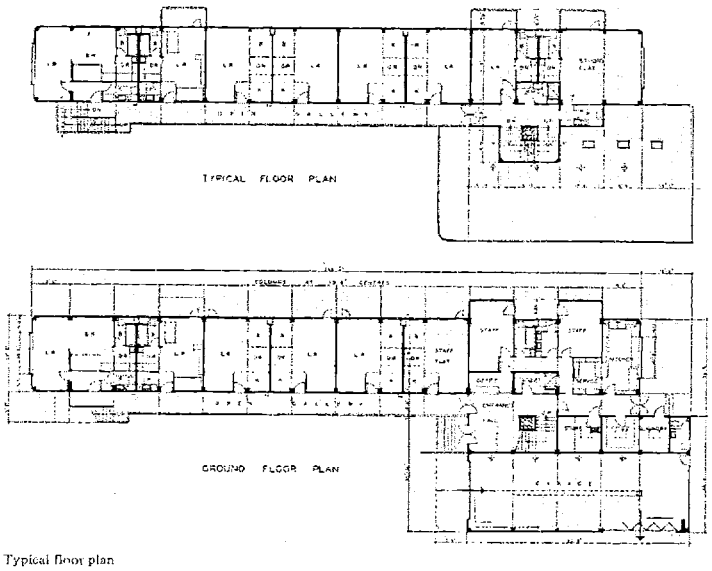
Chapter 5: Precedent Studies for High Occupancy Housing

In order to understand housing typologies that look toward higher density and flexible strategies, it was critical to understand how this housing design issue was not a new problem. The following are case studies of how architects in the 1930s, 1970s, and 1990s respectively, have dealt with the issue of density and tighter space conditions.

Wells Coates - **Lawn Road Flats** London, England

Actively devoted to minimum space, Coates was inspired by its conclusions about the "paramount importance of building in largish units, as the building of small attached houses will very quickly be discarded, when it is shown how economical and comfortable and convenient other methods may be.

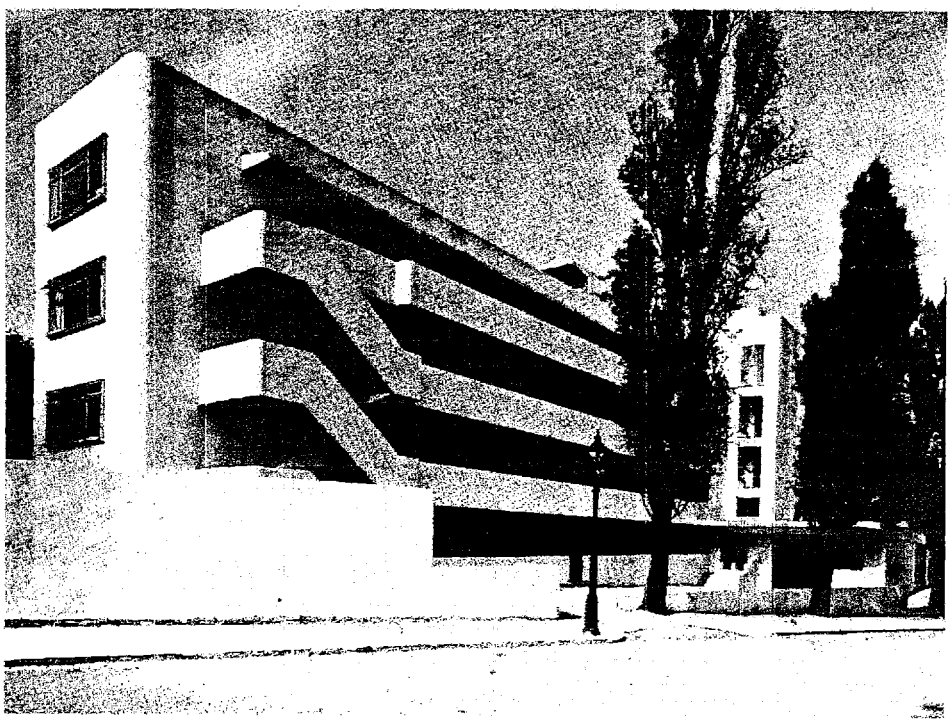
The 'other methods' referred to lead to the development of his idea of the "minimum flat" for Lawn Road: his answer to the search of the Modern Movement for the "rationed" dwelling[39].



Typical floor plan

[v]Plan of Lawn Road Flats

[39] Cantacuzino, Sherban, *Wells Coates: A Monograph*, 1978, pp.59



[vi] *Exterior Perspective*

Lawn Road as built, consisted of twenty-two minimum flats of access gallery type; four "double" flats at the south end, with the two main rooms divided by sliding screens; three studio flats at the north end over the main kitchen and staff quarters which were on the ground floor and one large penthouse flat for the owners of the building[40]. The building is situated at an angle to the road to make maximum use of the site between the two railway tunnels that ran underneath it. The building was also situated to maximize south-west orientation for the rooms.

[40] Cantacuzino, Sherban, *Wells Coates: A Monograph*, 1978, pp.59

Kisho Kurokawa - **Nakagin Tower** Tokyo, Japan

Pressed by the increasing pace of urbanization and resulting overcrowded conditions in Japanese cities, inspired by Kenzo Tange's pioneering work, in particular his Tokyo Plan in 1960, architects in the Metabolist Group proved to be the most productive in envisioning new modes of development for the metropolis[41]. Numerous revolutionary schemes, all relying on some form of mega-structure and the advanced industrial technology by then widely available in Japan, proposed extending the frontiers of city planning to include building above the level of the city's existing fabric and over the sea[42].

In line with the international trend of Structuralism, it did away with the Modern Movement's rigid practice of "master-planning" in favor of a master system as the basis for design, with the result that the sharp distinction between building and the urban realm was effectively challenged. The Metabolists combined their philosophical references to new discoveries in biological sciences with elements of Buddhist thinking on change and growth. The "techno-organic" visions of these architects were not only often profoundly poetic, but were also at the forefront of the modern approach to urban design which challenged the hegemony of Western ideals in urbanism[43]. Although the majority of their visions were not realized, their inherent ideas proved to be extremely influential for Japanese architecture and urbanism for years to come.

Of the projects that were realized, The Capsule Tower of 1972 is regarded as the epitome of Metabolist architecture. It consists of 144 prefabricated residential capsules bolted onto two reinforced concrete shafts containing vertical circulation.

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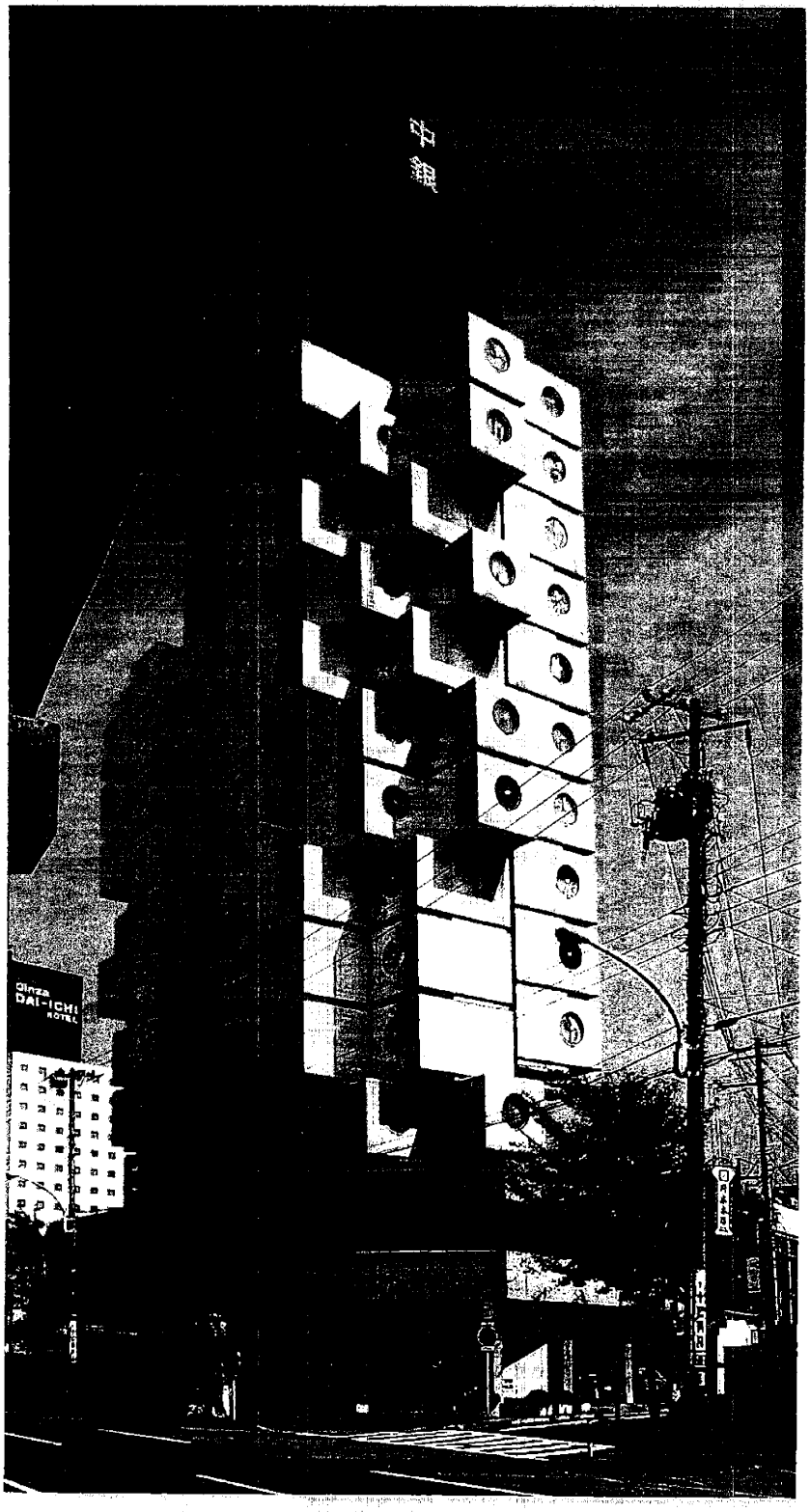
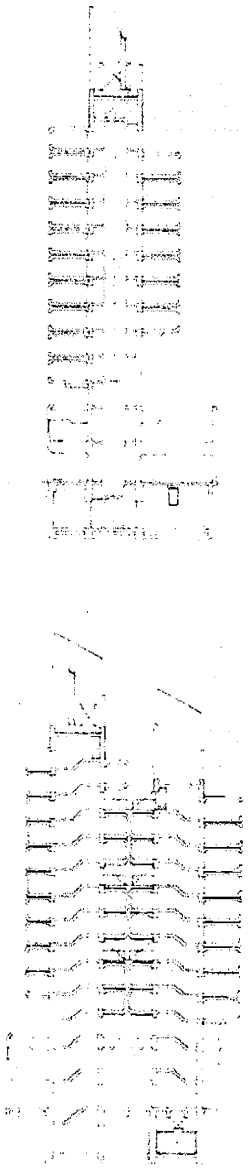
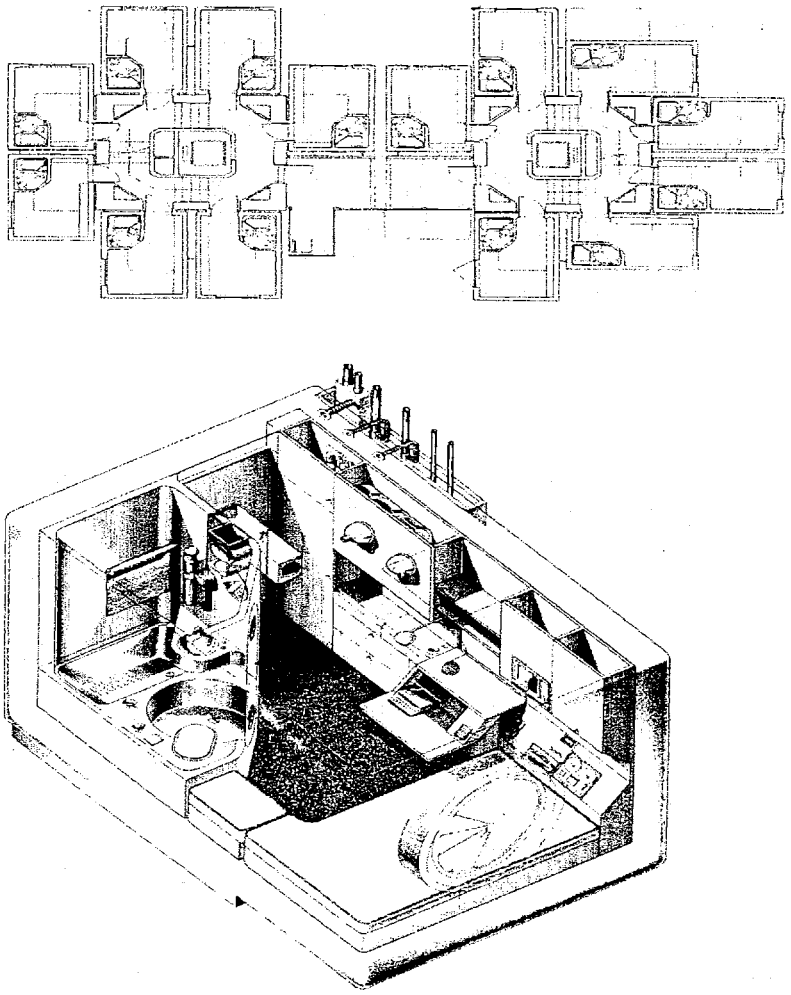
[41] Bognar, Botond, *World Cities Tokyo*, 1997, pp.55
[42] IBID, pp.55
[43] IBID, pp.55





