

# An Analysis of the Parameters which Affect the Expandability and Flexibility of Socialized Housing

Case Study: Subdivisions on the Eastern part of Metro Manila



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## Introduction

To provide an affordable housing is a gargantuan problem especially in the developing countries. Partly, this problem is due to the ratio of the fund allotted to finance the development of socialize housing and those families needing the funding to access the housing.

To own a house is a part of the social status of the Filipinos. It is a showcase of the individual personality and the standard of living of the Filipino family. The collective personality of the Filipino family is imparted in the design of the house structure including the personality of the designer. The amount of money involved in the procurement of the lot and the construction of the house including its maintenance and improvements is a gauge of the standard of living of the family.

This paper attempts to describe the processes in the determination of the parameters that affects the expandability and flexibility of socialized housing in the Philippines. The study will further analyze the weights of the individual factors and finally to derive an equation that will rate the efficiency of the designed and constructed socialized housing units. The researcher envisions that the paper will open opportunities to researches relating to floor and lot area ratio

and building densities that will promote sustainable development and the development of an efficient and economical structural system that is flexible.

# 1 Shelter Situation Analysis

## 1.1 Basic General Data

### Geography and Administration

The Philippines is an archipelago comprising of more than 7100 islands. The country lies on the southeastern coast of Asia and surrounded by two big bodies of water, the Pacific Ocean to the east and the China Sea to the west.

Geographically, the country is 4° 23' north to 21° 25' north latitude and 116° east to 127° east longitude.<sup>1</sup> The land area of the Philippines is 300,000 sq. m. and the climate is hot and humid.<sup>2</sup>

The archipelagic country is divided into three main groups of island. The biggest of the group is Luzon with Metro Manila as its main city. At the middle is Visayas, comprising of scattered group of islands, and the main city is Metropolitan Cebu. Mindanao is the southern most group with Metro Davao as its main city.

The 1987 Philippine Constitution advocates for a democratic system wherein the powers rest on the three co equal government branches; the Executive branch is headed by the president, the Legislative branch or the Congress is divided into the upper house or the senate and having 24 members and the lower house with 250 members, the Judicial branch, the highest body is the Supreme Court with 14 members and headed by the Chief Justice.

The members of the executive and the legislative branch are elected by the people to serve for a period of six years without re-election while the members of the Supreme Court are sworn in by the president from nominations coming from the Judicial Bar Council (JBC) to serve the court till they retire.<sup>1</sup>

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<sup>1</sup> NARIA

<sup>2</sup> NSO

## Demography and Health

The Philippines recorded a population of 84.241 million as of 2005 the NSO census record. The population as annual growth rate of 2.04% from the period of 2000 to 2007. The population of Metro Manila is 11553427 accounting to 13.04% of the national population. The present population density in Metro Manila is 19379 persons per square kilometre while nationally it is 295 persons per square kilometer. The average household member is 5. The estimated number of households is 16848.2 million based on the average household member.

Nationally the leading cause of death is diseases of the heart. The share of health expenditure to the gross domestic product is 3.1%.

## Economy

The 2008 economic indicator's gross national product is 6.1% while the gross domestic product is 4.6% for the whole country.

## 1.2 Shelter Related Fact and Figures

### Access to Shelter:

#### Housing stock

The Medium-Term Philippine Development Plan (MTPDP) for 2004-2010 stipulates that the priority of the National Government is poverty alleviation. The MTPDP enumerates five parts addressing to the United Nations Millennium Development Goals. Housing is one of the key components of Part I “Economic Growth and Job Generations” (NEDA, Medium Term Philippine Development Program, 2004-2010)

#### Housing deficit (quantitative and qualitative)

The accumulated need for housing in 2007 was 1.28 million which was broken down into those households in unacceptable housing units (homeless, dilapidated/condemned housing, and marginal housing), Doubled-up household in acceptable housing units and the projected housing needs.

#### Yearly percentage increase in number of dwelling units

## Occupancy

Metro Manila recorded a 97.4% of occupied dwelling units while the unoccupied has a 2.6% tally. Nationally the percentages of occupied and unoccupied dwelling units are slightly lower

## Housing standard

The National Building Code of the Philippines (PD 1096) sets the standards for the design and development of housing in the Philippines. The law on socialized housing BP 220 sets forth lower requirements for the design and development of a socialized housing to be affordable.

