ANALYSIS OF HOUSING NEEDS FOR GUAM
1993 - 1998

[D R A F T]

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CONTENTS

I. BACKGROUND AND INTRODUCTION

This report presents an analysis of housing conditions, trends, and needs in GUAM for the period from 1993 through 1998. The analysis was conducted by the Urban Institute for the Guam Economic Development Authority (GEDA) and the Guam Housing Corporation (GHC). Methods employed in this analysis have been designed to be implemented on a continuing basis, so that policy makers can reassess housing conditions and needs in the future.

PURPOSE OF THE HOUSING NEEDS ANALYSIS

During the last decade or so, Guam's housing sector experienced an unparalleled housing boom. Driven primarily by rapid growth in Japanese tourism, GUAM's economic growth put demand pressure on virtually all segments of the housing market, e.g., the Micronesian influx of unskilled workers pressing on lower-income rental housing, professional and managerial newcomers seeking to purchase higher-income homes, and rising incomes coupled with increased numbers of skilled workers putting excessive demands on the middle-income range of the housing market. In total, the number of GUAM's households increased by over one-fourth (26.3 percent) during the decade of the 1980s.

Not surprisingly, the dramatic increases in housing demand resulted in equally dramatic increases in housing costs. Median nominal rent increased by 155 percent during the 1980s, for example, while median nominal value of owner-occupied homes increased by 127 percent. Increased housing prices, in turn, induced substantial increases in the supply of housing in the private sector. However, "housing problems" are widely perceived to persist in GUAM, especially as manifest in the reduced affordability of suitable housing because of escalated prices and costs. Other perceptions of GUAM's housing problems include unavailability of units, physical inadequacy, and deficient neighborhood amenities and public services.

The Guam Housing and Urban Renewal Authority (GHURA) and the Guam Housing Corporation (GHC) have been the primary government agencies for expanding the private sector's response to housing needs on GUAM, particularly in meeting the needs of lower- and middle-income households. For example, GHURA currently assists up to 2,423 families through the existing Section 8, Moderate Rehabilitation, and Voucher Programs; GHURA and GHC own some 870 housing units which are rented to low-income families; and GHC is authorized to make mortgage loans to low- and moderate-income households for the purchase or construction of homes.

In recent years, the Guam Economic Development Authority (GEDA) has also assumed an increasingly important role in addressing GUAM's housing needs. For example, GEDA has attempted to induce developers to provide additional housing for low-income families by assisting developers in obtaining bond financing. Other recent Government of Guam housing initiatives include creation of the Guam Housing Corporation Mortgage Insurance Corporation (GHCMIC) to provide mortgage insurance to qualified first-time homebuyers, extension of ownership opportunities to public

housing tenants through the GHURA 500 program, and provision of ownership opportunities for landless low- and moderate-income families through programs implemented by GHURA and the Department of Land Management.

Recognizing the magnitude and complexity of Guam's housing problems on the one hand, and the several varied program initiatives to address those problems on the other, GEDA, GHC, and GHURA "are presently attempting to coordinate efforts at working towards a common housing interest strategy."[1] The Guam Comprehensive Housing Study generally, and the Housing Needs Assessment component in particular, are products of those efforts to work towards a common housing strategy. Conducted under the auspices of GEDA and GHC, the Housing Needs Assessment (HNA) is designed to document current housing conditions and problems, and to forecast future housing needs.

Although the HNA estimates of current and projected housing conditions reported upon in this document provide a basis for designing policy alternatives and program initiatives in the near-term, the HNA model and its forecasts also provide a long-term basis for policy formulation and program development. First, the very process of specifying the model and developing housing needs estimates serves to focus attention on such key policy issues as the relative priorities to be placed on addressing the problems of unaffordability, inadequacy, and crowding.

Second, the HNA model can be used to simulate alternative scenarios under differing assumptions about market conditions, about public housing policies and programs, and so forth. The model can be used by GUAM policy makers to update estimates of housing needs, thereby assisting in allocation of scarce housing resources on a continuing basis.

Third, housing needs estimates provided in this report will provide a baseline against which future estimates can be compared. This will enable policy makers to gauge changes in the nature and magnitude of GUAM's housing needs and, by inference, gauge progress in meeting the measured housing needs.

Fourth, analysis of GUAM's housing needs through use of the HNA model will facilitate other strategic planning efforts on GUAM. More broadly, insights and relationships deriving from the Housing Needs Assessment process are expected to dovetail with the efforts of the Territorial Planning Council's creation of a comprehensive master plan for Guam. A more immediate and specific use of the Housing Needs Assessment will be in support of the Comprehensive Housing Affordability Strategy (CHAS).

Housing policy and program planning requirements were imposed by the "National Affordable Housing Act of 1990." That legislation requires state and local governments to prepare a CHAS annually as a condition for obtaining funding under many federal

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[1] Territory of Guam: Abbreviated Comprehensive Housing Affordability Strategy (CHAS), October 1, 1991 to September 30, 1996, submitted by Guam Housing and Urban Renewal Authority, p. 3.

housing assistance programs administered by the U.S. Department of Housing and Urban Development. The CHAS must document current housing conditions and needs, discuss prevailing trends, forecast housing needs for the next five years, and explain how available resources (including those from the federal government) will be allocated to address the current and projected housing needs.

The CHAS requirements for documenting current and projected housing needs are precisely the objectives of the Housing Needs Assessment. Specifically, the assessment reported upon here provides a systematic analysis of current housing problems in the Territory of GUAM, as well as in each of its three geographic regions, and also forecasts housing needs from 1993 to 1998. Based on a series of reasonable assumptions about economic and demographic trends, the analysis forecasts the volume of housing production and rehabilitation necessary to house all Guam residents adequately by 1998.

OVERVIEW OF THE NEEDS ASSESSMENT METHODOLOGY

In order to support policy development and resource allocation decisions, a housing needs assessment must consist of three key components. First, it must quantify current housing problems, including the problems of physically deficient, crowded, and unaffordable housing. Second, it must forecast future needs for housing production and renovation, taking into account anticipated household growth as well as changes in income levels and housing costs. And finally, it must quantify the total magnitude of the gap between what households can afford to spend on housing and the costs of the housing solutions that they need to be adequately housed.

It is important to understand clearly from the outset that the housing needs forecasts presented in this report are not intended as predictions of how housing conditions in GUAM will *actually* change over the 1993 to 1998 period. Instead, they are estimates of how the housing stock would *need* to change (at a minimum) in order to house all of GUAM's residents adequately -- existing residents as well as newcomers. Correspondingly, estimates of the current and future affordability gap are not intended as predictions of *actual* public sector spending levels. Instead, they are estimates of the level of subsidy funding that *would be required* (at a minimum) to close the gap between what households can afford to pay for housing and the costs of the housing solutions they need.

Given the volume of housing problems in the U.S. today, as well as the severe constraints on federal and local public resources, the analysis and results presented here are not intended to imply that GUAM could or should provide sufficient subsidy funding to ensure adequate and affordable housing for all its residents by 1998. Rather, forecasts of both production and subsidy needs are broken down for different types of housing problems and for different segments of the population, in order to facilitate policy discussion about the allocation of available resources to households whose needs are considered most severe or who are perceived to be least able to meet their own needs without public sector assistance. In other words, this housing needs analysis is designed to provide comprehensive and reliable information about housing needs and resources, which will provide a basis for public debate and policy decision making.

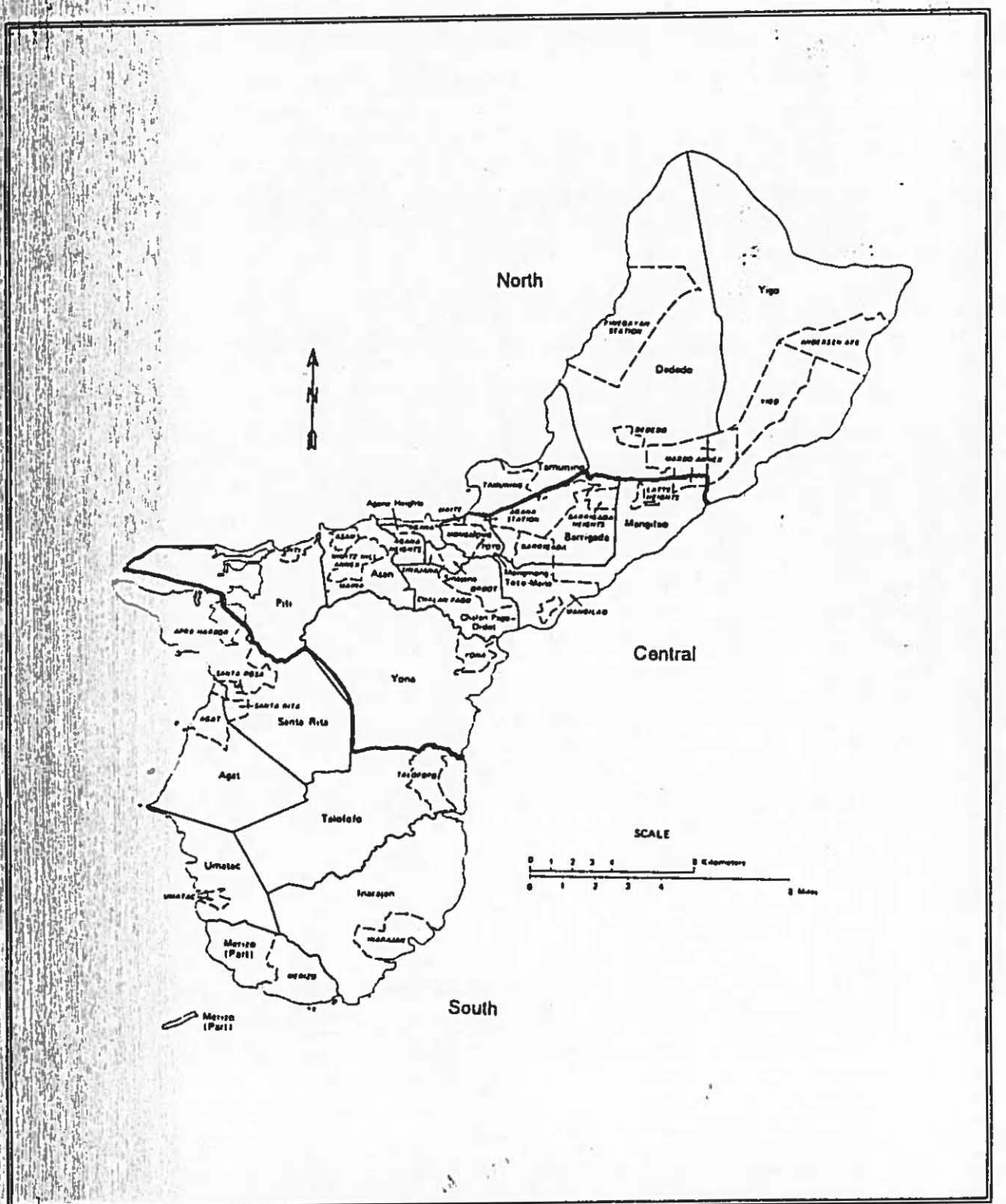
HOUSING ANALYSIS REGIONS FOR GUAM

For purposes of this analysis, GUAM has been partitioned into three geographic regions. Regional definitions are the same as those used for the GUAM Master Plan. Figure 1.1 lists the election districts in each region, and Figure 1.2 maps the regional boundaries.

Figure 1.1 – GUAM Election Districts by Region

Northern	Central
Dededo	Agana
Tamuning	Agana Heights
Yigo	Asan
	Barrigada
Southern	Chalan Pago-Ordot
	Manjilao
Agat	Mongmong-Toto-Maite
Inarajan	Piti
Merizo	Sinajana
Santa Rita	Yona
Talofofo	
Umatac	

Figure 1.2 – Map of GUAM by Election District



ORGANIZATION OF THE REPORT AND SUMMARY OF FINDINGS

The remainder of this needs analysis report consists of four major chapters. Chapter II documents current (1993) housing conditions and problems for GUAM as whole and for the three regions defined for the island. Data are drawn from the U.S. Census and have been adjusted to 1993 levels by using supplementary data and forecasts. Key findings of the analysis presented in Section II include:

- Affordability is the biggest problem facing GUAM's households, with about 22 percent (7,997 households) paying excessive housing cost burdens.
- An estimated 12 percent (4,323) of GUAM's households live in housing that is severely physically inadequate, and 14 percent (5,123) are crowded.
- Very low-income households, particularly renters, are the most likely to have affordability problems -- 85 percent of very low-income renters faced housing affordabiltiy problems in 1993.
- In addition to households with housing problems, the estimated affordability gap in 1993 was approximately 25 million dollars.

Chapter III describes the algorithm used by the HNA model to produce five-year forecasts of housing production and subsidy needs. Specifically, this section of the report explains how the HNA model forecasts the number of new and rehabilitated units that would be required to accommodate all new and existing residents adequately by 1998, and how it estimates the total gap between what GUAM residents can reasonably afford to spend for housing and the costs of the housing solutions they need.

Chapter IV documents housing market and demographic trends on the island and presents the estimates of future trends that serve as inputs to the housing needs analysis. More specifically, this chapter discusses trends in population growth and household formation, income growth and housing cost inflation. Key conclusions of this analysis include:

- The total number of households living in GUAM is projected to climb steadily during the 1990s, increasing annually by about 3 percent between 1993 and 1998.
- Under the Moderate economic scenario, household incomes are projected to grow by 7.5 percent annually in nominal terms over the entire 1993 to 1998 period.
- Housing prices are also expected to grow steadily and keep up with income growth, due to the combination of stable household growth and income gains across the entire income spectrum.

Chapter IV also presents the results of HNA model forecasts for the 1993 to 1998

period. Results include estimates of the minimum volume of production needed to meet the demands of existing and incoming residents, the number and characteristics of households who cannot afford the housing solutions that they need, and the total level of subsidy funding that would be required (at a minimum) to ensure adequate and affordable housing for all residents. Forecasts are generated for three alternative scenarios, reflecting differing assumptions about income growth and housing costs. In addition to the Moderate scenario, which conforms to the most likely economic and housing market trends, we simulated housing needs under Slow and Accelerated growth scenarios. Key findings include:

- At a minimum, 3,429 new housing units need to be built, and 7,766 units need rehabilitation to ensure adequate housing for all GUAM's residents by 1998.

- Even with all households assigned to the most affordable housing solutions they need, about 33 percent are forecast to be paying unaffordable cost burdens in 1998.

- The total gap between what households can afford to pay and the cost of the housing they need is forecast to be about 78.6 million dollars in 1998 under the Moderate scenario.

- By utilizing more pessimistic assumptions about economic growth during the 1990s, the projected affordability gap under the Slow growth scenario is smaller (67.6 million dollars in 1998), primarily due to lower housing cost inflation.

- If, however, renewed house price inflation is accompanied by healthy income growth, the affordability gap would be substantially larger, about 91 millions dollars in 1998 under the Accelerated growth scenario.

Finally, Chapter V estimates recent levels of housing production, renovation, and subsidy funding by both public and private sector actors in GUAM. These existing activity levels are compared to the HNA forecasts of housing needs in GUAM from 1993 to 1998. Key findings include:

[Insert summary of key findings.]

In conclusion, the majority of GUAM's households today live in adequate and affordable housing and will continue to do so over the next five years. Nonetheless, many households face serious problems of housing adequacy and unaffordability. The Urban Institute's Housing Needs Assessment (HNA) Model has been used to estimate what changes in the existing housing stock would be required (at a minimum) to house all residents on GUAM adequately by the year 1998, and what level of resources would be required to bridge the gap between what households can afford to pay and the cost of housing solutions that meet their needs.

These estimates indicate, based on historical data, that the housing construction

sector in GUAM has the capacity to build sufficient new housing units to satisfy projected needs, but that levels of housing rehabilitation may fall short of projected needs. In addition, the analysis indicates that federal and island government agencies currently commit substantial resources to housing, amounting to roughly to _____ of what would be required to bridge the gap between what households can afford to pay and the cost of the housing that they need in 1993.

II. CURRENT HOUSING CONDITIONS AND PROBLEMS

This chapter describes housing conditions on GUAM for the base year of 1993. The chapter begins with an overview of household characteristics for the island as a whole and for the three housing analysis regions: North, Central, and South. Next, the incidence and distribution of housing problems are reported, including the problems of physically inadequate housing, crowded housing, and unaffordable housing. The third section of the chapter estimates the total size of the housing affordability gap in GUAM for the current year. The affordability gap represents the difference between what households can afford to spend for housing and what they are actually spending for the housing in which they live.

Throughout this chapter, and the remainder of this report, key patterns and findings are illustrated graphically, using figures that accompany the text (all percentages are rounded to the nearest whole integer). All the statistics and estimates are reported in extensive tables which have been provided for reference at the end of the text portion of this report.

The availability of data to document household characteristics and housing conditions always lags behind by several years. At the time this analysis was conducted, the most reliable data source for documenting housing conditions for GUAM was the Decennial 1990 Census Micro-data file. For 1990, the Census Bureau administered a survey instrument to all of the households on GUAM. This instrument collected a variety of information on household size, composition, and income, as well as, various housing characteristics such as rent payments and property values. The Urban Institute requested special tabulations of these data from the Census Bureau, based on a set of household and housing unit characteristics designed to be compatible with the HNA model (Figure 2.1). Since the base, or starting, year was designated as 1993, the 1990 Census tabulations had to be updated to base-year levels. This procedure was accomplished by using data from various supplemental sources to scale the Census-supplied tabulations to reflect conditions in 1993. Annex C provides an explanation of the scaling method and a summary of the rates used to adjust the base data to the base year levels.

GUAM HOUSEHOLDS IN 1993

At the start of 1993, GUAM was home to an estimated 36,658 households. The tables and charts in this section describe the characteristics of the households, breaking down the total by housing tenure, income level, household type, and household size. Categories for these key household characteristics are summarized in Figure 2.1.

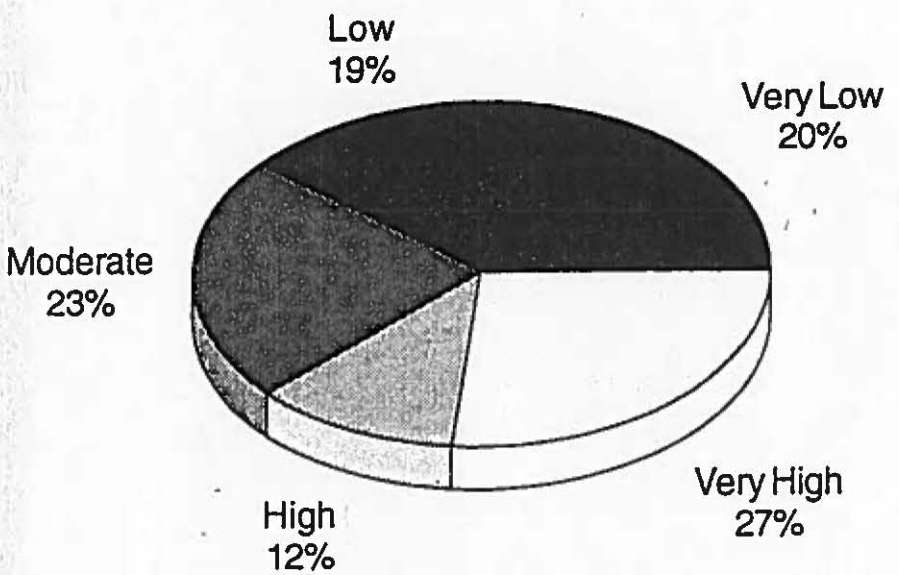
Figure 2.1
Household Characteristics - HNA Model

Variable Name	Group Classification Scheme
Income Group	Ranking of households by income $40,935 household median 20% Very Low (less than 50% island median) - 20,467 19% Low (50-80% of island median) 20,467 - 32,748 23% Moderate (80-120% of island median) 32,748 - 49,122 12% High (120%-150% of island median) 49,122 - 61,402 26% Very High (over 150% of island median) 61,402 +
Household Type	Type of household (based on head of household) Elderly household, (62 yrs. plus) 45-61 years old with/without children 30-44 years old with children 15-44 years old without children under 30 years with children
Household Size	Household size 1 - 2 persons 3 - 4 persons 5 - 6 persons 7 or more persons
Tenure	Housing Unit Tenure Owner-occupied Renter-occupied

Tables 2.1 through 2.5 present the distribution of households in GUAM in terms of their income group, housing tenure, household type, and size.[2] As illustrated by Figure 2.2, about one in five GUAM households (20 percent) are "very low" income, with incomes falling below fifty percent of the island median. Another 19 percent are classified as "low" income, with incomes between 50 and 80 percent of the median. Twenty-two (22) percent of GUAM's households fall in the "moderate" income range, which is defined as between 80 and 120 percent of the island median. Over 11 percent of all households have incomes above 120 percent of the median but below 150 percent of the median, placing them in the "high" income group. Finally, over 26 percent of the island's households are

[2]The percentages for each subgroup heading (e.g. Renters and Owners) give the percentage of that group out of the total number of households. The percentages for the income groups, however, sum to 100 percent within each subgroup.

Figure 2.2
Households by Income Class
1993 Estimates



grouped in the "very high" income category, where incomes exceed 150 percent of the island median.

Overall, 46 percent of GUAM's households own their own homes (Table 2.1 and Figure 2.3).[3] As shown in Figure 2.3, there is a strong relationship between household income and tenure. Some 37 percent of homeowners are in the highest income group, compared to only 18 percent of renters. Conversely, only 13 percent of owners are in the very low-income group while 26 percent of renters fall into this category. Taken together, households in the bottom two income groups have only a 32 percent probability of being owners, whereas households in the top two income groups have a 61 percent probability of being owners.

Figure 2.4 (Table 2.2) reports the distribution of households by household type and income group. Elderly households are the smallest group, comprising 12 percent of GUAM's total, while households with children headed by a person 30 to 44 years old are the largest group, with approximately 32 percent of the total. In fact, households with children make up at least 45 percent of GUAM's population, and for households headed by persons age 15 to 44 years, households with children outnumber households without children by about 2.5 to 1.

Households with children headed by persons age 15-29 are the most likely to have low incomes. These households have a 32 percent probability of being in the lowest income group and a 65 percent probability of being in the bottom two income groups. Elderly households are the second most likely group to be in the bottom two income groups, with a 43 percent probability. In contrast, households headed by a person who is 45 to 61 years old are the most likely to be in the upper income groups. Fifty-four (54) percent of these households have incomes greater than 120 percent of the island median and 40 percent have incomes greater than 150 percent of median.

Table 2.3 and Figure 2.5 show the distribution of GUAM's households according to size and income class. Households with 3-4 persons comprise over 38 percent of all households on the island. Households of 7-or-more people are the smallest group, comprising only 11 percent of total households. Although 1-2 person households are slightly more likely to have very low-incomes, the distribution by income classes is strikingly similar across all four household size categories, e.g., the proportions in the two lowest income classes differ by less than three percentage points, and the two highest income classes differ by less than two percentage points. This result is in part explained by the data characteristic that grouped household income according to household size. Overall, nearly two out of five households (39 percent) have either low or very low-incomes.

As shown in Table 2.4 and Figure 2.6, tenure patterns are unevenly distributed among the household size groups. Households with 7-or-more persons have the highest incidence of ownership at 74 percent while households with 1-2 persons are more likely

[3] This figure differs notably from the U.S. homeownership rate where just over 64 percent of all households own.

