1. Overview

In a pattern of rapid urbanization, more than 48% of Nicaragua's 1.9 million people were urban dwellers at the time of the 1971 census. The population had grown to an estimated 2.2 million by 1975; 50% were urban in 1974, projected to rise to 54% by 1990. Managua's population, growing at an annual rate of 7% (compared to a 1% rural growth rate and 2.8% for other cities and the country as a whole), had reached about 430,000 in 1972--nearly 50% of the urban population. The country's population is unevenly distributed: 60% live on 15% of the land area (the Pacific zone where 20 of the 36 cities of over 4,000 people are located); 32% live in the central zone which represents 35% of total area; 8% inhabit the remaining 50% of the country.

The earthquake which devastated Managua on December 23, 1972, killing more than 11,000 people, destroyed about 45% of the housing stock or 32,000 to 35,000 units*, damaged another 22-28%, and forced the evacuation of 160,000 to 250,000 people. The heavy structural losses, combined with a large existing housing deficit, created massive shelter needs over a wide income range in the post-earthquake period. As housing problems continue, the projected new housing requirements for the country as a whole for the period 1976-1986 are 361,594 units.

Two government decisions made in the aftermath of the earthquake were to affect future housing construction and settlement patterns: 1) new building codes taking the seismic characteristics of the region into account were developed because none had been established with design and structural requirements appropriate to the risk, despite the disastrous earthquake of 1931 which destroyed the city; 2) decentralized development was encouraged in order to minimize loss of life and property from future quakes and to promote the growth of secondary cities. The cost of extending infrastructure over a wider area and building with improved standards made strict implementation of the new regulations difficult. As a result, considerable unauthorized and unorganized building occurred, creating problems in the provision of services as well as potential hazards of unknown dimensions during future quakes.

The urban poor are generally housed in inner city rental units in cuarterias or, as city populations swell as a result of rural to urban migration, in improvised dwellings on the periphery. Varied self-help construction techniques and styles of houses are found throughout the countryside. The small, square rancho type, built largely of local materials, is typical of low-cost housing in the Pacific region.

* Initial estimate of about 53,000 units was later revised downward.

Projected Requirements for Number of Housing Units
July 1976-December 1986

Managua

Income Group	New Families	Replacements	Existing Need	Required Total
Less than:				
400	6,010	1,450	6,250	13,710
401-675	16,490	4,000	13,360	33,850
676-1,350	22,660	5,530	9,180	37,370
1,351-2,025	5,720	1,380	660	7,760
2,026-2,700	2,260	3,540	n.a.	2,800
2,701-3,375	960	280	n.a.	1,190
3,376-4,050	850	210	n.a.	1,060
4,051 and more	1,700	410	n.a.	2,110
Total	56,650	13,750	29,440	99,850

Other Urban Areas

Income Group	New Families	Replacements	Existing Need	Required Total
Less than:				
400	7,265	2,350	10,070	19,685
401-675	12,970	4,190	13,980	31,140
676-1,350	19,060	6,170	10,270	35,500
1,351-2,025	5,975	1,930	920	8,825
2,026-2,700	3,550	1,150	n.a.	4,700
2,701-3,375	1,235	400	n.a.	1,635
3,376-4,050	1,560	500	n.a.	2,060
4,051 and more	2,205	710	n.a.	2,915
Total	53,820	17,400	35,240	106,460

Source: AVINIC-Delcanda Politica Nacional de la Vivienda-Analisis

2. Housing Policy and Institutions *

The National Housing Bank (Banco de la Vivenda de Nicaragua-BAVINIC) is an autonomous agency established by the government in 1966 to construct

* Structure and Functions as of 1973

and finance housing units in both public and private sectors. It incorporates three departments: Instituto Nicaraguense de la Vivienda (INVU) with responsibility for low-cost housing development and financing; Savings and Loan Department with Caja Central de Ahorro y Prestamo (CACE) having supervision over a system of private savings and loan societies; Mortgage Insurance Department (Fomento de Hipotecas-FHA). BAVINIC was experiencing financial difficulties in 1978 when over $9 million in funds lent by the bank was in arrears.

In actual practice, most low-income families have lacked access to credit in the past, and "spontaneous construction" using family labor has been a common home building method.

3. Disaster/Low-cost Housing

75 to 80% of the people left homeless by the 1972 earthquake found shelter (in some cases for an extended period) with relatives on the outskirts of Managua or in more distant towns. Others took refuge in schools or other public buildings.

Perhaps because of these alternative solutions, the emergency housing provided was not fully used, including the tent cities erected in several locations with tents donated by the USG and other nations. One source suggests that the lack of receptivity was due to the layout of the camps along military lines (with the exception of that in Masaya) and the regimentation of family activities. The 500 spun polyurethane foam igloos provided by the West German Red Cross were slow in arriving and never fully occupied.

