

GUAM COMPREHENSIVE HOUSING STUDY POPULATION,EMPLOYMENT, INCOME & HOUSING FORECASTS

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POPULATION, EMPLOYMENT, INCOME & HOUSING FORECASTS**

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INTRODUCTION

Guam is experiencing a period of rapid economic growth and unparalleled prosperity. The visitor industry in particular is fueling Guam's economy to the point where unemployment is at a record low. Within this spectrum of growth and prosperity there are concerns that certain segments of the community are being negatively impacted. The foremost area of impact is perceived to be housing cost in general and affordability in particular for middle and lower income households. This study is designed to accomplish two basic objectives which are:

1. Provide a sound empirical quantitative and analytic examination of current and future housing needs. While everyone recognizes that there is a problem there is little information for how extensive the situation is or a complete understanding for all the underlying problems.
2. Utilized the results to design appropriate public response in the form of policy and programs to strategically address priority housing issues. A specific action plan will be designed for programming this response by government.

The Guam Comprehensive Housing Study is a joint undertaking by The Guam Economic Development Authority and the Guam Housing Corporation. In October 1991 a Request for Proposal was issued. Of the responses a short list was developed, with interviews of the three top firms held in December 1991. A ranking of the consultants was made in January 1992, and negotiations commenced with the highest rated team. Given the complex nature of the project, negotiations continued until May of 1992. In June of 1992 the contract was signed, the Notice to Proceed was issued for work to commence on July 20, 1992.

As stated in the contract the purpose of the Study is:

To systematically collect data regarding housing and demographics in the Territory of Guam, analyze such data, evaluate existing housing and housing related programs in the Territory of Guam, to identify housing programs used in other locals but not existing in the Territory of Guam, and to develop a comprehensive plan which includes projection of future housing needs and program development for the Territory of Guam.

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This product is an analytical/econometric model which provides a forecasts for the planning horizon which is the year 1998, for the following:

1. Estimates of Employment and Economic Structure
2. Forecast of Income
3. Estimates of Population Size and Composition
4. Household Formation
5. Housing Units Demanded and Supplied

While this product is a free standing research effort, the information contained herein will be utilized as a component of the Housing Needs Assessment (HNA) model.

FINDINGS

The Guam Comprehensive Housing Study has a five year time horizon. The year 1993 is estimated with the target date of 1998 as the forecast year. A market driven forecasting methodology has been derived for projecting employment and population for Guam. Based upon these findings, trends documented by the U.S. Census, and other supporting research as indicated, to forecast for household income, household formation and housing production are made.

Employment

Growth of employment on Guam is assessed as a function of the strength in the "Basic" sectors of the Guam economy and the external factors influencing that growth. Employment opportunities relative to work force growth will determine in or out migration, and therefore population.

Based upon growth in the basic sectors of the Guam economy, it is estimated that employment will rise from 67,465 in 1990 to 77,000 in 1993 and 87,500 in the year 1998. Changes in the military position on Guam have been estimated by information provided by the U.S. Navy. However, these figures should be monitored carefully, as the situation with military stationing is "fluid".

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Income

Incomes on Guam have risen over the last decade. The rise has been particularly significant in more recent years. Real income growth has increased annually by an average of 1.39%. This increase reflects not only higher wages but also smaller family sizes and more persons per family working. A continuing increase in real median household income is likely as the economy continues to expand faster than the local population can supply labor. A low, expected, and high increase in real household income has been set at a 1.0%, 1.4%, and 1.8% annual increase respectively, since 1990, and over the next five years.

Visitor Industry

It is estimated that the number of visitors coming to Guam will increase to 955,000 in 1993 and to 1,268,000 in the year 1998. Assuming there is 80% occupancy in hotels, this number of visitors will demand approximately 6,285 rooms in 1993 and 8,368 rooms in the year 1998. However, the actual number of rooms in the year 1998 may significantly exceed the 8,400 number, resulting in lower occupancy rates.

Population

The non-visitor population on Guam will rise to 153,000 persons in 1993 and 172,000 in the year 1998. The average daily visitor population will be 9,200 in 1993 and 12,200 in the year 1998. Total population in 1993 will be 162,000 and 184,000 in the year 1998.

Households and Housing

Household size on Guam decreased between 1980 and 1990. This rate of decrease has been forecasted to continue. Since the population is continuing to grow the rate of household formation will exceed the population growth rate. The number of households are expected to increase from about 31,400 in 1990 to 36,650 in 1993 and to 42,100 in 1998. This places the average annual increase in the number of households at about 2.8%.

According to the U.S. Census the number of housing units on Guam were 27,881 in 1980 and 35,223 as of March 1990. Between March of 1990 and August 1992 it

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is estimated that 3,915 new housing units were added to the housing inventory of Guam. This trend is documented by the issuance of Occupancy Permits. As the capacity of supply has been demonstrated, this trend is utilized for calculation purposes in estimating the number of new housing units possibly added to the inventory through 1998. From this gross inventory is subtracted those housing units no longer suitable for habitation, those demolished, etc. The net effect is that there will be 39,400 housing units in the year 1993 and 46,274 housing units in the year 1998.

METHODOLOGY And DETAILED FINDINGS

Developing an explicit methodological approach is an essential component of forecasting. In order to forecast there is a set of variables upon which assumptions must be made. These assumptions must be stated in order for users to understand the basis and more importantly the qualifications of the forecasts.

A basic principle of forecasting requires that the methodology be based upon empirical information and follow a logical analytical process. Empirical information means observed facts or relationships, real data wherever possible, and when such data is not available this must be accounted for by the development of explicit assumptions.

This principle is complimented by a logical analytical framework. This framework explains, in step by step fashion, how one gets to where you want to go, and is easy to understand conceptually.

There are two general styles of forecasts; those that are forward and those backward looking. Backward looking approaches are the most common, they analyze past trends and make assumptions about how these trends will extend into the future. Forward looking analyses assess conditions in the future regardless of past trends as an indicator of what the situation will be.

Both of these approaches have been applied to the forecasts prepared for the Guam Comprehensive Housing Study. However, it was determined that a backward looking approach was not appropriate for forecasting growth overall for Guam; the past in this case is not a good measure of what will occur in the future. This was concluded as growth pressures are externally controlled and therefore an assessment of those

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external factors influencing growth on Guam is a better measure than assessing trends on Island. But, in forecasting where growth is to occur and the structure of that growth in relation to housing on the island, backward looking indices were considered.

There are three separate but interrelated components of the model, these are (1) visitor industry forecast (2) the employment and population impacts created by this growth and (3) the influence this has on household creation. Income growth and housing development are a function of a separate investigation.

