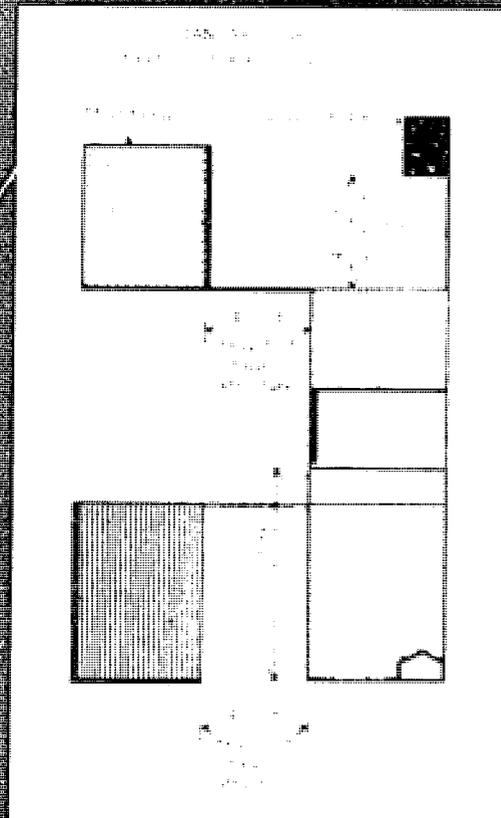


PROPOSED MINIMUM STANDARDS

FOR PERMANENT LOW-COST HOUSING
AND FOR THE IMPROVEMENT OF
EXISTING SUBSTANDARD AREAS



Prepared for the Agency for International Development
by the Office of International Affairs
Department of Housing and Urban Development
Washington, D.C. 20410

IDEAS AND METHODS EXCHANGE NO. 64 ■ 602.2 HOUSING CODES AND STANDARDS

**Ideas and Methods Exchange No. 64
602.2 Housing Codes and Standards**

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**May 1966
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FOREWORD

At the request of the Latin America Bureau, Agency for International Development, these proposed minimum standards were developed by the Office of International Affairs, Department of Housing and Urban Development, for use in Latin America. They are based principally on codes, ordinances and standards obtained from countries in Central and South America and the Caribbean Area, and on discussions with officials and technicians of selected countries in these regions. In so far as possible, they are performance standards, rather than specification standards and thus are generally applicable to the entire region.

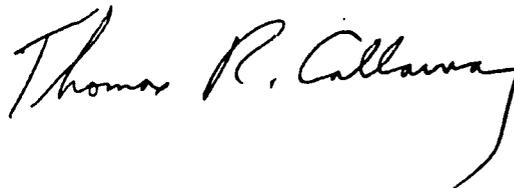
Existing codes were carefully examined for the purpose of finding deviations from usually accepted requirements due to social, climatic or other conditions. Only few such deviations were encountered. This leads us to believe that it may very well be possible to issue a single document covering basic minimum requirements for most any country, to be supplemented with addenda (or fly sheets) in order to cover the desired deviations. At the beginning of the study, all those concerned with it would have this not only impractical, but also quite impossible.

We believe that these standards will be a valuable guide, both in the design and in the evaluation of projects, and will hopefully result in better housing suited to the needs of low-income families.

They may also be of great value in areas that do not have any minimum standards at all and where they may serve as a basic temporary housing code until more comprehensive and permanent codes can be developed.



Senior Housing and
Urban Development Advisor
Agency for International Development



Director
Division of Technology & Documentation
Office of International Affairs
Department of Housing & Urban Development

TABLE OF CONTENTS

	<u>Page</u>
FOREWORD	iii
INTRODUCTION	1
ACKNOWLEDGMENTS	3
PURPOSE	6
APPLICATION	6
REQUIRED EXHIBITS	6
GENERAL ACCEPTABILITY CRITERIA	6
Local Codes and Regulations	6
Site Conditions	7
The Plot	7
Services and Facilities for Permanent Dwelling Units or Projects	7
Access	8
Types of Acceptable Permanent Dwellings	8
Non-Residential Uses	8
Community Facilities	9
Design and Administration	10
 STANDARDS GROUP A – SQUATTER AREAS INCLUDING CORE AND SHELL HOUSES	
A-1 Land Use - Allocation	11
A-2 Density	12
A-3 Streets	12
A-4 Lot Size	13
A-5 Lot Frontage	15
A-6 Building Lines	15
A-7 Distance Between Buildings on the Same Site	16
A-8 Lot Coverage	16

	<u>Page</u>
A-9 Dwellings and Ancillary Structures	16
A-10 Water Supply Requirements	17
A-11 Communal Sanitary Facilities	18
A-12 Street Lighting	20
A-13 Trash Removal	20
 STANDARDS GROUP B – DETACHED, SEMI-DETACHED AND ROW HOUSING	
B-100 NEIGHBORHOOD PLANNING	23
B-101 Objectives.	23
B-102 Land Allocations - Percentages	23
B-103 Distances to Amenities	24
B-104 Density	24
B-105 Streets	24
B-106 Right-of-Way Widths	24
 B-200 PLOT PLANNING	 27
B-201 Objectives.	27
B-202 General	27
B-203 Lot Frontage	27
B-204 Lot Area	27
B-205 Lot Coverage	27
B-206 Yard Dimensions (Building Lines)	28
B-207 Distances Between Buildings	28
B-208 Courts	28
 B-300 BUILDING PLANNING	 29
B-301 General	29
B-302 Space Standards	29
B-303 Minimum Room Sizes	29
B-304 Storage - General	31
B-305 Finish Grade at Habitable Rooms	34
B-306 Ceiling Height	34
B-307 Volume	34

	<u>Page</u>
B-308 Natural Light	34
B-309 Ventilation	34
B-310 Doors	35
B-311 Privacy	37
B-312 Stairway Planning	37
B-400 CONSTRUCTION	39
B-401 Design Loads	39
B-402 Scope	39
B-403 Definitions	40
B-404 Working Stresses	40
B-405 Testing Procedures	40
B-406 Strength of Elements	41
B-407 Joints, Fastenings and Connections	41
B-408 Floors	41
B-409 Walls	43
B-410 Partitions	45
B-411 Ceilings	46
B-412 Roofs	47
B-413 Earthquake Design	51
B-414 Insulation Requirements	52
B-415 Materials and Equipment (Construction)	53
B-416 Special Methods of Construction	54
B-417 Foundations	54
B-418 Chimneys	54
B-419 Interior Wall and Ceiling Finish	55
B-420 Painting and Decorating	55
B-500 HEATING	57
B-501 Objectives	57
B-502 General	57
B-503 Fuel Systems	58
B-504 Fuel Storage	58

	<u>Page</u>
B-505 Heat Loss Calculation	58
B-506 Design, Construction and Rating of Heating Units	58
B-507 Design and Installation of Heating Systems	58
B-600 PLUMBING AND SANITATION REQUIREMENTS	58
B-601 Objectives.	58
B-602 Water Supply	59
B-603 Emergency Supply	61
B-604 Sewage Disposal.	61
B-605 Waterborne Sewage.	61
B-606 Waste Water Systems - Installation	63
B-607 Rainwater Connections	64
B-608 Septic Tanks	65
B-609 Drain Field	66
B-610 Septic Tanks - Multifamily	66
B-700 ELECTRICAL	67
B-701 General	67
B-702 Service.	67
B-703 Wire Sizes	68
B-704 Circuits	68
B-705 Outlet Plugs and Lights	68
B-800 LOT IMPROVEMENT	68
B-801 Slope	69
B-802 Preservation of Site Assets	69
B-803 Cut and Fill.	69
B-804 Drainage Structures	69
B-805 Parking Spaces	70
B-806 Walks	70
B-807 Exterior Steps not Attached to Dwelling	70
B-808 Lawn and Ground Cover.	71
B-809 Trees, Shrubs and Vines	71

STANDARDS GROUP C – MULTI-FAMILY HOUSING

	<u>Page</u>
C-100 AREA PLANNING	73
C-101 Objectives.	73
C-102 Amenities.	73
C-103 Density	73
C-104 Street Widths.	73
C-200 PLOT PLANNING	73
C-201 Building Height	73
C-202 Maximum Lot Coverage	73
C-203 Yards.	75
C-204 Distance Between Buildings on the Same Site.	75
C-205 Parking Spaces and Garages.	75
C-206 Walks.	75
C-207 Laundry Drying Areas.	76
C-208 Children's Playgrounds.	76
C-300 BUILDING PLANNING	76
C-301 Room Sizes	76
C-302 Light and Ventilation	76
C-303 Public Stairs and Hallways	77
C-400 STRUCTURAL REQUIREMENTS	78
C-500 FIRE PROTECTION AND EGRESS.	78
C-501 Objectives.	78
C-502 General	78
C-503 Access to Spaces	78
C-504 Structural - General.	79
C-505 Fire Walls	79
C-506 Mixed Occupancy and Garages	79

	<u>Page</u>
C-507 Fire Resistance Ratings - General	79
C-600 HEATING REQUIREMENTS	80
C-700 PLUMBING AND SANITATION REQUIREMENTS	80
C-800 ELECTRICAL REQUIREMENTS	80
C-900 MECHANICAL EQUIPMENT AND SERVICE AREAS	80
C-901 Objectives.	80
C-902 Elevators	80
C-903 Refuse Chutes	83
C-904 Refuse Rooms and Areas.	83
C-905 Incinerators	84
C-1000 SITE (LOT) IMPROVEMENT	85
APPENDIX A - DEFINITIONS	87
APPENDIX B - SOURCES AND BACKGROUND DATA	93

INTRODUCTION

The following proposed minimum standards are based as far as possible on performance requirements rather than on specifications and could contribute significantly to lower construction and housing costs.

They are intended to provide:

1. An aid to designers, developers, or sponsors of housing projects, giving them a "floor" upon which to base their plans, specifications and cost estimates
2. A yardstick to measure the acceptability of housing projects proposed for financial and/or technical assistance from any source, local or foreign

They may also serve as a basic standard which could be useful to those countries interested in modifying existing codes or by-laws governing housing design and construction, or which could be adopted, with modifications, by urban communities which, at this time, do not have housing or building codes, ordinances, or standards.

The development of these standards involved three phases:

1. A review and analysis of existing building and housing codes, by-laws, ordinances and standards presently in force in various countries but principally in Latin America, the Caribbean Area, and the United States, and the formulation therefrom of a set of tentative standards for discussion purposes
2. Visits by two teams of two men each to selected South and Central American countries to discuss these tentative standards with officials and professional people to determine their acceptability in these countries and the region as a whole
3. Revision of the tentative standards to take into account the comments and recommendations of the officials and professional people in the Latin American countries visited.

The studies of existing Latin American codes and standards and the formulation of both the tentative standards and the final draft were carried out in the Division of International Affairs, Department of Housing and Urban Development, by J. Robert Dodge, formerly Director, Division of Technological Services; Thomas R. Callaway,

Housing Advisor; and Bernard Wagner, Regional Housing Advisor, on loan from AID to the Department of Housing and Urban Development (HUD).

The two teams who visited the selected Latin American countries were composed of staff members of the Department of Housing and Urban Development. One team was made up of Thomas R. Callaway, IA, and Robert C. Reichel, Director, Codes and Building Standards Branch, Urban Renewal Administration, HUD, who visited Costa Rica, El Salvador, Honduras and Nicaragua. The second team consisted of Bernard Wagner, AID, and Bernard Horn, Housing Economist, Office of Program Policy, HUD, who visited Argentina, Colombia, Costa Rica and Guatemala.

It was initially thought that it would be difficult or impossible to develop a set of standards that would be acceptable throughout Latin America. However, the standards revealed that the basic minimum requirements for health and safety in housing construction in urban areas were quite similar in most countries and variations are largely due to different climatic and geographical conditions. These studies also indicated that social differences, traditions and customs among people do not materially affect basic minimum standards, particularly where they are based largely on performance. It was, therefore, possible to develop a single set of standards that it is believed can be usefully employed throughout Central and South America. Necessary deviations to accommodate local conditions or customs are expected to be rare. In some instances, however, deviations may be absolutely necessary. Such cases could be taken care of by issuance of an addendum, stating the desired modifications.

Care has been exercised to avoid making these standards too rigid in order to encourage rather than inhibit the application of new ideas, new materials and new construction systems which may result in improved construction or in cost savings. It is understood, of course, that the proposed standards will have to be brought up to date from time to time in keeping with the economic development of the particular country in which they are applied.

Throughout these standards, measurements are given in both the metric system and the English system; the conversions made, however, are usually rounded to avoid fractions.

The plans and photographs shown are not intended to be model plans to be copied but rather serve as an illustration of the size and relationship of various areas to each other. Although they come close to meeting the standards proposed, they do not necessarily meet them in every respect.

ACKNOWLEDGMENTS

The original concept of the study was initiated by Harold Robinson of the L.A. Division of Housing and Urban Development of A.I.D., whose office also arranged for the contact with A.I.D. officials in the various countries visited. The cooperation of these officials has greatly facilitated the work of the two teams during their four-week travel period. In addition, valuable comments were collected from the following A.I.D. officials who reviewed the study: Osborne T. Boyd, Richard C. Knight, Juan Cabrero, Hermon Davis, Richard Zenger, Edmond H. Hoben, and William H. Coster. Review and comments on the part of Messrs. Victor Kimm and Michael Kane of the American Institute for Free Labor Development were likewise appreciated.

In the preparation of the standards, data from Argentina, Bolivia, Brazil, Colombia, Honduras, Mexico, Nicaragua, Panama, Peru, Puerto Rico, Surinam, and the Caribbean Area in general were drawn upon for comparison and specific data. In addition, significant data in the areas of planning, construction, sanitation, and service equipment were derived from Trinidad and Tobago, Jamaica, Venezuela and Chile. To verify and supplement specific items, data from European, Asian, and African countries were also drawn upon.

The format in general and certain of the objectives and general provisions follow, with some modifications, the various Minimum Property Standards of the United States Federal Housing Administration, including those for Puerto Rico. The format for the structural sections and many of the formulas employed were drawn from the 1947 Performance Standards of the former United States National Housing Agency.

Of particular value in the preparation of this second draft were the comments of the many officials and technicians of the various countries visited during the field study. Their contribution made this study a cooperative effort which we hope will continue in the future and lead to further improvements, refinements, and wider coverage of this difficult subject matter. We gratefully appreciate the cooperation and the suggestions given on the part of the following persons:

From Argentina: Mr. Arturo Luduena, Advisor to the Mayor; Mr. Maximo Vasquez Llona, Architect of the Municipal Housing Commission; Mr. Juan Antonio Sola, Architect; Mr. Luis Rolando Bach, Architect with BID; Mr. Luis Migone, Director, and Miss Martha Schteingart of the Bouwcentrum Argentina.

From Colombia: Mr. Julio Cala, Chief Architect of the Instituto de Credito Territorial, and his staff; Mr. Jorge Rivera Farfan, Planning Director of the Municipality of Bogota; Mr. Samuel Vieco, Architect of the Banco Central Hipotecario; Mr.

Roberto Pineda, Director of CINVA; Mr. Reinaldo Posada, Town Planner; Mr. Augusto Enteiche, Engineer of the CINVA Faculty and Mr. Miguel Lleras Pizarro, Director, Camera, Colombiana de la Construcción.

From Costa Rica: Mr. Eduardo Zuniga Chavatria, General Manager, INVU; Mr. Eladio Jara Jimenez, General Assistant Manager, INVU; Mr. Eduardo Jenkins; Mr. Rodrigo Vadgas; Mr. Edgar Hoepker; and Mr. Octavio Aviles, Architects and Engineers of INVU.

From El Salvador: Mr. Antonio Sandoval Martinez, DUA; Mr. Edgar Rodriguez Espinal, DUA; Mr. D. Eleazar Gonzales, Chief, Studies and Finance, IVU; Mr. Mauricio Mena, Designs and Projects, IVU; Mr. Osená Rene Sulegio, Chief, IVU Engineering Department; Mr. Enrique Noubleau; and Mr. Gonzola Yanes Diaz, IVU Architects.

From Guatemala: Mr. Roberto Barillas, Director, INVI; Mr. L. F. Toledo Saenz, Chief Engineer, INVI; and Mr. Albino Bonatti, Chief of Social Studies, INVI.

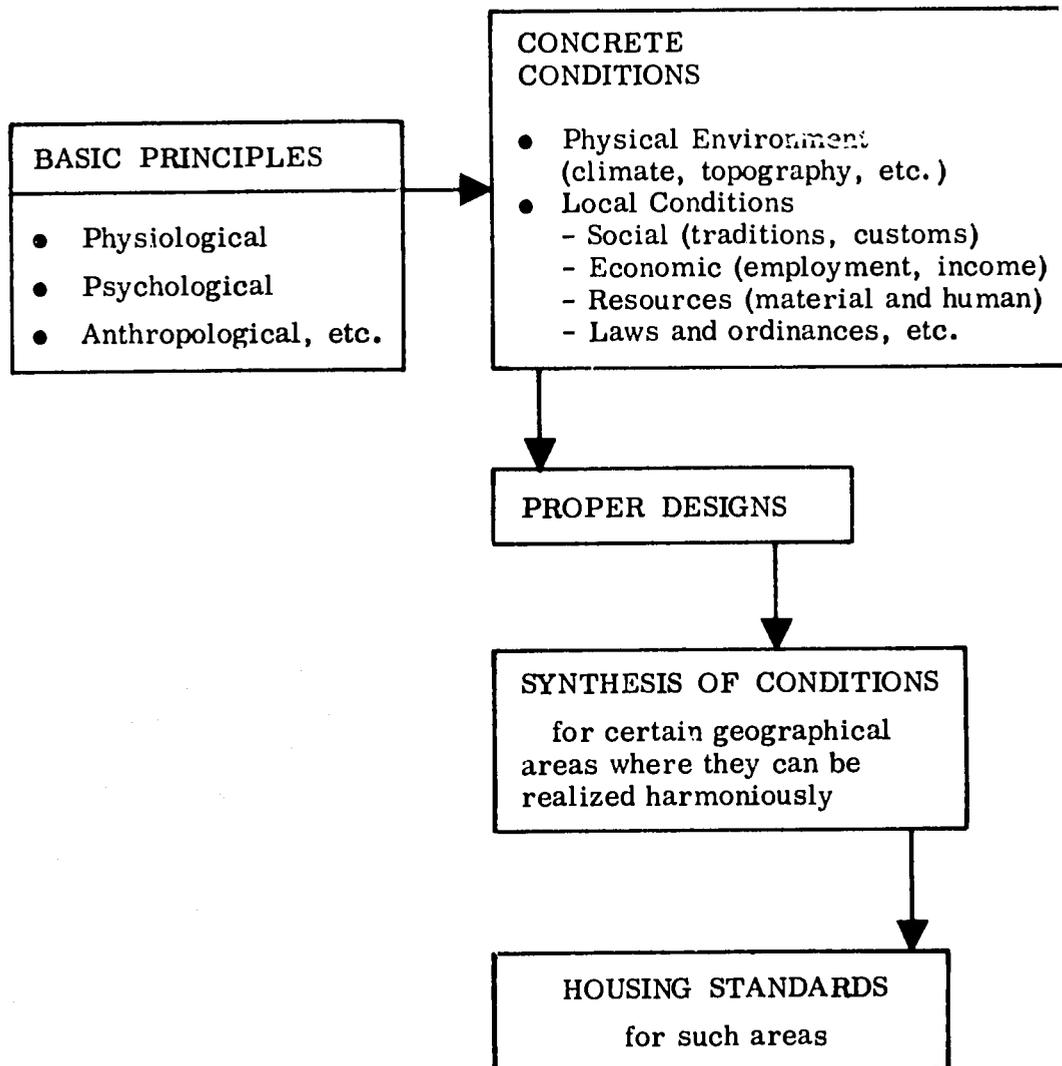
From Honduras: Mr. Francisco Pratts, INVA; Mr. Pablo Pastor, Engineer, SANAA; Mr. Pineda Fosquelle, Engineer; Mr. Roberto Pineda, Engineer; Mr. Ralph Merriam, Architect; and Mr. Emil Falk, Engineer.

From Nicaragua: Messrs. Zelanga and Martinez of INVI; Messrs. Rene Uriza and Jorge Seville, Office of Urbanism; Mr. Jose Francisco Teran, Architect AISA; Mr. Roberto Arguella Tefel, AISA; and Mr. Dayton Caldera, Decal Prefabricated Houses.

Finally, we gratefully acknowledge the particularly pertinent comments from Prof. Luis Bravo Heitmann, Technical Director of the "Instituto de Investigaciones de la Vivienda y de la Edificación", Santiago, Chile. Prof. Heitmann, like most of us, agrees with the value of having a basic minimum standard which will have to be modified where necessary to allow for special conditions of climate, economic factors, social customs, and so forth. His diagrammatic summary of the factors that influence the development of a standard is shown opposite and could serve as a useful guide in the development of specific standards for certain areas.

Diagrammatic Summary

of the Factors Influencing Development of a Standard



Courtesy: Prof. Luis Bravo Heitman
Instituto de Investigaciones de la
Vivienda y de la Edificación
Santiago, Chile - 1966

PURPOSE

These standards are not to be construed as "desirable standards", but rather are intended to meet only the minimum basic needs of families of low income. Their purpose is, however, to provide these families with a dwelling which is structurally safe, reasonably durable and which will not require excessive maintenance or repair during the life of the mortgage. They are also intended to provide a decent environment and to serve as a guide to improving, at least on a temporary basis, substandard areas which lack even the minimum of amenities, or a semblance of order.

Modifications may be made in these minimum standards from time to time as experience may indicate a need for such changes.

APPLICATION

The types of projects or dwellings to which these minimum standards apply include the following:

- a. Upgrading of squatter areas and controlled squatter development projects;
- b. Single family detached, semi-detached or row house projects;
- c. Multi-family dwellings.

They also apply to site improvements either permanent or temporary, made in existing substandard areas, but not to existing dwellings within the site unless such dwellings are to be remodeled or otherwise improved.

REQUIRED EXHIBITS

Complete architectural and engineering plans as well as specifications and cost estimates shall be submitted with any project application. These shall clearly show that structures and other improvements comply with or exceed the specific standards contained herein. If for any reason proposed structures or improvements do not comply with these minimum standards, reasons for non-compliance shall be clearly set forth along with any request for deviation from these standards. If, on the other hand, the designs submitted should clearly be in excess of these standards (to the point of causing expenditures which might better be invested in the construction of additional dwelling units) applicants may be required to modify their plans and specifications to effect significant project cost reductions.

GENERAL ACCEPTABILITY CRITERIA

Local Codes and Regulations

The minimum standards set forth herein shall not be construed as relieving the sponsor or builder of complying with local or national ordinances, codes, regulations which may be in force, including requirements of health authorities having jurisdiction. However, in the event local or national codes, regulations or requirements make excessive demands resulting in building costs that put housing beyond the reach of the

income groups for which the housing is intended, efforts should be made by sponsors or builders to obtain appropriate exceptions from the authorities.

Site Conditions

The sites on which new permanent housing is to be constructed shall be free of those hazards which can adversely affect the health and safety of the occupants or the structural soundness of the improvements or which may impair the customary use and enjoyment of the property. These hazards may be subsidence, flood, erosion or others.

Sites containing squatter areas or other substandard dwellings which are to be improved by permanently installing water and sewer lines, streets, etc., should also meet the criteria set forth in the preceding paragraphs. Where improvements are contemplated in substandard housing areas in which site conditions do not meet these minimum criteria in all respects, such improvements should either be of a temporary nature or site defects should be remedied prior to the installation of permanent improvements.

Access to employment centers and essential community facilities such as shopping centers, schools, recreation areas and police and fire protection shall be readily available to the property or provision shall be made to provide these facilities or services when they are lacking.

The Plot

The land to be occupied by a permanent structure comprising one to four living units offered as partial security for a mortgage shall be a single integral plot except that a primary plot with a secondary plot for appurtenant garage, utility building or other use essential to the marketability of the property will be accepted provided the two plots are in such proximity as to constitute a readily marketable real estate entity.