[vii]*Nakagin Capsule Tower*



[viii]Plan and Interior Perspective of capsule unit to Nakagin Tower

The capsules are identical in size and basic construction to standard shipping containers, and provide minimal yet flexibly-arranged living space for single people. Each unit incorporates working and sleeping areas, a bathroom unit, a kitchenette, as well as providing built-in furniture, a stereo, TV, and air conditioning[44].

[44] IBID, pp.91

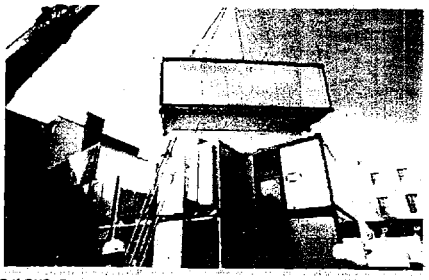
Cartwright Pickard Architects - **Murray Grove Apartments** London, England

The Peabody Trust, one of Britain's oldest housing associations charged with housing those who cannot afford to pay market rents, was increasingly frustrated with the results of its conventional building projects. Typical projects took far too long to build and once completed, were not of a high quality. Flying in the face of popular perceptions, the Trust decided to give prefabrication a try. In contrast to the system building of the 1960s, where heavy concrete panels were used, Murray Grove utilizes a genuinely industrialized method, where the flats are almost entirely pre-assembled and fitted out in a factory.

The 30-unit building's single-bedroom flats are made up of two 8x3.2 meter modules; two-bedroom units are comprised of three modules. All 74 of the modules required for the five-story unit in east London were manufactured by Yorkon Limited, a British company specializing in the fabrication of budget hotels and fast food restaurants[45].

The light, steel framed boxes developed by Cartwright-Pickard were designed with the same dimensions as Yorkon's standard hotel-room module so they could be manufactured on the company's existing production lines. The resources saved by building quickly, allowed the remaining funds to be allocated towards higher quality doors, windows, and fixtures as well as fittings that were screwed in place at the factory[46].

Once fabricated, the modules were delivered to the site and then hoisted by crane for assembly. **The entire building was erected in 10 days** and, in theory, can be taken apart as quickly and easily as it was put together[47].



[ix] Module being stacked by crane

[45] Arieff, Allison, *PRE FAB*, Gibbs-Smith Publisher, pp. 69
[46] IBID, pp.69
[47] IBID, pp.69

x Murray Grove Apartments

The building's exteriors are clad with a clip-on terra-cotta rain-screen cladding system and the roof is comprised of steel panels[48]. Perforated aluminum screens form a translucent veil in front of balconies and the main stair tower. The roof, distinctive circular entrance, and stairwell were delivered to the site as modular elements[49]. The elevator and stair tower were also hoisted into place by a crane. To save space, internal corridors were eliminated and instead entries to apartments are via a street facing external balconies. All of the flats include private balconies that look out onto a community garden and range in size from 600 to 800 square feet[50].

[48] IBID, pp.75
[49] IBID, pp.75
[50] IBID, pp. 75

Chapter 6: The Process of Disciplined Design through a Set of Priorities

The process of the proposed design method first prioritizes a set of design values from the initial stages of the development process in order to have the greatest impact on embedding and maintaining quality. Without an objective or a vision to what market one is designing towards, it is very difficult to design a sensible housing proposal. However, in order to get to the first set of priorities, a general sense of scale and site selection was required.

In order to get a range to understand the scale of the units for this middle-income housing, a real estate financial analysis was performed to understand the relationships between

a) the total development costs attributable on a per square foot basis
b) the relative income groups targeted (60-200% of AMI), and
c) the maximum affordable house purchase price
d) the respective amount of space that could be consumed based on price

The financial sensitivity analysis in Appendix A shows four scenarios of homeownership calculations. The major variables that affect housing prices which reflect how much space can be afforded are:

a) HUD income cap limit
b) Initial Equity down payment percentage
c) Total Development Costs
d) Interest rates on mortgage loans

Scenario 1 is the traditional market analysis under which the US Housing and Urban Development's (HUD) policy limits the allocation of housing consumption to 30% of gross income. Financial underwriters use this benchmark to analyze what price houses can be sold for into the market. Given that middle-income households (defined in this analysis as the range of 60% - 200% of the Area Median Income) have a limited gross income, 30% of this income further limits their capacity to afford space. In addition, this scenario has fixed the initial equity down payment toward the mortgage at 20%. This is relatively high considering that most of these households in this range of income group will be first time homebuyers and they will not have 20% of equity to place towards

housing. However, assuming that these typical market conditions result in total development costs of $500 per square foot (New York City market), this analysis tells us the following:

a) 2 personat 80% of AMI can afford to consume 320 square feet. This is 160 square feet per person.
b) 4-person household at 100% of AMI can afford to consume 508 square feet! That is 127 square feet per person.

Needless to say this is a very tight living condition.

Scenario 2 is an analysis of what happens to space consumption if the income limit were increased to 45% instead of 30%. The conceptual logic was that since most home-owners were paying upwards of 40% of their income toward housing then perhaps this income limit was worth understanding. By modifying this variable we observe that spatial allocation for each income group is enhanced by 30%. However, this scenario is highly unlikely to occur because households will be so strapped for spending that this high allocation towards housing may not be feasible.

Scenario 3 analyzes when the initial equity down payment is lowered to 5%. This reflects a more reasonable hurdle for households to afford the initial down payment. When this variable is modified, spatial allocation was diminished by 15% on average across all income groups. This reflects the importance of initial equity contributions toward housing consumption. This point will be reiterated in future analyses as well.

Finally, Scenario 4 reduced the total development cost by 50%. This was based on two assumptions.

a) the pre-fabricated modular system would be able lower hard construction and labor costs.
b) Land acquisition would not be the true market value because the specific sites targeted are city owned lots.

This reduced the total development costs down to $250 per square foot. Assuming a 5% equity and this new construction cost basis, resulted in an increase of spatial allocation across all income groups by 68%. Clearly there are

benefits to maintaining a low cost of construction. When comparing this scenario to the first one, we obtain the following results.

a) 2 person household at 80% of AMI can afford to consume 680 square feet. This is 340 square feet per person.
b) 4-person household at 100% of AMI can afford to consume 856 square feet! That is 214 square feet per person.

Since the range of scale for the units has now been obtained, the objective was to find a site suitable for such housing use. When looking for a city owned vacant lot that could handle densities at an FAR of 6, this brought the site selection to Harlem. This area is zoned as R-7 which allows for mid-rise and high-rise structures.

[xi] Harlem @.5 miles – Vacant Lots

In addition, this area was particularly attractive because of its proximity to Morningside Park, Columbia University, Central Park, and the A, C, B, D train line that runs north-south along Fredrick Douglas Boulevard.

The subject site is located on 117th street and Frederick Douglas Boulevard. It is one block north of the 116th Street A, C, B, D train station and is well situated within walking distance to both parks. Furthermore, the site takes up two-thirds of the length down 117th street and half of the block down Frederick Douglas Boulevard. This site was a contiguous area of land, enough for this high density, high occupancy development to be tested upon.

[xii] 117th Street and Frederick Douglas Boulevard

Since the scale and the site have been analyzed and set, the following phase in the design methodology brings us to the iterative design quality vs. cost trade-off test. The first step is to set up a set of design priorities within each specified unit. Given the broad income range that is targeted, I felt that the unit mix could accommodate single resident occupied units, two person occupied units, and four person occupied units. With this strategy a healthy array of design and income mix could be achieved.

It should be noted that when setting up the priorities to test this design vs. cost trade off, there were certain constraints held and certain constraints relaxed. The following is a list of the constraints:

Constraints Held:

1) Design within New York's construction cost framework
2) Hold FAR of building fixed to 6. This is the allowed zoning variable.

Constraints Relaxed:

1) City and State building code regulations that burden the pace of new housing construction.
2) City and State regulations that prohibit the design of single resident occupied units.
3) New York City's idiosyncratic labor union practices.
4) Building height restrictions.

Once these design priorities were decided, an initial design of the units were completed and a full building was designed. Plans, sections, elevations, and models were designed to understand the full architectural qualities of the housing. This housing design was subsequently tested against an equity down payment and interest rate matrix that captured the percentage of Area Median Income that could be supported based on the design's cost per square foot and maximum obtainable housing prices for each unit type. The matrix tells the story behind which income group can be housed within each type of design.

Once the observation for this first design was complete, we return to the stage of composing a new set of design priorities. Based on this new set of values, there would be design variations that would result in a different set of architectural ramifications. This would then be tested again against the Area Median Income Capture model to ultimately allow for the two designs to be compared and observed for their trade-offs from both an objective measure and to understand what the latent architectural trade-offs are[51].

[51] See Appendix B for Diagram of Design Process

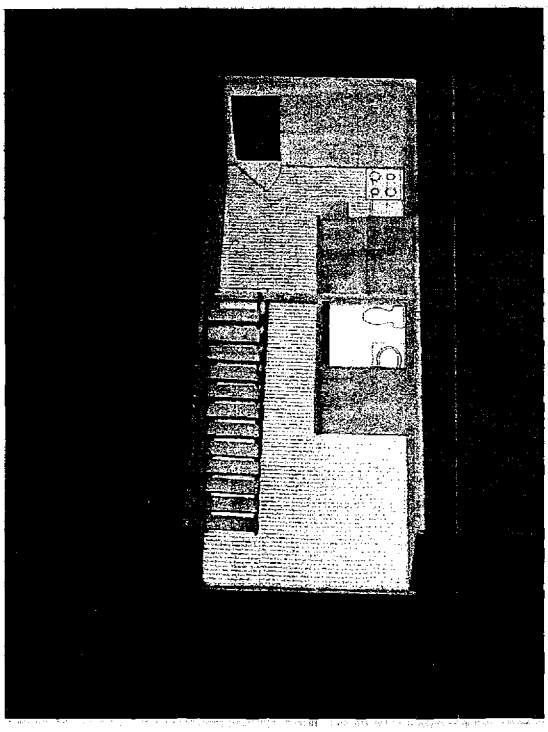
Chapter 7: The Latent Trade-Offs Made Through Flexible Housing Design

From the spatial financial analysis described in Chapter 6, the scale of a single module was set at 360 square feet in order to accommodate the 60% of AMI income group for a single resident. This meant that the module of each unit followed a 12' wide x 30' deep dimension.

Based on this unit dimension, the first set of design priorities (**Version A**) was established. They were:

1) Set up clear delineations of privacy from one space to the next
2) Allow light to get to the back of the unit
3) Make the overall building as efficient as possible. Hence common area was kept to a minimum.

When following these design priorities, I came up with the following physical model.