## Tenure of households

Metro Manila has almost 2.1 million households with 48% (about 1,008,000 households) owning or amortizing their housing. More than 30% (about 690,000) rent their housing units while 11% occupy their units free with owner's consent.

## House price to income ratio

Basing from gross floor areas enumerated by BP 220 and the minimum wage earned by family member(s), the house price to income ratio is 1.67 to 2.2.

## Land

The PD 1096 enumerates five land uses for housing, the low density, medium density, high density socialized housing, and for commercial housing.

## Housing construction

The conventional construction method of a house construction is used in the Philippines.

## Building materials

Reinforced concrete is commonly used in the construction of housing units in combinations of steel and lumber products.

## Access to and cost of Basic Services/Infrastructure

The residents of Metro Manila have access to the basic services/infrastructure and the cost to these services/infrastructure is legal enough since the cost are controlled by different regulatory boards by the government.

## Access to and cost of Education

The citizen of the country enjoys a free primary education provided for by the Department of Education and a limited access to free education in the secondary and tertiary levels of education

## 1.3 Housing Policy

The 1987 Constitution of the Republic of the Philippines under Article XIII mandates the "State to undertake a continuing program of urban land reform and housing, which will make available at affordable cost decent housing and basic

services to underprivileged and homeless citizens in urban centers and resettlement areas.

## 1.4 Actors in Shelter Delivery and their Roles

### 1.5 Shelter Design

#### Physical Planning

The professional that undertakes the physical planning of a housing unit are the architects responsible for the planning and design of the housing and the allied professions, the structural engineers, Sanitary engineers, and the electrical engineers for the structural design, sanitary and electrical designs respectively.

#### Land Use

As mandated by the Local Government Code, all cities and municipalities are mandated to formulate a Comprehensive Land Use Plan (CLUP) that will serve as the Local Government Unit's (LGU's) Comprehensive Development Plan and the Land Use Plan. The CLUP designates the type and intensity of land uses throughout the city or municipality. The Zoning Ordinance is the legal instrument that enforces the LGU's Land Use Plan.

#### Population Density

The laws that designates densities of housing/dwelling units are PD 957 identifying low, medium and high densities of housing, BP 220 stating a very high density of more than 200 dwelling units to a hectare and the Local Government Unit (LGU) zoning ordinance. The BP 220 allows maximum of more than a thousand populations to a hectare.

#### Shelter Quality

Housing development must comply to the requirements of the National Building Code of the Philippines (PD 1096) and other referral codes (Structural, Electrical, Sanitary, and Fire Code). The LGU (cities and municipalities) may issue additional ordinances pertaining to design and construction of buildings

Batas Pambansa 220 – National Law on socialized Housing – relaxed the standards in order to reduce development and construction costs and to make it more affordable to the lower – income group. The minimum lot size is 32 sq. m. and a minimum floor area of 18 – 24 sq. m. socialized housing.

## Presidential Decree 957 – Regulating the sale of Subdivision Lots and Condominiums, Providing Penalties for Violations Thereof.

- Follows the provisions of the National Building Code of the Philippines.
- Socialized housing-density of up to 100 dwelling units per hectare translating it into 70 sq. m. lot area.

### Housing Types

- Single – detached
- Semi – detached
- Cluster
- Row house (two story)
- Multi story apartments (with maximum heights of 4 stories) provided these do not pose problem on siting, privacy and / or amenity.
- Condominium project (40 sq. m. for household and 30 sq. m. for single occupancy units.

## 2 Organisation

The Far Eastern University (FEU) is a private non-sectarian university founded in 1928. Its 3 campuses were relegated to the sister companies FERN, FEU East Asia. The main campus is located in Sampaloc, Manila.

FEU Institute of Architecture and Fine Arts was established in 1950s offering B.S. Architecture and Bachelor of Fine Arts. The proponent to the program is a regular faculty member teaching the courses on Housing, Planning, and Building Technology. He is also engaged in the private practice of architecture and in planning consultancies. The graduates of the Institute(IARFA) have become key players to the building industry.

The University extension to the community is engaged in the upgrading of the housing units of the marginalized poor in coordination of the Gawad Kalinga. The proponent helps in the evaluation of the different housing units to be upgraded.