In the case of properties of more than four living units under a single mortgage, all of the land offered as (partial) security for the mortgage shall comprise a single plot except where the site is bisected by a street or streets in which case the resulting parcels shall comprise a readily marketable real estate entity. In the case of a rental project, the site and its improvements shall be so planned that a convenient and efficient management operation is possible.

Services and Facilities for Permanent Dwelling Units or Projects

Each property occupied by a permanent dwelling shall be one that can be used or maintained by the occupants without need to trespass upon adjoining properties.

In the cases of new, permanent single family detached, semi-detached or row houses, utility lines and other facilities should generally be independent for each property. Common gas and water service, however, may be permitted for two adjacent properties where:

1. The location of the common service line does not adversely affect the future use or resale of the lot and its improvements

2. The common service line is protected by a permanent easement agreement to assure continued maintenance and use and
3. Ownership of the common portion of the service line remains with the serving utility.

Each permanent living unit or property shall contain provisions for each of the following:

1. A continuing supply of potable water
2. Sanitary facilities and a safe method of sewage disposal
3. Electricity for lighting and for equipment used in the dwelling

Access

Each property shall be provided with access by means of an improved road or street or an improved pedestrian walkway which connects the property directly with an improved road or street designed for vehicular traffic and which is protected by a permanent easement.

The width and construction of the required street and/or path and provision for its continued maintenance shall provide safe and suitable vehicular and/or pedestrian access to and from the property at all times.

Each property shall be provided with means of access for the removal of garbage and trash, the delivery of fuel (where required), and for adequate fire protection.

A means of access to each living unit shall be provided without passing through any other living unit.

Types of Acceptable Permanent Dwellings

Acceptable dwellings include detached, semi-detached houses, row houses, and dwelling units in multi-family structures.

A semi-detached, row or end-row dwelling or a unit in a multi-family structure shall be separated from adjoining dwellings by a party or lot line wall of fire-retardant nature extending the full height of the dwelling or dwelling unit.

Non-Residential Uses

Any non-residential use of the property for a housing project shall be subordinate to its residential use and character.

In properties of 3 or 4 living units under a single mortgage, the area of the dwelling and accessory buildings including storage space, designed and used for non-residential purposes, shall not exceed 25 percent of the total floor area. The total floor area shall include the area of all floors and such portions of basements and finished attics, designed and used for both residential and nonresidential purposes. The computed

non-residential floor area shall include all space which is essential to the proper functioning of the non-residential area. If hallways or similar spaces serve both residential and non-residential areas, they shall be considered non-residential areas in determining the above percentage.

In projects having more than four living units under a single mortgage, the commercial space* must (a) be of a character which is incidental to and compatible with the residential purpose of the project; (b) have a location and other essentials which make it suitable for the use intended; (c) conform to zoning and to good standards of construction and planning; and (d) not exceed 10 percent of the gross building floor areas devoted to residential use, including access halls, stairs, elevators, lobbies, etc.

Community Facilities

In order to assure the development of complete neighborhoods and to prevent deterioration and/or conversion of residential space to commercial use, housing projects shall be provided with the following facilities, financing for which shall be assured prior to approval of the project:

1. Projects of 150 to 500 dwellings:
 - a. A grocery store and drug store
 - b. A primary school including kindergarten (unless existing in immediate vicinity)
 - c. Areas for common use (including parking, sidewalks, commercial space, and park and play areas) amounting to approximately 650 square feet (60 sq. m.) per family
2. Projects of 500 to 1500 dwellings:
 - a. A primary school and kindergarten
 - b. Commercial area of 110 square feet (10 sq. m.) per family: this includes covered and open areas, parking, service station, etc.
 - c. Areas for common use of 320 square feet (30 sq. m.) per family; this includes parking spaces, access roads, sidewalks, and park and play areas
 - d. Church
3. Projects of 1500 to 3000 dwellings:
 - a. A school large enough to take care of the anticipated school age population
 - b. A business, cultural and social area of approximately 110 square feet (10 sq. m.) per family
 - c. A small administrative center

***This may include space for cottage industries of a non-objectionable nature.**

- d. Areas for common use of approximately 320 square feet (30 sq. m.) per family; this includes parks, playgrounds, parking spaces, sidewalks, and commercial space
 - e. A church
 - f. A sports field
4. Special projects should have community facilities to allow complete self-sufficiency and administrative autonomy.

Design and Administration

Because these standards are aimed primarily at housing projects for low and low-middle income families, and are designed to reduce housing costs generally, all possible means should be explored to keep raw land costs within a reasonable percentage (possibly 25 percent) of total development costs. Attention should also be given to economical site improvement costs (urbanization).

As aesthetic qualities which constitute good design do not lend themselves to precise or quantitative definition, care must be taken to utilize the best available professional services in the design of both the site and the individual structures involved. Project approval will be influenced by visual and social aspects of a project, as well as structural and health requirements.

Supervision and inspection of construction by competent personnel must be assured prior to approval of a project in order to control the quality of the finished product. In addition, continued control in the form of administration and maintenance shall be provided for, and the necessary funds and personnel allocated for this purpose.

Adequate controls can make or break the appearance of a project, and can be of decisive influence on the spirit of the inhabitants. Home ownership involves responsibilities, as well as privileges, and effective administrative controls to prevent deterioration due to violations of contract agreements and/or non-payment of monthly installments are essential.

STANDARDS GROUP A

SQUATTER AREAS INCLUDING CORE AND SHELL HOUSES

Purposes

To create an environment conducive to acceptable health and privacy standards which, for the present will allow squatter families to create a "livable" environment through their own efforts and resources, and which will allow each household and the area as a whole to become a logical, planned and serviced extension of the larger community. Such planning will allow for a general and consistent upgrading of the area as funds and amenities become available. Dwellings constructed under Standards Group "A" can eventually meet the requirements of Standards Group "B" by means of starting out with a core house or shell house (or similar unit) which can later be expanded into a more spacious permanent structure.

General

The location of new areas to be developed for squatters shall, in so far as possible, be within reasonable distance (maximum commuting time 30 minutes) of places of employment and the general amenities and services of the larger community.

Whether a new area, or an existing squatter settlement which is to be upgraded, all such areas shall be in conformity with the master plan of the community concerned, and all streets, sewerage, water and electrical services shall be planned as a logical extension of existing and/or planned facilities of the community as a whole. Sufficient right-of-way for streets and other services shall be marked and maintained to provide for future growth and improvement of the area. Individual lots shall be marked, and no more than one single family dwelling shall be allowed on a given site.

A-1 LAND USE - ALLOCATION

Objective:

To provide a balanced use of land for all purposes consistent with the objective that a planned squatter area is intended to become a permanent and desirable part of the larger community. As such, a major concern must be provision for adequate space, properly zoned for private and public activity, including housing, commercial, industrial, religious, health and general community facilities, serviced by adequate roads, power, water and sewerage. As the provision of both public and private amenities is of economic necessity a long process, the allocation of land for these amenities shall be made at the earliest possible stage of development, and the land shall be maintained free of structures until such time as it is used for the intended purpose.

A-1.1 Allocation – Percentages

Based on total area of development:

The figures given do not present maximum or minimum percentages, but are given as guidelines, reasonable variations from which are permissible.

	<u>Percentage</u>
Housing lots	50 to 60
Roads, right-of-way	20 to 30
Other private uses (markets, light industrial, churches and private organizations, etc.)	5 to 10
Other public uses (parks and playgrounds, schools, clinics, police and public reserve) minimum of	10 to 20

A-2 DENSITY

Objective:

To control the sanitary, physical and social standards of the living environment within the range of reasonably desirable and economically maximum use of the available land.

A-2.1 Per Acre

	<u>Per Acre</u>	<u>Per Hectare</u>
Maximum families per net housing acre (or hectare)	40	99
Persons per net housing acre (or hectare) assuming average family size of 5	200	495
Families per gross acre (or hectare) of total development	20-24	50-60
Persons per gross acre (or hectare) assuming average family size of 5	100-120	247-296

In areas where average family size is higher or lower than five, figures must be adjusted accordingly.

A-3 STREETS

Objective:

To provide adequate and safe means of vehicular and pedestrian circulation, drainage of storm water, tree planting space, and where necessary, on-street parking of vehicles.



Lima, Peru. View of partially controlled squatter areas.
Note rights-of-way and electric lines.



Hong Kong

View of uncontrolled
squatter area

Note variation in size
of dwellings and diffi-
culties of access.

A-5 LOT FRONTAGE

Objective:

To provide reasonable access to streets and/or paths, to allow off-street parking where necessary, and to allow dwellings to be oriented toward the street (or as best suits local conditions) while keeping length of street and service lines (water, sewerage and electricity) to an economic minimum.

A-5.1 Frontage Dimensions

Minimum frontage for rectangular lots	or	20 feet 6.0 meters
Minimum frontage for irregularly shaped lots	or	13 feet 4 meters
Average width for irregularly shaped lots	or	23 feet 7 meters

A-6 BUILDING LINES

Objective:

To provide circulation around the dwelling, to allow adequate light and ventilation to the dwelling, to give reasonable privacy between dwellings, to provide area for necessary external domestic activities and off-street children's play; to prevent the spread of fire from one dwelling to another; and to allow access to the rear yard for service of sanitary facilities and for fire fighting equipment.

A-6.1 Building Lines (Setbacks)

Front (between dwelling and street right-of-way) a minimum of	or	10 feet 3 meters
Rear a minimum of	or	10 feet 3 meters

An exception to the rear building line is the case of back-to-back or "banked" sanitary facilities, which will be on the property line.

Where courtyards are provided rather than rearyards, their area shall not be less than the area that would result by the use of a 10 feet or 3 meter rear set-back along the full width of the property.

Side a minimum of	or	4 feet 1.3 meters
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A-7 DISTANCE BETWEEN BUILDINGS ON THE SAME SITE

Objective:

To allow adequate light and ventilation to the dwelling, to allow ease of circulation between structures, and to prevent the spread of fire from one structure to another.

A-7.1 Distance

Between dwelling and ancillary structure		8 feet
	or	2.4 meters
Between two ancillary structures		4 feet
	or	1.3 meters

A-8 LOT COVERAGE

Objective:

To insure adequate open space, and sanitary conditions, including adequate light, ventilation, and privacy.

A-8.1 Coverage

Including all roofed structures, maximum	60 percent for 1-story construction
	50 percent for 2-story construction
	35 percent for 3-story construction

A-9 DWELLINGS AND ANCILLARY STRUCTURES

Objective:

Through self-help (where possible, aided self-help) methods and using available materials, to create shelter from the weather, security for the family and its possessions, and privacy for the family members and their activities in a healthful environment.

A-9.1 General

Any new dwelling or any ancillary buildings constructed shall be structurally stable, taking into account weather and other local conditions, and shall be constructed in such a manner as to reduce to a practical minimum the hazard of fire.

The structure(s) shall be located on the assigned property within the limits outlined in these standards.

As economic factors permit, the dwelling, or portions thereof shall be reconstructed of permanent materials where this is not feasible in the first instance.

A-9.2 Minimum Number of Rooms

Permanent internal division of the dwelling will allow for a minimum of 2 separate areas to make possible separation of functions and to provide a degree of privacy for the occupants.

A-9.3 Space Standard

To provide reasonable space per occupant, conducive to both physical and mental health, a minimum of 270 square feet (25 sq. m.), with a minimum ceiling height of 7 feet 6 inches (2.27 m.) should be achieved per family of 5 persons.

A-10 WATER SUPPLY REQUIREMENTS

Objective:

To insure an adequate supply of safe, potable water for drinking, cooking, and sanitary purposes within, or at an economically minimum distance from all dwellings.

A-10.1 Communal Standpipe-- General

The pressure of service shall be constantly maintained to provide continuous service, to prevent pollution of the system, and to allow use by fire fighting equipment.

The volume of supply shall be sufficient to provide a minimum of 10 gallons (40 l.) per person in the area served during any 8 hour period.

A-10.2 Area of Standpipe

An area of at least 6 feet (1.8 m.) in diameter around the standpipe shall be surfaced with concrete or other impervious material, graded to drain away from the standpipe. Channels or other means will be provided to prevent the runoff from the area becoming standing pools or creating muddy conditions.

A-10.3 Distance to Standpipe

The maximum distance to a communal standpipe from any dwelling served by it shall not exceed:

330 feet
or 100 meters

A-10.4 Families Served

The maximum number of dwellings to be served by a single communal standpipe shall not exceed:

22

A-10.5 Distance to Dug Well

The maximum distance to a communal dug well shall not exceed:

200 feet
or 60 meters

A-10.6 Families Served

The maximum number of families to be served by a single communal dug well (bucket or pump) shall not exceed:

8

A-10.7 Wells - General

1. No well shall be closer than 40 feet (12.2 m.) to any pit privy, soak pit, septic tank, or any portion of a drain field serving a septic tank or other receptacle receiving domestic sewage or industrial waste.

Distances in excess of 40 feet (12.2 m.) may be required according to soil type and/or topography as determined by the public health authority or like responsible body.

2. A water tight paving shall be provided for a minimum radius of 4 feet (1.2 m.) around the well. Sufficient gradient or channels beyond this point shall be provided to prevent the formation of standing pools or muddy conditions.

3. An impervious casing shall be provided to a minimum depth of 6 feet (1.8 m.) below the level of the surrounding ground.

4. A curb of 12 inches (31 cm.) minimum height shall be provided to prevent entry of surface water or solid matter.

5. A "bucket well" shall be provided with:

a. A closely fitted, hinged cover of solid and durable construction

b. A rack or enclosure for the bucket not less than 12 inches (31 cm.) above the level of the paving

6. A "pump well" shall be provided with a closely fitted cover to prevent the entry of surface water or solid matter.

A-11 COMMUNAL SANITARY FACILITIES

Objective:

In the absence of individual water supply, to provide means for cleanliness of the person and clothing at an economically minimum distance from individual dwellings. Wherever possible, common toilet facilities should be avoided and the standard below used only in cases of emergency.

A-11.1 Area

The area set aside for community sanitary and/or washing facilities shall be not less than 1/8 acre (1/20 ha.) for each 100 dwellings (50 square feet or 5 sq. m. per dwelling).

A-11.2 Water Closets

The minimum number of W.C.s per 100 dwellings (with waterborne sewage) shall be:

12

A-11.3 Pit or Bucket Privy - Communal

The maximum number of families per communal pit or bucket privy shall be:

6

In the case of bucket privies, collection of fecal matter shall be carried out daily.

A-11.4 Banked Pit or Bucket Privy

Back-to-back (on the property line) or banked (at the junction of 4 lot corners) privies shall contain a separate compartment for each lot served. Each compartment shall open onto the lot served, and shall provide complete visual privacy.

A-11.5 Pit or Bucket Privy – Standards

Pit Privy and Pail Systems:

1. The sole entry to the enclosing shelter shall be from the open air.
2. The enclosing shelter for individual privies shall be a minimum of 12 feet (3.6 m.) from any dwelling or kitchen, and a minimum of 6 feet (1.8 m.) from the boundary of the lot, except in the case of back-to-back or banked privies.
3. The enclosing shelter shall be a minimum of 40 feet (12 m.) from any well, spring or stream used, or likely to be used as a source for drinking or domestic water.
4. The enclosing shelter shall be a minimum of 3 feet (0.9 m.) by 5 feet (1.5 m.) in dimension and be provided with an inward opening door having a minimum width of 24 inches (60 cm.).
5. The enclosing shelter shall be provided with an opening of at least 1 square foot (0.1 sq. m.) for light and ventilation, located as near the top of the shelter as possible, and provided with a metal or plastic insect screen.
6. The floor of the enclosing shelter shall be of a non-absorbent material, be not less than 9 inches (23 cm.) above the surrounding ground and drain toward the entrance door.
7. Seat, seat opening, and clearance between seat and pail shall be of such form and dimension as to prevent deposit of fecal matter elsewhere than in the pail.
8. The pail enclosure shall be constructed so as to allow easy access for emptying and cleaning and shall at other times provide complete closure, including a closely fitted seat cover.
9. Where fecal matter must be carried away from the site for disposal, a clear passage, open to the air, and not passing through any part of a dwelling or other domestic or public building shall be provided for this purpose.

A-11.6 Pit

The pit may be square or round, with a minimum horizontal dimension of 3 feet (0.9 m.) and shall be approximately 10 feet (3 m.) in depth. Where subject to possible cave in, the pit walls shall be protected by open masonry, or other suitable system of permanent shoring.

If the frost line in the area is deep enough to interfere with the proper functioning of the pit, it shall be enlarged to allow for sufficient capacity.

A-11.7 Showers – Communal

Where piped water is available on a communal basis only, the central installation shall contain bathing enclosures providing adequate privacy and be equipped with shower

heads on the minimum basis of 1 per 12 families. The floors of such shower enclosures shall be of concrete or other impervious and easily cleaned material, graded to lead used water to drains, ditches, soak pits or other means of disposal to prevent standing water or muddy conditions.

A-11.8 Laundry Tubs

Where piped water is on a communal basis only, laundry tubs shall be provided adjoining the shower area on the minimum basis of 1 per 12 families. Such tubs shall be of an easily cleaned material, and be provided with drains leading to soak pits or other means of disposal for used water in order to prevent standing water or muddy conditions.

The laundry area shall be provided with some form of protection from the sun, prevailing winds, and rain.

A-11.9 Distances

Bathing and laundry facilities shall not be located more than 500 feet (152 m.) from any individual dwelling to be served.

A-12 STREET LIGHTING

Objective:

To provide reasonable protection from natural hazards or crime for those circulating within or through the area concerned between the hours of sunset and dawn.

A-12.1 Position and Density

Where electricity is available, pole-mounted lights of adequate wattage, mounted at a reasonable height, shall be placed on the edge of road rights-of-way, spaced to provide a minimum of 1 pole per 20 families, or 1 pole per 330 feet (100 m.), whichever is shorter.

A-13 TRASH REMOVAL

Objective:

To prevent possible unsanitary conditions, to prevent unsightly appearance, objectionable odors and nesting for rodents, and to keep land clear and available for normal living activities.

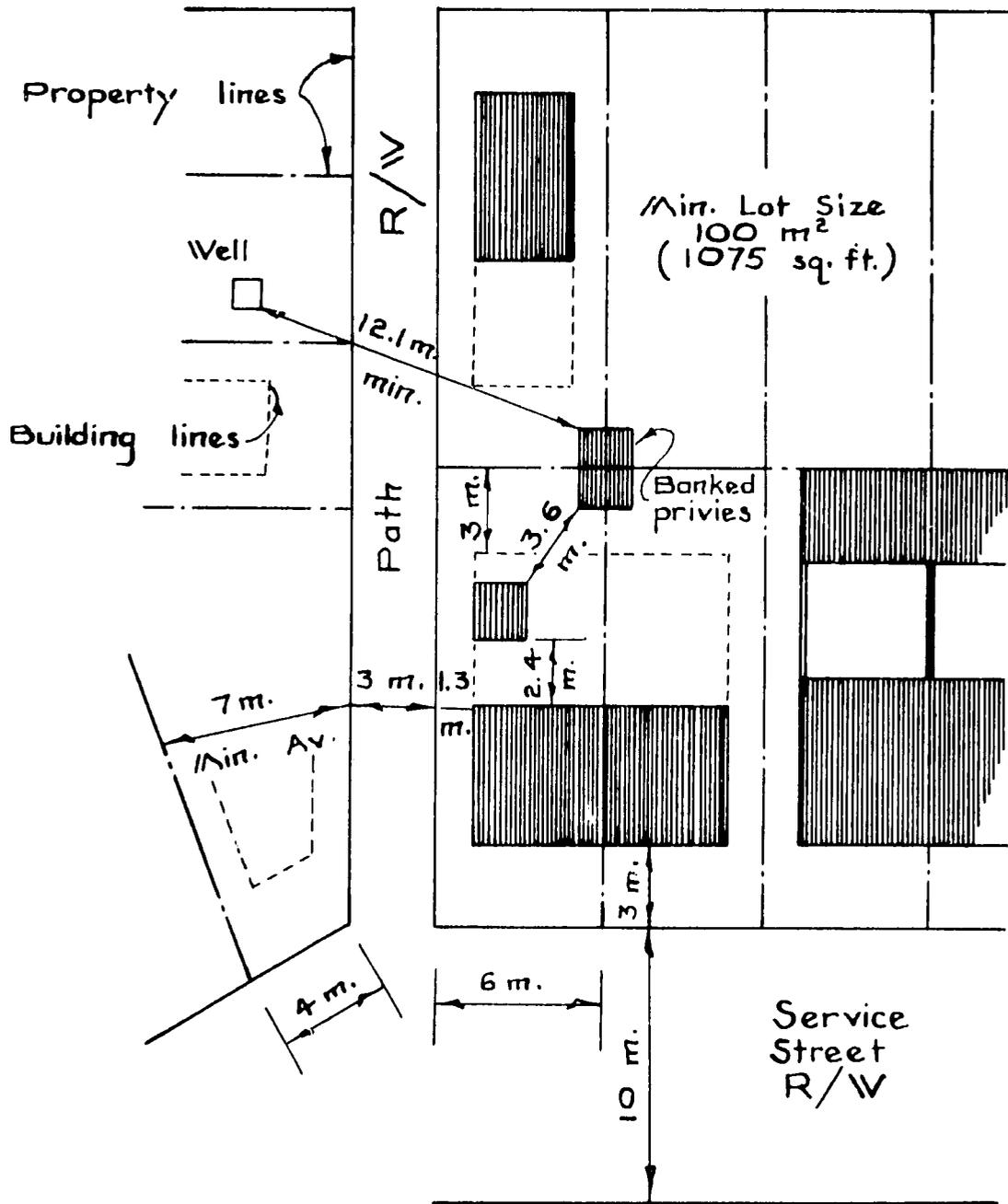
A-13.1 Facilities

Where possible, collection of trash and household garbage should be made from the individual lots. Where such collection is impossible or impracticable, areas shall be designated as trash collection centers, where refuse shall be deposited to await collection. Such areas shall be screened from view, and shall not immediately adjoin any property containing living quarters. Where used, trash collection centers shall not serve more than 24 families, and shall not be more than 200 feet (61 m.) from any dwelling served.

Collection shall be made at least twice weekly.

STANDARDS GROUP A

Streets, Lot Size, Building Lines, Lot Coverage



Dwelling Lot To :	Standpipe	100 m.	Max.
	Dug Well	60 m.	Max.
	Bath & Laundry Facilities	152 m.	Max.
	Refuse Area	61 m.	Max.

STANDARDS GROUP B

DETACHED, SEMI-DETACHED AND ROW HOUSING

B-100 NEIGHBORHOOD PLANNING

B-101 Objectives

To assure the best use of available land in providing private, commercial and public amenities for the residents of the area concerned by.

1. Providing adequate and consistent zoning within the master plan of the larger community, as well as the neighborhood unit, which will allow for future growth and change and which will maintain the value of properties and residential areas and protect them from smoke, noise, traffic and other nuisances associated with commercial and industrial activity. At the same time, a maximum of employment opportunities should be available within a reasonable distance of residential areas and be accessible by public transportation.

2. Establishing limits for density of persons and living units which will provide a desirable sanitary, physical and social environment.

3. Providing access to, egress from and circulation within the neighborhood area which allows access to private, commercial and public areas, and provide easy flow of vehicular and pedestrian traffic while protecting neighborhood activities from through traffic.

4. Providing those shopping and other commercial facilities normally used on a day-to-day basis within a reasonable distance of all dwelling units.

5. Providing reasonable access to and service from public facilities such as parks, playgrounds, libraries, clinics and police and fire protection.

B-102 Land Allocations - Percentages

Based on total area of development.

The figures given do not present maximum or minimum percentages, but are given as guidelines, reasonable variations from which are permissible.