[xiii] Version A - ¼" scale unit study model

With this layout, the 30' depth was divided into 3 equal 10' spaces. The kitchen eating area was immediately adjacent to the entrance. The living/bedroom was located toward the façade and the two spaces were separated by a bathroom and closet space. This is when the unit is designed for a single occupant. When a second module of the same dimension is stacked directly on top of this unit, a double height space is afforded in living/bedroom area[52].

In order for light to reach the kitchen/dining area, all of the walls for the bathrooms and closets are made translucent. Moreover, in order to save space, the furniture elements such as tables fold from the wall of the bathroom. This table can act as both kitchen cooking table as well as dining table. The bed can also fold up parallel to the bathroom wall along the front of the unit so that more space can be obtained in the case of entertaining guests. The intention of the design internal to the unit is such that each architectural element performs a double duty and allows for flexibility of use given the tight accommodations.

On an aggregate level, when this system is laid out throughout an entire building, a typical floor plan is has an efficiency of 87% net to gross area[53]. Moreover, within the total 10 story building, there are 206 units with a combination of

a) Type 1 - 1 person/single resident units

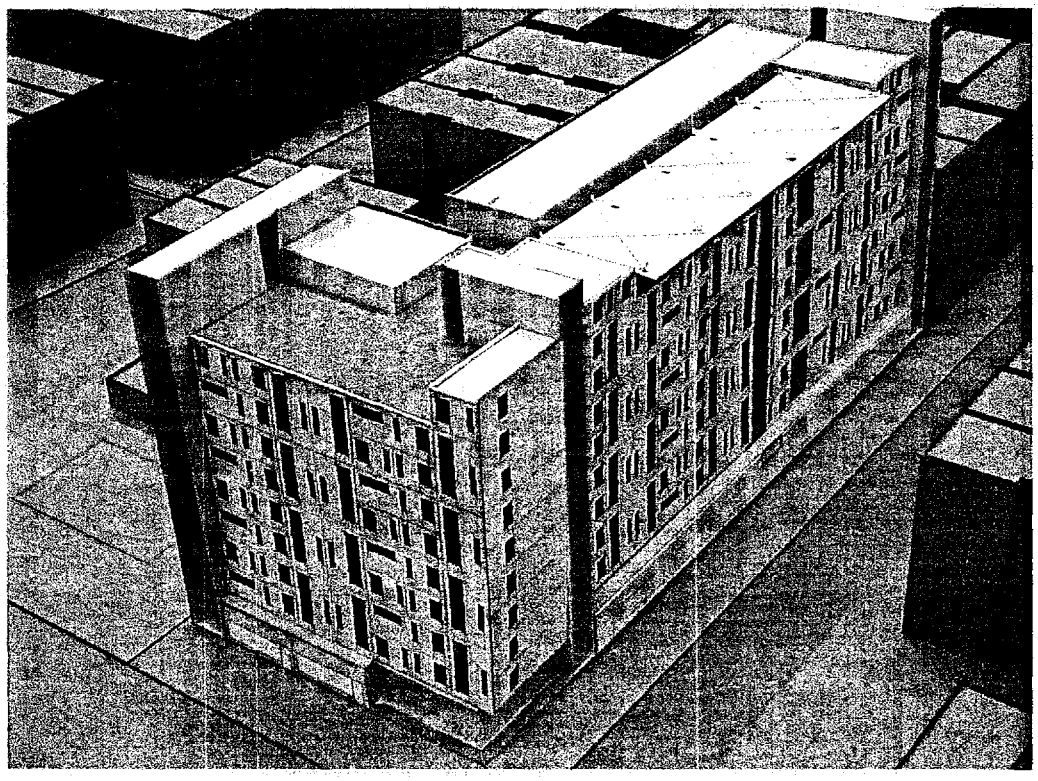
b) Type 2 - 2 person/1 bedroom units vertical

c) Type 3 – 2 person/1 bedroom units horizontal

d) Type 4 - 4 person/2 bedroom units

[52] See Elevation and Section Drawing in Appendix C
[53] See Appendix B for Typical Floor plan of Version A

This design was then tested against the aforementioned AMI capture financial model to see what income groups could be supported. Based on the analysis, across an interest rate range of 5%-10% and an initial equity down payment range of 0%-20%, Version A's design was able to support the 60% AMI range for the Type 1 units, the 80% AMI range for the Type 2 units, and the 140% and above for the Type 4 units[54], throughout most all combinations of interest rate environments and equity down payment structures. In essence, this "bare-boned" high efficiency design is able to accommodate all middle-income ranges from 60%-200% of Area Median Incomes from 1 person to 4 person occupancies[55].



[xiv] Version A: Architectural model at 1/16" scale

[54] See Appendix B for Typical Plan and AMI Matrix Chart
[55] This is all assuming that total development costs can be achieved at $250/SF.

As follows in the design process described in Chapter 6, a different set of design priorities were undertaken. As seen from the diagrams in Appendix C the variations made prioritize the following attributes:

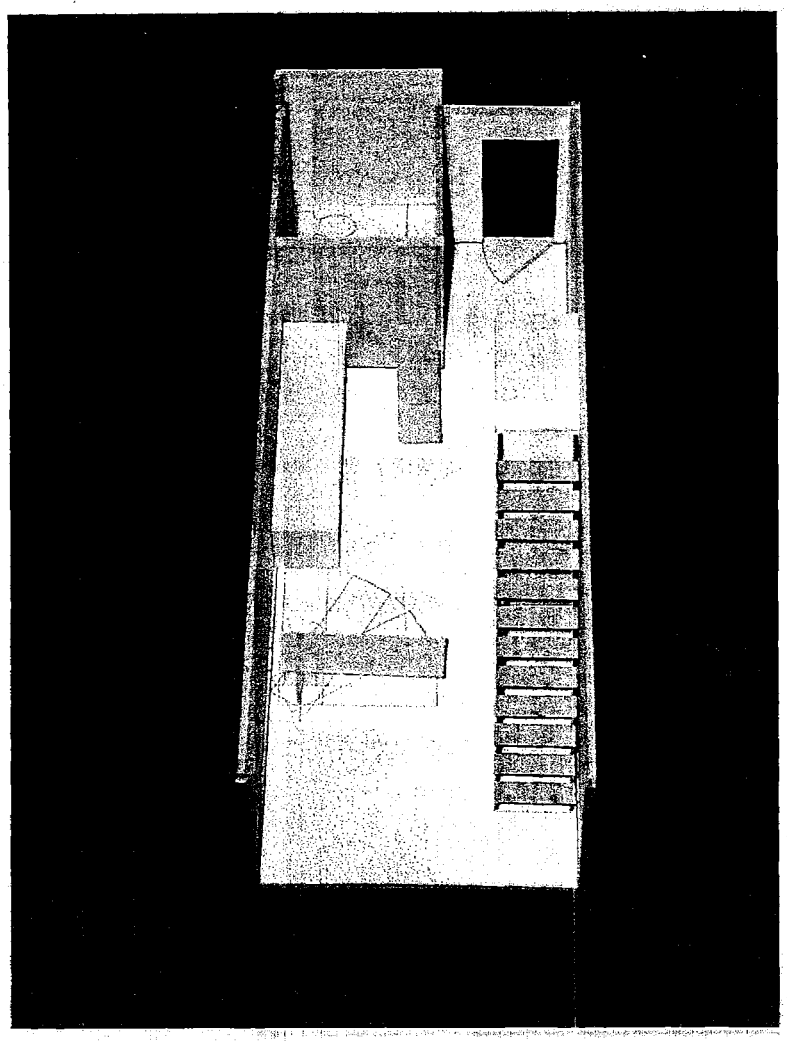
a) More contiguous space for light to carry easily to the back of the unit

b) Distinguish privacy for entry space

c) Allow for flexible space in the living/bedroom double height area

As a result what are shown in shaded green are the areas within the unit which have the most to gain in terms of architectural and spatial quality when such design priorities are undertaken. **Interestingly, these latent design quality enhancements correspond with where there is a non-linear relationship with construction costs.** In other words, by designing in flexibility in choice locations, such as double height spaces, which do not directly and proportionately add to the cost of construction, are the areas which observe maximum potential gains in spatial quality. The immediate difference will be observed between the Type 2 and Type 3 units. Both are 1 bedrooms but the Type 2 is the vertically oriented unit which does not appreciate in price as quickly as Type 3.

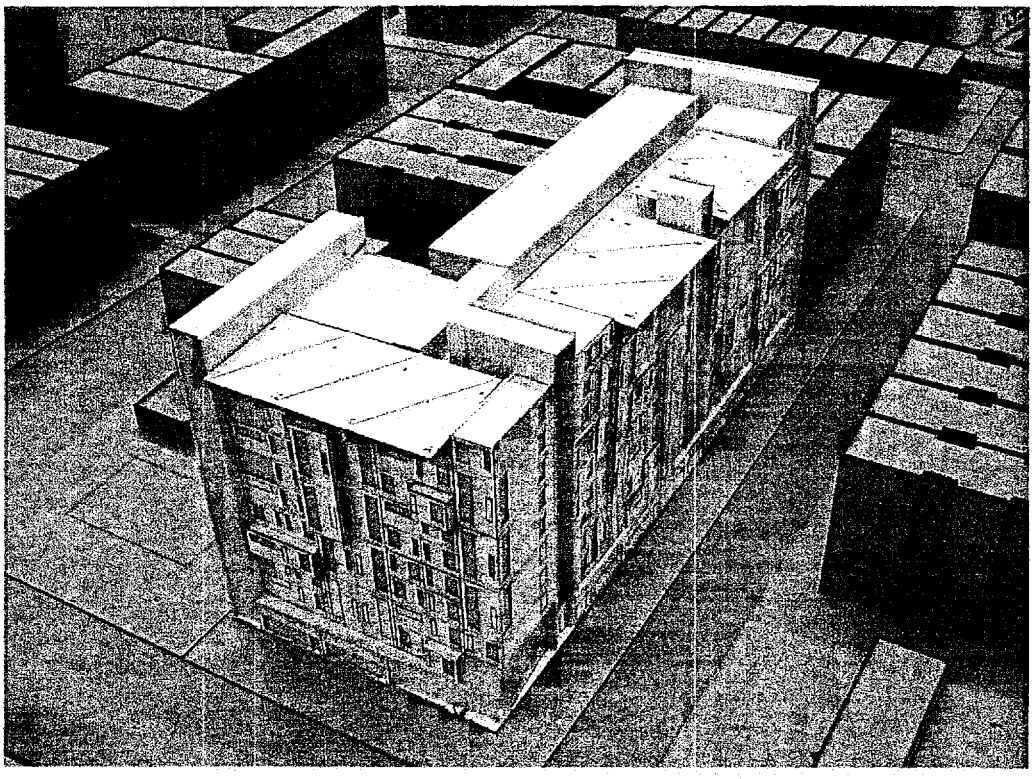
On a modular unit design basis, what happened was the bathroom and kitchen areas in Version A flipped such that the bathroom is now immediately adjacent to the entrance door and the kitchen space is contiguous with the living/bedroom area in Version B. In addition, the bathroom is pushed out into the public corridor zone. This move has enhanced both the contiguous space internal to the unit, such that light can easily be carried through the full depth of the apartment, as well as creates a distinct entry alcove for each unit.



[xv] Version B - ¼" scale unit study model

The flexible sliding façade element along the living/bedroom area adds an architectural element to the exterior of the building such that there is a hierarchy of scale based on those tenants who exercise their option to expand their unit. This sliding element is detailed such that it acts similar to a bottle cap where the sliding element would be tied back to the overall structure of the building but would be able to slide forward 4'. When the façade slides forward, a floor and ceiling piece would expand with it, so that a solid weather enclosure can be maintained.

On an aggregate level, the typical efficiency of net to gross area decreases to 75%. This is attributed to the increase necessary in the common areas due to the placement of bathrooms which push into the corridors. Since a minimum dimension to corridor space was maintained, the overall building for public space increased and private areas were traded off. As a result the total number of units in Version B is 203 units. The question does remain as to whether or not this option in design feature can maintain affordability and to what extent?