The newly integrated courses / subjects can help in the awareness of community planning ang housing.

### 3 Shelter Problem

For the past 30 years the factor affecting the housing problem, affordability, have been tackled by different administrations in different angles, as to how housing had to be defined according to Manahan. Laws were enacted to alleviate the disparity of available fund for housing and to make housing development economically feasible. Design standards were sacrificed. Government and private developers have come up with different schemes of housing development based on these laws.

The heavy burden by low and middle-income families to access housing is the cost of the housing package i.e. the cost of constructing a house and the purchase of a lot. The limited land area of the Philippines and the increasing number of families that are in need for housing is putting a pressure on the land are allotted/assigned to housing. The increasing competition for the use of land causes an ever-increasing value of land (price per sq. m. of land space). Over the years the housing package shrunk from a detached bungalow with a modest lot area to a squeezed row house and a small lot. Settlement densities grew from less than a hundred to a hectare to more than two hundred to a hectare.

Land value is the base line for the determination of the density of development. Raw land always commands the lowest price value of land space per sq.m. Developments within and outside the property and land uses built upon the land (the local government term is lot improvements house.) raise the value of the land space.

Economic consideration or the cost of delivering the developed housing package is the primary factor in the design of the design of the house. This is the answer of those institutions engaged in the delivery of housing to the issue of affordability.

To follow the requirements of the existing laws, PD 957 and PD 1096 would become unaffordable to the beneficiaries of socialized housing. The price per sq.m. of constructing a socialized housing unit would demand an amount of three to six times the price of the lot. The ratio between the house/shell development cost and the lot price ranges from one and a quarter (1.25) to more than twice the price of the lot. The house then is a big factor in the initial cost of the housing package, hence an obstacle to the access of housing. A new law was promulgated, the Batas Pambansa 220, The Rules and Standards for Economic and Socialized

Housing Projects, setting minimum standards and guidelines for the planning, design and development of socialized housing.

Socialized housing refers to housing programs and projects covering houses and lots and homelots undertaken by the government or the private sector for the underprivileged and homeless citizens which shall include sites and services development, long term financing, liberalizing terms on interest payments, and such benefits in accordance with the provisions of R.A. 7279 or The Urban and Development and Housing Act of 1992.

The quality of housing to be found within a settlement reflects the owner's economic status. Affordability is the main problem of accessibility for the families that belong to the low and middle-income groups. Once accessed, living in it is the second phase of the family problem. This problem is compounded if the family has not yet finished paying for the amortization of the housing package. Renovating a house (this may include addition of internal spaces) will incur a cost of 20% to 65% more on the price of the house (cost of construction per sq.m.). This assessment is based on the conventional construction method using mostly industrial building materials.

The conventional method of designing and constructing a house is primarily dictated by the industry. Construction materials produced by the building/construction industry dictates the design and construction of what composes the building envelope thus affecting the enveloped areas and the volume produced.

House design tend to become a finality, i.e., indifferent to the social and physical needs of the family. Expanding families (increasing number of family/household members) need more space for certain or specific activities. Because the house structure is so rigid expandability of the house/shell is superficially being considered, hence the flexibility of the housing unit is greatly affected.

The primary choice of construction materials used in the design and the construction industry is the combination of concrete and steel or the reinforce concrete. These heterogeneous structural materials are so rigid in terms of its structural properties. The secondary and tertiary choices of construction materials are lumber, then steel, though there is now a shift of choice from steel as a substitute of lumber. These building materials are used for the framing of the roofing system and the flooring system where expansion is anticipated to occur on



the house/shell. Structural properties of lumber and steel are similar in the method of joining structural members together achieving a less rigid construction method.

## 4 Proposal for Change and Improvement

The goal of this research is to come up with a means of rating the efficiency of socialized housing design that is flexible and expendable yet it is economically feasible. To achieve the goal an analysis of the different socialized houses constructed for the period of the 1970s to late 1990s was conducted.

1. The external space bounded by the legal boundaries of the lot was measured against the building foot print, i.e., the lot area and the ground floor area of the house (the original house).
2. The structural frames of the different structures were plotted and the materials including the method of construction used were identified.
3. The type and kind of roofing system was log and identified.
4. The most expensive areas to construct and very difficult to maintain were identified and measured, their location within the house were plotted and their areas were measured.
5. The location and areas of external walls and interior partitions was plotted and logged.