	<u>Percent</u>
Housing lots	50 to 60
Roads, rights-of-way and parking	20 to 30

	<u>Percent</u>	
Other private uses (markets and shops, light industry, churches and private organizations, etc.)	5 to 10	
Other public uses (parks and playgrounds, police and public reserve)	10 to 20	
B-103 Distances to Amenities		
Elementary school, recommended maximum	1/2 mile or 0.8 kilometer	
High school, recommended maximum	1-1/2 miles or 2.4 kilometers	
Children's playground, recommended maximum	1/4 mile or 0.4 kilometer	
Shopping facilities (day-to-day) recommended maximum	1/4 or 0.4 kilometer	
B-104 Density		
B-104.1 Maximum Number of Dwellings		
	<u>Per Net Housing Acre</u>	<u>Per Net Housing Hectare</u>
Detached dwellings	18.4	45.4
Duplex dwellings	27.1	67.0
Row dwellings	40.0	99.0
B-104.2 Maximum Persons Based on Family of 5 Persons		
	<u>Per Net Housing Acre</u>	<u>Per Net Housing Hectare</u>
Detached dwellings	92	227
Duplex dwellings	135.5	335
Row dwellings	200	294
B-105 Streets		
B-105.1 General		
Streets shall provide adequate and safe means of vehicular and pedestrian circulation, drainage of storm water, tree planting space, and where necessary, on-street parking of vehicles.		
B-106 Right-of-Way Widths		
B-106.1 Collector Streets		
Streets carrying through traffic, a minimum of	50 feet or 15 meters	
B-106.2 Service Streets		
Streets not carrying through traffic, a minimum of	33 feet or 10 meters	
B-106.3 Paths		
Paths giving access to internal lots (those not served by an adjoining service or collector street), a minimum of	10 feet or 3 meters	



WALK-WAYS SAVE COST

Example showing walk-way with gravel and stepping stones. It is wide enough to allow passage of firefighting equipment in emergencies.

Architects: Walter Harris and Temple Dick, Instituto Nacional de la Vivienda, (Formerly ICIV) Guatemala City, Guatemala (1958).

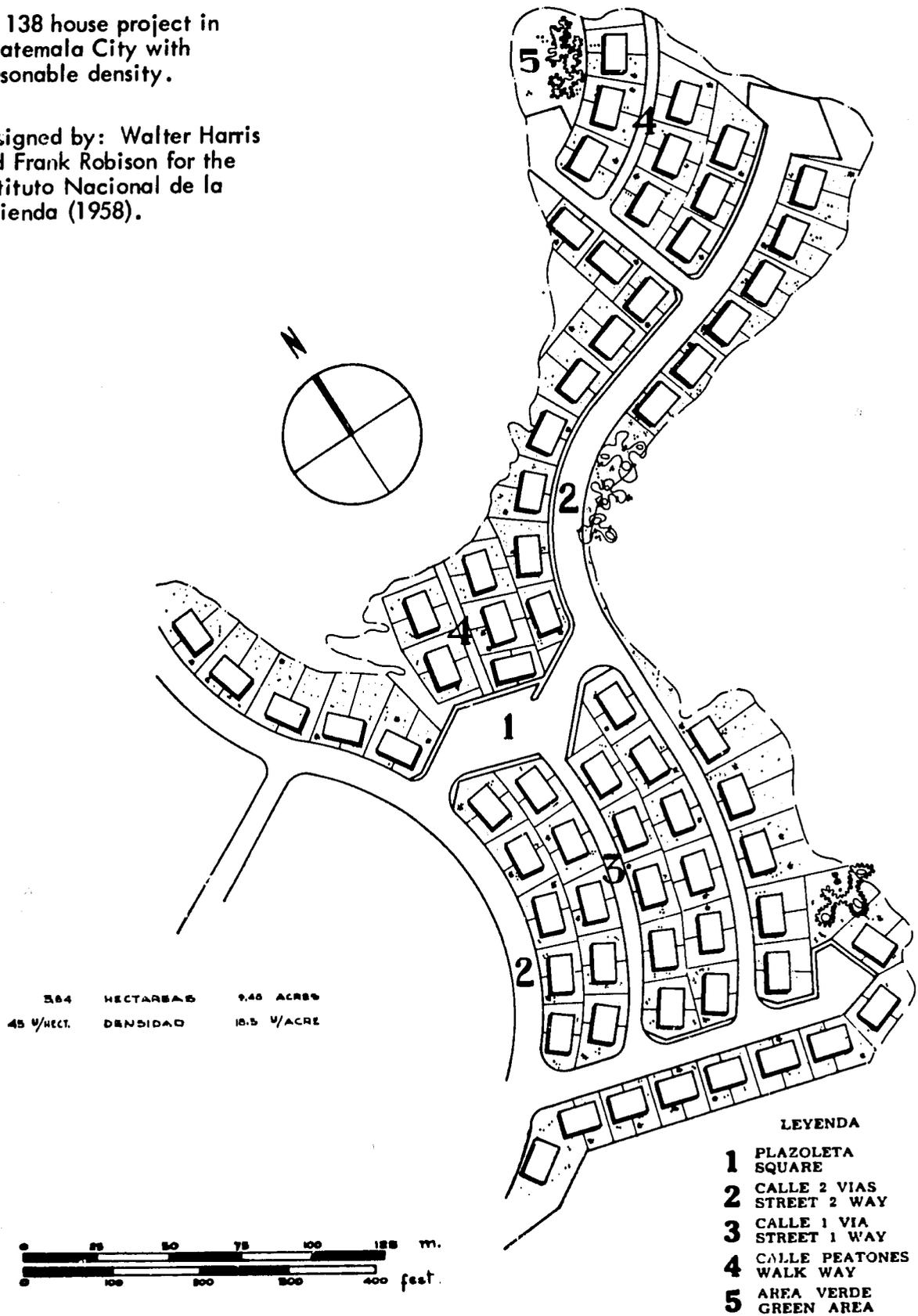
B-106.4 Dead End Streets(Cul-de-Sacs)

A dead-end street (cul-de-sac) shall be a maximum of 330 feet or 100 meters in length, 33 feet or 10 meters in right-of-way width, and shall have a turning area right-of-way at its inner end of at least 50 feet or 15 meters radius.

PLOT PLAN

Of 138 house project in
Guatemala City with
reasonable density.

Designed by: Walter Harris
and Frank Robison for the
Instituto Nacional de la
vivienda (1958).



B-200 PLOT PLANNING

B-201 Objectives

To provide for:

1. Convenient access to and circulation around the dwelling
2. Adequate natural light and ventilation of rooms and spaces
3. Reasonable privacy for each living unit
4. Utilization of the plot for laundry-drying, gardening, landscaping and other outdoor activities
5. Possible expansion of the dwelling
6. Adequate area to assure a safe and sanitary installation where individual water supply and/or sewage disposal systems are involved.

B-202 General

When the lot is internal (pedestrian and emergency vehicular access only) no dwelling shall be sited more than 330 feet (100 m.) from a vehicular road.

Each dwelling shall be provided with a means of access to the rear yard.

B-203 Lot Frontage

The minimum frontage for individual building lots is as follows:

Detached dwelling	40 feet or 12.2 meters
Semi-detached dwelling	30 feet or 9.1 meters
Row dwelling (one story)	20 feet or 6.0 meters
Row dwelling (two story)	18 feet or 5.4 meters
For lots of irregular shape	15 feet or 4.6 meters

B-204 Lot Area

The minimum lot area for individual sites shall be as follows:

Detached dwelling	2355 square feet or 220 square meters
Semi-detached dwelling	1605 square feet or 150 square meters
Row dwelling	1075 square feet or 100 square meters

B-205 Lot Coverage

The maximum area of the plot which may be used for building shall be as follows:

Detached dwelling	40 percent
Semi-detached dwelling	50 percent
Row dwelling	60 percent

The building area includes the total ground area of each building and accessory building, but does not include the area of uncovered entrance platforms, terraces and steps.

B-206 Yard Dimensions (Building Lines)

The minimum distance of a dwelling or other structure from the lot line shall be:

Front	10 feet or 3 meters
Side	6 feet or 1.8 meters
Rear	15 feet or 4.5 meters

Except for "back-to-back" sanitary facilities whose common wall is on property line.

Where courtyards and/or rear yards are provided, their total area shall not be less than the area that would result from 15 feet (4.5 m.) setback along the full width of the property.

B-207 Distance Between Buildings

B-207.1

Distance between buildings front-to-front, across street, path, or common area to be a minimum of 2-1/2 times the total building height.

B-207.2

Minimum distance between buildings back-to-back across property line (except in the case of courtyard houses), service land or common space to be 30 feet (9 m.).

B-207.3 Building on Same Site

The minimum distance between the dwelling and any accessory building on the same site shall be 8 feet (2.4 m.) except in the case of an attached garage or carport.

The minimum distance between accessory buildings on the same site shall be 4 feet (1.2 m.).

B-208 Courts

The minimum area of a courtyard shall be 100 square feet (9.3 sq. m.).

The minimum dimension of a court shall be 8 feet (2.4 m.) where windows open onto no more than 2 adjoining sides of the area.

The minimum dimension of a court shall be 10 feet (3 m.) where windows open onto the space from opposite walls, or where the roof overhang is in excess of 2 feet (0.6 m.).

B-300 BUILDING PLANNING

B-300.1 Objective

To provide for healthful environment and living facilities arranged and equipped to assure suitable and desirable living conditions commensurate with the type and quality of the property under consideration.

B-301 General

Each dwelling shall have at least 2 habitable rooms, of which one shall be for living, one for sleeping, and one for food preparation.

B-302 Space Standards

Each living unit shall be provided with space necessary to assure suitable living, sleeping, cooking and dining accommodations, adequate storage and shall contain or give access to laundry and sanitary facilities. The space shall be planned to permit placement of furniture and essential equipment characteristically used by the families to be served.

The area occupied by a stair, hallway, or closet shall not be included in the determination of required room area.

The minimum gross dwelling area for a family of five persons shall be 350 square feet or 33 square meters.

B-303 Minimum Room Sizes

Minimum room sizes shall be as noted below except that living, dining and kitchen areas shall be increased by 10 percent for each person in excess of five persons using the dwelling on a permanent basis.

B-303.1 Single Use

Living Room	120 square feet or 11.2 square meters
Dining Room	80 square feet or 7.5 square meters
Bedroom - 1st	100 square feet or 9.3 square meters
Bedroom - 2nd	85 square feet or 7.9 square meters
Bedroom - 3rd	75 square feet or 7 square meters
Other living areas	75 square feet or 7 square meters

(All of the above to have a minimum lateral dimension of 8 feet or 2.4 meters)

Kitchen 60 square feet or 5.4 square meters

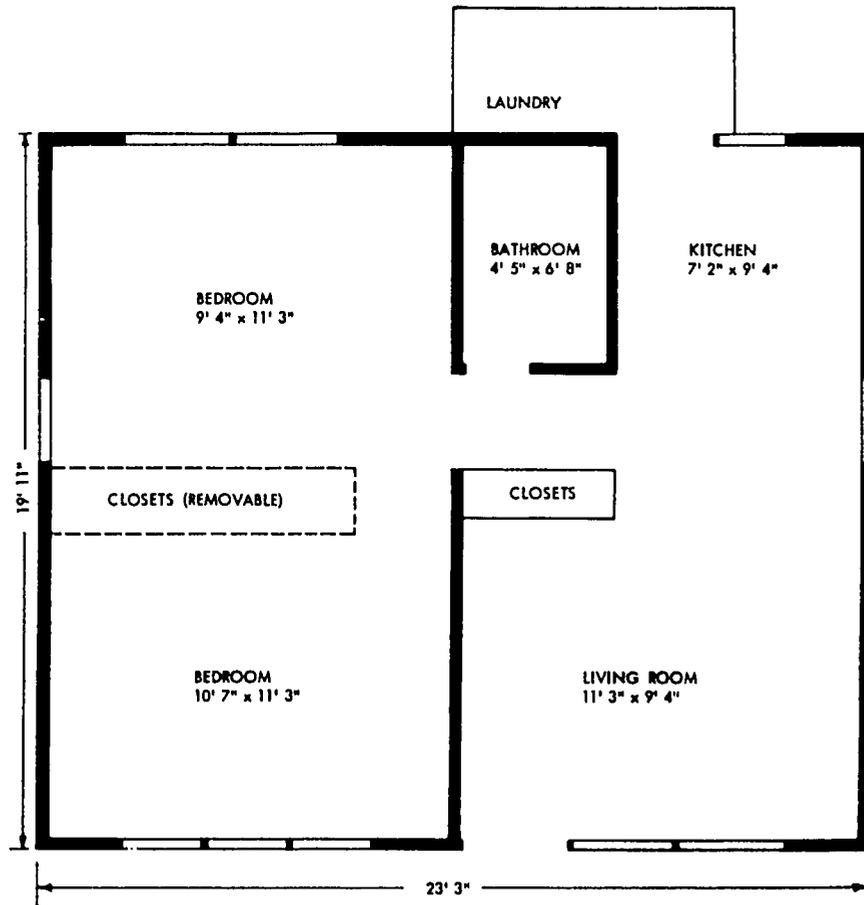
(The above to have a minimum lateral dimension of 6 feet or 1.8 meters)



View of typical house at
Colonia Managua,
Nicaragua (1959)

Low-cost home in
Managua.

Floor Plan (INVI)
(Architectural Advisor:
Richard Zenger)



B-303.2 Combined Rooms

Living-Dining	140 square feet or 13 square meters
Living-Dining-Sleeping	180 square feet or 16.8 square meters
Kitchen-Dining	80 square feet or 7.5 square meters

(All of the above to have a minimum lateral dimension of 8 feet or 2.4 meters)

B-303.3 Bath

Minimum area with combined w.c. and tub or shower	35 square feet or 3.2 square meters
Minimum area of separate shower space	24 square feet or 2.2 square meters
Minimum area of separate w.c. space	20 square feet or 1.8 square meters

B-303.4 Halls and Vestibules

Minimum Width	3 feet	or	0.9 meters
Minimum area	10.7 square feet or 1.0 square meter		

B-303.5 Laundry Room or Space

Provide space for washing equipment, and for its maintenance and use. Where a separate area is provided, the minimum area shall be 24 square feet or 2.16 square meters with a minimum lateral dimension of 4 feet or 1.3 meters.

B-304 Storage - General

A minimum total of 250 cubic feet or 7.1 cubic meters of storage of all types should be provided, of which 150 cubic feet or 4.2 cubic meters should be for bulk, periodic or exterior use. The latter may be in an accessory structure. Of the above, 100 cubic feet or 2.8 cubic meters must be in areas with depth not in excess of 4 feet or 1.2 meters and not less than 18 inches or 45 centimeters in width.

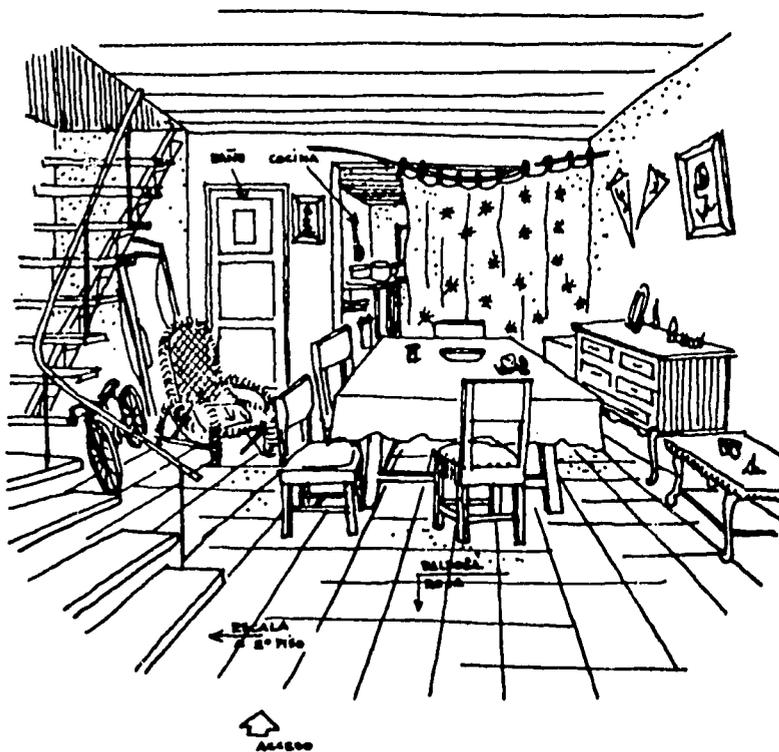
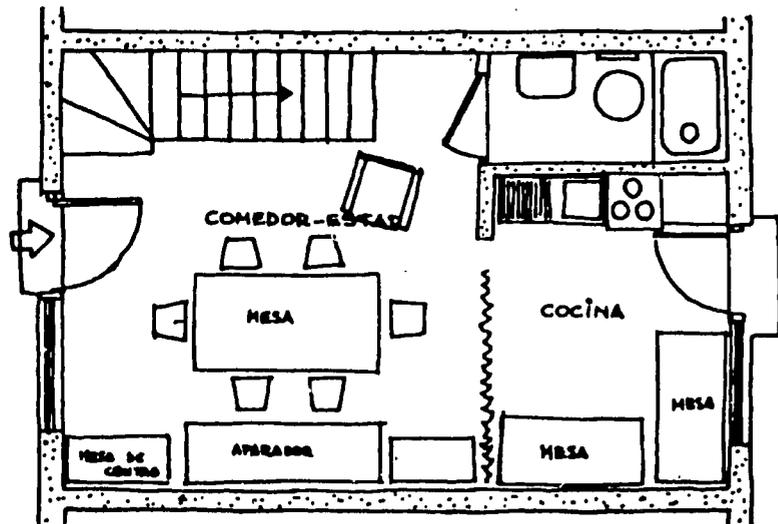
Attic or under-floor storage (except where a properly constructed basement or accessible floored attic space is provided) will not be counted as adequate storage area.

B-304.1 Fuel Storage

Depending upon the climate, facilities shall be provided as necessary for delivery, handling and storage of fuel, and should be planned to prevent fire hazard, cause unnecessary dirt, or obstruct internal or external circulation.

Where wood or coal is used, and where no external bulk storage is available, a minimum of 64 cubic feet or 1.8 cubic meters should be provided.

SPACE FOR FURNITURE



Floor plan and sketch of cramped minimum housing unit in Chile. This is not an example of logical space arrangement, but the result of failure to take into account the minimum areas required for furniture and for circulation.

Courtesy of Prof. Luis Bravo Heitmann, Technical Director of the "Instituto de Investigaciones de la Vivienda y de la Edificación, Santiago de Chile.

The message Prof. Heitman conveys to architects is to design space in relation to furniture placement and use rather than create minimum "areas."

B-304.2 Closets (Bedroom)

Each bedroom shall have a closet with a minimum depth of 2 feet or 60 centimeters and a minimum width of 3 feet or 90 centimeters. The height of the closet should be at least 5 feet 6 inches or 1.7 meters with one shelf a minimum of 12 inches or 30 centimeters below this level. One hanging rod must be provided at approximately 4 feet 6 inches or 1.4 meters height.

In areas where the use of wardrobes is traditional, closet space may be arranged in the form of alcoves sufficiently wide to receive a wardrobe of normal size; any additional space needed due to wardrobe size shall not reduce minimum areas required under Section B-303.

B-304.3 Coat Closet

A coat closet located for convenient access to the living area is required. (Minimum size same as that required for bedrooms).

B-304.4 Linen Closet

A linen closet located for convenient access to the bedroom(s) is recommended with the approximate dimensions of:

Depth	2 feet or 60 centimeters
Width	2 feet or 60 centimeters
Shelf Area	12 square feet or 1.1 square meters
Shelf Spacing	12 inches or 30 centimeters

Closet doors are not required for any of the above units. However, they should be constructed in such a way that doors could be installed later, i. e. framed openings shall be provided.

B-304.5 Kitchen Storage (General)

Each kitchen shall have accessible storage space for food and utensils, and space for such activities and equipment needed to perform the intended functions.

B-304.6 Shelves

Shelf area of 20 square feet or 1.8 square meters shall be provided, with a minimum shelf width of 8 inches or 20 centimeters. Maximum height of shelves above floor shall be 6 feet or 1.8 meters.

B-304.7 Counter and Sink

A minimum of 6 square feet (0.56 sq. m.) of counter space shall be provided, which shall be 3 feet (90 cm.) from the floor and at least 20 inches or 50 centimeters in depth. This counter space shall be provided in addition to a kitchen sink of at least 24 inches (60 cm.) x 20 inches (50 cm.) in dimension.

B-304.8 Food Cabinet(Where refrigeration is not provided)

An insect proof cabinet shall be provided, with a minimum volume of 6 cubic feet or 0.18 cubic meters finished so as to be easily cleaned. The door should be of a framed insect screen type to allow adequate ventilation.

B-305 Finish Grade at Habitable Rooms

In the case of the lower level of a two (or more) story building, the average finish grade elevation at exterior walls shall not be more than 48 inches or 1.2 meters above the finished floor of a habitable room. In the case of a single story dwelling, and in the area of doors or open passages on the lowest level of a two (or more) story building the floor level shall be a minimum of 4 inches (10 cm.) above finished grade, with adequate provision for external drainage.

B-306 Ceiling Height

Ceiling heights shall be not less than 7 feet 6 inches (2.29 m.). Where sloping ceilings are provided, a minimum height of 8 feet 0 inches (2.4 m.) must be provided over half the total floor area. No area with a ceiling height of less than 6 feet 0 inches (1.8 m.) will be included in the required minimum area.

B-307 Volume

Volume per person (including children) shall be at least 300 cubic feet or 8.5 cubic meters for all habitable rooms.

B-308 Natural Light

Minimum glazed and/or open window area shall be a percentage of the floor area of each room as follows:

Temperate zone	10 percent
Hot dry zone	5 percent
Hot wet zone	20 percent

In hot dry areas, to prevent excessive reflection from ground, window sills should be a minimum of 30 inches (76 cm.) from the floor.

Daylight factor, measured at 2 feet 9 inches (84 cm.) from the floor on a horizontal plane, should be at least 1 percent over 50 percent of the floor area, or 5 foot-candles.

B-309 Ventilation

B-309.1 Ventilation - Habitable Rooms

Ventilation in open and/or openable window area shall be the following minimum percentage of the total floor area of the room:

Temperate zone	5 percent
Hot dry zone	5 percent
Hot wet zone	20 percent

In tropical areas window glass need not be provided if openings are adequately protected by movable shutters and, where necessary, insect screens. Provision shall be made for cross-ventilation.

B-309.2 Ventilation of Structural Spaces

Objective: To provide natural ventilation of spaces such as attics and basementless spaces (crawl spaces) to minimize the effect of conditions conducive to decay and deterioration of the structure and to reduce attic heat in the summer.

B-309.3 Ventilation of Basementless Space (Crawl Space)

Where a wood, or partially wood, suspended floor is installed, a minimum of 1 vent per side shall be provided in the foundation wall. Actual opening (less frame, etc.) shall be equal in area to at least 1/150th of the basementless space (crawl space).

The above may be:

1. Reduced by 2/3 where adequate ground vapor barrier is provided, or
2. Eliminated where such basementless space (crawl space) opens into a properly constructed and ventilated basement.

B-309.4 Ventilation of Basements

Window area shall be a minimum of 1 percent of floor area.

B-309.5 Ventilation of Attic or Ceiling Spaces

Free ventilating area equal to 1/150th of the ceiling area shall be provided, with 50 percent above the height of any eave or cornice vents.

Any space which may later be ceiled for use as a room should have 50 percent of the required ventilation above any possible ceiling or enclosure.