A $3 million USAID grant helped finance the building of 11,000 low-cost temporary housing units on the outskirts of Managua (las Americas project). The 15' x 15' huts with no electricity and shared water and sanitary facilities had rough wood siding, corrugated metal roofs and dirt floors. The low initial occupancy (30-50% in the first six months) was believed by officials to be due to the reluctance of the earthquake victims to leave the homes of relatives for the uncertainty of a new housing project and possible unemployment. Though initial poor grading and drainage problems slowed the conversion of the huts to permanent shelters, they were eventually upgraded through an AID loan and fully occupied by late 1974.

4. Housing Types, Materials, Construction and Services

4.1 Housing Types

Urban

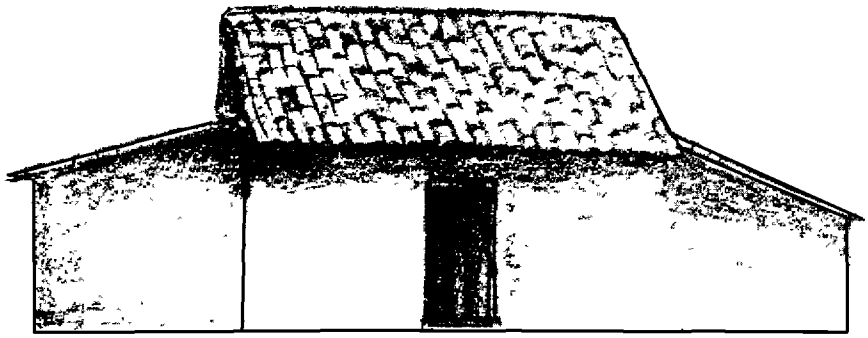
According to the 1971 census, over one-quarter of the housing units in Managua were makeshift shelters or rooms in cuarterias--old houses subdivided into single rental units with shared water and sanitary facilities. The typical migrant settlement pattern is to find shelter with friends or relatives in cuarterias, then move to makeshift housing on the city fringes (barrios). Unlike many Latin American cities, Managua has no tradition of illegal squatting by large, well-organized groups. 1971 census data also showed that 40% of Managua's families lived in a single room; 42% lacked sewerage service, 39% water service, 9% electricity; 48% were renters. Although there was a considerable mix of housing by income level in Managua at the time of the earthquake and losses at all levels, about 50% of those losses were lower middle-income housing in the city core.

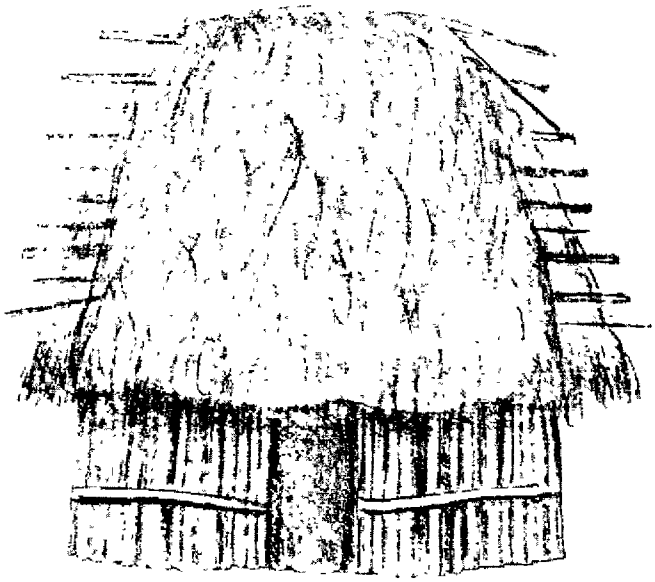
Rural

The simply constructed traditional housing of the rural poor is mainly of two types. The small rancho, common in the Pacific lowlands, has walls of poles (sometimes mud-covered) or cane, and often a straw roof distinguished by its four sides. There are usually two rooms: a dormitorio for sleeping and a salita (living room) which may also include a kitchen area.

The rectangular canoi-type house is the common dwelling of poor people in the highlands. Additions (barjareque) with single shed roofs are attached to the short sides of the house and sometimes to the back. Walls may be of poles, cane or board, or of poles or cane covered with mud-straw mix; roofs are frequently of tile. The main house consists of one or two rooms; the kitchen and possibly the sleeping areas are in the barjareque additions.

Adobe construction is sometimes seen in large houses in coastal towns but is rare in the countryside and among homes of the poorer classes.





Traditional Rural Dwellings

Drawings after photographs in Nicaragua by Rene Moser (Paris: Editions Delroisse)

4.2 Materials and Construction

Building materials used in Managua in 1972 included hollow clay tile, concrete and concrete block, brick, structural steel and, to a limited extent, wood. Materials used in traditional construction were presumably produced locally; structural steel and possibly some other modern materials were imported.