The identified factors that affect the flexibility and expandability of a socialized housing unit are the external and internal spaces used in expansion, the rigidity of the structural frame against change and the unmoved spaces.

Space as a factor affects the expandability of a socialized housing unit is measured on the amount of the space left for expansion. The legal working parameters of the external space is the lot boundaries, the developmental control of the Revised implementing Rules and Regulation of the National Building Code of 2004 an other relevant laws PD 957, BP 220, and the local Zoning Ordinance. The amount of external space left for expansion is taken from deducting the volume of the housing unit to the volume of space as set forth by the local zoning ordinance. Internal space expandability is dependent on the other internal spaces to be sacrificed (invasion and succession), the permanency and rigidity of the partitions and external walls to be removed and /or moved and the amount of external space left for the expansion

The function of the rigidity of the structural frame is derived from the structural property of the individual structural members. The structural property

measured is the weight to stress ratio and the design of the joints. Weight to stress ratio is an indication of the ability of the individual structural members to be able to sustain additional or extra loads without further changes on the members. The conventional structural design using reinforced concrete has a weight to stress ratio of 0.5 to 0.025, lumber has a stress ratio of 0.045 to 0.021 and steel has 0.01 to 0.008. Lumber though lightweight can carry a moderate amount of load without any modification to the original structural member. Steel with its heavy weight but with a very low weight to stress ratio can carry more than ten times more than its weight without modifying the original structure Reinforced concrete having a very low weight to stress ratio cannot take no more than a third (1/3) additional load without modification of its original structure.

In joining structural member to another, homogeneous members have almost the same property. Lumber and steel have identical joint details with the exception of steel that the material of one member to the other member can be fused when using arc welding. Reinforced concrete being heterogeneous has another joint detail. In continuous pouring of concrete the joints are monolithically fused, while a member that is joined at later time will require other structural workmanship and detail. Reinforced concrete being a heterogeneous member requires a bond between the reinforcing steel and the concrete. This can translate to exposing the reinforcing steel or taking of a portion of the structural member to construct a joint to ensure the bond between the newly poured concrete and the reinforcing steel.

Expanding a space will entail demolishing, moving and reconstructing an enclosing envelope (walls, roofs, partitions). Concrete hollow block walls that are demolished to give way to an expanding space have an almost zero percent recyclable materials (except for the steel bars) component. Double-walled lumber framed and steel framed walls/partitions have a minimal destroyed component during the process of moving the walls from its original place to a new location.

Depending on the area of the roofing system, when it comes to being moved to a higher elevation does not pose a problem. Once detached from the beams the whole roofing section or portions of it can be lifted/ elevated to a new position.

The parameters on the rating of flexibility on the building structure are the following:

- A. Rigidity on the process of connection is described as the amount of labor, materials and equipment used in the process of connection, the lesser the

consumed amount of labor, materials and equipments the higher the rating will be. This parameter is derived from the contractors (member of the PCA) and estimates done from actual constructions undertaken by the researcher.

- B. The effect of additional loads on the structural members is based on structural analysis on the design capacities of the different structural members. The rating is according to the efficiency of the structural member to accept additional loads without or with minimal alteration on the structural member. The factors of this rating are based on the amount of labor, materials, and equipments rental used in the modification process of the structural member. (Refer to table 3 on the Annex).

Flexibility in engineering system design is a design that can adopt when external changes occur. Using the right construction materials, structural system and structural components can make the house adaptive to change, its expandability. The structural frame must be able to accept additional loads with minimal changes in the member where the joints of additional structural members are made.

Expandability is the ability of a building/structure to increase in size, bulk or its volume of internal space. External factor is a crucial factor in the expandability of a house. Horizontal expansion is the first choice of the owners. Expansion occurs on the rear portion of the house where the utility spaces, the toilet and the kitchen are located. Vertical expansion follows horizontal expansion. There is a relation of the expansion order and the members of the family/household that influences decision in house improvements.