Figure 2.3
Households by Tenure & Income
1993 Estimates

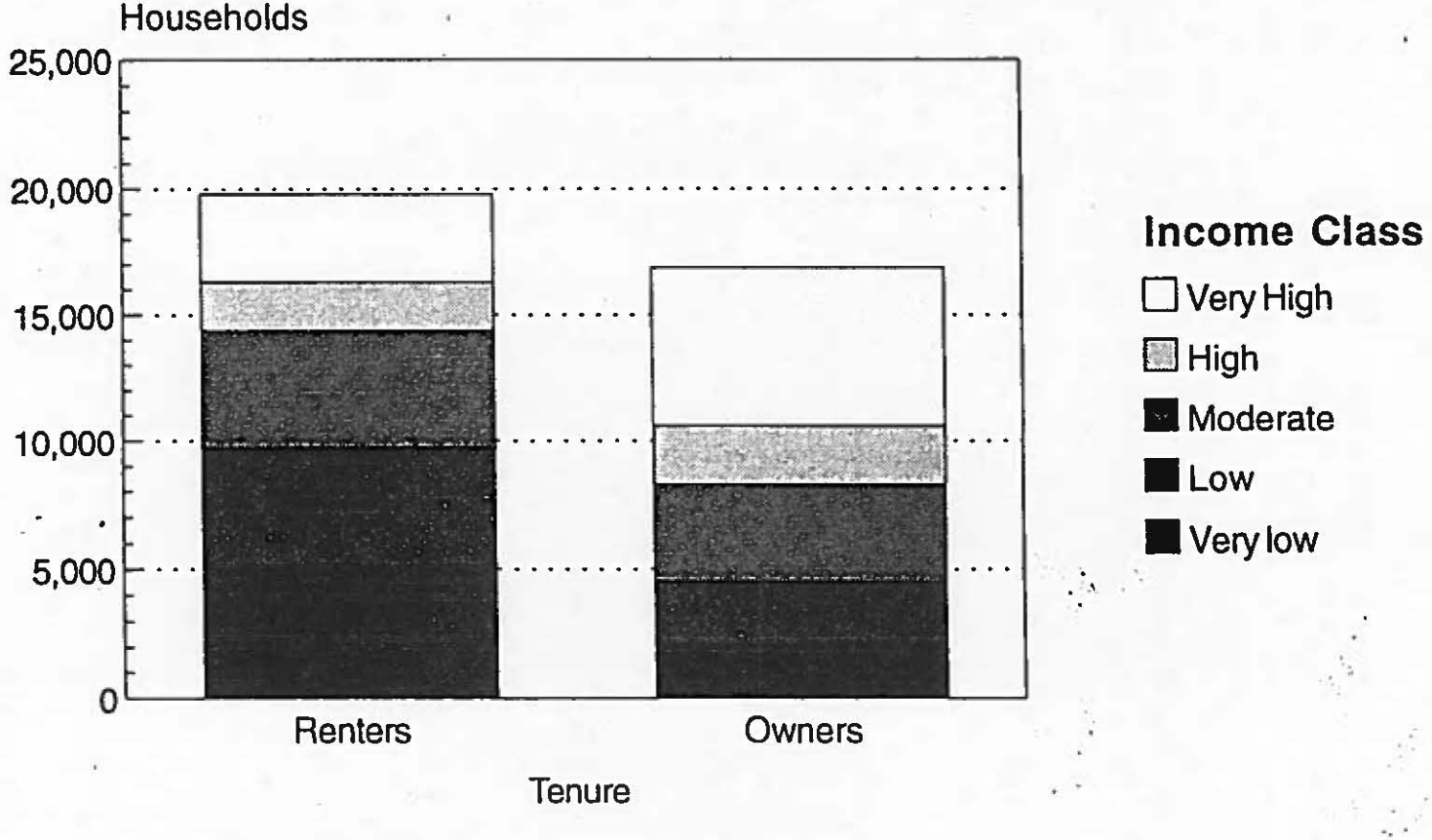


Figure 2.4
Households by Type & Income
1993 Estimates

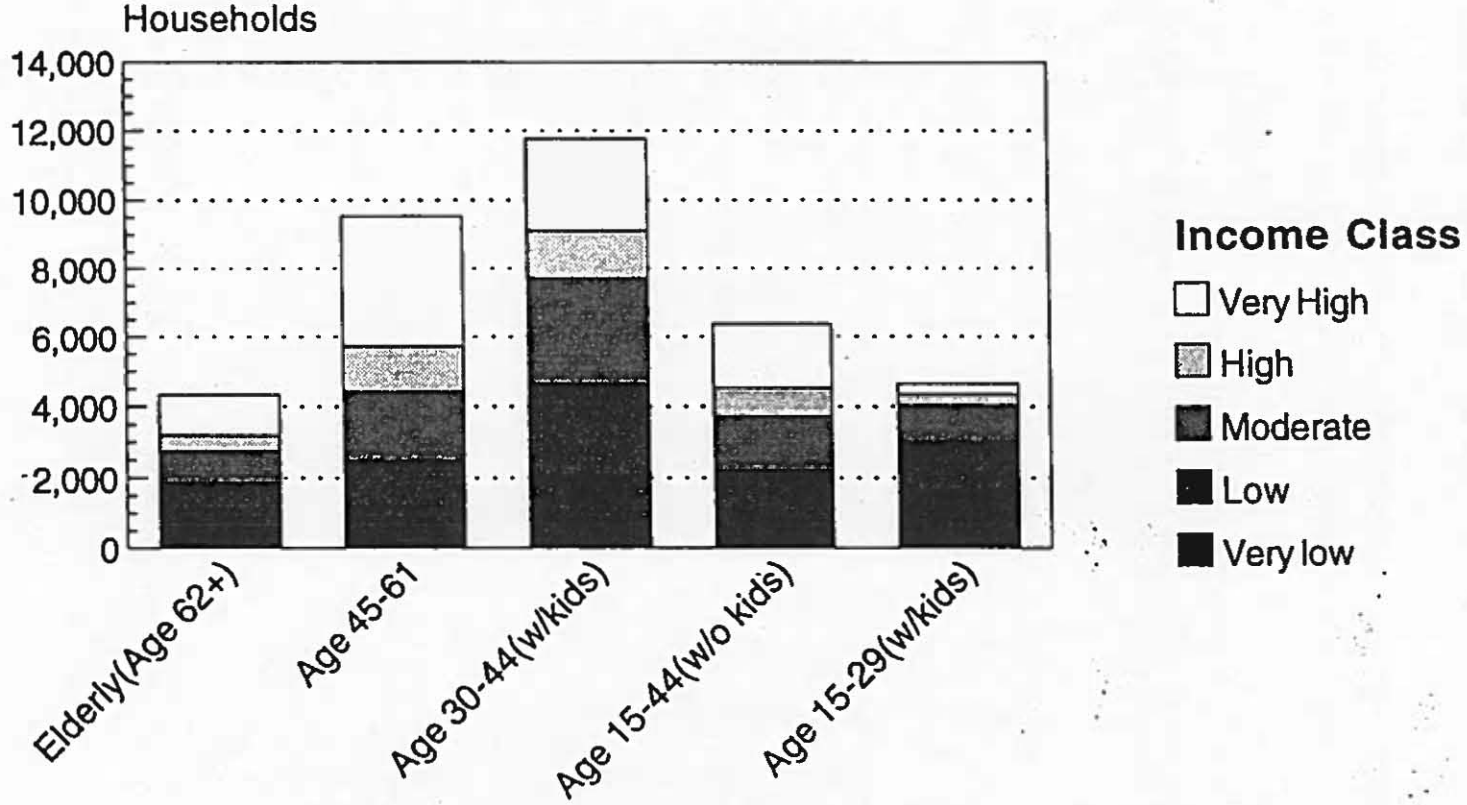


Figure 2.5
Household Size by Income Class
1993 Estimates

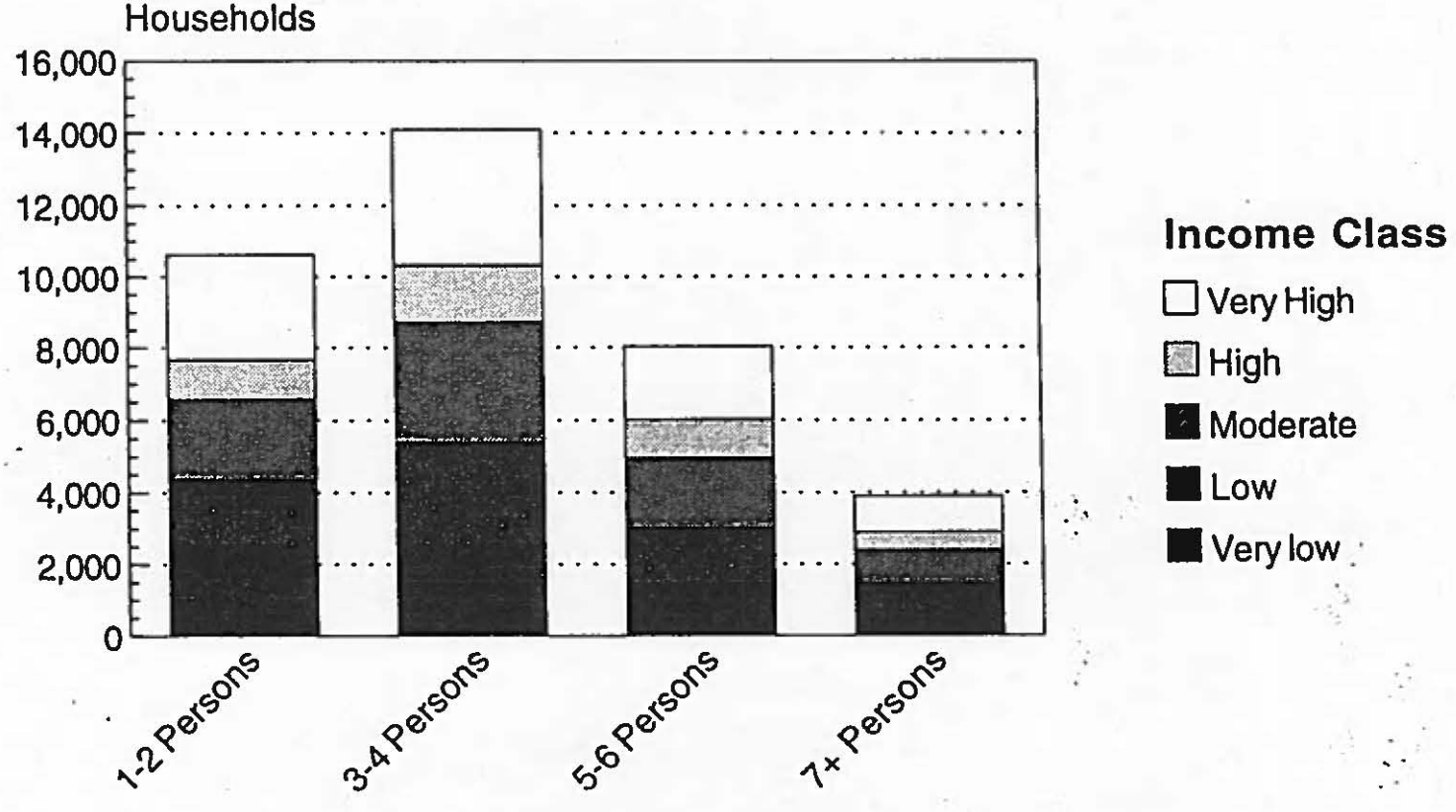
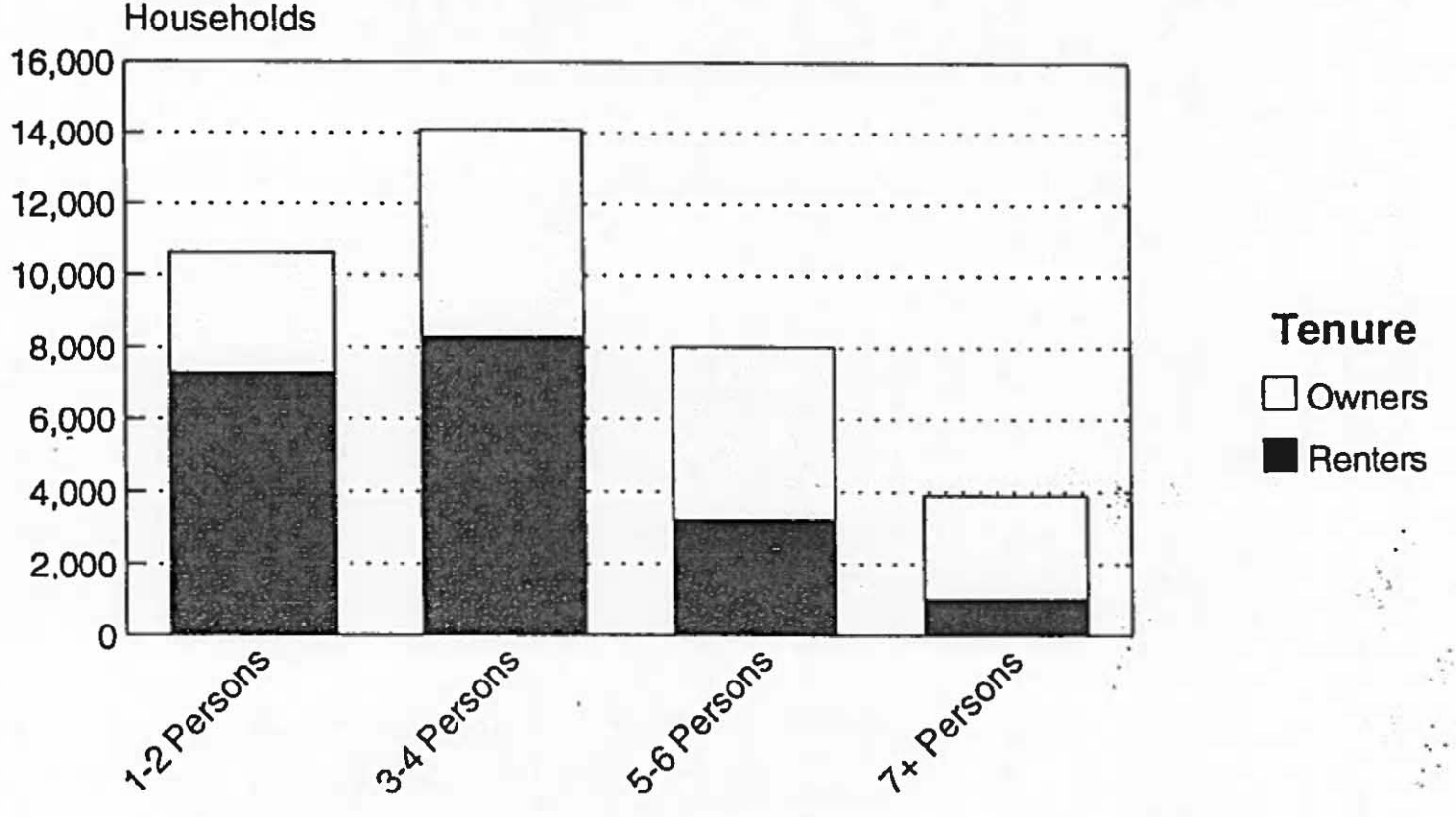


Figure 2.6
Household Size by Tenure
1993 Estimates



to rent than are any of the other groups, with ownership rate of 32 percent.

REGIONAL DIFFERENCES IN HOUSEHOLD CHARACTERISTICS

Tables 2.5 through 2.8 report the estimated number and distribution of households living in each region in 1993. As illustrated in Figure 2.7 (Table 2.5) the largest region is the Northern region, containing 50 percent (18,174) of the households on the island. Together, the Northern and Central regions comprise approximately 85 percent of all households on GUAM. The Southern region, although geographically large, contains only 15 percent (5,578) of all households on the island.

Homeownership is more prevalent in the Central region than in the other two regions. Figure 2.8 shows that over 52 percent of households in the Central region are homeowners while in the Northern and Southern regions 42 percent are homeowners (Table 2.6). The low ownership rate for the island as a whole results in part from the relatively lower income levels and higher housing costs found on GUAM than on the mainland, where the ownership rate is 64 percent.

Income is fairly similarly distributed in the North and South, but income in the Central region is slightly shifted to the higher end of the income distribution, with 42 percent of households in the two highest income groups (Table 2.7 and Figure 2.9). The likelihood of a Northern region household falling into the low-income class is 20 percent, while in the Central region the likelihood is only 16 percent. Conversely, in the Northern region the likelihood of a household falling into the very high-income group is 25 percent while the incidence increases to 31 percent for those households residing in the Central region. Over 40 percent of all households in the North and South regions fall into the very low- or low-income classes, whereas the Central region's share is about 36 percent.

The distribution of households by size is also fairly uniform between the regions (Table 2.8 and Figure 2.10). In the Northern region, the proportion of households in the 1-2 person group is the highest among the three regions, with a 30 percent share. The Southern region's share of 1-2 person households drops to 23 percent. The proportion of households in the 7-or-more person category in the Southern region is the highest among all three regions, over 12 percent. The single largest group of households on GUAM those with 3-4 persons, regardless of region.[4]

HOUSEHOLDS WITH HOUSING PROBLEMS

This section describes the number and characteristics of households with various types of housing problems in 1993. For each specific problem, tables are given showing the distribution of households with each particular problem by income, tenure, and household type and size. The tables focus, in turn, on households living in physically inadequate housing, households who are crowded, and households paying excessive cost burdens.

[4] The average household size on GUAM in 1990 was 3.97 persons (1990 Decennial Census).

Figure 2.7
Households by Region
1993 Estimates

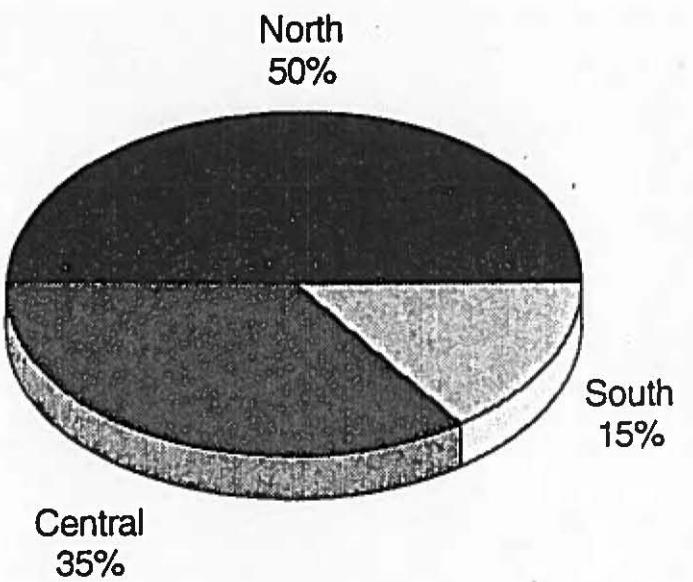


Figure 2.8
Households by Region and Tenure
1993 Estimates

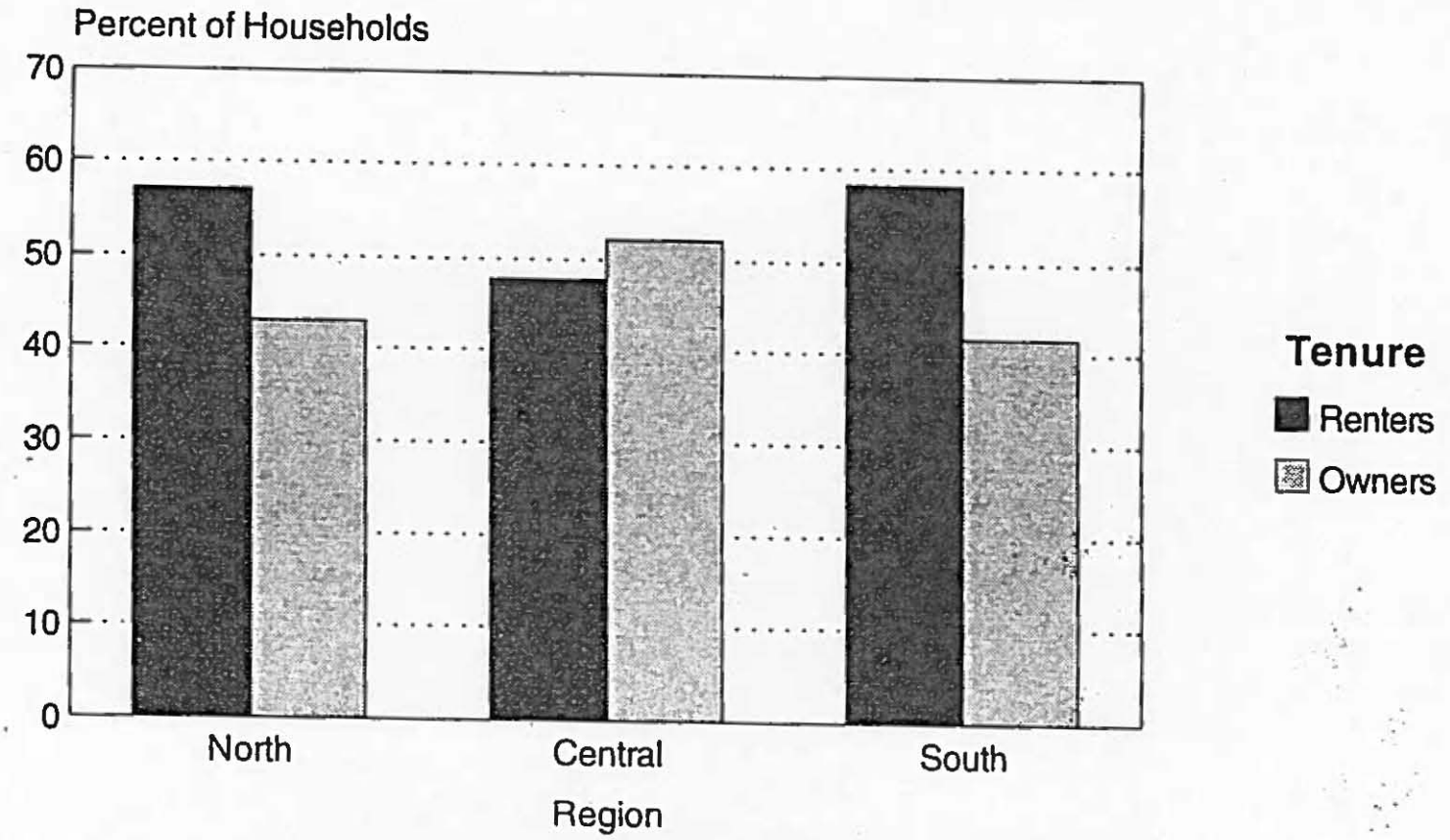


Figure 2.9
Households by Income and Region
1993 Estimates

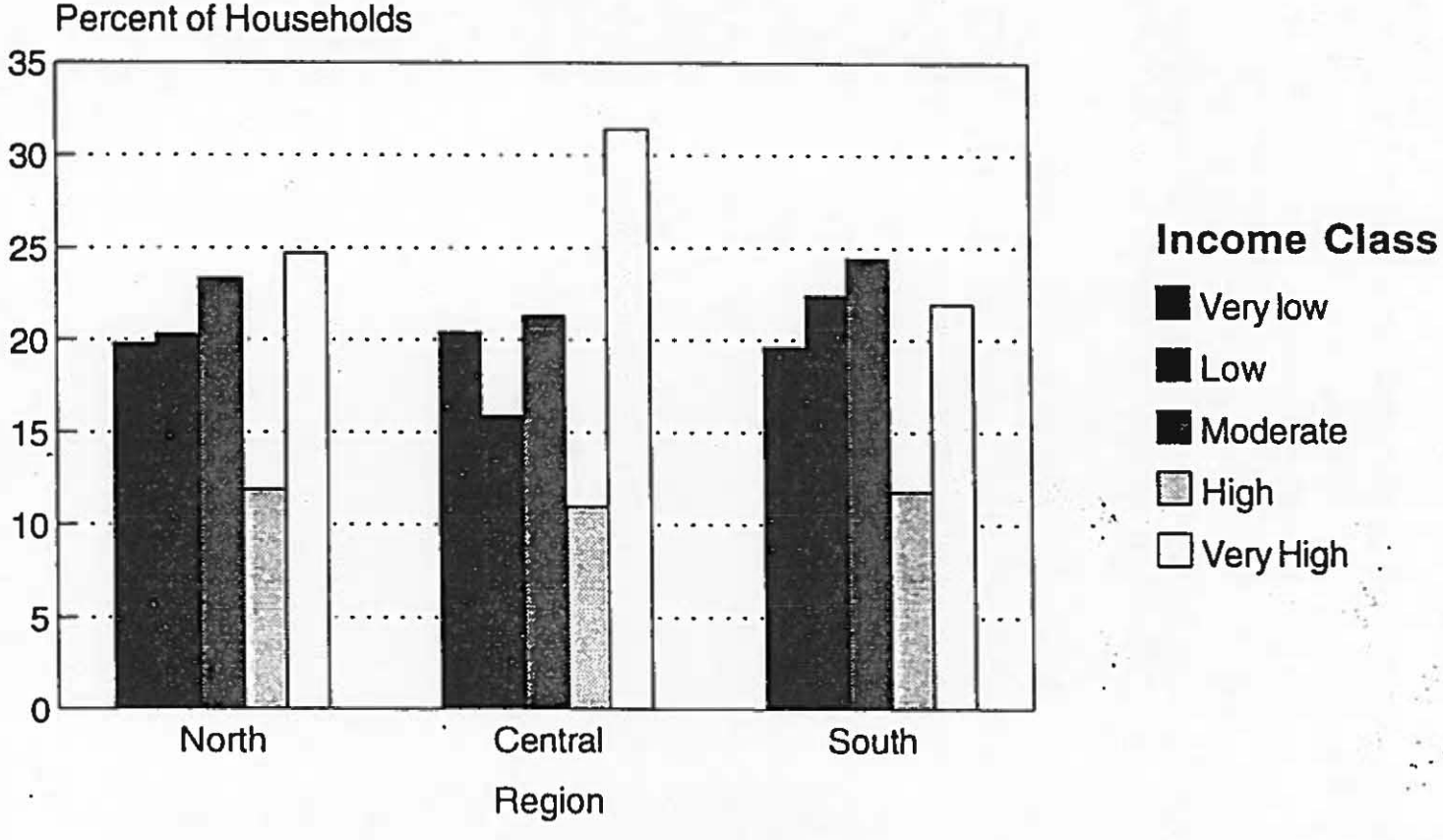
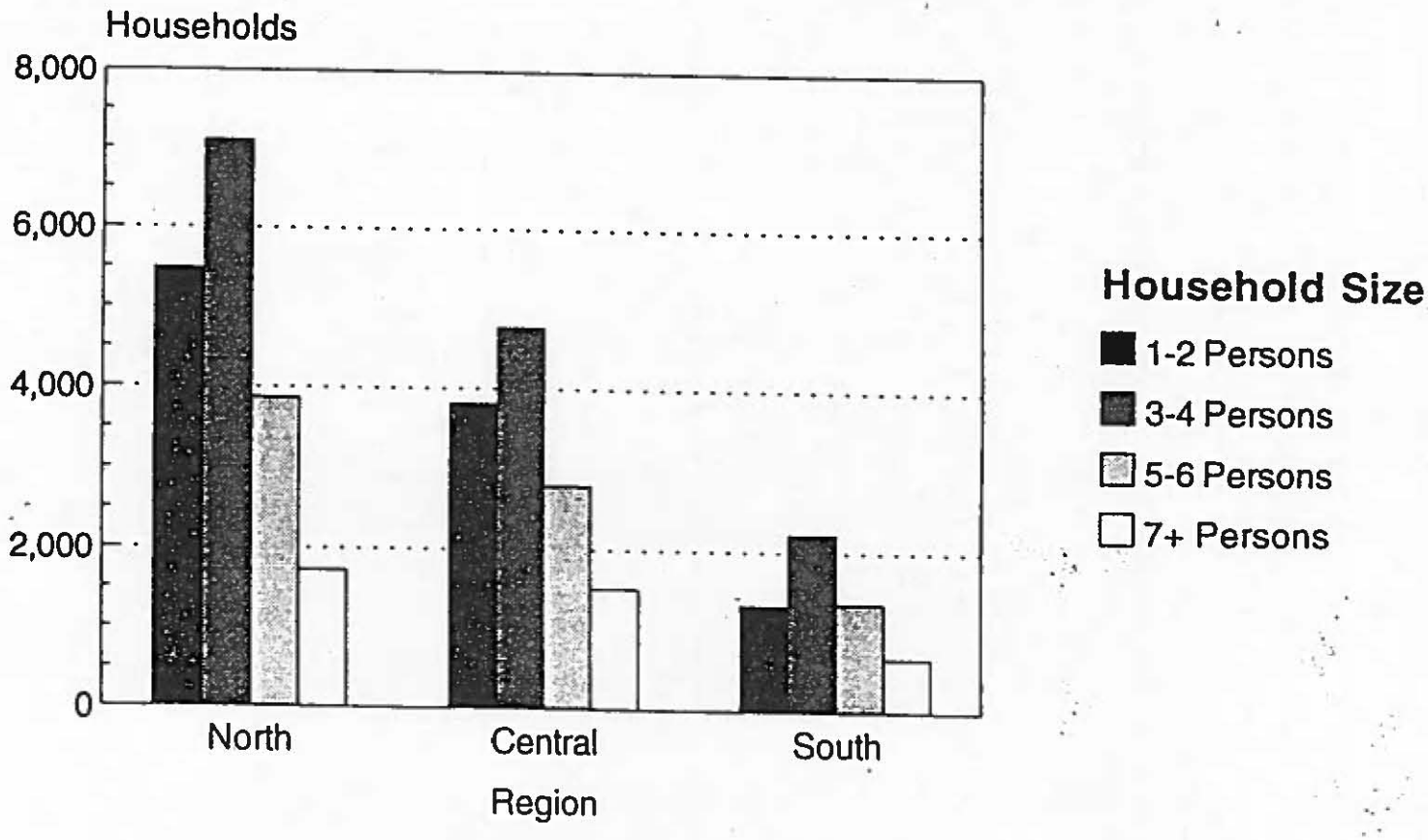


Figure 2.10
Household Size by Region
1993 Estimates



Inadequate Housing Conditions

Unfortunately, housing unit inadequacy is not reported in GUAM's 1990 Census Micro-Data File - the data used to construct the base data as input to the HNA model. Therefore, estimates of inadequacy were derived through a statistical model (LOGIT) that expressed the incidence of inadequacy as a function of housing type, size, tenure and household income levels. Two separate models were created for calculating the incidence of housing inadequacy, one for occupied units and another for vacant units. Annex D provides additional details on this estimation methodology.