[xvi] Version B: Architectural model at 1/16" scale

When testing Version B, with all of the design enhancements included, the results for AMI support were observed in Appendix D and Appendix E. Appendix D looked at the design enhancements of the kitchen bathroom flip but with no flexible façade enhancement. The façade would remain the same as Version A,

which is essentially a standard exterior stud wall with veneer system. When this analysis was performed the following observations were made:

1) The design enhancements can maintain to accommodate the 60% of AMI income group; however the possibility of this outcome has diminished. The lowest possible combination for this to occur is where a minimum of 8% equity down-payment is required at a 5% interest rate.
2) The higher end Type 4 units have risen in value such that a household must earn a minimum of 160% of AMI as opposed to 140% of AMI in Version A. (20% upward shift in AMI requirement in order to be able to afford the same unit).
3) The Type 2 and Type 3 units capture the 80%-140% of AMI range.
4) All things equal, middle-income affordability has been maintained but somewhat diminished.

In Appendix E, the flexible façade design element was taken into consideration (Version B': Flexible Design and AMI Support). With this design element addition, there are significant square footage gains to be had which inherently price up the value of the units proportionately. When this occurs the following observations were recorded.

1) The flexible façade maximizes the architectural features within the unit as well as enhances the urban form of the building; however there is a trade-off where the 80% of AMI income group is the lowest threshold that can be supported. The Type 1 units all become unaffordable to the 60% income group.

2) In general the majority Type 2 and 3 of units falls within the category of supporting 100%-160% of AMI. However due to the horizontality of Type 3's design, it becomes unaffordable (above 200% of AMI) under certain high interest/low equity down payment scenarios.
3) The Type 4 unit requires a minimum of 180% AMI
4) Overall the Type 2's, double height, 1 bedroom unit maintains affordability integrity.
5) The truly positive attribute is that all of the units maintain a range of 80%-180% of AMI affordability for the majority of interest vs. equity down payment scenarios.

Chapter 8: Conclusion

Given the 200+ units within an FAR of 6, in general the housing occupancy levels observed in this prototype performs similar to a building that behaves like an extended stay hotel. Such a housing typology is not typically seen in this country and furthermore, to take equity ownership position in this type of housing is a radical idea. However, it is my view that under particularly constrained situations where the supply of land is inelastic and where construction costs of new developments are considerably high; this type of housing could be considered for the purposes of encouraging an alternative type of market rate housing.

From our observations of Version A, Version B, and Version B', we can clearly see that there are both objective affordability trade-offs as well as latent design trade-offs. It is startling that small design shifts of flipping a bathroom and a kitchen, and adding a different detail to the facade can have such an impact on diminishing the capacity to support the lower end of the middle-income households.

In addition, it is highly encouraging to understand that flexible design does not necessarily mean huge jumps in house prices to the extent where middle income groups can be accommodated. Although, there is an immediate trade-off in terms of the sheer scale to a single unit, even with all of the designed spatial flexibility enhancements, the overall architectural quality to this built form is in my belief a housing type which enhances the area in which it is situated. The idea offers spatial and socio-economic variety and optionality that is embedded within the design both at the unit scale level and the urban building level.

Furthermore, this disciplined mechanism of wealth generation through gradual equity ownership of an apartment in New York City is a beneficial public and private benefit that could offset some of the aforementioned trade-offs when taking the macro-dynamic urban economic perspectives into consideration.

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Images

[i] *Source: U.S. Bureau of Census, 1999 New York City Housing and Vacancy Survey*
[ii] *Source: U.S. Bureau of Census, 2000 Census, Population Division*
[iii] *Source: U.S. Bureau of Census, 2000 Census, Population Division*
[iv] Source: RS Means Construction Cost Data 1998
[v] Cantacuzino, Sherban, *Wells Coates: A Monograph*, 1978, pp.59
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[viii] Bognar, Botund, *World Cities Tokyo*, 1997, pp.91
[ix] Arieff, Allison, *PRE FAB*, Gibbs-Smith Publisher, pp. 69
[x] Arieff, Allison, *PRE FAB*, Gibbs-Smith Publisher, pp. 69
[xi] Source: Open Accessible Space Information System for New York City 2003
[xii] Photograph of Subject Site
[xiii] Photograph of Version A ¼" Study Model
[xiv] Photograph of Version A Urban Model
[xv] Photograph of Version B ¼" Study Model
[xvi] Photograph of Version B Urban Model

Appendix A: Home Ownership Financial and Spatial Scale Calculations

Scenario 1: Traditional HUD Income Limit Calculation

Observations: Square Footage is small, the per person allocation of space is problematic above the SRO Per Person allocation of space is tight above 2 person occupancy level

Givens & Assumptions:

NYC AMI (gross annual income)	$	62,800
% of gross income available for PITI mortgage loan		30%
Estimated Real Estate taxes as a percentage of funds available		1.5%
Home Insurance Costs	$	500
Estimated Annual Mortgage Constant Charged by Lender for 30 Year Fixed Interest Loan		8%
Amortization Period		30
Equity down payment as a % of Purchase Price		20%
NYC Market Housing Construction Cost/SF	$	[illegible] Assumed to be total development costs (Land+Hard Costs+Soft Costs)

Home ownership Housing Calculation

Targeted Income Population		1 person @ 60% AMI	1 person @ 70% AMI	1 person @ 80% AMI	1 person @ 90% AMI	1 person @ 100% AMI	1 person @ 110% AMI	1 person @ 120% AMI
Annual Household Income Targets		$26,400	$30,800	$35,200	$39,600	$44,000	$48,400	$52,800
% of annual income available towards housing		$7,920	$9,240	$10,560	$11,880	$13,200	$14,520	$15,840
Sample Calculation for target population Scenario 1								
Max. funds available for mortgage		$7,920	$9,240	$10,560	$11,880	$13,200	$14,520	$15,840
(Real Estate Taxes)		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
(Home Insurance)	$	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Remaining funds available for Principle and Interest toward Mortgage		$7,301	$8,601	$9,902	$11,202	$12,502	$13,802	$15,102
Maximum Sustainable Mortgage		$82,195	$96,833	$111,470	$126,107	$140,745	$155,382	$170,020
Percentage of Purchase Price								
Represented by Mortgage		80%	80%	80%	80%	80%	80%	80%
Maximum Affordable Purchase Price		$102,744	$121,041	$139,338	$157,634	$175,931	$194,228	$212,524
Equity Down Payment		$20,549	$24,208	$27,868	$31,527	$35,186	$38,846	$42,505
Mortgage Loan		$82,195	$96,833	$111,470	$126,107	$140,745	$155,382	$170,020
Bank mortgage processing points fee (first time home buyers)	0%	$0	$0	$0	$0	$0	$0	$0
Maximum Affordable Purchase Price		$102,744	$121,041	$139,338	$157,634	$175,931	$194,228	$212,524

Costs and Spatial Implications

	Unit Types	Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1
Developer's Sale Price		$102,744	$121,041	$139,338	$157,634	$175,931	$194,228	$212,524
Construction cost / SF		$ 500	$ 500	$ 500	$ 500	$ 500	$ 500	$ 500
Total Affordable Sq Ft.		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Occupancy Density

Unit Types	Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1
Area of unit	205	242	279	315	352	388	425
Occupancy of people in unit	1	1	1	1	1	1	1
Person per Square Feet	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[redacted]

2 person @ 60% AMI	2 person @ 70% AMI	2 person @ 80% AMI	2 person @ 90% AMI	2 person @ 100% AMI	2 person @ 110% AMI	2 person @ 120% AMI
$30,100	$35,117	$40,134	$45,150	$50,167	$55,184	$60,200
$9,030	$10,535	$12,040	$13,545	$15,050	$16,555	$18,060
$9,030	$10,535	$12,040	$13,545	$15,050	$16,555	$18,060
$8,395	$9,877	$11,359	$12,842	$14,324	$15,807	$17,289
$94,505	$111,194	$127,883	$144,571	$161,260	$177,949	$194,638
80%	80%	80%	80%	80%	80%	80%
$118,131	$138,992	$159,853	$180,714	$201,576	$222,437	$243,298
$23,626	$27,798	$31,971	$36,143	$40,315	$44,487	$48,660
$94,505	$111,194	$127,883	$144,571	$161,260	$177,949	$194,638
$0	$0	$0	$0	$0	$0	$0
$118,131	$138,992	$159,853	$180,714	$201,576	$222,437	$243,298
Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1
$118,131	$138,992	$159,853	$180,714	$201,576	$222,437	$243,298
$ 500	$ 500	$ 500	$ 500	$ 500	$ 500	$ 500
Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1
236	278	320	361	403	445	487
2	2	2	2	2	2	2

4 person @ 60% AMI	4 person @ 70% AMI	4 person @ 80% AMI	4 person @ 90% AMI	4 person @ 100% AMI	4 person @ 110% AMI	4 person @ 120% AMI
$37,680	$43,960	$50,240	$56,520	$62,800	$69,080	$75,360
$11,304	$13,188	$15,072	$16,956	$18,840	$20,724	$22,608
$11,304	$13,188	$15,072	$16,956	$18,840	$20,724	$22,608
$10,634	$12,490	$14,346	$16,202	$18,057	$19,913	$21,769
$119,720	$140,612	$161,503	$182,395	$203,286	$224,178	$245,069
80%	80%	80%	80%	80%	80%	80%
$149,650	$175,765	$201,879	$227,993	$254,108	$280,222	$306,337
$29,930	$35,153	$40,376	$45,599	$50,822	$56,044	$61,267
$119,720	$140,612	$161,503	$182,395	$203,286	$224,178	$245,069
$0	$0	$0	$0	$0	$0	$0
$149,650	$175,765	$201,879	$227,993	$254,108	$280,222	$306,337
Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1
$149,650	$175,765	$201,879	$227,993	$254,108	$280,222	$306,337
$ 500	$ 500	$ 500	$ 500	$ 500	$ 500	$ 500
Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1
299	352	404	456	508	560	613
4	4	4	4	4	4	4

Scenario 2: What happens when HUD Income Limit is increased to 45%

Observations:

Square Footage allocation is enhanced by 30% on average
Default Risk is much greater. This may undermine the actual space allocation possible.

Givens & Assumptions:

NYC AMI (gross annual income)	$	62,800
% of gross income available for PITI mortgage loan		45%
Estimated Real Estate taxes as a percentage of funds available		1.5%
Home Insurance Costs	$	500
Estimated Annual Mortgage Constant Charged by Lender for 30 Year Fixed Interest Loan		8%
Amortization Period		30
Equity down payment as a % of Purchase Price		5%
NYC Market Housing Construction Cost/SF	$	500

Taken from current industry estimated data in NYC market

Home ownership Housing Calculation

Targeted Income Population	1 person @ 60% AMI	1 person @ 70% AMI	1 person @ 80% AMI	1 person @ 90% AMI	1 person @ 100% AMI	1 person @ 110% AMI	1 person @ 120% AMI
Annual Household Income Targets	$26,400	$30,800	$35,200	$39,600	$44,000	$48,400	$52,800
% of annual income available towards housing	$11,880	$13,860	$15,840	$17,820	$19,800	$21,780	$23,760
Sample Calculation for target population Scenario 1							
Max. funds available for mortgage	$11,880	$13,860	$15,840	$17,820	$19,800	$21,780	$23,760
(Real Estate Taxes)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
(Home Insurance)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Remaining funds available for Principle and Interest toward Mortgage	$11,202	$13,152	$15,102	$17,053	$19,003	$20,953	$22,904
Maximum Sustainable Mortgage	$126,107	$148,063	$170,020	$191,976	$213,932	$235,888	$257,844
Percentage of Purchase Price							
Represented by Mortgage	95%	95%	95%	95%	95%	95%	95%
Maximum Affordable Purchase Price	$132,745	$155,856	$178,968	$202,080	$225,191	$248,303	$271,414
Equity Down Payment	$6,637	$7,793	$8,948	$10,104	$11,260	$12,415	$13,571
Mortgage Loan	$126,107	$148,063	$170,020	$191,976	$213,932	$235,888	$257,844
Bank mortgage processing points fee (first time home buyers) 0%	$0	$0	$0	$0	$0	$0	$0
Maximum Affordable Purchase Price	$132,745	$155,856	$178,968	$202,080	$225,191	$248,303	$271,414

Costs and Spatial Implications

Unit Types	Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1
Developer's Sale Price	$132,745	$155,856	$178,968	$202,080	$225,191	$248,303	$271,414
Construction cost / SF	$ 500	$ 500	$ 500	$ 500	$ 500	$ 500	$ 500
Total Affordable Sq Ft.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	29%	29%	28%	28%	28%	28%	28%