Analytical Framework

The analytical framework was based upon the following five steps:

1. Establish base non-visitor population projections without migration.

To accomplish this a cohort survival model was prepared using the most recent figures provided by the U.S Census Bureau and the Guam Department of Commerce on fertility and survival rates by cohorts. A detailed explanation of the cohort survival method of forecasting is provided in the Appendix. Our base non-visitor population for 1993 is 140,600 and for 1998 is 155,600 (Table 1).

2. Project work-force supply through natural increase.

Natural increase is the number of births minus deaths without migration, which is displayed in Table 1. The labor-force are those in the age group of 15 years old and above who are actually working, thereby becoming part of the work-force. The working participation rate for this age group is 74% as derived from the 1990 U.S. Census. The labor-force in 1993 is estimated at 94,300 and 104,900 in the year 1998. The work-force in 1993 and 1998 is 74% of this number or 69,600 and 77,700 respectively.

3. Forecast work-force demand, which is described in the following section.
4. Employment demand relative to supply of work-force will determine in or out migration.

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TABLE 1

**GUAM POPULATION FORECAST 1993 - 2000
Cohort-Survival Model with Zero Migration**

Age Group	1993	1994	1995	Year 1996	1997	1998	1999	2000
0-4	16,964	17,380	17,795	18,040	18,284	18,529	18,773	19,018
5-9	15,297	15,486	15,675	16,089	16,504	16,918	17,333	17,747
10-14	14,000	14,353	14,705	14,894	15,083	15,272	15,461	15,650
15-19	12,766	12,832	12,899	13,250	13,602	13,953	14,305	14,656
20-24	11,980	12,232	12,483	12,550	12,618	12,685	12,753	12,820
25-29	11,030	11,091	11,152	11,402	11,653	11,903	12,154	12,404
30-34	10,847	10,811	10,775	10,836	10,898	10,959	11,021	11,082
35-39	10,584	10,723	10,862	10,827	10,792	10,757	10,722	10,687
40-44	9,661	9,851	10,041	10,179	10,317	10,454	10,592	10,730
45-49	7,761	8,336	8,911	9,099	9,286	9,474	9,661	9,849
50-54	5,422	5,634	5,847	6,406	6,965	7,524	8,083	8,642
55-59	4,275	4,415	4,556	4,759	4,962	5,166	5,369	5,572
60-64	3,546	3,562	3,579	3,711	3,843	3,975	4,107	4,239
65-69	2,834	2,979	3,124	3,143	3,162	3,180	3,199	3,218
70-74	1,801	1,916	2,031	2,155	2,280	2,404	2,529	2,653
75-79	1,059	1,102	1,144	1,234	1,324	1,413	1,503	1,593
80-84	559	601	644	675	706	736	767	798
85+	181	193	204	224	245	265	286	306
TOTAL	140,567	143,497	146,427	149,474	152,522	155,569	158,617	161,664
5 to 19	43,359	43,804	44,249	45,429	46,609	47,790	48,970	50,150
15 +	94,306	96,279	98,252	100,451	102,651	104,850	107,050	109,249

Migration is assumed to be directly linked to economic activity, employment surplus or deficit will be determined by the level of economic growth. A portion of those migrating will bring non-working dependents so that the population will increase will be greater than just counting the need for workers. As indicated by the 1990 U.S. Census 22,213 persons arrived on Guam in 1989 through census day 1990 (some having arrived in 1989 may have already left). Of this population 13,524 were working in some capacity. This suggests that for every worker demanded by the economy there will be an additional .64 persons accompanying them as a non-working dependent (workers/non-workers = ratio of non-working dependents per worker). A simple multiplier is produced whereby we multiply employment demanded by 1.64 in order to obtain total population increase.

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5. Combine population as determined in step 1, with migration as indicated in step 4, producing the forecast for total non-visitor population.

This analytic framework is unique in that growth is not based upon speculative development under the assumption that "if you build it they will come". What is different is that the determinant of population is market or demand driven. Item 3, projecting work-force demand is the engine which drives the model. Not surprisingly assessing work-force demand is the most difficult part of this forecasting process, as it depends upon economic performance which is subject to many externally controlled variables. It is for this reason that elaboration on the basis for developing work force demand is explicitly presented.

Historical Context for Population and Employment

Some accounts place Guam's population in 1521 at 80,000. By the turn of the 17th Century Guam had experienced a 90% decline in population. Some of the significant factors contributing to this decline include wars, exile to other islands, introduction of new diseases, and a disruption of the socioeconomic and cultural fabric of the island community under the Spanish occupation.

In 1898, the United States annexed Guam following the Spanish-American war. At this point in time the population numbered but a few thousands. There was a period of steady increase under the American annexation, which was disrupted by the Second World War and the subsequent Japanese occupation.

Immediately following the Second World War, strict U.S. military security clearance hampered economic growth. The population increased at an annual rate of only 1.2% during the period between the end of the war and 1960. Changes in social/political, economic and military interests led to the military security restrictions being lifted in 1962. The population growth rate increased to 3% between 1960 and 1975.

Between 1970-75, the growth rate was 4.3%, amongst the highest in the world, and is attributed to in-migration and high fertility.

The population deviations during this period can be classified into three distinct periods in Guam's history. The first period from 1900 to 1940 saw a gradual increase

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in population after the American annexation to the advent of the Second World War. Economics during this period was almost totally agrarian and military in nature. The second significant period was transitional from the war years through the lifting of travel restrictions. A sharp increase in population in 1950 can be attributed to the post World War II influx of military and civil servant personnel. The third period is discernable from 1960 to the present time. In the last three decades, Guam experienced an almost steady growth rate of 25% per decade. From 1960 onwards the island economy has seen a tremendous growth in the private sector, military expansion, and local government.

In 1980 the U.S. Census reported a total population of 105,979, and the 1990 report estimates the population at 133,152, an increase of 25% over the decade. This increase is the result of a high birth rate and relative economic well-being which the island has enjoyed during the last half of the decade leading to in-migration. Despite decreases in birth rates and family sizes the current fertility rates for Guam are still considerably higher than the national average while the mortality rates are almost the same as the national average.