Dwellings of Managua's very poor were at best crude shelters constructed with concrete floors and foundations, wood siding, tile or zinc roofs; most were shacks made of scrap materials. About half of lower middle-income housing was of wood, concrete block, or wood and block combination. The other half, mostly in the city center, was of a traditional construction called "taquezal" in which timber frame walls of widely spaced posts connected by double lathing were filled with stone and mud balls and plastered with stucco when dry. Floors and roofs were also wood framed, the latter overlaid with clay tile, cement asbestos sheeting, or corrugated metal. The outwardly substantial appearance of these houses belies their inherent weakness. With poor lateral force resisting strength and framing often weakened by termites, the structures collapsed in the earthquake, causing most of the deaths.

The extensive use of hollow clay tile as partitions and wall infills in frame buildings (reducing flexibility) also accounted for much structural damage. Many buildings of modern materials (concrete, reinforced concrete, masonry, etc.) also failed to withstand the shock, often because of inadequate attachment of roofs to walls. On the other hand, houses built to resist earthquakes generally suffered little damage.

With international agencies playing a major role in relief and reconstruction, 9,000 homes had been repaired, 27,000 new homes constructed by February 1976. Seismic-resistant stock was expected to be brought up from the 15% pre-earthquake level to 40% within four years. Most new buildings were in outlying areas of Managua and in the nearby cities of Leon, Granada, and Masaya.

4.3 Services

The Managua Water Co. (EAM), with World Bank assistance, was expected to carry out a project between 1978 and 1981 to improve and expand water and sewerage service, especially to low-income families.

The second stage of the "74 communities joint program," which would provide water and sewerage service to 10 major cities and increase water availability in 64 others, was to have been undertaken by the National Office of Water and Sewerage (DENECAL) in 1978. DENECAL also planned to improve the sewerage system in Managua and the pollution control of Lake Managua.

Indicators of Potable Water and Sewerage Services in the 20 Principal Cities of Nicaragua

	Potable Water (1976)		Sewerage Service (1975)	
Cities	% Population Served	# of Connections	% Population Served	# of Connections
Granada	100	7,619		
San Marcos	100	939		
Masaya	91	5,573	22.5	1,508
Esteli	82	4,000		
Ocotal	78	1,440	28.8	420
Jinotepe	75	1,880		
Somoto	73	838	28.8	315
Boaco	70	925		
Managua	68	54,360	66.0	46,473
Juigalpa	66	1,212		
Leon	60	6,232		
Rivas	60	1,186	32.3	770
Matagalpa	60	2,526		
Corinto	58	1,643		
Chinandega	57	3,405	16.6	1,029
San Carlos	49	274		
Jinotega	45	968		
Chichigalpa	42	1,321		
Diriamba	40	955		
Bluefields	30	878		

Source: Departamento Nacional de Acueductos y Alcantarillado (DENACAL) as cited in A Study of Housing and Urban Development in Nicaragua. PADCO, 1978.

Indicators of Electric Service in the 20 Principal Municipalities of Nicaragua in 1975

Municipalities	Average Consumption in Kwh per household	Total Consumption 1,000's of Kwh	# of Clients
Chichigalpa	11,579	17,206	1,486
Managua	7,028	379,359	53,976
Granada	4,112	26,671	6,486
Leon	3,720	38,014	10,220
Rivas	3,327	7,546	2,268
Diriamba	2,602	5,950	2,287
Corinto	2,505	6,465	2,581
Chinandega	2,485	13,546	5,450
Boaco	2,392	3,136	1,311
Jinotepe	1,998	4,228	2,116
Masaya	1,192	6,675	5,061
Bluefields	1,145	2,205	1,925
Juigalpa	1,105	1,557	1,410
Somoto	1,068	682	639
San Carlos	817	189	231

Source: Empresa Nacional de Luz y Fuerza (ENALUF) e Instituto de Energia Electrica as cited in A Study of Housing and Urban Development in Nicaragua. PADCO, 1978.

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1. Overview

Several major waves of rural to urban migration since the 1940's have changed Peru's population from predominantly rural to 55% urban by 1975, and put a great strain on urban resources. Metropolitan Lima, the destination of 58% of migrants to coastal areas, quadrupled its population between 1940 and 1970 (4,290,735 in 1977). Of the estimated 3.1 million housing units in Peru in 1977, 62% were in urban areas but only 51% of dwellings in Lima were considered of standard quality. The Metropolitan (Lima) Development Plan (PLANDEMET) estimates an additional 910,549 units will be needed in that city by 1990 to accommodate the projected population.

About 65% of all families own their own homes, though not necessarily the land; a single-family detached home is the predominant type (80%). The present high rate of inflation has priced all but a tiny minority out of the housing market. Self-help or "auto-construccion" is the only means for poor people to build permanent shelters, though such structures tend to be "under-built" or "over-built".