Occupancy Density

Unit Types	Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1
Area of unit	265	312	358	404	450	497	543
Occupancy of people in unit	1	1	1	1	1	1	1
Person per Square Feet	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	29%	29%	28%	28%	28%	28%	28%

[redacted]

2 person @ 60% AMI	2 person @ 70% AMI	2 person @ 80% AMI	2 person @ 90% AMI	2 person @ 100% AMI	2 person @ 110% AMI	2 person @ 120% AMI
$30,100	$35,117	$40,134	$45,150	$50,167	$55,184	$60,200
$13,545	$15,803	$18,060	$20,318	$22,575	$24,833	$27,090
$13,545	$15,803	$18,060	$20,318	$22,575	$24,833	$27,090
[redacted]						
$12,842	$15,066	$17,289	$19,513	$21,737	$23,960	$26,184
$144,571	$169,605	$194,638	$219,672	$244,705	$269,738	$294,772
95%	95%	95%	95%	95%	95%	95%
$152,181	$178,531	$204,882	$231,233	$257,584	$283,935	$310,286
$7,609	$8,927	$10,244	$11,562	$12,879	$14,197	$15,514
$144,571	$169,605	$194,638	$219,672	$244,705	$269,738	$294,772
$0	$0	$0	$0	$0	$0	$0
$152,181	$178,531	$204,882	$231,233	$257,584	$283,935	$310,286
Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1
$152,181	$178,531	$204,882	$231,233	$257,584	$283,935	$310,286
$ 500	$ 500	$ 500	$ 500	$ 500	$ 500	$ 500
[redacted]						
29%	28%	28%	28%	28%	28%	28%
Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1
304	357	410	462	515	568	621
2	2	2	2	2	2	2
[redacted]						
29%	28%	28%	28%	28%	28%	28%

4 person @ 60% AMI	4 person @ 70% AMI	4 person @ 80% AMI	4 person @ 90% AMI	4 person @ 100% AMI	4 person @ 110% AMI	4 person @ 120% AMI
$37,680	$43,960	$50,240	$56,520	$62,800	$69,080	$75,360
$16,956	$19,782	$22,608	$25,434	$28,260	$31,086	$33,912
$16,956	$19,782	$22,608	$25,434	$28,260	$31,086	$33,912
[redacted]						
$16,202	$18,985	$21,769	$24,552	$27,336	$30,120	$32,903
$182,395	$213,732	$245,069	$276,407	$307,744	$339,081	$370,418
95%	95%	95%	95%	95%	95%	95%
$191,995	$224,981	$257,968	$290,954	$323,941	$356,928	$389,914
$9,600	$11,249	$12,898	$14,548	$16,197	$17,846	$19,496
$182,395	$213,732	$245,069	$276,407	$307,744	$339,081	$370,418
$0	$0	$0	$0	$0	$0	$0
$191,995	$224,981	$257,968	$290,954	$323,941	$356,928	$389,914
Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1
$191,995	$224,981	$257,968	$290,954	$323,941	$356,928	$389,914
$ 500	$ 500	$ 500	$ 500	$ 500	$ 500	$ 500
[redacted]						
28%	28%	28%	28%	27%	27%	27%
Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1
384	450	516	582	648	714	780
4	4	4	4	4	4	4
[redacted]						
28%	28%	28%	28%	27%	27%	27%

Scenario 1: When Equity Down Payment is lowered to 5%

Observations:

Square Footage allocation is diminished by 15%
Risk is managed and this is with strict private market financing.
Middle Income people can buy an apartment they just live in less than a shoebox

Givens & Assumptions:

NYC AMI (gross annual income)	$	62,800
% of gross income available for PITI mortgage loan		30%
Estimated Real Estate taxes as a percentage of funds available		1.5%
Home Insurance Costs	$	500
Estimated Annual Mortgage Constant Charged by Lender for 30 Year Fixed Interest Loan		8%
Amortization Period		30
Equity down payment as a % of Purchase Price		5%
NYC Market Housing Construction Cost/SF	$	500

Home ownership Housing Calculation

Targeted Income Population	1 person @ 60% AMI	1 person @ 70% AMI	1 person @ 80% AMI	1 person @ 90% AMI	1 person @ 100% AMI	1 person @ 110% AMI	1 person @ 120% AMI
Annual Household Income Targets	$26,400	$30,800	$35,200	$39,600	$44,000	$48,400	$52,800
% of annual income available towards housing	$7,920	$9,240	$10,560	$11,880	$13,200	$14,520	$15,840
Sample Calculation for target population Scenario 1							
Max. funds available for mortgage	$7,920	$9,240	$10,560	$11,880	$13,200	$14,520	$15,840
(Real Estate Taxes)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
(Home Insurance)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Remaining funds available for Principle and Interest toward Mortgage	$7,301	$8,601	$9,902	$11,202	$12,502	$13,802	$15,102
Maximum Sustainable Mortgage	$82,195	$96,833	$111,470	$126,107	$140,745	$155,382	$170,020
Percentage of Purchase Price Represented by Mortgage	95%	95%	95%	95%	95%	95%	95%
Maximum Affordable Purchase Price	$86,521	$101,929	$117,337	$132,745	$148,152	$163,560	$178,968
Equity Down Payment	$4,326	$5,096	$5,867	$6,637	$7,408	$8,178	$8,948
Mortgage Loan	$82,195	$96,833	$111,470	$126,107	$140,745	$155,382	$170,020
Bank mortgage processing points fee (first time home buyers) 0%	$0	$0	$0	$0	$0	$0	$0
Maximum Affordable Purchase Price	$86,521	$101,929	$117,337	$132,745	$148,152	$163,560	$178,968

Costs and Spatial Implications

Unit Types	Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1
Developer's Sale Price	$86,521	$101,929	$117,337	$132,745	$148,152	$163,560	$178,968
Construction cost / SF	$ 500	$ 500	$ 500	$ 500	$ 500	$ 500	$ 500
Total Affordable Sq Ft:	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	-16%	-16%	-16%	-16%	-16%	-16%	-16%

Occupancy Density

Unit Types	Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1
Area of unit	173	204	235	265	296	327	358
Occupancy of people in unit	1	1	1	1	1	1	1
Person per Square Feet	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	-16%	-16%	-16%	-16%	-16%	-16%	-16%

[redacted]

	2 person @ 60% AMI	2 person @ 70% AMI	2 person @ 80% AMI	2 person @ 90% AMI	2 person @ 100% AMI	2 person @ 110% AMI	2 person @ 120% AMI
	$30,100	$35,117	$40,134	$45,150	$50,167	$55,184	$60,200
	$9,030	$10,535	$12,040	$13,545	$15,050	$16,555	$18,060
	$9,030	$10,535	$12,040	$13,545	$15,050	$16,555	$18,060
	$8,395	$9,877	$11,359	$12,842	$14,324	$15,807	$17,289
	$94,505	$111,194	$127,883	$144,571	$161,260	$177,949	$194,638
	95%	95%	95%	95%	95%	95%	95%
	$99,479	$117,046	$134,613	$152,181	$169,748	$187,315	$204,882
	$4,974	$5,852	$6,731	$7,609	$8,487	$9,366	$10,244
	$94,505	$111,194	$127,883	$144,571	$161,260	$177,949	$194,638
	$0	$0	$0	$0	$0	$0	$0
	$99,479	$117,046	$134,613	$152,181	$169,748	$187,315	$204,882
	Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1
	$99,479	$117,046	$134,613	$152,181	$169,748	$187,315	$204,882
$	500	$ 500	$ 500	$ 500	$ 500	$ 500	$ 500
	[redacted]						
	-16%	-16%	-16%	-16%	-16%	-16%	-16%
	Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1
	199	234	269	304	339	375	410
	2	2	2	2	2	2	2
	-16%	-16%	-16%	-16%	-16%	-16%	-16%

	4 person @ 60% AMI	4 person @ 70% AMI	4 person @ 80% AMI	4 person @ 90% AMI	4 person @ 100% AMI	4 person @ 110% AMI	4 person @ 120% AMI
	$37,680	$43,960	$50,240	$56,520	$62,800	$69,080	$75,360
	$11,304	$13,188	$15,072	$16,956	$18,840	$20,724	$22,608
	$11,304	$13,188	$15,072	$16,956	$18,840	$20,724	$22,608
	$10,634	$12,490	$14,346	$16,202	$18,057	$19,913	$21,769
	$119,720	$140,612	$161,503	$182,395	$203,286	$224,178	$245,069
	95%	95%	95%	95%	95%	95%	95%
	$126,021	$148,012	$170,003	$191,995	$213,986	$235,977	$257,968
	$6,301	$7,401	$8,500	$9,600	$10,699	$11,799	$12,898
	$119,720	$140,612	$161,503	$182,395	$203,286	$224,178	$245,069
	$0	$0	$0	$0	$0	$0	$0
	$126,021	$148,012	$170,003	$191,995	$213,986	$235,977	$257,968
	Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1
	$126,021	$148,012	$170,003	$191,995	$213,986	$235,977	$257,968
$	500	$ 500	$ 500	$ 500	$ 500	$ 500	$ 500
	[redacted]						
	-16%	-16%	-16%	-16%	-16%	-16%	-16%
	Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1
	252	296	340	384	428	472	516
	4	4	4	4	4	4	4
	-16%	-16%	-16%	-16%	-16%	-16%	-16%

Scenario 1: Land is not market and costs are maintained with median housing system.

Observations:

Square Footage allocation is enhanced by 68%
Per person occupancy allocation is reasonable.
Risk is managed but this is not straight forward market financing.

Givens & Assumptions:

NYC AMI (gross annual income)	$	62,800
% of gross income available for PITI mortgage loan		30%
Estimated Real Estate taxes as a percentage of funds available		1.5%
Home Insurance Costs	$	500
Estimated Annual Mortgage Constant Charged by Lender for 30 Year Fixed Interest Loan		8%
Amortization Period		30
Equity down payment as a % of Purchase Price		5%
NYC Market Housing Construction Cost/SF	$	[illegible] Assuming that Land is 50% of Total Development Costs

Home ownership Housing Calculation

Targeted Income Population		1 person @ 60% AMI	1 person @ 70% AMI	1 person @ 80% AMI	1 person @ 90% AMI	1 person @ 100% AMI	1 person @ 110% AMI	1 person @ 120% AMI
Annual Household Income Targets		$26,400	$30,800	$35,200	$39,600	$44,000	$48,400	$52,800
% of annual income available towards housing		$7,920	$9,240	$10,560	$11,880	$13,200	$14,520	$15,840
Sample Calculation for target population Scenario 1								
Max. funds available for mortgage		$7,920	$9,240	$10,560	$11,880	$13,200	$14,520	$15,840
(Real Estate Taxes)		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
(Home Insurance)		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Remaining funds available for Principle and Interest toward Mortgage		$7,301	$8,601	$9,902	$11,202	$12,502	$13,802	$15,102
Maximum Sustainable Mortgage		$82,195	$96,833	$111,470	$126,107	$140,745	$155,382	$170,020
Percentage of Purchase Price								
Represented by Mortgage		95%	95%	95%	95%	95%	95%	95%
Maximum Affordable Purchase Price		$86,521	$101,929	$117,337	$132,745	$148,152	$163,560	$178,968
Equity Down Payment		$4,326	$5,096	$5,867	$6,637	$7,408	$8,178	$8,948
Mortgage Loan		$82,195	$96,833	$111,470	$126,107	$140,745	$155,382	$170,020
Bank mortgage processing points fee (first time home buyers)	0%	$0	$0	$0	$0	$0	$0	$0
Maximum Affordable Purchase Price		$86,521	$101,929	$117,337	$132,745	$148,152	$163,560	$178,968

Costs and Spatial Implications

	Unit Types	Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1
Developer's Sale Price		$86,521	$101,929	$117,337	$132,745	$148,152	$163,560	$178,968
Construction cost / SF		$ 250	$ 250	$ 250	$ 250	$ 250	$ 250	$ 250
Total Affordable Sq Ft.		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
		68%	68%	68%	68%	68%	68%	68%