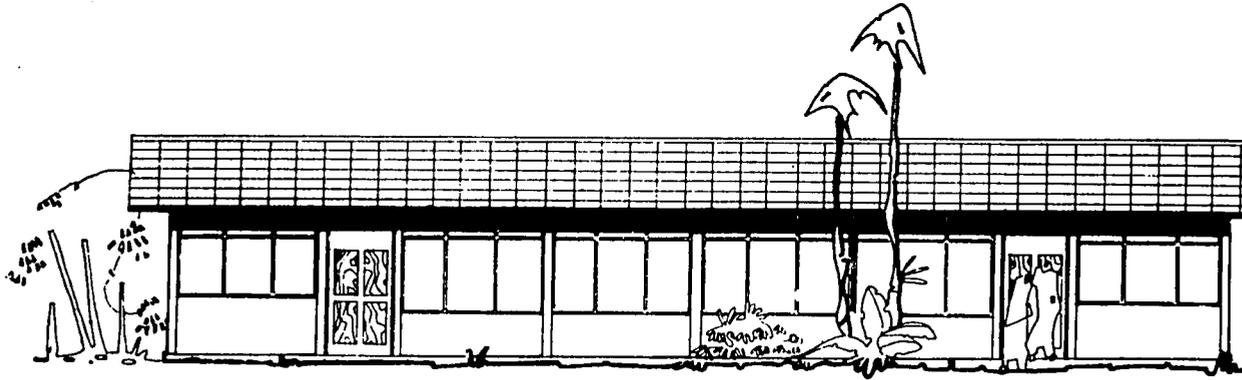
B-310 Doors

One exterior door shall have a minimum width of 3 feet 0 inches or 90 centimeters. Other exterior doors may have a minimum width of 2 feet 8 inches or 80 centimeters. Minimum exterior door height 6 feet 6 inches or 2 meters.

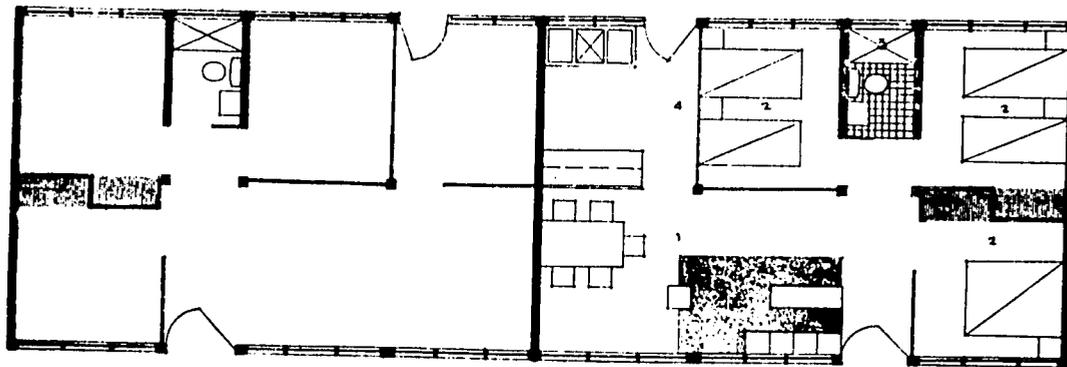
Interior doors shall be a minimum of 2 feet 6 inches or 75 centimeters in width and 6 feet 6 inches or 2 meters in height, with the exception of doors for:

Bathroom and toilet	2 feet 0 inches or 60 centimeters
Linen and broom closet	1 foot 6 inches or 75 centimeters

TROPICAL HOUSE
 (with plenty of ventilation)



ELEVACION
 ELEVATION



PLANTA
 FLOOR-PLAN

Area: 56.7 Sq. Meters

- LEYENDA
- 1** SALA-COMEDOR
LIVING-DINING
 - 2** DORMITORIO
BEDROOM
 - 3** BAÑO
BATHROOM
 - 4** COCINA
KITCHEN

ESCALA 100 200 300 400 500
 SCALE 1 0 1 2 3 4 5 6 7 8 9 10

Architect: Frank Robison for the
 Instituto Nacional de la Vivienda
 Guatemala City, Guatemala (1960).

B-311 Privacy

Objective: To provide a degree of privacy, commensurate with desirable living conditions, by means of the proper location of exterior openings in relation to exterior conditions and the interior arrangements of rooms, particularly with reference to accessibility of bathrooms from bedrooms.

B-311.1 Room Arrangements

The room arrangements shown in the following table are not acceptable:

<u>Only Access From</u>	<u>To</u>	<u>Through</u>
A habitable room	Another habitable room	A bedroom or bathroom
A bedroom	A bathroom	Another bedroom

B-312 Stairway Planning

Minimum continuous clear headroom of 6 feet 4 inches or 1.95 meters shall be measured vertically from outer edge of tread to a line parallel with stair pitch.

B-312.1 Stairway-Width

Width clear of handrail shall be a minimum of 2 feet 6 inches or 75 centimeters.

B-312.2 Tread

Tread maximum shall be 1 foot 1 inch or 33 centimeters (with nosing) and tread minimum 8 inches or 20 centimeters.

B-312.3 Riser

Riser maximum shall be 8 inches or 20 centimeters and riser minimum 5 1/2 inches or 14 centimeters.

B-312.4 Height

The maximum height landing to landing shall be 12 feet 0 inches or 3.6 meters.

B-312.5 Landing

Minimum landing width shall be 3 feet 0 inches or 90 centimeters.

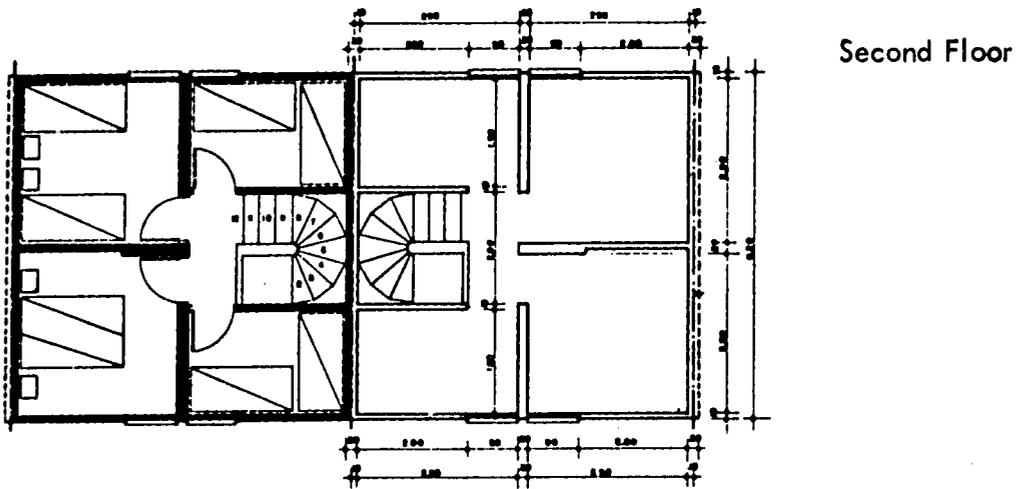
B-312.6 Handrail

A handrail shall be provided on at least one side of stairs where there are 3 or more risers.

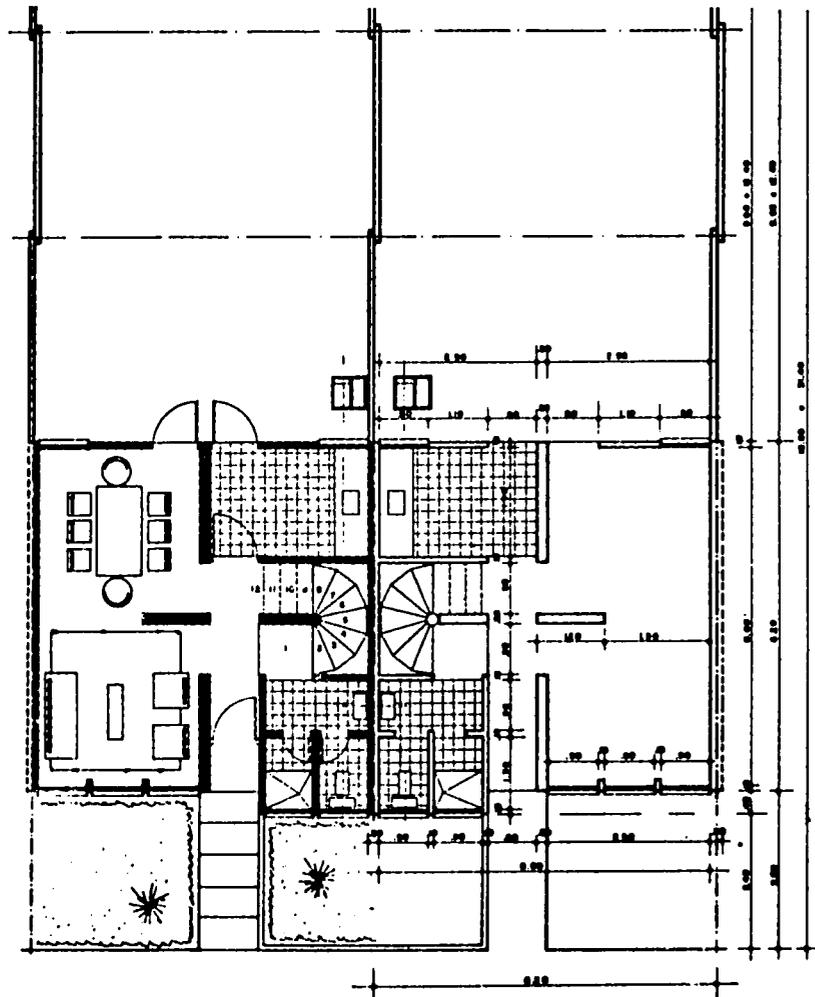
B-312.7 Circular Stairs

Circular stairs shall have a radius of at least 3 feet 4 inches or 1 meter.

MODULAR FLOOR PLAN



First Floor



Low-cost house designed by the Instituto de Credito Territorial Bogota, Columbia.
Excellent floor plan although third and fourth bedrooms could be enlarged a bit to allow for additional furniture.

B-400 CONSTRUCTION

B-400.1 Objective

To assure that the dwelling will provide:

1. Adequate structural strength and rigidity
2. Necessary resistance to the elements
3. Adequate protection from corrosion, decay, insects and other destructive forces
4. Reasonable durability and economy of maintenance
5. An acceptable quality of workmanship

B-400.2 General

The structure, including the component parts, shall have sufficient strength and rigidity to support the design load and to resist deformation without exceeding the allowable design stress or deflection indicated herein.

The strength and rigidity of individual members of assemblies shall be determined by a qualified engineer or architect in accordance with recognized engineering analysis procedures. Where assemblies or details of construction are of such nature that the strength, rigidity and other properties cannot be determined by analysis, these properties shall be determined by suitable tests.

B-401 Design Loads

B-401.1 Design Dead Loads

Dead loads in calculation shall consist of actual weights of all materials making up the construction including walls, floors, roofs, ceilings, partitions, stairways and fixed service equipment.

Where a choice of finishing or covering material is possible, the design dead load shall be based upon the heavier material.

B-401.2 Design Live Loads

Design live loads shall consist of the weight of all moving and variable loads that may be placed in the building, including loads on floors, operational loads on roofs and ceilings, and wind, snow and earthquake loads which may act upon the structure, either singly or in combination with other dead and live loads.

B-402 Scope

The following requirements apply to dwellings not over two and one-half stories in height containing one or two dwelling units, and not over two stories in height containing more than two dwellings units, and accessory structures, such as garages.

B-403 Definitions

For the purpose of this document:

1. "Component" means a part or member of an element
2. "Element" means any floor, wall, partition, ceiling or roof
3. "Element covering" means any material, or combination of materials, spanning between structural members or ribs. It does not include applied protective or wearing coverings such as paint, linoleum, roofing, etc.
4. "Dead load" means the weight of elements and other permanent portions of the dwelling
5. "Live load" means all loads other than dead loads
6. "Design loading" means total of dead and live loads, as used in design calculation
7. "Span" means clear span of element, or between ribs of ribbed elements
8. "Sustaining of load" means such sustaining without cracking, breaking, excessive deflection, or permanent buckling of principal structural components
9. "Residual deflection", "indentation", "displacement", "vertical shortening" and "lateral deflection", mean the "deflection" remaining after removal of load, generally expressed as a percentage of the maximum deflection, etc. under load.

Physical properties of materials shall conform to nationally recognized standards, or in the absence of such, shall be determined by appropriate tests. The necessity for, and kinds of tests required will depend on:

1. Type of material, or combination or assembly of materials
2. Proposed use and
3. Physical properties in question

B-404 Working Stresses

Working stresses used in calculations shall conform to nationally recognized standards, or in the absence of such, shall be based on results of tests interpreted in accordance with professional judgment and good engineering practice, taking into account the variability of test results, and providing a reasonable factor of safety.

B-405 Testing Procedures

Tests shall be substantially in accordance with procedures of the appropriate national standards organization or other responsible testing body, domestic or foreign (e. g. A. S. T. M. or DIN), whose authority is recognized in the country concerned.

B-406 Strength of Elements

Strength of Elements shall be determined by any of the following methods:

- a. Structural analysis based on nationally recognized engineering procedure
- b. Comparison with other constructions for which strengths have been determined under (a) above or (c) below
- c. Tests - made in accordance with "testing procedures" above. If characteristics are such as to indicate need, tests shall also be made under temperature and humidity ranges normal to the use of the material in question.

B-407 Joints, Fastenings and Connections

Joints, fastenings and connections shall be such as will effectively transmit 2 times the design loadings.

Structural Requirements:

B-408 Floors

B-408.1 Uniform Live Load

B-408.11 Requirements

- a. 40 pounds per square foot (195 kg. per sq. m.) for all habitable stories, except;
- b. 30 pounds per square foot (146 kg. per sq. m.) - for habitable stories above the first in single-family dwellings, including that portion of any attic which may be used for habitable rooms and which has at least:
 1. 7 1/2 foot (2.3 m.) ceiling height for one-half floor area; and
 2. 5 foot (1.5 m.) height under sloping ceilings.
- c. 20 pounds per square foot (98 kg. per sq. m.) for attics, other than attics as set forth in (b), which will permit use for light storage.

B-408.12 Acceptable Performances

- a. Under live load - maximum deflections:
 1. 1/360 of span if underside is to be plaster; or
 2. 1/240 of span if underside is other than plaster, or unfinished; but
 3. not more than 1/2 inch (1.27 cm.) in any case.
- b. Under uniform load (or equivalent) consisting of superimposed load equal to 1 times dead load plus 2 times live load:
 1. sustaining of load; and
 2. 25 percent maximum residual deflection (of total deflection).

B-408.2 Concentrated Load

B-408.21 Requirements

Load applied on 1-inch (2.54 cm.) disk on upper surface at point where greatest deflection or indentation, or both, will occur:

- a. 250 pounds (114 kg.) for all habitable stories, for:
 1. element span; and
 2. span between ribs, in ribbed elements.
- b. 150 pounds (68 kg.) for attics for light storage - span of element only (applied over rib in ribbed element).

B-408.22 Acceptable Performances

- a. Under load, maximum deflections or indentations:
 1. $1/360$ of span if element underside is to be plaster; or
 2. $1/240$ of span if underside is other than plaster, or unfinished; but
 3. not more than $1/2$ inch (1.27 cm.) in any case.Spans between ribs of ribbed elements:
 4. $1/240$ of span, or $1/16$ inch (1.59 mm.) whichever is greater
- b. Under 2 times load:
 1. sustaining of load; and
 2. 25 percent maximum residual deflection or indentation, or both.

B-408.3 Impact Load

B-408.31 Requirements

10 inch (25 cm.) diameter sandbag weighing 60 pounds (27 kg.), dropped on upper surface, at weakest point of element.

B-408.32 Acceptable Performances

- a. Under 4-foot (1.2 m.) drop, no residual deflection.
- b. Under 6-foot (1.8 m.) drop
 1. 25 percent maximum residual deflection; and
 2. no break through element covering.

B-409 Walls

B-409.1 Wind Load

B-409.11 Requirements

Live load, applied transversely, acting inward or outward:

- a. 15 pounds per square foot (73 kg. per sq. m.), or
- b. Load calculated by multiplying applicable value for maximum local conditions by the following factor:
 - 0.9 For walls of first story;
 - 1.1 For walls of second story;
 - 1.2 For walls above second story, up to two and one-half stories, whichever is greater, (a) or (b).

B-409.12 Acceptable Performances

- a. Under live load - maximum deflections:
 1. 1/360 of span if interior surface is to be plaster; or
 2. 1/240 of span if interior surface is other than plaster.
- b. Under 2 times live load:
 1. sustaining of load; and
 2. 25 percent maximum residual deflection.

B-409.2 Vertical Load

B-409.21 Requirements

Live load, acting within a plane not more than one-third of wall thickness from interior surface (eccentric loading):

- a. 500 pounds per linear foot (227 kg. per 30 cm.); or
- b. load resulting from imposed design loadings; whichever is greater (a) or (b).

B-409.22 Acceptable Performances

Under two times live load:

1. sustaining of load; and
2. 40 percent maximum residual vertical shortening or lateral deflection, or both.

B-409.3 Racking Load

B-409.31 Requirements

Live load, acting along upper edge of wall:

- a. 100 pounds per linear foot (45 kg. per 30 cm.); or
- b. load resulting from wind: whichever is greater (a) or (b).

B-409.32 Acceptable Performances

On wall 8 feet (2.4 m.) long and 8 feet (2.4 m.) high:

- a. Under live load, 1/8 inch (3.18 mm.) maximum displacement;
- b. Under 2 times live load:
 1. sustaining of load; and
 2. 25 percent maximum residual displacement (of total displacement).

B-409.4 Concentrated Load

B-409.41 Requirements

40 pounds (18 kg.) applied on 1-inch (2.54 cm.) disk on either surface where greatest deflection or indentation, or both, will occur.

B-409.42 Acceptable Performances

- a. Under load, maximum deflections or indentations in Spans between ribs of ribbed elements:
 1. 1/120 of the span plus 1/10 inch (2.54 mm.) for interior surface;
 2. 1/120 of the span or 1/8 inch (3.18 mm.) whichever is greater for exterior surface.

In any case;

3. 1/32 inch (.794 mm.) residual indentation for interior surface;
4. 1/64 inch (.397 mm.) residual indentation for exterior surface
- b. Under 2 times load:
 1. sustaining of load; and
 2. 25 percent maximum residual deflection or indentation, or both.

B-409.5 Impact Load

B-409.51 Requirements

10 inch (25 cm.) diameter sandbag weighing 60 pounds (27 kg.), dropped on either surface at weakest point of element.

B-409.53 Acceptable Performances

Span of element:

- a. Under 1-1/2 foot (46 cm.) drop, no residual deflection.
- b. Under 3 foot (91 cm.) drop, 25 percent maximum residual deflection.

B-410 Partitions

B-410.1 Windload

B-410.11 Requirements

15 pounds per square foot (73 kg. per sq. m.) live load, applied transversely.

B-410.12 Acceptable Performances

- a. Under live load, maximum deflections:
 1. $1/360$ of span if either surface is to be plaster; or
 2. $1/240$ of span if neither surface is plaster.
- b. Under 2 times live load:
 1. sustaining load; and
 2. 25 percent maximum residual deflection.

B-410.2 Vertical Load (Not applicable to nonbearing partitions.)

B-410.21 Requirements

Live load acting within a plane not more than one-third of partition thickness from surface:

- a. 500 pounds per linear foot (227 kg. per 30 cm.) or
- b. Load resulting from imposed design loadings; whichever is greater (a) or (b).

B-410.22 Acceptable Performances

Under 2 times live load:

1. sustaining of load; and
2. 40 percent maximum residual vertical shortening or lateral deflection, or both.

B-410.3 Racking Load (Not applicable to nonbearing partitions.)

B-410.31 Requirements

Live load acting along upper edge of partition:

- a. 100 pounds per linear foot (45 kg. per 30 cm.); or
- b. load resulting from wind; whichever is greater (a) or (b).

B-410.32 Acceptable Performances

On partition 8 feet (2.4 m.) long and 8 feet (2.4 m.) high:

- a. Under live load - $1/8$ inch (3.18 mm.) maximum displacement.

- b. Under 2 times live load:
 - 1. sustaining of load; and
 - 2. 25 percent maximum residual displacement.

B-410.4 Concentrated Load

B-410.41 Requirements

40 pounds (18 kg.) applied on 1-inch (2.54 cm.) disk, on either surface where greatest deflection or indentation, or both, will occur.

B-410.42 Acceptable Performances

- a. Under load - maximum deflection or indentations:
Span between ribs of ribbed elements:
 - 1. 1/120 of the span plus 1/10 inch (2.54 mm.) for either surface;
 In any case;
 - 2. 1/32 inch (.79 mm.) residual indentation for either surface.
- b. Under 2 times load:
 - 1. sustaining of load; and
 - 2. 25 percent maximum residual deflection, or indentation, or both.

B-410.5 Impact Load

B-410.51 Requirements

10 inch (25 cm.) diameter sandbag weighing 60 pounds (27 kg.), dropped on either surface at weakest point of element.

B-410.52 Acceptable Performances

Span of element:

- a. Under 1-1/2 foot (46 cm.) drop - no residual deflection:
- b. Under 3 foot (91 cm.) drop - 25 percent maximum residual deflection.

B-411 Ceilings

B-411.1 Uniform Load

B-411.12 Requirements

In any dwelling in which space above ceiling cannot be used for:

Habitable rooms	See	B-408.11 b
Light storage	See	B-408.11 c

No live load need be assumed for ceiling element. In any case, other than as set forth above, the ceiling surface is the underside of a floor element, or roof element; therefore, it is subject to the requirements of the element of which it is a component.

B-411.13 Acceptable Performances

- a. Under dead load - maximum deflections:
 - 1. 1/360 of span if surface is to be plaster, or
 - 2. 1/240 of span if surface is other than plaster, but
 - 3. not more than 1/2 inch (1.27 cm.) in any case.
- b. Under superimposed load of 1 times dead load:
 - 1. sustaining of load; and
 - 2. 25 percent maximum residual deflection (of total deflection).

B-411.2 Concentrated Load

B-411.21 Requirements

40 pounds (18 kg.) applied on 1-inch (2.54 cm.) disk on ceiling surface where greatest deflection or indentation, or both, will occur.

B-411.22 Acceptable Performances

- a. Under load, maximum deflections or indentations in spans between ribs of ribbed elements:
 - 1. 1/120 of the span plus 1/10 inch (2.54 mm.) for either surface:
 - 2. 1/32 inch (.794 mm.) residual indentation for either surface.
- b. Under 2 times load:
 - 1. sustaining of load; and
 - 2. 25 percent maximum residual deflection or indentation or both.