Since 1960 Guam has experienced cyclical growth and stabilization in economic activity and population growth. This cyclical pattern belies the stable decade by decade growth indicated by U.S. Census data. In the mid to late 60's the visitor industry opened up on Guam. This was followed by decline. Again in the early 70's visitor industry growth accelerated only to fall off in the mid to late 70's. Beginning in 1986 the visitor industry on Guam exploded with double digit annual percent changes in visitor arrivals, hotels with over 100% occupancy rates (late leaving visitors pay for the full day, late arriving visitors pay for the same room for the same day), new hotel and resort construction, and many planned and approved projects. In recent years new construction of hotels and golf courses has slowed. Although the number of visitors continue to increase occupancy rates at hotels have dropped and are now in the 70% to 80% range.

Detailed Findings

Economic Growth and Employment

To forecast economic performance we first make assumptions on how the economy

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operates. We have chosen the economic base model. This model equates the economy to an engine (Figure 1). An engine needs fuel, this fuel is money from outside the system coming in. You get this money from selling a good or service to someone living somewhere else, ie. an export or through government transfers. This money circulates through the economy with rounds of spending that decreases with each round based upon what money is exported to purchase goods and services from off-island. This continues until all the money is leaked to the outside. To keep the economy healthy and growing more money must be flowing in than what is flowing out to purchase imports. This is analogous to the factors determining the balance of trade among nations. Basic sectors bring in money to Guam while other sectors (non-basic) act to circulate that money through the economy. In this way the basic sectors are directly responsible for every job on Guam, both public and private.

The economic base model divides the economy into export earning activities and those that are non-export earners, or simply non-basic. The ratio of basic to non-basic establishes a multiplier relationship whereby forecasted increases (or decreases) in the basic sector can be assessed as to their overall impact on the economy. The economic base model is widely used as a forecasting tool, as it is relatively inexpensive to develop and often provides as reliable forecasts as more expensive and complicated models such as input/output. Since the basic economic model works best in small and isolated regions and because the technique is particularly useful in short term analysis of small economies it is appropriate for use on Guam. Further, as will be elaborated upon later, the typical basic/non-basic ratio generally range between 1 and 2.2. The Guam basic/non-basic ratio for the visitor industry is between 2.05 and 2.13. (Community Analysis and Planning Techniques, Robert Klosterman, 1990)

The basic sectors of the Guam economy include:

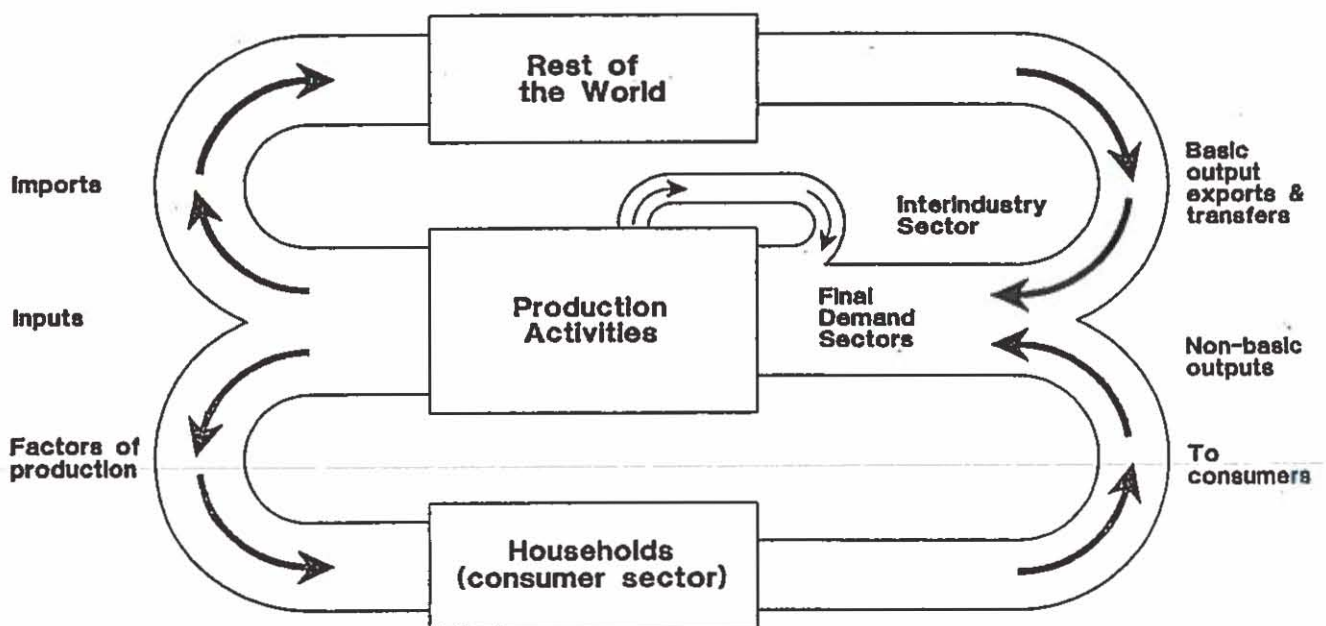
- The Military
- Federal Government
- Transshipment
- Construction (when externally financed)
- Visitor Industry

The visitor industry is the most dynamic basic sector. Federal spending and the military is the next most important sector. Federal non-military spending has been fairly steady over the last several years and there is no reason to expect a significant

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FIGURE 1

**Basic Activity Model of the Economy
Illustrating Money Flows**



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change. Military activity and spending is increasing and is expected to expand over the time frame of this forecast. However, long term growth is uncertain.

Transshipment is an important but small basic sector. Construction can have a profound effect on the local economy but it is a short term impact in that it creates taxes and jobs during a certain period and then stops. This sector is also dependent upon factors stimulating the economy and is not a stimulant in itself as is the visitor industry. For these reasons our attention has focused upon the visitor industry.

The methodology utilized in forecasting visitor industry activity on Guam is a departure from the typical approach. Usually growth projections in the visitor industry are based upon a backward looking trend analysis at the growth rates and assuming these will continue into the future, with the added information of what has been approved for development.

The approach taken in this analysis has been to look at the strength of the major visitor markets and those anticipating growth and projecting what they may be doing five years from now. Four market areas are examined, these include the Japanese, Taiwanese, Korean, and all others. Each of these markets have assumed growth rates based upon trends, national goals, and population growth. The Guam share of each of the outbound travel markets by country was assumed to be constant. There is a long history of Japanese arrivals which exhibits relative stability over the years with Guam steadily capturing between 5 and 6% of the Japanese outbound market. The Korean and Taiwan markets have experienced extreme fluctuations.