With these parameters (analyzed and presented) a rating formula on the efficiency of the designed house on its flexibility and expandability is proposed by the researcher stated as follows:

Efficiency on the flexibility and/or expandability is the fundamental function of the Exterior Space (bounded by the boundaries of the lot), the kind and composition of the structural frame and the area of the moved/relocated partitions. The weights of the cofactors are statistically derived from the rating done by consulted members of the allied professions in the design and construction industry. External space was rated the highest, followed by the structural frame, and lastly the moved/relocated walls/partitions.

$$E_F = (0.5 - 0.6) S_O + (0.35 - 0.4) S_F + (0.15 - 0.1) W$$

Where  $E_E$  - Efficiency on expandability

$S_O$  - Outside space bounded by the lot

$S_F$  - Structural Frame

$W$  - moved walls/ partitions

The upper limit on the equation is the statistical finding while the lower limit is the researchers own analysis.

The conventional method of construction using reinforced concrete as the structural frame including the prevailing masonry construction that the construction industry is using is very rigid. The area of the lot is so small allowing for a one-time expansion, horizontally on the front, rear, vertically up or the combination of those mentioned. As designers and planners, we have to look back at the traditional method of construction and how our basic community houses were laid. The balloon framing system of the traditional bahay kubo offered the most flexible structural design and the house is easily expanded when the needs arises.

The researcher recommends a further study on the weights of the different factors affecting the expandability and flexibility of socialized housing to derive more accurate weights on the different factors affecting the flexibility and expandability of socialized housing.

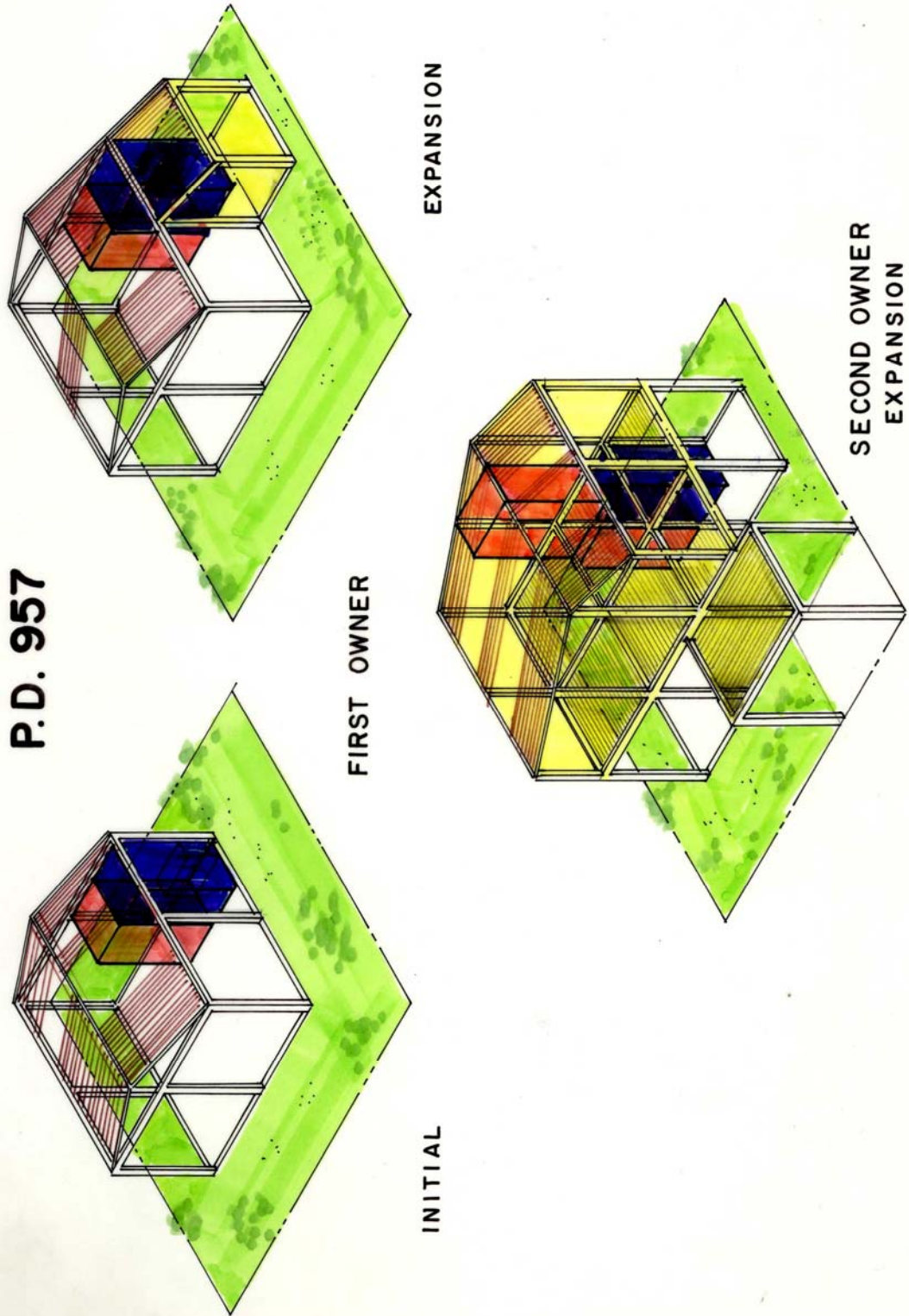
A short term action plan is to present to the home organization a proposal to undertake the relation of the Floor to Lot Area Ratio (FLAR) that will affect the density of development and what the site and the environment will offer to sustain the development.