A modified version of the American Housing Survey's (AHS) housing quality index (developed by U.S. Department of Housing and Urban Development researchers) was used to measure unit structural inadequacy. This index was derived from selected individual physical and structural characteristics found in the 1993 Household Survey designed by the Urban Institute and conducted in GUAM by Merrill and Associates for this study. The definition of inadequate housing closely corresponds to the definition used in the AHS for severely inadequate housing units. This permits units to be classified unambiguously as either physically adequate or inadequate.

An estimated 11.8 percent of the households in GUAM (4,323 households) live in inadequate units. Table 2.9 and Figure 2.11 show the number of households in inadequate units classified by housing tenure and income group. The majority of such households are renters (54 percent). The rightmost column in Table 2.9 gives the incidence of housing inadequacy for each group, that is, the probability that a household with those particular characteristics lived in an inadequate unit. The likelihood of living in an inadequate unit was dependent on income. Interestingly, the highest incidence of housing inadequacy was found among owner households with incomes between 80 and 120 percent of the island median while the lowest incidence of housing inadequacy is among households in the high income group.

The regional breakdown of the occurrence of inadequate housing is shown in Table 2.10 and Figure 2.12. Over 50 percent (2,232) of all households living in inadequate housing reside in the Northern region followed by the Central (36 percent) and Southern region. This pattern is partially explained by the fact that most of GUAM's population resides in the North; however, of the three regions the North has proportionally more households living in inadequate housing units, 12 percent, while only 9 percent of households in the Southern region experience this type of housing problem.

A disproportionate number of inadequate units are occupied by households headed by a elderly person and those headed by a 45-61 year olds (Table 2.11 and Figure 2.13). At a 17 percent incidence level, elderly households are more than twice as likely to live in an inadequate unit than are households in the 15 to 29 age category with children. The incidence of inadequate housing is the lowest for households in the 15 to 44 age group without children and varies from 4 percent in the Southern region to 7 percent in the Central region.

The incidence of housing inadequacy increases notably as household size increases

Figure 2.11
Households in Inaequate Housing Units by Tenure & Income
1993 Estimates

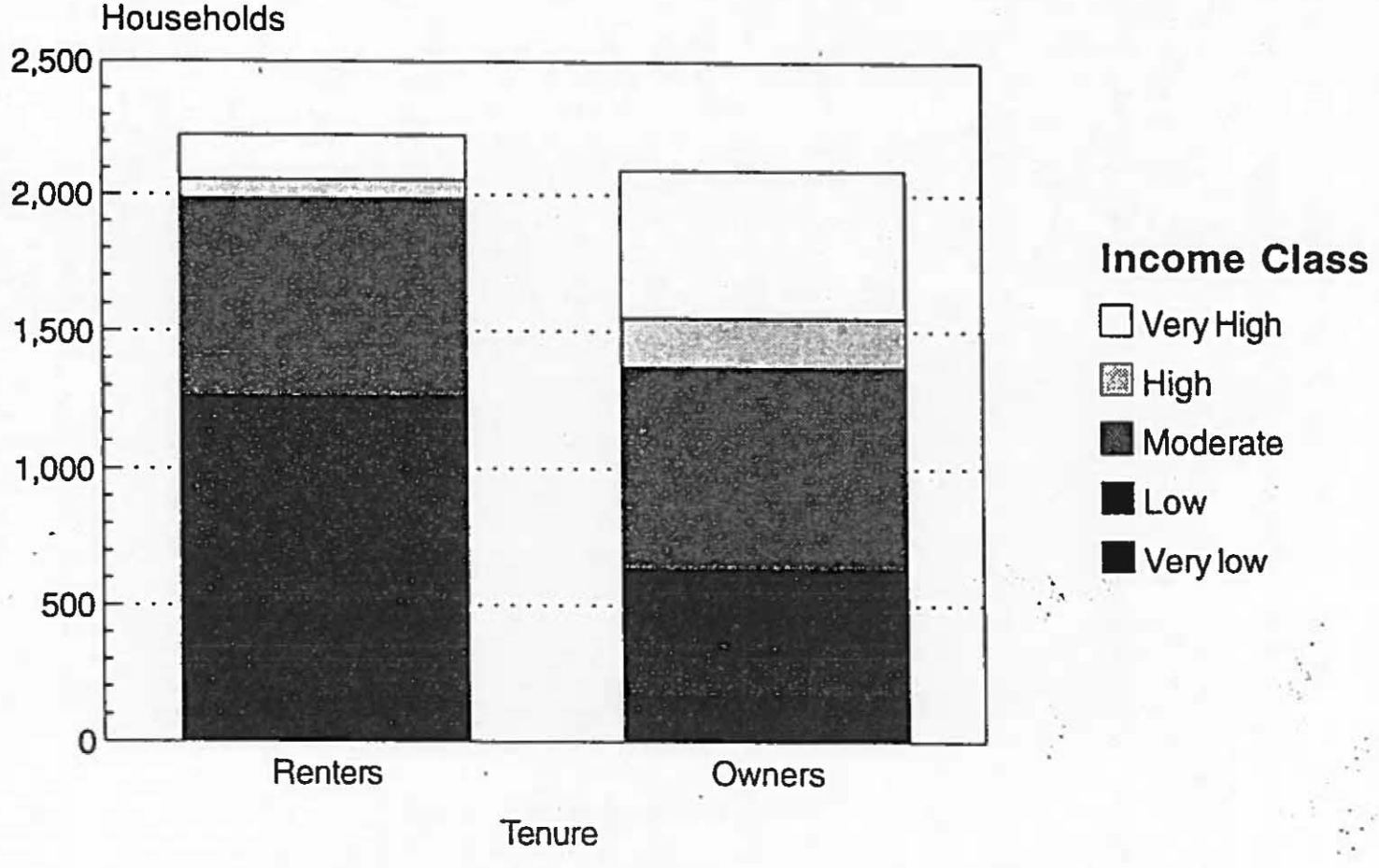


Figure 2.12
Inadequate Housing Units by Region
1993 Estimates

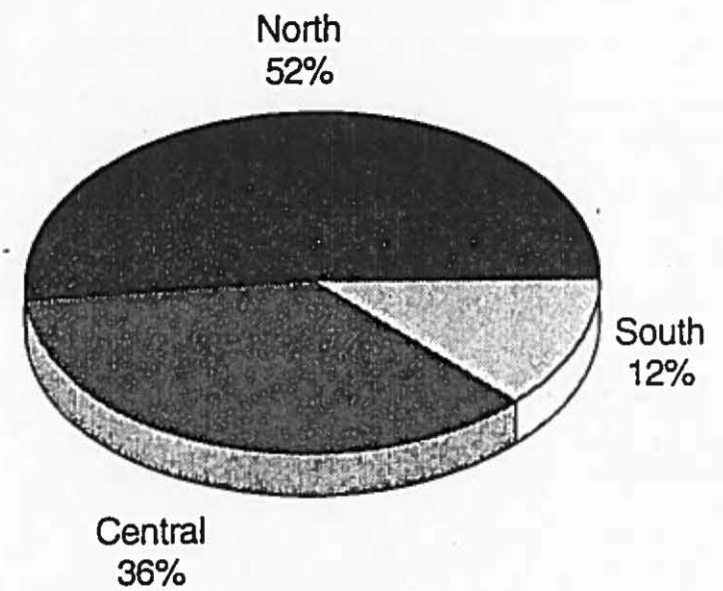
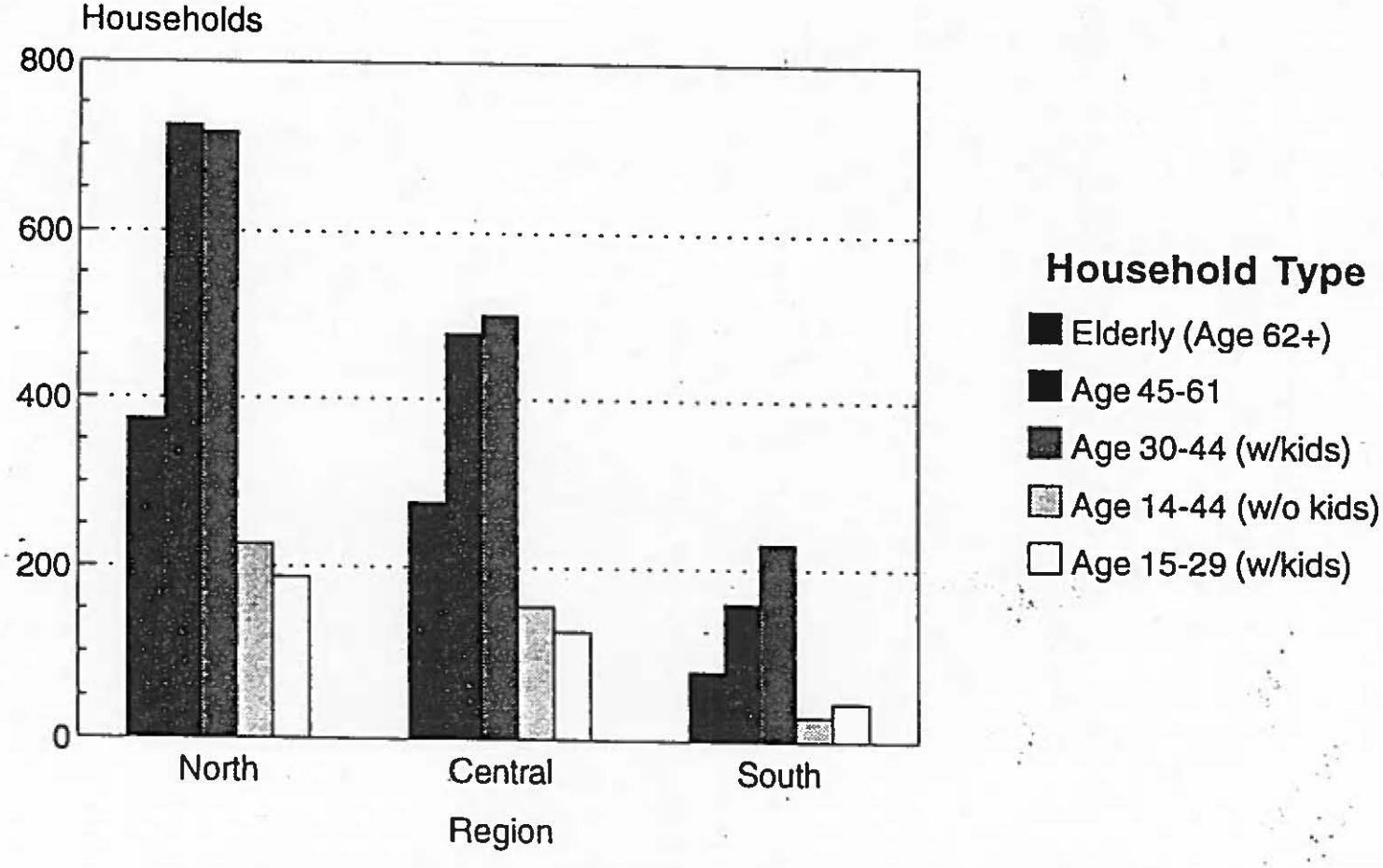


Figure 2.13
Households in Inadequate Housing Units by Type and Region
1993 Estimates



as shown in Table 2.12. This pattern holds not only for the island as a whole but also within each region. More than one quarter (28 percent) of all 7-or-more person households on GUAM live in inadequate housing, about the same incidence in all three regions. The largest number of households in inadequate units are those with 3-4 persons.

Crowded Housing Units

This section describes the characteristics of households in crowded units (i.e. units of insufficient size to accommodate the household). The conventional definition of crowding is used, where any household with over one person per room is classified as crowded. Figure 2.14 provides a matrix of household and dwelling sizes. The diagonal of the matrix and below (marked by "*") show those combinations that provide households with a unit of acceptable size. Combinations of households and housing units above the diagonal, indicated by "O", are designated as crowded units.

Figure 2.14 – Definition of Crowding

Dwelling size	Household Size			
	1-2 persons	3-4 persons	5-6 persons	7+ persons
Efficiency/1 bedroom	*	O	O	O
2 bedrooms	*	*	O	O
3 bedrooms	*	*	*	O
4+ bedrooms	*	*	*	*

As of 1993, an estimated 5,052 households living on GUAM are housed in crowded conditions (14 percent of all households), with similar incidence across region - 13 percent in the North, 14 percent in the South, and 15 percent in the Central region. Because of its relatively larger population, the greatest share of crowded households, 46 percent (or 2,383 households) are located in the North.

Crowding afflicts owners more than renters (Table 2.13 and Figure 2.15). Island-wide, the share of owner households living in overcrowded conditions is 16 percent. The share of owner households living in a crowded unit is 14 percent in the Northern region, 16 percent in the Central region, and 21 percent in the South. Renters, on the other hand, live in less crowded conditions. In the Northern region, only 12 percent of all renters live in crowded conditions and in the Southern region only 10 percent of the renter population experience crowding. Island-wide, the higher levels of crowding for owners is explained by the fact that owner households tend to be larger than renter

Figure 2.15(a)
Crowded Housing Units by Region
1993 Estimates

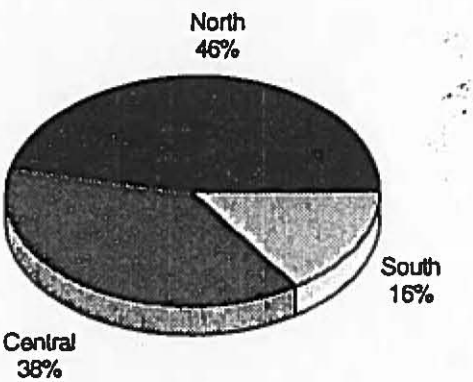
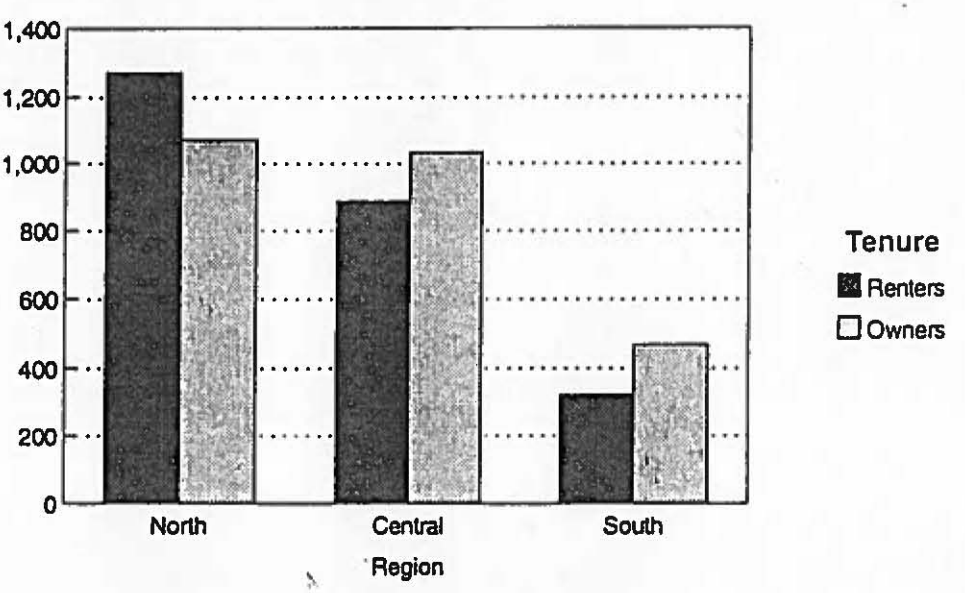


Figure 2.15(b)
Crowded Housing Units by Tenure and Region
1993 Estimates



households.

As one might expect, household types with the largest incidence of crowding are households with children (Table 2.15 and Figure 2.16). The elderly group's incidence of overcrowding is below group average, at 10 percent, while households headed by 45-61 year old is the highest at 16 percent. The household group with the lowest incidence of crowding has heads aged 15-44 without children group, where the incidence of crowding is only 0.5 percent.

In general, crowding is dependent upon income level. Among the 30-44 age group with children, the incidence of crowding increased dramatically as incomes decreased. This relationship between crowding and income is also illustrated by the statistics for all households, reaching a high for the very low-income group, where the incidence rose to 26 percent compared with 15 percent for the very high-income class.

Excessive Cost Burdens

A household faces an excessive cost burden if it must pay an unacceptably high proportion of its income for housing. The definition of excessive cost burden varies by tenure. For renters, housing costs exceeding 30 percent of household income is considered a cost burden; for owners, housing costs exceeding 40 percent of income is the cost burden threshold. (This definition is the same as that used by HUD for program evaluation.)

Housing affordability in GUAM is by far the most widespread housing problem. Overall, approximately 22 percent of the households (7,945 households) suffered under an excessive cost burden (Table 2.16). By definition, cost burden depends on income level. Therefore, the distribution of households having this problem is almost entirely explained by the relative income levels of the household groups. Eighty-four percent of the households with an excessive cost burden are in the bottom two income groups, whereas only 50 households, or 0.6 percent of total households with a cost burden, in the highest income group, have an excessive housing cost burden. Nearly three out of four very low-income households are estimated to be bearing excessive housing costs burdens in 1993.

Table 2.17 and Figure 2.17 indicate that 1-2 person households have the largest proportion of households with an excessive cost burden, some 36 percent of such households had excessive cost burdens. The incidence of affordability problems is moderately high among the 3-4 person group (20 percent), followed by 5-6 person household group (16 percent) and dropping drastically for the 7-or-more person group (4 percent). The incidence declines significantly with household size, however, ranging from 88 percent of 1-2 person households having very low-incomes to 76 percent of comparable 3-4 person households, 67 percent of 5-6 percent households, and 20 percent of 7-or-more person households.

Since renters as a group tend to have lower incomes than owners, renters have a higher share of affordability problems (Figure 2.18). Renters made up 88 percent of the households with an excessive cost burden; the incidence of excessive cost burden is 36

Figure 2.16
Overcrowded Households by Type & Income
1993 Estimates

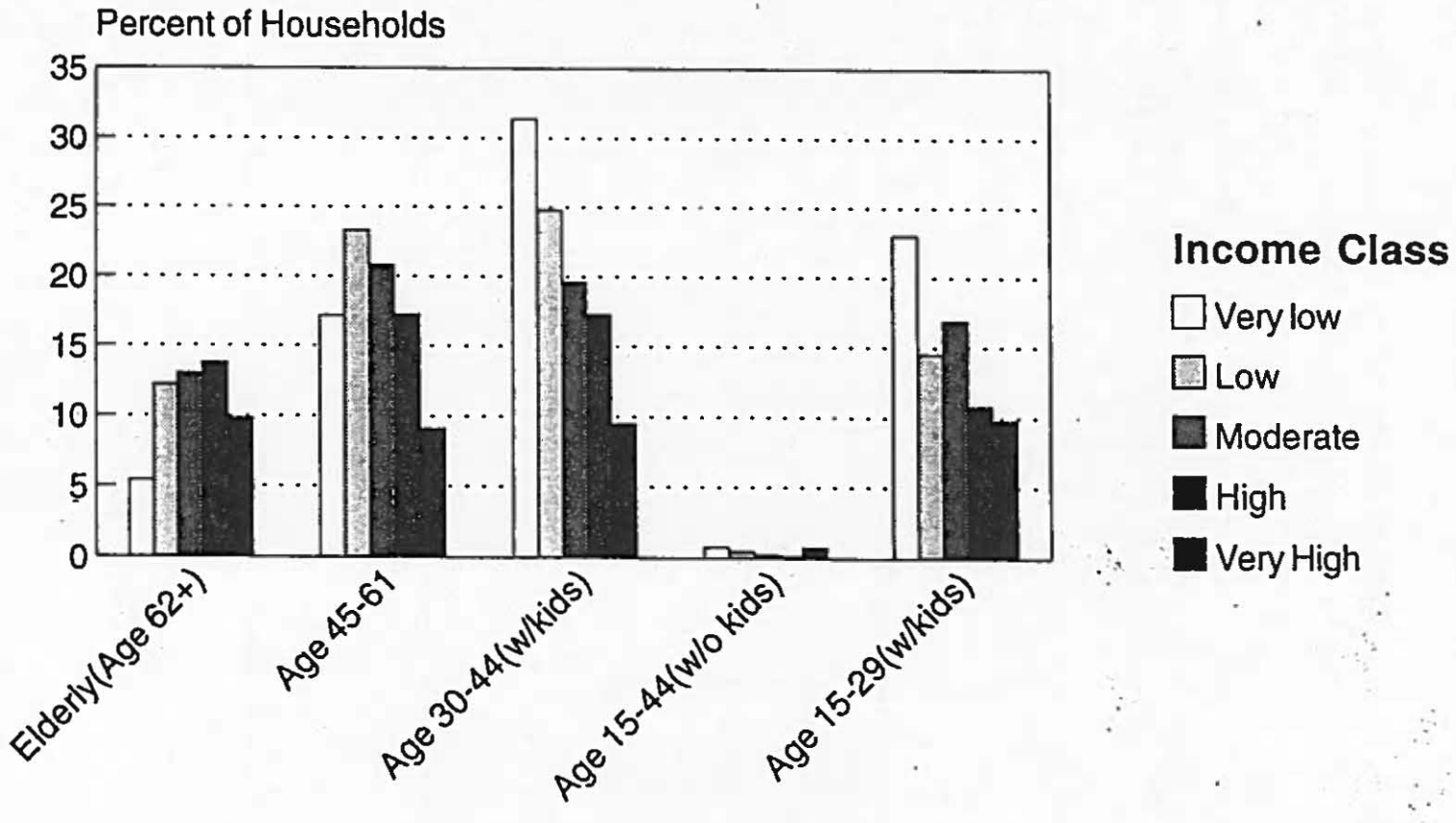


Figure 2.17
Housing Affordability by Household Size and Income Class
1993 Estimates