The Japanese Visitor Market

It is projected, by the Japan Travel Bureau, that the number of outbound travelers from Japan will increase from almost 11 million in 1990 to 20 million in the year 2000. This is just over a 6% annual growth rate. The Japanese market has experienced a 14% average annual growth rate between 1988 and 1990. The overall level of outbound Japanese travel was just about 10% in 1992, which compares to 20% for Taiwan and 35% for Hong Kong. Given these numbers and assuming a more stable Japanese economy, a total of 20 million outbound travelers by the year 2000 appears reasonable as this number represents 15% of the Japanese population (Table 2). Based upon Japanese census figures their population is growing at a very slow

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TABLE 2

PROJECTED OUTBOUND JAPANESE TRAVELERS AND GUAM MARKET SHARE 1990 - 2010

YEAR	TOTAL	%	NUMBER	GUAM MARKET SHARE	
	POPULATION	OUTBOUND	OUTBOUND	Number	Percent
1990	123,813,000	8.88%	10,997,400	637,569	5.80%
1991	124,432,065	9.38%	11,675,192	582,270	4.99%
1992	125,054,225	9.91%	12,394,757	644,527	5.20%
1993	125,679,496	10.47%	13,158,671	763,203	5.80%
1994	126,307,894	11.06%	13,969,666	810,241	5.80%
1995	126,939,433	11.68%	14,830,645	860,177	5.80%
1996	127,574,131	12.34%	15,744,687	913,192	5.80%
1997	128,212,001	13.04%	16,715,063	969,474	5.80%
1998	128,853,061	13.77%	17,745,246	1,029,224	5.80%
1999	129,497,327	14.55%	18,838,921	1,092,657	5.80%
2000	130,144,813	15.37%	20,000,002	1,160,000	5.80%

Outbound travel estimate for Year 2000 by Japan Travel Bureau,
Annual Growth 6.1632%.

Population Growth of .5% based on Japanese Census Data

TABLE 3

PROJECTED OUTBOUND S. KOREAN TRAVELERS AND GUAM MARKET SHARE 1990 - 2010

YEAR	TOTAL	%	NUMBER	GUAM MARKET SHARE	
	POPULATION	OUTBOUND	OUTBOUND	Number	Percent
1990	43,919,000	3.55%	1,560,923	7,645	0.49%
1991	44,463,596	4.05%	1,800,000	19,008	1.06%
1992	45,014,944	4.40%	1,980,000	36,630	1.85%
1993	45,573,129	4.78%	2,178,000	41,382	1.90%
1994	46,138,236	5.19%	2,395,800	45,520	1.90%
1995	46,710,350	5.64%	2,635,380	50,072	1.90%
1996	47,289,559	6.13%	2,898,918	55,079	1.90%
1997	47,875,949	6.66%	3,188,810	60,587	1.90%
1998	48,469,611	7.24%	3,507,691	66,646	1.90%
1999	49,070,634	7.86%	3,858,460	73,311	1.90%
2000	49,679,110	8.54%	4,244,306	80,642	1.90%

Annual outbound growth rate set at 10%, outbound growth is not formally predicted.
Population growth set at 1.24%, based upon current trend.

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.5% annual rate. Therefore, significant gains outbound Japanese travel must come as a result of a greater percentage of the population traveling abroad.

The South Korean Visitor Market

Growth of outbound travel from Korea is the fastest in the region. Between 1988 and 1990 S. Korea experienced an increase of outbound travelers at the annual rate of 46.7% reaching more than 1.5 million persons. The prospect for increased growth is excellent. In 1992 only 4.4% of S. Koreans traveled outside the country annually. With a population of over 44,000,000, and an expanding economy S. Korea will likely continue to post gains in outbound travelers.

A conservative 10% annual growth rate has been assumed for increases in outbound S. Korean travelers. With this rate of increase the Korean outbound travelers will still be less than 9% of the population in the year 2000. Guam now captures less than 2% of this outbound market. If Guam maintains it's market share the number of S. Koreans coming to Guam will increase by 10% each year. It is possible that S. Korean outbound travelers will increase faster than 10% over the next few years and that Guam may capture a much larger market share (Table 3).

The Taiwanese Visitor Market

Taiwan has boasted an increase of outbound travelers of 35.5% each year with about 4,300,000 traveled abroad in 1992 (Source: Japan Travel Bureau). Guam is capturing only .28% of this market. Continued rapid growth in the Taiwan market is not anticipated as outbound travelers already constitute 20% of the population. If the Taiwan outbound market grows at an average annual rate of 2%, and if Guam maintains its current market share of about .30% there will be 14,500 visitors coming to Guam from Taiwan in 1998. In addition, a significant increase in market share is possible (Table 4).

Other Visitor Markets

Other visitor markets include the U.S., Australia, Hong Kong, Europeans, and others. For this grouping we have assumed a 3% annual growth rate as representing "Steady

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**TABLE 4
PROJECTED OUTBOUND TAIWAN TRAVELERS
AND GUAM MARKET SHARE 1992 - 2010**

YEAR	TOTAL POPULATION	% OUTBOUND	NUMBER OUTBOUND	GUAM MARKET SHARE	
				Number	Percent
1990	20,454,000	14.39%	2,942,316	2,189	0.07%
1991	20,699,000	16.76%	3,470,000	8,574	0.25%
1992	20,947,000	20.53%	4,300,000	12,000	0.28%
1993	21,198,000	20.69%	4,386,000	13,158	0.30%
1994	21,452,000	20.85%	4,473,720	13,421	0.30%
1995	21,709,000	21.02%	4,563,194	13,690	0.30%
1996	21,970,000	21.19%	4,654,458	13,963	0.30%
1997	22,234,000	21.35%	4,747,547	14,243	0.30%
1998	22,501,000	21.52%	4,842,498	14,527	0.30%
1999	22,771,000	21.69%	4,939,348	14,818	0.30%
2000	23,044,000	21.86%	5,038,135	15,114	0.30%

Outbound travel forecasted to grow at 2% annually, no formal forecast available.
Population growth estimated at 1.2% based upon current trend.

**TABLE 5
PROJECTED OUTBOUND OTHER TRAVELERS
ARRIVALS ON GUAM 1992 - 2010**

YEAR	NUMBER OF ARRIVALS	GROWTH RATE
1990	120,786	
1991	118,870	-2%
1992	122,436	3%
1993	126,109	3%
1994	129,892	3%
1995	133,789	3%
1996	137,803	3%
1997	141,937	3%
1998	146,195	3%
1999	150,581	3%
2000	155,098	3%

Growth rate for '90 to 91 and
'91 to '92 actual, growth to the
year 2000 put at current rate of
increase.

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Growth". Between 1990 and 1991 the number of "Other" travelers actually declined by 2%. Growth has occurred and the level of "Other" travelers in 1992 is about 3% higher than the 1991 level (Table 5).