1977 Urban and Rural Housing Needs by Region

Regions	Total Units 1977	Housing Needs: New Units 1972-77	Housing Needs: Replacement Units 1972	Total
National	3,147,903	473,539	2,195,890	2,669,429
Urban	1,960,341	429,803	1,057,202	1,487,005
Rural	1,187,562	43,736	1,138,688	1,182,424
Coastal	1,812,813	345,263	1,020,149	1,365,412
Urban	1,468,461	342,525	680,404	1,022,929
Rural	344,352	2,738	339,745	342,483
Sierra	1,054,171	86,397	947,476	1,033,873
Urban	373,366	63,439	292,013	355,452
Rural	680,805	22,958	655,463	678,421
Selva	280,919	41,879	228,265	270,144
Urban	118,514	23,839	84,785	108,624
Rural	162,405	18,040	143,480	161,520

Source: Banco de la Vivienda del Peru, based on National Housing Census, 1972, as cited in AID Peru Shelter Sector Assessment, February 1979.

Urban Households

Department	Average Number of People per Household	Department	Average Number of People per Household
Amazonas	5.5	La Libertad	5.2
Ancash	5.1	Lambayeque	5.3
Apurimac	4.6	Lima	5.1
Arequipa	5.1	Loreto	6.5
Ayachucho	4.6	Madre de Dios	5.0
Cajamarca	5.9	Moquegua	5.0
Callao	5.2	Pasco	4.8
Cuzco	4.0	Piura	5.6
Huancavelica	4.7	Puno	4.4
Huanuco	5.7	San Martin	5.7
Ica	5.5	Tacna	5.0
Junin	5.1	Tumbes	5.8

Source: Compania Peruana de Investigacion de Mercados, S.A., Censo Muestra de Provincias, 1978, p. 13 as cited in AID Peru Shelter Assessment, February 1979.

2. Housing Policy and Institutions *

Ministry of Housing and Construction (MOHC) has overall direction of the housing sector. The Banco de la Vivienda del Peru (BVP) is its financial arm; EMADIPERU (Peruvian Real Estate Management Enterprise) administers MOHC housing portfolio. Several quasi-independent entities (e.g., Direccion General de Obras Sanitarias (DGOS) and ELECTROPERU) have responsibility for infrastructure.

The state-owned, semi-autonomous BVP is the principal source of finance for low-income housing and has had extensive experience in contracting foreign loans, including USAID loans for housing reconstruction after the 1970 earthquake.

17 savings and loan associations (7 in Lima), regulated by BVP, are authorized to lend for housing and infrastructure.

Banco Central Hipotecario (BCH), Central Mortgage Bank, finances higher-income housing.

* Structure and functions of institutions as of November 1979, when the country was in a transitional phase prior to the election of a civilian government in May 1980.

All banking institutions have been seriously decapitalized during the past few years by rapid inflation, necessitating government support, in part through subsidies, for BVP and S and L's.

Numerous other public and private institutions have responsibilities and programs related to housing. The Institute for Investigation of Housing Action (Instituto de Investigaciones para la Accion en Vivienda, INIAVI), a private voluntary organization, has potential for making an important contribution to self-help housing through its program of technical assistance using professional construction engineers, "master" supervisors, and teaching materials.

3. Disaster/Low-cost Housing

Following the disastrous May 1970 earthquake several types of emergency housing were provided by the GOP and international donors, some more readily accepted than others.

500 hemispherical, inflatable "igloos" of spun polyurethane were supplied by the German Red Cross for use in Caraz, Callejon de Huaylas. A 1976 survey found 272 still standing and only a few not occupied. In many instances the original units had been regrouped, enlarged by the addition of separate or abutting adobe structures, or otherwise modified. Though earthquake resistant and well insulated, the domes were not popular, their long-term occupancy apparently dictated by necessity rather than choice.

Several hundred multi-family units with corrugated cement asbestos roofing were built by the GOP in mountainous urban areas. The communal living arrangement, dirt floors, and lack of windows have been cited as reasons for their generally negative reception. In addition, the time required for building (3 to 6 months) limited their effectiveness as emergency housing. Some units were still occupied in 1976; others were being used for commercial or governmental purposes; still others had been disassembled and moved to other sites. The 662 AID-funded wood frame four-family modulars, built in rural communities of Callejon de Huaylas, met with many of the same objections as the GOP units. The plan to reuse materials in permanent structures proved unfeasible due to deterioration of the wood frames and cracking of the cement asbestos roofing.

More than one thousand 3x4.5 m windowless shelters of corrugated zinc sheets over wood frames provided by the OAS were built in rural areas of Yungay and Huaylos. Their thermal characteristics (too hot during the day and too cold at night) were the chief drawbacks.