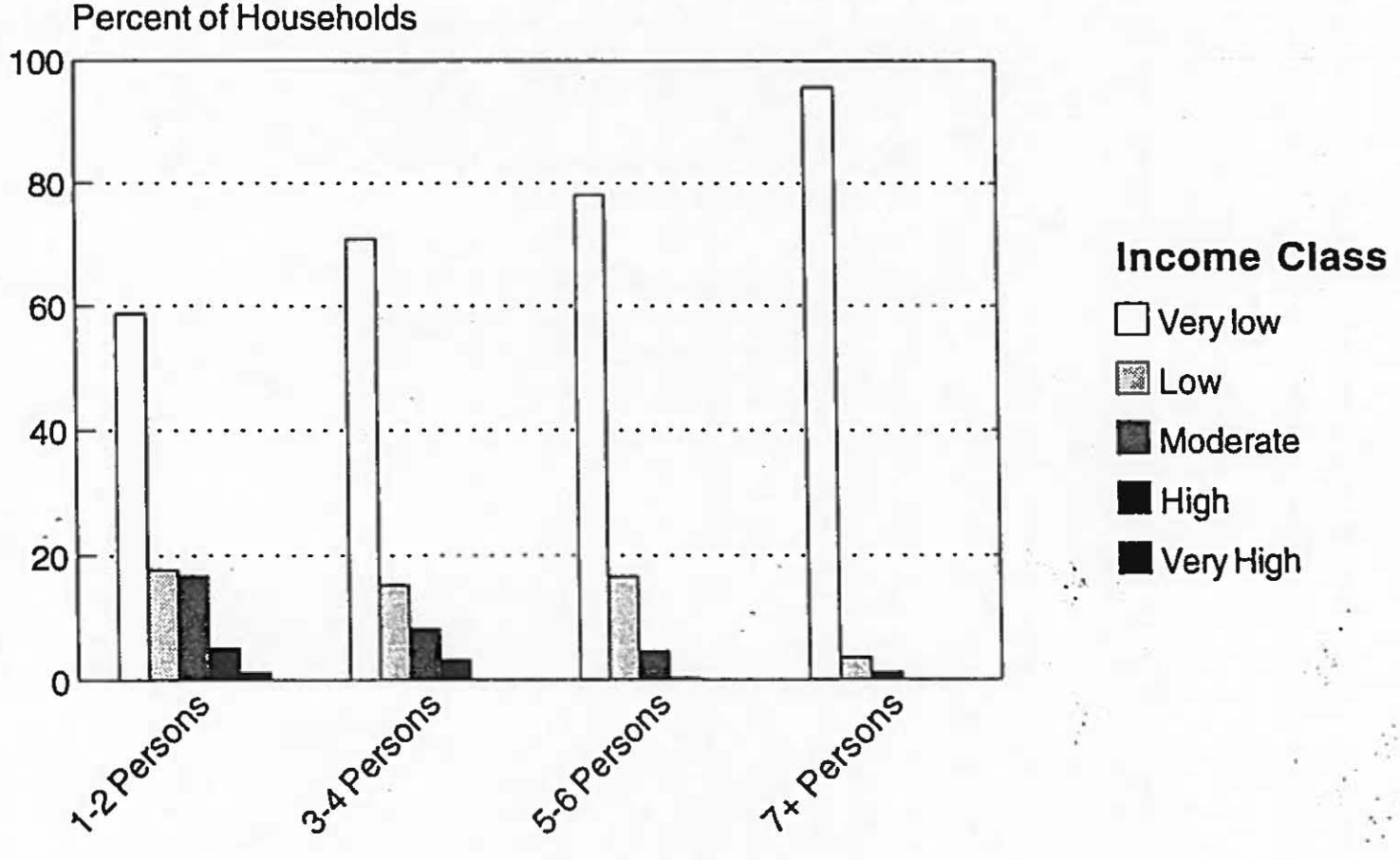
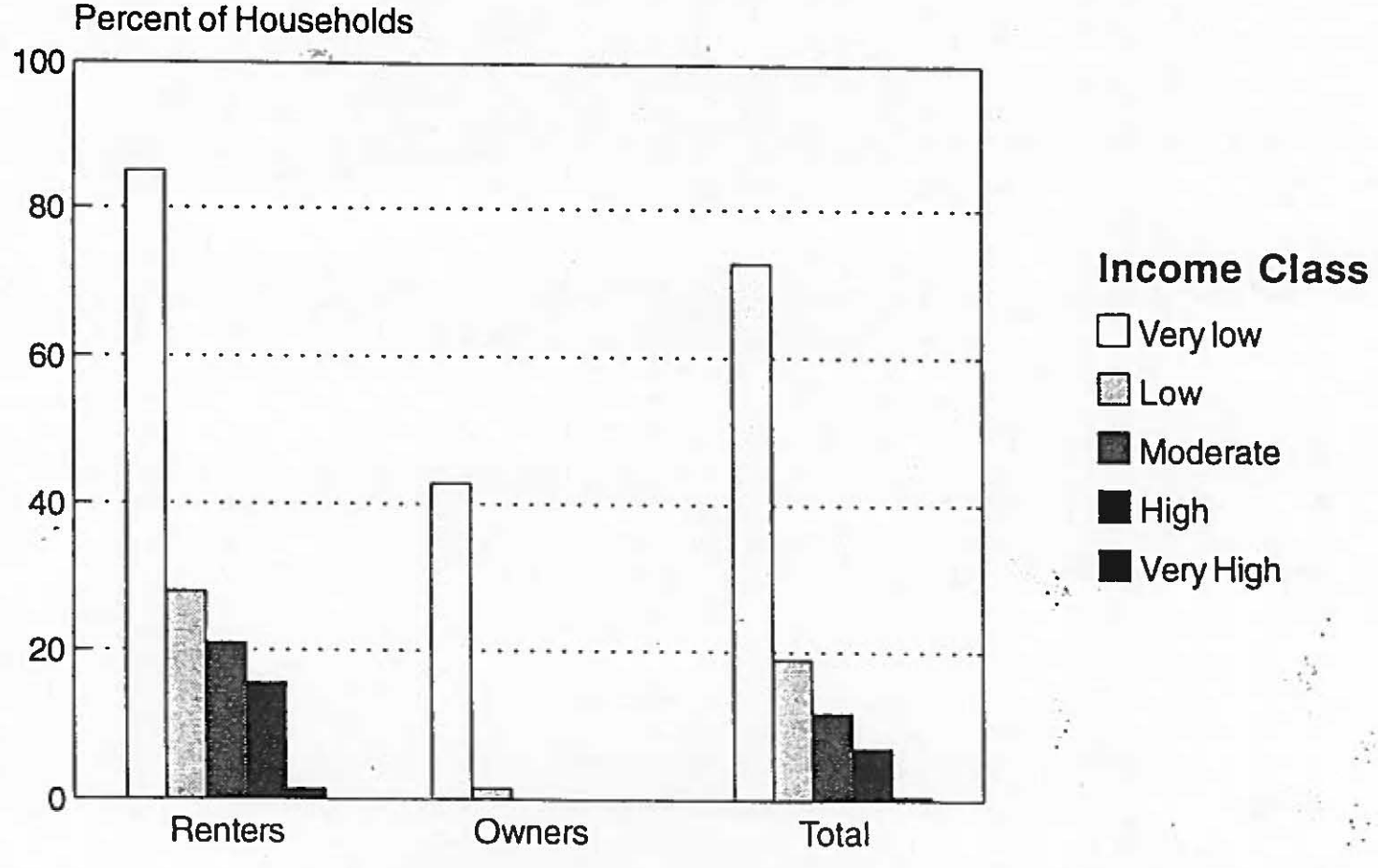


Figure 2.18
Households with Unaffordable Housing Needs by Tenure & Income
1993 Estimates



percent for renters overall and 86 percent for renters in the very low income group. By comparison, owners overall had an incidence level of only 6 percent, but the incidence jumped to 43 percent for owners in the very low-income group.

HOUSING AFFORDABILITY GAP

Tables 2.19 through 2.21 (Figures 2.20 through 2.21(b)) report the magnitude and distribution of the aggregate "affordability gap" for GUAM households in 1993. The affordability gap is defined as the difference between what households are paying for the housing in which they live, and what they can afford to pay. As discussed earlier, renters are assumed to be able to spend up to 30 percent of their income for housing, while homeowners are able to afford to spend up to 40 percent. The total affordability gap for 1993 was about 25 million dollars -- 23 million dollars for renters and 2 million dollars for owners.

Over four-fifths of GUAM's estimated affordability gap (70 percent or 18 million dollars) was attributed to very low-income households. Altogether, 5,325 very low-income households live in unaffordable housing, with an average per household affordability gap of 3,342 dollars. As would be expected, high- and very high-income households were much less likely to live in unaffordable housing and, for those who did, the affordability gap was considerably smaller, averaging only 1,891 dollars per household annually.

Overall, the per household affordability gap is much higher for renters than for owners; on average, renters experienced 1.7 times the average affordability gap of owners, 3,309 dollars verses 1,961 dollars. As shown in Figure 2.20, owners have no affordability gap in the higher income ranges, while renters still have significant affordability shortfalls even at the high-income level. More than half of all renters in unaffordable housing reside in the North. Affordability problems in the North are especially acute, with an average per household shortfall of 3,461 dollars annually. Low-income renters in the North have one of the highest per household affordability shortfalls -- about 4,000 dollars. The Central region also has a high average per household affordability gap, amounting to 2,989 dollars annually, while affordability problems in the South are somewhat less severe (2,034 dollars per household).

Another way to depict the housing affordability problem is to examine the distribution of households by the percentage of their income spent on housing. Figure 2.21(a) and 2.21(b) display the distribution separately for renters and owners. In comparing the two graphs, one notes that approximately 66 percent of households who own their units paid less than 15 percent of their income for housing in 1993, well below the affordability limit of 40 percent. Furthermore, the number of households decreased fairly steadily as the percentage of income paid for housing rose above 15 percent.

For renters, only 31 percent of the households paid less than 15 percent of their income for their units. The median proportion of income spent on housing was approximately 23 percent for renters -- much closer to the affordability limit of 30 percent than was the case for the owners. In addition, the distribution dropped off much less dramatically, with a larger share of renters than of owners having housing expenditures above 50 percent of their income. In comparison with owners, renters paid a higher

Figure 2.20
Affordability Gap by Region
1993 Dollar Estimates

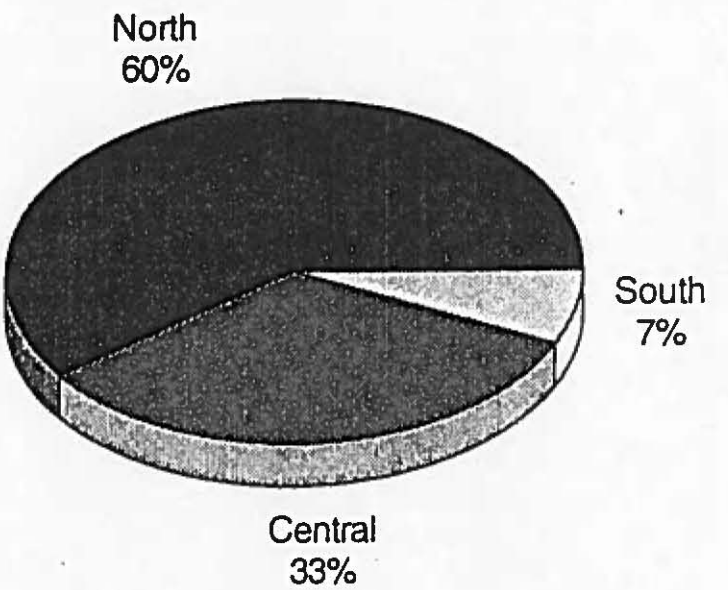


Figure 2.21(a)
Percent Income Spent on Housing
Renters - 1993

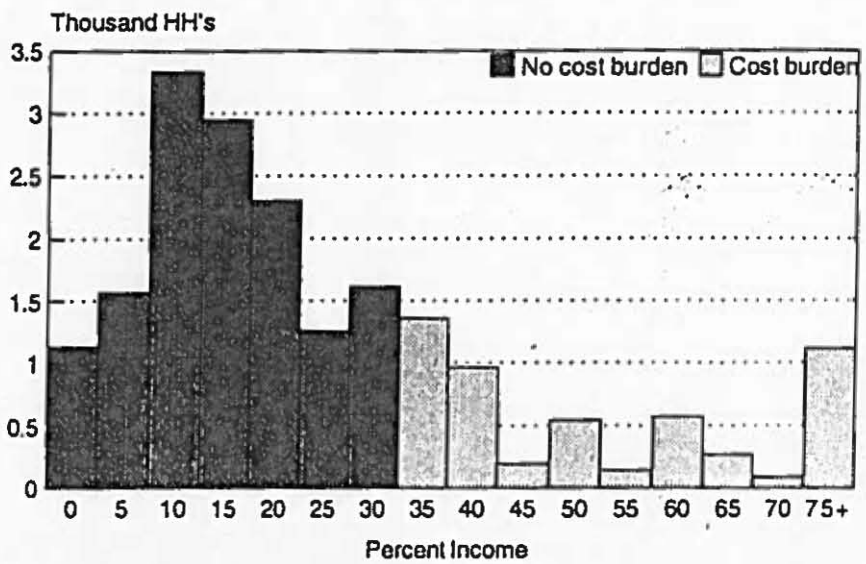
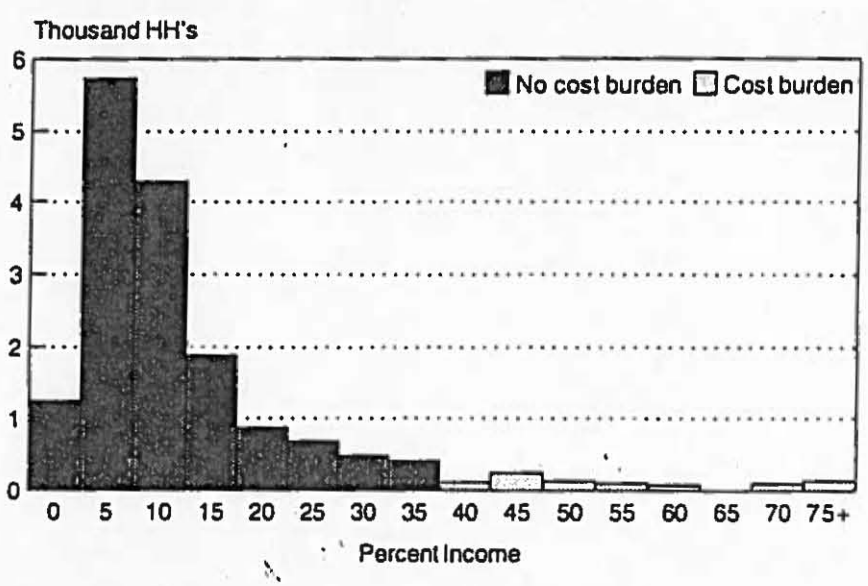


Figure 2.21(b)
Percent Income Spent on Housing
Owners - 1993



proportion of their income on housing; in addition, they were more likely to be spending near or above the affordability limit. Although the figures include all households on GUAM, a similar pattern holds if each of the three regions is examined separately.

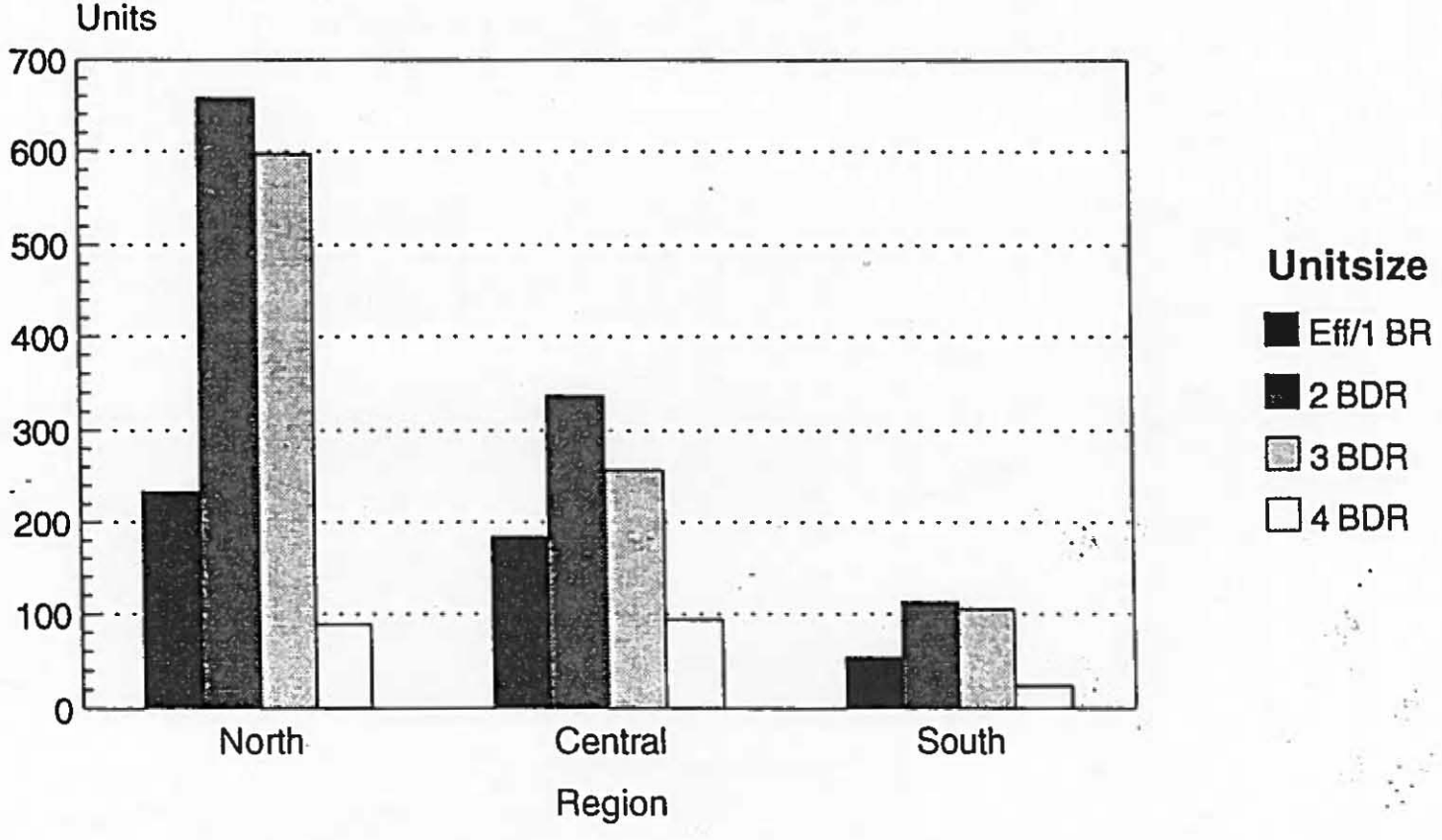
VACANT HOUSING UNITS

Table 2.21 reports numbers of vacant housing units on GUAM in 1993. The total counts of units for each region were taken directly from the 1990 U.S. Census housing data and estimated for 1993 by Dueñas and Associates based on historical trend data. Other characteristics of vacant units (size, cost group, and adequacy) were derived from the Census Micro-Data Sample or allocated through statistical procedures (see Annex D).

GUAM has 960 vacant three-bedroom units and 206 vacant units with four or more bedrooms, while efficiencies or one-bedroom units numbered only 471 units. In each region, over one-third of vacant units were two-bedroom units, for a total of 1,109 two-bedroom units island-wide. In the Northern region, some four out of five units were either two- or three- bedroom units (although the North had the smallest proportions of large households). Correspondingly, the smallest proportion of efficiency or one-bedroom vacant units was located in the North.

Table 2.22 and Figure 2.22 show the incidence of inadequacy for vacant housing units in each of the analysis regions. The incidence level was the highest in the Central region. Although the share of inadequate units among the vacant units did not vary among the three regions. In all, 434 vacant units, or 16 percent of the total, were structurally inadequate on the island in 1993. (This estimate is lower than 12 percent reported for occupied units.)

Figure 2.22
Vacant Units by Unitsize and Region
1993 Estimates



III. FORECASTING FUTURE HOUSING NEEDS

Chapter II documents the current housing problems facing GUAM residents, including the problems of physically deficient housing, crowded housing, and unaffordable housing costs. The next step in a systematic housing needs assessment is to forecast future needs for housing production and renovation, taking into account current needs as well as anticipated population growth, household formation, and changes in income levels and housing costs. Finally, a needs assessment must estimate the total affordability gap between what households can afford to spend on housing and the costs of the housing solutions that they require to be adequately housed.

This chapter explains the forecasting methodology developed by the Urban Institute to estimate five-year housing production and renovation needs and the total affordability gap for GUAM. As discussed in Chapter I, the housing needs forecasts presented in this report are not intended as predictions of how housing conditions in GUAM will *actually* change over the 1993 to 1998 period. Instead, they are estimates of how the housing stock would *need* to change (at a minimum) in order to house all island residents adequately -- existing residents as well as newcomers. Correspondingly, estimates of the affordability gap are not intended as predictions of *actual* government spending levels. Instead, they are estimates of the level of subsidy funding that *would be required* to close the gap between what households can afford to pay for housing and the costs of the housing solutions they need.

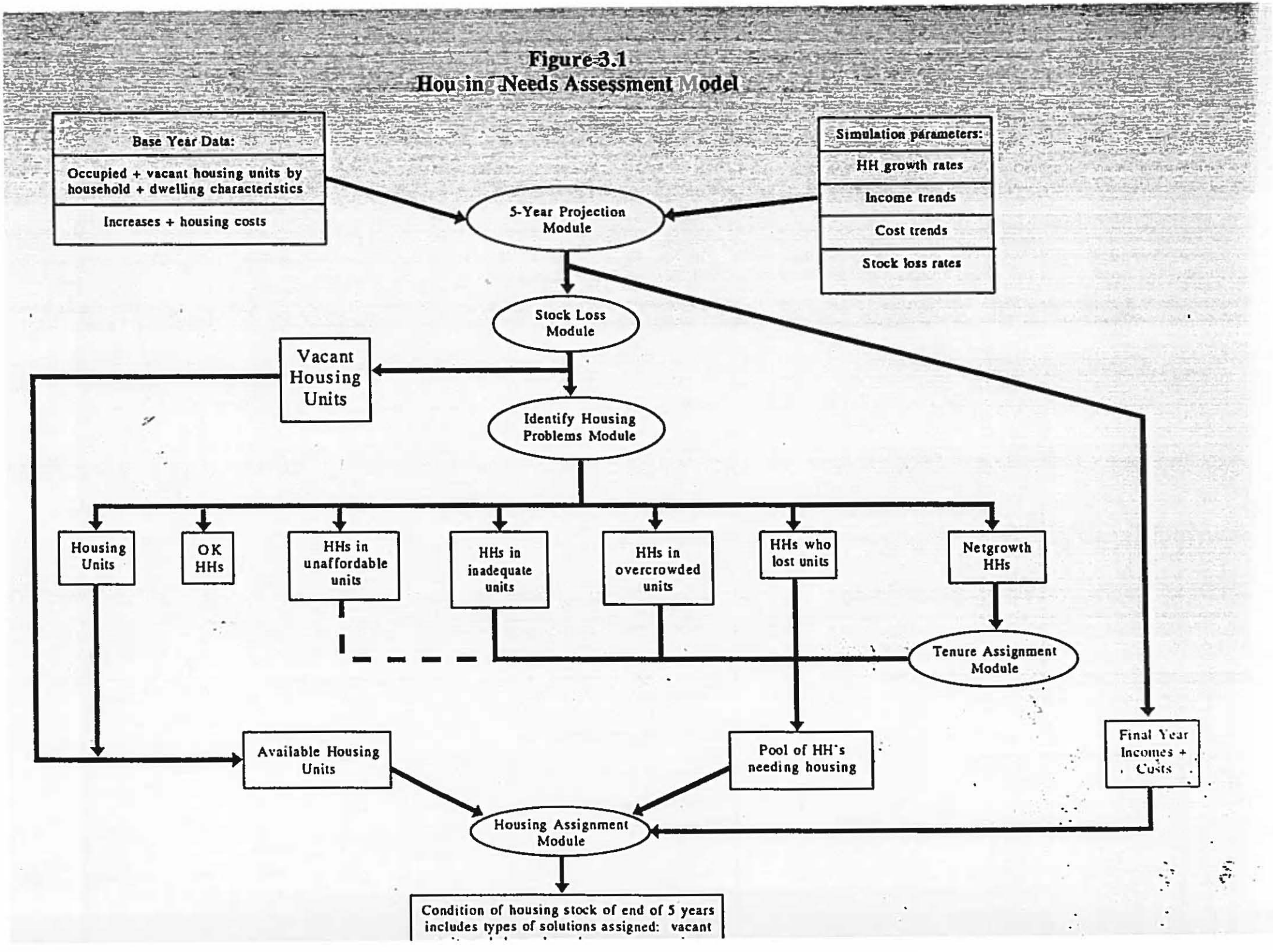
THE HOUSING NEEDS ASSESSMENT MODEL

The Urban Institute Housing Needs Assessment (HNA) Model estimates how the housing stock would have to change over the next five years to house all residents adequately. In other words, after accounting for all the households that are currently living in deficient or overcrowded housing, and the additional households projected to move onto the island or to be formed over the next five years (net of deaths and out-migration), and the housing units that will be lost from the stock, what is the minimum number of new units that need to be built and the minimum number of existing units will need to be renovated?[5] Figure 3.1 provides an overview of the HNA model's major components, including key inputs and outputs.

The forecasting model begins with the base-year housing data compiled from the U.S. Census Micro-data files. It then applies outside estimates of household growth rates to calculate the net number of households that will be added to the housing market over a five-year simulation period -- 1993 through 1998 (Module 1 in Figure 3.1). These net

[5]Note that Model forecasts are characterized as minimums because they are based on the most cost-effective allocation of households to housing units -- every household is assumed to "need" the most affordable solution available, and existing units are assumed to be used up before new units need to be built. Actual new construction and renovation needs may be greater, but there is no reliable way to quantify the impact of market inefficiencies on these basic needs forecasts.

Figure 3.1
Housing Needs Assessment Model



additional households are grouped by income, household type, and size, using the categories defined in Chapter II of this report. The model also uses estimates of income and housing cost trends to project these attributes for the base-year at the end of the simulation period. As discussed further in Chapter IV, these exogenous "simulation parameters" reflect ongoing and expected trends in population growth, household formation rates, income growth, and housing cost changes for the island.

Next, the HNA model predicts the numbers (and types) of occupied and vacant units that will be lost from the habitable housing stock over the five-year simulation period because of natural disasters (such as fires or typhoons), abandonment, demolition, or conversion to non-residential use (Module 2). The model also forecasts the number of physically adequate units that will become inadequate during these five years. Estimates of stock loss and degradation for this report are based on island-wide expected patterns, and are further documented in Chapter IV.

Taken together, the net additional households, households whose units have been lost from the stock, and households currently living in physically inadequate or overcrowded units form a pool of households who need a new or different housing solution.[6] The HNA model assigns appropriate housing solutions to all households in this pool. Possible solutions include: a) existing vacant units in adequate condition; b) existing units that are renovated to become physically adequate; c) existing units that are converted to be larger; and d) newly constructed units. Note that the first three of these solutions are obtained from the stock of existing housing units. Sources for such units include vacant housing and housing that was physically deficient or overcrowded in the base-year. In other words, all base-year households in deficient or overcrowded units are, in effect, removed from those units and placed in the pool of households needing a housing solution. Consequently, their units become available to be renovated if necessary and subsequently reassigned to households with matching needs and resources.