Combined Visitor Totals

Combining the visitor market projections we have an estimate of 954,900 visitors in 1993 and 1,268,000 visitors in 1998. One set of variables held constant throughout this analysis is visitor length of stay (3.5 nights) and number of visitors per room (1.8). These variables have been surprisingly constant over the last 15 years and more. Evidence has not been presented which would indicate a change in these factors. However, if such evidence is forthcoming then the forecasts should be adjusted accordingly. Given these variables, the number of hotel rooms demanded at 80% occupancy will be 6,285 in 1993 and 8,368 in 1998. More hotel rooms may be constructed, but if they are built, occupancy rates will fall (Table 6).

Employment and Population

The number of visitors has a direct relationship to job creation. For this we have developed a set of employment multipliers based upon the number of hotel rooms at 80% occupancy (Table 7). A clarification on what our projection of hotel rooms means is in order. Our analysis of hotel rooms demanded is based upon 80% occupancy. Actual occupancy may dip well below this figure, to say 60%, depending upon investor prerogative to construct additional hotel rooms.

Because of the number of hotel rooms currently under construction or with construction temporarily halted, it is believed that there will be a significantly higher number of rooms in 1998 than the 8,368 rooms projected. The actual number of rooms may be closer to 9,500. The overall number employed is held to our 80% occupancy figure.

The employment multipliers are a modified version of those derived by the Stanford Research Institute (SRI) for Guam in 1985. The modifications have come in two areas. The SRI study utilized 1985 data. Between 1985 and 1990 the average number of employees per hotel room increased from .63 To .85. Therefore, the multipliers derived in 1985 must also be modified to account for this increase.

TABLE 6
VISITOR INDUSTRY GROWTH FORECAST

Year	Total Visitors	Number of Air Arrivals	Number of Sea Arrivals	% Change Air Arrivals	Average Daily Census	Rooms Required	Rooms Necessary If 80% Occupancy	Number Increase
1988	585,799	576,170	9,629		5,525	3,069	3,837	
1989	668,827	658,883	9,944	14.36%	6,318	3,510	4,388	551
1990	780,404	769,876	10,528	16.85%	7,382	4,101	5,127	739
1991	737,260	728,722	8,538	-5.35%	6,988	3,882	4,853	(274)
1992	826,593	815,593	11,000	11.92%	7,821	4,345	5,431	578
1993	954,852	943,852	11,000	15.73%	9,051	5,028	6,285	854
1994	1,010,074	999,074	11,000	5.85%	9,580	5,322	6,653	368
1995	1,068,728	1,057,728	11,000	5.87%	10,143	5,635	7,043	391
1996	1,131,038	1,120,038	11,000	5.89%	10,740	5,967	7,458	415
1997	1,197,241	1,186,241	11,000	5.91%	11,375	6,319	7,899	441
1998	1,267,593	1,256,593	11,000	5.93%	12,050	6,694	8,368	468
1999	1,342,367	1,331,367	11,000	5.95%	12,767	7,093	8,866	498
2000	1,421,855	1,410,855	11,000	5.97%	13,529	7,516	9,395	529

Based on the average visitor staying 3.5 nights and 1.8 persons per room,
Percent growth assumes that the current slow growth is reversed and that
Japanese market share of about 5.8% is maintained. Other markets as indicated
in other Tables. Assumes arrivals by sea steady at 11,000 per year.

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In forecasting future hotel employment it is known from the Hotel and Restaurant Association that the hotels coming on line now have a higher average standard of service than the existing hotel inventory. These hotels will strive to attain an average of 1.5 persons working per room. This is assumed to be the marginal increase between 1990 and 1993. Between 1993 and the year 1998 the marginal increase is assumed to be 1.2 persons per room as other styles of hotels enter the market or labor shortages restrict actual employment. The number of hotel workers was reduced by a factor of 5% to account for those workers who hold more than one job (based upon a comparison of W2 forms issued and U.S Census data for 1990). The result is an increase of hotel specific employment per room to .97 in 1993 and .98 in the year 1998. The direct employment multiplier includes this factor and so must be increased accordingly.

The second modification concerned the indirect and induced employment multiplier. The multiplier derived by SRI was recalculated without counting construction workers, this reduced the multiplier from 2.59 to 2.30.

Construction workers are added to employment as a separate entry. While major new construction for a hotel is unlikely, continued construction activity in commercial and residential development as well as infrastructure expansion and improvement can be expected. According to the Guam Department of Labor, in 1990 there were 9,400 construction workers in 1992 their numbers increased to almost 12,300. This level of employment is expected to decline as major construction projects are completed. A level of 9,500 construction workers are estimated for 1993, which is 100 more than the level in 1990. The number of construction workers is held constant through 1998 indicating a decline in their numbers relative to other sectors. The forecasting the level of construction workers must be monitored as currently there is no sound empirical basis upon which to estimate future levels.

The jobs produced have been distributed into the economy (Table 9). Those working in hotels can be derived directly from the multiplier, other direct workers have been placed in service and retail according to their existing share of the economy. Indirect employees have been distributed throughout the private sector economy according to the existing percentage of employment in an economic sector excluding hotel and construction workers. Government of Guam workers are taken from the indirect jobs numbers prior to this distribution increasing their number at a rate of 2.5% between 1991 and 1993 reflecting historic patterns and population growth. After 1993 an

TABLE 9

EMPLOYMENT FORECAST: 1993 AND 1998							
SECTOR	Employment 1990	Employment 1993	Annual % increase	Employment 1998	Annual % increase	Change 1990-93	Change 1993-199
Agriculture/Fisheries	280	315	3.99%	353	2.29%	35	38
Construction	9,400	9,500	0.35%	9,500	0.00%	100	0
Manufacturing	1,940	2,182	3.99%	2,444	2.29%	242	262
Trans. & Pub. Util.	3,630	4,082	3.99%	4,572	2.29%	452	490
Wholesale Tr.	1,780	2,002	3.99%	2,242	2.29%	222	240
Retail Tr.	9,910	12,522	8.11%	15,577	4.46%	2,612	3,055
Fin., Ins. & Real Est.	2,360	2,654	3.99%	2,973	2.29%	294	318
Hotel Service	3,920	6,125	16.04%	8,193	5.99%	2,205	2,068
Other Services	6,150	7,771	8.11%	9,667	4.46%	1,621	1,896
TOTAL PRVT EMP.	39,370	47,154	6.20%	55,521	3.32%	7,784	8,367
Federal Govt.	6,880	6,880	0.00%	6,880	0.00%	0	0
Territorial Govt.	12,420	13,049	2.50%	14,057	1.50%	629	1,008
TOTAL PUBLIC EMP.	19,300	19,929	1.07%	20,937	0.99%	629	1,008
Military	8,795	9,995	4.36%	10,995	1.93%	1,200	1,000
GRAND TOTAL	67,465	77,077	4.54%	87,453	2.56%	9,612	10,376

Source: 1990 from Guam Department of Labor, figure for Territorial employment from 1991, forecast for 1993 and 1998 derived from model of marginal employment, developed by Duenas & Associates, Incorporated.