The USG also supplied tents which were still in use long after the initial emergency period. Since they could not provide adequate protection in rain and cold weather, the purchase and delivery of corrugated metal and aluminum roofing to cover temporary structures erected by earthquake victims became a high GOP priority.

The USG responded to Peru's need for temporary housing after the October 1974 earthquake near Lima by financing the purchase of locally obtainable "esteras" (woven cane mats) to be used in building shelters rather than investing in the far more expensive tents. The warm, dry weather of the region at the time of the emergency permitted that solution. Obtaining esteras proved difficult, however, because they had to be purchased from several small manufacturers along the entire coast.

4. Housing Types, Materials, Construction and Services

4.1 Housing Types

Urban

Two types of settlements house the majority of urban poor: tugurios (inner city tenements) and pueblos jovenes (squatter communities). Firm statistics are lacking, but a 1976 study reports more than 2.3 million people living in pueblos jovenes in 28 cities. Other studies suggest that at least 75% of Lima's population live in tugurios or pueblos jovenes.

Tugurios may be multi-story, multi-family houses; small, one- or two-room units off alleyways (callejones); or tenement-like structures built as rental accommodations. They are typically over-crowded, in deteriorating condition, and often with communal water and sanitary facilities.

By invading public and private land, migrants have built pueblos jovenes on the outskirts of cities. In contrast to tugurios, progressive improvement of living conditions has characterized these settlements. Largely through self-help development, temporary shelters lacking public services are often replaced by permanent dwellings with them. Population densities are low relative to inner city ones though increasing ("tugurization") in older settlements in the 1970's. Approved pueblos jovenes are eventually legitimized and the residents given title to their lots.

Rural

Rural houses are typically small with one or two rooms. Roofs are flat in dry Costa, gabled in Sierra; windows are often lacking. Kitchen may be separate low-roofed structure; cooking is often done over an open fire. Houses in rainforests of Selva are built of local materials and on stilts for protection from animals and flooding. Steeply pitched roofs of palm fronds allow run-off in heavy rains.

4.2 Materials and Construction

Five general kinds of traditional (non-engineered) structures are found throughout the country: adobe (sun-dried earthen bricks), quincha (wood frame with walls of mud-covered cane infill), tapial (rammed earth), unreinforced masonry (brick or block without proper reinforcing systems), and wooden houses (wood frame and timber, built by owner).

Despite the heavy structural and human losses in the 1970 earthquake, due to the primitive technology of traditional adobe construction, the low cost and climatic suitability of adobe accounts for its continued widespread use.* Although found in nearly every region except the jungle, adobe structures are concentrated in parts of the Sierra and along coastal river valleys where necessary adobe soils and bonding grasses are found. In coastal regions where the climate is dry and wood scarce, roofs of adobe houses may be flat (formed by laying a mesh of cane, bamboo mats, and mud over bamboo poles) or in southern coastal areas made of quincha (A-frame of mud plastered over a lattice work of bamboo and cane). Heavy rains in mountain areas make pitched roofs (usually 30°) necessary; they may be 2-sided or 4-sided, tile or sod. In larger cities of the Sierra, corrugated metal and asbestos roofing are growing in popularity. In addition to tapial and adobe block structures in mountain regions, adobe with small stone coursing and, in the high Andes, stone wall houses are also seen. "Self-help" in adobe construction is usually limited to assisting a hired mason (albanil), though skilled albanils are decreasing in number. Adobe occupies a middle position in the housing hierarchy: more desirable than quincha in the coastal region or tapial in the Sierra but lower in value than brick or concrete block.

* An earthquake (6.6 on the Mercalli scale) in the area of Arequipa on February 16, 1979, caused slight damage to pueblos jovenes in Arequipa and extensive structural damage in the provinces of Condesuyos, Castilla, and Camana. In the town of Chuquibamba, for example, virtually all adobe buildings were damaged and in need of reconstruction with stronger materials. The towns of Aplao, Pompacolca, and Viraco reported similar damage.