Before assigning the additional households to housing solutions, however, the HNA model must estimate the share of households in each of the specified groups that will become homeowners (Module 3). Households that were in inadequate or lost units retain their original tenure status. The tenure forecasts take into account estimated income levels, the cost of owner-occupied housing, and preferences for homeownership among different demographic groups. Functional relationships between those factors and the rate of homeownership were derived from data from the 1993 household survey. (Annex E further details the estimation procedure used for the purpose of determining tenure in the HNA model).

In assigning housing solutions (Module 4), the HNA model attempts to be as efficient as possible, and thereby provides a lower bound on the total projected housing need. To begin with, the assignment of households to units starts with the lowest-income group and works upward to the higher-income groups (a "bottom-up" approach). This method

[6]Optionally, the model can be directed to add households in adequate but unaffordable housing to the pool for reassignment.

of allocating units to households is a conservative one in that low-income households have the first chance to claim the lowest-cost housing. The result is that affordability problems may be *understated*, since in the real housing market, middle- and upper-income households would occupy some of the lower-cost housing. Consequently, some low-income households would face a larger affordability gap than what the HNA model estimates.

The model is also efficient in the manner in which types of housing solutions are made available to each household. At first, households are assigned only *existing, physically adequate* units that match the household's size. Once the supply of such units is depleted, *renovated* units of appropriate size are allocated to the remaining households. If some households are still without housing after all existing units of appropriate size have been allocated, the model assigns existing adequate units that are *larger* than the household's needs, and moves on to larger renovated units once the adequate units are used up. The model finally assigns adequate and renovated, existing units that are *smaller* than the household's needs (that is, units that need to be *converted* to a larger size). Only after all existing units have been distributed does the model assign newly constructed units as a housing solution.

By assigning solutions in this manner, the model minimizes the estimated amount of new construction, conversion, and rehabilitation required to meet housing needs. Therefore, the model results should be interpreted as lower-bound estimates of the levels of construction that would be sufficient to meet housing needs in the real world, and illustrate the extent to which housing needs can be met by existing units, as opposed to new construction.

In addition to being characterized by size and physical adequacy, housing units in the HNA model are broken down into three cost groups. Therefore, within the above constraints on the assignment algorithm, a household may face a choice of up to three different cost levels for the particular type of unit that it requires. The problem is to assign an appropriate cost solution for each household. Economists often use the concept of utility -- a quantitative measure of desirability or satisfaction -- to explain a household's preference for a particular choice among a set of possible alternatives. The HNA model utilizes this concept, defining the utility of a particular housing solution as a function of the cost of the solution and the household's income:

$$U = -COST^2 + 2 \cdot PCTY \cdot Y \cdot COST$$

where

U	= Utility,
$COST$	= Annual cost of housing solution,
$PCTY$	= Percentage of household income available for housing: default is 30% for renters, 40% for owners, and
Y	= Household's annual income.

Utility peaks when the housing cost (*COST*) equals the assumed maximum affordable amount for a household to spend on housing (*PCTY · Y*), and decreases as the cost falls below or rises above this point. In this case, housing cost is used as a proxy for desirability (or quality). It is assumed, therefore, that high cost dwellings are more desirable than low cost ones, and that a household balances housing expense against desirability when faced with different housing options. A high-income household would not take the cheapest dwelling it could get, but one that is more appropriate to its income level. Using the costs of the housing options available and the household's income, the model computes the utility of each option with the utility function. The household is assigned the housing solution that has the highest utility among those available.

In effect, all households that require a unit of a particular size are competing against one another for those units. The model begins by taking all of the lowest income households who need a dwelling of a given size. It then steps through the list of the different household groups (defined by household type, number of persons, and tenure choice) and assigns no more than 10 housing units to each group at a time. The model repeatedly passes through this list until either all households have been assigned solutions, or all units of the specified size have been used up. Limiting the number of units assigned to a household group during each assignment pass to 10 ensures that no group of households is arbitrarily assigned a disproportionate share of a particular type of unit.

Once the lowest-income households have been assigned, a similar procedure is carried out, in turn, for the remaining income groups. This first assignment round only includes those units that exactly match the household's size requirement. As described previously, another assignment round is then carried out using units that are larger than the household's needs. A final round assigns units that are smaller than the household's needs (conversions). Any households still without a housing solution at the end of all three assignment rounds are allocated new units.

At the end of the simulation, the HNA model reports the numbers and characteristics of households that were assigned to each type of dwelling. It also shows how many units were renovated or converted and how many new units were produced. Taken together, therefore, these steps identify what changes in the stock would have to occur over the next five years, in order for everyone in GUAM to be adequately housed. The results of model simulations using three different economic scenarios are presented in Chapter IV.

Housing Costs

The HNA model utilizes three different measures of housing costs: actual costs, entry costs, and new unit costs. All three of these cost measures are estimated and are adjusted to 1998 levels by the model. *Actual costs* are the median monthly costs paid by households occupying housing in the base-year. For renters, the actual cost is the monthly gross rent (i.e., rent plus utilities) paid by the household. For owners, the actual cost is the household's monthly mortgage payments plus other costs (utilities, insurance, taxes, etc.). The median actual costs are determined separately by tenure, unit size, and cost group.

Entry costs are the monthly costs that would have to be paid by a household moving into an existing unit. For renters, entry costs are the same as actual costs, since actual rents are presumed to keep pace with the market. For owners, however, actual mortgage payments do not fit the definition of entry costs because they do not represent what a new homeowner would pay to purchase a unit. Current homeowners would most likely be paying less than what new homeowners would have to pay for a comparable unit. An additional difficulty with using actual mortgage payments is that it is not possible to compare the costs of houses purchased in different years and under different mortgage terms.

To avoid these problems, an *estimated* monthly mortgage payment is calculated using the median value for the unit. The payment formula is based on a 30-year, fixed rate mortgage.[7] Estimates for monthly payments for utilities, insurance, taxes, and other fees are added to the calculated mortgage payment to derive the total monthly entry costs for owners. As with actual costs, the entry costs are defined separately by tenure, unit size, and cost group.

Finally, *new unit costs* are those faced by a household entering a newly constructed unit. These costs were taken from estimated costs found in 1993 Housing Survey by unit size and adjusted by a new housing cost factor as reported in *A Descriptive Analysis of Land and Home Sale Prices on Guam Between August 1991 and September 1992* by Dueñas and Associates. As was the case with entry costs, new unit costs for owners were calculated by taking the monthly mortgage payment derived from the median home value of recently constructed dwellings, and adding to it the estimated payments for other expenses.

Households who remain in their housing units through the end of the simulation period (i.e., households in adequate units) pay the actual costs of that unit. Those households who are assigned a housing solution by the model, however, must pay either the entry costs (for an existing unit) or the new unit costs (for new construction). For owners assigned to a renovated unit, the entry cost represents the cost of refinancing the

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[7] The mortgage payment formula is:

$$MORTPMT = \frac{VALUE \cdot (I/12)}{1 - (1 + I/12)^{-12 \cdot PERIOD}}$$

where

MORTPMT = Monthly mortgage payment
VALUE = Value of dwelling
I = Annual mortgage interest rate
PERIOD = 30 years

One weakness of this methodology is that it neglects the effect of the down payment on housing affordability. Unfortunately, data on the household wealth characteristics that would be required for such an analysis are not available in a form suitable for use by the model.

unit after renovations have taken place.[8]

Estimating the Affordability Gap

It is useful for GUAM policy makers to anticipate total needs for housing production and renovation, but it is obviously not necessary for the public sector to take responsibility for meeting all of those needs. Since most households in the United States can afford to pay for the housing they need, public policy should focus primarily on those households who cannot afford to pay for their housing and on the size of the gap between what these households can afford to pay and what it would cost to deliver the housing services they require.

Therefore, the Urban Institute HNA model calculates the amount of the needed stock change that is unaffordable for individual households, and how the gap between needs and resources is distributed across income levels, demographic groups, and types of housing solutions. More specifically, the methodology estimates the total number of households assigned to housing solutions (new or existing) that are unaffordable for them. As in Chapter II, housing is considered unaffordable if monthly costs absorb more than 30 percent of a renter's income or more than 40 percent of a homeowner's income.[9]

For each of the specified unaffordable housing solutions, the HNA model quantifies the dollar gap between what households can afford and what the solution costs. The estimates indicate the minimum dollar amount the public sector would have to contribute annually to subsidize housing in order to house all residents adequately and affordability by the end of 1998. There are many ways in which subsidies could be delivered, including construction of low-rent housing, subsidized housing rehabilitation, tax benefits, grants, low-interest loans, and rent subsidies. It is important to note that the model's estimates of the cost of meeting housing needs do not assume or prescribe any particular subsidy mechanism. The model estimates the total magnitude of demand-side subsidy funding (in annualized terms) that would be required, at a minimum, to house all households adequately and affordably. Finally, the HNA model tabulates how resource needs are distributed among household and housing types. As a result, they provide a basis for evaluating the merits of alternative targeting strategies, as well as possible packages of housing subsidy programs.

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[8] For renters assigned to a renovated unit, the cost is assumed to be equal to that for an existing, physically adequate unit. One might argue that renovated units should have *higher* rents, since the renter would have to pay for the renovations. An exhaustive search, which included sources at the U.S. Department of Housing and Urban Development, failed to uncover any substantive research on this topic, however. Indeed, some data showed that renovated units rent *below* current market rents. It was therefore impossible to attribute any additional cost to renovated units based on empirical evidence.

[9] This definition of affordability can be adjusted by the user.

TENURE CHOICE

As mentioned earlier, the HNA model uses a predictive equation to determine the tenure status of households projected to enter the housing market during the simulation period (Module 3 in Figure 3.1). This equation is based on the functional relationship between existing homeownership rates and key household characteristics, and was designed to conform to established theories explaining tenure choice.

The process of determining the tenure status of additional households involved three primary activities. First, relying on previously tested factors described in the tenure choice literature, variables deemed to be significant determinants of household tenure choice were selected from the household and housing characteristics used by the HNA model. Second, multivariate statistical tools were employed to estimate empirically the effect of each of these variables on the tenure status of existing households on GUAM. Third, the HNA model applied the resulting tenure choice equation to the additional households. Each step is explained more fully in turn.

Empirically Tested Determinants of Tenure Choice

Theoretical explanations of why a household chooses to own or to rent are well documented. Researchers have theorized that tenure choice is a function of both household characteristics and external factors.[10] A wide array of hypotheses have been tested by empirically estimating the relationship between housing tenure and various explanatory variables. Key household characteristics investigated include household income, race, wealth, prior tenure status, and life-cycle status, while external factors include credit constraints (reflected by downpayment requirements), the relative price of owning versus renting (for constant quality units), and geographic region or urban/rural location.

For most tenure choice models, household income and the life-cycle status of the household are among the most significant determinants of household tenure. Household income has a positive and significant impact on a household's decision to own, indicating that homeownership becomes more likely with relative increases in household income. Researchers have also linked the life-cycle of a household with ownership, and empirical results confirm that, even after controlling for other household characteristics, increases in age and size of a household generally increase the likelihood of homeownership. Other factors that appear to play an important role in determining household tenure status include the relative costs of owning versus renting, race and ethnicity, and urban/rural status.

The HNA Equation to Determine Tenure Status

The equation used to estimate the empirical relationship between the HNA data

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[10] A survey of the various equations used by researchers to estimate the empirical relationship between tenure status and household/housing characteristics is found in Margery Austin Turner and Kirkman O'Neal, *Household Tenure Choice: Review of the Empirical Literature*, The Urban Institute, Washington, DC, 1986.

variables and tenure status relied on previously tested hypotheses of why households choose one form of tenure over the other. Each variable in the equation not only had to conform to established evidence regarding housing ownership, but also had to be derivable from the list of HNA model variables. Using these two criteria, the following tenure choice equation was specified:

Probability of Homeownership = f(Household: Size, Type, Income)

The household size (four categories) and type (five categories) variables reflect the hypothesis that the life-cycle of a household affects tenure. As stated above, increases in income have consistently been shown to influence the decision to own; in the HNA tenure choice equation, household income is specified dichotomously as either above or below the island-wide median household income.[11]

Estimation of the Tenure Choice Equation

After the variables used to explain ownership were chosen, the relationship between those factors and tenure choice was estimated using the LOGIT methodology. LOGIT is a type of multivariate regression technique that statistically measures the strength of the relationship between a specified variable of interest and other variables believed to explain the occurrence of this variable. It is often employed when the dependent variable is a matter of qualitative choice and can be specified dichotomously.[12] In this case, the dependent variable is tenure choice and is specified as one (1) for owners and zero (0) for renters. Once the relationship is estimated, one can use the coefficients to estimate the probability of homeownership for a household with a given set of characteristics.

The data used to estimate this relationship came from the 1993 Household Survey designed by the Urban Institute and conducted by Merrill and Associates. These data were well suited for such an estimation process since they were the most recent data available as well as easily manipulated to construct the HNA model variables used as explanatory variables.

Allocating Tenure for All Incoming Households

After estimating the LOGIT equation and obtaining the log-odds coefficient for each variable, the probability of ownership was computed for each variable using a logarithmic transformation. Annex E reports the sets of coefficients for the equations. Combined, the probabilities represent the total effect of the housing and household characteristics

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[11] Ideally we would have preferred to enter income as a continuous variable into the equation. However, because the Household Survey grouped income into discrete categories, this was not possible. Nonetheless, the results of the estimation process provided estimates of tenure status consistent with historical patterns found on the island.

[12] A very good technical description of the LOGIT method is given in Robert Pindyck and D.L. Rubinfeld, *Economic Models and Economic Forecasts*, McGraw-Hill Book Company, New York, 1981.

on tenure choice. These probabilities, when applied to the same variables for the additional households, provide an estimate of homeownership rates.

IV. FIVE YEAR HOUSING NEEDS FORECASTS

This chapter reports on the HNA model's projections of housing needs on GUAM through 1998. Three different economic growth scenarios -- Moderate, Slow, and Accelerated growth scenarios -- were developed in order to assess the impacts of different economic conditions on housing needs. Under each economic scenario, the HNA model estimated the minimum levels of housing production necessary for the five-year simulation period. Production included the construction of new units, as well as the renovation of existing units. In addition to documenting production needs, this chapter reports the numbers and characteristics of households who cannot afford the housing that they need, and details the amount of subsidy that would be required (at a minimum) to ensure all residents of GUAM have adequate and affordable housing in 1998.

ALTERNATIVE FUTURE SCENARIOS FOR THE HNA MODEL

No forecast can anticipate the future with certainty. Although a forecast may have sound assumptions regarding long-term economic trends, it will be inaccurate if an area experiences random and unexpected events (such as typhoons of unusual severity). Therefore, when developing estimates of future housing demand, alternative economic scenarios should be developed so that planners can better anticipate and respond to housing needs as they materialize.

In addition to improving planning capabilities, the "alternative futures" method shows how sensitive housing needs are to economic events. In order to forecast a range of economic conditions, the HNA model estimated three alternative future economic scenarios: Accelerated (or constant growth based on current conditions), Moderate (25 percent decrease in income rates, house prices and rent from the Accelerated scenario), and Slow (25 percent decrease in incomes and housing costs from the Moderate growth scenario).

All Moderate scenario growth rates represent how the housing sector would appear given moderate economic growth. However, since economic conditions may change over a five year period, the two additional scenarios provide analysts with estimations of GUAM's housing need in the event of an economic slowdown as well as a continuation of the current pattern of accelerated growth. During an economic downturn, income, house values, and rental costs are affected therefore the model is implemented under different assumptions for these key variables, while holding other simulation parameters constant such as household growth rates, mortgage interest rates, housing adequacy change, and stock loss rates. The Accelerated scenario also was implemented under the same assumptions as the other two scenarios, except the pace of growth for key simulation parameters was based on the recent trends for income and housing costs.

Table 4.1 summarizes the key assumptions regarding growth rates of households, household income, housing prices, and mortgage rates for each scenario. The HNA model uses the best information available on historical trends in estimating the simulation parameters. (These same parameters were used to scale the 1990 Census supplied data

to 1993 levels.) The figure for the household growth rate is held constant across the three economic scenarios since population and households were assumed invariant with changing economic conditions. Because income growth rates vary with changes in the economy, different rates were used to estimate each scenario. Similarly, housing costs (as reflected in rent or house value) vary with economic conditions. Therefore, the Moderate and Slow growth scenario rates were adjusted proportionally using the current trends as the benchmark. The mortgage interest rate, projected for 1998, was held constant across all three scenarios, because it is in effect a composite of borrowers' and lenders' expectations about the future.

Detailed information about the current characteristics of GUAM's housing sector and income trends, obtained from a variety of sources, provides the basic simulation parameters for the HNA model. These parameter estimates determine the outcome of the simulation over a five-year time period. Accelerated scenario growth rates for rental prices and house prices were derived by comparing 1990 Census data with the 1993 Household Survey data. According to Census data, median rent in 1990 was 493 dollars, which when compared to the median rent of 675 dollars found in the 1993 Household Survey, yields an annual growth rate of about 12 percent. A housing study conducted by the Navy in 1992, *Update: GUAM Housing Market Analysis*, estimated an average rental growth rate of 12 percent between 1992 and 1996 by looking at current rent levels and projected nominal increases into the future. These data were used to support the 12 percent growth rate for rent prices for the Accelerated scenario. Because recent trends in income, and housing costs are not expected to continue through the 90s, two alternative scenarios were developed using plausible reduction factor for the current growth rates. For the Moderate growth scenario, this rate was reduced by 25 percent to 9 percent while for the Slow growth scenario this rate was further reduced by another 25 percent to 6 percent.

Similarly, median house prices increased from 130,500 dollars (1990 Census), to 180,000 dollars (1993 Household Survey), yielding an annual growth rate of about 10 percent over the three-year period. Estimations of the change in historical house prices for the 1991 to 1992 period were also corroborated by Dueñas and Associates in *A Descriptive Analysis of Land and Home Sales Prices on Guam Between August 1991 and September 1992* as well as by the Navy study, which estimated an annual increase of 10 percent over the most recent three-year period. This rate was used for the Accelerated growth scenario, while the Moderate growth rate was reduced by 25 percent and 50 percent under the Slow growth scenario.

Annual household income growth rates were extrapolated from recent income data found in various published sources. Household income on GUAM has been rapidly increasing in the recent past. Indicators of development, such as increased tourist traffic (100 percent increase from 1985 to 1990), extensive growth in the construction industry as well as the service sector (which relies on tourists), point toward increasing economic expansion for the island as whole. Based on Census data for the previous decade the average annual growth rate for household income was 7 percent from 1979 to 1989, although all indicators of development show incomes increasing even faster during the latter half of the decade. Data covering a four-year period from 1985 to 1989 show average incomes growing on GUAM by 44 percent or 9.7 percent annually (22,265 dollars

per household in 1985 to 32,085 dollars per household in 1989). Therefore, a 10 percent nominal income growth rate was used as the income growth rate simulation parameter for the Accelerated growth scenario. For the Moderate growth scenario, a 7.5 percent growth rate was used while for the Slow growth scenario a 5 percent nominal income growth rate was used.

The remaining simulation parameters were held constant across all three economic scenarios. Annual household growth estimates were based on *Population, Employment, Income, and Housing Forecasts* by Dueñas and Associates. Households were forecast to increase from their 1990 level of 31,418 to 36,658 in 1993, an approximate 3 percent annual growth rate.[13] Based on projected population growth and housing construction trends during the early 1990s, they estimate that a total of 42,104 households will reside on GUAM in 1998, regardless of the rate of economic growth. Therefore, the same household growth rate is assumed for all three economic scenarios. The annual growth rate for this simulation parameter was computed using the difference in household counts from 1993 to 1998 based on Dueñas and Associates projections.

The mortgage interest rate was also held constant across all three economic scenarios. It was derived from recent historical rates determined on the U.S. financial markets. During 1992, the yield rate on AAA-rated corporate bonds averaged 8.14 percent, or 0.26 less than the average rate on 30-year conventional mortgages. According to the March 1993 issue of *Blue Chip Indicators*, the highest rated (AAA) corporate bonds are forecast to carry a yield of 8.0 percent in March 1998. If the same spread between corporate bonds and conventional mortgages exists five years from now, the expected mortgage rate in 1998 will be 8.26 percent.[14]

Other simulation parameters include housing adequacy change, housing stock loss rates, and housing unit value and rent for new housing units. Similar to the household growth and mortgage interest rates, these parameters were also held constant across all three economic scenarios since these rates and levels do not appreciably change from year to year. Housing stock loss rates were reported in *Population, Employment, Income, and Housing Forecasts* by Dueñas and Associates and were derived from previously documented loss rates and predications based on the age of the housing stock on GUAM. The average loss over consecutive-year intervals was computed and used as the simulation parameter for all three scenarios (0.63 percent annual rate).

Since the housing adequacy measure used for the base data was newly constructed, consecutive year indicators of housing adequacy were not available. Therefore, the housing adequacy change parameter was based on historical patterns found in the U.S. and extrapolated from American Housing Survey data (2.0 percent annual rate). The 1993 Household Survey data were used to determine new (1993) house values and new

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[13] All rates of growth were calculated using the exponential method (Annex D gives the formula for this method).

[14] Interest rates on GUAM generally follow the rates set on the mainland since financial markets are closely linked.

rent prices (by unit size). The Survey's median value for house prices and rents in each unit size category was increased by 20 percent. This adjustment factor was derived from a recent study of new housing costs in relation to existing housing costs conducted by Dueñas and Associates. The adjusted housing costs were used as simulation parameters reflecting the cost for new housing in 1993.

Table 4.1 -- Summary of HNA Scenarios

	Accelerated	Moderate	Slow
Household Growth Rate	3.0%	3.0%	3.0%
Nominal Income Growth Rate	10.0%	7.5%	5.0%
Mortgage Rates	8.4% to 8.26%	8.4% to 8.26%	8.4% to 8.26%
House Price Growth	10.0%	7.5%	5.0%
Rental Price Growth	12.0%	9.0%	6.0%

RESULTS OF HOUSING NEEDS FORECASTS

Using the household growth rates, income growth rates, housing price inflation, and mortgage interest rates described above, three sets of HNA model simulations were produced to forecast housing needs for the three different economic scenarios. The results of the simulations are presented in this section, beginning with a characterization of the additional households that will be entering the housing market from 1993 to 1998 and estimates of the homeownership rates for those households. Next, the housing production needed for the next five years is detailed, which includes not only construction of new units but also renovation of existing units. Finally, the level of housing affordability problems projected under all three scenarios is analyzed.