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assumption is made that some efficiency of scale will be reached and growth in local government employment will grow at the reduced rate of 1.5% between 1993 and the year 1998. The number of construction workers are added according to the description above.

Our labor force and population forecast indicates that in year 1993 there will be a deficit of 7,517 workers and in 1998 this will be 9,753 workers short of demand (Table 12). When workers come some will bring non-working dependents, so that the actual number of migrants will be higher than the number of jobs. Exactly how much higher is difficult to measure. One indicator is the composition of workers and non-workers arriving on Guam in 1989 and 1990 as measured by the U.S. Census. Of these arrivals there was a ratio of one worker for every .64 non workers. Therefore by multiplying the number of workers short of demand by 1.64 provides an approximate number of those migrating to Guam.

Taking a combination of the population due to natural increase and migration as a result of demand for workers the resultant is a resident population of 153,000 in 1993, 172,000 in 1998 with an average daily visitor census of 9,156 and 12,155 respectively. Total population will be 162,000 in 1993 and 184,000 in the year 1998 (Table 10).

INCOME

Various measures of income were examined (Table 11). This included mean income for persons with income, median household income, per capita income, the gross average weekly average earnings of production (non-supervisory) workers and real median household income. Each income measure indicated gains between 1981 and 1990. Those indices with yearly figures illustrated that income growth rose faster between 1986 and 1990 than between 1981 and 1986. Real median income increased by 16% between 1979 and 1989 for an average annual increase of 1.39%. The rise in real income growth is also likely growing faster since 1986 than it did in the 1981 to 1986 period.

The increase in income reflects not only higher wages but also smaller family sizes and more persons per family working. A continuing increase in real median household income is likely as the economy continues to expand faster than the local population can supply labor. For this reason, a 1.40% average annual real increase in median

TABLE 10

LABOR FORCE & POPULATION FORECAST - 1993 & 1998		
	1993	1998
Labor Force Through Natural Increase (1)	69,560	77,700
Employment Demand Forecast (2)	77,077	87,453
Labor Surplus/Deficit (3)	(7,517)	(9,753)
Labor In-Migration with Dependents (4)	12,328	15,995
Population with Natural Increase (5)	141,000	156,000
Population with In-migration (6)	153,328	171,995
Average Daily Tourist Population (7)	9,156	12,155
Total Guam Population	162,484	184,150

(1) Natural increase numbers approximated by Cohort Survival projection without migration,

1990 is base year, labor force participation rate in ages 15 and above is 74%.

(2) Employment forecast by Duenas & Associates Incorporated

(3) = (2) - (1)

(4) The 1990 U.S. Census indicates those arriving in '89&'90 had a ratio of 1 worker to .64 non-workers.

(5) Total natural increase numbers by Cohort Survival projection without migration.

(6) = (4) + (5)

(7) Assumes average visitor stay is 3.5 days, number of visitors from Duenas & Associates Inc. projections.

TABLE 11
VARIOUS INCOME TRENDS 1981 - 1992

Year	Mean Income Persons With Income	Previous Year % Change	Median Household Income	Previous Year % Change	Per Capita Income	Previous Year % Change	Production Workers Gross Average Weekly Earnings	Previous Year % Change	Real Median Household Income Change 1979-1989 in Constant 1989 Dollars *	
									Income	Year
1981	11,609		16,058		4,496		210.14		26,789	1979
1982	11,971	3.12%	18,135	12.93%	4,789	6.52%	203.63	-3.10%		
1983	12,658	5.74%	15,478	-14.65%	5,087	6.22%	209.11	2.69%		
1984	12,859	1.59%	19,540	26.24%	5,412	6.39%	210.85	0.83%		
1985	13,222	2.82%	17,148	-12.24%	5,709	5.49%	237.01	12.41%		
1986	13,939	5.42%	15,659	-8.68%	5,912	3.56%	232.19	-2.03%		
1987	15,603	11.94%	24,541	56.72%	7,049	19.23%	223.73	-3.64%		
1988	16,343	4.74%	22,982	-6.35%	7,174	1.77%	236.31	5.62%		
1989	17,197	5.23%	22,922	-0.26%	8,399	17.08%	261.31	10.58%	30,755	1989
1990	18,454	7.31%	33,575	46.48%	9,885	17.69%	290.75	11.27%		
1991	n/a	n/a	n/a	n/a	n/a	n/a	291.06	0.11%		
1992	n/a	n/a	n/a	n/a	n/a	n/a	332.10	14.10%		
Average Annual Change										
81-90	5.28%		8.54%		9.15%		4.25%	(81-92)	1.39%	(79-89)
86-90	7.27%		21.01%		13.71%		6.15%	(86 to 92)		

Source: Guam Department of Labor, Bureau of Labor Statistics, and U.S. Bureau of the Census as indicated by the ***.

TABLE 12

REAL GROWTH IN MEDIAN HOUSEHOLD INCOME 1990 TO 1993 AND 1998 IN 1990 DOLLARS				
Growth Rate	Year			
	1990	1993	1998	
1.00%	\$33,575	\$34,592	\$36,357	
1.40%	\$33,575	\$35,005	\$37,525	
1.80%	\$33,575	\$35,421	\$38,726	

Source: Base year 1990 from Guam Department of Labor, forecast derived from Duenas & Associates, Incorporated.

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household income over the forecast period is a reasonable expectation. A rate of increase of 1.00% is used as a low and 1.80% represents a high growth rate (Table 12).

HOUSEHOLDS AND HOUSING UNITS

The number of households is a function of population and household size. The 1990 U.S. Census population figure for Municipal Districts (MD) was used as a base for forecasting purposes. The population estimate of 1993 and forecast to 1998 was prepared as described earlier. This population was distributed into MD's according to the relative number of residential units receiving occupancy permits that have been issued in that MD between May 1990 and August 1992 (See "Estimate of New Housing Units Developed Between the 1990 Census and August 1992" prepared by Duenas & Associates, Incorporated). It is assumed that this breakdown reflects relative population growth and that this trend will continue through 1998 (Table 13).