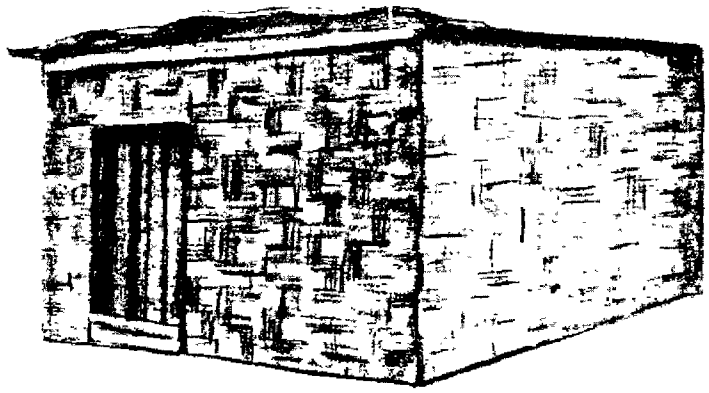
The vulnerability of adobe structures to earthquake damage in Peru is due to the country's generally inferior adobe (only a few regions have good adobe soils) and to dangerous building features such as high and heavy walls, heavy roofs, improper building configuration and balance, lack of reinforcement. Poor soil composition (high content of rock, clay, sand or, in coastal regions, salt), combined with inadequate stabilization and improper drying and curing of adobe accounts for its characteristic weaknesses: brittleness and susceptibility to erosion. Through research initiated by the GOP in 1971 some new techniques to reduce vulnerability of traditional structures have been developed but are not widely implemented. Among the developments is the promising use of asphalt as an effective adobe stabilizing agent, suitable for most regions. The introduction of stabilized adobe is expected to meet with resistance because of tradition, added cost, and problems of supply.

Peru produces nearly 95% of its own construction materials although difficult access to rain forests limits availability of lumber west of the Andes. An expensive though preferred technology for permanent buildings in coastal and mountain areas where seismic design criteria are needed is reinforced concrete skeleton frame (1979 A.I.D., Shelter Sector Assessment). Walls are of concrete block, fired tile or brick; reinforced fired tile is used for roofs and floors.

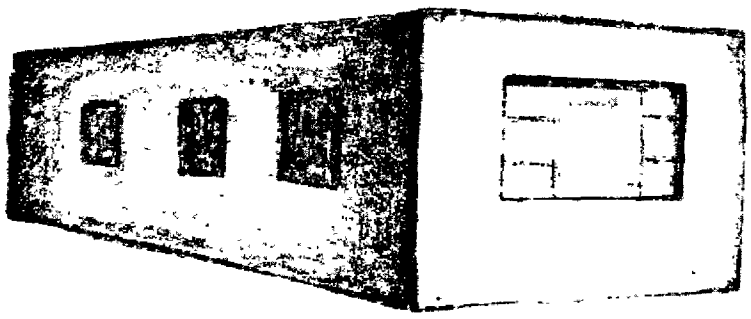
Temporary shelters in coastal regions made of cane mats ("esteras") stretched over wood poles are inexpensive and relatively long lasting in a dry climate but offer inadequate protection in winter.

Materials and technology standards are described as generally higher than income and climate justify. Several projects to test low-cost techniques for seismic zone construction have had mixed results. Taste and tradition are obstacles to innovation. The desired goal of many residents of pueblos jovenes is to acquire enough bricks, blocks ("materiales noble"), and steel to make a permanent room with concrete columns and beams regardless of cost.

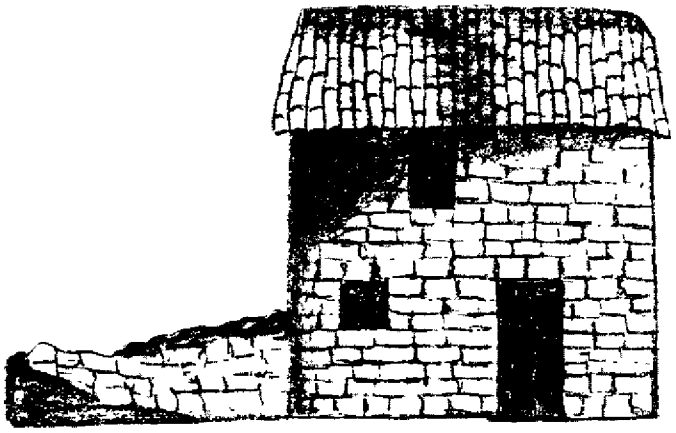
1972 census data: 56% of houses in Peru have roofs of permanent materials (14% concrete); 71% of urban houses have permanent roofs (25% concrete); 23% of houses countrywide, 38% of urban have walls of brick, concrete blocks, stone or reinforced concrete, with totals rising to 72% country-wide and 81% urban when adobe is included.



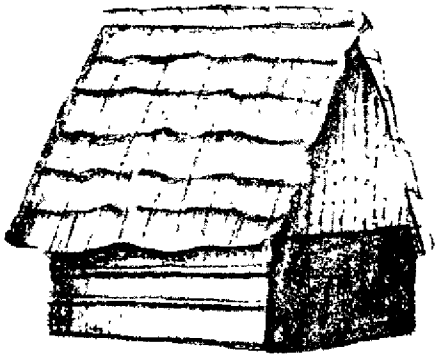
Temporary squatter shelter made of woven mats stretched over wooden poles.