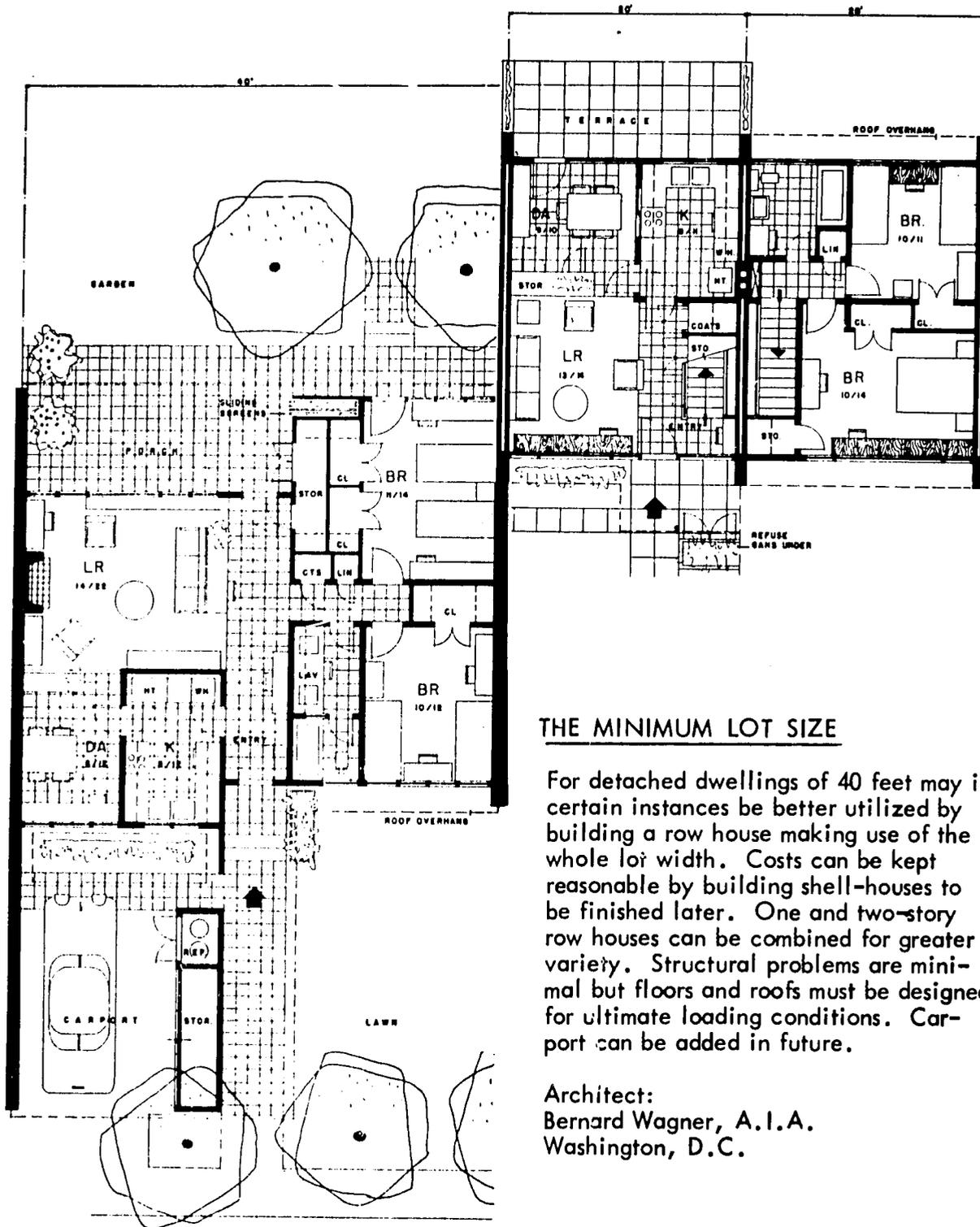
B-412 Roofs

B-412.1 Wind and Snow Loads Acting separately or in combination.

B-412.11 Requirements

Live Loads:

- a. Minima:
 - 1. 20 pounds per square foot (98 kg. per sq.m.) of horizontal projection acting downward and vertically for slopes of 40° or less.
 - 2. 12 pounds per square foot (59 kg. per sq.m.) of roof acting inward and normal to slope for slopes greater than 40°.
 - 3. 15 pounds per square foot (73 kg. sq.m.) of roof acting outward and normal to slope for all slopes.



THE MINIMUM LOT SIZE

For detached dwellings of 40 feet may in certain instances be better utilized by building a row house making use of the whole lot width. Costs can be kept reasonable by building shell-houses to be finished later. One and two-story row houses can be combined for greater variety. Structural problems are minimal but floors and roofs must be designed for ultimate loading conditions. Carport can be added in future.

Architect:
Bernard Wagner, A.I.A.
Washington, D.C.



b. Where live loads caused by wind and snow exceed the above minima, they shall be computed as follows:

1. Wind load, uniformly distributed, acting normal to slope of roof - Multiply local value in pounds per square foot or kilograms per square meter, by applicable factor below.

Direction of force	Number of Stories	Factor (including exterior plus interior) ¹				
		Slope				
		0° to 20°	30°	40°	50°	60° or more
Inward	1	0	0.37	0.53	0.70	0.86
	2	0	0.42	0.61	0.80	0.98
Outward	1	Any slope			¹ Interpolate for all other slopes	
	2	1.15 1.32				

2. Snow load - uniformly distributed acting vertically on the horizontal projection - Multiply local value in pounds per square foot or kilograms per square meter, by applicable factor below.

Slope	Factor ¹
0 to 30°	1.0
40°	.67
50°	.33
60°	0.00

¹Interpolate for all other slopes.

3. Combined load - wind, snow and dead loads may be reduced 25 percent, for design at normal working stresses provided the resultant load is not less than;

Snow and dead load; or

Wind and dead load; or

Load as set forth in a, 1, 2, or 3 above, plus dead load.

B-412.12 Acceptable Performances

- a. Under live load - maximum deflections;
 1. $1/360$ of span if underside is to be plaster; or
 2. $1/240$ of span if underside is other than plaster; or
 3. $1/180$ of span if underside is unfinished.
- b. Under uniform load (or equivalent) consisting of superimposed load equal to 1 times dead load plus 2 times live load:
 1. sustaining of load; and
 2. 25 percent maximum residual deflection.

B-412.2 Concentrated Load

B-412.21 Requirements

Load applied on 1-inch (2.54 cm.) disk, normal to upper surface where greatest deflection or indentation, or both will occur:

- a. 200 pounds (91 kg.) for slopes of 10° or less; or
- b. 150 pounds (68 kg.) for slopes greater than 10° and less than 20° ; or
- c. 100 pounds (45 kg.) for slopes of 20° or more, for
 1. Span of element; and
 2. Span between ribs, of ribbed elements.

B-412.22 Acceptable Performances

- a. Under load - maximum deflections or indentations in span of element:
 1. $1/360$ of span if underside is to be plaster; or
 2. $1/240$ of span if underside is other than plaster; or
 3. $1/180$ of span if underside is unfinished.

B-413 EARTHQUAKE DESIGN

B-413.1 General

In areas subject to earthquakes, the structure and all component parts shall be designed to resist vertical and horizontal forces resulting therefrom. (See B-413.6)

B-413.2 Foundation Walls

A concrete foundation wall shall be reinforced when higher than 6 times its thickness, and a masonry wall shall be reinforced when higher than 4 times its thickness.

B-413.3 Openings

In masonry walls, the total width of openings shall not exceed two-thirds of the wall length, and no single opening shall exceed 8 feet 6 inches (2.5 m.).

B-413.4 Walls

Masonry walls shall have reinforced ring beams at the level of each floor, and roof line, plus other horizontal and vertical reinforcement necessary to meet the design forces. Panel walls shall be securely tied to the frame on all sides. Timber frame structures shall have diagonal bracing at each corner, in both internal and external walls and at all large openings.

B-413.5 Chimneys

Masonry chimneys shall be reinforced and anchored to the structure at each floor. Vertical reinforcement shall extend from footing to cap, and rods, except for welded joints, shall be continuous and shall be hooked at both ends.

B-413.6 Design Forces

The minimum lateral force computed shall be related to the type of construction proposed, and to the condition of the soil on which the structure is to rest. The effective design load for a building may be found as follows:

$$W = DL + 1/2 LL$$

Where W = effective weight for design purposes

DL = dead load

LL = live load

The effective design loads shall then be increased by multiplication with a design factor K as indicated in the table below:

	<u>Rigid Construction</u> <u>Period: 0.4 seconds</u>	<u>Semi-Rigid Construction</u> <u>Period: 0.4 - 0.75 seconds</u>
Rock	0.08	0.05
Conglomerate or very compact soil	0.12	0.10
Sand and filled ground		
a. with mat foundation	0.10	0.12
b. without mat	0.12	0.15

All parapet walls and free standing ornamentation shall be designed to resist a lateral force equal to 100 percent of its weight.

Towers, water tanks, transformers and chimneys connected to buildings should use a K factor of 0.50.

B-414 Insulation Requirements

B-414.1 Objectives

Where heat loss is a health or comfort problem, to design a structure which will retain desired heat at a level in keeping with reasonable construction economy.

B-414.2 Resistance to Heat Loss

Means to reduce the heat loss of the dwelling, if necessary to attain compliance with Section B-414.3 shall be provided. Such means may include:

- a. Thermal insulation of exposed elements;
- b. Weatherstripping - permanently installed;
- c. Caulking;
- d. Storm sash, storm doors or double glazing.

B-414.3 Limitations to Heat Loss

- a. The heat loss of the dwelling in B. T. U. per hour (exclusive of unfinished enclosed spaces) shall not exceed 60 times the total number of square feet of floor area. For purposes of calculation the floor area shall be measured to the inside faces of enclosing walls.
- b. The maximum acceptable coefficients of heat transmission are as follows:
 1. Walls, exposed to outdoor temperature:

$$U = \frac{18}{68-D}$$

2. Floors over unheated space:

$$U = \frac{24}{68-D}$$

- c. Floor slabs on ground under habitable rooms shall have moisture and vermin-proof insulation, as well as heat insulation, around the perimeter of maximum acceptable conductance as follows:
 1. Ordinary slab floor on ground:

$$C = \frac{48}{68-D}$$

2. Slab floors used as radiant heating panels:

$$C = \frac{32}{68-D}$$

d. Ceilings:

$$U = \frac{25}{68-D}$$

B-414.4 Calculations to Heat Loss

Calculation of heat losses shall be based on the following:

- a. Data and methods set forth in the locally approved professional engineering standards, or in their absence, in the current edition of "Heating, Ventilating, Air Conditioning Guide", published by the ASHVE (U.S.A.), except as modified by Section B-414.5.
- b. Inside temperatures of 68^oF. or 20^oC.
- c. Outside design temperatures (D in the formulae in Section B-414.3) as recommended in the "Guide" or as dictated by established local practice.

B-414.5 Tests

Tests shall be made to determine coefficients of heat transmission of materials or elements for which such data are not available.

B-415 Materials and Equipment

Materials and equipment shall be appropriate and shall be of a standard equal to good practice commensurate with the class of dwelling being erected.

When proposed material or equipment is not in general use, or when there is doubt concerning its acceptability, it may be used when:

- a. Adequate authenticated documentation concerning structural performance and maintenance characteristics is presented for inspection to the responsible local authority and is approved by said body
- b. Elements of the material or equipment in question are inspected and tested by, and to the satisfaction of, the responsible local authority
- c. The person, firm, etc., wishing to use the material in question erects a test unit (or units) and carries out properly documented tests in a manner approved by the responsible local authority, meeting the performance requirements of said body.

Newly developed materials and equipment may be used when test data and service records are submitted which indicate durability, performance and appropriate use, provided these are acceptable to the responsible local authority, or conform to foreign standards acceptable to local responsible authorities.

B-416 Special Methods of Construction

New or special methods of construction, not generally considered conventional, may be used on approval by the responsible local authority.

B-417 Foundations**B-417.1 Excavations**

a. Excavation for foundations shall extend to a level which will provide adequate bearing. In case of doubt concerning bearing capacity, tests may be required for this determination. Where unstable conditions, such as heaving clay, shifting sand, or black cotton soil exist, design adaptable to the conditions shall be utilized.

b. Excavation for footings and foundation walls shall extend a minimum of 6 inches (15 cm.) into natural undisturbed soil which will provide adequate bearing except when bearing is on a stable rock foundation.

c. Where frost conditions occur, footings shall be below this level as established by custom and experience in the area concerned related to the most severe conditions in the previous 5-year period.

d. Where steps in the footing must occur due to the nature of the terrain, such steps shall not be greater than the horizontal distance to the next step.

B-417.2 Footings

a. Minimum footing width shall be that required to support the total design load as related to soil type without excessive settlement.

b. Minimum footing thickness shall be 6 inches (15 cm.) or 1-1/2 times the projection of the footing beyond the wall it supports, whichever is larger.

B-417.3 Foundation Walls

a. Where walls are of a monolithic nature (e.g. poured concrete or rammed earth) the foundation walls shall also be of a monolithic nature.

b. Where walls are of masonry units, foundations may be of similar construction or monolithic in nature.

c. In all cases, foundations are to have compressive strength and moisture resistance sufficient to carry the walls they support.

d. Foundation walls shall be at least as wide as the walls they support.

e. Where soil and/or climatic conditions dictate, foundation walls of basements or habitable rooms below grade shall be waterproofed.

B-418 Chimneys**B-418.1 Objective**

To provide design, construction and installation of chimneys and vents which are structurally safe, durable, smoketight and capable of withstanding action of flue gases.

B-418.2 General

Construction of flues shall be of locally approved material, and may include prefabricated elements with proven performance. Due care shall be taken to insulate adjoining structural and finishing materials from the chimney, and in no case shall wood be closer thereto than 2 inches (5 cm.).

The number and size of chimneys shall be determined by the number of units to be served and by the height of the structure, but in no case should the cross sectional area be less than 35 square inches (230 sq. cm.) or that provided by a nominal 8 inch by 8 inch (20 cm. x 20 cm.) flue liner.

Chimneys shall extend at least 4 feet 9 inches (1.5 m.) above the roof (flat).

B-419 Interior Wall and Ceiling Finish

B-419.1 Objective

To secure an interior wall and ceiling finish which will provide:

- a. Reasonable durability and economy of maintenance
- b. A waterproof finish in spaces subject to moisture

B-419.2 General

Wall and ceiling finishes shall be appropriate to the intended use and location. Wall finishes in showers, over bathtubs with showers, or in other locations susceptible to moisture, shall be of waterproof material. Interior finish in showers shall be at least 6 feet (1.8 m.) above the finished floor and over bathtubs with showers at least 4 feet (1.2 m.) above the top of tub. When applied surface materials are used, joints of corners of bathtubs and other intersections shall be caulked or suitably protected. Moldings designed for this purpose may be used.

B-420 Painting and Decorating

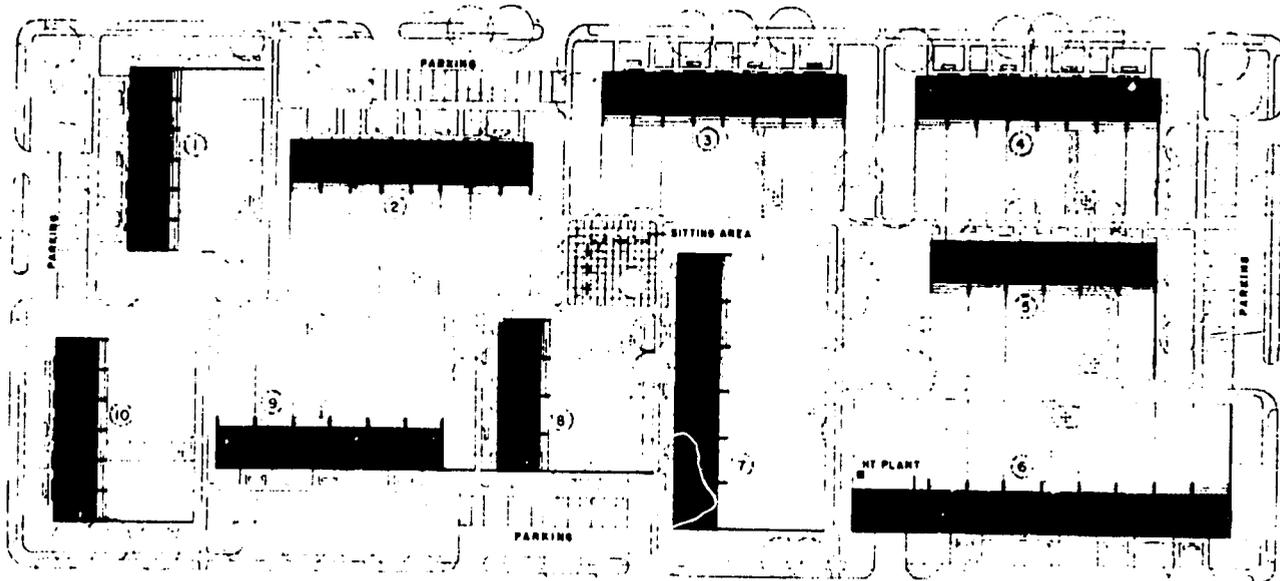
B-420.1 Objective

To provide a protective or decorative coating which will insure:

- a. Adequate resistance to weathering
- b. Protection from damage by corrosion
- c. Reasonable durability and economy of maintenance
- d. An attractive appearance

B-420.2 Materials

All paints and other coating materials shall be standard commercial brands with a history of satisfactory use under conditions equal to those in the area concerned, and shall be designed and recommended by manufacturer for the specific use and degree of exposure to the weather conditions anticipated.



■ LIVING-DINING AREA OF TYPICAL UNIT
⊕ LAUNDRY DRYING

SCALE

0 20 40 60 80 100 FT.

QUALITY OF DESIGN

Cannot be expressed in Minimum figures but should be given equal weight as room sizes or design loads in the evaluation of projects. Row houses can look monotonous or they can be grouped to create attractive courts and vistas. Above example is not shown to be copied; it simply shows one of many ways to group row houses within a typical city block. Lot sizes are generous, parking provisions are ample.

Architect:

Bernard Wagner, A.I.A.
Washington, D.C.

B-420.3 Application

Application of paint or other coating shall be in strict accordance with the manufacturer's directions as to preparation of the surface, application rate, number of coats, and allowable weather conditions (e. g. temperature, humidity, etc.).

B-420.4 Coverage Rate

Coverage rate shall be that providing at least 4.0 mils (0.004 in. or 0.102 mm.) in total dry film thickness (prime and finish coats). For best durability, 4.5 to 5.0 mils (0.0045 to 0.005 in. or 0.114 to 0.127 mm.) are recommended.

Primer coats applied at 450 to 500 square feet per gallon (10 sq. m. per liter approx.) will measure approximately 1.5 to 1.75 mils (0.0015 to 0.00175 in. or 0.03825 to 0.0445 mm.).

Paint Coverage

Coverage rate (sq. ft. per U.S. gal)	Approx. dry film thickness - finish coats (mils)
450	2.25
500	2.00
550	1.75
600	1.50
650	1.30
700	1.10
750	1.00

Coverage rate (liter per sq. m.)	Approx. dry film thickness - finish coats (mm.)
10	0.075
11	0.068
12	0.063
13	0.058
14	0.053
15	0.050
16	0.047

B-500 HEATING

B-501 Objectives

To assure winter comfort by means of facilities providing a quality of performance as well as economy and convenience of operation appropriate to the climate and the dwelling under consideration.

B-502 General

Where necessary, or normally furnished, each dwelling unit shall be provided with a new, permanently installed heating system adequate to maintain a minimum temperature of 68°F. or 20°C. during an equivalent of the coldest period experienced during the previous 5 years.

The system shall be safe to operate and maintain, and shall deliver a uniform distribution of heat.

The system shall be designed and installed in such a manner as to avoid the transmission of objectionable levels of heat to any part of the dwelling, shall be quiet in operation, and shall be reasonably free of vibration.

B-503 Fuel Systems

Lines carrying liquid or gaseous fuel shall be provided with shutoff valves at the fuel source and at the heating unit.

Storage for solid fuel shall be convenient to the heating unit for filling, and it shall not be necessary to pass through any habitable room to transport fuel from the storage area to heating unit, except in the case of individual room heaters where such are normally used in this class of construction.

In the case of solid fuels, a means of storage and removal of ash, etc., shall be provided without the necessity of passing through a habitable room, except in the case of individual room heaters.

B-504 Fuel Storage

See section on "Storage" (B-304)

B-505 Heat Loss Calculations

See "Calculation of heat loss" in section on "Insulation Requirements".

B-506 Design, Construction and Rating of Heating Units

These shall comply with nationally accepted standards, or in their absence, instructions provided by the manufacturer.

B-507 Design and Installation of Heating Systems

These shall comply with nationally accepted standards for the type of system involved, e. g. National Board of Fire Underwriters, U.S.A., American Society of Heating and Ventilating Engineers design data, etc. Where systems other than individual room heaters are employed, the design shall be provided by the manufacturers of the components or by architects or engineers specifically qualified to design such systems.

B-600 PLUMBING AND SANITATION REQUIREMENTS

B-601 Objectives

To provide:

- a. A properly installed system of piping and plumbing fixtures, appropriate to the size and class of dwelling under consideration, supplied with cold (and

where appropriate, hot) water in adequate volume and pressure for cooking, laundering, bathing, and toilet purposes.

- b. A sewerage system (where possible, waterborne) for the safe disposal of wastes in a manner to provide healthful and sanitary living conditions.

B-602 Water Supply

- a. Wherever possible, connections shall be made to an approved public water system;
- b. Where a public system is not available, connection to an approved community system is acceptable when evidence is submitted showing that the system and water provided are considered satisfactory by the local health authority, or like responsible body, of the area concerned;
- c. Where neither a public nor an acceptable community system is available, an approved individual water system is acceptable when evidence is submitted showing that the installation of an individual water system will provide an adequate supply of safe water, and that no hazard or potential hazard exists which might either reduce the supply, or pollute it so as to make it non-potable or unpalatable. Such evidence is to be submitted to the local health authority, or like responsible body, of the area concerned for approval.

B-602.1 Public Water Supply, Piped

B-602.11 General

Every dwelling unit supplied with piped water shall have a minimum of:

- a. One cold water (and where appropriate, one hot water) tap discharging into a sink constructed of impervious, easily cleaned material, draining to a public or communal sewerage line, individual septic tank, soak pit, or similar means of disposal.
- b. A w. c., a lavatory and shower or bath, drained as above.

B-602.12 Volume

The volume per dwelling unit shall be based on a minimum of 40 gallons (151 l.) per occupant per day, in the case of a single tap installation, or a minimum of 120 U.S. gallons (454 l.) per bedroom (or room used for sleeping), in the case of a full installation, including kitchen, laundry, bath and w. c.

B-602.13 Pipes

Pipes used for water supply lines shall be of new material of uniform thickness, dimension and weight, and shall be free of defects such as cracks, or deformations.

Where water supply lines are underground, they shall be as far as possible from sewer lines, and in no case at or below the level of the sewer line, nor closer than 3 feet (0.9 m.) thereto.

B-602.14 Water Supply Pipes-Installation

Hot and cold water pipes may be installed side by side, provided there is a minimum space of 5 centimeters (2 in.) between them, or provided they are furnished with insulating cover.

The supply system to each dwelling unit shall be provided with a shutoff valve, and in buildings with basements, with a valve to drain the system at its low point.

B-602.15 Inspection

Completed water supply systems shall be inspected and tested by the designated authority before the installation of the sanitary fixtures. Test pressure shall be approximately 75 pounds per square inch (5 kg. per sq. cm.) and shall be maintained for 15 minutes. A fall in pressure will indicate remedial action to be followed by a new test prior to approval.

B-602.2 Wells

Minimum standards for wells shall conform to those outlined under Standards Group "A".

B-602.3 Water Tanks and Cisterns

- a. 1. Where water tanks or cisterns are to serve as the sole source of domestic water where waterborne sewerage is not provided, their capacity shall be sufficient to stock 10 U.S. gallons (38 l.) per resident per day for the longest average annual period between periods of significant rainfall, plus five days, or a minimum of 400 U.S. gallons (1500 l.), whichever is larger.
2. Where water tanks or cisterns are to serve as the sole source of domestic water including waterborne sewerage, their capacity shall be sufficient to stock 20 U.S. gallons (76 l.) per resident per day for the period noted above, or a minimum of 500 U.S. gallons (1900 l.), whichever is larger. In either case, the total required may be stored in 2 or more units.
- b. An overflow pipe is to be provided and protected against animal or insect entry by screening.
- c. The draw-off point is to be a minimum of 3 inches (7.6 cm.) from the bottom of the tank or cistern.
- d. The tank shall be provided with a solid, close fitting cover.
- e. If a tank is wholly or partly below ground, it is to be of impervious material or lined with impervious material, and all pipe connections shall be made in a manner to ensure watertight joints.
- f. A tank or cistern with fitted cover shall have a manhole with a cover of sufficient size to allow entry for cleaning and shall be provided with ventilators fitted with non-corrosive screens to prevent entry of insects.

B-603 Emergency Supply

Where public or community systems are intermittent in operation, or for other reasons it is thought advisable by the local health authority, or like responsible body, that a reserve water supply is desirable in order to insure a potable supply and/or to insure the proper functioning of sanitary facilities, a supplementary tank or cistern shall be provided. In case of need, these facilities can also be used for fire fighting purposes.