Occupancy Density

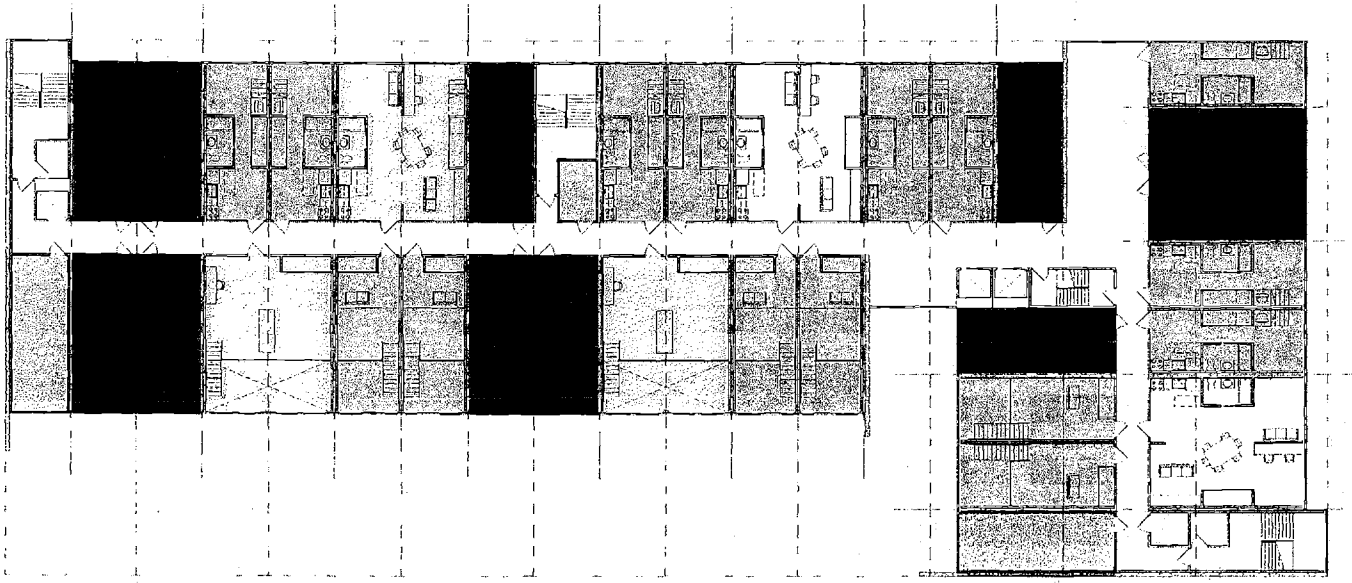
Unit Types		Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1
Area of unit		346	408	469	531	593	654	716
Occupancy of people in unit		1	1	1	1	1	1	1
Person per Square Feet		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
		68%	68%	68%	68%	68%	68%	68%

[redacted]

2 person @ 60% AMI	2 person @ 70% AMI	2 person @ 80% AMI	2 person @ 90% AMI	2 person @ 100% AMI	2 person @ 110% AMI	2 person @ 120% AMI
$30,100	$35,117	$40,134	$45,150	$50,167	$55,184	$60,200
$9,030	$10,535	$12,040	$13,545	$15,050	$16,555	$18,060
$9,030	$10,535	$12,040	$13,545	$15,050	$16,555	$18,060
[redacted]						
$8,395	$9,877	$11,359	$12,842	$14,324	$15,807	$17,289
$94,505	$111,194	$127,883	$144,571	$161,260	$177,949	$194,638
95%	95%	95%	95%	95%	95%	95%
$99,479	$117,046	$134,613	$152,181	$169,748	$187,315	$204,882
$4,974	$5,852	$6,731	$7,609	$8,487	$9,366	$10,244
$94,505	$111,194	$127,883	$144,571	$161,260	$177,949	$194,638
$0	$0	$0	$0	$0	$0	$0
$99,479	$117,046	$134,613	$152,181	$169,748	$187,315	$204,882
Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1
$99,479	$117,046	$134,613	$152,181	$169,748	$187,315	$204,882
$ 250	$ 250	$ 250	$ 250	$ 250	$ 250	$ 250
[redacted]						
68%	68%	68%	68%	68%	68%	68%
Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1
398	468	538	609	679	749	820
2	2	2	2	2	2	2
[redacted]						
68%	68%	68%	68%	68%	68%	68%

4 person @ 60% AMI	4 person @ 70% AMI	4 person @ 80% AMI	4 person @ 90% AMI	4 person @ 100% AMI	4 person @ 110% AMI	4 person @ 120% AMI
$37,680	$43,960	$50,240	$56,520	$62,800	$69,080	$75,360
$11,304	$13,188	$15,072	$16,956	$18,840	$20,724	$22,608
$11,304	$13,188	$15,072	$16,956	$18,840	$20,724	$22,608
[redacted]						
$10,634	$12,490	$14,346	$16,202	$18,057	$19,913	$21,769
$119,720	$140,612	$161,503	$182,395	$203,286	$224,178	$245,069
95%	95%	95%	95%	95%	95%	95%
$126,021	$148,012	$170,003	$191,995	$213,986	$235,977	$257,968
$6,301	$7,401	$8,500	$9,600	$10,699	$11,799	$12,898
$119,720	$140,612	$161,503	$182,395	$203,286	$224,178	$245,069
$0	$0	$0	$0	$0	$0	$0
$126,021	$148,012	$170,003	$191,995	$213,986	$235,977	$257,968
Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1
$126,021	$148,012	$170,003	$191,995	$213,986	$235,977	$257,968
$ 250	$ 250	$ 250	$ 250	$ 250	$ 250	$ 250
[redacted]						
68%	68%	68%	68%	68%	68%	68%
Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1	Single Type 1
504	592	680	768	856	944	1,032
4	4	4	4	4	4	4
[redacted]						
68%	68%	68%	68%	68%	68%	68%

Higher Occupancy ***Humanism***:
The Trade-Offs for Encouraging Middle-Income Housing in a Global City



Type 1 - Single Resident Unit

Type 2 - Double Unit

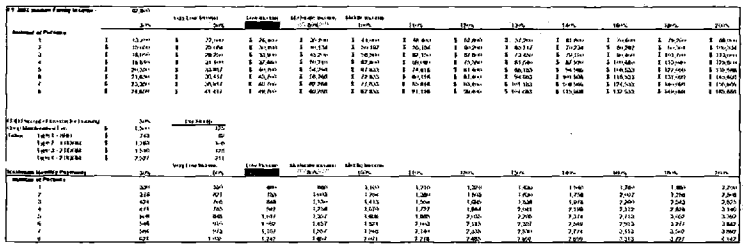
Type 3 - Double Unit

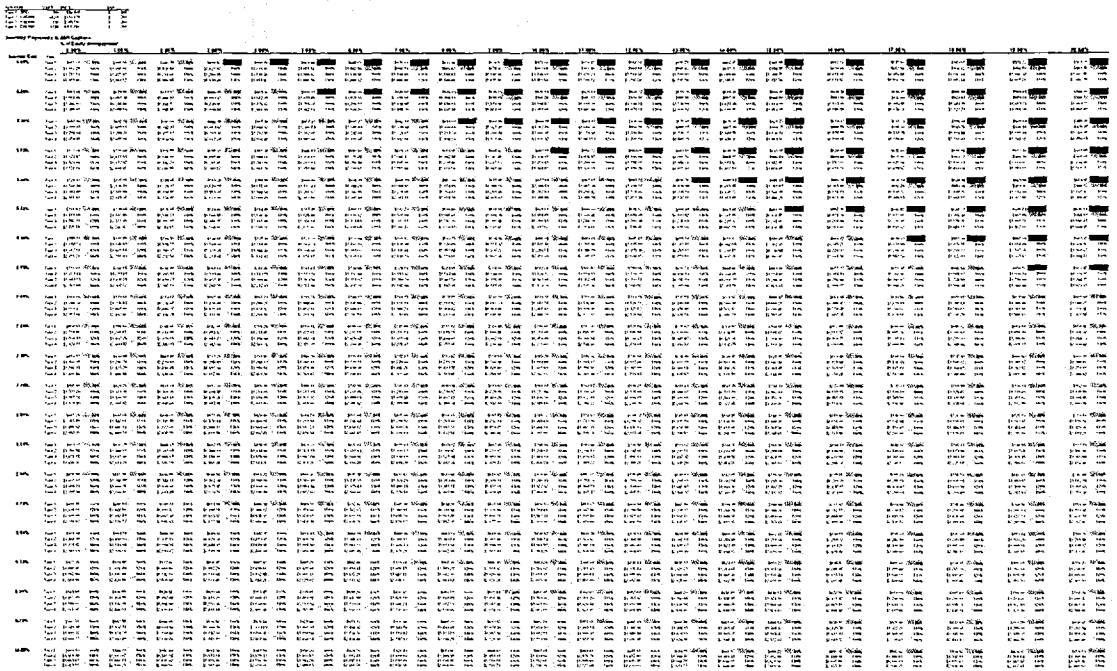
Type 4 - Quad Unit

Circulation and Common Areas

Mechanical and Storage

Observations:
1. Type 1 achieves 60% of AMI as long as there is a low interest rate environment and a 3% of equity down payment is obtained.
2. The Type 2 unit achieves 80% of AMI for the majority of situations.
3. Type 3 & Type 4 achieve middle income affordability throughout.
4. All units fall within 60%-180% of AMI as targeted.





Version A: Typical Plan & AMI Support

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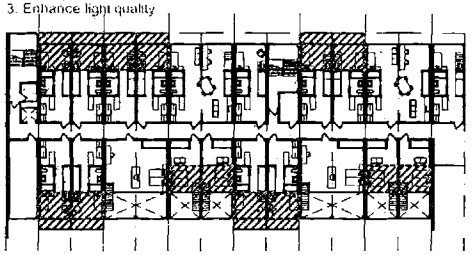
Appendix C

Variation Diagram 1

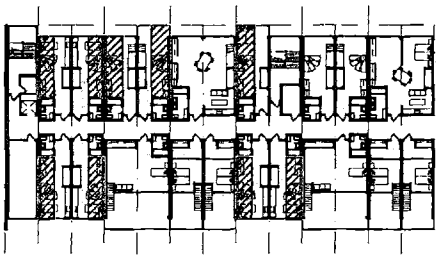
Priorities:
1. Augment spatial quality
2. Give more areas of privacy
3. Enhance light quality



Areas of maximum gain in quality enhancements

Flexible Variation Diagram 2

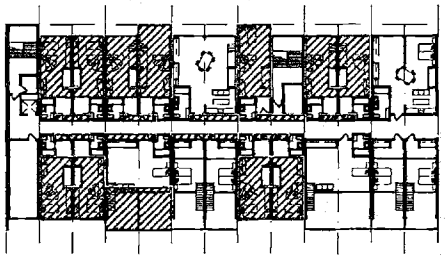
Priorities:
1. Gain more contiguous open space within unit
2. Allow an easier method for light to reach the back of unit