Additional Households in the Housing Market

Since all three future scenarios assume the same household growth rates, they yield identical numbers and types of households being added to GUAM during the five-year simulation period. Characteristics of these households are reported in Figures 4.2 through 4.3 (and Tables 4.2 through 4.6, see additional tables in Annex A). The HNA model estimates a net increase of 5,431 households in GUAM from 1993 to 1998. This estimate includes households migrating to GUAM from elsewhere and new households being formed from GUAM's existing population base, and subtracts out-migration and

Figure 4.2
Estimated Homeownership Rates for Households by Region
1993-1998 Estimates

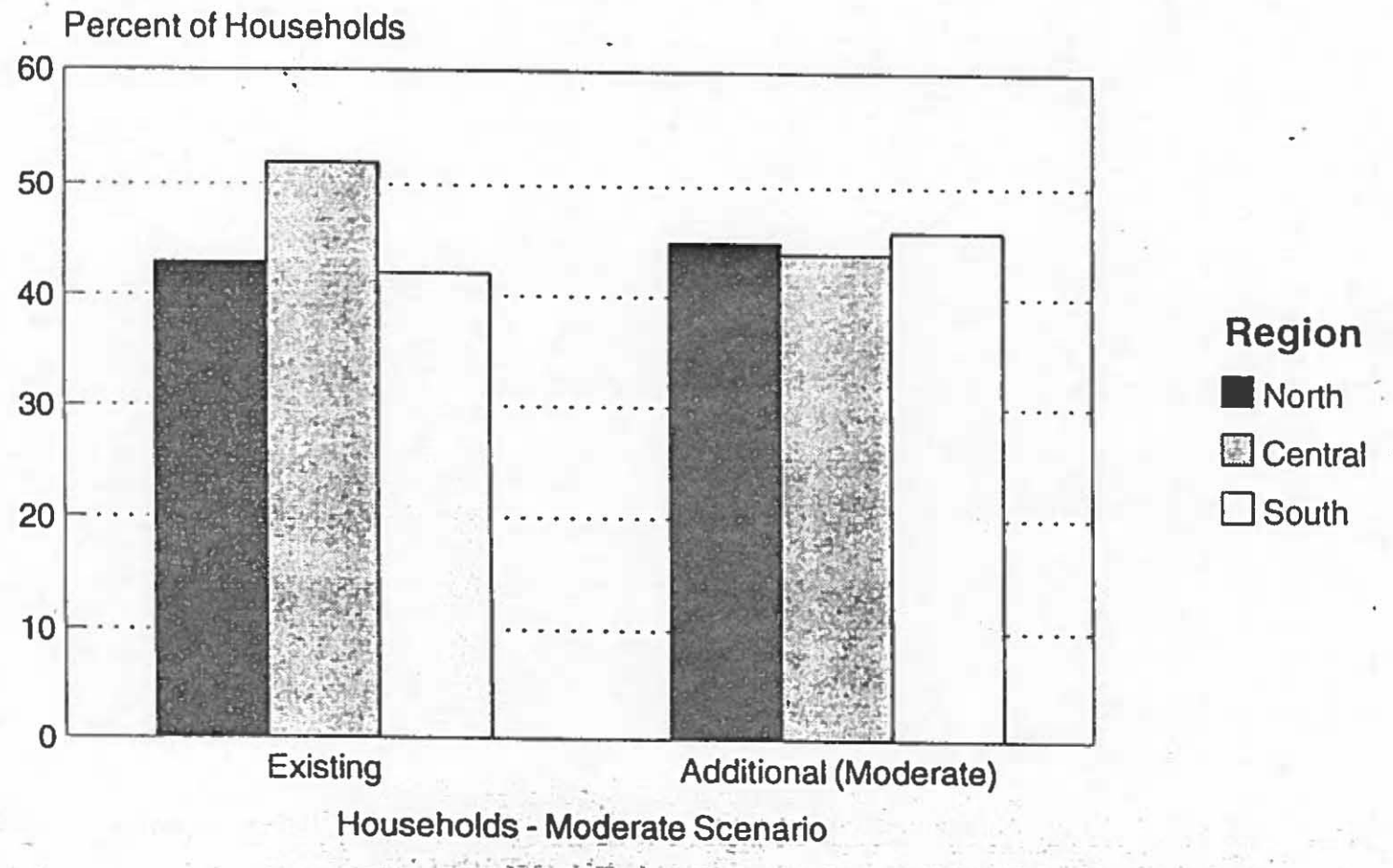
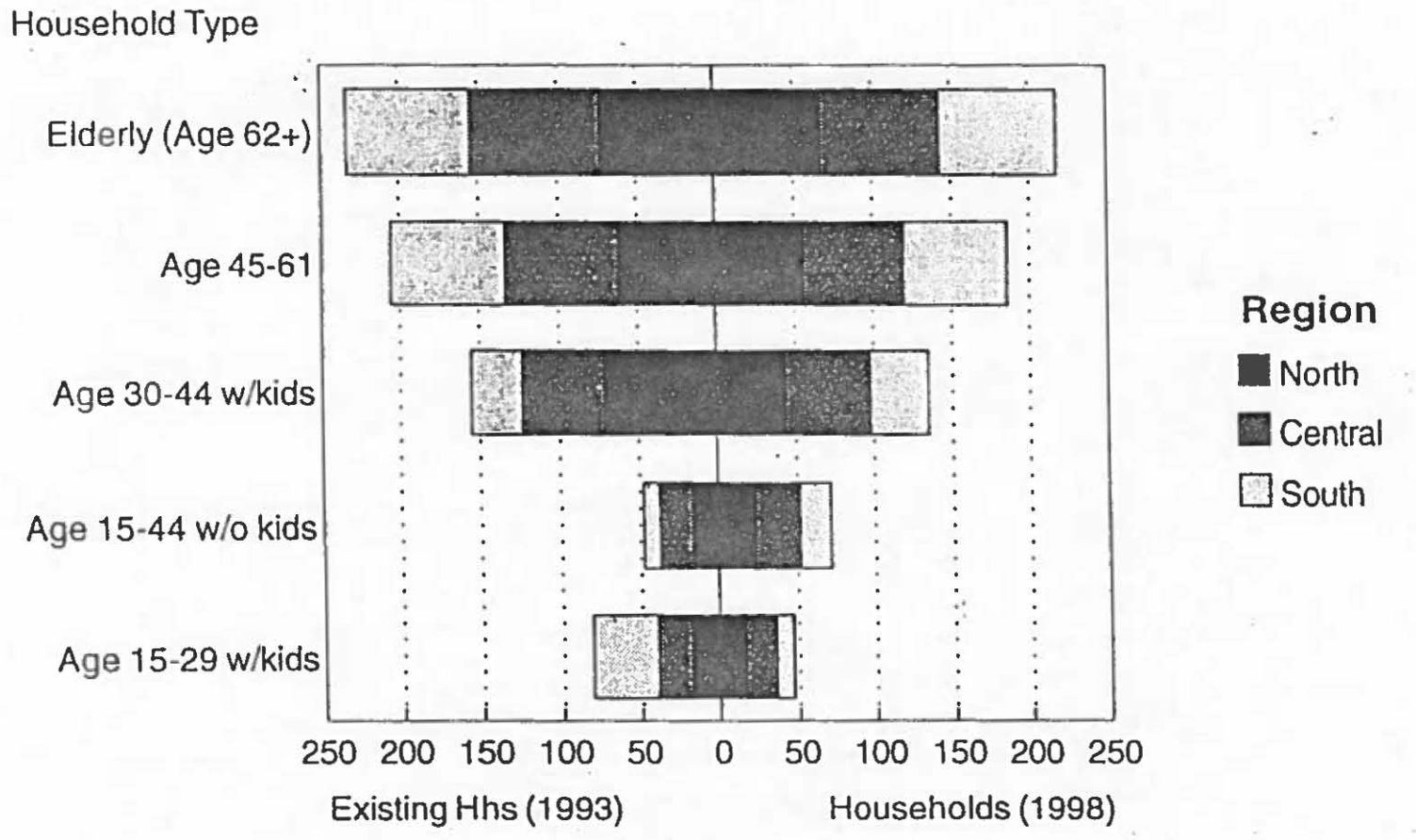


Figure 4.3
Estimated Homeownership Rates by Type and Region
Moderate Scenario (as a percent)



other losses (deaths or absorption) of existing, base-year households. The distribution of net additional households across regions reflects the same pattern as that for existing households in 1993.

Since household growth rates were specified for the island as a whole, the HNA model assumes that additional households will have the same household characteristics (except for tenure), such as household type and size, as current households. For example, since 24 percent of all households in the Northern region are in the very low income group in 1993, about 24 percent of the projected additional households in this region are likewise expected to have very low incomes.[15]

Ownership Rates for Additional Households

Table 4.3 displays ownership rates for existing households in 1993 and the projected ownership rates for additional households in 1998 under the three different economic scenarios. Ownership rates for additional households vary according to economic scenario. In the Central region, the ownership rate for newly formed households was only 44 percent, while the rate for existing households was 52 percent. This rate dropped even further under the Moderate and Slow scenarios (42 percent). The opposite was true for the Southern region, where the ownership rate for the Moderate scenario increased from the existing to the additional household group from 42 to 46 percent. The proportion of owners for all additional households was lower than that for existing 1993 households by about 3 percentage points. Further, the ownership rate for newly formed households did not change under the Moderate and Slow economic growth scenarios, irrespective of regional differences.

Tables 4.4 through 4.6 compare the estimated ownership rates in 1993 and 1998 for the Accelerated scenario by household type, income class and region. Under this scenario, ownership rates among the elderly and 45-61 age group, regardless of income class, decrease by 5 percentage points between 1993 and 1998 regardless which region they are located in. In each region, very low-income households in the 45-61 age group would experience a 6 percentage point decline in ownership between 1993 and 1998. By contrast, households in the age 15-44 without children group would have consistently higher rates of ownership. Overall, this group's ownership would increased by 5 percentage points over the five-year period. Ownership rates, particularly for the very low-income class, across all household types are forecast to decrease from 1993 to 1998.

In comparing ownership rates under alternative future scenarios, one notices that the results of the tenure estimation are consistent and do not vary greatly as a result of the different economic conditions. This is primarily because housing cost inflation keeps pace with income growth under the different assumptions for the three scenarios and because the number of households that do enter the market over the 5 year simulation

[15] It is perhaps unrealistic to assume that households entering the market would exhibit the same income distribution as existing households. Nonetheless, it would be difficult to model income changes accurately and, in any case, the error from making this assumption is likely to be insignificant given the relatively short time period of the projections and the relatively small number of additional households.

period are small in relation to the existing household base (see supplementary tables in Annex A).

Housing Production Needs

Figure 4.4 (Table 4.7) reports the minimum number of new and renovated units needed to meet the housing needs of all households on GUAM over the next five years. Since the estimated need for new units is driven by the number of households entering the housing market (relative to the size of the existing stock), the total number of new units and renovations is the same for all three future scenarios. Tables 4.8 through 4.10 show production needs by region. The model forecasts need for new units in all three regions, reflecting the fact that the existing, vacant housing stock is not sufficient (in principle) to accommodate the projected net increase in households (of varied sizes) either for separate regions or for the island as a whole. It is important to reiterate at this point that the Housing Needs Assessment methodology forecasts the minimum levels of new construction and rehabilitation that would be required to meet housing needs, assuming an efficient allocation of households to units. Therefore, these results should be interpreted as lower-bound estimates, and indicators of the *relative* need for housing production and rehabilitation activity by region.

Given the conservative assumptions of the HNA methodology, 7,766 existing units need to be rehabilitated, and a minimum of 3,429 additional units need to be built in order to house all of GUAM's households adequately by the end of 1998. No converted units (i.e., enlarged units) were required by the model to house households adequately, which indicates that the existing stock has a sufficient supply of larger units to accommodate the households that need them. The Northern region is projected to need the most rehabilitated units (4,018 units), along with the most new construction (1,371 units). Figure 4.5 displays housing rehabilitation needs by region.

Although the total level of housing production is the same for all three future scenarios, the numbers of different types of units needed vary slightly because of the differing tenure patterns and minor variations in the assignment of housing solutions. In all scenarios, the HNA model projects that most of the demand for housing production will be for rental units. Table 4.7 shows that over 4,500 renovations, or roughly 62 percent of all renovations, would be needed to house renters; the remaining 38 percent of renovated units would be designated for owners. Tenure choice is partly deduced from household income, based on the assumption that higher-income households who can afford to buy homes will become owners (see discussion of tenure choice in Chapter III).

Affordability Problems

The HNA model solves housing problems of unit inadequacy and overcrowding by reassigning all problem households to existing vacant, renovated, or new units of appropriate size. However, some of these households will not be able to afford the housing solution to which they have been assigned by the model. Furthermore, the model does not reassign households that had an excessive cost burden in the base-year. Therefore, at the end of the simulation period, households that have an excessive cost burden will remain.

Figure 4.4
Housing Production Needed by Tenure and Income Class
1993-1998 Moderate Growth Estimates

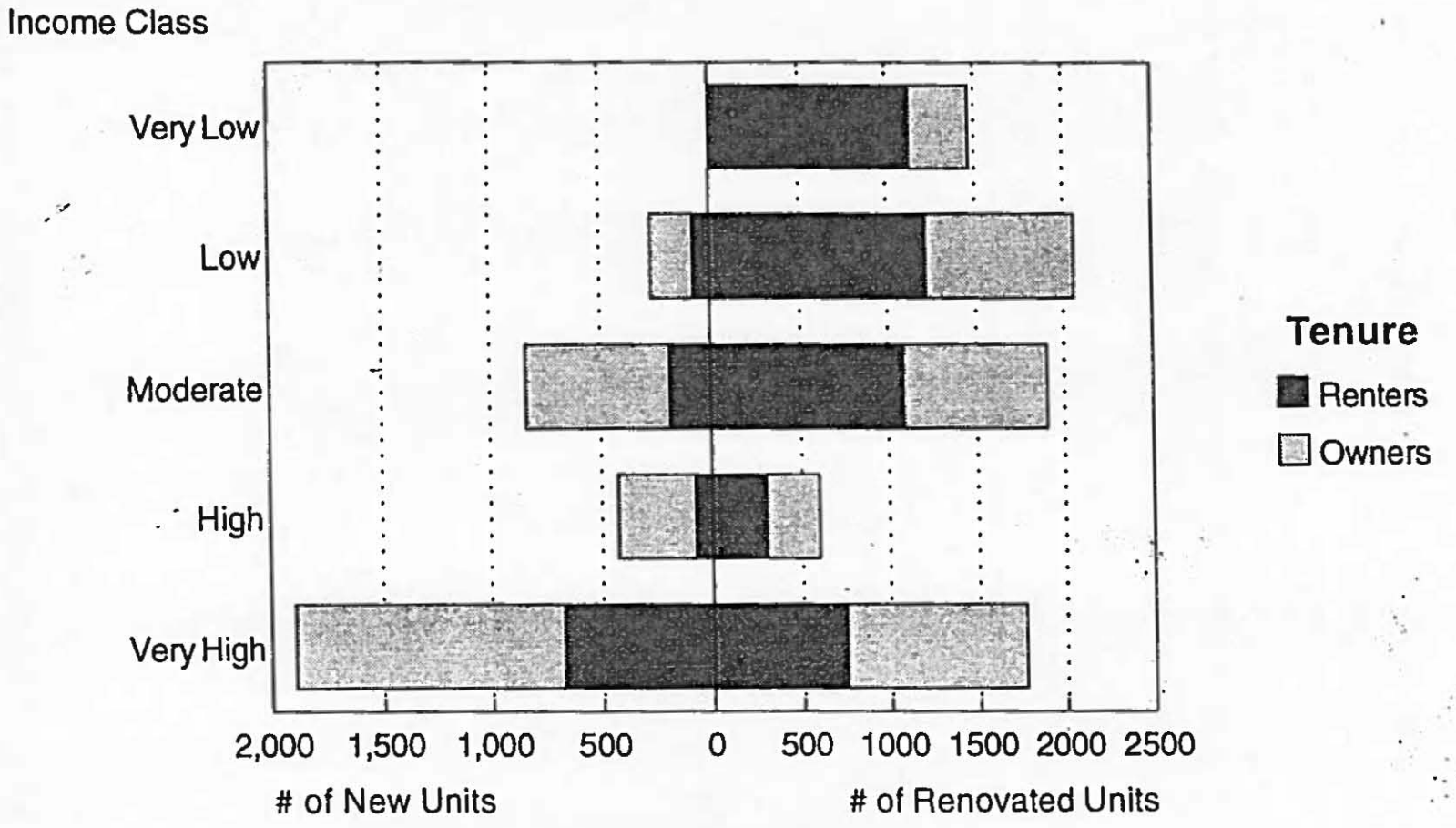


Figure 4.5(a)
Housing Production Needed by Tenure and Income Class, 1993-1998
Northern Region - Slow Growth Scenario

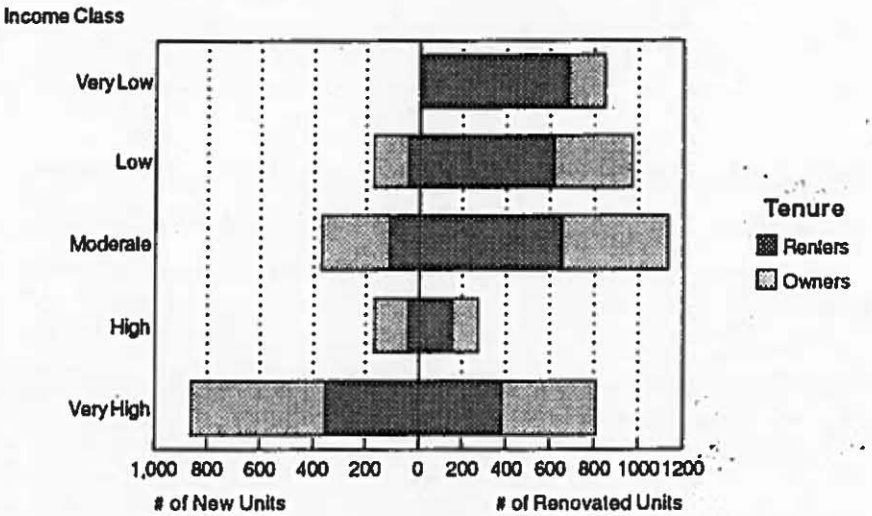


Figure 4.5(b)
Housing Production Needed by Tenure and Income Class, 1993-1998
Central Region - Slow Growth Scenario

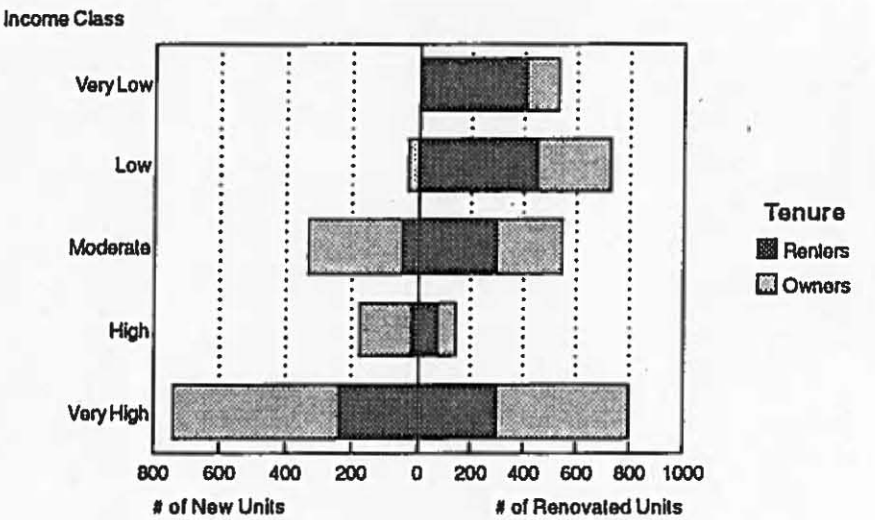
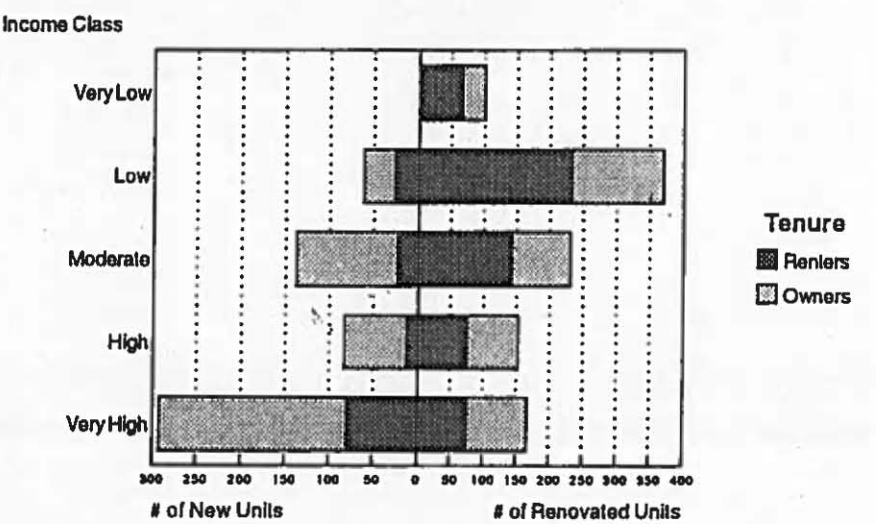


Figure 4.5(c)
Housing Production Needed by Tenure and Income Class, 1993-1998
Southern Region - Slow Growth Scenario



This section discusses the affordability problems of households at the end of the simulation period -- that is, the number of households (both existing and new) that have a cost burden and the gap between what those households can afford to pay and what they need to pay for their housing. The definition of affordability was given in the previous chapter. Renters who are paying more than 30 percent of their income and owners who are paying more than 40 percent of their income on housing costs are considered to have excessive cost burdens. It should be recalled that the HNA model attempts to allocate housing units to households in an efficient manner. For example, poorer households are given first opportunity to take lower cost units. As a result, the affordability problems reported by the HNA model are most likely conservative estimates.

For each economic scenario, Tables 4.11 through 4.16 and Figure 4.6 report the estimated number of households in unaffordable housing units in 1998, broken down by income group, tenure, and region. In addition, the tables give the total annual affordability gap for households (in millions of 1998 dollars).

Table 4.11 reports the numbers of households that are projected to have an affordability problem in 1998 under the Accelerated Growth scenario. The total number of households who can not afford their housing under this scenario is 91,355. The Northern region has the largest share of these households (7,334 or 53 percent), which is explained by the larger population in the North. In fact, the distribution of households in unaffordable housing almost exactly matches the distribution of households in each of the three regions, indicating that households in one region are no more likely to have affordability problems than those in the other two regions.

The affordability gap for the Accelerated growth scenario is presented in Table 4.12. As was explained previously, the affordability gap is the difference between what households need to pay and what they can afford to pay to be housed adequately. Under the Accelerated growth scenario, the total affordability gap for the year 1998 is projected to be 91.4 million dollars, or about 6,560 dollars for each household with an affordability problem. Again, the largest total gap is in the Northern region (48.3 million dollars). Households in the Central region have the largest average household gap (6,860 dollars), followed by those in the Northern and Southern regions (6,570 and 5,720 dollars, respectively). Figure 4.7 displays these data graphically.

Tables 4.11 and 4.12 also separate the affordability information by tenure status. Most of the households with affordability problems (71 percent) are renters, and most of the affordability gap (60 percent) is likewise attributable to these households. However, while owners are more likely to be able to afford their housing than renters, those owners who do have an affordability problem have a larger affordability gap than do renters. For example, under the Accelerated growth scenario the average gap per household in 1998 is 9,130 dollars for owners but only 5,520 dollars for renters. This pattern holds for all three regions, and explains the relatively higher household gap for the Central region. Since there are proportionally more owners than renters in this region, the average household gap for the region is weighted more towards the higher gap for owners.

In contrast to the Accelerated scenario, the Moderate growth scenario assumes that

Figure 4.6
Households Living in Unaffordable Housing by Tenure and Income
1993-1998 Estimates

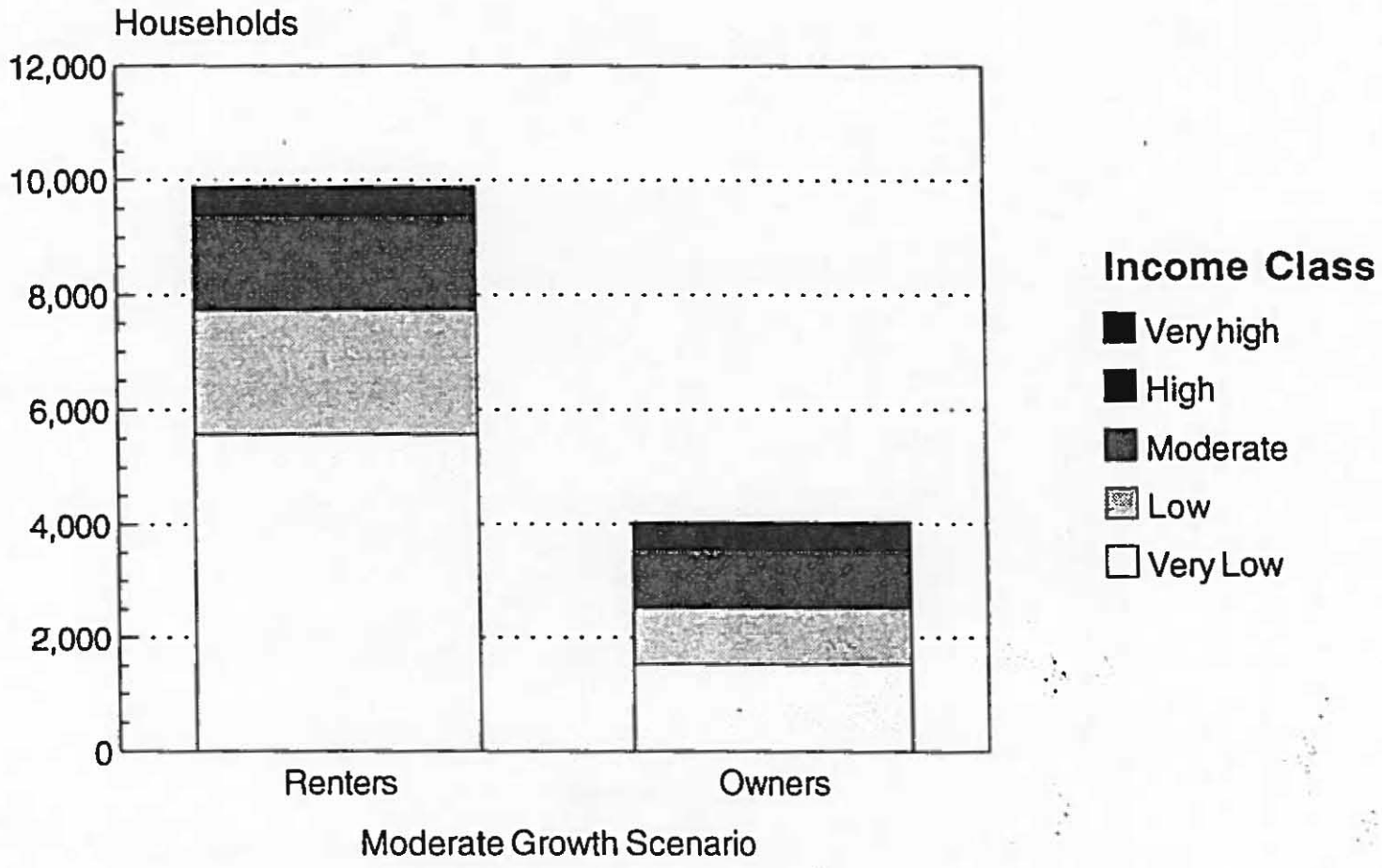


Figure 4.7(a)
Household Affordability Gap by Tenure and Income
Northern Region - 1998 Forecast

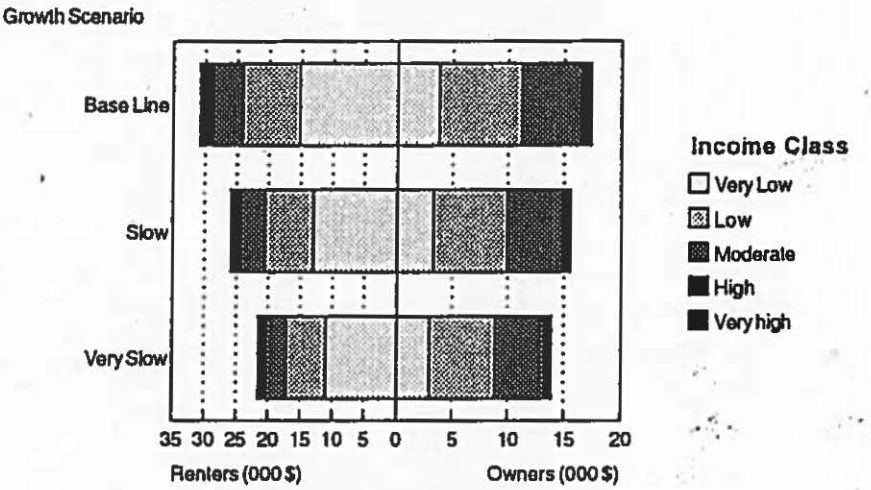


Figure 4.7(b)
Household Affordability Gap by Tenure and Income
Central Region - 1998 Forecast