The medium to long term action plan is to conduct research for the development of industrialized building components that imitates the structural properties of the balloon framing and to be able to apply and demonstrate these industrialized building subsystems in the actual design and construction of socialized housing with the help of the home organization and the building industry.

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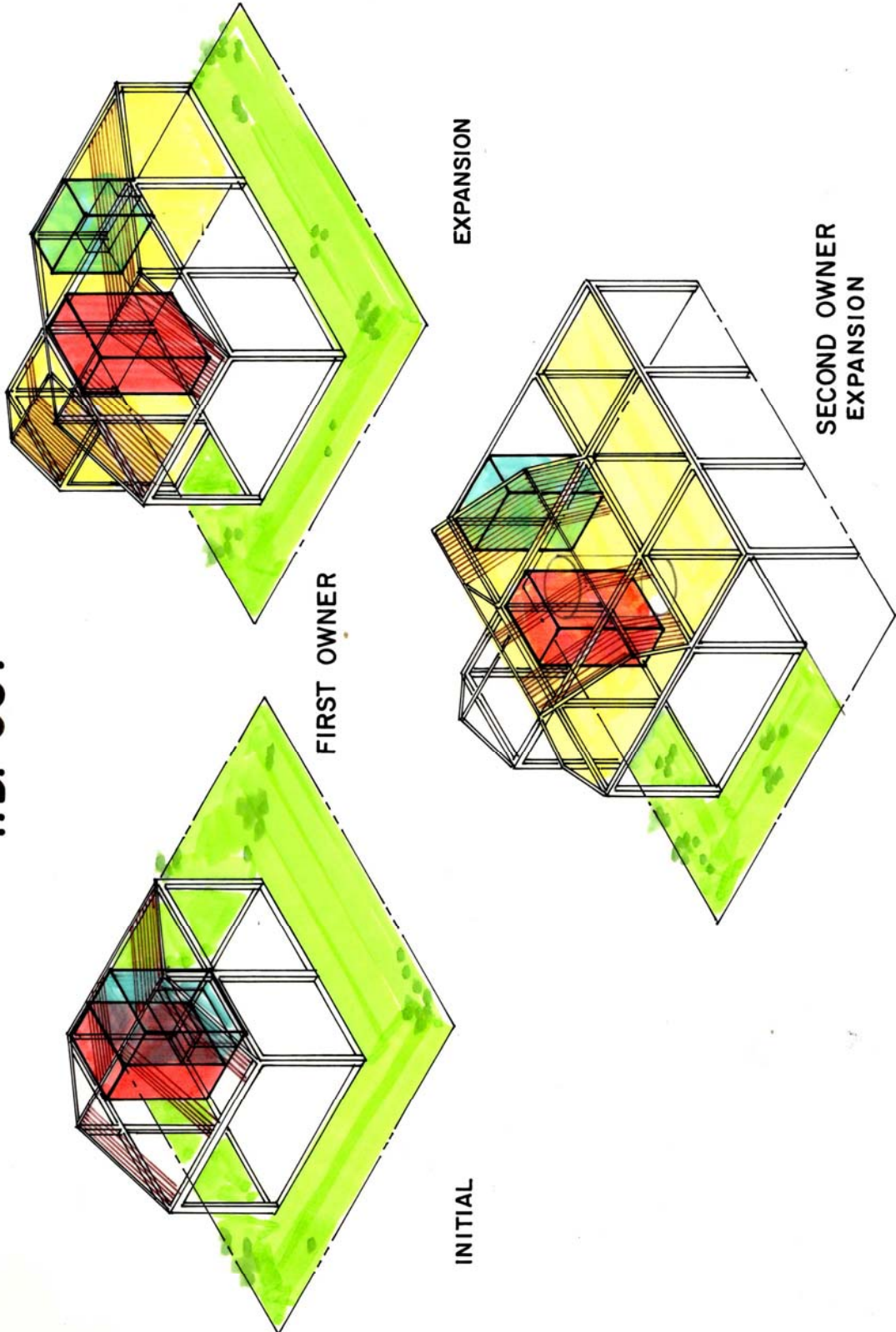
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# Annex A