The capacity of supplementary tanks shall be a minimum of 80 gallons (300 l.) per person, or a minimum of 240 gallons (900 l.) whichever is greater.

B-604 Sewage Disposal

B-604.1 General

- a. Wherever available, connection shall be made to an approved public sewerage system.
- b. Where a public system is not available, connection to an approved community system will be acceptable when evidence is submitted to show that the system and the method of disposal are considered safe by the local health authority, or like responsible body, of the area concerned.
- c. Where neither a public nor acceptable community system is available an individual sewage disposal system is acceptable, when evidence is submitted to show that the system and the method of disposal are suitable for the proposed loading, and that the conditions of the individual site will allow continued and efficient functioning of the system and method proposed without danger of pollution of any private or public water supply. Such evidence is to be submitted to the local health authority, or like responsible body, of the area concerned for approval.

B-605 Waterborne Sewage

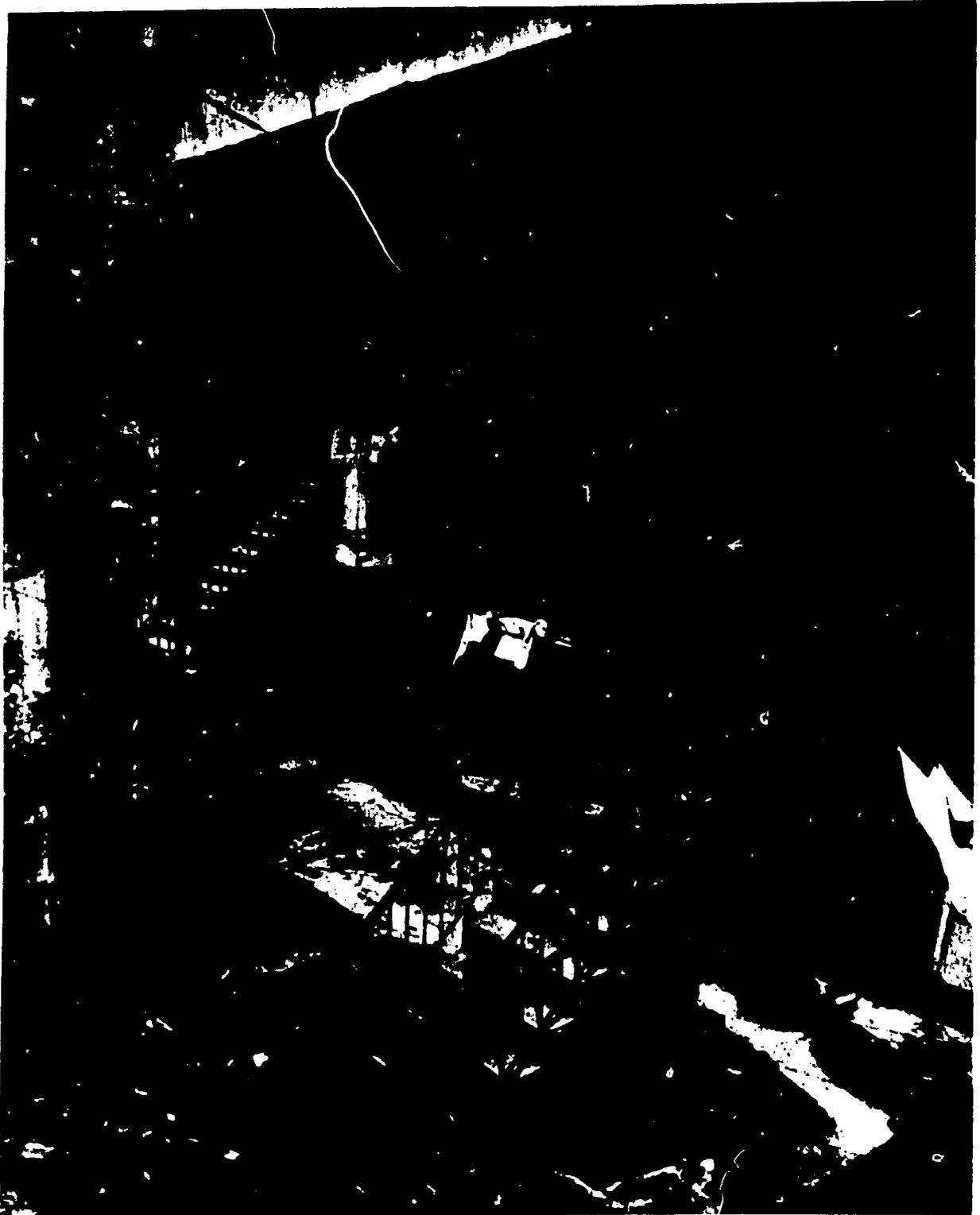
B-605.1 General

Every dwelling unit constructed within 100 feet (30 m.) of a public sewer line of sufficient capacity shall connect to and make exclusive use of such facility for the disposal of human waste.

Each dwelling unit connected to a public or community sewer line shall have at least one w. c. of either pedestal or "Turkish" pattern, properly vented and supplied with an adequate source of water at sufficient pressure to provide necessary flushing and washing action.

B-605.2 Installation-Space

All fixtures are to be installed with sufficient space surrounding them to allow proper use, cleaning, repairs and inspection.



The picture shows a substandard area in Buenos Aires, Argentina. Similar groups of houses (at "La Boca") have been rehabilitated, painted in bright colors, and have become a famous attraction for tourists and artists alike. The example has demonstrated (as have many others) that destruction of such areas is not always the answer and that rehabilitation is not only more economical but can also bring out a certain charm inherent in the original architecture of the area.

B-605.3 Waste Water Pipes--Materials

Pipes for waste water shall be new, of uniform dimension and free of cracks or other defects. Materials shall be those approved by the local public health authority, or like responsible body.

Vitrified clay, concrete or asbestos cement are permissible for underground use outside the area of construction (at least 3 feet or 0.9 meters distant). Cast iron, steel, galvanized iron, or asbestos cement may be used for aboveground installation. All joints shall be watertight.

B-605.4 Waste Water Pipes--Sizes

Minimum pipe sizes for waste lines shall be as follows:

Bath, basin, bidet, urinal	1-1/2 inches or 3.8 centimeters
Shower, sink, laundry tray	2 inches or 5.0 centimeters
W.C.	3 inches or 7.6 centimeters

B-606 Waste Water Systems -- Installation

B-606.1 General

Sewers shall be laid in straight lines. Junctions of sewer lines shall be at an angle of not more than 45° to the direction of flow. The installation of a sewer line parallel to a basement wall should not be made closer than 3 feet (0.9 m.) from the foundation of such wall, and should be above the line projected by a 45° angle underneath the bottom outer edge of the foundation.

B-606.2 Stacks and Vents

Vent stacks shall be of constant diameter, and shall be carried to the open air and project above the roof sufficiently to prevent flooding with a minimum of 6 inches (15 cm.) in any case.

All fixtures discharging below a w.c. shall be back vented.

Vent pipes venting a horizontal waste line shall extend vertically or at an angle of 45° until a minimum of 6 inches (15 cm.) above the level of the overflow of the fixture before levelling off.

The slope of the waste line from the trap of a fixture to the stack shall not be greater than 2 percent in order to prevent back siphonage. Horizontal runs of vent stacks shall have a minimum slope of 1 percent to allow discharge of condensation.

B-606.3 Traps

Every sanitary fixture shall be fitted with a trap of a locally approved pattern providing a water seal of 2 inches (5 cm.) minimum and 4 inches (10 cm.) maximum. Traps shall be installed as close to the outlet of the fixture as possible, but in no case more than 4 feet (1.2 m.) horizontally or 2 feet (0.6 m.) vertically from such an outlet. Traps for w.c.'s shall be built into the fixture.

B-606.4 Grease Traps and Grit Chambers

Any waste system carrying a sufficient volume of grease, oil, sand or other solid to affect the normal functioning of the system shall be equipped with grease traps and/or grit chambers, as appropriate. These shall be located so as to be easily inspected and cleaned, and shall be vented in a manner similar to other fixtures. Type and capacity shall be determined by function and local practice.

B-607 Rainwater Connections

B-607.1 General

Rainwater may be channeled into the sanitary sewer system only where the capacity of the main collector system is specifically designed for that purpose. Where collector systems are not so designed, rainwater from roofs, terraces, etc. shall be channeled to street gutters or to the garden.

Where combined rainwater-sanitary systems are allowed, each rainwater connection to the sanitary sewer shall be provided with a trap with a water seal and above this, a screen to prevent the entry of leaves or other debris. The screen shall have an area greater than that of the cross section of the pipe it serves and shall be accessible for cleaning.

B-607.2 Downspout Size

The diameter of downspouts can be calculated according to the following table:

Diameter of Downspout	Rainfall in millimeters per hour					
	50	75	100	125	150	200
	Area served in square meters of horizontal projection					
2" (5.08 cm.)	130	80	65	50	40	30
2-1/2" (6.35 cm.)	240	160	120	95	80	60
3" (7.62 cm.)	400	220	200	160	135	100
4" (10.16 cm.)	850	570	425	340	285	210
5" (12.7 cm.)	- -	- -	800	640	535	400
6" (15.24 cm.)	- -	- -	- -	- -	835	625

Where rainfall intensity is not known, use figures corresponding to 100 mm. per hour.

B-607.3 Manholes and Cleanouts

All sanitary and/or storm sewer systems shall be provided with cleanouts or manholes.

The minimum dimension for cleanouts for pipes below 8 inches diameter (20 cm.) shall be 4 inches (10 cm.). There shall be a cleanout for each stack before it joins the house connection.

Pipes larger in diameter than 8 inches (20 cm.) shall be served by manholes, placed at intervals of not more than 330 feet (100 m.) and at all points where the pipe changes direction by as much as 45°.

B-607.4 Tests

Complete sanitary and/or storm water systems shall be tested before back-filling of trenches, using water, air, or other approved method.

B-608 Septic Tanks**B-608.1 General**

Septic tanks shall be of a pattern approved by the local health authority, or like responsible body.

Tanks shall be constructed of durable material, completely waterproofed, and shall be designed to withstand the dead loads and live loads to which they will be subjected.

B-608.2 Grease Traps and Grit Chambers

Where grease traps and/or grit chambers are used they shall be vented. Use may be made of the house stack for this purpose if not more than 6 feet 6 inches (2 m.) distant.

B-608.3 Location

a. A septic tank and all parts of its drain field shall be a minimum of 40 feet (12 m.) from any well, spring or stream used, or likely to be used as a water source for any domestic purposes. The local health authority, or like responsible body shall determine when distances should exceed 40 feet (12 m.), based upon soil conditions.

- b. Septic tanks and drain fields shall be a minimum of -
1. 6 feet (1.8 m.) from any property line;
 2. 5 feet (1.5 m.) from any foundation wall;
 3. 10 feet (3.0 m.) from any water line;
 4. 6 feet (1.8 m.) from any seepage pit or dry well.

B-608.4 Septic Tank Design

a. The minimum capacity of a septic tank for use by no more than 2 families shall be 300 U.S. gallons (1140 l.) for up to 4 persons, plus 40 U.S. gallons (151 l.) for each additional person (see also standards for multi-family dwellings).

b. The minimum liquid depth shall be 3 feet (0.9 m.) with a minimum inside horizontal dimension of 3 feet (0.9 m.), and a minimum freeboard of 12 inches (30 cm.).

c. The inlet invert shall be approximately 1 inch (2.5 cm.) above the outlet invert, and the outlet baffle shall extend to 30 percent of the liquid depth.

d. A manhole shall extend to within approximately 8 inches (20 cm.) of ground level, and have an opening cover with a minimum dimension of 18 inches (45 cm.) in diameter or square.

B-609 Drain Field

a. The area of absorption trench required for a daily volume of 1000 liters (264 U.S. gallons) can be calculated by using the following table: (derived from Code of Caracas, Venezuela of Feb. 1962.)

Rate of Percolation (Minutes per 2.5 centimeters or 1 inch)	Area of Absorption (Square meters per 1000 liters)
1	4.9 (52.7 sq. ft.)
2	7.0 (75 sq. ft.)
3	8.5 (91 sq. ft.)
4	9.8 (105 sq. ft.)
5	11.0 (118 sq. ft.)
10	15.6 (167 sq. ft.)
15	19.1 (206 sq. ft.)
20	22.0 (237 sq. ft.)
25	24.6 (265 sq. ft.)
30	26.9 (289 sq. ft.)
40	31.10 (335 sq. ft.)
50	34.8 (374 sq. ft.)
60	38.1 (410 sq. ft.)

b. A minimum of 2 lateral trenches shall be provided for a drainfield, and the total trench length shall not be less than 70 feet (21.3 m.). Drainfield length in excess of 70 feet (21.3 m.) may be required by the local health authority, or like responsible body, according to soil conditions.

c. Trenches should be a minimum of 24 inches (60 cm.) in width and be between 18 inches (45 cm.) and 36 inches (90 cm.) in depth, with a minimum of 5 feet (1.5 m.) between parallel trenches. Trenches should have a layer of approximately 6 inches (15 cm.) of course material (min. 1/2 inch $\sqrt{1.3 \text{ cm.}}$ max. 2-1/2 inches $\sqrt{6.3 \text{ cm.}}$) under the pipe, and a minimum of 2 inches (5 cm.) over the pipe. Pipe size should be approximately 4 inches (10 cm.), laid with 1/4 inch (6 mm.) spaces between pipe ends, and a slope of 2 inches (5 cm.) to 6 inches (15 cm.) per 100 feet (30.5 m.) of length.

B-610 Septic Tanks - Multi-Family

For septic tanks serving several individual dwellings, a block of apartments, or other multi-family arrangement (where full water service is provided) the following figures may be used for the design of a two chamber unit, provided such a system is approved by the local health authority, or like responsible body.

No. of Persons	Water Volume (Cu. Meters & Gallons)	Length in Meters		Width in m.
		1st Chamber	2nd Chamber	
30	9.0 (2376 gal.)	2.45 (8'-0")	1.2 (4'-0")	1.7 (5'-6")
31-35	10.5 (2772 gal.)	2.75	1.3	1.8
36-40	12.0 (3168 gal.)	2.8	1.35	2.0
41-50	15.0 (3960 gal.)	3.15	1.55	2.2
51-60	18.0 (4752 gal.)	3.25 (10'-9")	1.6 (5'-3")	2.4 (7'-9")
61-70	21.0 (5544 gal.)	3.50	1.7	2.6
71-80	24.0 (6336 gal.)	3.85	1.85	2.7
81-90	27.0 (7128 gal.)	4.20	2.0	2.8
91-100	30.0 (7920 gal.)	4.30 (14'-0")	2.1 (7'-0")	3.0 (9'-9")

In each case, liquid depth should be at least 5 feet (1.5 m.) and freeboard 16 inches (0.4 m.).

B-610.1 Dosing Tank

With large systems, a dosing tank may be required to assure the even flow of effluent to the drain field. Such a tank shall have an automatic siphon, and be independent of the septic tank.

B-700 ELECTRICAL

B-700.1 Objective

To provide:

- a. All dwelling units with electric service;
- b. A system of wiring, equipment and appurtenances, properly installed to safely supply electrical energy for adequate illumination and for efficient operation of such appliances and equipment as are considered appropriate.

B-701 General

Installation shall comply with a nationally recognized electrical code, domestic or foreign (e.g. National Electrical Code, U.S.A., or equivalent).

Materials, equipment and appurtenances shall comply with a nationally recognized standard, domestic or foreign (e.g. Underwriters Laboratories, Inc., U.S.A., or equivalent).

B-702 Service

The service entrance conductors and equipment shall be of a capacity adequate to serve the calculated load and any spare circuits provided for future use.

B-703 Wire Sizes

Minimum wire sizes shall be as follows:

External connection	No. 6
Lighting distribution net	No. 14
Kitchen and laundry	No. 12
Heavy duty circuits	No. 12
Small motors	No. 12
Heating	No. 10
Stoves	No. 8

B-704 Circuits

There shall be a minimum of 2 circuits per dwelling unit and provision for at least one additional circuit for future use.

B-705 Outlet Plugs and Lights

A minimum of one lighting outlet shall be provided for each room, hall, and general storage area. Each habitable room shall have at least one conveniently located convenience outlet.

A light shall be provided at the entry porch (with indoor switch) and at each floor landing of stairwells (with threeway switches).

All light fixtures shall be controlled by wall switches, or where appropriate, pull chains. No switches shall be behind doors.

The switch in the bathroom shall not be accessible from the tub or shower. Electric stoves shall be provided with a special heavy duty outlet plug.

B-800 LOT IMPROVEMENT

B-800.1 Objective

- a. To preserve desirable site features where practicable;
- b. To provide diversion of water away from buildings;
- c. To prevent standing water and soil saturation detrimental to structures and to lot use;
- d. To provide disposal of water from the lot, except for any desired controlled irrigation;
- e. To provide appropriate finish grades for safe and convenient access to, and use of, lot areas with ease of maintenance.

B-801 Slope

The finish grade shall slope away from all walls and foundations and from wells. Rainwater shall be channeled to lot or street drains. Where ditching is required, it and the immediately adjoining area shall be protected by grass, stone fill, or paving, depending on the degree of slope.

Grading and ditching shall be executed in a manner that will prevent erosion or flooding of adjoining properties.

B-802 Preservation of Site Assets

Suitable trees, shrubs and desirable ground cover shall be preserved. Where topsoil of reasonable quality exists, it shall be removed from the building area and from any area where excavation is to take place, and shall be preserved for use as topping to achieve the finished grade in yard and garden areas.

B-803 Cut and Fill

Depressions on the site which might form a collection area for rainwater or be a hazard to circulation, or detrimental to the use of the site shall be filled. If, for some reason, this is impossible, the perimeter of the area shall be graded to a gentle slope, and the entire depression permanently drained by culverts or ditches, and the runoff channeled to approved drainage areas.

B-804 Drainage Structures**B-804.1 Splash Blocks**

Splash blocks shall be provided at the outlets of downspouts, the outfall of culverts, and at the junction of drainage ditches to prevent the undermining of any structure or the erosion of embankments.

B-804.2 Drain Lines

Drain lines shall be of durable material and of sufficient size and be installed in a manner to assure positive runoff.

Lines for surface drainage shall have sealed joints, while subsurface drains may be of perforated or open joint construction.

B-804.3 Soak Pits

Soak pits or dry wells shall be used for the disposal of rainwater only where the soil characteristics preclude the danger of flooding or saturation of the surrounding area. This determination shall be made by the local health authority, or like responsible body, and shall contain recommendations for the dimensions and construction of the facility.

Soak pits or dry wells shall be a minimum of:

- 10 feet (3 m.) from any structure;
- 40 feet (12 m.) from any well or pit privy; and
- 20 feet (6 m.) from any sewage disposal field.

B-805 Parking Spaces

B-805.1 Objective

- a. To provide safe and sufficient off-street, on-site parking, convenient to each dwelling unit;
- b. To allow streets to be cleared of stored vehicles when necessary or desirable, such as the possible future need for additional traffic lanes;
- c. To free on-street parking for guests or transit parking.

B-805.2 General

One parking space shall be provided per dwelling unit for present or future use. In the case of collective parking areas, a minimum of 50 percent of the total area allocated shall be surfaced or paved.

Parking areas and driveways shall be properly drained, and shall have some provision in the form of gravel, asphalt or concrete strips or lanes of sufficient bearing capacity to support normal vehicles in any weather without the formation of ruts or "pot holes".

Off-street parking areas shall be of sufficient dimension to prevent any portion of a vehicle from obstructing pedestrian or vehicular circulation, or projecting into a dedicated street or path right-of-way, or adjoining properties.

Walls, shrubs, and other visual barriers shall not be allowed to obstruct visibility to the extent that pedestrians or vehicles will be endangered by another vehicle entering or leaving on-site driveways or parking space.

B-805.3 Dimensions

Parking spaces shall be a minimum of:

Width - 8 feet 6 inches or 2.6 meters

Length - 16 feet or 4.9 meters

B-806 Walks

A walk shall be provided from the street, or from a paved on-site driveway to the main entrance of a dwelling. The walk shall be well drained, of durable material and shall be placed to encourage its use. Connecting streets shall have a 4 feet (1.20 m.) wide sidewalk on one side of the street. Minor streets and cul-de-sacs can be planned without sidewalks and can be constructed with roll-curbs and/or dishtype pavement.

B-807 Exterior Steps not Attached to Dwelling

Steps shall be at least as wide as the walk(s) they serve.

The minimum number of risers shall be two, and the riser and tread dimensions shall be uniform in each flight and flight to flight.

See section on "Stairs" for dimensional range.

Steps shall be evenly surfaced, and properly drained, with a maximum pitch to tread or landing of 2 percent.

Landings shall be of such linear dimension as to allow normal paces without "breaking stride" at steps.

A handrail shall be provided where there are more than 4 risers in a single flight.

B-808 Lawn and Ground Cover

B-808.1 Objective

- a. To prevent erosion;
- b. To prevent dusty or muddy conditions;
- c. To present a pleasant appearance;
- d. To create useful exterior activity areas.

B-808.2 General

Seeds and plants used for ground cover shall be of a variety appropriate to the use and location, and planted to allow complete and permanent coverage of any area thus treated. Seeds, sprigs, spot sods or full sodding may be used as appropriate to local custom and in keeping with the class of structure involved.

B-809 Trees, Shrubs and Vines

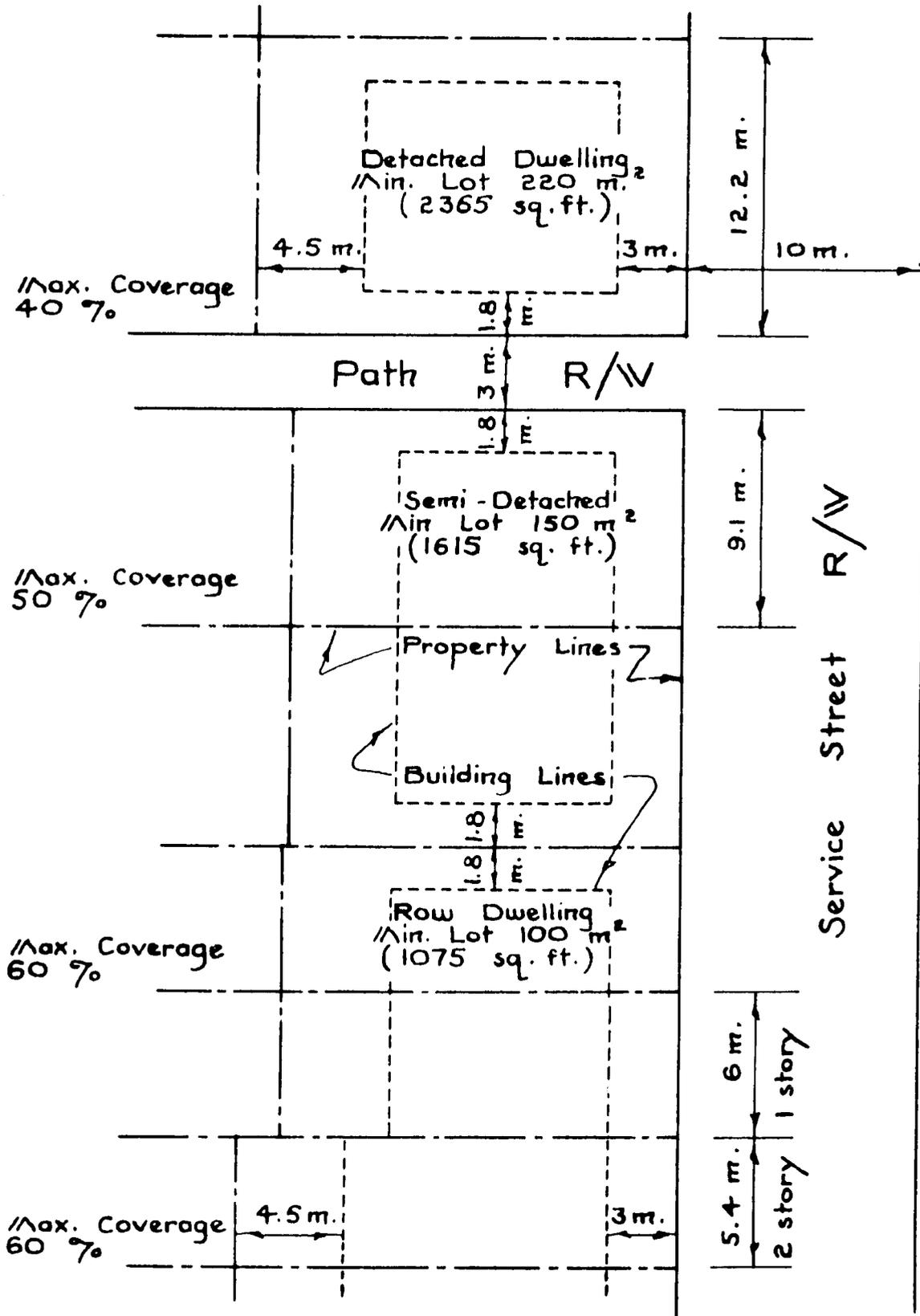
B-809.1 Objective

- a. To provide for screening of objectionable views;
- b. Provide shade;
- c. Provide an attractive setting for the dwelling.