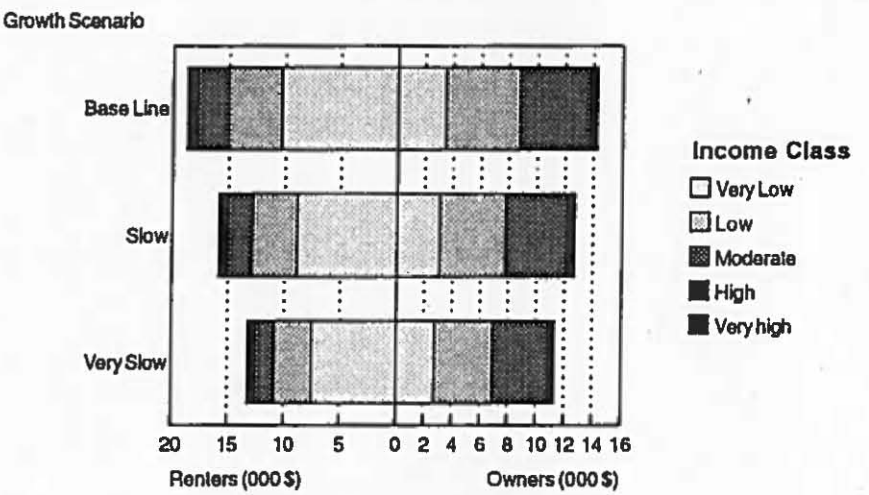
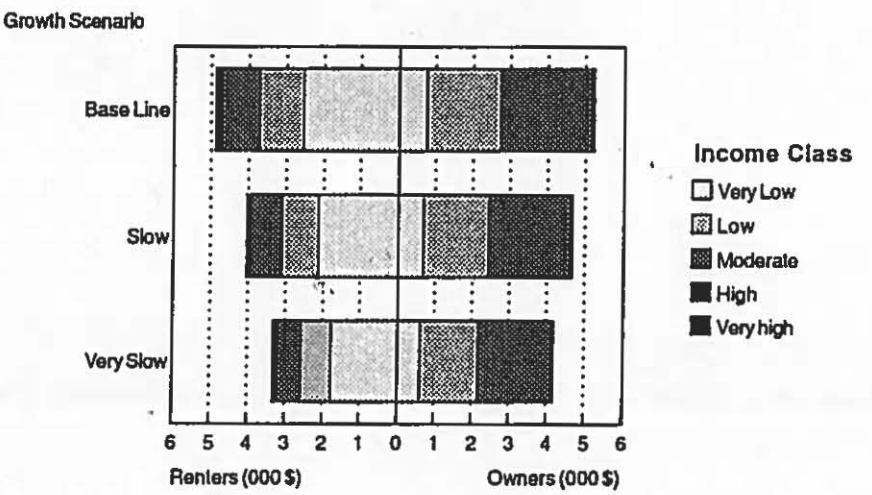


Figure 4.7(c)
Household Affordability Gap by Tenure and Income
Southern Region - 1998 Forecast



economic growth rates will be lower than the current pace through 1998. Consequently, it projects both slower income growth and lower housing price inflation than the Accelerated scenario, resulting in 0.6 percent fewer households (13,842) having affordability problems. While the number of households with affordability problems drops very slightly under the Moderate economic growth scenario, the affordability gap is reduced by 15 percent. This can be explained by the fact that, although increasing more slowly than in the Accelerated scenario, the rate of income growth is closer to the rate of housing cost inflation under the Moderate scenario. While this difference is not enough to affect significantly the incidence of affordability problems, it does reduce the size of the affordability gap for those households that have a cost burden.

Households in the very high-income categories are generally better off in the Moderate growth scenario. The number of households with a cost burden drops 48 percent in this income class across economic scenarios. The magnitude of the affordability gap also decreases by 15 percent for high-income households and 30 percent for the very high-income households. Most of these decreases are for owners, who benefit from the reduced housing inflation.

Annex A tables group households with an excessive cost burden by household type, size, and region. Since most of the affordability problems are explained by income level and tenure choice, these tables follow the general patterns discussed above.

As described in the beginning of this chapter, the three economic scenarios depict different possible economic futures for GUAM. The Accelerated scenario was derived from growth rates of the last few years with relatively high growth rates for income and housing costs, and forecasts an affordability situation in 1998 that is more severe than that in 1993. Table 4.17 shows the difference between the affordability gap in 1993 and the gap in 1998 under the Accelerated scenario by household type and income group. The magnitude of differences are, on average, on the order of a factor of 3.8, with substantial increases in the gap over the five-year period. Under this scenario, approximately 33 percent of the households in GUAM would have unaffordable housing in 1998, with a total affordability gap of approximately 91 million dollars. In 1993, XX percent of all households had a affordability problem, with a total gap of 25 million dollars. The increase in the gap in 1993 over 1998, is due to two factors: 1) the gap is measured in nominal dollars and not in constant dollars, so the effect of inflation in not included, and 2) the gap in 1998 includes the additional cost of solving all housing problems by 1998. The actual affordability gap would be lower, for instance, if households continue to live in overcrowded or physically inadequate units.

As was the case in the base-year, most of the households with affordability problems (74 percent) are in the two lower-income groups, and renters are more than twice as likely as owners to have an affordability problem. In addition, the Accelerated scenario shows that the number of owners with a cost burden will increase by 1998 (from 967 to 4,035 households). This is a result of applying higher "entry costs" to owners assigned to a unit, and can be thought of as the incremental cost of upgrading existing households from inadequate or overcrowded units, or purchasing units for new owners entering the market.

Figure 4.8(a)
Household Affordability Gap by Type and Income
1993 Estimates

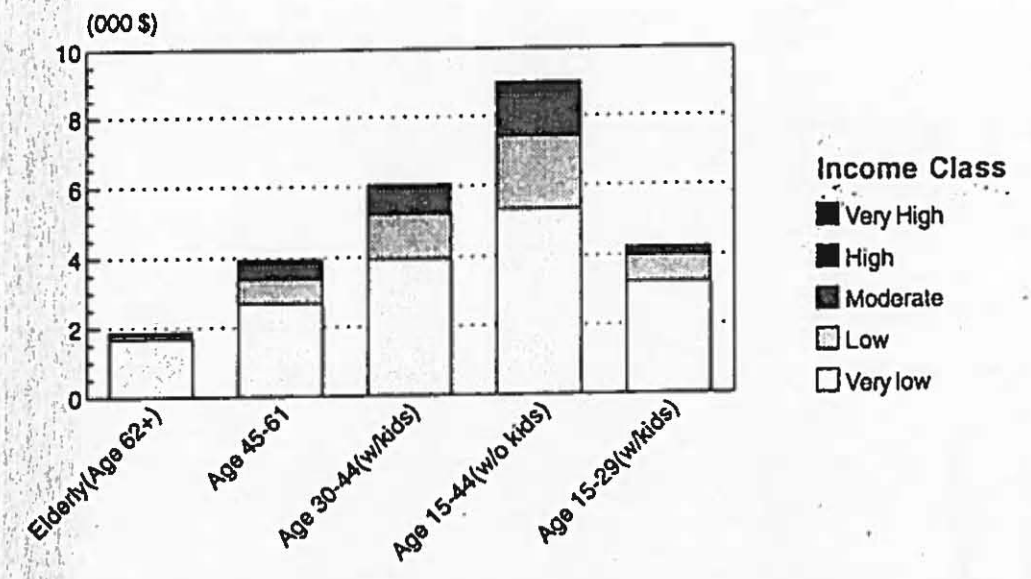
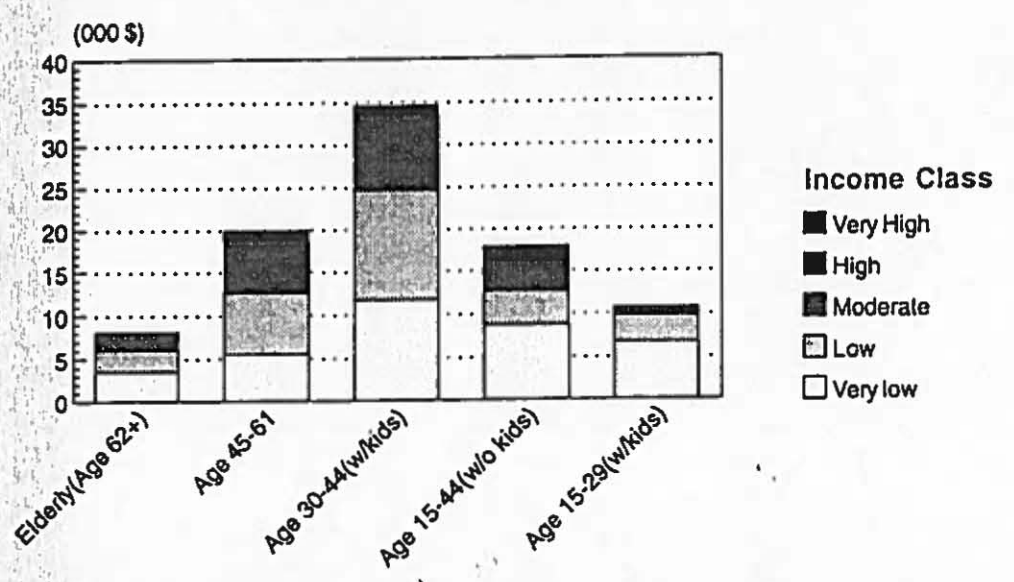


Figure 4.8(b)
Household Affordability Gap by Type and Income
1998 Estimates



Summary

This chapter presented the results of HNA model simulation runs for three different scenarios that represent possible economic futures for GUAM. The model projects that the number of households on the island will increase by 5,431 for a net annual growth of about 2.8 percent from 1993 to 1998.

The HNA model also estimates the minimum level of housing production that would be needed to accommodate both the new entrants to the housing market and the degradation and attrition of the housing stock. The model calculates that meeting the needs of all households would require renovation of at least 7,766 existing units and construction of at least 3,429 new units. Most of the renovations and new construction are needed in the Northern region, since half of all GUAM residences are in the North. Further, approximately 64 percent of the estimated new construction need is composed of 4 or more bedroom units and approximately 20 percent is composed of efficiencies and one-bedroom units.

The assumptions about income growth and housing inflation in the three future scenarios have different effects on the level of affordability problems at the end of the simulation period. If current income and housing costs trends continue, under the Accelerated scenario approximately 33 percent of the households on GUAM will not be able to afford the housing that they need, and the total gap between what they can afford to pay and the costs of the housing they require would be approximately 91 million dollars. In contrast, the lower income growth and housing inflation rates under the Moderate and Slow scenarios produce about the same incidence of affordability problems, but a smaller forecasted affordability gap of 79 and 68 million dollars, respectively. Low- and very low-income renters generally fare much worse under the all three scenarios, while the moderate-and higher-income households are more insulated from affordability problems due to the decrease in housing inflation.

V. CAPACITY TO MEET GUAM'S HOUSING NEEDS

Chapter IV presented estimates of housing needs for the Territory of Guam over the 1993 to 1998 period. To ensure that all residents of Guam are adequately housed by 1998, will require the average annual construction of some 1,086 new units and the rehabilitation or renovation of approximately _____ units. Although the majority of GUAM's households will be able to afford the cost of the needed housing, an estimated _____ will not be able to afford the needed housing. To bridge the gap between what those households can afford and the cost of the needed housing solutions would require subsidies ranging from $_____ million to $_____ million annually, depending upon economic conditions, demographic trends, and so forth.

Some of the affordability gap will be met by ongoing government programs. This chapter provides estimates of current levels of public sector spending in GUAM to determine the extent to which resources are already available to bridge the affordability gap and likely to be available in the foreseeable future as well. Before examining the nature and magnitude of available and needed public sector resources, the chapter provides estimates of recent housing production levels in GUAM to determine whether sufficient production capacity is likely to be available to meet the housing needs of all GUAM residents during the forecast period.

HOUSING CONSTRUCTION AND REHABILITATION IN GUAM

The HNA model provides estimates of the housing production levels necessary to adequately house all residents of GUAM by 1998. It is estimated that approximately 1,086 additional units will be needed annually to ensure that no households (including new immigrants) are living in inadequate or overcrowded units. At issue is the capacity of GUAM's housing production sector to meet that need.

By almost any criterion GUAM's housing supply has been highly responsive to the dramatic increases in housing demand in recent years, thereby indicating that ample capacity is likely to meet the identified needs, both currently and over the foreseeable future. The total number of housing units reported by the Census increased from 28,249 units in 1980 to 35,223 units, an annual increase of nearly 700 units over the ten-year period. Available evidence indicates that housing production has remained high into the 1990s. From May 1990 through August 1992, GUAM's Department of Public Works issued an average of 140 occupancy permits per month, a yearly average of 1,680 units.

It would therefore appear that, even in the current sluggish economy, aggregate housing production on GUAM is keeping pace with aggregate demand. Indeed, production may have been exceeding demand over the recent past thereby indicating that GUAM's housing sector is likely to have ample capacity for meeting the estimated housing needs over the foreseeable future.

Less clear is the capacity of GUAM's housing sector to produce the needed units in the optimal size, type, and locations. According to Census statistics, the percentage of housing units constructed in the Northern region of GUAM during the 1980s was

disproportionately large relative to the region's population growth. In contrast, percentages of total units constructed in the Central and Southern regions were somewhat lower than the percentages of population growth in those regions. There is also some reason to believe that production may have been disproportionately skewed toward units demanded by higher-income households, with substantially higher vacancy rates for such housing thought to evidence an inappropriate mix of production.

According to the Household Survey, some $24 million in renovation and rehabilitation is estimated to occur annually on GUAM, an estimate thought to be conservative. First, the total includes reported outlays only for additions, roof replacements, additions, kitchen or bathroom renovations, installation of storm windows/doors, insulation, and central air. Not included are the "other repairs or improvements" undertaken over the preceding two years and costing more than $500; such outlays were reported by approximately 12 percent of the respondents and would therefore total at least an additional $1 mill. annually. Second, reported outlays for each renovation or rehabilitation item are median estimates which are considerably less than mean estimates because of several extreme high values. Third, sweat equity contributions are excluded from the cost estimates, and in over half of all reported renovations and rehabilitations respondents said that most of the work was performed by members of the household.[16]

In sum, GUAM's housing production sector would seem to have ample capacity to meet the projected housing needs over the next five years, although there is less assurance that the mix of housing produced will be optimal. Therefore, if actual levels of housing production and rehabilitation fall short of projected needs, the cause is likely to be due to insufficient effective demand rather than to inadequately responsive supply. That is, the most appropriate public policy focus appears to be housing affordability, i.e., ensuring that households will be able to afford the needed housing.

PUBLIC SECTOR HOUSING EXPENDITURES

Federal, Territorial, and local governments all provide resources to the housing sector in a variety of forms: provision of financial and physical housing infrastructure; grants and loans for housing, acquisition, construction and rehabilitation; subsidies to operating and maintaining rental housing projects; and payments to supplement the rents that households can afford to pay private landlords. This section identifies existing forms of public assistance to GUAM's housing sector, and provides order-of-magnitude estimates of that assistance. Ongoing flows of public resources into GUAM's housing sector are then compared with the affordability gap estimated by the HNA model.

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[16] Over one third (38 percent) of those responding to the question said that their homes were currently in need of repairs. Nearly one in five (19.6 percent) estimated their needed renovations or repairs at more than $500. Again assuming the sampled households are representative of Guam's households generally, this would indicate that at least $3.6 million in renovations and repairs is needed now.

Spending estimates presented here ought to be viewed with caution, for several reasons: First, benefits and costs of government housing programs are often difficult to estimate and to aggregate, e.g., because they include below-market interest rates and loan guarantees as well as direct grants. Second, statistics are not available on a program-by-program basis for comparable time periods. Third, housing assistance programs are intermingled, both by administering agencies and for recipient households, thereby introducing the potential for a double-counting bias, among others. Therefore, levels of public sector assistance to GUAM's housing sector which are reported here ought to be viewed as instructive rather than as definitive.

GUAM received $2,723,000 from the Community Development Block Grant Program in 1992, and the same amount is allocated for 1993. Approximately 45 percent of that total ($1,225,000) is earmarked for ownership and other housing-related programs. Other HUD programs provide housing assistance to GUAM totaling an estimated $_____ annually.

The Farmers Home Administration (FmHA) made 32 home loans on GUAM in 1992 totalling $2.6 million. About the same level of activity is projected for 1993.[17] (A total of 1,093 FmHA loans are currently outstanding on GUAM number and have a combined value of $38 mill.) Government of Guam resources are currently provided in support of housing, particularly by GHC and GHURA. Their respective annual budgets are approximately $_____, virtually all of which support GUAM's housing sector.

Combined, these identified public expenditures for housing on GUAM total some $_____, or about _____percent of the annual affordability gap estimated for the 1993 to 1998 period. This means that an additional $_____ would be required in annual housing support to bridge the gap between what GUAM households can afford to pay for needed housing and what such housing will cost if government support is continued at current levels. But, again, estimates must be interpreted with caution; for example, government program assistance may not necessarily be targeted to households with housing problems, and they may not address housing needs with the lowest cost solution.

In the absence of more detailed and systematically obtained information regarding housing expenditure levels by government agencies, including their subsidy amounts and beneficiaries, we are able to say with confidence only that public funds are already flowing into GUAM's housing sector in sizeable amounts. Assuming them to be reasonable approximations of current funding levels, that they are continued over the next five years, and that they are targeted to addressing the problems of inadequacy, overcrowding, and unaffordability as identified by the HNA model, the remaining housing affordability gap to be bridged from government or other sources is on the order of $_____.

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[17]The Farmers Home Administration also operates a grants program, which may benefit some households on Guam. However, because the nationwide program is small, any funds flowing to Guam are likely to be negligible.

REFERENCES

Apgar, William C., Denise DiPasquale, Jean Cummings, and Nancy McArdle. 1991, *The State of the Nation's Housing.* Cambridge, MA: Joint Center for Housing Studies of Harvard University.

Apgar, William C., H. James Brown, George Masnick, John Pitkin, et. al. 1985. *The Housing Outlook: 1980-1990,* Praeger Publishers. New York City.

Case, Bradford, Henry O. Polakowski, and Susan M. Wachter. "On Choosing Among House Price Index Methodologies," in *AREUEA: Journal of the American Real Estate and Urban Economics Association.* Vol. 19, No. 3.

Case, Karl E. and Robert J. Shiller. 1987. *Prices of Single Family Homes Since 1970: New Indexes for Four Cities,* Cambridge, MA: National Bureau of Economic Research Inc.

Department of Commerce. 1982. *Detailed Housing Characteristics - GUAM, 1980 Census of Housing,* Department of Commerce Report HC80-1-B54, Washington, D.C.

_____. 1992. *Social, Economic, and Housing Characteristics - GUAM, 1990 Census of Population and Housing,* Department of Commerce Report CPH-6-G, Washington, D.C.

Dueñas and Associates, 1993. *Population, Employment, Income, and Housing Forecasts,* Dueñas and Associates report, Guam, January.

_____. 1992. *Descriptive Analysis of Land and Home Sale Prices on Guam Between August 1991 and September 1992,* Dueñas and Associates, Guam, December.

_____. 1992. *Estimates of New Housing Units Developed Between the 1990 Census and August 1992,* Dueñas and Associates, Guam, December.

_____. 1992. *Workshop Report,* Dueñas and Associates, Guam, October.

Economic Research Center (Department of Commerce). 1992. *Annual Economic Review and Statistical Abstract, 1990,* Economic Research Center Report, Guam.

Gujarati, Damodar N. 1988. *Basic Econometrics.* McGraw-Hill Book Company, New York.

Hughes, James W. 1991. " Clashing Demographics: Homeownership and Affordability Dilemmas," in *Housing Policy Debate.* Washington, D.C.: Fannie Mae. Vol 2, No. 4.

Isserman, Andrew M. 1984. "Projection, Forecast, and Plan: On the Future of Population Forecasting," *Journal of the American Planning Association*, Chicago, IL: American Planning Association.

Kort, John R., Joseph V. Cartwright, and Richard M. Beemiller. 1986. "Linking Regional Economic Models for Policy Analysis," in *Regional Econometric Modeling*, eds. M. Ray Perryman and James R. Schmidt, Boston, MA: Kluwer-Nijhoff Publishing.

Masnick, George S. 1989. *U.S. Household Trends: The 1980's and Beyond*, Working Paper W89-1. Cambridge, MA: Joint Center for Housing Studies of Harvard University.

Masnick, George S. 1989. *New Projections of Population and Households for States and Regions.* Cambridge, MA: Joint Center for Housing Studies of Harvard University.

Murdock, Steve H. 1991. "Evaluating Small-Area Population Projections," APA Journal.

Murdock, Steve H. et. al. 1991. "Evaluating Small-Area Population Projections," *Journal of the American Planning Association*, Chicago, IL: American Planning Association. Vol. 57, No. 4.

National Association of Homebuilders. 1991. *Forecast of Housing Activity.*

Pasquale, Vincent. 1985. *Westchester County and Municipality Population Projections: 1985-2010.* Westchester County Department of Planning White Plains, WY.

Pindyck, Robert and Rubinfeld, D.L. 1981. *Economic Models and Economic Forecasts.* McGraw-Hill Book Company, New York.

Silver, Josh, Peter Tatian, and Martha Kuhlman. 1993. *Housing Needs Model User's Manual*, Washington, DC: The Urban Institute. Document prepared for the New York State Division of Housing and Community Renewal.

Smith, Stanley K. 1986. "Accounting for Migration in Cohort-Component Projections of State and Local Populations," in *Demography*, Washington, D.C.: Population Association of America. Vol. 23, No. 1.

Sternlieb, George and James W. Hughes. 1986. *Demographics and Housing in America.* Washington, DC: Population Reference Bureau, Inc.

Struyk, Raymond J. 1987. "The Housing Needs Assessment Model." *American Planning Association Journal*, Spring 1987, pp. 227-234.

Struyk, Raymond J. and Christopher Walker. 1988. *America's Housing Needs to the 21st Century.* Washington, DC: The Urban Institute. Report prepared for the National Association of Realtors.

Tatian, Peter, Maris Mikelsons, Katie Mark, and Margery Austin Turner. 1990. *New York State Housing Needs Assessment System: Research Design.* Washington, DC: The Urban Institute. Document prepared for the New York State Division of Housing and Community Renewal.

Tatian, Peter, Maris Mikelons, Josh Silver, and Margery Austin Turner. 1992. *Analysis of Housing Needs for the State of New York, 1990-1995,* Washington, DC: The Urban Institute. Document prepared for the New York State Division of Housing and Community Renewal.

Turner, Margery Austin and Kirkman O'Neal. 1986a. *Household Tenure Choice: Review of the Empirical Literature.* Washington, DC: The Urban Institute. Report prepared for the Office of Policy Development and Research, US Department of Housing and Urban Development.

Turner, Margery Austin, and Kirkman O'Neal. 1986b. *Simulating Household Tenure Choice in the Metropolitan Housing Market Model.* Washington, DC: The Urban Institute. Report prepared for the Office of Policy Development and Research, US Department of Housing and Urban Development.

Turner, Margery Austin. 1989. *The Housing Quality Model: A User's Manual.* Washington, DC: The Urban Institute. Prepared for the US Agency for International Development (USAID), Office of Housing and Urban Programs.

United States Department of Navy. 1992. *UPDATE: Guam Housing Market Analysis,* United States Navy, Guam, May.