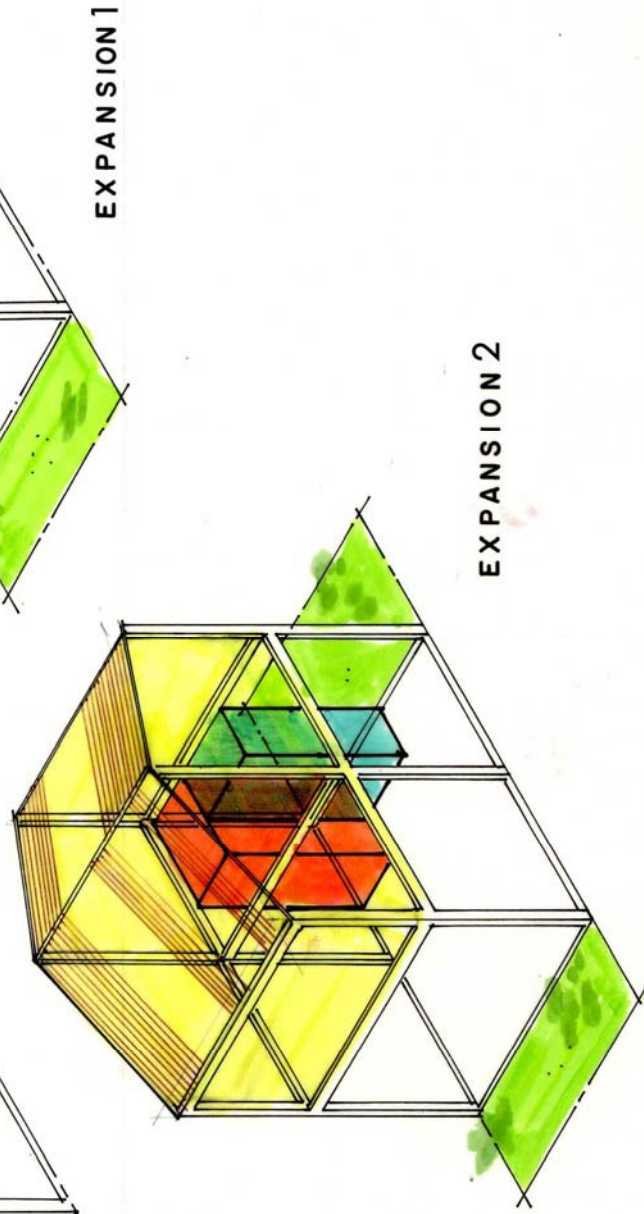
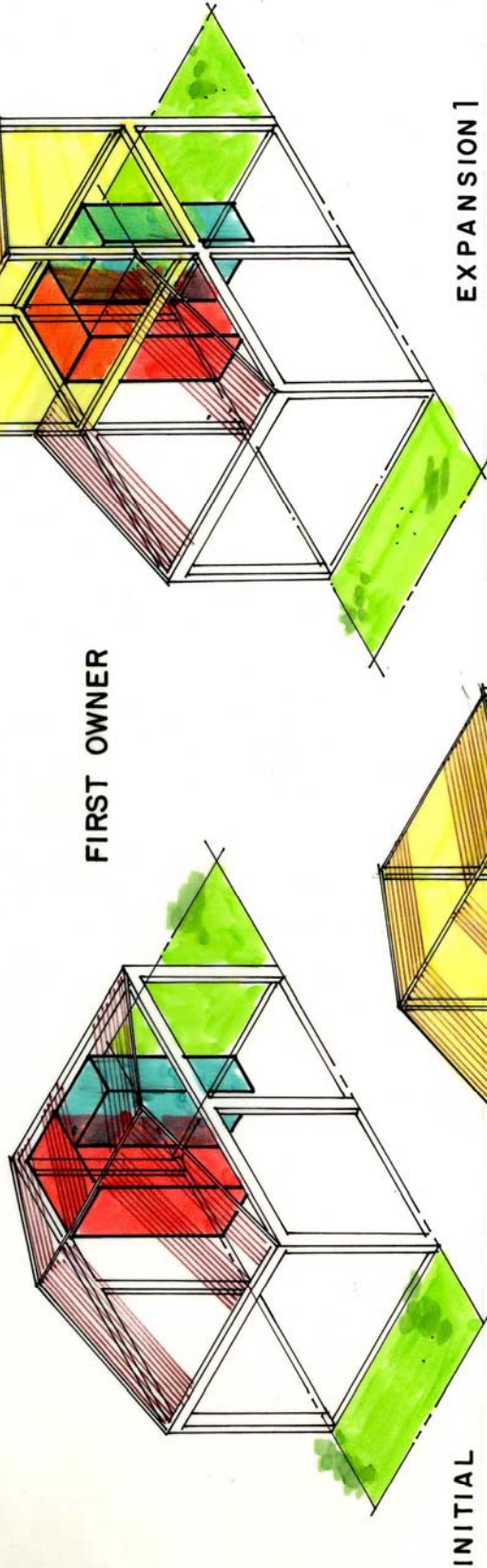
Annex B