Areas of maximum gain in quality enhancements

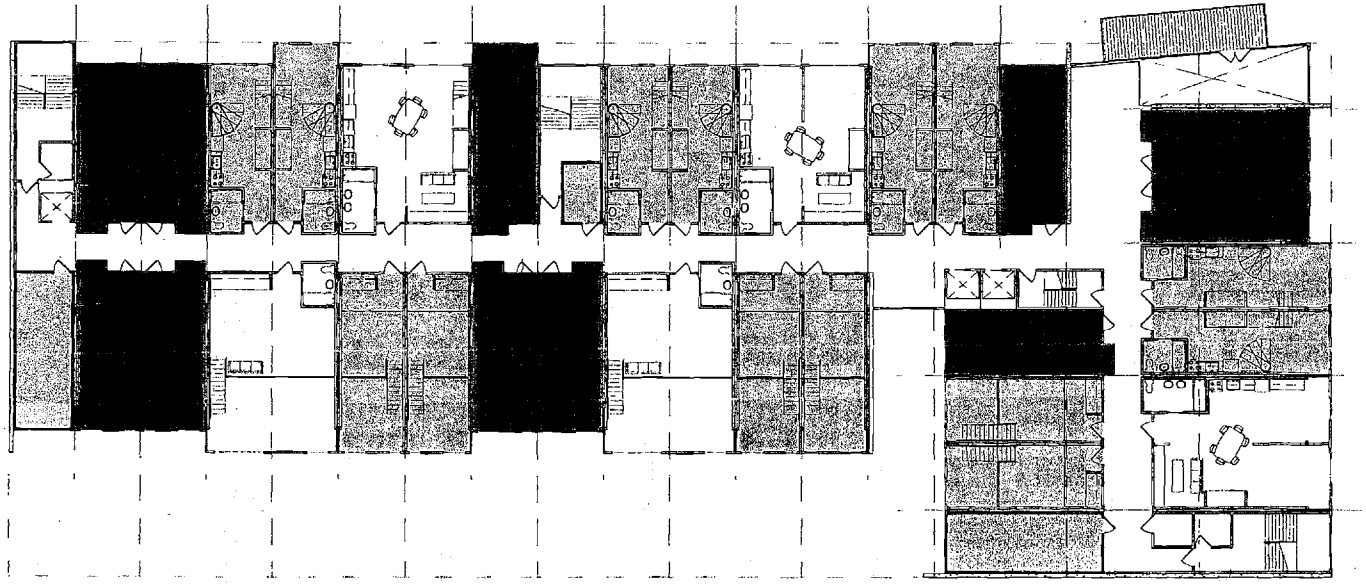
Flexible Variation Diagram 3

Priorities:
1. Distinguish privacy for entry
2. Delineate space within units
3. Expand common area circulation
4. Expand the living/bedroom capacity



Areas of maximum gain in quality enhancements

Higher Occupancy ***Humanism***:
The Trade-Offs for Encouraging Middle-Income Housing in a Global City



Type 1 - Single Resident Unit

Type 2 - Double Unit

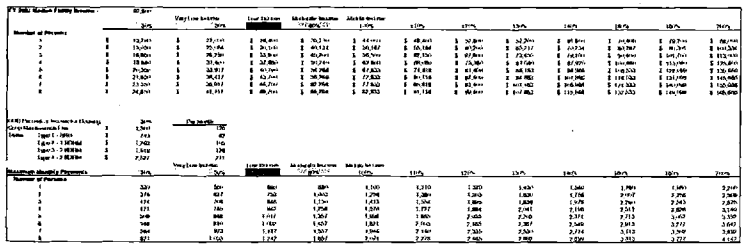
Type 3 - Double Unit

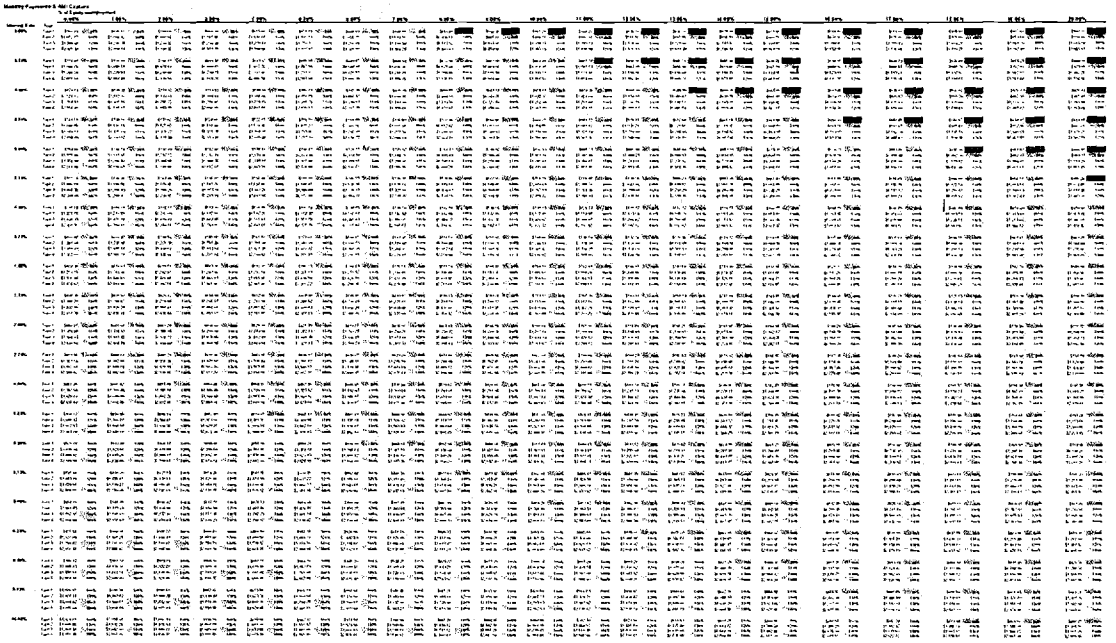
Type 4 - Quad Unit

Circulation and Common Areas

Mechanical and Storage

Observations:
1. The design enhancements while maintaining the existing facade system can accomodate the 60% of AMI as the lowest threshold. However, the 60% income group is not as well supported as Version A.





Version B: Design Enhancements & AMI

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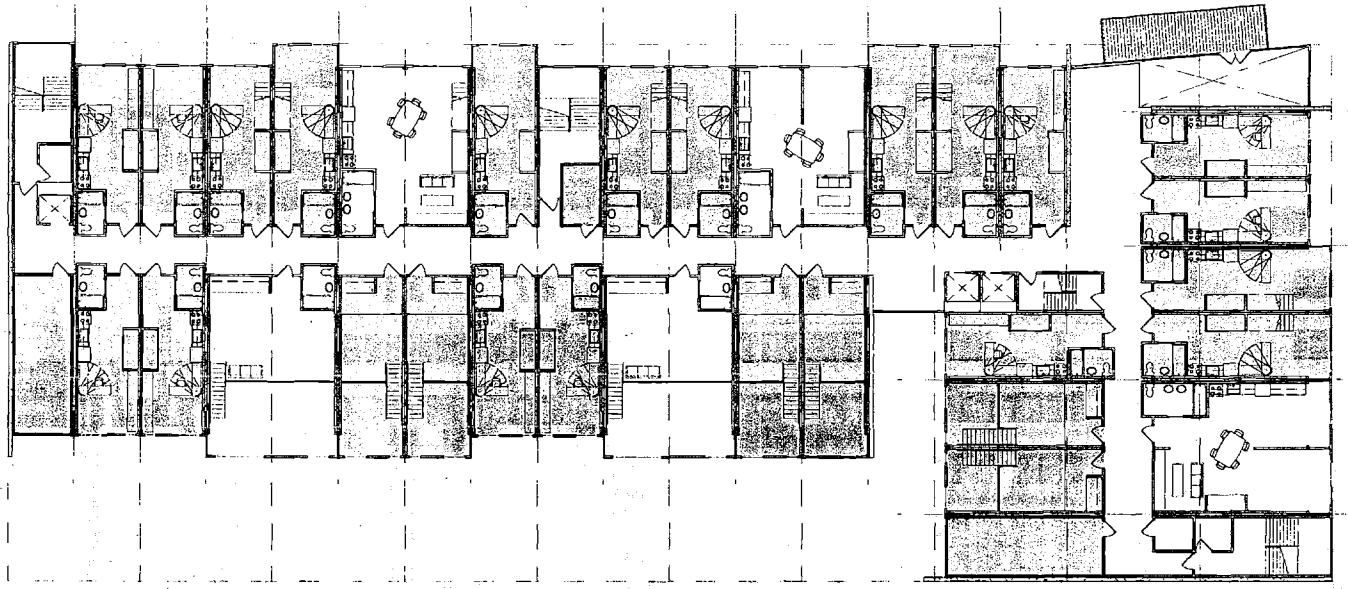
Higher Occupancy ***Humanism***:
The Trade-Offs for Encouraging Middle-Income Housing in a Global City



Type 1 - Single Resident Unit

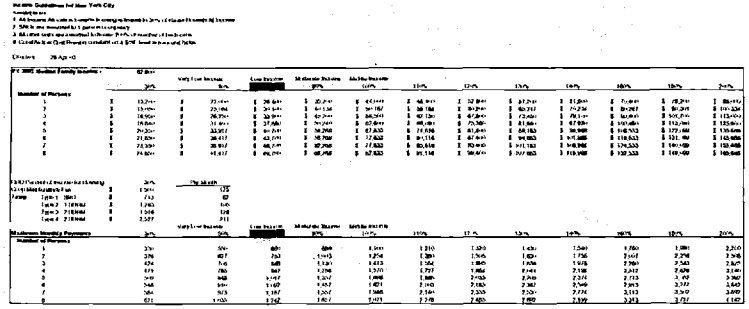
Type 2 - Double Unit

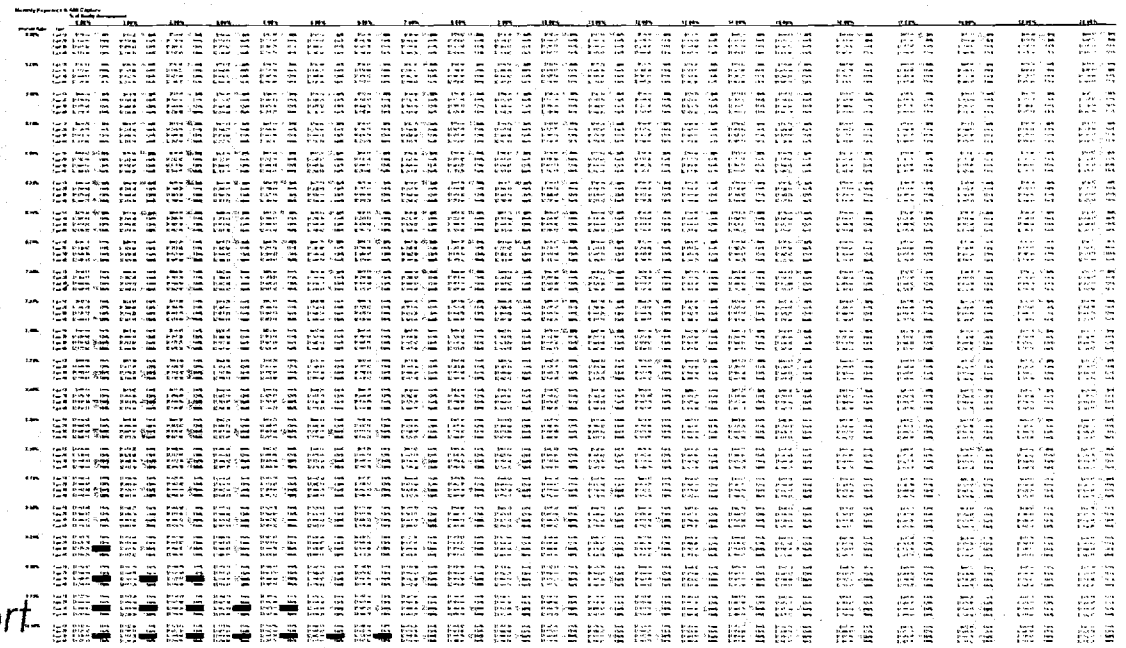
Type 3 - Double Unit

Type 4 - Quad Unit

Circulation and Common Areas

Mechanical and Storage





Observations:

1. The flexible facade pieces that maximize design enhanced features within the unit, results in a trade-off of being able to support up to the 80% of AMI as the lowest threshold.
2. The Type 3B unit becomes the most unaffordable the quickest.
3. In general, middle income affordability is maintained.