Household size by MD was documented by the 1980 and 1990 U.S. Census. The average annual percent change was calculated for each district. When household size indicated a decrease this trend was assumed to continue through 1998. When household size increased, as it did in three instances, the 1990 level was held as a maximum. The percentage of persons not in group quarters or otherwise not in households in 1990 by MD's was assumed to remain unchanged through the forecast period. Household size divided into population less those in group quarters provides an estimate of the number of households by MD's and overall (Table 14).

The number of housing units in the Guam inventory is calculated similarly to population growth. Some housing units are "dying" and others are being born. Those that are dying are doing so because they are no longer suitable for human habitation, they are demolished, or they are converted to another use. Those being born come about through new construction.

Each age grouping of housing units is assigned a survivability factor (like a death or loss rate). This loss rate is evidenced from the 1970, 1980, and 1990 U.S. Census figures. A comparison of the age of structures at the end of each decade illustrates the rate at which housing units are leaving the inventory per age category. In example, in 1970 about 8,000 housing units in the inventory were build in 1959 or

TABLE 13

GUAM POPULATION FORECAST BY MUNICIPAL DISTRICT: 1993 & 1998

Municipal District	1990 Population	% of Total	May '90 Aug '92(1)	% of Total	Marginal Population Change(2)	1993 Population	% of Total	Marginal Population Change	1998 Population	% of Total
Agana	1,139	0.86%	18	0.49%	96	1,235	0.81%	92	1,328	0.77%
Agana Heights	3,646	2.74%	78	2.10%	418	4,064	2.66%	400	4,464	2.60%
Agat	4,960	3.73%	112	3.02%	600	5,560	3.63%	574	6,134	3.57%
Asan-Maina	2,070	1.55%	51	1.38%	273	2,343	1.53%	261	2,605	1.51%
Barrigada	8,846	6.64%	180	4.86%	964	9,810	6.41%	923	10,733	6.24%
Chalan Pago/Ordot	4,451	3.34%	390	10.52%	2,089	6,540	4.27%	1,999	8,539	4.96%
Dededo	31,728	23.83%	916	24.72%	4,906	36,634	23.94%	4,696	41,330	24.03%
Inarajan	2,469	1.85%	76	2.05%	407	2,876	1.88%	390	3,266	1.90%
Mangilao	10,483	7.87%	244	6.58%	1,307	11,790	7.71%	1,251	13,041	7.58%
Merizo	1,742	1.31%	43	1.16%	230	1,972	1.29%	220	2,193	1.27%
Mongmong/Toto/Maita	5,845	4.39%	170	4.59%	910	6,755	4.42%	872	7,627	4.43%
Piti	2,480	1.86%	23	0.62%	123	2,603	1.70%	118	2,721	1.58%
Santa Rita	11,204	8.41%	20	0.54%	107	11,311	7.39%	103	11,414	6.64%
Sinajana	2,658	2.00%	47	1.27%	252	2,910	1.90%	241	3,151	1.83%
Talofofo	2,310	1.73%	31	0.84%	166	2,476	1.62%	159	2,635	1.53%
Tamuning	16,673	12.52%	929	25.07%	4,975	21,648	14.15%	4,763	26,411	15.36%
Umatac	897	0.67%	12	0.32%	64	961	0.63%	62	1,023	0.59%
Yigo	14,213	10.67%	285	7.69%	1,526	15,739	10.29%	1,461	17,201	10.00%
Yona	5,338	4.01%	81	2.19%	434	5,772	3.77%	415	6,187	3.60%
TOTAL	133,152	100.00%	3,706	100.00%	19,848	153,000	100.00%	19,000	172,000	100.00%

Source: 1990 from U.S. Census, 1993 and 1998 derived by Duenas & Associates, Incorporated.

(1) Residential occupancy permits from May 1990 through August 1992.

(2) Marginal change determined by percent of occupancy permits relative to population increase forecast, developed by Duenas & Associates, Incorporated.

TABLE 14

HOUSEHOLD SIZE AND NUMBER OF HOUSEHOLDS BY MUNICIPAL DISTRICT 1993-1998

Municipal District	Household Size		Average Annual % Change	% Persons In Group Quarters	Household Size(1)		Households(2)		
	1980	1990			1993	1998	1990	1993	1998
Agana	3.01	3.10	0.30%	0.1%	3.10	3.10	367	398	428
Agana Heights	3.81	3.73	-0.21%	3.8%	3.71	3.67	940	1,055	1,171
Agat	4.66	4.37	-0.64%	0.0%	4.29	4.15	1,135	1,297	1,478
Asan-Maina	3.80	3.63	-0.46%	1.0%	3.58	3.50	565	648	737
Barrigada	4.10	4.06	-0.10%	9.4%	4.05	4.03	1,974	2,196	2,414
Chalan Pago/Ordot	4.71	4.57	-0.30%	2.2%	4.53	4.46	953	1,412	1,872
Dededo	4.57	4.44	-0.29%	2.5%	4.40	4.34	6,967	8,115	9,288
Inarajan	5.21	5.01	-0.39%	0.9%	4.95	4.86	488	576	667
Mangilao	3.87	4.05	0.46%	6.1%	4.05	4.05	2,431	2,733	3,024
Merizo	4.70	4.47	-0.50%	0.0%	4.40	4.29	390	448	511
Mongmong/Toto/Maite	3.97	3.70	-0.70%	0.5%	3.62	3.50	1,572	1,855	2,170
Piti	3.61	3.48	-0.37%	8.5%	3.44	3.38	652	692	737
Santa Rita	3.90	3.86	-0.10%	25.5%	3.85	3.83	2,162	2,190	2,221
Sinajana	4.34	4.15	-0.45%	0.0%	4.09	4.00	640	711	787
Talofofo	4.97	4.41	-1.19%	0.6%	4.25	4.01	521	578	654
Tamuning	3.25	3.03	-0.70%	9.6%	2.97	2.86	4,974	6,596	8,334
Umatac	5.63	5.54	-0.16%	0.0%	5.51	5.47	162	174	187
Yigo	3.87	3.88	0.03%	8.0%	3.88	3.88	3,370	3,732	4,078
Yona	4.62	4.58	-0.09%	0.9%	4.57	4.55	1,155	1,252	1,348
Total					3.91	3.82	31,418	36,658	42,104

Source: 1980 and 1990 figures from U.S. Census, 1993 and 1998 figures derived by Duenas & Associates, Inc.