B-809.2 General

Planting, to whatever extent carried out, shall be of hardy varieties, of types appropriate for the use and location in question and planted so as to thrive with a minimum of maintenance.

STANDARD GROUP B
Roads, Lot Sizes, Building Lines, Lot Coverage



STANDARDS GROUP C

MULTI-FAMILY HOUSING

C-100 AREA PLANNING

C-101 Objective

See Neighborhood Planning, Standards Group "B", B-100

C-102 Amenities

Schools, shops, parks, playgrounds and incidental commercial facilities normally used on a day-to-day basis shall be provided in the quantity and at the distances recommended under B-100 (Neighborhood Planning) of Standards Group "B".

C-103 Density

Maximum density of persons per net housing acre shall be 405, or 1000 persons per net housing hectare.

Based on an average family of 5 persons, the number of families per net acre would be 81, and per net hectare 200.

C-104 Street Widths

Minimum street widths shall conform with those outlined under Standards Group "B".

C-200 PLOT PLANNING

C-201 Building Height

The height of any building shall not exceed 1.75 times the distance from the face of the ground floor of the structure to the further side of the street right-of-way on which it fronts.

In the case of a building fronting on two (or more) streets, the maximum height may be determined by the wider (widest) street.

C-202 Maximum Lot Coverage

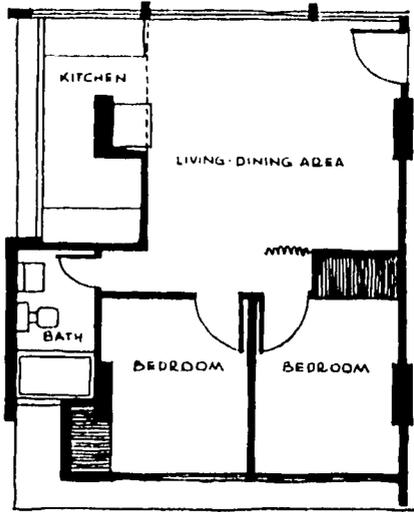
Maximum lot coverage for all construction shall not exceed 40 percent.

Elevation
(Note shops on
Ground Floor.)



MULTIFAMILY HIGH-RISE
in Panama

Instituto De Vivienda y Urbanismo
Republic of Panama



Two Bedroom Unit
(Area 520 square feet)

General Situation
(Note High Density
in Foreground)



C-203 Yards

C-203.1 Setback

Minimum front setback for a single structure in a built-up area may be determined by practice prevailing in the area, provided height requirement C-201 is met.

In the case of a built-up area newly zoned for multi-family structures, or in the case of a development containing two or more such structures, the minimum setback shall be 20 feet (6 m.).

C-203.2 Side and Rear Yards

Minimum side or rear yard shall be:

- a. 10 feet (3 m.) where no required light or ventilation for habitable rooms is derived from the side in question; or
- b. 15 feet (5 m.) where any habitable room derives any portion of its required light or ventilation from the side in question.

C-204 Distance Between Buildings on the Same Site

Distance between structures containing living units and ancillary structures, and between ancillary structures shall comply with the minimum noted in Standards Group "B".

Where more than one multi-family structure or a mixture of multi-family and single family structures occur on the same site or development, the distance between any multi-family unit and other structures containing dwelling units shall be a minimum of 4/7 of the height of the higher structure.

C-205 Parking Spaces and Garages

Space for garages and/or parking areas shall be provided in sufficient number to meet the needs of the occupants of the property and their guests without interference with normal movement of traffic. Such facilities shall provide for a minimum of one car (100 percent parking) for each living unit. While this requirement concerns future use, immediate provision for a minimum of 30 percent parking shall be made to accommodate storage of bicycles, etc.

Garage and parking areas shall be located for convenient access to the living units, and shall be so located and designed as not to impair views from living rooms, entrances or front yards.

C-206 Walks

Paved walks shall be provided for convenient and safe access to the living units from streets, driveways or parking spaces, and from living units to play areas, drying yards and other service facilities.

Major walks shall be a minimum of 6 feet (1.8 m.) in width and service walks a minimum of 3 feet (0.9 m.).

Where gradient is greater than 10 percent, steps or stepped ramps shall be used. In areas with snow and ice the maximum gradient shall be 3 percent. In no case shall less than 2 risers be used in one change of level.

C-207 Laundry Drying Area

Where individual or communal indoor drying facilities (e.g. by means of drying balconies, etc.) are not provided, outdoor laundry drying space of adequate area and suitable location shall be provided. Such areas shall not impair views from living rooms, entrances or front yards.

Allowing for rotated use, a minimum of 25 square feet (2.3 sq. m.) of ground area per living unit shall be provided. Where local custom demands, individual areas should be provided.

C-208 Children's Playgrounds

Play space and appropriate equipment shall be provided for all multi-family units. The minimum may range from 50 square feet (4.6 sq. m.) per unit for small numbers of families to 25 square feet (2.3 sq. m.) per unit for 50 or more units.

C-300 BUILDING PLANNING

C-301 Room Sizes

Minimum room standards for multi-unit and multi-story structures shall conform to those outlined in Standards Group "B", except that in the case of an efficiency or 1 bedroom apartment, a cooking alcove may be provided off the dining area, and may have a minimum of 21 square feet (2 sq. m.).

Individual storage shall be provided in the form of closets similar to provisions in Section B-304.2. General storage shall be provided in basement, ground floor, attic, or ancillary structure, and shall conform to Section B-304.

C-302 Light and Ventilation

Light and ventilation requirements for multi-unit and multi-story structures shall conform to those outlined in Standards Group "B", except that where necessary to achieve adequate natural light and ventilation and to take advantage of any view for the major habitable rooms, the bathroom and/or kitchen-alcove may be internal if adequate natural or mechanical ventilation is provided.

Mechanical ventilation shall be provided at a rate of at least 10 air changes per hour, with the fan or duct connecting directly with the open air.

The system, whether individual or central, shall allow the circulation of air within each unit to be controlled by the occupants thereof by means of a switch or damper. The system must operate without objectionable noise and vibration.

C-303 Public Stairs and Hallways

C-303.1 Objective

To obtain stairs which provide safety of ascent and descent and which are so designed, arranged and installed as to afford adequate headroom and space for the passage of furniture.

C-303.2 Provisions of Stairways

Any building of non-fireproof construction used for multi-family housing and having more than 3 floors shall have a minimum of 2 stairways, placed so that it is not necessary for anyone to travel more than 80 feet (25 m.) from the entrance of any living unit to the stairs. Stairways shall be in separate wells, but in buildings of more than 3 floors, every resident shall have access to two such stairways, giving access to the street, a garden or other unenclosed exterior area.

C-303.3 Light-Artificial

Adequate artificial lighting shall be provided at each stair platform and landing, at each floor level, and at each hallway for its full length. Such lighting must amount to at least 1 foot candle over all areas of the floor and stairs.

C-303.4 Light-Natural

Where possible, provision shall be made for natural light and ventilation. In keeping with the climatic zone, openings, glass, or translucent material should provide illumination comparable to that for habitable rooms, as outlined in Standards Group "B".

C-303.5 Ventilation

Louvers, openings, opening windows, ventilating skylights, etc., shall provide a minimum of 5 square feet (0.5 sq. m.) of ventilation area per floor.

C-303.6 Halls

No more than 4 living units shall open onto a hallway served by only one stair. The minimum width of a hallway shall be the width of the main stairway serving it. Its width shall be increased 6 inches (15 cm.) for each 16 feet (5 m.) of hall length in excess of 16 feet (5 m.) up to 6 feet (1.8 m.).

C-303.7 Stair Width

The minimum width of a stairway shall be 3 feet (0.9 m.), clear between hand-rails, and shall increase 8 inches (or 20 cms.) for each 25 persons or fraction thereof on the floor above.

C-303.8 Other Dimensions

Vertical clearance, riser and tread limitations shall be the same as those for Standards Group "B".

C-303.9 Landings

Public stairs shall be in runs of no more than 9 feet (2.7 m.) rise between landings.

Landings shall have a minimum width equal to the width of the stair. At floor landings this width shall be increased to a minimum of 4 feet (1.2 m.).

C-303.10 Handrail

Stairs shall have a handrail on at least one side, mounted at a height convenient for use. In cases of stairs in excess of 4 feet (1.2 m.) in width, a handrail shall be installed on both sides.

C-303.11 Winding Stairs

Winding stairs shall not be used in buildings over 3 stories in height.

C-400 STRUCTURAL REQUIREMENTS

See B-400, B-401 and B-413 through B-420 of Standards Group "B".

C-500 FIRE PROTECTION AND EGRESS

C-501 Objectives

- a. To obtain a structure which will provide a reasonable assurance of safety to lives and property of tenants through resistance to fire
- b. To provide adequate and safe means of egress in case of fire
- c. To prevent or retard the spread of fire within the structure and/or to adjoining structures

C-502 General

Every dwelling unit shall have constant access to exits leading to the ground level opening into the open air, not including inner courts or other enclosed area.

In structures having more than 4 floors, stairwells shall be provided with fire-resistant doors opening onto the "down" stairway.

Exterior and interior doors giving access to lobbies or other public spaces which can be, or are planned to be locked to prevent entry, shall be provided with "panic bars" or similar devices to allow egress at all times.

C-503 Access to Spaces

Attics, duct wells, and all similar structural spaces shall be provided with access for fire fighting purposes. No such space shall be used for storage.

C-504 Structural - General

In walls of other than solid or cellular masonry construction, firestops shall be provided at floor and partition intersections.

All structural elements such as columns or bearing partitions shall in themselves, or through the application of suitable covering, be equal to (or greater than) the fire resistance rating of the construction supported or adjoining.

C-505 Fire Walls

Fire walls shall not be pierced at any level used primarily for living quarters, and may be pierced on service floors only when provided with properly designed automatically closing fire doors or approved substitute. No opening shall occur in fire walls adjoining furnace or incinerator rooms, or areas used for storage of fuels or other combustible materials.

C-506 Mixed Occupancy and Garages

Any commercial area or storage garage shall be completely separated from residential areas by walls of incombustible materials having a fire resistance rating of at least 1-1/2 hours.

C-507 Fire Resistance Ratings - General

In all buildings over 4 stories in height, all structural elements shall be of incombustible materials, and shall be protected to provide the fire resistance ratings listed in the table below:

MINIMUM FIRE RESISTANCE REQUIREMENTS

NO.	DESCRIPTION	FIRE RESISTANCE IN HOURS
1.	Exterior walls (outside exposure) Distance from side lot line or other buildings on same property	
	1. Under 10 feet (3 m.)	2
	2. From 10 feet to 20 feet (6 m.)	1-1/2
	3. More than 20 feet (6 m.)	1
2.	Passageways from inner courts	2
3.	Exterior walls (inside exposure)	1
4.	Interior bearing walls	1
5.	Columns, girders, trusses	1
6.	Floor construction	1
7.	Roof construction	1
8.	Fire walls, party walls, and lot line walls	2
9.	Interior construction	
	1. Separating living units	1
	2. Enclosing public hallways	1
	3. Enclosing public stairways and other vertical openings	1

Minimum Fire Resistance Requirements (Cont)

NO.	DESCRIPTION	FIRE RESISTANCE IN HOURS
10.	Construction enclosing garages	
	1. Garage for 2 to 5 cars	1 (under 4 floors 3/4 hr.)
	2. Garage for more than 5 cars	1
11.	Construction enclosing boiler rooms, heater rooms, incinerator rooms and fuel storage rooms	1
12.	Other permanent construction	Incombustible
13.	Floor construction over garages	
	1. Garage for 2 to 5 cars.	1 (under 4 floors 3/4 hr.)
	2. Garage for more than 5 cars	1
14.	Garage floors	Incombustible
15.	Roofing	Fire Retardant

C-600 HEATING REQUIREMENTS

See section B-500 of Standards Group "B".

C-700 PLUMBING AND SANITATION REQUIREMENTS

See section B-600 of Standards Group "B".

C-800 ELECTRICAL REQUIREMENTS

See section B-700 of Standards Group "B".

C-900 MECHANICAL EQUIPMENT AND SERVICE AREAS

C-901 Objectives

To provide mechanical equipment and service areas necessary to the safe and efficient use of a multi-dwelling unit structure of 3 or more stories in height.

C-902 Elevators

C-902.1 Provision of

A building used for multi-family housing and having 4 or more floors above the ground floor shall be equipped with at least one elevator. In cases of 7 or more floors, or where there are more than 4 living units per floor above the 4th floor, there shall be a minimum of 2 elevators, one of which is to be of sufficient size to carry furniture of the largest dimension generally in use in the area concerned. In any case, no families shall be required to climb more than four floors from the principal or convenient building entrance (e.g. hillside developments with entrances at intermediate levels).

C-902.2 General

a. The elevator shall be capable of carrying not less than 4 adult persons at any one time by means of a guided elevator car mechanically operated in an enclosed well

b. The elevator shall be fitted with such control devices as may be necessary to prevent

1. The movement of the car in the well unless all the landing doors by which access to that car is obtained and the doors of the car itself are closed; and
2. The opening of a landing door unless a car is at rest opposite it.

Nothing in this paragraph shall be construed as to prevent the incorporation in the elevator mechanism of safety devices such as to permit in an emergency the opening, subject to suitable safeguards, of the doors of an elevator car or landing doors.

c. The elevator shall:

1. Be fitted with a door or doors which shall be either solidly faced or fitted with fine grillwork to prevent injury
2. Be equipped with means of ventilation, but otherwise be a fully enclosed structure
3. Be equipped with means of artificial lighting
4. Be fitted with a device which will enable an alarm signal capable of being heard outside the elevator well to be sounded in the event of an emergency
5. Have displayed conspicuously therein a notice stating the maximum working load and the maximum number of passengers permitted to be carried in the car.

d. The elevator well shall, except for landing doors, be enclosed with walls having a fire resistance of not less than that required for residential buildings according to the size of the building.

e. The landing doors shall be so constructed as to open by sliding or sliding-and-folding and shall have a fire resistance of not less than 30 minutes.

f. The elevator well shall not contain any pipes, wires or other equipment unless these form part of the elevator or are necessary for its operation and maintenance.

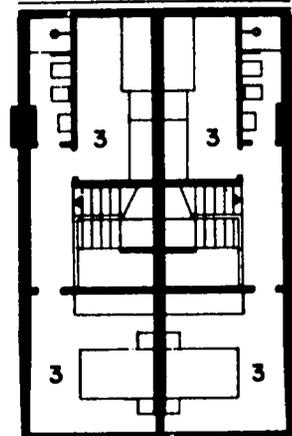
g. The machinery operating the elevator shall:

1. Be situated over the elevator well unless the written approval of the competent authority is obtained to its being sited elsewhere
2. Be separated from the elevator well by a floor, ceiling or wall of a construction such that, but for any essential apertures, it would have a fire resistance of not less than that of the walls enclosing the elevator well

SEVEN STORY APARTMENT BUILDING IN BRAZIL

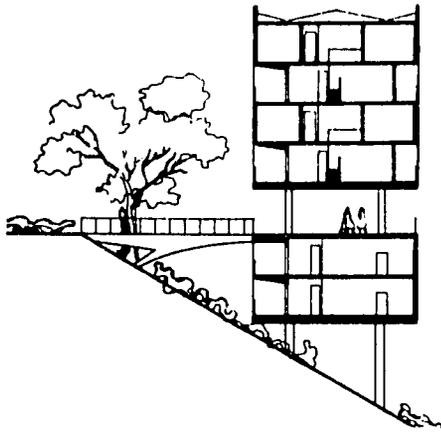
Note building following contour lines in Photo below.

- 1. Living Room
- 2. Kitchen
- 3. Bedroom

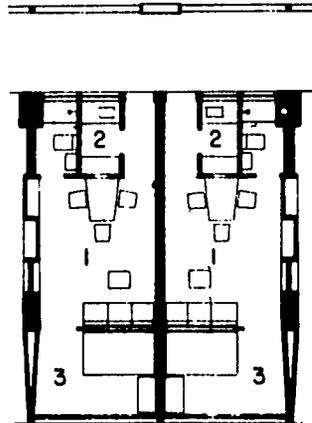


Pedregulho housing development, Rio De Janeiro

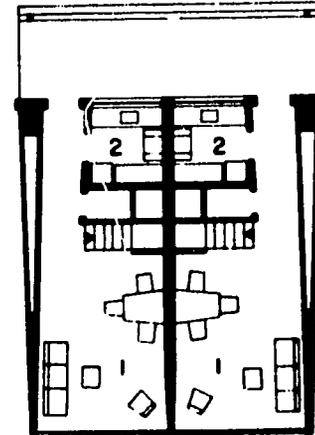
Architect: Alfonso Eduardo Reidy



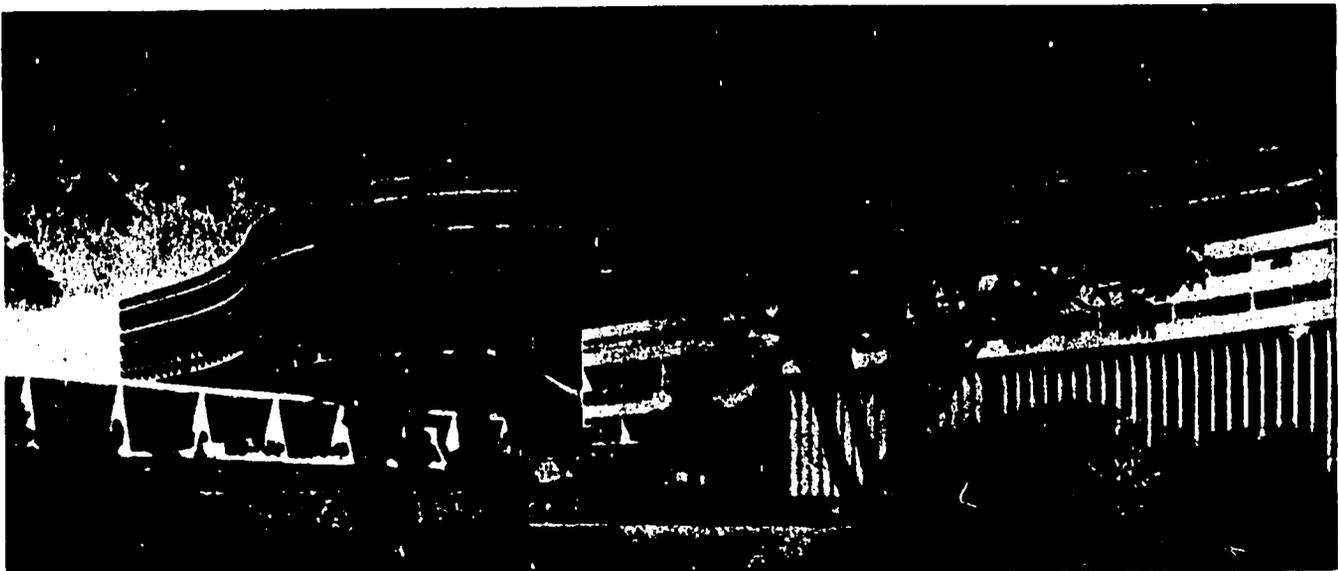
Section



Efficiency Apt.



Two Story Apt.



3. Be capable of being secured against access by unauthorized persons
4. Have sufficient circulation space all round to allow inspection and maintenance

h. The owner of any building in which a passenger elevator has been provided in accordance with this regulation shall cause the elevator and all machinery and mechanism connected therewith to be maintained at all times in a proper state of repair, and to be thoroughly examined by a competent person at intervals not exceeding 12 months.

C-903 Refuse Chutes

C-903.1 Objective

To conduct household refuse from a point convenient to each dwelling unit in a multi-story structure to a point at ground or basement level for collection and removal, or to an incinerator, in a sanitary and convenient manner.

C-903.2 General

Refuse chutes shall:

- a. Be constructed of durable, smooth, waterproof material approved by the local health authority or like responsible body
- b. The chute shall be vertical and shall be properly braced to prevent settling and vibrations
- c. Each section of the chute shall internally overlap that below
- d. The minimum dimension of the chute shall be 16 inches (40 cm.), which dimension shall be constant throughout the height of the chute
- e. The top of the chute shall be ventilated and shall project at least 2 feet (60 cm.) above the level of a flat roof. It shall be protected with a metal screen and a solid cover to prevent the entry of rainwater
- f. The junction between the chute and the receptacle shall be constructed so as to allow continuity
- g. Intake openings shall be installed at each floor, and shall be provided with a closely fitted, automatically closing bottom-hinged door smaller in dimension than the chute

C-904 Refuse Rooms and Areas

C-904.1 Objective

To provide storage of household trash and garbage in a sanitary and inoffensive manner, and in a position convenient for collection.

C-904.2 General

Refuse rooms and areas:

- a. Shall not be visible from habitable rooms of the structure they serve or those on adjoining property
- b. Shall be constructed of durable, impervious material, well drained, and provided with a constantly available supply of water and a drain to allow thorough cleansing
- c. Dimensions shall be such as to allow the storage of refuse within closed containers for the interval between collections
- d. Receptacles used for collection shall be of durable, easily cleaned material, and shall be provided with tightly fitted covers. The capacity of each container shall not exceed 26 U.S. gallons (100 l.)
- e. Access to the trash area for removal of material from the lot shall not be through any area used as outdoor activity space by the occupants.

C-905 Incinerators

C-905.1 Objective

To burn household refuse as accumulated in order to prevent large deposits of such material and the necessity for removal from the site for disposal. Incinerators are not required if adequate refuse removal is provided.