TABLES

Table 4.2
Additional Households by Region
GUAM Total
1993-1998 Estimates

	Number of Additional Hhs	Percent of Add'l Hhs
Region 1 -- North	2,742	50.5%
Region 2 -- Central	1,904	35.1%
Region 3 -- South	785	14.5%
Total	5,431	100.0%

Table 4.3
Estimated Homeownership Rates
Existing and Additional Households by Region
GUAM Total
1993-1998 Estimates

REGION	Existing Hhs (1993)	Additional Households (1993 - 1998)		
		Accelerated Growth	Moderate Growth	Slow Growth
Region 1 - North	43%	45%	43%	43%
Region 2 - Central	52%	44%	42%	42%
Region 3 - South	42%	46%	44%	44%
Total	46%	45%	43%	43%

Table 4.4
Estimated Ownership Rates by Type and Income Class, 1993 - 1998
Northern Region - Accelerated Growth Scenario

	Existing Hhs 1993	All Households 1998
Elderly (Age 62+)	73%	68%
very low inc	60%	55%
low inc	70%	66%
moderate inc	72%	68%
high	77%	73%
very high	85%	80%
Age 45-61	62%	56%
very low inc	45%	40%
low inc	57%	51%
moderate inc	64%	57%
high	66%	60%
very high	69%	62%
Age 30-44 w/kids	41%	44%
very low inc	28%	30%
low inc	32%	38%
moderate inc	40%	44%
high	48%	52%
very high	59%	61%
Age 15-44 w/o kids	16%	24%
very low inc	12%	16%
low inc	10%	19%
moderate inc	13%	22%
high	18%	27%
very high	23%	31%
Age 15-29 w/kids	18%	17%
very low inc	13%	12%
low inc	14%	15%
moderate inc	22%	21%
high	30%	27%
very high	35%	31%
Total	43%	43%
very low inc	30%	29%
low inc	34%	36%
moderate inc	42%	43%
high	49%	50%
very high	57%	56%

Table 4.5
Estimated Ownership Rates by Type and Income Class, 1993 - 1998
Central Region - Accelerated Scenario

	Existing Hhs 1993	All Households 1998
Elderly (Age 62+)	81%	75%
very low inc	65%	58%
low inc	80%	75%
moderate inc	87%	81%
high	86%	81%
very high	91%	85%
Age 45-61	71%	64%
very low inc	44%	39%
low inc	58%	52%
moderate inc	69%	62%
high	81%	72%
very high	80%	72%
Age 30-44 w/kids	52%	54%
very low inc	23%	25%
low inc	37%	42%
moderate inc	53%	56%
high	68%	69%
very high	73%	73%
Age 15-44 w/o kids	21%	28%
very low inc	15%	19%
low inc	12%	22%
moderate inc	15%	24%
high	24%	32%
very high	31%	38%
Age 15-29 w/kids	21%	19%
very low inc	13%	12%
low inc	16%	16%
moderate inc	24%	23%
high	38%	34%
very high	45%	39%
Total	52%	51%
very low inc	30%	29%
low inc	38%	40%
moderate inc	51%	51%
high	63%	61%
very high	70%	67%

Table 4.6
Estimated Ownership Rates by Type and Income Class, 1993 - 1998
Southern Region - Accelerated Scenario

	Existing Hhs 1993	All Households 1998
Elderly (Age 62+)	80%	75%
very low inc	64%	57%
low inc	84%	78%
moderate inc	83%	79%
high	93%	90%
very high	93%	87%
Age 45-61	73%	66%
very low inc	40%	35%
low inc	69%	62%
moderate inc	74%	66%
high	74%	68%
very high	82%	74%
Age 30-44 w/kids	32%	37%
very low inc	17%	20%
low inc	21%	28%
moderate inc	29%	35%
high	44%	49%
very high	62%	64%
Age 15-44 w/o kids	11%	20%
very low inc	6%	14%
low inc	8%	15%
moderate inc	14%	19%
high	30%	20%
very high	40%	28%
Age 15-29 w/kids	42%	11%
very low inc	26%	6%
low inc	27%	9%
moderate inc	38%	14%
high	53%	27%
very high	67%	38%
Total	43%	42%
very low inc	30%	25%
low inc	34%	30%
moderate inc	42%	40%
high	49%	53%
very high	57%	64%

Table 4.7
Housing Production Needed by Tenure and Income Class
GUAM Total - Accelerated Scenario
1993-1998 Estimates

	1993 - 1998	
	New Units	Renovations
Renters	1,007	4,500
very low inc	0	1,137
low inc	74	1,224
moderate inc	186	1,090
high	73	300
very high	674	750
Owners	2,422	3,266
very low inc	0	335
low inc	193	840
moderate inc	654	814
high	354	302
very high	1,220	1,017
Total	3,429	7,766
very low inc	0	1,472
low inc	267	2,064
moderate inc	840	1,904
high	427	602
very high	1,894	1,767

Table 4.8
Housing Production Needed by Tenure and Income Class
Northern Region - Slow Growth Scenario
1993-1998 Estimates

	Slow Growth	
	New Units	Renovations
Renters	551	2,484
very low inc	0	682
low inc	43	616
moderate inc	113	655
high	40	151
very high	355	380
Owners	1,020	1,534
very low inc	0	163
low inc	129	353
moderate inc	256	476
high	128	115
very high	507	427
Total	1,571	4,018
very low inc	0	845
low inc	172	969
moderate inc	369	1,131
high	168	266
very high	862	807

Table 4.9
Housing Production Needed by Tenure and Income Class
Central Region - Slow Growth Scenario
1993-1998 Estimates

	Slow Growth	
	New Units	Renovations
Renters	313	1,515
very low inc	0	403
low inc	4	447
moderate inc	50	294
high	20	74
very high	239	297
Owners	969	1,218
very low inc	0	123
low inc	29	278
moderate inc	283	249
high	156	68
very high	500	499
Total	1,282	2,733
very low inc	0	526
low inc	33	725
moderate inc	333	543
high	176	142
very high	739	796

Table 4.10
Housing Production Needed by Tenure and Income Class
Southern Region - Slow Growth Scenario
1993-1998 Estimates

	Slow Growth	
	New Units	Renovations
Renters	143	587
very low inc	0	66
low inc	27	232
moderate inc	23	141
high	13	75
very high	80	75
Owners	433	428
very low inc	0	34
low inc	35	138
moderate inc	115	89
high	70	77
very high	213	91
Total	576	1,015
very low inc	0	100
low inc	62	370
moderate inc	138	230
high	83	152
very high	293	166

Table 4.11
Households Living in Unaffordable Housing Units by Tenure and Income
GUAM Total - Accelerated Scenario
1998 Forecast

	North	Central	South	Total
	Number of HHlds	Number of HHlds	Number of HHlds	Number of HHlds
Renters	5,320	3,346	1,218	9,884
very low inc	2,754	2,005	807	5,566
low inc	1,329	655	179	2,163
moderate inc	919	530	203	1,652
high	281	98	18	397
very high	36	57	12	105
Owners	2,024	1,463	548	4,035
very low inc	783	561	182	1,526
low inc	541	334	125	1,000
moderate inc	429	399	197	1,025
high	271	170	44	485
very high	0	0	0	0
Total	7,344	4,809	1,766	13,919
very low inc	3,537	2,566	989	7,092
low inc	1,870	989	304	3,163
moderate inc	1,348	929	400	2,677
high	552	268	62	882
very high	36	57	12	105

Table 4.12
Household Affordability Gap by Tenure and Income by Region
GUAM Total - Accelerated Scenario
1998 Forecast

	North	Central	South	Total
	Region 1 Affordability Gap (000 $)	Region 2 Affordability Gap (000 $)	Region 3 Affordability Gap (000 $)	Affordability Gap (000 $)
Renters	30,873	18,751	4,888	54,512
very low inc	15,333	10,433	2,547	28,313
low inc	8,886	4,663	1,180	14,729
moderate inc	4,760	2,711	1,021	8,492
high	1,821	775	104	2,700
very high	72	169	36	277
Owners	17,404	14,233	5,206	36,843
very low inc	3,703	3,403	745	7,851
low inc	7,430	5,331	1,971	14,732
moderate inc	5,419	4,935	2,414	12,768
high	852	563	77	1,492
very high	0	0	0	0
Total	48,277	32,984	10,094	91,355
very low inc	19,036	13,836	3,292	36,164
low inc	16,316	9,994	3,151	29,461
moderate inc	10,179	7,646	3,435	21,260
high	2,673	1,338	181	4,192
very high	72	169	36	277

Table 4.13
Households living in Unaffordable Housing Units by Tenure and Income
GUAM Total - Moderate Scenario
1998 Forecast

	North	Central	South	Total
	Number of HHlds	Number of HHlds	Number of HHlds	Number of HHlds
Renters	5,312	3,346	1,217	9,875
very low inc	2,754	2,005	807	5,566
low inc	1,346	683	183	2,212
moderate inc	919	530	203	1,652
high	281	98	18	397
very high	11	28	6	45
Owners	1,998	1,428	541	3,967
very low inc	774	555	180	1,509
low inc	524	305	120	949
moderate inc	429	399	197	1,025
high	271	170	44	485
very high	0	0	0	0
Total	7,310	4,774	1,758	13,842
very low inc	3,528	2,560	987	7,075
low inc	1,870	988	303	3,161
moderate inc	1,348	929	400	2,677
high	552	268	62	882
very high	11	28	6	45

Table 4.14
Household Affordability Gap by Tenure and Income by Region
GUAM Total - Moderate Scenario
1998 Forecast

	North	Central	South	Total
	Region 1 Affordability Gap (000 $)	Region 2 Affordability Gap (000 $)	Region 3 Affordability Gap (000 $)	Affordability Gap (000 $)
Renters	25,981	15,838	4,058	45,877
very low inc	13,087	8,892	2,135	24,114
low inc	7,497	3,982	992	12,471
moderate inc	3,864	2,204	821	6,889
high	1,486	640	84	2,210
very high	48	121	26	195
Owners	15,518	12,645	4,645	32,808
very low inc	3,271	3,007	655	6,933
low inc	6,609	4,695	1,753	13,057
moderate inc	4,862	4,431	2,167	11,460
high	776	512	71	1,359
very high	0	0	0	0
Total	41,499	28,483	8,703	78,685
very low inc	16,358	11,899	2,790	31,047
low inc	14,106	8,677	2,745	25,528
moderate inc	8,726	6,635	2,988	18,349
high	2,262	1,152	155	3,569
very high	48	121	26	195

Table 4.15
Households Living in Unaffordable Housing Units by Tenure and Income
GUAM Total - Slow Growth Scenario
1998 Forecast

	North	Central	South	Total
	Number of HHlds	Number of HHlds	Number of HHlds	Number of HHlds
Renters	5,304	3,341	1,213	9,884
very low inc	2,754	2,005	807	5,566
low inc	1,346	683	183	2,163
moderate inc	912	526	199	1,652
high	281	98	18	397
very high	11	28	6	105
Owners	1,998	1,428	541	3,967
very low inc	774	555	180	1,509
low inc	524	305	120	949
moderate inc	429	399	198	1,026
high	271	170	45	486
very high	0	0	0	0
Total	7,302	4,769	1,754	13,825
very low inc	3,528	2,560	987	7,075
low inc	1,870	988	303	3,161
moderate inc	1,341	925	397	2,663
high	552	268	63	883
very high	11	28	6	45

Table 4.16
Household Affordability Gap by Tenure and Income by Region
GUAM Total - Slow Growth Scenario
1998 Forecast

	North	Central	South	Total
	Region 1 Affordability Gap (000 $)	Region 2 Affordability Gap (000 $)	Region 3 Affordability Gap (000 $)	Affordability Gap (000 $)
Renters	21,670	13,230	3,326	38,226
very low inc	11,109	7,531	1,774	20,414
low inc	6,243	3,324	819	10,386
moderate inc	3,089	1,765	648	5,502
high	1,194	522	67	1,783
very high	35	89	19	143
Owners	13,889	11,310	4,158	29,357
very low inc	2,926	2,687	586	6,199
low inc	5,905	4,191	1,566	11,662
moderate inc	4,353	3,968	1,940	10,261
high	705	465	66	1,236
very high	0	0	0	0
Total	35,559	24,540	7,484	67,583
very low inc	14,035	10,218	2,360	26,613
low inc	12,148	7,515	2,385	22,048
moderate inc	7,442	5,733	2,588	15,763
high	1,899	987	133	3,019
very high	35	89	19	143

Table 4.17
Household Affordability Gap by Type and Income
GUAM Total - Accelerated Growth
1993-1998 Estimates

	1993 Affordability Gap (000 $)	1998 Affordability Gap (000 $)
Elderly	1,890	8,158
very low inc	1,677	3,510
low inc	110	2,502
moderate inc	94	1,900
high	4	225
very high	5	20
Age 45-61	3,957	19,907
very low inc	2,683	5,498
low inc	706	7,080
moderate inc	410	6,145
high	125	1,060
very high	32	124
Age 30-44 w/kids	6,063	34,624
very low inc	3,945	11,699
low inc	1,283	12,941
moderate inc	705	8,778
high	131	1,195
very high	0	10
Age 15-44 w/o kids	9,010	17,901
very low inc	5,332	8,739
low inc	2,084	3,885
moderate inc	1,256	3,565
high	304	1,587
very high	33	123
Age 15-29 w/kids	4,240	10,764
very low inc	3,222	6,718
low inc	757	3,051
moderate inc	230	871
high	31	124
very high	0	0
Total	25,160	91,354
very low inc	16,859	36,164
low inc	4,940	29,459
moderate inc	2,695	21,259
high	595	4,191
very high	70	277

Table 2.1
Households by Tenure and Income Class
GUAM Total
1993 Estimates

	Number of Hhs	Percent
Renters	19,797	54.0%
very low inc	5,159	26.1%
low inc	4,594	23.2%
moderate inc	4,629	23.4%
high	1,917	9.7%
very high	3,497	17.7%
Owners	16,860	45.9%
very low inc	2,165	12.8%
low inc	2,386	14.2%
moderate inc	3,705	22.0%
high	2,348	13.9%
very high	6,255	37.1%
Total	36,658	100.0%
very low inc	7,324	20.0%
low inc	6,980	19.0%
moderate inc	8,334	22.7%
high	4,265	11.6%
very high	9,753	26.6%

Table 2.2
Households by Type and Income Class
GUAM Total
1993 Estimates

	Number of Hhs	Percent
Elderly (Age 62+)	4,330	11.8%
very low inc	1,155	26.7%
low inc	707	16.3%
moderate inc	895	20.7%
high	445	10.3%
very high	1,126	26.0%
Age 45-61	9,539	26.0%
very low inc	1,252	13.1%
low inc	1,249	13.1%
moderate inc	1,923	20.2%
high	1,295	13.6%
very high	3,820	40.0%
Age 30-44 w/kids	11,774	32.1%
very low inc	2,109	17.9%
low inc	2,570	21.8%
moderate inc	3,017	25.6%
high	1,422	12.1%
very high	2,652	22.5%
Age 15-44 w/o kids	6,373	17.4%
very low inc	1,121	17.6%
low inc	1,104	17.3%
moderate inc	1,502	23.6%
high	797	12.5%
very high	1,849	29.0%
Age 15-29 w/kids	4,645	12.7%
very low inc	1,686	36.3%
low inc	1,350	29.1%
moderate inc	998	21.5%
high	306	6.6%
very high	305	6.6%
Total	36,658	100.0%
very low inc	7,324	20.0%
low inc	6,980	19.0%
moderate inc	8,335	22.7%
high	4,265	11.6%
very high	9,753	26.6%

Table 2.3
Household Size by Income Class
GUAM Total
1993 Estimates

	Number of Hhs	Percent
1-2 Persons	10,628	28.8%
very low inc	2,531	23.8%
low inc	1,839	17.2%
moderate inc	2,202	20.7%
high	1,099	10.2%
very high	2,956	27.8%
3-4 Persons	14,098	38.5%
very low inc	2,584	18.3%
low inc	2,832	20.2%
moderate inc	3,313	23.6%
high	1,599	11.2%
very high	3,770	26.8%
5-6 Persons	8,026	21.6%
very low inc	1,454	18.1%
low inc	1,571	19.6%
moderate inc	1,935	24.1%
high	1,053	13.1%
very high	2,012	25.0%
7+ Persons	3,906	10.7%
very low inc	755	19.4%
low inc	738	18.7%
moderate inc	885	22.6%
high	513	13.6%
very high	1,015	26.1%
Total	36,658	100.0%
very low inc	7,324	20.0%
low inc	6,980	19.0%
moderate inc	8,335	22.7%
high	4,265	11.6%
very high	9,753	26.6%

Table 2.4
Household Size by Tenure
GUAM Total
1993 Estimates

	Number of Hhs	Percent of Group
Owners	16,860	46.0%
1-2 persons	3,349	19.6%
3-4 persons	5,802	35.4%
5-6 persons	4,815	28.9%
7+ persons	2,894	17.3%
Renters	19,798	54.0%
1-2 persons	7,280	36.7%
3-4 persons	8,296	41.9%
5-6 persons	3,211	16.1%
7+ persons	1,011	5.1%
Total	36,658	100.0%
1-2 persons	10,629	28.8%
3-4 persons	14,098	38.5%
5-6 persons	8,026	21.9%
7+ persons	3,905	10.7%

Table 2.5
Households by Region
GUAM Total
1993 Estimates

REGION	Number of Hhs in Region	Percent of Hhs in GUAM
Region 1 -- North	18,174	49.6%
Region 2 -- Central	12,907	35.2%
Region 3 -- South	5,578	15.2%
Total	36,658	100.0%

Table 2.6
Households by Region and Tenure
Guam Total
1993 Estimates

	% Hhs in Region by:	
REGION	Renters	Owners
Region 1 - North	57.1%	42.9%
Region 2 - Central	47.8%	52.2%
Region 3 - South	58.3%	41.7%

Table 2.7
Households by Income and Region
GUAM Total
1993 Estimates

	Percent of Households in Region by Income Group:				
REGION	Very Low	Low	Moderate	High	Very High
Region 1 - North	19.8%	20.3%	23.3%	11.9%	24.7%
Region 2 - Central	20.4%	15.9%	21.3%	11.0%	31.4%
Region 3 - South	19.6%	22.4%	24.4%	11.8%	21.9%
Total	19.9%	19.0%	22.8%	11.6%	26.6%

Table 2.8
Household Size by Region
GUAM Total
1993 Estimates

REGION	Number of Hhs	Percent of Group
Region 1 - North	18,174	49.0%
1-2 persons	5,484	30.1%
3-4 persons	7,099	39.1%
5-6 persons	3,869	21.2%
7+ persons	1,721	9.5%
Region 2 - Central	12,907	33.0%
1-2 persons	3,819	29.4%
3-4 persons	4,772	36.9%
5-6 persons	2,801	21.5%
7+ persons	1,515	11.5%
Region 2 - South	5,578	15.0%
1-2 persons	1,325	23.5%
3-4 persons	2,227	40.2%
5-6 persons	1,355	24.5%
7+ persons	670	12.3%
Total	36,658	100.0%
1-2 persons	10,628	28.8%
3-4 persons	14,098	38.5%
5-6 persons	8,025	21.5%
7+ persons	3,906	10.7%

Table 2.9
Households in Inadequate Housing Units by Tenure and Income
GUAM Total
1993 Estimates

	Number of Hhs with Problem	Group's Share of Prob Hhs	Incidence of Prob for Grp
Renters	2,227	53.5%	11.2%
very low inc	509	22.9%	9.8%
low inc	755	33.9%	16.2%
moderate inc	720	32.3%	15.2%
high	72	3.2%	3.7%
very high	170	7.6%	4.7%
Owners	2,095	46.5%	12.3%
very low inc	173	8.2%	7.9%
low inc	460	21.9%	19.3%
moderate inc	735	35.1%	19.9%
high	182	8.7%	7.7%
very high	544	25.9%	8.6%
Total	4,323	100.0%	11.8%
very low inc	682	15.8%	9.3%
low inc	1,216	28.1%	17.4%
moderate inc	1,457	33.7%	17.5%
high	254	5.9%	5.9%
very high	714	16.5%	7.3%

Table 2.10
Inadequate Housing Units by Region
GUAM Total
1993 Estimates

REGION	Number of Hhs with Problem	% of Problem Hhs in GUAM	Incidence of Problem
Region 1 - North	2,232	51.6%	13.0%
Region 2 - Central	1,542	35.7%	11.9%
Region 3 - South	548	12.7%	9.6%
Total	4,322	100.0%	11.8%

Table 2.11
Households in Inadequate Housing Units by Type and Region
GUAM Total
1993 Estimates

REGION	Inadequate Housing Units	Group's Share of Prob Hhs	Incidence of Prob for Grp
Region 1 - North	2,323	55.3%	13.0%
Elderly (Age 62+)	375	16.1%	17.9%
Age 45-61	725	31.2%	15.1%
Age 30-44 w/kids	717	30.9%	12.5%
Age 15-44 w/o kids	227	9.8%	6.6%
Age 15-29 w/kids	188	8.1%	8.3%
Region 2 - Central	1,542	36.7%	11.9%
Elderly (Age 62+)	278	18.0%	17.3%
Age 45-61	480	31.1%	13.3%
Age 30-44 w/kids	502	32.6%	12.5%
Age 15-44 w/o kids	155	10.1%	7.1%
Age 15-29 w/kids	126	8.2%	8.3%
Region 3 - South	548	13.0%	9.6%
Elderly (Age 62+)	81	14.8%	12.4%
Age 45-61	160	29.2%	12.1%
Age 30-44 w/kids	230	42.0%	10.8%
Age 15-44 w/o kids	29	5.3%	3.8%
Age 15-29 w/kids	45	8.2%	5.6%
Total	4,323	10.2%	11.8%
Elderly (Age 62+)	735	17.0%	16.9%
Age 45-61	1,366	31.6%	14.1%
Age 30-44 w/kids	1,449	33.5%	12.2%
Age 15-44 w/o kids	412	9.5%	6.5%
Age 15-29 w/kids	360	8.3%	7.7%

Table 2.13
Crowded Housing Units by Region
GUAM Total
1993 Estimates

REGION	Crowded Households	% of Problem Hhs in GUAM	Incidence of Problem
Region 1 - North	2,383	46.5%	13.1%
Region 2 - Central	1,941	37.9%	15.0%
Region 3 - South	799	15.6%	14.3%
Total	5,123	100.0%	13.9%

Table 2.14
Crowded Housing Units by Tenure and Region
GUAM Total
1993 Estimates

REGION	Crowded Households	Incidence of Problem
Region 1 - North	2,384	13.1%
Owners	1,090	13.9%
Renters	1,294	12.4%
Region 2 - Central	1,941	15.0%
Owners	1043	15.4%
Renters	898	14.6%
Region 3 - South	799	14.3%
Owners	467	20.1%
Renters	331	10.1%
Total	5,124	13.9%
Owners	2,600	15.4%
Renters	2,523	12.7%

Table 2.15
Crowded Households by Type and Income Class
GUAM Total
1993 Estimates

	Number of Hhs	Incidence
Elderly(Age 62+)	436	10.1%
very low inc	61	5.4%
low inc	88	12.2%
moderate inc	118	13.0%
high	59	13.8%
very high	111	9.8%
Age 45-61	1,473	15.5%
very low inc	212	17.2%
low inc	292	23.3%
moderate inc	401	20.8%
high	220	17.3%
very high	347	9.1%
Age 30-44 w/kids	2,365	20.2%
very low inc	662	31.4%
low inc	629	24.8%
moderate inc	587	19.6%
high	240	17.3%
very high	247	9.5%
Age 15-44 w/o kids	35	0.5%
very low inc	8	0.8%
low inc	6	0.5%
moderate inc	5	0.3%
high	2	0.2%
very high	15	0.8%
Age 15-29 w/kids	814	17.6%
very low inc	388	23.0%
low inc	197	14.5%
moderate inc	166	16.9%
high	33	10.8%
very high	28	9.8%
Total	5,123	14.1%
very low inc	1,332	26.0%
low inc	1,213	23.7%
moderate inc	1,278	24.9%
high	554	10.8%
very high	749	14.6%

Table 2.16
Housing Affordability by Tenure and Income
GUAM Total
1993 Estimate

	HHlds w/Cost Burden	Incidence
Renters	7,030	35.4%
very low inc	4,418	85.1%
low inc	1,285	28.0%
moderate inc	974	21.0%
high	301	15.6%
very high	50	1.4%
Owners	967	5.7%
very low inc	931	42.8%
low inc	36	1.5%
moderate inc	0	0.0%
high	0	0.0%
very high	0	0.0%
Total	7,945	21.6%
very low inc	5,349	72.6%
low inc	1,321	19.0%
moderate inc	974	11.7%
high	301	7.0%
very high	50	0.5%

Table 2.17
Housing Affordability by Household Size and Income Class
GUAM Total
1993 Estimates

	Number of Hhs w/Cost Burden	Incidence
1-2 Persons	3,808	
very low inc	2,239	
low inc	678	
moderate inc	639	
high	201	
very high	50	
3-4 Persons	2,760	
very low inc	1,965	
low inc	428	
moderate inc	272	
high	94	
very high	0	
5-6 Persons	1,267	
very low inc	968	
low inc	211	
moderate inc	59	
high	5	
very high	0	
7+ Persons	162	
very low inc	153	
low inc	5	
moderate inc	3	
high	0	
very high	0	
Total	7,997	22.0%
very low inc	5,325	73.0%
low inc	1,322	
moderate inc	973	
high	300	
very high	50	0.5%

Table 2.18
Households with Excessive Cost Burden by Region
GUAM Total
1993 Estimates

REGION	Number of Hhs with Problem	% of Problem Hhs in GUAM	Incidence
Region 1 - North	4,385	54.8%	
Region 2 - Central	2,759	34.5%	
Region 3 - South	853	10.7%	
Total	7,997	100.0%	

Table 2.20
Household Affordability Gap by Tenure, Income and Region
GUAM Total
1993 Estimates

	North Affordability Gap (000 $)	Central Affordability Gap (000 $)	South Affordability Gap (000 $)	All Affordability Gap (000 $)
Renters	$ 4,231	$7,508	$1,525	$23,264
very low inc	9,952	4,811	1,168	15,931
low inc	3,166	1,574	181	4,921
moderate inc	1,708	863	124	2,695
high	333	217	43	593
very high	18	43	8	69
Owners	$947	$739	$210	$1,896
very low inc	934	719	210	1,863
low inc	13	20	0	33
moderate inc	0	0	0	0
high	0	0	0	0
very high	0	0	0	0
Total	$15,178	$8,247	$1,735	$25,160
very low inc	10,886	5,530	1,378	17,794
low inc	3,179	1,594	181	4,954
moderate inc	1,708	863	124	2,695
high	333	217	43	593
very high	18	43	8	69

Table 2.21
Vacant Units by Unitsize and Region
Guam Total
1993 Estimates

REGION	Eff/1 BR	2 BR	3 BR	4+ BR
Region 1 - Northern	233	658	597	89
Percent	14.7%	41.8%	37.8%	5.6%
Region 2 - Central	184	337	257	94
Percent	21.1%	38.6%	29.4%	10.7%
Region 3 - Southern	54	113	106	24
Percent	18.1%	38.3%	35.6%	7.8%
Total	471	1109	960	206
Percent	17.1%	40.4%	34.9%	7.5%

Table 2.22
Vacant Housing Units by Housing Adequacy and Region
GUAM Total
1993 Estimates

REGION	Number of Inadequate Units	Incidence
Region 1 - North	243	15.4%
Region 2 - Central	144	16.6%
Region 3 - South	45	16.0%
Total	434	15.8%