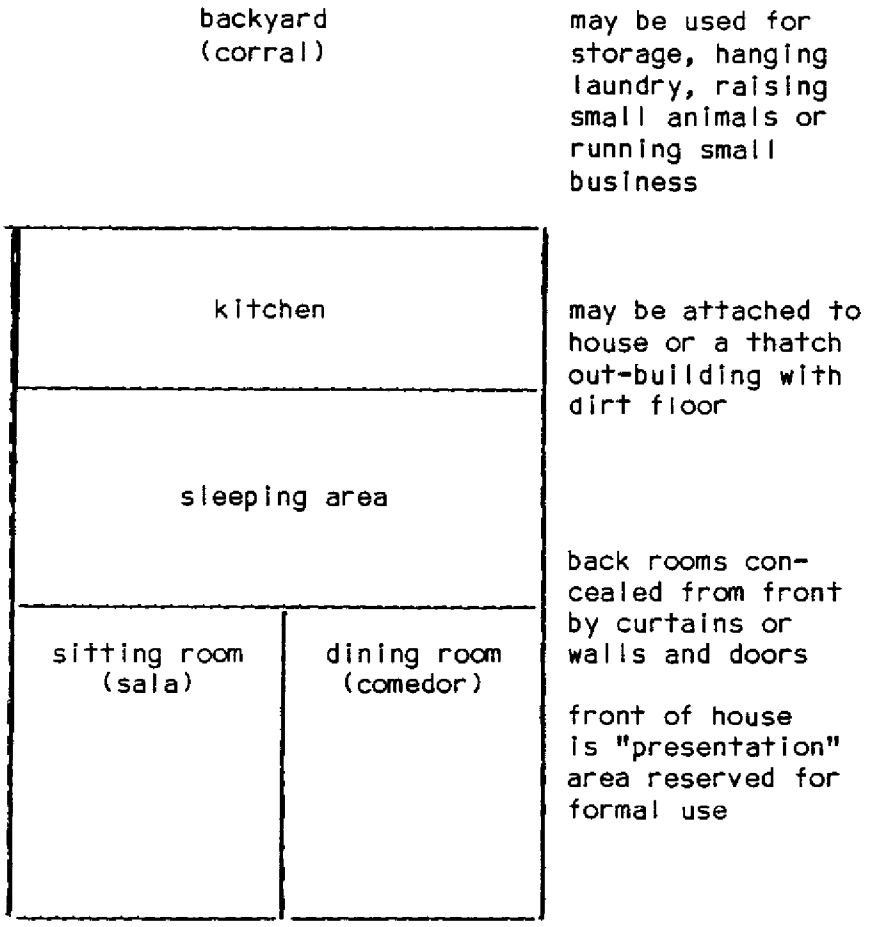
Flat roofed permanent dwelling in coastal pubelo joven.



House of adobe block or stone wall construction with burned tile roof found in mountain areas.



Jungle house of thatch.



Layout of self-built permanent dwelling in a pueblo joven shows division of front and back areas and reflects aspirations of settlers to better their living conditions and make improvements visible to neighbors and visitors. Front areas are finished first and furnished more elaborately than the private, informal family space in rear of house.

Suggested by description in AID Peru Shelter Sector Assessment, 1979, pp. 30-31.