P.D. 957



# Annex C

**B.P. 220**





## Annex D

Table 1: Showing percentile of portions of the building structural framing systems & building envelope using different building materials & method of construction.

Building Materials used in Building Structure	Building Structural components					Building Non Structural Component	
	Roof System	Structural Frame Beam/Col	Floor System	Stair	Shear Wall	Exterior Wall	Interior Partition
	A. Conventional						
Wood	70						
Steel	20	90-P	(90-P) 70	NILL			
Reinforced Concrete					NILL		
Masonry (CHB)					40	100 80	
B. Industrial							
Partial Building Products							
Structure System							
Subsystem (Partition)						10 10	
Exterior Walls							

Table 2: Showing expansions/ done on houses by owners' additions.

Space Description	Ownership			Location	
	1st	2nd	3rd	GND	Second
Kitchen					
Dining	80	80	90	100	
Utility/Service					
Living	20			100	
Bedroom	90	80	90	85	35
Carport	40				
Toilet & Bath	30			15	30

Table 3: Joints of structural members rigidity on the process of connection

	Rating
Wood	9
Steel	8
Reinforced Concrete	1
Industrial Building Products	6

Table 4: Effects of additional loads

	Ratings
Wood	6
Steel	8
Reinforced Concrete	3
Industrial Building Products	

Table 5: Decision making in the family regarding certain matters

	Choice of Residence	Improvement Of House	Choice of Vacation	Recreation	Buying Appliances
Husband	182	104	68	62	70
Wife	66	108	78	66	108
Both (husband & Wife)	416	444	466	458	444
Children	8	10	38	50	14
Mother in Law	-	-	2	2	-
Father in Law	-	-	-	-	-
Parents	6	6	4	4	4
Sister / Brother	10	10	8	8	8
Head aside from husband or Wife	14	14	12	12	12
Others (daughters in law)	-	-	-	-	-
	702	696	626	662	652

Table 7: Comparison of minimum Lot areas (sq.m.)

Type of Housing Lot	National Building Code	PD 957		BP 220	
		Eco	Soc	Eco	Soc
Single Detached	*301	180	100	72	64
Duplex/Single Attached		75	varies	54	48
Row Houses			50	36	28

\* NBC 2005 gave a lot area of 301 sq. m. as a basis for computation in determining development control. (Based on maximum allowed width & depth of enclosed structure which is 10.00 m x 15.00 m respectively.