Version B': Flexible Design & AMI Support

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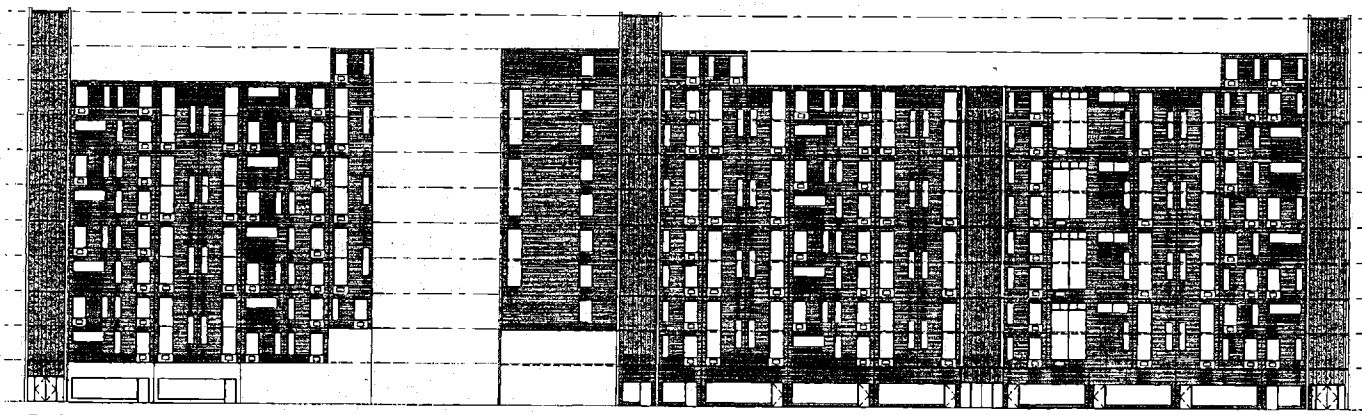
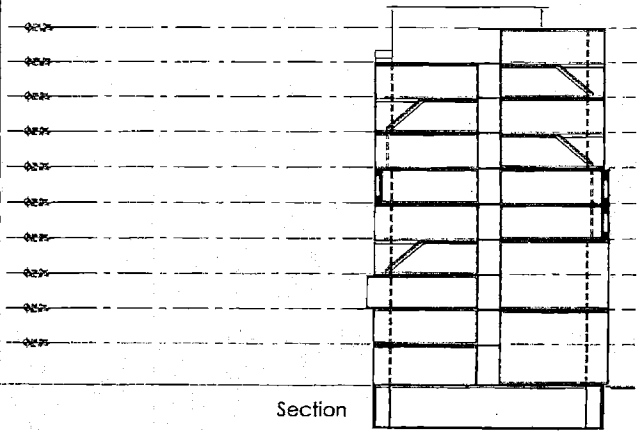
APPENDIX F

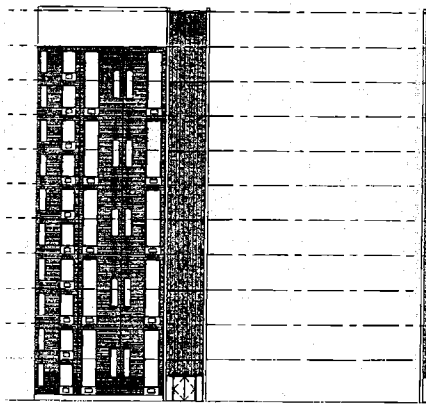


East Elevation

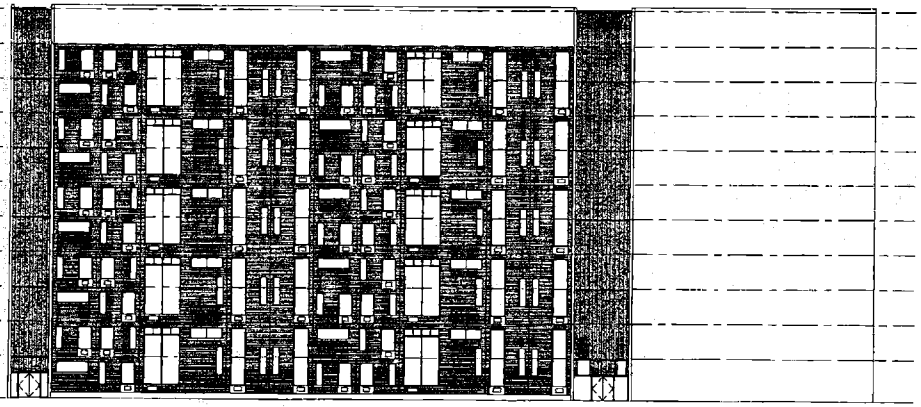
North Elevation



Section



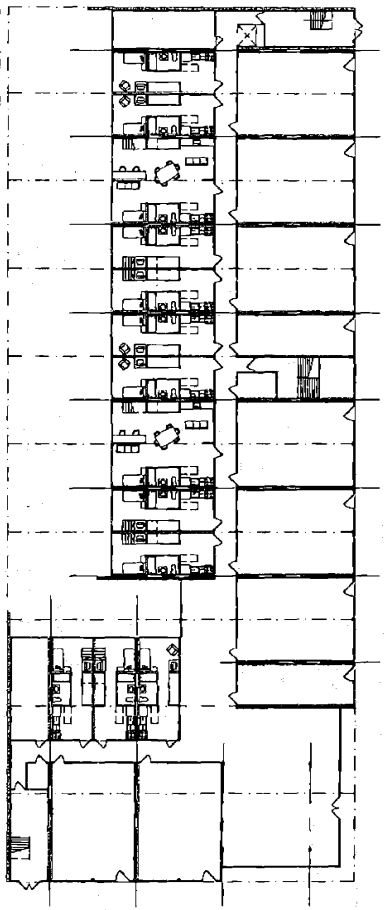
West Elevation



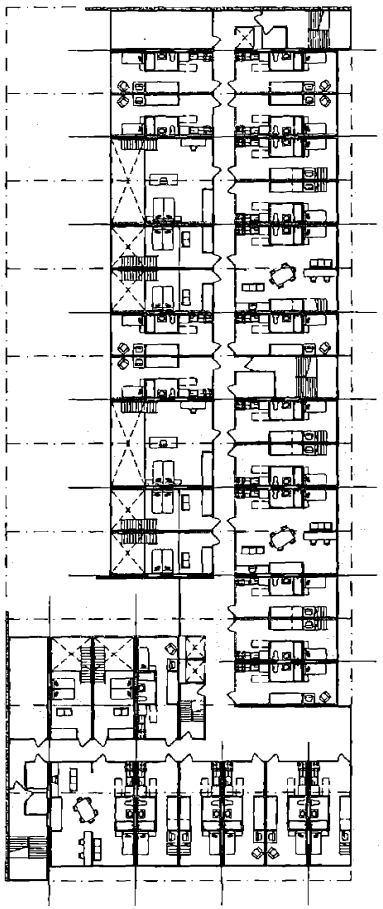
South Elevation

APPENDIX G: Version A

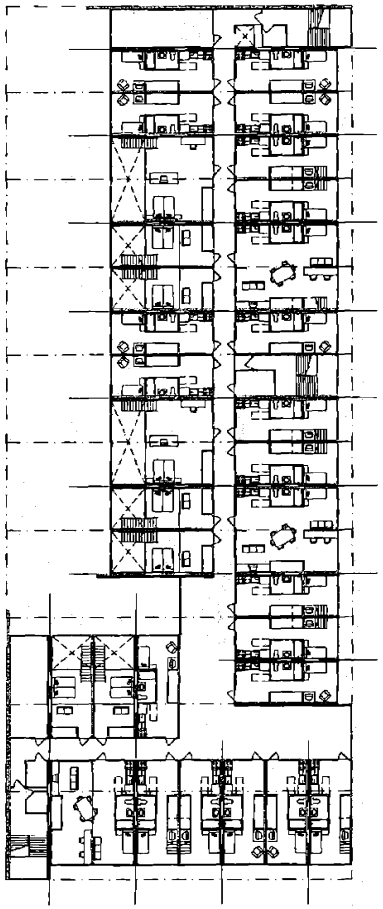
Ground Floor Plan
1/8"=1'0"



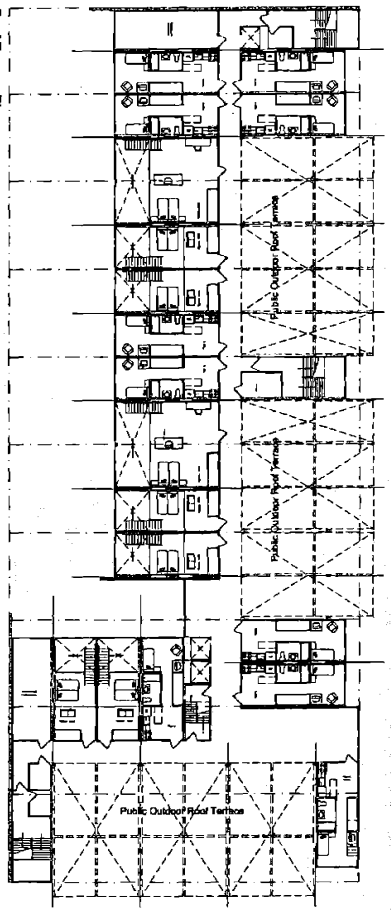
Second Floor Plan
1/8"=1'0"



Typical Plan
1/8"=1'0"

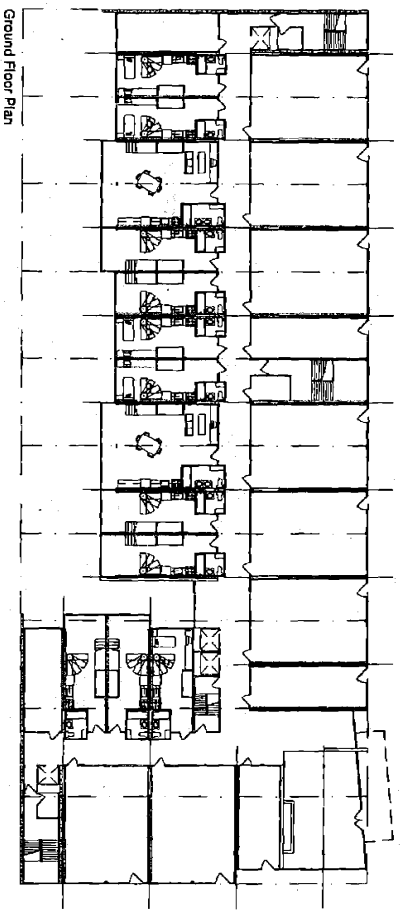


Roof Terrace Plan
1/8"=1'0"

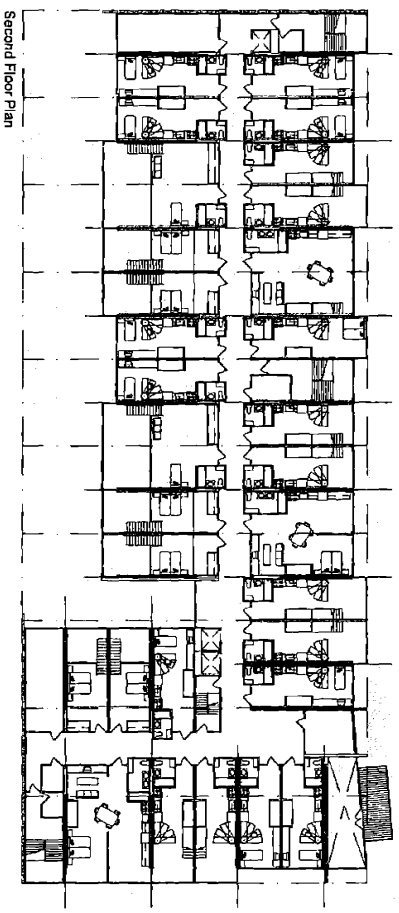


APPENDIX H: Version B

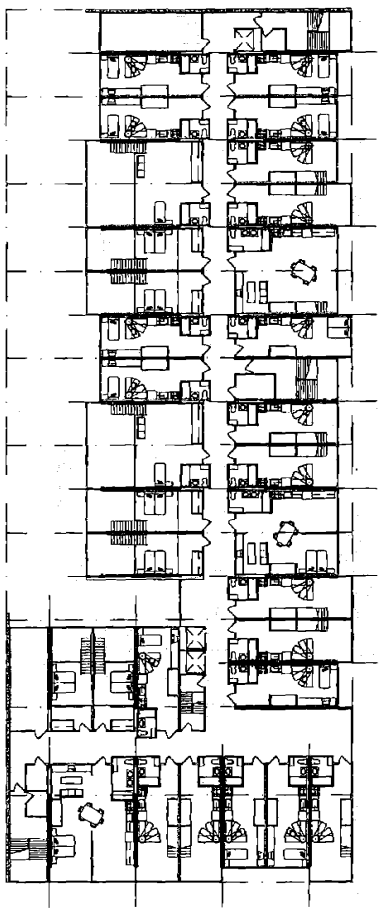
Ground Floor Plan
1/8"=1'0"



Second Floor Plan
1/8"=1'0"



Typical Plan
1/8"=1'0"



Roof Terrace Plan
1/8"=1'0"