4.3 Services

Urban and Rural Housing Without Basic Services by Region, 1977

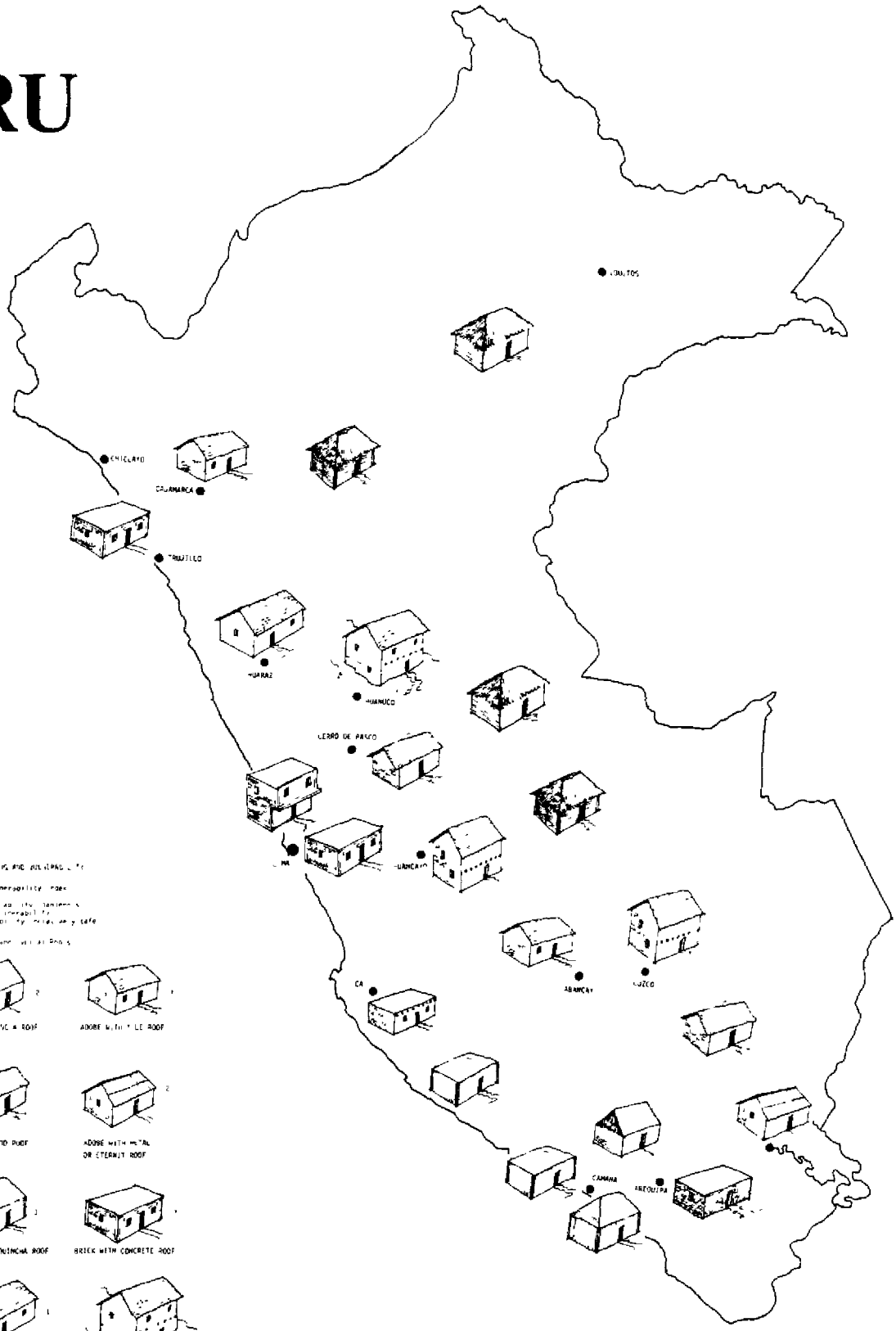
Regions	Total Housing Units 1977	Lacking Services		
		Water	Sewerage	Electricity
National	3,147,903	2,268,003	2,470,905	2,043,613
Urban	1,960,341	1,099,197	1,291,712	886,584
Rural	1,187,562	1,168,806	1,179,193	1,157,029
Coastal	1,812,813	1,064,753	1,200,012	896,627
Urban	1,468,461	729,776	860,141	571,352
Rural	344,352	334,977	339,872	325,275
Sierra	1,054,171	952,379	1,009,499	907,565
Urban	373,366	280,106	331,885	236,179
Rural	680,805	672,273	677,614	671,386
Selva	280,919	250,871	261,393	239,421
Urban	118,514	89,315	99,686	79,553
Rural	162,405	161,556	161,707	160,368

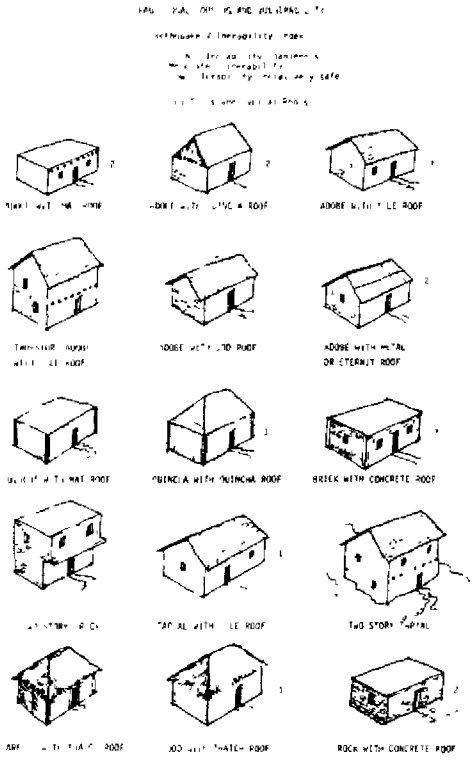
Source: BVP calculations based on 1972 National Housing Census as cited in AID, Peru Shelter Sector Assessment, February 1979.

Services are more likely to be available in urban areas than in rural, in urban areas as a whole than in squatter communities. In the latter, until infrastructure is provided, water of doubtful quality is delivered to each home by tank truck (often at exploitative rates) and stored in cisterns or barrels; kerosene lanterns and candles are used for lighting, kerosene stoves for cooking. Pit latrines provided in more crowded areas are the only sanitary service.

The water supply in Lima is from a central source, dependent on electricity for pumping. In the event of a major earthquake, the city water supply could be entirely cut off.

PERU





INTERTECT

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