C-905.2 General

- a. Incinerators shall be allowed only in buildings which are at least as high as existing or proposed structures in the surrounding area
- b. Discharge shall be directly into the incinerator, and chutes shall be vertical, with the possible exception of the lowest section, which should not deviate more than 30° from the vertical
- c. There shall be unobstructed walking space completely around the incinerators, which shall be insulated in such a manner that the temperature of its exterior surface shall not exceed 104°F. (40°C.) during peak operation
- d. There shall be a work space in front of the incinerators for inspection and manual loading as needed, for which purpose access doors shall be provided
- e. The room or area containing the incinerator shall be provided with natural ventilation equal to at least 20 percent of its floor area
- f. Chimney areas for buildings up to 3 stories shall be 18 inches (0.45 m.) in diameter or equivalent, and for 4 to 10 stories 20 inches (0.5 m.) in diameter or equivalent
- g. Adequate insulation shall be provided around all that portion of the chimney within or adjoining the building

h. A capacity of 660 pounds (300 kg.) per hour shall be considered maximum for the incinerators in apartment buildings

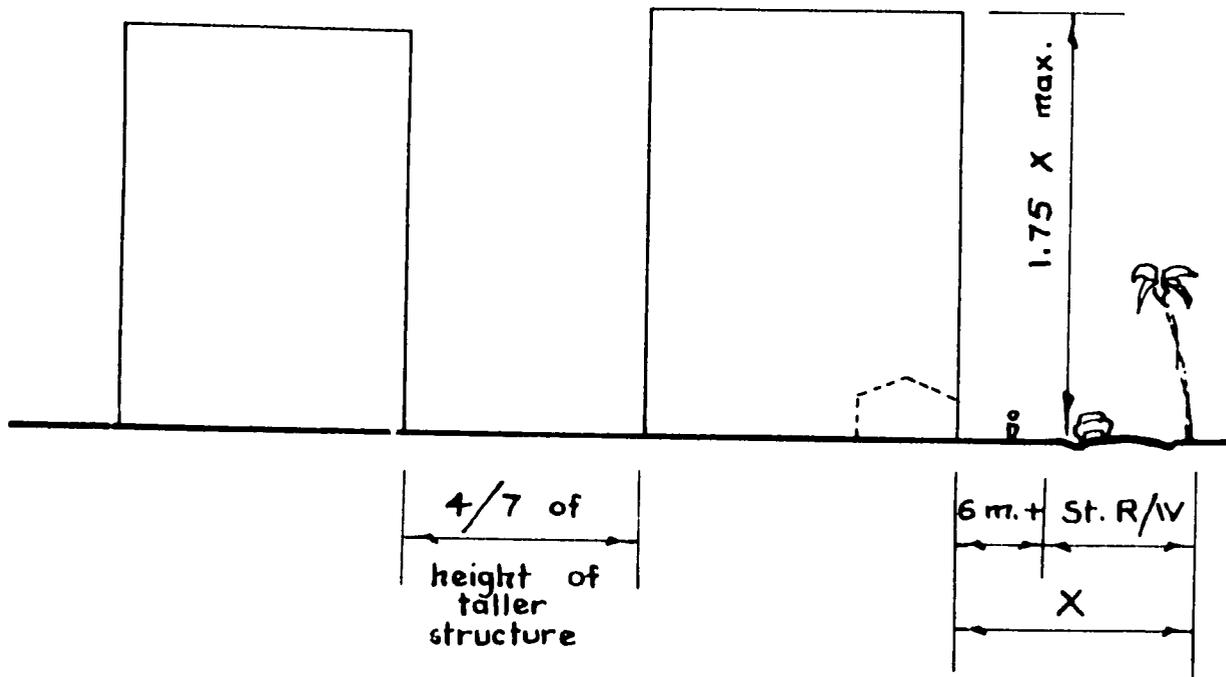
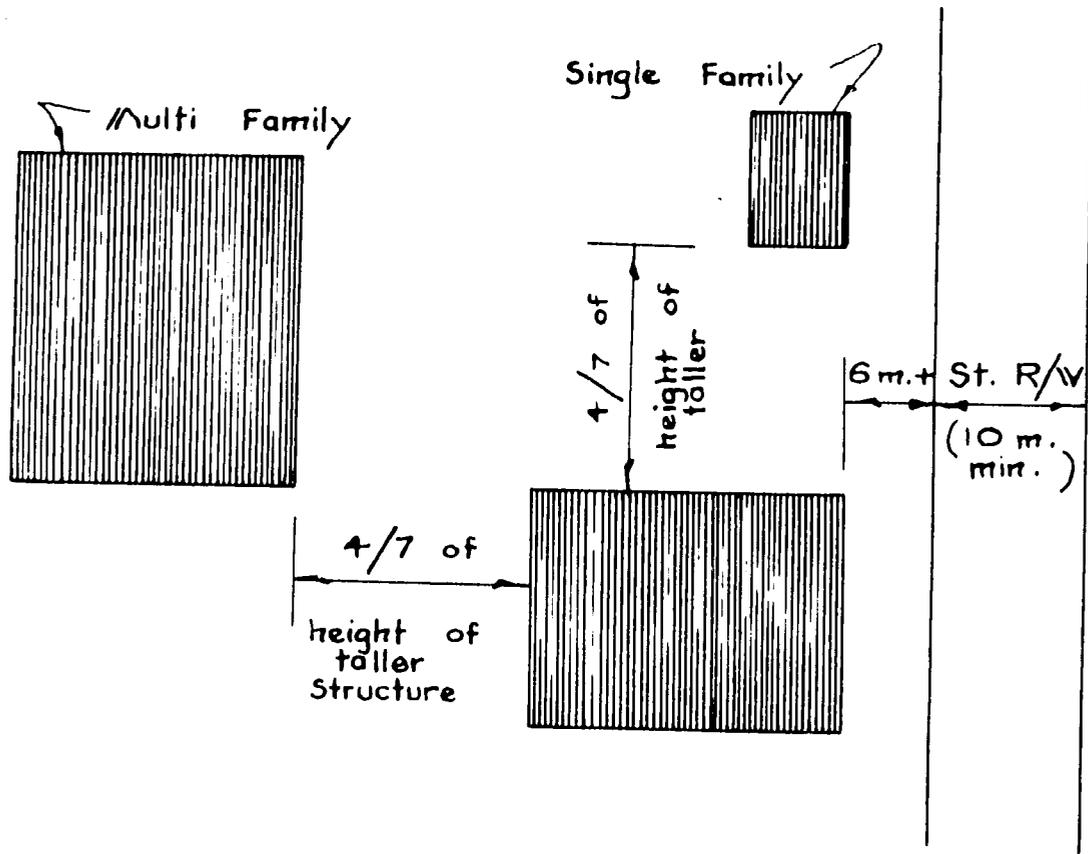
i. In incinerators of more than 330 pounds (150 kg.) per hour there shall be a second combustion chamber to care for gases produced, and when over 440 pounds (200 kg.) per hour there shall be facilities for removing soot from gases before discharge from the chimney

j. In calculating the daily volume of refuse to be burned, 2.2 pounds per person (1 kg.) can be assumed.

C-1000 SITE (LOT) IMPROVEMENT

See section B-800 of Standards Group "B".

STANDARDS GROUP C
 Streets, Setbacks, Building Heights



Appendix A

DEFINITIONS

Banked Soak Pits, Septic Tanks, or Privies: Several such facilities grouped to serve more than one family.

Building Area: The total of areas taken on a horizontal plane at the mean grade level of the principal buildings and all accessory buildings, exclusive of uncovered porches, terraces and steps.

Building Line: A line established by law or agreement beyond which a building shall not extend.

Community System (water or sewerage): Any system which is not a public system or an individual system, usually serving one or more residential developments.

Court (or Courtyard): An open space bounded on two or more sides by the exterior walls of a building or by exterior walls and lot lines.

- a. Inner Court: A court enclosed on all sides by exterior walls of a building or by exterior walls and lot lines on which walls are allowable.
- b. Outer Court: A court enclosed on not more than three sides by exterior walls of a building or by exterior walls and lot lines on which walls are allowable, with one side or end open to a street, driveway, alley or yard.

Coverage: That percentage of the plot area covered by the building area.

Driveway (Private): A private way for the use of vehicles and pedestrians.

Dry Well: A covered pit with open-jointed lining through which drainage from roofs or areaways may seep or leach into the surrounding porous soil. (Also defines seepage pit.)

Dwelling: A building designed or used as the living quarters for one or more families.

- a. Detached Dwelling: A dwelling which is completely surrounded by permanent open spaces.
- b. Semidetached Dwelling: A dwelling one side wall of which is a party or lot line wall.

- c. Row Dwelling: A dwelling the walls on two sides of which are party or lot line walls.
- d. End Row Dwelling: Same as semidetached dwelling.
- e. Multi-family Dwelling: A dwelling on one plot containing separate living units for 3 or more families; sometimes having joint services or facilities or both.

Family: One or more persons living, sleeping, cooking and eating on the same premises as occupants of one living unit.

Fire Resistant: An element of material which will burn, but which is not easily kindled, or which burns very slowly; to resist the spread of fire.

Fire Wall: A solid wall of incombustible material extending from the foundation level to a roof of fire resistant or incombustible material or through a roof of inflammable or low fire resistant materials intended to prevent or retard the spread of fire from one area of a building to adjoining areas.

Individual System (water or sewerage): A system serving a single property containing not more than four living units.

Living Facilities: Those provisions for living, sleeping, eating, cooking and sanitation, ordinarily considered as part of a permanent abode.

Living Unit: A dwelling or portion thereof, providing complete living facilities for one family.

Lot (or Plot): A parcel of land in one ownership that is described by reference to a recorded plat or by metes and bounds.

- a. Corner Lot: A lot abutting upon two or more streets at their intersection.
- b. Interior Lot: A lot bounded by a street on one side only.

Lot Line: A line bounding the lot as described in the title to the property.

Net Housing Acre (or ha.): The area actually used for housing lots, not including streets or other facilities.

Plat (Cadastral): A map, plan or chart of a city, town, section or subdivision, indicating the location and boundaries of individual properties.

Property: A lot or plot with any buildings or other improvements located thereon.

Property Line: A recorded boundary of a plot.

Public System (water or sewerage): A system which is owned and operated by a local governmental authority or by an established public utility company which is controlled and regulated by a governmental authority. (Such systems are usually existing systems serving a municipality, a township, an urban county, or a water or sewer district established and directly controlled under the laws of a state.)

Right-of-Way (R/W): The total dedicated width of an area containing a street or path, which will include all public walks, utilities, paving and planting, etc.

Rooms:

- a. **Habitable Room:** A room designed to be used for living, sleeping, eating or cooking, excluding bathrooms, toilet compartments, closets, halls, storage and similar spaces.
- b. **Utility Room:** A room, other than a habitable room, designed or used for laundry or heating equipment or for other related purposes.

Seepage Pit: See Dry Wells.

Septic Tank: A covered watertight sewage settling tank intended to retain the solids in immediate contact with the sewage flowing through the tank for a sufficient period to secure satisfactory decomposition of settled solids by bacterial action.

Shall: Indicates that which is required.

Should: Indicates that which is recommended but not required.

Standpipe: A pipe riser with tap used as a source of water for domestic or fire fighting purposes.

Street: A way, public or private, which affords principal means of access to abutting properties.

Wall:

- a. **Party Wall:** A wall, used jointly by two parties under easement agreement, centered and erected upon a line separating two parcels of land each of which is a separate real estate entity.
- b. **Lot Line Wall:** A wall, used only by the party upon whose lot the wall is located, erected at a line separating two parcels of land each of which is a separate real estate entity.

Yard:

- a. **Front Yard:** A yard across the full width of the lot, extending from the extreme front building line to the front lot line.
- b. **Rear Yard:** A yard across the full width of the lot, extending from the extreme rear building line to the rear lot line.

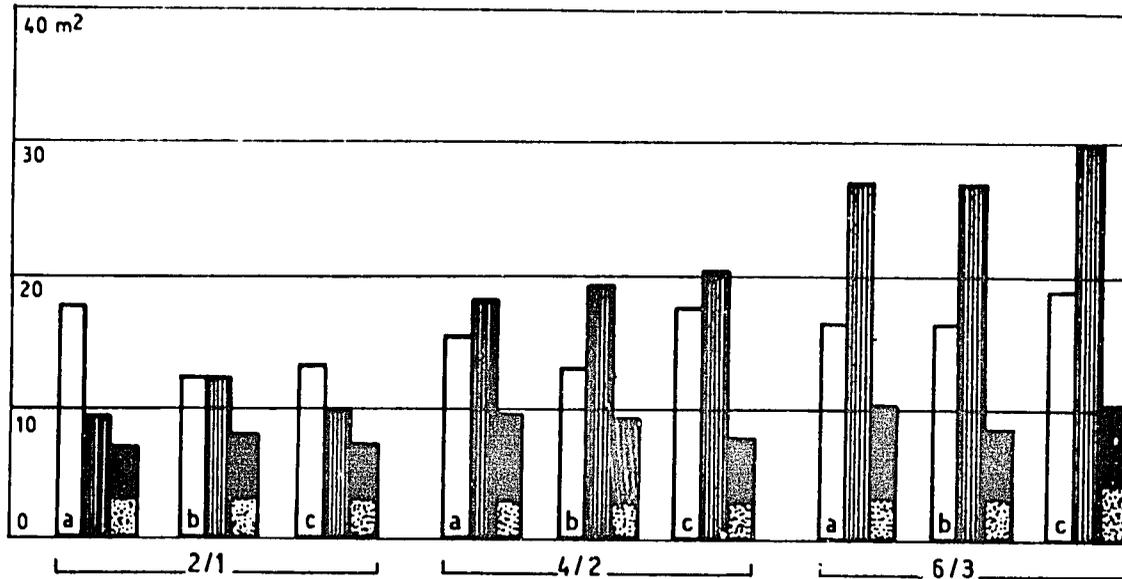
- c. Side Yard: A yard between the extreme side building line and the adjacent side lot line, extending from the front yard to the rear yard.
- d. Yard (General): An open, unoccupied space on the same lot with a building, between the lot line and the extreme front, rear or side wall of the building.

Appendix B
SOURCES AND BACKGROUND DATA

LOW COST HOUSING IN ARGENTINA

Average floor areas of various rooms (living, sleeping, kitchen and bath) in detached houses, row houses, and apartment buildings.

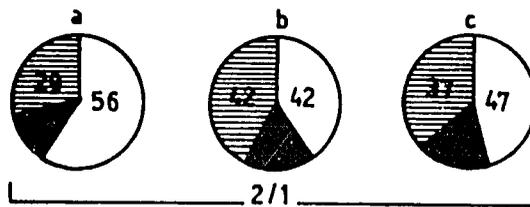
LA VIVIENDA DE INTERES SOCIAL EN ARGENTINA.



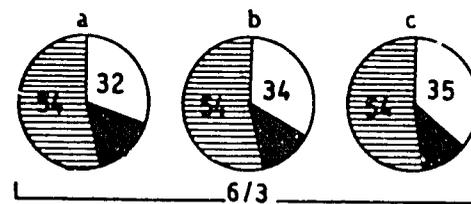
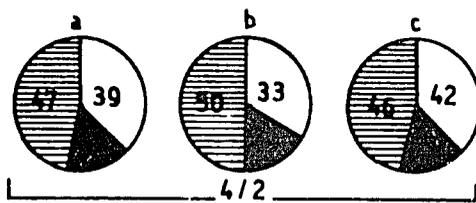
a. promedio de superficies de ambientes.

a. vivienda individual
 b. vivienda en cinta
 c. vivienda en block

2/1_2 personas / 1 dormitorio
 4/2_4 personas / 2 dormitorios
 6/3_6 personas / 3 dormitorios



estor cocina
 baño dormir



b. distribución porcentual.

Source. "Dimensiones Mínimas de la Vivienda de Interés Social" by M. Schteingart and V. Galiana, Bouwcentrum, Argentina, August 1965.

Appendix B

SOURCES AND BACKGROUND DATA

A wide variety of documents were studied. These included housing standards and codes, "as built" drawings, reports and recommendations by individuals, national and international bodies, etc. In addition, specialized subjects, such as squatter redevelopment, which are not extensively documented were supplemented by a study of problems and solutions elsewhere in the world, keeping in mind the general background, climatic range, etc. of the Americas.

Figures indicated as "average", "high" and "low" in the following tables are not meant to be absolute, nor their sources exhaustive, but simply reflect the range of data available at the time this study was made. In many cases, it will be noted that the number of sources for a given area of information is indicated. The sources thus indicated are in all cases from the area under study.

It will be noted that the recommended standards often do not reflect the "low" or "average" indicated in the following tables, but are based upon judgment made after a study of the available data, keeping in mind the wide geographic and sociological areas covered by this single set of figures.

Data from the following areas were incorporated in the draft document: Argentina, Bolivia, Brazil, Caribbean Area (general), Chile, Colombia, Ecuador, Guatemala, Honduras, Jamaica, Mexico, Nicaragua, Panama, Peru, Puerto Rico, Surinam, Trinidad and Tobago, and Venezuela.

Although some rural data are mentioned for comparison purposes, the study is limited to making recommendations for minimum standards for urban areas only.

Subdivision Roads:

Number of Sources: 7

	<u>Meters</u>	<u>Feet</u>
<u>Main Road</u>		
Average Right-of-Way (R/W)	14.8	48'-7"
Low R/W (Puerto Rico)	13	42'-8"
High R/W (Nicaragua)	18	59'-0"
<u>Minor Road</u>		
Average R/W	10.4	34'-1"
Low R/W (Trinidad and Tobago)	6.78	22'-3"
High R/W (Nicaragua)	16	52'-6"

Path

Average R/W	4.6	15'-1"
Low R/W (Trinidad and Tobago)	3.04	10'-0"
High R/W (Bolivia)	6	19'-8"

Lot Size: Number of Sources: 11

	<u>Square Meters</u>	<u>Square Feet</u>
Average Area	204	2196
Low (Bolivia)	104	1119
High (Trinidad and Tobago)	467	5027

Lot Coverage: Number of Sources: 11

	<u>Percent</u>
Average Coverage	35
Low (Ecuador)	18
High (Bolivia)	60

Dwelling Area (Minimum): Number of Sources: 18

	<u>Square Meters</u>	<u>Square Feet</u>
Average Area	39.2	422
Low (West Indies)	11.2	121
High (Ecuador)	59.5	640

Building Heights:

While a number of documents used in this study did not specify building height limits, a relatively wide range was noted as follows:

Mexico: - 1.75 x horizontal distance between the building and the property line opposite.

Nicaragua: - 0.75 x horizontal distance between the building and the property line opposite.

Living Room: Number of Sources 23

	<u>Square Meters</u>	<u>Square Feet</u>
Average Area	12.6	135
Low (Caribbean Area)	7.4	80
High Urban (Ecuador)	18	194

Main Bedroom: Number of Sources 32

Average Area	8.9	95
Low Urban (Caribbean Area)	7.4	80
Low Rural (Puerto Rico, Aided Self-Help)	6.4	68
High (Jamaica)	13.0	140

<u>2nd Bedroom:</u>	Number of Sources:	17	
			<u>Square Meters</u> <u>Square Feet</u>
Average Area		8.0	86
Low Urban (Puerto Rico & Virgin Islands)		7	75
High Urban (Brazil)		8.1	87
High Rural (Panama, by practice)		11.2	120
<u>3rd Bedroom:</u>	Number of Sources:	6	
Average Area		7.6	81
Low Urban (Brazil)		6.3	67
High Urban (Jamaica)		10.3	110
<u>Kitchen:</u>	Number of Sources:	25	
Average Area		4.9	52
Low (Surinam)		2.5	27
High Urban (Ecuador)		7	76
High Rural (Panama)		10.7	115
<u>Bath (tub or shower):</u>	Number of Sources:	25	
Average Area		2.2	24
Low (Brazil)		1.2	13
High (Ecuador)		6	65
<u>Ceiling Height:</u>	Number of Sources:	17	
		<u>Meters</u>	<u>Feet</u>
Average Height		2.63	8'-7"
Low (Bolivia)		2.26	7'-8"
High (Cuba)		4	13'-2"
<u>Closets:</u>			
Width - Colombia		0.9	3'-0"
Jamaica		0.9	3'-0"
Puerto Rico		0.9	3'-0"
Depth - Colombia		0.6	2'-0"
Jamaica		0.6	2'-0"
Puerto Rico		0.6	2'-0"
Height for Hanging - Colombia		1.8	5'-11"
Jamaica		1.5	5'-0"
Puerto Rico		1.7	5'-6"

Colombia further required 106 cubic feet (3 cu. m.) plus 35 cubic feet (1 cu. m.) per bedroom of general storage in addition to bedroom closets.

Ecuador also indicated 35 cubic feet (1 cu. m.) per bedroom general storage.

	<u>Meters</u>	<u>Feet</u>
<u>Linen Closet:</u>		
Depth - Jamaica	0.35	1'-2"
Puerto Rico	0.35	1'-2"
Width - Jamaica	0.53	1'-9"
Puerto Rico	0.45	1'-6"
Number of Shelves - Jamaica	4	
Puerto Rico	5	

	<u>Square Meters</u>	<u>Square Feet</u>
<u>Kitchen Shelves:</u>		
Puerto Rico - 2 or more bedrooms	2	21
Jamaica	3.6	40
Colombia - 1 bedroom	5	54
2 bedrooms	7	75
3 bedrooms	10	108

	<u>Centimeters</u>	<u>Inches</u>
<u>Shelf Width:</u>		
Colombia	30	12
Puerto Rico	28	11

	<u>Width</u> <u>Meters</u>	<u>Width</u> <u>Feet</u>	<u>Height</u> <u>Meters</u>	<u>Height</u> <u>Feet</u>
<u>Doors:</u>				
Bolivia - exterior	0.8	2'-8"	2	6'-7"
- kitchen and bath	0.6	2'-0"	2	6'-7"
Colombia - exterior (main)	0.9	3'-0"	2	6'-7"
- exterior (other)	0.8	2'-8"	2	6'-7"
- interior	0.75	2'-6"	2	6'-7"
- bath	0.6	2'-0"	2	6'-7"
Jamaica - exterior	0.9	3'-0"	2	6'-6"
- interior	0.8	2'-8"	2	6'-6"
Mexico - exterior (main)	0.9	3'-0"	2	6'-7"
- service	0.75	2'-6"	2	6'-7"
- bath	0.6	2'-0"	2	6'-7"
Puerto Rico - main	0.9	3'-0"	2	6'-8"
- service	0.8	2'-8"	2	6'-8"
- interior	0.75	2'-6"	2	6'-6"
- bath and closets	0.85	2'-9"	2	6'-6"

Stairs: Number of Sources: 6

	<u>Centimeters</u>	<u>Inches</u>
Maximum tread (Jamaica)	35.7	14
Minimum tread (Colombia and Jamaica)	22.9	9
Maximum riser (Colombia and Jamaica)	21.0	8
Minimum riser (Jamaica)	14.0	5-1/2
Average overhead clearance	199	6'-6-1/2"
Maximum clearance (Colombia)	200	6'-7"
Minimum clearance (Jamaica)	197	6'-6"

Corridor Width:

	<u>Meters</u>	<u>Feet</u>
Brazil - Single dwelling	0.8	2'-8"
- Multi-family	1.2	3'-11"
Mexico	0.9	3'-0"

Light - Natural (as Percent of Floor Area): Number of Sources: 12

	<u>Percent</u>
Average Window Area	11
Low Window Area (North Chile)	8
High Window Area (Brazil)	17

Ventilation (as Percent of Floor Area): Number of Sources: 9

	<u>Percent</u>
Average opening	8
Low opening area (Colombia)	4
High opening area (South Chile)	17

Chimney Height Above Roof:

	<u>Meters</u>	<u>Feet</u>
Bolivia	1.5	4'-11"
Mexico	2.0	6'-7"

Live Load - (Structural Design):

	<u>Kilograms per Square Meter</u>	<u>Pounds per Square Foot</u>
Bolivia	150	31
Mexico	150	31

Water Supply - Tanks and Cisterns:

	<u>Liters</u>	<u>U.S. Gallons</u>
Brazil - minimum capacity	1200	316
Trinidad & Tobago - minimum	1520	400

Brazil further states the per capita minimum as 40 U.S. gallons (150 l.) up to eight persons, and 33 U.S. gallons (125 l.) for each additional person.

Electrical Circuits and Outlets:

Available documents indicate that:

- Chile: requires a light point in each habitable room and service room.
- Mexico: requires 2 light fixtures and one duplex outlet for each low-cost multi-family living unit.
- Colombia: requires 2 circuits per dwelling as a minimum, with one for each 495 square feet (46 sq.m.) of floor area.

Electric Wire Sizes:

	<u>Colombia</u>	<u>Puerto Rico</u>
Outside service connection	6	6
Light duty branch circuits	14	14
Kitchen and laundry circuits	12	12
Heavy duty branch circuits	12	12
Small motors	12	12
Heaters	10	10
Stoves	8	8