(1) Household size extrapolates trend in smaller sized households from 1980 to 1990, assumes same trend through 1993 and 1998, except when household size has increased, the 1990 household size was kept as a maximum.

(2) The number of households is a function of population, household size, and percent of population in group quarters. The percent of population in group quarters in 1990 is held constant through 1998.

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before. In 1980 the number of houses remaining in the inventory built in this time period dropped to 4,000 and in 1990 to 3,305. The average annual decrease for these houses was 6.65% between 1970 and 1980 and 1.95% between 1980 and 1990.

A housing loss rate has then been forecasted through 1998 for the current housing stock and those additional units to be added through 1993. The forecasted loss rate was developed using the documented loss rate as a guide. Newer units have a better survivability rate than older units. Units built in 1994 to 1998 are not shown to have a loss. In addition, a higher rate of loss than would otherwise be used was applied to the 9/92 through 1993 period to account for typhoon damage (Table 15).

The production rate of new housing units is also estimated by using U.S. Census figures. In example, in 1990 3,254 respondents indicated that their home was built in 1989 through March 1990. The average monthly production rate equates to 217 units (3,254 units divided by 15 months). After March of 1990, development of housing units can be approximated from the number of housing units receiving occupancy permits. In the previously referenced study, it was determined that between May of 1990 and August 1992 an average of 140 housing units were added to the inventory every month. The net effect of estimated housing loss and new housing development is illustrated in Table 15.

A comparison of the number of households and housing units since 1980 indicates a pattern. In 1980 10.93% of the housing stock was vacant or otherwise unoccupied, in 1990 the number was 10.8%. If a production rate of 140 housing units per month is assumed the 1993 percent of vacant or unoccupied units is 6.97% of the housing units in this category. Continuing with an average production of 140 housing units per month indicates that by 1998 9.01% of the housing inventory will be vacant or unoccupied (Table 16).

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TABLE 15

ACTUAL AND ESTIMATED HOUSING UNITS WITH PRODUCTION AND HOUSING LOSS RATES BY YEAR 1970 TO 1998										
	1959 & Earlier	1960 to 1969	1970 to 1979(1)	1980 to 1984	1985 to 1988	1989 to 3/1990	4/1990 to 8/1992(2)	9/1992 to 1993	1994 to 1998	Total
In 1970	8,010	8,666	...	...	...	...	...	...	...	16,676
In 1980	4,024	7,566	16,291	...	...	...	...	...	...	27,881
In 1990	3,305	6,767	14,606	2,822	4,469	3,254	...	...	...	35,223
In 8/92	3,140	6,573	14,197	2,764	4,411	3,229	3,915	...	...	38,229
In 1993	2,923	6,299	13,801	2,706	4,350	3,193	3,893	2,240	...	39,404
In 1998	2,779	5,957	13,068	2,599	4,242	3,145	3,854	2,229	8,400	46,274
Loss '90/98	526	810	1,538	223	227	109	61	11		3,504
MONTHLY AVERAGE PRODUCTION RATE										
	Actual(3)						Forecasted			
	N/A	N/A	N/A	47	93	217	140	140	140	
AVERAGE ANNUAL HOUSING LOSS RATE BY YEAR OF CONSTRUCTION										
Actual										
1970 - 1980	-6.65%	-1.35%								
1980 - 1990	-1.95%	-1.11%	-1.09%							
Estimate/Forecast(4)										
1991-8/1992	-1.95%	-1.11%	-1.09%	-0.80%	-0.50%	-0.30%				
9/1992-1993	-5.00%	-3.00%	-2.00%	-1.50%	-1.00%	-0.80%	-0.40%			
1994 - 1998	-1.00%	-1.11%	-1.09%	-0.80%	-0.50%	-0.30%	-0.20%	-0.10%		
Source: 1970, 1980 and 1990 U.S. Census.										
Figures after 3/1990 derived by Duenas & Associates estimate.										
(1) 1980 Census number reduced by 210 to account for average production of 70 units per month between 1/80 and 3/80.										
(2) Month 4 (April) of 1990 estimated to produce 200 units as per trend in occupancy permits.										
(3) "Actual" production rate may understate production as loss rate has not been factored into estimate.										
(4) Housing loss rate for the 9/1991 through 1993 period increased to account for typhoon damage.										

TABLE 16

COMPARISON OF HOUSEHOLDS AND HOUSING UNITS: 1980 TO 1998

Year	Number Households	Number Housing Units	Number Vacant Units	Percent Vacant Units
1980	24834	27881	3,047	10.93%
1990	31,418	35,223	3,805	10.80%
1993	36,658	39,404	2,746	6.97%
1998	42,104	46,274	4,170	9.01%

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APPENDIX

THE COHORT-SURVIVAL TECHNIQUE

The Cohort-Survival technique takes the number of persons who are living in the study area in a given age group (cohort) and applies the probabilities of death, child birth and migration to derive the number of persons who will be living five years later. The required data for the Cohort-Survival projection is first, an age-sex cohort population of the study area; second, probabilities of living expressed as a decimal number for each age-sex cohort; third, probabilities of births for females in the child bearing cohorts; and fourth, probabilities of migration for each age-sex cohort.

The age-sex breakdown of Guam's population was obtained from the U.S Census Abstracts for 1960, 1970 and 1980. The accepted convention for these cohort populations is to disaggregate the population into five year cohorts starting from 0-4 years and ending at 85+ years old.

The probabilities of living are known as survival rates and indicate the proportion of persons who are living at age group X who will live to age group X + 5. The major source for survival information is the U.S. Bureau of Census. These rates are derived from vital statistics data for the United States and are tailored for the nation as a whole, but can be applied to individual study areas without correction. A comparison of the Guam's survival rates with the national average rates indicates only a minor difference. Hence the national average survival rates were used in projecting population by the Cohort-Survival model.

There are two primary sources of fertility data - U.S. Census publications and vital statistics which give age specific fertility rates by five year age groups of females. These rates represent the national trends in fertility. The age specific fertility rates for Guam were obtained from the census section of the Guam Department of Commerce and were used for the projections, because they did not compare with the national averages, and were substantially higher.

The final requirement is migration data. Unlike the first three data requirements, migration patterns are not recorded in any comprehensive manner. Therefore past migration trends must be estimated for the study area. Migration data is derived by computing the amount of population change which is a result of deaths and then assign the remainder of the variance to migration. The variance due to migration is then expressed as a five year, age specific probability of migration. The model was run assuming zero migration as it was our intention to measure migration based upon economic growth and ensuing employment demands.